
Business Class Trucks Maintenance Manual Contents

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BUSINESS CLASS TRUCKS MAINTENANCE MANUAL

Models: FL50

FL60

FL70

FL80

FL106

FL112

MB50

MB60

MB70

MB80

Foreword

When performed on a regular basis, lubricating the parts of your vehicle is the least costly way of obtaining safe and reliable vehicle operation. Added benefits and savings occur when you check that the engine, undercarriage, and noise emission control parts are in good working order during lubrication.

This maintenance manual explains when you should lubricate parts and what to look for when checking for wear or damage. For daily and weekly checks, refer to the vehicle driver's manual.

IMPORTANT: Descriptions and specifications in this manual were in effect at the time of printing. Freightliner LLC reserves the right to discontinue models at any time, or change specifications and design without notice and without incurring obligation.

For additional information, please contact Freightliner LLC, Service Systems and Documentation, P.O. Box 3849, Portland, OR 97208-3849, U.S.A. or refer to <http://www.Freightliner.com> and <http://www.FreightlinerTrucks.com>.

Environmental Concerns and Recommendations

Whenever you see instructions in this manual to discard materials, you should attempt to reclaim and recycle them. To preserve our environment, follow appropriate environmental rules and regulations when disposing of materials.

NOTICE: Parts Replacement Considerations

Do not replace suspension, axle, or steering parts (such as springs, wheels, hubs, and steering gears) with used parts. Used parts may have been subjected to collisions or improper use and have undetected structural damage.

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Descriptions of Service Publications

Freightliner LLC distributes the following major service publications.

Workshop/Service Manual	Workshop/service manuals contain service and repair information for all vehicle systems and components, except for major components such as engines, transmissions, and rear axles. Each workshop/service manual section is divided into subjects that can include general information, principles of operation, removal, disassembly, assembly, installation, specifications, and troubleshooting.
Maintenance Manual	Maintenance manuals contain routine maintenance procedures and intervals for vehicle components and systems. They have information such as lubrication procedures and tables, fluid replacement procedures, fluid capacities, specifications, procedures for adjustments and for checking the tightness of fasteners. Maintenance manuals do not contain detailed repair or service information.
Driver's/Operator's Manual	Driver's/operator's manuals contain information needed to enhance the driver's understanding of how to operate and care for the vehicle and its components. Each manual contains a chapter that covers pretrip inspection and daily maintenance of vehicle components. Driver's/operator's manuals do not contain detailed repair or service information.
Parts Technical Manual	Freightliner LLC publishes this manual to aid in the identification of serviceable replacement vehicle parts. This manual is used in conjunction with the parts book and the service parts catalog microfiche.
Service Bulletins	Service bulletins provide the latest service tips, field repairs, product improvements, and related information. Some service bulletins are updates to information in the workshop/service manual. These bulletins take precedence over workshop/service manual information, until the latter is updated; at that time, the bulletin is usually canceled. The service bulletins manual is available only to dealers. When doing service work on a vehicle system or part, check for a valid service bulletin for the latest information on the subject. IMPORTANT: Before using a particular service bulletin, check the current service bulletin validity list to be sure the bulletin is valid.
Recall Bulletins	These bulletins pertain to special situations that involve service work or replacement of parts in connection with a recall notice. Recall bulletins pertain to matters of vehicle safety. All bulletins are distributed to dealers; customers receive notices that apply to their vehicles.
Field Service Modifications	This publication is concerned with non-safety-related service work or replacement of parts. All field service modifications are distributed to dealers; customers receive notices that apply to their vehicles.

Introduction

Page Description

For a page example of the printed manual, see [Fig. 1](#).

Frame and Fifth Wheel

31-01 Frame Fastener Torque Checking

Because of "bedding in" (or seating), frame fasteners must be torqued at recommended intervals. When tightening fasteners, check the frame for cracks and other damage.

CAUTION: Continued vehicle operation with loose fasteners could result in bracket or frame damage.

Frame fasteners are used on front frame brackets, axle stops, equalizer stops, suspension brackets, fuel tank brackets, exhaust and air-intake brackets, engine trunnion supports, rear engine supports, frame crossmembers and gussets, fifth wheel mounting angles, and fifth wheel legs.

Refer to the frame section in the vehicle service manual for additional information on frame fasteners, and to the general information section in the vehicle service manual for fastener information and torque values.

31-02 Fifth Wheel Inspecting and Lubricating

WARNING: All fifth wheel maintenance, adjustment, and rebuilding must be done only by a qualified mechanic. Improper or incomplete procedures could result in a possible disengagement of the trailer from the tractor, which could result in personal injury or property damage.

Parts are under spring compression. Wear safety goggles during removal, installation, and rebuilding. Failure to do so can result in personal injury, due to parts ejecting with force.

FONTAINE

1. Disconnect the tractor from the trailer. For instructions, refer to the vehicle driver's manual.
2. Thoroughly steam-clean the fifth wheel.
3. Look for cracks in the fifth wheel assembly, mounting brackets, and mounting parts.

HOLLAND

1. Disconnect the tractor from the trailer. For instructions, refer to the vehicle driver's manual.
2. Thoroughly steam-clean the fifth wheel.
3. Check for loose nuts or broken bolts on the fifth wheel assembly.
4. Inspect for cracks or wear on the mounting bolts.
5. Check for improper locking action and for cracks or wear on the jaw locking mechanism.

4. Check moving parts for wear or damage.

5. Test the safety lock latch for free operation.

6. Check for loose nuts or bolts in the fifth wheel and in the mounting.

7. Check all springs to see if they are securely fastened and not deformed.

8. Check wedge adjustment.

8.1 Open the kingpin lock and vertically insert a 2-inch diameter shaft.

8.2 Release the lock by tripping the release latch at the bottom of the throat.

8.3 Adjust the wedge stop at the end of the wedge to approximately 1/4-inch (6-mm) clearance.

9. If you observe any problems when doing the above steps, correct them immediately. For instructions, refer to the fifth wheel section in the vehicle service manual.

10. Oil all moving parts on the fifth wheel, and grease the top plate and the two zerk fittings for the bracket bearing area.

11. Replace cracked, worn, or damaged parts with new parts. Replace loose mounting bolts with 5/8-11 SAE grade 8 bolts, grade C locknuts, and hardened washers. Do not re-use bolts, nuts, and washers on fifth wheel mountings.

Heavy Trucks Maintenance Manual, November 1993

31/1

11/28/2001

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A. Maintenance Operation Number consists of the Group Number followed by the Sequence Number

B. Group Title

C. Group Number

D. Release Date

E. Group Number/Page Number

Fig. 1, Page Example of the Printed Manual

Title of Maintenance Operation (MOP)	MOP Number
Initial Maintenance (IM) Operations Table	00-09
Lubrication Tables	00-18
Lubrication and Fluid Level Check (M1, FL112 models only)	00-17
Lubrication and Fluid Level Check (M1, all models but FL112)	00-15
Lubrication and Fluid Level Check (M2, all models but FL112)	00-16
M1 Maintenance Interval Operations Table	00-10
M2 Maintenance Interval Operations Table	00-11
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General Information

Federal Law, Part 205: Transportation Equipment Noise Emission Controls

Part 205, Transportation Equipment Noise Emission Controls, requires the vehicle manufacturer to furnish, with each new vehicle, such written instructions for the proper maintenance, use, and repair of the vehicle by the ultimate purchaser to provide reasonable assurance of the elimination or minimization of noise emission degradation throughout the life of the vehicle. In compliance with the law, the Noise Emission Control Systems maintenance located in each applicable group within this manual, in conjunction with the vehicle service manual, provides these instructions to owners.

Normal Vehicle Use

The maintenance instructions contained in this manual are based on average vehicle use and normal operating conditions. Unusual vehicle operating conditions may require service at more frequent intervals.

Recommendations for Replacement Parts

Replacement parts used for maintenance or for the repair of noise emission control systems should be genuine Freightliner parts. If other than genuine Freightliner parts are used for replacements or for the repair of components affecting noise emission control, the owner should be sure that such parts are warranted by their manufacturer to be equivalent to genuine Freightliner parts in performance and durability.

Freightliner Noise Emissions Warranty

Refer to the vehicle owner's warranty information book for warranty information concerning noise emission control systems.

Tampering With the Noise Control System is Prohibited

Federal law prohibits the following acts or the causing thereof: (1) the removal or rendering inoperative by any person other than for purposes of maintenance, repair, or replacement, of any device or ele-

ment of design incorporated into any new vehicle for the purpose of noise control prior to its sale or delivery to the ultimate purchaser or while it is in use, or (2) the use of the vehicle after such device or element of design has been removed or rendered inoperative by any person. Among those acts presumed to constitute tampering are the acts listed below:

- A. Removal of engine noise-deadening panels.
- B. Removal of or rendering the engine speed governor inoperative so as to allow engine speed to exceed manufacturer's specifications.
- C. Removal of or rendering inoperative the fan clutch, including by-passing the control on any thermostatic fan drive to cause it to operate continuously.
- D. Removal of the fan shroud.
- E. Removal of or rendering inoperative exhaust system components, including exhaust pipe clamping.
- F. Removal of air intake system components.
- G. Removal of hood liners (noise-deadening panels).

Maintenance Instructions

Scheduled intervals are in the maintenance tables in Group 00 of this manual. A "Verification of Inspections Log" is contained in the following table, and should be filled in each time the noise emission controls on the vehicle are maintained or repaired.

00

General Information

Verification of Inspections Log: 00–02**Verification of Inspections Log****Verification of Inspections Log — Group 20**

Verification of Inspections Log — Group 20 — Engine Cooling/Radiator				
Date	Mileage	Repair Description	Cost	Repair Facility

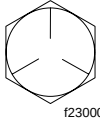
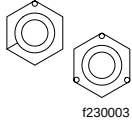
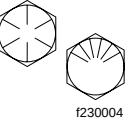
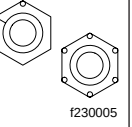
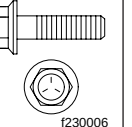
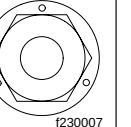
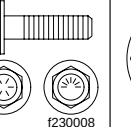
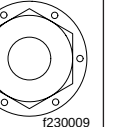
Verification of Inspections Log — Group 49

Verification of Inspections Log — Group 49 — Exhaust				
Date	Mileage	Repair Description	Cost	Repair Facility

General Information

00

Torque Specifications Tables: 00–03

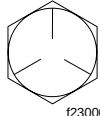
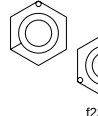
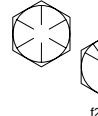
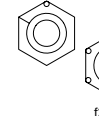
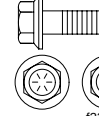
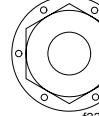
Torque Values for U.S. Customary Thread Fasteners with Lubricated * or Plated Threads †								
Thread Diameter–Pitch	Regular Hex				Flanged			
	Grade 5 Bolt	Grade 5 or B Nut	Grade 8 or 8.2 Bolt	Grade 8 or C Nut	Grade 5 Bolt	Grade B Nut	Grade 8 or 8.2 Bolt	Grade G Nut
	Torque: lbf·ft (N·m)		Torque: lbf·ft (N·m)		Torque: lbf·ft (N·m)		Torque: lbf·ft (N·m)	
								
1/4–20	7 (9)		8 (11)		6 (8)		10 (14)	
1/4–28	8 (11)		9 (12)		7 (9)		12 (16)	
5/16–18	15 (20)		16 (22)		13 (18)		21 (28)	
5/16–24	16 (22)		17 (23)		14 (19)		23 (31)	
3/8–16	26 (35)		28 (38)		23 (31)		37 (50)	
3/8–24	30 (41)		32 (43)		25 (34)		42 (57)	
7/16–14	42 (57)		45 (61)		35 (47)		60 (81)	
7/16–20	47 (64)		50 (68)		40 (54)		66 (89)	
1/2–13	64 (87)		68 (92)		55 (75)		91 (123)	
1/2–20	72 (98)		77 (104)		65 (88)		102 (138)	
9/16–12	92 (125)		98 (133)		80 (108)		130 (176)	
9/16–18	103 (140)		110 (149)		90 (122)		146 (198)	
5/8–11	128 (173)		136 (184)		110 (149)		180 (244)	
5/8–18	145 (197)		154 (209)		130 (176)		204 (277)	
3/4–10	226 (306)		241 (327)		200 (271)		320 (434)	
3/4–16	253 (343)		269 (365)		220 (298)		357 (484)	
7/8–9	365 (495)		388 (526)		320 (434)		515 (698)	
7/8–14	402 (545)		427 (579)		350 (475)		568 (770)	
1–8	—		582 (789)		—		—	
1–12	—		637 (863)		—		—	
1–14	—		652 (884)		—		—	

* Freightliner recommends that all plated and unplated fasteners be coated with oil before installation.

† Use these torque values if either the bolt or nut is lubricated or plated (zinc-phosphate conversion-coated, cadmium-plated, or waxed).

Table 1, Torque Values for U.S. Customary Thread Fasteners with Lubricated or Plated Threads

Torque Specifications Tables: 00–03

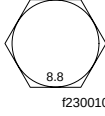
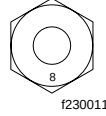
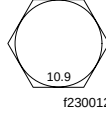
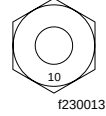
Torque Values for U.S. Customary Thread Fasteners with Dry (Unlubricated) * Plain (Unplated) Threads †						
Thread Diameter–Pitch	Regular Hex				Flanged	
	Grade 5 Bolt	Grade 5 or B Nut	Grade 8 or 8.2 Bolt	Grade 8 or C Nut	Grade 8 or 8.2 Bolt	Grade G Nut
	Torque: lbf·ft (N·m)		Torque: lbf·ft (N·m)		Torque: lbf·ft (N·m)	
	 f230002	 f230003	 f230004	 f230005	 f230008	 f230009
1/4–20	8 (11)		10 (14)		—	
1/4–28	9 (12)		12 (16)		—	
5/16–18	15 (20)		22 (30)		22 (30)	
5/16–24	17 (23)		25 (34)		—	
3/8–16	28 (38)		40 (54)		40 (54)	
3/8–24	31 (42)		45 (61)		—	
7/16–14	45 (61)		65 (88)		65 (88)	
7/16–20	50 (68)		70 (95)		—	
1/2–13	70 (95)		95 (129)		95 (129)	
1/2–20	75 (102)		110 (149)		—	
9/16–12	100 (136)		140 (190)		140 (190)	
9/16–18	110 (149)		155 (210)		—	
5/8–11	135 (183)		190 (258)		190 (258)	
5/8–18	155 (210)		215 (292)		—	
3/4–10	240 (325)		340 (461)		340 (461)	
3/4–16	270 (366)		380 (515)		—	
7/8–9	385 (522)		540 (732)		—	
7/8–14	425 (576)		600 (813)		—	
1–8	580 (786)		820 (1112)		—	
1–12	635 (861)		900 (1220)		—	
1–14	650 (881)		915 (1241)		—	

* Threads may have residual oil, but will be dry to the touch.

† Male and female threads (bolt and nut) must both be unlubricated and unplated; if either is plated or lubricated, use [Table 1](#). Freightliner recommends that all plated and unplated fasteners be coated with oil before installation.

Table 2, Torque Values for U.S. Customary Thread Fasteners with Dry (Unlubricated) Plain (Unplated) Threads

Torque Specifications Tables: 00-03

Torque Values for Metric Thread Fasteners with Lubricated * or Plated Threads †				
Thread Diameter-Pitch	Class 8.8 Bolt	Class 8 Nut	Class 10.9 Bolt	Class 10 Nut
	Torque: lbf·ft (N·m)		Torque: lbf·ft (N·m)	
				
M6	5 (7)		7 (9)	
M8	12 (16)		17 (23)	
M8 x 1	13 (18)		18 (24)	
M10	24 (33)		34 (46)	
M10 x 1.25	27 (37)		38 (52)	
M12	42 (57)		60 (81)	
M12 x 1.5	43 (58)		62 (84)	
M14	66 (89)		95 (129)	
M14 x 1.5	72 (98)		103 (140)	
M16	103 (140)		148 (201)	
M16 x 1.5	110 (149)		157 (213)	
M18	147 (199)		203 (275)	
M18 x 1.5	165 (224)		229 (310)	
M20	208 (282)		288 (390)	
M20 x 1.5	213 (313)		320 (434)	
M22	283 (384)		392 (531)	
M22 x 1.5	315 (427)		431 (584)	
M24	360 (488)		498 (675)	
M24 x 2	392 (531)		542 (735)	
M27	527 (715)		729 (988)	
M27 x 2	569 (771)		788 (1068)	
M30	715 (969)		990 (1342)	
M30 x 2	792 (1074)		1096 (1486)	

* Freightliner recommends that all plated and unplated fasteners be coated with oil before installation.

† Use these torque values if either the bolt or nut is lubricated or plated (zinc-phosphate conversion-coated, cadmium-plated, or waxed).

Table 3, Torque Values for Metric Thread Fasteners with Lubricated or Plated Threads

Metric/U.S. Customary Conversion Tables: 00–04

When You Know U.S. Customary	Multiply By	To Get Metric	When You Know Metric	Multiply By	To Get U.S. Customary
Length					
inches (in)	25.4	millimeters (mm)	0.03937		inches (in)
inches (in)	2.54	centimeters (cm)	0.3937		inches (in)
feet (ft)	0.3048	meters (m)	3.281		feet (ft)
yards (yd)	0.9144	meters (m)	1.094		yards (yd)
miles (mi)	1.609	kilometers (km)	0.6215		miles (mi)
Area					
square inches (in ²)	645.16	square millimeters (mm ²)	0.00155		square inches (in ²)
square inches (in ²)	6.452	square centimeters (cm ²)	0.155		square inches (in ²)
square feet (ft ²)	0.0929	square meters (m ²)	10.764		square feet (ft ²)
Volume					
cubic inches (in ³)	16387.0	cubic millimeter (mm ³)	0.000061		cubic inches (in ³)
cubic inches (in ³)	16.387	cubic centimeters (cm ³)	0.06102		cubic inches (in ³)
cubic inches (in ³)	0.01639	liters (L)	61.024		cubic inches (in ³)
fluid ounces (fl oz)	29.54	milliliters (mL)	0.03381		fluid ounces (fl oz)
pints (pt)	0.47318	liters (L)	2.1134		pints (pt)
quarts (qt)	0.94635	liters (L)	1.0567		quarts (qt)
gallons (gal)	3.7854	liters (L)	0.2642		gallons (gal)
cubic feet (ft ³)	28.317	liters (L)	0.03531		cubic feet (ft ³)
cubic feet (ft ³)	0.02832	cubic meters (m ³)	35.315		cubic feet (ft ³)
Weight/Force					
ounces (av) (oz)	28.35	grams (g)	0.03527		ounces (av) (oz)
pounds (av) (lb)	0.454	kilograms (kg)	2.205		pounds (av) (lb)
U.S. tons (t)	907.18	kilograms (kg)	0.001102		U.S. tons (t)
U.S. tons (t)	0.90718	metric tons (t)	1.1023		U.S. tons (t)
Torque/Work Force					
inch–pounds (lbf·in)	11.298	Newton–centimeters (N·cm)	0.08851		inch–pounds (lbf·in)
foot–pounds (lbf·ft)	1.3558	Newton–meters (N·m)	0.7376		foot–pounds (lbf·ft)
Pressure/Vacuum					
inches of mercury (inHg)	3.37685	kilo Pascals (kPa)	0.29613		inches of mercury (inHg)
pounds per square inch (psi)	6.895	kilo Pascals (kPa)	0.14503		pounds per square inch (psi)

Table 4, Metric/U.S. Customary Conversion

When You Know	Subtract	Then Divide By	To Get	When You Know	Multiply By	Then Add	To Get
degrees Fahrenheit (°F)	32	1.8	degrees Celsius (°C)	1.8	32		degrees Fahrenheit (°F)

Table 5, Temperature Conversion

Scheduled Maintenance Intervals, Description and Use: 00–05

Description

Schedule I (severe service) applies to vehicles that annually travel up to 6000 miles (10 000 kilometers) *or* that operate under severe conditions. Examples of Schedule I usage include: operation on extremely poor roads or where there is heavy dust accumulation; constant exposure to extreme hot, cold, salt-air, or other extreme climates; frequent short-distance travel; construction-site operation; city operation (fire truck, garbage truck); or farm operation.

Schedule II (short-haul transport) applies to vehicles that annually travel *up to* 60,000 miles (100 000 kilometers) and operate under normal conditions. Examples of Schedule II usage are: operation primarily in cities and densely populated areas; local transport with infrequent freeway travel; or high percentage of stop-and-go travel.

Schedule III (long-haul transport) is for vehicles that annually travel *more than* 60,000 miles (100 000 kilometers), with minimal city or stop-and-go operation. Examples of Schedule III usage are: regional delivery that is mostly freeway miles; interstate transport; or any road operation with high annual mileage.

The table under **Maintenance Schedule Table** shows three different schedules of vehicle usage. For each schedule the appropriate distance interval is given for performing Initial Maintenance and for repeating each maintenance operation set (M1 through M5). For Schedule I, the appropriate time interval is also given.

The tables under **Maintenance Interval Tables** show which maintenance operation set must be performed at the actual distances (miles and kilometers) for each maintenance schedule (or the actual hours of operation for Schedule I). The schedule of actual distances (and hours) is based on the intervals given in the Maintenance Schedule Table.

The tables under **Maintenance Operation Sets Tables** list, in numerical order, the text reference numbers and descriptions of *all* maintenance operations, and indicates all maintenance operation sets at which each operation must be performed.

Each Maintenance Interval Operations Table (IM through M5) lists the appropriate text reference numbers and descriptions of only those maintenance operations that must be performed at that maintenance operation set. Each maintenance operation set is listed in a separate Maintenance Operations Table.

Use

Before placing your new vehicle in service, determine the correct maintenance intervals that apply to your intended use of the vehicle. Refer to the Maintenance Schedule Table to determine the distance (or hour) interval at which each Maintenance Operation Set must be performed to comply with your vehicle's schedule. For Schedule I vehicles equipped with an hourmeter, use hours to determine maintenance intervals, rather than distance traveled.

When the vehicle reaches the actual distance (or hours) given for an interval, refer to the Maintenance Interval Tables to find the Maintenance Operation Set that applies to that interval. Then perform the maintenance operations listed in the applicable Maintenance Interval Operation Table. Use the maintenance operation reference numbers to find instructions in the manual for completion of each operation.

Complete each Maintenance Operation Set at the required interval. Then, when you have completed Maintenance Operation Set M5 under the 32nd Maintenance Number listed in the Maintenance Interval Table, repeat the pattern. The 33rd Maintenance Number will begin at Maintenance Operation Set M1, under the 1st Maintenance Number listed in the Maintenance Interval Table.

NOTE: When performing operations for the 33rd Maintenance Number, complete the M1 operations only, not the Initial Maintenance operations.

To determine the distance/hours for the 33rd Maintenance Number, add your schedule's distance/hours for the 1st Maintenance Number to the distance/hours for the 32nd Maintenance Number, then perform the operations listed in the applicable table in the Maintenance Operations Tables. For the 34th Maintenance Number, add the distance/hours for the 2nd to the distance/hours for the 32nd; continue this pattern for each successive Maintenance Number.

Maintenance Schedule Table: 00–06

Maintenance Schedule	Models	Maintenance Interval Operation	Maintenance Intervals			
			Frequency	Miles	Km	Hours
SCHEDULE I * (Severe Service) vehicles that annually travel up to 6000 miles (10 000 km)	FL50, FL60, FL70, FL80, FL106 and FL112	Initial Maintenance (IM)	first	1000	1600	100
		Maintenance 1 (M1)	every	1000	1600	100
		Maintenance 2 (M2)	every	4000	6400	400
		Maintenance 3 (M3)	every	8000	12 800	800
		Maintenance 4 (M4)	every	16,000	25 600	1600
		Maintenance 5 (M5)	every	32,000	51 200	3200
	MB50, MB60, MB70, and MB80	Initial Maintenance (IM)	first	4000	6000	100
		Maintenance 1 (M1)	every	4000	6000	100
		Maintenance 2 (M2)	every	8000	12 000	200
		Maintenance 3 (M3)	every	16,000	24 000	400
		Maintenance 4 (M4)	every	32,000	48 000	800
		Maintenance 5 (M5)	every	64,000	96 000	1600
SCHEDULE II (Short-Haul Transport) vehicles that annually travel up to 60,000 miles (100 000 km)	All	Initial Maintenance (IM)	first	8000	12 000	—
		Maintenance 1 (M1)	every	8000	12 000	
		Maintenance 2 (M2)	every	16,000	24 000	
		Maintenance 3 (M3)	every	32,000	48 000	
		Maintenance 4 (M4)	every	64,000	96 000	
		Maintenance 5 (M5)	every	128,000	192 000	
SCHEDULE III (Long-Haul Transport) vehicles that annually travel over 60,000 miles (100 000 km)	All	Initial Maintenance (IM)	first	10,000	16 000	—
		Maintenance 1 (M1)	every	10,000	16 000	
		Maintenance 2 (M2)	every	20,000	32 000	
		Maintenance 3 (M3)	every	40,000	64 000	
		Maintenance 4 (M4)	every	80,000	128 000	
		Maintenance 5 (M5)	every	160,000	256 000	

* For Schedule I (severe service) vehicles (equipped with an hourmeter), use maintenance intervals based on hours of operation rather than distance traveled.

Table 6, Maintenance Schedule Table

Maintenance Interval Tables: 00–07

Maintenance Intervals for Schedule I (FL50/60/70/80/106/112 models only)				
Maint. No.	Maintenance Interval	Miles	km	Hours
1	IM and M1	1000	1600	100
2	M1	2000	3200	200
3	M1	3000	4800	300
4	M1 and M2	4000	6400	400
5	M1	5000	8000	500
6	M1	6000	9600	600
7	M1	7000	11 200	700
8	M1, M2, and M3	8000	12 800	800
9	M1	9000	14 400	900
10	M1	10,000	16 000	1000
11	M1	11,000	17 600	1100
12	M1 and M2	12,000	19 200	1200
13	M1	13,000	20 800	1300
14	M1	14,000	22 400	1400
15	M1	15,000	24 000	1500
16	M1, M2, M3, and M4	16,000	25 600	1600
17	M1	17,000	27 200	1700
18	M1	18,000	28 800	1800
19	M1	19,000	30 400	1900
20	M1 and M2	20,000	32 000	2000
21	M1	21,000	33 600	2100
22	M1	22,000	35 200	2200
23	M1	23,000	36 800	2300
24	M1, M2, and M3	24,000	38 400	2400
25	M1	25,000	40 000	2500
26	M1	26,000	41 600	2600
27	M1	27,000	43 200	2700
28	M1 and M2	28,000	44 800	2800
29	M1	29,000	46 400	2900
30	M1	30,000	48 000	3000
31	M1	31,000	49 600	3100
32	M1, M2, M3, M4, and M5	32,000	51 200	3200

Table 7, Maintenance Intervals for Schedule I (FL50/60/70/80/106/112 models only)

Maintenance Interval Tables: 00–07

Maintenance Intervals for Schedule I (MB50/60/70/80 models only)				
Maint. No.	Maintenance Interval	Miles	km	Hours
1	IM and M1	4000	6000	100
2	M1 and M2	8000	12 000	200
3	M1	12,000	18 000	300
4	M1, M2, and M3	16,000	24 000	400
5	M1	20,000	30 000	500
6	M1 and M2	24,000	36 000	600
7	M1	28,000	42 000	700
8	M1, M2, M3, and M4	32,000	48 000	800
9	M1	36,000	54 000	900
10	M1 and M2	40,000	60 000	1000
11	M1	44,000	66 000	1100
12	M1, M2, and M3	48,000	72 000	1200
13	M1	52,000	78 000	1300
14	M1 and M2	56,000	84 000	1400
15	M1	60,000	90 000	1500
16	M1, M2, M3, M4, and M5	64,000	96 000	1600
17	M1	68,000	102 000	1700
18	M1 and M2	72,000	108 000	1800
19	M1	76,000	114 000	1900
20	M1, M2, and M3	80,000	120 000	2000
21	M1	84,000	126 000	2100
22	M1 and M2	88,000	132 000	2200
23	M1	92,000	138 000	2300
24	M1, M2, M3, and M4	96,000	144 000	2400
25	M1	100,000	150 000	2500
26	M1 and M2	104,000	156 000	2600
27	M1	108,000	162 000	2700
28	M1, M2, and M3	112,000	168 000	2800
29	M1	116,000	174 000	2900
30	M1 and M2	120,000	180 000	3000
31	M1	124,000	186 000	3100
32	M1, M2, M3, M4, and M5	128,000	192 000	3200

Table 8, Maintenance Intervals for Schedule I (MB50/60/70/80 models only)

General Information

00

Maintenance Interval Tables: 00–07

Maintenance Intervals for Schedules II and III (all models)					
Maint. No.	Maintenance Interval	Schedule II		Schedule III	
		Miles	km	Miles	km
1	IM and M1	8000	12 000	10,000	16 000
2	M1 and M2	16,000	24 000	20,000	32 000
3	M1	24,000	36 000	30,000	48 000
4	M1, M2, and M3	32,000	48 000	40,000	64 000
5	M1	40,000	60 000	50,000	80 000
6	M1 and M2	48,000	72 000	60,000	96 000
7	M1	56,000	84 000	70,000	112 000
8	M1, M2, M3, and M4	64,000	96 000	80,000	128 000
9	M1	72,000	108 000	90,000	144 000
10	M1 and M2	80,000	120 000	100,000	160 000
11	M1	88,000	132 000	110,000	176 000
12	M1, M2, and M3	96,000	144 000	120,000	192 000
13	M1	104,000	156 000	130,000	208 000
14	M1, and M2	112,000	168 000	140,000	224 000
15	M1	120,000	180 000	150,000	240 000
16	M1, M2, M3, M4, and M5	128,000	192 000	160,000	256 000
17	M1	136,000	204 000	170,000	272 000
18	M1 and M2	144,000	216 000	180,000	288 000
19	M1	152,000	228 000	190,000	304 000
20	M1, M2, and M3	160,000	240 000	200,000	320 000
21	M1	168,000	252 000	210,000	336 000
22	M1 and M2	176,000	264 000	220,000	352 000
23	M1	184,000	276 000	230,000	368 000
24	M1, M2, M3, and M4	192,000	288 000	240,000	384 000
25	M1	200,000	300 000	250,000	400 000
26	M1 and M2	208,000	312 000	260,000	416 000
27	M1	216,000	324 000	270,000	432 000
28	M1, M2, and M3	224,000	336,000	280,000	448 000
29	M1	232,000	348 000	290,000	464 000
30	M1 and M2	240,000	360 000	300,000	480 000
31	M1	248,000	372 000	310,000	496 000
32	M1, M2, M3, M4, and M5	256,000	384 000	320,000	512 000

Table 9, Maintenance Intervals for Schedules II and III (all models)

Maintenance Operation Sets Tables: 00–08

IMPORTANT: At each Maintenance Operation Set, in addition to the maintenance operations listed in this table, perform all daily and weekly maintenance operations listed in the "Pretrip Inspection and Daily Maintenance" chapter of the *Business Class Trucks Driver's Manual*.

NOTE: Maintenance operations appearing in *italics* in this table are for noise emission control components. Numbers in this table are maintenance operation reference numbers matching those in the text of this manual.

Maintenance Operation Sets for Groups 00 through 26							
REQUIRED MAINTENANCE OPERATION SET		IM	M1	M2	M3	M4	M5
Maintenance Operation Number and Operation Description							
00–15	Lubrication and Fluid Level Check (all models but FL112)	•	•	•	•	•	•
00–16	Lubrication and Fluid Level Check (all models but FL112)			•	•	•	•
00–17	Lubrication and Fluid Level Check (FL112 models only)	•	•	•	•	•	•
01–01	Engine-Support Fasteners Checking					•	•
01–02	Engine Drive Belt Inspection				•	•	•
09–01	Air Cleaner Element Inspecting and Replacing					•	•
13–01	Air Compressor Inspecting, Bendix			•	•	•	
13–02	Air Compressor Rebuilding/Replacing, Bendix						•
15–01	Alternator, Battery, and Starter Checking					•	•
20–01	Radiator Cap Checking			•	•	•	•
20–02	Radiator Pressure Flushing and Coolant Changing					•	•
20–03	<i>Fan Clutch Checking</i>			•	•	•	•
25–01	Clutch Release Bearing and Release Cross-Shaft Lubricating	•	•	•	•	•	•
25–02	Clutch (Pull-Type) Inspecting and Adjusting	•			•	•	•
25–03	Hydraulic Fluid Level Checking	•	•	•	•	•	•
25–04	Hydraulic Fluid Replacing						•
26–01	Manual Transmission Oil Level Checking		•	•	•		
26–02	Eaton Fuller and Meritor Transmission Oil Changing and Magnetic Plug Cleaning	•				•	•
26–03	Allison, Eaton/Fuller, and Meritor Transmission Breather Checking			•	•	•	•
26–04	Eaton/Fuller Transmission Air Filter/Regulator Element Cleaning			•	•	•	•
26–05	Allison Transmission Fluid and Filter Changing				•	•	•
26–06	Chrysler Transmission Fluid and Filter Changing	•	•	•	•	•	•
26–07	Chrysler Transmission Band Adjusting	•	•	•	•	•	•
26–08	Aisin Transmission Fluid and Filter Changing and Magnetic Plug Cleaning	•			•	•	•
26–09	Mercedes-Benz Transmission Leak Checking						•
26–10	Mercedes-Benz Transmission Fluid Changing and Magnetic Plug Cleaning						•

Table 10, Maintenance Operation Sets for Groups 00 through 26

General Information

00

Maintenance Operation Sets Tables: 00–08

Maintenance Operation Sets for Groups 31 through 41							
REQUIRED MAINTENANCE OPERATION SET		IM	M1	M2	M3	M4	M5
Maintenance Operation Number and Operation Description							
31-01	Frame Fastener Torque Checking	•				•	•
31-02	Fifth Wheel Inspecting	•	•	•	•	•	•
31-03	Fifth Wheel Lubricating	•	•	•	•	•	•
31-04	Holland Fifth Wheel Sliding Mechanism Inspecting				•	•	•
32-01	Suspension Inspecting	•	•	•	•	•	•
32-02	Suspension Lubricating	•	•	•	•	•	•
32-03	U-Bolt Torque Checking	•			•	•	•
33-01	Knuckle Pin Lubricating	•	•	•	•	•	•
33-02	Tie-Rod End Inspecting	•	•	•	•	•	•
33-03	Tie-Rod End Lubricating	•	•	•	•	•	•
33-04	All-Axle Alignment Checking	•				•	•
33-05	All-Wheel-Drive Front Axle Oil Level Checking	•	•	•			
33-06	All-Wheel-Drive Front Axle Oil Changing				•	•	•
35-01	Axle Lubricant Level Checking		•	•	•		
35-02	Axle Breather Checking	•	•	•	•	•	•
35-03	Axle Lubricant Changing and Magnetic Plug Cleaning	•				•	•
35-04	Two-Speed-Axle Shift Unit Oil Level Checking (for FL112s, perform at M1 interval)	•		•			
35-05	Two-Speed-Axle Shift Unit Oil Changing				•	•	•
40-01	Wheel Nut Checking				•	•	•
41-01	Driveline Inspecting	•	•	•	•	•	•
41-02	Driveline Lubricating	•	•	•	•	•	•

Table 11, Maintenance Operation Sets for Groups 31 through 41

Maintenance Operation Sets for Group 42							
REQUIRED MAINTENANCE OPERATION SET		IM	M1	M2	M3	M4	M5
Maintenance Operation Number and Operation Description							
42–01	Air Dryer Inspecting, Bendix AD–9	•	•	•	•	•	•
42–02	Air Brake Valve Inspecting and Leak Checking, Bendix BP–R1	•	•	•	•	•	•
42–03	Foot Brake Valve Actuator Lubricating, Bendix E–12	•	•	•	•	•	•
42–04	Air Brake Valve Operation Checking, Bendix BP–R1 and E–12	•	•	•	•	•	•
42–05	Relay Valve Checking, Midland	•	•	•	•	•	•
42–06	Quick Release and Flipper Valves Checking, Midland	•	•	•	•	•	•
42–07	Brake Chamber Inspecting (All Models)	•	•	•	•	•	•
42–08	Air Dryer Desiccant Replacing, Meritor WABCO System Saver 1000						•
42–09	Brake Adjusting, Manual Slack Adjusters	•	•	•	•	•	•

Maintenance Operation Sets Tables: 00–08

Maintenance Operation Sets for Group 42							
REQUIRED MAINTENANCE OPERATION SET		IM	M1	M2	M3	M4	M5
Maintenance Operation Number and Operation Description							
42–10	Camshaft Bracket Bushing Lubricating (for FL112s, perform at M1 interval)			•	•	•	•
42–11	Manual Slack Adjuster Lubricating	•	•	•	•	•	•
42–12	Automatic Slack Adjuster Checking, Meritor	•	•	•	•	•	•
42–13	Automatic Slack Adjuster Lubricating, Meritor	•	•	•	•	•	•
42–14	Automatic Slack Adjuster Inspecting, Meritor			•	•	•	•
42–15	Air Dryer Checking, Bendix AD–9				•	•	•
42–16	Air Dryer Desiccant Replacing, Bendix AD–9						•
42–17	Air Brake Valve Operation Checking, Bendix R–14 and TC–7	•	•	•	•	•	•
42–18	Air Brake Valve Leak Checking, Bendix TC–7	•	•	•	•	•	•
42–19	Air Reservoir Automatic Drain Valve Disassembly, Cleaning, Inspecting, and Lubricating, Bendix DV–2 (for FL112s, perform at M1 interval)			•	•	•	•
42–20	Air Brake Valve Disassembly, Cleaning, and Inspecting, Bendix E–12, QR–1, R–14, SR–1, ST–3, TC–7, and TP–5						•
42–21	Brake Lining Wear Checking, Hydraulic Disk Brakes	•	•	•	•	•	•
42–22	Brake Lines Checking, Hydraulic Disk Brakes	•	•	•	•	•	•
42–23	Power Booster Checking, Bendix Hydro-Max	•	•	•	•	•	•
42–24	Automatic Slack Adjuster Lubricating, Gunite	•	•	•	•	•	•
42–25	Automatic Slack Adjuster Inspecting and Adjusting, Gunite	•	•	•	•	•	•
42–26	Automatic Slack Adjuster Lubricating, Haldex	•	•	•	•	•	•

Table 12, Maintenance Operation Sets for Group 42

Maintenance Operation Sets for Groups 46 through 83							
REQUIRED MAINTENANCE OPERATION SET		IM	M1	M2	M3	M4	M5
Maintenance Operation Number and Operation Description							
46–01	Steering Driveline Lubricating (for FL112s, perform at M1 interval)			•	•	•	•
46–02	Drag Link Lubricating	•	•	•	•	•	•
46–03	Power Steering Reservoir Fluid Level Checking	•	•	•	•		
46–04	Power Steering Reservoir Fluid and Filter Changing					•	•
46–05	Steering Gear Lubricating (Ross TAS Series)	•	•	•	•	•	•
46–06	Miter Gear Lubricating (Right-Hand Drive Only)					•	
47–01	Fuel Tank Draining and Vent Checking				•	•	•
47–02	Gasoline In-Tank Fuel Filter Replacement					•	•
49–01	Exhaust System Inspecting			•	•	•	•
54–01	Electrical System Checking				•	•	•
54–02	Coolant Level Sensor Cleaning						•
72–01	Weatherstrip, Door Hinge, and Door Latch Lubricating	•	•	•	•	•	•

Maintenance Operation Sets Tables: 00–08

Maintenance Operation Sets for Groups 46 through 83							
REQUIRED MAINTENANCE OPERATION SET		IM	M1	M2	M3	M4	M5
Maintenance Operation Number and Operation Description							
83–01	Air Conditioner Checking, R–12 and R–134a Refrigerant Systems	•	•	•	•	•	•

Table 13, Maintenance Operation Sets for Groups 46 through 83

Initial Maintenance (IM) Operations Table: 00–09

IMPORTANT: After performing all operations in this table, perform all daily and weekly maintenance operations listed in the "Pretrip Inspection and Daily Maintenance" chapter of the *Business Class Trucks Driver's Manual*. Also, perform all M1 Maintenance Interval Operations at the Initial Maintenance (IM).

NOTE: Numbers in this table are maintenance operation reference numbers matching those in the text of this manual. The Initial Maintenance consists of all M1 Operations plus the other operations listed below.

Initial Maintenance (IM) Operations

Maint. Oper. No.	Initial Maintenance (IM) Operations
00–10	Perform All M1 Operations
25–02	Clutch (Pull-Type) Inspecting and Adjusting
26–02	Eaton Fuller and Meritor Transmission Oil Changing and Magnetic Plug Cleaning
26–08	Aisin Transmission Fluid and Filter Changing and Magnetic Plug Cleaning
31–01	Frame Fastener Torque Checking
32–03	U-Bolt Torque Checking
33–04	All-Axle Alignment Checking
35–03	Axle Lubricant Changing and Magnetic Plug Cleaning
35–04	Two-Speed-Axle Shift Unit Oil Level Checking

M1 Maintenance Interval Operations Table: 00–10

IMPORTANT: After performing all operations in this table, perform all daily and weekly maintenance operations listed in the "Pretrip Inspection and Daily Maintenance" chapter of the *Business Class Trucks Driver's Manual*.

NOTE: Numbers in this table are maintenance operation reference numbers matching those in the text of this manual.

M1 Maintenance Interval Operations

Maint. Oper. No.	M1 Maintenance Interval Operations
00–15	Lubrication and Fluid Level Check (all but FL112, includes the following): • Clutch Release Bearing and Cross-Shaft Lubricating • Hydraulic Fluid Level Checking • Manual Transmission Oil Level Checking • Fifth Wheel Lubricating • Suspension Lubricating • Knuckle Pin Lubricating • Tie-Rod End Lubricating • All-Wheel-Drive Front Axle Oil Level Checking • Axle Lubricant Level Checking • Driveline Lubricating • Foot Brake Valve Actuator Lubricating, Bendix E-12 • Manual Slack Adjuster Lubricating • Automatic Slack Adjuster Lubricating, Meritor • Automatic Slack Adjuster Lubricating, Gunite • Automatic Slack Adjuster Lubricating, Haldex • Drag Link Lubricating • Power Steering Reservoir Fluid Level Checking • Steering Gear Lubricating (Ross TAS Series) • Weatherstrip, Door Hinge, and Door Latch Lubricating

M1 Maintenance Interval Operations Table: 00–10

Maint. Oper. No.	M1 Maintenance Interval Operations
00–17	Lubrication and Fluid Level Check (FL112 only, includes the following): • Clutch Release Bearing and Cross-Shaft Lubricating • Manual Transmission Oil Level Checking • Fifth Wheel Lubricating • Suspension Lubricating • Knuckle Pin Lubricating • Tie-Rod End Lubricating • All-Wheel-Drive Front Axle Oil Level Checking • Axle Lubricant Level Checking • Two-Speed-Axle Shift Unit Oil Level Checking • Driveline Lubricating • Foot Brake Valve Actuator Lubricating, Bendix E-12 • Camshaft Bracket Bushing Lubricating • Manual Slack Adjuster Lubricating • Automatic Slack Adjuster Lubricating, Meritor • Air Reservoir Automatic Drain Valve Disassembly, Cleaning, Inspecting, and Lubricating, Bendix DV-2 • Automatic Slack Adjuster Lubricating, Gunite • Automatic Slack Adjuster Lubricating, Haldex • Steering Driveline Lubricating • Drag Link Lubricating • Power Steering Reservoir Fluid Level Checking • Steering Gear Lubricating (Ross TAS Series) • Weatherstrip, Door Hinge, and Door Latch Lubricating
26–06	Chrysler Transmission Fluid and Filter Changing
26–07	Chrysler Transmission Band Adjusting
31–02	Fifth Wheel Inspecting
32–01	Suspension Inspecting
33–02	Tie-Rod End Inspecting
35–02	Axle Breather Checking
41–01	Driveline Inspecting
42–01	Air Dryer Inspecting, Bendix AD–9
42–02	Air Brake Valve Inspecting and Leak Checking, Bendix BP–R1
42–04	Air Brake Valve Operation Checking, Bendix BP–R1 and E–12
42–05	Relay Valve Checking, Midland
42–06	Quick Release and Flipper Valves Checking, Midland
42–07	Brake Chamber Inspecting (All Models)

M1 Maintenance Interval Operations Table: 00–10

Maint. Oper. No.	M1 Maintenance Interval Operations
42–09	Brake Adjusting, Manual Slack Adjusters
42–12	Automatic Slack Adjuster Checking, Meritor
42–17	Air Brake Valve Operation Checking, Bendix R–14 and TC–7
42–18	Air Brake Valve Leak Checking, Bendix TC–7
42–21	Brake Lining Wear Checking, Hydraulic Disk Brakes
42–22	Brake Lines Checking, Hydraulic Disk Brakes
42–23	Power Booster Checking, Bendix Hydro-Max
42–25	Automatic Slack Adjuster Inspecting and Adjusting, Gunité
83–01	Air Conditioner Checking, R–12 and R–134a Refrigerant Systems

M2 Maintenance Interval Operations Table: 00–11

IMPORTANT: After performing all operations in this table, perform all daily and weekly maintenance operations listed in the "Pretrip Inspection and Daily Maintenance" chapter of the *Business Class Trucks Driver's Manual*. Also, perform all M1 Maintenance Interval Operations at the M2 Maintenance Interval.

NOTE: Maintenance operations appearing in italics in this table are for noise emission control components.

Numbers in this table are maintenance operation reference numbers matching those in the text of this manual. The M2 Maintenance consists of all M1 Interval Operations plus the other operations listed below.

M2 Maintenance Interval Operations

Maint. Oper. No.	M2 Maintenance Interval Operations
00–10	Perform All M1 Operations
00–16	Lubrication and Fluid Level Check (all but FL112, includes the following): • Two-Speed-Axle Shift Unit Oil Level Checking • Camshaft Bracket Bushing Lubricating • Air Reservoir Automatic Drain Valve Disassembly, Cleaning, Inspecting, and Lubricating, Bendix DV–2 • Steering Driveline Lubricating
13–01	Air Compressor Inspecting, Bendix
20–01	Radiator Cap Checking
20–03	<i>Fan Clutch Checking</i>
26–03	Allison, Eaton/Fuller, and Meritor Transmission Breather Checking
26–04	Eaton/Fuller Transmission Air Filter/Regulator Element Cleaning
42–14	Automatic Slack Adjuster Inspecting, Meritor
49–01	<i>Exhaust System Inspecting</i>

M3 Maintenance Interval Operations Table: 00–12

IMPORTANT: After performing all operations in this table, perform all daily and weekly maintenance operations listed in the "Pretrip Inspection and Daily Maintenance" chapter of the *Business Class Trucks Driver's Manual*. Also, perform all M1 and M2 Maintenance Interval Operations at the M3 Maintenance Interval.

NOTE: Numbers in this table are maintenance operation reference numbers matching those in the text of this manual. The M3 Maintenance consists of all M1 and M2 Interval Operations plus the other operations listed below.

M3 Maintenance Interval Operations

Maint. Oper. No.	M3 Maintenance Interval Operations
00–10	Perform All M1 Operations
00–11	Perform All M2 Operations
01–02	Engine Drive Belt Inspection
25–02	Clutch (Pull-Type) Inspecting and Adjusting
26–05	Allison Transmission Fluid and Filter Changing
26–08	Aisin Transmission Fluid and Filter Changing and Magnetic Plug Cleaning
31–04	Holland Fifth Wheel Sliding Mechanism Inspecting
32–03	U-Bolt Torque Checking
33–06	All-Wheel-Drive Front Axle Oil Changing
35–05	Two-Speed-Axle Shift Unit Oil Changing
40–01	Wheel Nut Checking
42–15	Air Dryer Checking, Bendix AD–9
47–01	Fuel Tank Draining and Vent Checking
54–01	Electrical System Checking

M4 Maintenance Interval Operations Table: 00–13

IMPORTANT: After performing all operations in this table, perform all daily and weekly maintenance operations listed in the "Pretrip Inspection and Daily Maintenance" chapter of the *Business Class Trucks Driver's Manual*. Also, perform all M1, M2, and M3 Maintenance Interval Operations at the M4 Maintenance Interval.

NOTE: Maintenance operations appearing in italics in this table are for noise emission control components. Numbers in this table are maintenance operation reference numbers matching those in the text of this manual. The M4 Maintenance consists of all M1, M2, and M3 Interval Operations plus the other operations listed below.

M4 Maintenance Interval Operations

Maint. Oper. No.	M4 Maintenance Interval Operations
00–10	Perform All M1 Operations
00–11	Perform All M2 Operations
00–12	Perform All M3 Operations
01–01	Engine-Support Fasteners Checking
09–01	Air Cleaner Element Inspecting and Replacing
15–01	Alternator, Battery, and Starter Checking
20–02	Radiator Pressure Flushing and Coolant Changing
26–02	Eaton Fuller and Meritor Transmission Oil Changing and Magnetic Plug Cleaning
31–01	Frame Fastener Torque Checking
33–04	All-Axle Alignment Checking
35–03	Axle Lubricant Changing and Magnetic Plug Cleaning
46–04	Power Steering Reservoir Fluid and Filter Changing
46–06	Miter Gear Lubricating (Right-Hand Drive Only)
47–02	Gasoline In-Tank Fuel Filter Replacement

M5 Maintenance Interval Operations Table: 00–14

IMPORTANT: After performing all operations in this table, perform all daily and weekly maintenance operations listed in the "Pretrip Inspection and Daily Maintenance" chapter of the *Business Class Trucks Driver's Manual*. Also, perform all M1, M2, M3, and M4 Maintenance Interval Operations at the M5 Maintenance Interval.

NOTE: Numbers in this table are maintenance operation reference numbers matching those in the text of this manual. The M5 Maintenance consists of all M1, M2, M3, and M4 Interval Operations plus the other operations listed below.

M5 Maintenance Interval Operations

Maint. Oper. No.	M5 Maintenance Interval Operations
00–10	Perform All M1 Operations
00–11	Perform All M2 Operations
00–12	Perform All M3 Operations
00–13	Perform All M4 Operations
13–02	Air Compressor Rebuilding/Replacing, Bendix
25–04	Hydraulic Fluid Replacing
26–09	Mercedes-Benz Transmission Leak Checking
26–10	Mercedes-Benz Transmission Fluid Changing and Magnetic Plug Cleaning
42–08	Air Dryer Desiccant Replacing, Meritor WABCO System Saver 1000
42–16	Air Dryer Desiccant Replacing, Bendix AD–9
42–20	Air Brake Valve Disassembly, Cleaning, and Inspecting, Bendix E–12, QR–1, R–14, SR–1, ST–3, TC–7, and TP–5
54–02	Coolant Level Sensor Cleaning

Lubrication and Fluid Level Check (M1, all models but FL112): 00–15

Maintenance Operation 00–15 (**Table 14**), summarizes all Lubrication and Fluid Level Check operations that must be performed at the **M1** Maintenance Interval for Schedules I, II, and III for all models but FL112.

Maintenance operation numbers given in the table are reference numbers used to help you find detailed

instructions in the manual on the lubrication or fluid check. Maintenance Operation **00–18** can be used as a guide by those who do not need to consult the detailed lubrication and fluid check instructions given elsewhere in the manual.

Maintenance Operation 00–15 M1 Lubrication and Fluid Level Check for All Models but FL112	
Maint. Oper. No.	Operation Description
25–01	Clutch Release Bearing and Cross-Shaft Lubricating
25–03	Hydraulic Fluid Level Checking
26–01	Manual Transmission Oil Level Checking
31–03	Fifth Wheel Lubricating
32–02	Suspension Lubricating
33–01	Knuckle Pin Lubricating
33–03	Tie-Rod End Lubricating
33–05	All-Wheel-Drive Front Axle Oil Level Checking
35–01	Axle Lubricant Level Checking
41–02	Driveline Lubricating
42–03	Foot Brake Valve Actuator Lubricating, Bendix E–12
42–11	Manual Slack Adjuster Lubricating
42–13	Automatic Slack Adjuster Lubricating, Meritor
42–24	Automatic Slack Adjuster Lubricating, Gunite
42–26	Automatic Slack Adjuster Lubricating, Haldex
46–02	Drag Link Lubricating
46–03	Power Steering Reservoir Fluid Level Checking
46–05	Steering Gear Lubricating (Ross TAS Series)
72–01	Weatherstrip, Door Hinge, and Door Latch Lubricating

Table 14, Maintenance Operation 00-15, M1 Lubrication and Fluid Level Check for All Models but FL112

Lubrication and Fluid Level Check (M2, all models but FL112): 00–16

Maintenance Operation 00–16 (**Table 15**), summarizes all Lubrication and Fluid Level Check operations that must be performed at the **M2** Maintenance Interval for Schedules I, II, and III for all models but FL112.

Maintenance operation numbers given in the table are reference numbers used to help you find detailed

instructions in the manual on the lubrication or fluid check. Maintenance Operation **00–18** can be used as a guide by those who do not need to consult the detailed lubrication and fluid check instructions given elsewhere in the manual.

Maintenance Operation 00–16 M2 Lubrication and Fluid Level Check for All Models but FL112	
Maint. Oper. No.	Operation Description
35–04	Two-Speed-Axle Shift Unit Oil Level Checking
42–10	Camshaft Bracket Bushing Lubricating
42–19	Air Reservoir Automatic Drain Valve Disassembly, Cleaning, Inspecting, and Lubricating, Bendix DV–2
46–01	Steering Driveline Lubricating

**Table 15, Maintenance Operation 00-16, M2 Lubrication and Fluid Level Check for
All Models but FL112**

Lubrication and Fluid Level Check (M1, FL112 models only): 00–17

Maintenance Operation 00–17 (**Table 16**), summarizes all Lubrication and Fluid Level Check operations that must be performed at the M1 Maintenance Interval for Schedules I, II, and III for FL112 models only.

Maintenance operation numbers given in the table are reference numbers used to help you find detailed

instructions in the manual on the lubrication or fluid check. Maintenance Operation **00–18** can be used as a guide by those who do not need to consult the detailed lubrication and fluid check instructions given elsewhere in the manual.

Maintenance Operation 00–17 M1 Lubrication and Fluid Level Check for FL112 Models Only	
Maint. Oper. No.	Operation Description
25–01	Clutch Release Bearing and Cross-Shaft Lubricating
26–01	Manual Transmission Oil Level Checking
31–03	Fifth Wheel Lubricating
32–02	Suspension Lubricating
33–01	Knuckle Pin Lubricating
33–03	Tie-Rod End Lubricating
33–05	All-Wheel-Drive Front Axle Oil Level Checking
35–01	Axle Lubricant Level Checking
35–04	Two-Speed-Axle Shift Unit Oil Level Checking
41–02	Driveline Lubricating
42–03	Foot Brake Valve Actuator Lubricating, Bendix E–12
42–10	Camshaft Bracket Bushing Lubricating
42–11	Manual Slack Adjuster Lubricating
42–13	Automatic Slack Adjuster Lubricating, Meritor
42–19	Air Reservoir Automatic Drain Valve Disassembly, Cleaning, Inspecting, and Lubricating, Bendix DV–2
42–24	Automatic Slack Adjuster Lubricating, Gunite
42–26	Automatic Slack Adjuster Lubricating, Haldex
46–01	Steering Driveline Lubricating
46–02	Drag Link Lubricating
46–03	Power Steering Reservoir Fluid Level Checking
46–05	Steering Gear Lubricating (Ross TAS Series)
72–01	Weatherstrip, Door Hinge, and Door Latch Lubricating

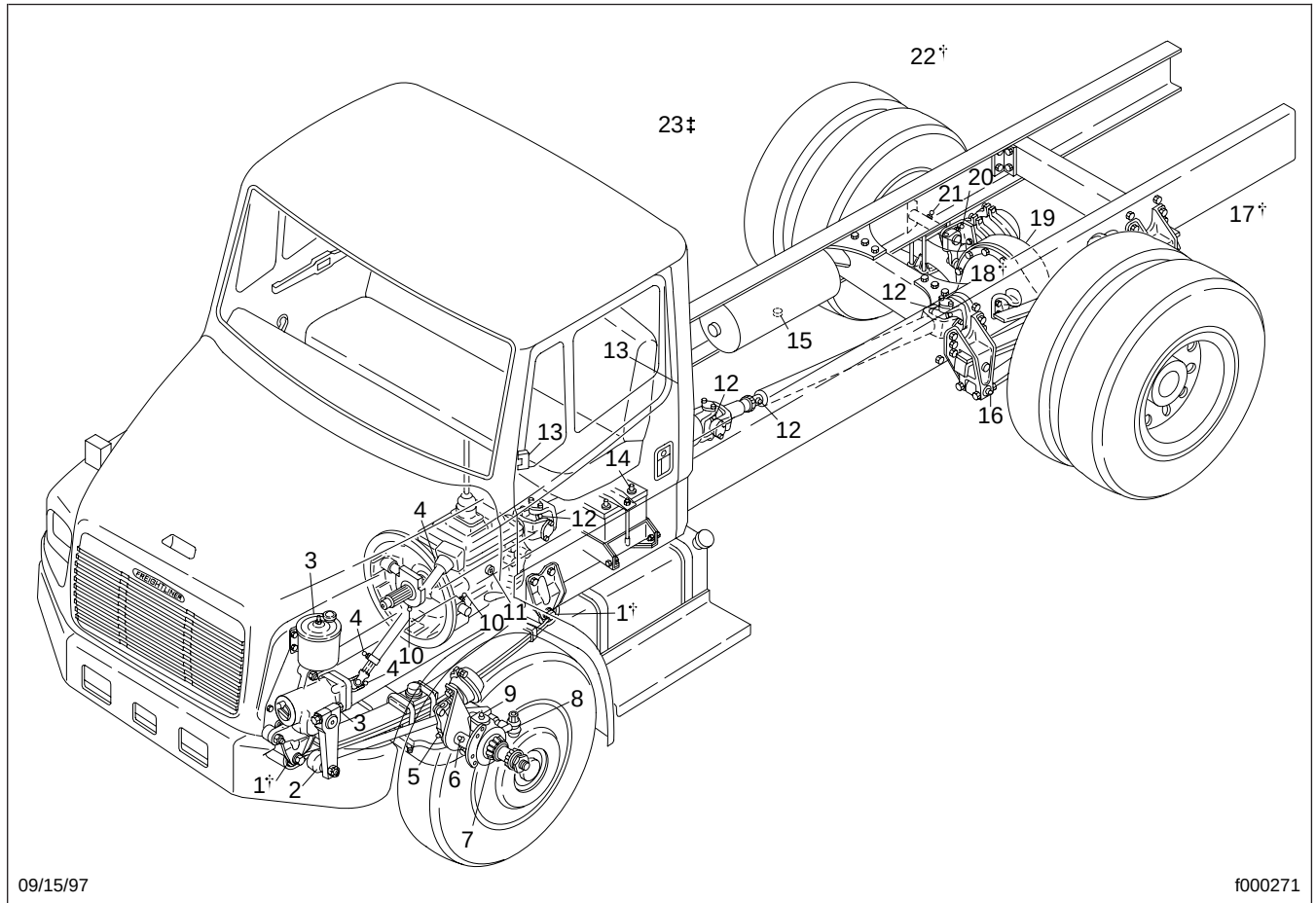
Table 16, Maintenance Operation 00-17, M1 Lubrication and Fluid Level Check for FL112 Models Only

General Information

00

Lubrication Tables: 00–18

See **Fig. 1** for lubrication points (not on FL112).



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Fig. 1, Lubrication Points (all models but FL112)

No.	MOP No.	Component	Remarks *
1	32-02	Front Suspension Spring Pins and Shackle Pins †	Lube both sides of vehicle; one grease fitting for each spring pin; two grease fittings for each shackle.
2	46-02	Drag Link	Two grease fittings; one on each end.
3	46-03, 46-04, 46-05	Power Steering	Check fluid level in reservoir (46-03); change fluid and filter (46-04), when required. Lubricate steering gear (46-05).
4	46-01, 46-06	Steering Driveline	Lubricate grease fittings at slip-joint splines and both universal joints. Lubricate miter gear (if applicable).
5	42-11, 42-13, 42-24, 42-26	Slack Adjusters, Front Axle	Lubricate both sides of axle; one grease fitting for each slack adjuster.
6	42-10	Camshaft Brackets, Front Axle	Lubricate both sides of axle; one grease fitting for each camshaft bracket.
7	33-05, 33-06	Oil-Lubricated All-Wheel-Drive Front Axle	Check oil level; add oil if low (33-05). Change oil (33-06) when required.

Lubrication Tables: 00–18

No.	MOP No.	Component	Remarks *
8	33–03	Tie Rod	Two grease fittings; one on each end of tie rod.
9	33–01	Knuckle Pins	Two grease fittings; one on top, one on bottom of knuckle pin. Lubricate both sides of axle.
10	25–01	Clutch Release Bearing and Release Cross-Shaft	One grease fitting on bottom of release bearing. Two grease fittings on release cross-shaft.
11	26–01 , 26–02 , 26–05 , 26–06 , 26–08 , 26–10	Transmission	Check fluid level; add fluid, if low (26–01). Change fluid (26–02, 26–05, 26–06, 26–08, or 26–10), when required.
12	41–02	Driveline U-Joints and Slip-Joints	One grease fitting for each U-joint, and one for each slip-joint.
13	72–01	Door Hinges, Latches, and Weatherstrips	Lubricate all door hinges, latches, and weatherstrips on the cab.
14	15–01	Batteries	Clean and lubricate if corrosion is present.
15	42–19	Air Reservoir Automatic Drain Valves	Disassemble, clean, inspect, and lubricate automatic drain valves.
16	32–02	Suspension Spring Pin	Lubricate on both sides of vehicle; one grease fitting for each spring pin.
17	32–02	Equalizer †	One grease fitting on each equalizer; lubricate both sides of vehicle.
18	35–04 , 35–05	Two-Speed-Axle Shift Unit †	Check oil level; add oil if low (35–04). Change oil (35–05) when required.
19	35–01 , 35–03	Rear Axle	Check fluid level; add fluid, if low (35–01). Change fluid, when required (35–03).
20	42–11 , 42–13 , 42–24 , 42–26	Slack Adjusters, Rear Axle	Lubricate slack adjusters on both sides of each rear axle, one grease fitting for each slack adjuster.
21	42–10	Camshaft Brackets, Rear Axle	Lubricate camshafts on both sides of each rear axle; one grease fitting for each camshaft bracket.
22	31–03	Fifth Wheel †	Inspect the fifth wheel, then lubricate top plate and all moving parts.
23	42–03	Air Valves ‡	Disassemble, clean, and lubricate all air valves.

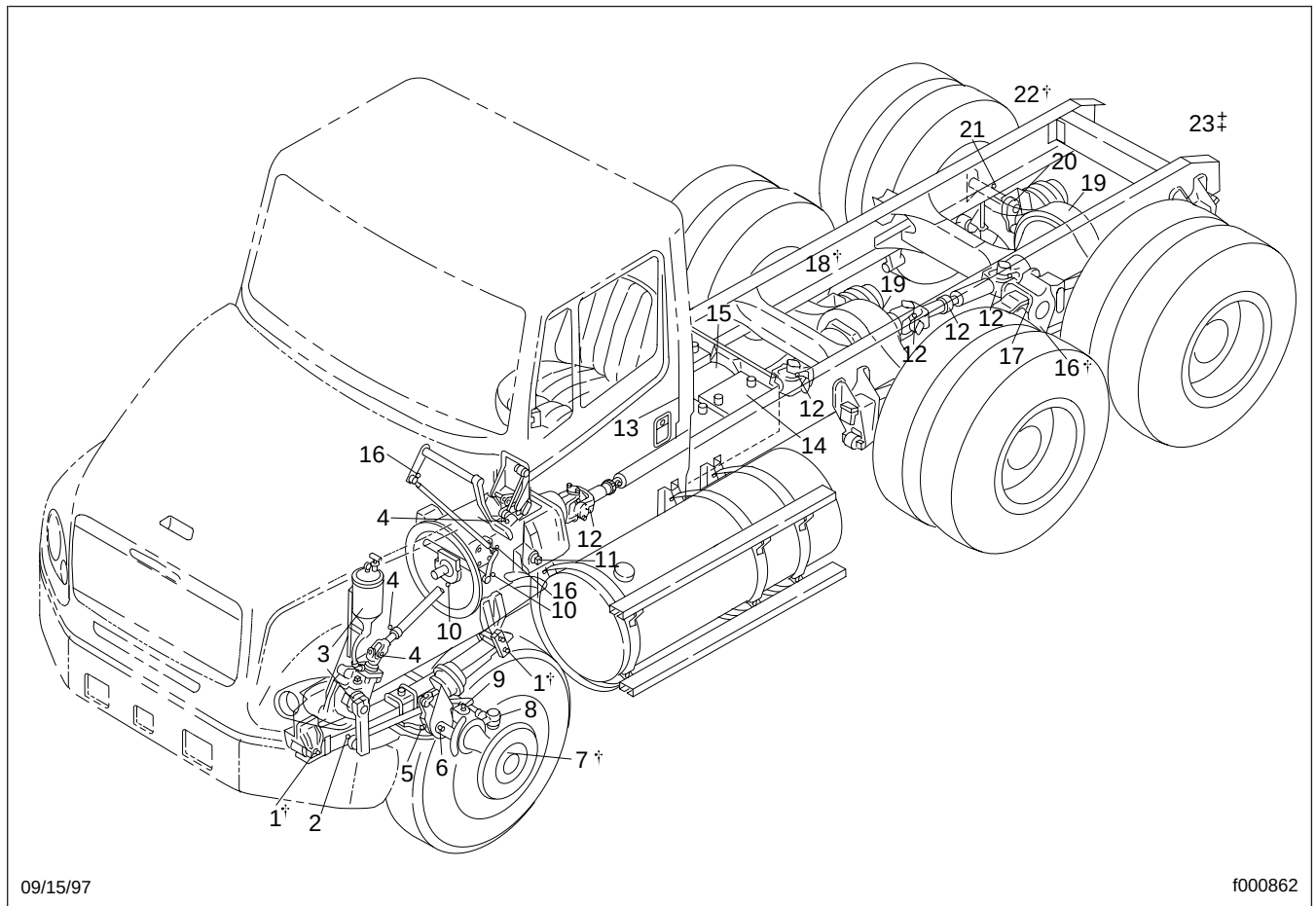
* Intervals and procedures are included in the "Maintenance Operations Tables" and the specific groups.

† Not shown in illustration.

‡ Air valves are located throughout the vehicle; inside the cab and on the chassis.

Table 17, Lubrication Table for All Models but FL112

See [Fig. 2](#) for lubrication points (FL112 models only).



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Fig. 2, Lubrication Points (FL112 models only)

No.	MOP No.	Components	Remarks *
1	32-02	Front Suspension Spring Pins and Shackle Pins †	Lube both sides of vehicle; one grease fitting for each spring pin; two grease fittings for each shackle.
2	46-02	Drag Link	Two grease fittings; one on each end.
3	46-03 , 46-04 , 46-05	Power Steering	Check fluid level in reservoir (46-03); change fluid and filter (46-04), when required. Lubricate steering gear (46-05).
4	46-01 , 46-06	Steering Driveline	Lubricate grease fittings at slip-joint splines and both universal joints. Lubricate miter gear (if applicable).
5	42-11 , 42-13 , 42-24 , 42-26	Slack Adjusters, Front Axle	Lubricate both sides of axle; one grease fitting for each slack adjuster.
6	42-10	Camshaft Brackets, Front Axle	Lubricate both sides of axle; one grease fitting for each camshaft bracket.
7	33-05 , 33-06	Oil-Lubricated All-Wheel-Drive Front Axle †	Check oil level; add oil if low (33-05). Change oil (33-06) when required.
8	33-03	Tie Rod	Two grease fittings; one on each end of tie rod.

Lubrication Tables: 00–18

No.	MOP No.	Components	Remarks *
9	33–01	Knuckle Pins	Two grease fittings; one on top, one on bottom of knuckle pin. Lubricate both sides of axle.
10	25–01	Clutch Release Bearing and Release Cross-Shaft	One grease fitting on bottom of release bearing. Two grease fittings on release cross-shaft.
11	26–01 , 26–02 , 26–05 , 26–06	Transmission	Check fluid level; add fluid, if low (26–01). Change fluid (26–02, 26–05, or 26–06), when required.
12	41–02	Driveline U-Joints and Slip-Joints	One grease fitting for each U-joint. One grease fitting for each slip-joint.
13	72–01	Door Hinges, Latches, and Weatherstrips	Lubricate all door hinges, latches, and weatherstrips on cab.
14	15–01	Batteries	Clean and lubricate if corrosion is present.
15	42–19	Air Reservoir Automatic Drain Valves	Disassemble, clean, inspect, and lubricate the automatic drain valves.
16	32–02	Suspension Spring Pin †	Lubricate on both sides of vehicle; one grease fitting for each spring pin.
17	32–02	Equalizer (Freightliner)	One grease fitting on each equalizer; lubricate on both sides of the vehicle.
18	35–04 , 35–05	Two-Speed-Axle Shift Unit †	Check oil level; add oil if low (35–04). Change oil (35–05) when required.
19	35–01 , 35–03	Rear Axle	Check fluid level; add fluid, if low (35–01). Change fluid, when required (35–03).
20	42–11 , 42–13 , 42–24 , 42–26	Slack Adjusters, Rear Axle	Lubricate slack adjusters on both sides of each rear axle, one grease fitting for each slack adjuster.
21	42–10	Camshaft Brackets, Rear Axle	Lubricate camshafts on both sides of each rear axle; one grease fitting for each camshaft bracket.
22	31–03	Fifth Wheel †	Inspect the fifth wheel, then lubricate the top plate and all moving parts.
23	42–03	Air Valves ‡	Disassemble, clean, and lubricate all air valves.

* Intervals and procedures are included in the "Maintenance Operations Tables" and the specific groups.

† Not shown in illustration.

‡ Air valves are located throughout the vehicle; inside the cab and on the chassis.

Table 18, Lubrication Table for FL112 Models Only

Title of Maintenance Operation (MOP)	MOP Number
Engine Drive Belt Inspection.	01-02
Engine-Support Fasteners Checking.	01-01

01-01 Engine-Support Fasteners Checking

Check the rear engine-support fasteners (**Fig. 1**, Ref. 4) for tightness. Tighten the 3/4-inch fasteners 215 to 265 lbf·ft (292 to 359 N·m).

Check the front engine-support fasteners for tightness. Tighten the 5/8-inch fasteners 125 lbf·ft (170 N·m).

NOTE: At engine overhaul, and whenever the engine has been removed, inspect the lower and upper isolators (Refs. 1 and 6), and replace them if they are worn. See **Group 01** of the *Business Class® Trucks Service Manual* for procedures.

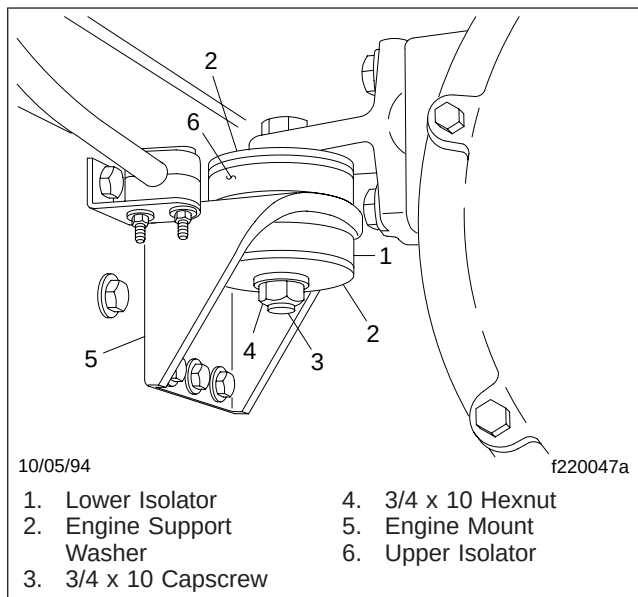


Fig. 1, Engine Rear Mount

01-02 Engine Drive Belt Inspection

Worn or loose drive belts may cause premature bearing failure or engine overheating. Excessive tension, or too little tension on the belt may result in excessive and premature belt wear. Poly-V belts, or serpentine belts, are retained by a belt tensioner that requires no tension adjustment. Replace the engine drive belt if any conditions described in the visual description are found. V-belts are installed as indi-

vidual belts, and as matched sets. When replacing a matched set of belts, always replace both belts at the same time. Matched belts must be from the same manufacturer. To inspect a belt, gently twist the belt to view the belt sidewalls and bottom. Visually inspect all drive belts for the following conditions, then perform the belt tension inspection.

Visual Inspection

1. Inspect the belt for glazing. See **Fig. 2**, Ref. A. Glazing is represented by shiny sidewalls, and is caused by friction created when a loose belt slips in the pulleys. It can also be caused by oil or grease contamination on the pulleys.
2. Check the belt for ply separation. See **Fig. 2**, Ref. B. Oil, grease, or belt dressing can cause the belt to fall apart in layers. Repair any oil or coolant leaks that are affecting the belts before replacing the drive belts. Do not use belt dressing on any belt.
3. Check the belt for a jagged or streaked sidewall. See **Fig. 2**, Ref. C. Jagged or streaked sidewalls are the result of foreign objects, such as sand or gravel in the pulley, or a rough pulley surface.
4. Check for tensile breaks (breaks in the cord body). See **Fig. 2**, Ref. D. Cuts in a belt are usually caused by foreign objects in the pulley, or by prying or forcing the belt during removal or installation.
5. Check for uneven ribs on serpentine (poly-V) belts. See **Fig. 2**, Ref. E. Foreign objects in the pulley will erode the undercord ribs, causing the belt to lose its gripping power.
6. Check the drive belts for cracks. See **Fig. 2**, Ref. F. Small irregular cracks are usually the signs of an old belt.
7. Visually inspect the pulleys for excessive play or wobble. Excessive play or wobble indicates a failure of the pulley bearing. Check for belt squealing or squeaking. Replace the bearings as necessary.

NOTE: If it is difficult to distinguish the location of a supposed bearing noise, obtain a stethoscope and place it on the component being checked, not the pulley, to isolate the area from outside interference.

8. Inspect all pulleys for foreign objects, oil, or grease in the grooves.

Belt Tension Inspection

NOTE: If engine drive belts require adjustment, see **Group 01** of the *Business Class® Trucks Service Manual*.

Threaded-Adjustment Type

1. Apply the parking brakes, and chock the tires to prevent the vehicle from moving.
2. Install a belt tension gauge at the center of the belt's longest free-span. Check belt tension. See [Table 1](#) for belt tension specifications.
3. If belt tension is not correct, see **Group 01** of the *Business Class® Trucks Service Manual* to adjust belt tension.

Spring-Tension Type

On belts equipped with a spring tensioner, the belt tension is automatically adjusted. Check that the tensioner is holding tension on the belt by inserting the

end of a breaker bar in the 1/2-inch square hole on the forward face of the tensioner, and rotating the tensioner down, away from the belt. When the breaker bar is slowly released, the tensioner should return to its original position. If not, see **Group 01** of the *Business Class® Trucks Service Manual* for replacement instructions.

NOTE: The following engines are provided with automatic drive belt tensioners: Caterpillar CFE, Detroit Diesel Series 55, and Dodge Magnum. The following engines, which appear in [Table 1](#), are provided with automatic tensioners for the fan and alternator belts (and refrigerant compressor for Caterpillar C10/C12): Caterpillar C10 and C12 and Cummins B and C Series.

Drive Belt Tensions		
Engine	Component	Belt Tension lbf (kg)
Cummins B and C Series	Refrigerant Compressor	100 (45)
Cummins M11	Alternator	105 (48)
	Fan	160 (73)
	Refrigerant Compressor	90 (41)
Detroit Diesel Series 50	Fan and Alternator	70 (32)
	Refrigerant Compressor	95 (43)
Mercedes-Benz OM366LA	Fan and Alternator	160 (73)
	Refrigerant Compressor	100 (45) or 140 (64) *
	Air Compressor	50 (23)

* For a regular V-belt, tighten the belt to 100 lb (45 kg). For a Powerband® V-belt, tighten the belt to 140 lb (64 kg).

Table 1, Drive Belt Tensions

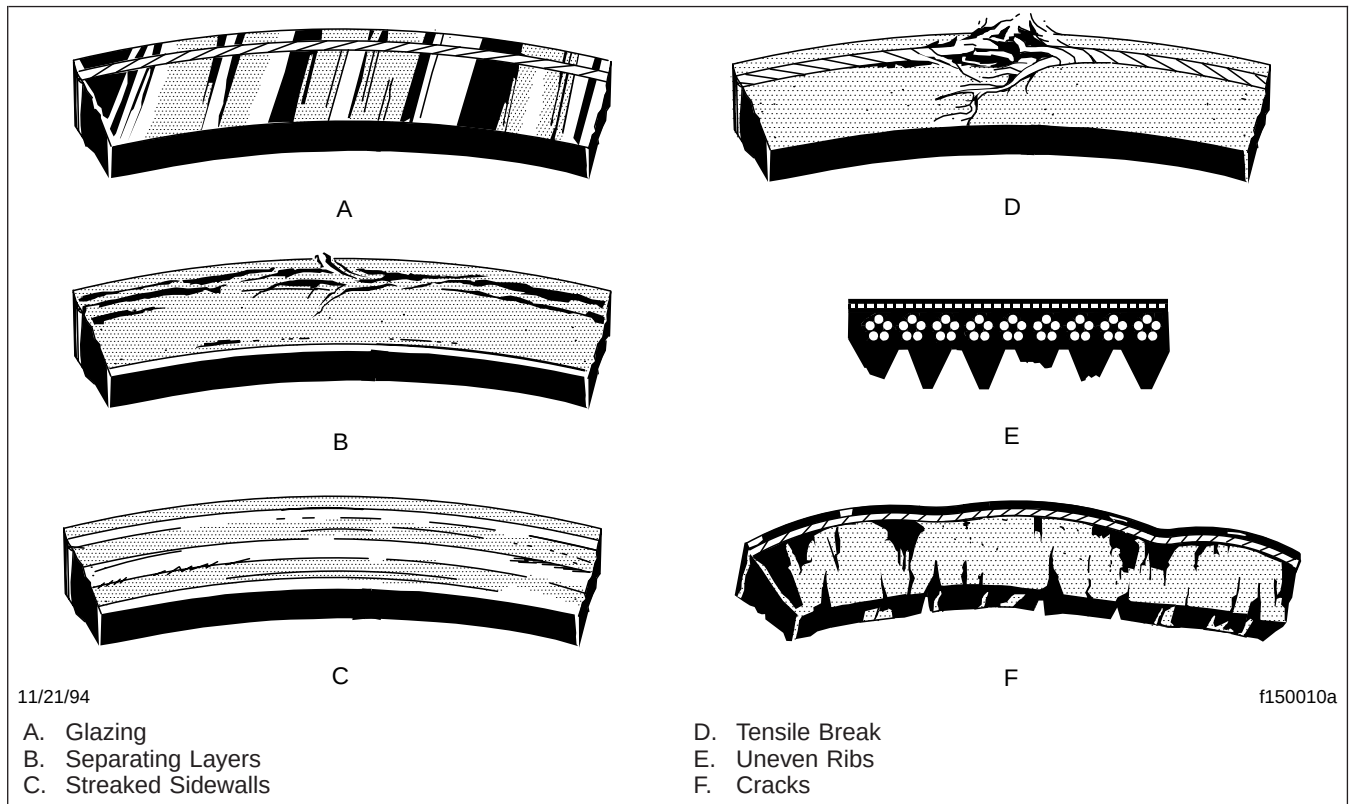


Fig. 2, Drive Belt Replacement Conditions

Title of Maintenance Operation (MOP)	MOP Number
Air Cleaner Element Inspecting and Replacing	09-01

09-01 Air Cleaner Element Inspecting and Replacing

Method 1

Replace the air cleaner element at the recommended interval or when the air restriction indicator reaches 22 inH₂O on a vehicle with an MBE engine, or 25 inH₂O on a vehicle with a Detroit Diesel, Caterpillar, or Cummins engine, if equipped with an air restriction indicator. For replacement instructions, see **Group 09** of the *Business Class Trucks Service Manual*. Reset the air restriction indicator.

If the maximum restriction is not reached, record the air restriction value. If the value is higher than the previous recording, reset the air restriction indicator. If the value is lower than the previous recording, inspect the air cleaner and air cleaner element of cracks, leaks, or any other damage.

If the air cleaner or air cleaner element is damaged, replace it and reset the air restriction indicator.

Method 2

Replace the air cleaner element at the recommended interval or when the air restriction indicator reaches 22 inH₂O on a vehicle with an MBE engine, or 25 inH₂O on a vehicle with a Detroit Diesel, Caterpillar, or Cummins engine, if equipped with an air restriction indicator. For replacement instructions, see **Group 09** of the *Business Class Trucks Service Manual*. Reset the air restriction indicator.

If the maximum restriction is not reached, inspect the air cleaner and air cleaner element for cracks, leaks, or any other damage. If the air cleaner or air cleaner element is damaged, replace it and reset the air restriction indicator.

Air Compressor

13

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Air Compressor Inspecting, Bendix	13-01
Air Compressor Rebuilding/ Replacing, Bendix	13-02

13-01 Air Compressor Inspecting, Bendix

Inspect the air intake line, oil supply and return lines, and coolant supply and return hoses for tight connections and general condition. Tighten the connections, and replace the lines and hoses, as needed. If the compressor air-intake adapter is loose, remove the adapter, replace its gaskets, and securely install it.

Check the cooling fins on the compressor crankcase. Clean the fins if they are clogged with debris.

13-02 Air Compressor Rebuilding/ Replacing, Bendix

Disassemble, clean, and inspect the air compressor. Replace all seals, gaskets, springs, and all parts that are worn or damaged beyond re-use. Replace the air compressor unloader mechanism components. Use only genuine Bendix replacement parts or kits. Test the operation of the unloader mechanism. See **Group 13** of the *Business Class® Trucks Service Manual* for rebuild (or replacement) instructions and test operations.

NOTE: Bendix factory-rebuilt air compressors are available from authorized Bendix distributors, and carry a new compressor warranty.

Alternator and Starter

15

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Alternator, Battery, and Starter Checking	15-01

15-01 Alternator, Battery, and Starter Checking



WARNING

Batteries release a gas mixture that is explosive. Do not smoke when working around batteries. Put out all flames, and remove any source of sparks or intense heat. Make sure the battery compartment has been completely vented before disconnecting or connecting battery cables.

Battery acid is extremely harmful if splashed in eyes or on skin. Always wear a face shield and protective clothing when working around batteries.

1. Check the tightness of the alternator bracket fasteners; tighten the fasteners as needed. For torque values, see **Group 15** of the *Business Class® Trucks Service Manual*.
2. Check the belt tension of the alternator drive belt. Use a tension gauge at the belt's widest span, and adjust the belt tension if needed. See **Group 01** in this manual for belt tension specifications. Some Caterpillar engines are equipped with dual alternator belts. Always check both belts for correct tension. Engines equipped with a serpentine, or poly-V belt have automatic belt tensioners and do not require belt tension inspection.
3. Check that all electrical connections at the alternator and starter are clean. Clean and tighten all charging system electrical connections as needed.
4. On the bundled cable running from the batteries to the starter, ensure that tie-straps are installed at least every 12 inches (300 mm). Replace any missing tie-straps and add tie-straps where spacing between straps exceeds 12 inches (300 mm).
5. Ensure that all cables have sufficient slack to allow for engine movement and that there is no pressure on any wiring connectors.
6. Check all wiring inside of damaged convoluted tubing and replace any damaged or missing convoluted tubing.
7. Inspect the battery cables for wear, and replace as needed. Clean the cable connector terminals

with a wire brush. See **Group 54** of the *Business Class® Trucks Service Manual* for troubleshooting instructions, and for adjustment, repair, or replacement instructions.

- 7.1 Clean and tighten the battery ground cable, terminal, and clamps.
- 7.2 Inspect the retainer assembly (or battery hold-downs) and the battery box. Replace worn or damaged parts. Remove any corrosion with a wire brush, and wash with a weak solution of baking soda and water. Rinse with clean water, and dry. Paint the retainer assembly, if needed, to prevent rusting.
- 7.3 Check that foreign objects, such as stones, bolts, and nuts are removed from the battery box.
- 7.4 After cleaning, connect the cables to the batteries, and tighten them to the torque specifications listed on the battery, generally 10 to 15 lbf·ft (14 to 20 N·m).
- 7.5 Spray each connection with dielectric red enamel and coat the battery terminals with dielectric grease; see **Table 1**.

Protectant Material	Approved Brand
Dielectric Grease	Lubriplate FLP DS-ES
Dielectric Red Enamel Spray	3M 1602 IVI-Spray Sealer
	Spray-On B-6-665

Table 1, Approved Dielectric Protectants

8. Check the alternator wiring for missing insulation, kinks, and heat damage. Replace or repair as needed.
9. Check the terminals on the battery shut-off switch and the magnetic switch. Make sure the terminal connections are clean and tight. Coat the terminal connections with dielectric red enamel after cleaning; see **Table 1**.

Engine Cooling/Radiator

20

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Fan Clutch Checking (Noise Emission Control)	20-03
Radiator Cap Checking.	20-01
Radiator Pressure Flushing and Coolant Changing	20-02

20-01 Radiator Cap Checking

WARNING

Do not remove or loosen the radiator cap until the engine and cooling system have completely cooled. Use extreme care when removing the cap. A sudden release of pressure from removing the cap prior to the system cooling can result in a surge of scalding coolant that could cause serious personal injury.

CAUTION

The radiator cap currently installed may not be the same one installed when the vehicle was built. If the radiator cap must be replaced, make sure that it is the correct cap for the cooling system of the vehicle. Because the radiator cap pressure rating affects the operating temperature of the engine, installing an improperly rated radiator cap may have adverse effects on the cooling system, and engine operating temperatures. This could cause premature engine wear or damage.

1. Using a radiator-cap tester, check the pressure cap to see if it maintains pressure to within 10% of the pressure rating marked on the cap. If it doesn't, replace the cap. Make sure that the replacement radiator cap is correctly rated for the cooling system of the vehicle.
2. There is a second valve in the radiator cap that opens under vacuum. This prevents the collapse of hoses and other parts that are not internally supported when the system cools. Inspect the vacuum-relief valve to be sure it is not stuck.
3. Make sure that the cap seals properly on the coolant filler neck seat, and that the radiator cap gasket is not damaged. On vehicles with screw on caps with O-rings, make sure that the O-ring is not cracked or deteriorated. Replace the cap if the gasket shows deterioration or damage.

20-02 Radiator Pressure Flushing and Coolant Changing

NOTE: For additional instructions on cleaning and flushing the cooling system, see the engine manufacturer's maintenance and operation manual.

1. Drain the radiator.
 - 1.1 Remove the surge tank cap. See [Fig. 1](#).

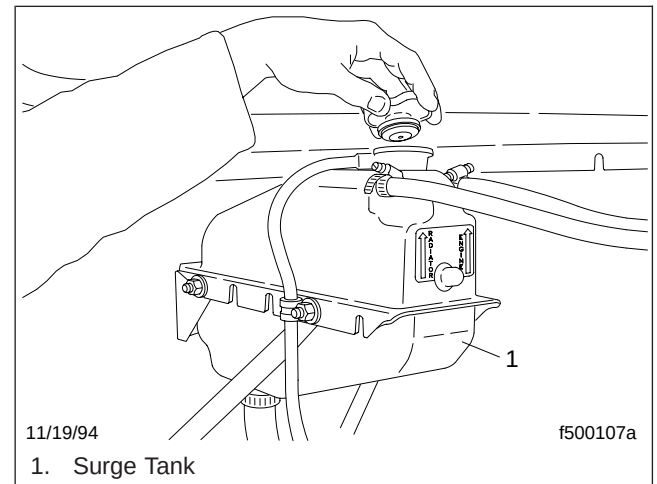


Fig. 1, Surge Tank and Cap

- 1.2 Open the petcock at the bottom of the radiator to drain the engine coolant. See [Fig. 2](#).
2. Disconnect the radiator inlet and outlet hose connections.
3. Flush the radiator.
 - 3.1 Attach a flushing gun nozzle to the radiator outlet.
 - 3.2 Run water in until the radiator is full.
 - 3.3 Apply no more than 20 psi (138 kPa) air pressure intermittently to help dislodge sediment buildup in the core.

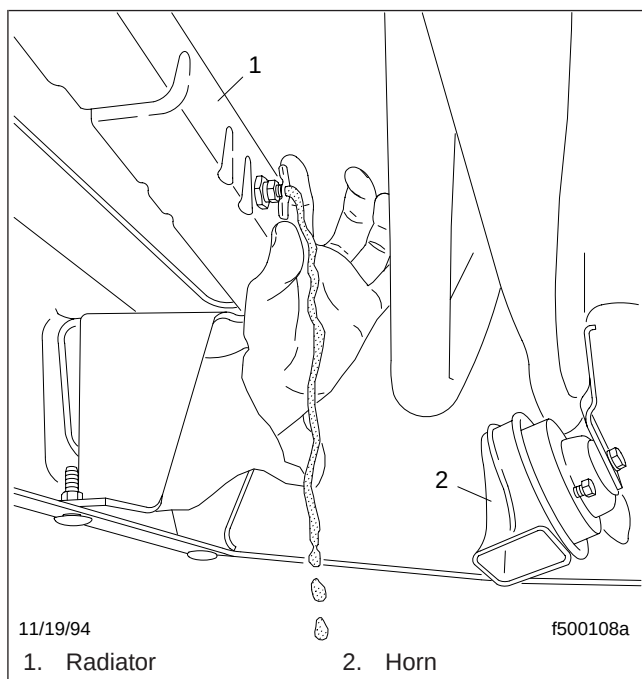


Fig. 2, Draining The Engine Coolant

**CAUTION**

When flushing the radiator, do not apply more than 20 psi (138 kPa) air pressure. Excessive pressure can damage the radiator or heater core.

4. Drain the radiator, and flush the radiator until clean water flows from the radiator. Remove the flushing gun.
5. Close the petcock at the bottom of the radiator.
6. Connect the hoses. Your hose clamps can be either T-bolt clamps (Fig. 3) or Breeze Constant-Torque clamps (Fig. 4).

When working with T-bolt type hose clamps, tighten the clamps 55 lbf·in (620 N·cm). These clamps are now standard on hoses with an inside diameter greater than 2 inches (51 mm).

When installing the Breeze Constant-Torque hose clamps, the clamps must be tightened to the correct torque. The screw tip of the clamp must extend about 1/4 inch (6 mm) from the clamp housing, and the belleville washer stacks must be collapsed almost flat. Use a torque wrench to install these hose clamps correctly.

The correct installation torque for Breeze Constant-Torque hose clamps is as follows:

For Breeze Constant-Torque hose clamps with a 5/16-inch tightening screw hex: 55 lbf·in (620 N·cm).

For Breeze Constant-Torque hose clamps with a 3/8-inch tightening screw hex: 90 lbf·in (1020 N·cm).

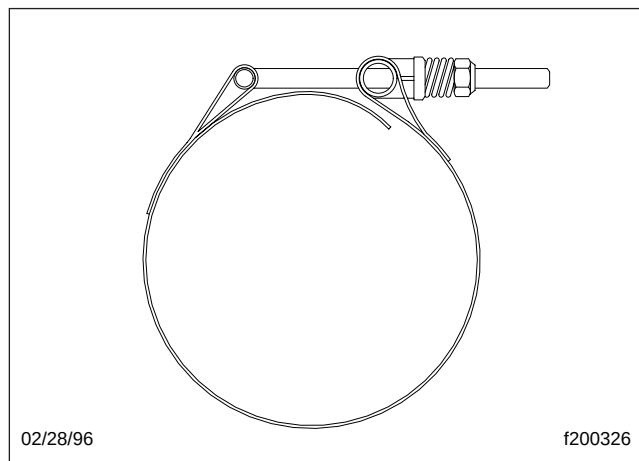


Fig. 3, T-Bolt Type Hose Clamp

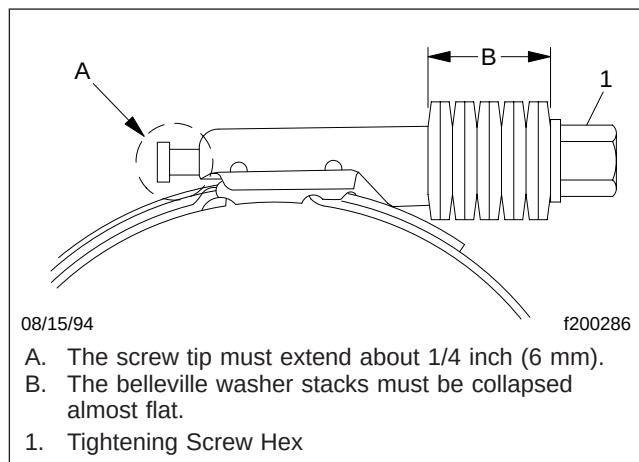


Fig. 4, Breeze Constant-Torque Hose Clamp Installation

NOTE: All hose clamps will lose torque after installation due to "compression set." However, when correctly installed, Breeze Constant-Torque clamps will hold enough torque to automatically adjust and keep consistent sealing pressure. During vehicle operation and shut-

Engine Cooling/Radiator

20

down, the screw tip may adjust according to temperature and pressure changes. The torque may need to be adjusted for individual applications.

7. Fill the radiator with coolant.

For Mercedes-Benz OM 366LA engines, maintain a minimum of 50 percent by volume of a corrosion-inhibiting antifreeze. Do not use more than 55 percent by volume of corrosion-inhibiting antifreeze, and do not add any other substances to the coolant.

For all other engines, use a mixture of 50 percent water and 50 percent corrosion-inhibiting antifreeze to protect the engine to -34°F (-37°C) year round.

See [Table 1](#) and [Table 2](#) for engine cooling system capacities.

See [Table 3](#) for approved antifreezes.

Coolant Capacities (all but FL112)		
Engine Make and Model	Radiator Core and System Capacity *	
	2 Row quarts (liters)	3 Row quarts (liters)
Caterpillar CFE Series	28 (26.5)	—
Cummins B Series	30.5 (28.9)	31.0 (29.3)
Cummins C Series and M11	31.2 (29.5)	—
Detroit Diesel Series 50	31.4 (29.7)	—
Dodge Magnum V-8	28 (26.5)	—
Dodge Magnum V-10	36 (34)	—
Mercedes-Benz OM 366LA	29.5 (27.9)	30.0 (28.4)

* System capacity includes all hoses, fittings, and the heater core.

Table 1, Coolant Capacities (all but FL112)

Coolant Capacities (FL112 only)		
Engine Make and Model	Radiator Core and System Capacity *	
	1000 Sq. In. quarts (liters)	1200 Sq. In. quarts (liters)
Caterpillar C10 Series	30.8 (29.1)	33.7 (31.9)
Caterpillar C12 Series	30.8 (29.1)	33.7 (31.9)
Cummins M11	30.0 (28.4)	32.9 (31.1)
Detroit Diesel Series 55	35.1 (33.2)	38.0 (36.0)

* System capacity includes all hoses, fittings, and the heater core.

Table 2, Coolant Capacities (FL112 only)

Approved Coolants		
Engine Type	Coolant Manufacturer	Coolant Designation *
Diesel	Texaco	JC04 Antifreeze
	Van Waters and Rogers Ltd. (Canada)	Diesel Antifreeze No. 6038
Gasoline †	Chrysler	Mopar

* Freightliner-approved antifreeze must meet one of the following conditions: A. Ethylene glycol solution that meets GM 6038-M Engineering Standards. B. Ethylene glycol solution that has less than 0.1% anhydrous sodium metasilicate, and meets either GM 1825-M or GM 1899-M Engineering Standards.

† Because Dodge Magnum Engines use aluminum parts, the coolant used with these engines must contain Alugard 340-2™.

Table 3, Approved Coolants

NOTE: You can mix purple-pink coolant (pre-charged with a borate/nitrate-based additive) with the common green coolant, although some color change will be apparent.

20-03 Fan Clutch Checking (Noise Emission Control)

Eaton Viscous Fan Clutch



CAUTION

If the fan drive assembly is damaged, replace the unit as soon as possible. Operating a seized or otherwise damaged clutch reduces fuel economy, and could cause serious engine damage.

See **Group 20** of the *Business Class® Trucks Service Manual* for replacement instructions.

1. With the engine off, rotate the fan at least one full turn by hand. It should have a smooth, steady drag. If it does not, replace the fan clutch.
2. Check for physical damage to the fan or fan shroud.
3. At the fan clutch mounting:
 - 3.1 Check for correct drive belt alignment and tension. For specifications, see **Group 01** of the *Business Class® Trucks Service Manual*.
 - 3.2 Check for wear of the fan clutch bearings. There should be no side-to-side or in-and-out movement of the fan clutch.
 - 3.3 Do all of the checks in **Section 20.02** of the *Business Class® Trucks Service Manual*.

Horton Advantage® Fan Clutch

NOTE: If any part of the fan clutch needs to be repaired or replaced, after performing the checks below, see **Group 20** of the *Business Class® Trucks Service Manual*.

1. Disconnect the electrical cables from the battery. Drain all air from the air system. If equipped with an air starter, drain the air starter reservoir.



WARNING

If the engine starts during this procedure, the fan could cause personal injury. If the vehicle is

equipped with an air starter, be sure that the air starter reservoir is drained.

2. Inspect the electrical connections and wires to the fan clutch solenoid. Secure the connection if loose; replace wires and connectors if damaged.
3. Clean the fan clutch air solenoid valve filter, if equipped.
 - 3.1 Unscrew the fan clutch solenoid valve air filter assembly and remove the filter element.
 - 3.2 Clean the filter element with cleaning solvent.
 - 3.3 Reassemble the clutch valve solenoid air filter assembly and install on the vehicle.
4. Visually check the fan for bent, cracked, or damaged blades. Replace if damaged. Check for adequate clearance between the fan and other components.
5. Check the fan belt for wear, tension, and alignment. Correct if necessary.
6. Check for wear on the friction facing. See **Fig. 5**. Replace the friction facing if it is worn to a 1/16-inch (1.6-mm) thickness or less. Also check the facing for signs of oil contamination or burn marks. If evidence of oil or burn marks are found, replace the friction facing.

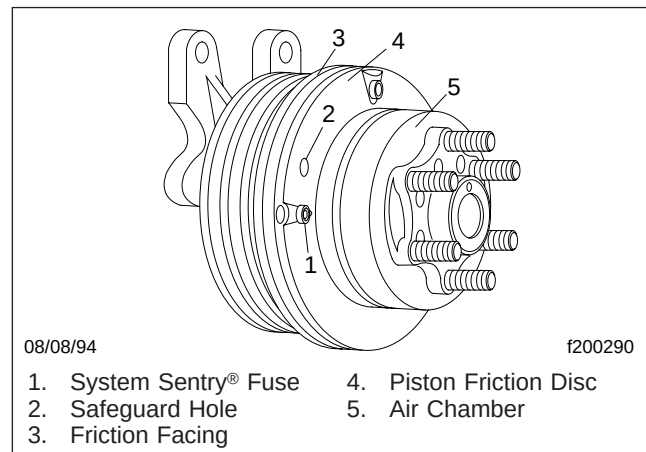


Fig. 5, Horton Advantage Fan Clutch

7. Connect the battery cables. Start the engine, and charge the air system to 120 psi (827 kPa). Shut

down the engine. Separate the halves of the fan solenoid connector. The fan clutch should engage.

If the fan does not operate correctly, see **Group 20** of the *Business Class® Trucks Service Manual* for troubleshooting and repair procedures.

8. With the air system charged to 120 psi (827 kPa), and with the fan solenoid connector halves separated, check the fan clutch for audible air leaks, using a suitable listening device.
9. If a leak is detected, remove the fan blade. Using a soapy water solution, check the fan clutch at the following locations to locate the source of the leak. Install a new seal kit. See **Group 20** of the *Business Class® Trucks Service Manual* for repair procedures.
 - 9.1 Check for a leak at the bleed hole on the fan pilot. Air leakage means that the cartridge assembly (**Fig. 6**, Ref. 16) or face seal (Ref. 17) is damaged.
 - 9.2 Check for air leaks between the air chamber and the piston friction disc. Air leakage means that the large O-ring (Ref. 14) is damaged.
 - 9.3 Check for air leaks around the safeguard hole on the piston friction disc. Air leakage means the small O-ring (Ref. 18) is damaged.
 - 9.4 Check for air leaking from the System Sentry® fuse. Leaking air means the clutch has gotten so hot the lead alloy in the fuse melted. This released the clutch before the heat could damage the clutch bearings. Before replacing the fuse, find and repair the source of the heat.
10. If equipped with an override toggle switch on the dash, check the fan clutch operation as follows:
 - 10.1 Connect the halves of the fan solenoid connector.
 - 10.2 Turn the air conditioner off.
 - 10.3 Start the engine and charge the air system to 120 psi (827 kPa). Tests must be performed with the engine temperature below 205°F (96°C) for Caterpillar en-

gines, and below 200°F (93°C) for Cummins and Detroit Diesel engines.

- 10.4 Set the toggle switch to the ON position; the fan clutch should engage.
- 10.5 Apply the foot brake, and release the parking brakes.
- 10.6 Set the toggle switch to the AUTO or OFF position; the air should exhaust and the fan clutch should disengage. Replace the switch if necessary.
11. If the fan stays engaged at all times on a Detroit Diesel engine, check the circuit breaker labeled "engine fan."

Kysor K22RA Fan Clutch

1. Disconnect the electrical cables from the battery. Drain all air from the air system. If equipped with an air starter, drain the air starter reservoir.

WARNING

If the engine starts during this procedure, the fan could cause personal injury. If the vehicle is equipped with an air starter, be sure that the air starter reservoir is drained.

2. Measure the distance from the back surface of the fan clutch retaining plate to the forward-most edge of the fan belt pulley. See **Fig. 7**, Ref. A.
3. Disconnect the line from the air inlet of the air cylinder. Connect a shop air hose to the inlet.
4. Apply a minimum of 100 psi (690 kPa) air pressure to the air cylinder—the bearing housing will move backwards, disengaging the clutch. Again, measure the distance from the back surface of the retaining plate to the forward-most edge of the fan belt pulley.
5. Compare the two measurements; if the difference between the two measurements exceeds 0.150 inches (3.8 mm), the clutch lining is worn and must be replaced. See **Group 20** of the *Business Class® Trucks Service Manual* for clutch lining replacement instructions.
6. Release the air pressure, then disconnect the shop hose from the air inlet of the air cylinder. Connect the vehicle air hose to the inlet.
7. Connect the electrical cables to the battery.

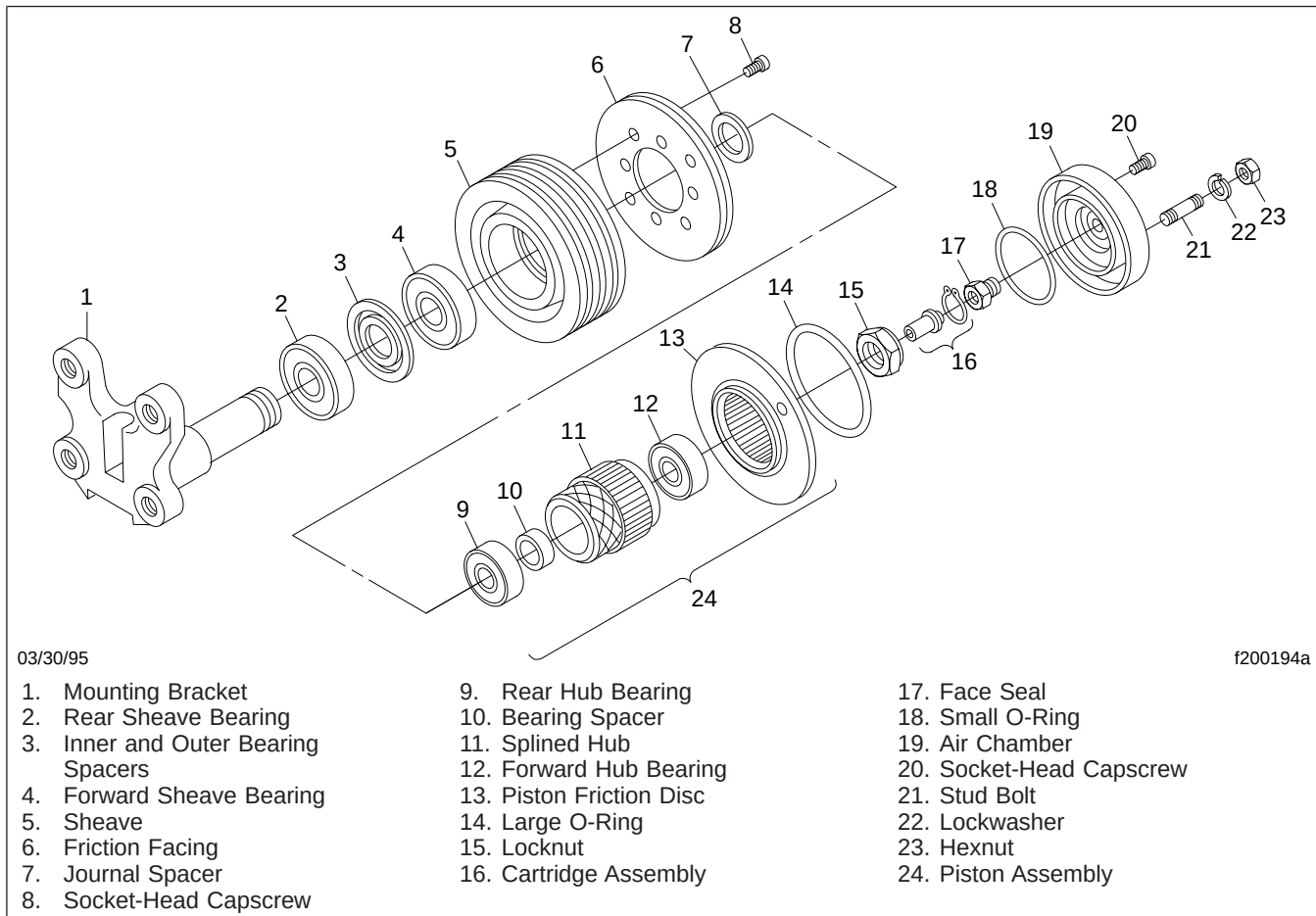


Fig. 6, Horton Advantage Fan Clutch Components

8. Start the engine.

Horton DriveMaster® Fan Clutch

NOTE: If any part of the fan clutch needs to be repaired or replaced after performing the checks below, see **Group 20** of the *Business Class® Trucks Service Manual*.

1. Disconnect the batteries at the negative terminals. Drain all air from the air system. If equipped with an air starter, drain the air starter reservoir.

WARNING

Make sure the batteries are disconnected, and if applicable, the air starter reservoir is drained before checking the fan clutch. If the engine starts during this procedure, the fan could engage, which could result in serious personal injury.

fore checking the fan clutch. If the engine starts during this procedure, the fan could engage, which could result in serious personal injury.

2. Inspect the electrical connections and wires to the fan clutch solenoid. Secure the connection if loose; replace wires and connectors if damaged.
3. Clean the fan clutch air solenoid valve filter, if equipped.
 - 3.1 Unscrew the fan clutch solenoid valve air filter assembly and remove the filter element.
 - 3.2 Clean the filter element with cleaning solvent.
 - 3.3 Using a clean, lint free cloth, wipe off any excess solvent.

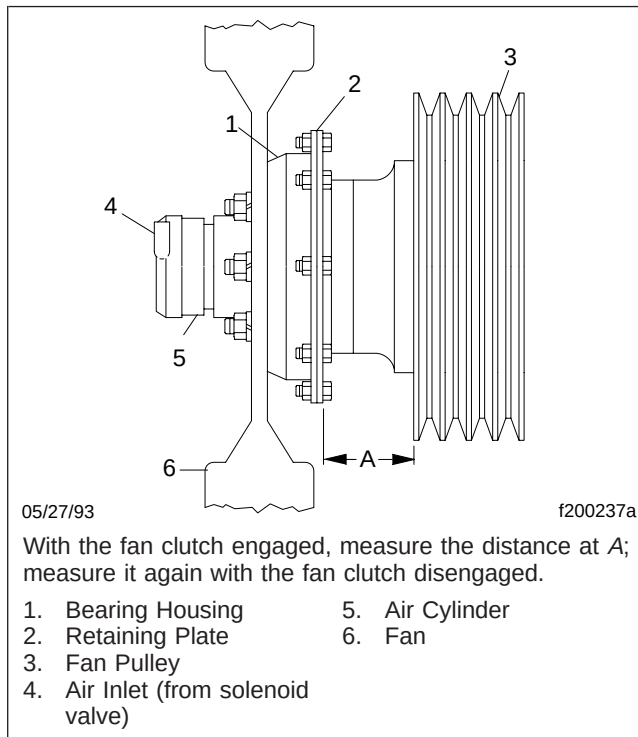


Fig. 7, Kysor K22RA Fan Clutch Lining Wear Checking

- 3.4 Reassemble the clutch valve solenoid air filter assembly and install on the vehicle.
4. Visually check the fan for bent, cracked, or damaged blades. Replace if damaged. Check for adequate clearance between the fan and other components.
5. Check the fan belt for wear, tension, and alignment. Correct, if necessary.
6. Check for wear on the friction facing. Replace the friction facing if it is worn to a 3/16-inch (4.8-mm) thickness or less. Also check the facing for signs of oil contamination or burn marks. If evidence of oil or burn marks are found, replace the friction facing.
7. Connect the battery cables. Start the engine, and charge the air system to 120 psi (827 kPa). Manually engage and disengage the fan clutch.
Check the fan and the fan clutch from a distance. Look for vibration, fan blade contact, fan clutch slippage, and overall fan clutch operation.

If the fan clutch does not operate correctly, see **Group 20** of the *Business Class® Trucks Service Manual* for troubleshooting and repair procedures.

8. With the air system charged to 120 psi (827 kPa), check the fan clutch for audible air leaks, using a suitable listening device.

Check at the solenoid valve, the air filter assembly, and the air hoses and fittings. See **Fig. 8**. Using a wet finger or a soapy water solution, check for a leak in the same areas.

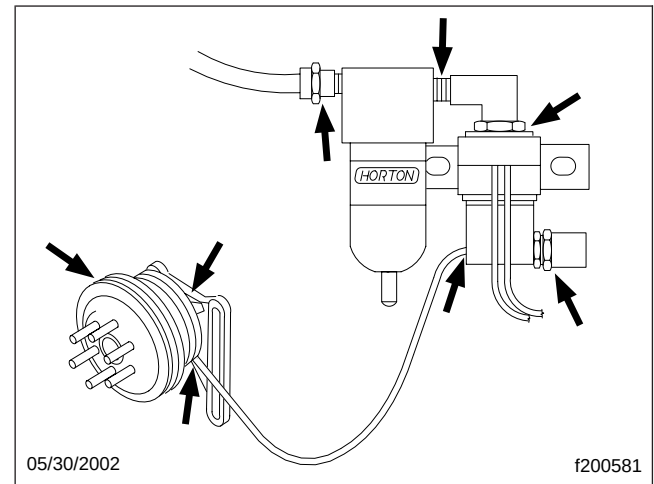


Fig. 8, Checking for Air Leaks (Horton DriveMaster)

9. If a leak is detected, remove the fan blade. Install a new seal kit. See **Group 20** of the *Business Class® Trucks Service Manual* for repair procedures.
10. Check the fan drive for discoloration or any other signs of slipping or overheating.

NOTE: The fan clutch may slip if the air supply pressure is below 70 psi (483 kPa) or if there is a leak inside the fan clutch. Any leak must be remedied.

11. Check the fan clutch bearings.
 - 11.1 Turn the fan in both directions and feel for worn hub bearings.
 - 11.2 If possible, remove the drive belt and check for worn sheave bearings by turning the sheave in both directions.

- 11.3 If either the hub or sheave bearings are worn, replace them, using a Horton Drive-Master Super Kit.

For instructions and kit part number, see **Group 20** of the *Business Class® Trucks Service Manual*.

Title of Maintenance Operation (MOP)	MOP Number
Clutch (Pull-Type) Inspecting and Adjusting	25-02
Clutch Release Bearing and Release Cross-Shaft Lubricating	25-01
Hydraulic Fluid Level Checking	25-03
Hydraulic Fluid Replacing	25-04

25-01 Clutch Release Bearing and Release Cross-Shaft Lubricating

Clutch Release Bearing

CAUTION

Do not over-lubricate the release bearing. Over-lubricating could contaminate the clutch internally, causing clutch slippage and eventual clutch failure.

On clutches with a grease-type release bearing (Fig. 1), wipe the dirt from the grease fitting. Using a pressure gun and high-temperature grease only, lubricate the release bearing at the grease fitting until the grease starts coming out of the fitting. Use only a lithium-based grease that meets NLGI grade 1 or 2 specifications.

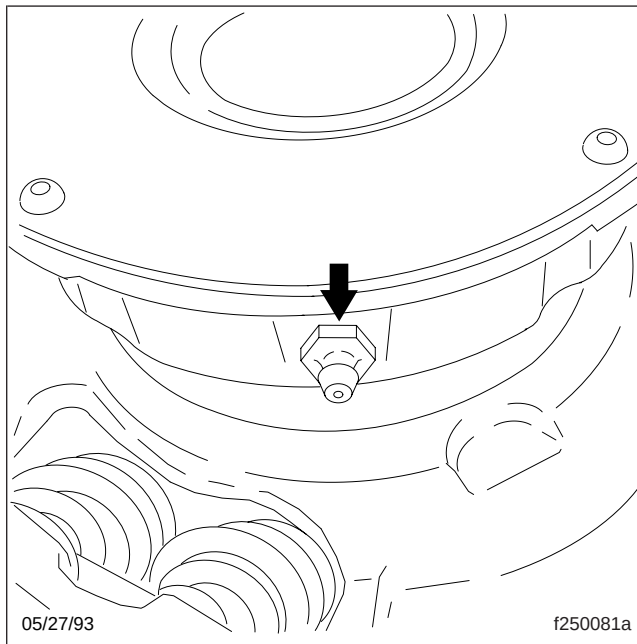


Fig. 1, Release Bearing Grease Fitting

NOTE: On clutches with a sealed release bearing, the release bearing is lubricated at the time of manufacture and requires no additional

grease for the life of the bearing. This type of release bearing is not equipped with a grease fitting.

On Sachs hydraulic clutches, never lubricate the release bearing. The release bearing is made of plastic with a kind of embedded grease.

Clutch Release Cross-Shaft

The clutch release cross-shaft is equipped with two grease fittings; one at each side of the transmission clutch housing. Wipe the dirt from the grease fittings. Using a pressure gun, lubricate the cross-shaft with multipurpose chassis grease.

25-02 Clutch (Pull-Type) Inspecting and Adjusting

See **Group 25** of the *Business Class® Trucks Service Manual* for clutch (pull-type) inspecting and adjusting.

25-03 Hydraulic Fluid Level Checking

WARNING

Use only approved DOT 3 brake fluid in the clutch hydraulic system. Do not mix different types of brake fluid. The wrong fluid will damage the rubber parts of the system, causing loss of clutch function and the risk of serious personal injury.

CAUTION

Do not allow the fluid level in the reservoir to go below the MIN mark. If too much air enters, it will not be possible to bleed the system properly, and the clutch could be damaged.

If the fluid level is below the MIN mark, fill the reservoir with DOT 3 brake fluid until the level reaches the MAX mark. See Fig. 2.

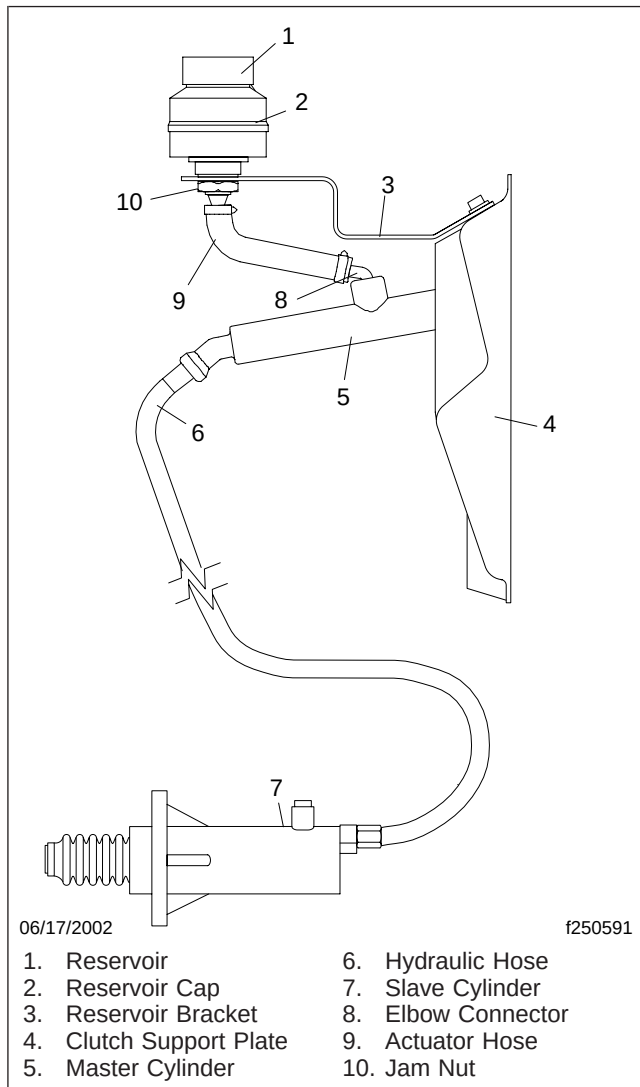


Fig. 2, Clutch Components

25-04 Hydraulic Fluid Replacing

Replace the clutch hydraulic fluid every two years to ensure clutch function is reliable and correct. Use the procedures below. Fluid replacement must be done at an authorized Freightliner service facility.

Draining and Filling

1. Shut down the engine.

2. Apply the parking brakes, chock the front and rear tires, and open the hood.

WARNING

Clutch hydraulic fluid (DOT 3 brake fluid) is hazardous. It may be a skin irritant and can cause blindness if it gets in your eyes. Always wear safety glasses when handling clutch hydraulic fluid or bleeding hydraulic lines. If you get clutch hydraulic fluid on your skin, wash it off as soon as possible.

3. Using a flat-head screwdriver, remove the quick-disconnect clamp that attaches the hydraulic hose to the slave cylinder. Retain the clamp for later installation. See Fig. 3.

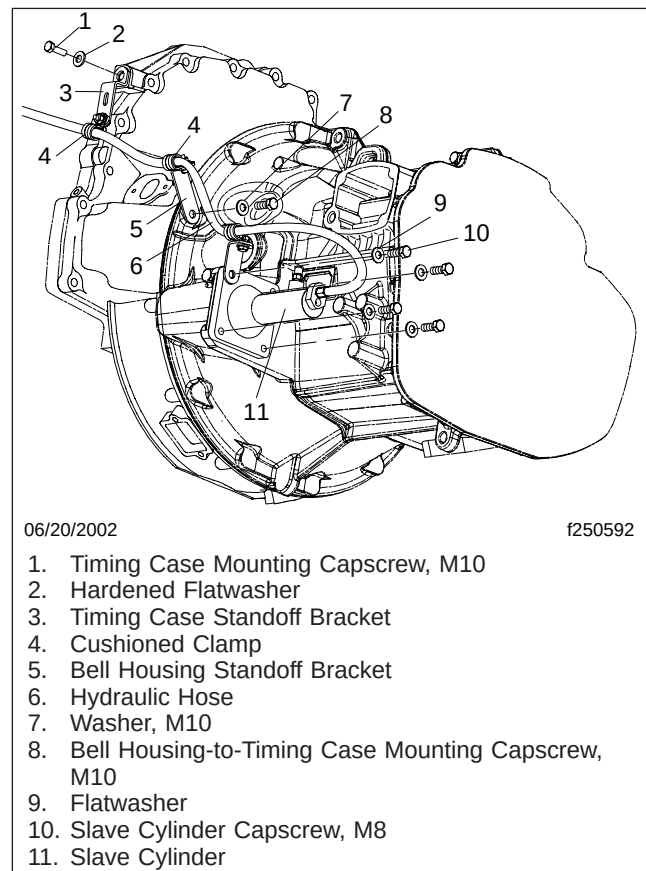


Fig. 3, Clutch Slave Cylinder

- 3.1 Using a drain pan or other suitable container, collect the fluid that drains from the pedal unit, not more than 0.3 quarts (0.3 liters).
- 3.2 Allow the open end of the drain hose to remain over the drain pan.
- 3.3 Press down on the pedal several times, until no more fluid drains from the reservoir in the pedal unit.
- 3.4 Cover the hose to avoid contamination of the clutch hydraulic fluid.
4. Connect the hydraulic hose to the slave cylinder. Install the clamp, as removed.
5. Fill the reservoir with approved DOT 3 brake fluid and bleed the system according to the procedures under the heading "Bleeding the Clutch." See [Fig. 4](#).
6. Press the clutch pedal all the way down and keep it down.
7. Open the slave cylinder bleed valve. Observe the flow of clutch hydraulic fluid through the drain hose. When no bubbles appear in the fluid, close the valve on the slave cylinder. Release the clutch pedal and then close the valve at the bleeder unit.
8. Disconnect the bleeder unit, and install the cap on the slave cylinder bleeder valve.
9. Check the fluid level in the reservoir. If necessary, add or remove clutch hydraulic fluid to bring the fluid level to the MAX line. Install the reservoir cap.
10. Depress the clutch pedal a few times. There should be resistance over the full pedal stroke.
11. Check the entire system for leaks. Tighten connections if necessary. Check the fluid level in the reservoir again.
12. Remove the chocks from the tires.

Bleeding the Clutch

1. Apply the parking brake and chock the tires.
2. Prepare the pressure bleeding equipment according to the manufacturer's instructions. Use DOT 3 brake fluid. Pressurize the bleeder unit to 15 psi (103 kPa).



CAUTION

Do not spill clutch hydraulic fluid (DOT 3 brake fluid) on the cab paint. Clean it off immediately if any is spilled. DOT 3 brake fluid can damage paint.

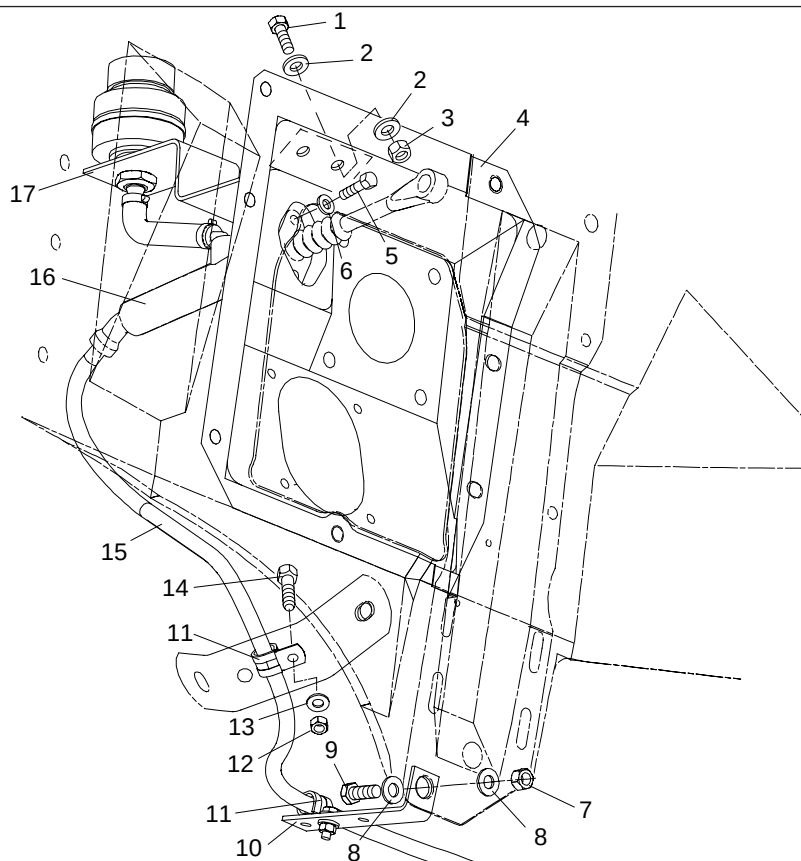
3. Remove the reservoir lid and install the pressure bleed adaptor on the reservoir.
4. Remove the cap from the bleed valve. Install a transparent drain hose on the bleed valve of the slave cylinder.

IMPORTANT: The slave cylinder may not be mounted in a horizontal position. If it isn't, remove the slave cylinder and hold it in a horizontal position to completely purge all air from the cylinder.

5. Pressurize the reservoir, filling the system. Open the bleed valve on the bleed tank.

NOTE: A pressure bleeder hose (J-29532) and a bleeder adaptor (J-35798) for the fluid reser-

voir are available through SPX Kent-Moore Tools and may be used to complete the following procedure. To order these parts, call Kent-Moore at 1-800-328-6657.



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- | | |
|---|---------------------------------|
| 1. Reservoir Bracket Mounting Bolt, 5/16-24 | 10. Frontwall Standoff Bracket |
| 2. Steel-Plated Washer, 5/16 | 11. Cushioned Clamp |
| 3. Locknut, 5/16-24 | 12. Locknut, 1/4-20 |
| 4. Clutch Support Plate | 13. Steel-Plated Washer, 1/4 |
| 5. Master Cylinder Capscrew, M6 | 14. Clamp Mounting Bolt, 1/4-20 |
| 6. Hardened Flatwasher, M6 | 15. Hydraulic Hose |
| 7. Locknut, 1/2-13 | 16. Master Cylinder |
| 8. Hardened Flatwasher, 0.53 | 17. Reservoir Bracket |
| 9. Frontwall Bracket Mounting Bolt, 1/2-13 | |

Fig. 4, Clutch Master Cylinder

Title of Maintenance Operation (MOP)	MOP Number
Aisin Transmission Fluid and Filter Changing and Magnetic Plug Cleaning	26-08
Allison Transmission Fluid and Filter Changing	26-05
Allison, Eaton Fuller, and Meritor Transmission Breather Checking.	26-03
Chrysler Transmission Band Adjusting.	26-07
Chrysler Transmission Fluid and Filter Changing.	26-06
Eaton Fuller Transmission Air Filter/Regulator Element Cleaning	26-04
Eaton Fuller and Meritor Transmission Fluid Changing and Magnetic Plug Cleaning	26-02
Manual Transmission Fluid Level Checking.	26-01
Mercedes-Benz (MBT) Transmission Leak Checking	26-09
Mercedes-Benz Transmission Fluid Changing and Magnetic Plug Cleaning.	26-10

26-01 Manual Transmission Fluid Level Checking

1. Park the vehicle on a level surface. Apply the parking brakes and chock the rear tires.
2. With the transmission at operating temperature (Eaton Fuller transmissions) or at room temperature (Meritor transmissions), check the oil level in the transmission.
 - 2.1 Clean the area around the fill plug, then remove the plug from the side of the case.
 - 2.2 Using your finger or a bent pipe cleaner, see if the oil is level with the lower edge of the fill opening. See [Fig. 1](#).
3. If needed, fill the transmission with oil until level with the lower edge of the fill opening.

See [Table 1](#) for approved lubricants.

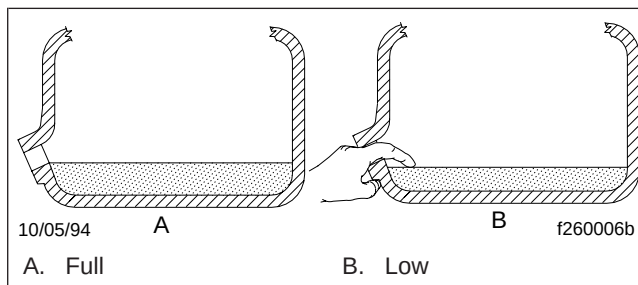


Fig. 1, Transmission Fluid Level Checking



CAUTION

Operating a manual transmission with the oil level higher or lower than recommended can result in transmission damage. Do not overfill the transmission; overfilling will force oil out of the case through the main shaft openings. Oil overflow may also drain onto the clutch or clutch brake, causing additional problems.

IMPORTANT: Do not mix types of oil, because of possible incompatibility. Do not use oil additives or friction modifiers. Do not use multi-viscosity oils or EP (Extreme Pressure) gear oils. If switching from a petroleum based lubricant to a synthetic, all areas of each affected

component must be thoroughly drained. Switching to a synthetic lubricant, when a petroleum-based lubricant has been used for 50,000 miles (80 000 km) or longer, may affect transmission performance. Monitor all seal areas for the first 10,000 miles (16 000 km) after changing to a synthetic from a petroleum-based lubricant.

4. Clean the fill plug, then install it in the gear case. Tighten the plug as follows:

Approved Manual Transmission Lubricants		
Lubricant Type *	Temperature in °F (°C)	SAE Viscosity
<i>Eaton Fuller Transmissions</i> †		
MobilTrans SHC 50 (RN 2952 E-5)	All	50
Synthetic transmission lubricant approved by Eaton	All	50
Heavy-duty engine oil (API service classification SF or CD)	Above 10 (–12)	40 or 50
	Below 10 (–12)	30
<i>Meritor Transmissions</i>		
Heavy-duty engine oil (API service classification CD, CE, SF, or SG)	Above 10 (–12)	40 or 50
	Above –15 (–26)	30
Mineral gear oil With rust and oxidation inhibitor (API GL–1)	Above 10 (–12)	90
	Above –15 (–26)	80
Synthetic transmission lubricant meeting Meritor specification 0–81	All	50
<i>Mercedes-Benz Transmissions</i>		
MobilTrans SHC 50 (RN 2952 E-2)	All	50

* Lubricants listed in order of preference. Do not mix types of oil.

† Call 1-800-826-4357 for a complete list of Eaton approved lubricants.

Table 1, Approved Manual Transmission Lubricants

- 25 to 35 lbf·ft (34 to 48 N·m) for Eaton Fuller transmissions with 3/4-inch pipe threads.
- 60 to 75 lbf·ft (81 to 102 N·m) for Eaton Fuller transmissions with 1-1/4-inch pipe threads.
- 35 to 50 lbf·ft (48 to 67 N·m) for all Meritor transmissions.

- 42 lbf·ft (57 N·m) for all Mercedes-Benz transmissions.

26-02 Eaton Fuller and Meritor Transmission Fluid Changing and Magnetic Plug Cleaning

Draining

1. Park the vehicle on a level surface. Apply the parking brakes and chock the rear tires.
2. Drain the oil while the transmission is warm.
3. Clean the area around the fill plug and the drain plug(s).
4. Remove the fill plug from the side of the gear case. Remove the drain plug(s) from the bottom of the case.
5. Clean the magnetic plug(s) before installation. Use a piece of key stock, or any other convenient steel slug, to short the two magnetic poles and divert the magnetic field.
6. Install and tighten the drain plug(s) 50 lbf·ft (68 N·m) for an Eaton Fuller plug and 35 to 50 lbf·ft (48 to 67 N·m) for a Meritor plug.

NOTE: Meritor recommends replacing the magnetic drain plug each time the oil is changed.

Filling

1. Add oil until it is level with the lower edge of the fill opening. See [Fig. 1](#). If the transmission has two fill openings, add oil to the level of both fill openings.

See [Table 1](#) for approved transmission lubricants. See [Table 2](#) for lubricant capacities of Eaton Fuller transmissions. See [Table 3](#) for lubricant capacities of Meritor transmissions.

Eaton Fuller Transmission Lubricant Capacities	
Transmission Model	Refill Capacity in Quarts (liters) *
<i>5-Speed FS Series</i>	
FS-4005A/B/C	5.25 (5.0)

Eaton Fuller Transmission Lubricant Capacities	
Transmission Model	Refill Capacity in Quarts (liters) *
FS-4205A/B	6.25 (5.9)
FS-5005A/B/C	5.25 (5.0)
FS-5205A/B	6.25 (5.9)
FS-6105A/B	9.5 (9.0)
FS-6305A/B	9.75 (9.2)
<i>All 6-Speed Series</i>	
FS-5106A	9.0 (8.5)
FS-5406A	9.75 (9.2)
FS-6206A	9.0 (8.5)
FS-6406A	9.75 (9.2)
FSO-6406A	
FS-7206A	10.0 (9.5)
FS-8206A	10.0 (9.5)
FSO-8406A	9.75 (9.2)
6-Speed Autoshift (all)	10.4 (9.8)
<i>7-Speed T Series</i>	
T-8607A/B	18.0 (17.0)
T-14607A/B	13.0 (12.3)
<i>All 9-Speed Series (except deep reduction)</i>	
RT-6609A	6.0 (5.7)
RT-8609A	6.0 (5.7)
RT-8709B	13.0 (12.3)
RT-11609A	13.5 (12.8)
RTO-11609A/B	
RTX-11609A/B/P/R	
RT-11709H	13.5 (12.8)
RTX-11709H	
RT-12609A	13.5 (12.8)
RTO-12609A/B	
RTX-12609A/B/P/R	
RT-12709H	13.5 (12.8)
RTX-12709H	
RT-13609A/H	13.5 (12.8)
RTX-13609B/H/R	

Transmission

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Eaton Fuller Transmission Lubricant Capacities	
Transmission Model	Refill Capacity in Quarts (liters) *
RT-14609A/H	13.5 (12.8)
RTX-14609B/H/R	
RTX-16709B/H	13.5 (12.8)
<i>9-Speed Deep Reduction</i>	
RT-8608L	13.5 (12.8)
RT-11707LL	14.0 (13.2)
<i>All 10-Speed Manual Series (except deep reduction)</i>	
10-Speed FR/FRO (all)	11.75 (11.1)
R-6610	6.0 (5.7)
RTO-6610	
RT-11610	13.0 (12.3)
RTO-11610	
RTX-11610	
RT-11710B	
RTX-11710B/C	
RT-12610	14.0 (13.2)
RTLO-12610B	14.0 (13.2)
RT-12710B	13.0 (12.3)
RTX-12710B/C	
RTLO-13610B	14.0 (13.2)
RTX-13710B/C	13.0 (12.3)
RTLO-14610B	14.0 (13.2)
RT-14710B	13.0 (12.3)
RTL-14710B	
RTX-14710B/C	
RTLO-15610B	14.0 (13.2)
RTX-15710B	13.0 (12.3)
<i>10-Speed Deep Reduction</i>	
RT-7608LL	9.75 (9.2)
RT-8908LL	14.0 (13.2)
RT-11708LL	
RTX-11708LL	
RTO-11908LL	
RTO-14908LL	
RTO-16908LL	

Eaton Fuller Transmission Lubricant Capacities	
Transmission Model	Refill Capacity in Quarts (liters) *
10-Speed Automated Models	
Top 2 (all)	14.0 (13.2)
Lightning (all)	13.5 (12.8)
10-Speed Autoshift AS2 (all)	13.0 (12.3)
11-Speed RTO Series	
RTO-11909ALL	14.0 (13.2)
RTO-14909ALL	
All 13-Speed Series	
RT-6613	8.0 (7.6)
RTO-6613	
RTO-11613	14.5 (13.7)
RTLO-12913A	14.0 (13.2)
RTLO-14913A	
RTLO-16913A	
All 15-Speed Series	
RT-11715	14.0 (13.2)
RTO-11715	
RTX-11715	
RT-14915	14.0 (13.2)
RTO-14915	
RTO-16915	
All 18-Speed Series	
RTLO-14918B	14.0 (13.2)
RTLO-16918B	
18-Speed Autoshift AS2 (all)	

* Quantities listed are approximate. Fill the transmission until the lubricant is level with the bottom of the fill hole, with the vehicle in normal operating position.

Table 2, Eaton Fuller Transmission Lubricant Capacities

Meritor Transmission Lubricant Capacities	
Transmission Model	Refill Capacity * in Quarts (liters)
<i>Meritor M/MO Series</i>	
M/MO (all)	10.25 (9.7)
<i>Meritor 9- and 10-Speed RM/RMO/RMX Series</i>	

Meritor Transmission Lubricant Capacities	
Transmission Model	Refill Capacity * in Quarts (liters)
–115A/B/C/R (all)	10.0 (9.5)
–125A/B/C/R (all)	
–135A/B/C/R (all)	10.25 (9.7)
–145A/B/C/R	10.25 (9.7)
–155A/B/C/R (all)	
–165A (all)	
Meritor 13-Speed RMO Series	
RMO13–145A	11.0 (10.4)

* Quantities listed are approximate. Fill the transmission until the lubricant is level with the bottom of the fill hole, with the vehicle in normal operating position.

Table 3, Meritor Transmission Lubricant Capacities



CAUTION

Operating a manual transmission with the oil level higher or lower than recommended can result in transmission damage. Do not overfill the transmission; overfilling will force oil out of the case through the main shaft openings. Oil overflow may also drain onto the clutch or clutch brake, causing additional problems.

IMPORTANT: Do not mix types of oil, because of possible incompatibility. Do not use multi-viscosity oils or EP (Extreme Pressure) gear oils. Do not use oil additives or friction modifiers. If switching from a petroleum based lubricant to a synthetic, all areas of each affected component must be thoroughly drained. Switching to a synthetic lubricant, when a petroleum-based lubricant has been used for 50,000 miles (80 000 km) or longer, may affect transmission performance. Monitor all seal areas for the first 10,000 miles (16 000 km) after changing to a synthetic from a petroleum-based lubricant.

NOTE: The correct oil level is established by checking the fill plug opening.

- Clean the fill plug, then install it in the gear case. Tighten the plug as follows:

- 25 to 35 lbf·ft (34 to 48 N·m) for Eaton Fuller transmissions with 3/4-inch pipe threads.
- 60 to 75 lbf·ft (81 to 102 N·m) for Eaton Fuller transmissions with 1-1/4-inch pipe threads.
- 35 to 50 lbf·ft (48 to 67 N·m) for all Meritor transmissions.
- 42 lbf·ft (57 N·m) for all Mercedes-Benz transmissions.

26-03 Allison, Eaton Fuller, and Meritor Transmission Breather Checking

Transmission housing breathers must remain clear. A plugged breather could result in pressure build-up, which could cause oil leakage.

If the breather is plugged, clean or replace it. See [Fig. 2](#). Check more often if the vehicle is operating under very dusty conditions.

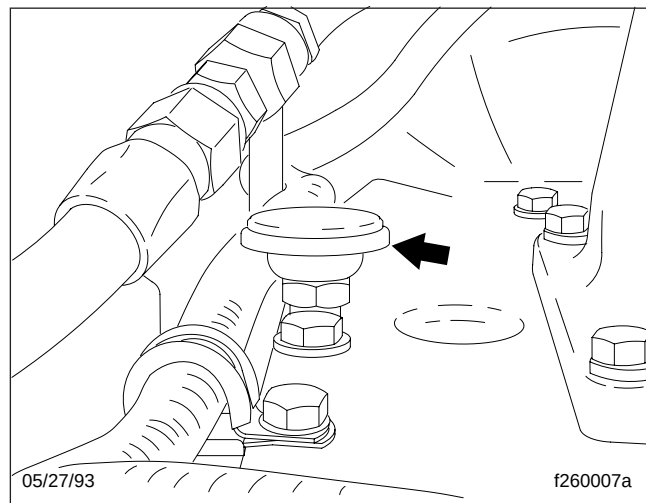


Fig. 2, Transmission Breather (Eaton Fuller shown)

26-04 Eaton Fuller Transmission Air Filter/ Regulator Element Cleaning

NOTE: Meritor transmissions do not have an air filter/regulator element that needs servicing.

1. Exhaust the air from the air reservoirs.

WARNING

Exhaust the air supply before servicing the air filter/regulator; otherwise, serious personal injury and component damage could result.

2. Clean the outside of the air filter/regulator with cleaning solvent, then let it air dry. See Fig. 3.

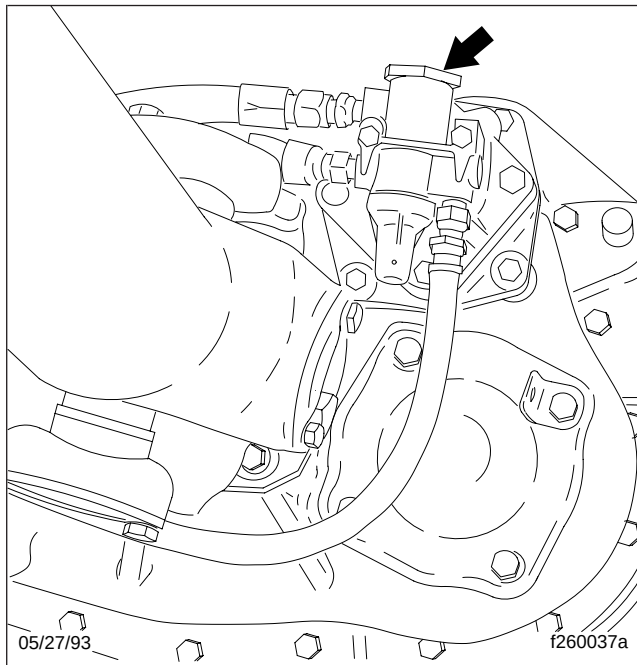


Fig. 3, Eaton Fuller Transmission Air Filter/ Regulator Location

3. Remove the end cap, large O-ring, and filter element from the filter housing. See Fig. 4. Remove the small O-ring from the end cap.

NOTE: Do not remove, disassemble, or adjust the air regulator. If the air regulator is not keep-

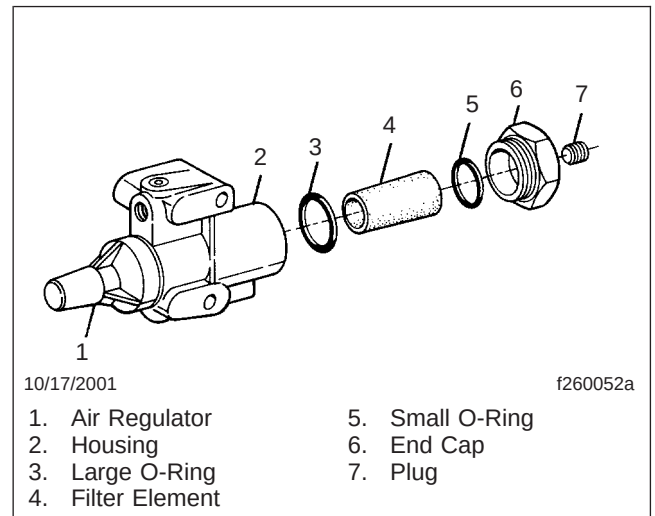


Fig. 4, Eaton Fuller Transmission Air Filter/ Regulator Components

ing the air pressure between 57 to 62 psi (396 to 431 kPa), replace the air filter/regulator. It cannot be repaired.

4. Clean the filter element.
 - 4.1 Dip the filter element in alcohol or other cleaning solvent. Blow compressed air through the filter element (inside to outside) to loosen surface dirt and to dry the element. The sintered metallic filter element will last the life of the vehicle, provided it is not damaged.
 - 4.2 Wipe out the filter housing with a clean, dry, lint-free rag.
5. Clean and inspect the O-rings and the end cap. Replace any parts that are damaged.
6. Install the large O-ring, then the filter element (small end first) into the filter housing.
7. Install the small O-ring into the end cap, then install the end cap on the filter housing. Tighten the end cap until firm.
8. Start the engine, and build up pressure in the air system. Check for air leaks at the filter housing and air line connections, and repair any leaks.

CAUTION

Repair any air leaks. A leaking air filter or air lines can cause slow or hard shifting of the transmission, and eventual transmission damage.

26-05 Allison Transmission Fluid and Filter Changing

AT Series

1. Park the vehicle on a level surface and apply the parking brakes.
2. Run the engine until the transmission fluid reaches the operating temperature of 160° to 200°F (71° to 93°C). Shift the transmission to neutral (N) and shut down the engine.

CAUTION

To prevent dirt from entering the transmission, use only clean containers and fillers for the transmission fluid. Do not use fillers or containers that have been used for water or antifreeze. Dirt, water, or antifreeze could damage the transmission.

3. Clean the area around the drain plug. While the transmission fluid is warm, remove the drain plug and drain the fluid. Disconnect the fill tube from the oil pan.

IMPORTANT: Examine the used transmission fluid for dirt, coolant or water, and metal particles. If any of these contaminants are present, a problem may exist within the transmission system.

4. Support the oil pan, then remove the twenty-one washer-head screws that attach the oil pan to the transmission case. Remove the pan, and discard the pan gasket.
5. Clean the oil pan with mineral spirits.
6. Remove the washer-head screw that attaches the internal fluid filter to the filter spacer, then remove the filter and discard it. See [Fig. 5](#). Remove the fluid intake tube, and then remove the seal ring from the intake tube, and discard the seal ring.

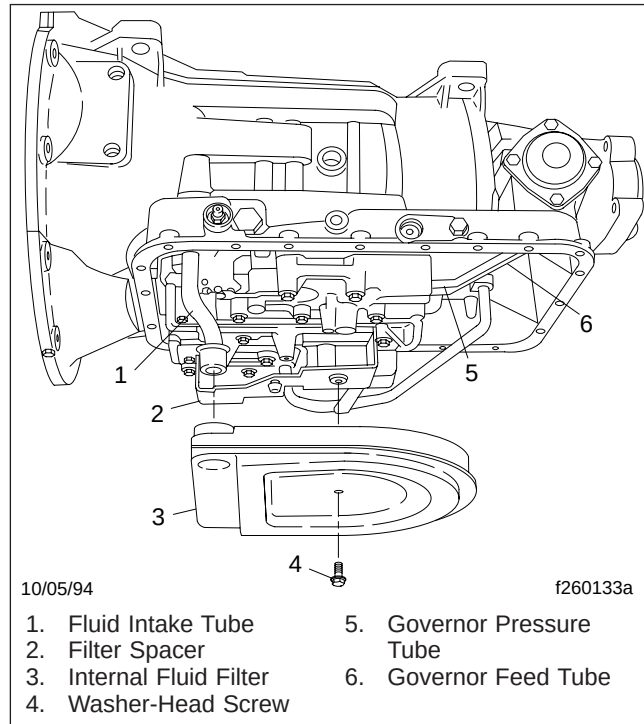


Fig. 5, Allison AT Series Transmission Filter

7. Remove, clean, and install the governor feed line screen, located in the control valve body. See [Fig. 6](#).
 8. Install a new seal ring into the fluid intake tube.
- IMPORTANT:** Avoid twisting the intake tube when installing the internal fluid filter, intake tube, and seal ring; the seal ring could be pinched, cut, or deformed. An air-tight seal must be maintained.
9. Install the intake tube, with the seal ring installed, into the main housing. Install the internal fluid filter on the intake tube, making sure the grommet in the filter fits the intake tube snugly.
 10. Install the washer-head screw to retain the fluid filter, and tighten it 10 to 15 lbf·ft (14 to 20 N·m).
 11. Submerge a new oil pan gasket in transmission fluid for five minutes. Then place the gasket on the pan; do not use any substance as a gasket retainer.

IMPORTANT: Do not use gasket-sealing compounds any place inside the transmission or where they might get washed into the transmis-

sion. Also, nonsoluble vegetable-based cooking compounds or fibrous greases must not be used inside the transmission.

12. Install the oil pan and gasket.

- 12.1 Guide the pan and gasket carefully into place. Guard against dirt or foreign material entering the pan. Retain the pan with four 5/16–18 washer-head screws, installed by hand into the corners of the pan.
- 12.2 Install the remaining seventeen washer-head screws by hand, carefully threading each through the gasket and into the transmission. Bottom all of the screws before tightening any of them.
- 12.3 Tighten all twenty-one screws evenly 10 to 15 lbf·ft (14 to 20 N·m). Check the gasket fit while the screws are being tightened.

IMPORTANT: The oil pan bolts must maintain a minimum torque of 60 lbf·in (680 N·cm) after the oil pan gasket has taken a set.

13. Install the fill tube at the side of the pan. Tighten the tube fitting 90 to 100 lbf·ft (122 to 136 N·m).
14. Install the drain plug and gasket, and tighten the plug 15 to 20 lbf·ft (20 to 27 N·m).
15. Replace the external (auxiliary) fluid filter.
16. Clean the area around the fill tube and remove the dipstick. Using a clean funnel in the fill tube, add transmission fluid. See [Table 4](#) for approved transmission lubricants, and [Table 5](#) for lubricant capacities.
17. Check and adjust the fluid level using the procedure under "Checking the Fluid Level."

MD and HD Series

When draining transmission fluid, check for evidence of dirt or water contamination. A small amount of condensation will appear in the fluid during operation.

Water contamination is normally characterized as a milky discoloration of the transmission fluid. Obvious contamination of the transmission fluid indicates a leak between the water and fluid areas of the trans-

mission cooler. Inspect and pressure-test the cooler to confirm the leak; replace leaking transmission coolers.



CAUTION

To prevent dirt from entering the transmission, use only clean containers and fillers for the transmission fluid. Do not use fillers or containers that have been used for water or antifreeze. Dirt, water, or antifreeze could damage the transmission.

1. Park the vehicle on a level surface, apply the parking brakes, and chock the rear tires.

Approved Allison Transmission Lubricants		
Lubricant Type *	Temperature in °F (°C)	SAE Viscosity
<i>All Allison Transmissions</i>		
Castrol TranSynd™	Above –67 (–55)	—
<i>AT and MD Series † ‡</i>		
Dexron® II	–25 to +120 (–32 to +48)	—
<i>MT Series</i>		
Dexron IIE	–10 to +120 (–23 to +48)	—
Dexron III	Above –17 (–27)	—
Type C4	10 to 120 (–12 to +48)	SAE 10W
Type C4	32 to 120 (0 to 48)	SAE 30W
<i>HD Series ‡</i>		
Dexron III	Above –17 (–27)	—

* Lubricants listed in order of preference. Do not mix types of oil.

† Factory filled with Dexron® II.

‡ For off-highway operation or where ambient temperature is consistently above 86°F (30°C) or below –17°F (–27°C), refer to the manufacturer's fluid recommendations.

Table 4, Approved Allison Transmission Lubricants

Allison Transmission Lubricant Capacities	
Transmission Model	Refill Capacity * in Quarts (liters)
<i>On-Highway Series</i>	
1000/2000/2400	15.0 (14.2)
<i>AT Series</i>	
AT–545	16.0 (15.1)
<i>MT Series</i>	

Allison Transmission Lubricant Capacities	
Transmission Model	Refill Capacity * in Quarts (liters)
MT-643	15.0 (14.2)
MT-653	
MD Series	
MD-3060	19.0 (18.0)
MD-3560	
HD Series (FL112 only) †	
HD-4060	36 (34)
HD-4560	
HD-4060P	39 (37)
HD-4560P	

* Quantities listed are approximate. Add the recommended amount of fluid as listed under refill capacity, then perform a "hot check" and add fluid as needed. Do not overfill.

† NOTE: Quantities listed are for a standard size (not shallow) oil pan.

Table 5, Allison Transmission Lubricant Capacities

- Operate the vehicle until the transmission reaches normal operating temperature: 160 to 200°F (71 to 93°C).
 - Clean the area around the drain plug and the transmission fluid pan. Place a drain pan under the transmission and remove the drain plug. Examine the fluid as it drains. If only the filter is being changed, do not drain the fluid.
 - Remove the 12 mounting bolts (six each) from the two filter covers.
- NOTE: A lot of fluid will drain when the filter covers are removed.
- Remove the filter covers, O-rings, and two square-cut seals from the transmission. See [Fig. 7](#).
 - Remove the filters from the bottom of the control module.
 - Lubricate the new O-rings with transmission fluid, and install them on the cover assemblies.
 - Install a new square-cut seal on each cover assembly, and install the fluid filter elements on the cover assemblies.
 - Install the filter and cover assemblies into the filter compartment.

- Align each cover assembly with the holes in the channel plate sump, and push the cover assemblies in by hand to seat the seals.



CAUTION

Do not use the bolts to draw the filter covers to the sump. This can damage the covers, seals, or sump.

- Install six bolts in each cover, and torque the bolts 38 to 44 lbf·ft (51 to 61 N·m).
- Replace the drain plug O-ring, and install the drain plug. Tighten the drain plug 18 to 24 lbf·ft (25 to 32 N·m).
- Refill the transmission with fresh Dexron® transmission fluid (see [Table 4](#)) and check the fluid level. See [Table 5](#) for lubricant capacities.
- Check and adjust the fluid level using the procedures under "Checking the Fluid Level."

MT Series

- Park the vehicle on a level surface. Apply the parking brakes and chock the rear tires.
- Start the engine and check that the transmission fluid temperature is 160° to 200°F (71° to 93°C) before draining the fluid. Shift the gear selector to neutral and shut down the engine.
- Place a suitable container under the transmission, then remove the drain plug and gasket from the transmission oil pan. Allow the fluid to drain. See [Fig. 8](#).
- Remove the nut that secures the oil filler tube to the transmission pan.
- Remove the 21 capscrews that secure the transmission oil pan to the transmission housing, then remove the transmission oil pan and gasket from the transmission. Discard the gasket.
- Clean the oil pan of any debris and residual fluid in an approved cleaning tank.
- Remove the washer-head capscrew that secures the filter to the transmission, then remove the filter and the filter intake pipe from the transmission.
- Separate the filter intake pipe from the filter, discard the O-ring, then clean the tube.

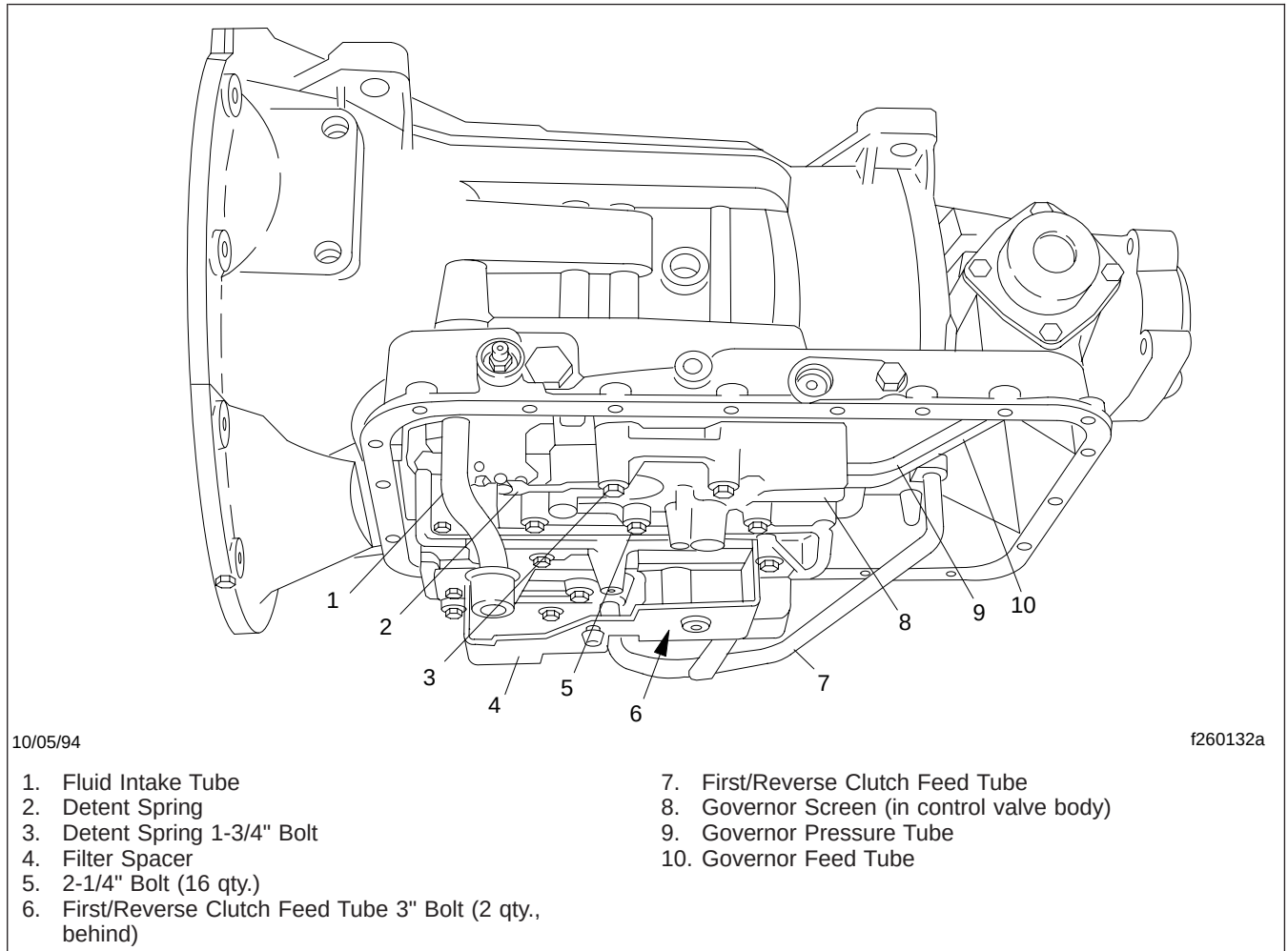


Fig. 6, Allison AT Series Transmission Governor

9. Install the filter intake pipe on the new filter. Install a new O-ring on the filter intake tube, then lubricate the O-ring with a light coat of transmission fluid.
10. Insert the filter intake pipe into the orifice on the bottom of the transmission, then secure the filter with the 5/16–18 x 5/8 inch washer-head capscrew. Tighten the capscrew 10 to 15 lbf·ft (14 to 20 N·m).
11. Place a new oil pan gasket on the oil pan. If desired, a sealant may be used on the gasket, but it must be applied carefully; sealant must be prevented from contacting areas of the oil pan flange that are inside the raised bead of the flange.

NOTE: Do not use gasket-type sealing compounds or cement anywhere inside the transmission or where they might get washed into the transmission. Non-soluble vegetable-base cooking compounds or fibrous grease must not be used inside the transmission.

12. Install the oil pan and gasket onto the transmission. Check that no dirt or debris enters the pan. Secure the pan to the transmission housing with four 5/16–18 washer-head capscrews, installed into the corners of the oil pan, but do not tighten.
13. Install the remaining 17 washer-head capscrews by hand. Check that all of the capscrews are hand tight.

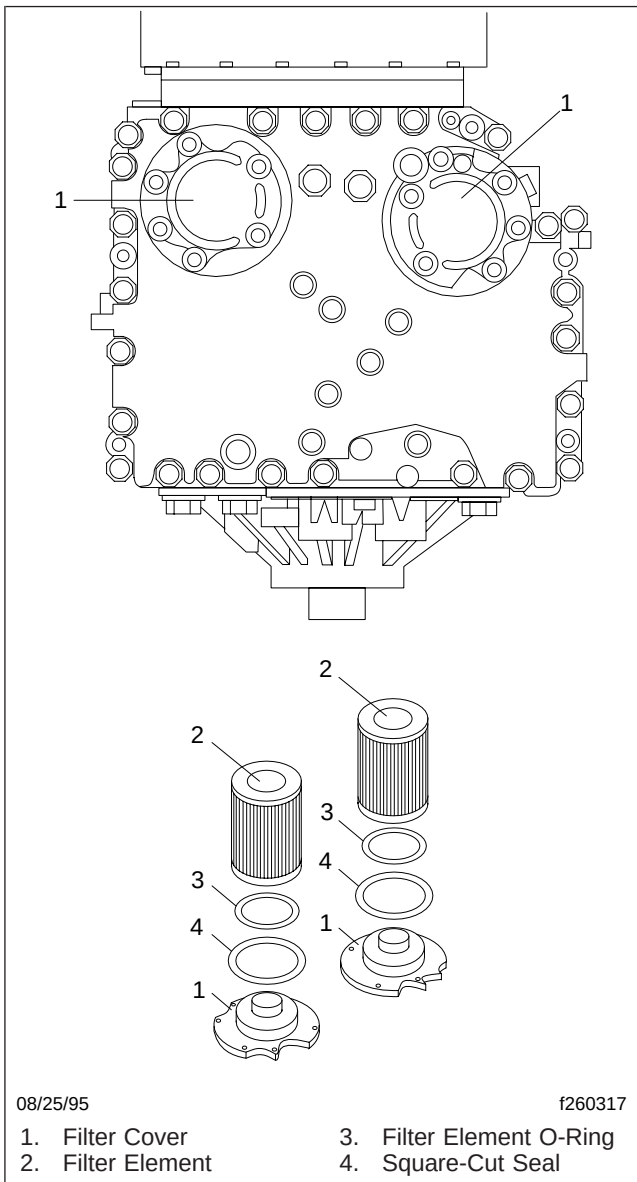


Fig. 7, Allison MD and HD Series Transmission Filter Locations and Components

14. Tighten each capscrew with a click-type torque wrench 5 lbf·ft (7 N·m). Use the torque pattern shown in **Fig. 9** to distribute the torque evenly. Repeat this procedure and torque the capscrews with a click-type torque wrench 15 to 20 lbf·ft (20 to 27 N·m).
15. Install the oil filler tube on the oil pan. Tighten the tube fitting 90 to 100 lbf·ft (122 to 136 N·m), then install the drain plug and gasket. Tighten the drain plug 15 to 20 lbf·ft (20 to 27 N·m).
16. Pour approximately 15 quarts (14 liters) of Dexron® IIE transmission fluid into the transmission. Start the engine and allow the transmission fluid to circulate. With the transmission in NEUTRAL, check the fluid level. Check for fluid leaks. Correct any leak with the engine OFF.

Checking the Fluid Level



CAUTION

Operating a transmission with the fluid level higher or lower than recommended can result in transmission damage. Do not overfill the transmission.

Do not mix types and brands of fluid, because of possible incompatibility. Do not use fluid additives, friction modifiers, extreme-pressure gear fluids, or multi-viscosity lubricants.

Cold Check

Clean all dirt away from around the end of the fluid fill tube before removing the dipstick.



CAUTION

Do not allow foreign matter to enter the transmission. Dirt or foreign matter in the hydraulic system may cause undue wear of transmission parts, make valves stick, and clog passages.

It is important to check the fluid level cold to determine if the transmission has a sufficient amount of fluid to be safely operated until a hot check can be performed.

1. Park the vehicle on a flat, level surface.
2. Apply the parking brakes and chock the rear tires.
3. Run the engine for at least one minute.
4. Shift from DRIVE to NEUTRAL, and then shift to REVERSE to fill the hydraulic system.
5. Shift to NEUTRAL and allow the engine to idle at 500–800 rpm.
6. With the engine running at idle, remove the dipstick from the tube and wipe clean.

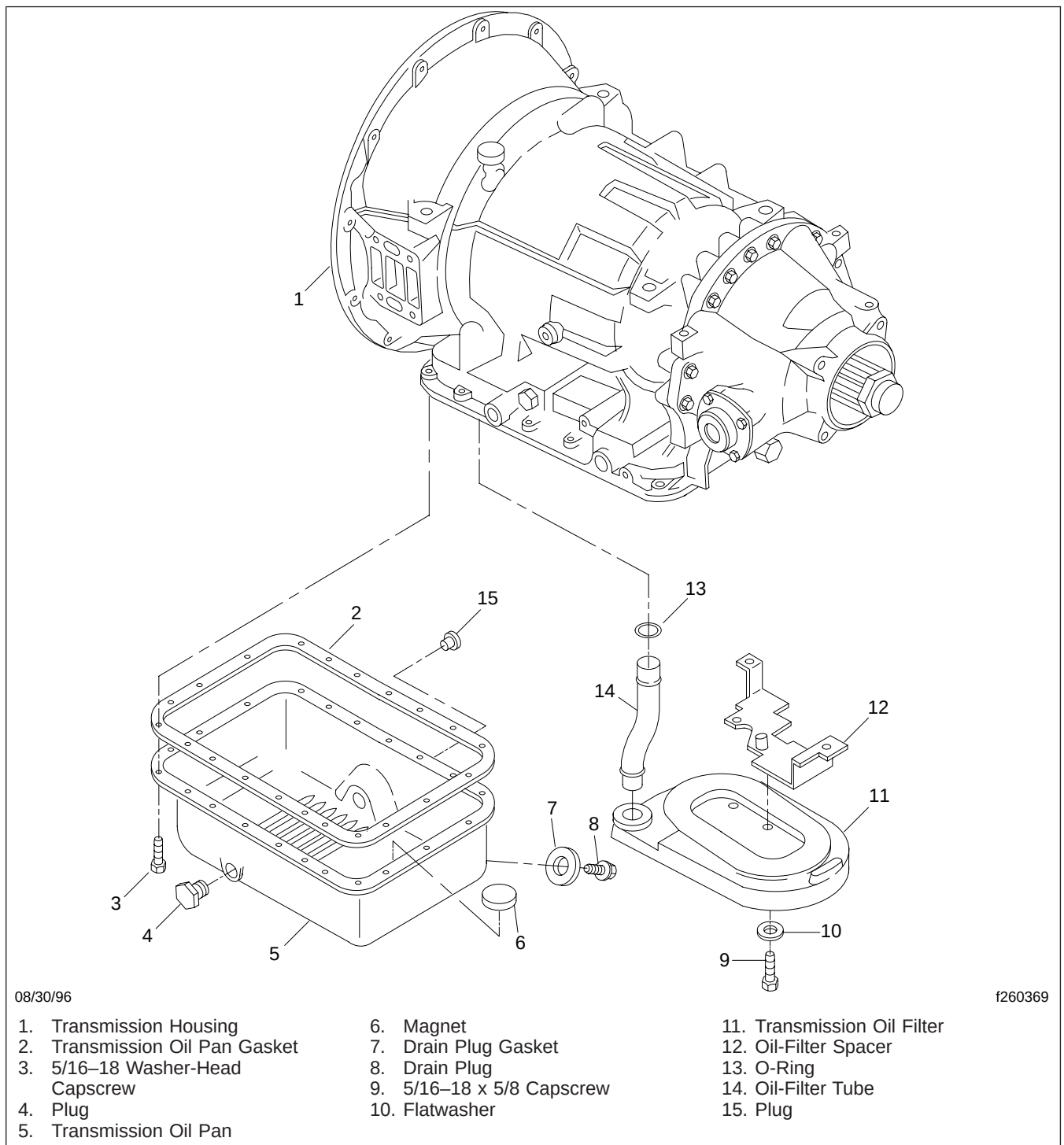


Fig. 8, Allison MT Series Transmission, Filter Removal

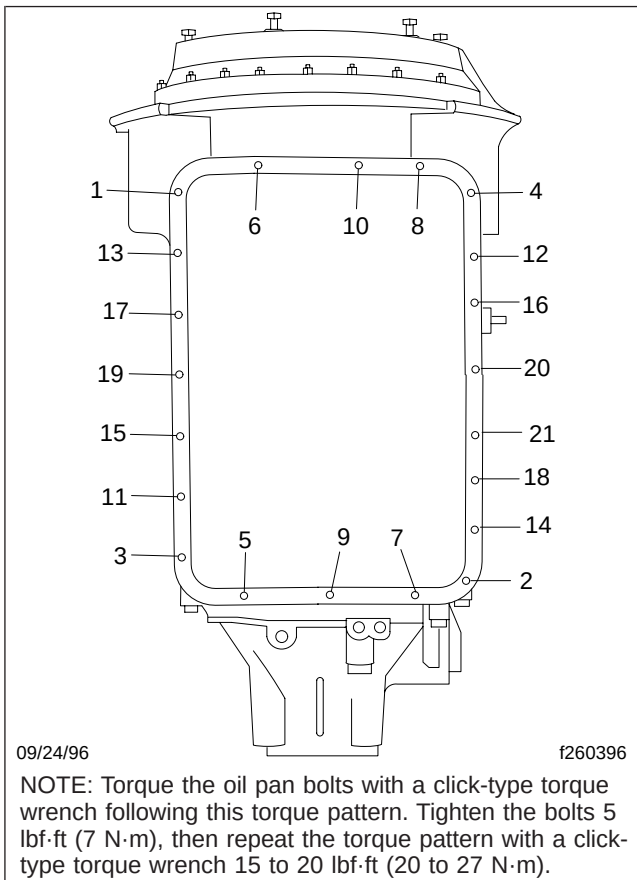


Fig. 9, Allison MT Series Transmission, Oil Pan Torque Pattern

7. Insert the dipstick into the tube and remove the dipstick.
8. Check the fluid level reading and repeat the check procedure to verify the reading.

If the fluid level is within the COLD RUN band, the transmission may be operated until the fluid is hot enough to perform a HOT RUN check.

If the fluid level is not within the COLD RUN band, add or drain fluid as needed to adjust the fluid level to the middle of the COLD RUN band. See **Fig. 10** for the AT, MD, and HD series, and **Fig. 11** for the MT series.



CAUTION

Do not fill above the COLD RUN band if the transmission fluid is below normal operating tempera-

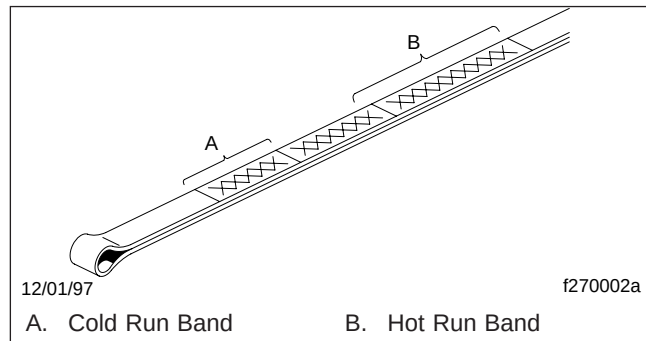


Fig. 10, AT, MD, and HD Series Dipstick Markings

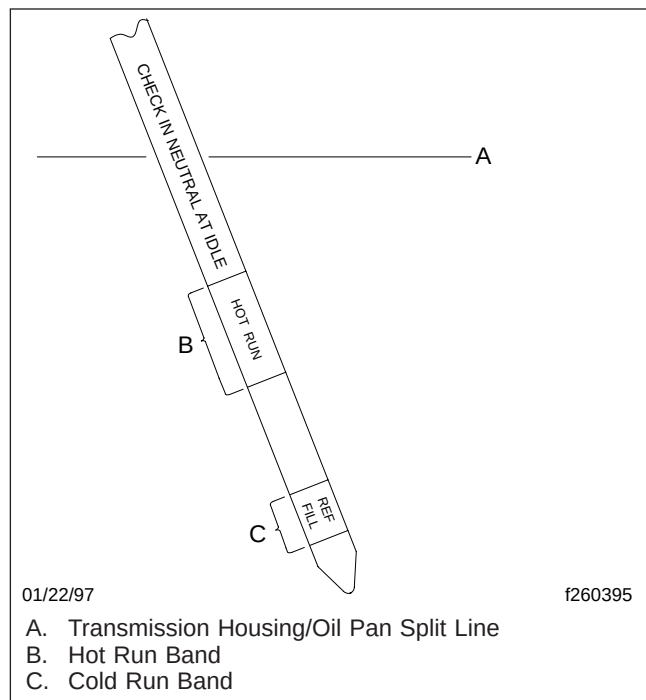


Fig. 11, MT Series Dipstick Markings, 5.1-Inch Depth Oil Pan

ture. As fluid temperature increases, so does the fluid level. Filling above the COLD RUN band when the transmission is below normal operating temperature may result in an overfilled transmission, which causes fluid foaming, and aeration. Fluid foaming and aeration cause transmission overheating and erratic shifting.

NOTE: Perform a hot check at the first opportunity after the normal operating temperature, 160° to 200°F (71° to 93°C) has been reached.

Hot Check

1. Park the vehicle on a flat, level surface. Apply the parking brakes and chock the rear tires.
2. Shift the transmission to NEUTRAL.
3. Operate the engine at idle (500–800 rpm) until normal operating temperature is reached. Check that the sump temperature is 160° to 200°F (71° to 93°C). Check that the converter-out temperature is 180° to 220°F (82° to 104°C).
4. With the engine idling, remove the dipstick from the tube and wipe it clean.
5. Insert the dipstick into the tube and remove it.
6. Check the fluid level reading and repeat the check procedure to verify the reading. Safe operating level is within the HOT RUN band on the dipstick. The HOT RUN band is between the HOT FULL and HOT ADD marks.

If the fluid level is not within the HOT RUN band, add or drain fluid as needed to bring the fluid level within the HOT RUN band. See [Fig. 10](#) for the AT, MD, and HD series, and [Fig. 11](#) for the MT series.

26–06 Chrysler Transmission Fluid and Filter Changing

Replacement

1. Park the vehicle on a level surface and apply the parking brakes.



CAUTION

To prevent dirt from entering the transmission, use only clean containers and fillers for the transmission fluid. Do not use containers or fillers that have been used for water or antifreeze. Dirt, water, or antifreeze could damage the transmission.

2. While the transmission fluid is warm, raise the vehicle, remove the oil pan, and drain the fluid.

IMPORTANT: Examine the used transmission fluid for dirt, coolant or water, and metal particles. If any of these contaminants are present, there may be a problem within the transmission.

3. Remove the three filter screws. Remove the filter from the valve body. See [Fig. 12](#).
4. Install the new filter.
 - 4.1 Position the new filter on the valve body and install the filter screws finger-tight.
 - 4.2 Tighten the filter screws 35 lbf·in (400 N·cm).
 - 4.3 Install the oil pan bolts and tighten them 13 lbf·ft (17 N·m).

Refilling After Fluid and Filter Change

1. Lower the vehicle and remove the dipstick. Using a clean funnel in the fill tube, add 2 quarts (1.9 liters) of Mopar ATF Plus, Type 7176 transmission fluid.
2. Check and adjust the fluid level using the procedures under "Checking the Fluid Level."

Checking the Fluid Level

1. With the transmission in neutral and the parking brake applied, run the engine at idle for at least one minute to clear the fluid system of air.
2. Shift the transmission briefly through all the gear ranges. Then shift back into neutral.
3. Wipe the dipstick clean and check the fluid temperature.

NOTE: Fluid at the operating temperature of approximately 180°F (82°C) is hot. Hot fluid cannot be held comfortably between the fingertips. The fluid will be hot if the vehicle has been driven 15 miles (23 km) or more.

Fluid at temperatures of approximately 85° to 125°F (29° to 52°C) is warm.

4. Wipe the dipstick clean again and reinsert it until seated. Check the fluid level and add or drain fluid as necessary.
 - 4.1 If the fluid is warm, any level above the MIN dot (see [Fig. 13](#)) is satisfactory. If the level is at or below the MIN dot, use a funnel to add fluid until the level is above this dot. At the next opportunity, check the fluid when it is hot.

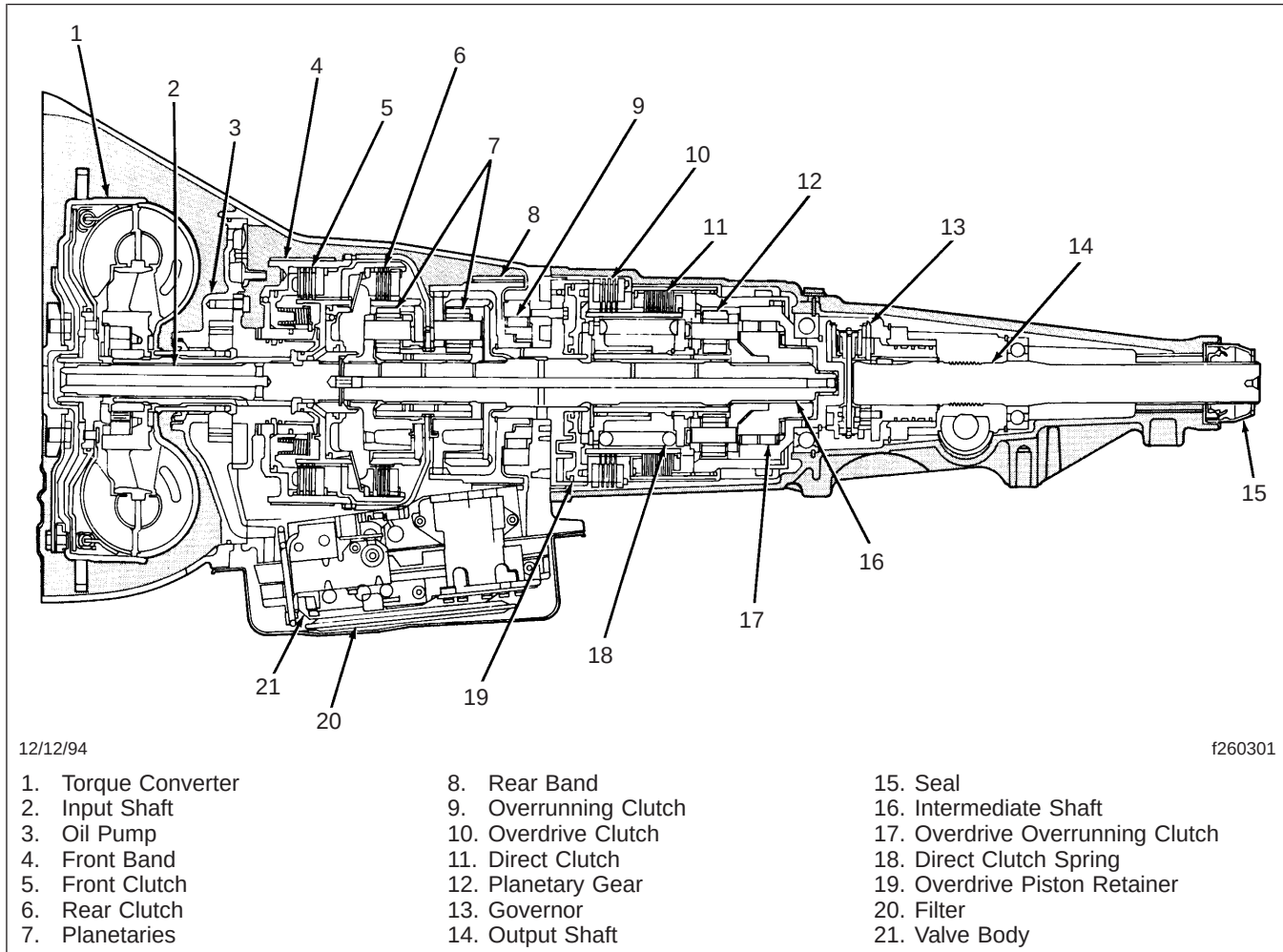


Fig. 12, Chrysler 46RH Transmission and Overdrive Unit

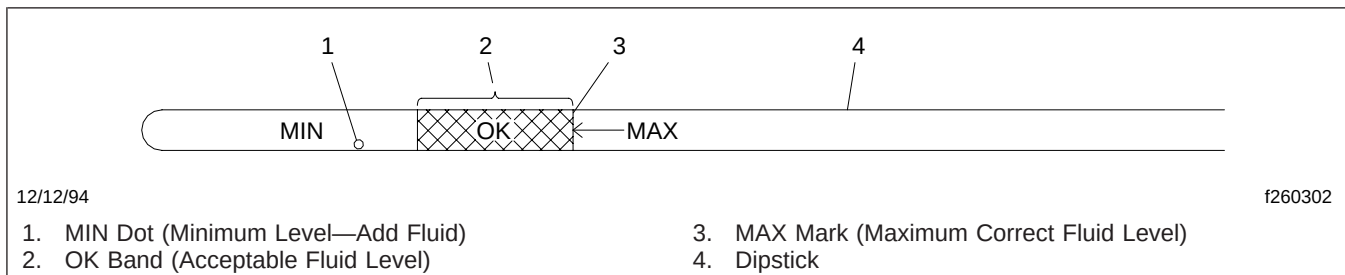


Fig. 13, Dipstick Fluid Level Markings, Chrysler Transmission



CAUTION

Do not overfill the transmission. Overfilling causes leakage from the pump vent (this can be

mistaken for a pump seal leak), bubbles in the fluid, and foaming. This can reduce fluid life significantly and cause shifting problems.

- 4.2 If the fluid is hot, any level within the OK band (see [Fig. 13](#)) is satisfactory. If the level is below the OK band, use a funnel to add just enough fluid to bring the level up to the MAX mark. **Do not overfill.**
- 4.3 If fluid is above the MAX mark, drain off any excess fluid at one of the cooler lines. If the cooler lines are too hot, use a suction gun and flexible tubing with a diameter of 1/8 inch to 3/16 inch (3 mm to 4.75 mm).

NOTE: See [Table 6](#) for approved transmission lubricants, and [Table 7](#) for lubricant capacities.

5. To prevent dirt and water from entering the transmission, be sure the dipstick cap is properly seated.
6. When the fluid level is correct, shut down the engine and release the parking brake.

Approved Chrysler Transmission Lubricants		
Lubricant Type	Temperature in °F (°C)	SAE Viscosity
Mopar ATF Plus, Type 7176	—	—

Table 6, Approved Chrysler Transmission Lubricants

Chrysler Transmission Lubricant Capacities	
Transmission Model	Refill Capacity in Quarts (liters)
46RH (Full Capacity)	10.9 (10.3)
46RH (Fill Amount After Fluid Change)	2.0 (1.9)
46RH (Fill Amount After Overhaul)	6.0 (5.7)

Table 7, Chrysler Transmission Lubricant Capacities

26-07 Chrysler Transmission Band Adjusting

Front Band Adjusting

The front (kickdown) band adjusting screw is located on the left-hand side of the transmission case above the manual lever shaft and the park/neutral position switch. See [Fig. 14](#).

1. Raise the vehicle.

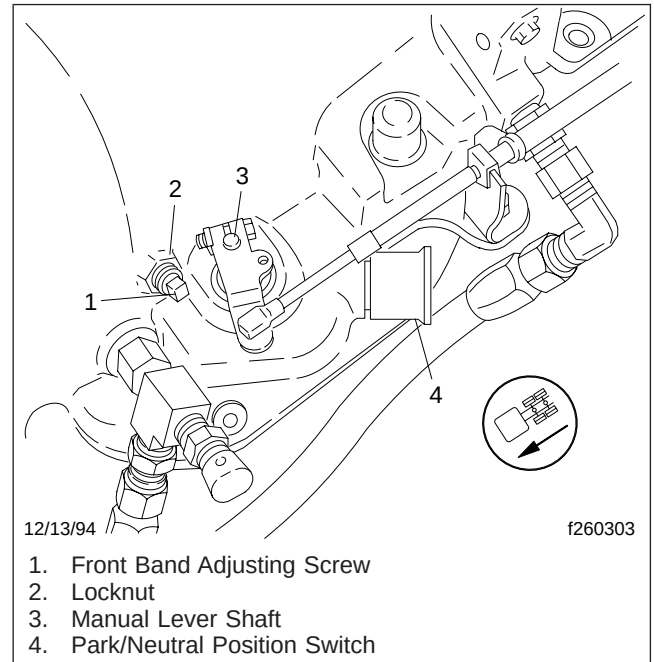


Fig. 14, Front Band Adjusting Screw, Chrysler

2. Loosen the locknut on the front band adjusting screw.
3. Back off the locknut three to five turns. Make sure the adjusting screw turns freely in the transmission case. If necessary, apply lubricant to the screw threads.
4. Set the adjusting screw. To turn the adjusting screw, use a 5/16-inch 8-point socket on a 0 to 100 lbf·in (0 to 1100 N·cm) torque wrench.
 - 4.1 Tighten the adjusting screw 72 lbf·in (800 N·cm).
 - 4.2 Back off the adjusting screw 2-7/8 turns.
5. Holding the adjusting screw in position, tighten the locknut 30 lbf·ft (41 N·m).
6. Lower the vehicle.

Rear Band Adjusting

The rear (low-reverse) band adjusting screw is located on the lower surface of the valve body. It is accessible only when the oil pan and filter are removed. See [Fig. 15](#).

1. Raise the vehicle.

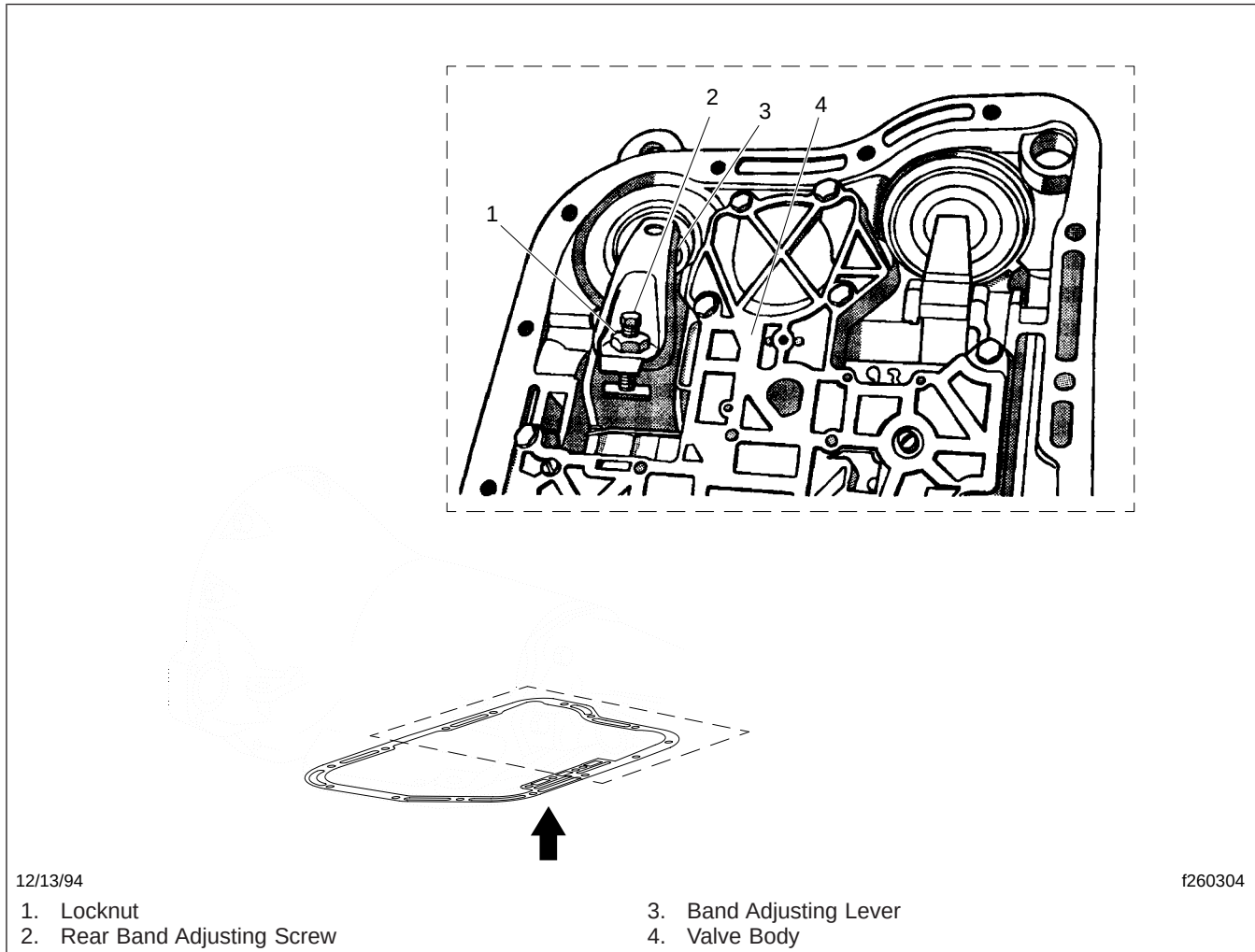


Fig. 15, Rear Band Adjusting Screw, Chrysler

2. Remove the transmission oil pan and drain the fluid. Remove the fluid filter.
3. Loosen the locknut and back it off five to six turns. Make sure the adjusting screw turns freely on the band adjusting lever.
4. Set the adjusting screw. To turn the adjusting screw, use a 5/16-inch 8-point socket on a 0 to 100 lbf·in (1100 N·cm) torque wrench.
 - 4.1 Tighten the adjusting screw 72 lbf·in (800 N·cm).
 - 4.2 Back off the adjusting screw two turns.
5. Holding the adjusting screw in position, tighten the locknut 25 lbf·ft (34 N·m).
6. Install the filter and oil pan. Replace the oil pan gasket. Tighten the oil pan bolts 13 lbf·ft (17 N·m).
7. Lower the vehicle.
8. Check and adjust the fluid level using the procedures under "Checking the Fluid Level."

26-08 Aisin Transmission Fluid and Filter Changing and Magnetic Plug Cleaning

1. Park the vehicle on a level surface and apply the parking brakes. Chock the rear tires.

2. Run the engine until the transmission fluid reaches the operating temperature of 160 to 200°F (71 to 93°C). Shift the transmission to neutral (N) and shut down the engine.

**CAUTION**

To prevent dirt from entering the transmission, use only clean containers and fillers for the transmission fluid. Do not use fillers or containers that have been used for water or antifreeze. Dirt, water, or antifreeze could damage the transmission.

3. Clean the area around the drain plug. While the transmission fluid is warm, remove the magnetic drain plug and drain the fluid. See Fig. 16.

NOTE: The transmission should drain about 7.9 quarts (7.5 L).

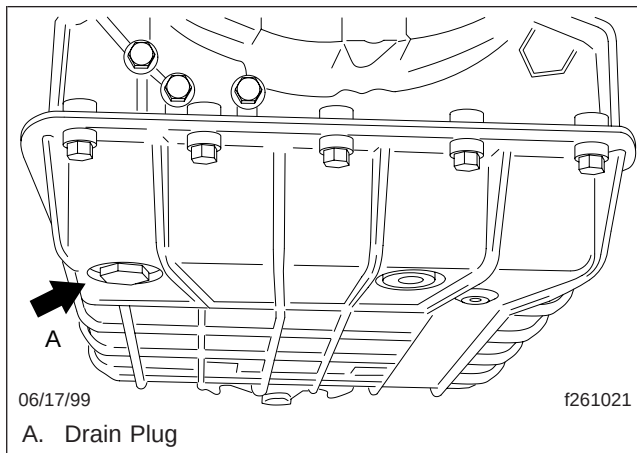


Fig. 16, Aisin Transmission Drain Plug

IMPORTANT: Examine the used transmission fluid for dirt, coolant or water, and metal particles. If any of these contaminants are present, a problem may exist within the transmission system.

4. Replace the filter. It is located on the passenger-side of the vehicle.
 - 4.1 Place a drain pan under the transmission fluid filter.

**CAUTION**

To prevent skin burns from hot transmission fluid, wear protective gloves when removing the filter.

- 4.2 Place a strap or chain wrench around the filter canister, and rotate in a counter-clockwise motion to separate the filter from the mounting. Carefully spin the filter off the mount and remove it from the vehicle.

- 4.3 Apply a light coat of transmission fluid to the O-ring gasket on the new filter. Fill the filter with the specified transmission fluid, and spin the filter back onto the mount.

NOTE: The filter fills slowly, so be patient to ensure the proper fluid level has been reached.

- 4.4 Once the filter has made contact with the mount, use a strap or chain wrench to rotate the filter canister an additional 180 to 270 degrees to firmly tighten the filter. Wipe the filter clean of any fluid after it is tightened.

5. Clean the plug before installing it.
6. Clean drain plug threads in the tank.
7. Install the plug. Tighten 32 lbf·ft (43 N·m).
8. Remove the transmission fluid dipstick.
9. Prepare 11 quarts (10 L) of Dexron® III automatic transmission fluid (ATF).
10. Through the dipstick tube, fill the transmission with Dexron® III, about 7.4 quarts (7 L).
11. Inspect the low temperature ATF level.
 - 11.1 Make sure the vehicle is in neutral and start the engine.
 - 11.2 Let the engine idle and successively shift positions to spread ATF throughout the transmission.
 - 11.3 Set the shift selector to neutral (N).
 - 11.4 Continue engine idle and remove the dipstick. Wipe it clean, re-insert it, remove it and measure the ATF level.
 - 11.5 If the ATF temperature is between 68 and 86° F (20 and 30° C), the fluid should measure in the COLD range. See Fig. 17.
 - 11.6 Refill the ATF until it reaches the appropriate range.

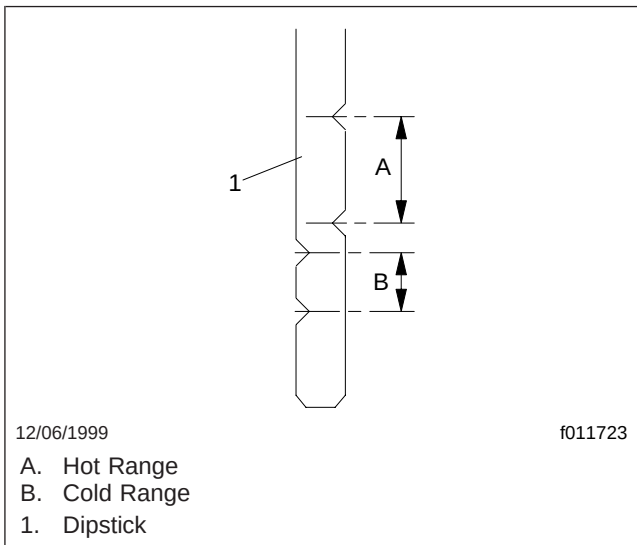


Fig. 17, ATF Dipstick, Aisin Transmission

12. Inspect the high temperature ATF level.

- 12.1 Make sure the vehicle is in neutral and start the engine and remove the chocks. Drive the vehicle for 30 minutes to raise the ATF temperature to normal working oil temperature.

Park the vehicle on a level service and chock the tires.

- 12.2 With the engine idling, engage the brake pedal and successively shift gear positions to spread ATF throughout the transmission.
- 12.3 Set the shift selector to neutral (N).
- 12.4 Continue engine idle and remove the dipstick. Wipe it clean, re-insert it, remove it and measure the ATF level.
- 12.5 If the ATF temperature is between 158 to 176°F (70 to 80°C), the fluid should measure in the HOT range. See [Fig. 17](#).
- If the ATF level is below the HOT range, add ATF until the level is within the HOT range.
 - If the ATF level is above the HOT range, remove the drain plug ([Fig. 16](#)) and drain ATF until the level is lower than the required range. Then, install the drain plug

and refill with ATF until the level is within the HOT range.

13. Remove the chocks from the tires.

26-09 Mercedes-Benz (MBT) Transmission Leak Checking

1. Park the vehicle on a level surface. Apply the parking brakes and chock the rear tires.
2. Check for signs of leakage at the breather. See [Fig. 18](#).

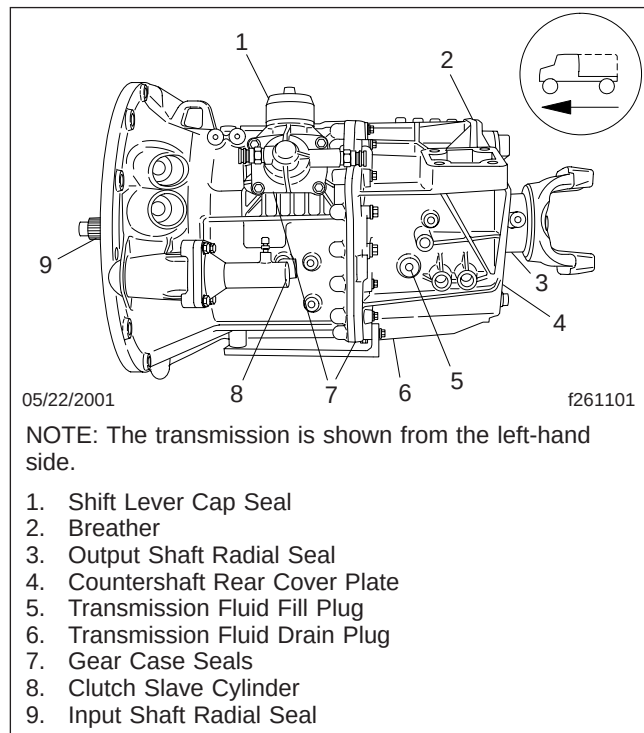


Fig. 18, MBT Transmission Leak Check

- 2.1 If leakage is found, check the breather for a missing cap. Replace the cap if necessary.
- 2.2 Check the fluid level at the fill plug. If the level is too high, correct the fluid level.
3. Check for signs of leakage at the cap seal on the shift lever. If the cap seal is damaged, replace it.

4. Check for signs of leakage at the radial seal on the output shaft. If leakage is found, remove the output yoke (end yoke) and replace the seal. For procedures, see **Section 26.00**, Subject 130, of the *Business Class® Trucks Service Manual*.

NOTE: There are two cover plates on the countershaft, one at the front and one at the rear.

5. Check for signs of leakage at the rear cover plate on the countershaft (next to the output yoke). If leakage is found, check the torque on the cover-plate bolts and check the flat seal for damage.
 - 5.1 If the flat seal is damaged, replace it.
 - 5.2 If the cover-plate bolts are too loose, tighten them 18 lbf·ft (25 N·m). If the cover-plate bolts are too tight, replace the flat seal and tighten to 18 lbf·ft (25 N·m).
6. Check for signs of leakage at the transmission fluid fill plug. If leakage is found, check the torque on the plug and check the aluminum gasket for damage.
 - 6.1 If the gasket is damaged, replace it.
 - 6.2 If the fill plug is too loose, tighten it 42 lbf·ft (57 N·m). If the plug is too tight, loosen it and tighten to 42 lbf·ft (57 N·m).
7. Check for signs of leakage at the transmission fluid drain plug. If leakage is found, check the torque on the plug and check the aluminum gasket for damage.
 - 7.1 If the gasket is damaged, replace it.
 - 7.2 If the drain plug is too loose, tighten it 42 lbf·ft (57 N·m). If the plug is too tight, loosen it and tighten to 42 lbf·ft (57 N·m).
8. Check for fluid dripping at the gear case seals. If substantial leakage is found at either location, replace the transmission.

NOTE: Weeping or sweating seals are not cause for transmission replacement.



WARNING

Clutch hydraulic fluid (DOT 3 brake fluid) is hazardous. It may be a skin irritant and can cause blindness if it gets in your eyes. Always wear safety glasses when handling clutch hydraulic

fluid or bleeding hydraulic lines. If you get clutch hydraulic fluid on your skin, wash it off as soon as possible.

9. Check for signs of leakage at the clutch slave cylinder.



CAUTION

Do not spill clutch hydraulic fluid (DOT 3 brake fluid) on the cab paint. Clean it off immediately if any is spilled. Clutch hydraulic fluid can damage paint.

- 9.1 If leakage is found on the slave cylinder body, check the fittings and hose for damage.
- 9.2 If leakage is found on the piston seals, replace the slave cylinder and bleed the clutch hydraulic system. For detailed instructions on bleeding the clutch, see **Group 25**.
- 9.3 If the slave cylinder fittings and/or the hose are damaged, replace them.
- 9.4 Check the torque on the slave cylinder mounting capscrews. Tighten them 15 lbf·ft (20 N·m).
- 9.5 If any leakage of clutch hydraulic fluid is found, check the fluid level in the reservoir, and add fluid if needed. For detailed procedures, see **Group 25**.

NOTE: There are two cover plates on the countershaft, one at the front and one at the rear.

10. Check for signs of leakage at the clutch bell housing. If leakage is found, check the radial seal on the input shaft, the front cover plate on the countershaft (inside the clutch bell housing), and the rear radial seal on the crankshaft.
 - 10.1 If the radial seal on the input shaft is leaking, replace the radial seal. For procedures, see **Section 26.00**, Subject 120, of the *Business Class® Trucks Service Manual*.
 - 10.2 If the front cover plate on the countershaft is leaking, replace the cover plate. Apply liquid gasket (Loctite 518) to the new cover plate when installing it.

- 10.3 If the rear radial seal on the engine crankshaft is leaking, replace the rear radial seal. For procedures, see the engine manufacturer's manual.

11. Remove the chocks from the tires.

26-10 Mercedes-Benz Transmission Fluid Changing and Magnetic Plug Cleaning

Draining

1. Park the vehicle on a level surface. Apply the parking brakes and chock the rear tires.
2. Drain the transmission fluid. See [Fig. 19](#).

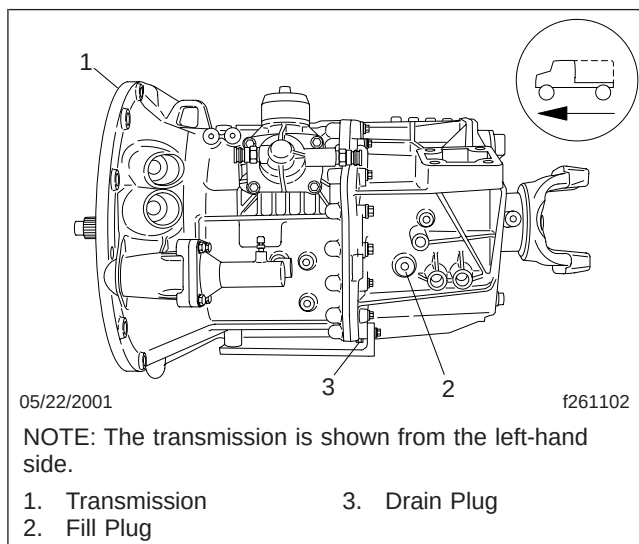


Fig. 19, MBT Transmission Drain and Fill Plugs

NOTE: Drain the transmission fluid while the transmission is warm.

- 2.1 Remove the magnetic drain plug from the bottom of the gear case.
- 2.2 Discard the aluminum gasket.
- 2.3 Catch the transmission fluid in a suitable container and dispose of it properly.
3. Clean the area around the fill plug.

4. Remove the fill plug from the side of the case. Discard the aluminum gasket.

NOTE: Use a piece of key stock, or any other convenient steel slug, to short the two magnetic poles and divert the magnetic field.

5. Clean the magnetic drain plug before installing it.
6. Install the drain plug (p/n A 124 997 01 32) and a new aluminum gasket (p/n N 00763 024105). Tighten the drain plug 42 lbf-ft (57 N·m).

Filling



CAUTION

Operating a manual transmission with the fluid level higher or lower than recommended can result in transmission damage. Do not overfill the transmission; overfilling will force transmission fluid out of the case through the main shaft openings.

1. Add transmission fluid until it is level with the lower edge of the fill opening. See [Fig. 19](#) for location of the fill plug and [Fig. 20](#) for correct level. See [Table 8](#) for approved transmission lubricants and [Table 9](#) for lubricant capacities.

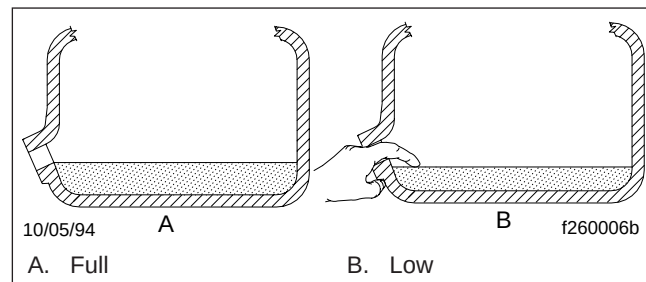


Fig. 20, Transmission Fluid Level Checking

MBT Transmission Lubricant Types	
Manufacturer	Type
Mobil	Mobiltrans SHC 50 (RN 2952 E-2)

Table 8, MBT Transmission Lubricant Types

MBT Transmission Lubricant Capacities	
Transmission Model	Refill Capacity * quarts (liters)
MBT660S-6O	9.5 (9.0)
MBT520S-6D	9.5 (9.0)

* Quantities listed are approximate. Fill the transmission until the lubricant is level with the bottom of the fill hole, with the vehicle in normal operating position.

Table 9, MBT Transmission Lubricant Capacities



CAUTION

Use only Mobiltrans SHC 50 (RN 2952 E-2) fluid. Do not mix fluid types. Adding RN 2952 E-5 fluid (used in Eaton and Meritor transmissions) could damage the radial seals.

2. Clean the fill plug before installing it.
3. Install the fill plug (p/n N000908 020001) and a new aluminum gasket (p/n N 00763 024105). Tighten the fill plug 42 lbf·ft (57 N·m).

Frame and Frame Components

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Frame and Frame Components

31

31-01 Frame Fastener Torque Checking

Because of "bedding in" (or seating), the frame fasteners must be torqued at the recommended intervals. These intervals apply to new vehicles, and to frame fasteners that have been removed and installed.

NOTE: For off-highway operations, retorque the frame fasteners the first 1000 miles (1600 km), then periodically, depending on the operating conditions.



CAUTION

Continued vehicle operation with insufficiently tightened fasteners could result in bracket or frame damage.

Typical frame fastener applications include front frame brackets, suspension brackets, spring brackets, fuel tank, exhaust and engine supports, frame crossmembers and gussets, and fifth wheel mounting brackets.

See **Group 00** of the *Business Class® Trucks Service Manual* for additional information on fasteners and torque values.

Tighten all Freightliner AirLiner suspension fasteners to the torque values in [Table 1](#). Also, tighten all suspension air line fittings and air lines.

Freightliner Airliner Suspension Torque Values		
Description	Size	Torque lbf·ft (N·m)
Leveling Valve Adjustment Nut	1/4-20	5 (7)
Leveling Valve Mounting Bolt Nuts	5/16-18	14 (19)
Air Spring Upper Mounting Locknuts	3/4-16	45 (61)
	1/2-13	23 (31)
Air Spring Lower Mounting Locknuts	1/2-13	55 (75)
Leaf Spring Mounting Eye Bolt Locknuts	3/4-16	270 (365)
Shock Absorber Upper Bracket Mounting Locknuts	5/8-11	125 (170)

Freightliner Airliner Suspension Torque Values		
Description	Size	Torque lbf·ft (N·m)
Air Spring Upper Mounting Bracket	5/8-11	125 (170)
Spring Hanger Mounting Locknuts	3/4-10	210 (285)
Lateral Control Rod Nut	5/8-11	185 (136)

Table 1, Freightliner AirLiner Suspension Torque Values

Tighten Hendrickson suspension fasteners to the torque values given in [Table 2](#).

Hendrickson Suspension Torque Values		
Description	Size	Torque lbf·ft (N·m)
Top Pad to Spring Aligning Setscrew (RT/RTE)	—	100-150 (135-200)
Top Pad Nut (RT/RTE)	—	275-400 (375-542)
U-Bolt Locknut (U/UE)	7/8-14	237-302 (321-409)
Spring Pin Locknut	1/2-13	45-63 (61-85)
Torque Rod Straddle Mount Nut	5/8-11	190 (260)
Torque Rod Stud Locknut	1-1/4-12	175-225 (235-305)
Saddle Cap Stud	7/8-14	55-65 (75-90)
	3/4-16	
Saddle Cap Locknut (RT/RTE)	7/8-14	225-275 (305-373)
Saddle Cap Locknut (U/UE)	3/4-16	125-145 (169-197)
Adapter-Type Beam End Locknut	3/4-16	210-240 (285-325)
Spring Center Bolt	7/16-20	50-60 (70-80)
	1/2-20	65-75 (90-100)
	1/2-13	
Rebound Spacer Locknut	1/2-13	38-45 (51-61)
Spring Alignment Clip	—	15 (20)

Hendrickson Suspension Torque Values		
Description	Size	Torque lbf·ft (N·m)
Fore and Aft Torque Rod Mount Nut	—	95 (130)

Table 2, Hendrickson Suspension Torque Values

All Hendrickson beam end fasteners must maintain their torque values to firmly clamp the rubber bushing inner metal tubes to the beam hanger legs.

WARNING

Insufficient beam end fastener torque could cause the beam to separate from the axle, and result in loss of vehicle control.

Tighten the nut (see [Fig. 1](#)) to the torque value in [Table 2](#). Do not over-torque.

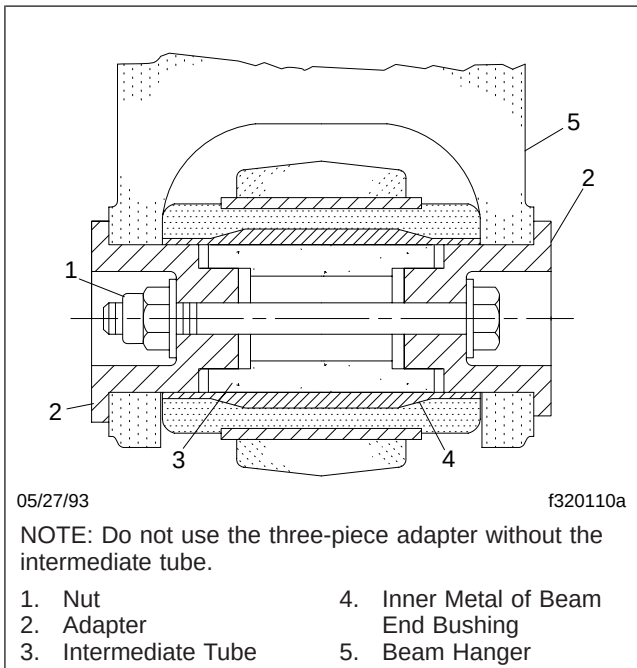


Fig. 1, Three-Piece Adapter-Type Beam End Connection

Check the drive-axle-flange fasteners ([Fig. 2](#)) for tightness. Tighten the fasteners as follows:

Tighten 1/2-inch drive-axle stud nuts (with or without dowels) 75 to 115 lbf·ft (102 to 156 N·m), and tighten 5/8-inch drive-axle stud nuts 150 to 230 lbf·ft (203 to 312 N·m).

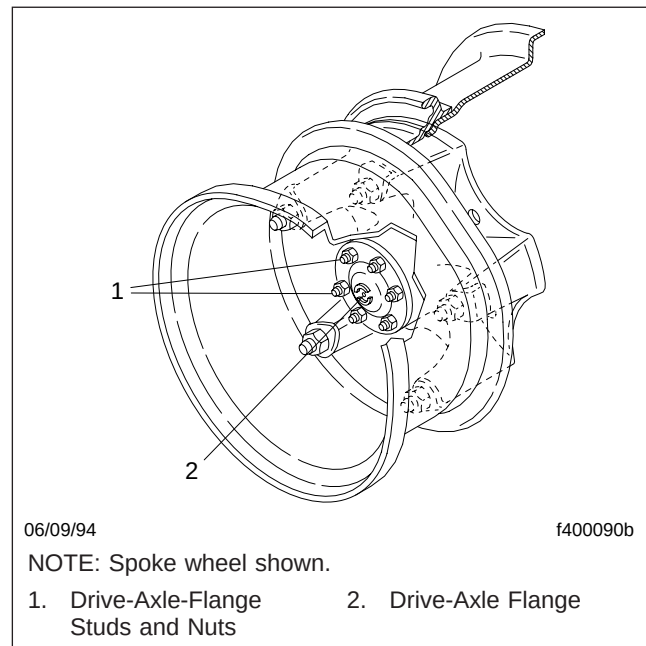


Fig. 2, Drive-Axle Flange

31-02 Fifth Wheel Inspecting

WARNING

All fifth wheel maintenance, adjustment, and rebuilding must be done only by a qualified mechanic. Improper or incomplete procedures could result in possible disengagement of the trailer from the tractor, causing serious damage or injury.

Wear safety goggles during removal, installation, and rebuilding. Failure to do so can result in personal injury, due to parts ejecting under spring compression.

Fontaine

Disconnect the tractor from the trailer. For instructions, see **Chapter 10** of the *Business Class® Trucks Driver's Manual*. Thoroughly steam clean the fifth wheel, then make the following checks:

1. Look for cracks in the fifth wheel assembly, mounting brackets, and mounting parts.

2. Check moving parts for wear or damage.
3. Test the safety lock latch for operation.
4. Check for loose nuts and bolts in the fifth wheel and in the mounting.
5. Check that all springs are securely fastened and not deformed.
6. Check wedge adjustment.
 - 6.1 Open the kingpin lock and insert a 2 inch (51 mm) diameter shaft vertically.
 - 6.2 Release the lock by tripping the release latch at the bottom of the throat.
 - 6.3 Adjust the wedge stop at the end of the wedge to approximately 1/4 inch (6 mm) clearance.
7. If you observe any problems doing the previous steps, correct them immediately. For instructions, see **Group 31** of the *Business Class® Trucks Service Manual*.
8. Replace cracked, worn, or damaged parts with new parts. Replace loose mounting bolts with 5/8-11 SAE grade 8 bolts, grade C nuts, and hardened washers. *Do not* reuse bolts, nuts, and washers on fifth wheel mountings.

Holland

Disconnect the tractor from the trailer. For instructions, see **Chapter 10** of the *Business Class® Trucks Driver's Manual*. Thoroughly steam clean the fifth wheel, then inspect for:

1. Loose nuts or broken bolts on the fifth wheel assembly.
2. Cracks or wear on the mounting bolts.
3. Improper locking action; cracks or wear on the jaw locking mechanism.
4. Gouges or wear on the fifth wheel top plate.
5. Fatigued or cracked welds.
6. Replace cracked, worn, or damaged parts with new parts. Replace loose mounting bolts with 5/8-11 SAE grade 8 bolts, grade C nuts, and hardened washers. *Do not* reuse bolts, nuts, and washers on fifth wheel mountings.
7. If you observe any problems doing the previous steps, correct them immediately. For instructions,

see **Group 31** of the *Business Class® Trucks Service Manual*.

31-03 Fifth Wheel Lubricating

Fontaine

Use a multipurpose extreme pressure (EP) chassis grease, and lubricate all moving parts on the fifth wheel. When lubricating the top plate at the grease fittings for the bracket bearing area, tilt the top plate forward and backward to evenly distribute the grease. Using a pry tool, separate the jaw and wedge and lubricate the serrations using a brush to distribute the grease. On slide-mount applications, lubricate the slide rail and tapered wedges for smooth operation.

Once the fifth wheel's moving parts are lubricated, apply a liberal coating of grease to the top plate and the trailer kingpin plate.

Holland

Lubricate all moving parts with oil or a light grease. Lubricate the fifth wheel top plate with a waterproof or multipurpose chassis grease.

Once the moving parts of the fifth wheel are lubricated, apply a heavy coat of grease to the top plate by direct application. On slide-mount applications, lubricate the baseplate rails and the plungers for smooth operation.

31-04 Holland Fifth Wheel Sliding Mechanism Inspecting

1. Loosen the locking plunger jam nut and turn the adjusting bolt out (counterclockwise). See **Fig. 3**.
2. Disengage and engage the locking plungers. Check that the plungers are securely seated without binding. If the locking plungers do not operate properly, see **Group 31** of the *Business Class® Trucks Service Manual* for adjustment procedures.
3. Turn the adjusting bolt in (clockwise) until it contacts the rack. Turn the adjusting bolt an additional 1/2 turn, then tighten the locking nut securely.

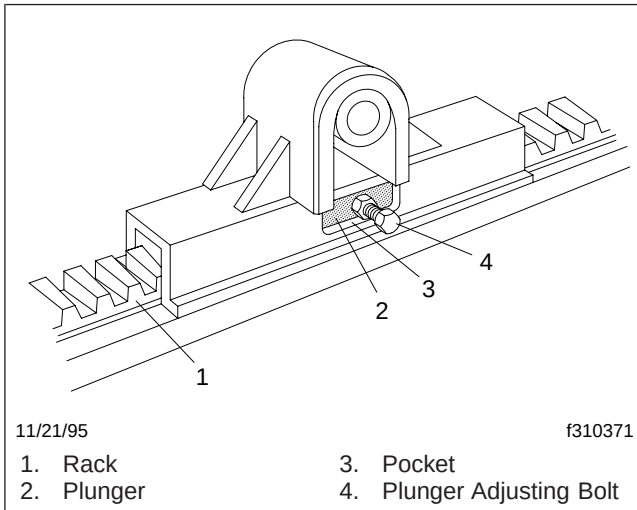


Fig. 3, Locking Plungers

Suspension

32

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32-01 Suspension Inspecting

Freightliner Spring Front and Rear Suspension Spring Assemblies Inspecting

Inspect the front and rear suspension spring assemblies for pitted, cracked, broken, or abnormally bent leaves and extreme rust. If any of these conditions exist, replace the spring assembly. See **Group 32** of the *Business Class® Trucks Service Manual* for instructions.

WARNING

Do not replace individual leaves of a damaged leaf spring assembly; replace the complete spring assembly. Visible damage (cracks or breaks) to one leaf causes hidden damage to other leaves. Replacement of only the visibly damaged part(s) is no assurance that the spring is safe. On front spring assemblies if cracks or breaks exist in the two top leaves, a loss of vehicle control could occur. Failure to replace a damaged spring assembly could cause an accident resulting in property damage, serious personal injury or death.

IMPORTANT: On multi-leaf suspensions, closely inspect each component of the leaf spring assemblies, including the brackets, U-bolts, and related parts.

Freightliner Spring Rear Suspension Spring Brackets and Equalizer Brackets Inspecting

Inspect the forward and rear spring brackets, equalizer brackets, and the wear pads, for wear, cracks, and other damage. If any of these conditions exist, replace the damaged bracket(s) and wear pad(s). See **Group 32** of the *Business Class® Trucks Service Manual* for instructions.

WARNING

Failure to replace the forward spring brackets, equalizer brackets, or rear spring brackets if they are worn, cracked, or otherwise damaged could result in progressive damage to and eventual breakage of the bracket. This could cause a loss

of vehicle control resulting in property damage, serious personal injury or death.

Freightliner Spring Tandem-Axle Suspension Crossmember and Gussets Inspecting

Inspect the tandem-axle frame crossmember and gussets for wear, cracks, and other damage. If any of these conditions exist, replace the damaged parts. See **Group 31** of the *Business Class® Trucks Service Manual* for instructions. Check all fasteners for tightness; see **Group 00** in this manual for torque values.

CAUTION

Failure to replace the suspension crossmember or gussets if they are cracked, worn, or otherwise damaged could result in damage to the vehicle chassis.

Freightliner Spring Shock Absorber Checking

Make sure that the shock absorber brackets are tight, and that the shock absorber is not striking or rubbing on the frame or some other part of the chassis. See **Fig. 1**. Check the rubber mounting bushings and replace if worn. Inspect the shock absorber for oil leakage.

If the shock absorber is worn or damaged, replace it with a new one.

Freightliner Spring (Tandem) Radius Rod Bushing Checking

1. Without detaching the torque arms, attempt to move (by hand) each of the radius-rod ends up, down, in, and out. If there is any movement, replace the torque arm.
2. Inspect the weld seams between the torque arm tube and the shorter bushing tubes. If there are cracks, replace the torque arm. Do not weld the torque arm for any reason.
3. Inspect the rubber bushing ends. See **Fig. 2**. Replace the torque arm for any of the following reasons:

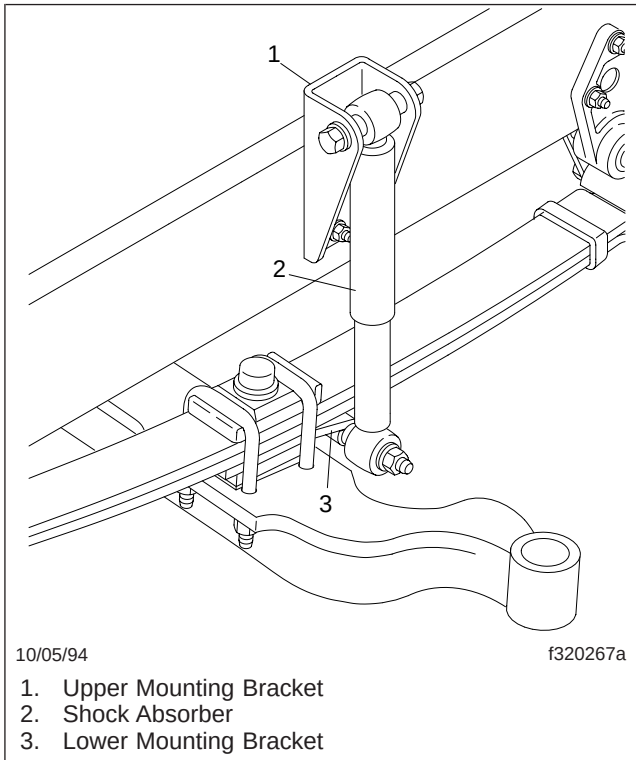


Fig. 1, Shock Absorber Installation (front suspension shown)

- There are gaps between the rubber bushing and the pin or the outer steel sleeve.
- Either bushing end contacts a torque arm pin mounting bolt.
- There are cracks in the bushing.
- Part of the rubber bushing extends beyond the outside diameter of the outer bushing sleeve.

Freightliner Spring (Tandem) Equalizer Bushing Checking

1. Block the frame up enough to take the weight of the chassis off of the springs. Attempt to move the equalizer up and down, by using a pry bar between the top of the equalizer and the top of the equalizer bracket. Apply hand pressure only. See Fig. 3. If movement at the center of the equalizer exceeds 1/8 inch (3 mm), replace the equalizer bushings.

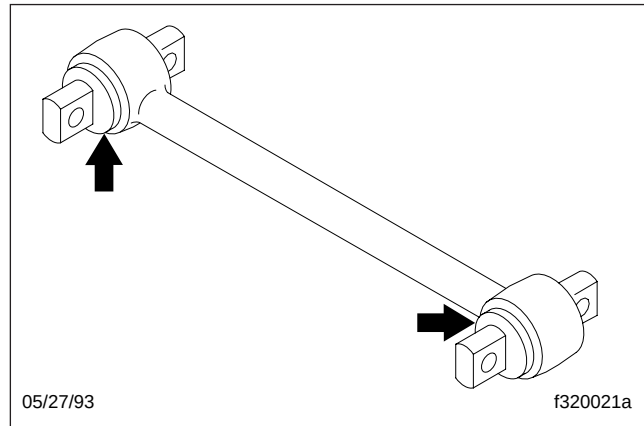


Fig. 2, Torque Arm Bushings

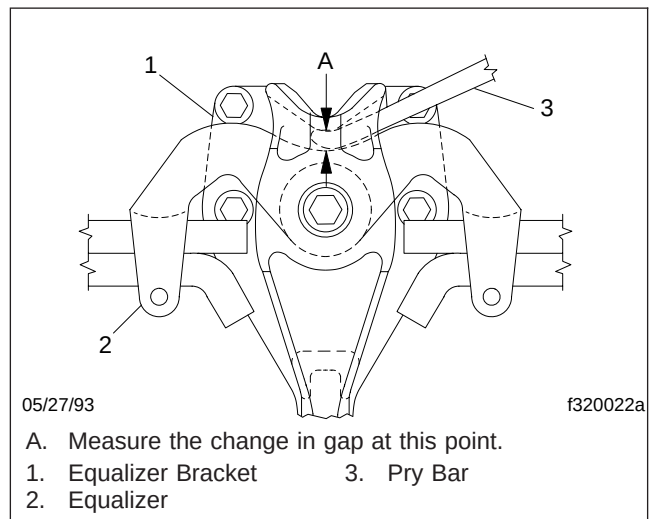


Fig. 3, Side View of the Equalizer

2. With the vehicle unloaded, attempt to move the equalizer side to side using a pry bar between the equalizer and frame rail. Apply hand pressure only. See Fig. 4. If clearance between the equalizer assembly and any frame component or fastener is less than 1/8 inch (3 mm), replace the equalizer bushings.

Freightliner AirLiner Component Clearance Checking

Check that the air line support brackets are positioned so the air lines do not rub against anything. Reposition any configurations that could contact and result in friction and wear. There must be at least 1 inch (25 mm) clearance around the rubber air spring

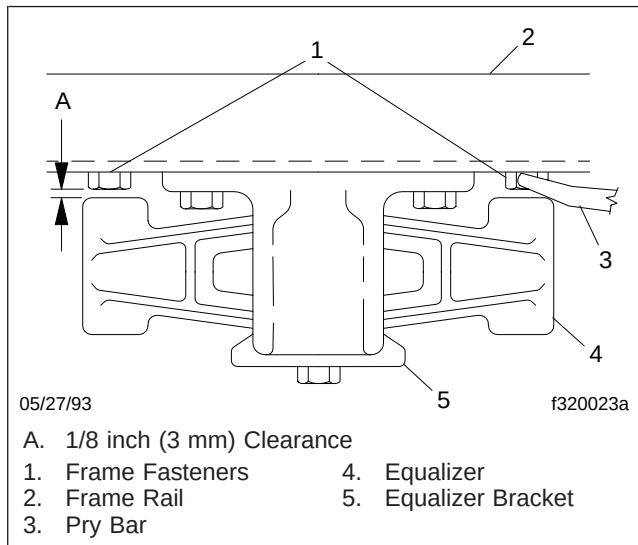


Fig. 4, Top View of the Equalizer

when inflated. If the clearance is less than 1 inch (25 mm), relocate the obstructing parts.



CAUTION

Failure to relocate obstructing parts could result in damage to the air spring.

Freightliner AirLiner Component Inspecting and Operation Checking



WARNING

Inspect the components and check their operation as described below. Failure to perform these inspections and checks could result in separation of worn suspension components and loss of vehicle control resulting in property damage, serious personal injury or death.

1. Chock the front tires. Raise the rear of the vehicle so the tires just clear the ground and the suspension is fully extended. Place safety stands under the vehicle frame.
2. Squeeze all air springs to check for complete deflation. If any air springs remain partially or fully inflated, see **Group 32** of the *Business Class® Trucks Service Manual*.
3. Inspect each air spring for wear at its connection to its pedestal. Replace any worn air springs; for

instructions, see **Group 32** of the *Business Class® Trucks Service Manual*.

4. Check the axle connection welds (beam-seat to equalizing-beam) and axle-adapter to axle for cracks. If welds are cracked, grind them out and reweld the parts.
5. Move the axle up and down while checking for signs of looseness due to worn parts at the front pivot connections. Replace any worn parts by following the procedures in **Group 32** of the *Business Class® Trucks Service Manual*.
6. Inspect the shock absorbers for oil leaks and worn rubber bushings. Replace the shock absorbers and/or rubber bushings if wear or damage is noted. For instructions, see **Group 32** of the *Business Class® Trucks Service Manual*.
7. Remove the safety stands and lower the rear of the vehicle to the ground. Run the engine until air pressure of at least 100 psi (689 kPa) is maintained throughout the system.
8. Check that all air springs are inflated. If the air springs do not inflate, see **Group 32** of the *Business Class® Trucks Service Manual* for possible causes and corrections.

Freightliner AirLiner Control Rod Checking

1. Without disconnecting the control rods, attempt to move (by hand) each of the control rod ends up, down, in, and out. If there is any movement, examine the control rods for wear or damage. Replace if necessary.
2. Inspect the rubber bushings for cracks or cuts.
3. Check for any shifting of the barpin.
4. Check for cracks in the metal components and welds.

NOTE: The Freightliner AirLiner Suspension is manufactured at numerous weight ratings up to 46,000 pounds. The control rod on the 46,000-pound-rated suspension is larger, and is fastened differently than on other applications; see **Group 32** of the *Business Class® Trucks Service Manual* for removal and installation information.

Hendrickson Suspension Inspecting

Inspect the suspension assembly for wear, cracks, and damage to its components. Replace the component(s) if any wear, cracks, or damage exists. For instructions, see **Group 32** of the *Business Class® Trucks Service Manual*. Check all fasteners for tightness.

Check for distorted or frayed rubber at the beam end bushings. If the bushings are damaged, replace them.

Check that the ends of the equalizer beam are not lower in the beam hanger.

If the equalizer beam ends appear lower, use a jack to raise each beam end, and check for movement of the inner metal of the rubber end bushing (see [Fig. 5](#)). Movement cannot be corrected by tightening the fastener, because parts could be damaged. If there is movement, replace the rubber end bushings and all connecting parts.

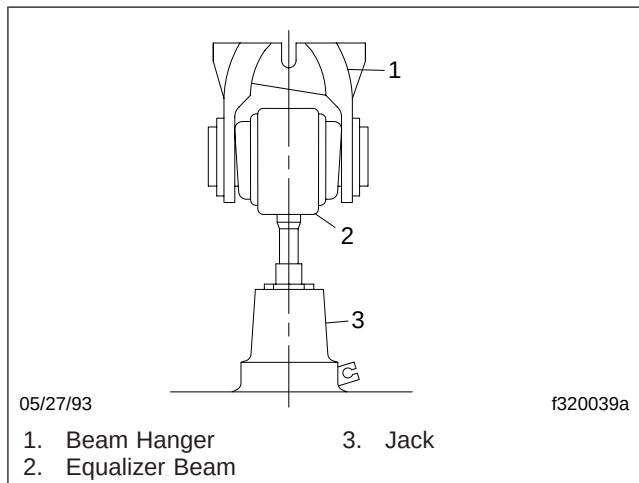


Fig. 5, Raising the Beam End

After repairs to the suspension, check the fastener torque after the vehicle has been in service for 2500 miles (4000 km). Tighten the adapter-type beam end connection nut (see [Fig. 6](#)), 210 to 240 lbf·ft (285 to 325 N·m). Do not over-torque.

WARNING

Insufficient beam end fastener torque could cause the beam to separate from the axle. This will

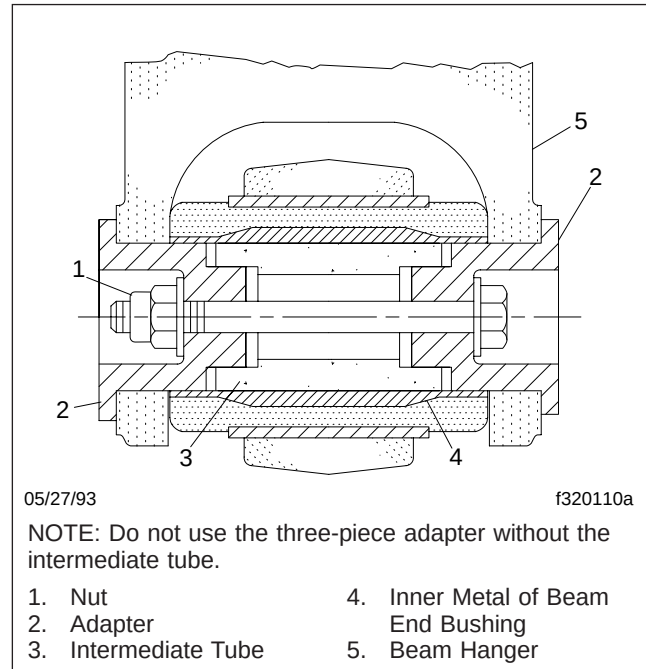


Fig. 6, Three-Piece Adapter-Type Beam End Connection

cause loss of vehicle control resulting in property damage, serious personal injury or death.

Hendrickson Leaf Spring Assembly Inspecting (See Fig. 7)

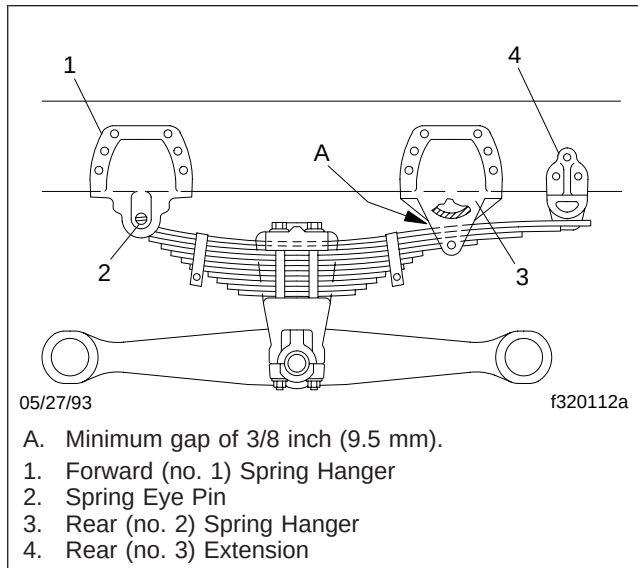


Fig. 7, Unloaded RTE or UE Spring Suspension

1. Inspect the spring hangers for wear of the spring pin holes, cams, and the spring hanger legs.
2. If equipped with the "RTE" or "UE" series, the gap between the rear (No. 2) spring hanger and the top spring leaf should measure at least 3/8 inch (9.5 mm) in an unloaded condition.

If the measurement is less than 3/8 inch (9.5 mm), install new rear (No. 3) extension hangers. Lubricate the bolt threads with SAE 20 oil. Tighten the 1/2–13 locknuts with hardened washers 85 lbf·ft (115 N·m).

3. Inspect the spring leaves for cracks, gouges, wear, or abnormal bends. The no. 1 main and no. 2 wrapper spring leaves (the top two spring leaves) may be individually replaced. If equipped with the "RTE" or "UE" series suspension, the nos. 1, 2, and 3 spring leaves (the top three spring leaves) may be individually replaced. If a spring leaf is damaged below these numbers in a pack, replace the spring assembly. In addition, replace both spring assemblies to ensure even spring deflection.

Hendrickson Radius Rod Bushing Checking

1. Without detaching the torque arms, attempt to move (by hand) each of the radius-rod ends up, down, in, and out. If there is any movement, replace the torque arm.
2. Inspect the rubber bushing ends. Replace the torque arm if there are gaps between the rubber bushing and the pin or the outer steel sleeve, if either bushing end contacts a torque arm pin mounting bolt, if there are cracks in the bushing, or if part of the rubber bushing extends beyond the outside diameter of the outer bushing sleeve.

Chalmers Suspension Inspecting

Chock the front wheels to prevent the vehicle from moving. Place the transmission in neutral, and release the spring or driveline brakes before inspecting the rear suspension.

Power wash the Chalmers rear suspension, or clean it with a hard-bristle brush before performing a visual inspection.

1. Visually inspect the rubber bushings for cracks or other damage.

Try to move the torque rod ends using your hands only, and check for any free-play. If free-play is felt, replace the torque rod end bushing. Do not use a pry bar to check for free-play. Use of a pry bar may lead to premature bushing replacement. See **Group 32** of the *Business Class® Trucks Service Manual* for replacement instructions.

2. If equipped with optional shock absorbers, check for worn, broken, or damaged shock bushings, heavy corrosion on the shock absorber body, or fluid leaking from the shock absorber. Replace the shock absorbers if any of these conditions are found; see **Group 32** of the *Business Class® Trucks Service Manual*.
3. Lift the rear of the vehicle and support the frame on jack stands to unload the suspension components. The vehicle is lifted high enough when the beam ends are off of the saddles. All jack stands must be of sufficient strength and rigidity to safely support the vehicle. Do not perform any work on or around a vehicle that is supported solely by a lifting device.

Visually inspect the walking beam for cracks, or other damage. If damage is found, see **Group 32** of the *Business Class® Trucks Service Manual* for replacement instructions.

Keep the vehicle supported by the jack stands for the next operation.

4. Manipulate the walking beam so that a micrometer, vernier, or dial caliper can be used to determine the wear area thickness on the bottom face. See **Fig. 8**. Measurements should be taken a minimum of 1/2 inch (13 mm) from the beam flange edges to eliminate any edge wear that may have occurred. Subtract the wear area thickness (**Fig. 8**, Ref. B), from the non-wear area thickness (**Fig. 8**, Ref. A), to determine the amount of wear.

If the beams show any wear greater than the allowable 0.062-inch (1.5-mm) wear, a Chalmers wear plate must be installed, or the walking beam must be replaced. See **Group 32** of the *Business Class® Trucks Service Manual* for repair and replacement instructions.

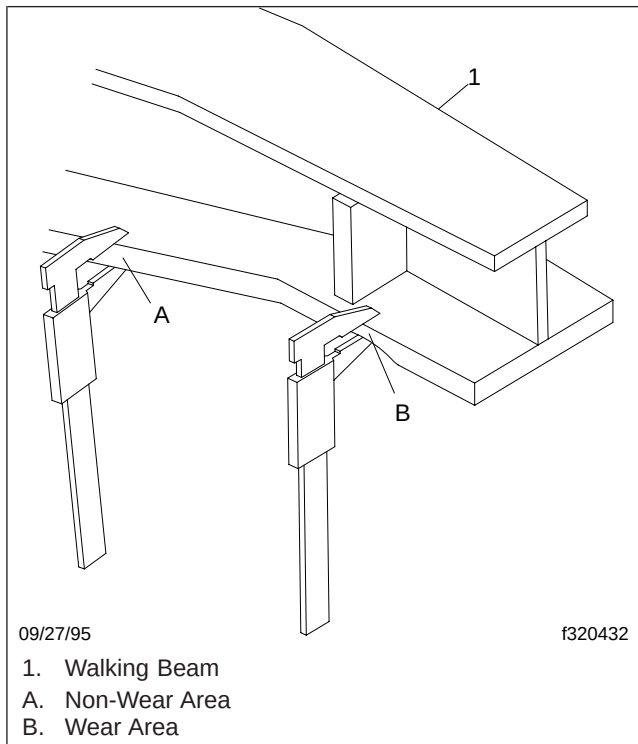


Fig. 8, Walking Beam End Wear Thickness

5. Rotate the restrictor cans 360 degrees and visually inspect the cans for cracks, severe corrosion, and distortion. If any of these conditions are present, or the restrictor can is missing, replace the restrictor can. See **Group 32** of the *Business Class® Trucks Service Manual* for replacement instructions.

! WARNING

Replace all cracked or missing restrictor cans. Failure to do so could lead to loss of vehicle control, which could result in property damage, serious personal injury or death. Vehicles with cracked or missing restrictor cans may be driven slowly to the nearest workshop for restrictor can replacement.

6. Remove the jack stands, then lower the vehicle. Check that the spring, or driveline brake is applied, then remove the wheel chocks.

Reyco 79KB Suspension Visual Inspection

The Reyco 79KB suspension requires minimal maintenance. To provide trouble-free operation in over-the-road applications, do the following visual inspection.

1. Park the vehicle on level ground. Apply the parking brakes, and chock the tires.
2. Check that the torque rod clamps are directed away from the spring to prevent possible interference during operation. See **Fig. 9**.
3. Check the fit of springs to hangers to ensure good ride characteristics.
4. Check for elongated holes in the suspension components. See **Group 32** of the *Business Class® Trucks Service Manual* for proper repair procedures.
5. Check bushing condition. Replace any bushing that is worn, cracked, dry-rotted, or otherwise damaged. See **Group 32** of the *Business Class® Trucks Service Manual* for removal and installation instructions.
6. Check tire condition. If abnormal tire wear is found, check and replace all worn or damaged components, and check suspension alignment. See **Group 32** of the *Business Class® Trucks Service Manual* for component removal and in-

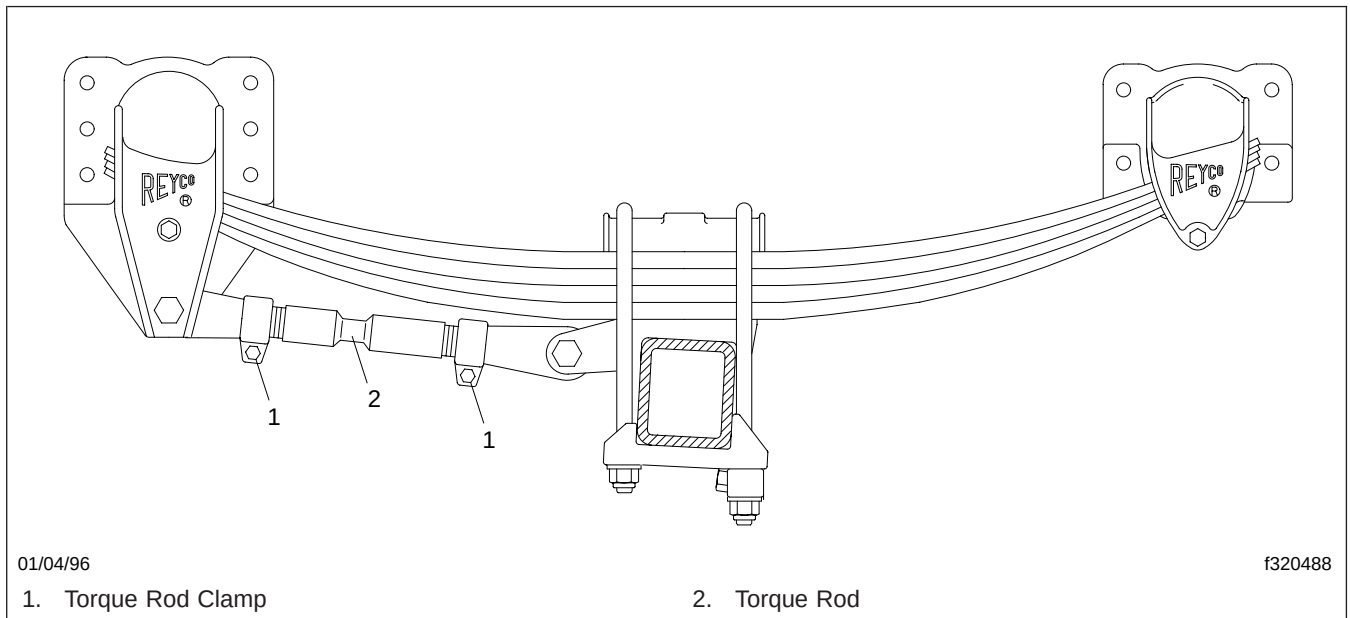


Fig. 9, Reyco 79KB Torque Rod Clamp Position

stallation procedures, and for suspension alignment instructions.

Reyco 79KB Fastener Torque Check

Check the U-bolt nuts, hanger mounting bolts, torque rod clamp nuts, and the spring retainer bolts for proper fastener torque.

1. Park the vehicle on level ground. Apply the parking brakes, and chock the tires.
2. Use a click-type torque wrench to check that U-bolt nuts are tightened 400 to 450 lbf·ft (540 to 610 N·m).
3. Use a click-type torque wrench to check that spring hanger bolts are tightened 190 lbf·ft (258 N·m).
4. Use a click-type torque wrench to check that the 5/8-inch torque rod clamp nuts are tightened 125 to 150 lbf·ft (170 to 203 N·m).
5. Use a click-type torque wrench to check that the two end-nuts for each torque rod are tightened 400 to 450 lbf·ft (540 to 610 N·m).
6. Use a click-type torque wrench to check that spring retainer bolts are tightened 60 to 80 lbf·ft (81 to 109 N·m).

32-02 Suspension Lubricating

Freightliner Spring Front Suspension

Wipe all dirt from the grease fittings at the forward spring pin and the spring shackle pins; then apply multipurpose chassis grease with a pressure gun until the old grease is forced out.

Freightliner Spring Rear Suspension Single Axle

Lubricate the spring pin by applying multipurpose chassis grease at the grease fitting. See Fig. 10. Lubricate with a grease gun until grease appears at the base of the fitting.

Tandem Axle

CAUTION

If the equalizer cap and tube assembly is equipped with a nonrelief grease fitting, excessive lubrication can damage the bushings.

Lubricate the equalizer cap-and-tube assembly bushings by applying multipurpose chassis grease at the pressure-relief grease fitting. See Fig. 11. Lubricate

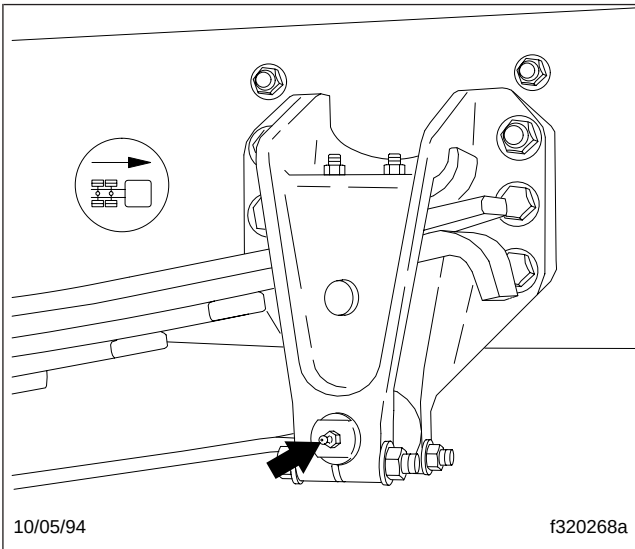


Fig. 10, Forward Spring Bracket Spring Pin Grease Fitting

with a hand gun or pressure gun until grease is forced out from the base of the pressure-relief fitting.

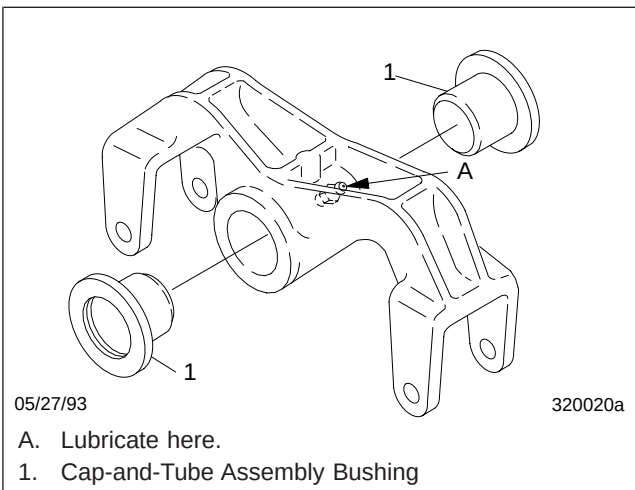


Fig. 11, Equalizer Assembly Lubrication

Hendrickson Equalizer Beam End Bushings and Rubber Center Bushings

No lubrication is required for the equalizer beam end bushings or equalizer beam rubber center bushings.

Hendrickson Spring Eye Pins, "RT," "RTE," "U," AND "UE" Series

Apply multipurpose chassis grease at the spring eye pin grease fitting (located on the inboard side of the spring eye pin) until clean grease appears at both ends of the spring eye pin.

32-03 U-Bolt Torque Checking

Check the U-bolt torque of both the front and rear axles (where applicable).



CAUTION

Failure to retorque the U-bolt nuts could result in spring breakage and abnormal tire wear.

1. Park the vehicle on a flat surface and apply the parking brakes. Chock the tires to prevent the vehicle from moving.
2. Check the U-bolt torque in a diagonal pattern. Set a click-type torque wrench to the highest torque value for the fastener being checked. See [Table 1](#) for U-bolt torque specifications. Turn the wrench in a clockwise motion (looking up) until the torque wrench clicks.
3. Remove the chocks.

U-Bolt Torque Values		
Description	Size	Torque lbf·ft (N·m)
Spring Assembly U-Bolt High Nuts	5/8–18	Stage 1: Hand Tighten Stage 2: 60 (81)* Stage 3: 200 (271)* Stage 4: 180 to 230 (245 to 313)*
	3/4–16	Stage 1: Hand Tighten Stage 2: 60 (81)* Stage 3: 200 (271)* Stage 4: 270 to 330 (367 to 449)*
	7/8–14	Stage 1: Hand Tighten Stage 2: 60 (81)* Stage 3: 200 (271)* Stage 4: 420 to 500 (571 to 680)*
	1–14	Stage 1: Hand tighten Stage 2: 60 (81)* Stage 3: 200 (271)* Stage 4: 520 to 600 (707 to 816)*

* Tighten in a diagonal pattern as shown in Fig. 12.

Table 1, U-Bolt Torque Values

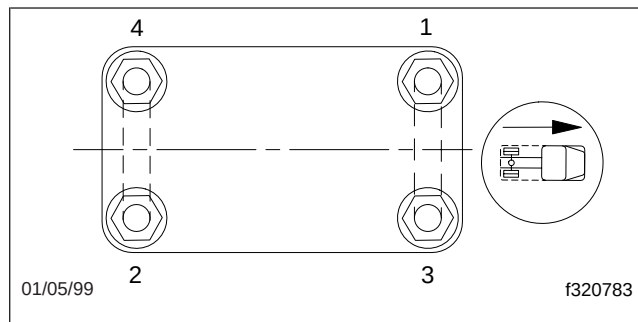


Fig. 12, Tightening Pattern for U-Bolt High Nuts

Title of Maintenance Operation (MOP)	MOP Number
All-Axle Alignment Checking	33-04
All-Wheel-Drive Front Axle Oil Changing	33-06
All-Wheel-Drive Front Axle Oil Level Checking	33-05
Knuckle Pin Lubricating	33-01
Tie-Rod End Inspecting	33-02
Tie-Rod End Lubricating	33-03

33-01 Knuckle Pin Lubricating

Hold a pressure gun on each fitting until fresh grease appears. See **Fig. 1**. This will ensure that all the old contaminated grease has been forced out. It is not necessary to exceed 4000 psi (27 560 kPa). The best distribution of new lubricant and the best purging of old lubricant occurs when about 4000 psi (27 560 kPa) pressure is applied at the grease gun nozzle. Using a 40 to 1 booster, the air should be limited to 100 psi (689 kPa); using a 50 to 1 booster, the air should be limited to 80 psi (551 kPa). Higher or lower pressures are not recommended.

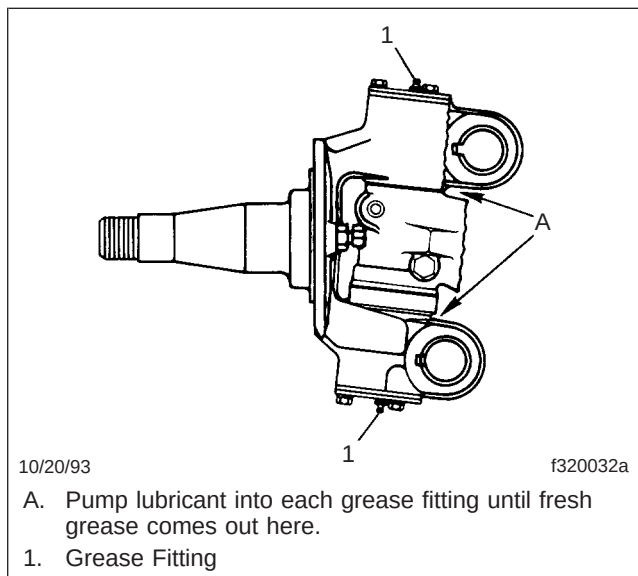


Fig. 1, Meritor Front Axle

When lubricating knuckle pin bushings for Initial Maintenance, raise the front axle until the front tires are off the ground. Wipe the lube fittings clean, and slowly feed multipurpose chassis grease (NLGI grade 1 or 2) into each bushing area while turning the wheels from extreme right to left and back again (lock to lock). This will eliminate small air pockets and improve grease distribution.

Lower the tires to the ground, and regrease both top and bottom bushings until new grease is seen at the seal on the bushing opposite the fittings. The grease seal will accept the grease pressure without damaging the seal, and is designed to have grease pumped out through it during lubrication. Even if grease leaks out around the top or bottom plate gasket, continue

pumping until new grease is seen at the seal on the bushing opposite the grease fitting.

When lubricating knuckle pin bushings at M1 through M5, do not raise the front axle. Wipe the lube fittings clean, and apply multipurpose chassis grease until new grease is seen at the grease seal on the bushing opposite the fittings. The grease seal will accept the grease pressure without damaging the seal, and is designed to have grease pumped out through it during lubrication. Even if grease leaks out around the top or bottom plate gasket, continue pumping until new grease is seen at the seal on the bushing opposite the grease fitting.

33-02 Tie-Rod End Inspecting

1. Shake the cross-tube. Movement or looseness between the tapered shaft of the ball and the cross-tube socket members means that the tie-rod end assembly must be replaced.
2. The threaded portion of the tie-rod end assembly must be inserted all the way into the cross-tube split, for adequate clamping. See **Fig. 2**. Replace the parts if this cannot be done. For instructions, see the axle manufacturer's service manual.
3. Check the tie-rod end nut and clamp nut torques. Tighten the tie-rod end nut 100 lbf·ft (136 N·m), and tighten the clamp nut 40 to 55 lbf·ft (54 to 75 N·m).

33-03 Tie-Rod End Lubricating

Wipe the tie-rod end grease fittings clean, then pump multipurpose chassis grease (NLGI grade 1 or 2) to the tie-rod ends until all used grease is forced out and new grease appears at the ball stud neck.

33-04 All-Axle Alignment Checking

Drive Axle Alignment Checking

Check the axle alignment, parallelism, and thrust angle measurements for the rear drive axles. Use the applicable procedure and specifications in **Group 35** of the *Business Class® Trucks Service Manual*.

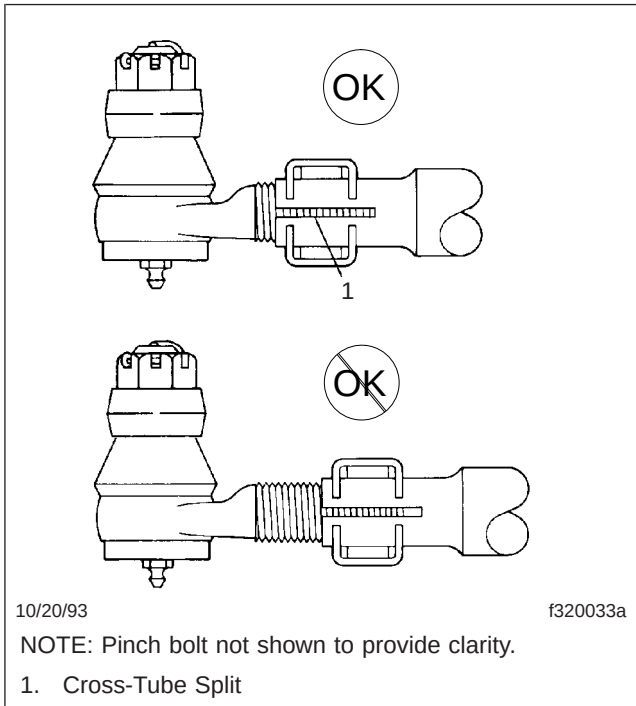


Fig. 2, Tie-Rod End Adjustment

Toe-In Checking, Front Axle

See **Group 33** of the *Business Class® Trucks Service Manual* for wheel alignment procedures.

33-05 All-Wheel-Drive Front Axle Oil Level Checking

1. On all front-wheel-drive vehicles, check the oil level in the differential. See [Fig. 3](#).
 - 1.1 Remove the oil level check-and-fill plug, and make sure the oil level is even with the bottom of the bore.
 - 1.2 If needed, add oil until the differential is filled to the bottom of the bore.
 - 1.3 Install the oil level check-and-fill plug, and tighten it firmly.
2. On front-wheel-drive vehicles equipped with MT-17 axles, check the oil level in the hubs.
 - 2.1 The oil drain bore must be at the bottom in order to check the oil level. See [Fig. 4](#).

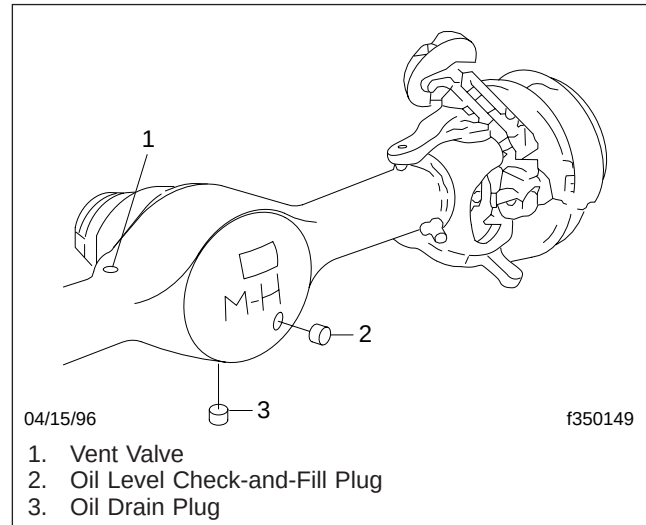


Fig. 3, All-Wheel-Drive Front Axle Differential

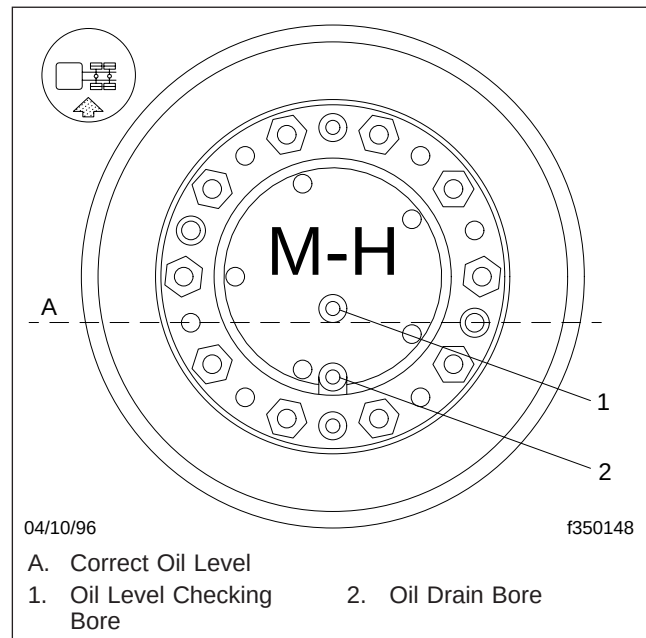


Fig. 4, All-Wheel-Drive Front Axle Hub, MT-17 Axles

- 2.2 Remove the plug from the oil level checking bore, and make sure the oil is level with the bottom edge of the bore.
- 2.3 If needed, add oil until each axle hub is filled to the bottom of the bore.
- 2.4 Install the plug in each oil level checking bore, and tighten it firmly.

33-06 All-Wheel-Drive Front Axle Oil Changing

1. Drive the vehicle until the axle oil is warmed, then park it, and chock the rear tires.
2. Jack up the front axle until the wheels are off the ground, then secure the axle on jack stands.
3. *On vehicles equipped with an MT-11 front axle, drain the oil from the differential.*

On vehicles equipped with an MT-17 front axle, drain the oil from the differential and the hubs.

- 3.1 Remove the oil-drain plug from the differential, and allow the oil to drain. See **Fig. 5**.

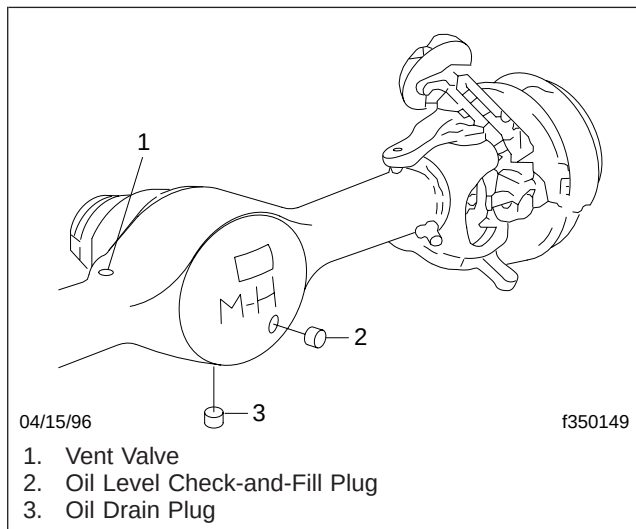


Fig. 5, All-Wheel-Drive Front Axle Differential

- 3.2 If applicable, rotate each wheel until the oil drain bore is at the bottom, then remove the drain bore plugs and allow the oil to drain into a suitable container. If needed use a bent piece of sheet metal to direct the draining oil so it doesn't splash on the tires.
4. Fill the differential and hubs (if applicable) with new oil.
 - 4.1 Install the drain bore plugs in each hub and the differential, then tighten the plugs firmly.
 - 4.2 Remove the plug from the oil level check bore in each hub and from the fill-and-check bore in the differential.
 - 4.3 Fill the hubs and differential until the oil level within each is even with the bottom of the fill-and-check bore.
 - 4.4 Install the check bore plug in each hub and install the fill-and-check plug in the differential. Tighten all the plugs firmly.
5. Lift the front axle off the jack stands, remove the stands and lower the vehicle to the ground. Then remove the chocks from the rear tires.

Title of Maintenance Operation (MOP)	MOP Number
Axle Breather Checking	35-02
Axle Lubricant Changing and Magnetic Plug Cleaning	35-03
Axle Lubricant Level Checking	35-01
Two-Speed-Axle Shift Unit Oil Changing	35-05
Two-Speed-Axle Shift Unit Oil Level Checking	35-04

35-01 Axle Lubricant Level Checking



CAUTION

Failure to keep the rear axle filled to the proper level, with the recommended lubricant, can result in rear axle damage.

1. Clean the oil fill hole plug, located in the carrier or the side of the axle housing, and the area surrounding it (**Fig. 1**). Remove the plug.

NOTE: Some Meritor axles have a small tapped and plugged hole located near and below the housing oil fill hole. This smaller hole is for the lubricant temperature sensor only, and must not be used as a fill or level hole.

2. With the vehicle on level ground, lubricant must be level with the bottom of the oil fill hole.

If low, add lubricant. See **Table 1** for approved axle lubricants and see **Table 2** or **Table 3** for axle capacities.

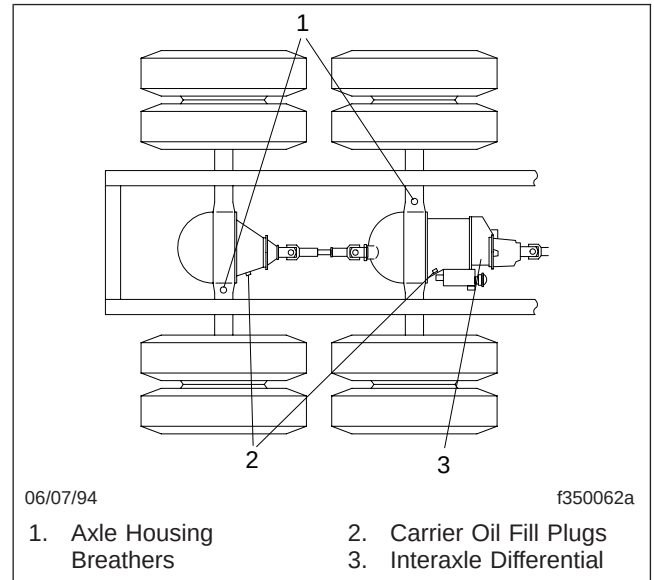


Fig. 1, Fill Hole Plug and Axle Housing Breather Locations

3. Install the fill hole plug, and tighten it 35 lbf·ft (47 N·m).

Rockwell Drive Axle Recommended Lubricant			
Recommended Lubricant Type	Ambient Temperature	Lubricant SAE Viscosity Grade	Rockwell Specification
Hypoid Gear Oil API Service Classification GL-5	+10°F (-12.2°C) and up *	85W-140	0-76-A
	-15°F (-26.1°C) and up *	80W-140	0-76-B
	-15°F (-26.1°C) and up *	80W-90	0-76-D
	-40°F (-40°C) and up *	75W-90	0-76-E
	-40°F (-40°C) to +35°F (+2°C)	75W	0-76-J
	-40°F (-40°C) and up *	75W-140	0-76-L
Synthetic Gear Oil	-40°F (-40°C) and up *	75W-90	0-76-N
	-40°F (-40°C) and up *	75W-140	0-76-M

* There is no upper limit on these ambient temperatures, but axle sump temperature must never exceed 250°F (121°C).

Table 1, Rockwell Drive Axle Recommended Lubricant

Rockwell Drive Axle Lubricant Capacities, Single Axles					
Axle Type	Axle Model	Capacity * pints (liters)	Axle Type	Axle Model	Capacity * pints (liters)
Single †	RS-13-120	16 (7.6)	Single †	RS-19-220	31 (14.7)
	RS-15-120	16 (7.6)		RS-21-145	32 (15.1)
	RS-15-210	16 (7.6)		RS-21-160	39.5 (18.7)
	RS-17-140	31 (14.7)		RS-21-230	39 (18.5)
	RS-17-145	33.6 (15.9)		RS-23-160	42 (19.9)
	RS-17-220	31 (14.7)		RS-23-240	45 (21.3)
	RS-19-145	34.4 (16.3)			

* Quantities listed are approximate and include 1 pint (0.5 liter) for each wheel end and with the drive pinion at 3 degrees.

† Single drive axles equipped with traction equalizers may require a "friction modifier" to correct a slip-stick condition, as described in the vehicle driver's manual. Rockwell's experience shows that the following additives perform adequately: Add Elco No. 2 Friction Modifier (1 ounce [30 ml] of additive for each 1 pint [0.5 liter] of lube capacity) or Lubrizol No. 797 or 762 (1 ounce [30 mL] of additive for each 1 pint [0.5 liter] of lube capacity).

Table 2, Rockwell Drive Axle Lubricant Capacities, Single Axles

Rockwell Drive Axle Lubricant Capacities, Tandem Axles	
Axle Model	Capacity * pints (liters)
RT-34-135	Forward 29.8 (14.1) Rear 34 (16.1)
RT-40-145	Forward 30.4 (14.4) Rear 34.4 (16.3)

* Quantities listed are approximate and include 1 pint (0.5 liter) for each wheel end and with the drive pinion at 3 degrees.

Table 3, Rockwell Drive Axle Lubricant Capacities, Tandem Axles

35-02 Axle Breather Checking

The axle housing breather (Fig. 1) must remain clean. Whenever the axle lubricant level is checked, check that the axle breather is open. Check more often under poor operating conditions. If the breather is plugged, clean or replace it as needed.

35-03 Axle Lubricant Changing and Magnetic Plug Cleaning

A regular schedule for changing the axle lubricant in a particular vehicle and operation can be accurately determined by analyzing oil samples taken from the axle at specified intervals or mileages. Lubricant suppliers frequently make their laboratory facilities avail-

able for determining the useful life of their product under actual service conditions. The final schedule that is recommended may, for economic reasons, be correlated with lubricant changes that are governed by climatic conditions and magnetic plug maintenance. Change lubricant type and viscosity as climatic temperatures demand, regardless of vehicle mileage or established change schedule.

The normal operating temperature of compounded lubricants during the summer season is about 160° to 220°F (71° to 104°C). The chemicals and additives that give these lubricants increased load-carrying capacity, oxidize faster at temperatures above 220°F (104°C), contributing to more rapid lubricant deterioration. For this reason, lubricants of this type, that operate continuously at high temperatures, must be changed more frequently.

CAUTION

Failure to change the axle lubricant at more frequent intervals, when adverse operating conditions require, could result in axle damage.

Axle Draining and Flushing

1. Remove the plug at the bottom of the housing and drain the lubricant while the unit is warm. Allow enough time for all the old lubricant to drain completely.

2. Flush the unit with clean flushing oil, then drain it completely.

IMPORTANT: Do not flush axles with solvent, such as kerosene.

3. Clean the drain plugs. For magnetic drain plugs, a piece of key stock or any other convenient steel slug may be used to short the two magnetic poles and divert the magnetic field.

NOTE: Meritor recommends using magnetic plugs with elements having a minimum pickup capacity of 2 pounds (1 kg) of low-carbon steel, in plate or bar form. Magnets will rapidly lose effectiveness as collected material bridges the gap between the two poles. Clean or change the plugs before this occurs. It may be necessary to clean or change the plugs one or more times between lubrication change intervals.

4. After cleaning the drain plugs, install and tighten them 35 lbf·ft (47 N·m).

Axle Filling

1. With the vehicle on a level surface, fill the axle housings to the bottom of the oil fill hole (in the carrier or housing) with lubricant. See [Table 1](#) for approved axle lubricants and see [Table 2](#) or [Table 3](#) for axle capacities.

NOTE: Meritor axles have a small tapped and plugged hole located near and below the housing oil fill hole. This smaller hole is for the lubricant temperature sensor only, and must not be used as a fill or level hole.

2. Install the fill hole plug, and tighten it 35 lbf·ft (47 N·m).
3. After filling the carrier and housing assembly with lubricant, drive the vehicle, unloaded, for 1 or 2 miles (2 or 3 kilometers) at speeds not to exceed 25 mph (40 km/h), to thoroughly circulate the lubricant throughout the assembly.

35-04 Two-Speed-Axle Shift Unit Oil Level Checking

CAUTION

Failure to keep lubricant at the specified level could cause damage to the axle shift unit.

1. Clean the oil fill hole plug in the shift unit housing cover, and the area surrounding it. See [Fig. 2](#). Remove the fill hole plug.

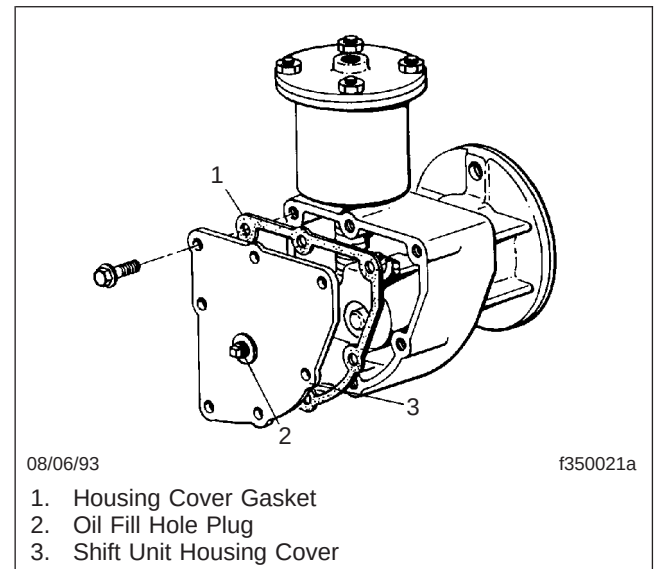


Fig. 2, Two-Speed-Axle Shift Unit

2. The lubricant level should be maintained at the bottom of the fill hole. If low, add the specified lubricant.

CAUTION

Before adding additional lubricant, make sure what type is currently in the axle shift unit. Do not mix engine oil and automatic transmission fluid, to prevent component damage.

IMPORTANT: When the vehicle operating temperatures are above 0°F (-18°C), use SAE 10 heavy-duty engine oil, API service classification SD (sulfated ash content must not exceed 1.85%). When the vehicle operating temperatures are below 0°F (-18°C), use one part of

kerosene to three parts of SAE 10 heavy-duty engine oil, API service classification SD (sulfated ash content must not exceed 1.85%). This cold-weather mixture can be safely used up to 32°F (0°C).

Commercially available automatic transmission fluid may be used in place of SAE 10 engine oil. Automatic transmission fluid can be used for all temperatures. Do not mix kerosene with automatic transmission fluid.

3. Apply a small amount of Loctite® 242, or equivalent sealant, to the threads of the fill hole plug. Install the fill hole plug finger-tight; then, using a wrench, tighten the plug 1-1/2 turns more.

5. Apply a small amount of Loctite 242, or an equivalent sealant, to the threads of the oil fill hole plug. Install the oil fill hole plug finger-tight; then, using a wrench, tighten the plug 1-1/2 turns more.

35-05 Two-Speed-Axle Shift Unit Oil Changing

1. Remove the shift unit housing cover ([Fig. 2](#)), and drain the old lubricant. Discard the housing cover gasket, and the old lubricant.
2. Thoroughly wash the axle shift parts and housing cover, and allow them to air dry.
3. Install the housing cover and a new housing cover gasket. Tighten the housing cover cap-screws 90 to 110 lbf·in (1020 to 1240 N·cm), then remove the oil fill hole plug from the cover.
4. Fill the shift unit housing through the oil fill hole until the specified lubricant is level with the bottom of the opening.

IMPORTANT: When the vehicle operating temperatures are above 0°F (-18°C), use SAE 10 heavy-duty engine oil, API service classification SD (sulfated ash content must not exceed 1.85%). When the vehicle operating temperatures are below 0°F (-18°C), use one part of kerosene to three parts of SAE 10 heavy-duty engine oil, API service classification SD (sulfated ash content must not exceed 1.85%). This cold-weather mixture can be safely used up to 32°F (0°C).

Commercially available automatic transmission fluid may be used in place of SAE 10 engine oil. Automatic transmission fluid can be used for all temperatures. Do not mix kerosene with automatic transmission fluid.

Title of Maintenance Operation (MOP)

MOP Number

Wheel Nut Checking. 40-01

40-01 Wheel Nut Checking

IMPORTANT: In addition to the maintenance interval in this manual, check the wheel nut torque the first 50 to 100 miles (80 to 160 km) of operation after a wheel has been removed and installed.

When checking wheel nuts on a dual disc assembly, remove one outer nut at a time, tighten the inner nut, then reinstall the outer nut. Repeat this procedure for all of the inner wheel nuts in the sequence shown in [Fig. 1](#), then tighten all of the outer wheel nuts in the same sequence.

CAUTION

Too little wheel nut torque can cause wheel shimmy, resulting in wheel damage, stud breakage, and extreme tire tread wear. Too much wheel nut torque can break studs, damage threads, and crack discs in the stud hole area.

See [Table 1](#), [Table 2](#), or [Table 3](#) for wheel nut torque specifications, and see [Fig. 1](#) for the tightening sequence.

Fastener Torque for 10-Hole Disc Wheel With Inner and Outer Locknuts			
Description	Nut Size	Wheel Manufacturer	Torque (dry threads) lbf·ft (N·m)
Front Wheel Nut	3/4-16, 1-1/8-16	Accuride	450-500 (610-680)
Rear Wheel Inner Nut	3/4-16	Accuride	450-500 (610-680)
Rear Wheel Outer Nut	1-1/8-16	Accuride	450-500 (610-680)
Wheel Stud Retainer Nut	3/4-16	Accuride	175-200 (235-270)

Table 1, Fastener Torque for 10-Hole Disc Wheel With Inner and Outer Locknuts

Fastener Torque for 8-Hole Disc Wheel With Cone Locknuts		
Description	Nut Size	Torque (lubricated threads) lbf·ft (N·m)
Front and Rear Wheel Nuts	M20	280-310 (380-420)

Table 2, Fastener Torque for 8-Hole Disc Wheel With Cone Locknuts

Spoke-Type Wheel Fastener Torque			
Description	Size	Wheel Manufacturer	Torque (dry threads) lbf·ft (N·m)
Front Wheel Nut, 5- and 6-Spoke	3/4-10	Gunite	200-225 (270-305) *
Rear Wheel Nut, 5- and 6-Spoke With Channel Spacer (Fig. 2)	3/4-10	Gunite	200-225 (270-305)
Rear Wheel Nut, 5- and 6-Spoke With Corrugated Channel Spacer (Fig. 3)	3/4-10	Gunite	240-260 (325-350)

* On front axles with over 12,000 lbs (5448 kg) capacity, tighten the wheel nuts 240 to 265 lbf·ft (325 to 359 N·m). Gunite part number W-854 nut with a phosphate and oil coating must be used.

Table 3, Spoke-Type Wheel Fastener Torque

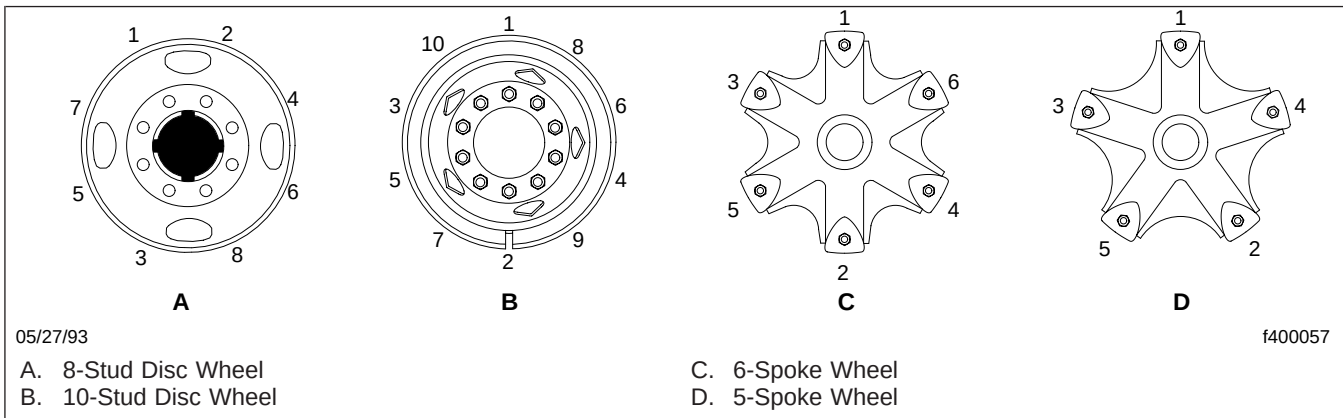


Fig. 1, Wheel Nut and Rim Nut Tightening Sequence

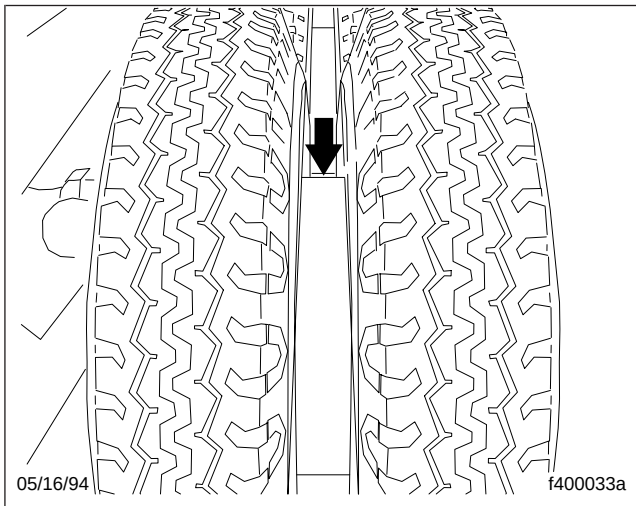


Fig. 2, Non-Corrugated Channel Spacer

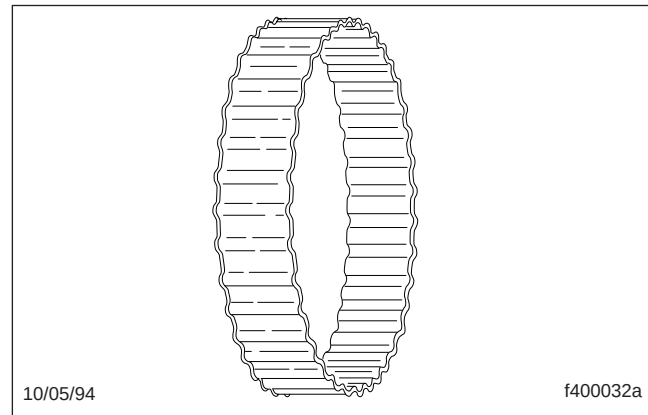


Fig. 3, Corrugated Channel Spacer

Title of Maintenance Operation (MOP)	MOP Number
Driveline Inspecting	41-01
Driveline Lubricating	41-02

41-01 Driveline Inspecting

Inspecting

- Check that the yoke-strap capscrews (**Fig. 1**, Ref. 4) are tightened as follows:
 - Spicer 1590 and 1610: 50 to 60 lbf·ft (68 to 81 N·m)
 - Spicer 1710: 125 to 135 lbf·ft (170 to 183 N·m)



CAUTION

Do not overtighten the yoke-strap capscrews, due to the extreme load occurring at high-speed rotation. A loose or broken capscrew at any point in the driveline weakens the driveline connection, which could eventually result in serious vehicle damage.

- Check each of the output and input end yokes (**Fig. 1**, Refs. 2 and 11) for cracks and looseness. Replace cracked yokes. If any end yoke can be moved in or out on its shaft, or can be rocked on its shaft, disconnect the driveshaft and U-joint from the end yoke. Check the drive component's shaft seal for leakage or other visible damage that may have been caused by the loose yoke. Replace the seal if needed. Tighten the end-yoke nut to the value in **Table 1**. If the end yoke is still loose after tightening the yoke nut, install a new yoke and yoke nut.

End-Yoke Nut Torque Specifications		
Description	Thread Size	Torque lbf·ft (N·m)
<i>Transmissions</i>		
Fuller FS 4005, 5005, 5106, 6105, and 6206	1-1/4-18	300-350 (405-475)
Fuller RT 6609, RT/RTO 6610, and RT 8609	1-1/2-18	400-450 (540-610)
Fuller T 8607, RT 7608LL, RT 8608L, and RT/RTO 6613	2-16	450-500 (610-675)

End-Yoke Nut Torque Specifications		
Description	Thread Size	Torque lbf·ft (N·m)
Allison AT-545	1/2-20 *	100-120 (140-160)
Allison MD Series	2-16	600-800 (815-1085)
<i>Single Axle Input Shaft</i>		
Meritor RS-13-120, RS-15-120 and -210, RS-17-140 and -20, RS-19-145 and -220, and RS-21-145 and -230	M32 x 1.5	740-920 (1000-1250)
Meritor RS-23-160	M45 x 1.5	1000-1230 (1355-1670)
Meritor RS-23-240	M39 x 1.5	920-1130 (1250-1530)
<i>Tandem Axle Input and Output Shafts</i>		
Meritor RD- and RR-17-145, (of RT-34-145), and RD- and RR-20-145 (of RT-40-145)	M39 x 1.5	920-1130 (1250-1530)
<i>Coupling Shaft (Midship Bearings)</i>		
Spicer 1590, 1610, and 1710	1-1/4-18	475-525 (644-712)

* The Allison AT-545 transmission output shaft end-yoke is retained by a 1/2-20 x 1-1/2-inch bolt and a 1-1/16-inch washer. Both the bolt and the washer must be replaced each time they are removed.

Table 1, End-Yoke Nut Torque Specifications

NOTE: If the end-yoke locknut was removed for any reason, install a new one.

- Check the U-joint assemblies for wear by attempting to move the driveshaft up and down, and from side to side. If movement of the U-joint trunnion in the bearings is greater than 0.006 inch (0.15 mm), replace the U-joint assembly.
- Check the midship bearing and bracket for looseness and deterioration by attempting to move the driveshaft up and down, and from side to side. If the bearing is loose on its shaft, or rattles, replace it. If the bearing bracket is loose on the frame, or the bearing mount is loose on the bracket, tighten the mounting bolt nuts 91 lbf·ft

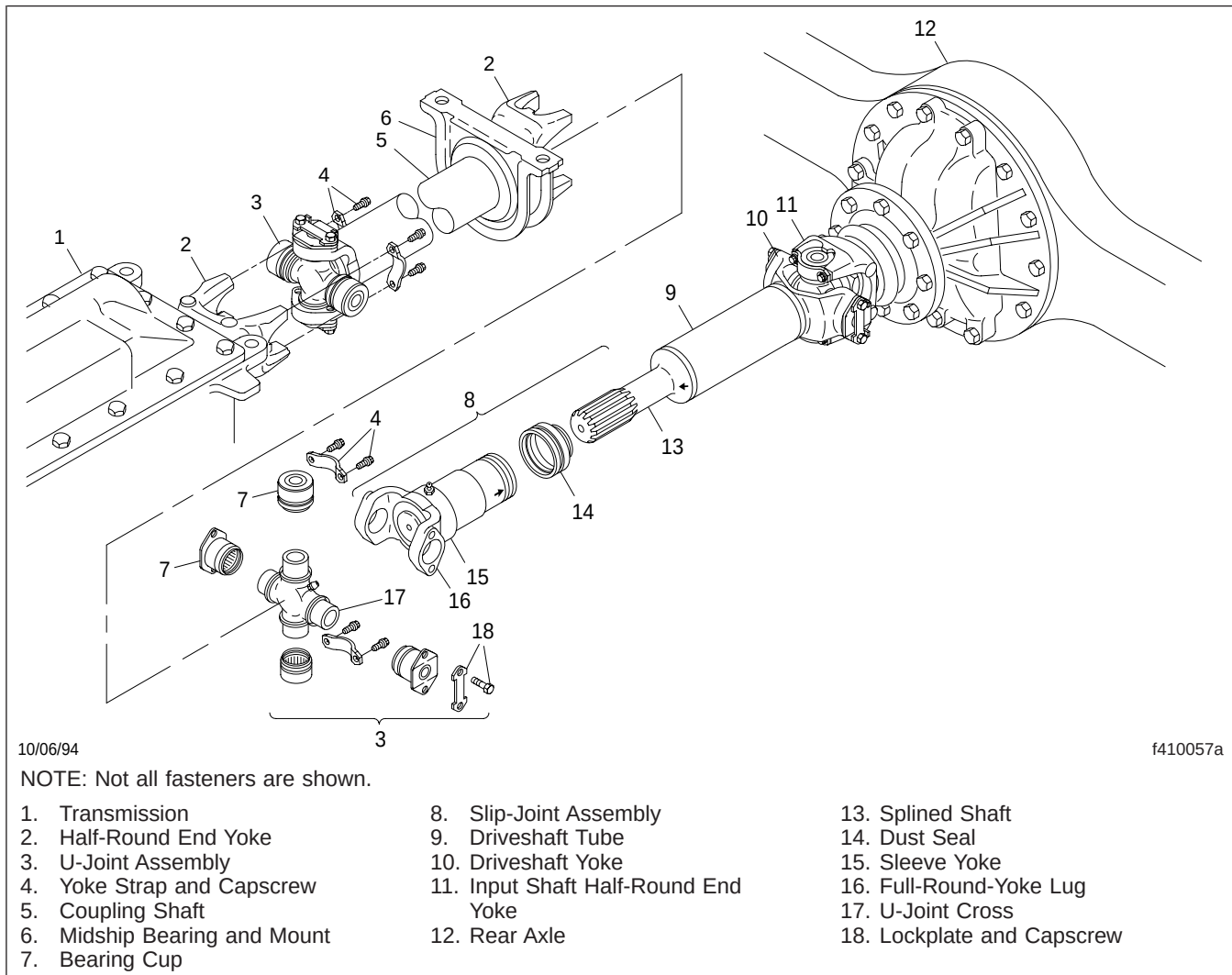


Fig. 1, Driveline Assembly With Midship Bearing For Single-Axle Installation

(123 N·m). Replace the midship bearing assembly if the rubber cushion is worn or oil-soaked.

5. Check the slip-joints for spline wear by trying to bend the sleeve-yoke and splined shaft back and forth (**Fig. 2**). If looseness is greater than 0.007 inch (0.18 mm), replace both the sleeve-yoke and the splined shaft.
6. Check the driveshaft tubes for dents, bends, twists, or other damage. If any tube appears to be damaged, remove the driveshaft and check the runout on the tube. If the tube is not straight (and cannot be straightened) within 0.015 inch (0.38 mm) on the slip-joint seal surface of the

splined shaft, 0.020 inch (0.51 mm) on the tube 3 inches (76 mm) from the front and rear welds, and 0.025 inch (0.635 mm) at the center of the tube, replace the tube. See **Fig. 3**.

If the driveshaft tube requires straightening or replacement, balance the repaired driveshaft before installing it. See **Group 41** of the *Business Class® Trucks Service Manual*.

7. Check the driveshaft for missing balance weights, and for debris build-up. Remove any build-up. If any balance weights are missing, re-

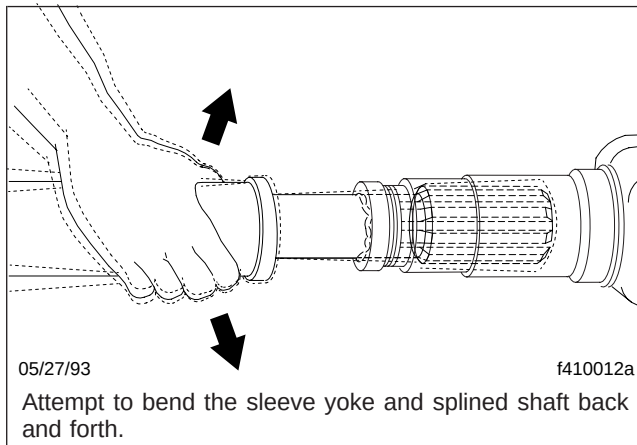


Fig. 2, Slip-Joint Spline Wear Checking

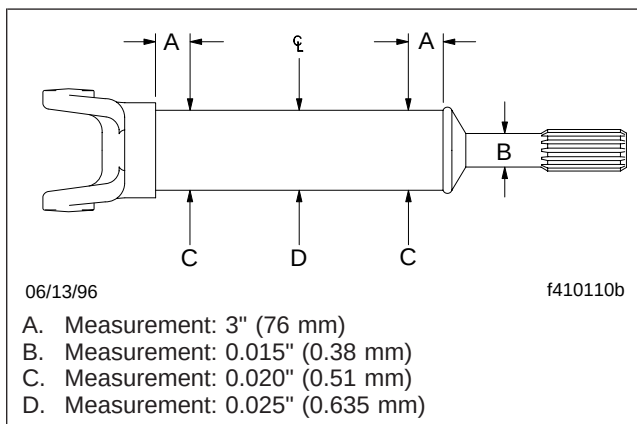


Fig. 3, Driveshaft Runout Specifications

move the driveshaft and have it balanced; see **Group 41** of the *Business Class® Trucks Service Manual*.

8. For driveshafts with slip-joints, check that the yoke plug is not loose or missing. See **Fig. 4**, Ref. 2. Replace the yoke plug if needed. If the yoke plug is missing, the splined shaft may be hitting the yoke plug and knocking it out; check the driveshaft for proper length.

41-02 Driveline Lubricating

U-Joint Lubricating

1. Wipe all old grease and dirt from each U-joint grease fitting. See **Fig. 4**, Ref. 8.

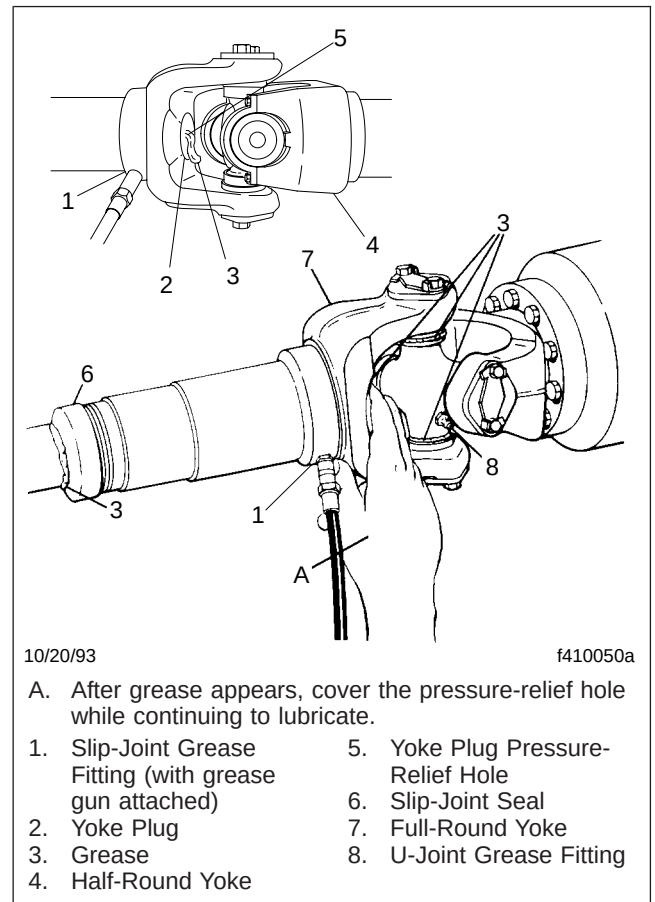


Fig. 4, Slip-Joint and U-Joint Lubricating

2. Use a hand-type grease gun, or a high-pressure gun with a low-pressure adapter, to lubricate the U-joints.

NOTE: If a low-pressure adapter is not used with the high-pressure gun, the U-joints may not receive enough lubricant.

3. Using lithium 12 hydroxy stearate grease (NLGI grade 1 or 2, with EP additives), lubricate until new grease can be seen at all four U-joint seals.

IMPORTANT: Fresh lubricant must be seen escaping from *all four* bearing cup seals of each U-joint.

On full-round yokes, if most of the grease being added to a U-joint can be seen escaping from just one of the U-joint seals, bend the tabs of the lockstrap away from the heads of the bear-

ing cup capscrews, then check the torque on the bearing cup capscrews at that seal. Tighten the bearing cup capscrews as follows:

5/16–24 capscrews: 24 lbf·ft (32 N·m)

3/8–24 capscrews: 37 lbf·ft (50 N·m)

Bend the lockstrap tabs up, against a flat side of each capscrew. If the capscrews were already tight, or all of the U-joint seals still do not purge, remove the bearing cup at that seal, and examine the seal for damage. If the seal is damaged, replace the complete U-joint assembly.

If grease does not appear at one of the seals, use a screwdriver to pry the U-joint trunnion away from the non-purging seal, or tap the driveshaft or yoke with a plastic or rawhide mallet (on the side opposite the dry seal), while continuing to apply gun pressure. If grease still does not appear, bend the tabs of the lockstrap away from the heads of the bearing cup capscrews, then loosen the bearing cup capscrews (at the bearing with the dry seal) to relieve seal tension. Lubricate the U-joint until the old grease is purged, then tighten the capscrews to the above specifications, and bend the tabs of the lockstrap against a flat side of each capscrew. If the bearing will not take grease, replace the U-joint assembly; see **Group 41** of the *Business Class® Trucks Service Manual*.

4. Check the old grease. If it appears rusty, gritty, or burned, replace the U-joint assembly. See **Group 41** of the *Business Class® Trucks Service Manual*.
5. Wipe any excess grease from the seals and grease fittings.

Slip-Joint Spline Lubricating

1. Wipe all old grease and dirt from the slip-joint grease fitting. See **Fig. 4**, Ref. 1.
2. Use a hand-type grease gun or a high-pressure gun with a low-pressure adapter, to lubricate the slip-joint. Using lithium 12 hydroxy stearate grease (NLGI grade 1 or 2, with EP additives), lubricate until fresh grease appears at the pressure-relief hole in the yoke plug. Then cover the relief hole with your finger, while continuing to lubricate until fresh grease appears at the slip-

joint seal (**Fig. 4**, Ref. 6). This ensures complete lubrication of the splines.

3. Wipe any excess grease from the pressure-relief hole, slip-joint seal, and grease fitting.

Title of Maintenance Operation (MOP)	MOP Number
Air Brake Valve Disassembly, Cleaning, and Inspecting, Bendix E-12, QR-1, R-14, SR-1, ST-3, TC-7, and TP-5	42-20
Air Brake Valve Inspecting and Leak Checking, Bendix BP-R1	42-02
Air Brake Valve Leak Checking, Bendix TC-7	42-18
Air Brake Valve Operation Checking, Bendix BP-R1 and E-12	42-04
Air Brake Valve Operation Checking, Bendix R-14 and TC-7	42-17
Air Dryer Checking, Bendix AD-9	42-15
Air Dryer Desiccant Replacing, Bendix AD-9	42-16
Air Dryer Desiccant Replacing, Meritor WABCO System Saver 1000	42-08
Air Dryer Inspecting, Bendix AD-9	42-01
Air Reservoir Automatic Drain Valve Disassembly, Cleaning, Inspecting, and Lubricating, Bendix DV-2	42-19
Automatic Slack Adjuster Checking, Meritor	42-12
Automatic Slack Adjuster Inspecting and Adjusting, Gunite	42-25
Automatic Slack Adjuster Inspecting, Meritor	42-14
Automatic Slack Adjuster Lubricating, Gunite	42-24
Automatic Slack Adjuster Lubricating, Haldex	42-26
Automatic Slack Adjuster Lubricating, Meritor	42-13
Brake Chamber Inspecting (All Models)	42-07
Brake Lines Checking, Hydraulic Disc Brakes	42-22
Brake Lining Wear Checking, Hydraulic Disc Brakes	42-21
Camshaft Bracket Bushing Lubricating	42-10
Foot Brake Valve Actuator Lubricating, Bendix E-12	42-03
Manual Slack Adjuster Lubricating	42-11
Meritor Brake Adjusting, Manual Slack Adjusters	42-09
Power Booster Checking, Bendix Hydro-Max®	42-23
Quick Release and Flipper Valves Checking, Midland	42-06
Relay Valve Checking, Midland	42-05

42-01 Air Dryer Inspecting, Bendix AD-9

1. Check the reservoirs for moisture. A small amount (teaspoon or less) is normal. Larger amounts may mean that the desiccant needs to be replaced. Check the mounting and connecting lines.
2. Tighten the fasteners attaching the air dryer to the vehicle. Use the following torque values.

28 lbf·ft (38 N·m) for SAE grade 5, 3/8–16 fasteners.

135 lbf·ft (183 N·m) for SAE grade 5, 5/8–11 fasteners.

Check all air lines, fittings, and electrical connections for damage, leakage, or looseness.
3. Replace damaged or leaking parts, and tighten loose fittings or electrical connections.

42-02 Air Brake Valve Inspecting and Leak Checking, Bendix BP-R1

1. Clean the valve exterior and inspect it for corrosion and damage.
2. Inspect the air lines connected to the valve for signs of wear or damage. Replace the lines as needed.
3. Check the valve for leakage.
 - 3.1 Apply the service brakes and hold them on full line pressure of at least 80 psi (550 kPa).
 - 3.2 Check the air line fittings for leaks; tighten or replace the fittings as needed.
 - 3.3 Coat the exhaust port and body of the valve with soapy water, and check for leakage. Leakage is excessive if it produces a 1-inch (25-mm) bubble within 5 seconds.

If the brake valve does not function as described above, or if leakage is excessive, replace it with a new or remanufactured unit.

Repeat the leakage checks before placing the brake valve in service.

42-03 Foot Brake Valve Actuator Lubricating, Bendix E-12

1. Clean any dirt, gravel, and other foreign debris from the plunger boot and brake base bracket.
2. Check the brake plunger boot for cracks, holes, or deterioration. Replace if necessary.
3. Lift up the edge of the brake plunger boot and check the plunger for existing lubrication. If the plunger is dry, remove it by removing the cotter pin from the clevis pin and pulling the clevis pin out. Remove the piston rod and boot. Lift out the plunger. Lubricate the plunger and the tip of the piston rod with barium grease part number BW 246671, or Penzoi Adhezoplex EP 2. Install the piston rod, boot, clevis pin, and cotter pin.

If the plunger has grease on it, lift the edge of the brake plunger boot enough to apply 2 to 4 drops of light oil around the brake plunger. Do not over-oil. Install the plunger boot.

4. Lubricate the clevis pin with light oil.
5. Check for leakage; see **Group 42** of the *Business Class® Trucks Service Manual* for instructions.

42-04 Air Brake Valve Operation Checking, Bendix BP-R1 and E-12

Check for proper operation; see **Group 42** of the *Business Class® Trucks Service Manual*.

42-05 Relay Valve Checking, Midland

Chock the tires. Start the engine and run it long enough to pressurize the air system to at least 80 psi (550 kPa), then turn off the engine.

Repeat as necessary, to maintain 80 psi (550 kPa) pressure during this check.

Clean off road grime from the relay valve, and any debris from the valve exhaust port. Listen for air leakage around the fittings or exhaust port. Tighten the fittings as necessary. Use two wrenches to avoid twisting the tubing.

If the valve fails this check, or is damaged, repair or replace it; see the Midland service manual for instructions. Remove the chocks from the tires.

42-06 Quick Release and Flipper Valves Checking, Midland

Chock the tires. Start the engine and run it long enough to pressurize the air system to at least 80 psi (550 kPa), then turn off the engine.

Repeat as necessary, to maintain 80 psi (550 kPa) pressure during these checks.

Clean off road grime from the valves, and any material from the valves' exhaust ports. Listen for air leakage around the fittings and exhaust ports. Tighten the fittings, as necessary. Use two wrenches to avoid twisting the tubing.

If any valve fails this check, or is damaged, repair or replace it; see the Midland service manual for instructions. Remove the chocks from the tires.

42-07 Brake Chamber Inspecting (All Models)

DANGER

Do not loosen or remove the parking brake clamp ring (see [Fig. 1](#)) for any purpose at any time. The parking/emergency brake section is not intended to be serviced. Serious injury or death may result from sudden release of the power spring.

Before doing any repairs or adjustments on a service/parking brake chamber, read the applicable warnings and instructions in the applicable brake chamber section in Group 42 of the *Business Class® Trucks Service Manual*.

WARNING

Do not operate the vehicle with the front brakes backed off or disconnected. Backing off or disconnecting the front brakes will not improve vehicle handling and may lead to loss of vehicle control resulting in property damage or personal injury.

NOTE: Vehicles operating under severe or adverse conditions should be checked more frequently. If the brake chamber requires disassembly, see **Group 42** of the *Business Class® Trucks Service Manual* for instructions.

1. With the slack adjuster properly adjusted, check the angle formed by the centerline of the piston rod and slack adjuster. This angle should be greater than 90 degrees in the released position and approach 90 degrees in the applied position. See [Fig. 2](#).

At angles less than 90 degrees, brake chamber force is reduced, which reduces braking efficiency.

2. Check each brake chamber for correct installation.
 - 2.1 Check each mounting stud for the presence of prevailing torque locknuts and hardened flatwashers. Make sure that the hardened flatwashers are installed between the mounting bracket and the locknuts. Do not install flatwashers touching the service (non-pressure) chamber.
 - 2.2 If the locknuts are loose, tighten them. For correct torque values, see the applicable brake chamber section in **Group 42** of the *Business Class® Trucks Service Manual*.
3. Observe the piston rod engagement with the clevis. Engagement of at least 7 threads is required; there should be 1-inch (25-mm) clearance from the centerline of the clevis pin hole to the end of the piston rod. See [Fig. 3](#). Adjust if needed.

4.

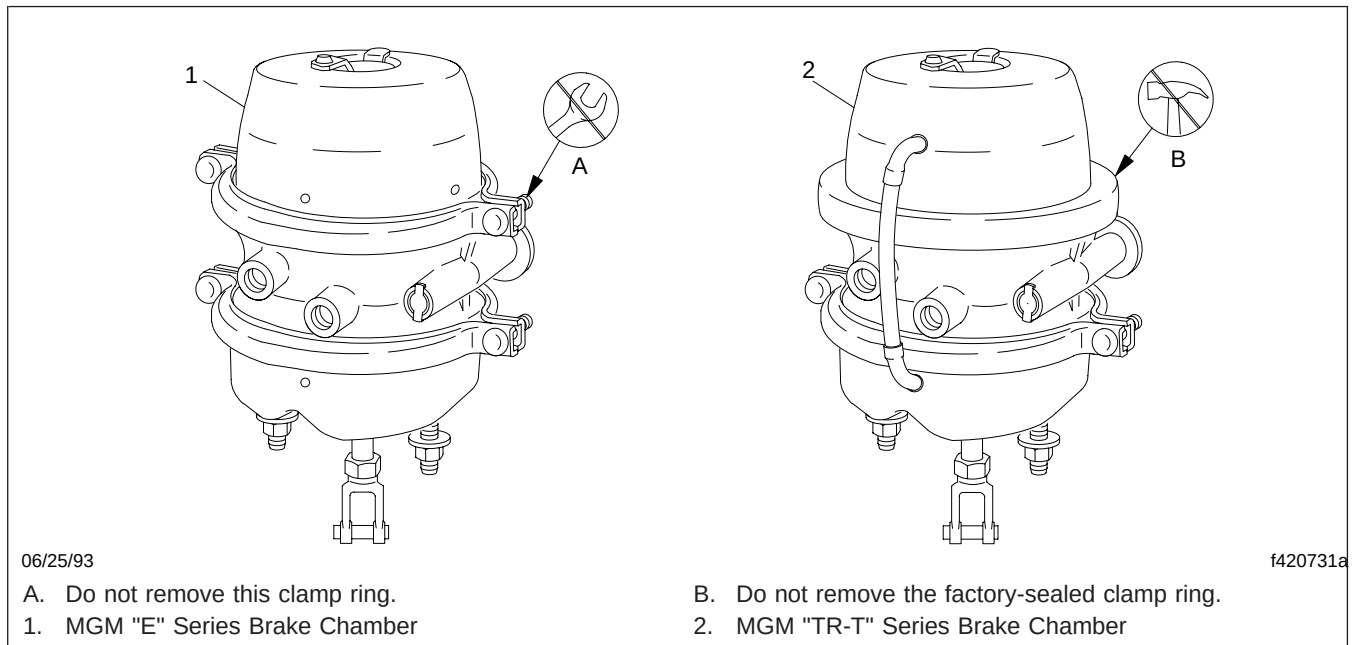


Fig. 1, Service/Parking Brake Chambers

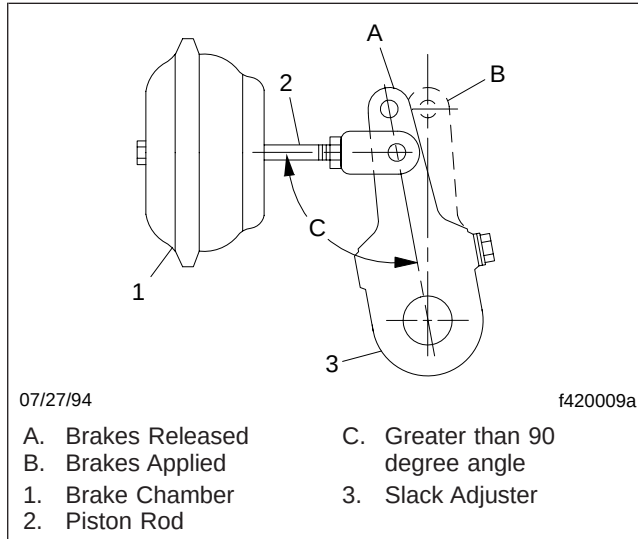


Fig. 2, Angle Between Piston Rod and Slack Adjuster

Check the tightness of the piston rod nut. See [Table 1](#) for torque values. Tighten if needed.

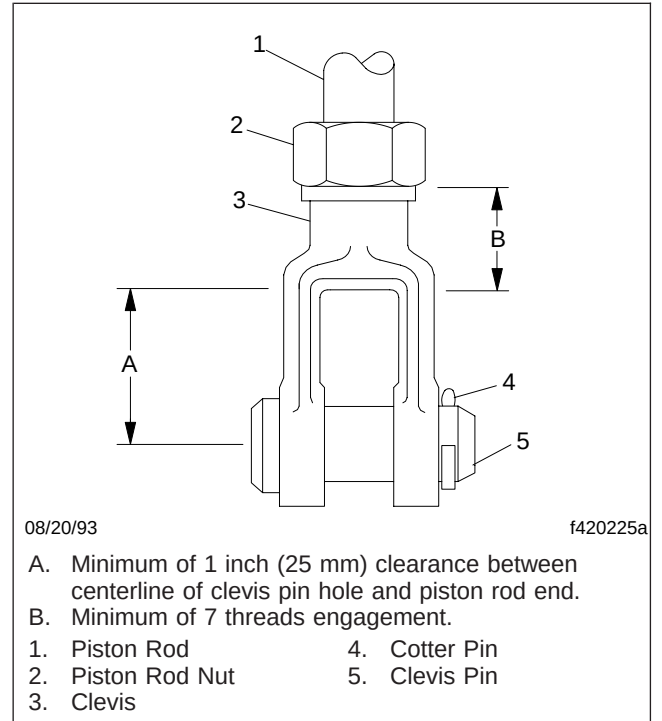


Fig. 3, Piston Rod Engagement With the Clevis

Piston Rod Nut Torque Values		
Description	Rod Size: inches	Torque: lbf-ft (N·m)
Anchorlok Tandem Chambers	All	15–25 (20–34)
MGM Tandem Chambers	All	25–35 (34–47)
Bendix Service Chambers	1/2	20–30 (27–41)
	5/8	30–50 (41–68)
Midland Service Chambers	1/2	20–30 (27–41)
	5/8	33–90 (45–122)

Table 1, Piston Rod Nut Torque Values

- See if the chamber piston rod is in line with the slack adjuster. Misalignment can cause the piston rod to rub on the non-pressure chamber and cause a dragging brake. Reposition the brake chamber on the mounting bracket, if necessary.
- Inspect the condition of the hose(s) to the brake chamber. Check carefully for chafing, restrictions such as kinking or bending, and make sure the hoses are properly supported. Replace a damaged hose with the same size hose. With the service brakes applied, check for leaks at the hose-to-chamber connections. Any leaks are probably caused by loose connections or by a damaged hose fitting. Eliminate all leaks.

On chambers equipped with an external breather tube, make sure that the flexible elbows are in place and that the connector tube is inserted into each elbow 1/2 inch (13 mm).

DANGER

Read and follow all applicable warnings and instructions in Group 42 of the *Business Class® Trucks Service Manual* for repairs to the service/parking brake chambers. These chambers contain a power spring, which if released, could cause serious injury or death.

- Inspect the exterior surfaces of the chamber for damage. Make sure the breather holes in the non-pressure section(s) are open and free of debris. Using the instructions in **Group 42** of the *Business Class® Trucks Service Manual*, replace any damaged parts.
- On parking brake chambers equipped with integral release bolts, lubricate the bolt with thread anti-seize compound. Check the tightness of the

bolt. For torque values, see the applicable brake chamber section in **Group 42** of the *Business Class® Trucks Service Manual*.



CAUTION

If the external breather tube is missing or incorrectly installed, road dirt and debris can adversely affect the operation of the brake chamber. Once inside the chamber, dirt and debris cause the internal parts to deteriorate and shorten their lives.

- On brake chambers equipped with an external breather tube, make sure the flexible elbows are in place and the connector tube is inserted into each elbow 1/2 inch (13 mm).
- On all parking brake installations, check for presence of an end cover cap or dust plug and make sure the cap or plug is securely snapped into place.

Service Brake Operation and Leakage Checking



DANGER

Do not loosen or remove the parking brake clamp ring (see **Fig. 1**) for any purpose at any time. The parking/emergency brake section is not intended to be serviced. Serious injury or death may result from sudden release of the power spring.

Before doing any repairs or adjustments on a service/parking brake chamber, read the applicable warnings and instructions in the applicable brake chamber section in Group 42 of the *Business Class® Trucks Service Manual*.

- Apply the service brakes and check that the piston rods move out promptly, without binding.
- Release the service brakes and check that the piston rods return to the released positions promptly, without binding.



DANGER

Read and follow all applicable warnings and instructions in Group 42 of the *Business Class® Trucks Service Manual* for repairs to the service/parking brake chambers. These chambers contain a power spring, which if released, could cause serious injury or death.

3. Check the service brake chambers for leakage.

- 3.1 Apply the service brakes and hold them on full line pressure of at least 80 psi (550 kPa).



CAUTION

Do not overtighten the clamp ring. This can distort the flange sealing surface, or the clamp ring itself.

- 3.2 Using soapy water, coat the service chamber clamp ring. Leakage is excessive if it produces a 1-inch (25-mm) bubble within 5 seconds. See [Fig. 1](#). On Bendix service chambers, tighten the clamp ring enough to stop the leakage, but do not exceed the maximum torque limits in [Table 2](#). *Do not overtighten.*

On other service chamber makes, if leakage is detected, tighten the clamp ring; but do not exceed the maximum torque limits in **Group 42** of the *Business Class® Trucks Service Manual*.

Clamp Ring Torque Values (Bendix Chambers)	
Description	Torque: lbf·in (N·cm)
5/16–24 Nut	130–150 (1460–1700)
3/8–16 Nut	140–180 (1580–2040)

Table 2, Clamp Ring Torque Values (Bendix Chambers)

- 3.3 If leakage persists, use the instructions in **Group 42** of the *Business Class® Trucks Service Manual* to replace the service brake diaphragm.
- 3.4 Using soapy water, coat the area around the piston-rod bore. On some Bendix service chambers loosen the boot, if necessary. No leakage is permitted. If there is leakage, use the instructions in the applicable brake chamber section in **Group 42** of the *Business Class® Trucks Service Manual* and replace the service brake diaphragm.

NOTE: On weatherproof Bendix chambers, the leakage check can be performed at the cross-drilled mounting stud.

Parking Brake Operation and Leakage Checking



DANGER

Do not loosen or remove the parking brake clamp ring (see [Fig. 1](#)) for any purpose at any time. The parking/emergency brake section is not intended to be serviced. Serious injury or death may result from sudden release of the power spring.

Before doing any repairs or adjustments on a service/parking brake chamber, read the applicable warnings and instructions in the applicable brake chamber section in **Group 42 of the *Business Class® Trucks Service Manual*.**

1. Chock the tires.
2. Build the air pressure in the system to at least 100 psi (690 kPa), and shut off the engine.
3. Place the park control valve in the park position. The brake should apply immediately. Then, place the park control valve in the released position. The brake should release immediately.

If the brakes do not apply or release as required, see the air brake system troubleshooting guide in the applicable brake chamber section in **Group 42** of the *Business Class® Trucks Service Manual* for possible causes and corrections.



WARNING

Do not disconnect the pressurized parking brake hose. If disconnected under pressure, the parking brake hose will whip as air escapes from the line, and the air stream can direct dirt or sludge toward persons in the area, which could result in injury.

4. Check the parking brake chambers for leakage.
 - 4.1 With the park control valve released, apply soapy water around the parking brake diaphragm clamp ring and at the drain slots and exhaust breather on the body. Disconnect the service brake hose at the service port, and apply soapy water to check for piston O-ring leakage.

DANGER

Read and follow all applicable warnings and instructions in the applicable brake chamber section in Group 42 of the *Business Class® Trucks Service Manual* for repairs to the service/parking brake chambers. These chambers contain a power spring, which if released, could cause serious injury or death.

- 4.2 If leakage is detected at either the clamp ring or the drain slots, replace the parking brake section. Slight leakage is permitted at the service port. Any other leakage is not acceptable. Using the instructions in the applicable brake chamber section in **Group 42** of the *Business Class® Trucks Service Manual*, replace the parking brake section (*do not attempt to service the parking brake section*).
5. Connect the air hose to the brake chamber, making sure that the fittings are clean and free of debris. Tighten the nut finger-tight. Using a wrench, further tighten the nut until you feel resistance. Then, tighten the nut one-sixth turn more.
6. Repeat the above steps for each parking brake chamber.
7. Apply the parking brakes. Remove the chocks from the tires.

42-08 Air Dryer Desiccant Replacing, Meritor WABCO System Saver 1000

Replace the desiccant cartridge. For instructions, see **Group 42** of the *Business Class® Trucks Service Manual*.

NOTE: Desiccant change intervals may vary from vehicle to vehicle. Typical desiccant cartridge life is three years. However, if experience has shown that extended or shortened life has resulted on a particular installation, then the interval can be increased or decreased accordingly.

42-09 Meritor Brake Adjusting, Manual Slack Adjusters

Meritor

1. Check the adjustment on Meritor brakes whenever the brake chamber piston rod applied stroke exceeds the maximum allowable stroke.
 - 1.1 With the brakes released, measure the distance from the face of the brake chamber to the centerline of the clevis pin (**Fig. 4**, Ref. A). Record the exact distance as measurement A.
 - 1.2 Apply the service brakes and hold them on full line pressure of at least 80 psi (550 kPa). Measure the distance from the face of the brake chamber to the centerline of the clevis pin (**Fig. 4**, Ref. B). Record the exact distance measured as measurement B.
 - 1.3 Subtract measurement A from measurement B to determine the applied stroke.
2. If the applied stroke equals or exceeds the maximum allowable stroke, adjust the brakes. See **Table 3**.

Maximum Allowable Brake Chamber Stroke, with Meritor Manual Slack Adjusters	
Chamber Size Effective Area: square inches	Maximum Allowable Stroke: * inches (mm) (B minus A)
12	1-1/2 (38)
16	1-3/4 (44)
20	1-3/4 (44)
24	1-3/4 (44)
24 (long stroke)	2 (51)
30	2 (51)

* Adjust the brakes whenever the applied stroke exceeds the maximum.

Table 3, Maximum Allowable Brake Chamber Stroke, with Meritor Manual Slack Adjusters

- 2.1 Wipe clean the adjusting screw hexhead. See **Fig. 4**. Position a wrench or socket over the adjusting screw hexhead.

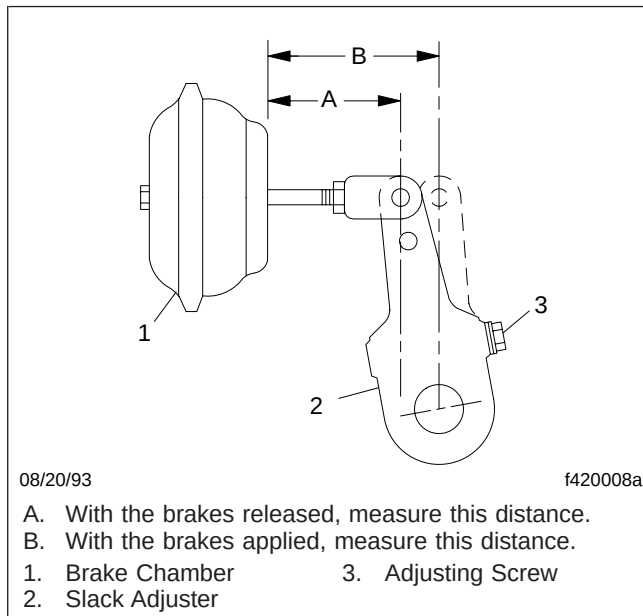


Fig. 4, Brake Adjusting, Typical Manual Slack Adjuster

IMPORTANT: On slack adjusters equipped with an adjusting screw locking sleeve, wipe clean the locking sleeve area, and depress the locking sleeve when positioning the wrench or socket over the adjusting screw. Do not try to turn the adjusting screw without fully depressing the locking sleeve.

- 2.2 Turn the adjusting screw until it is tight; then, back off the adjustment until the drum is free. Normally, the adjusting screw will need to be backed off 2 or 3 clicks.
- 2.3 To see if the drum is free, strike the brake drum with a steel tool and listen for a clear ringing sound. If a dull thud is heard, the brake is dragging and further adjustment is needed.

NOTE: Checking the brake adjustment when the wheel is off the ground may be unreliable. Looseness or wear anywhere in the wheel bearings will cause the drum to be misaligned while the wheel is off the ground. Check the brake adjustment with the wheel on the ground.

IMPORTANT: On slack adjusters equipped with an adjusting screw locking sleeve, make sure that the locking sleeve is engaged around the adjusting screw hexhead after adjustment, thus locking the adjusting screw in place.

42-10 Camshaft Bracket Bushing Lubricating

Pump multipurpose chassis grease (NLGI grade 1 or 2) into the chamber bracket until it appears at the slack adjuster end of the bracket. See Fig. 5. Use care that no grease enters the drum cavity. If grease leaks out under the camhead, the camshaft grease seal is worn or damaged, or is installed backwards.

NOTE: The use of meter-type fittings, having a maximum 40 psi (275 kPa) pressure relief at shutoff, is recommended.

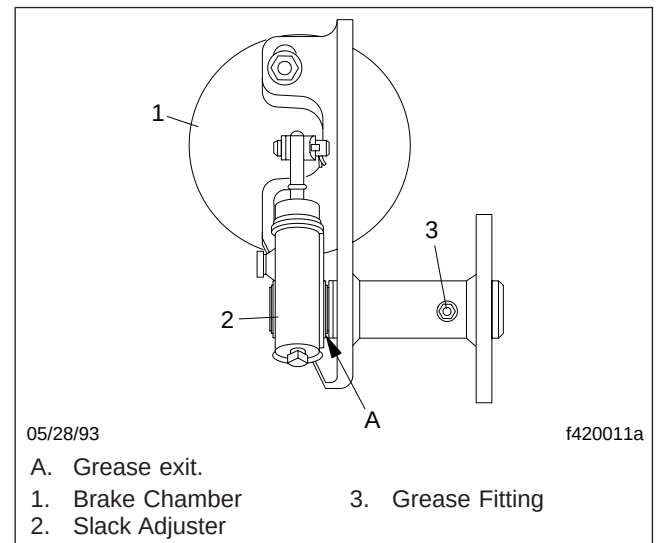


Fig. 5, Camshaft Bracket Bushing Lubrication

42-11 Manual Slack Adjuster Lubricating

Bendix Manual Slack Adjusters

Lubricate the slack adjuster with chassis grease (NLGI grade 1 or 2). Apply enough grease to completely fill the body cavity.

Midland Manual Slack Adjusters

Midland slack adjusters are greased for life at assembly. However, a grease fitting is furnished to permit optional lubricating.

42-12 Automatic Slack Adjuster Checking, Meritor

1. Check the boot for cuts, tears, etc., and replace it if necessary. See [Fig. 6](#).

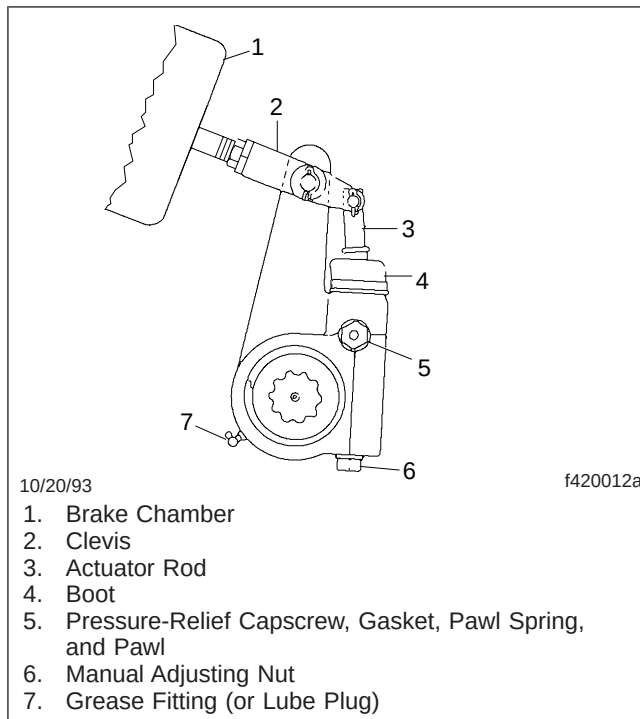


Fig. 6, Meritor Automatic Slack Adjuster

2. Check the brake shoe lining wear to determine the proper reline time. For instructions, see [Brake Lining Wear Checking, Hydraulic Disc Brakes](#).
3. Check the free-stroke. If the vehicle has new brakes or brakes with new linings, you must check the free-stroke. If the vehicle is in for routine maintenance and the brakes or linings are not new, go to the next step and check the brake chamber stroke.

IMPORTANT: Do not use installation templates to check the slack adjuster angles. Installation templates are used only when installing a new slack adjuster or reinstalling the existing slack adjuster.

- 3.1 With the brakes fully released, measure the distance from the bottom of the brake chamber to the center of the large clevis pin. See [Fig. 7](#), Ref. A.

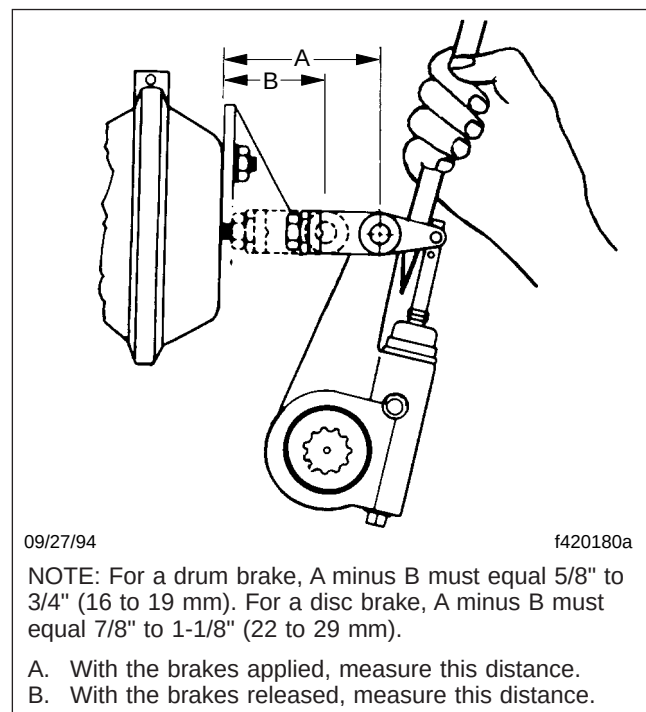


Fig. 7, Measuring Free-Stroke

- 3.2 Use a pry bar to move the slack adjuster, applying the brakes. Again, measure the distance from the bottom of the brake chamber to the center of the large clevis pin. See [Fig. 7](#), Ref. B.

The difference between the two measurements is the initial free-stroke, and sets the clearance between the linings and the drum. The free-stroke must be:

- drum brakes—5/8 to 3/4 inch (16 to 19 mm);
- disc brakes—7/8 to 1-1/8 inch (22 to 29 mm).

- 3.3 If the free-stroke is incorrect, remove the pressure-relief capscrew, gasket, pawl spring, and pawl (Fig. 6, Ref. 5) from the slack adjuster housing. If equipped with a pull-pawl assembly (Fig. 8), carefully insert a screwdriver and raise the relief cap about 1/8 inch (3.2 mm).

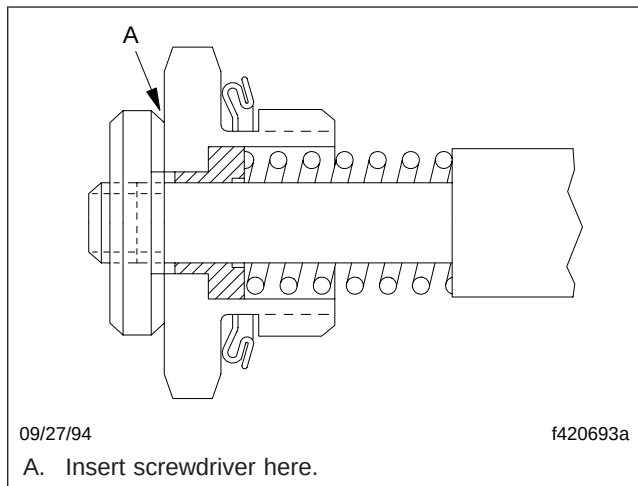


Fig. 8, Pull-Pawl Assembly (sectional view)



CAUTION

Before turning the adjusting nut, remove the pressure-relief capscrew, gasket, pawl spring, and pawl. If equipped with a pull-pawl assembly, raise the relief cap as instructed. Failure to do so could strip the teeth on the pawl.

- 3.4 Turn the adjusting nut one-eighth turn, as shown in Fig. 9. Measure the stroke again, and adjust until correct.



CAUTION

Do not make the adjusted chamber stroke too short. The free-stroke must not be less than the measurements given previously. If the chamber stroke is too short, the linings can drag, which could damage the brake.

- 3.5 If removed, install the pawl, pawl spring, gasket, and pressure-relief capscrew. Tighten the capscrew 15 to 20 lbf·ft (20 to 27 N·m). Or, remove the screwdriver from the pull-pawl assembly (if equipped).

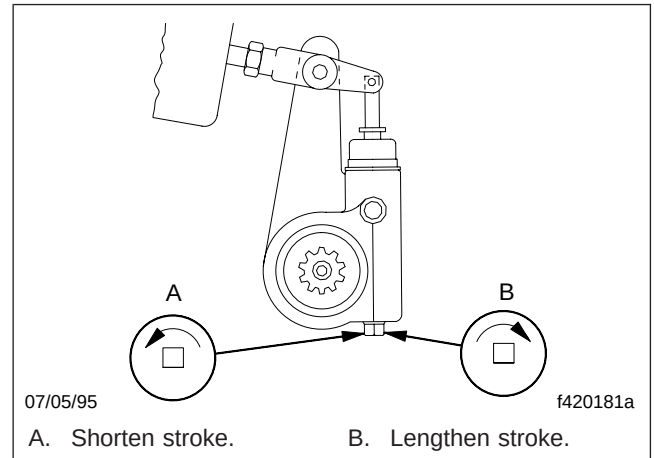


Fig. 9, Brake Stroke Adjusting

4. Check for correct brake chamber stroke.
- 4.1 With the brakes fully released, measure the distance from the bottom of the brake chamber to the center of the large clevis pin. See Fig. 7, Ref. A.
- 4.2 Build air pressure to 100 psi (690 kPa). Shut down the engine. Fully apply the brakes, then measure the distance from the bottom of the brake chamber to the center of the large clevis pin. See Fig. 7, Ref. B. The difference between the measurements is the brake chamber stroke.
- 4.3 The brake chamber stroke must be less than the measurements shown in Table 4. If the brake chamber stroke is incorrect, remove the pressure-relief capscrew, gasket, pawl spring, and pawl (Fig. 6, Ref. 5) from the slack adjuster housing. If equipped with a pull-pawl assembly (Fig. 8), carefully insert a screwdriver and raise the relief cap about 1/8 inch (3.2 mm).

Maximum Allowable Brake Chamber Stroke, with Meritor Automatic Slack Adjusters	
Chamber Size Effective Area: square inches	Maximum Allowable Stroke: * inches (mm) (B minus A)
12	Less than 1-3/8 (35)
16	Less than 1-3/4 (44)
20	Less than 1-3/4 (44)

Maximum Allowable Brake Chamber Stroke, with Meritor Automatic Slack Adjusters	
Chamber Size Effective Area: square inches	Maximum Allowable Stroke: * inches (mm) (B minus A)
24	Less than 1-3/4 (44)
24 (long stroke)	Less than 2 (51)
30	Less than 2 (51)

* Adjust the brakes whenever the applied stroke exceeds the maximum.

Table 4, Maximum Allowable Brake Chamber Stroke, with Meritor Automatic Slack Adjusters



CAUTION

Before turning the adjusting nut, remove the pressure-relief capscrew, gasket, pawl spring, and pawl. If equipped with a pull-pawl assembly, raise the relief cap as instructed. Failure to do so could strip the teeth on the pawl.

- 4.4 Turn the adjusting nut one-eighth turn, as shown in [Fig. 9](#). Measure the stroke again, and adjust until correct.

If the stroke varies or remains greater than the specified range, check the brake components, including the camshafts, camshaft bushings, anchor pins, rollers, chamber brackets, clevis, and clevis pins. For instructions, see **Group 42** of the *Business Class® Trucks Service Manual*.

- 4.5 If removed, install the pawl, pawl spring, gasket, and pressure-relief capscrew. Tighten the capscrew 15 to 20 lbf·ft (20 to 27 N·m). Or, remove the screwdriver from the pull-pawl assembly (if equipped).

42-13 Automatic Slack Adjuster Lubricating, Meritor

Lubricate the slack adjuster using high-temperature, water-proof grease NLGI grade 1, Texaco Thermotex EP 1, Shell Darina No. 1, Marathon 528 heavy-duty, Sunaplex No. 1 EP, Amdex No. 1 EP, or Philube B No. 1. It should be smooth-textured, corrosion-resistant grease, free of fillers and abrasives.

42-14 Automatic Slack Adjuster Inspecting, Meritor

1. Remove the pressure-relief capscrew, gasket, pawl spring, and pawl. See [Fig. 6](#), Ref. 5.
2. Examine the pawl for grease retention and condition. If the grease is in good condition, install the pressure-relief capscrew, gasket, pawl spring, and pawl; then, tighten the capscrew 15 to 20 lbf·ft (20 to 27 N·m). Lube the slack adjuster through the grease fitting until lubricant is forced out through the pressure-relief fitting (or pawl slot). Then, if a hollow capscrew is used, install and tighten it 15 to 20 lbf·ft (20 to 27 N·m).

If the grease is hardened, or the pawl is dry and shows extreme wear, remove the slack adjuster. Disassemble and clean it. Inspect the internal parts. Install new seals and a new boot when assembling; then, install and lubricate the slack adjuster. See **Group 42** of the *Business Class® Trucks Service Manual*.

42-15 Air Dryer Checking, Bendix AD-9

During cold-weather operation, check the operation of the end cover heater and thermostat assembly.

1. With the ignition on, check for voltage to the heater and thermostat assembly. Unplug the electrical connector at the air dryer, and place the test leads of a voltmeter on each of the pins of the male connector. If there is no voltage, look for a blown fuse, broken wires, or corrosion in the vehicle wiring harness. Check that a good ground path exists.
2. Check the thermostat and heater operation. Turn off the ignition switch and cool the end cover assembly to below 40°F (4°C). Using an ohmmeter, check the resistance between the electrical pins in the female connector. The resistance should be 1.5 to 3.0 ohms for the 12-volt heater assembly.

Warm the end cover assembly to over 90°F (32°C) and again check the resistance. It should exceed 1000 ohms. If it does, the thermostat and

heater assembly is operating properly. If it does not, replace the purge-valve housing assembly, which includes the heater and thermostat assembly.

42-16 Air Dryer Desiccant Replacing, Bendix AD-9

The desiccant change interval may vary from vehicle to vehicle. Although typical desiccant cartridge life is three years, many will perform adequately for a longer period of time. To take maximum advantage of desiccant life and ensure that replacement occurs only when necessary, disassemble, clean, and inspect the air dryer. Replace the desiccant cartridge. See **Group 42** of the *Business Class Trucks Service Manual* for instructions.

42-17 Air Brake Valve Operation Checking, Bendix R-14 and TC-7

Check the valve for proper operation; see **Group 42** of the *Business Class® Trucks Service Manual* for instructions.

42-18 Air Brake Valve Leak Checking, Bendix TC-7

Check for leakage; see **Group 42** of the *Business Class® Trucks Service Manual* for instructions.

42-19 Air Reservoir Automatic Drain Valve Disassembly, Cleaning, Inspecting, and Lubricating, Bendix DV-2

Disassemble the drain valve, clean the parts with mineral spirits, and inspect the parts. Replace all rubber parts and any worn or damaged parts; use only genuine Bendix replacement parts or kits. Assemble and install the valve, then check for proper operation and leakage. See **Group 42** of the *Business Class® Trucks Service Manual* for instructions.

42-20 Air Brake Valve Disassembly, Cleaning, and Inspecting, Bendix E-12, QR-1, R-14, SR-1, ST-3, TC-7, and TP-5

Disassemble each brake valve, clean the parts with mineral spirits, and inspect the parts. Replace all rubber parts and any worn or damaged parts; use only genuine Bendix replacement parts or kits. Assemble and install the valves, then check for proper operation and leakage. See **Group 42** of the *Business Class® Trucks Service Manual* for instructions.

42-21 Brake Lining Wear Checking, Hydraulic Disc Brakes

Before checking lining wear with the wheel removed, review the following brake lining exposure warnings.

WARNING

Breathing brake lining dust (asbestos or non-asbestos) could cause lung cancer or lung disease. Unless exposure can be reduced below legal limits, wear an air purifying respirator approved by MSHA or NIOSH at all times when servicing the brakes, starting with removal of the wheels and continuing through assembly.

To reduce asbestos exposure below legal limits, apply one of the following methods: (1) An enclosed-cylinder vacuum system equipped with a High Efficiency Particulate Air (HEPA) filter; (2) A solvent spray system that keeps the asbestos-contaminated parts wet until they can be placed in a sealed and labelled plastic bag.

To minimize the possibility of creating airborne brake lining dust, clean the dust from the brake rotor, brake caliper, and brake assembly, using an industrial-type vacuum cleaner equipped with a high-efficiency filter system. Then, using a rag soaked in water and wrung until nearly dry, remove any remaining dust. Do not use compressed air or dry brushing to clean the brake assembly.

1. Check lining wear.

- 1.1 Apply the parking brakes. Chock the tires to prevent vehicle movement.
- 1.2 Remove one or more of the lining inspection plugs, and measure brake lining thickness.
- 1.3 On front and rear axles, replace linings worn to less than 1/16 inch (1.6 mm).
- 1.4 Make sure that the brake rotor and linings are free of oil and grease.
- 1.5 Install the inspection plug(s).
2. If the wheel and hub assembly is removed from the axle, check lining wear. Replace the linings on all brake assemblies if worn to less than 1/16 inch (1.6 mm) at the thinnest point.

NOTE: To replace the brake linings, see the applicable foundation brake section in **Group 42** of the *Business Class® Trucks Service Manual*.

42-22 Brake Lines Checking, Hydraulic Disc Brakes

Check all hydraulic lines and fittings for damage, leakage, or looseness.

Replace damaged or leaking components, and tighten loose fittings.

42-23 Power Booster Checking, Bendix Hydro-Max®

Check for proper operation; see **Group 42** of the *Business Class® Trucks Service Manual* for instructions.

42-24 Automatic Slack Adjuster Lubricating, Gunite

Lubricate the slack adjuster until grease flows from the grease relief opening. See [Fig. 10](#). For temperatures to -40°F (-40°C), use Lubriplate Aero; for temperatures to -20°F (-29°C), use Texaco Multifak EP-2 or Mobil Grease No. 77.

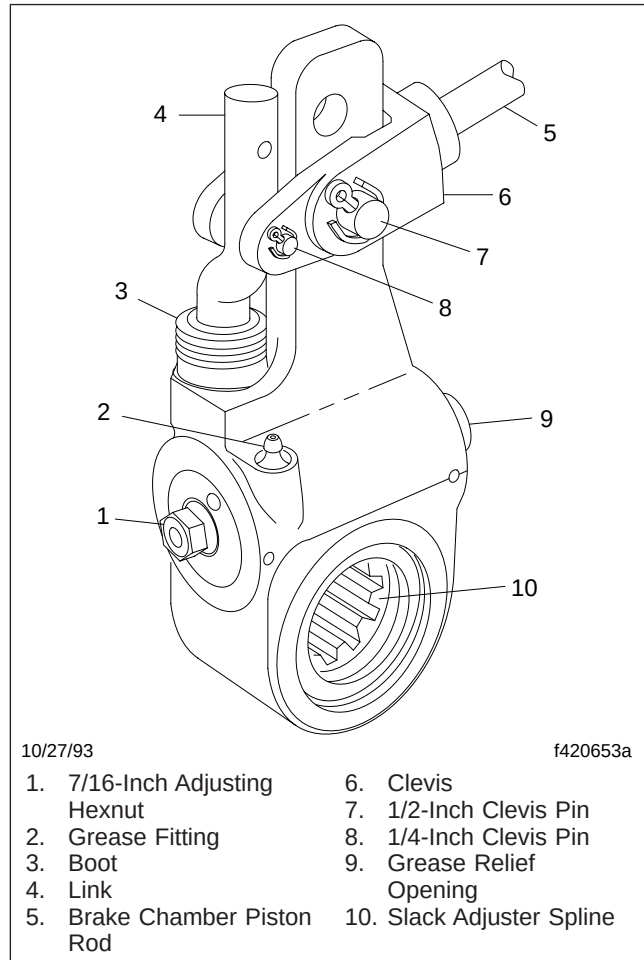


Fig. 10, Gunite Automatic Slack Adjuster

42-25 Automatic Slack Adjuster Inspecting and Adjusting, Gunite

1. Inspect the slack adjuster for structural damage. Replace the slack adjuster if needed.
2. Inspect the slack adjuster boot for cuts or tears. If the boot is damaged, replace it (see [Fig. 10](#)).
 - 2.1 Remove the two clevis pins.
 - 2.2 Rotate the worm shaft adjusting hexnut counterclockwise to move the link away from the clevis. About 45 lbf·ft (60 N·m) is needed. You will hear a clicking sound.

Remove the old boot from the link.

- 2.3 Install a new boot on the link, heavy section down. Be careful not to damage the boot.
- 2.4 Seat the boot so that the bottom of the boot is in the boot insert, and the top is in the groove of the link.
- 2.5 Rotate the adjusting hexnut clockwise until the 1/4-inch hole in the clevis lines up with the hole in the link.
Install the 1/4-inch clevis pin and the cotter pin.
- 2.6 Tap the clevis upward or downward until the large hole in the slack adjuster lines up with one in the clevis.
Install the 1/2-inch clevis and the cotter pin.



WARNING

Make sure both clevis pins are installed. Failure to do so will cause the slack adjuster to work incorrectly, which could lead to loss of braking control. This could result in an accident causing personal injury or property damage.

3. Check for correct chamber stroke.
 - 3.1 With the brakes fully released, use a ruler to measure the distance from the bottom of the brake chamber to the center of the large clevis pin. See **Fig. 11**, Ref. A.
 - 3.2 Build air pressure to at least 85 psi (585 kPa). Apply the brakes, then measure the distance from the bottom of the brake chamber to the center of the large clevis pin. See **Fig. 11**, Ref. B. The difference between the measurements is the brake chamber stroke.

Compare this measurement with those shown in **Table 5**.
4. If the brake chamber stroke exceeds the measurements shown in **Table 5**, check the foundation brakes for problems such as worn cams, bushings, pins and rollers, or broken springs. Repair or replace as needed. For instructions,

see **Group 42** of the *Business Class® Trucks Service Manual*.

5. If there are no problems with the foundation brakes, manually adjust the slack adjuster as follows:
 - 5.1 Turn the adjusting hexnut three-quarters of a turn counterclockwise. See **Fig. 10**.

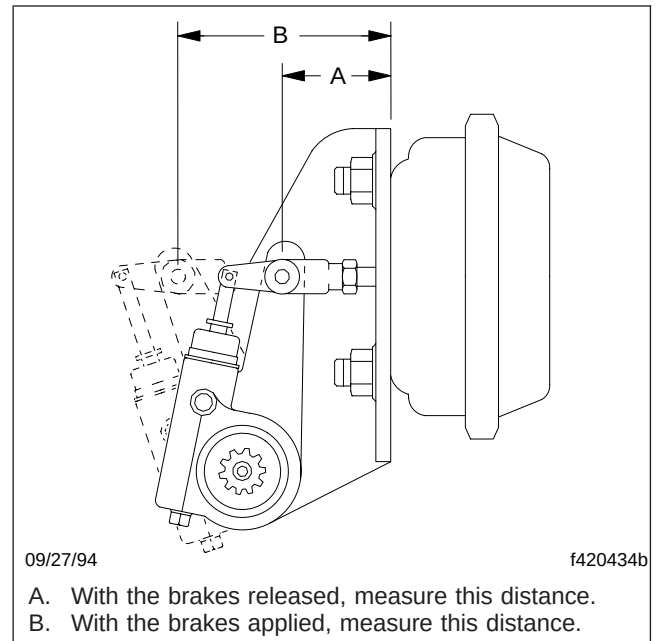


Fig. 11, Brake Stroke Check, Gunite Automatic Slack Adjuster

Maximum Allowable Brake Chamber Stroke, with Gunite Automatic Slack Adjusters	
Chamber Size	Maximum Allowable Stroke
12	Less than 1-3/8 inches (35 mm)
16	Less than 1-3/4 inches (44 mm)
20	
24	
24 (long stroke) 30	Less than 2 inches (51 mm)

Table 5, Maximum Allowable Brake Chamber Stroke, with Gunite Automatic Slack Adjusters

- 5.2 Keeping the wrench on the adjusting hexnut, have someone apply the brakes several times while you watch the hexnut. It

should turn clockwise. If it does not, replace the slack adjuster.

NOTE: The adjusting hexnut will turn in small steps. You will not be able to see it turn very well without a wrench on it.

- 5.3 Check the counterclockwise torque of the adjusting hexnut. The torque should be greater than 15 lbf·ft (20 N·m). If it is not, replace the slack adjuster.

42-26 Automatic Slack Adjuster Lubricating, Haldex

Lubricate a Haldex automatic slack adjuster at the grease fitting with any extreme-pressure NLGI Grade 1 or Grade 2 grease if the operating temperature is -20°F (-29°C) and above. If the operating temperature is below -20°F (-29°C), use a low-temperature extreme-pressure grease.

Title of Maintenance Operation (MOP)	MOP Number
Drag Link Lubricating	46-02
Miter Gear Lubricating (Right-Hand Drive Only).	46-06
Power Steering Reservoir Fluid Level Checking.	46-03
Power Steering Reservoir Fluid and Filter Changing	46-04
Steering Driveline Lubricating	46-01
Steering Gear Lubricating.	46-05

46-01 Steering Driveline Lubricating

Wipe the grease fittings clean. See [Fig. 1](#). Using a pressure gun, apply a lithium-based grease (NLGI grade 2) sparingly to the universal joints and slip-joint splines.

- Using a pressure gun, apply multipurpose chassis grease at the grease fittings until old grease is forced out of the socket.

NOTE: Use multipurpose chassis grease NLGI grade 1 (6% 12-hydroxy lithium stearate grease) or NLGI grade 2 (8% 12-hydroxy lithium stearate grease). Grade 2 chassis grease is pre-

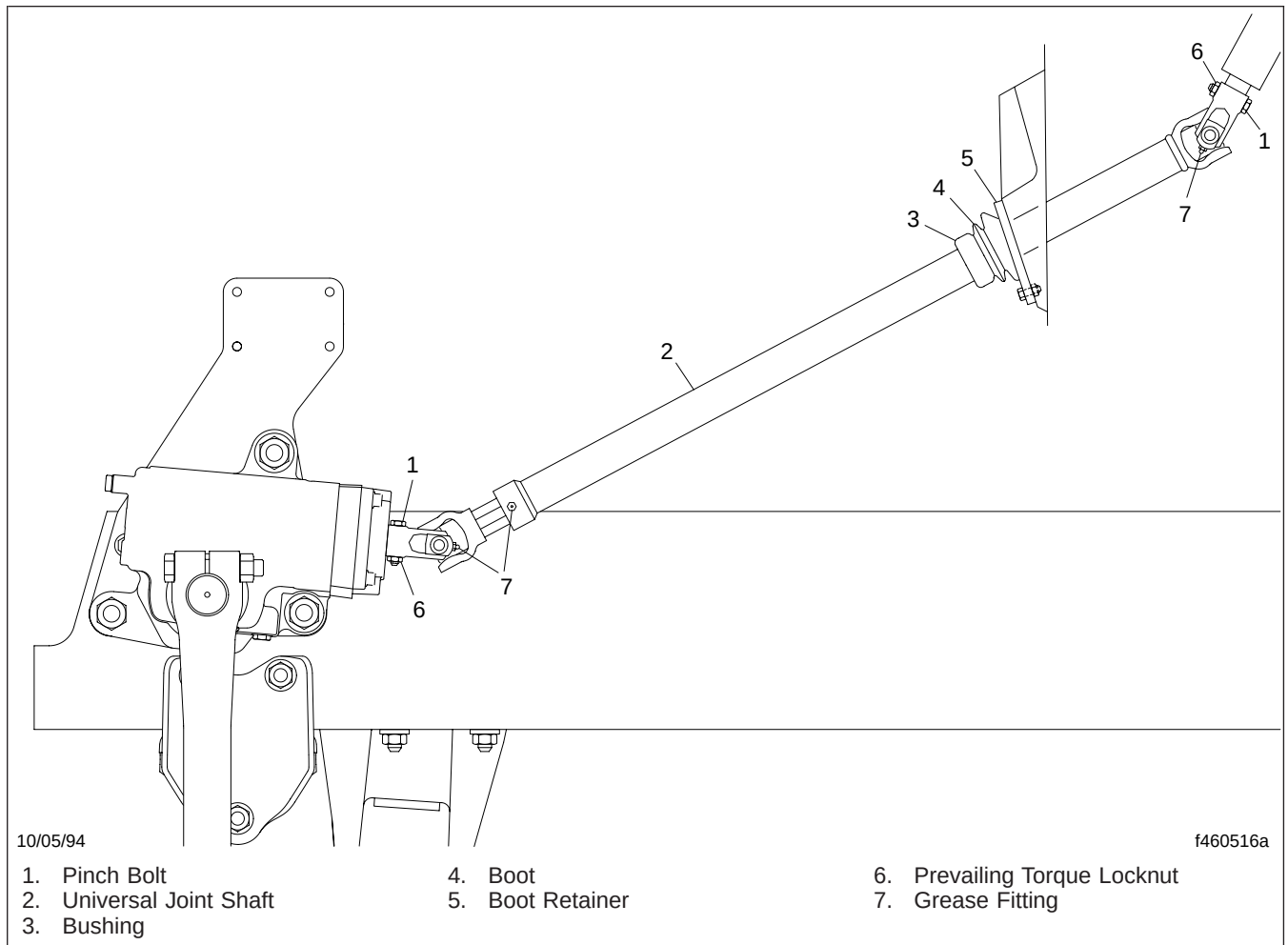


Fig. 1, Steering Driveline

46-02 Drag Link Lubricating

ferred.

- Using a clean rag, wipe the dirt from both grease fittings on the drag link. See [Fig. 2](#).

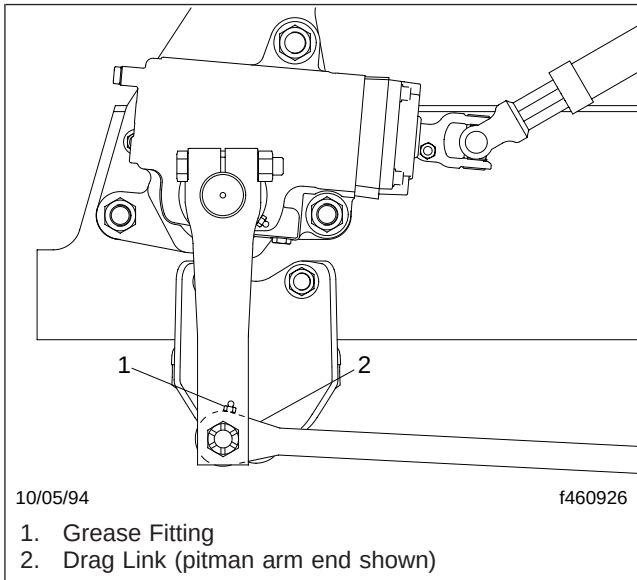


Fig. 2, Steering Drag Link Lubricating

46-03 Power Steering Reservoir Fluid Level Checking

- Clean around the power steering reservoir dipstick (fill cap) with a clean rag, then remove the dipstick. See Fig. 3.

WARNING

Fill only with approved clean fluid. Do not mix fluid types. Any mixture or any unapproved fluid could lead to seal deterioration and leaks. Fluid leakage could cause loss of power steering assist.

Failure to keep the power steering reservoir full could result in damage to the power steering pump, and improper operation of the power steering system.

- With the power steering fluid at operating temperature, check the fluid level on the dipstick. If below the ADD mark, add enough fluid to bring the level up to the full mark on the dipstick. See Table 1 for approved power steering fluid.

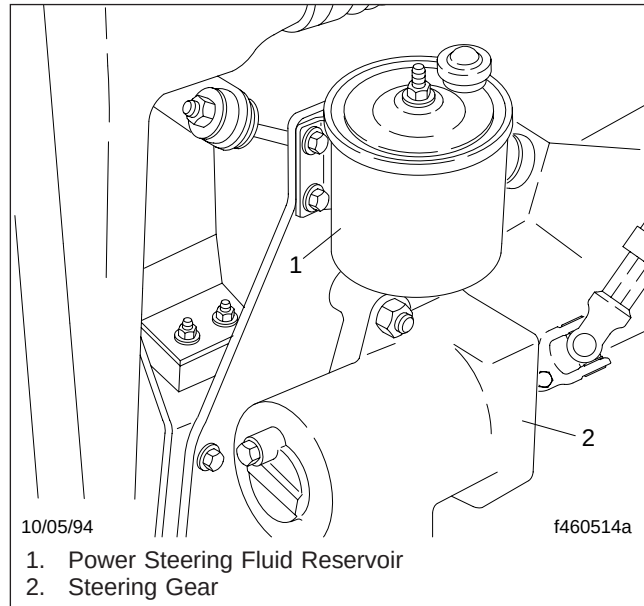


Fig. 3, Power Steering Reservoir

Approved Power Steering Fluids		
Fluid Type	Approved Fluid	
Automatic Transmission Fluid Type *	Dexron® II Dexron® III	
Heavy-Duty Engine Oil *	Union	10W-40
	Texaco	10W-40
	Chevron	10W-40
	Mobil Super	10W-40
	Union	15W-40
	Shell Rotella	T30W

* Do not mix engine oil with automatic transmission fluid (ATF). Use the same lubricant for parts as is used in the power steering system.

Table 1, Approved Power Steering Fluids

- Install the dipstick (fill cap) in the power steering reservoir.

46-04 Power Steering Reservoir Fluid and Filter Changing

- Remove the dipstick, 3/8-16 hexnut, and cover. See Fig. 3.
- Drain the power steering reservoir by disconnecting the power steering gear-to-reservoir hose from the reservoir. Keep the hose in an upright position to prevent drainage of fluid.

3. Catch the fluid from the reservoir in a drain bucket, then cap the reservoir port.
4. Lift out the spring and filter element.
5. Thoroughly clean the reservoir with a lint-free cloth.
6. Install a new filter element, and position the spring on top of the filter element.
7. Fill the reservoir with approved power steering fluid. See [Table 1](#).

WARNING

Fill only with approved clean fluid. Do not mix fluid types. Any mixture or any unapproved fluid could lead to seal deterioration and leaks. Fluid leakage could cause loss of power steering assist.

IMPORTANT: Do not start the engine while draining the system.

8. Place the disconnected end of the steering gear-to-reservoir hose in a drain bucket. Raise the front of the vehicle with a floor jack and support it with jack stands. Have someone turn the steering wheel to full lock left and right, and capture the fluid flowing from the hose in the drain bucket. Add fluid to the reservoir as needed. Continue turning the steering wheel until clean power steering fluid flows from the hose into the drain bucket. Remove the plug from the reservoir and reconnect the steering gear-to-reservoir hose to the reservoir.
9. Tighten the hose fitting nut finger-tight, then with a wrench, tighten until there is firm resistance. Tighten one-sixth turn more. Do not overtighten.

Remove the jack stands and lower the vehicle.
10. Fill the reservoir with approved fluid as needed. Start the engine and let it idle. Have someone turn the steering wheel from lock to lock until no bubbles are seen in the reservoir. Turn off the engine.
11. Install a new cover gasket, the cover, and the 3/8–16 hexnut. Tighten the hexnut 28 lbf·ft (38 N·m). Install the dipstick.
12. Start the engine and check the power steering reservoir fluid level. If the fluid level is low, add more of the approved fluid to bring the level up to the full mark on the dipstick.

46–05 Steering Gear Lubricating

1. Wipe off debris from the grease fitting. See [Fig. 4](#).
2. Using a hand-type grease gun, apply multipurpose chassis grease until the grease starts coming out of the sector shaft dirt and water seal.

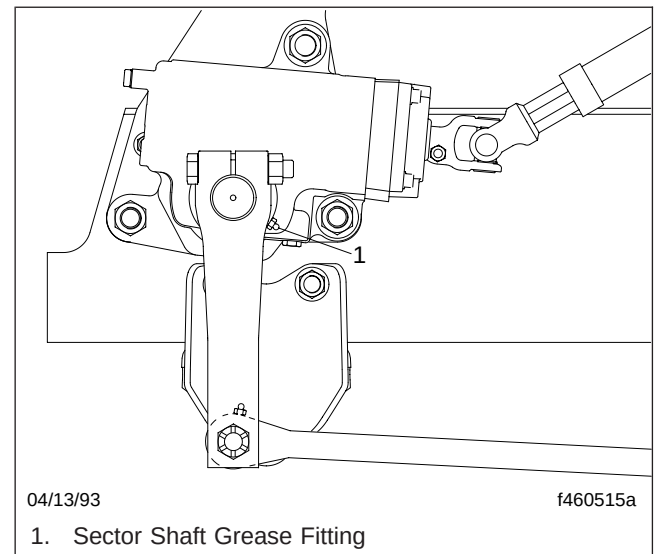


Fig. 4, Sector Shaft Lubricating, Ross TAS Series

46–06 Miter Gear Lubricating (Right-Hand Drive Only)

NOTE: The following procedure applies to right-hand drive vehicles only. Two miter gears connect to a transverse shaft running underneath the dashboard.

1. Inside the cab, remove the under-dash faceplate and expose the miter gears.

NOTE: The miter gears may or may not be equipped with a grease fitting opposite the shaft. If no grease fitting is present, the unit requires no maintenance. If a grease fitting is present, follow the procedure below.

2. Using a hand-type grease gun, apply no more than one ounce (28 g) of multipurpose chassis grease at the grease fitting.



CAUTION

Do not use a pressure gun. Apply only a small amount of grease. It is not necessary to fill the unit with grease. Do not force excess grease out past the shaft seal.

Title of Maintenance Operation (MOP)	MOP Number
Fuel Tank Draining and Vent Checking	47-01
Gasoline In-Tank Fuel Filter Replacement.	47-02

47-01 Fuel Tank Draining and Vent Checking

Remove the plug or open the drain valve at the bottom of the fuel tank, and allow the tank to drain until all traces of water and sediment have disappeared; install the plug or close the drain valve.

On earlier vehicles with a screw-on fuel cap, remove the fuel cap and clean it with solvent. Make sure the fuel cap vent is open. Install the cap.

On vehicles with a quarter-turn fuel cap, check to be sure the vent line at the inboard side of the fuel tank is clean and not plugged.

47-02 Gasoline In-Tank Fuel Filter Replacement

The fuel pump module is located in the fuel tank on gas powered vehicles, and is fitted with a fuel filter on its base. The fuel pump draws fuel from the bottom of the fuel tank to prevent cavitation on turns or inclines. The in-tank fuel filter prevents dirt and sediment that collects on the bottom of the fuel tank from entering the fuel system. The in-tank fuel filter must be changed periodically to ensure proper fuel system operation.

1. Park the vehicle on a level surface. Apply the parking brakes, and chock the tires.
2. Disconnect the batteries to prevent static discharge.



WARNING

Release the fuel system pressure before removing the fuel pump module. Otherwise fuel could spray out, possibly resulting in severe personal injury and property damage, including fire. Always wear proper eye protection when releasing the fuel system pressure. Fuel squirted into the eyes can cause serious injury, including blindness.

3. Release the fuel system pressure and drain the fuel tank.



WARNING

Gasoline is flammable and can ignite if exposed to open flame, intense heat, or other ignition source.

Do not drain fuel near, or expose fuel vapor to open flame or intense heat. Exposure to open flame, intense heat, or other ignition source could start a fire, possibly resulting in personal injury or property damage. When working on a fuel system, have a fire extinguisher within easy reach.

- 3.1 Remove the fuel tank cap to release the fuel tank pressure.
- 3.2 Unscrew the protective plastic cap from the pressure test port on the fuel rail. See [Fig. 1](#), Ref. 3.

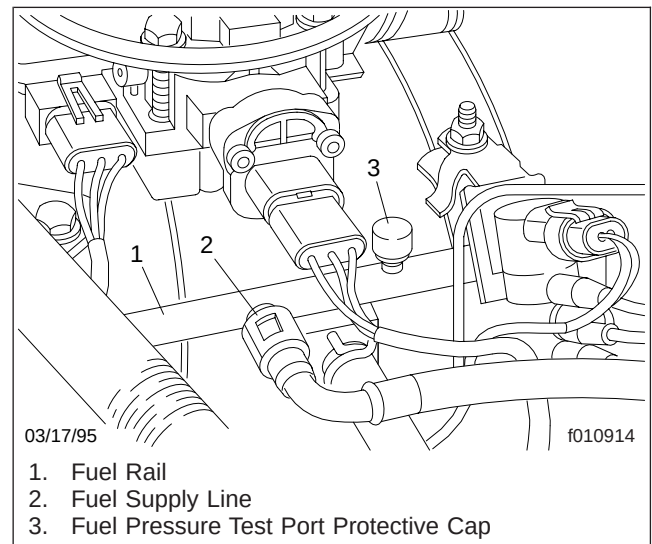
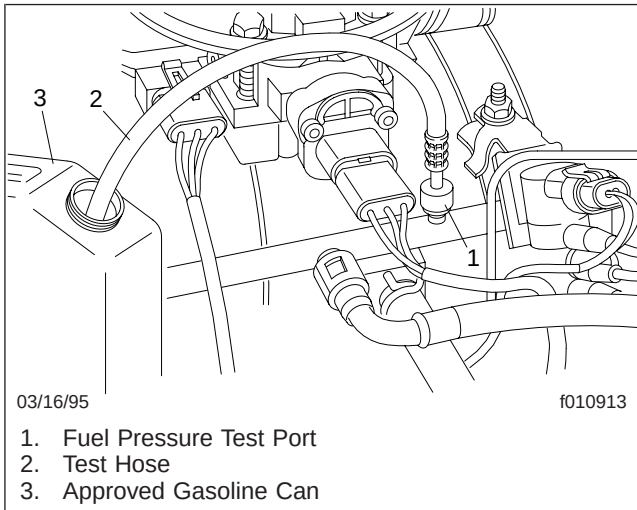


Fig. 1, Fuel Pressure Test Port

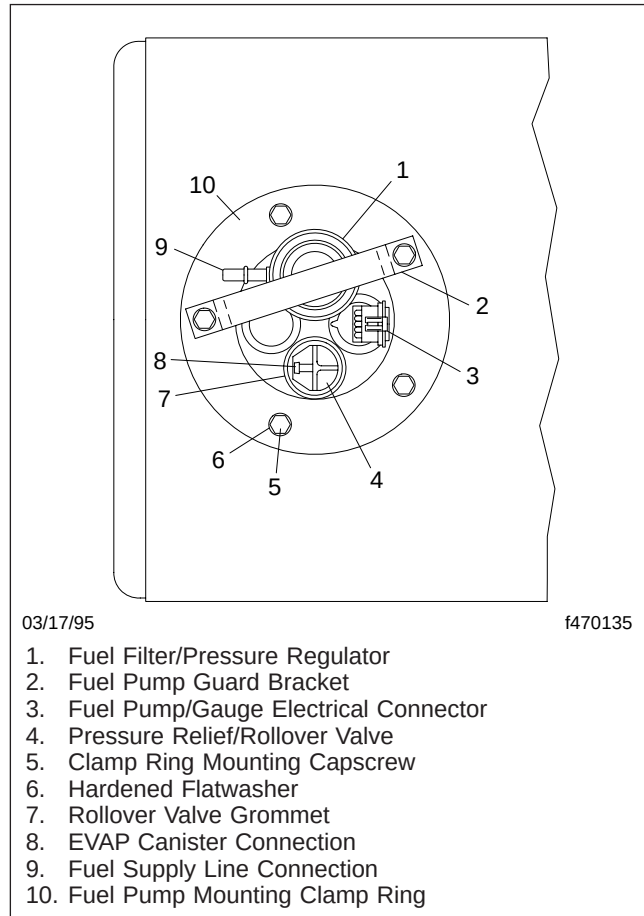
- 3.3 Obtain a Kent-Moore fuel pressure gauge tool set (#5069), or equivalent tool. Remove the gauge from the hose. Place one end of the hose into an approval gasoline container. See [Fig. 2](#).

IMPORTANT: Do not allow fuel to spill onto the engine intake or exhaust manifolds. Place a shop towel under and around the pressure test port when the pressure is released from the fuel rail.

- 3.4 Place a shop towel under the test port, then screw the other end of the hose onto the test port. Allow the fuel to flow into the gasoline container until fuel pressure is completely released.

**Fig. 2, Relieving Fuel Pressure**

- 3.5 Remove the hose from the test port, and reconnect the gauge to the hose.
- 3.6 Install the protective plastic cap to the pressure test port on the fuel rail.
- 3.7 Install the filler cap on the fuel tank.
4. Disconnect the fuel supply line from the filter/pressure regulator, then disconnect the EVAP canister line from the rollover valve. See [Fig. 3](#).
5. Disconnect the electrical connector.
6. Remove the fuel pump module from the fuel tank.
 - 6.1 Clean the top of the fuel pump module to prevent dirt from entering the fuel tank.
 - 6.2 Remove the two capscrews holding the fuel pump guard bracket in place. Remove the guard bracket, capscrews, and hardened flatwashers.
 - 6.3 Remove the other three capscrews holding the fuel pump clamp ring in place. Remove the capscrews and hardened flatwashers.
 - 6.4 Remove the fuel pump module from the fuel tank. See [Fig. 4](#).
 - 6.5 Remove the fuel pump module gasket from the fuel tank (see [Fig. 5](#)) and discard the old gasket.

**Fig. 3, Fuel Pump Module (top view)**

7. Replace the fuel filter.
 - 7.1 Use an appropriate tool to pry back the retaining tabs. See [Fig. 4](#).
 - 7.2 Remove the in-tank fuel filter from the fuel pump module.
 - 7.3 Install the new filter into the retaining tabs until the filter is firmly seated.
8. Check that the sensing unit, electrical wires, float, and in-tank fuel filter are properly installed.
9. Install a new fuel pump module gasket in the opening of the fuel tank.
10. Position the fuel pump module in the orifice on top of the fuel tank. Check that the fuel filter/pressure regulator is facing the frame rail. See [Fig. 3](#).

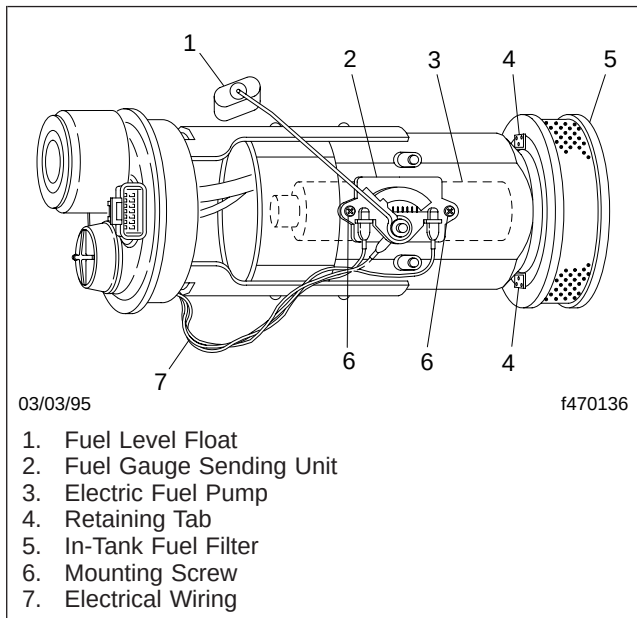


Fig. 4, Fuel Pump Module (side view)

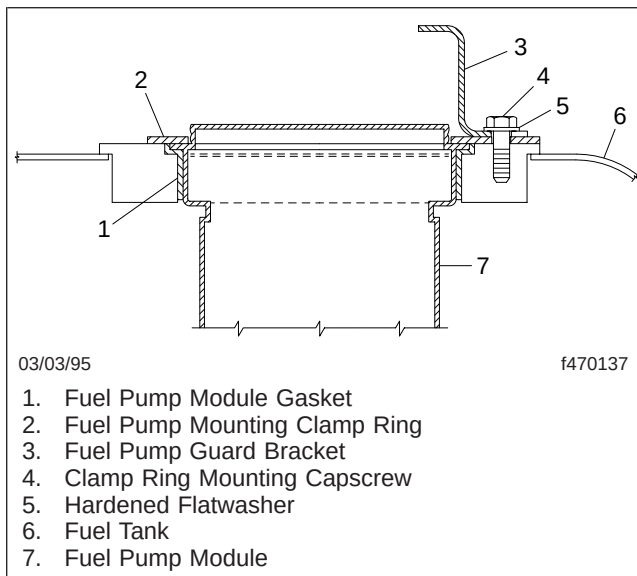


Fig. 5, Fuel Pump Module (cutaway view)

11. Apply a light coat of silicone spray to the gasket if needed to ease installation, then install the fuel pump module in the fuel tank.

IMPORTANT: Only use grade 8 capscrews.

NOTE: Use the holes not intended for the guard bracket.

- 11.1 Install the fuel pump clamp ring over the fuel pump module, then install three 5/16–18 grade 8 capscrews and hardened flatwashers to hold it in place. Do not tighten the capscrews yet.
- 11.2 Install the fuel pump guard bracket over the fuel filter/pressure regulator, then fasten it in place with the remaining two capscrews and hardened flatwashers.
- 11.3 Tighten all five capscrews 15 lbf·ft (20 N·m).
12. Connect the fuel lines to the fittings on the fuel filter/pressure regulator and the rollover valve. Reconnect the electrical connector.
13. Fill the fuel tank with clean, unleaded gasoline.
14. Connect the batteries, start the engine, and check for fuel leaks. Also check that the fuel level gauge is working properly. Correct any fuel leaks with the engine OFF.

Title of Maintenance Operation (MOP)

MOP Number

Exhaust System Inspecting (Noise Emission Controls) 49-01

49-01 Exhaust System Inspecting (Noise Emission Controls)

NOTE: In addition to the maintenance interval in this manual, inspect the exhaust system if the vehicle has a noticeable increase in noise level at any time. Replace parts that show leakage, wear, or damage.

1. Check the muffler body, muffler outlet stack, muffler shield, and inlet tubes, for leakage, dents, corrosion, or holes in the muffler.
2. Inspect the exhaust pipe for leakage, wear, or damage; replace with new parts, if needed. Do not reuse wide-band clamps. Once a clamp is removed, it must be replaced.
 - 2.1 On Caterpillar, Cummins, and Detroit Diesel engines, check for leakage at the V-type clamp that attaches the exhaust pipe to the turbocharger exhaust outlet. If leakage exists, tighten the nut on the V-type clamp 85 lbf·in (940 N·cm). If leakage persists, install a new V-band coupling.
 - 2.2 On Mercedes-Benz OM 366LA and Dodge Magnum engines, check the tightness of the fasteners that attach the exhaust pipe to the exhaust flange (**Fig. 1**). If needed, tighten the fasteners 33 lbf·ft (45 N·m) for Mercedes-Benz OM 366LA engines. For Dodge Magnum engines, tighten the fasteners 25 lbf·ft (34 N·m).
3. Check for leakage at each wide-band exhaust clamp (**Fig. 2**). If leakage exists, tighten the nuts 40 to 60 lbf·ft (54 to 81 N·m). If leakage persists, install a new wide-band exhaust clamp. See **Group 49** of the *Business Class® Trucks Service Manual* for procedures.

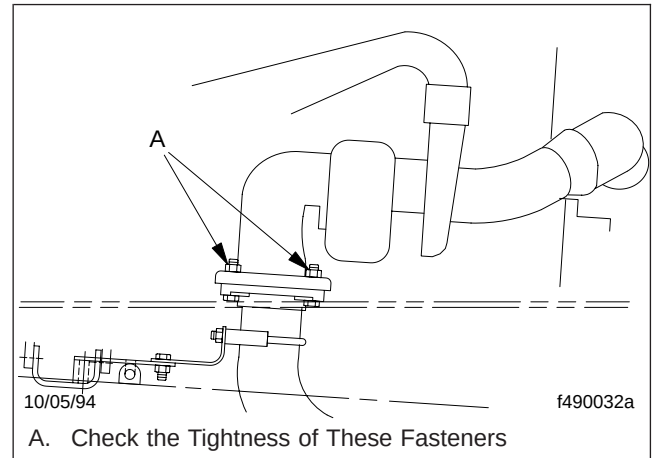


Fig. 1, Typical Exhaust-Pipe to Exhaust-Flange Fasteners, OM 366 Engine Shown

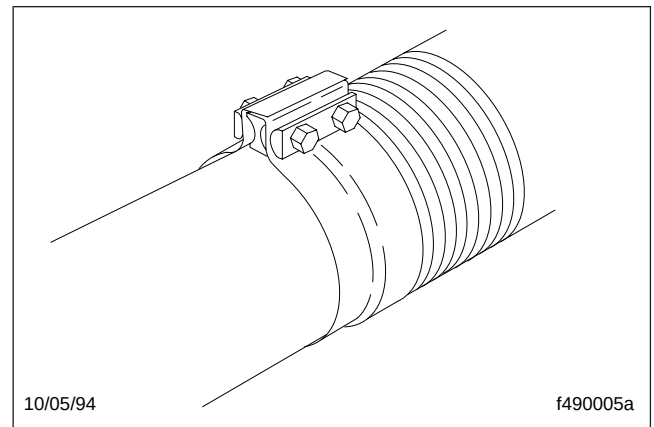


Fig. 2, Wide-Band Exhaust Clamp

Electrical, Instruments, and Controls

54

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Coolant Level Sensor Cleaning.	54-02
Electrical System Checking.	54-01

54-01 Electrical System Checking

Cab

1. Uncover the electrical panel (**Fig. 1**) by removing the fasteners.

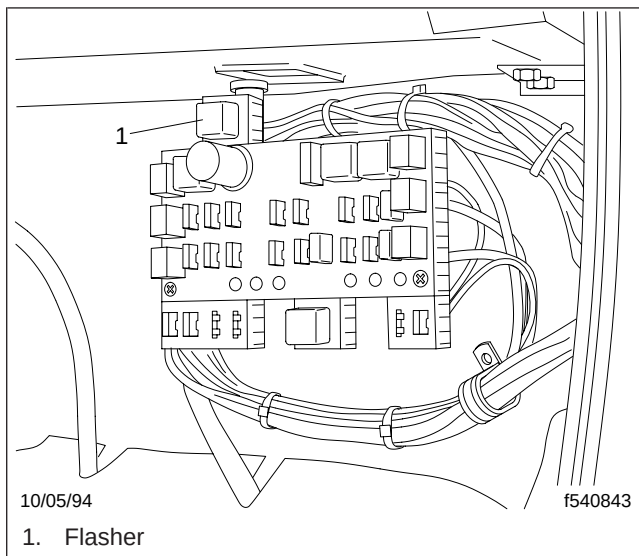


Fig. 1, Under-Dash Electrical Panel

2. Check the wiring harness for movement that could strain the electrical connections. Install more clamps on the harness, if needed.
3. Check all the wiring for chafing, kinks, and discolored insulation. Find the cause of any problems, then repair, replace, or reroute the wires, as needed.
4. Check that all the relays are firmly seated in their mounting plates.
5. Check the turn-signal flasher (if so equipped). See **Fig. 1**. Make sure that the two male and female connectors are firmly connected. Check that the flasher fuse is firmly seated in its holder.
6. Check the cigarette lighter. Look inside the socket for signs of overheating (discoloration, melting) caused by misuse of the lighter socket.
7. Test the electric horn. If it does not work, check the adjustment screw on the horn unit. Turn the screw in or out, until the horn works. If the horn

still does not work, check the wiring to it. If the wiring checks out okay, replace the horn.

8. Check connectors on the right side of the firewall, below the radiator surge tank. See **Fig. 2**. Check the terminals for tightness, damage, and corrosion or dirt.

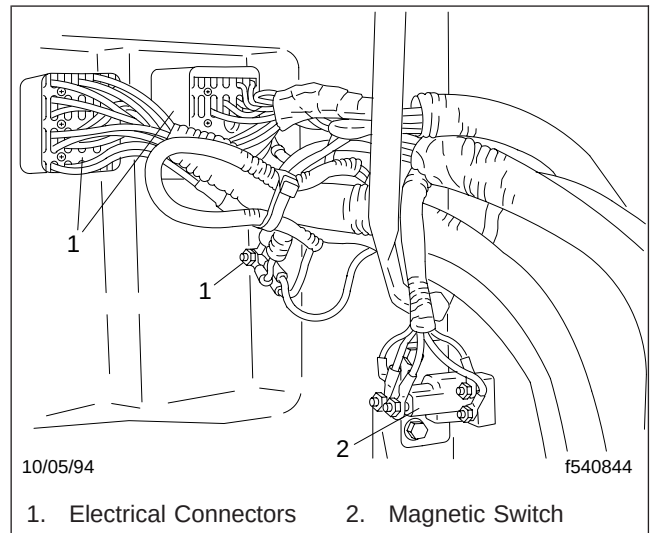


Fig. 2, Right Side of the Firewall

9. Check the seven-way trailer cable plug at the back of the cab. Make sure all the pins are tight and free of dirt and grease.

Chassis

1. Check the main wiring harness. Check the wiring insulation for damage from chafing or heat. Also check for kinks. Reroute, repair, or replace the wires as needed.
2. Check all the tie straps for breakage or damage. Replace any broken or cracked tie straps.

CAUTION

Do not use flat-strip aluminum tie straps for holding electrical wiring. The sharp edges on these tie straps may cause breaks in the wire insulation, allowing the aluminum tie strap to make contact with the wire. This could cause a short circuit and damage to the wiring.

3. Check the temperature sending units on the axles and transmission. Check for damaged wires and loose connectors.

54-02 Coolant Level Sensor Cleaning

1. Drain enough coolant from the radiator to expose the coolant level sensor.
2. Disconnect wire 173 from the sensor in the radiator surge tank. Remove the sensor from the surge tank.
3. Using a fine-grit sandpaper, clean the sensor until the metal is exposed. Clean the tapped hole with a wire brush.
4. Install the sensor (do not seal the sensor threads with tape), and reconnect wire 173. Fill the cooling system to the proper level.
5. Start the engine. The LOW WTR light and warning buzzer should be off. If the light and buzzer are off, the sensor is okay. If the light and buzzer are on, replace the sensor.

Title of Maintenance Operation (MOP)

MOP Number

Weatherstrip, Door Latch, and Door Hinge Lubricating. 72-01

72-01 Weatherstrip, Door Latch, and Door Hinge Lubricating

Lightly coat door weatherstrips with a lubricant that is safe (as recommended by the lubricant manufacturer) on rubber.

Apply a few drops of light engine oil, or spray a light coating of silicone lubricant (such as WD-40® or an equivalent) on the door latch mechanism. This will help reduce noise and wear. Wipe off any excess oil or silicone lubricant.

Lubricate door hinges by spraying them with a light coating of silicone lubricant (such as WD-40 or an equivalent).

Always lubricate new cab-door hinges at installation.

Title of Maintenance Operation (MOP)

MOP Number

Air Conditioner Checking, R-12 and R-134a Refrigerant Systems. 83-01

83-01 Air Conditioner Checking, R-12 and R-134a Refrigerant Systems

Preliminary Checks

1. Apply the parking brakes and chock the tires.
2. Make sure the refrigerant compressor drive belt is not damaged, and is correctly tensioned. Also check the tightness of the compressor mounting fasteners. For instructions and torque values, see **Group 01** of the *Business Class® Trucks Service Manual*.
3. Using a feeler gauge, check for correct clutch clearance. For instructions, see **Group 83** in the *Business Class® Trucks Service Manual*.
4. Inspect the compressor clutch coil wire. Check the connector for damage or looseness. Replace the wire if it is damaged.
5. Check for broken, burst, or cut hoses. Also check for loose fittings on all parts.



WARNING

Wear eye protection when using compressed air or high-pressure water to clean parts, as permanent harm to eyes could result from flying debris.

6. Check for a build-up of road debris on the condenser fins. Using a whiskbroom and air pressure, or a spray of soapy water, carefully clean off the condenser; be careful not to bend the fins.

Cooling Checking

1. Start the engine, and set engine speed at 1500 rpm. Close the doors and windows.

IMPORTANT: When outside temperature and humidity are high, it will take longer to cool the cab, especially if fresh-air vents are left open.

2. Turn on the air conditioner; set the controls at maximum cooling and blower speed.
3. Allow the system to run for at least 10 minutes (longer on hot and humid days).

4. Check air flow from the vents. If there is not enough air flow, check the air intake vent for blockage, and the blower motor for proper operation.

If the air flow is not cold enough, see **Group 83** of the *Business Class® Trucks Service Manual*.

5. Carefully feel the system lines.
 - The compressor discharge line should feel hot.
 - The condenser inlet line should be noticeably warmer than the outlet line.
 - The line from the condenser should feel warm.
 - The inlet and outlet lines of the receiver-drier should be about the same temperature.
 - The line from the receiver-drier to the evaporator should feel warm.
 - The line from the evaporator to the compressor should feel cold.

NOTE: Oily spots on the lines or at the fittings could indicate a system leak.

Refrigerant Checking

1. If equipped with a moisture indicator sight glass, check the color of the moisture indicator. See **Fig. 1**, Ref. 1.

If the indicator is a deep cobalt blue, the refrigerant charge is dry.

If the indicator is *not* blue, the system is contaminated with water; recover the refrigerant, replace the receiver-drier, evacuate the system, and add a full refrigerant charge.

2. *On R-12 refrigerant systems only*, check the receiver-drier sight glass. See **Fig. 1**, Ref. 2.

The presence or absence of bubbles tells whether or not the system has enough refrigerant. Bubbles normally appear when the system is started, then disappear after a few seconds. Only an occasional bubble should be seen during normal operation. If bubbles continue all of the time the system is running, the system is merely low on (not completely out of) refrigerant.

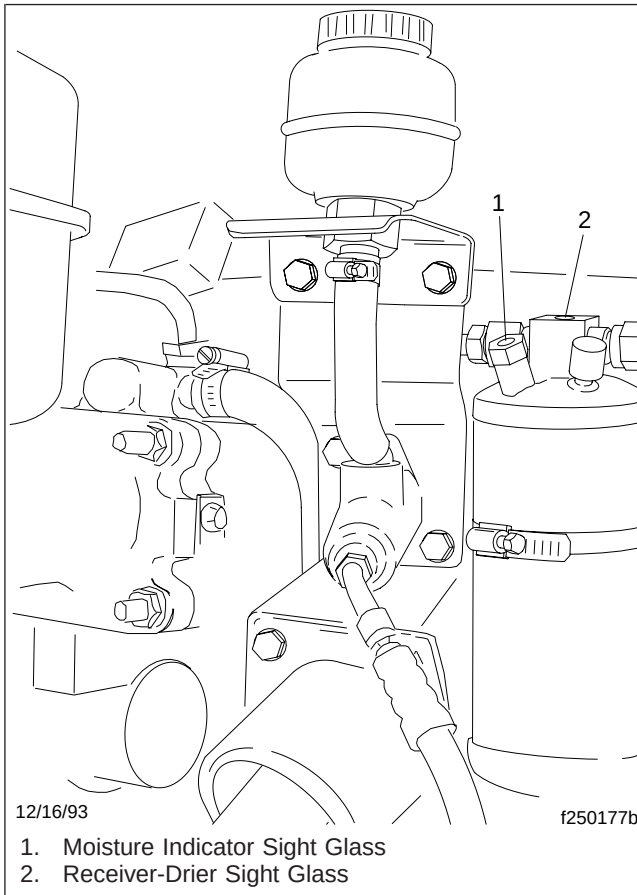


Fig. 1, Receiver-Drier

A clear sight glass means that the system has enough refrigerant to work properly, or that it is completely out of refrigerant, or that it is over-charged.

A cloudy sight glass means that dirt or broken-down bits of desiccant are flowing through the system. This is a serious condition that requires complete flushing of the system, installation of a new receiver-drier, and, if the desiccant cartridge of the receiver-drier has fallen apart, installation of a new refrigerant compressor and expansion valve.

Oil streaks in the sight glass mean low refrigerant, or too much oil in the system.