BM 624 Chip Spreader

Operators, Maintenance and Parts Manual

GEFFS MANUFACTURING INC.

Introduction

READ THIS MANUAL **carefully** to learn how to operate and service your machine correctly. Failure to do so could result in personal injury or equipment damage.

THIS MANUAL SHOULD BE CONSIDERED a permanent part of your machine and should remain with the machine when you sell it.

THIS MANUAL INCORPORATES operation and maintenance information for the Geffs Manufacturing, Inc. chip spreaders. It is a compilation of the best information available at the time of writing. Some information may be specific to options not on all machines. All information and specifications are subject to change without notice.

USE ONLY CORRECT REPLACEMENT PARTS AND FASTENERS. Metric and inch fasteners may require a specific metric or inch wrench.

RIGHT-HAND AND LEFT-HAND sides are determined by facing in the direction of forward travel.

WRITE SERIAL NUMBERS in the back page of Introduction Section. Accurately record all the numbers to help in tracing the machine should it be stolen. File the serial numbers in a secure place off the machine.

WARRANTY is provided as part of Geffs Manufacturing Inc. support program for customers who operate and maintain their equipment as described in this manual.

The warranty is explained on the warranty certificate, which is in the Introduction Section.

This warranty provides the assurance that Geffs Manufacturing, Inc. will back its products where defects appear within the warranty period. In some circumstances, Geffs Manufacturing, Inc. also provides improvements, often without charge to the customer, even if the product is out of warranty. Should the equipment be abused, or modified to change its performance beyond the original factory specifications, the warranty will become void and improvements may be denied. Setting fuel delivery above specifications or otherwise overpowering the machine will result in such action.

An extended warranty program is also available through Geffs Manufacturing, Inc.

 WARNING: THE MODEL BM624 IS A PIECE OF CONSTRUCTION EQUIPMENT. IT IS NOT MANUFACTURED PRIMARILY FOR USE ON OPEN PUBLIC STREETS OR HIGHWAYS NOR IS IT TO BE CONSIDERED SUITABLE FOR USE AS A MOTOR VEHICLE TO BE OPERATED OR USED ON PUBLIC STREETS, ROADS OR HIGHWAYS BY ANYONE WITHOUT FIRST ASSURING THAT ALL APPLICABLE SAFETY REQUIREMENTS AND PRECAUTIONS REQUIRED BY LAW OF SUCH USE HAVE BEEN MET.

Contents

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Serial Numbers:

Spreader # _____

Fixed Hopper # _____

Expandable Hopper # _____

Sliding Hopper # _____

Side Delivery Conveyor # _____

Side Delivery Blade # _____

Engine # _____

Transmission # _____

Front Axle # _____

Rear Axle # _____

Section 1

Safety

This section provides information about general and specific safety practices and procedures. Always follow good safety practices and procedures. Carefully read all safety messages in this manual and on your machine safety signs.

RECOGNIZE SAFETY INFORMATION

This is the safety-alert symbol. When you see this symbol on your machine or in this manual be alert to the potential for personal injury.

Follow recommended precautions and safe operating practices.

UNDERSTAND SIGNAL WORDS

A signal word - DANGER, WARNING, or CAUTION - is used with the safety-alert symbol.

DANGER indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.

WARNING indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury, and includes hazards that are exposed when guards are removed.

CAUTION indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury.

DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs.

WARNING or CAUTION also call attention to safety messages in this manual.

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.

WEAR PROTECTIVE CLOTHING

Wear close fitting clothing and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.

FOLLOW SAFETY INSTRUCTIONS

Carefully read all safety messages in this manual and on your machine safety signs. Keep safety signs in good condition. Replace missing or damaged safety signs. Be sure new equipment components and repair parts include the current safety signs. Replacement safety signs are available from Geffs Manufacturing, Inc.

Learn how to operate the machine and how to use controls properly. Do not let anyone operate without instructions.

Keep your machine in proper working condition. Unauthorized modifications to the machine may impair the function and/or safety and affect machine life.

If you do not understand any part of this manual and need assistance, contact Geffs Manufacturing, Inc.

DRIVING THE CHIP SPREADER

Operate chip spreader only when all guards are in their correct position.

Before driving away, check immediate vicinity of machine for bystanders. Use the horn as a warning immediately before driving away.

Riders are subject to injury such as being thrown off the machine. Riders also obstruct the operator's view resulting in the machine being operated in an unsafe manner.

USE SAFETY LIGHTS AND DEVICES

Slow moving self-propelled equipment and attachments can create a hazard when driven on public roads. They are difficult to see, especially at night. Avoid personal injury or death resulting from collision with a vehicle.

Whenever driving on public roads, use flashing warning lights and turn signal according to local regulation. To increase visibility, use the lights and devices provided with your machine.

Keep safety items in good condition. Replace missing and damaged items.

WORK IN VENTILATED AREA

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.

WORK IN CLEAN AREA

Before starting a job:

Clean work area and machine.
Make sure you have all necessary tools to do your job.
Have the right parts on hand.
Read all instructions thoroughly. Do not attempt shortcuts.

ILLUMINATE WORK AREA SAFELY

Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

USING HIGH-PRESSURE WASHERS

IMPORTANT: Directing pressurized water at electronic/electrical components or connectors, bearings and hydraulic seals, fuel injection pumps or other sensitive parts and components may cause product malfunctions. Reduce pressure, and spray at a 45° or 90° angle.

USE PROPER LIFTING EQUIPMENT

Lifting heavy components incorrectly can cause severe injury or machine damage.

Follow recommended procedure for removal and installation of components in the manual.

USE PROPER TOOLS

Use tools appropriate to the work. Makeshift tools and procedures can create safety hazards.

Use power tools only to loosen threaded parts and fasteners.

For loosening and tightening hardware, use the correct size tools. DO NOT use U.S. measurements tools on metric fasteners. Avoid bodily injury caused by slipping wrenches.

Use only service parts meeting Geffs Manufacturing, Inc. specifications.

USING SPECIAL TOOLS

Faulty or broken tools can result in serious injury. When constructing tools, use proper, quality materials and good workmanship.

Do not weld tools unless you have the proper equipment and experience to perform the job.

SUPPORT MACHINE PROPERLY

Always lower the attachment to the ground before you work on the machine. If you must work on the lifted machine or attachment, securely support the machine or attachment.

Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.

HANDLE FLUIDS SAFELY - AVOID FIRES

When you work around fuel, do not smoke or work near heaters or other fire hazards.

Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.

Fill fuel tank outdoors.

Make sure machine is clean of trash, grease and debris. Always clean up spilled fuel.

Do not store oily rags. They can ignite and burn spontaneously.

PREVENT BATTERY EXPLOSIONS

Keep sparks, lighted matches, and open flame away from the top of battery. Battery gas can explode.

Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer.

Do not charge a frozen battery, it may explode. Warm battery to 16°C (60°F).

PREVENT ACID BURNS

Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed in eyes.

Avoid the hazard by:

1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Using proper jump start procedure.

If you spill acid on yourself:

1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid on skin.
3. Flush your eyes with water for 15-30 minutes. Get medical attention immediately.

If acid is swallowed:

1. Do not induce vomiting.
2. Drink large amounts of water or milk, but do not exceed 2 quarts (2 L).
3. Get medical attention immediately.

AVOID HEATING NEAR PRESSURIZED FLUID LINES

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area.

AVOID HIGH-PRESSURE FLUIDS

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluid.

If an accident occurs, see a doctor immediately. Any fluid injected in the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source.

HANDLE CHEMICAL PRODUCTS SAFELY

Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with Geffs Manufacturing, Inc. equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products, physical and health hazards, safety procedures, and emergency response techniques.

Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

Contact Geffs Manufacturing, Inc. for MSDS's on chemical products used with Geffs Manufacturing, Inc. equipment.

REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Do all work outside or in a well-ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating.

If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.

If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

AVOID CONTACT WITH MOVING PARTS

Keep hands, feet and clothing away from power driven parts. Never clean, lubricate or adjust machine when it is running.

PRACTICE SAFE MAINTENANCE

Understand service procedure before doing work.

Never lubricate, service or adjust machine while it is moving. Keep hands, feet, and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Stop the engine. Remove the key. Allow machine to cool.

Securely support any machine elements that must be raised for service work.

Keep all parts in good condition and properly installed. Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil or debris.

Disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

SERVICE COOLING SYSTEM SAFELY

Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to the first stop then relieve the pressure before removing completely.

DISPOSE OF WASTE PROPERLY

Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with Geffs Manufacturing, Inc. include such items as oil, fuel, coolant, filters, and batteries.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone in drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center.

Section 2

Descriptions

Self-propelled Chip Spreader

The Geffs Manufacturing, Inc. Chip Spreader is self-propelled and is specifically designed to apply most types of aggregate, coated or uncoated, in a smooth even spread on roads and highways.

The computer application rate system (C.A.R.S) insures that the chip spreader will apply an even amount of aggregate on roads and highways at any given speed, whether you are traveling uphill or downhill.

The basic machine consists of a chassis and engine, a power shift transmission, brakes, tires and wheels, hydraulic power steering, conveyors, hydraulic system and front and rear hoppers.

The machine serial number location is on the forward left side. The serial number for the front hopper is located on the left side of the hopper.

Model BM624 indicates that this machine is a model with 24 inch conveyor belts and a 6.5 cubic yard struck capacity rear hopper.

Serial number example (020312)

02 - represents the year the machine was built.
03 - represents the month the machine was built.
12 - represents the number of the machine that was manufactured.

WARNING: Always keep hands, feet and clothing away from power driven parts. Never clean, lubricate or adjust machine when it is running.

Keep your machine in proper working condition.

Operate chip spreader only when all guards are in their correct position.

Computer Application Rate System (C.A.R.S)

The following is a brief description of the computer rate application. Please refer to the C.A.R.S. Manual for complete details.

Geffs Manufacturing, Inc. computer rate application system will control the gates and allow the operator to apply aggregate on the roadway more efficiently, with greater operator ease and less material waste. The operator simply enters the amount of aggregate wanted on the roadway into the keypad in pounds per square yard and the computer maintains that amount.

This system constantly monitors the machine's ground speed and adjusts the front hopper gates accordingly to maintain a constant amount of aggregate being deposited on the roadway. The system will automatically adjust gates for changes in acceleration. Thus it maintains the proper amount of material and reduces waste from over and under compensation. The operator will be able to operate the machine with greater ease and more efficiency because he will not have to manually control the rate of flow from the front hopper.

The display shows the operator the current application setting (pounds per square yard), ground speed, trip distance, and total distance accumulated.

The keypad allows the operator to calibrate the system as well as change the application rate setting (pounds per square yard), and reset the trip and total distance. The application rate setting (pounds per square yard) can be changed at any time and the flow rate and width will self-adjust instantly for the new setting.

The auto/manual switch changes the operation of the front hopper gates from computerized rate control to manual operation.

1. With the auto/manual switch in manual mode the open/closed switch simply opens or closes the gates.

2. With the auto/manual switch in auto mode the open/closed switch, when depressed, will open the front hopper gates and the computer system will control application rates.

The gate clear switch will cause the gates to quickly open completely and then close to the original position resuming the computerized rate control. This feature is for passing a large stone, sticks or etc., functional only in auto mode.

Hydraulic System

The Geffs Manufacturing, Inc. Chip Spreader is equipped with four (4) hydraulic pumps. The power to the pumps is supplied by a P.T.O. drive shaft connected to the crank shaft on the front of the engine. One pump is located on the rear of the transmission.

The first two (2) pumps nearest the engine are the conveyor drive pumps, which share a common charge pump. These pumps are hydrostatic type pumps. They each drive a low speed high torque hydraulic motor, which are the conveyor drive motors. Each conveyor can be operated manually with a control handle located at the right-hand forward operators station. The conveyor drive pumps have a pressure setting of 4012 psi.

The Geffs Manufacturing, Inc. Chip Spreader also comes with a one man operation system. This allows the conveyors the option of running fully automatic. The one man operation consists of two (2) air cylinders attached to the pump mount bracket and the swash plate lever arms on the conveyor drive pumps. There are two (2) switches located below the discharge end of each conveyor, which will shut off the conveyors when the front hopper fills to the desired aggregate level. Once the aggregate level in the front hopper drops, the switch will restart the conveyor and refill the front hopper to the desired aggregate level. Each conveyor works independently of the other.

The remaining pumps are used for the hopper drive circuit, steering, truck hitch and the gate opening valve. These pumps are pressure compensated, with the maximum pressure set at 2200 psi. The oil flows from the pump through a distribution manifold to each system. Each system has an orifice or flow control, which only allows the proper amount of flow to that system. By restricting the flow to each system with the orifice, this allows ample fluid to run each system independently or all at the same time and does not over speed the systems.

The hydraulic tank has an oil capacity of 50 gallons with a magnetic dip stick and two (2) 10 micron filters. A hydraulic cooler cools the return fluid to ensure the total system will not over heat even in hot weather.

WARNING: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic lines. If accident occurs, see a doctor immediately.

Aggregate Handling System

The model BM624 incorporates two (2) 24 inch conveyor belts. The function of the two conveyor belts is to transport materials from the rear hopper into the front hopper. These belts are also independently controlled by hydrostatic pumps that have a built in pressure relief valve set at 4012 psi. There are 8 troughing idlers in each conveyor, 4 return rolls, self cleaning tail pulley, head pulley, belt wiper and full length rubber side lining. Each conveyor is rated at 1500 tons per hour.

The rear receiving hopper on the BM624 has a struck capacity of 6 1/2 cubic yards with rubber skirting to prevent spillage. The rear hopper has two (2) 24 x 60 inch openings, one over each conveyor. A grate covering each opening allowing aggregate size of 1 1/2 inch maximum to fall on the conveyor.

WARNING: Always stay clear and do not stand in hoppers when engine is running. Conveyors can turn on automatically and cause injury or death.

Always keep hands, feet and loose clothing away from power driven parts.

Use extreme caution when adjusting conveyor belts. Serious injury or death can occur.

Front Hoppers

Geffs Manufacturing, Inc. offers four (4) kinds of front hoppers. All the hoppers are attached to the front of the machine. They are held to the chip spreader on a seat that interlocks with a lip on the rear edge of the hopper. The hoppers also are held in place by two (2) snap pins, one on each side of the conveyor frame. The pins are spring loaded and with a half turn will snap out to secure the hopper.

FIXED WIDTH COMPUTER RATE HOPPER - This hopper comes in several widths, from 10 feet to 16 feet 6 inches wide, in 6 inch increments. The hopper spread width can be set from 6 inches to the maximum width of the hopper. Each gate has a handle linkage attached to it. This linkage is used to shut the gate, or open the gate to the metered opening (located on the front of the hopper). The hopper also has a metering shaft that controls the application rate for all the gates (if handle linkage is attached to it). The hopper has a rotating agitator and a spread-roll that is driven by a hydraulic motor at a constant speed.

FIXED WIDTH COMPUTER CONTROLLED HOPPER - This hopper comes in several widths, from 10 feet to 16 feet 6 INCHES wide, in 6 inch increments. The hopper spread width can be set from 12 inches to the maximum width of the hopper. Each gate has an air cylinder that will open or close the gate. The gates can be closed with a switch to adjust the drop width of the hopper (12 inch increments). A metering shaft controls the opening and closing of the gates, which controls the application rate.

EXPANDABLE HOPPER - This hopper comes in two (2) sizes. One with an operating width of 10 feet expandable to 17 feet 6 inches. The other hopper has an operating width of 11 feet 6 inches expandable to 20 feet. The expandable sections have two sizes of removable gates, 12 inches and 9 1/2 inches. By arranging the gates, the width can be adjusted in 6 inch increments. Each gate has an air cylinder that will open or close the gate. The gates can be closed or opened with a switch to adjust the drop width of the hopper while in operation. A metering shaft controls the opening and closing of the gates, which controls the application rate.

TWIN HOPPER SYSTEM – This hopper comes in four (4) sizes: 9'–18', 10'–20', 11'-22', 12'-24'. This hopper has two (2) independent fixed width hoppers. Each hopper has a spread width of 1 foot to 12 feet starting at the center of the machine. The hoppers move in opposite directions giving a spread width of 1 foot to 24 feet. Each hopper spread width can be adjusted on the go with continues aggregate application. This feature gives the hopper any possible width setting from 1 foot to 24 feet. The hoppers have 12 inch and 6 inch gates. Each gate has an air cylinder that will open or close the gate. The gates can be closed or opened with a switch to adjust the drop width of the hopper while in operation. A metering shaft controls the opening and closing of the gates, which controls the application rate. Each hopper has a rotating auger, agitator and spread-roll that are driven by hydraulic motors at a constant speed.

WARNING: Always keep hands, feet and clothing away from power driven parts. Never clean, lubricate or adjust machine when it is running.

Keep your machine in proper working condition.

Operate chip spreader only when all guards are in their correct position.

Never stand in front of the hopper when machine is running. Serious injury or death can occur.

Never stand in or on top of hopper when the engine is running or machine is in operation. Serious injury or death can occur.

Side Delivery Conveyor

The side delivery conveyor is a cross conveyor that is mounted in place of the front spread hopper. It is attached to the front of the machine using the same mounts as the spread hopper. The side delivery can be adjusted to deliver the chips or rock at different distances

from the left side of the chip spreader. The purpose of the side delivery conveyor is to widen the shoulder of the road.

Side Delivery Blade

The side delivery blade will grade the chips or rock flat. The blade is adjustable up and down and with another adjustment to angle the blade. The blade can be set at a fixed height or set to float with the road surface. The rake angle is adjusted by a fixed link bolted to the desired rake angle. When the blade is not used, it will pivot along side the chip spreader.

Section 3

Specifications

A. General

Diesel Engine - 220 hp

Transmission - Power shift (2 wheel drive and 4 wheel drive)
6 gears forward
3 gears reverse

Axles Options -
Front - Steerable drive with 17.00 x 4.00 drum brakes (air activated hydraulic) 12 bolt wheels.
- Steerable Non-drive with 15.00 x 4.00 drum brakes (air activated hydraulic) 10 bolt wheels.

Rear - Drive with 16.50 x 7.00 drum brakes (air s-cam) 12 bolt wheels.
- Non-drive with 16.50 x 7.00 drum brakes (air s-cam) 10 bolt wheels

Tires and Pressures -

11.00 x 20 Smooth Compactor	Tire pressure – 100 psi
385/65R x 22.5 Highway tread	Tire pressure – 120 psi

Conveyors -
Belt - 4 ply, 24” wide, 37’8” length
Rating - 1500 tons per hour
Drive system pressure - 4012 psi
Speed – 0 to 800 Feet per minute

Hopper drive system pressure - 2200 psi

Electrical system - 12 volts DC and 24 volts DC

Steering - hydraulic power

Lighting - Safety strobe, brake, turn and emergency flashers

B. Capacities

Fuel tank - - - - - - - 85 gallons

Hydraulic tank - - - - - - - 60 gallons

Engine capacities - - - see engine manual

Coolant - - - - 8 gallons (60/40 mix)

Transmission - - - see transmission manual

Axle lubrication - - - see axle manual

Brake hydraulic system - - - - - 1 quart

Rear receiving hopper - - - - 6 1/2 cu yards

Front hoppers - - - - 0.12 cu yards per foot of hopper width (each twin hopper)

C. Dimensions

Spreader

Weight - - - - - - 22,120 lb. with front hopper
- 17,250 lb. with no hopper

Shipping height - - - - 9’ 2”

Shipping width (without front hopper) - - - - - 10’ 6”

Shipping length (without front hopper) - - - - 21’ 9”

Shipping length (with front expandable hopper) - - - - 24’ 9”

Shipping length (with front twin hopper) - - - - 25’ 3”

Wheel base (center to center)

Length - - - - 11’ 2 1/4”

Front axle width (center of tire to center of tire) - - - - 6’ 10 5/8”

Rear axle width (center of tire to center of tire) - - - - 7’ 8 1/2”

Hoppers	Weight	Shipping Height	Shipping Width	Shipping Length
Fixed width computer rate hopper				
10’		4’ 1”	4’ 2”	11’
10’ 6”		4’ 1”	4’ 2”	11’ 6”
11’		4’ 1”	4’ 2”	12’
11’ 6”		4’ 1”	4’ 2”	12’ 6”
12’		4’ 1”	4’ 2”	13’
12’ 6” ”		4’ 1”	4’ 2”	13’ 6”
13’		4’ 1”	4’ 2”	14’
13’ 6” ”		4’ 1”	4’ 2”	14’ 6”
14’		4’ 1”	4’ 2”	15’
14’ 6” ”		4’ 1”	4’ 2”	15’ 6”
15’		4’ 1”	4’ 2”	16’
15’ 6” ”		4’ 1”	4’ 2”	16’ 6”
16’		4’ 1”	4’ 2”	17’
16’ 6” ”		4’ 1”	4’ 2”	17’ 6”
Fixed width computer controlled hopper				
10’	2100	4’ 6”	4’ 1”	10’ 4”
10’ 6”	2200	4’ 6”	4’ 1”	10’ 10”
11’	2310	4’ 6”	4’ 1”	11’ 4”
11’ 6”	2415	4’ 6”	4’ 1”	11’ 10”
12’	2520	4’ 6”	4’ 1”	12’ 4”
12’ 6”	2625	4’ 6”	4’ 1”	12’ 10”
13’	2730	4’ 6”	4’ 1”	13’ 4”
13’ 6”	2835	4’ 6”	4’ 1”	13’ 10”
14’	2940	4’ 6”	4’ 1”	14’ 4”
14’ 6”	3045	4’ 6”	4’ 1”	14’ 10”
15’	3150	4’ 6”	4’ 1”	15’ 4”
15’ 6”	3255	4’ 6”	4’ 1”	15’ 10”
16’	3360	4’ 6”	4’ 1”	16’ 4”
16’ 6”	3465	4’ 6”	4’ 1”	16’ 10”
Expandable				
17’6”	4350	4’ 6”	5’ 4”	10’ 8”
20’	5315	4’ 6”	5’ 4’	11’ 11”
Twin Hopper System				
9’-18’		6’ 4”	5’ 11”	10’ 8”
10’-20’		6’ 4”	5’ 11”	10’ 10”
11’-22’		6’ 4”	5’ 11”	11’ 10”
12’-24’		6’ 4”	5’ 11”	12’ 10”

Side Delivery	Weight	Shipping Height	Shipping Width	Shipping Length
Conveyor	2600	3’ 6”	4’ 2”	12’
Blade	500	3’	3’	9’

Section 4

Operators Stations

A. Drivers Station Console

B. Right and Left Hand Drivers Station

1. Seat with armrests
2. Steering wheel
3. Turn signal controls
4. Foot brake

C. Right Front Operator's Station

1. Right and left conveyor manual speed control handles (to set speed of conveyors and for manual operation).
2. Auger switches (ON-OFF).
3. Hitch button (OPEN-CLOSE).
4. Deflector adjustment controls (used to diverts a percentage of flow of aggregate to each side)

Section 5

Prestarting Checks

BEFORE STARTING CHECKS

Before starting the engine for the first time each day:

- Visually inspect the entire machine for any damage or required repairs prior to starting the engine.
- Check engine oil level. Do not operate engine when oil level is below mark on dip stick.
- Check coolant level.
- On level ground check hydraulic oil level. Add oil if you need to. Do not overfill.
- Check engine air intake system and element.
- With key on, fuel gauge needle will show the amount of fuel in tank.
- Fuel tank capacity is 50 U S Gallons.
- If dirty fuel has been used, follow the procedure in your engine manual to replace filters and clean the system.
- If engine has not been operated for a long time, see engine manual for starting procedure.
- Grease the machine every 50 hours.

Notes

Section 6

Operating the Chip Spreader

 **CAUTION: When the law requires, make sure that the flashing warning lights are turned on when traveling on, streets, roads or highways.**

A. Starting the Engine

 **CAUTION: Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.**

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.

If you have any problems starting the engine, see the engine manual for the proper way to start your engine.

If you are starting the engine for the first time, refer to the engine manual for information regarding the initial break-in procedure.

Be certain that the transmission is in the neutral position, park brake is set, and all persons are clear of chip spreader before starting engine.

Sound horn before starting engine to clear people away from chip spreader.

1. Move the transmission shifter lever to the **NEUTRAL** position.
2. Turn the park brake switch to the **ON** position.
3. Turn the conveyors to **OFF** position.
4. Turn ignition key clockwise to the **ON** position.
5. Sound horn before starting engine.
6. Move the throttle lever 1/4 above the idle position.

7. Push the **START** button and crank engine until the engine starts.

CAUTION: Do not operate starter motor continuously for more than 30 seconds. Allow starter motor to cool for at least 2 minutes between unsuccessful attempts.

NOTE: If the transmission is not in neutral or the brake foot pedal is engaged, machine **will not start**.

8. Move throttle lever to idle position as soon as engine starts.
9. After engine has started, check all gages for proper response. (Oil pressure gage should be observed within 15 seconds after starting.)

CAUTION: Avoid full throttle operation when engine is cold.

When the chip spreader has set for a long period of time, start the engine and let it idle at the low RPM for 5 minutes minimum. This will allow the hydraulic pump to charge the system.

B. Starting the Engine In Cold Weather

CAUTION: Be cautious when starting the engine in cold weather (below 32°F).

If the temperature is below 10°F, preheat the hydraulic oil to 32°F before starting the engine. This will prevent damage to the hydraulic pumps and motors.

Let the engine idle at the low RPM for 5 minutes minimum. This will allow the hydraulic oil to warm and the hydraulic pump to charge the system.

Check your engine manual before using starter fluid.

If you have any problems starting the engine, see the engine manual for the proper way to prime and start the engine.

C. Stopping the Engine

IMPORTANT: Before stopping an engine that has been operating at working load, idle engine at least 2 minutes (1400 rpm maximum) with no load to cool hot engine parts.

1. Move the transmission shifter lever to the **NEUTRAL** position.
2. Turn the park brake switch to the **ON** position.
3. Turn the conveyor switches to the **OFF** position.
4. Move the throttle lever to **IDLE** position.
5. Turn the key to the **OFF** position.

CAUTION: Remove key from switch to prevent accidents and battery discharge.

D. Steering System

Wheel controls hydraulic power steering through fluid link to cylinders.

WARNING: On models that have dual driver's stations, there can only be one operator steering at a station at any one time. Both steering wheels are live. Failure to comply may result in injury and death.

CAUTION: System does not return front wheels to a straight-ahead position when the operator releases the wheel. When the wheel is released, the wheel will remain in that position.

E. Air Pressure Warning Light

Warning light will light when air pressure is below 60 psi.

WARNING: Do not operate chip spreader if air pressure is below 60 psi. This is what is required to fully activate air brake system. Also, it takes 60 psi to release the park brake. Failure to comply can result in excessive wear of brake pads, injury or death.

F. Conveyor Controls

Auto / Manual

1. Auto / Manual toggle switch located at the operators console is used in the one-man operations mode. When toggle switches are in the manual position, it is the operator in the right hand front operator's station controlling the conveyors and the flow of aggregate into the front hopper.
2. When the toggle switches are in the auto position, the conveyors will respond automatically according to the switches located under the discharge end of each conveyor. As the front hopper fills to the desired setting of the switch, it will shut off automatically.

WARNING: As with all conveyor systems, use extreme caution when working around conveyors. Failure to do so can result in injury or death.

G. Strobe Light

The toggle switch for the strobe light is located at the operator's console. This switch turns the strobe light ON or OFF.

H. Reverse Signal Alarm

The chip spreader is equipped with reverse signal alarm. This alarm automatically sounds when the machine starts to move in reverse.

I. Lighting System

1. Headlights and marker lights toggle switch is located on the operator's console.
2. Turn signal and emergency flashers are located on the steering column. Lift lever to signal right. Move lever down to signal left. Pull hazard lever out to activate emergency flashers.

NOTE: Operation of the turn signal will deactivate emergency flashers.

J. Air Horn

Air horn button is located at the drivers' station console. Push button to activate horn.

NOTE: It is a good safety practice to sound horn before starting the engine. This practice will warn and clear people away from the chip spreader before the chip spreader is started.

K. Cold Start (if equipped)

The cold start button is located at the driver's station console just below the horn button. If the chip spreader is equipped with a cold start system, see the engine manual for the proper use of this system.

L. 4 X 4 (if equipped)

The 4 X 4 switch will engage or disengage the drive.

CAUTION: It is recommended that the machine be at a complete stop before the 4 X 4 drive is engaged.

M. Tachometer

Shows the engine speed in 100 rpm increments.

N. Hour Meter

Indicates hours in tenths that engine has been operated.

P. Engine Oil Pressure

Indicates the engine oil pressure.

Q. Engine Water Temperature Gage (coolant)

Normal operating temperature should be between 165° and 195° F.

CAUTION: Do not operate engine over 225° F, or engine damage could result.

Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to the first stop then relieve the pressure before removing completely.

R. Volt Meter

Indicates the state of the battery charge, in volts.

S. Fuel Gage

Indicates the level of the fuel in the 50 gallon fuel tank.

T. Hydraulic Oil Temperature Gage

Shows what the hydraulic oil temperature is in the reservoir.

U. Head Baffles

The head baffles are anchored to the upper end of each conveyor. The function of the baffles is to aid in controlling the conveyor material. The head baffle deflectors should be spaced to deflect the material in an even fan shaped cascade along the entire face of the baffle plates.

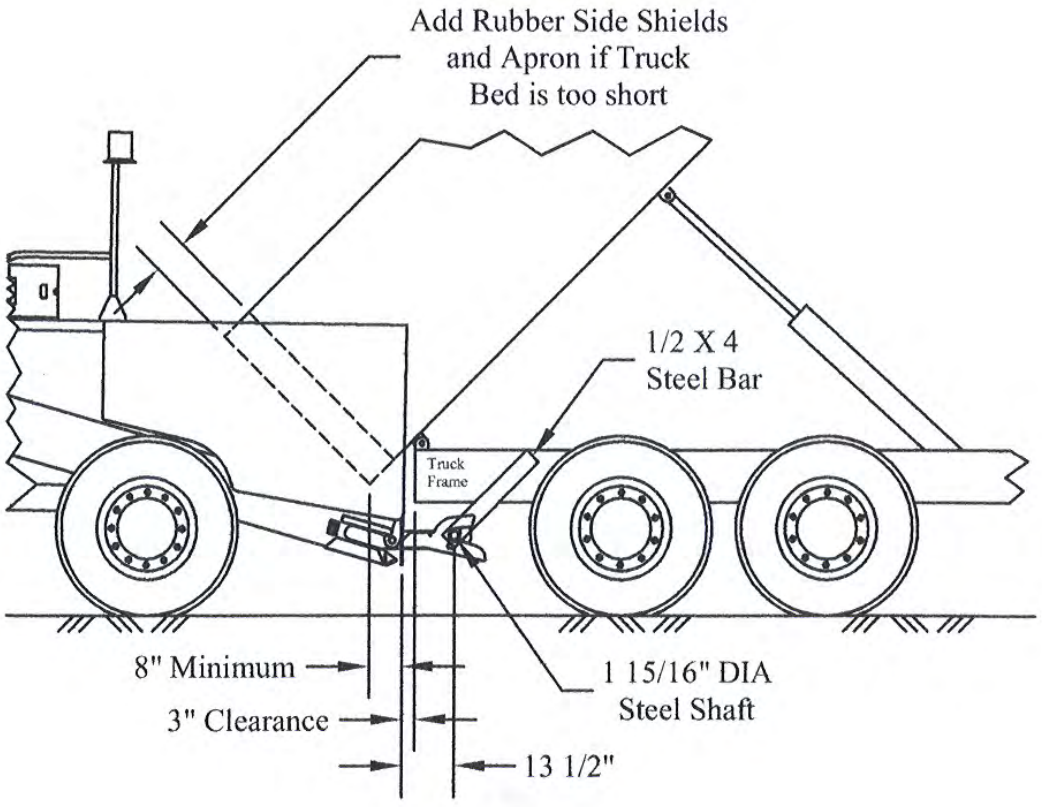
Mounted vertically at the apex of the baffle plates is another deflector plate. The function of this plate is to control the material stream from side to side. On a narrower than full width spread, this vertical deflector must be moved to control the flow of material. The vertical deflector plates are adjusted with a reach rod and locked in place with a twist.

U. Adjusting and Coupling the Truck Hitch

The function of the truck hitch is to provide a means whereby the truck can be held in a close relationship with the rear hopper. The success of the entire spreading operation is directly related to this hook-up, and extreme care should be taken to insure proper hook-up with each truck in your fleet.

1. Adjust the hitch height by using the toggle switch on the console.
2. Move the hitch up or down so the center of the hitch matches the height of the truck's draw bar.
3. Open the hitch and couple the chip spreader and truck together.

The following sketch will aid in adapting individual truck differences to your chip spreader.



DANGER: Never stand between the truck and the rear of the chip spreader while machine and truck are running. Failure to heed this warning may result in injury or death.

CAUTION: Avoid raising the truck bed to high. If truck bed is raised too high and the bed bottoms out on chip spreader receiving hopper truck will lift off the ground. Failure to operate the bed properly will result in damage to the chip spreader truck hitch.

V. Sealing the Truck Bed

The tailgates of all truck beds must sit at least 8 inches inside the hopper retaining skirt when the bed is raised. Variances in the frame length, dump bed overhangs, and rear wheel locations make it necessary to check each bed in relation to the rear hopper of the chip spreader.

On large tandem trucks, the frame, rear wheels, and often the tail gates of the dump bed are usually on the same perpendicular line. In such cases, it is necessary to install bed extensions to insure a proper seal in the dump position. Hitches should be set to allow 3 inches clearance between the truck frame and the bumper of the chip spreader.

If trouble is encountered with spillage while dumping into the rear hopper, check these items:

1. Make sure the tailgate sits inside the rubber skirt on the rear hopper.
2. On large trucks, make sure you have restraining chains on the tailgate.
3. Where restraining chains are used, allow approximately 18 inches of slack in the chains.

W. Towing the Chip Spreader

The Chip Spreader can only be towed for 1 mile at 1 ½ MPH maximum speed.

CAUTION: Do not tow the Chip Spreader for more than 1 mile and above 1 ½ MPH maximum speed. Failure to follow this procedure will result in damage to the transmission! See Meritor manual for towing requirements.

Section 7

Maintenance

CAUTION: Review and follow all safety instructions before performing any maintenance. To prevent injury, never lubricate or service chip spreader, engine, or clean the machine while it is running. Engine must be off, park brake engaged, and key removed.

IMPORTANT: Use hour meter as a guide for servicing the chip spreader. The service times are for average conditions. Service more often if chip spreader is used in extreme conditions.

A. Engine

See the engine maintenance manual for your engine to determine proper service times and procedures.

B. Transmission

See the Funk Transmission Service and Maintenance Manual for proper procedures to check and service the transmission.

C. Axle Hubs, Brakes and Differentials

See the proper axle manual to check, lubricate, repair, and service the axle.

D. Conveyor Belt Adjustment

The belts on the conveyor are pre-adjusted at the factory when the chip spreader is test operated. Final adjustments must be made in the field due to stretching, load variation, side lining drag, etc.

To move the belt to the right, tighten the nut at the top right hand edge of the conveyor frame, raising the return idler. To move the belt to the left, tighten the left hand nut. Care should be used in this adjustment as the belt will respond slowly and over-adjustment can occur. Adjustments should be made with the conveyor belts running and loaded. **Always keep hands and clothing away from the moving belt and rollers.**

To further aid in adjusting the tightness of belts, due to wear and/or to align the tail pulleys, and adjustment may be made at the tail pulleys. To do this tighten the opposite side of the belt that you wish to move. Extreme care should be taken to issue that the belts are running straight and evenly on the head and tail pulleys.

When new belt is installed, loosen the tail pulley adjusters and the adjusters behind the head pulleys. This will give sufficient slack to allow the belt ends to be pulled together without the use of a belt stretcher. When re-tightening the belt, be sure that the belt does not sag excessively between the troughing rolls when loaded.

E. Rubber Conveyor Side Lining Wear

The conveyor side linings are held in place by a channel bolted to the conveyor sides. To adjust or replace the side linings, loosen the 3/8" bolts and lower or remove as desired. To replace, simply insert the new lining under the channel and tighten the hold down bolts.

Care should be taken in installing or adjusting the side lining to insure an even bearing on the conveyor belt. Be very sure the opening remaining on the conveyor belt surface is parallel to the belt or excess spillage and wear will occur.

F. Conveyor Belt Wiper

Immediately under the front of each head pulley is a rubber wiper that touches the conveyor belt. The function of this wiper is to aid in cleaning adhesive particles from the conveyor and to prevent excessive gravel from compiling under the head pulleys when overloading of the hopper occurs. This wiper strip should be replaced or moved up whenever wear causes clearance from the conveyor belt.

G. Conveyor Belt Splices

If a splice is necessary we suggest that the splice be made with Flexco SRB lacing, but any good lacing works. The lacing must fit around a **6 inch** diameter pulley. This is important because too large of a lacing will tear the belt.

H. Front Axle Pivot

Grease the front axle pivot with a good multi-purpose grease bi-weekly or every 25 hours of operation.

IMPORTANT: Clean the bearing zerk and the grease gun nozzle before lubricating the axle pivot.

I. Roller Chains

Roller chains should be kept tight and lubricated. Adjustment of the roller chains is accomplished by moving the idler to tighten the chain. Lubricate the chains every 200 hours with SAE 30 or heavier weight engine oil or an aerosol chain lube.

J. Bearings

The bearings come pre-greased from the manufacturer. Over greasing will damage the seal causing premature bearing failure. When greasing bearings, use good multi-purpose grease, and only pump the grease gun **ONCE** for each bearing. If you see grease coming from the bearing it is over greased. See the Lubrication Maintenance Chart for the service time period to grease each bearing.

IMPORTANT: Clean the bearing zerk and the grease gun nozzle before lubricating the bearing. Over greasing will damage the seal causing premature bearing failure.

K. U-joints

Grease all u-joints once a week or every 50 hours of operation.

IMPORTANT: Clean the bearing zerk and the grease gun nozzle before lubricating the bearing. Over greasing will damage the seal causing premature bearing failure.

L. Bolts

All bolts and nuts should be checked frequently and tightened as necessary.

M. Tire Pressure and Wheel Torque Specifications

Check tires pressure before each season. Tire pressure should be 100 psi for the 11.00 X 20 tire or 120 psi for the 385/65R x 22.5 tire. Torque wheel lug nuts to 450 - 460 foot-pounds. **The wheel lug nuts should be checked daily.**

N. Hydraulic System

CAUTION: Extreme care should be taken to assure that no foreign matter enters your hydraulic system. Always clean off quick disconnects and hoses before coupling. Severe damage may occur to the chip spreader hydraulic system.

Do not use Teflon tape; use a thread sealant.

When the chip spreader has set for a long period of time, start the engine and let it idle at the low RPM for 5 minutes minimum. This will allow the hydraulic pump to charge the system.

There are two types of hydraulic systems used on the chip spreader. One is a hydrostatic system used on the conveyor drives. The second is an open loop system.

The hydrostatic system uses its own charge pump to supply oil to the hydrostatic pumps. The oil that is supplied to the charge pump is filtered before it enters the charge pump. This filter is located on the reservoir.

The open loop system supplies oil to run the steering, front hopper motors, and all cylinder operations. The oil is supplied from the reservoir to the pump. The reservoir is located at the front of the machine and is accessed from the deck lid that pivots up to reveal the reservoir.

There is an oil cooler in the oil return line. The oil cooler, located close to the reservoir, cools the return oil by allowing air to move over the cooling fins. This allows the oil to be cooled down before it enters the reservoir. Remove all dirt and trash from the cooler. If this is not done the cooler will not work properly.

IMPORTANT: The oil that is used in the system is high quality hydraulic oil (ISO 32). See the Lubrication Chart for different brands of oil that can be used.

O. Towing the Chip Spreader

The Chip Spreader can only be towed for 1 mile at 1 ½ MPH maximum speed.

 **CAUTION: Do not tow the Chip Spreader for more than 1 mile and above 1 ½ MPH maximum speed. Failure to follow this procedure will result in damage to the transmission!**

Notes

Section 8

Lubrication Chart

Geffs Manufacturing, Inc. uses only Pennzoil products for their lubrication needs. The following list is a competitive cross-reference list for these Pennzoil products. Other brands of lubricant can be used if it meets the same standard as the brands listed below. Hydraulic oil must meet the ISO 32 standard. Transmission oil must be J20C Compliant.

Always use a good quality of multi-purpose grease to lubricate bearings, u-joints, and axle pivot.

Brands	Hydraulic System	Engine Oil	Axle Oil	Trans. Oil	Brake Fluid
Pennzoil	AW 32 ISO 32	SAE 15W-40	SAE 80W90 GL5	Dexron-III ATF	DOT 3
Amoco	AW 32	SAE 15W-40	SAE 80W90	Dexron-III ATF	DOT 3
Chevron	AW Hydraulic Oil 32	SAE 15W-40	SAE 80W90	Dexron-III ATF	DOT 3
Conoco	Super Hydraulic Oil 32	SAE 15W-40	SAE 80W90	Dexron-III ATF	DOT 3
Exxon	Nuto H 32	SAE 15W-40	SAE 80W90	Dexron-III ATF	DOT 3
Gulf	Universal Tractor Fluid	SAE 15W-40	SAE 80W90	Dexron-III ATF	DOT 3
Mobil	AW Hydraulic Oil 32	SAE 15W-40	SAE 80W90	Dexron-III ATF	DOT 3
Quaker State	Tractor Hydraulic/ Transmission	SAE 15W-40	SAE 80W90	Dexron-III ATF	DOT 3
Texaco	Rando HD 32	SAE 15W-40	SAE 80W90	Dexron-III ATF	DOT 3
Valvoline	AW Hydraulic Oil 32	SAE 15W-40	SAE 80W90	Dexron-III ATF	DOT 3
Synthetic Pennzoil	AWX MV32 Hydraulic Oil	15/40 Synthetic Blend	75/90 GL-5 Synthetic	Hydra-Tranz	DOT 34

Lubrication Maintenance Schedule

Maintenance Schedule	New After 40 Hours	Daily	Bi-Weekly Every 25 Hours	Weekly or Every 50 Hours	Yearly or Every 250 Hours	See Product Manual For Time	If Over Heats
Engine Oil Level Check		X			X		X
Engine Radiator Level Check		X			X		X
Transmission Oil Level Check	X			X	X		X
Axle Differential Level Check	X			X	X		X
Axle Hubs Level Check	X			X	X		X
Hydraulic Tank Oil Level Check	X			X	X		X
Engine Oil & Filter Change	X				X	X	X
Transmission Oil & Filter Change	X				X	X	X
Hydraulic Filters Change	X				X		X
Hydraulic Oil Change	X				X		X
Hitch Bearings Grease					X		X
Other Bearings Grease				X	X		X
Front Axle Pivot Grease			X		X		
PTO U-joints Grease				X	X		
Air Dryer Filter					X		

Section 9

Trouble Shooting

CAUTION: Review and follow all safety instructions before performing any maintenance. To prevent injury, never lubricate or service chip spreader, engine or clean the machine while it is running. Engine must be off, park brake engaged, and key removed.

Extreme care should be taken to assure that no foreign matter enters your hydraulic system. Always clean off quick disconnects and hoses before coupling. Severe damage may occur to the chip spreader hydraulic system.

Do not use Teflon tape: use thread sealant.

Do not tow the Chip Spreader for more than 1 mile and above 1 ½ MPH maximum speed. Failure to follow this procedure will result in damage to the transmission!

A. Engine

If there are any problems with the engine or it needs servicing, refer to the manufacture's manual for the proper maintenance and trouble shooting procedures. If you need assistance contact your local engine dealer or Geffs Manufacturing, Inc.

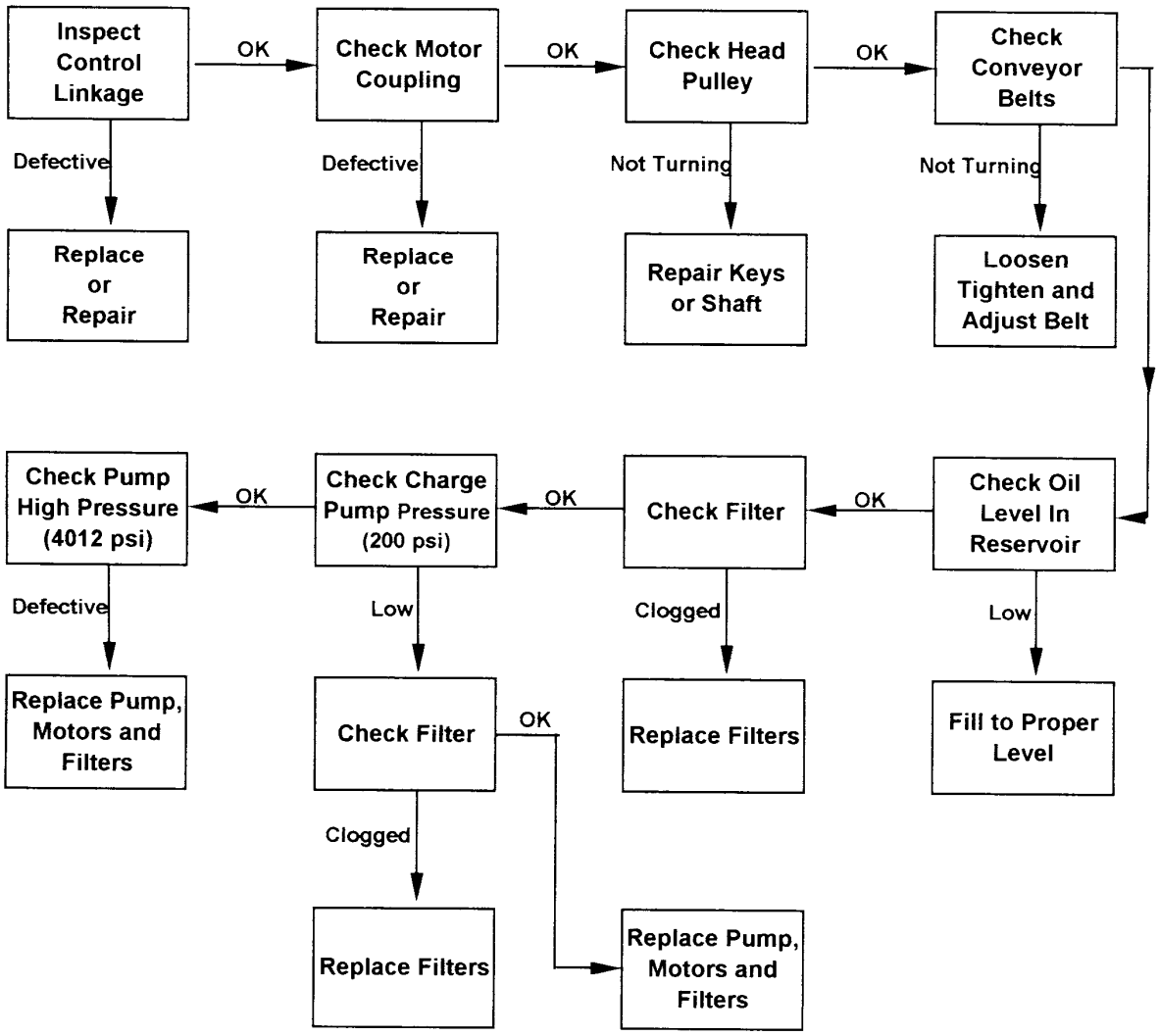
B. Transmission

If there are any problems with the transmission or it needs servicing, refer to the Funk manual for the proper maintenance and trouble shooting procedures. If you need assistance contact your local John Deere Funk dealer or Geffs Manufacturing, Inc.

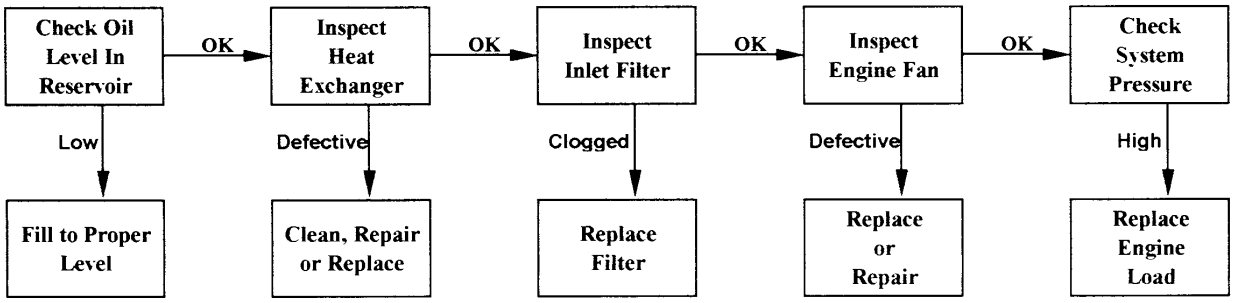
C. Axles

If there are any problems with the axles or if they needs servicing, refer to the manufacture's manual for the proper maintenance and trouble shooting procedures. If you need assistance contact Geffs Manufacturing, Inc.

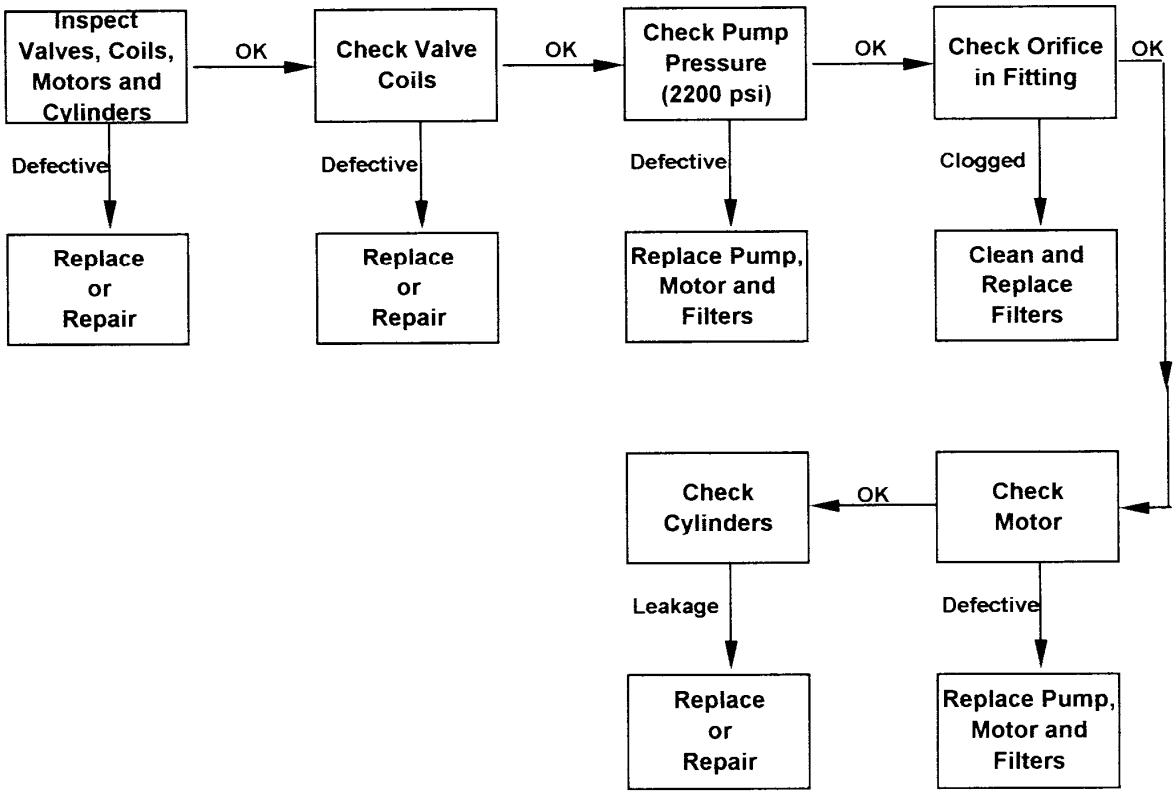
D. Conveyor Hydraulic Drive System



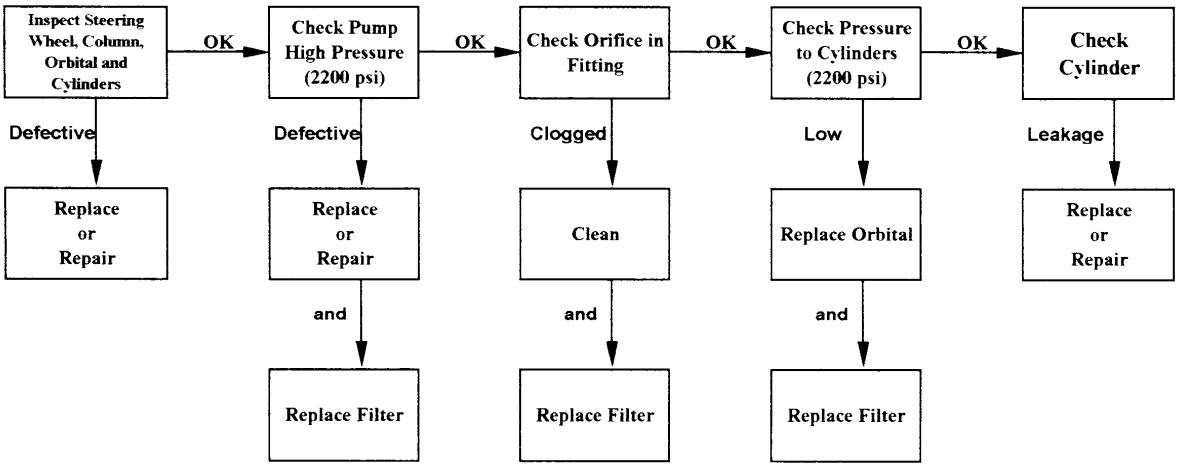
E. System Operating Hot



F. Hopper Drive, Truck Hitch and Gate Control Hydraulic System



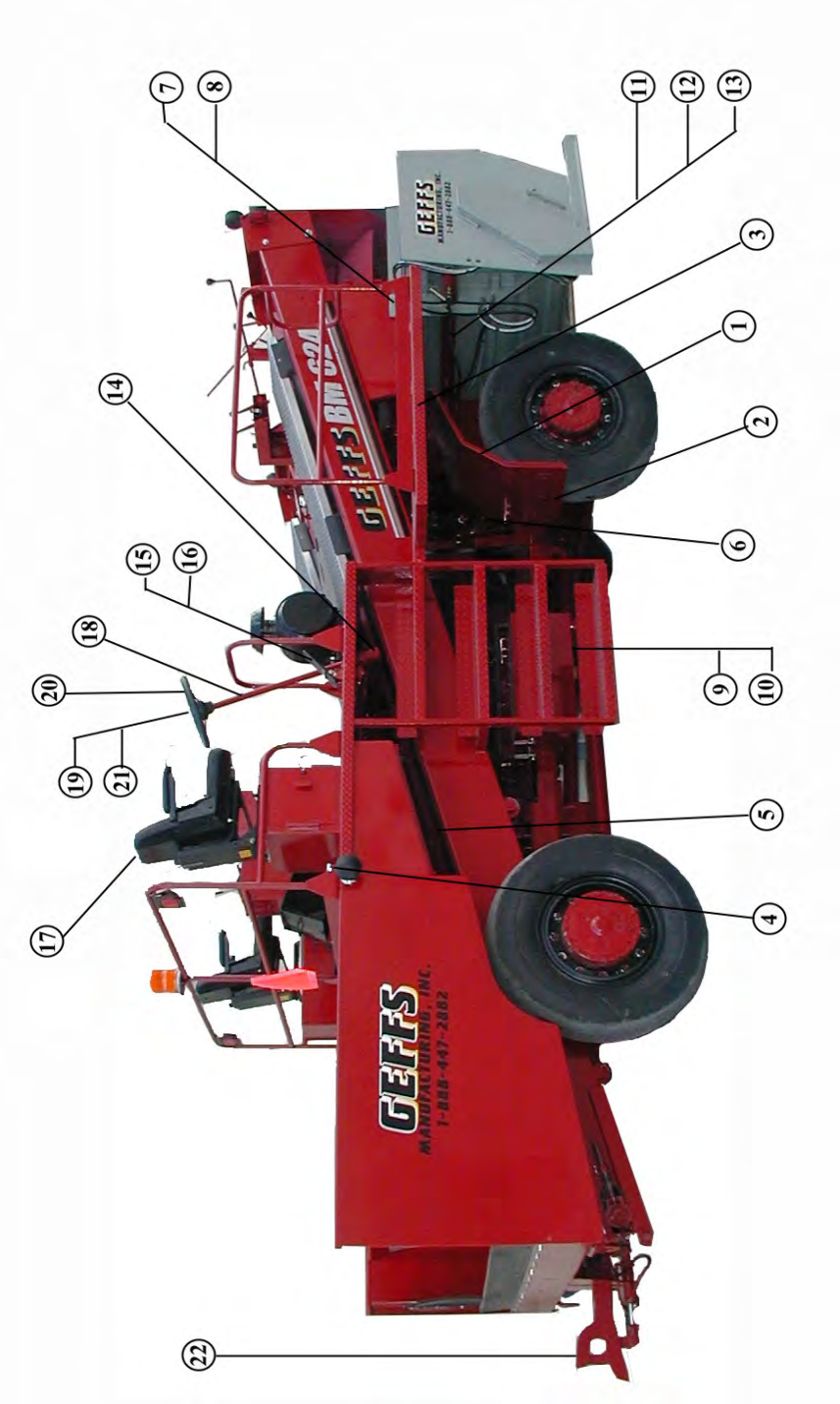
G. Power Steering Hydraulic System



Section 10

Parts List

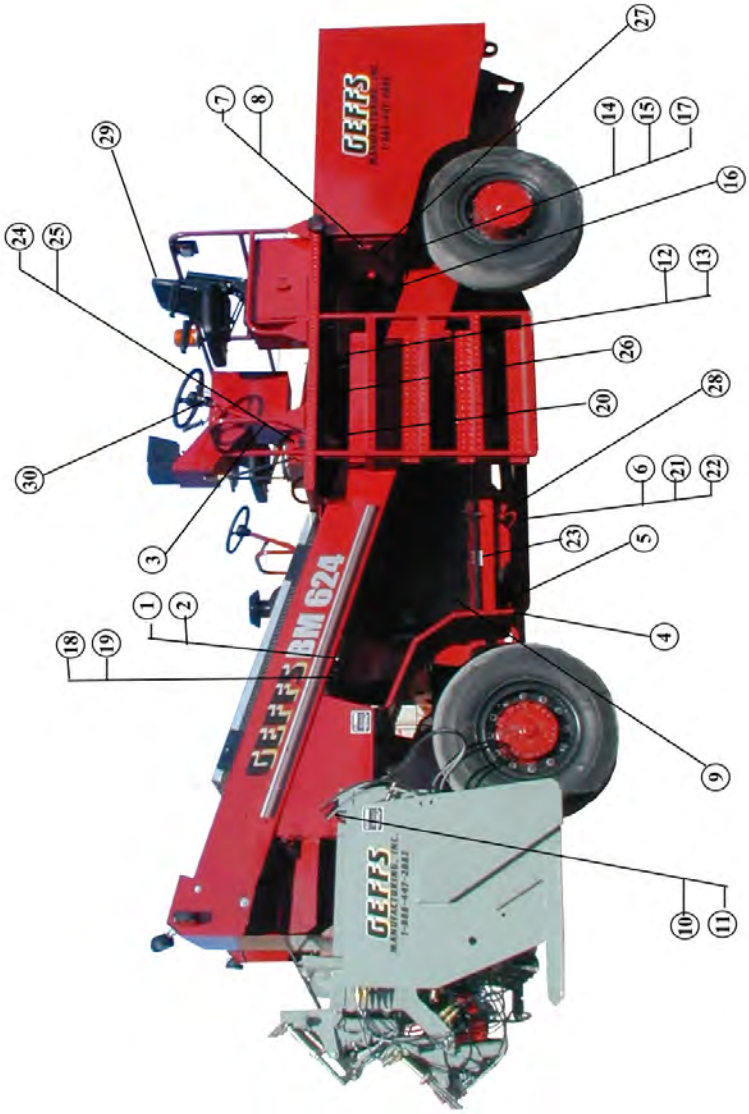
Right Hand Side



Right Hand Side

ITEM NO.	PART NO.	DESCRIPTION	NO. REQ.	REMARKS
1	50273	Fender, Front	2	
2	50381	Fender Bracket	2	
3	60021	Extended Front Deck Assembly	1	
4	80136	Locking Fuel Cap	1	
5	60092	Fuel Tank Assembly	1	Complete
	80127	Belting	2	
	60026	Fuel Level Sensor	1	
6	60218	Right Hand Safety Screen	1	
7	80018	Compression Spring	1	
8	50031	Hopper Hinge Pin	1	
9	80031	Battery 12V	2	
10	80032	Battery Holddown	2	
11	80207	Air Reservoir Bracket	4	
12	80208	Air Reservoir Tank	3	
13	80345	Quick Relief Valve	3	
14	80321	Steering Orbital - 4X4 only	2	
	80474	Steering Orbital - 2 X 4 only	2	
15	80308	Treadle Valve	1	
16	80301	Foot Operated Valve	1	
17	80020	Seat with Arm Rest	2	
18	80269	Steering Column	2	
19	80021	Steering Wheel Cap	2	
20	80022	Steering Wheel	2	
21	80270	Steering Wheel Hex Nut	2	

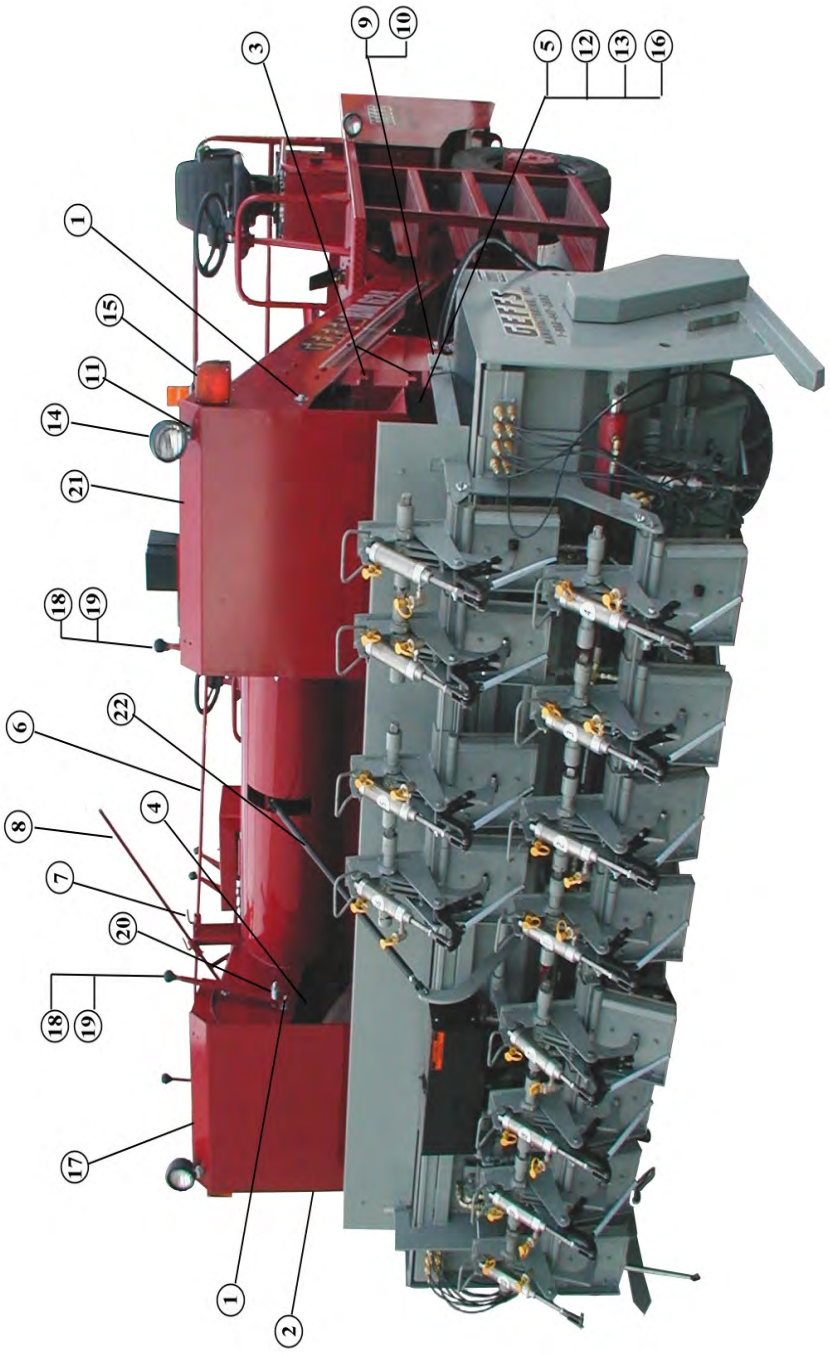
Left Hand Side



Left Hand Side

ITEM NO.	PART NO.	DESCRIPTION	NO. REQ.	REMARKS
1	50179	Gate Indicator Assembly	1	
2	60320	Gate Indicator Weld	1	
3	80269	Steering Column	2	
4	50273	Front Fender	1	
5	50381	Fender Bracket	1	
6	50569	Master Cylinder Plate	1	
7	60292	Terminal Box Assembly	1	Complete
	60026	(see Terminal Box Assembly)		
8	60105	Terminal Box Door	1	
9	60219	Left Hand Safety Screen	1	
10	50031	Hopper Hinge Pin	1	
11	80018	Compression Spring	1	
12	80306	Air Horn	1	
13	80307	Air Solenoid for Air Horn	1	
14	80207	Air Reservoir Bracket	4	
15	80208	Air Reservoir Tank	3	
16	80341	Petcock - Air	1	
17	80345	Quick Relief Valve	3	
18	80296	Indicator Width Cable	1	
19	80035	1/4" Clevis	2	
20	80321	Steering Orbital - 4 X 4 only	2	
	80474	Steering Orbital - 2 X 4 only	2	
21	80312	36" Master Cylinder	1	
22	80342	Miniature Air Regulator	1	
23	80318	Caution Brake Fluid Only Decal	1	
24	80308	Treadle Valve	1	
26	80309	Dual Control Check Valve	1	
27	80212	Air Check Valve	1	
28	80305	Air Dryer Assembly	1	
29	80020	Seat with Arm Rest	2	
30	60254	Trun Signal Assembly	1	

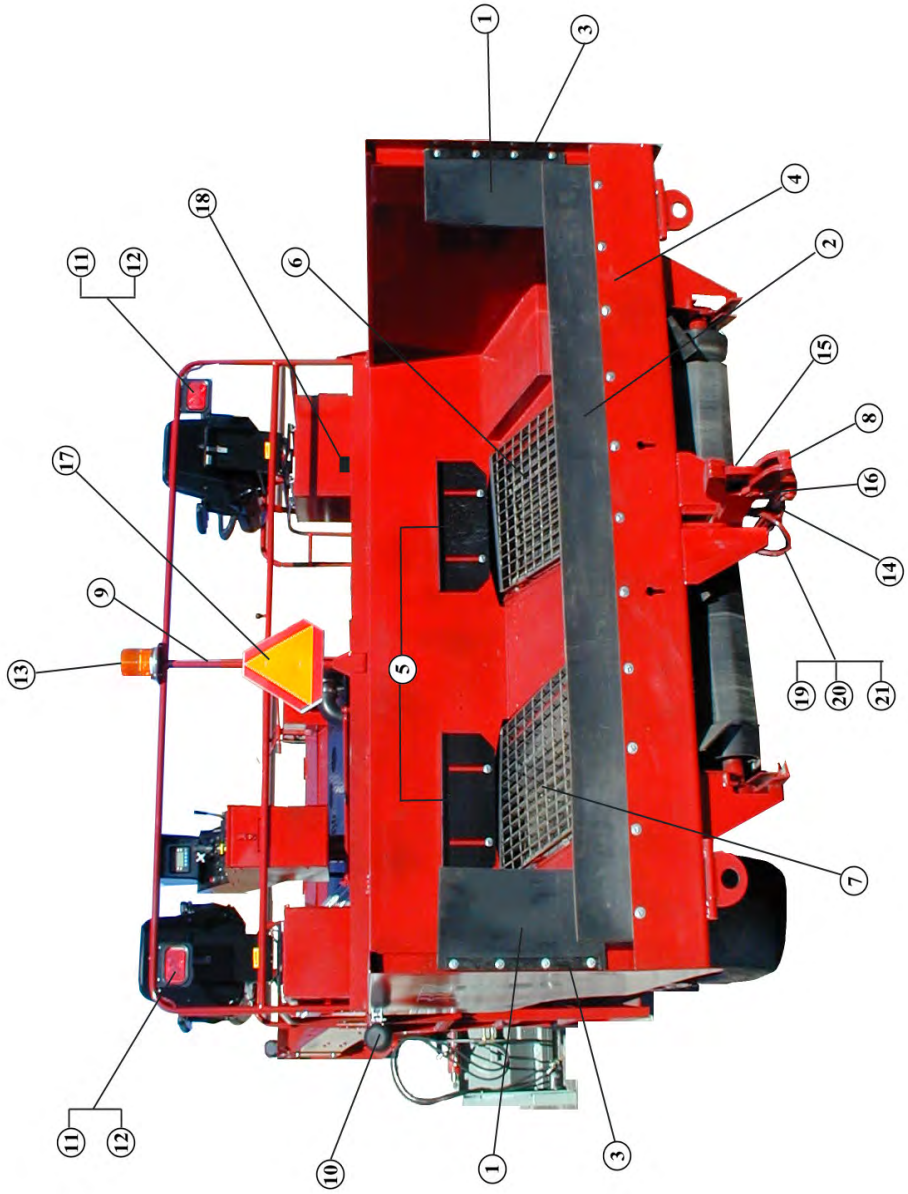
Front



FRONT

ITEM NO.	PART NO.	DESCRIPTION	NO. REQ.	REMARKS
1	50206	Head Baffle Bushing	4	
2	60073	Right Hand Baffle Extension	1	
3	60074	Left Hand Baffle Extension	1	
4	60106	Level Switch Paddle Assembly	2	
5	60030	Handle Bracket Assembly	1	
6	60031	Long Discharge Handle	1	
7	60032	Discharge Handle Tightener	2	
8	60026	Short Discharge Handle	1	
9	50031	Hopper Hinge Pin	2	
10	80018	Compression Spring	2	
11	60266	Light Harness	1	
12	80148	Dry Level Control Switch	2	
13	80431	Strain Relief	2	
14	80198	Headlight - Halogen Implement	2	
15	80199	Front Turn Lamp	4	
16	80107	Limit Switch - Lever Arm	2	
17	60083	Right Hand Baffle Assembly	1	Complete
18	60082	Baffle Lever Assembly	1	
1	50206	Head Baffle Bushing	1	
19	80118	Rubber Knob	1	
20	80119	Compression Spring	1	
21	60084	Left Hand Baffle Assembly	1	Complete
18	60082	Baffle Lever Assembly	1	
1	50206	Head Baffle Bushing	1	
20	80119	Compression Spring	1	
22	60216	Metering Tie Rod	1	Complete
	50482	All Thread	1	
	60215	Tie Rod Weld	1	
	80036	1/2" Clevis	1	

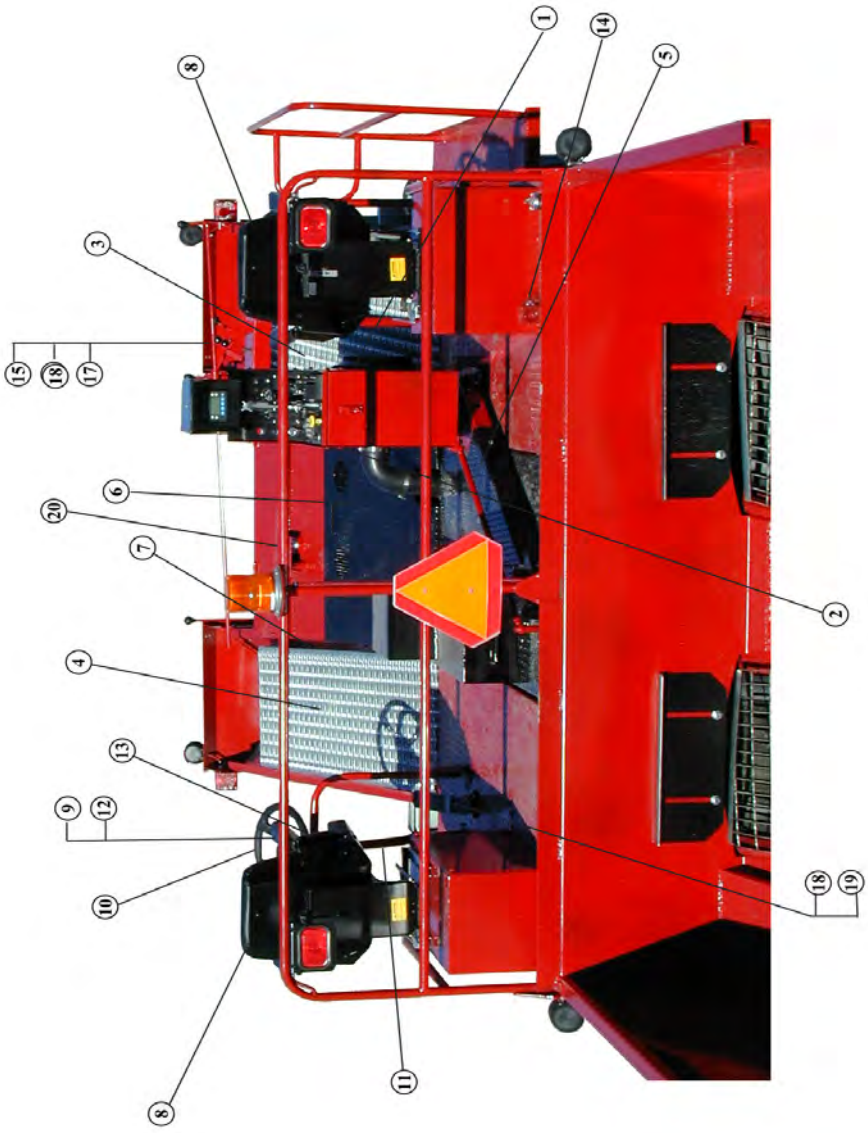
Rear



Rear

ITEM NO.	PART NO.	DESCRIPTION	NO. REQ.	REMARKS
1	50150	Vertical Belt-Seal	2	
2	50151	Horizontal Belt-Seal	1	
3	50448	Mounting Strip	2	
4	50449	Horizontal Mounting Strip	1	
5	50236	Rear Hopper Gate	2	
6	60173	Right Hand Grate	1	
7	60174	Left Hand Grate	1	
8	60026	Hitch Assembly	1	
9	60266	Light Harness	1	
10	80198	Headlight - Halogen Implement	2	
11	80200	Rear Tail Light	2	
12	80201	Tail Light Bracket	2	
13	80268	Strobe Light	1	
14	80125	Hydraulic Cylinder 2 X 4	1	
15	50101	Pintle Hitch	4	
16	50835	Pintle Pin	1	
17	80123	Slow Moving Vehicle Sign	1	
18	80193	Back Up Alarm	1	
19	60308	Hydraulic Hose Assembly-3/8 X ST X ST X 19	1	
20	60309	Hydraulic Hose Assembly-3/8 X ST X ST X 24	1	
21	60310	Hydraulic Hose Assembly-3/8 X ST X 90 X 96	2	

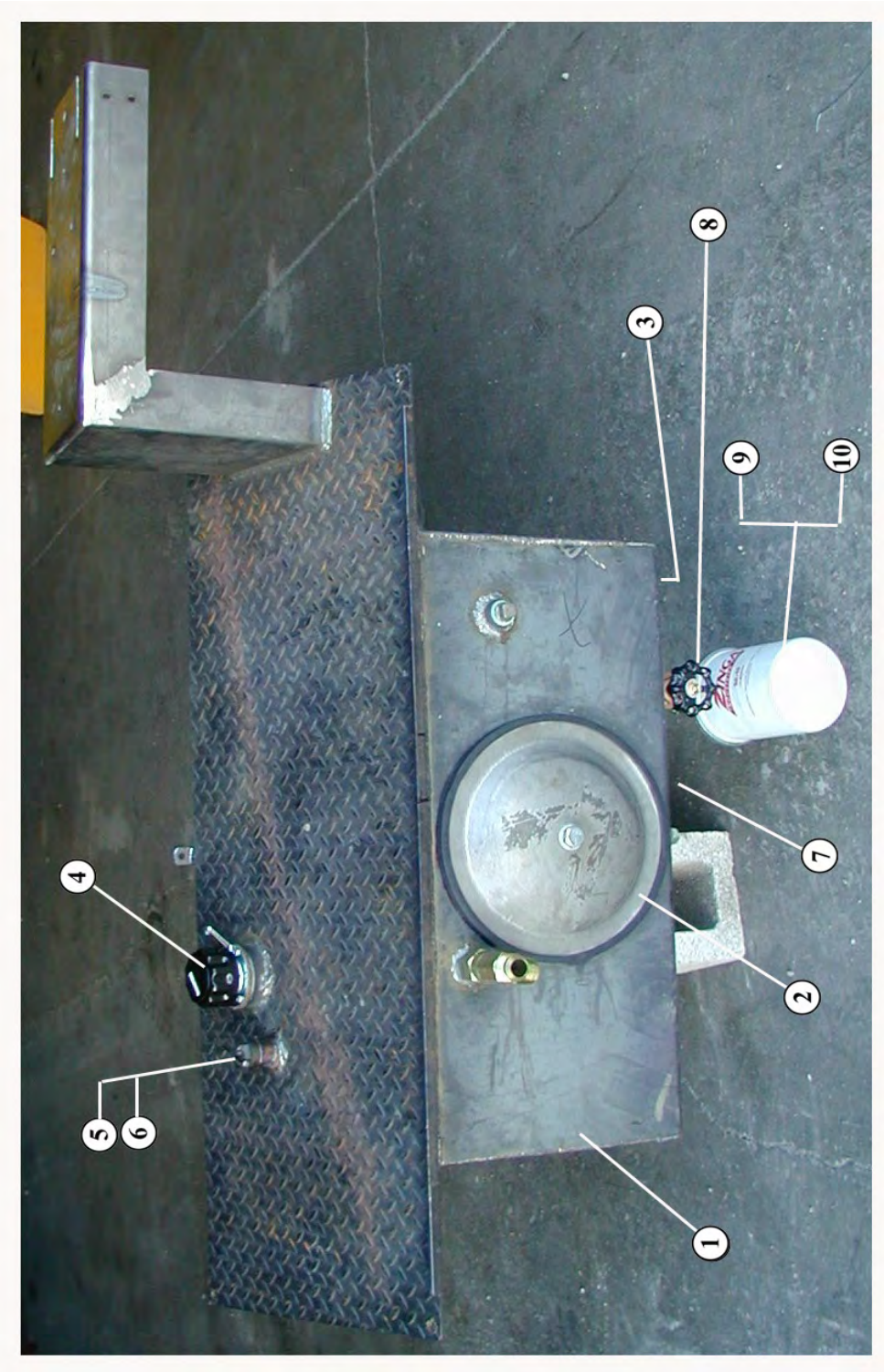
Top Deck



Top Deck

ITEM NO.	PART NO.	DESCRIPTION	NO. REQ.	REMARKS
1	50215	Right Hand Air Filter Bracket	1	
2	50216	Left Hand Air Filter Bracket	1	
3	50402	Right Hand Conveyor Grate	1	
4	50403	Left Hand Conveyor Grate	1	
5	60020	Center Deck Assembly	2	
6	60023	Front Deck Plate Assembly	1	
7	60136	Grate Bracket Assembly	8	
8	60026	Seat with Arm Rest	2	
9	80021	Steering Wheel Cap	2	
10	80022	Steering Wheel	2	
11	80269	Steering Column	2	
12	80270	Steering Wheel Hex Nut	2	
13	60254	Turn Signal Assembly	1	
14	80193	Backup Alarm	1	
15	80041	Control Lever Throttle / Hydraulic	4	
16	80340	Conveyor Control Cable	2	
17	80035	1/4" Clevis	2	
18	80301	Foot Operated Valve	2	
19	80308	Treadle Valve	2	
20	60104	Hydraulic Tank Assembly (see Hydraulic Tank Assembly for details)	1	Complete

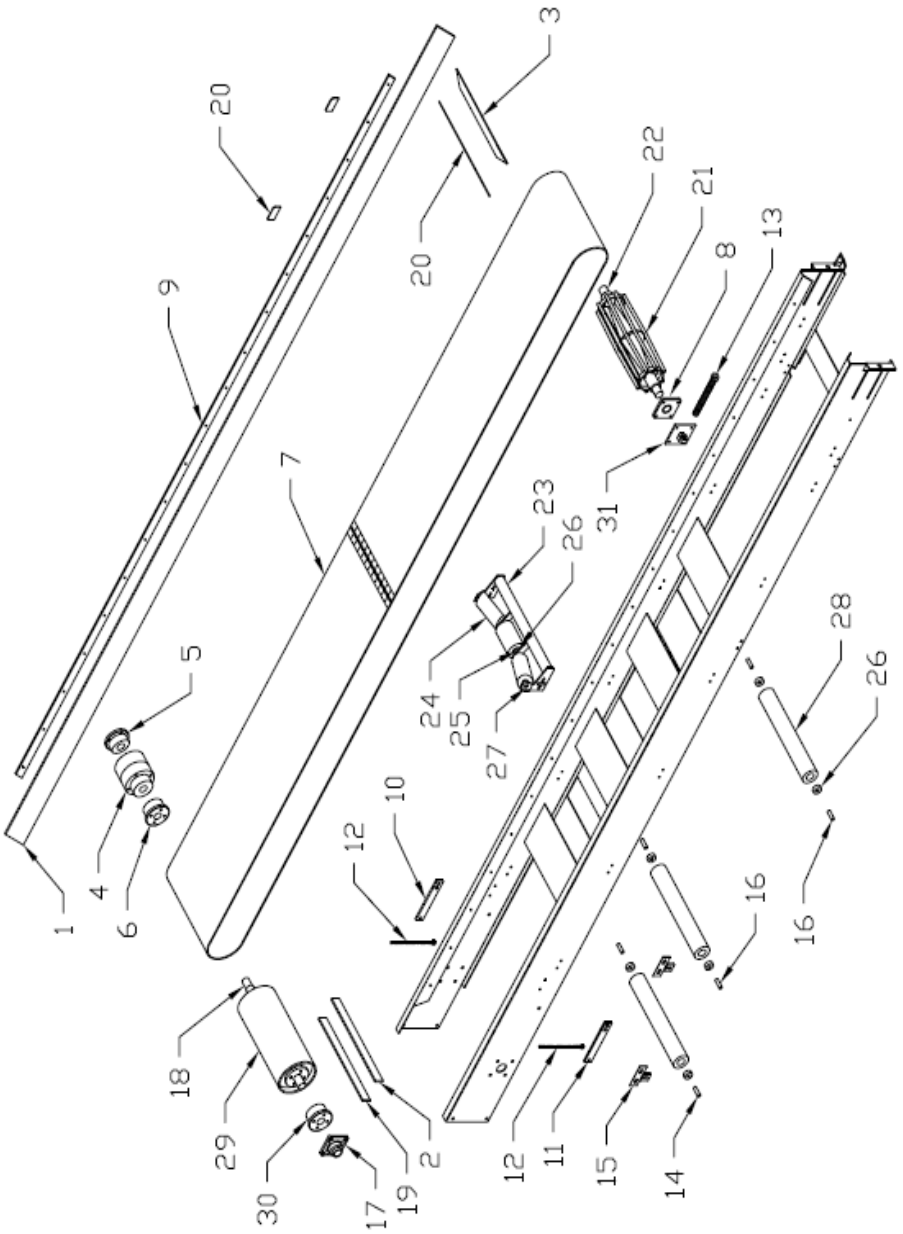
Hydraulic Tank Assembly



Hydraulic Tank Assembly

ITEM NO.	PART NO.	DESCRIPTION	NO. REQ.	REMARKS
1	60104	Hydraulic Tank Assembly	1	Complete
2	80150	End Cover	1	Complete
	80151	Seal	1	
	80152	Crush Washer	1	
3	80154	Tank Mounted Strainer	1	
4	60026	Locking Filler Breather	1	
5	80281	Magnetic Dipstick	1	
6	60291	Magnetic Plug WELD	1	
7	80295	Temperature Sending Unit	1	
			4	

Conveyors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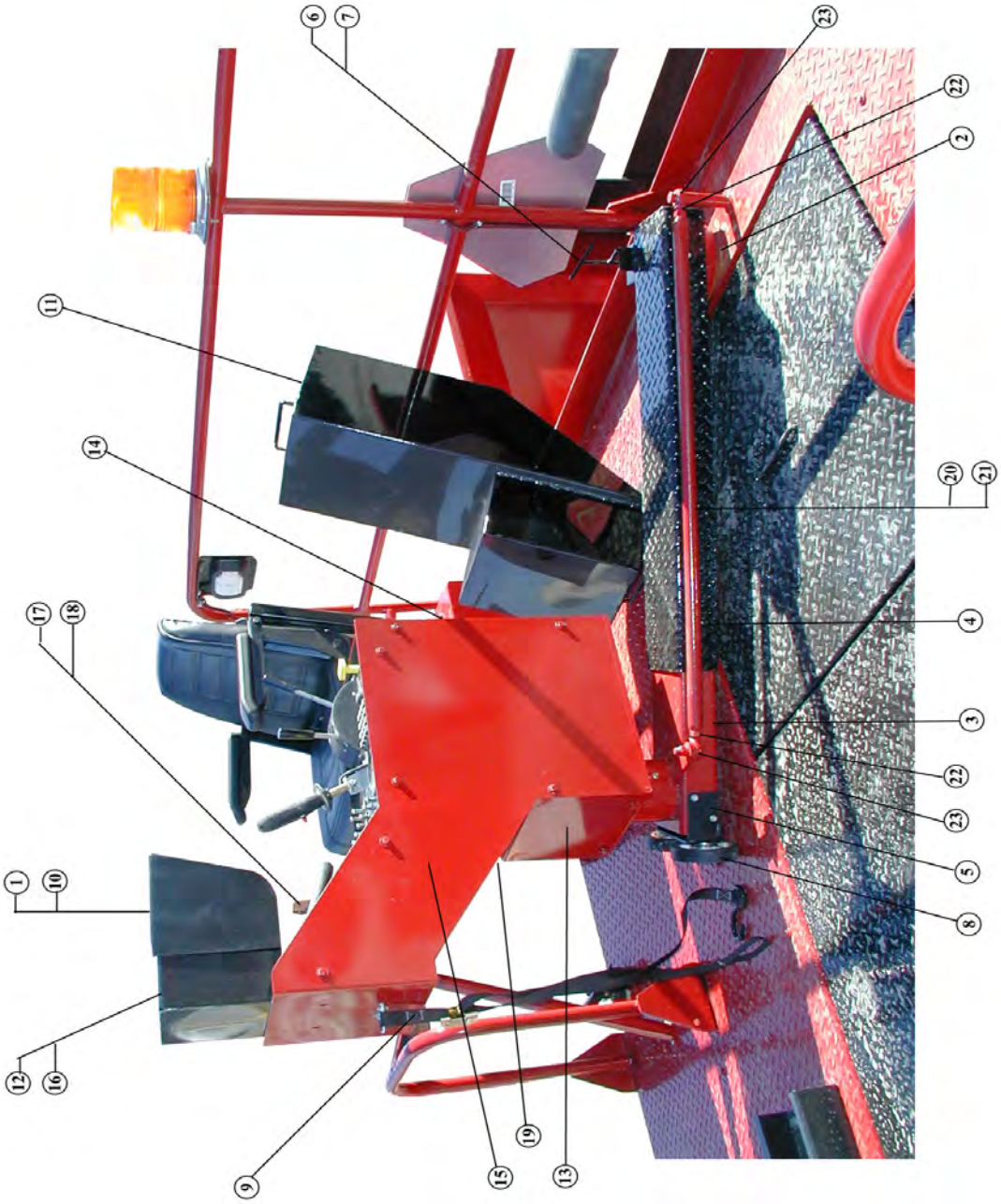
Conveyors

ITEM NO.	PART NO.	DESCRIPTION	NO. REQ. RH	NO. REQ. LH	REMARKS
1	50025	Conveyor Belt Shield	2	2	
2	50026	Conveyor Belt Cleaner	1	1	
3	50447	Conveyor End	1	1	
4	80008	Rigid Coupler	1	1	
5	80009	Taper Lock Bushing 1 1/4 Bore	1	1	
6	80010	Taper Lock Bushing 1 3/4 Bore	1	1	
7	80017	Conveyor Belt	1	1	Complete
8	80004	Tail Pulley Bearing	2	2	
9	50007	Lagging Hold Down	2	2	
10	50018	Right Hand Idler Plate	1	1	
11	50019	Left Hand Idler Plate	1	1	
12	60004	Idler Adjuster Bolt Assembly	2	2	
13	60006	Tail Pulley Bolt Adjuster Assembly	2	2	
14	60008	Cut End Shaft	2	2	
15	80006	Idler Mount Bracket	4	6	
16	80000	Idler Shaft	6	6	
17	80004	Head Pulley Bearing	2	2	
18	50008	Head Pulley Shaft	1	1	
19	50065	Lagging Bracket	1	1	
20	50738	Grate Stop	4	4	
21	60003	Tail Pulley Assembly	1	1	Complete
22	50009	Tail Pulley Shaft	1	1	
23	80001	Troughing Idler	8	8	Complete
25	80110	Center Shaft	16	16	
26	80111	Idler Bearing	48	48	
27	80112	End Shaft	16	16	
28	80005	24" Conveyor Idler Roller	4	4	Complete
26	80111	Idler Bearing	8	8	
29	80002	Head Pulley 24"	1	1	Complete
30	80003	Taper Lock Bushing 1 15/16	2	2	

Control Console Assembly



Control Console

ITEM NO.	PART NO.	DESCRIPTION	NO. REQ.	REMARKS
1	50347	Shield Face Plate	1	
2	50488	Thrust Bearing - Nylon	1	
3	60150	Swing Arm Weld	1	
4	60151	Swing Arm Cover	1	
5	60181	Swing Arm Roller Mount	1	
6	60182	Latch Weld	1	
7	80332	Compression Spring	1	
8	60026	Rubber Tire Idler	2	
9	80565	Console Tie Down	1	
10	50383	Display Sun Cover Shield	1	
11	60137	Control Panel Security Cover	1	
12	60138	Display Panel Assembly	1	
13	60146	Front Control Panel Assembly	1	
14	60147	Back Control Panel Assembly	1	
15	60148	Control Panel Weldment	4	
16	80253	Retainer Ring	1	
17	80428	Display Knob	1	
18	50833	All Thread, 3/8 x 6	1	
19	80259	4 x 4 Relay	1	
20	60294	Tie Rod Assembly	1	Complete
21	60293	Tie Rod Weld	1	
22	15006	1/2 Fine Jam Nut	2	
23	80314	Rod End	2	

Top Console Panel

Top Console Panel

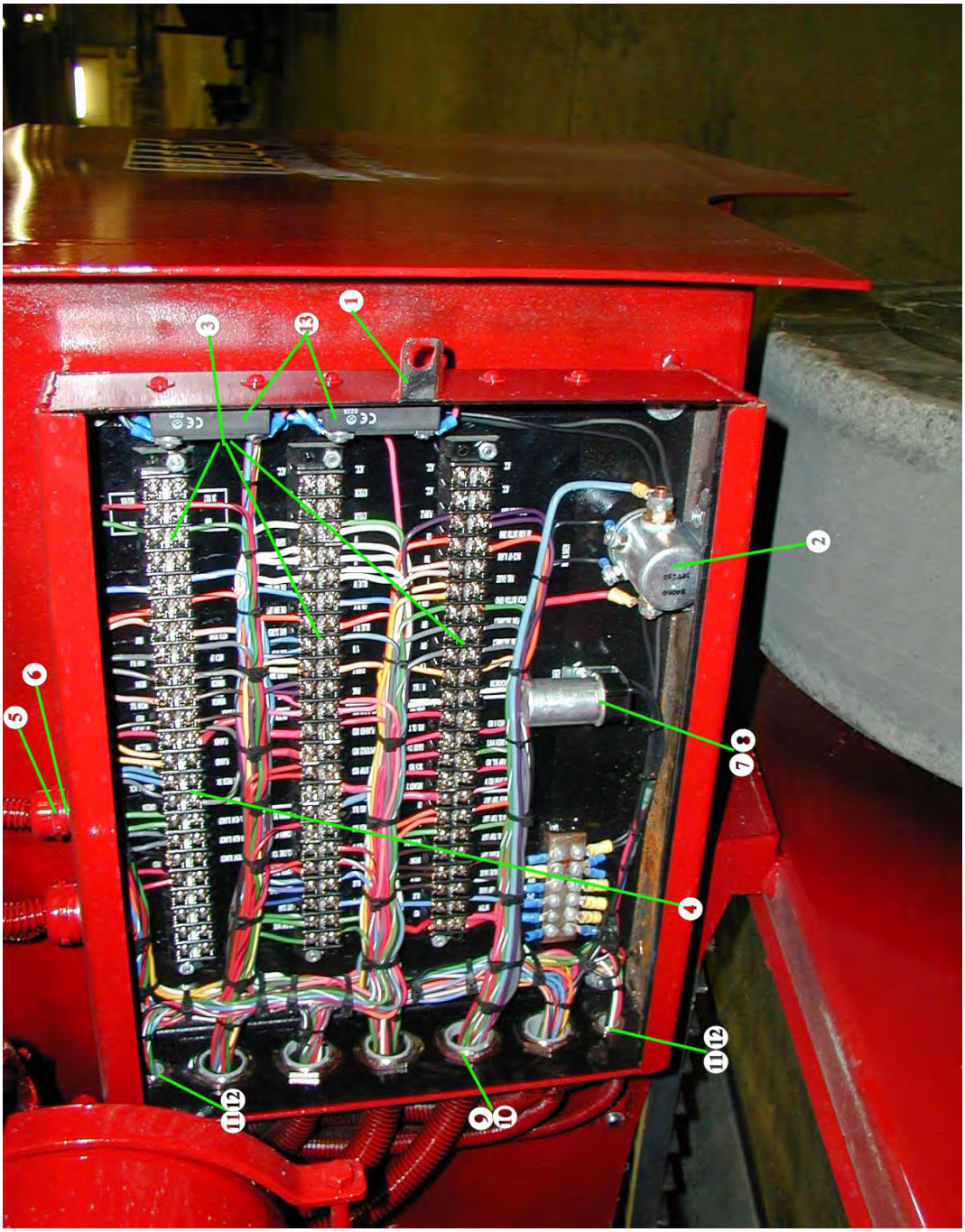
ITEM NO.	PART NO.	DESCRIPTION	NO. REQ.	REMARKS
	60171	Control Panel Gauge Assembly	1	Complete
1	60144	Upper Control Panel Assembly	1	
2	80026	Push Button Switch	1	
3	80027	Ignition Switch	1	
4	80028	Dual Alarm Light & Buzzer	1	
5	80029	10 amp Circuit Breaker	1	
6	60026	20 amp Circuit Breaker	3	
7	80037	Gauge Cluster Panel	1	
8	80038	Hydraulic Oil Temperature Gauge	1	
9	80039	Air Pressure Gauge	1	
10	80361	Pressure Switch 60 psi	1	
11	50347	Shield Face Plate	1	
12	50383	Display Sun Cover Shield	1	
13	60138	Display Panel Assembly	4	
14	80428	Display Knob	1	
15	50833	All Thread, 3/8 X 6	1	
16	80255	Panel View 300 Display	1	
17	60148	Control Panel Weldment	1	

Throttle Control Panel

Throttle Control Panel

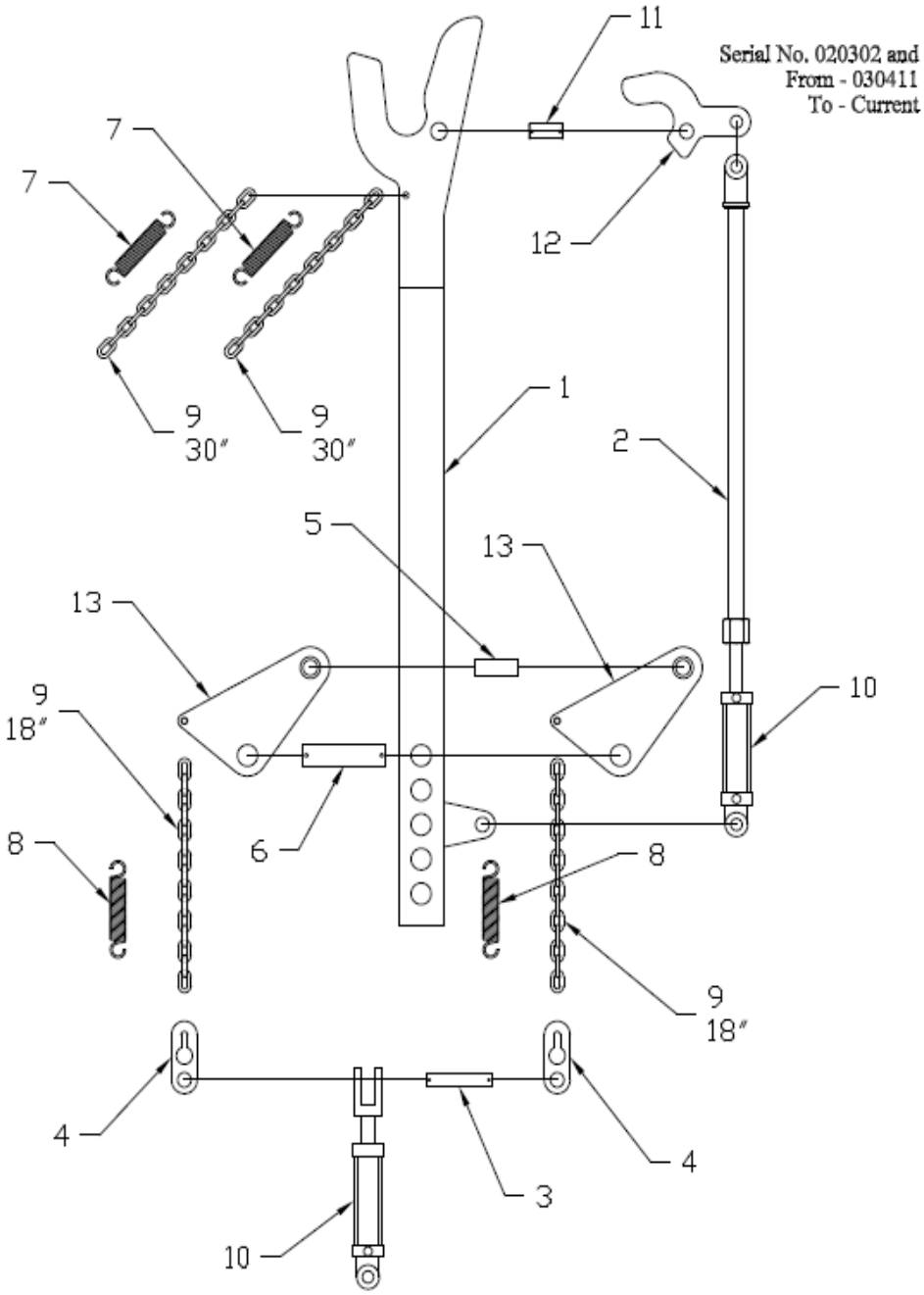
ITEM NO.	PART NO.	DESCRIPTION	NO. REQ.	REMARKS
	60172	Lower Control Panel Assembly	1	Complete
1	60259	Throttle Assembly	1	Complete
	50498	Control Lever Throttle	1	
	60257	Throttle Cable Assembly	1	
	60258	Throttle Handle Assembly	1	
2	60026	Shifter Assembly	1	Complete
	80057	9 Pin Socket	1	
	80059	Strain Relief	1	
	80060	Pin for Socket	9	
3	80024	Toggle Switch SPST 2 Screw (on - off)	5	
4	80026	Push Button Switch	2	
5	80033	Control Panel Template	4	
6	80040	Tachometer w/Hour Meter	1	
7	80183	Toggle Switch SPDT (mom on - off - mom on)	1	
8	80258	Maxi Brake Dash Valve Switch	1	
9	80484	Toggle Switch SPST (on - off)	1	
10	80657	Toggle Switch SPDT (mom on - off - on)	2	
11	60256	Keypad Assembly	1	
	80214	Keypad	1	
	50489	Keypad Spacer	1	
	60255	Cable Assembly	1	
13	60147	Back Control Panel Assembly	1	

Terminal Box Assembly



Terminal Box Assembly

ITEM NO.	PART NO.	DESCRIPTION	NO. REQ.	REMARKS
	60292	Terminal Box Assembly	1	Complete
1	60103	Terminal Box Weld	1	
2	80025	Neutral Safety Switch	1	
3	80045	23 Pole Terminal Strip	3	
4	80046	Jumper for Terminal Strips	12	
5	80062	Strain Relief, 3/4"	2	
6	60026	Nut for 3/4" Strain Relief	2	
7	80196	Flasher Socket	1	
8	80197	Flasher	1	
9	80435	1" Strain Relief	5	
10	80436	Nut for 1" Strain Relief	5	
11	80439	5/16" Strain Relief	2	
12	80440	Nut for 5/16" Strain Relief	2	
13	80441	Relay	4	


Serial No. 020302 and
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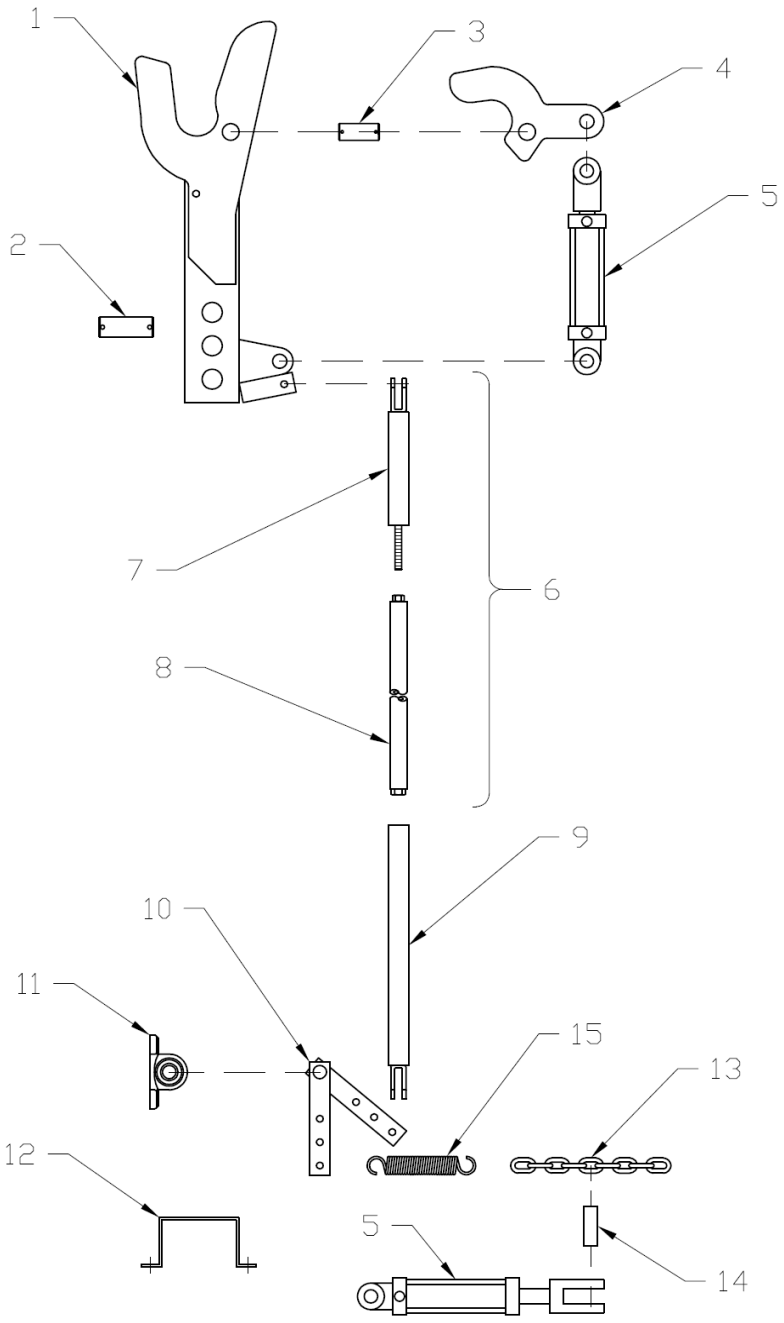
Truck Hitch

Serial No. - 0200302 & 030411 to current

ITEM NO.	PART NO.	DESCRIPTION	NO. REQ.	REMARKS
1	60026	Hitch Assembly	1	
2	60027	Hitch Ram Extension	1	
3	50385	Hitch Cylinder Pin	1	
4	50386	Chain Hitch Bracket	2	
5	50387	Hitch Roller	1	
6	50842	Hitch Pin	1	
7	80322	Extension Spring	2	
8	80331	Extension Spring	2	
9	16172	Chain	8 FT	
10	80125	Hydraulic Cylinder 2 X 4	2	
11	50835	Pintle Pin	1	
12	50101	Pintle Hitch	1	
13	60321	Hitch Lever Assembly	2	Complete
	80664	Bearing, Truck Hitch	2	

Truck Hitch

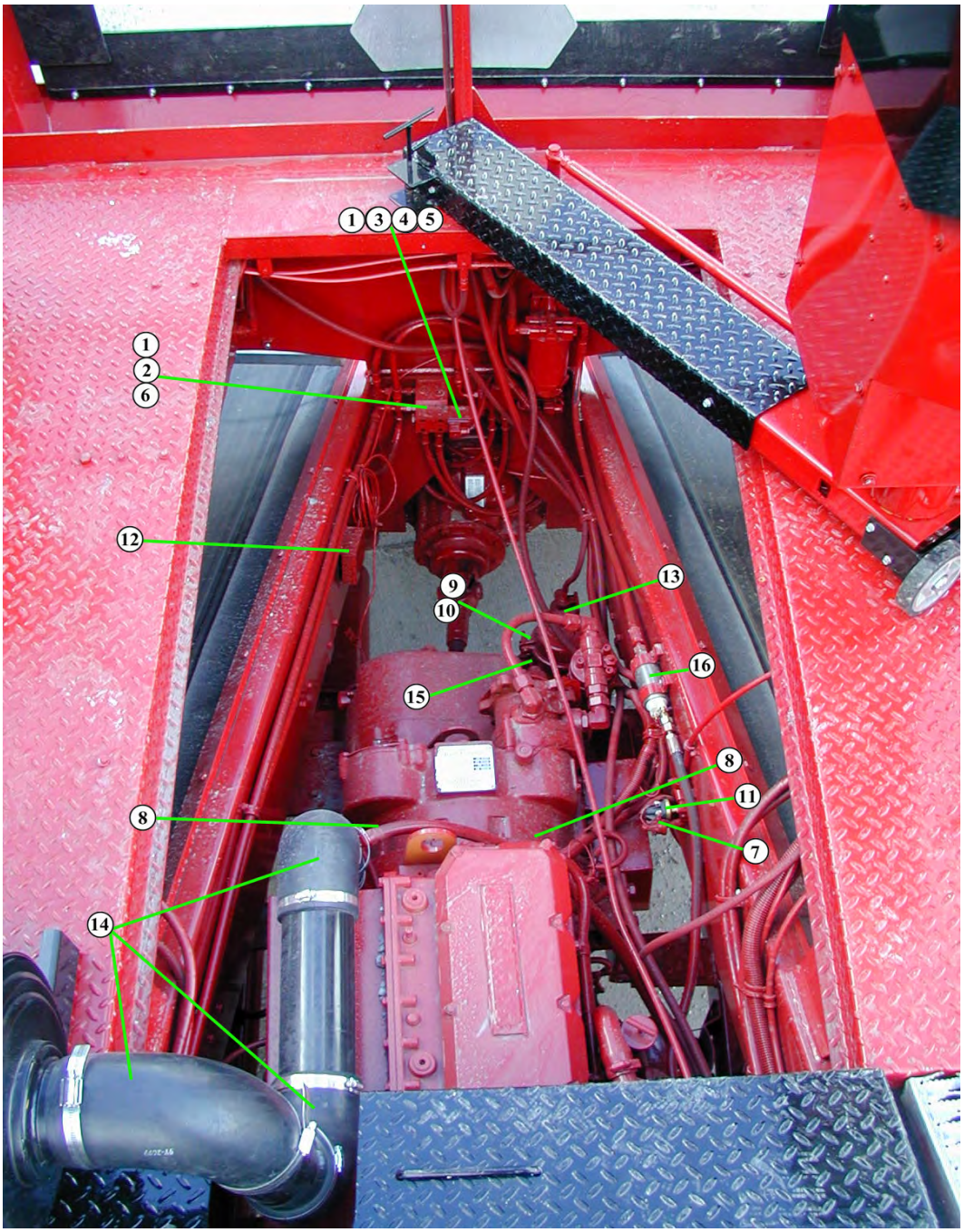
Serial No. 020303 To 030310



Truck Hitch

ITEM NO.	PART NO.	DESCRIPTION	NO. REQ.	REMARKS
1	60177	Hitch Assembly	1	
2	50097	Hitch Pin	1	
3	50835	Pintle Pin	1	
4	50101	Pintle Hitch	1	
5	80125	Hydraulic Cylinder 2 X 4	2	
6	60180	Hitch Tie Rod Assembly	1	Complete
7	60178	Hitch Tie Rod	1	
8	60026	Hitch Tie Rod End	1	
9	60221	Hitch Rod End	1	
10	60175	Cylinder Pivot Assembly	1	
11	80272	Bearing - Truck Hitch	2	
12	50511	Cylinder Clamp	1	
13	16172	Chain	2 FT	1 Foot Each
14	50514	Cylinder Pin	1	
15	80331	Spring	4	

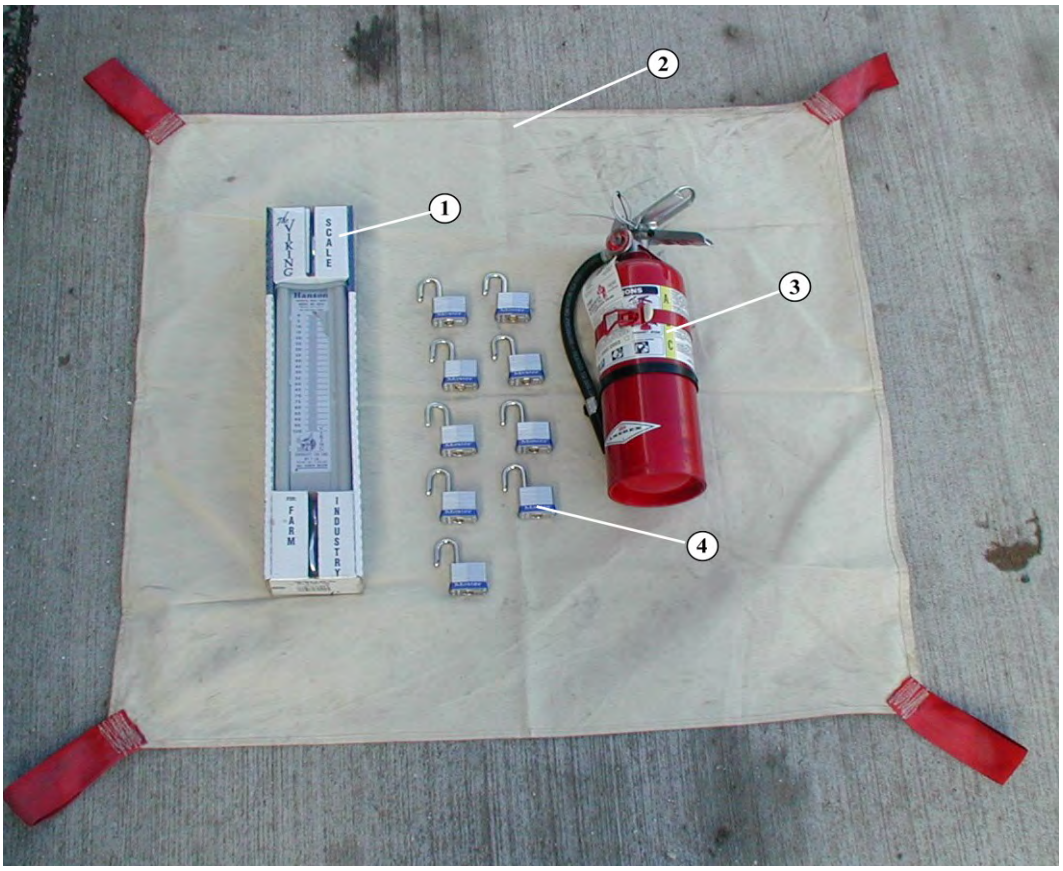
Engine Compartment



Engine Compartment

ITEM NO.	PART NO.	DESCRIPTION	NO. REQ.	REMARKS
1	80146	Din Plug	3	
2	80170	Proportional & Hitch Valve Base	1	
3	80175	Hydraulic Valve	1	
4	80177	Hydraulic Valve Body	1	
5	80178	12 V DC Valve Coil	2	
6	80299	Valve on Truck Hitch	1	
7	80048	Pressure Switch 15 lb NC	1	
8	60026	Transmission Mount	2	

Miscellaneous



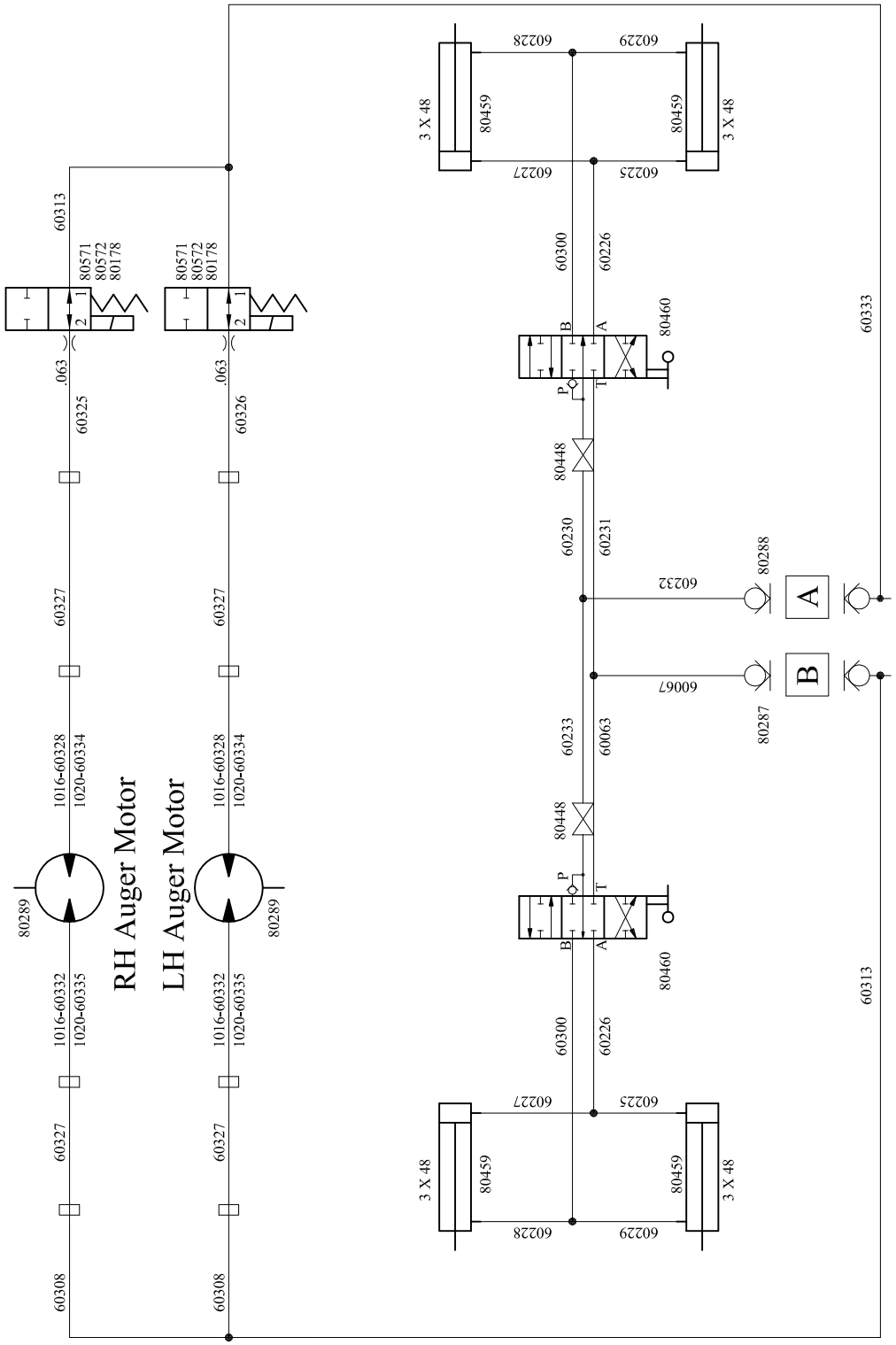
Miscellaneous

ITEM NO.	PART NO.	DESCRIPTION	NO. REQ.	REMARKS
1	80064	Hanging Scale	1	
2	80079	Metering Tarp 1 square yard	1	
3	80323	Fire Extinguisher	1	
4	80324	9 Padlocks Keyed Alike	1	
5	80473	Hydraulic Oil ISO 32	40	Gallons
6	80412	Brake Fluid	AR	Gallons
7	80468	SAE 15W40 Engine Oil	AR	Gallons
8	80470	Gearplus SAE 80W90-GL5	90	Pints
9	80472	Anti Freeze	4	Gallons
10	80469	Dexron-III/Mercon ATF	5	Gallons

Section 11

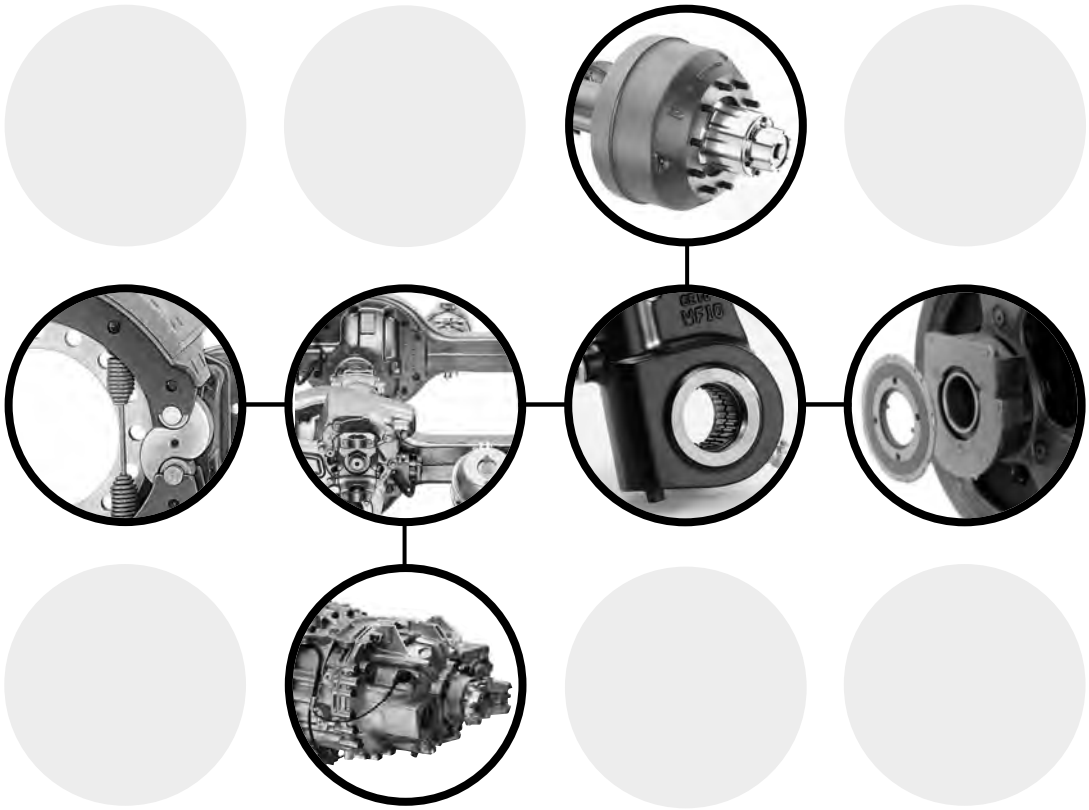
Schematics

Hydraulic Schematic



Lubrication

Maintenance Manual 1



MERITOR

an ArvinMeritor brand

Before You Begin

This manual provides maintenance intervals and procedures, lubricant specifications, and product capacities for Meritor and ZF Meritor components. Before you begin procedures:

1. Read and understand all instructions and procedures before you begin to service components.
2. Read and observe all Caution and Warning safety alerts that precede instructions or procedures you will perform. These alerts help to avoid damage to components, serious personal injury, or both.
3. Follow your company's maintenance and service, installation, and diagnostics guidelines.
4. Use special tools when required to help avoid serious personal injury and damage to components.

Safety Alerts, Torque Symbol and Notes

WARNING	A Warning alerts you to an instruction or procedure that you must follow exactly to avoid serious personal injury.
CAUTION	A Caution alerts you to an instruction or procedure that you must follow exactly to avoid damage to components.
	A torque symbol alerts you to tighten fasteners to a specified torque value.
NOTE	A Note provides information or suggestions that help you correctly service a component.

Access Product and Service Information on Our Website

Visit the DriveTrain Plus™ by ArvinMeritor Tech Library at arvinmeritor.com to access and order product and service information.

To Order Information by Phone

Call ArvinMeritor's Customer Service Center at 800-535-5560 to order the following publications and those specified in this manual.

- Lubrication video. $20. (T-9398V)
- Transmission Lubricant Specifications (TP-90114)
- Drivetrain Plus™ by ArvinMeritor Technical Electronic Library on CD. Features product and service information on most Meritor, ZF Meritor and Meritor WABCO products. $20. Order TP-9853.

MERITOR®

Table of Contents

Table of Contents

MERITOR®

Additional Maintenance and Service Information

Refer to the Service Notes page on the inside front cover of this manual for instructions on how to obtain additional maintenance and service information for components included in this manual.

Introduction

This manual provides grease and oil lubricant specifications, procedures, service intervals and product capacities. Following these guidelines will enable you to correctly lubricate and maintain components, and help to ensure maximum component life.

- Always use the specified oil or grease lubricant from a manufacturer that provides quality products and complete application instructions.
- Always follow recommended lubrication intervals and procedures.

Regularly Scheduled Maintenance

Internal components can shed fine metal wear particles at a steady rate, especially during the break in period. If wear particles, moisture and other contaminants are allowed to circulate in the lubricant, the components will wear at a faster rate than normal.

Regularly scheduled maintenance using the specified lubricants will help to ensure maximum component performance and life.

Oil Lubricants

There are three types of oil lubricants: petroleum oil, full-synthetic oil and semi-synthetic oil. Both full-synthetic and semi-synthetic oils retain their lubrication properties longer than petroleum oil.

- Petroleum oil is derived from crude oil. Crude petroleum oil also yields combustible fuels and a wide range of petroleum chemicals.
- Full-synthetic oil uses a man-made-base oil with predictable physical properties. Full synthetic oil contains no refined petroleum-based fluids.
- Semi-synthetic oil contains a mixture of petroleum-based and synthetic fluids that can help extend service intervals, improve cold weather properties and reduce volatility.

Viscosity

⚠ CAUTION

Use correct viscosity lubricants. Do not lower the viscosity of lubricants by adding thinning agents, such as kerosene, gasoline or other dilutents. Damage to components will result.

Select the correct viscosity oil for a specific component from the charts in each section of this manual. When more than one lubricant is listed, choose an oil viscosity that is suitable for the expected outside temperature.

Oil viscosity grades and classifications are provided by the SAE (Society of Automotive Engineers) and the API (American Petroleum Institute).

- Use multigrade oils when vehicles operate in both cold and warm weather between oil changes.
- Use low viscosity single grade oils only in cold climates. Single grade 75W oils are not approved for use in drive axles where ambient (outside) temperatures exceed 40°F (4°C).
- Use multigrade oil for drive axles only. The hypoid gearing requires a GL-5 oil with Extreme Pressure (EP) additives to provide adequate lubricant film protection that prevents gear failure.

Oil Change Schedules

To determine an oil change schedule, take an oil sample at a specified interval or mileage recommendation. Analyze the sample to establish a schedule.

However, service duty will often dictate when to change the oil, regardless of mileage or a previously established schedule.

Oil Drain Conditions

Differential Oils (Hypoid Gear Oils)

Drain and replace used differential oil that does not meet with the following used-oil analyses. Replace the drained oil with oil specified for hypoid drive axle use.

Used-Oil Analyses (ppm = parts per million)

Iron (Fe)	If level is between 1000 ppm and 1500 ppm, resample the oil. If resampling indicates that iron level is above 1000 ppm, drain and replace the oil. If level is above 1500 ppm, drain and replace the oil.
Silicon (Si)	If level is greater than 100 ppm, drain and replace the oil.
Water (H_2O)	If level is greater than 0.3%, drain and replace the oil.
Phosphorus (P)	If level is less than 900 ppm, it is possible that the oil is not a GL-5 gear oil. Contact the lubricant manufacturer or Meritor Materials Engineering to determine the expected phosphorus level of a new oil sample. Only GL-5 type gear oils are approved for use in Meritor differentials.
Toluene Insolubles	If level is greater than 0.100 wt.%, drain and replace the oil.

Manual Transmission Oils

If used transmission oil analyses indicate that any one of these criteria is not met, drain the used oil and replace it with an oil that is recommended for manual transmissions.

Used-Oil Analyses (ppm = parts per million)

Iron (Fe)	If level is greater than 500 ppm, drain and replace the oil.
Silicon (Si)	If level is greater than 100 ppm, drain and replace the oil.
Water (H_2O)	If level is greater than 0.3%, drain and replace the oil.

Grease Lubricants

Grease lubricants contain three substances: oil, a thickener base and additives. The oil lubricates. The thickener (base) holds the oil in place and releases it to provide the necessary lubrication. The thickener may be a simple or complex soap (lithium, calcium, aluminum, etc.), organic (polyurea) or inorganic (clay). The additives enhance the characteristics of the oil and thickener. Extreme Pressure (EP) additives help prevent scoring, galling and welding of moving parts.

Do not mix different types of greases. The possibility of incompatible greases may reduce the lubricating ability of the greases.

An important property of a grease is its dropping point, the temperature where grease changes from a semi-solid state to a liquid state. However, the operating temperature of a specific grease is not determined solely by the dropping point. Other properties such as resistance to change in consistency and chemical deterioration at high temperatures must be considered.

National Lubricating Grease Institute (NLGI) Standards

The National Lubricating Grease Institute (NLGI) classifies and grades grease lubricants according to a grease's consistency and the application for which it is used.

The NLGI also issues licensed labels that identify approved grease lubricant applications.

Extreme Pressure (EP) Lubricants

⚠ CAUTION

Do not use multi-viscosity or Extreme Pressure (EP) GL-5 gear oils in a manual transmission or transfer case. Damage to the transmission will result.

Extreme Pressure lubricants are often identified by the abbreviation "EP." Extreme Pressure lubricants contain additives that provide extra anti-wear protection to heavily-loaded parts. EP greases or EP oils are required in various applications.

Approved hypoid gear oils contain EP additives that protect against tooth scoring and surface fatigue.

Labels licensed by the NLGI identify approved grease applications.

⚠ WARNING

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

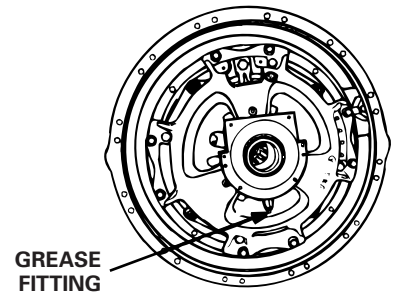
Release Bearing

⚠ CAUTION

Verify that the inspection cover on the clutch housing is used. If an inspection cover is not used, dirt and contaminants will enter the clutch housing and damage the clutch.

1. Remove the inspection cover on the clutch housing.
2. Clean all grease fittings prior to lubrication.
3. Correctly lubricate the release bearing. Apply grease to the grease fitting on the release bearing until a small amount of grease comes out of the bearing housing. Do not overgrease.
4. Apply grease to the release yoke tips where they contact the bearing housing. Also apply grease to the exposed transmission input shaft between the bearing housing and the transmission input bearing retainer to lubricate the release sleeve bushing.
5. If the release bearing is equipped with a lube tube, grease must be coming out of the bearing housing, which ensures that lubricant is reaching the bearing. Verify that the lube tube is secured and not damaged.
6. Use the same procedure for extended maintenance clutches.
7. Install the inspection cover. Use a high temperature, multi-purpose wheel bearing grease (Meritor Specification O-661) or the lubricant recommended by the vehicle manufacturer. **Figure 2.1**.

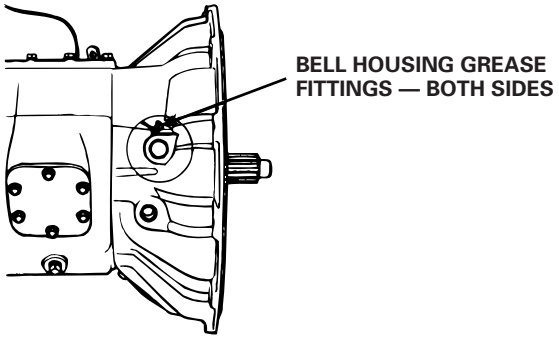
Figure 2.1
RELEASE BEARING LURICATION POINTS



Bell Housing

1. Clean all grease fittings prior to lubrication.
2. Grease the release fork cross shaft by applying grease to each fitting on the bell housing until a small amount of grease purges out. Use the specified lubricant at the recommended interval. Refer to the lubricant specifications and maintenance intervals of the vehicle manufacturer. **Figure 2.2**.

Figure 2.2

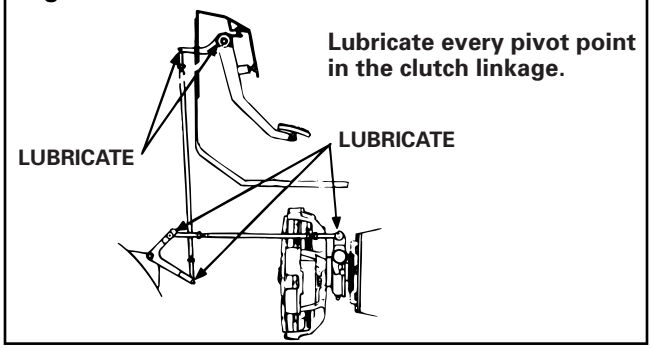


Linkage

NOTE: Some vehicle manufacturers may use "lubed-for-life" ball joints in the clutch linkage. Refer to the vehicle manufacturer's instructions.

Lubricate each pivot point on the linkage according to the vehicle manufacturer's procedure. **Figure 2.3**. Use the specified lubricant at the recommended interval. Refer to the lubricant specifications and maintenance intervals in the tables below.

Figure 2.3



Greasing Interval and Specifications

Component	Greasing Interval	Grease	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
Release Bearing	①	High Temperature Multi-Purpose Wheel Bearing Grease	O-661	3	Lithium Complex	Down to –40°F (–40°C)
Bell Housing	①	②	—	—	—	—
Clutch Linkage	①	②	—	—	—	—

① Use the interval specified by the vehicle manufacturer or the fleet, but make sure the release bearing is greased once per month.

② Use the grease specified by the vehicle manufacturer.

Approved Lubricants

Lubricant	Recommendation
Clutch Bearing Grease	Exxon Unirex N Grade 3 (NLGI Grade No. 3, Lithium Complex)

WARNING

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

Driveline Styles

Industry Name/ Description	Series	Type	Lubrication Requirements
Standard or Conventional Driveline	16N 17N 176N 18N	Full Round	Splines and Universal Joints
	16T 17T 176T 18T	Easy Service (1/2 Round)	
Wing-Style Greaseable	92N	Wing-Style	
Wing-Style Permalube	92N	Wing-Style	Splines Only
RPL Series (Meritor Permalube)	RPL 25 RPL 20	Combination Wing and Full Round	None

Refer to Maintenance Manual MM-96147, Drivelines, for service procedures. To obtain this publication, refer to the Service Notes page at the beginning of this manual.

RPL Series Permalube™ Driveline Universal Joint, Slip Yoke and Splines

The universal joint, slip yoke and splines are permanently lubricated and sealed and do not require regular lubrication. **Figure 3.1**.

Standard/Conventional Driveline Universal Joint (Figure 3.2)

1. Check the driveline for looseness. If loose, service the driveline as necessary.
2. Clean all grease fittings prior to lubrication.
3. Apply the specified grease at the grease fitting on the universal joint. Apply grease until new grease purges from all four seals.
   - **If new grease does not purge at all the seals:** Loosen the problem bearing cap bolts and regrease until all four cups purge.
   - **If new grease still does not purge:** Replace the universal joint.

Standard/Conventional Driveline Slip Yoke and Splines (Figure 3.2)

1. Check the driveline for looseness. If loose, service the driveline as necessary.
2. Cover the vent hole in the welch plug with a finger.
3. Apply the specified grease at the grease fitting on the slip yoke until the grease purges from the deflector. Six to eight pumps or approximately one ounce (28 grams) is sufficient to lube the splines.

Figure 3.1

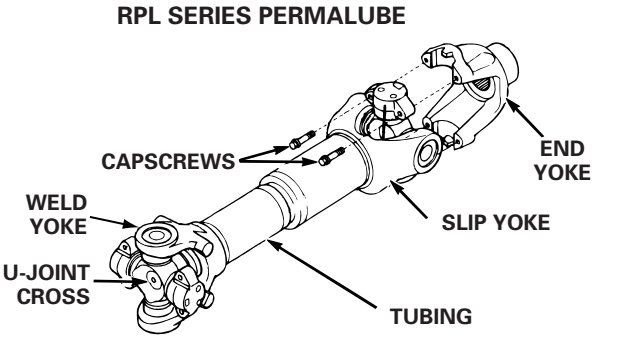
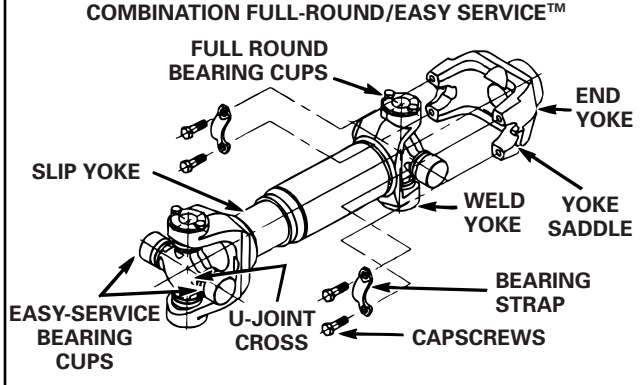


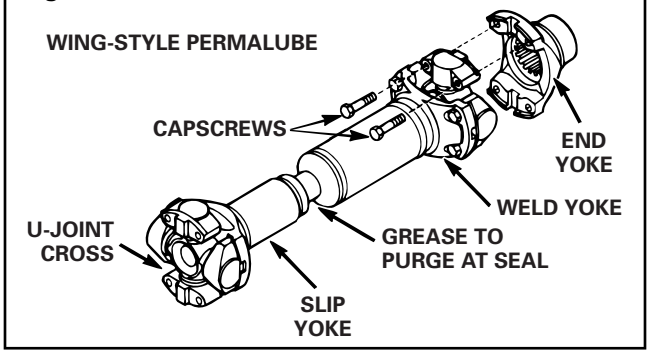
Figure 3.2



Wing-Style Permalube Driveline Universal Joint

The universal joint is permanently lubricated and does not require regular maintenance. **Figure 3.3**.

Figure 3.3



Wing-Style Greaseable Driveline Universal Joint

1. Check the driveline for looseness. If loose, service the driveline as necessary.
2. Clean all grease fittings prior to lubrication.
3. Apply the specified grease at the grease fitting on the universal joint. Apply grease until new grease purges from all four seals.
   - **If new grease does not purge at all the seals:** Loosen the problem bearing cap bolts and regrease until all four cups purge.
   - **If new grease still does not purge:** Replace the universal joint.

Wing-Style Permalube and Greaseable Driveline Slip Yoke and Splines

1. Check the driveline for looseness. If loose, service the driveline as necessary.
2. Clean all grease fittings prior to lubrication.
3. Cover the vent hole in the welch plug.
4. Apply the specified grease at the grease fitting on the slip yoke until grease purges from the deflector. Six to eight pumps or approximately one ounce (28 grams) is sufficient to lube the splines.

Greasing Intervals and Specifications for Standard/Conventional Drivelines

Component	Application	Greasing Interval	Grease	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
Universal Joint, Slip Yoke and Splines	Line Haul — Applications where tractor is operated entirely on concrete or smooth paved road surfaces	50,000 miles (80 000 km)	Universal Joint Grease	O-634-B	2	Lithium 12-Hydroxy Stearate with Molybdenum Disulfide	②
	On Highway — Applications where tractor is operated at least 90% on paved road surfaces and up to 10% on gravel, dirt or unpaved roads	16,000 miles (25 000 km)					
	City — Applications where truck is operated at least 90% in city environment	6,500 miles (10 000 km)					
	Construction — Straight trucks used in the construction industry to move materials to and from job sites. They operate 90% on-road and 10% off-road with a high number of stops and starts	①					

① The greasing interval depends on the individual operating conditions, speed and loads. To determine the interval, inspect for the presence of grease at all positions until an interval can be determined. Grease the assembly as necessary.

② Refer to the grease manufacturer's specifications for the temperature service limits.

Approved Lubricants

Lubricant	Recommendation
Universal Joint Grease	Must meet Meritor Specification O-634-B (NLGI Grade No. 2, Lithium 12-Hydroxy Stearate with Molybdenum Disulfide)
	Amalie All Purpose Grease with Moly-L1-2M
	Exxon 5160
	Shell Super Duty Special FF
	Marathon Maralube Molycode 529
	Phillips Petroleum Philube MW-EP2 Grease
	Shell Moly Poly Grease
	Kendall L424 Grease
	Amoco Super Chassis Grease
	Ford Specification M1C-75B or part number PN-C1AZ 19590

WARNING

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

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

General Information

Drive axles generate small metal wear particles at a fairly steady rate, especially during the break-in period. If these fine, but hard particles are allowed to circulate in the lubricant, along with external moisture and dirt, internal components will wear at a much faster rate than normal.

Magnets and Magnetic Drain Plugs

Front drive axles are equipped with magnetic drain plugs that have a minimum pick-up capacity of 1.5 pounds (0.7 kilograms) of low carbon steel.

The magnetic drain plug can be reused if, after cleaning, the plug has a minimum pick-up capacity of 1.5 pounds (0.7 kilograms) of low carbon steel.

Inspect the magnetic drain plug each time the oil is changed. Use the correct part. Pipe plugs will leak if used as a drain plug.

Breather

CAUTION

Cover the breather when steam cleaning the housing to prevent water from entering the housing and contaminating the oil. Damage to components will result.

Baffle-type breathers help keep axles free from external moisture and dirt which can cause premature oil and component failure.

Seals

CAUTION

Always use the correct tools and procedures when replacing seals to ensure correct installation and help prevent seals from leaking.

Seals keep lubricant in and dirt out of a component. When they are worn or damaged, seals leak and produce low lubricant levels which may damage components.

Durable triple lip seals, standard in Meritor axles, protect the quality and levels of the lubricant and provide superior performance.

Temperature Indicators

CAUTION

Meritor axles can operate above 190°F (88°C) without damage. However, if the oil temperature reaches 250°F (121°C), stop the vehicle immediately and check for the cause of overheating. Damage to components can result.

Many Meritor axles have a tapped hole in the housing for the installation of a lubricant temperature indicator that will help reduce the failure of axle parts from overheated oil.

Oil Level

Check and Adjust Oil

1. Park the vehicle on a level surface.
2. Remove the fill plug from the axle.
3. The oil level must be even with the bottom of the fill plug hole.
   - **If oil flows from the hole when the plug is loosened:** The oil level is high. Let the oil drain to the correct level.
   - **If the oil level is below the bottom of the fill plug hole**: Add the specified oil.
4. Install and tighten the fill plug 35-50 lb-ft (48-67 N•m). T

Drain and Replace Oil

1. Park the vehicle on a level surface. Place a large container under the axle.
2. Remove the drain plug from the bottom of the axle. Drain and discard the oil properly.
3. Clean, install and tighten the drain plug 35-50 lb-ft (48-67 N•m). T
4. Remove the fill plug from the axle.
5. Fill the axle to the bottom of the fill plug hole with the specified oil. Allow enough time for oil to circulate through the axle assembly.
6. Install and tighten the fill plug 35-50 lb-ft (48-67 N•m). T

Wheel Bearings and Wheel Ends

Refer to Section 12 for lubrication information on oil- and grease-lubricated wheel bearings and wheel ends.

Knuckle King Pins

With the vehicle weight on the wheel end, pump grease through the grease fittings located on the upper cap or steering arm and lower cap assemblies. Grease should purge through the seals and thrust bearing.

Camshaft Retainer Bushing and Cam Bushing

Pump grease until it purges through the seals.

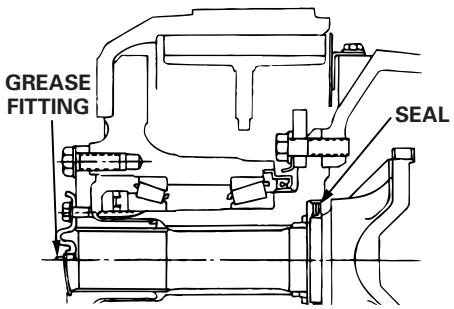
Drive Axle Shaft Universal Joint

1. Permanently lubricated Permalube™ joints do not have a grease fitting provided. Periodic greasing is not required for these parts. For serviceable universal joints with grease fittings, follow Steps 2 and 3.
2. Clean all grease fittings prior to lubrication.
3. Apply the specified grease at the grease fitting on the universal joint. Apply grease until new grease purges from all the seals.
   - **If new grease does not purge at every seal:** Move the driveline while applying grease at the fittings until new grease purges at every seal.
   - **If new grease still does not purge:** Disassemble the universal joint. Inspect the grease and the components. Service as necessary.

Axle Shaft Spline and Thrust Washer

On axles with greaseable drive flanges, pump grease through the grease fitting until it purges at the axle shaft seal. **Figure 4.1**.

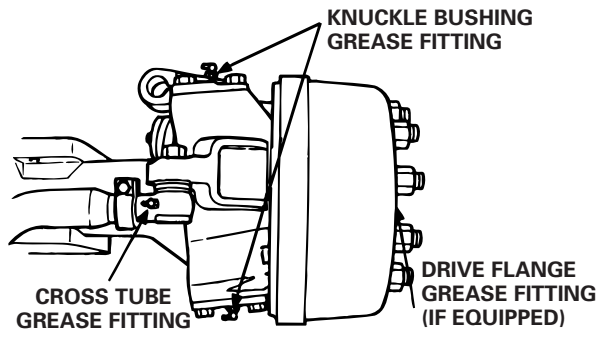
Figure 4.1



Cross Tube End Assembly

1. Check the cross tube for looseness of more than 0.060-inch (1.52 mm). **Figure 4.2**. If the cross tube is loose, service as necessary.
2. Apply the specified grease at the grease fitting on the cross tube until new grease purges from all the seals.
   - **If new grease does not purge at the seals:** Move the cross tube while applying grease at the fittings until new grease purges from all the seals.
   - **If new grease still does not purge:** Disassemble the cross tube. Inspect the grease and the components. Service as necessary.

Figure 4.2



Knuckle Bushing

1. Check the knuckle for looseness. The correct end play for non-MX Series axles is 0.005-0.015-inch (0.127-0.381 mm). For MX Series axles, the correct end play is 0.001-0.065-inch (0.025-1.65 mm) for new axles and 0.001-0.075-inch (0.025-1.9 mm) for in-service axles. If loose, service as necessary.
2. Clean all grease fittings prior to lubrication.
3. Apply the specified grease at the grease fitting on the knuckle until new grease purges from all the seals. **Figure 4.2**. Grease the lower pin cap with the vehicle weight on the wheel end to ensure that the thrust bearing is completely greased.
   - **If new grease does not purge at the seals:** Move the knuckle while applying grease at the fittings until new grease purges at the seals.
   - **If new grease still does not purge:** Disassemble the knuckle. Inspect the grease and the components. Service as necessary.

Oil Change Intervals and Specifications

Vocation	Mileage Change Intervals	
	Petroleum Lube	**Synthetic Lube**
Oil Field	30,000 miles (48 000 km) or Annually	50,000 miles (80 000 km)
Construction	25,000 miles (40 000 km) or Annually	50,000 miles (80 000 km)
Fire Truck and Rescue	5,000 miles (8000 km) or Annually	10,000 miles (16 000 km)

Initial Oil Change	No longer required as of January 1, 1993
Check Oil Level	Every 5,000 miles (8000 km), once a month, or the fleet maintenance interval, whichever comes first
Petroleum Oil Change	Every 25,000 miles (40 000 km) or annually, whichever comes first *
Synthetic Oil Change	Every 50,000 miles (80 000 km) or annually, whichever comes first

* For continuous heavy-duty operation, check the oil level every 1,000 miles (1600 km). Add the correct type and amount of oil as required.

Meritor Specifications	Specification Approval	Oil Description	Outside Temperature			
			F°		C°	
			Min.	Max.	Min.	Max.
O-76A Gear Oil	MIL-PRF-2105-E and SAE J2360	GL-5, SAE 85W/140	10	None	–12	None
O-76D Gear Oil		GL-5, SAE 80W/90	–15	None	–26	None
O-76E Gear Oil		GL-5, SAE 75W/90	–40	None	–40	None
O-76J Gear Oil		GL-5, SAE 75W	–40	35	–40	2
O-76L Gear Oil		GL-5, SAE 75W/140	–40	None	–40	None
O-76M Full Synthetic Oil		GL-5, SAE 75W/140	–40	None	–40	None
O-76N Full Synthetic Oil		GL-5, SAE 75W/90	–40	None	–40	None
Military Specification Approval for all oils is ML-L-2105D or MIL-PRF-2105-E **NOTE:** Axle lube oil capacity is 2 gallons (7.5 liters).						

Greasing Intervals and Specifications

Component	Greasing Intervals	Grease	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
Cross Tube End Assemblies, Knuckle Bushings and Drive Flange	3,000 miles (4800 km) or 200 hours of operation, whichever comes first.	Multi-Purpose Grease	O-617-A or O-617-B	1 or 2	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.
U-Joints		U-Joint Grease	O-634-B	2	Lithium 12-Hydroxy Stearate with Molybdenum Disulfide	

Oil Capacities

Axle Model	Oil Capacity	
	Pints	Liters
FDS-75	13.0	6.2
FDS-78	13.0	6.2
FDS-85	13.0	6.2
FDS-90	13.0	6.2
FDS-93	13.0	6.2
FDS-750	13.9	6.5
FDS-1600	21.0	9.9
FDS-1800	28.0	13.2
FDS-1805	28.0	13.2
FDS-1807	28.0	13.2
FDS-1808	28.0	13.2
FDS-2100	28.0	13.2

Axle Model	Oil Capacity	
	Pints	Liters
FDS-2101	28.0	13.2
FDS-2102	43.0	20.3
FDS-2107	43.0	20.3
FDS-2110	43.0	20.3
FDS-2111	43.0	20.3
FDS-2117	43.0	20.3
MX-10-120	20.0	9.0
MX-12-120	20.0	9.0
MX-14-120	20.0	9.0
MX-16-120	20.0	9.0
MX-23-160	43.0	20.0
RF-7-106*	14.0	6.6

Axle Model	Oil Capacity	
	Pints	Liters
RF-7-120	15.0	7.0
RF-9-106*	14.0	6.6
RF-9-120	15.0	7.0
RF-12-120	15.0	7.0
RF-12-125*	15.3	7.2
RF-16-145*	36.4	17.2
RF-21-155*	27.9	13.2
RF-21-156*	27.9	13.2
RF-21-160*	43.7	20.7
RF-21-355*	28.0	13.2
RF-22-166	43.0	20.0
RF-23-180*	39.3	18.6

* Oil capacities are for standard track axles that have been measured at various common drive pinion angles. The quantities listed include enough oil for both wheel ends. These oil capacities will change if the track or the drive pinion angle is different.

⚠ WARNING

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

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip or fall over. Serious personal injury and damage to components can result.

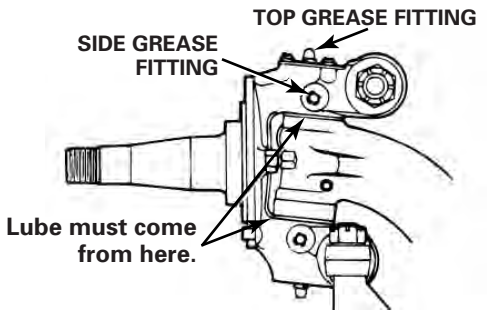
Refer to Maintenance Manual 2, Front Non-Drive Steer Axles, for service procedures. To obtain this publication, refer to the Service Notes page at the beginning of this manual.

King Pins

Axles With Conventional Wheel Ends

1. Park the vehicle on a level surface. Place blocks in front and in back of the rear wheels to keep the vehicle from moving. Set the parking brake.
2. Verify that the tires touch the ground. Do not raise the vehicle.
3. Clean all grease fittings prior to lubrication.
4. Lubricate the king pins through the top and the bottom grease fittings. **Figure 5.1**.
5. Apply lubricant to the top fitting until new lubricant purges from between the upper shim pack and thrust bearing seal.
6. Apply lubricant to the bottom fitting until new lubricant purges and fills the thrust bearing.

Figure 5.1



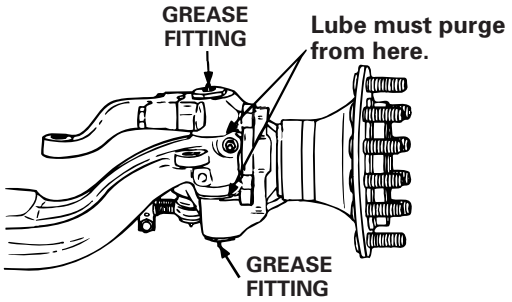
Axles With Unitized Wheel Ends

⚠ CAUTION

The unitized wheel end is sealed and greased for life and does not require lubrication. If you disassemble, repair or lubricate a unitized wheel-end assembly, you will void Meritor's warranty. Damage to components can result.

1. Park the vehicle on a level surface. Place blocks in front and in back of the rear wheels to keep the vehicle from moving. Set the parking brake.
2. Verify that the tires touch the ground. Do not raise the vehicle.
3. Clean all grease fittings prior to lubrication.
4. Lubricate the king pins through the grease fittings on the top and bottom king pin caps. **Figure 5.2**.
5. Force lubricant into upper and lower king pin grease fitting caps until new lubricant flows from between the following two areas:
   - Upper axle beam end and the knuckle. **Figure 5.2**.
   - Lower axle beam end and the knuckle. **Figure 5.2**.

Figure 5.2



Ball Studs on the Steer Arm, Tie Rod Arm Ends and Drag Link

Axles With Conventional and Unitized Wheel Ends

1. Park the vehicle on a level surface. Place blocks in front and in back of the rear wheels to keep the vehicle from moving. Set the parking brake.
2. The tires must touch the ground. Do not raise the vehicle.
3. Clean and remove oil grease fittings prior to lubrication.
4. Apply lubricant at each grease fitting until new lubricant flows from the boot. **Figures 5.3** (conventional) or **Figure 5.4** (unitized).

Figure 5.3

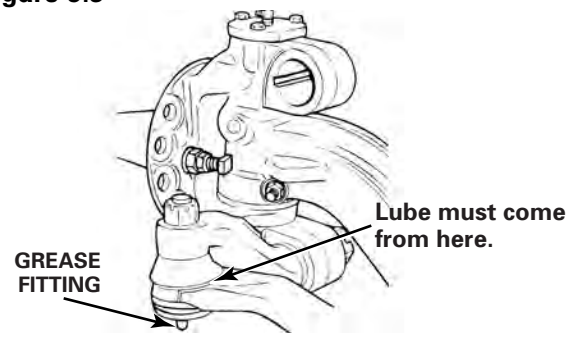
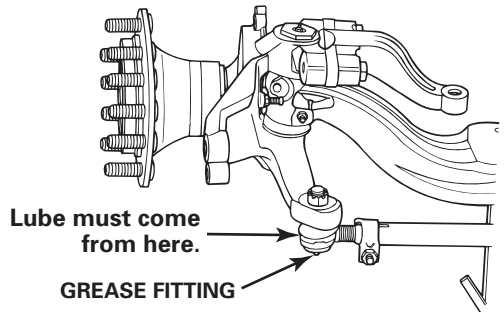


Figure 5.4



Tie Rod End

This procedure refers to all tie rod ends on Meritor non-drive steer axles.

1. Park the vehicle on a level surface. Place blocks in front of and behind the wheels.
2. Turn the vehicle wheels to the straight ahead position.
3. Wipe the grease fitting, seal and boot clean with shop towels. **Figure 5.5**.
4. Attach either a hand or air pressure grease gun to the grease fitting. **Figure 5.6**. If using air pressure, do not exceed 150 psi (1035 kPa).
5. Discolored old grease should come out of the purge holes near the boot crimp or bellows area, typically three or more places.

Figure 5.5

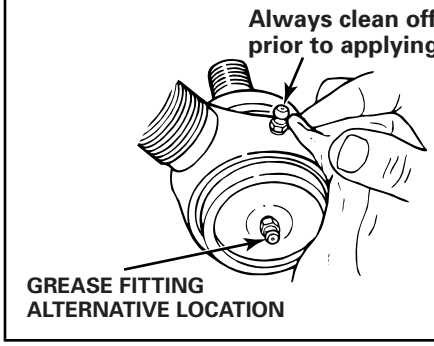
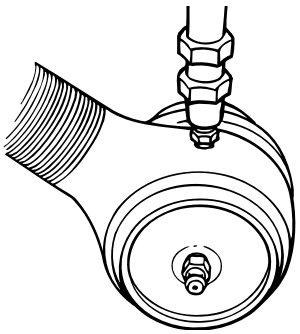


Figure 5.6



6. Use the following procedure if the tie rod end is designed for lube service and it does not accept grease.
   A. Remove the grease fitting.
   B. Inspect the threaded grease fitting hole in the tie rod end and remove any obstructions.
   C. Install a new grease fitting. Continue the lubrication procedure.
7. Apply grease until all old grease is purged from the boot.

Wheel Bearings and Wheel Ends

Axles With Conventional and Unitized Wheel Ends

Refer to Section 12 for oil and grease lubrication information.

Vocational Groups

Group Number	Typical Vocations	Vehicle Build	Typical Operation Conditions
1	On highway or turnpike, linehaul only	After July 1, 1996 Before July 1, 1996, use category 3	High mileage operation (more than 50,000 miles/year [80 500 km/year]) 95% on-highway/turnpike surface
2	Fire and rescue, city delivery, inner city coach, heavy haul, school bus, motor home, transit coach	After July 1, 1996 Before July 1, 1996, use category 3	Lower mileage operation (less than 50,000 miles/year [80 500 km/year])
3	Logging, oil field, construction, heavy haul, yard tractor (highway licensed), residential refuse	ALL	Low mileage operation (less than 25,000 miles/year [40 250 km/year]) Heavy-duty service with substantial off-road operation
4	Mining, yard tractor (non-highway licensed), and land fill refuse		Heavy-duty service
5	Mining, logging and construction		Severe duty 80-100% off highway

Lubrication, Inspection and Maintenance Schedule

Component	Service Intervals									
	48 hours	5,000 miles/ 100 hours	First 6,000 miles of operation	10,000 miles	20,000 miles	36,000 miles	40,000 miles	50,000 miles	100,000 miles	200,000 miles
		8050 km	10 000 km	16 100 km	32 200 km	58 000 km	64 000 km	80 500 km	160 000 km	320 000 km
Tie Rod Ends										
Group 1 Vocations								I	L*	
Group 2 Vocations					I		L*			
Group 3 Vocations				I,L*						
Group 4 Vocations		I,L*								
Group 5 Vocations	I,L*									
Inspect the Tie Rod Assembly for Movement										
Group 1 Vocations								I		
Group 2 Vocations					I					
Group 3 Vocations				I						
Group 4 Vocations		I								
Group 5 Vocations	I									
Tie Rod End Shop Inspection										
Ball Studs on Steer Arms									L*	
Easy Steer Plus Axle Ball Studs									I	
Sealed Axle Ball Studs									I	
Drag Link									L*	
King Pins and Bushings									L*	
Steer Arms Bolts										I
Thrust Bearings									L*	
Steer Knuckle Vertical End Play Inspection										
Group 1 Vocations								I		
Group 2 Vocations					I					
Group 3 Vocations				I						
Group 4 Vocations		I								
Group 5 Vocations	I									
Upper and Lower King Pin Bushings for Wear										
Group 1 Vocations								I		
Group 2 Vocations					I					
Group 3 Vocations				I						
Group 4 Vocations		I								
Group 5 Vocations	I									
Draw Key Nuts										
New Vehicle			T							
In-Service Vehicle						T				
Sealed Hub Unit Inspection										I

I = Inspect L = Lubricate T = Tighten to specified torque

* If power washers are used during vehicle cleaning operations, lubrication intervals need to be adjusted. Frequent power washed vehicles will require more frequent lubrication.

Conventional Front Axle Greasing Intervals and Specifications

Applies to all FF and FD Series axle models used in linehaul and city delivery vocations and including FD-931, FD-933 and FD-961 applications.

Component	Greasing Intervals	Grease ②	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
King Pins and Bushings	100,000 miles (160 000 km) or once a year, whichever comes first.	Multi-Purpose Grease ②	O-617-A	1	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.
Ball Studs on Steer Arm, Tie Rod Arm Ends and Drag Link ①			O-617-B	2		

Applies to all FF Series axle model used in other vocations (not linehaul) and including all FC-901, FC-903, FC-921, FC-941, FD-901, FE-970, FG-931, FG-933, FG-941, FG-943, FL-931, FL-941, FL-951, FU-910 and FU-935 applications.

Component	Greasing Intervals	Grease	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
King Pins and Bushings	50,000 miles (80 000 km) or once a year, whichever comes first.	Multi-Purpose Grease	O-617-A	1	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.
Ball Studs on Steer Arm, Tie Rod Arm Ends and Drag Link ①			O-617-B	2		

Easy Steer Plus Front Axle Greasing Intervals and Specifications

Applies to FF 981, FF 982, FF 983, FF 984 and FF 985 front steer axles in all vocations.

Component	Greasing Intervals	Grease	Meritor Specification	NLGI Grade	Grease Description
King Pins and Bushings	100,000 miles (160 000 km) or once a year, whichever comes first.	Multi-Purpose Grease	O-617-A	1	Lithium 12-Hydroxy Stearate or Lithium Complex
Ball Studs on Steer Arm, Tie Rod Arm Ends and Drag Link ①			O-617-B	2	
Unitized Wheel End	No Lube to Hub	Unit sealed for life of component		NONE	DO NOT LUBRICATE

① Applies to ball studs on conventional and Easy Steer front axles. For sealed axles, inspect the boot on the ball stud every 96,000 miles (154 000 km) for wear and damage. Service as necessary.

② Meritor recognizes that industry trends are moving toward increased selection and usage of synthetic grease in vehicle maintenance. However, some seals are known to expand when in contact with synthetic grease. Consult your local Meritor representative or call ArvinMeritor's Customer Service Center at 800-535-5560 for synthetic grease application references before using any synthetic grease when performing axle service and maintenance.

⚠ WARNING

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

⚠ ASBESTOS AND NON-ASBESTOS FIBERS WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

⚠ CAUTION

When grease flows from the seal near the cam head, replace the seal. Remove any grease from the cam head, rollers and linings. Grease on the linings can increase stopping distances.

If grease flows from the seal near the cam head, replace the seal. Remove any grease or oil from the cam head, rollers and linings. Always replace contaminated linings. Grease on the linings can increase stopping distances. Serious personal injury and damage to components can result.

Cam Brakes

Q Plus™ and Cast Plus™; and Q, P and T Series

Meritor's cam brakes are air-actuated, cam-operated, two-shoe brakes with each shoe mounted on a separate anchor pin. The brakes are available with automatic slack adjusters and can be assembled with spring brakes.

Q Plus™ LX500 Cam Brake Package With the Extended Lube Feature

NOTE: You must continue to observe all Meritor's recommended preventive maintenance schedules and procedures for Q Plus LX500 and MX500 cam brakes with Meritor's factory-installed automatic slack adjusters. Refer to Maintenance Manual MM-96173, Q Plus LX500 and MX500 Cam Brakes; and 4B, Automatic Slack Adjuster, for procedures. To obtain these publications, refer to the Service Notes page at the beginning of this manual.

This package is available for on-highway linehaul and all other applications and includes the following features.

- Q Plus LX500 cam brakes with Meritor's factory-installed automatic slack adjusters.
- Extended lube feature.

Q Plus™ MX500 Cam Brake Extended Maintenance Package Option

This package is available for on-highway linehaul applications only and includes the following features.

- Proprietary friction material on five-inch wider shoes for front axles, and six-inch wider shoes for rear axles for more wearable volume.
- Camshafts and automatic slack adjusters do not require lubrication and reline for three years or 500,000 miles (800 000 km), whichever comes first.
- Meritor factory-installed automatic slack adjusters.

How to Identify LX500 and MX500 Cam Brakes

NOTE: Do not remove the identification tag from the camshaft bracket during the extended maintenance period.

1. Check the identification tag affixed to the brake. The tag identifies the brake as a Q Plus brake.

2. Check the identification tag affixed to the brake chamber bracket over the top of the plugged grease hole. The tag reads "See Meritor Maintenance Manual MM-96173 for Lube Info," which identifies the brake as a Q Plus LX500 or MX500 brake.

Lubricating LX500 and MX500 Cam Brakes

1. Remove the identification tag from the chamber bracket housing.
2. Remove the grease plugs from both the chamber bracket and the automatic slack adjuster.
3. Install the grease fittings and lubricate the brake assembly through the grease fitting in the bracket with Meritor-approved synthetic grease O-695 until new grease flows from the inboard seal.
4. Lubricate the automatic slack adjuster through the grease fitting until new grease flows out of the pull pawl or camshaft seal.
5. Replace the fittings with new grease plugs and cover the bracket plug with a new identification tag.

Wedge Brakes

Meritor's Stopmaster® wedge brakes for on-highway vehicles are air-actuated and are available as single-actuated (RSA) and dual-actuated (RDA). Both models can be specified with 12-, 14- or 16-degree wedge angles.

For complete maintenance and service information for Meritor's wedge brakes, refer to Maintenance Manual 4R, Wedge Brakes. To obtain this publication, refer to the Service Notes page at the beginning of this manual.

Air Disc Brakes

For complete maintenance and service information for Meritor's Dura-Master® air disc brakes, refer to Maintenance Manual 4M, Wedge Brakes. To obtain this publication, refer to the Service Notes page at the beginning of this manual.

Meritor's air disc brakes include the following features.

- An easily-visible indicator to detect lining wear.
- A caliper that pivots away from the disc for quick shoe and lining changes.
- Meritor's automatic slack adjuster.
- A caliper that's sealed and lubricated to protect components that actuate the brake.
- Standard-service air chambers, or air chambers with springs.

Conventional Automatic Slack Adjuster Grease Specifications

Component	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
Automatic Slack Adjuster	O-616-A	1	Clay Base	Down to –40°F (–40°C)
	O-692	1 and 2	Lithium Base	Down to –40°F (–40°C)
	O-645	2	Synthetic Oil, Clay Base	Down to –65°F (–54°C)
Clevis Pins	Any of Above	Refer to Above	Refer to Above	Refer to Above
	O-637*	1-1/2	Calcium Base	Refer to the grease manufacturer's specifications for the temperature service limits.
	O-641	—	Anti-Seize	

* Do not mix O-637 calcium-base, corrosion-control grease with other greases.

Manual Slack Adjuster Grease Specifications

Component	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
Manual Slack Adjuster	O-616-A	1	Clay Base	Down to –40°F (–40°C)
	O-617-A or O-617-B	1 2	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.
	O-645	2	Synthetic Oil, Clay Base	Down to –65°F (–54°C)
	O-692	1 and 2	Lithium Base	Down to –40°F (–40°C)
Clevis Pins	Any of Above	Refer to Above	Refer to Above	Refer to Above
	O-637*	1-1/2	Calcium Base	Refer to the grease manufacturer's specifications for the temperature service limits.
	O-641	—	Anti-Seize	

* Do not mix O-637 calcium-base, corrosion-control grease with other greases.

Cam Brake Grease Specifications

Components	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
Retainer Clips Anchor Pins Roller (Journals Only) Camshaft Bushings When the brake is disassembled, or when necessary, lubricate the anchor pins and rollers where they touch the brake shoes. Do not allow grease to come in contact with the part of the cam roller that touches the cam head.	O-616-A	1	Clay Base	Down to –40°F (–40°C)
	O-617-A or O-617-B	1 2	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.
	O-645	2	Synthetic Oil, Clay Base	Down to –65°F (–54°C)
	O-692	1 and 2	Lithium Base	Down to –40°F (–40°C)
Camshaft Splines	Any of Above	Refer to Above	Refer to Above	Refer to Above
	O-637*	1-1/2	Calcium Base	Refer to the grease manufacturer's specifications for the temperature service limits.
	O-641	—	Anti-Seize	

* Do not mix O-637 calcium-base, corrosion-control grease with other greases.

Air Disc Brake (1540, 1560, 1760) Grease Specifications

Component	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
Caliper ①	O-616-A	1	Clay Base	Down to –40°F (–40°C)
	O-645	2	Synthetic Oil, Clay Base	Down to –65°F (–54°C)
Slide Pin Retainers	O-637 ②	1-1/2	Calcium Base	Refer to the grease manufacturer's specifications for the temperature service limits.
	O-641	—	Anti-Seize	
Powershaft Splines	Any of Above	Refer to Above	Refer to Above	Refer to Above

① The grease used inside the caliper must be non-melting and also allow proper brake function at the cold temperatures listed.

② Do not mix O-637 calcium-base, corrosion-control grease with other greases.

Wedge Brake Grease Specifications

Component	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
All Actuating Components, All Areas Where Shoes Contact Spider, Anchor Plungers, Adjusting Bolts or Retainer Hardware	O-616-A	1	Clay Base	Down to –40°F (–40°C)
	O-645	2	Synthetic Oil, Clay Base	Down to –65°F (–54°C)

Q Plus LX500 and MX500 Greasing Service Intervals and Specifications

On-Highway Linehaul Applications	3 years or 50,000 miles (80 000 km), whichever comes first
All Other Applications	One year, regardless of mileage

Component	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
Camshaft Splines and Clevis Pins	O-695	2	Synthetic Polyurea	–40°F (–40°C)
Anchor Pins When the brake is disassembled, or when necessary, lubricate the anchor pins where they touch the brake shoes.	O-617-A or O-617-B	1 2	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.
	O-645	2	Synthetic Oil, Clay Base	Down to –65°F (–54°C)
	O-692	1 and 2	Lithium Base	Down to –40°F (–40°C)
Shoe Rollers When the brake is disassembled, or when necessary, lubricate the rollers where they touch the brake shoes. DO NOT get grease on the part of the roller that touches the cam head.	O-617-A or O-617-B	1 2	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.
Automatic Slack Adjusters	O-695	2	Synthetic Polyurea	–40°F (–40°C)

Approved Greases

Lubricant	Recommendation
O-616-A	Shell Darina Grease No. 1 Texaco Thermatex EP-1 Texaco Hytherm EP-1 Aralub 3837
O-617-A O-617-B	Multi-Purpose Lithium Chassis Grease
O-637*	Witco Chemical Corp. SA-824946
O-641	Never-Seez Anti-Seize
O-645	Mobilgrease 28 (Military) Mobiltemp SHC 32 (Industrial) Aerospace Lubricants Inc. Tribolube 12-Grade 1
O-692	Amoco Super Permalube #2 Citgo Premium Lithium EP-2 #2 Exxon Ronex MP-2 #2 Kendall L-427 Super Blu #2 Mobilith AW-1 #1 Sohio Factran EP-2 #2
O-695	EVO-LUBE TEK-615

* Do not mix O-637 calcium-base, corrosion-control grease with other greases.

WARNING

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

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

Refer to Section 1 for recommended oil drain conditions based on used axle oil analysis.

Magnets and Magnetic Drain Plugs

Planetary axles are equipped with magnetic drain plugs that have a minimum pick-up capacity of 20 ounces (0.57 kilograms) of low carbon steel. The drain plug must be checked for metal particles at every oil change interval.

Inspect the magnetic drain plug each time the oil is changed. Use the correct part. Pipe plugs will leak if used as a drain plug.

The magnetic drain plug can be reused if, after cleaning, the plug has a minimum pick-up capacity of 20 ounces (0.57 kilograms) of low carbon steel.

Breather

CAUTION

Cover the breather when steam cleaning the housing to prevent water from entering the housing and contaminating the oil. Damage to components will result.

Breathers release pressure and vacuum condensation to help maximize oil and component life.

Seals

CAUTION

Always use the correct tools and procedures when replacing seals to prevent incorrect installation and leaking seals.

Seals keep lubricant in and dirt out of a component. When they are worn or damaged, seals leak and produce damaging low lubricant levels that will damage components.

Temperature Indicators

CAUTION

Axles can operate above 190°F (88°C) without damage. However, if the oil temperature reaches 250°F (121°C), stop the vehicle immediately and check for the cause of overheating to prevent damage to components.

Oil Level

Check and Adjust

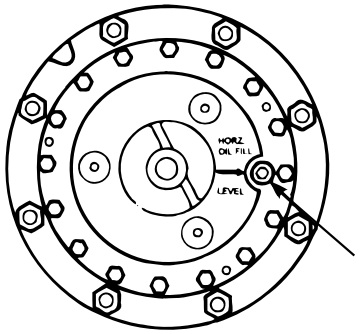
For complete fill procedures for wet disc brakes, refer to Maintenance Manual 4L, Wet Disc Brakes. To obtain this publication, refer to the Service Notes page at the beginning of this manual.

NOTE: Fill and drain plugs are located in the axle housing bowl and the wheel ends. Most axles have a common oil level. All steer axles and some rigid axles have separate oil levels in each wheel end and the axle housing bowl.

1. Park the vehicle on a level surface. Place blocks in front and in back of the rear wheels to keep the vehicle from moving.
2. For an axle with a common oil level that has drain and fill plugs only in the axle assembly, proceed to Step 4.
3. Rotate the wheels so that the oil level lines on the wheel ends are parallel to the ground.

4. Clean the areas around the fill or level plugs. Remove the plugs from the wheel end and the axle housing bowl. **Figure 7.1**. The oil level must be even with the bottom of the fill or level plug.
   - **If oil flows from the hole when you loosen the plug:** The oil level is high. Drain the oil to the correct level.
   - **If the oil level is below the bottom of fill or level plug hole:** Add the specified oil according to one of the following procedures:
     A. **For axles with separate oil levels in the wheel ends and the axle housing bowl:** Fill each area with specified oil to the bottom of the fill plug holes.
     B. **For axles with a common oil level:** Fill the axle with specified oil at each wheel end and axle housing bowl to the bottom of the fill plug holes. Wait and allow the oil to flow through the axle. Check the oil level again and fill to the correct level, if necessary.
5. Install and tighten the fill or level plugs to the correct torque specification.

Figure 7.1



Drain and Replace

NOTE: Fill and drain plugs are located in the axle housing bowl and the wheel ends. Most axles have a common oil level. All steer axles and some rigid axles have separate oil levels in each wheel end and the axle housing bowl.

1. Park the vehicle on a level surface. Place blocks in front and in back of the rear wheels to keep the vehicle from moving.
2. Place large containers under the axle and wheel ends.
3. Raise the vehicle so that the wheels are off the ground. Support the vehicle with safety stands.
4. Rotate the wheels so that the fill or level plugs in the wheel ends are toward the ground.
5. Remove the drain plugs from the wheel ends. Drain the oil. Follow correct procedures to discard the oil. Clean the drain plug.
6. Install and tighten the drain plug in the axle housing bowl and the wheel ends 35-50 lb-ft (48-67 N•m). T
7. Rotate the wheels so that the oil level lines on the wheel ends are parallel to the ground. Lower the vehicle.
8. Clean the area around the fill or level plug. Remove the fill or level plug from the wheel ends and the axle housing bowl.
9. Add the specified oil until the oil level is even with the bottom of the fill or level hole.
   - **For axles with separate oil levels in the wheel ends and the axle housing bowl:** Fill each area with specified oil to the bottom of the fill plug holes.
   - **For axles with a common oil level:** Fill the axle with specified oil at each wheel end and axle housing bowl to the bottom of the fill plug holes. Wait and allow the oil to flow through the axle. Check the oil level again and fill to the correct level, if necessary.
10. Install and tighten the fill or level plugs to the correct torque specification.

Planetary Drive Axle Oil Change Intervals and Specifications

Operation	On-Highway*	Off-Highway*
Initial Oil Change	2,500 miles (4000 km)	100 operating hours*
Check Oil Level	5,000 miles (8000 km)	250 operating hours*
Petroleum Oil Change	25,000 miles (40 000 km) or once a year (whichever comes first)	1,500 operating hours or twice a year (whichever comes first)*
Synthetic Oil or Semi-Synthetic Oil Change	Refer to Technical Publication TP-9303	3,000 operating hours or once a year (whichever comes first)

Meritor Specifications	Specification Approval	Oil Description	Outside Temperature			
			°F		°C	
			Min.	Max.	Min.	Max.
O-76A Gear Oil	MIL-PRF-2105-E and SAE J2360	GL-5, SAE 85W/140	10	None	–12	None
O-76D Gear Oil		GL-5, SAE 80W/90	–15	None	–26	None
O-76E Gear Oil		GL-5, SAE 75W/90	–40	None	–40	None
O-76L Gear Oil		GL-5, SAE 75W/140	–40	None	–40	None
O-76M Gear Oil		GL-5, SAE 75W/140	–40	None	–40	None
O-76N Gear Oil		GL-5, SAE 75W/140	–40	None	–40	None

* The interval depends on the individual operating conditions, speeds and loads. Severe operating conditions may require more frequent intervals.

Planetary Drive Axle Oil Capacities

Axle Model	Axle Housing Approximate Oil Capacity*		Wheel Ends Approximate Oil Capacity*	
	Pints	Liters	Pints	Liters
PR-53	33.0	15.6	3.0	1.4
PR-60	27.0	12.8	3.0	1.4
PR-100	22.0	10.4	3.5	1.6
PR-108	29.0	13.7	7.0	3.3
PR-111	27.0	12.8	4.6	2.2
PR-112	44.0	20.8	6.0	2.8
PR-145	32.0	15.1	5.0	2.4
PR-150	29.0	13.7	5.0	2.0
PR-151	30.0	14.2	8.0	3.8
PR-153	31.0	14.7	7.5	3.6
PR-200	40.0	18.9	6.0	2.8
PR-205	46.0	21.8	7.0	3.3
PR-207	45.0	21.3	6.0	2.8
PR-208	43.0	20.3	8.0	3.8
PR-209	56.0	26.4	5.0	2.4

Axle Model	Axle Housing Approximate Oil Capacity*		Wheel Ends Approximate Oil Capacity*	
	Pints	Liters	Pints	Liters
PR-251	42.0	19.9	12.0	5.7
PR-253	39.0	18.5	13.0	6.20
PR-256	44.0	20.8	18.0	8.50
PR-270	44.0	20.8	18.0	8.50
PR-350	28.0	13.2	14.0	16.60
PR-400	32.0	15.1	16.0	7.60
PR-500	56.0	26.5	28.0	13.20
PR-501	64.0	30.3	28.0	13.20
PR-502	62.0	29.3	31.0	14.70
PR-700	64.0	30.3	30.0	14.19
PRC-184	32.0	15.1	4.0	1.80
PRC-264	16.0	7.5	4.0	1.80
PRC-755	32.0	15.1	10.0	4.70
PRC-864	30.0	14.1	6.0	2.80
PRC-867	48.0	22.7	10.0	4.70

* Due to varied planetary drive axle specifications, these fill quantities are for reference only.

Planetary Drive Axle Oil Capacities

Axle Model	Axle Housing Approximate Oil Capacity*		Wheel Ends Approximate Oil Capacity*	
	Pints	Liters	Pints	Liters
PRC-1925	32.0	15.1	16.0	7.57
PRC-3795	28.0	13.2	14.0	6.62
PRC-3796	48.0	22.7	28.0	13.20
PRC-3805	58.0	27.4	22.0	10.40
PRC-4805	60.0	28.3	31.0	14.60
PRC-5324	80.0	37.8	24.0	11.30
PRC-5334	80.0	37.8	24.0	11.30
PRC-7314	72.0	34.0	24.0	11.30
PRLC-344	44.0	20.8	6.0	2.84
PRLC-614	29.0	13.7	7.0	3.31
PRLC-675	56.0	26.5	5.0	2.37
PRLC-823	44.0	20.8	18.0	8.51
PRLC-1756	39.0	18.5	13.0	6.15
PRLC-1757	39.0	18.5	13.0	6.15
PRLC-1925	72.0	34.0	12.0	5.60
PRLM-855	28.0	13.2	8.0	3.70
PRM-672	29.0	13.7	5.0	2.37
PRM-673	29.0	13.7	5.0	2.37
PRM-676	46.0	21.8	7.0	3.31
PRM-677	46.0	21.8	7.0	3.31
PRM-1314	44.0	20.8	18.0	8.51
PRM-1315	44.0	20.8	18.0	8.51
PRM-1615	44.0	20.8	18.0	8.51
PRM-1756	43.0	20.3	13.0	6.15
PRM-1757	43.0	20.3	13.0	6.15
PRTA-134	14.0	6.6	4.0	1.80
PRTC-203	19.0	8.9	6.0	2.80
PRS-16	27.0	12.8	3.0	1.42
PS-100	20.0	9.5	3.5	1.66
PS-150	22.0	10.4	5.0	2.37
PS-200	38.0	18.0	6.0	2.84
PS-260	44.0	20.8	8.0	3.25
PS-270	44.0	20.8	8.0	3.78
PS-310	36.0	17.0	14.0	6.62

Axle Model	Axle Housing Approximate Oil Capacity*		Wheel Ends Approximate Oil Capacity*	
	Pints	Liters	Pints	Liters
PS-500	58.0	27.4	29.0	13.72
PSC-204	29.0	13.7	6.0	2.80
PSC-593	28.0	13.0	4.0	1.89
PSC-594	28.0	13.2	4.0	1.89
PSC-1615	40.0	18.9	8.0	3.78
PSC-1617	40.0	18.9	8.0	3.78
PSC-1875	56.0	26.4	20.0	9.40
PSC-4564	58.0	27.4	29.0	13.72
PSM-826	42.0	19.9	6.0	2.80
PSM-1044	44.0	20.8	6.0	2.80
PSM-1045	44.0	20.8	6.0	2.80
PSM-1614	44.0	20.8	8.0	3.70
PSTM-824	28.0	13.2	6.0	2.80
EPRC-1356				
Forward	32.0	15.1	14.0	6.60
Middle	32.0	15.1	14.0	6.60
Rear	32.0	15.1	14.0	6.60
SPRC-1356				
85" Track	32.0	15.1	14.0	6.60
90" Track	33.5	15.9	14.0	6.60
100" Track	36.0	17.0	14.0	6.60
SPRC-1357				
Forward	36.0	17.0	14.0	6.60
Rear	36.0	17.0	14.0	6.60
SPRC-1357				
85" Track	32.0	15.1	14.0	6.60
90" Track	33.5	15.9	14.0	6.60
100" Track	36.0	17.0	14.0	6.60
SPRC-1735				
85" Track	32.0	15.1	15.0	7.10
90" Track	33.5	15.9	15.0	7.10
100" Track	36.0	17.0	15.0	7.10
SPRC-1736				
Forward	36.0	17.0	15.0	7.10
Rear	36.0	17.0	15.0	7.10
SPRC-1736				
85" Track	32.0	15.1	15.0	7.10
90" Track	33.5	15.9	15.0	7.10
100" Track	36.0	17.0	15.0	7.10
SPRC-1926	32.0	15.1	16.0	7.60
SPRC-4806	64.0-72.0	31.0-34.0	32.0	15.10

* Due to varied planetary drive axle specifications, these fill quantities are for reference only.

WARNING

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

CAUTION

Fill axles with specified lubricants only. Filling an axle with non-approved lubricants will void Meritor's warranty. Damage to axle components also can result.

To avoid axle component damage, fill axles with approved lubricants only. Using non-approved lubricants also will void Meritor's warranty.

NOTE: For information on lubricant suppliers, refer to technical bulletin TP-9539. To obtain this publication, refer to the Service Notes page at the beginning of this manual.

NOTE: Refer to Section 12 for information on wheel bearings and wheel ends.

Magnets and Magnetic Drain Plugs

NOTE: Inspect the magnetic drain plug each time the oil is changed. Use the correct part. Pipe plugs will leak if used as a drain plug.

Although axles are normally equipped with magnetic plugs having a minimum pick-up capacity of 1.5 pounds (0.7 kilograms) of low carbon steel, Advanced Lube axles have stronger magnetic "cleansing" features.

These axles are equipped with strong five-pound (2.2 kilograms) pull magnets, and high grade magnetic fill and drain plugs that collect damaging particles at the bottom of the axle housing.

Tandem axles have four magnets in each housing and high grade magnetic fill and drain plugs. Single axles have six magnets in each housing and high grade magnetic drain and fill plugs.

Check the drain plug for metal particles every 100,000 miles (160 000 kilometers). A magnetic drain plug can be used if the plug has a minimum pick-up capacity of 1.5 pounds (0.7 kilograms) of low carbon steel after cleaning.

Breather

CAUTION

Cover the breather when steam cleaning the housing to prevent water from entering the housing and contaminating the oil. Damage to components can result.

Baffle-type breathers release pressure and vacuum condensation to minimize premature oil and component failure.

Seals

CAUTION

Always use the correct tools and procedures when replacing seals to prevent incorrect installation, leaking seals and damage to components.

Seals keep lubricant in and dirt out of a component. When they are worn or damaged, seals leak and produce damaging low lubricant levels.

Durable triple-lip pinion seals protect the quality and levels of the lubricant and provide superior performance. Advanced Lube axles have triple-lip seals designed to work with current and future lubricants.

Temperature Indicators

CAUTION

Axles can operate above 190°F (88°C) without damage. However, if oil the temperature reaches 250°F (121°C), stop the vehicle immediately and check for the cause of overheating. Damage to components can result.

Some axles may have a tapped hole in the housing to install a temperature indicator. A temperature indicator monitors oil temperature and helps to maximize component life, which can be shortened by high oil temperatures that result from severe operating conditions, or unequally inflated and mismatched tires.

Advanced Lube Axles

Advanced Lube axles require different drain intervals than other axles. Refer to the Oil Change Intervals and Axle Oil Specifications tables in this section.

The vehicle manufacturer may attach a tag at the axle fill hole or on the inside of the door to identify an Advanced Lube axle. The tag specifies that the axle is filled with semi-synthetic or full-synthetic gear oil.

R-170 Axles Equipped With Traction Equalizer®

R-170 axles with traction equalizer normally operate with either standard petroleum, semi-synthetic or full-synthetic oils.

Limited Slip Friction Modifiers

Occasionally the traction equalizer will "slip" or "stick." When this happens, you will hear intervals of shrill noises when the vehicle operates at low speed or when the vehicle makes sharp turns. You can correct this condition by adding limited slip friction modifiers.

NOTE: Limited slip friction modifiers usually deteriorate more quickly than extreme pressure (EP) additives. Shorten the lubricant change schedule when using a friction modifier.

- **At the initial lubricant change interval for an R-170 equipped with traction equalizer:** Replace the factory-installed lubricant with an approved lubricant and one of the additives specified in the table below.
- **After the initial change interval:** Change the lubricant and the additive at or before 50,000 miles (80 000 km).

Specifications

For all GL-5 oils (petroleum oil or synthetic), add one of the following limited slip friction modifiers specified in the table below.

Manufacturer	Specification
DSL-178	Guardsman Products
Equa-Torque #2411 and #2414	Sta-Lube Corporation
Lubrizol # 6178	Lubrizol Corporation

Quantities for R-170 Axles With and Without Traction Equalizer

WITH Traction Equalizer	WITHOUT Traction Equalizer
40 pints oil (18.9 liters) + 3 Pints additive (1.4 liters)	43 pints oil (20.3 liters)

Oil Level

Fill Plug Locations

1. If the fill plug is only in the axle-housing bowl, use that fill plug. Do not use the temperature sending unit hole. **Figure 8.1**.
2. If the drive pin angle is seven degrees or less, use the fill plug in the differential carrier. **Figures 8.2 and 8.7**.
3. If the drive pin angle is more than seven degrees, use the fill plug in the axle-housing bowl. **Figures 8.4 through 8.8**.

Figure 8.1

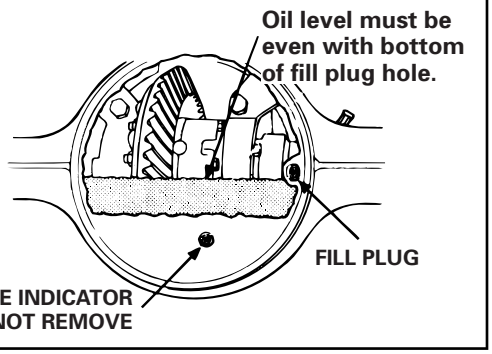


Figure 8.2

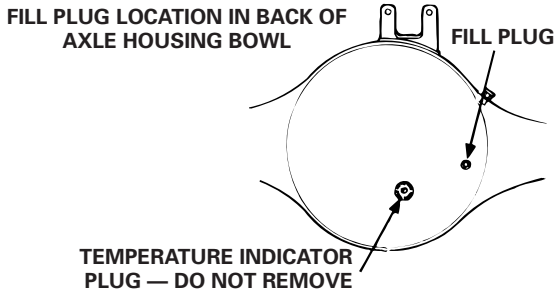


Figure 8.3

FRONT-MOUNTED SINGLE-REDUCTION AXLES

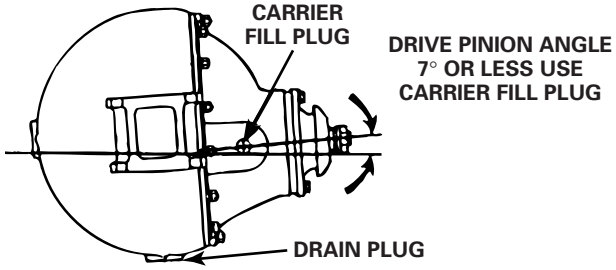


Figure 8.4

FRONT-MOUNTED SINGLE-REDUCTION AXLES

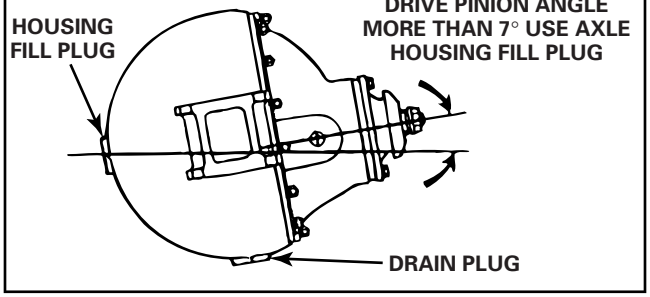


Figure 8.5

FRONT-MOUNTED SINGLE-REDUCTION TANDEM AXLES

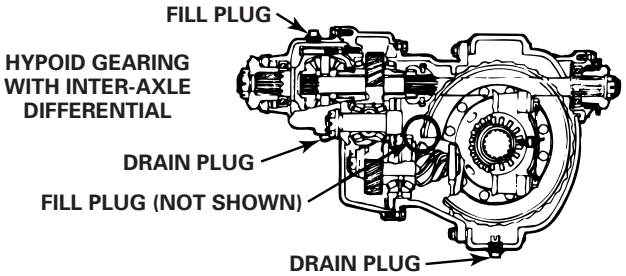


Figure 8.6

FRONT-MOUNTED SINGLE-REDUCTION
TANDEM AXLES

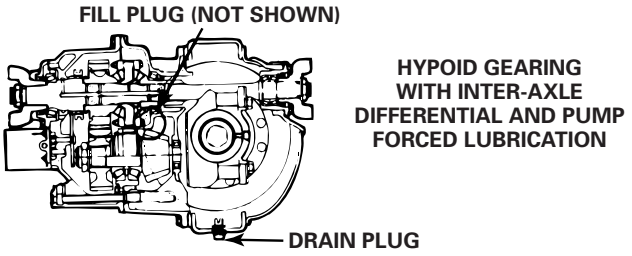


Figure 8.7

FRONT-MOUNTED DOUBLE-REDUCTION
AND TWO-SPEED AXLES

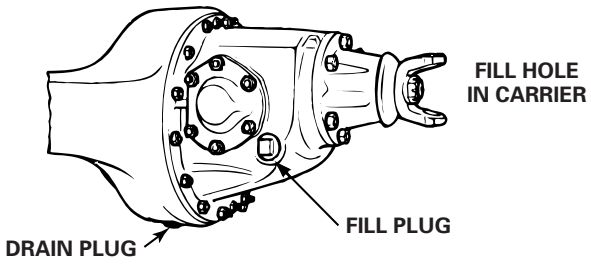
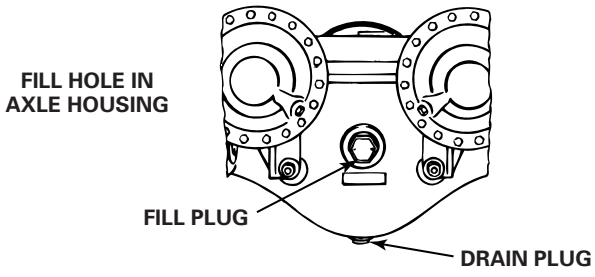


Figure 8.8

FRONT-MOUNTED DOUBLE-REDUCTION
AND TWO-SPEED AXLES



Check and Adjust

WARNING

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

Check the oil level when the axle is at room temperature. When hot, the oil temperature may be 190°F (88°C) or more and can cause burns. A correct level is not obtained when the axle is warm or hot. Serious personal injury and damage to components can result.

1. Park the vehicle on a level surface. Place blocks under the front wheels to prevent the vehicle from moving. The axle must be cold or near room temperature.
2. Clean the area around the fill plug. Remove the fill plug from the differential carrier or the axle-housing bowl (depending on the axle). Do not remove the temperature indicator plug. **Figures 8.2 through 8.8**.
3. Check the oil level. The level must be even with the bottom of the fill plug hole. **Figure 8.1**.
4. Install the fill plug. Tighten the plug 35-50 lb-ft (48-67 N•m).

Drain and Replace

NOTE: Drain the oil when it is warm. Remove and replace the oil filters each time the oil is drained.

1. Refer to Fill Plug Locations in this section.
2. Park the vehicle on a level surface. Place blocks under the front wheels to prevent the vehicle from moving. Place a large container under the axle.
3. Install the drain plug. Tighten the plug 35-50 lb-ft (48-67 N•m).
   - **If an oil pump is used:** Remove and replace the oil filters.
   - **For Advanced Lube axles:** Replace the oil filter every 100,000 miles (160 000 km).
4. Clean the area around the fill plug. Remove the fill plug from the differential carrier of the axle-housing bowl (depending on the axle). Do not remove the temperature indicator plug.
5. Add the specified oil until the oil is even with the bottom of the fill plug hole. Wait to allow the oil to flow through the axle.
   - **If the inter-axle differential has a top fill plug hole:** Add an additional two pints (0.946 liters) of the same oil into the inter-axle differential housing.
6. Check the oil level again. If necessary, continue to add oil until it is even with the bottom of the fill plug hole.
7. Install the fill plug. Tighten the plug 35-50 lb-ft (48-67 N•m).

Inter-Axle Assemblies With Separate Housings

SLHD, SQHD, STDD and SFDD forward-rear tandem axle carrier models include separate housings for inter-axle differential assemblies.

The baffles and dams used in these housings hold a reservoir of oil that can also trap wear particles and debris. Always purge the oil from these reservoirs when changing the axle oil.

These carriers have separate drain and fill holes in either the inter-axle differential cover or housing.

Oil Change Intervals and Specifications for All Rear Drive Axles①

Vocation or Vehicle Operation	Linehaul Motorhome Intercity Coach	City Delivery School Bus Fire Truck	Construction Transit Bus Refuse Yard Tractor Logging Heavy Haul Mining Oil Field Rescue
Initial Oil Change	No longer required as of January 1, 1993		
Check Oil Level	Every 25,000 miles (40 000 km), or the fleet maintenance interval (whichever comes first)	Every 10,000 miles (16 000 km), once a month, or the fleet maintenance interval (whichever comes first)	Every 5,000 miles (8000 km), once a month, or the fleet maintenance interval (whichever comes first) ②
Petroleum Based Oil Change on Axle with or without Pump and Filter System	Every 100,000 miles (160 000 km) or annually, whichever comes first	Every 50,000 miles (80 000 km) or annually, whichever comes first	Every 25,000 miles (40 000 km) or annually, whichever comes first
Synthetic Oil Change on Axle without Pump and Filter System ③	Every 250,000 miles (400 000 km) or 3 years, whichever comes first	Every 100,000 miles (160 000 km) or annually, whichever comes first	Every 50,000 miles (80 000 km) or annually, whichever comes first
Synthetic Oil Change on Axle with Pump and Filter System ③	Every 500,000 miles (800 000 km)	Every 250,000 miles (400 000 km)	Every 100,000 miles (160 000 km)
Filter Change on Axle with Pump and Filter System	Every 100,000 miles (160 000 km)	Every 100,000 miles (160 000 km)	Every 100,000 miles (160 000 km)

① If a No-Spin differential is installed, change the oil (petroleum or synthetic) at minimum interval or 40,000 miles (64 000 km) or a maximum interval or 50,000 miles (80 000 km).

② For continuous heavy-duty operation, check the oil level every 1,000 miles (1600 km). Add the correct type and amount of oil as required.

③ This interval applies to approved semi-synthetic and full synthetic oils only. For list of approved extended-drain axle oils, refer to TP-9539, Approved Rear Drive Axle Lubricants. To obtain this publication, refer to the Service Notes page at the beginning of this manual.

Axle Oil Specifications

	Gear Oil Type	A.P.I. Specification	SAE Grade	Meritor Specification	Military/SAE Specification	Outside Temperature
Non-Extended Drain Lubricants	Petroleum with EP Additives	GL-5	85W/140	O-76A	MIL-PRF-2105E and SAE J2360	Above +10°F (–12°C)
			80W/140	O-76B		Above –15°F (–26°C)
			80W/90	O-76D		Above –15°F (–26°C)
			75W/90	O-76E		Above –40°F (–40°C)
			75W	O-76J		From –40°F (–40°C) to 35°F (2°C)
			75W/140	O-76L		Above –40°F (–40°C)
Extended Drain Lubricants	Petroleum with Extended Drain Additives	GL-5	80W/90	—	MIL-PRF-2105E and SAE J2360	Above –15°F (–26°C)
	Semi-Synthetic		80W/90	—		Above –15°F (–26°C)
	Full Synthetic		75W/140	O-76M		Above –40°F (–40°C)
	Full Synthetic		75W/90	O-76N		Above –40°F (–40°C)

Single Rear Drive Axle Oil Capacities*

	Oil Capacity*	
Axle Model	**Pints**	**Liters**
A-150	5.5	2.6
B-100	10.0	4.7
B-140	12.0	5.7
B-150	3.5	1.7
C-100	12.5	5.9
D-100	12.5	5.9
D-140	12.5	5.9
E-100	15.0	7.1
E-105	12.5	5.9
E-150	9.0	4.3
F-100	13.0	6.2
F-106	13.0	6.2
F-120	15.0	7.1
F-121	15.0	7.1
F-140	14.0	6.6
G-161	21.0	9.9
H-100	20.0	9.5
H-140	21.0	9.9
H-150	11.0	5.2
H-162	20.0	9.5
H-170	27.0	12.8
H-172	27.0	12.8
L-100	23.0	10.9
L-140	24.0	11.4
L-155	24.0	11.4
L-172	27.0	12.8
M-172	27.0	12.8
Q-100	31.0	14.7
Q-145	24.0	11.4
QT-140	24.0	11.4
R-100	30.0	14.2
R-140	28.0	13.3

	Oil Capacity*	
Axle Model	**Pints**	**Liters**
R-155	28.0	13.3
R-160	28.0	13.3
R-163	34.0	16.1
R-170	43.0	20.3
R-270	55.0	26.0
RL-170	48.0	22.7
RC-22-145	32.3	15.3
RC-23-160	41.0	19.4
RC-25-160	39.5	18.7
RS-13-120	18.4	8.7
RS-15-120	18.4	8.7
RS-15-210	14.3	6.8
RS-15-220	30.0	14.0
RS-17-140	28.6	13.5
RS-17-144	32.0	15.0
RS-17-145	33.6	15.9
RS-17-220	30.7	14.5
RS-17-224	29.0	13.0
RS-19-144	32.0	15.0
RS-19-145	33.2	15.7
RS-19-220	30.0	14.0
RS-19-224	29.0	13.0
RS-21-145	32.3	15.3
RS-21-160	39.0	18.0
RS-21-230	38.9	18.4
RS-23-160	39.5	18.7
RS-23-161	37.2	17.6
RS-23-180	47.3	22.4
RS-23-186	47.3	22.4
RS-23-240	37.4	17.7
RS-23-380	63.6	30.1
RS-25-160	37.0	17.0

	Oil Capacity*	
Axle Model	**Pints**	**Liters**
RS-26-160	47.5	22.5
RS-26-180	46.6	22.0
RS-26-185	46.0	22.0
RS-26-380	58.2	27.5
RS-30-180	46.6	22.0
RS-30-185	46.0	22.0
RS-30-380	58.2	27.5
RS-38-380	53.1	25.1
S-170	43.0	20.3
U-140	24.0	11.4
U-170	43.0	20.3
U-270	55.0	26.0
W-170	43.0	20.3
W-270	55.0	26.0
59722	30.5	14.4
59723	30.5	14.4
59732	30.5	14.4
59733	30.5	14.4
59843	30.5	14.4
61142	42.0	19.8
61143	41.0	19.3

* Oil capacities are for standard track axles that have been measured at various common drive pinion angles. The quantities listed include enough oil for both wheel ends. These oil capacities will change if the track or the drive pinion angle is different.

Tandem Rear Drive Axle Oil Capacities

Axle Model	Carrier	Oil Capacity ①	
		Pints	Liters
MT-40-143MA-N	Forward Rear	30.2 25.8	14.3 12.2
RT-34-140	Forward Rear	26.0 35.0	12.3 16.6
RT-34-144	Forward Rear	30.0 25.0	14.0 12.0
RT-34-145	Forward Rear	29.6 25.4	14.0 12.0
RT-34-145P	Forward Rear	25.7 23.4	12.1 11.1
RT-40-140	Forward Rear	30.2 22.8	14.3 10.8
RT-40-145	Forward Rear	30.2 25.8	14.3 12.2
RT-40-149	Forward Rear	30.0 25.0	14.0 12.0
RT-40-160	Forward Rear	39.1 39.4	18.5 16.3
RT-40-169	Forward Rear	39.0 34.0	18.0 16.0
RT-44-145	Forward Rear	29.3 25.1	13.9 11.9
RT-46-16HEH/HP	Forward Rear	38.0 33.0	18.0 15.0
RT-46-160	Forward Rear	39.1 34.4	18.5 16.3
RT-46-164	Forward Rear	39.1 39.4	18.5 16.3
RT-46-164EH/P	Forward Rear	38.0 33.0	18.0 15.0
RT-46-169	Forward Rear	39.0 34.0	18.0 16.0
RT-48-180 ②	Forward Rear	61.1 36.8	28.9 17.4
RT-48-380 ②	Forward Rear	61.1 63.6	28.9 30.1
RT-50-160	Forward Rear	38.0 33.0	18.0 15.0
RT-52-160	Forward Rear	44.1 41.2	20.9 19.5
RT-52-180 ②	Forward Rear	56.1 36.1	26.5 17.1
RT-52-185	Forward Rear	56.1 36.1	26.5 17.1
RT-52-380 ②	Forward Rear	56.1 58.2	26.5 27.5
RT-58-180 ②	Forward Rear	56.1 36.1	26.5 17.1
RT-58-185	Forward Rear	56.1 36.1	26.5 17.1
RT-58-380 ②	Forward Rear	56.1 58.2	26.5 27.5
RT-70-380 ②	Forward Rear	54.4 53.1	25.7 25.1
SFHD	Forward Rear	17.0 16.5	8.0 7.8
SL-100	Forward Rear	39.6 37.7	18.7 17.8
SLHD	Forward Rear	32.5 32.0	15.3 15.1
SQ-100	Forward Rear	39.6 37.7	18.7 17.8
SQ-100A	Forward Rear	39.3 37.6	18.6 17.8
SQHD	Forward Rear	34.0 31.0	16.0 14.7
SQHP	Forward Rear	40.0 36.0	18.9 17.0
SR-170	Forward Rear	55.0 43.0	26.0 20.3
SRHD	Forward Rear	39.0 36.0	18.5 17.0
SSHD	Forward Rear	34.0 28.0	16.0 13.2
ST-170	Forward Rear	55.0 43.0	26.0 20.3
STHD	Forward Rear	34.0 28.0	16.0 13.2
SU-170	Forward Rear	55.0 43.0	26.0 20.3
SUHD	Forward Rear	34.0 28.0	16.0 13.2
SW-170	Forward Rear	55.0 43.0	26.0 20.3

① Oil capacities are for standard track axles that have been measured at various common drive pinion angles. The quantities listed include enough oil for both wheel ends. These oil capacities will change if the track or the drive pinion angle is different.

② Forward carrier with oil pump system.

Tridem Rear Drive Axle Oil Capacities

Axle Model	Carrier	Oil Capacity ①	
		Pints	Liters
RZ-166	Axle 1 Axle 2 Axle 3	39.1 39.1 34.4	18.5 18.5 16.3
RZ-186	Axle 1 Axle 2 Axle 3	56.1 39.1 34.4	26.5 18.5 16.3
RZ-188	Axle 1 Axle 2 Axle 3	56.1 56.1 36.1	26.5 26.5 17.1

⚠ WARNING

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

TB Series Trailer Axles With Unitized Wheel-End Assemblies

⚠ CAUTION

TB Series trailer axles with unitized wheel-end assemblies use conventional brakes and automatic slack adjusters, as well as conventional tire and wheel assemblies. Service these components as you would under normal operation conditions to avoid damage to components.

A unitized wheel end is permanently sealed and lubricated as an assembly. Do not attempt to remove the hub bearings, seals and lubricant. You cannot service or reinstall these components into a unitized wheel-end assembly. Damage to components can result.

NOTE: Removal of the long-life bearings, seals and lubricant from the hub assembly will void the warranty.

The TB series trailer axle features a permanently sealed and lubricated unitized wheel end assembly designed to help reduce wheel-end maintenance.

The unitized wheel end is designed to remain in place on the axle for a minimum of five years or 500,000 miles (800 000 km).

For TB series unitized wheel-end service procedures, refer to technical bulletin TP-96175, Servicing Meritor's TB Series Trailer Axles with Unitized Hub Assemblies. To obtain this publication, refer to the Service Notes page at the beginning of this manual.

Unitized Wheel Ends and Conventional Wheel Ends

On a unitized wheel end, you install the hub, seal, lubricant and bearings onto the axle spindle as an assembly. **Figure 9.1**.

On a conventional wheel end, you install the hub, seal, lubricant and bearings onto the axle spindle as separate components. **Figure 9.2**.

Figure 9.1

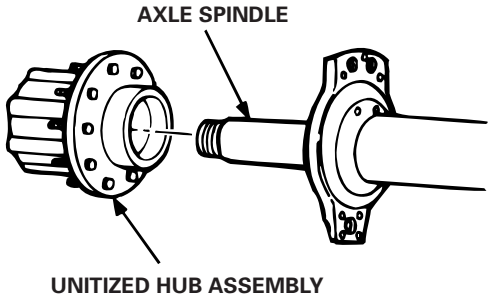
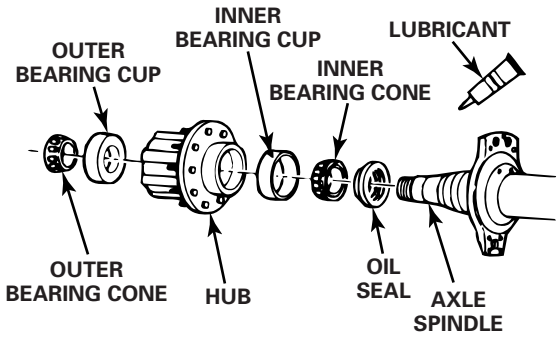


Figure 9.2



Trailer Axle With Unitized Wheel Ends

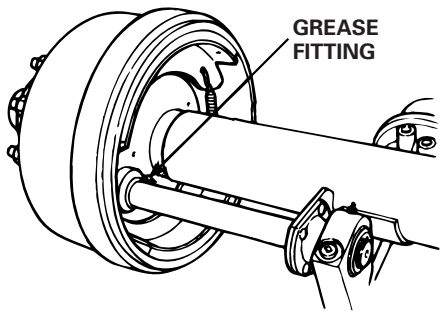
- The model number designation for the TB series is prefixed with TB; for example, TB-4670 or TB-8670.
- The axle spindles are shorter with a single journal.
- The hubs contain non-serviceable bearings, seals and lubricant.
- The hubcaps screw onto the axle spindle and have no provisions for adding lubricant.
- The axle spindle retention hardware features a thicker inner nut and a bendable tab lockwasher.
- Warranty information is stamped on each unitized wheel end:

Important:

Removal of long-life bearings, seals or lubricant from the Meritor TB series trailer axle hub will void the warranty. Refer to Technical Bulletin TP-96175 or call 800-535-5560 for information.

MERITOR® TP-9700

Figure 9.3



Camshaft Bushings

Conventional and TB Series

Apply the specified grease at the grease fitting on the spider. Apply grease until new grease purges from all the seals. **Figure 9.3**.

Conventional and TB Series Camshaft Bushing Greasing Intervals and Specifications

Greasing Interval*	Grease	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
Use the schedule below that gives the most frequent lubrication: • The lubrication schedule of the fleet. • The lubrication schedule of the vehicle manufacturer. • A minimum of four times during the life of the brake linings.	Multi-Purpose Grease	O-617-A or O-617-B	1 or 2	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.

* Applies to standard-duty on-highway service. Lubricate more frequently for heavy-duty applications. Determine intervals by inspecting lubricant every two weeks for a four month period. Look for hard, contaminated or missing grease. Choose an interval based on the inspection.

Conventional Trailer Axle Wheel-End Oil Change Intervals and Specifications

Check Oil Level	Oil Change *	Meritor Specification	Specification Approval	Oil Description	Outside Temperature °F Min.	Outside Temperature °F Max.	Outside Temperature °C Min.	Outside Temperature °C Max.
1,000 miles (1600 km)	**General Service:** Change oil if the wheel end is disturbed during wheel or hub removal or if the oil is contaminated. **Standard-Duty Service:** For 100,000 miles (160 000 km) or more a year, change the oil every 100,000 miles (160 000 km). For less than 100,000 miles (160 000 km) a year, change the oil once a year. **Heavy-Duty Service:** For 60,000 miles (96 000 km) or more a year, change oil every 30,000 miles (48 000 km). For less than 60,000 miles (96 000 km) a year, change the oil every 6 months.	O-76A Gear Oil	MIL-PRF-2105-E and SAE J2360	GL-5 SAE 85W/140	10	None	–12	None
		O-76D Gear Oil		GL-5 SAE 80W/90	–15	None	–26	None
		O-76E Gear Oil		GL-5 SAE 75W/90	–40	None	–40	None
		O-76J Gear Oil		GL-5 SAE 75W	–40	35	–40	2
		O-76L Gear Oil		GL-5 SAE 75W/140	–40	None	–40	None
		O-76M Full Synthetic Gear Oil		GL-5 SAE 75W/140	–40	None	–40	None
		O-76N Full Synthetic Gear Oil		GL-5 SAE 75W/90	–40	None	–40	None
		O-81 Full Synthetic Oil		SAE 50	–40	None	–40	None

* The recommended oil change interval is based on operating conditions, speeds and loads. Limited service applications may allow the recommended interval to be increased. Severe service applications may require the recommended interval to be reduced. For more information, contact ArvinMeritor's Customer Service Center at 800-535-5560.

Conventional Trailer Axle Greasing Intervals and Specifications

Greasing Interval *	Grease	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
General Service: Grease the bearings if the wheel end is disturbed during wheel or hub removal or if the grease is contaminated. **Standard-Duty Service:** For 100,000 miles (160 000 km) or more a year, grease the bearings every 100,000 miles (160 000 km). For less than 100,000 miles (160 000 km) a year, grease the bearings once a year. **Heavy-Duty Service:** For 60,000 miles (96 000 km) or more a year, grease the bearings every 30,000 miles (48 000 km). For less than 60,000 miles (96 000 km) a year, grease the bearings every 6 months.	Multi-Purpose Grease	O-617-A or O-617-B	1 or 2	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.
	Trailer Axle Bearing	O-647	00	Lithium Complex	

* The recommended greasing interval is based on operating conditions, speeds and loads. Limited service applications may allow the recommended interval to be increased. Severe service applications may require the recommended interval to be reduced. For more information, contact an ArvinMeritor service representative.

WARNING

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

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

Operating Information

Magnets and Magnetic Drain Plugs

Most transfer cases are equipped with magnetic plugs having a minimum pick-up capacity of 20 ounces (0.57 kilograms) of low carbon steel.

NOTE: Inspect the magnetic drain plug each time the oil is changed. Use the correct part. Pipe plugs will leak if used as a drain plug.

The magnetic drain plug can be reused if, after cleaning, the plug has a minimum pick-up capacity of 20 ounces (0.57 kilograms) of low carbon steel.

Breather

CAUTION

Cover the breather when steam cleaning the housing to prevent water from entering the housing and contaminating the oil. Damage to components will result.

Breathers release pressure that builds up inside the transfer case during vehicle operation.

Seals

CAUTION

Always use the correct tools and procedures when replacing a seal. A seal that is not correctly installed can leak. Damage to components can result.

Seals keep lubricant in and dirt out of a component. When they are worn or damaged, seals leak and produce low lubricant levels which may damage components. Always replace seals after yokes have been removed.

Temperature Indicator

CAUTION

Transfer cases may operate above 190°F (88°C) without damage. However, if the oil temperature reaches 250°F (121°C), stop the vehicle immediately and check for the cause of overheating. Maximum continuous running oil temperature should not exceed 225°F (107°C). Damage to components can result.

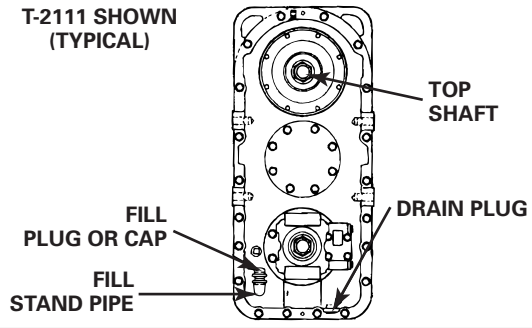
Check and Adjust Oil Level

CAUTION

Only use new lubricant when changing or adjusting the oil in the transfer case. Do not reuse lubricants which can contain metallic particles and other contaminants. Damage to components can result.

1. Park the vehicle on a level surface. Place blocks under the wheels to prevent the vehicle from moving.
2. Clean the area around the fill plug or fill cap. Remove the fill plug or fill cap from the transfer case. **Figure 10.1**. The oil level must be even with the bottom of the fill plug hole or the top of the stand pipe.
   - **If oil flows from the hole when you loosen the plug:** The oil level is high. Drain the oil to the bottom of the fill hole.
   - **If the oil level is below the bottom of fill or level plug hole or stand pipe:** Add the specified oil until oil is even with the bottom of the fill hole.
3. Install and tighten the fill plug 35-50 lb-ft (47-68 N•m). T

Figure 10.1



Drain and Replace the Oil

1. Park the vehicle on a level surface. Place blocks under the wheels to prevent the vehicle from moving. Place a large container under the transfer case.
2. Remove the drain plug from the bottom of the transfer case. Drain and discard the oil correctly. Clean the plug. **Figure 10.1**.
3. Install and tighten the drain plug 35-50 lb-ft (47-68 N•m). (T)
4. Clean the area around the fill plug. Remove the fill plug from the transfer case.
5. Add the specified oil until the oil level is even with the bottom of the fill plug hole.
6. Install and tighten the fill plug 35-50 lb-ft (47-68 N•m). (T)
7. Run the vehicle for 1/4 mile (0.4 km). Top off the oil level by adding oil to the fill opening.
8. Reinstall and tighten the fill plug 35-50 lb-ft (47-68 N•m). (T)

Transfer Case Oil Change Intervals

Operation	On-Highway	Off-Highway
Check Oil Level	2,000 miles (3200 km)	40 operating hours
Initial Oil Change	2,500 miles (4000 km)	40-100 operating hours
Scheduled Oil Change	12,000-25,000 miles (19 000-40 000 km)	200-300 operating hours
Synthetic Oil	25,000 miles (40 000 km) or twice a year (whichever comes first)	3,000 hours or twice a year (whichever comes first)
Severe Service Synthetic Oil Change ①	10,000 miles (16 000 km) or 3 times per year	3 times per year

① Severe service applies to vehicles with a 2400+ rpm engine/ overdrive transmission combination that operate at maximum vehicle speed for long trips (> 30 minutes).

Transfer Case Oil Capacities

Transfer Case Model	Oil Capacity	
	Pints*	Liters*
T-32	2.0	0.95
T-136	14.0	6.62
T-215	3.0	1.42
T-221	4.0	1.89
T-223	5.0	2.37
T-226	6.5	3.07
T-228	21.0	9.93
T-232	6.2	2.93
T-1138	13.5	6.38
T-2111	3.0	1.42
T-2111-HD	5.0	2.37
T-2111-HT	5.0	2.37
T-2111-PD	10.0	4.73
T-2111-SD	5.0	2.37
T-2120	4.0	1.89
T-2120-RS	6.5	3.10
T-600	6.2	2.93
TG-2213	6.5	3.10
T-2119	7.0	3.30
MTC-4208	9.0	4.30
MTC-4210	9.0	4.30
MTC-4213	9.0	4.30

* Due to the varied transfer case configurations, these fill quantities are for reference only. The fill procedure for all transfer cases is as follows:

1. Fill to the top of the stand pipe or fill hole.
2. Run the vehicle for 1/4 mile (0.4 km).
3. Top off the oil level.
4. Check that the sump temperature does not exceed 225°F (107°C).

Refer to bulletin TP-90114 for a list of approved distributors of synthetic oil. To obtain this publication, refer to the Service Notes page in the front inside cover of this manual.

Transfer Case Oil Specifications①④⑤

Oil Description	Meritor Specification	A.P.I. Specification	Military Specification	SAE Grade	Outside Temperature
Petroleum GL-1 Oil with Rust and Oxidation Inhibitor ②	—	A.P.I. GL-1	—	90W 80W	Above 10°F (–12°C) Above –15°F (–26°C)
Heavy Duty Engine Oil ②		A.P.I.-CD, CE, SF or SG ⑥		50W 40W 30W	Above 10°F (–12°C) Above 10°F (–12°C) Above –12°F (–26°C)
Full Synthetic Oil ③	O81	—	—	50W	Above –40°F (–40°C)
A.P.I. GL-5 (Axle Lube) ①	DO NOT USE IN TRANSFER CASES				

① Do not use multi-viscosity (I.E. 80/90W) GL-5 Gear Oil (axle lube).

② 90W GL-1 or 50W motor oil is same viscosity and commonly used above 10°F (–12°C).

③ Meritor approved full synthetic oil for manual ZF Meritor transmissions is also approved for Meritor transfer cases. Use synthetic oil only if the transfer case was initially filled with synthetic oil.

④ Do not mix or switch oil types. Use the same oil that initially filled the transfer case.

⑤ Do not use multi-viscosity oils.

⑥ Current designations are acceptable.

WARNING

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

NOTE: For a list of synthetic oil suppliers, refer to TP-2053. To obtain this publication, refer to the Service Notes page at the front of this manual.

Oil Drain Conditions

Manual Transmission Oils

If used transmission oil analyses indicate that any one of these criteria is not met, drain the used oil and replace it with an oil that is recommended for manual transmissions.

Used-Oil Analyses (ppm = parts per million)

Iron (Fe)	If level is greater than 500 ppm, drain and replace the oil.
Silicon (Si)	If level is greater than 100 ppm, drain and replace the oil.
Water (H_2O)	If level is greater than 0.3%, drain and replace the oil.

Magnets and Magnetic Drain Plugs

All transmissions have four magnets in the bottom of the main case. The magnets and magnetic plugs have a minimum pick-up capacity of 1.5 pounds (0.7 kilograms) of low carbon steel.

NOTE: Inspect the magnetic drain plug each time the oil is changed. Use the correct part. Pipe plugs will leak if used as a drain plug.

The magnetic drain plug can be reused if, after cleaning, the plug has a minimum pick-up capacity of 1.5 pounds (0.7 kilograms) of low carbon steel.

Transmission Oil Coolers

Required

- An engine has a rating of 399 HP or above.
- The transmission operating temperature is always above 225°F (107°C) at continuous operation or reaches 275°F (135°C) during intermittent operation.

Recommended

- An engine has a rating of 350 to 398 HP.
- Some aerodynamic vehicles that have engine ratings below 399 HP because of the amount of air that flows over the transmission to dissipate heat.

Temperature Indicator

The temperature indicator is optional. The temperature sending unit is on the bottom right side of the main case. The normal operating temperature range is less than 225°F (107°C).

Use the temperature indicator gauge to check transmission operation. For example:

- If the temperature suddenly rises to 275°F (135°C) or more, check the transmission for the cause of the increase.
- When operating a vehicle on a mountain grade, if the temperature increases 50-75°F (10-24°C) but returns to the normal operating temperature, this indicates a normal operating condition. If the temperature does not return to the normal range, check the transmission.

Oil Level

WARNING

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

Before Checking the Oil Level

1. The oil must be at room temperature.
2. The vehicle must be parked for at least 10 minutes.

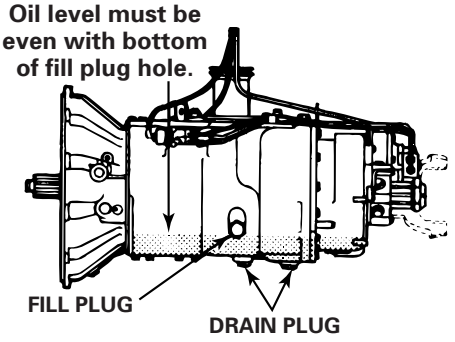
Check and Adjust the Oil Level

1. Park the vehicle on a level surface. Place blocks under the wheels to prevent the vehicle from moving.

NOTE: If foam appears when you remove the fill plug, the oil is too hot to check. Install the oil plug and allow the oil to cool. If oil flows from the fill plug hole when you remove the plug, the oil level is too high. Drain the oil to the correct level.

2. Clean the area by the fill plug. Remove the fill plug from the side of the transmission.
3. Check for oil leaks. If a transmission oil leak is evident, refer to the Troubleshooting section of Maintenance Manual 26A, 9-, 10- and 13-Speed Transmissions, for procedures. To obtain this publication, refer to the Service Notes page at the beginning of this manual.
4. Check the transmission oil level. Verify that it is even with the bottom of the fill plug. If the oil level is BELOW the bottom of the oil fill plug, add the specified oil. **Figure 11.1**.

Figure 11.1



5. Install the oil fill plug and tighten 35-50 lb-ft (48-67 N•m). (T)
6. Operate the vehicle for 5 minutes. Check for transmission oil leaks and correct operation.

Drain and Replace the Oil

NOTE: Drain the oil when the transmission is hot.

1. Park the vehicle on a level surface. Place blocks under the wheels to prevent the vehicle from moving.
2. Place a large container under the transmission. Place a screen on top of the container.
3. Remove the drain plugs from the bottom of the transmission. Drain the oil. Follow United States Environmental Protection Agency (EPA) guidelines to recycle used oil.
4. Inspect the screen on top of the container for metal particles and damaged parts.
5. If the transmission is disassembled or replaced and a transmission oil cooler is used, remove the cooler.
   A. Remove the oil from the oil cooler and the oil lines. Follow United States Environmental Protection Agency (EPA) guidelines to recycle used oil.
   B. Install the oil cooler and the oil lines. Tighten the fittings to the vehicle manufacturer's specifications.
6. Install the drain plug and tighten 35-50 lb-ft (48-67 N•m). (T)
7. Clean the air by the fill plug. Remove the fill plug from the side of the transmission.

⚠ CAUTION

Only use the specified oil. Do not use multi-viscosity engine oils or Extreme Pressure (EP) GL-5 gear oils. Damage to components can result. The use of multi-viscosity or EP oils will void ZF Meritor's warranty.

8. Add the specified transmission oil through the fill plug hole. Add the oil until the oil level is even with the bottom of the fill plug hole.
9. Install and tighten the fill plug 35-50 lb-ft (48-67 N•m). (T)
10. Operate the vehicle for 5 minutes. Check for correct operation.

Oil Change Intervals

Manual Transmissions Engine Synchro Shift™ (ESS™) SureShift™

Check Oil Level	Approved Petroleum Lubricant Oil Change	Approved Synthetic Oil Change
10,000 miles (16 000 km)	50,000 miles (80 000 km)	500,000 miles (800 000 km) ①

Oil Specifications

Manual Transmissions② Engine Synchro Shift™ (ESS™) SureShift™

Oil Description	ZF Meritor Specification	A.P.I. Specification	Military Specification Approval	SAE Grade	Outside Temperature
Heavy-Duty Engine Oil	—	A.P.I. -CD, -CE, -SG, -SH or SJ ③	MIL-L-2104 E or F ③	50	Above 10°F (–12°C)
				40	Above 10°F (–12°C)
				30	Above –15°F (–26°C)
Petroleum GL-1 Oil with Rust and Oxidation Inhibitor	—	A.P.I. - GL-1	—	90	Above 10°F (–12°C)
				80	Above –15°F (–26°C)
Full-Synthetic Oil	O-81	—	—	50	Above –40°F (–40°C)

① This interval is for linehaul applications.

② Do not use multi-viscosity or EP (Extreme Pressure) GL-5 gear oils. DO NOT MIX OILS IN THE TRANSMISSION.

③ Current designations are acceptable.

ZF Meritor-Approved Oil Lubricant Specifications for FreedomLine™ Transmissions

Description/Specification	API Spec	Military Spec	Outside Temperature
Mobiltrans SHC 50 Full-Synthetic Oil	—	—	Above –60°F (–51°C)
Cognis EMGARD (#2924) 50W Full-Synthetic Oil	—	—	Above –60°F (–51°C)

Manual Transmissions

9-Speed Manual

Model	Optional Internal Oil Pump	Oil Capacity (pints)	Length (inches)	Weight (lbs.*)	PTO Speed (% of engine)
M-11G9A-M11		20.5	29.5	605	75.8
M-12G9A-M12		20.5	29.5	605	75.8
M-13G9A-M13		20.5	29.5	605	75.8
M-14G9A-M14		20.5	29.5	605	75.8
M-15G9A-M15	STD.	20.5	29.5	608	75.8
MO-12G9A-M12		20.5	29.5	605	101.7
MO-13G9A-M13		20.5	29.5	605	101.7
MO-14G9A-M14		20.5	29.5	605	101.7
MO-11G9B-M11		20.5	28.9	605	87.1
MO-12G9B-M12		20.5	28.9	605	87.1
MO-13G9B-M13		20.5	29.5	605	87.1
MO-14G9B-M14		20.5	29.5	605	87.1
MO-15G9B-M15	STD.	20.5	29.5	608	87.1

*Weights are approximate, less clutch housing, shift controls, output yoke and lubricant.

13-Speed Manual

Model	Optional Internal Oil Pump	Oil Capacity (pints)	Length (inches)	Weight (lbs.*)	PTO Speed (% of engine)
RMO13-145A		22	32.4	666	75.8

*Weights are approximate, less clutch housing, shift controls, output yoke and lubricant.

10-Speed Manual

Model	Optional Internal Oil Pump	Oil Capacity (pints)	Length (inches)	Weight (lbs.*)	PTO Speed (% of engine)
M-11G10A-M11		20.5	29.5	605	75.8
M-12G10A-M12		20.5	29.5	605	75.8
M-13G10A-M13		20.5	29.5	605	75.8
M-14G10A-M14		20.5	29.5	605	75.8
M-15G10A-M15	STD.	20.5	29.5	608	75.8
M-14G10A-M16	STD.	20.5	29.5	608	75.8
MO-11G10A-M11		20.5	29.5	605	75.8
MO-12G10A-M12		20.5	29.5	605	75.8
MO-13G10A-M13		20.5	29.5	605	101.7
MO-14G10A-M14		20.5	29.5	605	101.7
MO-15G10A-M15	STD.	20.5	29.5	608	101.7
MO-14G10A-M16	STD.	20.5	29.5	608	101.7
MO-16G10A-M16	STD.	20.5	29.5	608	101.7
MO-16G10A-M18	STD.	20.5	29.5	608	101.7
MO-11G10C-M11		20.5	29.5	605	98.2
MO-12G10C-M12		20.5	29.5	605	98.2
MO-13G10C-M13		20.5	29.5	605	98.2
MO-14G10C-M14		20.5	29.5	605	98.2
MO-15G10C-M15	STD.	20.5	29.5	608	98.2
MO-16G10C-M16	STD.	20.5	29.5	608	98.2
MO-14G10C-M16	STD.	20.5	29.5	608	98.2
MO-16G10C-M18	STD.	20.5	29.5	608	98.2
MO-17G10C-M17	STD.	20.5	29.5	608	98.2
MO-17G10C-M19	STD.	20.5	29.5	608	98.2
MO-18G10C-M18	STD.	20.5	29.5	608	98.2
MO-18G10C-M20	STD.	20.5	29.5	608	98.2

*Weights are approximate, less clutch housing, shift controls, output yoke and lubricant.

ESS System Automated Transmissions

9-Speed ESS

Model	Optional Internal Oil Pump	Oil Capacity (pints)	Length (inches)	Weight (lbs.*)	PTO Speed (% of engine)
M-11G9A-X11		20.5	29.5	605	75.8
M-12G9A-X12		20.5	29.5	605	75.8
M-13G9A-X13		20.5	29.5	605	75.8
M-14G9A-X14		20.5	29.5	605	75.8
M-15G9A-X15	STD.	20.5	29.5	608	75.8
MO-12G9A-X12		20.5	29.5	605	101.7
MO-13G9A-X13		20.5	29.5	605	101.7
MO-14G9A-X14		20.5	29.5	605	101.7
MO-11G9B-X11		20.5	29.5	605	87.1
MO-12G9B-X12		20.5	29.5	605	87.1
MO-13G9B-X13		20.5	29.5	605	87.1
MO-14G9B-X14		20.5	29.5	605	87.1
MO-15G9B-X15	STD.	20.5	29.5	608	87.1

*Weights are approximate, less clutch housing, shift controls, output yoke and lubricant.

10-Speed ESS

Model	Optional Internal Oil Pump	Oil Capacity (pints)	Length (inches)	Weight (lbs.*)	PTO Speed (% of engine)
M-11G10A-X11		20.5	29.5	605	75.8
M-12G10A-X12		20.5	29.5	605	75.8
M-13G10A-X13		20.5	29.5	605	75.8
M-14G10A-X14		20.5	29.5	605	75.8
M-15G10A-X15	STD.	20.5	29.5	608	75.8
M-14G10A-E16	STD.	20.5	29.5	608	75.8
MO-11G10A-X11		20.5	29.5	605	75.8
MO-12G10A-X12		20.5	29.5	605	75.8
MO-13G10A-X13		20.5	29.5	605	101.7
MO-14G10A-X14		20.5	29.5	605	101.7
MO-15G10A-X15	STD.	20.5	29.5	608	101.7
MO-14G10A-E16	STD.	20.5	29.5	608	101.7
MO-16G10A-X16	STD.	20.5	29.5	608	101.7
MO-16G10A-E18	STD.	20.5	29.5	608	101.7
MO-11G10C-X11		20.5	29.5	605	98.2
MO-12G10C-X12		20.5	29.5	605	98.2
MO-13G10C-X13		20.5	29.5	605	98.2
MO-14G10C-X14		20.5	29.5	605	98.2
MO-15G10C-X15	STD.	20.5	29.5	608	98.2
MO-16G10C-X16	STD.	20.5	29.5	608	98.2
MO-14G10C-X16	STD.	20.5	29.5	608	98.2
MO-16G10C-X18	STD.	20.5	29.5	608	98.2
MO-17G10C-E17	STD.	20.5	29.5	608	98.2
MO-17G10C-E19	STD.	20.5	29.5	608	98.2
MO-18G10C-E18	STD.	20.5	29.5	608	98.2
MO-18G10C-X20	STD.	20.5	29.5	608	98.2

*Weights are approximate, less clutch housing, shift controls, output yoke and lubricant.

SureShift™ Automated Transmissions (All J1939 Engines)

9-Speed SureShift

Model	Optional Internal Oil Pump	Oil Capacity (pints)	Length (inches)	Weight (lbs.*)	PTO Speed (% of engine)
M-11G9A-S11		20.5	29.5	620	75.8
M-12G9A-S12		20.5	29.5	620	75.8
M-13G9A-S13		20.5	29.5	620	75.8
M-14G9A-S14		20.5	29.5	620	75.8
M-15G9A-S15	STD.	20.5	29.5	623	75.8
MO-12G9A-S12		20.5	29.5	620	101.7
MO-13G9A-S13		20.5	29.5	620	101.7
MO-14G9A-S14		20.5	29.5	620	101.7
MO-11G9B-S11		20.5	29.5	620	87.1
MO-12G9B-S12		20.5	29.5	620	87.1
MO-13G9B-S13		20.5	29.5	620	87.1
MO-14G9B-S14		20.5	29.5	620	87.1
MO-15G9B-S15	STD.	20.5	29.5	623	87.1

*Weights are approximate, less clutch housing, shift controls, output yoke and lubricant.

10-Speed SureShift

Model	Optional Internal Oil Pump	Oil Capacity (pints)	Length (inches)	Weight (lbs.*)	PTO Speed (% of engine)
M-11G10A-S11		20.5	29.9	620	75.8
M-12G10A-S12		20.5	29.9	620	75.8
M-13G10A-S13		20.5	29.5	620	75.8
M-14G10A-S14		20.5	29.5	620	75.8
M-15G10A-S15	STD.	20.5	29.5	623	75.8
M-14G10A-S16	STD.	20.5	29.5	623	75.8
M0-11G10A-S11		20.5	29.9	620	75.8
M0-12G10A-S12		20.5	29.9	620	75.8
M0-13G10A-S13		20.5	29.5	620	101.7
M0-14G10A-S14		20.5	29.5	620	101.7
M0-15G10A-S15	STD.	20.5	29.5	623	101.7
M0-14G10A-S16	STD.	20.5	29.5	623	101.7
M0-16G10A-S16	STD.	20.5	29.5	623	101.7
M0-16G10A-S18	STD.	20.5	29.5	623	101.7
M0-11G10C-S11		20.5	29.5	620	98.2
M0-12G10C-S12		20.5	29.5	620	98.2
M0-13G10C-S13		20.5	29.5	620	98.2
M0-14G10C-S14		20.5	29.5	620	98.2
M0-15G10C-S15	STD.	20.5	29.5	623	98.2
M0-16G10C-S16	STD.	20.5	29.5	623	98.2
M0-14G10C-S16	STD.	20.5	29.5	623	98.2
M0-16G10C-S18	STD.	20.5	29.5	623	98.2
M0-17G10C-S17	STD.	20.5	29.5	623	98.2
M0-17G10C-S19	STD.	20.5	29.5	623	98.2
M0-18G10C-S18	STD.	20.5	29.5	623	98.2
M0-18G10C-S20	STD.	20.5	29.5	623	98.2

*Weights are approximate, less clutch housing, shift controls, output yoke and lubricant.

FreedomLine™ Automated Transmissions

12-Speed FreedomLine

Model	Optional Internal Oil Pump	Oil Capacity (pints)	Length (inches)	Weight (lbs.*)
M-13Z12A-A13	STD.	23.25	31.7	565
M-14Z12A-A14	STD.	23.25	31.7	565
M0-14Z12A-A14	STD.	23.25	31.7	565
M0-15Z12A-A15	STD.	23.25	31.7	565
M0-16Z12A-A16	STD.	23.25	31.7	565

*Weights are approximate, less shift controls, output yoke and lubricant.

16-Speed FreedomLine

Model	Optional Internal Oil Pump	Oil Capacity (pints)	Length (inches)	Weight (lbs.*)	PTO
M0-14Z16A-A14	STD.	25.0	33.4	604	Available
M0-15Z16A-A15	STD.	25.0	33.4	604	Available
M0-16Z16A-A16	STD.	25.0	33.4	604	Available

*Weights are approximate, less shift controls, output yoke and lubricant.

Platform "F" Manual Transmission Oil Capacities ①

Model	Oil Capacity (Pints)	Length (In.)	Weight (Lbs.)	PTO (% of Engine)
RM9-115A ③	20.0	28.9	588	75.8
RM9-125A ③	20.0	28.9	588	75.8
RM9-135A ③	20.5	29.5	605	75.8
RM9-145A ③	20.5	29.5	605	75.8
RM9-155A ③	20.5	29.5	608	75.8
RMO9-125A	20.0	28.9	588	101.7
RMO9-135A	20.5	29.5	605	101.7
RMO9-145A	20.5	29.5	605	101.7
RMX9-125A ③	20.0	28.9	588	101.7
RMX9-135A ③	20.5	29.5	605	101.7
RMX9-145A ③	20.5	29.5	605	101.7
RMO9-115B	20.0	28.9	588	87.1
RMO9-125B	20.0	28.9	588	87.1
RMO9-135B	20.5	29.5	605	87.1
RMO9-145B	20.5	29.5	605	87.1
RMX9-115B ③	20.0	28.9	588	87.1
RMX9-125B ③	20.0	28.9	588	87.1
RMX9-135B ③	20.5	29.5	605	87.1
RMX9-145B ③	20.5	29.5	605	87.1
RMX9-155B ③	20.5	29.5	608	87.1
RMX9-115R ③	20.0	28.9	588	101.7
RMX9-125R ③	20.0	28.9	588	101.7
RMX9-135R ③	20.5	29.5	605	101.7
RMX9-145R ③	20.5	29.5	605	75.8
RM10-115A ③	20.0	28.9	588	75.8

Model	Oil Capacity (Pints)	Length (In.)	Weight (Lbs.)	PTO (% of Engine)
RM10-125A ③	20.0	28.9	588	75.8
RM10-135A ③	20.5	29.5	605	75.8
RM10-145A ③	20.5	29.5	605	75.8
M-14F10A-M16 ③	20.5	29.5	605	75.8
RM10-155A ③	20.5	29.5	608	75.8
RD10-145A	20.5	29.5	605	75.8
RMX10-115A ③	20.0	28.9	588	101.7
RMX10-125A ③	20.0	28.9	588	101.7
RMX10-135A ③	20.5	29.5	605	101.7
RMX10-145A ③	20.5	29.5	605	101.7
MO-14F10A-M16 ③	20.5	29.5	605	101.7
RMX10-155A ③	20.5	29.5	608	101.7
RMX10-165A ③	20.5	29.5	608	101.7
RMX10-115C ③	20.5	29.5	605	98.2
RMX10-125C ③	20.5	29.5	605	98.2
RMX10-135C ③	20.5	29.5	605	98.2
RMX10-145C ③	20.5	29.5	605	98.2
MO-14F10C-M16 ③	20.5	29.5	605	98.2
RMX10-155C ③	20.5	29.5	608	98.2
RMX10-165C ③	20.5	29.5	608	98.2
MO-16F10C-M18 ③	20.5	29.5	608	98.2
RMO13-145A ③	22.0	32.4	666	75.8

① Oil capacities are approximate. Fill the transmission to the bottom of the fill plug hole. On transmissions equipped with an oil pump and/or oil cooler, operate the engine for 5 minutes after the initial fill and check the oil level again.

② Weights are approximate, less clutch housing, shift controls, output yoke and lubricant.

③ Available with Meritor's Engine Synchro Shift™ (ESS™) System. For ESS transmission models, replace the "M" in the above model numbers with an "S".

⚠ WARNING

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

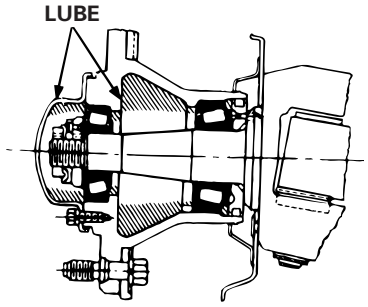
Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle only supported by jacks. Jacks can slip or fall over. Serious personal injury and damage to components can result.

Grease-Lubricated Wheel Bearings

Axles With Conventional Wheel Ends

1. Park the vehicle on a level surface. Place blocks under the wheels to prevent the vehicle from moving.
2. Raise the vehicle so that the wheels are off the ground. Support the vehicle with safety stands.
3. Remove the tire and wheel assembly. Remove and dissemble the hub.
4. Use the correct cleaning solvent to remove the old grease from all parts. Discard the seals. Inspect the wheel bearings for wear or damage. Replace worn or damaged bearings.
5. Before installing the wheel bearings, lubricate the bearing journals on the spindle with the grease that is used for the bearings. **Figure 12.1**.
6. Use a pressure packer to force the specified grease from the large end of the cones into the cavities between the rollers and cage. Pack the hub between the bearing cups with grease to the level of the smallest diameter of the cups.
   - **If a pressure packer is not available**: Grease the bearings by hand.
7. Install the inner and outer bearing cones into the cups in the hubs. The bearing cups must be pressed tight against the shoulder in the hubs.
8. Install new wheel seals in the hubs.
9. Install the hub and the wheel and tire assembly. Install the outer wheel bearing cone in the hub. Install the adjusting nut.
10. Adjust the wheel bearings.

Figure 12.1
TYPICAL GREASE-LUBRICATED WHEEL BEARINGS



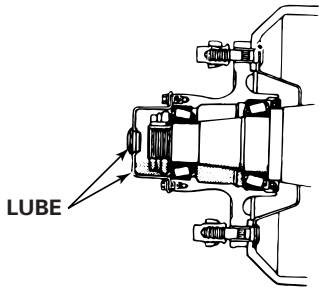
Oil-Lubricated Wheel Bearings

Axles With Conventional Wheel Ends

NOTE: If you cannot observe the oil level because the sightglass is stained, remove the fill plug, check the oil level with your finger and follow the procedures for Step 3, below. Replace the stained sightglass as soon as possible.

1. Park the vehicle on a level surface. Place blocks under the wheels to prevent the vehicle from moving.
2. Check the oil level on the cap.
3. If the oil level is more than 1/4-inch (6 mm) below the specified level on the cap, remove the fill plug.
4. Add the specified oil to the specified level. **Figure 12.2**.
5. Install the fill plug.

Figure 12.2
TYPICAL OIL-LUBRICATED WHEEL BEARINGS



Drive Axle Hubs Without Fill Holes

1. Add the specified amount of lubricant through the carrier or housing bowl oil fill hole.
2. Tilt the axle to the right and to the left to let the oil flow into the hub cavities. Keep the axle tilted for one minute in each position.
3. With the axle in the level position, add the specified oil so that the level is even with the bottom of the fill plug hole.
4. Install and tighten the fill plug.

Wheel-End Axle Greasing Intervals and Specifications

Greasing Interval	Grease	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
Whichever comes first: Replacing Seals Relining Brakes On-Highway: 30,000 miles (48 000 km) On/Off Highway and Off-Highway: Twice a year	Multi-Purpose Grease	O-617-A (preferred) or O-617-B (acceptable)	1 or 2	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.

Wheel-End Oil Change Intervals and Specifications

Operation	On-Highway	Off-Highway
Check Oil Level	1,000 miles (1600 km)	1,000 miles (1600 km)
Petroleum Oil Change	Whichever comes first. Seals replaced. Brakes relined. 100,000 miles (160 000 km). Once a year.	Whichever comes first. Seals replaced. Brakes relined. Once a year.
Synthetic Oil Change	Whichever comes first. Seals replaced. Brakes relined. 100,000 miles (160 000 km). Once a year.	Whichever comes first. Seals replaced. Brakes relined. Once a year.

Meritor Specifications	Military/SAE Specifications	Oil Description	Outside Temperature			
			°F		°C	
			Min.	Max.	Min.	Max.
O-76A Gear Oil	MIL-PRF-2105-E and SAE J2360	GL-5, SAE 85W/140	10	None	–12	None
O-76D Gear Oil		GL-5, SAE 80W/90	–15	None	–26	None
O-76E Gear Oil		GL-5, SAE 75W/90	–40	None	–40	None
O-76J Gear Oil		GL-5, SAE 75	–40	35	–40	2
O-76M Full Synthetic Oil		GL-5, SAE 75W/140	–40	None	–40	None
O-76N Full Synthetic Oil		GL-5, SAE 75W/90	–40	None	–40	None
Heavy-Duty Engine Oil	MIL-L-2104 E or F	A.P.I. -CD, -CE, -SG, -SH or -SJ SAE 40 or 50 ①	10	None	–12	None
Heavy-Duty Engine Oil	MIL-L-210 E or F	A.P.I. -CD, -CE, -SG, -SH or -SJ SAE 30 ②	–15	None	–26	None

① Current designations are acceptable. Multi-grade engine oils are acceptable if the SAE rating ends in 40 or 50.

② Current designations are acceptable. Multi-grade engine oils are acceptable if the SAE rating ends in 30.

Grease Lubricants①

Meritor Specification	Grease	Typical Application	NLGI Grade	Grease Description	Outside Temperature
O-616	Brake Grease	Cam Brake Anchor Pins, Mechanical Brake Anchor Pins	2	Clay Base	②
O-616-A	Brake Grease	Air Disc Brake Caliper, Automatic Slack Adjuster, Wedge Brake Components	1	Clay Base	Down to –40°F (–40°C)
O-617-A or O-617-B	Multi-Purpose Grease	Cam Brake Chamber Brackets, Cam Brake Hold Down Clips, Cross Tube Ends, Drag Link, Wheel Bearings, King Pins and Bushings, Knuckle Bushings, Manual Slack Adjuster, Steering Arm, Ball Studs, Tie Rod End Ball Studs, Trailer Axle Wheel Bearings, Wedge Brake Hold-Down Clips, Wedge Brake Shoe Contacts at Anchors.	1 or 2	Lithium 12-Hydroxy Stearate or Lithium Complex	②
O-634-B	Universal Joint Grease	Driveshaft Slip Yokes, Driveshaft Splines, Driveshaft Universal Joints	2	Lithium 12-Hydroxy Stearate with Molybdenum Disulfide	②
O-637 ③	Special Rust-Preventing Brake Grease	Air Disc Brake Slide Pin, Splines and Clevis Pins, Cam Brake Camshaft Splines	1-1/2	Calcium	②
O-645	Low-Temperature Brake Grease	Air Disc Brake Caliper, Automatic Slack Adjuster, Wedge Brake Components	2	Synthetic	Down to –65°F (–54°C)
O-647	Trailer Axle Bearing Grease	Trailer Axle Wheel Bearings	00	Synthetic	②
O-661	High-Temperature Multi-Purpose Wheel Bearing Grease	Clutch Release Bearing	3	Lithium Complex	②
O-692	Automatic Slack Adjuster Grease	Automatic Slack Adjuster	1 and 2	Lithium Base	Down to –40°F (–40°C)

① Grease recommendations are based on commercial products that have given satisfactory results in normal operation. However, there are many proprietary grease products on the market which will perform satisfactorily and may be preferable because of supply problems, common usage for other truck components, etc. When such products are recommended by reputable suppliers for the specific lubrication of our components, Meritor has no objections, provided that these substitute products are equal to or better than Meritor recommendations in lubrication properties, water resistance, corrosion protection, high and low temperature characteristics, oxidation stability, shear stability, etc. All substitute products are subject to Meritor approval. For more information, contact an ArvinMeritor service representative.

② Refer to the manufacturer's specifications for the temperature service limits.

③ Do not mix O-637 calcium-base, corrosion-control grease with other greases.

Oil Lubricants

Meritor Specification	Oil	Typical Application	Military/SAE Specifications	Oil Description	Outside Temperature °F Min.	°F Max.	°C Min.	°C Max.
O-62	Petroleum Oil	Transfer Case	—	SAE 90	10	None	–12	None
O-63	Petroleum Oil	Transfer Case	—	SAE 140	40	None	4	None
O-76A	Gear Oil	Front Drive Axle, Front Drive Axle Wheel Bearings, Non-Drive Axle Wheel Bearings, Planetary Axle, Rear Drive Axle, Trailer Axle Wheel Bearings	MIL-PRF-2105-E and SAE J2360	GL-5 SAE 85W/140	10	None	–12	None
O-76D	Gear Oil	Front Drive Axle, Front Drive Axle Wheel Bearings, Non-Drive Axle Wheel Bearings, Planetary Axle, Rear Drive Axle, Trailer Axle Wheel Bearings		GL-5 SAE 80W/90	–15	None	–26	None
O76E	Gear Oil	Front Drive Axle, Front Drive Axle Wheel Bearings, Non-Drive Axle Wheel Bearings, Planetary Axle, Rear Drive Axle, Trailer Axle Wheel Bearings		GL-5 SAE 75W/90	–40	None	–40	None
O-76J	Gear Oil	Front Drive Axle, Front Drive Axle Wheel Bearings, Non-Drive Axle Wheel Bearings, Planetary Axle, Rear Drive Axle, Trailer Axle Wheel Bearings		GL-5 SAE 75W	–40	35	–40	2
O-76L	Gear Oil	Front Drive Axle, Front Drive Axle Wheel Bearings, Non-Drive Axle Wheel Bearings, Planetary Axle, Rear Drive Axle, Trailer Axle Wheel Bearings		GL-5 SAE 75W/140	–40	None	–40	None
O-76M	Full Synthetic Oil	Front Drive Axle, Front Drive Axle Wheel Bearings, Non-Drive Axle Wheel Bearings, Planetary Axle, Rear Drive Axle, Trailer Axle Wheel Bearings		GL-5 SAE 75W/140	–40	None	–40	None
O-76N	Full Synthetic Oil	Front Drive Axle, Front Drive Axle Wheel Bearings, Non-Drive Axle Wheel Bearings, Planetary Axle, Rear Drive Axle, Trailer Axle Wheel Bearings		GL-5 SAE 75W/90	–40	None	–40	None
O-81	Full Synthetic Oil	Transmission	—	SAE 50	–40	None	–40	None
—	Heavy Duty Engine Oil	Transmission	MIL-L-2104 -E or -F*	A.P.I. -CD, -CE, -SG, -SH or -SJ; SAE 50*	10	None	–12	None
—	Heavy Duty Engine Oil	Transmission		A.P.I. -CD, -CE, -SG, -SH or -SJ; SAE 40*	10	None	–12	None
—	Heavy Duty Engine Oil	Transmission		A.P.I. -CD, -CE, -SG, -SH or -SJ; SAE 30*	–15	10	–26	–12
—	Petroleum Gear	Transmission		A.P.I.-GL-1; SAE 90	10	None	–12	None
—	Petroleum Gear	Transmission		A.P.I.-GL-1; SAE 80	–15	None	–26	None

* Current designations are acceptable.

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MERITOR®

an ArvinMeritor brand

Revised 09-02

Cam Brakes

Maintenance Manual 4

16.5-Inch
Q Plus™ Brake
with a Stamped Spider

- Q Plus™
- Cast Plus™
- Q Series
- P Series
- T Series

Before You Begin

This manual describes the correct service and repair procedures for Meritor cam brakes. Before you begin procedures:

1. Read and understand all instructions and procedures before you begin to service components.
2. Read and observe all Caution and Warning safety alerts that precede instructions or procedures you will perform. These alerts help to avoid damage to components, serious personal injury, or both.
3. Follow your company's maintenance and service, installation, and diagnostics guidelines.
4. Use special tools when required to help avoid serious personal injury and damage to components.

Safety Alerts, Torque Symbol and Notes

WARNING	A Warning alerts you to an instruction or procedure that you must follow exactly to avoid serious personal injury.
CAUTION	A Caution alerts you to an instruction or procedure that you must follow exactly to avoid damage to components.
T	A torque symbol alerts you to tighten fasteners to a specified torque value.
NOTE	A Note provides information or suggestions that help you correctly service a component.

Access Product and Service Information on Our Website

Visit the DriveTrain Plus™ by ArvinMeritor Tech Library at arvinmeritor.com to access and order product and service information.

To Order Information by Phone

Call ArvinMeritor's Customer Service Center at 800-535-5560 to order the following publications.

- Automatic Slack Adjuster (Maintenance Manual 4B)
- Q Plus™ LX500 and MX500 Cam Brakes (Maintenance Manual MM-96173)
- Q and Q Plus™ Cam Brake Maintenance (Video T-90233V)
- Meritor Automatic Slack Adjuster Installation and Maintenance (Video T-90234V)
- New Generation Automatic Slack Adjuster (Video T-9443V)
- Drivetrain Plus™ by ArvinMeritor Technical Electronic Library on CD. Features product and service information on most Meritor, ZF Meritor and Meritor WABCO products. $20. Order TP-9853.

How to Order Tools, Supplies and Brake Conversion Kits

Call ArvinMeritor's Commercial Vehicle Aftermarket at 888-725-9355 to order tools and supplies specified in this manual. You also can order the following brake conversion kits.

- A kit to convert Q Series cam brake shoes (except models with cast shoes) to Q Series brakes with "quick change" shoes
- A kit to convert standard 16.5-inch Q Series cam brakes to Q Plus™ cam brakes

MERITOR®

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Asbestos and Non-Asbestos Fibers

ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

Hazard Summary

Because some brake linings contain asbestos, workers who service brakes must understand the potential hazards of asbestos and precautions for reducing risks. Exposure to airborne asbestos dust can cause serious and possibly fatal diseases, including asbestosis (a chronic lung disease) and cancer, principally lung cancer and mesothelioma (a cancer of the lining of the chest or abdominal cavities). Some studies show that the risk of lung cancer among persons who smoke and who are exposed to asbestos is much greater than the risk for non-smokers. Symptoms of these diseases may not become apparent for 15, 20 or more years after the first exposure to asbestos.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons. OSHA has set a maximum allowable level of exposure for asbestos of 0.1 f/cc as an 8-hour time-weighted average and 1.0 f/cc averaged over a 30-minute period. Scientists disagree, however, to what extent adherence to the maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling asbestos dust. OSHA requires that the following sign be posted at the entrance to areas where exposures exceed either of the maximum allowable levels:

DANGER: ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA.

2. Respiratory Protection. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA for use with asbestos at all times when servicing brakes, beginning with the removal of the wheels.

3. Procedures for Servicing Brakes.

a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.

b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

c. If an enclosed vacuum system or brake washing equipment is not available, employers may adopt their own written procedures for servicing brakes, provided that the exposure levels associated with the employer's procedures do not exceed the levels associated with the enclosed vacuum system or brake washing equipment. Consult OSHA regulations for more details.

d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.

e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.

4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

NON-ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to non-asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

Hazard Summary

Most recently manufactured brake linings do not contain asbestos fibers. These brake linings may contain one or more of a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers and silica that can present health risks if inhaled. Scientists disagree on the extent of the risks from exposure to these substances. Nonetheless, exposure to silica dust can cause silicosis, a non-cancerous lung disease. Silicosis gradually reduces lung capacity and efficiency and can result in serious breathing difficulty. Some scientists believe other types of non-asbestos fibers, when inhaled, can cause similar diseases of the lung. In addition, silica dust and ceramic fiber dust are known to the State of California to cause lung cancer. U.S. and international agencies have also determined that dust from mineral wool, ceramic fibers and silica are potential causes of cancer.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to non-asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons.

2. Respiratory Protection. OSHA has set a maximum allowable level of exposure for silica of 0.1 mg/m^3 as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend that exposures to other ingredients found in non-asbestos brake linings be kept below 1.0 f/cc as an 8-hour time-weighted average. Scientists disagree, however, to what extent adherence to these maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling non-asbestos dust.

Therefore, wear respiratory protection at all times during brake servicing, beginning with the removal of the wheels. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA, if the exposure levels may exceed OSHA or manufacturers' recommended maximum levels. Even when exposures are expected to be within the maximum allowable levels, wearing such a respirator at all times during brake servicing will help minimize exposure.

3. Procedures for Servicing Brakes.

a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.

b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

c. If an enclosed vacuum system or brake washing equipment is not available, carefully clean the brake parts in the open air. Wet the parts with a solution applied with a pump-spray bottle that creates a fine mist. Use a solution containing water, and, if available, a biodegradable, non-phosphate, water-based detergent. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.

e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.

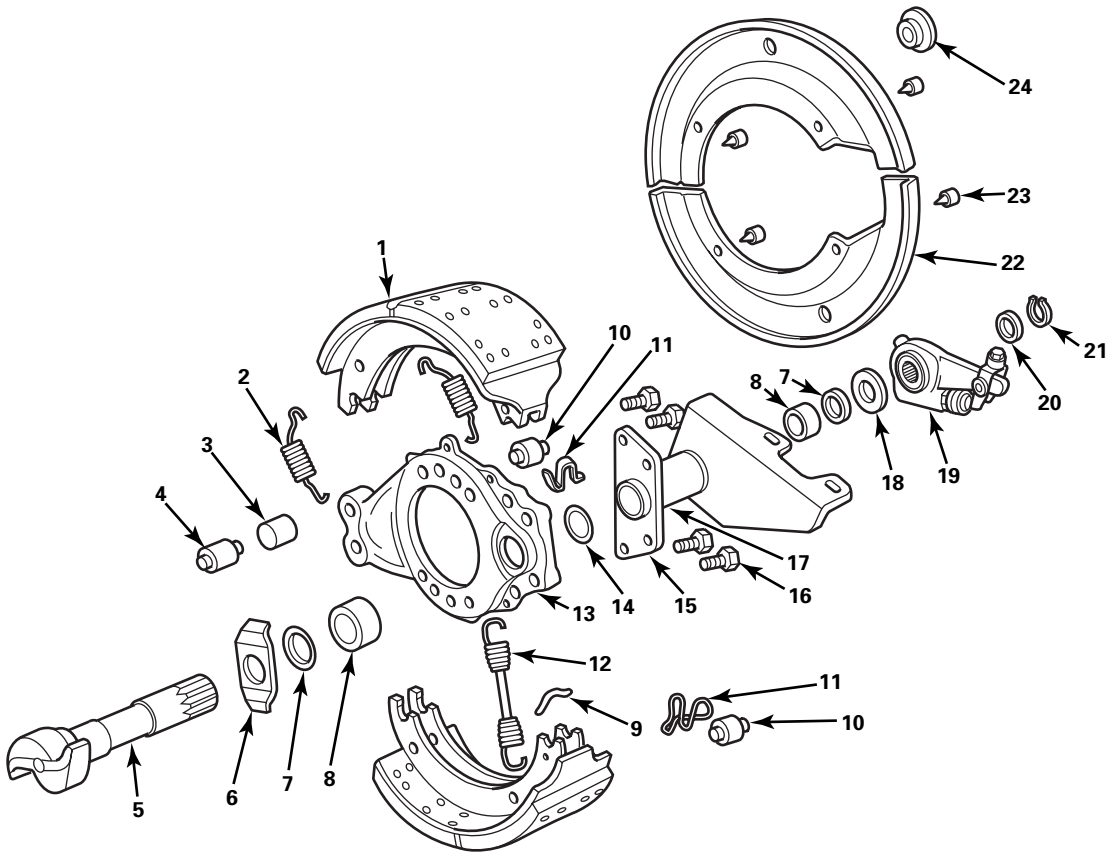
4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA, to minimize exposure. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

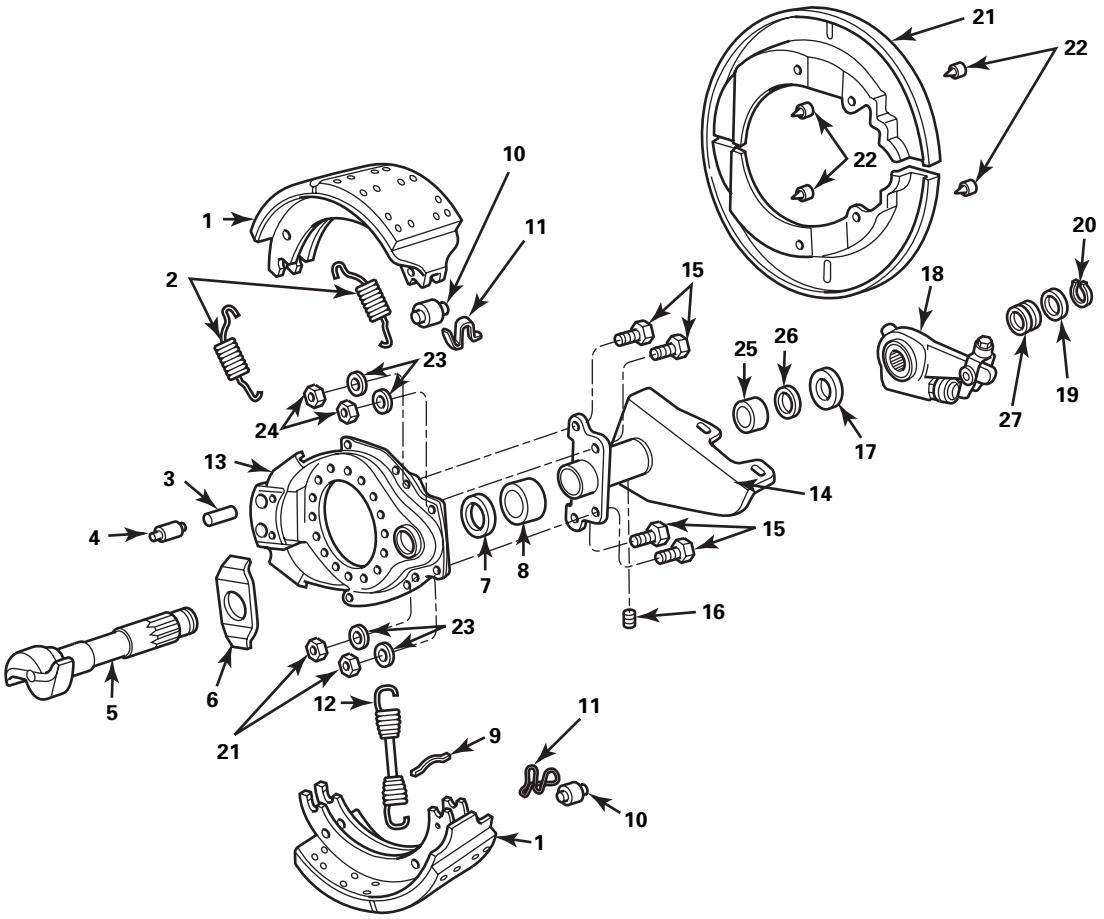
References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.



15- and 16.5-Inch Q Plus™ and Q Series Cam Brakes with Cast Spiders

Item	Description
1	Shoe and Lining Assembly
2	Spring — shoe retaining
3	Bushing — anchor pin
4	Anchor Pin — brake shoe
5	Camshaft — "S" head
6	Washer — camhead
7	Seal — camshaft (grease)
8	Bushing — camshaft
9	Pin — return spring
10	Roller — brake shoe
11	Retainer — shoe roller
12	Spring — brake shoe return

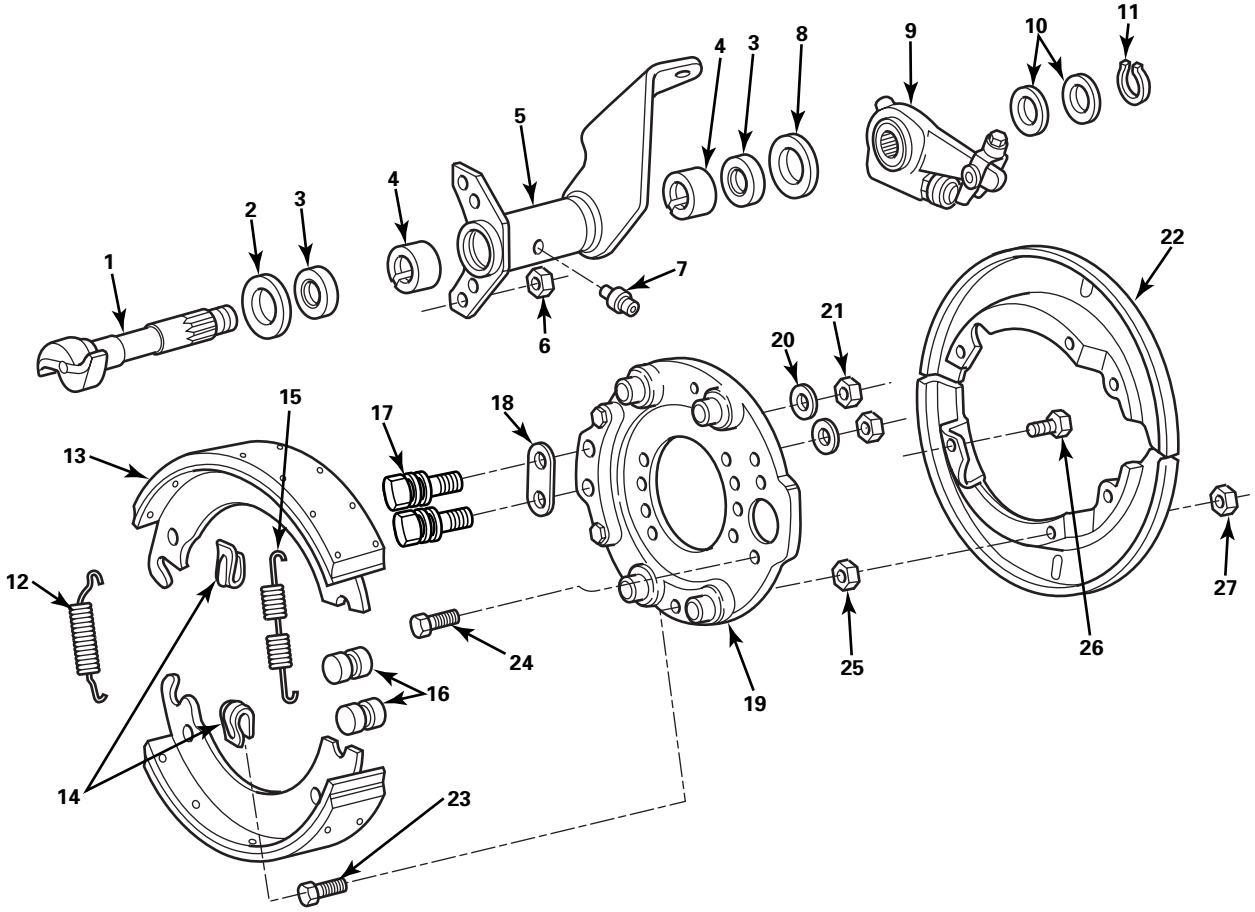
Item	Description
13	Cast spider — brake
14	Seal — chamber bracket
15	Bracket — camshaft and chamber
16	Capscrew — chamber bracket
17	Fitting — grease
18	Washer — camshaft (thick)
19	Slack Adjuster — automatic
20	Washer — spacing
21	Snap Ring — camshaft
22	Dust Shield
23	Capscrew — dust shield
24	Plug



16.5-Inch Q Plus™ Cam Brake with a Stamped Spider

Item	Description
1	Shoe and Lining Assembly
2	Spring — shoe retaining
3	Bushing — anchor pin
4	Anchor Pin — brake shoe
5	Camshaft — “S” head
6	Washer — camhead
7	Orange seal — camshaft
8	Bushing — camshaft
9	Pin — return spring
10	Roller — brake shoe
11	Retainer — shoe roller
12	Spring — brake shoe return
13	Stamped spider — brake
14	Bracket — camshaft and chamber

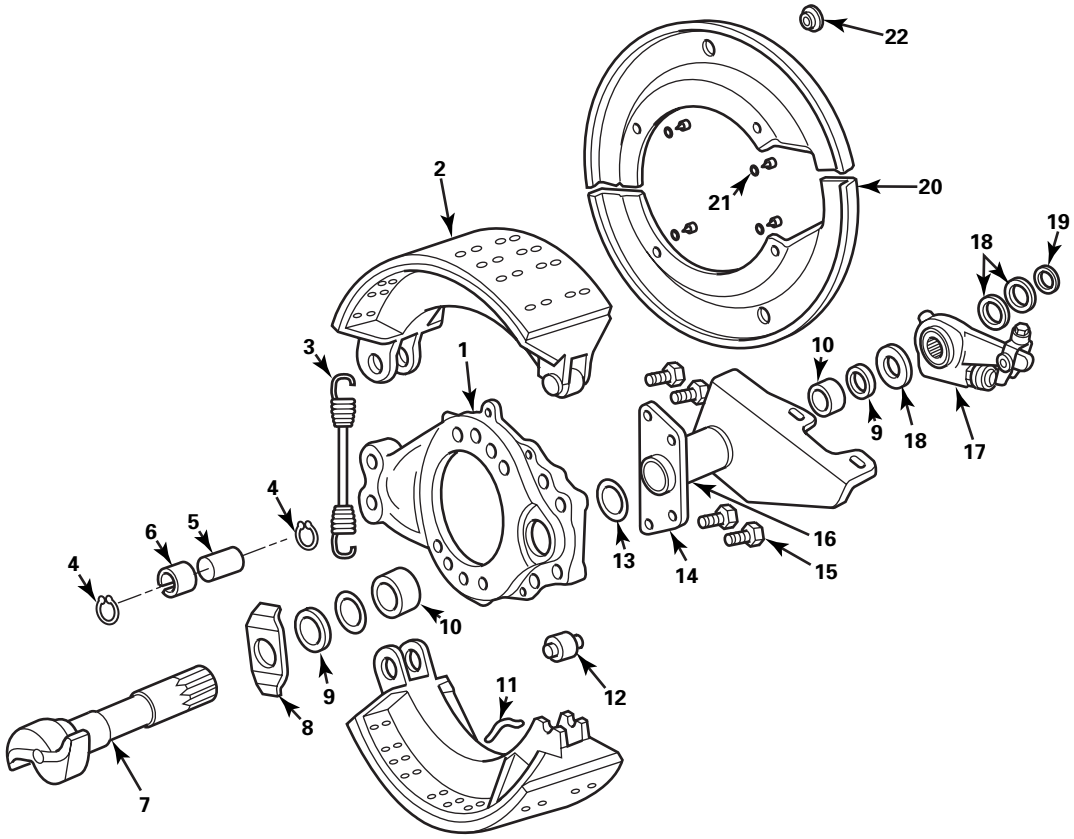
Item	Description
15	Capscrew — Grade 8
16	Plug — pipe
17	Washer — camshaft (thick)
18	Slack adjuster — automatic
19	Washer — spacing
20	Snap ring — camshaft
21	Dust shield
22	Capscrew — dust shield
23	Washer (4) — hard
24	Nut (4) — Grade 8
25	Bushing — camshaft
26	Seal — camshaft
27	Washer — spacing (thin)



15-Inch Q Series Cam Brakes

Item	Description
1	Camshaft
2	Washer — camhead
3	Seal — camshaft (grease)
4	Bushing — camshaft
5	Bracket — camshaft
6	Nut — camshaft bracket
7	Grease Fitting
8	Washer — spacing
9	Slack Adjuster — automatic
10	Spacers — camshaft
11	Snap Ring — camshaft
12	Spring — shoe retaining
13	Shoe and Lining Assembly
14	Clips — anti-rattle

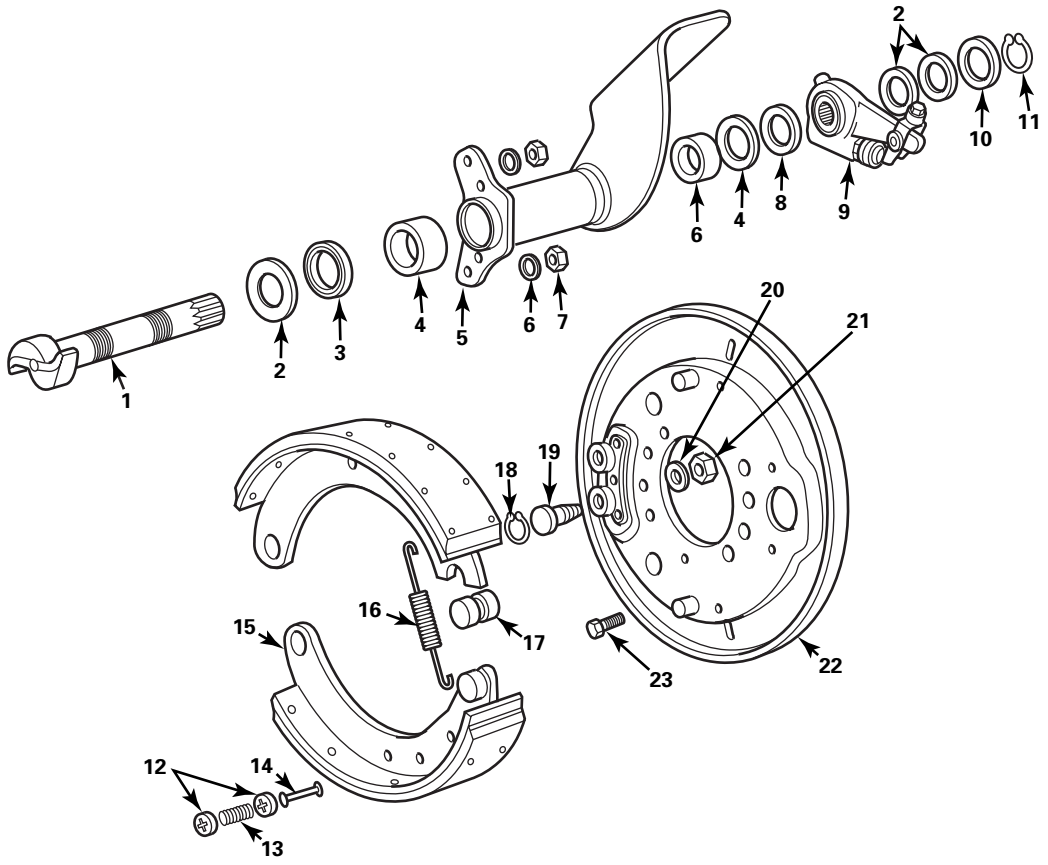
Item	Description
15	Spring — shoe return
16	Rollers — brake shoe
17	Anchor Pins — brake shoe
18	Plate — support
19	Backing Plate
20	Washer — anchor pin
21	Nut — anchor pin
22	Dust Shield
23	Bolt — shoe clip
24	Bolt — camshaft bracket
25	Nut — clip to backing plate
26	Capscrew — dust shield
27	Nut — dust shield



16.5-Inch P Series Cam Brakes

Item	Description
1	Spider — brake
2	Shoe and Lining Assembly
3	Spring — brake shoe return
4	Snap Ring — anchor pin
5	Anchor Pin — brake shoe
6	Bushing — anchor pin
7	Camshaft — “S” head
8	Washer — camhead
9	Seal — camshaft (grease)
10	Bushing — camshaft
11	Pin — return spring

Item	Description
12	Roller — cam
13	Seal — camshaft bracket
14	Bracket — camshaft and chamber
15	Capscrew — camshaft bracket
16	Fitting — grease
17	Slack Adjuster — automatic
18	Washer — spacing
19	Snap Ring — camshaft
20	Dust Shield
21	Capscrew — dust shield
22	Plug



15-Inch T Series Cam Brakes

Item	Description
1	Camshaft
2	Washer — camhead
3	Seal — camshaft (grease)
4	Bushing
5	Bracket — camshaft and chamber
6	Lockwasher — bracket
7	Nut — bracket
8	Washer — spacing
9	Slack Adjuster — automatic
10	Washer — spacer
11	Snap Ring — camshaft
12	Retainer — anti-rattle spring

Item	Description
13	Spring — anti-rattle
14	Rod — anti-rattle
15	Shoe and Lining Assembly
16	Spring — shoe return
17	Roller — brake shoe
18	Snap Ring — anchor pin
19	Anchor Pin — brake shoe
20	Washer — anchor pin
21	Nut — anchor pin
22	Backing Plate
23	Capscrew — dust shield

Cam Brakes

Q Plus™

Figure 2.1

- More lining thickness increases service life and mileage between relines.
- A redesigned S-cam and heavy-duty shoe return spring allow additional shoe travel.
- An improved camshaft bushing contributes to longer service life.
- The trailer axle version of the 16.5 x 7.0-inch Q Plus brake uses a heavy-duty, bolt-on camshaft bushing.

Figure 2.1

Q Plus LX500 and Q Plus MX500

Figure 2.2

For complete maintenance and service information on Meritor's Q Plus LX500 and MX500 cam brakes, refer to Maintenance Manual MM-96173, Q Plus™ LX500 and MX500 Cam Brakes. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

- The Q Plus LX500 cam brake and the Q Plus MX500 cam brake both include an Extended Lube Feature and Meritor factory-installed automatic slack adjusters.
- The Q Plus MX500 cam brake also includes all features found in the Q Plus LX500 brake plus special long life brake shoes and linings.

Figure 2.2

Cast Plus™

Figure 2.3

- The Cast Plus brake is spec'd for heavy-duty, off-highway and people-mover applications.
- Uses Meritor's Q Plus cam brake linings, that provide increased service life and mileage between relines.
- A redesigned S-cam and heavy-duty shoe return spring allow additional shoe travel.
- An improved camshaft bushing contributes to longer service life.
- The brake uses Meritor's cast P Series brake shoe design.

Figure 2.3

Q Series Brakes

Figure 2.4

- Open anchor pins for "Quick Change" service.
- Single web shoe (15-inch only).
- Two shoe retainer springs in addition to the shoe return springs.
- Available in 16.5-inch diameter with 5, 6, 7, 8.625 and 10-inch widths with 0.75-inch tapered brake lining.
- Available in 15.0-inch diameter for front non-drive axle applications.

Figure 2.4

P Series

Figure 2.5

- 16.5-inch and 18-inch diameters with 7-inch wide cast shoes.
- 0.75-inch tapered brake lining.

Figure 2.5

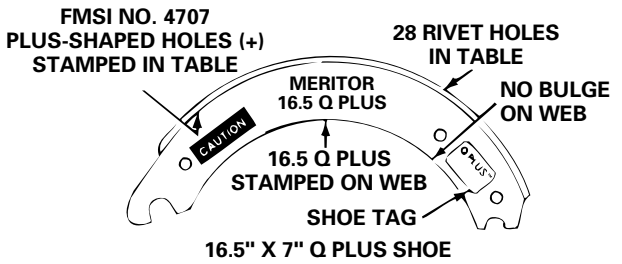
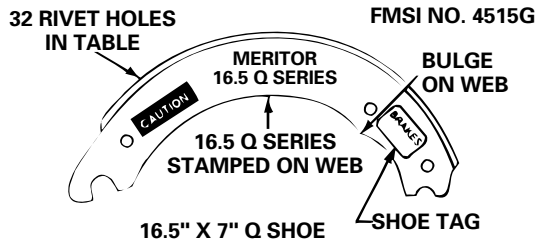
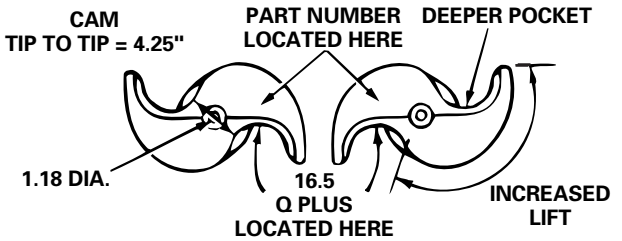
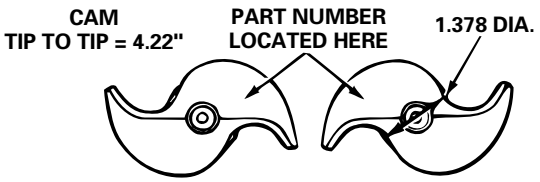
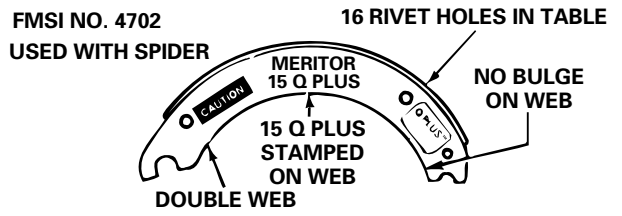
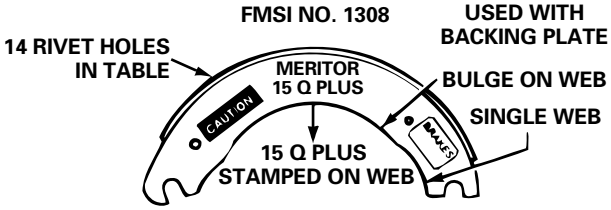
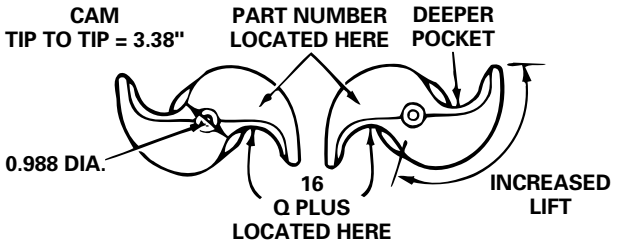
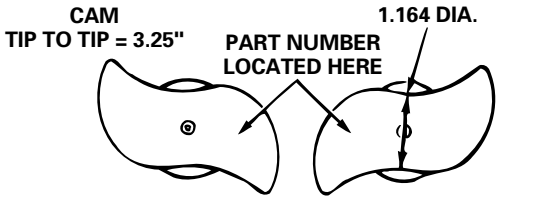
T Series

Figure 2.6

- 15-inch diameter with 3.5-inch and 4-inch widths for smaller capacity axles.
- 0.438-inch thick lining.

Figure 2.6

Differences Between Q Plus and Q Series Cam Brakes

Q Plus Components	Q Series Components
 16.5" X 7" Q PLUS SHOE	 16.5" X 7" Q SHOE
 16.5" Q PLUS CAMSHAFT (1.5" DIA.-28 SPLINES)	 16.5" Q CAMSHAFT (1.5" DIA.-10 OR 28 SPLINES)
 15" X 4" Q PLUS SHOE	 15" X 4" Q SHOE
 15" Q PLUS CAMSHAFT (1.5" DIA.-28 SPLINES)	 15" Q CAMSHAFT (1.25" DIA.-10 OR 24 SPLINES)

Camshafts	Shoes	Return Springs
Q Plus	Q Plus	Heavy-duty (blue)
Q Plus	Q Series	Standard
Q	Q Series	Standard

ASBESTOS AND NON-ASBESTOS FIBERS WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials. Refer to Page 1 in this manual for hazard summaries and recommended work practices.

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance and service.

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip or fall over. Serious personal injury and damage to components can result.

Removal

Wheel Components

1. Park the vehicle on a level surface.
2. Block the wheels to prevent the vehicle from moving.
3. Raise the vehicle, so that the area you will service is off of the ground. Support the vehicle with safety stands.

WARNING

Before you service a spring chamber, carefully follow the manufacturer's instructions to compress and lock the spring to completely release the brake. Verify that no air pressure remains in the service chamber before you proceed. Sudden release of compressed air can cause serious personal injury and damage to components.

4. If the brake has spring chambers, carefully cage and lock the spring, so that the spring cannot actuate during assembly.

Automatic Slack Adjuster

For complete maintenance and service information on Meritor's automatic slack adjuster, refer to Maintenance Manual 4B, Automatic Slack Adjuster. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

CAUTION

You must disengage a pull pawl or remove a conventional pawl before you rotate the manual adjusting nut, or you'll damage pawl teeth. A damaged pawl will not allow the slack adjuster to automatically adjust brake clearance. Damage to components can result. Replace a damaged pawl before returning the vehicle to service.

1. Disengage the pull pawl. Use a screwdriver or equivalent tool to pry the pull pawl at least 1/32-inch to disengage the teeth. **Figure 3.1**.
   - **If the slack adjuster has a conventional pawl:** Remove the pawl. **Figure 3.1**.
2. Use a wrench to turn the manual adjusting nut COUNTERCLOCKWISE until the brake shoes are fully retracted, and the lining clears the drum. **Figure 3.2**.

Figure 3.1

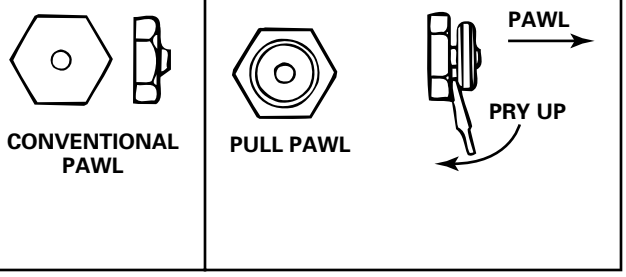


Figure 3.2

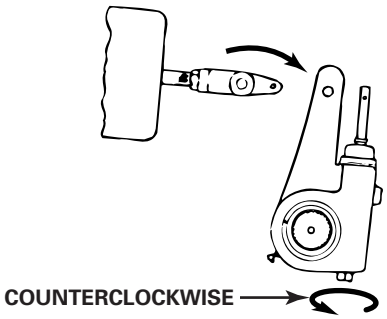
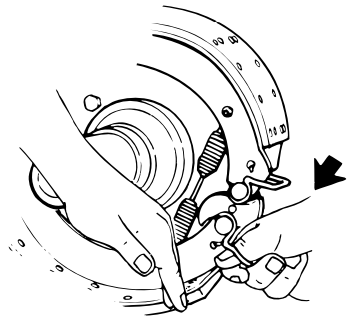


Figure 3.3



⚠ WARNING

When you remove a clevis pin that has a spring, hold the spring with pliers. The spring can disengage from the clevis with enough force to cause serious personal injury.

3. Remove both clevis pins, and retainer clips or cotter pins. Move the slack adjuster away from the clevis.
4. Follow the manufacturer's instructions to remove the wheel and drum from the axle.

Brake Shoes

All Q Plus and Q Series 15-Inch and 16.5-Inch Brakes

1. Push down on the bottom brake shoe. Pull on the cam roller retainer clip to remove the bottom cam roller. **Figure 3.3**.
2. Lift the top brake shoe and pull on the cam roller retainer clip to remove the top cam roller.
3. Lift the bottom shoe to release the tension on the brake shoe return spring. **Figure 3.4**.
4. Rotate the bottom shoe to release the tension on the brake shoe retainer springs. **Figure 3.5**.
5. Remove the shoe retainer springs and the brake shoes.

Figure 3.4

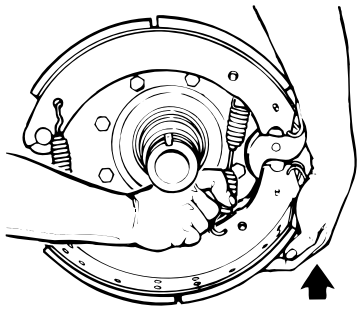
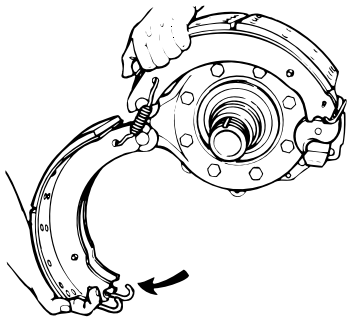


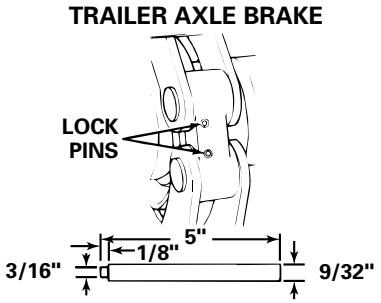
Figure 3.5



P Series and Cast Plus Brakes

Some trailer axle P Series brakes have anchor pins that are secured with lock pins. You can use a steel rod to make a tool to drive out the lock pins. **Figure 3.6**.

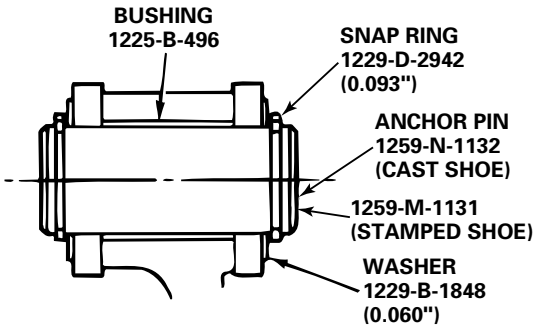
Figure 3.6



NOTE: The current anchor pin arrangement is shown in **Figure 3.7**. Older P Series brakes can include additional parts.

1. Remove the anchor pin snap ring, washer, retainer, felts, seals or capscrews as required.

Figure 3.7



WARNING

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

2. Remove the top anchor pin with a brass drift. **Figure 3.8**.
3. Rotate the top shoe to release the tension on the brake shoe return spring. Remove the shoe. **Figure 3.9**.
4. Remove the bottom anchor pin. Refer to Step 2. Remove the bottom shoe. If necessary, remove the cam rollers. **Figure 3.10**.

Figure 3.8

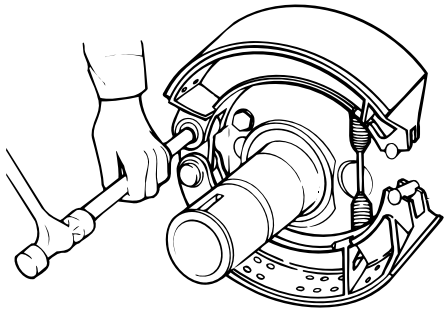


Figure 3.9

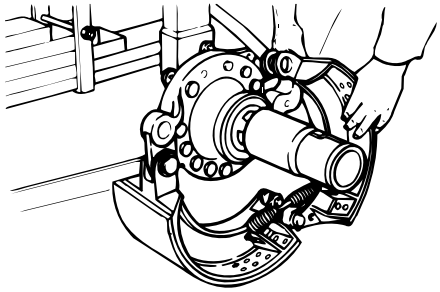
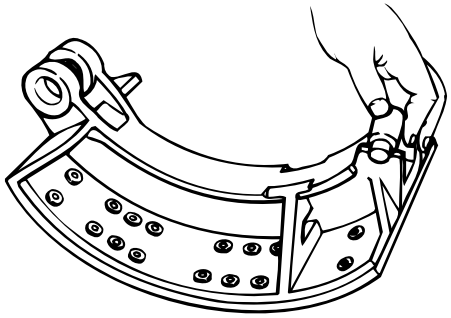


Figure 3.10



T Series Cam Brakes

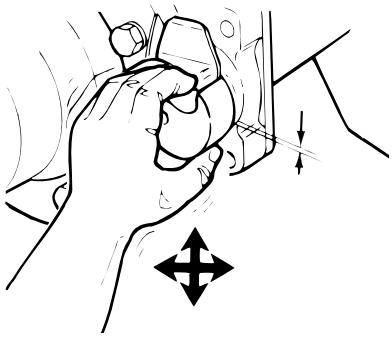
1. Remove the anti-rattle spring retainer and spring from the anti-rattle rod.
2. Push down on the bottom brake shoe to provide enough clearance to remove the bottom cam roller. Remove the roller.
3. Lift the top brake shoe. Remove the top cam roller. Remove the anchor pin snap ring and the anchor pin.
4. Rotate the bottom shoe to release the tension on the brake shoe retainer springs. Remove the shoe retainer springs and the brake shoes.

Check Cam-to-Bushing Radial Free Play and Axial End Play

Before you remove the automatic slack adjuster and camshaft, move the camshaft as shown in **Figure 3.11**. Use a feeler gauge to verify that the cam-to-bushing radial free play and axial end play are within specification.

- **If radial free play movement is less than 0.030-inch (0.76 mm):** Do not replace the bushings and seals.
- **If radial free play movement exceeds 0.030-inch (0.76 mm):** Replace the bushings and seals.
- **If axial end play movement exceeds 0.060-inch (1.52 mm):** Remove the snap ring. Add an appropriate number of spacing washers between the slack adjuster and snap ring to achieve the correct specification of 0.005-0.060-inch (0.127-1.52 mm).

Figure 3.11



Remove the Automatic Slack Adjuster and Camshaft

1. Remove the snap ring, washers and spacers from the camshaft.
2. Remove the automatic slack adjuster from the camshaft.
   - **If the slack adjuster has a "quick connect" clevis, and the gap between the clevis and clevis collar exceeds 0.060-inch (1.52 mm):** Remove the clevis from the push rod.
3. Remove the camshaft from the spider. Use the correct size driver to remove the camshaft bushings from the spider and spider bracket.

WARNING

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

ASBESTOS AND NON-ASBESTOS FIBERS WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials. Refer to page 1 in this manual for hazard summaries and recommended work practices.

WARNING

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, and emulsion-type and petroleum-base cleaners. Read the manufacturer's instructions before using a solvent cleaner, then carefully follow the instructions. Also follow the procedures below.

- **Wear safe eye protection.**
- **Wear clothing that protects your skin.**
- **Work in a well-ventilated area.**
- **Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.**
- **You must use hot solution tanks or alkaline solutions correctly. Read the manufacturer's instructions before using hot solution tanks and alkaline solutions. Then carefully follow the instructions.**

CAUTION

Do not use hot solution tanks or water and alkaline solutions to clean ground or polished parts. Damage to parts can result.

Clean and Dry Parts

Use soap and water to clean non-metal parts. Dry parts immediately after cleaning with soft, clean paper or cloth, or compressed air.

Corrosion Protection

1. **If you assemble parts immediately after you clean them:** Lubricate parts with grease to prevent corrosion. Parts must be clean and dry before you lubricate them.
2. **If you store parts after you clean them:** Apply a corrosion-preventive material. Store parts in a special paper or other material that prevents corrosion.

Inspect Parts

1. Check the spider for expanded anchor pin holes and for cracks. Replace damaged spiders and anchor pin bushings.
2. Check the camshaft bracket for broken welds, cracks and correct alignment. Replace damaged brackets.
3. Check anchor pins for corrosion and wear. Replace worn or damaged anchor pins.
4. Check brake shoes for rust, expanded rivet holes, broken welds and correct alignment. Replace a shoe with any of the above conditions.

16.5-Inch Brake Shoes Only

Anchor pin holes must not exceed 1.009-inches (25.63 mm) in diameter. The distance from the center of the anchor pin hole to the center of the roller hole must not exceed 12.779-inches (32.46 cm). Replace brake shoes with measurements that do not meet specifications.

1. Check the camshaft for cracks, wear and corrosion. Check the cam head, bearing journals and splines. Replace worn or damaged camshafts.
2. Inspect the large and small clevis pins for wear or damage. Replace worn or damaged parts.

⚠ CAUTION

Always replace used clevis pin retainer clips with new ones when you service an automatic slack adjuster or chamber. Do not reuse retainer clips. Discard used clips. When you remove a retainer clip, it can bend or "gap apart" and lose retention. damage to components can result.

NOTE: If you remove cotter pins from a slack adjuster during maintenance and service procedures, Meritor recommends that you install clevis pin retainer clips at assembly.

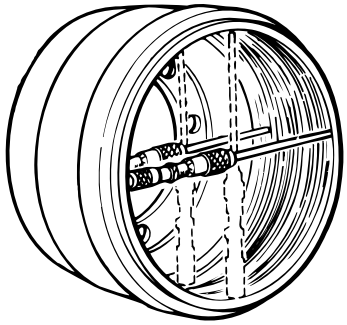
3. Inspect clevis pin retainer clips or cotter pins for wear or damage. Replace worn or damaged retainer clips or cotter pins. Do not reuse clevis pin retainer clips. Always replace used retainer clips with new ones. Discard used clips.

⚠ WARNING

Do not operate the vehicle with the brake drum worn or machined beyond the discard dimension indicated on the drum. The brake system may not operate correctly and damage to components and serious personal injury can result.

4. Use the following procedure to inspect the brake drums.
   A. Check the brake drums for cracks, severe heat checking, heat spotting, scoring, pitting and distortion. Replace drums as required. Do not turn or rebore brake drums, which decreases the strength and heat capacity of the drum.
   B. Measure the inside diameter of the drum in several locations with a drum caliper or internal micrometer. **Figure 4.1.** Replace the drum if the diameter exceeds the specifications supplied by the drum manufacturer.
5. Check dust shields for wear and damage. Repair or replace worn or damaged parts as necessary.

Figure 4.1



Automatic Slack Adjuster

1. If the slack adjuster has a "quick connect" clevis, check the gap between the clevis and the collar.
   - **If the gap exceeds 0.060-inch (1.52 mm):** Replace the clevis with a one-piece threaded clevis.
2. Check the clevis pins, clips and bushing in the slack adjuster arm for wear and damage. Replace worn or damaged parts. Check the bushing's diameter to ensure it does not exceed 0.531-inch (13.5 mm).
   - **If the bushing diameter exceeds 0.531-inch (13.5 mm)**: Replace the bushing.

⚠ CAUTION

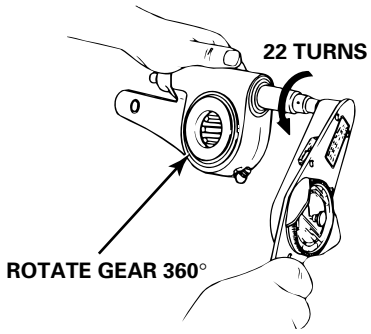
You must disengage a pull pawl or remove a conventional pawl before rotating the manual adjusting nut, or you will damage the pawl teeth. A damaged pawl will not allow the slack adjuster to automatically adjust brake clearance. Replace damaged pawls before putting the vehicle in service.

NOTE: When you service an automatic slack adjuster with a conventional pawl, replace the conventional pawl with a pull pawl.

3. Disengage the pull pawl. Use a screwdriver or equivalent tool to pry the pull pawl at least 1/32-inch to disengage the teeth. **Figure 4.2.**
   - **If the slack adjuster has a conventional pawl:** Remove the pawl. **Figure 4.2.**

Figure 4.2

Figure 4.3



CAUTION

Only turn the adjusting nut counterclockwise when you check gear torque on an automatic slack adjuster. If you turn the adjusting nut incorrectly, you will damage the pawl teeth. A damaged pawl will prevent the slack adjuster from automatically adjusting clearance between the linings and drum. Damage to components can result.

4. Use a lb-in torque wrench and turn the adjusting nut COUNTERCLOCKWISE (**Figure 4.3**) to rotate the gear 360 degrees (22 turns of the wrench) as you read the torque scale on the wrench. The value should remain at less than 25 lb-in (2.83 N•m) as you rotate the gear.
   - **If the torque value remains less than 25 lb-in (2.8 N•m) as you rotate the gear:** The slack adjuster is operating correctly.
   - **If the torque value exceeds 25 lb-in (2.8 N•m) as you rotate the gear:** The slack adjuster is not operating correctly. Disassemble the slack adjuster. Check that it's assembled correctly. Check that parts are aligned correctly.
5. Re-engage the pull pawl. Remove the screwdriver or equivalent tool. The pull pawl will re-engage automatically.
   - **If the slack adjuster has a conventional pawl:** Install the pawl assembly into the housing. Tighten the capscrew to 12-17 lb-ft (16-23 N•m). T

NOTE: If necessary, install a camshaft into the slack adjuster gear to minimize grease flow through the gear holes.

6. Use a grease gun to apply Meritor lubricant specification O-616-A, O-692 or O-645 to the slack adjuster grease fitting, until grease flows from around the camshaft splines and pawl assembly. Refer to Section 8 for more lubricant information.

Camshafts

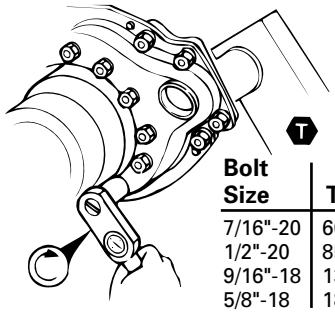
NOTE: Install new camshaft bushings and seals whenever you install a new camshaft.

1. Tighten all spider bolts to the correct torque. **Figure 4.4**. T
2. Use a seal driver to install new camshaft seals and new bushings into the cast spider and camshaft bracket.
   - **If the brake has a stamped spider:** Install both bushings into the bracket. Install the seals with the seal lips toward the slack adjuster. **Figure 4.5**.

If the Camshaft Bracket Has Been Removed

Install the chamber bracket seal and bracket onto the spider. Tighten the capscrews to the correct torque. **Figure 4.4**. T

Figure 4.4



Bolt Size	Torque	
7/16"-20	60-75 lb-ft	81-102 N•m
1/2"-20	85-115 lb-ft	115-156 N•m
9/16"-18	130-165 lb-ft	176-224 N•m
5/8"-18	180-230 lb-ft	244-312 N•m

Figure 4.5

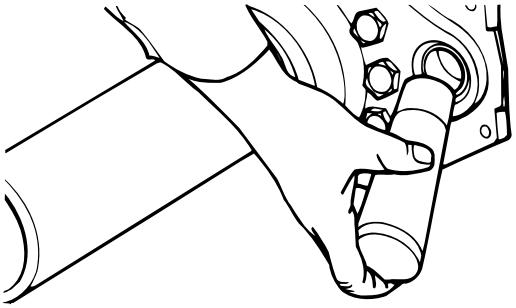
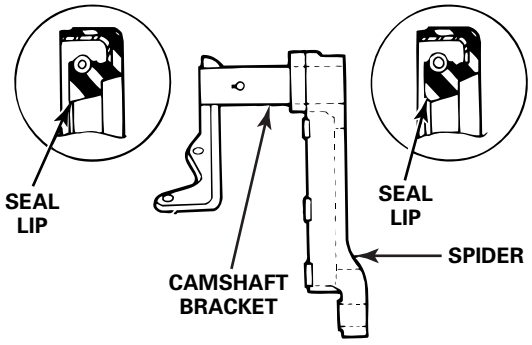


Figure 4.6



⚠ WARNING

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

Do not use the straight-center bar shoe return spring with the Q Plus camshaft. The shoe spring can interfere with the camshaft and affect braking performance. Serious personal injury and damage to components can result.

⚠ ASBESTOS AND NON-ASBESTOS FIBERS WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials. Refer to page 1 in this manual for hazard summaries and recommended work practices.

⚠ CAUTION

Only install a Q Plus camshaft in a Q Plus brake. A Q Series hammerclaw camshaft will not provide enough clearance between the brake shoe and the brake drum. Brake drag and damage to components can result.

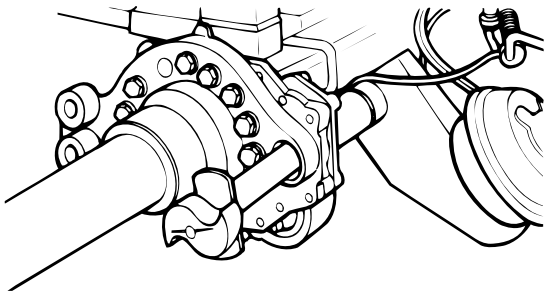
To install a new brake drum so that it fits correctly over a Q Plus brake shoe, you must install a Q Plus camshaft to prevent damage to components.

Installation

Camshaft

1. Install the cam head thrust washer onto the camshaft. Apply Meritor specification O-617-A or O-617-B grease to the camshaft bushings and journals.
2. Install the camshaft through the spider and bracket so that the camshaft turns freely by hand. **Figure 5.1**.

Figure 5.1



Replace a Q Series Camshaft with a Q Plus Camshaft

All Front and Drive Axle 16.5-Inch Q Series Brakes

When you replace a Q Series camshaft with a Q Plus camshaft, continue to follow maintenance and service procedures for a Q Series brake and a Q Plus camshaft.

Replace a Hammerclaw Camshaft with a Standard Q Plus Camshaft

Front Axles Only

A standard Q Plus camshaft and a shoe return spring with an offset center bar replaces the hammerclaw Q Series camshaft and shoe return spring with a straight center bar on 16.5 x 5-inch and 6-inch Q Series cam brake. **Figures 5.2 and 5.3**.

A Q Plus camshaft has deeper roller pockets than a Q Series camshaft and has “Q Plus” forged into one of the pockets. You may notice a larger gap between the brake lining and the drum after you assemble the brake shoe and shoe return spring with an offset center bar. **Figure 5.4**. The excess gap will be eliminated when you correctly adjust the brake.

1. Follow Steps 1 and 2 under Q Plus and Q Series 16.5-Inch Brakes in this section to replace a Q Series hammerclaw camshaft with a standard Q Plus camshaft.
2. Continue to follow service and maintenance procedures for a Q Plus camshaft and Q Series brake.

Figure 5.2

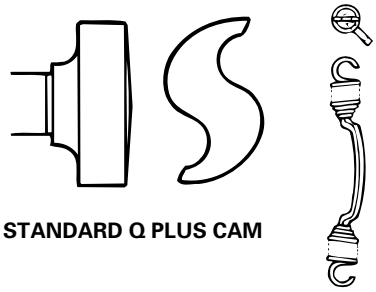


Figure 5.3

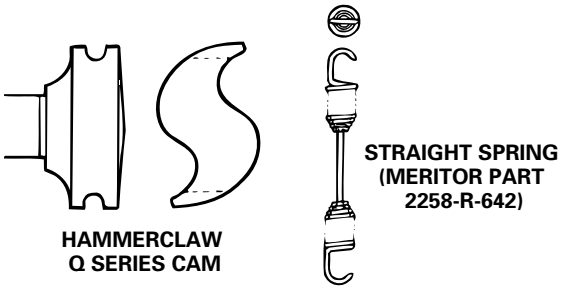
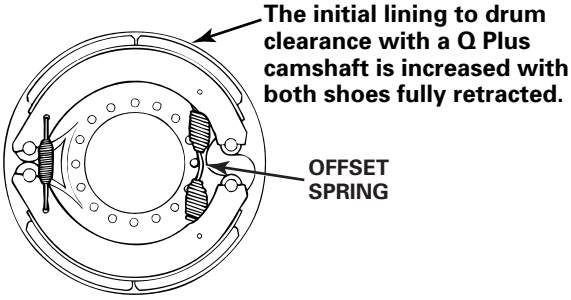


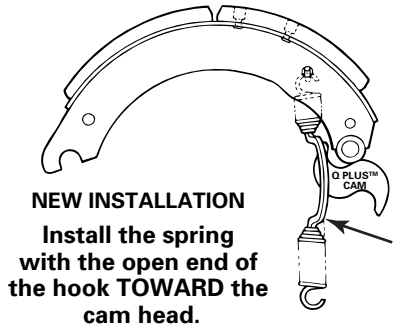
Figure 5.4



Shoe Return Spring

Install the new offset shoe return spring with the open end of the spring hooks toward the camshaft. **Figure 5.5**.

Figure 5.5



Automatic Slack Adjuster onto the Camshaft

1. Check the camshaft and bushings and seals for wear and corrosion. Turn the camshaft by hand to check for smooth operation. Repair or replace parts as required.
2. Apply the service brake and spring brake several times. Check that the chamber return spring retracts the push rod quickly and completely. If necessary, replace the return spring or the air chamber.
3. Verify that the new automatic slack adjuster is the same length as the one you are replacing. Refer to Table A.

Table A: Chamber and Automatic Slack Adjuster Sizes

Length of Slack Adjuster (Inches)	Size of Chamber (Square Inches)
5	9*, 12*, 16, 20, 24, 30
5-1/2	9*, 12*, 16, 20, 24, 30, 36
6	24, 30, 36
6-1/2	30, 36

* Use an auxiliary spring on slack adjusters used with these size chambers. A size 9 or 12 chamber return spring cannot supply enough spring tension to completely retract the slack adjuster.

WARNING

Before you service a spring chamber, carefully follow the manufacturer's instructions to compress and lock the spring to completely release the brake. Verify that no air pressure remains in the service chamber before you proceed. Sudden release of compressed air can cause serious personal injury and damage to components.

4. If the vehicle has spring brakes, follow the chamber manufacturer's instructions to compress and lock springs to completely release the brakes. Verify that no air pressure remains in the service chambers.

CAUTION

Most Meritor automatic slack adjusters manufactured after January 1990 have lubrication holes in the gear splines. Do not operate the actuator rod before you install the slack adjuster. Lubricant can pump through the holes and onto the splines. Damage to components can result.

5. If the automatic slack adjuster gear has a 10-tooth spline, apply Meritor specification O-637 (part number 2297-U-4571) anti-seize compound, or equivalent. This specification is a corrosion-control grease. Do not mix this grease with other greases.

NOTE: Install the slack adjuster so that you can remove a conventional pawl or disengage a pull pawl when you adjust the brake.

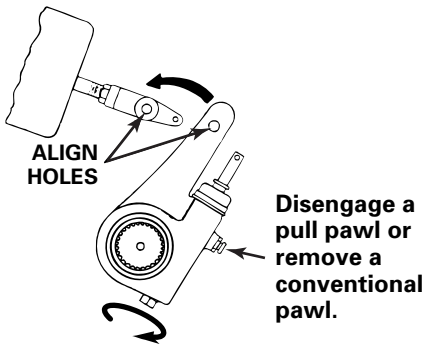
6. Install the slack adjuster onto the camshaft. Position the slack adjuster so that you can access the pawl when you adjust the brake.
7. Verify that camshaft axial end play is 0.005-0.060-inch (0.127-1.52 mm).
   - **If axial end play exceeds 0.060-inch (1.52 mm):** Remove the snap ring. Add an appropriate number of spacing washers to achieve the correct specification.
8. Install the clevis onto the push rod.

CAUTION

You must disengage a pull pawl or remove a conventional pawl before rotating the manual adjusting nut, or you will damage the pawl teeth. A damaged pawl will not allow the slack adjuster to automatically adjust brake clearance. Replace damaged pawls before putting the vehicle in service.

9. Disengage the pull pawl or remove a conventional pawl. Turn the manual adjusting nut to align the holes in the slack adjuster arm and clevis. **Figure 5.6**.

Figure 5.6



Welded Clevis

1. Check the clevis position. Apply Meritor specification O-637 (part number 2297-U-4571) anti-seize compound or equivalent to the large and small clevis pins. This specification is a corrosion-control grease. Do not mix this grease with other greases.

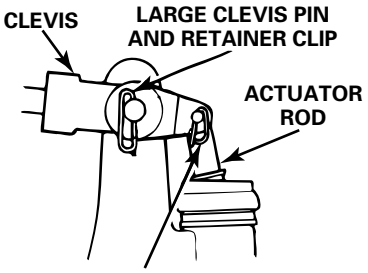
⚠ CAUTION

Always replace used clevis pin retainer clips with new ones when you service an automatic slack adjuster or chamber. Do not reuse retainer clips. Discard used clips. When you remove a retainer clip, it can bend or "gap apart" and lose retention. Damage to components can result.

NOTE: Meritor recommends that you replace cotter pins with clevis retainer clips at assembly.

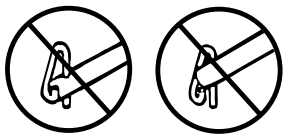
2. Install new clevis pin retainer clips or cotter pins to secure the clevis pins. Retainer clips must be fully installed and positioned around the side of the clevis pin. **Figure 5.7**.

Figure 5.7



LARGE CLEVIS PIN RETAINER CLIP MERITOR PART 2257-D-1174

SMALL CLEVIS PIN RETAINER CLIP MERITOR PART 2257-C-1173



The clevis pin retainer clips must be fully installed and positioned around the side of clevis pin.

Threaded Clevis

Adjust the Clevis Position on the Chamber Push Rod

Automatic Slack Adjuster Template Method for Standard Stroke Chambers Only

⚠ WARNING

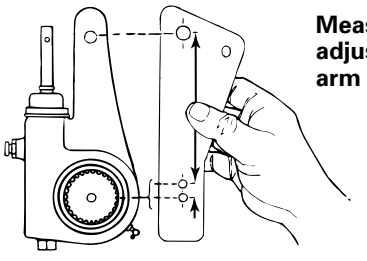
Meritor provides a slack adjuster template for truck and tractor, trailer, and coach drum brakes. *These templates are not interchangeable*. You must use the correct template when you install the clevis.

If you use the wrong template, the automatic slack adjuster will not adjust the brakes correctly. Under-adjustment can increase stopping distances. Over-adjustment can cause the linings to drag. Serious personal injury and damage to components can result.

1. Install the large clevis pin through the large clevis pin hole in the correct slack adjuster template for the drum brake you're servicing. **Figure 5.8**.

Figure 5.8

Color of Template	Part Number	Applications
Dark brown	TP-4786	Truck or tractor drum brake
Tan	TP-4787	Trailer drum brake
White	TP-4781	Coach drum brake

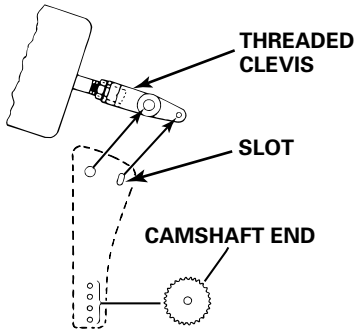


Measure slack adjuster arm length.

CAMSHAFT CENTER

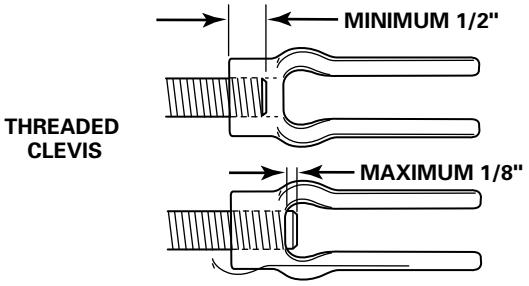
2. Select the hole at the small end of the template that matches the slack adjuster arm length. Position and hold the hole on the center of the camshaft.
3. Look through the small clevis pin slot on the template to see if the small clevis hole completely aligns within the slot.
   - **If the small clevis hole doesn't align within the slot:** Adjust the clevis until you can see the small clevis pin hole within the slot. **Figure 5.9**.

Figure 5.9



4. Verify that thread engagement between the clevis and push rod is 1/2-5/8-inch (12.7-15.9 mm). **Figure 5.10**.

Figure 5.10



5. Verify that the push rod does not extend through the clevis more than 1/8-inch (12.7 mm).
   - **If the push rod extends through the clevis more than 1/8-inch (12.7 mm):** Cut the push rod, or install a new air chamber and push rod.
6. Tighten the jam nut against the clevis to the torque specification in Table B. (T)

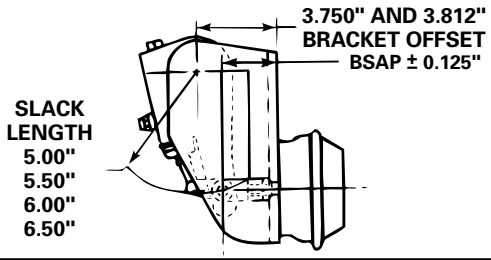
Table B: Jam Nut Torque Specifications

Threads	Torque
1/2-20	20-30 lb-ft (27-41 N•m)
5/8-18	35-50 lb-ft (48-68 N•m)

Brake Slack Adjuster Position (BSAP) Method for Standard Stroke and Long Stroke Chambers

When you install the slack adjuster, verify that the BSAP chamber dimension matches the table in **Figure 5.11**.

Figure 5.11



Slack Adjuster Size	Standard Stroke Chamber Clevis (1.38") 1.38"	Long Stroke Chamber Clevis (1.30") 1.30"
5.00"	2.75"	2.25"
5.50"	2.75"	2.25"
6.00"	2.75"	2.25"
6.50"	2.62"	2.25"

±0.125" Tolerance. You must use the correct clevis with the correct chamber type.

Correct positions of the automatic slack adjuster are 3.750-inch and 3.812-inch offsets only. For other bracket offsets, refer to the vehicle manufacturer's specifications.

Brake Shoes

NOTE: Meritor recommends that you replace springs, rollers, anchor pins and cam bushings at each reline.

Q Plus and Q Series 16.5-Inch Brakes

1. Place the upper brake shoe into position on the top anchor pin. Hold the lower brake shoe on the bottom anchor pin. Install two new brake shoe retaining springs. **Figure 5.12**.
2. Rotate the lower brake shoe forward. Install a new brake shoe return spring with the open end of the spring hooks toward the camshaft. **Figure 5.13**.
3. Pull each brake shoe away from the camshaft to enable you to install the camshaft roller and roller retainer. Press the retainer "ears" to fit into the retainer between the brake shoe webs. **Figure 5.14**.

Figure 5.12

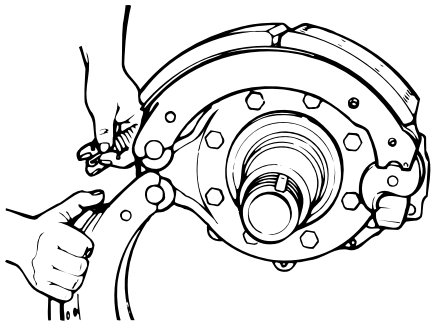


Figure 5.13

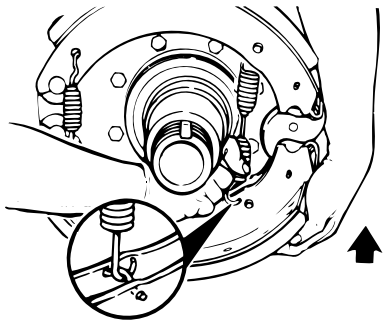
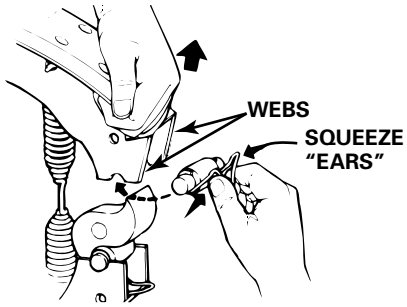


Figure 5.14



4. Push the camshaft roller retainer into the brake shoe until the "ears" lock into the shoe web holes. **Figure 5.15**.
5. Use Meritor specification grease O-617-A or O-617-B to lubricate the camshaft roller pin and anchor pin. **Figure 5.16**.

Figure 5.15

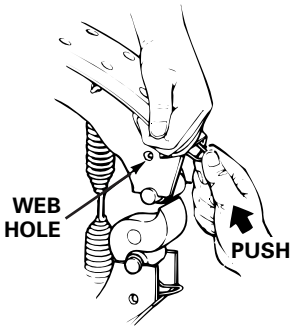
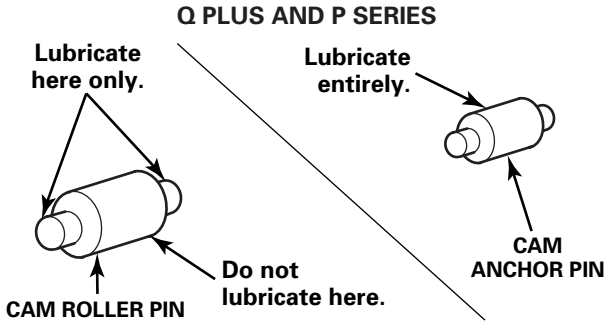


Figure 5.16



Q Series 15-Inch Cam Brake

1. Install the anchor pins, washers and nuts to the spider if these parts were removed previously. Tighten the anchor pin nuts to 325-375 lb-ft (441-509 N•m). T
2. Install a new brake shoe return spring with the open end of the spring hooks toward the camshaft. Install the brake shoes onto the anchor pins. **Figure 5.17**.
3. Hold the bottom brake shoe in position. Install the shoe return spring. Pull the brake shoe away from the camshaft to enable you to install the camshaft roller and roller retainer.
4. Use Meritor specification grease O-617-A or O-617-B to lubricate the camshaft roller pin and anchor pin. **Figure 5.18**.

Figure 5.17

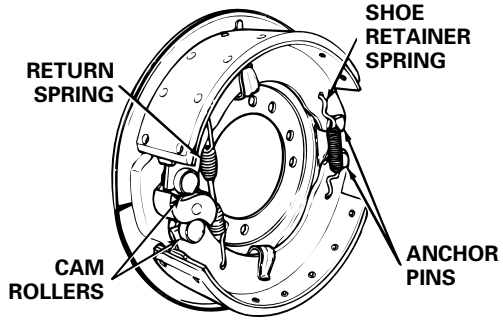
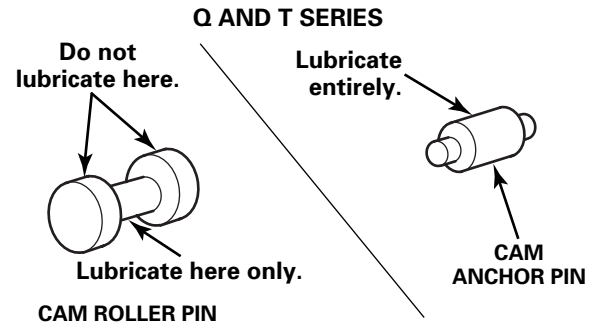


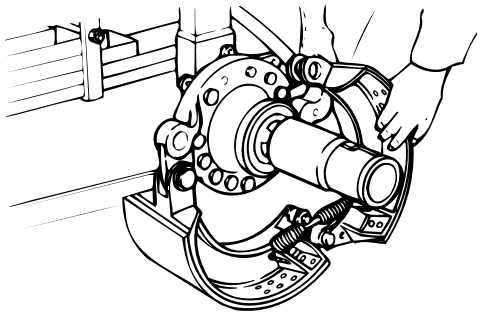
Figure 5.18



P Series and Cast Plus Cam Brakes

1. Install the anchor pin bushings. If necessary, align the holes in the bushings with the holes in the spider.
2. Install a new cam roller and cam roller retainers.
3. Install the lower brake shoe in position on the spider.
4. Use a hammer and brass drift to install the anchor pin. If necessary, align the groove on the anchor pin with the holes in the spider and bushing.
5. Install the anchor pin washers, felts, seals, retainers and snap rings, if required. Install lock pins or lock screws, if required. Tighten the screws to 10-15 lb-ft (13.6-20.3 N•m). T
6. Install a new shoe return spring onto the brake shoe. **Figure 5.19**. Place the upper brake shoe into position over the spider. Repeat Steps 4 and 5.
7. Lubricate the camshaft roller pin and anchor pin with Meritor specification O-617-A or O-617-B grease. **Figure 5.16**.

Figure 5.19



T Series Cam Brake

1. Install the anchor pins, washers and nuts onto the backing plate if these parts were previously removed. Tighten the anchor pin nuts to 185-350 lb-ft (251-475 N•m). T
2. Install the anti-rattle rod. Install the brake shoe onto the anchor pins and anti-rattle rod.
3. Install the anchor pin snap rings, anti-rattle spring and anti-rattle retainer spring onto the anti-rattle rod.
4. Pull the brake shoe away from the camshaft to enable you to install the brake shoe roller. Install a new brake shoe return spring onto the brake shoe.
5. Lubricate the camshaft roller pin and anchor pin with Meritor specification grease O-617-A or O-617-B. **Figure 5.18**.

Drum and Wheel

Follow the manufacturer's instructions to install the drum and wheel onto the axle.

WARNING

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

ASBESTOS AND NON-ASBESTOS FIBERS WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials. Refer to page 1 in this manual for hazard summaries and recommended work practices.

WARNING

Before you service a spring chamber, carefully follow the manufacturer's instructions to compress and lock the spring to completely release the brake. Verify that no air pressure remains in the service chamber before you proceed. Sudden release of compressed air can cause serious personal injury and damage to components.

Adjust the Brakes

When you perform preventive maintenance procedures on an in-service brake, check both the free stroke and adjusted chamber stroke. Refer to Commercial Vehicle Safety Alliance (CVSA) Guidelines to Measure Push Rod Travel (Adjusted Chamber Stroke) in this section.

Free stroke sets the clearance between the linings and drum. The in-service free stroke may be slightly longer than 1/2-5.8-inch (12.7-15.9 mm) specified in this procedure. This is not a concern if the adjusted chamber stroke is within the limits shown in Table C and Table D in this section.

Measure Free Stroke

CAUTION

You must disengage a pull pawl or remove a conventional pawl before rotating the manual adjusting nut, or you will damage the pawl teeth. A damaged pawl will not allow the slack adjuster to automatically adjust brake clearance. Replace damaged pawls before putting the vehicle in service.

1. Disengage a pull pawl. Use a screwdriver or equivalent tool to pry the pull pawl at least 1/32-inch to disengage the teeth.
   - **If the slack adjuster has a conventional pawl:** Remove the pawl.
2. Use a wrench to turn the manual adjusting nut COUNTERCLOCKWISE until the brake shoes are fully retracted, and the lining clears the drum. **Figure 6.1**. Then back-off the adjusting nut one-half turn in the opposite direction.
3. Measure the distance from the center of the large clevis pin to the bottom of the air chamber while the brake is released. The measurement you obtain is "X" in **Figure 6.2**.
4. Use a pry bar to move the slack adjuster and position the linings against the drum (brakes applied). Measure the same distance again while the brakes are applied. The measurement you obtain is "Y" in **Figure 6.2**.

CAUTION

Do not set free stroke shorter than 1/2-5/8-inch (12.7-15.9 mm) for drum brakes. If the measurement is too short, linings can drag. Damage to components can result.

5. Subtract "X" from "Y" to obtain the in-service free stroke. The measurement must be 1/2-5/8-inch (12.7-15.9 mm) for drum brakes. **Figure 6.2**.
   - **If the free stroke measurement is not within specification:** Turn the adjusting nut COUNTERCLOCKWISE 1/8 turn to adjust free stroke. **Figure 6.2**. Follow the steps above to check free stroke again, until the measurement is within specification.

6. Re-engage the pull pawl by removing the screwdriver or equivalent tool. The pull pawl will re-engage automatically.
   - **If the slack adjuster has a conventional pawl:** Install the pawl assembly into the housing. Tighten the capscrew to 12-17 lb-ft (16-23 N•m).
7. If the brakes have spring chambers, carefully release the springs. Test the vehicle before you return it to service.

Figure 6.1

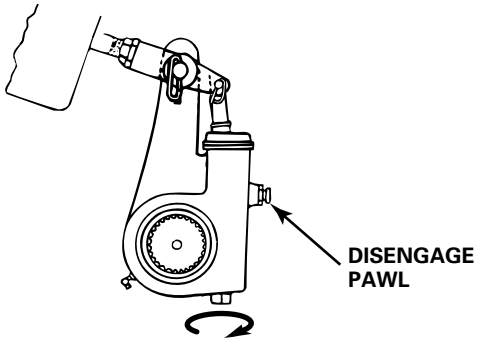
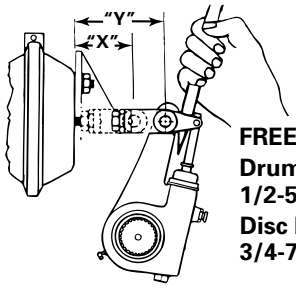
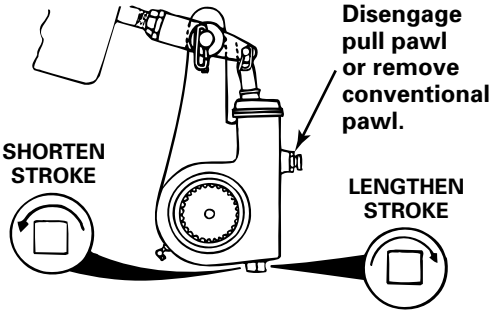


Figure 6.2



FREE STROKE = "Y" MINUS "X"
Drum brake free stroke must be 1/2-5/8" (12.7-15.9 mm).
Disc brake free stroke must be 3/4-7/8" (19.1-22.2 mm).

Figure 6.3



Commercial Vehicle Safety Alliance (CVSA) Guidelines

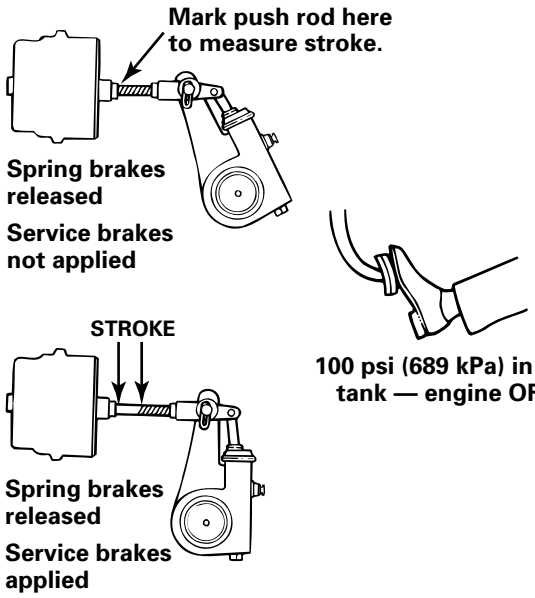
Measure Push Rod Travel (Adjusted Chamber Stroke)

Use the following procedure to check in-service push rod travel (adjusted chamber stroke) on truck and tractor brakes.

NOTE: Hold the ruler parallel to the push rod and measure as carefully as possible. A measurement error can affect CVSA re-adjustment limits. CVSA states that "any brake 1/4-inch or more past the re-adjustment limit, or any two brakes less than 1/4-inch beyond the re-adjustment limit, will be cause for rejection."

1. The engine must be OFF. If the brake has a spring chamber, follow the manufacturer's instructions to release the spring. Verify that no air pressure remains in the service section of the chamber.
2. Verify that pressure is 100 psi (689 kPa) in the air tanks. Determine the size and type of brake chambers on the vehicle.
3. With the brakes released, mark the push rod where it exits the chamber. Measure and record the distance. Have another person apply and hold the brakes on full application. **Figure 6.4**.
4. Measure push rod travel (adjusted chamber stroke) from where the push rod exits the brake chamber to your mark on the push rod. Measure and record the distance. **Figure 6.4**.
5. Subtract the measurement you recorded in Step 3 from the measurement you recorded in Step 4. The difference is push rod travel (adjusted chamber stroke).
6. Refer to Table C or Table D to verify that the stroke length is correct for the size and type of air chambers on the vehicle.
   - **If push rod travel (adjusted chamber stroke) is greater than the maximum stroke shown in Table C or Table D:** Inspect the slack adjuster and replace it, if necessary.

Figure 6.4



Alternate Method to Measure Push Rod Travel (Adjusted Chamber Stroke)

Use the CVSA procedure, except in Steps 3 and 4, measure the distance from the bottom of the air chamber to the center of the large clevis pin on each of the brakes.

CVSA North American Out-of-Service Criteria Reference Tables

Information contained in the following tables is for reference only. Consult the CVSA's Out-of-Service Criteria Handbook for North American Standards, Appendix A. Visit their website at http://64.35.82.7/ to order the handbook.

Table C: "Standard Stroke" Clamp-Type Brake Chamber Data

Type	Outside Diameter (inches)	Brake Adjustment Limit (inches)	
6	4-1/2	1-1/4	As short as possible without lining to drum contact
9	5-1/4	1-3/8	
12	5-4/16	1-3/8	
16	6-3/8	1-3/4	
20	6-25/32	1-3/4	
24	7-7/32	1-3/4	
30	8-3/32	2	
36	9	2-1/4	

Table D: "Long Stroke" Clamp-Type Brake Chamber Data

Type	Outside Diameter (inches)	Brake Adjustment Limit (inches)	
16	6-3/8	2.0	As short as possible without lining to drum contact
20	6-25/32	2.0	
24	7-7/32	2.0	
24*	7-7/32	2.5	
30	8-3/32	2.5	

* For 3" maximum stroke type 24 chambers.

⚠ WARNING

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

⚠ ASBESTOS AND NON-ASBESTOS FIBERS WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials. Refer to page 1 in this manual for hazard summaries and recommended work practices.

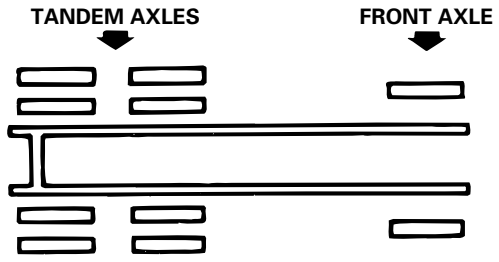
Important Information on Linings and Primary Shoe Locations

Use the Correct Lining Material

Use the lining material specified by the vehicle manufacturer. This will help to ensure that the brakes perform correctly and meet Department of Transportation (DOT) performance regulations.

ALso note that the drums and linings on a front axle can be different than drums and linings on a rear axle. **Figure 7.1**.

Figure 7.1



Both wheel ends of each axle must have identical drums and lining.

Single Axles

Always reline both wheels of a single axle at the same time.

Always install the same linings and drums on both wheels of a single axle.

Tandem Axles

Always reline all four wheels of a tandem axle at the same time.

Always install the same linings and drums on all four wheels of a tandem axle.

Combination Friction Linings

⚠ CAUTION

When you install combination friction linings, you must install the *primary* lining on the *primary* brake shoe. If you install combination friction linings incorrectly, damage to components will result. Carefully follow instructions included with the replacement linings.

You can combine brake linings, which means that the linings you install on the primary shoe will have a different friction rating than the linings you install on the secondary shoe.

However, you must install the primary lining on the primary shoe. Carefully follow the instructions included with the replacement combination linings.

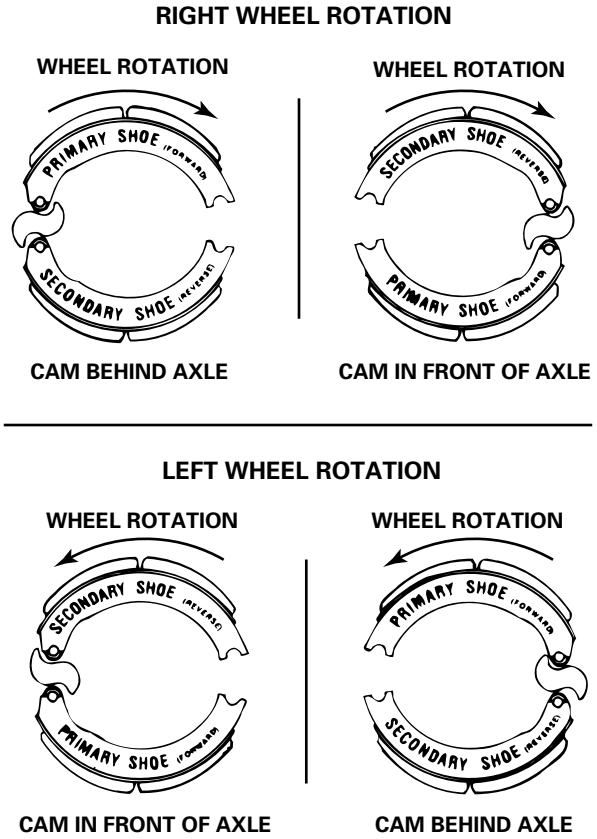
Primary Shoe Locations

The first shoe past the camshaft in the direction of wheel rotation is the primary shoe. **Figure 7.2**. The primary shoe can be either at the top or bottom position, depending on the location of the camshaft.

If the camshaft is behind the axle, the top shoe is the primary shoe.

If the cam is in front of the axle, the top shoe is the primary shoe.

Figure 7.2



⚠ WARNING

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

⚠ ASBESTOS AND NON-ASBESTOS FIBERS WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials. Refer to page 1 in this manual for hazard summaries and recommended work practices.

⚠ WARNING

During lubrication procedures, if grease flows from the seal near the camshaft head, replace the seal. Remove all grease or oil from the camshaft head, rollers and brake linings. Always replace linings contaminated with grease or oil, which can increase stopping distances. Serious personal injury and damage to components can result.

Lubrication and Maintenance

NOTE: Refer to Table E in this section for grease specifications.

Camshaft Bushings

Meritor recommends that you install new camshaft bushings whenever you install a new camshaft.

Lubricate through the fitting on the bracket or spider until new grease flows from the inboard seal.

Rollers and Anchor Pins

When the brake is disassembled, or when necessary, lubricate the anchor pins and rollers where these parts touch the brake shoes.

Do not allow grease to contact the area of the camshaft roller that touches the camshaft head. **Figures 8.1 and 8.2**.

Figure 8.1

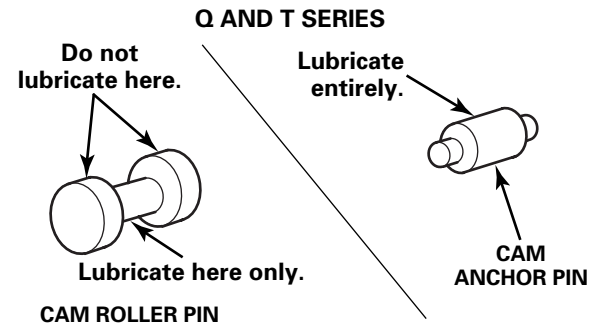
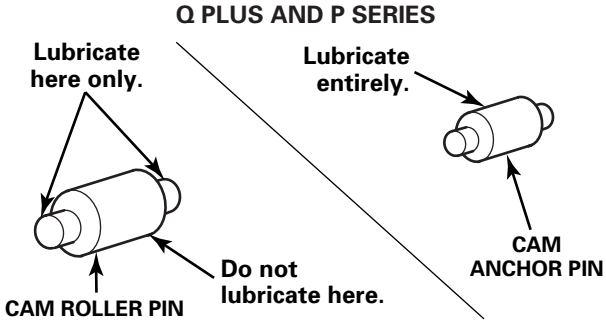


Figure 8.2



Automatic Slack Adjuster

Inspect and lubricate the automatic slack adjuster according to one of the schedules below. Use the schedule that requires the most frequent inspection and lubrication, and whenever you reline the brakes. Refer to Table F in this section for grease specifications.

- Vehicle manufacturer's schedule
- Fleet's schedule
- Every six months
- A minimum of four times during the life of the linings

Anti-Seize Compound

Use anti-seize compound on the clevis pins of all automatic slack adjusters.

For a conventional automatic slack adjuster, use anti-seize compound on the slack adjuster and camshaft splines, if the slack adjuster gear does not have a grease groove and holes around its inner diameter.

Factory-Installed Automatic Slack Adjusters on Q Plus LX500 and MX500 Cam Brake Packages

Q Plus LX500 and MX500 cam brake packages include factory-installed automatic slack adjusters that do not have grease fittings. Also, lubrication intervals are different than intervals for conventional slack adjusters.

For complete maintenance and service information for Meritor's LX500 and MX500 cam brakes, refer to Maintenance Manual MM-96173. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

Table E: Cam Brake Grease Specifications

Components	Meritor Specification	NLGI Grade	Grease Type	Outside Temperature
• Retainer Clips • Anchor Pins • Rollers (Journals Only) • Camshaft Bushings	O-616-A	1	Clay Base	Down to –40°F (–40°C)
	O-617-A or O-617-B	1 2	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.
	O-645	2	Synthetic Oil, Clay Base	Down to –65°F (–54°C)
	O–692	1 and 2	Lithium Base	Down to –40°F (–40°C)
Camshaft Splines	Any of Above	See Above	See Above	See Above
	O-637*	1-1/2	Calcium Base	Refer to the grease manufacturer's specifications for the temperature service limits.
	O-641	—	Anti-Seize	

Table F: Automatic Slack Adjuster Grease Specifications

Component	Meritor Specification	NLGI Grade	Grease Type	Outside Temperature
• Automatic Slack Adjuster	O-616-A	1	Clay Base	Down to –40°F (–40°C)
	O-692	1 and 2	Lithium Base	Down to –40°F (–40°C)
	O-645	2	Synthetic Oil, Clay Base	Down to –65°F (–54°C)
• Clevis Pins	Any of Above	See Above	See Above	See Above
	O-637*	1-1/2	Calcium Base	Refer to the grease manufacturer's specifications for the temperature service limits.
	O-641	—	Anti-Seize	

*** Do not mix Meritor grease specification O-637 (part number 2297-U-4571), a calcium-base, rust-preventive grease, with other greases.**

Maintenance Intervals

On-Highway Linehaul Applications

Q Plus, Cast Plus and Q Series Brakes

Every 100,000 miles (160 000 km) or every six months, whichever comes first.

P Series Brakes

Every 50,000 miles (80 000 km) or every six months, whichever comes first.

Off-Highway Linehaul Applications

At least every four months when you replace the seals and reline the brakes.

Every two weeks during the first four-month period, inspect for hardened or contaminated grease and for the absence of grease to help determine lubrication intervals.

Lubricate more often for severe-duty applications.

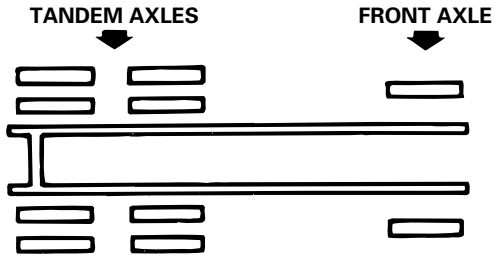
WARNING

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

Before You Return the Vehicle to Service

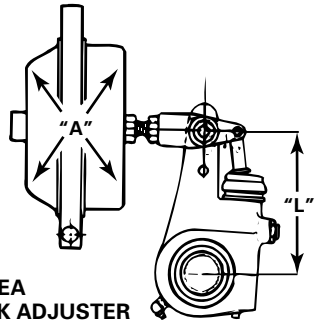
1. Check the complete air system for worn hoses and connectors. With air pressure at 100 psi (689 kPa), brakes released and engine off, loss of tractor air pressure must not exceed two psi a minute. Total tractor and trailer loss must not exceed three psi per minute.
2. Check to see that the air compressor drive belt is tight. Air system pressure must rise to approximately 100 psi (689 kPa) in two minutes.
3. The governor must be checked and set to the specifications supplied by the vehicle manufacturer.
4. Both the tractor and trailer air systems must match the specifications supplied by the vehicle manufacturer.
5. Both wheel ends of each axle must have the same linings and drums. All four wheel ends of tandem axles also must have the same linings and drums. It is not necessary for the front axle brakes to be the same as the rear driving axle brakes. **Figure 9.1**.
6. Always follow the specifications supplied by the vehicle manufacturer for the correct lining to be used. Vehicle brake systems must have the correct friction material and these requirements can change from vehicle to vehicle.
7. The return springs must retract the shoes completely when the brakes are released. Replace the return springs each time the brakes are relined. The spring brakes must retract completely when they are released.
8. The air chamber area multiplied by the length of the automatic slack adjuster is called the "AL" factor. This number must be equal for both ends of a single axle and all four ends of a tandem axle. **Figure 9.2**.

Figure 9.1



Both wheel ends of each axle must have identical drums and lining.

Figure 9.2



"AL" FACTOR = A x L
A = AIR CHAMBER AREA
L = LENGTH OF SLACK ADJUSTER

Recommended Periodic Service

Adjust the Brakes

NOTE: Adjust the wheel bearings before you adjust the brakes.

Clean, inspect and adjust the brakes every time you remove a wheel hub.

Adjust the brakes when the chamber stroke exceeds CVSA limits in Table C and Table D in Section 6.

Adjust the brake as frequently as necessary for correct operation.

Check for correct lining-to-drum clearance, push rod travel and brake balance.

Lubrication

Refer to Table E and Table F in Section 8 to lubricate the brakes and automatic slack adjuster.

Reline the Brakes

⚠ CAUTION

Reline the brakes when the lining thickness is 0.25-inch (6.3 mm) at the thinnest point. The rivets or bolts must not touch the drum. Damage to components will result.

Meritor recommends that you replace springs, rollers, camshaft bushings and anchor pins at each reline.

Reline the brake when the lining thickness is 0.25-inch (6.3 mm) at the thinnest point.

Replace shoe retainer springs, check the drum, and perform a major inspection when you reline the brakes.

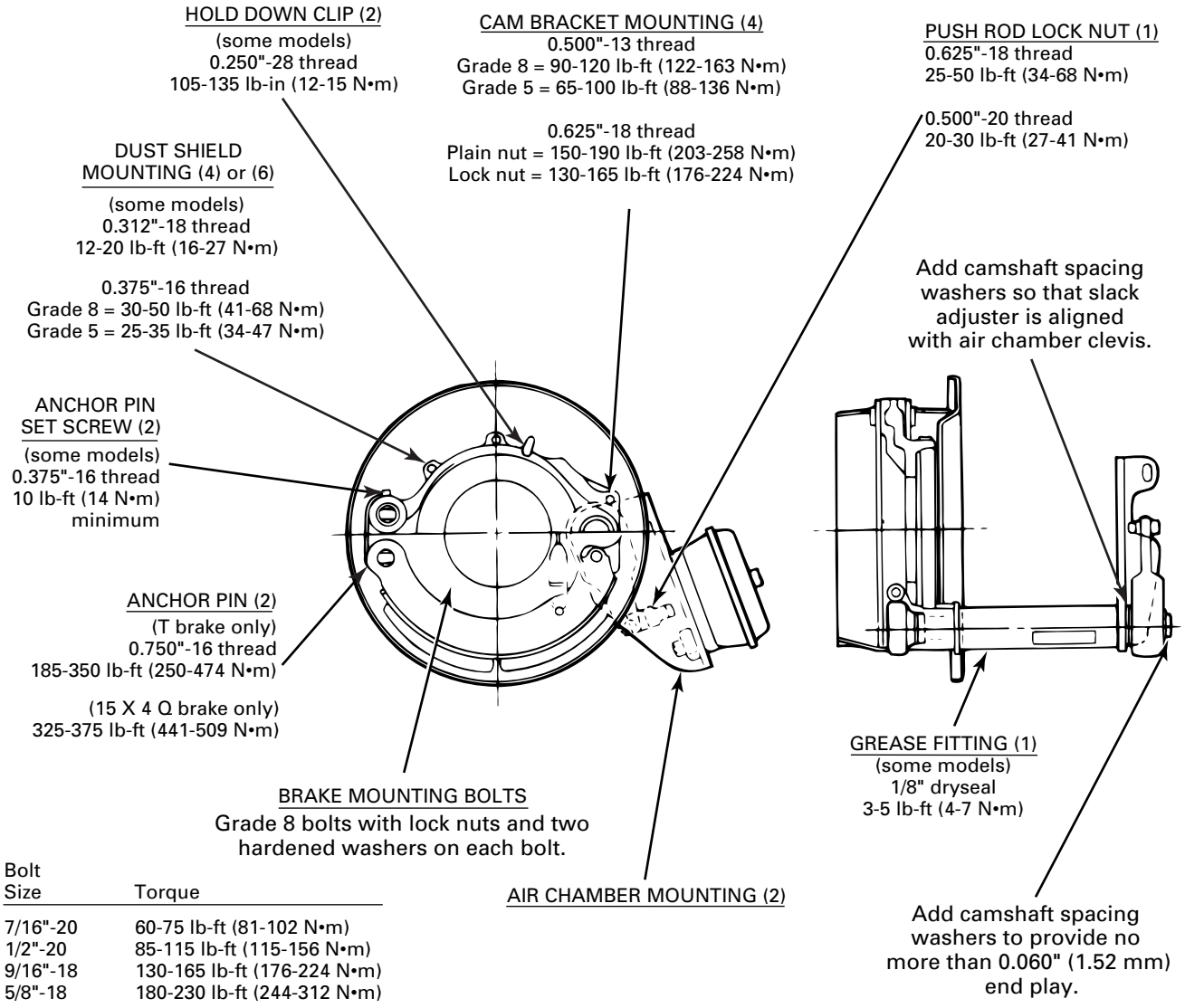
Inspection

Refer to Section 8 for inspection guidelines.

Major Overhaul

Perform a major overhaul at every second reline, or as necessary. Replace shoe return springs. Replace damaged or worn parts with genuine Meritor parts. Check components for the following conditions.

- Spiders for distortion and loose bolts
- Anchor pins for wear and correct alignment
- Brake shoes for wear at anchor pin holes or roller slots
- Camshafts and camshaft bushings for wear
- Brake linings for grease on the lining, wear and loose rivets or bolts
- Drums for cracks, deep scratches or other damage



Bolt Size	Torque
7/16"-20	60-75 lb-ft (81-102 N•m)
1/2"-20	85-115 lb-ft (115-156 N•m)
9/16"-18	130-165 lb-ft (176-224 N•m)
5/8"-18	180-230 lb-ft (244-312 N•m)

Grade 8 Nuts and Hard Flat Washers								
Chamber Size	**9**	**12**	**16**	**20**	**24**	**30**	**36**	**Spring Chamber**
Bendix	20-30 lb-ft (27-41 N•m)		30-45 lb-ft (41-61 N•m)			45-65 lb-ft (61-88 N•m)		65-85 lb-ft (88-115 N•m)
Haldex	35-50 lb-ft (48-68 N•m)			70-100 lb-ft (95-136 N•m)				
MGM	35-40 lb-ft (48-54 N•m)			133-155 lb-ft (180-210 N•m)				
Anchorlok/Haldex				130-150 lb-ft (177-203 N•m)				

Air Chambers

To ensure correct brake balance, all brake chambers on the same axle must be the same size and type to help ensure a balanced brake system for maximum lining wear and drum life.

Brake Kits

Meritor brake shoes, rollers, camshafts and shoe return springs are designed to perform as a system. Always install OEM spec-level components during maintenance or when you upgrade from standard to long-life brakes to help ensure correct brake performance and maximum lining life.

Cam Heads

Cam heads can look the same, but that doesn't mean they will perform the same in your brake system. Two cam head profiles can appear to be identical, but very small differences in cams from different manufacturers can be significant enough to affect the performance of your brakes. To ensure a balanced brake system and optimum lining and drum life, always install the correct replacement cam.

Cam Rollers

To avoid flat spots, lubricate a cam roller directly in the web roller pocket and not at the cam-to-roller contact area. Flat spots can affect brake adjustment and result in premature brake wear or reduced braking performance.

Drums

To help ensure balanced braking, even lining and drum wear, and correct function of the automatic slack adjuster, do not install a cast drum and a centrifuse drum on the same axle.

A cast drum and a centrifuse drum each absorbs and dissipates heat differently. When drum types and weights are mixed, different rates of heat absorption and dissipation occur that can effect the brake system.

Hardware

When you service cam brakes, replace all the springs, anchor pins, bushings and rollers — not just the shoe return springs — to help ensure maximum braking performance.

Linings

Insist on the same brand of quality OEM friction lining material to help ensure fewer relines and compatibility with your present system.

Replacement Parts

Always use OEM quality standard parts. Meritor brakes work as a system, and when you replace original parts with "will-fit" parts, you can compromise the performance of the entire system.

Return Springs

Replace cam brake return springs at every cam brake reline. The return spring is critical to alignment, accurate return of the brake away from the drum and correct automatic slack adjustment.

Trailer Cam Brakes

Long-life bushings require correct lubrication for maximum performance and bushing life. Although you do not have to replace spider cam bushings on trailer axles as frequently, Meritor recommends that you lubricate the bushings at least four times during the life of your brake lining.

Automatic Slack Adjusters

"Automatic" doesn't mean maintenance-free. Properly installed and lubricated automatic slack adjusters help to ensure maximum brake system performance.

Never mix automatic slack adjusters on the same axle. When you replace automatic slack adjusters, always use replacement parts that were originally designed for the brake system to help ensure even brake wear, balanced braking and maximum brake performance.

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MERITOR™
A Heritage of Rockwell Technology

Hydraulic and Mechanical Drum Brakes

Maintenance Manual No. 4H
Revised 4-96

Hydraulic Brakes
- DLH
- DSH
- DH
- FSH
- H

Mechanical Brakes
- DCM
- DLM
- DM

Service Notes

This maintenance manual describes the correct service and repair procedures for Meritor hydraulic and mechanical brakes. Information contained in this publication was in effect at the time the publication was approved for printing and is subject to change.

You must follow your company procedures when you service or repair equipment or components. You must understand all procedures and instructions before you begin to work on a unit. Some procedures require the use of special tools for safe and correct service. Failure to use special tools when required can cause serious personal injury to service personnel, as well as damage to equipment and components.

Meritor uses the following notations to warn the user of possible safety problems and to provide information that will prevent damage to equipment and components.

WARNING

A WARNING indicates a procedure that you must follow exactly to avoid serious personal injury.

CAUTION

A CAUTION indicates a procedure that you must follow exactly to avoid damaging equipment or components. Serious personal injury can also occur.

NOTE: A NOTE indicates an operation, procedure or instruction that is important for proper service. A NOTE can also supply information that can help to make service quicker and easier.

This symbol indicates that fasteners must be tightened to a specific torque value.

How to Order

Order items from Meritor Literature Distribution Center, c/o Vispac, Inc., 35000 Industrial Road, Livonia, MI 48150. For videos, include a purchase order or check for $20 payable to Meritor International for each video.

Phone orders are also accepted by calling Meritor's Customer Service Center at 800-535-5560.

MERITOR™

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MERITOR™

Asbestos and Non-Asbestos Fibers

⚠ *ASBESTOS FIBER WARNING*

The following procedures for servicing brakes are recommended to reduce exposure to asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from Meritor.

Hazard Summary

Because some brake linings contain asbestos, workers who service brakes must understand the potential hazards of asbestos and precautions for reducing risks. Exposure to airborne asbestos dust can cause serious and possibly fatal diseases, including asbestosis (a chronic lung disease) and cancer, principally lung cancer and mesothelioma (a cancer of the lining of the chest or abdominal cavities). Some studies show that the risk of lung cancer among persons who smoke and who are exposed to asbestos is much greater than the risk for non-smokers. Symptoms of these diseases may not become apparent for 15, 20 or more years after the first exposure to asbestos.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons. OSHA has set a maximum allowable level of exposure for asbestos of 0.1 f/cc as an 8-hour time-weighted average and 1.0 f/cc averaged over a 30-minute period. Scientists disagree, however, to what extent adherence to the maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling asbestos dust. OSHA requires that the following sign be posted at the entrance to areas where exposures exceed either of the maximum allowable levels:

DANGER: ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA

2. Respiratory Protection. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA for use with asbestos at all times when servicing brakes, beginning with the removal of the wheels.

3. Procedures for Servicing Brakes.

a) Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.

b) As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

c) If an enclosed vacuum system or brake washing equipment is not available, employers may adopt their own written procedures for servicing brakes, provided that the exposure levels associated with the employer's procedures do not exceed the levels associated with the enclosed vacuum system or brake washing equipment. Consult OSHA regulations for more details.

d) Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.

e) **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.

4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

⚠ *NON-ASBESTOS FIBERS WARNING*

The following procedures for servicing brakes are recommended to reduce exposure to non-asbestos fiber dust, a potential cancer and lung disease hazard. Material Safety Data Sheets are available from Meritor.

Hazard Summary

Most recently manufactured brake linings do not contain asbestos fibers. These brake linings may contain one or more of a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers and silica that can present health risks if inhaled. Scientists disagree on the extent of the risks from exposure to these substances. Nonetheless, exposure to silica dust can cause silicosis, a non-cancerous lung disease. Silicosis gradually reduces lung capacity and efficiency and can result in serious breathing difficulty. Some medical experts believe other types of non-asbestos fibers, when inhaled, can cause similar diseases of the lung. In addition, silica dust and ceramic fiber dust are known to the State of California to cause lung cancer. U.S. and international agencies have also determined that dust from mineral wool, ceramic fibers and silica are potential causes of cancer.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to non-asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons.

2. Respiratory Protection. OSHA has set a maximum allowable level of exposure for silica of 0.1 mg/m^3 as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend that exposures to other ingredients found in non-asbestos brake linings be kept below 1.0 f/cc as an 8-hour time-weighted average. Scientists disagree, however, to what extent adherence to these maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling non-asbestos dust.

Therefore, wear respiratory protection at all times during brake servicing, beginning with the removal of the wheels. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA, if the exposures levels may exceed OSHA or manufacturer's recommended maximum levels. Even when exposures are expected to be within the maximum allowable levels, wearing such a respirator at all times during brake servicing will help minimize exposure.

3. Procedures for Servicing Brakes.

a) Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.

b) As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

c) If an enclosed vacuum system or brake washing equipment is not available, carefully clean the brake parts in the open air. Wet the parts with a solution applied with a pump-spray bottle that creates a fine mist. Use a solution containing water, and, if available, a biodegradable, non-phosphate, water-based detergent. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

d) Wear a respirator equipped with a HEPA filter approved by NIOSH of MSHA when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.

e) **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.

4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA, if the exposure levels may exceed OSHA or manufacturers' recommended maximum levels. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

Section 1
Introduction

Meritor supplies a complete line of brakes for heavy-duty vehicle applications. This Maintenance Manual covers the hydraulic and mechanical brakes shown below.

Hydraulic Brake Model	Sizes
DLH (Dual Leading Hydraulic)	17" x 4" (431.8 mm x 101.6 mm)
DSH (Duo Servo Hydraulic)	12.5" x 2.5" (317.5 mm x 63.5 mm)
DH (Duplex Hydraulic)	16.5" x 4", 5", 6" (419.1 mm x 101.6 mm, 127 mm, 152.4 mm)
FSH (Floating Shoe Hydraulic)	8" x 1.75" (203.2 mm x 44.4 mm) 10.5" x 1.5", 2.25" (266.7 mm x 38.1 mm, 57.1 mm) 12.5" x 2.25" (317.5 mm x 57.1 mm)
H (Hydraulic Brake)	7.125" x 2" (180.9 mm x 50.8 mm) 10.5" x 2.25" (266.7 mm x 57.1 mm) 15" x 3" (381 mm x 76.2 mm) 16" x 2.25" (406.4 mm x 57.1 mm) 16" x 3.5" (406.4 mm x 88.9 mm) 16.25" x 3.5" (412.7 x 88.9) 16.5" x 5.5" (419.1 mm x 139.7 mm) 17" x 4" (431.8 mm x 101.6 mm) 17.25" x 4" (438.1 mm x 101.6 mm)

Mechanical Brake Model	Sizes
DCM (Duplex Cam Mechanical)	10" x 3" (254 mm x 76.2 mm) 12" x 3", 4", 5" (304.8 mm x 76.2 mm, 101.6 mm, 127 mm)
DLM (Duplex Lever Mechanical)	7.25" x 1.5" (184.1 mm x 38.1 mm) 10" x 1.5" (254 mm x 38.1 mm) 13.375" x 2" (339.7 mm x 50.8 mm)
DM (Duplex Mechanical)	7.125" x 2" (180.9 mm x 50.8 mm)

DLH Brake
(Dual Leading Hydraulic)

Description

The DLH brake is a 17" x 4", (431.8 mm x 101.6 mm) two cylinder hydraulic actuated brake. The dual leading shoe design permits balanced, equal torque action in both forward and reverse directions. Each shoe transfers its force into an anchor pin during forward direction stops and into an adjustment bolt during reverse direction stops. The two wheel cylinders balance the forces within the brake. The DLH brake has manual brake adjustment. **Figures 2.1 and 2.2.**

Figure 2.1

DLH BRAKE

WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Disassemble DLH Brake

WARNING

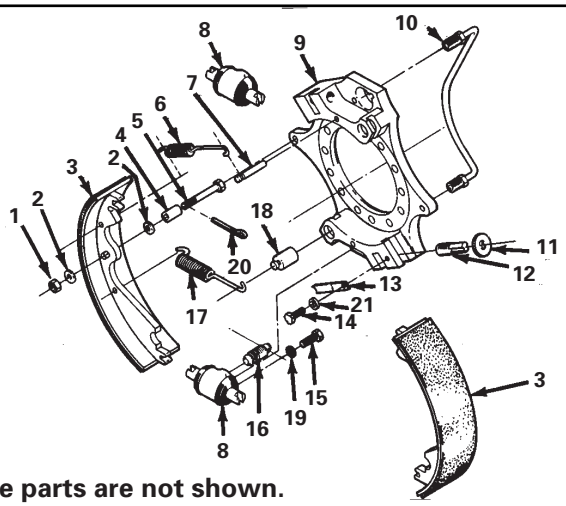
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.
3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
4. Remove the wheels and brake drums from the axle. If necessary, manually retract the brake shoes by rotating the adjustment bolt star wheel so that the brake drums will clear the linings.
5. Remove the four brake shoe return springs from their pins on the spider.
6. Support each shoe with one hand and remove the two shoe guide nuts and washers from their bolts.
7. Disassemble the shoes, anchor pins, star wheel clips and adjustment bolts.
8. If complete disassembly is necessary, disconnect the hydraulic brake tube and hydraulic brake lines. Remove the wheel cylinder capscrews and the cylinders.

Figure 2.2



NOTE: Some duplicate parts are not shown.

1. Nut
2. Washer
3. Shoe and Lining Assy.
4. Shoe Guide Bolt Spacer
5. Shoe Guide Bolt
6. Shoe Return Spring
7. Brake Spring Pin
8. Wheel Cylinder Assy.
9. Spider
10. Hydraulic Tube
11. Adjuster Starwheel
12. Adjuster Bolt
13. Starwheel Clip
14. Capscrew
15. Capscrew
16. Hydraulic Fitting
17. Shoe Return Spring
18. Anchor Pin
19. Lock Washer
20. Cotter Pin
21. Washer

9. Clean and inspect all parts. Refer to Section 4.

Assemble DLH Brake

⚠ CAUTION

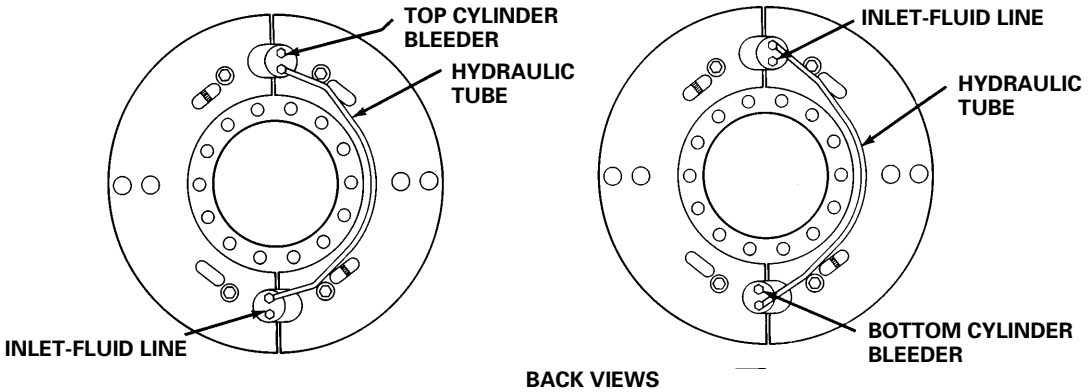
Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings MUST be replaced.

1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
   a. Adjustment bolt assemblies.
   b. Anchor pins, anchor pin holes and anchor pin slots.
   c. Push rod ends of the wheel cylinders.
   d. The surfaces of the guide washers that slide against the brake shoes.
2. Install the wheel cylinder to the spider. Tighten the wheel cylinder capscrews to 15-20 lb. ft. (20-27 N•m). T
3. Install the two adjustment bolt and star wheel assemblies into their threaded holes. The end of each adjustment bolt must extend into the slot for the shoe approximately 0.125 inch (3.175 mm). Install each star wheel clip with its screw and lock washer.
4. Install the two anchor pins, with their slots in position to engage the shoes, in the anchor pin holes.
5. Install both shoe guide bolts into their holes from the back of the spider and assemble one spacer and one washer on each bolt.
6. Place one shoe in position to engage the anchor pin slot, the adjustment bolt slot and the wheel cylinder push rod. Install a shoe guide washer and nut to the shoe guide bolt.
7. Put the other shoe in position to engage the opposite anchor pin slot, adjustment bolt and wheel cylinder push rod. Install a shoe guide washer and nut to the shoe guide bolt.
8. Tighten the shoe guide nut on each shoe guide bolt until there is no clearance between the washer and the shoe. Loosen the nut 1/2 turn and install the cotter pins.
9. Install the four shoe return springs.

NOTE: The bleeder cylinder can be installed at either the top or bottom positions on the brake. In either installation the bleeder outlet MUST be installed at the top of the cylinder. **Figure 2.3.**

10. Install the hydraulic brake tube assembly to the two wheel cylinders.
11. Connect the hydraulic line and install the brake drum and wheel.
12. Bleed the hydraulic system after all brakes are assembled and adjusted. (See page 19.)

Figure 2.3

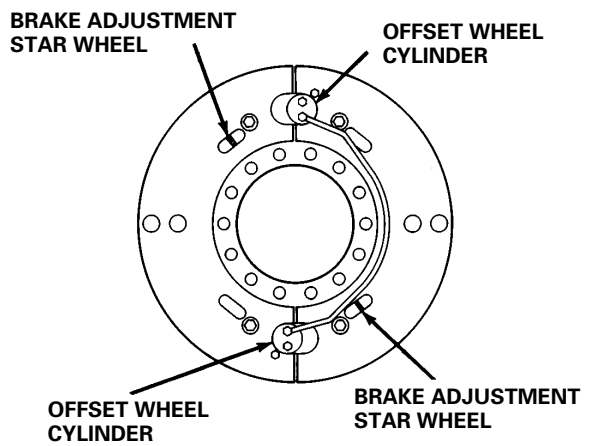


Adjust DLH Brake

NOTE: Each brake shoe must be adjusted separately.

1. The DLH brake is adjusted manually by rotating the adjustment bolt star wheels from the back of the brake. **Figure 2.4.**

Figure 2.4



2. The adjustment wheels are located opposite the wheel cylinder offset.
3. Adjust one shoe by rotating its star wheel with a brake adjusting spoon until a small resistance can be felt when the brake drum is rotated. Then adjust in the other direction until the brake drum can rotate freely.

NOTE: The adjusting tool pivots against the dust shield hole (or against the brake spider if no dust shield is used) and rotates the star wheel in the direction opposite to the handle movement. Move the handle of the adjusting tool toward the axle housing while the spoon of the tool is engaged in the star wheel to adjust the shoes closer to the brake drum. Move the handle away from the axle housing to adjust the shoes away from the brake drum.

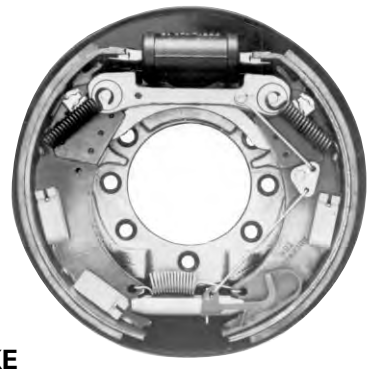
4. Adjust the other shoe after you complete the first shoe adjustment.

DSH Brake
(Duo Servo Hydraulic)

Description

The DSH brake is a 12.50" x 2.50" (317.5 mm x 63.5 mm) hydraulic actuated brake. The duo servo design permits the leading shoe to transfer all of its force through the adjusting bolt to the trailing shoe. This increases the braking action, because the force from both shoes is transmitted into the anchor of the trailing shoe. The brake has automatic adjustment and can be supplied with an optional cable operated lever for parking brake linkage. **Figures 2.5 and 2.6.**

Figure 2.5



DSH BRAKE

WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Disassemble DSH Brake

WARNING

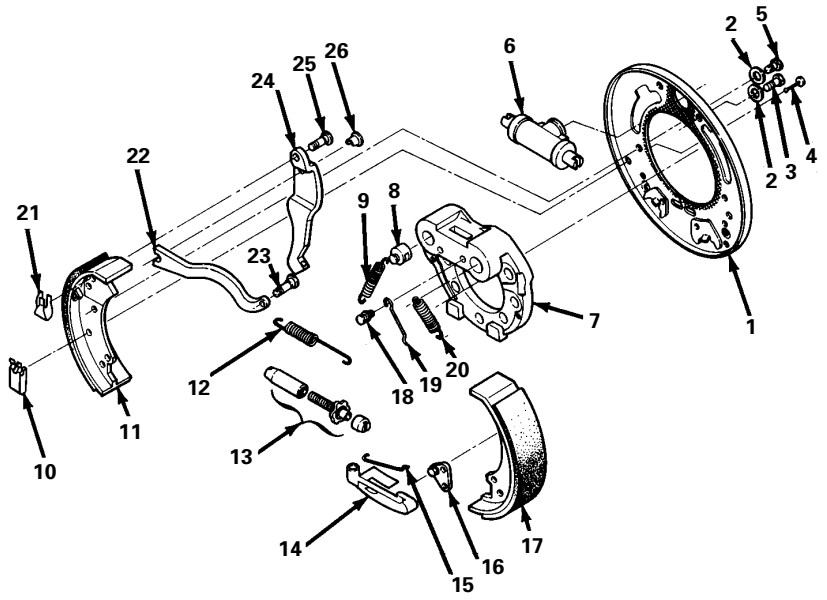
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.

Figure 2.6



NOTE: Some duplicate parts are not shown.

ITEM	DESCRIPTION
1	Backing Plate
2	Lock Washer
3	Capscrew
4	Hold Down Retainer Pin
5	Capscrew
6	Wheel Cylinder Assy.
7	Spider
8	Anchor Pin
9	Shoe Return Spring (Black)
10	Shoe Hold Down Clip
11	Shoe Lining Assy. (Trailing)
12	Shoe Spring
13	Adjuster Bolt Assy.
14	Automatic Adjuster Stamped Spring
15	Automatic Adjuster Wire (Long)
16	Automatic Adjuster Pivot
17	Shoe and Lining Assy.(Leading)
18	Adjuster Wire Pin
19	Automatic Adjuster Wire (Short)
20	Shoe Return Spring (Green)
21	Parking Lever Spring Clip
22	Link
23	Pivot Pin - Link
24	Parking Lever
25	Pivot Pin - Parking Lever
26	Slide Pin - Link

3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
4. Remove the wheels and brake drums from the axle. If necessary, manually retract the brake shoes through the forward adjustment slot so that the brake drums will clear the linings. Insert a stiff wire or pick through the adjustment slot to push the automatic adjustment stamped spring away from the star wheel while using an adjusting tool to rotate the adjustment bolt star wheel.
5. Remove the fastener that attaches the automatic adjusting wires and the pivot to the leading shoe.
6. Remove the two brake shoe return springs from the anchor pins.
7. Support the leading shoe with one hand and remove the shoe hold-down spring clip. Lift and rotate the spring clip until it is released from the retainer pin.
8. Remove the shoe spring and the adjustment bolt at the bottom of the brake.
9. Support the trailing shoe with one hand and remove the two shoe hold-down spring clips. Lift and rotate each spring clip until it is released from the retainer pin.
10. If the brake has a parking brake lever, disassemble the link from the leading shoe by removing the spring clip. To disassemble the parking lever from the trailing shoe, remove its spring clip.
11. Remove the anchor pins from holes.
12. If complete disassembly is necessary, disconnect the hydraulic line and remove the wheel cylinder capscrews and the wheel cylinder.
13. Clean and inspect all parts. Refer to Section 4.

Assemble DSH Brake

CAUTION

Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings MUST be replaced.

1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
   a. Adjustment bolt assemblies.
   b. All edges of brake levers and shoes that slide against each other.

c. Push rod ends of the wheel cylinder.

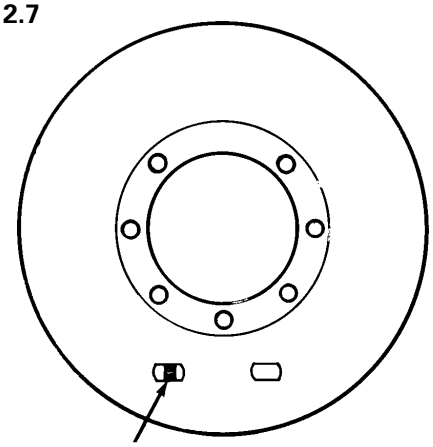
d. Anchor pins, anchor pin holes and anchor pin slots.

2. Install the wheel cylinder to the backing plate. Tighten the wheel cylinder capscrews to 15-20 lb. ft. (20-27 N•m). T
3. If used, install the parking brake lever on the trailing shoe and the parking brake link on the leading shoe.
4. Install the two anchor pins in the holes in the backing plate.
5. Put the trailing shoe in position into the anchor pin slot and engage it with the wheel cylinder push rod.
6. To install the two shoe retainer clips, engage the clip on to the retainer pin and rotate the clip down until it sets flat on the shoe.
7. If used, install the parking cable through the backing plate and engage the cable in the parking brake lever. Install a cable retainer bracket (not supplied by Meritor) where the cable enters through the backing plate.
8. Install the stamped automatic adjustment spring on the leading shoe.
9. Assemble a star wheel adjustment bolt and shoe spring on both shoes while you put the leading shoe in position into the anchor pin slot and engage it with the wheel cylinder push rod.
10. If used, install the parking link to engage with the parking lever slide pin.
11. Hold the shoe in its correct position and install the shoe hold-down spring clip on to the retainer pin.
12. Install the green shoe return spring on to the leading shoe for right hand brake and onto trailing shoe for left hand brake.
13. Install the short automatic adjustment wire to connect the pivot to the pin near the anchor location. Install the long automatic adjustment wire to connect the pivot to the stamped automatic adjustment spring.
14. Install the automatic adjustment pivot and spacer to the leading shoe on its shoulder bolt fastener. Be careful that the pivot is not pinched under the edge of the shoulder.
15. Rotate the star wheel on the adjustment bolt to see that it can easily rotate with a “click” in one direction and cannot easily rotate in the other direction.
16. Connect the hydraulic line and install the brake drum and wheel.
17. Bleed the hydraulic system after all brakes are assembled. (See page 20).

Adjust DSH Brake

1. Adjust the DSH brake through the forward adjustment slot (toward the front of the vehicle) at the bottom of the backing plate. **Figure 2.7.**

Figure 2.7



2. Insert an adjusting tool through the forward slot of the backing plate to engage the star wheel on the adjustment bolt. To move the shoes closer to the brake drum, move the tool handle down. The adjusting tool pivots against the backing plate slot and rotates the star wheel in the direction opposite to the handle movement.
3. Adjust the linings until a light resistance can be felt when the brake drum is rotated. Then adjust in the other direction until the brake drum can just rotate freely.
4. If the brake has a parking brake lever, adjust the parking cable until a light resistance can be felt when the brake drum is rotated. Then adjust the cable in the opposite direction until the brake drum can rotate freely. Apply and release the parking brake to see that it operates correctly.

DH Brake
(Duplex Hydraulic)

Description

The DH brake is a dual primary shoe, hydraulic actuated brake and it is available in 16.50" x 4", 5" and 6" (419.1 mm x 101.6 mm, 127 mm, 152.4 mm) sizes. The brake has manual adjustment. **Figures 2.8 and 2.9.**

Figure 2.8

DH BRAKE

⚠ WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Disassemble DH Brake

⚠ WARNING

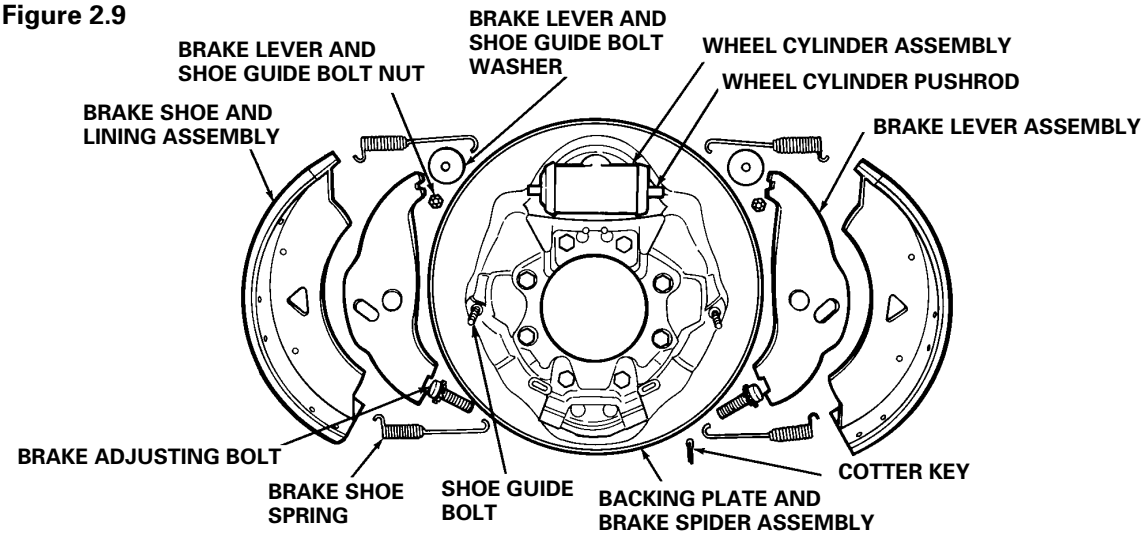
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

⚠ WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.
3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
4. Remove the wheels and brake drums from the axle. If necessary, manually retract the brake shoes by rotating the adjustment bolts so that the brake drums will clear the linings.
5. Remove the cotter keys from the two shoe guide bolts.
6. Install a wheel cylinder clamp to hold the pistons in the wheel cylinder.
7. Push one shoe against the backing plate with one hand and remove the shoe guide bolt nut and washer with the other hand.

Figure 2.9



NOTE: Some duplicate parts are not shown.

8. Allow the shoe to rotate about the abutment ends until the return spring tension is relaxed. Remove the return springs, brake shoe and the brake lever assembly.
9. Use the same procedure (Steps 6 and 7) to disassemble the other brake shoe and lever.
10. Remove the brake shoe adjusting bolts.
11. If complete disassembly is necessary, disconnect the hydraulic line, and remove the wheel cylinder capscrews and the wheel cylinder.
12. Clean and inspect all parts. Refer to Section 4.

Assemble DH Brake

⚠ *CAUTION*

Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings MUST be replaced.

1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
   a. Brake shoe adjustment bolts.
   b. The edges of the brake levers and shoes that slide against each other.
   c. Push rod ends of the brake levers and cylinder.
2. Install the wheel cylinder to the backing plate. Tighten the wheel cylinder capscrews to 25-35 lb. ft. (34-47 N•m). T
3. Install the two brake shoe adjusting bolts until the bolts are fully retracted.
4. Install the brake levers in position so that the ends match with the push rod at the top and the adjusting bolts at the bottom.

NOTE: There are right and left hand brake levers. Make sure that the levers are installed in the correct positions.

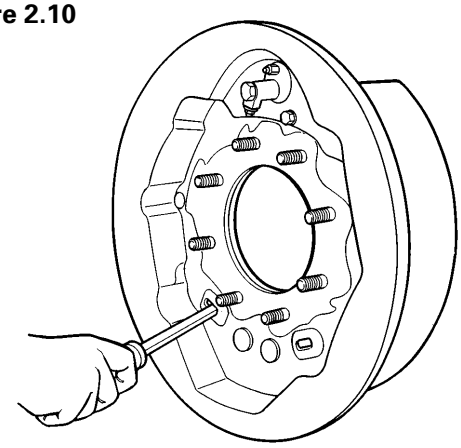
5. Attach the short ends of the shoe return springs into the brake shoe web holes of one brake shoe.
6. Attach the long end of the upper shoe return spring to the pin on the spider.
7. Attach the long end of the lower shoe return spring into the end of the adjusting bolt.
8. Lift the shoe and lining assembly over the shoe guide bolt and into position on the brake lever, pivoting about the abutments.
9. Assemble the washer and nut on the shoe guide bolt. Tighten the nut until the cotter key can be put into its hole in the guide bolt. The shoe and lever must be able to move freely.
10. Lock the guide bolt nut with the cotter key.
11. Use the same procedure (Step 5 -10) to install the other shoe.
12. Connect the hydraulic line.
13. Bleed the hydraulic system after all brakes are assembled. (See page 19).

Adjust DH Brake

NOTE: Each brake shoe must be adjusted separately.

1. The DH brakes are adjusted through the slots in the rear of the backing plate. **Figure 2.10.**

Figure 2.10



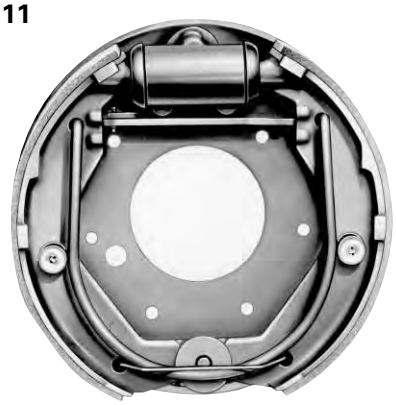
2. Put an adjusting tool through the slots to engage the lugs on the adjusting bolts. To expand the shoes, move the handle of the tool down when in the left hand slot and move the handle up when in the right hand slot.
3. Adjust one shoe until a slight resistance can be felt when the brake drum is rotated. Then adjust in the other direction until the brake drum can rotate freely.
4. Adjust the other shoe after you complete the first shoe adjustment.

FSH Brake
(Floating Shoe Hydraulic)

Description

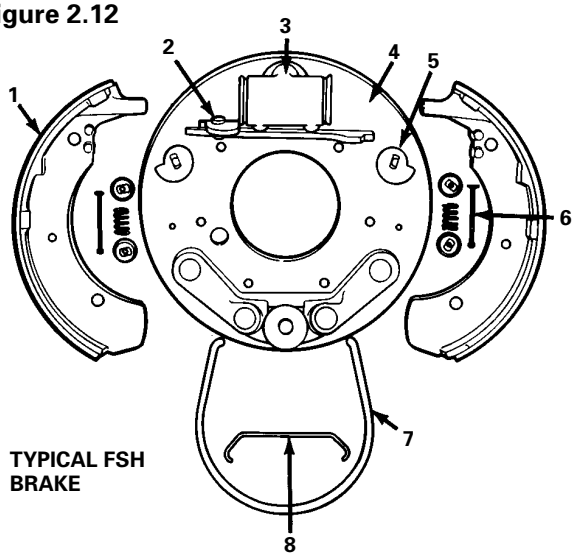
The FSH brakes are floating shoe, hydraulic actuated brakes. They are available in 8" x 1.75" (203.2 mm x 44.4 mm), 10.5" x 1.5", 2.25" (266.7 mm x 38.1 mm, 57.1 mm), 12.5" x 2.25" (317.5 mm x 57.1 mm) and 14" x 2.25" (355.6 mm x 57.1 mm) sizes. The brakes can be supplied with an optional mechanical parking brake and automatic or manual brake adjustments. **Figures 2.11, 2.12, and 2.13.**

Figure 2.11



FSH BRAKE

Figure 2.12

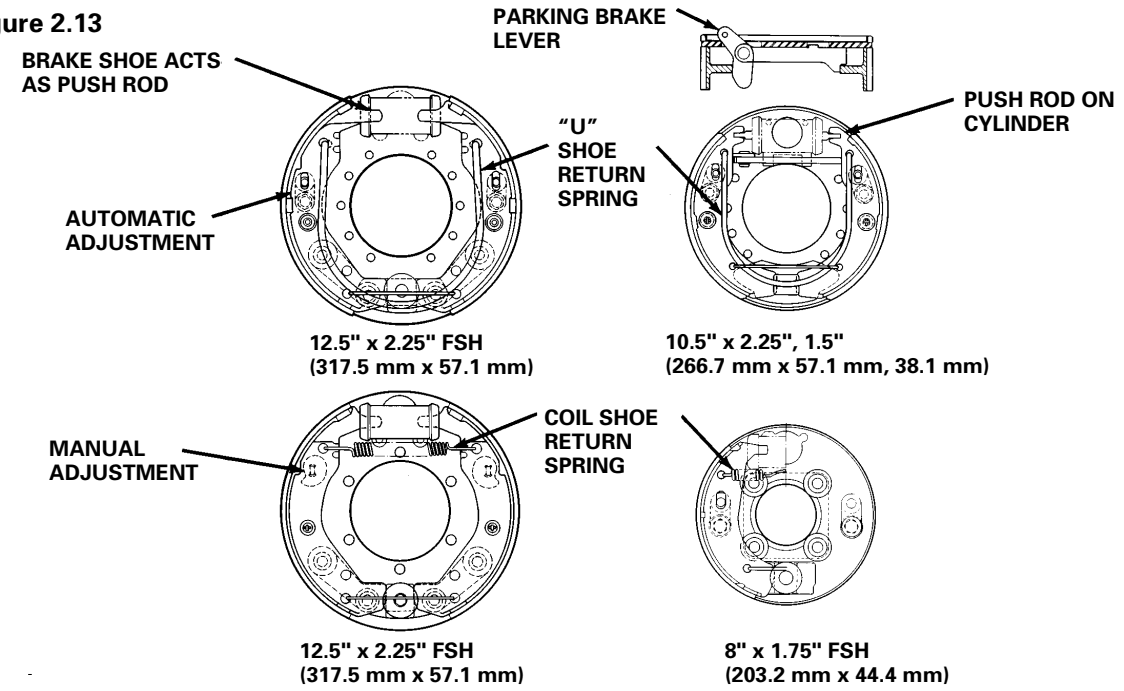


TYPICAL FSH BRAKE

1. Shoe and Lining Assy.
2. Parking Brake Lever Assy.
3. Wheel Cylinder Assy.
4. Backing Plate Assy.
5. Manual Shoe Adjustment Shown
6. Shoe Hold Down Spring Assy.
7. "U" Return Spring
8. Retainer Spring Clip

Some of the designs of the FSH brake are shown in **Figure 2.13.**

Figure 2.13



⚠ *WARNING*

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Disassemble FSH Brake

⚠ *WARNING*

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

⚠ *WARNING*

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

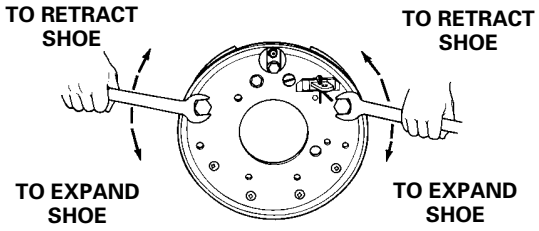
1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.
3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.

⚠ *CAUTION*

Do NOT apply more than 20 lb. ft. (27 N•m) torque to the heads of the adjustment bolts in step 4. More torque can damage the automatic adjustment assemblies. Do NOT use a power wrench on the adjustment bolts.

4. Remove the wheels and brake drums from the axle. If necessary, manually retract the brake shoes by rotating the adjustment bolts so that the brake drums will clear the linings. To retract each brake shoe rotate the adjustment bolt heads 1/8 of a turn. **Figure 2.14.**
5. Remove the retainer spring clip from over the "U" spring.

Figure 2.14



BACK VIEW

NOTE: Some FSH brakes, which do not have an optional parking brake, have an upper coil shoe return spring in place of the "U" spring.

6. Release and remove the shoe return spring.
7. Push down on the shoe retainers so that the retainer nails can be reached with pliers. Hold the retainers so that they do not twist while you rotate the nails 1/4 turn. Remove the retainers, springs and retainer nails.
8. Remove the brake shoes.
9. On brakes with the mechanical parking brake, remove the cotter key, spacer, spring clip and lever assembly.
10. If complete disassembly is necessary, disconnect the hydraulic line and remove the wheel cylinder attaching capscrews and wheel cylinder.
11. Clean and inspect all parts. Refer to Section 4.

Assemble FSH Brake

⚠ *CAUTION*

Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings MUST be replaced.

1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
   a. Push rod ends of shoes and cylinder.
   b. Surfaces of the adjusting cams and the matching surfaces of the brake shoes.
   c. Surfaces of the shoe support pads on the backing plate assembly and the ends of the shoe webs that slide against the anchor bracket.
2. Install the wheel cylinder to the backing plate. Tighten the wheel cylinder attaching screw and capscrew to 25-35 lb. ft. (34-47 N•m). (T)
3. Connect the hydraulic line.
4. If a mechanical parking brake is used, install the lever assembly, spring clip, spacer and cotter key.
5. Install the brake shoes in position so that the push rod ends of the shoes are engaged with the wheel cylinder or push rods.
6. Assemble the retainer nails, springs and retainers. Lock the nails in position by pushing down on the retainers while you twist the nails 1/4 turn with pliers.
7. To assemble the shoe return spring, put one hook in position in a brake shoe. Pull the spring open to install the opposite hook in the other shoe.
8. Assemble the retainer spring clip into the brake shoes.
9. On brakes with automatic adjustment, you must tap the shoes with a soft mallet until the brake assembly will fit into the brake drum.
10. Bleed the hydraulic system after all the brakes are assembled. (See page 19)

Adjust FSH Brake

1. FSH brakes with automatic adjustment will adjust to the correct lining to brake drum clearance when you pump down on the brake pedal to set the adjuster. These brakes have 9/16 inch or 3/4 inch adjustment bolt heads.

NOTE: Each brake shoe must be adjusted separately.

2. The manual adjustment FSH brakes have two eccentric cams that can be adjusted with either an 11/16 inch or a 15/16 inch open end wrench on the two adjustment bolt heads.
   a. Position the wrench handle horizontally, away from the brake, then rotate the handle down to move the lining closer to the brake drum. Adjust the shoes until a slight resistance can be felt when the brake drum is rotated by hand. **Figure 2.14.**
   b. Turn the adjustment bolt head in the opposite direction until the brake drum can just rotate freely.
   c. Adjust the other shoe after you complete the first shoe adjustment.

H Brake
(Hydraulic)

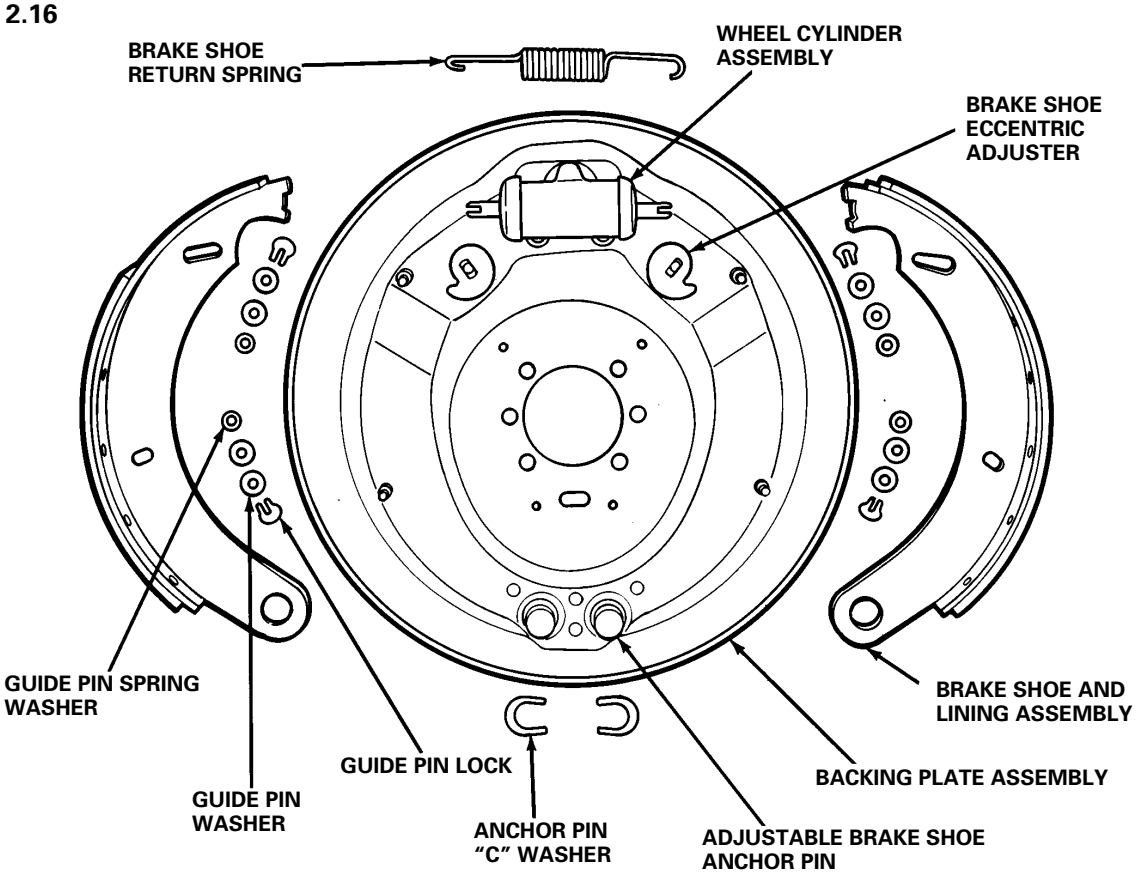
Description

The H brakes are two shoe hydraulic brakes mounted on backing plates or on planetary axle housings. Many of the H brakes have adjustable anchor pins to permit the centering of the brake shoe arc with the drum and eccentric cams for secondary brake shoe adjustment. H brakes are available in nine different sizes from 7.125" x 2" to 17.25" x 4" (180.9 mm x 50.8 mm to 438.1 mm x 101.6 mm). **Figures 2.15 and 2.16.**

Figure 2.15

H BRAKE

Figure 2.16



There are several design variations within the nine models of H brakes. Several of the designs are shown in **Figure 2.17**.

⚠ WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Disassemble H Brake

⚠ WARNING

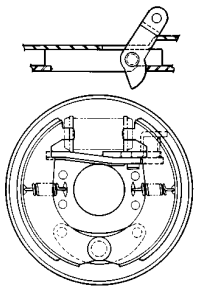
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

⚠ WARNING

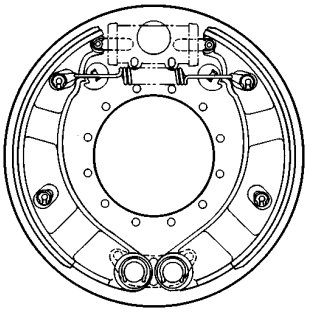
Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.
3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
4. Remove the wheels and brake drums from the axle. If necessary, manually retract the brake shoes by rotating the adjustment cams from the back of the brake so that the brake drums will clear the linings.

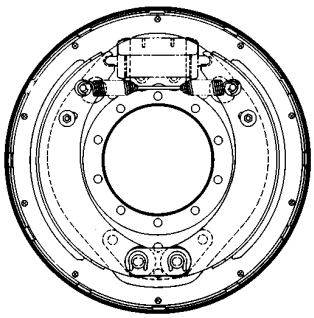
Figure 2.17



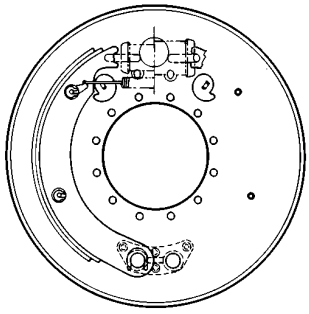
7-1/2" x 2" H



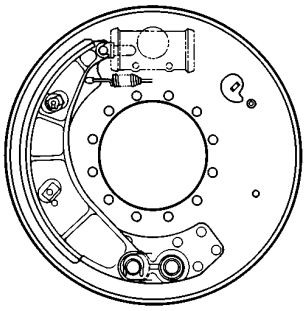
16" x 3-1/2" H



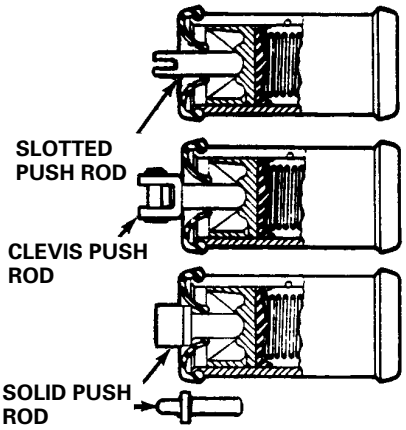
16-1/2" x 5-1/2" H



16" x 3-1/2" H



17" x 4" H



5. Disconnect the brake shoe return spring or springs.
6. Remove the anchor pin "C" washers and the guide pin locks and washers.
7. Remove the brake shoe and lining assemblies.
8. Remove the anchor pin lock nuts, lock washers and anchor pins.
9. If complete disassembly is necessary, remove the capscrews, washers and wheel cylinder assembly. Disconnect the hydraulic lines.
10. Clean and inspect all parts. Refer to Section 4.

Assemble H Brake

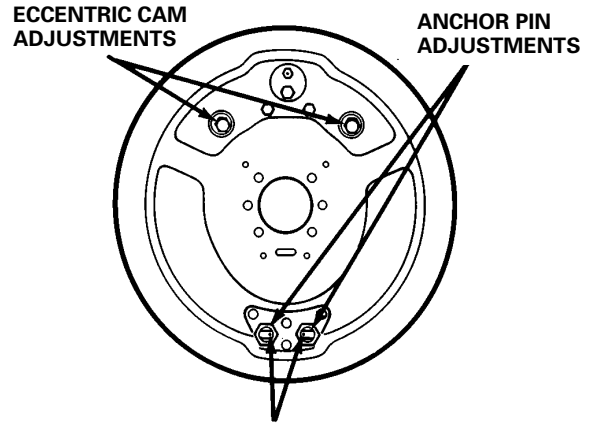
⚠ *CAUTION*

Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings MUST be replaced.

1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
   a. Surfaces of the adjusting cams and the matching surfaces of the shoe webs.
   b. Push rod ends of shoes and cylinder.
   c. Surfaces of anchor pins and matching surfaces of shoe webs.
2. Install the wheel cylinder to the backing plate. Tighten the capscrews and lock washers to 25-35 lb-ft (34-47 N•m). T
3. Connect the hydraulic lines.
4. Assemble the anchor pins to the backing plate with the washers and lock nuts.

NOTE: The punch marks on the base of the adjustable anchor pins must meet and the flat sides of the anchor pins must be aligned. **Figure 2.18.**

Figure 2.18



5. Put the shoe and lining assemblies in correct position over the guide pins. Install the guide pin washers, lock rings and the anchor pin "C" washers.
6. Turn the adjusting cams so that the push rod ends of the shoes are engaged with the wheel cylinder push rods.
7. To assemble the shoe return spring, put one hook in position in the brake shoe. Pull the spring open to install the opposite hook in the other shoe.
8. Bleed the hydraulic system after all the brakes are assembled. (See page 19).

Adjust H Brake

NOTE: Each brake shoe must be adjusted separately.

NOTE: If adjustable anchor pins are not used, omit Brake Adjustment Steps 2 and 3.

The first adjustment after assembly must be carefully made to put the shoes in the correct position in the brake drum.

1. Turn the eccentric cam adjustment so that the lining touches the brake drum. **Figure 2.18.**
2. Turn the anchor pin adjustment, if used, until the brake drum just rotates freely. **Figure 2.18.**
3. Repeat Steps one and two until additional rotation of the anchor pin no longer decreases the brake drum resistance.
4. Tighten the anchor pin lock nut to the torque shown below:
   - **0.750-16 Thread Size:**
     Tighten to 85-115 lb-ft (115-156 N•m) when using a 13X-13 jam nut.

     Tighten to 100-145 lb-ft (136-197 N•m) when using a standard height nut.
   - **0.875-14 Thread Size:**
     Tighten to 150-190 lb-ft (203-258 N•m).
   - **0.875-11 Thread Size:**
     Tighten to 180-230 lb-ft (244-312 N•m).
5. Turn the adjusting cam in the opposite direction until the brake can rotate freely.
6. Use the same procedure (Steps 1 - 5) to adjust the other shoe.
7. Further adjustment for lining wear must be made with the adjustment cams only. Adjust the lining until a slight resistance can be felt when the brake drum is rotated.
8. Turn the cams in the opposite direction until the brake drum just can rotate freely.

Wheel Cylinder Maintenance

WARNING

- ***These hydraulic brakes are all internal wheel cylinder brakes. If master cylinders and/or power units are being serviced, it is required that they be able to maintain 12-20 PSI (0.8-1.3 bar) residual line pressure. Otherwise these internal wheel cylinder brakes will not perform properly and can cause serious personal injury.***
- ***Leaks that coat the outside of the boot and cylinder with fluid can cause a decreased fluid level in the reservoir or dampen and stain the brake linings. Any leaks must be immediately corrected. Contaminated linings must be replaced to prevent serious personal injury.***
- ***Some hydraulic brake systems use a non-petroleum hydraulic brake fluid (SAE-J-1703 or SAE-J-1702f) some systems use petroleum base brake fluids. Make sure that you use the correct brake fluid and seals as required in the vehicle brake system specifications. Do not mix different types of brake fluid. The use of the wrong brake fluid can damage the cup seals of the wheel cylinder, cause loss of braking and serious personal injury.***

Check to determine if wheel cylinders need overhauling or replacing:

- when you replace the brake shoes and
- when a cylinder leaks.

Wheel Cylinder Diagnostics

There are two types of wheel cylinder problems:

1. Leaks

Cylinder leaks can be caused by:

a. using the incorrect type of brake fluid causing the seals to leak,

b. corrosion or damage on the surface of the cylinder bore,

c. worn or oversize cylinder bore, and

d. damaged seal cups.

To find leaks that are not immediately visible, pull back the cylinder boot. A small amount of fluid on the inside of the boot is normal. Unless other conditions causing poor brake performance are known, the wheel cylinder must be checked.

2. Poor Cylinder Action

Cylinder binding can be caused by:

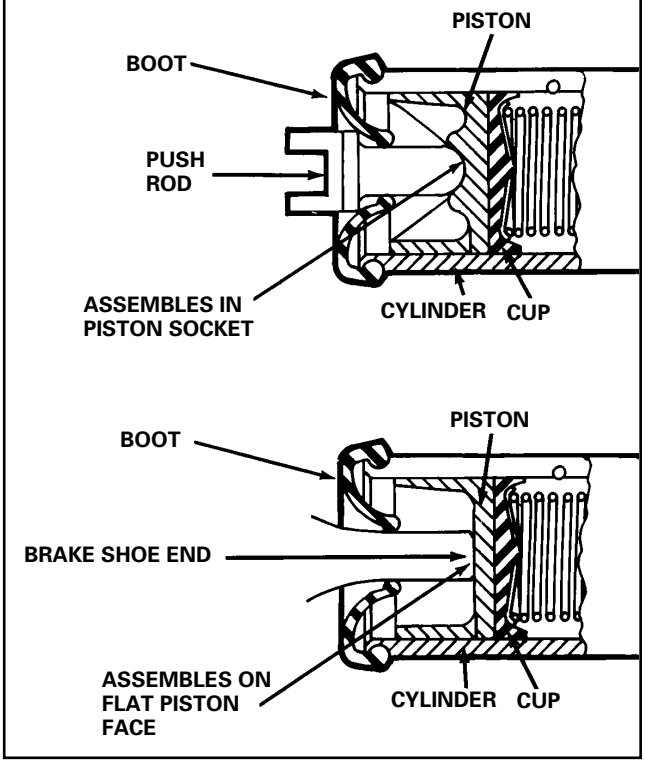
a. Corrosion or deposits in the cylinder bore.

b. Swollen cups caused by contaminated or wrong type of brake fluid.

c. Cups wedged into excessive clearance between the piston and the cylinder bore.

d. Wrong type of pistons for push rods or brake shoe ends. **Figure 2.19.**

Figure 2.19



Disassemble Wheel Cylinder

⚠ *WARNING*

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

⚠ *CAUTION*

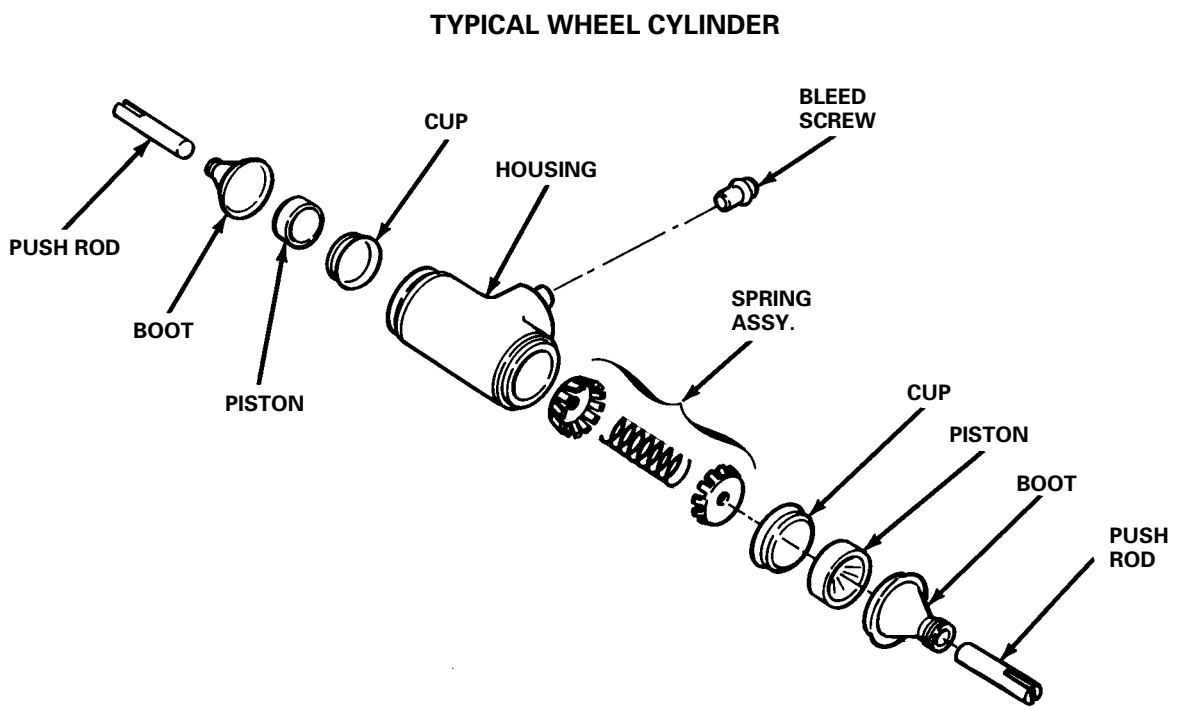
Hydraulic system parts must not contact oil or grease. Even a small amount of a petroleum product from dirty hands is enough to damage the rubber parts. **Figure 2.20.**

1. Remove dust boots from the cylinder.
2. Remove the internal parts of the cylinder from the housing. If necessary, use a wood dowel driver or apply low pressure compressed air to the fluid inlet port.

NOTE: Parts which cannot be easily removed indicate that they are damaged and the cylinder must be replaced.

3. Clean the cylinder and the parts in the correct brake fluid for the vehicle. Do NOT use gasoline or other petroleum products. Use only lint-free wiping rags.
4. Use a crocus cloth to clean small scratches, rust, corrosion or discoloration from the cylinder bore and pistons. Use the crocus cloth in a circular movement, not a lengthwise movement. A clean-up hone can be used. Remove any burrs at the edge of the fluid intake or bleeder screw ports.
5. After the cylinder is cleaned, check the clearance of the piston in the cylinder. Replace cylinder with more than 0.002 inch (0.05 mm) diameter clearance.

Figure 2.20



Assemble Wheel Cylinder

1. Before the cylinder is assembled, lubricate the **new** cups and the piston with the correct brake fluid.
2. If the boots are deteriorated, or do not fit tightly on the push rods and the cylinder housing, replace the boots.
3. Wash the wheel cylinder with brake fluid.
4. Install the spring in the cylinder.
5. Install the cups in each end of the cylinder with the open ends of the cups toward each other.
6. Install the pistons in each end of the cylinder with the recessed end of the pistons toward the open ends of the cylinder.
7. Install dry boots over each end of the cylinder.

Bleed Hydraulic System

After servicing the brakes it is necessary to bleed all of the components of the hydraulic system. Follow the bleeding instructions in the OEM'S vehicle maintenance manual. If the manual is not available, the following procedures will provide a proper bleed:

Bleeding must start first with the hydrovac, power cluster or master cylinder. The first wheel cylinder to be bled MUST be the one that is the greatest distance from the master cylinder.

⚠ *CAUTION*

Some hydraulic brake systems use a non-petroleum hydraulic brake fluid (SAE-J-1703 or SAE-J-1702f) some hydraulic brake systems use petroleum base brake fluids. Make sure that you use the correct brake fluid and seals as required in the vehicle brake system specifications. The use of the wrong brake fluid can damage the cup seals of the wheel cylinder. Different types of brake fluids MUST NOT be mixed.

1. Fill the master cylinder with brake fluid. Connect one end of the bleeder hose to the bleeder screw and hang the other end of the hose in a clean container. **Do not permit fluid to contact brake lining.**
2. Loosen the bleeder screw and slowly push the brake pedal to the floor. Close the bleeder screw before you release the brakes. If the bleeder hose is kept submerged in the container of brake fluid, it is not necessary to close the bleeder screw on each application. Repeat this procedure eight or ten times on each component bleed.
3. Fill the master cylinder or power cluster with the correct hydraulic fluid and check the brake pedal for correct pressure and travel. (The brakes must be in correct adjustment).
   a. If pressure bleeding equipment is used, connect the outlet hose to the master cylinder or power cluster and bleed the system following the same procedures as above. The flow of the brake fluid must be checked while the bleeder hose is kept submerged in the brake fluid in the container. When the air bubbles are eliminated and the brake fluid runs in a clean, solid flow, the bleeding is complete.
   b. If vacuum bleeding equipment is used, small air bubbles can be drawn past the cylinder seals into the wheel cylinders. A conventional bleed of each wheel cylinders. A conventional bleed of each wheel cylinder should be performed after a vacuum bleeding.
4. Repeat this procedure at each wheel cylinder. Fill the master cylinder reservoir after each wheel cylinder is bled.
5. When bleeding is complete, check the fluid level of the master cylinder. If necessary, fill to the specified level.

DCM Brake
(Duplex Cam Mechanical)

Description

The DCM brake is a two shoe mechanically actuated brake. The brake is available in 10" x 3" (254 mm x 76.2 mm) and 12" x 3", 4" and 5" (304.8 mm x 76.2 mm, 101.6 mm, 127 mm) sizes. **Figures 3.1 and 3.2.**

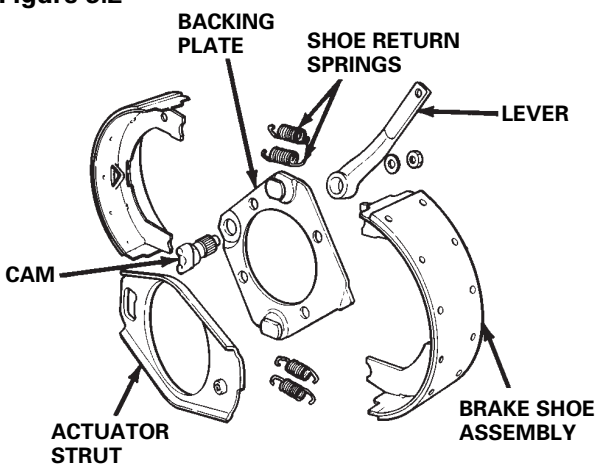
Figure 3.1

DCM BRAKE

WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Figure 3.2



Disassemble DCM Brake

WARNING

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

WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.
3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
4. Disconnect the drive shaft using standard procedures.
5. Release the brake.
6. Remove the brake drum using standard procedures
7. Remove the nut and washer that hold the cam to the lever.
8. Remove the cam and the lever.
9. Use a brake shoe return spring removal tool to remove the two or four brake shoe return springs from the ends of the brake shoes. Discard the springs and replace them with new springs at assembly.
10. Remove both brake shoes and mark them to identify their original position at assembly.
11. Remove the actuator strut.

NOTE: Make a note of how the brake backing plate is mounted. Use the position of the cam as the reference point.

12. If complete disassembly is necessary, remove the four brake backing plate capscrews and washers.
13. Clean and inspect all parts. Refer to Section 4.

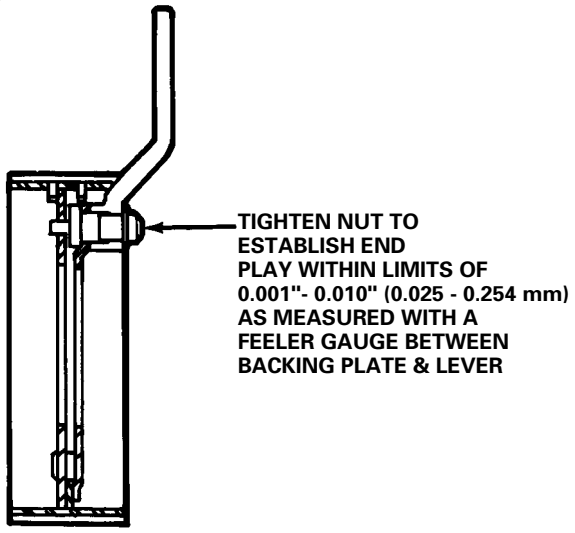
Assemble DCM Brake

⚠ CAUTION

Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings MUST be replaced.

1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
   a. Cam head face and journals.
   b. The sides of the shoe webs and the actuator strut that slide together.
   c. Both sides of the backing plate at the cam hole.
2. If it was removed, install the brake backing plate in the same position as marked in Step 10 of the Disassembly Section. Tighten the four capscrews to the specifications set by the OEM.
3. Install the brake shoes in the same position as marked in Step 8 of the Disassembly Section with the web ends in position on the backing plate bosses.
4. Use a brake shoe installation tool to install the **four new** brake shoe return springs at the ends of the brake shoes.
5. Assemble the cam through the backing plate, lever, lock washer and nut. Tighten the nut to give an end play of 0.001" to 0.010" (0.025 - 0.254 mm) as measured with a feeler gauge between the backing plate and the lever. **Figure 3.3**.

Figure 3.3



6. Install the actuator strut with the pressure points against the shoe web pressure points and the cam head in position in the slot of the strut.
7. Assemble the brake drum and drive shaft using standard procedures.

Adjust DCM Brake

Equal adjustment of the brake shoes is controlled by the actuating lever. The only required adjustment is through the connecting linkage to the lever arm. The adjustment can be made after the brake drum and drive shaft are assembled.

DLM Brake
(Duplex Lever Mechanical)

Description

The DLM brake is a two-shoe mechanically actuated brake. The brake is available in 7.25" x 1.5", 10" x 1.5" and 13.375" x 2" (184.1 mm x 38.1 mm, 254. mm x 38.1 mm and 339.7 mm x 50.8 mm) sizes. **Figures 3.4 and 3.5.**

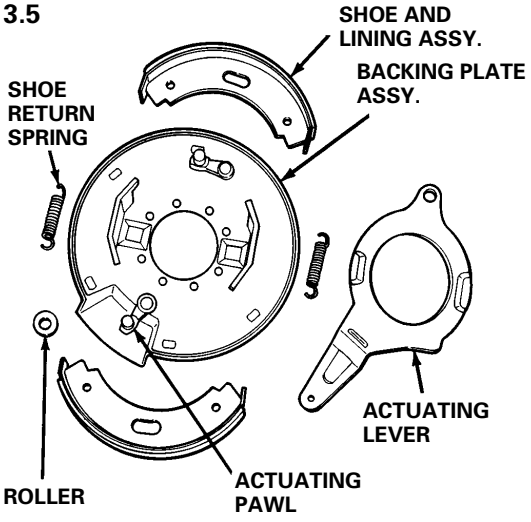
Figure 3.4

DLM BRAKE

WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Figure 3.5



Disassemble DLM Brake

WARNING

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

WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.
3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
4. Disconnect the drive shaft using standard procedures.
5. Release the brake.
6. Remove the brake drum using standard procedures.
7. Use a brake shoe return spring removal tool to remove the two brake shoe return springs.
8. Remove both brake shoe and lining assemblies.
9. Lift the brake actuator lever from the pawls and remove the roller from the actuator pawl pin under the arm of the lever.

NOTE: Some smaller DLM brakes use a roller on each pawl.

10. If complete disassembly is necessary, remove the brake backing plate capscrews and washers. Make a note of how the brake backing plate is mounted. Use the position of the actuator lever opening as a reference point.
11. Clean and inspect all parts. Refer to Section 4.

Assemble DLM Brake

CAUTION

Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings MUST be replaced.

1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
   a. The sides of the brake lever and shoes that slide against each other.
   b. The ends of the shoe webs.
   c. The surfaces of the wear pads and actuating pawls.
2. If it was removed, install the brake backing plate in the same position as marked in Step 10 of the Disassembly Section. Tighten the capscrews to the specifications set by the vehicle builder.
3. Put the roller(s) in position on the actuator pawl pin at the lever opening on the backing plate.
4. Install the brake actuator lever with the large hole in the tab over the pawl pin that is opposite the actuator pawl. Set the lever arm in the backing plate opening with the outer edge of the lever next to the roller.
5. Install the brake shoes with the webs against the actuator lever and the pawl pins through the web slots.

WARNING

Failure to correctly install spring in slot could pull shoe away from actuating pawl and render brake inoperative. Serious personal injury can occur.

6. Use a brake shoe return spring installation tool to connect the shoe return springs to the brake shoes in the slots nearest the backing plate.
7. Assemble the brake drum and drive shaft using standard procedures.

Adjust DLM Brake

Equal alignment of the brake shoes is controlled by the actuating lever. The only required adjustment is through the connecting linkage to the lever arm. The adjustment can be made after the brake drum and drive shaft are assembled.

DM Brake
(Duplex Mechanical)

Description

The DM brake is a two shoe mechanically actuated brake. The brake is available in 7.125" x 2" (180.9 mm x 50.8 mm), sizes. **Figures 3.6 and 3.7.**

Figure 3.6

DM BRAKE

WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Disassemble DM Brake

WARNING

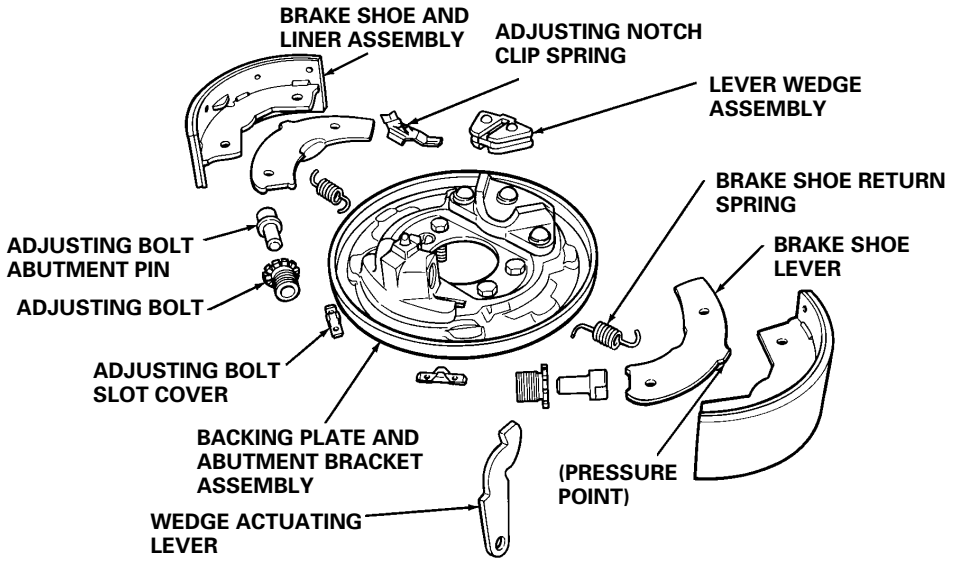
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.
3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
4. Disconnect the drive shaft using standard procedures.
5. Release the brake.

Figure 3.7



6. Remove the brake drum using standard procedures.
7. Disconnect and remove the shoe return springs with a "button hook" type of spring tool.
8. Remove the shoe and lining assemblies.
9. Disassemble the actuating lever, both shoe levers and the wedge assembly.
10. Remove the adjusting bolt spring clip.
11. Pull the abutment pins from the bores inside the adjusting bolts.
12. Remove both adjusting bolts.

NOTE: Make a note of how the brake backing plate is mounted. Use the position of the slot for the actuator lever as the reference point.

13. If complete disassembly is necessary, remove the four brake backing plate capscrews and washers.
14. Clean and inspect all parts. Refer to Section 4.

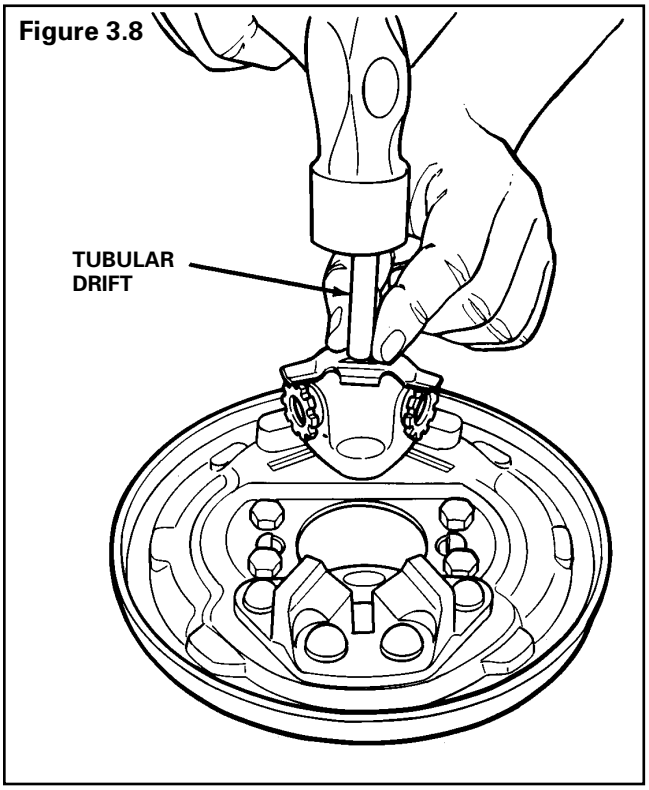
Assemble DM Brake

⚠ *CAUTION*

Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings MUST be replaced.

1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
   a. Adjusting bolts.
   b. Side slots and the actuator lever groove in the wedge assembly.
   c. The sides of the brake levers and shoes that slide against each other.
2. Install both adjusting bolts.
3. Put the abutment pins in the adjusting bolt bores.
4. Install the adjusting bolt spring clip with a tubular drift. **Figure 3.8.**

Figure 3.8



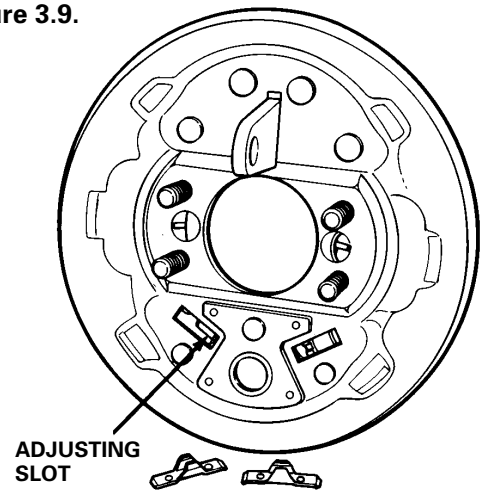
5. Install shoe and lining assemblies on the backing plate with the web pressure points above the center line.
6. Put the straight ends of the shoe return springs in the shoe webs. Install the round ends in the backing plate slots.
7. Install the brake shoe levers with the pressure points against the pressure points on the webs of the shoes.
8. Put the actuator lever through the slot in the back of the backing plate. Pull apart the shoe and shoe lever assemblies to install the wedge assembly.
9. Assemble the brake drum and drive shaft using standard procedures.

Adjust DM Brake

NOTE: Each brake shoe must be adjusted separately.

1. Insert an adjusting tool through the holes in the backing plate to engage the teeth on the adjusting bolts. To expand the shoes, move the tool handle down when the tool is in the right hand slot, and move the handle up when the tool is in the left hand slot. **Figure 3.9.**

Figure 3.9.



2. Adjust the lining tight against the brake drum, then release the adjustment until the brake drum just can rotate freely.
3. Install the adjusting slot covers.

Clean Ground or Polished Parts

WARNING

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

WARNING

If you use cleaning solvents, hot solution tanks or alkaline solutions incorrectly, serious personal injury can occur. To prevent serious personal injury, follow the instructions supplied by the manufacturer of these products. Do NOT use gasoline to clean parts. Gasoline can explode and cause serious personal injury.

CAUTION

- ***Do not use cleaning solvents on hydraulic seals, boots or pistons. Cleaning solvents can damage these components. Protect the brake lining from solvents, lubricants, rust inhibitors, or other contaminants that can change the friction properties of the lining. Contaminated linings MUST be replaced.***
- ***Use only solvent cleaners to clean ground or polished metal parts. Hot solution tanks or water and alkaline solutions will damage these parts. Isopropyl alcohol, kerosene or diesel fuel can be used for this purpose.***
- ***If required, use a sharp knife to remove gasket material from parts. Be careful not to damage the ground or polished surfaces.***

a. Use a cleaning solvent to clean ground or polished parts and surfaces. Kerosene or diesel fuel can be used for this purpose. DO NOT USE GASOLINE.

b. DO NOT clean ground or polished parts in a hot solution tank or with water, steam or alkaline solutions. These solutions will cause corrosion of the parts.

Clean Parts With Rough Finishes

a. Rough parts can be cleaned with the ground or polished parts.

b. Rough parts also can be cleaned in hot solution tanks with a weak alkaline solution.

c. Parts must remain in the hot solution tanks until they are completely cleaned and heated.

Dry Cleaned Parts

a. Parts must be dried immediately after they are cleaned.

b. Dry parts with clean paper or rags, or compressed air.

Prevent Corrosion and Rust on Cleaned Parts

CAUTION

Wheel cylinders and cup seals must only be lubricated with the fluid used in vehicle brake system. Cylinder boots must be kept dry to avoid rust and corrosion.

a. Apply axle lubricant to the cleaned and dried metal parts that are to be immediately assembled.

b. If parts are to be stored, apply a special material that prevents rust and corrosion to all surfaces.

Inspect Parts

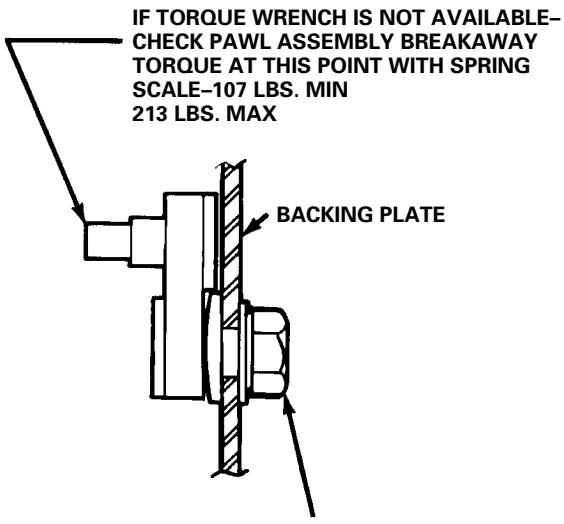
It is important that you carefully inspect all parts before assembly starts. Check all parts for wear or damage and repair or replace them as required. Replacement of these parts now can prevent problems with the assembly later.

a. Check all castings and backing plates for cracks, loose rivets and correct alignment. Replace all damaged parts.

b. Check all adjusting bolts, guide pins and pawl pins for corrosion and wear. Replace or repair damage parts.

c. If the brake has automatic adjuster pawls, check the pawl breakaway torque with a torque wrench to verify that the torque is between 120-240 lb. in. (13-27 N•m). (T) **Figure 4.1**.

Figure 4.1



Check brake shoes for rust, expanded rivet holes, broken welds and correct alignment. Replace damaged shoes.

d. Check anchors, anchor pins and shoe bushings for wear or damage. Replace as necessary.

e. Replace all shoe return springs at time of brake overhaul.

f. Check the brake drums for cracks, severe heat checking, heat spotting, scoring, pitting and distortion. Replace damaged brake drums.

g. Inspect wheel cylinders for leaks and smooth action. (See page 17).

Maintenance Schedules

WARNING

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

A schedule for periodic adjustment, cleaning, inspection, and lubricating of the brake equipment must be made according to type of brake and type of vehicle operation. Each operator must establish maintenance schedules based on vehicle applications. Start with inspections every two months and adjust the schedules as necessary. Severe service and high levels of contamination must have more frequent brake adjustments and inspections.

Brakes must be cleaned, inspected, lubricated and adjusted every time the wheel hubs are removed. Do NOT clean or contaminate the linings with fluid.

Minor Inspection: Hydraulic Brakes

1. Check the brake pedal travel with brake drums assembled. Too much travel can indicate the need for brake adjustment.
2. Check the brake adjustment unless the brakes are equipped with automatic adjustment.
3. Check the operation of the parking brake by actuating and releasing the parking brake control and observing the brake actuation and release.
4. Check lining wear:
   a. Check the wear side-to-side and end-to-end.
   b. The lining wear must be even on both shoes of the brake and on both sides of the axle.
5. Check the brake lining to brake drum contact pattern. Contact must be the same on both shoes of the brake and on both sides of the axle.
6. Check the operation of the brake by pressing and releasing the brake pedal in the cab and observing the brake actuation and release.

Major Inspection: Hydraulic Brakes

Major inspection must be made at every reline. Severe duty cycles or environmental conditions require more frequent major inspections.

1. Check all of the points described in the minor inspection procedures.
2. Check the anchors and the shoes bushings for wear.
3. Check the levers for rust, bending or seizing.
4. Check the adjustment components for rust, bending or seizing.
5. Check for loose shoe return springs.
6. Check for loose or broken lining rivets.
7. Check for brake fluid, grease or oil on the linings. Do NOT reuse contaminated linings.
8. Check the brake shoes for rust and bending.
9. Check the brake drums for wear or damage.
10. Check the brake lines for cracking, pinching and corrosion.
11. Check the wheel cylinders for leaking and binding. (See page 17).
12. Before assembly, lubricate the sliding parts with a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent listed on page 31.
13. Assemble the brakes.
14. Bleed the hydraulic system. (See page 19.)

Minor Inspection: Mechanical Brakes

1. Check lining wear. Lining wear must be even on both shoes.
2. Check the lining to brake drum contact pattern. Contact must be the same on both shoes.
3. Check the operation of the brake by actuating and releasing the brake control and observing the actuation and release.
4. Check the brake adjustment.

Major Inspection: Mechanical Brakes

Major inspection must be made at every reline and when there is poor brake performance.

1. Check all the points described in the minor inspection procedures.
2. Check for worn or corroded areas where components contact or slide against each other.
3. Replace all shoe return springs.
4. Check the cam (if used) for wear, rust, bending and seizing.
5. Check the actuator lever for rust, bending, seizing or other damage.
6. Check the spider or backing plate for looseness and elongated mounting holes.
7. Check for loose or broken lining rivets.
8. Check for grease or oil on the lining. Do NOT reuse contaminated linings.
9. Check the brake shoes for bending and rust.
10. Check the actuator pawl, if used, for wear and correct alignment.
11. Check the brake drums for wear and damage.
12. Before assembly, lubricate the sliding parts with a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent listed on page 31.

Torque Chart

DLH Brake wheel cylinder capscrews	15-20 lb-ft (20-27 N•m)
DSH Brake wheel cylinder capscrews	15-20 lb-ft (20-27 N•m)
DH Brake wheel cylinder capscrews	25-30 lb-ft (34-47 N•m)
FSH Brake wheel cylinder attaching screw and capscrew	25-35 lb-ft (34-47 N•m)
H Brake wheel cylinder lock washers and capscrews	25-35 lb-ft (34-47 N•m)
H Brake anchor pin lock nut: 0.750-16 thread size: • w/13x-13 jam nut • w/ standard height nut 0.875-14 thread size 0.875-11 thread size	 85-115 lb-ft (115-156 N•m) 100-145 lb-ft (136-197 N•m) 150-190 lb-ft (203-258 N•m) 180-230 lb-ft (244-312 N•m)
Adjuster pawl	120-240 lb-in (13-27 N•m)

Lubrication

Meritor Specification 0-616:	
Standard Oil of Ohio	Sohio #101
Warren Refining Co.	Plastilube #2
Fisher Bros. Refining Co.	SA Lubricant
Shell Oil Company	Darina Grease 2 Extrema EP-2 Darina EP-2
Texaco	Thermatex EP-2

Notes

Notes

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Troy, MI 48084 U.S.A.
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Meritor do Brasil Ltda.
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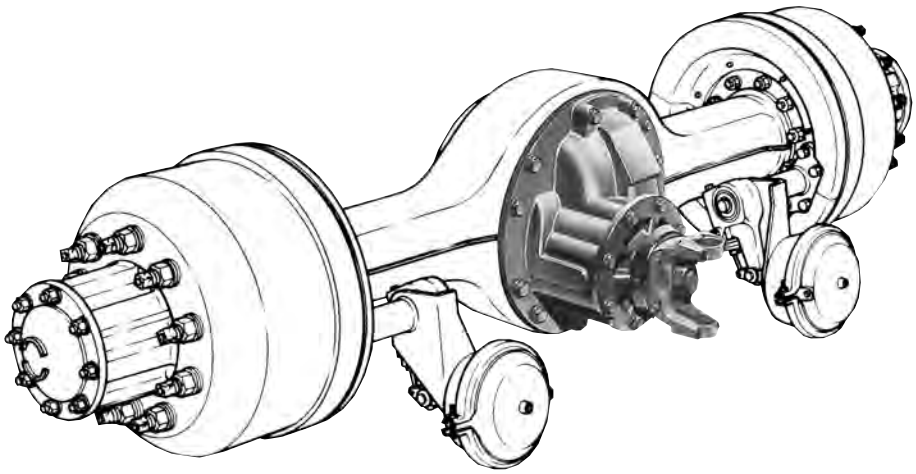
MERITOR®

Revised 09-00
$2.50

Single Reduction Rear Differential Carriers

Maintenance Manual 5A



RS and RT Series
Single Reduction
Axles

RF Series Front
Drive Axles
(Single, Rear of Tandem,
Front Drive Steering)

Before You Begin

This manual provides instructions for Meritor's RS-, RT-, and RF-Series axles. Before you begin procedures:

1. Read and understand all instructions and procedures before you begin to service components.
2. Read and observe all Caution and Warning safety alerts that precede instructions or procedures you will perform. These alerts help to avoid damage to components, serious personal injury, or both.
3. Follow your company's maintenance and service, installation, and diagnostics guidelines.
4. Use special tools when required to help avoid serious personal injury and damage to components.

Safety Alerts, Torque Symbol and Notes

WARNING	A Warning alerts you to an instruction or procedure that you must follow exactly to avoid serious personal injury and damage to components.
CAUTION	A Caution alerts you to an instruction or procedure that you must follow exactly to avoid damage to components and possible serious injury.
	A torque symbol alerts you to tighten fasteners to a specified torque value.
NOTE	A Note provides information or suggestions that help you correctly service a component.

Access Information on ArvinMeritor's Web Site

Additional maintenance and service information for ArvinMeritor's commercial vehicle systems component lineup is also available at www.arvinmeritor.com.

To access information, click on Products & Services/Tech Library Icon/HVS Publications. The screen will display an index of publications by type.

Additional Information

For complete maintenance and service procedures for all single reduction rear differential carriers, call ArvinMeritor's Customer Service Center at 800-535-5560 to order the following publications.

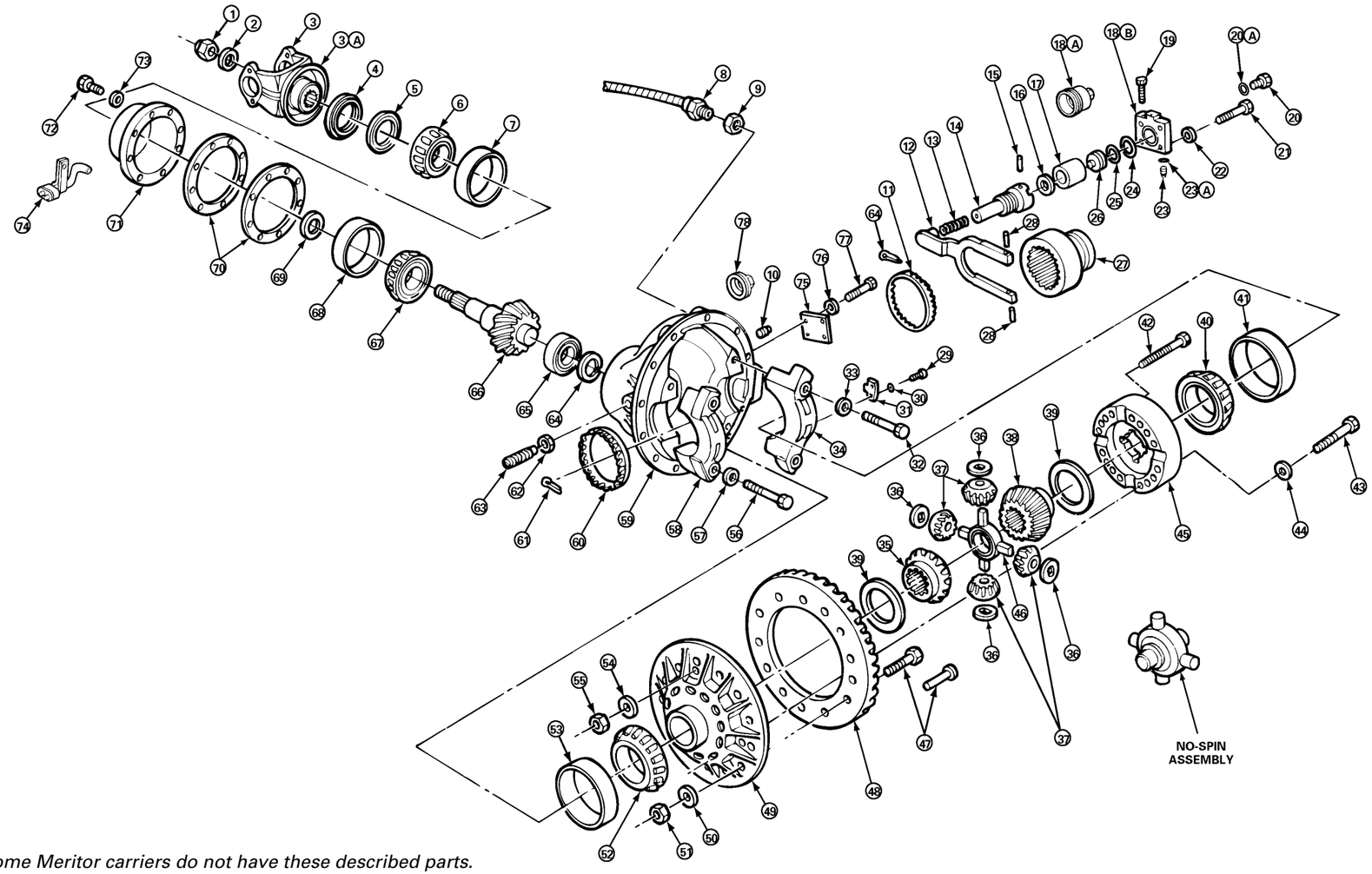
- *Traction Controls* package contains two videos: *Splitting the Difference* (T-87127V) and *Driver-Controlled Full Locking Main Differential* (T-9007V). $50. Order T-95125V for this package. Each video is also available separately.
- *Technical Electronic Library* on CD. Features product and service information on most ArvinMeritor, ZF Meritor and Meritor WABCO components. $20. Order TP-9853.

Axle Models Covered in this Manual

Single Drive Axles			
RS-13-120	RS-17-144	RS-23-160A	RS-25-160A
RS-15-120	RS-17-145	RS-23-161	RS-26-160
RS-16-140	RS-19-144	RS-23-161A	RS-26-180
RS-16-141	RS-19-145	RS-23-180	RS-26-185
RS-16-145	RS-21-145	RS-23-185	RS-30-180
RS-17-140	RS-21-160	RS-23-186	RS-30-185
RS-17-141	RS-23-160	RS-25-160	
Rear Axle of Tandem Axles			
RT-34-140	RT-40-145P	RT-46-160	RT-50-160
RT-34-144	RT-40-146	RT-46-160A	RT-50-160P
RT-34-145	RT-40-160	RT-46-160P	RT-52-180
RT-34-145P	RT-40-169	RT-46-164	RT-52-185
RT-34-146	RT-44-145	RT-46-164EH	RT-58-180
RT-40-140	RT-44-145P	RT-48-180	RT-58-185
RT-40-145A	RT-44-149	RT-48-185	
Front Drive Steering Axles			
RF-7-120	RF-16-145	RF-21-160	RF-22-166
RF-9-120	RF-21-155	RF-21-185	RF-23-180
RF-12-120	RF-21-156	RF-21-355	RF-23-185
RF-12-125			

For other models (non RS-, RT- and RF-Series), refer to Maintenance Manual 5, *Single Reduction Differential Carriers*.

Single Reduction Differential Carrier



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

1 Nut — Drive Pinion*
2 Washer — Drive Pinion*
3 Input Yoke* or Flange*
3A Deflector
4 POSE™ seal
5 Triple Lip (Main) Seal
6 Bearing Cone — Outer
7 Bearing Cup — Inner
8 Sensor Switch
9 Lock Nut — Sensor Switch
10 Plug
11 Adjusting Ring — R.H.
12 Shift Fork
13 Spring — Shift Shaft
14 Shift Shaft
15 Pin — Spring Retaining

16 Washer* or Silastic* — Air Cylinder
17 Tube — Air Cylinder
18A Screw-In Differential Lock Cylinder
18B Cylinder Cover
19 Capscrew — Manual Actuation
20 Plug — Cylinder Cover
20A Gasket — Cover Plug
21 Capscrews — Cylinder Cover
22 Washers — Cylinder Cover
23 Plug — Cylinder Cover
23A Gasket — Cover Plug
24 Copper Gasket — Cylinder Cover
25 O-Ring — Piston
26 Piston
27 Shift Collar
28 Pins — Shift Fork

29 Capscrews* — Lock Plate*
30 Washers* — Lock Plate*
31 Lock Plate — Adjusting Ring
32 Capscrews — Differential Bearing Cap
33 Washers
34 Caps — Differential Bearing
35 Side Gears — Differential
36 Thrust Washers — Differential Pinion
37 Pinions — Differential
38 Differential — Side Gears
39 Thrust Washers — Differential Side Gear
40 Cone — Differential Bearing
41 Cup — Differential Bearing

42 “Thru” Bolt
43 Bolts* — Differential Case
44 Washers — Differential Case
45 Case Assembly — Main Differential
46 Spider — Differential
47 Bolts* or Rivets* — Ring Gear and Case Half
48 Ring Gear (Pinion Drive Gear)
49 Case Half — Flange
50 Washers — Case Half
51 Nuts* — Case Half
52 Bearing Cone — Differential L.H.
53 Bearing Cup — Differential L.H.
54 Washer for “Thru” Bolt
55 Nut for “Thru” Bolt

56 Capscrews — Differential Bearing Cup
57 Washers
58 Caps — Differential Bearing
59 Carrier
60 Adjusting Ring
61 Cotter Pin — Adjusting Ring
62 Jam Nut* — Thrust Screw*
63 Thrust Screw*
64 Snap Ring
65 Spigot Bearing
66 Drive Pinion
67 Bearing Cone — Pinion Inner
68 Bearing Cup — Pinion Inner
69 Spacer — Pinion Bearing
70 Shims
71 Bearing Cage — Drive Pinion
72 Capscrew — Bearing Cage
73 Washer
74 Clip and Cable Holder
75 Cover — Bolt-On
76 Washer
77 Bolt
78 Cover — Screw-In

MERITOR®

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MERITOR®

Standard Single Reduction Carriers Without Differential Lock

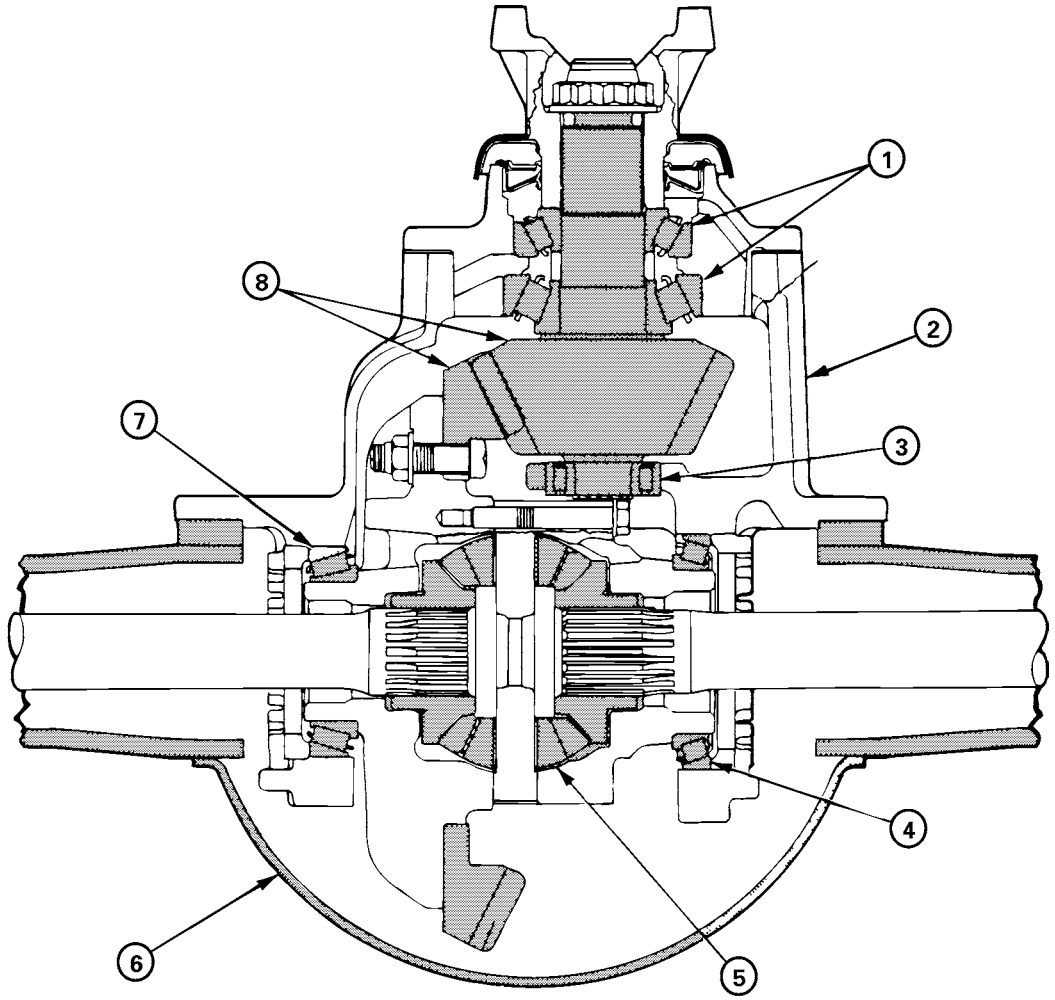
Meritor single reduction standard carriers, **Figure 1.1**, are used in most Meritor single axles, rear of tandem axles and front drive steering axles.

The single reduction carrier models are front mounted into the axle housing. These carriers have a hypoid drive pinion and ring gear set and bevel gears in the differential assembly.

A straight roller bearing (spigot) is mounted on the head of the drive pinion. All other bearings in the carrier are tapered roller bearings.

When the carrier operates, there is normal differential action between the wheels all the time.

Figure 1.1



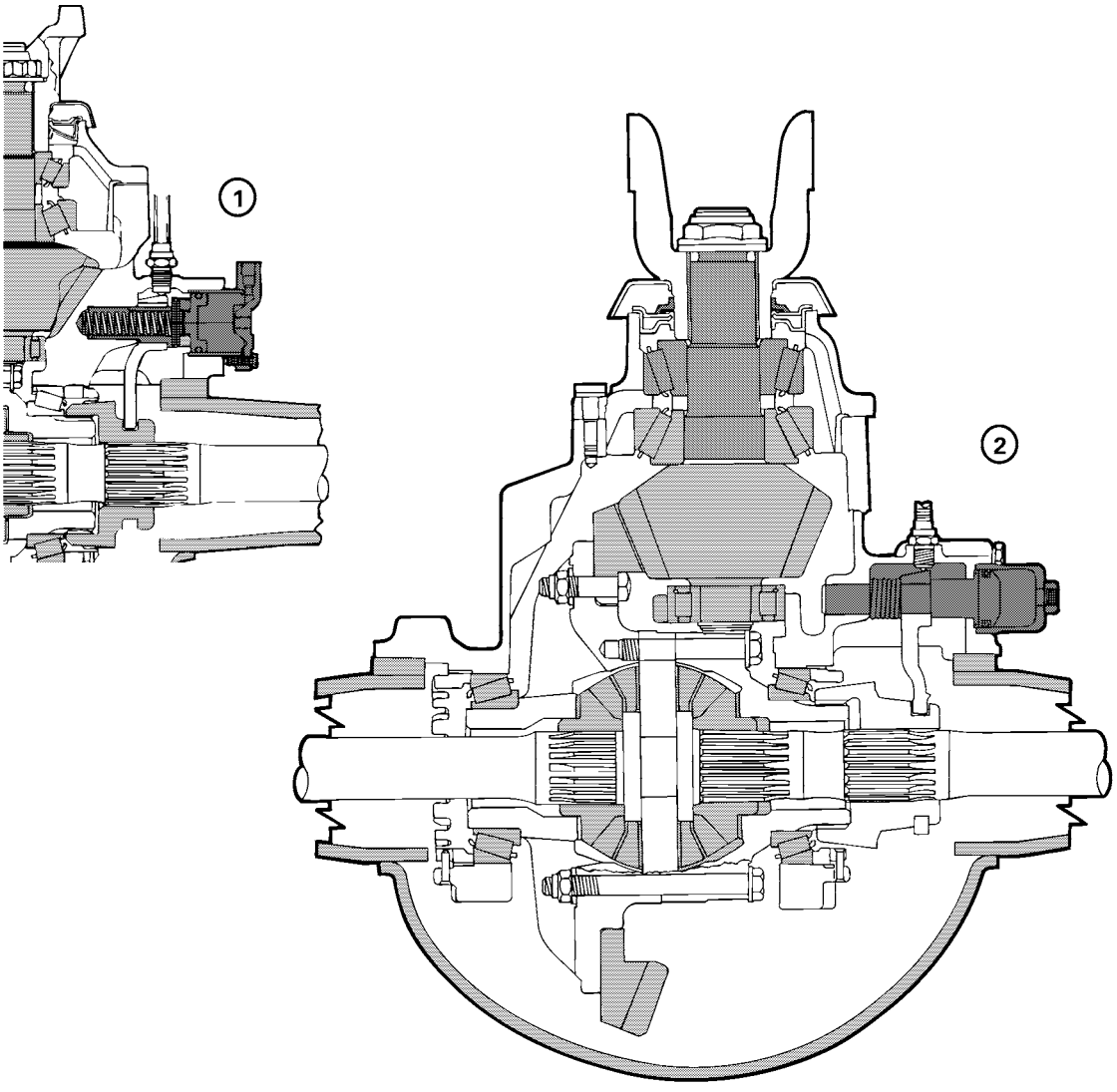
1 TAPERED ROLLER BEARINGS
2 CARRIER
3 STRAIGHT ROLLER BEARING
4 TAPERED ROLLER BEARING
5 BEVEL DIFFERENTIAL GEARS
6 HOUSING
7 TAPERED ROLLER BEARING
8 HYPOID DRIVE PINION AND RING GEAR

Single Reduction Carriers with DCDL (Driver-Controlled Main Differential Lock)

Meritor single reduction carriers with Differential Lock, **Figure 1.2**, have the same type of gears and bearings as the standard type carriers.

The differential lock is operated by an air actuated shift assembly that is mounted on the carrier. When the differential lock is activated, the shift collar is moved along the splines of the axle shaft toward the differential case. When the splines on the collar are engaged with splines on the differential case the axle shafts and differential assembly are locked together. When the carrier operates in the locked position, there is no differential action between the wheels. When the carrier is operated in the unlocked position, there is normal differential action between the wheels all the time.

Figure 1.2



1 BOLT-IN STYLE
2 SCREW-IN STYLE (THREADED)

STANDARD CARRIER WITH DIFFERENTIAL LOCK (DCDL)

Remove Differential Carrier from Axle Housing

⚠ *WARNING*

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

NOTE

If the vehicle is equipped with a driver-controlled main differential lock, the DCDL collar must be engaged before removing axle shafts. Refer to complete instructions in "Driver-Controlled Main Differential Lock Assembly" and **Figure 6.1**.

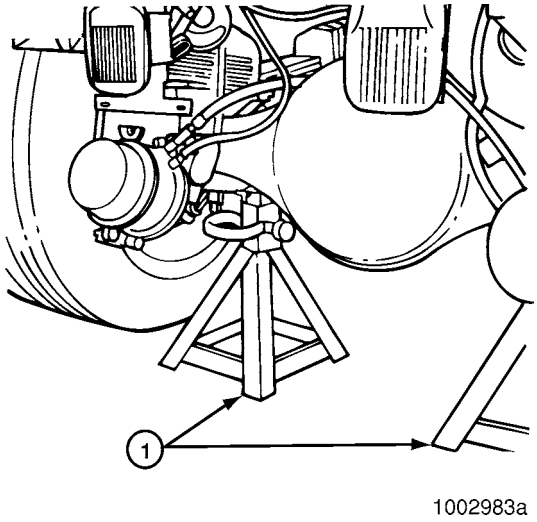
1. Raise the end of vehicle where the axle is mounted. Use a jack or other lifting tool, and place safety stands under each side of the axle. **Figure 2.1**.

⚠ *WARNING*

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

2. Place jack stands under each spring seat of the axle to hold vehicle in the raised position. **Figure 2.1**.
3. Remove the plug from bottom of axle housing and drain lubricant from the assembly.

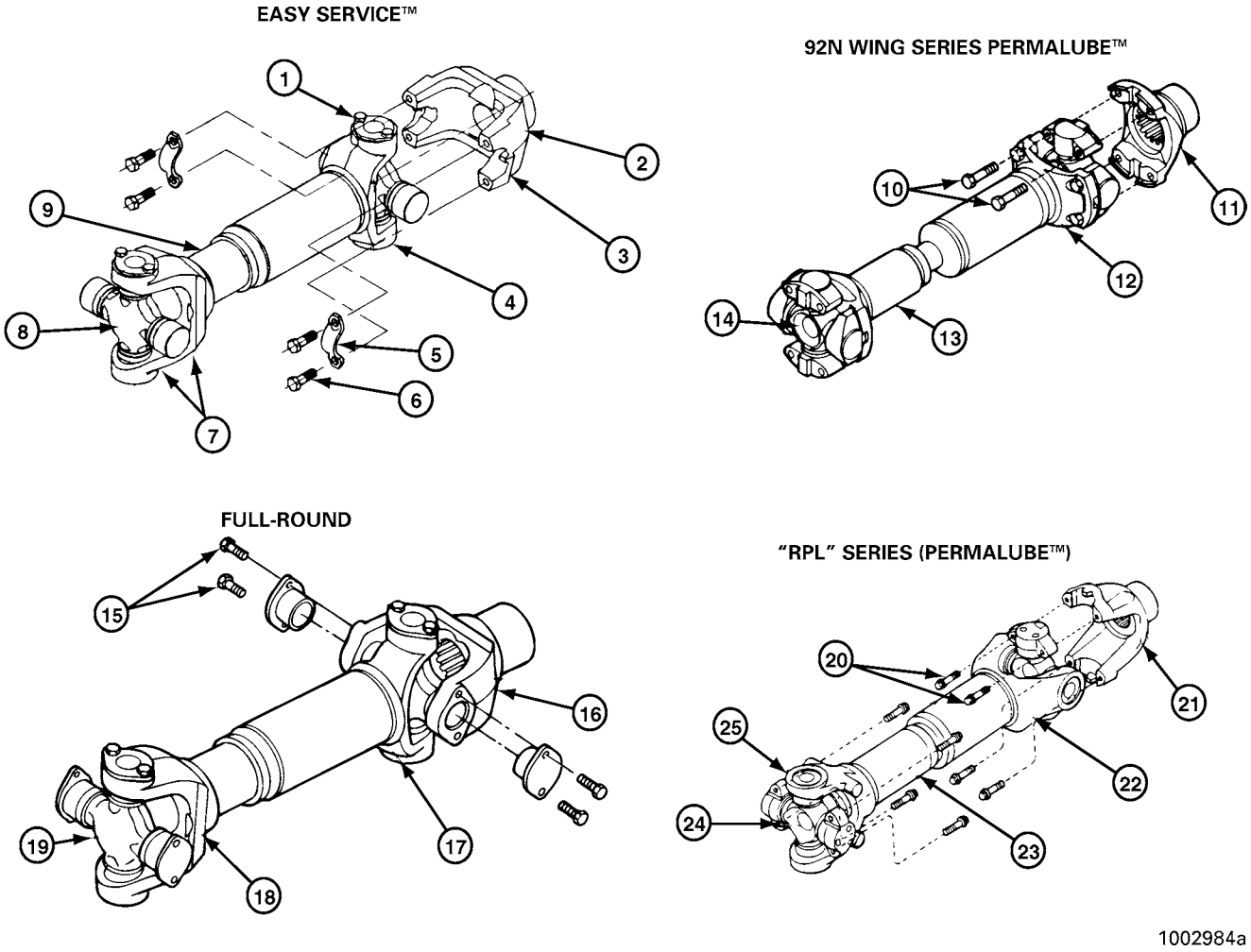
Figure 2.1



1 SAFETY STANDS

4. Disconnect the driveline universal joint from the pinion input yoke or flange on the carrier. **Figure 2.2**.
5. Remove the capscrews* and washers or stud nuts* and washers from the flanges of both axle shafts.

Figure 2.2



1 FULL ROUND BEARING CUPS
2 END YOKE
3 YOKE SADDLE
4 WELD YOKE
5 BEARING STRAP
6 CAPSCREWS
7 EASY-SERVICE BEARING CUPS
8 U-JOINT CROSS
9 SLIP YOKE
10 CAPSCREWS
11 END YOKE
12 WELD YOKE
13 SLIP YOKE
14 U-JOINT CROSS
15 CAPSCREWS
16 END YOKE
17 WELD YOKE
18 SLIP YOKE
19 U-JOINT CROSS
20 CAPSCREWS
21 END YOKE
22 SLIP YOKE
23 TUBING
24 U-JOINT CROSS
25 WELD YOKE

*Some Meritor carriers do not have these described parts.

6. Loosen the tapered dowels* in the axle flanges of both axle shafts using one of the following methods.

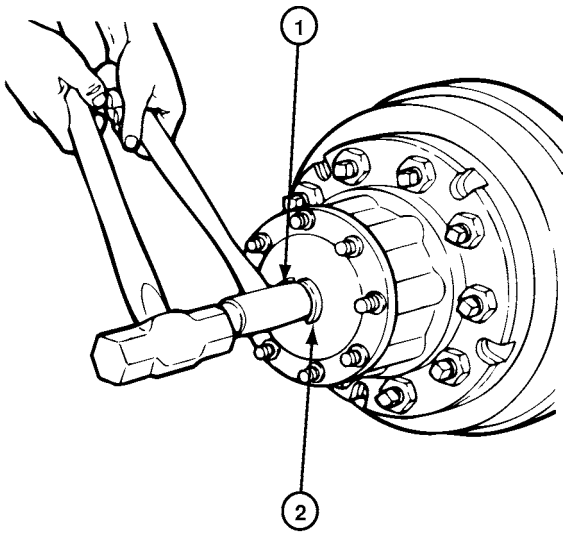
Brass Drift Method

⚠ WARNING

Do not strike the round driving lugs on the flange of an axle shaft. Pieces can break off and cause serious personal injury.

1. Hold a 1-1/2-inch diameter brass drift against the center of the axle shaft, inside the round driving lugs. **Figure 2.3**.

Figure 2.3



1002985a

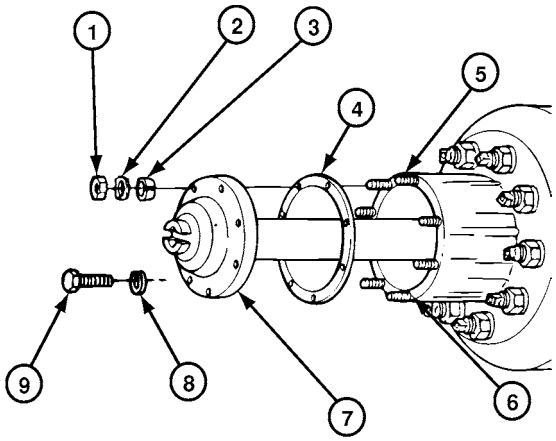
1 BRASS HAMMER
2 DRIVING LUGS

NOTE

A 1-1/2 inch diameter brass hammer can be used as a drift.

2. Strike the end of the drift with a large hammer (five to six pounds) and the axle shaft and tapered dowels will loosen.
3. Mark to identify each axle shaft before it is removed from the axle assembly.
4. Remove the tapered dowels and separate the axle shafts from the main axle hub assembly. **Figure 2.4**.

Figure 2.4



1002986a

1 STUD NUT
2 WASHER
3 TAPERED DOWEL
4 GASKET
5 STUD
6 SHAFT HUB AXLE
7 AXLE SHAFT (FLANGE)
8 WASHER
9 CAPSCREW

5. Install a cover over the open end of each axle assembly hub where an axle shaft was removed.

Air Hammer Vibration Method

⚠ WARNING

Wear safe eye protection when using an air hammer. When using power tools, axle components can loosen and break off causing serious personal injury.

⚠ CAUTION

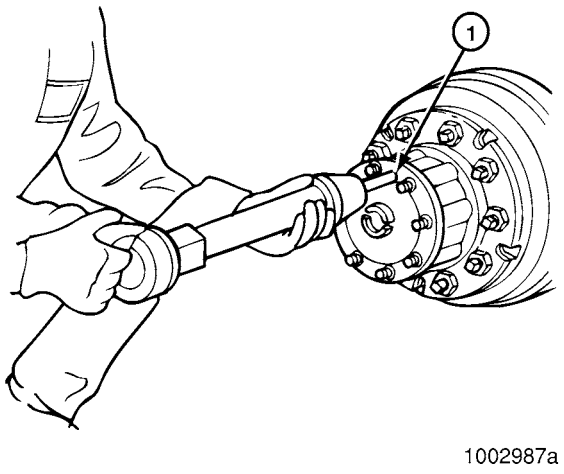
Do not use a chisel or wedge to loosen the axle shaft and tapered dowels. Using a chisel or wedge can result in damage to the axle shaft, the gasket and seal, and/or the axle hub.

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

*Some Meritor carriers do not have these described parts.

2. Place the round hammer bit against the axle shaft (flange) between the hub studs. Operate the air hammer at alternate locations between the studs to loosen the tapered dowels and axle shaft from the hub. **Figure 2.5**.

Figure 2.5



1 ROUND HAMMER BIT BETWEEN HUB STUDS

3. Mark to identify each axle shaft before it is removed from the axle assembly.
4. Remove the tapered dowels and separate the axle shaft from the main axle hub assembly. **Figure 2.4**.

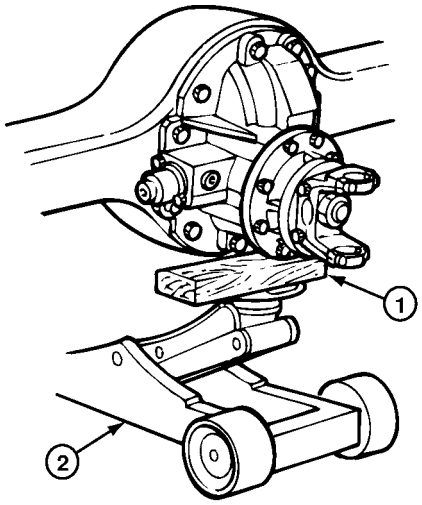
CAUTION

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.

Carrier Removal from Axle

1. Place a hydraulic roller jack under the differential carrier to support the assembly. **Figure 2.6**.
2. Remove all but the top two carrier to housing capscrews or stud nuts and washers.
3. Loosen the top two carrier-to-housing fasteners and leave attached to the assembly. The fasteners will hold the carrier in the housing.
4. Loosen the differential carrier in the axle housing. Use a leather mallet to hit the mounting flange of carrier at several points.
5. After the carrier is loosened, remove the top two fasteners.

Figure 2.6



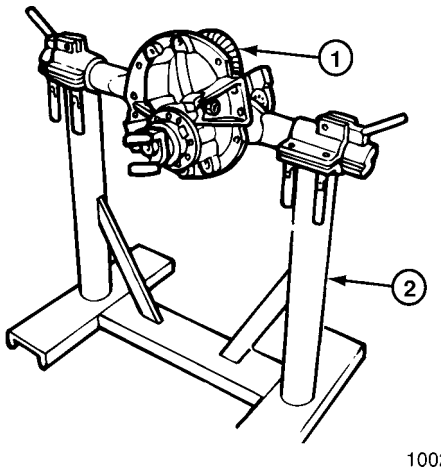
1 WOOD BLOCK
2 ROLLER JACK

CAUTION

When using a pry bar be careful not to damage the carrier or housing flange. Damage to these surfaces will cause oil leaks.

6. Carefully remove the carrier from the axle housing using the hydraulic roller jack. Use a pry bar that has a round end to help remove the carrier from the housing.
7. Lift the differential carrier by the input yoke or flange and place the assembly in a repair stand. **Figure 2.7**. Use a lifting tool for this procedure. Do not lift by hand. A carrier stand can be built by referring to **Figure 2.8**.

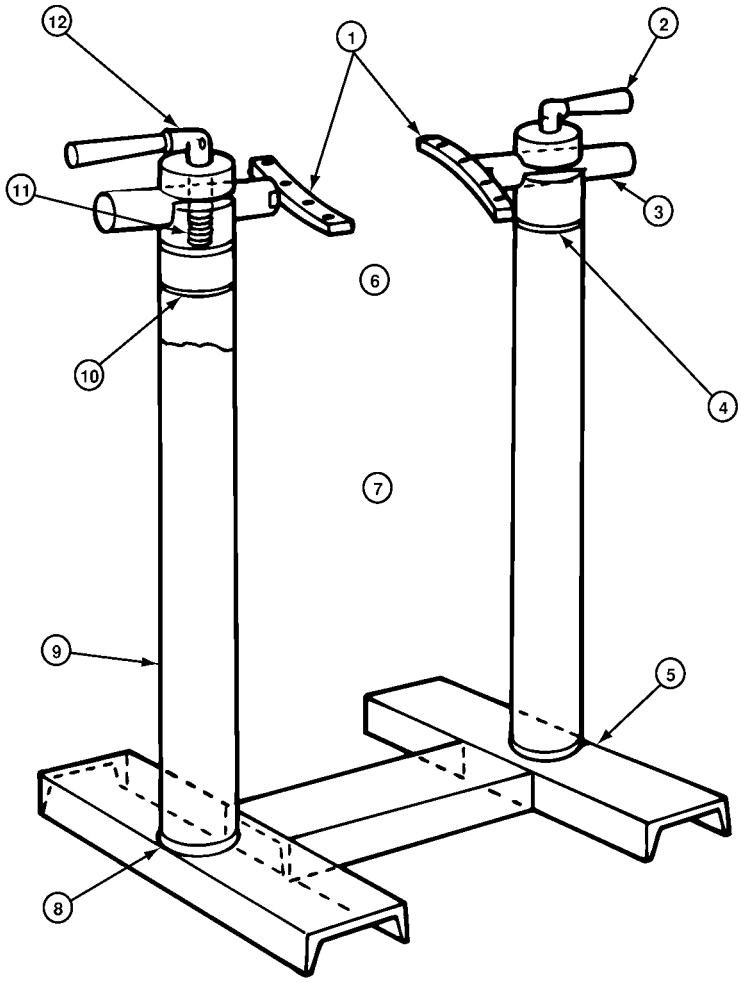
Figure 2.7



1 DIFFERENTIAL CARRIER
2 REPAIR STAND

A carrier stand, part number J 3409-D is available from Kent-Moore, Heavy-Duty Division, 28635 Mound Road, Warren, MI 48092.

Figure 2.8



1 PLATES 8′ LONG x 3/4″ THICK x 1-1/4″ WIDE WITH A TONGUE TO FIT SLOT IN BAR WELD PLATES TO BAR
2 HANDLE 7″ LONG WITH SLOT IN ONE END TO FIT CLAMP SCREW
3 BAR 2″ DIAMETER x 9″ LONG WITH ONE END SLOTTED TO FIT PLATE
4 WELD ALL AROUND AFTER PRESSING PLUG IN PIPE
5 WELD
6 SHAPE AND SIZE OF HOLES TO FIT CARRIER
7 23-1/2″ CENTER TO CENTER OF PIPE
8 CHAMFER END OF PIPE FOR WELDING
9 4″ DIAMETER PIPE
10 PLUG 4″ DIAMETER x 7″ LONG WITH ONE END TURNED 3″ LONG TO FIT PIPE. DRILL 2″ HOLE AND MILL 3/16″ WIDE SLOT 2″ FROM TOP
11 SCREW 3-1/2″ LONG x 5/8″ DIAMETER WITH FLATS ON END TO FIT HANDLE AND 2-1/2″ LENGTH OF THREAD ON OTHER END
12 DRILL 3/8″ HOLE THROUGH HANDLE AND SCREW

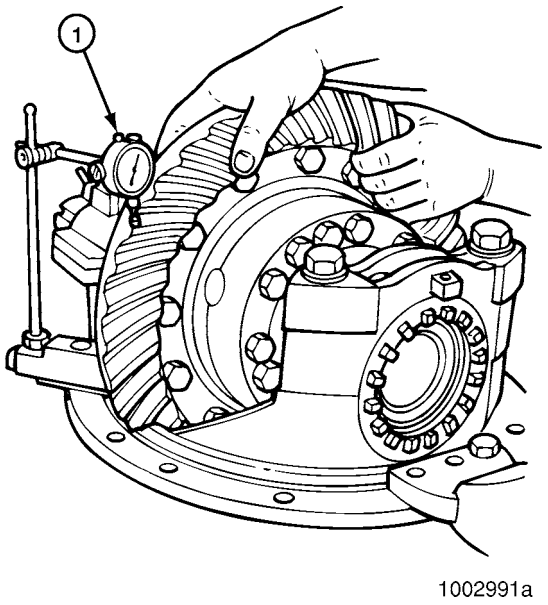
CARRIER STAND

Remove the Differential and Ring Gear from the Carrier

NOTE

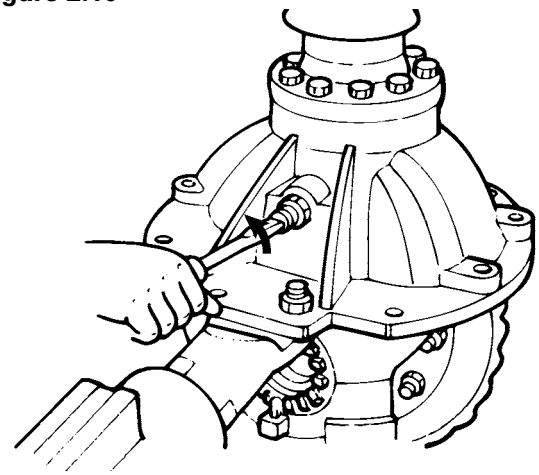
Before working on the differential carrier, inspect the hypoid gear set for damage. If inspection shows no damage, the same gear set can be used again. Measure the backlash of the gear set and make a record of the dimension. **Figure 2.9**. ***(Refer to "Ring Gear Backlash Adjustment," steps 1-5 and*** **Figure 5.59**.***) During differential reassembly, adjust the backlash to the original recorded dimension when the gear set is installed into the carrier.***

Figure 2.9



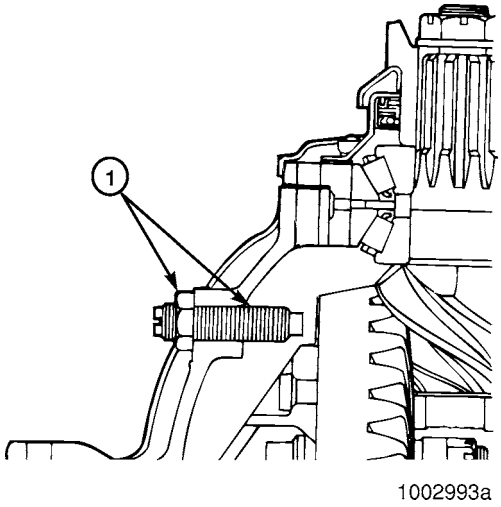
1 DIAL INDICATOR

Figure 2.10



1. Loosen the jam nut* on the thrust screw*.
2. Remove the thrust screw* and jam nut* from the differential carrier. **Figure 2.10** and **Figure 2.11**.

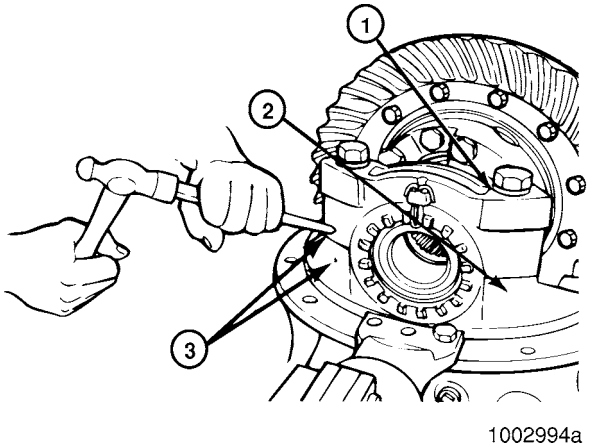
Figure 2.11



1 THRUST SCREW AND JAM NUT

3. Rotate the differential carrier in the repair stand until the ring gear is at the top of the assembly.
4. Mark one carrier leg and bearing cap to correctly match the parts during carrier assembly. Mark the parts using a center punch and hammer. **Figure 2.12**.

Figure 2.12

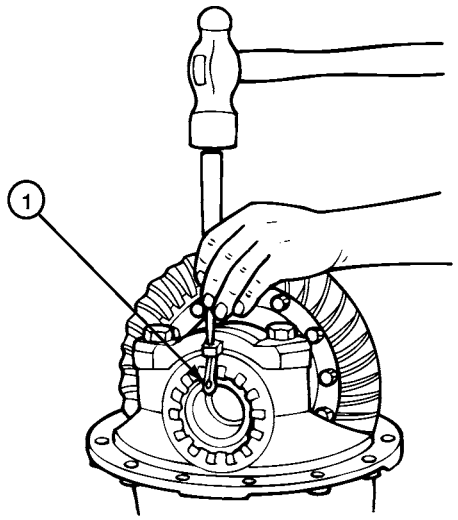


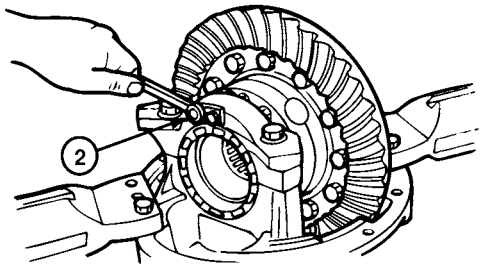
1 BEARING CAP
2 CARRIER LEG
3 MATCH MARKS

*Some Meritor carriers do not have these described parts.

5. Remove the cotter keys*, pins* or lock plates* that hold the bearing adjusting rings in position. Use a small drift and hammer to remove pins. Each lock plate is held in position by two capscrews. **Figure 2.13**.
6. Remove the capscrews and washers that hold the two bearing caps on the carrier. Each cap is held in position by two capscrews and washers. **Figure 2.14**.
7. Remove the bearing caps and bearing adjusting rings from the carrier. **Figure 2.15**.
8. Safely lift the main differential and ring gear assembly from the carrier. Place the assembly on a work bench. **Figure 2.16**.

Figure 2.13

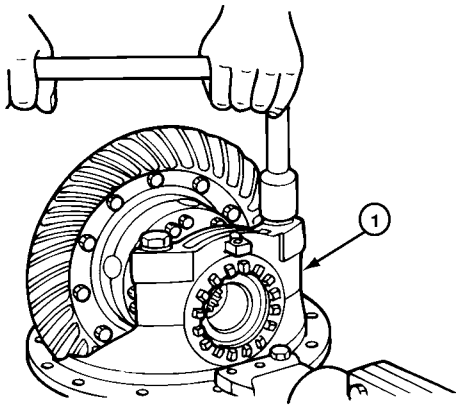




1002995a

1 REMOVING COTTER KEY
2 REMOVING LOCK PLATE

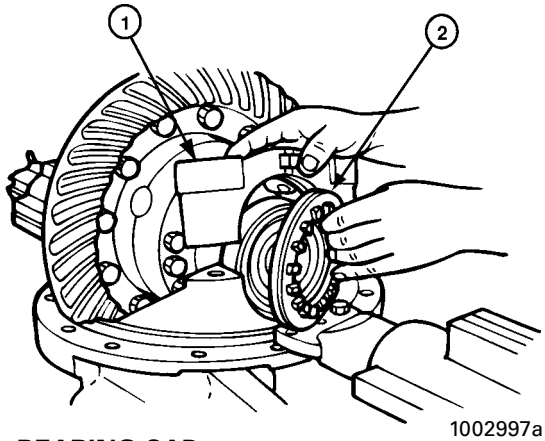
Figure 2.14



1002996a

1 BEARING CAP

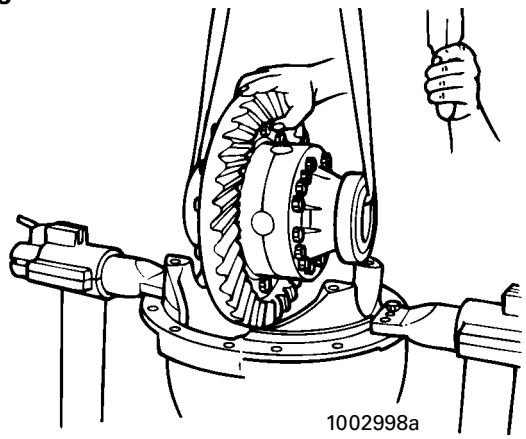
Figure 2.15



1002997a

1 BEARING CAP
2 BEARING ADJUSTING RING

Figure 2.16



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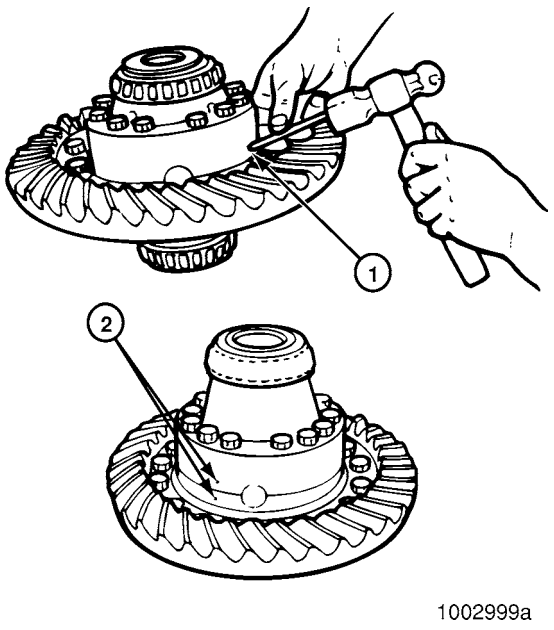
*Some Meritor carriers do not have these described parts.

Disassemble the Differential and Ring Gear Assembly

1. If the matching marks on the case halves of the differential assembly are not visible, mark each case half with a center punch and hammer. The purpose of the marks is to match the plain half and flange half correctly when you assemble the carrier. **Figure 2.17**.

Figure 2.17



1 MATCH MARKS
2 MATCH MARKS

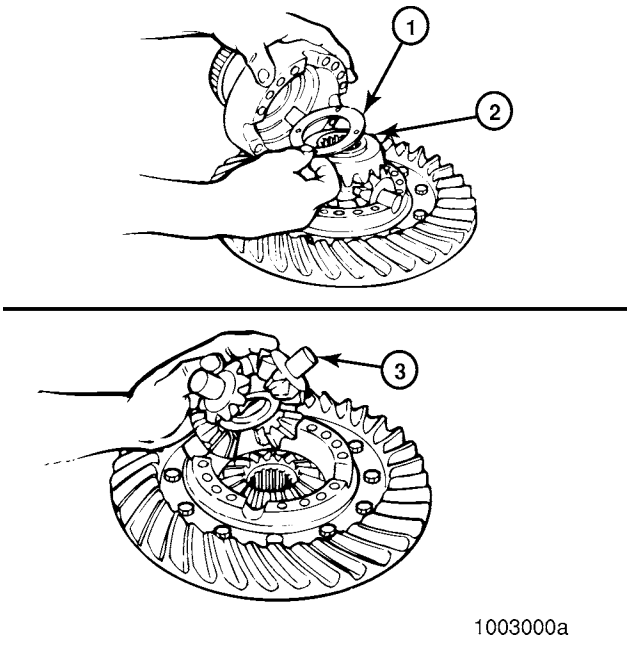
2. Remove the capscrews* and washers* or bolts*, nuts* and washers that hold the case halves together.

⚠ WARNING

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

3. Separate the case halves. If necessary, use a brass, plastic or leather mallet to loosen the parts.
4. Remove the differential spider (cross), four pinion gears, two side gears and six thrust washers from inside the case halves. **Figure 2.18**.
5. If the ring gear needs to be replaced, remove the bolts*, nuts*, and washers* that hold the gear to the flange case half.

Figure 2.18



1 THRUST WASHER
2 SIDE GEAR
3 SPIDER, PINIONS AND THRUST WASHERS

⚠ WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

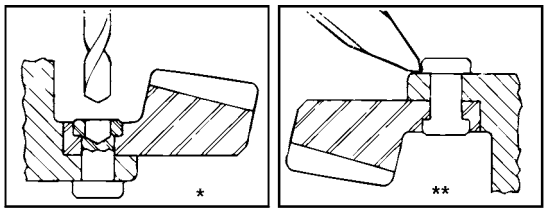
⚠ CAUTION

Do not remove the rivets or rivet heads with a chisel and hammer. Using a flat edge tool can cause damage to the flange case. Refer to **Figure 2.19**.

6. If rivets* hold the ring gear to the flange case half, remove the rivets as follows:
   a. Carefully center punch each rivet head in the center, on the ring gear side of the assembly.
   b. Drill each rivet head on the ring gear side of the assembly to a depth equal to the thickness of one rivet head. Use a drill bit that is 1/32 of an inch smaller than the body diameter of the rivets. **Figure 2.19**.

*Some Meritor carriers do not have these described parts.

Figure 2.19



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*** CORRECT DRILLING RIVETS FROM HEAD**
**** WRONG CHISELING RIVETS FROM HEAD**

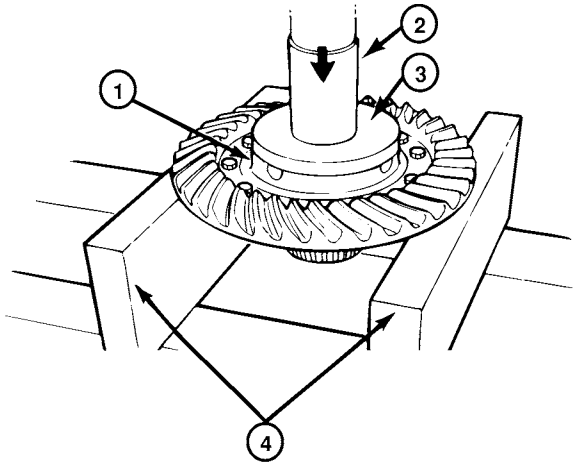
c. Press the rivets through holes in the ring gear and flange case half. Press from the drilled rivet head.

WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

7. Separate the case half and ring gear using a press. Support the assembly under the ring gear with metal or wood blocks and press the case half through the gear. **Figure 2.20**.

Figure 2.20

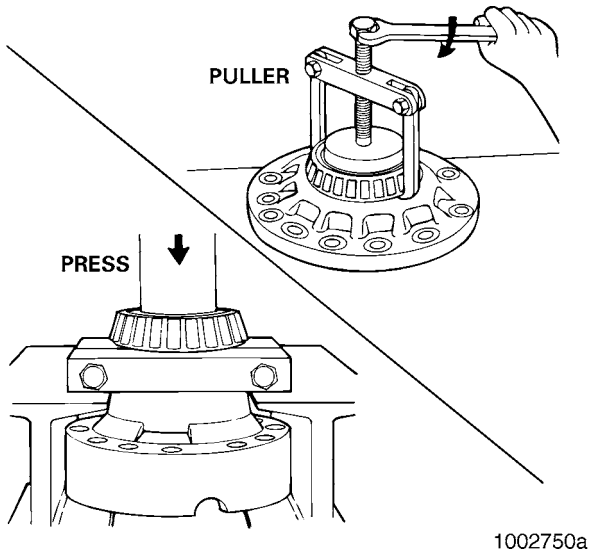


1003002a

1 CASE HALF
2 PRESS
3 PLATE
4 SUPPORTS

8. If the differential bearings need to be replaced, remove the bearing cones from the case halves. Use a bearing puller or press. **Figure 2.21**.

Figure 2.21



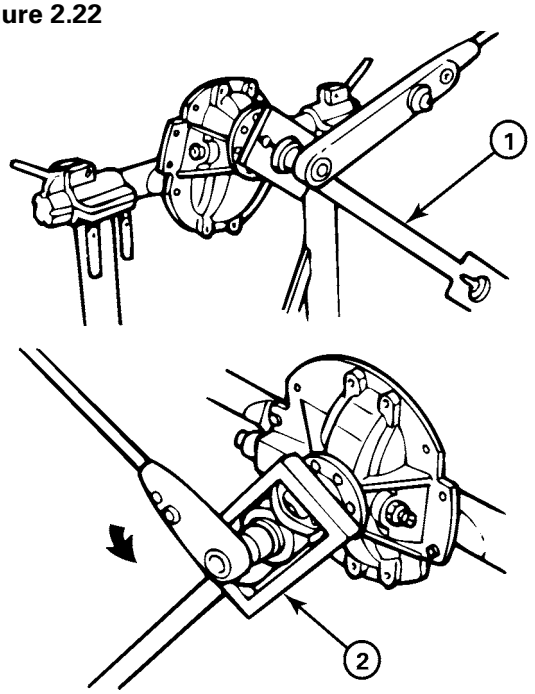
1002750a

*** PULLER**
**** PRESS**

Remove the Drive Pinion and Bearing Cage from Carrier

1. Fasten a flange bar to the input yoke or flange. When the nut is removed, the bar will hold the drive pinion in position. **Figure 2.22**.

Figure 2.22



1 FLANGE BAR
2 YOKE BAR

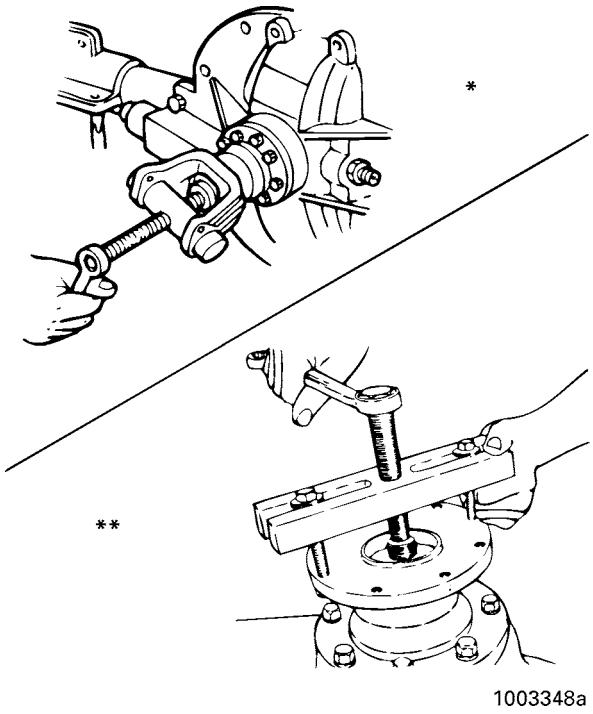
2. Remove the nut and washer* from the drive pinion. **Figure 2.22**.
3. Remove the yoke or flange bar.

⚠ CAUTION

Do not use a hammer or mallet to loosen and remove the yoke or flange. A hammer or mallet can damage the parts and cause driveline runout, or driveline imbalance problems after carrier to driveline assembly.

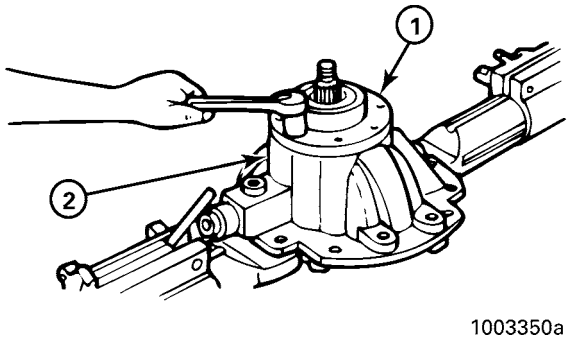
4. Remove the yoke or flange from the drive pinion. If the yoke or flange is tight on the pinion, use a puller for removal. **Figure 2.23**.
5. Remove the capscrews and washers that hold the bearing cage in the carrier. **Figure 2.24**.

Figure 2.23



*** YOKE PULLER**
**** FLANGE PULLER**

Figure 2.24



1 BEARING CAGE
2 CARRIER

*Some Meritor carriers do not have these described parts.

⚠ WARNING

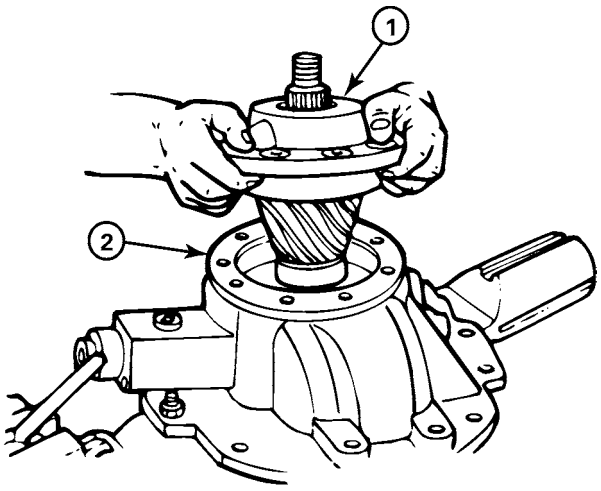
Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

⚠ CAUTION

Do not use a pry bar to remove the bearing cage from the carrier. A pry bar can damage the bearing case, shims and carrier.

6. Remove the drive pinion, bearing cage and shims from the carrier. If the bearing cage is tight in the carrier, hit the bearing cage at several points around the flange area with a leather, plastic or rubber mallet. **Figure 2.25**.

Figure 2.25

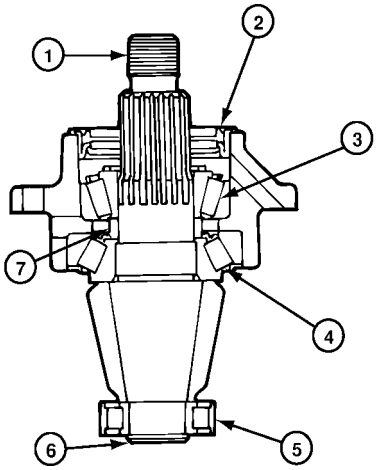


1 DRIVE PINION AND BEARING CAGE
2 SHIMS

7. If the shims are in good condition, keep the shims together for use later when the carrier is assembled.
8. If shims are to be discarded because of damage, first measure the total thickness of the pack. Make a note of the dimension. The dimension will be needed to calculate the depth of the drive pinion in the carrier when the gear set is installed.

Disassemble the Drive Pinion and Bearing Cage

Figure 2.26



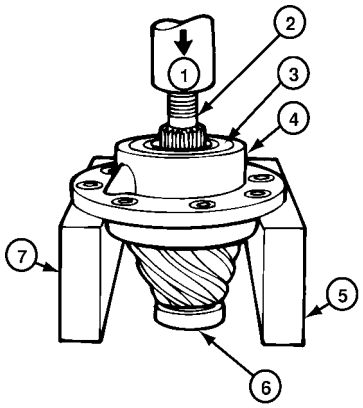
1 DRIVE PINION
2 OIL SEAL
3 OUTER BEARING (CUP AND CONE)
4 INNER BEARING (CUP AND CONE)
5 SPIGOT BEARING
6 SNAP RING
7 BEARING SPACER

⚠ WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

1. Place the drive pinion and bearing cage in a press. The pinion shaft must be toward the top of the assembly. **Figure 2.27**.

Figure 2.27



1 PRESS
2 DRIVE PINION
3 OIL SEAL
4 BEARING CAGE
5 SUPPORT
6 SPIGOT BEARING
7 SUPPORT

2. Support the bearing cage under the flange area with metal or wood blocks. **Figure 2.27**.
3. Press the drive pinion through the bearing cage. **Figure 2.27**.

⚠ WARNING

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

NOTE

The inner bearing cone and bearing spacer will remain on the pinion shaft.

4. If a press is not available, use a leather, plastic or rubber mallet to drive the pinion through the bearing cage.

⚠ CAUTION

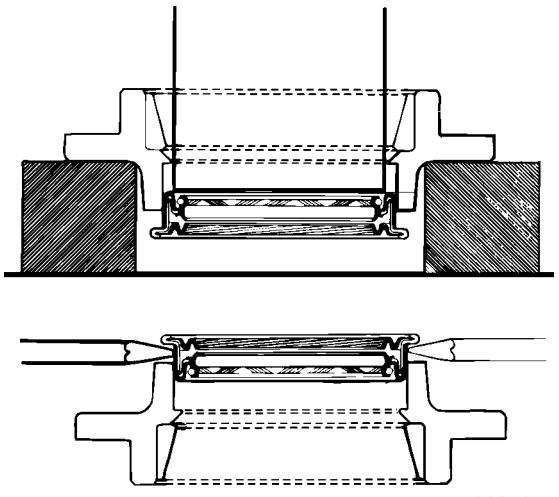
Be careful when removing the seal. Do not damage the wall of bore. Damage to the bore wall can result in oil leaks.

NOTE

When the oil seal has been removed, always replace it with a new seal during component reassembly.

5. Use a press and a sleeve to remove the triple-lip or unitized oil seal from the bearing cage. If a press is not available, place a tool with a flat blade under the flange to remove the oil seal from the cage. **Figure 2.28**.

Figure 2.28



1002437a

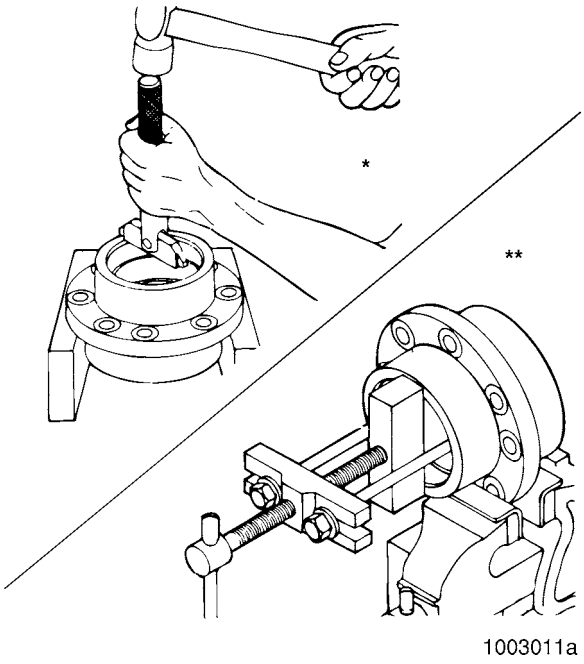
⚠ WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

6. If the pinion bearings need to be replaced, remove the inner and outer bearing cups from the inside of cage. Use a press and sleeve, bearing puller or a small drift hammer. The type of tool used depends on the design of the bearing cage. **Figure 2.29**.

   When a press is used, support the bearing cage under the flange area with metal or wood blocks.

Figure 2.29

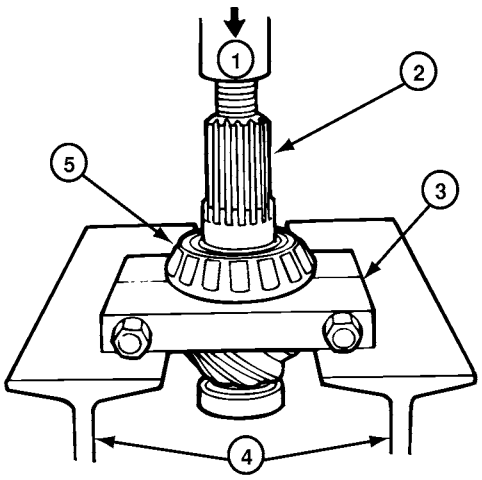


1003011a

*** BEARING DRIVER**
**** BEARING PULLER**

7. If the pinion bearings need to be replaced, remove the inner bearing cone from the drive pinion with a press or bearing puller. The puller ***must*** fit under the inner race of the cone to remove the cone correctly without damage. **Figure 2.30**.

Figure 2.30



1003012a

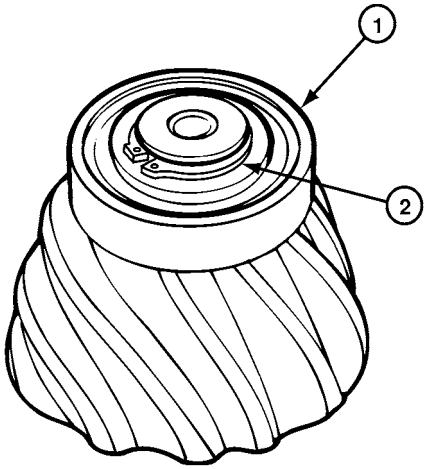
1 PRESS
2 DRIVE PINION
3 BEARING PULLER
4 SUPPORTS
5 INNER BEARING CONE

8. If the spigot bearing needs to be replaced, place the drive pinion in a vise. Install a soft metal cover over each vise jaw to protect the drive pinion.
9. Remove the snap ring* from the end of drive pinion with snap ring pliers that expand. **Figure 2.31**.

NOTE

Some spigot bearings are fastened to the drive pinion with a special peening tool. **Figure 2.32**.

Figure 2.31



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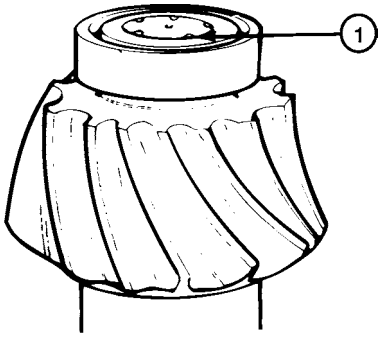
1 SPIGOT BEARING
2 SNAP RING

Figure 2.32



1003014a

1 PEENING POINTS

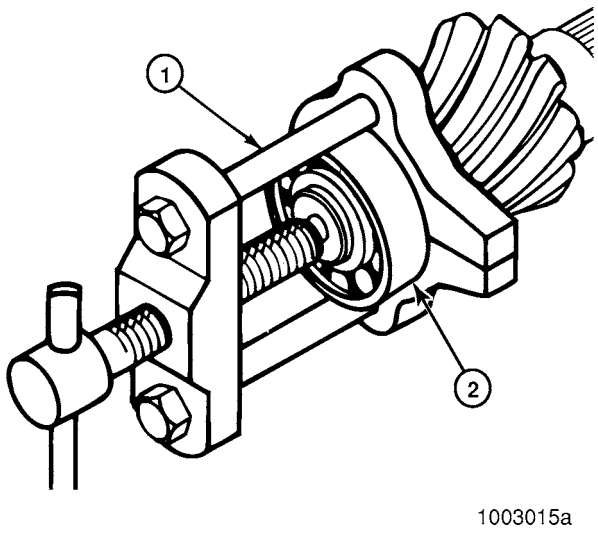
*Some Meritor carriers do not have these described parts.

10. Remove the spigot bearing from the drive pinion with a bearing puller. **Figure 2.33**.

NOTE

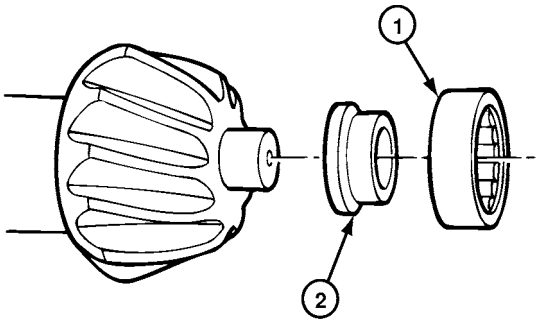
Some spigot bearings are a two-piece assembly. Remove the inner race from the pinion with a bearing puller. Remove the outer race/roller assembly from carrier with a drift or a press. **Figure 2.34.**

Figure 2.33



1 BEARING PULLER
2 SPIGOT BEARING

Figure 2.34



1 REMOVE OUTER RACE AND ROLLER ASSEMBLY FROM CARRIER
2 REMOVE INNER RACE FROM PINION

Clean and Inspect Yokes

WARNINGS

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

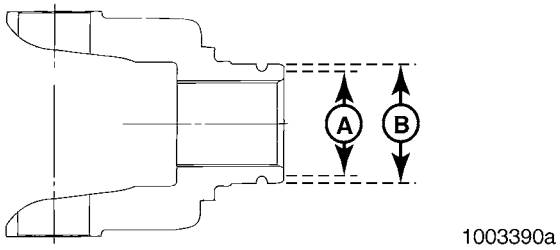
⚠ Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetraphcloride, emulsion-type cleaners and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures:

- ***Wear safe eye protection.***
- ***Wear clothing that protects your skin.***
- ***Work in a well-ventilated area.***
- ***Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.***
- ***You must use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.***

1. Clean the ground and polished surface of the yoke journal using a clean shop towel and a safe cleaning solvent. Do not use abrasive cleaners, towels, or scrubbers to clean yoke or flange surface. DO NOT USE GASOLINE.
2. Inspect the original yoke seal surface for any grooves.
   a. The rubber inner sleeve of the unitized pinion seal (UPS) allows the reuse of yokes with grooves unless the groove depths are excessively deep. If grooves are present, measure the groove diameters with calipers. Refer to **Figure 3.1** to determine if the yoke is usable.
   b. If grooves are present on yoke hubs which are used with single or triple lip seals, then the yokes must be replaced.
3. If any of the yoke grooves measure less than the dimensions in **Figure 3.1**, replace the yoke. The rubber inner sleeve of the unitized pinion seal (UPS) is designed to seal on the yoke and rotate with the yoke.

Figure 3.1

YOKE SEAL DIAMETER	MINIMUM YOKE DIAMETER AT GROOVE (INCHES)
3.000/3.005"	2.990"
3.250/3.255"	3.240"



A MINIMUM GROOVE DEPTH — DIAMETER
B YOKE SEAL DIAMETER

UNITIZED PINION SEAL (UPS)

⚠ *CAUTION*

Do not install a press on shaft excluder (or POSE™ seal) after installation of a unitized pinion seal. The use of a POSE™ seal will prevent correct seating of the unitized pinion seal on the yoke and will result in lubricant leakage at the seal. POSE™ seal installation is recommended only for triple lip and other previous design seals.

Do not use thin metal wear sleeves to refresh the yoke surface. Wear sleeves pressed onto the yoke will prevent correct seating of the pinion seal and damage the pinion seal assembly. Wear sleeve usage will cause the seal to leak.

Cleaning Ground and Polished Parts

WARNING

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

1. Use a cleaning solvent to clean ground or polished parts or surfaces. Kerosene or diesel fuel oil can be used for this purpose. ***Do not use gasoline.***

WARNING

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures:

- ***Wear safe eye protection.***
- ***Wear clothing that protects you skin.***
- ***Work in a well-ventilated area.***
- ***Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.***
- ***You must use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.***

2. Use a tool with a flat blade if required, to remove sealant material from parts. Be careful not to damage the polished or smooth surfaces.

CAUTION

Do not use hot solution tanks or water and alkaline solutions to clean ground or polished parts. Damage to parts will result.

3. ***Do not*** clean ground or polished parts with water or steam. Do not immerse ground or polished parts in a hot solution tank or use strong alkaline solutions for cleaning, or the smooth sealing surface may be damaged.

Cleaning Rough Parts

1. Clean rough parts with the same method as cleaning ground and polished parts.
2. Rough parts can be cleaned in hot solution tanks with a weak or diluted alkaline solution.
3. Parts must remain in hot solution tanks until heated and completely cleaned.

WARNING

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures:

- ***Wear safe eye protection.***
- ***Wear clothing that protects you skin.***
- ***Work in a well-ventilated area.***
- ***Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.***
- ***You must use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.***

4. Parts must be washed with water until all traces of the alkaline solution are removed.

Cleaning Axle Assemblies

1. A complete axle assembly can be steam cleaned on the outside to remove dirt.
2. Before the axle is steam cleaned, close or place a cover over all openings in the axle assembly. Examples of openings are breathers or vents in air chambers.

Drying Parts After Cleaning

1. Parts must be dried immediately after cleaning and washing.
2. Dry the parts using soft, clean paper or cloth rags.

CAUTION

Damage to bearings can result when they are rotated and dried with compressed air.

3. Except for bearings, parts can be dried with compressed air.

Preventing Corrosion on Cleaned Parts

1. Apply axle lubricant to cleaned and dried parts that are not damaged and are to be assembled.
2. To store parts, apply a special material that prevents corrosion to all surfaces. Wrap cleaned parts in a special paper that will protect the parts from moisture and prevent corrosion.

Inspecting Parts

It is very important to inspect all parts carefully and completely before the axle or carrier is assembled. Check all parts for wear and replace damaged parts. Replacement of damaged or worn parts now, will prevent failure of the assembly later.

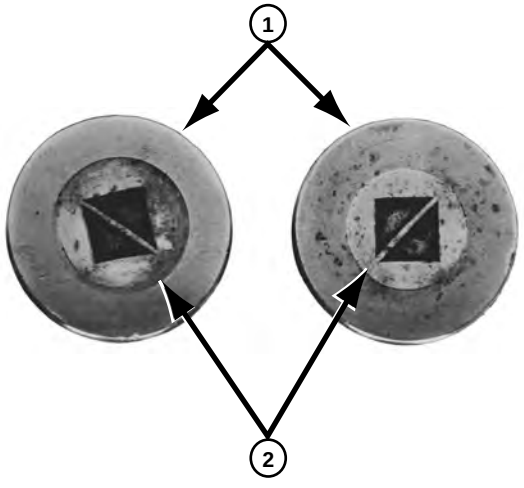
1. Inspecting Tapered Roller Bearings:

   Inspect the cup, cone, rollers and cage of all tapered roller bearings in the assembly. If any of the following conditions exist, the bearing ***must*** be replaced.

   a. The center of large-diameter end of rollers worn level with or below the outer surface. **Figure 3.2**.

   b. The radius at large-diameter end of rollers worn to a sharp edge. **Figure 3.2**.

Figure 3.2



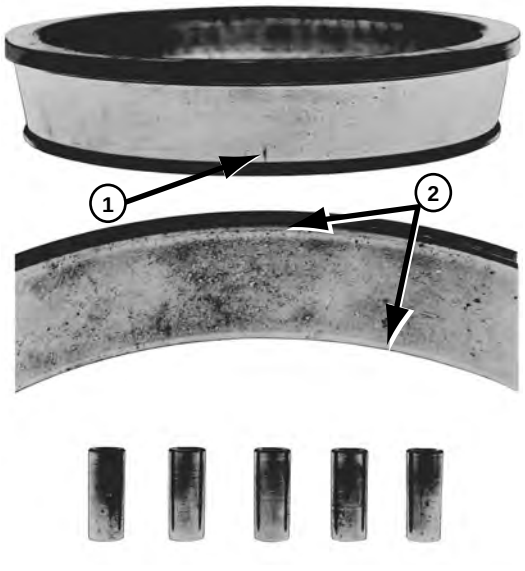
1 WORN RADIUS
2 WORN SURFACE

   c. A visible roller groove in the cup or cone inner race surfaces. The groove can be seen at the small- or large-diameter end of both parts. **Figure 3.3**.

   d. Deep cracks or breaks in the cup, cone inner race or roller surfaces. **Figure 3.3**.

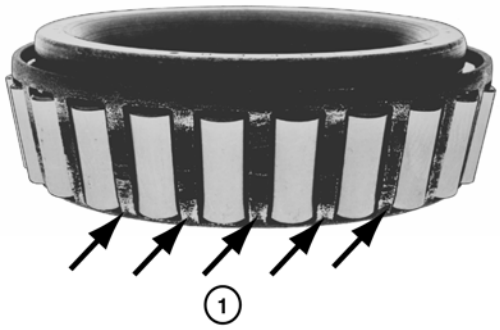
   e. Bright wear marks on the outer surface of the roller cage. **Figure 3.4**.

Figure 3.3



1 CRACK
2 WEAR GROOVE

Figure 3.4

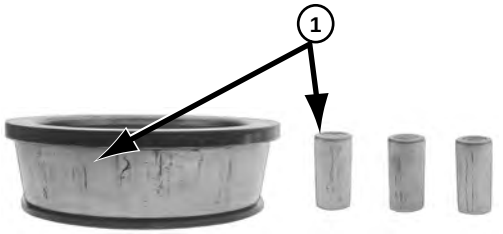


1 WEAR MARKS

f. Damage on rollers and on surfaces of the cup and cone inner race that touch the rollers. **Figure 3.5**.

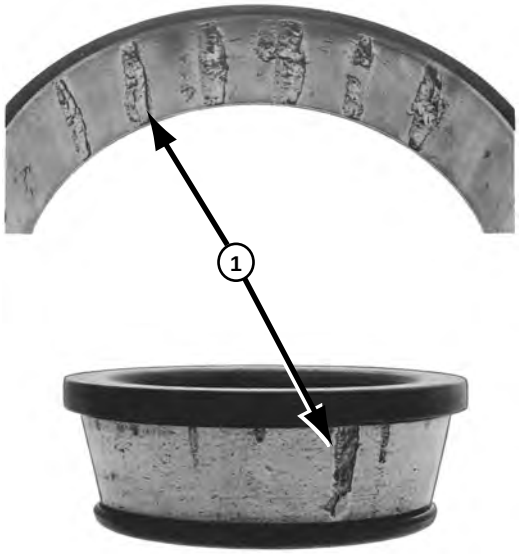
g. Damage on the cup and cone inner race surfaces that touch the rollers. **Figure 3.6**.

Figure 3.5



1 ETCHING AND PITTING

Figure 3.6



1 SPALLING AND FLAKING

CAUTION

Hypoid drive pinions and ring gears are machined in matched sets. When a drive pinion or ring gear of a hypoid set needs to be replaced, both drive gear and pinion must be replaced at the same time.

2. Inspect hypoid pinions and gears for wear or damage. Gears that are worn or damaged ***must*** be replaced.

CAUTION

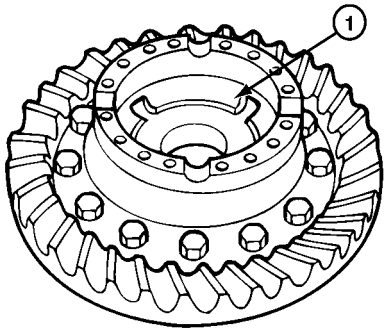
Always replace thrust washers, differential side gears and pinion gears in full matched sets. A higher stress on original parts and early failure of the entire assembly will result if a new part is used in combination with parts that are older or worn.

3. Inspect the Main Differential Assembly:

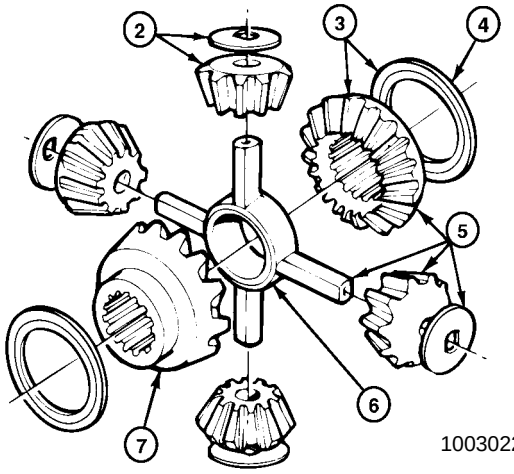
   Inspect the following parts for wear or stress. Parts that are damaged ***must*** be replaced. **Figure 3.7**.

Figure 3.7

DIFFERENTIAL CASE HALVES



DIFFERENTIAL GEAR NEST ASSEMBLY



1 INSPECT INSIDE SURFACES
2 PINION AND THRUST WASHER
3 SIDE GEAR AND THRUST WASHER
4 INSPECT
5 INSPECT
6 SPIDER (CROSS)
7 INSPECT
*** DIFFERENTIAL CASE HALVES**
**** DIFFERENTIAL GEAR NEST ASSEMBLY**

a. Inside surfaces of both case halves.
b. Both surfaces of all thrust washers.
c. The four trunnion ends of the spider (cross).
d. Teeth and splines of both differential side gears.
e. Teeth and bore of all differential pinions.

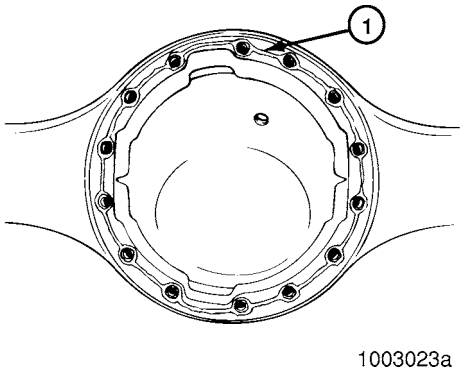
4. Inspect Axle Shafts:
   a. Inspect axle shafts for wear and cracks at the flange, shaft and splines.
   b. Replace axle shafts, if required.

Repair or Replacement of Parts, General

Replace worn or damaged parts of an axle assembly. The following are some examples in checking for part replacement or repair.

1. Replace any fastener if corners of the head are worn.
2. Replace washers if damaged.
3. Replace gaskets, oil seals or grease seals at the time of axle or carrier repair.
4. Clean parts and apply new silicone gasket material where required when axle or carrier is assembled. **Figure 3.8**.

Figure 3.8



1 REMOVE SILICONE GASKET FROM PARTS

5. Remove nicks, mars and burrs from parts with machined or ground surfaces. Use a fine file, india stone, emery cloth or crocus cloth for this purpose.

CAUTION

Threads must be without damage and clean so that accurate adjustments and correct torque values can be applied to fasteners and parts.

6. Clean and repair threads of fasteners and holes. Use a die or tap of the correct size or a fine file for this purpose.

WARNING

Repair of axle housings by bending or straightening will cause poor or unsafe vehicle operation and early failure of the axle.

Repair Axle by Welding

1. Meritor will permit repairing drive axle housing assemblies by welding ***only*** in the following areas:
   a. Only RT-46-160 axles housing to cover weld joints. Refer to TP-9599.
   b. Snorkel welds.
   c. Housing seam welds between the suspension attaching brackets.
   d. Bracket welding to drive axle housing. Refer to TP-9421.
   e. Refer to Meritor Maintenance Manual 8 for approved axle welding procedures.

WARNINGS

Using wrong welding procedures or welding at locations other than the three areas permitted by Meritor will make the heat-treated component weak. A weak component will cause poor or unsafe operation of the vehicle and early axle failure. The following procedure must be used.

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures:

- ***Wear safe eye protection.***
- ***Wear clothing that protects you skin.***
- ***Work in a well-ventilated area.***
- ***Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.***
- ***You must use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.***

⚠ CAUTION

Welding can be used when the crack or damaged area is within the old weld material. Replace the axle housing if the crack extends into the metal next to the old weld. A repaired housing must be used in correct applications.

2. Welding Procedure
   a. Drain the lubricant from the axle assembly.
   b. Remove the axle shafts and differential carrier from the axle housing.
   c. Remove hub, drum, wheel bearing and brake air chambers.
   d. Clean the damaged area inside and outside the housing. Cleaning solvent can be used.
   e. Grind the damaged weld to the base metal.
   f. Warm the complete axle housing to a temperature of 70°F-80°F (21°C-27°C) or higher.
   g. Before you start welding, heat the damaged area to be repaired to approximately 300°F (149°C).
   h. Use a 70,000 psi tensile weld material and the correct voltage and amperage for the diameter weld rod used. Examples of weld rods that can be used are E-7018 or ER-70S-3.
   i. Fill in the weld gap as follows:

CAUTIONS

⚠ ***If the E-7018 weld rod is used, the rod must be kept dry. Electrodes that are not stored in the correct sealed containers must be heated at 700°F (371°C) for one hour before welding. Wet electrodes must be dried at 180°F (82°C) for one to two hours and then heated at 700°F (371°C) for one hour before welding.***

⚠ ***Do not connect the ground cable at any point on the axle assembly that will place a bearing between the ground cable and weld area. If a bearing is between the ground cable and weld, the bearing will be damaged because of electricity arcing.***

⚠ ***A good location to connect the ground cable is the spring mounting pad of the housing.***

1. The opening in cover welds ***must*** be filled level with the old weld.
2. The opening in seam welds ***must*** be ground out to 70% of the wall thickness. The wall thickness can be measured at the carrier opening of housing.
3. Clean the new weld area. Carefully remove all the rough weld material.
4. Install the differential carrier and axle shafts.
5. Fill the axle assembly with the correct amount of lubricant. Refer to Maintenance Manual 1, *Lubrication,* for information on lubricants.

NOTE

Before welding brackets or other components to the axle housing, contact Meritor for proper welding procedures.

Bending or Straightening Drive Axle Housings

Meritor is emphatically opposed to any attempt to correct or modify drive axle housings by bending or straightening. All damaged drive axle housings should be replaced.

⚠ WARNING

Do not bend or straighten damaged drive axle housings. Any bending or straightening process may result in misalignment or weakening of the axle housing and result in component damage or serious personal injury.

Removing Dri-Loc® Fasteners

If it is difficult to remove fasteners from components, the strength of Dri-Loc®, Meritor adhesive or Loctite® 277 can be decreased by heating. Use the following procedure:

1. Heat the fastener for three to five seconds ***only*** and try to loosen the fastener with a wrench. ***Do not*** use an impact wrench to loosen the fastener or hit the fastener with a hammer.

⚠ CAUTION

Do not exceed 350°F (177°C) maximum. Heating must be done slowly to prevent thermal stresses in the other components.

2. Repeat step 1 until the fastener can be removed.

Installing Fasteners with Pre-applied Adhesive, Meritor Liquid Adhesive 2297-C-7049, Loctite® 680 Liquid Adhesive or Equivalent

Installing New Fasteners with Pre-applied Adhesive Patches

WARNING

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

1. Clean the oil and dirt from threaded holes. Use a wire brush. There is no other special cleaning required.

CAUTION

Do not apply adhesives or sealants on new fasteners with pre-applied adhesive patches or inside closed threaded holes. If other adhesives or sealants are used, the new adhesive will not function correctly.

2. Assemble parts using the new pre-applied adhesive fasteners.

NOTE

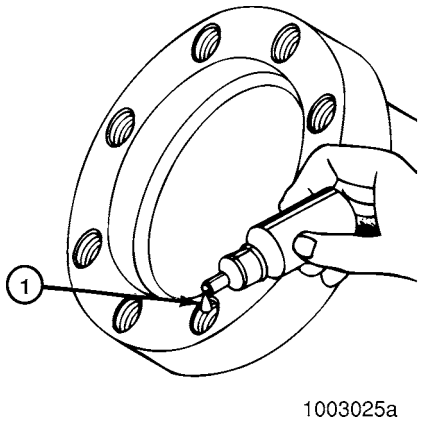
There is no drying time required for fasteners with pre-applied adhesive.

3. Tighten the fasteners to the required torque value for that size fastener.

Installing Original or Used Fasteners Using Meritor Liquid Adhesive 2297-C-7049 or Loctite® 680 or Equivalent

1. Clean the oil, dirt and old adhesive from all threads and threaded holes. Use a wire brush.
2. Apply four or five drops of Meritor Liquid Adhesive, Loctite® 680 or equivalent inside each threaded hole or bore ONLY. Make sure the adhesive is applied inside to the bore threads. **Figure 4.1**.

Figure 4.1



1 4 TO 5 DROPS ON BORE THREADS

CAUTION

Do not apply adhesive directly to the fastener threads. Air pressure in a closed hole will push the adhesive out and away from mating surfaces as the fastener is installed.

3. Tighten the fasteners to the required torque value for that size fastener.

NOTE

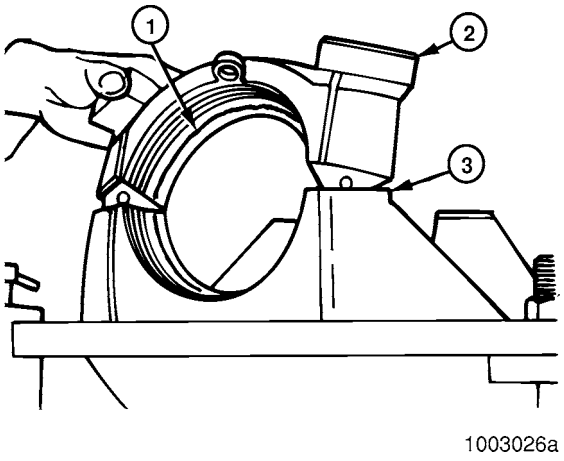
There is no drying time required for Meritor Liquid Adhesive 2297-C-7049, Loctite® 680 or equivalent.

Application of Meritor Adhesive 2297-T-4180 in Bearing Bores for the Differential

Use adhesive 2297-T-4180 for all axles.

1. Clean the oil and dirt from outer diameters of bearing cups and bearing bores in the carrier and bearing caps. There is no special cleaning required.
2. Apply axle lubricant to the bearing cones and the inner diameters of the bearing cups of the main differential. ***Do not*** get oil on the outer diameter of the bearing cup and ***Do not*** permit oil to drip on the bearing bores.
3. Apply a single continuous bead of the adhesive to the bearing bores in the carrier and bearing caps. Apply the adhesive 360° around the smooth, ground surfaces only. ***Do not*** place adhesive on threaded areas. **Figure 4.2**.

Figure 4.2



1 ADHESIVE
2 BEARING CAP
3 CARRIER LEG

NOTE

Meritor adhesive 2297-T-4180 will become hard (dry) in approximately two hours. The following two steps of the procedure must be done in two hours from the time the adhesive was applied. If two hours have passed since application, clean the adhesive from the parts again and apply new adhesive.

4. Install the main differential assembly, bearing cups and bearing caps into the carrier. Use the normal procedure, refer to "Install the Differential and Ring Gear Assembly" and **Figure 5.47** through **Figure 5.50**.
5. Adjust preload of the differential bearings, backlash and tooth contact patterns of the gear set as required using the normal procedures. Refer to "Adjust Preload of Differential Bearings" through "Install Differential Carrier into Axle Housing."

Application of Three Bond 1216 or Equivalent Silicone Gasket Material

WARNING

When you apply some silicone gasket materials, small amounts of acid vapor are present. To prevent possible serious injury, the work area must be well ventilated. If the silicone gasket material gets into your eyes, flush them with water for 15 minutes. Have your eyes checked by a doctor as soon as possible.

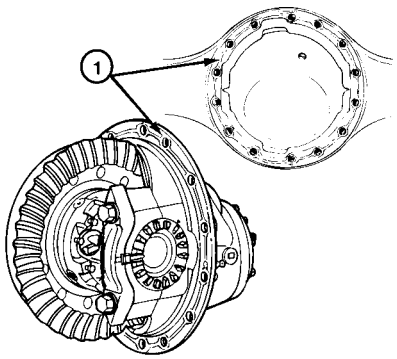
NOTE

The following silicone gasket products or equivalent can be used for Meritor components:

- ***Three Bond Liquid Gasket No. TB 1216 (Grey)***
- ***Loctite® Ultra Grey Adhesive/Sealant #18581***
- ***From Meritor: Ten-ounce tubes, Part No. 2297-F-7052***

1. Remove all old gasket material from both surfaces. **Figure 4.3**.
2. Clean the surfaces where silicone gasket material will be applied. Remove all oil, grease, dirt and moisture without damaging the mating surfaces. **Figure 4.3**.
3. Dry both surfaces.

Figure 4.3



1 REMOVE OLD SEALANT MATERIAL

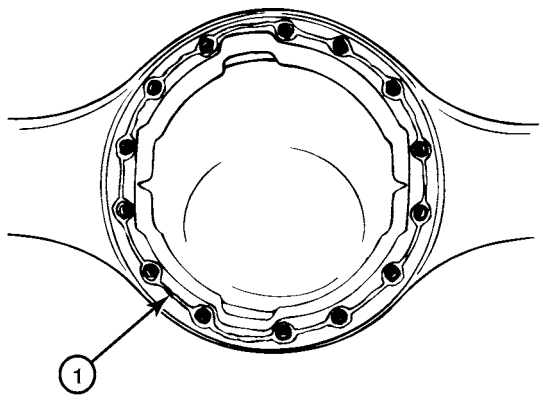
HOUSING AND CARRIER SHOWN

⚠ CAUTION

The amount of silicone gasket material applied must not exceed 0.125 inch (3 mm) diameter bead. Too much gasket material can block lubrication passages and result in damage to the components.

4. Apply 0.125 inch (3 mm) diameter continuous bead of the silicone gasket material around one surface. Also apply the gasket material around the edge of all fastener holes on that surface. **Figure 4.4**.
5. Assemble the components immediately to permit the silicone gasket material to compress evenly between the parts. Tighten fasteners to the required torque value for that size fastener. There is no special procedure or additional torque value required. Refer to **Table J**.
6. Wait 20 minutes before filling the assembly with lubricant.

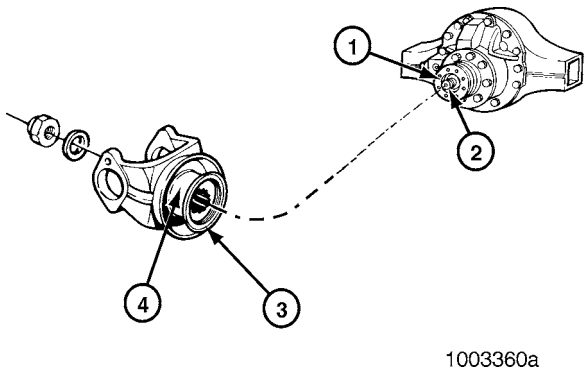
Figure 4.4



1 0.125″ (3 MM) DIAMETER SILICONE GASKET BEAD

Installing Tight Fit Yokes and POSE™ Seal

Figure 4.5



1 LUBRICATE TRIPLE-LIP (MAIN) SEAL
2 INPUT SHAFT (PINION)
3 POSE™ SEAL (0.25″–0.50″ ONTO HUB)
4 INSPECT YOKE HUB

1. Apply the same lubricant used in the axle housing to the hub of the yoke or flange.
2. Inspect and make sure the lips of the POSE™ seal and the outer retainer of the triple-lip seal (main seal) are clean and free from dirt and particles that may cause lubricant leakage between the seals.

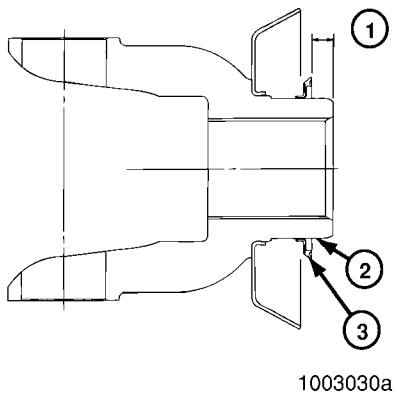
3. Install the POSE™ seal on the hub of the yoke or flange by hand. The lips of the seal must face toward the end of the hub (opposite shoulder). Slide the POSE™ seal on the hub until the lips are from 0.25 inch to 0.50 inch (6.4 mm–12.7 mm) from the end of the hub. ***Do not install the POSE™ seal against the shoulder.*** **Figure 4.6**.

NOTE

The POSE™ seal will position itself correctly as the yoke or flange is pressed on the shaft.

4. Before you install the yoke or flange on the shaft, again apply the same lubricant used in the axle housing to the hub.

Figure 4.6



1 0.25"–0.50" (6.4 MM–12.7 MM)
2 YOKE HUB
3 FACE SEAL ASSEMBLY (POSE™ SEAL ELEMENT)

5. Install the yoke or flange using the correct procedure.

NOTE

The yoke must be completely seated before tightening pinion nut to the input shaft.

Installing Any Type Yoke with a Unitized Pinion Seal (UPS)

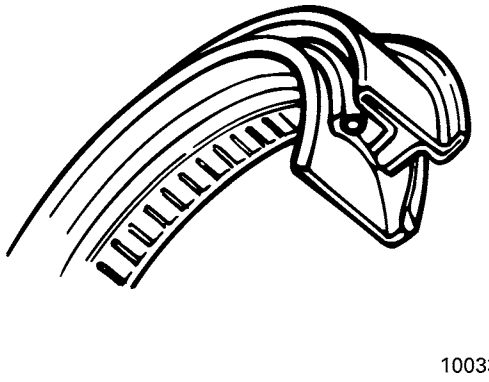
CAUTIONS

⚠ ***Once the yoke is partially or fully installed and then removed for any reason, the unitized pinion seal will be damaged and unusable. If the yoke and unitized pinion seal are removed after partial or full installation, remove and discard the original unitized pinion seal and replace it with another new unitized pinion seal.***

⚠ ***If the inner sleeve of the seal is removed, the seal is not usable. A new seal is required. This will occur if a yoke is installed into the seal and then removed.***

1. Remove the replacement unitized seal from the package. **Figure 4.7**.
2. Select the correct seal driver from **Table A**. Each seal driver is designed to correctly install a specific diameter seal. To determine the yoke seal diameter, measure the yoke journal. Refer to **Table A**.
3. Position the seal on the driver.

Figure 4.7



UNITIZED SEAL

Table A — Unitized Pinion Seals and Seal Drivers

Single Models	Tandem Models	Meritor Unitized Pinion Seal	Seal Installation Location	Meritor Seal Driver	Yoke Seal Diameter Inches
RS-17-145 RS-19-145 RS-21-145 RS-21-160 RS-23-160 /A RS-23-161 /A RS-25-160 /A RS-23-186 RS-26-185 RS-30-185	RT-34-144 /P RT-34-145 /P RT-40-145 /A /P RT-40-149 /A /P RT-44-145 /P RT-40-160 /A /P RT-40-169 /A /P RT-46-160 /A /P RT-46-169 /A /P RT-46-164EH /P RT-46-16HEH /P RT-50-160 /P RT-52-185* RT-58-185*	A-1205-R-2592	Tandem Forward Input (145 models from 11/93 to present)	R4422402	3.250 3.255
		A-1205-P-2590	Tandem Forward Output (Tandem Forward Input 145 models before 11/93 with seal A-1205-F-2424)	R4422401	3.000 3.005
		A-1205-N-2588	Tandem and Single Rear Input (145 models)	R4422401	3.000 3.005
		A-1205-Q-2591	Tandem and Single Rear Input (160/164/185 models)	R4422402	3.250 3.255
To obtain Meritor seal driver KIT 4454, call 888-725-9355.					

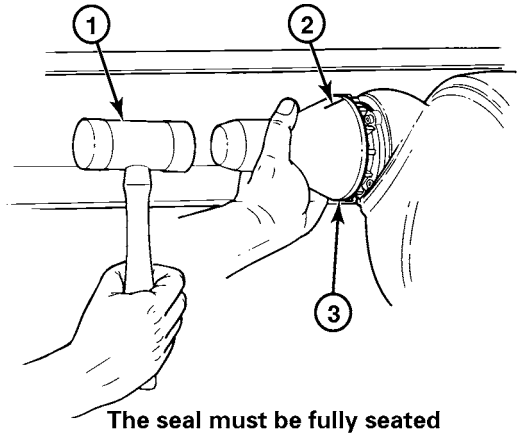
* Forward and rear input only.

CAUTION

Use a rubber mallet to install the seal. Do not use a steel, brass or plastic hammer to install the seal. Using a steel, brass or plastic hammer can damage the seal and driver tool.

4. Use a rubber mallet to drive the seal into or against the bearing cage. The seal must fully seat into or against the bearing cage. **Figure 4.8**.

Figure 4.8



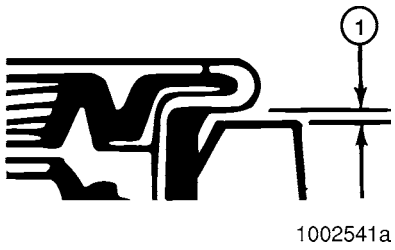
The seal must be fully seated into or against the bearing cage.

1003389a

1 RUBBER MALLET
2 REFERENCE MARK
3 SEAL DRIVER R4422401

5. Use a 0.010-inch shim to check for clearance between the entire seal flange circumference and the bearing cage.
   - **If the 0.010-inch shim slides between the seal flange and bearing cage:** Correctly position the seal driver and drive the seal into the bore until the 0.010-inch shim cannot slide between the seal flange and bearing cage at any point around the seal flange. **Figure 4.9**.

Figure 4.9 MEASURING SEAL GAP



1 0.010 INCH (0.254 MM)

Clean, Inspect and Install the Yoke After Installing a Unitized Pinion Seal

WARNING

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures:

- ***Wear safe eye protection.***
- ***Wear clothing that protects your skin.***
- ***Work in a well-ventilated area.***
- ***Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.***
- ***You must use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.***

1. Clean the ground and polished surface of the yoke journal using a clean shop towel and a safe cleaning solvent. Do not use gasoline, abrasive cleaners, towels, or scrubbers to clean the yoke. Do not attempt to polish the yoke.

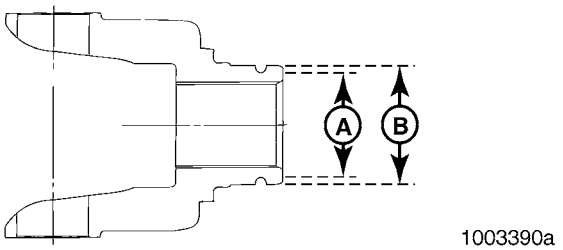
NOTE

The unitized seal features a rubber inner sleeve that is designed to seal and rotate with the yoke. This feature allows you to reuse a yoke with minor grooves.

2. Inspect the yoke seal surface for grooves.
   - **If you find grooves on the yoke:** Use calipers to measure the groove diameters. If any groove diameter measures less than the dimensions shown in **Figure 4.10**, replace the yoke.

Figure 4.10

YOKE SEAL DIAMETER	MINIMUM YOKE DIAMETER AT GROOVE (INCHES)
3.000/3.005"	2.990"
3.250/3.255"	3.240"



A MINIMUM GROOVE DEPTH — DIAMETER
B YOKE SEAL DIAMETER

CAUTIONS

Do not install a POSE™ seal after you install a unitized pinion seal. The use of a POSE™ seal will prevent correct seating of the unitized pinion seal on the yoke and can result in lubricant leakage at the seal. POSE™ seal installation is recommended only for triple lip and other previous design seals.

Do not use thin metal wear sleeves to refresh the yoke surface. Wear sleeves pressed onto the yoke can prevent correct seating of the pinion seal, damage the pinion seal assembly and can cause the seal to leak.

3. Before you install the yoke, lightly lubricate or coat the yoke seal journal with axle oil.
4. Align the yoke splines with the shaft splines. Slide the yoke over the shaft spline.

General Yoke and U-Joint Reassembly

Install the end yoke hub capscrews by hand after seating the U-joint. Tighten the capscrews according to manufacturer's torque specifications.

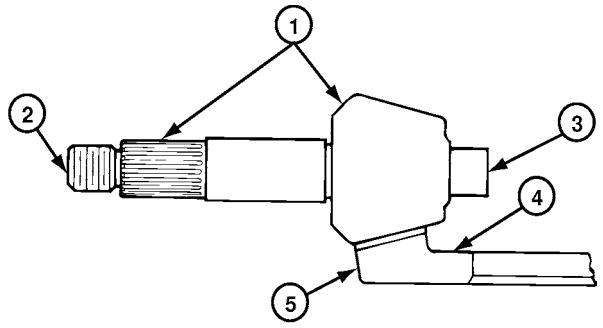
Gear Set Information (Drive Pinion and Ring Gear Marks)

NOTE

Read the following information before installing a new gear set in the carrier. Always check the gear set for correct marks to make sure the gears are a matched set.

The location of the marks are shown in* Figure 4.11*.

Figure 4.11



1 ALTERNATE LOCATIONS: PART NO., TOOTH COMBINATION NO., GEAR SET MATCH NO., PINION CONE VARIATION NO.

2 PART NO., TOOTH COMBINATION NO.

3 GEAR SET MATCH NO., PINION CONE VARIATION NO.

4 PART NO., TOOTH COMBINATION NO., GEAR SET MATCH NO.

5 PART NO., TOOTH COMBINATION NO., GEAR SET MATCH NO., PINION CONE VARIATION NO.

1. Part Number

a. Examples of gear set part numbers:

- Conventional ring gear, 36786.
- Conventional drive pinion, 36787.
- Generoid ring gear, 36786 K or 36786 K2.
- Generoid drive pinion, 36787 K or 36787 K2.

NOTE

The last digit in part numbers for Generoid gears is a letter or letter and number.

b. Location on Drive Pinion: End at threads.

c. Location on Ring Gear: Front face or outer diameter.

2. Tooth Combination Number

a. Example of a tooth combination number: 5-37.

NOTE

A 5-37 gear set has a 5-tooth drive pinion and a 37-tooth ring gear.

b. Location on Drive Pinion: End at threads.

c. Location on Ring Gear: Front face or outer diameter.

3. Gear Set Match Number

Meritor drive pinions and ring gears are available only as matched sets. Both gears of a set have a match number.

a. Example of a gear set match number: M29.

NOTE

A gear set match number has any combination of a number or letter and number.

b. Location on Drive Pinion: End of gear head.

c. Location on Ring Gear: Front face or outer diameter.

4. Pinion Cone Variation Number

NOTE

The pinion cone variation number is not used when checking for a matched gear set. The number is used when you adjust the depth of the pinion in the carrier. Refer to the procedure for adjusting the shim pack thickness under the pinion cage in "Adjusting Shim Pack Thickness for the Pinion Cage (Depth of Pinion)."

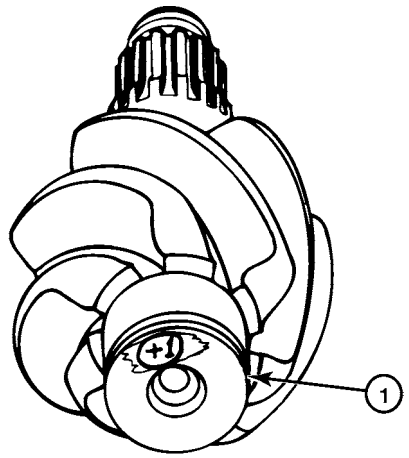
a. Examples — refer to **Figure 4.12**.

Pinion cone variation numbers:

- PC+3
- +2
- +0.01 mm
- PC–5
- –1
- –0.02 mm

b. Location on Gear Set: End of pinion gear head or outer diameter of ring gear.

Figure 4.12



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1 PINION CONE VARIATION NUMBER

Assemble the Drive Pinion, Bearings and Bearing Cage

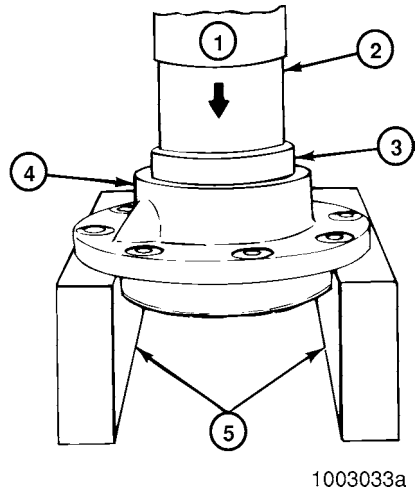
WARNINGS

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

⚠ Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

1. Place the bearing cage in a press. **Figure 5.1**.

Figure 5.1



1 PRESS
2 SLEEVE
3 BEARING CUP
4 CAGE
5 SUPPORTS

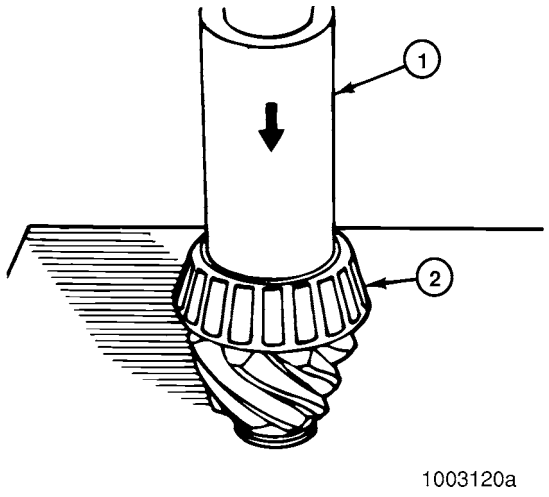
2. Support the bearing cage with metal or wood blocks.
3. Press the bearing cup into the bore of bearing cage until cup is flat against bottom of bore. Use a sleeve of the correct size to install bearing cup. **Figure 5.1**.

NOTE

Use the same procedure for both bearing cups.

4. Place the drive pinion in a press, gear head (teeth) toward the bottom. **Figure 5.2**.

Figure 5.2



1 SLEEVE
2 INNER BEARING CONE

5. Press the inner bearing cone on the shaft of the drive pinion until the cone is flat against the gear head. Use a sleeve of the correct size against the bearing inner race.

NOTE

Spigot bearings are usually fastened to the drive pinion with a snap ring. Some are fastened with a peening tool, and some are a two-piece bearing assembly with the inner race pressed on the nose of the pinion and the outer race pressed into its bore in the carrier. Use the following procedure to install the spigot bearing.

NOTE

The following procedure applies to all axles except:

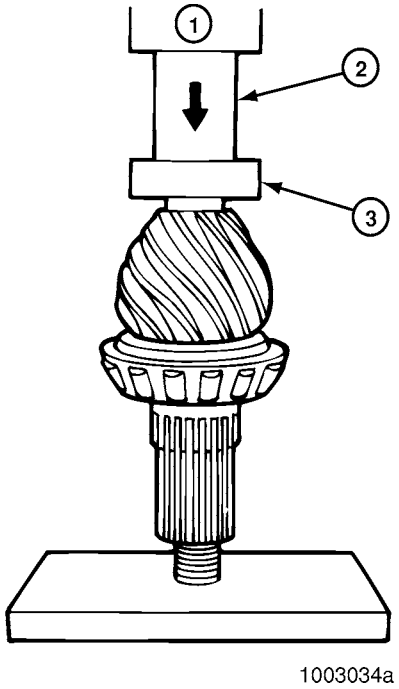
- ***Some 160 Series single axles may use snap rings.***
- ***Some 160 and 180 Series rear rear tandem axles may use snap rings.***

6. Installing the One-Piece Spigot Bearing on the Drive Pinion with Snap Ring

a. Place the drive pinion in a press, gear head (teeth) toward the top. **Figure 5.3**.

b. Press the spigot bearing on the end of drive pinion until the bearing is flat against the gear head. Use a sleeve of the correct size against the bearing inner race. **Figure 5.3**.

Figure 5.3



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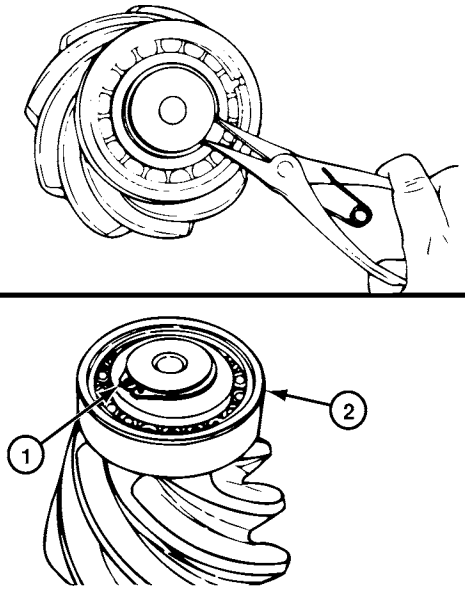
1 PRESS
2 SLEEVE
3 SPIGOT BEARING

c. Install the snap ring* into groove in end of drive pinion with snap ring pliers. **Figure 5.4**.

Figure 5.4



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1 SNAP RING
2 SPIGOT BEARING

NOTE

The following procedure applies to some 180 Series rear rear tandem axles with existing snap ring components.

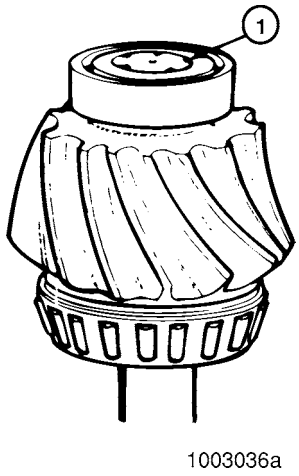
7. Staking the One-Piece Spigot Bearing on the Drive Pinion (Without Snap Ring)

Specification

- Apply 6,614 lb. (3,000 kg) force on a 0.375-inch (10 mm) ball.
- Stake the end of drive pinion at a minimum of five points. **Figure 5.5**.

*Some Meritor carriers do not have these described parts.

Figure 5.5



1 STAKING POINTS

When using a staking tool and press (**Figure 5.5**), calculate the force required on the tool as follows.

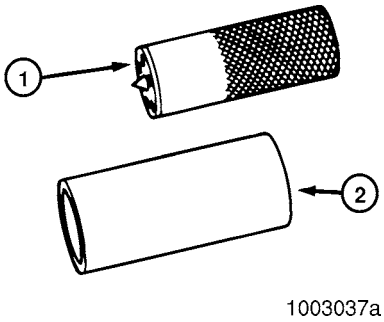
6,614 lb. (3,000 kg) x amount of balls in tool = pounds or kilograms

Example

6,614 lb. x 3 balls = 19,842 pounds

For information about the staking tool, contact your local Meritor representative. **Figure 5.6**.

Figure 5.6



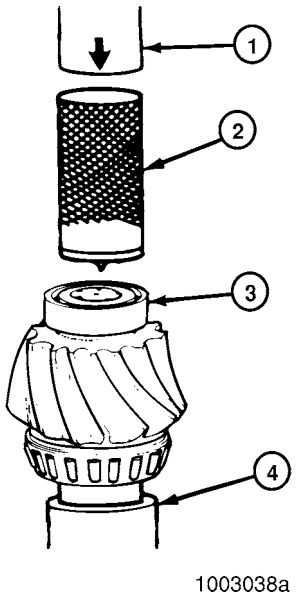
1 PUNCH
2 TUBE

a. Place the drive pinion and the tube of the staking tool in a press, spigot bearing toward the top. **Figure 5.7**.

b. Calculate the amount of force that will be required on the staking tool. Refer to specification and example calculation.

c. Place the punch of the staking tool over the end of the pinion and spigot bearing. Apply the required amount of force on the punch. **Figure 5.7**.

Figure 5.7



1 PRESS
2 INSTALL AND CENTER THE PUNCH ON THE END OF PINION
3 SPIGOT BEARING
4 PUT THE SHAFT OF PINION INTO TUBE

⚠ *CAUTION*

Do not align new points with grooves in end of drive pinion or in old points. If the new staked points are placed in the wrong areas, the spigot bearing will not be held correctly on the pinion shaft.

d. Rotate the punch as many times as required for a minimum of five points. Repeat step **c** for each point.

NOTE

If a three-ball stake tool is used, rotate the tool 180° (degrees).

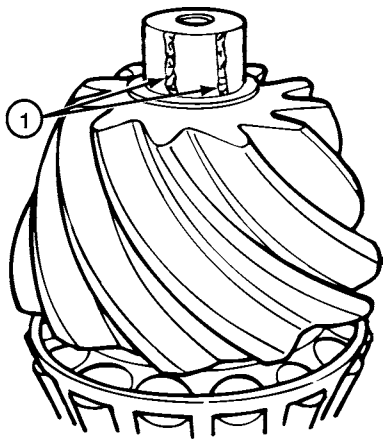
8. Installing and Staking the Two-Piece Spigot Bearing on the Drive Pinion

NOTES

- ***This procedure applies to some 160 Series single rear axles and rear rear tandem axles. These axles may also use a one-piece spigot bearing with a snap ring retainer.***
- ***The inner race of two-piece spigot bearings must be staked in place on RS and RR-160 series rear axles. Before you stake the pinion, you must heat the pinion stem to soften it.***
- ***Kent-Moore Kit J-39039 includes the staking tool, temperature indicating liquid, heating shield and plastigage needed for this job.***

a. Apply two stripes of temperature indicating liquid on the pinion stem from the top to the bottom. **Figure 5.8**. Apply a green stripe to indicate 400°F (205°C) and a blue stripe to indicate 500°F (260°C).

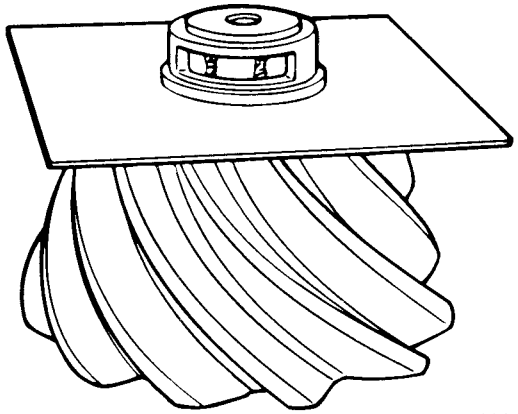
Figure 5.8



1 TEMPERATURE INDICATING LIQUID APPLICATION

b. Place the heating shield over the pinion stem so that you can see the temperature indicating liquid through the hole in the shield. **Figure 5.9**.

Figure 5.9



WARNING

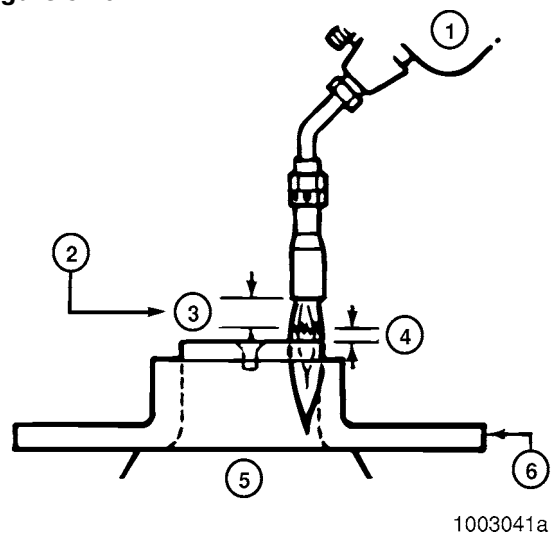
Always wear safe clothing, gloves and eye protection when working with a torch for heating parts to prevent serious personal injury during assembly.

CAUTION

Do not heat the pinion stem without the heat shield in place. Also, do not overheat the pinion stem or you will weaken the metal which can cause early failure. Correct heating will take approximately 25-35 seconds, depending on how hot the torch is.

c. Light and adjust the torch until the white part of the flame is approximately 1/4 inch long. Keep the white part of the flame approximately 1/8 inch from the top of the stem. **Figure 5.10**. Move the flame around the outer diameter of the top of the pinion stem. The green temperature indicating liquid will turn black before the blue liquid does. Heat the stem until the blue liquid turns black at a point in the middle of the window.

Figure 5.10



1	TORCH	4	1/8"
2	WHITE PART OF FLAME	5	PINION
3	1/4"	6	HEATING SHIELD

d. Remove the flame and the heat shield from the pinion. Let the pinion air cool for 10 minutes. Use a razor blade to remove the temperature indicating liquid.

⚠ *WARNING*

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

⚠ *CAUTION*

Do not press or directly strike the new inner race in step e or damage to the bearing will result.

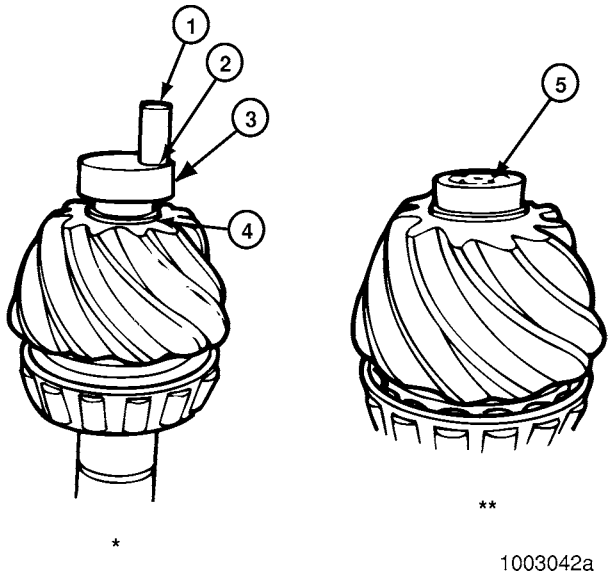
e. Use a press, if available, or a brass hammer to install the new inner race. Use the old inner race as a sleeve. The face is completely seated when you cannot fit a 0.002-inch feeler gauge between the race and the pinion shoulder.

NOTES

- ***To hold the races in place, use a staking tool, instead of the old race, to start the new race on the stem. The old race can be used to completely seat the new race.***
- ***In step f, you do not need to use the plastigage for every stake. Use the plastigage until you are sure you are hitting the punch with the correct amount of force.***

f. Place the staking tool over the bearing race. Cut a one inch piece from the green plastigage strip and place in between the punch and the staking tool. **Figure 5.11 — View A**.

Figure 5.11



1	PUNCH
2	PLASTIGAGE
3	STAKING TOOL
4	BEARING INNER RACE
5	STAKES
*	VIEW A
**	VIEW B

g. Strike the punch with a two-three pound brass hammer to upset the end of the pinion stem. Then, remove the strip and measure its thickness against the gauge on the wrapper that the strip came in. The strip must not be less than 0.003 inch thick. This thickness indicates that you are using enough force when you hit the punch. If the strip is too thin, then you must hit the punch harder so the stake will hold the race in place. Rotate the tool and repeat this procedure until there are six evenly spaced stake marks around the stem. **Figure 5.11 — View B**.

h. With a press or a soft mallet and sleeve, install the outer race and roller assembly into its bore in the carrier. Use a sleeve that is the same size as the outer race and press the bearing until it is squarely against the shoulder in the bottom of its bore.

9. Apply axle lubricant to the bearing cups and to the bearing cones in the cage.
10. Install the drive pinion into the bearing cage.
11. Install the bearing spacer or spacers on pinion shaft against the inner bearing cone. **Figure 5.12**.

NOTE

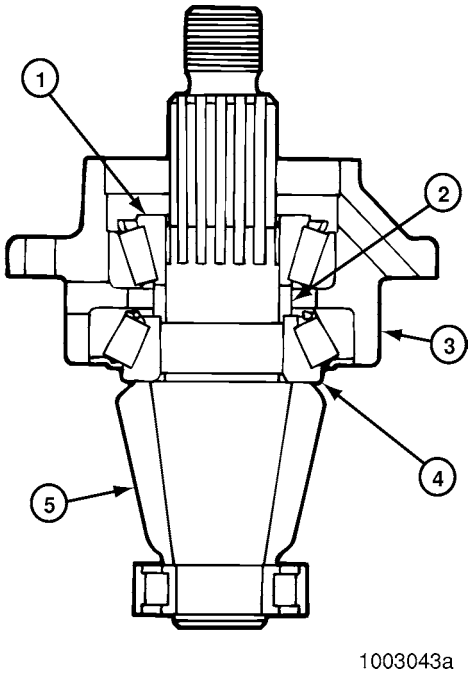
The spacer or spacers control the preload adjustment of the drive pinion bearings.

12. Install the outer bearing cone on pinion shaft against the spacer. **Figure 5.12**.

NOTE

DO NOT install pinion seal in bearing cage. Continue with adjusting preload of pinion bearings.

Figure 5.12



1 OUTER BEARING CONE
2 BEARING SPACER
3 BEARING CAGE
4 INNER BEARING CONE
5 DRIVE PINION

Adjusting Preload of Pinion Bearings

Specifications

- New pinion bearings — torque
  — 5 to 45 lb-in (0.56-5.08 N•m) (T)
- Used pinion bearing in good condition — torque
  — 10 to 30 lb-in (1.13-3.39 N•m) (T)

Press Method

NOTES

- ***If a press is not available, or the press does not have a pressure gauge, use the yoke or flange method to adjust pinion bearing preload. Refer to "Yoke or Flange Method."***
- ***Do not read starting torque. Read only the torque value after the cage starts to rotate. Starting torque will give a false reading.***

a. Place the drive pinion and cage assembly in a press, gear head (teeth) toward the bottom.

b. Install a sleeve of the correct size against the inner race of the outer bearing **Figure 5.13**.

c. Apply and hold the correct amount pressure to the pinion bearings. Refer to **Table B**. As pressure is applied rotate the bearing cage several times so that bearings make normal contact.

Table B

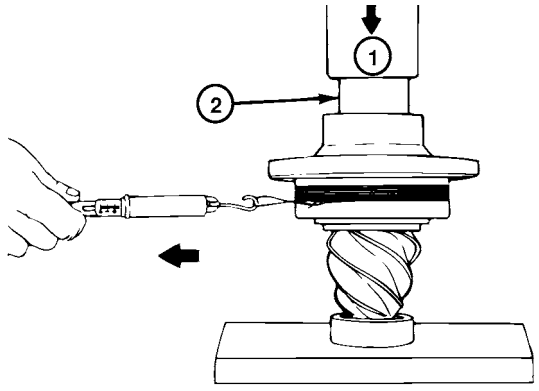
Thread Size of Pinion Shaft	Press Pressure Needed on Bearings for Correct Preload.		Torque Value Needed on Pinion Nut for Correct Bearing Preload.	
	pounds/tons	(kg/metric tons)	lb-ft	(N•m)
7/8"-20	22,000/1	(9979/10)	200-275	(271-373)
1"-20	30,000/15	(13608/13.6)	300-400	(407-542)
1 1/4"-12	54,000/27	(24494/24.5)	700-900	(949-1220)
1 1/4"-18	54,000/27	(24494/24.5)	700-900	(949-1220)
1 1/2"-12	54,000/27	(24494/24.5)	800-1100	(1085-1491)
1 1/2"-18	54,000/27	(24494/24.5)	800-1100	(1085-1491)
1 3/4"-12	50,000/25	(22680/22.7)	900-1200	(1220-1627)
2"-12	50,000/25	(22680/22.7)	1200-1500	(1627-2034)

d. While pressure is held against the assembly, wind a cord around the bearing cage several times.

e. Attach a spring scale to the end of the cord.

f. Pull the cord with scale on a horizontal line. As the bearing cage rotates, read the value indicated on scale. Write down and record the reading. **Figure 5.13**.

Figure 5.13



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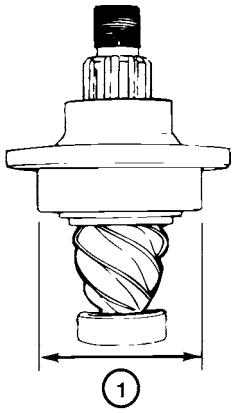
1 PRESS
2 SLEEVE

g. Measure the diameter of bearing cage where the cord was wound. Measure in inches or centimeters. **Figure 5.14**.

h. Divide the dimension in half to get the radius. Write down and record the radius dimension.

Figure 5.14



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1 MEASURE DIAMETER OF CAGE

i. Use the following procedure to calculate the bearing preload (torque).

- Pounds Pulled x Radius (inches) = lb-in Preload

  — Preload x 0.113 = N•m Preload

- Kilograms Pulled x Radius (cm) = kg-cm lb-in Preload

  — Preload x 0.098 = N•m Preload

or

Examples

- Reading from spring scale = 7.5 pounds (3.4 kg)
- Diameter of bearing cage = 6.62 inches (16.8 cm)
- Radius of bearing cage = 3.31 inches (8.4 cm)

  7.5 lb. x 3.31 in. = 24.8 in-lb Preload

  Preload x 0.113 = 2.8 N•m Preload

or

3.4 kg x 8.4 cm = 28.6 kg-cm Preload

Preload x 0.098 = 2.8 N•m Preload

j. If the preload (torque) of pinion bearings is not within specifications, do the following procedure then repeat steps **a** through **i**.

To increase preload, install a thinner bearing spacer. To decrease preload, install a thicker bearing spacer.

k. Check the bearing preload with the drive pinion and cage assembly installed in the carrier. Follow the procedures to adjust preload of pinion bearings, yoke or flange method.

Yoke or Flange Method

WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

CAUTION

Do not install tight fit yokes or flanges on shafts using a hammer or mallet. A hammer or mallet will damage the yoke or flange.

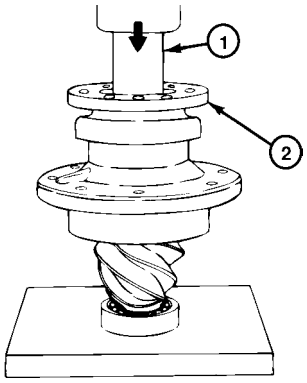
NOTE

Use a press to install the yoke or flange. **Figure 5.15.**

a. Install the input yoke or flange, nut and washer* on the drive pinion. The yoke or flange ***must*** be seated against the outer bearing.

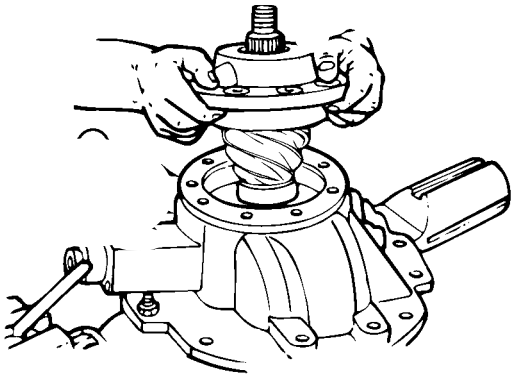
b. Temporarily install the drive pinion and cage assembly in the carrier. Do not install shims under the bearing cage. **Figure 5.16**.

Figure 5.15



1 PRESS
2 INPUT FLANGE SHOWN

Figure 5.16

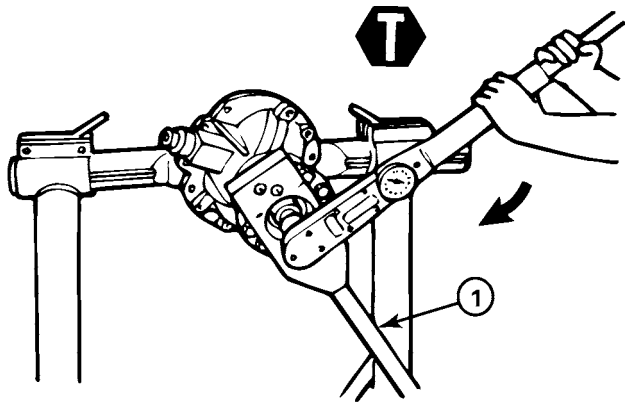


*Some Meritor carriers do not have these described parts.

c. Install the bearing cage to carrier capscrews. Washers are not required at this time. Tighten the capscrews by hand until snug.

d. Fasten a yoke or flange bar to the input yoke or flange. The bar will hold the drive pinion in position when the nut is tightened. **Figure 5.17**.

Figure 5.17



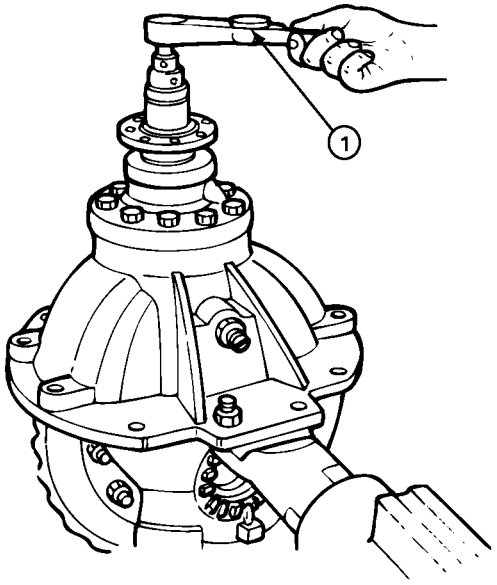
1 FLANGE BAR SHOWN

e. Tighten the nut on drive pinion to the correct torque value. **Figure 5.17**. Refer to **Table B**.

f. Remove the yoke or flange bar.

g. Attach a torque wrench on the drive pinion nut. Rotate the drive pinion and read the value indicated on torque wrench. **Figure 5.18**.

Figure 5.18



1 READ TORQUE VALUE

h. If the preload (torque) of pinion bearings is not within specifications, remove the pinion and cage assembly from carrier. Do the following procedure then repeat steps **a** through **g**.

- To **increase** preload, install a thinner bearing spacer.
- To **decrease** preload, install a thicker bearing spacer.

13. After adjusting preload of pinion bearings, remove the drive pinion and bearing cage from carrier. Follow steps 1-5 in "Remove the Drive Pinion and Bearing Cage from Carrier."

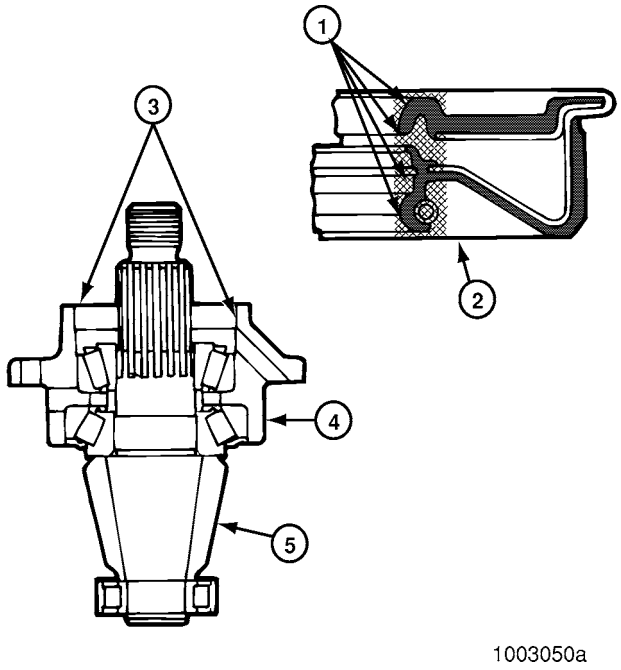
14. Install a new triple-lip seal as follows.

⚠ *CAUTION*

Make sure that the seal lips are clean and free from dirt and particles that will cause a leak between the yoke and the seal.

a. Apply the same lubricant used in the axle housing to the outer surface of the seal and the seal bore in the bearing cage. **Figure 5.19**.

Figure 5.19



1 APPLY GREASE
2 TRIPLE-LIP (MAIN) SEAL
3 APPLY LUBRICANT TO SEAL BORE
4 BEARING CAGE
5 DRIVE PINION

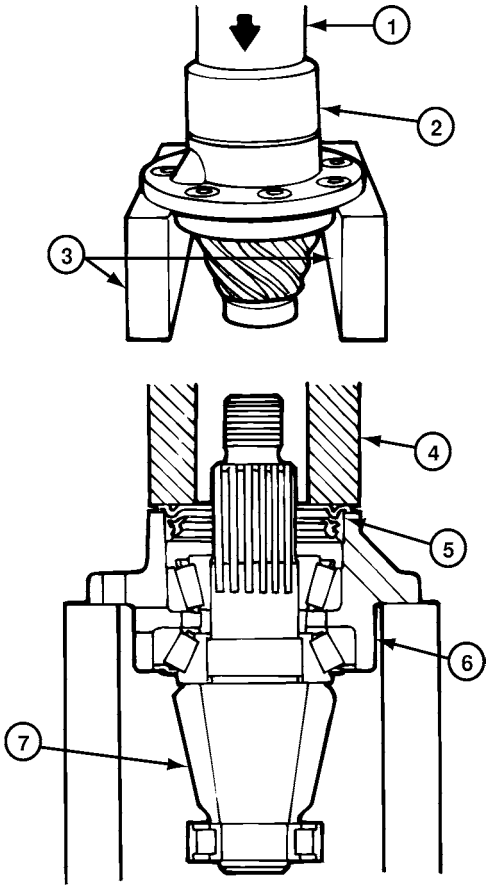
b. Place the drive pinion and cage assembly in a press, seal bore toward the top.

NOTE

If a press is not available, use a mallet and the sleeve or driver to install the seal. **Figure 5.21.**

c. Press the seal into bearing cage until flange of seal is flat against the top of bearing cage. Use a sleeve or seal driver of the correct size that fits against the metal flange of seal. The diameter of the sleeve or driver ***must*** be larger than the diameter of the flange. **Figure 5.20**.

Figure 5.20



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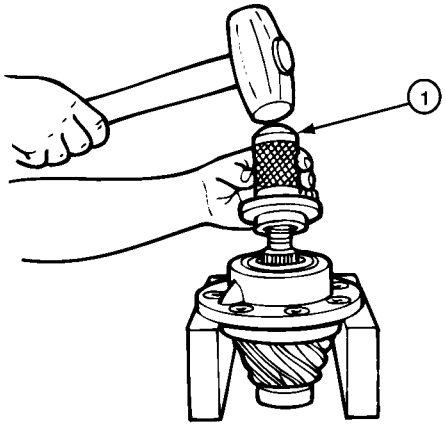
1 PRESS
2 SLEEVE
3 SUPPORTS
4 SLEEVE
5 SEAL
6 BEARING CAGE
7 DRIVE PINION

Figure 5.21



1003052a

1 SEAL DRIVER

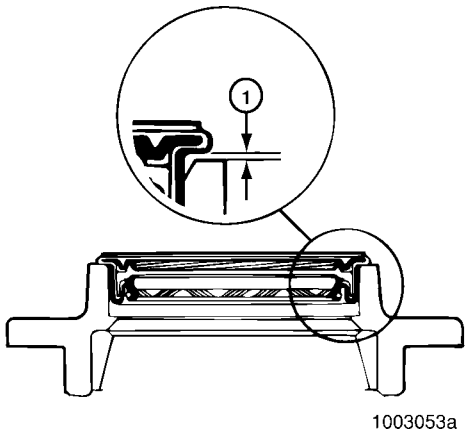
WARNING

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

d. After the triple-lip seal is installed, a gap of approximately 0.015 to 0.030 inch (0.38-0.76 mm) between the flange and bearing cage is normal. **Figure 5.22**.

Check the gap with a feeler gauge at several points around the seal. The gap must be within 0.015 to 0.030 inch (0.38-0.76 mm). The difference between the largest and smallest gap measurement ***must not*** exceed 0.010 inch (0.0254 mm).

Figure 5.22



1003053a

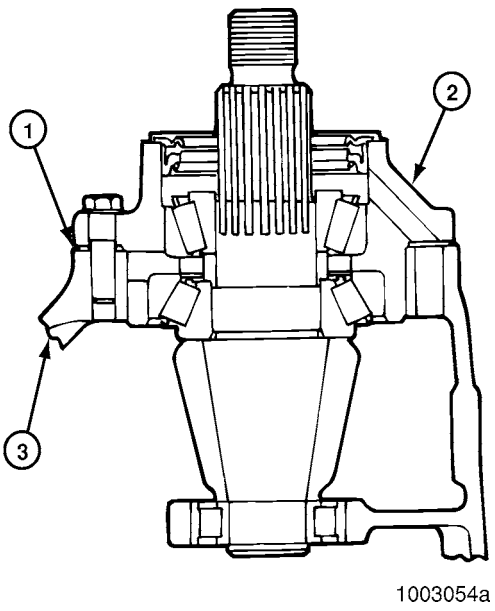
1 0.015-0.030" (0.38-0.76 MM)
SHOWN WITHOUT BEARINGS AND PINION

Adjusting Shim Pack Thickness for the Pinion Cage (Depth of Pinion)

NOTE

Use this procedure if a new drive pinion and ring gear set is installed, or if the depth of the drive pinion has to be adjusted. **Figure 5.23.**

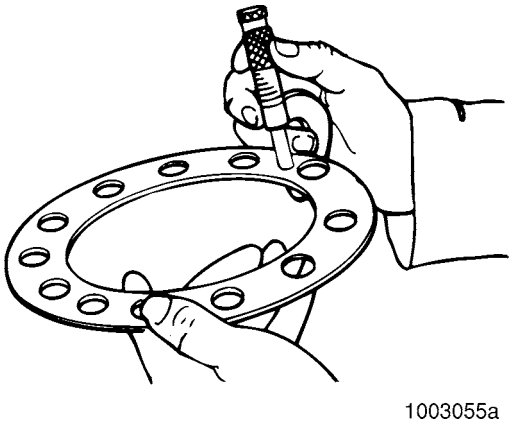
Figure 5.23



1 SHIM PACK CONTROLS DEPTH OF PINION
2 BEARING CAGE
3 CARRIER

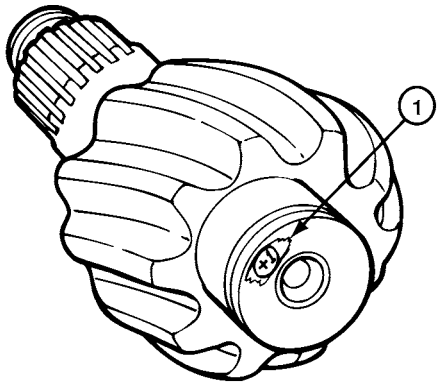
1. Measure the thickness of the old shim pack that was removed from under the pinion cage with a micrometer. Record the measurement for use later. **Figure 5.24.**

Figure 5.24



2. Look at the pinion cone (PC) variation number on the old drive pinion that is being replaced. Refer to Gear Set Information at the end of Section 4 for examples and location of the number. Record the number for later use. If (PC) variation number cannot be located, assemble gear set with shim pack thickness found in step 1. **Figure 5.25.**

Figure 5.25



1 PINION CONE VARIATION NUMBER

NOTE

The pinion cone number can be either 100ths of a millimeter or 1,000ths of an inch. Refer to the following examples:

PC +3, PC –3, +3 or –3 = 0.003 inch

PC +.03, PC 0.03 mm, +0.03 mm or –0.03 = 0.03 mm

To change millimeters to inches — millimeters x 0.039

To change inches to millimeters — inches x 25.40

3. If the old pinion cone number is a plus (+) number, subtract the number from the old shim pack thickness that was measured in step 2.
4. If the old pinion cone number is a minus (–) number, add the number to the old shim pack thickness that was measured in step 2.

NOTE

The value calculated in step 3 or 4 is the thickness of the standard shim pack, without a variation.

5. Look at the pinion cone (PC) variation number on the new drive pinion that will be installed. Record the number for later use.
6. If the new pinion cone number is a plus (+) number, add the number to the standard shim pack thickness that was calculated in step 3 or 4.
7. If the new pinion cone number is a minus (–) number, subtract the number from the standard shim pack thickness that was calculated in step 3 or 4.

NOTE

The value calculated in step 6 or 7 is the thickness of the new shim pack that will be installed. Refer to the following examples, **Table C*.***

8. Install the drive pinion bearing cage and new shim pack into the carrier.

Table C

Examples	Inches	mm
1. Old Shim Pack Thickness Old PC Number, PC +2 inches (+0.05 mm) Standard Shim Pack Thickness New PC Number, PC +5 inches (+0.13 mm) New Shim Pack Thickness	0.030 – 0.002 = 0.028 + 0.005 = 0.033	0.760 – 0.050 = 0.710 + 0.130 = 0.840
2. Old Shim Pack Thickness Old PC Number, PC –2 inches (–0.05 mm) Standard Shim Pack Thickness New PC Number, PC +5 inches (+0.13 mm) New Shim Pack Thickness	0.030 + 0.002 = 0.032 + 0.005 = 0.037	0.760 + 0.050 = 0.810 + 0.130 = 0.940
3. Old Shim Pack Thickness Old PC Number, PC +2 inches (+0.05 mm) Standard Shim Pack Thickness New PC Number, PC –5 inches (–0.13 mm) New Shim Pack Thickness	0.030 – 0.002 = 0.028 – 0.005 = 0.023	0.760 – 0.050 = 0.710 – 0.130 = 0.580
4. Old Shim Pack Thickness Old PC Number, PC –2 inches (–0.05 mm) Standard Shim Pack Thickness New PC Number, PC –5 inches (–0.13 mm) New Shim Pack Thickness	0.030 + 0.002 = 0.032 – 0.005 = 0.027	0.760 + 0.050 = 0.810 – 0.130 = 0.680

NOTE

Drive pinions and ring gears MUST be replaced as fully matched sets.

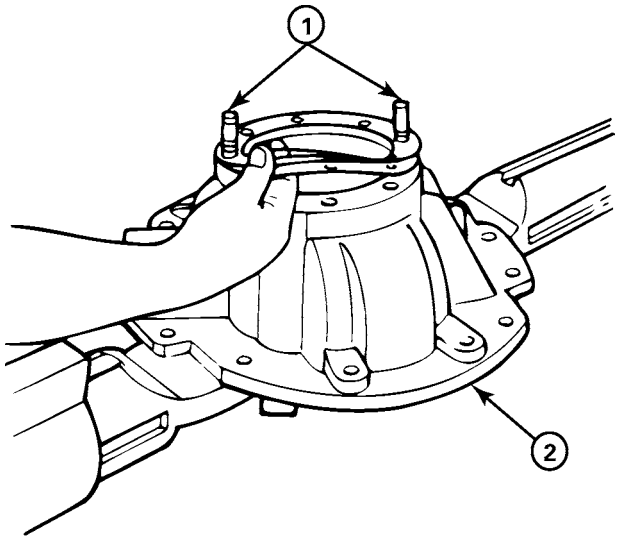
Installing the Drive Pinion, Bearing Cage and Shim Pack into the Carrier

NOTE

If a new drive pinion and ring gear set is installed, or if the depth of the drive pinion has to be adjusted, calculate the thickness of the shim pack. Refer to the procedure "Adjusting Shim Pack Thickness for the Pinion Cage (Depth of Pinion)."

1. Select the correct shim pack between the bearing cage and carrier. **Figure 5.26**.
2. Apply Loctite® 518 Gasket Eliminator to face of carrier.
3. Align the oil slots in the shims with oil slots in the bearing cage and carrier. The use of guide studs will help align the shims. **Figure 5.26**.

Figure 5.26



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1 GUIDE STUDS
2 CARRIER

NOTE

If the pack is made from different thickness shims, install the thinnest shims on both sides of the pack for maximum sealing.

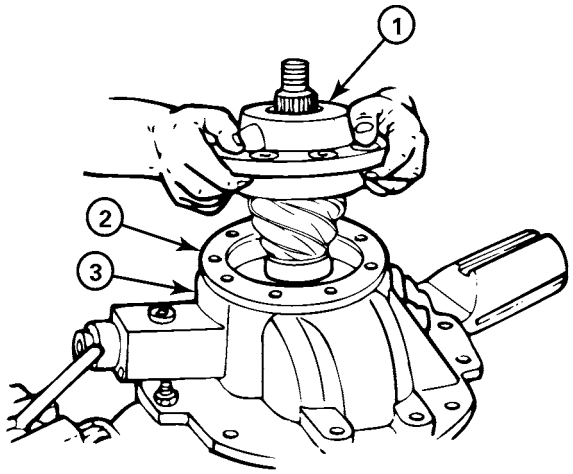
4. Apply Loctite® 518 Gasket Eliminator to top of shim pack.

WARNING

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

5. Install the drive pinion and bearing cage into the carrier. If necessary, use a rubber, plastic or leather mallet to hit the assembly into position. **Figure 5.27**.

Figure 5.27



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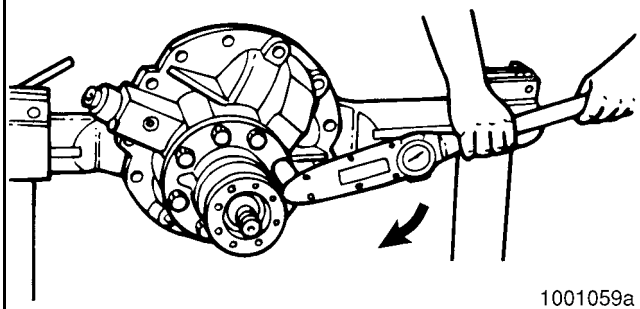
1 DRIVE PINION AND BEARING CAGE
2 SHIMS
3 CARRIER

6. Install the bearing cage to carrier capscrews and washers. Tighten capscrews to correct torque value. Refer to **Table J**. **Figure 5.28**.

Figure 5.28



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Installing Tight Fit Yokes and POSE™ Seal

CAUTIONS

⚠ ***Make sure that the seal lips are clean and free from dirt and particles that will cause a leak between the yoke and the seal.***

⚠ ***Do not install tight fit yokes on shafts using a hammer or mallet. Using a hammer or mallet can damage the yoke.***

⚠ ***Make sure that the seal lips are clean and free from dirt and particles that can cause a leak between the yoke and the POSE™ seal.***

NOTE

DO NOT install POSE™ seal all the way against the yoke shoulder. This seal is designed to position itself as yoke is installed.

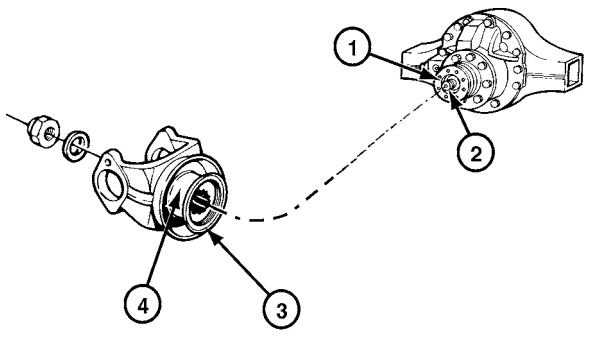
1. Apply axle lubricant on the yoke seal.
2. Check all surfaces of the yoke hub for damage.

   If carrier uses a POSE™ seal element, install a new POSE™ seal as follows:

   a. Lightly lubricate yoke journal with same lubricant used in the axle housing.

   b. Partially install the POSE™ seal onto the yoke to 1/4 inch-1/2 inch as shown in **Figure 5.29**.

Figure 5.29



1 LUBRICATE TRIPLE-LIP (MAIN) SEAL
2 INPUT SHAFT (PINION)
3 POSE™ SEAL (0.25"-0.50" ONTO HUB)
4 CHECK YOKE HUB

   c. Before installing the yoke onto the drive pinion, lubricate the yoke again with the same lubricant used in the axle housing.

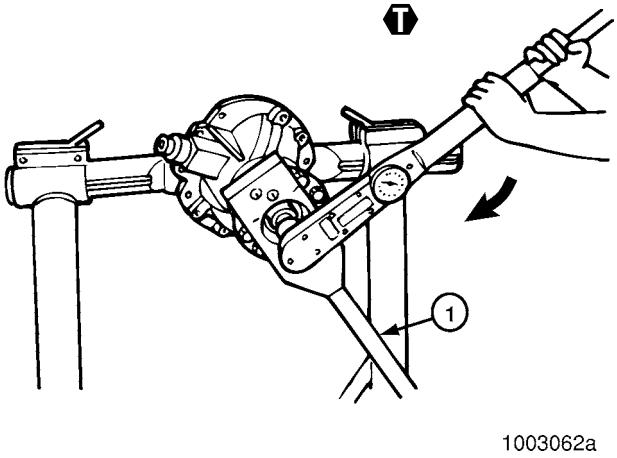
3. Slide the yoke over the input shaft pinion. Align the yoke splines with the shaft splines.

⚠ *CAUTION*

Do not use a hammer or mallet to install the yoke to the input pinion shaft. Using a hammer or mallet can damage the yoke or flange.

4. Install the input yoke flange onto the drive pinion shaft. The yoke or flange must be fully seated against the outer differential bearing ***before*** the nut is torqued to specifications.
5. Install the drive pinion nut and washer* on the input pinion shaft and against the yoke collar. Tighten the nut against yoke collar to torque specifications. **Figure 5.30**. Refer to **Table J**.

Figure 5.30



1 USE FLANGE OR YOKE BAR

*Some Meritor carriers do not have these described parts.

Installing Any Type Yoke with a Unitized Pinion Seal (UPS)

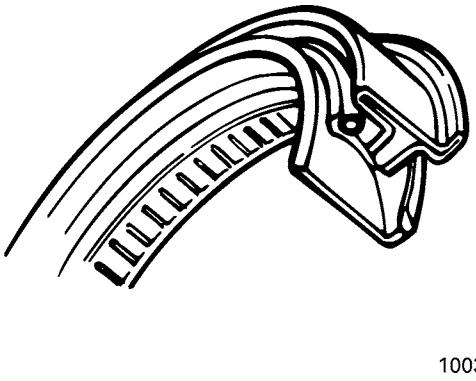
CAUTIONS

⚠ ***Once the yoke is partially or fully installed and then removed for any reason, the unitized pinion seal will be damaged and unusable. If the yoke and unitized pinion seal are removed after partial or full installation, remove and discard the original unitized pinion seal and replace it with another new unitized pinion seal.***

⚠ ***If the inner sleeve of the seal is removed, the seal is not usable. A new seal is required. This will occur if a yoke is installed into the seal and then removed.***

1. Remove the replacement unitized seal from the package. **Figure 5.31**.
2. Select the correct seal driver from **Table D**. Each seal driver is designed to correctly install a specific diameter seal. To determine the yoke seal diameter, measure the yoke journal. Refer to **Table D**.
3. Position the seal on the driver.

Figure 5.31



UNITIZED SEAL

Table D — Unitized Pinion Seals and Seal Drivers

Single Models	Tandem Models	Meritor Unitized Pinion Seal	Seal Installation Location	Meritor Seal Driver	Yoke Seal Diameter Inches
RS-17-145 RS-19-145 RS-21-145 RS-21-160 RS-23-160 /A RS-23-161 /A RS-25-160 /A RS-23-186 RS-26-185 RS-30-185	RT-34-144 /P RT-34-145 /P RT-40-145 /A /P RT-40-149 /A /P RT-44-145 /P RT-40-160 /A /P RT-40-169 /A /P RT-46-160 /A /P RT-46-169 /A /P RT-46-164EH /P RT-46-16HEH /P RT-50-160 /P RT-52-185* RT-58-185*	A-1205-R-2592	Tandem Forward Input (145 models from 11/93 to present)	R4422402	3.250 3.255
		A-1205-P-2590	Tandem Forward Output (Tandem Forward Input 145 models before 11/93 with seal A-1205-F-2424)	R4422401	3.000 3.005
		A-1205-N-2588	Tandem and Single Rear Input (145 models)	R4422401	3.000 3.005
		A-1205-Q-2591	Tandem and Single Rear Input (160/164/185 models)	R4422402	3.250 3.255
To obtain Meritor seal driver KIT 4454, call 888-725-9355.					

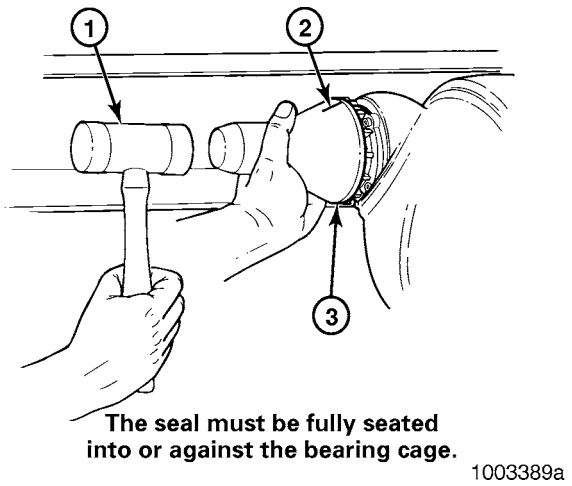
* Forward and rear input only.

CAUTION

Use a rubber mallet to install the seal. Do not use a steel, brass or plastic hammer to install the seal. Using a steel, brass or plastic hammer can damage the seal and driver tool.

4. Use a rubber mallet to drive the seal into or against the bearing cage. The seal must fully seat into or against the bearing cage. **Figure 5.32**.

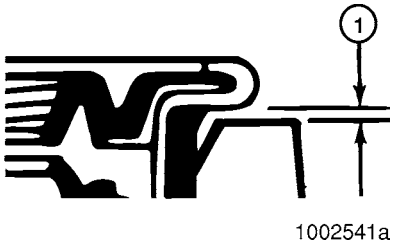
Figure 5.32



1 RUBBER MALLET
2 REFERENCE MARK
3 SEAL DRIVER R4422401

5. Use a 0.010-inch shim to check for clearance between the entire seal flange circumference and the bearing cage.
   - **If the 0.010-inch shim slides between the seal flange and bearing cage:** Correctly position the seal driver and drive the seal into the bore until the 0.010-inch shim cannot slide between the seal flange and bearing cage at any point around the seal flange. **Figure 5.33**.

Figure 5.33 MEASURING SEAL GAP



1 0.010 INCH (0.254 MM)

Clean, Inspect and Install the Yoke After Installing a Unitized Pinion Seal

WARNING

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures:

- ***Wear safe eye protection.***
- ***Wear clothing that protects your skin.***
- ***Work in a well-ventilated area.***
- ***Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.***
- ***You must use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.***

1. Clean the ground and polished surface of the yoke journal using a clean shop towel and a safe cleaning solvent. Do not use gasoline, abrasive cleaners, towels, or scrubbers to clean the yoke. Do not attempt to polish the yoke.

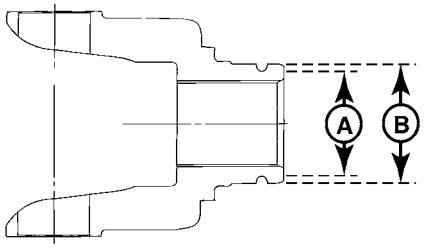
NOTE

The unitized seal features a rubber inner sleeve that is designed to seal and rotate with the yoke. This feature allows you to reuse a yoke with minor grooves.

2. Inspect the yoke seal surface for grooves.
   - **If you find grooves on the yoke:** Use calipers to measure the groove diameters. If any groove diameter measures less than the dimensions shown in **Figure 5.34**, replace the yoke.

Figure 5.34

YOKE SEAL DIAMETER	MINIMUM YOKE DIAMETER AT GROOVE (INCHES)
3.000/3.005"	2.990"
3.250/3.255"	3.240"



A MINIMUM GROOVE DEPTH — DIAMETER
B YOKE SEAL DIAMETER

CAUTIONS

⚠ ***Do not install a POSE™ seal after you install a unitized pinion seal. The use of a POSE™ seal will prevent correct seating of the unitized pinion seal on the yoke and can result in lubricant leakage at the seal. POSE™ seal installation is recommended only for triple lip and other previous design seals.***

⚠ ***Do not use thin metal wear sleeves to refresh the yoke surface. Wear sleeves pressed onto the yoke can prevent correct seating of the pinion seal, damage the pinion seal assembly and can cause the seal to leak.***

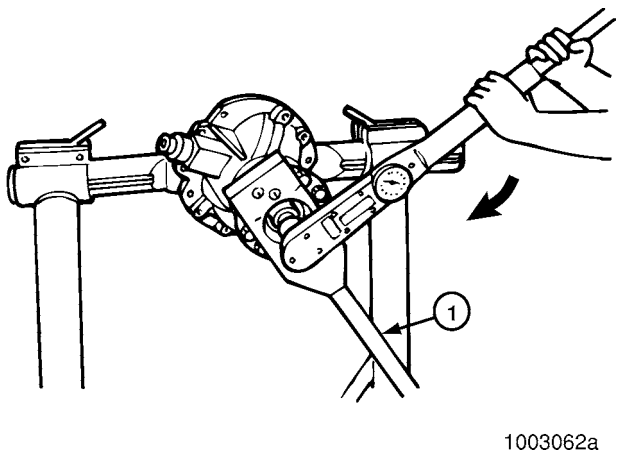
3. Before you install the yoke, lightly lubricate or coat the yoke seal journal with axle oil.
4. Align the yoke splines with the shaft splines. Slide the yoke over the shaft spline.

⚠ *CAUTION*

Do not use a hammer or mallet to install the yoke to the input pinion shaft. Using a hammer or mallet can damage the yoke or flange.

5. Install the input yoke flange onto the drive pinion shaft. The yoke or flange must be fully seated against the outer differential bearing ***before*** the nut is torqued to specifications.
6. Install the drive pinion nut (and washer if required) on the input pinion shaft and against the yoke collar. Tighten the nut against yoke collar to torque specifications. **Figure 5.35**. Refer to **Table J**.

Figure 5.35



1 USE FLANGE OR YOKE BAR

Assemble the Main Differential and Ring Gear Assembly

⚠ CAUTION

Do not press a cold ring gear on the flange case half. A cold ring gear will damage the case half because of the tight fit. Metal particles between the parts will cause gear runout that exceeds the Meritor specification of 0.008 inch (0.2 mm).

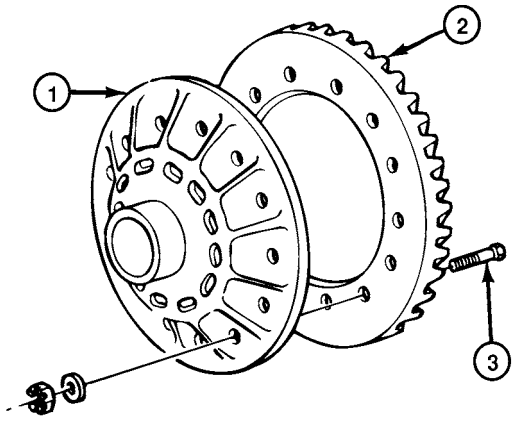
1. Expand the ring gear by heating the gear in a tank of water to a temperature of 160°F to 180°F (71°C-82°C) for 10 to 15 minutes.

⚠ WARNING

Wear safe clothing and gloves for protection from injury when working with the hot ring gear.

2. Safely lift the ring gear from the tank of water using a lifting tool.
3. Install the ring gear on the flange case half immediately after the gear is heated. If the ring gear does not fit easily on the case half, heat the gear again. Repeat step 1.
4. Align fastener holes of the ring gear and flange case half. Rotate the ring gear as needed.
5. If rivets* were used to hold the ring gear to the flange case half, replace them with bolts, nuts and washers.
6. Install the bolts*, nuts* and washers* that hold the ring gear to the flange case half. Install the bolts from the gear side of the assembly. The bolt heads ***must*** be against the ring gear. **Figure 5.36**.

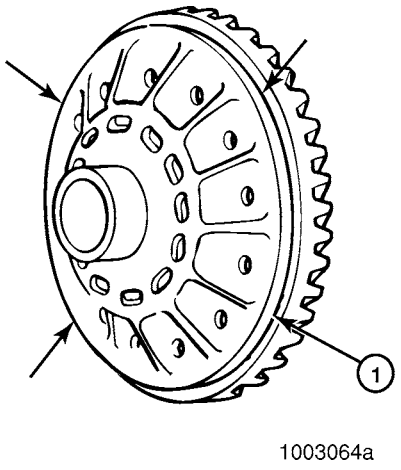
Figure 5.36



1 FLANGE CASE HALF
2 RING GEAR
3 BOLT HEAD AGAINST GEAR

7. Tighten the bolts* and nuts* to the correct torque value. Refer to **Table J**.
   a. After the bolts are installed, check for gaps between the back surface of the ring gear and the case flange. Use an 0.08 mm (0.003 inch) feeler gauge and check at four points around the assembly. **Figure 5.37**.
   b. Check the flange case half and ring gear for the problem that causes the gap. Repair or replace parts.
   c. After the parts are repaired or replaced, assemble the ring gear on the flange case half. Repeat the procedure in "Installing Tight Fit Yokes and POSE™ Seal," and steps **a** through **c**.

Figure 5.37

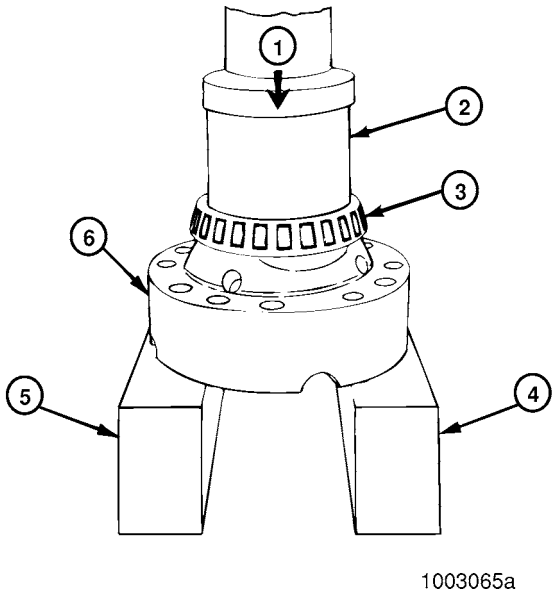


1 CHECK FOR 0.003" GAP AT FOUR LOCATIONS

*Some Meritor carriers do not have these described parts.

8. Install the bearing cones on both of the case halves. Use a press and sleeve of the correct size. **Figure 5.38**.

Figure 5.38



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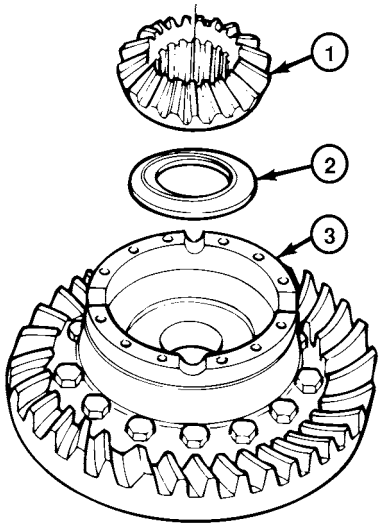
1 PRESS
2 SLEEVE
3 BEARING CONE
4 SUPPORT
5 SUPPORT
6 CASE HALF

9. Apply axle lubricant on the inside surfaces of both case halves, spider (cross), thrust washers, side gears and differential pinions.
10. Place the flange case half on a bench, ring gear teeth toward top.
11. Install one thrust washer and side gear into the flange case half. **Figure 5.39**.

Figure 5.39



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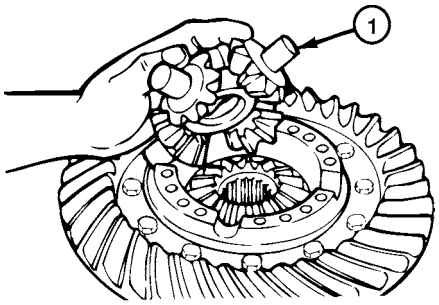
1 SIDE GEAR
2 THRUST WASHER
3 FLANGE CASE HALF

CAUTION

The side gears in some carrier models have hubs of different lengths. Install the correct length side gear into the flange case half.

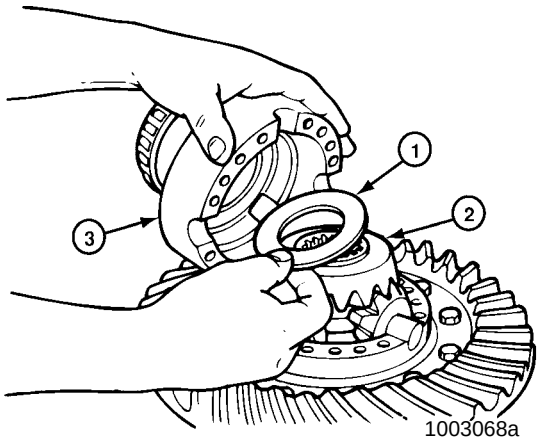
12. Install the spider (cross), differential pinions and thrust washers into the flange case half. **Figure 5.40**.
13. Install the second side gear and thrust washer over spider and differential pinions. **Figure 5.41**.

Figure 5.40



1 SPIDER, PINION AND THRUST WASHERS

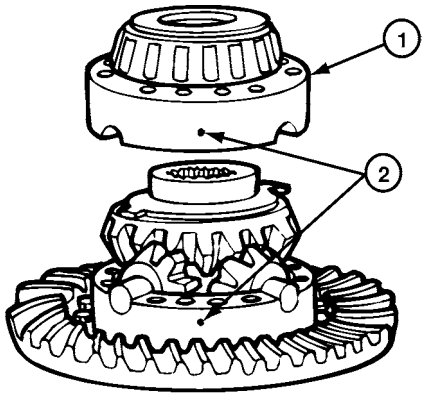
Figure 5.41



1 THRUST WASHER
2 SIDE GEAR
3 PLAIN CASE HALF

14. Place the plain half of the differential case over the flange half and gears. Rotate the plain half as needed to align the match marks. **Figure 5.41** and **Figure 5.42**.

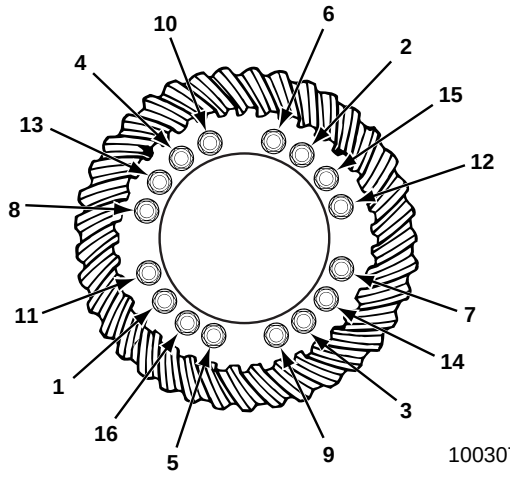
Figure 5.42



1 PLAIN CASE HALF
2 MATCH MARKS

15. Install Dri-Loc fasteners into the case halves. Refer to "General Information" and the following steps **a** and **b**.
    a. Install four capscrews* and washers* or bolts*, nuts* and washers* into the case halves. The distance between the fasteners ***must*** be equal. Tighten the fasteners to the correct torque value in a progressive criss-cross pattern opposite each other. Refer to **Figure 5.43** and **Table J**.
    b. Install the other fasteners into the case halves. Tighten the fasteners to the correct torque value. Refer to **Table J**.
16. Check the rotating resistance of the differential gears. Use the following procedure.

Figure 5.43



*Some Meritor carriers do not have these described parts.

Rotating Resistance Check of Differential Gears

Specification

- 50 lb-ft (67.8 N•m) maximum torque applied to one side gear. T

NOTE

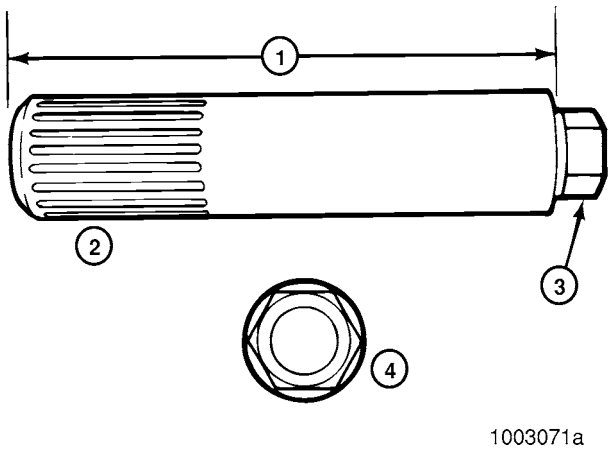
***Make a tool for checking the rotating resistance of the differential gears. The tool can be made from an axle shaft that matches the spline size of the differential side gear. Refer to* Figure 5.44.**

a. Install soft metal covers over vise jaws to protect the ring gear. **Figure 5.45**.

b. Place the differential and ring gear assembly in the vise.

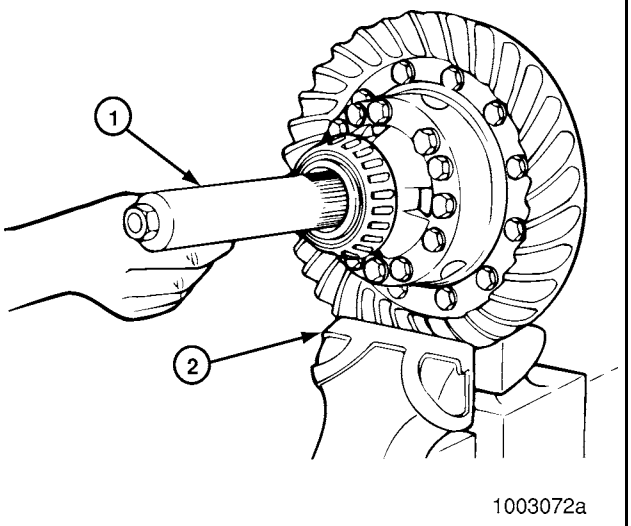
c. Install the tool into the differential until the splines of the tool and one side gear are engaged. **Figure 5.45**.

Figure 5.44



1 APPROXIMATELY 12 INCHES (304.8 MM)
2 SIDE VIEW
3 WELD NUT TO END OF SHAFT
4 END VIEW

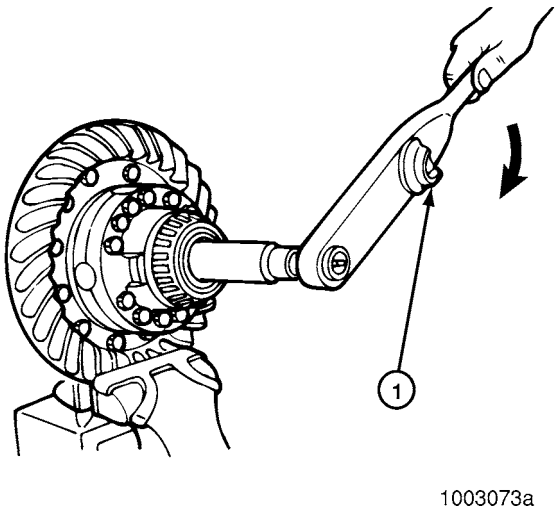
Figure 5.45



1 TOOL FOR CHECKING RESISTANCE
2 SOFT METAL COVER

d. Attach a torque wrench to the nut of the tool and rotate the differential gears. As the differential gears rotate, read the value indicated on the torque wrench. **Figure 5.46**.

Figure 5.46



1 READ TORQUE VALUE

e. If the torque value exceeds the specification, disassemble the differential gears from the case halves.

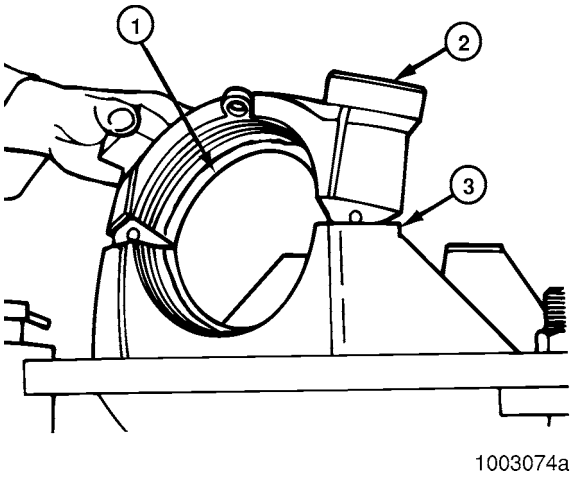
f. Check the case halves, spider, gears and thrust washers for the problem that causes the torque value to exceed the specification. Repair or replace parts.

After the parts are repaired or replaced, assemble the parts and repeat steps **a** through **f**.

Install the Differential and Ring Gear Assembly

1. Clean and dry the bearing cups and bores of the carrier legs and bearing caps.
2. Apply axle lubricant on the inner diameter of the bearing cups and on both bearing cones that are assembled on the case halves.
3. Apply Meritor Adhesive into the bearing bores of the carrier legs and bearing caps. Make certain not to allow adhesive to contact adjusting ring threads. Refer to "General Information." **Figure 5.47**.

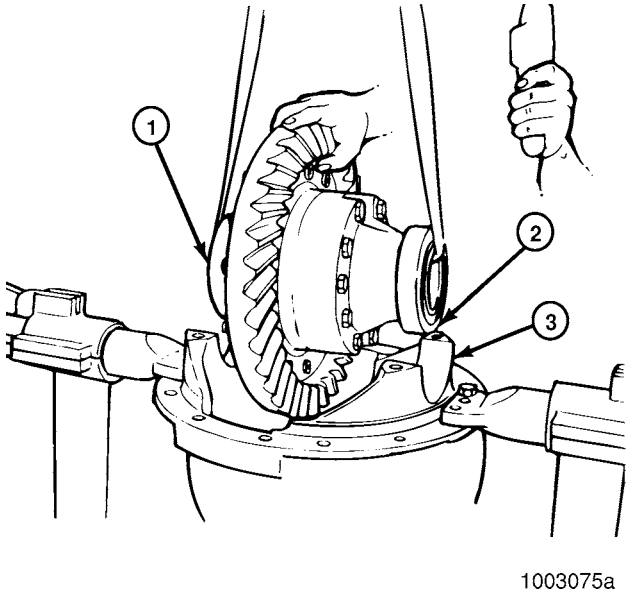
Figure 5.47



1 ADHESIVE
2 BEARING CAP
3 CARRIER LEG

4. Install the bearing cups over the bearing cones that are assembled on the case halves. **Figure 5.48**.
5. Safely lift the differential and ring gear assembly and install into the carrier. The bearing cups ***must*** be flat against the bores between the carrier legs. **Figure 5.48**.

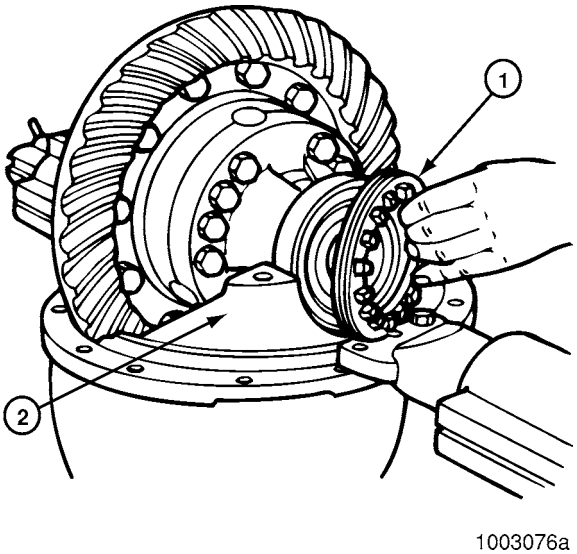
Figure 5.48



1 BEARING CUP
2 BEARING CUP
3 LEG BORE

6. Install both of the bearing adjusting rings into position between the carrier legs. Turn each adjusting ring hand-tight against the bearing cup. **Figure 5.49**.

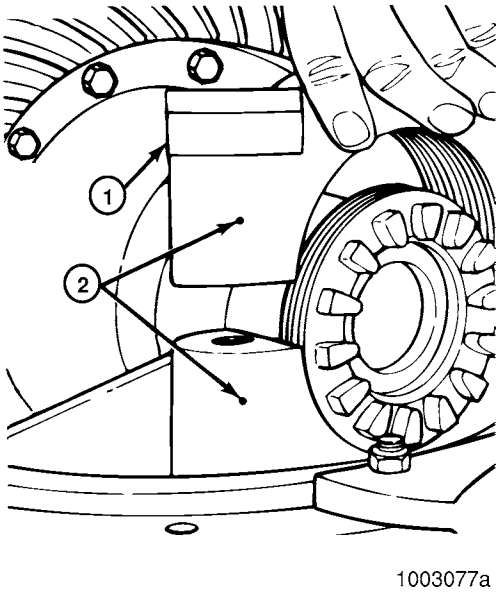
Figure 5.49



1 ADJUSTING RING
2 LEG

7. Install the bearing caps over the bearings and adjusting rings in the correct location as marked before removal. **Figure 5.50**.

Figure 5.50



1 BEARING CAP
2 MATCH MARKS

⚠ *WARNING*

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

8. Seat each bearing cap with a light leather, plastic or rubber mallet. The caps ***must*** fit easily against the bearings, adjusting rings and carrier. ***Do not force the bearing caps into position.***

⚠ *CAUTION*

If bearing caps are not installed in correct locations, the bores and threads in caps will not match the carrier. You will have problems assembling the caps on the carrier and damage to parts can occur. Do not force the bearing caps into position.

9. If bearing caps do not correctly fit into position, check the alignment of match marks between caps and carrier. Remove the caps and repeat steps 6-8.

10. Install the capscrews and washers that hold bearing caps to the carrier. Tighten the capscrews by hand four to six turns, then tighten the capscrews to the correct torque value. Refer to **Table J**.

NOTE

Do not install the cotter keys*, pins* or lock plates* that hold the bearing adjusting rings in position. Continue by adjusting the preload of differential bearings, adjust backlash of the hypoid gear and check tooth contact patterns.

Adjust Preload of Differential Bearings

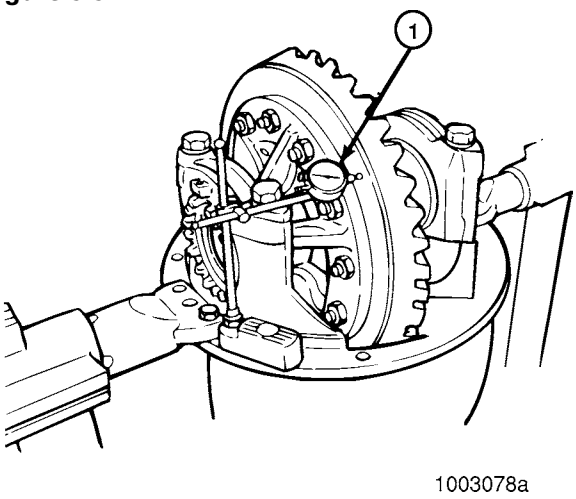
Specifications

- Preload of differential bearings (all carrier models)
  - — 15 to 35 lb-in (1.7-3.9 N•m) torque. T
- Expansion between bearing caps (leg spread)
  - — RS-140, RS-145 and RS-160 carrier models: 0.002 to 0.009 inch (0.05-0.229 mm)
  - — RS 120 and all other carrier models: 0.006 to 0.013 inch (0.15-0.33 mm)

Method 1

1. Attach a dial indicator on the mounting flange of the carrier.
2. Adjust the dial indicator so that the plunger or pointer is against the back surface of the ring gear. **Figure 5.51**.

Figure 5.51



1 DIAL INDICATOR

*Some Meritor carriers do not have these described parts.

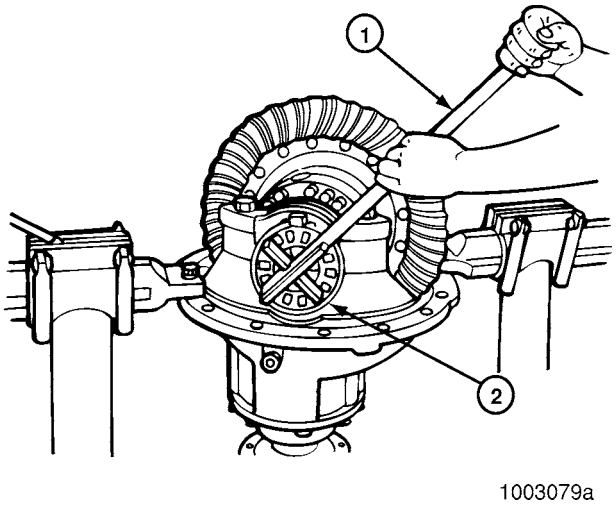
CAUTION

When you turn the adjusting rings, always use a tool that engages two or more opposite notches in the ring. A "T" bar wrench can be used for this purpose. If the tool does not correctly fit into the notches, damage to the lugs will occur. **Figure 5.52.**

3. Loosen the bearing adjusting ring that is opposite the ring gear so that a small amount of end play shows on the dial indicator. **Figure 5.52.** Move the differential and ring gear to the left and right with pry bars while you read the dial indicator. Use the following step **a** or **b**.

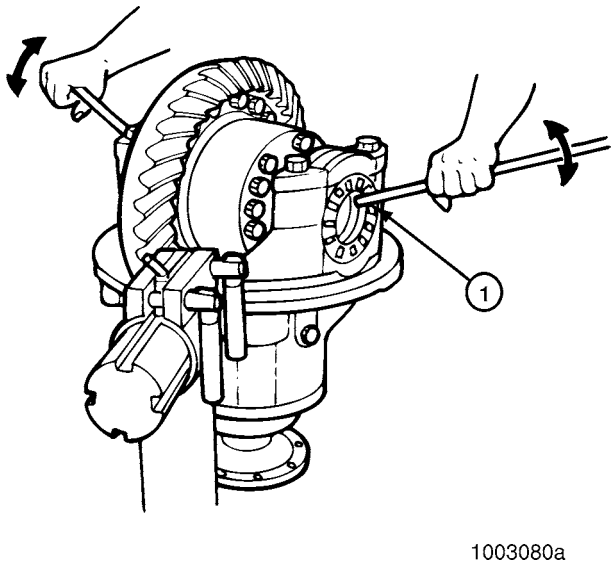
   a. Use two pry bars that fit between the bearing adjusting rings and ends of the differential case. The pry bars ***must not*** touch the differential bearings. **Figure 5.53.**

Figure 5.52



1 "T" BAR WRENCH
2 ADJUSTING RING OPPOSITE RING GEAR

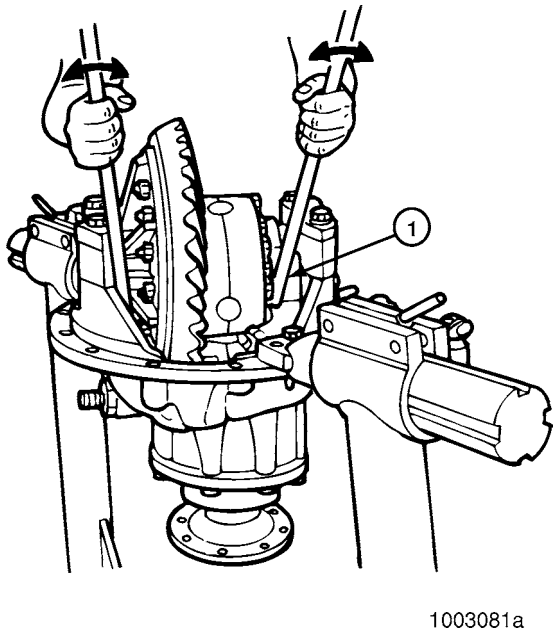
Figure 5.53



1 BARS MUST NOT TOUCH BEARINGS

   b. Use two pry bars between the differential case or ring gear and the carrier at locations other than described in step **a**. The pry bars ***must not*** touch the differential bearings. **Figure 5.54.**

Figure 5.54



1 BARS MUST NOT TOUCH BEARINGS

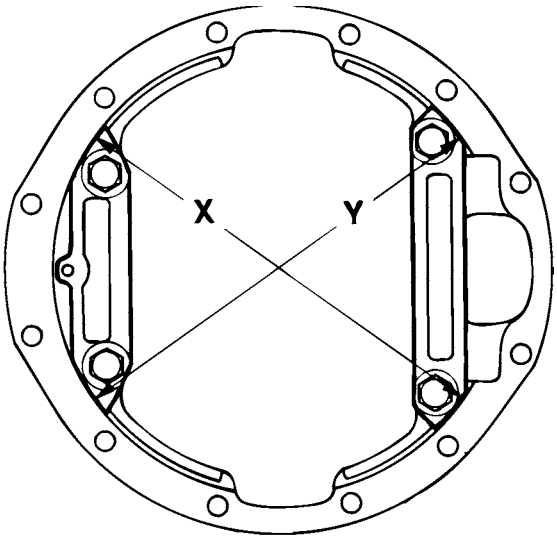
4. Tighten the same bearing adjusting ring so that no end play shows on the dial indicator. Move the differential and ring gear to the left and right as needed. Repeat step **a** or **b**.
5. Tighten each bearing adjusting ring one notch from the zero end play measured in step 4.
6. Continue by checking runout of the ring gear.

Method 2

A second method of checking preload is to measure the expansion between the bearing caps (leg spread) after the adjusting rings are tightened. Use the following procedure.

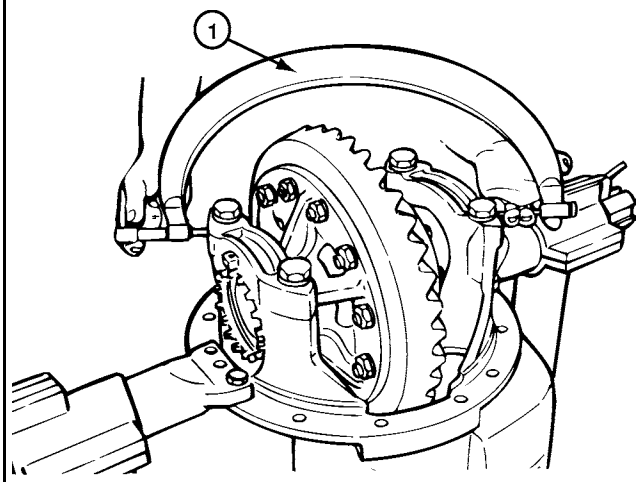
1. Turn both adjusting rings hand tight against the differential bearings.
2. Measure the distance X or Y between opposite surfaces of the bearing caps. Use a large micrometer of the correct size. **Figure 5.55** and **Figure 5.56**. Record the measurement.

Figure 5.55



1003082a

Figure 5.56



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1 MICROMETER

3. Tighten each bearing adjusting ring one notch.
4. Measure the distance X or Y again. Compare the dimension with the distance X or Y measured in step 2. The difference between the two dimensions is the amount the bearing caps have expanded.

Example

- Measurements of RS-145 carrier
- Distance X or Y

  — before tightening adjusting rings = 13.927 inch (353.74 mm).
- Distance X or Y

  — after tightening adjusting rings = 13.936 inch (353.97 mm)
- 13.936 inch — 13.927 inch = 0.009 inch (0.23 mm) difference.

  If the dimension is within specifications, continue by checking runout of the ring gear. If the dimension is less than specifications, repeat steps 3 and 4 as needed.

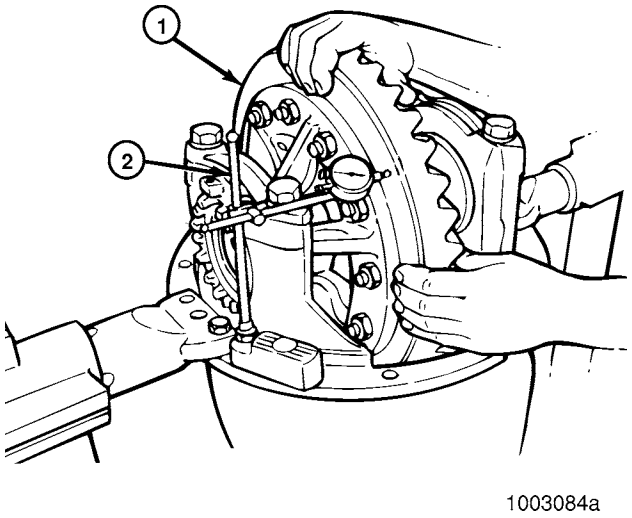
Check Runout of Ring Gear

Runout Specification

- 0.008 inch (0.20 mm)

1. Attach a dial indicator on the mounting flange of the carrier. **Figure 5.57**.

Figure 5.57



1 ROTATE RING GEAR
2 DIAL INDICATOR

2. Adjust the dial indicator so that the plunger or pointer is against the back surface of the ring gear.
3. Set the dial indicator to zero (0).
4. Rotate the differential and ring gear and read the dial indicator. The runout of the ring gear ***must not exceed*** 0.008 inch (0.20 mm). **Figure 5.57**.

   If runout of the ring gear exceeds specifications, remove the differential and ring gear assembly from the carrier. Refer to "Remove the Differential and Ring Gear from the Carrier" and the following steps 5 and 6.
5. Check the differential parts including the carrier for the problem that causes the runout of gear to exceed specifications. Repair or replace parts.
6. After the parts are repaired or replaced, install the differential and ring gear into the carrier. Refer to "Install the Differential and Ring Gear Assembly."
7. Repeat preload adjustment of differential bearings.

Ring Gear Backlash Adjustment

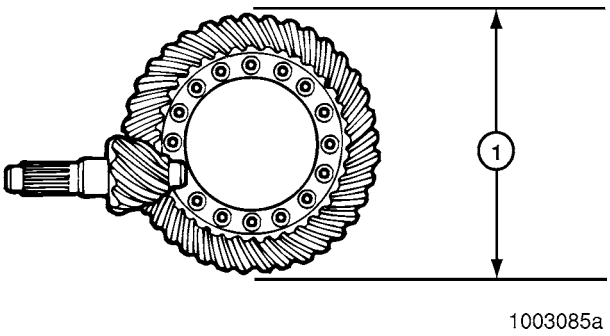
Specifications

- Ring gears that have a pitch diameter of less than 17 inches (431.8 mm)
  - — Range of backlash setting: 0.008 to 0.018 inch (0.20-0.46 mm)
  - — Backlash setting for new gear sets: 0.012 inch (0.30 mm)
- Ring gears that have a pitch diameter greater than 17 inches (431.8 mm)
  - — Range of backlash setting: 0.010 to 0.020 inch (0.25-0.51 mm)
  - — Backlash setting for new gear sets: 0.015 inch (0.38 mm)

NOTE

Measure the outer diameter of ring gear for approximate pitch diameter. **Figure 5.58.**

Figure 5.58



1 MEASURE OUTER DIAMETER FOR APPROXIMATE PITCH DIAMETER

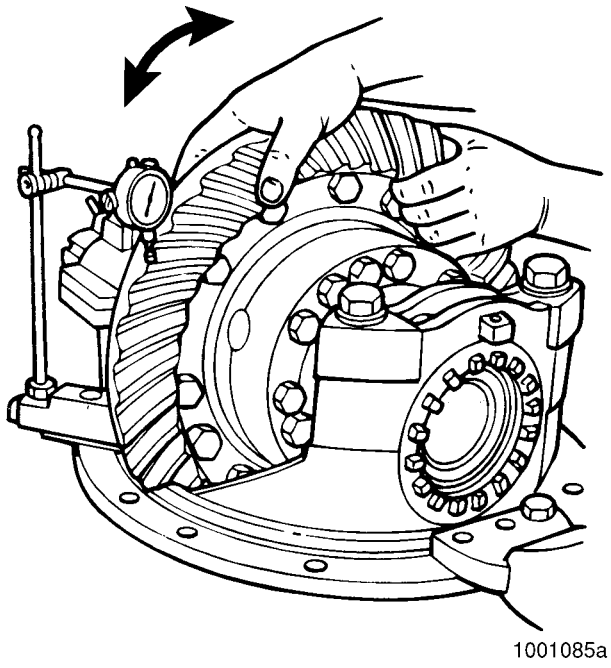
If the old gear set is installed, adjust the backlash to the setting that was measured before the carrier was disassembled.

If a new gear set is installed, adjust the backlash to the correct specification for new gear sets.

After checking of the tooth contact patterns, the backlash can be adjusted within specification limits, if needed. To change the location of the pattern use the following procedures.

1. Attach a dial indicator on the mounting flange of the carrier. **Figure 5.59**.

Figure 5.59



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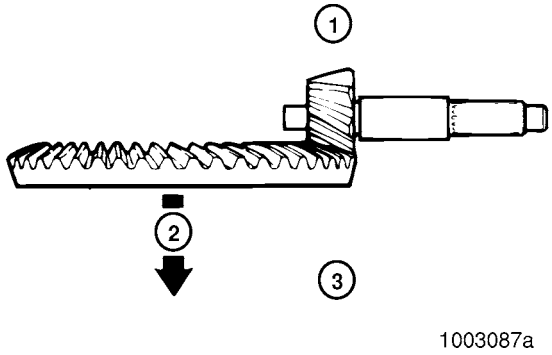
2. Adjust the dial indicator so that the plunger or pointer is against the tooth surface. **Figure 5.59**.
3. Adjust the indicator dial to zero (0).
4. Hold the drive pinion in position.
5. After reading the dial indicator, rotate the differential and ring gear a small amount in both directions, against the drive pinion teeth. If the backlash reading is within specification, continue checking tooth contact patterns. If the backlash reading is not within specifications, adjust backlash as needed. Continue following steps 6 and 7.

Figure 5.60



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1 TIGHTEN ADJUSTING RING THIS SIDE
2 INCREASE BACKLASH
3 LOOSEN ADJUSTING RING THIS SIDE

NOTES

- ***Backlash is increased by moving the ring gear away from the drive pinion.*** **Figure 5.60.**
- ***Backlash is decreased by moving the ring gear toward the drive pinion.*** **Figure 5.61.**

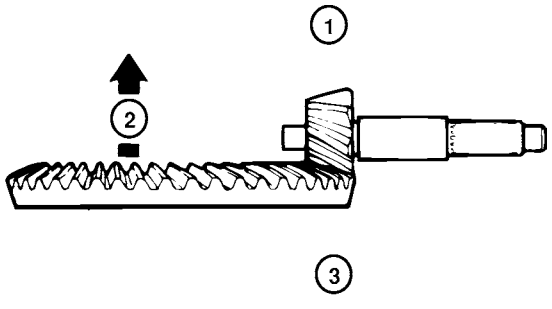
6. Loosen one bearing adjusting ring one notch then tighten the opposite ring the same amount. Refer to **Figure 5.60** and **Figure 5.61**.

NOTE

When you adjust backlash, move the ring gear ONLY. DO NOT move the drive pinion.

7. Repeat steps 2-6 until the backlash is within specifications.

Figure 5.61



1003088a

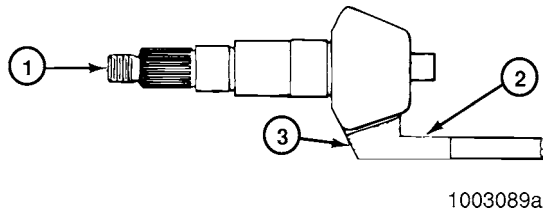
1 LOOSEN ADJUSTING RING THIS SIDE
2 DECREASE BACKLASH
3 TIGHTEN ADJUSTING RING THIS SIDE

Checking Tooth Contact Patterns (Backlash) of the Gear Set

General Information

Meritor carriers can have a ***generoid*** hypoid gear set. The tooth contact patterns for each type of gear set are different. Look at the part numbers to see what type of gear set is in the carrier. Refer to **Figure 5.62** for the location of part numbers.

Figure 5.62



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1 PART NO.
2 PART NO.
3 PART NO. OPTION

Examples

Part numbers for ***generoid*** gear sets

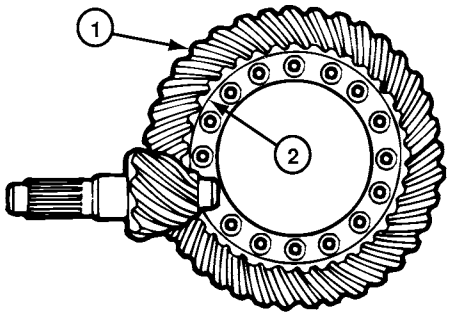
— 36786-K or 36786-K2 for the ring gear

— 36787-K or 36787-K2 for the drive pinion

In the following procedures, movement of the contact pattern in the length of the tooth is indicated as toward the “heel” or “toe” of the ring gear. **Figure 5.63**.

Always check tooth contact patterns on the drive side of the gear teeth. **Figure 5.64**.

Figure 5.63



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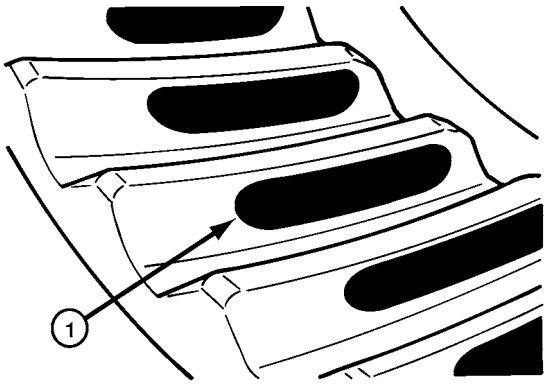
1 HEEL
2 TOE

Figure 5.64



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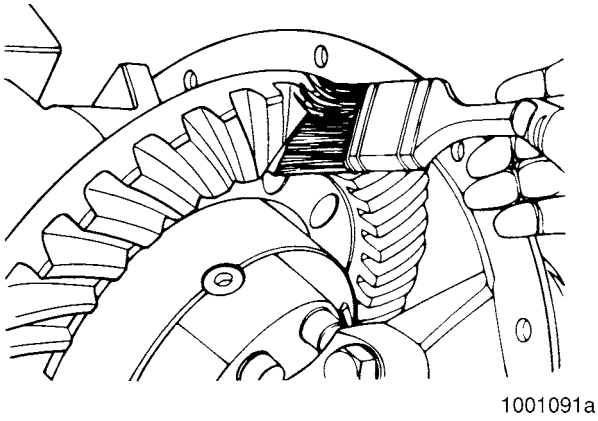
1 DRIVE SIDE (CONVEX)

Tooth Contact Patterns of Generoid Hypoid Gear Sets

1. Adjust the backlash of a new gear set to either 0.012 inch (0.305 mm) or 0.015 inch (0.380 mm) depending on the size of the ring gear. Adjust the backlash of an old gear set to the setting that was measured before the carrier was disassembled. Refer to "Ring Gear Backlash Adjustment."
2. Apply a marking compound to approximately 12 gear teeth of the ring gear. Rotate the ring gear so that the 12 gear teeth are next to the drive pinion. **Figure 5.65**.

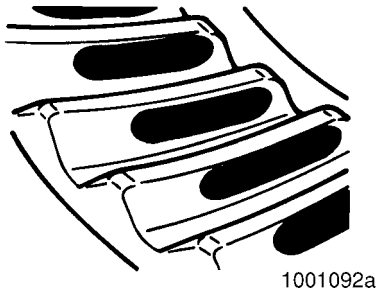
Figure 5.65



3. Rotate ring gear forward and backward so that the 12 gear teeth go past the drive pinion six times to get the contact patterns. Repeat if needed to get a more clear pattern.

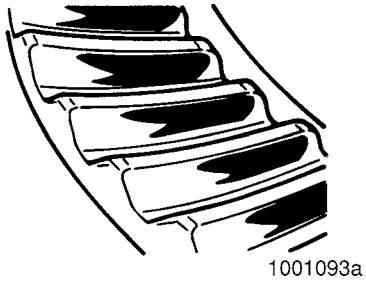
Hypoid Generoid Gears

Figure 5.66



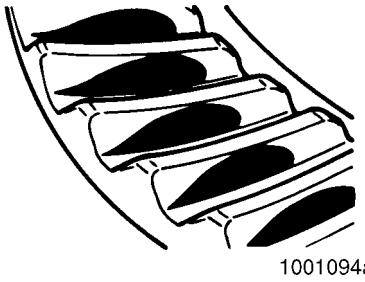
Good Hand-Rolled Pattern

Figure 5.67



High Pattern

Figure 5.68



Low Pattern

4. Look at the contact patterns on the ring gear teeth. Compare the patterns to **Figure 5.66**, **Figure 5.67** and **Figure 5.68**.

   The Location of Good Hand-Rolled Contact Patterns

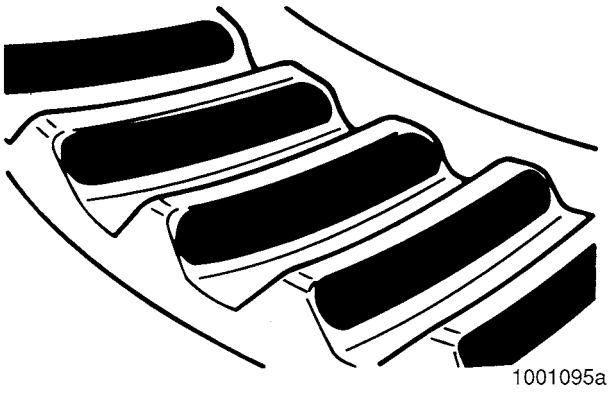
   New Conventional and Generoid Gear Sets — toward the toe of the gear tooth and in the center between the top and bottom of the tooth. Refer to **Figure 5.66**.

   When the carrier is operated, a good pattern will extend approximately the full length of the gear tooth. The top of the pattern will be near the top of the gear tooth. Refer to **Figure 5.69**.

   The location of a good hand-rolled contact pattern for an old gear set ***must*** match the wear pattern in the ring gear. The new contact pattern will be smaller in area than the old wear pattern.

If the contact patterns require adjustment, continue by following step 5 to move the contact patterns between the top and bottom of the gear teeth. If the contact patterns are in the center of the gear teeth, continue by following step 6.

Figure 5.69



Good Pattern in Operation (GENEROID GEARS)

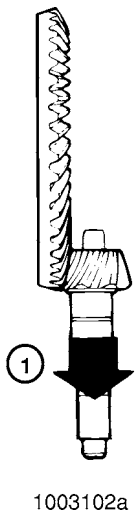
NOTE

A high contact pattern indicates that the drive pinion was not installed deep enough into the carrier. A low contact pattern indicates that the drive pinion was installed too deep in the carrier.

5. Change the thickness of the shim pack under bearing cage to move the contact patterns between the top and bottom of the gear teeth. Use the following procedure.
   a. Remove the drive pinion and bearing cage from the carrier. Refer to "Remove the Drive Pinion and Bearing Cage from Carrier."
   b. To correct a high contact pattern, **Figure 5.67** decrease the thickness of the shim pack under the bearing cage. When decreasing the thickness of the shim pack, the drive pinion will move toward the ring gear. **Figure 5.70**.

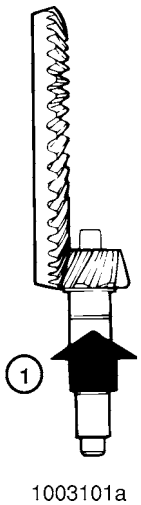
      To correct a low contact pattern, **Figure 5.71** increase the thickness of shim pack under the bearing cage. When increasing the thickness of the shim pack, the drive pinion will move away from the ring gear. **Figure 5.71**.

Figure 5.70



1 DECREASE SHIM PACK

Figure 5.71

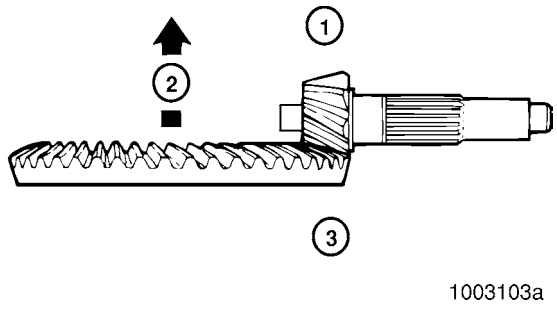


1 INCREASE SHIM PACK

   c. Install the drive pinion, bearing cage and shims into the carrier. Refer to "Adjusting Shim Pack Thickness for the Pinion Cage (Depth of Pinion)."
   d. Repeat steps 2-5 until the contact patterns are in the center between the top and bottom of the gear teeth.

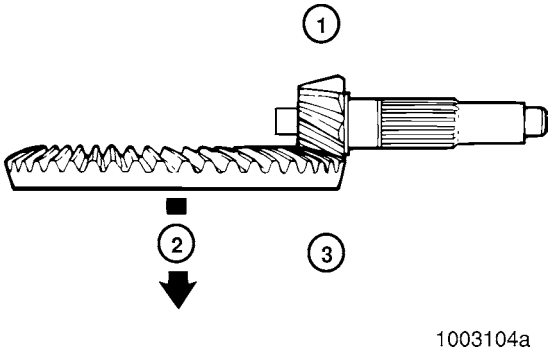
6. Adjust backlash of the ring gear within specification range to move the contact patterns to the correct location in the length of the gear teeth. Refer to "Ring Gear Backlash Adjustment."
   a. Decrease backlash to move the contact patterns toward the toe of the ring gear teeth. **Figure 5.72**.
   b. Increase backlash to move the contact patterns toward the heel of the ring gear teeth. **Figure 5.73**.

Figure 5.72



1 MOVE PATTERN TOWARD TOE, LOOSEN ADJUSTING RING THIS SIDE
2 DECREASE BACKLASH
3 TIGHTEN ADJUSTING RING

Figure 5.73



1 MOVE PATTERN TOWARD TOE, LOOSEN ADJUSTING RING THIS SIDE
2 DECREASE BACKLASH
3 LOOSEN ADJUSTING RING

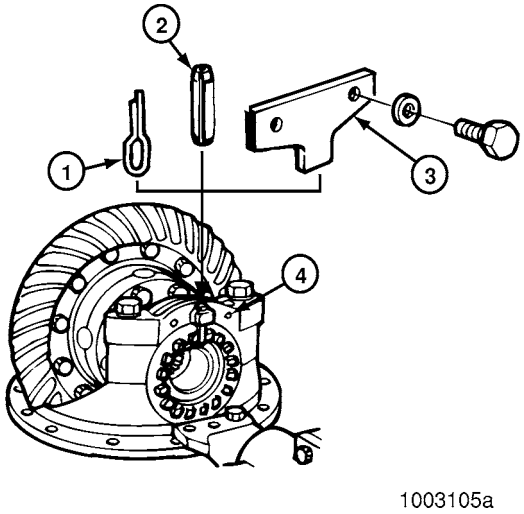
   c. Repeat steps 2-4 and 6 until the contact patterns are at the correct location in the length of the gear teeth.

⚠ *CAUTION*

If the carrier has cotter keys, lock the adjusting rings only with cotter keys. If your carrier has roll pins, reuse the roll pins or lock the adjusting rings with cotter keys. Do not force a roll pin into a cotter key hole.

7. Install cotter keys*, pins*, or lock plates* that hold the two bearing adjusting rings in position. Use the following procedures.
   a. **Cotter Keys*** — Install cotter keys between lugs of the adjusting ring and through the boss of the bearing cap. Bend the two ends of the cotter key around the boss. **Figure 5.74**.
   b. **Pins*** — Install pin through boss of the bearing cap until the pin is between lugs of the adjusting ring. Use a drift and hammer to install the pin. **Figure 5.74**.
   c. **Lock Plates*** — Install lock plate on bearing cap so that the tab is between lugs of the adjusting ring. Install the two capscrews that hold the lock plate to the bearing cap. Tighten the capscrews to correct torque value. Refer to **Table J**. **Figure 5.74**.

Figure 5.74



1 COTTER KEY
2 PIN
3 LOCK PLATE
4 THREADED HOLES IN CAP WHEN LOCK PLATE IS USED

*Some Meritor carriers do not have these described parts.

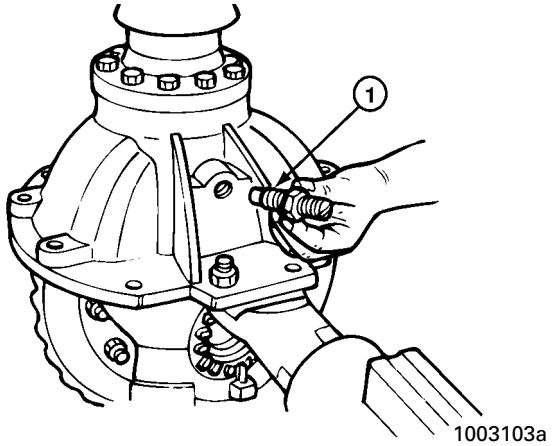
Install and Adjust the Thrust Screw*

Specification

- Clearance between thrust screw and ring gear — 0.025 to 0.045 inch (0.65-1.14 mm).
- Loosen the thrust screw 1/2 turn or 180°.

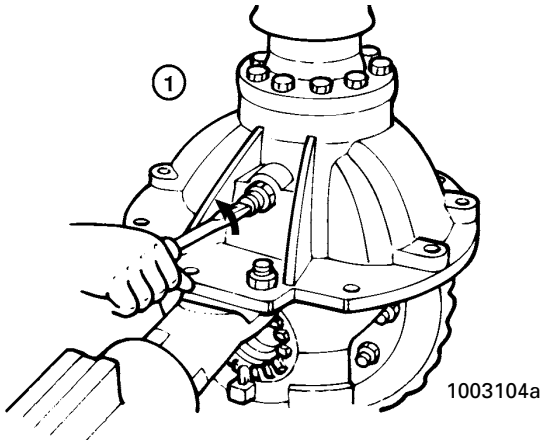
1. Rotate the carrier in the repair stand until the back surface of ring gear is toward the top.
2. Install the jam nut* on the thrust screw*, one half the distance between both ends. **Figure 5.75**.
3. Loosen the thrust screw* 1/2 turn, 180°. **Figure 5.76**.

Figure 5.75



1 THRUST SCREW AND JAM NUT

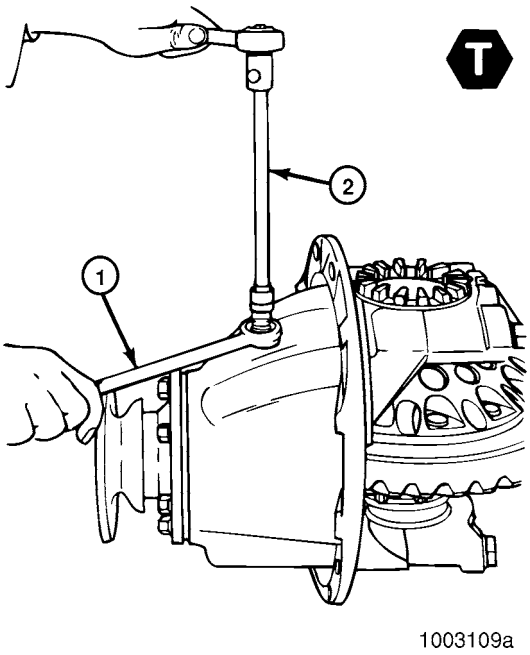
Figure 5.76



1 LOOSEN THRUST SCREW 1/2 TURN

4. Tighten the jam nut* to the correct torque value against the carrier. Refer to **Table J**. **Figure 5.77**.

Figure 5.77



1 HOLD THRUST SCREW IN POSITION
2 TIGHTEN JAM NUT TO CORRECT TORQUE VALUE

NOTE

To complete the assembly of axles equipped with driver-controlled main differential locks, refer to "Installation of the DCDL Assembly into Carrier" through "Traction Control Video Package." Start with "Installation of the DCDL Assembly into Carrier."

*Some Meritor carriers do not have these described parts.

Install Differential Carrier into Axle Housing

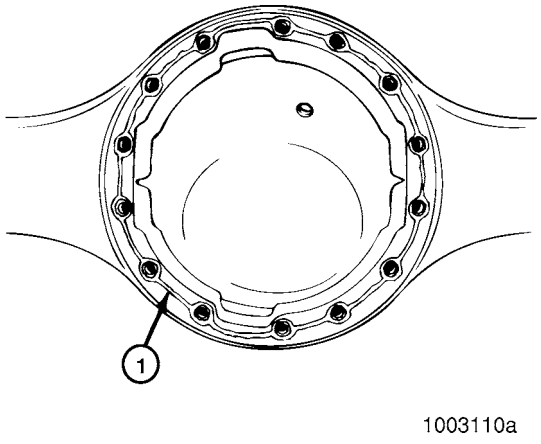
⚠ WARNING

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures:

- ***Wear safe eye protection.***
- ***Wear clothing that protects you skin.***
- ***Work in a well-ventilated area.***
- ***Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.***
- ***You must use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.***

1. Clean the inside of axle housing and the mounting surface where the carrier fastens. Use a cleaning solvent and rags to remove dirt. Blow dry the cleaned areas with air. Also refer to "Cleaning Axle Assemblies."
2. Inspect the axle housing for damage. Repair or replace the axle housing. Refer to "Repair or Replacement of Parts, General," "Repair Axle by Welding" and "Bending or Straightening Drive Axle Housings."
3. Check for loose studs* in the mounting surface of the housing where the carrier fastens. Remove and clean the studs* that are loose.
4. Apply liquid adhesive to the threaded holes and install the studs* into axle housing. Refer to "Application of Meritor Adhesive 2297-T-4180 in Bearing Bores for the Differential." Tighten studs* to correct torque value. Refer to **Table J**. (T)
5. Apply silicone gasket material to the mounting surface of the housing where the carrier fastens. Refer to "Application of Three Bond 1216 or Equivalent Silicone Gasket Material." **Figure 5.78**.

Figure 5.78



1 1/8" (3.2 MM) DIA. SILICONE GASKET BEAD

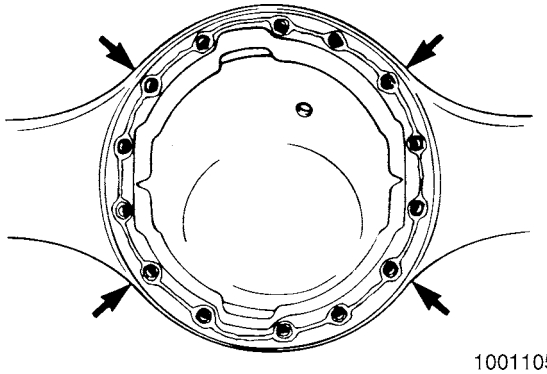
6. Install the carrier into the axle housing. Use a hydraulic roller jack or a lifting tool.

⚠ CAUTION

Do not install the carriers using a hammer or mallet. A hammer or mallet will damage the mounting flange of carrier and cause oil leaks.

7. Install nuts* and washers or capscrews and washers in the four corner locations around the carrier and axle housing. Tighten the fasteners hand tight at this time. **Figure 5.79**.
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 5.79**.

Figure 5.79



*Some Meritor carriers do not have these described parts.

9. Repeat step 8 until the four fasteners are tightened to the correct torque value. Refer to **Table J**.
10. Install the other fasteners and washers that hold the carrier in the axle housing. Tighten fasteners to the correct torque value. Refer to **Table J**.
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 5.80**.

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 5.80**.
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 **Table E**.

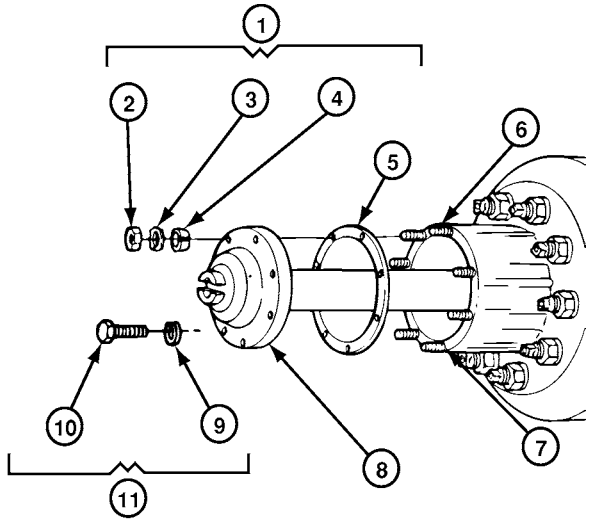
Table E — Shaft-to-Hub Torque Fastener Chart — Non-tapered Dowel Applications

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

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 5.80**.
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 **Table F**.

Figure 5.80



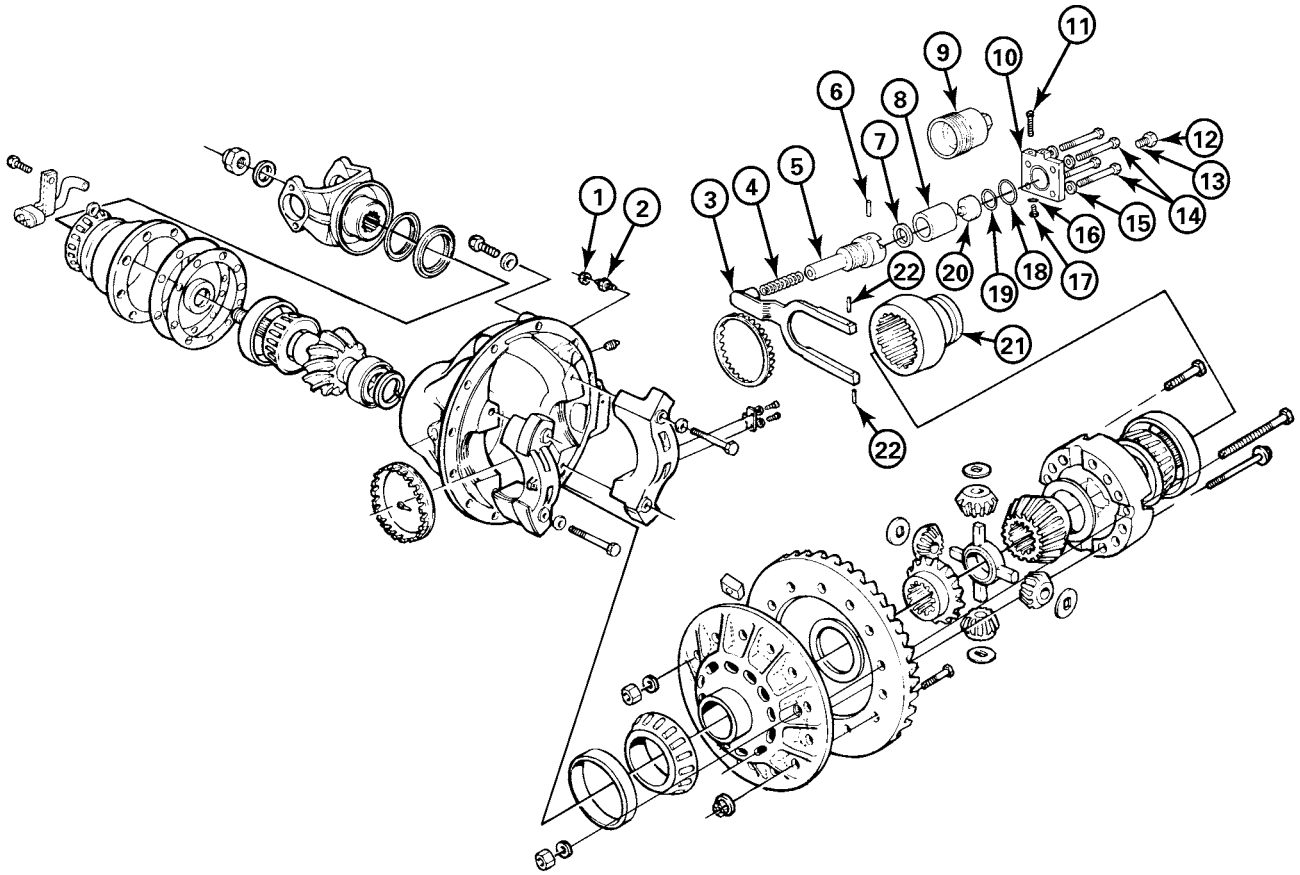
1 TAPERED DOWEL RETENTION
2 STUD NUT
3 WASHER
4 TAPERED DOWEL
5 GASKET
6 STUD
7 SHAFT HUB AXLE
8 AXLE SHAFT (FLANGE)
9 WASHER
10 CAPSCREW
11 NON-TAPERED DOWEL RETENTION

Table F — 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 .50-20 .56-18 .62-18	50-75 (81-102) 75-115 (115-156) 110-165 (176-224) 150-230 (244-312)	40-65 (67-88) 65-100 (102-136) 100-145 (149-197) 130-190 (203-258)
Studs	All	Install the course thread end of stud into hub and tighten to last thread.	

Driver-Controlled Main Differential Lock Assembly

Figure 6.1



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 REQUIRED)
8 AIR CYLINDER TUBE
9 SCREW-IN DIFFERENTIAL LOCK
10 CYLINDER COVER
11 CAPSCREW — MANUAL ACTUATION (STORAGE POSITION)
12 WASHER (OPERATING POSITION)
13 PLUG GASKET (OPERATING POSITION)
14 COVER CAPSCREWS
15 WASHERS
16 PLUG GASKET (STORAGE POSITION)
17 COVER PLUG (STORAGE POSITION)
18 COVER COPPER GASKET
19 PISTON O-RING
20 PISTON
21 SHIFT COLLAR
22 SHIFT FORK ROLL PINS

Some Meritor 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 6.1**.

NOTE

The Meritor 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* Table J*, 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 "Vehicle Towing Instructions."
2. Install the axle shafts after the vehicle is towed. Refer to "Vehicle Towing Instructions."
3. If the differential carrier must be removed from the axle housing, use the following procedures.

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 "Vehicle Towing Instructions," starting with "After Towing or Drive-Away."

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*

During DCDL disassembly, when the DCDL is in the locked (engaged) position and one of the vehicle's wheels is raised from the floor, do not start the engine and engage the transmission. The vehicle can move and cause serious personal injury.

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

⚠ *WARNING*

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

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

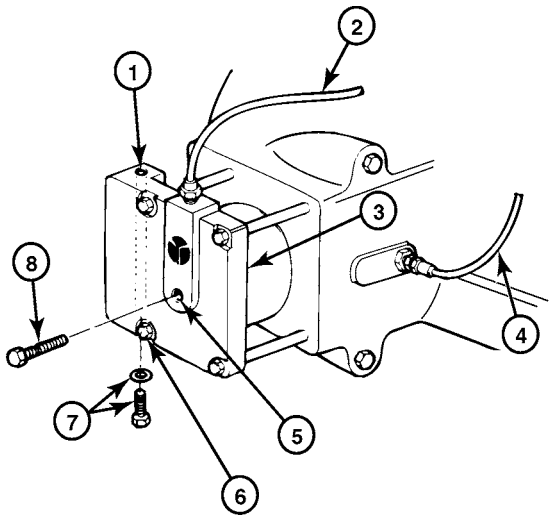
DCDL Assembly Manual Engaging Methods

Bolt-On Style Differential Lock Cylinder

Use the following manual engaging method to lock out the bolt-on DCDL assembly. **Figure 6.2**.

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.

Figure 6.2



1 TOP SIDE STORAGE HOLE (FOR MANUAL ENGAGING CAPSCREW)
2 AIR LINE
3 CYLINDER COVER
4 WIRE
5 SERVICE POSITION CAPSCREW HOLE
6 BOTTOM SIDE STORAGE HOLE FOR PLUG AND GASKET
7 PLUG AND GASKET
8 MANUAL ENGAGING CAPSCREW

BOLT-ON DCDL ASSEMBLY

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.

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.

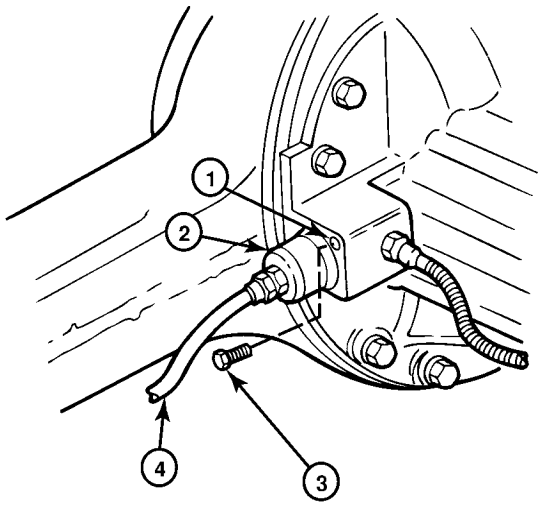
7. Remove the carrier from the axle housing as described in steps 1-7 of "Carrier Removal from Axle."

Screw-in 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 6.3**.
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 of "Carrier Removal from Axle."

Figure 6.3



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1 STORAGE HOLE
2 CYLINDER
3 MANUAL ENGAGING CAPSCREW
4 AIR HOSE

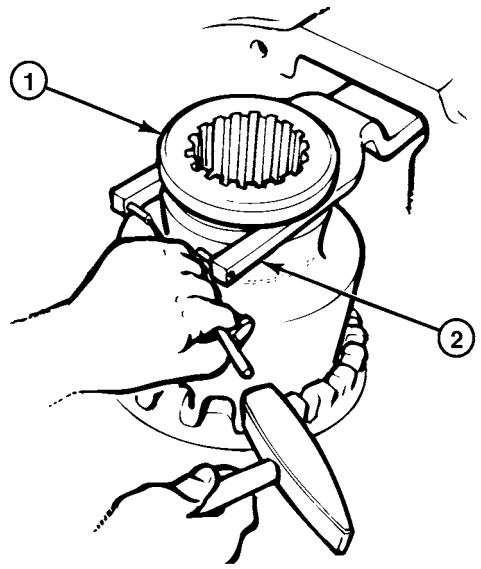
THREADED SHIFT ASSEMBLY

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 6.4**.
2. For carriers ***without*** roll pins: snap out collar from fork.
3. If required, remove the DCDL assembly at this time.

Figure 6.4



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1 SHIFT COLLAR
2 SHIFT FORK

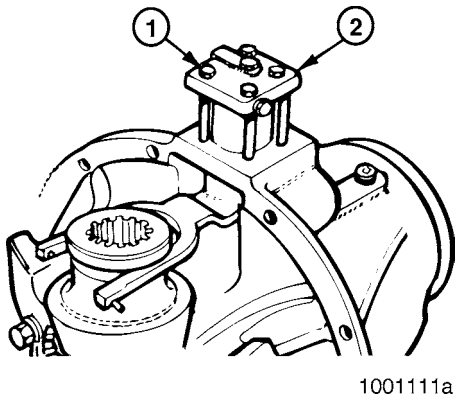
*Some Meritor carriers do not have these described parts.

Bolt-On 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 6.5**.

Figure 6.5



1 CAPSCREW AND WASHER
2 COVER (COPPER GASKET UNDER COVER)

BOLT-ON 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."

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 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 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."

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.

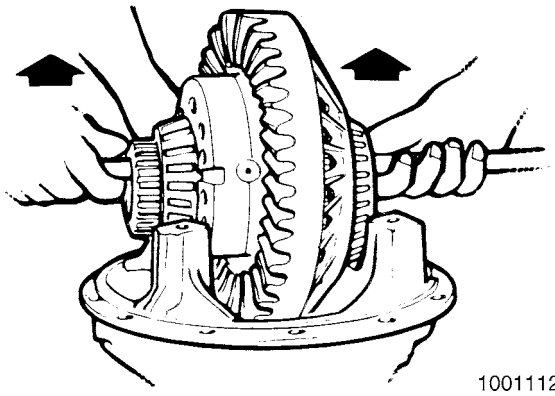
5. Match mark one bearing cap and one carrier leg so that these parts will be assembled in the correct positions. Remove the bearing cap capscrews and washers, the bearing caps and the adjusting rings.

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 6.6**.

FURTHER DISASSEMBLY OF THESE CARRIERS IS THE SAME AS AXLES WITHOUT THE DRIVER-CONTROLLED MAIN DIFFERENTIAL LOCK. TO CONTINUE DISASSEMBLY, FOLLOW THE PROCEDURES STARTING WITH "REMOVE THE DIFFERENTIAL AND RING GEAR FROM THE CARRIER."

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

Figure 6.6



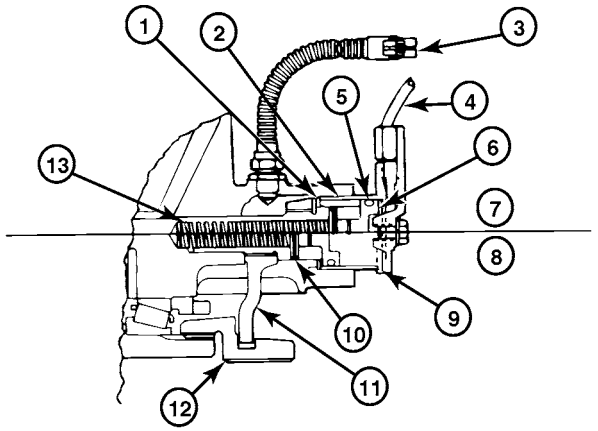
 *Some Meritor carriers do not have these described parts.

Installation of the DCDL Assembly into Carrier

Bolt-On 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 6.7**.

Figure 6.7

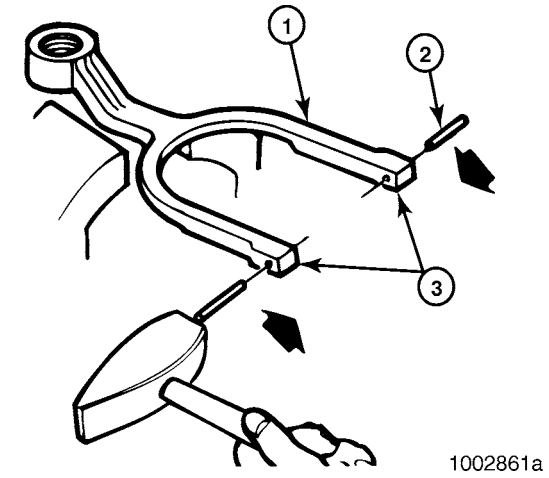


1 FLAT WASHER OR SILASTIC AS REQUIRED
2 CYLINDER
3 ELECTRIC CONNECTION FOR SENSOR
4 AIR LINE
5 O-RING
6 PISTON
7 (DISENGAGED)
8 (ENGAGED)
9 COPPER GASKET
10 PIN
11 SHIFT FORK
12 COLLAR
13 SHIFT SHAFT AND SPRING

BOLT-ON STYLE

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 6.8**. Do not install completely at this time.

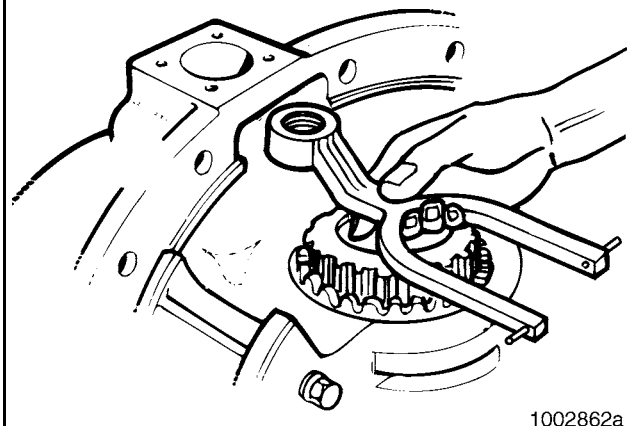
Figure 6.8



1 SHIFT FORK
2 ROLL PIN
3 INNER YOKE FACES

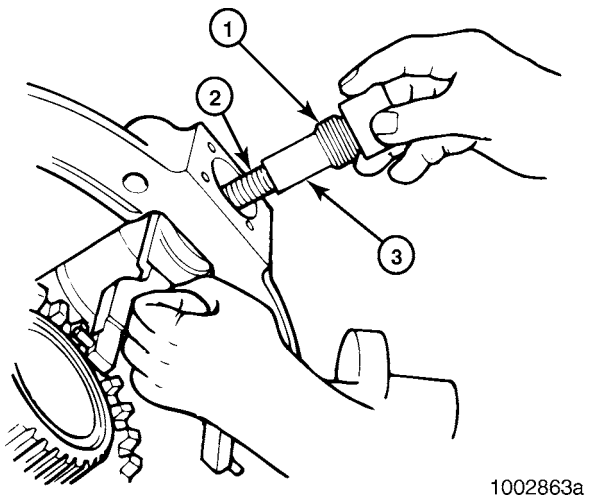
2. On models without roll pins, snap fork into position.
3. Apply Loctite 222 (purple) (Meritor Part No. 2297-B-6112) to the threads of the shift shaft.
4. Install the shift fork into its correct position in the carrier case. **Figure 6.9**.

Figure 6.9



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 6.10**.

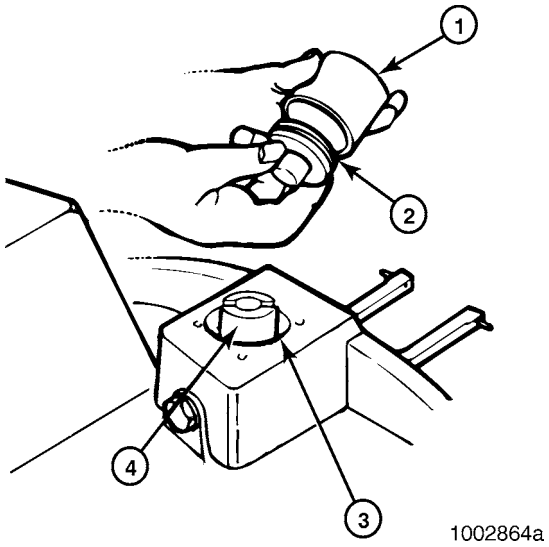
Figure 6.10



1 APPLY LOCTITE 222
2 SPRING
3 SHIFT SHAFT

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
7. Install the flat washer (when used) or apply silastic sealant (Meritor Part No. 1199-Q-2981) to the bottom of the cylinder bore. **Figure 6.11**.
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 6.11**.

Figure 6.11

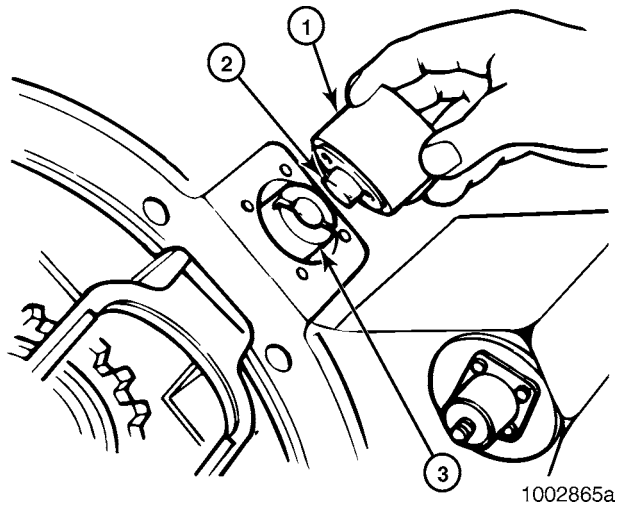


1 AIR CYLINDER
2 PISTON AND O-RING
3 INSTALL FLAT WASHER OR APPLY SILASTIC SEALANT
4 SHIFT SHAFT

BOLT-ON STYLE

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 6.12**.

Figure 6.12



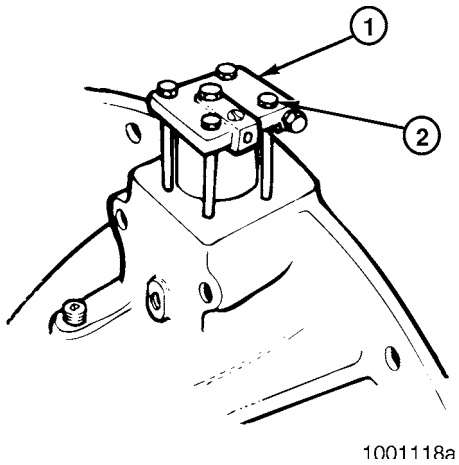
1 CYLINDER AND PISTON
2 PILOT JOURNAL
3 SHIFT SHAFT

BOLT-ON STYLE

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. **Figure 6.7** and **Figure 6.13**. 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."

Figure 6.13

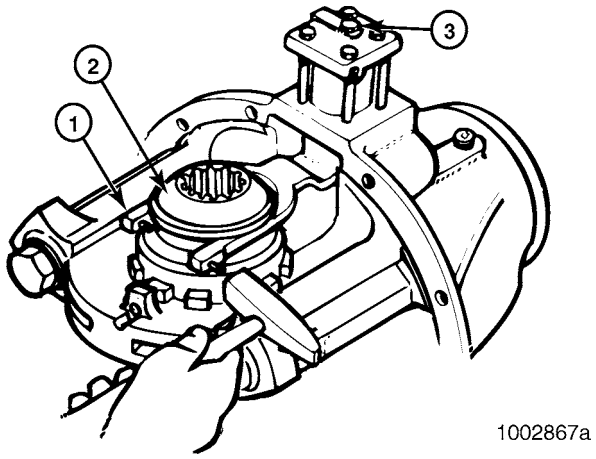


1 CYLINDER COVER
2 CAPSCREW 7.4-8.9 LB-FT (10-12 N•m) T

BOLT-ON STYLE

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 6.14**.

Figure 6.14



1 SHIFT COLLAR
2 SHIFT FORK
3 MANUAL ACTUATION CAPSCREW

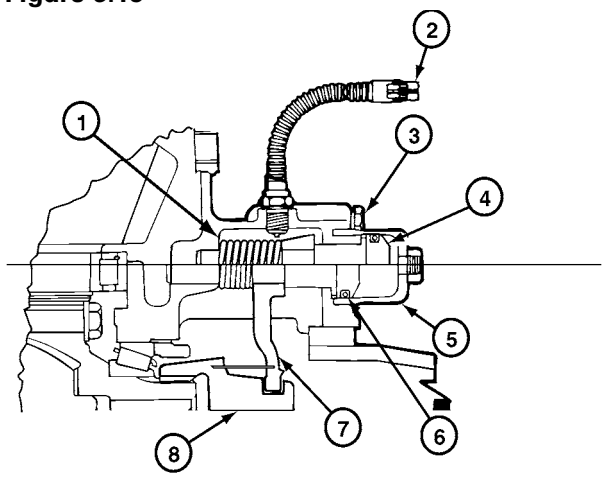
BOLT-ON STYLE

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.

Screw-In 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 style shift assembly are shown in **Figure 6.15**.

Figure 6.15



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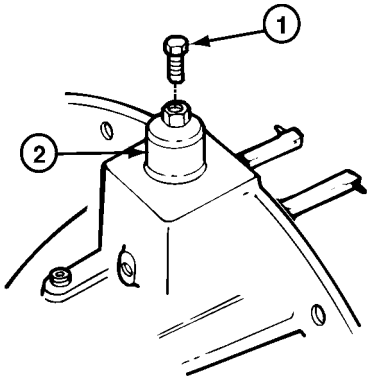
1 SHIFT SHAFT AND SPRING
2 ELECTRIC CONNECTION FOR SENSOR
3 PISTON
4 (DISENGAGED)
5 (ENGAGED)
6 CYLINDER
7 O-RING
8 SHIFT FORK
9 COLLAR

SCREW-IN STYLE

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. **Figure 6.16**.

Figure 6.16



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1 MANUAL ACTUATION CAPSCREW
2 SCREW-IN CYLINDER 80 TO 100 LB-FT (109-136 N•m)

SCREW-IN 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 capscrew to move the shift collar splines into the differential case splines. Refer to "Manual Engaging Method."

9. Install sensor switch into its hole. Tighten from 25 to 35 lb-ft (35-45 N•m).
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 checks, the sensor switch should be replaced.

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:

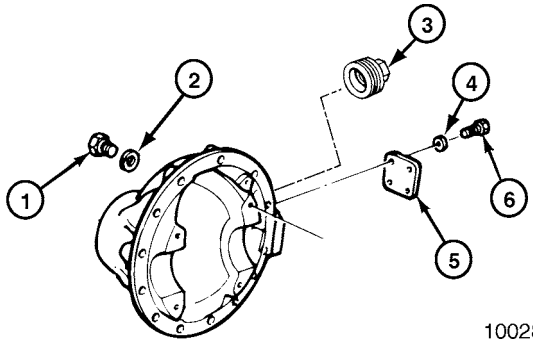
Bolt-On Cover Plate Assemblies

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 6.18**.
2. Apply silicone gasket material to the cover plate mounting surface on the carrier. Refer to "Application of Three Bond 1216 or Equivalent Silicone Gasket Material."
3. Install the four washers and capscrews. Tighten the capscrews from 7.4 to 8.9 lb-ft (10-12 N•m). **Figure 6.17**.

Screw-In 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).

Figure 6.17



1 SENSOR SWITCH PLUG
2 WASHER
3 SCREW-IN COVER PLATE (APPLY LOCTITE 518 TO COVER PLATE THREADS)
4 WASHER
5 BOLT-ON COVER PLATE (APPLY SILICONE GASKET MATERIAL)
6 CAPSCREW

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"). 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

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures:

- ***Wear safe eye protection.***
- ***Wear clothing that protects you skin.***
- ***Work in a well-ventilated area.***
- ***Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.***
- ***You must use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.***

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 "Cleaning Axle Assemblies.")
2. Inspect the axle housing for damage. If necessary, repair or replace the housing. (Refer to "Repair or Replacement of Parts, General" through "Bending or Straightening Drive Axle Housings.")
3. Check 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.

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 "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 manual engaging capscrew into the DCDL storage hole in the bolt-on or the screw-in DCDL assembly. **Figure 6.18** and **Figure 6.19**.

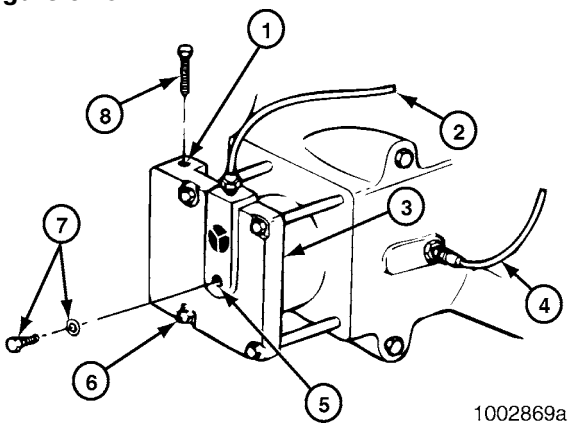
NOTE

Check to ensure sealing gasket is under the head of the capscrew.

a. On a bolt-on DCDL shift assembly, remove the short plug and gasket from the storage hole of the DCDL.

Install the short plug and gasket into the service position hole in the center of the DCDL. Refer to **Figure 6.18**.

Figure 6.18

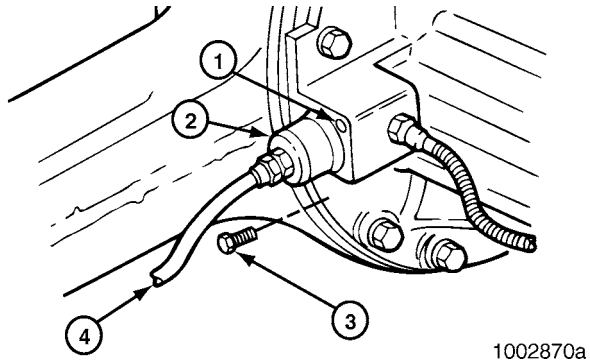


1 TOP STORAGE HOLE FOR MANUAL ENGAGING CAPSCREW
2 AIR LINE
3 CYLINDER COVER
4 WIRE
5 SERVICE POSITION CAPSCREW HOLE
6 BOTTOM STORAGE HOLE FOR PLUG AND GASKET
7 PLUG AND GASKET
8 MANUAL ENGAGING CAPSCREW

BOLT-ON DCDL SHIFT ASSEMBLY

b. On a screw-in DCDL shift assembly, install the short screw (plug) into the storage hole located in the top of the screw-in DCDL shift assembly. **Figure 6.19**.

Figure 6.19



1 STORAGE HOLE
2 CYLINDER
3 MANUAL ENGAGING CAPSCREW
4 AIR HOSE

SCREW-IN DCDL SHIFT ASSEMBLY

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 style cylinders and from 7 to 11 lb-ft (10-15 N•m) for screw-in type reverse shifters. T
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.
13. Install the right and left-hand axle shafts. Follow the procedures from “Before Towing or Drive-Away” in Section 10, “Vehicle Towing Instructions.”
14. Remove the jack stand from under the drive axle and lower the vehicle to the floor.
15. Proceed to “Check the Differential Lock.”

*Some Meritor carriers do not have these described parts.

Check 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

During DCDL disassembly, when the DCDL is in the locked (engaged) position and one of the vehicle's wheels is raised from the floor, do not start the engine and engage the transmission. The vehicle can move and cause serious personal injury.

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 check 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."

Driver Caution Label

Figure 6.20

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 6.20**.

Driver Caution labels (TP-86101) are available from Meritor, Troy, Michigan.

Figure 6.20

TP-86101

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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 Meritor'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 Meritor Automotive, Literature Distribution, 35000 Industrial Road, Livonia, Mich. 48150, or call Meritor 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).

NOTE

For complete information on lubricating drive axles and carriers, refer to Maintenance Manual 1, **Lubrication.**

Refer to **Table G**, **Table H** and **Table I** for standard information on lubricants, schedules and capacities.

Table G — Lubricant Cross Reference (Viscosity) and Temperature Chart

Meritor Lubricant Specification	Description	Cross Reference	Minimum Outside Temperature	Maximum Outside Temperature
0-76-A	Hypoid Gear Oil	GL-5, S.A.E. 85W/140	+10°F (–12.2°C)	- - -**
0-76-B	Hypoid Gear Oil	GL-5, S.A.E. 80W/140	–15°F (–26.1°C)	- - -**
0-76-D	Hypoid Gear Oil	GL-5, S.A.E. 80W/90	–15°F (–26.1°C)	- - -**
0-76-E	Hypoid Gear Oil	GL-5, S.A.E. 75W/90	–40°F (–40°C)	- - -**
0-76-J	Hypoid Gear Oil	GL-5, S.A.E. 75W	–40°F (–40°C)	+35°F (+ 1.6°C)
0-76-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 ***must never exceed* **+121°C (250°F).**				

Table H — Oil Change Intervals and Specifications for All Front Drive and Rear Drive Axles ①

Vocation or Vehicle Operation	Linehaul Motorhome Intercity Coach	City Delivery School Bus Fire Truck	Construction Transit Bus Refuse Yard Tractor Logging Heavy Haul Mining Oil Field Rescue
Initial Oil Change	No longer required as of January 1, 1993		
Check Oil Level	Every 25,000 miles (40,000 km) or the fleet maintenance interval (whichever comes first)	Every 10,000 miles (16,000 km), once a month or the fleet maintenance interval (whichever comes first)	Every 5,000 miles (8,000 km), once a month or the fleet maintenance interval (whichever comes first) ②
Petroleum based oil change on axle WITH or WITHOUT pump and filter system	Every 100,000 miles (160,000 km) or annually, whichever comes first	Every 50,000 miles (80,000 km) or annually, whichever comes first	Every 25,000 miles (40,000 km) or annually, whichever comes first
Synthetic oil change on axle WITHOUT pump and filter system ③	Every 250,000 miles (400,000 km) or annually, whichever comes first	Every 100,000 miles (160,000 km) or annually, whichever comes first	Every 50,000 miles (80,000 km) or annually, whichever comes first
Synthetic oil change on axle WITH pump and filter system ③	Every 500,000 miles (800,000 km)	Every 250,000 miles (400,000 km)	Every 100,000 miles (160,000 km)
Filter change on axle with pump and filter system	Every 100,000 miles (160,000 km)	Every 100,000 miles (160,000 km)	Every 100,000 miles (160,000 km)

① If a No-Spin differential is installed, change the oil (petroleum or synthetic) at a minimum interval of 40,000 miles (64,000 km) or a maximum interval of 50,000 miles (80,000 km).

② For continuous heavy-duty operation, check the oil level every 1,000 miles (1,600 km). Add the correct type and amount of oil as required.

③ This interval applies to approved semi-synthetic and full synthetic oils only. For a list of approved extended-drain axle oils, refer to TP-9539, *Approved Rear Drive Axle Lubricants*. To order this publication, call Meritor's Customer Service Center at 800-535-5560.

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.

Table I

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-12-125	15.3	7.2
RF-16-145	36.4	17.2
RF-21-155	27.9	13.2
RF-21-156	27.9	13.2
RF-21-160	43.7	20.7
RF-21-185	39.3	18.6
RF-21-355	28.0	13.2
RF-22-166	43.7	20.7
RF-23-180	39.3	18.6
RF-23-185	39.3	18.6
RS-13-120	15	7.2
RS-15-120	15	7.2
RS-16-140	33.6	15.9
RS-16-141	33.6	15.9
RS-16-145	33.6	15.9
RS-17-140	32	15.4
RS-17-141	33.6	15.9
RS-17-144	32.3	15.3
RS-17-145	33.6	15.9
RS-19-144	32.3	15.3
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-23-160A	39.5	18.7
RS-23-161/161A	37.2	17.6
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-25-160A	37.2	17.6
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

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

Axle Model	Capacity	
	U.S. Pints	Liters
Rear Axle of Tandems		
RT-34-140 (RR-17-140)	35	16.9
RT-34-144	25.8	12.2
RT-34-145 (RR-17-145 rear)	36	17.1
RT-34-145P	25.4	12.0
RT-34-146	25.4	12.0
RT-40-140 (RR-20-140)	35	16.9
RT-40-145/149 (RR-20-145 rear)	36	17.3
RT-40-145P	25.8	12.2
RT-40-146	25.8	12.2
RT-40-160	34.4	16.3
RT-40-169	34.4	16.3
RT-44-145 (RR-22-145 rear)	35	16.9
RT-44-145P	25.1	11.9
RT-46-160/169 (RR-23-160 rear)	43/41	20.7/19.5
RT-46-160A/160P	34.4	16.3
RT-46-164	33.2	15.7
RT-46-164EH/16HEH	33.2	15.7
RT-48-180 (RR-24-180 rear)	39	18.6
RT-50-160/160P	33.2	15.7
RT-52-160 (RR-26-160 rear)	51	24.2
RT-52-180/185 (RR-26-180 rear)	39	18.3
RT-58-180/185 (RR-29-180 rear)	39	18.3

Torque Values for Fasteners

General Information

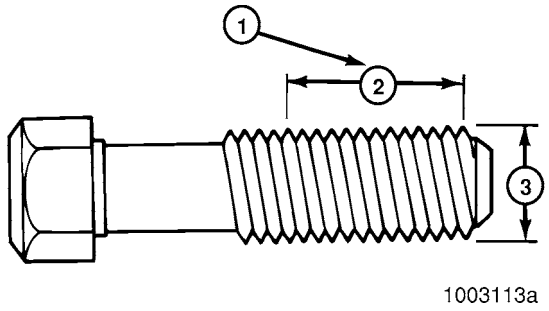
1. The torque values in **Table J** are for fasteners that have a light application of oil on the threads.
2. If the fasteners are dry, increase the torque values by ten percent (10%).
3. If the fasteners have a heavy application of oil on the threads, decrease the torque values by ten percent (10%).
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 8.1**.

b. Count the amount of threads there are in one inch (1.0 inch). **Figure 8.1**.

Figure 8.1



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1 AMOUNT OF THREADS IN ONE INCH
2 1″
3 X

X DIMENSION = (EXAMPLE 1/2″)

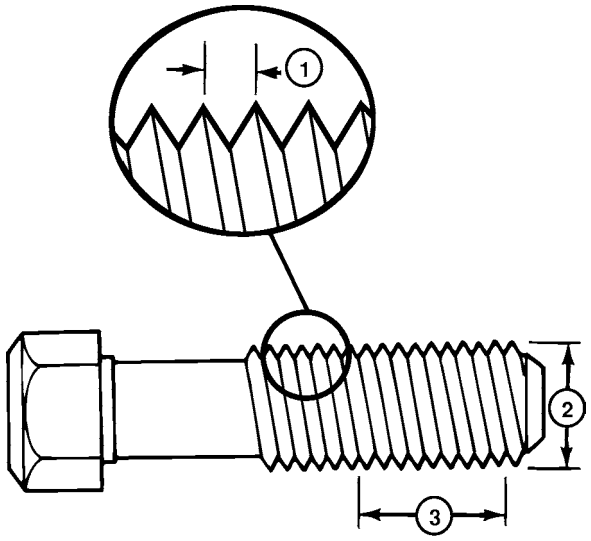
Example

- 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 8.2**.

Figure 8.2



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1 PITCH
2 X
3 Y

X DIMENSION = (EXAMPLE M8 OR 8 MM)
Y DIMENSION = DISTANCE OF 10 THREADS

b. Measure the distance of ten (10) threads, point to point in millimeters (mm), dimension Y. Make a note of dimension Y. **Figure 8.2**.

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 **Table J** to find the correct torque value.

Figure 8.3

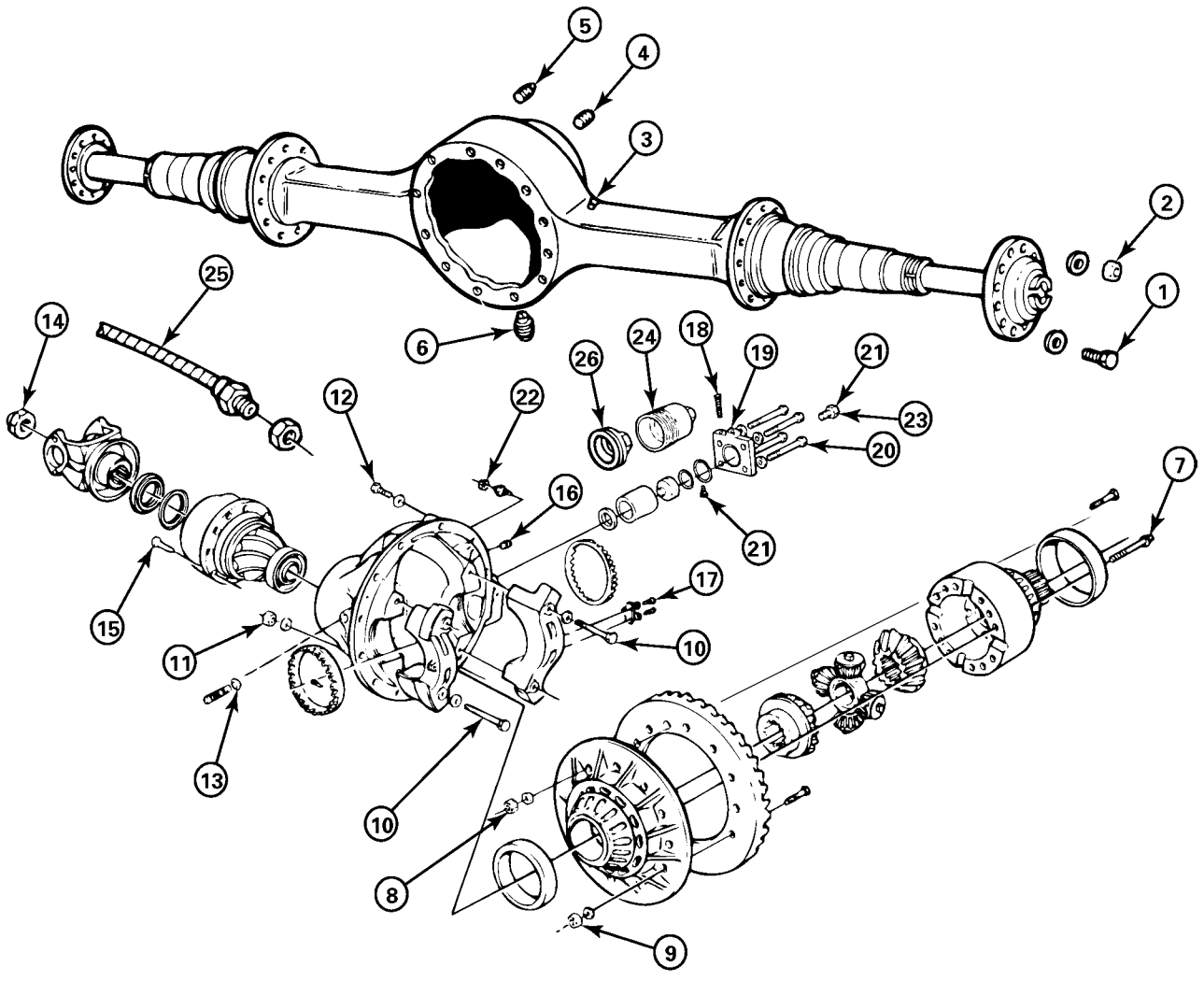


Table J — Torque Chart

Fastener		Thread Size	Torque Value lb-ft (N•m) T	
1.	*Capscrew, Axle Shaft	.31-24 .50-13	18-24 85-115	(24-33) (115-156)
2.	*Nut, Axle Shaft Stud	Plain Nut .44-20 .50-20 .56-18 .62-18 Lock Nut .44-20 .50-20 .56-18 .62-18	50-75 75-115 110-165 150-230 40-65 65-100 100-145 130-190	(68-102) (102-156) (149-224) (203-312) (54-88) (88-136) (136-197) (176-258)
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 Grade 10.9 Flange Head Grade 10.9 Standard Hex Head Grade 12.9 Standard Hex Head Grade 12.9 Flange Head Grade 12.9 Standard Head	.38-16 .44-14 .50-13 .56-12 .62-11 M12 x 1.75 M12 x 1.75 M12 x 1.75 M16 x 2 M16 x 2	35-50 60-75 85-115 130-165 180-230 85-103 74-96 105-125 203-251 220-310	(48-68) (81-102) (115-156) (176-224) (244-312) (115-140) (100-130) (143-169) (275-340) (300-420)
8.	*Nut, Differential Case Bolt	.50-13 .50-20 .62-11 .62-18 M12 x 1.75 M16 x 2	75-100 85-115 150-190 180-230 74-96 220-310	(102-136) (115-156) (203-258) (244-312) (100-130) (300-420)
9.	*Nut, Ring Gear Bolt Flange Head Standard Hex Head	.50-13 .50-20 .62-11 .62-18 M12 x 1.25 M12 x 1.75 M16 x 1.5 M16 x 1.5	75-100 85-115 150-190 180-230 66-81 77-85 192-214 196-262	(102-136) (115-156) (203-258) (244-312) (90-110) (104-115) (260-190) (265-355)
10.	Capscrew, Bearing Cap	.56-12 .62-11 .75-10 .88-14 .88-9 M16 x 2 M20 x 2.5 M22 x 2.5	110-145 150-190 270-350 360-470 425-550 181-221 347-431 479-597	(149-197) (203-258) (366-475) (488-637) (576-746) (245-300) (470-585) (650-810)
11.	Nut, Housing to Carrier Stud	.44-20 .50-20 .56-18 .62-18	50-75 75-115 110-165 150-230	(68-102) (102-156) (149-224) (203-312)

*Some Meritor carriers do not have these described parts.

Table J — Torque Chart (Continued)

Fastener		Thread Size	Torque Value lb-ft (N•m)	
12.	Capscrew, Carrier to Housing	.44-14 .50-13 .56-12 .62-11 .75-10 M12 x 1.75 M16 x 2	50-75 75-115 110-165 150-230 270-400 74-89 181-221	(68-102) (102-156) (149-224) (203-312) (366-542) (100-120) (245-300)
13.	*Jam Nut, Thrust Screw	.75-16 .88-14 1.12-16 M22 x 1.5 M30 x 1.5	150-190 150-300 150-190 148-210 236-295	(203-258) (203-407) (203-258) (200-285) (320-400)
14.	Input Yoke-to-Input Shaft Nut	Refer to **Table K**.		
15.	Capscrew, Bearing Cage	.38-16 .44-14 .50-13 .56-12 .62-11 M12 x 1.75	30-50 50-75 75-115 110-165 150-230 70-110	(41-68) (68-102) (102-156) (149-224) (203-312) (90-150)
16.	*Plug, Oil Fill (Carrier)	.75-14 1.5-11.5 M24 x 1.5	25 minimum (34 minimum) 120 minimum (163 minimum) 35 minimum (47 minimum)	
17.	*Capscrew, Lock Plate	.31-18 M8 x 1.25	20-30 21-26	(27-41) (28-35)

Torque Values are for Carriers with Bolt-On 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 15-25	 (20-35) (20-35)
22.	Lock Nut, Sensor Switch	M16 x 1	25-35	(35-45)

Torque Values are for Carriers with Screw-In 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)

*Some Meritor carriers do not have these described parts.

Table K — Input and Output Yoke Pinion Nut Fastener Torque Specifications

Single and Rear of Tandem Axles

Axle Model / Pinion Nut Location	RS-120, RS-125, RS-140	RS-144/145	RF-166, RS-160, RS-161, RS-185, RS-186	RS-210, RS-220, RS-230	RS-240	RS-380
Carrier Input Yoke	740-920 lb-ft (1000-1245 N•m) Fastener Size: M32 X 1.5	920-1130 lb-ft (1250-1535 N•m) Fastener Size: M39 X 1.5	1000-1230 lb-ft (1350-1670 N•m) Fastener Size: M45 X 1.5	740-920 lb-ft (1000-1245 N•m) Fastener Size: M32 X 1.5	740-920 lb-ft (1000-1245 N•m) Fastener Size: M39 X 1.5	800-1100 lb-ft (1085-1496 N•m) Fastener Size: 1-1/2 - 12 UNF

Drive Pinion Bearings — Preload (Refer to Section 5, "Assembly")

Specification	New bearings — 15 to 25 lb-in (1.7-2.8 N•m) torque (T) Used bearings — 15 to 25 lb-in (1.7-2.8 N•m) torque (T)
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 (Refer to Section 5, "Assembly")

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.
Adjustment	Change the thickness of the shim pack to get a good gear tooth contact pattern.

Hypoid Gear Set — Tooth Contact Patterns (Hand Rolled) (Refer to Section 5, "Assembly")

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
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 (Refer to Section 5, "Assembly")

Specification	15 to 35 lb-in (1.7-3.9 N•m) torque (T) ***or*** Expansion between bearing caps — RS-140, RS-145 and RS-160 carrier models — 0.002 to 0.009 inch (0.05-0.229 mm) — All other carrier models — 0.006 to 0.013 inch (0.15-0.33 mm)
Adjustment	Preload is controlled by tightening both adjusting rings after zero end play is reached

Main Differential Gears — Rotating Resistance (Refer to Section 5, "Assembly")

Specification	50 lb-ft (68 N•m) torque applied to one side gear (T)

Ring Gear — Backlash (Refer to Section 5, "Assembly")

Specification	Ring gears that have a pitch diameter of less than 17 inches (431.8 mm) — Range: 0.008 to 0.018 inch (0.20-0.46 mm) 0.012 inch (0.30 mm) for a new gear set Ring gears that have a pitch diameter of 17 inches (431.8 mm) or greater — Range: 0.010 to 0.020 inch (0.25-0.51 mm) 0.015 inch (0.38 mm) for a new gear set
Adjustment	Backlash is controlled by the position of the ring gear. Change backlash within specifications to get a good tooth contact pattern. — 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 (Refer to Section 5, "Assembly")

Specification	0.008 inch (0.20 mm) maximum

DCDL Sensor Switch — Installation (Refer to Section 5, "Assembly")

Specification	Shift the differential to the locked position. Tighten the sensor switch into the carrier until the test light comes on. Tighten the sensor switch one additional turn and tighten lock nut to correct torque value.

Spigot Bearing — Peening on the Drive Pinion (Refer to Section 6, "Driver Controlled Main Differential Lock")

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

MERITOR®

TYPE OF AXLE:

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

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

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 Meritor 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. Meritor recommends that you use the following procedure.

⚠ *CAUTION*

If the vehicle is equipped with a front drive axle, tow the vehicle from the front, with the front wheels off the ground. If this is not possible, you must remove the front drive shaft before towing.

Before Towing or Drive-Away

WARNINGS

⚠ ***To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.***

⚠ ***Engage the parking brake to prevent the vehicle from moving before you begin maintenance or service procedures that require you to be under the vehicle. Serious personal injury can result.***

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* Table L *at this time, from the axle(s) that will remain on the road when the vehicle is transported. Continue with step 5.

5. Remove the stud nuts or capscrews and the washers from the flange of the axle shaft. **Figure 10.1**.

Table L

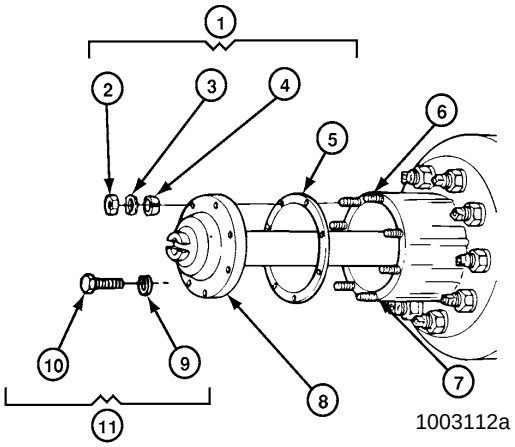
Single Axles Remove the left-hand (road side) axle shaft
Tandem Axles **Forward Axle:** Remove the right-hand (curb side) axle shaft **Rear Axle:** Remove the left-hand (road side) axle shaft

⚠ *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 10.1**.

Figure 10.1



1	**TAPERED DOWEL RETENTION**	**7**	**SHAFT HUB AXLE**
2	**STUD NUT**	**8**	**AXLE SHAFT (FLANGE)**
3	**WASHER**	**9**	**WASHER**
4	**TAPERED DOWEL**	**10**	**CAPSCREW**
5	**GASKET**	**11**	**NON-TAPERED DOWEL RETENTION**
6	**STUD**		

7. **Brass Drift Method:**

WARNING

Do not strike the round driving lugs on the flange of an axle shaft. Pieces can break off and cause serious personal injury.

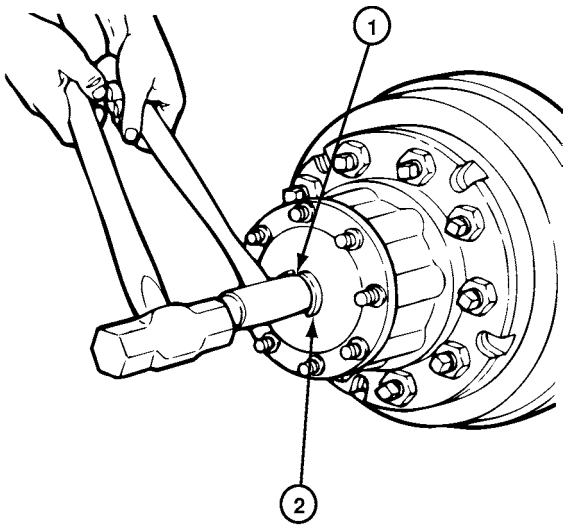
NOTE

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 10.2**.

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 10.2**.

Figure 10.2



1 BRASS HAMMER INSIDE LUGS
2 ROUND DRIVING LUG

8. **Air Hammer Vibration Method:**

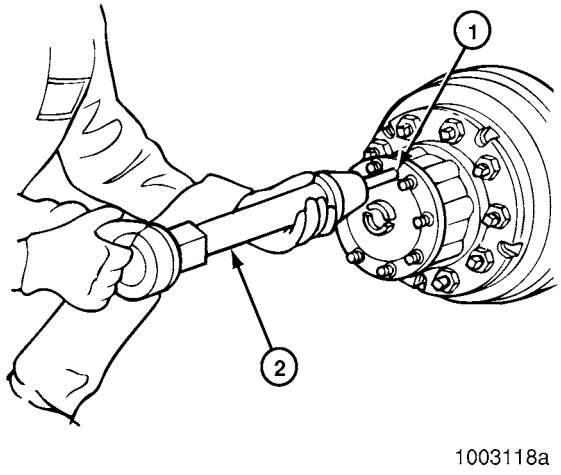
WARNING

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 10.3**.

Figure 10.3



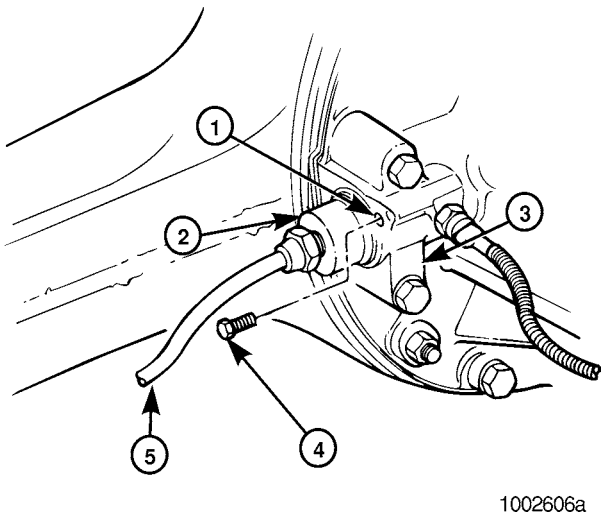
1 BIT PLACED BETWEEN STUDS
2 AIR HAMMER AND BIT

9. 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.)

10. Remove the tapered dowels, gasket (if used) and the axle shaft from the axle assembly. **Figure 10.1**.

11. Disconnect the air hose from the shift cylinder. **Figure 10.4**.

Figure 10.4

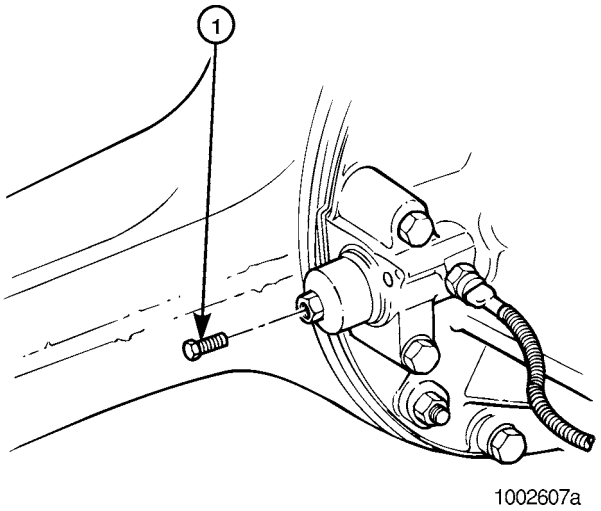


1 STORAGE HOLE
2 CYLINDER
3 SHIFT TOWER
4 MANUAL ENGAGING CAPSCREW
5 AIR HOSE

THREADED SHIFT ASSEMBLY

12. 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 10.4**.
13. Lock (engage) the main differential using the Manual Engaging Method.
14. **Manual Engaging Method:**
    a. Install the manual engaging capscrew into the threaded hole in the center of the cylinder. **Figure 10.5**.

Figure 10.5



1 MANUAL ENGAGING CAPSCREW

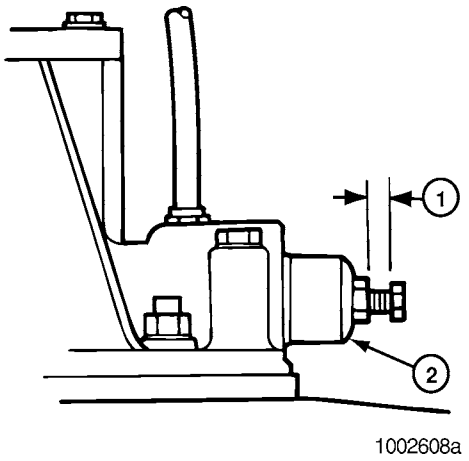
THREADED SHIFT ASSEMBLY

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 10.6**. 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 10.6



1 0.25" TO 0.50" (6.4 TO 12.7 MM)
2 CYLINDER

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**.

15. 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 starting with "Before Towing or Drive-Away."

16. 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 17 and 18, otherwise continue with step 19.

17. 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 19.

18. When the correct amount of air pressure is in the brake system, release the parking brakes of the vehicle that is being transported. Step 19 is not required.

⚠ *WARNING*

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

19. 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

WARNINGS

⚠ ***To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.***

⚠ ***Engage the parking brake to prevent the vehicle from moving before you begin maintenance or service procedures that require you to be under the vehicle. Serious personal injury can result.***

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 chamber, carefully follow the service instructions of the chamber manufacturer. 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.

Table M

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

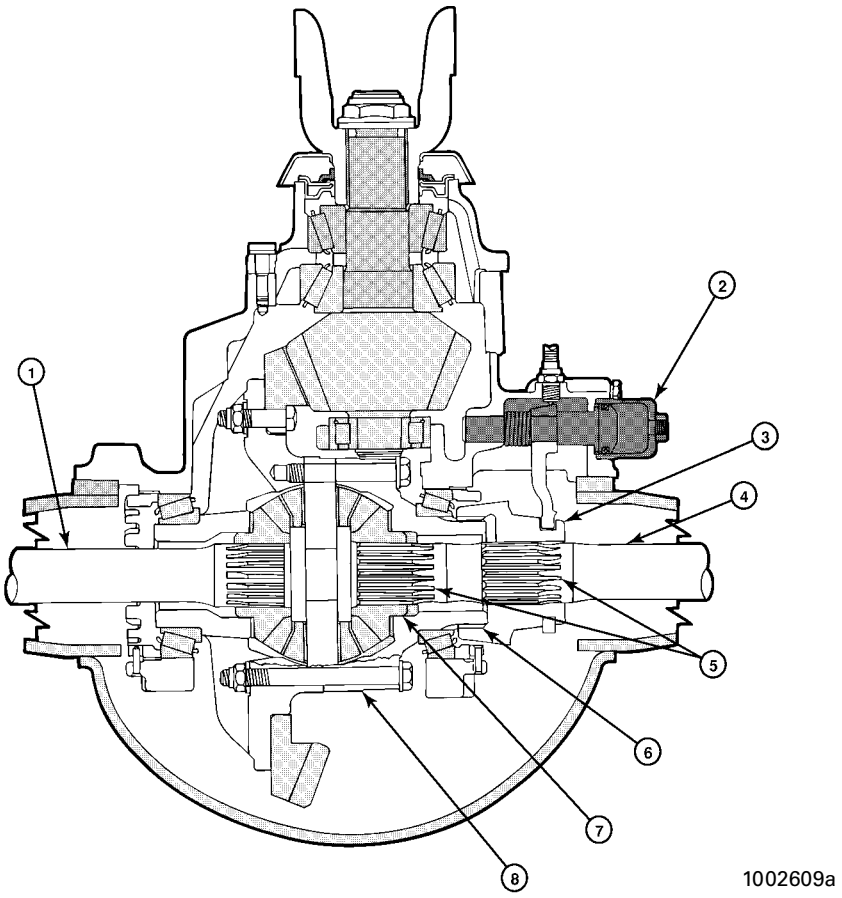
NOTE

Install only the axle shaft(s) shown in* Table M *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 10.7*. Continue with step 5 of "After Towing or Drive-Away."

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 10.1**.
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 the following table.

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

Figure 10.7



1 LEFT-HAND (ROAD SIDE) AXLE SHAFT
2 SHIFT ASSEMBLY
3 SHIFT COLLAR
4 RIGHT-HAND (CURB SIDE) AXLE SHAFT
5 DOUBLE ROW OF SPLINES
6 SHIFT COLLAR AND DIFFERENTIAL CASE SPLINES ENGAGED (LOCKED)
7 SIDE GEAR
8 DIFFERENTIAL CASE

SINGLE AXLE OR REAR AXLE OF TANDEM SHOWN WITH SCREW-IN SHIFT ASSEMBLY AND IN THE LOCKED (ENGAGED) POSITION

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 10.4**. T
10. Connect the air hose to the shift cylinder. Tighten to 22 to 30 lb-ft (30-40 N•m). T
11. Install the remaining axle shaft into the axle housing and carrier. Follow steps 5 through 7.
12. Check 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 Maintenance Manual 1, *Lubrication*, or refer to the Lubrication Section of the Maintenance Manual for the axle model you are working with.

MERITOR®

TYPE OF AXLE:

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

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

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 Meritor 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. Meritor recommends that you use the following procedure.

⚠ *CAUTION*

If the vehicle is equipped with a front drive axle, tow the vehicle from the front, with the front wheels off the ground. If this is not possible, you must remove the front drive shaft before towing.

Before Towing or Drive-Away

WARNINGS

⚠ ***To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.***

⚠ ***Engage the parking brake to prevent the vehicle from moving before you begin maintenance or service procedures that require you to be under the vehicle. Serious personal injury can result.***

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.

Table N

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

NOTE

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

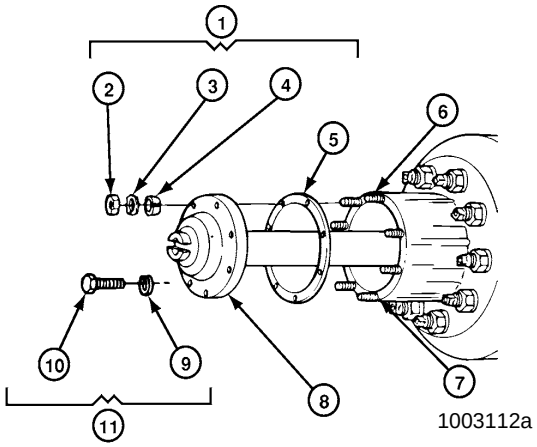
5. Remove the stud nuts or capscrews and the washers from the flange of the axle shaft. **Figure 10.8**.

⚠ *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 10.8**.

Figure 10.8



1	**TAPERED DOWEL RETENTION**	**7**	**SHAFT HUB AXLE**
2	**STUD NUT**	**8**	**AXLE SHAFT (FLANGE)**
3	**WASHER**	**9**	**WASHER**
4	**TAPERED DOWEL**	**10**	**CAPSCREW**
5	**GASKET**	**11**	**NON-TAPERED DOWEL RETENTION**
6	**STUD**		

7. Brass Drift Method:

WARNING

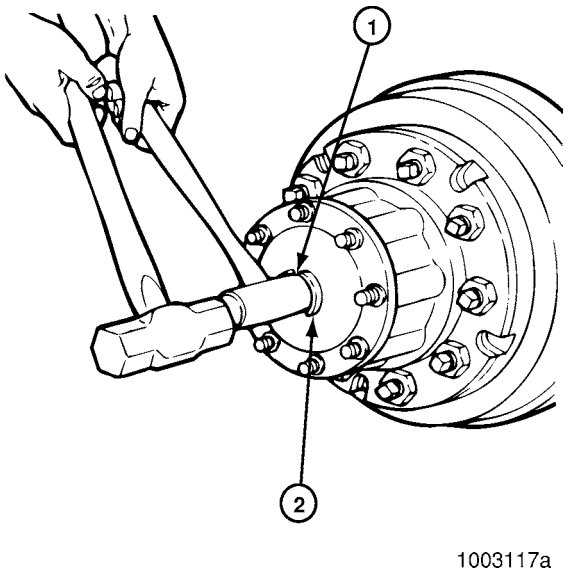
Do not strike the round driving lugs on the flange of an axle shaft. Pieces can break off and cause serious personal injury.

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 10.9**.

Figure 10.9



1 BRASS HAMMER INSIDE LUGS
2 ROUND DRIVING LUG

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 10.9**.

8. Air Hammer Method:

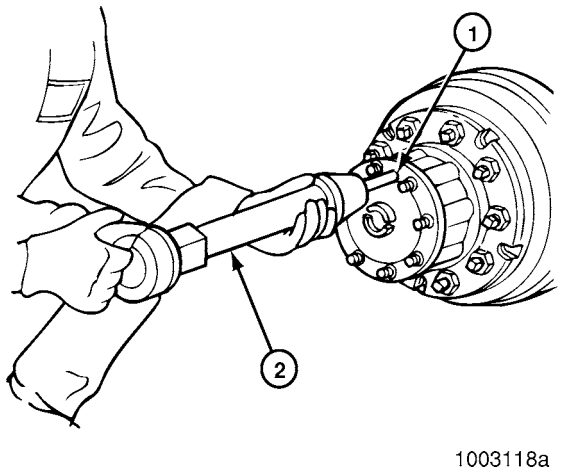
WARNING

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 10.10**.

Figure 10.10



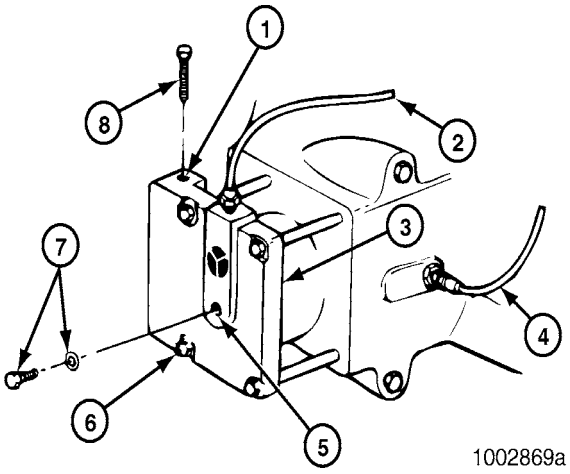
1 BIT PLACED BETWEEN STUDS
2 AIR HAMMER AND BIT

9. 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.)

10. Remove the tapered dowels, gasket (if used) and the axle shaft from the axle assembly. **Figure 10.11**.

11. Remove the manual engaging capscrew from the storage hole. The storage hole of bolted-on shift assemblies is located in the top side of the shift cylinder cover. **Figure 10.11**.

Figure 10.11



1 TOP STORAGE HOLE FOR MANUAL ENGAGING CAPSCREW
2 AIR LINE
3 CYLINDER COVER
4 WIRE
5 SERVICE POSITION CAPSCREW HOLE
6 BOTTOM STORAGE HOLE FOR PLUG AND GASKET
7 PLUG AND GASKET
8 MANUAL ENGAGING CAPSCREW

BOLT-ON SHIFT ASSEMBLY

12. 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 10.11**. T
13. Lock (engage) the main differential using one of the two following methods: Air Pressure Method or Manual Engaging Method.

14. 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 10.12**.

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.

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.

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 10.14**.

f. Stop the engine. Continue with step 16.

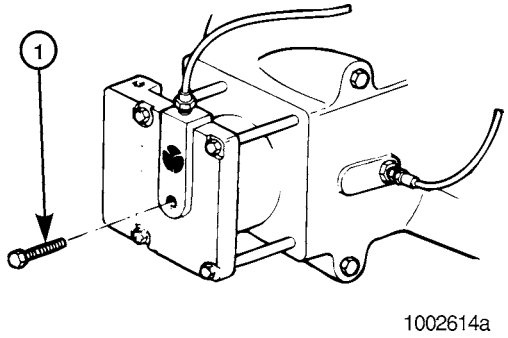
15. Manual Engaging Method:

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.

a. Install the manual engaging capscrew into the threaded hole in the center of the cylinder cover. **Figure 10.12**.

Figure 10.12

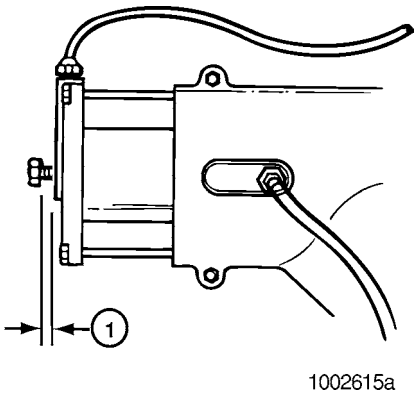


1 MANUAL ENGAGING CAPSCREW

BOLT-ON SHIFT ASSEMBLY

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 10.13**. 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 10.13



1 0.25" TO 0.50" (6.4-12.7 MM)

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**.

16. 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 starting with "Before Towing or Drive-Away."

17. 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 18 and 19. Otherwise continue with step 20.

18. 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 20.
19. When the correct amount of air pressure is in the brake system, release the parking brakes of the vehicle that is being transported. Step 20 is not required.

⚠ *WARNING*

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

20. 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

WARNINGS

⚠ ***To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.***

⚠ ***Engage the parking brake to prevent the vehicle from moving before you begin maintenance or service procedures that require you to be under the vehicle. Serious personal injury can result.***

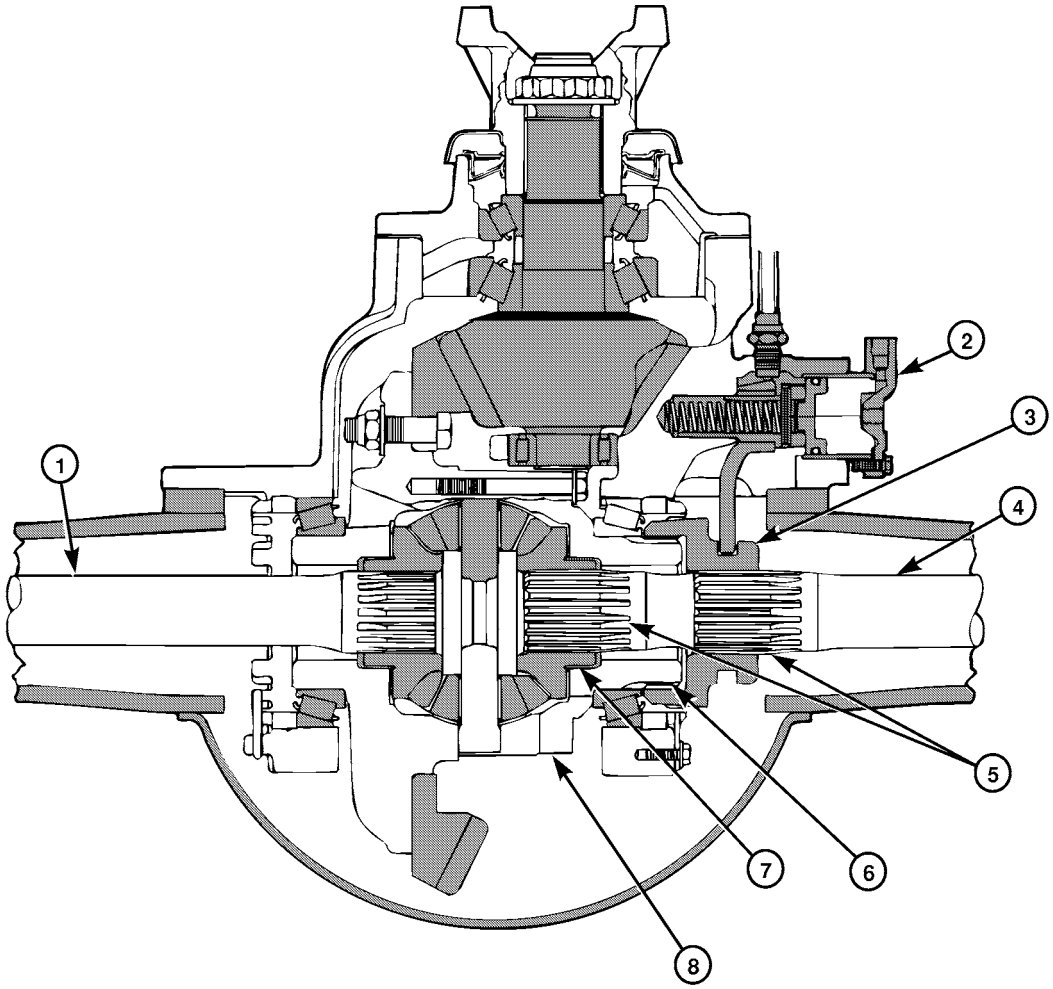
1. If an auxiliary air supply was used, apply the vehicle parking brakes using the switch inside the cab of the vehicle. If an auxiliary air supply was not used, begin with step 2.

⚠ *WARNING*

When you work on a spring chamber, carefully follow the service instructions of the chamber manufacturer. 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.

Figure 10.14



1 LEFT-HAND (ROAD SIDE) AXLE SHAFT
2 SHIFT ASSEMBLY
3 SHIFT COLLAR
4 RIGHT-HAND (CURB SIDE) AXLE SHAFT
5 DOUBLE ROW OF SPLINES
6 SHIFT COLLAR AND DIFFERENTIAL CASE SPLINES ENGAGED (LOCKED)
7 SIDE GEAR
8 DIFFERENTIAL CASE

SINGLE AXLE OR REAR AXLE OF TANDEM SHOWN WITH BOLTED-ON SHIFT ASSEMBLY AND SHOWN IN THE LOCKED (ENGAGED) POSITION

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.

Table O

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

NOTE

Install only the axle shaft(s) shown in* Table O *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 10.14*.

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 10.8**.
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 the table below.

Fastener	Thread Size	Torque Value lb-ft (N•m) T
Capscrews:	0.31"-24	18-24 (24-33)
	0.50"-13	85-115 (115-156)
Stud Nuts:		
(plain nuts)	0.44"-20	50-75 (68-102)
	0.50"-20	75-115 (102-156)
	0.56"-18	110-165 (149-224)
	0.62"-18	150-230 (203-312)
	0.75"-16	310-400 (420-542)
(lock nut)	0.44"-20	40-65 (54-88)
	0.50"-20	65-100 (88-136)
	0.56"-18	100-145 (136-197)
	0.62"-18	130-190 (176-258)
	0.75"-16	270-350 (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 bolted-on 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 10.11**. T
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). T
11. Install the remaining axle shaft into the axle housing and carrier. Follow steps 5 through 7 of "After Towing or Drive-Away."
12. Check 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 Maintenance Manual 1, *Lubrication*, or refer to the Lubrication Section of the Maintenance Manual for the axle model you are working with.

TYPE OF AXLE:

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

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

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 Meritor 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. Meritor recommends that you use the following procedure.

⚠ CAUTION

If the vehicle is equipped with a front drive axle, tow the vehicle from the front, with the front wheels off the ground. If this is not possible, you must remove the front drive shaft before towing.

Before Towing or Drive-Away

WARNINGS

⚠ ***To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.***

⚠ ***Engage the parking brake to prevent the vehicle from moving before you begin maintenance or service procedures that require you to be under the vehicle. Serious personal injury can result.***

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 <u>both</u> axle shafts.

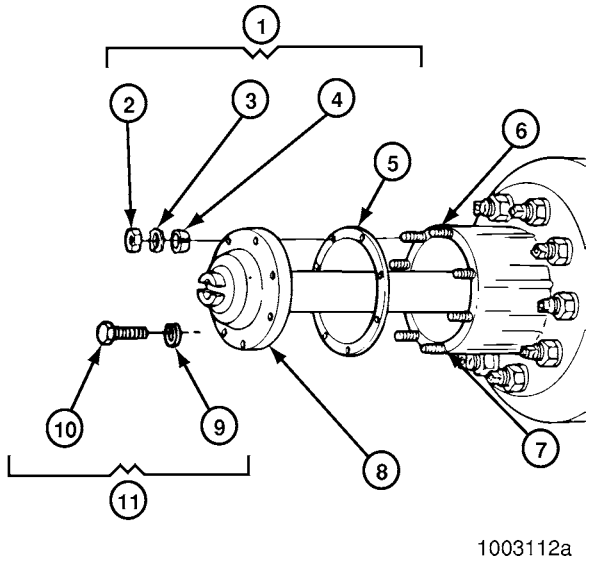
5. Remove the stud nuts or capscrews and the washers from the flange of the axle shaft. **Figure 10.15**.

⚠ 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 10.15**.

Figure 10.15



1 TAPERED DOWEL RETENTION
2 STUD NUT
3 WASHER
4 TAPERED DOWEL
5 GASKET
6 STUD
7 SHAFT HUB AXLE
8 AXLE SHAFT (FLANGE)
9 WASHER
10 CAPSCREW
11 NON-TAPERED DOWEL RETENTION

NOTE

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

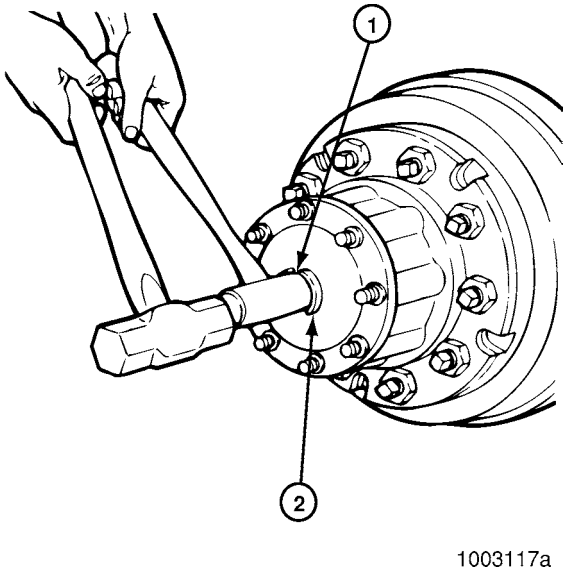
7. **Brass Drift Method:**

WARNING

Do not strike the round driving lugs on the flange of an axle shaft. Pieces can break off and cause serious personal injury.

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 10.16**.

Figure 10.16



1 BRASS HAMMER INSIDE LUGS
2 ROUND DRIVING LUG

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 10.16**.

8. **Air Hammer Vibration Method:**

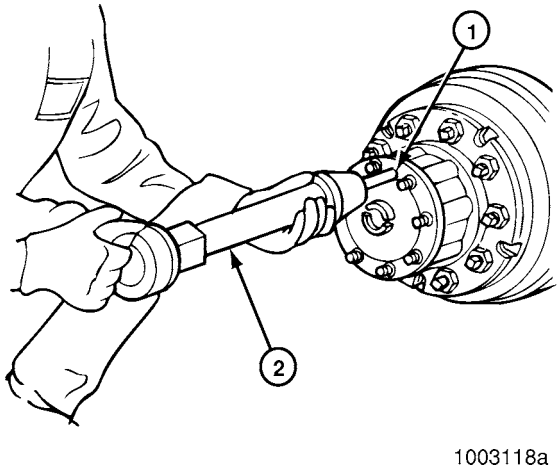
WARNING

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 10.17**.

Figure 10.17



1 BIT PLACED BETWEEN STUDS
2 AIR HAMMER AND BIT

9. 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.)

10. Remove the tapered dowels, gasket (if used) and the axle shaft from the axle assembly. **Figure 10.15**.

11. 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 12 and 13, otherwise continue with step 14.

12. 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 14.
13. When the correct amount of air pressure is in the brake system, release the parking brakes of the vehicle that is being transported. Step 14 is not required.

⚠ *WARNING*

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

14. 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

WARNINGS

⚠ ***To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.***

⚠ ***Engage the parking brake to prevent the vehicle from moving before you begin maintenance or service procedures that require you to be under the vehicle. Serious personal injury can result.***

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 chamber, carefully follow the service instructions of the chamber manufacturer. 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 10.15**.
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 the table below.
8. Check 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 Maintenance Manual 1, *Lubrication*, or refer to the Lubrication Section of the Maintenance Manual for the axle model you are working with.

Fastener	Thread Size	Torque Value lb-ft (N•m) T
Capscrews:	0.31"-24	18-24 (24-33)
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(lock nut)	0.44"-20	40-65 (54-88)
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	0.56"-18	100-145 (136-197)
	0.62"-18	130-190 (176-258)
	0.75"-16	270-350 (366-475)

Notes

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Planetary Axle Wheel Ends

Coverless Planetary Spider Design

Maintenance Manual 9G

Before You Begin

This manual provides maintenance and service procedures for Meritor coverless planetary spider design wheel end assemblies. Before you begin procedures:

1. Read and understand all instructions and procedures before you begin to service components.
2. Read and observe all Caution and Warning safety alerts that precede instructions or procedures you will perform. These alerts help to avoid damage to components, serious personal injury, or both.
3. Follow your company's maintenance and service, installation, and diagnostics guidelines.
4. Use special tools when required to help avoid serious personal injury and damage to components.

Safety Alerts, Torque Symbol and Notes

WARNING	A Warning alerts you to an instruction or procedure that you must follow exactly to avoid serious personal injury and damage to components.
CAUTION	A Caution alerts you to an instruction or procedure that you must follow exactly to avoid damage to components and possible serious personal injury can also occur.
	The torque symbol alerts you to tighten fasteners to a specified torque value.
NOTE:	A Note provides information or suggestions that help you correctly service a component.

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⚠ ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from Meritor.

Hazard Summary

Because some brake linings contain asbestos, workers who service brakes must understand the potential hazards of asbestos and precautions for reducing risks. Exposure to airborne asbestos dust can cause serious and possibly fatal diseases, including asbestosis (a chronic lung disease) and cancer, principally lung cancer and mesothelioma (a cancer of the lining of the chest or abdominal cavities). Some studies show that the risk of lung cancer among persons who smoke and who are exposed to asbestos is much greater than the risk for non-smokers. Symptoms of these diseases may not become apparent for 15, 20 or more years after the first exposure to asbestos.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons. OSHA has set a maximum allowable level of exposure for asbestos of 0.1 f/cc as an 8-hour time-weighted average and 1.0 f/cc averaged over a 30-minute period. Scientists disagree, however, to what extent adherence to the maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling asbestos dust. OSHA requires that the following sign be posted at the entrance to areas where exposures exceed either of the maximum allowable levels:

DANGER: ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA

2. Respiratory Protection. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA for use with asbestos at all times when servicing brakes, beginning with the removal of the wheels.

3. Procedures for Servicing Brakes.

a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.

b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

c. If an enclosed vacuum system or brake washing equipment is not available, employers may adopt their own written procedures for servicing brakes, provided that the exposure levels associated with the employer's procedures do not exceed the levels associated with the enclosed vacuum system or brake washing equipment. Consult OSHA regulations for more details.

d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.

e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.

4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

⚠ NON-ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to non-asbestos fiber dust, a potential cancer and lung disease hazard. Material Safety Data Sheets are available from Meritor.

Hazard Summary

Most recently manufactured brake linings do not contain asbestos fibers. These brake linings may contain one or more of a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers and silica that can present health risks if inhaled. Scientists disagree on the extent of the risks from exposure to these substances. Nonetheless, exposure to silica dust can cause silicosis, a non-cancerous lung disease. Silicosis gradually reduces lung capacity and efficiency and can result in serious breathing difficulty. Some scientists believe other types of non-asbestos fibers, when inhaled, can cause similar diseases of the lung. In addition, silica dust and ceramic fiber dust are known to the State of California to cause lung cancer. U.S. and international agencies have also determined that dust from mineral wool, ceramic fibers and silica are potential causes of cancer.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to non-asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons.

2. Respiratory Protection. OSHA has set a maximum allowable level of exposure for silica of 0.1 mg/m^3 as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend that exposures to other ingredients found in non-asbestos brake linings be kept below 1.0 f/cc as an 8-hour time-weighted average. Scientists disagree, however, to what extent adherence to these maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling non-asbestos dust.

Therefore, wear respiratory protection at all times during brake servicing, beginning with the removal of the wheels. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA, if the exposures levels may exceed OSHA or manufacturer's recommended maximum levels. Even when exposures are expected to be within the maximum allowable levels, wearing such a respirator at all times during brake servicing will help minimize exposure.

3. Procedures for Servicing Brakes.

a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.

b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

c. If an enclosed vacuum system or brake washing equipment is not available, carefully clean the brake parts in the open air. Wet the parts with a solution applied with a pump-spray bottle that creates a fine mist. Use a solution containing water, and, if available, a biodegradable, non-phosphate, water-based detergent. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.

e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.

4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA, to minimize exposure. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

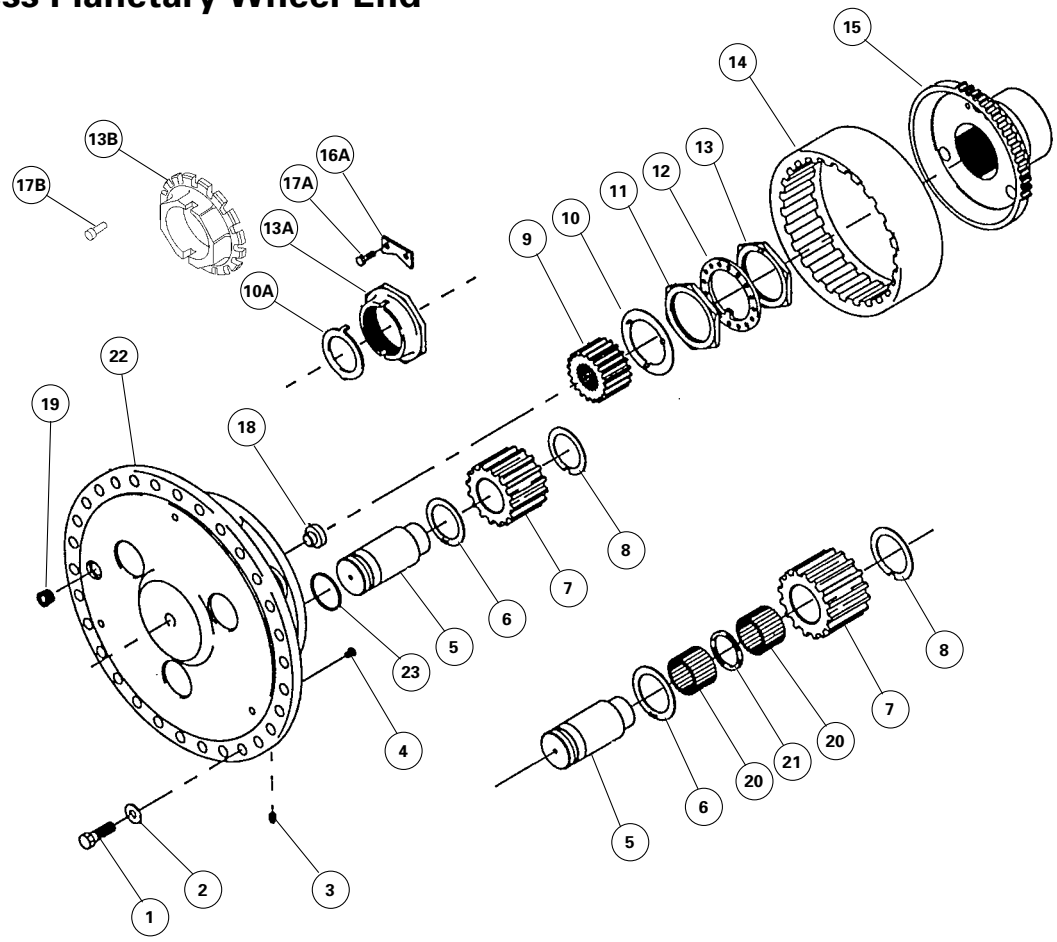
5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

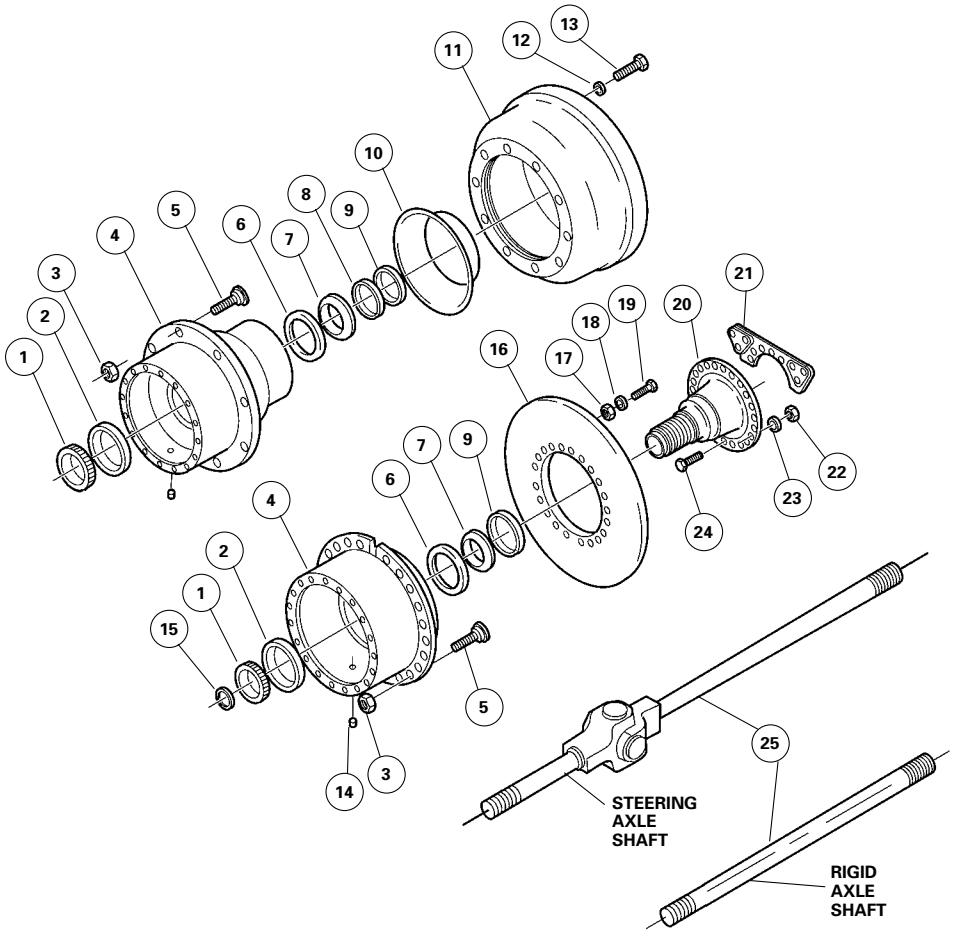
References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

Coverless Planetary Wheel-End



Item	Description	Item	Description
1	Planetary Spider to Hub Capscrew	13/13A	Wheel Bearing Adjusting Nut
2	Planetary Spider to Hub Washer	13B	Wheel Bearing Adjusting Nut
3	Shaft Planet Pinion Setscrew	14	Planetary Ring Gear
4	Ring Gear Thrust Button	15	Planetary Ring Gear Hub
5	Planet Pinion Shaft	16A	Hub Nut Lock
6	Planet Pinion Outer Thrust Washer	17A	Capscrew
7	Planetary Drive Pinion	17B	Capscrew
8	Planet Pinion Inner Thrust Washer	18	Axle Shaft Thrust Button
9	Planetary Sun Gear	19	Oil Drain Plug
10	Sun Gear Thrust Washer	20	Needle Roller Bearing
10A	Sun Gear Thrust Washer	21	Needle Roller Bearing Spacer
11	Wheel Bearing Adjusting Jam Nut	22	Spider
12	Wheel Bearing Adjusting Washer	23	O-Ring

Drum Brake and Disc Brake Assemblies



Item	Description
1	Outer Wheel Bearing Cone
2	Outer Wheel Bearing Cup
3	Wheel Stud Nut
4	Wheel Hub
5	Wheel Stud
6	Inner Wheel Bearing Cup
7	Inner Wheel Bearing Cone
8	Spacer
9	Hub Inner Bearing Oil Seal
10	Oil Slinger
11	Brake Drum
12	Drum Mounting Washer
13	Drum Mounting Capscrew

Item	Description
14	Oil Drain Plug
15	Axle Shaft Snap Ring
16	Brake Disc
17	Disc Mounting Nut (If Applicable)
18	Disc Mounting Washer
19	Disc Mounting Capscrew
20	Spindle
21	Caliper Mounting Adapter
22	Spindle to Housing Nut (If Applicable)
23	Spindle to Housing Washer
24	Spindle to Housing Capscrew
25	Axle Shaft

Description

Meritor coverless spider design planetary axles incorporate a single or double reduction carrier with hypoid gearing mounted in the axle center. Final gearing reduction occurs in the wheel hubs by planetary design spur gears.

Meritor planetary axles permit the carrier hypoid gearing and axle shafts to carry only nominal torsional loads. At the same time, the planetary axles also provide the highest practical numerical gear reduction at the wheels.

- Power is transmitted by the hypoid gear set in the carrier to the axle shafts and the sun gear of the final reduction, through the revolving planetary gears and into the planetary spider which drives the wheel hub.
- The floating sun gear teeth mesh with teeth of the planetary spur gears.
- The planetary gears rotate on planetary shafts mounted on the spider. The planetary gear teeth, in turn, mesh with the fixed or floating ring gear teeth.

Axle Models Covered in This Manual

Rigid Axles

PRC 594	PRC 866	PRLC 755	PRLC 1736
PRC 671	PRC 867	PRLC 756	PRLC 1756
PRC 673	PRC 1314	PRLC 824	PRLC 1752
PRC 674	PRC 1756	PRLC 874	PRLC 1757
PRC 727	PRLC 616	PRLC 1735	PRLC 1794
			PRLS 614

Steering Axles

PSC 594	PSC 1044	PSC 1794
PSC 822	PSC 1485	PSTC 824
PSC 824	PSC 1614	
PSC 825	PSC 1615	
PSC 826	PSC 1617	

Tandem Axles

SPRC 673
SPRC 1356
SPRC 1735
SPRC 1756

Tridem Axles

EPRC 1356
EPRC 1735

Identification

To determine the exact axle model specification, refer to the identification tag located on the axle. **Figures 2.1, 2.2 and 2.3.**

Figure 2.1 Axle Identification Tag Location

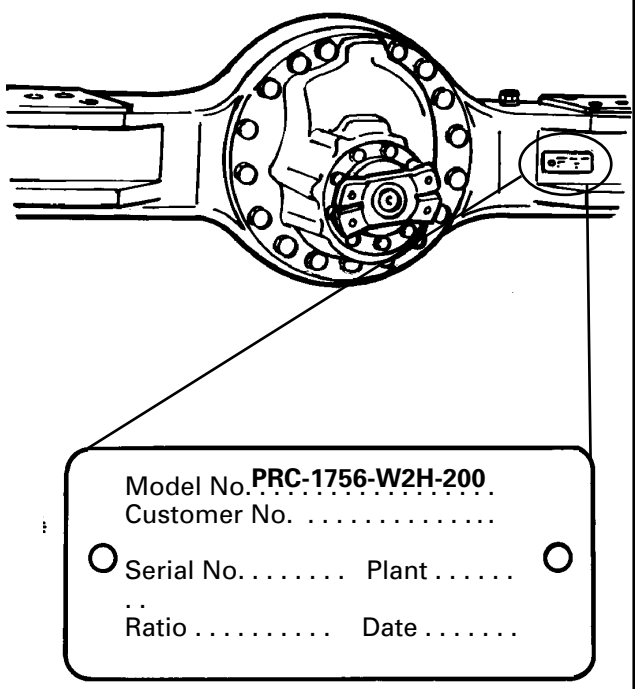


Figure 2.2

Single Planetary Axles

Steering Example	P	S		C	1	6	1	7		P	1	0	0	
Rigid Example	P	R		C	1	7	3	5	W	4	H	2	0	0

P = Planetary
N = Non-Drive

R = Rigid
S = Steering

Only If Applicable:
T = Transmission on Carrier
O= Oscillating or Pin Mount
L = Mounting Other Than Pad With Drilling

Housing Type Designation
C = Integral Cast

First Two Digits Wheel End Designation (Basic Model Number)

Last Digit – Carrier Designation for Base Model Number

Exact Specification

Brake Type:

DLH	— 17 in. (432 mm) Hydraulic Drum – (Dual Leading Hydraulic)
H	— Hydraulic Drum
HDB	— Hydraulic Dry Disc
M	— Mechanical Drum
N	— None
NR	— With Rotor Less Calipers
P	— "P" Series Cam
RDA	— Wedge (Dual Air Chamber)
RDH	— Wedge (Dual Hydraulic Cylinders)
RSA	— Wedge Single Air Chamber
RSH	— Wedge (Single Hydraulic Cylinders)
W2H	— Dura-Disc® 9" (224) Wet Disc
W3H	— Dura-Disc® 13" (330) Wet Disc
W4H	— Dura-Disc® 17 in. (432 mm) Wet Disc
W4M	— Dura-Disc® 17 in. (432 mm) Wet Disc Spring Applied Hydraulic Release

Figure 2.3

Tandem and Tridem Axles

P R C – 1 7 5 6

P = Planetary
N = No Planetary Gears

R = Rigid
S = Steering

Housing Type Designation
C = Integral Cast

First Two or Three Digits Wheel End Designation (Basic Model Number)

Last Digit – Carrier Designation for Base Model Number

Remove and Disassemble the Planetary Wheel Ends

⚠ WARNING

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

1. Park the vehicle on a level surface.

⚠ WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle that is supported only by jacks. Jacks can slip or fall over and cause serious personal injury.

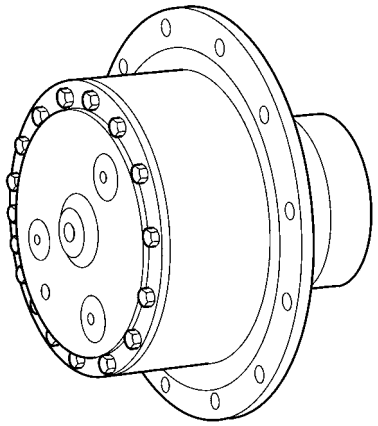
2. Block the wheels that will not be raised to prevent the vehicle from moving.
3. Raise the vehicle, so that the area you will service is off of the ground. Support the vehicle with safety stands. Refer to the vehicle manufacturer's maintenance manual for instructions on raising the vehicle.

Remove the Tires and Rims

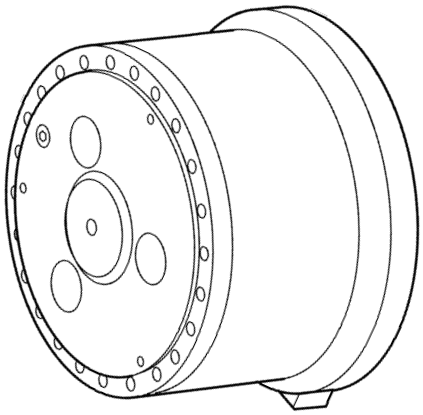
Planetary axles can come equipped with dual demountable hubs or flange style hubs. **Figure 3.1.** You can service the planetary gearing on flange style hubs without removing the tire from the wheel end.

1. **For axles with dual demountable hubs:** Refer to the vehicle manufacturer's removal instructions.
2. If the axle is equipped with an oil drain plug in the planetary spider, rotate the hub until the plug is at the bottom.
3. Remove the drain plug.
4. Drain and discard the lubricant.

Figure 3.1 FLANGE STYLE HUB



DUAL DEMOUNTABLE HUB

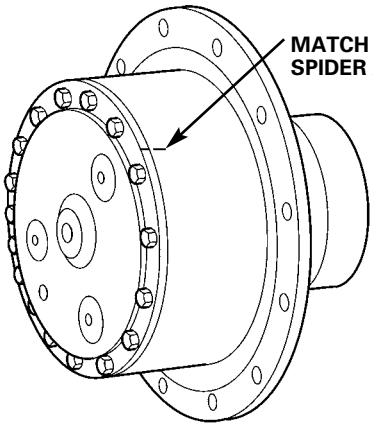


Remove the Planetary Spider Assembly

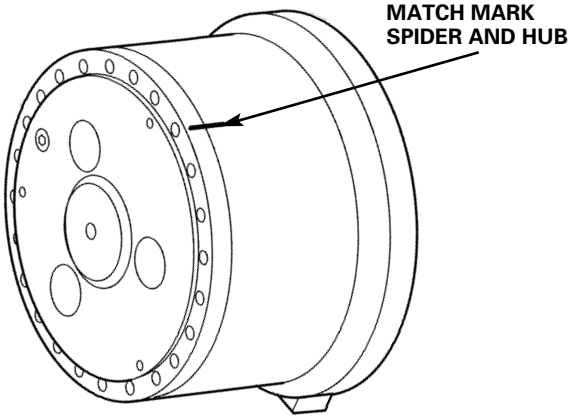
1. Match mark the spider and wheel hub for correct alignment when you reassemble the unit. **Figure 3.2**.

Figure 3.2

FLANGE STYLE HUB

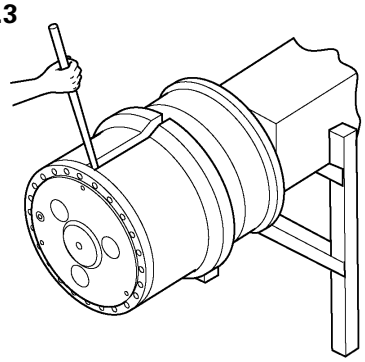


DUAL DEMOUNTABLE HUB



2. Insert a pry bar into the assembly notches and separate the planetary spider assembly from the wheel hub assembly. **Figure 3.3.** Do not remove the spider assembly at this time.
   - **For axles without assembly notches:** Hit the spider with a plastic or rubber mallet to separate the planetary assembly from the wheel hub assembly. Do not remove the spider assembly at this time.

Figure 3.3

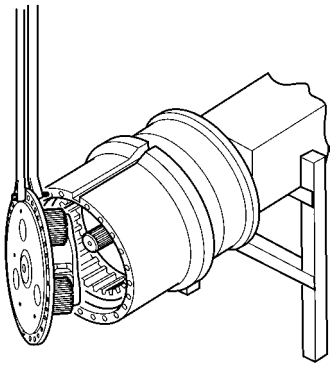


⚠ WARNING

Take care when you use lifting devices. When you use a lifting strap, inspect the strap for damage before you use it. Do not use a lifting strap to shock load or drop load a component. Serious personal injury and damage to components can result.

4. Use a lifting device to remove the planetary spider assembly from the wheel hub assembly. **Figure 3.4**.

Figure 3.4



Disassemble the Planetary Spider Assembly

⚠ WARNING

Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

NOTE: During disassembly, mark or tag the planetary spider parts you do not plan to replace. Marking and tagging these parts, will aid correct installation during assembly.

1. Remove the setscrew from each pinion shaft.
2. Place the spider assembly in a press with the flange side DOWN.
   - **If a press is not available:** Use a brass drift and mallet to remove the pinion shafts.
3. Support the spider assembly as required.
4. Place a container of cushioning material under the press to catch the planetary pinion shafts as you press them out of the spider and planetary pinion gears.
5. Press each pinion shaft out of the spider and planetary gear. **Figure 3.5 and Figure 3.6.**

Figure 3.5 Planetary pinion shaft with needle roller bearings

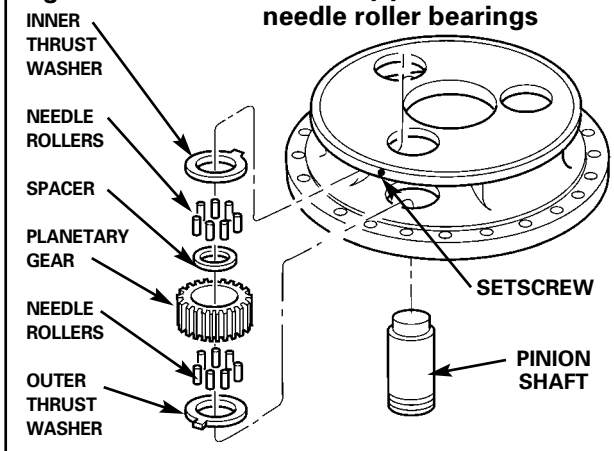
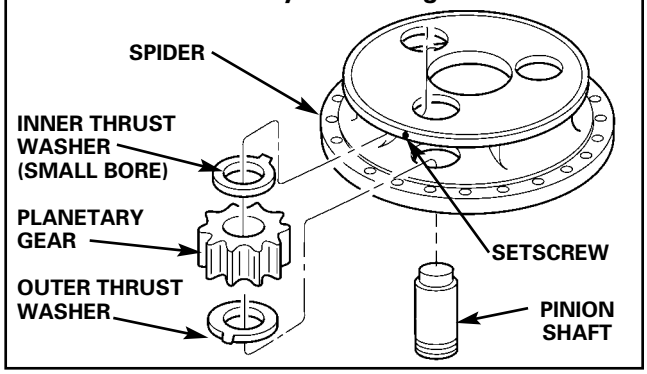


Figure 3.6 Planetary pinion shaft with nylon coating

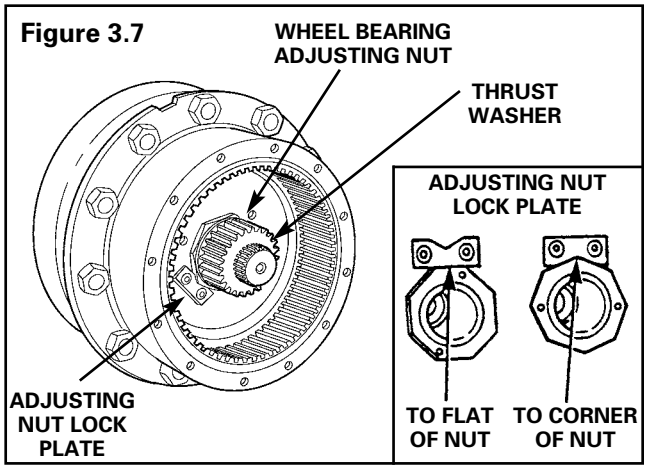


6. Remove the planetary gears and thrust washers from the planetary spider.
7. **For planetary pinion shafts with needle roller bearings:** Remove the needle roller bearings and spacer from the bore of the planetary gear.

Remove the Ring Gear and Axle Shaft

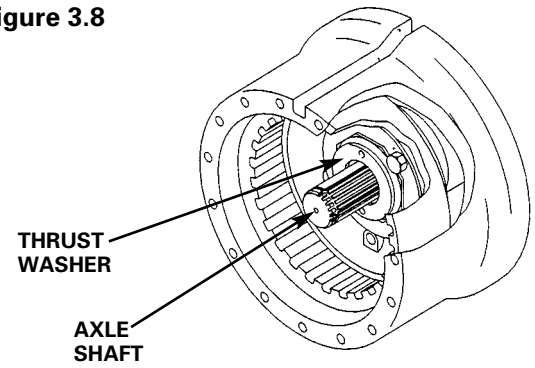
1. Remove the floating ring gear. If necessary, use a lifting device to remove the ring gear. **Figure 3.7.**
2. Remove the snap ring from the end of the axle shaft.
3. Remove the sun gear. **Figure 3.7.**

Figure 3.7



4. Remove the sun gear thrust washer assembly. **Figure 3.8.**

Figure 3.8



5. Remove the axle shaft.
   - **To remove the axle shaft from a steering axle:** Remove the wheel hub and spindle before you remove the axle shaft.

Prepare to Remove the Wheel Hub

Axles With Dry Disc Brakes

Remove the brake caliper and adapter assembly. Refer to Maintenance Manuals 4S, SCL 2 Series Dry Disc Brake Calipers and Maintenance Manual 4Y, SCL 35, 46, 53 Dry Disc Brake Calipers. To order these publications, call Meritor's Customer Service Center at 800-535-5560.

Axles With Wet Disc Brakes

Refer to Maintenance Manual 4L, Wet Disc Brakes, for instructions on removing and servicing the wheel hub, brake driver, hub oil seal, wheel bearings and spindle. To order this manual, call Meritor's Customer Service Center at 800-535-5560.

Axles With Hydraulic or Mechanical Brakes

For hydraulic or mechanical brake removal and service instructions refer to Maintenance Manual 4S, SCL 2 Series Dry Disc Brake Calipers and Maintenance Manual 4Y, SCL 35, 46 and 53 Dry Disc Brake Calipers. To order these manuals, call Meritor's Customer Service Center at 800-535-5560.

Axles With P Series or RSA Drum Brakes

⚠ WARNING

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

1. If the brake has spring chambers, manually compress and lock the springs to release the brakes.
2. Turn the slack adjuster manual adjusting nut until the brake shoes fully retract and the drum clears the lining. If Meritor automatic slack adjusters are used, refer to Meritor Maintenance Manual 4B, Automatic Slack Adjuster for the correct adjustment procedure. To order this publication, call Meritor's Customer Service Center at 800-535-5560.

Prepare to Remove the Ring Gear Hub and Wheel Hub

Wheel Bearings With Single Adjusting Nut and Lockplates

1. Remove the capscrews from the adjusting nut lock. The adjusting nut features one of the following designs.
   - A ring that secures all corners of the nut
   - One or two "bow ties" that secure one or two corners of the adjusting nut or the flat of the nut
2. Remove the wheel bearing adjusting nut lock and wheel bearing nut.

Wheel Bearings With Scalloped Flange Adjusting Nut

NOTE: To aid in capscrew removal, it may be necessary to use a torch to apply heat to the capscrew to loosen it. Follow the torch manufacturer's instructions.

1. Remove the locking capscrew located in the scallop of the nut. Check the capscrew for wear. Replace a worn or damaged capscrew.
2. Remove the wheel bearing nut.

Wheel Bearings With Double Adjusting Nuts

Remove the wheel bearing jam nut, washer and wheel bearing adjusting nut.

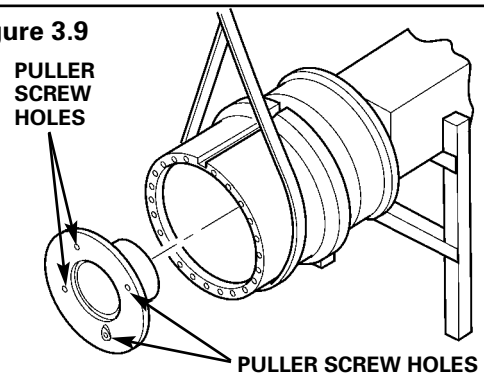
Remove the Ring Gear Hub and Wheel Hub

⚠ CAUTION

Support the wheel hub, as shown in Figure 3.10, before you remove the ring gear and the ring gear hub assembly. Do not remove the ring gear and the ring gear hub assembly without supporting the wheel hub. Serious personal injury and damage to components can result.

1. Remove the ring gear hub by pulling it straight out of the wheel hub and off of the spindle. To avoid dropping and possibly damaging the outer wheel bearing cone, ensure that the outer wheel bearing cone remains in place as you remove the ring gear hub. **Figure 3.9.**
   - **If you cannot remove the ring gear hub by hand:** Install capscrews into the puller screw holes in the ring gear hub flange. Tighten each capscrew the same amount to separate the ring gear hub assembly from the spindle and the wheel hub.

Figure 3.9



2. Remove the outer wheel bearing from the ring gear hub.

NOTE: Some ring gear hub assemblies include a hub and ring sleeve insert. You can not service these components separately.

3. Use a chain fall or similar device to lift the hub and drum slightly to relieve the hub weight and drum-to-brake shoe drag. **Figure 3.10 and Figure 3.11.**
4. Remove the assembly from the hub spindle.

Figure 3.10

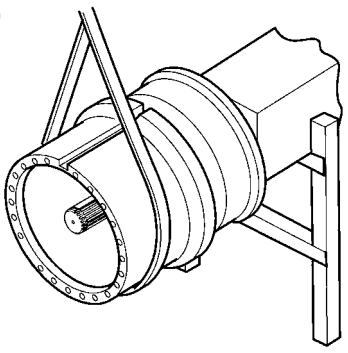
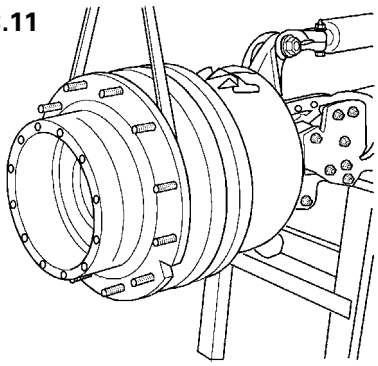


Figure 3.11



Remove the Hub Oil Seal and Bearings

1. Position the wheel hub with the brake end UPWARD.
2. Some axle model designs with dry disc brakes provide enough clearance to remove the hub oil seal, bearing cone and bearing cups without removing the rotor.
   - **If you can remove the hub oil seal, bearing cone and bearing cups from the axle without removing the rotor:** Proceed to Step 4.
   - **If you must remove the rotor from the wheel hub to remove the hub oil seal, bearing cone and bearing cups:** Proceed to Step 3.
3. Remove the rotor mounting capscrews and washers. Remove the rotor.
4. Remove the hub oil seal with a suitable puller. Do not scratch the hub seal bore surface.
5. Remove the inner bearing cone.
6. Remove the bearing cups with a suitable puller.

Remove the Brake Drum or Disc Brake Rotor

1. Match mark the drum and hub.
2. Remove the capscrews and washers from the brake drum or rotor joint.

⚠ WARNING

Take care when you use lifting devices. When you use a lifting strap, inspect the strap for damage before you use it. Do not use a lifting strap to shock load or drop load a component. Serious personal injury and damage to components can result.

3. Remove the brake drum or rotor from the wheel hub. If necessary, use a lifting device to remove the brake drum or rotor.

Remove the Brake Shoes

To remove the brake shoes, refer to the correct maintenance manual.

- **For P series brakes:** Refer to Maintenance Manual 4, Cam Brakes.
- **For RSA drum brakes:** Refer to Maintenance Manual 4P, Off-Highway Heavy-Duty Brakes.
- **For SCL 2 series dry disc brakes:** Refer to Maintenance Manual 4S, SCL 2 Series Dry Disc Brake Calipers.
- **For SCL 35, 46 or 53 series dry disc brakes:** Refer to Maintenance Manual 4Y, SCL 35, 46, 53 Dry Disc Brake Calipers.

To order these publications, call Meritor's Customer Service Center at 800-535-5560.

Remove the Spindle

Axles With Dry Disc Brakes

1. Match mark the spindle and housing flange.
2. Use straps and a lifting device to support the spindle.
3. Remove the spindle mounting capscrews and washers.
4. Remove the spindle from the axle housing or steer knuckle.

Steering Axles With RSA Drum Brakes

1. Remove all air from the air system.
2. Remove the air lines from the air chamber. Tag the lines and ports to aid reassembly.

⚠ WARNING

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

3. If the brake has spring chambers, manually compress and lock the springs to release the brakes.

4. Match mark the air chamber housing tube and the brake spider plunger housing to aid reassembly.
5. Remove the set-screw that retains the air chamber assembly in the spider plunger housing.
6. **If there is a collet nut on the threads of the chamber housing tube:** Use a hammer and a brass drift to loosen the collet nut.
7. Remove the air chamber assembly from the plunger housing. If necessary, use a strap wrench to remove the air chamber assembly.
8. Remove the brake shoe return springs.
9. Rotate the brake shoes to allow access to the spindle/brake spider mounting capscrews.
10. Match mark the brake spider and steering knuckle to aid correct installation at assembly.
11. Remove the two capscrews and washers that mount the brake spider and spindle to the steering knuckle at the 11 and 1 o'clock positions.
12. To aid spindle removal, install two 4- 6-inch (10.16-15.24 cm) long studs with 0.875-14 UNF threads on the end that engage the steering knuckle.
13. Support the spindle and brake spider assembly.
14. Remove the remaining capscrews and washers.
15. Remove the brake spider and brake shoe assembly.

⚠ CAUTION

Avoid damaging the oil seal in the spindle when you remove the spindle. Lubricant loss and damage to components can result.

16. Carefully remove the spindle from the steering knuckle by sliding the spindle over the outer end of the axle shaft and universal joint.
17. Remove the axle shaft and universal joint assembly.

Steering Axles With RSH Drum Brakes

1. Remove the hydraulic lines from the hydraulic chamber. Tag the lines to aid reassembly.
2. Match mark the hydraulic chamber housing tube and the brake spider plunger housing to aid reassembly.
3. Remove the set screw that retains the fluid within the spider plunger housing.
4. **If there is a collet nut on the threads of the chamber housing tube:** Use a hammer and a brass drift to loosen the collet nut.
5. Remove the hydraulic chamber assembly from the plunger housing. If necessary, use a strap wrench to remove the hydraulic chamber assembly.
6. Remove the brake shoe return springs.
7. Rotate the brake shoes to allow access to the spindle/brake spider mounting screws.
8. Match mark the brake spider and steering knuckle to aid reassembly.
9. Remove the two capscrews and washers that mount the brake spider and spindle to the steering knuckle at the 11- and 1-o'clock positions.
10. To aid spindle removal, install two 4- 6-inch (10.16-15.24 cm) long studs with 0.875-14 UNF threads on the end that engage the steering knuckle.
11. Support the spindle and brake spider assembly.
12. Remove the remaining capscrews and washers.
13. Remove the brake spider and brake shoe assembly.

⚠ CAUTION

Avoid damaging the oil seal in the spindle when you remove the spindle. Lubricant loss and damage to components can result.

14. Carefully remove the spindle from the steering knuckle by sliding the spindle over the outer end of the axle shaft and universal joint.
15. Remove the axle shaft and universal joint assembly.

Steering Axles With P Series Cam Brakes

1. Remove the brake shoe return springs.
2. Rotate the brake shoes until enough clearance exists to remove the spindle mounting nuts and washers with a wrench.
3. Remove the spindle mounting nuts and washers.

CAUTION

Avoid damaging the oil seal in the spindle when you remove the spindle. Lubricant loss and damage to components can result.

4. Carefully remove the spindle from the steering knuckle by sliding the spindle over the outer end of the axle shaft assembly.
5. Remove the axle shaft and universal joint assembly.

Rigid Axles With P Series Cam Brakes

Some rigid axles feature a two-piece camshaft and coupling which allows you to remove the camshaft without removing the slack adjuster. When servicing an axle with a two-piece camshaft and coupling, proceed to Step 6.

1. Remove the brake shoe return springs.
2. Rotate the brake shoes to allow access to the brake camshaft and the spindle mounting capscrews.
3. Remove the slack adjuster clevis pin that connects the air chamber push rod.
4. Remove the snap ring and washers that connect the slack adjuster to the brake camshaft. Stack the washers and separate them from other parts.
5. Remove the slack adjuster and washers. Separate the washers from other parts and prevent them from mixing with the washers you previously removed.
6. Remove the snap rings that retain the camshaft in the spindle support boss.
7. Remove the brake camshaft from the spindle. Separate the washers you removed from the face of the spindle boss. Prevent the washers from mixing with the washers you previously removed.

WARNING

Take care when you use lifting devices. When you use a lifting strap, inspect the strap for damage before you use it. Do not use a lifting strap to shock load or drop load a component. Serious personal injury and damage to components can result.

8. Use straps and a lifting device to support the spindle and brake shoe assembly.
9. Match mark the housing and spindle flange.
10. Remove the mounting capscrews and washers.
11. Remove the spindle from the axle housing.

Clean Ground or Polished Parts

⚠ WARNING

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

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures:

- **Wear safe eye protection.**
- **Wear clothing that protects your skin.**
- **Work in a well-ventilated area.**
- **Do not use gasoline or solvents that contain gasoline. Gasoline can explode.**
- **You must use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.**
- Use a cleaning solvent to clean ground or polished parts or surfaces. Kerosene or diesel fuel oil can be used for this purpose. NEVER USE GASOLINE.
- Remove gasket material from parts. Be careful not to damage ground surfaces.
- DO NOT clean ground or polished parts in a hot solution tank, water, steam or alkaline solution.

Clean Parts With Rough Finishes

- Parts with a rough finish can be cleaned with cleaning solvent or in a hot solution tank with a weak alkaline solution.
- Parts must remain in hot solution tanks until completely cleaned and heated.
- Parts must be washed with water until the alkaline solution is removed.

Clean Axle Assemblies

- A complete axle assembly can be steam cleaned on the outside to remove dirt.
- Before the axle is steam cleaned, close or put a cover over all openings in the axle assembly. Examples of openings are breathers or vents in air chambers.

Dry Cleaned Parts

- Dry the parts immediately after cleaning and washing.
- Dry the parts with soft clean paper or rags.

⚠ CAUTION

Damage to bearings can be caused if dried by rotating with compressed air.

- Except for bearings, parts can be dried with compressed air.

Prevent Corrosion

- Apply a light lubricant to cleaned and dried parts that are not damaged and are to be assembled.
- Apply a special material that prevents corrosion to all surfaces. If parts are to be stored, wrap the parts in special paper that prevents corrosion.

Inspect Parts

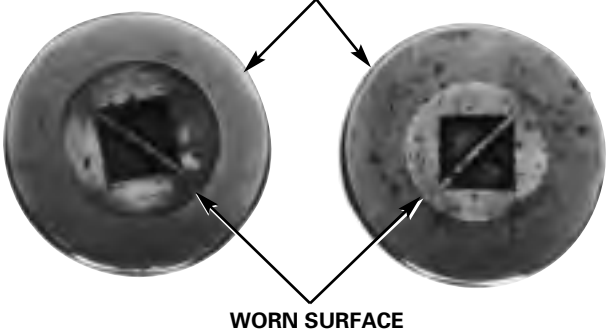
It is very important to inspect all parts carefully and completely before the axle or carrier is assembled. Check all parts for wear and replace damaged parts. Replacement of damaged or worn parts will prevent breakdown of assembly later.

Inspect Tapered Roller Bearings

Inspect the cup, cone, rollers and cage of all tapered roller bearings in the assembly. If any of the following conditions exist, the bearing must be replaced:

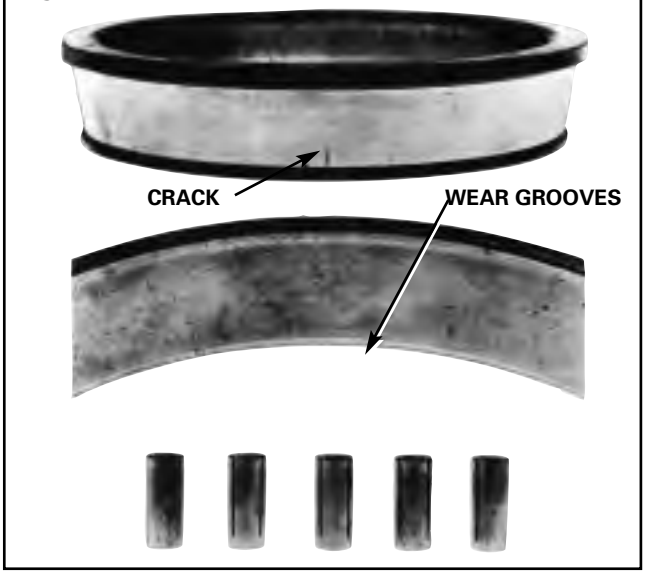
- The center of the large diameter end of the rollers are worn level with, or below the surface.
- The center of the large diameter end of the rollers are worn to a sharp edge. **Figure 4.1.**

Figure 4.1



- A visible roller groove in the cup or cone inner race surfaces. The groove can be seen at the small or large diameter end of both parts. **Figure 4.2.**

Figure 4.2

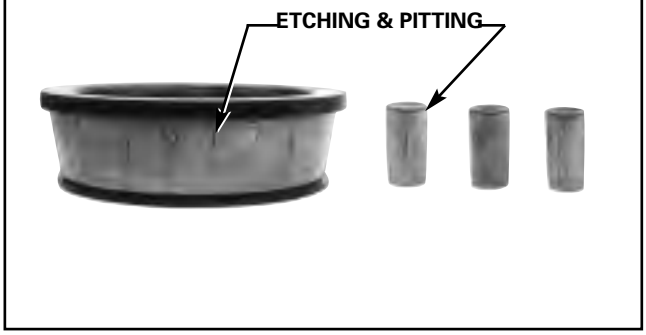


- Deep cracks or breaks in the cup, cone inner race or roller surfaces.
- Bright wear marks on the outer surface of the roller cage. **Figure 4.3.**

Figure 4.3

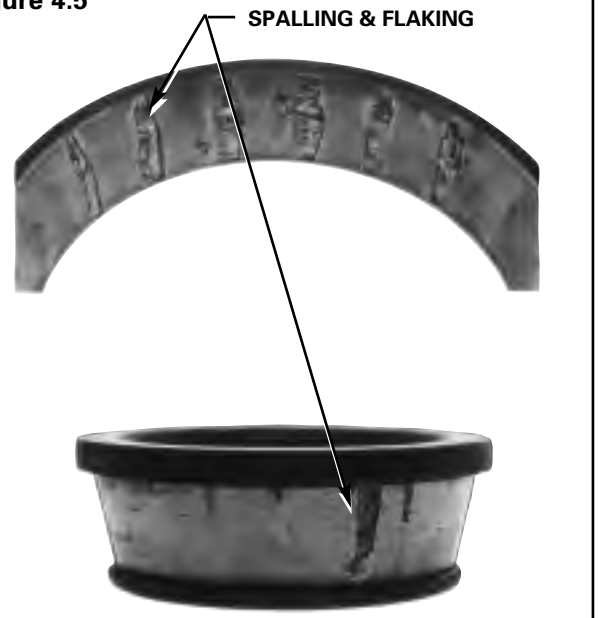
- Damage on rollers and on surfaces of the cup and cone inner race that touch the rollers. **Figure 4.4.**

Figure 4.4



- Damage on the cup and cone inner race surfaces that touch the rollers. **Figure 4.5.**

Figure 4.5



Inspect Planetary Wheel End Components

Inspect the planetary reduction, planetary gears, sun gear and ring gear assembly for wear or damage. Replace gears, shafts or thrust washers that are scored, pitted, ridged, chipped or worn.

Repair or Replace Parts

Replace worn or damaged parts of an axle assembly. The following are some examples to check for repair and possible replacement:

- Replace any fastener if corners of the head are worn.
- Replace washers if damaged.
- Replace gaskets, oil seals or grease seals at the time of axle repair.
- Clean parts and apply new liquid gasket material where required when axle is assembled.
- Remove nicks, marks and burrs from parts having machined or ground surfaces. Use a fine file, India stone, emery cloth or crocus cloth for this purpose.
- Clean and repair threads of fasteners and holes. Use a die or tap of the correct size or a fine file for this purpose.

⚠ CAUTION

Threads must be without damage and clean so that accurate adjustment and correct torque values can be applied to fasteners and parts.

- Tighten all fasteners to correct torque values.

⚠ WARNING

Do not repair axle housings by bending or straightening. Repair of axle housings by bending or straightening can cause poor performance and possible unsafe operation of the axle. This can cause serious personal injury.

Repair Welding

Do not repair weld drive axle assemblies. Repair welding can detract from the structural integrity of a component, particularly to heat treated parts where the benefit of heat treatment can be nullified by welding.

Remove Capscrews Fastened With Liquid Adhesive

⚠ CAUTION

Do not use impact wrenches or strike components with a hammer.

To remove capscrews fastened with liquid adhesive, use the regular mechanical disassembly procedure.

If the removal of a capscrew, for example, becomes difficult due to a worn head or unusually high breakaway torque, the locking strength can be reduced by heating the threaded area to approximately 300°F (150°C). Heat slowly to avoid thermal stresses in components.

Cleaning

⚠ WARNING

To avoid serious personal injury, trichloroethylene must not come in contact with your skin. Do not smoke and avoid breathing vapors in closed rooms without ventilation. Do not use trichloroethylene near flames, welding operations or hot surfaces exceeding 900°F (482°C).

Clean the capscrew, nut or bolt tapped hole and fastener thread carefully. Use a cleaning solvent such as trichloroethylene or equivalent to remove dirt, oil, grease or moisture.

Using Dri-Loc Fasteners and Meritor Liquid Adhesive

NOTE: Do not apply Meritor liquid adhesive or any other type of fastener retainer material, sealant or adhesive on Dri-Loc fasteners or in the threaded holes.

NOTE: No cure time is required for Dri-Loc fasteners before rebuilding the axle and returning it to service.

1. Wipe excess oil residue from the threaded holes of all components that use Dri-Loc fasteners.
2. Assemble the components that use Dri-Loc fasteners.
3. Tighten the Dri-Loc fasteners to the specified torque value.

Reusing Dri-Loc Fasteners and Loctite® No. 277

⚠ WARNING

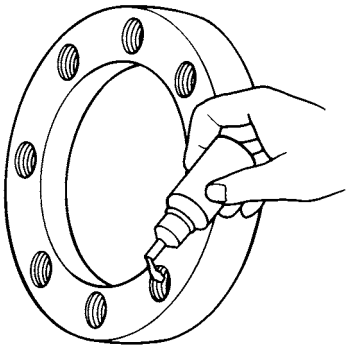
Take care when you use Loctite® to avoid serious personal injury. Follow the manufacturer's instructions to prevent irritation to the eyes and skin.

1. Wipe excess oil residue from the Dri-Loc fasteners and threaded holes.

NOTE: Do not apply liquid adhesive to the fastener. Trapped air in the threaded hole will create back pressure and "blow out" the adhesive as the fastener advances.

2. Apply Loctite® No. 277 adhesive to the threaded holes only. Before threading in the fasteners, visually check to make sure that the adhesive contacts the threads. **Figure 4.6.**

Figure 4.6



3. Tighten the fasteners to the specific torque value recommended for the fastener. Loctite® No. 277 will not alter the torque requirement.

NOTE: No cure time is required for Loctite® No. 277 before rebuilding the axle and returning it to service.

4. **When servicing drive units assembled with Dri-Loc fasteners or with Loctite® No. 277 in threaded holes where the fasteners do not require removal:** Check each fastener for tightness by tightening the fastener to the minimum specified torque.
   - If the fastener does not rotate, the fastener is tightened to the correct torque.
   - If the fastener rotates to any degree, remove it from the component and apply liquid adhesive to the threaded hole.

Applying Silicone Gasket Material

Meritor recommends the following liquid gasket materials:

- ThreeBond 1216
- Loctite® 5699

⚠ WARNING

Take care when you use silicone gasket materials to avoid serious personal injury. Follow the manufacturer's instructions to prevent irritation to the eyes and skin.

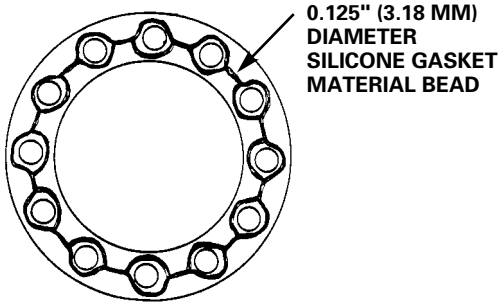
⚠ CAUTION

The amount of liquid gasket material applied must not exceed a 0.125 in. (3.18 mm) diameter bead. Too much gasket material can block lubrication passages and result in damage to components.

1. Remove all old gasket material from both surfaces.
2. Clean the surfaces where liquid gasket material will be applied. Remove all oil, grease, dirt and moisture.
3. Thoroughly dry both surfaces.
4. Apply approximately a 0.125 inch (3.18 mm) diameter continuous bead of liquid gasket material around one surface.

   Also apply gasket material around the edge of all fastener holes on that surface. **Figure 4.7.**

Figure 4.7



5. Assemble the components quickly to permit the gasket material to compress evenly between parts.
6. Tighten the fasteners with the required torque.

Flush Lube From the Axle

The rigid axle wheel end and housing bowl share the same oil. Lubricant contamination of the wheel end or housing bowl can spread to all areas of the axle.

1. If the housing bowl has magnets, remove all metallic debris from the magnets.
2. Flush lubricant from the entire axle, including the wheel ends and housing bowl, before you assemble the axle.

Install the Spindle

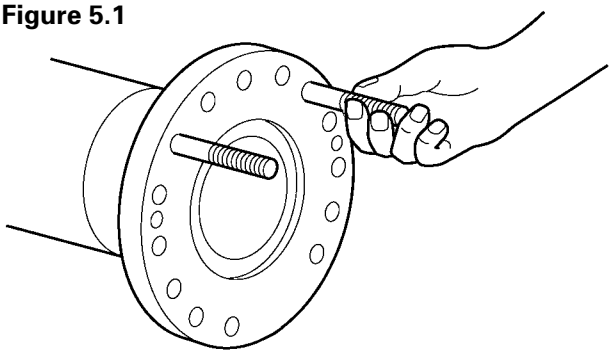
Install the Spindle on Rigid Axles With P Series Cam Brakes

⚠ WARNING

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

1. Install two 4-inch (10.14 cm) long temporary studs into the axle housing flange at the 1- and 11- o'clock positions. **Figure 5.1.**

Figure 5.1



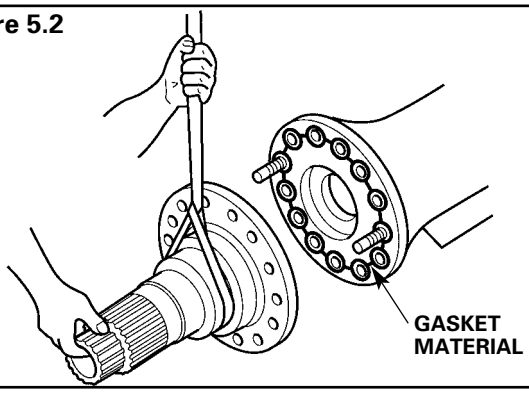
2. Apply a 0.125-inch (3.18 mm) diameter continuous bead of liquid gasket material around the flange mounting face of the axle housing.

⚠ WARNING

Take care when you use lifting devices. When you use a lifting strap, inspect the strap for damage before you use it. Do not use a lifting strap to shock load or drop load a component. Serious personal injury and damage to components can result.

3. Align the spindle and axle housing match marks. Install the spindle on the axle housing. If necessary, use an overhead crane to lift and support large spindles. **Figure 5.2.**

Figure 5.2



4. Install and hand tighten the spindle mounting capscrews and washers. Remove the temporary studs and replace them with capscrews and washers.
5. Tighten the capscrews according to the torque specifications shown in **Table A.**

Table A: Spindle Mounting Capscrew Torque Specifications

Size	Torque	
	lb-ft	N•m
1/2"-12	85-115	115-156
9/16"-18	130-165	176-224
5/8"-11, - 18	210-230	284-311
3/4"-10	310-400	420-542
7/8"-9, - 14	575-650	779-880
1"-12, - 14	850-1100	1152-1491

6. Replace the brake camshaft bushings and grease seals in the spindle boss and camshaft brackets. Refer to Maintenance Manual 4, Cam Brakes. To order this publication, call Meritor's Customer Service Center at 800-535-5560.
7. Install the cam head thrust washer onto the camshaft. Apply O-617-A or -B chassis grease to the camshaft bushings and journals.
8. Install the camshaft through the spindle bushings. Install the washers and slide the camshaft through the air chamber support bracket.
   - **For two-piece camshaft designs:** Engage the coupling when you install the camshafts.

9. Install the slack adjuster, washers, and snap ring. Connect the slack adjuster to the air chamber push rod yoke. Check that the snap ring is installed to the camshaft at the inner face of the spindle boss.

Install the Spindle on Rigid Axles With Dry Disc Brakes

1. **For axle models that use capscrews to mount the spindle:** Install two 4-inch (10.14 cm) long temporary studs into the axle housing flange at the 1-and 11-o'clock positions. **Figure 5.1.**
2. **For axle models that use a "bow-tie" caliper configuration:** Use one bolt to guide the spindle onto the axle.
3. Apply a 0.125-inch (3.18 mm) diameter continuous bead of liquid gasket material around the flange mounting face of the axle housing.
4. Align the spindle with the axle housing match marks to correctly position the brake caliper mounting bosses. Install the spindle on the axle housing.
5. Install and hand tighten the spindle mounting capscrews and washers. Remove the temporary studs and replace them with capscrews and washers.
   - **For models with studs in the axle housing:** Install washers and locknuts.
5. Tighten the capscrews or locknuts according to the torque specifications shown in **Table B.** T

Table B:Spindle Mounting Capscrew and Locknut Torque Specifications

	Torque	
Size	**lb-ft**	**N•m**
1/2"-12	85-115	115-156
9/16"-18	130-165	176-224
5/8"-11, - 18	210-230	284-311
3/4"-10	310-400	420-542
7/8"-9, - 14	575-650	779-880
1"-12, - 14	850-1100	1152-1491

Install the Spindle on Steering Axles With P Series Cam Brakes

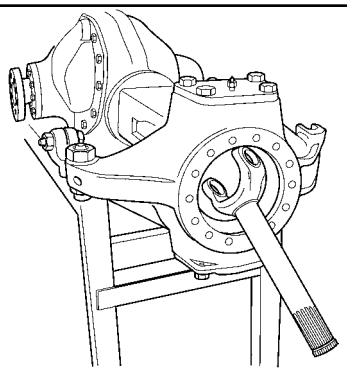
1. Install the differential carrier assembly and the steering knuckles on the steering axles.
2. Apply a thin coat of NLGI grade 1 or 2 grease to the following areas:
   - Oil seal lips and bushing bore in the end of the axle housing
   - Axle shaft assembly seal and bushing journals

⚠ CAUTION

Avoid damaging the housing oil seal when you install the shaft assembly. Lubricant loss and damage to components can result.

3. Carefully install the axle shaft assembly through the steering knuckle and axle housing until the shaft engages the differential assembly side gear. **Figure 5.3.**
4. **If the original shaft support bushing in the bore of the spindle is worn or damaged:** Remove the oil seal and bushing and install a new bushing.

Figure 5.3



5. Install a new oil seal in the spindle bore. Apply a thin coat of NLGI grade 1 or 2 grease to the seal lips and bushing bore.

⚠ CAUTION

Avoid damaging the oil seal in the spindle when you install the spindle. Lubricant loss and damage to components can result.

6. Carefully install the spindle on the steering knuckle by carefully sliding it over the outer end of the axle shaft assembly.
7. Install the spindle mounting washers and nuts. Hand tighten the nuts.
8. Tighten the 3/4-inch-19 nuts or capscrews to 310-400 lb-ft (420-542 N•m). T
9. **If you removed the brake shoes or camshaft:** Install the brake shoes or camshaft. Refer to Maintenance Manual 4, Cam Brakes. To order this publication, call Meritor's Customer Service Center at 800-535-5560.

Install the Spindle on Steering Axles With RSA Drum Brakes

1. Install the differential carrier assembly and the steering knuckles on the steering axle.
2. Apply a thin coat of NLGI grade 1 or 2 grease to the following areas:
   - Oil seal lips and bushing bore in the end of the axle housing
   - Axle shaft assembly seal and bushing journals

⚠ CAUTION

Avoid damaging the housing oil seal when you install the axle shaft assembly. Lubricant loss and damage to components can result.

3. Carefully install the axle shaft assembly through the steering knuckle and axle housing until the shaft engages the differential assembly side gear.
4. **If the original shaft support bushing in the bore of the spindle is worn or damaged:** Remove the oil seal and bushing and install a new bushing.
5. Install a new oil seal in the spindle bore. Apply a thin coat of NLGI grade 1 or 2 grease to the seal lips and bushing bore.

⚠ CAUTION

Avoid damaging the oil seal in the spindle when you install the spindle. Lubricant loss and damage to components can result.

6. Use a lifting device to install the spindle onto the steering knuckle. Carefully slide the spindle over the outer end of the axle shaft assembly and engage the two temporary guide studs.
7. Align the brake spider and brake shoe assembly with the spindle match marks. Install the brake spider and brake shoe assembly on the spindle. Refer to Maintenance Manual 4P, Off-Highway Heavy-Duty Brakes.
8. Install the spindle and brake spider mounting capscrews and washers. Remove the two temporary studs you installed during disassembly. Replace the temporary studs with capscrews and washers.
9. Tighten the capscrews according to the torque specifications shown in **Table C.** T

Table C: Spindle Mounting Capscrew and Locknut Torque Specifications

	Torque	
Size	**lb-ft**	**N•m**
1/2"-12	85-115	115-156
9/16"-18	130-165	176-224
5/8"-11, - 18	210-230	284-311
3/4"-10	310-400	420-542
7/8"-9, - 14	575-650	779-880
1"-12, - 14	850-1100	1152-1491

10. Install the air chamber assembly into the brake spider. Refer to Maintenance Manual 4P, Off-Highway Heavy-Duty Brakes.
11. Install the brake shoe return spring.
12. Connect the air lines to the correct ports in the air chamber assembly. Release the spring chamber after you adjust the wheel hub.

Install the Axle Shaft in Rigid Axle Models

Install the axle shaft through the spindle bore and housing until it engages the differential side gear. The shaft end with the snap ring groove must extend beyond the outer end of the spindle.

Assemble the Ring Gear Hub Assembly

NOTE: Install the ring gear immediately before you assemble the planetary spider.

1. Install the outer wheel bearing cone on the ring gear hub journal squarely against the hub shoulder.
2. Apply the same lubricant used in the wheel ends to the rollers.
3. Slip fit the bearing cone over the ring gear hub journal. Do not install the ring gear hub assembly on the spindle at this time.

Assemble the Hub, Bearings, Oil Seal and Drum or Rotor

1. If the hub bearing cups need to be replaced, install the new cups with a suitable driver.

NOTE: Most models require installation of the inner bearing cone prior to installation of the wheel hub oil seal into the bore of the wheel hub.

2. Apply lubricant to the inner bearing cone rollers. Install the bearing cone into the wheel hub.
3. If used, install the oil seal guard washer.
4. Position the new wheel hub oil seal so that the spring lip of the seal faces the wheel bearing. Use a suitable seal driver to drive the seal into the same location as the original wheel hub oil seal. Refer to the following list for three possible seal installation locations:
   - Bottom of the hub bore
   - Pushed-in until it contacts the guard washer
   - Flush with the end face of the hub

⚠ CAUTION

Use extreme care to avoid nicking the oil seal wear sleeve end when you install the oil seal wear sleeve. A nicked oil seal wear sleeve end can damage the seal lip when you install the wheel hub. Lubricant loss and damage to components can result.

5. If a sleeve is used, carefully install a new oil seal wear sleeve on the spindle.
6. Lubricate the seals in the following areas only.
   - **Conventional seals:** Lubricate the oil seal lips.
   - **Unitized seals:** Lubricate the inside diameter of the seal.
   - **Face seals:** Lubricate the contact surfaces of the metal rings. Do not apply lubricant to any other part of the face seal.
7. Apply a thin coat of lubricant to the oil seal journal surface of the spindle.
8. Install the brake rotor or drum and oil slinger.
   - **If the slinger fits loosely between the hub and drum:** Apply a bead of liquid gasket material to prevent rattling.
9. Install the drum or rotor mounting capscrews and washers.
   - **For dual tire models:** Align the air valve stem clearance notch in the drum outside diameter with the wheel hub notch.
10. Tighten the capscrews according to the torque specifications shown in **Table D.** (T)

Table D: Brake Rotor Mounting Capscrew Torque Specifications

	Torque	
Size	**lb-ft**	**N•m**
1/2"-12	85-115	115-156
9/16"-18	130-165	176-224
5/8"-11, - 18	210-230	284-311
3/4"-10	310-400	420-542
7/8"-9, - 14	575-650	779-880
1"-12, - 14	850-1100	1152-1491

Install the Wheel Hub

⚠ WARNING

Take care when you use lifting devices. When you use a lifting strap, inspect the strap for damage before you use it. Do not use a lifting strap to shock load or drop load a component. Serious personal injury and damage to components can result.

1. Use a lifting device to carefully lift and slide the wheel hub assembly over the spindle. Keep the wheel hub assembly aligned with the spindle to avoid oil seal damage. **Figure 5.5 and Figure 5.6.**
   - **For axle models with three threaded holes (5/8 inch-11 UNC) in the boss area near the outer wheel bearing:** You can temporarily attach the planetary ring gear hub assembly to the wheel hub prior to installation on the spindle.

Figure 5.5

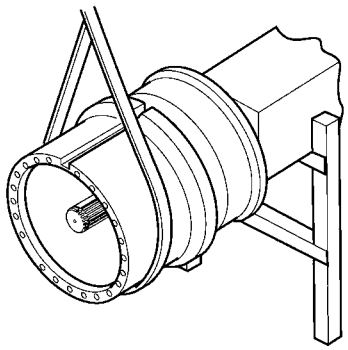
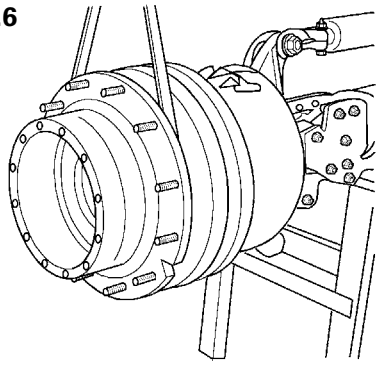


Figure 5.6



2. Install the ring gear hub assembly, which includes the outer bearing cone, on the spindle.
3. Install the wheel bearing adjusting nut on the spindle.
   - **If you temporarily attached the planetary ring gear hub assembly to the wheel hub in Step 1:** Remove the temporary capscrews from the ring gear hub.

Adjust the Wheel Bearing Preload

For wheel bearing adjustment procedures for axles equipped with wet disc brakes, refer to Meritor Maintenance Manual 4L, Wet Disc Brakes. To order this publication, call Meritor's Customer Service Center at 800-535-5560.

Single Nut Design with Lockplates

1. Tighten the wheel bearing adjusting nut to the initial seating torque listed in **Table E**, while rotating the wheel hub. (T)
2. Continue to rotate the hub a minimum of one full revolution in both directions.
3. Tighten the wheel bearing adjusting nut again to the initial seating torque listed in **Table E,** while rotating the wheel hub in both directions. (T)
4. Repeat Steps 1 and 2 until the adjusting nut will not advance with the application of the initial seating nut torque. (T)
5. Loosen the adjusting nut 1/8 – 1/4 turn
6. Tighten the adjusting nut to the final adjustment nut torque listed in **Table E** while rotating the wheel hub. (T)

Table E: Single Wheel Bearing Adjustment

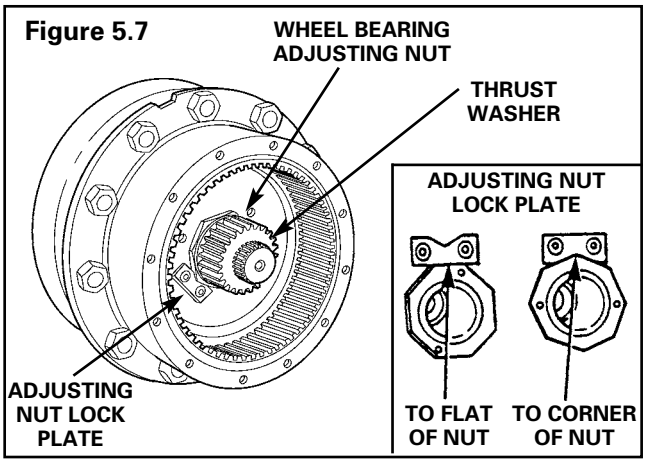
Rigid Axle Models	Steering Axle Models	Adjusting Nut Torque			
		Initial Seating		Final Adjustment	
		lb-ft	N•m	lb-ft	N•m
PRC594-PRC727	PSC594-PSC825	400	542	200	271
PRC1757	PSC826-PSC1617	400	542	350	474
PRLC824-PRLC1794	PSC1794	500	678	400	542

CAUTION

Do not loosen the adjusting nut when you install the adjusting nut lockplate. Loosening the adjusting nut from the setting in Step 6 can result in an incorrect bearing preload and damage to components.

7. Use one of the following procedures to install the adjusting nut lockplate:
   - Place the flat side of the lockplate against a flat surface of the nut.
   - Place the lockplate notch over a corner of the adjusting nut. **Figure 5.7.**

Figure 5.7



8. If necessary, tighten the adjusting nut to align the lockplate holes with the threaded holes in the ring gear hub. Do not loosen the adjusting nut.

WARNING

Take care when you use Loctite® to avoid serious personal injury. Follow the manufacturer's instructions to prevent irritation to the eyes and skin.

9. Install new lockplate capscrews with pre-applied locking agent on the threads. If you use the original capscrews, apply 2 or 3 drops of Loctite 277 or equivalent to the internal threads of the ring gear hub. Tighten the capscrews 60-75 lb-ft (81-102 N•m). T

Scalloped Flange Single Nut Design

1. Tighten the wheel bearing adjusting nut to the initial seating torque listed in **Table E**, while rotating the wheel hub. T
2. Continue to rotate the hub a minimum of one full revolution in both directions.
3. Tighten the wheel bearing adjusting nut again to the initial seating torque listed in **Table E,** while rotating the wheel hub in both directions. T
4. Repeat Steps 1 and 2 until the adjusting nut will not advance with the application of the initial seating nut torque. T
5. Loosen the adjusting nut 1/8 – 1/4 turn
6. Tighten the adjusting nut to the final adjustment nut torque listed in **Table E** while rotating the wheel hub. T

CAUTION

Do not loosen the adjusting nut when you install the capscrew. Loosening the adjusting nut from the setting in Step 6 can result in an incorrect bearing preload and damage to components.

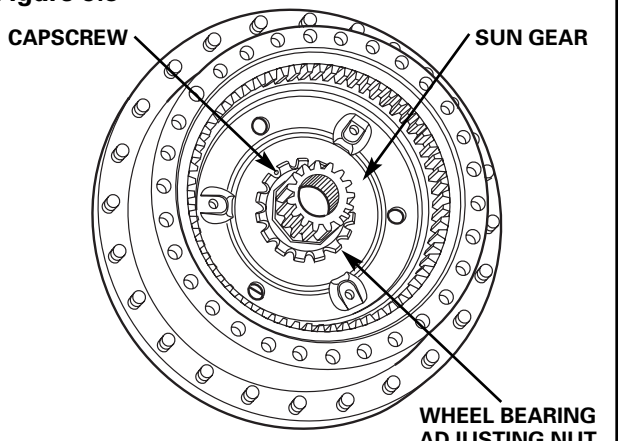
7. If necessary, tighten the adjusting nut to align a scallop with a threaded hole in the ring gear hub. Do not loosen the adjusting nut.

⚠ WARNING

Take care when you use Loctite® to avoid serious personal injury. Follow the manufacturer's instructions to prevent irritation to the eyes and skin.

8. Install the capscrew. Apply 2 or 3 drops of Loctite 242 or equivalent to the internal threads of the ring gear hub. Tighten the capscrew 20-30 lb-ft (27-40 N•m). **Figure 5.8.** (T)

Figure 5.8



Double Nut Design

1. Install the wheel bearing adjusting nut so that the nut lock faces OUTWARD. Installing the wheel bearing adjusting nut will seat the bearings and related components.
2. Tighten the nut to 400 lb-ft (542 N•m) while you rotate the hub in both directions. (T)
3. Tap the hub several times with a brass or plastic hammer.
4. Tighten the nut to 400 lb-ft (542 N•m). (T)
5. Loosen the adjusting nut to 0 lb-ft (0 N•m) to relieve the preload on the bearings.
6. Tighten the adjusting nut to 25 lb-ft (34 N•m). (T)
7. Install the nut lock ring washer. Ensure that the washer tang fits into the slot on the spindle and that the adjusting nut engages a washer hole.
8. Install the jam nut. Tighten the jam nut to 600-800 lb-ft (813-1085 N•m). (T)

Install the Planetary Ring Gear and Sun Gear

1. Apply grease to the inner face of the sun gear thrust washer (the side with tangs or dowel pins). Install the thrust washer so that the tangs or dowels engage the slots or holes in the wheel bearing adjusting nut.
2. Install the sun gear on the axle shaft and against the thrust washer. **Figure 5.7.**
3. Install the snap ring into the axle shaft groove.
4. Install the planetary ring gear onto the ring gear hub.

Assemble the Planetary Spider

Meritor coverless spider planetary wheel ends come equipped with two different planetary designs.

- Planetary pinion shaft with needle roller bearings
- Nylon coated planetary pinion shafts

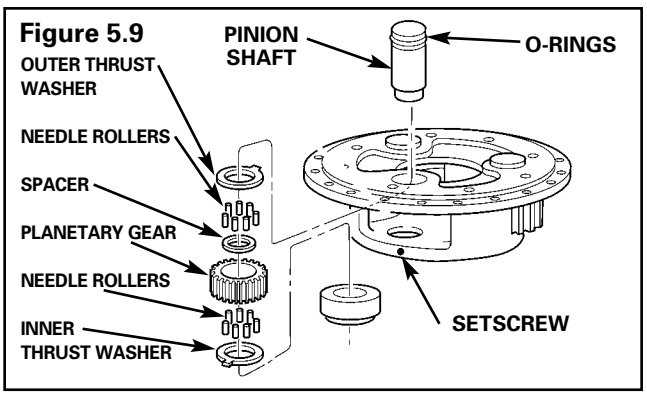
Refer to the correct assembly procedure for the type of planetary design you are servicing.

Planetary Pinion Shaft With Needle Roller Bearings

NOTE: For maximum planetary gear life, replace the pinion shafts and needle roller bearings on both wheel ends at the same time.

1. Separate the inner thrust washers from the outer thrust washers.
   - **To differentiate between the thrust washers:** Compare the washers' inner diameters. Outer thrust washers feature a larger inner diameter than inner thrust washers.
2. Apply approved O-617-A or -B, NLGI grade 1 or 2 grease to the side of the inner thrust washer opposite the tang.
3. Place the greased side of the inner thrust washer toward the planetary gear. The thrust washer tangs fit into the spider grooves.
4. Place the inner thrust washer on the end of the new planetary gear.
5. Apply approved O-617-A or -B, NLGI grade 1 or 2 grease to the planetary gear bore.

6. Install the needle roller bearings. Install new needle roller bearings if you replace the pinion shafts.
   - **To install the needle roller bearings:** Install a row of needle roller bearings around the pinion bore and against the inner thrust washer. Install as many needle roller bearings as will fit. The number of needle roller bearings installed in the pinion bore differs among axle models.
7. Place the spacer into the bore of the gear on top of the needle rollers. Install another row of needle rollers on top of the spacer.
8. Apply approved O-617-A or -B, NLGI grade 1 or 2 grease to the side of the outer thrust washer opposite the tang.
9. Place the outer thrust washer on the end of the planetary gear. The tang must align with the tang of the opposite washer.
10. Set the planetary spider on a level surface with the flange side facing UP. Carefully slide the loaded planetary gear assembly into the planetary spider. Ensure that the following conditions exist before you proceed to Step 11:
    - The outer thrust washer (large bore) must be on top of the gear assembly.
    - The washer tangs must fit in the planetary spider grooves.
    - The needle roller bearings must be in place.
11. Install the pinion shaft through the spider, the planetary gear and the thrust washers. Allow the pinion shaft to extend out from spider. Do not press the pinion shaft into the spider at this time. **Figure 5.9.**



12. Repeat Steps 1-11 to install the second and third sets of pinion shafts, gears, needle roller bearings and thrust washers.
13. Check the alignment of the pinion shafts.
    - Place the spider cover over the shaft ends. When necessary, rotate the shafts so that spider cover fits over the flats. After you align the shafts, remove the cover.

⚠ WARNING

Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

14. Install each pinion shaft into the spider gear assembly by hand.
    - **If you cannot install a pinion shaft into the spider gear assembly by hand:** Use a press to install the pinion shaft into the spider assembly until the shoulder of the shaft bottoms against the inner (bottom) thrust washer. When a press is not available, use a brass drift and mallet to install the pinion shafts.

Nylon Coated Planetary Pinion Shaft

1. Inspect the large bore chamfers. The chamfers must be smooth to prevent damage to the nylon coating on the planetary pinion shaft during installation.
   - **If the large bore chamfers are not smooth:** Use an emery cloth to clean the chamfer surface.
2. Install a new O-ring into the O-ring groove on the pinion shaft.
3. Inspect the planetary gear bores. Do not use planetary gears with rough bore surfaces.

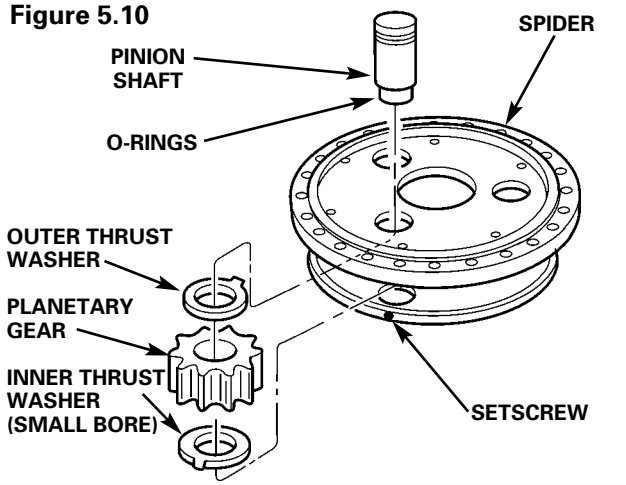
⚠ WARNING

Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

4. Place the spider in a press with the flange side UP. Support the spider as required.

5. Install the inner thrust washer (small bore). Place the washer tab into the spider indent and align the washer bore with the spider bore.
6. Apply a thin coat of the same gear lubricant used in the wheel end to the planetary gear bore.
7. Slide the planetary gear and the outer thrust washer into the spider. Align the bores of the parts and place the outer thrust washer tab into the spider indent.
8. Apply a thin coat of gear lube to the nylon coating on the pinion shaft.
9. Install the planetary pinion shaft in the spider and through the planetary gear and thrust washer. **Figure 5.10.**

Figure 5.10



10. Repeat Steps 1-9 to install the second and third sets of planetary pinion shafts, gears and washers.
11. Install the set screw into the spider to secure the pinion shaft.

Install the Planetary Spider Assembly

⚠ WARNING

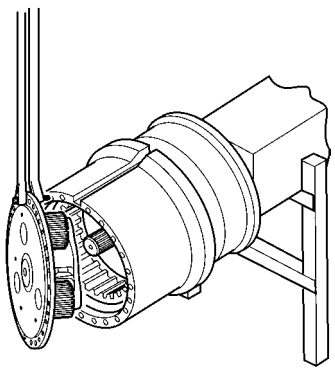
Take care when you use silicone gasket materials to avoid serious personal injury. Follow the manufacturer's instructions to prevent irritation to the eyes and skin.

⚠ CAUTION

Use only the correct gasket material. Do not use non-approved gasket material. Lubricant loss and damage to components can result.

1. Apply silicone (RTV) gasket material to the spider flange at the hub mounting face. Refer to "Applying Silicone Gasket Material" in Section 4.
2. Install the spider and pinion assembly in the wheel hub. Align the planetary gear teeth with the sun gear and ring gear teeth. Align the spider flange and wheel hub match marks you previously marked at disassembly. **Figure 5.11.**

Figure 5.11



3. Correctly align the spider mounting holes with the wheel hub holes or studs. Push the spider assembly against the hub.
4. Install the nuts and washers or capscrews and washers.
   - **To install studs with integral hex and washers:** Use a 3.25-inch internal depth, extra deep socket.

5. Tighten the wheel studs, capscrews or nuts according to the torque specifications shown in **Table F.**

Table F: Planetary Spider Mounting Capscrew and Stud Torque Specifications

	Torque	
Size	**lb-ft**	**N•m**
1/2"-13	85-115	115-156
9/16"-12	130-165	176-224
5/8"-11, – 14	210-230	284-311
3/4"-10	310-400	420-542
7/8"-14	575-750	780-1017

Adjust the Brakes

Adjust the brakes for axles with P series and RSA drum brakes only.

- **For P series brakes:** Refer to Maintenance Manual 4, Cam Brakes.
- **For RSA brakes:** Refer to Maintenance Manual 4P, Off-Highway Heavy Duty Brakes.

To order these publications, call Meritor's Customer Service Center at 800-535-5560.

Install the Tires and Rims

1. Install the tires and rims. Secure them with wheel rim clamps, nuts and washers.
2. Tighten the wheel nuts according to the vehicle manufacturer's specifications.

Fill the Wheel Ends With Lubricant

1. Rotate the wheel end until the oil fill line and oil level line are parallel to the ground.
2. Lower the vehicle to the ground.
3. Remove the oil fill plug from the cover. Clean all magnetic plugs and install the oil drain plug in the spider prior to filling the wheel end with lubricant.

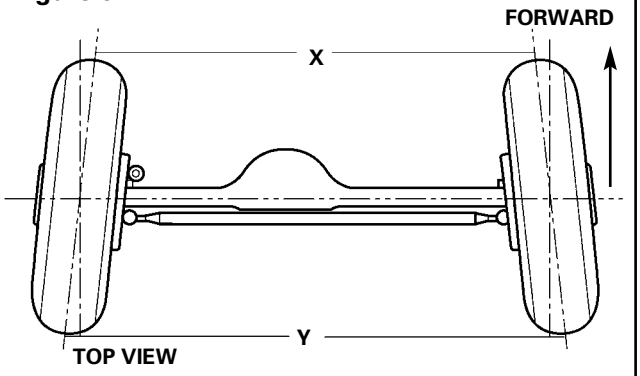
NOTE: The rigid axle wheel end and housing bowl share the same oil and oil level.

4. Fill each wheel-end and the axle housing bowl to the bottom of the fill/level plug hole with the specified oil. Do not fill oil through the bowl only.
5. Wait for the oil to evenly flow through the axle.
6. Check the oil level. Add oil if necessary.
7. Replace and securely tighten all plugs.

Measure and Adjust the Toe Setting

Toe is the difference in distance between the front of the front tires and the rear of the front tires. **Figure 5.12.**

Figure 5.12



Y MINUS X EQUALS TOE-IN

Check and adjust the toe setting after you install any of the following components:

- a front steering axle
- a new steering knuckle
- a tie rod component

Meritor performs the toe adjustment with the axle in an unloaded condition.

The toe specification for Meritor off-highway steering axles is 1/16-inch (1.60 mm) toe-in [± 1/16-inch (1.60 mm)]. This specification is based on a 24-inch (60.96 cm) radius (theoretical tire with a 48-inch (121.92 cm) outside diameter).

Tire Matching for Tandem and Tridem Axles

⚠ CAUTION

Unmatched tires on both tandem drive units and tridem drive units will cause tire wear and scuffing and possible damage to the drive units. Meritor recommends that the tires be matched to within 1/8-inch (3.18 mm) of the same rolling radius, 3/4-inch (19.05 mm) of the same rolling circumference.

Tandem Axles

The four largest tires should never be installed on one driving axle or the four smallest tires on the other driving axle. Such tire mounting will cause an interaxle "fight," unusually high axle lubricant temperatures that result in premature lubricant breakdown and possible costly axle service.

In addition to matching individual tire rolling radii or rolling circumference, Meritor recommends matching, as nearly as possible, the total tire circumference of one driving axle to the total tire circumference of the other driving axle. This will usually result in satisfactory tandem axle lubricant temperatures that lengthen drive unit service with higher tire mileage.

Park the vehicle on a level surface. The vehicle must carry a correctly distributed rated capacity load. All the tires must be the same size. Measure new tires to verify that they will be correctly matched.

1. Inflate all tires to the same pressure.
2. Carefully measure the rolling circumference of each tire with a steel tape.
3. Mark the size on each tire with chalk and arrange the tires in order of size, largest to smallest.
4. Mount the two largest tires on one side of one axle and mount the two smallest on the opposite side of the same axle.
5. Mount the four other tires on the other axle in the same manner.
6. Test run the vehicle to gather accurate rear axle lubricant temperature readings on the two axle lubricant temperature gauges.
7. Vary tire air pressure within the tire manufacturer's recommended range so the lubricant temperature of both axles is within 30°F (-1°C) of each other and not in excess of 200°F (93°C). This will usually result in uniform tire loading and good tire life.

Tridem Axles

When three driving axles are "hooked" together in a tridem series, unmatched tires will compound the problems described in the preceding paragraphs. Meritor recommends matching, as nearly as possible, the total tire circumference of each of the three driving axles.

To match tires on tridem units, follow the same procedure used for tandem units.

Arrange the tires in order of size:

- The two largest and two smallest go on one axle.
- The next two largest and smallest go on the second axle.
- The remaining four tires go on the third axle.

Lubrication Schedule

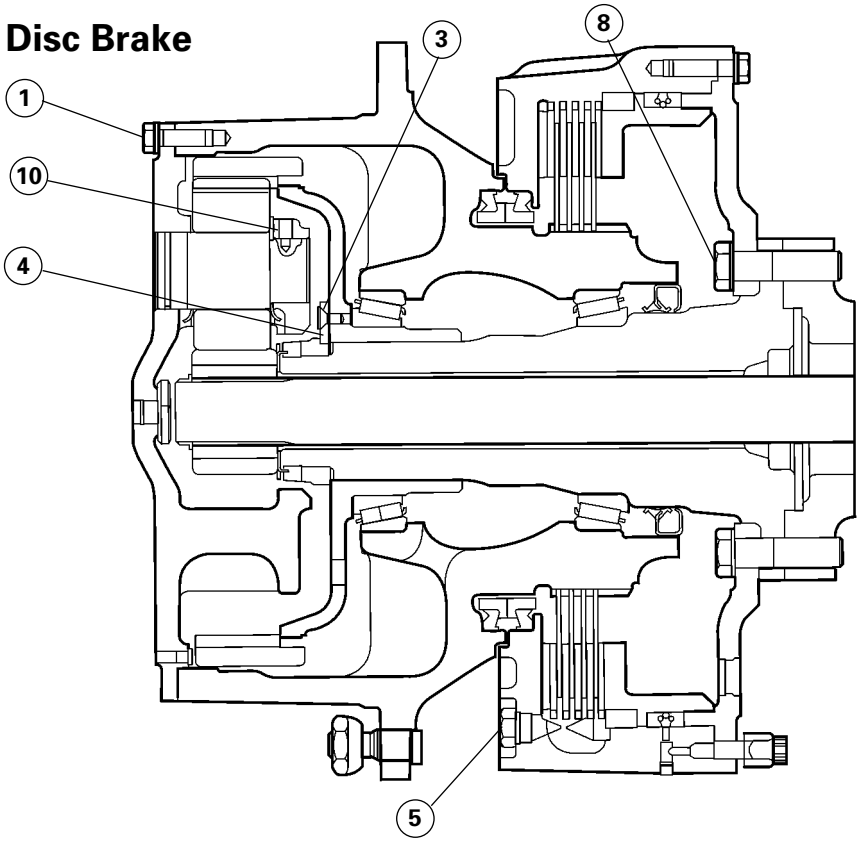
Operation	Off-Highway①
Initial Oil Change	100 operating hours①
Check Oil Level	250 operating hours①
Petroleum Oil Change	1,500 operating hours or twice a year (whichever comes first)①
Synthetic Oil or Semi-Synthetic Oil Change	3,000 operating hours or once a year (whichever comes first)

① The interval depends on the individual operating conditions, speeds and loads. Severe operating conditions may require more frequent intervals.

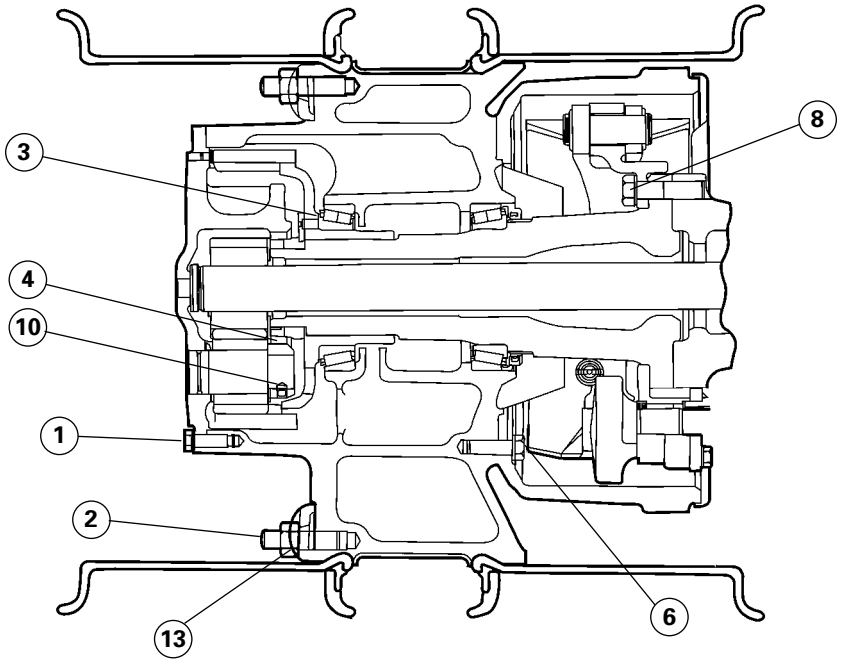
Lubricant Specifications

Meritor Specifications	Military Specification Approval	Oil Description	Outside Temperature			
			°F		°C	
			Min.	Max.	Min.	Max.
O-76A, Gear Oil	MIL-L-2105D or MIL-PRF-2105-E	GL-5, SAE 85W/140	10	None	-12	None
O-76D, Gear Oil		GL-5, SAE 80W/90	-15	None	-26	None
O-76E, Gear Oil		GL-5, SAE 75W/90	-40	None	-40	None
O-76L, Gear Oil		GL-5, SAE 75W/140	-40	None	-40	None
O-76M, Gear Oil		GL-5, SAE 75W/140	-40	None	-40	None
O-76N, Gear Oil		GL-5, SAE 75W/140	-40	None	-40	None

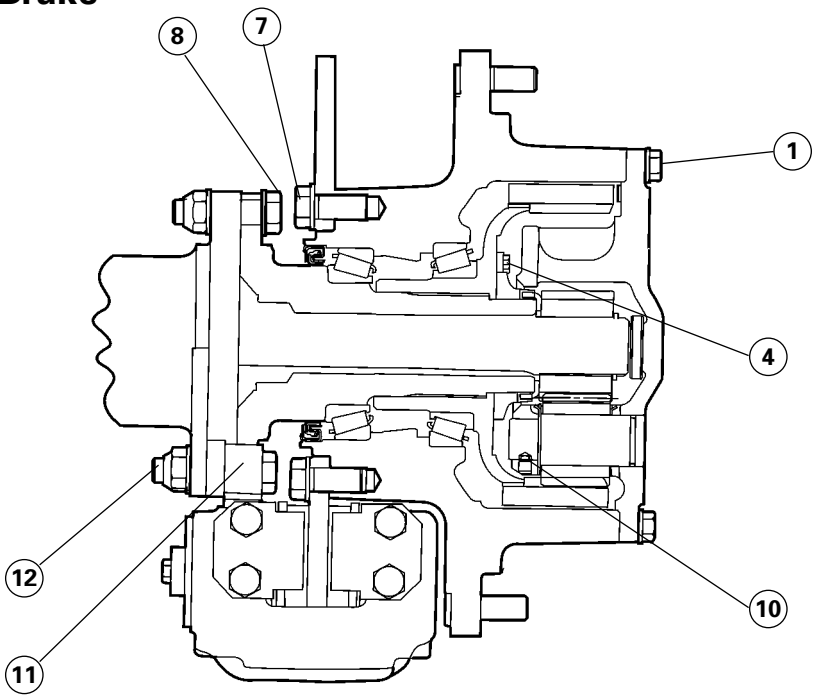
Rigid Axle Wet Disc Brake



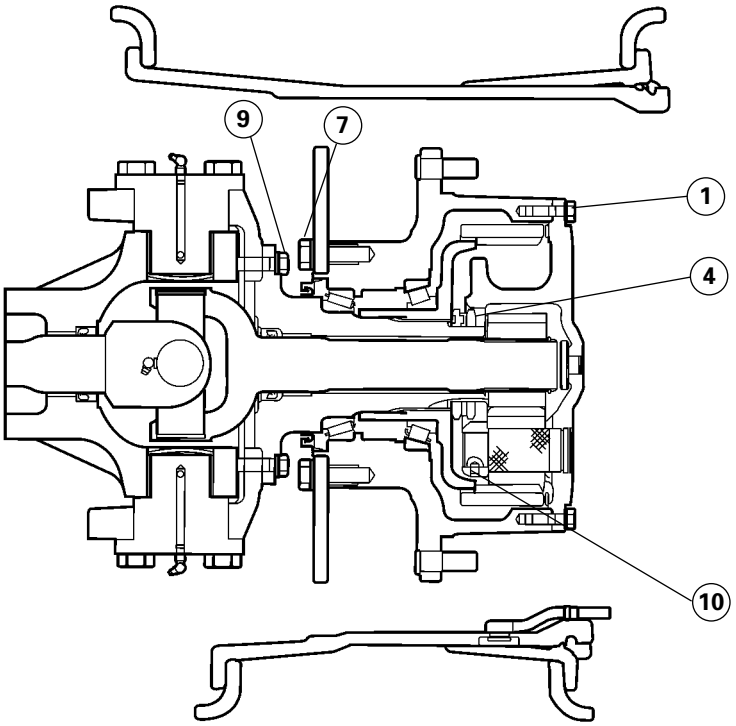
Rigid Axle Drum Brake



Rigid Axle Dry Disc Brake



Steering Axle Dry Disc Brake



Planetary Axle Wheel End Torque Specifications

Item	Fastener Description	Size	Torque	
			lb-ft	N•m
1	Planetary Spider Mounting Capscrew	1/2"-13	85-115	115-156
		9/16"-12	130-165	176-224
		5/8"-11, -14	210-230	284-311
		3/4"-10	310-400	420-542
		7/8"-14	575-750	780-1017
2	Wheel Stud Nut	3/4"-10	310-400	420-542
		7/8"-14	575-750	780-1017
3	Lockplate Capscrew	3/8"-16	30-45	41-61
4	Wheel Bearing Adjusting Nut	Refer to "Adjusting the Wheel Bearing Preload" in Section 5.		
5	Wet Brake Driver Mounting Capscrew	7/8"-14	575-750	780-1017
		1"-12	850-1100	1152-1491
6	Brake Drum Mounting Capscrew	5/8"-11, -18	210-230	284-311
		9/16"-18	130-165	172-224
		3/4"-10	310-400	420-542
		7/8"-14	575-750	780-1017
7	Brake Rotor Mounting Capscrew	1/2"-12	85-115	115-156
		9/16"-18	130-165	176-224
		5/8"-11, -18	210-230	284-311
		3/4"-10	310-400	420-542
		7/8"-9, -14	575-650	779-880
		1"-12, -14	850-1100	1152-1491
8	Spindle Mounting Capscrew	1/2"-12	85-115	115-156
		9/16"-18	130-165	176-224
		5/8"-11, -18	210-230	284-311
		3/4"-10	310-400	420-542
		7/8"-9, -14	575-650	779-880
	(Nut on Stud)	1"-12, -14	850-1100	1152-1491
9	Spindle to Steer Knuckle Capscrew	1/2"-13	85-115	115-156
		5/8"-11	210-230	284-311
		9/16"-12	130-165	176-224
		7/8"-14	575-750	780-1017
10	Pinion Shaft Locknut	3/8"-16	30-45	41-61
11	Caliper Adapter to Spindle Bolt	7/8"-9	440-580	597-786
12	Caliper to Adapter Capscrew	3/4"-10	310-400	420-542
		M20	369-479	500-650
13	Wheel Rim Clamp Nut	Refer to OEM specifications		
	Oil Level/Drain Plug (Not Shown)	3/4"-14	35	47
	Planetary Ring Gear Lock Capscrew	3/8"-16	35-50	47-68
	(Not Shown)	7/16"-14	60-75	81-102

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Maintenance Manual 9G
Revised 02-02
47865/Meritor

GEFFS MANUFACTURING, INC.
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USER GUIDE

GEFFS MANUFACTURING INC.

CHIP SPREADER

HOPPER CONTROL

Table of Contents

I. Revisions

LEVEL	DESCRIPTION – ECO NUMBER	DATE	BY
100	Created	6/7/12	AP
101-105	Changes made during on-site startup.	6/29/12	AP
106	Changed data type of the Gate Position profile output to U16 to properly transmit in the CAN message.	7/9/12	AP

II. Software Specification

Module	NODE #	HWD Version	Baud Rate	Program Number
82780-1	11		250	
82780-3	12		250	
82780-2	13		250	
82780-5			2.5	

III. Description of Operation

The Plus+1 Application Rate control system has two modes of operation, Automatic and Manual. In Manual mode the main gate opening is controlled by the joystick rocker switch. In Automatic mode the gate is controlled by machine speed and the Pounds per Square Yard (PSY) setting.

Before the machine can operate the Joystick and Gate Cylinder Sensor must be calibrated. This is done on the Setup Screen. To use the Automatic rate control the operator must setup calibration of the machine for proper aggregate rate. This is done on the Gate Calibration screen.
These calibrations are only required once unless changes are made or components replaced.

Start Screen:
This screen is display at power up and shows the current revision level of the installed Plus+1 software.

This screen is display for 5 seconds and then switches to the engine screen.

Engine Screen:

The Engine screen displays information from the engine ECM. If the ECM detects a problem the fault indicator will flash red, pressing button 4 will switch to the Engine Faults screen.

Once the engine is started the screen will automatically switch to the Main Run Screen.

Engine RPM is controlled with the Joystick. At power up the joystick must be pulled back to zero before the Plus+1 will allow RPM control.

The minimum and maximum RPM values are 750 to 2500 RPM and can be set with the service tool. This uses the TSC1 command to the engine so the ECM has final say in the RPM setting. It is possible to set the min or max RPM value outside of the range allowed by the engine ECM.

Screen Navigation: Pressing the left arrow will switch to the Engine Faults Screen. The right arrow buttons will switch to the Main Run Screen. Pressing the ESC button will switch to the Main Run Screen.

Main Run Screen: (Expanded Gate Hopper screen shown)

This screen is the main application rate control.

Conveyors: Press Button 1 and 2 to turn on the respective conveyor.
Once on, pressing button 2 or 6 will activate that conveyors speed control (the Up/Down Arrow icon will appear). Press the Up or Down arrow button to adjust the speed. A green indicator will appear on as the speed is adjusted and will turn of when the maximum or minimum adjustment is reached. Pressing 2 or 6 again will turn off the speed control.

Gate On/Off: Pressing button 3 will activate left to right control and button 4 activates right to left (the Left/Right Arrow icon will appear). Once active use the left or right arrow to scroll through the gates. (Since it is possible to turn off all gates from left to right or right to left, a red arrow indicator will appear to show which direction the gate has been turned off from.)
Pressing button 8 will turn all gates back on.
Gate icons are displayed as follows: Gray when off, Green when on and open. Red when they are on, but the main control is not on yet (Manual Mode), and Yellow when they are on, but the main control is not on yet (Auto Mode).

Auto/Manual Mode: Press the 'OK' button to toggle between Auto and Manual modes.

Manual Mode*:* The Gate position is controlled with the joystick rocker switch. Gate position graph will shown the gate current position once the gate is opened any air gate set to on will open. (Their icon will switch from Red to Green).

Auto Mode*:* The Gate position is controlled by the application rate software that utilizes the PSY setting, ground speed feet per minute (FPM) and the Mix number ratio. The gate will remain closed until two conditions have been met. A travel rate of 60 FPM or greater, and pressing the rocker switch in the open direction. At anytime the gate can be closed by pressing the rocker in the close direction.
The operator can increase or decrease the application rate by adjusting the PSY value. Make sure the conveyor speed controls are off (no Up/Down Arrow icons are on). Press and release either the Up or Down arrow button (the Up/Down Arrow icon will appear). Now use the Up or Down arrow to adjust the PSY value.

Screen Navigation: Pressing the right arrow will bring up the Functions Screen, the left arrow will switch to the Engine Screen (If either Gate On/Off functions are active the arrow buttons will not change screens). Button 4 will switch to the System Faults Screen and the ESC button will switch to the Engine Screen.

Functions Screen:

This screen has controls for the Console Swing, Augers (not available with CCH Hopper) and Hitch Up/Down.

Console Swing: Press and hold button 1 to swing the console to the right. Stand on the left side of the console when operating the Swing Right function.
Press and hold button 5 to swing the console to the left Stand on the right side of the console when operating the Swing Left function.

Augers On/Off: (Not available with CCH Hopper). Press button 3 to turn the Left Auger on and off. Button 6 to toggle the Right Conveyor on and off.

Hitch Up/Down: Press and hold button 3 to raise the Hitch. Press and hold button 7 to lower it.

Hitch Open: Press and hold the button on the front of the joystick to open the hitch, release the button to close it (this function will work regardless of which screen is displayed).

Screen Navigation: Pressing the right arrow will bring up the Hydraulic Pressure Screen, the left arrow will switch to the Main Run Screen.
The ESC button will switch to the Main Run Screen.

Hydraulic Pressure Screen:

This screen displays the hydraulic pressure of the Work, Left Conveyor and Right Conveyor pumps.

Screen Navigation:
Pressing the right arrow will bring up the Chip Distance Screen, the left arrow will switch to the Engine Screen (If either Gate On/Off functions are active the arrow buttons will not change screens). Button 4 will switch to the System Faults Screen and the ESC button will switch to the Engine Screen.

Chip Distance Screen

This screen displays the distance traveled while chip spreading Totals will only advance when the gate is open.

Press button 4 for 5 seconds to reset the Trip Distance to zero.
Press button 8 for 5 seconds to reset Total Distance to zero.

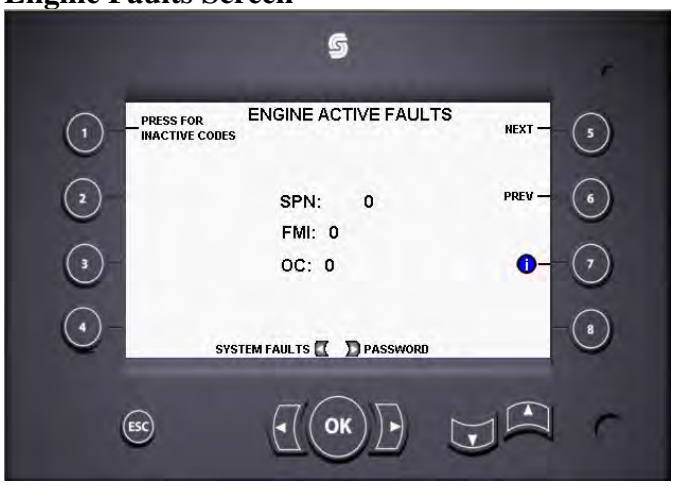
Screen Navigation: Pressing the right arrow will bring up the System Faults Screen, the left arrow will switch to the Hydraulic Pressures Screen. The ESC button will switch to the Main Run Screen.

System Faults Screen

A red box will appear next to the problem that has been detected.
An “Offline” fault means that there not CAN communication with the device.
An input device fault (temp sensor, Pressure sensor, joystick or Gate position) indicates that the value at the input pin is above or below the specified range. This could be am open or short circuit to the device.

The output faults indicate an open or short circuit for that output.
T
Screen Navigation: Pressing the right arrow will bring up the Engine Faults Screen, the left arrow will switch to the Chip Distance Screen. The ESC button will switch to the Main Run Screen.

Engine Faults Screen



This screen will display any engine faults codes received from the engine controller. Button 5 and 6 are used to scroll through the fault codes.

Button 1 will toggle between Active and Inactive codes.

Button 7 will display a list of common faults that can cause engine shutdown.

The list of common codes shown can cause engine shutdown and may be something that can be addressed onsite. Contact the engine manufacturer for information on other codes.

Screen Navigation: Pressing the right arrow will bring up the Password Screen, the left arrow will switch to the System Faults Screen. The ESC button will switch to the Engine Screen.

Password Screen

The Gate Calibration and Setup screens are password protected. The default password is **208**, but can be changed with the laptop service tool.

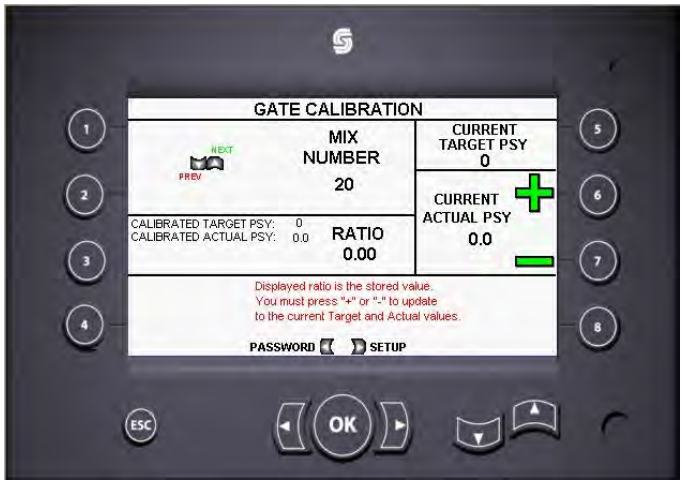
Press the Right or Left Arrow button to select the digit. Press the Up or Down arrow button to adjust the value.

Press the OK button to submit the password.

If the password is correct the Setup screen will appear. A wrong password will return to the Main screen.

Screen Navigation: The ESC button will switch to the Main Run Screen.

Gate Calibration Screen



This screen is used for calibrating the Mix ratio.

Pressing the Up or Down button will change the Mix number. This sets the mix that will be used in the Main Run Screen.

The current stored Ratio is displayed along with the Target and Actual PSY settings used in calibrating that ratio.

The Current Target PSY is the value set on the Main Run Screen.

Calibration of the Hopper Gate system:

1. Select the Target PSY (pounds per square yard) from the Main Run Screen.
2. Select the Mix number to use on the Gate Calibration screen.
3. Adjust the Current Actual PSY to match the Target PSY so the Ratio =1.00
4. Apply aggregate across 3' x 3' tarp.
5. Weigh applied material and adjust the Current Actual PSY to the measured weight.

The Calibrated Target PSY, Calibrated Actual PSY and Ratio will update to the new values and the Mix will maintain those values until a new calibration is performed.

Screen Navigation: Pressing the right arrow will bring up the Setup Screen, the left arrow will switch to the Password Screen. The ESC button will switch to the Main Run Screen.

Setup Screen

This screen is for setting brightness, low fuel level, Joystick and Gate cylinder input calibration.

Screen brightness:
The brightness is adjusted by pressing button 1 or 2. The brightness is also affected by internal screen temperature and can be automatically reduced.

Low Fuel Level Warning:
This is the percentage of fuel left in the tank where the low fuel indicator will come on.

Calibration:
The joystick and Gate Cylinder Sensor must be calibrated for the controller to be operational. The faults screen on the DP610 will show the NO CAL fault if the device has not been calibrated.

Joystick calibration **:**

1. Place the joystick full forward position.
2. Press the Joystick Reset button to clear any stored values.
3. Wait approx. 5 seconds for the controller to capture the joystick MAX position.
4. Shift the joystick to the full reverse position and wait approx. 5 seconds for the controller to capture the joystick MIN position.

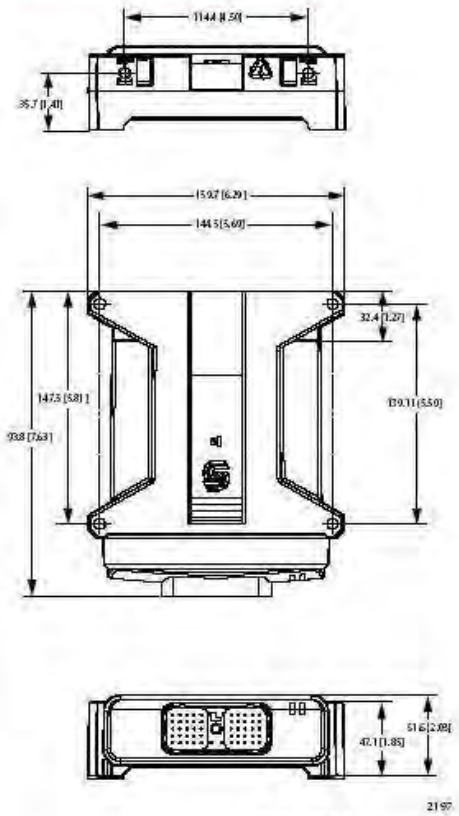
Gate Cylinder Calibration**:**

1. On the Main Run Screen place the Gate in Manual Mode.
2. Use the rocker switch on the joystick to place the gate cylinder in the fully retracted position.
3. Press the Gate Cyl Reset button to clear any stored values.
4. Wait approx. 5 seconds for the controller to capture the Gate MAX position.
5. Use the rocker switch to place the gate cylinder in the fully retracted position
6. Wait approx. 5 seconds for the controller to capture the Gate MIN position.

Screen Navigation: Pressing left arrow will switch to the Gate Calibration Screen. The ESC button will switch to the Main Run Screen.

IV. I/O Table 82780-1:

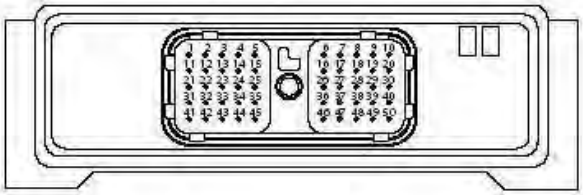
Dimensions and Pin Assignment



mounting dimensions

Power ground -	C1-P1
Power supply +	C1-P2
CAN1 +	C1-P3
CAN1 -	C1-P4
AIN/CAN1 shield	C1-P5
DIN	C1-P6
DIN	C1-P7
5 V DC sensor power +	C1-P8
Sensor power ground -	C1-P9
DIN	C1-P10
DIN	C1-P11
DIN	C1-P12
DIN	C1-P13
DIN/AIN	C1-P14
DIN/AIN	C1-P15
DIN/AIN	C1-P16
DIN/AIN	C1-P17
DIN/AIN/FreqIN	C1-P18
DIN/AIN/FreqIN	C1-P19
CAN2 +	C1-P20
CAN2 -	C1-P21
AIN/CAN2 shield	C1-P22
DIN/AIN/FreqIN	C1-P23
DIN/AIN/FreqIN	C1-P24
DIN/AIN/FreqIN	C1-P25

DIN/AIN/FreqIN	C1-P26
AIN/Temp/Rheo	C1-P27
AIN/Temp/Rheo	C1-P28
AIN/Temp/Rheo	C1-P29
AIN/Temp/Rheo	C1-P30
DOUT	C1-P31
DOUT	C1-P32
DOUT	C1-P33
DOUT/PVE Pwr1	C1-P34
DOUT/PVE Pwr2	C1-P35
DOUT/PVE Pwr3	C1-P36
PWM/DOUT/PVE 1OUT	C1-P37
PWM/DOUT/PVE 1OUT	C1-P38
PWM/DOUT/PVE 1OUT	C1-P39
PWM/DOUT/PVE 1OUT	C1-P40
PWM/DOUT/PVE 2OUT	C1-P41
PWM/DOUT/PVE 2OUT	C1-P42
PWM/DOUT/PVE 2OUT	C1-P43
PWM/DOUT/PVE 2OUT	C1-P44
PWM/DOUT/PVE 3OUT	C1-P45
PWM/DOUT/PVE 3OUT	C1-P46
Power supply +	C1-P47
Power supply +	C1-P48
Power supply +	C1-P49
Power supply +	C1-P50



50 pin connector

Above pinouts are for device pins.
Use care when wiring mating connector.

Specifications

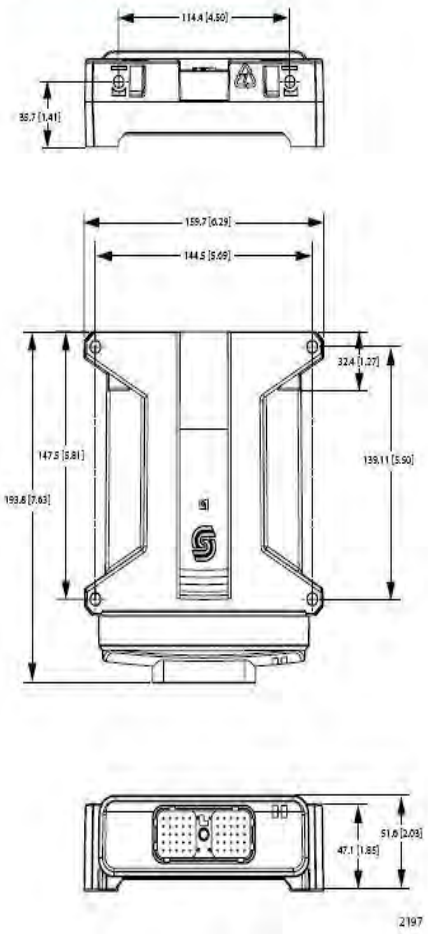
Product Parameters	
Supply voltage:	9 to 36 V
Operating temperature (ambient):	-40 to 70° C
Storage temperature:	-40 to 85° C
IP rating:	IP 67
EMI/RFI rating:	100 V/M
Weight:	0.53 kg (1.16 lb)
Vibration:	IEC 60068-2-64
Shock:	IEC 60068-2-27 test Ea
Maximum current:	40 A

Ordering Information	Part Number
Related Products	**Part Number**
USB to CAN communicator	
Deutsch mating connector bag assembly	
PLUS 1 GUIDE single user license	
Comprehensive Technical Information	
PLUS 1 Controller Family Technical Information manual order number:	

V. I/O Table 82780-3:

Controller

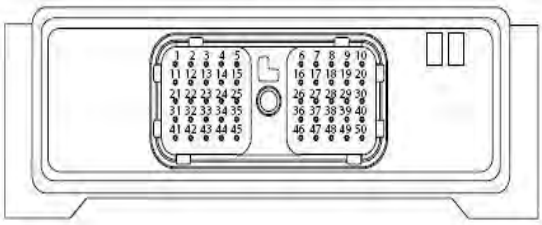
Dimensions and Pin Assignment



mounting dimensions.

Power ground -	C1-P1
Power supply +	C1-P2
CAN1 +	C1-P3
CAN1 -	C1-P4
AIN/CAN1 shield	C1-P5
DIN	C1-P6
DIN	C1-P7
5 V DC sensor power +	C1-P8
Sensor power ground -	C1-P9
DIN	C1-P10
DIN	C1-P11
DIN	C1-P12
DIN	C1-P13
DIN	C1-P14
DIN	C1-P15
DIN	C1-P16
DIN	C1-P17
DIN/AIN	C1-P18
DIN/AIN	C1-P19
CAN2 +	C1-P20
CAN2 -	C1-P21
AIN/CAN2 shield	C1-P22
DIN/AIN	C1-P23
DIN/AIN	C1-P24
DIN/AIN/FreqIN	C1-P25

DIN/AIN/FreqIN	C1-P26
DIN/AIN/FreqIN	C1-P27
DIN/AIN/FreqIN	C1-P28
DIN/AIN/FreqIN	C1-P29
DIN/AIN/FreqIN	C1-P30
AIN/Temp/Rheo	C1-P31
AIN/Temp/Rheo	C1-P32
DOUT	C1-P33
DOUT	C1-P34
DOUT	C1-P35
DOUT	C1-P36
DOUT	C1-P37
DOUT	C1-P38
DOUT/PVE Pwr1	C1-P39
DOUT/PVE Pwr2	C1-P40
PWMOUT/DOUT/PVE 1OUT	C1-P41
PWMOUT/DOUT/PVE 1OUT	C1-P42
PWMOUT/DOUT/PVE 1OUT	C1-P43
PWMOUT/DOUT/PVE 2OUT	C1-P44
PWMOUT/DOUT/PVE 2OUT	C1-P45
PWMOUT/DOUT/PVE 2OUT	C1-P46
Power supply +	C1-P47
Power supply +	C1-P48
Power supply +	C1-P49
Power supply +	C1-P50



50 pin connector.

Above pinouts are for device pins.
Use care when wiring mating connector.

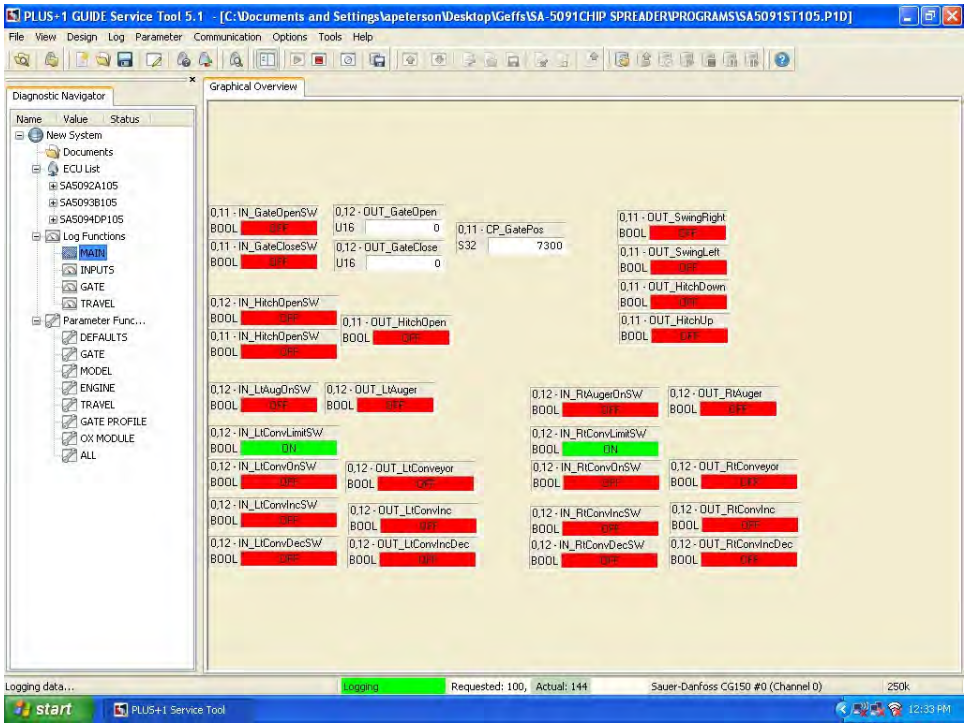
Specifications

Product Parameters	
Supply voltage:	9 to 36 V
Operating temperature (ambient):	-40 to 70° C
Storage temperature:	-40 to 85° C
IP rating:	IP 67
EMI/RFI rating:	100 V/M
Weight:	0.53 kg (1.16 lb)
Vibration:	IEC 60068-2-64
Shock:	IEC 60068-2-27 test Ea
Maximum current:	40 A

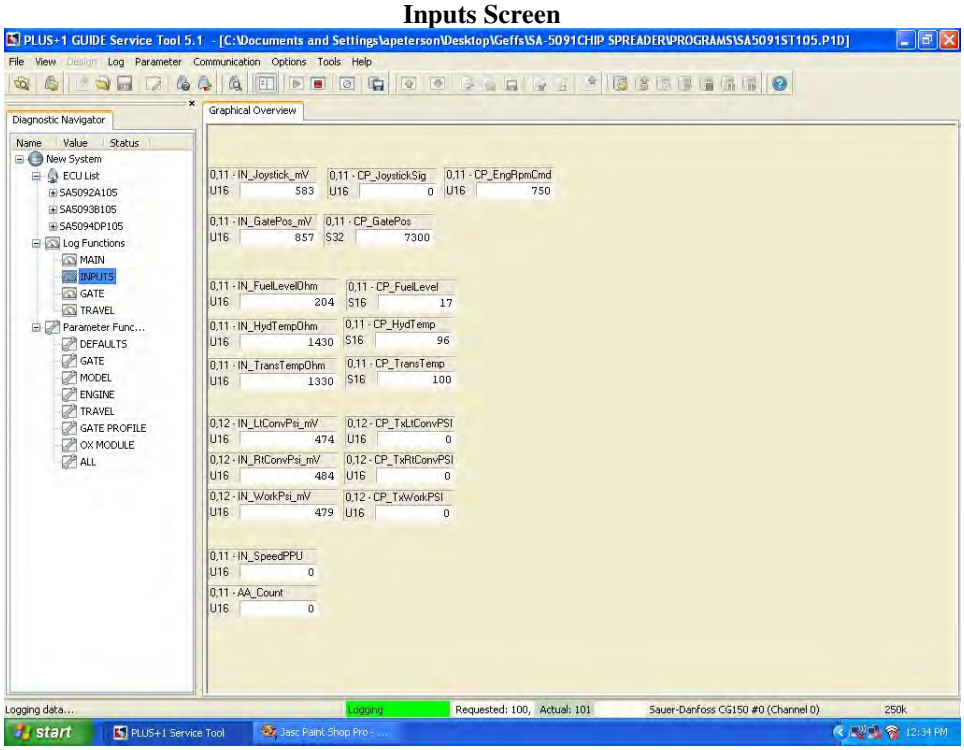
Ordering Information	Part Number
Related Products	**Part Number**
USB to CAN communicator	
Deutsch mating connector bag assembly	
PLUS 1 GUIDE single user license	
Comprehensive Technical Information	
PLUS 1 Controller Family Technical Information manual order number:	

VI. Service Tool

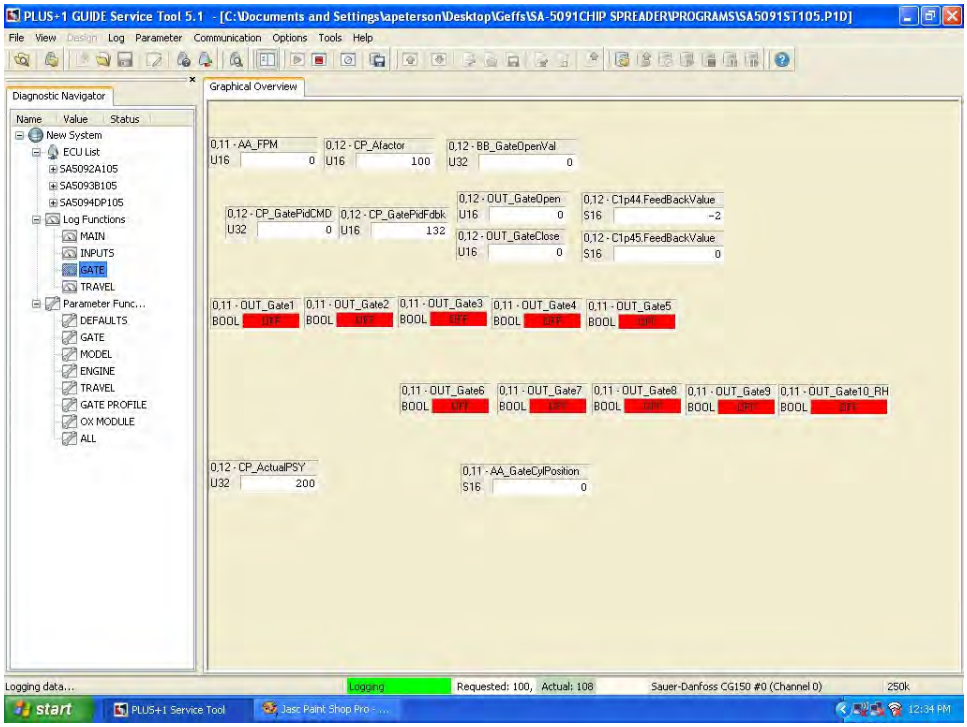
Main Screen



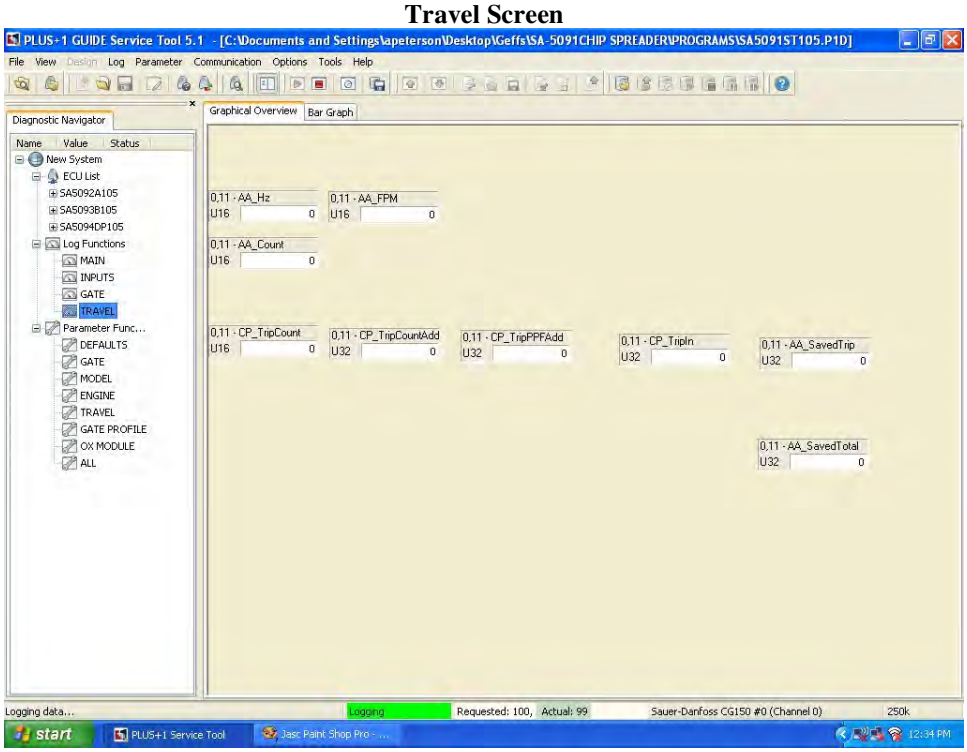
Inputs Screen



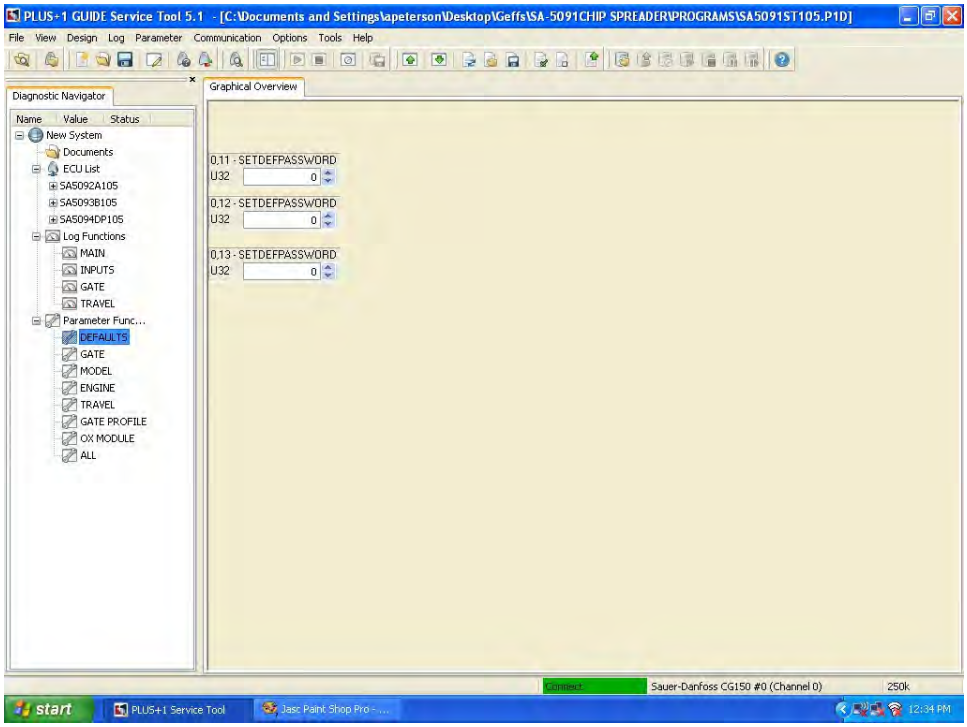
Gate Screen



Travel Screen

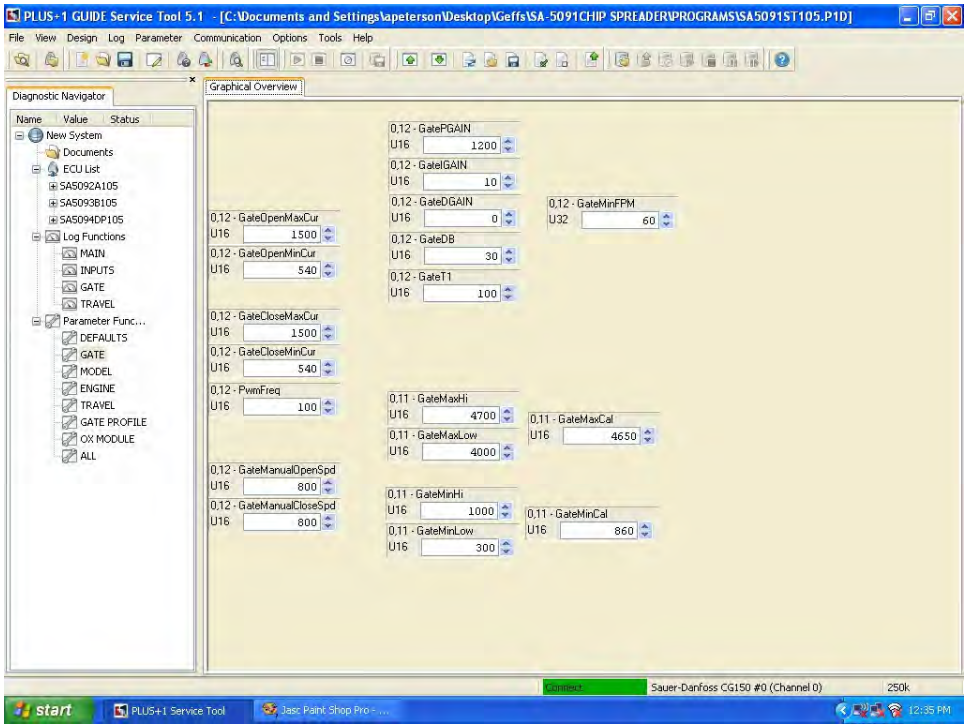


Defaults Parameters Screen

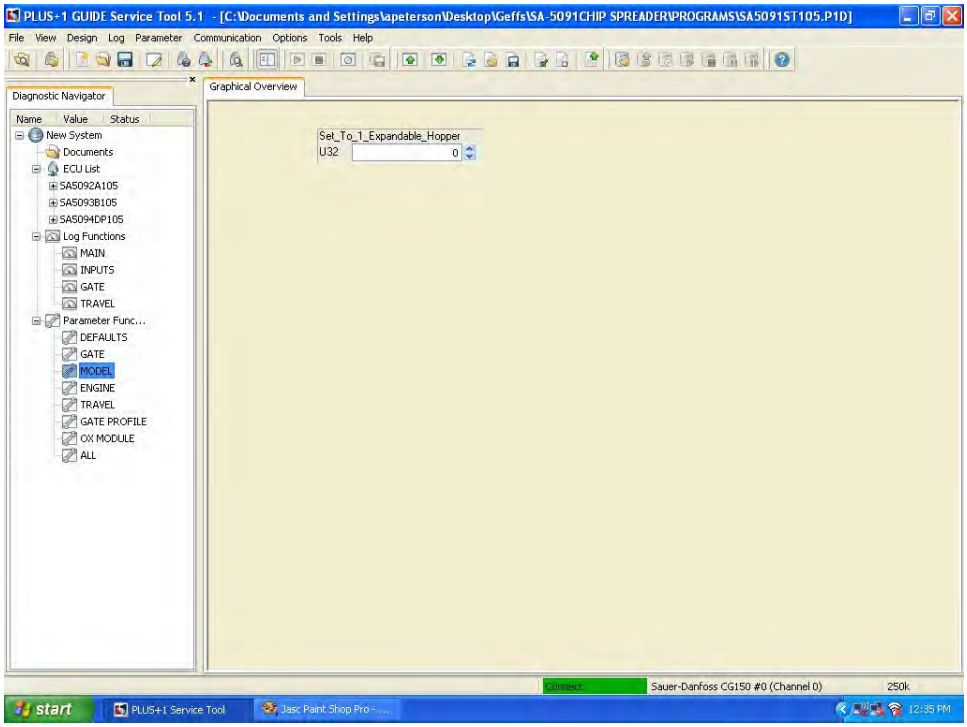


Press the “Upload Parameters From ECU” button.
Enter 2012 into the SETDEFPASSWORD BOXES and press the “Download Parameters to ECU” button to reset parameters to the factory defaults.

Gate Parameters Screen



Model Parameters Screen

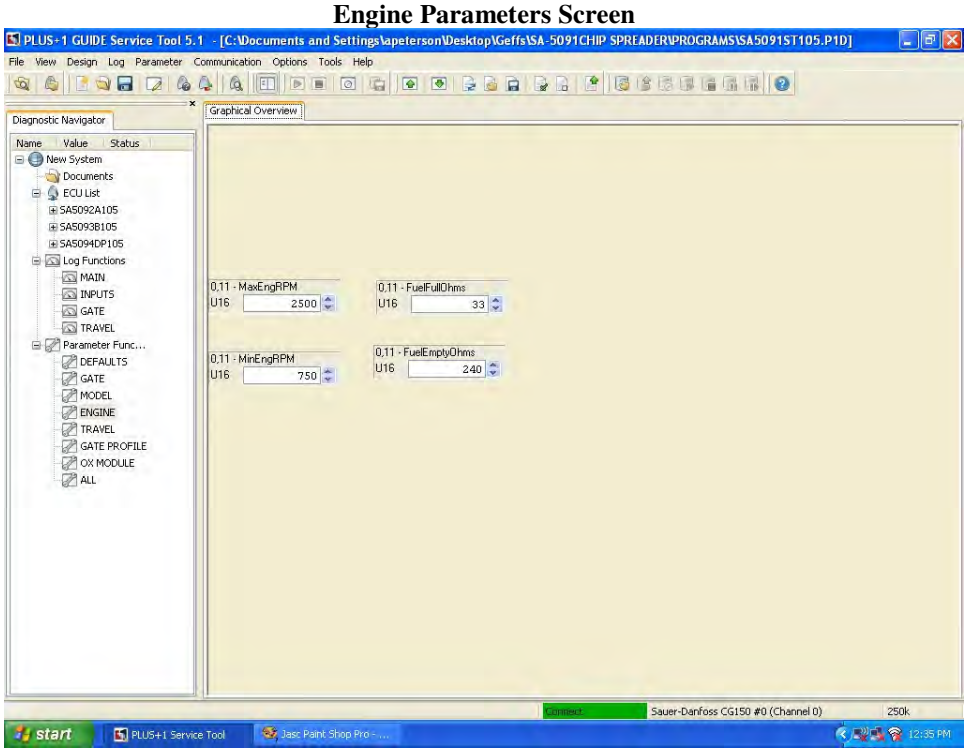


0 = CCH Hopper

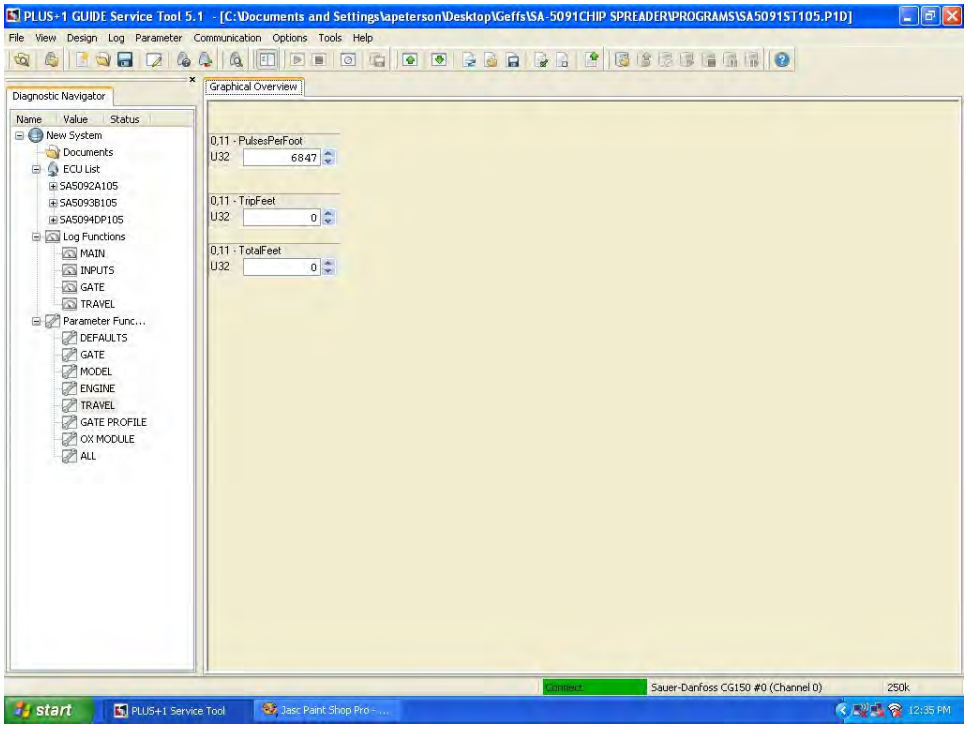
1= Expandable Hopper

Enetr value and press the “Download Parameters to ECU” button.

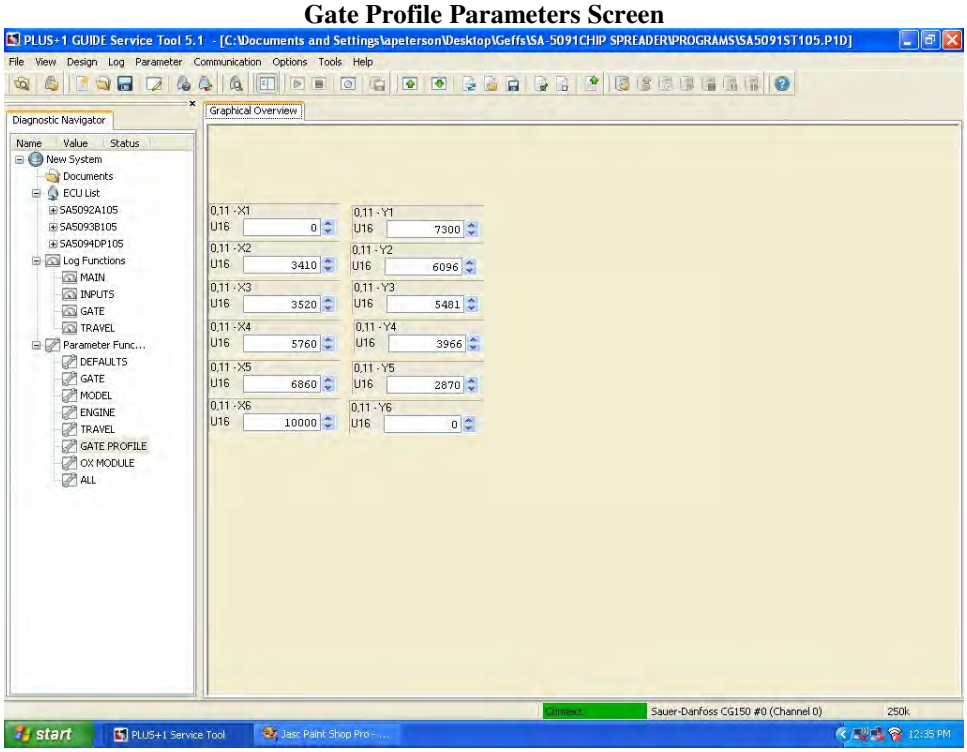
Engine Parameters Screen



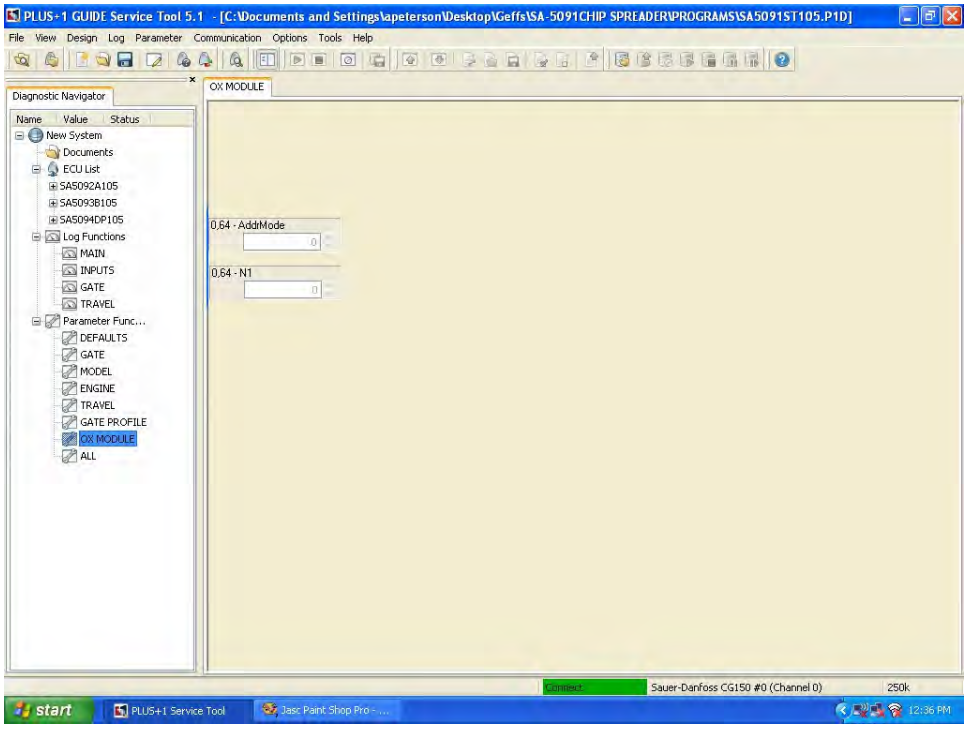
Travel Parameters Screen



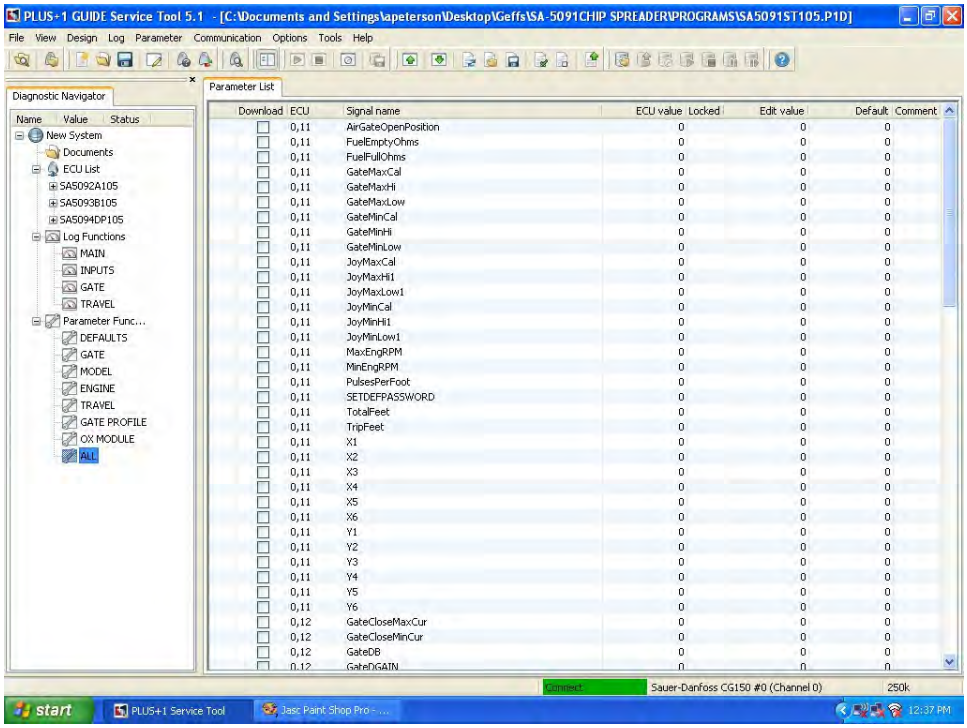
Gate Profile Parameters Screen



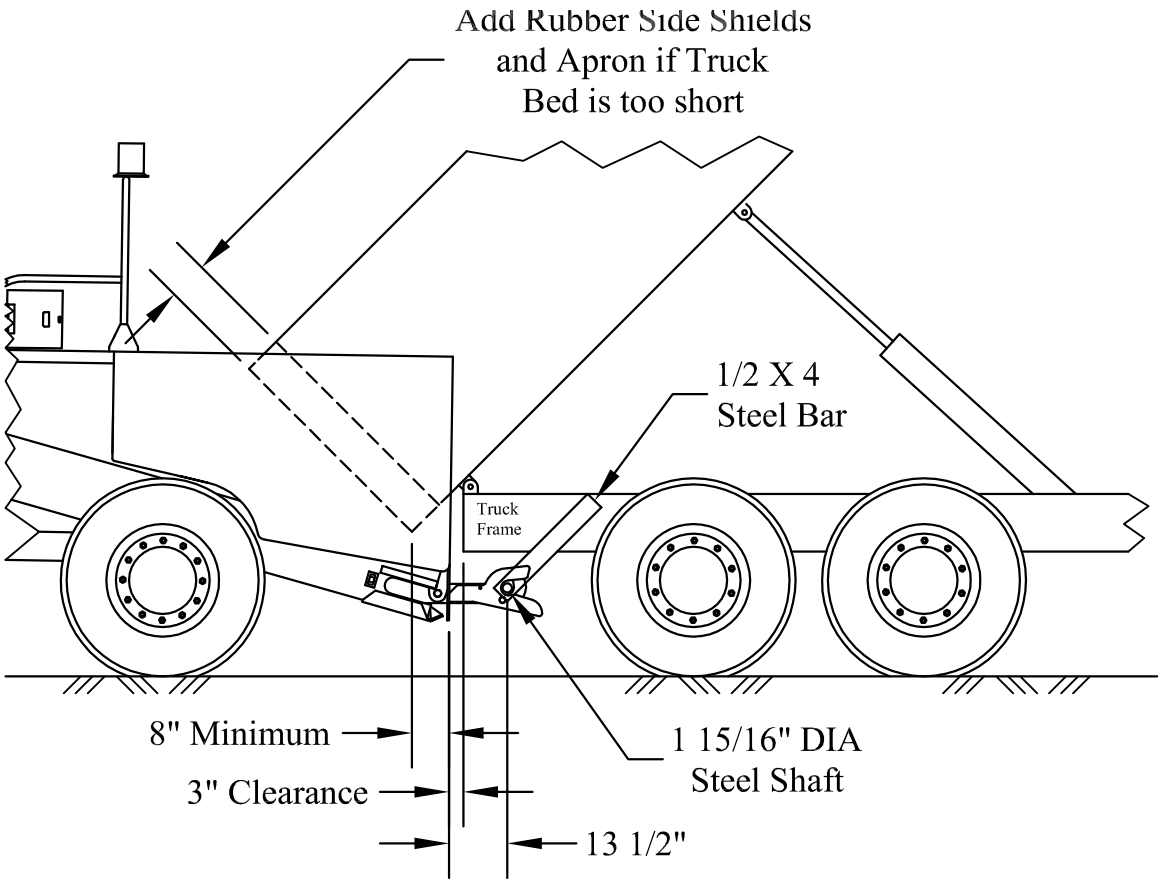
OX Module Parameters Screen



All Parameters Screen



This screen includes all parameters from each controller.
This can be exported to save a file of all machine parameters.


Add Rubber Side Shields
and Apron if Truck
Bed is too short
1/2 X 4
Steel Bar
Truck
Frame
8" Minimum
3" Clearance
13 1/2"
1 15/16" DIA
Steel Shaft

Air Schematic

4 X 4 Drive
2 X 4 Front Wheel Drive

All Other Lines are
3/8 DOT Air Tubing

Hydraulic Schematic