STERLING
TRUCKS

L-LINE AND A-LINE MAINTENANCE MANUAL

Models: L7500
L7501
L8500
L8511
L8513
L9500
L9501
L9511
L9513
L9522
A9500
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Foreword

Scheduled maintenance provides a key element for the safe operation of your vehicle. A proper maintenance program also helps to minimize downtime and to safeguard warranties. This maintenance manual provides information necessary for years of safe, reliable, and cost-efficient vehicle operation.

IMPORTANT: The maintenance operations in this manual are **not all-inclusive**. Also refer to other component and body manufacturers' instructions for specific inspection and maintenance instructions.

Perform the operations in this maintenance manual at scheduled intervals. Perform the pretrip and post-trip inspections, and daily/weekly/monthly maintenance, as outlined in the vehicle driver's manual. Major components, such as engines, transmissions, and rear axles, are covered in their own maintenance and operation manuals, that are provided with the vehicle. Perform any maintenance operations listed at the intervals scheduled in those manuals. Your Sterling Dealership has the qualified technicians and equipment to perform this maintenance for you. They can also set up a scheduled maintenance program tailored specifically to your needs. Optionally, they can assist you in learning how to perform these maintenance procedures.

IMPORTANT: Descriptions and specifications in this manual were in effect at the time of printing. Daimler Trucks North America LLC reserves the right to discontinue models and to change specifications or design at any time without notice and without incurring obligation. Descriptions and specifications contained in this publication provide no warranty, expressed or implied, and are subject to revision and editions without notice.

Refer to www.Daimler-TrucksNorthAmerica.com and www.SterlingTrucks.com for more information, or contact Daimler Trucks North America LLC at the address below.

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

Daimler Trucks North America LLC distributes the following major service publications in paper and electronic (via ServicePro®) formats.

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, and specifications.

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, and 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 and post-trip inspections, and daily, weekly, and monthly maintenance of vehicle components. Driver's/operator's manuals do not contain detailed repair or service information.

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.

Parts Technical Bulletins

Parts technical bulletins provide information on parts. These bulletins contain lists of parts and BOMs needed to do replacement and upgrade procedures.

Web-based repair, service, and parts documentation can be accessed using the following applications on the AccessSterling.com website.

ServicePro

ServicePro® provides Web-based access to the most up-to-date versions of the publications listed above. In addition, the Service Solutions feature provides diagnostic assistance with Symptoms Search, by connecting to a large knowledge base gathered from technicians and service personnel. Search results for both documents and service solutions can be narrowed by initially entering vehicle identification data.

PartsPro

PartsPro® is an electronic parts catalog system, showing the specified vehicle's build record.

EZWiring

EZWiring™ makes Sterling, Freightliner, Freightliner Custom Chassis Corporation, Thomas Built Buses, and Western Star products' wiring drawings and floating pin lists available online for viewing and printing. EZWiring can also be accessed from within PartsPro.

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Descriptions of Service Publications

Warranty-related service information available on the AccessSterling.com website includes the following documentation.

Recall Campaigns Recall campaigns cover situations that involve service work or replacement of parts in connection with a recall notice. These campaigns pertain to matters of vehicle safety. All recall campaigns are distributed to dealers; customers receive notices that apply to their vehicles.

Field Service Campaigns Field service campaigns are concerned with non-safety-related service work or replacement of parts. All field service campaigns are distributed to dealers; customers receive notices that apply to their vehicles.

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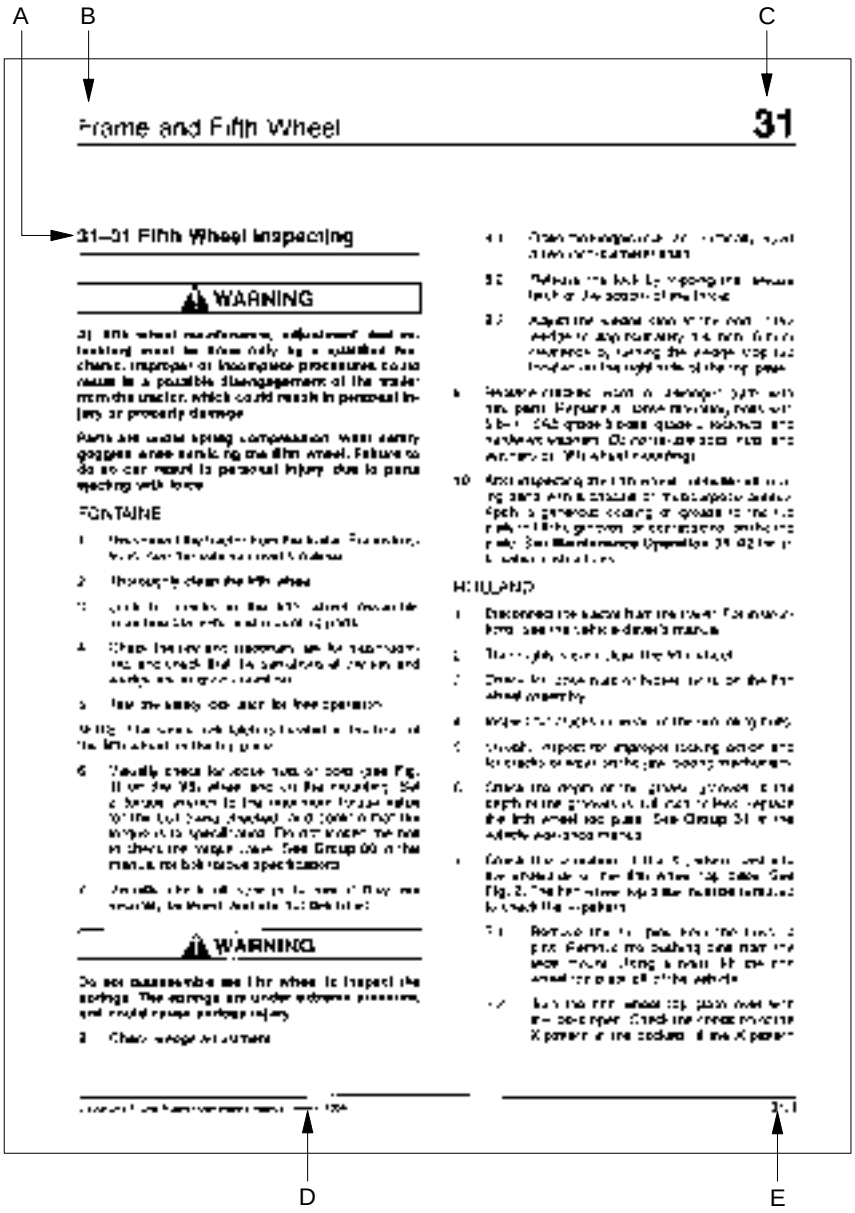
Page Description

For an example of an *L-Line and A-Line Maintenance Manual* page, see **Fig. 1**.



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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, Example of an L-Line and A-Line Maintenance Manual Page

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Maintenance Manual Contents

Group No.	Group Title
00	General Information
01	Engine
09	Air Intake
13	Air Compressor
15	Alternators and Starters
20	Engine Cooling/Radiator
25	Clutch
26	Transmission
31	Frame and Fifth Wheel
32	Suspension
33	Front Axle
35	Rear Axle
40	Wheels and Tires
41	Driveline
42	Brakes
46	Steering
47	Fuel
49	Exhaust
54	Electrical, Instruments, and Controls
72	Doors
83	Heater and Air Conditioner
88	Hood, Grille, and Cab Fenders

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Determining Scheduled Maintenance Intervals

Performing regular maintenance on your Sterling vehicle will help ensure that your Sterling vehicle delivers safe reliable service and optimum performance for years to come. Failure to follow a regular maintenance program can result in inefficient operation and unscheduled down time.

To determine the correct maintenance intervals for your vehicle you must first determine the type of service or conditions the vehicle will be operating in. Generally, most vehicles operate under conditions that fall within one of the three types of service described. Before placing your new vehicle in service, determine the type of service (Service Schedule I, II, or III) that applies to the intended use of the vehicle. After determining the vehicle's type of service, refer to the service schedule table or the vehicle maintenance schedule table, to determine how often maintenance should be performed.

When the vehicle reaches the distance given for a maintenance interval, see the "Maintenance Interval Operations Table" for a list of the maintenance operations to be performed at that maintenance interval. Use the maintenance operation reference numbers to find detailed instructions in the manual on each operation.

Types of Service

Service Schedule I (severe service) applies to vehicles that annually travel less than 6000 miles (10 000 kilometers) *or* that operate under severe conditions. Examples of Schedule I (severe service) 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); or farm operation.

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

Service 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 (long-haul transport) usage are: regional delivery that is mostly freeway miles; interstate transport; or any road operation with high annual mileage.

NOTE: Maintenance instructions in this manual are based on average vehicle use and normal operating conditions. Unusual vehicle operating conditions may require service at more frequent intervals.

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Maintenance Service Table: 00–02

Maintenance Service Table					
Service Schedule	**Maintenance Interval Operation**	**Maintenance Intervals**			
		Frequency	**Miles**	**km**	**Hours**
Schedule I* — (severe service) vehicles that annually travel up to 6000 miles (10 000 km)	Initial Maintenance (IM)	first	1000	1600	100
	Maintenance 1 (M1)	every	1000	1600	100
	Maintenance 2 (M2)	every	5000	8000	500
	Maintenance 3 (M3)	every	10,000	16 000	1000
	Maintenance 4 (M4)	every	20,000	32 000	2000
Schedule II† — (short-haul transport) vehicles that annually travel up to 60,000 miles (100 000 km)	Initial Maintenance (IM)	first	9500	15 000	—
	Maintenance 1 (M1)	every	9500	15 000	
	Maintenance 2 (M2)	every	37,500	60 000	
	Maintenance 3 (M3)	every	75,000	120 000	
	Maintenance 4 (M4)	every	150,000	240 000	
Schedule III† — (long-haul transport) vehicles that annually travel over 60,000 miles (100 000 km)	Initial Maintenance (IM)	first	12,500	20 000	—
	Maintenance 1 (M1)	every	12,500	20 000	
	Maintenance 2 (M2)	every	50,000	80 000	
	Maintenance 3 (M3)	every	100,000	160 000	
	Maintenance 4 (M4)	every	300,000	480 000	

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

† Use Schedule I (severe service) maintenance intervals for vehicles that operate under severe conditions, such as extremely poor roads, heavy dust accumulation, extreme climate, frequent short distance travel, construction-site operation, city operation (garbage truck), or farm operation.

Table 1, Maintenance Service Table

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Vehicle Maintenance Schedule Tables: 00–03

1st through 35th Vehicle Maintenance Intervals for Service Schedule I					
Maint. Number	Required Maintenance Operation Interval	Service Date	Service I		
			Miles	km	Hours
1st	Initial Maintenance (IM) and M1		1000	1600	100
2nd	M1		2000	3200	200
3rd	M1		3000	4800	300
4th	M1		4000	6400	400
5th	M1 and M2		5000	8000	500
6th	M1		6000	9600	600
7th	M1		7000	11 200	700
8th	M1		8000	12 800	800
9th	M1		9000	14 400	900
10th	M1, M2 and M3		10,000	16 000	1000
11th	M1		11,000	17 600	1100
12th	M1		12,000	19 200	1200
13th	M1		13,000	20 800	1300
14th	M1		14,000	22 400	1400
15th	M1 and M2		15,000	24 000	1500
16th	M1		16,000	25 600	1600
17th	M1		17,000	27 200	1700
18th	M1		18,000	28 800	1800
19th	M1		19,000	30 400	1900
20th	M1, M2, M3 and M4		20,000	32 000	2000
21st	M1		21,000	33 600	2000
22nd	M1		22,000	35 200	2200
23rd	M1		23,000	36 800	2300
24th	M1		24,000	38 400	2400
25th	M1 and M2		25,000	40 000	2500
26th	M1		26,000	41 600	2600
27th	M1		27,000	43 200	2700
28th	M1		28,000	44 800	2800
29th	M1		29,000	46 400	2900
30th	M1, M2 and M3		30,000	48 000	3000
31st	M1		31,000	49 600	3100
32nd	M1		32,000	51 200	3200
33rd	M1		33,000	52 800	3300
34th	M1		34,000	54 400	3400

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Vehicle Maintenance Schedule Tables: 00–03

1st through 35th Vehicle Maintenance Intervals for Service Schedule I					
Maint. Number	Required Maintenance Operation Interval	Service Date	Service I		
			Miles	km	Hours
35th	M1 and M2		35,000	56 000	3500

Table 2, 1st through 35th Vehicle Maintenance Intervals for Service Schedule I

36th through 70th Vehicle Maintenance Intervals for Service Schedule I					
Maint. Number	Required Maintenance Operation Interval	Service Date	Service I		
			Miles	km	Hours
36th	M1		36,000	57 600	3600
37th	M1		37,000	59 200	3700
38th	M1		38,000	60 800	3800
39th	M1		39,000	62 400	3900
40th	M1, M2, M3 and M4		40,000	64 000	4000
41st	M1		41,000	65 600	4100
42nd	M1		42,000	67 200	4200
43rd	M1		43,000	68 800	4300
44th	M1		44,000	70 400	4400
45th	M1 and M2		45,000	72 000	4500
46th	M1		46,000	73 600	4600
47th	M1		47,000	75 200	4700
48th	M1		48,000	76 800	4800
49th	M1		49,000	78 400	4900
50th	M1, M2 and M3		50,000	80 000	5000
51st	M1		51,000	82 000	5100
52nd	M1		52,000	83 700	5200
53rd	M1		53,000	85 300	5300
54th	M1		54,000	86 900	5400
55th	M1 and M2		55,000	88 500	5500
56th	M1		56,000	90 100	5600
57th	M1		57,000	91 700	5700
58th	M1		58,000	93 300	5800
59th	M1		59,000	94 900	5900
60th	M1, M2, M3 and M4		60,000	96 500	6000
61st	M1		61,000	98 200	6100
62nd	M1		62,000	99 800	6200
63rd	M1		63,000	101 400	6300
64th	M1		64,000	103 000	6400

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36th through 70th Vehicle Maintenance Intervals for Service Schedule I					
Maint. Number	Required Maintenance Operation Interval	Service Date	Service I		
			Miles	km	Hours
65th	M1 and M2		65,000	104 600	6500
66th	M1		66,000	106 200	6600
67th	M1		67,000	107 800	6700
68th	M1		68,000	109 400	6800
69th	M1		69,000	111 000	6900
70th	M1, M2 and M3		70,000	112 700	7000

Table 3, 36th through 70th Vehicle Maintenance Intervals for Service Schedule I

71st through 100th Vehicle Maintenance Intervals for Service Schedule I					
Maint. Number	Required Maintenance Operation Interval	Service Date	Service I		
			Miles	km	Hours
71st	M1		71,000	114 300	7100
72nd	M1		72,000	115 900	7200
73rd	M1		73,000	117 500	7300
74th	M1		74,000	119 100	7400
75th	M1 and M2		75,000	120 700	7500
76th	M1		76,000	122 300	7600
77th	M1		77,000	123 900	7700
78th	M1		78,000	125 500	7800
79th	M1		79,000	127 100	7900
80th	M1, M2, M3 and M4		80,000	128 700	8000
81st	M1		81,000	130 400	8100
82nd	M1		82,000	132 000	8200
83rd	M1		83,000	134 000	8300
84th	M1		84,000	135 200	8400
85th	M1 and M2		85,000	137 000	8500
86th	M1		86,000	138 400	8600
87th	M1		87,000	140 000	8700
88th	M1		88,000	141 600	8800
89th	M1		89,000	143 200	8900
90th	M1, M2 and M3		90,000	144 800	9000
91st	M1		91,000	146 500	9100
92nd	M1		92,000	148 100	9200
93rd	M1		93,000	150 000	9300
94th	M1		94,000	151 300	9400

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Vehicle Maintenance Schedule Tables: 00–03

71st through 100th Vehicle Maintenance Intervals for Service Schedule I					
Maint. Number	Required Maintenance Operation Interval	Service Date	Service I		
			Miles	km	Hours
95th	M1 and M2		95,000	153 000	9500
96th	M1		96,000	155 000	9600
97th	M1		97,000	156 100	9700
98th	M1		98,000	157 700	9800
99th	M1		99,000	159 300	9900
100th	M1, M2, M3 and M4		100,000	160 900	10 000

Table 4, 71st through 100th Vehicle Maintenance Intervals for Service Schedule I

Vehicle Maintenance Intervals for Service Schedule II				
Maint. Number	Required Maintenance Operation Interval	Service Date	Miles	km
1st	Initial Maintenance (IM) and M1		10,000	16 000
2nd	M1		19,000	30 000
3rd	M1		28,000	45 000
4th	M1 and M2		38,000	60 000
5th	M1		47,000	75 000
6th	M1		56,000	90 000
7th	M1		66,000	105 000
8th	M1, M2 and M3		75,000	120 000
9th	M1		84,000	135 000
10th	M1		94,000	150 000
11th	M1		103,000	165 000
12th	M1 and M2		112,000	180 000
13th	M1		122,000	195 000
14th	M1		131,000	210 000
15th	M1		141,000	225 000
16th	M1, M2, M3 and M4		150,000	240 000

Table 5, Vehicle Maintenance Intervals for Service Schedule II

Vehicle Maintenance Intervals for Service Schedule III				
Maint. Number	Required Maintenance Operation Interval	Service Date	Miles	km
1st	Initial Maintenance (IM) and M1		12,500	20 000
2nd	M1		25,000	40 000
3rd	M1		37,000	60 000
4th	M1 and M2		50,000	80 000

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Vehicle Maintenance Intervals for Service Schedule III				
Maint. Number	**Required Maintenance Operation Interval**	**Service Date**	**Miles**	**km**
5th	M1		62,000	100 000
6th	M1		75,000	120 000
7th	M1		87,000	140 000
8th	M1, M2 and M3		100,000	160 000
9th	M1		112,000	180 000
10th	M1		125,000	200 000
11th	M1		137,000	220 000
12th	M1 and M2		150,000	240 000
13th	M1		162,000	260 000
14th	M1		175,000	280 000
15th	M1		187,000	300 000
16th	M1, M2 and M3		200,000	320 000
17th	M1		212,000	340 000
18th	M1		225,000	360 000
19th	M1		237,000	380 000
20th	M1 and M2		250,000	400 000
21st	M1		262,000	420 000
22nd	M1		275,000	440 000
23rd	M1		287,000	460 000
24th	M1, M2, M3 and M4		300,000	480 000

Table 6, Vehicle Maintenance Intervals for Service Schedule III

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Lubrication and Fluid Level Check: 00–04

Table 7 summarizes all operations that must be performed to complete lubrication and fluid level checks in the M1 maintenance interval for all service schedules.

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.

M1 Maintenance Operation 00–04, Lubrication and Fluid Level Check for Service Schedules I, II, and III		
Maintenance Operation Number	**Operation Description**	**Check**
25–01	Clutch Release Bearing Lubricating	
26–04	Transmission Breather and Oil Level Checking	
31–02	Fifth Wheel Lubricating	
31–05	Trailer Electrical Connector Lubricating	
32–02	Suspension Lubricating	
33–01	Knuckle Pin Lubricating	
33–02	Tie-Rod End Inspecting and Lubricating	
35–01	Axle Breather and Lubricant Level Checking	
41–02	Driveline Lubricating	
42–02	Automatic Slack Adjuster Lubricating and Checking	
46–01	Steering Driveline Lubricating	
46–02	Drag Link and Power Steering Cylinder Lubricating	
46–03	Power Steering Reservoir Fluid Level Checking	
46–05	TRW Power Steering Gear Lubricating, TAS Series	
72–01	Door Latch and Door Hinge Lubricating	
88–01	Hood Hinge Bushing Lubricating	

Table 7, M1 Maintenance Operation 00-04, Lubrication and Fluid Level Check for Service Schedules I, II, and III

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Maintenance Operation Sets Table: 00–05

IMPORTANT: At each maintenance operation set, in addition to the maintenance operations listed in this table, perform all daily, weekly, and monthly maintenance operations listed in **Chapter 11, "Pretrip and Post-Trip Inspections and Maintenance"** of the *L-Line and A-Line Driver's Manual*.

The "Maintenance Operation Number" is a reference number matching the text in this manual which provides detailed instructions on the maintenance operations to be performed.

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

Maintenance Operation Sets							
Maintenance Operation Number	Operation Description	Maintenance Interval				
		IM	M1	M2	M3	M4
01–01	*Engine Rear-Support Assembly Checking*				•	•
01–02	*Engine Noise Panel Inspecting*				•	•
01–03	Jacobs Engine Brake Wiring Inspecting			•	•	•
01–04	Engine Drive Belt Inspecting				•	•
09–01	Air Cleaner Element Inspecting and Replacing				•	•
13–01	Bendix Air Compressor Inspecting		•	•	•	•
15–01	Alternator, Battery, and Starter Checking	•			•	•
20–01	Radiator Cap Checking			•	•	•
20–02	Radiator Pressure Flushing and Coolant Changing					•
20–03	*Fan Drive and Clutch Checking*			•	•	•
25–01	Clutch Release Bearing Lubricating		•	•	•	•
26–01	Allison Transmission Fluid and Filter Changing					•
26–02	Manual Transmission Magnetic Plug Cleaning and Oil Changing	•		•	•	•
26–03	Transmission Air Filter/Regulator Checking, and Cleaning or Replacing			•	•	•
26–04	Transmission Breather and Oil Level Checking		•	•	•	•
31–01	Fifth Wheel Inspecting		•	•	•	•
31–02	Fifth Wheel Lubricating		•	•	•	•
31–03	Frame Fastener Torque Checking	•				
31–04	Holland Fifth Wheel Sliding Mechanism Inspecting			•	•	•
31–05	Trailer Electrical Connector Lubricating	•	•	•	•	•
32–01	Suspension Inspecting	•	•	•	•	•
32–02	Suspension Lubricating	•	•	•	•	•
32–03	Suspension U-Bolt Torque Checking	•			•	•
33–01	Knuckle Pin Lubricating		•	•	•	•
33–02	Tie-Rod End Inspecting and Lubricating		•	•	•	•
33–03	All-Axle Alignment Checking	•				
35–01	Axle Breather and Lubricant Level Checking		•	•	•	•
35–02	Axle Lubricant Changing, Oil Filter Replacing, and Magnetic Strainer Cleaning	•			•	•

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Maintenance Operation Sets Table: 00–05

Maintenance Operation Sets						
Maintenance Operation Number	Operation Description	Maintenance Interval				
		IM	M1	M2	M3	M4
40–01	Wheel Nut and Rim Nut Checking			•	•	•
41–01	Driveline Inspecting	•	•	•	•	•
41–02	Driveline Lubricating	•	•	•	•	•
42–01	Camshaft Bracket Bushing Lubricating			•	•	•
42–02	Automatic Slack Adjuster Lubricating and Checking		•	•	•	•
42–03	Bendix Air Dryer Checking (AD–IP or AD–9)				•	•
42–04	Bendix Air Dryer Desiccant Replacing (AD–9)					•
42–05	Bendix Air Brake Valve Operation Checking (BP–R1 and E–12)				•	•
42–06	Bendix Air Brake Valve Disassembly, Cleaning, and Inspecting (Double Check Valve, E–12, MV–3, PP–7, QR–1, SR–1, ST–3, TC–6, TP–5, TR–3)				•	•
42–07	Bendix Air Brake Valve Disassembly, Cleaning, Inspecting, and Lubricating (DV–2 and Single Check Valve)			•	•	•
42–08	Bendix Air Brake Valve Inspecting and Testing (MV–3 and TC–6)				•	•
42–09	Bendix Foot Brake Valve Actuator Lubricating and Leak-Testing (E–12)				•	•
42–10	Brake Inspection	•	•	•	•	•
46–01	Steering Driveline Lubricating		•	•	•	•
46–02	Drag Link and Power Steering Cylinder Lubricating		•	•	•	•
46–03	Power Steering Reservoir Fluid Level Checking		•	•	•	•
46–04	Power Steering Reservoir Fluid and Filter Changing			•	•	•
46–05	TRW Power Steering Gear Lubricating, TAS Series		•	•	•	•
47–01	Fuel Tank Vent Checking			•	•	•
47–02	Fuel Tank Band Nut Tightening	•	•	•	•	•
47–03	Fuel Separator Sight Bowl Cleaning and Element Replacing			•	•	•
49–01	*Exhaust System Inspecting*	•	•	•	•	•
54–01	Electrical System Checking	•			•	•
72–01	Door Latch and Door Hinge Lubricating		•	•	•	•
83–01	Air Conditioner Inspecting			•	•	•
83–02	Air Filter Replacing*					
88–01	Hood Hinge Bushings Lubricating		•	•	•	•

* Replace the HVAC filter every 6 months regardless of mileage.

Table 8, Maintenance Operation Sets

https://www.besttruckmanuals.com/

Initial Maintenance (IM) Operations: 00–06

IMPORTANT: After performing all operations listed in this table, perform all daily, weekly, and monthly maintenance operations listed in **Chapter 11, "Pre-trip and Post-Trip Inspections and Maintenance"** of the *L-Line and A-Line Driver's Manual*.

The "Maintenance Operation Number" is a reference number matching the text in this manual which provides detailed instructions on the maintenance operations to be performed.

Initial Maintenance (IM) Operations for Service Schedules I, II, and III		
Maintenance Operation Number	**Operation Description**	**Check**
15–01	Alternator, Battery, and Starter Checking	
26–02	Manual Transmission Magnetic Plug Cleaning and Oil Changing	
31–03	Frame Fastener Torque Checking	
32–01	Suspension Inspecting	
32–02	Suspension Lubricating	
32–03	Suspension U-Bolt Torque Checking	
33–03	All-Axle Alignment Checking	
35–02	Axle Lubricant Changing, Oil Filter Replacing, and Magnetic Strainer Cleaning	
41–01	Driveline Inspecting	
41–02	Driveline Lubricating	
47–02	Fuel Tank Band Nut Tightening	
54–01	Electrical System Checking	

Table 9, Initial Maintenance (IM) Operations for Service Schedules I, II, and III

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M1 Maintenance Interval Operations Table: 00–07

The "M1 Maintenance Interval Operations" table lists all maintenance operations that are to be performed at the M1 maintenance interval. The "Maintenance Operation Number" is a reference number matching the text in this manual that provides detailed instructions on the maintenance operations to be performed.

IMPORTANT: After performing all operations listed in this table, perform all daily, weekly, and monthly maintenance operations listed in **Chapter 11, "Pre-trip and Post-Trip Inspections and Maintenance"** of the *L-Line and A-Line Driver's Manual*.

M1 Maintenance Interval Operations for Service Schedules I, II, and III		
Maintenance Operation Number	**Operation Description**	**Check**
00–04	Lubrication and Fluid Level Check (includes the following): • Clutch Release Bearing Lubricating • Transmission Breather and Oil Level Checking • Fifth Wheel Lubricating • Trailer Electrical Connector Lubricating • Suspension Lubricating (Front and Rear) • Knuckle Pin Lubricating • Tie-Rod End Inspecting and Lubricating • Axle Breather and Lubricant Level Checking • Driveline Lubricating • Automatic Slack Adjuster Lubricating and Checking • Steering Driveline Lubricating • Drag Link and Power Steering Cylinder Lubricating • Power Steering Reservoir Fluid Level Checking • TRW Power Steering Gear Lubricating, TAS Series • Door Latch and Door Hinge Lubricating • Hood Hinge Bushings Lubricating	
13–01	Bendix Air Compressor Inspecting	
31–01	Fifth Wheel Inspecting	
32–01	Suspension Inspecting	
41–01	Driveline Inspecting	
42–10	Brake Inspecting	
47–02	Fuel Tank Band Nut Tightening	
49–01	*Exhaust System Inspecting*	

Table 10, M1 Maintenance Interval Operations for Service Schedules I, II, and III

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M2 Maintenance Interval Operations Table: 00–08

The "M2 Maintenance Interval Operations" table lists all maintenance operations that are to be performed at the M2 maintenance interval. The "Maintenance Operation Number" is a reference number matching the text in this manual which provides detailed instructions on the maintenance operations to be performed. All M1 maintenance interval operations must be completed before performing M2 maintenance interval operations.

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

M2 Maintenance Interval Operations for Service Schedules I, II, and III		
Maintenance Operation Number	**Operation Description**	**Check**
00–07	Perform all M1 Operations	
01–03	Jacobs Engine Brake Wiring Inspecting	
20–01	Radiator Cap Checking	
20–03	*Fan Drive and Clutch Checking*	
26–02	Manual Transmission Magnetic Plug Cleaning and Oil Changing	
26–03	Transmission Air Filter/Regulator Checking, and Cleaning or Replacing	
31–04	Holland Fifth Wheel Sliding Mechanism Inspecting	
40–01	Wheel Nut and Rim Nut Checking	
42–01	Camshaft Bracket Bushing Lubricating	
42–07	Bendix Air Brake Valve Disassembly, Cleaning, Inspecting, and Lubricating (DV–2 and Single Check Valve)	
46–04	Power Steering Reservoir Fluid and Filter Changing	
47–01	Fuel Tank Vent Checking	
47–03	Fuel Separator Sight Bowl Cleaning and Element Replacing	
83–01	Air Conditioner Inspecting	
83–02	Air Filter Replacing*	

* Replace the HVAC filter every 6 months regardless of mileage.

Table 11, M2 Maintenance Interval Operations for Service Schedules I, II, and III

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M3 Maintenance Interval Operations Table: 00–09

The "M3 Maintenance Interval Operations" table lists all maintenance operations that are to be performed at the M3 maintenance interval. The "Maintenance Operation Number" is a reference number matching the text in this manual which provides detailed instructions on the maintenance operations to be performed. All maintenance interval operations in M1 and M2 must be completed before performing M3 maintenance interval operations.

IMPORTANT: After performing all operations listed in this table, perform all daily, weekly, and monthly maintenance operations listed in **Chapter 11, "Pre-trip and Post-Trip Inspections and Maintenance"** of the *L-Line and A-Line Driver's Manual*.

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

M3 Maintenance Interval Operations for Service Schedules I, II, and III		
Maintenance Operation Number	**Operation Description**	**Check**
00–08	Perform all M1 Operations	
00–09	Perform all M2 Operations	
01–01	*Engine Rear-Support Assembly Checking*	
01–02	*Engine Noise Panel Inspecting*	
01–04	Engine Drive Belt Inspecting	
09–01	Air Cleaner Element Inspecting and Replacing	
15–01	Alternator, Battery, and Starter Checking	
32–03	Suspension U-Bolt Torque Checking	
35–02	Axle Lubricant Changing, Oil Filter Replacing, and Magnetic Strainer Cleaning	
42–03	Bendix Air Dryer Checking (AD–IP or AD–9)	
42–05	Bendix Air Brake Valve Operation Checking (BP–R1 and E–12)	
42–06	Bendix Air Brake Valve Disassembly, Cleaning, and Inspecting (Double Check Valve, E–12, MV–3, PP–7, QR–1, SR–1, ST–3, TC–6, TP–5, and TR–3)	
42–08	Bendix Air Brake Valve Inspecting and Testing (MV–3 and TC–6)	
42–09	Bendix Foot Brake Valve Actuator Lubricating and Leak-Testing (E–12)	
47–03	Fuel Separator Sight Bowl Cleaning and Element Replacing	
54–01	Electrical System Checking	

Table 12, M3 Maintenance Interval Operations for Service Schedules I, II, and III

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M4 Maintenance Interval Operations Table: 00–10

The "M4 Maintenance Interval Operations" table lists all maintenance operations that are to be performed at the M4 maintenance interval. The "Maintenance Operation Number" is a reference number matching the text in this manual which provides detailed instructions on the maintenance operations to be performed. All maintenance interval operations in M1, M2 and M3 must be completed before performing M4 maintenance interval operations.

IMPORTANT: After performing all operations listed in this table, perform all daily, weekly, and monthly maintenance operations listed in **Chapter 11, "Pre-trip and Post-Trip Inspections and Maintenance"** of the *L-Line and A-Line Driver's Manual*.

M4 Maintenance Interval Operations for Service Schedules I, II, and III		
Maintenance Operation Number	**Operation Description**	**Check**
00–07	Perform all M1 Operations	
00–08	Perform all M2 Operations	
00–09	Perform all M3 Operations	
20–02	Radiator Pressure Flushing and Coolant Changing	
26–01	Allison Transmission and Fluid Filter Changing	
42–04	Bendix Air Dryer Desiccant Replacing (AD–9)	

Table 13, M4 Maintenance Interval Operations for Service Schedules I, II, and III

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Noise Emission Controls Maintenance: 00–11

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-control degradation throughout the life of the vehicle. In compliance with the law, the noise emission controls maintenance information in each applicable group of this manual, in conjunction with the vehicle service manual, provides these instructions to owners.

Recommendations for Replacement Parts

Replacement parts used for maintenance or repair of noise emission controls should be genuine Sterling parts. If using other than genuine Sterling parts, the owner should be sure that such parts are warranted by their manufacturer to be equivalent to genuine Sterling parts in performance and durability.

Sterling Noise Emission Controls Warranty

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

Tampering With Noise Controls 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 element 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.
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 cab-tunnel or hood noise-deadening panels.

   C. Removal of, or rendering inoperative, the engine speed governor so as to allow engine speed to exceed manufacturer's specifications.

   D. Removal of, or rendering inoperative, the fan clutch, including bypassing the control on any thermostatic fan drive to cause it to operate continuously.

   E. Removal of the fan shroud.

   F. Removal of, or rendering inoperative, exhaust components, including exhaust pipe clamping.

   G. Removal of air intake components.

Maintenance Instructions

Scheduled intervals are in the maintenance tables in this group. "Verification of Inspections Log" (Groups 01 and 20, and Group 49) follows, and should be filled in each time noise emission controls on the vehicle are maintained or repaired.

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Verification of Inspections Log

Verification of Inspections Log, Groups 01 and 20				
Date	**Mileage**	**Item**	**Cost**	**Maintenance Facility**
Group 01 — Engine Rear Supports and Engine Noise Panels				
Group 20 — Fan Drive				

Table 14, Verification of Inspections Log, Groups 01 and 20

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Verification of Inspections Log: 00–12

Verification of Inspections Log, Group 49				
Date	**Mileage**	**Item**	**Cost**	**Maintenance Facility**
Group 49 — Exhaust System Components				

Table 15, Verification of Inspections Log, Group 49

https://www.besttruckmanuals.com/

Metric/U.S. Customary Conversion Tables: 00–13

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 16, Metric/U.S. Customary Conversion Table

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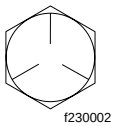
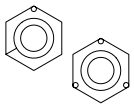
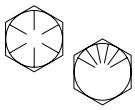
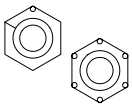
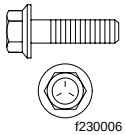
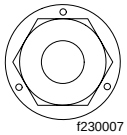
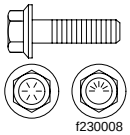
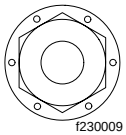
Metric/U.S. Customary Conversion Tables: 00–13

Temperature 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 17, Temperature Conversion

https://www.besttruckmanuals.com/

Torque Specifications Tables: 00–14

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)	
	 f230002	 f230003	 f230004	 f230005	 f230006	 f230007	 f230008	 f230009
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)		—		—	

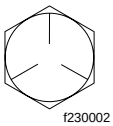
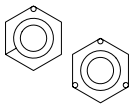
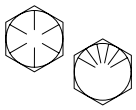
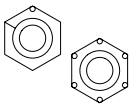
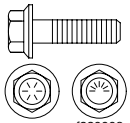
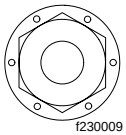
* Sterling recommends that all plated and unplated fasteners be coated with oil before installation.

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

Table 18, Torque Values for U.S. Customary Thread Fasteners With Lubricated or Plated Threads

https://www.besttruckmanuals.com/

Torque Specifications Tables: 00–14

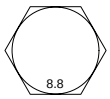
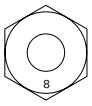
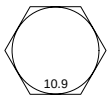
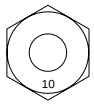
Torque Values for U.S. Customary Thread Fasteners With Dry (Unlubricated)* Plain (Unplated) Threads†						
Thread Diameter–Pitch	Regular Hex				Flanged	
	Grade 5 Bolt	Grade 5 or B Nut	Grade 8 or 8.2 Bolt	Grade 8 or C Nut	Grade 8 or 8.2 Bolt	Grade G Nut
	Torque: lbf·ft (N·m)		Torque: lbf·ft (N·m)		Torque: 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 18**. Sterling recommends that all plated and unplated fasteners be coated with oil before installation.

Table 19, Torque Values for U.S. Customary Thread Fasteners With Dry (Unlubricated) Plain (Unplated) Threads

https://www.besttruckmanuals.com/

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)	
	 f230010	 f230011	 f230012	 f230013
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)	

* Sterling 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 20, Torque Values for Metric Thread Fasteners With Lubricated or Plated Threads

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Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Engine Drive Belt Inspecting	01–04
Engine Noise Panel Inspecting (Noise Emission Control)	01–02
Engine Rear-Support Assembly Checking (Noise Emission Control)	01–01
Jacobs Engine Brake Wiring Inspecting	01–03

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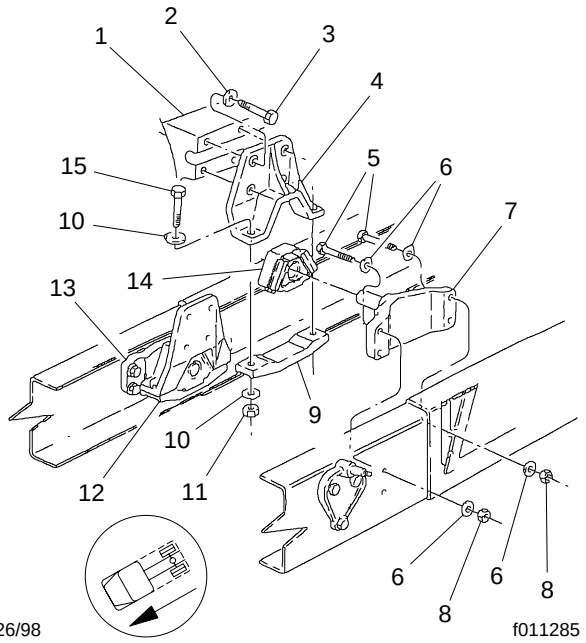
01–01 Engine Rear-Support Assembly Checking (Noise Emission Control)

Front and rear engine supports for vehicles built from January 2007 require no periodic maintenance. Mounts should be inspected when the engine is removed for service. For vehicles manufactured prior to January 2007, perform the following check.

Visually inspect the rubber insulators (see **Fig. 1**) for cracks, cuts, and other damage; replace if damaged. Also, at engine overhaul or whenever the engine has been removed, replace the insulators. See **Group 01** of the *L-Line and A-Line Workshop Manual* for insulator replacement procedures.

Check the engine rear-support fasteners for tightness. See **Fig. 1**.

See **Table 1** for torque specifications.



1. Flywheel Housing
2. Flatwasher
3. Hexbolt (M12 x 1.75 x 55)
4. Engine Rear Support Bracket (left-hand)
5. Hexbolt (5/8–11 x 3.50)
6. Flatwasher
7. Engine Support Bracket (left-hand)
8. Locknut (5/8–11)
9. Engine Support-to-Frame Cap
10. Flatwasher
11. Locknut (1/2–13)
12. Engine Rear Support Bracket (right-hand)
13. Engine Support Bracket (right-hand)
14. Engine Support Rubber Insulator
15. Hexbolt (1/2–13 x 2.50)

Fig. 1, Engine Rear Support Assembly

01–02 Engine Noise Panel Inspecting (Noise Emission Control)

If so equipped, inspect for torn engine noise panels. See **Fig. 2** for a Caterpillar engine, or see **Fig. 3** for a Cummins engine. If panels are torn, replace them with new panels; see **Group 01** of the *L-Line and A-Line Workshop Manual* for procedures. Cummins M11 and N14 engines, and Detroit Diesel Series engines do not have engine noise panels.

Rear Engine-Support Fastener Torque Specifications			
Fastener Description	**Size**	**Grade**	**Torque*: lbf·ft (N·m)**
Engine-Support-Insulator Nut	5/8–11	C	160 (216)
Frame-Mounted Engine-Support-Bracket Nut	5/8–11	C	190 (258)
Transmission-Mounted Engine-Support-Bracket Capscrew	3/4–10	8	340 (461)
Overslung Crossmember Nut	1/2–13	C	95 (129)

* Torque values are for dry, unplated fasteners.

Table 1, Rear Engine-Support Fastener Torque Specifications

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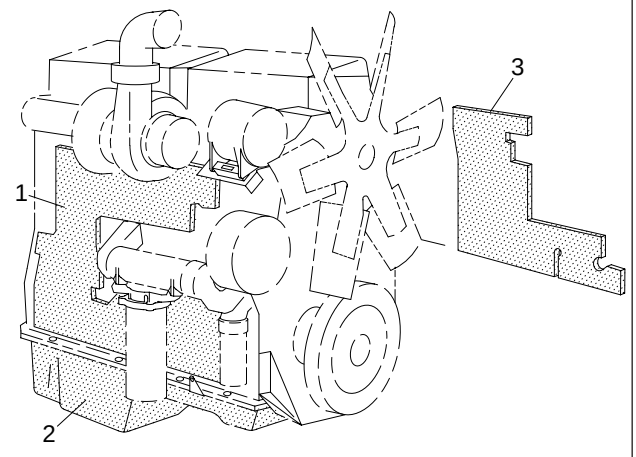

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NOTE: Caterpillar 3406E engines do not have right-side noise panels.

1. Right-Side Noise Panel
2. Oil Pan Noise Panel
3. Left-Side Noise Panel

Fig. 2, Caterpillar Engine Noise Panels

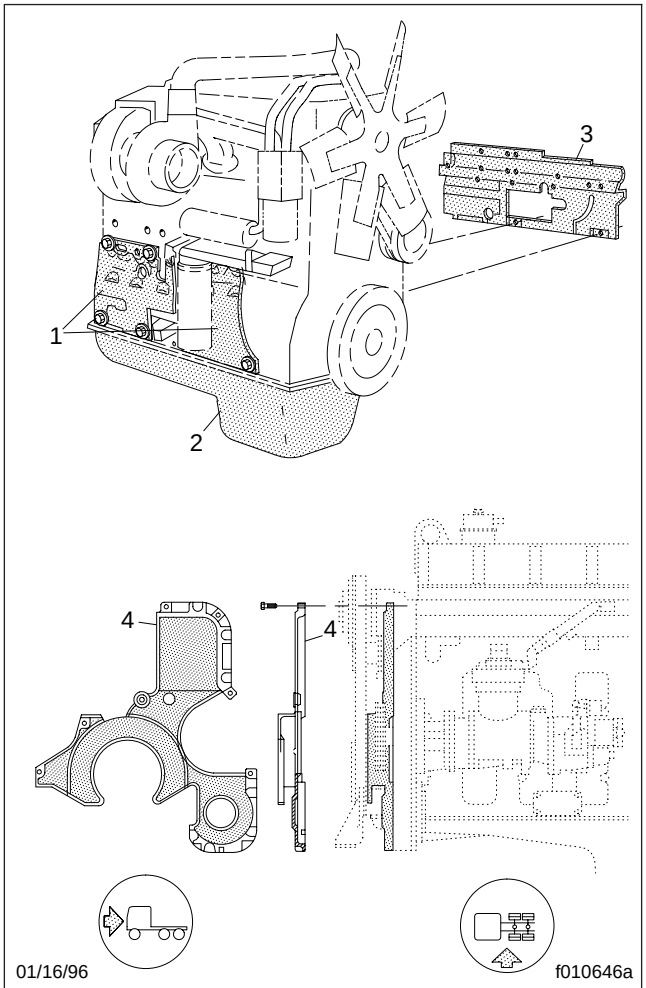
01–03 Jacobs Engine Brake Wiring Inspecting

Inspect the wiring from the dash switches to the engine brake housings for breaks and for broken or chafed insulation. Make sure that all terminal connections are in good condition and are fastened. Inspect the wiring to the clutch and throttle switches.

NOTE: Some engine brake installations do not use clutch or throttle switches.

01–04 Engine Drive Belt Inspecting

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 individual 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:



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1. NTC Right-Side Noise Panels
2. NTC Oil Pan Noise Panel
3. NTC Left-Side Noise Panel
4. L10 Front Gear Cover Noise Panel

Fig. 3, Cummins Engine Noise Panels

Visual Inspection

1. Inspect the belt for glazing. See **Fig. 4**, Ref. A. Glazing is represented by shiny sidewalls, and is caused by friction created when a loose belt slips

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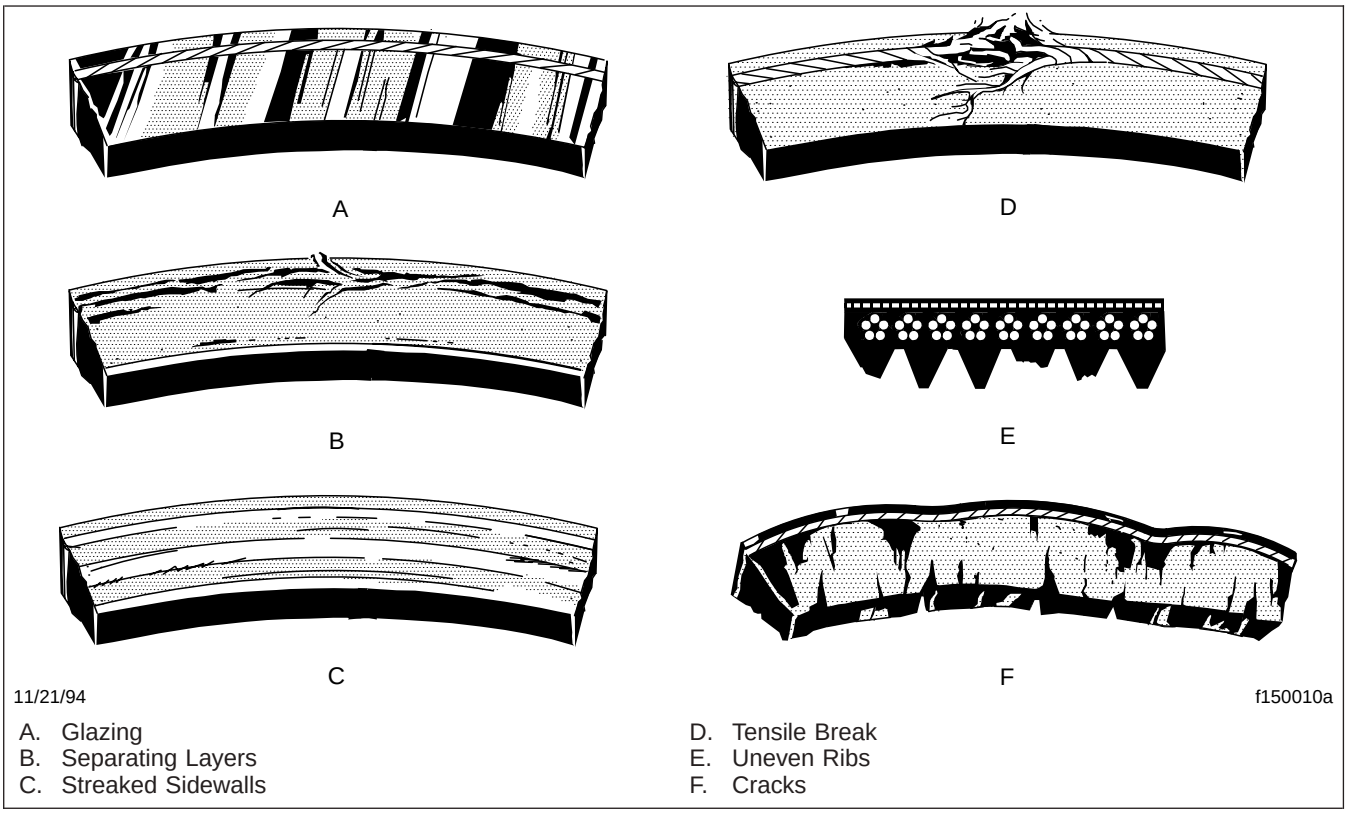
in the pulleys. It can also be caused by oil or grease contamination on the pulleys.

2. Check the belt for ply separation. See **Fig. 4**, 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. 4**, 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. 4**, 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. 4**, 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. 4**, 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, place a stethoscope 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.



A. Glazing
B. Separating Layers
C. Streaked Sidewalls
D. Tensile Break
E. Uneven Ribs
F. Cracks

Fig. 4, Drive Belt Replacement Conditions

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Belt Tension Inspection

NOTE: If engine drive belts require adjustment, see **Group 01** of the *L-Line and A-Line Workshop 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 2** for belt tension specifications.
3. If belt tension is not correct, see **Group 01** of the *L-Line and A-Line Workshop 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 *L-Line and A-Line Workshop Manual* for replacement instructions.

Drive Belt Tension		
Engine	**Component**	**Belt Tension: lbf (kg)**
Caterpillar C10 (3176)	Refrigerant Compressor	80–100 (36–45)
Caterpillar 3406E	Alternator and Refrigerant Compressor	40–50 (18–23), per belt
	Fan	80–100 (36–45)
Cummins M11	Alternator	90–120 (41–55)
	Fan	155–165 (70–75)
	Refrigerant Compressor	80–100 (36–45)
Cummins N14	Alternator	40–50 (18–23), per belt
	Fan	80–120 (36–55)
	Refrigerant Compressor	80–100 (36–45)
Detroit Diesel Series 60	Alternator and Refrigerant Compressor	80–100 (36–45), power band
	Fan	60–80 (27–36)

Table 2, Drive Belt Tension

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Index, Alphabetical

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

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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 20 inH_2O on a vehicle with a Detroit Diesel engine, 22 inH_2O on a vehicle with an M-B engine, or 25 inH_2O on a vehicle with a Caterpillar or Cummins engine. For replacement instructions, see **Group 09** of the *L-Line and A-Line Workshop 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 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.

Method 2

Replace the air cleaner element at the recommended interval or when the air restriction indicator reaches 20 inH_2O on a vehicle with a Detroit Diesel engine, 22 inH_2O on a vehicle with an M-B engine, or 25 inH_2O on a vehicle with a Caterpillar or Cummins engine. For replacement instructions, see **Group 09** of the *L-Line and A-Line Workshop 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.

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Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Bendix Air Compressor Inspecting	13–01

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13–01 Bendix Air Compressor Inspecting

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 the adapter gaskets, and securely install the adapter.

Check the cooling fins on the compressor crankcase. Clean the fins if they are clogged with dirt or grease.

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Title of Maintenance Operation (MOP)	MOP Number
Alternator, Battery, and Starter Connections Check	15–01

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15–01 Alternator, Battery, and Starter Connections Check

⚠ WARNING

Batteries generate explosive gas as a by-product of their chemical process. Do not smoke when working around batteries. Put out all flames and remove any source of sparks or intense heat in the vicinity of the battery compartment. Make sure the battery compartment has been completely vented before disconnecting or connecting the battery cables.

Battery acid is extremely harmful if splashed in the eyes or on the 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 *L-Line and A-Line Workshop 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** for belt tension specifications. Some 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. Clean and tighten all charging system electrical connections, including the connections at the starter B terminal and ground terminal, and where the alternator charging cable terminates.
4. Inspect the battery cables for wear, and replace as needed. Clean the cable connector terminals with a wire brush. See **Group 54** of the *L-Line and A-Line Workshop Manual* for troubleshooting instructions, and for adjustment, repair, or replacement instructions.
   - 4.1 Clean and tighten the battery ground cable, terminal, and clamps.
   - 4.2 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.
   - 4.3 Be sure there are no foreign objects, such as stones, bolts, and nuts, in the battery box.
   - 4.4 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).
   - 4.5 Coat the battery terminals with dielectric grease.
5. Check the alternator wiring for missing insulation, kinks, and heat damage. Replace or repair as needed.
6. 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.

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

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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 percent 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 applicable engine manufacturer's maintenance and operation manual.

1. If necessary, remove the aerodynamic cover from the front bumper.
2. Drain the radiator as follows:

   For a low-flow cooling system, disconnect the radiator bottom tank inlet and outlet hoses, and tighten the radiator cap. Attach the flushing gun nozzle to the outlet hose.

   For a high-flow cooling system, disconnect the radiator upper and lower hoses, and tighten the radiator cap. Attach the flushing gun nozzle to the lower hose.
3. Run the water until the radiator is full.

⚠ CAUTION

Excessive pressure can damage the radiator or heater core.

4. Gradually apply air pressure to help dislodge sediment built up in the radiator core. Do not apply more than 15 psi (103 kPa) air pressure to the radiator. Pressures exceeding 15 psi (103 kPa) could damage the radiator core.
5. Shut off the air at the pressure gun nozzle and allow the radiator to refill with water.
6. Repeat the previous two steps until clean water flows from the radiator.
7. Remove the radiator side tank drain plug and allow the radiator to drain. Install and tighten the side tank drain plug and the radiator outlet pipe drain plug after the radiator has been drained. Do not overtighten the plugs.
8. Connect the hoses. Your hose clamps can be either T-bolt clamps (see **Fig. 1**) or Breeze Constant-Torque clamps (see **Fig. 2**).

   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 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. Correct in-

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stallation torque for Breeze Constant-Torque hose clamps is as follows:

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

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

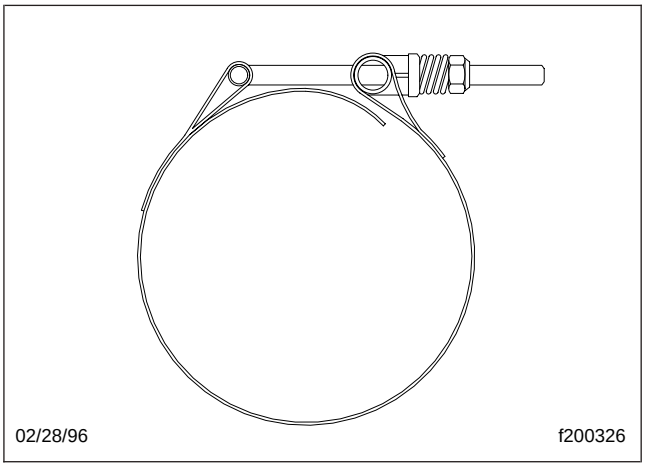
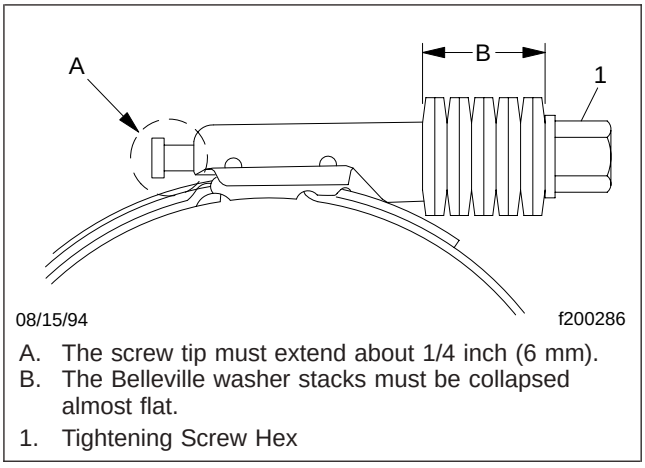


Fig. 1, T-Bolt Type Hose Clamp



A. The screw tip must extend about 1/4 inch (6 mm).
B. The Belleville washer stacks must be collapsed almost flat.
1. Tightening Screw Hex

Fig. 2, 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 shutdown, the screw tip may adjust according to temperature and pressure changes. The torque may need to be adjusted for individual applications.

IMPORTANT: On vehicles with EPA07 compliant engines, the coolant capacity varies depending on the engine and accessory installation. After servicing the cooling system, always verify that the coolant level is between the MIN and MAX lines on the surge tank.

9. Fill the radiator with new coolant. See **Group 20**of the *L-Line and A-Line Workshop Manual* for guidelines. See **Table 1** for cooling system capacities for antifreeze protection information. Certain equipment such as fuel heaters, water filters, and auxiliary heaters may increase the coolant capacity and require additional coolant. The cooling system is filled when the coolant level reaches the MAX line on the surge tank. Sterling recommends the use of a precharged and premixed antifreeze when refilling the cooling system. See **Table 2** for a list of some of the precharged antifreeze available. Use of an equivalent antifreeze to those listed in the table is also acceptable. Always check that the antifreeze used meets Sterling specifications and is at the proper concentration for protection in the vehicle operating area. See **Table 3** for antifreeze protection information. Sterling specifies that the antifreeze must be an ethylene glycol solution that meets GM 6038 M Engineering Standards or an ethylene glycol solution that has less than 0.1 percent anhydrous sodium metasilicate, and meets either GM 1825 M or GM 1899 M Engineering Standards. If supplemental coolant additives are being used, add the supplements to the coolant as necessary. See the coolant additive manufacturer's instructions for the correct amount of additive required. Don't forget to consider the volume of the supplemental coolant additive being added to the system when determining the amount of coolant required to refill the system.

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Cooling System Capacity (pre-EPA07 engines)				
Engine Make	Engine Model	Radiator Core and System Capacity*: quarts (liters)		
		Standard	1050 sq. inch	1300 sq. inch
Caterpillar	All, Except 3306C/3406E	31.0 (29.4)	32.9 (31.2)	34.2 (32.4)
	3306C	39.2 (37.2)	41.1 (39.0)	42.4 (40.2)
	3406E	45.7 (43.3)	47.6 (45.1)	48.9 (46.3)
Cummins	8.3L	32.3 (30.7)	34.2 (32.5)	35.5 (33.7)
	M11	31.4 (28.8)	33.3 (30.6)	34.6 (31.8
	N14	40.6 (38.6)	42.5 (40.4)	43.8 (41.6)
Detroit Diesel	Series 60	47.3 (44.9)	49.1 (46.7)	50.5 (47.9)

* System capacity includes all hoses, fittings, and the heater core. Add 1.8 quarts (1.7 liters) for sleeper units.

Table 1, Cooling System Capacity (pre-EPA07 engines)

Approved Antifreeze		
Manufacturer	Antifreeze	Type
Caterpillar	Caterpillar Diesel Engine Antifreeze/Coolant	Contains supplement additives. Available as a premixed solution.
Cummins	Fleetguard® Compleat Premix	Premixed solution with supplement additives
Detroit Diesel	Detroit Diesel Power Cool	Premixed solution with supplement additives
Old World Industries	Fleet Charge™	With supplement additives

Table 2, Approved Antifreeze

Maximum Coolant Protection in °F (°C) at Various Antifreeze Concentrations											
Cooling System Capacity: gal (L)*	ETHYLENE-GLYCOL BASE ANTIFREEZE REQUIRED gallons (liters)										
	2 (8)	3 (11)	4 (15)	5 (19)	6 (23)	7 (26)	8 (30)	9 (34)	10 (38)	11 (42)	12 (45)
10 (38)	16 (–9)	4 (–16)	–12 (–24)	–34 (–37)	–62 (–52)†						
11 (42)	18 (–8)	8 (–13)	–6 (–21)	–23 (–31)	–47 (–44)	–62 (–52)†					
12 (45)	19 (–7)	10 (–12)	0 (–18)	–15 (–26)	–34 (–37)	–57 (–49)					
13 (49)	21 (–6)	13 (–11)	3 (–16)	–9 (–23)	–25 (–31)	–45 (–43)	–62 (–52)†				
14 (53)		15 (–9)	6 (–14)	–5 (–19)	–18 (–28)	–34 (–37)	–54 (–48)				
15 (57)		16 (–9)	8 (–13)	0 (–18)	–12 (–24)	–26 (–32)	–43 (–42)	–62 (–52)†			
16 (61)		17 (–8)	10 (–12)	2 (–17)	–8 (–22)	–19 (–28)	–34 (–37)	–52 (–47)	–62 (–52)†		

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Maximum Coolant Protection in °F (°C) at Various Antifreeze Concentrations											
Cooling System Capacity: gal (L)*	ETHYLENE-GLYCOL BASE ANTIFREEZE REQUIRED gallons (liters)										
	2 (8)	3 (11)	4 (15)	5 (19)	6 (23)	7 (26)	8 (30)	9 (34)	10 (38)	11 (42)	12 (45)
17 (64)		18 (–8)	12 (–11)	5 (–15)	–4 (–20)	–14 (–26)	–27 (–33)	–42 (–41)	–58 (–50)		
18 (68)		19 (–7)	14 (–10)	7 (–14)	0 (–18)	–10 (–23)	–21 (–29)	–34 (–37)	–50 (–46)	–62 (–52)†	
19 (72)		20 (–7)	15 (–9)	9 (–13)	2 (–17)	–7 (–22)	–16 (–27)	–28 (–33)	–42 (–41)	–56 (–49)	
20 (76)			16 (–9)	10 (–12)	4 (–16)	–3 (–19)	–12 (–24)	–22 (–30)	–34 (–37)	–48 (–44)	–62 (–52)†

* For cooling system capacities not shown, the required amount of antifreeze can be calculated using the following: ethylene-glycol base antifreeze in a 25% solution protects to 10°F (–12°C), 33% to 0°F (–18°C), 40% to –12°F (–24°C), 50% to –34°F (–37°C), and 60% to –62°F (–52°C).

† 60% ethylene-glycol base antifreeze and 40% water by volume gives maximum coolant protection (–62°F [–52°C]). Exceeding 60% antifreeze diminishes coolant protection; concentrated ethylene-glycol base antifreeze will freeze at approximately 0°F (–18°C).

Table 3, Maximum Coolant Protection in Degrees F (Degrees C) at Various Antifreeze Concentrations

20–03 Fan Drive and Fan Clutch Checking (Noise Emission Control)

Eaton Viscous Fan Drive

Periodic maintenance is not required because an Eaton viscous fan drive is a sealed unit. However, periodically check it for damage and for correct operation. If the fan drive is inoperative or damaged, replace it with a new one. See **Group 20** of the *L-Line and A-Line Workshop Manual* for instructions.

Horton Advantage® and HT 550 Fan Clutch

NOTE: If any part of the fan clutch needs to be fixed or replaced, after performing the checks below, see **Group 20** of the *L-Line and A-Line Workshop Manual*.

1. Inspect all electrical connections and wires. Tighten the connections if loose, and replace wires and connections if damaged.
2. Charge the air system to 120 psi (627 kPa), then proceed as follows:

⚠ WARNING

Do not jumper the thermal switch while the engine is running. This could start the cooling fan, which could result in serious personal injury.

If the vehicle is equipped with Detroit Diesel Optimized Idling®, make sure this feature is not activated. If Optimized Idling were activated, the engine could start up without warning, resulting in serious personal injury.

2.1 *If equipped with an electric thermal switch,* make sure the engine is not running. Put the ignition switch in the ON position (engine shut down). Place a jumper between the thermal switch connectors (located in the engine thermostat housing), while observing the fan clutch. The fan clutch should be seen and heard engaging.

If equipped with a fanstat (shutterstat), run the engine until its temperature is above the fanstat engagement setting of 195°F (91°C). The fan clutch should engage, causing the fan to turn.

⚠ WARNING

Wear safety goggles when draining the air system or loosening an air line, because dirt or sludge

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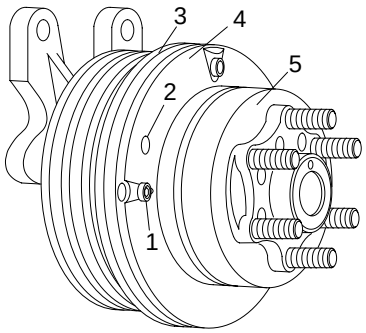
could fly out at high speeds. Do not direct the airstream at anyone. Do not disconnect pressurized hoses, since they may whip as air escapes. Failure to take all necessary precautions could result in personal injury.

2.2 If the fan clutch does not engage, see if compressed air is in the fan clutch actuating air line: With the ignition on, but the engine shut down, slowly loosen the fitting that connects the actuating air line to the fan clutch; do not disconnect the fitting. If compressed air escapes, the fan clutch is inoperative and must be repaired. If no compressed air escapes, replace the solenoid valve or fanstat, as applicable. Tighten the fitting.

3. Check all air connections for air leaks.

4. Check for wear on the friction facing. See **Fig. 3** (Type S and HT/S) or **Fig. 4** (HT 550). Replace the facing if it is worn to 1/16-inch (1.6-mm) thickness or less on a Type S or HT/S fan clutch, or to 7/32-inch (5.6-mm) on an HT 550 fan clutch.



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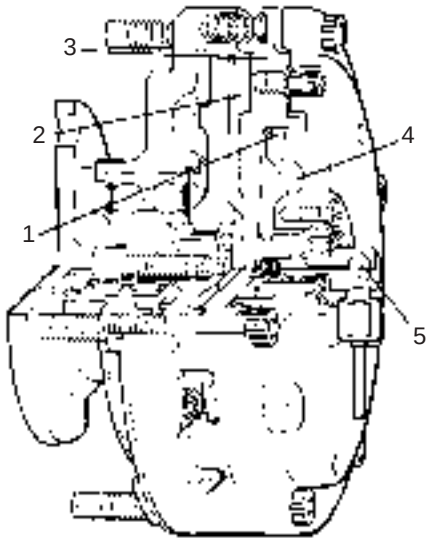
1. System Sentry® Fuse
2. Safeguard Hole
3. Friction Facing
4. Piston Friction Disc
5. Air Chamber

Fig. 3, Horton Type S and HT/S Fan Clutch

5. If equipped with a toggle switch on the dash, run the engine with the engine temperature below 205°F (96°C) for Caterpillar engines, or below 200°F (93°C) for all other engines. Set the toggle switch to the ON position; the fan clutch should engage. 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.



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1. O-Ring Seal
2. Friction Facing
3. Piston
4. Air Chamber
5. Rotary Air Union

Fig. 4, Horton HT 550 Fan Clutch

6. With the engine off and the fan clutch engaged, use a listening device to check for air leaks. If a leak is heard, check for air leaks in the fan clutch by lightly brushing a soap solution in the following areas:

6.1 *Type S and HT/S Fan Clutches* (**Fig. 3**)

Check for air leaks at the bleed hole on the fan pilot. Air leakage means that the cartridge assembly (**Fig. 5**, Ref. 16) or face seal (Ref. 17) is damaged.

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.

Check for air leaks around the safeguard hole on the piston friction disc. Air leakage means the small O-ring (Ref. 18) is damaged.

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.

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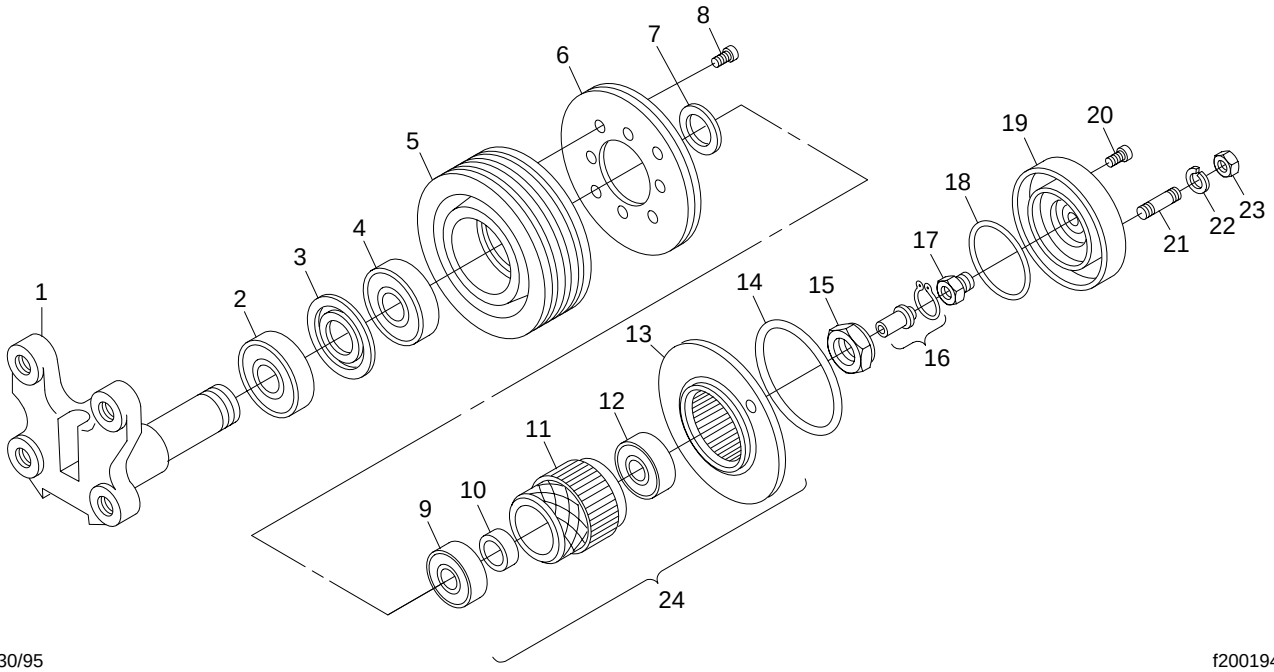

1. Mounting Bracket
2. Rear Sheave Bearing
3. Inner and Outer Bearing Spacers
4. Forward Sheave Bearing
5. Sheave
6. Friction Facing
7. Journal Spacer
8. Socket-Head Capscrew
9. Rear Hub Bearing
10. Bearing Spacer
11. Splined Hub
12. Forward Hub Bearing
13. Piston Friction Disc
14. Large O-Ring
15. Locknut
16. Cartridge Assembly
17. Face Seal
18. Small O-Ring
19. Air Chamber
20. Socket-Head Capscrew
21. Stud Bolt
22. Lockwasher
23. Hexnut
24. Piston Assembly

Fig. 5, Horton Type S and HT/S Fan Clutch Components

6.2 *HT 550 Fan Clutch* (**Fig. 4**)

Check the rotary air union for air leaks. Make sure the air line at the air union is not restricted due to kinking or bending. If air leakage is found, replace the rotary air union (**Fig. 6**, Ref. 10).

Check for air leaks around the piston (Ref. 15) and air chamber (Ref. 13). If air leakage is found, replace the O-ring seal (Ref. 11).

Kysor/Dynair® and K22RA Fan Clutch

NOTE: *Check the lining wear at the first M3 maintenance interval;* the lining wear does not require checking at the first M2 interval. Subsequent checks must be made at each M2 maintenance interval.

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 forwardmost edge of the fan belt pulley. See **Fig. 7**, Ref. A.

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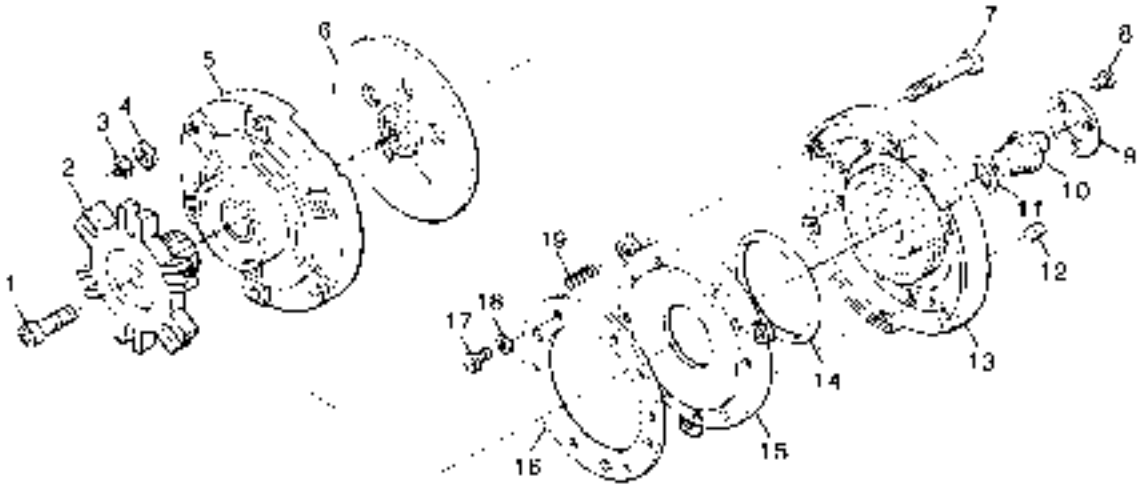

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1. Capscrew
2. Mounting Bracket
3. Hexnut
4. Washer
5. Drive Sleeve
6. Friction Disc
7. Capscrew
8. Panhead Screw
9. Retaining Washer
10. Rotary Air Union
11. O-Ring Seal
12. Setscrew
13. Air Chamber Assembly
14. O-Ring Seal
15. Piston Assembly
16. Friction Facing
17. Capscrew
18. Washer
19. Compression Spring

Fig. 6, Horton HT 550 Fan Clutch Components

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 forwardmost edge of the fan belt pulley.
5. Compare the two measurements; if the difference exceeds the wear limit given in **Table 4** for the Kysor/Dynair, or exceeds the wear limit of 0.15 inch (3.8 mm) for the Kysor K22RA, the clutch lining is worn and must be replaced. See **Group 20** of the *L-Line and A-Line Workshop Manual* for overhaul 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.

Kysor/Dynair Fan Clutch Wear Limits		
Model Numbers*	**Retaining Plate Fasteners***	**Wear Limit: in (mm)**
1090–05261–01 1090–05262–01 1090–05261–02 1090–05262–02	Bolt, Lockwasher, and Nut	0.16 (4.1)
1090–06620–01 1090–06060–01 1090–07050–01 1090–08000–01 1090–06620–02 1090–06060–02 1090–07050–02	Capscrew and Lockwasher	0.17 (4.3)

* The fan clutch model number is stamped on the tag on the air cylinder. Also, the models can be identified by the type of retaining plate fasteners used.

Table 4, Kysor/Dynair Fan Clutch Wear Limits

7. Connect the electrical cables to the battery. If equipped with an air starter, charge the air starter reservoir.

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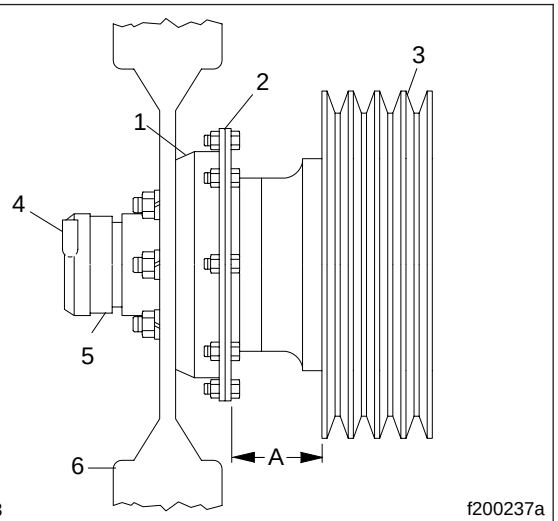

A. With the fan clutch engaged, measure the distance here; measure it again with the fan clutch disengaged.
1. Bearing Housing
2. Retaining Plate
3. Fan Pulley
4. Air Inlet (from the solenoid valve)
5. Air Cylinder
6. Fan

Fig. 7, Kysor/Dynair and Kysor K22RA Fan Clutch Lining Wear Checking

8. 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.

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 *L-Line and A-Line Workshop 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 before 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.
   - 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 *L-Line and A-Line Workshop 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.

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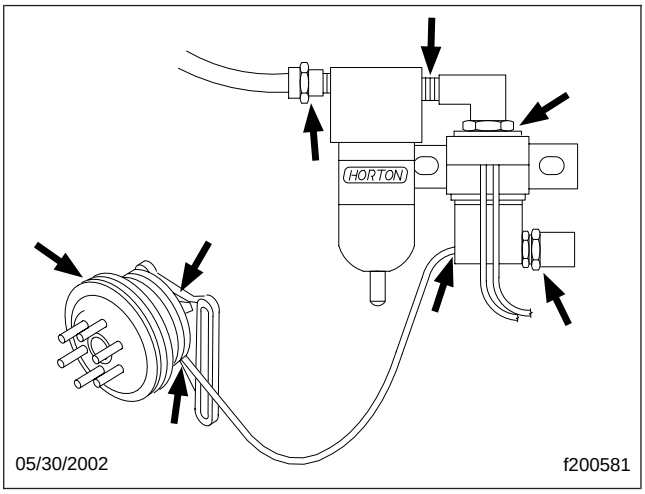

Fig. 8, Checking for Air Leaks (Horton DriveMaster)

9. If a leak is detected, remove the fan blade. Install a new seal kit. See **Group 20** of the *L-Line and A-Line Workshop 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 DriveMaster Super Kit.

      For instructions and kit part number, see **Group 20** of the *L-Line and A-Line Workshop Manual*.

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Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Clutch Release Bearing Lubricating	25–01

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25–01 Clutch Release Bearing Lubricating

NOTE: For a clutch 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.

For a clutch with a grease-type release bearing (see **Fig. 1**), wipe the dirt from the grease fitting.

⚠ CAUTION

Do not over-lubricate the clutch release bearing. Over-lubrication could contaminate the clutch internally, causing clutch slippage and premature failure. Do not use chassis grease or multipurpose lubricants.

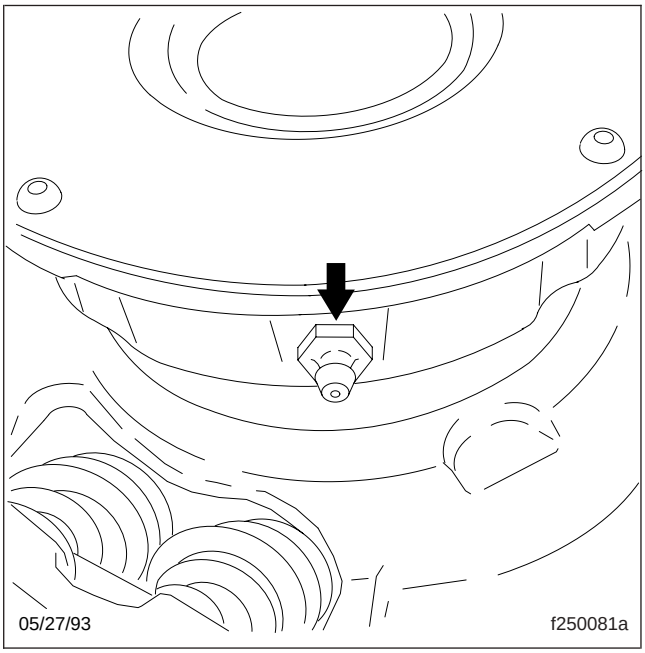

Fig. 1, Release Bearing Grease Fitting

IMPORTANT: If the release bearing is *not* equipped with a grease-fitting extension that extends outside the bell housing, lubricate the bearing with the engine stopped. If equipped with a grease-fitting extension that does extend outside the bell housing, lubricate the bearing with the engine running.

Using a pressure gun and high-temperature grease only, lubricate the release bearing at the grease fitting until grease starts coming out of the fitting. *Do not* use chassis lube or multipurpose lubricants.

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Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Allison Transmission Fluid and Filter Changing	26–01
Manual Transmission Magnetic Plug Cleaning and Oil Changing	26–02
Transmission Air Filter/Regulator Checking and Cleaning, or Replacing	26–03
Transmission Breather and Oil Level Checking	26–04

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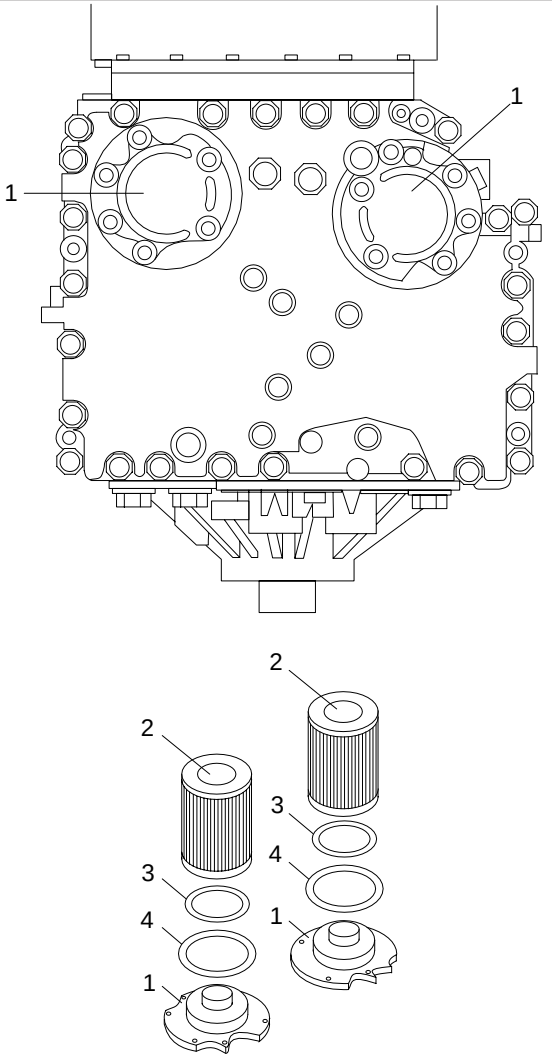
26–01 Allison Transmission Fluid and Filter Changing

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

1. Park the vehicle on a level surface. Apply the parking brakes and chock the tires.
2. Operate the vehicle until the transmission reaches normal operating temperature: 160 to 200°F (71 to 93°C).
3. 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 the filter is the only component being changed, do not drain the fluid.
4. Remove the 12 mounting bolts (6 each) from the two filter covers.
5. Remove the filter covers, O-rings, and two square-cut seals from the transmission. See **Fig. 1**.
6. Remove the filters from the bottom of the control module.
7. Lubricate the new O-rings with transmission fluid, and install them on the cover assemblies.
8. Install a new square-cut seal on each cover assembly, and install the fluid filter elements on the cover assemblies.
9. Install the filter and cover assemblies into the filter compartment.
10. Align each cover assembly with the holes in the channel plate sump, and push the cover assemblies in by hand to seat the seals.



1. Filter Cover
2. Filter Element
3. Filter Element O-Ring
4. Square-Cut Seal

Fig. 1, Allison Transmission Filter Location and Components

CAUTION

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

11. Install six bolts in each cover, and torque the bolts 38 to 44 lbf·ft (51 to 61 N·m).

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12. 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).
13. Refill the transmission with fresh Dexron® III transmission fluid and check the fluid level.

NOTE: Do not overfill the transmission. Follow instructions in **Maintenance Operation 26–04**.

26–02 Manual Transmission Magnetic Plug Cleaning and Oil Changing

Manual Transmission Oil Change

IMPORTANT: For all transmissions that are filled with approved synthetic lubricants, the lubricant must be changed every 500,000 miles (800 000 km). Transmissions with petroleum-based lubricants must have the lubricant changed at each Maintenance 2 (M2) interval. All transmissions with synthetic or petroleum-based lubricants must have the transmission breather checked and the magnetic plugs cleaned at each M1 interval.

NOTE: For vehicles equipped with auxiliary transmissions, use this procedure to change the auxiliary transmission oil and to check the auxiliary transmission breather whenever changing the main transmission oil and checking the main transmission breather.

1. With the vehicle parked on level ground, apply the parking brakes, and chock the tires. Place a large drain pan under the transmission.
2. Clean the area around the fill plug, and remove it from the side of the case. Remove each drain plug from the bottom of the transmission case. Drain the oil while the transmission is warm.
3. Clean the fill and drain plugs. For magnetic plugs, use a piece of key stock or any other convenient steel slug to short the two magnetic poles and divert the magnetic field.
4. Install and tighten each drain plug 50 lbf·ft (68 N·m).
5. 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 operates under very dusty conditions.

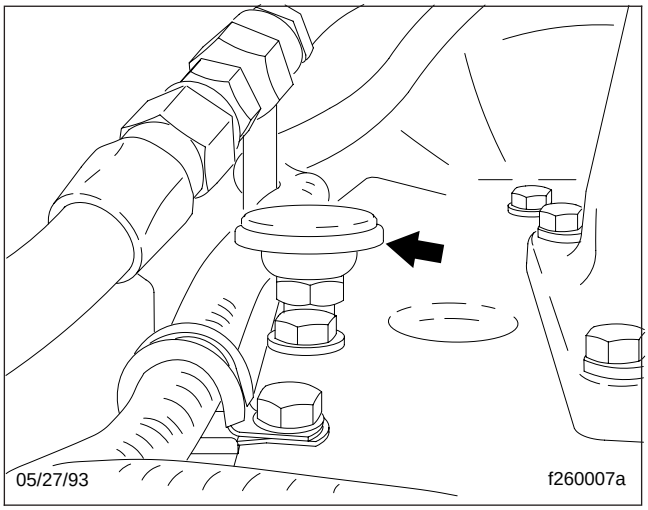

Fig. 2, Transmission Breather (Fuller shown)

IMPORTANT: Do not mix types and brands of oil, because of possible incompatibility. Do not use oil additives, friction modifiers, extreme-pressure gear oils, or multiviscosity lubricants. Do not use extreme-pressure additives, such as those found in multipurpose or rear axle-type lubricants. These additives are not required, and may create transmission problems. Multipurpose oils have relatively poor oxidation stability, a high rate of sludge formation, and a greater tendency to react on or corrode steel and bronze parts.

NOTE: The correct oil capacity is established by the fill opening.

6. Add oil until it is level with the lower edge of the fill opening. If the transmission has two fill openings, add oil to the level of both openings. See **Fig. 3**. See **Table 1** for transmission lubricant capacities, and see **Table 2** for approved transmission lubricants.

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Transmission Lubricant Capacities	
Transmission Make and Model	**Capacity: pt (L)**
Allison	
AT–542	30 (14.2)
AT–545	40 (18.9)
MT–600	34 (16.1)
MT–700	60 (28.4)
MD Series	58 (27.4)
HD Series	102 (48.2)
Eaton 5-Speed	
FS–4205	11.5 (5.2)
FS–5205	12.5 (5.9)
FS–6305	19.0 (9.0)
Eaton 6-Speed	
FS–5306/6306	18.0 (8.5)
Eaton 9-Speed	
Fuller RT–6609	12.0 (5.7)
All Others	27 (12.8)
Eaton 10-Speed	
Fuller FR/FRO–11210, FR/FRO–12210, FR/FRO–13210, FR/FRO–14210, FR/FRO–15210, FR/FRO–16210,	23.5 (11.1)
Fuller RT/RTX–11710, RT/RTX–12710, RT/RTX–13710, RT/RTX–14710, RTX–15710, RTX–16710	26.0 (12.3)
All Others	28.0 (13.2)
Eaton 11-Speed	
All	28 (13.2)
Eaton 13-Speed	
All	28 (13.2)
Eaton 15-Speed	
All	28 (13.2)
Eaton 18-Speed	
All	28 (13.2)

Table 1, Transmission Lubricant Capacities

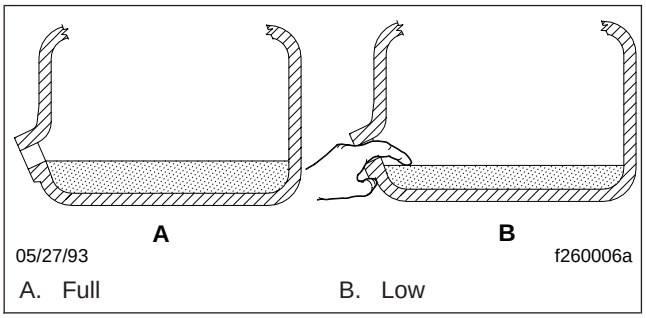

Fig. 3, Checking Transmission Oil Level

⚠ CAUTION

Operating a Fuller or Spicer transmission with the oil level higher or lower than recommended can result in transmission damage. Do not overfill the transmission. On Fuller transmissions, overfilling will force oil out of the case through the main shaft openings. On Spicer transmissions, overfilling usually causes oil breakdown, due to excessive heat and aeration from the churning action of the gears. Early breakdown of the oil causes heavy varnish and sludge deposits that plug oil ports and build up on splines and bearings. Oil overflow may also drain onto the clutch or clutch brake, causing additional problems.

7. For a transmission equipped with an oil pump or an oil cooler, operate the engine for five minutes after filling the transmission, then check the oil level again.
8. Install the fill plug, then tighten it 50 lbf·ft (68 N·m).
9. Operate the vehicle to check for correct operation.

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Approved Transmission Lubricants			
Transmission	**Lubricant Type***	**Temperature**	**SAE Viscosity**
Allison	Dexron® III	Above -17°F (–27°C)	—
Fuller	Heavy-Duty Engine Oil meeting MIL–L–2104B, C, or D, or API Service Classification SF or CD (previous API designations are acceptable)	Above +10°F (–12°C)	50 or 40
		Below +10°F (–12°C)	30
	Mineral Gear Oil with Rust and Oxidation Inhibitor API–GL–1	Above +10°F (–12°C)	90
		Below +10°F (–12°C)	80W
Meritor	Heavy-Duty Engine Oil meeting API Service Classification SF or SG, or API Service Classification CD or CE, or MIL–L–2104B, C, or D	Above +10°F (–12°C)	50 or 40
		Below +10°F (–12°C)	30
	Mineral Gear Oil with Rust and Oxidation Inhibitor API–GL–1	Above +10°F (–12°C)	90
		Below +10°F (–12°C)	80
	Synthetic Engine Oil meeting Meritor Specification 0–81	All	50
Spicer	Heavy-Duty Engine Oil meeting MIL–L–2104D or MIL–L–46152B, or API Service Classification SF or CD (MIL–L–2104B and C, or MIL–L–46152 are acceptable)	Above 0°F (–18°C)	30, 40, or 50
		Below 0°F (–18°C)	30
	Mineral Gear Oil with Rust and Oxidation Inhibitor API–GL–1	Above 0°F (–18°C)	90
		Below 0°F (–18°C)	80
	Synthetic Engine Oil meeting MIL–L–2104D or MIL–L–46152B, or API Service Classification SF or CD	All	50 or 30

* Lubricants listed in order of preference. Do not mix types or brands of oil. Multi-weight and extreme-pressure gear oils are not recommended.

Table 2, Approved Transmission Lubricants

26–03 Transmission Air Filter/ Regulator Checking and Cleaning, or Replacing

Fuller Transmission

⚠ WARNING

Drain the air supply; if the air supply is not drained before the air filter/regulator is serviced, serious injury and component damage could result.

1. Apply the parking brakes and chock the tires. Drain the air from the air reservoirs.
2. Clean the outside of the air filter/regulator with cleaning solvent, then let it air dry. See **Fig. 4**.
3. Remove the end cap, large O-ring, and filter element from the filter housing. See **Fig. 5**. 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 keeping the air pressure between 58 and 63 psi (400 and 434 kPa), replace the air filter/regulator, which is not serviceable.

⚠ WARNING

Wear eye protection when using compressed air to clean parts, as permanent harm to eyes could result from flying debris.

4. Clean the filter element by dipping it 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. If it is not damaged, the sintered metallic filter element will last the life of the vehicle.

   Wipe out the filter housing with a clean, dry, lint-free rag. Clean and inspect the O-rings and the end cap. Replace any parts that are damaged.

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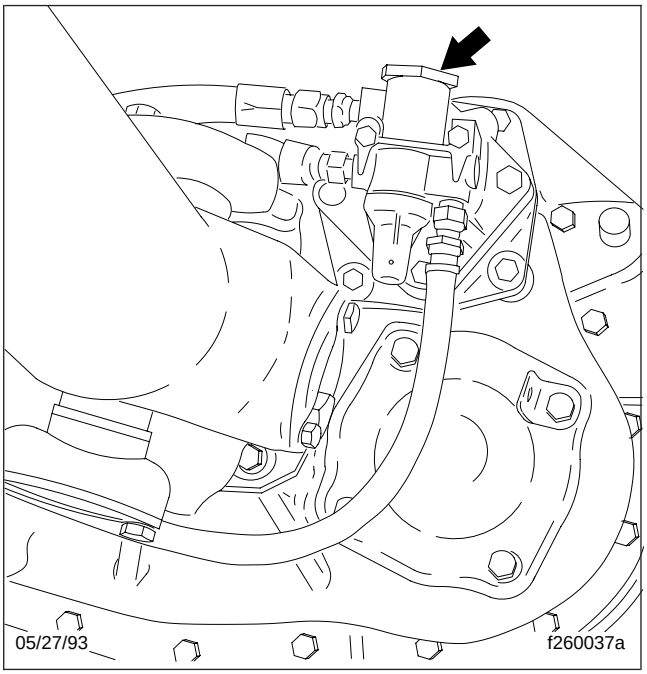
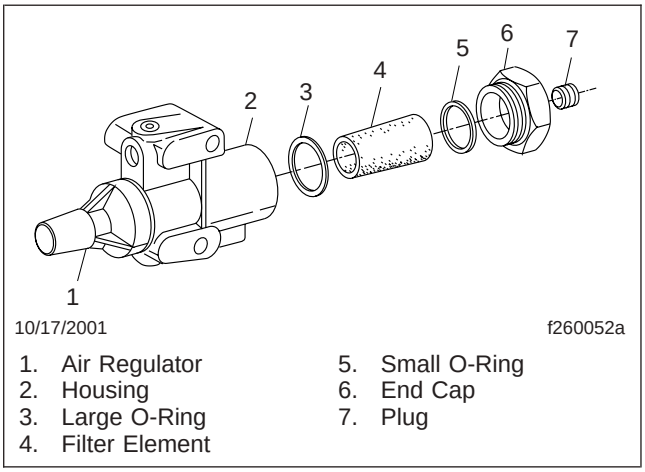


Fig. 4, Air Filter/ Regulator Location (Fuller transmission shown)



1. Air Regulator
2. Housing
3. Large O-Ring
4. Filter Element
5. Small O-Ring
6. End Cap
7. Plug

Fig. 5, Eaton Fuller Transmission Air Filter/Regulator Components

5. Install the large O-ring, then the filter element (small end first) into the filter housing.
6. Install the small O-ring in the end cap, then install the end cap and tighten it 8 to 12 lbf·ft (11 to 16 N·m).
7. Start the engine, and build pressure in the air system. Check for air leaks at the filter housing and air line connections; repair any leaks.

CAUTION

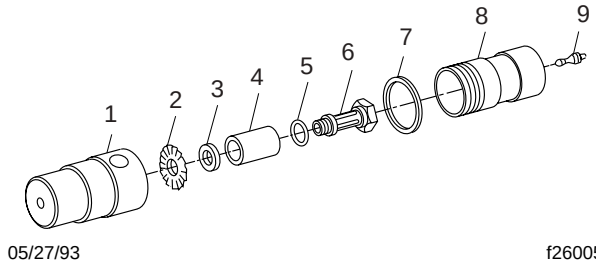
A leaking air filter or air lines can cause slow or hard shifting of the transmission, and eventual transmission damage.

Spicer Transmission

WARNING

Drain the air supply; if the air supply is not drained before the air filter/regulator is serviced, serious injury and component damage could result.

1. Apply the parking brakes, and chock the tires. Drain the air from the air reservoirs.
2. Clean the outside of the air filter/regulator (**Fig. 6**) with cleaning solvent, then let it air dry.



1. Regulator
2. Louver
3. Upper Gasket
4. Element
5. Lower Gasket
6. Stud
7. O-Ring
8. Bowl
9. Drain Valve

Fig. 6, Spicer Transmission Air Filter/Regulator Components

3. Loosen or remove the air filter/regulator bracket clamp, then unscrew the bowl; hold the regulator to prevent it from turning. Remove the O-ring.
4. Unscrew the stud from the regulator. Remove the louver, upper gasket, element, and lower gasket from the stud.

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WARNING

Wear eye protection when using compressed air to clean parts, as permanent harm to eyes could result from flying debris.

5. Clean and inspect all parts. Use only a petroleum-based solvent to clean the parts. Blow air through the filter element (inside to outside) to loosen surface dirt.

IMPORTANT: After three cleanings, replace the filter element with a new one.

Do not disassemble the regulator, as it is not repairable. If the air regulator does not work properly, replace the unit.

6. Install the lower gasket, the cleaned or new element, the upper gasket, and the louver, on the stud. Install the element so the large end of the internal taper (thinnest wall section) is toward the hex on the stud.
7. Install and tighten the stud 5 to 10 lbf·in (60 to 100 N·cm).
8. Apply a light coat of Dow Corning DC7 silicone grease, or an equivalent, to the O-ring seating surfaces on the regulator and the bowl.
9. Apply a light, even coat of Molykote "G," or an equivalent, to the bowl threads. Install and tighten the bowl 5 to 10 lbf·in (60 to 100 N·cm).
10. Install and/or tighten the air filter/regulator bracket clamp.
11. Install and torque the drain valve, if removed, 10 to 15 lbf·in (120 to 160 N·cm).
12. Build air pressure in the system, check for leaks, and make any necessary repairs.

Meritor Transmission

WARNING

Drain the air supply; if the air supply is not drained before the air filter/regulator is serviced, serious injury and component damage could result.

1. Apply the parking brakes, and chock the tires. Drain the air from the air reservoirs.
2. Clean the outside of the air filter/regulator with cleaning solvent, then let it air dry.
3. Remove the end cap from the air filter/regulator assembly, then inspect the O-rings in the end cap. Replace worn or damaged O-rings.
4. Remove the element from the filter/regulator assembly.
5. Inspect the element for oil. If oil is in the element, replace the element. Inspect the air supply system for the source of oil, and service it as needed.
6. Install the element in the filter/regulator assembly.
7. Apply a light coat of Dow Corning DC7 silicone grease, or an equivalent, to the O-rings in the end cap.
8. Install and tighten the end cap 10 to 15 lbf·ft (14 to 20 N·m).
9. Build air pressure in the system, check for leaks, and make any needed repairs.

26–04 Transmission Breather and Oil Level Checking

NOTE: For vehicles with auxiliary transmissions, use this procedure to check the auxiliary transmission oil level and breather whenever checking the main transmission oil level and breather.

Breather Check

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 operates under very dusty conditions.

Allison Transmission

CAUTION

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

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

Cold Check

Clean all dirt from around the end of the fluid fill tube before removing the dipstick. 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 brake and chock the 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 to 800 rpm.
6. With the engine running at idle, remove the dipstick from the tube and wipe it clean.
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 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. 7**.

⚠ CAUTION

As the fluid temperature increases, so does the fluid level. Do not fill above the COLD RUN band if the transmission fluid is below normal operating temperature.

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.

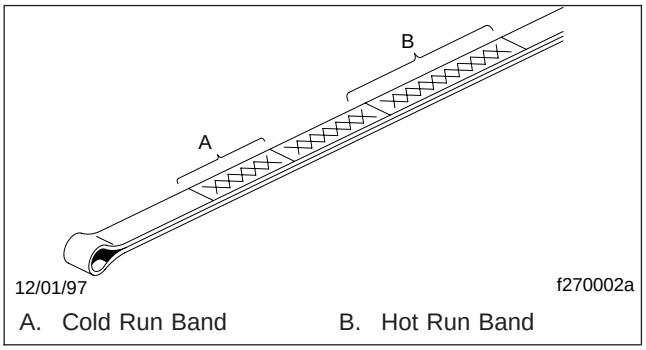

Fig. 7, Dipstick Markings

Hot Check

1. Park the vehicle on a flat, level surface. Apply the parking brake and chock the tires.
2. Shift the transmission to NEUTRAL.
3. Operate the engine at idle (500 to 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 the dipstick.
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. 7**.

Eaton/Fuller Transmission

⚠ CAUTION

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

Do not mix types and brands of fluid, because of possible incompatibility. Do not use fluid addi-

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tives, friction modifiers, extreme-pressure gear fluids, or multiviscosity lubricants.

With the transmission at operating temperature, and the vehicle on a level surface, check the fluid level in the transmission.

1. Clean the area around the fill plug, and remove it from the side of the case.
2. Using your finger or a bent pipe cleaner, see if the fluid is level with the fill opening. See **Fig. 3**.
3. If the transmission fluid level is low, check the transmission for leaks, and correct as needed.
4. If needed, add the recommended fluid, until it is level with the lower edge of the fill opening. See **Table 2** for approved transmission lubricants.
5. Clean the fill plug, install it in the transmission, then tighten it 50 lbf·ft (68 N·m).

Meritor Transmission

⚠ 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 multiviscosity lubricants.

1. Remove the fill plug from the transmission.
2. Insert a finger or pipe cleaner into the transmission.
3. Check that the fluid level is even with the base of the fill plug. See **Fig. 3**.

   The correct fluid capacity is established by the fill opening. If the transmission has two fill plugs, check that the fluid level is consistent at both fill plugs.
4. If the transmission fluid level is low, check the transmission for leaks, and correct as needed.
5. If needed, add the recommended fluid, until it is level with the lower edge of the fill opening. See **Table 2** for approved transmission lubricants.

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31–01 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 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 while servicing the fifth wheel. 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, see **Chapter 10** of the *L-Line and A-Line Driver's Manual*.
2. Thoroughly clean the fifth wheel.
3. Look for cracks in the fifth wheel assembly, mounting brackets, and mounting parts.
4. Check the jaw and stationary jaw for mushrooming, and check that the serrations at the jaw and wedge are in good condition.
5. Test the safety lock latch for ease of operation.

NOTE: The safety lock latch is located at the front of the fifth wheel on the top plate.

6. Check for loose nuts or bolts (see **Fig. 1**) on the fifth wheel and on the mounting. Set a torque wrench to the maximum torque value for the bolt being checked, and confirm that the torque is to specification. Do not loosen the bolt to check the torque value. See **Group 00** of this manual for bolt torque specifications.
7. Visually check all springs to see if they are securely fastened, and are not deformed.

⚠ WARNING

Do not disassemble the fifth wheel to inspect the springs. The springs are under extreme pressure, and could cause serious injury.

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 by turning the wedge stop rod located on the right side of the top plate.
9. Replace cracked, worn, or damaged parts with new parts. Replace all 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.
10. After inspecting the fifth wheel, lubricate all moving parts with a chassis or multipurpose grease. Apply a generous coating of grease to the top plate to fill the grooves, or depressions, on the top plate. See **Maintenance Operation 31–02** for lubrication instructions.

Holland

1. Disconnect the tractor from the trailer. For instructions, see **Chapter 10** of the *L-Line and A-Line Driver's Manual*.
2. Thoroughly steamclean 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. Visually inspect for improper locking action, and for cracks or wear on the jaw locking mechanism.
6. Check the depth of the grease grooves. If the depth of the grooves is 1/8 inch or less, replace the fifth wheel top plate. See **Group 31** of the *L-Line and A-Line Workshop Manual*.
7. Check the condition of the X-pattern cast into the underside of the fifth wheel top plate. See **Fig. 2**. The fifth wheel top plate must be removed to check the X-pattern.
   - 7.1 Remove the roll pins from the bushing pins. Remove the bushing pins from the slide mount. Using a hoist, lift the fifth wheel top plate off of the vehicle.
   - 7.2 Turn the fifth wheel top plate over with the locks open. Check the condition of the X-pattern in the pockets. If the X-pattern is worn away, replace the fifth wheel top plate.

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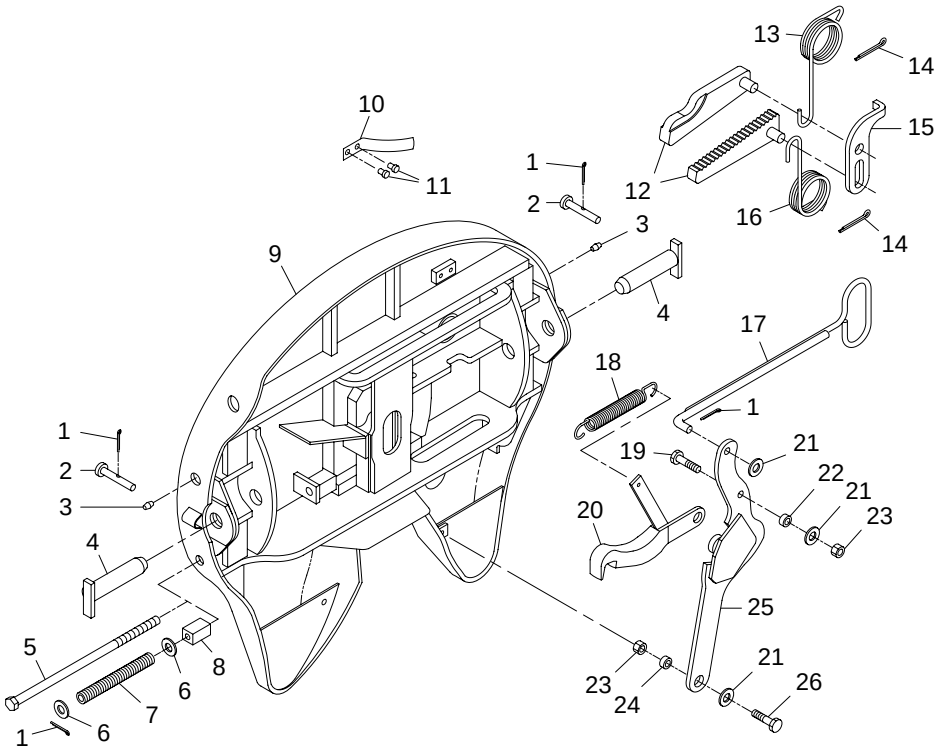

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1. 3/16" x 1" Cotter Pin
2. Lower Bracket Retainer Pin
3. Grease Fitting
4. Lower Bracket Pin
5. Wedge Stop Rod
6. Flatwasher
7. Wedge Stop Rod Spring
8. Wedge Stop Rod Nut
9. Side Release Upper Assembly
10. Leaf Spring
11. 1/4–20 x 3/8 Thread-Cutting Screw
12. Step Jaw and Wedge
13. Jaw Spring
14. 1/4" x 3" Cotter Pin
15. Timer
16. Wedge Spring
17. Pull Handle
18. Bumper Handle Spring
19. 1/2–13 x 2 Bumper Pivot Bolt
20. Bumper
21. Flatwasher
22. 5/16" Bumper Pivot Bushing
23. 1/2–13 Locknut
24. 7/16" Handle Pivot Bushing
25. Operating Handle (side-release only)
26. 1/2–13 x 2 Handle Pivot Bolt

Fig. 1, Fontaine H5092 Series Fifth Wheel (Left-Side Release Shown)

7.3 Install the fifth wheel top plate, bushing pins, and roll pins.

8. Inspect for fatigue or cracked welds.
9. Replace cracked, worn, or damaged parts with new parts. Replace all 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.
10. After inspecting the fifth wheel, lubricate all moving parts with a chassis or multipurpose grease. See **Maintenance Operation 31–02** for lubrication instructions.

31–02 Fifth Wheel Lubricating

To maintain proper fifth wheel operation, always lubricate the fifth wheel after an inspection has been performed.

IMPORTANT: Lubricate the fifth wheel:

- After power washing, or steam cleaning;
- If the vehicle operates in harsh conditions such as salt spray from road surfaces, or in extremely dusty environments;

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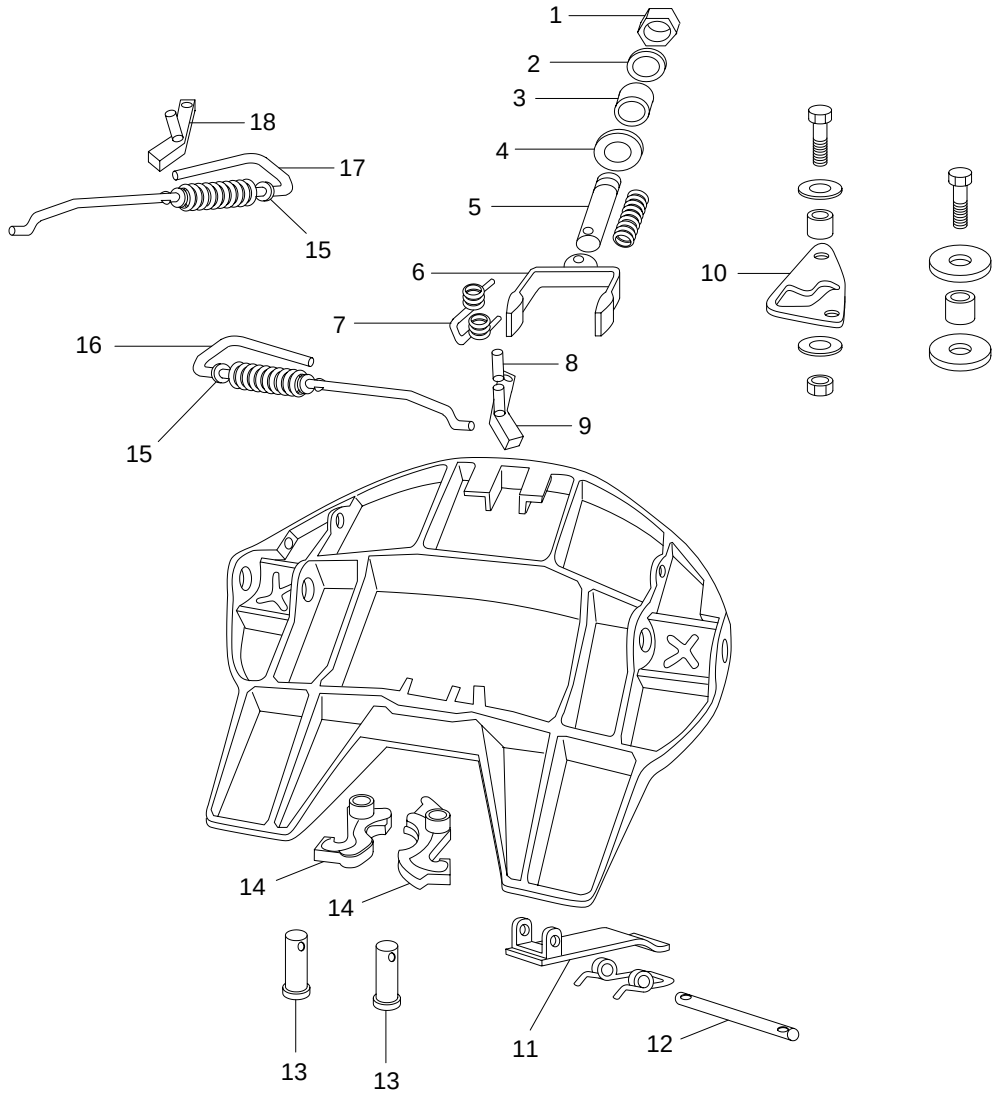

1. Locknut, 3/4–16
2. Washer
3. Rubber Washer
4. Lock Adjustment Tag
5. Yoke Shaft
6. Yoke Subassembly
7. Torsion Spring
8. Roll Pin
9. Secondary Lock, Right-Hand
10. Cam Plate
11. Lock Guard
12. Pin
13. Lock Pin
14. Lock Jaw
15. Washer
16. Right-Hand Release Handle
17. Left-Hand Release Handle
18. Secondary Lock, Left-Hand

Fig. 2, Holland Fifth Wheel

- After any operation that requires the removal of lubrication from the fifth wheel head or components.

⚠ WARNING

Failure to properly lubricate the fifth wheel could result in a possible disengagement of the trailer

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from the tractor, which could result in personal injury or property damage.

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

Holland

Lubricate all moving parts with a multipurpose chassis grease. Lubricate the two grease fittings located on either side of the top plate with a multipurpose chassis grease.

Once the fifth wheel's moving parts 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.

31–03 Frame Fastener Torque Checking

Frame brackets and components secured with Huckbolt® fasteners do not require a torque check, however, they should be inspected for damage. Frame brackets and components secured with conventional bolts and nuts are to be checked at Initial Maintenance (IM). Check the torque of frame fasteners to offset the effects of "bedding in" (or seating). When checking torque, torque the nut, not the bolt head whenever possible. This will give a true torque reading by eliminating bolt body friction. When checking the torque of frame fasteners, inspect the frame for cracks and other damage. Set a click-type torque wrench to the maximum torque of the fastener you are checking. Apply pressure until the torque wrench clicks. Do not loosen the bolt to check the torque.

See the applicable torque table in **Group 00** for torque specifications.

⚠ CAUTION

Make sure frame fasteners are properly tightened. Continued vehicle operation with loose fasteners could result in bracket or frame damage.

NOTE: Engine supports on vehicles built from January 2007 do not require checking.

Inspect and check the fasteners at the following locations:

- axle stops
- deck plates
- engine trunnion supports
- equalizer brackets
- exhaust brackets
- fifth wheel legs
- fifth wheel mountings
- frame crossmembers and gussets
- front frame brackets
- front suspension spring brackets
- fuel tank brackets
- radius rods
- rear engine supports
- rear suspension spring brackets
- shock absorbers
- all other frame fasteners

Any component that shows signs of cracking, or other damage must be repaired or replaced. Refer to the vehicle workshop manual for repair or replacement information in the respective section for the component in question.

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**.

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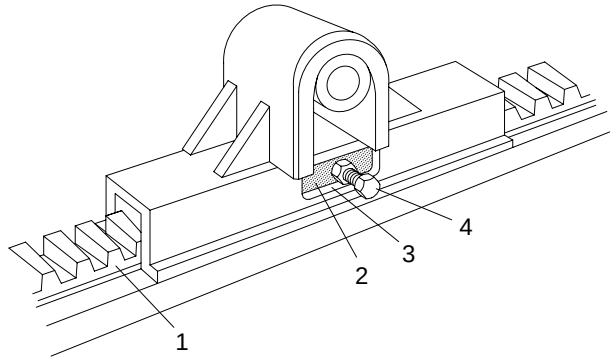

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1. Rack
2. Plunger
3. Pocket
4. Plunger Adjusting Bolt

Fig. 3, Locking Plungers

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 *L-Line and A-Line Workshop 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 securely tighten the locking nut.

31-05 Trailer Electrical Connector Lubricating

In some cases, failure of trailer cables occurs due to intrusion of chloride-based road deicing chemicals into the trailer connector. Once inside the connector, the chloride-based chemicals corrode the brass terminals and create bridging between positive and ground terminals.

NOTE: The use of soap is not recommended for cleaning the electrical connector, as some soaps may increase the corrosion process.

1. Wash out any existing grease, dirt, and corrosion on the trailer connectors with electrical contact cleaner spray.
2. Grease the trailer connector with a lithium-based dielectric grease.

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32–01 Suspension Inspecting

Front Suspension Check

⚠ 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.

Inspect the front spring assemblies for cracked, broken, or abnormally bent leaves. If any of these conditions exist, replace the spring assembly. See **Group 32** of the *L-Line and A-Line Workshop Manual* for instructions.

Front and Rear Suspension Shock Absorber Check

Make sure the shock absorber brackets are tight, and the shock absorber is not striking or rubbing the frame or some other part of the chassis. Striking or rubbing the frame is characterized by chafe marks on the shock absorber body and the frame rail. See **Fig. 1**. Check the rubber mounting bushings for cracks, cuts, swelling, and dry rot. Also, check the bushings for missing pieces. Replace the bushings as needed.

Inspect the shock absorber for oil leakage. If the shock absorber is damaged or leaking, replace it with a new one. See **Group 32** of the *L-Line and A-Line Workshop Manual* for replacement instructions.

Rear Suspension Check

Spring Suspension

⚠ 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 visibly damaged parts is no assurance that the spring is safe. Failure to replace a damaged spring assembly could cause an accident, resulting in serious personal injury or property damage.

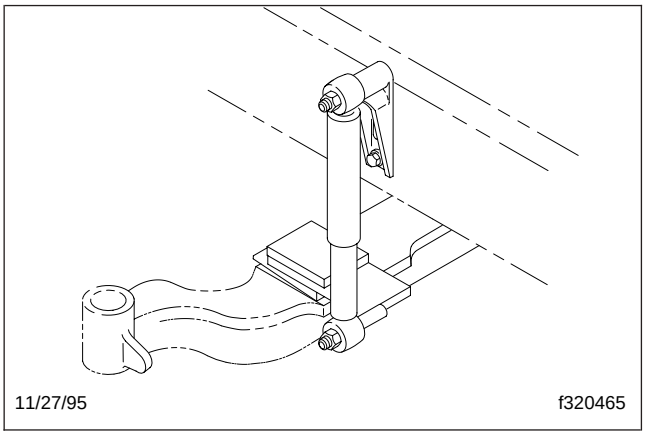

Fig. 1, Direct-Acting Shock Absorber (Front Suspension Shown)

Replace worn, cracked, or damaged spring brackets. Failure to do so could result in bracket breakage, possibly leading to loss of vehicle control and resulting in personal injury or property damage.

1. Inspect the forward and rear spring brackets and equalizer brackets for loose fasteners, wear, cracks, and other damage. If any of these conditions exist, replace the damaged bracket(s). See **Group 32** of the *L-Line and A-Line Workshop Manual* for instructions.
2. Inspect the tandem-axle frame crossmember and gussets for loose fasteners, wear, cracks, and other damage. If any of these conditions exist, replace the damaged parts. See **Group 32** of the *L-Line and A-Line Workshop Manual* for instructions.

⚠ 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.

3. Without detaching the radius rods, attempt to move (by hand) each radius-rod end up, down, in, and out. If there is any movement, replace the

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radius rod. If a radius rod needs to be replaced, see **Group 32** of the *L-Line and A-Line Workshop Manual* for instructions.

4. Inspect the weld seams between the radius rod tube and the shorter bushing tubes. If there are cracks, replace the radius rod. Do not weld the radius rod for any reason.
5. Inspect the rubber bushing ends. See **Fig. 2**. Replace the radius rod for any of the following reasons:
   - If there are gaps between the rubber bushing and the pin or outer steel sleeve.

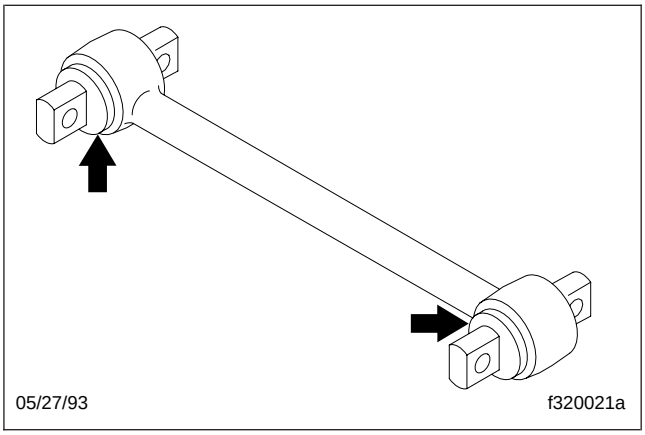
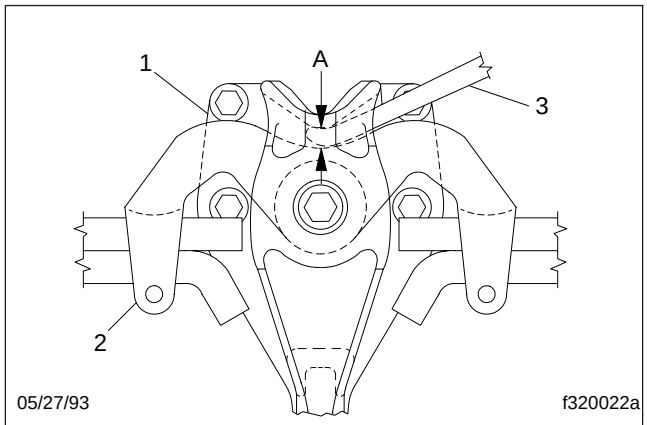


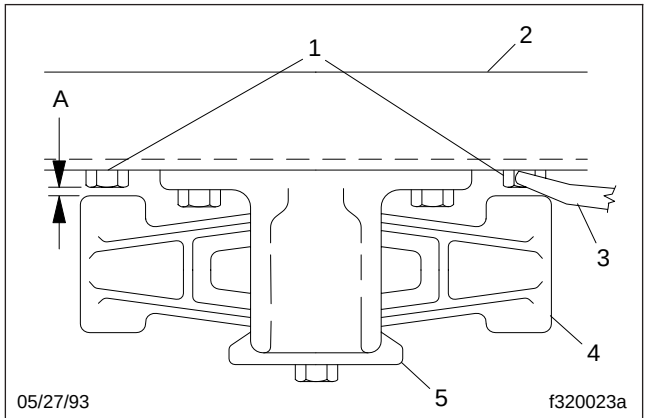
Fig. 2, Radius Rod Bushings

   - If either bushing end contacts a radius rod pin mounting bolt.
   - If there are cracks in the bushing.
   - If part of the rubber bushing extends beyond the outer circumference of the outer bushing sleeve.
6. Block up the frame enough to take chassis weight off the springs. Attempt to move the equalizer up and down, using a pry bar between the top of the equalizer and 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. See **Group 32** of the *L-Line and A-Line Workshop Manual* for instructions.
7. 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. See **Group 32** of the *L-Line and A-Line Workshop Manual* for instructions.



A. Measure the change in gap at this point.
1. Equalizer Bracket
2. Equalizer
3. Pry Bar

Fig. 3, Side View of the Equalizer



A. 1/8 inch (3 mm) Clearance
1. Frame Fasteners
2. Frame Rail
3. Pry Bar
4. Equalizer
5. Equalizer Bracket

Fig. 4, Top View of the Equalizer

Hendrickson Spring/Walking Beam Suspension, Models RT, RTE, and RTEA

1. Inspect the suspension assembly for loose fasteners, wear, cracks, and damage to its components. Replace the component(s) if any wear, cracks, or damage exist. If any of these condi-

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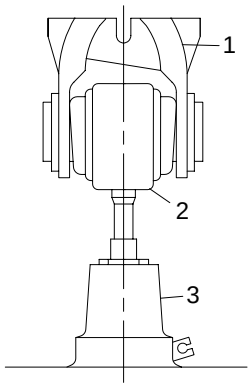
tions exist, replace the damaged bracket(s). See **Group 32** of the *L-Line and A-Line Workshop Manual* for instructions.

2. Check for distorted or frayed rubber at the beam end bushings. If the bushings are damaged, replace them.
3. 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. See **Group 32** of the *L-Line and A-Line Workshop Manual* for instructions.



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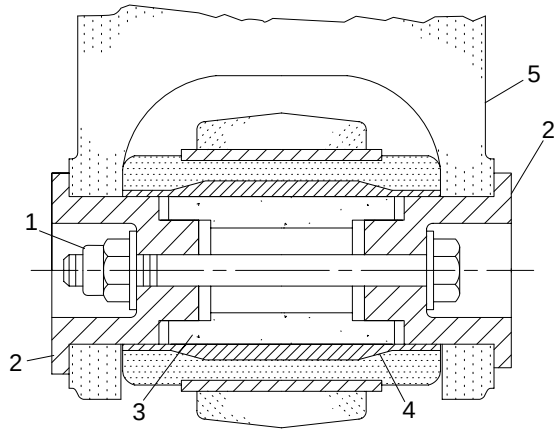
1. Beam Hanger
2. Equalizer Beam
3. Jack

Fig. 5, Raising the Hendrickson Suspension Beam End

⚠ WARNING

Insufficient beam end fastener torque could cause the beam to separate from the axle. This will cause loss of vehicle control resulting in property damage, serious personal injury or death.

4. *After repairs to the suspension,* check the fastener torque after the vehicle has been in service for 2500 miles (4000 km). If equipped with the adapter-type beam end connection (see **Fig. 6** for the three-piece adapter-type beam end connection, or **Fig. 7** for the two-piece adapter-type beam end connection), tighten the nut 210 to 240 lbf·ft (285 to 325 N·m). If equipped with the tube-type beam end connection (see **Fig. 8**), tighten the nut 375 to 425 lbf·ft (508 to 576 N·m). Do not overtorque.



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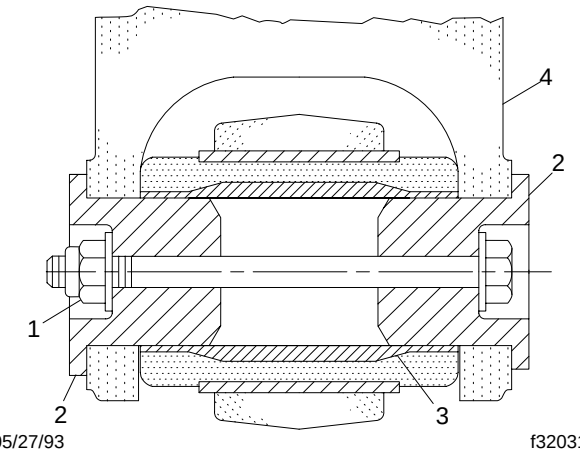
NOTE: Do not use the three-piece adapter without the intermediate tube.

1. Nut
2. Adapter
3. Intermediate Tube
4. Inner Metal of Beam End Bushing
5. Beam Hanger

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



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1. Nut
2. Adapter
3. Inner Metal of Beam End Bushing
4. Beam Hanger

Fig. 7, Two-Piece Adapter-Type Beam End Connection

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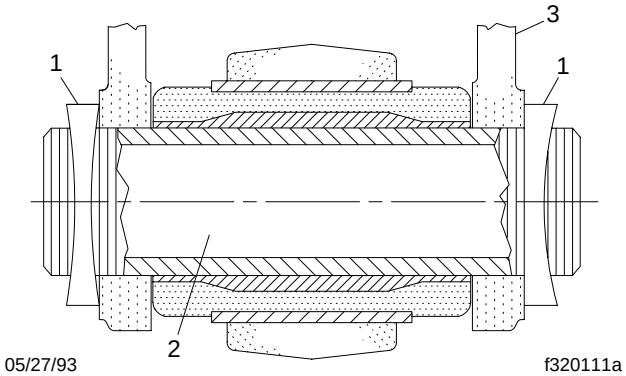


1. Nut
2. End Tube
3. Beam Hanger

Fig. 8, Tube-Type Beam End Connection

5. Without detaching the radius rods, attempt to move (by hand) each radius-rod end up, down, in, and out. If there is any movement, replace the radius rod. If a radius rod needs to be replaced, see **Group 32** of the *L-Line and A-Line Workshop Manual* for instructions.
6. Inspect the rubber bushing ends. Replace the radius rod for any of the following reasons:
   - If there are gaps between the rubber bushing and the pin or outer steel sleeve.
   - If either bushing end contacts a radius rod pin mounting bolt.
   - If there are cracks in the bushing.
   - If part of the rubber bushing extends beyond the outer circumference of the outer bushing sleeve.

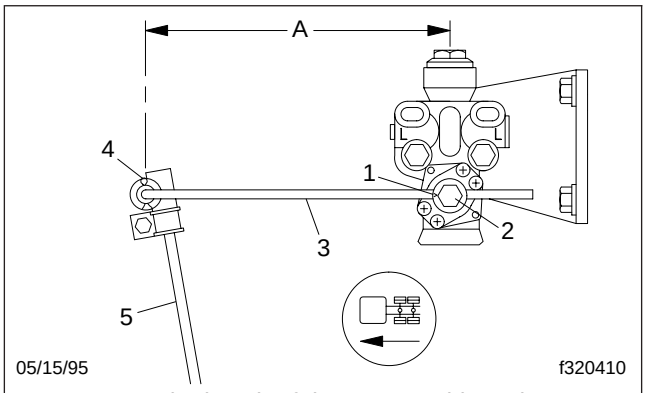
AirLiner Suspension

⚠ 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: Before checking the AirLiner suspension height, make sure there is no load on the chassis, and the trailer is unhitched.

1. Park the vehicle on a level surface, using a light application of the brakes. Do not apply the parking brakes. Shift the transmission into neutral, and build the secondary air pressure to at least 100 psi (690 kPa). Shut down the engine.
2. 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 or wear. There must be at least 1-inch (25-mm) clearance around the rubber air spring when inflated. If clearance is less than 1-inch (25-mm), relocate the obstructing parts.
3. Mark the location of the front and rear tires on the floor, and chock the tires on one axle only.
4. Check the length of the overtravel lever between its pivot points. See **Fig. 9**, Ref. A.



A. Measure the length of the overtravel lever between these two points.
1. V-Shaped Mark
2. Adjustment Locknut
3. Overtravel Lever
4. Cotter Pin
5. Linkage Rod

Fig. 9, AirLiner Overtravel Lever and Linkage Rod Measurement

4.1 If the vehicle is equipped with an adjustable-mount leveling valve, the length should be 8 inches (203 mm). If the length is incorrect, see **Group 32** of the *L-Line and A-Line Workshop Manual* for adjustment procedures.

4.2 If the vehicle is equipped with a fixed-mount leveling valve, see **Group 32** of

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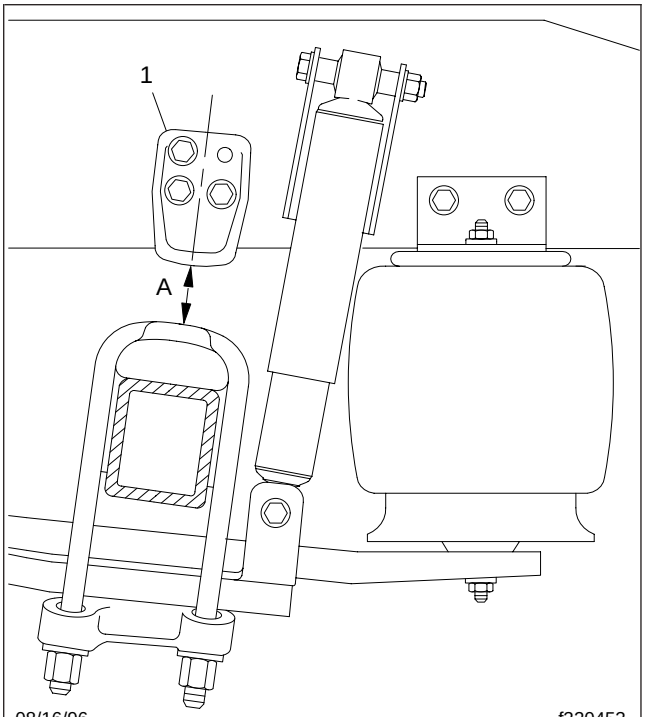
the *L-Line and A-Line Workshop Manual* for the overtravel lever length for the rear axle installed in your vehicle.

5. On single-drive rear axle configurations, measure the distance from the bottom of the left axle stop to the top of the U-bolt pad. On tandem (dual-drive) rear axle configurations, measure the distance from the bottom of the forwardmost left axle stop to the top of the axle U-bolt pad. See **Fig. 10**, Ref. A. The correct distance for single and dual-drive rear axles is between 2-3/8 inches and 2-7/8 inches (60 to 73 mm).



A. Measure height here.
1. Left Forwardmost Axle Stop

Fig. 10, AirLiner Axle Stop Measurement

6. If the axle stop measurement is not correct, see **Group 32** of the *L-Line and A-Line Workshop Manual* for adjustment procedures.
7. Without detaching the control rods, attempt to move (by hand) each control-rod end up, down, in, and out. If there is any movement, examine the control rod for wear or damage. If a control rod needs to be replaced, see **Group 32** of the *L-Line and A-Line Workshop Manual* for instructions.
8. Inspect the rubber bushings for cracks or cuts.
9. Check for any shifting of the barpin.
10. Inspect the weld seams between the control rod tube and the shorter bushing tubes. If there are cracks, replace the control rod. Do not weld the control rod for any reason.
11. 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.
12. Squeeze all air springs to check for complete deflation. If any air springs remain partially or fully inflated, see "Troubleshooting" in the appropriate section in **Group 32** of the *L-Line and A-Line Workshop Manual*.
13. Inspect each air spring for wear at its connection to its pedestal. Replace any worn air springs; for instructions, see **Group 32** of the *L-Line and A-Line Workshop Manual*.
14. 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.
15. 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 *L-Line and A-Line Workshop Manual*.
16. 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 *L-Line and A-Line Workshop Manual*.
17. 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.
18. Check that all air springs are inflated. If the air springs do not inflate, see **Group 32** of the *L-Line and A-Line Workshop Manual* for possible causes and corrections.
19. Apply the parking brakes, and remove the chocks.

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Reyco Suspension, 79KB and 179

Park the vehicle on level ground and chock the front tires to prevent the vehicle from moving. Place the transmission in neutral, and release the parking brakes.

1. Check that the torque rod clamps are directed away from the spring to prevent possible interference during operation. See **Fig. 11** for a Reyco 79KB, or **Fig. 12** for a Reyco 179.
2. Check the fit of springs to hangers to ensure good ride characteristics.
3. Check for elongated holes in the suspension components. See **Group 32** of the *L-Line and A-Line Workshop Manual* for proper repair procedures.
4. Check bushing condition. Replace any bushing that is worn, cracked, dry-rotted, or otherwise damaged. See **Group 32** of the *L-Line and A-Line Workshop Manual* for bushing removal and installation instructions.
5. Check tire condition. If abnormal wear is found, check and replace all worn or damaged components, and check suspension alignment. See **Group 32** of the *L-Line and A-Line Workshop Manual* for component removal and installation procedures, and for suspension alignment instructions.
6. Inspect all suspension fasteners for proper torque values. See **Group 00** of this manual for proper bolt torque specifications.

Chalmers Walking Beam Suspension, 800 Series

Chock the front tires to prevent the vehicle from moving. Place the transmission in neutral, and release the parking brakes before inspecting the Chalmers 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.
2. 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, replace the walking beam.

   Keep the vehicle supported by the jack stands for the next operation.
3. Manipulate the walking beam so that a micrometer, vernier, or dial caliper may be used to determine the wear area thickness on the bottom face. See **Fig. 13**. 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. 13**, Ref. B) from the thickness at the non-wear area (**Fig. 13**, Ref. A) to determine the amount of wear.

   If the beams show any wear greater than 0.062 inch (1.5 mm), a Chalmers wear plate must be installed, or the walking beam must be replaced.
4. 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.

⚠ 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.

Hendrickson Walking Beam Suspension, RS Series

1. Inspect the frame-hanger-to-frame attaching fasteners for the proper torque. See **Group 00** of this manual for torque specifications.

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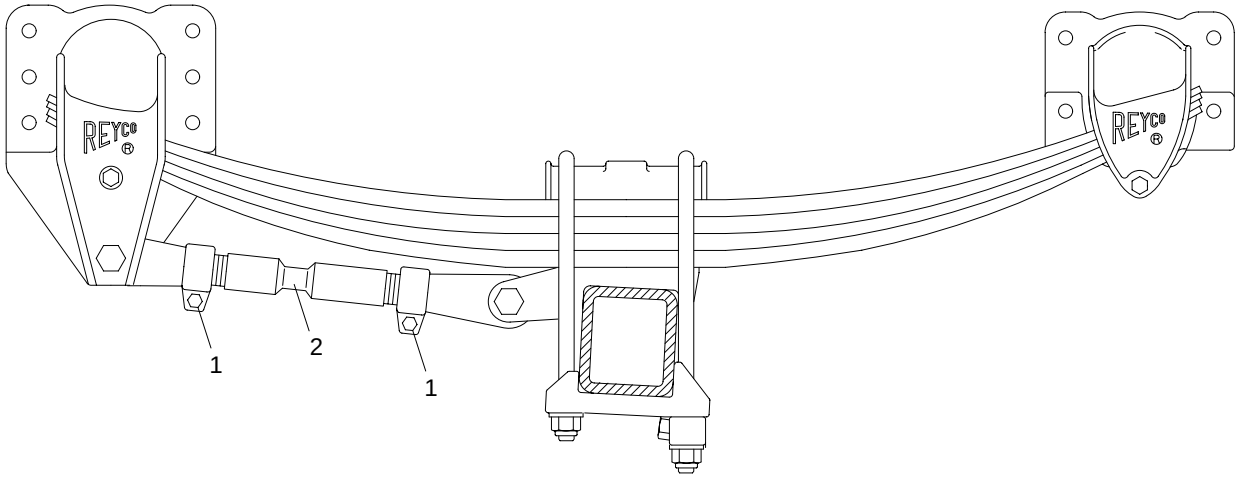

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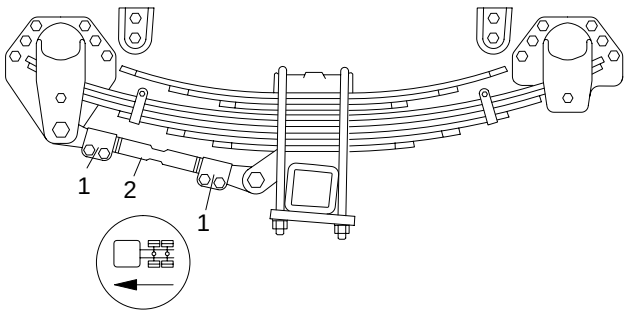
1. Torque Rod Clamp
2. Torque Rod

Fig. 11, Reyco 79KB Torque Rod Clamp Position



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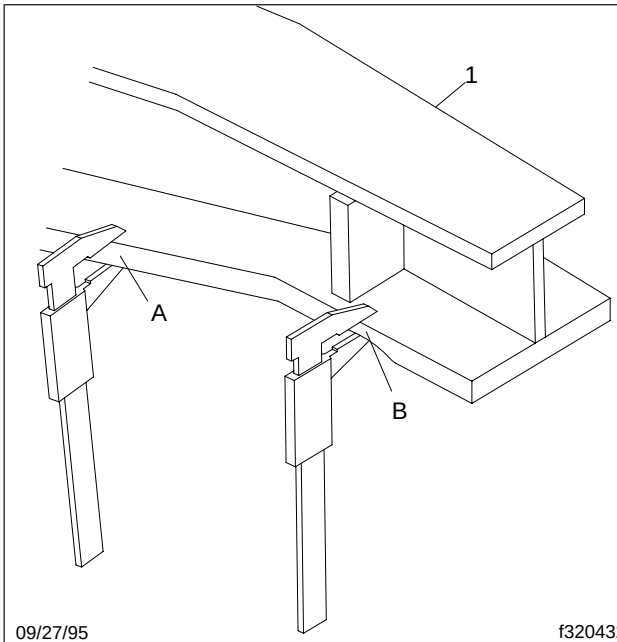
1. Torque Rod Clamp
2. Torque Rod

Fig. 12, Reyco 179 Torque Rod Clamp Position

⚠ WARNING

Be sure that fasteners are torqued correctly. Fasteners that do not provide a tightly clamped joint between the frame and the hanger can cause premature fracture of the frame hanger, separation of components, loss of vehicle control, and possible personal injury or property damage.



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A. Non-Wear Area
B. Wear Area
1. Walking Beam

Fig. 13, Walking Beam End Wear Thickness

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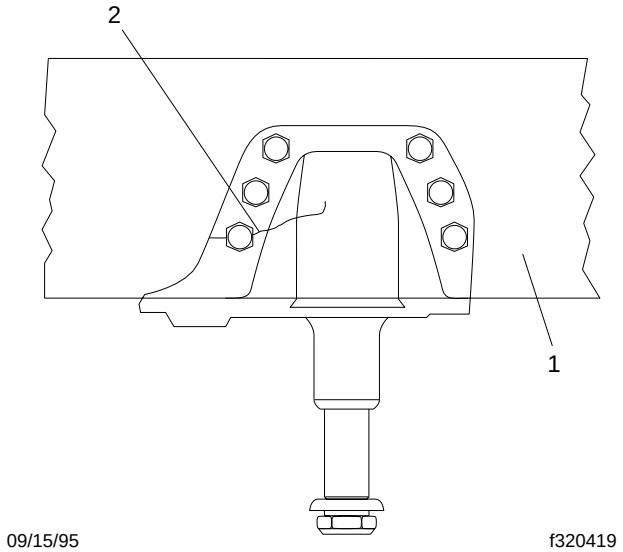
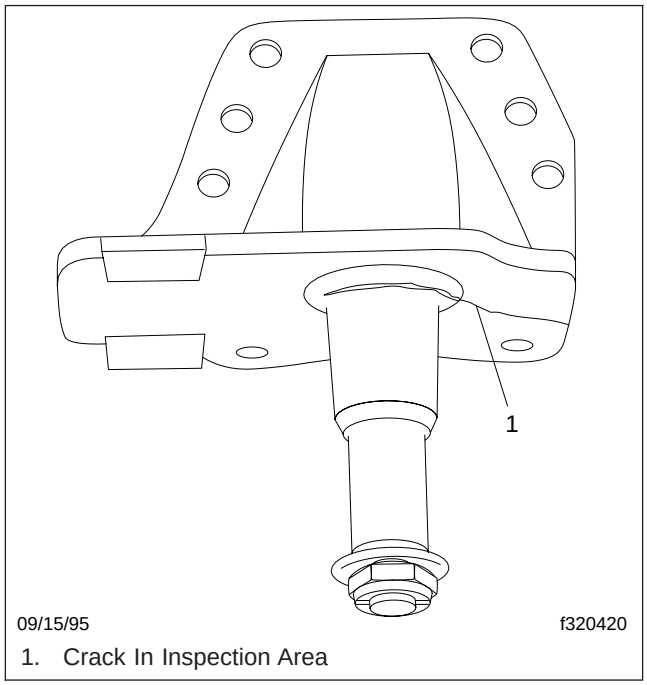
2. Visually inspect each frame hanger for any evidence of cracks in the vertical mounting flange. See **Fig. 14**.



1. Frame Rail
2. Crack In Inspection Area

Fig. 14, Hendrickson RS Series Vertical Mounting Flange

3. Visually inspect each frame hanger for evidence of cracks in the horizontal mounting flange adjacent to the vertical drive pin area. See **Fig. 15**.
4. Visually inspect each frame hanger for severe rust on the horizontal mounting flange adjacent to the vertical drive pin area. See **Fig. 16**.
5. Inspect the load cushions for cuts and swelling. See **Fig. 17**. Cushions cut by the retaining lips of the saddles or frame hangers indicate the cushions may not be the correct hardness or configuration for the vehicle operation.
6. Inspect the lower side of the vertical drive bushings for evidence of torn or shredded rubber. Check that the concave washers are installed with the lips pointing downward.
7. Inspect the saddles and saddle cap fasteners for wear. The allowable thrust washer wear in aluminum saddles is up to 3/16 inch (4.8 mm) into the saddles as measured at the top of the thrust washer diameter. Check that the locknuts are torqued to specification to prevent wear of the beam center bushings into the legs of the saddles. See **Group 00** of this manual for torque specifications.



1. Crack In Inspection Area

Fig. 15, Hendrickson RS Series Horizontal Mounting Flange

Hendrickson Suspension, RT2 and RTE2 Series

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

   Raise the rear of the vehicle until the rear wheels are suspended in the air, then support the vehicle with safety stands.
2. Check the torque of the number-one spring hanger (double-lock-bolt design) lock bolt nuts. If a loose connection has caused pin hole wear, replace the hanger.
3. Inspect the pin hole in the outboard leg of the number one spring hanger (draw-key design) for wear or elongation.

WARNING

Wear at this point requires hanger replacement, or premature fracture of the spring hanger pin may occur, with possible separation of components

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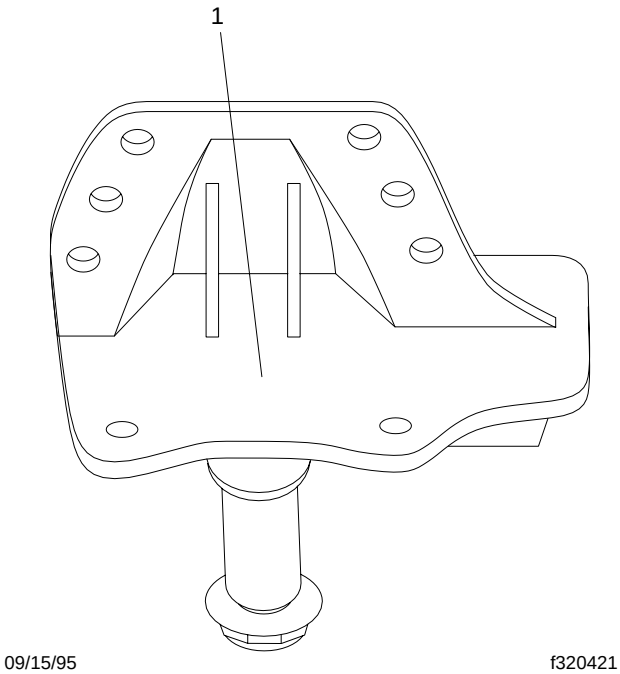


1. Rust Inspection Area

Fig. 16, Hendrickson RS Series Rust Inspection

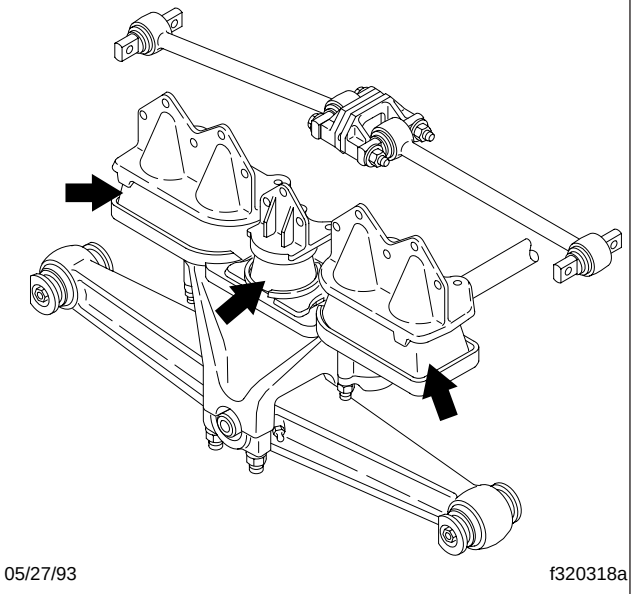


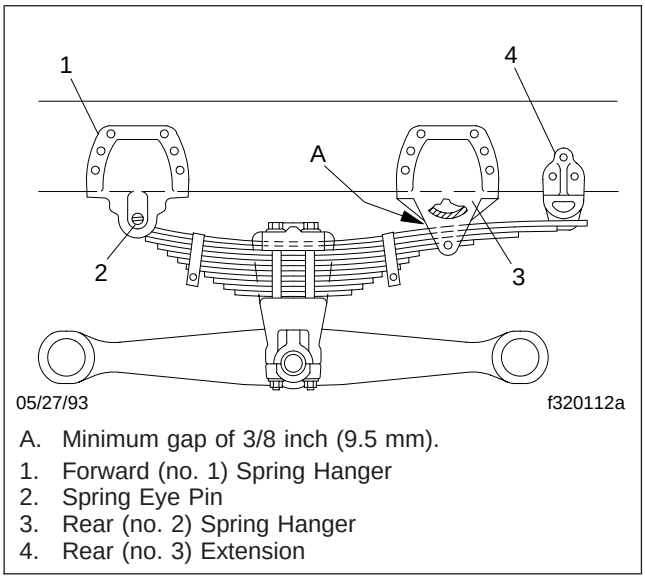
Fig. 17, Hendrickson RS Series Load Cushion Inspection

and loss of vehicle control. This could result in serious personal injury or property damage.

4. Visually inspect the cam surface of the number-two spring hanger for wear due to operating mileage. Also, inspect the outside legs for wear which can be caused by worn spring eye bushings.

NOTE: RTE2 (extended-leaf-spring) suspensions require a minimum gap of 3/8 inch (9.5 mm) between the cam surface of the number-two spring hanger and the top of the main leaf in the unloaded condition. See **Fig. 18**. If this gap is less than 3/8 inch (9.5 mm), the extended-leaf portion of the spring will not perform satisfactorily for an empty ride.

5. Inspect the cam surface on the number-three spring hanger (extended-leaf-springs only) for wear. Excessive wear will reduce the gap available at the number-two spring hanger. Refer to the previous note.



A. Minimum gap of 3/8 inch (9.5 mm).
1. Forward (no. 1) Spring Hanger
2. Spring Eye Pin
3. Rear (no. 2) Spring Hanger
4. Rear (no. 3) Extension

Fig. 18, RTE Suspension (Unloaded)

6. Place a block of wood on the leaf spring. See **Fig. 19**. Place a pry bar on the block of wood and insert the end of the pry bar under the frame hanger. Attempt to lift the frame hanger, as shown in **Fig. 19**. Also, with an empty chassis and the brakes applied, attempt to rock the chassis back and forth while observing the spring eye. In either case, if 1/8 inch or more of move-

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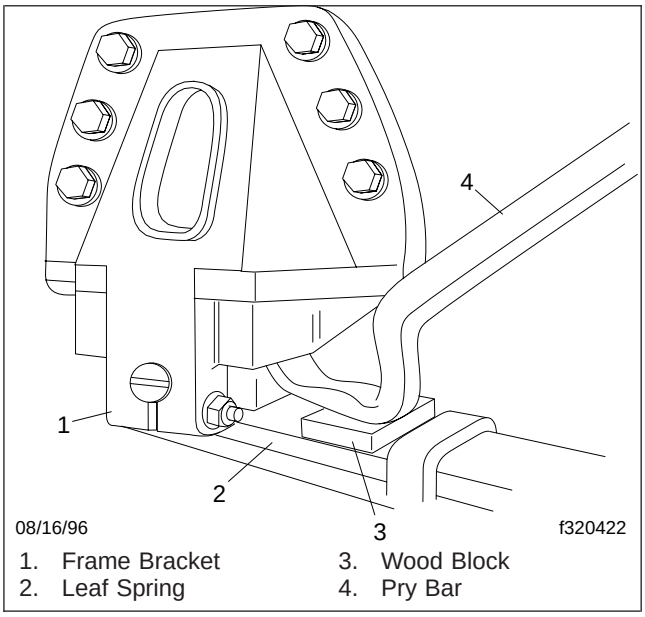
ment is observed, the bushing and pin should be replaced. This also could indicate that a broken spring eye and spring are connected to the spring hanger through the wrapper eye of the second leaf. In this case, the main leaf or the complete spring should be replaced immediately.



1. Frame Bracket
2. Leaf Spring
3. Wood Block
4. Pry Bar

Fig. 19, Hendrickson RT2 and RTE2 Series Frame Bracket Inspection

Neway Suspension

⚠ 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, possibly causing personal injury or death, or property damage.

1. Park the vehicle on a level surface. Apply the parking brakes and chock the tires to prevent the vehicle from moving.
2. Inspect the rear suspension for any signs of damage, loose components, wear, or cracks. Replace any damaged components to prevent failure or equipment breakdown.
3. Inspect all bolts and nuts at the pivot and axle connections to ensure they are properly torqued. Check all other nuts and bolts for proper torque. See **Group 00** of this manual for torque specifications.
4. Check the air pressure gauge to confirm that there is in excess of 65 psi (448 kPa) in the air system, and inspect the air springs for sufficient and equal firmness.

NOTE: Height control valves control all air springs. Check for air leaks by applying a soapy solution, then checking for bubbles, at all air connections and fittings.

5. Check the riding height of the air suspension by measuring the distance from the centerline of the rear axle (see **Fig. 20**) to the bottom of the frame rail. If the riding height is incorrect, adjust the air suspension.

32–02 Suspension Lubricating

Front Suspension

Wipe all dirt away from the grease fittings (if equipped) on the spring-eye bushings. Apply multipurpose chassis grease with a pressurized grease gun until the old grease is forced out.

NOTE: Service Schedule IV vehicles equipped with a 12,000 lb (5452 kg) front axle are fitted with maintenance-free rubber bushings, and do not require lubrication.

Rear Suspension

Sterling Spring

Single Axle

No lubrication is required on Sterling single-axle rear suspensions.

Tandem Axle

Lubricate the equalizer cap-and-tube assembly bushings by applying multipurpose chassis grease at the grease fitting until the old grease is forced out from the cap-and-tube assembly. See **Fig. 21**.

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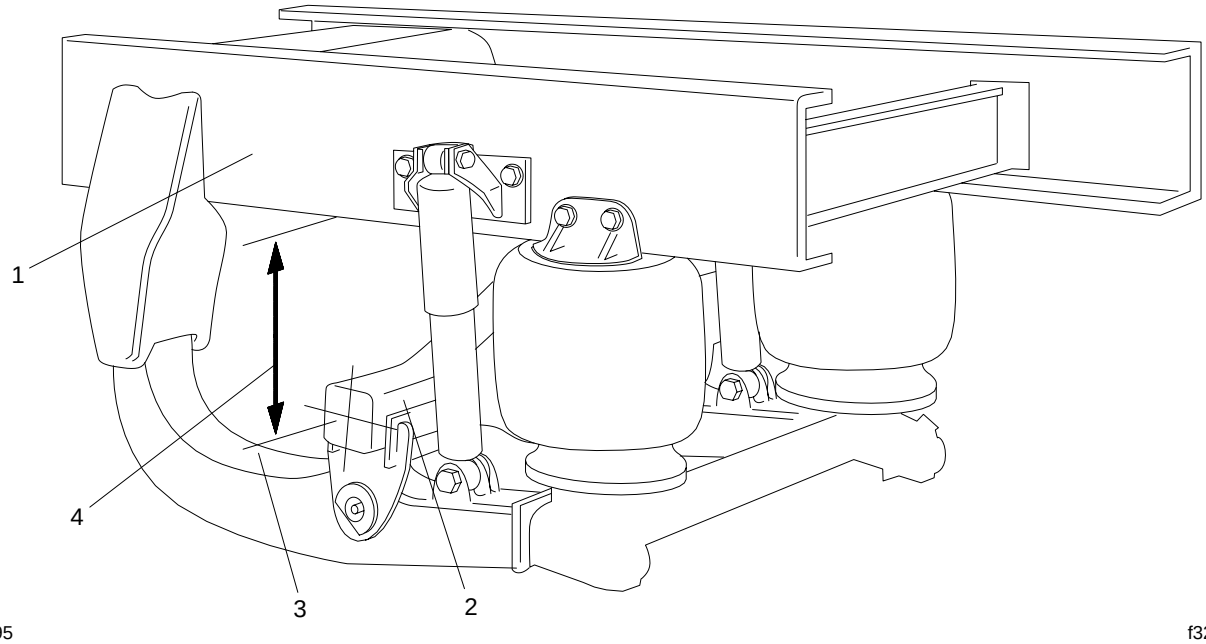
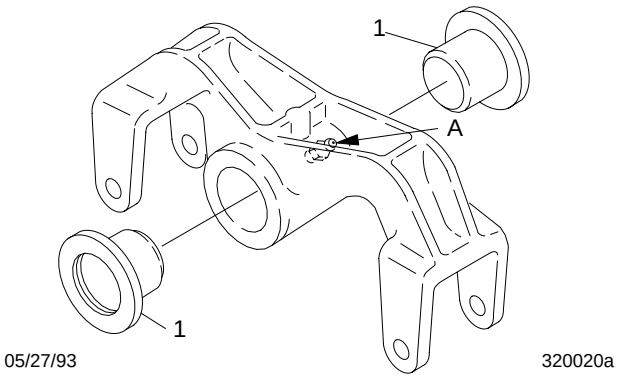


1. Frame Rail
2. Axle Housing
3. Axle Centerline
4. Suspension Ride Height

Fig. 20, Neway Ride Height Inspection



A. Lubricate here.
1. Cap-and-Tube Assembly Bushing

Fig. 21, Equalizer Assembly Lubrication

Hendrickson Spring Suspension, RT2 and RTE2 Series

Lubricate the bronze, ball-indented bushings in the spring eye, as follows:

1. Park the vehicle on a level surface, apply the parking brakes, and chock the front tires.
2. Raise the rear of the vehicle until the rear wheels are suspended in the air, then support the vehicle with safety stands. This relieves the load on the bushings and pins to allow the proper flow of lubricant around them.
3. Using a multipurpose chassis grease, lubricate the bronze, ball-indented bushings in the spring eyes at the grease fitting. See **Fig. 22**. Continue to lubricate until grease exits both ends of the bushing. If the pin will not accept lubricant, remove the pin and clean the lubrication channels where lubricant may have hardened. Remove the safety stands and lower the vehicle after lubrication is complete.

Hendrickson Walking Beam, Series RS

No lubrication is required on RS Series suspensions equipped with rubber bushings.

If the equalizer beam has a bronze center bushing, apply multipurpose grease at the beam grease fitting

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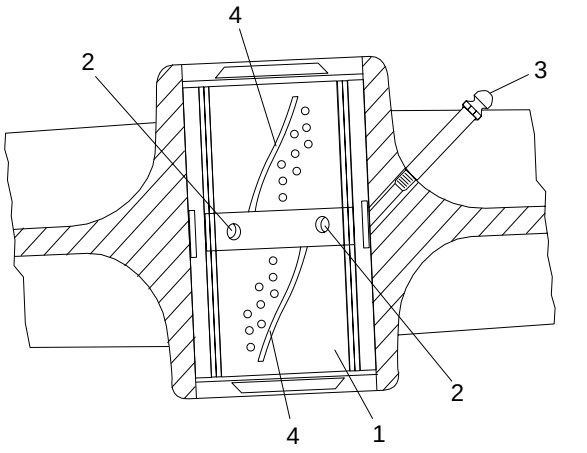

1. Bronze Bushing
2. Lubrication Hole
3. Grease Fitting
4. Lubrication Groove

Fig. 22, Hendrickson RT2 and RTE2 Series Bushing Lubrication

on the equalizer beam center hub, until clean grease appears at both ends of the grease seals.

Chalmers Walking Beam

No lubrication is required on the Chalmers rear suspension.

Neway Suspension

No lubrication is required on Neway rear suspensions.

Reyco Suspension

No lubrication is required on Reyco rear suspensions.

32–03 Suspension U-Bolt Torque Checking

⚠ 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. Turn the wrench in a clockwise motion until the torque wrench clicks. See **Table 1** of this manual for U-bolt torque specifications.
3. Remove the chocks.

Spring Assembly U-Bolt High Nut Torque Values*	
Size	**Torque: lbf·ft (N·m)**
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. 23**.

Table 1, Spring Assembly U-Bolt High Nut Torque Values

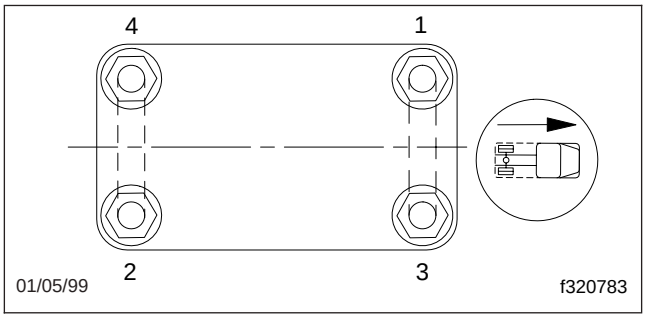

Fig. 23, Tightening Pattern for U-Bolt High Nuts

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All-Axle Alignment Checking	33–03
Knuckle Pin Lubricating	33–01
Tie Rod End Inspecting and Lubricating	33–02

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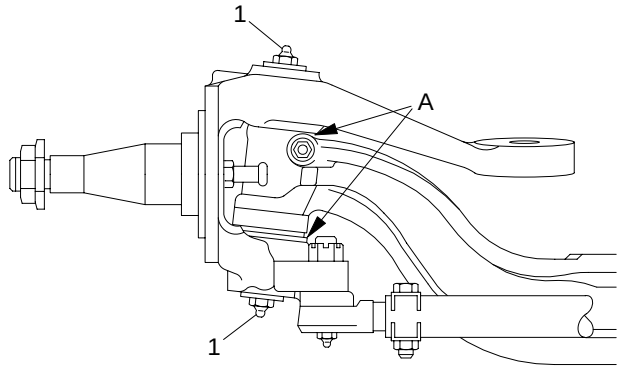
33–01 Knuckle Pin Lubricating

CAUTION

Use regulated pressure when lubricating the knuckle assemblies, otherwise damage could result to the knuckle caps.

Dana Spicer

Park the vehicle on a level surface, apply the parking brakes, and chock the wheels. When lubricating upper and lower knuckle assemblies, do not raise the front axle. Wipe the fittings clean. Apply multipurpose chassis grease, (NLGI grade 1 [6% 12-hydroxy lithium stearate grease] or NLGI grade 2 [8% 12-hydroxy lithium stearate grease]), until new grease is seen at the junctions of the axle beam and knuckles. See **Fig. 1**. Knuckle pins without grease fittings are permanently lubricated.

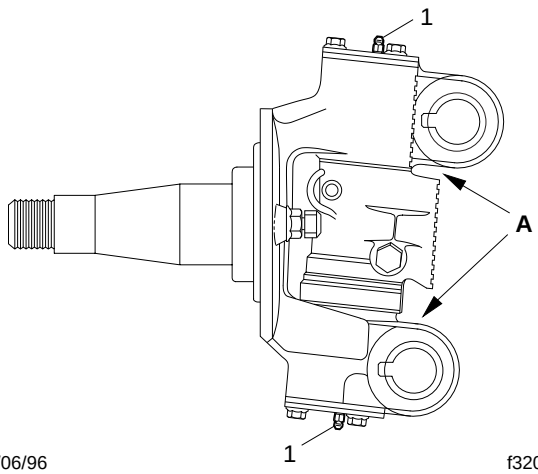


A. Grease Exit
1. Grease Fitting

Fig. 1, Dana Spicer Knuckle Pin Lubrication

Meritor

When lubricating knuckle pin bushings, do not raise the front axle. Wipe the lube fittings clean and apply multipurpose chassis grease, (NLGI grade 1 [6% 12-hydroxy lithium stearate grease] or NLGI grade 2 [8% 12-hydroxy lithium stearate grease]), until new grease is seen at the bushing grease seal opposite the fittings. The grease seal will accept grease pressure without damage, 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 bushing seal opposite the grease fitting. See **Fig. 2**.



A. Grease Exit
1. Grease Fitting

Fig. 2, Meritor Knuckle Pin Lubrication

33–02 Tie Rod End Inspecting and Lubricating

Inspect the tie-rod ends as follows:

1. Shake the cross-tube. A loose fit, or movement between the tapered shaft of the ball and the cross-tube socket members indicates 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. 3**. Replace the components if this cannot be done. For instructions, see **Group 46** of the *L-Line and A-Line Workshop Manual*.
3. For any Dana Spicer, Meritor, or Sterling axle that requires lubrication of the tie-rod ends, wipe the grease fittings clean. Pump multipurpose chassis grease, (NLGI grade 1 [6% 12-hydroxy lithium stearate grease] or NLGI grade 2 [8% 12-hydroxy lithium stearate grease]), into the tie-rod ends until all used grease is forced out and fresh grease is seen at the ball stud neck.

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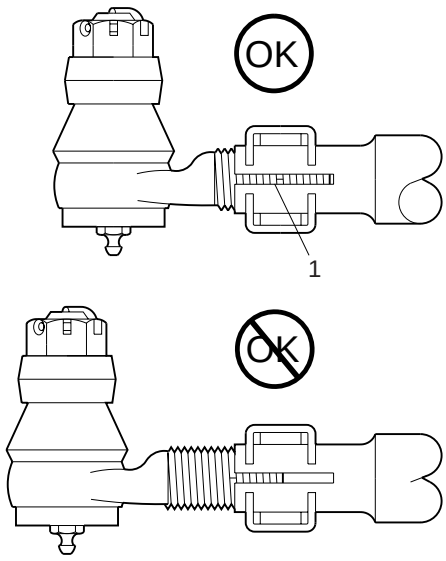

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NOTE: Pinch bolt not shown to provide clarity.

1. Cross-Tube Split

Fig. 3, Tie-Rod End Adjustment

33–03 All-Axle Alignment Checking

Drive Axle Alignment

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 *L-Line and A-Line Workshop Manual*.

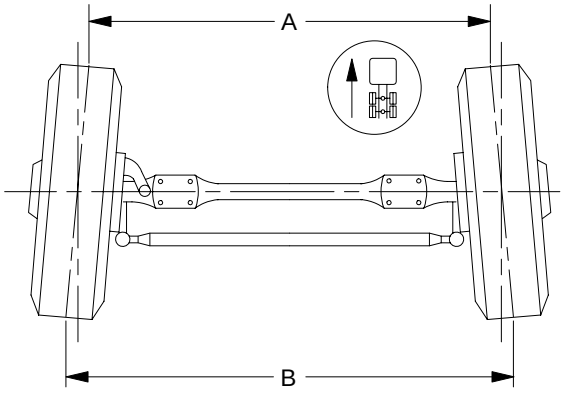
Toe-In Inspection

For vehicle alignment to be accurate, the shop floor must be level in every direction. The turn-plates for the front wheels must rotate freely without friction, and the alignment equipment must be calibrated every three months by a qualified technician from the equipment manufacturer. Sterling dealers must have proof of this calibration history.

1. Apply the parking brakes and chock the rear tires.
2. Raise the front of the vehicle until the tires clear the ground. Check that the safety stands will support the combined weight of the cab, axle, and frame. Place safety stands under the axle.
3. Using spray paint or a piece of chalk, mark the entire center rib of each front tire.
4. Place a scribe or pointed instrument against the marked center rib of each tire, and turn the tires. The scribe must be held firmly in place so that a single straight line is scribed all the way around each front tire.
5. Place a turn-plate or turntable under both front tires. Raise the front of the vehicle, remove the safety stands from under the axle, then lower the vehicle. Remove the lock-pins from the gauges; make sure the tires are exactly straight ahead.

NOTE: If turn-plates or turntables are not available, lower the vehicle. Remove the chocks from the rear tires and release the parking brakes. Move the vehicle backward and then forward about 6 feet (2 meters).

6. Place a trammel bar at the rear of the front tires; locate the trammel pointers at spindle height, and adjust the pointers to line up with the scribe lines on the center ribs of the front tires. See **Fig. 4**. Lock in place. Check that the scale is set on zero.



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NOTE: B minus A equals toe-in.

Fig. 4, Wheel Toe-In (overhead view)

7. Move the trammel bar to the front of the tires (see **Fig. 5**), and adjust the scale end so that the pointers line up with the scribe lines. See **Fig. 6**.
8. Read the toe-in from the scale, and compare it to the toe-in specification in **Group 33** of the *L-Line*

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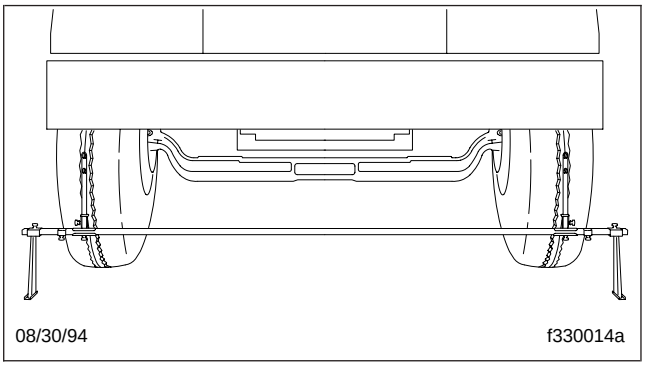

Fig. 5, Trammel Bar Positioning

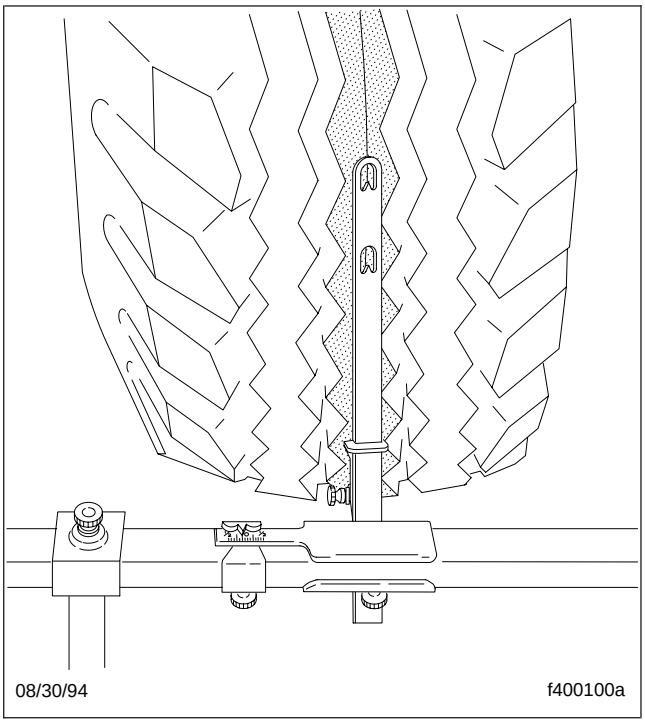

Fig. 6, Setting the Trammel Bar Pointers

and A-Line Workshop Manual. If corrections are needed, see **Group 33** of the *L-Line and A-Line Workshop Manual* for instructions on adjusting the toe-in.

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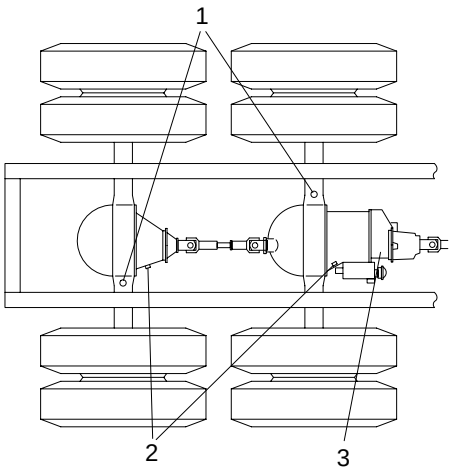
35–01 Axle Breather and Lubricant Level Checking

Meritor Axle Lubricant Level Check

CAUTION

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

1. With the vehicle parked on level ground, apply the parking brakes, and chock the tires.
2. Clean the fill plug in the side of the axle carrier, and the area surrounding it. See **Fig. 1**. Then remove the plug.



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1. Axle Housing Breathers
2. Carrier Oil Fill Plugs
3. Interaxle Differential

Fig. 1, Fill Plug and Axle Housing Breather Locations

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

3. With the vehicle on level ground, lubricant should be level with the bottom of the fill hole. If low, check for oil leaks, correct as needed, then add specified lubricant. See **Table 1** for recommended drive axle lubricants and **Table 2** for drive axle lubricant capacities.
4. Install and tighten the fill plug 35 lbf·ft (47 N·m).

NOTE: When adding to or checking the oil level of non-drive axles, make certain the hub cap and plug are cleaned before removal of the plug; this will minimize the possibility of dirt and road grime entering the assembly.

5. On non-drive axles using oil-lubricated wheel bearings, check oil level at the wheels, and add oil if low. Use the same lubricant as specified for the drive axle.

Meritor Axle Breather Check

Axle housing breathers (see **Fig. 1**) must remain clean. Whenever the axle lubricant level is checked, check the axle breather to be sure it is open. Check more often under adverse operating conditions. If the breather is plugged, clean or replace it as needed.

Dana Spicer Axle

CAUTION

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

1. Park the vehicle on level ground, apply the parking brakes, and chock the tires.
2. If the vehicle has just been driven, allow a few minutes for the lubricant to settle.
3. Clean the oil fill plug and area surrounding it, then remove the plug from the fill hole (see **Fig. 2**), or from the standpipe (if so equipped) installed in the fill hole.

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Meritor Drive Axle Recommended Lubricant			
Recommended Lubricant Type	**Ambient Temperature**	**Lubricant SAE Viscosity Grade**	**Meritor 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, Meritor Drive Axle Recommended Lubricant

Meritor Drive Axle Lubricant Capacities		
Axle Model		**Capacity*: pints (liters)**
Single-Drive, Single Reduction†		
RS–21–160		39.5 (18.7)
RS–23–160		39.5 (18.7)
RS–23–161		37.2 (17.6)
RS–23–185		47.3 (22.4)
RS–25–160		37.2 (17.6)
Tandem-Drive, Single Reduction		
RT–40–145, RT–40–145A, RT–40–145P	Forward	30.2 (14.3)
	Rear	25.8 (12.2)
RT–44–145, RT–44–145P	Forward	29.3 (13.9)
	Rear	25.1 (11.9)
RT–46–160, RT–46–160P	Forward	39.1 (18.5)
	Rear	34.4 (16.3)

* Quantities listed are approximate. Fill axle until lubricant is level with bottom of fill hole with vehicle on level ground.

† See "Traction Equalizer Additives" in the text.

Table 2, Meritor Drive Axle Lubricant Capacities

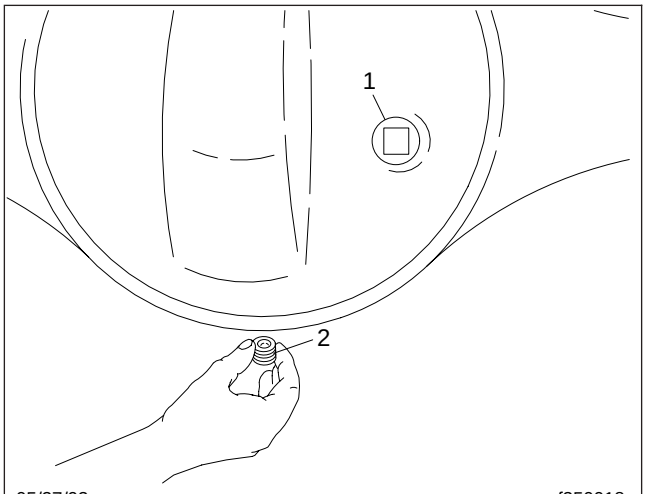

Fig. 2, Axle Housing Drain and Fill Plugs

IMPORTANT: A lubricant level close enough to be seen or touched is not sufficient. It must be level with the bottom of the fill hole (see **Fig. 3**), or the top of the standpipe opening.

4. Lubricant should be level with the bottom of the fill hole (see **Fig. 3**), or with the top of the standpipe opening. If low, check the axle for oil leaks, and correct as needed. Add lubricant as required. See **Table 3** for recommended drive axle lubricants and **Table 4** for recommended drive axle lubricant capacities.

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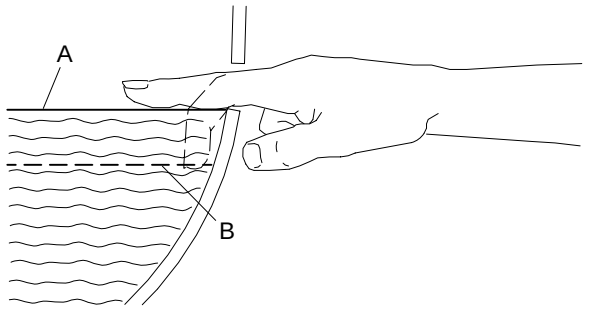


A. Correct (lube level at bottom of fill hole)
B. Incorrect (lub level below fill hole)

Fig. 3, Axle Lubricant Level Inspection

Dana Spicer Drive Axle Recommended Lubricant		
Lubricant Type	**Condition**	**Lubricant SAE Viscosity Grade**
Eaton® Roadranger® Synthetic Drive Axle Lubricants, or Equivalent with Military Specification MIL–L–2105D	Over-the-Road Service	75W–90
	Off-Highway Equipment, or Under Extra Heavy Loads	80W–140

Table 3, Dana Spicer Drive Axle Recommended Lubricant

Dana Spicer Drive Axle Lubricant Capacities		
Axle Type	**Axle Model**	**Capacity*: pints (liters)**
Single-Drive-Axle Installation		
Single Reduction	23080S, 23080D	40 (18.9)
	23105S, 23105D	48 (22.7)
Dual-Drive-Axle Installation		
Single Reduction	DD404, DD404–P	31 (14.7)†
	DS404, DS404–P	39 (18.5)†
	DS461–P	43 (20.3)†
Dual Range (2-Speed)	DT402, 402–P	34 (16.1)†
	DT451–P	39 (18.5)†
	DT461–P	43 (20.3)†

Dana Spicer Drive Axle Lubricant Capacities		
Axle Type	**Axle Model**	**Capacity*: pints (liters)**
Double Reduction	DP451–P	34 (16.1)†
	DP461–P	43 (20.3)†

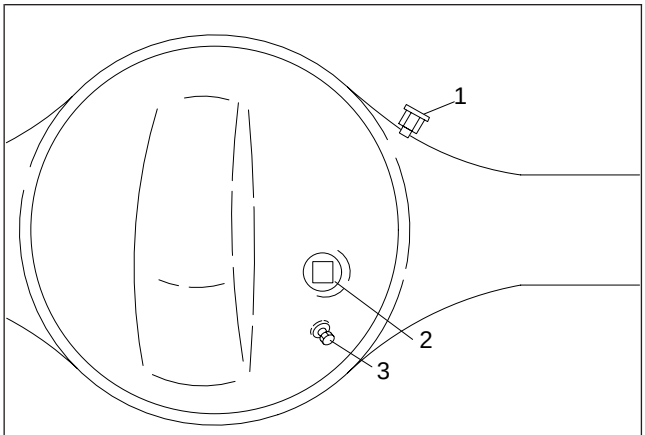
* Quantities listed are approximate. Fill axle until lubricant is level with bottom of fill hole with vehicle on level ground.

† Add 2 pints (1 L) of additional lubricant to the power divider.

Table 4, Dana Spicer Drive Axle Lubricant Capacities

IMPORTANT: Axle housing breathers (see **Fig. 4**) must remain clean and unclogged. Always check the axle breather whenever checking lubricant level. Ensure that it is open and unclogged. Check the breather more frequently under adverse operating conditions. If the breather is plugged or damaged, clean or replace it as needed.

5. Install and tighten the fill plug 40 to 60 lbf·ft (54 to 81 N·m).
6. For a two-speed axle with a shift unit, check the lubricant level of the shift unit; see elsewhere in this maintenance operation for the shift unit lubricant level inspection procedure.
7. Remove the chocks from the tires.



1. Axle Housing Breather
2. Fill Plug
3. Temperature Indicator Plug

Fig. 4, Dana Spicer Axle Housing Breather

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35–02 Axle Lubricant Changing, Oil Filter Replacing and Magnetic Strainer Cleaning

Meritor Axle Lubricant Change and Oil Filter Replacement

Axle Lubricant Change-Interval Information

A regular schedule for changing axle lubricant in a particular vehicle and operation can be accurately determined by analysis of oil samples taken from the assembly at specific intervals or mileages. The final schedule recommended may, for economic reasons, be correlated with lubricant changes governed by climatic conditions and magnetic plug maintenance. Lubricant changes should be made as climatic temperatures demand, regardless of vehicle mileage or established change schedule.

Normal operating temperature of compounded lubricants during the summer season is approximately 160° to 220°F (71° to 104°C). 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 to realize the inherent advantages they offer.

⚠ CAUTION

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

Traction Equalizer Additives

Single drive axles equipped with traction equalizers may require a "limited-slip friction modifier" to correct a slip-stick condition. Meritor's experience shows that the following additives (friction modifiers) perform adequately:

A. For all GL–5 gear oils (mineral oil or synthetic) other than Mobil, add any of the following (1.6 ounces [35 mL] of additive for each pint [0.5 L] of lube capacity):

- Elco No. 2 Friction Modifier (Elco Corporation)
- Lubrizol No. 6178 (Lubrizol Corporation)
- Hi–Tec E–336 (Edwin Cooper, Inc.)
- Equa–Torque No. 2411 (Sta-Lube Corporation)
- Equa–Torque No. 2414 (Sta-Lube Corporation)

B. For Mobilube HD (mineral oil) and Mobilube SHC (synthetic) use Mobil No. 204 (Mobil Oil Corporation). Add 1.1 ounces [23 mL] of additive for each pint [0.5 L] of lube capacity.

IMPORTANT: These friction modifiers generally deteriorate faster than conventional extreme-pressure additives, so the lubricant change schedule must be shortened when using these additives. The traction equalizer additive (and recommended drive axle lubricant) must be changed at the Maintenance 2 (M2) interval, instead of the Maintenance 3 (M3) interval as recommended in the "Maintenance Operation Sets Table," (see **Group 00** in this manual), for axles that require only those lubricants recommended in **Table 1**.

Axle Lubricant and Oil Filter Replacement Procedure

1. With the vehicle parked on level ground, apply the parking brakes, and chock the tires.
2. Remove the axle carrier fill plug (see **Fig. 1**), then remove the drain plug at the bottom of the housing and completely drain the lubricant while the unit is warm. Allow sufficient time for all old lubricant to drain. On tandem drive axles, it is also necessary to remove the plug at the bottom of the interaxle differential housing to drain the lubricant.
3. If so equipped, replace the axle oil filter.

   IMPORTANT: When the drive unit is equipped with an oil filter, the filter should be replaced every time the oil is changed.

   3.1 To remove the filter from the helical gear cover, remove only the two relief valve cover stud nuts and washers, then lift off

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the filter cover. Do not remove the capscrews. See **Fig. 5**.

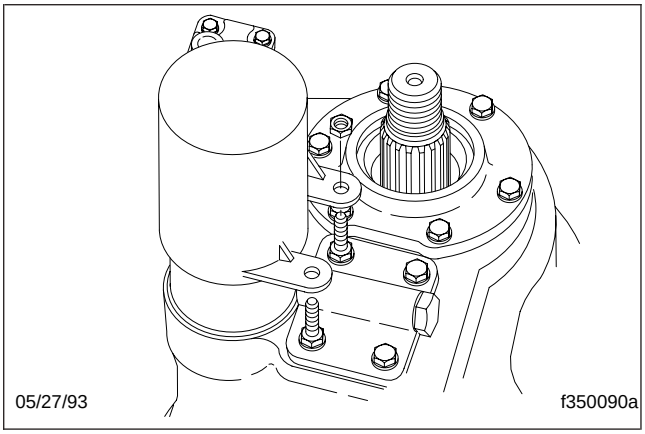

Fig. 5, Axle Oil Filter Cover Removal and Installation

3.2 Remove the oil filter, using a suitable filter strap wrench. See **Fig. 6**. Discard the filter.

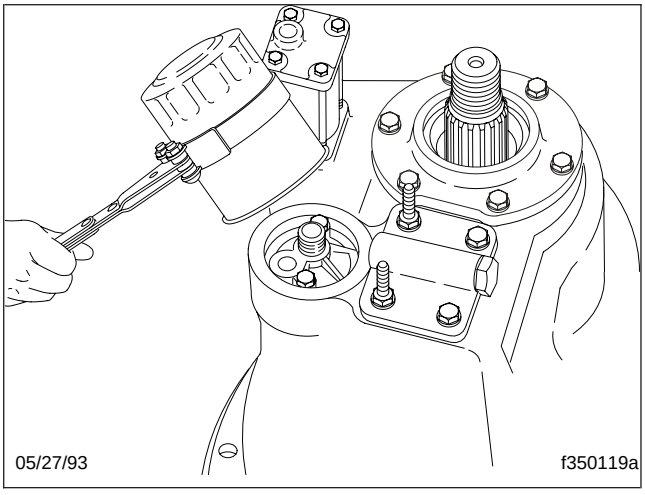

Fig. 6, Axle Oil Filter Removal

NOTE: There may be about one pint (0.5 L) of lubricant remaining in the filter. Be careful not to spill it when removing the filter.

3.3 Remove the capscrews, washers, and oil filter adapter from the gear cover; then inspect the threads of the filter mounting tube and adapter casting. See **Fig. 7**. If the threads are stripped or the casting is cracked, replace the damaged component.

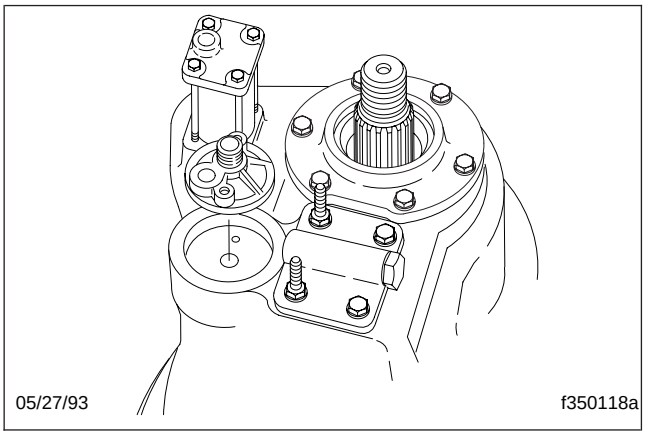

Fig. 7, Axle Oil Filter Adapter Removal and Installation

3.4 Place the oil filter adapter in its bore. Install the washers and capscrews, then tighten the capscrews 20 to 30 lbf·ft (27 to 41 N·m).

3.5 Using the specified drive axle lubricant, coat the face of the gasket on a new oil filter. Install the filter on the adapter. Tighten the filter one full turn after the gasket contacts the base; do not overtighten the filter.

3.6 Install the filter cover over the filter and shouldered studs, and secure it with two nuts and washers. Tighten the nuts 10 to 15 lbf·ft (14 to 20 N·m).

4. For a new or reconditioned axle, flush the axle with clean flushing oil, then drain it thoroughly. It is necessary to flush the axle the first time (only) that the axle lubricant is changed.

IMPORTANT: Axles should not be flushed with any solvent, such as kerosene.

5. Clean the fill and drain plugs. For magnetic 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 plugs with elements having a minimum pickup capacity of 1-1/2 pounds (0.7 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 neces-

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sary to clean or change the plugs one or more times between lubrication change intervals.

6. After cleaning the drain plug(s), install and tighten it 35 lbf·ft (47 N·m).
7. With the vehicle on a level surface, fill the axle housings to the bottom of the fill hole, using specified lubricant. See **Table 1** for recommended axle lubricants and **Table 2** for drive axle lubricant capacities.

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

8. Install and tighten the fill plug 35 lbf·ft (47 N·m).
9. Whenever the interaxle differential housing has been drained, add an additional 2 pints (1 L) of specified lubricant directly into the interaxle differential housing.
10. Remove the chocks, then drive the vehicle, unloaded, for 1 or 2 miles (2 or 3 km) at speeds not to exceed 25 mph (40 km/h), to thoroughly circulate lubricant throughout the carrier and housing assemblies.

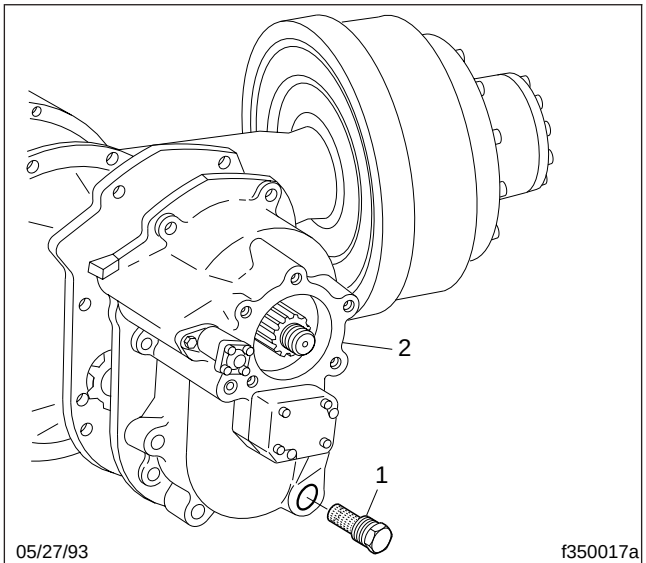
Dana Spicer

Dana Spicer does not recommend the use of friction modifiers in any of their rear axle assemblies. Friction modifiers should be used in Dana Spicer rear axles only if a slip-stick condition is found, as described in the vehicle driver's manual.

1. Park the vehicle on level ground, apply the parking brakes, and chock the tires.
2. Clean the area around, and including, the fill plug. Remove the plug from the oil fill hole (or standpipe if installed in the oil fill hole) located in the axle housing rear cover. See **Fig. 2**.
3. Place a drain pan under the rear axle drain plug. Remove the drain plug at the bottom of the axle housing and allow sufficient time for all old lubricant to run out. See **Fig. 2**.
4. On dual drive axles, also remove the plug at the bottom of the power divider to drain oil from the power divider.

NOTE: Some dual drive axles are equipped with a cylindrical magnetic strainer, below the lube pump on the front of the power divider cover, that must be removed and cleaned at each axle oil change. All rear axle assemblies are fitted with magnetic drain and fill plugs. See **Fig. 8**.

5. Remove and clean the magnetic strainer, if so equipped.



1. Magnetic Strainer
2. Power Divider

Fig. 8, Dana Spicer Dual-Drive-Axle Magnetic Strainer

5.1 Remove the magnetic strainer from the power divider cover.

⚠ WARNING

Always wear eye protection when using compressed air to clean parts, as flying debris could cause permanent damage to unprotected eyes. Do not point the air stream in the direction of other persons.

5.2 Wash the strainer in solvent, and blow it dry with compressed air to remove oil and metal particles.

5.3 Install and tighten the magnetic strainer 40 to 60 lbf·ft (54 to 81 N·m).

6. Clean the fill plugs and drain plugs. To help clean magnetic plugs, a piece of key stock or any other convenient steel slug may be used to

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short the two magnetic poles and divert the magnetic field.

IMPORTANT: 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.

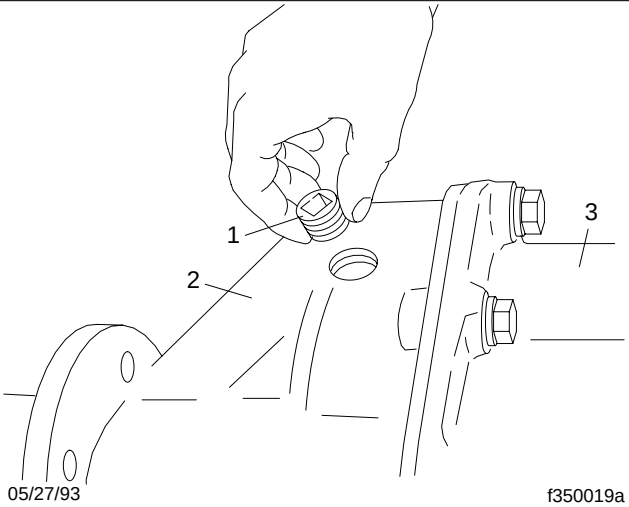
7. After cleaning, install and tighten the drain plug(s) 40 to 60 lbf·ft (54 to 81 N·m).
8. Fill the axle with recommended lubricant. See **Table 3** for recommended drive axle lubricants, and **Table 4** for drive axle lubricant capacities.

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

   8.1 Using recommended lubricant, fill the axle through the oil fill hole or standpipe opening. Lubricant should be level with the bottom of the oil fill hole (see **Fig. 8**) or top of the standpipe opening.

   8.2 Install and tighten the fill plug 40 to 60 lbf·ft (54 to 81 N·m).

   8.3 For forward drive axles, remove the power divider fill plug, located slightly offset to the right in the top portion of the forward differential carrier. See **Fig. 9**. Add two pints (1 L) of lubricant through this fill hole. Do not use the hole at the *top* of the differential carrier as a fill hole. Install and tighten the fill plug 40 to 60 lbf·ft (54 to 81 N·m).
9. For a two-speed axle with a shift unit, change the shift unit lubricant; see elsewhere in this maintenance operation for the shift unit lubricant changing procedure.



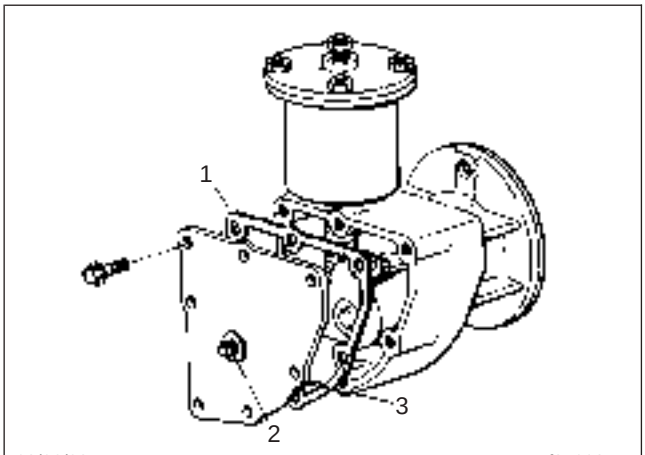
1. Fill Plug
2. Power Divider
3. Forward Differential Carrier

Fig. 9, Power Divider Fill Plug

Two-Speed-Axle Shift Unit Lubricant Changing

Dana Spicer and Meritor Axles

1. Remove the shift unit housing cover. See **Fig. 10**. Drain and discard the old lubricant. Discard the housing cover gasket.



1. Housing Cover Gasket
2. Oil Fill Plug
3. Shift Unit Housing Cover

Fig. 10, Two-Speed-Axle Shift Unit

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2. Thoroughly wash the axle shift parts and housing cover, and allow them to air dry.
3. Install the housing cover and a new cover gasket. Tighten the housing cover capscrews 7.5 to 9.2 lbf·ft (10.2 to 12.5 N·m), then remove the oil fill plug from the cover.

IMPORTANT: When the ambient temperature is above 0°F (–18°C), use SAE 10 heavy-duty engine oil, API service classification SD (sulfated ash content must not exceed 1.85 percent). When the ambient temperature is below 0°F (–18°C), use one part kerosene to three parts SAE 10 heavy-duty engine oil, API service classification SD (sulfated ash content must not exceed 1.85 percent). 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 it with kerosene. To prevent component damage, do not mix engine oil and automatic transmission fluid.

4. Fill the shift unit housing through the oil fill hole until specified lubricant is level with the bottom of the opening.
5. Apply a small amount of Loctite® 242, or equivalent sealant, to the threads of the fill plug. Install the plug finger-tight on the rear axle housing. Use a wrench and tighten it an additional 1-1/2 turns.

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Title of Maintenance Operation (MOP)	MOP Number
Wheel Nut and Rim Nut Checking	40–01

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40–01 Wheel Nut and Rim Nut Checking

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

See **Table 1** for wheel nut torque specifications, and see **Fig. 1** for the wheel nut tightening sequence.

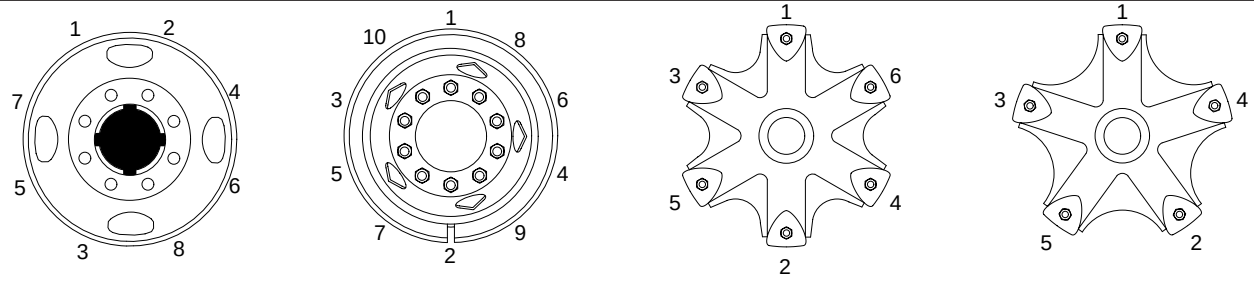
⚠ CAUTION

Insufficient wheel nut (rim nut) torque can cause wheel shimmy, resulting in wheel damage, stud breakage, and extreme tire tread wear. Excessive wheel nut torque can break studs, damage threads, and crack discs in the stud hole area. Use the recommended torque values, and follow the sequence shown in Fig. 1.

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 wheel nuts, using the sequence shown in **Fig. 1**.

Wheel Fastener Torque			
Description	**Nut Size**	**Wheel Manufacturer**	**Torque (dry threads): lbf·ft (N·m)**
10-Stud Disc Wheel with Two-Piece Flanged Nuts			
Front and Rear Wheel Nut	M22 x 1.5	All	450–500 (610–677)
Spoke Wheel Rim Nuts			
Cadium or Zinc Rim Stud (Silver Finish)	3/4–16	All	240–260 (324–352)
Phosphate and Oil (Black Finish)	3/4–16	All	170–220 (230–298)

Table 1, Wheel Fastener Torque



A. 8-Stud Disc Wheel
B. 10-Stud Disc Wheel
C. 6-Spoke Wheel
D. 5-Spoke Wheel

Fig. 1, Wheel Nut and Rim Nut Tightening Sequence

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

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41–01 Driveline Inspecting

Before lubricating driveline U-joints and slip joints, proceed as follows:

⚠ CAUTION

Do not over-tighten bearing-cap capscrews or yoke-strap capscrews. Due to the extreme load occurring at high-speed rotation, a loose or broken capscrew at any point in the driveline will weaken the driveline connection, which could eventually result in serious vehicle damage.

1. For each full-round driveline yoke with thread-locking capscrews, tighten the bearing-cap capscrews.

   For each half-round driveline yoke, tighten the yoke-strap capscrews. See **Fig. 1**, Ref. 6.

   Tighten all U-joint bearing cap fasteners to the torque values given in **Table 1**.

Fastener Torque Values		
Description	Size	Torque: lbf·ft (N·m)
Yoke-Strap Capscrew	1/2–20	130 (176)
Bearing-Cap Capscrew	5/16–24	24 (33)
	3/8–24	37 (50)
	7/16–20	60 (81)

Table 1, Fastener Torque Values

2. Check each input and output end yoke (see **Fig. 1**) 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, then tighten the end yoke nut. For torque values, see **Group 41** of the *L-Line and A-Line Workshop Manual*. If the end yoke is still loose after tightening the yoke nut, replace the yoke and yoke nut.

   Replace the prevailing torque locknut (end yoke nut) if it was removed for end yoke replacement, seal replacement, or any other reason.

3. Check 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 cross in the bearings can be felt or seen, replace the complete U-joint.

4. Check the midship bearing and mounting 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 it rattles, replace it. If the bearing mount is loose on the frame, tighten the mounting bolt nuts to the applicable torque value in the torque tables in **Group 00** of this manual. Replace the midship bearing assembly if the rubber cushion is deteriorated or oil-soaked.

5. Check slip joints for spline wear by attempting to bend the sleeve yoke and splined shaft back and forth. See **Fig. 2**. If radial looseness is greater than 0.007 inch (0.18 mm), replace both the sleeve yoke and the splined shaft.

6. Visually examine the driveshaft tubes for dents, bends, twists, or other damage. If any tube appears to be damaged, remove the driveshaft and check the run-out 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.

7. Examine the driveshaft for evidence of missing balance weights, and for build-up of foreign material. Remove any foreign material. If there is any evidence that balance weights are missing, remove the driveshaft and have it balanced.

8. For driveshafts with slip joints, check to be sure the yoke plug is not loose or missing. See **Fig. 4**, Ref. 2. Repair or replace the yoke plug as needed. If the yoke plug is missing, the splined shaft may be hitting the plug and knocking it out; contact your Regional Service Office for assistance in determining the correct driveshaft length.

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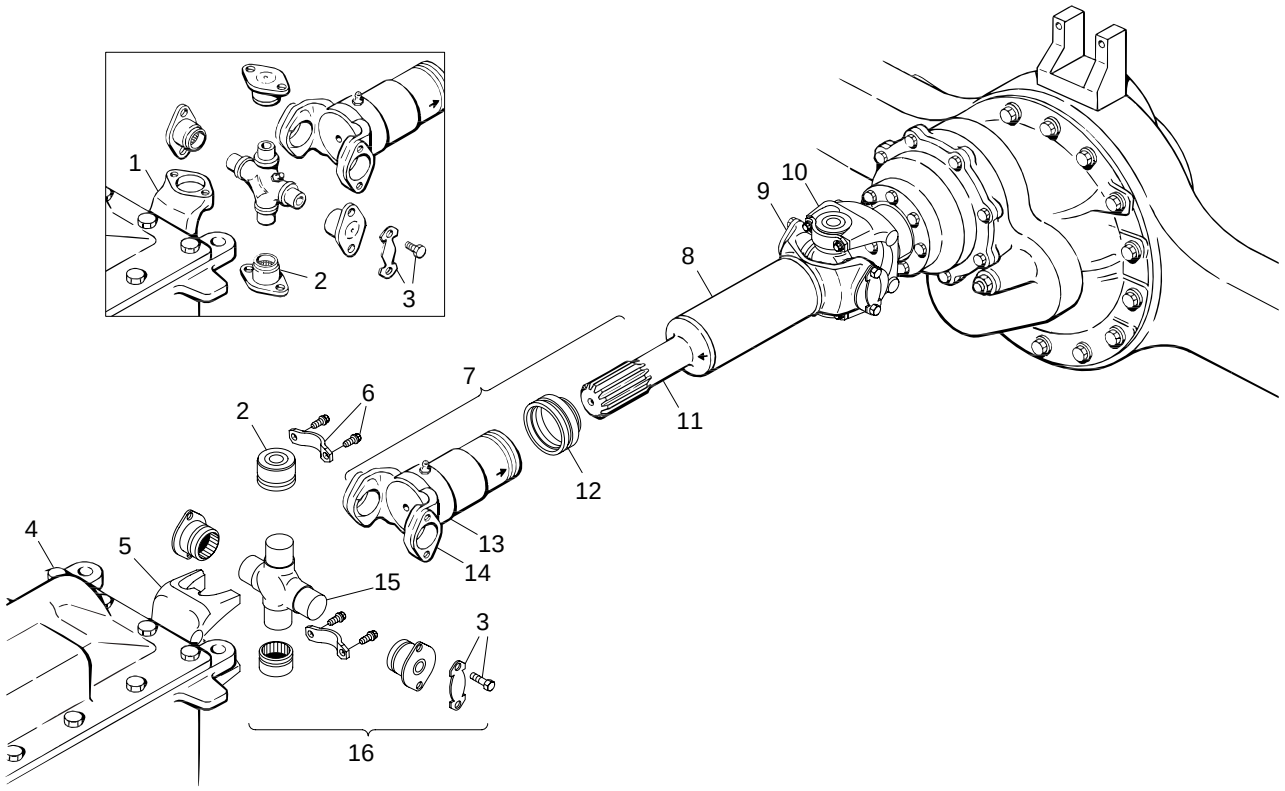

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NOTE: Not all fasteners are shown.

1. Full-Round End Yoke
2. Bearing Cap
3. Lockplate and Capscrew
4. Main Transmission
5. Half-Round End Yoke
6. Yoke Strap and Capscrew
7. Slip Joint Assembly
8. Driveshaft Tube
9. Driveshaft Yoke (Full-Round)
10. Input Shaft End Yoke (Half-Round)
11. Splined Shaft
12. Slip Joint Seal Assembly
13. Sleeve Yoke (Full-Round)
14. Yoke Lug
15. U-Joint Cross
16. U-Joint Assembly

Fig. 1, Driveline Assembly

41–02 Driveline Lubricating

U-Joint Lubrication

1. Wipe all old grease and dirt from each U-joint grease fitting. See **Fig. 4**, Ref. 8.
2. Use a hand-type grease gun, or a high-pressure gun with a low-pressure adapter, to lubricate U-joints. If a low-pressure adapter is not used with the high-pressure gun, the U-joints may not receive enough grease.

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

IMPORTANT: Fresh grease must be seen escaping from all four bearing-cap seals of each U-joint. On full-round yokes, if most of the grease being added to a U-joint can be seen

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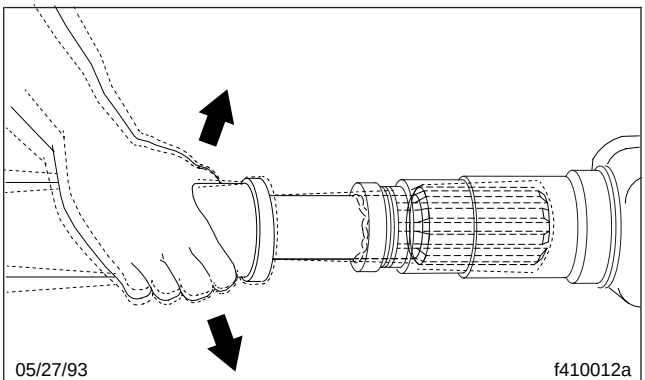

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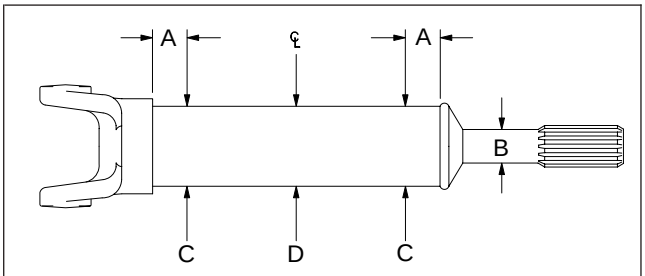
Attempt to bend the sleeve yoke and splined shaft back and forth.

Fig. 2, Slip Joint Spline Wear Checking



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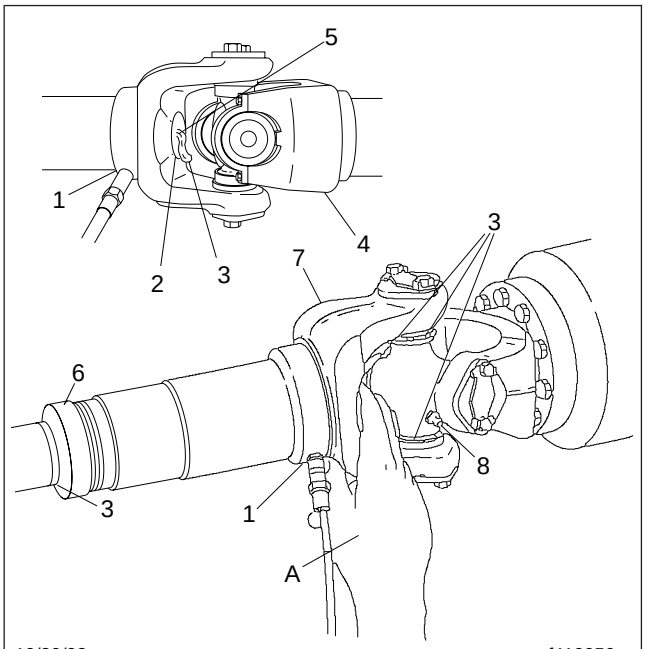
A. Measurement: 3 inch (76 mm)
B. Measurement: 0.015 inch (0.38 mm)
C. Measurement: 0.020 inch (0.51 mm)
D. Measurement: 0.025 inch (0.635 mm)

Fig. 3, Driveshaft Runout Specifications

escaping from just one of the U-joint seals, bend the tabs of the lockstrap (if equipped) away from the heads of the bearing-cap capscrews. Check the torque on the capscrews at that seal. Tighten the bearing-cap capscrews to the torque values given in **Table 1**. If equipped, bend the lockstrap tabs up, against a flat side of each capscrew head. If the capscrews were already tight, or all of the U-joint seals still do not purge, remove the bearing cap at that seal, and examine the seal for damage. If the seal is damaged, replace the complete U-joint.

If grease does not appear at one seal, 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



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A. After grease appears, cover the pressure-relief hole while continuing to lubricate.
1. Slip Joint Grease Fitting (with grease gun attached)
2. Yoke Plug
3. Grease
4. Half-Round Yoke
5. Yoke Plug Pressure-Relief Hole
6. Slip Joint Seal
7. Full-Round Yoke
8. U-Joint Grease Fitting

Fig. 4, Slip Joint and U-Joint Lubricating

side opposite the dry seal, while continuing to lubricate. If grease still does not appear, bend the tabs of the lockstrap away from the heads of the bearing-cap capscrews, then loosen the capscrews at the bearing with the dry seal, to relieve seal tension. Lubricate the U-joint until new grease is seen at the seal, then tighten the capscrews to the above specifications, and bend the tabs of the lockstrap against a flat side of each capscrew head. If the bearing will not take grease, replace the U-joint.

For U-joint replacement, follow the procedure in **Group 41** of the *L-Line and A-Line Workshop Manual*.

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3. Check the purged grease. If it appears rusty, gritty, or burned, replace the U-joint.
4. Wipe the purged grease from the seals, and any excess grease from the grease fitting.

Slip Joint Spline Lubrication

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. Add multipurpose chassis grease (lithium 12-hydroxy stearate, NLGI grade 1 or grade 2, with EP additives) until it appears at the pressure-relief hole in the yoke plug. Then cover the relief hole with your finger, while continuing to apply gun pressure until new grease appears at the slip joint seal. See **Fig. 4**. This ensures complete lubrication of the splines.
3. Wipe the purged grease from the pressure-relief hole and slip joint seal, and any excess grease from the grease fitting.

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Title of Maintenance Operation (MOP)	MOP Number
Automatic Slack Adjuster Lubricating and Checking	42–02
Bendix Air Brake Valve Disassembly, Cleaning, Inspecting, and Lubricating (DV–2 and Single Check Valve)	42–07
Bendix Air Brake Valve Disassembly, Cleaning, and Inspecting (Double Check Valve, E–12, MV–3, PP–7, QR–1, SR–1, ST–3, TC–7, TP–5, and TR–3)	42–06
Bendix Air Brake Valve Inspecting and Testing (MV–3 and TC–6)	42–08
Bendix Air Brake Valve Operation Checking (BP–R1 and E–12)	42–05
Bendix Air Dryer Checking (AD–IP or AD–9)	42–03
Bendix Air Dryer Desiccant Replacing (AD–9)	42–04
Bendix Foot Brake Valve Actuator Lubricating and Leak Testing (E–12)	42–09
Brake Inspection	42–10
Camshaft Bracket Bushing Lubricating	42–01

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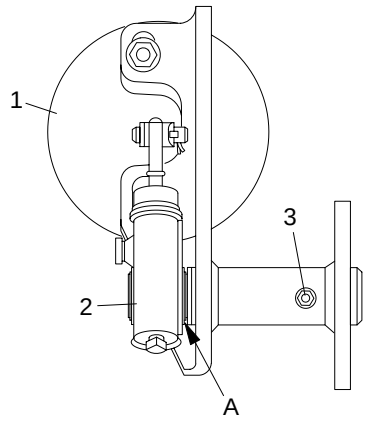
42–01 Camshaft Bracket Bushing Lubricating

IMPORTANT: Perform **MOP 42–10** before lubricating the camshaft bracket.

Pump grease into the camshaft bracket until it appears at the slack adjuster end of the bracket. See **Fig. 1**. Multipurpose chassis grease is recommended: NLGI Grade 1 (6% 12-hydroxy lithium stearate grease) or NLGI Grade 2 (8% 12-hydroxy lithium stearate grease). Be careful that no grease enters the drum cavity. If grease leaks out under the cam head, the camshaft grease seal is worn or damaged, or is installed backwards.

NOTE: Use of meter-type fittings, which have a maximum 40 psi (275 kPa) pressure relief at shutoff, is recommended.

Camshaft brackets without grease fittings are fitted with special seals and packed with extended-lubrication-interval chassis grease. Grease them only when the camshaft is disassembled for servicing.



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A. Grease Exit
1. Brake Chamber
2. Slack Adjuster
3. Non-Pressure-Relief Grease Fitting

Fig. 1, Camshaft Bracket Bushing Lubrication

42–02 Automatic Slack Adjuster Lubricating and Checking

⚠ WARNING

Manually adjusting an automatic slack adjuster to bring the pushrod stroke within legal limits is likely masking a mechanical problem. Adjustment is not repairing. Before adjusting an automatic slack adjuster, troubleshoot the foundation brake system and inspect it for worn or damaged components. Improperly maintaining the vehicle braking system may lead to brake failure, resulting in property damage, personal injury, or death.

IMPORTANT: Perform **MOP 42–10** before lubricating the slack adjusters.

Gunite Automatic Slack Adjusters

1. Lubricate the slack adjuster until grease flows from the grease relief opening. See **Fig. 2**. 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.

   The newest Gunite slack adjusters are produced without a grease relief. During lubrication with a grease gun, lubricant is forced through the drilled worm wheel onto the camshaft. Lubricate the slack adjuster at the grease fitting until grease appears on the camshaft.

2. Inspect the slack adjuster for structural damage. Replace the slack adjuster if needed.

3. Inspect the slack adjuster boot for cuts or tears.

   If the boot is damaged, replace it as follows. See **Fig. 2**.

   3.1 Remove the two clevis pins.

   3.2 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.

   3.3 Install a new boot on the link, heavy section down. Be careful not to damage the boot.

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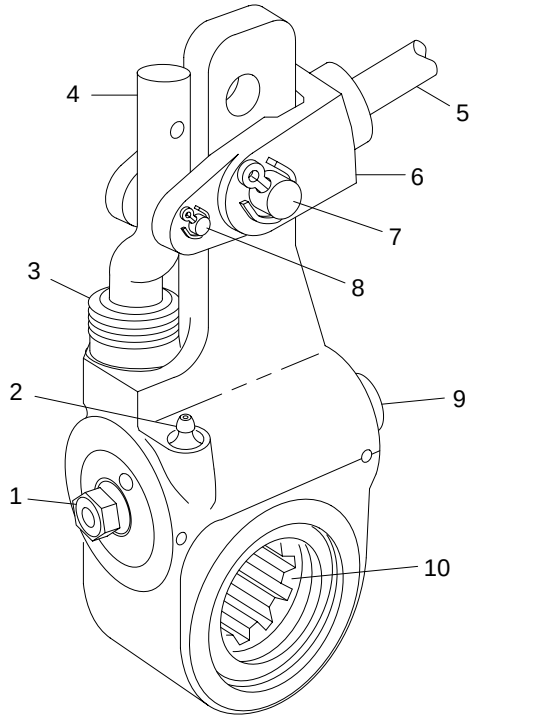

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1. 7/16-Inch Adjusting Nut
2. Grease Fitting
3. Boot
4. Link
5. Brake Chamber Piston Rod
6. Clevis
7. 1/2-Inch Clevis Pin
8. 1/4-Inch Clevis Pin
9. Grease Relief Opening
10. Slack Adjuster Spline

Fig. 2, Gunite Automatic Slack Adjuster

3.4 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.

3.5 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.

3.6 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 pin 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.

42–03 Bendix Air Dryer Checking (AD–IP or AD–9)

During cold weather, 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 a test lead on each pin 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 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 resistance between the electrical pins in the female connector. Resistance should be 1.5 to 3.0 ohms for the 12-volt heater, and 6.8 to 9.0 ohms for the 24-volt heater. Some early models of the AD–9 will have resistance readings of 1.0 to 2.5 ohms for the 12-volt heater, and 4.8 to 7.2 ohms for the 24-volt heater. If resistance is higher than this, replace the purge-valve housing assembly, which includes the heater-and-thermostat assembly.
3. Warm the end cover assembly to over 90°F (32°C) and check resistance again. It should exceed 1000 ohms. If it does, the thermostat-and-heater assembly is operating properly. If it doesn't, replace the purge-valve housing assembly, which includes the heater-and-thermostat assembly.

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42–04 Bendix Air Dryer Desiccant Replacing (AD–9)

Disassemble, clean, and inspect the Bendix air dryer. Replace the desiccant cartridge. See **Group 42** of the *L-Line and A-Line Workshop Manual* for instructions.

NOTE: Desiccant change intervals 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 assure that replacement occurs only when necessary, it is important to perform the other maintenance operations in this group.

42–05 Bendix Air Brake Valve Operation Checking (BP–R1 and E–12)

Check for proper operation; see **Group 42** of the *L-Line and A-Line Workshop Manual* for instructions.

42–06 Bendix Air Brake Valve Disassembly, Cleaning, and Inspecting (Double Check Valve, E–12, MV–3, PP–7, QR–1, SR–1, ST–3, TC–7, TP–5, and TR–3)

NOTE: See **Group 42** of the *L-Line and A-Line Workshop Manual* for valve removal, disassembly, inspection, assembly, and leakage-checking instructions.

Remove and disassemble the valves.

Clean the valve 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 for leakage.

42–07 Bendix Air Brake Valve Disassembly, Cleaning, Inspecting, and Lubricating (DV–2 and Single Check Valve)

NOTE: See **Group 42** of the *L-Line and A-Line Workshop Manual* for valve removal, disassembly, inspection, assembly, and leakage-checking instructions.

Remove and disassemble the valves.

Clean the valve 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.

For a DV–2 valve, lubricate the air reservoir automatic drain valve. If there is a filter screen in the adaptor fitting, replace it with a new one.

Assemble and install the valves, then check for proper operation and for leakage.

42–08 Bendix Air Brake Valve Inspecting and Testing (MV–3 and TC–6)

1. Clean the exterior of the valves, and check them for corrosion and damage.
2. Inspect the air lines connected to the valves for signs of wear or damage. Replace the lines as needed.
3. Test the air line fittings for excessive leakage. Tighten or replace the fittings as needed.
4. Check the valves for leakage. See **Group 42** of the *L-Line and A-Line Workshop Manual* for instructions.

   For TC–6 valves, check for proper operation. See **Group 42** of the *L-Line and A-Line Workshop Manual* for instructions.

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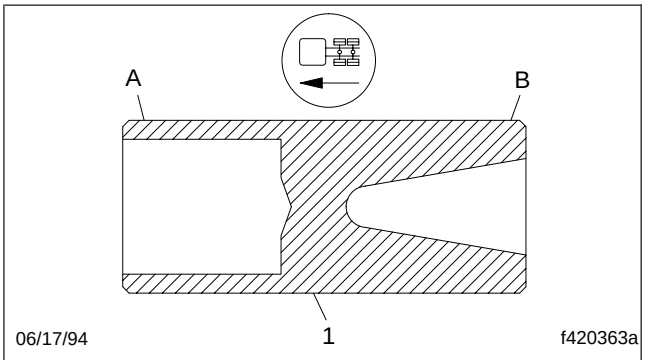
42–09 Bendix Foot Brake Valve Actuator Lubricating and Leak Testing (E–12)

NOTE: You may need to remove tie straps and an air line to gain access to the valve bore. It should not be necessary to remove the adaptor from the valve.

1. Remove the three mounting bolts that hold the foot brake valve on the firewall.
2. From outside the cab, pull the valve away from the firewall; then remove the brake valve mounting adaptor and plunger. See **Group 42** of the *L-Line and A-Line Workshop Manual* for instructions.
3. Thoroughly clean any grease and contaminants from the brake valve mounting adaptor bore and the plunger surface. See **Fig. 3**.



A. This end toward the foot brake valve.
B. This end toward the brake pedal piston rod.
1. Plunger

Fig. 3, Brake Plunger

4. Inspect the adaptor bore and the plunger sliding surface for corrosion. The bore and plunger surfaces should be smooth, with no pitting or roughness. Some discoloration is permissible. If there is pitting roughness, replace with new parts. See **Table 1**.

E-12 Brake Valve Service Parts List		
Description	**Part Number**	**Qty**
Valve Adaptor	BW 5002378	1
Plunger	BW 5002379	1

E-12 Brake Valve Service Parts List		
Description	**Part Number**	**Qty**
Gasket	12–15695–000	1

Table 1, E-12 Foot Brake Valve Service Parts List

5. Apply one of the specified silicone greases to the sliding surfaces of the plunger and the adaptor bore; see **Table 2**. If installing a new adaptor or plunger, first apply the grease included with the kit.

Silicone Greases		
Description	**Manufacturer**	**Source**
BW 291126 (silicone base grease spec. BW–650–M) 3.7 cc packet*	Allied Signal	PDC
55 O-RIng Lubricant (formerly Molykote DC–55M Pneumatic Grease)	Dow-Corning Corporation	Locally
V–755 O-Ring Lubricant	Rhone-Poulenc Silicone VSI Inc.	Locally

* Each 3.7 cc packet is adequate to lubricate one foot valve adaptor assembly.

Table 2, Silicone Greases

6. Install the brake valve mounting adaptor and plunger, using a new gasket.

42–10 Brake Inspection

IMPORTANT: This procedure should be performed prior to lubrication of the brake components.

Parking Brake Operational Check

⚠ CAUTION

Perform the following check in a clear safe area. If the parking brakes fail to hold the vehicle, personal injury or property damage may result.

1. With the engine running, and air pressure at cut-out pressure, set the parking brake.
2. Put the vehicle in the lowest gear and gently attempt to move it forward. The vehicle should not move. If the vehicle moves, the parking brakes

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are not operating correctly and must be repaired before the vehicle is returned to service. See **Group 42** of the *L-Line and A-Line Workshop Manual* for repair procedures.

Brake Component Inspection

1. Park the vehicle on a level surface, set the parking brake, and chock the tires. Once the tires are chocked, release the parking brake.

⚠ WARNING

Manually adjusting an automatic slack adjuster to bring the pushrod stroke within legal limits is likely masking a mechanical problem. Adjustment is not repairing. Before adjusting an automatic slack adjuster, troubleshoot the foundation brake system and inspect it for worn or damaged components. Improperly maintaining the vehicle braking system may lead to brake failure, resulting in property damage, personal injury, or death.

2. With the engine off, and 100 psi (689 kPa) of air tank pressure, have an assistant apply and hold an 80 to 90 psi (550 to 620 kPa) brake application.
3. Check to see if the colored over-stroke band on each brake chamber pushrod is exposed.

   If a band shows, the stroke is too long. Check the foundation brake components for wear or damage, and repair as needed. See **Group 42** of the *L-Line and A-Line Workshop Manual* for inspection, troubleshooting, and repair procedures.
4. Measure the applied chamber stroke. See **Table 3** for the proper stroke for the type of chamber being used. If the stroke is too short, the brakes may drag or will not fully apply. Check for improper operation or adjustment of the automatic slack adjuster. See **Group 42** of the *L-Line and A-Line Workshop Manual* for inspection and troubleshooting procedures.
5. Start the engine and build air pressure to at least 100 psi (689 kPa). Shut down the engine.
6. Check all of the foundation brake components for damage, wear, and loose or missing parts. Repair as needed. See **Group 42** of the *L-Line and A-Line Workshop Manual* for repair procedures.

Brake Chamber Stroke Specifications

Chamber			Max Applied Stroke: inch (mm)
Manufacturer	**Type***	**Size†**	
Gunite	Standard Stroke	9	1-3/8 (35)
		12	
		16	1-3/4 (44)
		20	
		24	
		30	2 (51)
		36‡	2-1/4 (57)
	Long Stroke	16	2 (51)
		20	
		24 (2-1/2 inch rated stroke)	
		24 (3 inch rated stroke)	2-1/2 (64)
		30	

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Brake Chamber Stroke Specifications			
Chamber			Max Applied Stroke: inch (mm)
Manufacturer	Type*	Size†	
Haldex	Standard Stroke	12	1-3/8 (35)
		16	1-3/4 (44)
		20	
		24	
	2-1/2-Inch Extended Stroke	24	2 (51)
	3-Inch Extended Stroke	24	2-1/2 (64)
	Standard Stroke	30	2 (51)
	Long Stroke	30	2-1/2 (64)
Meritor	Standard Stroke	9	Less than 1-1/2 (38)
		12	
		16	Less than 1-3/4 (44)
		20	
		24	Less than 1-7/8 (48)
	Long Stroke	24	Less than 2 (51)
	Standard Stroke	30	
Dana Spicer	Long Stroke	16L	2 (51)
		20L	
		24L	
		24LS	2-1/2 (64)
		30LS	

* Long stroke design is indicated by a tag, or embossing, on the brake chamber.

† Specifications are relative to a brake application with 80 to 90 psi (550 to 620 kPa) air pressure in the brake chambers.

‡ If type 36 chamber is used, slack length should be less than 6 inches.

Table 3, Brake Chamber Stroke Specifications

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Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Drag Link and Power Steering Cylinder Lubricating	46–02
Power Steering Reservoir Fluid Level Checking	46–03
Power Steering Reservoir Fluid and Filter Changing	46–04
Steering Driveline Lubricating	46–01
TRW Power Steering Gear Lubricating, TAS Series	46–05

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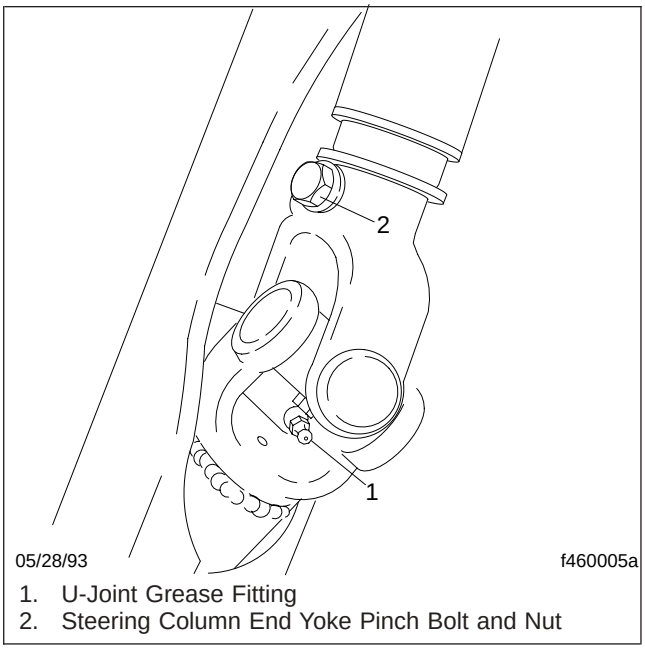
46–01 Steering Driveline Lubricating

Wipe the steering driveline grease fittings clean. See **Fig. 1**, **Fig. 2**, and **Fig. 3**. Using a pressure gun, apply multipurpose chassis grease sparingly to the universal joints and slip-joint splines.



1. U-Joint Grease Fitting
2. Steering Column End Yoke Pinch Bolt and Nut

Fig. 1, Steering Driveline Upper Universal Joint

46–02 Drag Link and Power Steering Cylinder Lubricating

1. Using a clean rag, wipe all dirt from both drag link grease fittings and, if so equipped, both power steering cylinder grease fittings. See **Fig. 4**, **Fig. 5**, and **Fig. 6**.
2. Using a pressure gun, apply clean grease at the grease fittings until old grease is forced out of the socket. Use multipurpose chassis grease NLGI grade 2 (8% 12-hydroxy lithium stearate grease) or NLGI grade 1 (6% 12-hydroxy lithium stearate grease). Grade 2 is preferred.

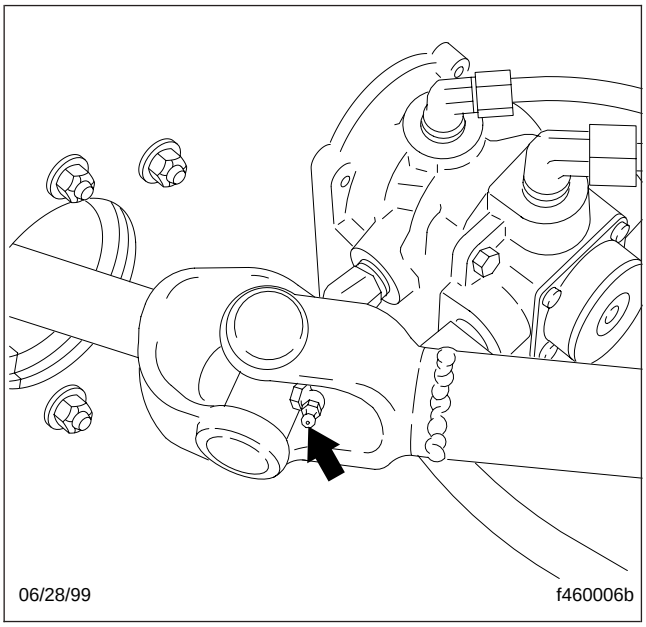


Fig. 2, Intermediate Shaft U-Joint Grease Fitting

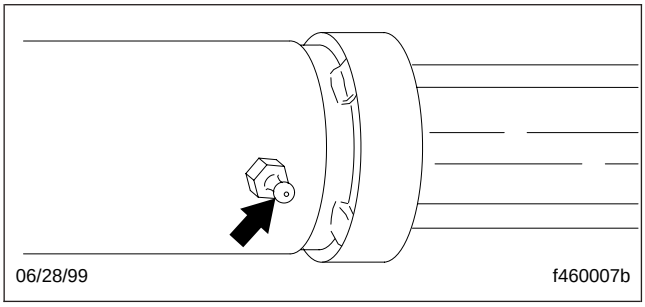


Fig. 3, Slip-Joint Grease Fitting

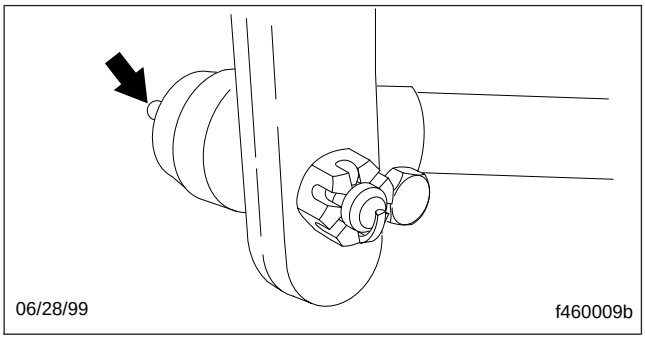


Fig. 4, Drag Link Grease Fitting (pitman arm end)

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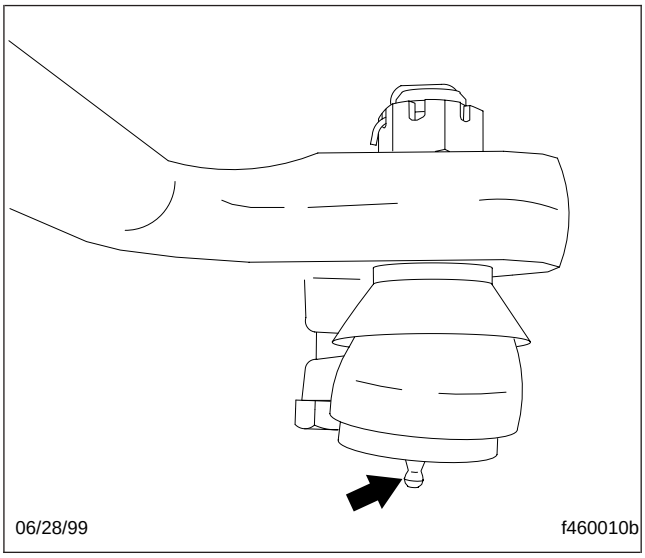

Fig. 5, Drag Link Grease Fitting (axle steering arm end)

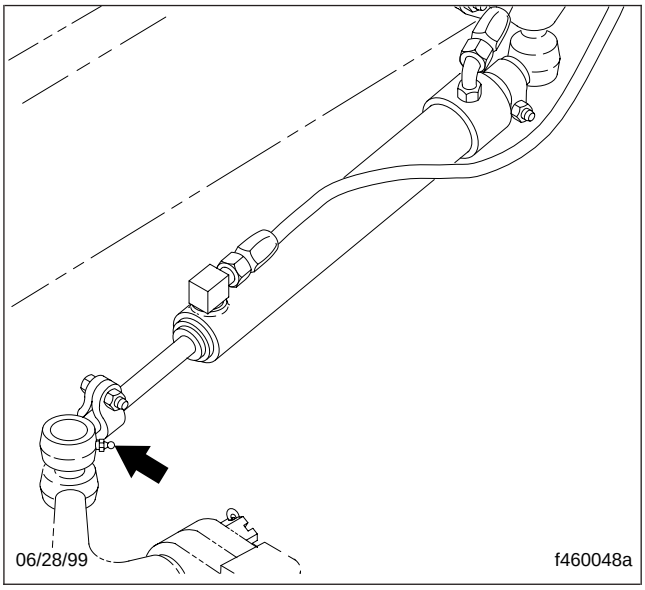

Fig. 6, Power Steering Cylinder Grease Fitting (axle steering arm end)

46–03 Power Steering Reservoir Fluid Level Checking

Metal Ventra Reservoir

1. Turn off the engine, apply the parking brakes, and chock the tires.
2. Open the hood.
3. Clean around the power steering reservoir fill cap with a clean rag, then remove the dipstick.

⚠ 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, possibly resulting in personal injury and property damage.

4. 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. Use Dexron® III automatic transmission fluid (ATF) in the power steering reservoir.
5. Install the fill cap on the power steering reservoir.
6. Close the hood, and remove the chocks from the tires.

Nelson Reservoir

NOTE: If the power steering reservoir in the vehicle looks like the reservoir shown in **Fig. 7**, use the following procedure.

1. Turn off the engine, apply the parking brakes, and chock the tires.
2. Open the hood.
3. With the engine cool, the level should be between MIN COLD and MAX HOT lines with the engine off. Add or remove fluid as necessary to bring the fluid level to the line between the MIN COLD and MAX HOT lines. Use only Dexron® III automatic transmission fluid.
4. With the engine hot, the fluid level should be at the MAX HOT line with the engine off. Add or

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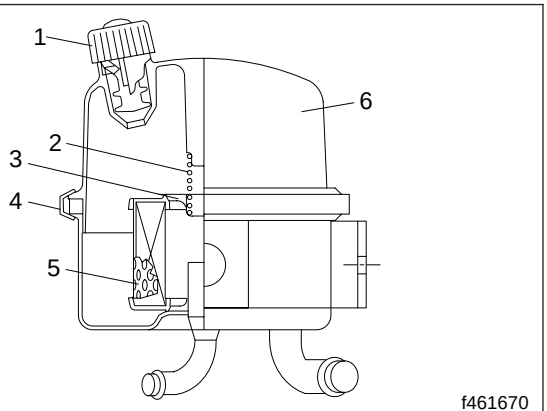

1. Fill Cap
2. Filter Spring
3. Filter Top Plate
4. Clamp
5. Filter
6. Reservoir Cover

Fig. 7, Nelson Power Steering Reservoir and Filter

remove fluid as necessary to bring the fluid level to the MAX HOT line. Use only Dexron® III automatic transmission fluid.

5. Close the hood, and remove the chocks from the tires.

46–04 Power Steering Reservoir Fluid and Filter Changing

Metal Ventra Reservoir

⚠ WARNING

Fill only with approved clean fluid. Failure to use the proper fluid could cause seal deterioration and leaks. Fluid leaks could eventually cause loss of power steering assist. This could lead to an accident resulting in personal injury or property damage. Wear eye protection when changing the fluid and filter.

1. Turn off the engine, apply the parking brakes, and chock the tires.
2. Open the hood.
3. Remove the band clamp and cover from the power steering reservoir.
4. Disconnect the hose, between the reservoir and the steering gear, from the reservoir. Then drain the reservoir in a drain pan, and cap the reservoir port.
5. Remove the filter element.
6. Thoroughly clean the reservoir with a lint-free cloth.
7. Install a new filter element, and position the spring on top of the filter element.
8. Fill the reservoir with Dexron® III automatic transmission fluid.

⚠ 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, possibly resulting in personal injury and property damage.

9. Place the end of the hose in the drain pan. **Do not start the engine while draining the system.** 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 pan. Add fluid to the reservoir, as needed. Continue turning the steering wheel until clean power steering fluid flows from the hose.
10. Remove the plug from the reservoir and connect the hose to the reservoir. 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.
11. Fill the reservoir with ATF 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.
12. Install a new cover gasket, the cover, and the band clamp. Install the fill cap.
13. Start the engine and check the power steering reservoir fluid level. If the fluid level is low, add ATF to bring the level up to the FULL mark on the dipstick.
14. Close the hood, and remove the chocks from the tires.

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Nelson Reservoir

⚠ WARNING

Fill only with approved clean fluid. Failure to use the proper fluid could cause seal deterioration and leaks. Fluid leaks could eventually cause loss of power steering assist. This could lead to an accident resulting in personal injury or property damage. Wear eye protection when changing the fluid and filter.

NOTE: If the power steering reservoir in the vehicle looks like the reservoir shown in **Fig. 7**, use the following procedure.

1. Turn off the engine, apply the parking brakes, and chock the tires.
2. Open the hood.
3. Place a drain pan under the reservoir, and remove the steering gear-to-reservoir return hose at the reservoir. Drain the steering fluid into the drain pan and dispose of the fluid properly. Plug the return line fitting on the reservoir.
4. Loosen the clamp and remove the cover along with the filter spring and the filter top plate. See **Fig. 7**.

NOTE: Always replace the reservoir filter when changing the fluid.

5. Remove the filter. It may be necessary to wiggle the filter to remove it from its base. Do not use pliers to aid in removal of the filter; pliers could cause metal chips to enter the steering system. Clean the inside of the reservoir using a lint-free cloth.

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

6. Place the disconnected end of the steering gear-to-reservoir hose in a drain pan. 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. Capture the fluid flowing from the hose in a drain pan. Add fluid to the reservoir as needed. When clean fluid flows from the hose into the drain pan, remove the plug from the reservoir and reconnect the steering gear-to-reservoir hose to the reservoir. Remove the jack stands and lower the vehicle.
7. With the larger opening at the top, install a new filter in the reservoir.
8. Clean the reservoir cover and gasket. Inspect the O-ring and the cover for cracks, deformities, or damage. Replace the gasket seal or cover as needed.
9. Install the reservoir cover along with the spring and the top plate. Make sure the center of the top plate fits into the opening at the top of the filter.
10. Place the clamp over the flanges of the cover and shell assembly, then tighten the clamp 25 to 30 lbf·ft (35 to 40 N·m).
11. Fill the reservoir with Dexron® III automatic transmission fluid to the FULL COLD mark.
12. Start the engine and operate it at idle. Turn the steering wheel to full lock left and right to adjust the fluid level and remove any existing air from the power steering pump and gear. Check the fluid level again. Add fluid as needed. The system is properly bled when the steering pump does not labor when turning the wheel.
13. Check for leaks in the power steering system and repair as needed. Fill the reservoir as needed.
14. Turn off the engine, close the hood, and remove the chocks from the tires.

46–05 TRW Power Steering Gear Lubricating, TAS Series

1. Wipe off debris from the grease fitting.
2. Using a hand-type grease gun, apply multipurpose chassis grease until grease starts coming out of the sector shaft dirt-and-water seal.

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Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Fuel Separator Sight Bowl Cleaning and Element Replacing	47–03
Fuel Tank Band Nut Tightening	47–02
Fuel Tank Vent Checking	47–01

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47–01 Fuel Tank Vent Checking

On 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 Fuel Tank Band Nut Tightening

Hold each fuel tank band retention nut with a wrench while backing off its jam nut. Then tighten the retention nuts 30 to 45 lbf·ft (41 to 60 N·m). After the retention nuts have been tightened, hold each with a wrench while tightening its jam nut 50 to 65 lbf·ft (68 to 88 N·m). Do not overtighten.

47–03 Fuel Separator Sight Bowl Cleaning and Element Replacing

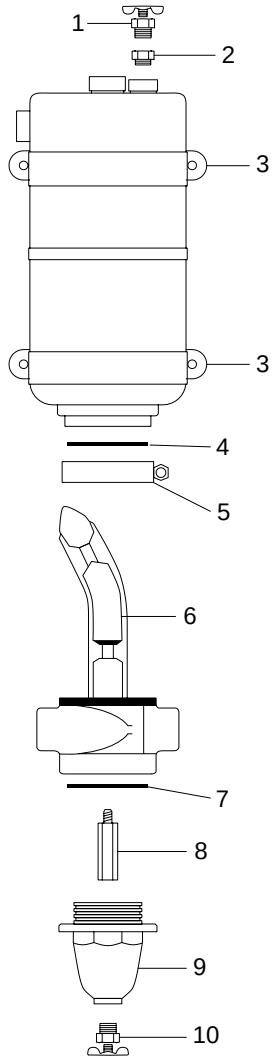
ConMet Fuel Separator Sight Bowl Cleaning

The only maintenance necessary on ConMet fuel separators is to clean the sight bowl, if equipped. See **Fig. 1**.

⚠ WARNING

Diesel fuel is flammable and can ignite if exposed to an 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 or intense heat 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.

1. Drain the fuel separator.
2. Unscrew the sight bowl from the fuel separator.
3. Wipe the sight bowl clean, using a soft cloth.
4. Lubricate the gasket with a film of oil, and reinstall it on the sight bowl. If the gasket appears dry-rotted or damaged, replace the gasket.



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1. Vacuum Breaker/Drain Valve
2. Reducer Bushing
3. Mounting Brackets
4. O-Ring (when equipped with heater)
5. Stainless Steel V-Clamp (when equipped with heater)
6. Heater Assembly
7. Gasket
8. Sight Bowl Heater Rod
9. Sight Bowl Assembly
10. Vacuum Breaker/Drain Valve

Fig. 1, ConMet Fuel Separator

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5. Lightly lubricate the threads on the sight bowl, with oil, then thread the sight bowl into the bottom of the fuel separator.
6. Hand-tighten until the gasket is in full contact with the fuel separator, then tighten an additional 1/4 to 1/3 turn.
7. Check that the drain valve is tightened and closed.
8. Prime the fuel separator.
   - 8.1 Remove the vacuum breaker fitting and fill the unit with diesel fuel.
   - 8.2 Install and close the vacuum breaker fitting when the unit is full of fuel.

   IMPORTANT: The fitting must be air-tight and the valve closed.

Racor Fuel Separator Element Replacement

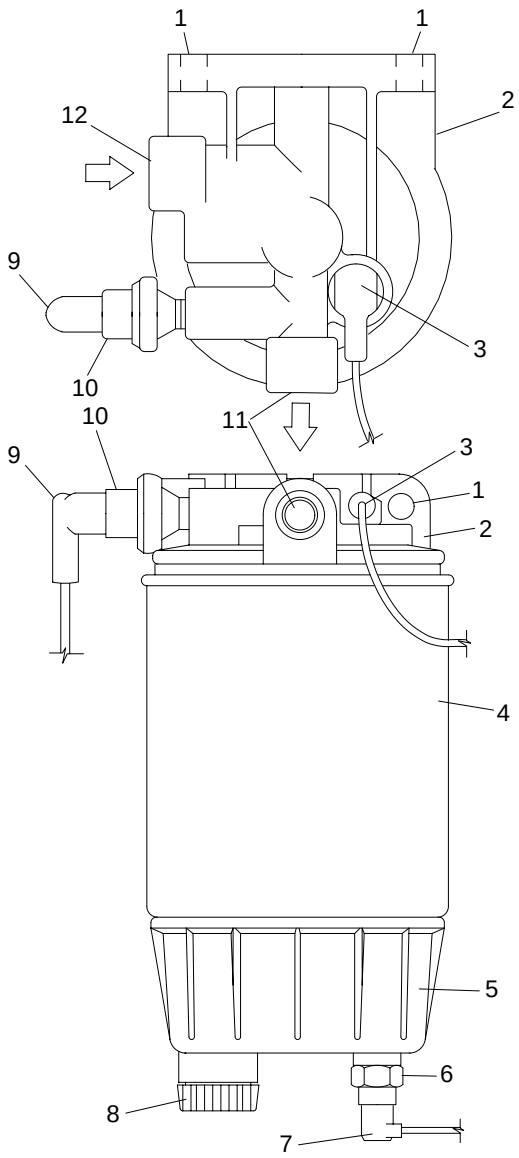
The only service necessary on Racor fuel separators is to replace the filter element.

Racor 325R and 330R

⚠ WARNING

Diesel fuel is flammable and can ignite if exposed to an 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 or intense heat 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.

1. Disconnect the water sensor probe connector, if equipped. See **Fig. 2**.
2. Place a suitable container under the fuel heater/water separator, then drain the fuel from the fuel heater/water separator by opening the drain valve.
3. Remove the filter element and collection bowl together, by turning the filter element off of the mounting head.
4. Remove the filter element from the collection bowl by turning the collection bowl; then discard the filter element.



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1. Mounting Hole
2. Mounting Head
3. Heater Connector
4. Filter Element
5. Collection Bowl
6. Water Sensor
7. Water Sensor Connector
8. Drain Valve
9. Vacuum Switch Connector
10. Vacuum Switch
11. Fuel Outlet
12. Fuel Inlet

Fig. 2, Racor 325R Fuel Heater/Water Separator (330R Similar)

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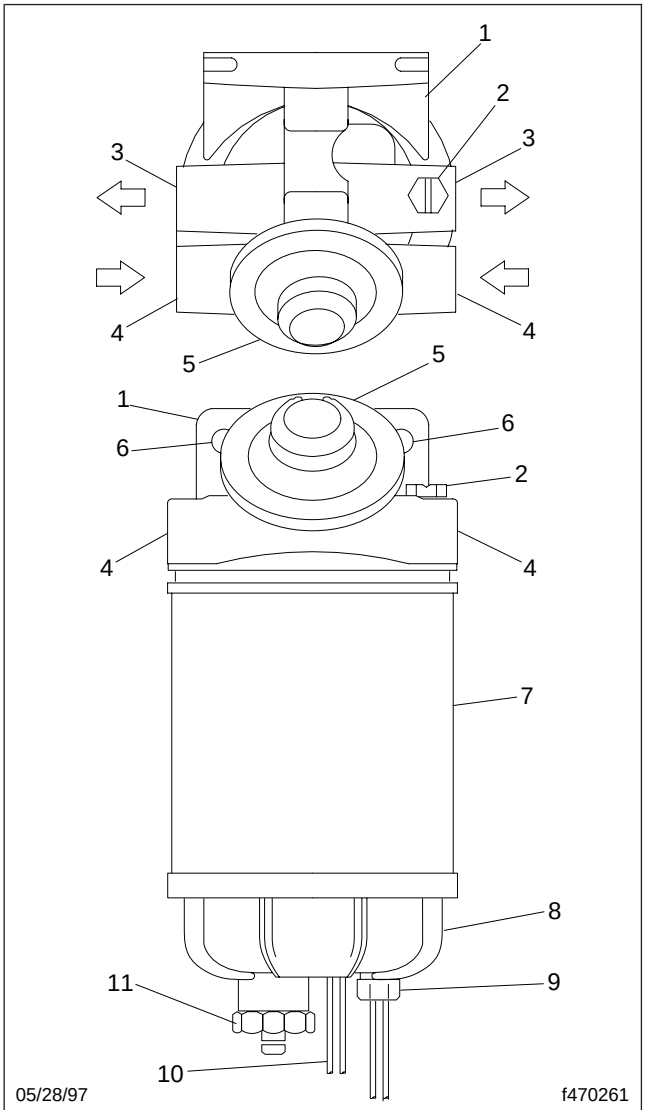
5. Remove and discard the bowl O-ring; then clean the bowl of debris using diesel fuel only. Clean the bowl O-ring seat with a shop cloth.
6. Lubricate the new bowl O-ring with clean diesel fuel or motor oil; then seat it in the collection bowl.
7. Attach the collection bowl to a new filter element, hand-tight. Do not use tools.
8. Lubricate the new filter element square-cut gasket with clean diesel fuel or motor oil.
9. Fill the filter and bowl assembly with clean diesel fuel.
10. Spin the filter and bowl assembly onto the mounting head until the gasket contacts the head base; then turn it an additional 1/3 to 3/4 of a turn.
11. Connect the water sensor probe connector if equipped.
12. Start the engine and check for fuel leaks. Repair all fuel leaks with the engine off.

Racor 460R

⚠ WARNING

Diesel fuel is flammable and can ignite if exposed to an 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 or intense heat 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.

1. Disconnect the water sensor probe connector, if equipped. See **Fig. 3**.
2. Disconnect the bowl heater connector, if equipped.
3. Place a suitable container under the fuel heater/water separator, then loosen the vent plug and drain the fuel from the fuel heater/water separator by opening the drain valve.
4. Remove the filter element and collection bowl together, by turning the filter element off of the mounting head.
5. Remove the filter element from the collection bowl by turning the collection bowl. Discard the filter element.



1. Mounting Head
2. Vent Plug
3. Fuel Outlet
4. Fuel Inlet
5. Fuel Priming Pump
6. Mounting Hole
7. Filter Element
8. Collection Bowl
9. Water Sensor Probe
10. Fuel Heater Wire
11. Drain Valve

Fig. 3, Racor 460R Fuel Heater/Water Separator

6. Remove and discard the bowl O-ring. Clean the bowl of debris using diesel fuel only. Clean the bowl O-ring seat with a shop cloth.
7. Lubricate the new bowl O-ring with clean diesel fuel or motor oil. Seat it into the contaminant bowl.

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8. Hand-tighten the collection bowl to a new filter element. Do not use tools.
9. Lubricate the new filter element square-cut gasket with clean diesel fuel or motor oil.
10. Spin the filter and bowl assembly onto the mounting head until the gasket contacts the head base. Turn it an additional 1/3 to 3/4 turn.
11. Connect the water sensor probe connector, if equipped.
12. Connect the bowl heater connector, if equipped.
13. Loosen the vent plug, then operate the primer pump until the fuel purges at the vent plug. Close the vent plug.
14. Start the engine and check for fuel leaks. Repair all fuel leaks with the engine off.

Racor 490R

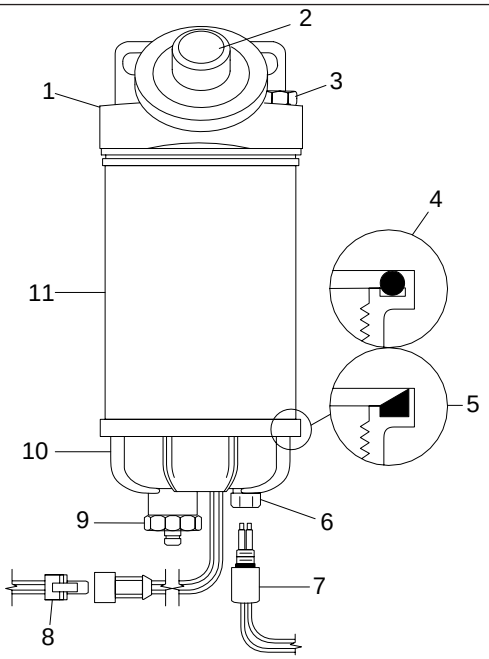
WARNING

Diesel fuel is flammable and can ignite if exposed to an 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 or intense heat 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.

1. Drain some fuel by loosening the vent plug and opening the drain valve. See **Fig. 4**.
2. Disconnect the water sensor and heater connections, if equipped.
3. Remove the element and bowl, together, by turning counterclockwise.
4. Remove the bowl from the element, and clean the O-ring.
5. Apply a coating of clean fuel or motor oil to the new O-ring and element seal.
6. By hand only, spin the bowl onto the new element, then snugly spin them both onto the filter head.

IMPORTANT: Do not use tools to tighten.

7. Connect the water sensor and heater connectors, if equipped.
8. Prime the fuel separator.



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1. Mounting Head
2. Fuel Primer Pump
3. Metal Vent Plug
4. Bowl O-Ring
5. Bowl Bevel-Cut Gasket
6. Bowl Probe Plug
7. Water Sensor Probe
8. Heater Connector
9. Bowl Drain Valve Assembly
10. Bowl with Drain and Water Sensor
11. Service Element

Fig. 4, Racor 490R Fuel Separator

8.1 Loosen the vent plug. Operate the primer pump until the fuel purges at the vent plug.

8.2 Close the vent plug.

9. Start the engine and check for fuel leaks.
10. Shut down the engine and correct any fuel leaks.

Racor 690R and 6120R

WARNING

Diesel fuel is flammable and can ignite if exposed to an 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 or intense heat could start a fire, possibly resulting in personal injury or property dam-

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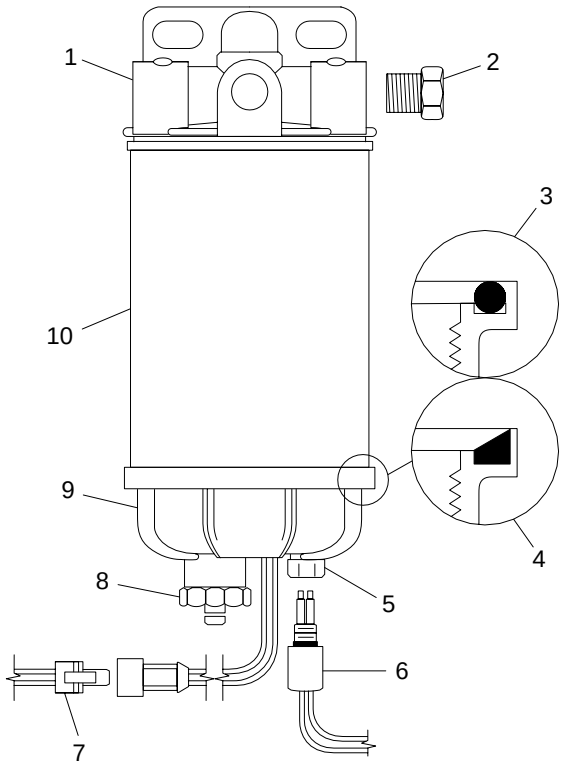
age. When working on a fuel system, have a fire extinguisher within easy reach.

1. Drain some fuel by loosening the vent plug and opening the drain valve. See **Fig. 5**.



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1. Mounting Head
2. Metal Plug, 3/8-inch NPT
3. Bowl O-Ring
4. Bowl Bevel-Cut Gasket
5. Bowl Probe Plug
6. Water Sensor Probe
7. Heater Connector
8. Bowl Drain Valve Assembly
9. Bowl with Drain and Water Sensor
10. Service Element

Fig. 5, Racor 690R Fuel/Water Separator (6120R similar)

2. Disconnect the water sensor and heater connections, if equipped.
3. Remove the element and bowl, together, by turning counterclockwise.
4. Remove the bowl from the element, and clean the O-ring.
5. Apply a coating of clean fuel or motor oil to the new O-ring and element seal.
6. By hand only, spin the bowl onto the new element, then snugly spin them both onto the filter head.

IMPORTANT: Do not use tools to tighten.

7. Connect the water sensor and heater connectors, if equipped.
8. Prime the fuel separator.
   - 8.1 Remove the 3/8-inch metal plug located at the top of the fuel/water separator (see **Fig. 5**, Ref. 2), and manually fill the unit with diesel fuel.
   - 8.2 Replace and tighten the 3/8-inch metal plug when the unit is full.
9. Start the engine and check for fuel leaks.
10. Shut down the engine and correct any fuel leaks.

Racor 900FG and 1000FG

⚠ WARNING

Diesel fuel is flammable and can ignite if exposed to an 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 or intense heat 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.

1. Remove the lid by turning the T-handle. See **Fig. 6**.
2. Remove the filter element by raising the handle built into the filter element. Carefully turn the filter element while lifting up.
3. Remove and discard the lid gasket. Replace it with a new one.
4. Lubricate the lid gasket with clean diesel fuel. Seat it into the lid.
5. Fill the unit with clean diesel fuel.
6. Replace the lid. Hand-tighten it or tighten it to 10 lbf·ft (14 N·m).
7. Start the engine and check for fuel leaks. Repair all fuel leaks with the engine off.

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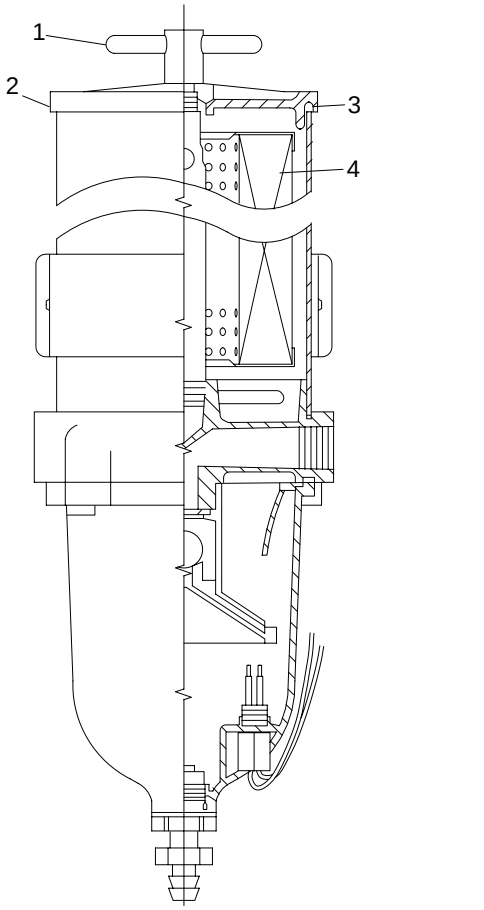


1. T-Handle
2. Lid
3. Lid Gasket
4. Filter Element

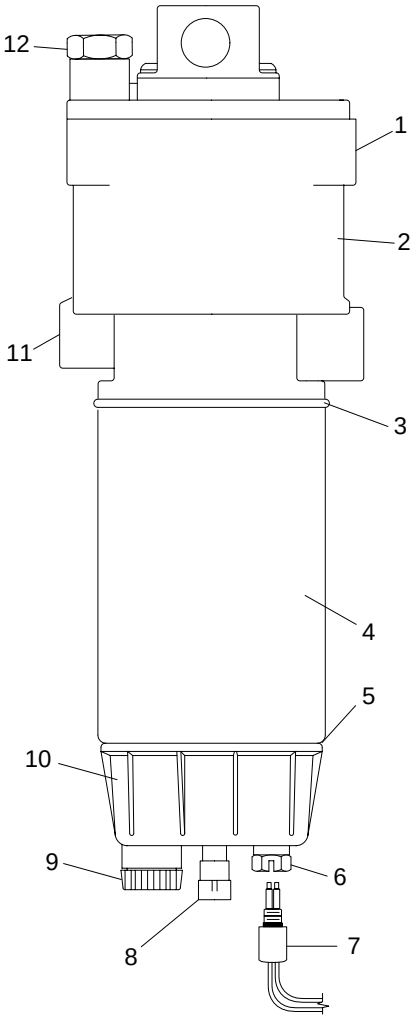
Fig. 6, Racor 900FG Fuel Heater/Water Separator (1000FG similar)

Racor 6400

⚠ WARNING

Diesel fuel is flammable and can ignite if exposed to an 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 or intense heat 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.

1. Disconnect the water sensor probe connector and bowl heater connector, if equipped. See **Fig. 7**.



1. Fuel Inlet
2. Head Assembly
3. Filter Top Seal
4. Filter Element
5. Bowl O-Ring Seal
6. Water Sensor Probe Plug
7. Water Sensor Probe
8. Bowl Heater Connector
9. Drain Valve
10. Contaminant Collection Bowl
11. Fuel Outlet
12. Priming Plug

Fig. 7, Racor 6400 Fuel Heater/Water Separator

2. Place a suitable container under the fuel heater/water separator, then drain the fuel from

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the fuel heater/water separator by opening the drain valve.

3. Remove the filter element and collection bowl together, by turning the filter element off of the mounting head.
4. Remove the filter element from the collection bowl by turning the collection bowl. Discard the filter element.
5. Remove and discard the bowl O-ring. Clean the bowl of debris using diesel fuel only. Clean the bowl O-ring seat with a shop cloth.
6. Lubricate the new bowl O-ring with clean diesel fuel or motor oil. Seat it into the collection bowl.
7. Hand-tighten the collection bowl onto a new filter element. Do not use tools.
8. Lubricate the new filter element gasket with clean diesel fuel or motor oil.
9. Spin the filter and bowl assembly onto the mounting head until the gasket contacts the head base. Turn it an additional 1/3 to 3/4 turn.
10. Connect the water sensor probe connector and bowl heater connector, if equipped.
11. Remove the priming plug located at the top of the fuel/water separator and manually fill the fuel/water separator with clean diesel fuel. Replace and tighten the priming plug.
12. Start the engine and check for fuel and coolant leaks. Repair all leaks with the engine off.

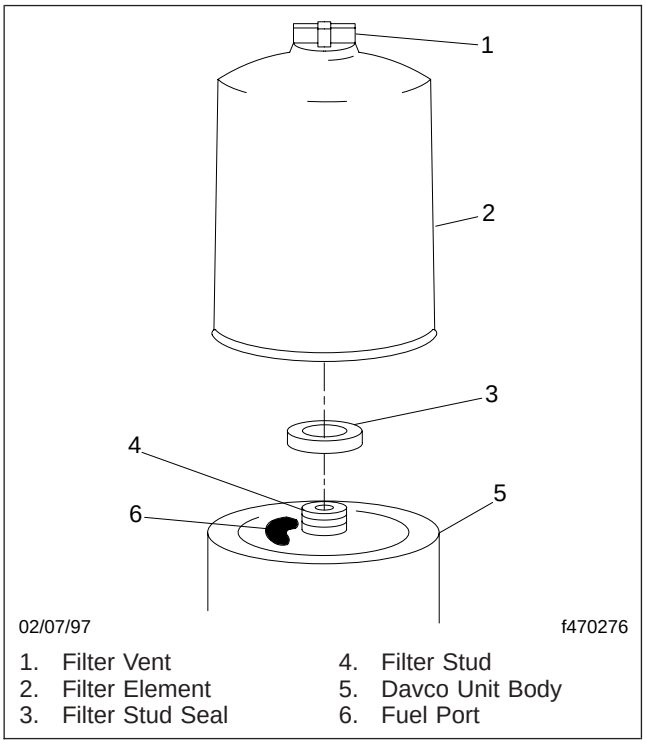
Davco Fuel Heater/Water Separator Filter Element Replacement

Davco 321

The only maintenance necessary on Davco 321 fuel separators is to replace the filter element. See **Fig. 8**.

⚠ WARNING

Diesel fuel is flammable and can ignite if exposed to an 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 or intense heat 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.



1. Filter Vent
2. Filter Element
3. Filter Stud Seal
4. Filter Stud
5. Davco Unit Body
6. Fuel Port

Fig. 8, Davco 321

1. Place a suitable container under the fuel heater/water separator. Open the filter vent using a 1-1/8 inch wrench. Drain the fuel from the fuel heater/water separator by opening the drain valve.
2. Close the drain valve.
3. Remove the filter element by spinning the filter element off of the fuel heater/water separator body.
4. Remove the filter stud seal. Clean the top of the unit body.
5. Add fuel to the fuel heater/water separator housing until it reaches the top of the fuel port.
6. Install a new filter stud seal.
7. Coat the filter gasket with clean oil. Spin the filter element onto the unit housing until it contacts the gasket. Turn it an additional 1/2 to 3/4 turn. Do not use a filter wrench to tighten the filter.

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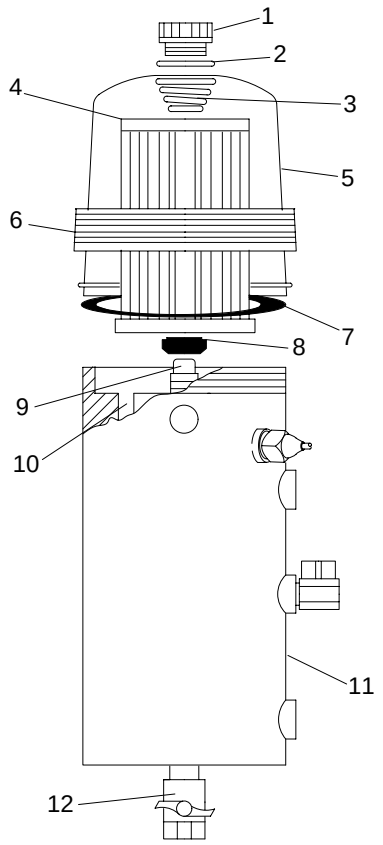
8. Start the engine, then raise the rpm for one to two minutes to purge air from the system, and check for fuel leaks.
9. Shut down the engine and correct any fuel leaks.

Davco 380

The only maintenance necessary on Davco 380 fuel separators is to replace the filter element. See **Fig. 9**.



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1. Filter Vent
2. Filter Vent Seal
3. Filter Spring
4. Filter Element
5. Filter Cover
6. Filter Collar
7. Filter Cover Seal
8. Grommet
9. Threaded Filter Stud (for emergency use)
10. Fuel Port
11. Davco Unit Body
12. Drain Valve

Fig. 9, Davco 380

WARNING

Diesel fuel is flammable and can ignite if exposed to an 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 or intense heat 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.

NOTE: As an emergency option, the Davco 380 will accept a spin-on-type filter onto its threaded filter stud with the grommet removed.

1. Place a suitable container under the fuel heater/water separator. Open the filter vent. Drain the fuel below the collar level by opening the drain valve. Close the drain valve.
2. Remove the filter collar, using the Davco filter collar wrench. See **Fig. 10**.

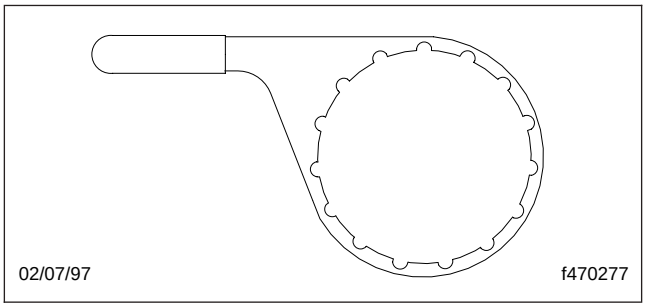

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Fig. 10, Davco Filter Collar Wrench (Davco P/N 380134)

3. Remove the filter cover. Retain the filter cover seal for re-use.
4. Remove the filter element. Remove the grommet from the element. Discard the element. Retain the grommet for re-use.
5. Add fuel to the fuel heater/water separator housing until it reaches the top of the fuel port.
6. Install the grommet on the new filter element.

CAUTION

Do not use the filter collar wrench to tighten the filter collar. Using the filter wrench to tighten the collar can damage the collar, resulting in a fuel leak.

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7. Install the filter element, filter cover and cover seal, and filter collar. Hand-tighten the filter collar.
8. Remove the filter vent. Fill with fuel until fuel is about one inch above the collar. Replace the filter vent.
9. Start the engine, then raise the rpm for one minute to purge air from the system, and check for fuel leaks.
10. Shut down the engine and correct any fuel leaks.

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Title of Maintenance Operation (MOP)	MOP Number
Exhaust System Inspecting (Noise Emission Control)	49–01

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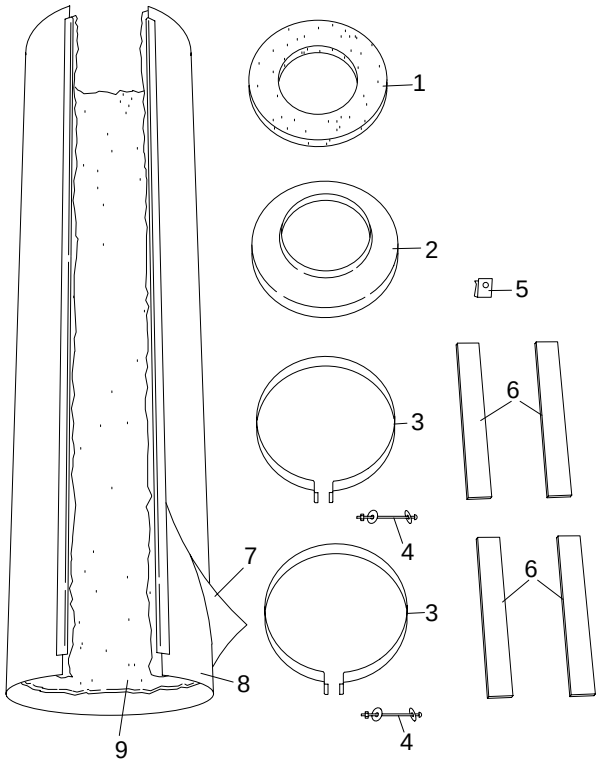
49–01 Exhaust System Inspecting (Noise Emission Control)

In addition to inspecting the exhaust system at the scheduled maintenance interval, inspect the exhaust system if the noise level of the vehicle has increased. Replace parts that show leakage, wear, or damage, with genuine Sterling parts.

Pre-EPA07 Exhaust System Inspecting

1. Check the condition of the muffler body, top stack or top stack silencer, and muffler wrap. See **Fig. 1**. Check the inlet/outlet tubes for leakage, dents, and corrosion, and check for holes in the muffler. Replace parts as required. Use new parts, equivalent to parts originally installed on the vehicle. See **Group 49** of the *L-Line and A-Line Workshop Manual* for replacement procedures.
2. Inspect the exhaust flex hose (see **Fig. 2**) for leakage, wear, or damage. Replace with new parts if replacement is needed.
3. Check for leakage at the V-band coupling, which attaches the exhaust pipe to the turbocharger exhaust outlet. See **Fig. 2**.
4. If leakage exists, tighten the nut on the V-band coupling 15 lbf·ft (20 N·m). If leakage persists, install a new V-band coupling.
5. Inspect the turbo outlet pipe, and replace it as needed.
6. Check the U-bolt clamps for tightness, and tighten as needed.
7. Check for leakage at all wide-band exhaust clamps.

   If leakage exists, tighten the nuts on Donaldson seal clamp exhaust clamps (see **Fig. 3**) or Riker Tru-Seal exhaust clamps (see **Fig. 4**) 50 to 75 lbf·ft (68 to 102 N·m). Tighten Torca Torctite exhaust clamps (see **Fig. 5**) 35 to 45 lbf·ft (47 to 61 N·m). If leakage persists, install a new wide-band exhaust clamp. Do not re-use seal clamps.



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1. Fiberglass Pad
2. Top Cover
3. Installation Band
4. Long Bolt, Washers, and Nut
5. Seam Clip
6. Seam Strips
7. Protective Paper
8. Muffler Wrap Body
9. Fiberglass Mat

Fig. 1, Muffler Wrap Assembly

EPA07 Exhaust System Inspecting

IMPORTANT: The Environmental Protection Agency's 2007 regulations require lower exhaust emissions, thus requiring new exhaust system components. See **Fig. 6**. In particular the after-treatment device (ATD), which is part of the after-treatment system (ATS), requires special attention during regularly scheduled maintenance inspections. If any discrepancies are discovered, refer to the engine manufacturer's service literature for repair instructions.

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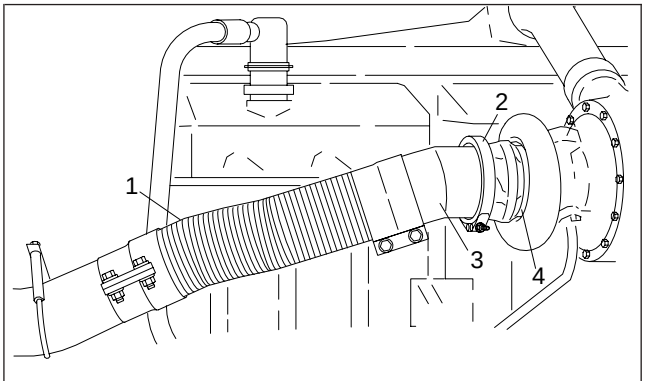

1. Flex Hose
2. V-Band Coupling
3. Exhaust Pipe
4. Turbocharger Exhaust Outlet

Fig. 2, V-Band Coupling and Flex Hose

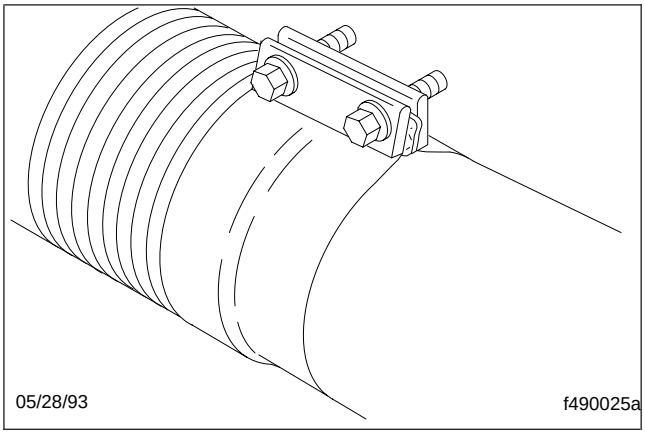

Fig. 3, Donaldson Seal Clamp Wide-Band Exhaust Clamp

Definitions of ATS Components

Refer to the following list of definitions of ATS components.

- After-Treatment System (ATS)—the entire exhaust system from the turbocharger to the exhaust stack or tail pipe.
- After-Treatment Device (ATD)—a muffler-like canister that houses a DPF, DOC, and sensors.
- Diesel Particulate Filter (DPF)—a filter that collects and holds particulate matter (soot and ash).

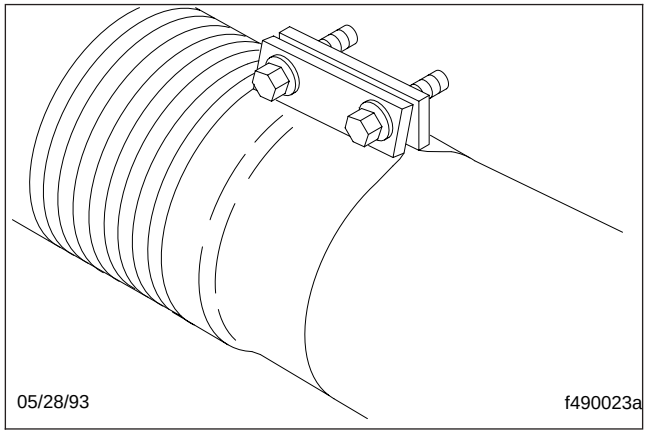

Fig. 4, Riker Tru-Seal Wide-Band Exhaust Clamp

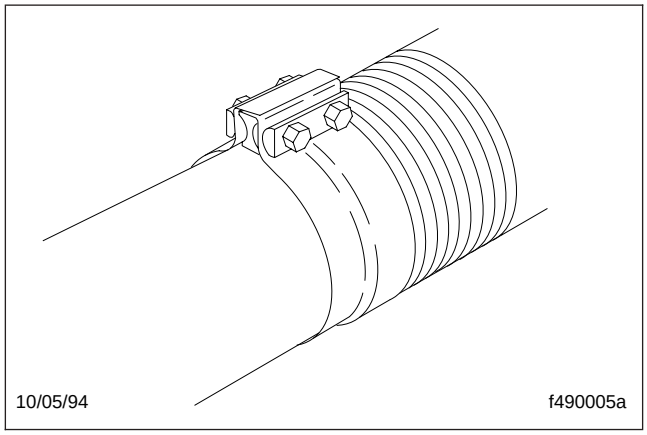

Fig. 5, Torca Torctite Wide-Band Exhaust Clamp

- Diesel Oxidation Catalyst (DOC)—oxidizes hydrocarbons and reduces NOx.
- Sensors—detect temperatures and pressures in the ATS.

Inspection

1. Check for leakage at the clamp that attaches the exhaust pipe to the turbocharger exhaust outlet. If leakage exists, tighten the nut on the clamp to the required torque. If leakage persists, install a new clamp.
2. Check the exhaust pipe, bellows, and each exhaust seal clamp for leakage, wear, cracks, or damage. Replace damaged components as needed. If leakage exists at a clamp, tighten the nuts to the required torque. If leakage persists, install a new exhaust seal clamp. Do not reuse

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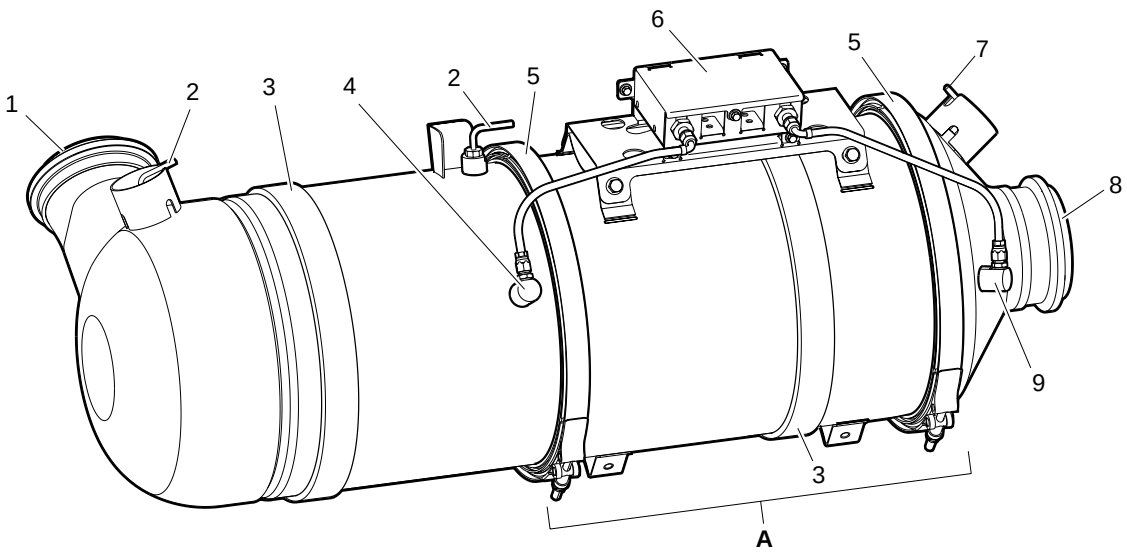
seal clamps. Once a seal clamp is loosened or removed, it must be replaced.

3. If present, check the condition of the insulation material around the exhaust pipe between the turbocharger and the ATD.
4. Check the ATD mounting bands for tightness. Tighten to 30 lbf·ft (41 N·m) if needed. Do not overtighten.
5. Check for leaks around the clamps that attach the ATD in the ATS, and around the clamps that retain the DPF in the ATD. No leaks are allowed anywhere in the system.
6. Check all sensors attached to the ATD for leaks or damaged wires. No leaks are allowed.
7. Check the DPF exterior surface for dents or other damage. See Item A of **Fig. 6**. A dent over 3 inches (76 mm) in diameter and 1/4-inch (6-mm) deep could cause internal damage to the DPF, causing it to malfunction.
8. Check for heat discoloration on the surface of the ATD. Heat discoloration may indicate internal damage; especially around the DPF.
9. Check any wires, lines, or hoses within 4 inches (10 cm) of the exhaust system for heat damage. Repair or reroute as needed.



A. Inspect this area of the canister for dents.
1. Marmon Fitting at Inlet from Turbocharger
2. DOC Temperature Sensor
3. ATD Mounting Band
4. DPF Intake Pressure Sensor
5. DPF V-Band Mounting Clamps
6. Sensor Housing
7. DPF Outlet Temperature Sensor
8. Exhaust Outlet Marmon Fitting
9. DPF Outlet Pressure Sensor

Fig. 6, Typical After-Treatment Device

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Electrical System Checking	54–01

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54–01 Electrical System Checking

Cab Interior

Inspect the wiring and electrical connections at the electrical mounting plate, cab-to-chassis interface connectors, cab-to-engine interface connectors, main cab-power and cab-ground studs, and electrical junction blocks.

Check all wiring for chafing, kinks, and discolored insulation. Find the cause of any problems, then repair, replace, or reroute wires as needed.

Check that all relays are firmly seated in their mounting plates.

Check the tightness of the connections on the electrical junction block(s), main cab-power stud, and cab-ground stud, as equipped.

Install all of the removed panels.

Chassis

1. Check the main chassis wiring harness. Check the wiring insulation for damage from chafing or heat. Also check for kinks. Reroute, repair, or replace wires as needed.

⚠ 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.

2. Check all tie straps for breakage and damage. Replace any broken or cracked tie straps.
3. Check the wires of all sensors on or near the engine. Make sure no wires are closer than 6 inches (15 cm) to hot surfaces. If any are, and can not be rerouted, make sure they are protected by heat shields. Check that sensor connectors are tight, clean, and undamaged.
4. On engines with electronic controls, check the wiring and connectors on the computer units.

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Door Latch and Door Hinge Lubricating	72–01

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72–01 Door Latch and Door Hinge Lubricating

Apply a few drops of light engine oil to the door latch mechanism to reduce noise and wear. Wipe off excess oil. This includes baggage doors, ventilator doors, and the oil-check door.

Lubricate door hinges every six months. In addition, lubricate new door hinges at installation. Lubricate the hinges by spraying them with a light coating of silicone lubricant such as WD–40® or an equivalent.

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Air Conditioner Inspecting	83–01
Air Filter Replacing	83–02

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83–01 Air Conditioner Inspecting

⚠ WARNING

Wear eye protection, gloves, and protective clothing when working on the air conditioning system. Leaking refrigerant from a damaged hose or line could cause blindness or serious skin burns.

Preliminary Checks

1. Park the vehicle on a level surface, apply the parking brakes, and chock the tires.
2. Check the appearance of the air conditioner compressor pulley assembly. If the friction surface of the pulley shows signs of excessive grooving due to belt slippage, replace both the pulley and the drive plate. Visually inspect the refrigerant compressor drive belt for damage, and check that the belt is set at the proper tension. Also check the tightness of the compressor mounting fasteners. For instructions and torque values, see **Group 01** of the *L-Line and A-Line Workshop Manual*.
3. Inspect the drive plate. If the friction surface of the drive plate shows visible signs of damage due to excessive heat, replace the drive plate and pulley assembly. See **Group 83** of the *L-Line and A-Line Workshop Manual* for removal and installation procedures.
4. On a Sanden refrigerant compressor, use a feeler gauge to check that the drive plate clutch clearance is 0.016 to 0.03 inch (0.4 to 0.8 mm). See **Fig. 1**. If the drive plate clutch requires adjustment, see **Group 83** of the *L-Line and A-Line Workshop Manual*.

   On a Climate Control refrigerant compressor, place a feeler gauge between the air conditioner compressor clutch and the pulley to check the compressor clutch clearance. Drive plate to pulley clearance is 0.02 to 0.03 inch (0.6 to 0.8 mm). If the clearance is not correct, see **Group 83** of the *L-Line and A-Line Workshop Manual*.
5. Inspect the compressor clutch coil wire. Check that the connector is not damaged or loose. Replace the wire if it is damaged.

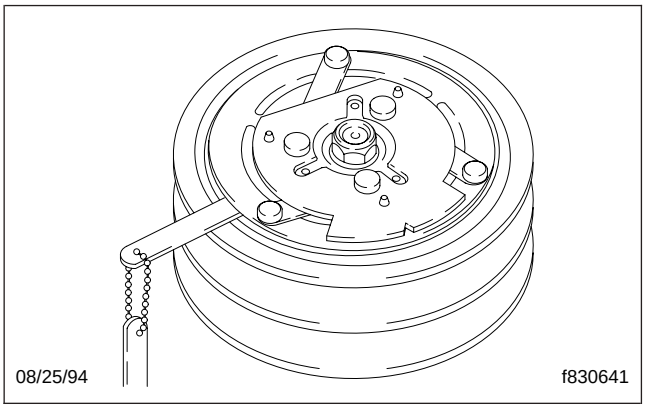

Fig. 1, Drive Plate Clearance Inspection

6. Check the overall condition of the air conditioning hoses. Look for cracks, cuts, and abrasions on the hoses. Replace damaged hoses, see **Group 83** of the *L-Line and A-Line Workshop Manual* for replacement instructions. Also, check for loose fittings on all air conditioning components.
7. Check for a buildup of road debris on the condenser fins. See **Group 83** of the *L-Line and A-Line Workshop Manual* for cleaning instructions.

83–02 Air Filter Replacing

The air filter must be replaced every six months, regardless of mileage, to permit proper operation of the HVAC system.

IMPORTANT: When replacing the air filter, use only a Sterling-approved air filter.

1. Turn off the engine, apply the parking brakes, and chock the tires.
2. Open the hood.
3. Remove the screws that attach the filter cover to the filter housing. See **Fig. 2**.

IMPORTANT: Do not operate the vehicle with the filter removed. Dust and debris could enter the blower motor and cause damage.

4. Remove the filter from the housing.
5. Install a new filter in the housing.
6. Using screws, attach the filter cover to the housing.
7. Close the hood.

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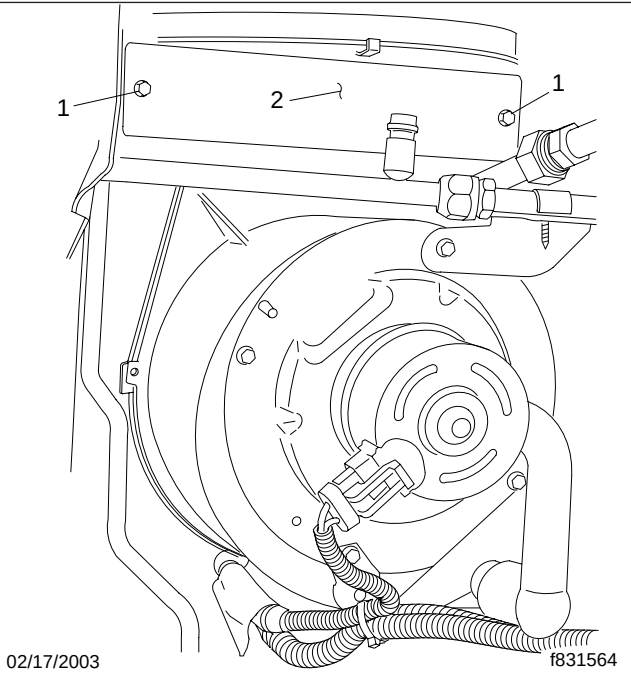
8. Remove the chocks from the tires.



1. Screw 2. Filter Cover

Fig. 2, Air Filter Replacement

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Hood Hinge Bushings Lubricating	88–01

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88–01 Hood Hinge Bushings Lubricating

Lubricate the hood hinge bushings at the zerk fittings, using multi-purpose chassis grease. Use a hand-type grease gun, or a high-pressure gun with a low-pressure adapter.

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