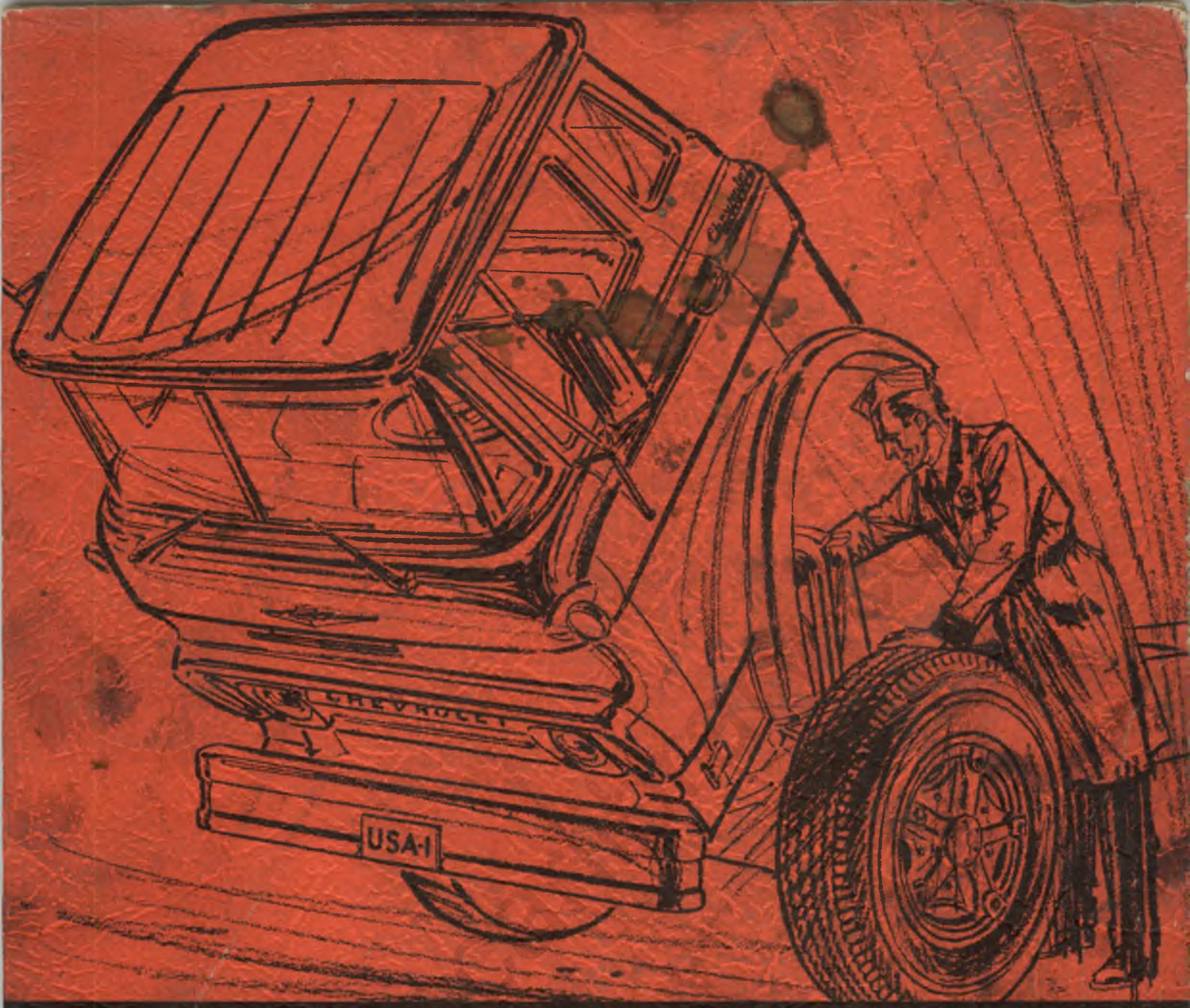

HEAVY DUTY TRUCK SUPPLEMENT

SERVICE MANU

CHEVROLET

1972 CHEVROLET HEAVY DUTY TRUCK

(SERIES 70, 80, and 90)

SHOP MANUAL SUPPLEMENT

FOREWORD

This supplement has been prepared for use with the 1970 Heavy Duty Truck Shop Manual and the 1971 Heavy Duty Truck Shop Manual Supplement. It covers additional service information peculiar to 1972 Chevrolet Heavy Duty Trucks.

Summaries of new or revised Specifications for truck components are included at the end of each major section.

All information, illustrations and specifications contained in this literature are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

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CHEVROLET MOTOR DIVISION
General Motors Corporation
DETROIT, MICHIGAN

Printed in U.S.A.

SERVICE SECTION INDEX

INTRODUCTION

Information in this Supplement, when used in conjunction with 1970 Heavy Duty Truck Manual ST135-70 and the 1971 Heavy Duty Truck Shop Manual Supplement ST332-71 provided coverage for all 70 thru 90 Series trucks listed on Model Data Chart on pages ii and iii.

The information in this Supplement is arranged in the same section sequence as in 1970 Heavy Duty Truck Service Manual ST135-70.

IMPORTANT: Refer to the applicable section in this Supplement (see Index below) to determine whether there is supplementary information before servicing any unit or system on 70 thru 90 Series trucks.

SECTION INDEX

MODEL DATA

TRUCK SERIES	ENGINE		CLUTCH		FRONT AXLE		REAR AXLE		TRANSMISSION	
	STD.	OPT.	STD.	OPT.	STD.	OPT.	STD.	OPT.	STD.	OPT.
HM80	401M	478M	13-2	13-2* 14-2	F070	F090, F120	17121	17221, 18121, 18221, 19221	285V	282V, 387V, 5652, 5752C, MT40, AT540
HV70	6V-53N	—	14-2	—	F070	F090, F120	17221	18221, 19121, 19221	5752C	MT41
JM80	401M	478M	13-2	13-2* 14-2	F090	F120, FL901	30DSC	34DSC, SLHD, SQHD	5652/w 6041 Aux.	401V, 7041 Aux. MT40
JV70	6V-53N	—	14-2	—	F090	F120, FL901	34DSC	SLHD	385V/w 7041 Aux.	MT41
RM80	401M	478M	13-2	13-2* 14-2	F090	—	H162	H361, L162, L362	285V	325V, MT42
HM80	478SN	—	—	—	F160	F161	U200	—	MT42	—
TM80	401M	478M	13-2	13-2* 14-2	F070	F090, F120	17121	17221, 18121, 18221, 19221	285V	282V, 387V, 5652, 5752C, MT40, AT540
TV70	6V-53N	—	14-2	—	F070	F090, F120	17221	19121, 19221	5752C	MT41
WM80	401M	—	13-2	13-2*	F090	F120	34DSC	SLHD	5652/w 6041 Aux.	—
WV70	6V-53N	—	—	—	FL901	—	34DSC	—	MT41	—
WW90	6V-71N	—	14-2	—	F120	—	SLHD	—	RT910	—
HC90	NHCT270	NTC335	14-2**	15½-2**	F090	F120	19121	R170	RT910	RT09513
HE90	637	—	14-2	—	F090	F120	18221	19221	408V	—
HH90	8V-71N	—	14-2	14-2** 15½-2**	F090	F120	19121	R170	RT910	RT09513
HI90	6-71N	—	14-2	14-2** 15½-2**	F090	F120	18221	19121, 19221, R170	6852S	6853C, RT910
HN90	NHC250	NH230	14-2	14-2** 15½-2**	F090	F120	18221	19121, 19221, R170	7452E	RT910, RT09513
JB90	8V-903	—	14-2**	—	F120	—	SLHD	—	RT910	—
JC90	NHCT270	NTC335	14-2**	15½-2**	F090	F120, FL901	SLHD	SQHD	RT910	RT09513

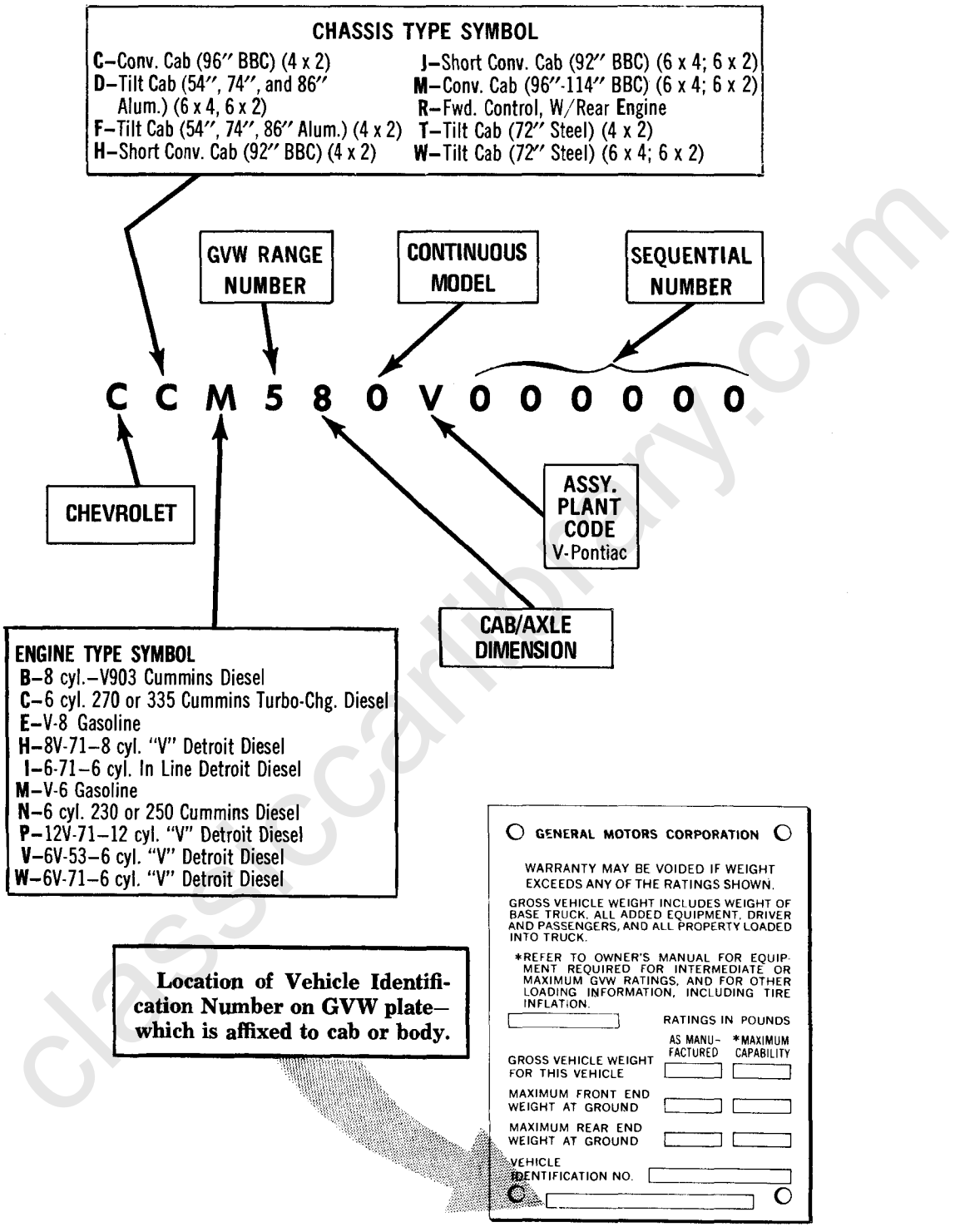
MODEL DATA (continued)

TRUCK SERIES	ENGINE		CLUTCH		FRONT AXLE		REAR AXLE		TRANSMISSION	
	STD.	OPT.	STD.	OPT.	STD.	OPT.	STD.	OPT.	STD.	OPT.
JE90	637	—	14-2	—	F090	F120, FL901	SLHD	34D3C	RT910 —	6852K
JH90	8V-71N	—	14-2	14-2** 15½-2**	F090	F120, FL901	SLHD	SQHD	RT910	RT09513, T905A, 8341C Aux.
JI90	6-71N	—	14-2	14-2** 15½-2**	F090	F120, FL901	SLHD	SQHD, 34D3C	RT910	RT09513, 6852K
JN90	NHC250	NH230	14-2	14-2** 15½-2**	F090	F120, FL901	34DSC	SLHD, SQHD, 34D3C	RT910	RT09513, 7352B, 8552A, 8341C Aux.
MB90	8V-903	—	14-2**	—	F120	—	SLHD	—	RT910	—
MC90	NTC350	—	15½-2**	—	F120	—	SLHD	—	RT910	—
MH90	8V-71N	—	14-2	15½-2**	F090	F120, FL901	SLHD	SQHD, 34D3C	RT910	RT09513, 8716-3B
TE90	637	—	14-2	—	F090	F120	18221	19221	408V	—
FB90	8V-903	—	14-2**	—	F120	—	19121	—	RT910	—
FC90	NHCT270	NTC335	14-2	14-2** 15½-2**	F120	—	19121	R170	RT910	RT09513
FH90	8V-71N	—	14-2	15½-2**	F120	—	19121	R170	RT910	RT09513
FI90	6-71N	—	14-2	—	F120	—	18221	19121, 19221, R170	6852S	7452E, RT910, RT09513
FN90	NHC250	NH230	14-2	14-2** 15½-2**	F120	—	18221	19121, 19221, R170	RT910	—
DB90	8V-903	—	14-2**	—	F120	—	SLHD	—	RT09513	—
DC90	NHCT270	NTC335	14-2	14-2** 15½-2**	F120	FL901	SLHD	SQHD, SSHD	RT910	RT09513
DH90	8V-71N	—	14-2	15½-2**	F120	FL901	SLHD	SQHD, SSHD, 34DSC, 34D3C	RT910	RT09513, 8716-3B
DI90	6-71N	—	14-2	—	F120	—	34D3C	34DSC, SLHD, SQHD	7352B	RT910, RT09513
DN90	NHC250	NH230	14-2	15½-2** 14-2**	F120	—	34D3C	34DSC, SLHD, SQHD	RT910	RT09513
DP90	12V-71	—	15½-2**	—	F120	—	SQHD	—	RT01213	—

*Equipped with Cerametalix Clutch Discs. **Spicer Clutch.

VEHICLE MODEL IDENTIFICATION

In order that a vehicle may be specifically identified as to manufacturer, chassis type, engine type, GVW range, cab/axle dimension, continuous model, plant code, and sequential number, refer to the chart below.



SECTION 0
Lubrication

All information contained in the 1970 Heavy Duty Truck Service Manual ST135-70 under LUBRICATION (SEC. 0) will apply to vehicles covered by this publication. The following information will also apply.

AIR CLEANERS

Air cleaner should be inspected and serviced at intervals specified in Emission Control System booklet, or more often under severe dust conditions, also whenever dirt is visible in element or oil.

TRANSMISSION CAPACITIES

The lubricant capacities for transmissions AT540, RTO9513, and RTO12513 are as follows:

	Pints	
Transmission	U.S.	Imperial
AT540	22	18¼
RTO9513	27	22½
RTO12513	27	22½

REAR AXLE CAPACITY (AXLE MODEL E30DSC)

The Imperial capacity of lubricant for this axle rear unit is 22½ pints instead of 20¾ pints as specified in 1970 Heavy Duty Truck Service Manual ST135-70, page 0-10.

TWO AND THREE-SPEED AXLE SHIFT UNIT

Lubricant for axle shift unit should be a refrigeration machine type oil which is a highly refined straight mineral petroleum oil. Formerly, regular engine oil was specified for this purpose.

The identification symbol on all future lubrication charts will be S7 for this type lubricant.

Apply oil to level of filler hole opening at 12,000 mile intervals.

OIL AND FILTER REPLACEMENT (AUTOMATIC TRANSMISSIONS)

DRAINING AND FILLING

When new or after overhaul, drain fluid and change filter element after 3000 miles; thereafter at 24,000-mile intervals (12,000 miles under severe conditions for MT Series only). Drain while fluid is at operating temperature (160°F. minimum).

MT Series Transmission

1. Remove bolt, nut, and strap which secure filter cover to oil pan.
2. Carefully remove filter cover to prevent oil "gushing" out. When drainage is complete, remove cover and filter element.
3. Install new element, retainer seal ring, and cover seal ring. Secure cover to oil pan with strap. Tighten strap retaining bolt to 11-14 foot-pounds. Pour 18 pints of specified oil into transmission.
4. Start engine and check fluid level. DO NOT OVERFILL.

AT475 and AT540 Transmissions

1. Remove dipstick and filler tube to drain fluid (AT540 only). Remove oil pan (both models).
2. Remove single bolt which retains filter element to valve body. Remove element.
3. Install new element using new O-ring at top of oil intake pipe; torque attaching bolt to 10 to 13 foot-pounds, then install oil pan using new gasket.
4. Install filler tube (AT540), then pour approximately 22 pints (AT540) or 10 pints (AT475), of specified oil into transmission.
5. Check fluid level.

CLUTCH IDLER LEVER (ALL CONVENTIONAL CAB MODELS EXCEPT HE AND JE)

These vehicles are equipped with mechanical type clutch controls. The only component of linkage arrangement which requires lubricant is the linkage idler lever and shaft, bracket-mounted to frame rail.

Apply "MPG" lubricant to single fitting at 6,000 mile intervals.

LUBRICATION CHARTS

All lube charts have been updated.

LUBRICATION

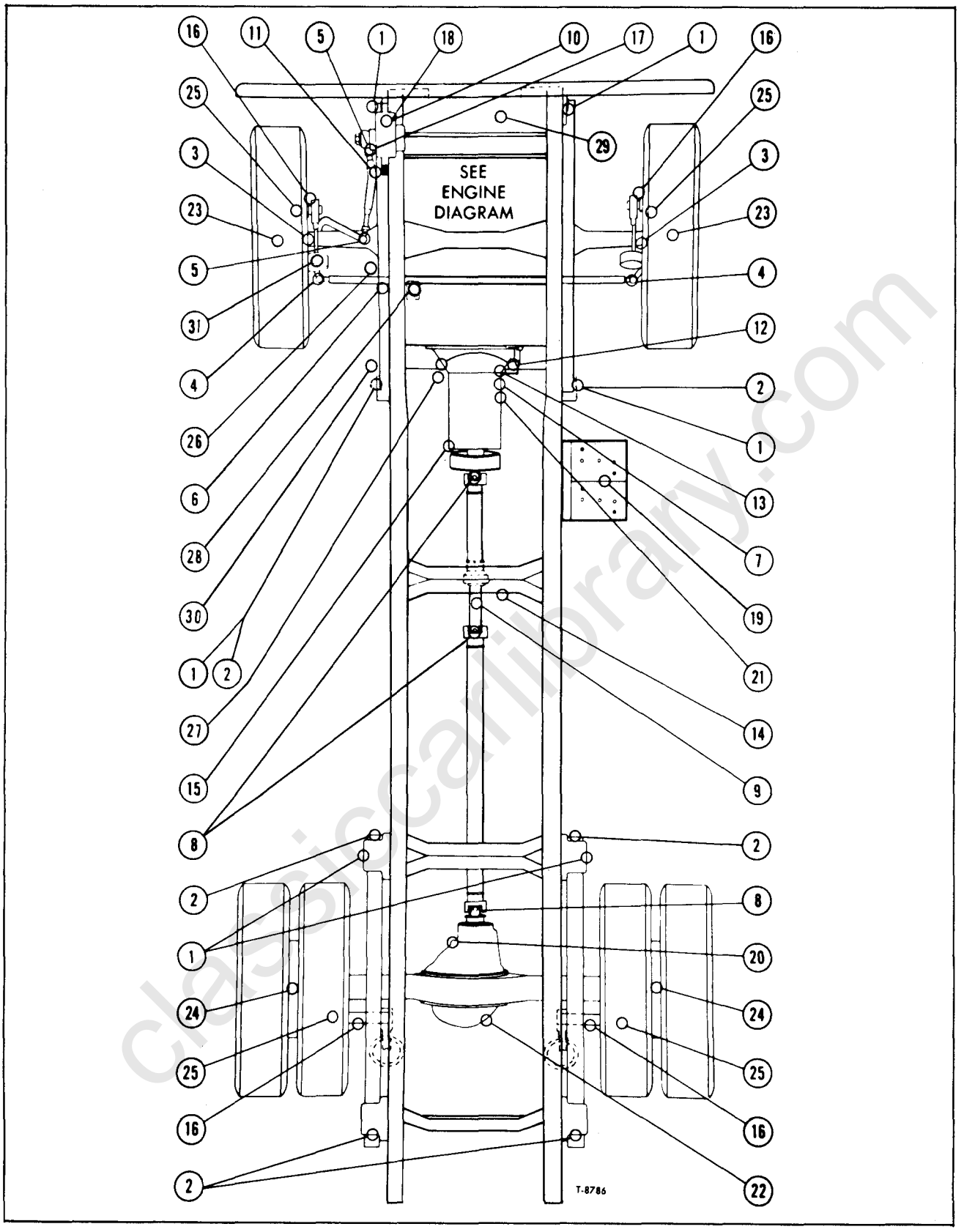


Figure 1—Lubrication Chart (Conventional Cab Models)

LUBRICATION DATA
(CHART ON OPPOSITE PAGE)

Item No.	Item	Remarks	Symbol	Miles(c)
1	Spring Shackles & Brackets (d)	2 fittings each shackle (if used)	MPG	6,000
		1 fitting each bracket (if used)	MPG	6,000
2	Spring Slip Pads (d)	Apply each end	MPG	6,000
3	Steering Knuckles	2 fittings each side	MPG	6,000
4	Steering Tie Rod Ends	1 fitting each end	MPG	6,000
5	Steering Drag Link Ends	1 fitting each end	MPG	6,000
6	Power Steering Cylinder Ends (d)	2 fittings	MPG	6,000
7	Auxiliary Transmission Shift Tower (d)	1 fitting	MPG	6,000
8	Prop. Shaft "U" Joints	1 fitting each joint	MPG	6,000
9	Prop. Shaft Slip Joint	1 fitting each joint	MPG	6,000
10	Steering Column "U" Joint	1 fitting each joint	MPG	6,000
11	Steering Column Slip Joint (d)	1 fitting	MPG	6,000
12	Clutch Release Cross Shaft (d)	1 fitting each end	MPG	6,000
13	Clutch Release Bearing (d)	Cup or fitting (sparingly)	S27	6,000
14	Tru-Stop Brake (d)	4 or 8 fittings	MPG	6,000
15	Speedometer Adapter (d)	1 fitting	MPG	6,000
16	Brake Camshaft (d)	1 fitting (apply sparingly)	MPG	6,000
17	Clutch Master Cylinder (d)	Fill - ½" below opening	S12	6,000
18	Steering Gear Housing	To level of filler plug	SG	6,000
19	Battery Terminals (Except "ST" Type)	Keep coated	S3	6,000(i)
20	Electric Shift Unit (2 or 3 spd.) (d)	To level of filler plug	S7	12.000
21	Transmission (NP & GMC) (d)	To level of filler plug	MPO	6,000
		Drain and refill	MPO	12,000
21	Transmission (Clark & Fuller) (d)	To level of filler plug	GO	6,000
		Drain and refill	GO	12,000
21	Transmission (Spicer) (d)	To level of filler plug	ES	6,000
		Drain and refill	ES	12,000
21	Transmission - Auxiliary (d)	To level of filler plug	ES	6,000
		Drain and refill	ES	12,000
21	Transmission - Automatic (d)	Check level	S19	6,000
		Drain and refill	S19	12,000
22	Rear Axle	To level of filler plug	MPO	6,000(b)
		Drain and refill	MPO	12,000
23	Front Wheel Bearings (g)	Hand pack or use lubricator	MPG	20,000
24	Rear Wheel Bearings (h)	Hand pack or use lubricator	MPG	20,000(a)
25	Brake Cam Roller Pins (e)	Apply	E	20,000(a)
26	Steering Idler Lever (d)	1 fitting	MPG	6,000
27	Brake and Axle Cylinder Air Cleaner(d)	Clean and reinstall	-	6,000
28	Brake Master Cylinder (f)	Fill ½" below opening	S12	3,000(j)
29	Hood Latch Mechanism, Pivot Points and Hinges	Apply	S17	6,000(k)
30	Clutch Idler Levers (Note: Two clutch idler levers on MC & MB Models)	1 fitting	MPG	6,000
31	Speedometer Drive Adapter(d)	1 fitting	MPG	6,000

(a) Or once a year, whichever occurs first.
(b) Or every 6 months, whichever occurs first.
(c) When "MPG" (Multi-Purpose Grease) is specified, lubricate every 6,000 miles or 60 days.
(d) If used.
(e) Air cam brakes only.
(f) Hydraulic brakes only.
(g) Optional oil lubricated front wheel bearings use "GO" type oil.
(h) No periodic servicing with oil lubricated bearings (Stemco seals).
(i) No lube required on side terminal type battery.
(j) Or every 30 days, whichever occurs first.
(k) Or every 4 months, whichever occurs first.

LUBRICATION

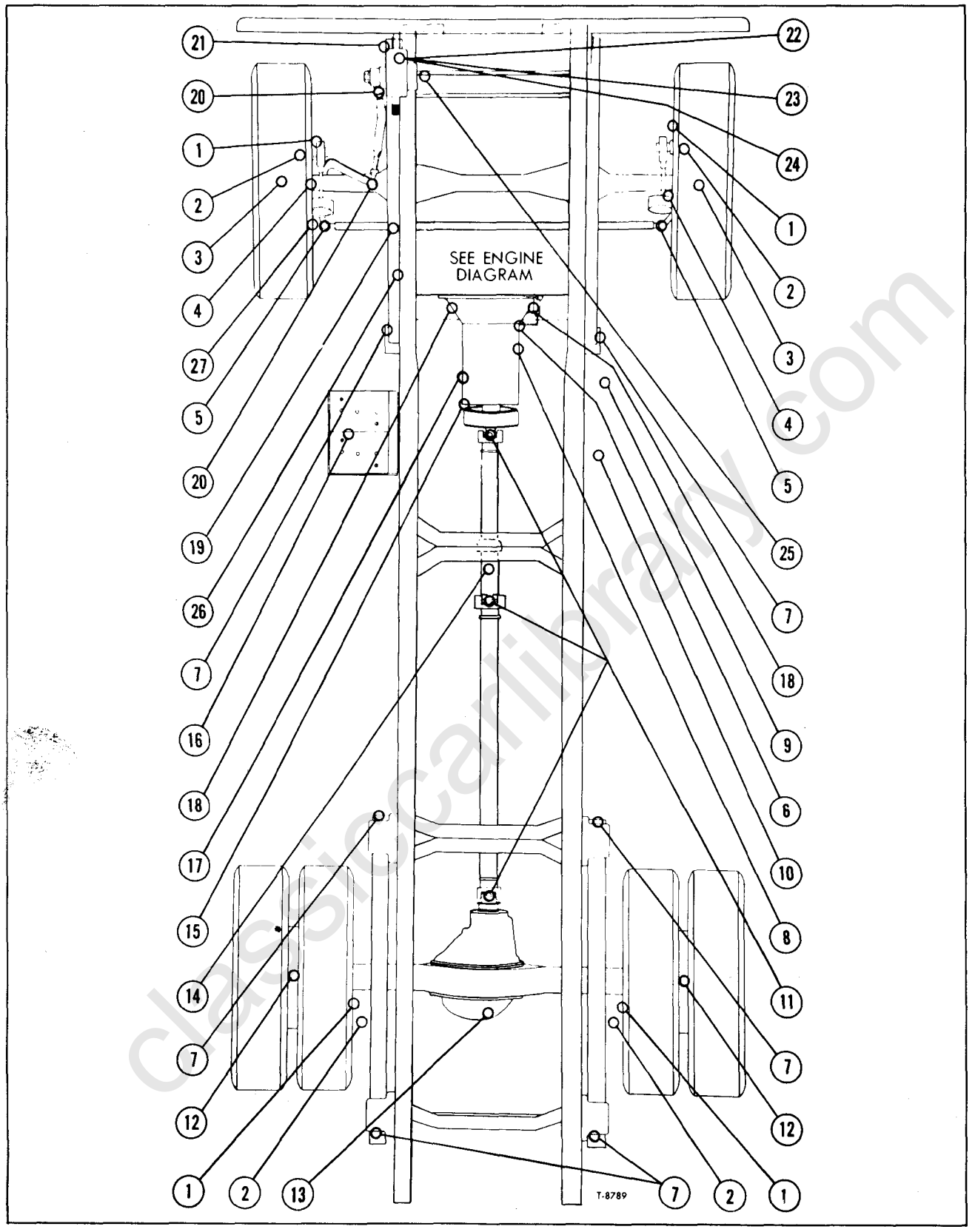


Figure 2–Lubrication Chart (Aluminum Tilt Cab Models)

LUBRICATION DATA
(CHART ON OPPOSITE PAGE)

Item No.	Item	Remarks	Symbol	Miles(c)
1	Brake Camshaft (d)	1 fitting each (apply sparingly)	MPG	6,000
2	Brake Cam Roller Pins (d)	Apply	E	20,000
3	Front Wheel Bearings (f)	Hand pack or use lubricator	MPG	20,000(a)
4	Steering Knuckles	2 fittings each side	MPG	6,000
5	Steering Tie Rod Ends	1 fitting each end	MPG	6,000
6	Clutch Release Bearing	Cup or fitting (apply sparingly)	S27	6,000
7	Spring Slip Pads	Apply each end	MPG	6,000
8	Transmission (Fuller)	To level of filler plug	GO	6,000
		Drain and refill	GO	12,000
8	Transmission (Spicer)	To level of filler plug	ES	6,000
		Drain and refill	ES	12,000
9	Blower Air Cleaner	See instructions (See SEC. 6M)	-	--
10	Tilt Cab Hydraulic System	To level of filler plug	S23	6,000
11	Propeller Shaft U-Joints	1 fitting each joint	MPG	6,000
12	Rear Wheel Bearings (g)	Hand pack or use lubricator	MPG	20,000(a)
13	Rear Axle	To level of filler plug	MPO	6,000
		Drain and refill	MPO	24,000(b)
14	Propeller Shaft Slip Joint	1 fitting each joint	MPG	6,000
15	Speedometer Adapter Cable (d)	1 fitting	MPG	6,000
16	Battery Terminals	Keep coated	S3	6,000
17	Transmission Shift Rod U-Joint	1 fitting each joint	MPG	6,000
18	Clutch Release Cross Shaft	1 fitting each end	MPG	6,000
19	Power Steering Cylinder Ends (d)	2 fittings	MPG	6,000
20	Steering Drag Link	1 fitting each end	MPG	6,000
21	Clutch Linkage (e)	3 fittings	MPG	6,000
22	Steering Gear Housing	To level of filler plug	SG	6,000
23	Steering Column U-Joints	1 fitting each joint	MPG	6,000
24	Steering Column Slip Joint	1 fitting	MPG	6,000
25	Accelerator Cross Shaft	1 fitting	MPG	6,000
26	Power Steering Reservoir (d)	To oil level mark	S32	6,000
27	Speedometer Drive Adapter (d)	1 fitting	MPG	6,000

(a) Or once a year, whichever occurs first.
(b) Or every six months, whichever occurs first.
(c) When "MPG" (Multi-Purpose Grease) is specified, lubricate every 6,000 miles or 60 days, whichever occurs first.
(d) If used.
(e) Front idler lever grease fitting is accessible through opening in front bumper. Rear idler lever grease fitting is accessible at transmission. Clutch pedal grease fitting through splash shield opening. (Loosen screw, then move access cover to expose grease fitting.)
(f) Optional oil lubricated front wheel bearings use "GO" type oil.
(g) No periodic servicing with oil lubricated bearings (Stemco seals).

LUBRICATION

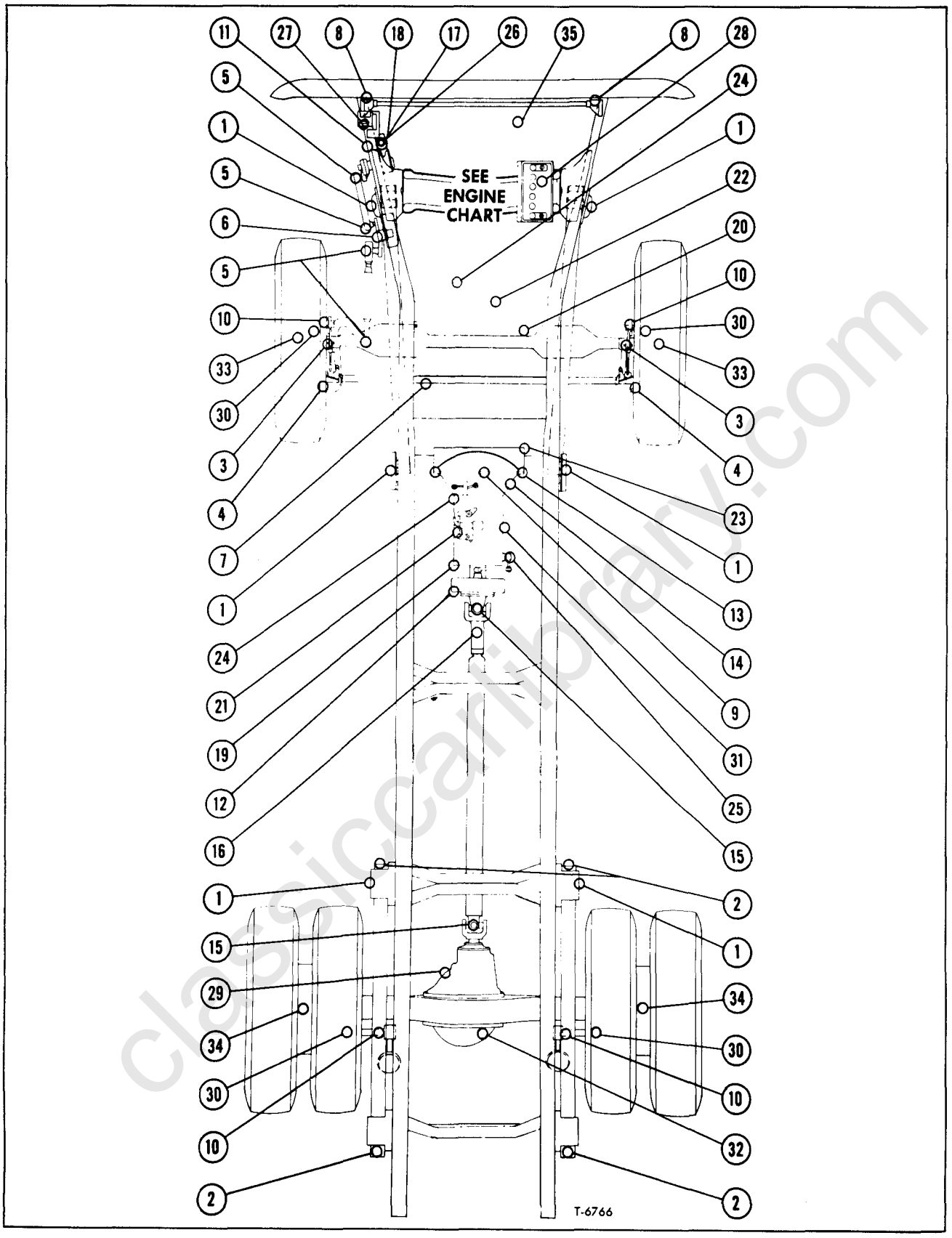


Figure 3—Lubrication Chart (Steel Tilt Cab Models)

LUBRICATION DATA
(CHART ON OPPOSITE PAGE)

Item No.	Item	Remarks	Symbol	Miles (c)
1	Spring Shackles and Brackets (d)	2 fittings each shackle	MPG	6,000
		1 fitting each bracket	MPG	6,000
2	Spring Slip Pads (d)	Apply each end	MPG	6,000
3	Steering Knuckles	2 fittings each side	MPG	6,000
4	Steering Tie Rod Ends	1 fitting each end	MPG	6,000
5	Steering Drag Links	1 fitting each end	MPG	6,000
6	Steering Idler Lever (d)	1 fitting	MPG	6,000
7	Power Steering Cylinder Ends (d)	2 fittings	MPG	6,000
8	Cab Hinges	1 fitting each side	MPG	6,000
9	Cab Hold-Down Latch	1 fitting	MPG	6,000
10	Brake Camshafts (d & e)	1 fitting each	MPG	6,000
11	Clutch and Brake Pedals	2 fittings	MPG	6,000
12	Tru-Stop Brake (d)	4 or 8 fittings	MPG	6,000
13	Clutch Release Cross Shaft (d)	1 fitting each side	MPG	6,000
14	Clutch Release Bearing (d)	Cup (when used)	S27	6,000
15	Propeller Shaft U-Joints	1 fitting each joint	MPG	6,000
16	Propeller Shaft Slip Joints	1 fitting each joint	MPG	6,000
17	Steering Column U-Joints	1 fitting each joint	MPG	6,000
18	Steering Column Slip Joint	1 fitting	MPG	6,000
19	Speedometer Adapter	1 fitting	MPG	6,000
20	Transmission Shift Levers	2 fittings	MPG	6,000
21	Transmission Shift Linkage (Clark)	2 fittings (N.P. 1 fitting)	MPG	6,000
22	Auxiliary Trans. Shift Tower (d)	1 fitting	MPG	6,000
23	Auxiliary Trans. Shift Levers (d)	2 fittings	MPG	6,000
24	Transmission Shift Rod U-Joints (d)	1 fitting each joint	MPG	6,000
25	Hand Brake Bell Crank (d)	1 fitting	MPG	6,000
26	Steering Gear Housing	To level of filler plug	SG	6,000
27	Clutch and Brake Master Cylinder (d)	Fill - ½" below opening	S12	6,000
28	Battery Terminals	Keep coated	S3	6,000
29	Electric Shift Unit (2-Spd. or 3-Spd.)	To level of filler plug	S7	12,000
30	Brake Cam Roller Pins (e)	Apply	E	20,000
31	Transmission (N.P.)	To level of filler plug	MPO	6,000
		Drain and refill	MPO	12,000
31	Transmission (Clark)	To level of filler plug	GO	6,000
		Drain and refill	GO	12,000
31	Transmission (Spicer)	To level of filler plug	ES	6,000
		Drain and refill	ES	12,000
31	Transmission - Auxiliary (d)	To level of filler plug	ES	6,000
		Drain and refill	ES	12,000
31	Allison Automatic (d)	Full mark on dipstick	S19	1,000
		Drain and refill	S19	12,000
32	Rear Axle	To level of filler plug	MPO	6,000
		Drain and refill	MPO	24,000 (b)
33	Front Wheel Bearings (f)	Hand Pack or use lubricator	MPG	20,000 (a)
34	Rear Wheel Bearings (g)	Hand Pack or use lubricator	MPG	20,000 (a)
35	Brake Air Cleaner	Clean and reinstall	-	6,000

(a) Or once a year, whichever occurs first.
(b) Or every 6 months, whichever occurs first.
(c) When "MPG" Multi-Purpose Grease is specified lubricate every 6,000 miles or 60 days, whichever occurs first.
(d) If used.
(e) Air Brakes only.
(f) Optional oil lubricated front wheel bearings use "GO" type oil.
(g) No periodic servicing with oil lubricated bearings (Stemco seals).

LUBRICATION

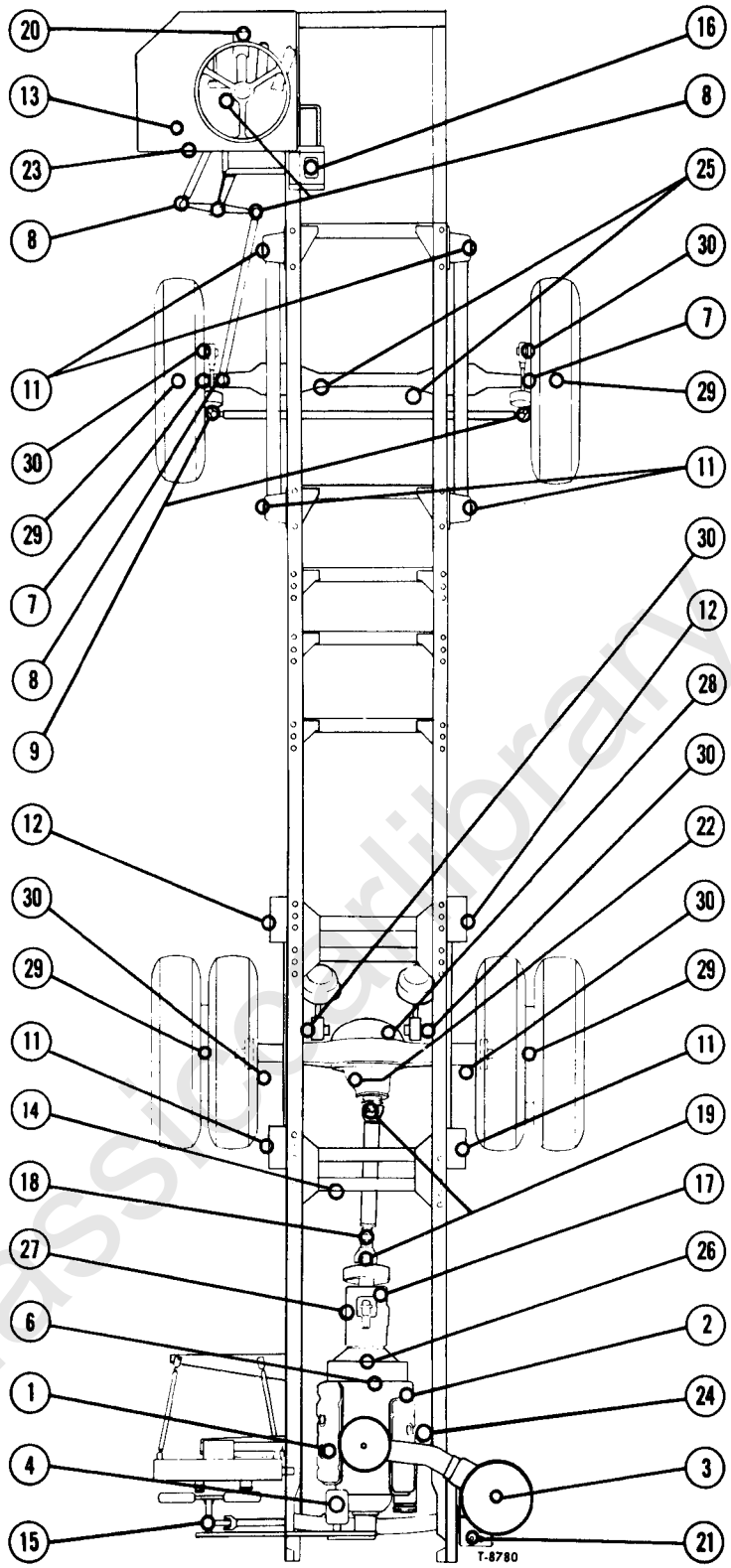


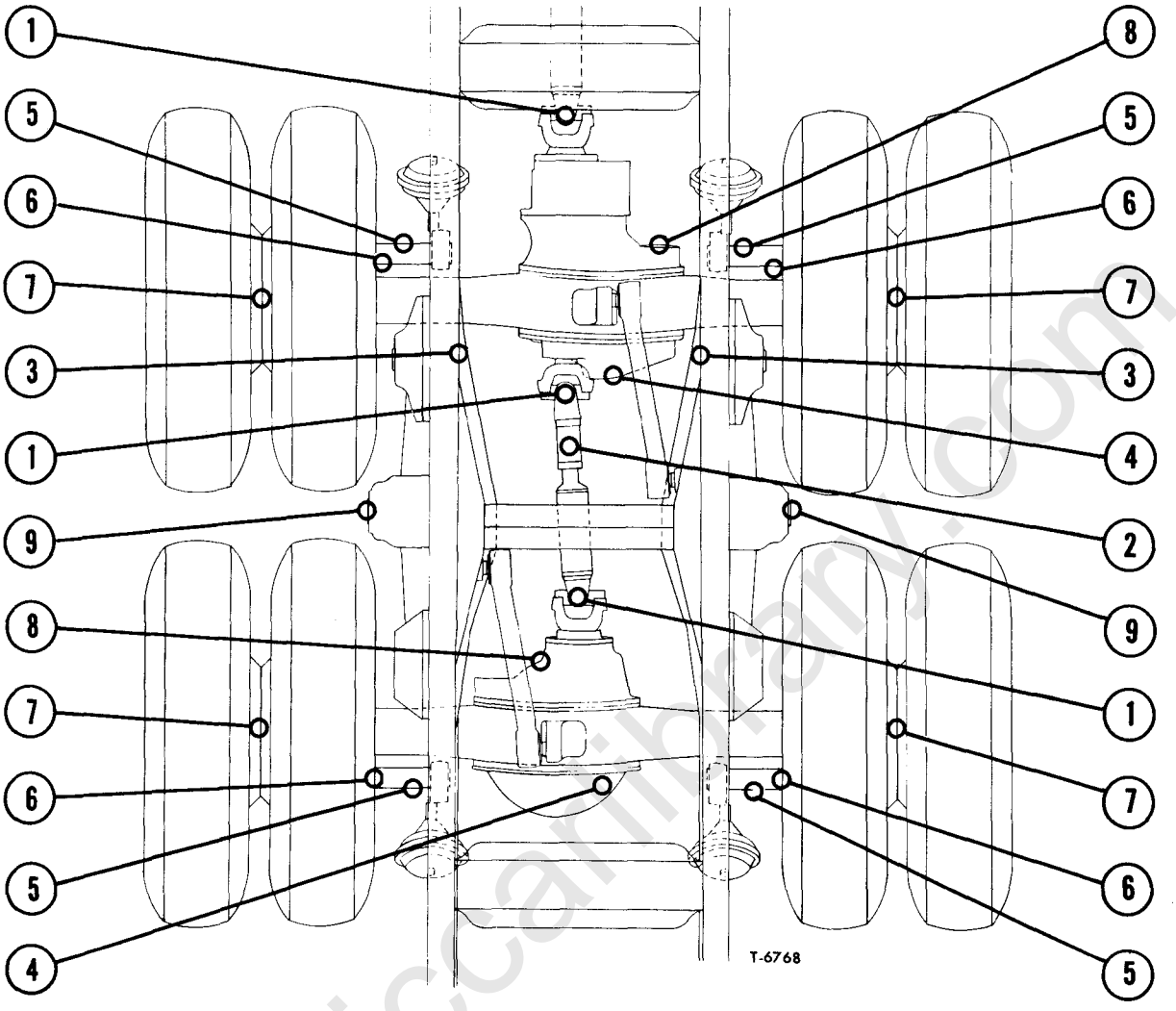
Figure 4—Lubrication Chart (Rear Engine Models)

LUBRICATION DATA
(CHART ON OPPOSITE PAGE)

Item No.	Item	Remarks	Symbol	Miles(c)
1	Engine	Keep to "FULL" mark	E	Daily
2	Engine Oil Filter	See Instructions	-	-
3	Carburetor Air Cleaner	Clean and refill. See Instructions	E	6,000
4	Generator	No lubrication required	-	-
6	Distributor	Breaker cam - sparingly	S3	6,000
		Breaker pivot - 1 drop	E	6,000
7	Steering Knuckles	2 fittings each side	MPG	6,000
8	Steering drag link Ends	1 fitting each end	MPG	6,000
9	Steering Tie Rod End	1 fitting each	MPG	6,000
10	Steering Idler Lever	1 fitting	MPG	6,000
11	Spring Brackets and Shackle	1 fitting each bracket	MPG	6,000
		2 fittings each shackle	MPG	6,000
12	Spring Slip Pads	Apply each side	MPG	6,000
13	Clutch Pedal (d)	1 fitting	MPG	6,000
14	Transmission Control Bell Crank	1 fitting	MPG	6,000
15	Fan Support	1 fitting	MPG	6,000
16	Transmission Shift Tower	2 fittings	MPG	6,000
17	Speedometer Adapter	1 fitting	MPG	6,000
18	Prop. Shaft Slip Joint	1 fitting	MPG	6,000
19	Prop. Shaft U-Joints	1 fitting each joint	MPG	6,000
20	Steering Gear Housing	To level of filler plug (Remove rubber cover)	SG	6,000
21	Battery Terminals (Post Type)	Keep coated	S3	6,000
22	Electric Shift Unit (2 Spd.) (d)	To level of filler plug	S7	12,000
23	Clutch master Cylinder (d)	Fill - ½" below opening	S12	6,000
24	Power Steering Reservoir (d)	To "OIL LEVEL" mark	S32	6,000
25	Power Steering Cylinder Ends (d)	2 fittings	MPG	6,000
26	Clutch Release Bearing (d)	1 fitting - sparingly	S27	6,000
27	Transmission (Clark)	To level of filler plug	GO	6,000
		Drain and refill	GO	12,000
27	Transmission (Allison MT 42)	Check level	S19	6,000
		Drain and refill	S19	24,000(e)
28	Rear Axle	To level of filler plug	MPO	6,000
		Drain and refill	MPO	24,000(b)
29	Wheel Bearings	Hand pack or use lubricator	MPG	20,000(a)
30	Brake Camshaft (F. & R.)	1 fitting each - sparingly	MPG	6,000

(a) Or once a year, whichever occurs first.
(b) Or every 6 months, whichever occurs first.
(c) When "MPG" Multi-Purpose Grease is specified lubricate every 6,000 miles or 60 days, whichever occurs first.
(d) If used.
(e) 12,000 miles under severe operation (change filter when changing oil).

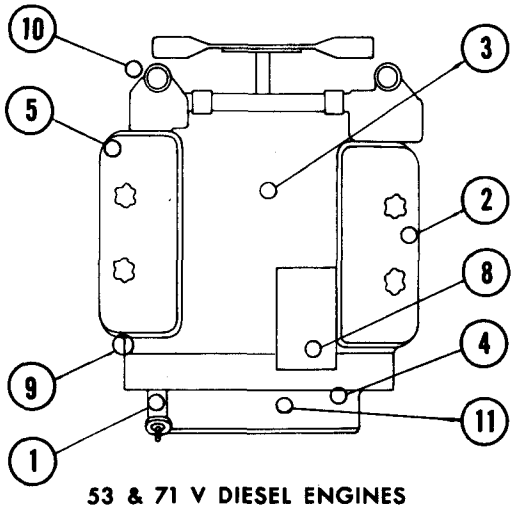
LUBRICATION



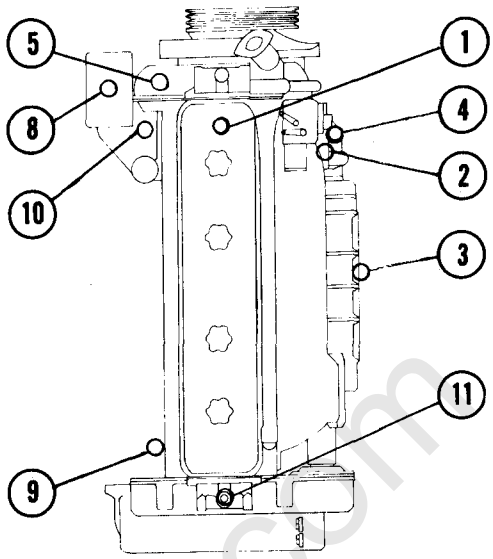
Item No.	Item	Remarks	Symbol	Miles
1	Propeller Shaft U-Joint	1 fitting each joint	MPG	3,000
2	Propeller Shaft Slip Joint	1 fitting each joint	MPG	3,000
3	Rear Spring Pin (c)	1 fitting each side	MPG	6,000
4	Rear Axles	To level of filler plug	MPO	6,000
		Drain and refill	MPO	24,000(b)
5	Brake Camshafts (c)	1 fitting each	MPG	6,000
6	Brake Shoe Roller Pins (c)	Apply	E	20,000
7	Wheel Bearings (d)	Hand pack or use lubricator	MPG	20,000(a)
8	Axle Shift Unit (2 or 3 Speed) (c)	To level of filler plug	S7	12,000
9	Equalizer Beam (RT 380)	1 fitting each beam	MPG	6,000

(a) Or once a year, whichever occurs first. (b) Or every 6 months, whichever occurs first. (c) If used. (d) No periodic servicing with oil lubricated bearings (Stemco seals).

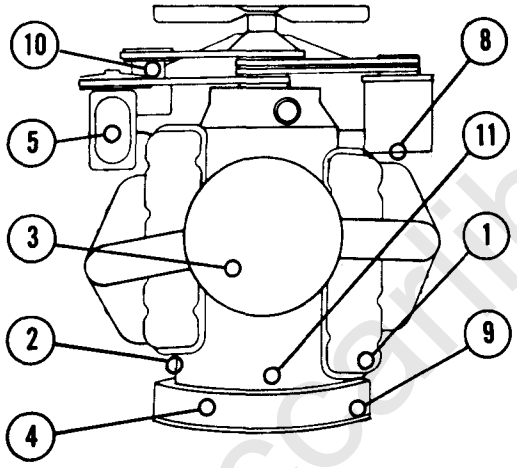
Figure 5—Lubrication Chart Tandem Bevel (SLHD, SQHD, SSHD, 30DS, 34DS, and 34D3)



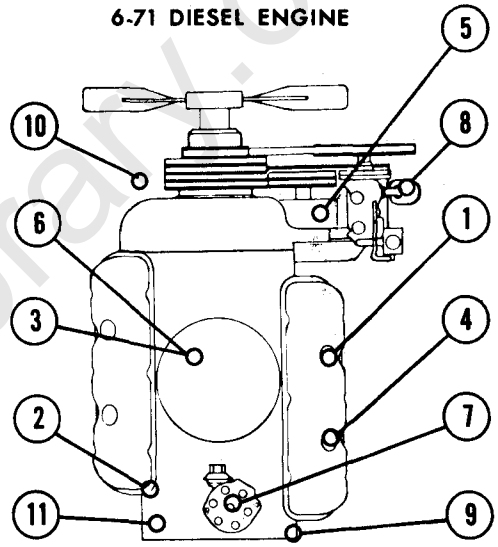
53 & 71 V DIESEL ENGINES



6-71 DIESEL ENGINE



TURBIUM ENGINE



V GASOLINE ENGINE T-9022

Item No.	Item	Remarks	Symbol	Miles
1	Engine	Keep to "FULL" mark	E	Daily
2	Engine Oil Filter	See instructions	-	-
3	Engine Air Cleaner	See instructions (Sec. 6M)	-	-
4	Crankcase Breather	See instructions	-	-
5	Air Compressor Air Strainer (b)	Clean and install	-	6,000
6	Governor Air Filter (c)	Clean and install	-	6,000
7	Distributor (c)	½ turn of cam lubricator	-	12,000 (a)
		Breaker pivot - 1 drop	E	6,000
		Rotor felt - 4 drops	E	6,000
8	Generator	No lubrication required		
9	Starter	See instructions	E	-
10	Power Steering Reservoir (b)	To "OIL LEVEL" mark	S32	6,000
11	Tachometer Adapter (b)	1 fitting	MPG	6,000

(a) Replace lubricator at 24,000 mile intervals. (b) If used. (c) Gas Engine Only.

Figure 6—Engine Lubrication Chart (Except Cummins)

LUBRICATION

CRANKCASE CAPACITIES

ENGINE MODEL	QTS. LESS FILTER		QTS. WITH FILTER	
	U.S.	IMP.	U.S.	IMP.
401M	8	6¾	10	8¼
478M	8	6¾	10	8¼
637	17	14¼	19	15¾
6V-53	14	11¾	16	13¼
6-71	17	14¼	19	15¾
8V-71	22	18¼	24	20
12V-71	34	28¼	38	31¾
NH230	20	16¾	23	19¼
NHC250	20	16¾	23	19¼
NTC270E*	28	23¼	45	37½
NTC335*	28	23¼	45	37½
NTC350*	28	23¼	45	37½
V-903	23	19¼	26	21¾

* Luberfiner Std.

Note: Add 1 qt. when oil cooler (if used) is drained.

Crankcase capacities are for normal refill. Add oil as indicated when oil filter is drained and element changed. Capacities given may be approximate - keep level as close as possible to "FULL" mark without over-filling. Do not operate with level below "ADD" mark, or "LOW" mark.

ENGINE OIL (DIESEL ENGINE) (SYMBOL "E" ON CHARTS)

ENGINE OIL RECOMMENDATIONS

Use only high quality oils which are intended for Service Designations "MS" and "DM" (SE/CC New A.P.I. Designation) see NOTE.

The following additive limitations, which require emphasis, have been placed on the recommended MIL-L-2104B (now superseded by MIL-L-46152) and Supplement 1 oils.

1. Sufficient zinc dithiophosphate to produce a minimum of 0.07 and a maximum of 0.10 per cent by weight.

2. Sulfated ash (ASTM D-874) of 1.00 per cent maximum by weight, except lubricants that contain only barium detergent-dispersants where 1.50 per cent by weight is allowed.

NOTE: Supplement 1 engine oils (based upon now obsoleted MIL-L-2104A) have been superseded by MIL-L-2104B engine oils. However, Supplement 1 engine oils MS-DM (SE/CC New A.P.I. Designation), with a history of satisfactory performance are available, and may be used.

The use of proper engine oils and oil change intervals are your best assurance of continued reliability and performance from your engine.

IMPORTANT: Non-detergent and other lower quality engine oils are specifically not recommended.

ENGINE OIL (GAS ENGINE) (SYMBOL "E" ON CHARTS)

ENGINE OIL RECOMMENDATIONS

Use only high quality oils which are intended for Service Designations "MS" and "DM" (SE/CC New A.P.I. Designation).

NOTE: Supplement 1 engine oils (based upon now obsoleted MIL-L-2104A) have been superseded by MIL-L-2104B engine oils. However, Supplement 1 engine oils MS-DM (SE/CC New A.P.I. Designation), with a history of satisfactory performance are available, and may be used. (MIL-L-2104B is now superseded by MIL-L-46152.)

The use of proper engine oils and oil change intervals are your best assurance of continued reliability and performance from your engine.

IMPORTANT: Non-detergent and other lower quality engine oils are specifically not recommended.

LUBRICATION OIL (SPECIAL) (SYMBOL "ES" ON CHARTS)

Oils such as "Aviation Grade Engine Oil" or S.A.E. 50 Heavy Duty Engine Oils may be used. Use of S.A.E. 30 is recommended when temperature falls below 0°F. instead of 32°F. on page 0-19 of Service Manual ST135-70.

POWER STEERING FLUID (SYMBOL "S32"ON CHART)

GM Approved Hydraulic Power Steering Fluid is available through wholesale warehouses and truck centers. Check fluid level every 6,000 miles or 4 months, whichever occurs first. Fill pump reservoir to proper level. If GM Power Steering Fluid is not available, DEXRON® Automatic Transmission Fluid (Symbol S19) may be used.

CAUTION: DO NOT use GM Power Steering Fluid in automatic transmissions.

SECTION 1

Cab and Body Mountings

Maintenance information on cab subjects common to models covered by this supplement is the same as contained in 1970 Heavy Duty Truck Service Manual ST135-70, pages 1-1 through 1-142, except for the following:

DOOR LOCK STRIKER ADJUSTMENT (ALL CABS)

The following is additional information applicable to all models covered by this supplement:

1. Adjust door lock striker after door seals have been installed.
2. Check to make sure the striker bolt aligns with center of "V" on door as shown in figure 1.
3. Close door slowly and listen for the first click in the door latch (secondary latch position - safety lock only).
4. Observe relative location of the door to the cab side panel. Door should be approximately 3/8-inch out-of-flush with cab side panel.
5. Open the door, then slam door and determine if door is in primary latch position. Door should be flush with cab side panel.
6. If the latch will not reach primary latch position, loosen striker bolt and move it inward on aluminum tilt cab models or outward on conventional cab or steel tilt cab models. Tighten striker bolt firmly.
7. Repeat the above procedure until door reaches primary latch position and the door is flush with cab side panel and is securely latched.

NOTE: Striker bolt is adjusted vertically and transversely by loosening it with a 5/16-inch hex wrench. The bolt fore and aft adjustment is obtained by use of shim spacers located between the bolt washer and the base.

8. After proper adjustments have been completed, inspect the door lock for proper operation.

DOOR LOCK INSTALLATION INSPECTION (ALL CABS)

1. Lower window and depress locking button to locked position. Close door without depressing outside or inside handles.
2. Actuate inside and outside handles to ensure the door will not unlatch.
3. Raise locking button to unlocked position.
4. Actuate outside push button to open the door.
5. Actuate inside handle through full travel and release slowly to rest position. Depress outside push button through full travel and release slowly to rest position. Without depressing outside or inside handles, slowly close door until latch reaches first click (secondary latch position); then apply a swift manual pull on door handle (attempt to open door) to assure that door will not open.
6. Actuate inside handle to open the door.

HEATING SYSTEM (CONVENTIONAL CAB MODELS)

Some series 90 conventional cab models are equipped with heater line shut-off valves, which are installed at the engine end of lines. If it becomes necessary to service any heater system components, the valves can be closed, making it unnecessary to drain the entire heating system.

CAB MOUNTINGS (CONVENTIONAL CAB MODELS)

Four point type cab mountings are used on these vehicles.

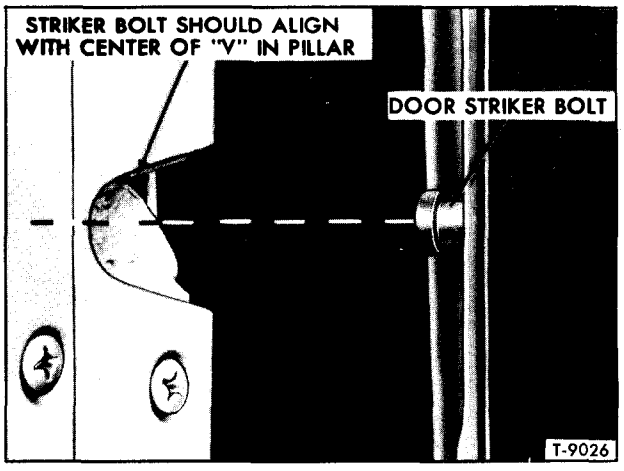


Figure 1—Checking Striker Bolt Adjustment

CAB AND BODY MOUNTINGS

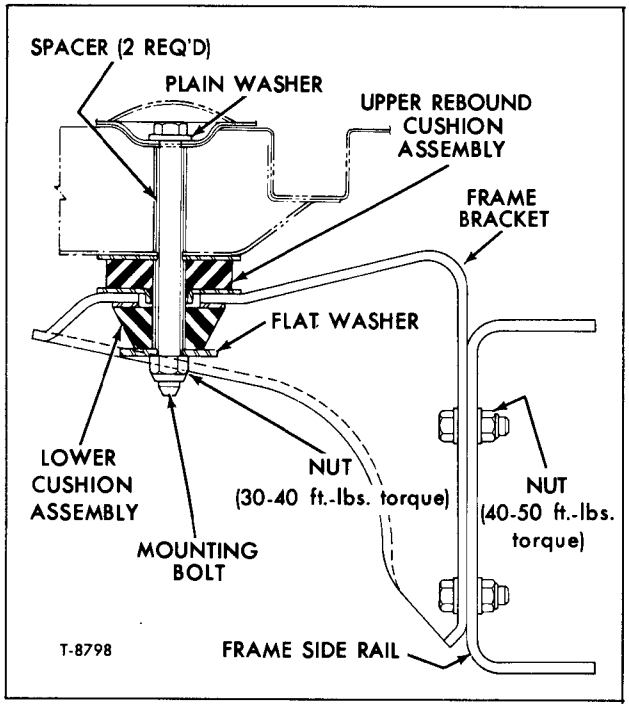


Figure 2—Cab Front Mount (with Upper and Lower Cushion)

The front mount consists of an upper and lower cushion assembly as shown in figure 2, or a one-piece cushion assembly as shown in figure 3.

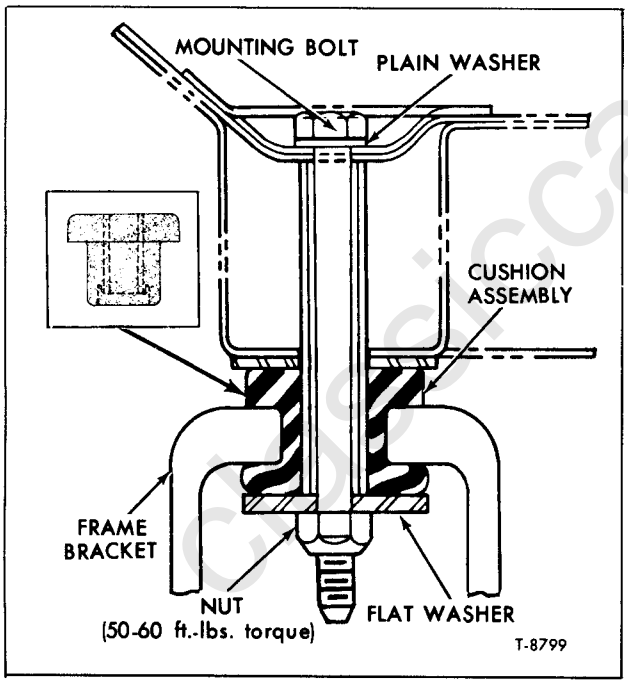


Figure 3—Cab Front Mount (with One Piece Cushion)

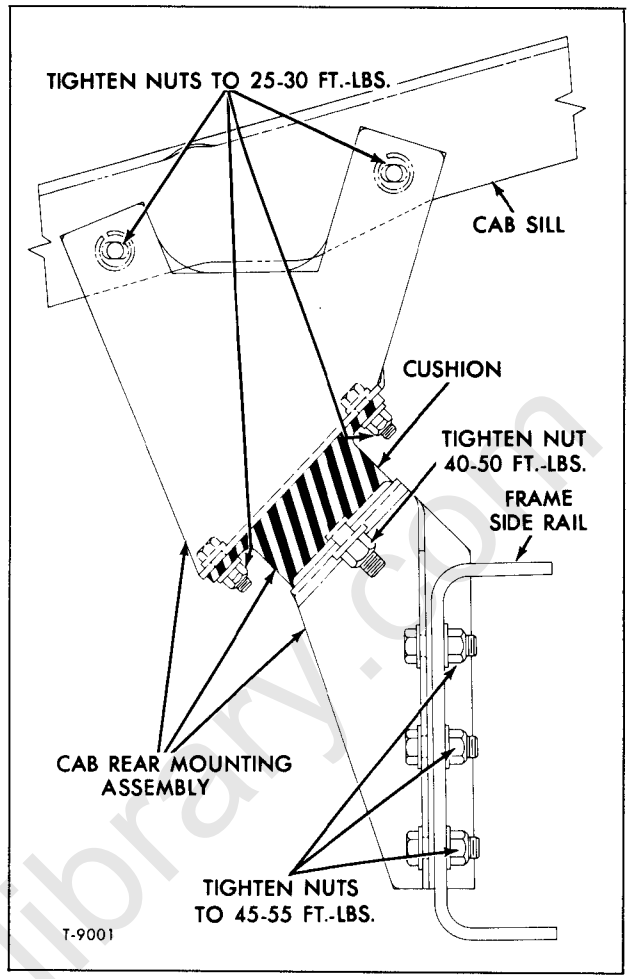


Figure 4—Cab Rear Mounting

Cab rear mounts are of the semi-sheer type and are serviced only as an assembly. The semi-sheer type rear mounts are bolted to the cab sill and the frame side rail as shown in figure 4.

At regular intervals, all cab mountings should be checked for loose attaching parts and for deteriorated or collapsed rubber cushions.

Any one cab mounting can be readily replaced after removing the weight of cab from that particular mounting.

IMPORTANT

Raise cab only to height necessary to replace mounting components. If cab is raised too high, damage to vehicle wiring, operating controls, and lines may occur.

AIR OPERATED WINDSHIELD WIPERS

DUAL WIPER CONTROL VALVES

All model vehicles with air operated windshield wipers are equipped with dual control valves as shown in schematic (fig. 5).

The control knob at left operates left wiper and control knob at right operates right wiper.

To operate wipers, turn wiper control knobs counterclockwise toward run position. Variable speed air powered wiper motors will operate wipers. To stop wipers, turn knobs clockwise to park position. If blades do not park properly momentarily, turn knob or knobs clockwise against spring tension beyond park position. Blades will park.

NOTE: Speed of the wiper motors is controlled by the control valves.

To check control valve, connect air supply line to "IN" port and turn control on. If air flows from the "RUN" port only the control is operating properly. If air flows from the "PARK" port as well as the "RUN" port, the rubber slide valve is defective, and the control valve can be serviced as described in 1970 Heavy Duty Truck Service Manual ST135-70, Section 1A, page 1-21.

NOTE: When using Valve Service Kit, assemble new pre-greased valve to backing plate and place valve cavity in correct position to receive control stem. Lubricate with Silicone Grease Type GE-SS-4067 or DC-4.

IMPORTANT: Be sure to replace old slide valve (fig. 6) with new valve of the same thickness.

WIPER MOTOR AIR LINES

(Refer to Figure 7)

Air lines for models covered in this supplement are of nylon type lines with brass fittings. Nylon ferrule design or metal ball sleeve design is available for service.

WIPER BLADE REPLACEMENT

(Refer to Figure 8)

1. Hold fillister head screw with screwdriver and remove lock nut. Remove screw which is threaded into wiper arm and remove blade. Reverse procedure to install.

IMPORTANT: Turning the fillister head block attaching screw too far into the wiper arm will bend the blade arm and cause blade to bind and wipe erratically.

NOTE: Curved windshield wiper blade is designed to accept a refill insert for service replacement.

AIR OPERATED WIPER MOTOR SERVICING (CONV. CAB MODELS)

If inspection indicates a faulty wiper motor unit, the unit can be readily removed from vehicle, disassembled and repaired. For repair information see "Troubleshooting and Repair of Wiper System" later in this section.

WIPER MOTOR REPLACEMENT

Removal

1. Disconnect lines at motor.
2. Remove the four motor mounting plate-to-cowl bolts and nuts.
3. Move motor forward from cowl, then through cowl opening, disconnect transmission link from motor crank arm. The link attached to the right motor is retained with two small nut assemblies. The left motor is connected to link with a spring clip and flat washer. Remove wiper motor.

Installation

NOTE: Before installing motor, remove any old sealing compound from around motor mounting surfaces, then apply bead of new compound to surfaces. Install motor in the reverse sequence of the "Removal" procedure.

TRANSMISSION AND LINKAGE REPLACEMENT

NOTE: Access to transmissions and linkage can be obtained from under dash panel at left side and by removing ash tray panel at the right side. The linkage connection at the motor crank arms is

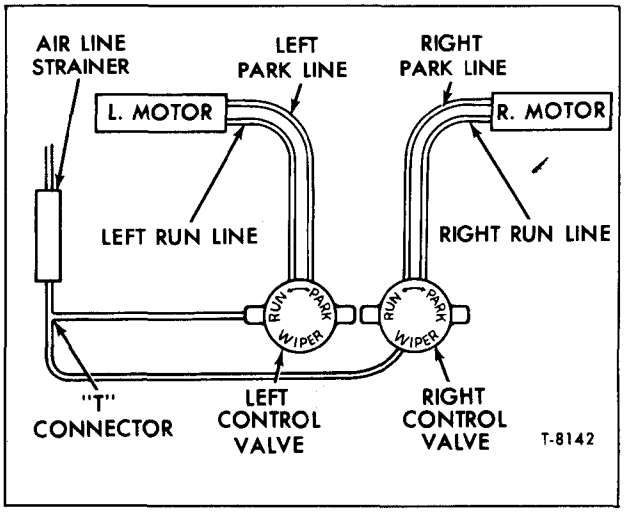


Figure 5—Dual Wiper Control Valve Schematic

CAB AND BODY MOUNTINGS

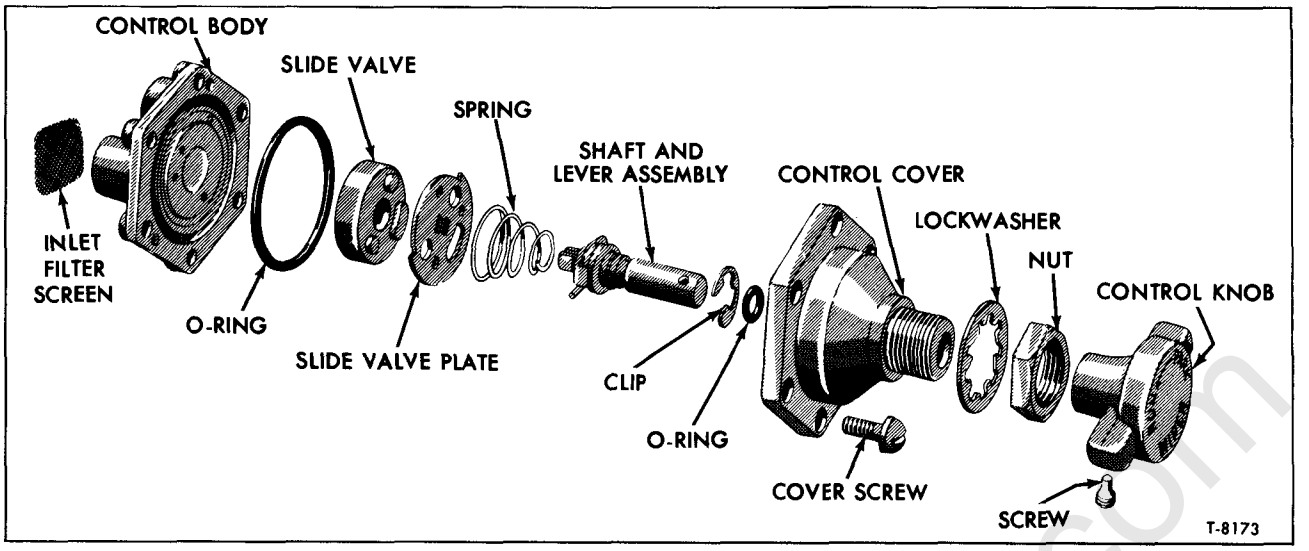


Figure 6—Exploded View of Windshield Wiper Control Valve

accessible after moving the motor outward from cowl, then reaching through the cowl opening.

1. Remove the wiper arm from transmission shaft, then remove the special retaining nut, steel washer and seal washer from transmission at front of cowl.

2. Remove the two cross-recess screws which attach transmission unit to cowl bracket. Separate the wiper motor from cowl for access to linkage connection at motor crank or separate connection from rear side of cowl. Remove transmission and link. If desired, the link can be separated from transmission shaft arm.

3. In the event motor was removed, make sure new sealing compound is applied to motor mounting base before installing. Also, use a new seal washer or one in good condition under the special retaining nut at the transmission shaft, forward of cowl.

MOTOR REPAIR

Key numbers in text refer to figure 9.

For all internal repairs it is necessary to remove valve head assembly (26). If necessary to take motor apart, all parts should be carefully checked for wear and lubricated before assembly. Worn or damaged parts should be replaced.

Valve Head Replacement and Repair

1. Remove six valve head attaching screws (27) and turn motor shaft (8) so that gear rack assembly (24) is brought back as near as possible to the valve head assembly (26).

2. Lift valve head (26) and unhook valve stop unit assembly (22).

3. To repair valve head assembly, refer to figure 10 and proceed as follows:

a. Remove brass fitting and brass cylinder from valve head, then two brass washers, piston and O-ring.

b. To remove valve from valve head, refer to inset of figure 10, and remove spring from valve bracket. Valve bracket and valve stop unit bracket can be removed from valve head. Remove valve from valve head assembly (park line).

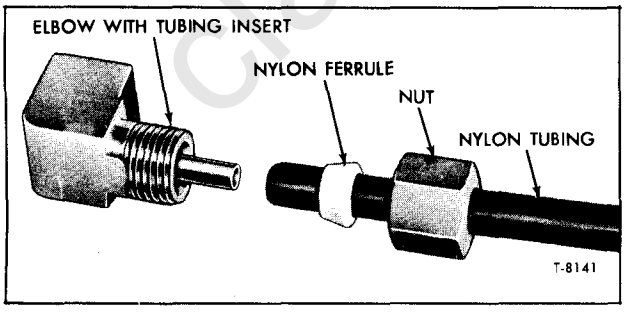


Figure 7—Wiper Motor Air Line Connection (Typical)

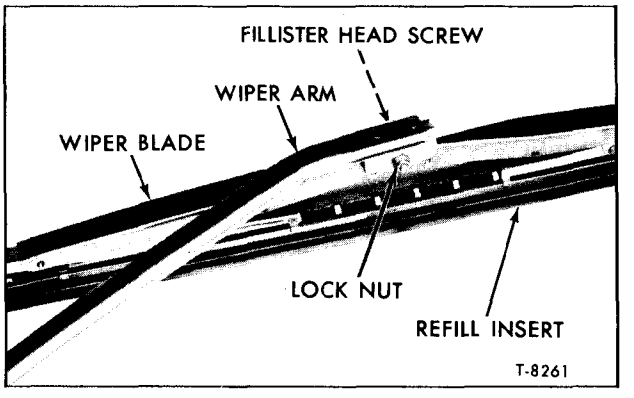


Figure 8—Wiper Blade Replacement

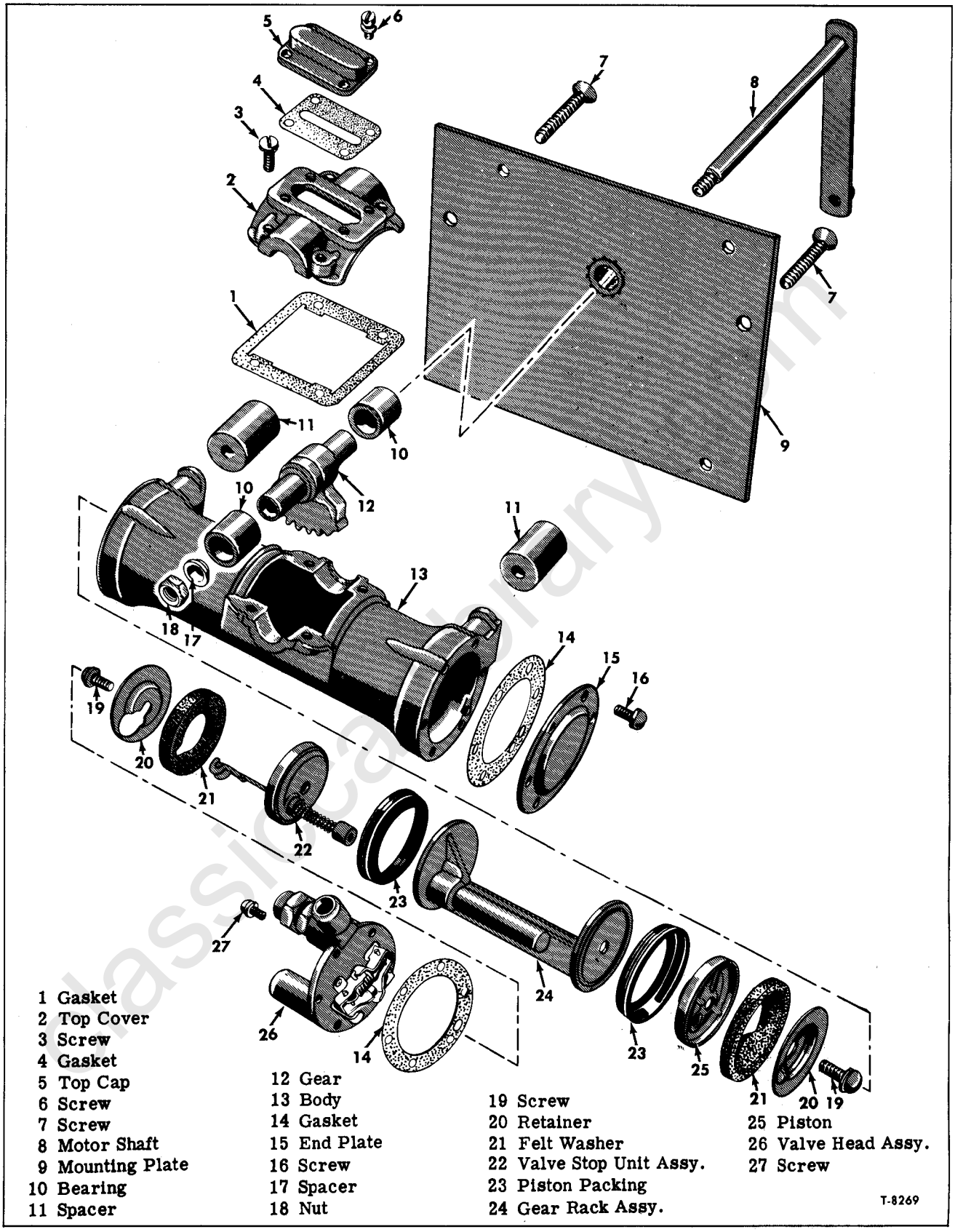


Figure 9—Air Operated Windshield Wiper (Series 90 Conventional Cab)

CAB AND BODY MOUNTINGS

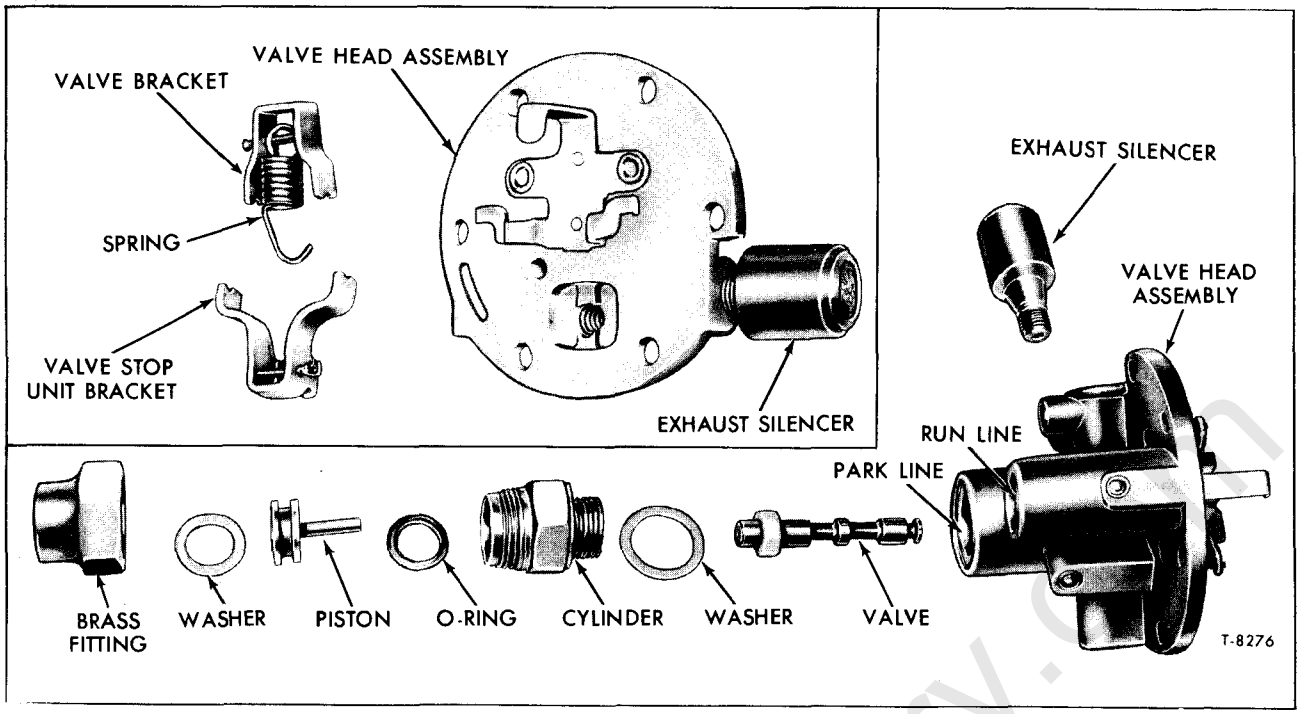


Figure 10—Valve Head Assembly Components

c. Reassemble in reverse order of disassembly making sure all parts are clean and lubricated with Silicone Grease Type GE-SS-4067 or DC-4. Make sure valve is properly hooked in valve bracket.

4. To replace valve head assembly (26), move gear rack assembly (24) as near to the opening as possible.

NOTE: Use new gasket (14) when replacing valve head assembly.

5. Raise valve stop unit (22) and hook under pin on valve stop unit bracket (fig. 10), making sure that air passage in head is directly opposite air tube in cylinder.

6. Move rack assembly (24) slightly away from end to provide clearance and install 6 attaching screws.

Piston Packing and Valve Stop Unit Replacement

1. Remove valve head assembly (26) as outlined previously.

2. Remove top cover (2) by removing four attaching screws (3).

IMPORTANT: Be sure top covers (2) position are marked so that they can be positioned exactly when assembling.

3. Remove two mounting plate screws (7) and spacers (11), then remove shaft (8), gear (12) with bushings (10).

4. Gear rack (24) can now be withdrawn from cylinder body (13).

NOTE: If necessary, tapered motor shaft (8) can be pressed from gear (12) and bushings (10) by removing nut (18) and spacer (17). Note position of shaft arm and teeth of gear are both in down position for correct installation.

5. Remove screw (19) from both ends of gear rack (24) to remove piston packing (23), piston (25), valve stop unit (22), washer (21) and retaining ring (20).

6. Clean all parts thoroughly, replacing damaged or worn packing or other parts. Lubricate packing and cylinder walls with a special formula grease designed for this purpose (Silicone Grease Type GE-SS-4067, or DC-4).

7. Assemble parts, making sure they are placed in their relative position as shown in figures 9 and 10.

IMPORTANT: A shim can be used to slip the gear rack assembly into the cylinder as follows:

a. Wrap entire gear rack (24) (with piston packing, piston, washer, and retaining ring installed) in steel shim stock.

b. Insert gear rack and shim into cylinder far enough to pass opposite end of opening in cylinder body. Hold shim stock and push rack assembly down as far as it will go. Hold rack assembly at this point with screwdriver and withdraw shim.

c. Lubricate end of cylinder (13) before replacing valve head (26).

NOTE: When installing gear (12) into gear rack (24) make sure that the teeth match the rack

(the last tooth in sector should mesh with the last tooth of rack at either end).

Stop Screw Adjustment

IMPORTANT: The following instructions must be carefully followed, otherwise screws will be improperly set:

1. Turn wiper on and allow to operate at slowest possible speed.
2. Remove top cap cover (fig. 9) by prying up with screwdriver, forcing out rivet.
3. Loosen lock nut and run down stop screw until wiper is stopped by screw.
4. Back out screw just enough to permit wiper to operate. With stop screw in this position, run down and tighten lock nut.
5. Repeat the previous operation on the remaining stop screw.

TROUBLESHOOTING AND REPAIR OF WIPER SYSTEM

WIPER MOTOR TROUBLESHOOTING

A general inspection of wiper system should precede any attempt to repair motor. Be sure to check air line for plugged fittings, kinked tubing or leaks. Make sure that all connections are tight.

NOTE: A quick method to check for leaks is to disconnect the line, stop up one end and blow smoke through the other, this will reveal the point of leakage, if any.

IMPORTANT: Exhaust silencer assembly (fig. 10) should be replaced when it becomes clogged. Tighten exhaust silencer to 30 to 35 inch-pounds torque.

If air line is satisfactory, turn on wiper regulating valve to diagnose motor trouble as follows:

CONDITION	PROBABLE CAUSE
a. Wiper works slowly or uneven.	Shaft bind. Make sure that shaft is free and does not bind in the hole.
b. Wiper runs slowly and without power.	Packing leaks. Defective valve.
c. Wiper runs with jerks.	Bent valve stop unit.
d. Wiper works only in one direction.	Broken valve stop unit. Valves are bent or sticky.
e. Wiper will not run.	Air line plugged. Valve defective or broken. Gear sector broken. Wiper valve or piston gummed up due to foreign deposits, due to dirty air line.

CAB AND BODY MOUNTINGS

IMPORTANT

ALWAYS WEAR HEAVY TYPE GLOVES TO PREVENT INJURY WHEN HANDLING GLASS.

IMPORTANT

NEVER SLEEP IN CAB UNLESS ADEQUATE VENTILATION IS PROVIDED.

IMPORTANT

DO NOT DRILL ADDITIONAL HOLES IN FRAME.

DO NOT WELD HEAT TREATED FRAMES.

SECTION 2

Frame

All information pertaining to frames as described in 1970 Heavy Duty Truck Service Manuals ST135-70 and Supplement ST332-71, FRAME (SEC. 2) is applicable to models covered by this supplement. The following updated information will also apply:

GENERAL RULES

Listed below are general rules which apply to frame repair and reinforcements. Most of these rules are discussed in the 1970 Heavy Duty Truck Service Manual ST135-70; however, the importance of adhering to them cannot be overemphasized.

1. Always identify the material of base rail.
2. Frame straightening or repair must be attempted only by highly qualified specialists.
3. Always attempt to identify the cause of failure.
4. Fifth wheel, body, and accessory mountings should not be made through frame flanges. (See "Body Builder's Book.")
5. Do not drill holes in the lower flanges.
6. Use only proper electrodes as specified for base rail material when welding is necessary.
7. Do not use oxyacetylene welding equipment on frames.
8. Do not weld reinforcements across the frame flanges.
9. Do not weld within ¾-inch of the edge of a frame flange.
10. Remove all notches or weld build-ups from flange edge when repairing a broken frame.
11. Do not weld cast brackets to frame.
12. Do not weld the flange of cracked reinforcements and base rails together.
13. Do not patch cracks. Properly repair and reinforce the area.
14. Reinforcement should be of the same or better material than base rail.
15. Always scarf reinforcement ends to provide adequate stress relief.
16. Always stagger ends of reinforcements by a minimum of eight inches apart.
17. Before welding, disconnect negative battery cable to prevent possibility of electrical damage to generating system.

Vehicle load capacity is dependent upon frame strength and rigidity. To assure effective repairs in the event of damage, frame service should be undertaken only by competent personnel using proper materials and equipment.

Improper welding or welding methods are a major cause of stress concentration points, which may ultimately result in frame failure. (Refer to "General Welding Instructions" in the Heavy Duty Truck Service Manual ST135-70.)

FRAME SPECIFICATIONS

ELECTRODE CHARTS

Electrodes
E-7011 E-7016 E-7018 E-11016 E-11018

Available Sizes	Current Range	Arc Voltage
Flat Welding		
5/64" x 9"	30— 60	20—22
3/32" x 12"	45— 80	21—23
1/8" x 14"	80—115	21—23
5/32" x 14"	125—165	22—24
3/16" x 14"	160—200	22—24
7/32" x 18"	200—250	23—25
1/4" x 18"	250—320	23—25
5/16" x 18"	325—400	24—28
Overhead Welding		
3/32" x 12"	45— 75	20—22
1/8" x 14"	80—125	20—24
5/32" x 14"	120—190	21—24
3/16" x 14"	150—240	21—24

PLUG WELD CHART

Thickness of Material	Diameter of Plug	Depth of Plug
1/4	3/4	1/4
3/8	1	3/8
1/2	1-1/8	7/16
5/8	1-1/4	1/2
3/4	1-3/8	9/16
1	1-1/2	9/16

S.A.E. 950 HIGH STRENGTH LOW ALLOY STEEL

Trade Name	Type	Source
N-A-X	—	Great Lakes Steel
Jalten	#1	Jones & Laughlin Steel Company
Republic Double Strength		Republic Steel Company
Republic "50"	—	Republic Steel Company
Yoloy	"S"	Youngstown Steel & Tube Company
Man-Ten	—	U.S. Steel
Medium-Manganese	—	Bethlehem Steel Company
Tri-Ten	"E"	U.S. Steel

HIGH PERFORMANCE STEEL

Trade Name	Source
Van "80"	Jones & Laughlin Steel Company

FRAME WIDTHS

Model	Front Width*	Rear Width*
"M", "H" and "J"	34-1/8"	34-1/8"
"W" and "T"	53-5/16"	34-1/16"
"R"	34-1/8"	34-1/8"
"D" and "F"	34"	34"

*Outside Dimension of Base Rails

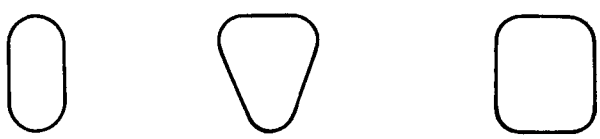
ELECTRODE USAGE WITH FRAME MATERIAL

Material	1023-950	High Performance (Van "80")
Type or Electrode	E-7011	E-11016
	E-7016	E-11018
	E-7018	

SIDE RAIL MATERIAL IDENTIFICATION

(Location—Centerline of Front Axle)

SAE1023 SAE950 High Performance



SECTION 3
Front Suspension
SECTION 3A
Front End Alignment

All information and alignment instructions in the 1970 Heavy Duty Truck Service Manual ST135-70 "FRONT END ALIGNMENT" (SEC. 3A) are applicable to Models covered by this supplement. An updated "Front End Alignment Specifications" chart and current illustrations are included.

FRONT END ALIGNMENT SPECIFICATIONS

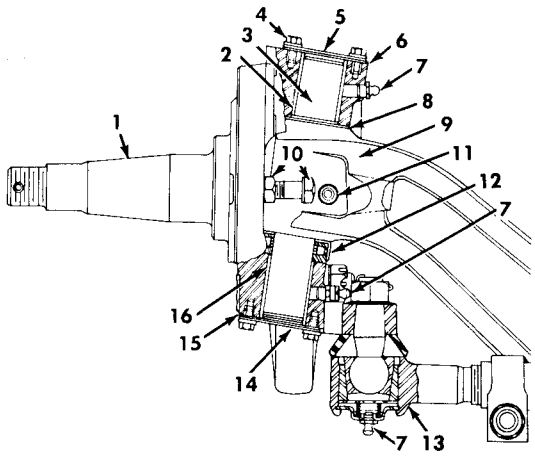
TRUCK MODEL	CAMBER L.H.	CAMBER R.H.	CASTER MANUAL & POWER	TOE-IN WHEEL (Inch)	TOTAL TOE-IN (Inch)	AXLE	*TURNING ANGLES IN-SIDE	*TURNING ANGLES OUT-SIDE	KING PIN INCLINATION LEFT	KING PIN INCLINATION RIGHT
HM80	1° 30′ ±30′	1° 30′ ±30′	2° 48′ ±30′	1/16 to 1/8	1/8 to 1/4	F-070	39°	28° 43′	7°	7°
	0° 15′ ±30′	−0° 15′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-070	39°	27° 45′	5.45°	6.15°
	0° 15′ ±30′	−0° 15′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-120	39°	28° 30′	5.45°	6.15°
HV70	1° 30′ ±30′	1° 30′ ±30′	2° 48′ ±30′	1/16 to 1/8	1/8 to 1/4	F-070	39°	28° 43′	7°	7°
	0° 15′ ±30′	−0° 15′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-090	39°	27° 45′	5.45°	6.15°
	0° 15′ ±30′	−0° 15′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-120	39°	28° 30′	5.45°	6.15°
JM80	0° 15′ ±30′	−0° 15′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-090	39°	27° 45′	5.45°	6.15°
JV70	0° 15′ ±30′	−0° 15′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-120	39°	28° 30′	5.45°	6.15°
WV70	1° ±30′	1° ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	FL-901	39°	27° 35′	5° 30′	5° 30′
HM80	1° ±30′	1° ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-160	39°	27° 45′	8°	8°
	1° ±30′	1° ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-161	39°	27° 45′	8°	8°
RM80	0° 15′ ±30′	−0° 15′ ±30′	3° ±30′	1/16 to 1/8	1/8 to 1/4	F-090	39°	27° 45′	5.45°	6.15°
TM80	0° 15′ ±30′	−0° 15′ ±30′	0° +30′, 0° −0′	1/16 to 1/8	1/8 to 1/4	F-090	39°	27° 45′	5.45°	6.15°
	0° 15′ ±30′	−0° 15′ ±30′	0° +30′, 0° −0′	1/16 to 1/8	1/8 to 1/4	F-120	39°	27° 45′	5.45°	6.15°
TV70	1° 30′ ±30′	1° 30′ ±30′	1° 15′ ±30′	1/16 to 1/8	1/8 to 1/4	F-070	39°	27° 45′	7°	7°
TM80	0° 15′ ±30′	−0° 15′ ±30′	1° 15′ ±30′	1/16 to 1/8	1/8 to 1/4	F-090	39°	27° 45′	5.45°	6.15°
	0° 15′ ±30′	−0° 15′ ±30′	1° 15′ ±30′	1/16 to 1/8	1/8 to 1/4	F-120	39°	27° 45′	5.45°	6.15°
WM80	0° 15′ ±30′	−0° 15′ ±30′	0° +30′, 0° −0′	1/16 to 1/8	1/8 to 1/4	F-090	39°	27° 45′	5.45°	6.15°
	0° 15′ ±30′	−0° 15′ ±30′	0° +30′, 0° −0′	1/16 to 1/8	1/8 to 1/4	F-120	39°	27° 45′	5.45°	6.15°
HC/HE/HI/HN/ HM/HH/MB/ MC90	0° 15′ ±30′	−0° 15′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-090	39°	27° 45′	5.45°	6.15°
	0° 15′ ±30′	−0° 15′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-120	39°	28° 30′	5.45°	6.15°
TE90	0° 15′ ±30′	−0° 15′ ±30′	0° +30′, 0° −0′	1/16 to 1/8	1/8 to 1/4	F-090	37°	26° 45′	5.45°	6.15°
	0° 15′ ±30′	−0° 15′ ±30′	0° +30′, 0° −0′	1/16 to 1/8	1/8 to 1/4	F-120	39°	27° 45′	5.45°	6.15°
J-90	0° 15′ ±30′	−0° 15′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-090	39°	27° 45′	5.45°	6.15°
	0° 15′ ±30′	−0° 15′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-120	39°	28° 30′	5.45°	6.15°
	1° ±30′	1° 30′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	FL-901	39°	27° 35′	5° 30′	5° 30′
MH90	0° 15′ ±30′	−0° 15′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-090	39°	27° 45′	5.45°	6.15°
	0° 15′ ±30′	−0° 15′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-120	39°	28° 30′	5.45°	6.15°
	1° ±30′	1° 30′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	FL-901	39°	27° 35′	5° 30′	5° 30′
FC/FH/FI/FN/ DC/DH/DI/DN/ DP/DB/FB90	0° 15′ ±30′	−0° 15′ ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	F-120	39°	28° 36′	5.45°	6.15°
	1° ±30′	1° ±30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	FL-901	39°	27° 35′	5° 30′	5° 30′
Some Models	0° ±30′	0° −30′	1° ±30′	1/16 to 1/8	1/8 to 1/4	FE-900	—	—	6°	7°
(Special Equipment)	1° ±30′	1° ±30′	0° −1°	—	.06 -.06	FE-970	—	—	1°	1°

*Regardless of maximum turning angles specified, adjustment of stop screws must provide 5/8-inch minimum clearance of tire with any chassis components. A bent steering arm will cause improper turning angles.

SECTION 3B

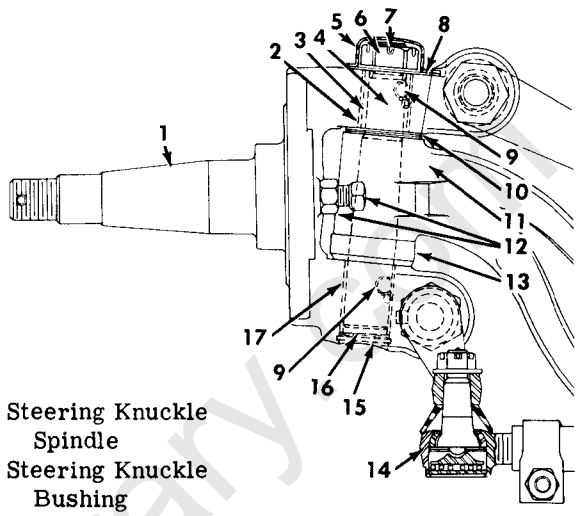
Front Axle

The following illustrations and specifications have been updated. The Front Axle repair information in the 1970 Heavy Duty Truck Service Manual ST135-70 is generally applicable for the axles FE900 and FL901 used in models covered by this supplement.



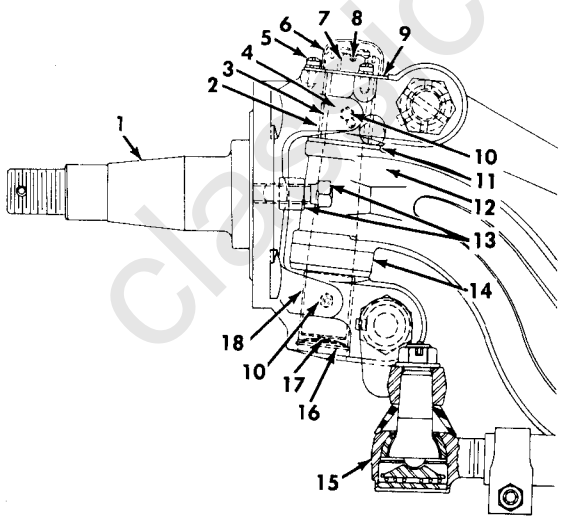
1 Steering Knuckle Spindle
2 Kingpin Bushing (Upper)
3 Kingpin
4 Cap Screw
5 Kingpin Bearing Cap (Upper)
6 Gasket
7 Lube Fitting
8 Shim
9 Axle Center
10 Stop Bolt and Lock Nut
11 Draw Key
12 Thrust Bearing
13 Tie Rod End Assy.
14 Kingpin Bearing Cap (Lower)
15 Gasket
16 Kingpin Bushing (Lower) T-8793

Figure 1—Steering Knuckle (F070 Axle)



1 Steering Knuckle Spindle
2 Steering Knuckle Bushing
3 Kingpin Bushing (Upper)
4 Kingpin
5 Dust Cap
6 Kingpin Nut
7 Cotter Pin
8 Gasket
9 Lube Fitting
10 Washers or Shims
11 Axle Center
12 Stop Bolt and Lock Nut
13 Thrust Bearing
14 Tie Rod Assembly
15 Plug Retainer
16 Expansion Plug
17 Kingpin Bushing (Lower) T-8794

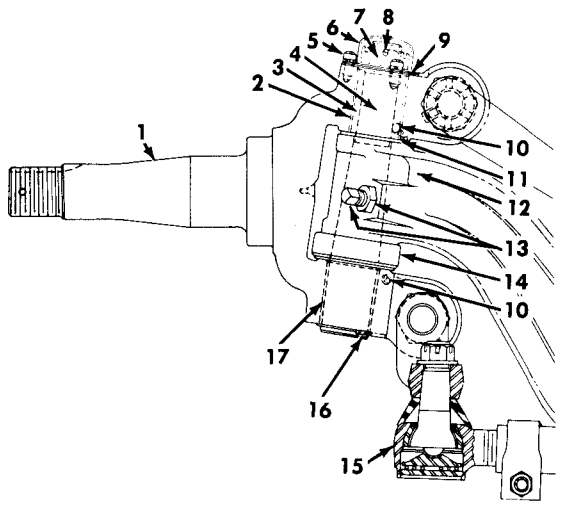
Figure 2—Steering Knuckle (F090 Axle)



1 Steering Knuckle Spindle
2 Steering Knuckle Bushing
3 Kingpin Bushing (Upper)
4 Kingpin
5 Cap Screw
6 Dust Cap
7 Kingpin Nut
8 Cotter Pin
9 Gasket
10 Lube Fitting
11 Spacers or Shims
12 Axle Center
13 Stop Bolt & Lock Nut
14 Thrust Bearing
15 Tie Rod End Assy.
16 Plug Retainer
17 Expansion Plug
18 Kingpin Bushing (Lower)

T-8795

Figure 3—Steering Knuckle (F120 Axle)



1 Steering Knuckle Spindle
2 Steering Knuckle Bushing (Upper)
3 Kingpin Bushing
4 Kingpin
5 Cap Screw
6 Dust Cap
7 Kingpin Nut
8 Cotter Pin
9 Gasket
10 Lube Fitting
11 Washer or Shims
12 Axle Center
13 Stop Bolt and Lock Nut
14 Thrust Bearing
15 Tie Rod End Assy.
16 Retaining Ring
17 Steering Knuckle Bushing (Lower)

T-8796

Figure 4—Steering Knuckle (F160 Axle)

FRONT AXLE (F161)

REMOVAL

1. Safely support axle, then remove hubs and bearings as directed under "FRONT HUBS AND BEARINGS" (SEC. 3D).

2. Remove tie rod from one or both steering arms.

3. Remove three screws and washers which attach kingpin dust cap to top of steering knuckle. Remove cap and cap gasket.

4. At bottom of kingpin, remove lock ring and expansion plug. If plug cannot be readily removed, it will come out later when kingpin is driven from knuckle.

5. Using a suitable drift, drive out the two draw keys by placing drift against small end of each key.

NOTE: Keys were originally installed from opposite sides of center.

6. With axle components properly supported, drive the kingpin downward using a brass driving bar or drift.

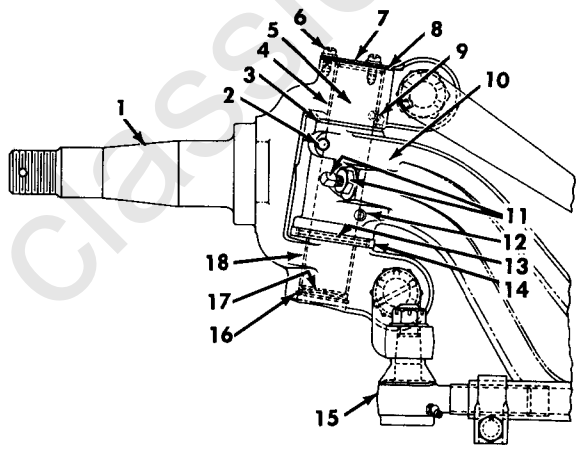
7. Remove knuckle, thrust bearing and spacing shim(s).

STEERING KNUCKLE INSTALLATION

1. Make sure that kingpin hole in axle center is clean and dry, then position and support knuckle on the axle center.

2. Slide the thrust bearing races and seal between axle center and knuckle lower yoke.

3. Place a jack under the knuckle and raise knuckle so that all clearance is taken up at thrust bearing.

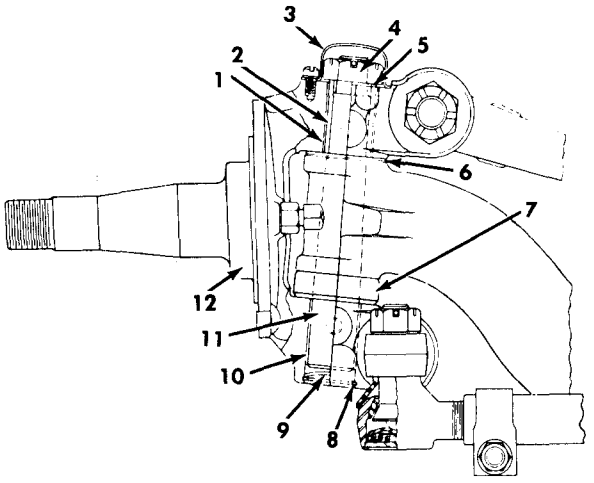


1 Steering Knuckle
2 Upper Draw Key (Short)
3 Spacing Washers
4 Steering Knuckle Bushing (Upper)
5 Kingpin
6 Kingpin cap screw
7 Kingpin Cap
8 Gasket
9 Lube Fitting
10 Axle Center
11 Stop Bolt and Lock Nut
12 Lower Draw Key (Long)
13 Thrust Bearing
14 Seal
15 Tie Rod End Assembly
16 Retainer
17 Expansion Plug
18 Steering Knuckle Bushing (Lower)

T-9078

Figure 5—Steering Knuckle (F161 Axle)

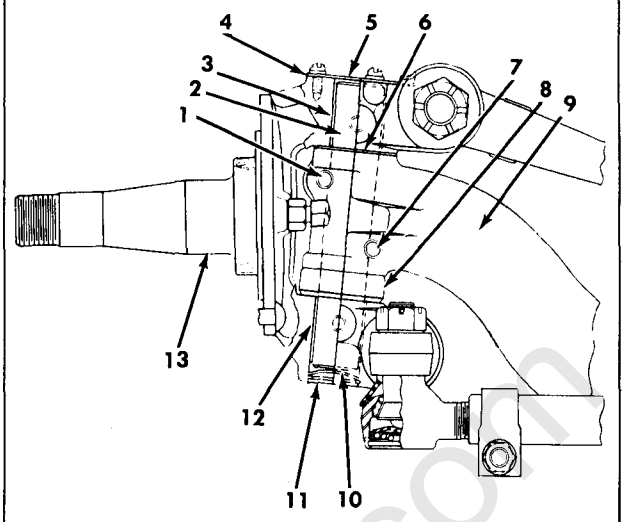
FRONT AXLE



1 Knuckle Upper Bushing
2 Kingpin Sleeve
3 Upper Dust Cap
4 Kingpin Nut
5 Spacer
6 Spacing Washer and Shim
7 Thrust Bearing
8 Expansion Plug Lock Ring
9 Expansion Plug
10 Knuckle Lower Bearing
11 Tapered Kingpin
12 Knuckle Wheel Spindle

T-8180

Figure 6—Steering Knuckle (FE900 Axle)



1 Upper Draw Key (Short)
2 Kingpin
3 Upper Bushing
4 Cap Gasket
5 Kingpin Cap
6 Spacing Shim
7 Lower Draw Key
8 Thrust Bearing
9 Axle Center
10 Expansion Plug
11 Lock Ring
12 Lower Bushing
13 Steering Knuckle

T-8171

Figure 7—Steering Knuckle (FL901 Axle)

4. Check the clearance between knuckle upper yoke and axle center. The clearance must not exceed 0.005". Spacing shims are available in 0.010" and 0.015" thickness.

Spacing washers are available in 0.093", 0.125" and 0.156" thickness.

5. After positioning the proper shim or washer, align the flats on kingpin to align with draw key holes in axle center then drive the kingpin through knuckle bearing, shims and axle center until draw key holes are in alignment.

6. Draw keys are available in three different sizes as shown in figure 9. Select the draw key to obtain the following condition when fully installed:

Large end of key must be recessed into axle center hole no less than 1/8-inch or more than 3/16-inch.

NOTE: The short key is installed in upper hole and the long key in lower hole.

IMPORTANT: DO NOT INSTALL BOTH KEYS FROM SAME SIDE OF AXLE CENTER.

7. After selecting proper key, peen or prick punch edge of hole as shown in figure 9.

8. At bottom of knuckle, install expansion plug and plug lock ring.

9. Install kingpin dust cap and gasket to knuckle with three retaining screws and washers.

10. Install steering tie rod, hubs and brakes and all other adjacent components previously removed.

FRONT AXLE (FE900)

The FE900 axle (fig. 6) is similar in basic construction to the F120 axle covered in the 1970 Heavy Duty Truck Service Manual ST135-70, and all service information for the F120 axle will apply to axle FE900.

FRONT AXLE (FL901)

The FL901 axle (fig. 7) used on some late models is similar to the FE970 axle covered in the 1970 Heavy Duty Truck Service Manual ST135-70. The major difference in these axles is that the FL901 has a tilted or inclined kingpin and the kingpin of the FE970 axle is vertical, having pivot point in direct line with center of tire. Repair procedures are identical. The front wheel bearing adjustment procedure is the same as explained for the F120 axle.

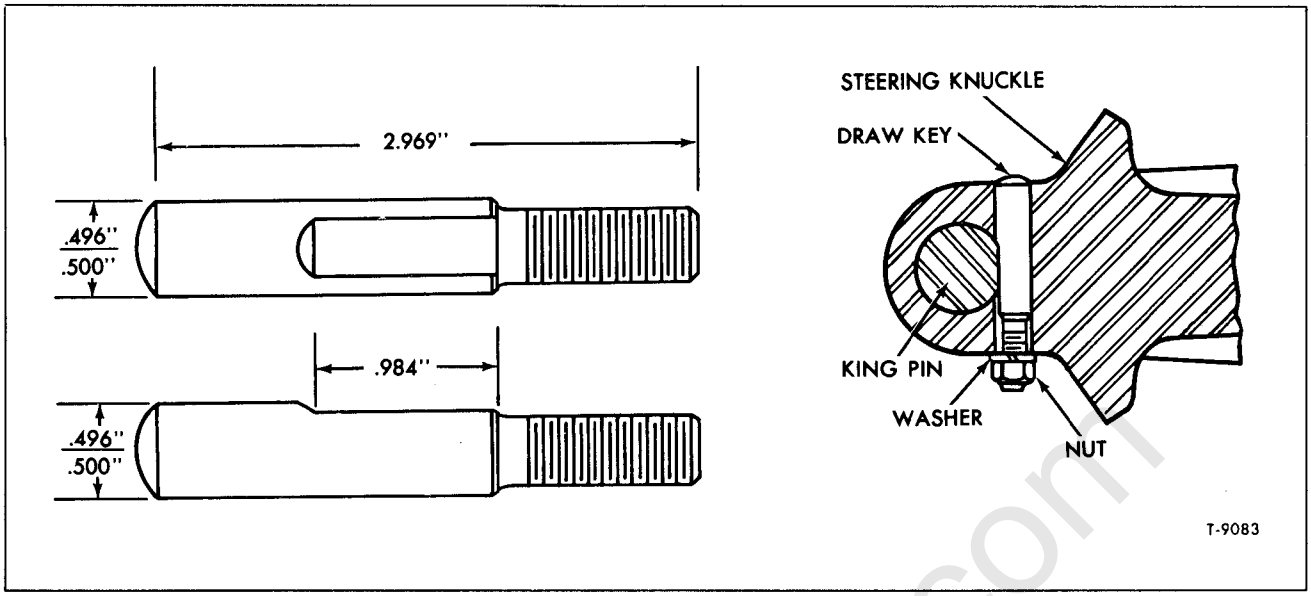
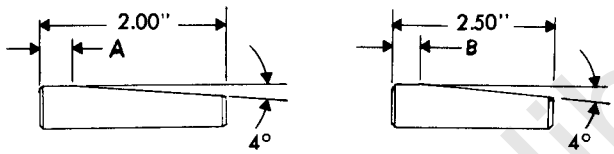


Figure 8—King Pin Draw Key F070 Axle

F161 AXLE

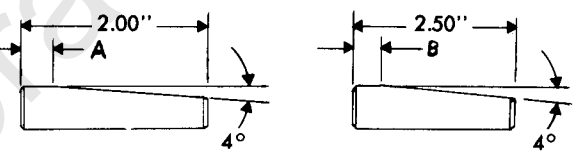


UPPER LOWER

A	GM Part No.	B	GM Part No.
.44"	684933	.50"	684929
.32"	684934	.40"	684930
.56"	684935	.60"	684931

O.D. .435"-.437"

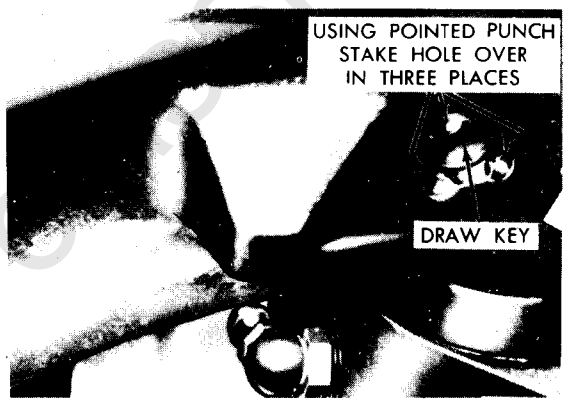
FL901 AXLE



UPPER LOWER

A	GM Part No.	B	GM Part No.
.18"	2452872	.68"	2452869
.32"	2452873	.80"	2452870
.08"	2452874	.56"	2452871

O.D. .498"-.500"



Select the proper size draw key to obtain the following condition when fully installed:

Large end of key must be recessed into axle center hole no less than 1/8-inch or no more than 3/16-inch. With key installed, stake around draw key hole as shown. T-9051

Figure 9—King Pin Draw Keys (F161 and F901 Axles)

FRONT AXLE

AXLE SPECIFICATIONS

AXLE MODEL	F070	F090	F120	F160	F161	FE900	FL90T
KING PIN							
Length	7-57/64"	8-3/4"	9-21/32"	10-11/16"	9"	9-3/4"	11-3/64"
Diameter							
At Top	1.2492"—1.2496"	1.1855"—1.1865"	1.3085"—1.3095"	1.3085"—1.3095"	1.826"—1.827"	1.3085" —1.3095"	1.9980"—1.9990"
At Bottom	1.2492"—1.2496"	1.4330"—1.4340"	1.6060"—1.6070"	1.794"—1.793"		1.6060" —1.6070"	
KING PIN BUSHING							
Length	—	1-29/32"	2-3/8"	2-1/2"	—	2-3/8"	—
Diameter							
Outer	—	1.4330"—1.4340"	1.6060"—1.6070"	1.7930"—1.7940"	—	1.6060" — 1.6070"	—
Inner	—	1.1870"—1.1880"	1.2970"—1.3000"	1.3000"—1.3030"	—	1.297" — 1.300"	—
STEERING KNUCKLE BUSHING*							
Length						2.22"	2.76"
Upper	1-7/8"	1.709"—1.729"	2-7/32"	2-9/32"	2.281"		
Lower	1-7/8"	1.990"—2.010"	2-7/32"	2-9/32"	1.940"		
I.D. When Installed	1.2496"—1.2526"	*1.4365"—1.4375"	1.607"—1.610"	1.7940"—1.7970"	*1.827"—1.830"	1.607"—1.610"	1.999"—2.002"
STEERING KNUCKLE TO AXLE CENTER CLEARANCE	0.005"	0.004"—0.012"	0.015" Max.	0.015" Max.	.015" Max.	.005"	0.015" Max.
SPACING WASHERS AVAILABLE	—	0.114"-0.116"White 0.121"-0.123"Yellow 0.128"-0.130"Blue	0.093" 0.125"	0.093" 0.125" 0.156"	.093" .125" .156"	0.093" 0.125"	
SPACING SHIMS AVAILABLE	0.005"	0.005"—0.010"	0.010"—0.015"	0.010"—0.015"	0.010"—0.015"	0.010" —0.015"	
TORQUE SPECIFICATIONS							
King Pin Nut	—	250 Ft. Lbs. Then Advance to Next Cotter Pin Hole	250 Ft. Lbs. Then Advance to Next Cotter Pin Hole	250 Ft. Lbs. Then Advance to Next Cotter Pin Hole	—	350 - 390 Ft. Lbs.	—
King Pin Bearing Cap, Cap Screw	5 - 6 Ft. Lbs.	—	—	—	5 - 6 Ft. Lbs.		5 - 6 Ft. Lbs.

* Burnish after Installation

SECTION 3C

Front Springs

All information on front springs contained in the 1970 Heavy Duty Truck Service Manual ST135-70, "FRONT SPRINGS" (SEC. 3A) is generally applicable to models covered by this supplement. The following illustrations, information, and specifications have been updated. The major changes are in the various torque values.

CAUTION: When replacing shock absorbers, check the model number stamped on the unit to make sure it is the same model as the one removed. Refer to "Specifications" for shock absorber nut torque.

CAUTION: U-bolts must be kept tight at all times to hold axle in place at springs. Otherwise axle may shift, causing misalignment or spring leaf failure in the vicinity of the spring center bolt.

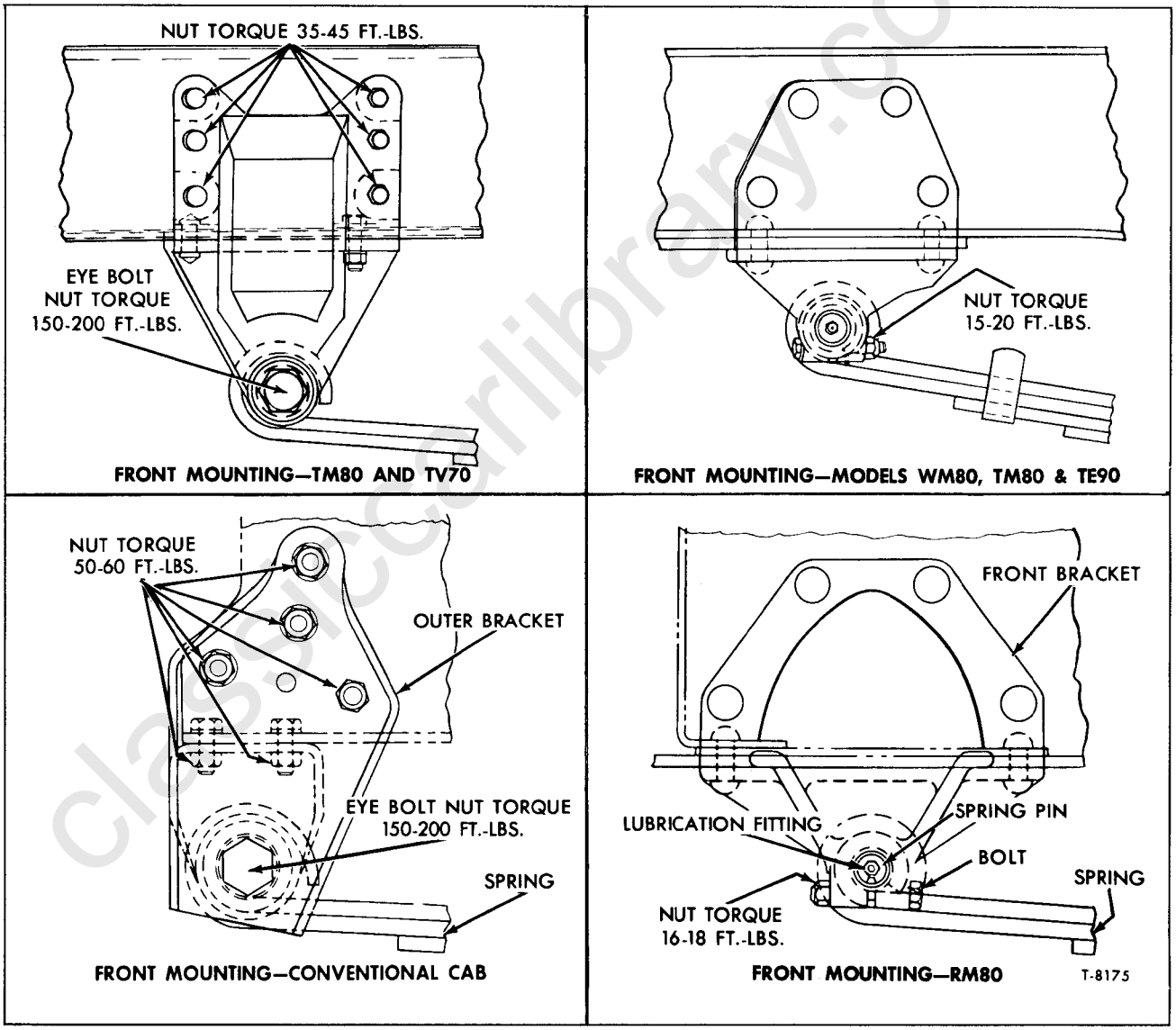


Figure 10—Front Spring Front Mountings (Typical)

FRONT SPRINGS

NOTE: ALL SPRING ATTACHMENTS, INCLUDING CENTER BOLTS, ARE IMPORTANT ATTACHING PARTS IN THAT THEY COULD AFFECT THE PERFORMANCE OF VITAL COMPONENTS AND SYSTEMS, AND/OR COULD RESULT IN MAJOR REPAIR EXPENSE. THEY MUST BE REPLACED WITH PARTS OF THE SAME PART NUMBERS OR WITH EQUIVALENT PARTS IF REPLACEMENT BECOMES NECESSARY. DO NOT USE REPLACEMENT PARTS OF LESSER QUALITY OR SUBSTITUTE DESIGN. TORQUE VALUES MUST BE USED AS SPECIFIED DURING REASSEMBLY TO ASSURE PROPER RETENTION OF THESE PARTS.

IMPORTANT: U-bolts must be retightened to torque listed in "Specifications" after 500 miles when new, or after spring repair or replacement.

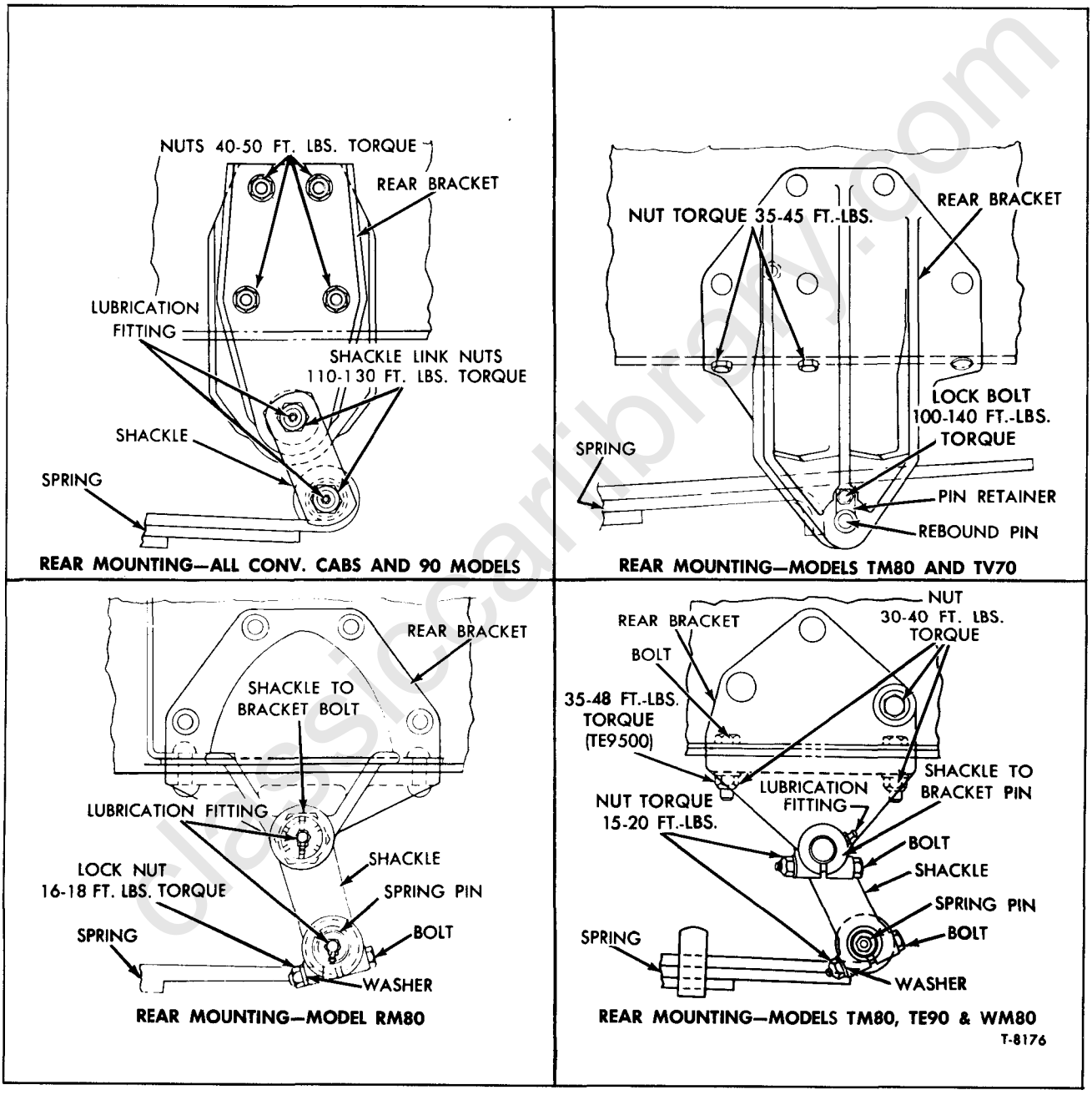


Figure 11—Front Spring Rear Mountings (Typical)

FRONT SPRING SPECIFICATIONS

	LGT.	O.D.	I.D.
SPRING EYE BUSHING			
(RM-TM-HM-JM80, TV-WV-HV-JV70)	3.225" – 3.250"	1.688"–1.693"	.940"–.947"
(Conv. Cab 90)			
(TM-WM80, TV70)			
(TE 90)	2.968"	1.251"–1.253"	.992"–.994"
(HM 80)			
(Alum. Tilt Models 90)	2.900" – 3.000"	1.680"–1.682"	1.419"-1.421"
SPRING EYE PIN			
(TM-WM 80)	4.938"	.996" – .998"	
(TE 90)			
SPRING EYE BOLT			
(JV-JM 70)	5.16" – 5.25"	.927"–.936"	
(Conv. Cab 90)			
(Alum. Tilt 90)			
SPRING SHACKLE PIN			
(TM-WM 80)	4.78"	.996"–.998"	
(TE 90)			
(JV70, JM80)	4.79"	1.414"–1.418"	
(Conv. Cab 90)			
(Alum. Tilt 90)			
SPRING REBOUND PIN	5"	.56"	
SPRING SHACKLE & BRACKET BUSHINGS	1.312"	1.124"–1.126"	
DELRIN INTERLEAF LINER THICKNESS		.037" – .043"	

TORQUE SPECIFICATIONS

	MODELS	FT. LBS.
FRONT SPRING U BOLTS (NUTS)	HM80, HV-TV-WV70	90 - 110
	JM-RM-TM80, JV70	190 - 210
	HM80	190 - 210
	Conv. Cab 90	190 - 210
	Alum. Tilt 90	190 - 210
	TE 90	200 - 220
FRONT SPRING EYE BOLT (NUT)	HM-JM-TM80, HV-JV70	150 - 200
	HM80	150 - 200
	Conv. Cab 90	150 - 200
	TV70	320 - 420
FRONT SPRING BRACKET TO FRAME BOLT (NUT)	All Models except TM80	50 - 60
	TM80	35 - 45
FRONT SPRINGS REAR BRACKET TO FRAME BOLT (NUT)	HM80, HV70	40 - 50
	JM80, JV70	50 - 60
	TM80	35 - 45
	TV70, WM80	55 - 75
	WV70	30 - 40
	HM80	50 - 60
	TE90	35 - 45
	Conv. Cab 90	50 - 60
	Alum. Tilt except DB-FB 90	50 - 60
	DB-FB90	65 - 85
SPRING SHACKLE LINK TO REAR BRACKET AND SPRING PIN (NUTS)	All Models when used	110 - 130
FRONT SPRING FRONT AND REAR SHACKLE CLAMP BOLT (NUT)	RM80	16 - 18
	TM-WM80, WV70	15 - 20
	TE90	15 - 20
	Alum. Tilt 90	35 - 45
FRONT SPRING TO AXLE BUMPER (NUT)	RM80	25 - 30
FRONT SPRING CENTER BOLT (*)	HM80, HV-JV70	50 - 60
	TM80, TV70	50 - 60
	Conv. Cab 90	50 - 60
	HM80	55 - 65
	Alum. Tilt 90	55 - 65
FRONT SPRING REBOUND PIN CLIP (BOLT)		20 - 25

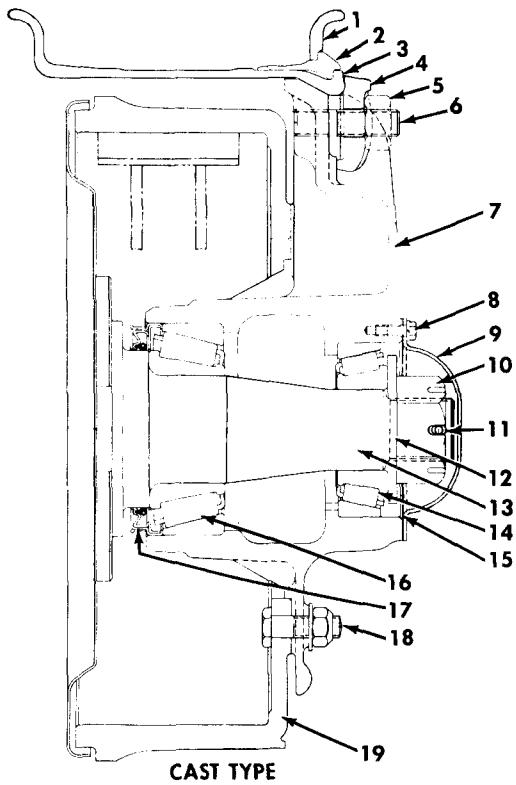
* Peen Bolts After Assembly

SECTION 3D

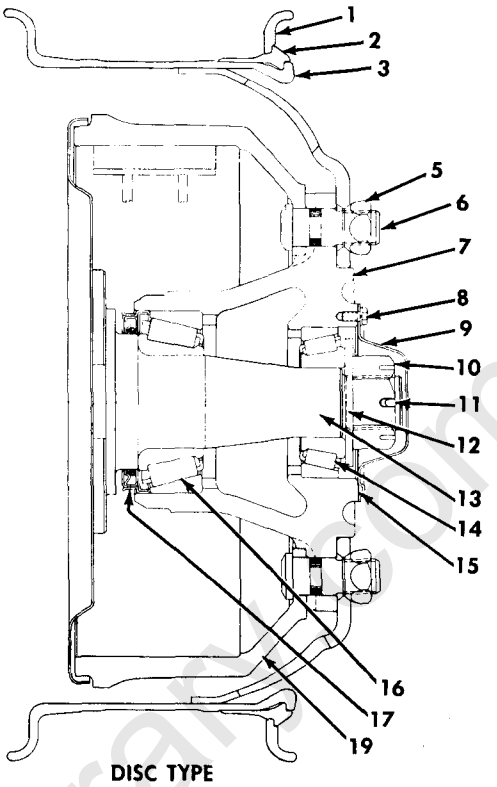
Front Hubs and Bearings

All information in the 1970 Heavy Duty Truck Service Manual ST135-70, "FRONT HUBS AND BEARINGS" (SEC. 3D) is generally applicable for models covered by this supplement, with new illustrations for FL901 Axle Hubs and Bearings (fig. 12) and oil lubricated front wheel bearings (fig. 13).

FRONT HUBS AND BEARINGS



CAST TYPE

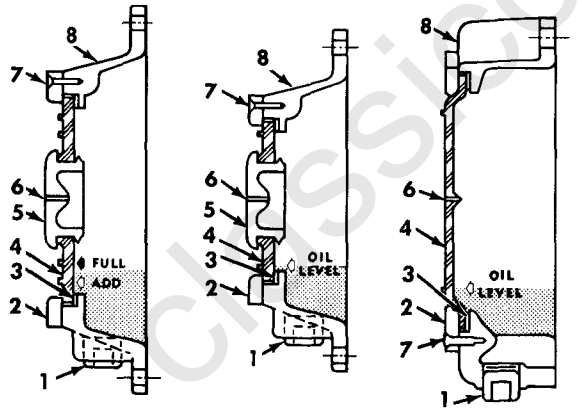


DISC TYPE

1 Side Ring
2 Lock Ring
3 Wheel
4 Wheel Clamp
5 Wheel Stud Nut
6 Wheel Stud
7 Hub
8 Cap Screw and Washer
9 Hub Cap
10 Bearing Adjusting Nut
11 Cotter Pin
12 Adjusting Nut Washer
13 Steering Knuckle
14 Bearing Cone and Roller Assembly (Outer)
15 Gasket
16 Bearing Cone and Roller Assembly (Inner)
17 Inner Oil Seal
18 Hub to Drum Bolt
19 Brake Drum

T-9027

Figure 12–Front Hubs and Bearings for FL901 Axle with Cast or Disc Wheels



1 Drain or Fill Plug
2 Window Ring
3 Gasket
4 Window
5 Rubber Plug
6 Vent
7 Screw
8 Housing

T-9036

Figure 13–Oil Levels (Oil Lubricated Type Bearings)

FRONT WHEEL BEARINGS (OIL LUBRICATED)

There are three types of oil seals used at this time. The smallest seal with a 2¾" window diameter with one raised "oil level" indicating line. A 3½" window diameter with two raised lines indicating "ADD" and "FULL" as shown in figure 13, for oil level reference. A 4-3/8" window diameter to be used mainly on the FL901 front axle. It will have a vent hole in the center and one raised "OIL LEVEL" indicating line. Oil has to be added or drained through a 3/8" pipe plug and should not be over the line on this type. Oil can be added through the 3/8" pipe plug or the rubber window plug on the other types and drained through the pipe plug.

On single line window type except FL901 axle, the oil level should be at the line or up to ¼" above the line. On double line window type the oil should remain between the "ADD" and "FULL" lines at all times. Vehicles with seals should be in a level position for checking or adding oil.

SECTION 4
Rear Suspension

SECTION 4A
Rear Axle and Controls

All information in "REAR AXLE AND CONTROLS" (SEC. 4A) of 1970 Heavy Duty Truck Service Manual ST135-70 is applicable to models covered in this supplement. The Torque Chart has been updated as follows:

REAR AXLE TORQUE SPECIFICATIONS

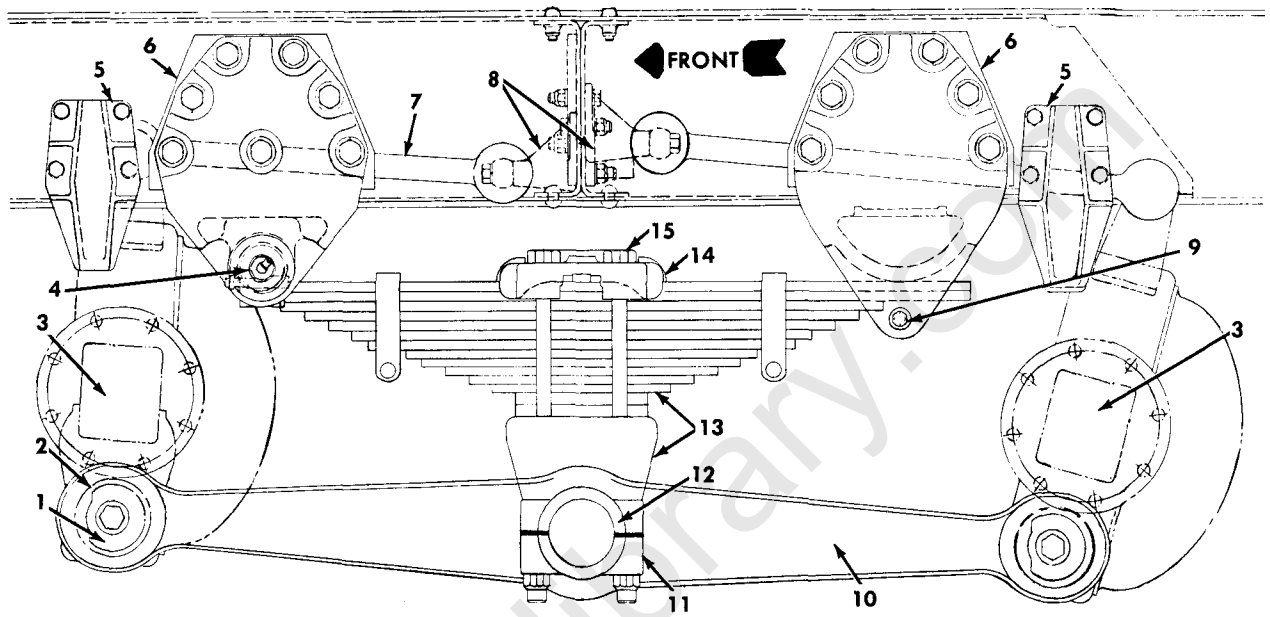
ITEM	TORQUE (FT. LB.)
DRIVE PINION YOKE NUT	
Eaton	
1⅛"-18	320-450
1¼"-12	400-600
1½"-18	500-700
Rockwell	
1"-20	300-400
1¼"-18	700-900
1½"-18	800-1100
Corporation	
1⅛"-18	160-280
DIFFERENTIAL CARRIER TO HOUSING	
Eaton	
½"-13 Cap Screw	75-85
⅝"-11 Cap Screw	160-175
⅝"-18 Stud Nut	220-240
Rockwell	
½"-20 Stud Nut	92-118
⅝"-18 Stud Nut	185-235
Corporation	
7/16"-20 Cap Screw	75-90
9/16"-18	130-170
OIL SEAL RETAINER & PINION CAGE	
Eaton	
9/16"-12	115-125
Rockwell	
7/16"-14	60-70
½"-13	80-105
9/16"-12	115-150
Corporation	
½"-13 (H135)	160-170
½"-13 (H150)	80-105
½"-13 (T150)	80-105
⅝"-11 (H110)	160-170
SHIFT CHAMBER	
Stud Nut—⅜"-24	30-35
Bolt—7/16"-14	40-50
AXLE SHAFT FLANGE	
Stud Nut—½"	50-60
Stud Nut—⅝"	90-110
Cap Screw—5/16"-24	11-18

IMPORTANT

When parking vehicle equipped with a two- or three-speed axle, the axle should be shifted into LOW range with engine running. Engage clutch and transmission to be sure axle has completed shift into LOW range. Apply parking brake, place transmission in neutral and shut off engine. When leaving the vehicle parked or unattended the previous instructions must be followed.

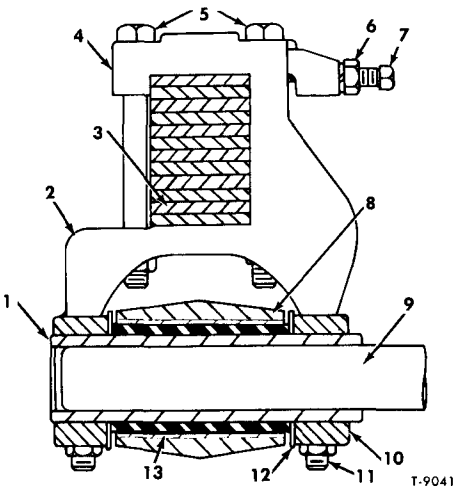
SECTION 4B
Rear Springs and Suspension

All information pertaining to "REAR SPRINGS AND SUSPENSION" (SEC. 4B) as described in 1970 Heavy Duty Truck Service Manual ST135-70, is applicable to models covered by this supplement with addition of the following updated illustrations, specifications, and torque charts.



1 Beam End Adapter
2 Beam End Bushing
3 Rear Axle
4 Spring Eye Pin
5 Axle Bumper
6 Frame Bracket
7 Torque Rod
8 Torque Rod Frame Bracket
9 Rebound Bolt
10 Equalizer Beam
11 Saddle Cup
12 Beam Center Bushing
13 Spring and Saddle Assembly
14 Top Pad
15 Saddle Bolts

Figure 1—Tandem Rear Suspension (Hendrickson RT) (Typical)



1 Beam Center Bushing
2 Spring Saddle
3 Spring Assembly
4 Spring Saddle Top Pad
5 Top Pad to Spring Saddle Bolts
6 Lock Nut
7 Setscrew
8 Equalizing Beam
9 Cross Tube
10 Spring Saddle Cap
11 Stud
12 Thrust Washer
13 Bushing

Figure 2—Section Through Spring, Saddle, and Beam (Hendrickson RT)

REAR SPRINGS AND SUSPENSION

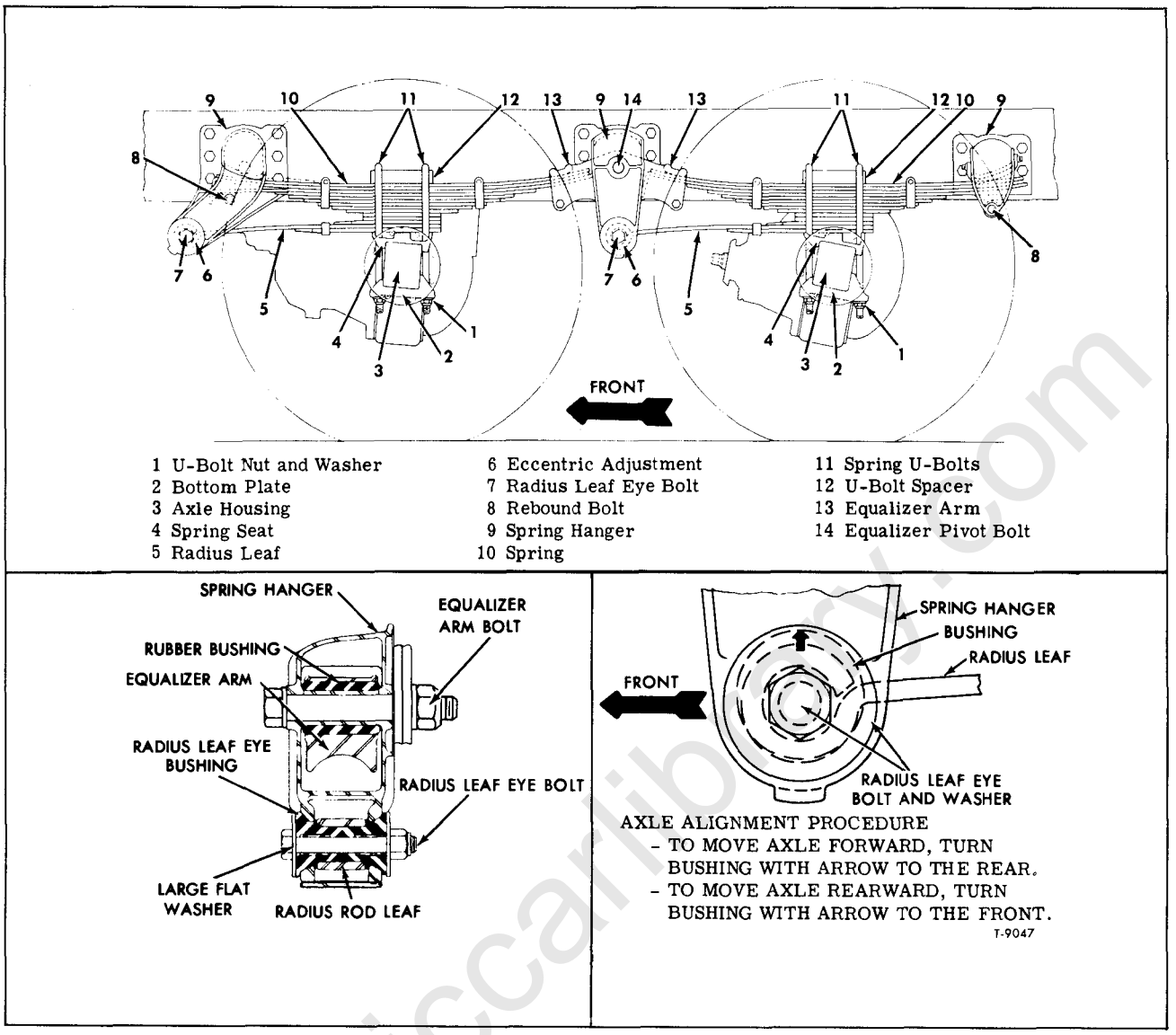


Figure 3—Reyco 101 Suspension and Radius Leaf Adjustment

AIR SUSPENSION

REAR AXLE CONTROL ARMS

Control arms as shown in figure 4 are equipped with replaceable rubber bushings which attach rear axle to frame brackets. Control arms are secured to axles by U-bolts and anchor plates. A Delrin liner is used on top and bottom of control arms at the axle housing. Control arms are secured to bellows support brackets by bolts and nuts, and by pivot bolts at center frame bracket.

NOTE: All suspension repairs should be made on level surface.

CONTROL ARM REMOVAL

1. Raise frame to remove load from rear suspension units, then block frame securely.
2. Loosen control arm setscrews to remove clamping effect on casting.
3. Remove two bolts which attach bellows support bracket to control arm.
4. Loosen control arm pivot bolt.
5. Remove U-bolt nuts, lower control arm, then remove pivot bolt.

NOTE: If bellows support bracket removal is necessary, tag bracket "Front" or "Rear" and scribe between bracket and control arm.

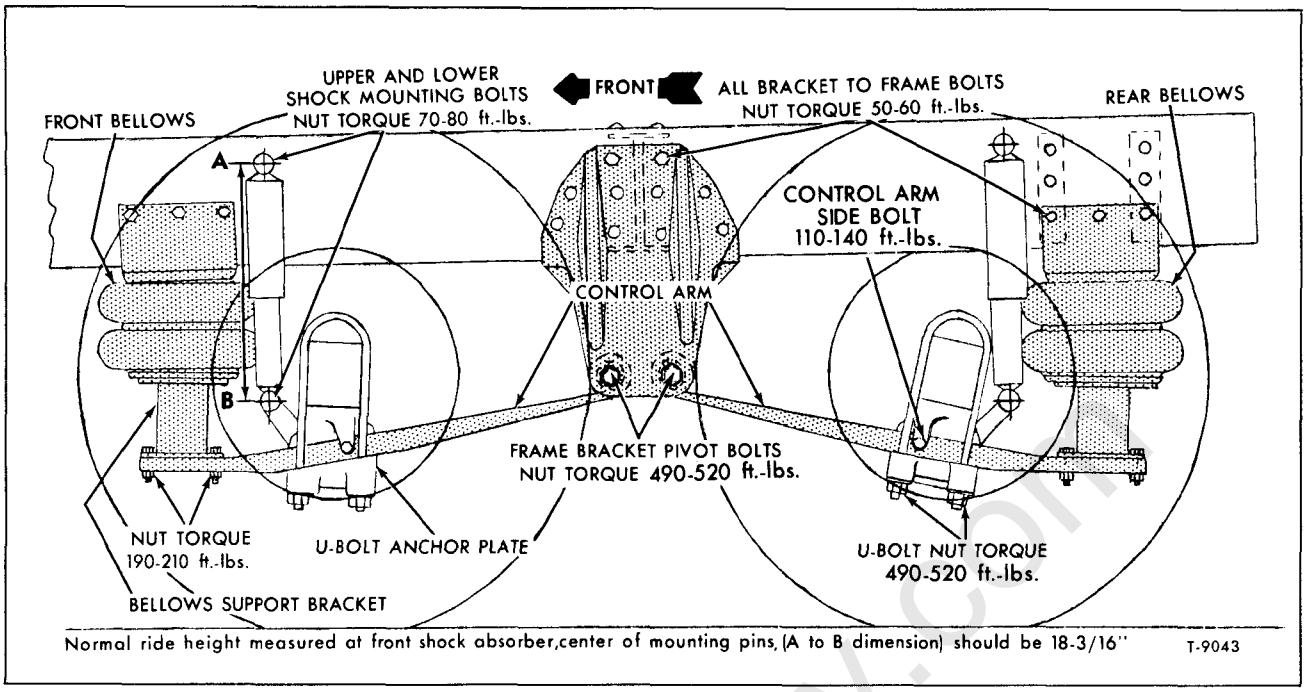


Figure 4—Air Suspension System

CONTROL ARM INSTALLATION

IMPORTANT: Before final torquing of control arm-to-frame bracket pivot bolts and nuts, the rear suspension should be at normal ride height. If connections are tightened without first obtaining this adjustment, a torsional preload will be imposed on rubber bushings when the frame assumes normal height relative to axle.

1. Position Delrin liners, one on top and one at bottom of control arm. These can be held in place with masking tape while installing control arm. TAPE MUST NOT BE BETWEEN BRACKET AND LINER.

2. See that dowel pin hole is clean in control arm and axle bracket. If previously removed, insert dowel pin and raise control arm into position at frame bracket and loosely install pivot bolt. Raise control arm, at axle, then loosely install anchor plate and attaching U-bolts and nuts.

3. Install bolts and nuts attaching bellows support bracket to control arm and torque to "Specifications."

4. Establish vehicle at normal ride height by jacking up frame. Refer to dimension "A" to "B" in figure 4.

5. Initially tighten control arm pivot bolts and U-bolt nuts.

6. Tighten both control arm setscrews approximately equal distance and torque to "Specifications."

7. Final torque control arm pivot bolts and U-bolt nuts to "Specifications."

HM8721B SUSPENSION

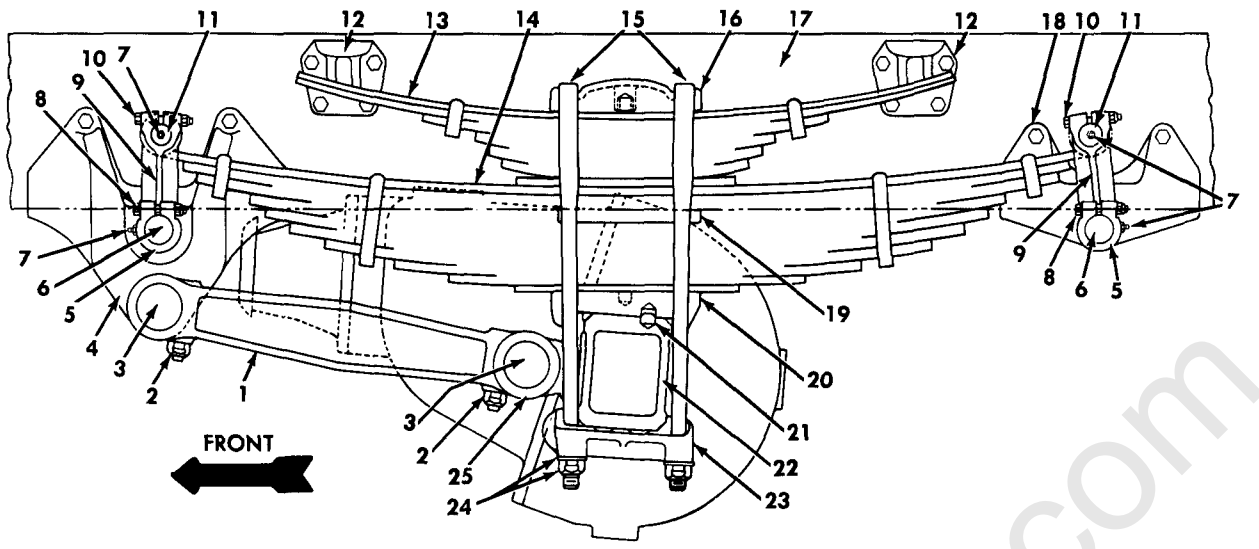
DESCRIPTION

Rear springs are semi-eliptic type with combined auxiliary spring (fig. 5). All spring hangers and brackets are bolted to the frame. Auxiliary spring is mounted on top of main spring and contacts separate brackets bolted to frame side rail. Springs are attached to axle housing with U-bolts. A separate spring seat is used between spring and axle and is held in place by the spring U-bolts and bottom plate. A separate radius rod eye bracket is held in place at forward side of axle housing by the spring seat, U-bolt and bottom plate. A rubber axle bumper is bolted to frame above axle housing.

Rear springs are shackled at rear end as illustrated in figure 6. Shackle stud is secured in shackle bracket by a nut and washer, and shackle is retained on stud by a clamp ring (nut) and clamp bolt.

Radius rod front bracket is integral with shackle bracket and installation at front bracket is shown in figure 7. All shackles and shackle pins are drilled and equipped with lubrication fittings. Radius rods are mounted on rubber bushings and require no lubrication.

REAR SPRINGS AND SUSPENSION



1 Radius Rod	9 Spring Shackle	18 Shackle Bracket (Rear)
2 Draw Key and Nut	10 Shackle Clamp Bolt	19 Axle Bumper
3 Radius Rod Pin	11 Spring Eye Pin	20 Spring Seat
4 Shackle and Radius Rod Bracket	12 Auxiliary Spring Bracket	21 Dowel
5 Clamp Ring (Nut)	13 Auxiliary Spring Leaves	22 Axle Housing
6 Shackle Bracket Stud	14 Main Spring Leaves	23 Spring Bottom Plate
7 Lube Fitting	15 Spring U-Bolt	24 U-Bolt Nut and Washer
8 Clamp Ring Clamp Bolt	16 Spring U-Bolt Spacer	25 Radius Rod Eye Bracket
	17 Frame	T-9059

Figure 5—HM-80 Suspension

REAR SPRING SHACKLE PIN OR BRACKET REPLACEMENT (Fig. 6)

Removal

1. Jack up vehicle frame until load is removed from spring and block frame securely.

2. Remove nuts and washers from clamp bolts, then drive clamp bolts out of shackle.

3. Remove lubrication fitting from end of shackle pin. Remove pin using slide hammer (J-2619) and adapter (J-8118) as shown in figure 4 on page 4-27 of 1970 Heavy Duty Truck Service Manual ST135-70.

4. To remove rear spring front bracket, remove radius rod as described in "Radius Rods" - "Removal at Front End," later in this section.

5. Remove bracket to frame mounting bolts and remove bracket.

INSTALLATION

1. Replace any damaged or worn shackle pin or bracket and bolt bracket to frame. Torque bolts to "Specifications" listed at end of this section.

2. Align spring eye with holes in shackle so bushing will not be damaged when pin is driven into place.

3. Insert pin in shackle, aligning grooves in pin with clamp bolt holes in shackle. Drive pin into place using soft hammer.

4. Insert clamp bolts through holes in shackle, install washers and nuts, and torque to "Specifications" listed at end of this section.

5. Install lubrication fitting in end of pin. Lubricate as directed in LUBRICATION (SEC. 0), then remove frame blocks and jacks.

REAR SPRING SHACKLE OR SHACKLE BUSHING REPLACEMENT (Fig. 6)

Shackle Removal

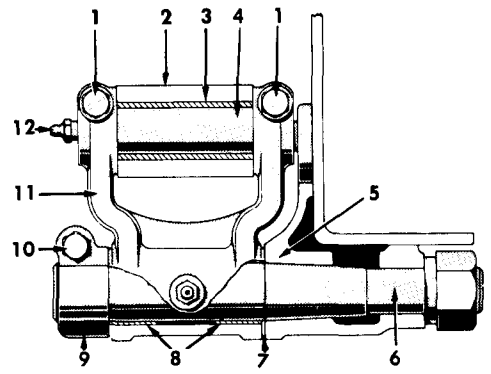
1. Remove shackle pin as previously directed under "Rear Spring Shackle Pin or Bracket Replacement."

2. Remove clamp bolt from shackle stud clamp ring (nut), then unscrew clamp ring from stud.

3. Slide shackle off stud, noting location of spacing washers on one or both sides of shackle.

4. Inspect shackle stud for wear or other damage. If necessary to replace stud, remove nut and washer from inner end of stud, then drive stud out of shackle bracket.

5. Inspect shackle for cracks or distortion. If shackle is not damaged, inspect bushing. If bushing is worn excessively, replace as directed.



1 Shackle Pin Clamp Bolt
2 Spring Eye
3 Spring Eye Bushing
4 Shackle Pin
5 Shackle Bracket
6 Shackle Stud
7 Spacing Washer
8 Shackle Bushings
9 Clamp Ring
10 Clamp Ring Clamp Bolt
11 Shackle
12 Lubrication Fitting

T-9060

Figure 6—Rear Spring Rear Shackle Installation

Shackle Bushing Replacement

Press old bushing out of shackle. Press new bushing into each side of shackle until flush with edge of shackle. Burnish bushings to size listed in "Specifications" at end of this section.

Shackle Installation

1. If shackle stud was removed, install new stud in shackle bracket and secure with washer and nut. Tighten nut firmly.

2. Place shackle on stud, making sure spacing washers are in proper place as noted during removal, and that lubrication fitting is away from spring.

3. Install clamp ring (nut) on outer end of shackle stud, tighten snugly enough against shackle to remove all end play. Install clamp bolt in clamp ring and torque to "Specifications" listed at end of this section.

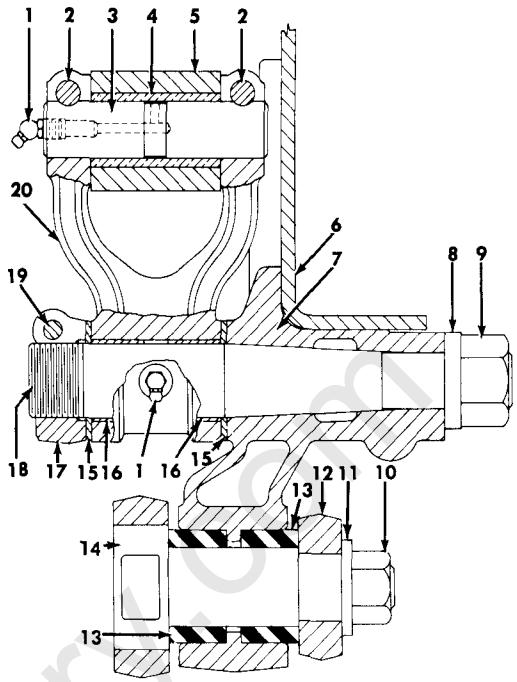
4. Attach spring to shackle as previously directed under "Rear Spring Shackle Pin or Bracket Replacement."

REAR SPRING REMOVAL

1. Jack up axle and block securely, then remove wheels. Jack up frame until tension is removed from spring. Loosen spring U-bolt nuts.

2. Remove pins attaching spring ends to shackles as previously directed under "Rear Spring Shackle Pin or Bracket Replacement."

3. Remove nuts and washers from spring U-bolts, remove U-bolts, bottom plate and U-bolt spacer, then remove spring assembly.



1 Lubrication Fittings
2 Shackle Pin Clamp Bolts
3 Shackle Pin
4 Spring Eye Bushing
5 Spring Eye
6 Frame Side Rail
7 Spring Shackle and Radius Rod Bracket
8 Shackle Stud Washer
9 Shackle Stud Nut
10 Radius Rod Pin Nut
11 Radius Rod Pin Washer
12 Radius Rod
13 Radius Rod Bushings
14 Radius Rod Pin
15 Spacing Washers
16 Shackle Bushings
17 Shackle Stud Clamp Nut
18 Shackle Stud
19 Clamp Bolt
20 Spring Shackle

T-9061

Figure 7—Rear Spring Front Shackle and Radius Rod Installation

SPRING DISASSEMBLY

Clamp spring leaves firmly together, using one C-clamp on each side of center bolt, or using an arbor press.

Scribe a mark down side of spring pile so spring can be reassembled in same relative position. Remove rebound clip bolts and spacers, and remove spring center bolt. When clincher type rebound clips are used, spread clips to permit disassembly. Release C-clamps or arbor press slowly to avoid possible injury.

CLEANING AND INSPECTION

1. Clean all rust and dirt from spring leaves, using a wire brush if necessary.

2. Inspect leaves for cracks or breaks. No. 1 and No. 2 leaves on both the main and auxiliary springs can be replaced. If other than the No. 1

or No. 2 leaf are broken, the complete spring assembly should be replaced.

3. Wash all grease and dirt from shackle, shackle pin or stud. Make sure lubricant passages in pins are clean. Replace pins if excessive wear or other damage is evident.

4. Inspect spring eye bushing for wear. If excessive wear is evident, press old bushings out and press new bushings into place. Refer to "Specifications" at end of this section for bushing sizes.

5. Replace rebound clip bolts, center bolt, and U-bolts if distorted or damaged in any way.

REAR SPRING ASSEMBLY

1. Coat each spring leaf with a light film of graphite grease. Stack spring leaves in correct order, then compress leaves with C-clamps or arbor press. Install center bolt and nut and tighten firmly.

2. Install rebound clip bolts and spacers. Tighten bolts just enough to hold spring leaves in alignment, but not enough to restrict free movement of leaves. When clincher type rebound clips are used, bend clips into place.

REAR SPRING INSTALLATION

1. Position spring seat on axle, making sure dowel is in place to properly locate seat. Position spring on seat, being sure center bolt enters locating hole in seat. Place U-bolt spacer on top of spring. Install spring U-bolts, at the same time installing radius rod bracket. Install nuts on U-bolts and tighten firmly.

IMPORTANT: U-bolt nuts must be retightened with vehicle loaded after installation is completed.

2. Connect spring eyes to shackles as previously directed under "Rear Spring Shackle Pin or Bracket Replacement."

3. Lubricate all shackle pins as directed in LUBRICATION (SEC. 0).

4. Install wheels, then remove blocks from under axle and frame.

5. Place normal load on vehicle, then tighten U-bolt nuts to torque listed in "Specifications" at end of this section.

RADIUS RODS

DESCRIPTION

Cast I-beam type radius rods have yoke type ends. Radius rods are secured to brackets by pins, with rubber bushings used between rod and pins (fig. 7). Pins are secured with nuts, washers, and are locked to radius rod by draw keys inserted through one side of each radius rod yoke, engaging a flat on head of pin. Radius rod front bracket (eye) is integral with rear spring front shackle bracket (fig. 7). Radius rod rear bracket (eye) is a separate part, clamped between lip on forward side of spring seat and lip on front end of U-bolt bottom plate. These radius rods require no lubrication.

REMOVAL AT FRONT END

1. Remove nut, and washer from radius rod pin.

2. Remove nut and from radius rod pin draw key and drive draw key out of radius rod yoke.

3. Remove pin from radius rod yoke and bracket. Remove rubber bushings from bracket.

REMOVAL AT REAR END

1. Loosen nuts on spring U-bolts and back off nearly to end of threads. Drive U-bolt bottom plate down away from axle and let it rest on U-bolt nuts.

2. Using a lead hammer, strike top of radius bracket to dislodge bracket from between lip on spring seat and axle housing.

3. With radius rod and rear bracket assembly removed from vehicle, disconnect radius rod from rear bracket as previously directed under "Removal at Front End."

INSTALLATION AT REAR END

1. Install new rubber bushings in radius rod bracket, inserting one from each side. Bushings may be coated with hydraulic brake fluid to facilitate installation, but under no circumstances should grease or oil be applied to bushings.

2. Position radius rod bracket in radius rod end yoke and insert pin from outer side, aligning flat on head of pin with draw key hole in rod yoke.

3. Install draw key in radius rod yoke, install nut on key, and tighten finger-tight.

4. Install washer and nut on radius rod pin and tighten firmly. Tighten nut on radius rod pin draw key.

5. Place radius rod and rear bracket under vehicle. Position upper edge of bracket between lip on spring seat and axle housing, driving it into place with a lead hammer. Raise bottom plate up against axle housing, making sure lower edge of radius rod bracket is in place between lip on plate and axle housing. Tighten spring U-bolt nuts, with vehicle under normal load, to torque listed in "Specifications" at end of this section.

INSTALLATION AT FRONT END

To install radius rod at front end, accomplish steps 1 through 4 under "Installation at Rear End."

REAR SUSPENSION SPECIFICATIONS

(MODEL HM-8721B SUSPENSION)

SPRING EYE BUSHING (BRONZE)

I.D.	1.254"-1.249"
O.D.	1.500"
Length	3"

SPRING EYE PIN

O.D.	1.248"-1.246"
Length	5"

RADIUS ROD BUSHING (RUBBER)

I.D.	1.755"-1.760"
O.D.	2.480"-2.490"
Length	1.495"-1.505"

SHACKLE BRACKET STUD THRUST WASHERS

I.D.	1.656"
O.D.	2.625"
Width	0.125"

SHACKLE BRACKET BUSHINGS (BRONZE)

I.D.	1.627"-1.628"
O.D.	1.749"-1.751"
Length	1.250"

TORQUE SPECIFICATIONS

VARI-RATE REAR SPRINGS	TYPE OF PART	TORQUE (FT. LBS.)
Rear Spring U-Bolt	Nut	190-210
Radius Leaf Eysbolt-To-Hanger	Nut	320-350
Torque Rod Eyebolt-To-Hanger	Nut	150-200
Rear Spring Bumper Bolt	Nut	10- 15
Pin Retainer To Spring Hanger	Bolt	25- 30
Rear Spring Radius Leaf Pin Clamp Bolt	Nut	20- 25
Rebound Pin Bolt	Nut	25- 30
Rebound Pin Retainer Frame Lock	Bolt	25- 30
Front Spring Pad Bracket To Frame Bolt	Nut	50- 60
Spring Hanger-To-Side Rail Bolt (Front)	Nut	90-110
Spring Hanger-To-Side Rail Bolt (Rear)	Nut	50- 60
Shock Absorber Mounting Stud (Upper and Lower)	Nut	70- 80

HENDRICKSON (Series RT)		
Spring Frt. Pin Lock Bolt (Draw Key)	Nut	30- 40
Spring Saddle Top Pad Bolt	Nut	275-300
Spring Saddle Cap Stud	Nut	275-300
Spring Saddle Top Pad Set Screw	—	100-150
Spring Center Bolt 7/16"-20	Bolt	50- 60
1/2"-20	Bolt	65- 75
Rear Spring Rear Rebound Bolt	Nut	40- 50
Rear Spring Front Pin Lock Bolt	Nut	30- 40
Equalizing Beam End Adapter	Nut	190-210
Torque Rod Bracket-To-Crossmember Bolt	Nut	50- 60
Torque Rod and Bracket-To-Crossmember Bolt	Nut	90-110
Torque Rod Ball Stud	Nut	350-400

HENDRICKSON (Series RU)		
Spring Center Bolt	Nut	65- 75
Spring Saddle Top Pad U-Bolt	Nut	235-305
Spring Saddle Cap-To-Saddle*	Bolt	310-340
Spring Front Pin Lock Bolt (Draw Key)	Nut	30- 40
Spring Rear Rebound Bolt	Nut	40- 50
Spring Bracket and Spacer-To-Side Rail Bolt*	Nut	90-110
Equalizing Beam End Adapter	Nut	190-210
Bumper Stop To Frame	Bolt	85-105
Torque Rod-To-Axle Housing Stud	Nut	120-150
Torque Rod Bracket-To-Crossmember Bolt	Nut	50- 60
Torque Rod and Bracket-To-Crossmember Bolt	Nut	90-110
Torque Rod Ball Stud	Nut	350-400

REYCO SUSPENSION	TYPE OF PART	TORQUE (FT. LBS.)
Spring Hanger Bracket-To-Frame (ALL)	Nut	90-110
Spring Center	Bolt	65- 75
Spring to Axle U-Bolt	Nut	190-210
Radius Leaf Rod Eyebolt	Nut	160
Equalizer Bracket Shaft	Nut	450-500
Front Spring Roller	Cap Screw	55- 65
Front Spring Roller at Center and Rear Frame Hanger Brackets	Cap Screw	40- 50

AIR SUSPENSION		
Control Arm-To-Frame Bracket Pivot Bolt	Nut	490-520
Bellows Support Bracket-To-Control Arm Bolt	Nut	190-210
Bellows-To-Support Bracket Stud	Nut	8- 12
Bellows Upper Support Bracket-To-Frame Bolt	Nut	50- 60
Axle U-Bolt-To-Anchor Plate	Nut	490-520
Height Control Valve Link Stud	Nut	5- 8
Height Control Valve Bracket-To-Frame Bolt	Nut	50- 60
Height Control Valve-To-Mounting Bracket Bolt	Nut	3- 5
Shock Absorber Upper and Lower Mounting Bolt	Nut	70- 80
Shock Absorber Upper Bracket-To-Frame Bolt	Nut	90-110
Control Arm Frame Bracket-To-Bogie Crossmember Bolt	Nut	190-210
Control Arm Side Bolt		110-140

HM 8721B SUSPENSION		
Rear Spring U-Bolt	Nut	300-330
Radius Rod (Draw Key)	Nut	50- 60
Radius Rod Pin	Nut	320-350
Shackle Stud-To-Shackle Bracket	Nut	500-550
Shackle Stud Clamp Ring**	Nut	15- 20
Shackle (Draw Key)	Nut	50- 60
Spring Hanger-To-Frame Bolt	Nut	50- 60
Axle Bumper Bolt	Nut	6- 8

*Lubricate Bolt Threads with SAE #20 oil before tightening.

**Torque to Specification after all end play is removed.

SECTION 4D

Propeller Shafts

All information pertaining to "PROPELLER SHAFTS" as described in 1970 Heavy Duty Truck Service Manual ST135-70, is applicable to models covered by this supplement with the exception of the following:

UNIVERSAL JOINTS

IMPROVED 1800 SERIES UNIVERSAL JOINTS

The improved design incorporates the following changes which will increase the service life of the joint:

1. A nylon thrust washer has been added between the end of the trunnion and the bearing cap to reduce the effects of end thrust which is encountered during high rpm over-the-road service (see fig. 1).

2. One-way plastic check valves are now inserted in each end of the trunnion (see fig. 1). This feature helps retain lubricant at the outer bearing area to prevent a drainback of warm, more liquid lubricant, to the center of the trunnion. The drainback condition could occur when the vehicle is brought to a stop and remains for a period of time after extended, high speed, high rpm usage.

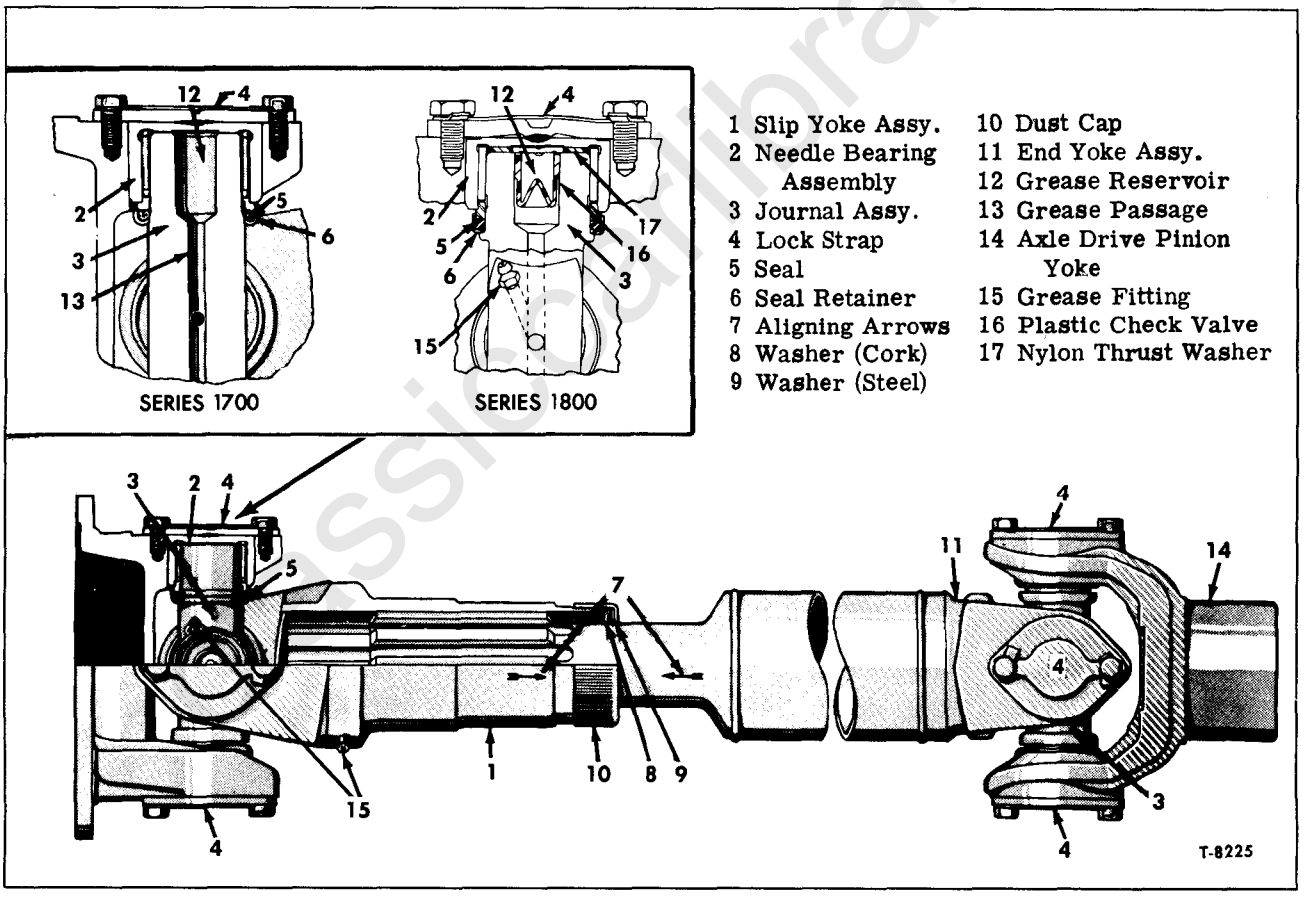


Figure 1—Typical Propeller Shaft with Type 1700 or 1800 Series Universal Joint

MAINTENANCE AND LUBRICATION

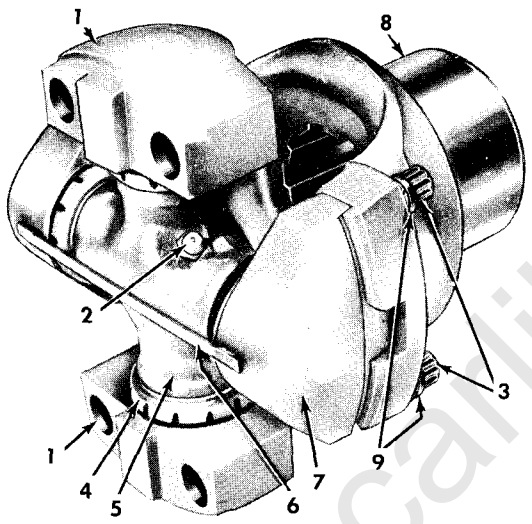
It should be emphasized that universal joint service life can be increased when the following recommendations are conscientiously adhered to:

1. Use a good quality Lithium Soap Multi-Purpose Grease which meets GM Specification 6031M (Symbol "MPG" on Lubrication Charts).

2. When greasing the joint, appearance of grease at all four trunnion seals should be visible to ensure the proper amount of lubrication has been used to lubricate the joint. If grease does not appear at all four trunnion seals, the universal joint trunnion should be rotated in all four directions while applying lubricant under pressure to relieve any air lock inside the joint which would prevent lubricant from reaching the bearing area.

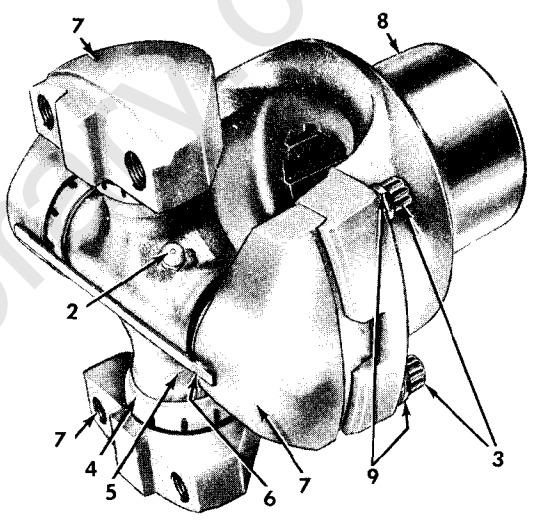
UNIVERSAL JOINTS 58 AND 68WB

The Delta Wing bearing of the 58WB and 68WB type universal joint, has the basic design change as shown in figure 2. New design change relieves all previous high stress areas. Other design changes include a special synthetic rubber, lip-type grease seal for more uniform lubrication. Thrust washers are standard or optional where required to eliminate galling.



HIGH WING TYPE

1 High Wing Bearing (Not Threaded)
2 Lubrication Fitting
3 Special Cap Screw
4 Oil Seal
5 Journal
6 Tie Bar



DELTA WING TYPE

7 Delta Wing Bearing (threaded)
8 Propeller Shaft Yoke
9 Lock Washer

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Figure 2—Type 58WB and 68WB Universal Joints Showing High and Delta Wing Bearings

PROPELLER SHAFT

UNIVERSAL JOINT APPLICATION

The following tabulation lists Universal Joints used with Standard and Optional Equipment.

TRUCK SERIES	AXLE SERIES	AT MAIN TRANS.	AUX. TRANS. (WHEN USED)	CENTER BEARINGS (WHEN USED)	AT REAR AXLE	INTER-AXLE SHAFT
HM-80	E-17000	1480		1480	1480	
	E-18-19000	58WB		58WB	58WB	
HV-70	E-17-18000	58WB		58WB	58WB	
	E-19000	68WB		68WB	68WB	
JM-80	E-30DS	(1) 58WB	68WB	68WB	68WB	58WB
		(2) 58WB	68WB	68WB	68WB	68WB
JV-70	E-34DS	(3) 58WB	68WB	68WB	68WB	58WB
	SLHD	(4) 68WB		68WB	68WB	58WB
		(4) (5) 68WB	1700	1700	1700	68WB
RM-80	H-162 H-362	(1) (2) 58WB		58WB	58WB	
	L-162 L-362	(6) 68WB		68WB	68WB	
TM-80	E-17000	1480		1480	1480	
	E-18-19000	58WB		58WB	58WB	
TV-70	E-17 or 19000	58WB		58WB	58WB	
WM-80	E-34DS—SLHD	58WB	68WB	68WB	68WB	58WB
WV-70	E-34DS	(4) 68WB		68WB	68WB	58WB
HM-80	U-200	68WB		68WB	68WB	
TE/HE/HI/HN-90	E-18-19000	68WB		68WB	68WB	
HI-90	E-19000—R-170	(7) 1700		1700	1700	
HN-90	E-19000—R-170	(7) (8) 1700		1700	1700	
JE-90	E-34D3—SLHD	68WB		68WB	68WB	68WB
JI-90	E-34D3	(9) 68WB		68WB	68WB	68WB
JI-90	SLHD—SQHD	(7) (9) 1700		1700	1700	68WB
JN-90	E-34DS—E-34D3 SLHD—SQHD	1700		1700	1700	68WB
JN-90	E-34DS	(10) 1700		1700	1700	1700
JH-JC-MH-MC-90	SLHD—SQHD	1700		1700	1700	1700
JH-90	SQHD	(10) 1700	1800	1800	1800	1700
HC-HH-90	E-19000—R170	1700		1700	1700	
MB/JB-90	SLHD	1700		1700	1700	68WB
DB-90	SLHD	1700		1700	1700	1700
DP-90	SQHD	1800		1800	1800	1700
DC/DH-90	E-34DS—SLHD SQHD—SSHD	1700		1700	1700	1700
DI/DN-90	E-34DS—E-34D3 SLHD—SQHD	1700		1700	1700	68WB
FB/FC/FH/FI/FN-90	E-19000—R-170	(8) 1700		1700	1700	
FI-90	E-18-19000	(11) (12) 68WB		68WB	68WB	

(1) V6 401 Engine
(2) V6 478 Engine
(3) CL 385V Main Trans.
(4) MT 41 Main Trans.
(5) SP 7041 Aux. Trans.
(6) MT 42 Main Trans.
(7) RT 910 Main Trans.
(8) RTO 9513 Main Trans.
(9) SP 6852K Aux. Trans.
(10) SP 8341C Aux. Trans.
(11) SP 6852S Aux. Trans.
(12) SP 7452E Aux. Trans.

SECTION 5

Brakes

All information in 1970 Heavy Duty Truck Service Manual ST135-70 BRAKES (SEC. 5) also applies to vehicles covered by this supplement except as specifically stated in the following procedures:

SECTION 5A

Hydraulic Brakes

BRAKE SYSTEM MAINTENANCE

Refer to 1970 Heavy Duty Truck Service Manual ST135-70, page 5-1 under above heading. The statement in Step 1 — "At least once a year, drain and flush entire brake system and refill with new fluid" no longer applies.

Flushing system and replacing fluid is necessary only when it is known or suspected that system has become contaminated with dirt, water, wrong type fluid, etc.

CLEANING AND FLUSHING BRAKE PARTS AND SYSTEM

Under the headings of "Bleeding Brakes," "Master Cylinder Overhaul," and "Wheel Cylinder Repair" in 1970 Heavy Duty Truck Service Manual ST135-70 instructions are given to wash or clean parts with DENATURED ALCOHOL.

Latest instructions specifically state "DO NOT USE ALCOHOL" for flushing hydraulic brake systems or for washing parts with internal passages in which fluid could be trapped. The only approved fluid for such cleaning or flushing operations is new brake fluid. Parts without internal passages may be cleaned with alcohol but must be completely dried and coated with brake fluid before assembly.

CAUTION: DO NOT use kerosene, gasoline, or other unapproved solvents for cleaning or flushing hydraulic brake systems or parts.

BRAKE PEDAL PUSH ROD ADJUSTMENT

IMPORTANT: If any doubt exists relative to push rod adjustment, remember it is better to have push rod too short than for it to be too long.

"H" AND "J" MODELS

1. Loosen lock nut on brake pedal push rod and shorten push rod until brake pedal is completely clear of brake pedal bumper stop.
2. Place a 0.040-inch shim between brake pedal and brake pedal bumper stop.
3. With master cylinder properly installed on fire wall and master cylinder piston in rearmost position against retaining ring, adjust push rod length until push rod contacts master cylinder piston.
4. Hold push rod firmly and tighten lock nut.
5. Check operation of brakes.

TILT CAB MODELS

1. Set emergency brake or block wheels.
2. Tilt cab (see instructions).
3. To adjust, loosen adjusting nut and turn rod in or out of rod end as necessary. Adjust so that there is 1/8" free play movement of brake pedal at pad before end of push rod contacts piston.
4. Tighten adjusting nut.
5. Check operation of brakes.

MASTER CYLINDER REPLACEMENT

CONVENTIONAL MODELS

Removal

1. Place a suitable container under master cylinder to catch fluid when hydraulic line is disconnected. DO NOT RE-USE THIS FLUID.
2. Disconnect hydraulic line from outlet.
3. Remove two bolts and lock washers attaching master cylinder to fire wall (nuts are welded to inner side) and remove master cylinder assembly.

Installation

1. Place master cylinder in position on fire wall. Make certain push rod is aligned properly and

that boot is in place on push rod and through fire wall.

2. Install two bolts and lock washers. Tighten firmly.

3. Connect hydraulic line to brake cylinder outlet.

4. Adjust push rod according to instructions.

5. Fill master cylinder reservoir and bleed as necessary.

TILT CAB MODELS

Removal

1. Tilt cab forward and place a suitable container under master cylinder to catch fluid when hydraulic lines are disconnected.

NOTE: DO NOT RE-USE THIS FLUID.

2. Disconnect hydraulic lines from outlets.

3. Remove three bolts attaching master cylinder to support bracket and remove master cylinder assembly.

Installation

1. Position master cylinder assembly at support bracket and guide push rods into pistons. Make certain that push rod boot is in place on push rod and on support bracket. Attach cylinder with three bolts. Tighten bolts firmly.

2. Connect hydraulic lines to brake and clutch cylinder outlets.

3. Adjust push rods as directed.

4. Fill master cylinder reservoir and bleed brake system as necessary.

MASTER CYLINDER OVERHAUL

Refer to 1970 Heavy Duty Truck Service Manual ST135-70 under above heading in "Inspection and Repair" procedure on page 5-8. Instructions reading "Do not hone more than necessary ---" should read "DO NOT HONE." If scratches or corrosion spots cannot be polished out with crocus cloth, cylinder should be scrapped and replaced with a new cylinder.

SECTION 5B
Air Brakes

BRAKE ADJUSTMENTS

Information relative to brake pedal and brake treadle adjustments are the same as given in Service Manual ST135-70, except for Conventional Cab Models. The suspended pedal installation shown in figure 2, page 5-10, is no longer used. All Conventional Cab Models use a treadle type installation as shown in figure 5, page 5-31. This is the same type as used on the 90 Series and is NOT adjustable.

BRAKE APPLICATION VALVES

All information in Service Manual ST135-70 under above subject applies to vehicles covered by this supplement except that pertaining to "Conventional Cab Models" on page 5-38. Information under the heading of "Aluminum Tilt Models" (pages 5-38 - 5-39) applies to Conventional Cab Models covered by this supplement.

MOISTURE EJECTOR VALVE

Models HH, HC, JH, JC 90 use a different type moisture ejector valve than the type described on pages 5-37 and 5-38 of Service Manual ST135-70. An adapter fitting is part of the valve and is threaded into a tee in the drain port of the air tank.

Inlet and exhaust valves in the moisture ejector are normally closed. When air compressor is operating to increase reservoir pressure the inlet valve opens allowing air and contaminants to collect in the sump of the ejector. When cut-out pressure is reached, the spring action of the valve guide closes inlet valve.

When reservoir pressure drops slightly (approx. 2 psi) air pressure in the sump cavity opens exhaust valve and allows water and contaminants to be ejected. When pressure in sump drops, exhaust valve closes.

The length of time the exhaust valve remains open and the amount of water and contaminants ejected depends upon the sump pressure and the reservoir pressure drop that occurs each time air is used from the system.

If necessary, manual draining through the valve can be accomplished by moving the wire in the exhaust port upward and holding it until draining is completed.

To remove valve from vehicle, drain air from system and unthread adapter from tee in air tank drain port.

To install valve and adapter assembly, simply thread adapter into tee in air tank drain port.

AIR LINES

NYLON TUBING

Some vehicles covered by this supplement use nylon tubing for air lines in areas where such material is suitable. Nylon tubing is flexible, durable, and weather resistant.

In the event it is necessary to replace a nylon line it will be necessary to assemble the ends to the tubing which must be cut to required length. Refer to figure 1.

1. Cut nylon tube to required length.
2. Install nut and ring over tube.
3. Insert mandrel into barb body.
4. Place mandrel and barb body into jig.
5. Thread nut onto mandrel threads finger-tight up to jig face.
6. Push nylon tube in jig over barb body until nylon tube seats against barb body.
7. Push ring into jig until it seats against barb body.
8. Hold jig securely with a wrench or in a vise.
9. Withdraw mandrel from barb body and nylon tube by turning nut on mandrel threads.
10. Check sight notch in ring to be sure nylon tubing is seated against barb body flange.
11. Install fitting at other end of nylon tube using above procedure.

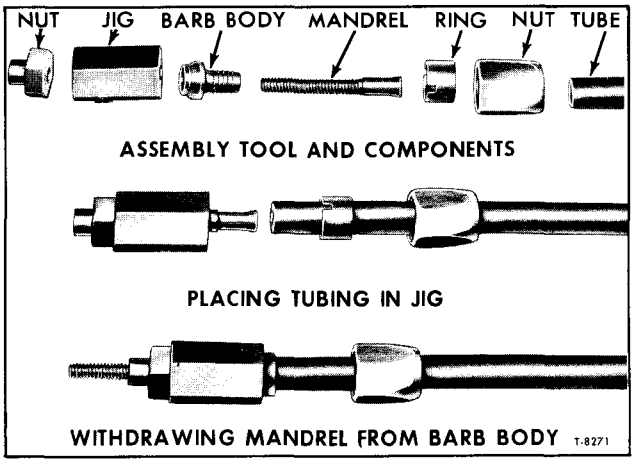


Figure 1–Nylon Tubing Assembly

AIR BRAKES

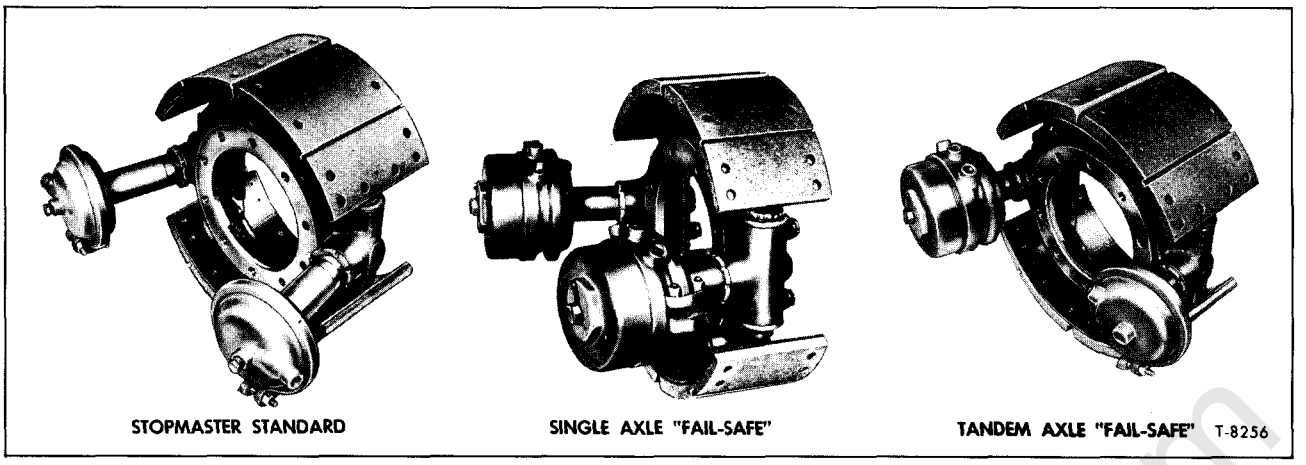


Figure 2–Stopmaster Brake Assemblies

STOPMASTER BRAKES

Minor changes relative to "Stopmaster Brakes" as covered in Service Manual ST135-70 are as follows:

1. Figure 24 (page 5-53) - Wiper grooves have been added to the brake linings of Stopmaster brake assemblies. See figure 2.

2. Figure 25 (page 5-53) - The term "guide" has been changed to "pawl." This is a nomenclature change ONLY; there is no change in the part. See figure 3.

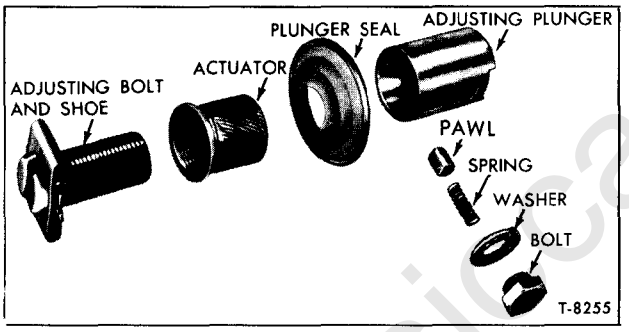


Figure 3–Automatic Adjuster Components

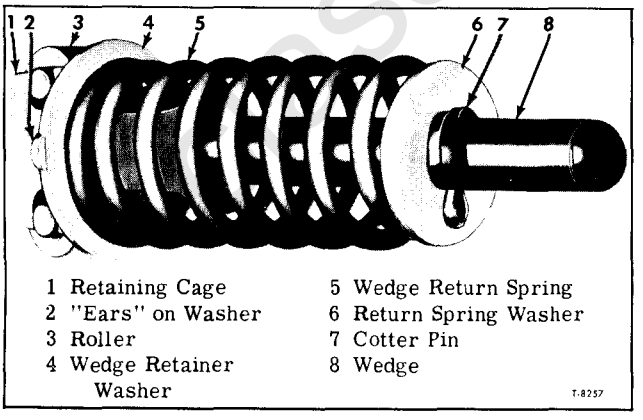


Figure 4–Wedge and Roller Assembly

3. "Plunger Guide" - Wherever the term "plunger guide" or "guide" is used it should be changed to read "adjusting pawl" or "pawl." This also is a nomenclature change ONLY.

4. Add Copy to Step 4 of "Brake Chamber Assembly and Installation" procedure on page 5-56. "NOTE: Final tighten nut with brakes applied if possible. This makes a more positive lock on collet nut."

5. Figure 31 (page 5-58) Item #8 (wedge) has a groove around its circumference near the rounded end. This is an identification mark used to differentiate different wedge lengths. The wedge with

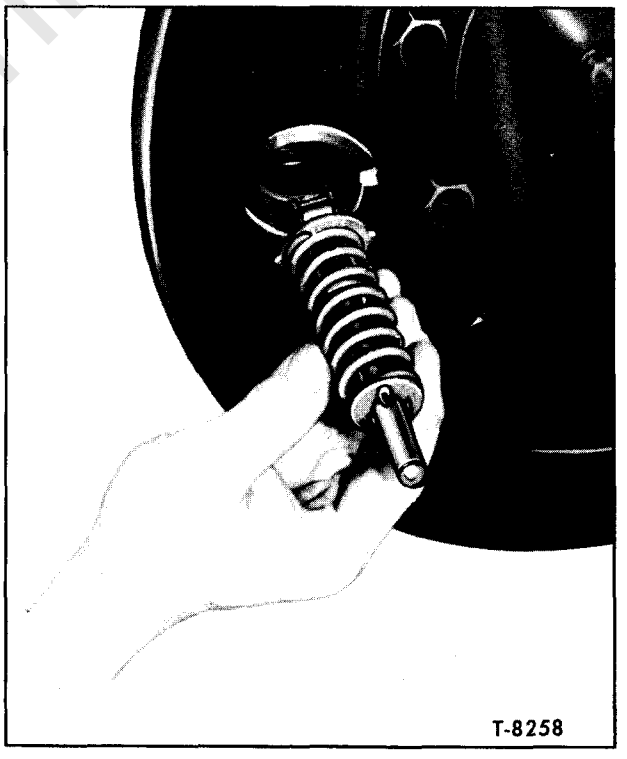
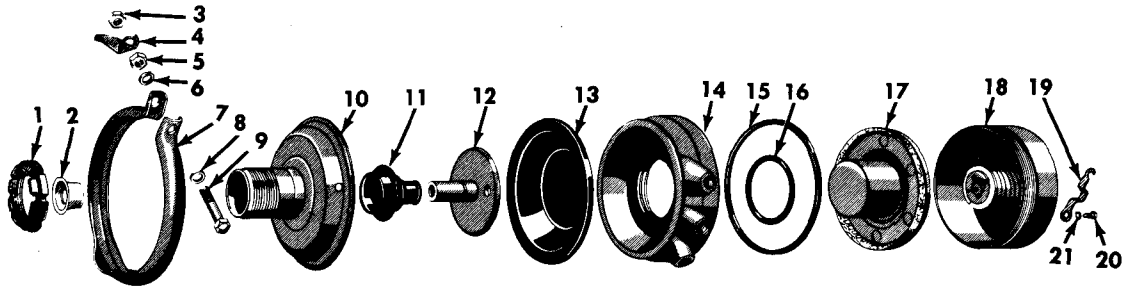


Figure 5–Installing Wedge Assembly



1 Spanner Nut
2 Wedge Rod Guide
3 Tag Nut
4 Caution Tag
5 Nut
6 Lock Washer
7 Clamping Ring
8 Washer
9 Bolt
10 Non-Pressure Housing
11 Push Rod Boot
12 Diaphragm Plate Rod
13 Rubber Diaphragm
14 "Fail-Safe" Pressure Housing
15 Housing to Cap Rubber Washer
16 Housing to Plunger "O" Ring
17 Air Chamber Piston Plunger Assembly
18 Air Chamber Cap Assembly
19 Release Bolt Spring Lock
20 Capscrew
21 Lock Washer

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Figure 6—"Fail-Safe" Air Chamber Components

the groove is ¼" longer than the wedge without a groove. The parts are not interchangeable except as complete assemblies. See figure 4.

6. Figure 35 (page 5-59) — The wedge in this illustration should show the identification groove as explained above. See figure 5.

7. Figure 39 (page 5-62) Item #1 (washer) and Item #2 (nut) have been replaced by a tapered collet nut which, when tightened, is a self-locking type nut. Procedures covering installation or removal of this part are the same except reference to the retaining washer is to be removed. See figure 6.

BREATHER AND FILTER ASSEMBLIES

Figures 7 and 8 illustrate three different breather and filter assemblies. Figure 7 (left view) shows the original type breather. Replacement is covered in 1970 Heavy Duty Truck Service Manual ST135-70, page 5-66. To remove the intermediate type filter (fig. 7, right view) or the latest type (fig. 8), remove two screws and lift cover and filter off housing. To install, set filter in place on housing and attach cover. Filters can be cleaned and reused but breather cannot. If removed, breather must be replaced with new parts.

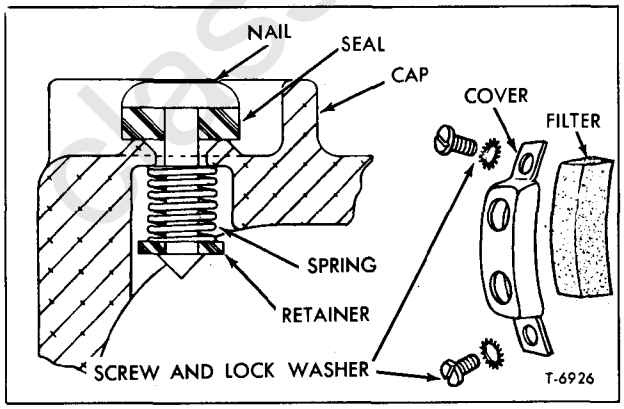


Figure 7—Breather and Filter Assembly

AIR LINE TORQUE

Refer to page 5-41 of 1970 Heavy Duty Truck Service Manual ST135-70 and change the following torque values:

3/8-inch from 30-50 to 50-75
1/2-inch from 90-115 to 120-150
5/8-inch from 100-125 to 150-200

Also change "re-torqued to a higher than minimum value" by removing "than minimum."

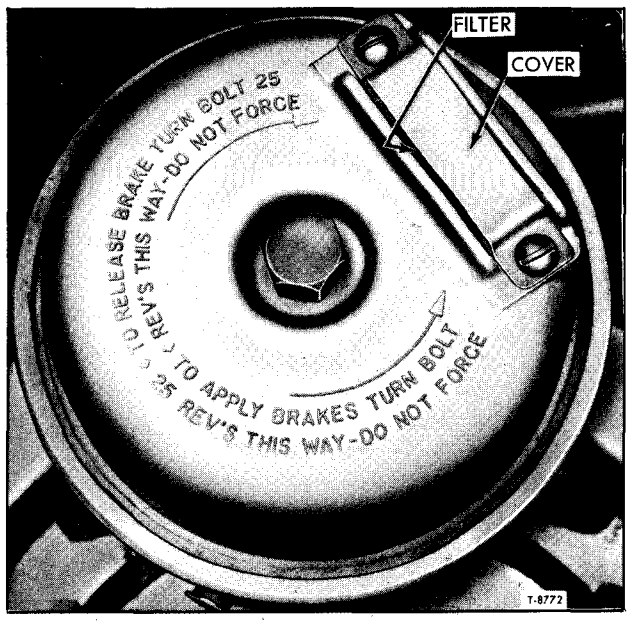


Figure 8—Filter Installed

PREVENTIVE MAINTENANCE CHART

The vehicles covered by this Maintenance Manual are used in different types of operation. With these conditions, it is impossible to establish the maintenance intervals (either time or mileage). Therefore, any such intervals given in the following Maintenance Chart must be related to the type of operation in which a particular vehicle is used. Intervals given are manufacturer's recommendations and should be considered as maximum periods. Maintenance operations at shorter intervals are preferable to longer intervals.

Whenever any assembly is removed and disassembled for maintenance it is advisable to replace all grommets, gaskets, O-rings etc., and any other parts which show wear or deterioration.

ITEM	INTERVAL (1)	MAINTENANCE OPERATION
Check Valves	6 Mos.—50,000 Miles—1800 Hrs.	Remove, disassemble, clean, inspect
Air Tank Check Valve	6 Mos.—50,000 Miles—1800 Hrs.	Remove, disassemble, clean, inspect
Low Air Pressure Switch	300 Hrs.—8,000 Miles	Check Electrical Connections
	3,600 Hrs.—100,000 Miles—1 Year	Remove, disassemble, clean, inspect
Safety Valve	Annually	Remove, disassemble, clean, inspect
Air Lines	5,000 Miles	Test for leaks; tighten as necessary
Moisture Ejector Valve	1800 Hrs.—50,000 Miles—6 Mos.	Remove, disassemble, clean, inspect
Alcohol Evaporator	10,000 Miles—2 Months	Remove and clean strainer
	50,000 Miles—1 Year	Remove, disassemble, clean, inspect
Brake Shoe Assemblies	(2)	Check lining thickness (5/16" or less, reline)
Slack Adjuster	3,000 Miles	Lubricate at chassis lubrication
Std. Brake Chamber	3,600 Hrs.—100,000 Miles—1 Year	Remove, disassemble, clean, inspect
Anchorlok Brake Chamber Stopmaster Brake Chamber	2 Months—25,000 Miles	Check operation and air lines
"Fail-Safe" Brake Chamber "Super Fail-Safe" Brake Chamber	Annually—100,000 Miles or at Brake Reline	Remove, disassemble, clean, inspect
Application Valve	300 Hrs.—8,000 Miles—30 Days	Lubricate treadle pin and roller pin
	3,600 Hrs.—100,000 Miles—1 Year	Remove, disassemble, clean, inspect
Relay Valve	3,600 Hrs.—100,000 Miles—1 Year	Remove, disassemble, clean, inspect
Push-Pull Valve	3,600 Hrs.—100,000 Miles—1 Year	Remove, disassemble, clean, inspect
Limiting-Quick Release Valve	Annually	Remove, disassemble, clean, inspect
Pressure Protection Valve	6 Months—50,000 Miles	Remove, disassemble, clean, inspect
Trailer Brake Hand Control Valve	1500 Hrs.—50,000 Miles	Check operation—lubricate cam and follower
	3000 Hrs.—100,000 Miles—1 Year	Remove, disassemble, clean, inspect
Tractor Protection Valve	Annually	Remove, disassemble, clean, inspect
Double Check Valve and Stop Light Switch	Monthly—10,000 miles	Check electrical connections and operation
	Annually—50,000 Miles	Remove, disassemble, clean, inspect
Trailer Emergency Stop Light Switch	900 Hrs.—25,000 Miles	Check electrical connections and operation
	Annually—50,000 Miles	Remove, disassemble, clean, inspect
Air Compressor	(2)	Clean carbon from valves and discharge line. Check mounting bolts and tighten. Check lines for leaks.
Governor	500 Hrs.—15,000 Miles	Clean or replace filters
	3000 Hrs.—100,000 Miles	Remove, disassemble, clean, inspect, re-set

(1) Where more than one interval is given, operation to be performed at time of whichever occurs first.

(2) Determined by severity of service.

SPECIFICATIONS

FRONT BRAKES

SIZE	TYPE	MODELS
15 x 3	Wedge	HM 80, HV 70
15 x 3-1/2	Wedge	JM 80, JV70, TE, MB, MC, JB, HC, HE, HH, HI, HN, JC, JE, JH, JI, JN, MH 90 and all 90
15 x 3	Cam	TV 70
15 x 3-1/2	Cam	RM, WM, TM 80
16-1/2 x 4	Cam	WV 70
17-1/4 x 3-1/2	Cam	HM 80

REAR BRAKES

SIZE	TYPE	MODELS
15 x 6	Wedge	HM-JM80, HV 70
15 x 7	Wedge	JV 70, TE, MB, MC, JB, HC, HE, HH, HI, HN, JC, JE, JH, JI, JN, MH 90 and all 90
15 x 7	Cam	RM-TM 80, TV 70
16-1/2 x 7	Cam	WM-HM 80, WV 70

AIR BRAKES

The air compressor is the source of supply for the vehicle braking system. Faulty operation of the compressor will result in improper function of brakes.

SECTION 6A

Gasoline Engines

ENGINE APPLICATION		
TRUCK MODEL	STANDARD	OPTIONAL
HM80	401M	478M
JM80	401M	478M
RM80	401M	478M
TM80	401M	478M
WM80	401M	-
HE90	637	-
TE90	637	-
JE90	637	-

The information pertinent to truck models covered by this supplement is same as given in 1970 Heavy Duty Truck Service Manual ST135-70 and 1971 Supplement ST332-71 with the following exceptions and/or additions:

CRANKCASE VENTILATION SYSTEM

The information pertaining to crankcase ventilation system in Manuals ST135-70 and ST332-71 is applicable to engines in vehicles covered by this manual.

However, the replacement interval for crankcase ventilation valves is currently every 24 months, or at 24,000 miles.

An inspection of crankcase ventilation system should be made at first oil change on new vehicles

WINDOW READING	PROBABLE TROUBLE	REMEDY
GREEN	System Satisfactory	
YELLOW	Vent valve partially plugged. Blow-by close to capacity of valves	Check the valves
	Tester hose kinked or blocked	Reposition or clean hose
	Crankcase not sealed properly	Check tester plugs and other seal-off points
	Tester "selector knob" set incorrectly	Check setting
YELLOW-GREEN	Vent-valves partially plugged	Check vent valves
	Slight kink in CT-3 tester hose	Reposition tester hose
	Modest engine blow-by	Check vent valves
	Crankcase not sealed properly	Check tester plugs and other seal-off points
	Tester "selector knob" set incorrectly	Check setting
RED-YELLOW	Vent valve partially or fully plugged	Check vent valves
	Engine blow-by exceeds valve capacity	Engine overhaul indicated
	Rubber vent hose collapsed or plugged	Clean or replace hose
RED	Vent valves plugged	Check vent valves
	Vent valves stuck at engine off position	Check vent valves
	Rubber vent hose collapsed or plugged	Replace hose
	Extreme engine blow-by	Engine requires major overhaul T-8221

Figure 1–PCV Valve Problem Analysis Chart (Using AC Tester CT-3)

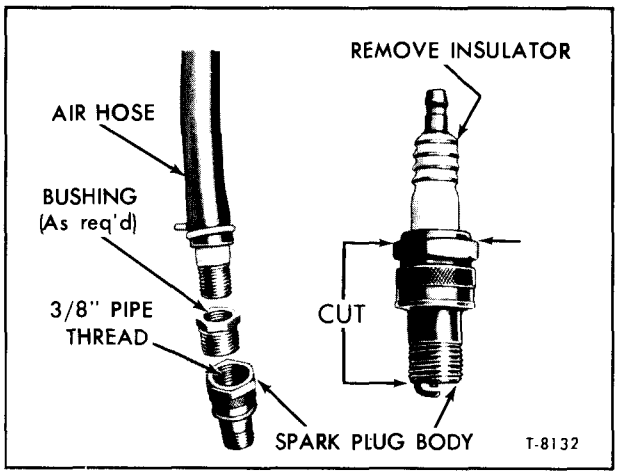


Figure 2—Air Supply Adapter Tool

and at every 12-month or 12,000 mile interval thereafter. A tester (AC Type CT-3) is available for use in checking the condition of the crankcase ventilation system. Follow the instructions furnished with the tester when making system check.

The CT-3 Tester functions as a pressure and or vacuum gauge. Changes in either the pressure or vacuum will move a colored viewing drum upward or downward in relation to fixed window openings. A selector knob on the bottom of tester, with settings "A" through "O" permits tester calibration to match air flow through valves. With the CT-3 properly connected to an idling engine, a single color or a combination of colors of red, green or orange visible in the window openings, indicates the operating condition of the Positive Crankcase Ventilation System. Window reading interpretations, probable troubles, and remedies are fully covered in the PCV Diagnosis Chart (fig. 1).

Brief instructions for using the CT-3 tester are as follows:

1. Install the dipstick tube plug provided in the tester kit.
2. Set parking brake, start engine, and allow to idle.
3. Remove the breather connection from the air cleaner and place the PCV tester connection at the opening to the crankcase (rocker arm cover). The PCV tester should be set to the "M" position for V6 engine, or to "K" position on V8 engines.
4. A green reading indicates the system is operating satisfactorily and no further testing is required. An orange or red reading indicates insufficient air flow in the ventilation line. Additional testing is required to determine the cause.
5. Remove rocker arm covers and inspect the crankcase ventilation valves which are screwed into threaded ports in cylinder heads.

NOTE: One valve is used in each cylinder head on V6 engines, and two valves are used in each cylinder head on V8 engines.

Use socket wrench to remove crankcase ventilation valves in case the testing indicates a malfunction in crankcase ventilation system.

Clean valves, hoses, and breather assembly, then install parts and repeat the test as previously described.

If, after ventilation valves and/or hoses and other system components are installed, the test indicates unsatisfactory performance of the ventilation system, a check should be made to see that crankcase openings were all completely sealed during test.

It may be necessary to make repairs to engine components such as valves, piston rings, or oil seals to make possible a satisfactory operating crankcase ventilation system.

VALVE SPRING REPLACEMENT (V6 AND V8 CYLINDER HEAD)

In most vehicles it is possible to replace a broken or defective valve spring without removing cylinder head from engine. Figure 2 shows how to make an air hose adapter from a discarded spark plug to be used to connect air line to cylinder at which the valve spring is to be replaced. Adapter is made from spark plug by cutting off electrode and the upper portion of plug body as shown. Remove insulator from body, then thread the body upper cavity with 3/8-inch pipe tap. Install bushing and fittings as necessary to connect air hose.

Use same procedure as described in Service Manuals ST135-70 and ST332-71 to replace valve springs and/or valve stem oil seals.

CRANKSHAFT PULLEY AND HUB REPLACEMENT

NOTE: 401M engines do not use a crankshaft damper.

CRANKSHAFT PULLEY
AND/OR HUB REMOVAL

1. Remove radiator if necessary, to provide access to crankshaft pulley. On engines with fan blades installed on crankshaft pulley, remove fan blades from crankshaft pulley hub. Also remove accessory drive belts.

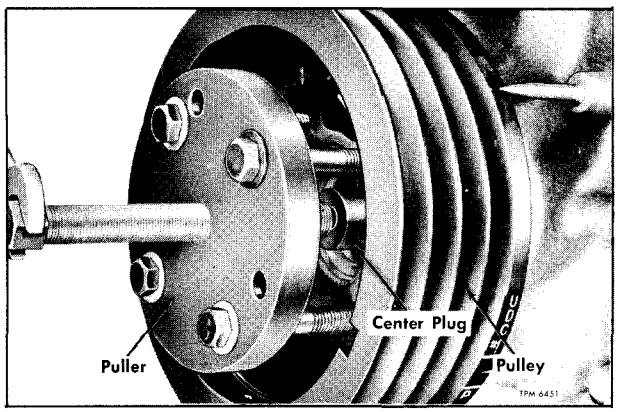


Figure 3—Crankshaft Pulley Removal (Typical)

2. Use impact wrench or block the crankshaft to prevent turning and use suitable socket wrench and handle to loosen bolt which secures pulley hub to crankshaft.

3. Remove bolt and thick washer, then assemble special puller and center plug in manner shown in figure 3. Turn puller screw to remove pulley hub or damper from crankshaft. A tapered cone (fig. 4) is used in addition to retainer washer on engines having a crankshaft damper assembly, or Tilt cab models with crankshaft pulley hub.

4. Remove key from keyway in crankshaft.

INSTALLING PULLEY HUB
OR DAMPER ASSEMBLY

1. Clean seal area on crankshaft pulley hub or damper hub thoroughly and apply engine oil on surface contacted by oil seal.

2. On 637 engine check position of O-ring seal (1, fig. 5) which should be located approximately ¼" from slinger (2, fig. 5) so it will roll into counterbore in hub as damper is installed.

IMPORTANT: On 637 engines, lubricate O-ring with engine oil.

3. Align keyway in pulley with key in crankshaft, then start pulley or hub onto front end of crankshaft. Assemble special installer typically shown in figure 5, and turn nut with wrench to force pulley firmly into place on crankshaft.

4. Remove installer, then referring to figure 4, locate cone (if used) at hub, and install retaining washer and bolt. Tighten retaining bolt to "Specifications" at end of this section.

5. Mount crankshaft pulley on pulley hub or damper.

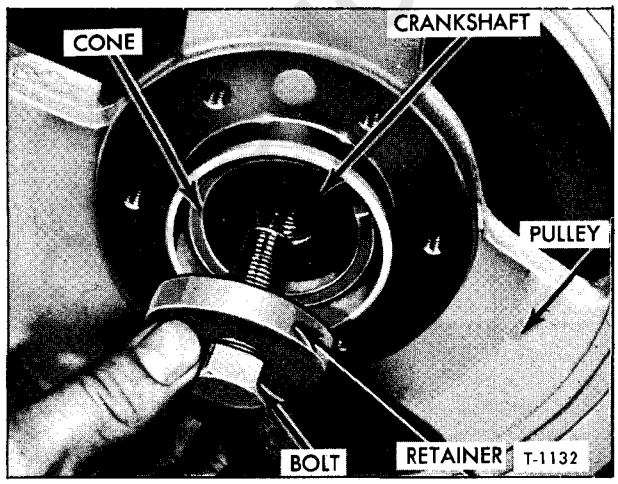


Figure 4—Crankshaft Damper Retaining Parts (Typical)

ENGINE OIL PAN REPLACEMENT (V8 ENGINE)

(Key Numbers in Text Refer to Figure 6)

OIL PAN REMOVAL

1. Clean all dirt and accumulated material from oil pan attaching bolts and drain plug.

2. Drain oil from oil pan.

3. Remove lower oil pan bolts (14), then remove lower pan (1) and gasket (12).

4. Loosen upper and lower oil inlet tube nuts (7) see inset in figure 6.

5. Remove two bolts, nuts, and washers (5) attaching oil pump suction screen bracket (8) to upper pan (2).

6. Remove lower oil inlet tube nut (7), remove float assembly (9) and suction screen bracket (8).

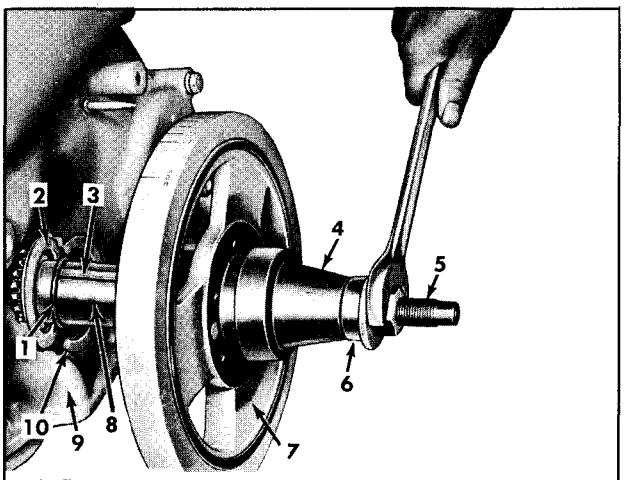
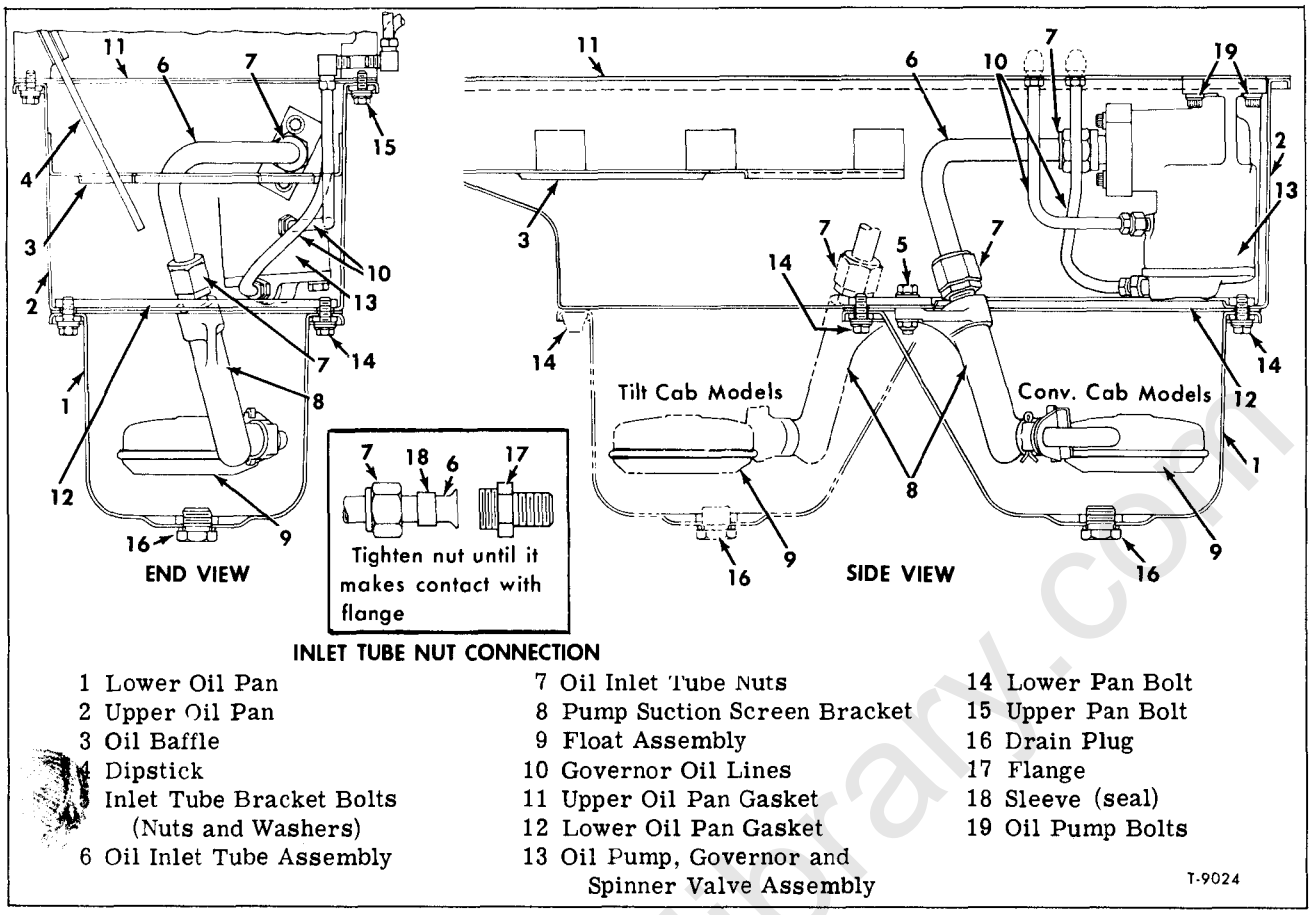


Figure 5—Installing Damper on Crankshaft with Special Tool Set



1 Lower Oil Pan
2 Upper Oil Pan
3 Oil Baffle
4 Dipstick
5 Inlet Tube Bracket Bolts (Nuts and Washers)
6 Oil Inlet Tube Assembly
7 Oil Inlet Tube Nuts
8 Pump Suction Screen Bracket
9 Float Assembly
10 Governor Oil Lines
11 Upper Oil Pan Gasket
12 Lower Oil Pan Gasket
13 Oil Pump, Governor and Spinner Valve Assembly
14 Lower Pan Bolt
15 Upper Pan Bolt
16 Drain Plug
17 Flange
18 Sleeve (seal)
19 Oil Pump Bolts

Figure 6—Oil Pan, Oil Pump, and Inlet Screen Installation (637 V-8 Engine)

7. Remove upper oil inlet tube nut and remove oil inlet tube assembly (6).

IMPORTANT: Note condition of sleeves (18) on oil inlet tube assembly (16). Replace if damaged.

8. Remove upper oil pan bolts (15) and stud nut, then remove oil pan (2). Scrape off any portions of gasket (11) which adhere to oil pan flange or bolting flange on cylinder block and engine front cover.

OIL PAN INSTALLATION

1. Using new oil pan gasket install upper oil pan assembly.

NOTE: Use gasket cement to hold the oil pan gasket (11) in place at cylinder block and front cover. Tighten bolts evenly to 10 to 15 foot-pounds torque. Overtightening the bolts will distort the oil pan flange.

IMPORTANT: Make sure the sleeves (18) on oil inlet tube assembly (6) are in good condition and not distorted or damaged.

2. Install oil inlet tube assembly (6), and tighten upper nut (7) loosely on oil pump.

3. Install two bolts, washers, and nuts (5), attaching oil pump suction screen bracket (8) and float assembly (9) loosely to upper oil pan (2).

4. Align oil inlet tube assembly (6) with oil pump suction screen bracket (8) and connect lower inlet tube nut (7).

IMPORTANT: Tighten upper and lower oil inlet tube assembly nuts (7) until they make contact with flanges (17). Refer to inset in figure 6.

5. Tighten bolts (5) attaching bracket (8) to upper oil pan (2) to 8 to 12 foot-pounds torque.

6. Install lower oil pan (1) using new gasket (12) and bolts (14) which have threads coated with sealer to prevent oil leaks. Correct torque on lower pan bolts is 6 to 8 foot-pounds.

7. Install drain plug (16) with new gasket, then fill crankcase with engine oil to "FULL" mark on dip stick. Use oil as specified in LUBRICATION (SEC. 0) in this manual.

ENGINE OIL PUMP REPLACEMENT (V8 ENGINE)

(Key Numbers in Text Refer to Figure 6)

REMOVAL

1. Remove engine oil pan as previously instructed.

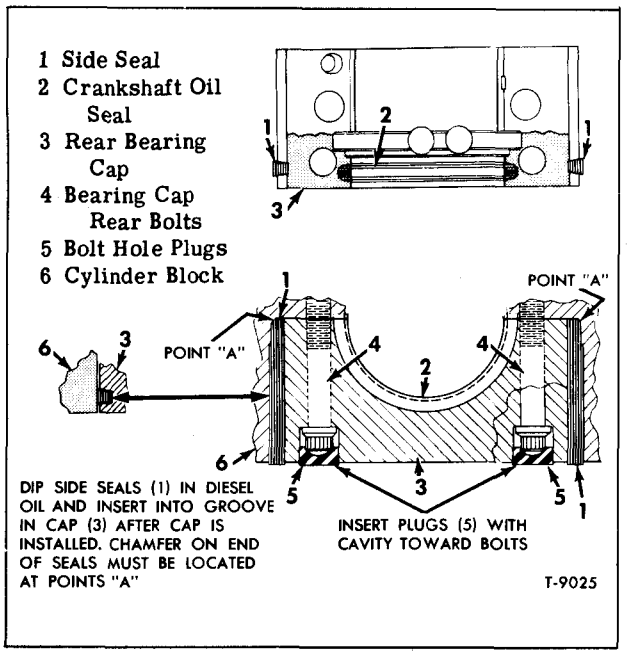


Figure 7—Cross Section of Rear Bearing Cap and Seals

2. Remove oil lines (10) used between spinner valve (13) and fitting in cylinder block.

3. Remove bolts (19) holding oil pump assembly to cylinder block, then remove pump assembly. Oil pump drive shaft will usually disengage from socket in distributor and will remain with oil pump as it is removed.

4. Remove gasket and clean gasket contact areas on pump mounting flange and on cylinder block.

INSPECTION OF SUCTION TUBE AND SCREEN

Inspect screen (9) and bracket (8) for damage. If the screen is damaged or clogged, the assembly should be replaced with new part when assembling pump on engine. Solvent may be used to clean the screen in some instances.

INSTALLATION (Fig. 6)

1. Place new pump-to-block gasket on oil pump flange, and insert pump drive shaft in drive socket in pump shaft.

2. Set oil pump assembly in position at cylinder block and turn pump as necessary to engage the pump drive shaft with drive socket at distributor.

3. Align mounting bolt holes in pump flange with holes in block and install pump to block bolts (19).

4. Install oil lines (10) between fittings at spinner valve and cylinder block.

5. Install engine oil pan, following the instructions previously given under "Engine Oil Pan Replacement."

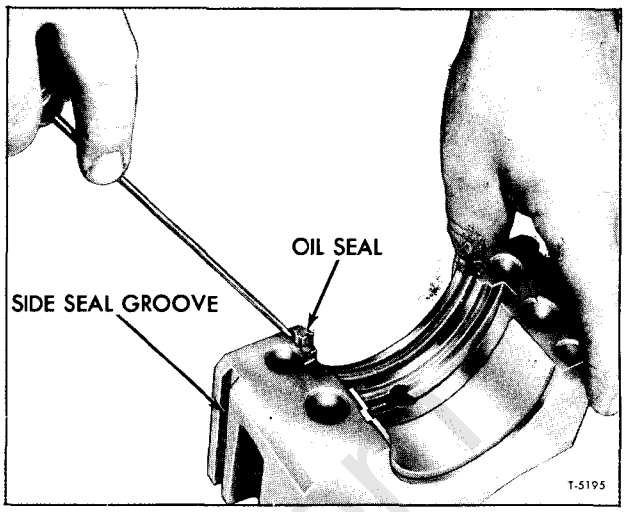


Figure 8—Removing Seal Lower Half From Bearing Cap

CRANKSHAFT REAR BEARING OIL SEAL REPLACEMENT (V8 ENGINE)

REMOVAL

1. Drain oil out of crankcase, then referring to instructions given previously in this manual, remove oil pan, and oil pump.

2. Referring to figure 7, remove bolt hole plugs (5), then remove the four rear main bearing cap bolts, and the two side bolts.

3. Remove rear bearing cap. If necessary to start bearing cap out of block, use a pair of round bars inserted in bolt holes to work cap out of block.

4. Remove seal from groove in bearing cap with screwdriver as shown in figure 8. To remove seal upper half from groove in cylinder block use a light weight hammer and soft metal drift (aluminum, copper, or brass) to start the seal out of

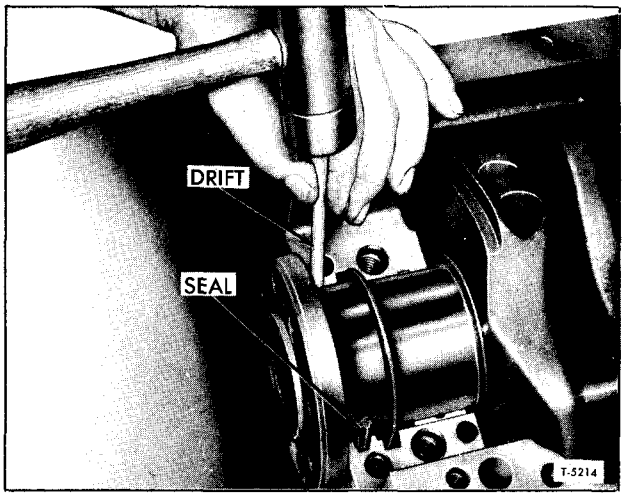


Figure 9—Removing Seal Upper Half From Block

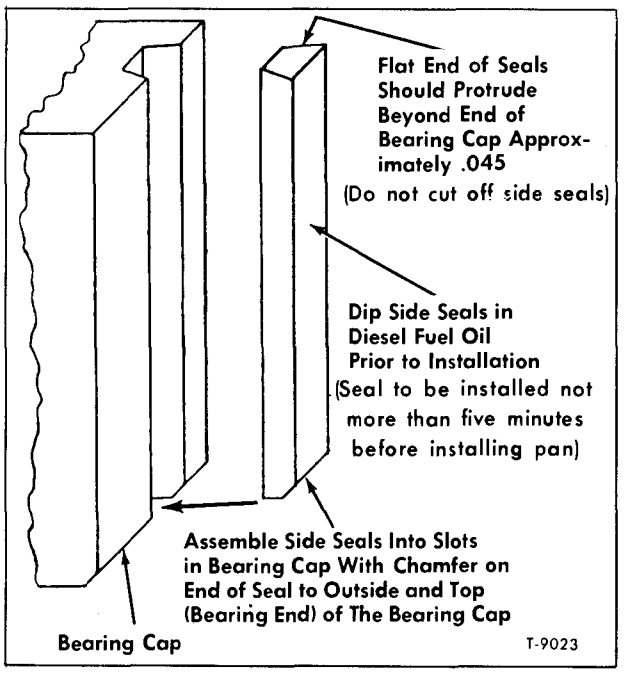


Figure 10—Bearing Cap Side Seal Installation

groove (fig. 9), then use pliers to complete the seal removal.

INSTALLATION

The two seal halves must be installed with lip toward front of engine.

1. Apply engine oil on seal lip, then insert end of seal into groove in block then while pushing seal firmly against crankshaft with hammer handle, turn crankshaft to roll the seal into place (similar to installing a main bearing).

2. Insert seal lower half in groove in bearing cap, lubricate seal lip with engine oil, but do not apply oil on ends of either seal.

NOTE: Seals are cut to length and protruding ends must not be cut off.

3. Apply sealer on cylinder block area contacted by main bearing cap (shaded area in figure 7). Oil the cap bolt threads and washers with S.A.E. #10 engine oil. Insert 5/8-11 bolts with washers into holes in bearing cap and start bolts into threads but do not tighten bolts until side bolts and the two vertical bolts (4, fig. 7) have been started into threads.

4. Using torque wrench, tighten the 5/8-11 cap-to-cylinder block bolts to 170 to 180 foot-pounds. Tighten the ½-13 bolts to 90 to 100 foot-pounds torque and insert plugs (5, fig. 7) into bolt holes with cavity toward bolt heads.

5. Apply diesel fuel oil on bearing cap side seals, then insert a seal in groove at each side of rear bearing cap chamfered end first (fig. 10). Narrow edge of seals must mate with narrow side of groove in cap (fig. 10).

IMPORTANT: Seals must be installed not more than 5 minutes before installing pan.

NOTE: When side seals are fully inserted exposed end will protrude approximately 0.045-inch beyond surface of bearing cap. DO NOT CUT OFF SIDE SEALS.

6. Following instructions previously given in this supplement section, install engine oil pump and oil pan, and fill crankcase with engine oil.

USE ENGINE OIL AS SPECIFIED IN LUBRICATION (SEC. 0) AND SERVICE CRANKCASE VENTILATION UNITS AND OIL FILTER REGULARLY.

Gasoline Engine Tune-up Specifications

V6 GASOLINE ENGINE TUNE-UP CHART (ENGINE MODELS 401M AND 478M)

TYPE AND NUMBER OF CYLINDERS . . . 60° V-6

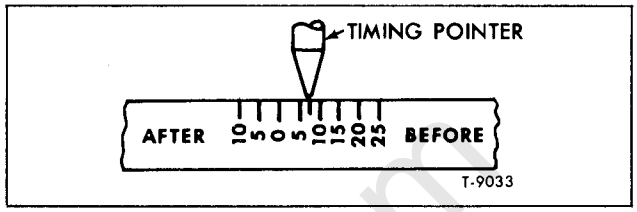
CYLINDER COMPRESSION (PSI) 401-125
. 478-115

SPARK PLUGS
- Spark Plug Make and No. AC-CR-43N
- Spark Plug Gap . . . . . 0.035"
- Spark Plug Tightening Torque (Ft.-Lbs.) . . . 32

IGNITION DISTRIBUTOR
- Dwell Angle (Degrees) 31-34
- Point Gap (New) . . . . . 0.019"
- Point Gap (Used) . . . . . 0.016"
- Contact Lever Spring Tension (Oz.) 19-23

FIRING ORDER 1-6-5-4-3-2

IGNITION TIMING (See NOTE below) . . 7½° BUDC



VALVE LASH
- Intake . . . . . 0.012"
- Exhaust . . . . . 0.018"

ENGINE GOVERNOR SETTINGS(Full Load RPM)*
- 401M 3400
- 478M 3200

ENGINE IDLING SPEED (RPM) 525

FUEL PUMP PRESSURE (PSI) 5-6.5

CYLINDER HEAD BOLT TORQUE (FT.-LBS.) 60-65

NOTE: At engine idle speed with vacuum line disconnected and plugged.
* No load speed is approximately 300 rpm higher than full load speed.

V8 GASOLINE ENGINE TUNE-UP CHART (ENGINE MODEL 637)

TYPE AND NUMBER OF CYLINDERS . . . 60° V-8

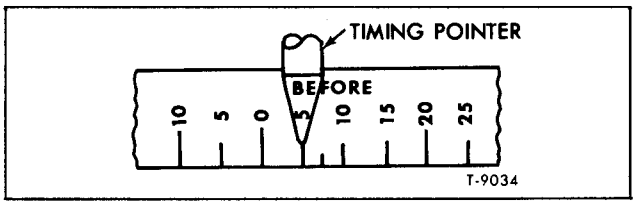
CYLINDER COMPRESSION (PSI) 115

SPARK PLUGS
- Spark Plug Make and No. AC-CR-42N
- Spark Plug Gap . . . . . 0.035"
- Spark Plug Tightening Torque (Ft.-Lbs.) 32

IGNITION DISTRIBUTOR
- Dwell Angle (Degrees) 28-32
- Point Gap (New) . . . . . 0.019"
- Point Gap (Used) . . . . . 0.016"
- Contact Lever Spring Tension (Oz.) 19-23

FIRING ORDER 1-8-4-3-6-5-7-2

IGNITION TIMING (See NOTE below) . . . 5° BUDC



VALVE LASH
- Intake . . . . . 0.010"
- Exhaust . . . . . 0.018"

ENGINE GOVERNOR SETTINGS (Full Load Rpm) 2800*

ENGINE IDLING SPEED (RPM) 475

FUEL PUMP PRESSURE (PSI) 7.5-9

CYLINDER HEAD BOLT TORQUE (FT.-LBS.) 130-135

NOTE: At engine idle speed with vacuum line disconnected and plugged.
* No load speed is approximately 300 rpm higher than full load speed.

GASOLINE ENGINES

TORQUE SPECIFICATIONS

ALL 401, 478, AND 637 GASOLINE ENGINES UNLESS OTHERWISE NOTED
(Dry Threads Unless Otherwise Indicated)

ITEM	FT.-LBS.
Flywheel to Crankshaft Bolts	100-110
Main Bearing Cap Bolts (401 & 478 Engines) 9/16"	130-140
Rear Main Bearing Cap Bolts (401 & 478 Engines) ½"	* 90-100
Main Bearing Cap Vertical Bolt (637 Engine) 5/8"	*170-180
Main Bearing Cap Side Bolts and Rear Main Bearing Cap Bolts ½"	* 90-100
Oil Pump Mounting Bolt	30-35
Fuel Pump Eccentric to Camshaft Bolt	* 55-65
Camshaft Thrust Plate Bolts	25-30
Connecting Rod Nut	* 55-65
Intake Manifold Bolts	25-30
Exhaust Manifold Bolt	15-20
Front Cover to Cylinder Block Bolt	22-27
Damper or Pulley Hub (with Cone) to Crankshaft Bolt	240-260
Crankshaft Hub Bolt (without Cone) (401 Engine)	180-200
Flywheel Housing to Cylinder Block Bolt (Standard Transmission)	50-60
Flywheel Housing to Cylinder Block Bolt (Automatic Transmission)	85-105
Oil Filter Housing to Cylinder Block Bolt	26-36
Oil Filter Center Stud Bolt	40-50
Oil Pan to Cylinder Block Bolt	10-15
Oil Pan Drain Plug	20-30
Valve Lifter Cover Bolt	4-5
Rocker Arm Cover Screw	3-5
Rocker Shaft Bracket Bolts	20-25
Camshaft Idler Gear Shaft to Cylinder Block Bolt (637 Engine)	25-30
Camshaft Idler Gear Shaft to Cylinder Block Bolt (401 & 478 Engines)	12-15
Distributor Clamp to Block Bolt	12-17
Idler Gear Thrust Washer Bolt	25-30
Spark Plugs	30-34
Cylinder Head Bolt (401 & 478 Engines)	* 60-65
Cylinder Head Bolt (637 Engine)	*130-135
Balance Shaft Counterweight (637 Engine)	25-30
Balance Shaft Thrust Plate to Block Bolt (637 Engine)	25-30
Balance Idler Gear Shaft to Block Bolt (637 Engine)	* 25-30
Camshaft Gear to Camshaft Bolt (637 Engine)	* 50-60
Water Outlet Manifold to Cylinder Head Bolt (401 & 478 Engines)	20-25
Water Outlet Manifold (401 & 478 Engines)	20-25
Fuel Pump Mounting Bolts 5/16"	12-17
Fuel Pump Mounting Bolts 3/8"	20-25
Oil Pump Cover Bolts	8-15

* Lubricate threads and bolt head with S.A.E. # 10 Engine Oil.

SECTION 6C

53 and 71 Series Diesel Engines

Contents of this section are listed in Index below:

Information contained in Heavy Duty Truck Service Manual ST135-70 on 53 AND 71 SERIES DIESEL ENGINES (SEC. 6C) on pages 6C-1—6C-62, is applicable to engines used in vehicles covered by this supplement except for subjects indicated by the Index above. The information under each of the subjects either supplements, or replaces information in Service Manuals ST135-70 and ST332-71, or provides additional information. Information for the V-71 SERIES DIESEL ENGINE in Service Manual ST135-70 and in this supplement will apply to V12-71, except as noted in following text.

GENERAL INFORMATION

DIESEL ENGINE APPLICATION CHART

HH and JH Models use a V8-71 engine which is mounted at a 12° angle to the right and information in Service Manual ST135-70 will apply, except as specified in this supplement.

ADVANCED CAMSHAFT TIMING (6V-53 DIESEL ENGINE)

Starting with engine serial number 6D-66099, 6V-53 diesel engines have advanced camshaft timing. This change was made to meet Federal exhaust smoke emission requirements that apply to engines built on or after January 1, 1970. It is not necessary to advance time engines built prior to this serial number.

On advanced timed engines, the inscribed triangle mark on the idler gear should line up with the point corresponding to "VR-A" on the crankshaft (fig. 1). Continue to use the 1.460" injector timing gauge (J-1853) with all injector sizes.

CYLINDER HEADS (71 SERIES DIESEL ENGINE)

To provide a more accurate alignment of the cylinder head to the liner bore of the cylinder

53 AND 71 SERIES DIESEL ENGINES

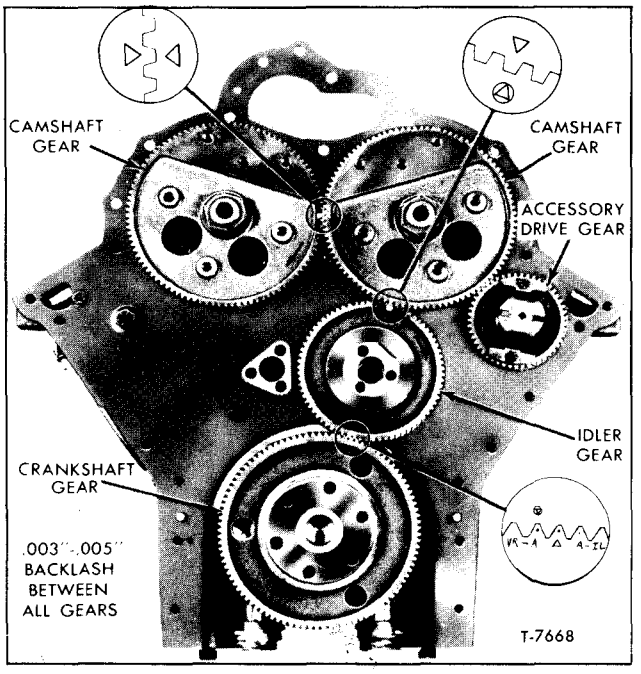


Figure 1—Advanced Timing on 6V-53 Diesel Engine

block and to eliminate the possibility of an exhaust valve to cylinder liner interference, the cylinder heads for 71 Series diesel engines have been revised.

The cylinder heads now have a piloting sleeve installed in the reamed mounting hole at each end of the cylinder head (exhaust side) which acts as a hollow dowel and gives a closer fit between the sleeve and the cylinder head mounting bolt.

Also, the exhaust valve head diameter was reduced from 1.195"-1.205" to 1.175"-1.185". This provides greater clearance between valves and cylinder liner.

INSTALLING SERIES 71 FOUR-VALVE SLEEVED CYLINDER HEADS

When installing a current Series 71 four-valve cylinder head, which includes two piloting sleeves per cylinder head. The following procedure should be used in conjunction with procedure on page 6C-33 or 6C-34 in Service Manual ST135-70.

1. Be sure the sleeves are installed flush or below flush to the fire deck surface of the cylinder head.

NOTE: The piloting sleeves can be installed in a former cylinder head. Check the mounting hole at each end of the cylinder head (exhaust side) and, if necessary, ream the holes to 0.687"-0.688" diameter x 0.750" deep. Then install the sleeves as stated in Step 1.

2. Lower the cylinder head over the already installed cylinder head studs in the cylinder block until the head is about a ½" from the surface of the cylinder block.

3. Check to be sure all of the gaskets and seals are correctly positioned.

4. Install a cylinder head bolt at each end of the cylinder head through the piloting sleeves and thread them finger-tight into the cylinder block.

5. Continue to tighten these bolts as the head is lowered into position on the cylinder block.

6. Install the balance of the bolts and stud nuts and tighten them according to the procedure outlined in Service Manual ST135-70, page 6C-32 through 6C-33.

NOTE: Guide studs (J-9665) should not be used when installing a cylinder head with piloting sleeves.

CYLINDER BLOCK CHANGE (8V-71 DIESEL ENGINE)

The new 8V-71 cylinder block which provides water cooling below the air box port belt, and the former dry block differ at the rear face area in that one tapped bolt hole has been eliminated from the new block.

On the former dry blocks there were four tapped holes surrounding an opening to the air box. Clamping of the four bolts insured a tight seal of the block, gasket, and end plate. On water below port blocks there is no opening to the air box in this area. Consequently, the tapped hole is omitted although the pad is still cast and machined flat. The end plate and gasket retain a hole in this location so interchangeability is not affected. When installing an 8V-71 water below port block, there will be one 3/8"-16 x 1" bolt not needed.

ENGINE TUNE-UP OPERATIONS

VARIABLE LOW SPEED LIMITING SPEED MECHANICAL GOVERNOR

Page 6C-21 in Service Manual ST135-70 describes the standard limiting speed governor gap adjustment during tune-up. If vehicle is equipped with variable low speed limiting speed governor the information and procedure following should be used.

GENERAL

The variable low-speed limiting speed mechanical governor (fig. 2) used on Series 53 and 71 Diesel engines is used where the same engine powers both the vehicle and auxiliary equipment and a high rpm idle range is desired during the auxiliary operation.

The current governor is a single weight type and provides an idle speed range of 500 to 1800

rpm. The variable low-speed limiting speed governor is similar to the limiting speed governor with the exception of the spring housing and its components.

Governor identification is provided by a name plate attached to the governor housing. The letters V.L.S.L.S. stamped on the name plate denote a variable low-speed limiting speed mechanical governor.

OPERATION

During highway operation the governor functions as a limiting speed governor, controlling the engine idling speed and limiting the maximum operating speed. At the unloading area, or when power take-off is to be used, the throttle is left in the idle speed position and the remote control knob is turned to the speed required within the above range to operate the auxiliary equipment. The governor then functions as a variable speed governor, maintaining a constant speed when the load is continuously changing during the unloading operation. Before resuming highway operation, the remote control knob must be turned all the way back to idle position.

ADJUST GOVERNOR GAP

NOTE: Perform the governor adjustment (tune-up) as follows: After adjusting the exhaust valves, timing the injectors, adjust the governor, position the injector rack control levers, no-load adjustment, idle and buffer screw adjustment.

With the engine at operating temperature, adjust the governor gap as follows:

1. With the engine stopped, remove flexible coupling, manual control shaft, the two attaching bolts and withdraw the governor high speed spring retainer cover (fig. 3).

2. Loosen lock nut and back out the buffer screw.

IMPORTANT: The buffer screw must be adjusted with caution, since it contacts the connecting link, and turning the buffer screw in causes injectors to go toward full fuel position.

3. Make the preliminary idle speed (550 rpm minimum) adjustment as follows (figs. 2 and 3).

a. Back out the variable low-speed adjusting shaft until the shoulder on the shaft contacts the shaft retainer.

b. Start the engine. Then, hold the idle adjusting lock nut and loosen the low-speed adjusting shaft retainer.

c. Adjust the retainer and shaft assembly to obtain the desired idle speed (550 rpm minimum). Tighten lock nut to retain the adjustment. Back out the buffer screw after the idle speed is established,

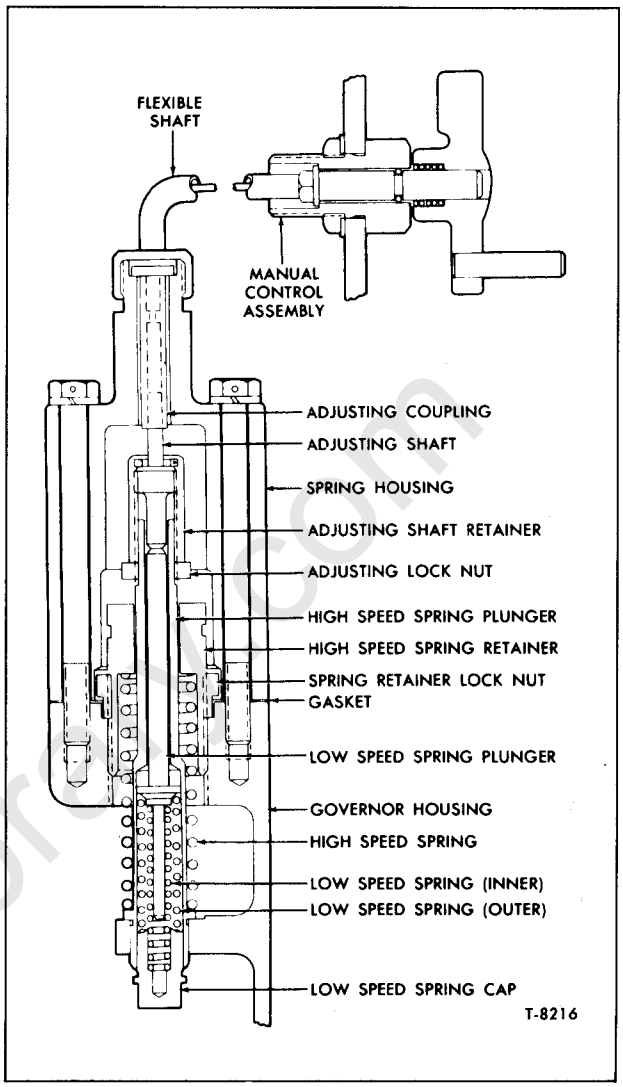


Figure 2—Variable Low Speed Limiting Speed Mechanical Governor Spring Housing and Components (Typical)

until it extends approximately 5/8" from the lock nut.

NOTE: It may be necessary to slightly adjust the buffer screw to take the surge or roll from the engine to stabilize idle speed for accurate setting. DO NOT RAISE ENGINE SPEED ABOVE IDLE SPEED SETTING BY TURNING BUFFER SCREW IN.

4. Stop the engine, disconnect throttle and stop linkage, and remove the governor cover and lever assembly.

5. Clean and remove the valve rocker cover, on In-line 6-71 Series diesel engine.

6. Remove the fuel rod from the differential lever and the injector control tube lever on In-line 6-71 Series diesel engine. This is not necessary on V engines.

53 AND 71 SERIES DIESEL ENGINES

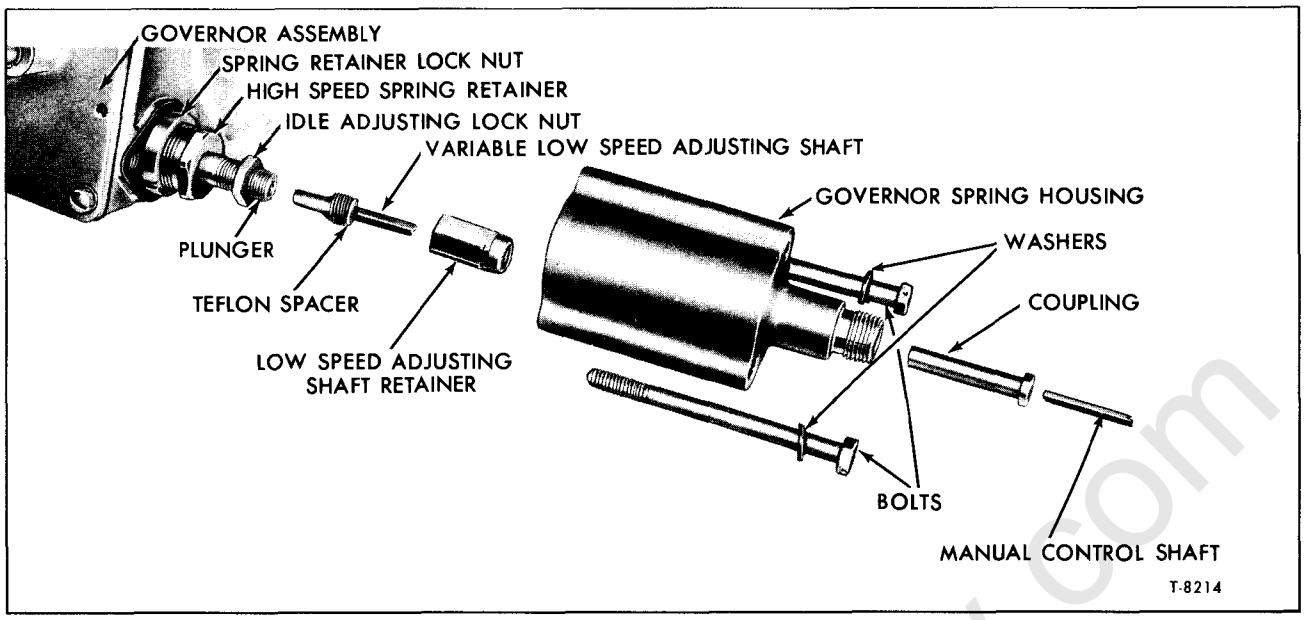


Figure 3—Variable Low Speed Limiting Speed Mechanical Governor Spring Housing Components

CAUTION: DO NOT OVER-SPEED ENGINE AS GOVERNOR IS NOW DISCONNECTED AND CANNOT CONTROL ENGINE SPEED.

a. On In-line 6, start engine; then by hand, move control tube so as to operate engine at approximately 700 to 800 rpm.

b. On V engines, start engine and run engine at 800-1,000 rpm by manual operation of differential lever.

NOTE: A shop towel can be placed over part of governor housing to prevent splash of oil.

7. With engine running at specified rpm, measure gap between low speed spring cap and plunger (fig. 4). If there is not a slight drag on a 0.0015" feeler gauge loosen lock nut and turn adjusting screw until desired gap is obtained, then tighten lock nut. Recheck gap after tightening lock nut.

8. Stop the engine.

a. On In-line engine, install connecting link between governor and injector control tube lever. Install control housing cover and gasket, being sure that throttle shaft pin engages differential lever fork, and that the stop lever will release the control rack to "NO-FUEL" position. Install four cover screws and washers.

b. On V8 engines, remove shop towel, install governor cover and gasket, being sure that throttle shaft pin engages differential lever fork and that the stop lever will release the control racks to "NO-FUEL" position. Install cover screws and washers.

CAUTION: If governor cover is not properly installed there will be no control of the engine and serious damage can occur.

POSITION INJECTOR RACK CONTROL LEVERS

Position the injector rack control levers as outlined in "Limiting Speed Mechanical Governor" in 53 AND 71 SERIES DIESEL ENGINES (SEC. 6C), page 6C-19 or 6C-21 of Service Manual ST135-70.

NOTE: See torque requirement for injector rack control lever screws on next page.

ADJUST MAXIMUM NO-LOAD ENGINE SPEED

Adjust the maximum no-load engine speed as outlined for the limiting speed mechanical governor in Service Manual ST135-70, page 6C-23, (SEC. 6C).

ADJUST IDLE SPEED

The engine must be at operating temperature when making final idle speed adjustment.

1. Start engine and operate at idle speed while observing rpm at tachometer.

IMPORTANT: It may be necessary to turn buffer screw in slightly to reduce surge or roll in engine. Do not increase engine rpm with buffer screw.

2. If necessary to adjust, hold lock nut and loosen the variable low-speed adjusting shaft retainer (fig. 3). Adjust the retainer and shaft assembly to obtain the desired idle speed (550 rpm minimum) IN to increase or OUT to decrease.

Lock adjusting screw with lock nut when idle speed is approximately 15 rpm below desired setting.

BUFFER SCREW ADJUSTMENT

With the idle speed set, the buffer screw may be adjusted as follows:

1. With the engine running at normal operating temperature, turn the buffer screw in so that it contacts the differential lever as lightly as possible and still eliminates the engine roll.

NOTE: Do not increase the engine idle speed more than 15 rpm with the buffer screw.

2. Buffer screw can be checked for proper adjustment by accelerating engine and de-accelerating. When engine comes to idle from de-acceleration it should roll one to two times and level off to smooth idle.

NOTE: If engine rolls or surges more than three times, the buffer screw needs to be adjusted in slightly.

If engine does not roll one to two times, the buffer screw is adjusted in too far.

3. With buffer screw properly adjusted, hold the buffer screw and tighten the lock nut and recheck.

4. Recheck the maximum no-load speed. If it has increased more than 25 rpm, back off the buffer screw until the increase is less than 25 rpm.

5. After the governor tune-up has been completed, install the variable low speed adjuster coupling and spring housing. Center the adjusting coupling before securing the housing assembly to the governor housing with two lock washers and bolts. Install the flexible shaft and manual control assembly.

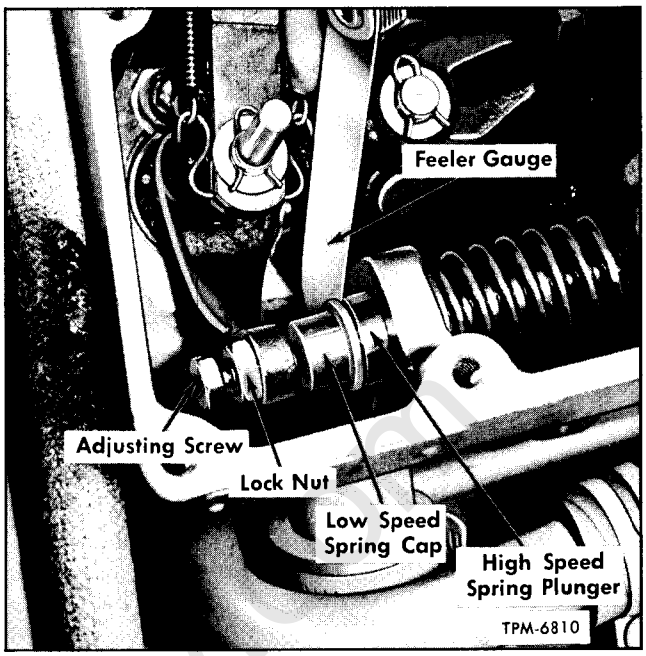


Figure 4—Low Speed Spring Gap Adjustment (Typical)

TORQUE REQUIREMENT FOR INJECTOR RACK CONTROL LEVER SCREWS (53 AND 71 DIESEL ENGINES)

Overtightening of the injector rack control lever screws can cause damage to the injector control tube.

The recommended torque for these screws is 24 to 36 in.-lbs. which can be obtained generally using a screwdriver with a one-inch diameter handle and turning it with one hand. Using a torque wrench with a screwdriver adapter, for final adjustment, eliminates the touch or feel by hand that is helpful in making uniform rack settings, important to good engine performance.

Overtightening of these screws can result if a larger screwdriver is used and both hands are applied to tighten the screws. Tests show that the screws start to cut into the control tube when torque exceeds 40 inch-pounds.

TORQUE WRENCH SPECIFICATIONS

Cylinder head bolts and nuts torque on pages 6C-15, 6C-25 and 6C-48 in ST135-70 Service Manual should be 175 to 185 foot-pounds instead of 190 to 200 foot-pounds.

INJECTOR VALVE OPENING PRESSURE

Injector valve opening pressure on pages 6C-8 and 6C-25 in Service Manual ST135-70 should read 2300 and 3300 psi instead of 2000 to 3200 psi.

ENGINE REPLACEMENT-HH AND JH MODELS

V8 DIESEL ENGINE REMOVAL

The procedure on page 6C-27 of Service Manual ST135-70 will apply with the addition of the following information:

It is not necessary to raise the cab if a dolly, to support and move engine forward before lifting the engine, is available. Also, in some instances it may not be necessary to remove the front cross members.

53 AND 71 SERIES DIESEL ENGINES

ENGINE BRAKE-OPTIONAL EQUIPMENT ITEM

SLAVE PISTON-TO-VALVE BRIDGE CLEARANCE ADJUSTMENT-71 SERIES DIESEL ENGINE BRAKE

Service Manual ST135-70 gives the service information for the engine brake (optional equipment item) on 71 Series diesel engines. On page 6C-42 in Section 6C of ST135-70 the slave piston-to-valve bridge clearance adjustment is given as 0.066-inch. This dimension is correct for all 71 Series engines except those with advanced camshaft timing (N65 brown tag injectors in engines built after Serial Numbers 6A-162000 and 8VA-53550 and specially modified engines. On engines with advanced timing the clearance adjustment should be 0.071-inch.

ENGINE TIMING

6V-53 DIESEL ENGINE

The camshaft gears are positioned so that the triangle timing marks are adjacent to each other (fig. 1). One circle-triangle timing mark on the idler gear is aligned with the second "triangle" on the mating camshaft gear. The other timing mark on the idler gear is aligned with the proper timing mark on the crankshaft gear.

The crankshaft gear is stamped "IL-A" and "A-VR" on the left and right side of the triangle timing mark (fig. 1). For Standard Timing, the "triangle" on the crankshaft gear is aligned with the circle-triangle on the idler gear. For Advance Timing, the "A" adjacent to the "VR" on the crankshaft gear is aligned with the circle-triangle on the idler gear.

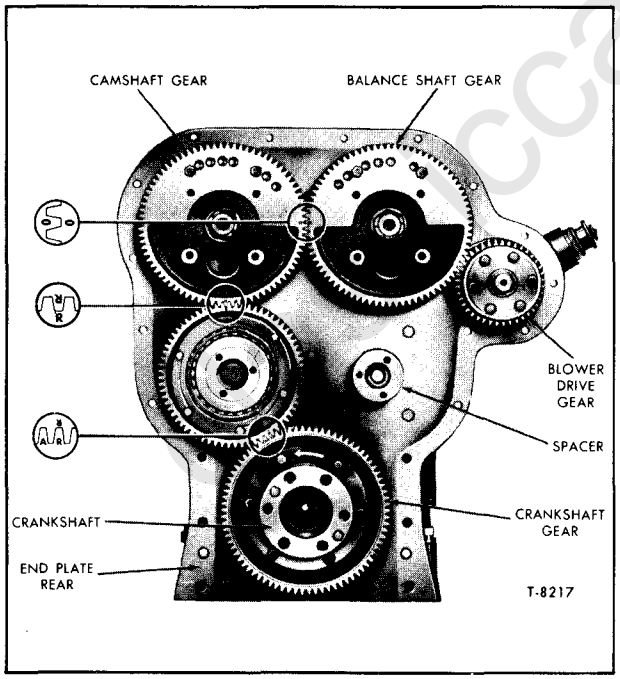


Figure 5—6-71 Engine Timing

6-71 DIESEL ENGINE

The camshaft gears are positioned so the "O" marks are adjacent to each other (fig. 5). One "R" on the idler is aligned with the "R" on mating camshaft gear. The other "R" on the idler gear is aligned with the "R" on the crankshaft gear for standard timing and with the "A" on the crankshaft gear for advance timing.

V-71 DIESEL ENGINE

The camshaft gears are positioned so the "V" marks are adjacent to each other (fig. 6). The "VR" mark on the camshaft gear is aligned with the "R" on the idler gear. The second "R" on the idler gear is aligned with the "R" on crankshaft gear for standard timing and with the "A" on the crankshaft gear for advanced timing.

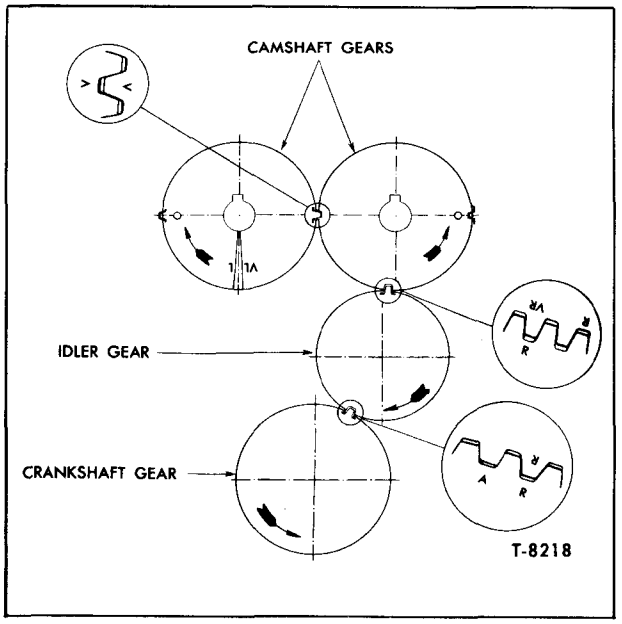


Figure 6—V-71 Engine Timing

ENGINE TIMING CHART

ENGINE	STANDARD TIMING			ADVANCED TIMING		
	RETARDED 1 TOOTH	STANDARD	ADVANCED 1 TOOTH	RETARDED 1 TOOTH	STANDARD	ADVANCED 1 TOOTH
*6V-53	0.174"-0.184"	0.201"-0.211"	0.227"-0.237"	0.201"-0.211"	0.227"-0.237"	0.253"-0.263"
**6-71 & 8V-71	0.192"-0.202"	0.225"-0.235"	0.257"-0.267"	0.225"-0.235"	0.257"-0.267"	0.284"-0.294"
12V-71	0.192"-0.202"	0.225"-0.235"	0.257"-0.267"			

*Engines built before Serial Number 6D-66099 use standard timing.
**N55 or N60 injectors—standard timing; N65 injectors (brown tag identification) use Advanced Timing.

T-9052

Figure 7—Diesel Engine Timing Chart

CHECKING ENGINE TIMING (53 AND 71 DIESEL ENGINES)

When an engine is suspected of being out of time, due to an improperly assembled gear train, a check can be made without having to remove the flywheel housing to inspect the gear train markings.

NOTE: Before checking engine timing, refer to "Engine Timing Chart" (fig. 7) to determine if engine should have standard or advance timing.

Access to the vibration damper or crankshaft pulley, to mark the top-dead-center position of the selected piston, and to the front end of the crankshaft or flywheel for barring the engine over is necessary in performing the timing check. Then, proceed as follows:

1. Clean and remove the cylinder head rocker cover.

2. Select any cylinder for the timing check. It is suggested that a cylinder adjacent to one of the cylinder head cover studs (when used) be chosen since the stud may be used for mounting a dial indicator.

3. Remove the fuel lines (at the cylinder selected) and install shipping caps on injector fuel fittings to prevent the entry of dirt. Make sure that the valve and injector rocker arms are all in the "up" position, then remove the rocker shaft bracket bolts and swing the rocker arm assemblies back out of the way. Remove the injector assembly.

4. Carefully place (do not drop) a rod approximately ¼" x 12" long through the injector hole and on top of the piston.

5. With the throttle in the "NO-FUEL" position, turn the crankshaft slowly in the direction of rotation of the engine, and stop when the rod reaches the end of its upward travel. Remove the rod and turn the crankshaft opposite the direction of rotation between 1/16 and 1/8 of a turn.

6. Select a dial indicator with 0.001" graduations and with a spindle movement of at least 1 inch. Use suitable mounting attachments for the indicator so that it can be mounted over the injector hole in the cylinder head. Provide an extension for the spindle of the indicator. The extension must be long enough to contact the piston as it approaches its upper position.

7. Mount the indicator over the injector hole and tighten mountings sufficiently to hold the indicator rigid.

NOTE: The mounting leg may be threaded into the rocker cover stud; or, the stud may be removed from the cylinder head and the leg threaded into the tapped hole, depending upon the length of the rod used in making up the mounting attachments.

Make sure that the spindle extension is free in the injector hole, does not bind, and is free to travel its full 1-inch movement.

8. Provide a suitable pointer and attach it to the crankshaft front cover or engine front end plate as illustrated in figure 3. The pointer should extend over the vibration damper, or crankshaft pulley, whichever is used.

9. Rotate the crankshaft in the direction of rotation slowly until the hand on the dial indicator just stops moving.

10. Continue to rotate the crankshaft in the direction of rotation until the indicator hand just starts to move. Reset dial to "0." Continue turning the crankshaft slowly until the indicator reading is 0.010" -- then stop turning.

11. Scribe a line on the damper (or crankshaft pulley) (fig. 8) in line with the end of the pointer.

12. Rotate the crankshaft opposite the direction of rotation slowly until the hand on the dial indicator just stops moving.

13. Continue to rotate the crankshaft opposite the direction of rotation until the indicator hand just starts to move. Reset dial to "0." Continue turning the crankshaft slowly until indicator reading is 0.010" -- then stop turning.

14. Scribe a second line on the vibration damper (or crankshaft pulley) in the same manner as in Step 11 (fig. 8).

15. Scribe a third line halfway between the first two lines. This is positive top-dead-center. The three scribed lines are shown on the crankshaft pulley in figure 3. Remove the indicator from the engine.

NOTE: Make certain that the crankshaft pulley

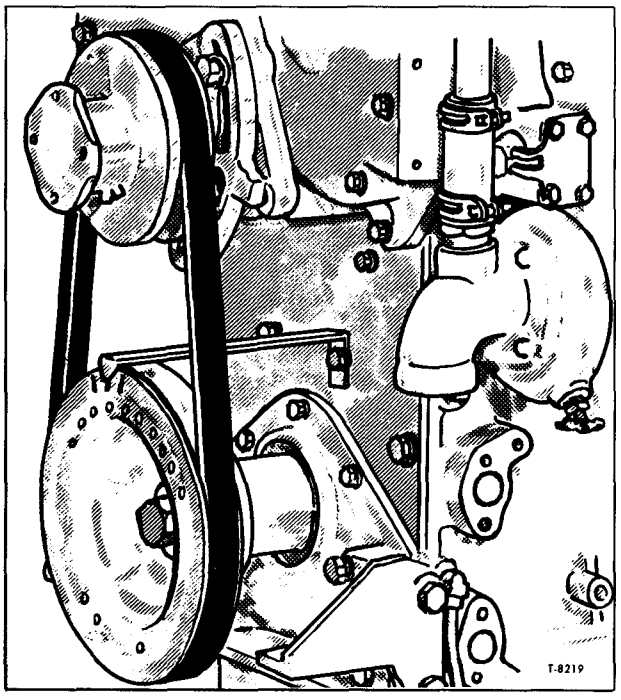


Figure 8—Pointer Installation for Marking Top-Dead-Center (Typical)

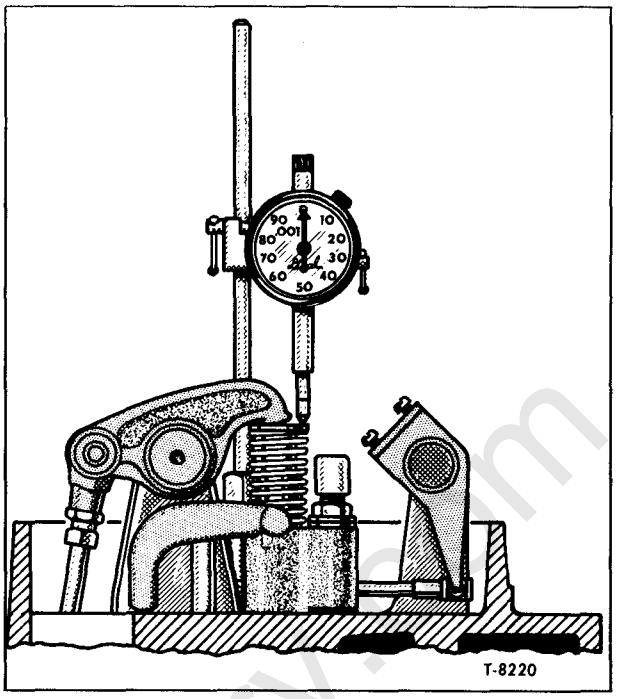


Figure 9—Checking Engine Timing by Measuring Injector Movement (Typical)

retaining bolt is not loosened while turning the crankshaft. The bolt must be tightened to specified torque if it becomes loose.

16. Install the injector assembly. Swing the injector and valve rocker arms back into position and install the rocker arm brackets and tighten the bolts to specified torque. Adjust the valve clearance and time the injector. Rotate the crankshaft until the exhaust valves in the selected cylinder are open.

17. Install the dial indicator again so the spindle of the indicator rests on top of the injector follower as illustrated in figure 9. Set the indicator dial to "0." Rotate the crankshaft slowly in the direction of rotation, and stop when the TDC mark, described in Step 15, on the vibration damper or crankshaft pulley lines up with the pointer.

18. Note the reading on the dial indicator and compare with particular engine as shown on "Engine Timing Chart" (fig. 7).

19. After completing the timing check, remove the dial indicator. Remove the shipping caps from the injector, and install the injector fuel lines, making sure that they are torqued to prevent any leaks.

20. Remove the pointer attached to the front of the engine.

21. Install the cylinder head rocker cover.

CHECKING EXHAUST VALVE SPRINGS (71 SERIES ENGINES)

To more accurately determine the acceptability of a used exhaust valve spring on a 71 Series Diesel Engine, the specification for checking the spring has been revised. The new specification is: Replace a four-valve cylinder head exhaust valve spring (Part No. 5117561) when a load of less than 25 pounds will compress the spring to a length of 1.80 inches (installed length). Formerly the specification was: Replace spring when a load of less than 100 pounds will compress the spring to a length of 1.397 inches.

The special tool for removing valve spring with cylinder head installed is J-7455, and is shown in figure 13, 6C-11 in Service Manual ST135-70.

All Tune-Up Operations and Adjustments Should Be Performed Carefully and In Proper Sequence

Testing and Problem Analysis

(53 AND 71 SERIES DIESEL ENGINES)

Certain abnormal conditions which sometimes interfere with satisfactory engine operation, together with methods of determining cause of such conditions, are covered on the following pages.

Contents of this section are listed in Index below:

SATISFACTORY ENGINE OPERATION DEPENDS PRIMARILY ON:

1. The presence of an adequate supply of air compressed to a sufficiently high compression pressure.

2. The injection of the proper amount of fuel at the right time.

Lack of power, uneven running, excessive vibration, stalling at idle speed, and hard starting, may be caused by either low compression, faulty injection in one or more cylinders, or lack of sufficient air.

Since proper compression, fuel injection and the proper amount of air are important to good engine performance, detailed procedures for their investigation are given later.

A test panel may be fabricated locally as shown in figure 10. This would enable tests to be made with one hook up.

Figure 11 shows Test Kit (J-9531-01) with hand tachometer and figure 12 shows Test Kit (J-22506) with electric tachometer. Also, in these Diesel Test Kits are gauges, hoses, and adapters, for making various tests. The instructions on the following pages show the various tests and analysis which can be made.

LOCATING A MISFIRING CYLINDER

(Refer to Fig. 13)

1. Start the engine and run it at part load until it reaches normal operating temperature.

2. Stop the engine and remove the valve rocker cover(s). Discard the gasket(s).

3. Check the valve clearance 0.024" for the 53 Series engine and 0.014" for 71 Series engine as described in Service Manual ST135-70, Section 6C.

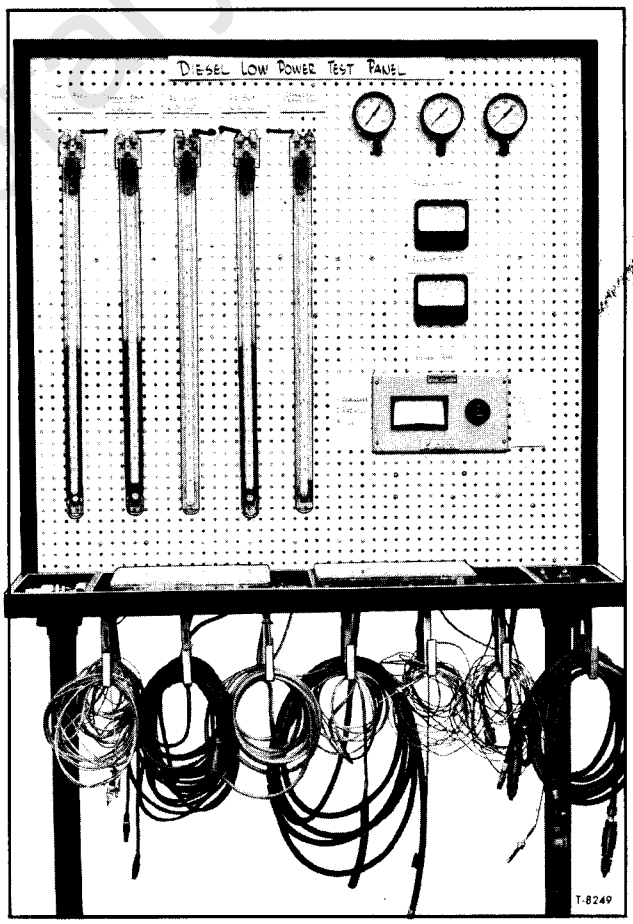
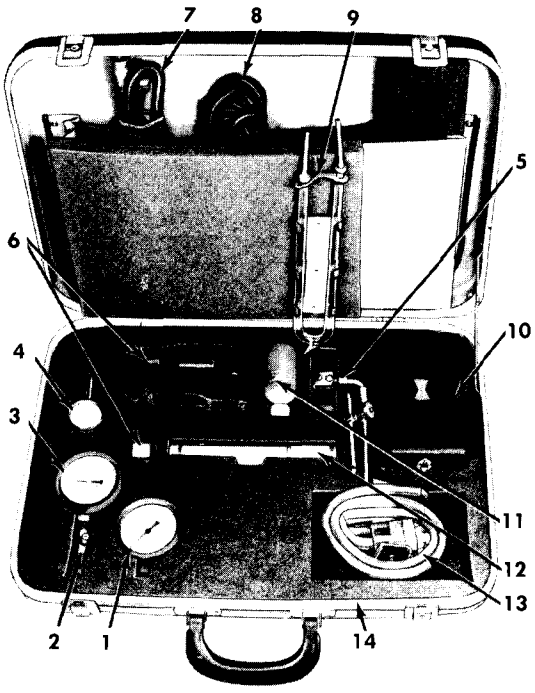


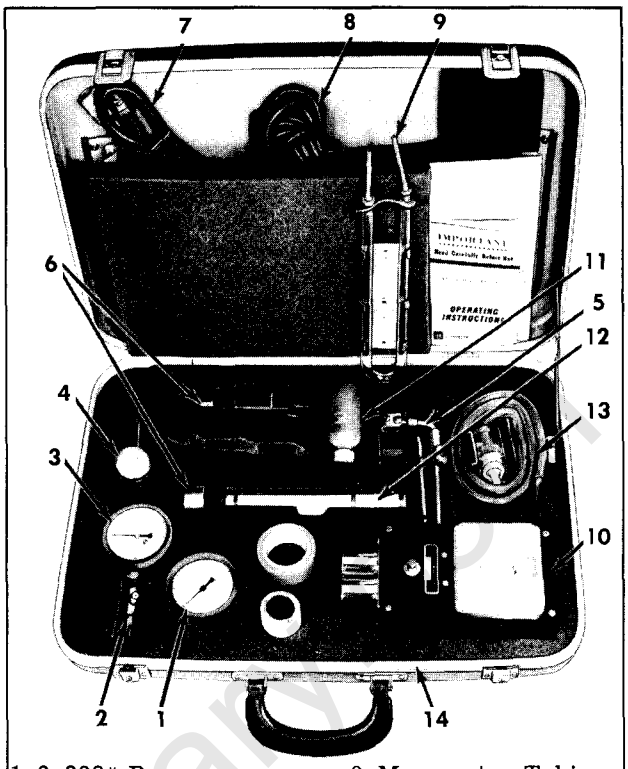
Figure 10—Test Panel (Fabricate Locally)

53 AND 71 SERIES DIESEL ENGINES



1 0-300# Pressure Gauge	8 Manometer Tubing
2 Pressure Relief Valve	9 2½-0-2½ Manometer
3 0-1000# Pressure Gauge	10 Hand Tachometer
4 Dial Indicator	11 Mercury - 10 Oz.
5 Magnetic Base	12 100-300 Thermometer
6 Comp. Gauge Adapter	13 12-0-12 Manometer
7 Pressure Hose	14 Box and Filler T-8039

Figure 11—Test Kit J-7127 (Hand Tachometer)



1 0-300# Pressure Gauge	8 Manometer Tubing
2 Pressure Relief Valve	9 2½-0-2½ Manometer
3 0-1000# Pressure Gauge	10 Electronic Tachometer
4 Dial Indicator	11 Mercury - 10 Oz.
5 Magnetic Base	12 100-300 Thermometer
6 Comp. Gauge Adapter	13 12-0-12 Manometer
7 Pressure Hose	14 Box and Filler T-8040

Figure 12—Test Kit J-22475 (Electric Tachometer)

4. Start the engine and hold an injector follower down with a screwdriver, to prevent operation of the injector. If the cylinder has been misfiring, there will not be any noticeable difference in the sound and operation of the engine. If the cylinder has been firing properly, there will be a noticeable difference in the sound and operation when the injector follower is held down. This is similar to short-circuiting a spark plug in a gasoline engine.

5. If the cylinder is firing properly, repeat the procedure on the other cylinders until the faulty one has been located.

6. Provided the injector operating mechanism of the faulty cylinder is functioning satisfactorily, remove the fuel injector and install a new one by performing the removal and installation procedure outlined in ENGINE FUEL SYSTEM (SEC. 6M) of Service Manual ST135-70, on page 6M-26.

If installation of a new injector does not eliminate misfiring, check the compression pressures.

CHECKING COMPRESSION PRESSURE

(Refer to Figure 14)

1. Start the engine and run it at approximately one-half rated load until normal operating temperature is reached.

2. With the engine stopped, remove the fuel lines from the injector and the fuel connectors.

3. Remove the injector and install the adapter and pressure gauge from Diagnosis Kit (J-9531-01 or J-22506) (fig. 11 or 12). Refer to ENGINE FUEL SYSTEM (SEC. 6M in Service Manual ST135-70, page 6M-26 for procedure to remove injectors.

4. Use one of the fuel lines as a jumper connection between the fuel inlet and return passage to permit fuel to flow directly to the return passage.

5. Start the engine and run it at 600 rpm. Observe and record the compression pressure indicated on the gauge.

NOTE: Do not crank the engine with the starting motor to check the compression pressure.

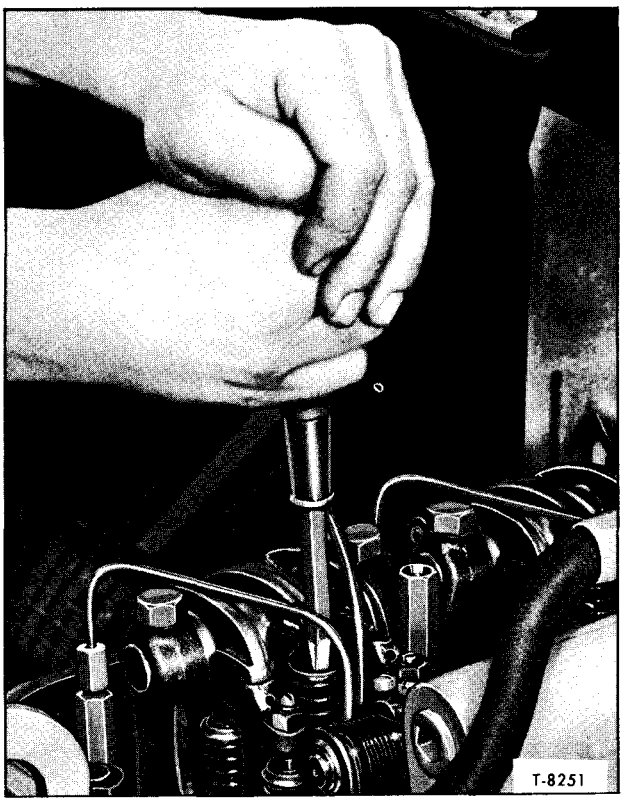


Figure 13—Locating a Misfiring Cylinder (Typical)

Compression pressure is affected by altitude as follows:

Min. Compression Pressure, Psi		Altitude, Feet
53 Series	71 Series	Above Sea Level
540	515	0
500	480	2,500
465	440	5,000
430	410	7,500
395	380	10,000

6. Perform Steps 2 through 5 on each cylinder. The compression pressure in any one cylinder should not be less than 515 psi on Series 71 (540 psi for 53 Series engine) at 600 rpm at sea level. In addition, the variation in compression pressures between cylinders of the engine must not exceed 25 psi at 600 rpm. Low cylinder pressures may result from any one of several causes:

a. Piston rings may be stuck or broken. To determine the condition of the rings, remove the air box cover and inspect them by pressing on the compression rings with a blunt tool (fig. 15). A broken or stuck compression ring will not have a "spring like" action.

b. Compression pressure may be leaking past the cylinder head gasket, valve seats, burned or broken valves, injector tubes, or through a hole in the piston.

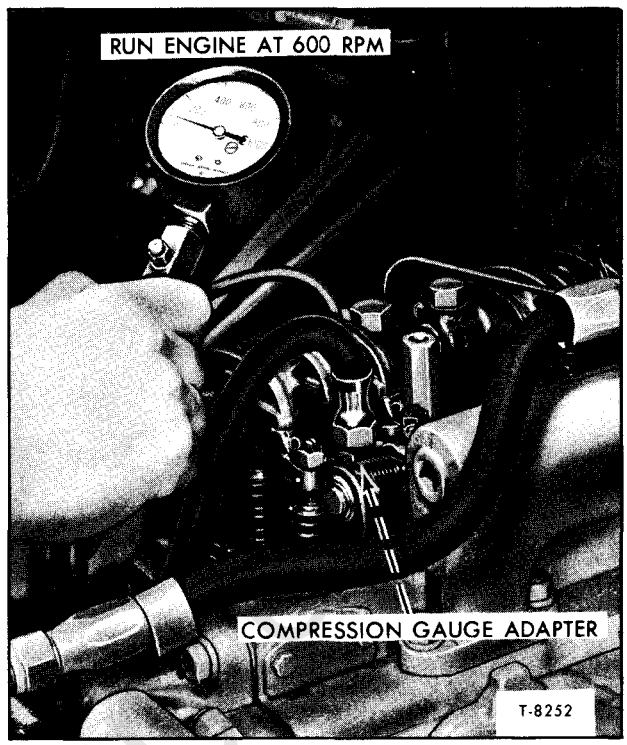


Figure 14—Checking Compression Pressure (Typical)

FUEL QUALITY

The quality of fuel oil used for diesel engine operation is a major factor in satisfactory engine performance and life. The fuel oils selected must be clean, completely distilled, stable, and non-corrosive. Enlist your supplier's aid in obtaining proper fuel oil. The responsibility for clean fuel lines rests with fuel supplier as well as with operator.

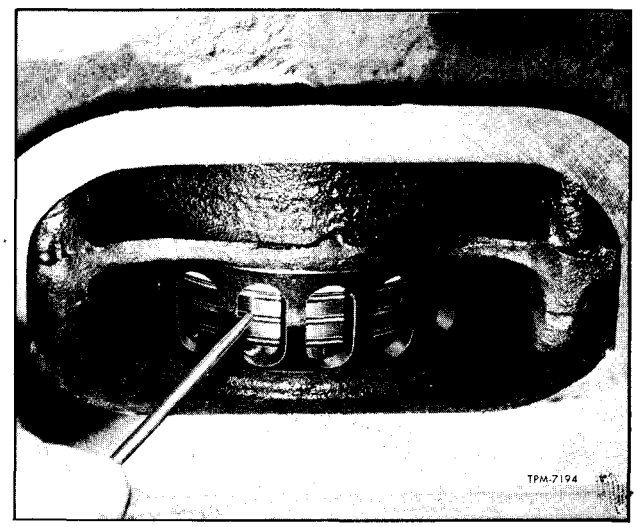


Figure 15—Inspection for Broken or Stuck Piston Rings (Typical)

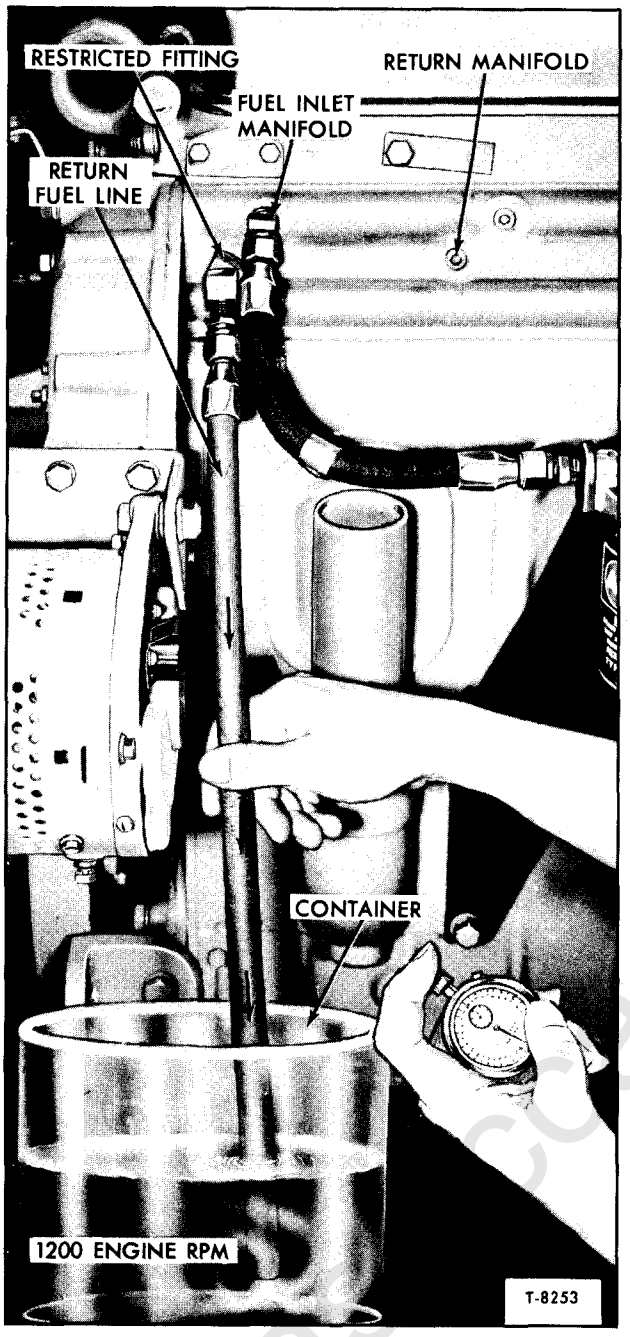


Figure 16—Fuel Flow Test (Typical)

DISTILLATION RANGE, CETANE NUMBER, AND SULFUR CONTENT are three of the most important properties in the selection of diesel fuels for optimum combustion and minimum wear. Engine speed, load, and atmospheric temperature influence the selection of the fuels with respect to distillation range and cetane number. THE SULFUR CONTENT OF THE FUEL MUST BE AS LOW AS POSSIBLE, to avoid excessive deposit formation and premature wear.

ENGINE OUT OF FUEL

The problem in restarting the engine after it is run out of fuel stems from the fact that after the fuel is exhausted from the fuel tank, fuel is then pumped from the primary fuel strainer and sometimes partially removed from the secondary fuel filter before the fuel supply becomes insufficient to sustain engine firing. Consequently, these components must be refilled with fuel and the fuel lines purged of air in order for the system to provide adequate fuel for the injectors.

When an engine is run out of fuel inadvertently, there is a definite procedure to follow for restarting the engine. The procedure is outlined below:

1. Fill the fuel tank with the recommended grade of fuel oil. If only partial filling of the tank is possible, add a minimum of ten gallons of fuel.
2. Remove the primary fuel strainer shell and element from the strainer cover and fill the shell with fuel oil. Install the shell and element.
3. Remove and fill the secondary fuel filter shell and element with fuel oil as in Step 2.
4. Start the engine. Check the filter and strainer for leaks.

NOTE: In some instances, it may be necessary to remove a valve rocker cover and loosen a fuel pipe nut in order to bleed trapped air from the fuel system. Be sure the fuel pipe is retightened securely before replacing the rocker cover.

Primer (J-5956) may be used to prime the entire fuel system. Remove the filter plug in the fuel filter cover and install the primer. Prime the system. Remove the primer and install filter plug.

FUEL FLOW TEST

(Refer to Figure 16)

NOTE: This test should be run in conjunction with Fuel Pressure Test.

1. Disconnect the fuel return line and hold the open end in a suitable container.
2. Start and run the engine at approximately 1200 rpm and measure the fuel flow from the return line for one minute.

NOTE: At least .6 gallons of fuel on 53 Series and .9 gallons on 71 Series engine should flow from the return line per minute.

3. Be sure all line connections between the fuel supply and the pump are tight so no air will be drawn into the fuel system; then, immerse the end of the fuel return line into the fuel in the container.

Air bubbles rising to the surface of the fuel will indicate a leak on the suction side of the pump, or faulty check valve in the injector.

If the quantity of fuel is less than specified, this will cause a loss in power, rough running and indicates air in the system, or a restriction in the fuel system.

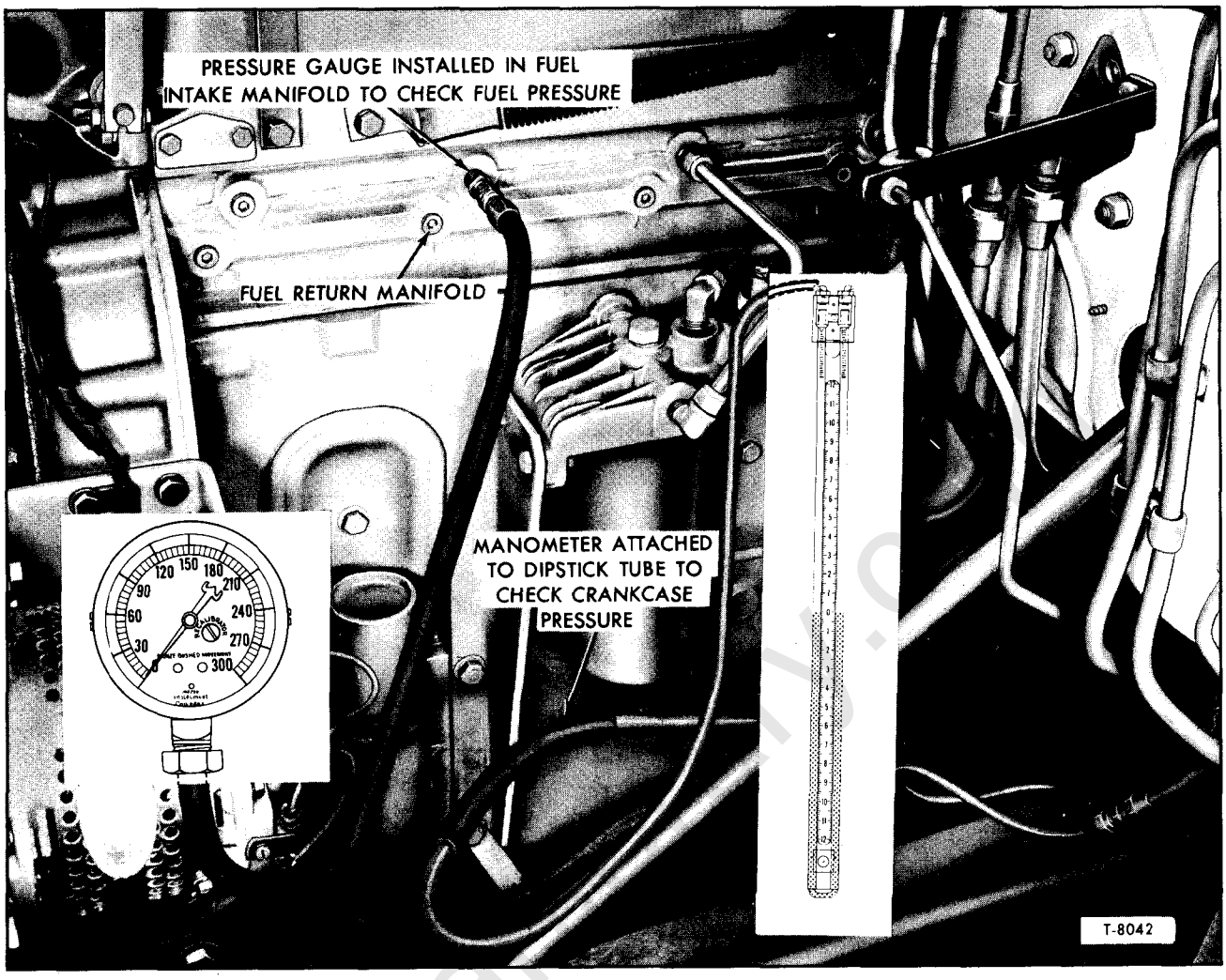


Figure 17—Fuel and Crankcase Pressure Check (Typical for 6-71)

If the quantity of fuel returned is excessive, the restricted fitting is too large or not correct size and must be replaced with correct restricted fitting in order to hold pressure to injectors for full power.

FUEL PRESSURE TEST

The fuel pressure gauge can be used in checking fuel pressure at the intake manifold with the engine in operation (fig. 17). Remove the plug from the fuel intake manifold and install the fuel gauge. Start engine and run at specified speed and read pressure gauge. Refer to "Fuel Pressure" chart opposite:

Uneven running, excessive vibration, stalling when idling, and a loss of power may be caused by an insufficient fuel supply to injectors due to one of the following conditions:

1. Clogged primary or secondary fuel filter element.
2. Air in the system due to loose fuel line connections or filter gasket leaks.
3. Clogged injector fuel filters.
4. Fuel line restricted or leaking.
5. Defective fuel pump.

FUEL PRESSURE					
	SPEED (RPM)				
Engine	1200	1800	2100	2200	2600
6V-53				45-70	45-70
6-71	30-65	45-70	45-70		
V-71	45-70	45-70	45-70		

CRANKCASE PRESSURE TEST

(Refer to Figure 17)

The crankcase pressure indicates the amount of air that has passed between the oil control rings and the liner into the crankcase, most of which is

53 AND 71 SERIES DIESEL ENGINES

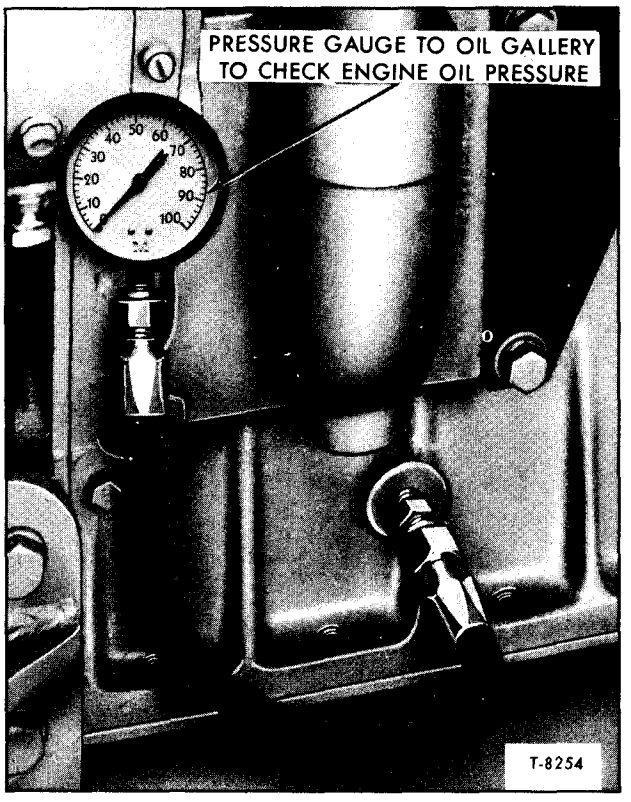


Figure 18—Oil Pressure Test (Typical for 6-71)

clean air from the air box. A slight pressure in the crankcase is needed to prevent the entrance of dust.

A loss of engine lubricating oil through the breather tube, crankcase ventilator, or dipstick hole in the cylinder block is indicative of excessive crankcase pressure. The maximum crankcase pressure is shown in the following chart:

CRANKCASE PRESSURE (Max. in Inches of Water)				
	SPEED (RPM)			
Engine	1200	1800	2100	2600
6V-53				1.0
6-71	2.0	2.8	3.1	
V-71	0.5	1.1	1.5	

The crankcase pressure may be checked with the manometer in the Engine Diagnosis Test Kit (J-9531-01 or J-22506) (fig. 17). The manometer should be connected to the oil level dipstick opening in the cylinder block. Check the readings obtained at various engine speeds with the specifications in the chart.

Excessive crankcase pressure indicates one of the following:

1. Worn or improper seating of blower seals.
2. Defective blower.
3. Excessive blow-by on piston rings.
4. Hole or crack in piston crown.
5. Loose piston pin retainers.
6. Breather tube obstruction.
7. Leaking cylinder head gasket.
8. Leaking end plate gaskets.
9. Excessive exhaust back pressure.

ENGINE OIL PRESSURE TEST

(Refer to Figure 18)

To check operating oil pressure connect the pressure gauge to the oil gallery or into oil line from gallery to oil filter.

Start engine. For satisfactory pressures refer to following chart:

OIL PRESSURE					
	SPEED (RPM)				
Engine	1200	1800	2100	2200	2600
6V-53				40-60 Min. 30	40-60 Min. 32
6-71	30-60 Min. 18	38-60 Min. 27	40-60 Min. 30		
V-71	35-55 Min. 25	50-70 Min. 28	50-70 Min. 30		

Low oil pressure may be caused by:

1. Clogged oil screen.
2. Suction leak to lubricating oil pump.
3. Improper function of the pressure regulating valve.
4. Worn bearings and oil pump gears.
5. Improper grade or viscosity of lubricating oil.
6. Dilution of oil by fuel.

OIL COOLER PRESSURE DROP

To check for excessive oil pressure drop through the oil cooler, connect the gauge to the oil cooler adapter. A ¼" tapped hole is provided in the oil cooler adapter for this purpose. Use 5/16" to ¼" connector.

Pressure drop between oil cooler and oil gallery should not exceed twenty-five pounds.

Pressure drop of more than twenty-five pounds is an indication oil cooler may be partially clogged or oil cooler by-pass valve is not functioning properly.

COOLING SYSTEM

Refer to ENGINE COOLING SYSTEM (SEC. 6K) of this supplement for cooling system checks.

AIR BOX PRESSURE TEST
(Refer to Figure 19)

Proper air box pressure is required to maintain sufficient air for combustion and scavenging of the burned gases.

To check the air box pressure connect a manometer to the air box drain tube. (fig. 19).

Check the readings obtained at various speeds with the specifications in the chart.

AIR BOX PRESSURE (Min. in Inches of Mercury) Max. Exhaust Back Pressure (Full Load)				
	SPEED (RPM)			
Engine	1200	1800	2100	2600
6V-53				8.4
6-71	3.2	7.6	10.1	
V-71	2.3	6.4	8.2	
(Zero Exhaust Back Pressure)				
6V-53				5.2
6-71	1.7	4.3	6.0	
V-71	1.1	3.8	5.0	

Lack of power or black or grey exhaust smoke are also indications of low air box pressure.

If less than minimum air box pressure is indicated, some restriction is causing high air intake vacuum, and it may be caused by:

1. Emergency shut-off door adjusted wrong.
2. Restricted or damaged air cleaners.
3. Worn or damaged blower due to improper adjustment.
4. Leaking end plate gaskets.
5. Clogged blower air inlet screen.

If excessive air box pressure is indicated, there is a restriction in cylinder liner ports or the exhaust system.

AIR INTAKE RESTRICTION
(Refer to Figure 20)

Excessive restriction of the air inlet will affect the flow of air to the cylinders and result in poor combustion and lack of power. Consequently, the restriction must be kept as low as possible considering the size and capacity of the air cleaner. An obstruction in the air inlet system or dirty or damaged air cleaners will result in a high blower inlet restriction. The air inlet restriction may be checked with a water manometer connected to a fitting in the air intake housing.

On some models a drilled hole is provided for this connection (fig. 20). On models where a drilled hole is not provided, it is necessary to remove the blower air intake assembly and drill and tap a hole

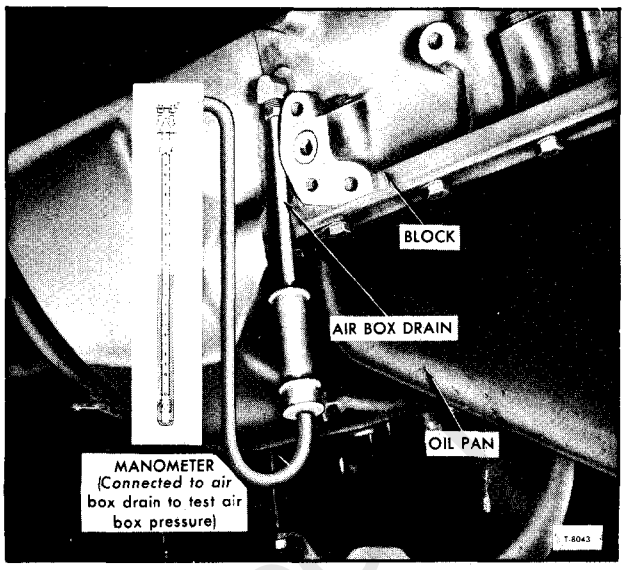


Figure 19—Air Box Pressure Check (Typical)

(11/32" drill and 1/8" pipe thread tap). The hole sgould be located at point above emergency stop.

The air intake restriction should be checked at a specific engine speed. Then, the air cleaner and ducting should be removed from the air inlet housing and the engine again operated at the same speed while noting the manometer reading.

The difference between the two readings, with the air cleaner and ducting and without the air cleaner and ducting, is the actual restriction caused by the air cleaner and ducting.

Check the normal air intake vacuum at various speeds (at no-load) and compare the results with the following chart:

AIR INTAKE RESTRICTIONS (In Inches of Water) Max. With Dirty Air Cleaner (Oil Bath or Dry)				
	SPEED (RPM)			
Engine	1200	1800	2100	2600
6V-53				24.5
6-71	12.4	25.0	25.0	
V-71	12.4	25.0	25.0	
Max. With Clean Air Cleaner (Oil Bath or Dry) With Precleaner				
6V-53				14.7
6-71	8.7	13.4	15.9	
V-71	8.7	13.4	15.9	
Max. With Clean Air Cleaner (Dry) No Precleaner				
6V-53				9.2
6-71	5.2	9.1	11.5	
V-71	5.2	9.1	11.5	

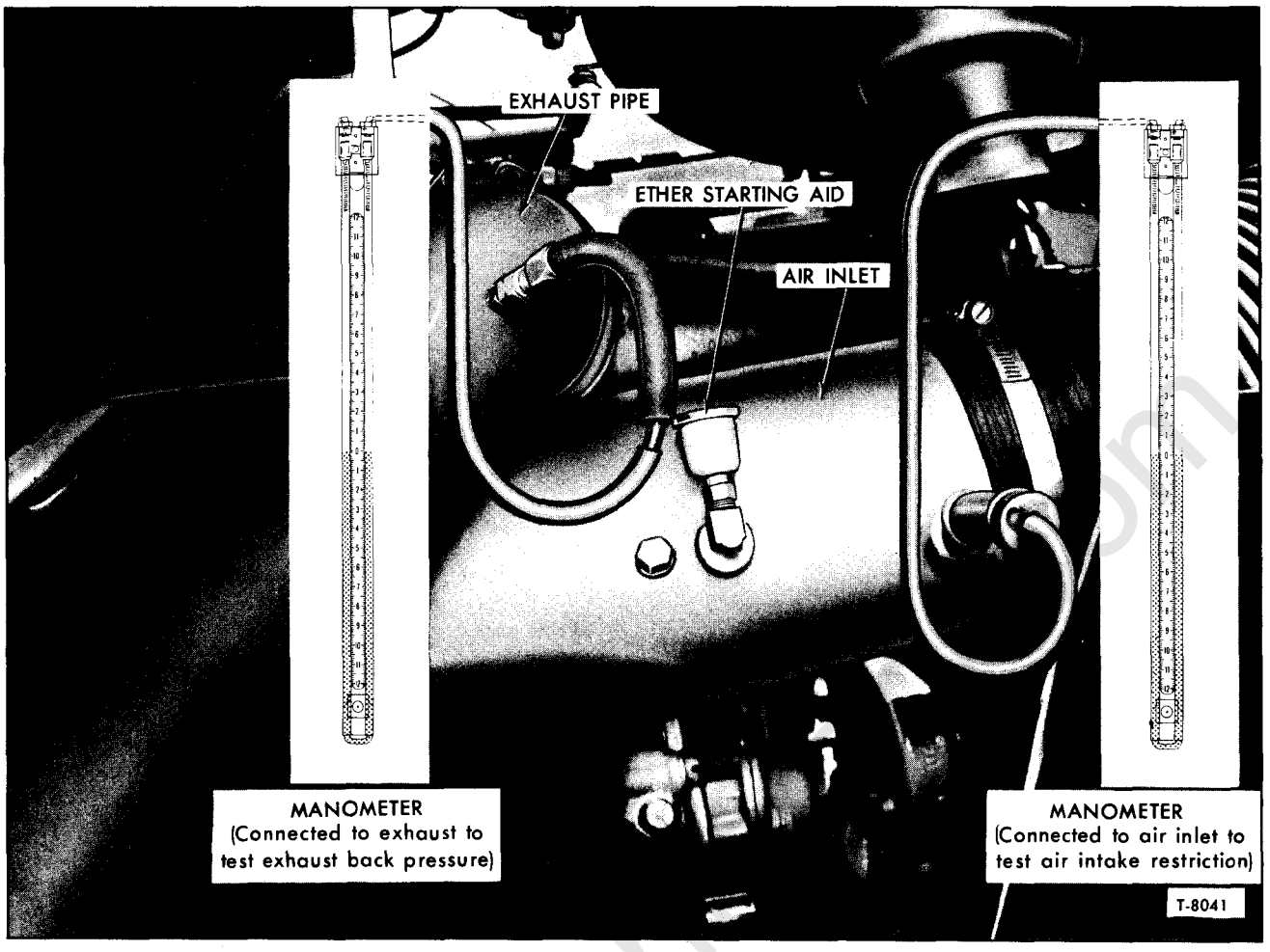


Figure 20—Air Inlet and Exhaust Pressure Check (Typical)

A reading higher than specifications indicates the following:

1. Dirty air cleaners.
2. Damaged air cleaners.

EXHAUST BACK PRESSURE

(Refer to Figure 20)

A slight pressure in the exhaust system is normal. However, excessive exhaust back pressure seriously affects engine operation. It may cause an increase in the air box pressure with a resultant loss of efficiency of the blower. This means less air for scavenging which results in poor combustion and higher temperatures. The maximum exhaust back pressure (no-load) is shown in the following chart:

NOTE: Due to variations in exhaust systems (horizontal or vertical stacks) the above chart is typical.

EXHAUST BACK PRESSURE – NO LOAD
(Max. in Inches of Mercury)

	SPEED (RPM)				
Engine	1200	1800	2000	2100	2600
6V-53					2.7
6-71	1.2	2.8	3.5	3.5	
V-71	.09	2.1	2.6	2.6	

The exhaust back pressure, measured in inches of mercury, may be checked with the manometer in the Engine Diagnosis Test Kit (J-9531-01 or J-22506) (fig. 20). The manometer or pressure gauge is connected to the exhaust manifold by removing the 1/8" pipe plug which is provided for that purpose. If there is no opening provided, one can be made by drilling an 11/32" hole in the exhaust manifold companion flange and tapping a 1/8" pipe thread.

Check the readings obtained at various speeds

(no-load) with the specifications in the "Exhaust Back Pressure" chart.

Excessive exhaust pressure indicates a restricted exhaust system. Inspect for:

1. Loose or broken muffler baffles.
2. Sharp bends in exhaust pipe due to damage or special installations.
3. Restricted due to carbon deposits or foreign matter.
4. Improper type of muffler.
5. Exhaust pipe too long or small in diameter.

PROPER USE OF MANOMETER

The U-tube manometer is a primary measuring device indicating pressure or vacuum by the difference in the height of two columns of fluid.

Connect the manometer to the source of pressure, vacuum, or differential pressure. When the pressure is imposed, add the number of inches one column of fluid travels up to the amount the other column travels down to obtain the pressure (or vacuum) reading.

The height of a column of mercury is read differently than that of a column of water. Mercury does not wet the inside surface; therefore, the top of the column has a convex meniscus (shape). Water wets the surface and therefore has a concave meniscus. A mercury column is read by sighting horizontally between the top of the convex mercury surface (fig. 21) and the scale. A water manometer is read by sighting horizontally between the bottom of the concave water surface and the scale.

Should one column of fluid travel further than the other column, due to minor variations in the inside diameter of the tube or to the pressure imposed, the accuracy of the reading obtained is not impaired.

The manometer reading may be converted into other units of measurement by use of the pressure conversion chart.

PRESSURE CONVERSION CHART

1" water	=	.0735" mercury
1" water	=	.0361 psi
1" mercury	=	.491 psi
1" mercury	=	13.6" water
1 psi	=	27.7" water
1 psi	=	2.036" mercury

OIL, FUEL, AND COOLANT LEAK TROUBLESHOOTING

A "Troubleshooting" procedure to be used to disgnose leaks within the engine, fuel, or cooling system is as follows:

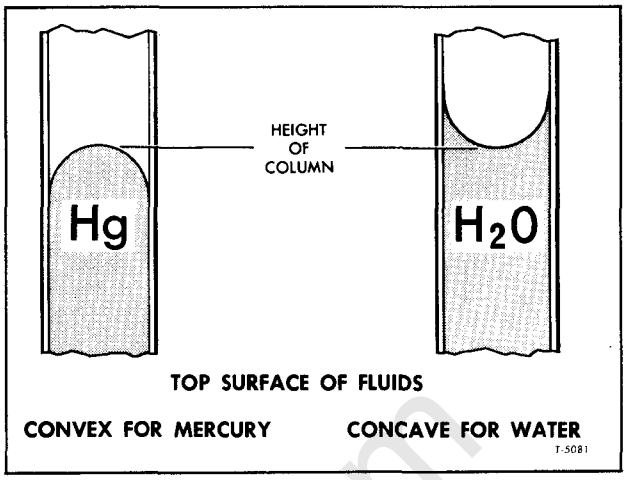


Figure 21—Comparison of Column Height for Mercury and Water Manometer

The first and most important factor is to determine the type of dilution that exists, using your sense of sight, feel, and smell. You must determine if it is engine oil and water, fluid and water, or fuel oil and engine oil. The four most common types of dilution are:

1. Water in engine oil.
2. Engine oil in water system.
3. Fuel oil in engine oil.
4. Converter fluid in water.

1. Water in Engine Oil

a. Injector Tube Leaks. The tubes may have become cracked because of distortion by heat, overtorquing upon injector installation, or improper sealing of the injector tube sealing ring. This may be checked as follows:

(1) Obtain normal operating temperature and remove valve covers.

(2) Pressurize water system with a tester as described in ENGINE COOLING SYSTEM (SEC. 6K) of this supplement.

NOTE: Excessive pressure may damage system components.

(3) Observe all tubes carefully for possible leaks.

b. Engine Oil Cooler may put water in the engine oil after the engine has stopped. The pressure maintained in the water system may force water in oil cooler that has a defective core or gasket. To check the cooler must be removed from engine. Examine gaskets upon removal for signs of leaks. Make a suitable plate and attach to the flange side of the cooler core. Plate should be drilled and tapped to permit air hose fitting to be attached to inlet side of cooler. Attach hose and apply 75 psi of air pressure. Submerge cooler core and plate into water and any leaks will be indicated by bubbles in the water. If leaks are indicated, replace the core.

c. Cylinder Head and Gasket Leaks are checked by removing head from cylinder block. Inspect all synthetic rubber seal rings around water and oil passages. The cylinder head can be checked for leaks as follows:

(1) Seal off water holes in the head. This is done by steel plates and rubber gaskets clamped in place by bolts. Drill and tap a suitable hole in one of the plates to install an air hose connection. Install scrap or dummy injectors to insure seating of injector hole tubes. Tighten injector clamps to 20-25 foot-pounds torque.

(2) Apply 80 to 100 psi of air pressure and immerse in tank of water heated to 180°F., for about fifteen to twenty minutes. Air bubbles will indicate leaks.

d. Air Compressor Check. On water-cooled air compressor, the water system should be pressurized by using the procedure previously described under injector tube test. Whenever practical, remove crankcase bottom cover, turn engine over manually and observe crankcase for water leakage. If this is not practical, it will be necessary to remove the unit.

e. Cylinder Block may be cracked causing water in engine oil. This may be checked as follows:

(1) Using plates and suitable rubber gaskets, seal off inlet and outlet holes air-tight. One inlet or outlet plate should be drilled and tapped for fitting. Attach tee to fitting with provision for air and water inlet.

(2) Adapter fitting should be equipped with shut-off valve and regulated air.

(3) Remove hand hole cover so as to observe any water in passages (ports).

(4) Fill block with hot water and pressurize block with 20 pounds of air pressure. Turn engine over manually, observing sleeves and leakage of water into air passage. Drain engine oil and remove oil pan. Observe sleeves and block for cracks. Turn engine over manually again while inspecting bottom of block.

2. Engine Oil in Water

a. Engine Oil Cooler defect is one of the most common causes for oil in the water. Remove engine oil cooler and pressure test as previously described in "Water in Oil" procedure.

b. Cylinder Head Seals may cause oil in water. This frequently occurs at pressurized vertical oil passage that supplies oil to the cylinder head. One is located at the rear of the block on the right bank cylinder head. Inspect this area carefully when removing cylinder heads for leakage.

c. Cylinder Head may be checked as previously described.

d. Engine Block may cause leakage of oil in water if cracked between pressurized oil passage and water jacket. Engine block test has been previously discussed.

3. Fuel Oil in Engine Oil

This condition will usually be noticed by the increase in oil level when measured with dipstick. This will warrant further investigation into the consistency of the oil (thinning).

a. Fuel Injector Cross-Over Pipes may be split at flare or nuts of line may be split. Retighten line if leaking only to specified torque of 12-15 foot-pounds. If leak does not stop, remove and examine. Remember, most fuel line leaks are caused by over-torquing and twisting of lines.

b. Injector Body Seals leaking may be observed by running engine. A mirror is helpful in observing injector seals of right bank, or removal of compartment panel under rear seat.

c. Injector Dribbling may occur when the injector valve is not properly seated. This will cause pre-ignition. This cannot be checked unless put on a testing stand and timed to testing specification. A drop or two of fuel at spray tip is only an indication of fuel trapped in the spray tip and is not detrimental as long as the pressure drop is within testing specifications.

If fuel leaks externally from the body of the injector, it should be changed.

Fuel system may be checked by connecting pressurized (40 psi) fuel to outlet of the secondary filter and observing injector lines.

4. Converter Oil in Water

This is caused by the transmission heat exchanger (converter oil cooler) leaking. To check, remove transmission heat exchanger. Using suitable adapter plates and rubber gaskets, apply regulated air pressure of 40 to 50 pounds to oil inlet (plugging outlet). Submerge in water heated to 180°F. Air bubbles will indicate leakage.

GASKET INSTALLATION

Recommendations covering the installation of gaskets are provided in the following seven steps:

1. Clean all gasket mating surfaces completely of old gasket material. The presence of old gasket material imposes an irregularity between the mating surfaces that can cause breakage of engine castings and/or leaks.

2. Check for old gasket material or raised metal by sliding the sharp edge of a putty knife lightly across all gasket surfaces. Remove any raised metal with a file to ensure a proper seal. Be sure all foreign material is removed from around the studs.

3. Check the fit of a new gasket. Time in storage can cause a gasket to shrink or expand. A gasket that fits poorly should not be used.

4. Coat the gasket surface of the casting lightly with a non-hardening gasket cement.

5. Place the gasket on the coated surface carefully. Be sure the gasket lies flat. Bulges may result in a poor seal.

6. Coat the exposed gasket surface lightly with the non-hardening gasket cement. Complete the assembly of the main housing by installing all retaining bolts finger-tight.

7. Tighten the bolts to the prescribed torque and in the proper sequence as outlined in applicable manual.

NOTE: When the bolt tightening sequence is not prescribed, first tighten all bolts one-fourth to one-half of the prescribed torque to set the gasket properly. Then tighten the bolts to the torque recommended.

Install gaskets correctly. The time and money to replace a leaking gasket or a broken engine casting is costly.

CLEANING INJECTOR SPRAY TIP

Pre-cleaning of the exterior surface of an injector spray tip should be done with a brass wire buffing wheel and not a steel wire wheel. The best motor speed for maximum brush life and the best polishing effect is 3,000 rpm.

The hardness of the steel wire buffing wheel tends to distort the tip holes. Excessive buffing with a brass wheel can also alter the size and shape of the holes.

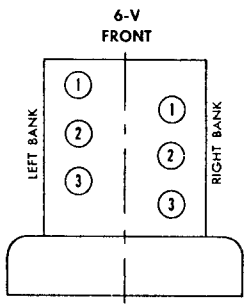
DIESEL ENGINE TUNE-UP CHARTS

(The Following Tune-Up Charts Have Been Up-Dated)

6V-53 DIESEL ENGINE TUNE-UP CHART

Engine Type	6V-53 (2 Stroke Cycle)
Number of Cylinders	6
Firing Order	1L-3R-3L-2R-2L-1R
Valve Lash	0.024" (Hot) or 0.026" (Cold)
Cylinder Head Bolt Torque	175-185 Ft.-Lbs.*
Engine Idle Speed	500 Rpm
Engine Governed Speed	
Full Load	2600 Rpm
No Load	2750 Rpm
Fuel Injector Type	N45
Injector Valve Opening Pressure	2300-3300 Psi.
Compression Ratio	21:1
Cylinder Compression	540 Psi**
Injector Timing Dimension	1.460"***
Fuel Supply Pump	
Capacity (At 1500 Engine Rpm)	90 Gal. Per Hr.
Relief Valve Opens (Max. Lbs. Pressure)	75

* Threads and bolt heads coated with International Compound #2 (Part No. 5198563).
** With engine running at 600 rpm. Variation between cylinders not to exceed 25 psi.
*** Use injector timing gauge No. J-1853.



53 AND 71 SERIES DIESEL ENGINES

DIESEL ENGINE TUNE-UP CHARTS (CONT.)

NOTE: If engine is equipped with an engine brake, refer to Maintenance Procedure covered in Section 6C of ST135-70 Service Manual for servicing the engine brake mechanism.

6-71NE & 6-71N

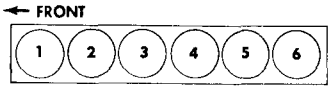
ENGINE TYPE	6-71NE & 6-71N (2 Stroke Cycle)
NUMBER OF CYLINDERS	6
FIRING ORDER	1-5-3-6-2-4
VALVE LASH	
Hot	0.013" Go, 0.015" No Go
Cold	0.015" Go, 0.017" No Go
CYLINDER HEAD BOLT TORQUE	175-185 Ft. Lbs.*
ENGINE IDLE SPEED	400-450 RPM
ENGINE GOVERNED SPEED (Full Load) Note 1	
6-71NE	1950 RPM
6-71N	2100 RPM
FUEL INJECTOR TYPE	
6-71N	N60 or N65
6-71NE	N55
INJECTOR VALVE OPENING PRESSURE	2300-3300 PSI
COMPRESSION RATIO	18.7:1
CYLINDER COMPRESSION (Min.)	515 PSI**
INJECTION TIMING DIMENSION	
(Except opt. N65 Injector)	1.460"
(Opt. N65 Injector)	1.484"***
FUEL SUPPLY PUMP	
Capacity (at 1500 engine RPM)	90 Gal. Per Hr.
Relief Valve Opens (Approx)	70 PSI

*Threads and bolt heads coated with international compound #2 part number 5198563 or equivalent.

**At sea level, with engine running at 600 RPM. Variation between cylinders not to exceed 25 PSI.

***Camshaft timing on inline 6 and 8V engines equipped with the optional N65 injectors is advanced one tooth (identified by "A" stamped on the serial number pad of the cylinder block). When checking or setting these injectors, use timing tool J-1242 with 1.484" dimension instead of J-1853 as used on all other injectors.

Note 1: No-load governed speed is approximately 150 RPM more than full-load speed.



8V-71N, 8V-71NE & 12V-71

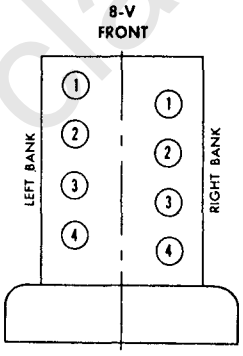
ENGINE TYPE	2 Stroke Cycle
FIRING ORDER (V8)	1L-3R-3L-4R-4L-2R-2L-1R
FIRING ORDER (V12)	1L-5L-3R-4R-3L-4L-2R-6R-2L-6L-1R-5R
VALVE LASH	
Hot	0.013" Go, 0.015" No Go
Cold	0.015" Go, 0.017" No Go
CYLINDER HEAD BOLT TORQUE	175-185 Ft. Lbs.*
ENGINE IDLE SPEED	400-450 RPM
ENGINE GOVERNED SPEED (Full Load) Note: 1	
8V-71N & V12-71	2100 RPM
8V-71NE	1950 RPM
FUEL INJECTOR TYPE	
8V-71NE	N55
8V-71N	N60 or N65
V12-71	N60
INJECTOR VALVE OPENING PRESSURE	2300-3300 PSI
COMPRESSION RATIO	18.7:1
CYLINDER COMPRESSION (Min.)	515 PSI**
INJECTION TIMING DIMENSION	
(Except opt. N-65 Injector)	1.460"
(Opt. N65 Injector)	1.484***
FUEL SUPPLY PUMP	
Capacity (at 1500 engine RPM)	90 Gal. Per Hr.
Relief Valve Opens (Approx.)	70 PSI

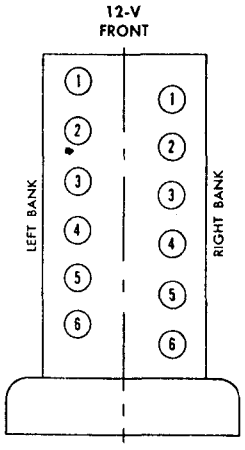
*Threads and bolt heads coated with international compound #2 part number GM 5198563 or equivalent.

**At sea level, with engine running at 600 RPM. Variation between cylinders not to exceed 25 PSI.

***Camshaft timing on inline 6 and 8V engines equipped with the optional N65 injectors is advanced one tooth (identified by "A" stamped on the serial number pad of the cylinder block). When checking or setting these injectors, use timing tool J-1242 with 1.484" dimension instead of J-1853 as used on all other injectors.

Note 1: No-load governed speed is approximately 150 RPM more than full-load speed.





SECTION 6D

Engine Mountings

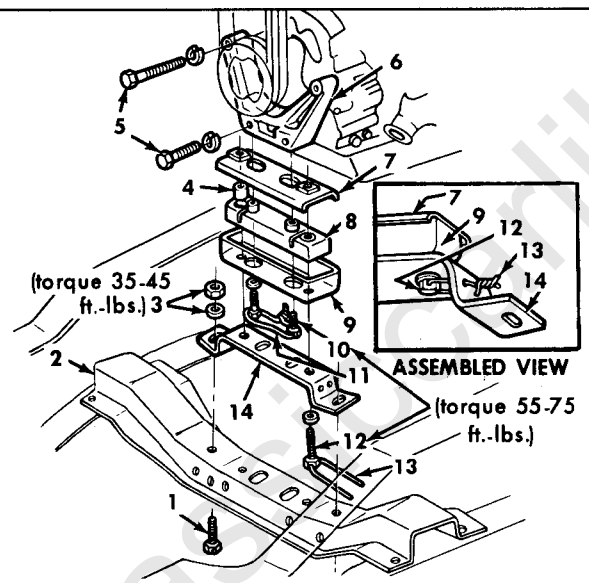
GENERAL INFORMATION

Cushion-type mountings are used at both front and rear of engines on all vehicles covered in this supplement. (Front refers to end of engine opposite flywheel.)

The various types of mounts are typically illustrated in this section (figs. 1 thru 13), and torque for the mounts are shown in the illustration. Torque values to be used in tightening mounting bolts, bracket bolts and nuts are shown in the chart at end of this section.

GENERAL MAINTENANCE

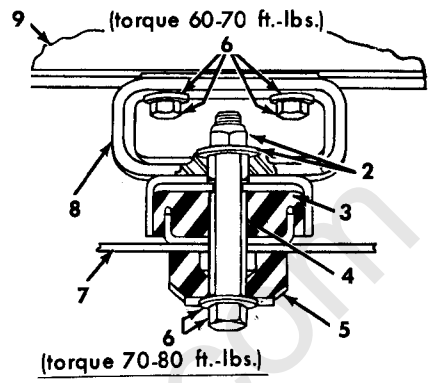
Engine mountings should be inspected periodically and if found damaged or deteriorated they should be replaced.



1 Bracket-to-Crossmember Bolts
2 Crossmember
3 Nut and Washer
4 Spacer
5 Bracket-to-Engine Bolts and Washers
6 Engine Mounting Bracket
7 Plate
8 Mounting Cushion Assembly
9 Cushion Retainer
10 Mounting-to-Bracket Bolts and Washers
11 Bolt Lock Wire
12 Bracket-to-Plate Bolt
13 Lock Wire
14 Bracket (at Crossmember)

T-9063

Figure 1—Front Compressive Mount



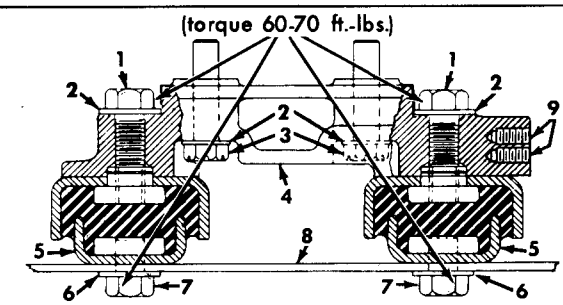
1 Support Bolts
2 Mounting Bolt Nut and Washer
3 Upper Mount
4 Spacer
5 Lower Cushion
6 Mounting Bolt w/Flat Washer
7 Frame Bracket or Crossmember
8 Support
9 Engine Front Cover

T-9048

Figure 2—Front Compressive Mount w/Rebound Cushion Mount

IMPORTANT: Broken or deteriorated mounts can cause misalignment and eventual destruction of certain drive train components. Also, when a single mounting failure occurs, the remaining mountings are subjected to abnormally high stresses.

When inspecting engine mounts, check all attaching bolts and nuts for tightness.

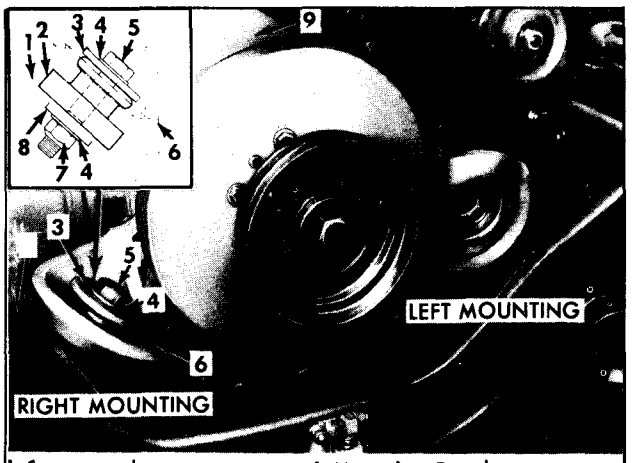


1 Bracket-to-Mounting Bolt
2 Flat Washer
3 Bracket-to-Engine Bolts
4 Support Bracket
5 Engine Mounting
6 Flat and/or Helical Spring Washer
7 Mounting Bolts
8 Crossmember or Welded Bracket
9 Tapped Holes For Oil Cooler Hose Support

T-9065

Figure 3—Front Dual Compressive Mount

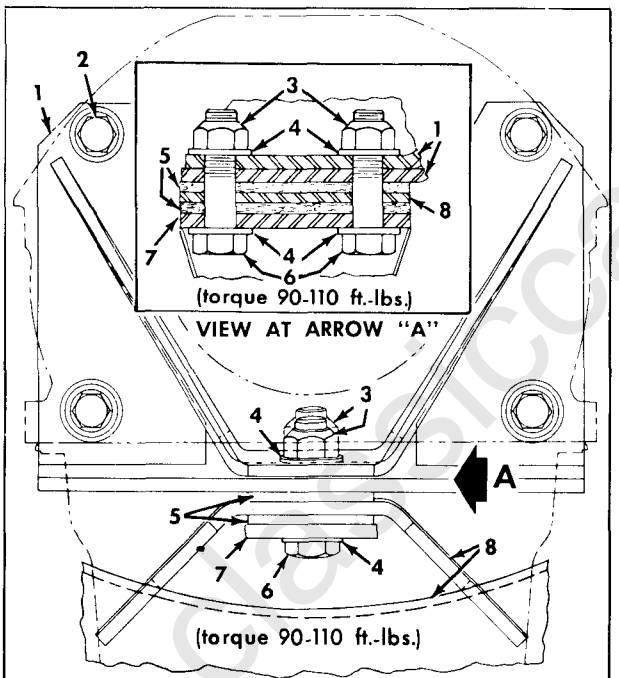
ENGINE MOUNTINGS



1 Crossmember
2 Mounting Cushion
3 Upper Washer
4 Plain Washer
5 Mounting Bolt
6 Mounting Bracket (Bolted to Engine)
7 Nut (Torque 180-190 ft.-lbs.)
8 Lower Washer
9 Engine Front Cover T-9068

Figure 4—Front Center Bond Cushion Mount

NOTE: Before removing or replacing bolts make sure to inspect type of bolt used for proper installation and torque.



1 Engine Bracket Assy. (Welded)
2 Bolts with Plain Washers
3 Mounting Bolt Nuts
4 Plain Washers
5 Insulator
6 Mounting Bolts
7 Plate
8 Frame Member T-9067

Figure 5—Front Fabreeka Mount

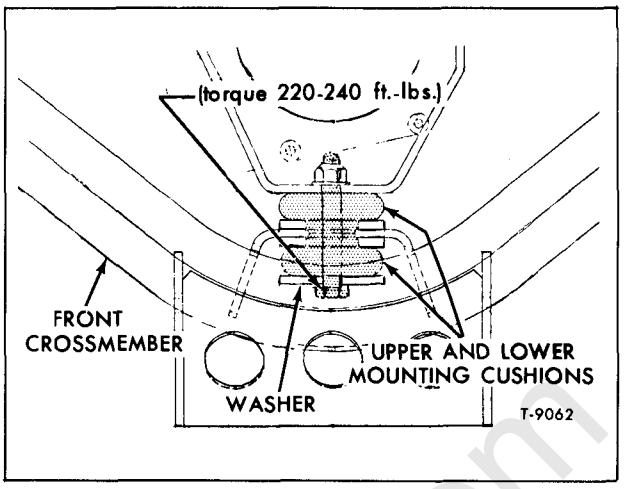


Figure 6—Front Elasto Mount

MOUNTING CUSHION REPLACEMENT

IMPORTANT: When supporting engine to replace a mount, raise engine only to height required to provide clearance for mounting removal. In some cases it may be necessary to drain cooling system and disconnect hoses to avoid damage when

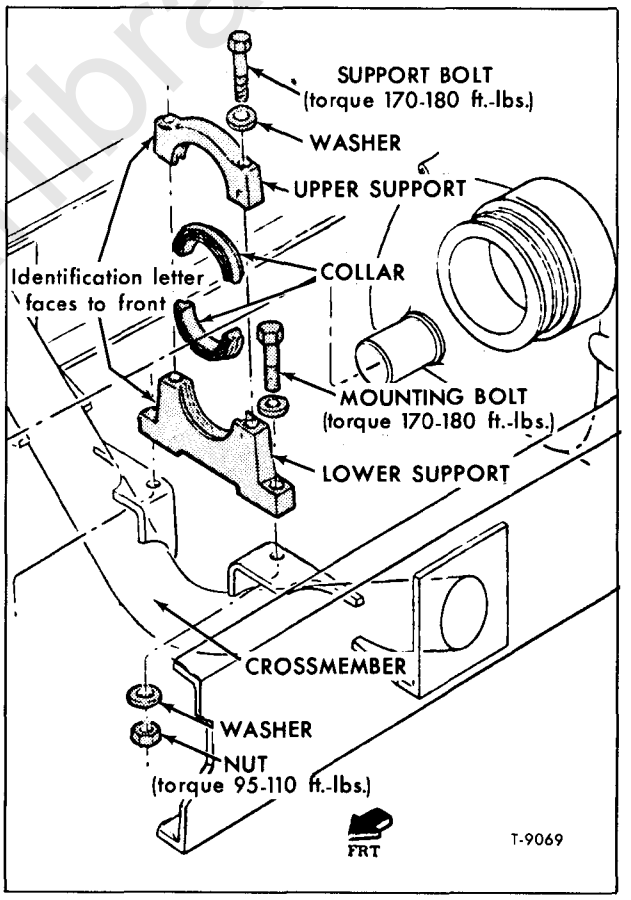


Figure 7—Front Trunnion Mount

engine is raised. Use care to see that control linkage and wiring are not damaged as a result of raising engine.

NOTE: When replacing a single front mounting on engines having a two-point type front mounting, both mountings should be detached before attempting to raise the engine. Failure to do this will place excessive stress on the attached mounting when engine is raised.

Lubricate center bond type mounting cushion with raw linseed oil before installation.

The instructions for replacing mountings which follow cover general procedures on various types as illustrated in this section.

ENGINE FRONT MOUNTING
REPLACEMENT

NOTE: On some vehicles it may be necessary to remove lock wire which secures mounting bolts.

1. SAFELY provide for necessary support to raise front of engine as required.

NOTE: Refer to "TRANSMISSION ON-VEHICLE SERVICE OPERATIONS" (SEC. 7-17) of ST135-70 Service Manual for information on transmission rear support on vehicles so equipped, and disconnect as necessary to allow rear end of transmission to move downward. Also, loosen cap bolts at engine rear mountings.

2. Remove bolt(s), washer(s), or nut(s) attaching bracket and mounting assembly to crossmember or engine, then remove bracket and mounting assembly.

3. Separate and inspect mounting components. Replace as required.

NOTE: On some vehicles if engine front mounting bracket requires replacement, the pulley and damper must be removed first. Remove attaching bolts and remove brackets.

4. Reverse the removal procedures previously given to install the parts. Tighten all bracket and mounting bolts to torque specified.

ENGINE REAR MOUNTING
REPLACEMENT

NOTE: If necessary, remove any wiring, piping, or accessories which would be damaged by raising engine.

1. SAFELY provide for jack to raise rear of engine or transmission, as necessary.

CAUTION: Raise rear of power plant only high enough to permit removal of upper cushion; amd provide safety blocking to prevent tipping and possible damage to front mountings.

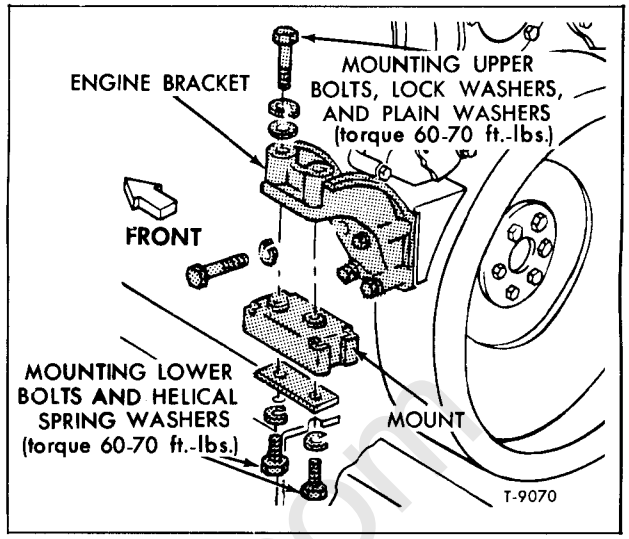


Figure 8—Rear Compressive Mount

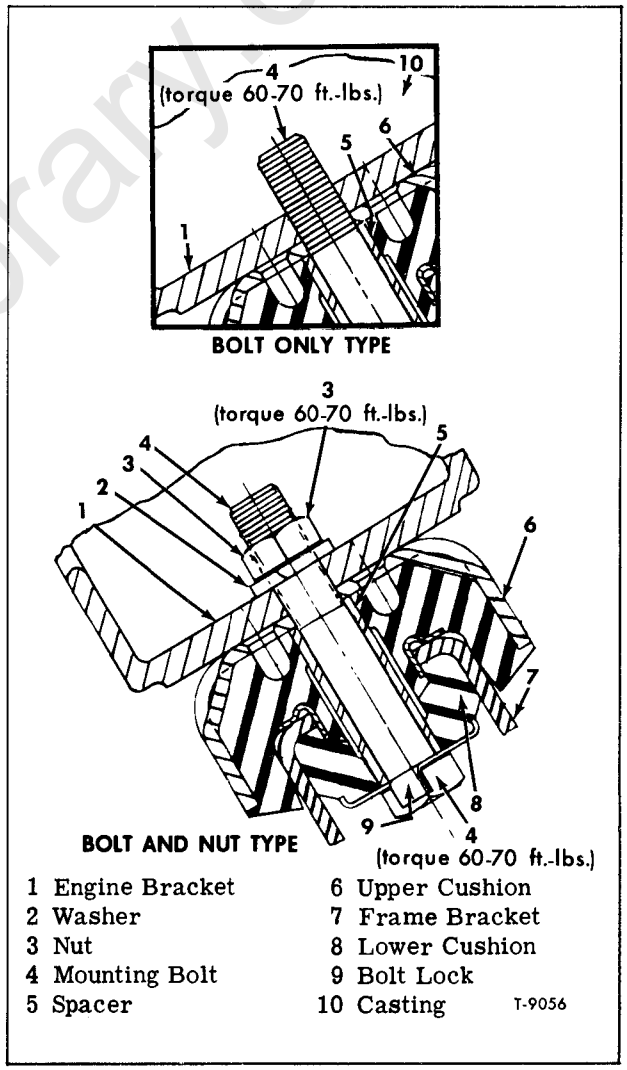


Figure 9—Rear Saddle Mount

ENGINE MOUNTINGS

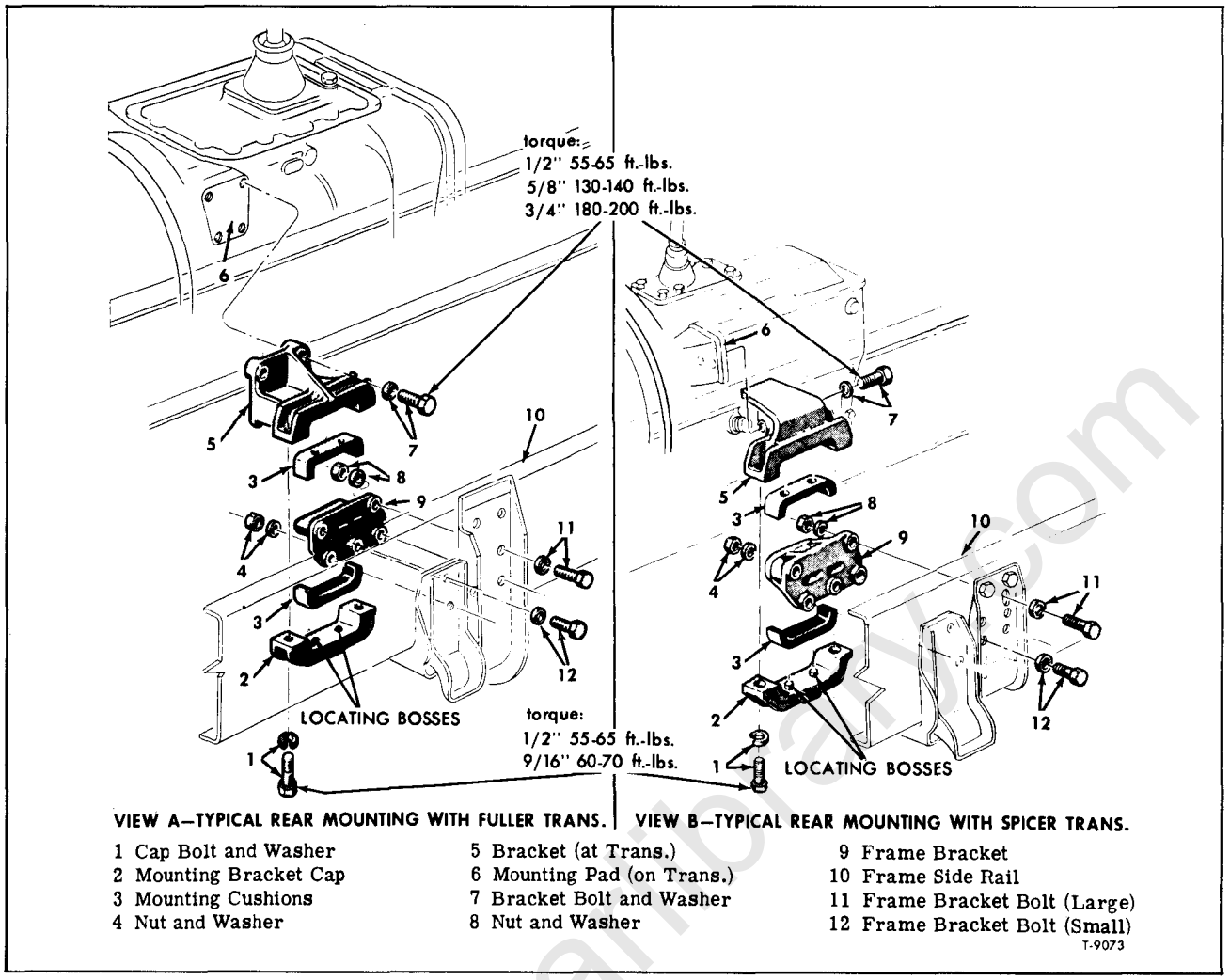


Figure 10—Rear Trunnion Mount

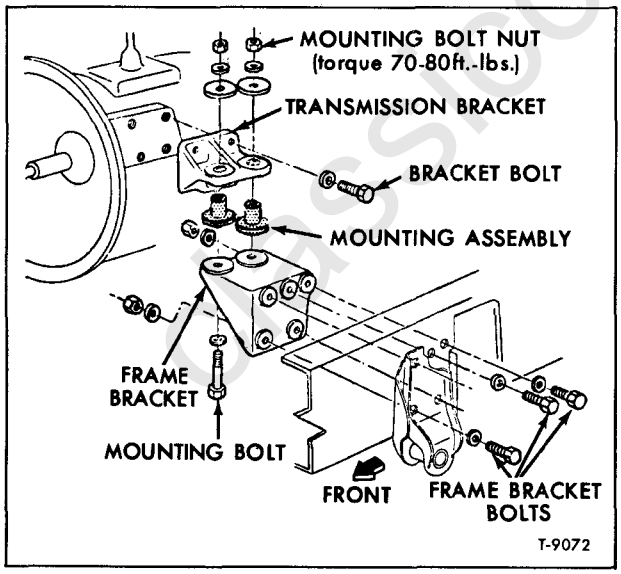


Figure 11—Rear Dual Center Bond Mount

2. Remove bolts or nuts and washers from both rear mounts, then raise rear of power plant sufficiently to remove mountings.

NOTE: If a mounting is used at rear of transmission, it will be necessary to disconnect attaching parts to permit rear of transmission to be raised for engine rear mounting replacement. Refer to applicable portion of "TRANSMISSION-ON-VEHICLE SERVICE OPERATIONS" (SEC. 7-17) in ST135-70 Service Manual for necessary information to disconnect transmission rear support and to assemble the components to provide correct load after replacing engine rear mounting.

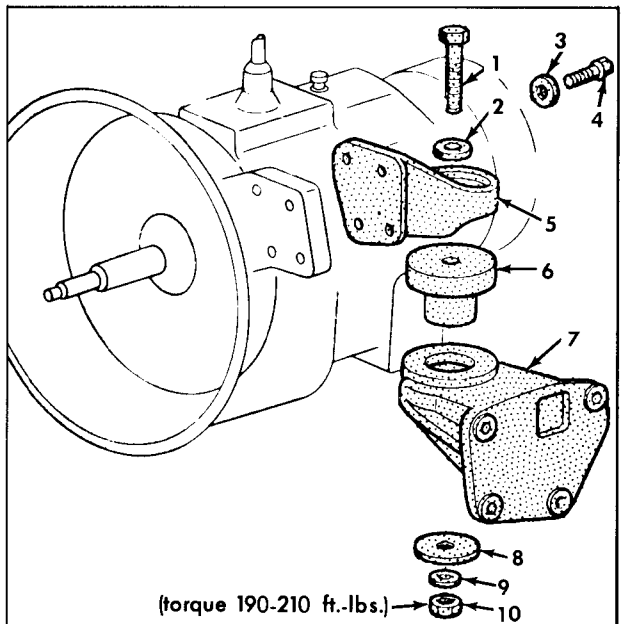
3. Separate and inspect mounting components. Replace as required.

NOTE: If engine brackets require replacement remove attaching bolts and remove brackets.

4. Reverse the removal procedure to install mounting brackets and/or cushions.

5. Tighten all bolts to torque specifications.

ENGINE MOUNTINGS



1 Mounting Bolt
2 Washer
3 Washer
4 Bracket-to-Engine Bolt
5 Engine Mounting Bracket
6 Mounting Cushion
7 Frame Bracket
8 Special Washer
9 Washer
10 Nut

T-9071

Figure 12—Rear Center Bond Mount

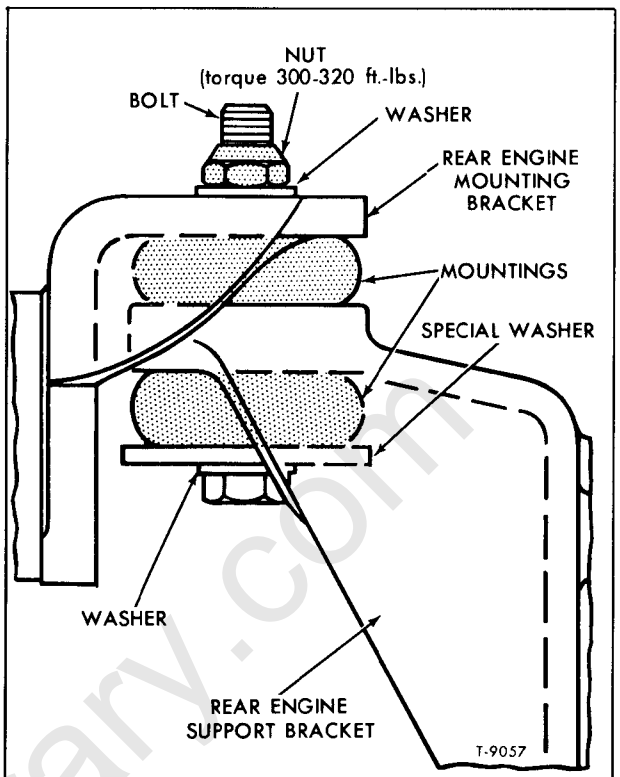


Figure 13—Rear Elasto Mount

MOUNTING BOLTS, BRACKET BOLTS, AND NUT TORQUES

BOLT OR NUT SIZE	GM 280-M BOLT FT.-LBS.	BOLT HEAD IDENTIFICATION	GM 300-M BOLT FT.-LBS.	BOLT HEAD IDENTIFICATION	NUT TORQUE FT.-LBS.
1/4" - 20-28	8-10		10-15		5-8
5/16" - 18-24	20-25		25-30		8-12
3/8" - 16-24	25-30		35-45		15-20
7/16" - 14-20	40-50		70-80		25-30
1/2" - 13-16	55-65 *		85-105		40-50
9/16" - 12-18	60-70 **		90-110		50-60
5/8" - 11-18	130-140 ***		170-180		70-80
3/4" - 10-16	180-200		300-320		110-130
7/8" - 9-14	240-270		400-430		210-230
1" - 8-14	325-380		700-730		320-350

* 40 - 50
** 55 - 65 Torque for aluminum casting.
*** 60 - 70

T-9074

ENGINE MOUNTINGS

Inspect engine front and rear mountings as part of regular engine maintenance program. Be sure to keep bolts and nuts tightened to torque values specified on chart.

SECTION 6K

Engine Cooling System

Information pertinent to truck models covered by this supplement is the same as explained in ENGINE COOLING SYSTEM (SEC. 6K) in Heavy Duty Truck Service Manual ST135-70 and Supplement ST332-71, except as indicated by the following information which is either new or supplemental in nature.

Reference should be made to RADIATOR AND SURGE TANK (SEC. 13) in this supplement for information regarding radiator mounting, radiator core and surge tank and cooling system filler cap.

NOTE: For cooling system information related to Cummins Engine that is not covered in this supplement, refer to appropriate Cummins Service Publication.

COOLING SYSTEM GENERAL MAINTENANCE

All vehicles covered by this supplement are equipped with pressure type radiator filler caps.

Most vehicle cooling systems have a 9 psi pressure cap. These 9-pound pressure caps are stamped RC-12-9.

Other cooling systems have either 13-psi, or 15-psi pressure caps. The 13-pound cap is stamped either RC-12-13 or RC-35-13. Stamping on 15 psi pressure cap is RC-15-15.

COOLING SYSTEM PRESSURE CHECK

Several types of cooling system pressure checking devices are available locally and manufacturer's instructions should be followed for proper use. A typical tester is illustrated in figure 1 and usual procedure is given below for making test of pressure cap and cooling system.

1. Testing Radiator Cap

CAUTION: The radiator cap should not be removed while the engine is at normal operating temperature. If it is necessary to remove the cap while the engine is hot, first relieve the pressure in the system by turning the radiator cap counterclockwise to first stop, using caution not to scald hands. Push down on cap and turn counterclockwise to remove cap.

a. With radiator filler cap removed, wet the cap gasket with water and wash off any sediment from sealing surface, then install cap on tester.

b. Pump up pressure by operating pump plunger handle. When the pressure stamped on cap is reached, observe tester dial and note the rate of decrease in pressure.

c. The indicator hand on gauge dial should remain within the corresponding pressure segment of scale for approximately 10 seconds. If pressure cap does not meet this requirement it should be replaced with new cap.

2. Testing Cooling System

a. Tighten all radiator and heater hose clamps. Also, check other connections for leaks at air compressor coolant lines, etc.

b. Fill cooling system to level of filler cap seat.

c. Attach tester to filler neck following the instructions supplied with tester.

d. Build pressure up to 20 psi. (maximum).

e. The cooling system should hold the 20 psi pressure for approximately two minutes. If pressure drops appreciably in less than two minutes, a leak in system is indicated.

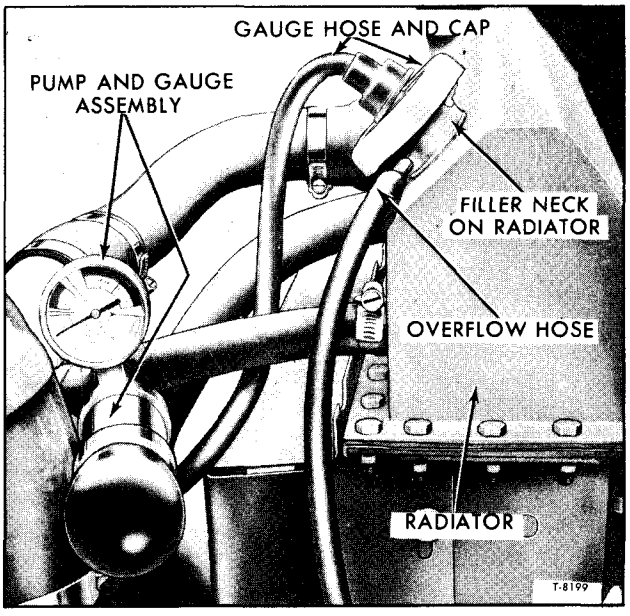


Figure 1—Typical Use of Cooling System Tester

ENGINE COOLING SYSTEM

COOLING SYSTEM PROBLEM ANALYSIS

1. Remove filler cap or tester from filler neck so there will be no pressure in system, then attach system tester at filler neck (fig. 1).

2. Start engine and run until normal operating temperature is reached (approx. 175°F.).

3. Observe gauge on tester. If no pressure in system is indicated use tester pump to pressurize the system. If system will not hold pressure, inspect hoses, fittings, and gaskets. Also, look for water draining from hole in water pump body between the pump seal and the bearing.

4. If no leaks are evident, it is possible that coolant is leaking internally into crankcase, oil cooler, or combustion chambers.

5. To determine if there is coolant leakage into oil cooler or crankcase, look for water droplets on engine oil dipstick. Also, look for engine oil in cooling system which would indicate that defective oil cooler or gaskets exist.

NOTE: Refer to applicable portion of SERIES 53 AND 71 DIESEL ENGINES (SEC. 6C) in this supplement for "Testing and Problem Analysis" which gives additional information on detecting defective cooling system components on 53 and 71 Series Diesel engines.

ENGINE COOLANT RECOMMENDATIONS

NOTE: Method of testing, and precautions pertaining to cooling system maintenance procedures are included in ENGINE COOLING SYSTEM (SEC. 6K) in Heavy Duty Truck Service Manual ST135-70, with supplemental information in RADIATOR AND SURGE TANK (SEC. 13) in this supplement.

Recommendations are for a high quality inhibited Ethylene Glycol base coolant meeting GM Specifications 1899M and to provide the freezing and corrosion protection (at least 0°F.).

Additional inhibitors are not required on the initial fill if a minimum antifreeze concentration of 30% by volume is used. Solutions of less than 30% concentration do not provide sufficient corrosion protection. Concentrations over 67% adversely affect freeze protection and heat transfer rates. Several brands of permanent antifreeze are available with sealer additives. The specific type of sealers vary with the manufacturer. Antifreeze with sealer additives is not recommended due to plugging problems throughout various areas of the cooling system.

NOTE: Refer to "Standard Cooling System Capacities Chart" at the end of this section for system capacities.

COOLING SYSTEM CORROSION PREVENTION

NOTE: Addition of supplemental additives and other available materials which have not been specifically approved by GM are not normally required. Use of these materials will result in unwarranted operating expense.

Every two years, the cooling system should be serviced as follows:

1. Drain coolant, when hot, through the radiator drain valve.
2. Close valve and add sufficient plain water to fill system.
3. Run engine until normal operating temperature is reached.
4. Drain and refill the system as described in Steps 1, 2, and 3 a sufficient number of times until the drained liquid is colorless.
5. Allow system to drain completely and then close radiator drain valve tightly.
6. Add the necessary amount of high quality inhibited glycol base coolant meeting GM Specification 1899-M to provide the required freezing and corrosion protection (at least to 0°F.).
7. Run engine until normal operating temperature is reached.
8. Check and adjust level of coolant after system has cooled sufficiently to remove radiator cap.

CAUTION: When an engine is at normal operating temperature or above, the internal pressure built up in the cooling system will blow out scalding fluid and vapors if the radiator cap is suddenly removed. To prevent loss of coolant and to avoid the danger of being burned, the coolant level should be checked or coolant added only when the engine is cool. To remove the cap when engine is cool, slowly rotate cap counterclockwise to the stop on filler neck (DO NOT PRESS DOWN WHILE ROTATING), wait until any residual pressure is relieved - as indicated by a hissing sound, then press down on the cap while continuing to rotate counterclockwise. Radiator pressure caps should be checked by a qualified mechanic periodically for proper operation and replaced as required with the applicable AC type. Pressure cap testing procedure is covered previously in this section.

Regardless of whether freezing temperatures are or are not expected, cooling system protection should be maintained at least to 0°F., to provide

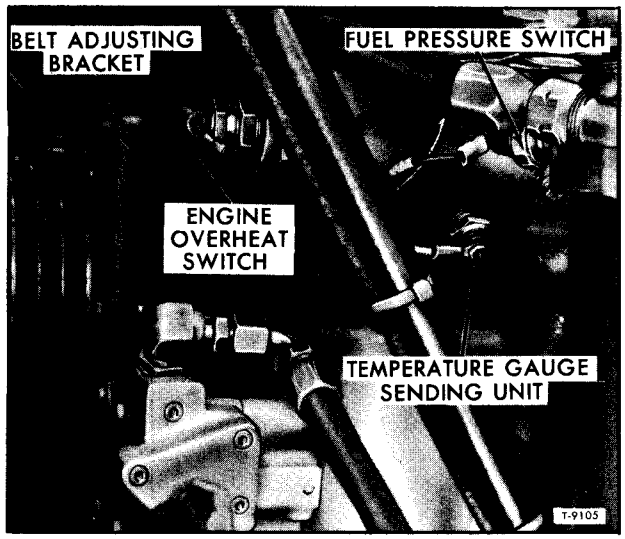


Figure 2—Temperature Gauge Sending Unit and Engine Overheat Switch (12V-71 Diesel Engine)

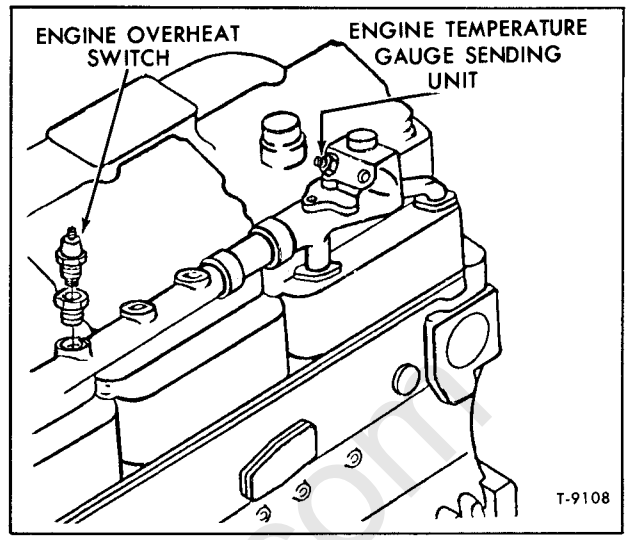


Figure 3—Temperature Gauge Sending Unit and Engine Overheat Switch (6 Cyl. Cummins Diesel Engine)

adequate corrosion protection. When coolant additions are required because of coolant loss or to provide additional protection against freezing at temperatures lower than -20°F., (-32°F. in Canada), a sufficient amount of an Ethylene Glycol base coolant meeting GM Specification 1899-M should be used.

NOTE: Alcohol or methanol base coolants or plain water are not recommended.

IMPORTANT: DO NOT run engine when gauge or tell-tale indicates "hot" engine.

WATER TEMPERATURE INDICATOR

Figures 2 and 3 illustrate temperature gauge sending units and engine overheat switch on 12V-71 Diesel Engine and Cummins Six-Cylinder Diesel Engine. Information and testing is described on pages 6K-8 and 6K-9 in Service Manual ST135-70.

ENGINE THERMOSTATS

Figure 4 illustrates the thermostat installation of 12V-71 Diesel engine on the left side of the engine. There are four thermostats, two in each side. Pages 6K-9 and 6K-10 in Service Manual ST135-70 describes operation and checks.

When replacing thermostats make sure and clean gasket surfaces. Install gasket, two thermostats, thermostat housing, and tighten six bolts securely.

V-BELT TENSION

Fan belt tension on vehicles equipped with V-belts should be adjusted to 120-130 pounds on new belts using BT-33-73F Belt Tension Gauge. Used drive V-belts should be adjusted to 80-90 pounds. Gauge should be placed at center of the greatest span.

IMPORTANT: After a belt has been in operation one hour or approximately 50 miles, it is considered used. Belt dressing can be used to extend belt life. When V-belts are worn they should be replaced as excessive tightening will not prevent slippage and can cause damage to bearings.

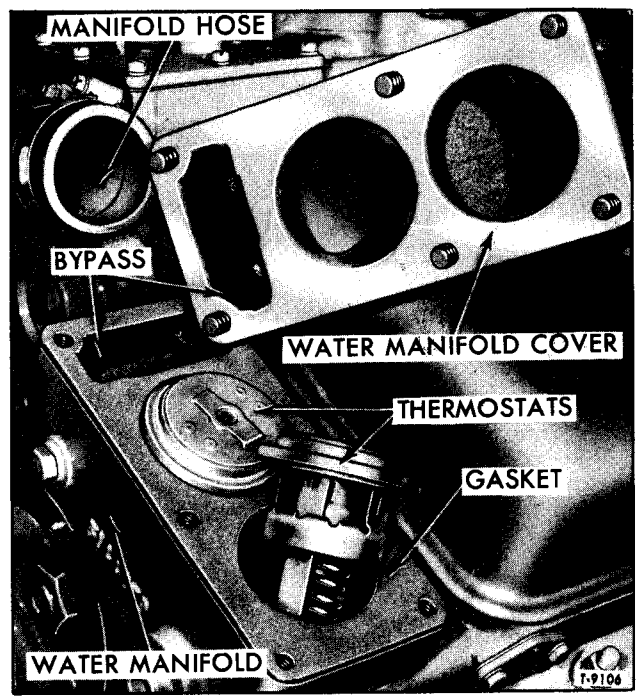
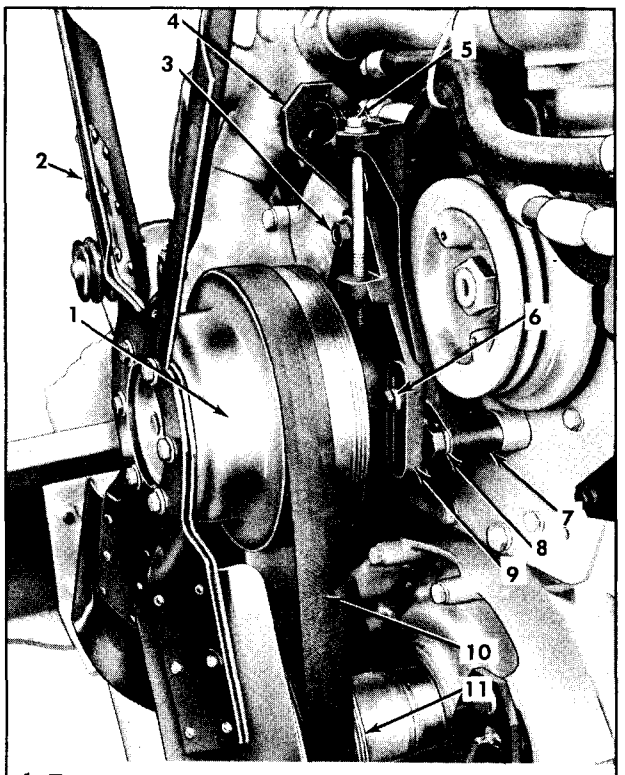


Figure 4—Thermostat Installation (12V-71 Diesel Engine)

ENGINE COOLING SYSTEM



1 Fan Hub
2 Fan Blades
3 Upper Bolt and Washer
4 Lifting Bracket
5 Adjusting Bolt
6 Side Bolt and Washer (2 Used)
7 Adapter Bracket
8 Bracket Bolt and Washer
9 Fan Bracket and Bearing Assembly
10 Fan Drive Belt
11 Crankshaft Pulley

Figure 5—Fan Drive Belt Adjustment on DI, FI, DH, and FH, Models

NOTE: Poly-V Belt Tension is described on pages 6K-12 and 6K-13 of Service Manual ST135-70.

FAN SUPPORT AND BELT ADJUSTMENT (DI, FI, DH, FH90 MODELS)

Figure 5 shows the fan installation for vehicles indicated above.

Poly-V drive belt is used and fan blade and hub assembly is mounted on a moveable bracket attached to front of engine by bolts.

Permanently lubricated sealed bearing and shaft assembly is held in bracket by snap ring.

FAN BELT REPLACEMENT (DI, FI, DH, FH90 MODELS)

(Key Numbers in Text Refer to Figure 5)

REMOVAL

1. Loosen the generator and/or air conditioner compressor (if used) to permit slackening drive belts.

2. Loosen the two side bolts (6) which secure hub bracket assembly (9) to bracket (7), then loosen upper bolt (3) just enough to allow bracket (9) to be pushed downward as adjusting bolt (5) is backed off.

3. Remove fan belt (10) from crankshaft pulley first, then pass the belt over fan blades and remove belt.

INSTALLATION

1. Position new fan drive belt over fan and into grooves in fan pulley (1) and crankshaft pulley (11).

2. With bracket bolts (3 and 6) just loose enough to permit bracket (9) to be moved as adjusting bolt (5) is turned, turn bolt (5) clockwise to tighten belt.

3. Use Poly-V belt tension gauge (J-23586) to measure belt tension. Correct tension for new fan drive belt is 255 to 265 pounds as indicated on gauge dial.

NOTE: Tension for used fan drive belt (after 1 hour or 50 miles of running) is 235 to 245 pounds.

4. When belt has been adjusted to correct tension, tighten bracket bolts. Correct torque for two side bolts (6) is 35 to 45 foot-pounds, and for upper bolt (3) is 85 to 105 foot-pounds.

FAN SUPPORT BRACKET REPLACEMENT (DI, FI, DH, FH90 MODELS)

(Key Numbers in Text Refer to Figure 5)

REMOVAL

1. Remove the fan drive belt as previously directed.

2. Remove adjusting bolt and washer (5), then remove two side bolts and washers (6) and upper bolt and washer (3), and remove fan bracket and bearing assembly (9).

3. Remove bolts and washers (8) which attach adapter bracket (7) to engine and remove bracket (7) and lifting bracket (4).

NOTE: If it is necessary to disassemble fan blades, pulley and fan bearing assembly, follow appropriate procedure as given under "Fan Shaft and Bearing Replacement" on page 6K-15 in Service Manual ST135-70.

INSTALLATION

NOTE: Key numbers in text refer to figure 5.

1. Position lifting bracket (4) and adapter bracket (7) at engine and install bolts and washers (8). Tighten bolts to 170 to 180 foot-pounds torque.

2. Place bracket assembly (9) including pulley (1) at bracket (7) and install adjusting bolt (5) with

washer. Bolt (5) will support bracket assembly (9) while starting bolts (3 and 6).

3. Install upper bolt and washer (3), and two side bolts and washers (6), but do not tighten bolts.

4. Install fan drive belt (10) and adjust belt tension as previously instructed. Bolts (3 and 6) should be threaded into bracket far enough to put light pressure on washers but must allow for movement of bracket assembly (9) when adjusting bolt (5) is turned.

5. When belt adjustment is correct, tighten upper bolt (3) to 85 to 105 foot-pounds, and tighten two side bolts (6) to 35 to 45 foot-pounds torque.

FAN SUPPORT AND BELT ADJUSTMENT (DP 90 MODELS)

Figures 2 and 6 show fan installation and drive for 12V-71 engine.

The pulley hub turns on a double row ball bearing at the front and a single row ball bearing at the rear of hub (fig. 6). The bearings and the cavity between the bearings are packed with grease and should be lubricated as outlined in the assembly procedure.

DISASSEMBLY (Refer to Fig. 6)

1. Remove the fan blade and spacer by taking out six mounting bolts, nuts, and washers.

2. Free the fan belts by loosening the adjusting bolt and bracket bolts.

3. Remove the bracket bolts and detach the hub and bracket assembly.

4. Remove the hub cap, then take out the cotter pin and remove the nut. If the bearings are to be removed, take out the retaining ring.

5. Support the hub, front face up, on wooden blocks high enough to allow the bracket to be removed. Tap the fan shaft with a plastic hammer to free the fan shaft and bracket assembly from the bearings in the hub.

6. Remove the ball bearings from the pulley hub as follows:

a. Support the pulley hub, rear face up, on two wood blocks, spaced far enough apart to permit the removal of the bearing from the hub.

b. Tap the front bearing out of the hub by tapping alternately around the rear face of the bearing outer race with a small brass rod and hammer.

c. Reverse the pulley hub on the two wood blocks and remove the rear bearing from the hub in the same manner.

INSPECTION

1. Clean the fan and related parts with clean fuel oil, and dry them with compressed air. Shielded bearings must not be washed; dirt may be washed in and the cleaning fluid could not be entirely removed from the bearing.

2. Examine the bearings for any indications of corrosion or pitting. Hold the inner race or cone so it does not turn and revolve the outer race or cup slowly by hand. If rough spots are found, replace the bearings.

3. Check the fan blades; if blades are cracked or bent, replace them. Look for cracks in the adjusting and support bracket castings.

4. When replacement of either the fan shaft or adjusting bracket is necessary, a new fan shaft and bracket assembly must be used.

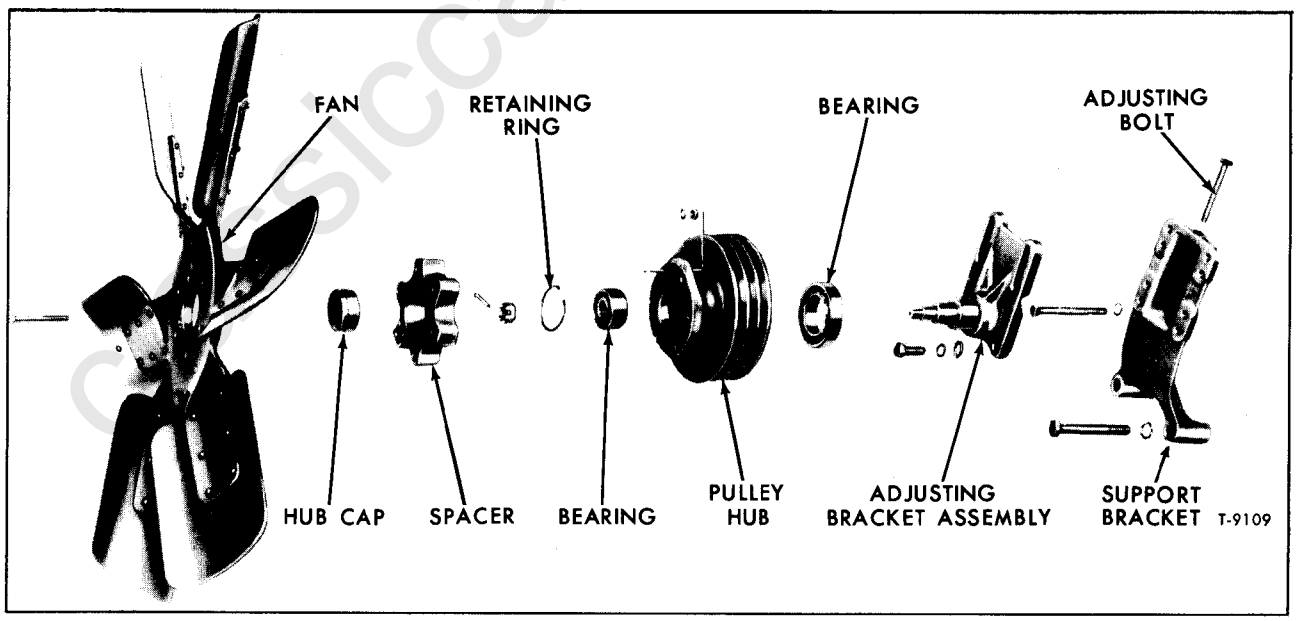


Figure 6—Fan Support, Pulley, and Fan (12V-71 Diesel Engine)

ENGINE COOLING SYSTEM

ASSEMBLY (Refer to Fig. 6)

1. Install the rear bearing in the pulley hub.
2. Pack the cavity in the pulley hub half full of Lithium base multi-purpose grease.
3. Place the adjusting bracket on wood blocks setting on the bed of an arbor press, then press the pulley hub on the fan shaft.
4. Install the front bearing in the pulley hub.
5. Install the retaining ring and nut. Tighten the nut to 60-90 foot-pounds torque and secure it with a cotter pin.
6. Pack the front cavity half full of grease (refer to item 2) and install a new hub cap.

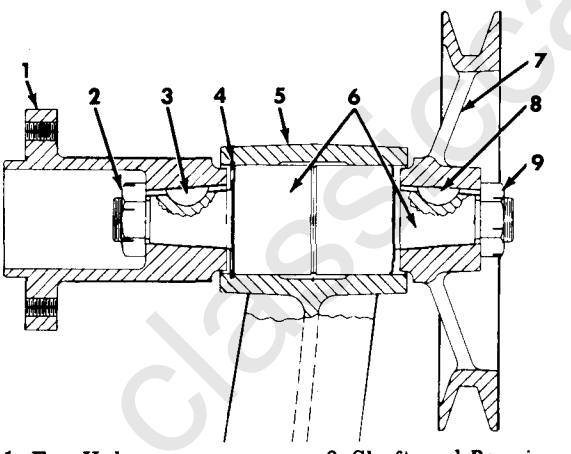
INSTALL FAN, HUB, AND BRACKET

1. Place the fan belts on the pulley (fig. 2).
2. Position the fan, hub, and adjusting bracket against the bracket support and install the bolts finger-tight in the support.
3. Adjust the bracket to provide the proper tension on the fan belts as described previously under "V-Belt Tension." Tighten the bracket adjusting bolts 55-65 foot-pounds torque.
4. Secure the fan blade and spacer to the hub with the six bolts, nuts, and lock washers. Tighten the nuts to 15-19 foot-pounds torque.

FAN SHAFT AND HOUSING ASSEMBLY (RM 80 MODELS)

REMOVAL

1. Loosen fan drive belt, then remove belt from fan shaft pulley.



1 Fan Hub
2 Hub Nut
3 Hub Drive Key
4 Bearing Retainer Ring
5 Fan Shaft Housing
6 Shaft and Bearing Assembly
7 Drive Belt Pulley
8 Pulley Drive Key
9 Shaft Nut TPM-7407

Figure 7—Fan Shaft and Housing Assembly (RM 80)

2. Disconnect yoke end of belt tension adjusting rod from fan shaft housing (5, fig. 7).
3. Remove pivot bolt and nut which attach fan shaft housing to housing frame support. Remove fan, shaft, and housing unit from vehicle.
4. Remove pivot bolt spacer from pivot hole of fan shaft housing.

DISASSEMBLY

NOTE: Key numbers in text refer to figure 7.

1. Remove four bolts and lock washers which attach fan blade to fan hub (1). Remove fan blade.
2. Remove nut (9) retaining drive belt pulley (7) to shaft (6). Using a conventional puller tool, force pulley from shaft. Remove drive key (8).
3. At fan end of shaft, using a deep socket wrench, remove nut (2) which attaches fan blade hub (1) to shaft assembly (6). Using puller tool, force hub from shaft. Remove drive key (3).

NOTE: Retainer ring (4) need not be removed in order to remove shaft and bearing assembly (6).

4. Place shaft support on bed of arbor press with pulley end of shaft downward. Using a suitable driver between press ram and shaft bearing outer race, press shaft assembly (6) from housing (5).

INSPECTION

IMPORTANT: Bearing and shaft assembly, which cannot be disassembled, is lubricated and sealed at time of manufacture and requires no further lubrication. Immersing bearing and shaft assembly in cleaning solution will wash out or dilute lubricant and render the assembly unfit for further use. Wipe outside of bearing and shaft assembly clean with a cloth dampened in cleaning solution.

Check for looseness of bearings on shaft. If end play of shaft exceeds 0.006-inch replace with new shaft and bearing assembly. Rotate shaft in bearing to check for bearing roughness. Examine bearing shields for damage. If the assembly is damaged in any way, replace with new assembly.

ASSEMBLY

NOTE: Key numbers in text refer to figure 7.

1. Position fan shaft support (5) on bed of arbor press with pulley side up. This will place the retainer ring (4) at the bottom to which the shaft bearing, when pressed into housing, is to contact.
2. Insert shaft end of shaft assembly (6) into housing. Original position is recommended.
3. Press shaft bearing into housing by pressing on bearing outer race. Press into housing until bearing seats firmly to retainer ring (4).
4. Place drive key (3) into slot at fan end of shaft, then install fan hub (1) to shaft with nut (2). Tighten nut to 100 to 110 foot-pounds torque.
5. At opposite end of shaft, place drive key

(8) in shaft slot and install drive belt pulley (7) to shaft with nut (9). Tighten nut to 100 to 110 foot-pounds torque.

6. Install fan blade on hub (1). Tighten bolts evenly and firmly.

INSTALLATION

1. Insert bolt spacer into pivot bolt hole at bottom of shaft housing. Check to see that spacer is free to turn and then lubricate through fitting until lubricant is forced out around ends of spacer. Locate housing unit between flanges of frame support. Install pivot bolt from radiator side. Tighten pivot bolt nut to 190-210 foot-pounds torque.

2. Connect drive belt tension adjustment rod to fan bearing housing. Install drive belt and adjust tension as instructed previously under V-belt tension.

FAN DRIVE HUB ASSEMBLY (TILT CAB MODELS)

V6 GASOLINE ENGINES

On page 6K-15 in Service Manual ST135-70, under "Fan Drive Hub Installation" change torque from 20 to 25 foot-pounds in Step 3, to read "Install fan blade and secure with six special bolts. Tighten bolts evenly to 35 to 45 foot-pounds torque."

6V-53 ENGINE WATER PUMP

The water pump for vehicles covered in this supplement has a ceramic seal similar to the 71 Series Diesel Engines which started with engine Serial Number 6066897. Disassembly and assembly of this pump is the same as covered in Service Manual ST135-70, page 6K-17 through 6K-20, except that it is important when removing the impeller, to protect the ceramic insert from damage at all times during pump overhaul. ALWAYS lay the impeller on a bench with the ceramic insert UP to prevent damage to the insert.

NOTE: Replacement of the seal is described on pages 6K-23 and 6K-24 of Service Manual ST135-70.

INSTALLING WATER PUMP ON V-71 ENGINE

NOTE: The water pump for 12V-71 is similar to 8V-71 and the procedure for servicing in Service Manual ST135-70, pages 6K-22 through 6K-26 will also apply.

When installing the water pump on a V-71 engine, it is important that the gear lash (clearance) between the water pump gear and the camshaft gear be checked.

Check the gear lash by installing a bolt in one of the impeller puller holes and measuring with an indicator the movement of the bolt when the pump impeller is "rocked." A bolt movement of 0.0015-inch to 0.0045-inch indicates a proper gear lash.

If minimum lash cannot be obtained, the dowel hole in the water pump body can be drilled or reamed oversize and the water pump shifted to obtain the desired lash. A 0.0015-inch movement of the pump directly away from the camshaft will increase the lash 0.001-inch. Likewise, moving the pump toward the camshaft 0.0015-inch will decrease the lash 0.001-inch.

NOTE: DO NOT drill or ream the dowel hole in the pump body more than necessary.

ENGINE COOLING SYSTEM

SPECIFICATIONS

Included in "Cooling System Specifications" below are all models for 1972 and updated information on capacities and thermostats.

STANDARD COOLING SYSTEM CAPACITIES (INCL. HEATER)

TRUCK MODELS	QUARTS	
	U.S.	IMPERIAL
RM80	41	34¼
HM/JM80	38	31¾
HV/JV70	38	31¾
TM/WM80	48	40
TV/WV70	33	27½
HM80	44	36¾
TE90	55	45¾
HE/JE90	52	43¼
HI/JI90,DI/FI90	52	43¼
HN/JN90, DN/FN90	54	45
HC/JC90	63	52½
DC/FC90	56	46¾
w/NTC335	63	52½
HH/JH90	81	67½
JB/MB90, DB/FB90	62	51¾
MH/DH/FH90	74	61¾
MC90	65	54¼
DP90	99	82½
NOTE: Optional Engines or Cooling System May Increase System Capacities.		

ENGINE THERMOSTATS

ENGINE	NUMBER USED	MEAN TEMP. (°F)	STARTS TO OPEN (°F)	FULL OPEN (°F)
V6 Gasoline Except RM80	2	170	167-173	192
RM80 w/V6 Gas	2	180	177-183	202
637 V8 Gas	1	180	177-183	202
6V53 Detroit Diesel	2	175	174-176	190
6-71N Detroit Diesel	1	180	179-181	195
8V-71 Detroit Diesel	2	180	179-181	195
12V-71 Detroit Diesel	4	180	179-181	195
Cummins Except 903V	1	180	170	185
Cummins 903V	2	180	170	185

ENGINE OVERHEAT SWITCH

Switch Contacts Close At:	
Gasoline Engines	225 °F.
Detroit Diesel Engines	215 °F.
Cummins Diesel Engines	205 °F.

SECTION 6M

Engine Fuel System

This group is divided into four sections as shown in Index below:

Air Cleaners
(ALL ENGINES)

All information in Service Manual ST135-70 pertaining to "AIR CLEANERS," pages 6M-1 through 6M-6 is applicable to models covered by this supplement with the addition of the following:

Air cleaner should be inspected and serviced at intervals specified in Emission Control Systems booklet. Air cleaners should be serviced whenever dirt becomes visible in element or oil. Under adverse conditions or extensive operation on dusty or sandy roads unit should be cleaned every day. Air cleaners on vehicles operating in dust storm areas should be cleaned immediately after such storm occurs.

GASOLINE ENGINES

CAUTION: In addition to its function of filtering air drawn into the engine through the carburetor, the air cleaner also acts as a flame arrester in the event the engine backfires. Because backfiring may cause fire in the engine compartment the air cleaner should be installed at all times unless temporary removal is necessary during repair or maintenance of the vehicle.

DIESEL ENGINES

AIR CLEANER SERVICE INSTRUCTIONS (Fig. 1)

Some FH and DH Models use the vee-type element air cleaner as shown in figure 1.

Measuring the restriction of the air cleaner element is the only way to tell if it needs to be serviced. Restriction can be measured with a water manometer, vacuum gauge, or with a permanently installed indicator as shown in figure 1, and is measured at governed engine speed. When restriction is higher than 25 inches of water the element should be cleaned or replaced.

To replace element, stop engine, tilt cab, remove 6 nuts and washers, and remove cover. Remove retention bracket and vee-type element.

IMPORTANT: When cleaning or handling be careful to prevent element from being punched or damaged, which would allow foreign material to enter engine.

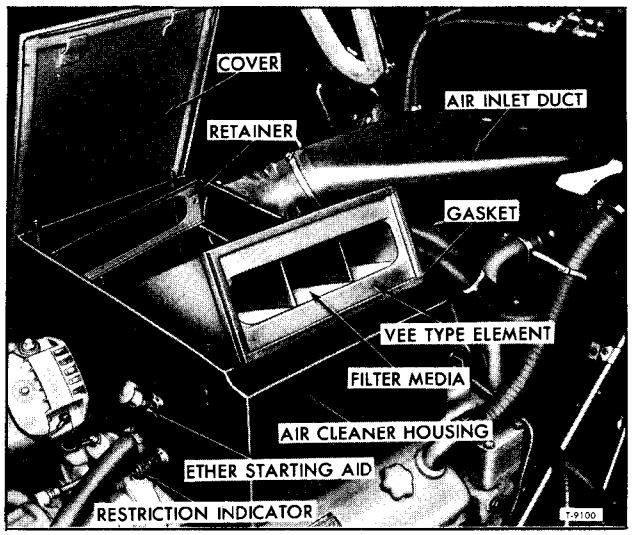


Figure 1—Air Cleaner (Some DH and FH Models)

Cleaning

Compressed air (less than 100 psi) used at least one inch from inside filter media is effective when element is loaded with dust.

Washing from inside element with water only (less than 40 psi) will often work when air is not available and when the element has only dust on it. Rinse thoroughly until water comes through clear. Good rinsing is important.

Low sudsing detergent (D-1400) and water is best when a combination of exhaust carbon, soot, oil, and dust are on the element. Follow instructions on package of D-1400.

CAUTION: DO NOT use gasoline or other solvents, or attempt to clean by beating or rapping the element.

Dry element thoroughly. Mechanical dryers can be used but heated air must be circulated and must be less than 180^{O}. After cleaning and drying, and before installation inspect element for damaged gasket, ruptured filter media and dust on inside of element. If gasket seal leaks, or filter media is ruptured replace element. Gasket sealing surface must be smooth, flat, and clean. To detect ruptured media place bright light inside and inspect element from outside. Install element and fully engage retention system.

NOTE: To retain high engine efficiency and extend engine life, it is most important that air cleaner elements are serviced at recommended intervals.

Gasoline Engines

All information in Service Manual ST135-70 and ST332-71 pertaining to "GASOLINE ENGINES" is applicable to models covered by this supplement with the addition of the following:

ACCELERATOR LINKAGE ADJUSTMENT

STEEL TILT CAR (SERIES 70)

(Refer to Figure 1)

1. Disconnect pedal and throttle return springs, then check front and rear cable clamps for proper tightness on accelerator control cable assembly.
2. Disconnect rod end assembly "B" from throttle lever. Verify that rod end assembly "B" is threaded on the cable assembly ½-inch, then reconnect to throttle lever.
3. Depress accelerator pedal to ¼-inch from floor.
4. Disconnect rod end assembly "A" from relay lever.
5. Move throttle lever to full throttle (wide open). Thread rod end assembly "A" on cable, sufficiently, to provide free-entry of rod end assembly "A" into relay lever.

NOTE: If additional adjustment is required, adjust position of rod end assembly "B" on cable assembly, accordingly. Minimum allowable thread engagement at either rod end assembly is ¼-inch.

6. Reconnect pedal and throttle return springs.
7. Check operation of linkage to make sure carburetor throttle lever is at full throttle before accelerator pedal reaches floor mat. Readjust, if necessary.

BENDIX-STROMBERG CARBURETORS

REPLACING PLASTIC LIMITER CAPS ON IDLE MIXTURE SCREWS

IMPORTANT: Plastic limiter caps are installed on the idle mixture screws (see fig. 2) of Bendix-Stromberg carburetors to prevent unauthorized adjustment. These plastic caps are not to be removed unless made necessary by some major carburetor repair or replacement which affects the idle mixture screw adjustment.

REMOVING PLASTIC CAPS

(Refer to Figure 3)

1. With the aid of two standard screwdrivers, simply insert tips of screwdriver blades behind plastic cap, as shown.

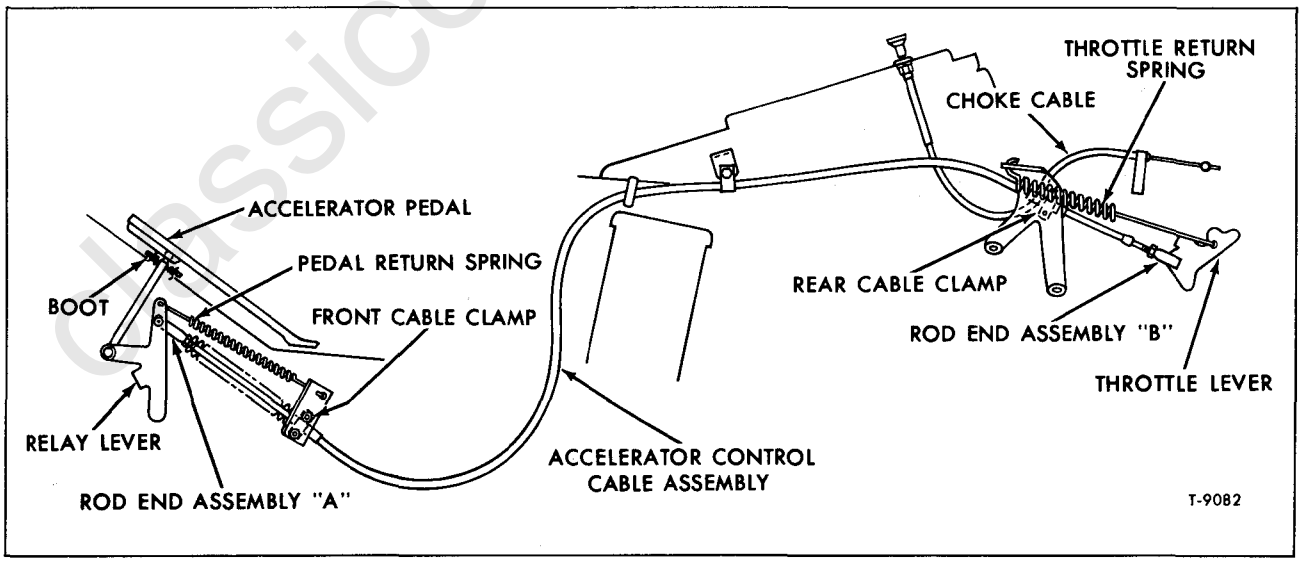


Figure 1—Accelerator Linkage (TM, WM 80)

FUEL SYSTEM—GASOLINE ENGINES

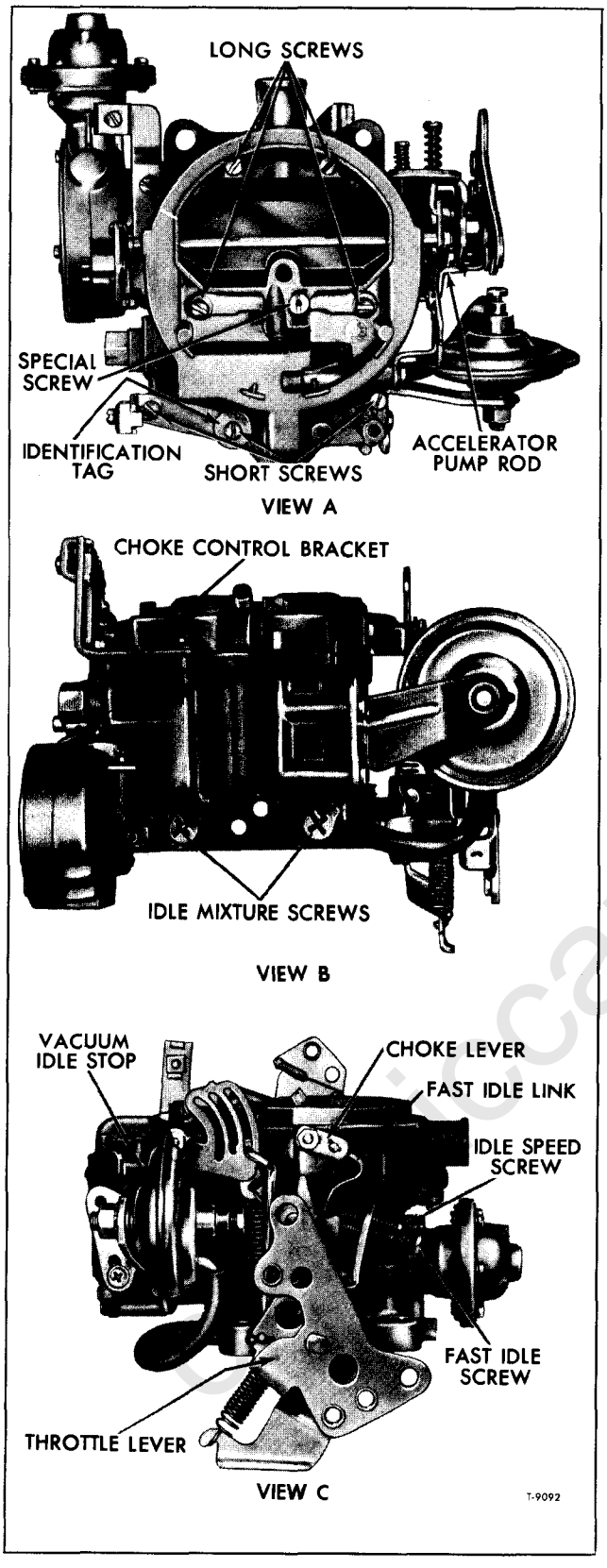


Figure 2—Bendix-Stromberg Carburetor (WWC Series)

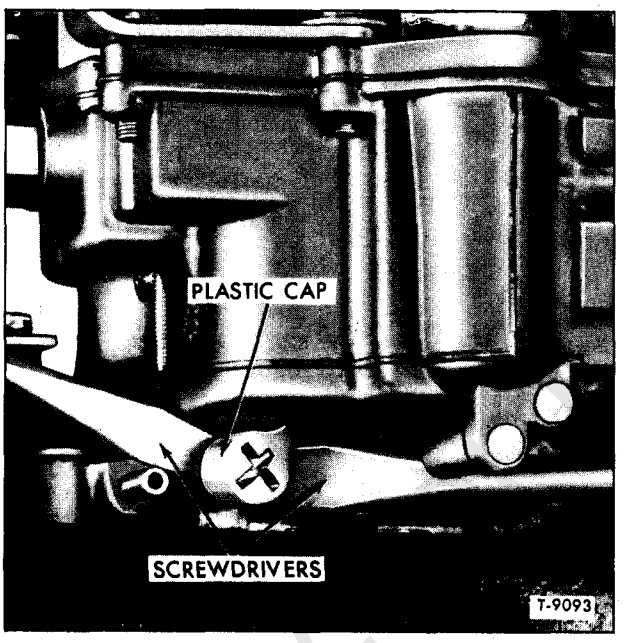


Figure 3—Removing Plastic Caps (WWC Series)

CAUTION: It is most important to use equal pressure on both screwdrivers when prying off the plastic caps, to prevent the idle mixture screw(s) from being bent. If idle mixture screw is bent during removal of plastic cap, the screw must be replaced.

2. Remove plastic cap from each idle mixture screw.

INSTALLING PLASTIC CAPS

(Refer to Figure 4)

NOTE: The carburetor must be installed on the engine and properly adjusted prior to installation of the plastic caps.

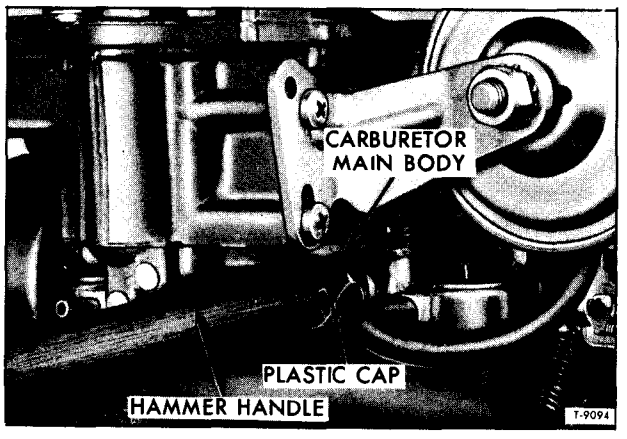


Figure 4—Installing Plastic Caps (WWC Series)

1. Thoroughly warm up the engine. Be sure choke is open.

2. Check dwell reading and adjust, if necessary. Dwell reading on V6 engines should be 31 to 34 degrees. Dwell reading on 637 V8 engine should be 28 to 32 degrees.

3. Adjust ignition timing with vacuum advance hose disconnected and plugged.

Engine	Ignition Timing
401M, 478M, 478SN . .	7½° BTDC
637 - V8	5° BTDC
Reconnect vacuum advance hose.	

4. Engine idle speed should be:

Engine	Idle Speed
401M, 478M	575 rpm
478SN	525 rpm
637 - V8	525 rpm

If necessary to adjust idle speed, perform the following:

a. Referring to figure 5, place a ¼-inch open end wrench on diaphragm extension of vacuum idle stop to prevent its rotation while adjusting plunger.

CAUTION: UNDER NO CONDITIONS SHOULD THE DIAPHRAGM EXTENSION BE ALLOWED TO ROTATE OR INTERNAL DAMAGE WILL RESULT TO VACUUM IDLE STOP UNIT.

b. Adjust the plunger with a 3/8-inch open end wrench until the face of the plunger hex contacting the carburetor throttle lever results in the idle speed given earlier in Step 4.

5. Adjust the idle mixture screws. With engine running and idling speed set, turn each mixture screw "in" until engine begins to slow down or run unevenly, then back out screws until engine runs smoothly with highest vacuum gauge reading.

NOTE: If vacuum gauge is not available adjust idle mixture screws to give highest idle speed. Turning idle mixture screws "in" gives leaner mixture; while turning screws "out" gives richer mixture. DO NOT turn screws in tight against seats since screws or seats will be damaged.

6. With the aid of a hammer handle or other suitable driving tool install plastic caps on each idle mixture screw as shown in figure 4. Each plastic cap is to be installed in fuel RICH position (as shown). Tang on cap should contact main body of carburetor. Use care when installing caps to prevent bending of idle mixture screws.

7. Reset the engine idle speed as directed in Step 4.

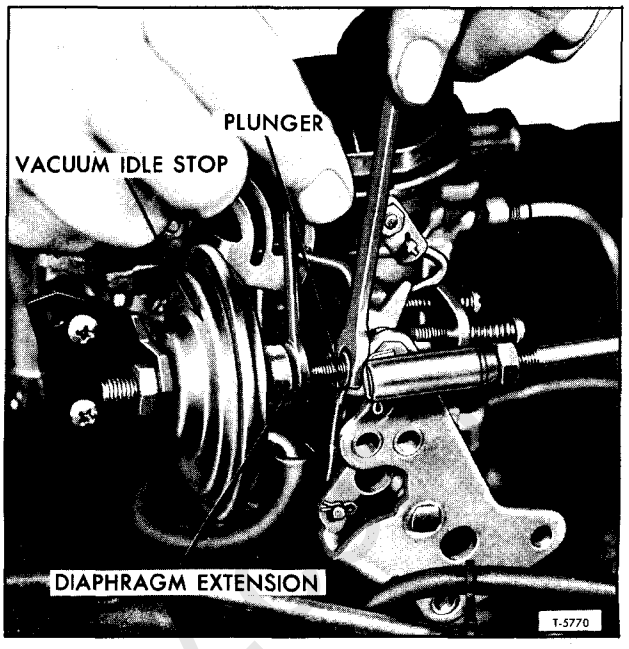


Figure 5—Adjusting Vacuum Idle Stop

8. Turn "in" idle mixture screws equally by rotating clockwise to LEAN mixture until the following idle speeds are reached:

Engine	Idle Speed
401M, 478M	525 rpm
478SN	500 rpm
637 - V8	475 rpm

IDLE AND MIXTURE ADJUSTMENT

PRELIMINARY CHECKS

1. Thoroughly warm up the engine. Be sure the choke is open.

2. Be sure the carburetor is properly secured to the intake manifold, which will exclude the possibility of air leaks. Carburetor-to-manifold bolts or nuts should be tightened to 20-25 foot-pounds torque.

3. Inspect the manifold heat control valve (if used) for freedom of action and correct spring tension.

4. Air conditioning, when used, should be turned on during the carburetor adjustments.

5. Check dwell reading and adjust, if necessary. Dwell reading on V6 engines should be 31 to 34 degrees. Dwell reading on 637-V8 engine should be 28 to 32 degrees.

6. Adjust ignition timing with vacuum advance disconnected and plugged.

Engine	Ignition Timing
401M, 478M, 478SN . .	7½° BTDC
637-V8	5° BTDC
Reconnect vacuum advance hose.	

FUEL SYSTEM—GASOLINE ENGINES

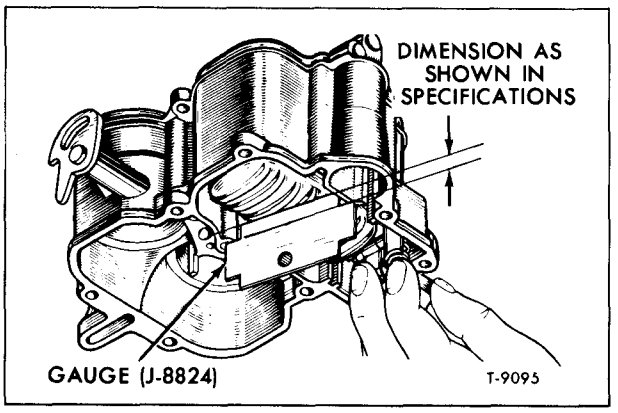


Figure 6—Checking Float Level

CARBURETOR ADJUSTMENT

1. Engine idle speed should be:

Engine	Idle Speed
401M, 478M	575 rpm
478SN	525 rpm
637-V8	525 rpm

If necessary to adjust idle speed perform the following:

a. Referring to figure 5, place a ¼-inch open end wrench on diaphragm extension of vacuum idle stop to prevent its rotation while adjusting plunger.

CAUTION: UNDER NO CONDITIONS SHOULD THE DIAPHRAGM EXTENSION BE ALLOWED TO ROTATE OR INTERNAL DAMAGE WILL RESULT TO VACUUM IDLE STOP UNIT.

b. Adjust the plunger with a 3/8-inch open wrench until the face of the plunger hex contacting the carburetor throttle lever results in the idle speed given earlier in Step 1.

2. Rotate idle mixture screws counterclockwise until tang on each plastic cap contacts main body of carburetor as shown in View B, figure 2.

3. Reset the idle speed as directed in Step 1.

4. Turn "in" idle mixture screws equally by rotating clockwise to LEAN mixture until the following idle speeds are reached:

Engine	Idle Speed
401M, 478M	525 rpm
478SN	500 rpm
637-V8	475 rpm

FLOAT LEVEL ADJUSTMENT

1. Remove air cleaner and disconnect choke and accelerator linkage and fuel line from carburetor. Disconnect fast idle link and accelerator pump rod.

2. Remove carburetor-to-manifold retaining bolts or nuts, then remove carburetor from engine.

3. Referring to View A, figure 2, remove three short screws, four long screws, and special screw. Separate air horn and throttle body from main body of carburetor. Carefully pour fuel from float bowl.

4. Hold main body inverted as shown in figure 6. This will allow weight of float to hold needle in the closed position. Use float gauge (J-8824) to check relationship of the float to top of the fuel bowl as shown. Refer to specifications for proper float level adjustment. Setting is correct when the edge of the gauge touches top of the rib on float.

5. Use tool (J-4395) to bend float lever next to float to change the float setting. Use bending tool as illustrated in figure 7.

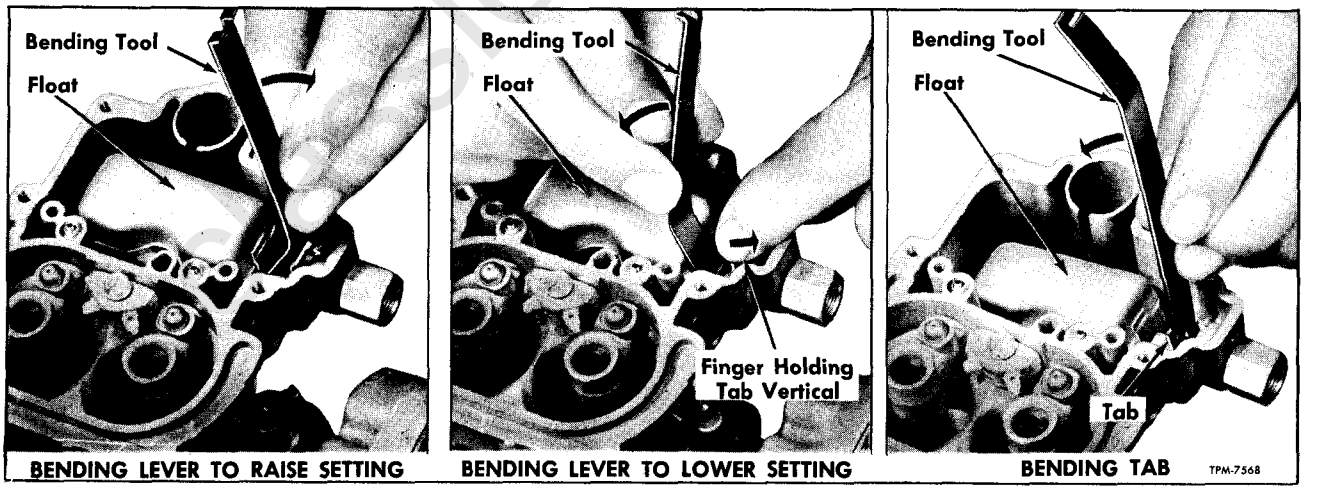


Figure 7—Typical Use of Bending Tool to Set Float Level

6. After checking float level, install air horn and throttle body to main body using new gaskets. Referring to figure 2 install screws, locate choke control bracket and identification tag in original positions. Install carburetor with new gasket on engine. Tighten the carburetor-to-intake manifold bolts or nuts to 20-25 foot-pounds torque. Connect fast idle link, accelerating pump rod, fuel lines, choke wire, and accelerator linkage. Install air cleaner.

BENDIX–STROMBERG CARBURETOR MODEL APPLICATION

EXCLUDING CALIFORNIA VEHICLES

TRUCK MODEL	ENGINE	GM PART NO.	BENDIX NO.	CODE NO.
HM, JM80	401M or 478M	685993	381308	23-245
TM, WM80	401M or 478M	685994	381309	23-246
RM80	401M or 478M	685995	381310	23-247
HM80	478SN	674795	381299	23-243
HE, JE, TE90	637	685997	381311	23-251

CALIFORNIA VEHICLES ONLY

TRUCK MODEL	ENGINE	GM PART NO.	BENDIX NO.	CODE NO.
HM, JM, TM, WM80	401M or 478M	687115	381313	23-249
TM, WM80*	401M or 478M	690120		
RM80	401M or 478M	687116	381314	23-250
HM80	478SN	674795	381299	23-243

*with Allison MT40 Transmission

BENDIX–STROMBERG CARBURETOR SPECIFICATIONS

GM PART NO.	685993 685994 685995 687115 687116 690120	674795	685997
Venturi Size	1-5/16	1-5/16	1-15/32
Main Metering Jet Size	0.065*	0.064	0.078
High Speed Bleeder No.	No. 68	No. 68	No. 68
Power By-Pass Jet	1 No. 52	1 No. 53	1 No. 52
Accelerating Pump Discharge Jet No.	70	70	70
Idle Discharge Holes:			
Primary No.	50	50	52
Secondary No.	60	65	60
Tertiary No.	56	56	56
Idle Tube Feed Hole No.	64	64	64
Idle Air Bleed Cluster No.	53	54	51
Vacuum Spark Hole	2 No. 65	2 No. 65	2 No. 65
Float Needle Valve Seat	0.113	0.113	0.113
Governor Diaphragm Spring No.	389702	389702	389702
Governor Throttle Spring No.	389703	389703	389703
Throttle Spring Anchor Position	No. 3	No. 3	No. 3
Discharge Nozzle No.	28	28	28
Nozzle Tip to Wall:			
Left	0.380	0.400	0.250
Right	0.380	0.400	0.250
Float Level	7/32	7/32	7/32
Accelerator Pump Travel	3/16	3/16	3/16

*Carburetors Part No. 687115, 687116, 690120 Main Metering Jet is 0.064.

FUEL SYSTEM—GASOLINE ENGINES

SPECIFICATIONS (CONT.)

FUEL PUMP SPECIFICATIONS

ENGINE	GM PART NO.	PRESSURE (P.S.I.)	VOLUME
V6	6440050	5.5-6	1 pint in 20-25 seconds
637 V8	6440943	7.5-9	1 pint in 8-12 seconds

HYDRAULIC-TYPE GOVERNOR

SPINNER VALVE

Location.....At Engine Oil Pump
Type.....Centrifugal, Pre-set

SLAVE UNIT

Location.....Carburetor Throttle Body

ENGINE GOVERNED SPEED (FULL LOAD)

401M Engine .....3400 RPM
478M Engine .....3200 RPM
478SN Engine .....3200 RPM
637 Engine .....2800 RPM

Note: Refer to GASOLINE ENGINES (sec. 6A) for spinner valve adjustment procedure.

It is most important to perform Carburetor Idle and Mixture Adjustment as directed in this section.

53 And 71 Series Diesel Engines

All information in Service Manual ST135-70 pertaining to 53 and 71 Series Diesel Engines, Pages 6M-18 thru 6M-34 is applicable to models covered by this supplement with the exception of the following:

FUEL FILTERS

V12-71 fuel filters are shown in figure 1. Primary fuel filter, stamped T-80, is connected in line between fuel tank and fuel pump. Use replacement element type TP-541.

Filter element is noncleanable type and should be replaced at 5,000 to 10,000 mile intervals. A drain plug at bottom of filter should be opened daily and a small amount of fuel should be drained. Observe fuel drained for presence of water. If water is indicated regularly, the fuel tank and lines should be drained and cleaned.

Secondary fuel filter stamped T-75 is located between supply pump and injectors. Use replacement element type TP-642.

Regular element replacement interval is 20,000 to 25,000 miles or six months, whichever occurs first. Element replacement intervals are dependent on the cleanliness of the fuel and on storage facilities.

Fuel filter elements on these engines should be replaced at regular intervals established by the operator. Servicing of V12-71 fuel filters is same as described in Service Manual ST135-70, page 6M-18.

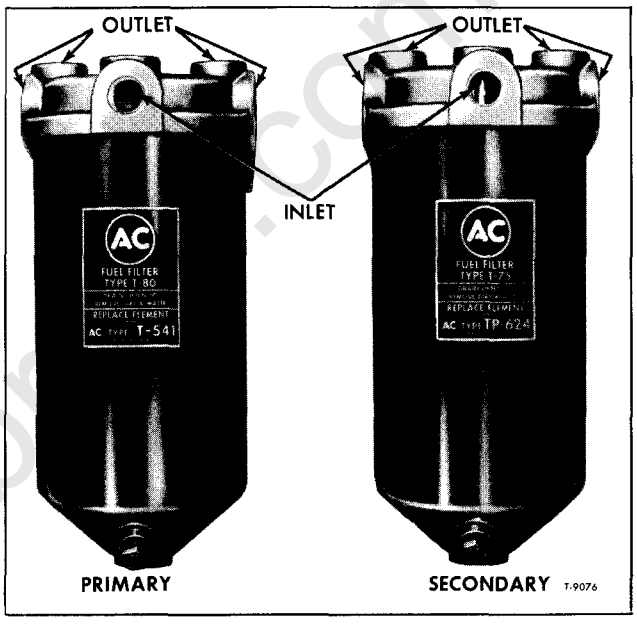


Figure 1—12V-71 Fuel Filters

ACCELERATOR AND THROTTLE LINKAGE ADJUSTMENT

STEEL TILT CAB MODELS
(Refer to Figure 2)

With accelerator controls installed, make the following checks:

(a) Thread of rod end assembly "D" engaged ½".
(b) Governor lever "C" properly installed.

1. Depress and hold the accelerator pedal "A" ¼-inch from floor mat.

2. Adjust rear rod assembly "B" to obtain full throttle at governor lever "C."

3. In some cases it may be necessary to adjust rod end assembly "D" in front.

HH AND JH MODELS
(Refer to Figure 3)

1. Adjust accelerator pedal stop bolt to 1.50" dimension from the floor board to top of adjusting bolt as shown in figure 3.
2. Remove spring "D" from throttle lever.
3. Disconnect trunnion "A" from bell crank "B" by removing lock pin and washer. Loosen lock nut on rod "C."
4. Hold accelerator pedal against bolt stop in floor and governor in full throttle.
5. Adjust trunnion at "A" until trunnion shaft will insert in bell crank "B" freely. Tighten lock nut on rod "C." Install washer and lock pin on trunnion "A."

53 AND 71 SERIES DIESEL ENGINES

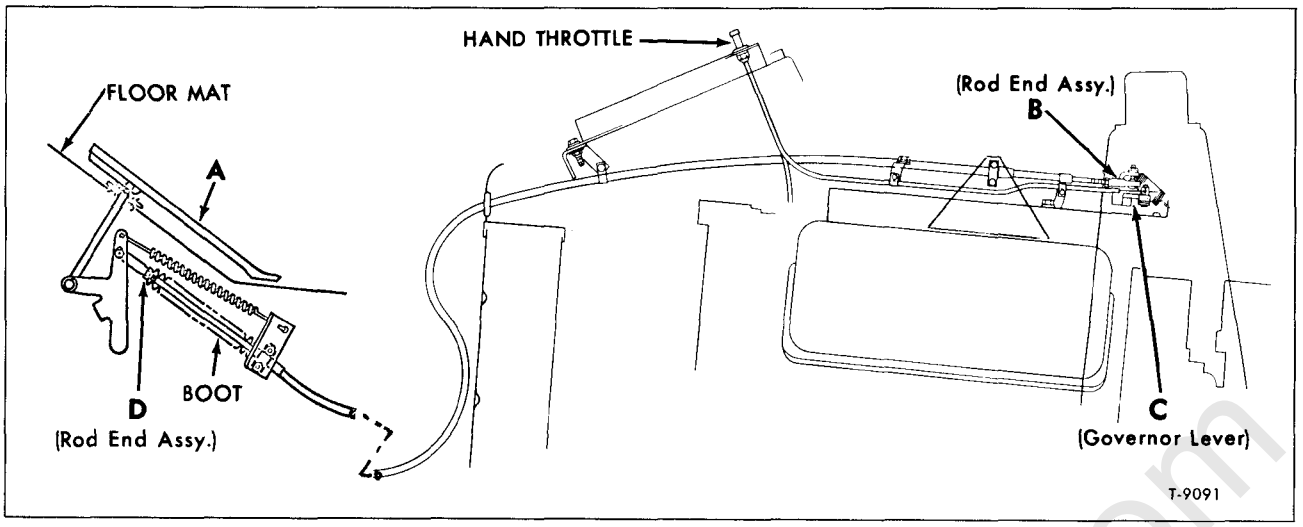


Figure 2—Flexible Accelerator Cable (Steel Tilt Cab Models)

6. Install accelerator spring "D" at throttle lever.

MH 90 MODELS

(Refer to Figure 4)

1. Disconnect pull back spring "E." Disconnect rod "B" at governor lever on engine at "A."

2. With accelerator pedal "C" just touching floor covering "D" and governor lever "A" in wide open position, adjust rod "B" so the end freely enters at "A." Tighten lock nut, then install pull back spring "E."

ALUMINUM TILT CAB MODELS

(Refer to Figure 5)

The cab mounted components of the accelerator control mechanism are identical with either V or In-line Diesel powered vehicles covered in this supplement, however the engine mounted components differ, according to engine type.

To adjust the linkage on all vehicles, refer to figure 5 and the following instructions:

NOTE: Hand throttle must be in "OFF" position.

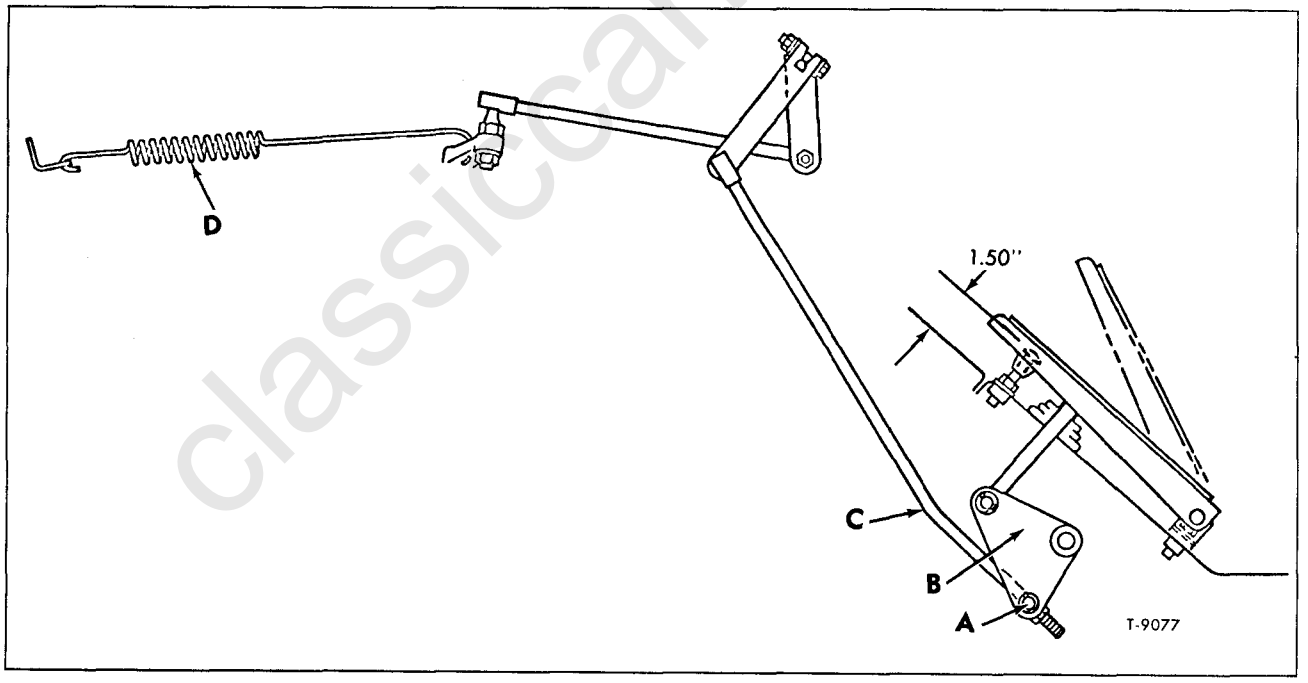


Figure 3—Accelerator Linkage (HH and JH Models)

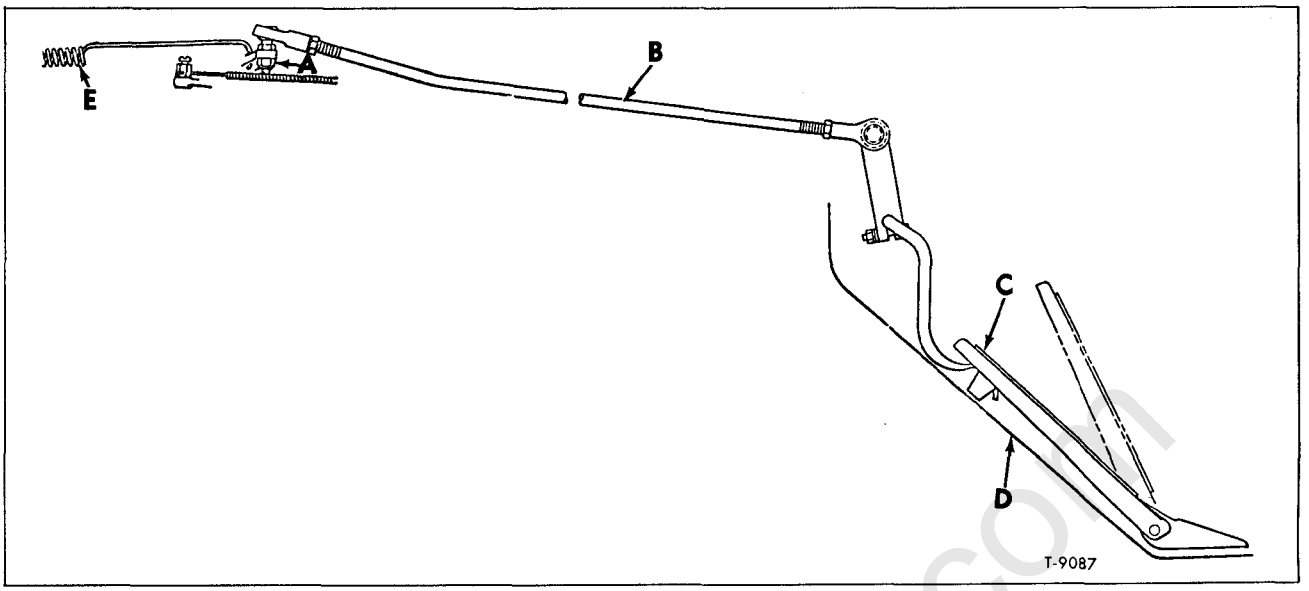


Figure 4—Accelerator Linkage (MH Models)

1. With the cab in the driving position, loosen bracket assembly "A" attaching bolts, then slide bracket to obtain 1/8-inch clearance between lever "B" and roller "C." Torque attaching bolts to 5 to 8 foot-pounds.

2. Rotate lever assembly "B" to full throttle position and adjust stop "D" to contact accelerator. Tighten stop bolts "E."

V12—71 EMERGENCY STOP LINKAGE ADJUSTMENT (FIG. 6)

NOTE: Emergency stop adjustment is the same as on other series 71 Diesel engines and is described in ST135-70 Service Manual, page 6M-22.

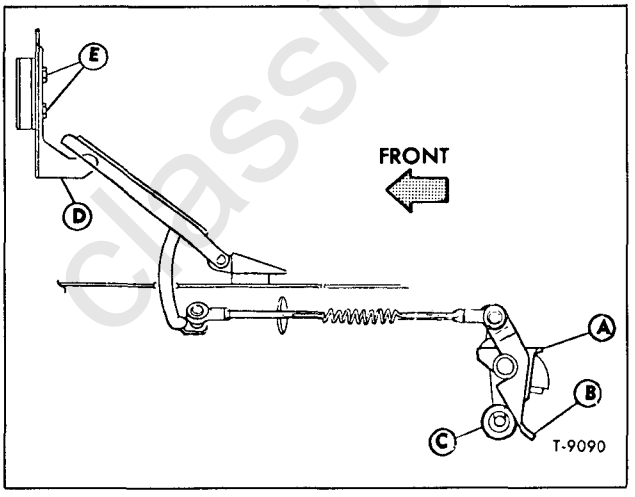


Figure 5—Aluminum Tilt Cab Linkage (Typical)

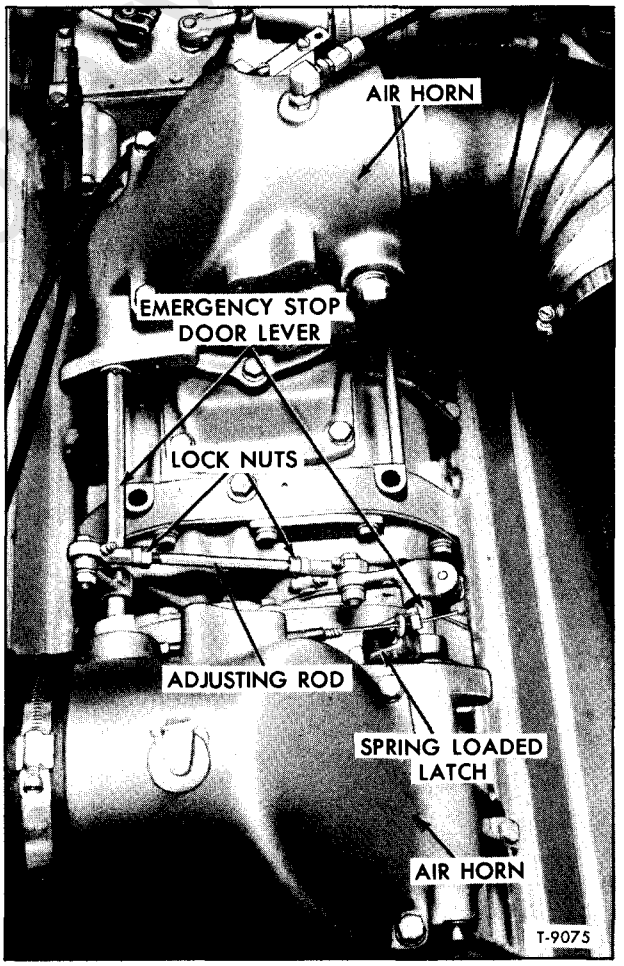


Figure 6—12V-71 Emergency Stop Linkage

53 AND 71 SERIES DIESEL ENGINES

IMPORTANT: When emergency stop has been released, the stop knob in the cab must be pushed all the way down, and the spring loaded latch must be manually re-set.

1. When emergency stop linkage requires adjustment remove air cleaner hoses from both air horns (fig. 6).
2. Loosen adjusting rod lock nuts, and turn adjusting rod so both emergency stop doors close at the same time. Tighten lock nuts.

NOTE: Check emergency stop doors by putting hand in each air horn.

3. Connect air cleaner hoses to air horns.

DIESEL FUEL REQUIREMENTS

Distillation range, cetane number, and sulphur content are three of the most important properties in the selection of Diesel fuels for optimum combustion and minimum engine wear.

Engine speed, load and atmospheric temperature influence the selection of the fuel with respect to distillation range and cetane number. The sulphur content of the fuel must be as low as possible to avoid excessive deposit formation, corrosion, and premature wear.

NOTE: Refer to the latest Dealer Service Information Bulletin which pertains to Diesel Fuel Requirements.

The satisfactory performance of a diesel engine depends on sufficiently high compression pressure and the injection of the proper amount of fuel at the right time.

It is important that extreme care be exercised in the handling and storage of diesel fuel oil, as absolute cleanliness is essential to satisfactory engine operation.

Cummins Diesel Engine

All information in Service Manual ST135-70 pertaining to "CUMMINS DIESEL ENGINES" pages 6M-36 and 6M-37, is applicable to models covered by this supplement with the exception of the following:

ACCELERATOR AND THROTTLE LINKAGE ADJUSTMENT

JB MODELS

(Refer to Figure 1)

1. Adjust pedal stop "G" to 1.56" dimension from floor board to top of stop as shown. Remove spring "E."
2. Disconnect rod "A" from throttle lever "C." Loosen lock nut "B."
3. Make sure throttle pedal is against pedal stop "G" by pushing throttle lever "C" rearward.
4. Adjust slip joint "D" until attached stud enters lever "C" freely. Install nut attaching rod "A" to lever "C" and torque 3 to 5 foot-pounds.
5. Lengthen rod "A" by turning slip joint "D" three complete turns (to provide overtravel) and tighten lock nut "D." Replace spring "E."

MB MODELS

(Refer to Figure 2)

1. Adjust accelerator pedal stop "G" to 1.50" dimension from floor to head of bolt as shown. Remove spring "F."
2. Loosen lock nut "B," and disconnect rod "A" at lever "C."
3. Make sure accelerator pedal is against stop "G" pushing lever "C" rearward.
4. Adjust slip joint "D" until attaching stud will enter lever "C" freely. Install nut and torque to 3 to 5 foot-pounds. Lengthen rod "A" by turning slip joint "D" three additional turns (to provide overtravel) and lock nut "B" securely. Install spring "F."

MC MODELS

(Refer to Figure 3)

1. Adjust pedal stop "A" to 1.50" dimension from floor "B" to stop "A" as shown in figure 3. Remove throttle spring "I."
2. Loosen throttle lever "C" and set throttle lever "D" when at idle position to 18^{0} 15' as shown. Tighten bolt "C."

NOTE: A protractor can be used for this setting.

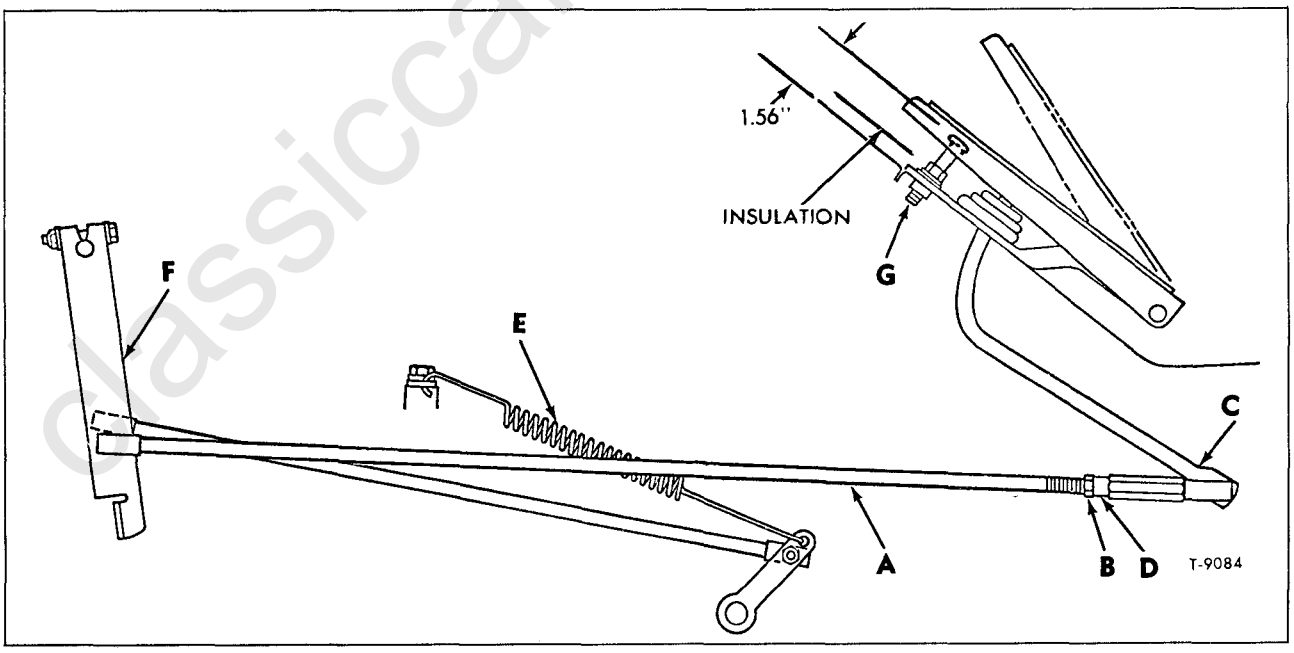


Figure 1—Accelerator Linkage (JB Models)

CUMMINS DIESEL ENGINE

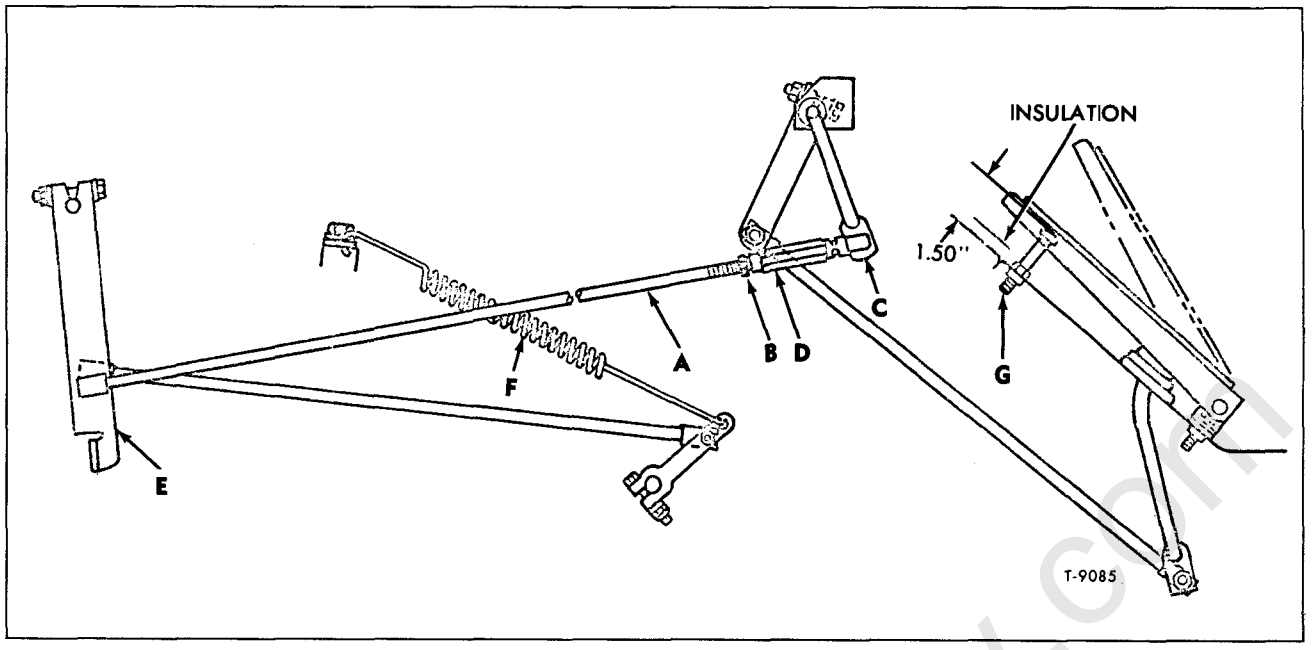


Figure 2—Accelerator Linkage (MB Models)

3. Loosen lock nut "G." Remove nut and remove rod "E" at lever "D." Make sure accelerator pedal is against pedal stop "A" by pushing accelerator rod "F" rearward. Adjust slip joint

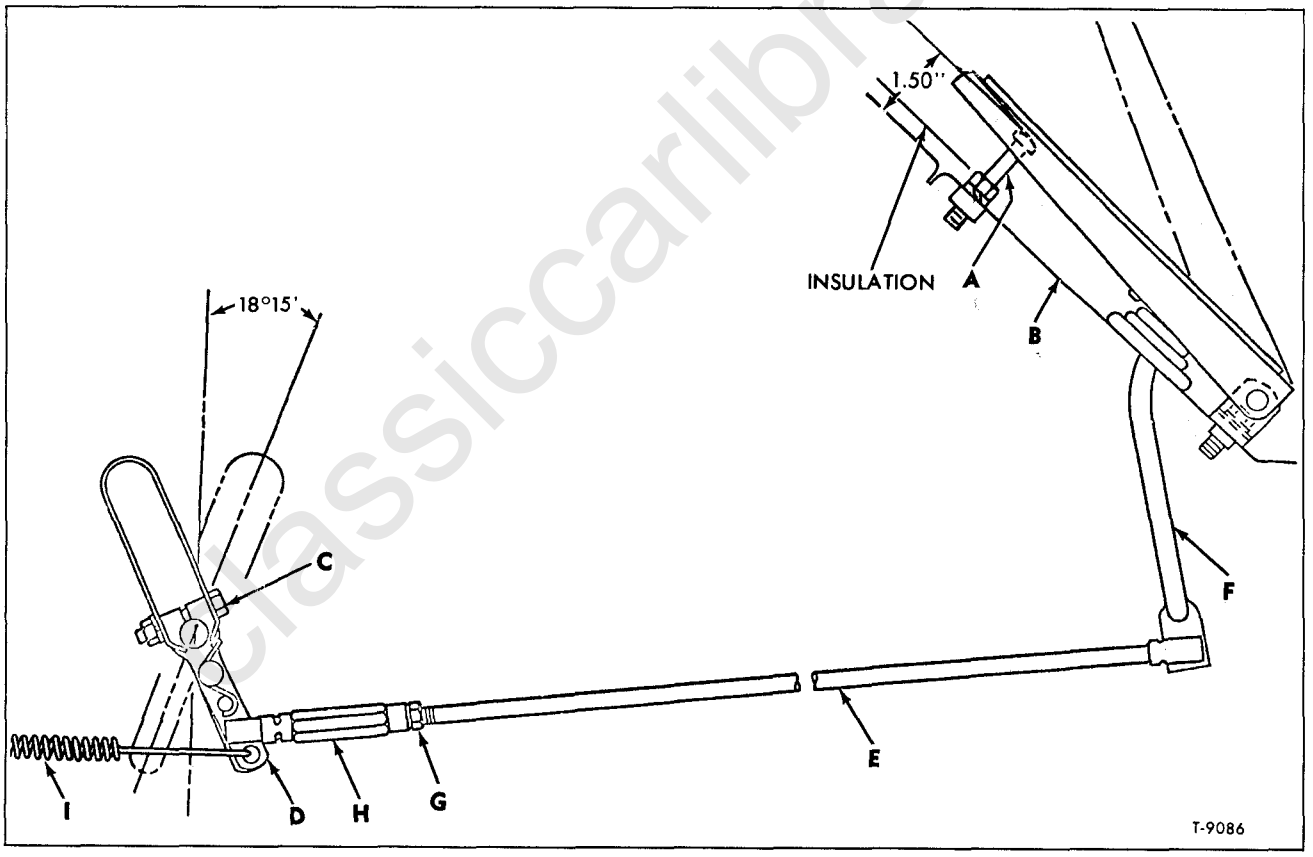


Figure 3—Accelerator Linkage (MC Models)

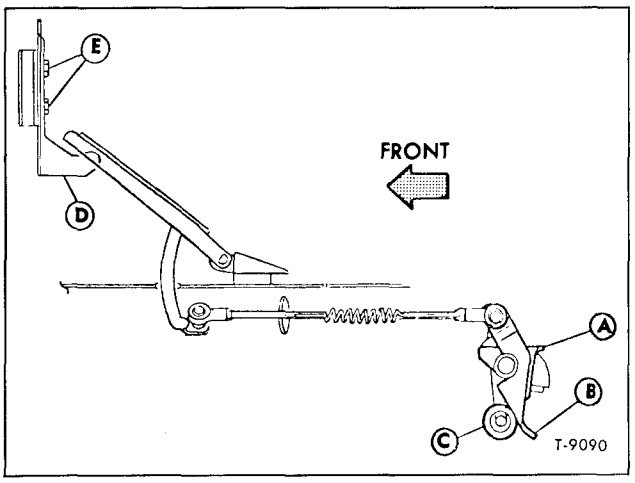


Figure 4—Aluminum Tilt Cab Models (Typical)

"H" until stud in rod "E" will enter lever "D" freely when lever "D" is at full throttle. Install nut on stud on lever "E" and torque to 5 to 8 foot-pounds.

4. Shorten rod "E" by turning slip joint "H" three complete turns (this will provide overtravel). Lock nut "G," then replace throttle spring "I."

ALUMINUM TILT CAB MODELS

(Refer to Figure 4)

The cab mounted components of the accelerator control mechanism are identical with either V or In-line Diesel powered vehicles covered in this manual, however, the engine mounted components differ, according to engine type. To adjust the linkage on all vehicles refer to figure 4 and the following instructions:

NOTE: Hand throttle must be in "OFF" position.

1. With the cab in driving position loosen bracket assembly "A" attaching bolts; then slide bracket to obtain 1/8-inch clearance between lever "B" and roller "C." Torque attaching bolts to 5 to 8 foot-pounds.

2. Rotate lever assembly "B" to full throttle position and adjust stop "D" to contact accelerator pedal. Tighten stop bolts "E."

For servicing of fuel filters, fuel injection and governor system on Cummins Diesel Engine refer to "CUMMINS OPERATION AND MAINTENANCE MANUAL."

ENGINE FUEL SYSTEM

ENGINE LIFE EXTENDING TECHNIQUES

1. Air cleaners should be inspected and serviced at regular intervals.
2. Check fuel filters daily for water and cleanliness of fuel to increase injector life. Change elements at regular intervals which are dependent on fuel and storage facilities.
3. Make necessary adjustments or repairs to accelerator linkage.
4. Before stopping engine allow engine to idle three to five minutes.
5. Turbo-charged engine, when started, should be run at idle until normal engine idle speed oil pressure registers on oil gauge.
6. Super-charged air compressor (when used), run engine at idle when starting to build air pressure. (Super-charged air compressors operate under heavier bearing load.)

SECTION 6T

Air Compressor and Governor

Service information applicable to air compressors and governors used on vehicles covered by this supplement remains the same as covered on pages 6T-1 through 6T-10 in AIR COMPRESSORS AND GOVERNORS (SEC. 6T) in Service Manual ST135-70, except as follows:

GENERAL INFORMATION

Midland-Ross and Bendix Westinghouse air compressors are interchangeable as complete assemblies on many models covered by this supplement. On such models, the mechanic must determine which of the two makes is used on a specific vehicle before proceeding with compressor adjustment or repair. All other models are equipped with either a Bendix-Westinghouse compressor or a Midland-Ross compressor as specified in the "Air Compressor Model Application Chart" at end of this section.

DESCRIPTION

The air compressors used on vehicles covered by this supplement are two-cylinder, piston-type compressors. The rated capacity of an air compressor is its piston displacement in cubic feet-per-minute when operating at 1250 rpm. Standard air compressors are rated at 7¼, 12, or 14½ cubic-feet-per-minute and optional compressors are rated at 12 or 14½ cubic-feet-per-minute. The model number is shown on a plate which is attached to the cylinder block.

NOTE: Air compressor support bracket-to-mounting bracket pivot bolt nut should be tightened to 90 to 110 foot-pounds torque.

DRIVE BELT MAINTENANCE AND ADJUSTMENT

TENSION ADJUSTMENT

Drive belt must be kept at proper tension. A loose or broken belt will affect operation of the compressor. A drive belt that is too tight will place excessive strain on bearings.

All belt driven compressors are pivot base mounted. To adjust drive belt tension, loosen the adjustment arm clamp bolt, idler pulley adjustment bolt (if used), and air compressor to mounting bracket or support bracket pivot bolt. Move air compressor or idler pulley as required to obtain recommended tension. Tighten adjustment arm or idler pulley bolt and compressor mounting bracket to support bracket pivot bolt after adjustment is completed.

V-Belt Tension

Air compressor drive belt tension on vehicles equipped with V-belts should be adjusted to 120-130 pounds on new belts using belt tension gauge (J-23600). Used belts should be adjusted to 80-90 pounds. Place gauge at center of greatest belt span when adjusting drive belt tension.

NOTE: A drive belt is considered used after 2 hours or 50 to 100 miles of operation. Refer to ENGINE COOLING SYSTEM (SEC. 6K) for drive belt replacement.

GOVERNOR ADJUSTMENT

Governor adjustment procedures remain the same as covered under "Governor Adjustment" in AIR COMPRESSORS AND GOVERNORS (SEC. 6T) in Service Manual ST135-70, except refer to "Governor Adjustment Chart" following for governor cut-in and cut-out pressures.

GOVERNOR ADJUSTMENT CHART

Compressor Model	Governor Model	Cut-In (Psi)	Cut-Out (Psi)
Midland-Ross			
N-5903W	N-20856	85	105
N-6000-H,N-6000-K, N-6300-AC,N-6400-N	N-20856-C	105	125
Bendix-Westinghouse			
Except 283480		105	125
Model 283480	276558	90	105

AIR COMPRESSOR AND GOVERNOR

AIR COMPRESSOR MODEL APPLICATION CHART

STANDARD

70-80 SERIES

TRUCK MODELS	COMPRESSOR MODEL	MANU-FACTURER	CU. FT. CAPACITY	TYPE COOLING	TYPE DRIVE	TYPE FILTER
HM, JM, TM, WM	N-6400-N	M-R	7¼	Air	Belt	Paper Fibers
	or 281977	B-W	7¼	Air	Belt	Paper
HV, JV	280094	B-W	7¼	Water	Gear	Foam
TV	280367	B-W	7¼	Water	Gear	Paper
WV	284796	B-W	7¼	Water	Belt	Foam
RM	N-6300-AC	M-R	7¼	Water	Belt	None

80 SERIES

HM-80	N-5903-W	M-R	12	Water	Belt	None

90 SERIES

HE, JE	N-6000-H	M-R	12	Air	Belt	None
	or 281415	B-W	12	Air	Belt	Paper
HH, JH, MH	282928	B-W	12	Water	Gear	None
HI, JI	282626	B-W	12	Water	Gear	None
TE	N-6000-K	M-R	12	Air	Belt	None

90 SERIES

DH, FH	282012	B-W	12	Water	Gear	None
DI, FI	282010	B-W	12	Water	Gear	None
DP	283480	B-W	14½	Water	Gear	

OPTIONAL

70-80 SERIES

HM, JM, TM, WM	N-6000-H	M-R	12	Air	Belt	None
	or 281415	B-W	12	Air	Belt	Paper
HV, JV	280095	B-W	12	Water	Gear	Foam
TV	280368	B-W	12	Water	Gear	Paper

90 SERIES

DH, FH	282013	B-W	14½	Water	Gear	None
DI, FI	282011	B-W	14½	Water	Gear	None

SECTION 6Y

Engine Electrical

NOTE: Electrical system information applicable to models covered by this supplement remains the same as covered on pages 6Y-1 through 6Y-47 in ENGINE ELECTRICAL (SEC. 6Y) in Service Manual ST135-70 except as follows:

This group, covering "ON-VEHICLE MAINTENANCE AND REPLACEMENT" of charging system components is divided into sections shown in Index following:

NOTE: Refer to applicable wiring diagrams in Section 12 of ST135-70 for electrical circuits and connections for standard and optional equipment used on vehicles covered by this supplement.

Battery

Service information applicable to batteries used on vehicles covered by this supplement remains the same as covered under "BATTERY" pages 6Y-1 through 6Y-7 in ENGINE ELECTRICAL (SEC. 6Y) in Service Manual ST135-70, except as follows:

BATTERY MODEL APPLICATION CHART

TRUCK SERIES	STANDARD PART NO.	MODEL
HM/JM/RM/TM/WM80	1980038	E-3000
HV/JV/TV/WV70	1980760	8DR-205
HI/JI/DI/FI90	1980760	8DR-205
HM80 (Two Batteries in Series)	1980928	4H-928
HE/JE/TE90 (Two Batteries in Series)	1980516	2M-516
MH90 (Two Parallel Batteries)	1980760	8DR-205
HN/JN/DN/FN90 (Four Batteries)	1980716	4HR-160
HC/HH/JB/JC/JH/MB/MC90 (Four Batteries)	1980718	7DR-200
DB/DC/DH/DP/FB/FC/FH90 (Four Batteries)	1980718	7DR-200

(Cont'd)

BATTERY

MODEL APPLICATION CHART (CONT.)

TRUCK SERIES	OPTIONAL PART NO.	MODEL
HV/JV/TV70;RM80	1980046	8D-984
HE/JE/TE/DI90	1980046	8D-984
HM/JM80	1980974	9H9-974
HM/TM/WM80 (Two Batteries in Series)	1980926	3H-926
HI/HN/JI/JN/MH90 (Two Parallel Batteries)	1980046	8D-984
DI90 (Two Batteries in Series)	1980109	7D-939
HC/HH/JC/JH90 (Four Batteries)	1980109	7D-939
DC/DH/DI/DN/DP/FC/FH/FN90 (Four Batteries)	1980109	7D-939
DI90 (Four Batteries)	1980928	4H-928

USE OF BOOSTER BATTERY AND JUMPER CABLES

CAUTION

Any procedure other than the following could result in:

1. Personal injury caused by electrolyte squirting out of the battery vents.

2. Personal injury or property damage due to battery explosion.

3. Damage to the charging system of the booster vehicle or of the immobilized vehicle.

DO NOT attempt to jump start a vehicle having a frozen battery because the battery may rupture or explode. If a frozen battery is suspected, examine all fill vents on the battery. If ice can be seen, or if the electrolyte fluid cannot be seen, do not attempt to start with jumper cables as long as the battery remains frozen.

Both booster battery and discharged battery should be treated carefully when using jumper cables. Follow EXACTLY the procedure outlined below, being careful not to cause sparks:

CONNECTING BOOSTER BATTERY AND JUMPER CABLES

1. Set parking brake and place automatic transmission in "PARK" (neutral for manual transmission). Turn off lights, heater and other electrical loads.

2. Remove vent caps from both the booster and the discharged batteries. Lay a cloth over the open vent wells of each battery. These two actions help reduce the explosion hazard always present in either battery when connecting "live" booster batteries to "dead" batteries.

3. Attach one end of one jumper cable to the positive terminal of the booster battery (identified by a red color, "+" or "P" on the battery case, post or clamp) and the other end of same cable to positive terminal of the discharged battery. DO NOT permit vehicles to touch each other, as this could establish a ground connection and counteract the benefits of this procedure.

4. Attach one end of the remaining negative (-) cable to the negative terminal (black color, "-" or "N") of the booster battery, and the other end to ground location on the vehicle being started (DO NOT connect directly to negative post of dead battery) - taking care that clamps from one cable do not inadvertently touch the clamps on the other cable. DO NOT lean over the battery when making this connection.

NOTE: The "ground location" on models having the battery installed under the hood would be on the engine. The "ground location" on models with frame mounted battery would be on the frame rail. It is to be at least 12 inches from the battery filler caps, providing a good electrical conductivity and current carrying capacity, and must avoid moving, hot or electrical hazards such as fans, manifolds and spark plug terminals.

REMOVING BOOSTER BATTERY AND JUMPER CABLES

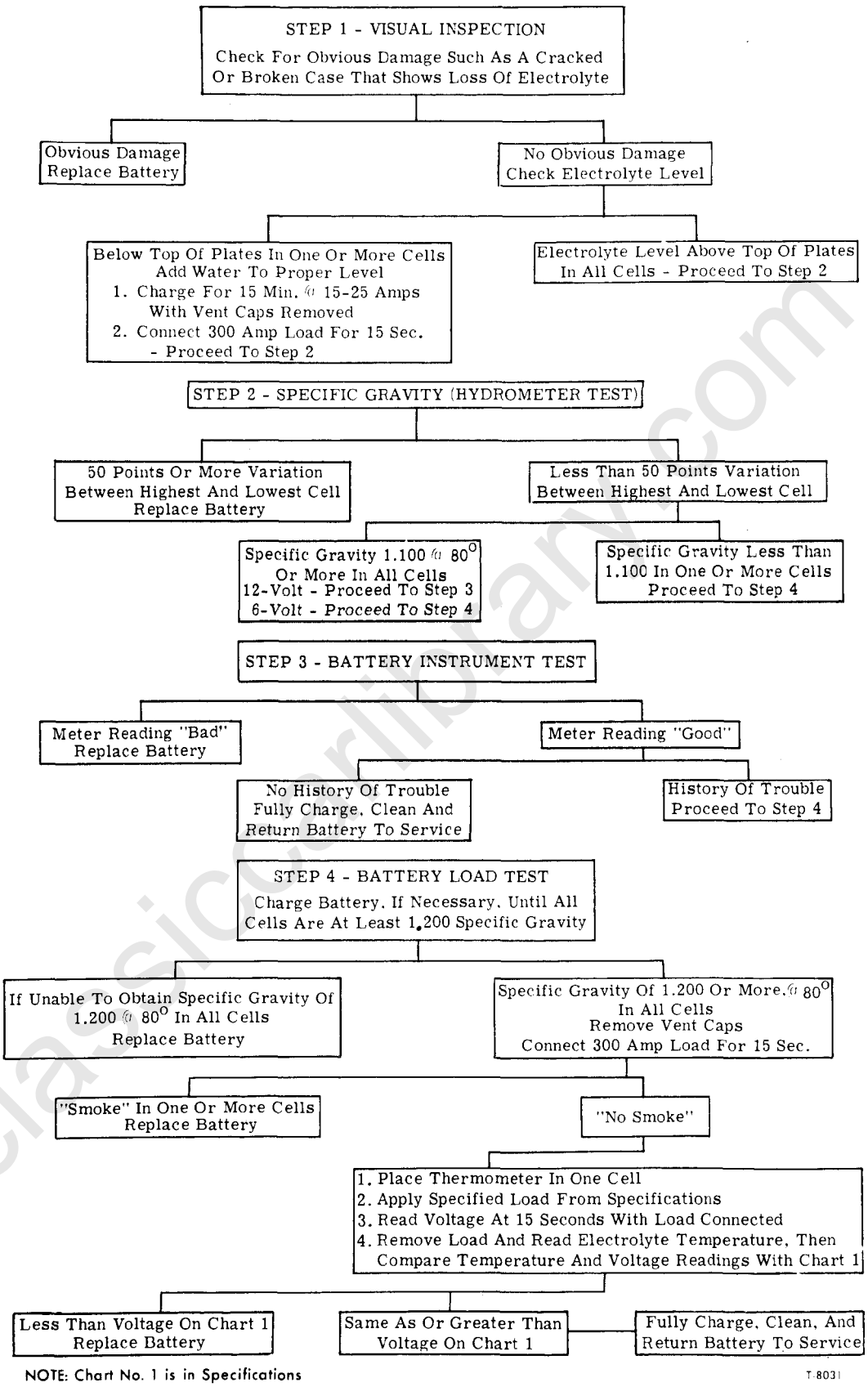
1. Taking care that clamps from one jumper cable do not inadvertently touch clamps on other jumper cable, disconnect jumper lead from ground location on the vehicle being started. DO NOT lean over the battery when disconnecting this lead.

2. Remove remaining end of negative (-) jumper cable from negative (-) terminal of the booster battery.

3. Remove one end of the remaining jumper cable from positive terminal of the discharged battery, then remove other end of the same cable from positive terminal of the booster battery.

4. Remove cloths from open vent wells of each battery. Discard cloths as they may have corrosive acid on them. Install vent caps on both the booster and the discharged battery.

BATTERY TEST PROCEDURE



NOTE: Chart No. 1 is in Specifications

T-8031

STARTING SYSTEM

BATTERY SPECIFICATIONS

MAKE / PART NO.	Delco-Remy 1980038	Delco-Remy 1980046	Delco-Remy 1980109	Delco-Remy 1980516	Delco-Remy 1980716	Delco-Remy 1980718	Delco-Remy 1980760	Delco-Remy 1980926	Delco-Remy 1980928	Delco-Remy 1980974
Model No.	E-3000			2M-516	4HR-160	7DR-200	8DR-205	3H-926	4H-928	9H9-974
Catalog No.	Y-71	985	939	516	716	718	760	926	928	974
Volts	12	12	6	6	6	6	12	6	6	12
No. of Plates Per Cell	11	29	29	17	21	27	27	21	23	15
Amp. Hr. Capacity at 20 Hr. Rate	70	205	200	120	160	200	205	145	160	85
Cranking Ability at 0°F. and 300 Amps.	2.0 min.	10.5 min.	10.5 min.	4.5 min.	7.0 min.	10.5 min.	10.5 min.	6.0 min.	7.0 min.	2.8 min.
Load Test Amp. Load	210	450	450	360	450	450	450	440	450	250
Voltage-Temperature Chart	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1

*Voltage must not drop below minimum listed at given temperature when battery is subjected to proper load for 15 seconds and is 1.200 specific gravity at 80°F. or more.

CHART NO. 1—VOLTAGE AND TEMPERATURE CHART

Electrolyte Temperature	80°F	70°F	60°F	50°F	40°F	30°F	20°F	10°F	0°F
Voltage (Minimum)									
6-Volt	4.8	4.8	4.7	4.7	4.6	4.5	4.4	4.3	4.2
12-Volt	9.6	9.6	9.5	9.4	9.3	9.1	8.9	8.7	8.5

Starting System

Starting system information applicable to vehicles covered by this supplement remains the same as covered under "STARTING SYSTEM" pages 6Y-8 through 6Y-13 in ENGINE ELECTRICAL (SEC. 6Y) in Service Manual ST135-70 except as follows:

STARTING MOTOR MODEL APPLICATION CHART

TRUCK SERIES	STANDARD PART NO.
HM/JM/RM/TM/WM80	1108484
HV/JV/TV/WV70	1114101
HM80	1113171
HE/JE/TE90	1107586
HC/HH/HN/JB/JC/JH/JN/MB/MC/MH90	1114143
HI/JI/DI/FI90	1114178
DP90	1109631
DB/DC/DH/DN/FB/FC/FH/FN90	1114143

	OPTIONAL PART NO.
HM/JM/RM/TM80 (With 478M Engine)	1107586
HI/JI/DI/FI90	1114161

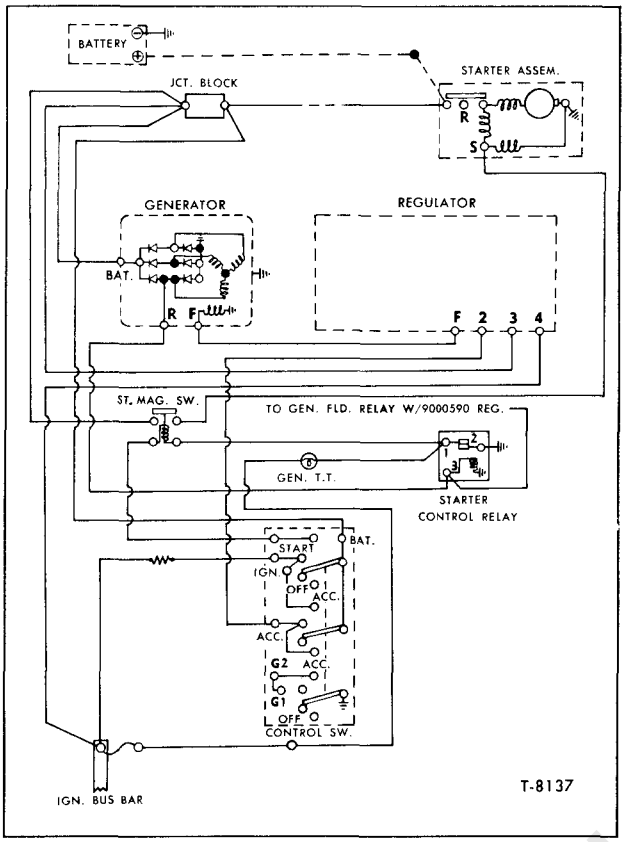


Figure 1—Starter Automatic Disengagement and Lock-out (Series TE90)

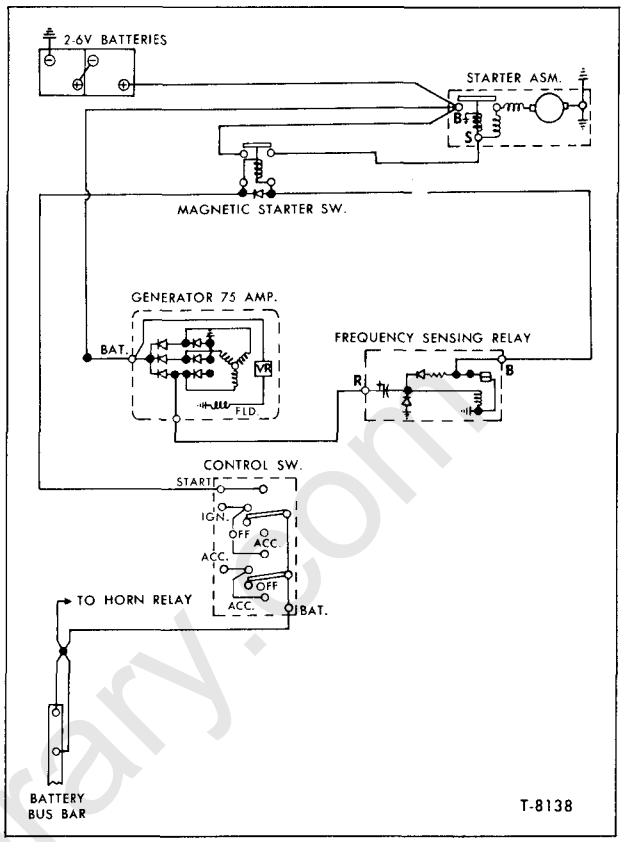


Figure 2—Starter Automatic Disengagement and Lock-Out (Series HC/JC 90) (Typical)

STARTER AUTOMATIC DISENGAGEMENT AND LOCK-OUT

Information application to the starter automatic disengagement and lock-out system used on vehicles covered by this supplement remains the same as covered in the 1970 Heavy Duty Truck Service Manual ST135-70 except as follows:

SERIES TE90
(WITH V8-637 ENGINE)

A typical interlock system used on Series TE90 is shown in figure 1. With ignition switch is placed in "START" position, current from the battery is supplied through the ignition switch and starter magnetic switch coil winding to ground through normally closed contact points within the starter control relay. With windings energized, switch contacts will close to complete circuit to starter solenoid. When engine is started, current from "R" terminal on generator will flow through starter control relay coil windings. With windings energized, starter control relay contact points will open to break circuit between battery and starter magnetic switch.

SERIES HC/JC90
(WITH CUMMINS DIESEL ENGINE)

A typical interlock system used on these vehicles is shown in figure 2.

When control switch is placed in "START" position, current will flow through starter magnetic switch coil windings and frequency sensing control

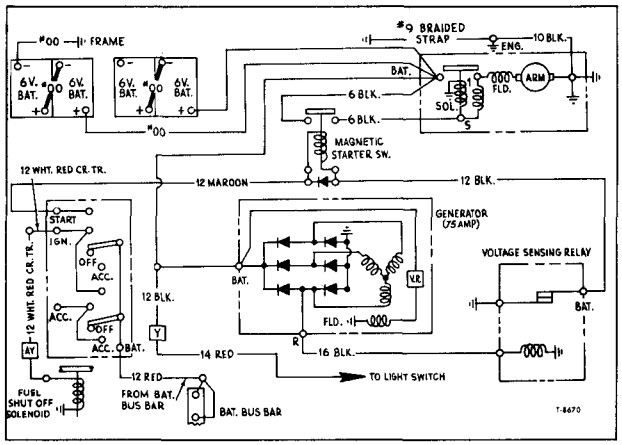


Figure 3—Starter Automatic Disengagement and Lock-Out (Series JB/MB/MC 90) (Typical)

STARTING SYSTEM

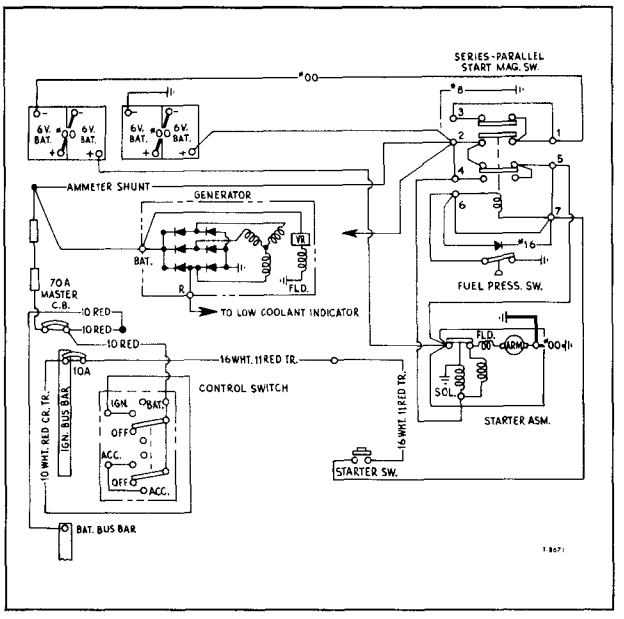


Figure 4—Starting System (Series DP 90)

relay contact points to ground. With windings energized, the magnetic switch contacts close to complete circuit from battery to starter solenoid operating coil causing normally open contact points to close and complete circuit from battery to starter solenoid. With solenoid energized, starter will operate.

When engine is started, current from generator "R" terminal will flow through frequency sensing relay condenser and operating coil causing relay contacts to open, thus breaking the circuit between the battery and starter magnetic switch.

NOTE: The condenser and resistor in the frequency sensing relay will determine at what frequency the relay contacts will open.

SERIES JB/MB/MC90

A typical interlock system used on these vehicles is shown in figure 3.

When control switch is placed in "START" position, current will flow through starter magnetic control switch coil windings and the normally closed voltage sensing relay contact points to ground. With windings energized, the magnetic switch contacts will close to complete circuit from battery to starter solenoid operating coil causing normally open switch contact points to close and complete circuit from battery to starter solenoid. With solenoid energized, starter will operate.

NOTE: A diode is installed across the starter magnetic switch to protect the contact points.

When engine is started, current from generator "R" terminal will flow to ground through voltage sensing relay operating coil causing normally closed contact points to open, thus breaking the circuit between the battery and magnetic switch.

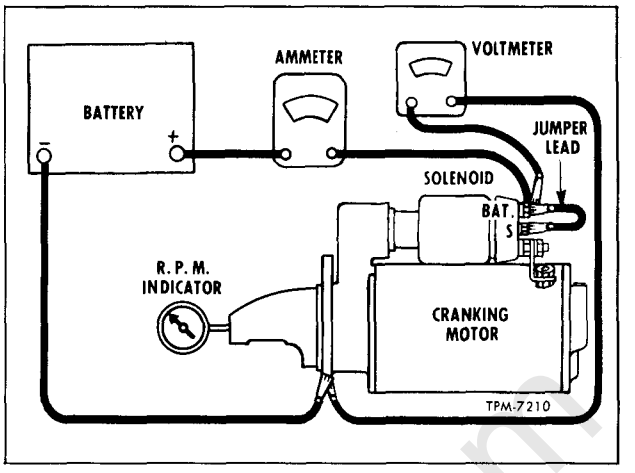


Figure 5—Circuit For Checking Motor Free Speed

SERIES PARALLEL STARTER MAGNETIC SWITCH (SERIES DP90)

A series parallel starter magnetic switch is used on series DP90 equipped with the 12V-71 engine to provide 24 volts for the cranking circuit (fig. 4).

When control switch is placed in "IGN" position and starter switch is energized, current from No. 1 circuit breaker will flow through starter switch and No. 7 terminal on the series parallel switch to ground through the fuel pressure switch to energize the series parallel switch coil winding. A diode is installed between No. 6 and No. 7 terminal on the switch to protect the fuel pressure switch contacts.

With windings energized, normally open switch contacts will close and current from No. 5 terminal on switch will flow through closed contact points and No. 4 switch terminal to provide 24 volts to energize the starter solenoid. With solenoid energized, the starter will operate.

When engine is started and fuel pressure switch opens, the series parallel switch contacts will close. Current from generator "BAT" terminal will then flow through No. 2 and No. 3 terminals on the series parallel starter magnetic switch to charge the batteries.

STARTER FREE SPEED CHECK

The free speed check is recommended after a starting motor has been overhauled. If necessary, test equipment is available, accomplish the following steps to perform the free speed check. Refer to figure 5 for test connections.

1. Connect a 12-volt battery in series with an ammeter to "BAT" terminal on solenoid on starting motor.

2. Connect a lead from frame of starting motor to negative post on battery.

3. Connect a voltmeter from solenoid "BAT" terminal to ground.

4. Connect a tachometer to starting motor.

5. Connect a jumper lead from "BAT" terminal on battery to switch "S" terminal on starter solenoid.

6. Observe ammeter, voltmeter, and tachommeter and compare readings with "No Load Test" specifications listed in "Specifications."

STARTING SYSTEM SPECIFICATIONS

STARTER MODEL	1107586	1108484	1109631	1113171	1114101 1114178	1114143 1114161
MAKE	Delco-Remy	Delco-Remy	Delco-Remy	Delco-Remy	Delco-Remy	Delco-Remy
Series		10MT	50MT	30MT	40MT	40MT
Type		125	250	175	250	250
Type of Drive	Over running Clutch	Over running Clutch	Over running Clutch	Over running Clutch	Over running Clutch	Over running Clutch
Rotation (View at Drive End)	CW	CW	CW	CW	CW	CW
No Load Test						
Volts	9	9	20	9	9	9
Min. Amps.*	50	35	95	50	120	140
Max. Amps.*	80	75	120	70	150	190
Min. R.P.M.	5500	6000	5500	3500	3000	4000
Max. R.P.M.	9000	9000	7500	5500	4500	7000
Pinion Clearance	0.010"-0.140"	0.010"-0.140"	23/64" ± 1/32"	0.010"-0.140"	23/64" ± 1/32"	23/64" ± 1/32"

* Includes Solenoid

STARTER SOLENOID						
Model	1114356	1114359	1119848	1115510	1119862	1119879
Rated Voltage	12	12	24	12	12	12
Current Consumption						
Pull-In Winding						
Amps.	13-15.5	13-15.5	10-11.5	26-29	65.3-73.3	65.3-73.3
Volts	5	5	5	5	10	10
Hold-In Winding						
Amps.	12.7-14.3	12.7-14.3	6.8 Max.	18-20	14.5-16.5	14.5-16.5
Volts	10	10	20	10	10	10

FREQUENCY SENSING RELAY

Make	Delco-Remy
Model No.	1115872

STARTER INTERLOCK RELAY

Make	Delco-Remy
Model No.	1115848
Point Opening (In.)	0.017-0.033
Opening Voltage Range	3.7-5.2

STARTER CONTROL RELAY

Make	Delco-Remy
Model No.	1116876
Air Gap at Core	
Points Closed (In.)	0.011 Min.
Point Opening (In.)	0.025
Closing Voltage Range	3.8-5.2
Opening Voltage	0.6 Min.
Sealing Voltage	0-0.2 Above Closing

STARTER MAGNETIC SWITCH

Make	Delco-Remy	Delco-Remy
Model No.	001466	1119828
Rated Voltage	12	12
Current Consumption Both Windings		
Amps	2.1-2.3	2.1-2.4
Volts	8	8

TORQUE SPECIFICATIONS

ITEM	TYPE OF PART	TORQUE (FT. LBS.)
STARTER TO FLYWHEEL HOUSING		
V6 or V8 Gasoline Engine Models	Bolt	25-30
6V-53 Diesel Engine		
Except TV 70	Bolt	80-90
TV 70 (Only)	Bolt	110-160
6-71 Diesel Engine	Nut	40-50
8V-71 Diesel Engine	Nut	40-50
Cummins Diesel Engine Models	Bolt	50-60

Ignition System

Ignition system information applicable to vehicles covered by this supplement remains the same as covered under "IGNITION SYSTEM" in ENGINE ELECTRICAL (SEC. 6Y) in Service Manuals ST135-70 and ST332-71, except as follows:

GENERAL

The ignition system consists of the source of power (battery or generator) ignition switch, ignition coil, distributor, condenser, spark plugs, and high and low tension wires.

A 1.52 OHM resistance wire is installed in the engine wiring harness on all vehicles equipped with the V6 or V8 gasoline engine (except Series RM-70). This wire is installed between the ignition terminal on the ignition switch and the (+) terminal on the ignition coil.

On Series RM-7500, a 1.52 OHM ignition resistance unit, mounted on the rear electrical equipment control panel, is connected between the ignition coil (+) terminal and the engine control switch.

The resistance wire or unit is used to increase ignition coil efficiency and lengthen distributor point life. If resistance wire becomes damaged, replace with wire of same gauge size and length.

IMPORTANT: DO NOT use copper wire in place of the resistance wire. When replacing a resistance wire or resistance unit, use recommended parts.

IGNITION TIMING

Information applicable to ignition timing remains the same as covered under "Ignition Timing" in "IGNITION SYSTEM" in ENGINE ELECTRICAL (SEC. 6Y) in Service Manuals ST135-70 and ST332-71 except as follows:

On the V6 401M engine, set timing to 7½° before upper-dead-center (BUDC) with engine running at 525 rpm. On the V6 478M engine, set timing to 7½° BUDC with engine running at 525 rpm; and on the V8 637 engine, set timing to 5° BUDC with engine running at 475 rpm.

NOTE: If timing mark does not align with pointer, loosen distributor mounting clamp cap screw and rotate distributor body as required to synchronize timing light flashes with timing mark on engine crankshaft pulley. Tighten distributor mounting clamp cap screw after adjustment is made.

IGNITION SYSTEM SPECIFICATIONS

ENGINE DISTRIBUTOR	401M & 478M	478SN	637
Make	Delco-Remy	Delco-Remy	Delco-Remy
Model No.	1110478	1110451	1111985
Rotation (Viewed at Rotor)	CW	CW	CW
Point Opening (In.)	0.016		
Cam Angle (Degrees) (1)	31-34	31-34 (3)	28-32
Centrifugal Advance (2)			
Start (Degrees)	0-2	0-3	1-3
R.P.M	510	450	550
Intermediate (Degrees)	4-6	2.3-5.4	
R.P.M	750	530	
Intermediate (Degrees)	6.5-8.5	3.6-5.6	5-7
R.P.M	1100	570	800
Maximum (Degrees)	10-12	10-12	13-15
R.P.M	1750	1800	1600
Firing Order	1-6-5-4-3-2	1-6-5-4-3-2	1-8-4-3-6-5-7-2
Ignition Timing Point			
Degrees	7 1/2° BUDC	7 1/2° BUDC	5° BUDC
R.P.M. (Engine)	525	500	475

(1) Set with vacuum advance line disconnected and plugged.
(2) Satisfactory Range. When adjusting set to 30 degrees. (Gives 0.016 point opening).
(3) Reconnect hose to opposite side of vacuum unit & adjust cam angle w/vac. full retard.

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

IGNITION SYSTEM SPECIFICATIONS (Cont.)

DISTRIBUTOR VACUUM CONTROL			
Model No.	1973423	1973416	1115358
Inches of Mercury to Start Advance	3-5	7-9	3-5
Inches of Mercury for Maximum Advance	6.25-8.2	14.7-14.9	7.3-9.7
Maximum Advance (Distributor Degrees)*	7.5	5	9
Vacuum Retard Range (Distributor Degrees)**	—	4-6	—
* Plus or minus one degree.			
** Full retard must be obtained by 11 inches Hg.			
IGNITION COIL			
Make	Delco-Remy	Delco-Remy	Delco-Remy
Model No.	1115205	1115205	1115205
SPARK PLUGS			
Make	AC	AC	AC
Type	CR-43N	CR-44NS	CR-42N
Size	14MM	14MM	14MM
Point Gap (In.)	0.035	0.040	0.035
Torque (Ft. Lbs.)			

Alternating Current Generating System

(NON-INTEGRAL TYPE)

A non-integral (generator and separate regulator) or an integral (generator with a solid state regulator built in) type generating system is used on vehicles covered by this supplement.

Information applicable to the non-integral type alternating current generating system remains the same as covered under "ALTERNATING CURRENT GENERATING SYSTEM" pages 6Y-22 through 6Y-47 in ENGINE ELECTRICAL (SEC. 6Y) in Service Manual ST135-70 except as follows:

Information applicable to the integral type alternating current generating system is described later in this section. Refer to "Model Application Chart" following and "Specifications" at end of this section.

MODEL APPLICATION CHART

AMPERAGE	TRUCK SERIES	GENERATOR (STANDARD)	USE WITH REGULATOR
42-AMP. --	HM/JM80	1100842	1119507
42-AMP. --	TM/WM80	1100842	1119515
61-AMP. --	HV/JV/TV70; RM/WM80*	1100849	1119507
62-AMP. --	HE/HI/HN/JE/JI/JN/TE90	1117754	1116374
62-AMP. --	MH90	1117787	1116374
75-AMP. --	HM80; HC/HH/JB/JC/JH/MB/MC90	1117225	Integral
75-AMP. --	DB/DC/DN/FB/FC/FN90	1117225	Integral
75-AMP. --	DH/DI/DP/FH/FI90	1117231	Integral

* Requires 1115827 Field Relay on RM80.

(Cont'd)

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

MODEL APPLICATION CHART (CONT.)

AMPERAGE	TRUCK SERIES	OPTIONAL	USE WITH REGULATOR
61-AMP. --	HM/JM80	1100849	1119507
61-AMP. --	TM/WM80	1100849	1119515
62-AMP. --	HM/JM/RM80	1117754	1116374
62-AMP. --	TM/WM80	1117754	1116378
62-AMP. --	HE/HI/JE/JI/FH90	1117756	9000590 (1)
62-AMP. --	TE90	1117756	9000590 (2)
62-AMP. --	MH90	1117781	9000590 (1)
145-AMP. --	RM80	1117143	Integral
105-AMP. --	DH/DI/FH/FI90 (Leece Neville)	655988	Integral

(1) Requires 1115841 Field Relay.
(2) Requires 1115827 Field Relay.

GENERATING SYSTEM GENERAL DESCRIPTION (NON-INTEGRAL TYPE SYSTEM)

The basic charging system components include the battery, the self-rectifying alternating current generator, the voltage regulator, and interconnecting wiring.

An indicator lamp (tell-tale) which lights when there is a malfunction within the charging system is used on steel tilt cab models. An ammeter or voltmeter type charge indicator is available on all vehicles covered by this supplement.

Figure 1 illustrates a schematic diagram of the generating system used on vehicles equipped with the two-unit type voltage regulator. The left view applies to vehicles equipped with the 1119515 regulator and the right view applies to vehicles equipped with the 1119507 type regulator.

Figure 2 illustrates a schematic diagram of the generating system used on vehicles equipped with the 1116374 transistorized type regulator and figure 3 illustrates a schematic diagram of the generating system used on vehicles equipped with the 1116378 transistorized type regulator.

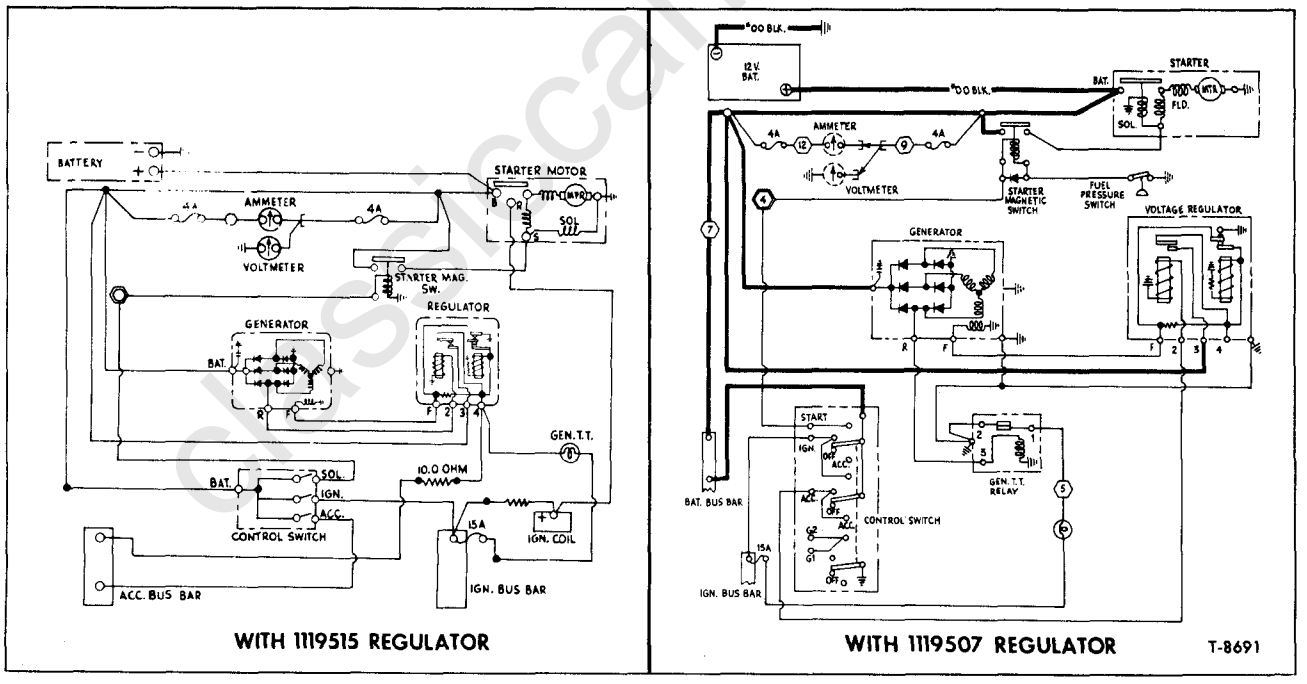


Figure 1—Schematic Diagram of A.C. Charging Circuit with Two-Unit Type Regulator (Typical)

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

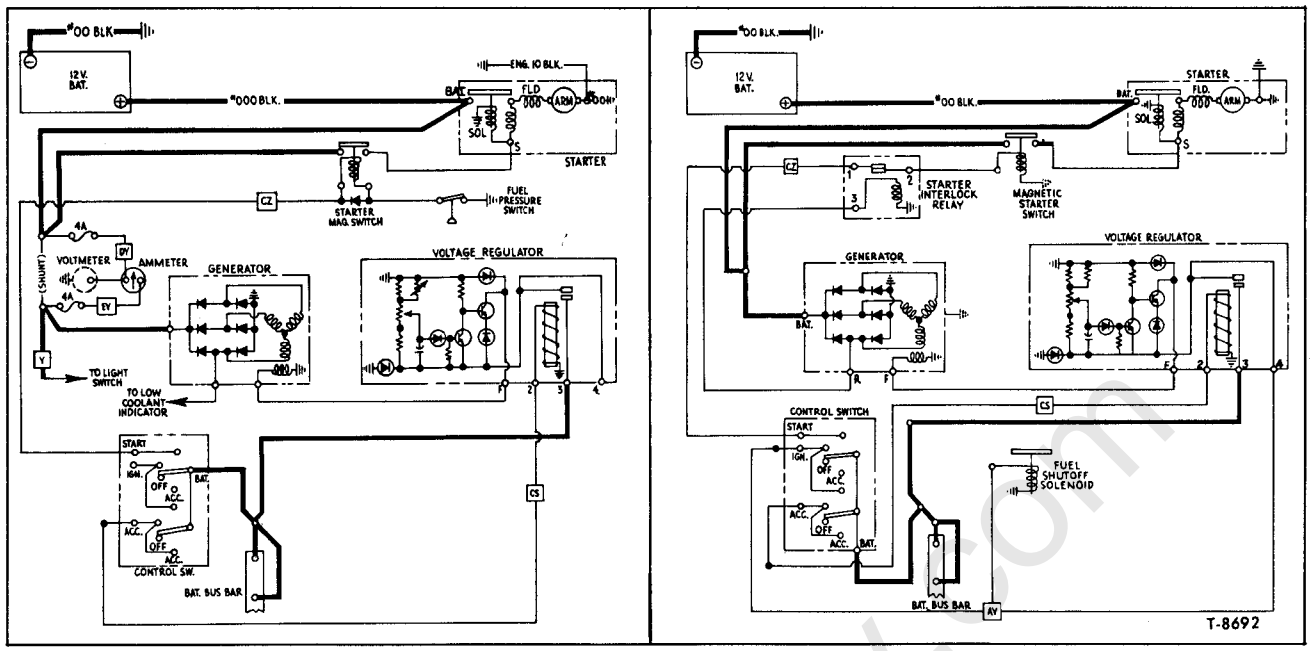


Figure 2—Schematic Diagram of A.C. Charging Circuit with 1116374 Regulator (Typical)

A schematic diagram of the generating system used on vehicles equipped with the 9000590 full transistor regulator and the 1115841 separate field relay unit is illustrated in figure 4.

A schematic diagram of the generating system used on vehicles equipped with the 9000590 full transistor type regulator and the 1115827 separate field relay unit is illustrated in figure 5.

A schematic diagram of the generating system used on Series RM80 equipped with the 1119507 regulator and the 1115827 separate field relay unit is shown in figure 6.

NOTE: Schematic diagrams of generating systems used on vehicles equipped with the integral type generating systems (generator with solid state regulator built-in) are covered later in this section.

The alternating current type generator is used as standard and optional equipment on all vehicles

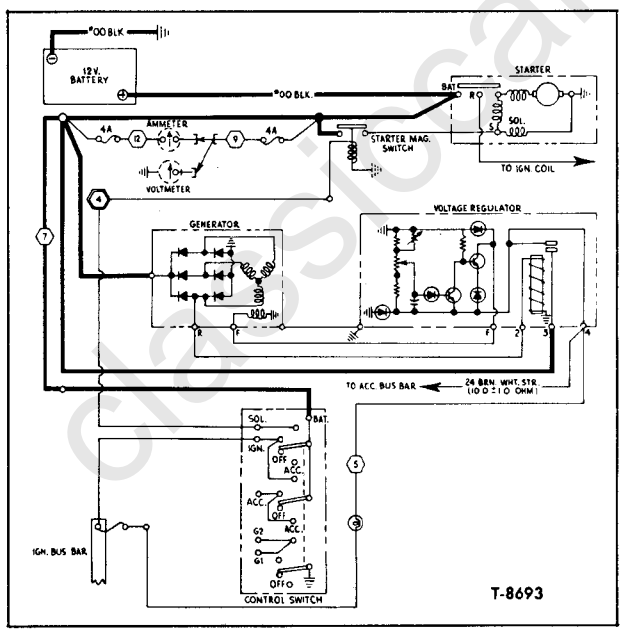


Figure 3—Schematic Diagram of A.C. Charging Circuit with 1116378 Regulator (Typical)

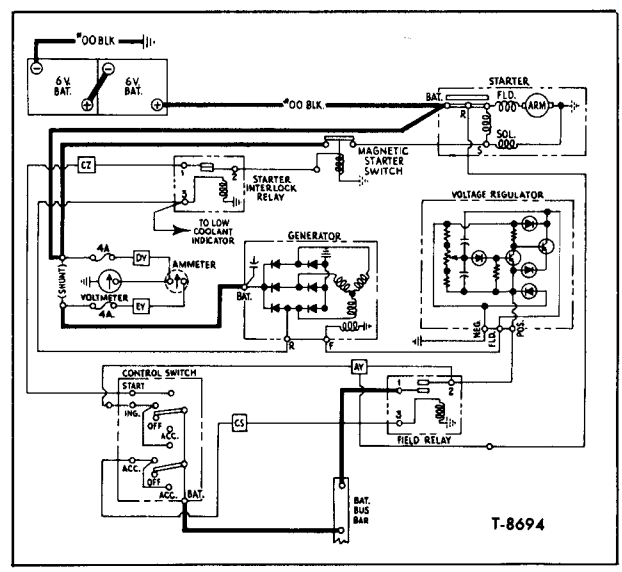


Figure 4—Schematic Diagram of A.C. Charging Circuit with Full Transistor Regulator and 1115841 Field Relay (Typical)

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

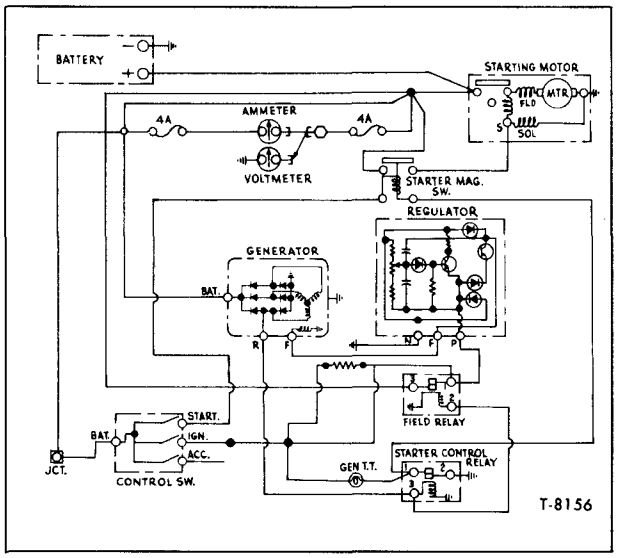


Figure 5—Schematic Diagram of A.C. Charging Circuit with 9000590 Regulator and 1115827 Field Relay (Typical)

covered by this supplement. All units are self-rectifying, alternating current (A.C.) type with direct current (D.C.) output.

The generator is air-cooled by a single fan attached to the drive pulley or by blades attached to each end of the rotor assembly.

The alternating current generator consists of the slip ring end frame, the drive end frame, the stator, and the rotor. The stator is composed of a large number of windings assembled on the inside of a laminated iron core that is attached to the gen-

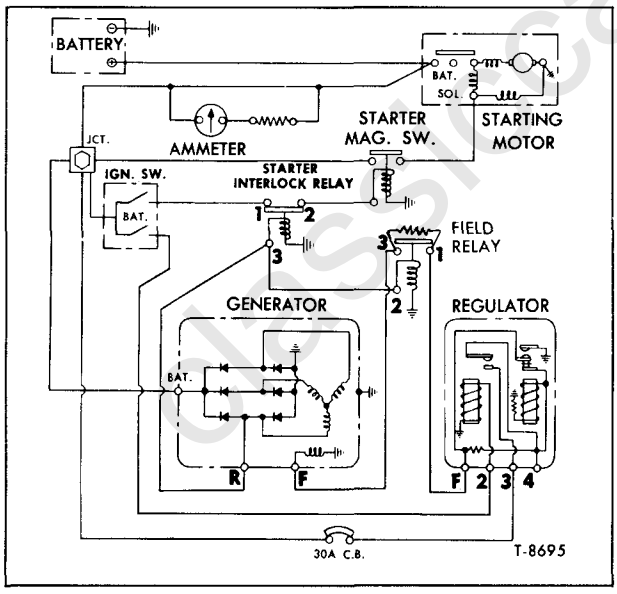


Figure 6—Schematic Diagram of A.C. Charging Circuit with 1119507 Regulator and 1115827 Field Relay

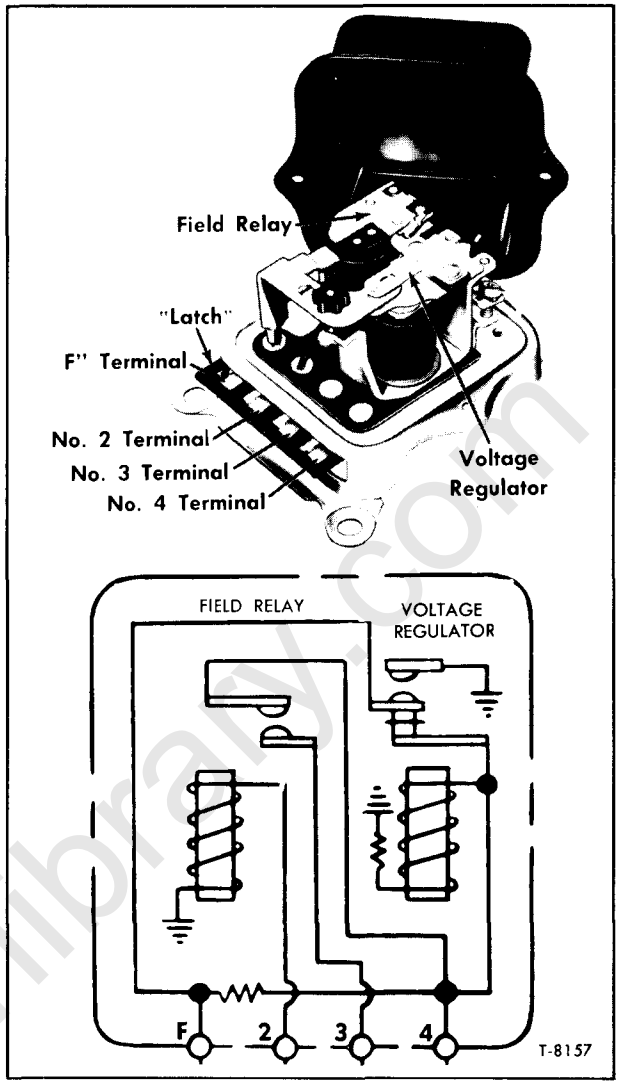


Figure 7—Vibrating Point Type Regulator (Typical)

erator frame, or that forms the generator frame. The rotor revolves within the stator on bearings in each end frame.

NOTE: On 42-, and 61-amp generators, a ball bearing is used at the drive end and a roller bearing is used at the slip ring end. On 62-amp generators, the rotor revolves on a ball bearing in each end frame.

On 42-, 61-, and 62-amp generators (except 62-amp generator models 1117756 and 1117781), two brushes carry current through two slip rings to the field coils which is wound concentric with the rotor shaft.

On 62-amp generator models 1117756 and 1117781, two separate brush assemblies, each of which contain two brushes, carry current through two slip rings to the field coil which is wound concentric with the rotor shaft. A special constant

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

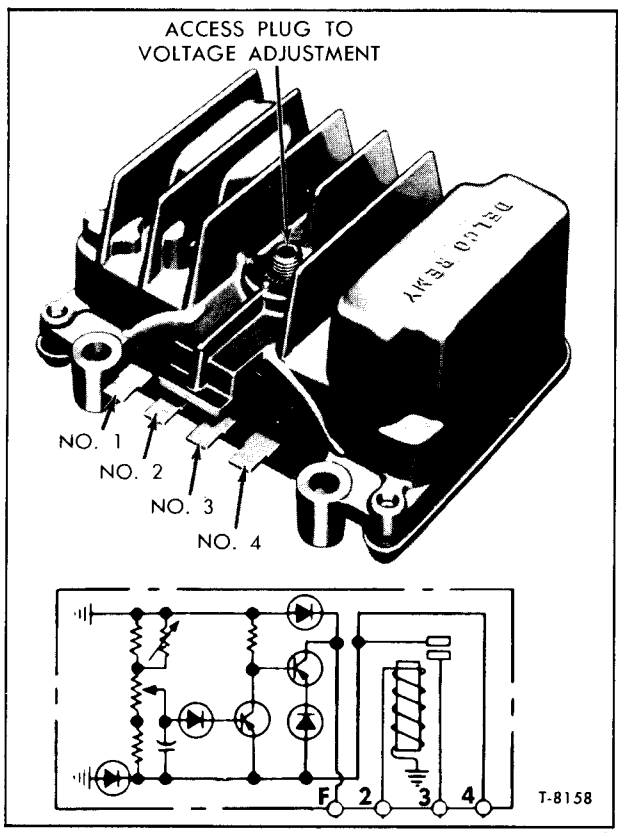


Figure 8—Transistorized Type Regulator (Model 1116374 or 1116378) (Typical)

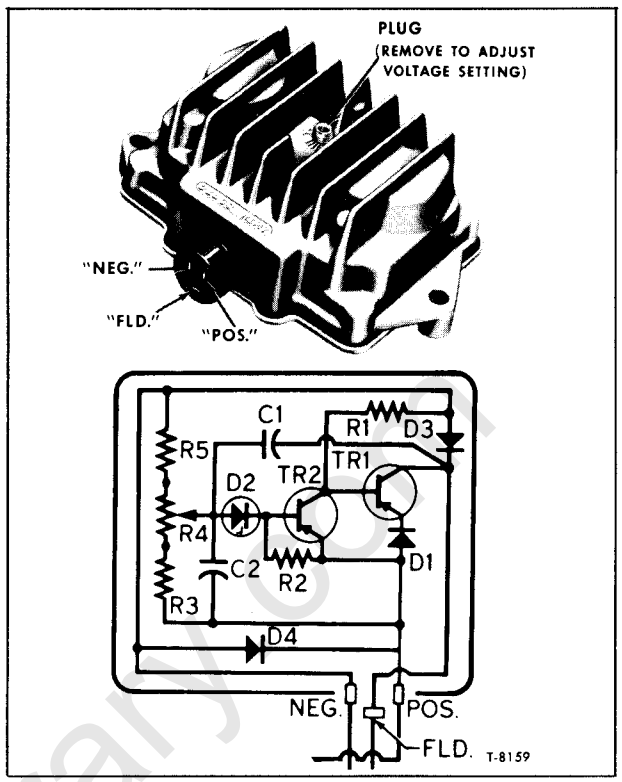


Figure 9—Full Transistor Type Regulator (Model 9000590) (Typical)

tension brush spring holds each brush in contact with the slip ring.

Although generators vary with respect to current output and type of voltage regulation, the operating principles in each system are similar.

The generator is driven from the engine and converts mechanical energy to electrical power. Six rectifier diodes, mounted in the slip ring end frame and heat sink assembly, are connected to the stator windings. These diodes act to change generator "A.C." voltages to a "D.C." voltage which appears at the output "BAT." terminal on the generator.

The regulator controls generator voltage output by varying current flow in field windings in generator rotor assembly. No current regulating device is required in regulator used with the "A.C." generator since the generator has inherent current regulation as long as the voltage is controlled. A cut-out relay is not required with the A.C. generating system as the diodes will not conduct an electrical current in reverse direction; i.e., from battery to ground through the generator.

On 42-, and 61-amp generating systems, voltage is controlled by a vibrating point type regulator (fig. 7). On 62-amp generating systems (except with 1117756 or 1117781 generator), voltage is controlled by a transistorized type regulator (fig. 8). On 62-amp generating systems equipped with the 1117756 or 1117781 generator, voltage is controlled by a full transistor type regulator (fig. 9).

The two-unit double contact regulator assembly (fig. 7) consists of a double contact voltage regulator unit and a field relay unit. The voltage regulator unit uses an upper and lower set of contact points to limit the generator voltage output to a pre-set value.

NOTE: On steel tilt cab models, the field relay unit is used to control the indicator lamp circuit. The relay unit allows the indicator lamp to light (as a bulb check) with the control switch in "IGN" position and engine not running. When the engine is started and the generator begins to charge, the indicator light goes out, indicating that the system is operating normally.

The transistorized type regulator (fig. 8), is an assembly composed principally of transistors, diodes, resistors, a capacitor, and a thermistor to form a completely static voltage regulating unit in combination with a conventional vibrating type field relay.

The transistor is an electrical device which limits the generator voltage to a pre-set value by controlling the generator field current. The diodes,

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

capacitor and resistor act together to aid the transistors in controlling the generator voltage. This is the only function the regulator performs in the charging circuit. The thermistor provides a temperature-compensated voltage setting. A wiring diagram showing the internal circuitry of this regulator is shown in figure 8.

The voltage at which the generator operates is determined by the regulator adjustment. The regulator voltage setting can be adjusted externally by removing a pipe plug in the cover (fig. 8) and turning the adjusting arm inside the regulator. This procedure is explained under "Maintenance and Adjustments," and permits regulator adjustments without removing the cover.

The full transistor type regulator, used on vehicles equipped with 62-amp generator model 1117756 or 1117781 (fig. 9), is composed of transistors, diodes, capacitors, and resistors which form a completely static electrical unit containing no moving parts. The regulator limits generator voltage to a pre-set value by controlling generator field current.

Regulator voltage setting can be adjusted externally by removing a pipe plug in the cover, then rotating the adjustment screw within the regulator as explained under "Maintenance and Adjustment" later in this section.

PRECAUTIONS

Observe the following precautions when performing service operations on the alternating current generating system. Failure to observe these precautions may result in serious damage to the charging system.

1. THE ELECTRICAL SYSTEM IS NEGATIVE GROUND. Connecting the battery or a battery charger with the positive terminal grounded will endanger generator diodes and vehicle wiring by high current flow. Burned wiring harnesses and burned "Open" diodes will result.

2. Never operate the generator on an open circuit (field terminal connected and output terminal disconnected). With no battery or electrical load in the circuit (open circuit) the generator can build up excessively high voltage. Be sure all connections in the charging circuit are secure.

3. The generator cannot be polarized. Any attempt to polarize the generator may result in serious damage to charging system components.

4. When working near the generator or regulator and before replacing electrical system components, disconnect negative lead from the battery to prevent accidental shorting at generator and regulator terminals where battery voltage is available.

NOTE: Replace voltage regulator with same type and model.

5. Do not short across or ground terminals on the generator or regulator.

6. When using a booster battery, be sure to connect negative battery terminals together and positive terminals together.

7. Disconnect battery leads while charging batteries. Do not use a fast charger as a booster for starting the engine. When attaching battery charger leads to the battery, connect charger positive lead to battery positive terminal and charger negative lead to battery negative terminal.

8. Disconnect lead from the battery negative terminal before welding on vehicle since a reverse current flow from the welder may damage generator diodes as well as other electrical components.

9. Never replace the brown and white stripe special resistance wire in harness connected to the ignition or control switch unless it is of same gauge and length (approx. 60 inches long). Generating system will not function without this wire. Wire is identified on applicable diagrams in "Wiring Diagrams" section of Service Manual ST135-70 as 24-BRN.-W.S. Resistance value of wire is approximately 10 ± 1.0 ohms, 6.25 watts.

IMPORTANT: Always locate and correct the cause of a malfunction to prevent reoccurrence.

ON VEHICLE MAINTENANCE, TESTS, AND ADJUSTMENTS

GENERATING SYSTEM MAINTENANCE

At regular intervals, inspect generating system to locate and correct the potential causes of trouble before generating system performance is affected. Inspect terminals for corrosion and loose connections, and the wiring for frayed insulation. Check mounting bolts for tightness and the drive belt for alignment, proper tension and wear.

On 62-amp generators, slip rings and brushes can be inspected through the end frame by removing the brush holder assembly or brushes. A small penlight will aid in viewing the slip rings. If slip rings are dirty, rough, or out-of-round, the generator must be removed and disassembled.

With engine running, listen for noise and check generator for vibration. If generator is noisy or vibrates excessively, it should be removed for inspection and repair.

NOTE: Excessive generator noise may be caused by worn or dirty bearings, loose mounting bolts, a loose drive pulley, a defective diode, or a defective stator.

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

GENERATOR DRIVE BELT

TENSION ADJUSTMENT

CAUTION: When adjusting drive belt tension, apply pressure at center of generator and never against either end frame.

Drive belts must be kept at proper tension. A loose or broken belt will affect operation of the generator. A drive belt that is too tight will place excessive strain on bearings.

All generators are pivot-base mounted. To adjust drive belt tension, loosen the adjustment arm clamp bolt and generator to mounting bracket or support bracket pivot bolt, and move generator to obtain recommended tension.

V-Belt Tension

Generator drive belt tension on vehicles equipped with V-belts should be adjusted to 120-130 pounds on new belts, using belt tension gauge (J-23600). Used drive belts should be adjusted to 80-90 pounds. Place gauge at center of greatest belt span when adjusting drive belt tension.

NOTE: On a new vehicle, or after having installed a new drive belt, check tension twice in first 200 miles of operation. Refer to ENGINE COOLING SYSTEM (SEC. 6K) for drive belt replacement.

IMPORTANT: When replacing dual drive belts, it is essential that the entire set be replaced at the same time. Belts are available in matched sets only.

Poly-V Belt Tension

Generator drive belt tension on vehicles equipped with Poly-V belts should be adjusted using (J-23586) belt tension gauge. Gauge should be placed at center of longest belt span to obtain proper reading. When adjusting a new drive belt, adjust tension to "NEW" belt specification, turn engine over several times, then reset belt tension to "NEW" belt specification.

NOTE: A Poly-V belt is considered USED after one hour's operation or approximately 50 miles driving time. Refer to ENGINE COOLING SYSTEM (SEC. 6K) for drive belt replacement.

Generator drive belt tension on vehicles equipped with the 6-71 Diesel engine and Poly-V drive belt should be adjusted to 44-54 pounds on a new belt using (J-23586) belt tension gauge. Used belts should be adjusted to 29-39 pounds.

Generator drive belt tension on vehicles equipped with the 8V-71 Diesel engine and Poly-V drive belt should be adjusted to 84-94 pounds on a new belt or 64-74 pounds on a used belt.

GENERATING SYSTEM TROUBLE SYMPTOMS

Abnormal operation of the charging system will usually be indicated by one or more of the following conditions:

1. Faulty indicator lamp operation (steel tilt cab models only).

a. Failure of indicator lamp to illuminate when ignition or control switch is turned on with engine not running.

b. Indicator lamp continues to glow with engine running.

c. Indicator lamp fails to go out when ignition or control switch is turned off.

2. Battery undercharged (low specific gravity of electrolyte).

3. Battery overcharged as evidenced by excessive water usage indicating an extremely high charging rate.

4. Ammeter shows a high charging rate with a fully charged battery.

5. Ammeter shows a low or no-charge with a partially discharged battery.

GENERATOR ON VEHICLE TEST

The following is a list of the most common generator defects encountered:

1. Open or shorted generator diodes.
2. Open, shorted, or grounded stator winding.
3. Open, shorted, or grounded field winding.
4. Worn generator brushes.
5. Excessive generator noise.

Generator diodes and stator windings should be checked as explained under "Generator Output Test" later in this section. If a defect is indicated by this test, remove the generator and repair.

Generator field windings and brushes should be checked as outlined under "Charging System Trouble Analysis Chart" later in this section. If this check indicates a defect in the field winding, remove the generator and repair. Replace worn brushes as explained under "Generator Brush Replacement" later in this section.

Excessive generator noise is usually the result of one or more of the following:

1. Brush "Squeal" caused by a hard spot on one of the brushes or rough or dirty slip rings.
2. Dry or rough bearings in generator end frame.

IMPORTANT: Dry or rough bearings may be the result of over-tightening generator drive belt, loose generator mountings, or an unbalanced generator fan or pulley. Remove generator and repair.

3. A defective diode or stator resulting in an electrical unbalance.

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

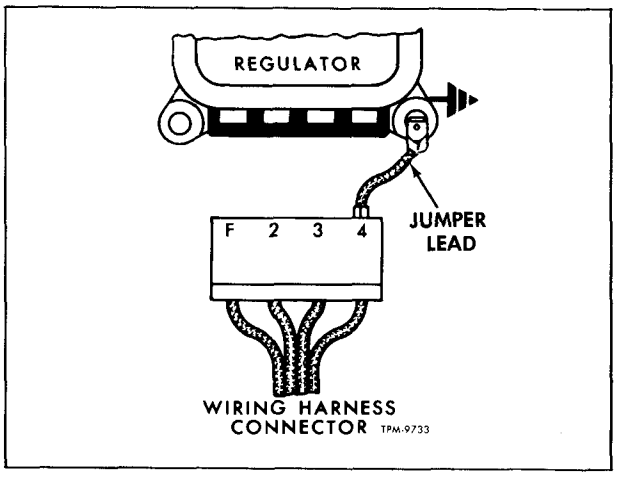


Figure 10—Checking Indicator Lamp Circuit (Typical)

GENERATOR CHARGE INDICATOR LAMP CIRCUIT TEST

STEEL TILT CAB MODELS
WITH 1119507 REGULATOR

1. Check the indicator lamp bulb which may be burned out.

2. Visually check wiring harness for grounds and wiring connections including slip type connectors at the generator tell-tale relay, generator, and regulator.

3. Check for faulty indicator lamp operation as follows:

a. If indicator lamp comes on with ignition or control switch off, a generator diode may be shorted. This condition will cause a discharged battery.

b. If indicator lamp does not come on with the ignition or control switch on and engine not running, check for an open in the indicator lamp circuit with the switch on as follows:

(1) Use a jumper lead to ground the generator tell-tale relay base.

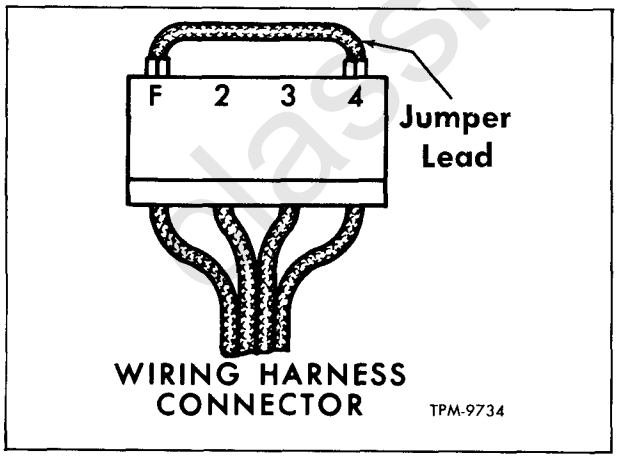


Figure 11—Checking Indicator Lamp Wiring

(2) If lamp comes on - correct poor relay ground.

(3) If lamp does not come on - use a jumper lead to ground the generator tell-tale relay No. 1 terminal. If the lamp comes on, replace the relay. If the lamp does not come on, check for an open in the No. 1 terminal lead circuit between relay and ignition or control switch.

c. If the indicator lamp comes on with the ignition or control switch on and the engine idling, observe the following procedure:

(1) Insert a test prod into the harness connector at lamp relay No. 4 terminal.

(2) Connect a voltmeter from test prod to ground.

(3) Operate engine at slightly above idle speed and observe voltmeter. If reading is 5 volts or above and lamp fails to go out, replace the generator tell-tale relay.

(4) If voltmeter reading is below 5 volts, connect voltmeter from generator "R" terminal to ground.

(5) If voltmeter reading is above 5 volts, "R" terminal lead is defective.

(6) If voltmeter reading is below 5 volts, refer to "Undercharged Battery Test" later.

STEEL TILT CAB MODELS
WITH 1119515 REGULATOR

1. Check the indicator lamp bulb which may be burned out.

2. Visually check wiring harness for grounds and wiring connections including slip type connectors at the generator and regulator.

3. If indicator lamp comes on with ignition or control switch off and engine not running, there may be a shorted diode in the generator or a short between leads Nos. 2, 3, and 4 at the regulator.

4. If the indicator lamp does not come on with the ignition or control switch on and the engine not running, check for an open in the indicator lamp circuit as follows:

a. Lift up on the regulator terminal latch slightly, then pull connector from regulator terminals.

b. Referring to figure 10, insert a jumper lead (J-9782-1) into No. 4 terminal socket in harness connector and ground the other end of the lead to regulator base. Momentarily (not more than 10 seconds) turn on ignition or control switch. Indicator lamp should light. If indicator lamp does not light, check for an open in No. 4 lead circuit between the regulator and ignition or control switch.

c. If indicator lamp comes on when No. 4 socket in wiring harness connector is grounded (fig. 10), connect jumper lead between wiring harness connector "F" terminal and No. 4 terminal as shown in figure 11.

(1) If light comes on, an open circuit exists within the regulator. Refer to regulator tests later.

(2) If light does not come on, leave jumper lead connected as shown in figure 11 and connect a long jumper lead from generator field "F" terminal to ground. If lamp does not come on, "F" terminal lead is open circuited. If lamp does come on, generator field is open circuited.

5. If indicator lamp comes on with the ignition or control switch on and the engine idling, refer to "Undercharged Battery Test" later in this section.

STEEL TILT CAB MODELS
WITH 1116378 REGULATOR

1. Check indicator lamp bulb.

2. Visually inspect wiring harness for grounds and poor wiring connections including connectors at the generator and regulator.

3. If indicator lamp does not come on with the ignition or control switch in "IGN." position, and engine not running, remove wiring harness connector from regulator and connect a jumper lead from connector-body terminal No. 4 to ground (fig. 10).

NOTE: Make sure jumper lead is pushed into the connector far enough to contact the terminal covered by the connector.

a. If the indicator lamp does not come on, check for an open circuit between No. 4 terminal on regulator and the ignition or control switch, or between the battery and jumper lead.

b. If the indicator lamp does come on, connect a jumper lead between wiring harness connector "F" terminal and No. 4 terminal (fig. 11). If the indicator lamp comes on, there is an open circuit within the regulator. If the indicator lamp does not come on, there is either an open in the field lead between the regulator and generator or in the generator field coil.

c. With jumper lead still connected between wiring harness connector "F" terminal and No. 4 terminal, insert another jumper lead in connector-body of generator "F" terminal and connect other end of lead to ground on the generator. If the indicator lamp does not come on, the lead between the regulator and generator is open. If indicator lamp does come on, the generator field circuit is open.

4. If the indicator lamp does not go out with the engine and generator in operation, check the following:

a. Check generator drive belt tension as explained under "Generator Drive Belt" previously.

b. Check for an open resistor which is in parallel with the indicator lamp bulb as follows:

(1) Stop the engine; turn off all loads and insert a voltmeter test prod into the wiring harness connector No. 4 terminal.

(2) Connect the other test prod to ground on regulator base, then turn ignition or control switch on and observe the voltmeter. If voltmeter registers less than 3½ volts, the resistor is open and if voltmeter registers over 3½ volts, the resistor is good.

c. Connect a voltmeter between No. 3 terminal on regulator wiring harness connector and ground. A zero reading indicates an open circuit between the battery and No. 3 regulator terminal.

d. Insert test prod from voltmeter into No. 2 wiring harness connector terminal and the other test prod to ground on the regulator base. Start engine and note voltmeter reading. If voltage reading is less than 5 volts proceed to step "e." If voltage reading is above 5 volts, proceed to step "f."

e. Connect voltmeter between generator "R" terminal and ground. Start the engine and observe voltmeter reading. If reading is 5 volts or more, the lead between generator "R" terminal and regulator No. 2 terminal is faulty. If voltmeter reading is less than 5 volts, refer to "Voltage Regulator" section later.

f. With the engine running, temporarily ground the regulator base to a known good ground. If indicator lamp goes out, clean and tighten regulator ground connections. If indicator lamp does not go out, the relay unit of the regulator is defective.

5. If the indicator lamp does not go out with the ignition or control switch off proceed as follows:

a. Disconnect wiring harness from generator "F" and "R" terminals. If the indicator light goes out, the generator has a shorted diode in the heat sink. If the light does not go out, connect wiring to generator "F" and "R" terminals and remove wiring harness connector from regulator. If the indicator light remains on wiring leading to No. 3 and No. 4 regulator terminals is shorted together. If the indicator light goes out, regulator relay points are stuck or there is a short between a wire containing battery voltage and the lead to No. 2 regulator terminal. Proceed to step "b."

b. If indicator light does not go out with wiring disconnected from the regulator, connect a voltmeter between No. 2 terminal of regulator wiring harness connector and ground. Any voltage reading indicates a shorted condition in the wiring. No voltage reading indicates a stuck relay unit.

STEEL TILT CAB MODELS
WITH 9000590 REGULATOR

1. Check indicator lamp bulb which may be burned out.

2. Visually inspect wiring harness for grounds and wiring connections including connectors at generator and regulator.

3. If indicator lamp does not illuminate with ignition or control switch on and engine not running,

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

check for excessive resistance between the battery and ignition or control switch, and between the field relay No. 1 terminal and the ignition or control switch.

4. If indicator lamp does not go out with ignition or control switch on and engine running, replace the field relay unit.

5. If indicator lamp does not go out with ignition or control switch off, generator may have a shorted diode. This condition can result in a discharged battery.

AMMETER CIRCUIT TEST (WITH 1116374 OR 1116378 REGULATOR)

1. If ammeter indicates a discharge with all accessories "OFF" and ignition or control switch in "OFF" position proceed as follows:

a. Disconnect negative cable from battery. If ammeter reading is unchanged, the ammeter is not properly calibrated. If ammeter returns to zero, proceed to Step "b."

b. Disconnect wiring harness from generator "F" and "R" terminals. If ammeter reading returns to zero, there is a shorted diode in the positive heat sink of the generator. If ammeter continues to show a discharge, connect wiring harness to generator "F" and "R" terminals and proceed to Step "c."

c. Remove connector from regulator terminals. If the ammeter continues to show a discharge, wiring is grounded. If ammeter no longer shows a discharge, proceed to Step "d."

d. Connect a voltmeter between regulator No. 2 terminal and ground.

NOTE: Ignition switch must be "OFF" and connector removed from regulator.

A voltage indication on the meter indicates a short between the wire leading to No. 2 terminal and a wire containing battery voltage. No voltage indication on the meter indicates a stuck relay unit and the regulator must be repaired or replaced.

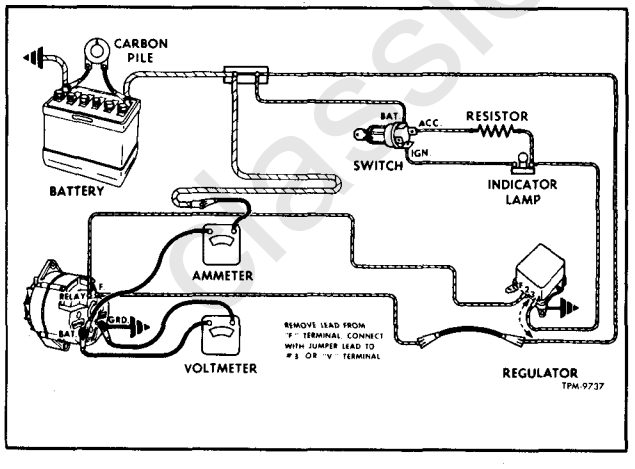


Figure 12—Connections for Testing Generator Output (with 1119507 or 1119515 Regulator)

2. If ammeter indicates a discharge with all accessories "OFF" and the engine running at idle speed, check for an open relay or an open regulator field circuit as follows:

a. Connect a jumper lead between regulator base and a good ground. If ammeter shows a slight charge, the regulator is not properly grounded.

b. Connect voltmeter between regulator No. 2 terminal and ground. No reading on voltmeter indicates an open circuit between regulator No. 2 terminal and generator "R" terminal.

c. Connect voltmeter between regulator No. 3 terminal and ground. If no reading is noted, check for an open circuit between regulator No. 3 terminal and battery.

d. If a lead is attached to regulator No. 4 terminal, disconnect wiring harness connector from regulator and connect a voltmeter from No. 4 terminal of connector to ground. If no reading is indicated, check for an open circuit between regulator No. 4 terminal and the battery. If battery voltage is noted, reconnect wiring harness connector to regulator and proceed to Step "e."

e. Connect voltmeter between regulator "F" terminal and ground. If no reading is noted, repair or replace the regulator. If 10 volts or more are available, connect voltmeter between generator "F" terminal and ground. If no reading is noted, the lead from generator "F" terminal to regulator "F" terminal is open. If the reading is 10 volts or more, refer to procedure outlined under "Regulator Circuit Tests" later in this section.

UNDER CHARGED BATTERY TEST (WITH 1119507 REGULATOR)

This condition as evidenced by slow cranking can be caused by one or more of the following:

LOOSE GENERATOR DRIVE BELT

Generator drive belts should be properly adjusted and tightened as explained previously under "Generator Drive Belt."

DEFECTIVE BATTERY

Check battery as explained under "Battery Test Procedure" in "BATTERY" section previously.

POOR CIRCUIT CONNECTIONS

Inspect all connections to make sure they are clean and tight, including connectors at regulator and generator. Check wiring harness for grounds. Make continuity checks as follows with the ignition switch on:

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

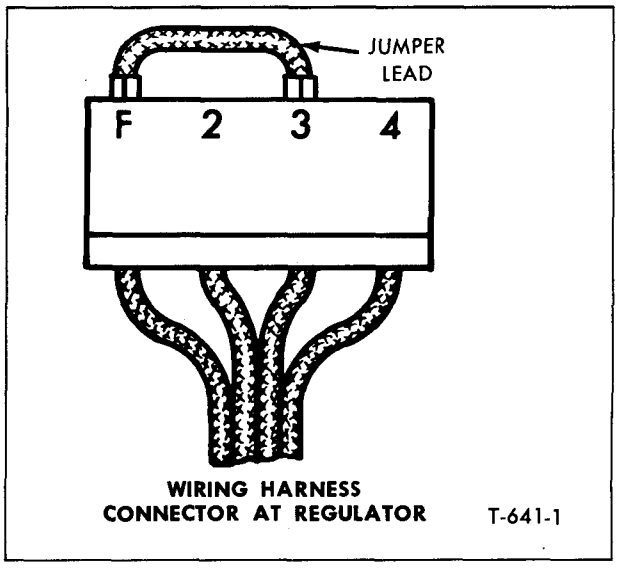


Figure 13—Generator Output Test-Jumper Lead Connections (Two-Unit Type Regulator)

1. Insert a test prod into regulator No. 3 terminal, then connect a voltmeter from test prod to ground. If voltmeter registers zero, circuit is open between battery and No. 3 terminal on regulator.

2. Connect a voltmeter from regulator No. 2 terminal to ground.

a. If voltmeter reading is zero, circuit is open between regulator No. 2 terminal and ignition or control switch.

b. If voltmeter reading was obtained at regulator No. 2 terminal, connect voltmeter from regulator "F" terminal to ground. If reading is zero, adjust regulator voltage setting as explained later.

c. If voltmeter reading was obtained at regulator "F" terminal, connect voltmeter from generator "F" terminal to ground. Harness must be properly connected to generator "F" terminal. If reading is zero, circuit is open in lead between generator and regulator "F" terminal.

d. If voltmeter reading was obtained in Step "c" proceed to "Generator Output Test" following:

GENERATOR OUTPUT TEST

1. Disconnect negative battery cable from battery and disconnect wire from "BAT" terminal on generator. Connect an ammeter between the wire and generator "BAT" terminal (fig. 12).

2. Connect a voltmeter from generator "BAT" terminal to ground.

3. Lift latch on regulator harness connector upward to disengage, then pull connector from regulator. Connect a jumper lead between "F" terminal and No. 3 terminal as shown in figure 13.

4. Connect negative battery cable to battery.

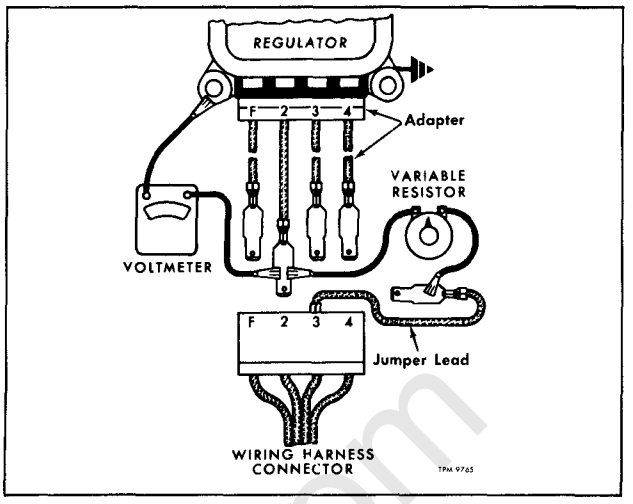


Figure 14—Testing Field Relay (Two-Unit Regulator)

IMPORTANT: With wiring connected as shown in figure 12, the regulator is taken out of the circuit. Load the battery with a carbon pile or turn on vehicle accessories to control generator output voltage. Do not allow voltage to exceed setting specified for regulator as listed in "Specifications."

5. Connect a tachometer to engine, then start engine. Adjust engine speed and carbon pile (if used) or turn on vehicle accessories to obtain maximum current output. If ampere output is within 10 amperes of rated output as listed in "Specifications," generator is good. If generator does not produce current within its rated capacity, it can be considered defective and in need of repair.

NOTE: Procedure for replacing the generator are given later.

6. Remove instruments and jumper lead and connect wiring harness connector to regulator.

7. If no defects were found by the preceding checks, yet the battery remains undercharged, adjust the voltage regulator setting as explained under "Adjusting Voltage Setting" later.

UNDER CHARGED BATTERY TEST (WITH 1119515 REGULATOR)

This condition, as evidenced by slow cranking, can be caused by one or more of the following:

LOOSE GENERATOR DRIVE BELT

Generator drive belt should be properly adjusted and tightened as explained previously under "Generator Drive Belt."

DEFECTIVE BATTERY

Check battery as explained under "Battery Test Procedure" in "BATTERY" section previously.

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

POOR CIRCUIT CONNECTIONS

Inspect all connections to make sure they are clean and tight, including connectors at regulator and generator. Check wiring harness for grounds, then proceed with continuity checks with ignition switch on as follows:

1. With harness connector attached to regulator, insert a test prod into regulator No. 3 terminal, then connect voltmeter from test prod to ground. If reading is zero, circuit is open between No. 3 terminal and battery.

2. Connect voltmeter from generator "F" terminal to ground. If a voltage reading is obtained, proceed to "Open Resistor" check later.

a. If reading is zero, connect voltmeter from regulator "F" terminal to ground.

b. If reading is obtained, "F" terminal lead is open.

c. If reading is zero, connect voltmeter from regulator No. 4 terminal to ground.

d. If reading is zero, circuit is open between regulator No. 4 terminal and ignition switch.

e. If voltmeter reading was obtained in Step "c," replace regulator or adjust regulator voltage setting as explained later in this section.

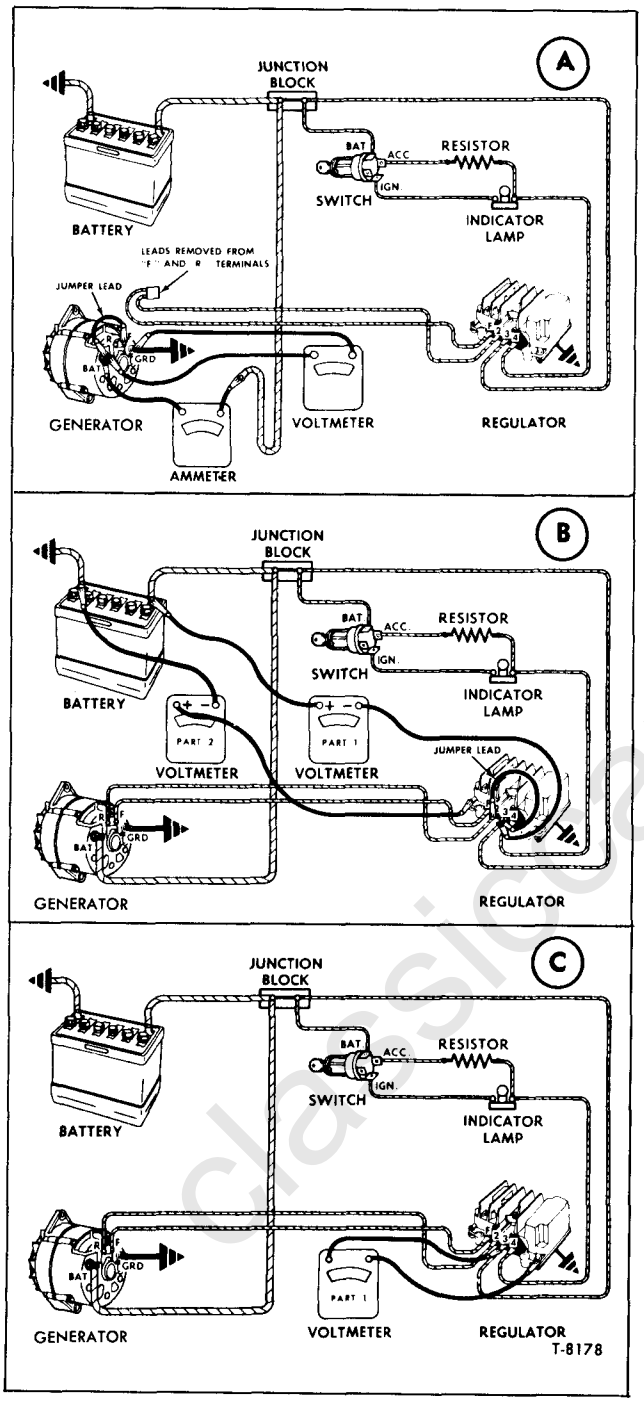


Figure 15—Connections for Testing 1116374 or 1116378 Regulator (Typical)

OPEN RESISTOR

Connect voltmeter from regulator No. 4 terminal to ground. Turn ignition switch to "ACC" position. If reading is zero, resistor is open.

FIELD RELAY CHECK

If indicator lamp fails to go out with the generator in operation, and in circuits using the optional ammeter, check the field relay as follows:

1. Connect a voltmeter from regulator No. 2 terminal to ground (fig. 14), then start engine and run at slightly above idle speed.

a. If voltmeter reading is 5 volts or above, and indicator lamp fails to go out, replace the regulator.

b. On vehicles equipped with the optional ammeter, if reading is above 5 volts, connect voltmeter from regulator No. 3 terminal to No. 4 terminal. If reading is over 1 volt, replace the regulator.

2. If voltmeter reading in Step 1 was below 5 volts, connect voltmeter from generator "R" terminal to ground.

a. If reading is 5 volts or above, the lead between generator "R" terminal and regulator No. 2 terminal is defective.

b. If reading is below 5 volts, check for a defective generator as follows:

GENERATOR OUTPUT TEST

This test is the same as the "Generator Output Test" given in "Undercharged Battery Test - With 1119507 Regulator" previously in this section.

REGULATOR CIRCUIT TEST (WITH 1116374 OR 1116378 REGULATOR)

Since most charging system troubles show up as an undercharged or overcharged battery, the

battery should be checked for correct specific gravity. Then generator drive belt should be checked for proper tension, and wiring should be visually inspected for loose or corroded connections.

NOTE: On some vehicles equipped with the 1116374 regulator, the No. 4 regulator terminal is not used.

A typical circuit with an indicator lamp is shown in figure 15, however, the same test connections are made on vehicles equipped with the ammeter type charge indicator.

1. Disconnect wiring from generator "BAT" terminal and wiring harness connector from generator "F" and "R" terminals. Make connections as shown in View A, figure 15.

NOTE: Ammeter is connected between generator "BAT" terminal and the lead disconnected from generator "BAT" terminal. Voltmeter is connected between generator "BAT" terminal and ground, and jumper lead is connected between "R" and "F" terminal on generator.

2. Refer to generator specifications at end of this section, then start engine and operate at specified speed. Turn on accessories or connect a carbon pile across the battery as required to obtain specified voltage and observe current output.

IMPORTANT: Do not permit voltage to exceed 16 volts.

a. If current output is lower than specified, repair or replace the generator.

NOTE: If generator failure was caused by a defective stator or diode, no further checks are required on the system; however, if generator failure was caused by a defective field winding, the following checks must be made to locate possible damage to the regulator.

b. If current output is within limits listed in "Specifications" the generator is satisfactory.

3. Remove jumper lead, ammeter, and voltmeter from generator and connect wiring harness connector to generator "F" and "R" terminals and connect lead to "BAT" terminal on generator.

4. Make connections as shown in View B, Part 1, figure 15. Slide test prods into regulator connector body to make connections and do not leave jumper lead connected longer than five minutes.

NOTE: Voltmeter positive lead is connected to battery positive post and voltmeter negative lead is connected to No. 3 terminal on regulator. Jumper lead is connected between No. 2 and No. 3 terminals on the regulator.

a. Turn ignition or control switch on and record the voltage drop.

b. Make connections as shown in View B, Part 2, figure 15, and record the voltage drop.

NOTE: Voltmeter positive lead is connected to regulator mounting bolt and voltmeter negative lead is connected to battery negative post with jumper lead connected between No. 2 and No. 3 terminals on the regulator.

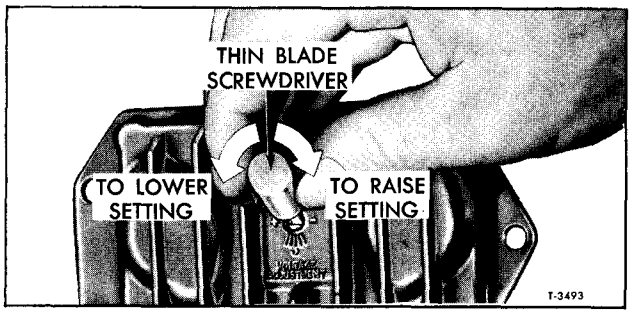


Figure 16—Adjusting Voltage Setting (Typical)

c. Add voltage in Step a. to voltage in Step b. above. If total voltage (a. + b.) is greater than .25 volt, check system wiring for high resistance.

d. If total voltage in Step c. is below .25 volt, remove jumper lead connected between regulator No. 2 terminal and No. 3 terminal and connect voltmeter between No. 3 terminal on regulator and ground as shown in View C, figure 15.

e. Start engine and run at approximately 1275 rpm for 15 minutes. Leave cover on regulator. Place a thermometer ¼-inch from regulator cover and compare voltage with "Specifications" given in "Temperature Voltage Chart" at end of this section.

f. If voltage is not within specified limits, remove access plug from regulator cover and note position of plastic screw slot beneath the plug. The slot will be aligned with one of the division lines cast on the cover. For each line the slot has been moved toward the "+" mark, add 0.3 volt to previous specified range for proper voltage limits, and for each division the slot has been moved toward "-" mark, subtract 0.3 volt from previous specified range for the proper specified voltage limits.

g. If actual regulating voltage is not within the voltage range specified for measured ambient temperature, repair or replace the regulator.

h. If actual regulating voltage as checked, is within the voltage range specified for the measured ambient temperature, the charging system operation is satisfactory; however, the regulator voltage setting must be changed to meet battery charging requirements.

5. To adjust voltage regulator setting, remove access plug from regulator cover and use a thin, flat-bladed instrument to turn the slotted adjuster (fig. 16).

NOTE: After two notches in each direction there is a positive stop.

a. To raise the voltage setting, turn slotted adjuster one notch (clockwise), then check for an improved battery condition after a service period of reasonable length.

b. To lower the voltage setting, turn slotted

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

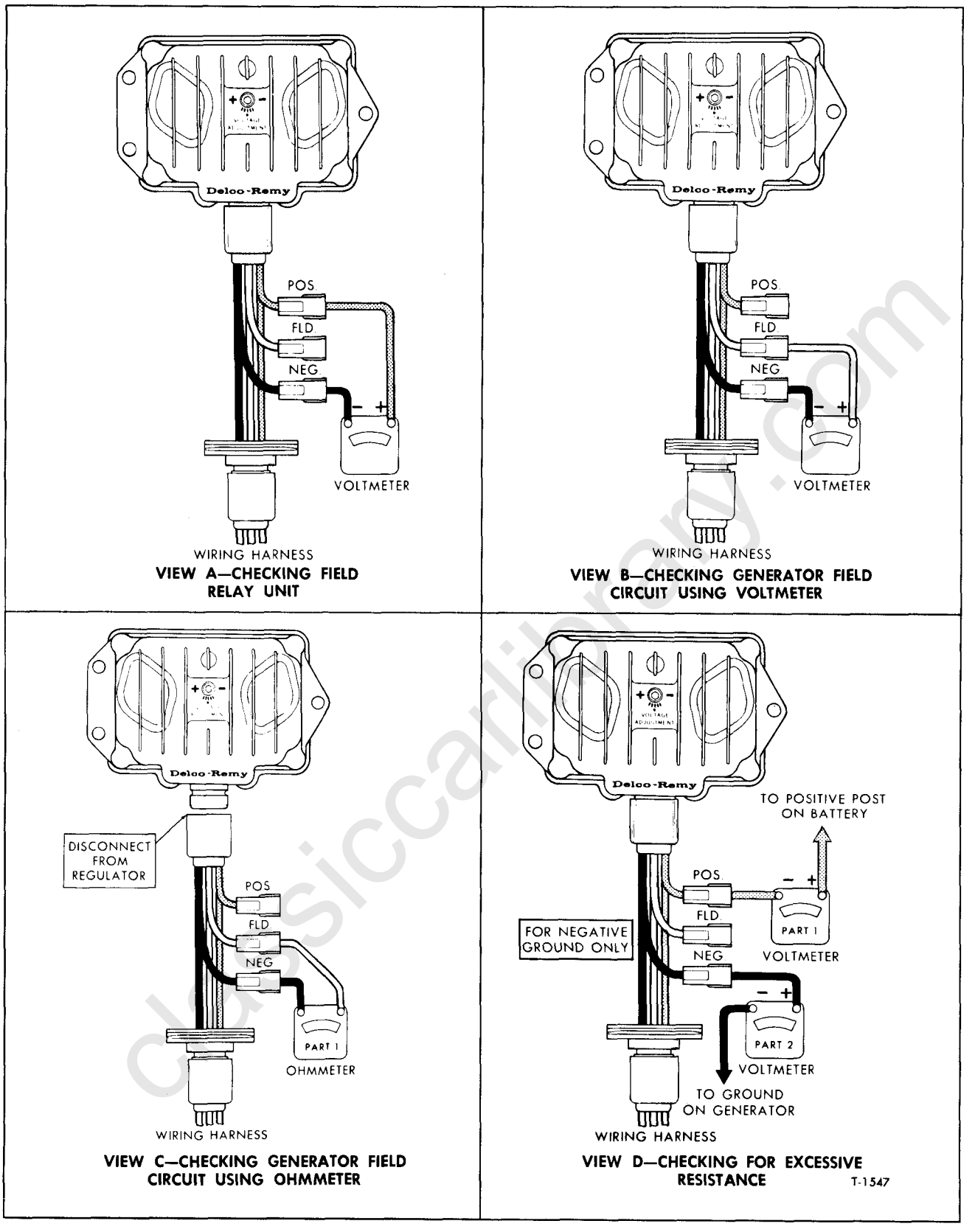


Figure 17—Using Adapter (J-21600) to Check Circuit with 9000590 Type Regulator

adjuster one notch counterclockwise, then check for an improved battery condition after a service period of reasonable length.

c. If the regulator cannot be adjusted to a value within the specified range, repair or replace the regulator.

REGULATOR CIRCUIT TEST (WITH 9000590 REGULATOR)

IMPORTANT: Observe the following test procedures in order listed. Improper connections and procedures may instantly damage the equipment.

NOTE: Test adapter (J-21600) may be used to facilitate making test connections at the regulator.

FIELD RELAY CHECK

1. Connect a voltmeter to test adapter as shown in View A, figure 17.

2. Make sure ignition or control switch is in "OFF" position.

3. Observe voltmeter reading.

a. If voltmeter indicates battery voltage, the field relay contacts are stuck closed and the relay must be replaced.

b. If voltmeter reads zero, proceed to Step 4.

4. Connect a jumper lead between field relay No. 1 terminal and No. 3 terminal. Slide test prods into connector body to make connections.

5. Turn ignition or control switch on.

a. If voltmeter reads battery voltage, proceed to "Field Circuit Check" later in this section.

b. If voltmeter reads zero, check for excessive resistance or an open circuit between battery and "BAT" terminal on generator, between battery and No. 3 relay terminal, between No. 1 terminal on relay and "POS" terminal on regulator, or between "NEG" terminal on regulator and ground.

FIELD CIRCUIT CHECK

1. Connect a voltmeter to test adapter (J-21600) as shown in View B, figure 17.

2. Turn ignition or control switch on.

3. If voltmeter reads 1 or 2 volts less than battery voltage, proceed to "Generator Output Check."

4. If voltmeter reads zero, the regulator is defective and must be repaired or replaced.

NOTE: Since the regulator defect may have been caused by a defective generator field, check the field as follows before installing a new regulator.

a. Turn ignition or control switch off and disconnect negative battery cable from battery. Disconnect test adapter from the regulator.

b. Connect an ammeter to the adapter as shown in View C, figure 17.

c. If ohmmeter reads high, there is an open, or excessive resistance in the field winding or in wiring between regulator "FLD" terminal and generator "F1" terminal.

d. If ohmmeter reads low, the winding is shorted or grounded.

NOTE: Since the reading is taken through the adapter, leads, brushes, and slip rings, the ohmmeter reading on a good field winding will be slightly higher than the specified value. This is because the specified value is for an ohmmeter reading directly across the slip rings.

e. Disconnect ohmmeter and connect negative battery cable to the battery.

5. If the voltmeter reads battery voltage, the regulator is shorted and must be replaced or repaired, or the generator field winding is open or grounded.

a. To check the field winding, follow procedures listed in a. through e. under Step 4 above.

b. To check the regulator, connect a voltmeter as shown in View A, figure 17, then start engine and operate at moderate speed. If voltage is uncontrolled and increases with speed to values above the specified setting range, replace or repair the regulator.

GENERATOR OUTPUT CHECK

NOTE: Check generator for specified output as follows:

1. Connect an ammeter in circuit at output "BAT" terminal on the generator.

2. Connect a voltmeter to the adapter as shown in View A, figure 17.

3. Turn on ignition or control switch.

4. Operate generator at specified speed and check for rated output as listed in "Specifications" at end of this section. Load battery with a carbon pile or vehicle accessories (if needed) to obtain rated output. If generator does not produce rated output, repair or replace the generator.

NOTE: After generator is installed on the vehicle, connect an ammeter in circuit at output "BAT" terminal of the generator and check for excessive resistance as follows:

EXCESSIVE RESISTANCE CHECK

NOTE: Excessive resistance in the sensing circuit consisting of leads from No. 1 and No. 3 terminals on the field relay and leads from "NEG" or "POS" terminals on the regulator can cause an overcharged battery. If trouble is *not* battery overcharge, refer to "Voltage Setting Adjustment" later in this section, otherwise proceed as follows:

1. Connect a voltmeter as shown in View D, Part 1 and Part 2 in figure 17.

2. Remove jumper lead from field relay unit, then connect a jumper lead from battery to No. 2 terminal on the relay. Disconnect lead after 60 seconds to prevent overheating.

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

3. Turn on ignition or control switch, but do not start engine.

4. If the two voltmeter readings total more than 0.3 volt, check for excessive resistance in leads between battery and field relay, between field relay and regulator, and between regulator and generator. If these leads are satisfactory, replace the relay.

5. Remove jumper lead connected between battery and No. 2 terminal on field relay and connect lead to No. 1 and No. 3 terminal on relay.

VOLTAGE SETTING ADJUSTMENT

NOTE: A voltage setting not tailored to meet vehicle requirements can result in an undercharged or overcharged battery. Adjust voltage setting as follows:

1. Connect a voltmeter to the adapter as shown in View A, figure 17.

2. Connect an ammeter in circuit at output "BAT" terminal on the generator.

3. Turn all accessories off.

4. Operate generator at approximately 3,000 rpm and check for rated output.

NOTE: Output should be at least 10 amperes below rated generator output for this check.

5. To adjust the voltage setting, remove plug from regulator cover and turn slotted adapter inside the regulator as follows:

NOTE: After two notches in each direction, there is a positive stop.

a. For an undercharged battery, raise voltage setting by turning adjuster one notch clockwise toward the "+" mark on cover.

b. For an overcharged battery, lower the voltage setting by turning the adjuster one notch counterclockwise toward the "-" mark on cover.

c. If regulator cannot be adjusted to a value within limits listed in "Specifications" at end of this section, replace the regulator.

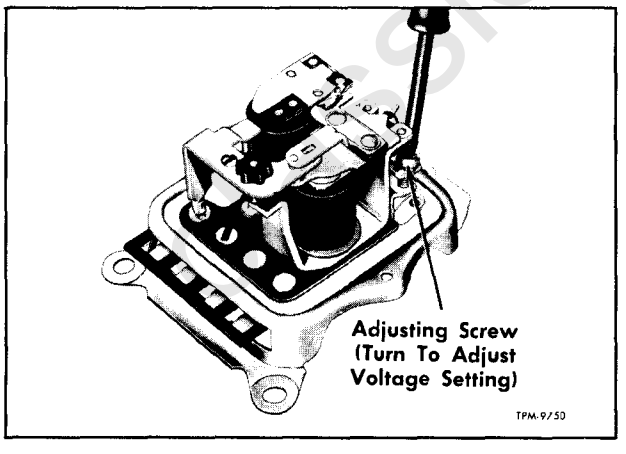


Figure 18—Adjusting Voltage Setting (Two-Unit Type Regulator) (Typical)

ADJUSTING REGULATOR VOLTAGE SETTING (WITH 1119507 OR 1119515 REGULATOR)

The proper voltage setting is attained when the battery remains fully charged with a minimum use of water.

The voltage at which the regulator operates varies with changes in regulator ambient temperature which is the temperature of the air measured at a distance of ¼-inch from the regulator cover.

Check and adjust voltage setting as follows:

1. Insert a test prod into wiring harness connector at regulator No. 3 terminal, then connect a voltmeter from the test prod to ground.

2. Disconnect negative battery cable from the battery and connect a ¼-ohm 25-watt resistor in series.

NOTE: In the event the battery is partially discharged, the resistor will limit generator output to 10 amperes or less which is required when checking and adjusting the voltage setting.

3. Secure a thermometer close to regulator cover to establish operating temperature; then with all accessories turned off and harness connected to regulator, start and operate engine at 1500 rpm for 15 minutes to establish regulator operating temperature.

IMPORTANT: Do not operate engine with battery disconnected.

4. Cycle the regulator by disconnecting, then connecting the wiring harness connector at the regulator.

5. Bring engine speed up to approximately 2500 rpm, note the ambient temperature and voltage setting and compare with applicable "Temperature Voltage Chart" in "Specifications" at end of this section.

6. Adjust voltage setting for the upper or shorting contacts as follows:

a. Disconnect wiring harness connector from regulator, then remove regulator cover and connect wiring harness connector to regulator.

b. Turn adjusting screw shown in figure 18, to adjust the voltage setting.

IMPORTANT: Ensure that spring holder is against head of adjusting screw. When turning the screw counterclockwise, turn until the screw head is approximately 1/8-inch above the holder, then pry holder up against screw head. Always turn screw clockwise to make final setting.

7. After adjusting the voltage setting, cycle the regulator by disconnecting, then connecting the wiring harness connector at the regulator.

8. Operate engine at approximately 2500 rpm and check the voltage setting. Adjust if necessary. Always cycle the regulator (Step 7) before reading the final voltage setting.

9. Check and adjust the voltage setting on the lower or series contacts as follows:

Slowly decrease the 2500 rpm value and observe the voltmeter. When operation changes from upper to lower contacts, voltmeter reading should suddenly decrease a few tenths of a volt. Compare difference in voltage readings with "Specifications" at end of this section.

IMPORTANT: Always remove wiring harness connector from regulator when removing or installing regulator cover to avoid accidental grounds and consequent damage to regulator.

10. If voltage operation is erratic, and if the regulator cannot be adjusted to a steady value, replace the regulator.

ADJUSTING REGULATOR VOLTAGE SETTING (WITH 1116374 OR 1116378 REGULATOR)

NOTE: Regulator voltage setting should be checked as explained previously under "Regulator Circuit Test - With 1116374 pr 1116378 Regulator."

VOLTAGE SETTING ADJUSTMENT

1. Remove access plug from regulator cover and use a thin-bladed screwdriver to adjust the voltage setting.

2. For an undercharged battery condition, turn the adjuster clockwise one notch (0.3 volt) to increase the setting.

NOTE: After two notches in each direction there is a positive stop.

3. For an overcharged battery condition turn the adjuster counterclockwise one notch (0.3 volt) to decrease the setting.

4. After adjusting the voltage setting, check for an improved battery condition after a service period of reasonable length. If necessary, repeat the above procedure for a higher or lower setting.

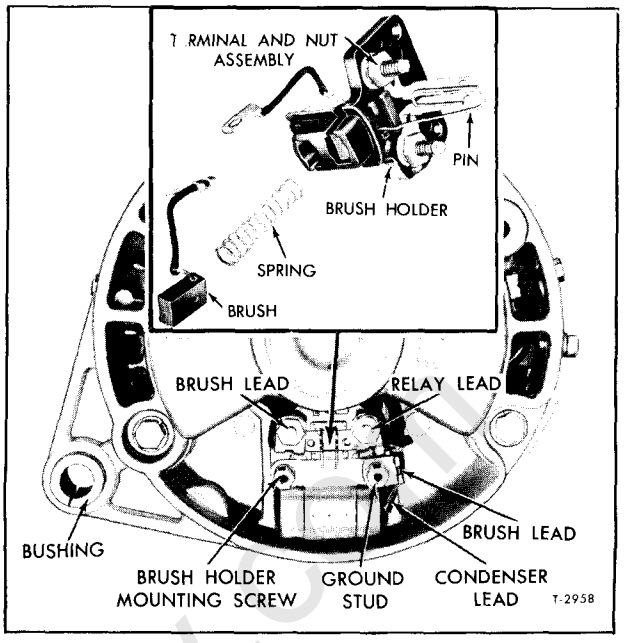


Figure 19—Generator Brush Replacement (Model 1117754 or 1117787)

SERVICE OPERATIONS

GENERATOR REPLACEMENT

Due to variations in design and equipment on vehicles using A.C. generators, the replacement procedures will vary accordingly. The removal and installation instructions following are intended only as a guide. Additional operations will be required on some vehicles to remove other equipment to permit access to generator, belts, and/or brackets.

GENERATOR REMOVAL

1. Disconnect negative battery cable from the battery.

CAUTION: It is important that battery negative terminal be disconnected, since generator will be damaged if wiring or terminals are accidentally shorted or grounded while being disconnected.

2. On 42-, 61-, and 62-amp generators, depress lock on connector and pull connector out of socket on generator. Pull rubber boot off "BAT" terminal and remove terminal nut. Disconnect wire from "GRD" terminal and remove wiring clip.

3. Loosen adjusting arm clamp bolt and generator to mounting bracket pivot bolts. Move generator to loosen drive belt(s) and remove from generator pulley.

4. Remove adjusting arm clamp bolt and generator to mounting bracket pivot bolts, then remove the generator.

GENERATOR INSTALLATION

IMPORTANT: Be sure negative battery cable is disconnected from battery. Failure to disconnect the negative battery cable may result in damage to the generator.

1. Attach generator to mounting bracket and install adjusting arm clamp bolt.

2. Place drive belt(s) over generator drive

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

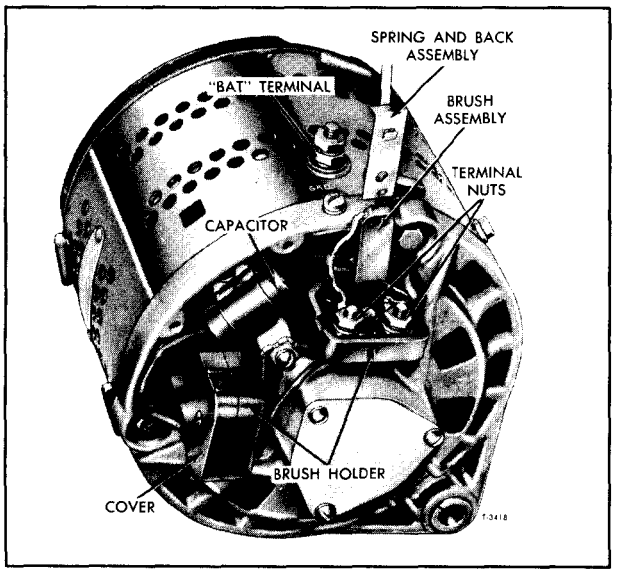


Figure 20—Generator Brush Replacement (Model 1117756 or 1117781) (Typical)

pulley and adjust belt tension as explained under "Drive Belt Tension Adjustment" previously. Tighten flange type lock nuts and mounting bolts to torque recommended in "Specifications" at end of this section.

3. On 42-, 61-, or 62-amp generators, push the wiring harenss connector into socket, making sure lock on connector engages end frame. Place harness clip on ground terminal marked "GRD" and connect ground wire to terminal.

4. Attach red wire to "BAT" terminal on generator and fit boot over terminal.

5. Perform "Generator Output Test" described previously to determine if generator is operating properly and that regulator is correctly adjusted.

GENERATOR BRUSH REPLACEMENT

NOTE: Brush replacement on 42- and 61-amp generator models requires partial disassembly of the generator and is considered a part of the unit overhaul procedure.

BRUSH REPLACEMENT
(MODEL 1117754 OR 1117787)

NOTE: Refer to figure 19.

1. Remove two screws which attach terminal connector to end frame and remove.

2. Remove nut retaining indicator light wire to connector and disconnect lead from post.

3. Remove two screws which attach condenser and brush holder to end frame.

NOTE: Condenser lead is connected inside the generator. Leave condenser with generator.

4. Remove brush holder, brushes, and brush springs from generator end frame.

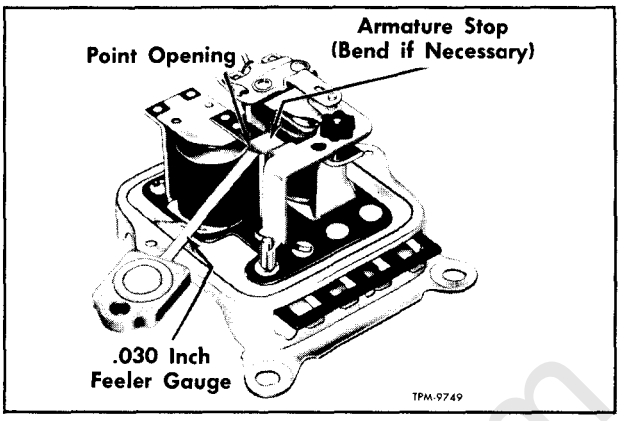


Figure 21—Adjusting Field Relay Contact Points (Two-Unit Type Regulator)

NOTE: If brushes are 1/8-inch or shorter in length, replace the brushes.

5. Position brush springs and brushes in brush holder and insert a pin through hole in brush holder and brushes to retain in position.

6. Position brush holder and brushes in end frame. Secure brush and condenser leads to terminals as shown in figure 19.

7. Install brush holder mounting screws and tighten firmly.

8. Remove pin from brush holder and check to be sure all leads are properly connected. Install cover over brush holder.

BRUSH REPLACEMENT
(MODEL 1117756 OR 1117781)

NOTE: Refer to figure 20.

1. Remove cover from brush holder.

2. Remove nuts and washers from brush terminals.

3. Press down and in on brush spring and back assembly to disengage from holder. Lift brush assemblies out of cavities in brush holders.

NOTE: If brushes are 3/8-inch or shorter in length replace the brushes.

4. Position brush assemblies in cavities in brush holder as shown in figure 20.

5. Attach brush leads to terminals and secure with nuts and washers. Tighten nuts firmly.

6. Position a brush spring and back assembly over each brush, then press down on spring and back assembly to engage lock tangs in brush holder.

7. Position cover over brush holder and secure with screw.

REGULATOR REPLACEMENT

REMOVAL

1. Disconnect negative battery cable.

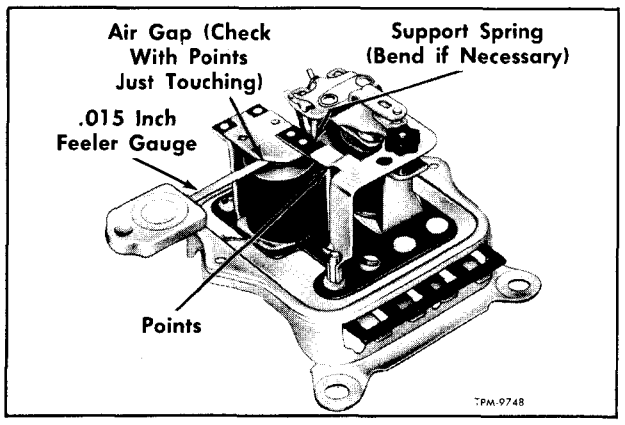


Figure 22—Adjusting Field Relay Air Gap (Two-Unit Type Regulator) (Typical)

2. On vehicles equipped with the 9000590 type regulator, carefully pull wiring harness connector from regulator.

3. On all other vehicles, lift up on regulator wiring harness connector, then pull connector from regulator.

4. Remove regulator mounting screws and remove the regulator.

INSTALLATION

IMPORTANT: Make sure the negative battery cable is disconnected from the regulator.

1. Place regulator-to-generator ground wire on regulator mounting and install regulator attaching screws.

2. On vehicles equipped with the 9000590 regulator, insert wiring harness connector into regulator receptacle. Make sure connector is fully engaged with terminals.

3. On all other vehicles, lift up on regulator terminal latch and insert harness connector over terminals. Make sure connector is fully engaged over terminals and locked in position.

4. Connect negative battery cable to battery.

REGULATOR REPAIR (MODEL 1119507 OR 1119515)

While most regulator adjustments are made on the vehicle as outlined under "On-Vehicle Maintenance, Tests, and Adjustments" previously, the regulator may be removed for field relay point opening and air gap adjustment.

IMPORTANT: The voltage regulating contacts should never be cleaned as they are made of special material that may be destroyed by cleaning.

FIELD RELAY ADJUSTMENT

1. Referring to figure 21, insert an 0.030-inch feeler gauge between the contact points with the armature in its normal rest position.

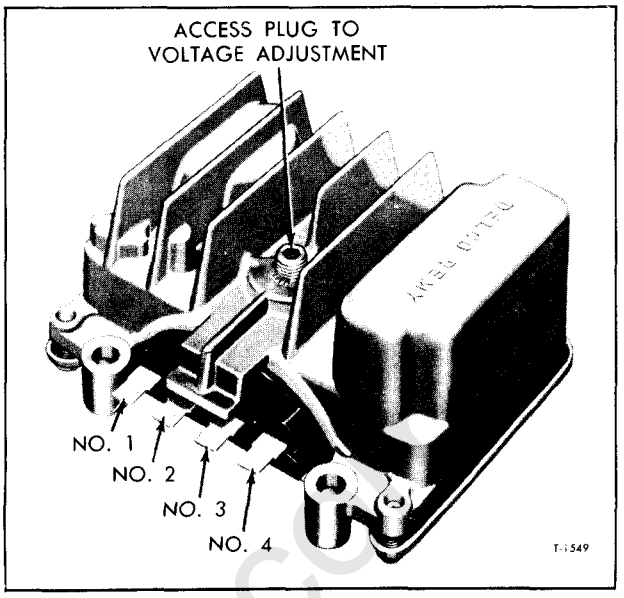


Figure 23—Transistorized Type Regulator (Typical)

2. If adjustment is necessary, carefully bend the armature stop.

3. Referring to figure 22, insert an 0.015-inch feeler gauge between the armature and core and exert just enough pressure on the armature to allow it to touch the gauge. The contact set should just close at this time.

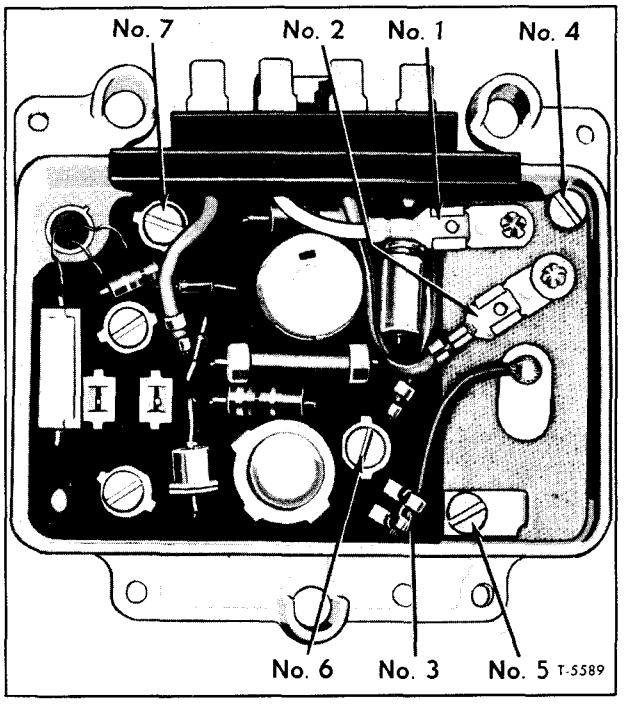


Figure 24—Regulator with Cover Removed

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

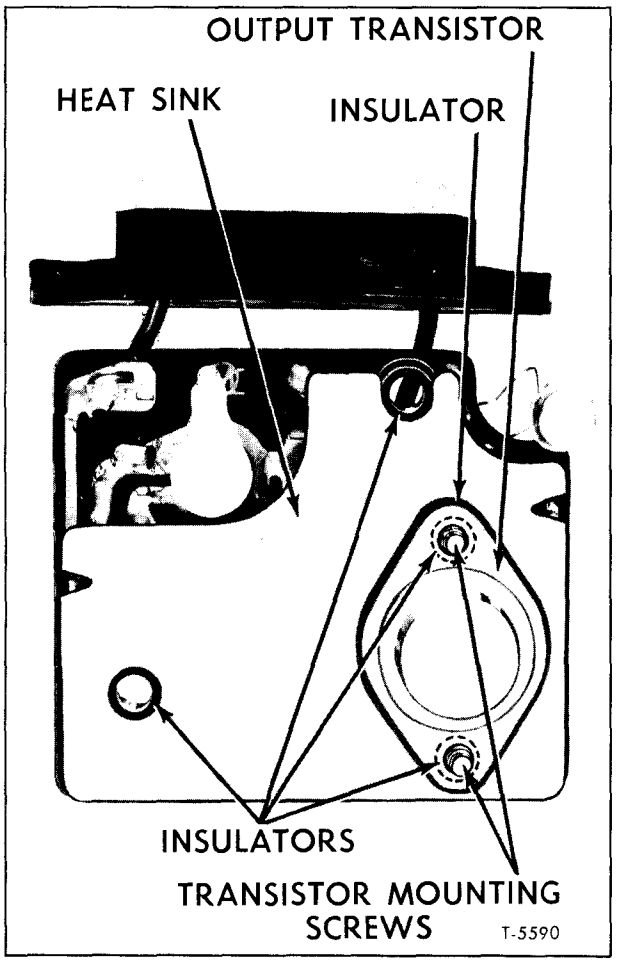


Figure 25—Heat Sink and Circuit Board Assembly

NOTE: The air gap normally need not be adjusted. If the point opening and closing voltages are within limits listed in "Specifications" at end of this section, the relay will operate satisfactorily even though the air gap may not be exactly according to specifications.

4. If adjustment is necessary, bend the flat contact support spring.

REGULATOR REPAIR (MODEL 1116374 OR 1116378)

To check the regulator (fig. 23) for defective components proceed as follows:

1. Remove four screws which attach cover to base plate and remove the cover.

2. Referring to figure 24, remove leads from terminals 1, 2, and 3, then remove screws 4 and 5 which attach relay to base and remove relay.

3. Remove screws (6 and 7, fig. 24), then lift circuit board, heat sink and terminal assembly from the regulator base.

4. Note the insulation between the output transistor and heat sink, and the insulators separating the heat sink from the panel board (fig. 25).

5. Remove screws which attach transistor to panel board and separate the transistor and heat sink and insulators from the panel board.

6. Visually inspect all copper traces on the panel board for opens and for shorts or grounds which could be caused by solder runs.

NOTE: An ohmmeter having a 1½-volt cell, which is the type usually found in service stations, is recommended for checking transistors and parts

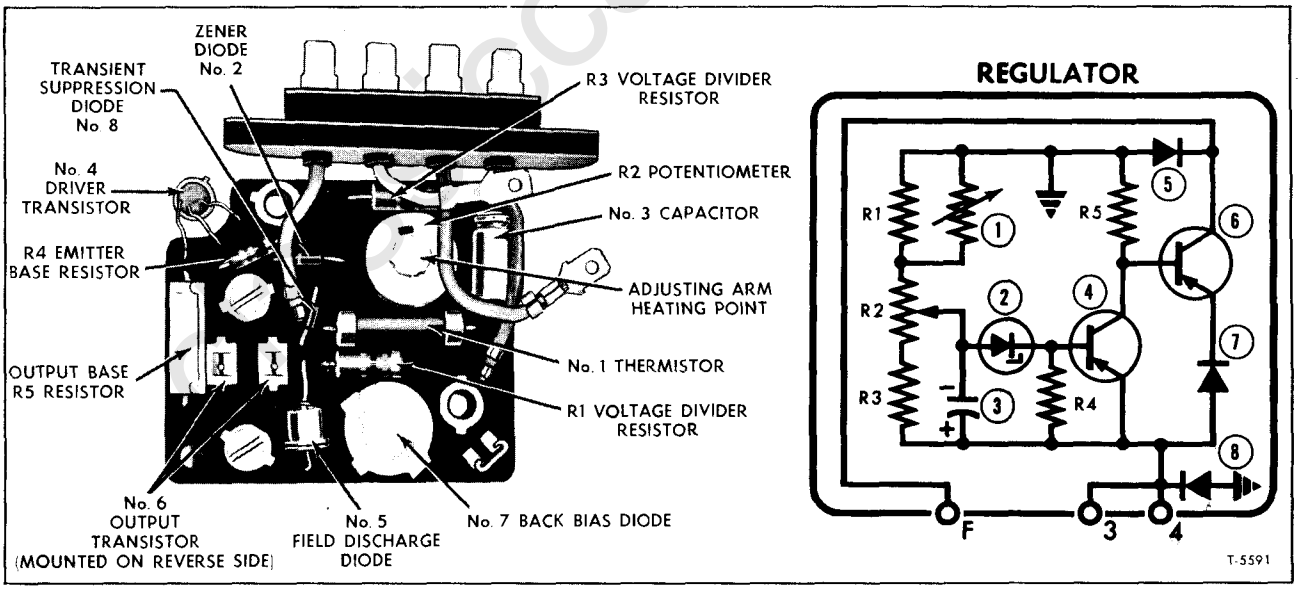


Figure 26—Component Parts of Panel Board Assembly

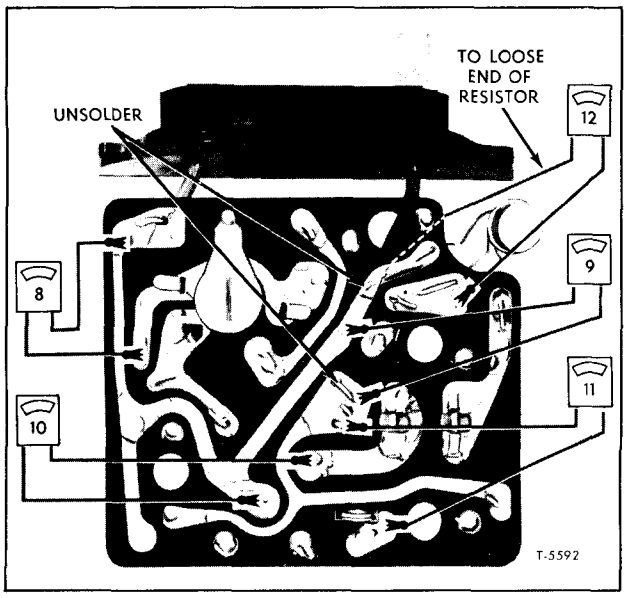


Figure 27—Checking Regulator Circuits

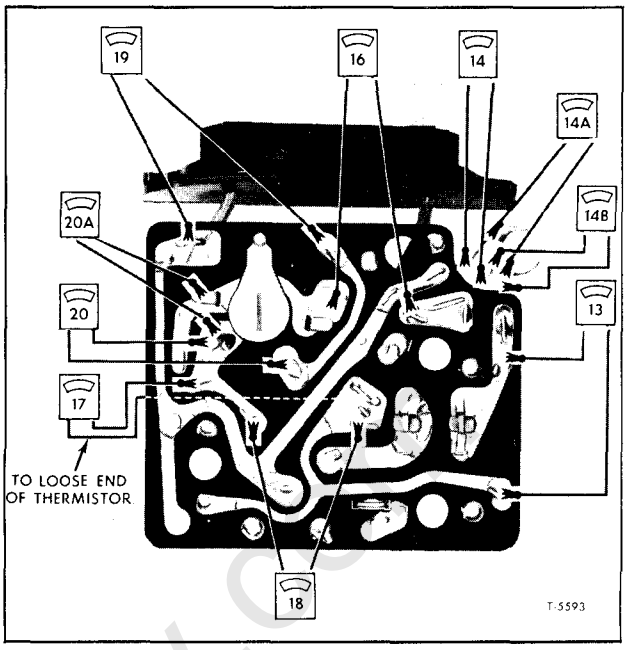


Figure 28—Checking Regulator Circuits

of the panel board. The low range scale on the ohmmeter should be used.

If a component part on the panel board is found to be faulty, it should be replaced before proceeding with the remaining checks. A 25-watt soldering gun is recommended, and a 60% tin 40% lead solder should be used when re-soldering. Avoid excessive heat which may damage panel board traces. Component parts are identified in figures 25 and 26.

In all of the following checks, connect the ohmmeter as shown, then reverse ohmmeter leads to obtain a second reading:

NOTE: Refer to figures 25 and 26 for identification and location of following connections:

7. To check component parts of the panel board, it is necessary to carefully unsolder the specific connections at points shown in figure 27.

FILTER CAPACITOR
(PART 8, Fig. 27)

If both ohmmeter readings are zero, the capacitor is defective. Visually inspect for open soldered connections and broken leads. To assemble a new capacitor properly, note location of the "+" identifying mark in figure 26.

TRANSIENT SUPPRESSION DIODE
(PART 9, Fig. 27)

If the two ohmmeter readings are identical, the diode is faulty.

BACK BIAS DIODE
(PART 10, Fig. 27)

Replace the diode if both readings are zero, if both readings are infinite, or if both readings are identical.

FIELD DISCHARGE DIODE
(PART 11, Fig. 27)

Replace the diode if both readings are zero, if both readings are infinite, or if both readings are identical.

EMITTER BASE RESISTOR (IF USED)
(PART 12, Fig. 27)

Connect ohmmeter as shown. If the reading is infinite, the resistor is open and must be replaced.

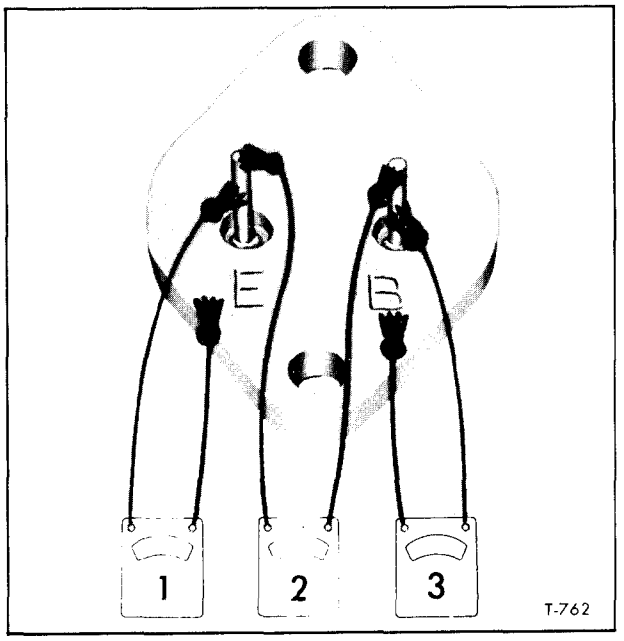


Figure 29—Checking Transistors for Shorts

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

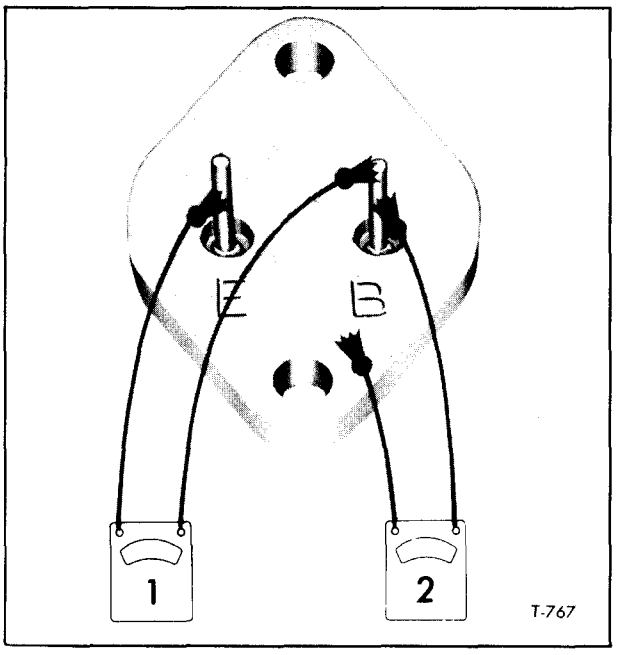


Figure 30—Checking Transistors for Opens

OUTPUT BASE RESISTOR
(PART 13, Fig. 28)

If one reading is infinite or nearly infinite, or if both readings are infinite or nearly infinite, the resistor is open.

DRIVER TRANSISTOR
(PART 14, 14A, 14B, Fig. 28)

If both readings in Step 14 are zero or if both readings are very low and identical, the transistor is shorted and must be replaced. Similarly, if both readings in Step 14A or 14B are zero or very low and identical, the transistor is shorted.

If both readings in Step 14 or 14B are infinite, or if both readings are very high and identical, the transistor is open and must be replaced.

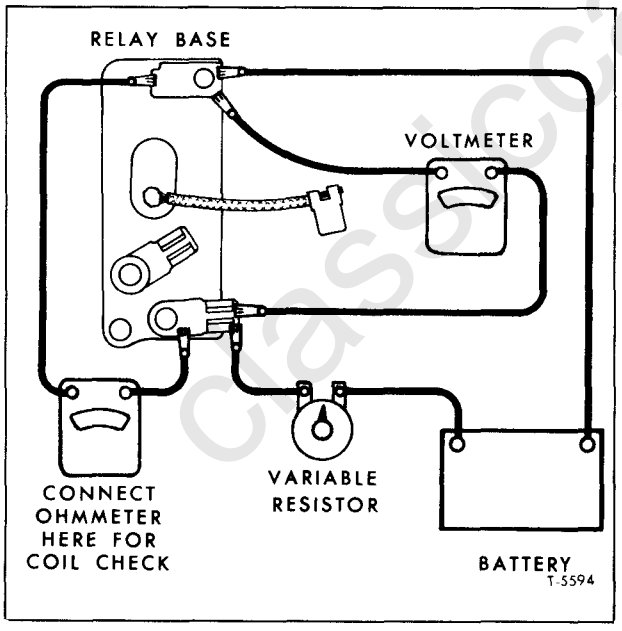


Figure 31—Field Relay Unit Check

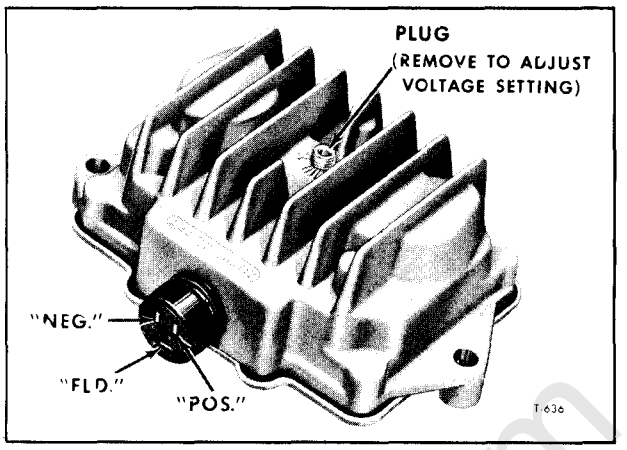


Figure 32—Full Transistor Type Regulator

OUTPUT TRANSISTOR
(PART 15, Figs. 29 and 30)

In figure 29, if both readings in Step 1 are zero, or if both readings are very low and identical, the transistor is shorted. Similarly, if both readings in Step 2 or Step 3 are zero or very low and identical, the transistor is shorted.

In figure 30, if both readings in Step 1 are infinite, or if both readings are very high and identical, the transistor is open. Similarly, if both readings in Step 2 are infinite or very high and identical, the transistor is open.

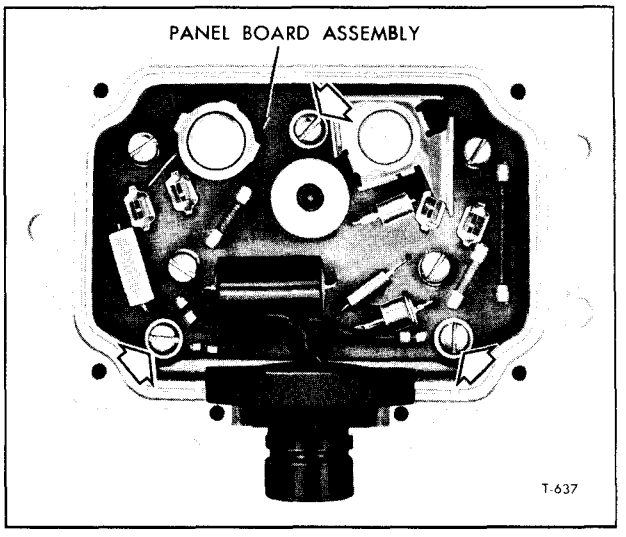


Figure 33—Regulator with Bottom Plate Removed

IMPORTANT: Replacing any of the previous components should not affect the voltage setting. If any of the following components require replacement, adjust the voltage setting as explained under "Regulator Voltage Adjustment" later in this section.

ZENER DIODE
(PART 16, Fig. 28)

If both readings are infinite or if both readings are identical, replace the diode.

THERMISTOR
(PART 17, Fig. 28)

Connect the ohmmeter as shown in figure 25. If the reading is infinite, the thermistor is open and should be replaced.

VOLTAGE DIVIDER RESISTOR R-1
(PART 18, Fig. 28)

If one reading is infinite or nearly infinite, or if both readings are infinite or nearly infinite the resistor is open and should be replaced.

VOLTAGE DIVIDER RESISTOR R-3
(PART 19, Fig. 28)

If one reading is infinite or nearly infinite, or if both readings are infinite or nearly infinite, the resistor is open and should be replaced.

POTENTIOMETER
(PART 20 AND 20A, Fig. 28)

If one reading is infinite or nearly infinite when connected as shown in Part 20, the potentiometer is open. If one reading is infinite or nearly infinite when connected as shown in Part 20A, the potentiometer is open.

NOTE: When installing a new potentiometer, locate the adjusting lever in a vertical position (fig. 26), turn the potentiometer resistance adjustment to the middle position, then use a soldering iron to melt the lever into potentiometer.

REGULATOR UNIT RELAY (MODEL 1116374 OR 1116378)

The relay unit may be checked as follows. Refer to figure 31 for test connections.

1. Connect an ohmmeter across terminals as shown in figure 31. An infinite reading indicates an open shunt coil which will require replacing the relay.

2. To check closing voltage, connect a battery, 50 ohm variable resistor and voltmeter into circuit as shown in figure 31. Slowly decrease resistance and note voltage at which relay points close. If voltage at which points close is not within limits listed in "Specifications" replace the relay.

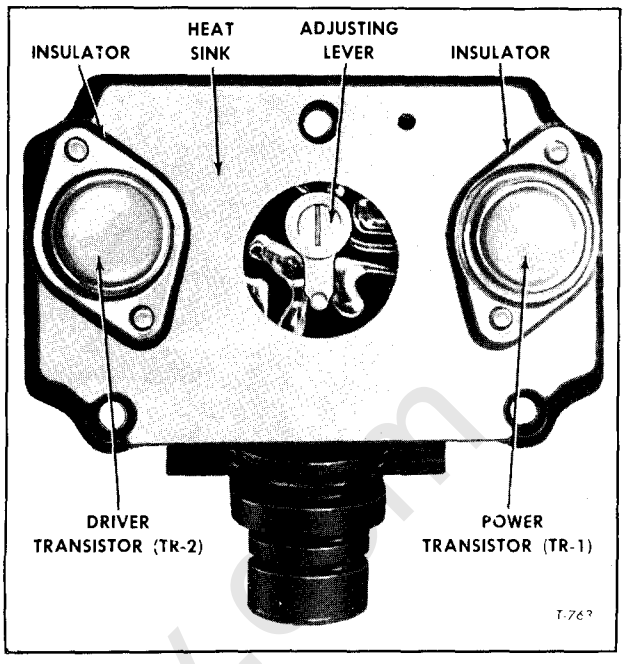


Figure 34—Top Side of Panel Board Assembly

REGULATOR VOLTAGE ADJUSTMENT (MODEL 1116374 OR 1116378)

After replacing any components in Part 16 through 20 previously, regulator voltage must be calibrated to compensate for variations in operating characteristics between components. The voltage setting must be precise to maintain system voltage within limits listed in "Specifications" at end of this section.

1. Carefully apply soldering iron to lever of potentiometer at point shown in figure 26, then disconnect lever from opposite side of panel board while heat is being applied.

2. Use a small screwdriver to position center portion of potentiometer in middle position.

3. With regulator assembled, except for bottom cover plate and potentiometer lever, connect the generator, regulator, and battery into circuit. Connect a test ammeter between battery post and battery lead.

4. Drive generator at 6,000 rpm with an electric load of 15 to 20 amperes.

NOTE: A carbon pile resistor may be required across battery posts to obtain required amperage.

5. Connect a test voltmeter between regulator No. 3 terminal and ground.

6. Adjust center position of potentiometer to obtain a voltage setting of 14.4 volts at regulator. Voltage will require readjustment every five minutes until voltage becomes stable. Normally 15 to 20 minutes will be required for this process.

NOTE: This voltage is based on the assumption that regulator is being set on a test bench at

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

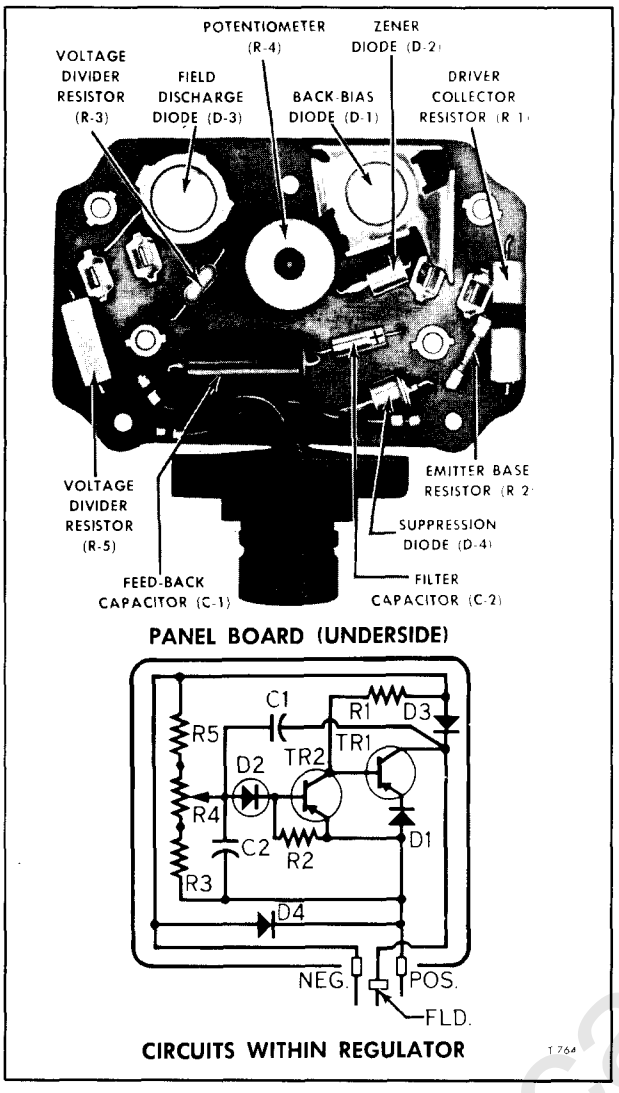


Figure 35—Under Side of Panel Board Assembly

normal room temperature. If regulator is being set on the vehicle, voltage should be set 0.1 volt lower than the middle range given in "Specifications" to compensate for the higher ambient temperature.

7. Remove the panel board, heat sink and terminal assembly from regulator case. Insert lever into potentiometer so that it will mate with middle position of adjustment slots in regulator case. Use a soldering iron to melt adjustment lever into potentiometer.

8. Assemble regulator components into the case and attach cover plate.

REGULATOR REPAIR (MODEL 9000590)

To check the regulator (fig. 32) for defective components, proceed as follows:

1. Remove the bottom plate from the regulator (fig. 33).

2. Remove the three panel board attaching screws identified by arrows (fig. 33), and lift the assembly from the housing.

3. To aid in reassembly, note or make any identifying markings on the two transistors and their respective locations on the panel board and heat sink assembly (fig. 35).

4. Note the insulators between the transistors and the heat sink, and the insulators separating the heat sink from the panel board (fig. 35).

5. Remove the transistor attaching screws, and separate the transistors and heat sink from the panel board.

With the transistors separated from the assembly, an ohmmeter may be used to check the transistors and components on the panel board for defects. An ohmmeter having a 1½-volt cell, which is the type usually found in service stations, is recommended. The low range scale on the ohmmeter should be used.

If a component part of the panel board is found to be faulty, it should be replaced before proceeding with the remaining checks. A 25-watt soldering gun is recommended, and a 60% tin, 40% lead solder should be used when resoldering. Avoid excessive heat which may damage the panel board. Chip away any epoxy involved, and apply new epoxy which is commercially available. The component parts are identified in figures 34 and 35.

In order to check the panel board assembly, it is necessary to unsolder the emitter-base resistor at location shown in figure 36.

In all of the following checks, connect the ohmmeter as shown, then reverse ohmmeter leads to obtain two readings.

NOTE: Refer to figures 34 and 35 for identification and location of following components:

FEED-BACK CAPACITOR (C1),
(PART A, Fig. 36)

If both readings are zero, the capacitor is defective. Visually inspect for open soldered connections and broken leads.

FILTER CAPACITOR (C2),
(PART B, Fig. 36)

If both readings are zero, the capacitor is defective. Visually inspect for open soldered connections and broken leads. To assemble a new capacitor properly, note location of the "+" identifying mark in figure 35.

SUPPRESSION DIODE (D4),
(PART C, Fig. 36)

If the two readings are identical, the diode is faulty.

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

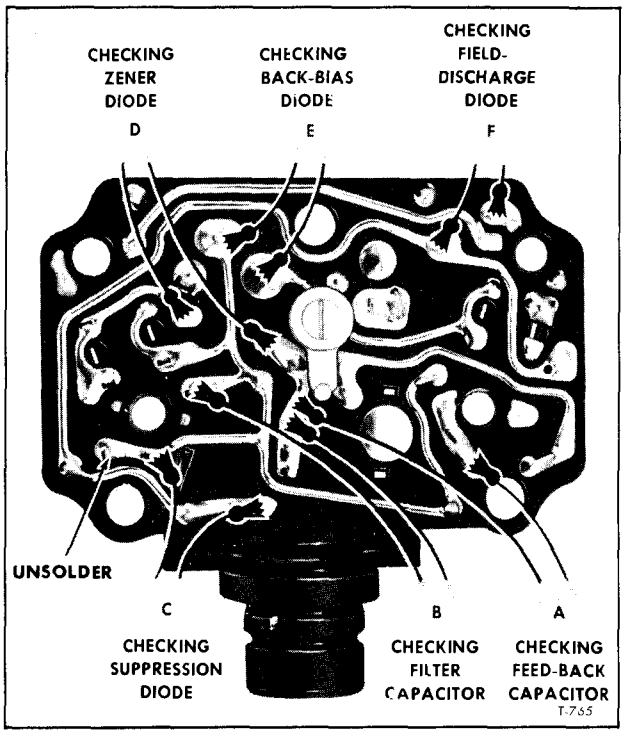


Figure 36—Checking Regulator Circuits

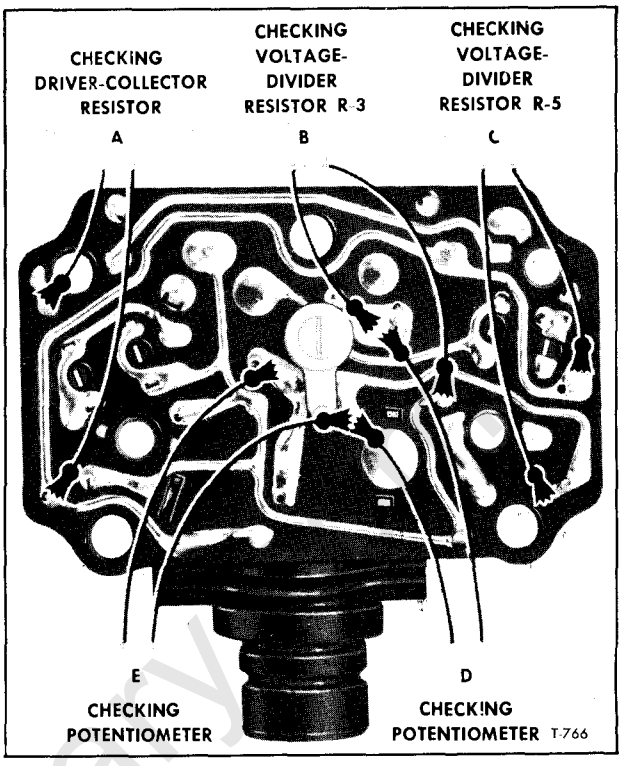


Figure 37—Checking Regulator Circuits

ZENER DIODE (D2),
(PART D, Fig. 36)

Replace the diode if both readings are zero, or if both readings are infinite.

BACK-BIAS DIODE (D1),
(PART E, Fig. 36)

Replace the diode if both readings are zero, if both readings are infinite or identical.

FIELD-DISCHARGE DIODE (D3),
(PART F, Fig. 36)

Replace the diode if both readings are zero, if both readings are infinite, or if both are identical.

DRIVER-COLLECTOR RESISTOR
(PART A, Fig. 37)

If both readings are infinite, the resistor is open.

VOLTAGE-DIVIDER RESISTOR (R3),
(PART B, Fig. 37)

If one reading is infinite or nearly infinite, or if both readings are infinite or nearly infinite, the resistor is open.

VOLTAGE DIVIDER RESISTOR (R5),
(PART C, Fig. 37)

If one reading is infinite or nearly infinite, or if both readings are infinite or nearly infinite, the resistor is open.

POTENTIOMETER
(PARTS D AND E, Fig. 37)

If one reading is infinite or nearly infinite in Part D, the potentiometer is open. If both readings are infinite in Part E, the potentiometer is open.

NOTE: When installing a new potentiometer, mount on panel board and turn the potentiometer adjustment to the middle position. Then, after all tests have been completed and the unit has been assembled as shown in figure 34, connect the regulator to a generator and adjust the potentiometer to 14 volts. With the adjustment lever in a vertical position (fig. 34) use a soldering iron to melt the adjusting lever into the potentiometer.

EMITTER-BASE RESISTOR
(OHMMETER CHECK NOT ILLUSTRATED)

Since the resistor has been unsoldered from the panel board at one end, merely connect an ohmmeter across the resistor - an infinite reading indicates an open. Replace if defective.

DRIVER AND POWER TRANSISTORS
(Refer to Fig. 29)

If both readings in Step 1 are zero, or if both readings are very low and identical, the transistor is shorted. Similarly, if both readings in Step 2, or in Step 3, are zero or very low and identical, the transistor is shorted.

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

DRIVER AND POWER TRANSISTORS (TR-1 AND TR-2), (Refer to Fig. 30)

If both readings in Step 1 are infinite, or if both readings are very high and identical, the transistor is open. Similarly, if both readings in Step 2 are infinite or very high and identical, the transistor is open.

REASSEMBLY AND FINAL CHECK

During assembly, coat with silicone grease both sides of the flat insulators used between the transistors and heat sink, and also the heat sink on the side on which the transistors are mounted. The silicone grease increases heat conduction.

NON-INTEGRAL TYPE ALTERNATING CURRENT GENERATOR SPECIFICATIONS

GENERATOR MODEL	1100842	1100849	1117754	1117756
Make	Delco-Remy	Delco-Remy	Delco-Remy	Delco-Remy
Series	10DN	10DN	20DN	20DN
Type	100	100	150	250
Rotation (Viewing Drive End)	Clockwise	Clockwise	Clockwise	Clockwise
Field Current at 80°F.				
Amps.	2.2-2.6	2.2-2.6	4.1-4.6	4.1-4.6
Volts	12	12	12	12
Cold Output at Specified Volts				
Specified Volts	14	14	14	14
Amps.	28	33	20*	20*
Generator RPM (Approx.)	2000	2000	1100	1100
Amps.	40	58	55*	55*
Generator RPM (Approx.)	5000	5000	2500	2500
Rated Hot Output	42	61	62	62

GENERATOR MODEL	1117781	1117787	
Make	Delco-Remy	Delco-Remy	
Series	20DN	20DN	
Type	255	155	
Rotation (Viewing Drive End)	Clockwise	Clockwise	
Brush Spring Tension (Oz.)	—	—	
Field Current at 80°F.			
Amps.	4.1-4.6	4.1-4.6	
Volts	12	12	
Cold Output at Specified Volts			
Specified Volts	14	14	
Amps.	20*	20*	
Generator RPM (Approx.)	1100	1100	
Amps.	55*	55*	
Generator RPM (Approx.)	2500	2500	
Rated Hot Output	62	62	

*If Generator Output is Checked Without a Regulator, Output Should Be 5-10% Higher Than Value Given.
**At Maximum Operating Speed.

TWO-UNIT TYPE VOLTAGE REGULATOR

Make	Delco-Remy	Delco-Remy
Model	1119507	1119515
Field Relay		
Air Gap (In.) (a)	0.015	0.015
Point Opening (In.)	0.030	0.030
Closing Voltage Range	3.8-7.2	1.5-3.2
Voltage Regulator		
Air Gap (In.) (Approx.) (b)	0.067	0.067
Point Opening (In.)	0.014	0.014
Voltage Chart	No. 1	No. 1

(a) Tolerance Plus or Minus 20%
(b) Make Final Adjustment as Per Text

NON-INTEGRAL TYPE ALTERNATING CURRENT GENERATOR SPECIFICATIONS (CONT.)

TEMPERATURE—VOLTAGE CHART* NO. 1

Degrees F.	65	85	105	125	145	165	185
Voltage Setting	13.9-15.0	13.8-14.8	13.7-14.6	13.5-14.4	13.4-14.2	13.2-14.0	13.1-13.9

*Operation on lower contacts must be 0.05-0.4 Volt lower than on upper contacts.

TRANSISTORIZED TYPE VOLTAGE REGULATOR

Make	Delco-Remy	Delco-Remy
Model	1116374	1116378
Field Relay		
Closing Voltage Range	4.5-8.0	2.0-4.0
Voltage Chart (a)	No. 2	No. 2

(a) Allowable Range at "0" Position of Adjusting Screw.

TEMPERATURE—VOLTAGE CHART NO. 2

Regulator Ambient Temp. (Deg. F.)	65	85	105	125	145	165	185
Voltage Setting	14.1-14.8	13.9-14.7	13.7-14.5	13.6-14.3	13.4-14.2	13.2-14.0	13.1-13.8

FULL TRANSISTOR TYPE VOLTAGE REGULATOR
(MODEL 9000590)

Make	Delco-Remy
Voltage Setting*	13.7-14.3

*Allowance Range at "0" Position of Adjusting Screw.

FIELD RELAY UNIT SPECIFICATIONS

Relay Model	**1115827**	**1115841**
Make	Delco-Remy	Delco-Remy
Air Gap at Core (Points closed) (In.)	0.011-0.018	0.012
Point Opening (In.)	0.020-0.030	0.015-0.025
Closing Voltage Range	2.5-3.5	7-8
Sealing Voltage Range	0-1 Volt-above closing	10 Max.

A. C. GENERATING SYSTEM (NON-INTEGRAL TYPE)

NON-INTEGRAL TYPE ALTERNATING CURRENT GENERATING SYSTEM TORQUE SPECIFICATIONS

ITEM	TYPE OF PART	TORQUE (FT. LBS.)
Generator Pulley Nut		
Except with 61-Amp. Generator	Nut	60-65
With 61-Amp. Generator	Nut	50-60
Adjusting Arm to Generator Bolt		
With 42-Amp. Generator	Bolt	20-25
With 61-Amp. Generator		
HM/JM/TM/WM-80	Bolt	6-8
RM-80	Bolt	15-20
TV-70	Bolt	20-25
With 62-Amp. Generator (Model 1117754)		
Except HN/JN-90	Bolt	25-30
HN/JN-90	Bolt	35-45
With 62-Amp. Generator (Model 1117756)		
Except DC/DN/FC/FN-90	Bolt	25-30
Series DC/DN/FC/FN-90	Bolt	35-45
With 62-Amp. Generator (Model 1117781 or 1117787)	Bolt	25-30
Adjusting Arm to Engine or Mounting Bracket		
With 42-Amp. Generator	Bolt	25-30
With 61-Amp. Generator (Model 1100849)		
HM/TM/WM-80	Bolt	20-30
HV/JV-70	Bolt	25-30
RM-80	Bolt	15-20
TV-70	Bolt	40-50
With 62 Amp. Generator (Model 1117754)		
Except HN/JN-90	Bolt	25-30
Series HN/JN-90	Bolt	70-80
With 62-Amp. Generator (Model 1117756)		
Except DC/DN/FC/FN-90	Bolt	25-30
Series DC/DN/FC/FN-90	Bolt	70-80
With 62 Amp. Generator (Model 1117781)	Bolt	25-30
With 62-Amp. Generator (Model 1117787)	Bolt	25-30
Generator to Mounting Bracket or Support		
Bracket Pivot Bolt		
With 42-Amp. Generator	Nut	25-30
With 61-Amp. Generator		
HV/JV/TV-70; RM-80	Nut	15-20
HM/TM/WM-80	Nut	20-30
With 62-Amp. Generator (Model 1117754)		
Except HN/JN-90	Nut	25-30
Series HN/JN-90	Bolt	70-80
With 62-Amp. Generator (Model 1117756)		
Except Series 90	Nut	25-30
Series DH/DI/FH/FI-90	Nut	35-45
Series DC/DN/FC/FN-90	Bolt	70-80
With 62-Amp. Generator (Model 1117781 or 1117787)	Nut	25-30
Generator to Support Bracket Bolt	Bolt	25-30
Generator Support Bracket to Mounting Bracket		
Series RM-80 with 130-Amp. Generator	Bolt	40-50
Series HI/JI/DH/FH-90		
With 1117756 Generator	Bolt	25-30
Series MH-90 with 1117781 or 1117787 Generator	Bolt	25-30
Generator Mounting Bracket to Engine		
With 42-, or 61-Amp. Generator	Bolt	40-50
With 62-Amp. Generator (Model 1117754)		
HM/JM/RM/TM/WM-80	Bolt	40-50
HE/JE/TE-90	Bolt	40-50
HI/JI/MI-90	Bolt	25-30
HN/JN-90	Bolt	35-45
With 62-Amp. Generator (Model 1117756)		
HI/JI/DI/FI-90	Bolt	25-30
DC/DN/FC/FN-90	Bolt	35-45
DH/FH-90	Bolt	40-50
With 62-Amp. Generator (1117781 or 1118887)	Bolt	40-50

Alternating Current Generating System

(INTEGRAL TYPE)

The integral (generator with solid state regulator built in) alternating current type generating system is used as standard and optional equipment on vehicles shown in the Model Application Chart below.

Information applicable to the integral-type alternating current generating system remains the same as covered under "INTEGRAL TYPE ALTERNATING CURRENT GENERATING SYSTEM" in ENGINE ELECTRICAL (SEC. 6Y) in the Heavy Duty Truck Service Manual ST135-70, except as follows:

MODEL APPLICATION CHART

AMPERAGE		TRUCK SERIES	GENERATOR
STANDARD			
75-AMP.	Delco-Remy	HM-80;HC/HH/JB/JC/JH/MB/MC90	1117225
75-AMP.	Delco-Remy	DB/DC/DN/FB/FC/FN90	1117225
75-AMP.	Delco-Remy	DH/DI/DP/FH/FI90	1117231
OPTIONAL			
145-AMP.	Delco-Remy	RM80	1117143
105-AMP.	Leece-Neville	DH/DI/FH/FI90	655988

STANDARD 75-AMP. INTEGRAL TYPE GENERATING SYSTEM

GENERAL DESCRIPTION

The basic charging system components include the battery, the self-rectifying, integral-type alternating current generator having a built-in regulator, and interconnecting wiring. An ammeter and/or voltmeter type charge indicator is used on all vehicles equipped with the integral type generating system.

The generator features a solid state regulator mounted inside the generator slip ring end frame. All regulator components are enclosed in a solid mold. This unit, is attached to the slip ring end frame. The regulator voltage setting can be adjusted as explained later in this section.

The generator is air-cooled by a fan attached to the drive end. The rotor bearings contain a supply of lubricant sufficiently adequate to eliminate the need for periodic lubrication.

The stator is composed of a large number of windings assembled on the inside of a laminated core that forms a part of the generator frame. A rectifier bridge connected to the stator windings contains six diodes, and electrically changes the stator A.C. voltage to a D.C. voltage which appears at the generator output terminal. Generator field current is supplied through a diode trio connected to the stator windings. A capacitor, or condenser, mounted in the end frame, protects the rectifier bridge and the diode trio from high voltage and suppresses radio noise.

The specially designed output terminal is connected directly to the battery. The red output terminal lead must be connected to the battery positive terminal.

NOTE: The hex head bolt on the output terminal is electrically insulated, therefore, no voltage reading can be obtained by making test connections at the hex head bolt.

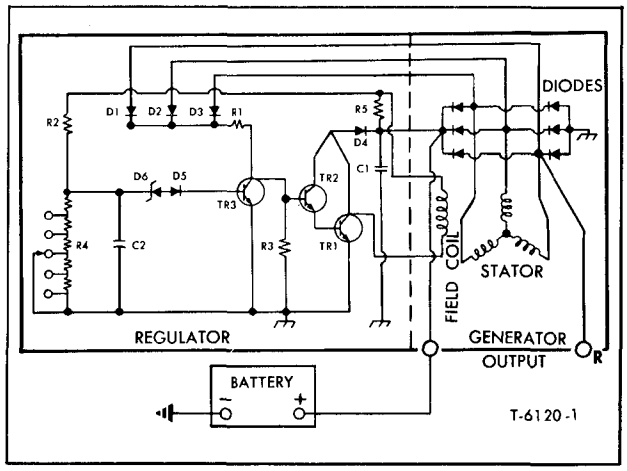


Figure 1—Generator and Regulator Circuitry (Typical)

A. C. GENERATING SYSTEM (INTEGRAL TYPE)

NOTE: On vehicles equipped with the Cummins Diesel engine, a frequency sensing relay is fed from the generator "R" terminal. For information relative to this relay, refer to "Starter Automatic Disengagement and Lock Out" in "STARTING SYSTEM" previously.

OPERATING PRINCIPLES

A typical diagram showing generator and regulator internal circuitry is shown in figure 1. As the rotor begins to turn, the residual magnetism therein induces voltages in the stator windings. Current then flows through the diodes D1, D2, and D3, resistors R1 and R3, and the generator diodes back to the stator winding. The transistors TR1 and TR2 then turn on, and the battery supplies current through resistor R5 the field coil, and TR1. As system voltage increases, a voltage across R4 is impressed across diodes D5 and D6, caused by current flow through R5, R2, and R4. When the pre-set voltage is reached, diodes D5 and D6 conduct, TR3 turns on, TR1 and TR2 turn off, and the generator voltage decreases. Diodes D5, D6, and TR3 then turn off, TR1 and TR2 turn back on, and the cycle repeats many times per second to limit the generator voltage to the adjusted value.

Diode D4 prevents high field-coil-induced voltages when TR1 and TR2 turn off.

Capacitor C2 smooths out the voltage across R4. Resistor R5 raises the generator voltage slightly as generator output increases to maintain a more nearly constant voltage across the battery by compensating for line drop.

Capacitor C1 protects the generator diodes from high transient voltages, and suppresses radio interference.

GENERATOR DRIVE BELT

For information applicable to generator drive belt, refer to "Generator Drive Belt" under "On-Vehicle Maintenance, Tests, and Adjustments" in "ALTERNATING CURRENT GENERATING SYSTEM - NON-INTEGRAL TYPE" previously.

TROUBLESHOOTING PROCEDURES

Information applicable to integral type generating system troubleshooting procedures remains the same as covered under "Troubleshooting Procedures" on pages 6Y-51 through 6Y-54 in the 1970 Heavy Duty Truck Service Manual ST135-70 except as follows:

CHARGING SYSTEM TROUBLES

3. Defective Generator - Statement should read:

If the battery and circuit connection checks are satisfactory, the generator may be checked either on or off the vehicle by making connections as shown in figure 6.

GENERATING SYSTEM SPECIFICATIONS

GENERATOR MODEL	1117225 1117231
Make	Delco-Remy
Series	25 SI
Type	400
Field Current at 80°F	
Amps	4.1-4.5
Volts	12
Cold Output at Specified Volts	(a)
Specified Volts	
Amps	—
Generator R.P.M. (Approx.)	—
Amps	77
Generator R.P.M. (Approx.)	5000
Rated Hot Output	75 (b)

GENERATOR MODEL	1117143	655988
Make	Delco-Remy	Leece Neville
Series	40 SI	—
Type	150	Integral
Field Current at 80°F		
Amps	4-4.5	3
Volts	12	12
Cold Output at Specified Volts	(a)	14
Specified Volts		
Amps	—	36
Generator R.P.M. (Approx.)	—	1100
Amps	150	97
Generator R.P.M. (Approx.)	5000	2500
Rated Hot Output	145	105

TORQUE SPECIFICATIONS

ITEM	TYPE OF PART	TORQUE FT. LBS.
Generator Pulley Nut		
With 75-Amp. Generator	Nut	70-80
With 105-Amp. Generator	Nut	50-60
Adjusting Link to Generator		
With 75-Amp. Generator	Bolt	55-65
With 105-Amp. Generator	Bolt	40-50
Adjusting Link to Engine Bolt		
With 75-Amp. Generator (Model 1117231)	Bolt	25-30
With 75-Amp. Generator (Model 1117225)	Bolt	70-80
With 105-Amp. Generator	Bolt	25-30
Generator Mounting Bracket to Engine		
With 75-Amp. Generator (Model 1117225)	Bolt	35-45
With 75-Amp. Generator (Model 1117231)	Bolt	50-60
With 105-Amp. Generator	Bolt	50-60
Generator Support Bracket to Mounting Bracket		
With 75-Amp. Generator (Model 1117231)	Bolt	20-25
With 105-Amp. Generator	Bolt	20-25
Generator to Mounting Bracket Pivot Bolt		
With 75-Amp. Generator (Model 1117225)	Bolt	55-65
With 75-Amp. Generator (Model 1117231)	Bolt	40-50
With 105-Amp. Generator	Bolt	40-50

(a) Voltmeter Not Needed for Cold Output Check. Load Battery With Carbon Pile to Obtain Maximum Output.
(b) At Maximum Operating Speed.

SECTION 7
Transmissions and Clutches

This group is divided into six sections as shown in Index below:

SECTION 7A
Transmission Control Linkage

All information in Heavy Duty Truck Service Manual ST135-70 and ST332-71 pertaining to "TRANSMISSION CONTROL LINKAGE" is applicable to models covered by this supplement with addition of the following:

TRUCK MODELS WITH ALLISON MT SERIES AUTOMATIC TRANSMISSIONS

LINKAGE ADJUSTMENTS

Prior to making any checks or adjustments of transmission manual and throttle control linkage, check performance of the engine. The transmission is often blamed for poor operation of the vehicle when the engine is not tuned to deliver peak power. Refer to GASOLINE ENGINES (SEC. 6A) or 53 AND 71 SERIES DIESEL ENGINES (SEC. 6C) of this supplement for recommended tune-up procedures. It should be kept in mind, that to assure efficient performance of power plant, the transmission should be as carefully balanced with the engine as are fuel and ignition systems.

The transmission control linkage must be checked and properly adjusted whenever any of the following events occur:

1. At time of "New Vehicle Inspection," after final engine idle adjustments have been made.
2. After any transmission control linkage has been removed or replaced.
3. After transmission has been removed and reinstalled in vehicle.
4. When the transmission is not performing properly.

WARNING

DO NOT START ENGINE WITH SHIFT LINKAGE DISCONNECTED, AS SERIOUS INJURY COULD RESULT TO VEHICLE OR PERSONNEL.

ACCELERATOR AND TV LINKAGE

The TV (throttle valve) linkage must be properly adjusted so that engine and transmission, as a matched pair, can give maximum performance. If transmission TV linkage is incorrectly adjusted, the engine may not operate at full governed rpm, or the transmission upthift and downshift points may be incorrect.

The TV linkage should be adjusted so that transmission upshift occurs at approximately 50 rpm below engine governed speed during full load operation.

A detent position is incorporated in the TV linkage to provide additional control of transmission shifts. DETENT, referred to as "full throttle" is the point of full fuel control opening where accelerator pedal resistance is felt. THRU-DETENT is accomplished by depressing pedal through pedal resistance until it bottoms.

NOTE: The RM80 and HM80 do not utilize a THRU-DETENT type TV linkage. When the linkage reaches DETENT (full throttle) there is no additional travel left in the TV linkage. This linkage is possible due to the use of the high-torque 478M engine and MT42 Allison Transmission.

If the DETENT shift points are correct, but the THRU-DETENT shift points are not correct, the TV mechanism in the transmission may be sticking. The THRU-DETENT position should not allow transmission to upshift and should allow downshifts at the highest rpm possible.

TRANSMISSON CONTROL LINKAGE

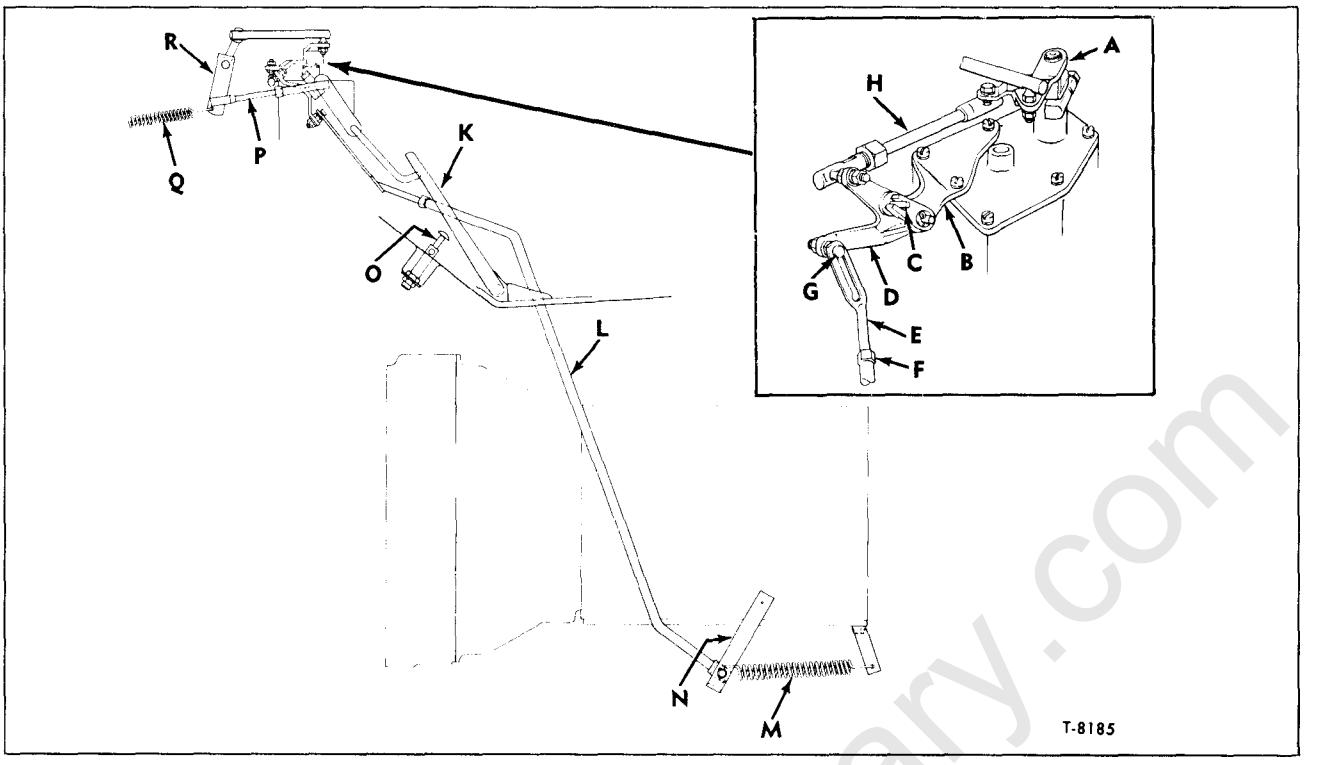


Figure 1—TV Linkage (HV, JV70)

CAUTION: TRANSMISSION SHOULD NOT BE OPERATED IF THE THROTTLE LINKAGE IS NOT ADJUSTED CORRECTLY BECAUSE INSUFFICIENT TV PRESSURE COULD CAUSE REDUCTION OF THE MAIN PRESSURE, WHICH IN TURN, MIGHT RESULT IN CLUTCH SLIPPAGE AND TRANSMISSION FAILURE.

TV Linkage Adjustment - Diesel Engine Models

IMPORTANT: Be sure engine idle (500 rpm with MT Series transmission) and governed speed are properly adjusted, before proceeding. Refer to 6V-53 DIESEL ENGINE (SEC. 6C) of this supplement for adjustments.

NOTE: Key letters in the following text refer to figures 1 and 2.

1. Apply parking brake and block vehicle's driving wheels.

2. To facilitate installation of TV Linkage Adjustment Gauge (J-23739), disconnect manual range selector linkage at transmission.

3. Disconnect TV rod (L) from TV lever (N). Also disconnect TV lever return spring (M) from TV lever.

4. Perform the following on models HV, JV-70 (see fig. 1):

a. Disconnect throttle return spring (Q).

b. Disconnect accelerator rod assembly (P) from cross shaft lever (R).

c. Depress accelerator pedal (K) to THRU-DETENT (detent button (O) - compressed). Ample clearance must exist between the pedal and cab floor, to assure complete movement of TV linkage to the THRU-DETENT position. If necessary, adjustment of the detent button (O) is accomplished by relocating the two jam nuts located on the detent button assembly.

d. With accelerator pedal just touching detent button (O) hold the governor throttle lever (A) in full throttle position and adjust length of accelerator rod assembly (P) for free-entry into cross shaft lever (R). Connect the rod assembly and release accelerator pedal.

5. Perform the following on models TV, WV-70 (see fig. 2):

a. Disconnect throttle return spring (Q).

b. Disconnect and remove swivel (J) from governor throttle lever (A).

c. Depress accelerator pedal (K) to THRU-DETENT (detent button (O) - compressed). Ample clearance must exist between the pedal and cab floor to assure complete movement of TV linkage to the THRU-DETENT position. If necessary, adjustment of the detent button (O) is accomplished by relocating the two jam nuts located on the detent button assembly.

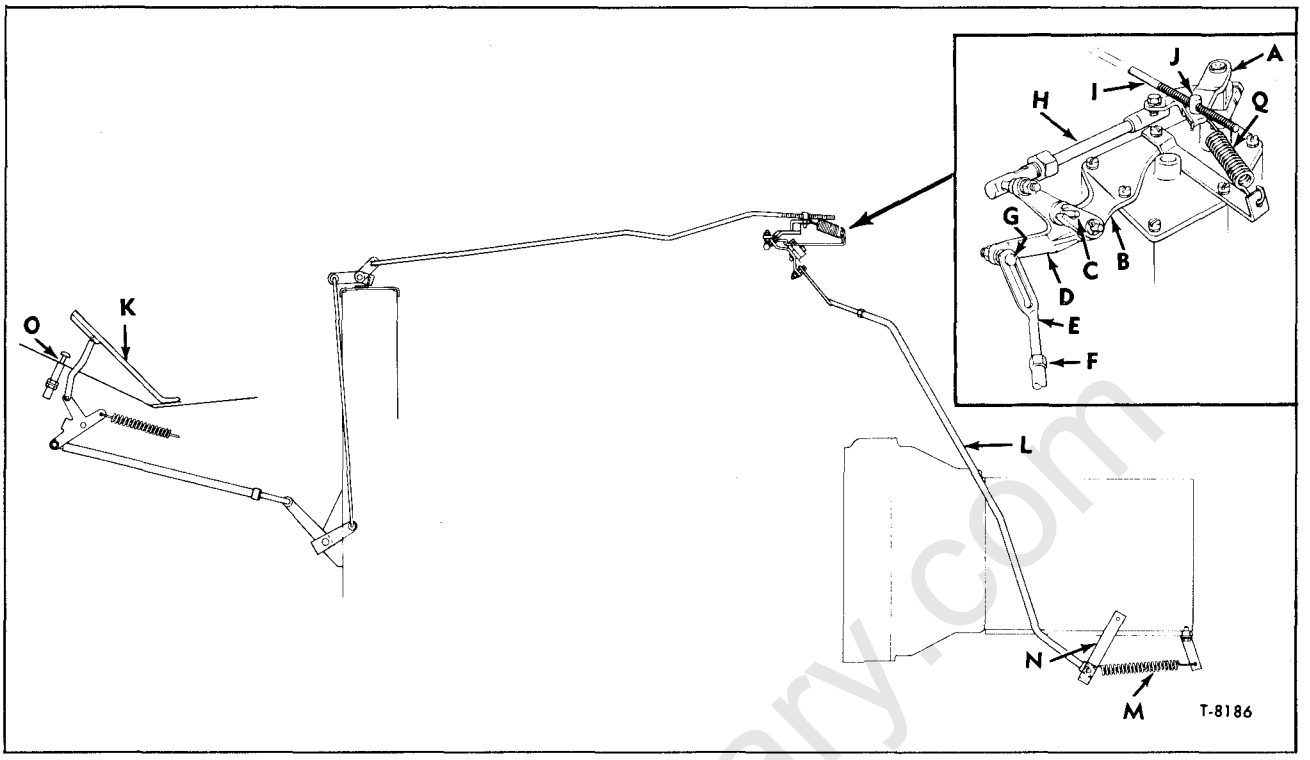


Figure 2—TV Linkage (TV, WV70)

d. With accelerator pedal just touching detent button (O) hold the governor throttle lever (A) in full throttle position and adjust position of swivel (J) on rod (I) for free-entry into governor throttle lever (A). Connect swivel (J) to governor throttle lever and release accelerator pedal.

6. Connect throttle return spring (Q).

7. Install gauge (J-23739) as shown in figure 3. Note gauge is installed on manual selector nut.

8. Hold TV lever (N) full counterclockwise against the transmission internal stop. Align the "STOP" line on gauge with forward edge of TV lever. If necessary, reposition gauge on manual selector nut to obtain alignment. Use a mirror if unable to view directly.

9. Move TV lever (N) full clockwise as shown in figure 4. TV lever should be aligned with "THRU-DETENT" line. This step is a check to be sure no internal condition exists in the transmission that would prevent full movement of the TV lever.

NOTE: All MT Series transmissions covered by this supplement are of the Long Stroke design and TV lever travel must be the same as shown in figure 4. Correct any internal transmission condition, if necessary, before proceeding.

10. Reconnect TV rod (L) to transmission TV lever (N).

11. Disconnect rod (H) from lever (D) and loosen nut (F).

12. Insert ¼-inch diameter rod (C) through hole in lever (D) and slot in governor bracket (B).

13. With governor throttle lever (A) in IDLE position, adjust length of rod (H) for free-entry into lever (D). Install attaching parts retaining rod (H) to lever (D).

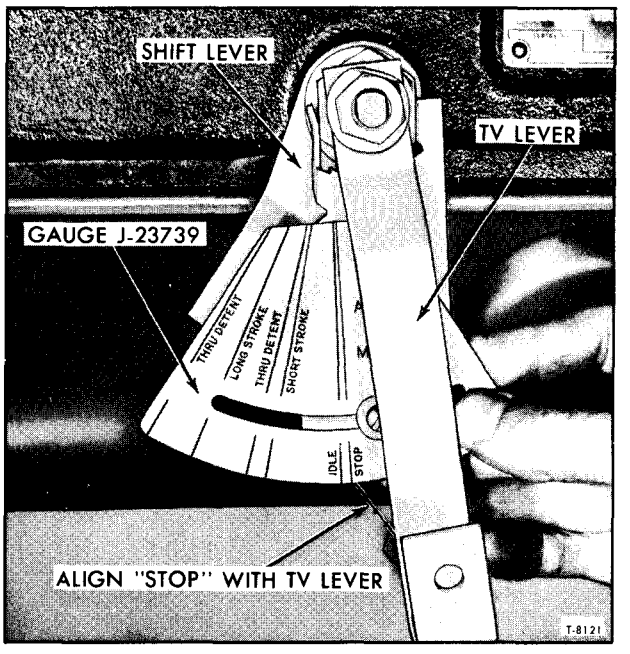


Figure 3—Installing TV Linkage Adjustment Gauge

TRANSMISSION CONTROL LINKAGE

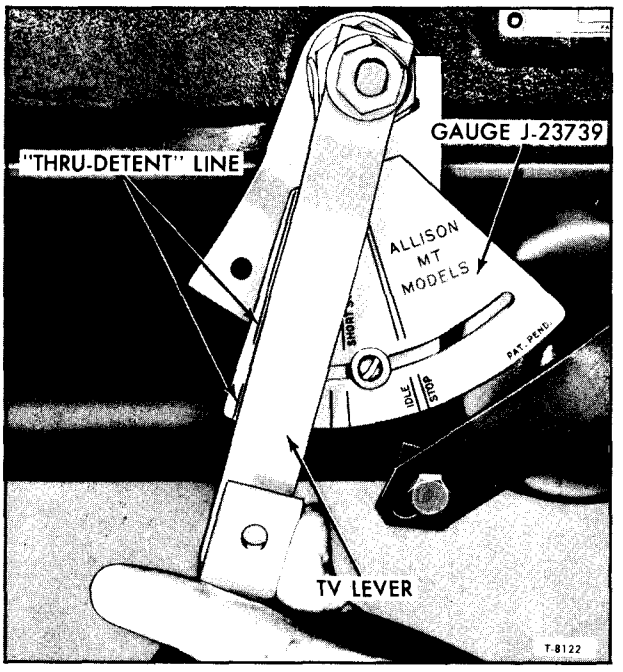


Figure 4—Checking For Proper TV Lever Travel

14. With engine "OFF" and accelerator pedal at "IDLE" position, the forward edge of TV lever should be aligned with the "IDLE" line on gauge as shown in figure 5. Shorten or lengthen TV rod to obtain alignment with gauge by performing the following:

a. Referring to figure 5, align TV lever with "IDLE" line on gauge.

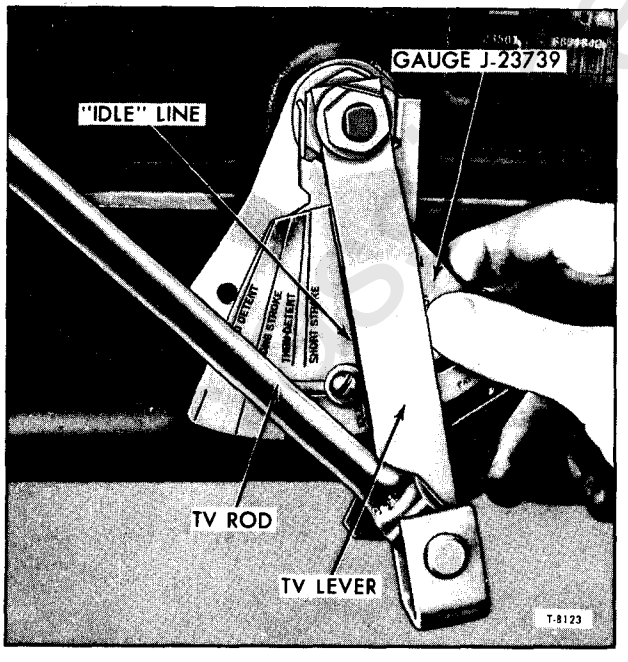


Figure 5—Position of TV Lever at Idle

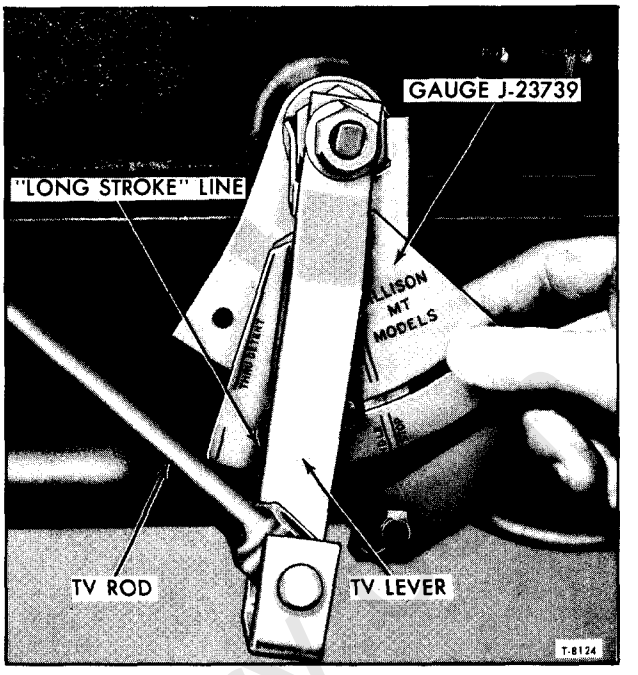


Figure 6—Checking For Proper TV Linkage Adjustment at Full Throttle

b. With ¼-inch diameter rod (C) installed as shown, have assistant position slotted-rod (E) so upper portion of slot contacts stud (G). Secure slotted-rod (E) to TV rod (L) by tightening nut (F).

c. Recheck TV lever on transmission to be sure it is aligned with "IDLE" line on gauge (fig. 5).

d. Remove ¼-inch diameter rod (C).

15. Have assistant depress accelerator pedal to full throttle (DETENT). Referring to figure 6, TV lever should be aligned with "LONG STROKE" line on gauge.

NOTE: Any under- or over-travel in Step 15 indicates faulty or improper linkage components.

16. Remove gauge from transmission and connect manual range selector linkage at transmission.

17. Check TV linkage by having assistant depress accelerator pedal to THRU-DETENT (detent button - compressed). Hold TV lever (N) in this position. When assistant releases the accelerator pedal, governor throttle lever and accelerator pedal must return freely to "IDLE" position. Connect TV lever return spring (M).

18. Using a tachometer to accurately check engine rpm, with selector lever in "N" (neutral), check engine idle speed (500 rpm). Road test or dynamometer test vehicle to check for full load upshift (5th to 6th). Upshift should occur at approximately 50 rpm below the engine governed speed (2600 rpm). If upshifts do not occur at specified rpm adjust as follows:

a. To raise shift point, shorten TV rod (L) by

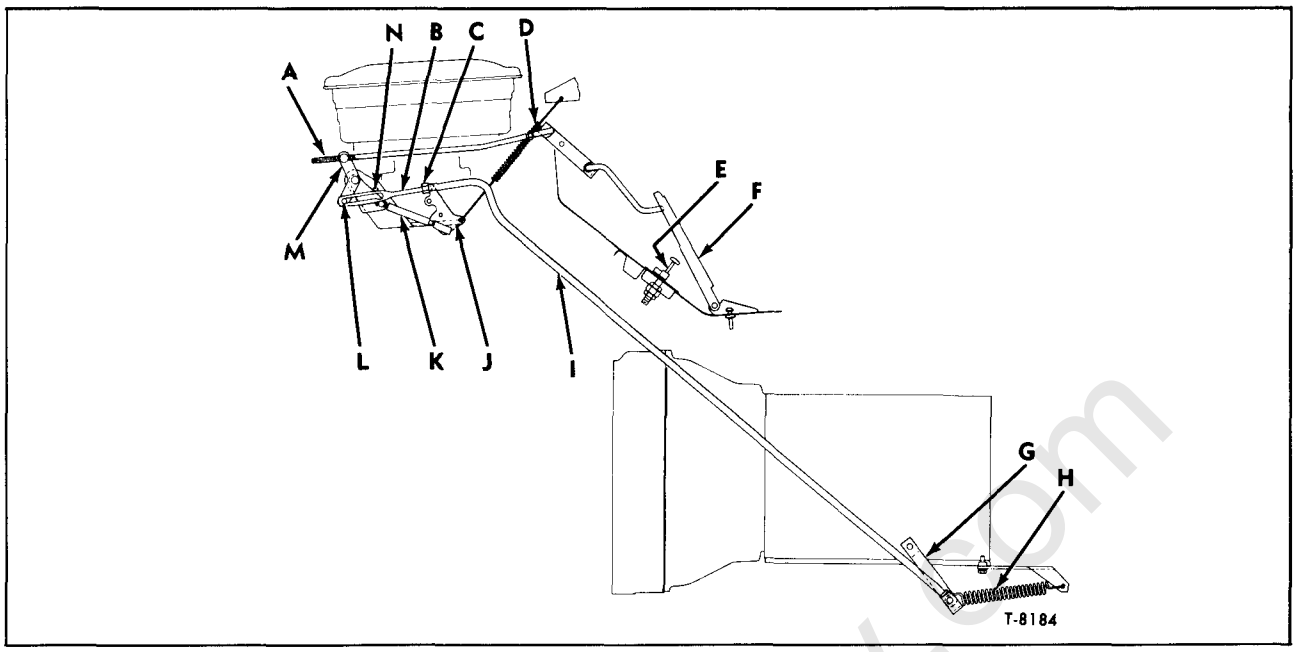


Figure 7—TV Linkage (HM, JM80)

loosening nut (F), then reposition slotted-rod (E) as required. Tighten nut (F) against shoulder of rod (L).

b. To lower shift point, lengthen rod (L) in the same manner as the preceding step.

TV Linkage Adjustment — Gasoline Engine Models, Except RM80 and HM80

IMPORTANT: Be sure engine idle (525 rpm with MT Series transmission) and governed speed are properly adjusted before proceeding. Refer to ENGINE FUEL SYSTEM (SEC. 6M) of the Heavy Duty Truck Service Manual ST135-70 for adjustments. Note the key letters in the following text refers to figures 7 and 8.

1. Apply parking brake and block vehicle's driving wheels.

2. To facilitate installation of TV Linkage Adjustment Gauge (J-23739) disconnect manual range selector linkage at transmission.

3. Disconnect TV rod (I) from TV lever (G). Also, disconnect TV lever return spring (H) from TV lever.

4. Disconnect link assembly (K) from lever (M).

5. With carburetor throttle lever (J) at IDLE position and lever assembly (M) held against stop pin (N), adjust the length of link assembly (K) so that it freely enters lever (M).

6. Disconnect rod (A) from lever assembly (M) and also disconnect throttle return spring (D).

7. Depress accelerator pedal (F) until detent button (E) is compressed (THRU-DETENT). Ample clearance must exist between the pedal and floor to assure complete movement of the TV linkage to the THRU-DETENT position. If necessary, adjustment of the detent button (E) is accomplished by relocating the two jam nuts located on the detent button assembly.

8. With accelerator pedal just touching detent button (E) hold the throttle lever (J) in full throttle position and adjust length of rod assembly (A) for free-entry into lever (M). Connect rod (A) to lever (M).

9. Connect throttle return spring (D).

10. Install gauge (J-23739) as shown in figure 3. Note gauge is installed on manual selector nut.

11. Hold TV lever (G) full counterclockwise against the transmission internal stop. Align the "STOP" line on gauge with forward edge of TV lever. If necessary, reposition gauge on manual selector nut to obtain alignment. Use a mirror if unable to view directly.

12. Move TV lever (G) full clockwise as shown in figure 4. TV lever should be aligned with "THRU-DETENT" line. This step is a check to be sure no internal condition exists in the transmission that would prevent full movement of the TV lever.

NOTE: All MT Series transmissions covered by this supplement are of the Long Stroke design and TV lever travel must be the same as shown in figure 4. Correct any internal transmission condition, if necessary, before proceeding.

13. Reconnect TV rod (I) to transmission TV lever (G).

14. With engine "OFF" and accelerator pedal at "IDLE" position, the forward edge of TV lever should be aligned with the "IDLE" line on gauge as

TRANSMISSON CONTROL LINKAGE

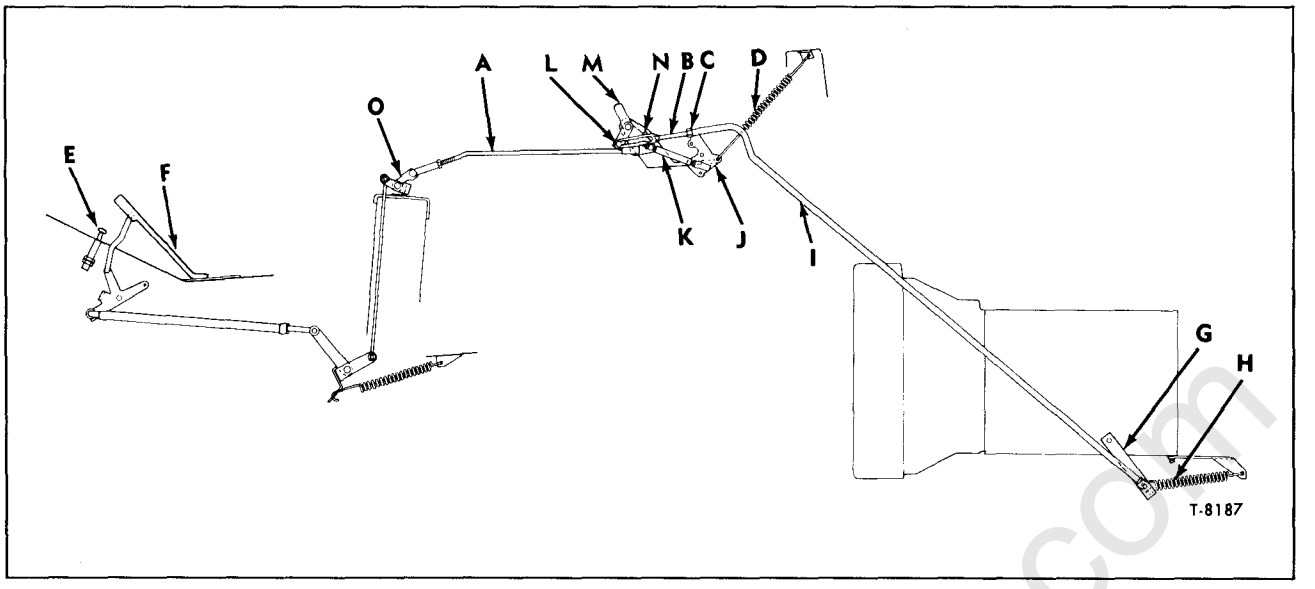


Figure 8—TV Linkage (TM80)

shown in figure 5. Shorten or lengthen TV rod (I) to obtain alignment with gauge by performing the following:

a. Have assistant loosen retaining nut (C) holding slotted-rod (B) in position on TV rod (I).

b. Referring to figure 5, align TV lever (G) with "IDLE" line on gauge.

c. With accelerator linkage at "IDLE" position, have assistant position slotted-rod (B) so upper portion of slot contacts stud (L). Secure slotted-rod (B) to TV rod (I) by tightening nut (C). Recheck TV lever (G) on transmission to be sure it is aligned with "IDLE" line on gauge (fig. 5).

15. Have assistant depress accelerator pedal to full throttle (DETENT - just touching detent button). Referring to figure 6, TV lever should be aligned with "LONG STROKE" line on gauge.

NOTE: Any under- or over-travel in Step 15 indicates faulty or improper linkage components.

16. Remove gauge from transmission and connect manual range selector linkage at transmission.

17. Check TV linkage by having assistant depress accelerator pedal to THRU-DETENT (detent button - compressed). Hold TV lever (G) in this position. When assistant releases the accelerator pedal, carburetor throttle lever (J) and accelerator pedal must return freely to "IDLE" position. Connect TV lever return spring (H).

18. Using a tachometer to accurately check engine rpm, with selector lever in "N" (neutral), recheck engine idle speed (525 rpm). Road test or dynamometer test vehicle to check for full load upshift (5th to 6th). Upshift should occur at approximately 50 rpm below the engine governed speed (3400 rpm with 401M engine). If upshifts do not occur at specified rpm adjust as follows:

a. To raise shift point shorten TV rod (I) by loosening nut (C), then reposition slotted-rod (B) as required. Tighten nut (C) against shoulder of rod (I).

b. To lower shift point, lengthen rod (I) in the same manner as the preceding step.

TV Linkage Adjustment — Model RM80

IMPORTANT: Be sure engine idle (575-600 rpm) and governed speed are properly adjusted before proceeding. Refer to ENGINE FUEL SYSTEM (SEC. 6M) of Heavy Duty Truck Service Manual ST135-70 and Supplement ST332-71 for adjustments.

NOTE: Key letters in text refer to figure 9.

1. Apply parking brake and block vehicle's driving wheels.

2. To facilitate installation of TV Linkage Adjustment Gauge (J-23739) disconnect manual range selector linkage at transmission.

3. Loosen nut (E) on slotted-rod (J). Disconnect TV lever return spring (M) from TV lever (L).

4. Have assistant depress accelerator pedal (B) until contact is made with stop bolt (C) and hold in this position. The carburetor throttle lever (G) should be in full throttle position. If adjustment is necessary, loosen jam nuts (D) and rotate turnbuckle (N) until accelerator pedal (B) contacts stop bolt (C) with carburetor throttle lever in full throttle position. Retighten jam nuts (D).

NOTE: Stop bolt (C) may be repositioned, if sufficient adjustment cannot be attained in Step 4.

5. Install gauge (J-23739) as shown in figure 3. Note that gauge is installed on manual selector nut.

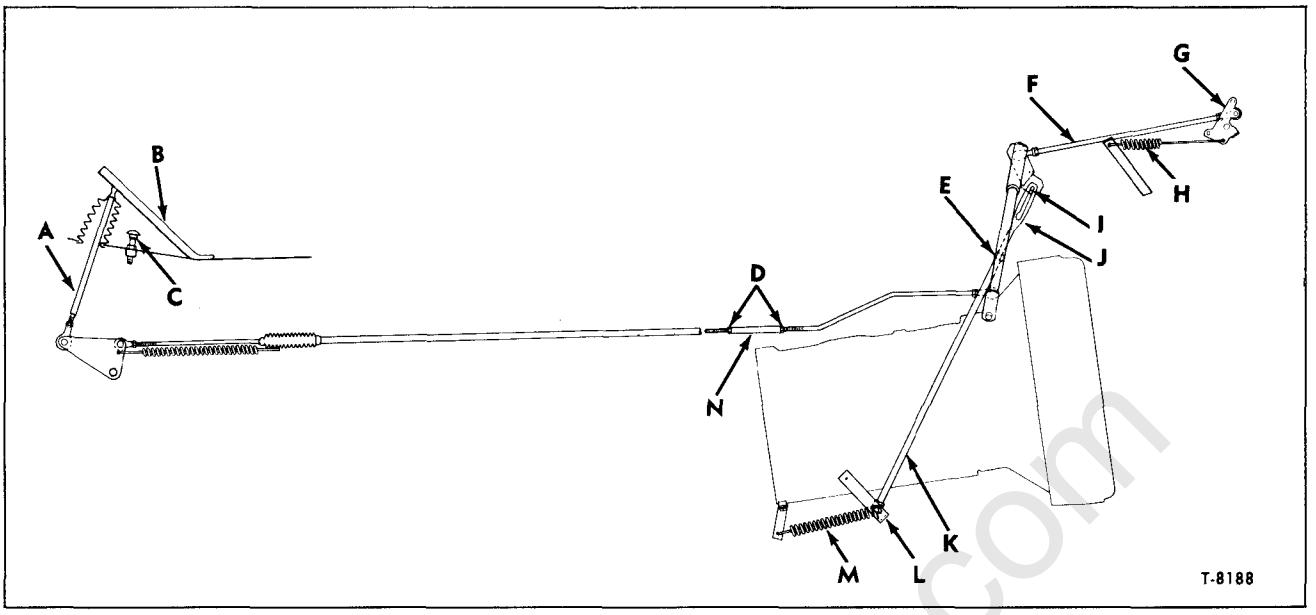


Figure 9—TV Linkage (RM80)

6. Hold TV lever (L) full counterclockwise against the transmission internal stop. Align the "STOP" line on gauge with forward edge of TV lever. If necessary, reposition gauge on manual selector nut to obtain alignment. Use a mirror if unable to view directly.

7. Move TV lever full clockwise as shown in figure 6. TV lever (L) should be aligned with "LONG STROKE" line on gauge. This step is a check to be sure no internal condition exists in transmission that would prevent full movement of the TV lever. Correct any internal transmission condition, if necessary, before proceeding.

8. With engine "OFF" and accelerator pedal at "IDLE" position, align TV lever (L) with "IDLE" line on gauge as shown in figure 5.

9. With accelerator linkage at "IDLE" position, have assistant position slotted-rod (J) so upper portion of slot contacts stud (I). Secure slotted-rod (J) to TV rod (K) by tightening nut (E). Recheck TV lever (L) to be sure it is aligned with "IDLE" line on gauge (fig. 5).

10. Have assistant depress accelerator pedal to full throttle position. Referring to figure 6, TV lever should be aligned with "LONG STROKE" line on gauge.

NOTE: Any under- or over-travel in Step 9 indicates faulty or improper linkage components.

11. Remove gauge (J-23739) from transmission and connect manual range selector linkage at transmission.

12. Using a tachometer to accurately check engine rpm, with selector lever in "N" (neutral), recheck engine idle speed (525 rpm). Road test or dynamometer test vehicle to check for full load upshift (5th to 6th). Upshift should occur at approximately 50 rpm below the engine governed speed (3200 rpm with 478M engine). If upshifts do not occur at specified rpm adjust as follows:

a. To raise shift point shorten TV rod (K) by loosening nut (E), then reposition slotted-rod (J) as required. Tighten nut (E) against shoulder of rod (K).

b. To lower shift point, lengthen rod (K) in the same manner as the preceding step.

TV Linkage Adjustment — Model HM80

IMPORTANT: Be sure engine idle (500 rpm with MT Series transmission) and governed speed are properly adjusted before proceeding. Refer to ENGINE FUEL SYSTEM (SEC. 6M) for adjustments. Note the key letters in the following text refer to figure 10. Illustrations showing TV Linkage Adjustment Gauge (J-23739) are for vehicles with a rod-type linkage, but are applicable to the HM80 which is equipped with a cable-type TV linkage.

1. Apply parking brake and block vehicle's driving wheels.

2. To facilitate installation of TV Linkage Adjustment Gauge (J-23739) disconnect manual range selector linkage at transmission.

3. Loosen nut (J) at clevis (K). Disconnect clevis (K) from clevis pin (M). Disconnect TV lever return spring (F) from TV lever (E).

4. Adjust stop bolt (c), if necessary, to a height of 1-3/16-inch above vehicle's floor.

5. Have assistant depress accelerator pedal (D) until contact is made with stop bolt (C) and

TRANSMISSON CONTROL LINKAGE

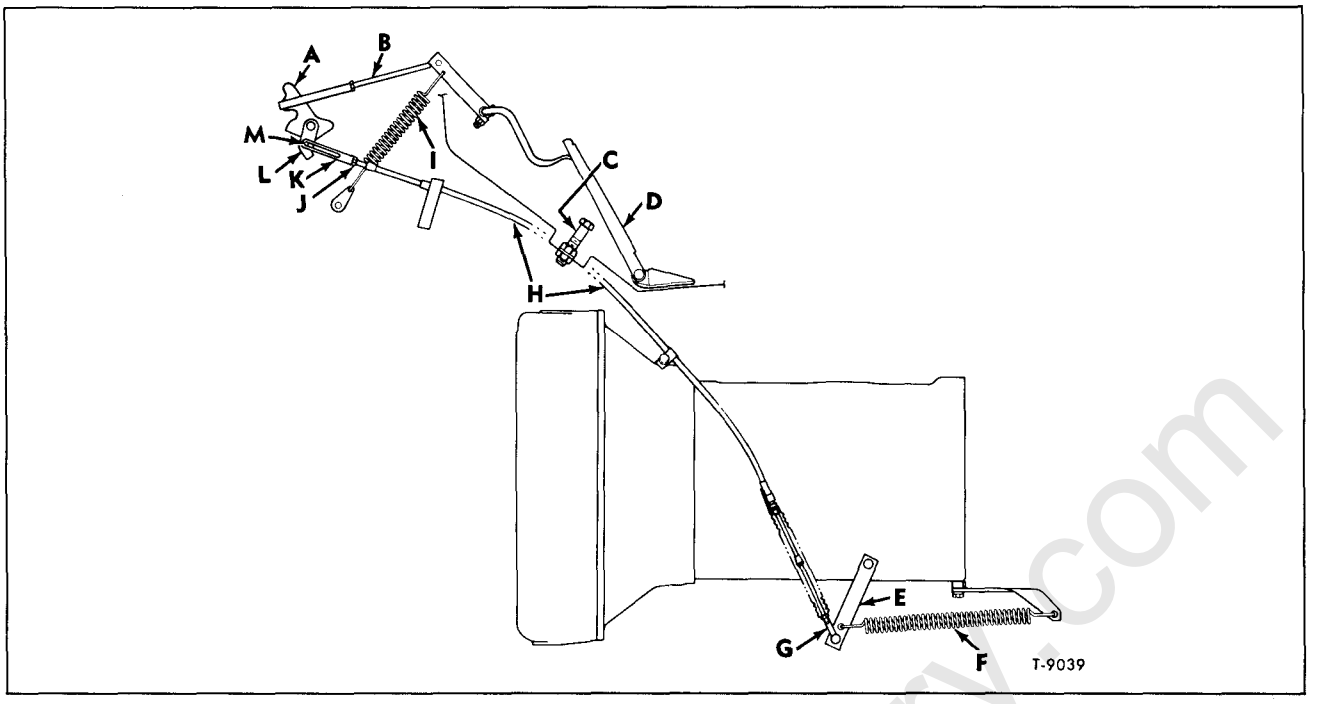


Figure 10—TV Linkage (HM80)

hold in this position. The carburetor throttle lever (A) should be in full throttle position. If adjustment is necessary, adjust length of rod assembly (B) until accelerator pedal contacts stop bolt (C) with carburetor throttle lever in full throttle position.

6. Install gauge (J-23739) as shown in figure 3. Note the gauge is installed on manual selector nut.

7. Hold TV lever (E) full counterclockwise against the transmission internal stop. Align the "STOP" line on gauge with forward edge of TV lever. If necessary, reposition gauge on manual selector nut to obtain alignment. Use a mirror if unable to view directly.

8. Move TV lever full clockwise as shown in figure 6. TV lever (E) should be aligned with "LONG STROKE" line on gauge. This step is a check to be sure no internal condition exists in transmission that would prevent full movement of the TV lever. Correct any internal transmission condition, if necessary, before proceeding.

9. With engine "OFF" and accelerator pedal at "IDLE" position, align TV lever (E) with "IDLE" line on gauge as shown in figure 5.

10. With accelerator linkage at "IDLE" position, have assistant position slotted clevis (K) so upper portion of slot contacts clevis pin (M). Secure clevis (K) to clevis pin (M). Tighten nut (J) against clevis (K). Recheck TV lever (E) to be sure it is aligned with "IDLE" line on gauge (fig. 5).

11. Have assistant depress accelerator pedal to full throttle. Referring to figure 6, TV lever should be aligned with "LONG STROKE" line on gauge.

NOTE: Any under- or over-travel in Step 11 indicates faulty or improper linkage components. Be sure cable clamps are secure at both ends of cable.

12. Remove gauge (J-23739) from transmission and connect manual range selector linkage at transmission.

13. Using a tachometer to accurately check engine rpm, with selector lever in "N" (neutral) recheck engine idle speed (500 rpm). Road test or dynamometer test vehicle to check for full load upshift (5th to 6th). Upshift should occur at approximately 50 rpm below the engine governed speed. If upshifts do not occur at specified rpm adjust as follows:

a. To raise shift point shorten TV cable (H) by repositioning clevis (G) as required on cable (H). Tighten nut against shoulder of clevis.

b. To lower shift point, lengthen shift cable (H) in the same manner as the preceding step.

TRUCK MODELS WITH ALLISON AT540 AUTOMATIC TRANSMISSIONS

LINKAGE ADJUSTMENTS

MANUAL RANGE SELECTOR LINKAGE ADJUSTMENT (Refer to Fig. 11)

The manual selector linkage should fully engage all transmission range positions just before the lever hits the "stops" incorporated in the shift control tower. Shift the selector lever through each position while feeling for full engagement in the transmission. Note the position of the selector lever *after each shift*. Transmission should not engage "D" (Drive) or "R" (Reverse) until the selector lever on control tower is completely out of the "N" (Neutral) notch. If lever is not properly located or operating, the linkage should be adjusted as follows:

1. Locate transmission selector lever (B) against stop in "N" position.
2. Check cable for dimension shown in View A-A, and adjust if necessary. Anchor cable to bracket at point (D).
3. Disconnect clevis (G) from manual shift lever (H). Anchor cable (E) securely at point (F).
4. Locate manual shift lever (H) in "N."

NOTE: Neutral position of manual shift lever is obtained by rotating lever completely forward, then back one notch.

5. Adjust clevis (G) for free-entry of clevis pin through clevis and manual shift lever (H). Then shorten cable by rotating clevis 2 turns clockwise. Tighten jam nut against clevis, install clevis pin and secure with cotter pin.
6. After completing all adjustments, operate vehicle and check operation of the selector lever through all shift ranges. Readjust if necessary.

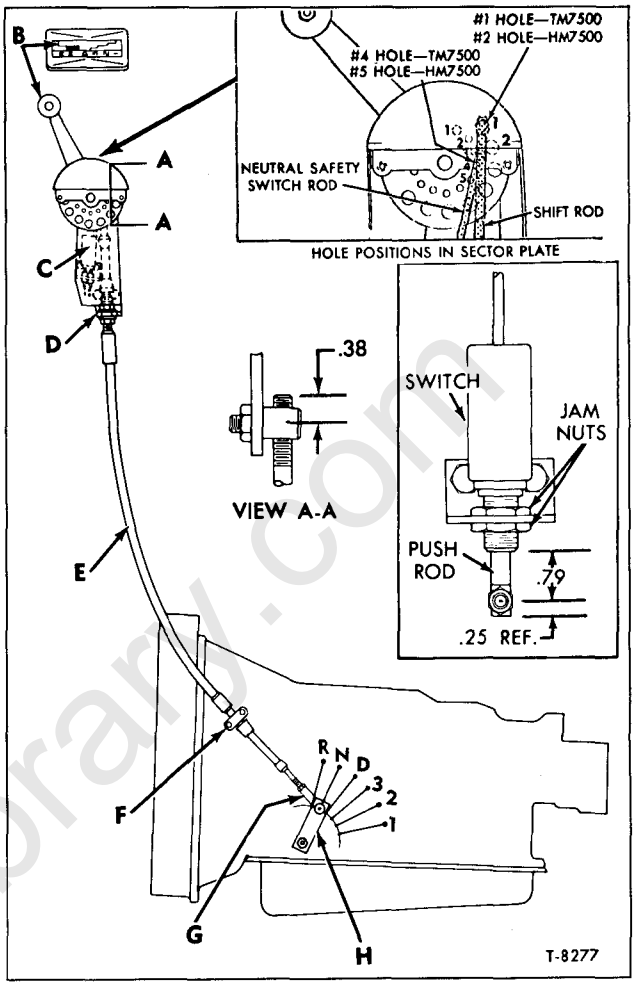


Figure 11—Typical Manual Shift Linkage (AT540 Automatic Transmission)

NEUTRAL SAFETY AND BACK-UP LIGHT SWITCH ADJUSTMENT (Refer to Inset, Fig. 11)

NOTE: "Manual Range Selector Linkage Adjustment" should be performed as described previously, prior to adjustment of the neutral safety switch.

1. Block driving wheels, apply parking brake, and perform the following to prevent the vehicle from accidentally starting while performing adjustment:
2. Pull secondary wire out of center socket in distributor cap and ground wire to prevent possible damage to coil.
3. Move lever (B) to "N" (Neutral) position, then referring to Inset (fig. 18), loosen jam nuts and adjust length of push rod to dimension shown.
4. With switch push rod properly adjusted, tighten jam nuts securely.
5. Check each range position of shift linkage to make sure the starter does not operate with the selector lever in any position other than "N." Have assistant check for proper operation of back-up lights with selector lever in "R." If necessary, readjust switch.
6. Reconnect secondary wire to distributor cap.

NOTE: AT540 transmission replacement procedures are found in "TRANSMISSION ON-VEHICLE SERVICE OPERATIONS" (SEC. 7B) following in this supplement.

SECTION 7B

Transmission On-Vehicle Service Operations

All information in the 1970 Heavy Duty Truck Service Manual ST135-70 pertaining to "TRANSMISSION ON-VEHICLE SERVICE OPERATIONS" (SEC. 7B) is applicable to models covered by this supplement with the addition of the following:

MANUAL TRANSMISSION REPLACEMENT

CAUTION: DUE TO THE TYPE ENGINE MOUNTS USED ON VEHICLES EQUIPPED WITH CUMMINS ENGINE, ALWAYS SUPPORT ENGINE WITH OVERHEAD HOIST DURING TRANSMISSION OR CLUTCH REPLACEMENT TO PREVENT ENGINE FROM TIPPING.

SHEAR-TYPE TRANSMISSION MOUNTING

NOTE: Truck Models HH, HC, JH, JC90 and also DB90 with Fuller RTO9513 transmission are equipped with Shear-Type transmission rear mounts as shown in figure 1. When replacing transmission, use procedure described in ST135-70, pages 7-20 and 7-21. Install transmission rear mount as described following:

1. With support beam attached to the transmission, carefully lower the power plant so that the transmission and engine weight is supported by the engine mountings. Be sure all engine mounting components are properly installed as described in ENGINE MOUNTINGS (SEC. 6D) of this supplement.

2. Measure the space between outer ends of support beam and cushion assembly (dimension "A"), then select spacers approximately equal to this gap.

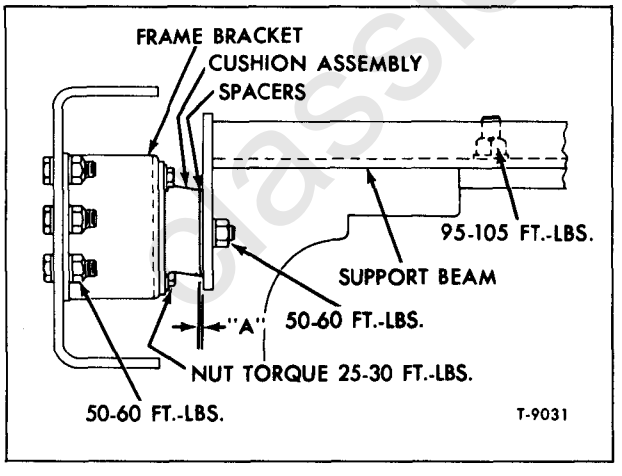


Figure 1—Shear Type Transmission Mounting

NOTE: The maximum permissible gap after spacer installation is 1/32-inch. Spacers are available 1/32 and 1/16 inch thick.

There may be a difference in gap between left- and right-hand sides of the rear mounting. If this condition exists, measure the total gap between the left- and right-hand sides and divide by two. This thickness of spacers is required at each side of the rear mounting to provide the proper weight distribution of the transmission.

3. Insert spacers between cushion assembly and support beam. Install all attaching parts as shown in figure 1. Be sure all attaching parts are properly torqued.

SUPPORT BEAM MOUNTING (DP90)

NOTE: Truck model DP90 with Fuller RTO-9513 is equipped with support-beam transmission rear mounting as shown in figure 2. When replacing transmission, use procedure described in 1970 Heavy Duty Truck Service Manual, pages 7-20 and 7-21. Install transmission rear mounting as following:

1. If support beam has not been removed from vehicle, raise transmission until contact is made with support beam. Secure transmission to support beam.

2. If support beam has been removed from vehicle install transmission as follows:

a. With clutch housing-to-flywheel housing bolts installed and engine rear mountings installed,

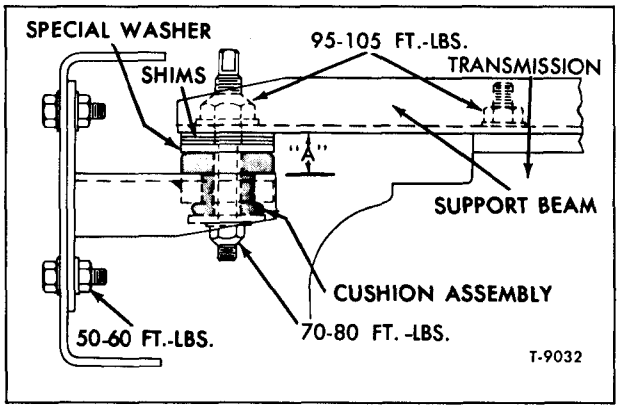


Figure 2—Transmission Rear Mounting (DP90)

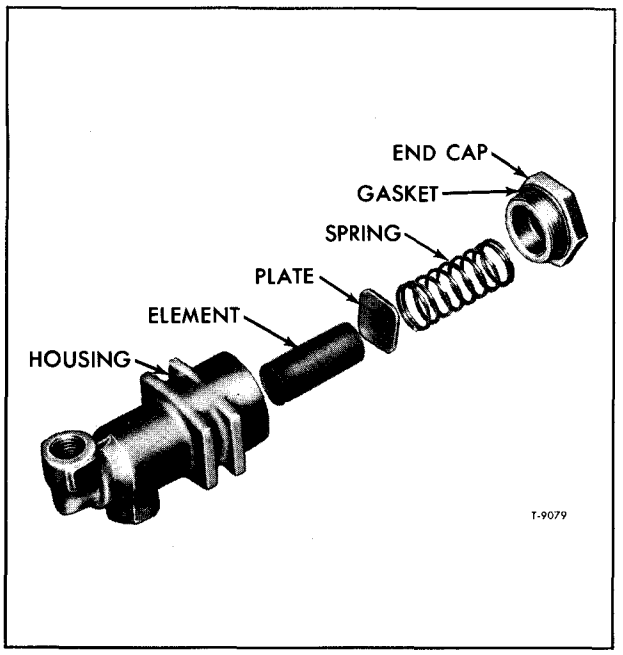


Figure 3—Fuller Transmission Air Filter

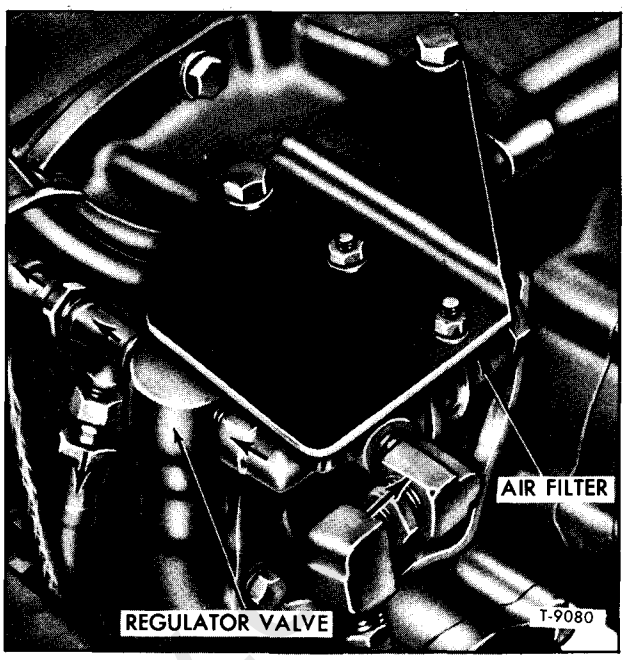


Figure 4—Fuller Transmission Regulator Valve

place a cushion assembly and special washer on each rear mounting bracket.

b. Attach support beam to transmission. Tighten retaining nuts to 95-105 foot-pounds torque.

c. Carefully lower the transmission and engine so that the weight of the transmission and engine is supported by the engine mountings.

d. Measure the distance between support beam and rear mounting bracket (dimension "A"). Add 1/16-inch to dimension "A" (allows for uniform distribution of engine and transmission weight to both engine and transmission mountings), then subtract 11/16-inch (installed thickness of cushion assembly between special washer and rear mounting bracket). This final dimension is the thickness of shims (including special washer) required at the rear mounting.

NOTE: There may be a difference in gap between the right- and left-hand sides of the rear mounting. If this condition exists, determine the thickness of shims required for each side of the mounting as explained in Step d. Add these two dimensions and divide by two. This thickness of shims is required at each side of the rear mounting.

e. Raise transmission sufficiently to permit installation of shims and other rear mount attaching parts as shown in figure 2. Be sure all attaching parts are properly torqued.

NOTE: Shims are U-shaped for ease in installation and are available in three sizes: 0.25", 0.12", and 0.06".

f. Check the installed height of cushion assembly between special washer and rear mounting bracket (lifting equipment removed) which should be 11/16-inch. Reduce shim-pack if less than 11/16-inch and increase shim-pack if more than 11/16-inch, accordingly.

COMPANION FLANGE OR OUTPUT YOKE NUT TORQUE

Transmission Model	Nut Torque (Ft.-Lbs.)
Clark 385V or 387V)	550-600*
Fuller RTO9513	550-600

*Secure with cotter pin.

AIR SYSTEM—FULLER TRANSMISSION

A new air filter and regulator valve are being used on all Fuller transmissions covered by this supplement.

AIR FILTER (Fig. 3)

The air filter is mounted on the rear face of the transmission's auxiliary section. The element should be cleaned or replaced every 12,000 miles. The paper-type element may be cleaned with lacquer thinner, alcohol or any quick drying solvent.

REGULATOR VALVE (Fig. 4)

The regulator valve is non-repairable. If found to be damaged or defective it must be replaced with a new valve. To make a simple check of the valve's condition, install an air pressure gauge at the valve's outlet. If the reading is not between 57 and 62 psi the valve should be replaced.

TRANSMISSION ON-VEHICLE SERVICE

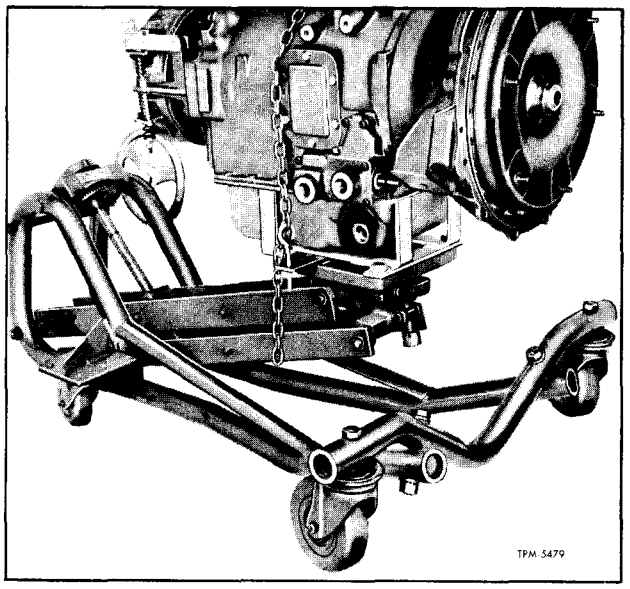


Figure 5—Transmission Mounted on Adjustable Dolly

ALLISION MT SERIES AUTOMATIC TRANSMISSION REPLACEMENT

The following procedures apply to all vehicles covered by this supplement. However, it may be necessary to remove air tanks, fuel tanks, special equipment, etc., on some vehicles to provide clearance before the transmission is removed.

IMPORTANT: The torque converter and transmission must be removed from, or installed into the vehicle as a unit. The transmission cannot be removed from or installed on the converter in the vehicle.

Overhaul information for MT Series transmissions is contained in Allison Manual SA1126.

REMOVAL

1. Block vehicle so that it cannot move. Disconnect ground strap from battery negative (-) post. Remove the spark plugs (gasoline engine) so the engine can be turned over manually. On models equipped with diesel engine, be sure the fuel "STOP" knob is pulled all the way out (no-fuel position).

2. Loosen the transmission oil filter cover by loosening cover strap retaining bolt and nut to allow transmission oil to drain. Do not remove the filter cover from the oil pan as oil will gush out too quickly. When oil stops flowing, tighten the cover strap retaining bolt.

3. Disconnect the range selector cable from shift lever at left side of transmission.

4. Disconnect TV (throttle valve) rod from TV lever at left side of transmission.

5. Remove the oil level gauge (dipstick). Disconnect oil filler tube at right side of transmission oil pan and remove tube clamp. Remove vent hose clamps and lift out filler tube and vent hose assembly. Replace dipstick in tube and cover the vent hose and oil pan openings to prevent entry of foreign material.

6. Disconnect oil cooler lines from transmission. Plug line ends and transmission openings with clean lint-free material. Disconnect wiring from hot oil switch.

7. Disconnect the speedometer shaft fitting from adapter at rear of the transmission.

8. Disconnect the propeller shaft from transmission as described in "PROPELLER SHAFTS" (SEC. 4D) of the 1970 Heavy Duty Truck Service Manual ST135-70.

9. Disconnect the mechanical parking brake linkage at right side of transmission (if used).

10. Through the opening in the flywheel housing, use a pry-bar, as necessary to manually turn the flywheel. As the flywheel is rotated, remove the six nuts retaining flywheel flex plate assembly to converter pump cover.

CAUTION: DO NOT rotate flywheel by using wrench on the nuts or prying against studs on converter cover.

11. Support the transmission with a 1,000-lb. (minimum) transmission floor jack or dolly (see fig. 5). The jack or dolly must be positioned so the transmission oil pan will not support the weight of the transmission. Fasten a safety chain over top of transmission and to both sides of the jack.

NOTE: On model WV70 remove the two transmission rear mounting bolts.

12. On models with rear engine mounts on converter housing, place a support under rear of engine and remove converter housing-to-frame support bolts. Raise the engine to remove weight from the engine rear mounts.

13. Remove the converter housing-to-flywheel housing attaching bolts and washers.

14. Separate transmission from the engine, lower the assembly carefully and move it from the vehicle.

INSTALLATION

1. Raise vehicle sufficiently to allow installation of transmission. With transmission assembly properly mounted on transmission jack or dolly as shown in figure 5, move transmission into position aligning converter housing with flywheel housing. Check for and clean away any foreign material in flywheel pilot hole and on flywheel flex plate assembly and converter housing face. Rotate flywheel as necessary so that the six studs on the converter cover can freely enter holes in engine flywheel flex plate assembly. Carefully move the transmission assembly toward engine so studs can enter holes in flex plate and so that pilot on transmission enters pilot hole in center of flywheel.

2. Install bolts and washers that attach converter housing to engine flywheel housing. Tighten bolts to 20-25 foot-pounds torque.

3. Loosely install six nuts that hold converter cover to flywheel flex plate. On next hand rotation of engine, tighten nuts to 15-20 foot-pounds torque.

4. Carefully lower engine and transmission assembly onto engine rear mounts if rear engine mounts were removed. Tighten engine mounting fasteners as described in ENGINE MOUNTINGS (SEC. 6D) of this supplement.

NOTE: On model WV70 install the two transmission rear mounting bolts. Tighten bolts to 170-180 foot-pounds torque.

5. Remove plugs from oil cooler lines and transmission valve body openings. Be sure fittings are clean and lint-free, then connect oil cooler lines to transmission. Connect wiring to oil temperature warning switch on transmission.

NOTE: Oil temperature warning switch is located in the oil cooler line fitting in the forward opening in retarder valve body.

6. Install the oil filler tube and clamp at right side of transmission oil pan. Check for serviceable condition of the transmission vent tube and clamps, then install these parts. Install oil level gauge.

NOTE: Cover oil filler tube upper opening to keep out foreign material while being pushed up into engine compartment during installation.

7. Connect speedometer shaft fitting to adapter at rear of transmission.

8. Connect propeller shaft to transmission as described in "PROPELLER SHAFTS" (SEC. 4D) of the Heavy Duty Truck Service Manual ST135-70.

9. Connect parking brake linkage (if used) at side of transmission.

10. Connect the range selector cable to shift lever at left side of transmission.

11. Connect TV linkage on left side of transmission.

12. Install new oil filter element in auxiliary oil filter (if used) and add transmission oil as described in LUBRICATION (SEC. 0) of the 1970 Heavy Duty Truck Service Manual ST135-70.

13. Install spark plugs (gasoline engine) and connect battery ground strap, previously disconnected (for safety).

14. Refer to the "TRANSMISSION CONTROL LINKAGE" (SEC. 7A) of this supplement for adjustment of manual shift linkage and TV linkage.

ALLISION AT540 AUTOMATIC TRANSMISSION REPLACEMENT

The following procedures apply to all vehicles covered by this supplement. However, it may be necessary to remove air tanks, fuel tanks, special equipment, etc., on some vehicles to provide clearance before the transmission is removed.

NOTE: Troubleshooting, maintenance, and overhaul information for the AT540 transmission is contained in Allison Automatic Transmission Service Manual SA-1241.

REMOVAL

1. Block vehicle so that it cannot move. Disconnect ground strap from battery negative (-) post. Remove the spark plugs so the engine can be turned over manually.

2. Remove the oil level gauge (dipstick). Drain transmission by disconnecting oil filler tube at right side of transmission oil pan. Remove bracket holding oil filler tube to transmission and remove filler tube from vehicle. Replace dipstick in tube and cover the oil pan opening to prevent entry of foreign material.

3. Disconnect oil cooler lines from fittings on right side of transmission case. Plug line ends and case openings with lint-free material.

4. Disconnect the range selector cable from shift lever at left side of transmission.

5. Disconnect vacuum modulator line from modulator.

6. Disconnect the speedometer shaft fitting from adapter at rear of transmission.

7. Disconnect the propeller shaft from transmission as described in "PROPELLER SHAFTS" (SEC. 4D) of the 1970 Heavy Duty Truck Service Manual ST135-70.

8. Disconnect the mechanical parking brake linkage at the right side of transmission (if used).

9. Through the opening in the flywheel housing, use a pry-bar, as necessary, to manually turn the flywheel. As the flywheel is rotated, remove the six bolts retaining flywheel flex plate assembly to converter cover.

10. Support the transmission with a 500-lb. (minimum) transmission floor jack. The jack must be positioned so the transmission oil pan will not support the weight of transmission. Fasten a safety chain over top of transmission and to both sides of jack.

11. Place a support under rear of engine and remove transmission case-to-crossmember support bolts. Raise the engine to remove weight from engine rear mounts.

12. Remove the transmission case-to-flywheel housing bolts and washers.

13. Carefully inspect transmission and surrounding area to be sure no lines, hoses, or wires will interfere with transmission removal.

IMPORTANT: When removing transmission, keep rear of transmission lower than the front so as not to lose converter.

14. Move transmission assembly from the engine, lower the assembly carefully and move it out from the vehicle.

AUXILIARY TRANSMISSION

INSTALLATION

1. Raise vehicle sufficiently to allow installation of transmission. With transmission assembly mounted on transmission jack, move transmission into position aligning converter with flywheel. Check for and clean away any foreign material in flywheel pilot hole, flywheel flex plate assembly, and front face of transmission case. Rotate flywheel as necessary so that the six bolt holes in flex plate are aligned with bolt holes in converter cover. Carefully move transmission assembly toward engine so flex plate-to-converter cover bolts can be loosely installed and so that pilot on transmission converter enters pilot hole in center of flywheel.

2. Install bolts and washers that attach transmission case to flywheel housing. Tighten bolts to 25-30 foot-pounds torque.

3. Tighten the six flex plate-to-converter cover bolts to 35-40 foot-pounds torque.

4. Carefully lower engine and transmission assembly onto the engine rear mounts. Tighten engine mounting fasteners as described in ENGINE MOUNTINGS (SEC. 6D) of this supplement. Remove lifting equipment from beneath vehicle.

5. Remove plugs from oil cooler lines and transmission case fittings. Be sure fittings are clean and lint-free, then connect oil cooler lines to transmission.

6. Install oil filler tube and bracket on right side of transmission. Install oil level gauge (dipstick).

7. Connect the speedometer shaft fitting to adapter at rear of transmission.

8. Connect propeller shaft to transmission as described in "PROPELLER SHAFTS" (SEC. 4D) of the 1970 Heavy Duty Truck Service Manual ST135-70.

9. Connect parking brake linkage (if used) at right side of transmission.

10. Connect the range selector cable to shift lever at left side of transmission.

11. Connect the vacuum modulator line to modulator.

WARNING: TO PREVENT ACCIDENTAL STARTING OF VEHICLE, WHILE IN A DRIVE RANGE, BE SURE IGNITION SWITCH IS IN THE "OFF" POSITION BEFORE PROCEEDING TO THE NEXT STEP.

12. Install spark plugs and connect battery ground strap, previously disconnected (for safety).

13. Connect any other lines, hoses, or wires which were disconnected to aid in transmission removal.

14. Refill transmission with approximately 11 quarts of DEXRON® fluid. Check level using dipstick and correct as necessary.

SECTION 7C
Auxiliary Transmission

All information in Service Manual ST135-70 pertaining to "AUXILIARY TRANSMISSIONS" is applicable to models covered by this supplement with the addition of the following:

AUXILIARY TRANSMISSION REPLACEMENT

NOTE: The following replacement procedures apply to those auxiliary transmission combinations which are not covered in Service Manual ST135-70. Refer to "Auxiliary Transmission Application and Alignment Data Chart" shown later.

REMOVAL

1. Drain lubricant from auxiliary transmission.

2. Disconnect propeller shafts from input and output ends of transmission. Refer to "PROPELLER SHAFTS" (SEC. 4D) in the 1970 Heavy Duty Truck Service Manual ST135-70.

NOTE: Support propeller shafts securely, to prevent damage from dropping.

3. Disconnect shift control rods or cables from the front of the transmission.

4. Disconnect speedometer cable from adapter at rear of the transmission.

NOTE: Some models have the speedometer drive mounted on the front axle instead of at rear of transmission.

5. Disconnect parking brake linkage (when used).

6. Remove all connections to the auxiliary transmission power take-off (when used).

7. Position a suitable dolly or jack under the transmission and adjust to safely carry the weight of the transmission.

8. Remove attaching parts from auxiliary transmission front and rear mountings. Lower transmission away from the chassis.

INSTALLATION (Refer to Fig. 1)

The procedures required to install auxiliary transmission are dependent on the type of transmission mountings which vary due to different vehicle driveline configurations.

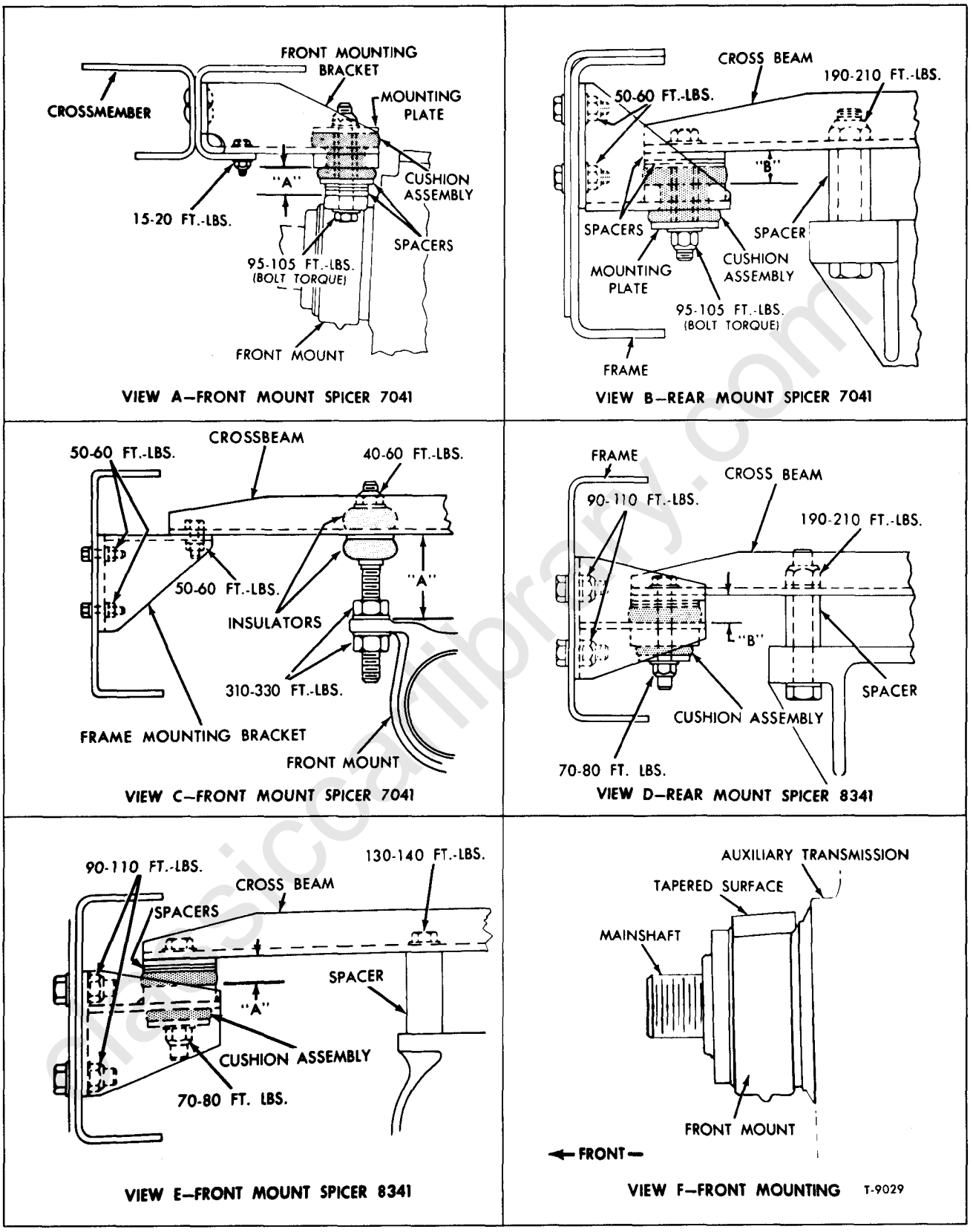


Figure 1—Auxiliary Transmission Mountings

AUXILIARY TRANSMISSION

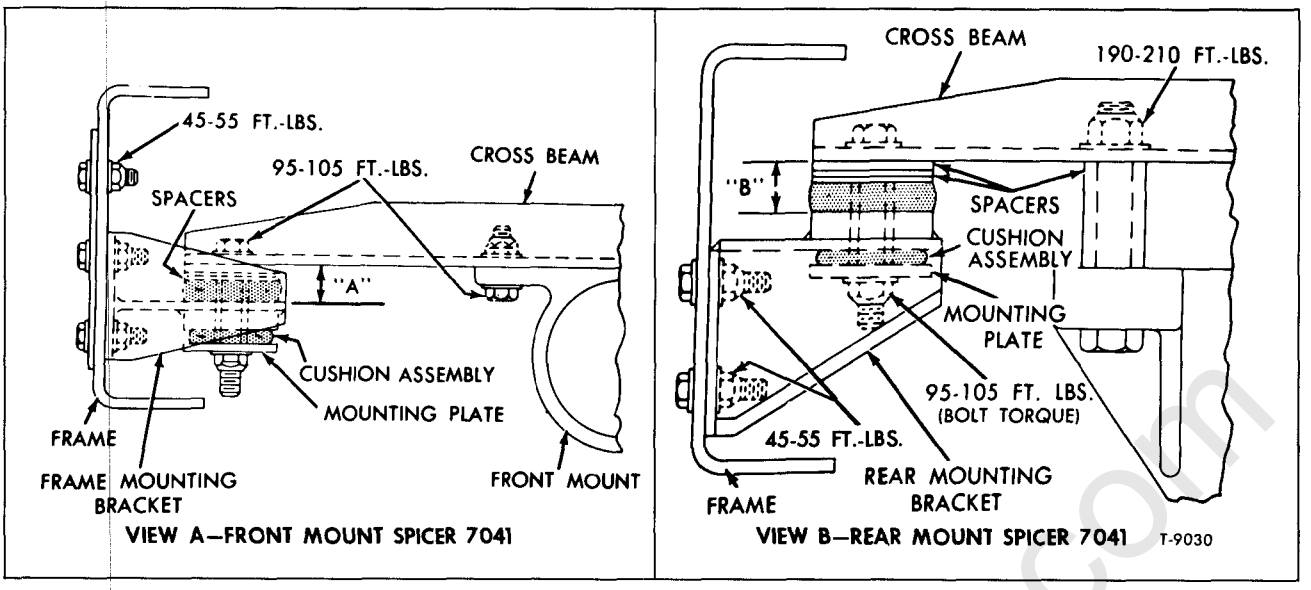


Figure 2—Auxiliary Transmission Mountings

AUXILIARY TRANSMISSION APPLICATION AND ALIGNMENT DATA CHART

(Use in conjunction with Figures 1 and 2)

TRUCK MODELS	ENGINE	MAIN TRANSMISSION	AUXILIARY TRANSMISSION	FRONT MOUNTING	DIMENSION "A" INCHES	REAR MOUNTING	DIMENSION "B" INCHES
JM80	478M	CL401V	SP7041	Figure 1, View A	1-1/8	Figure 1, View B	1-1/8
JV70	6V-53	CL385V	SP7041	Figure 2, View A	1-3/16	Figure 2, View B	1-3/16
JV70	6V-53	CL385V	SP7041	Figure 1, View A	1-3/16	Figure 2, View B	1-3/16
JV70	6V-53	MT41	SP7041	Figure 1, View C	3-7/8	Figure 1, View B	1-3/16
JH90	8V-71	T905A	SP8341C	Figure 1, View E	1-1/8	Figure 1, View D	1-1/8
JN90	NHC250	SP8552	SP8341C	Figure 1, View E	1-1/8	Figure 1, View D	1-1/8

1. Be sure the tapered surface of the auxiliary transmission front mount (except JV70 with MT41 transmission) faces the front of the vehicle as shown in View F, figure 1.

NOTE: The front mount on a JV70 equipped with Allison MT41 transmission and Spicer 7041 auxiliary transmission, does not have the tapered surface shown in View F, figure 1.

2. With transmission mounted on a suitable dolly or jack move into position under the vehicle. Adjust front and rear height as listed in "Auxiliary Transmission Application and Alignment Data" chart shown later.

3. Tighten attaching parts to proper specifications as shown.

NOTE: For proper torque on frame-to-rear mounting bracket attaching parts (if removed) refer to torque specifications.

4. Reconnect propeller shafts to the input and output ends of the transmission as described in "PROPELLER SHAFTS" (SEC. 4D) in the 1970 Heavy Duty Truck Service Manual ST135-70.

IMPORTANT: The preceding steps, serve to locate the auxiliary transmission in relation to the vehicle's frame. Also, it is essential that the auxiliary transmission be checked for proper driveline angle adjustment as described under "PROPELLER SHAFTS" (SEC. 4D) in the Heavy Duty Truck Service Manual ST135-70.

5. Reconnect power take-off (when used).

6. Reconnect parking brake linkage (when used).

7. Connect speedometer cable to adapter at the rear of the transmission.

8. Reconnect shift control rods or cables to the front of the transmission and adjust linkage if necessary.

9. Refill transmission with lubricant recommended in LUBRICATION (SEC. 0) in the 1970 Heavy Duty Truck Service Manual ST135-70.

SECTION 7D

Clutch Controls

All information in the 1970 Heavy Duty Truck Service Manual ST135-70 pertaining to "CLUTCH CONTROLS" is applicable to models covered by this supplement with the exception of the following:

MECHANICAL CLUTCH LINKAGE ADJUSTMENTS

All conventional cab models, with the exception of HE, JE90, covered by this supplement are equipped with mechanical clutch linkage. The HE, JE90 models are equipped with hydraulic clutch controls.

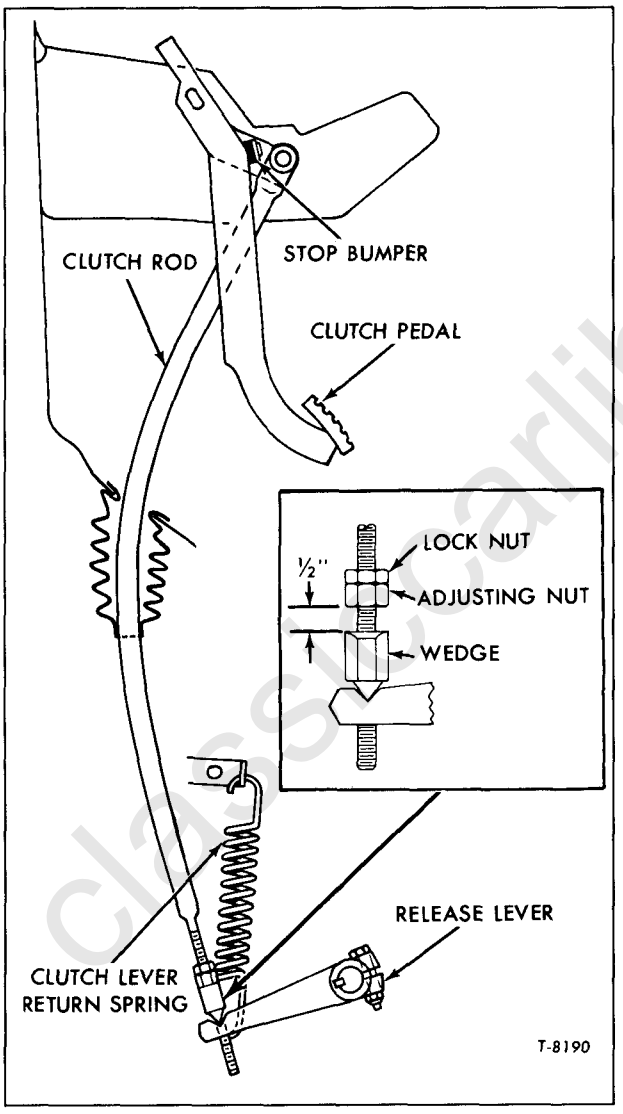


Figure 1—Clutch Controls (HV, JV70 and HM, JM80 with 478M Engine)

As clutch facings wear, the amount of pedal free-travel is reduced and in time this will result in clutch slippage. Therefore, it is necessary to adjust the free-travel at periodic intervals to permit full engagement of the clutch. Adjustment is necessary when pedal free-travel is reduced to less than ¾-inch. Adjust linkage as follows:

MODELS HV, JV70 AND HM, JM80 WITH 478M ENGINE (Refer to Fig. 1)

1. Disconnect clutch lever return spring.
2. With clutch pedal against stop bumper, move the release lever to a position where the release bearing can be felt to just barely contact the clutch release fingers.
3. Referring to the Inset of figure 1, loosen lock nut. Adjust clearance between wedge and adjusting nut to ½-inch. Then tighten lock nut so as to maintain the ½-inch clearance between wedge and adjusting nut.

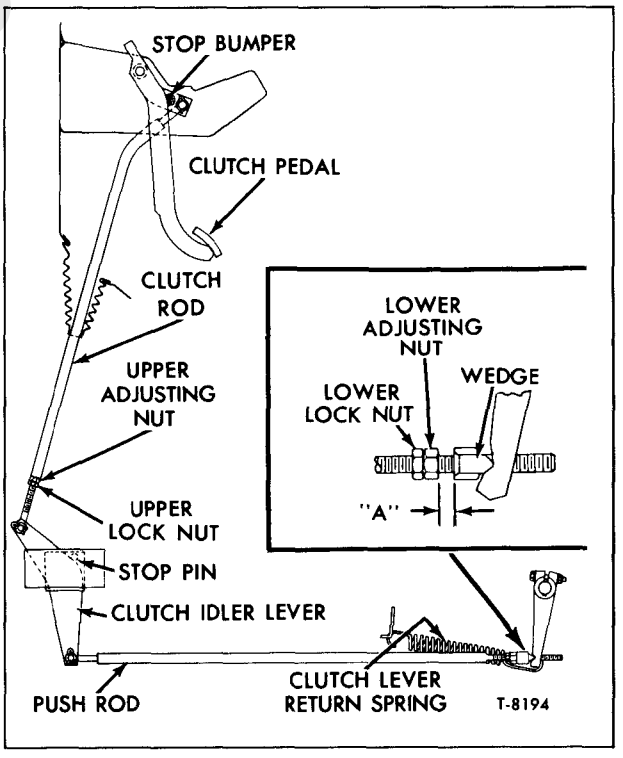


Figure 2—Mechanical Clutch Controls (Series 90 Conv. Cab Except JB, MB, MC90)

CLUTCH CONTROLS

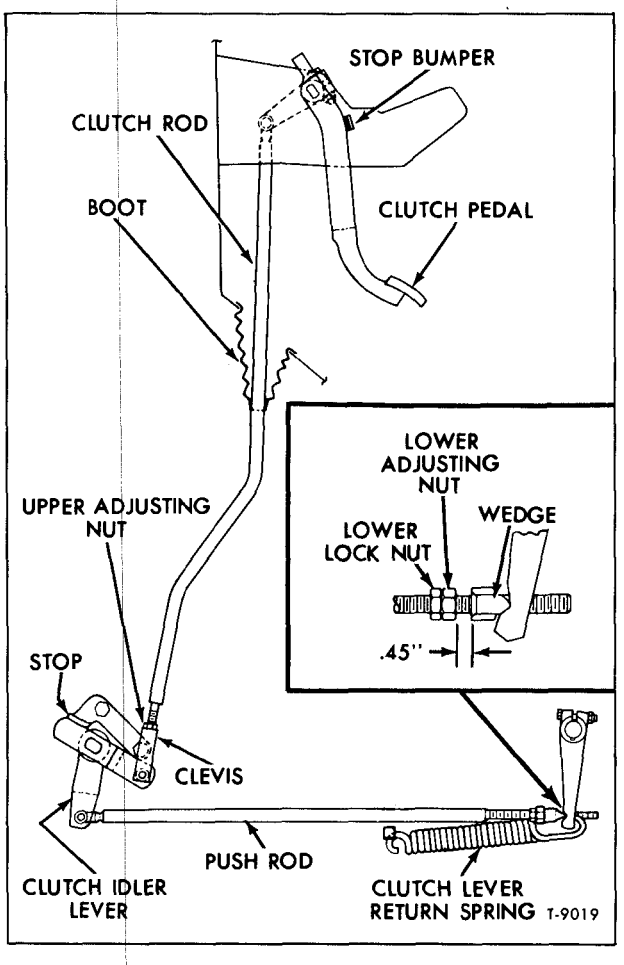


Figure 3—Clutch Controls (JB90)

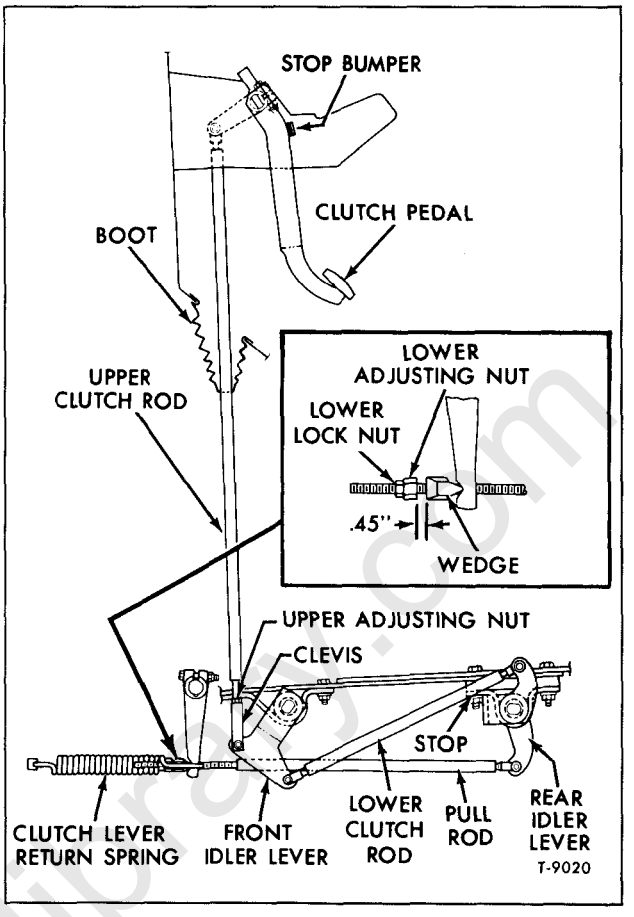


Figure 4—Clutch Controls (MB90)

4. Connect clutch lever return spring to release lever, then check operation of clutch linkage.

90 CONV. CAB EXCEPT
JB, MB, MC90 (Fig. 2)

IMPORTANT: If vehicle is equipped with a Spicer clutch, be sure to, first, adjust the clutch internally as described in "Internal Clutch Adjustment" in the 1970 Heavy Duty Truck Service Manual ST135-70, pages 7-43—7-45. After the internal clutch adjustment has been performed, adjust the external linkage as follows:

1. Block clutch pedal in fully engaged position (against stop bumper) and rotate clutch idler lever clockwise until lever contacts STOP.

NOTE: All models are not equipped with a STOP PIN as shown. Some models are equipped with a STOP BRACKET mounted on frame rail and others the STOP is the frame rail itself. Refer to figures 10 and 11.

2. Lengthen clutch rod by two turns, rotate upper adjusting nut until it contacts clutch rod. Tighten upper lock nut against upper adjusting nut.

3. Disconnect clutch lever return spring from release lever.

NOTE: Clearance "A" equals:
1/2-inch (all models, except HH, JH90 with Spicer Clutch).
.45-inch (HH, JH with Spicer clutch).

4. Loosen lower lock nut. Adjust position of lower adjusting nut to provide clearance "A" between wedge and adjusting nut, with release lever held rearward until the release bearing is just contacting the release fingers (Lipe Clutch) or until the release yoke contacts the release bearing (Spicer).

5. Tighten lower lock nut against lower adjusting nut and connect clutch lever return spring. Remove block from clutch pedal and check operation of clutch linkage.

JB90 CLUTCH LINKAGE ADJUSTMENT
(Refer to Fig. 3)

IMPORTANT: This vehicle is equipped with a Spicer clutch. Be sure to, first, adjust the clutch internally as described in "Internal Clutch Adjustment" in 1970 Heavy Duty Truck Service Manual ST135-70, pages 7-43—7-45. After the internal clutch adjustment has been performed, adjust the external linkage as follows:

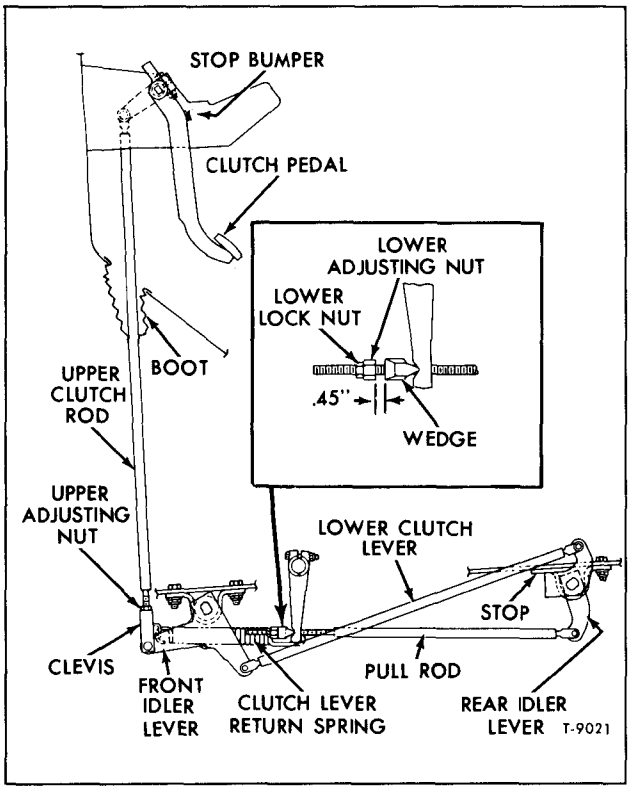


Figure 5—Clutch Controls (MC90)

1. Block clutch pedal in fully engaged position (against stop bumper). Clutch idler lever should contact STOP, as shown. If necessary, reposition clevis on clutch rod to allow idler lever to contact STOP. Tighten upper adjusting nut to 12-14 foot-pounds torque.

2. Disconnect clutch lever return spring from release lever.

3. Loosen lower lock nut. Referring to Inset, figure 3, adjust position of lower adjusting nut to provide .45-inch clearance between wedge and adjusting nut, with the release lever held rearward until the release yoke just contacts the release bearing.

4. Tighten lower lock nut against lower adjusting nut and connect clutch lever return spring. Remove block from clutch pedal and check operation of clutch linkage.

MB, MC90 CLUTCH LINKAGE

ADJUSTMENT (Figs. 4 and 5)

IMPORTANT: These vehicles are equipped with Spicer clutches. Be sure to, first, adjust the clutch internally as described in "Internal Clutch Adjustment" in the 1970 Heavy Duty Truck Service Manual ST135-70, pages 7-43—7-45. After the internal clutch adjustment has been performed, adjust the external linkage as follows:

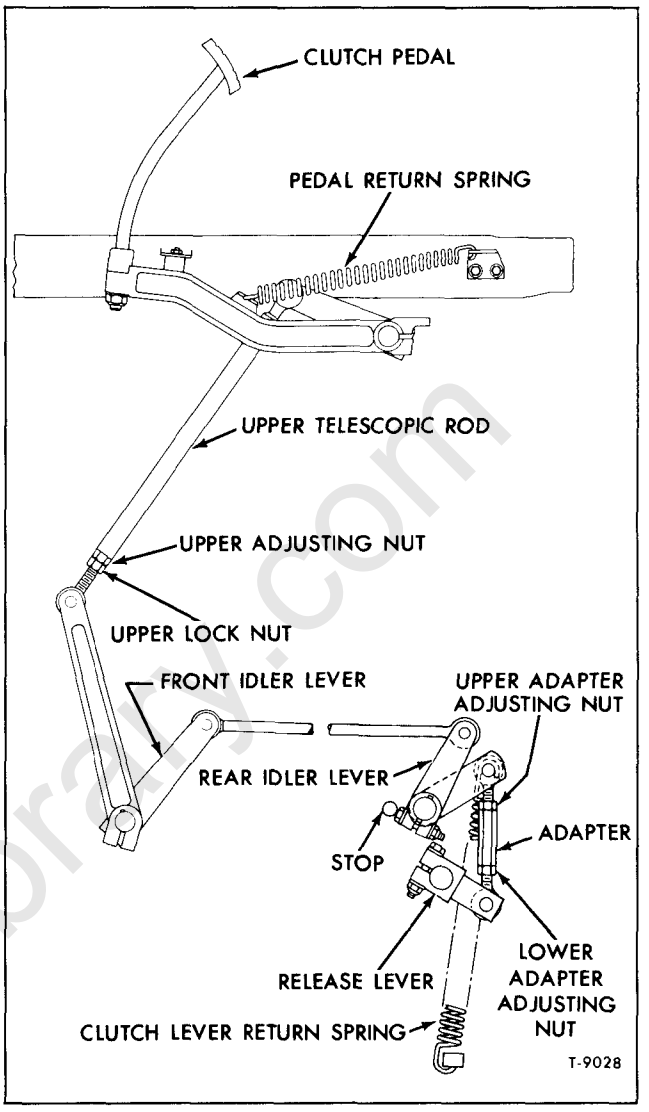


Figure 6—Clutch Controls (DP90)

1. Block clutch pedal in fully engaged position (against stop bumper). Rear idler lever should contact STOP, as shown. If necessary, reposition clevis on upper clutch rod to allow rear idler lever to contact STOP. Tighten upper adjusting nut to 12-14 foot-pounds.

2. Disconnect clutch lever return spring from release lever.

3. Loosen lower lock nut. Referring to the Inset in figures 10 and 11, adjust position of lower adjusting nut to provide .45-inch clearance between wedge and adjusting nut, with the release lever held rearward until the release yoke just contacts the release bearing.

4. Tighten lower lock nut against lower adjusting nut and connect clutch lever return spring. Remove block from clutch pedal and check operation of clutch linkage.

CLUTCH CONTROLS

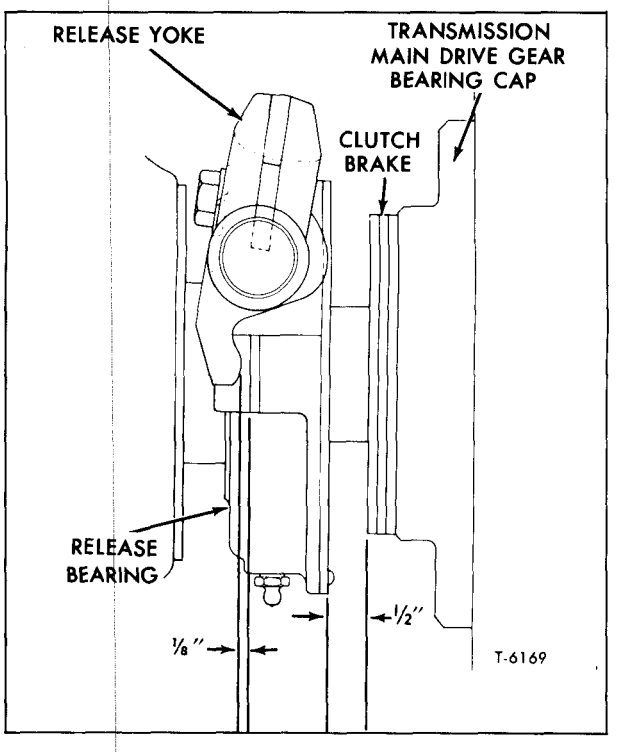


Figure 7—Release Bearing Clearance

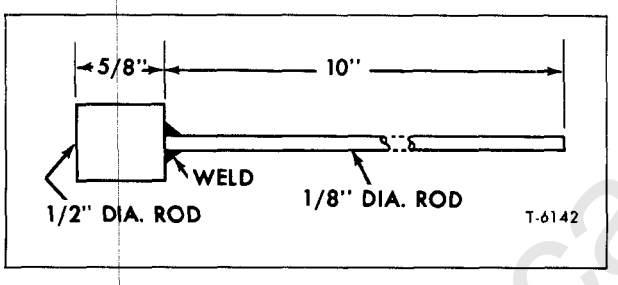


Figure 8—Improvised Release Bearing Clearance Checking Tool

DP90 CLUTCH LINKAGE ADJUSTMENT
(Refer to Fig. 6)

IMPORTANT: This vehicle is equipped with a Spicer clutch. Be sure to, first, adjust the clutch internally as described in "Internal Clutch Adjustment" in the 1970 Heavy Duty Truck Service Manual ST135-70, pages 7-43—7-45. After the internal clutch adjustment has been performed, adjust the external linkage as follows:

1. With cab in normal riding position (locked-down), block clutch pedal in the fully engaged position (against stop bumper) and hold rear idler lever against stop (as shown).

2. Rotate upper adjusting nut until it contacts upper telescopic rod. Tighten upper lock nut against upper adjusting nut.

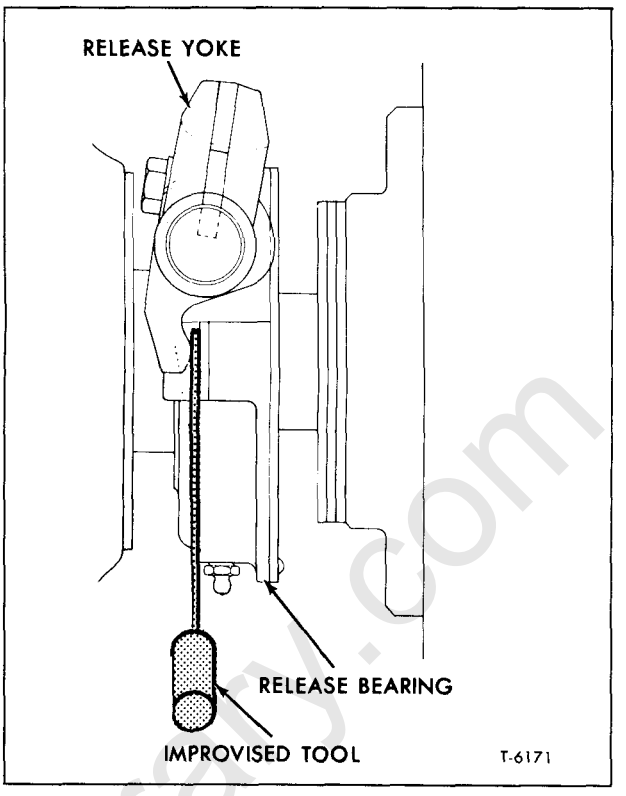


Figure 9—Checking Clearance Between Yoke and Release Bearing

NOTE: While performing the following steps the rear idler lever must be held against STOP, as shown, and the clutch lever return spring disconnected as shown.

3. Loosen upper adapter adjusting nut (left-hand threads) and the lower adapter adjusting nut (right-hand threads).

4. The clearance between release bearing and yoke (free-travel) should be 1/8-inch as shown in figure 7 - using small end of improvised tool (fig. 8), check clearance between yoke and release bearing as shown in figure 9. If clearance is more or less than recommended, rotate release lever adapter, using a ¾-inch open end wrench, until gap between yoke and release bearing is 1/8-inch.

5. Connect clutch lever return spring and cycle the pedal a few times.

NOTE: While assistant is cycling pedal, check for yoke movement when pedal is depressed, to verify that "free-travel" in the cab is actually release bearing clearance and not lost motion in the linkage due to worn bushings, shafts, or linkage arms.

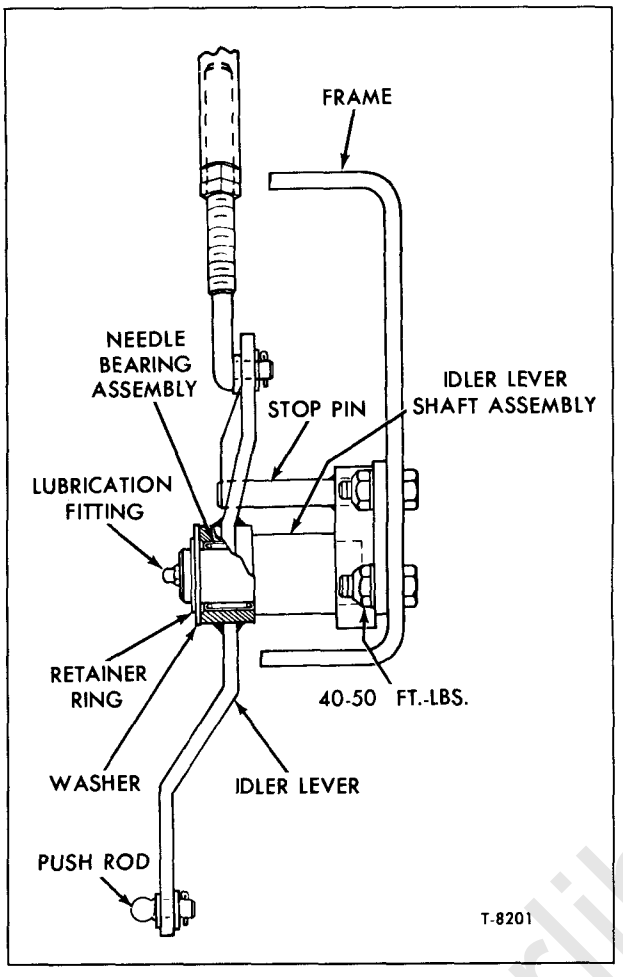


Figure 10—Clutch Idler Lever with Stop Pin (Typical)

6. Recheck clearance between yoke and release bearing as described in Step 4 and readjust if necessary.

7. When satisfied that free-travel is correct, tighten both the upper adapter adjusting nut (left-hand threads) and the lower adapter adjusting nut (right-hand threads).

8. Install inspection hole cover in lower portion of clutch housing.

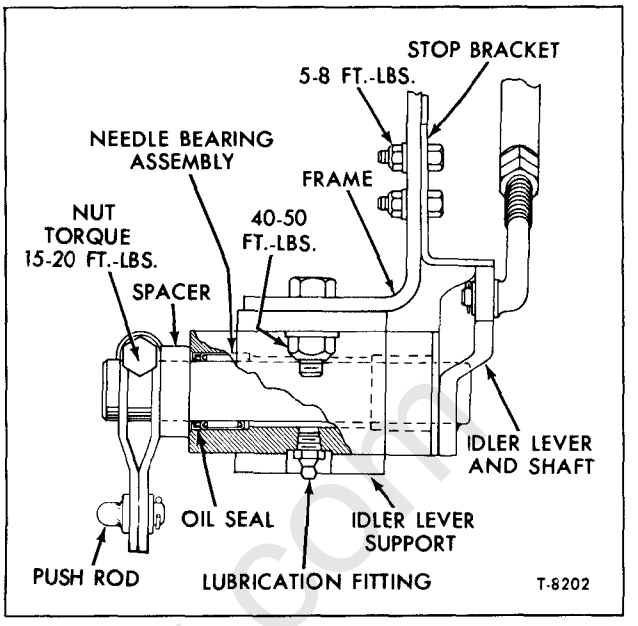


Figure 11—Clutch Idler Lever with Stop Bracket (Typical)

DB, FB90 CLUTCH LINKAGE ADJUSTMENT

Linkage adjustment procedures for the DB, FB90 are the same as described in the 1970 Heavy Duty Truck Service Manual ST135-70, pages 7-42—7-45.

CLUTCH IDLER LEVER REPLACEMENT

SERIES 90 CONVENTIONAL CAB
(Refer to Figures 10 and 11)

Following disassembly of clutch idler components, check all parts for wear, cracks, distortion, or other damage. Replace all components that would affect proper operation of the clutch idler assembly. Lubricate idler linkage at grease fitting with "MPG." For explanation of "MPG" refer to LUBRICATION (SEC. 0) of the 1970 Heavy Duty Truck Service Manual ST135-70, page 0-19.

SECTION 7E

Clutches

All information in the 1970 Heavy Duty Truck Service Manual ST135-70 pertaining to "CLUTCHES," pages 7-57—7-66, is applicable to models covered by this supplement with the addition of the following:

IMPORTANT: All V6 and 637-V8 gasoline engines are equipped with a unique pressure plate. The pressure plate surface is of convex shape (curved outward) to improve heat distribution and reduce warpage. This surface curvature is designed into the plate and will aid in giving improved clutch performance and extended life.

Spicer 14-Inch Dual Disc Angle-Spring Clutch is illustrated in figure 1. Replacement procedures are the same as described for Spicer Clutches in the 1970 Heavy Duty Truck Service Manual ST135-70.

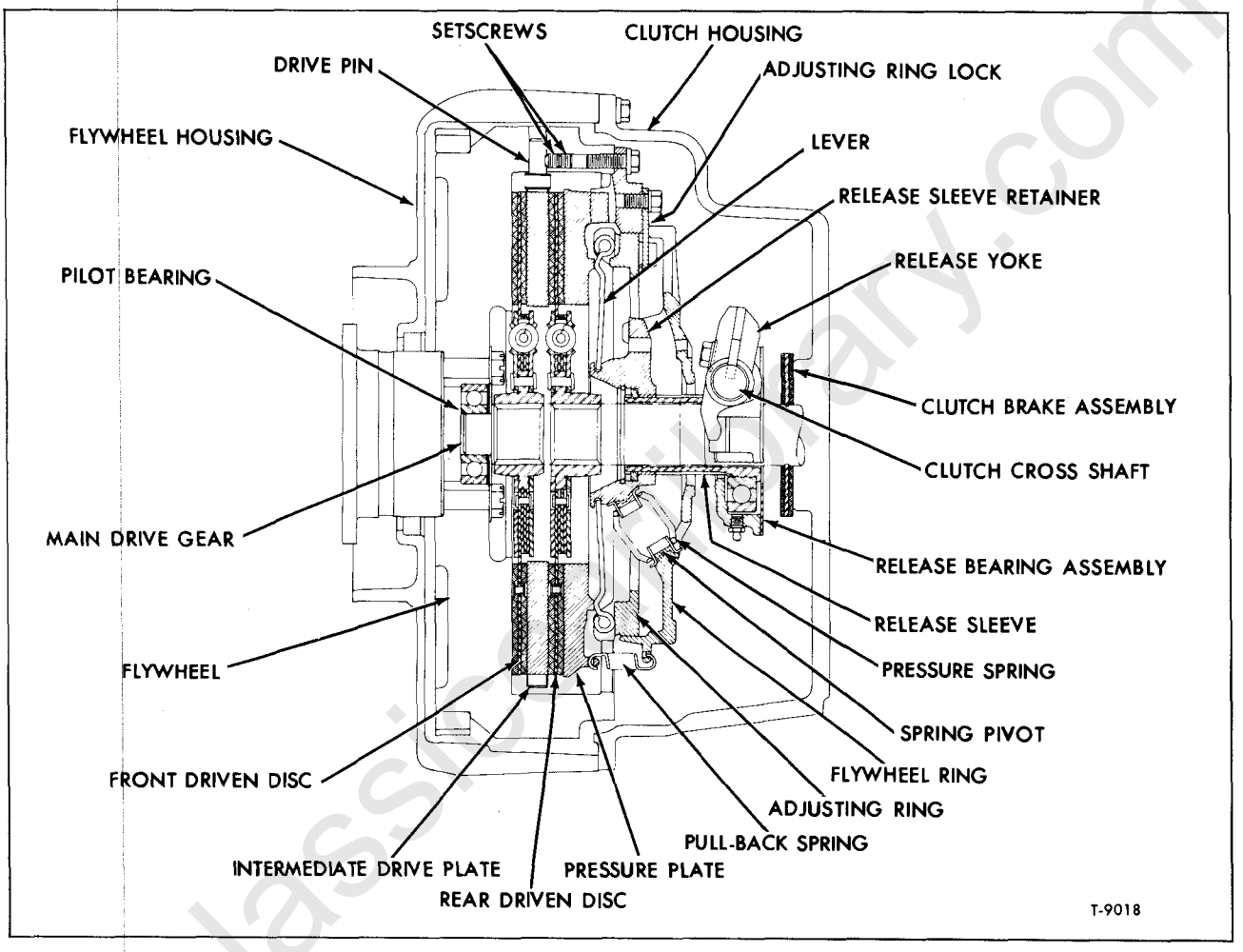


Figure 1—Spicer 14" Dual Disc Angle-Spring Clutch

SECTION 7F

Front End Drive Power Take-Off

All information in the 1970 Heavy Duty Truck Service Manual ST135-70 pertaining to "FRONT END DRIVE POWER TAKE-OFF" pages 7-67 and 7-68, is applicable to models JM80 and JI90 covered by this supplement.

SECTION 8
Fuel Tank and Exhaust

SECTION 8A
Fuel Tank, Lines, and Gauge System

All information in Section 8A of the 1970 Heavy Duty Truck Service Manual ST135-70, starting on page 8-1 is applicable to models covered by this supplement. The following information has been added: Also

FUEL TANK REPAIR

Remove all lines, wires, and gauge unit from tank assembly. Remove tank for major repairs. In event of repairs that involve soldering or welding, even though the tank has been drained, it must be purged or cleansed to be made safe.

The purging process removes the fuel molecules that remain in the metal walls of the tank forming the dangerous fumes. Flush the tank out with clean water for 5 minutes. Next, pour in a specified amount of purging material per manufacturer's specification. Insert an air hose to the bottom of the tank and agitate with air 7 to 10 minutes on smaller tanks. Empty the tank and make necessary repairs. Reinstall gauge unit and install tank to vehicle. Connect lines and wire and when repair area is cool refill tank with fuel to prevent rust formation.

If tank is to be stored after repair, insert a small quantity of kerosene and #10 engine oil mixed 50/50 and agitate tank. Pour off excess and seal openings to prevent rust formation.

FUEL TANK SAFETY CAP

Some vehicles are equipped with a special fuel tank cap which in the event of being subjected to heat exceeding 160° to 170°F., four fusible alloy plugs will melt out of cap. This will relieve tank pressure to reduce the possibility of explosion.

Care should be taken during sheet metal, or other repairs in the areas around the fuel tank.

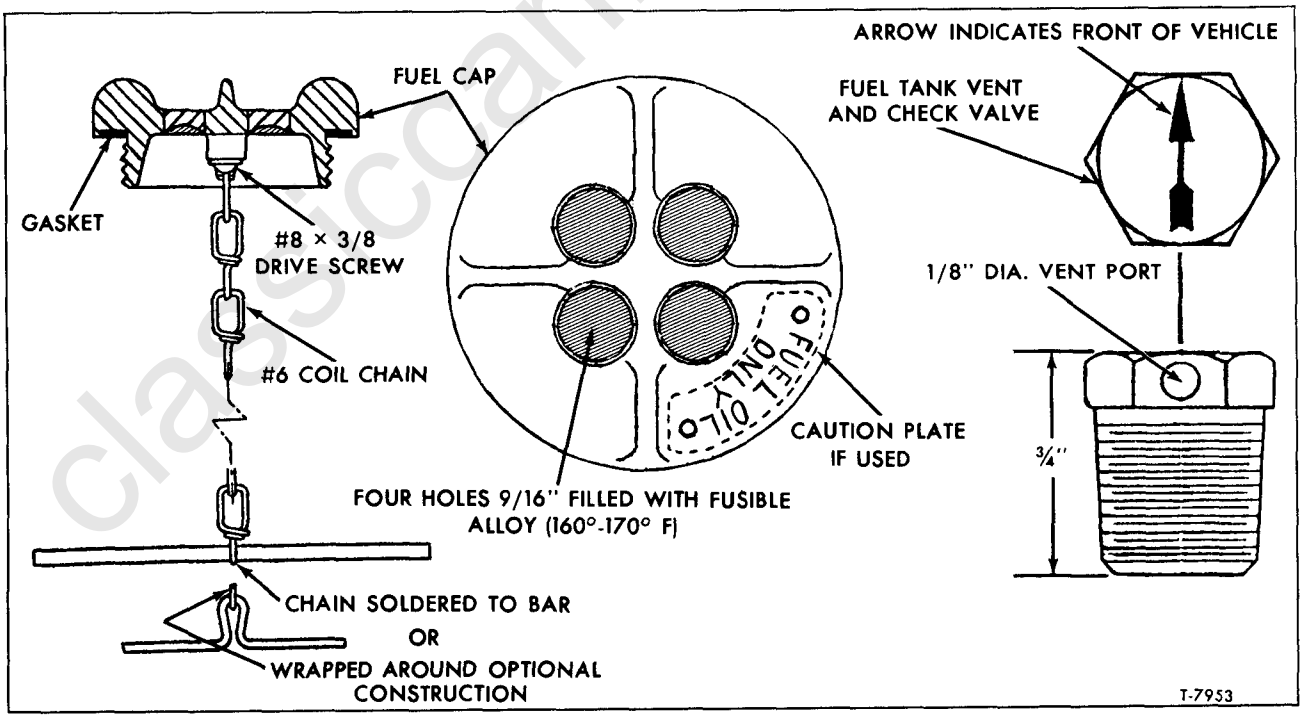


Figure 1—Safety Cap and Vent Check Valve Plug (Typical)

FUEL TANK, GAUGE, AND LINES

The cap should be covered with a protective cover if the vehicle is put into a paint oven or if a heat lamp is used near the tank. If the alloy should melt for any reason, no attempt should be made to replace it. The cap assembly should be replaced. It can be replaced by working the safety chain out of the neck of the tank. A new cap and chain should be installed so that chain is hooked inside the neck and will not allow cap to fall during normal use.

A check valve vent (fig. 1) is used in conjunction with the safety cap as a vent for the tank and a check valve in case the tank becomes inverted. The vent port should be kept open and clear at all times. Any dirt should be removed from the port, the fuel cap removed and air forced into the vent port to clean it.

FUEL GAUGE SYSTEM

Refer to "FUEL TANK, LINES, AND GAUGE SYSTEM" (SEC. 8A) of the 1970 Heavy Duty Truck Service Manual ST135-70, pages 8-5 and 8-6 for figures 10, 11, and 12.

TANK UNIT

The fuel tank strainer, fuel pickup pipe, and tank gauge unit comprise a complete assembly. The fuel tank gauge unit is mounted on top of fuel tank. The large area fuel strainer is of sufficiently fine mesh to prevent entrance of contaminants into fuel system and operates with a self-cleaning action. Inspect condition of strainer whenever tank unit is removed and replace or clean as required.

A protective top (fig. 10) is used on some models to shield the fuel gauge assembly. The tank unit (fig. 11 or 12) houses a variable resistor (rheostat) which controls the flow of current through the dash gauge according to position of the float. The tank unit rheostat may be checked for accuracy with an ohmmeter. With float in "EMPTY" position, an ohmmeter connected across the rheostat should indicate 0 to 1.0 ohm resistance. With float in "FULL" position, resistance should measure approximately 90 ohms.

As the tank is fulled, the tank unit float arm will rise to increase rheostat resistance which in turn will cause the pointer in dash gauge to move toward the "FULL" position.

FUEL TANK AND LINE TORQUE SPECIFICATIONS

APPLICATION		TORQUE
18 GALLON TANK		
Gauge Assembly Mounting Screw		17- 25 In. Lbs.
Neck Assembly Mounting Stud	(Nut)	42- 52 In. Lbs.
Tank Strap to Mounting Bracket	(Nut)	25- 30 Ft. Lbs.
Tank Strap to Frame	(Nut)	6- 8 Ft. Lbs.
Tank Mounting Bracket to Frame Bolt	(Nut)	25- 30 Ft. Lbs.
20 GALLON TANK		
Gauge Assembly Mounting Screw		17- 25 In. Lbs.
Tank Strap to Mounting Bracket	(Nut)	8- 12 Ft. Lbs.
30 GALLON TANK		
Tank Strap to Frame	(Nut) (7/16 x 14)	15- 20 Ft. Lbs.
	(Nut) (1/2 x 20)	40- 50 Ft. Lbs.
Tank Mounting Bracket to Frame	(Nut)	15- 20 Ft. Lbs.
37 and 64 GALLON TANKS		
Gauge Assembly Mounting Screw		17- 25 In. Lbs.
Gauge Protector Top Cover Bolt		5- 6 Ft. Lbs.
Tank Strap to Mounting Bracket	(Lower Bolt) (Nut)	55- 75 Ft. Lbs.
	(Top Nut)	30- 40 Ft. Lbs.
Tank Mounting Bracket to Frame Bolt	(Nut)	70- 80 Ft. Lbs.
50, 75 and 100 GALLON TANK		
Gauge Assembly Mounting Screw		17- 25 In. Lbs.
Gauge Protector Top Cover Bolt		3- 5 Ft. Lbs.
Fuel Tank Strap to Upper or Lower Mounting	(Nut)	30- 35 Ft. Lbs.
Fuel Tank Cross Over Support to Tank Mounting Bracket Bolt - Nut	GM 286-M (7/16 x 14)	25- 35 Ft. Lbs.
	GM 301-M (7/16 x 14)	35- 45 Ft. Lbs.
Fuel Line Clip Bolt	(Nut)	8- 10 Ft. Lbs.
Fuel Tank Support Bracket to Tank Mounting Bracket	(Bolt)	65- 85 Ft. Lbs.
	(Nut)	50- 60 Ft. Lbs.
Fuel Tank Mounting Bracket to Frame	(Bolt) (1/2 x 13)	65- 85 Ft. Lbs.
	(Nut) (5/8 x 11)	90-110 Ft. Lbs.
	(Bolt) (5/8 x 11)	125-145 Ft. Lbs.

SECTION 8B
Exhaust System

All information in Section 8B of the 1970 Heavy Duty Truck Service Manual ST135-70, starting on page 8-9 is applicable to models covered by this supplement. The following information has been added:

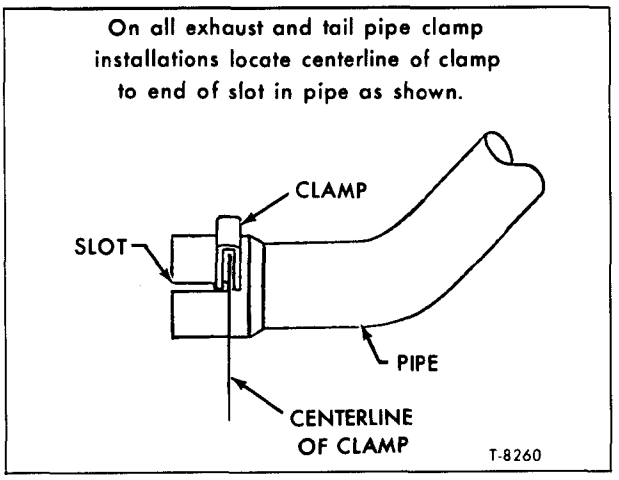


Figure 1—Exhaust Pipe Clamp Installation

EXHAUST SYSTEM ALIGNMENT

During installation of a new exhaust pipe, muffler or tail pipe, care should be taken to properly position components in relation to each other. Particular care should be given to the installation of the exhaust pipe and crossover pipe assembly on "V" engines equipped with single exhaust system.

On all joints except exhaust manifold, apply sealer (GM 9985020) or equivalent, to prevent possible leaks.

Incorrectly assembled parts of exhaust system are frequently the cause of annoying noises and rattles due to improper clearances. Therefore, leave all clamp U-bolts and muffler strap bolts loose temporarily until the entire system has been inspected to determine if there is adequate clearance between exhaust components and frame members. The weight of the exhaust system should be properly distributed on all supporting brackets and hangers. If the load is not properly balanced, reposition pipes at connecting joints to relieve any concentrated loads. After adjusting hangers, aligning pipes, and repositioning muffler, check entire system for adequate clearance and then tighten all clamps, working from front to rear. Start engine and inspect all connections for leakage.

NOTE: When installing exhaust pipe to manifold, always use new packing and nuts. Be sure to clean manifold stud threads with a wire brush before installing new nuts.

The exhaust pipe clamps must be installed over slots in exhaust pipes as shown in figure 1.

NOTE

Exhaust system performance complaints such as excessive back pressure or a malfunctioning gasoline engine exhaust control valve are usually noticeable by their effect on engine performance.

EXHAUST SYSTEM

WARNING—CARBON MONOXIDE

KEEP COWL VENT AND HEATER INTAKES CLOSED WHEN OPERATING IN CONGESTED TRAFFIC TO PREVENT DEADLY EXHAUST GASES FROM ENTERING CAB.

IMPORTANT: Some areas of the country require that an operating vehicle meets a noise-meter test. For assurance of minimum exhaust system noise, use Chevrolet Replacement parts or equivalent.

SECTION 9

Steering System

This section is divided into two separate sections as shown in the following Index:

SECTION 9A

Mechanical Steering

All information pertaining to "MECHANICAL STEERING" (SEC. 9A) in the 1970 Heavy Duty Truck Service Manual ST135-70 is applicable to models covered by this supplement. The following information also applies.

STEERING WHEEL REPLACEMENT

All information in the 1970 Heavy Duty Truck Service Manual ST135-70, pages 9-10 - 9-11 under general heading of "Steering Wheel Replacement" will apply to models covered by this supplement with the exception of the following:

IMPORTANT: When installing steering wheel be sure to place special (hardened) flat washer under the attaching nut.

STEERING IDLER LEVER BUSHING REPLACEMENT (MODEL RM80)

All information in the 1971 Heavy Duty Truck Shop Manual ST332-71, (Sec. 9A) under this heading is applicable to models covered by this supplement except: Torque all clamp bolt nuts of the adjustable drag link to 55-65 foot-pounds after making adjustments.

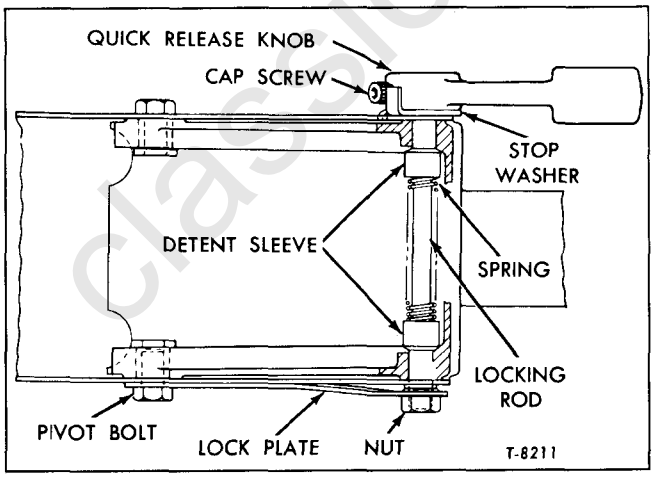


Figure 1—Tilt Column Quick Release Mechanism

FOUR POSITION TILT STEERING COLUMN (EXCEPT 90 SERIES)

All information in the 1970 Heavy Duty Truck Service Manual ST135-70 and Supplement ST332-71 under this heading is applicable to models covered by this supplement. The following information also applies:

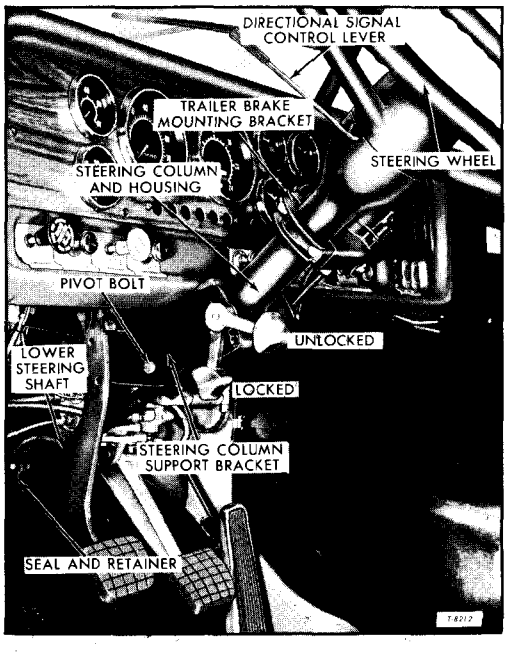


Figure 2—Steering Column and Shaft Components (Conventional Cab Models) (Typical)

MECHANICAL STEERING

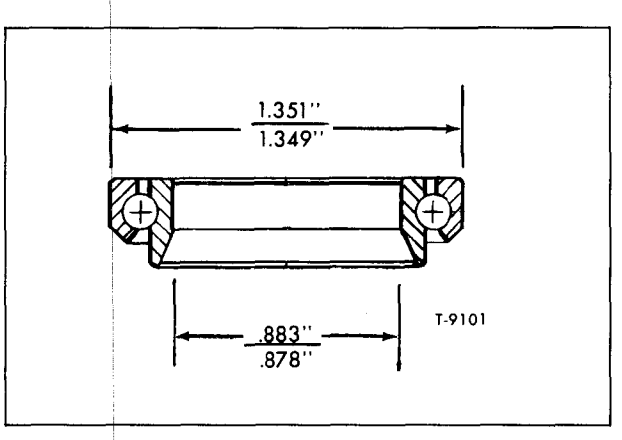


Figure 3—Steering Column Lower Bearing

TILT COLUMN QUICK RELEASE

A "release" and "lock" lever located at left side of column (figs. 1 and 2) permits relocating the position of column.

To reposition the column, raise lever to unlock position; move column to desired position, then push lever down to lock column in selected position (fig. 2).

The tilt column mechanism may be replaced as outlined in the 1970 Heavy Duty Truck Service Manual ST135-70, under "Tilt Column Quick Release" on page 9-11.

NOTE: ALL STEERING COMPONENT ATTACHMENTS ARE IMPORTANT ATTACHING PARTS IN THAT THEY COULD AFFECT THE PERFORMANCE OF VITAL COMPONENTS AND SYSTEMS, AND/OR COULD RESULT IN MAJOR REPAIR EXPENSE. THEY MUST BE REPLACED WITH PARTS OF THE SAME PART NUMBERS OR WITH EQUIVALENT PARTS IF REPLACEMENT BECOMES NECESSARY. DO NOT USE REPLACEMENT PARTS OF LESSER QUALITY OR SUBSTITUTE DESIGN. TORQUE VALUES MUST BE USED AS SPECIFIED DURING REASSEMBLY TO ASSURE PROPER RETENTION OF THESE PARTS.

STEERING COLUMN AND SHAFT

The steering column upper shaft lower bearing has been replaced with an improved type as shown in figure 3.

STEERING GEARS

On all steering gears covered in this supplement will have the side cover attached to the main housing with flange type cap screws.

On steering gears 553DV and 555DV, the stub end of the steering gear worm shaft (fig. 4) will have a cross groove and a section of the serrations machined flat. With the steering gear centered, the steering intermediate shaft clamp yoke and clamp bolt can only be installed one way.

On steering gear 568DV used on the RM80 model, the brass fill pipe has been extended for easier filling.

STEERING TIE ROD

Vehicles covered in this supplement have a three-piece tie rod connecting left and right steering arms. The tie rod assembly (figs. 5 and 7) consists of a tube and two socket end assemblies. Socket end assemblies are threaded into tube and locked in place with clamps. Right- and left-hand threads are provided to facilitate toe-in adjustment.

The tie rod ends are non-repairable and require lubrication as specified in LUBRICATION (SEC. 0) and inspection to see that ball studs are tight. Socket ends should be replaced when excessive up and down motion or any lost motion or end play at ball end of stud exists.

STEERING COLUMN AND SHAFT (CONVENTIONAL CAB MODELS)

During reassembly of the steering shaft to the steering gear worm shaft, or models using a flexible

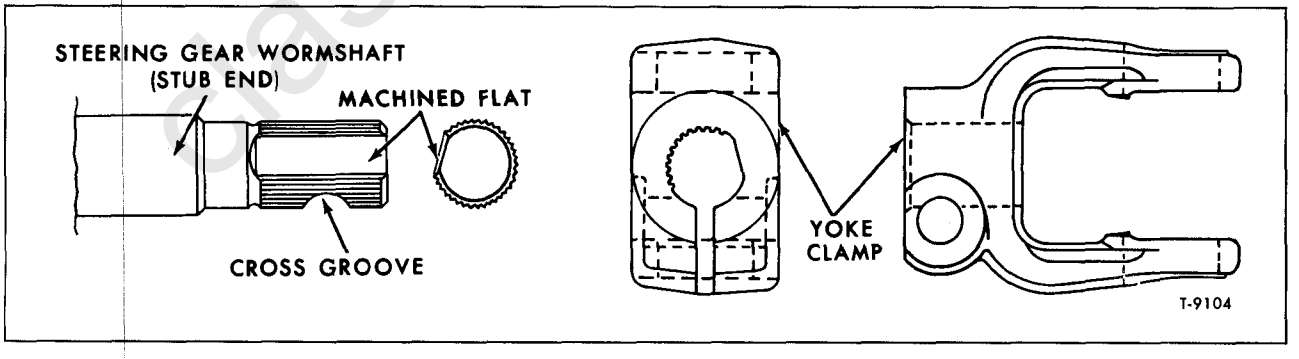
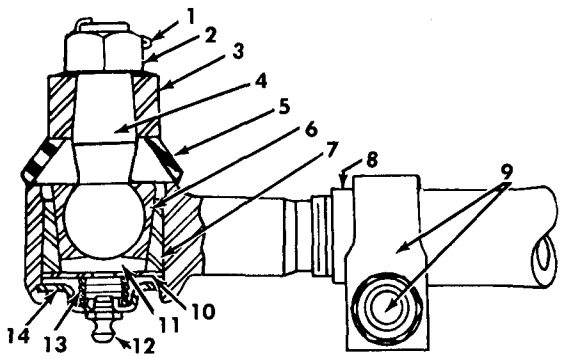


Figure 4—Steering Gear Wormshaft (Stub End) and Intermediate Shaft Yoke and Clamp



1 Cotter Pin
2 Nut
3 Steering Arm
4 Stud
5 Rubber Dust Cover
6 Ball Seat
7 Ball Seat Wedge
8 Tie Rod Tube
9 End Clamp and Bolt
10 Washer
11 Grease Cavity
12 Lube Fitting
13 Spring
14 Retaining Plug

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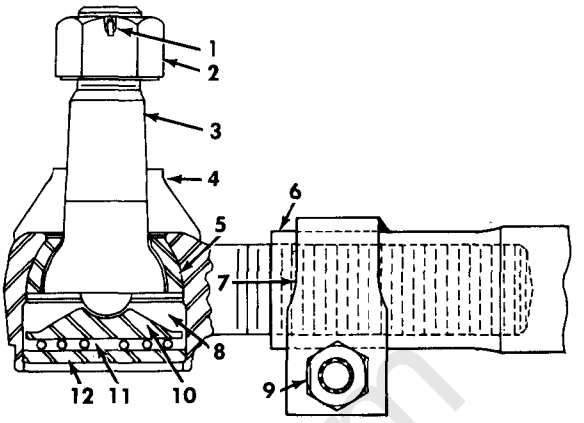
Figure 5—Tie Rod End (F070 Axle)



1 Cotter Pin
2 Nut
3 Stud
4 Rubber Dust Cover
5 Socket Bearing
6 Tie Rod Tube
7 End Clamp
8 Grease Cavity
9 Clamp Bolt
10 End Stud Seat
11 Spring
12 Retaining Plug

T-8467

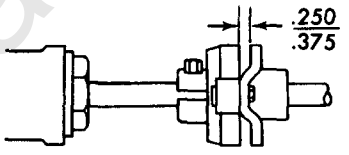
Figure 7—Tie Rod End (All Axles Except F070)

coupling, the coupling should be adjusted as shown in figure 6.

IMPORTANT: To prevent axial bind, the cab mounts and steering shaft to worm shaft clamp bolts must be tightened prioer to tightening steering column to dash and instrument panel bolts.

STEERING WHEEL "CLUNKING" NOISE

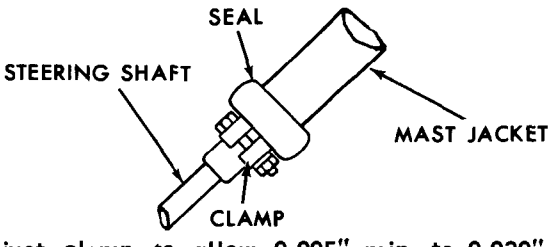
When steering wheel "clunking" noise is experienced and is accompanied by up-and-down movement of the steering wheel, it is possible that the mast jacket clamps and lower steering shaft clamp need adjusting. The "clunking" is caused by up-and-down movement of upper and lower shaft joints and can be eliminated as follows:



This dimension must be held to prevent distortion of flexible coupling with resultant bind and harshness. T-6476

Figure 6—Flexible Coupling Adjustment (Conv. Cab)

1. Loosen mast jacket clamps at dash and fire wall.
2. Push steering wheel down until all up-and-down movement has been removed.
3. Tighten clamp at dash; then tighten clamp at fire wall (if used).
4. Adjust "stop" clamp at bottom of steering shaft to allow 0.005" to 0.030" up-and-down movement of the upper shaft assembly (fig. 8).



Adjust clamp to allow 0.005" min. to 0.030" max. axial movement of shaft assembly and torque clamp bolt to 8 to 11 foot-pounds. This clearance must be maintained to prevent excessive axial chucking of the upper steering shaft or binding of the upper steering shaft bearing. T-6470

Figure 8—Steering Column Stop Clamp Adjustment (Conv. Cab) (Typical)

MECHANICAL STEERING

MANUAL STEERING GEAR APPLICATION CHART

TRUCK SERIES	GEAR MODEL	RATIO
TM80-TV70	553-D-98	28.14 to 1
RM80	568-D-73	30.51 to 1
TM-WM80	568-D-31	30.51 to 1
HM-JM80, HV-JV70	553-D-95	28.14 to 1
HC-HE-HH-HI-HN-JC-JE-JH-JI-JN-MH90	553-D-95	28.14 to 1
TE90	568-D-31	30.51 to 1
DB-FB90	555-D-37	28.14 to 1
DC-DH-DI-DN-DP-FC-FH-FI-FN90	555-D-41	28.14 to 1
JB-MB-MC90	555-D-40	28.14 to 1

TORQUE SPECIFICATIONS

LOCATION	TYPE OF PART	TORQUE (FT.-LBS.)
Steering Wheel Nut	Nut	45-50
Steering Column Pivot Bolt Conventional Cab Models and Series 90	Bolt	8-10
Steering Column Release Bolt Conventional Cab Models	Nut	8-10
Support Bracket to Instrument Panel Steel Tilt Cab Models	Bolt	20-25
Steering Column Support Bearing Cap Bolts—Series 90	Bolt	20-25
Mast-Jacket Mounting Clamp to Support Bracket Tilt Cab Models	Bolt	8-12
Steering Upper Shaft Lower Bearing Stop Bolt	Nut	8-12
Steering Shaft Coupling to Worm Shaft Clamp	Bolt	35-40
Steering Shaft Slip Yoke to Worm Shaft Clamp Bolt	Nut	40-50
Intermediate Shaft to Worm Shaft Clamp Bolt		
Series TV-70	Nut	35-45
Except Series TV-70 & TE-90	Nut	35-40
Series TE-90	Nut	40-50
Steering Upper Shaft to Lower Shaft Clamp Bolt MH 90	Nut	25-30
Drag Link to Pitman Arm Stud*	Nut	125-150
Drag Link to Steering Arm Stud*	Nut	125-150
Drag Link to Idler Lever Stud*	Nut	125-150
Drag Link Clamp Bolt		
Except F-070 or F-090 Front Axle	Nut	65-75
With F-070 or F-090 Front Axle	Nut	55-65
Connecting Rod to Pitman Arm Stud*	Nut	125-150
Connecting Rod to Steering Arm Stud*	Nut	125-150
Idler Link to Pitman Arm Stud*	Nut	125-150
Idler Lever Pivot Bolt	Nut	90-110
Idler Link to Idler Lever Stud*	Nut	125-150
Idler Lever to Frame Stud	Nut	110-130

LOCATION	TYPE OF PART	TORQUE (FT.-LBS.)
Idler Lever to Idler Lever Bracket Stud*	Nut	175
Tie Rod to Steering Arm Stud*		
Except F-070 Front Axle	Nut	125-150
With F-070 Front Axle	Nut	150-180
Tie Rod End Clamp Bolt		
Except F-070 Front Axle	Nut	65-75
With F-070 Front Axle	Nut	80-100
Steering Arm to Axle Stud*		
Except F-070 Front Axle	Nut	400
With F-070 Front Axle	Nut	180-240
Steering Gear to Frame Bolt		
Conventional Cab Models	Nut	50-60
Series RM-80	Nut	90-110
Steel Tilt Cab Models and Series 90	Nut	90-110
Steering Gear:		
Lash Adjuster Screw	Nut	25-35
Side Cover to Housing	Bolt	25-35
End Cover to Housing	Bolt	35-45
Worm Bearing Adjuster Screw	Nut	70-100
Back-up Adjuster Screw	Nut	70-100
Pitman Arm to Shaft:		
553-D-17	Nut	185-215
553-D-81 Pinch Bolt	Nut	100-110
553-D-95 Pinch Bolt	Nut	100-110
553-D-98	Nut	220-250
555-D-37 Pinch Bolt	Nut	90-110
555-D-38 Pinch Bolt	Nut	100-110
555-D-40 Pinch Bolt	Nut	100-110
555-D-41 Pinch Bolt	Nut	100-110
568-D-31	Nut	250-300
568-D-45	Nut	250-300
568-D-46	Nut	250-300
568-D-73	Nut	250-300

*Tighten to Specified Torque, Then Advance to Next Aligning Slot and Install New Cotter Pin.

SECTION 9B
Power Steering

All information pertaining to "POWER STEERING" (SEC. 9B) in the 1970 Heavy Duty Truck Service Manual ST135-70 is applicable to models covered by this supplement. The following information also applies.

GENERAL

All information in the 1970 Heavy Duty Truck Service Manual ST135-70, page 9-26, pertaining to the F160 axle will al so apply to the FL901 axle.

MAINTENANCE

NOTE: If for any reason the power steering system should fail, the control valve "locks up" and the steering gear operates manually, giving the driver full control of the vehicle. Response of the steering gear in effort applied to the steering wheel will be increased.

Should the power steering system becomes inoperative due to the loss of power steering fluid, one of the following steps should be taken before the truck is moved under its own power or before running engine:

1. Make all necessary repairs, fill and bleed steering system.

2. Remove pump drive belt, if pump is driven by a separate belt from the crankshaft. This will prevent further possible damage to the pump while driving with manual steering.

CAUTION: When pump drive belt is also used to drive the fan or other engine components it should not be disconnected. The pump becomes an idler pulley and if allowed to run dry would burn up bearing causing fan to stop and possibly damage engine further. Do not operate pump without steering fluid in pump reservoir.

3. If failed component is not at pump, reroute pump pressure line directly back into pump reservoir.

If at the time of final repair it has been determined the pump has failed or was damaged to the point of replacement, the entire steering system should be cleaned and flushed out.

Due to scoring of the pump at time of failure, the control valve, and cylinder should be disassembled and any particles of metal wiped clean from all parts. Lines and hoses should be removed and blown clear. Tag all lines and hoses for proper relocation.

PUMP DRIVE BELT

MAINTENANCE

The drive belt must be kept at proper tension. A loose belt will reduce output of the hydraulic pump, while a tight belt will cause eventual bearing failure. A regular, periodic inspection is recommended to check condition of drive belt. Replace belt if frayed or badly worn.

ADJUSTMENT

NOTE: When adjusting a new drive belt, adjust tension to "New" belt specifications, turn engine over several times, then reset belt to "New" specifications specified below:

1. Adjusting Poly-V Belt Using Strand gauge (J-23586)

NOTE: Gauge should be placed at the center of the greatest span of the belt.

a. Loosen pump mounting bolts.

b. If "Used" belt, position pump to obtain 78 to 88 pounds.

c. If "New" belt, position pump to obtain 103 to 113 pounds.

d. Tighten pump attaching bolts firmly.

NOTE: A Poly-V belt is considered "Used" after one hour's operation or approximately 50 miles operation.

2. Adjusting Ordinary V-Belt Using Strand Gauge (Burroughs BT-33-73-F)

NOTE: Gauge should be placed at the center of the greatest span of the belt.

a. Loosen pump mounting bolts.

b. If "Used" belt, position pump to obtain 80 to 90 pounds.

c. If "New" belt, position pump to obtain 120 to 130 pounds.

d. Tighten pump attaching bolts firmly.

NOTE: A V-belt is considered "Used" after two hour's operation or approximately 50 to 100 miles operation.

NOTE: ALL STEERING COMPONENT ATTACHMENTS ARE IMPORTANT ATTACHING PARTS IN THAT THEY COULD AFFECT THE PERFORMANCE OF VITAL COMPONENTS AND

POWER STEERING

SYSTEMS, AND/OR COULD RESULT IN MAJOR REPAIR EXPENSE. THEY MUST BE REPLACED WITH PARTS OF THE SAME PART NUMBERS OR WITH EQUIVALENT PARTS IF REPLACEMENT BECOMES NECESSARY. DO NOT USE REPLACEMENT PARTS OF LESSER QUALITY OR SUBSTITUTE DESIGN. TORQUE VALUES MUST BE USED AS SPECIFIED DURING REASSEMBLY TO ASSURE PROPER RETENTION OF THESE PARTS.

POWER STEERING HOSES

When servicing power steering hoses, avoid twisting the hoses unnecessarily. Install hoses with the wheels in the straight-ahead position, then turn the wheels to the right and left, while observing movement of the hoses. Note and correct any hose contact with other parts of the vehicle that could cause chafing or wear.

Any maintenance operation, on the power steering equipment, should include a thorough inspection of the hydraulic line system, including the oil cooler if used,

POWER STEERING GEAR AND CONTROL VALVE

All information in the 1970 Heavy Duty Truck Service Manual ST135-70 on page 9-29 is applicable to models covered by this supplement. The following information also applies:

The 553-DV, 554-DV, and 568-DV type power steering gear assemblies are basically the same except for size and mounting. The 568-DV type steering gear (figs 1 and 2) incorporates a back-up adjuster to prevent the worm shaft from flexing and stop pins are located at each end of the worm thread to prevent the ball nut from bottoming on extreme turns.

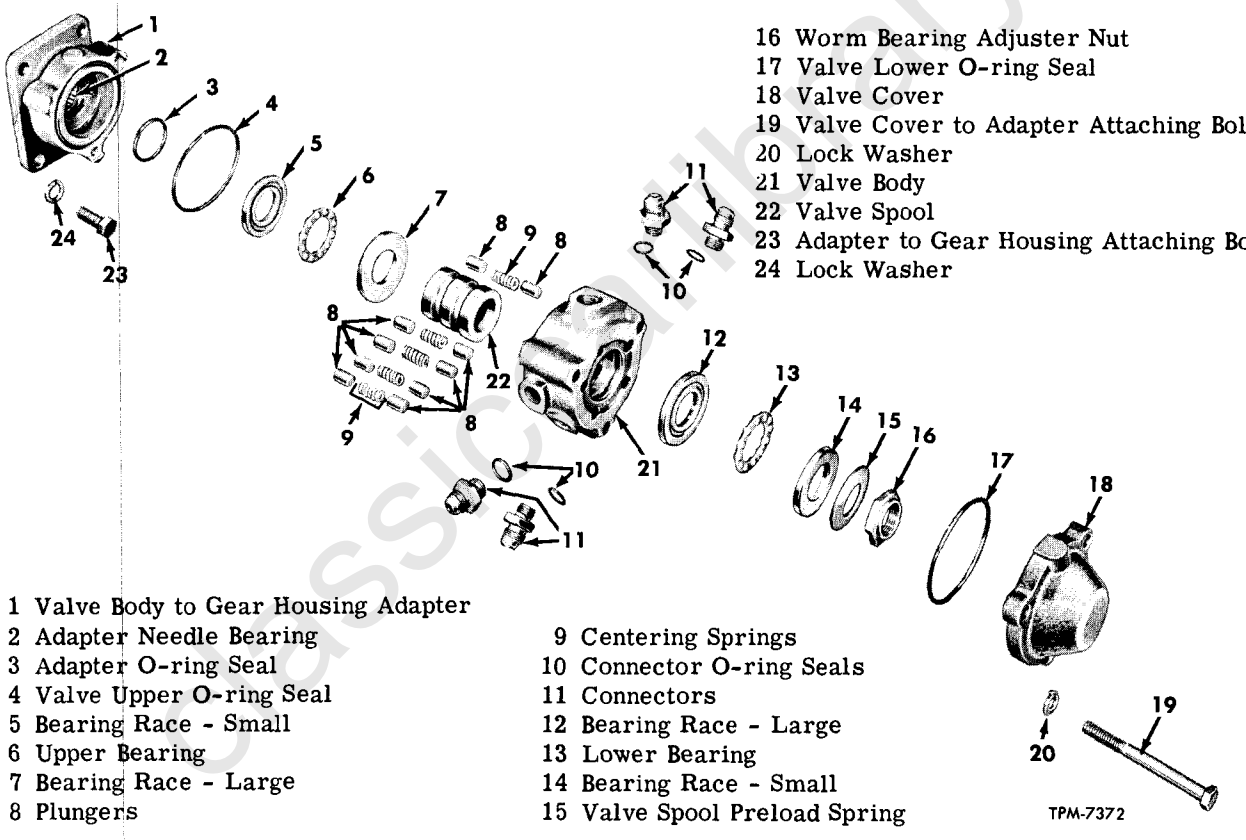


Figure 1—568-DV Steering Gear Hydraulic Valve Components

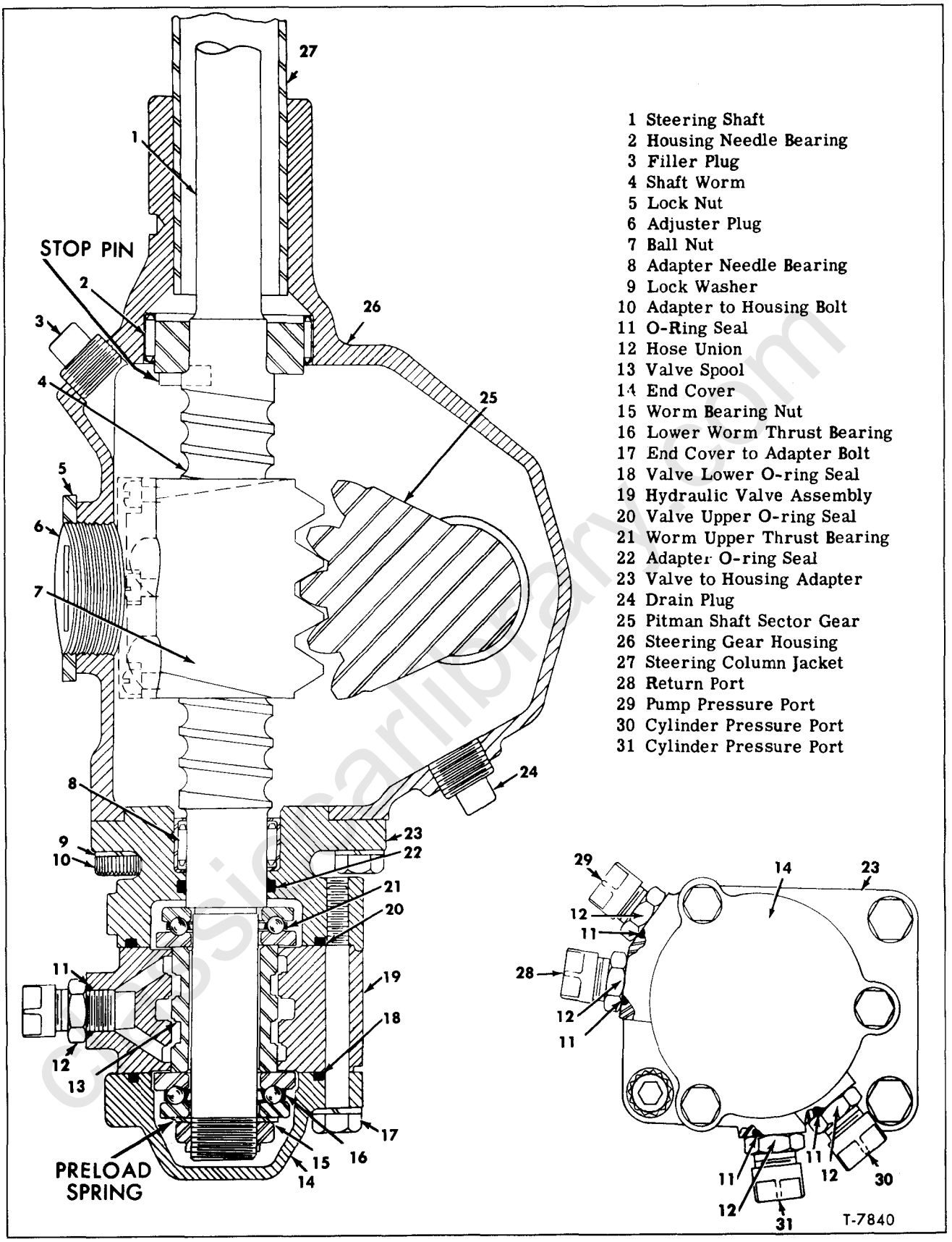


Figure 2—Power Steering Gear and Control Valve Type 568-DV (Used on RM 80 Model)

SPECIFICATIONS
MEDIUM AND HEAVY DUTY POWER STEERING UNITS

POWER STEERING GEAR

Make	Saginaw Steering Gear Division
Type	Recirculating Ball
Ratio	28.14 to 1; 30.51 to 1
Number of Circuit Balls	553DV ....106-9/32" 554DV ....106-9/32" 568DV ....90-11/32"
Thrust Bearing Preload	1 to 3 inch-pounds in excess of valve assembly drag.
Thrust Bearing Adjustment Plus Seal Drag	8 inch-pounds maximum.
Pitman Shaft Preload	4 to 8 inch-pounds in excess of total bearing preload and valve drag.
Final Over-Center Reading—(Total of Valve and Seal Drag, Worm Bearing Preload, and Lash Adjuster Preload)	16 inch-pounds maximum.

HYDRAULIC PUMPS

SAGINAW TYPE PUMP

MODELS	**235-P-19, 235-P-36, 235-P-46, 235-P-48, 235-P-49, 235-P-125, 235-P-132, 235-P-137**
Capacity Per Minute:	
Maximum	3.5 gpm of Power Steering fluid at 170° F. temperature when operating pump against 50 psi pressure at 1500 R.P.M.
Minimum	2.35 gpm of Power Steering fluid at 170° F. temperature when operating pump at 590 R.P.M. against 665/735 psi pressure.
Pressure Relief Valve:	
Minimum PSI	900
Maximum PSI	1000

MODELS	**235-P-141**
Capacity Per Minute:	
Maximum	4.25 gpm of Power Steering fluid at 170° F. temperature when operating pump against 50 psi pressure at 1500 R.P.M.
Minimum	2.35 gpm of Power Steering fluid at 170° F. temperature when operating pump at 590 R.P.M. against 665/735 psi pressure.
Pressure Relief Valve:	
Minimum PSI	900
Maximum PSI	1000

MODELS	**235-P-43**
Capacity Per Minute:	
Maximum	4.8/5.2 gpm of Power Steering fluid at 170° F. temperature when operating pump against 50 psi pressure at 1500 R.P.M.
Minimum	2.35 gpm of Power Steering fluid at 170° F. temperature when operating pump at 590 R.P.M. against 665/735 psi pressure.
Pressure Relief Valve:	
Minimum PSI	1100
Maximum PSI	1200

THOMPSON TYPE PUMP

MODELS	**14-150100-16**
Capacity	
Maximum (Flow Control Range)	3.4-4.1 gpm
Minimum	1.45 gpm when operating pump at 450 R.P.M. against 665/735 psi pressure.
Pressure Relief Valve:	
Minimum PSI	1000 psi
Maximum PSI	1100 psi

VICKERS TYPE PUMP

MODELS	**VTM 27-50-30-10-MJ-L-1-12**
Maximum Capacity	3.0 G.P.M.
Pressure Relief Valve (Controlled Flow)	1500 R.P.M. Pump Speed at 100 psi pressure

MODELS	**VTM 27-60-45-10-MJ-L-1-12**
Maximum Capacity	4.5 G.P.M.
Pressure Relief Valve (Controlled Flow)	1500 R.P.M. Pump Speed at 100 psi pressure

SPECIFICATIONS (CONT.)

POWER STEERING GEAR APPLICATION CHART

TRUCK SERIES	GEAR MODEL	RATIO
HM-JM80, HV-JV70	553-D V-82	28.14 to 1
RM80	568-D V-74	30.51 to 1
TV70	553-D V-94	28.14 to 1
TM-WM80, WV70	553-D V-90	28.14 to 1
HM80	553-D V-86	28.14 to 1
HC-HE-HH-HI-HN-JC-JE-JH-JI-JN-MH 90	553-D V-82	28.14 to 1
DC-DH-DI-DN-FC-FH-FI-FN 90	554-D V-5	28.14 to 1

POWER STEERING POWER CYLINDER

TRUCK SERIES	TYPE OF MOUNTING	RETRACTED LENGTH	EXTENDED LENGTH	STROKE
Conventional Cab Models with F-070; F-090; F-120; F-160 Front Axle	Side	16.680″	25.740″	9 1/16″
Series R-80 with F-090 Front Axle	Axle	17.936″	26.996″	9 1/16″
Series T 70/80				
With F-070 Front Axle	Axle	16.680″	25.740″	9 1/16″
F-090; F-120 Front Axle	Axle	19.806″	30.866″	11 1/16″
Series T/W-70/80/90, D/F90				
With F-090 Front Axle	Axle	17.936″	26.996″	9 1/16″
F-120, F-160 Front Axle	Axle	19.806″	30.866″	11 1/16″

POWER STEERING HYDRAULIC PUMP MODEL APPLICATION CHART

TRUCK SERIES	PUMP MODEL	TYPE PUMP
HM-JM80	235 P 125	VANE
HV-JV70	235 P 36	VANE
RM80	235 P 49	VANE
TV70	235 P 19	VANE
TM-WM80	235 P 48	VANE
WV70	235 P 141	VANE
HM80	235 P 43	VANE
HC-HN-JN-JC90	235 P 137	VANE
HE-JE90	235 P 48	VANE
HH-JH90	VTM 27-60-45-10-MJ-L-1-12	VANE
HI-JI90	235 P 46	VANE
MH90	VTM 27-50-30-10-MJ-L-1-12	VANE
TE90	14-150 100-16	SLIPPER
DC-DH-DN-FC-FH-FN90	235 P 137	VANE
DI-FI90	235 P 132	VANE

POWER STEERING

POWER STEERING TORQUE SPECIFICATIONS

LOCATION	TYPE OF PART	TORQUE (FT.-LBS.)
Steering Gear to Frame Bolt		
Conventional Cab Models	Nut	50-60
Series RM-80	Nut	90-110
Steel Tilt Cab Models	Nut	90-110
Pitman Arm to Shaft		
Conventional Cab Models—Pinch Bolt	Nut	150-175
Series RM-80	Nut	250-300
Series D/F-90—Pinch Bolt	Nut	100-125
Steel Tilt Cab Models	Nut	185-215
Steering Gear Adjustments		
Lash Adjuster Screw	Nut	25-35
Side Cover to Housing	Bolt	25-35
Worm Bearing Adjuster Plug		
Except 568-DV-64	Nut	50-110
Type 568-DV-64	Nut	50-75
Control Valve to Steering Gear		
Except 568-DV-74	Bolt	35-45
Control Valve Adapter to Steering Gear		
Type 568-DV-74	Bolt	25-30
Control Valve to		
Adapter Type 568-DV-74	Bolt	15-20
Pressure Hose Union	—	30-40
Hose Fittings to Ports	—	20-30
Power Steering Cylinder		
Anchor Bracket to Frame Bolt	Nut	50-60
Power Steering Cylinder		
Anchor Bracket to Axle Bolt	Nut	50-60
Power Steering Cylinder		
to Pitman Arm Stud*	Nut	125-150
Power Steering Cylinder		
Anchor Bracket to Tie Rod U-Bolt	Nut	35-45
Power Steering Cylinder		
Ball Stud Socket Clamp Bolt	Bolt	50-60
Power Steering Cylinder to R.H. Idler		
Arm Stud* With F-160 Front Axle	Nut	125-150
R.H. Idler Arm—With F-160 Front Axle		
Support Bracket to Frame Bolt	Nut	50-60
Idler Arm to Idler Shaft Clamp Bolt	Nut	100-110
Drag Link to Pitman Arm Stud*		
Conventional Cab Models	Nut	125-150
Drag Link to Idler Lever Stud*		
Series RM-80	Nut	125-150
Tilt Cab Models	Nut	125-150
Drag Link to Steering Arm Stud*	Nut	125-150
R.H. Drag Link to Idler Arm Stud*		
With F-160 Front Axle	Nut	125-150
Power Steering Junction Block to		
Frame Bolt With F-160 Front Axle	Nut	20-25
Reservoir Mounting Bracket to Support	Bolt	20-25
Reservoir to Mounting Bracket	Bolt	20-25
Oil Cooler to Support Bracket	Bolt	10-15
Vane Type Hydraulic Pump		
Mounting Bolt or Stud	—	25-40
Port Fitting	—	25-40
Slipper Type Hydraulic Pump		
Reservoir Cap Screw	—	15-20
Pressure Relief Valve	—	30
Front Insert Nut	—	95-105
Tie Rod to Steering Arm Stud*		
Except F-070 Front Axle	Nut	125-150
With F-070 Front Axle	Nut	150-180
Tie Rod End Clamp Bolt		
Except F-070 Front Axle	Nut	65-75
With F-070 Front Axle	Nut	80-100

*Tighten Nut to Specified Torque. Then Advance to Next Aligning Slot and Install a New Cotter Pin to Secure.

All torques for F-160 Front Axle are applicable for the FL-901 Front Axle.

POWER STEERING FLUID

GM APPROVED POWER STEERING FLUID IS AVAILABLE THROUGH WHOLESALE WAREHOUSES AND TRUCK CENTERS. CHECK FLUID LEVEL EVERY 6,000 MILES OR FOUR MONTHS, WHICHEVER OCCURS FIRST. IF GM POWER STEERING FLUID IS NOT AVAILABLE, DEXRON AUTOMATIC TRANSMISSION FLUID MAY BE USED.

CAUTION: DO NOT USE GM POWER STEERING FLUID IN AUTOMATIC TRANSMISSION.

SECTION 10

Wheels and Tires

All information pertaining to WHEELS AND TIRES (SEC. 10) of the 1970 Heavy Duty Truck Service Manual ST135-70 is applicable with addition of the following:

GENERAL DESCRIPTION

CAST SPOKE MOUNTING

Cast spoke wheels have hub and wheel integral. Demountable rims are clamped to wheels by studs, clamps, and nuts. Rim driver blocks at each side of valve stem hole prevent rim slippage and valve stem damage. Figure 1 shows positioning of both rim types to wheel with spacer. Depicted also are differences in tire and rim cross sections. Dual rear tire spacing is the sum of the wheel offsets plus rim spacer width.

BUDD DISC TYPE MOUNTING

Wheels are secured to hubs by bolts and ball seat type nuts. Unique in the dual rear attachment is the inner and outer threaded nut arrangement permitting removal of outside wheel without interfering with inner wheel.

WHEEL STUDS OR BOLTS AND NUTS

(Refer to Figures 2 and 3)

BUDD DISC STUDS

Stripped threads on the studs may be the result of excessive torquing of the studs, or it may be a result of damage during wheel installation, when placing the wheel over the studs.

Where a damaged thread is discovered, the stud should be replaced.

Broken studs are a direct result of operating with loose cap nuts or improperly seated wheels.

When a broken stud is found all the studs should be replaced. This is because the other studs in the assembly have been subjected to undue strain in carrying all the load and may have become excessively fatigued.

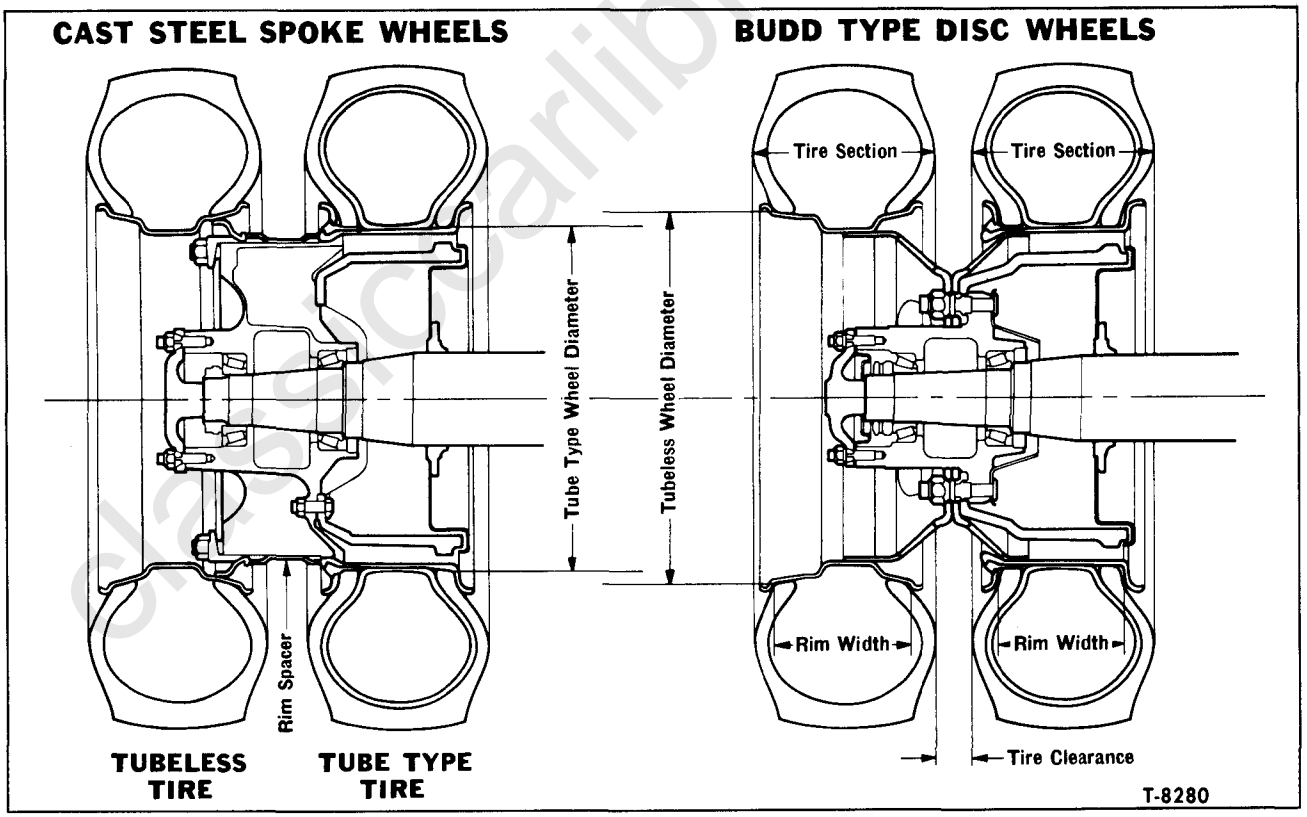


Figure 1—Wheels and Rim Mounting for Cast Spoke and Budd Type Disc Wheels

WHEELS AND TIRES

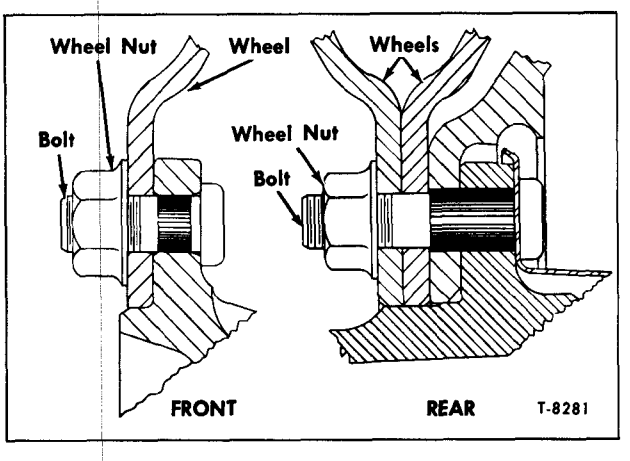


Figure 2—Corporation Type Disc Wheel Mounting

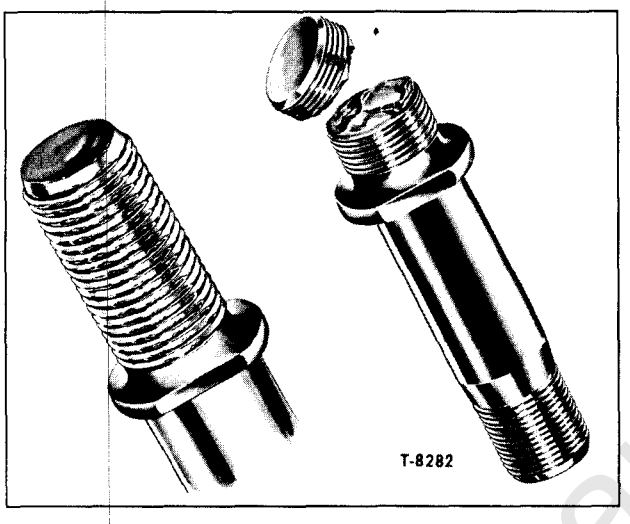


Figure 3—Budd Type Damaged or Broken Studs

Damaged Inner or Outer Cap Nuts (Fig. 4)

When this condition is found - it is a definite indication of a loose mounting condition. Cap nuts and studs, if necessary, must be replaced. If wheel ball seats are damaged, the wheel also should be replaced.

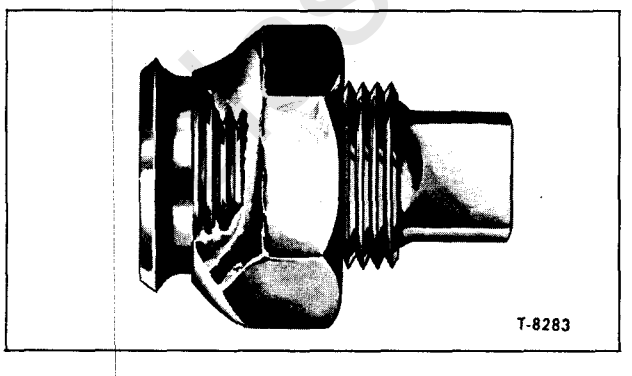


Figure 4—Budd Type Damaged Inner or Outer Cap Nuts

Freezing of Nut

This condition results from one of two basic causes:

1. Corrosion or galling of the stud and nut assembly can reach a point where removal of cap nuts is difficult. If this is a persistent problem, the threads of the stud and the threads of the inner cap nut should be cleaned with a wire brush.

To further aid in this problem, use cadmium plated cap nuts with a dichromate dip.

2. Improper tightening of the inner cap nuts. If the inner nut, during assembly, is UNDER-TIGHTENED to only 200-250 foot-pounds, and then the outer tightened correctly to 500-550 foot-pounds, the very act of backing off the outer nut will sometimes turn the inner.

CAST WHEEL STUDS

CAUTION: Insufficient wheel stud nut torque can cause rim slippage, resulting in broken valve stems, worn parts, wheel shimmy and extreme tread wear. Excessive mounting torque can cause damage by stripping studs, collapsing spacer bands, out-of-round rim condition or broken studs or cracks in the stud hole area.

WHEEL INSPECTION (DISC TYPE)

WORN WHEEL STUD HOLES (Fig. 5)

This condition will usually be accompanied by appearance of a shiny worn surface on wheel face, indicating that loose wheels were moving against each other. If the stud holes are out of shape - oval or egg shaped - and where a build-up of metal is around them, these wheels must be replaced.

CRACKED DISC WHEELS (Fig. 5)

Cracks running from hand-hole to stud-hole or bolt-hole to center-hole or hand-hole to hand-hole, or hand-hole to rim, or stud hole to stud-hole, are a direct result of overloading. Check working loads of axles, discard damaged wheels, check wheel studs and complete assembly.

The hub assembly may have a worn mounting face as a result of moving of the inner wheel on the hub. The studs may have turned in the hub and worn the stud groove or the studs may have actual cracks or breaks resulting from this condition. The wheel may have worn ball seats in the stud holes. All these possibilities must be checked and all damaged parts replaced.

DAMAGED OR CRACKED RIMS

The rim as shown in figure 6 has cracked from fatigue and overload. This type of failure is

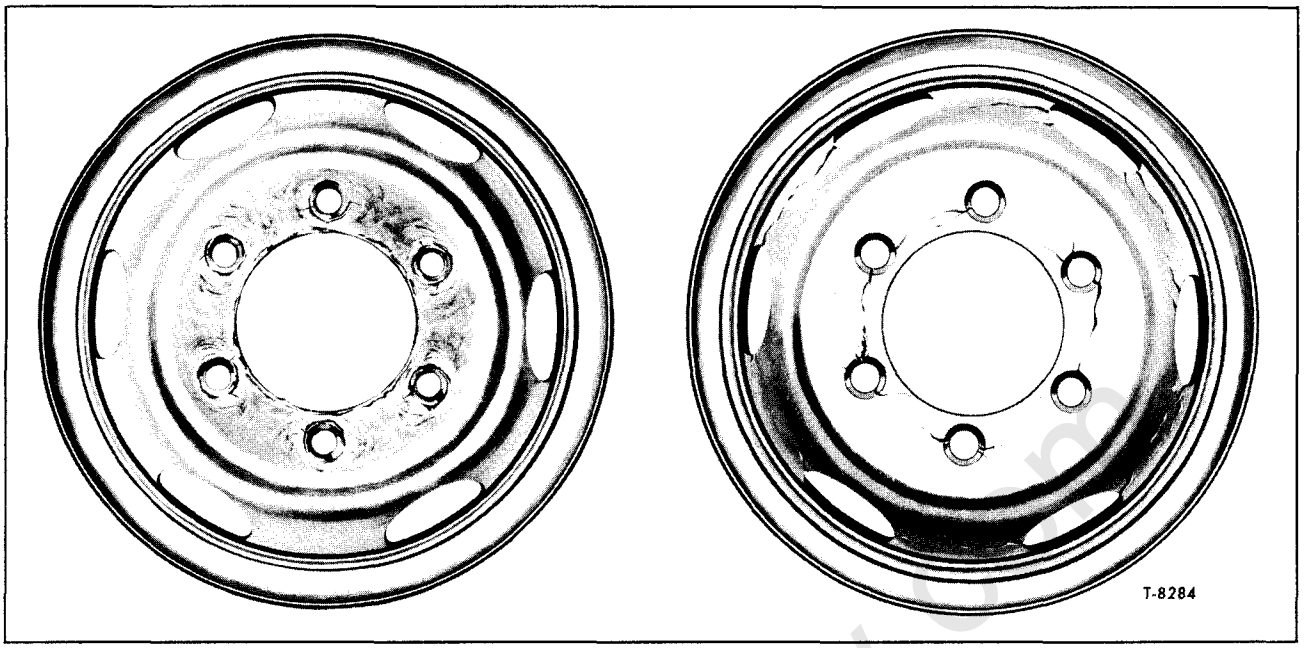


Figure 5—Worn Wheel Stud Holes and Cracked Disc Wheels

common to overloaded rims and dangerous. Careful checks should be made for this condition before tire mounting and defective parts are replaced.

Corrosion sometimes is also observed (fig. 6) and where corrosion is excessive, may cause poor seating of lock or side rings. Where damage of excessive corrosion is observed, wheel should be replaced.

Rust Streaks on Discs
Emanating From Stud Holes

This is a positive indication that the cap nuts are, or have been, loose. In this case, the assembly should be checked carefully because damage to hub, studs, or wheel may have been caused by running in this condition.

Damaged or Sprung Rings

Broken or cracked rings as shown in figure 7, are generally caused by rough use of tire tools or improper initial seating in gutter of rim. When found, the ring should be replaced. Bent or sprung rings are caused by rough and improper removal of this part and cannot be properly sprung back so as to seat accurately in the rim gutter. They should be replaced.

Cracked or Eroded Side Rings (Fig. 8)

Cracks through side ring, spreading laterally through the entire section. These are caused by improper mounting and demounting techniques, impact with road obstructions, and excessive clamping torques.

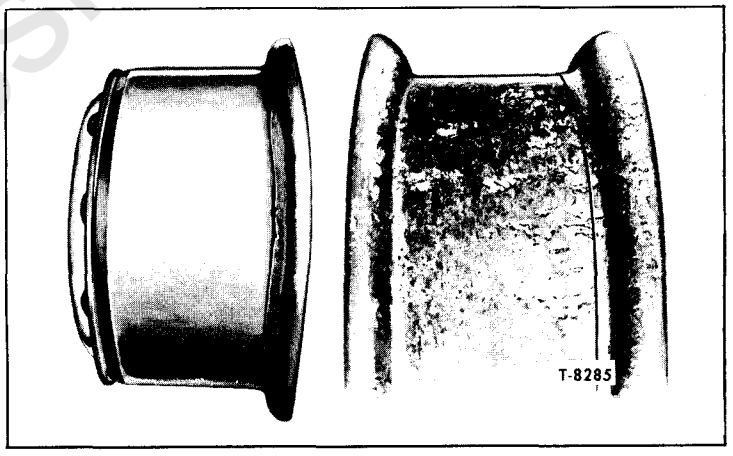


Figure 6—Cracked or Corroded Rims

WHEELS AND TIRES

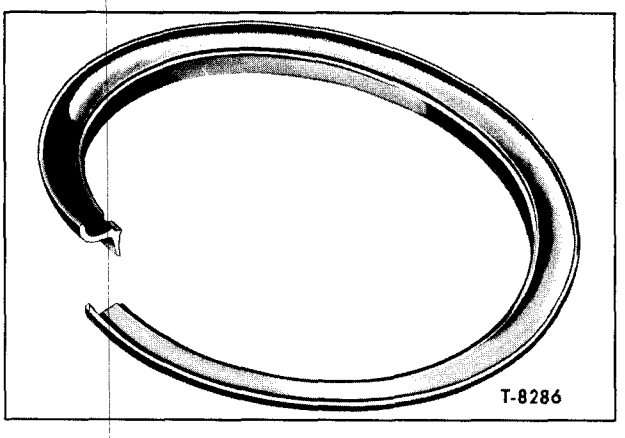


Figure 7—Damaged or Sprung Rings

Erosion and chipping of bead seat of lock ring, resulting from excessive corrosion.

NOTE: Insure that replacements are made with the proper sizes and types of rims and rings.

Wheel Maintenance

Thoroughly remove rust, dirt, and other foreign materials from all surfaces. Hand or electric wire brushes, sand blasting or chemical baths may be used. Gutter of rim base should be cleared of rust and other materials obstructing safe, positive seating of rings.

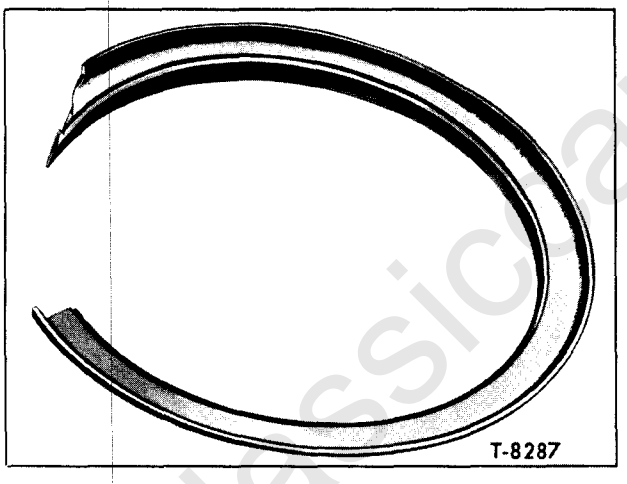


Figure 8—Cracked or Eroded Side Rings

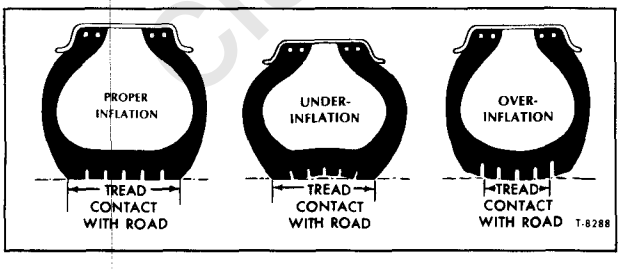


Figure 9—Inflation of Tires

Bead seat areas of rim should be free of rust and rubber deposits. This is especially important for drop-center tubeless rims, because the 15° bead seat is the air-sealing element.

Rings should be cleaned with wire brush. Pay particular attention to seating surfaces and bead seat areas.

Paint rim by brush or spray with a fast-drying metal primer. Surfaces should be clean and dry prior to painting. Insure that bare metal areas on outside or tire side of rim are covered. This is especially important on drop-center tubeless rings, because warm and sometimes moist air is in constant contact with the metal surface on the tire side of the rim.

INFLATION OF TIRES

(Refer to Figure 9)

Inflate to correct pressure when tires are cool. If tires are continually carrying less than the recommended maximum load, adjust air pressure downward to correspond to the actual load carried.

Never "bleed" tires to relieve build-up of pressure. Tire temperature will increase when the tire is in service and allows for the normal build-up in air pressure. Tire temperature and air pressure will remain within limits that are not harmful to the tire when used in accordance with the recommendations for load and air pressure.

If excessive build-up of air pressure occurs, load, underinflation, speed, or a combination of these is responsible. Use the size and type of tire that has the capacity to carry the load at recommended cold starting pressure.

TIRES

OVERLOAD

Overloading is the cause of many kinds of cord body breaks and is the most costly of all truck tire abuses. Such breaks are due to abnormal flexing or overworking of the cord body of the tire.

Overload flex breaks occur in the sidewall or in the shoulder of a tire and run with the circumference of the tire. Sometimes they are only two or three inches long.

Other times they will extend partly around the tire, resulting either in a large blowout or a pinched tube which allows the tire to go flat.

Normal flexing of a tire can go on indefinitely without causing any appreciable damage to the cords. But if the tire is overworked or overflexed from overload, abnormal heat is generated and the cords become fatigued and break.

Underinflation will cause this same result. In addition, crowned roads, sprung axles, mismatched duals and poor load distribution tend to produce flex breaks; however, overloading exceeds all other

forms of abuse and costs truck owners large sums of money annually. This tremendous waste can be avoided if trucks are equipped with tires and rims of the proper size and type, large enough to carry the load. The rated carrying capacity of a tire cannot be increased by inflating it beyond the maximum recommended pressure.

Valve Stem

After installation of tires, make sure valve stem does not rest on brake drum. If brass stems are too close to the brake drums, excessive heat may damage valve and cause possible loss of air pressure.

WHEEL AND TIRE BALANCING

CORRECTING IRREGULAR TIRE WEAR

Heel and Toe Wear -- This is a saw-toothed effect where one end of each tread block is worn more than the other. The end that wears is the one that first grips the road when the brakes are applied.

Heel and toe wear is less noticeable on rear tires than on front tires, because the propelling action of the rear wheels creates a force which tends to wear the opposite end of the tread blocks. The two forces, propelling and braking, make for more even wear of the rear tires, whereas only the braking forces act on the front wheels, and the saw-toothed effect is more noticeable.

A certain amount of heel and toe wear is normal. Excessive wear is usually due to high speed driving and excessive use of brakes. The best remedy, in addition to cautioning the owner on his driving habits, is to interchange tires regularly.

Side Wear -- This may be caused by incorrect wheel camber, underinflation, high cambered roads or by taking corners at too high a rate of speed.

The first two causes are the most common. Camber wear can be readily identified because it occurs only on one side of the treads, whereas underinflation causes wear on both sides. Camber wear requires correction of the camber first and then interchanging tires. There is, of course, no correction for high cambered roads. Cornering wear is discussed further on.

Misalignment Wear -- This is wear due to excessive toe-in or toe-out. In either case, tires will revolve with a side motion and scrape the tread rubber off. If misalignment is severe, the rubber will be scraped off of both tires; if slight, only one will be affected.

The scraping action against the face of the tire causes a small feather edge of rubber to appear on one side of the tread and this feather edge is certain indication of misalignment. The remedy is readjusting toe-in, or rechecking the entire front end alignment if necessary.

Cornering Wear -- When a truck makes an extremely fast turn, the weight is shifted from an even loading on all wheels to an abnormal load on the tires on the outside of the curve and very light load on the inside tires, due to centrifugal force. This unequal loading may have two unfavorable results.

First, the rear tire on the inside of the curve may be relieved of so much load that it is no longer geared to the road and it slips, grinding off the tread on the inside half of the tire at the excessive rate. This type of tire shows much the same appearance of tread wear as tire wear caused by negative camber.

Second, the transfer of weight may also overload the outside tires so much that they are laterally distorted resulting in excessive wear on the outside half of the tire, producing a type of wear like that caused by excessive positive camber.

Cornering wear can be most easily distinguished from abnormal camber wear by the rounding of the outside shoulder or edge of the tire and by the roughening of the tread surface which denotes abrasion.

Cornering wear often produces a fin or raised portion along the inside edge of each row in the tread pattern. In some cases this fin is almost as pronounced as a toe-in fin, and in others, it tapers into a row of tread blocks to such an extent that the tire has a definite "step wear" appearance.

The only remedy for cornering wear is proper instruction of operations. Driving more slowly on curves and turns will avoid grinding rubber off tires. To offset normal cornering wear as much as possible, tires should be interchanged at regular intervals.

Uneven Wear -- Uneven or spotty wear is due to such irregularities as unequal caster or camber, bent front suspension parts, out-of-balance wheels, brake drums out-of-round, brakes out of adjustment or other mechanical conditions. The remedy in each case consists of locating the mechanical defect and correcting it.

Power and Speed -- Excessive speed has always been harmful to tires. Speed creates heat - heat softens tires.

Stops and Starts -- Quick stops and starts grind off tread in a hurry, may cause flat spots which continue to grow for the life of the tire.

Temperature -- Considerably less mileage can be expected from a tire used in all warm weather driving as compared to all cool weather driving, or from a tire first put into service in warm weather.

MECHANICAL IRREGULARITIES (Fig. 10)

Following are some wheel or vehicle irregularities which may cause rapid or uneven tread wear:

Toe-In -- The wheels on the same axle are closer together in the front than they are in the

WHEELS AND TIRES

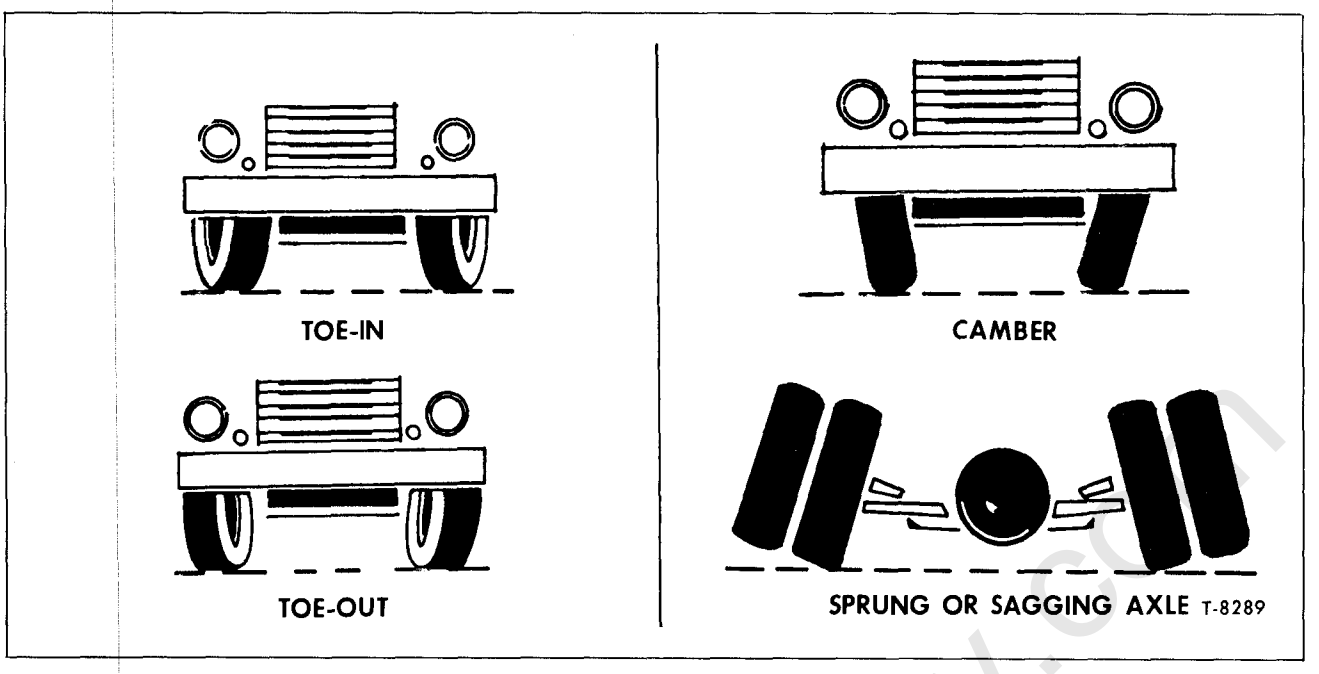


Figure 10—Mechanical Irregularities

rear. When toe-in is excessive the tire wear shows feathered edges on inside edge of the skid design.

Toe-Out -- The wheels on the same axle are closer together in the rear than they are in the front. Tire wear shows feathered edges on outside edge of the skid design.

Camber -- This designates the tilt of the wheel. Positive camber is when wheels are closer together at point of road contact. Negative camber is when wheels are closer together at top. Too much camber results in excessive wear on one side of tire.

Caster -- This is the backward tilt of the axle or inclination of the kingpin at the top. Too little caster causes wheel to wander or weave - result, spotty wear. Excessive caster may cause wheel "flight" or shimmy wear. Unequal caster causes wheel to pull to one side, resulting in excessive and uneven wear.

Sprung or Sagging Axle -- Either of these conditions causes uneven distribution of the load. A sprung or sagging axle will cause the inside dual tire to carry the greater load.

Tandem and Spread Axle Wheels -- Fast tire wear often occurs on tandem wheels because of side scuffing when the vehicle rounds a curve and the tires are not moving in a straight path. The same thing happens when spread axle tires are dragged or pushed sideways; for example, while spread axle trailers are being spotted at or pulled away from loading docks.

Sprung or Twisted Frame -- Will cause rapid or uneven tread wear.

Grabbing Brakes -- Brakes out of adjustment and out-of-round brake drums cause tire treads to wear rapidly in spots. Out-of-round brake drums usually wear out tires in a single spot. Improperly adjusted brakes produce several worn places.

Worn wheel bearings, loose radius rods and U-bolts, unbalanced wheels, or wobbly wheels all result in uneven and irregular tread wear.

At first sign of uneven tire tread wear, check and correct all mechanical irregularities.

SELECTION OF TIRES

TIRE MATCHING
(Refer to Figure 11)

Unmatched tires on either Tandem Drive Units or Tridem Drive Units will cause tire wear and scuffing and possible damage to the drive units. Consequently we recommend the tires be matched to within 1/8" of the same rolling radius, ¾" of the same rolling circumference.

TANDEM UNITS

IMPORTANT: The four largest tires should never be installed on one driving axle or the four smallest tires on the other driving axle. Such tire mounting will cause an inter-axle "fight," unusually high axle lubricant temperatures that result in premature lubricant breakdown and possible costly axle service.

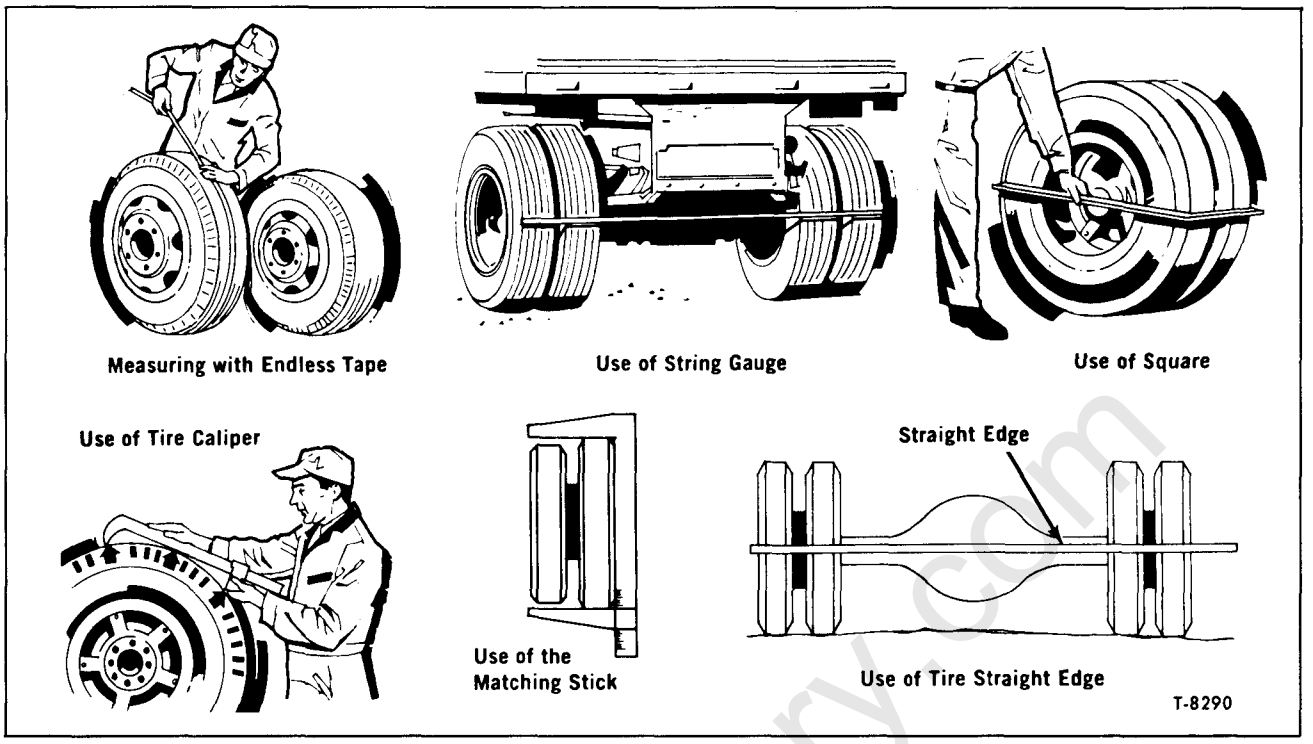


Figure 11—Types of Tire Measurement

In addition to matching individual tire rolling radii or rolling circumference, we recommend matching, as nearly as possible, the total tire circumference of one driving axle to the total tire circumference of the other driving axle. This will usually result in satisfactory tandem axle lubricant temperatures that lengthen drive unit service with higher tire mileage.

TRIDEM UNITS

When three driving axles are "hooked" together in a Tridem Series, unmatched tires will compound the problems described in the preceding paragraphs.

Therefore, we recommend matching, as nearly as possible, the total tire circumference of each of the three driving axles.

HOW TO MATCH TIRES

TANDEM UNITS

The vehicle should be on a level floor, carrying a correctly distributed rated capacity load. Be sure all tires are the same size (measure new tires to be sure they will be correctly matched).

1. Inflate all tires to the same pressure.
2. Carefully measure the rolling circumference of each tire with a steel tape.
3. Mark the size on each tire with chalk and arrange them in order of size, largest to smallest.
4. Mount the two largest tires on one side of one axle and mount the two smallest on the opposite side of the same axle.
5. Mount the four other tires on the other axle in the same manner.
6. Test run the vehicle to get accurate rear axle lubricant temperature readings on the two axle lubricant temperature gauges.
7. Vary tire air pressure, within the tire manufacturer's recommended range, so the lubricant temperature of both axles is within 30°F., of each other and not in excess of 220°F. This will usually result in uniform tire loading and good tire life.

Follow the same procedure (Items 1 thru 7) for matching tires on a Tridem Unit. Arrange the tires in order of size. The two largest and two smallest go on one axle, the next two largest and smallest on the second axle, and the remaining four on the third axle.

Measuring the circumferences of the tires with a steel tape after they are on the rims and inflated but before they are applied to a vehicle is the most accurate method.

Measuring in this manner takes into account any irregularities in wear. In checking tires already on a vehicle, either a square, similar to but larger than a carpenter's square, a string gauge, a large pair of calipers, or a wooden straight-edge long enough to lie across the treads of all four tires, may be used.

WHEELS AND TIRES

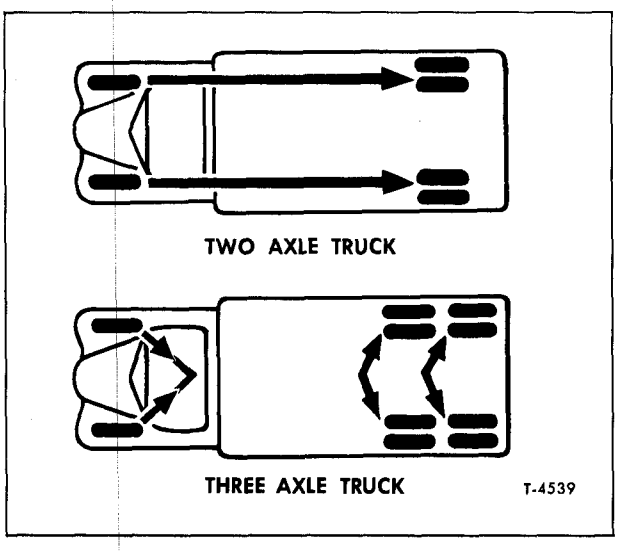


Figure 12—Tire Rotation

TIRE ROTATION

Generally, it is the best practice to "break in" new tires on front wheels. "Breaking in" on an easy position generally increases the overall tire life.

The movement of the tires from front to various rear wheel positions depends upon the type of unit being operated. It is generally necessary to use tires with good non-skid tread design on drive wheels.

Tires with least tread design should be used on trailer wheels, and particularly on the rear of tandem wheels. This is due to the fact that cuts are found more often on the trailer and rear tandem tires and by using well worn tires on these wheels, loss on tires due to road hazards is minimized.

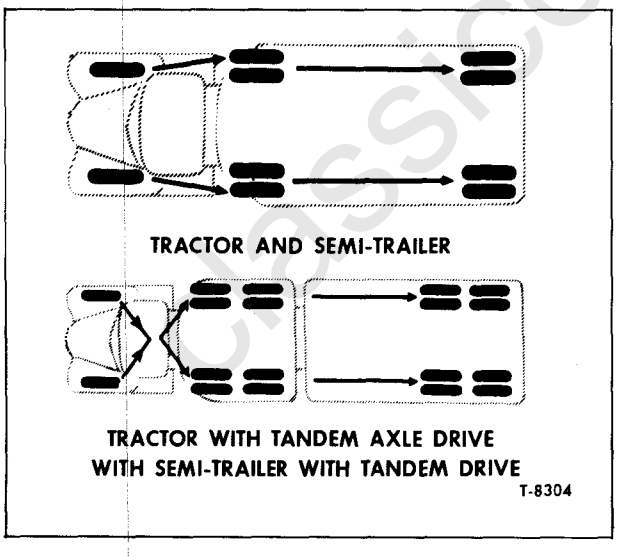


Figure 13—Tire Rotation

NOTE: When rotating any tire, follow recommendations in "selection of tires" as covered previously.

TWO-AXLE TRUCK

Tires should be moved from front wheels to rear wheels (fig. 12) after 1/3 of the tread design is worn off. If there is uneven front wheel tire wear, rotate tires immediately and check vehicle for mechanical irregularities. When tires are moved to the rear, follow recommendations in matching them with other tires.

TRUCK WITH TANDEM AXLE DRIVE

Follow the same practice as described for single-drive axle except tires must be removed from the fronts at less service in order to provide 8 tires for the rear wheels instead of 4 for the single-axle drive. Since there are 5 tires on each side of the vehicle (fig. 12) the front tires should be moved to the rear when 1/5 of the tread design is worn off. Then match tires on each wheel as already described but with an additional precaution - the sum of the circumferences of the four tires for the front of the tandem drive axles should equal the sum of the circumferences of the four tires on the rear of the tandem axles. This precaution is necessary to prevent excessive wear from slippage. If there is a third differential between the two drive axles, this precaution is unnecessary.

TRACTOR AND SEMI-TRAILER

After 1/5 of the tread design is worn off, tires should be moved from the front to the inside or outside driving wheels (shown in figure 13), the position being determined by matching as recommended. Later the tires should be moved to the trailer wheels. The possibility of injury from cuts, bruises, etc., is greater in the trailer wheel position. By following this rotation plan with tires, ending their service on trailer wheels, at least the greater portion of the tire service has been obtained even if they are damaged.

TRACTOR WITH TANDEM AXLE DRIVE
WITH SEMI-TRAILER WITH TANDEM AXLE

Follow same procedure as above for tractor and semi-trailer with single-axle except tires must be removed from the front wheels at less service in order to provide for 16 tires instead of 8. Since there are 9 tires on each side of the vehicle, the front tires should be moved to the rear when 1/9 of the tread design is worn off (fig. 13). Then match tires on each wheel as already described but with an additional precaution - the sum of the circumferences of the 4 tires for the front of the tandem

drive axles should equal the sum of the circumferences of the 4 tires on the rear of the tandem axles. This precaution is necessary to prevent excessive wear from slippage. If there is a third differential between these two drive axles, disregard this recommendation. Likewise it is to be disregarded for semi-trailer tandem tires because these are on free-rolling wheels.

SYNTHETIC TUBES AND FLAPS

TUBES CHAFED OR PINCHED BY FABRIC BREAKS

Tubes may fail as a result of being chafed or pinched by fabric breaks inside the tire. The direction and shape of the tube injuries have rather closely followed the pattern of the fabric breaks. A tire does not necessarily go flat immediately when a fabric break occurs on the inside of the tire because it may take some time for the injury to chafe completely through the tube.

TUBES DAMAGED BY MISMOUNTED FLAPS

The tube may become chafed by a fold at the edge of the flap. In mounting tires requiring flaps, it is essential that the flaps be properly centered between beads to prevent folds or wrinkles. Flaps which have once become twisted, creased, or folded over at edges, should not be used again.

TUBES AND CASINGS DAMAGED BY FOREIGN MATERIALS IN CASINGS

Any foreign material between the casing and tube will cause a chafing action. In time, one or both will become badly damaged and fail. The result of grit, pebbles, or other hard substances which become embedded in the tube wall, will chafe tube and finally cause failure.

TUBES STRETCHED AND CREASED

When a tube is larger than the inside of the casing it has become stretched and can become creased. Creasing can also happen to a new tube of proper size when incorrectly mounted. If the crease occurs in the flexing area of the tire, the resulting additional thickness of the tube where folded causes a hinging action which cuts the tube and frequently damages the fabric - resulting in a costly failure.

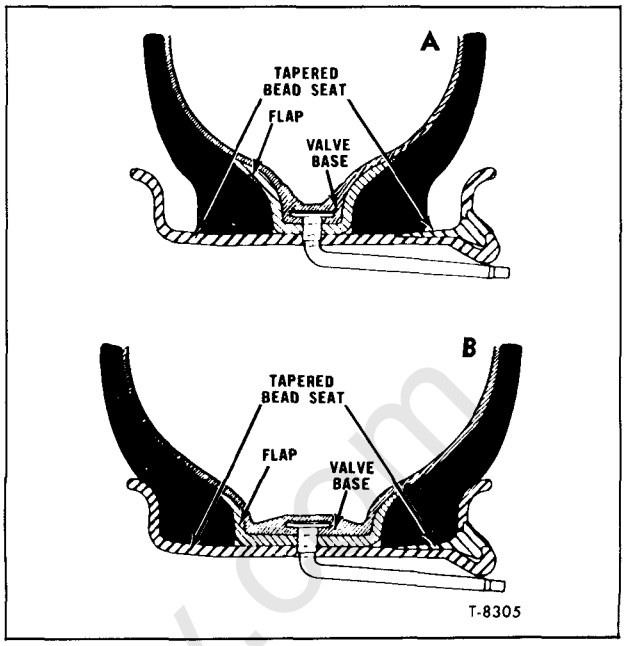


Figure 14—Improper Tube Inflation

CREASES CAUSED BY REMOUNTING USED TUBES

Tubes usually undergo some stretch or growth in service. This is particularly true of truck tubes because of the high temperatures which develop. When a used tube is remounted in a new, or nearly new tire, a folded condition will usually result, and eventually will cause both tube and tire to fail.

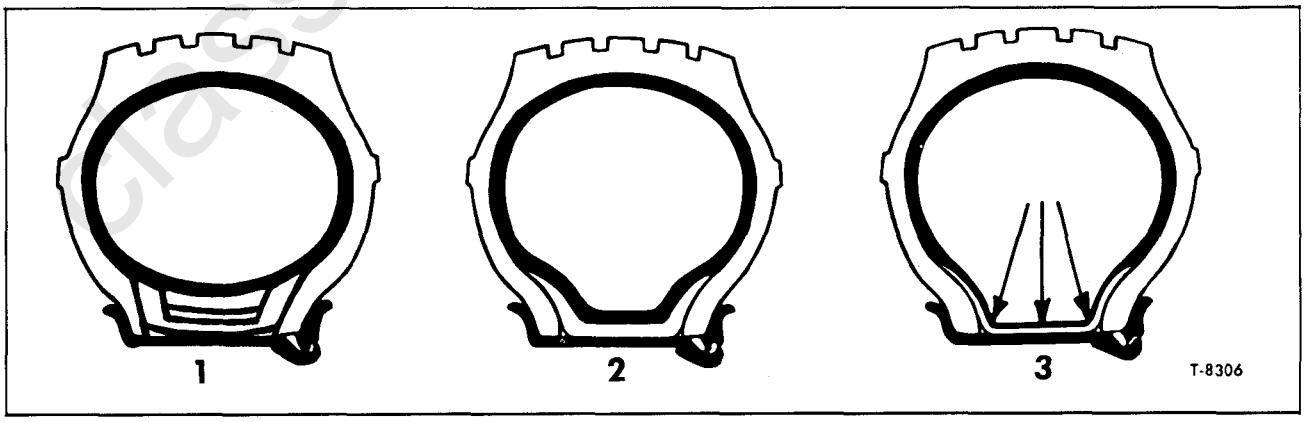


Figure 15—Proper Tube Inflation

WHEELS AND TIRES

TUBE BREAKS NEXT TO THE VALVE

Improper inflation procedure may cause a circumferential crack or tear in the valve base at the edge of the bridge washer. Figure 14, View A shows the position of beads, flap and tube with 4 or 5 lbs. inflation pressure. The tube is fully rounded out within the tire, but the pressure is insufficient to move the beads on wide base rims. Depending upon tire size and condition of the rim, from 20 to 40 lbs. pressure is required to push the beads onto the tapered bead seats as shown in figure 14, View B.

Forced by this high pressure, the tube can stretch only in the rim area. Because the resistance to stretch is greatest at the valve base, tension there is often enough to crack the tube at edge of the valve base.

This can be avoided by proper inflation procedure as described later in this section.

TUBE INSTALLATION

1. Insert tube in tire and inflate as shown in figure 15, View 1. rounded out. Use approximately 1 lb. of air or less.

2. Using a brush or cloth swab, apply a solution of neutral vegetable oil soap in the area of the tire beads, including flap. Do not allow soap solution to run down into tire. Extra ply rated tires may require soap on the rim bead seat area.

3. Mount tire on rim, center valve and pull it through hole in rim and hold firmly against the rim. Hold in this position while inflating until beads are properly seated.

4. Completely deflate by removing valve core or using deflating tool. This is extremely important to prevent tube buckling.

5. Re-inflate tube to recommended pressure (fig. 15, View 2). Refer to "Load and Inflation Table" at end of this section.

NOTE: Used flaps may cause tube failure UNLESS mounted with the size tire and rim originally used. When tube and flap are not properly lubricated and mounted, they will be stretched thin in the tire bead and rim region (fig. 15, View 3). This will cause premature failure.

Always clean rims thoroughly to remove rust.

Certain precautions must be taken when mounting used flaps, or damage to the tire and tube will result.

New truck and bus flaps can be used with any one of several different tire and rim sizes as recommended. But once used, the flap must be remounted in the same size tire and on the same size rim from which it was removed. Always use flap of adequate width to prevent tube pinching.

As a precaution against flap failure, mark the tire and rim size on the flap at the time of removal - if inspection shows that it is not damaged and can be used again. When the flap is again mounted, this marking protects against the danger of misusing the flap with the wrong size tire and rim.

New flaps and tubes should be used after tire or rim repairs. It is inexpensive insurance since small wear spots and imperfections in tubes and flaps are hard to see. This could prevent future tire failures.

TUBE RECOMMENDATIONS

1. Long life and high mileage received from present day tires exhaust the useful service life of tubes. Therefore, when a casing is worn to the point of being unsafe, the tube generally is in the same condition and should be replaced with a new one.

2. If valve cap is lost, clean end of valve before applying air hose to prevent dust and dirt from being blown into the tube. Apply new cap.

3. When tubes are inflated for inspection, they should not be inflated to the point of "ballooning." When a tube is "ballooned," it thins out in the stretched area, making the tube too large in that area and resulting in folds or wrinkles when remounted.

SPACER BANDS

INSTALLATION PROCEDURE

1. Check the spacer band for concentricity, and assure yourself that it has not been distorted or bent, or otherwise mishandled in shipment.

2. Do not move vehicles, wheels, axles, or assemblies by rolling on spacers.

3. Place the inside rim over the cast spoke wheel as far as possible up to the mounting level.

4. Push the spacer band over the cast spoke wheel with a consistent pressure on both sides. Guard against cocking. The band should fit snugly to the spokes and against the inside rim gutter edge. (At this point, the concentricity can be checked by turning the spacer band on the wheel.)

5. Apply outer rim clamps. Tighten clamp nuts evenly to the recommended range, 5/8" studs from 150-175 foot-pounds, and ¾" studs from 190-210 foot-pounds torque. Apply torque evenly by gradually tightening nuts in an alternating pattern across the diameter of the wheels.

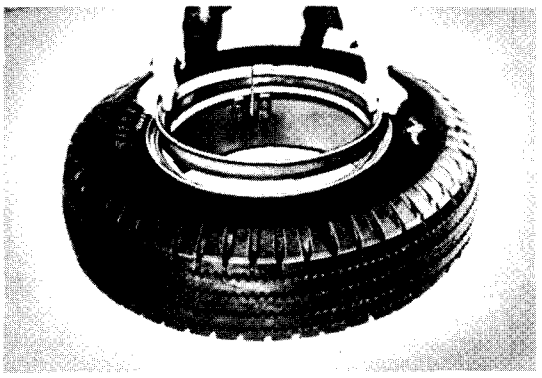
6. Check to see that clamps do not bottom out, and be sure the rim edges consistently meet the spacer band edges.

7. Recheck torque after assembly is used in service after 500 and 1,000 miles.

MOUNTING AND DEMOUNTING RIMS

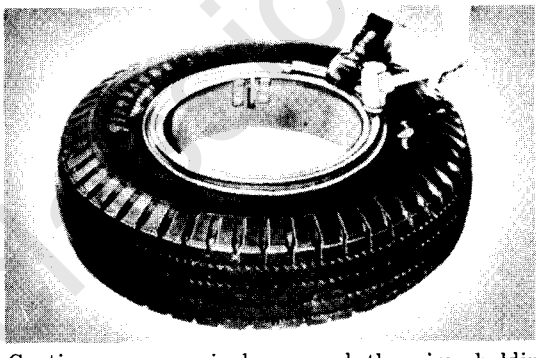
For proper procedures in mounting and demounting different type rims, refer to figures 16, 17, 18, and 19 for applicable type.

MOUNTING



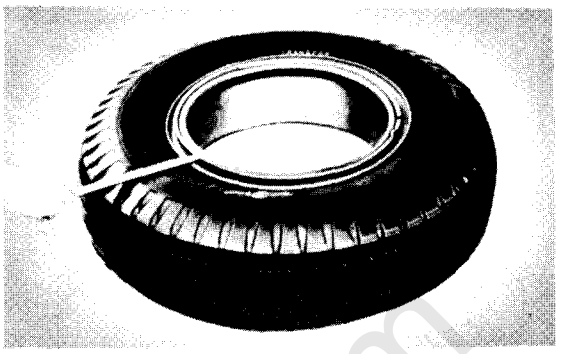
After applying tire and tube in usual manner, place removable side ring (flange) on bead of tire. Then insert tapered toe of lock ring between side ring and rim base.

To fasten lock ring, hold with foot at one end of split and hammer end of ring into place with rim mallet.

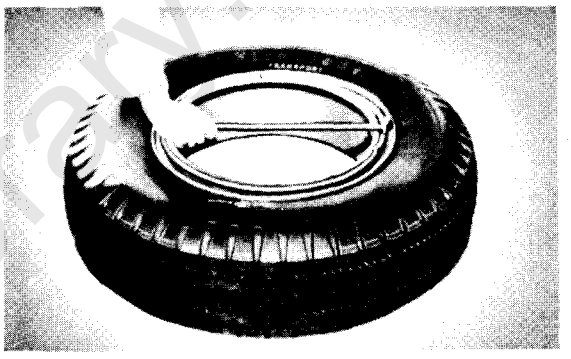


Continue progressively around the rim, holding ring with foot and hammering until entire ring is seated. Check seating of rings and inflate tire to recommended pressure.

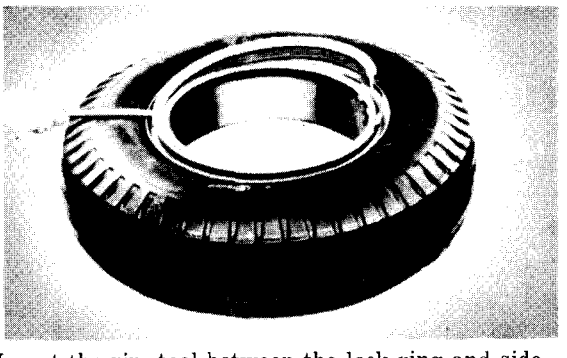
DEMOUNTING



Completely deflate tire by removing valve core or using deflator cap. Place tapered end of rim tool in depression in lock ring, or between rings, and press down on side ring to free bead. Continue downward pressure on side ring progressively around the tire until the bead is completely freed from the bead seat.



To disengage lock ring from the gutter, insert rim tool in removing notch, near split in the ring, and push downward. If desired, a second similar tool may be used to facilitate removal.



Insert the rim tool between the lock ring and side ring and press downward to pry ring up. Move progressively around the rim until lock ring is free, then lift off lock and side rings. Turn assembly over, unseat tire bead, stand tire up and remove rim base.

T-8307

Figure 16—Mounting and Demounting 3-Piece Convertible Rims

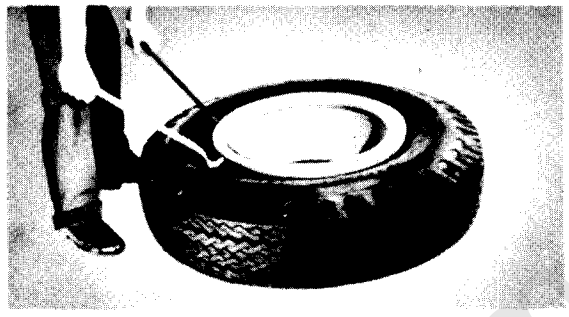
MOUNTING

To fasten side ring, place foot at one end near the split and push down into place.

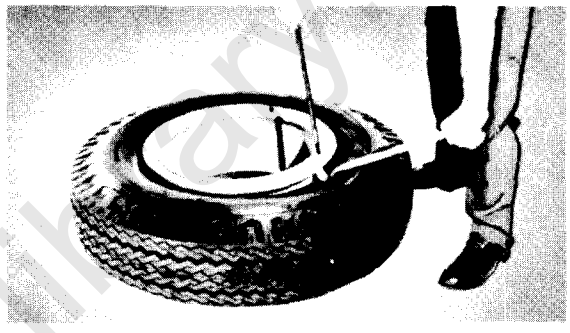
Continue progressively around the rim "walking" the side ring firmly into place.

Above illustration shows side ring fully engaged in rim gutter. Check seating of ring and inflate tire to recommended pressure.

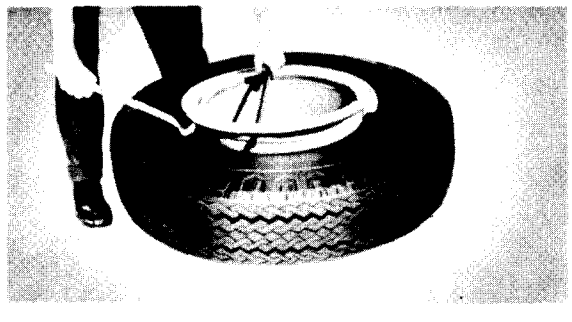
DEMOUNTING



Completely deflate tire, then with curved end of rim tool and hooked-end rim tool pry bead loose from side ring by downward pressure on rim tools. Continue prying operation progressively around the tire until the ring is completely freed from the bead seat.



To disengage side ring from the gutter insert one rim tool in tool slot of side ring and pry ring upward and outward. This operation can be assisted (as shown) by inserting hooked-end tool between the tire and ring, prying upward on ring and downward on tire to free ring from tire bead.

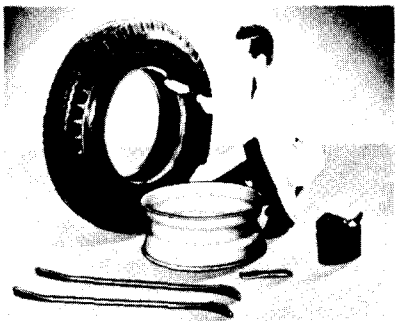


Continue in this manner progressively around rim until ring is completely removed. Turn assembly over, unseat tire bead, stand tire up and remove rim base.

T-8308

Figure 17—Mounting and Demounting 2-Piece Convertible and DT Rims

MOUNTING

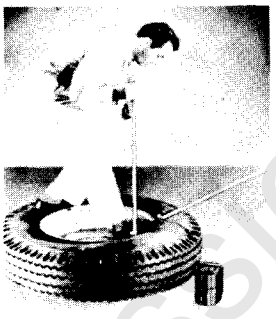


Be sure right valve is used and is properly installed in the rim. Inspect rim to insure bead seats are clean and smooth. Then place rim on floor with wide side down and lubricate first bead of tire and upper bead seat of rim.

Push first bead into well of rim and onto rim as far as possible. Using straight end of tool (with stop resting on rim flange) take small bites to work remaining section of first bead onto rim.

Hold second bead in well by standing on tire and anchor with vise-grip pliers (snub side toward tire). Using spoon end of tire tool with stop toward rim, use small bites until bead slips over flange. If necessary, insert second tire tool and lubricate last 6" of bead before completing mounting. Inflate tire to recommended pressure. Examine valve assembly occasionally to avoid leaks.

DEMOUNTING



Deflate tire. With tire lying flat, loosen both beads by walking on tire with heels close to rim. With wide side of rim down, lubricate top bead. With stops toward rim, insert spoon ends of both tools about 10" apart. Holding bead in well with foot, pull one tool toward center of rim.

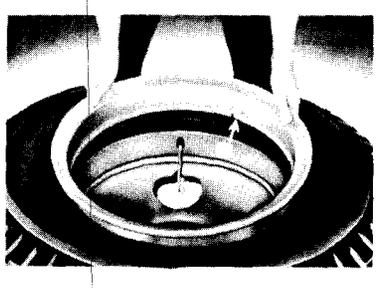
Hold tool in position with one foot and pull second tool toward center of rim. Progressively work bead off rim, taking additional bites if necessary.

Stand assembly in vertical position. Lubricate second bead. At top of assembly insert straight end of tool between bead and back flange of rim at about a 45° angle. Turn tool so that it is perpendicular to rim. Pry second bead off.

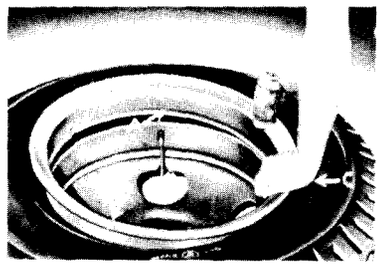
T-8309

Figure 18—Mounting and Demounting 15° Drop-Center Tubeless Rims

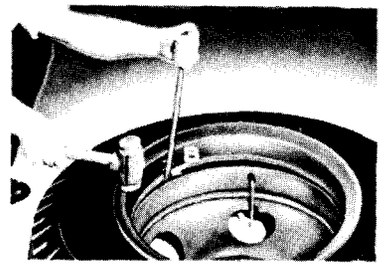
MOUNTING



Place disc portion of wheel on floor with rim gutter up. Apply tire with valve pointing in direction desired. Place side ring in position with operating notch located between two embossings (point B) approximately three inches from valve, on either side.



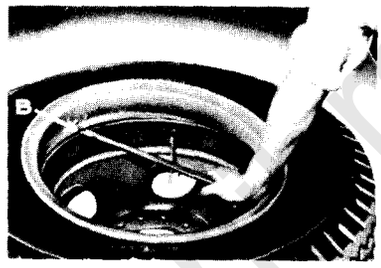
The two cutaway portions opposite each other in the inner diameter of the ring (points A) are placed so as to span the rim gutter. At point C, opposite valve, force half of ring into the gutter as far as possible using hand and rim mallet.



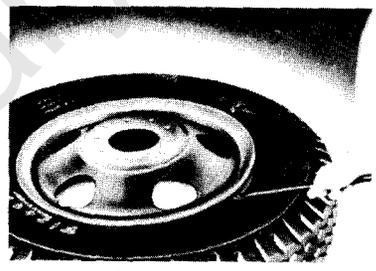
Insert straight end of rim tool in operating notch (point B), then pull in direction indicated by arrow. Retain pressure with tool and strike ring downward with mallet at point between tool slot and cutaway portion, thereby engaging ring over rim gutter at that point. Remove tool and strike additional blows progressively toward other cutaway portion until entire toe of ring has passed over the rim gutter. Check seating of ring as shown below and inflate tire to recommended pressure.

DEMOUNTING

CAUTION: Make certain tire is completely deflated. To loosen tire bead from side ring, drive curved bead-loosening end of above recommended rim tool, or a larger tire tool, between ring and bead. Pry downward on bead and repeat this operation around the ring until bead is loose.

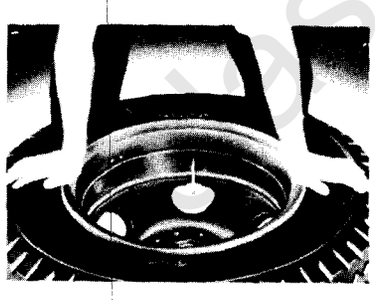


Remove ring by putting straight end of rim tool into notch in ring located between embossings (point B). Push ring downward at point opposite operating notch. Force tool handle downward as illustrated, causing ring to disengage from rim gutter. Continue operation, prying away from rim gutter with flat end of tool until free.



Turn assembly over and unseat tire bead from back flange in same manner as loosening bead from side ring in first step. Stand tire up and remove rim base.

NOTE: It is unnecessary to free the side ring from the tire bead if tire is to be removed for tube repair and immediately replaced. Simply loosen bead from back (permanent) flange as in third demounting step. Then turn the assembly over and remove ring, with tire attached, as in second demounting step.



SAFETY PRECAUTIONS:

Before inflating tire, be sure side ring has completely cleared the gutter of rim base. In this position the side ring can be depressed by hand or will yield to a light hammer blow. DO NOT INFLATE IF SIDE RING DOES NOT MOVE FREELY.

T-8317

Figure 19—Mounting and Demounting RH5° Rims

RIM AND WHEEL SAFETY PRECAUTIONS

CAUTION

An inflated tire and rim can be very dangerous. Many accidents, some fatal, have resulted from improper handling and operation of truck rims and wheels. It is, therefore, of the utmost importance that the precautions outlined in this section be carefully noted by all persons concerned in order to avoid personal injuries and costly damage.

HOW TO PREVENT RIM ACCIDENTS

(Refer to Figure 20)

DURING TIRE DEMOUNTING

Completely Deflate Tire Prior to Demounting (Refer to Fig. 20, View A)

If either rim or rings are damaged or ring appears to be unseated, the tire should be deflated prior to removal of the tire and rim assembly from the vehicle.

First, reduce the pressure by pushing the plunger, then remove the entire core. Keep your eyes away from the valve.

Remove valve core to ensure complete deflation.

Follow Recommended Demounting Procedures

See previous pages of this section for demounting instructions.

Check For Damaged or Worn Parts

Mark defective parts for destruction to preclude their future use.

DURING TIRE MOUNTING

Replace Damaged Parts

Abuse during road operations or in mounting the tire can cause dents, cracks or distortions which weaken the parts and prevent safe, proper assembly.

BEFORE mounting a tire and assembling the rim, inspect the rim parts carefully for damage, rust, and distortion. Avoid the use of rims, locking rings or flanges which are out of shape, rusted, or broken. Avoid the use of a ring or rim parts of different manufacture than the rim, or of any different size or type than the rim.

Avoid the use of any lubricant which contains water or solvent that is injurious to rubber. A combination lubricant and rust-preventive compound is preferable. This protective measure is of particular importance with drop-center tubeless rims as the air in the tire is contained by the tire-side rim surface.

Remove Rust and Other Foreign Matter

Accumulation of such material in the rim gutter can prevent the proper fitting of rings. Parts that are excessively corroded are weakened and should be replaced. Use of a rust preventive compound (not containing water) during mounting will minimize rusting.

Do Not Use Over-Size or Over-Inflated Tires

Use only preferred or alternate-size rims for tires and do not exceed recommended air pressures (see page 205). These are common causes of rim failures and accidents.

Follow Recommended Mounting Procedures

See previous pages of this section for mounting instructions.

ADDED PRECAUTION: Re-check assemblies just prior to inflation, particularly if they have been rolled across the floor or have received rough handling between mounting and inflation.

Rim Ring Seating (Fig. 20, View B)

MAKE CERTAIN the rim ring is seated to the full depth of the groove, fits tightly all around, and is securely locked. With certain types of wheels, however, it is necessary to seat the rings while the tire is being inflated. In either case BEFORE inflating.

Safety Device or Cage (Fig. 20, View C & Fig. 21)

ATTACH A PORTABLE SAFETY DEVICE, OR USE SAFETY CAGE, MADE ESPECIALLY FOR THE PURPOSE, TO THE ASSEMBLY. This portable device can be used with all types of wheels and rims.

Or, if the assembly is not of the type which requires inflation to seat the rings, a SAFETY CAGE can be used. This is recommended to prevent personal injury during inflation. An inflated tire contains potentially explosive energy that can blow rings loose. A clip-on type air chuck should also be used, so that the operator can stand to one side during tire inflation.

Avoid a position where the face or body is immediately over the work being done on any tire

WHEELS AND TIRES

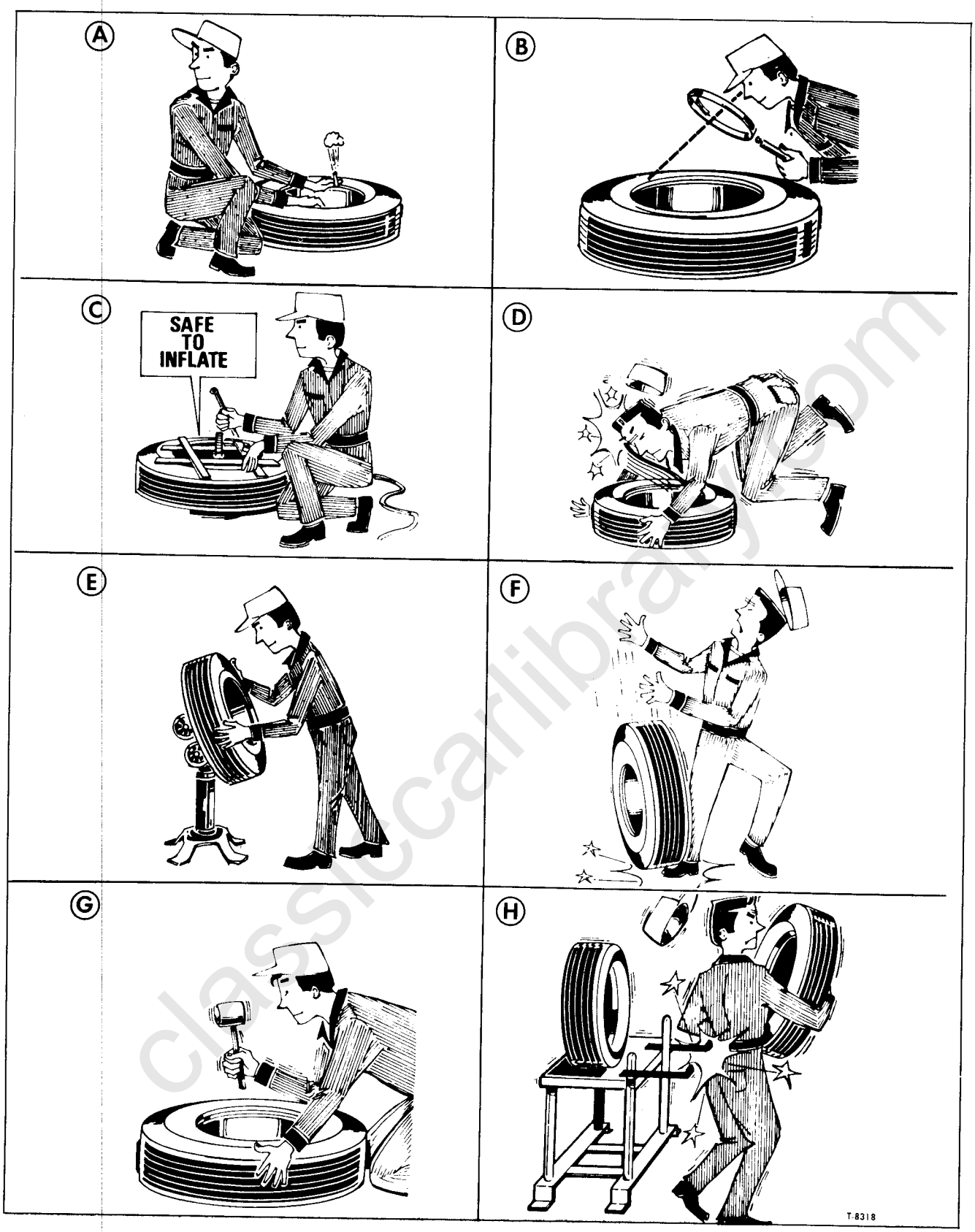


Figure 20—Rim and Wheel Safety Precautions

in which there is pressure (fig. 20, View D).

Use only accurate, tested gauges to ensure proper air pressure. Check all gauges regularly with a master gauge.

Drop Center Wheels (Fig. 20, View E)

IN CHANGING TIRES on drop center wheels, remove wheels from the truck and place on a wheel holder or tire changing machine, removing and mounting the tires in this way. Greater speed and ease thus can be obtained than by making the change with the wheel on the vehicle.

This also will prevent cuts on hands and wrists from fender edges and will make it unnecessary to use a hammer for seating the tire.

Use only standard tire mounting tools and equipment. The use of makeshift tools, screwdrivers or pliers to force tires on or off rims or wheels is dangerous.

All Wheel and Rim Assemblies
(Refer to Fig. 20, View F)

IN THE SERVICING OF ALL TIRES use caution not to drop them, or the wheels or assemblies, on the feet, hands, or body, or heavily on the floor.

Learn how to lift properly -- use your legs as well as your body. This can help prevent painful, internal injury or rupture.

Tire Iron Safety (Fig. 20, View D)

BE CAREFUL IN USING TIRE IRONS, particularly as to gripping them firmly and keeping the hands free of oil and grease. The irons can slip and fly with tremendous force.

Hammers (Fig. 20, View G)

USE CARE IN HAMMERING RINGS OR RIMS WITH STEEL HAMMERS. Small bits of steel may be broken off the hammer or rim, flying into the eye, face, or body.

Use rubber-covered steel-headed hammers wherever possible.

Do not hammer on rims or rings after tire inflation has started.

Changing Equipment (Fig. 20, View H)

TIRE SPREADER ARMS CAN BE DANGEROUS. Keep them closed when the machine is idle and use care in all respects while operating the spreader

Face and Eye Protection

ALWAYS WEAR GOGGLES or face shields when buffing rims or tires, or when hammering rings.

DURING VEHICLE OPERATION

Do Not Overload Tires

Ensure that the combination of load and vehicle weight does not exceed the rated load of the tires used. Rims are designed to sustain the maximum rated load of the maximum tire size recommended for that rim (see page 205).

Figure 21—Safety Cage (Typical)

Do Not Exceed Maximum Inflation Pressures

This is determined by the size and ply rating of the tire (see page 206). It is also important to maintain uniform inflation in both tires of a dual assembly so that weight is equally sustained.

Do Not Run Vehicle on One Tire of Dual Assembly

When there is loss of air in a dual tire the carrying capability is reduced and the load must be sustained by the other tire and rim. Both tires should be inflated to balanced, recommended pressures before further operation.

Never Re-Inflate a Tire That Has Been Run Flat Without First Thoroughly Inspecting It and The Rim and Wheel Assembly

It is especially important to make sure the lock ring is secure in the gutter and has not been damaged prior to re-inflation.

Periodically Check Clamps and Wheel Nuts

Loose clamps can cause dangerous rim slippage or detachment of rim and tire from the vehicle while in motion. Loose wheel nuts can cause dangerous wheel shimmy and loss of vehicle control. Excessive torque is also dangerous in that it can cause stud and ring breakage. Refer to page 205 for torque recommendations.

WHEELS AND TIRES

WHAT HAPPENS WHEN TIRES GET HOT

As a tire becomes heated, the air in the tire expands and the air pressure is raised. This is normal unless the pressure build-up is excessive. Build-ups of over 20 lbs. are excessive, indicating underinflation, overload, too much speed, too small a tire or, more often, a combination of these factors. Therefore, pressure build-ups of over 20 lbs. should be studied to determine cause and proper corrective action. Normal pressure build-ups (not over 20 lbs.) reduce flexing. Thus the amount of heat generated allows the tire to reach a heat balance (the temperature at which the rate of heating equals the rate of cooling) at a lower temperature than if the inflation pressure were maintained uniformly by frequently bleeding out air. Tires should never be bled. When the pressure builds up excessively - reduce the speed or the load instead.

A tire operated for a considerable distance at sustained highway speeds, in a severely underinflated or flat condition, becomes extremely hot due to internal friction, and this heat transmits to the tire's outer surface. If and when the outer surface temperature reaches the combustion point, the tire bursts into flame. This usually occurs after the vehicle has stopped. Such an occurrence usually involves a dual assembly where one of the tires is flat and the other is, therefore, extremely overloaded (possibly also underinflated even for normal load). In such cases, either the tire which is severely underinflated or completely flat, or the tire which is extremely overloaded, could get so hot as to reach the point of spontaneous combustion.

CAUSE AND PREVENTION OF TIRE FIRES

A major cause of tire fires is heat caused by a dragging brake, particularly if there is excessive grease and/or oil around the brake drum The heat produced by the dragging brake ignites the grease or oil which in turn can eventually ignite the tire, even though the tire is not overloaded or underinflated.

Regardless of the cause of a tire fire, the tire's internal temperature is so high that even if the flames are extinguished, repeated spontaneous ignition occurs until the internal temperature decreases sufficiently. A fire extinguisher usually will not have sufficient capacity to control the fire until the burning tire can be removed. Operators should carry special asbestos blankets which, in case of tire fire, are useful in preventing the fire from spreading to vehicle and cargo. If possible, a steady stream of water should be placed on the tire until it is cool enough for removal.

The best protection against tire fires is to avoid running on a flat tire, prevent underinflation through regular checking of inflation pressures, and avoid accumulation of grease or oil around brake drum areas. Operators carrying cargo which is explosive or readily combustible should check tires at 50-mile intervals and should also use a pressure warning device.

INSTRUCTIONS FOR MAINTENANCE OF TIRES ON OFF-THE-HIGHWAY UNITS IN HIGHWAY TRANSIT

Many Off-The-Highway Tires are designed and built to give maximum service for mining and construction operations. Because of the extra heavy construction built into these tires, special precautions must be observed when equipment is being moved over the highway for delivery or when transferring to a new job site. If these precautions are not observed, the tires may build up excessive heat and cause premature failure.

The following recommendations are made in the interest of protecting your investment against loss and delay. These recommendations apply to all tires on vehicles in transit, whether driven or towed.

LOAD AND PRESSURE

1. Vehicles must be empty during transit.
2. Inflation pressure is determined by cold pressure checks before starting. Pressure is not to be reduced by "bleeding" tires during transit.
3. Inflation pressures are to be determined by use of the following charts. If load cannot be accurately estimated, use the maximum inflation pressure shown for the ply rating in question.
4. Tires with "dry" ballast must not be used for vehicle transport purposes.

SPEED

Regular Skid Depth Tires

1. Maximum highway speed 30 mph.
2. Stop for 30-minute cooling period after each 50 miles of driving or before 2 hours' sustained operation, whichever comes first.
3. One hour minimum mid-day lunch stop should be observed during full day operations.

Extra Skid Depth and Special Compound Tires

Vehicles equipped with extra skid depth or special compound tires are not to be driven in transit over the highway unless the proposed trip is reviewed and approved by qualified personnel.

Super Deep Tread Tires

Under no circumstances should the Super Deep Tread tires be moved (roaded) over the highway.

Vehicles in transit must be controlled and accompanied by responsible personnel in a pilot car to enforce recommendations and maintain a check on equipment. This is good insurance for a valuable investment.

SPECIFICATIONS

WHEEL NUT TORQUE

CAST TYPE WHEELS
Tighten nuts as directed in text to:
Front . . . . . 190-210 foot-pounds
Rear . . . . . 190-210 foot-pounds

BUDD TYPE (DISC) WHEELS
Tighten nuts as directed in text to:
Front . . . . . 500-550 foot-pounds
Rear (Inner and Outer Nuts) . . . . . 500-550 foot-pounds*
Aluminum Wheels and/or Hubs . . . . . 450-500 foot-pounds*

CORPORATION TYPE (DISC) WHEELS
Tighten nuts as directed in text to:
Front . . . . . 300-400 foot-pounds
Rear . . . . . 300-400 foot-pounds

* Loosen outer nuts, tighten inner nuts, then tighten outer nuts.

TIRES FOR TRUCKS IN HIGHWAY SERVICE
LOAD AND INFLATION TABLE

Tire and Rim Association Standard Tire Loads At Various Inflation Pressures.

TIRES USED AS SINGLES

TIRE IDENTIFICATION		TIRE LOAD LIMITS AT VARIOUS INFLATION PRESSURES										
SIZE	LOAD RANGE	50	55	60	65	70	75	80	85	90	95	100
8.25-20	E	2800	3010	3190	3370	3560	3730	3890	4050			
8.25-20	F	2800	3010	3190	3370	3560	3730	3890	4050	4210	4350	4500
9.00-15	F		2950	3150	3330	3500	3660	3830	3980	4140	4290	
9.00-18	E		3320	3530	3730	3920	4120	4300				
9.00-20	E		3560	3770	4000	4210	4410	4610				
9.00-20	F		3560	3770	4000	4210	4410	4610	4790	4970	5150	
10.00-15	F			3580	3780	3980	4170	4370	4540			
10.00-15	G			3580	3780	3980	4170	4370	4540	4710	4880	5050
10.00-20	F			4290	4530	4770	4990	5220	5430			
10.00-20	G			4290	4530	4770	4990	5220	5430	5640	5840	6040
10.00-22	F			4560	4820	5070	5310	5550	5780			
10.00-22	G			4560	4820	5070	5310	5550	5780	6000	6210	6430
11.00-20	F			4670	4940	5200	5450	5690	5920			
11.00-20	G			4670	4940	5200	5450	5690	5920	6140	6370	6590
11.00-22	F			4960	5240	5520	5790	6040	6290			
11.00-22	G			4960	5240	5520	5790	6040	6290	6530	6770	7000
11.00-24	F			5270	5570	5860	6140	6420	6680			
12.00-20	G				5620	5920	6200	6480	6740	7000		
12.00-24	G				6330	6660	6980	7280	7580	7880		

NOTE: Underlined Figures Indicate Maximum Recommended Load.

WHEELS AND TIRES

SPECIFICATIONS (CONT.)

TIRES USED AS DUALS

TIRE IDENTIFICATION		TIRE LOAD LIMITS AT VARIOUS INFLATION PRESSURES										
SIZE	LOAD RANGE	40	45	50	55	60	65	70	75	80	85	90
8.25-20	E	2460	2640	2800	2960	3120	3270	3410	3550			
8.25-20	F	2460	2640	2800	2960	3120	3270	3410	3550	3690	3820	3950
9.00-15	F		2590	2760	2920	3070	3210	3360	3490	3630	3760	
9.00-18	E		2910	3100	3270	3440	3610	3770				
9.00-20	E		3120	3310	3510	3690	3870	4040				
9.00-20	F		3120	3310	3510	3690	3870	4040	4200	4360	4520	
10.00-15	F			3140	3320	3490	3660	3830	3980			
10.00-15	G			3140	3320	3490	3660	3830	3980	4130	4280	4430
10.00-20	F			3760	3970	4180	4380	4580	4760			
10.00-20	G			3760	3970	4180	4380	4580	4760	4950	5120	5300
10.00-22	F			4000	4230	4450	4660	4870	5070			
10.00-22	G			4000	4230	4450	4660	4870	5070	5260	5450	5640
11.00-20	F			4100	4330	4560	4780	4990	5190			
11.00-20	G			4100	4330	4560	4780	4990	5190	5390	5590	5780
11.00-22	F			4350	4600	4840	5080	5300	5520			
11.00-22	G			4350	4600	4840	5080	5300	5520	5730	5940	6140
11.00-24	F			4620	4890	5140	5390	5630	5860			
12.00-20	G				4930	5190	5440	5680	5910	6140		
12.00-24	G				5550	5840	6120	6390	6650	6910		

NOTE: Underlined Figures Indicate Maximum Recommended Load.

LOAD RANGE DESIGNATION LETTER TO PLY RATING NUMBER CONVERSION CHART

LOAD RANGE LETTER	PLY RATING
E	10
F	12
G	14

CAUTION: DO NOT stand unprotected in front of clamp ring when inflating tire. If a protective inflation cage is not available, wrap three lengths of chain, evenly spaced around tire and rim. Secure chains but leave loose enough to permit expansion of tire during inflation. Use an extension gauge with clip on chuck so air pressure build-up can be closely watched and so that you can stand well back from the assembly during the bead seating process to avoid possibility of personal injury.

SECTION 11
Sheet Metal and Fiberglass

All information pertaining to SHEET METAL AND FIBERGLASS as described in the 1970 Heavy Duty Truck Service Manual ST135-70 is applicable to models covered in this supplement except as follows:

FIBERGLASS FENDER EXTENSION AND SEAL REPLACEMENT (H AND J MODELS)

REMOVAL

1. Tilt the hood assembly forward.

2. Referring to figure 1, remove five bolts which attach fender extension to the cab and extension support bracket. Remove the extension assembly.

3. Separate the metal brace rods from extension. Note the number of shim washers at lower end of brace rod.

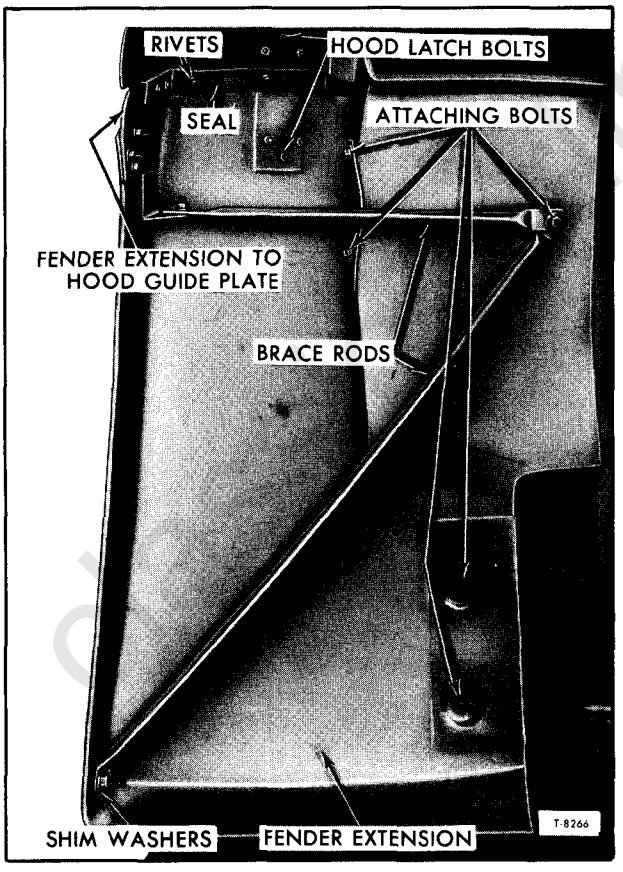


Figure 1—Typical Fender Brace (H and J Models)

INSTALLATION

Assemble and install extension assembly in reverse of the "Removal" procedures.

For proper alignment with hood, add or remove shims as shown in figure 1.

SEAL REPLACEMENT

CAUTION: Wear eye protection when removing seal rivets. With drill, remove five rivets from fender extension seal and remove seal. Install seal on new fender extension with rivets.

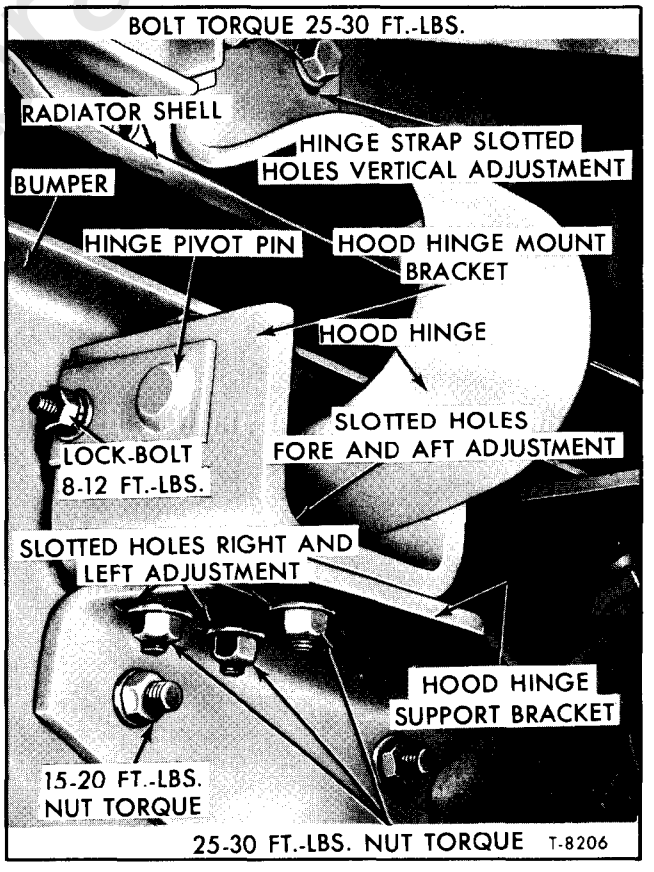


Figure 2—Hood Hinge (HH, JH, HC, and JC Models)

SHEET METAL AND FIBERGLASS

REPAIR OF FIBERGLASS HOOD AND FENDER COMPONENTS

Repair procedures of fiberglass parts are simple and the paint refinishing procedure is the same as for metal parts.

In general, all repairs to fiberglass parts consist of filling the damaged area (which has been sanded or ground down) with plastic filler or with fiberglass cloth and resin. Use of the various materials is determined by the type of repair to be made. The repair is allowed to harden and then the finishing operations are performed.

Such repairs as large holes, torn sections, and separated joints require the adhesive qualities of resin and the reinforcing qualities of the fiberglass sheets which can be procured locally. Small dents, scratches, surface cracks and pits can be readily repaired after sanding down then using plastic filler.

FIBERGLASS HOOD ALIGNMENT

On Models HH, JH, HC, and JC, the hood assembly is adjustable fore and aft, right and left, after loosening the hood hinge mounting bracket bolts (fig. 2). Fore and aft adjustment is obtained through slotted holes in hood hinge mounting bracket. Right and left adjustment by means of slotted holes in hood hinge mounting support bracket also shown in figure 2.

The height (vertical adjustment) of the front end is also adjustable by means of slotted attaching bolt holes in each hood hinge strap. Loosen hood hinge strap bolts. With the aid of an assistant, raise or lower hood to proper alignment, then retorque hinge strap bolts.

When working with fiberglass repair materials, avoid contact with skin and never work near fire or flame. If materials should come in contact with skin, wash thoroughly with soap and water as soon as possible.

SECTION 12

Chassis Electrical and Instruments

Information pertaining to CHASSIS ELECTRICAL AND INSTRUMENTS (SEC. 12) as described in the 1970 Heavy Duty Truck Service Manual ST135-70 and Supplement ST332-71 is applicable to vehicles covered by this supplement with the exception of the following:

WIRING DIAGRAMS

Wiring diagrams, included in "Wiring Diagrams" in section 12 of Service Manual ST135-70, show electrical circuits and connections for standard and optional equipment used on each truck series covered by this supplement. The truck series to which each diagram applies is also shown on each diagram.

NOTE: On series 90 vehicles, a schematic diagram of the electrical system is located on inner side of console panel access cover.

WIRING HARNESSES AND WIRES

On vehicles equipped with the V6-401M or V6-478 gasoline engine, except Series RM80, a 1.52 ohm resistance wire is used in the engine wiring harness, connecting the "IGN" terminal of the ignition switch to the positive (+) terminal on the ignition coil. The proper length wire is used to provide the correct resistance. This wire is identified on applicable wiring diagrams in "Wiring Diagrams in Section 12 of Service Manual Supplement ST332-71 as "20-BLK." or "20-WHT. ORN. & PPL. CR. TR." DO NOT use regular copper wire in place of this resistance wire.

On vehicles equipped with the V8-637 gasoline engine, a 1.35 ohm resistance wire is used in the engine wiring harness to connect the "IGN" terminal of the ignition switch to the positive (+) terminal on the ignition coil. The proper length wire is used to provide the correct resistance. This wire is identified on applicable wiring diagrams in "Wiring Diagrams" booklet X-7205 as "20-BLK." DO NOT use regular copper wire in place of this resistance wire.

On Series RM80, a 1.52 ohm ignition coil resistor is connected into the circuit between "IGN" terminal on ignition switch and positive (+) terminal on the ignition coil. The resistor provides increased voltage during engine cranking.

MAINTENANCE AND REPAIR

TESTING CIRCUITS

A careful study of the wiring diagrams should be made to determine the source and flow of current through each electrical circuit. When a circuit is thoroughly understood, a point-to-point check can be made with the aid of the applicable wiring diagram to determine location of trouble. Any circuit can be tested for continuity or short circuits with a 2-candlepower test light or low-reading voltmeter.

Each wire in the electrical system is of a specific size as designated on the Wiring Diagrams. When replacing wires, the correct size as indicated must be used. Never replace a wire with one of a smaller size.

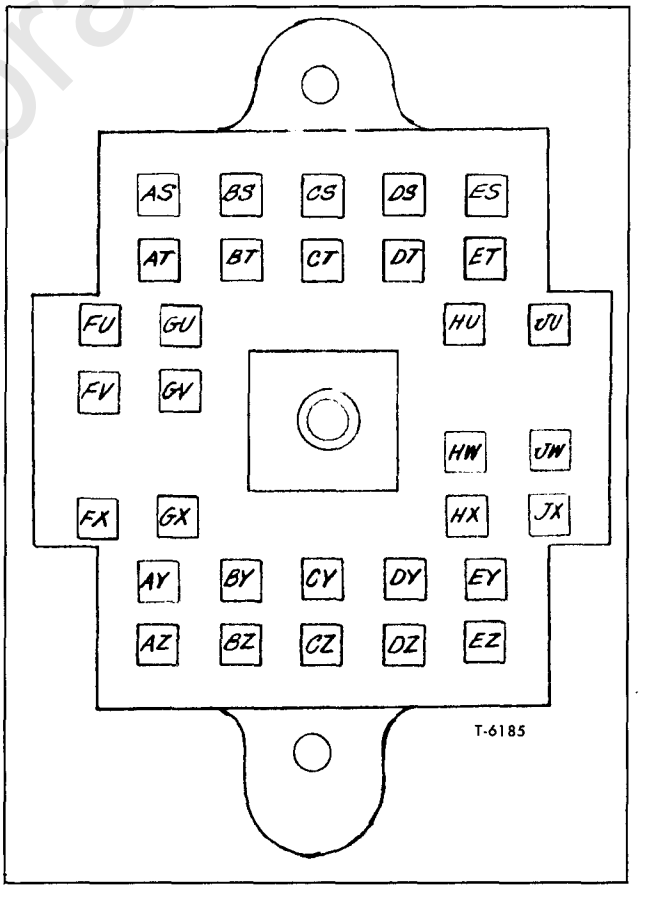


Figure 1—Harness to Instrument Harness Bulkhead Connector

CHASSIS ELECTRICAL AND INSTRUMENTS

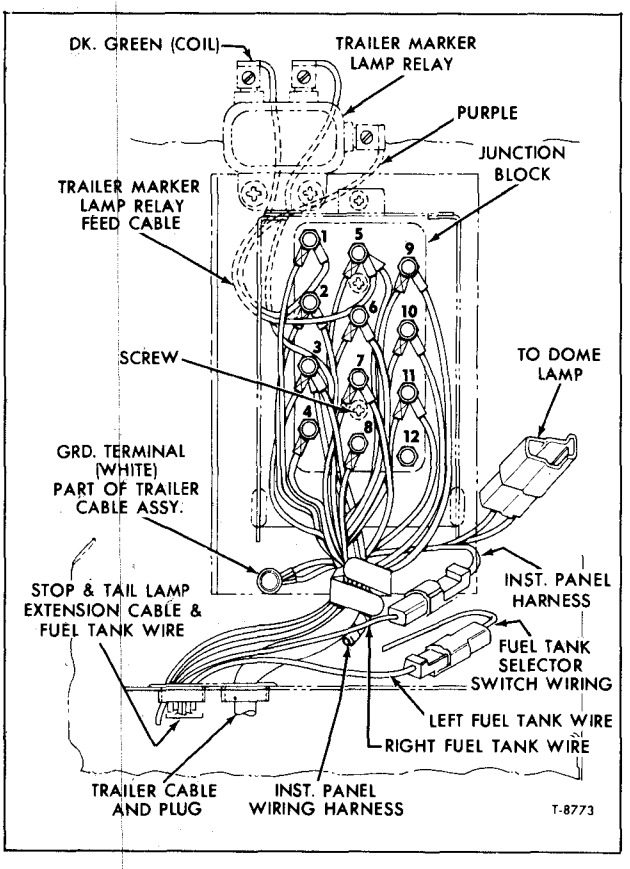


Figure 2—Chassis Junctions (Conv. Cab) (Typical)

The insulation on each wire is distinctly colored and patterned to assist in tracing and testing circuits and to assist in making connections. Abbreviations and symbols used in wire insulation color and pattern designations on Wiring Diagrams are as follows:

BLK. . . .	Black	ORG. . . .	Orange
BRN. . . .	Brown	PPL. . . .	Purple
CH. . . .	Check	TR. . . .	Tracer
CR. . . .	Cross	YELL. . . .	Yellow
GRN. . . .	Green	// . . .	Parallel
NAT. . . .	Natural	WHT. . . .	White

ENGINE HARNESS-TO-INSTRUMENT PANEL HARNESS CONNECTOR

NOTE: Information pertaining to the 32-terminal engine harness to instrument panel harness connector used on Series 90 tilt cab models remains the same as covered in CHASSIS ELECTRICAL AND INSTRUMENTS (SEC. 12), pages 12-1 through 12-79 in the 1970 Heavy Duty Truck Service Manaul ST135-70 except as follows:

Power supply to the engine and cab wiring harness on conventional cab models and Series 90 tilt cab models is made through a male-female type connector enclosed in rubber.

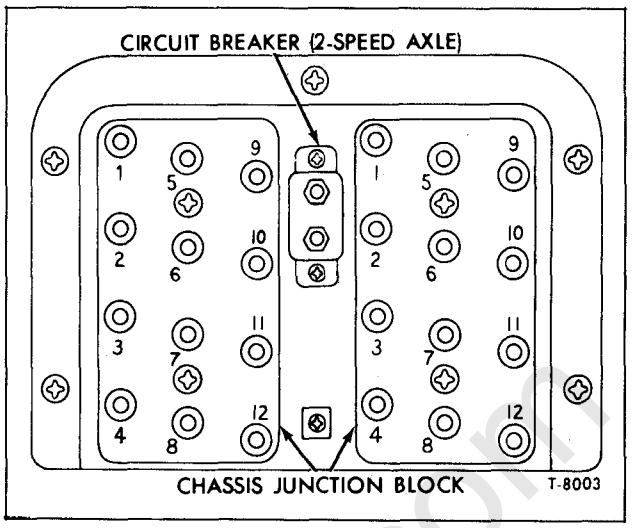


Figure 3—Chassis Junction Block (Tilt Cab Models) (Typical)

It is recommended that this connector, as well as similar connectors in the wiring harness, be cleaned and lubricated with a multi-purpose grease whenever the connector is separated or whenever difficulty caused by corrosion has been encountered. The lubricant will keep moisture off the electrical terminals and thus prevent corrosion which can cause high resistance in the system.

On conventional cab models, the 32-terminal connector is mounted on the upper right-hand side of the dash panel in the engine compartment. Terminal letters shown on wiring connector body (fig. 1) correspond to letters on wiring diagrams and in the tabulation which follows: the tabulation lists each terminal letter, the circuit it carries, and the size, color, and pattern of the wire which connects to each terminal.

Connector Replacement

NOTE: Wiring connector terminals should be checked for proper alignment and to ensure that they are properly seated in connector cavities.

1. Remove two screws which attach the two-post junction block to the dash panel; then remove two screws which attach the 32-terminal bulkhead connector to the dash panel.

2. Insert a 7/16-inch socket through engine harness wiring, then turn retaining bolt out of connector body. Separate engine harness connector from instrument panel harness connector.

NOTE: The retaining bolt will remain in the engine harness connector.

IMPORTANT: Mating connectors must be assembled straight and slowly to assure proper alignment of terminals. Tighten bolt slowly to approximately 60-inch-pounds torque. While bolt is being tightened, check to be sure gap between connectors is uniform.

3. Assemble connector with index rib and groove aligned.

4. After bolt is tightened, visually inspect connection to be sure no terminals have been pushed out of connector.

5. Position bulkhead connector on dash panel and install two screws to attach. Tighten screws firmly, then position the two-post junction block on dash panel (if removed) and attach with screws.

ENGINE HARNESS-TO-INSTRUMENT PANEL HARNESS BULKHEAD CONNECTOR
(CONVENTIONAL CAB MODELS) (SYMBOL ☐)

Terminal Letter	Circuit	Wire Size	Color Code
AS	OPEN		
AT	OPEN		
AY	IGNITION		
	From Control Switch "IGN"	12	Wht.-Red. Cr. Tr.
	To Regulator #4 Terminal	24	Brn.-Wht. Str.
	To Fuel Shut-off Solenoid	12	Blk.
	To Ignition Coil "+"	20	Wht.-Orn. Ppl. Cr. Tr.
AZ	HOT ENGINE SWITCH		
	Engine Alarm Buzzer and Low Water Tell-tale	18	Grn.-Wht. Tr.
	To Hot Engine Switch	16	Blk.
	To Low Coolant Indicator	18	Wht.
BS	LOW COOLANT PROBE		
	From Low Coolant Indicator	18	Yell.
	To Low Coolant Probe	16	Blk.
BT	GENERATOR "R" TERMINAL		
	From Generator "R" Terminal	16	Blk.
	To Starter Interlock Relay #3 Terminal	16	Blk.
	To Low Coolant Indicator	18	Grn.
BY	R.H. DIRECTIONAL LAMP		
	From Instrument Panel Harness		
	To Directional Switch Harness 8-Way Connector	18	Blue
	To 2-Way Connector to R.H. Front Directional Lamp	16	Blk.
BZ	L.H. DIRECTIONAL LAMP		
	From Spliced Connection From Instrument Panel Harness 8-Way Connector	18	Blue-Wht. Cr. Tr.
	To 2-Way Connector To L.H. Front Directional Lamp	16	Blk.
CS	REGULATOR RELAY		
	From Control Switch "ACC"	12	Brn.-Blk. Tr.
	To Regulator #2 Terminal	12	Blk.
CT	LOW OIL SWITCH		
	From Alarm Buzzer	16	Yell. // Blue Tr.
	To Low Oil Switch	16	Blk.
CY	HEADLAMP HI-BEAM		
	From Dimmer Switch "HI"	14	Grn.-Wht. Cr. Tr.
	To 3-Way Connector To Headlamp Upper Beam	14	Blk.
	To 3-Way Connector To Headlamp Upper Beam	14	Lt. Grn.
CZ	STARTER MAGNETIC SWITCH		
	From Control Switch "START"	12	Maroon
	To Starter Interlock Relay #1 Terminal	12	Blk.
DS	HEADLAMP LO-BEAM		
	From Dimmer Switch "LO"	16	Brn.-Wht. Cr. Tr.
	To 3-Way Connector To Headlamp Low Beam Unit	16	Blk. or Tan
DT	ENGINE TEMPERATURE SENDER UNIT		
	From Temperature Gauge	18	Grn.-Blk. Tr.
	To Engine Temperature Sender Unit	16	Blk.
DY	AMMETER		
	From 4-Amp. Fuse From Battery	18	Blk.
	To Ammeter	18	Blk.
DZ	BACK-UP LAMP FEED		
	From Accessory Bus Bar 10-Amp. Fuse	16	Grn.
	To Back-Up Lamp Switch	16	Blk.
ES	MARKER OR PARKING LAMPS		
	From Main Light Switch #4 Terminal	18	Maroon
	To 3-Way Connector To Marker or Parking Lamps	16	Blk.
ET	HORN		
	From Horn Relay	16	Blk.
	To 8-Way Connector To Horn Button	18	Blk.
EY	AMMETER		
	From Ammeter	18	Blk.-Wht. Tr.
	To 4-Amp. Fuse	18	Blk.

ENGINE HARNESS-TO-INSTRUMENT PANEL HARNESS BULKHEAD CONNECTOR (CONVENTIONAL CAB MODELS) (SYMBOL □) (CONT'D.)

Terminal Letter	Circuit	Wire Size	Color-Code
EZ	BACK-UP LAMP		
	From Back-Up Lamp Switch	16	Blk.
	To #10 Junction on 12-Post Junction Block	16	Grn.-Wht. Cr. Tr.
FU	OPEN		
FV	OPEN		
FX	OPEN		
GU	OPEN		
GV	OPEN		
GX	OPEN		
HU	OPEN		
HW	ELECTRIC TWO-SPEED W/S WIPER & WASHER		
	From Wiper Switch "LO"	16	Blk.
	To W/S Wiper & Washer Motor #3 Terminal	16	Blk.
HX	W/S WIPER & WASHER FEED		
	From Accessory Bus Bar 15-Amp. Fuse	16	Yell.
	To W/S Wiper Motor & Washer #2 Terminal	16	Blk.
JU	OPEN		
JW	W/S WIPER & WASHER "HI" SPEED		
	From W/S Wiper and Washer Switch "HI"	16	Blue-Wht. Cr. Tr.
	To W/S Wiper Motor #1 Park Switch Terminal	16	Blk.
JX	W/S WASHER		
	From W/S Washer Switch	18	Blue
	To W/S Wiper Motor & Washer #1 Terminal	16	Blk.

CHASSIS JUNCTIONS

Terminal posts on junction blocks are numbered to correspond with numbers shown in symbols on applicable wiring diagrams in "Wiring Diagrams" in Section 12 of the 1970 Heavy Duty Truck Service Manual ST135-70.

CONVENTIONAL CAB MODELS

The chassis junction block (fig. 2) is located on right-hand side panel between the door pillar and back of cab. The junction block cover must be removed for access to junction terminals.

NOTE: On some models, the wiring connections are made by use of mating connectors. Refer to applicable wiring diagrams for arrangement of wiring.

The tabulation which follows lists each terminal number, the circuit it carries and the size, color, and pattern of wires which connect to each terminal. Terminal post numbers on wiring diagrams appear in the symbol ⬡.

CHASSIS JUNCTION BLOCK (CONVENTIONAL CAB MODELS) (SYMBOL ⬡)

Terminal No.	Circuit	Wire Size	Color Code
1	TRAILER MARKER LAMPS		
	From Battery Bus Bar 20-Amp. Fuse	16	Blk.
	To Trailer I.C.C. Marker Lamp Relay #1 Terminal	14	Ppl.
2	TRAILER CABLE L.H. DIRECTIONAL LAMP		
	From Spliced Connection From 8-Way Connector From Directional and Hazard Warning Switch	14	Yell.
	To 6-Wire Semi-Trailer Plug	14	Yell.
	To 7-Wire Semi-Trailer Plug	12	Yell.
3	STOP, TAIL, DIRECTIONAL AND LICENSE LAMPS		
	From Light Switch #4 Terminal	16	Brn.
	To 4-Way Connector To Stop, Tail, Directional and License Lamps	16	Brn.
	To 6-Wire Semi-Trailer Plug	14	Brn.
	To 7-Wire Semi-Trailer Plug	12	Brn.
4	AXLE SHIFT SWITCH (WHEN USED)		
	From Accessory Bus Bar20-Amp. Circuit Breaker	14	Wht.-2 Red Tr.
	To Axle Shift Switch	14	Pink
	To Air Pressure Switch	16	Blk.
5	REAR MARKER LAMPS		
	From Marker Blink Switch	16	Blk.
	To Trailer I.C.C. Marker Lamp Relay #3 Terminal	14	Dk. Grn.
	To Rear I.C.C. Marker Lamps	14	Blk.

CHASSIS JUNCTION BLOCK (CONVENTIONAL CAB MODELS) (SYMBOL ◯) (CONT'D.)

Terminal No.	Circuit	Wire Size	Color Code
6	STOP LAMPS OR SPARE		
	From Trailer Emergency Stop Light Switch "TRL"	14	Red
	To 6-Wire Semi-Trailer Plug	14	Red
	To 7-Wire Semi-Trailer Plug	12	Red
7	L.H. STOP, TAIL, AND DIRECTIONAL LAMP		
	From Spliced Connection From 8-Way Connector From Directional and Hazard warning Switch	14	Yell.
	To 4-Way Connector To L.H. Stop, Tail, and Directional Lamp	16	Dk.Grn.-Yell.Str.
8	TWO-SPEED AXLE (WHEN USED)		
	From Axle Shift Switch "LO"	14	Blk.
	From Air Pressure Switch	16	Blk.
	To Axle Shift Motor "LO"	12	Blk. (Smooth)
	To Speedometer Adapter	16	Blk.
9	R.H. REAR DIRECTIONAL LAMP (TRAILER)		
	From Spliced Connection From 8-Way Connector From Directional and Hazard Warning Switch	14	Grn.
	To 6-Wire Semi-Trailer Plug	14	Grn.
	To 7-Wire Semi-Trailer Plug	12	Grn.
10	BACK-UP LAMPS		
	From 32-Terminal Bulkhead Connector "EZ"	16	Grn.-Wht.Cr.Tr.
	To 4-Way Connector to Back-up Lamp	16	Lt. Grn.
11	STOP, TAIL, DIRECTIONAL AND LICENSE LAMP		
	From Spliced Connection From 8-Way Connector From Directional and Hazard Warning Switch	14	Grn.
	To 4-Way Connector To R.H. Stop, Tail, and Directional Lamp	16 or 18	Dk. Grn.
12	TWO-SPEED AXLE (WHEN USED)		
	From Axle Shift Switch "HI"	14	Dk. Grn.
	To Axle Shift Motor "HI"	12	Blk. (Ribbed)

STEEL TILT CAB MODELS

Chassis junction block (fig. 3) is located under left-hand step riser panel and is accessible when left door is open and cover is removed. Two 12-terminal junction blocks are used.

The junction block is used to complete electrical circuit to the instrument panel harness, the engine wiring harness, the dome lamp, and the trailer wiring harness assembly.

Electrical connections between the trailer wiring harness and the trailer cable assembly are completed through a 6-terminal junction block.

The tabulation which follows lists each terminal number, the circuit it carries, and the size, color, and pattern of wires which connect to each terminal. Terminal post numbers on applicable wiring diagrams appear in the symbol ◯ for the left-hand junction block or in the symbol ◎ for the right-hand junction block. The 6-post junction block is identified in the symbol ◯.

L.H. CHASSIS JUNCTION BLOCK (STEEL TILT CAB MODELS) (SYMBOL ◯)

Terminal No.	Circuit	Wire Size	Color Code
1	STOP, TAIL, DIRECTIONAL AND LICENSE LAMPS		
	From Main Light Switch #4 Terminal	14	Brn.
	To 4-Way Connector To Stop, Tail, Directional and License Lamps	16	Blk.
	To 6-Post Junction Block #1 Junction	12	Brn.
2	DOME LAMP		
	From Dome Lamp	16	Wht.
	To Main Light Switch "Dome"	16	Wht.
3	DOME LAMP		
	From Battery Bus Bar 20-Amp. Fuse "Tail, Dome Lamps"	16	Orn.
	To Dome Lamp	16	Orn.
4	STOP LAMPS		
	From Stop Switch (Vacuum Models)	14	Wht.
	From Emergency Park Brake Stop Lamp Switch	14	Blk.
	From Air Stop Switch	14	Red
	From Trailer Emergency Stop Switch "TRL"	14	Red
	From 8-Way Connector From Hazard Warning Switch	14	Red
	To 6-Post Junction Block #4 Junction	12	Red

L. H. CHASSIS JUNCTION BLOCK (STEEL TILT CAB MODELS) (SYMBOL ⬡) (CONT'D.)

Terminal No.	Circuit	Wire Size	Color Code
5	GENERATOR TELL-TALE		
	From Generator Tell-Tale Lamp	16	Brn.
	From Generator Tell-Tale Lamp	18	Brn.-Wht. Str.
	To Generator Tell-Tale Relay #1 Terminal	16	Blk.
	To Starter Control Relay #1 Terminal	16	Blk.
	To Regulator #4 Terminal	16	Blk.
6	ELECTRIC TWO-SPEED AXLE (WHEN USED)		
	From Regulator #2 Terminal	16	Blk.
	To Two-Speed Axle 20-Amp. Circuit Breaker	12	Blk.
7	FEED CIRCUIT		
	From Battery	10	Blk.
	To Spliced Connection To Control Switch, Horn Relay, Light Switch, and Fuse Block - Tail, Dome Lamps, and Trailer Marker Lamps	10	Red
8	SPARE		
	From Ignition Bus Bar on Fuse Block	16	Pink
	From Control Switch "IGN"	16	Pink
	To Spliced Connection To Ignition Coil "+" and Regulator #4 Terminal	14	Blk.
	To Field Relay #1 Terminal	14	Blk.
9	AMMETER AND VOLTMETER		
	From 4-Amp. Fuse From Battery	14	Blk.
	To Ammeter or Voltmeter	18	Blk.
10	FUEL GAUGE		
	From Fuel Gauge	18	Tan
	To Line Connector To Fuel Gauge Tank Unit	16	Blk.
11	WATER TEMPERATURE GAUGE		
	From Water Temperature Gauge	18	Dk. Grn.
	To Water Temperature Sender	16	Blk.
12	AMMETER		
	From Ammeter	18	Blk.-Wht. Str.
	To 4-Amp. Fuse in Fuse Holder	14	Blk.

R.H. CHASSIS JUNCTION BLOCK (STEEL TILT CAB MODELS) (SYMBOL ⬢)

Terminal No.	Circuit	Wire Size	Color Code
1	OIL PRESSURE GAUGE		
	From Oil Pressure Gauge	18	Dk. Blue
	To Oil Pressure Sender	16	Blk.
2	R.H. STOP, TAIL AND DIRECTIONAL LAMP		
	From 8-Way Connector From Directional and Hazard Warning Switch	14	Dk. Grn.
	To 4-Way Connector to R.H. Stop, Tail, and Directional Lamp	16	Blk.
3	L.H. STOP, TAIL, AND DIRECTIONAL LAMP		
	From 8-Way Connector From Directional and Hazard Warning Switch	14	Yell.
	To 4-Way Connector To L.H. Stop, Tail, and Directional Lamp	16	Blk.
4	STARTER INTERLOCK		
	From Control Switch "START"	12	Ppl.
	To Starter Magnetic Switch	16	Blk.
	To Engine Harness Connector To Transmission Control "NEUTRAL"	16	Blk.
5	TRAILER I.C.C. MARKER LAMP		
	From Line Connector From Marker Blink Switch	14	Blk.
	From Line Connector From Trailer I.C.C. Marker Lamp Relay #2 Terminal	14	Blk.
	To 6-Post Junction Block #5 Junction	12	Blk.
	To Line Connector To Rear I.C.C. Marker Lamps	16	Blk.
6	SPARE		
	From 6-Post Junction Block #6 Junction	12	Dk. Blue

(Cont'd.)

R. H. CHASSIS JUNCTION BLOCK (STEEL TILT CAB MODELS) (SYMBOL ⬡) (CONT'D.)

Terminal No.	Circuit	Wire Size	Color Code
7	ELECTRIC TWO-SPEED AXLE		
	From Line Connector From Axle Shift Switch "LO"	14	Blk.
	To Speedometer Adapter	16	Blk.
	ALLISON TRANSMISSION OIL TEMPERATURE SWITCH		
	From Bolted Connection From Control Switch "G1"	16	Blk.
	To Transmission Oil Temperature Switch	16	Blk.
8	L.H. DIRECTIONAL LAMP (TRAILER)		
	From Spliced Connection From 8-Way Connector From Directional and Hazard Warning Switch	14	Yell.
	To 6-Post Junction #2 Junction	12	Yell.
9	R.H. DIRECTIONAL LAMP (TRAILER)		
	From Spliced Connection From 8-Way Connector From Directional and Hazard Warning Switch	14	Dk. Grn.
	To 6-Post Junction Block #3 Junction	12	Dk. Grn.
10	HOT ENGINE SWITCH		
	From Engine Alarm Buzzer	18	Dk. Grn.-Wht.Str.
	To Hot Engine Switch	16	Blk.
11	LOW OIL SWITCH - ENGINE ALARM		
	From Engine Alarm Buzzer	18	Blk.-Yell.Str.
	To Low Oil Switch	16	Blk.
12	BACK-UP LAMP		
	From 20-Amp. Stop & Back-up Lamp Fuse on Fuse Block	14	Orn.
	From 4-Way Connector From Allison Transmission Control "REV"	16	Blk.
	To Back-up Lamp Switch	16	Blk.
	To Emergency Park Brake Stop Light Switch	14	Blk.

TRAILER WIRING HARNESS TO TRAILER CABLE 6-TERMINAL POST JUNCTION BLOCK (STEEL TILT CAB MODELS) (SYMBOL ◯)

Terminal No.	Circuit	Wire Size	Color Code
1	TAIL LAMPS - TRAILER		
	From L.H. Junction Block #1 Junction	12	Brn.
	To 6-Wire Semi-Trailer Plug	14	Brn.
	To 7-Wire Semi-Trailer Plug	12	Brn.
2	L.H. DIRECTIONAL LAMP - TRAILER		
	From R.H. Junction Block #8 Junction	12	Yell.
	To 6-Wire Semi-Trailer Plug	14	Yell.
	To 7-Wire Semi-Trailer Plug	12	Yell.
3	R.H. DIRECTIONAL LAMP - TRAILER		
	From R.H. Junction Block #9 Junction	12	Dk. Grn.
	To 6-Wire Semi-Trailer Plug	14	Grn.
	To 7-Wire Semi-Trailer Plug	12	Grn.
4	STOP LAMPS - TRAILER		
	From L.H. Junction Block #4 Junction	12	Red
	To 6-Wire Semi-Trailer Plug	14	Red
	To 7-Wire Semi-Trailer Plug	12	Red
5	TRAILER I.C.C. MARKER LIGHTS		
	From R.H. Junction Block #5 Junction	12	Blk.
	To 6-Wire Semi-Trailer Plug	14	Blk.
	To 7-Wire Semi-Trailer Plug	12	Blk.
6	SPARE		
	From R.H. Junction Block #6 Junction	12	Dk. Blue
	To 7-Wire Semi-Trailer Plug	12	Blue

SERIES RM80

A forward junction panel shown in figure 4 is located at left of driver and a rear junction panel shown in figure 5 is located at right rear of vehicle.

A 6-terminal post junction block is located on the rear junction panel and a 16-terminal post junction panel is located on the front electrical equipment and circuit breaker panel.

Terminal numbers on the junction panel correspond to numbers shown on wiring diagrams and in the tabulations which follow. The tabulations list each terminal number, the circuit it carries, and the size, color, and pattern of the wire which connects to each terminal.

CHASSIS ELECTRICAL AND INSTRUMENTS

REAR 6—TERMINAL POST ELECTRICAL EQUIPMENT JUNCTION PANEL (SERIES RM-80)

Terminal No.	Circuit	Wire Size	Color Code
1	SPEEDOMETER		
	From Speedometer Generator "O"	16	Blk.-947
	To Front Electrical Equipment Panel #2 Junction	14	Grn.-Nat. Cr. 908
2	SPEEDOMETER		
	From Speedometer Generator "S"	16	Blk.-946
	To Front Electrical Equipment Panel #7 Junction	16	Yell.-909
3	STOP AND TAIL LAMP		
	From Front Electrical Equipment Panel #12 Junction	16	Nat.-17
	To Stop and Tail Lamp Connector	16	Blk.-17
4	TEMPERATURE GAUGE		
	From Front Electrical Equipment Panel #5 Junction	16	Grn.-35
	To Temperature Gauge Sender Unit	16	Blk.-35
5	OIL PRESSURE GAUGE		
	From Front Electrical Equipment Panel #6 Junction	16	Blue-31
	To Oil Pressure Gauge Sending Unit	16	Blk.-31
6	STOP AND TAIL LAMP		
	From Front Electrical Equipment Panel #11 Junction	16	Blk.-Nat. Tr.-9
	To Stop and Tail Lamp Connector	16	Blk.-9

FRONT 16—TERMINAL POST ELECTRICAL EQUIPMENT JUNCTION PANEL (SERIES RM-80)

Terminal No.	Circuit	Wire Size	Color Code
1	FUEL GAUGE		
	From Fuel Gauge Tank Unit	16	Tan-30
	To Multiple Connector To Fuel Gauge	16	Brn.-Wht. Cr. Tr.-30
2	SPEEDOMETER		
	From Rear Electrical Equipment Panel 6-Post Junction Block #1 Junction	16	Grn.-Nat. Cr. Tr.-908
	To Speedometer	14	Grn.-Wht. Cr. Tr.-947
3	AMMETER		
	From Ammeter Shunt on Rear Electrical Equipment Panel	12	Blk.-105
	To Multiple Connector To Ammeter	12	Blk.-105
4	AMMETER		
	From Ammeter Shunt on Rear Electrical Equipment Panel	14	Red-106A
	To Multiple Connector To Ammeter	14	Blk.-Wht. Tr.-106
5	TEMPERATURE GAUGE		
	From Multiple Connector From Temperature Gauge	16	Grn.-Blk. Tr.-35
	To Rear Electrical Equipment Panel Junction Block #4 Junction	16	Grn.-35
6	OIL GAUGE		
	From Multiple Connector From Oil Gauge	16	Blue-Wht. Tr.-31
	To #5 Junction on Rear Electrical Equipment Junction Panel	16	Blue-31
7	SPEEDOMETER		
	From #2 Junction on Rear Electrical Equipment Junction Panel	16	Yell.-909
	To Multiple Connector To Speedometer	14	Yell.-946
8	CHOKE SWITCH		
	From Spliced Connection From Choke Relay #3 Terminal and Choke Switch	16	Nat.-Blk. Tr.-907A
	To Multiple Connector To Choke Switch	16	Wht.-907
9	TRANSMISSION TEMPERATURE SWITCH		
	From Line Connector From Ignition Switch Connector	14	Blk.-120
	To Transmission Temperature Switch	14	Blk.-120
10	ENGINE CONTROL		
	From Multiple Connector From Ignition Switch Connector	16	Maroon-5
	To Engine Control Switch	14	Maroon-5
11	STOP AND TAIL LAMP		
	From Multiple Connector From Light Switch	14	Brn.-9
	To #6 Junction on Rear Electrical Equipment Junction Panel	16	Blk.-Nat. Tr.-9
12	STOP AND TAIL LAMP		
	From Air Stop Switch and Park Brake Stop Lamp Switch	14	Wht.-17A
	To #3 Junction on Rear Electrical Equipment Junction Panel		
13	STARTER CONTROL		
	From Starter Magnetic Switch	14	Wht.-156
	To 4-Way Connector To Neutral Safety Switch	14	Wht.-156
14	OPEN		
15	OPEN		
16	OPEN		

SERIES 90 TILT CAB MODELS

Information applicable to the junction block used on Series 90 Tilt Cab Models remains the same as covered under "Chassis Junctions" in CHASSIS ELECTRICAL AND INSTRUMENTS (SEC. 12) page 12-5 in Service Manual ST135-70 except as follows:

junction block mounted on the console circuit breaker and junction panel are shown in the tabulation which follows: The tabulation lists each terminal number, the circuit it carries, and the size, color, and pattern of wires which connect to each terminal. Terminal post numbers on wiring diagrams appear in the symbol ⬡.

CHASSIS JUNCTION BLOCK (SERIES 90 TILT CAB MODELS) (SYMBOL ⬡)

Terminal No.	Circuit	Wire Size	Color Code
1	STOP, TAIL, DIRECTIONAL AND LICENSE LAMP		
	From #4 Terminal on Main Light Switch	16	Brn.
	To Instrument Panel Harness Connector Terminal "ES"	16	Brn.
	To 6-Wire Semi-Trailer Plug	14	Brn.
	To 7-Wire Semi-Trailer Plug	12	Brn.
2	DIRECTIONAL LAMPS (L.H.)		
	From Spliced Connection From 8-Way Connector From Directional and Hazard Warning Switch	14	Yell.
	To 6-Wire Semi-Trailer Plug	14	Yell.
	To 7-Wire Semi-Trailer Plug	12	Yell.
3	R.H. DIRECTIONAL LAMPS		
	From 9-Way Connector From Directional and Hazard Warning Switch	14	Blue
	To Instrument Panel Harness Connector "HX"	16	Grn.
	To 6-Wire Semi-Trailer Plug	14	Grn.
	To 7-Wire Semi-Trailer Plug	12	Grn.
4	TRAILER STOP LAMPS		
	From Trailer Emergency Stop Lamp Switch "TRL"	16	Red
	To 6-Wire Semi-Trailer Plug	14	Red
	To 7-Wire Semi-Trailer Plug	12	Red
5	TRAILER I.C.C. MARKER LAMPS		
	From Marker Lamp Switch "ON"	16	Blk.
	To I.C.C. Marker Lamps	16	Blk.
	To 6-Wire Semi-Trailer Plug	14	Blk.
	To 7-Wire Semi-Trailer Plug	12	Blk.
6	SPARE		
	To 7-Wire Semi-Trailer Plug	12	Blue

CIRCUIT BREAKERS

Information applicable to circuit breakers used on vehicles covered by this supplement remains the same as covered under "Circuit Breakers" in CHASSIS ELECTRICAL AND INSTRUMENTS (SEC. 12) page 12-5 in Service Manual ST135-70 except as follows:

NOTE: Three basic types of circuit breakers are used on vehicles covered by this supplement. Refer to "Circuit Breaker Tabulation" at end of this section for circuit breaker amperage rating and location on the vehicle.

MANUAL RESET TYPE CIRCUIT BREAKER (MODEL 90 ONLY)

A manual reset type master circuit breaker is used on Series 90 tilt cab models. Circuit breaker is mounted in console just below the headlight switch knob and will disconnect all circuits except the headlight circuit when load exceeds 70 amps. By pushing reset button, circuits can be re-energized. If breaker trips instantly (button pops outward), or signs of electrical overload such as a burnt smell or smoke appears, IMMEDIATELY PULL MASTER CIRCUIT BREAKER BUTTON OUT until white ring is exposed. This should also be done whenever console access cover is removed. DO NOT OPERATE VEHICLE LONGER THAN

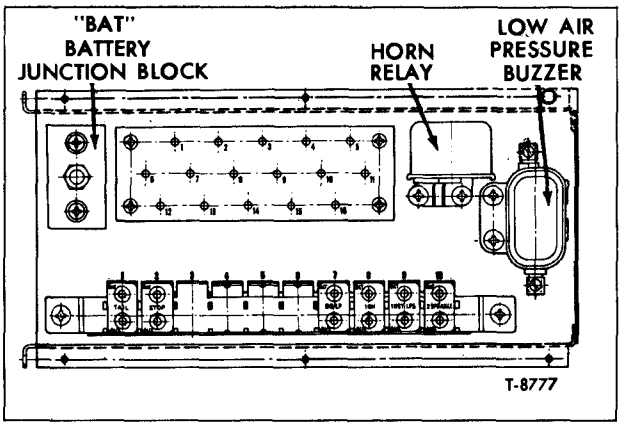
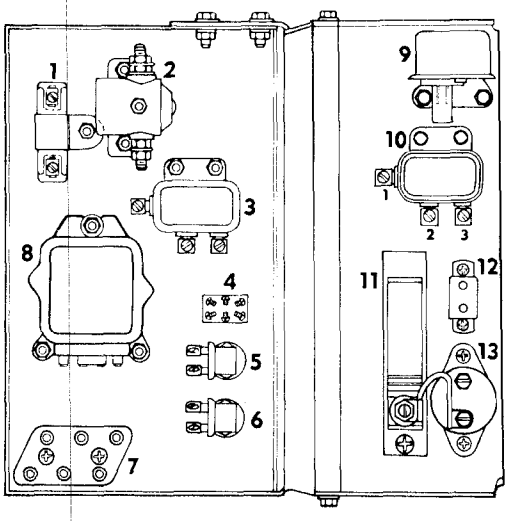


Figure 4—Front Chassis Junction ("R" Models) (Typical)



1 Ignition Resistor
2 Starter Magnetic Switch
3 Choke Relay
4 Engine Control Switch
5 Starter Switch
6 Choke Switch
7 Junction Block
8 Voltage Regulator
9 Field Relay
10 Starter Interlock Relay
11 Ammeter Shunt
12 30-Amp. Circuit Breaker
13 Master Circuit Breaker - 70-Amp. With 61- or 62-Amp. Generator 90-Amp. With 130-Amp. Generator

T-8200

Figure 5—Rear Chassis Junction ("R" Models) (Typical)

NECESSARY WITH CIRCUIT BREAKER OPEN and do not attempt to "jump" across breaker terminals inside console to by-pass this protective device.

Any condition which causes an overload on the circuit will cause the bimetallic element to open the circuit and force the reset button outward, thus de-energizing circuits protected by the circuit breaker.

To energize the circuit, press the reset button on the circuit breaker "IN." If a repeated overload is encountered, locate and correct the cause of the overload.

AUTOMATIC RESET TYPE CIRCUIT BREAKER

Automatic reset type circuit breakers are used on Series RM80, Series 70-90 tilt cab models, and Series 90 tilt cab models. Refer to "Circuit Breaker Tabulation" at end of this section for circuit breaker amperage rating and location.

Automatic reset type circuit breakers can be identified by a long "Accessory" terminal stud and a short "Battery" terminal stud on the circuit breaker. Two nuts are used to attach terminal leads to the circuit breaker.

An overload on the circuit, such as a short, will cause the circuit breaker bimetallic element to open the circuit. When the element cools, the circuit breaker will close the circuit. This off-and-on cycle will repeat until the switch controlling the defective circuit is turned off, or until the cause of the overload has been located and corrected.

If the circuit breaker becomes inoperative (burns out or sticks closed), the defective circuit breaker must be replaced. Circuit breakers must be installed so the feed or battery wire is connected to the "Battery" or short terminal and the wire or wires carrying the circuit to the unit is connected to the "Auxiliary" or long terminal.

IMPORTANT: When replacing a circuit breaker use a replacement circuit breaker having the same amperage rating and voltage as stamped on the unit being replaced.

REMOTE RESET TYPE CIRCUIT BREAKER

The remote reset type circuit breaker used on some conventional cab models has fuse clip adaptors installed over the circuit breaker terminal studs. These adapters snap into fuse clips in the fuse block. Refer to "Circuit Breaker Tabulation" at end of this section for circuit breaker amperage rating and usage.

An overload on the circuit, such as a short, will cause the circuit breaker bimetallic element to open the circuit. A heating element within the circuit breaker will hold the bimetallic element open until the switch controlling the defective circuit is turned off or until the circuit breaker is removed from the circuit.

WARNING

DO NOT remove an open circuit breaker with bare hands. The heating element will cause the circuit breaker to remain hot as long as the circuit breaker is open.

It will require approximately 35 seconds for the element to cool sufficiently to permit the circuit breaker to complete the circuit after the controlling switch is turned off or the circuit breaker is removed.

If a circuit breaker opens, turn off the switch controlling the defective circuit or remove the circuit breaker. Wait approximately 35 seconds for the element to cool, then turn on the controlling switch or install the circuit breaker in the fuse block.

If the circuit breaker becomes inoperative (burns out or sticks closed), replace the circuit breaker with a new unit of the same type and having the same amperage rating and voltage as stamped on the case.

FUSE BLOCK CIRCUIT BREAKERS
(CONVENTIONAL CAB MODELS)

Amperage	Circuit	Wire Size	Color Code	Fed From
30-AMP.	HEATER			Accessory Bus Bar
	To Heater Blower Control Switch	14	Brn.	
	To Blower Control Switch	14	Brn.	
10-AMP.	BACK-UP LAMPS			Accessory Bus Bar
	To Instrument Panel Harness To Engine Harness Connector Cavity "DZ"	16	Grn.	
20-AMP.	DIRECTIONAL & HAZARD WARNING LIGHTS			Battery Bus Bar
	To Hazard Warning Flasher	16	Blue	
20-AMP.	TRAILER MARKER LIGHTS			Battery Bus Bar
	To 12-Post Junction Block No. 1 Terminal To Trailer I. C. C. Marker Lamp Relay	16	Blk.	
15-AMP.	TAIL LAMPS			Battery Bus Bar
	To Light Switch No. 5 Terminal	16	Brn. Blk. Cr. Tr.	
10-AMP.	DOME LAMP			Battery Bus Bar
	To Two Terminal Connector To Dome Lamp	I8	Org.	
15-AMP.	STOP LIGHTS			Ignition Bus Bar
	To Air Stop Switch and Emergency Park Brake Stop Light Switch	14	Org.	
20-AMP.	IGNITION			
	From Control Switch "IGN."	12	Wht.-Red Cr.Tr.	
	To Multiple Connector To Differential Lock Tell-tale, Low Water Tell-tale, Low Oil Tell-tale, Low Air Tell-tale, Alarm Buzzer, and Low Coolant Indicator	16	Wht.//-Red. Tr.	

SERIES RM80

Circuit breakers mounted on the front chassis junction panel are identified in figure 4. The tabulation which follows lists each circuit breaker number, the circuit it carries, and the size, color, and pattern of the wire which connects to each terminal.

Circuit Breaker No.	Amps.	Circuit	Wire Size	Color Code
1	15	LIGHT SWITCH		
		From Battery Junction Block	12	R-2C
		To Multiple Connector to Light Switch	14	O-40
2	15	STOP LIGHTS		
		From Ignition Switch "IGN." Terminal	14	W-R-CT-3B
		To Air Stop Switch	14	W-//-R-Tr-39Y
		To Park Brake Stop Light Switch	14	W-//-R-Tr-39Z
3		OPEN		
4		OPEN		
5		OPEN		
6		OPEN		
7		OPEN		
8	15	ALARM AND GAUGES		
		From Multiple Connector From Ignition Control Switch "IGN."	12	W-R-CT-3A
		To Low Air Buzzer	16	W-//-R-Tr-39B
		To Multiple Connector to Dash Gauges	14	W-//-R-Tr-39A
9	8	INSTRUMENT PANEL LAMPS		
		From Multiple Connector From Light Switch	16	Gr-44
		To Instrument Panel Gauge Lamps	16	GY-8
10	15	SPARE		
		From Multiple Connector From Ignition Switch Connector "ACC."	12	BRN-BLK-Tr-4

SERIES 90 TILT CAB MODELS

In addition to the 70-amp master circuit breaker mounted on the heater control panel, 12 automatic reset type circuit breakers are mounted on the circuit breaker and junction panel in the console compartment. Circuit breakers are mounted on the ignition bus bar, the battery bus bar, or the accessory bus bar.

Circuit breakers mounted on the ignition bus bar are fed from ignition "IGN" terminal on the control switch. Circuit breakers mounted on the battery bus bar are fed from the battery through the 70-amp master circuit breaker, and circuit breakers mounted on the accessory bus bar are fed from the No. 2 terminal of the accessory feed relay when engine control switch is energized.

CHASSIS ELECTRICAL AND INSTRUMENTS

Circuit breaker numbers shown on Wiring Diagrams and in the tabulation which follows are identified in figure 7 in CHASSIS ELECTRICAL AND INSTRUMENTS (SEC. 12) page 12-7 in Service Manual ST135-70. The tabulation which follows lists each circuit breaker number, the circuit it carries and the size, color, and pattern of the wire which connects to each terminal.

CONSOLE COMPARTMENT CIRCUIT BREAKERS
(SERIES 90 TILT CAB MODELS)

Circuit Breaker No.	Amps.	Circuit	Wire Size	Color Code
1	10	GAUGES, ALARM, SOLENOID FEED, AND COOLANT LOSS INDICATOR		
		From Ignition Bus Bar From Control Sw. "IGN."	10	Wht-Red Cr. Tr.
		To Spliced Connection: Oil Pressure Gauge, Fuel Gauge, Water Temperature Gauge, Engine Oil Temperature Gauge, Starter Switch, Engine Alarm Buzzer, Low Coolant Indicator, & Tachographs	16	Wht // Red Tr.
2	15	ELECTRIC SPEEDOMETER, AIR STOP SWITCH AND TRAILER EMERGENCY STOP LIGHT SWITCH		
		From Ignition Bus Bar:		
		To Electric Speedometer "+"	16	Wht-Blk & Red Cr. Tr.
		To Air Stop Switch and Trailer Emergency Stop Lamp Switch "IGN."	14	Wht-Blk & Red Cr. Tr.
3	5	DOME LAMP		
		From Battery Bus Bar:		
		To 3-Way Connector to Dome Lamp and Sleeper Dome Lamp	16	Org.
4	15	TAIL LAMPS		
		From Battery Bus Bar:		
		To Light Switch No. 5 Terminal	12	Brn-Blk. Cr. Tr.
5	20	MARKER LAMPS		
		From Battery Bus Bar:		
		To Marker Lamp Switch	12	Org-Blk. Tr.
6	20	DIRECTIONAL AND HAZARD WARNING AND CIGAR LIGHTER		
		From Battery Bus Bar:		
		To Flasher Terminal "X"	12	Blue
		To Cigar Lighter	12	Red
7	5	GAUGE AND INSTRUMENT LAMPS		
		From Light Switch No. 2 Terminal	16	Grn.
		To Spliced Connection to Instrument Lamps and Cigar Lighter Lamp	18	Gray
8	30	HEATER BLOWER CONTROL, AIR PRESSURE SWITCH, SPEEDOMETER ADAPTER, BACK-UP LAMP SWITCH, STARTER SWITCH, AND FIELD RELAY UNIT		
		From Accessory Bus Bar:		
		To Heater Blower Control Switch	14	Brn.
		To Instrument Panel Harness Connector Cavity "EZ."	16	Wht // Red Tr.
9	5	TELL-TALE LIGHTS		
		From Accessory Bus Bar:		
		To Spliced Connection to Low Air Tell-tale, Low Oil Tell-tale, Low Water Tell-tale, and Differential Lock Tell-tale	16	Red-Wht Tr.
10	8	ENGINE BRAKE		
		From Accessory Bus Bar:		
		To Engine Brake Switch	16	Brn.-Blk. Tr.
11	20	POWER WINDOW SWITCH		
		From Accessory Bus Bar:		
		To Power Window Switch	14	Red-Wht. Tr.
12	30	AUXILIARY LAMPS		
		From Battery Bus Bar	12	Red
		To Auxiliary Lamp Switch	12	Org.-Blk. Tr.

FUSE BLOCKS AND FUSES

A typical fuse block used on Series 70 through 90 tilt cab models is shown in figure 6, otherwise information applicable to fuse blocks and fuses remains the same as covered in CHASSIS ELECTRICAL AND INSTRUMENTS (SEC. 12) in Service Manual ST135-70.

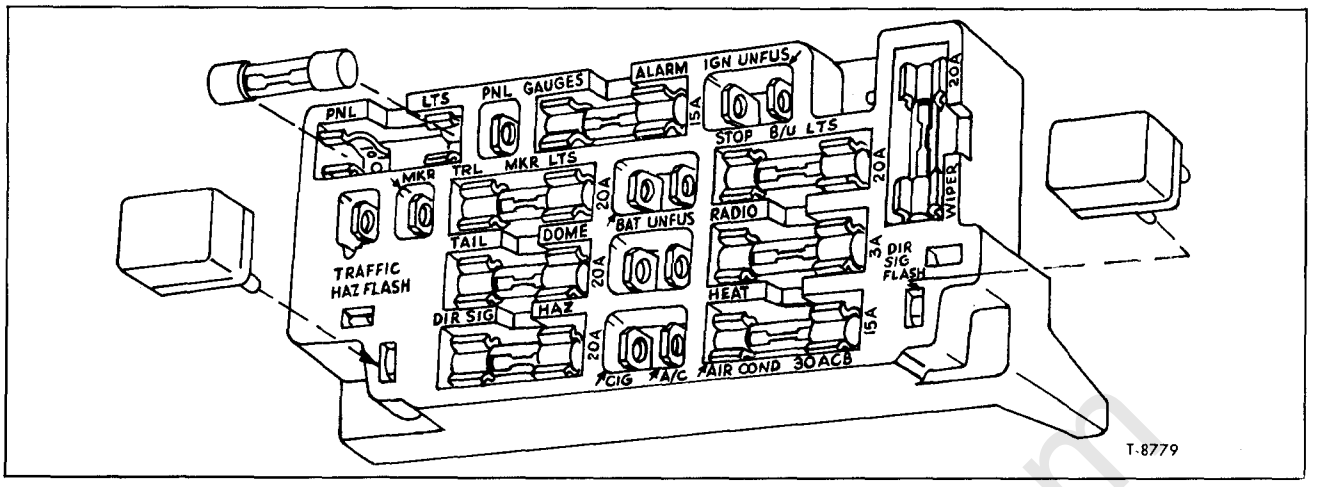


Figure 6—Fuse Block (Tilt Cab Models) (Typical)

FUSIBLE LINK

On conventional cab models, a fusible link is connected into the engine wiring harness at the junction block as shown in figure 7. The fusible link is used to protect the chassis wiring harness from an overload or short in an unfused circuit. If a short circuit or overload occurs, the fusible link burns open to protect the rest of the circuit.

Precise location of each fusible link used on vehicles covered by this supplement is shown in the tabulation on applicable wiring diagrams in "Wiring Diagrams" in Manual Supplement ST332-71.

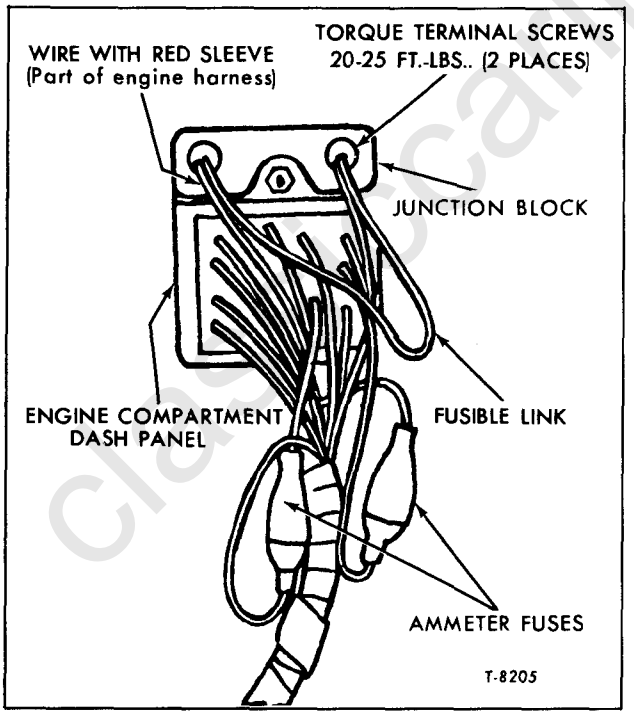


Figure 7—Fusible Link and Ammeter Fuses (Typical)

ELECTRIC HORN

Information applicable to the electric horn used on vehicles covered by this supplement remains the same as covered under "Electric Horn" in CHASSIS ELECTRICAL AND INSTRUMENTS (SEC. 12) in Service Manual ST135-70, except a schematic diagram of the horn control circuit (fig. 8) has been added to clarify procedures used in checking the horn circuit.

If the horn fails to operate, use a jumper lead to check the external horn circuit as follows:

1. Connect jumper lead from No. 2 terminal on horn relay to ground. If horn operates, the trouble is in the horn control circuit. If the horn does not operate, remove jumper lead and proceed with Step 2.

2. Momentarily connect jumper lead between No. 3 and No. 1 terminals on horn relay. If horn operates, the relay is defective.

3. The horn circuit is internally grounded through the mounting. Therefore, it is necessary that a good ground connection be maintained between the horn mounting bracket and its mating part. Check for a good ground by connecting a jumper lead from the horn mounting bracket to the vehicle frame or grounded side of the battery. Be

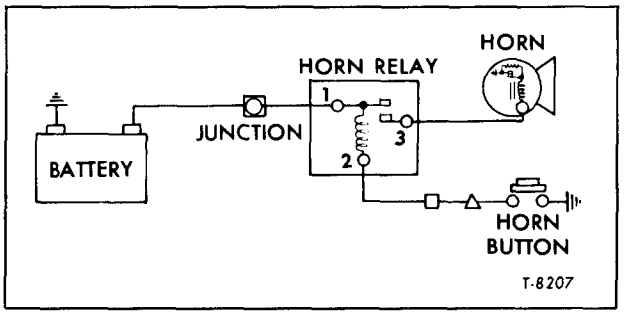


Figure 8—Electric Horn Control Circuit

sure contact is made through the paint or the horn bracket and frame.

If trouble was not corrected by the preceding checks, a foreign particle may be holding the horn contacts open. This condition can sometimes be corrected by energizing the horn, then lightly tapping the horn power plant to dislodge the particle. If this fails to correct the problem, replace horn.

TRAILER EMERGENCY STOP LIGHT SWITCH (WHEN USED)

The trailer emergency stop light switch is used as optional equipment on some vehicles covered by this supplement. Refer to applicable wiring diagram in "Wiring Diagrams" in Manual Supplement ST332-71 for electrical connections at the switch.

INSTRUMENTS AND GAUGES

Information applicable to instruments and gauges used on vehicles covered by this supplement remains the same as covered under "Instruments and Gauges" in CHASSIS ELECTRICAL AND INSTRUMENTS (SEC. 12) pages 12-17 through 12-23 in Service Manual ST135-70 except as follows:

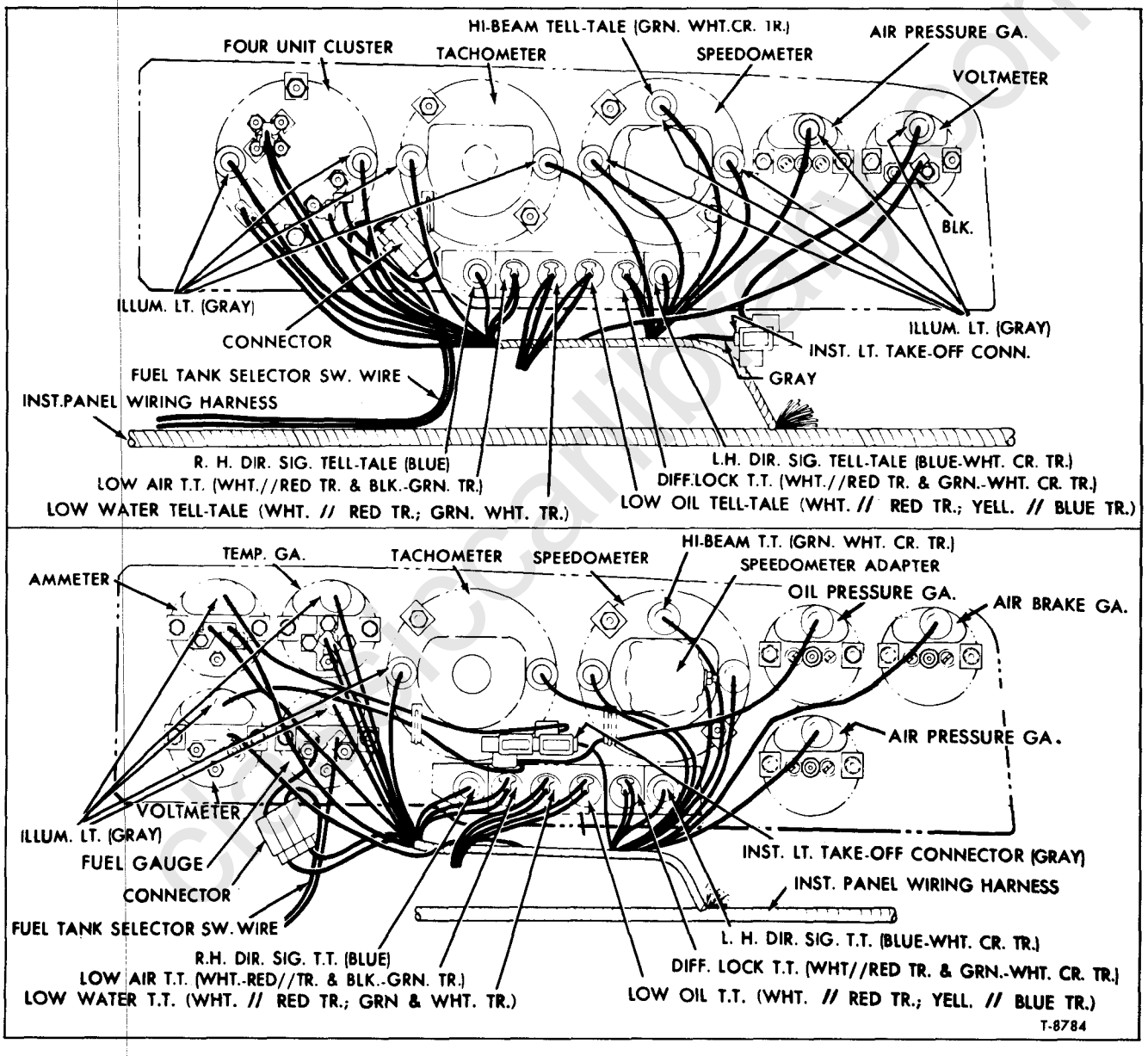


Figure 9—Connections at Rear of Instrument Cluster (Conv. Cab Models) (Typical)

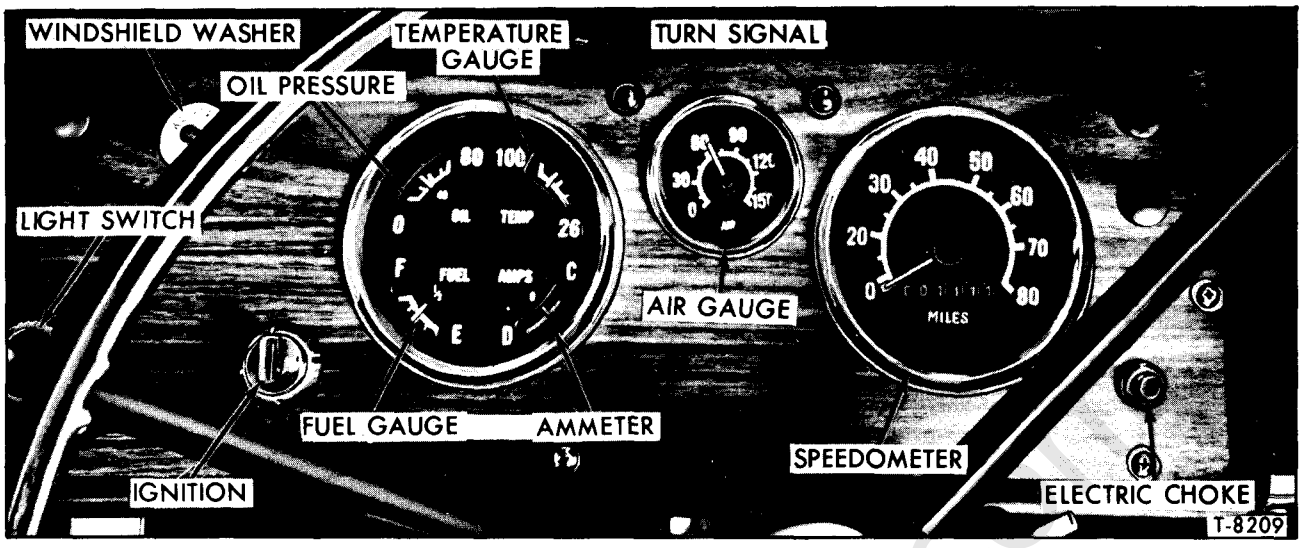
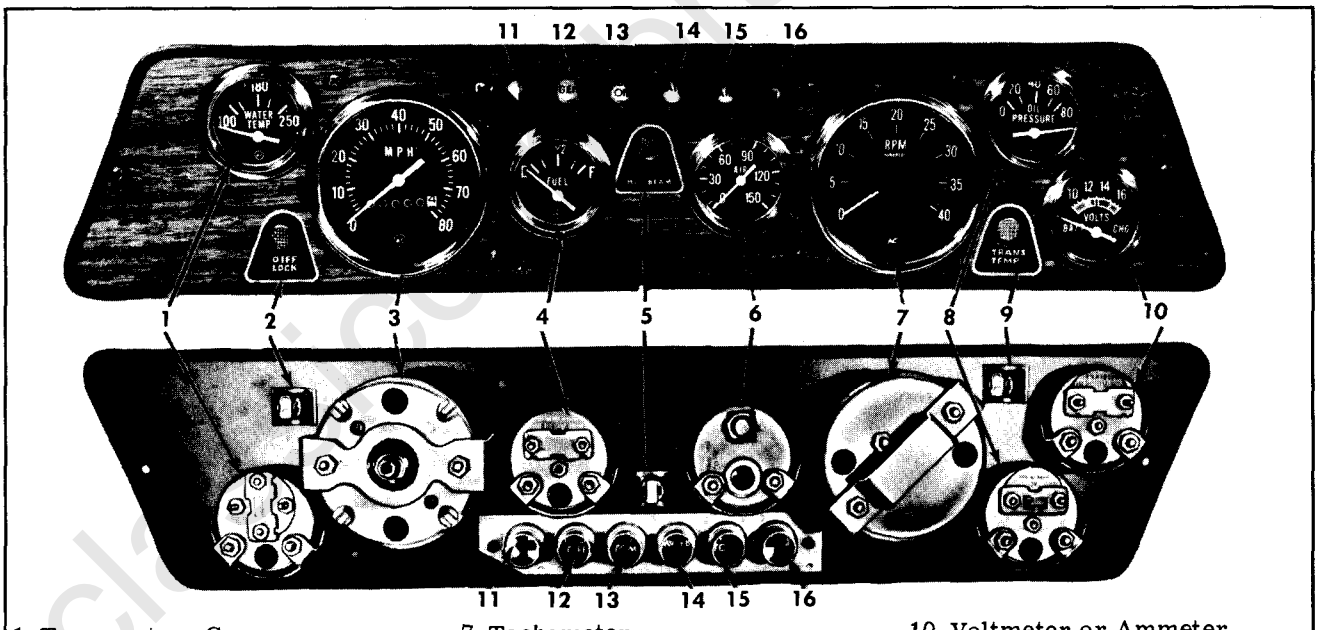


Figure 10—Instrument Cluster (RM80) (Typical)

CONVENTIONAL CAB MODELS

Information applicable to instruments and gauges used on conventional cab models remains the same as covered under "Instruments and Gauges" in CHASSIS ELECTRICAL AND INSTRUMENTS (SEC. 12) pages 12-17 and 12-18 in Service Manual ST135-70 except refer to figure 9 for typical electrical connections at rear of instrument cluster on these models.



1 Temperature Gauge
2 Differential Lock Tell-tale
3 Speedometer
4 Fuel Gauge
5 Hi-Beam Tell-tale
6 Air Pressure Gauge, Vacuum Gauge, Voltmeter, or Ammeter
7 Tachometer
8 Engine Oil Pressure Gauge, Vacuum Gauge, Voltmeter, or Ammeter
9 Transmission Temperature Tell-tale (With MT-40 or MT-41 Transmission)
10 Voltmeter or Ammeter
11 L.H. Turn Signal Tell-tale
12 Generator Tell-tale
13 Low Oil Tell-tale
14 Water Temperature Tell-tale
15 Low Air Tell-tale
16 R.H. Turn Signal Tell-tale

T-8210

Figure 11—Instrument Cluster (Series 70-90 Steel Tilt Cab Models) (Typical)

CHASSIS ELECTRICAL AND INSTRUMENTS

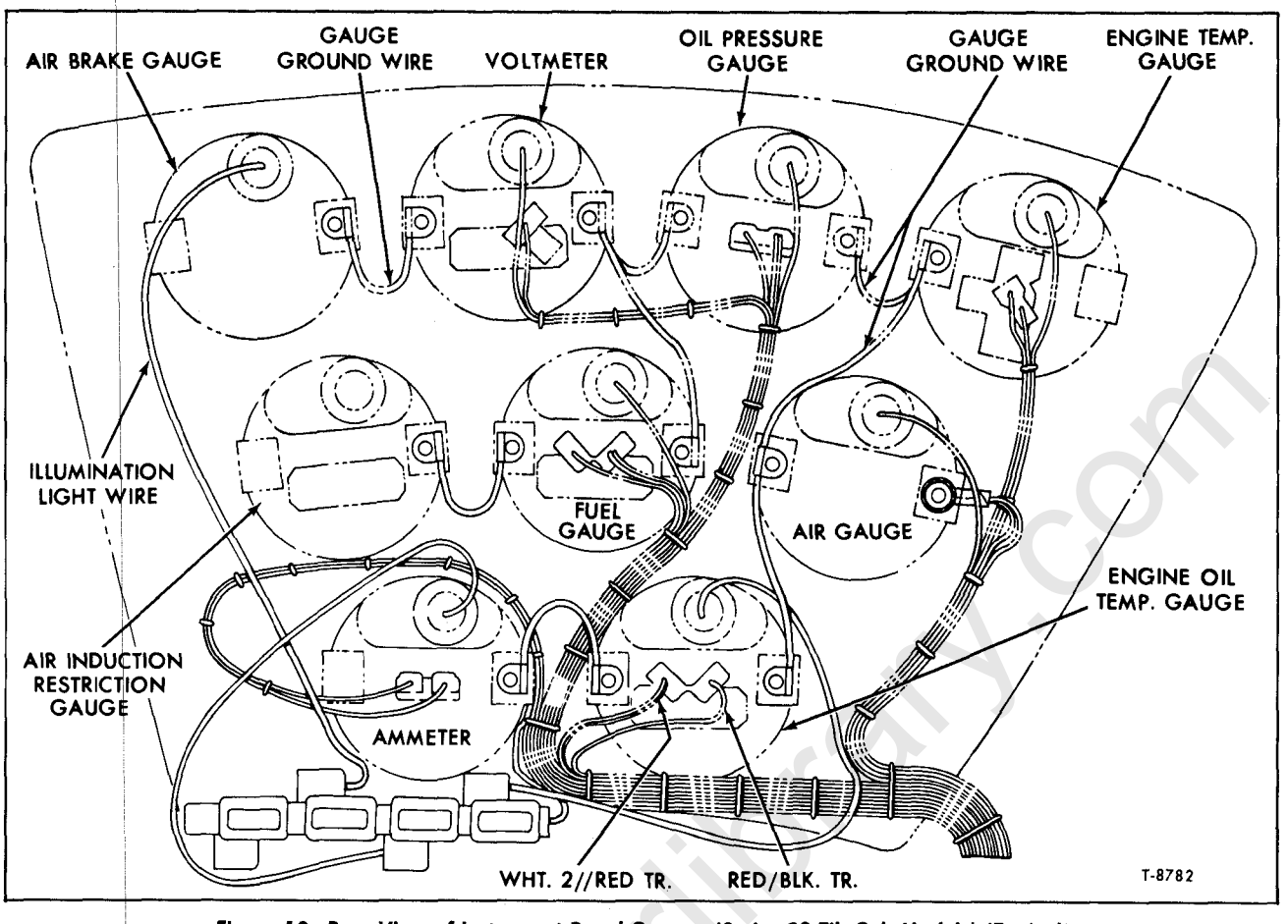


Figure 12—Rear View of Instrument Panel Gauges (Series 90 Tilt Cab Models) (Typical)

SERIES RM80

A typical instrument cluster used on Series RM80 is shown in figure 10. The four unit cluster contains a generator ammeter, engine temperature gauge, fuel gauge, and an oil pressure gauge. A matching round electric speedometer and an air pressure gauge, mounted between the cluster and speedometer, are used on this model.

Electrical connections at rear of cluster are made through plastic blade-type connectors or screw-type terminals. Instrument and tell-tale light bulbs snap into back of cluster.

SERIES 70 THROUGH 90 TILT CAB MODELS

Information applicable to the instruments and gauges used on steel tilt cab models remains the same as covered under "Instruments and Gauges" in CHASSIS ELECTRICAL AND INSTRUMENTS (SEC. 12) pages 12-17 through 12-23 in Service Manual ST135-70 except refer to figure 11 for a typical instrument cluster.

SERIES 90 TILT CAB MODELS

Information applicable to instruments and gauges used on Series 90 tilt cab models remains the same as covered under "Instruments and Gauges" in CHASSIS ELECTRICAL AND INSTRUMENTS (SEC. 12) in Service Manual ST135-70 except refer to figure 12 for rear view of instrument panel gauges.

LIGHTING SYSTEM

Lighting system information applicable to vehicles covered by this supplement remains the same as covered under "LIGHTING SYSTEM" in CHASSIS ELECTRICAL AND INSTRUMENTS (SEC. 12) pages 12-24 through 12-34 in Service Manual ST135-70 except as follows:

AUXILIARY LAMPS (ALL WEATHER)

Auxiliary all weather lamps, available as optional equipment on some vehicles, are used to provide increased illumination. The lamps, which are mounted at lower front of vehicle are controlled by a toggle-type switch mounted on the light switch and heater control panel. Refer to "Light Bulb Data" at end of this section for sealed-beam unit type and trade number.

PARKING LIGHTS

Parking lights (when used) are an integral part of the directional light assembly. The parking lights are illuminated when the main light switch knob is pulled out to the first detent position. The parking light circuit is protected by an automatic reset type circuit breaker built into the main light switch.

BULB REPLACEMENT

NOTE: Refer to "Light Bulb Data" at end of this section for bulb size and type.

Remove screws which attach directional lamp lens to housing, then remove the lens. Press inward on bulb and turn counterclockwise to release from socket. Press new bulb into socket and turn clockwise to secure. Replace gasket if damaged, then position lens on lamp housing and attach with screws.

CAB FRONT MARKER AND IDENTIFICATION LIGHTS

Front marker and identification lights are mounted across front top of cab. On conventional cab and Series 70 through 90 tilt cab models, the light circuit is energized by a separate marker lamp switch fed from the main light switch when light switch is in "ON" position. On Series 90 tilt cab models, the light circuit is energized by a separate marker lamp switch fed from the 20-amp No. 5 circuit breaker in the console compartment.

Bulbs are accessible for replacement after removing screws which attach lamp lens to housing, then removing the lens.

DIRECTIONAL AND HAZARD WARNING LIGHTS

Information applicable to "Directional Signal Lights" and the "Hazard Warning System" remains the same as covered under "Lighting System" pages 12-29 and 12-30 in CHASSIS ELECTRICAL AND INSTRUMENTS (SEC. 12) in Service Manual ST135-70 except as follows:

NOTE: When checking electrical circuits, refer to applicable wiring diagram in "Wiring Diagrams" in (SEC. 12) of Service Manual ST135-70 for wiring arrangement.

On Series HC/HH/JC/JH90 and Series 90 tilt cab models, an arrow at either side of the telltale cluster flashes when the left or right signal light is illuminated. When turn is completed, the switch must be returned to the neutral "OFF" position to cancel the lights.

On Series HC/HH/JC/JH90 and Series 90 tilt cab models, the hazard warning switch lever is located on the directional signal switch housing below the turn signal lever. Pull hazard warning switch lever out to activate the system. To cancel or "turn-off" the lights, move directional signal switch lever up or down. The hazard warning signal lever is spring-loaded and will cancel the hazard warning lights when released by movement of the directional signal switch lever.

If switch becomes inoperative, check for a blown fuse, defective circuit breaker, or a weak flasher. If this fails to correct the condition, replace the hazard warning or directional signal switch.

DIRECTIONAL SIGNAL CONTROL ASSEMBLY (EXCEPT ALUMINUM TILT CAB MODELS)

Information applicable to the directional signal control assembly remains the same as covered on pages 12-32 and 12-33 in CHASSIS ELECTRICAL and INSTRUMENTS (SEC. 12) in Service Manual ST135-70, except the directional signal wiring harness connector used on conventional cab models has been revised to conform with the wiring harness connector used on series 70-90 tilt cab models.

LIGHT BULB DATA AND SPECIFICATIONS

NOTE: Information applicable to alarm buzzers, relays, coolant loss indicator, and flasher units remains the same as covered under "Specifications" in "CHASSIS ELECTRICAL AND INSTRUMENTS (SEC. 12) Service Manual ST135-70.

LIGHT BULB DATA

	BULB NO.	CANDLE-POWER
HEADLAMP		
Dual Sealed-Beam Unit		
Inside Light (Type 1)	4001	37½ Watts
Outside Light (Type 2)	4002	37½-50 Watts
Single Sealed-Beam Unit	6014	50-60 Watts
AUXILIARY ALL WEATHER LAMPS (When Used)		
Sealed Beam Unit	GE-4421	
DIRECTIONAL SIGNAL LIGHTS		
Directional and Parking Lights	1157	32
Combination Directional, Parking and Side Marker Light	1156	32
Side Marker Light	1816	2
Double Faced Front Directional and Side Marker Light	1156	32
Side Marker Light	1895	2
Front Marker Lights	1155 1641	4
STOP, TAIL AND DIRECTIONAL LIGHT	1157	32
BACK-UP LIGHT	1156	32
LICENSE LIGHT	67	4
INSTRUMENT AND TELL-TALE LIGHTS	53 or 57	1 or 2
DOME LIGHT	211 1411	12 21
DIRECTIONAL SIGNAL TELL-TALE LIGHT		
Series RM-80	GM-667583	(Green)
HI-BEAM TELL-TALE LAMP		
Conventional Cab and Series 90 Tilt Cab Models	57	2
Series RM-80	53	1
Series 70-90 Tilt Cab Models	GM-667582	(Red)
DIFFERENTIAL LOCK TELL-TALE LIGHT		
Series 70-90 Tilt Cab Models	GM-667582	(Red)
TRANSMISSION TEMPERATURE TELL-TALE LIGHT		
Series 70-90 Tilt Cab Models	GM-667582	(Red)

SPECIFICATIONS

CHOKE RELAY (Series RM-80)	Delco-Remy
Make	1116876
Model	
Air Gap at Core, Points Closed (In.)	0.011 Min.
Point Opening (In.)	0.025
Closing Voltage	3.8-5.2
Opening Voltage	0.6 Min.
Sealing Voltage	0-0.2 Above Closing

SPECIFICATIONS (CONT.)

CIRCUIT BREAKER TABULATION

CIRCUIT BREAKERS

NOTE: A 25-Amp. Circuit Breaker is installed inside the main light switch on all models covered by this supplement.

CONVENTIONAL CAB MODELS		
CIRCUIT BREAKER	AMPERAGE	LOCATION
Headlamp Switch	25 Amp.	Inside Headlamp Switch
Two-speed Axle	20 Amp.	Inside Glove Box
Tail and Marker Lamp*	15 Amp.	Inside Glove Box
Stop Lamps*	15 Amp.	Inside Glove Box
Dome Lamp*	10 Amp.	Inside Glove Box
Back-up Lamps*	10 Amp.	Inside Glove Box
Acc. Post (Fuse Block)*	20 Amp.	Inside Glove Box
Directional Signal & Ignition*	20 Amp.	Inside Glove Box
Hazard Lamp*	20 Amp.	Inside Glove Box
Instrument Lamps*	10 Amp.	Inside Glove Box
A/C Motor Fan	30 Amp.	Inside Glove Box
***Series HC-JC-HH-JH-JB-MB-MC-90**		
SERIES **RM80**		
Headlamp Switch	25 Amp.	Inside Headlamp Switch
Instrument Lamps	8 Amp.	On Front Electrical Equipment Panel
Master	70 Amp.	On Rear Electrical Equipment Panel
Chock and Starter Relay Switch	30 Amp.	On Rear Electrical Equipment Panel
Stop and Tail Lamp	15 Amp.	On Front Electrical Equipment Panel
Ignition	15 Amp.	On Front Electrical Equipment Panel
Two-Speed Axle	15 Amp.	On Front Electrical Equipment Panel
SERIES 70-90 TILT CAB MODELS		
Headlamp Switch	25 Amp.	Inside Headlamp Switch
Two-Speed Axle	20 Amp.	At Cab Chassis Junction (located below left door step riser panel).
SERIES 90 TILT CAB MODELS		
Headlamp Switch	25 Amp.	Inside Headlamp Switch
Heater and Defroster	30 Amp.	Inside Console on C.B. Panel
Tail Lamps	15 Amp.	Inside Console on C.B. Panel
Stop Lamps	15 Amp.	Inside Console on C.B. Panel
Dome Lamps	5 Amp.	Inside Console on C.B. Panel
Tachographs	10 Amp.	Inside Console on C.B. Panel
Marker Lamps	20 Amp.	Inside Console on C.B. Panel
Turn Signal & Hazard Warning	20 Amp.	Inside Console on C.B. Panel
Instrument Lamps	5 Amp.	Inside Console on C.B. Panel
Indicator Lamps (Warning)	5 Amp.	Inside Console on C.B. Panel
Jacobs Engine Brake	8 Amp.	Inside Console on C.B. Panel
Power Window	30 Amp.	Inside Console on C.B. Panel
Master	70 Amp.	On Front of Console

SPECIFICATIONS (CONT.)

FUSE TABULATION

FUSES

FUSE	AMPERAGE	TYPE	LOCATION
CONVENTIONAL CAB MODELS			
Instrument Lights	5	3AG or AGC	In Glove Box in Fuse Block
Windshield Wiper	15	3AG or AGC	In Glove Box in Fuse Block
Stop Lamps	15	3AG or AGC	In Glove Box in Fuse Block
Heater	15	3AG or AGC	In Glove Box in Fuse Block
Dome Lamp	5	3AG or AGC	In Glove Box in Fuse Block
Tail and Marker Lamps	15	3AG or AGC	In Glove Box in Fuse Block
Directional & Hazard Warning	20	SAE	In Glove Box in Fuse Block
Engine Alarm & Gauges	20	SAE	In Glove Box in Fuse Block
Radio	3	3AG or AGC	In Glove Box in Fuse Block
Back-up Lamps	10	3AG or AGC	In Glove Box in Fuse Block
Trailer Marker	20	SAE	In Glove Box in Fuse Block
Ammeter (2)	4	SAE	In Fuse Holder in Engine Harness at Fire Wall
SERIES 70-90 TILT CAB MODELS			
Heater	15	3AG or AGC	In Fuse Block Inside Cab
Directional and Hazard Warning	20	SAE	In Fuse Block Inside Cab
Stop & Back-up Lamps	20	SAE or AGC	In Fuse Block Inside Cab
Dome & Tail Lamps	20	SAE or AGC	In Fuse Block Inside Cab
Instrument Lamps	3	3AG or AGC	In Fuse Block Inside Cab
Windshield Wiper	20	SAE	In Fuse Block Inside Cab
Gauges and Alarm	15	3AG or AGC	In Fuse Block Inside Cab
Radio	3	3AG or AGC	In Fuse Block Inside Cab
Trailer Marker	20	SAE	In Fuse Block Inside Cab
Ammeter (2)	4	SAE	In Fuse Holder at Island Leg
SERIES 90 TILT CAB MODELS			
Radio	3	3AG or AGC	In Fuse Holder Inside Console
Ammeter	30	AGC	In Fuse Holder at Engine Near Starter

FUSIBLE LINKS

Precise location of each fusible link used on vehicles covered by this supplement is shown in the tabulation on applicable wiring diagram in "Wiring Diagrams" in Manual Supplement ST-332-71.

SECTION 13

Radiator and Surge Tank

All information in RADIATOR AND SURGE TANK (SEC. 13) of the 1970 Heavy Duty Truck Service Manual ST135-70, pages 13-1 through 13-12 will apply to models covered by this supplement with the exception of the following:

RADIATOR STABILIZER RODS (ALL MODELS)

The stabilizer rod and components as shown on page 13-3 in Service Manual ST135-70 are common to all models except Models HC, JC, HH, JH-90 and FC, DC-90 with NTC 335 engine which are shown in figure 1. The insulators and attaching parts as shown in figure 1, are located at the lower (frame) end instead of at the upper (radiator) end.

ADJUSTMENT

When adjustment is required the stabilizer rod can be lengthened or shortened by moving adjusting nuts up or down, and then torque nuts to 15 to 20 foot-pounds.

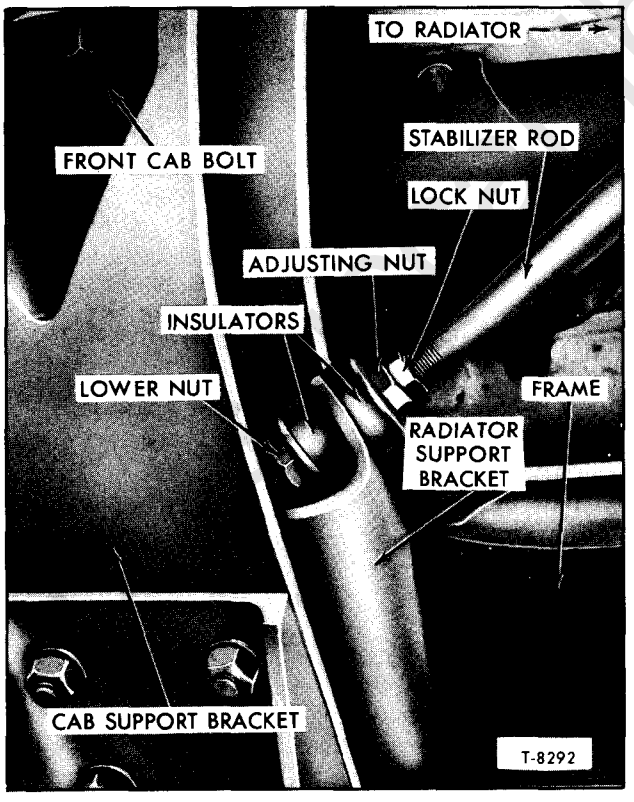


Figure 1—Stabilizer Rod (Models HC, JC, HH, and JH90; DC, FC90 with NTC 335 Engine)

When properly adjusted the top of radiator should tilt 2 to 4 degrees toward the rear. Be sure both rods are adjusted the same and there is adequate clearance between fan and radiator.

RADIATOR SHUTTERSTAT (MODELS HC, JC, HH, & JH90 FC & DC90 WITH NTC 335 ENGINE)

Shutterstat is mounted in radiator lower tank. For service information, refer to page 13-9 of Service Manual ST135-70 which will apply.

RADIATOR MOUNTING (MODELS JB, MB90 & DB, FB90)

The radiator on these models is trunnion mounted with a stabilizer rod provided at each side to adjust and maintain position of radiator as shown in figure 2.

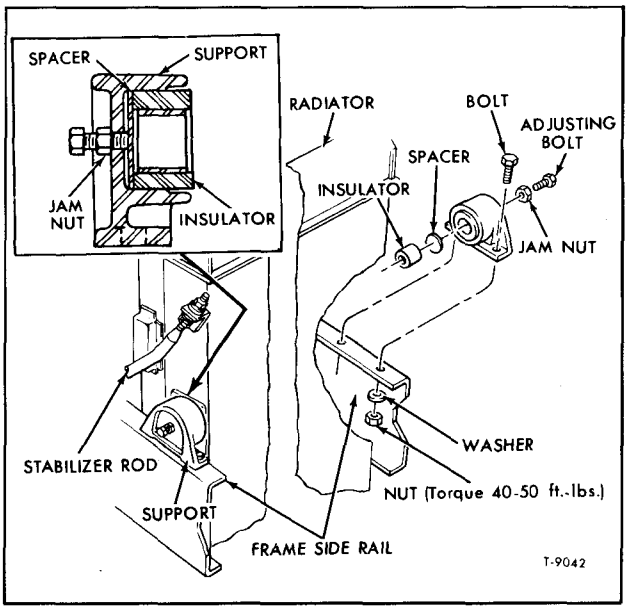


Figure 2—Radiator Mounting (Model JB, MB90; DB, FB90)

RADIATOR AND SURGE TANK

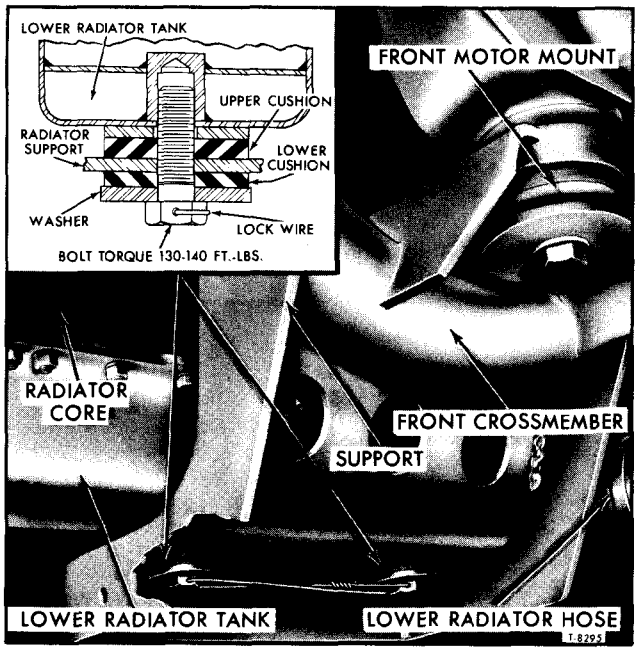


Figure 3—Radiator Mounting (Models HC, JC, HH, and JH90; DC, FC90 with NTC 335 Engine) (Typical)

RADIATOR MOUNTING (MODELS HC, JC, HH, & JH90 FC & DC90 WITH NTC 335 ENGINE)

Radiator lower mounting as shown in figure 3, is of the foot-mounted type.

RADIATOR CORE REPLACEMENT (CONVENTIONAL CAB MODELS HC, JC, HH, & JH90)

REMOVAL

1. Gain access to radiator core as follows:

a. Fiberglass Hood - Tilt the hood assembly forward.

b. Sheet Metal Hood - Remove the hood assembly as described in SHEET METAL AND FIBERGLASS (SEC. 11) of Service Manual ST135-70.

c. On models with shutters, close shut-off cock in air supply line at air tank and disconnect air line from shutterstat body.

2. Drain radiator. Disconnect lines and drain oil cooler. Disconnect all coolant holes and oil lines from radiator core assembly.

3. If vehicle is equipped with air conditioning or power steering, remove cooling coils from radiator. In addition, remove power steering reservoir and receiver-dehydrator if attached to radiator.

4. Remove fan shroud attaching bolts, then lay shroud back over fan blade.

5. Remove nut, washer, and bolt at upper end of each radiator stabilizer rod.

6. Remove lockwire, two bolts, washers, and cushions (fig. 3) from radiator support.

7. Attach a lifting sling or chain to each radiator upper mounting bracket.

8. With a chainfall (using sling) carefully lift radiator assembly from vehicle. Remove upper cushion (fig. 3).

INSTALLATION

1. Using a chainfall and sling (attached to radiator upper mounting brackets) carefully lift radiator assembly into position in vehicle.

NOTE: Be sure to install upper cushion on radiator support (fig. 3).

2. Install washers and cushions on two bolts (fig. 3). Install bolts through radiator support and upper cushion into lower radiator tank. Torque bolts to 130 to 140 foot-pounds. Install lockwire.

3. Install bolt, washer, and nut on each radiator stabilizer rod (fig. 1). Tighten nut on each rod to 50 to 60 foot-pounds torque.

4. Install fan shroud.

5. Install air conditioning and power steering cooling coils, power steering reservoir, and receiver-dehydrator (if removed).

6. Connect all coolant hoses and oil lines to radiator core assembly.

7. If equipped, connect air line to shutterstat and open shut-off cock in supply line at air tank.

8. Be sure hoses, lines, brackets, or fan shroud will not interfere with operation of fan.

9. Add coolant to radiator, start engine and allow it to warm up. Inspect system for leaks. Recheck radiator coolant level and add coolant if necessary.

10. On models equipped with sheet metal hood, install the hood assembly as described under SHEET METAL AND FIBERGLASS (SEC. 11) in Service Manual ST135-70.

RADIATOR CORE REPLACEMENT (FC & DC90 WITH NTC 335 ENGINE)

REMOVAL

1. Drain radiator.

2. Tilt cab to fully tilted position as described in "ALUMINUM TILT CABS" (SEC. 1D) in Service Manual ST135-70.

3. Disconnect all hoses from radiator, and remove coolant level indicator wire from radiator tank probe unit if so equipped.

4. On models with shutters, close shut-off cock in air supply line at air tank and disconnect air line from shutterstat body.

5. If vehicle is equipped with air conditioning or power steering, remove cooling coils from

radiator. In addition, remove power steering reservoir and receiver-dehydrator if attached to radiator.

NOTE: Move the condenser and receiver-dehydrator as a unit, away from radiator as far as possible and tie in that position to prevent interference with radiator during removal. This method avoids the necessity of disconnecting air conditioning lines, and evacuating the system upon assembly.

6. Remove nut, washer and bolt at upper end of each radiator stabilizer rod.

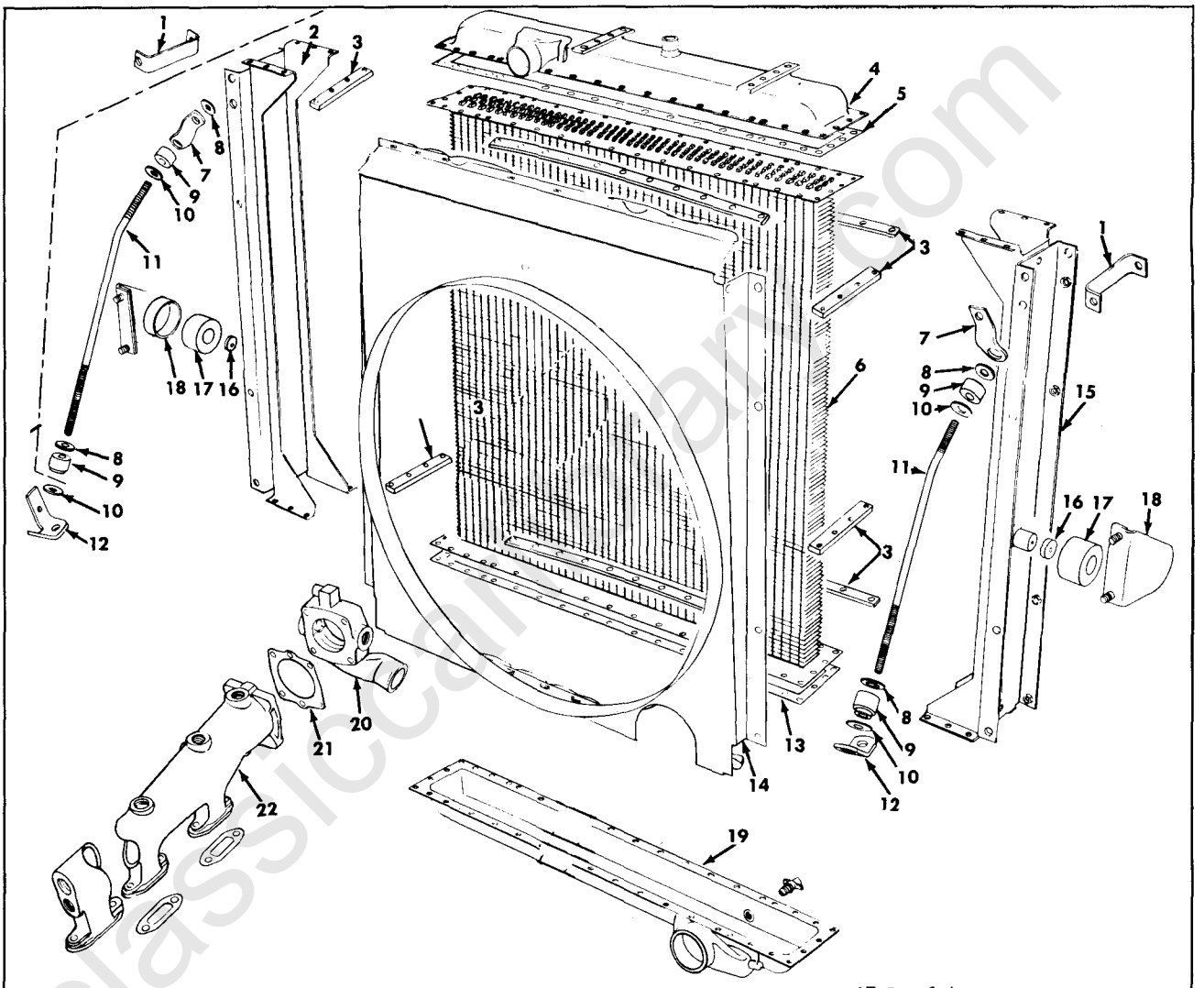
7. Remove lockwire, two bolts, washers, and cushions (fig. 3) from radiator support.

8. Attach a lifting sling or chain to each radiator upper mounting bracket.

9. Remove any other tubes, brackets, or lines that would interfere with vertical removal of radiator.

10. With a chainfall supporting radiator (using sling) raise core slightly.

NOTE: Radiator may not balance in an exact



1 Brace - Radiator Support
2 Radiator L.H. Side Assy.
3 Tapping Bar
4 Radiator Upper Tank
5 Gasket
6 Radiator Core
7 Tie Rod Anchor
8 Washer
9 Insulator
10 Washer
11 Tie Rod
12 Bracket
13 Gasket
14 Shroud
15 R.H. Side Assembly
16 Insert
17 Insulator
18 Tube - Radiator
19 Radiator Lower Tank
20 Thermostat Housing
21 Gasket
22 Engine Water Outlet Manifold

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Figure 4—Perfex Type Radiator (Typical)

RADIATOR AND SURGE TANK

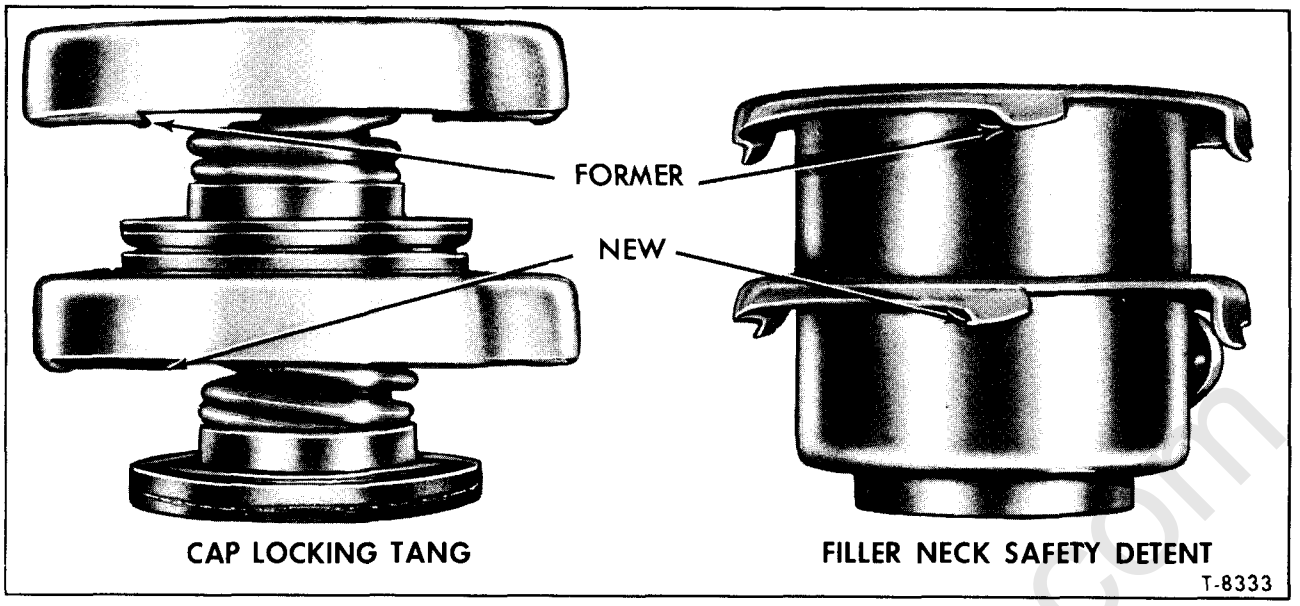


Figure 5—Radiator Caps and Filler Necks

perpendicular manner with the lift hooks installed in upper mounting brackets, and it may be necessary to guide radiator past bottom of fan by pressing lower part of radiator forward.

11. Carefully raise and remove radiator. Remove upper cushion.

INSTALLATION

1. Using a chainfall and sling (attached to radiator upper mounting brackets) carefully lift radiator assembly into position in vehicle.

NOTE: Install upper cushion on radiator support (fig. 3).

2. Install washers and cushions on two bolts (fig. 3) and install through radiator support and upper cushion into radiator lower tank, then torque bolts to 130 to 140 foot-pounds. Replace lockwire.

3. Install bolt, washer, and nut on each radiator stabilizer rod. Tighten nut on each rod 50 to 60 foot-pounds torque.

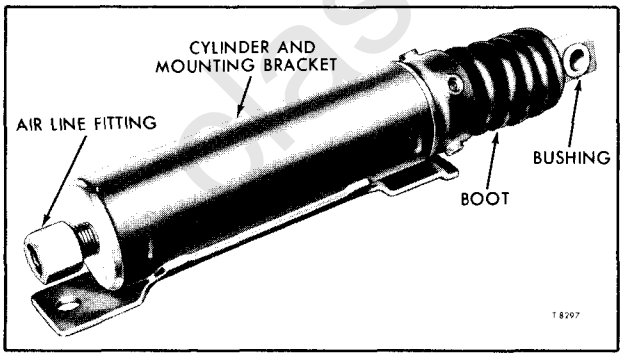


Figure 6—Radiator Shutter Air Cylinder

4. Assemble all hoses to radiator fittings, then tighten clamps cirmly. Install coolant low level indicator wire terminal, to probe on upper tank, if so equipped.

5. If equipped, connect air line to shutterstat then open shut-off cock in supply line at air tank.

6. Carefully install air conditioning and power steering cooling coils, power steering reservoir, and receiver-dehydrator (if removed).

7. Connect or install all other items that were removed or disconnected during radiator removal.

8. Be sure hoses, lines, brackets, or fan shroud will not interfere with operation of fan.

9. Add coolant to radiator, start engine and allow it to warm up. Inspect system for leaks. Recheck radiator coolant level and add coolant if necessary.

NOTE: Information applicable to radiator repair remains the same as covered under "Radiator Repair" in RADIATOR AND SURGE TANK (SEC. 13) in Service Manual ST135-70, except refer to figure 4 for typical Perfex radiator assembly.

RADIATOR CAPS AND FILLER NECKS

Changes were made in the radiator cap and mating radiator filler neck to make it more difficult to remove a radiator cap without first stopping in the safety position. These changes consist of flattening out the trailing edge of the cap locking tangs and removing the inside ramp on the safety detent on the filler neck (refer to fig. 5). The cap and filler neck meet at right angles in the safety position and the cap cannot be turned beyond this point without pressing down on the cap.

IMPORTANT

The cooling system should be checked when it is cool, but if the cap must be removed when the engine is at normal or above temperature, a cloth should be placed over the cap. The cap should then be rotated counterclockwise without pressing downward until the relief position is reached. The pressure must be allowed to escape completely. This may take some time for a large engine. The cap should then be depressed and rotated again counterclockwise to the removal position.

RADIATOR SHUTTER AIR CYLINDER

Vehicles equipped with radiator shutters, use an air cylinder of type shown in figure 6. The cylinder is designed with built-in over-travel features and does not require periodic adjustment or maintenance.

For all other information on shutters and controls, refer to RADIATOR AND SURGE TANK (SEC. 13) page 13-7 of Service Manual ST135-70.

COOLING SYSTEM NOTES AND PRECAUTIONS

1. Overheating is not always caused by a defective cooling system; incorrect ignition timing, dragging brakes, under-inflated tires, and improper use of transmission gears can cause overheating.

2. Keep water pump and fan drive belts at proper tension. Refer to ENGINE COOLING SYSTEM (SEC. 6K).

3. Do not over-fill cooling system. Expansion of coolant when hot will cause loss of coolant through overflow tube.

4. Do not remove radiator filler cap when engine is hot. Wait until system cools off.

5. Do not pour cold water into cooling system when the engine is hot. Wait until system cools off.

6. If cooling system requires frequent refilling, check for leaks.

7. Keep all connections tight, and make sure gasket on radiator filler cap is in good condition.

8. When filling system with anti-freeze solution ALWAYS FOLLOW RECOMMENDATIONS of anti-freeze manufacturer.

9. Use only Ethylene Glycol base coolant meeting GM Specification 1899-M. DO NOT use Glycol Ether (Methoxy Propanol Type) in Toro-Flow II Engines.

10. Drain and flush cooling system every other year, preferably at the beginning or end of winter operation.

Refer to next page for "Specifications."

RADIATOR AND SURGE TANK

SPECIFICATIONS

RADIATOR AND SURGE TANK PRESSURE CAPS

COMBINATION FILLER AND PRESSURE CAP	
Stamped	RC-12-9
Opening Pressure	9 PSI.
FILLER CAP (RM-80 AND DP-90)	
Stamped	RC-25-13
Opening Pressure	13 PSI.
RADIATOR FILLER CAP (DP-90)	
Stamped	RC-1-7
Opening Pressure	7 PSI.
FILLER CAP (HM-80)	
Stamped	RC-10

Special Tools

References are made to special tools in the various sections of this supplement. These tools, or their equivalent are necessary and are recommended to readily and efficiently accomplish certain service operations. The tools, however, are not supplied by Chevrolet Division. Information regarding availability of these tools can be obtained from the Zone Office or from the Product and Safety Activities Department of Central Office.

SECTION 4B – REAR SUSPENSION

Tool No.	Tool Name
J-2619	Slide Hammer Adapter

SECTION 5B – AIR BRAKES

N.A.	Nylon Tubing Fitting Installer Kit (Includes various size mandrels)

SECTION 6A – GASOLINE ENGINES

A.C. Type CT-3	P.C.V. Tester

SECTION 6C – SERIES 53 & 71 DIESEL ENGINES

J-1242	Timing Gauge (1.484")
J-1853	Timing Gauge (1.460")
J-5956	Hand Primer
J-7455	Valve Spring Remover
J-9531-01	Diesel Test Kits (Hand Tachometer)
J-9665	Guide Studs
J-22506	Diesel Test Kits (Electric Tachometer)

SECTION 6M – GASOLINE ENGINE FUEL SYSTEM

J-4395	Float Lever Bending Tool
J-8824	Carburetor Float Gauge

SECTION 6Y – ENGINE ELECTRICAL

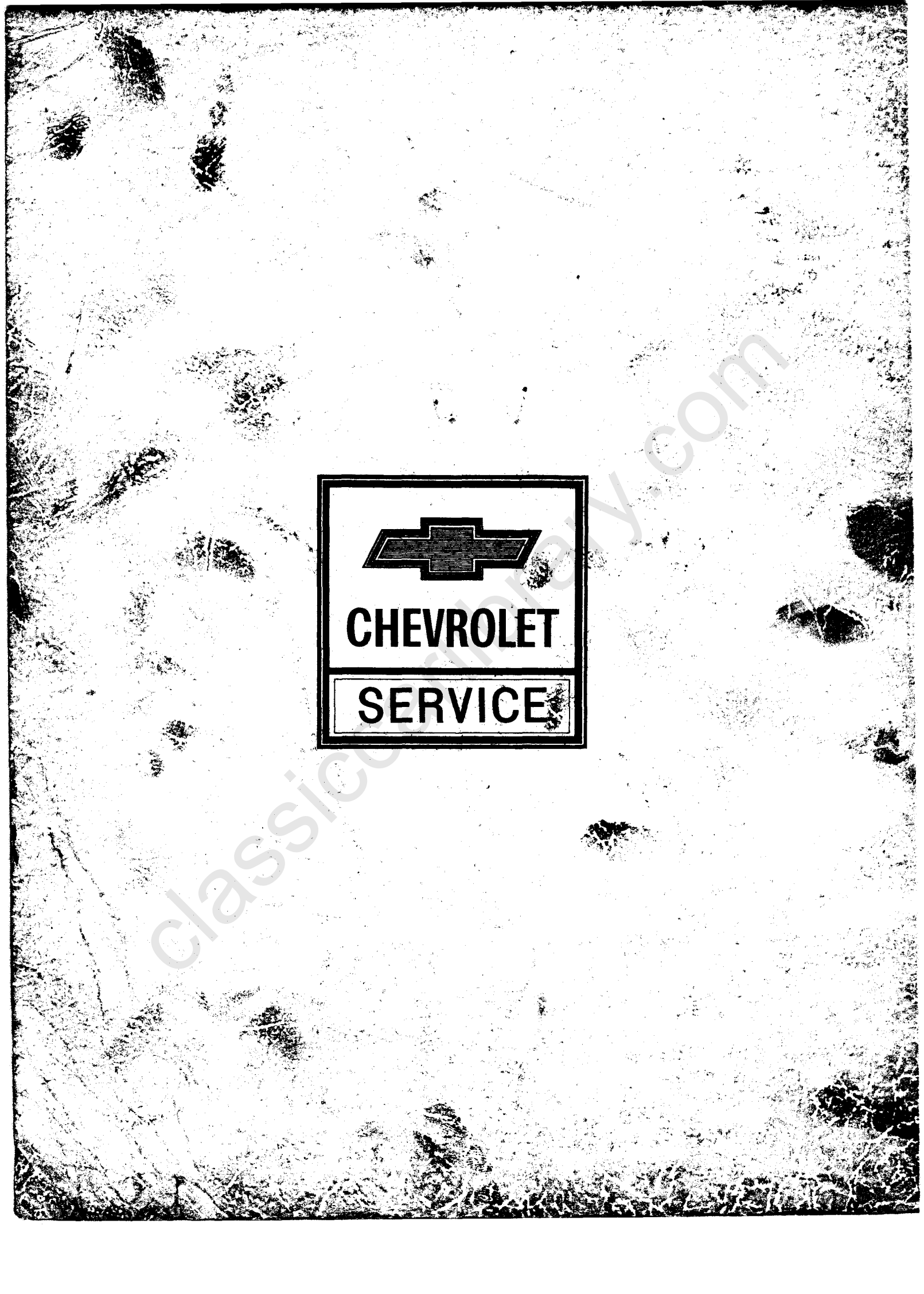
J-9782-1	Jumper Lead
J-21600	Adapter
J-23586	Belt Tension Gauge (Poly-V)
J-23600	Belt Tension Gauge

SECTION 7 – TRANSMISSIONS AND CLUTCHES

J-23739	Automatic Transmission TV Linkage Adjustment Gauge

SECTION 9B – POWER STEERING

J-23586	Belt Tension Gauge (Poly-V)
Burroughs BT-33-73-F	V-Belt Tension Gauge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