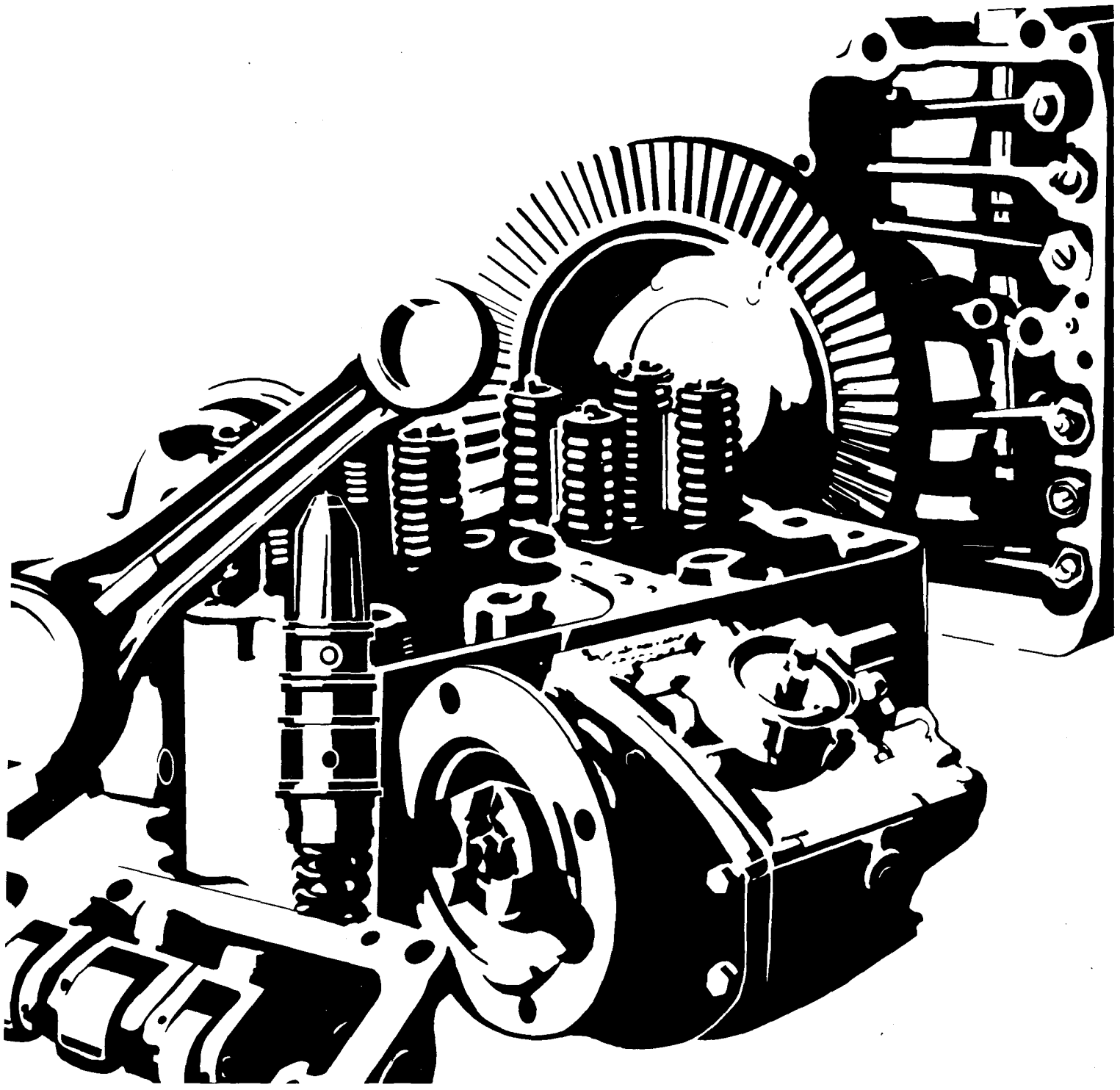
Cummins

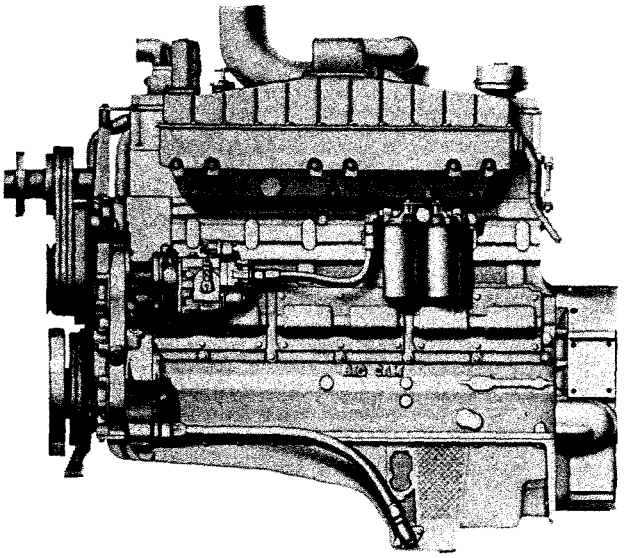
Parts Catalog

NH-855 Series

Automotive, Construction, Industrial Applications



Cummins Diesel NTA-855-C/L (Big Cam)



Specifications

	Metric
Power Rating . . . . . 360 bhp	269 kW
Rated Speed . . . . . 2100 rpm	2100 rpm
Peak Torque (1500 RPM) . 1080 lb.-ft.	1 464 N•m
Nominal Torque Rise 20%	20%
Power Rating . . . . . 400 bhp	298 kW
Rated Speed . . . . . 2100 rpm	2100 rpm
Peak Torque (1500 RPM) . 1150 lb.-ft.	1 559 N•m
Nominal Torque Rise 15%	15%
Number of Cylinders 6	6
Bore and Stroke . . . . . 5½ × 6 in.	140 × 152 mm
Piston Displacement . . . . 855 cu. in.	14 L
Operating Cycles 4	4
†Oil System Cap. . . . . 7.6 U.S. gals.	28.8 L
Coolant Capacity . . . . . 5.5 U.S. gals.	21 L
Net Weight with Std. Accessories, Dry . . . . . 2870 lbs.	1 305 kg

†By-pass filter is not included in total.

Design Features

Aftercooler: Large capacity aftercooler results in cooler, denser intake air for more efficient combustion and reduced internal stresses for longer life. Aftercooler is located in engine coolant system, eliminating need for special plumbing.

Bearings: Replaceable, precision type, steel backed inserts. Seven main bearings, 4.5 in. (114 mm) diameter. Connecting rod bearings 3.125 in. (79 mm) diameter.

Camshaft: Single large diameter camshaft precisely controls valve and injector timing. Lobes are induction hardened for long life. Seven replaceable precision type bushings 2.5 in. (64 mm) diameter.

Camshaft Followers: Induction hardened, roller type for long cam and follower life.

Connecting Rods: Drop forged, I-beam section 12 in. (305 mm) center to center length. Rifle drilled for pressure lubrication of piston pin. Rod is tapered on piston pin end to reduce unit pressures.

Cooling System: Belt driven centrifugal water pump. Large volume water passages provide even flow of coolant around cylinder liners, valves, and injectors. Modulating by-pass thermostat regulates coolant temperature. Spin-on corrosion resistor checks rust and corrosion, controls acidity, and removes impurities.

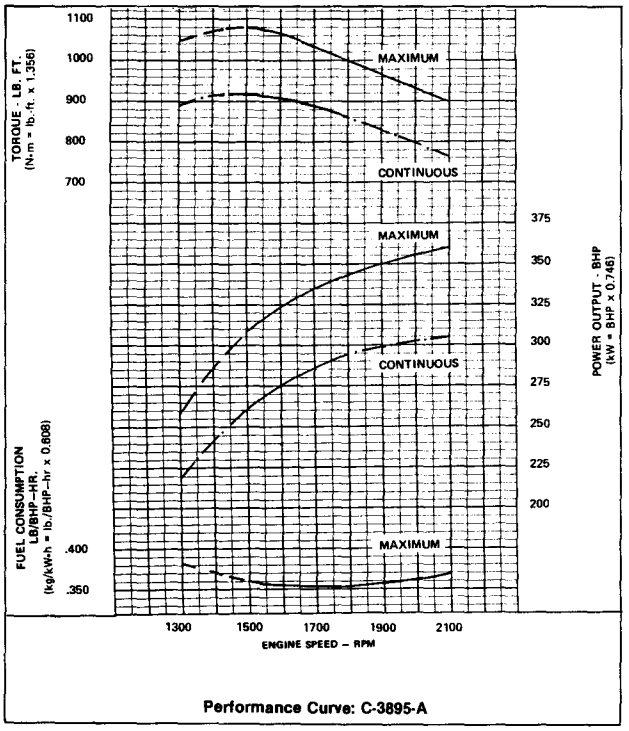
Crankshaft: Fully counterweighted high tensile strength steel forging with induction hardened fillets and journals.

Cylinder Block: Alloy cast iron with removable wet liners.

Cylinder Heads: Alloy cast iron. Each head serves two cylinders. Drilled fuel supply and return lines. Valve seats are replaceable corrosion resistant inserts. Valve guides and cross head guides are replaceable inserts.

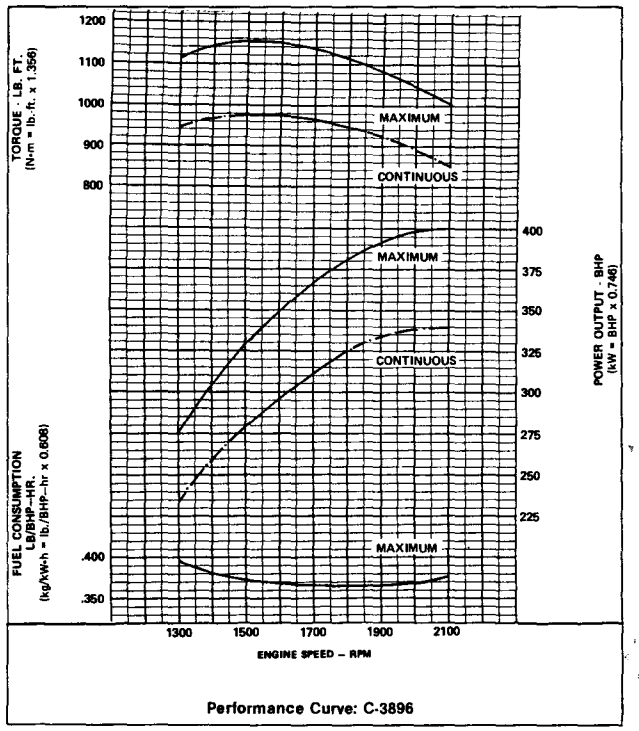
Design Features continued on back page.

NTA-855-C/L **360 H.P.**



Performance Curve: C-3895-A

NTA-855-C/L **400 H.P.**



Performance Curve: C-3896

Design Features Continued

Cylinder Liners: Replaceable wet liners dissipate heat faster than dry liners and are easily replaced without reboring the block.

Fuel System: Cummins exclusive low pressure PT™ system with wear compensating pump and integral dual flyweight governor. Camshaft actuated fuel injectors give accurate metering and timing. Fuel lines are internal drilled passages in cylinder heads. Spin-on fuel filters.

Gear Train: Timing gears and accessory drive gears are induction hardened helical gears driven from crankshaft and located at front of block.

Lubrication: Large capacity gear pump provides pressure lubrication to all bearings and oil supply for piston cooling. All pressure lines are internal drilled passages in block and heads. Oil cooler, full-flow filters, and by-pass filters maintain oil condition and maximize oil and engine life.

Pistons: Aluminum alloy, cam ground and barrel shaped to compensate for thermal expansion assures precise fit at operating temperatures. CeCorr™ grooved skirt finish provides superior lubrication. Oil cooled for rapid heat dissipation. Three compression and one oil ring.

Piston Pins: Full floating, tubular steel retained by snap rings. 2 in. (51 mm) diameter.

Turbocharger: Cummins exhaust gas driven turbocharger mounted at side of engine. Turbocharging provides more combustion air for power, improved fuel economy, altitude compensation, and lower smoke and noise levels.

Valves: Dual 1.875 in. (48 mm) diameter poppet type intake and exhaust valves. Wear resistant face on exhaust valves.

Performance

Horsepower, torque, and fuel consumption curves represent performance at S.A.E. standard J816b conditions of 500 ft. (150 m) altitude (29.00 inches [736 mm] Hg Dry Barometer), 85°F. (29°C.) intake air temperature and 0.38 in. (9.6 mm) Hg water vapor pressure.

Curves represent performance of the engine with water pump, lubricating oil pump, fuel system, muffler, and air cleaner; not included are alternator, fan, compressor, and optional equipment. Curves represent performance with No. 2 diesel or a fuel corresponding to ASTM D2.

The 360 hp engine may be operated at altitudes up to 12,000 feet (3 600 meters) and the 400 hp engine may be operated at altitudes up to 10,000 feet (3 000 meters) without changing the fuel setting.

Rating Guidelines

Maximum Rating may be used for intermittent load applications (full throttle operation is cyclically interrupted) where the average load factor does not exceed the continuous rating, and where full throttle operation does not exceed 60 minutes without interruption. This rating conforms with BS 649: 1958 and DIN "B" 6270, and BS 2953: 1958 intermittent traction rating.

Continuous Rating may be used for constant load applications requiring uninterrupted service at full throttle for extended periods of time and conforms with BS 649: 1958 and DIN "A" 6270, and BS 2953: 1958, and U.I.C. 623-1 O.R. continuous traction rating.

Cummins has always been a pioneer in product improvement. Thus specifications may change without notice. Illustrations may include optional equipment.

Cummins Engine Company, Inc., Columbus, Indiana 47201

Bulletin 3380316 (BC) Litho in USA 10-80

Available Equipment

Air Cleaner: Two stage, dry type.

Air Compressors: Coupling driven Cummins (single or dual cylinder) and Bendix-Westinghouse (dual cylinder) compressor.

Electrical Equipment: Various 12 and 24 volt negative ground alternators with outputs ranging from 30 to 130 amperes.

Engine Mounting: Pad type or trunnion type front support.

Exhaust Outlet Connections: 5 in. (127 mm) diameter, straight or 90°.

Fan Drives: Belt driven hubs with fan centers from 15¼ in. (387 mm) to 24½ in. (623 mm) and drive ratios of .75:1, .86:1, and 1:1.

Fans: 28 in. (711 mm) to 40 in. (1 016 mm) diameter.

Filters: Fleetguard. Lubricating oil: spin-on full flow type, mounted, and by-pass type, not mounted. Fuel: dual spin-on paper element type, mounted.

Flywheel Housings: Cast iron SAE No. 1 for wet or dry applications.

Flywheels: To fit various clutches, torque converters and transmissions.

Governors: Limiting speed governor, variable speed governor, and torque converter governor.

Hydraulic Pump Drives: SAE A flange on rear of lube pump at 1.5:1 drive ratio and SAE B flange on front of gear cover at 1.33:1 drive ratio.

Lubricating Oil Cooler: Shell and tube type with optional series flow torque converter oil cooler.

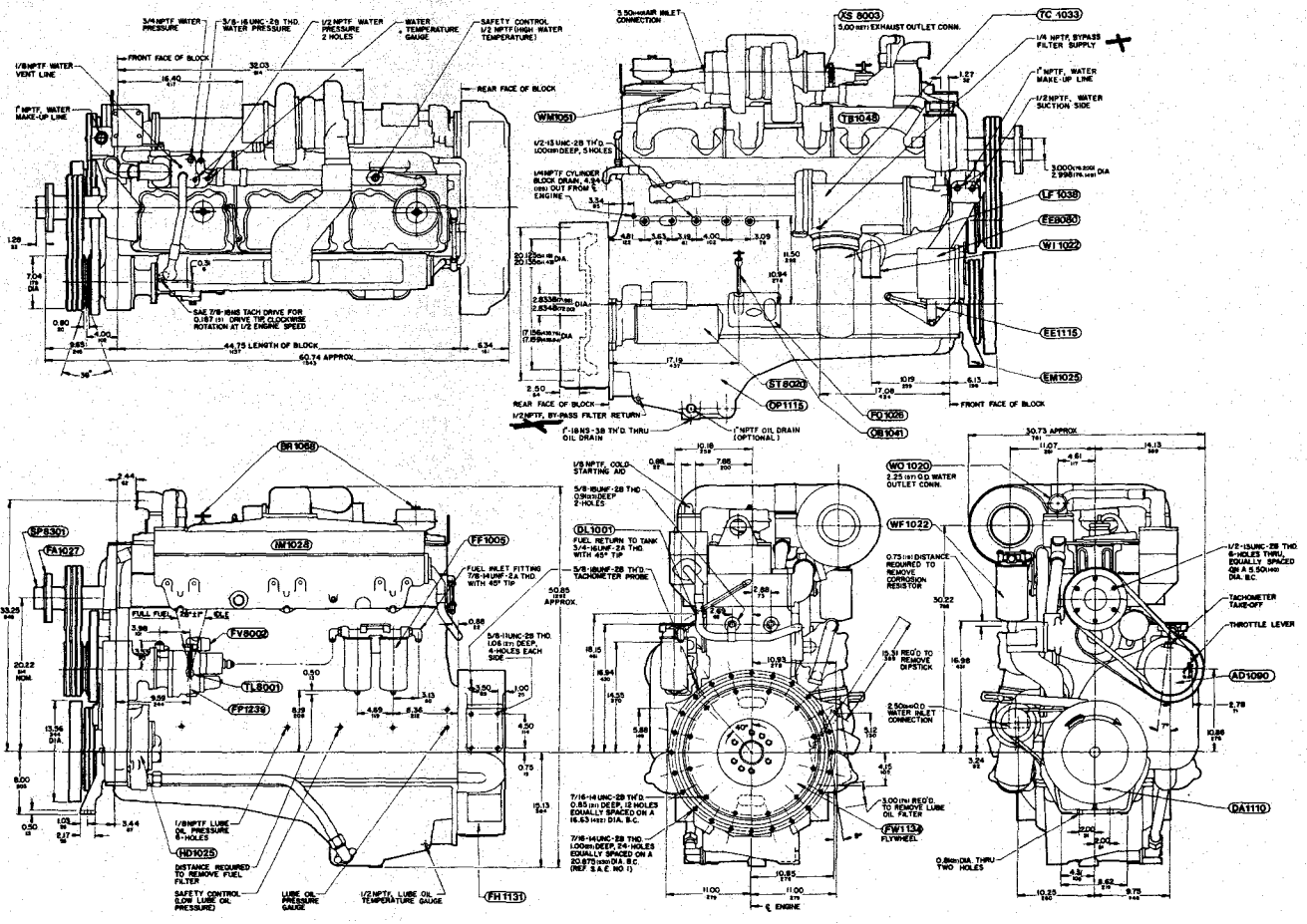
Oil Pan: Center, front, and rear sump types with angularity capability ranging from 20° up to 45°.

Starters: 12 or 24 volt positive engagement starting motor or air starter.

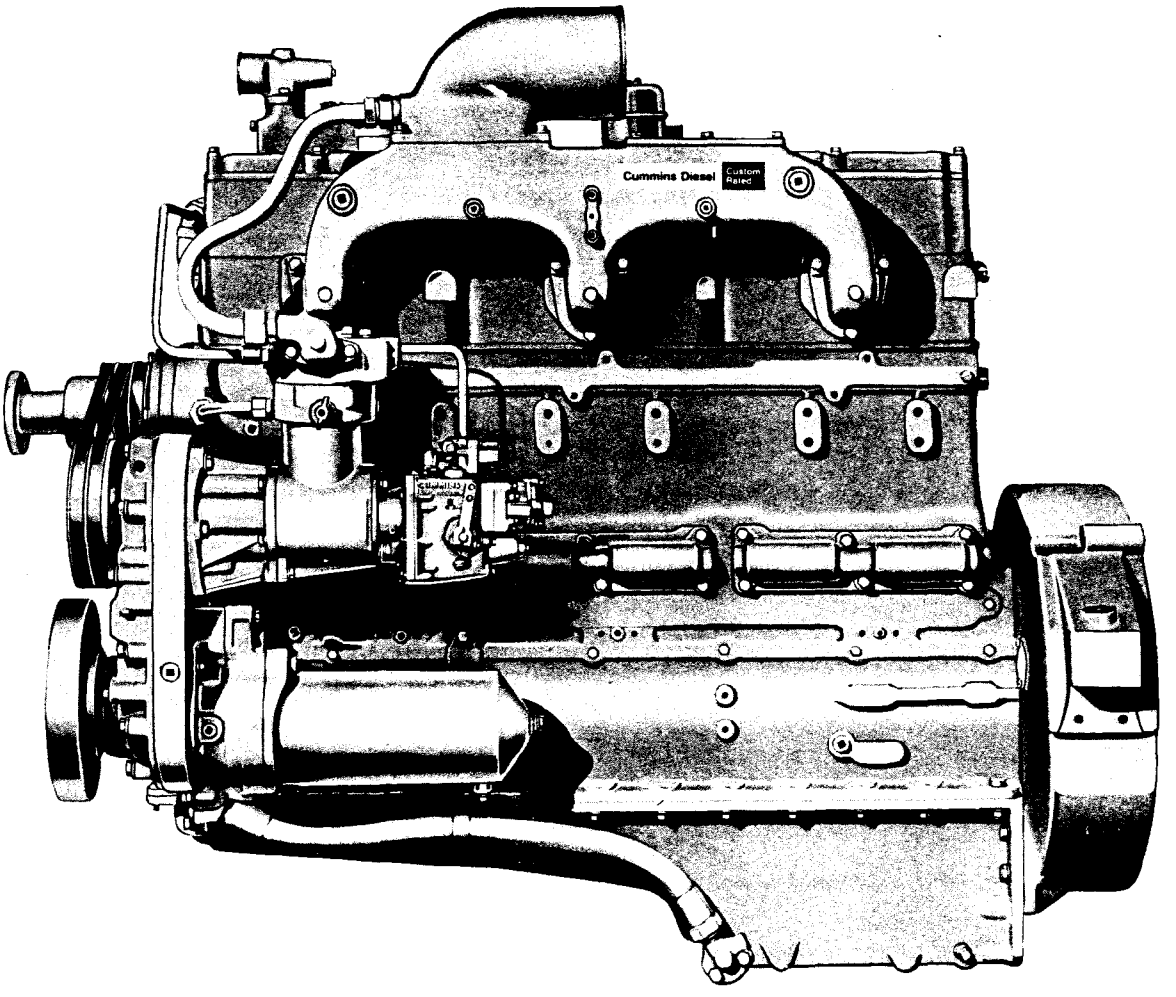
Starting Aids: Metered starting fluid, injection type; immersion type oil heaters; external type coolant heaters.

Thermostats: Modulating by-pass type.

Turbochargers: Front and rear exhaust.



NTA-855-C/L Big Cam Engine Installation Diagram 3022169



Parts Ordering for: NH 5 1/2" Bore, 855 Series

Genuine Cummins Parts and service facilities are worldwide. There are more than 3700 Cummins Sales and Service locations in the principal cities of the United States and Canada, and more than 800 Sales and Service locations situated elsewhere throughout the free world. Each distribution outlet is thoroughly equipped with technical data, factory-trained mechanics, modern equipment and a full, adequate stock of Genuine Cummins Parts.

For quicker and better service, your parts requirements should be ordered from your nearest Cummins Distributor or Dealer. At any of the locations prompt, intelligent, courteous service is a basic trademark. Each is ready and eager to help in every possible way through personal contact or through the mail - at your convenience.

The satisfactory ordering and receiving of parts by the purchaser is greatly dependent upon the proper use of available information. In order that all avoidable errors may be eliminated, the following instructions are offered as the purchaser's guide:

Write your order clearly, using a typewriter if possible.

Be sure to list the correct part number. If in doubt as to the correct part number, state the model and serial number of the engine on which the part is to be used. Part numbers are usually located in various places on the part itself.

When possible, arrange your purchase order in part number numerical sequence.

Always specify shipping instructions - "Best Way" is satisfactory if you have no preference.

State your company name and shipping address clearly.

Genuine Cummins Parts mean QUALITY! They're designed and engineered to fit best in your Cummins Diesel. Each part is made of the highest quality material - on the most accurate of machines - by the top craftsmen of the trade.

You can be sure a Genuine Cummins Part will fit better - do the job better - lessen the chances of costly breakdown. When you buy replacement parts, buy quality. Buy Genuine Cummins Parts!

YOU OWN THE BEST...REPAIR WITH THE BEST

This Parts Catalog contains standard parts information for the following NH-5 1/2" bore, "Naturally Aspirated", 855 series engines:

AUTOMOTIVE	CONSTRUCTION	INDUSTRIAL	LOCOMOTIVE
NH-230	N-855-C220	N-855-P190	N-855-L3 (235)
NHC-250	N-855-C235	N-855-P220	
		N-855-P235	
		N-855-P250	

Part numbers appearing in ( ) are for identification purposes only and should not be used when ordering service replacement parts.

The form below is provided for your convenience and when properly filled out, will allow proper identification of your unit and the normal maintenance items. Parts information errors that could cause extended down time may be avoided if the information on this form is referred to when ordering parts from your Cummins Distributor or Dealer.

ALWAYS SPECIFY ENGINE MODEL AND SERIAL NUMBER WHEN ORDERING PARTS FROM THIS CATALOG

Engine Model _____ Engine Serial No. _____

MFG Make _____ Model _____ Chassis No. _____

Fuel Pump Assembly No. _____ Injector No. _____

Belt, Fan _____ Belt, Water Pump _____ Belt, Gen. _____

Element, Fuel Filter _____ Full Flow Lub. Filter _____

Air Cleaner _____ By-Pass Lub. Filter _____

Special Equipment

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Cummins Distributor _____

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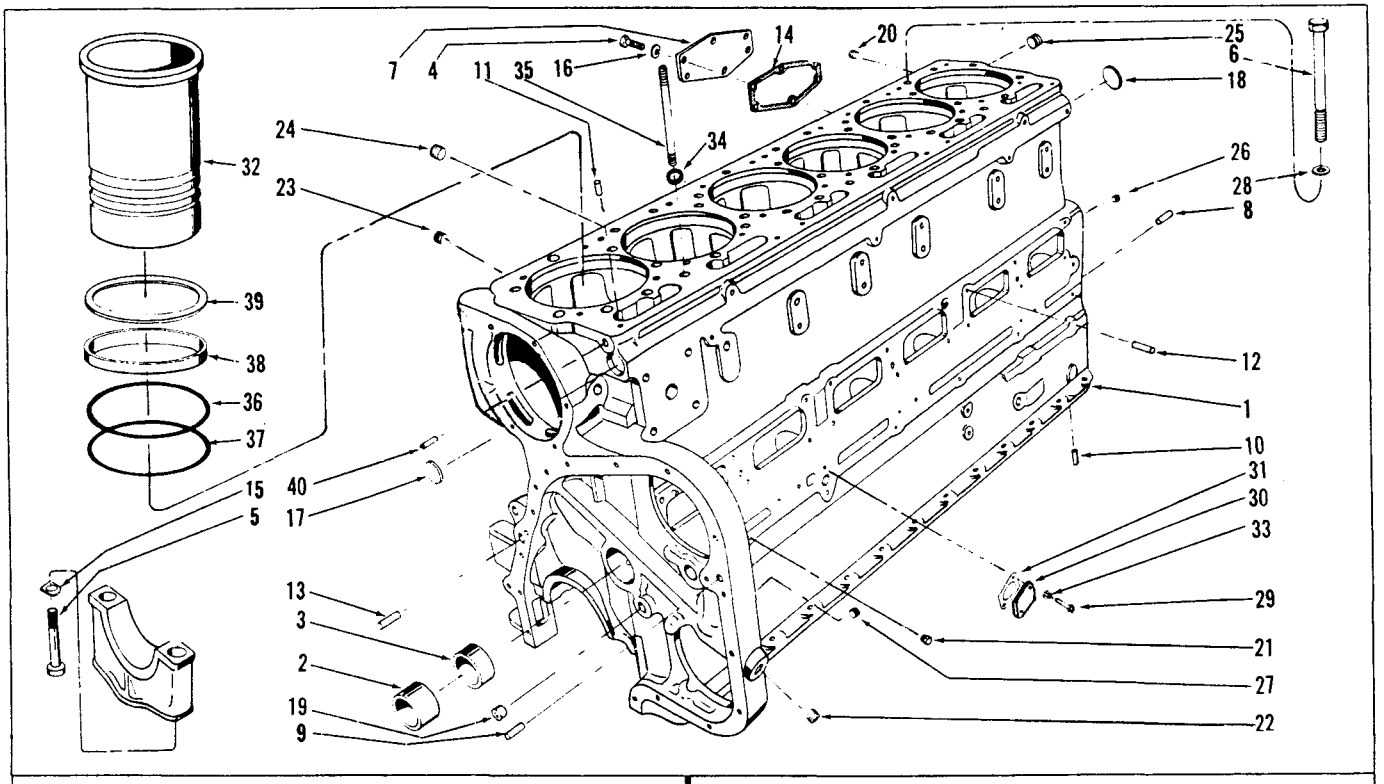
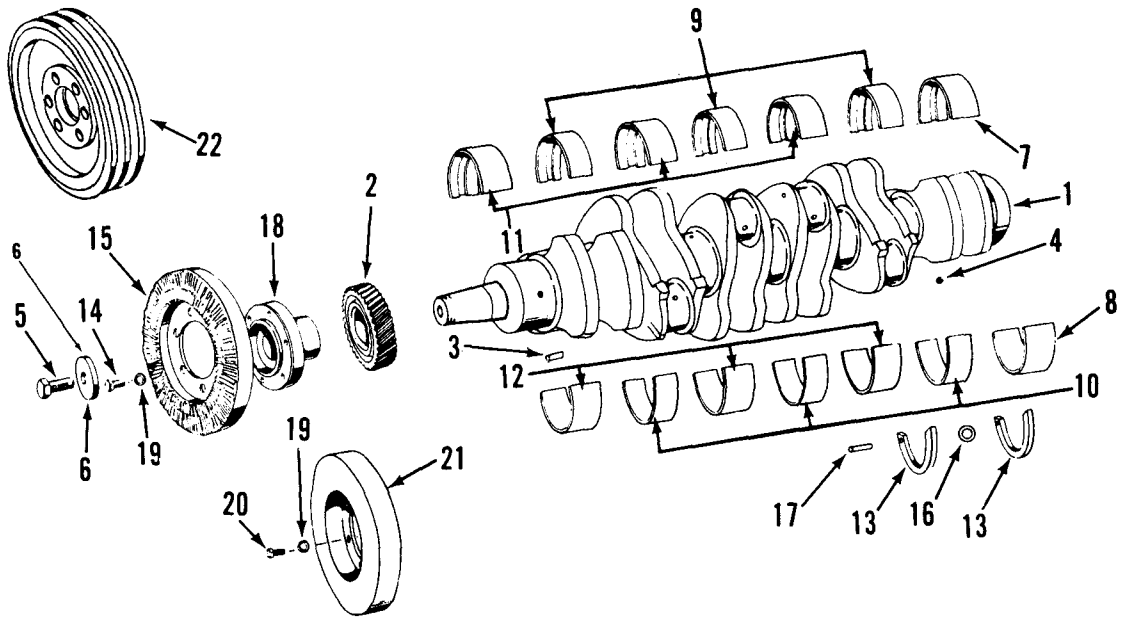
NOTES



REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		CYLINDER BLOCK	
		All models except: N-855-C220, N-855-C235, N-855-P235, N-855-L3	
1	AR-09883	Cylinder block assembly (3007930)	1
	BM-27253	Bushing assembly, camshaft	1
2	100670	Bushing, camshaft	1
3	157870	Bushing, camshaft	6
4	S-118-A	Capscrew (1/4" - 20 x 5/8")	12
5	105953	Capscrew (1" - 14 x 6 3/4")	14
6	209700	Capscrew, cylinder head	36
7	132019	Cover, water header	2
8	9226	Dowel, flywheel housing to block	2
9	60408	Dowel, gear cover	1
10	67211	Dowel, rear main bearing	2
11	68445	Dowel, cylinder head to block	6
12	68585	Dowel, cam follower housing	6
13	70653	Dowel, gear cover	1
14	70089-1	Gasket, water header cover	2
15	3009213	Lockplate	14
16	S-600	Lockwasher	12
17	S-716	Plug, expansion	1
18	S-719	Plug, expansion	1
	210884	Plug, hex socket	1
19	3008467	Plug, pipe (3/8")	6
20	3008466	Plug, pipe (1/4")	2
21	S-911-B	Plug, pipe (1/8")	1
22	3008468	Plug, pipe (1/2")	4
23	S-962	Plug, pipe (1")	2
	S-901	Plug, pipe (1/4")	1
24	3008469	Plug, pipe (3/4")	1
25	S-966-E	Plug, pipe (1")	1
26	69901	Plug, pipe (1/8")	6
27	199067	Plug, pipe	1
28	69699	Washer, cylinder head	36
	66292	Washer, copper	1
	S-679	Washer, copper (25/64")	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		N-855-C220, N-855-C235, N-855-P235, N-855-L3	
		Same as above except	
	OMIT		
	AR-09883	Cylinder block assembly (3007930)	
	ADD		
	3010082	Cylinder block assembly (3007937)	
		MOUNTING PARTS	
	S-190-C	Capscrew (3/8" - 24 x 5/8")	1
29	S-129	Capscrew (3/8" - 24 x 1")	2
30	132648	Flange, lubricating oil suction	1
31	67963	Gasket, suction flange	1
32	213740	Liner, cylinder	6
33	S-604	Lockwasher (3/8")	2
34	156545	O-ring, lubricating oil pipe	3
40	43468-E	Pin, groove	1
35	133029	Pipe, lubricating oil	3
36	215091	Ring, packing	6
37	183049	Ring, packing (SILICONE)	6
38	215090	Seal, crevice	6
	S-2286	Screw, nameplate	5
39	143938	Shim, liner (.007")	A/R
39	143939	Shim, liner (.008")	A/R
39	143946	Shim, liner (.009")	A/R
39	143947	Shim, liner (.020")	A/R
39	143948	Shim, liner (.031")	A/R
39	143949	Shim, liner (.062")	A/R
		N-855-P190, N-855-P220, N-855-P250	
		Same as above except:	
	OMIT		
7	132019	Cover	1
	ADD		
	3003094	Cover	1
	S-114	Screw, hex	6
	S-600	Lockwasher	6

PARTS INDENTED ARE INCLUDED IN THE PART UNDER WHICH THEY ARE INDENTED



REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		CRANKSHAFT	
		All models except: N-855-C220, N-855-C235, N-855-P235, N-855-L3	
	AR-08637	Crankshaft assembly	1
1	208460	Crankshaft	1
2	142804	Gear, crankshaft	1
3	9300-1	Key, gear	1
4	S-911-B	Plug, pipe	6
5	140410	Capscrew, self-locking	1
6	140411	Retainer, hub	1
		N-855-C220, N-855-C235, N-855-P235, N-855-L3 Same as above except	
	OMIT		
	AR-08637	Crankshaft assembly	1
	208460	Crankshaft	1
	142804	Gear, crankshaft	1
	9300-1	Key, gear	1
	ADD		
	3004165	Crankshaft assembly	1
	3000140	Crankshaft	1
	215965	Gear, crankshaft	1
	210179	Key, gear	1
		MAIN BEARINGS	
		All Models	
	AR-07110*	Set, main bearing shell	1
7	44387	Shell, main bearing (No. 7 upper)	1
8	44388	Shell, main bearing (No. 7 lower)	1
9	44385	Shell, main bearing (No. 2, 4 and 6 upper)	3
10	44386	Shell, main bearing (No. 2, 4 and 6 lower)	3
11	44383	Shell, main bearing (No. 1, 3 and 5 upper)	3
12	44384	Shell, main bearing (No. 1, 3 and 5 lower)	3
13	157280	Ring, thrust	4
16	60575	Dowel, ring	7
17	67294	Dowel, thrust ring	2
	9427	Lockplate	
		*Main bearings may be purchased in .010", .020", .030" or .040" undersize.	
		VIBRATION DAMPER NH-230, NHC-250	
14	69952	Capscrew	6
15	BM-71196	Damper, vibration	1
18	204836	Flange, crankshaft	1
19	S-608	Lockwasher (1/2")	6
22	214236	Pulley, crankshaft	1
		N-855-C220, N-855-C235, N-855-L3	
	AR10319	Damper, vibration	1
	211918	Pulley, crankshaft	1
	204165	Screw	6
	127316	Washer	6
		N-855-P190, N-855-P220, N-855-P250	
	20633-1	Damper, vibration	1
	204836	Flange, crankshaft	1
	S-112-A	Screw, hex	6
	S-608	Washer, lock	6
		N-855-P235	
	211914	Damper, vibration	1
	211918	Pulley, crankshaft	1
	204165	Screw, hex	6
	127316	Washer	6

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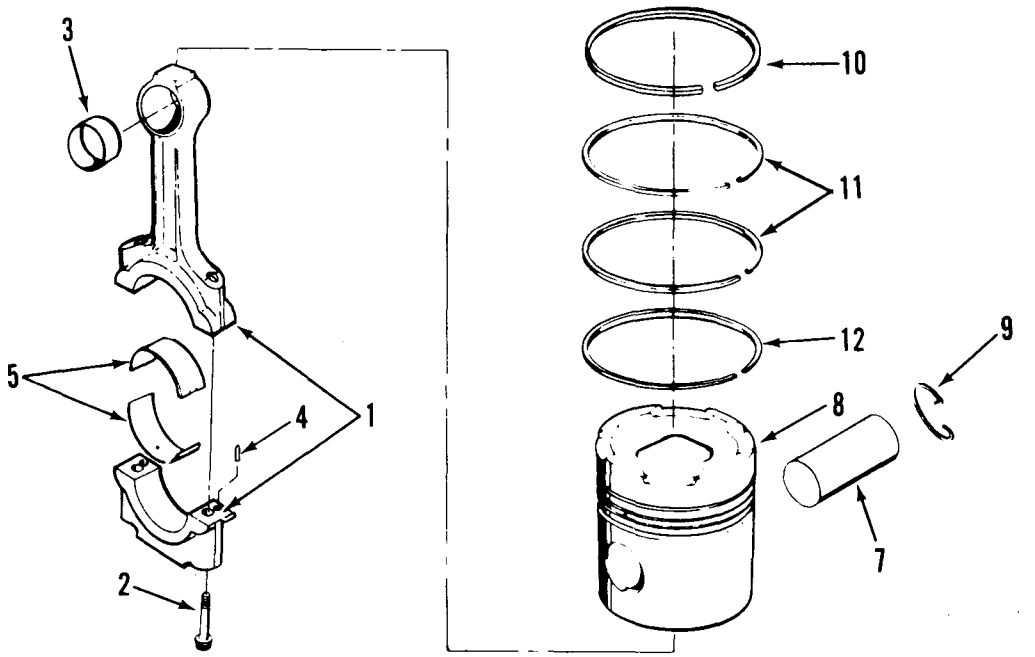

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		CONNECTING ROD	
		All Models	
1	3013930	Connecting rod assembly (218808)	6
2	219153	Bolt, connecting rod	12
3	187420	Bushing, piston pin	6
4	70550	Dowel	12
5	214950*	Shell, connecting rod bearing	12
		*Connecting rod bearing shells may be purchased in .010", .020", .030" and .040" undersize.	
		PISTON	
		All Models	
	AR-06000	Piston assembly	6
7	191970	Pin, piston	6
8	198660	Piston	6
9	61908	Ring, snap	12
		PISTON RINGS	
		All Models	
	AR-06680	Ring set, piston (Std)	6
10	147670	Ring, compression	6
11	132880	Ring, compression	12
12	218732	Ring, oil	6

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		CYLINDER LINER KIT	
		All Models	
	AR-11317	Cylinder kit	1
	213740	Liner, cylinder	1
	215090	Seal, crevice	1
	3008998	Packing, liner	1
	183049	Packing, liner	1
	AR-06000	Piston, assembly	1
	198660	Piston	1
	191970	Pin, piston	1
	61908	Ring, snap	2
	AR-06680	Ring, set	1
	147670	Ring, compression	1
	132880	Ring, compression	2
	218732	Ring, oil	1

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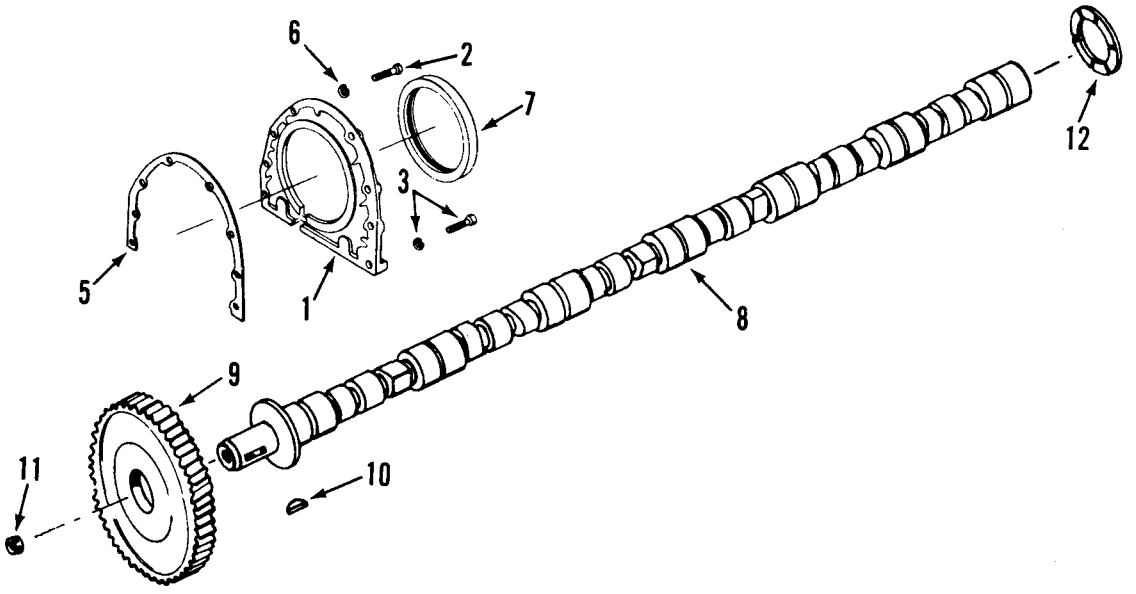

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		REAR COVER	
		All Models	
1	209919	Cover, rear	1
2	S-120-A	Capscrew (3/8" - 24 x 7/8")	6
3	3010594	Capscrew and lockwasher assembly	2
5	40662-A	Gasket	A/R
7	211253	Seal, oil	1
		CAMSHAFT	
		All Models	
8	129860	Camshaft (R.H.)	1
9	156228	Gear, camshaft	1
10	69550	Key, gear	1
11	68193	Plug, pipe	1
12	9235-1	Ring, thrust	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D

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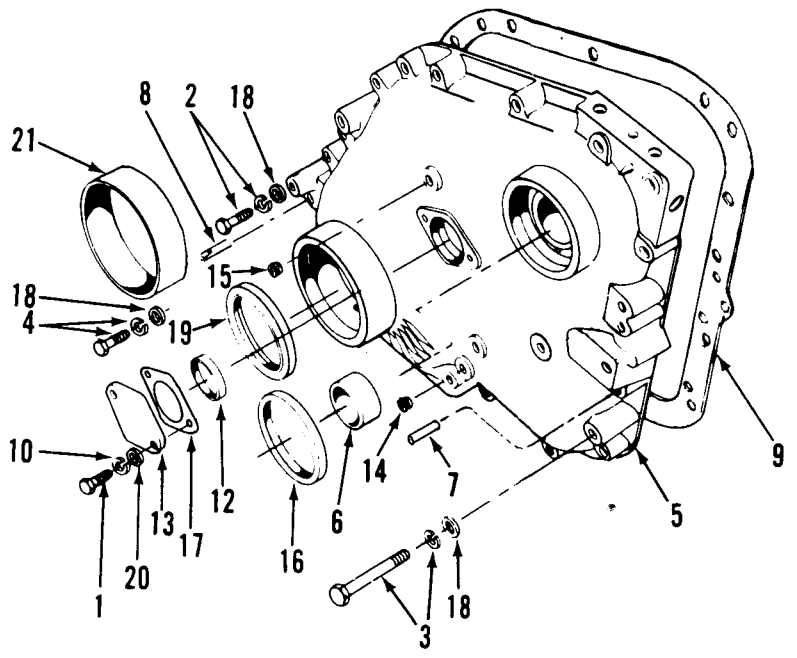

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		GEAR COVER	
		NH-230, NTC-250, N-855-P190, N-855-P220, N-855-P250	
1	S-112	Capscrew (3/8" - 16 x 1")	2
2	3011711	Capscrew and lockwasher assembly (7/16" - 20 x 2")	15
3	3011713	Capscrew and lockwasher assembly (7/16" - 20 x 2 5/8")	1
4	3011714	Capscrew and lockwasher assembly (7/16" - 20 x 3")	1
5	BM-70398	Cover, gear (137164)	1
6	132770	Bushing	1
21	68226-1	Bushing, trunnion	1
7	60408	Dowel	1
8	70653	Dowel	1
9	214633	Gasket, cover (Segmented)	1
10	S-604	Lockwasher (3/8")	2
12	67270	Packing, camshaft thrust plate	1
13	138988	Plate, camshaft thrust	1
14	3013786	Plug, pipe (3/8")	1
15	68606	Plug, pipe (1/8")	1
16	211255	Seal	1
	BM-56657	Shim assembly	1
17	68192-A	Shim (.010")	A/R
17	68192-B	Shim (.005")	A/R
17	68192-C	Shim (.002")	A/R
17	185574	Shim, camshaft thrust (.025")	1
18	S-622	Washer, plain (15/32")	17
19	208069	Seal, crankshaft oil	1
20	S-602	Washer plain (13/32")	2

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		GEAR COVER	
		N-855-C220, N-855-C235, N-855-P235, N-855-L3	
	S-119-C	Capscrew (7/16" - 20 x 3 1/4")	1
	3011711	Capscrew and lockwasher assembly	9
	3011713	Capscrew and lockwasher assembly	1
	3011714	Capscrew and lockwasher assembly	3
	3011715	Capscrew and lockwasher assembly	3
5	AR-09473	Cover, gear (210713)	1
6	132770	Bushing	1
7	60408	Dowel	1
8	70653	Dowel	1
	210411	Gasket	1
	S-610	Lockwasher (7/16")	10
	S-622	Lockwasher (15/32")	10
	68606	Plug, pipe (1/8")	1
	3013786	Plug, pipe (3/8")	2
	215705	Seal, o-ring	1
	AR-01176		
	65259-A	Shim	A/R
	65259-B	Shim	A/R
	65259-C	Shim	A/R
	185573	Shim, insert	1

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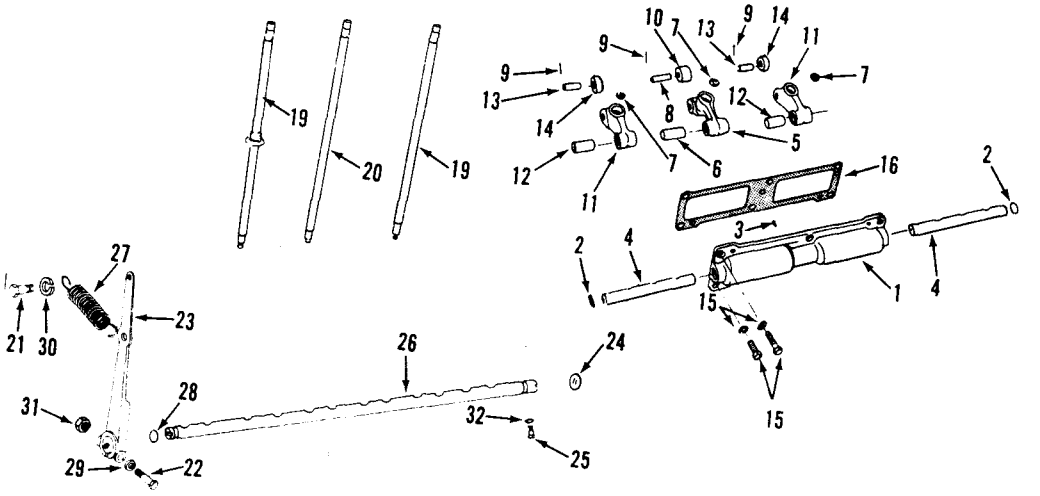

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		CAM FOLLOWER AND HOUSING	
	3018051	Housing, cam follower	3
1	44035	Housing	3
2	175831	Plug, expansion	6
3	69736	Screw, shaft	6
4	3017031	Shaft	6
	3018049	Cam follower assembly, injector	6
5	3018050	Cam follower lever and bushing (3017545)	6
6	118377	Bushing	6
7	107738	Insert	6
	213559	Socket	6
8	3017544	Pin, roller	6
9	118939	Pin, roll	6
10	7348-2	Roller, injector cam	6
11	BM-37634	Cam follower assembly, intake and exhaust (120543)	12
12	118378	Bushing	12
7	107738	Insert	12
13	68513	Pin, roller	12
9	118939	Pin, roll	12
14	9260-1	Roller, valve cam	12
		MOUNTING PARTS	
15	3010593	Capscrew and lockwasher assembly (3/8" - 24 x 1")	18
16	120819	Gasket (.029")	A/R
16	9266	Gasket (.015")	A/R
16	9266-A	Gasket (.007")	A/R

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		PUSH RODS	
19	BM-47778	Push Rod, intake and exhaust	12
20	BM-47779	Push Rod, injector	6
		COMPRESSION RELEASE	
		Auto Application	
21	S-108	Capscrew (5/16" - 24 x 5/8")	1
22	208411	Bolt, carriage	1
23	208581	Lever	1
24	S-719	Plug, expansion	1
25	9237	Screw, shaft lock	1
26	210685	Shaft	1
27	139289	Spring	1
28	43696	O-ring	1
29	S-604	Lockwasher (3/8")	1
30	S-605	Lockwasher (5/16")	1
31	S-223	Nut	1
32	S-602	Washer, plain (13/32")	1
	43468-E	Pin	1

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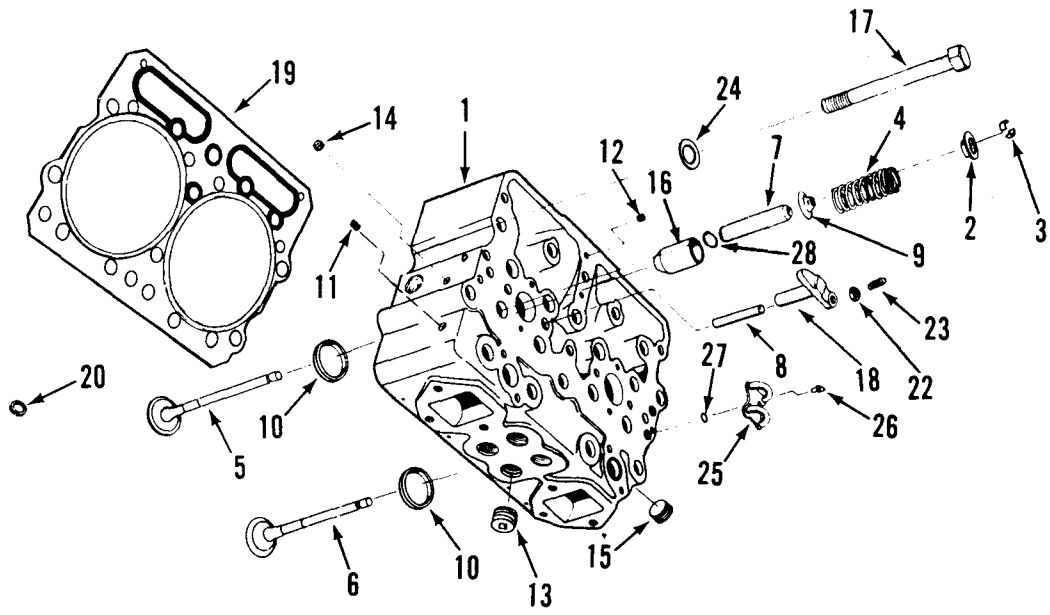

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		CYLINDER HEAD	
1	3007834	Head, cylinder (3007717)	3
2	170296	Guide, valve spring	24
3	127554	Half-collet, valve	48
4	211999	Spring, valve	24
5	145701	Valve, exhaust	12
6	135957	Valve, intake	12
	3007833	Head, cylinder (less valves)	3
7	3006456	Guide, valve stem	24
8	123558	Guide, crosshead valve	12
9	172034	Guide, valve spring	24
10	127930	Insert, exhaust valve seat	24
28	3007759	O-ring	6
11	70459	Plug, fuse	3
	S-915-A	Plug, pipe (1/2")	3
12	S-965-E	Plug, pipe	6
13	S-962	Plug, pipe (1")	6
14	S-911-B	Plug, pipe (1/8")	12
15	S-995	Plug, pipe (3/4")	18
16	202606	Sleeve, injector	6
		MOUNTING PARTS	
17	209700	Capscrew, cylinder head	36
18	3009465	Crosshead, valve	12
19	AR-07256	Gasket, head (3005541)	3
20	193949	Grommet, water	24
22	203131	Nut, crosshead adjusting	12
23	177734	Screw, crosshead adjusting	12
24	69699	Washer	36
25	147100	Fuel crossover assembly	2
26	70772	Capscrew, springtite	8
27	131026	O-ring	8

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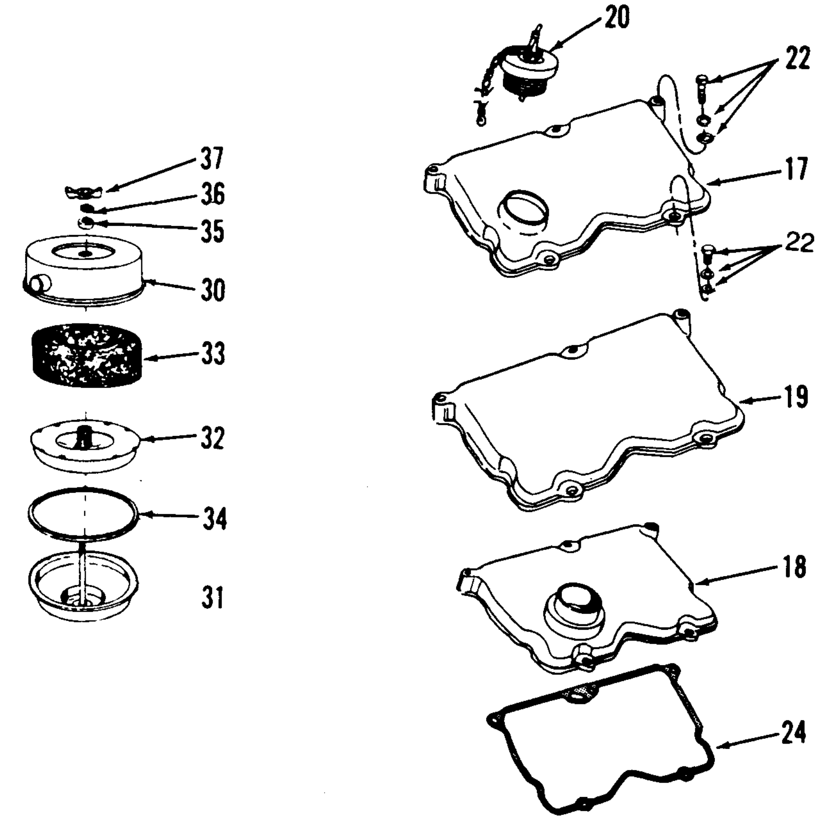

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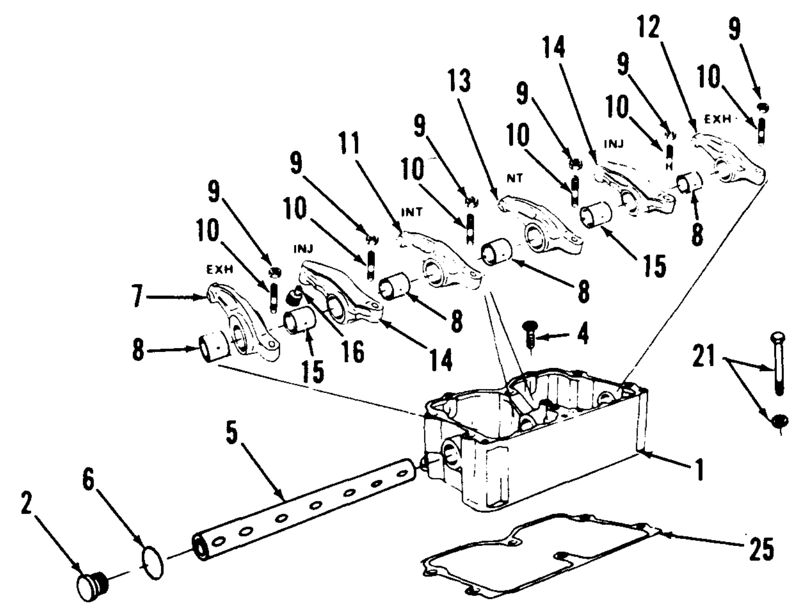

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REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		ROCKER LEVER HOUSING	
		All Models	
	AR-03312	Housing, rocker lever	3
1	3007242	Housing, rocker lever	3
4	168319	Screw, rocker lever shaft	3
5	140297	Shaft, rocker lever	3
2	218736	Plug, shaft and housing	6
6	3000521	O-ring	6
7	BM-95148	Lever, exhaust valve (168804)	3
8	140330	Bushing, lever	3
9	S-212	Nut, adjusting screw	3
10	168306	Screw, adjusting	3
	208084	Rivet, blind	3
12	BM-95149	Lever, exhaust valve (168802)	3
8	140330	Bushing, lever	3
9	S-212	Nut, adjusting screw	3
10	168306	Screw, adjusting	3
	208084	Rivet, blind	3
13	BM-95159	Lever, intake valve (168805)	3
8	140330	Bushing, lever	3
9	S-212	Nut, adjusting screw	3
10	168306	Screw, adjusting	3
11	BM-95160	Lever, intake valve (168803)	3
8	140330	Bushing, lever	3
9	S-212	Nut, adjusting screw	3
10	168306	Screw, adjusting	3
14	AR-02308	Lever, injector (218152)	6
15	218153	Bushing, lever	6
16	194037	Socket	6
9	S-212	Nut, adjusting screw	6
10	213109	Screw, adjusting	6
		ROCKER HOUSING COVER	
		All Models except: N-855-P190, N-855-P220, N-855-P250	
17	3006349	Cover, rocker housing	1
18	3006358	Cover, rocker housing	1
19	3006183	Cover, rocker housing	1
		ROCKER HOUSING COVER N-855-P190, N-855-P220, N-855-P250	
	OMIT		
17	3006349	Cover, rocker housing	1
	ADD		
19	3006183	Cover, rocker housing	1
		MOUNTING PARTS	
	AR-12972	Baffle, breather (219065)	1
	3000528	Nut, push on	2
20	107981	Cap, oil filler (Construction and locomotive only)	1
21	3010589	Capscrew with washer assembly, housing	18
22	3006182	Capscrew and washer assembly, cover	15
24	3009999	Gasket, cover	3
24	149651	Gasket, cover (Naturally aspirated engines only)	3
25	187589	Gasket, housing to head	3
	101322	Cap, filler (Without chain)	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		BREATHER	
		All Models	
	257014	Assembly, crankcase breather	1
30	255804	Body, upper	1
31	255806	Body, lower	1
32	257419	Element, vapor	1
33	256837	Element	1
34	254608	Gasket	1
35	255815	Gasket	1
36	255816	Washer	1
37	125017	Wing, nut	1
	69793	Capscrew	1
	68425	Clip, hose	1
	43828	Clamp, hose	2
	64775	Hose	1
	S-604	Lockwasher (3/8")	1
	S-205	Nut	1
	111670	Support, oil gauge tube	1
	142486	Tube, breather vent	1
		ENGINE LIFTING BRACKET	
		All Models except: N-855-C220, N-855-C235, N-855-P235, N-855-L3	
	3009185	Bracket, lifting	2
	S-176	Capscrew	4
	S-608	Lockwasher (1/2")	4
		ENGINE LIFTING BRACKET N-855-C220, N-855-C235 N-855-L3, N-855-P235	
	3009185	Bracket, lifting	1
	S-176	Capscrew	4
	S-608	Lockwasher (1/2")	2
	3001726	Bracket, lifting	1

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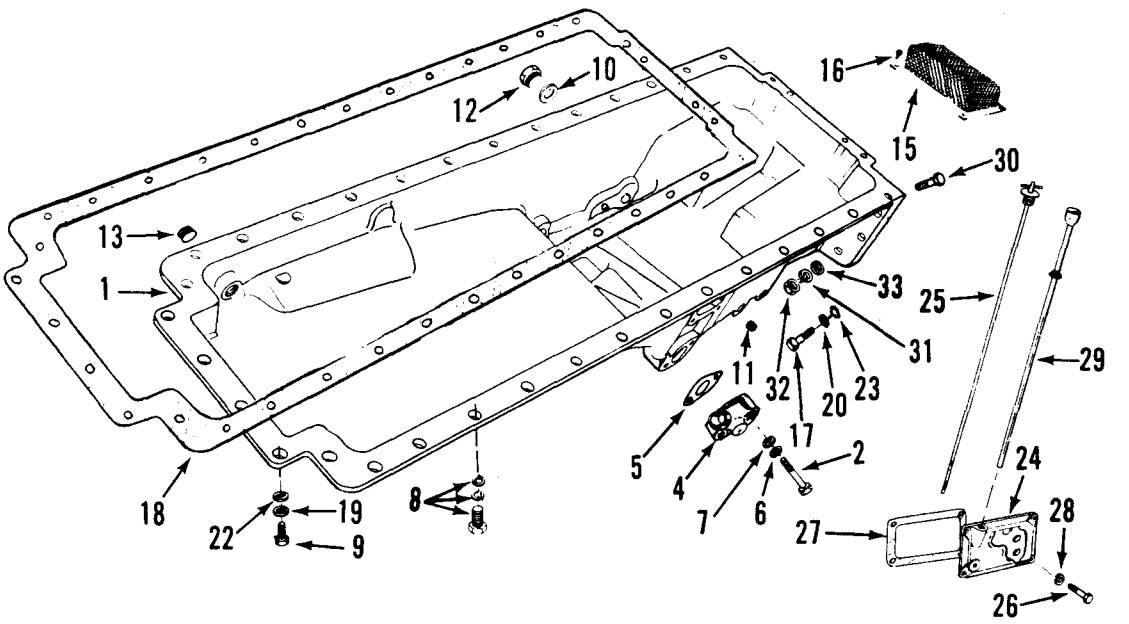

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		OIL PAN NH-230, NHC-250	
1	193625	Pan, oil	1
2	S-120	Capscrew	2
8	3008069	Capscrew and lockwasher (7/16" - 20 x 1 1/2")	28
	3012470	Capscrew and lockwasher (3/8" - 16 x 3/4")	1
9	185804	Capscrew	4
17	105574	Capscrew	4
30	S-125	Capscrew (1/2" - 13 x 2")	3
	67950	Clip, tube	1
4	179688	Flange, suction	1
5	157551	Gasket, flange	1
18	178788	Gasket, pan to block	1
10	67946	Gasket	1
6	S-604	Lockwasher (3/8")	2
31	S-608	Lockwasher (1/2")	3
19	S-610	Lockwasher (7/16")	28
20	S-605	Lockwasher (5/16")	4
32	S-208-A	Nut	3
11	3008468	Plug, pipe (1/2")	4
13	S-995	Plug, pipe (1/4")	1
	3013786	Plug, pipe (3/8")	1
	S-908	Plug, pipe (3/8")	1
12	110907	Plug, drain	1
15	20622	Screen, suction	1
16	S-1354	Screw, screen	4
	104856	Spacer	4
7	S-602	Washer, plain (13/32")	2
22	S-622	Washer, plain (15/32")	28
23	S-626	Washer, plain	4
33	S-601	Washer, plain	3
	AS1602906MS	Hose, lubricating oil supply	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		OIL GAUGE BRACKET NH-230, NHC-250	
24	41044-1	Bracket, oil gauge	1
25	199445	Dipstick	1
26	S-112	Capscrew (3/8" - 16 x 1")	4
27	65274	Gasket	1
28	S-604	Lockwasher (3/8")	4
29	101814	Tube, dipstick	1
	S-602	Washer, plain (13/32")	4

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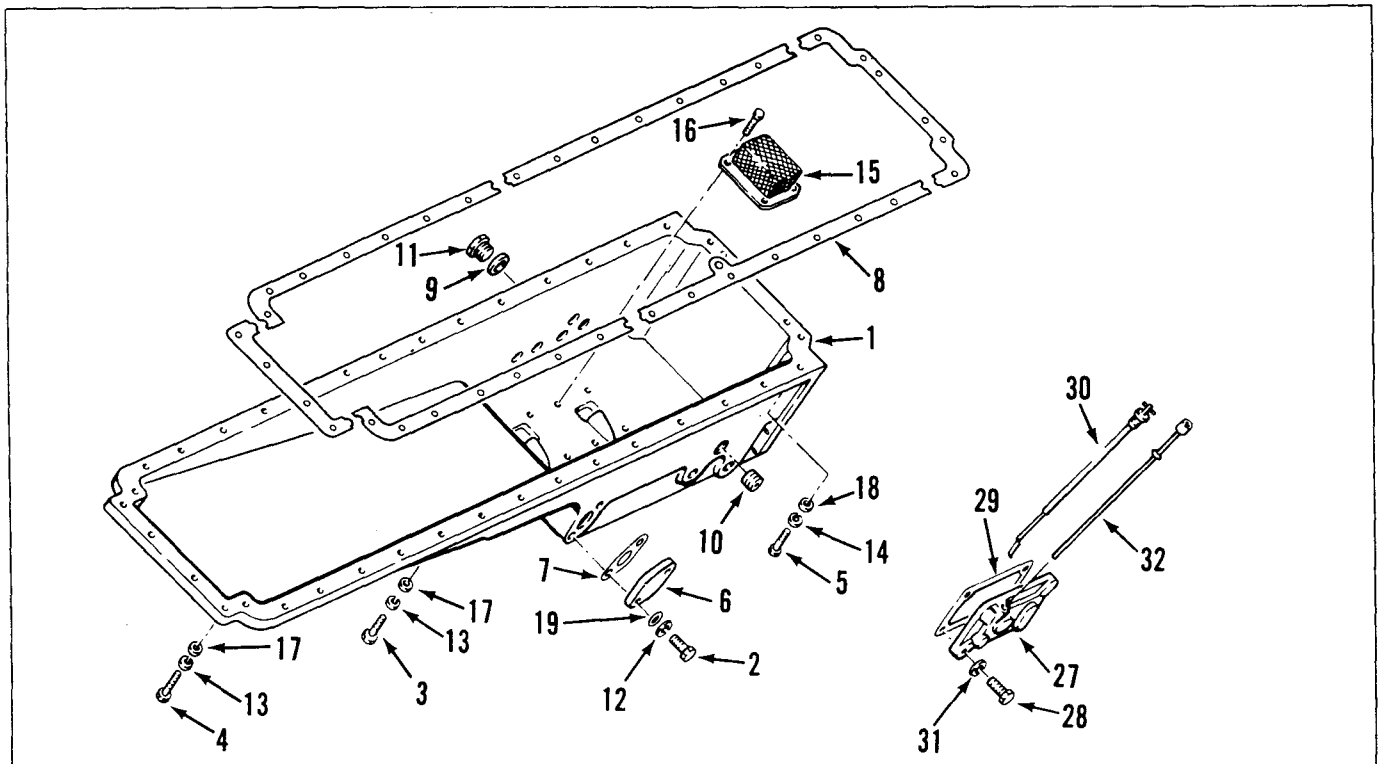

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		OIL PAN **N-855-C220, N-855-C235** **N-855-L3, N-855-P235**	
1	193631	Pan, oil	1
2	S-112	Capscrew (3/8" - 16 x 1")	2
	S-125	Capscrew (1/2" - 13 x 2")	2
3	3008069	Capscrew (7/16" - 20 x 1 3/8")	28
4	185804	Capscrew	4
5	105574	Capscrew	4
6	132648	Flange, lubricating oil	1
7	157551	Gasket, suction flange	1
8	178788	Gasket, oil pan (segmented)	1
9	67946	Gasket	1
	S-200	Nut (1/2")	1
	3008470	Plug, pipe (1")	2
10	3008468	Plug, pipe (1/2")	2
11	69962	Plug, oil drain	1
	3013786	Plug, pipe (3/8")	1
12	S-604	Lockwasher (3/8")	2
13	S-610	Lockwasher (7/16")	34
14	S-605	Lockwasher (5/16")	4
	S-608	Lockwasher (1/2")	2
15	20622	Screen lubricating oil plate	1
16	S-1354	Screw, suction screen	4
17	S-622	Washer, plain (15/32")	34
18	S-626	Washer, plain	4
19	S-602	Washer, plain (13/32")	2
	104856	Spacer	4

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		OIL GAUGE BRACKET AND DIPSTICK **N-855-C220, N-855-C235** **N-855-L3, N-855-P235**	
27	41044-1	Bracket, oil gauge	1
28	S-112	Capscrew (3/8" - 16 x 1")	4
29	65274	Gasket	1
30	3001047	Dipstick	1
31	S-604	Lockwasher (3/8")	4
32	101814	Tube, dipstick	1
	S-602	Washer, plain (13/32")	4

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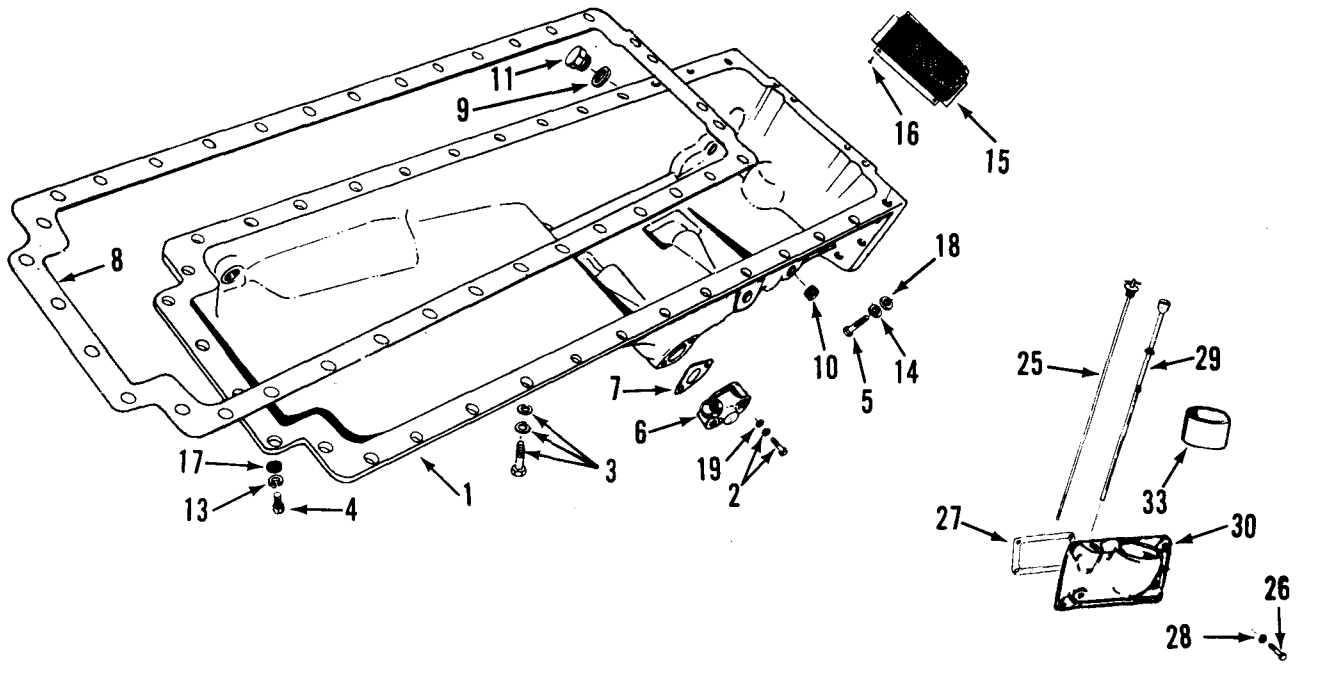

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		OIL PAN N-855-P190, N-855-P220, N-855-P250	
1	3005179	Pan, oil	1
	3008069	Capscrew and washer (7/16" - 20 x 1 1/2")	28
2	3010595	Capscrew and lockwasher (3/8" - 16 x 1")	2
3	70349	Capscrew (7/16" - 20 x 1 3/8")	28
4	185804	Capscrew	4
5	105574	Capscrew	4
	S-125	Capscrew (1/2" - 13 x 2")	3
	67950	Clip, tube	1
6	132648	Flange, lubricating oil	1
7	67963	Gasket, suction flange	1
8	178788	Gasket, oil pan	1
9	67946	Gasket	1
	S-200	Nut (1/2")	1
	3013786	Plug, pipe (3/8")	1
	3008470	Plug, pipe (1")	2
10	3008468	Plug, pipe (1/2")	2
11	110907	Plug, oil drain	1
	S-908	Plug, pipe (3/8")	2
	S-604	Lockwasher (3/8")	2
13	S-610	Lockwasher (7/16")	6
14	S-605	Lockwasher (5/16")	4
	S-608	Lockwasher (1/2")	3
15	20622	Screen, lubricating oil plate	1
16	S-1354	Screw, suction screen	4
	104856	Spacer	4
17	S-622	Washer, plain (15/32")	6
18	S-626	Washer, plain	4
19	S-602	Washer, plain (13/32")	2
	S-601	Washer, plain	3
	AS1602806MS	Hose, lubricating oil supply	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		OIL GAUGE BRACKET N-855-P190, N-855-P220, N-855-P250	
30	115590	Bracket, oil gauge	1
26	S-112	Capscrew (3/8" - 16 x 1")	4
27	65274	Gasket	1
25	101368	Dipstick	1
28	S-604	Lockwasher (3/8")	4
29	101814	Tube, dipstick	1
33	101264	Tube, oil filler	1

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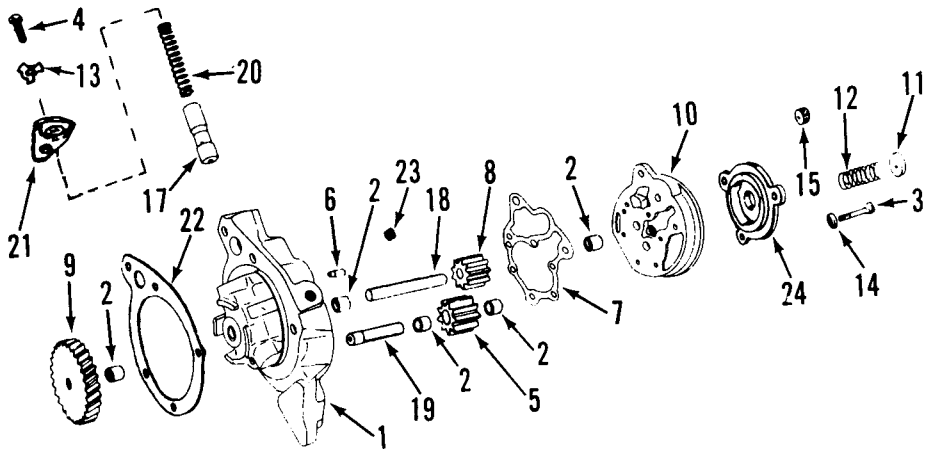

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		LUBRICATING OIL PUMP NH-230, NHC-250, N-855-P190 N-855-P220, N-855-P250	
	AR-01059	Pump, oil	1
1	AR-01017	Body and bushing (173160)	1
2	68586	Bushing	2
3	191772	Capscrew	5
4	S-109	Capscrew (3/8" - 16 x 7/8")	1
5	3017065	Gear, idler (68589)	1
2	68586	Bushing	2
6	69519	Dowel	1
7	173161	Gasket	1
8	68588	Gear, drive	1
9	125988	Gear, main drive	1
10	AR-01018	Head, filter (173162)	1
2	68586	Bushing	1
11	200819	Disc, by-pass	1
12	251152	Spring, by-pass	1
13	109319	Lockplate	1
14	S-604	Lockwasher (3/8")	5
24	173163	Plate	1
15	S-908	Plug, pipe (3/8")	1
23	3008468	Plug, pipe (1/2")	1
	3013786	Plug, pipe (3/8")	1
17	127558	Plunger	1
18	126284	Shaft, drive	1
19	126289	Shaft, idler	1
20	68274	Spring, by-pass valve	1
21	126304	Yoke, retainer	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		MOUNTING PARTS	
	S-101-A	Capscrew	1
	S-127-A	Capscrew (7/16" - 20 x 3")	3
	S-183-A	Capscrew (7/16" - 20 x 2 1/2")	1
22	121907	Gasket, pump to block	1
	S-610	Lockwasher (7/16")	5
	S-142	Screw, hex (5/16" - 24 x 1/4")	1
	S-603	Lockwasher (5/8")	1

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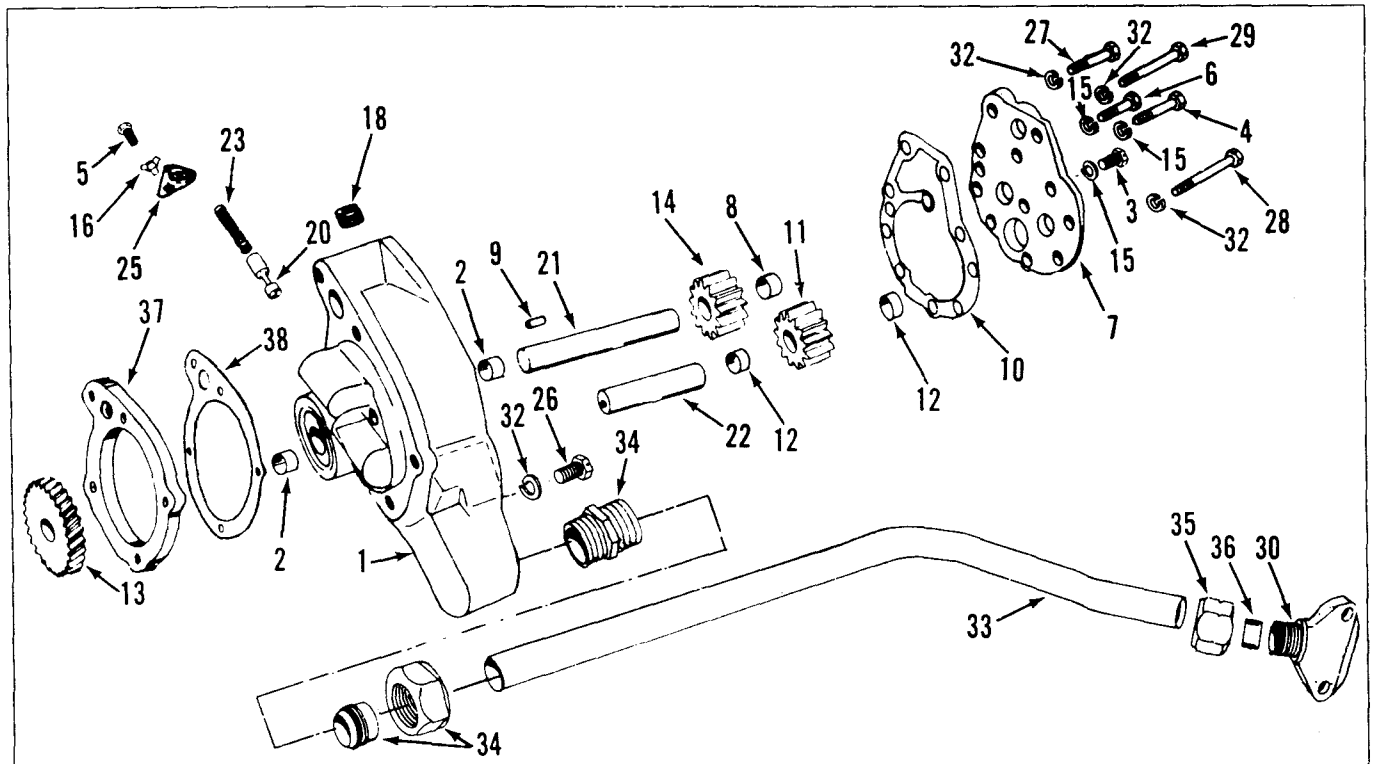

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		LUBRICATING OIL PUMP N-855-C220, N-855-C235 N-855-L3, N-855-P235	
	AR-12341	Pump, lubricating oil	1
1	AR-11065	Body and bushing (215348)	1
2	69521	Bushing	2
3	S-102	Capscrew (5/16" - 18 x 1")	6
4	S-103	Capscrew (5/16" - 18 x 2 1/4")	1
5	S-109	Capscrew (3/8" - 16 x 7/8")	1
6	S-111	Capscrew (5/16" - 18 x 1 1/2")	1
7	AR-04258	Cover and bushing (177414)	1
8	69521	Bushing	1
9	69519	Dowel	1
10	203145	Gasket, cover	1
11	3014293	Gear and bushing (199078)	1
12	199586	Bushing	2
13	143190	Gear, pump drive	1
14	199069	Gear, lubricating pump	1
15	S-605	Lockwasher (5/16")	8
16	109319	Lockplate	1
18	3008469	Plug, pipe (3/4")	2
	134596	Plug, by-pass valve	1
20	109333	Plunger, pressure regulator	1
21	177417	Shaft, pump drive	1
22	177419	Shaft, pump idler	1
23	211939	Spring, by-pass valve	1
25	126304	Yoke, retaining	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		MOUNTING PARTS	
	S-105	Capscrew (3/8" - 16 x 3 1/2")	2
26	S-108-A	Capscrew (7/16" - 20 x 1 3/4")	2
27	69406	Capscrew (7/16" - 20")	1
28	134963	Capscrew (7/16" - 20 x 5 1/2")	1
29	S-119-C	Capscrew (7/16" - 20 x 3 3/4")	1
	3012479	Capscrew and lockwasher (7/16" - 20 x 1")	2
30	190168	Connection, oil suction	1
	157551	Gasket, suction flange	1
	S-604	Lockwasher (3/8")	2
32	S-610	Lockwasher (7/16")	5
	S-602	Washer, plain (13/32")	2
34	217257	Fitting	1
35	3008795	Nut	2
36	197230	Sleeve	2
33	210017	Tube, oil suction	1
37	212760	Spacer, lubricating oil pump	1
38	212761	Gasket, spacer	1

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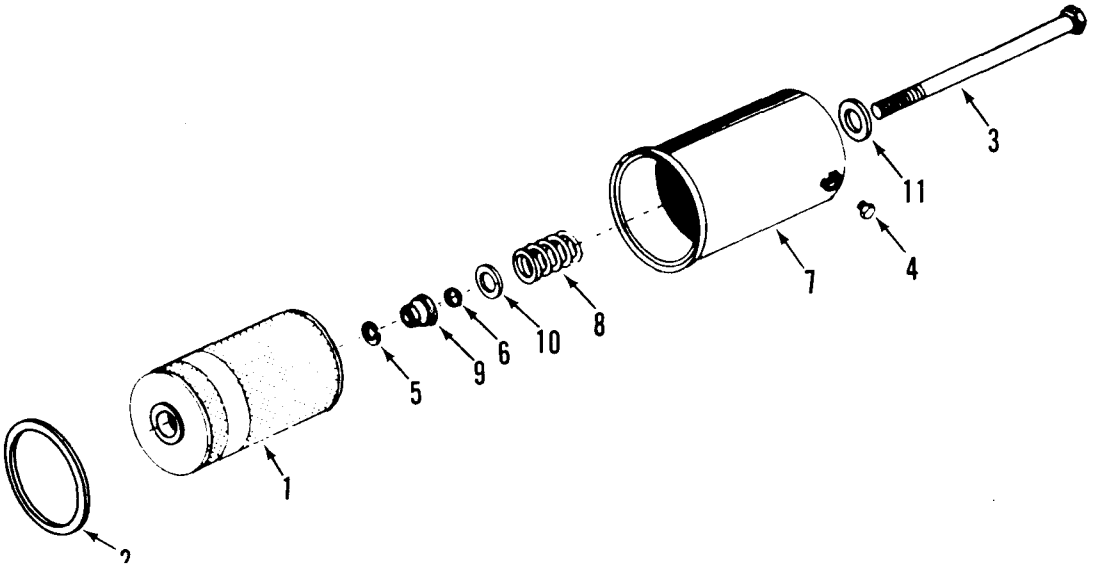

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.	REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		LUBRICATING OIL FILTER					
	AR-01058	Filter, lubricating oil	1				
1	LF-516	Cartridge (paper) (158139)	1				
2	173368	Seal	1				
	179599	Shell and bolt	1				
3	184265	Bolt	1				
4	69901	Plug, drain	1				
5	S-16245	Ring, snap	1				
6	153518	Seal, bolt	1				
7	184386	Shell	1				
8	173176	Spring	1				
9	183342	Support, cartridge	1				
10	153520	Washer, bolt seal	1				
11	8265	Washer, copper	1				

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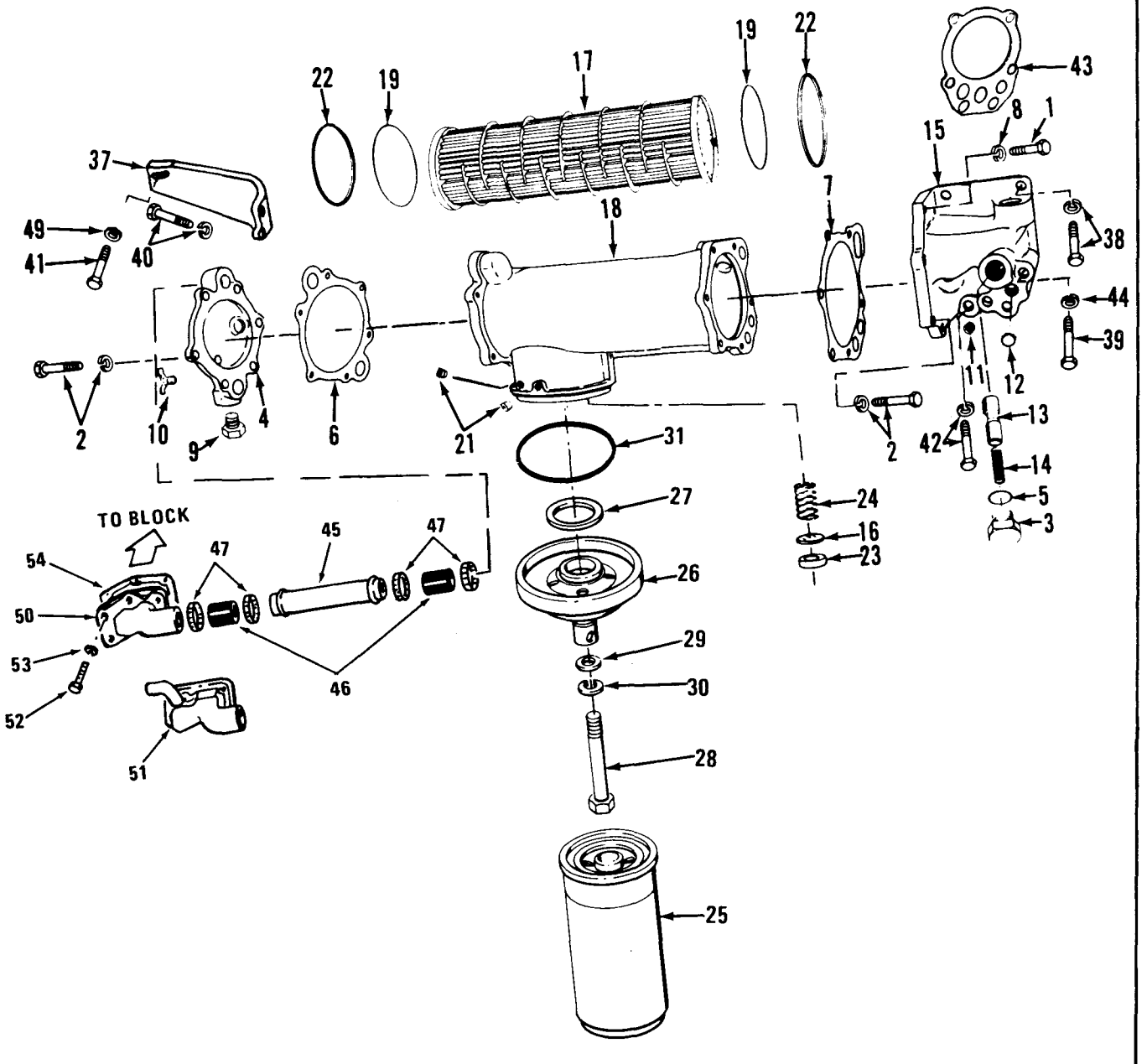
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REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		LUBRICATING OIL COOLER AND FILTER N-855-C220, N-855-C235 N-855-L3, N-855-P235	
	3004967	Assembly, lubricating oil cooler	1
1	S-126	Capscrew (3/8" - 16 x 2 1/2")	1
2	3010596	Capscrew and lockwasher (3/8" - 16 x 1 1/4")	10
3	3012475	Capscrew and lockwasher (3/8" - 16 x 2 1/4")	1 1
4	183913	Cap, pressure regulator	1
5	217315	Cover	1
6	67946	Gasket, by-pass valve	1
7	218245	Gasket, oil cooler cover	1
8	3010030	Gasket, oil cooler	1
9	S-604	Lockwasher (3/8")	2
10	108307	Cock, drain	1
11	S-910-B	Plug, pipe (1/4")	1
12	110907	Plug, oil	1
13	127558	Plunger, pressure regulator	1
14	68274	Spring, by-pass valve	1
15	210967	Support, cooler	1
	142110	Plug	1
	AR-09999	Cooler, lubricating oil	1
16	201707	Disc, by-pass	1
17	208149	Element, oil cooler	1
18	210915	Housing, filter and cooler	1
19	3007713	O-ring	2
	3008466	Plug, pipe (1/4")	2
	3008469	Plug, pipe (3/4")	1
21	S-911-B	Plug, pipe (1/8")	1
22	3006745	Retainer, cooler	2
23	179063	Seat, filter by-pass	1
24	202128	Spring, filter by-pass	1
	3013786	Plug, pipe (3/8")	2
25	299670	Filter, spin-on	1
26	3300908	Adapter	1
27	3300917	Gasket	1
28	138045	Center bolt	1
29	200861	Washer	1
30	70216	Lockwasher	1
31	173368	Sealing ring	1
		MOUNTING PARTS	
32	210966	Brace, cooler	1
38	3010596	Capscrew and lockwasher (3/8" - 16 x 1 1/4")	2
39	S-106-C	Capscrew	2
40	3010595	Capscrew and lockwasher (3/8" - 16 x 1")	2
41	S-145	Capscrew (1/2" - 13 x 1 1/4")	1
42	3010597	Capscrew and lockwasher (3/8" - 16 x 3 3/4")	2
43	3008017	Gasket, cooler support	1
44	S-604	Lockwasher (3/8")	2
45	3000907	Tube, water transfer	1
46	3018059	Hose	2
47	3008690	Clamp, hose	4
49	203310	Washer, plain	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		OIL FILTER CONVERSION KIT (Center Bolt To Spin-On)	
	3007775*	Kit Conversion	1
	3300908	Adapter	1
	3300917	Gasket	1
	138045	Center bol.	1
	200861	Washer	1
	70216	Lockwasher	1
	173368	Sealing ring	1
	299670	Filter, spin-on (LF-670)	1
		*Reference Service Topic 75T 7-10	
		WATER OUTLET CONNECTION	
51	3001939	Water, connection	1
	S-141-A	Capscrew (3/8")	4
52	S-168-C	Capscrew	2
53	S-600	Lockwasher	6
54	70089-1	Gasket	1
50	3011233	Water connection	1
	3011342	Capscrew and washer	6
	70089-1	Gasket	1

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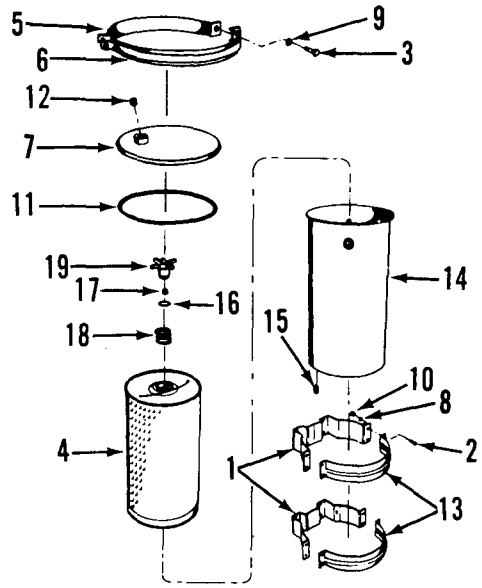

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		LUBRICATING OIL BY-PASS FILTER N-855-C220, N-855-C235, N-855-L3	
	159706	Filter, lubricating oil	1
1	145664	Bracket, mounting	2
2	70188	Capscrew, bracket	8
3	70449	Capscrew, coupling half	2
4	256838	Cartridge (LF-750)	1
	250856	Assembly, coupling	1
5	(3300947)	Coupling half with nuts	1
6	(3300948)	Coupling half, cover	1
7	(159667)	Cover	1
8	70189	Lockwasher, bracket	8
9	70194	Lockwasher, coupling half	2
10	70299	Nut, bracket	8
11	164159	O-ring, cover	1
12	S-908	Plug, cover (3/8")	1
13	145665	Strap, mounting	2
14	257222	Shell, filter	1
	157152	Decal, filter	1
15	S-908	Plug, drain (3/8")	1
	257218	Support, upper	1
16	116029	O-ring, support	1
17	131911	Orifice, plug	1
18	(150037)	Spring, hold down	1
19	257216	Support, upper	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D

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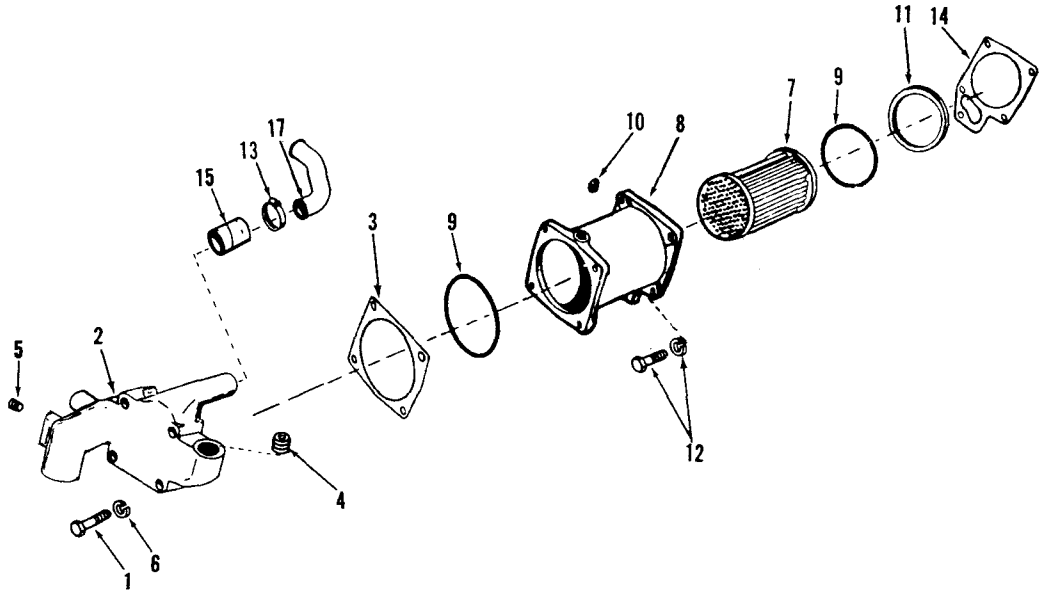

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		LUBRICATING OIL COOLER NH-230, NHC-250	
	AR-06038	Cooler assembly, lubricating oil	1
1	S-126	Capscrew (3/8" - 16 x 2 1/2")	4
2	199897	Cover, lubricating oil cooler	1
3	68210	Gasket, cover to housing	1
4	3008470	Plug, pipe (1")	1
5	3013786	Plug, pipe (3/8")	4
6	S-604	Lockwasher (3/8")	4
	BM-57837	Housing and element assembly	1
7	110848	Element	1
8	127863	Housing	1
9	148293	O-ring	2
10	3008466	Plug, pipe (1/4")	2
11	110827	Retainer, O-ring	2
		MOUNTING PARTS	
12	3010596	Capscrew and lockwasher (3/8" - 16 x 1 1/4")	5
13	43828-B	Clamp, hose	4
14	121779	Gasket	1
15	63495	Hose	2
17	21133	Pipe, water by-pass	1

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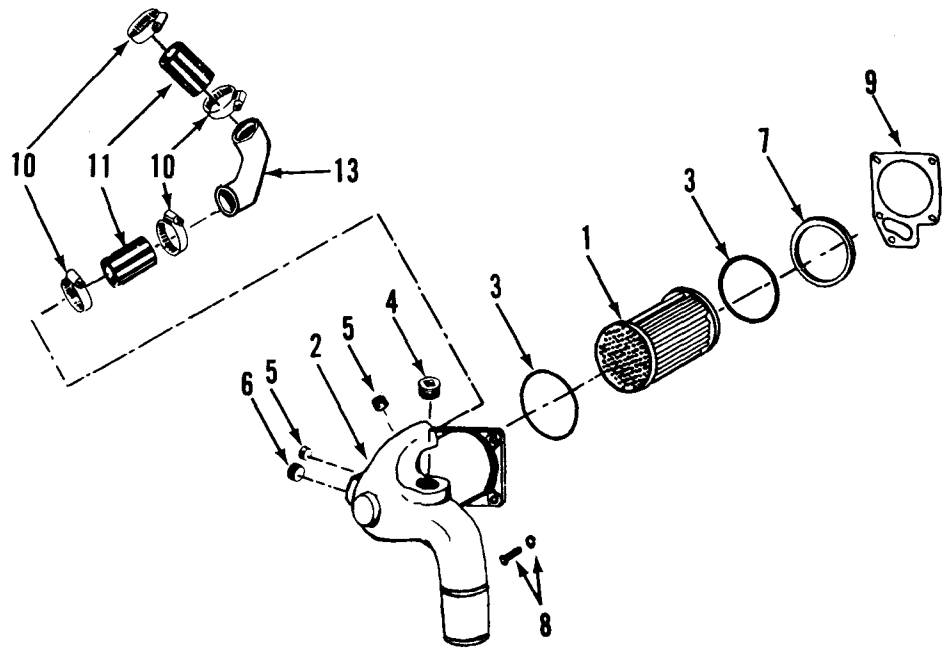
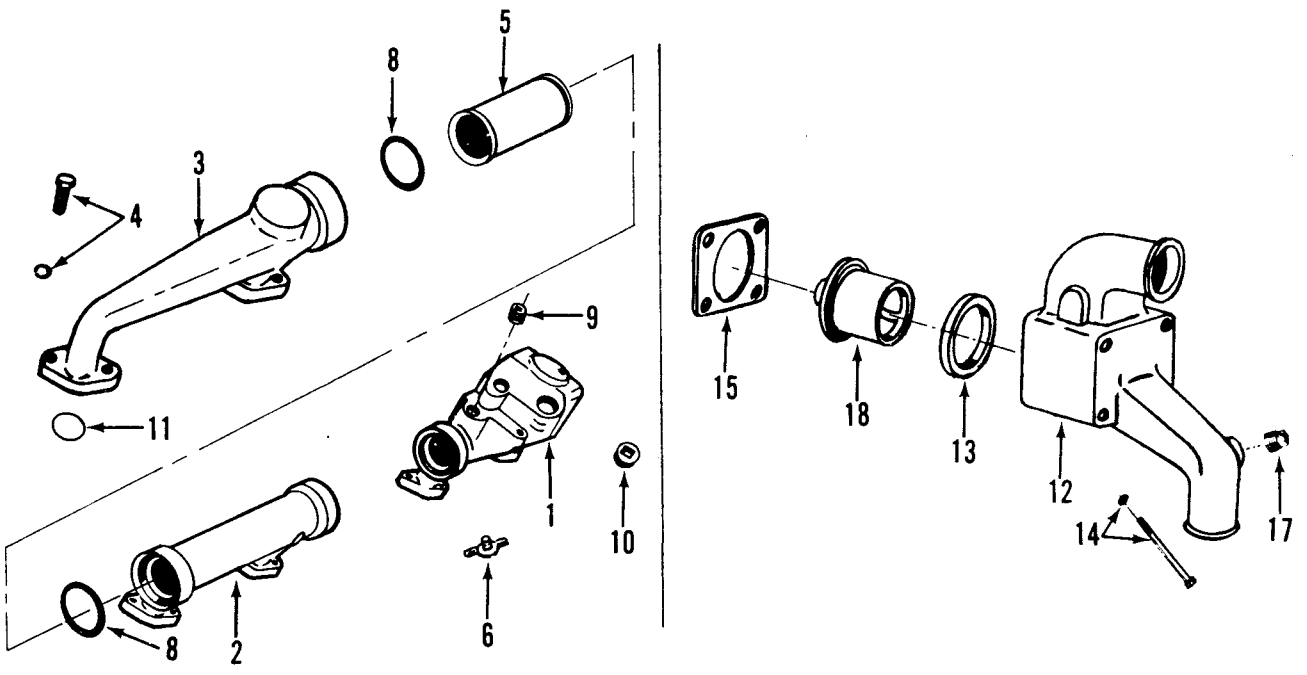


REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		LUBRICATING OIL COOLER N-855-P190, N-855-P220, N-855-P250	
	AR-00875	Cooler, lubricating oil	1
	S-126	Capscrew (3/8" - 16 x 2 1/2")	2
	3000604	Cover, lubricating oil cooler	1
	68210	Gasket, cover to housing	1
4	3008470	Plug, pipe (1")	1
5	3013786	Plug, pipe (3/8")	4
12	S-604	Lockwasher (3/8")	4
	AR-45070	Housing and element assembly	1
1	110848	Element	1
2	127863	Housing	1
3	148293	O-ring	2
6	3008466	Plug, pipe (1/4")	2
7	110827	Retainer, o-ring	2
		MOUNTING PARTS	
8	3010596	Capscrew and lockwasher (3/8" - 16 x 1 1/4")	5
9	121779	Gasket	1
10	43828-B	Clamp, hose	4
11	63495	Hose	2
13	21133	Pipe, by-pass	1
5	3013786	Plug, pipe (3/8")	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D

PARTS INDENTED ARE INCLUDED IN THE PART UNDER WHICH THEY ARE INDENTED



REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		WATER MANIFOLD NH-230, NHC-250, N-855-P190, N-855-P220, N-855-P250	
1	130117	Manifold, water (front)	1
2	130118	Manifold, water (center)	1
3	3013000	Manifold, water (rear)	1
4	3010596	Capscrew and lockwasher (3/8" - 16 x 1 1/4")	12
5	130394	Coupling, manifold	2
6	S-962-E	Cock, drain	1
8	70624	O-ring, coupling	4
9	3008468	Plug, pipe (1/2")	2
10	3008469	Plug, pipe (3/4")	1
	3013786	Plug, pipe (3/8")	1
11	148203	Ring, sealing	6
		THERMOSTAT HOUSING NH-230, NHC-250	
12	BM-90637	Housing and seal, thermostat (161380)	1
13	186780	Seal, thermostat	1
14	3010597	Capscrew and lockwasher (3/8" - 16 x 3 3/4")	4
15	70441	Gasket, thermostat housing	1
17	3013786	Plug, pipe (3/8")	1
18	204586	Thermostat (170 deg. - 185 deg.)	1
		N-855-P190, N-855-P220, N-855-P250	
		Same as above except:	
	BM-38609	Housing and seal, thermostat (146106)	

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		WATER OUTLET CONNECTION N-855-P190, N-855-P220 N-855-P250	
	3010595	Capscrew and lockwasher (3/8" - 16 x 1")	2
	212839	Connection, water outlet	1
	210859	Gasket, water outlet	1

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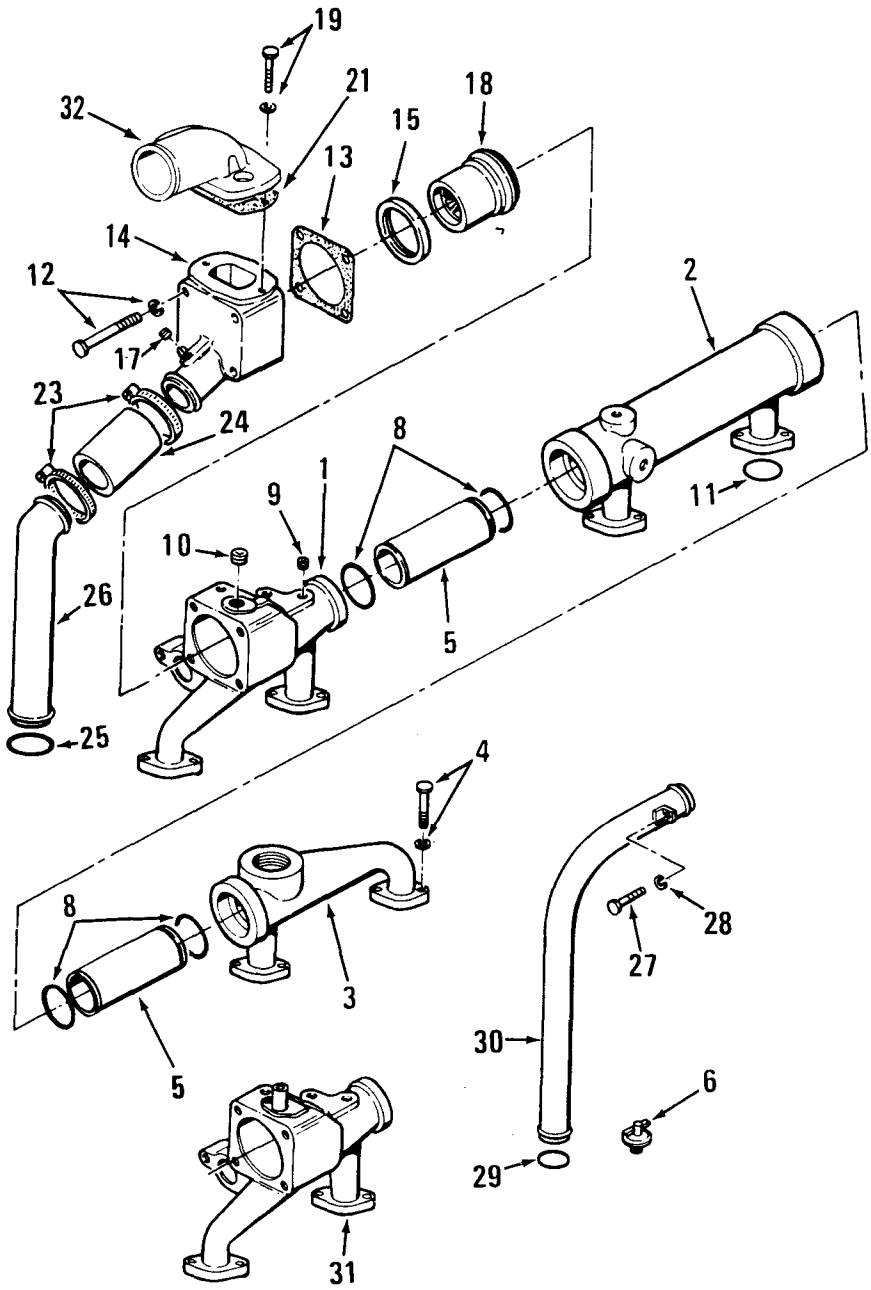
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REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		WATER MANIFOLD N-855-C220, N-855-C235, N-855-P235, N-855-L3	
1	211016	Manifold, water (front)	1
2	130118	Manifold, water (center)	1
3	3013001	Manifold, water (rear)	1
4	3010596	Capscrew and lockwasher (3/8" - 16 x 1 1/4")	12
5	130394	Coupling, manifold	2
6	S-962-E	Cock, drain	1
8	70624	O-ring, coupling	4
9	3008468	Plug, pipe	3
10	3008469	Plug, pipe	1
	3013786	Plug, pipe	1
11	148203	Ring, sealing	6
		THERMOSTAT HOUSING N-855-C220, N-855-C235, N-855-P235, N-855-L3	
12	3010597	Capscrew and lockwasher (3/8" - 16 x 3 3/4")	4
13	208128	Gasket, housing	1
	AR-10124	Housing, thermostat	1
14	211435	Housing	1
15	186780	Seal, housing	1
17	3013786	Plug, pipe	1
18	204586	Thermostat	1
		WATER OUTLET CONNECTION N-855-C220, N-855-C235, N-855-P235, N-855-L3	
19	3010595	Capscrew and lockwasher (3/8" - 16 x 1")	2
32	210916	Connection, water outlet (with radiator)	1
21	210859	Gasket, water outlet	1
		FRONT WATER BY-PASS N-855-C220, N-855-C235, N-855-P235, N-855-L3	
	S-110	Capscrew	1
	S-605	Lockwasher (5/16")	1
23	43828-B	Clamp, hose	2
24	102522	Hose	1
25	43463-A	O-ring	1
26	213485	Tube, water by-pass	1
	214617	Clamp, tube	1
		WATER TRANSFER TUBE N-855-C220, N-855-C235, N-855-P235, N-855-L3	
	158416	Bracket, water	1
27	S-110	Capscrew	1
28	S-605	Lockwasher (5/16")	1
29	212161	O-ring	2
30	211027	Tube, water transfer	1

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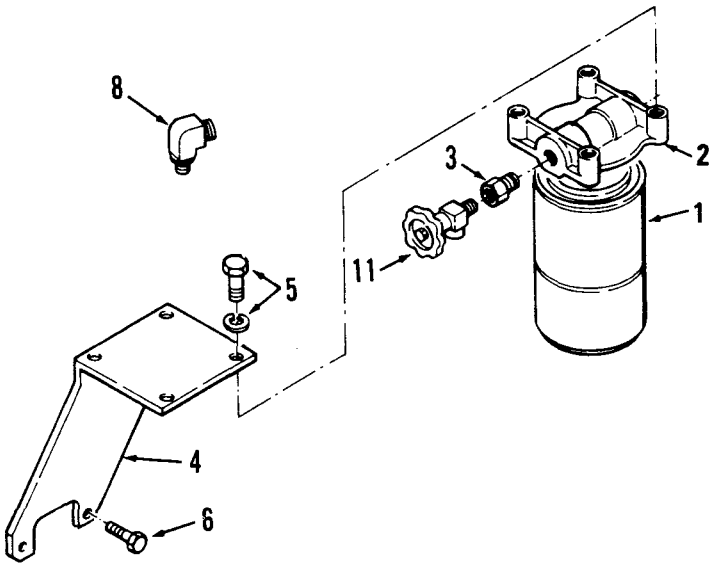

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		WATER FILTER NH-230, NHC-250	
	258264	Filter, water	1
1	299083	Element (WF-2013) Precharge	1
1	299080	Element (WF-2010) Service	1
2	204163	Head	1
	3000802	Decal	1
		MOUNTING PARTS	
4	208759	Bracket	1
3	S-983	Bushing, pipe	1
5	3010596	Capscrew and lockwasher (3/8" - 16 x 1 1/4")	4
6	S-199-A	Capscrew (3/8" - 16 x 4")	2
	179904	Clamp, hose	4
8	179903	Elbow	2
	179912	Hose	1
	179916	Hose	1
	S-604	Lockwasher (3/8")	2
11	179901	Valve, shutoff	2
		WATER FILTER N-855-P190, N-855-P220, N-855-P250	
	258264	Filter, water	1
1	299083	Element (WF-2013) Precharge	1
1	299080	Element (WF-2010) Service	1
2	204163	Head	1
	3000802	Decal	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		MOUNTING PARTS	
	208927	Bracket	1
	S-983	Bushing, pipe	1
	3010596	Capscrew and lockwasher (3/8" - 16 x 1 1/4")	4
	S-145	Capscrew (1/2" - 13 x 1 1/4")	2
	179904	Clamp, hose	4
	179902	Coupling	1
	70470	Elbow	1
	179903	Elbow	1
	179912	Hose	1
	179918	Hose	1
	S-608	Lockwasher (1/2")	2
	179901	Valve, shutoff	2

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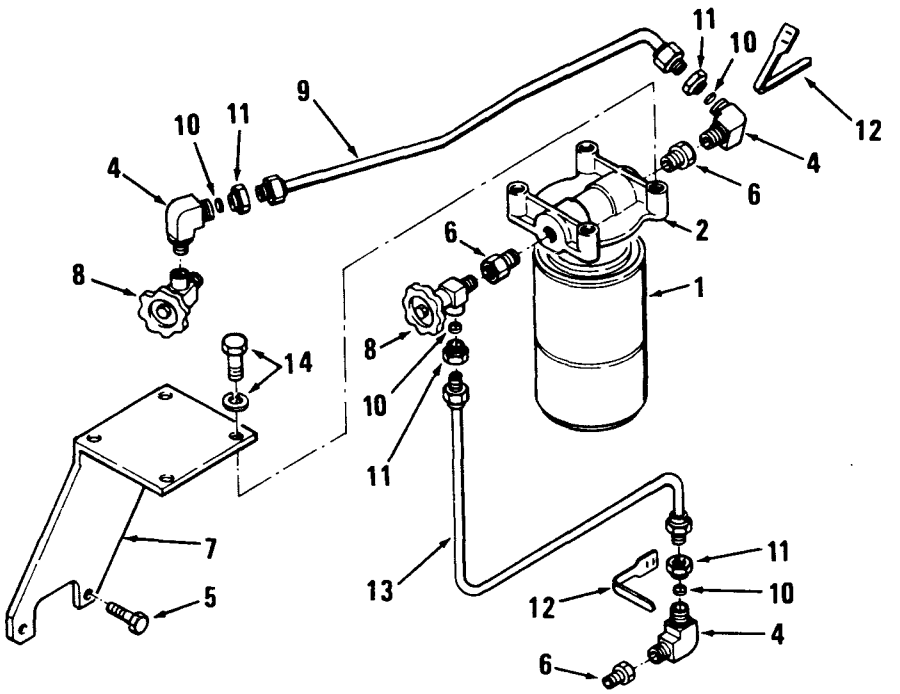

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		WATER FILTER N-855-C220, N-855-C235, N-855-P235, N-855-L3	
	258265	Filter, water	1
1	299084	Element, precharge (WF-2014)	1
2	204163	Head	1
1	299080	Element, service (WF-2010)	1
		MOUNTING PARTS	
	S-1002-A	Connector	
4	S-1005-A	Elbow	3
5	137890	Capscrew	2
6	187317	Adapter	3
7	211448	Bracket	1
8	3008760	Valve, water shut-off	2
9	3008792	Tube, water filter	1
10	S-1003-A	Sleeve	2
11	S-1004-A	Nut, tube	2
12	68088	Tag	1
13	3008794	Tube, water filter	1
10	S-1003-A	Sleeve	2
11	S-1004-A	Nut, tube	2
12	68088	Tag	1
14	3010596	Capscrew and lockwasher (3/8" - 16 x 1 1/4")	4

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D

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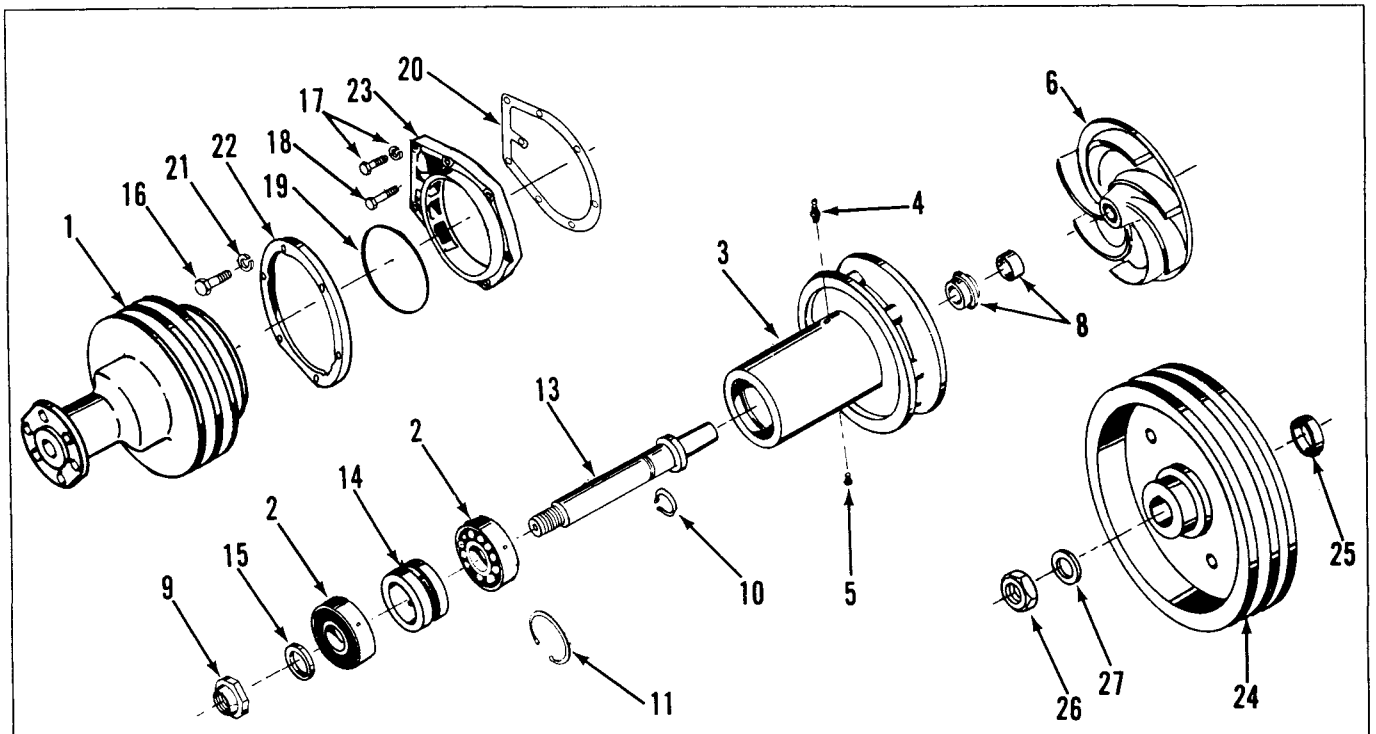

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		WATER PUMP NH-230, NHC-250	
	AR-04550	Pump, water (with pulley)	1
1	151156	Pulley, water pump	1
	AR-04548	Pump, water (less pulley)	1
2	185112	Bearing, ball	2
3	196830	Body, water pump	1
4	S-2268	Fitting, grease	1
5	191175	Fitting, relief	1
6	201766	Impeller	1
8	AR-12732	Seat + seal assembly	1
9	115508	Nut, huglock	1
10	112302	Ring, retaining	1
11	S-16255	Ring, snap	1
13	196828	Shaft, water pump	1
14	196826	Spacer, bearing	1
15	115550	Washer	1
		MOUNTING PARTS	
	172856	Belt	2
16	105831	Capscrew, pump	1
17	3010594	Capscrew and lockwasher (3/8" - 24 x 1 1/2")	2
18	106549	Capscrew, support (3/8" - 24 x 1 3/4")	6
19	130240	Gasket, pump	1
20	130226	Gasket, support	1
21	S-604	Lockwasher	6
22	193431	Ring, clamp	1
	108330	Spacer	6
23	130227	Support	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		DRIVE PULLEY NH-230, NHC-250	
24	AR-05820	Pulley, fan and water pump drive (190522)	1
25	190397	Sleeve, pulley	1
26	3012526	Locknut	1
27	194380	Washer, plain	1
	193136	Spacer	1

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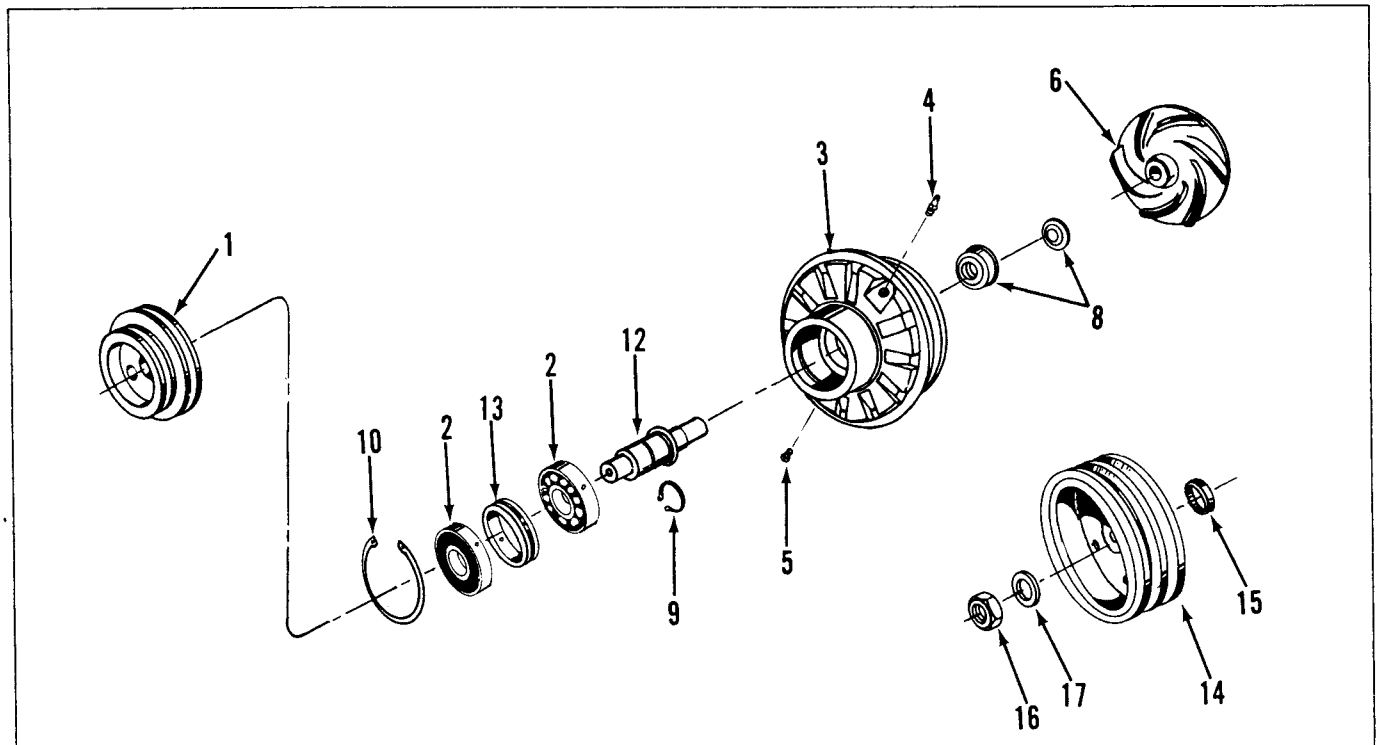

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		WATER PUMP N-855-P190, N-855-P220, N-855-P250	
	AR-04284	Pump, water (with pulley)	1
1	154966	Pulley, water pump	1
	AR-04283	Pump, water (less pulley)	1
2	115519	Bearing, water pump	2
3	196845	Body, water pump	1
4	S-2268	Fitting, grease	1
5	191175	Fitting, relief	1
6	201766	Impeller	1
8	AR-12732	Seat + seal assembly	1
9	112302	Ring, retaining	1
10	S-16255	Ring, snap	1
12	199410	Shaft, water pump	1
13	196844	Spacer, bearing	1
		DRIVE PULLEY N-855-P190, N-855-P220, N-855-P250	
14	AR-05021	Pulley, fan and water pump drive (190406)	1
15	190397	Sleeve, pulley	1
	178570	Belt, water pump drive	1
16	3012526	Locknut	1
17	194380	Washer, plain	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D

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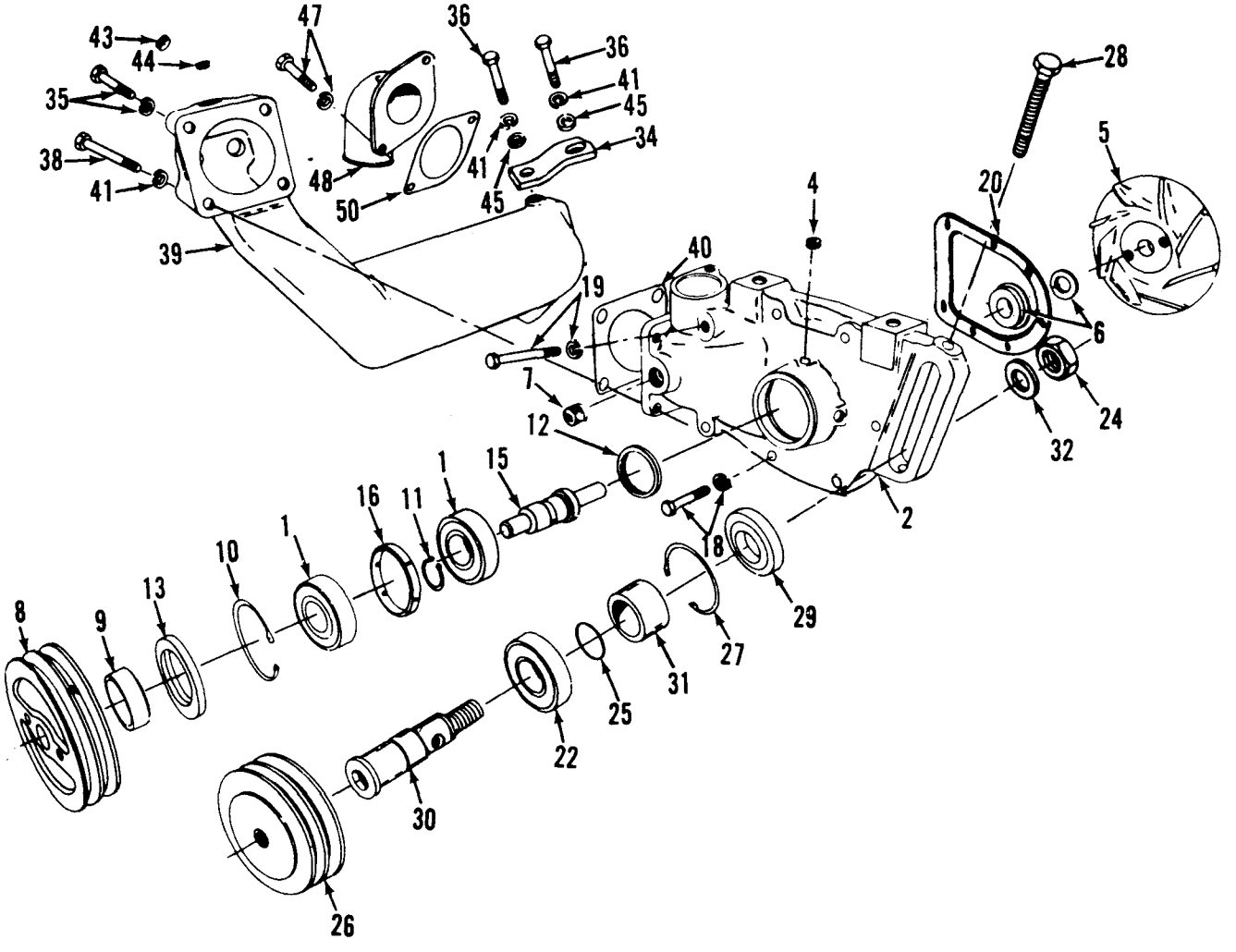
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REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		WATER PUMP AND IDLER N-855-C220, N-855-C235 N-855-L3, N-855-P235	
	AR-45348	Assembly, water pump and idler	1
	AR-45091	Pump, water	1
1	S-16073	Bearing, ball	2
2	219040	Body, water pump	1
4	S-911-B	Plug, pipe	2
5	3010646	Impeller	1
6	AR-12732	Seat and seal assembly	1
7	67622	Plug, pipe	1
8	3007075	Pulley, water pump (3005506)	1
9	203097	Sleeve, wear	1
10	S-16255	Ring, snap	1
11	112302	Ring, snap	1
12	203100	Seal, oil	1
13	203101	Seal, oil	1
15	3000889	Shaft, water pump	1
16	196844	Spacer, water pump bearing	1
	AR-08851	Idler, water pump	1
22	3010150	Bearing, ball	1
24	S-201	Nut	1
25	145506	O-ring	1
26	208118	Pulley, idler	1
27	S-16255	Ring, snap	1
29	203101	Seal, oil	1
30	208119	Shaft, idler	1
31	208120	Spacer, idler	1
32	213082	Washer	1
	S-965-E	Plug, pipe	1
28	182706	Screw, adjusting	1
		MOUNTING PARTS	
	215356	Belt, water pump	2
18	3012468	Capscrew and lockwasher (3/8" - 24 x 2 1/4")	5
19	3012469	Capscrew and lockwasher (3/8" - 24 x 3 1/4")	2
20	3002385	Gasket	1
		WATER TRANSFER CONNECTION N-855-C220, N-855-C235 N-855-L3, N-855-P235	
34	3004261	Bracket, water transfer connection	1
35	3012476	Capscrew and lockwasher (3/8" - 16 x 3")	2
36	S-130-A	Capscrew	2
39	216467	Connection, water transfer	1
40	208132	Gasket, water transfer	1
41	S-604	Lockwasher (3/8")	3
43	3008468	Plug, pipe (1/2")	1
44	3008470	Plug, pipe (1")	1
38	S-109	Capscrew (3/8" - 16 x 7/8")	1
45	108330	Washer	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		WATER INLET CONNECTION N-855-C220, N-855-C235 N-855-L3, N-855-P235	
	S-103-D	Capscrew (3/8" - 16 x 1 1/4")	1
47	3010595	Capscrew (3/8" - 16 x 1")	2
48	3012438	Connection, water inlet	1
50	3011931	Gasket	1

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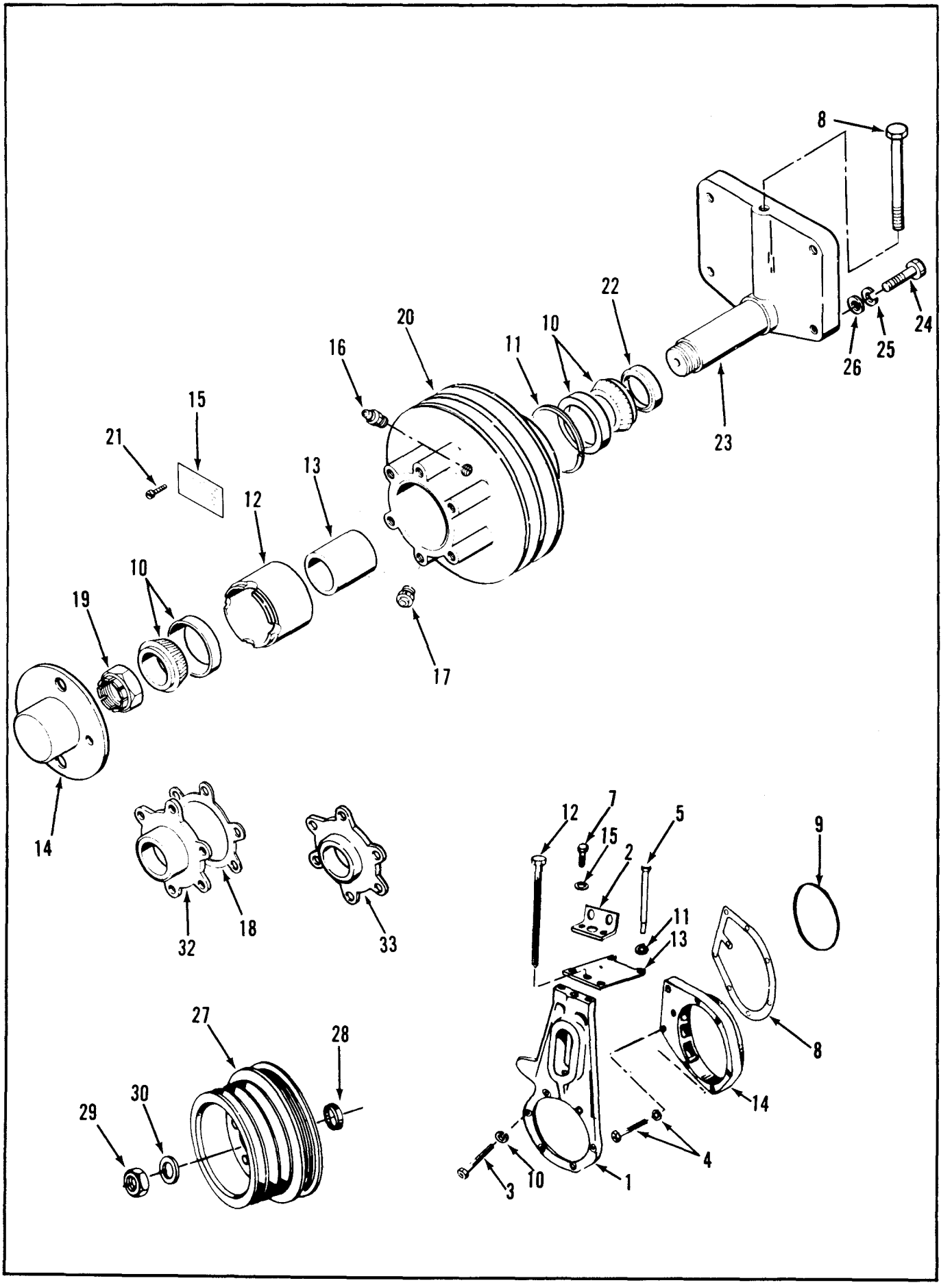
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REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		FAN BRACKET N-855-P190, N-855-P220, N-855-P250	
1	132150	Bracket, fan	1
2	70173	Bracket, radiator brace	1
3	105831	Capscrew	6
4	S-165	Capscrew	2
5	S-176	Capscrew	2
7	S-145	Capscrew	2
8	130226	Gasket, water pump support	1
9	130240	Gasket, water pump	1
10	S-604	Lockwasher	8
11	S-608	Lockwasher	2
12	66912-1-A	Screw, fan adjusting	1
13	131622	Support, fan bracket	1
14	130227	Support, water pump	1
15	S-670	Washer, plain	3
		FAN HUB N-855-P190, N-855-P220, N-855-P250	
	3013377	Hub, fan assembly	1
	3005370	Bearing, assembly	1
10	3001281	Bearing, roller	2
11	3001280	Ring, snap bearing	1
12	3002129	Spacer, bearing	1
13	217007	Spacer, inner	1
14	210886	Cover	1
15	210890	Decal, fan hub	1
16	S-2268	Fitting, grease	1
17	191175	Fitting, relief	1
18	3005592	Gasket	1
19	142176	Locknut	1
20	3002615	Pulley, fan hub	1
21	S-117	Screw, hex	2
22	200307	Seal, rectangular	1
23	201148	Shaft, fan hub	1
		MOUNTING PARTS	
24	S-105	Capscrew	4
25	S-604	Lockwasher	4
32	3005589	Spacer (All models except N-855-P220)	1
33	3005590	Spacer	1
26	117267	Washer	4
		ACCESSORY DRIVE PULLEY N-855-P190, N-855-P220, N-855-P250	
27	AR-05021	Pulley, drive (215993)	1
28	190397	Sleeve, pulley	1
		MOUNTING PARTS	
	134809	Belt, fan drive	2
29	3012526	Locknut	1
30	193136	Spacer	1

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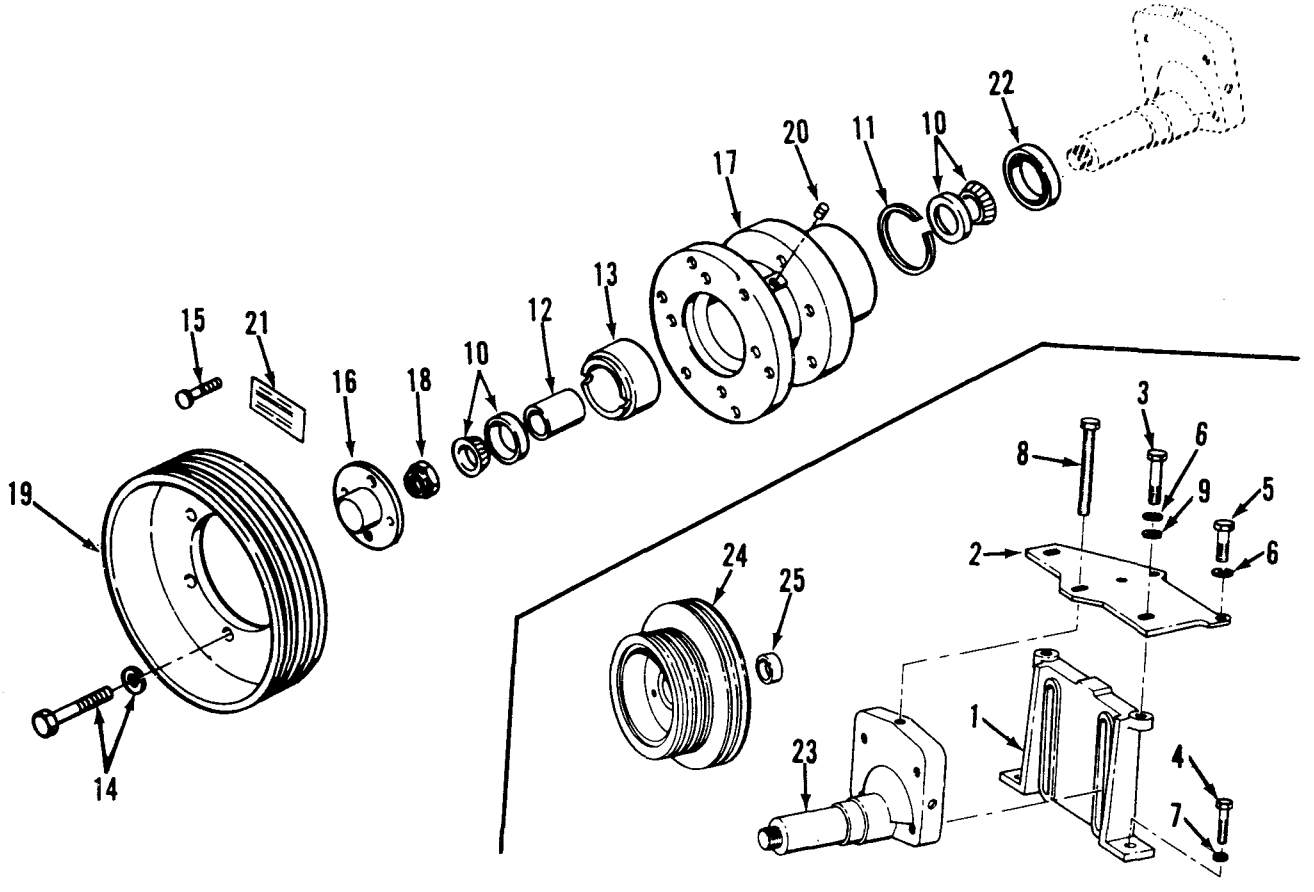
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REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		FAN BRACKET N-855-C220, N-855-C235, N-855-L3	
1	210235	Bracket, fan	1
2	217034	Brace, fan bracket	1
3	S-149-B	Capscrew	2
4	103009	Capscrew (7/16" - 14 x 1 1/4")	2
5	120516	Capscrew	2
6	S-608	Lockwasher (1/2")	2
7	S-610	Lockwasher (7/16")	2
8	66912-1A	Screw, fan adjusting	1
9	3000082	Washer (17/32")	2
		FAN HUB N-855-C220, N-855-C235 N-855-L3	
	3012662	Hub, fan assembly	1
	3005370	Bearing, assembly	1
10	3001281	Bearing, roller	2
11	3001280	Ring, snap	1
12	3002129	Spacer, bearing	1
13	217007	Spacer, inner	1
14	3010596	Capscrew and lockwasher (3/8" - 16 x 1 1/4")	6
15	70896	Capscrew	2
	200310	Cover, fan hub	1
16	210886	Cover, fan hub	1
21	210890	Decal	1
17	212485	Hub, fan	1
18	142176	Nut, luglock	1
19	212492	Pulley, fan hub	1
20	S-911-B	Plug, pipe (1/8")	2
	204864	Ring, retaining	1
22	200307	Seal, oil	1
23	201620	Shaft, fan hub	1
		MOUNTING PARTS	
	S-125	Capscrew (1/2" - 13 x 2")	4
	S-608	Lockwasher (1/2")	4
	117267	Washer, adjustment link	4
	3005589	Spacer, fan pilot	1
		FAN SPACER N-855-C220, N-855-C235, N-855-L3	
	208081	Spacer, fan	1
		FAN DRIVE BELT N-855-C220, N-855-C235, N-855-L3	
	178662	Belt, fan drive	3
		DRIVE PULLEY N-855-C220, N-855-C235, N-855-L3	
24	AR-45215	Pulley, drive (216017)	1
25	190397	Sleeve, wear	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		Mounting Parts	
	3012526	Nut	1
	193136	Spacer	1
		FAN BRACKET N-855-P235	
1	208829	Bracket, fan	1
2	217034	Brace, fan	1
3	S-149-B	Capscrew	2
	S-172-A	Capscrew (3/8" - 16 x 1 1/8")	3
4	103009	Capscrew	2
5	120516	Capscrew	2
6	S-608	Lockwasher (1/2")	2
7	S-610	Lockwasher (7/16")	2
	S-285	Nut	1
	117267	Washer	2
9	3000082	Washer	2
		FAN HUB N-855-P235	
	3013362	Hub, fan assembly	1
	3005369	Bearing, assembly	1
10	3001281	Bearing, roller	2
11	3001280	Ring, snap	1
12	217011	Spacer, bearing	1
13	217008	Spacer, inner	1
	S-117	Capscrew (3/8" - 16 x 3/4")	2
16	210886	Cover, fan hub	1
21	210890	Decal	1
18	142176	Nut, lock	1
20	S-911-B	Plug, pipe (1/8")	2
19	211866	Pulley, fan hub	1
22	200307	Seal, oil	1
	201146	Shaft, fan hub	1
		ACCESSORY DRIVE PULLEY N-855-P235	
24	AR-09016	Pulley, drive (208831)	1
25	190397	Sleeve, wear	1
		MOUNTING PARTS	
	3012526	Nut	1
	193136	Spacer	1

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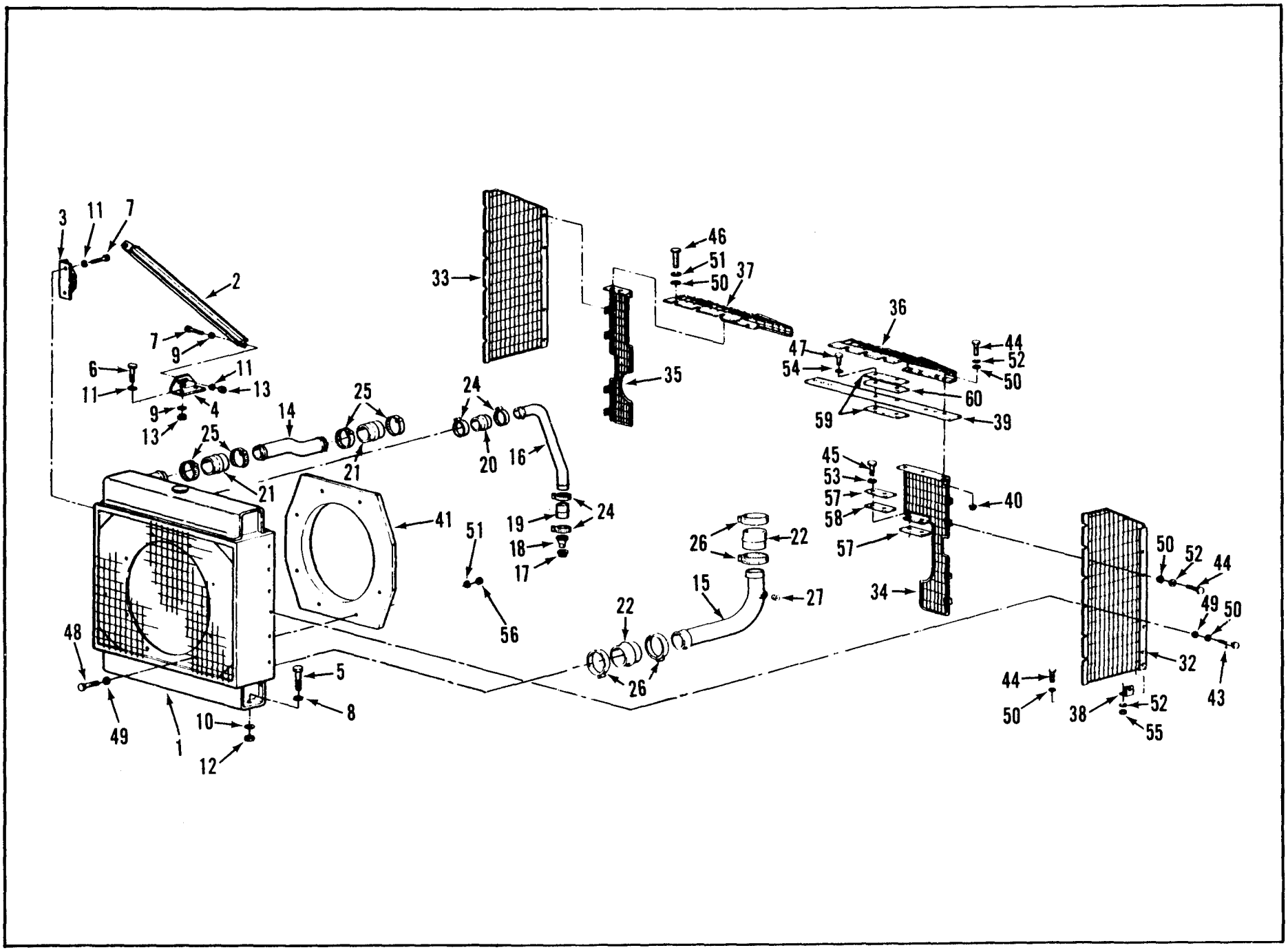
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REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		RADIATOR N-855-P235	
1	3000277	Assembly, radiator	1
2	3000256	Support, radiator	2
3	3000257	Bracket, upper radiator support	2
4	3000258	Bracket, lower radiator support	2
		MOUNTING PARTS	
5	S-113	Capscrew	4
6	3011715	Capscrew	4
7	S-112	Capscrew	12
8	S-670	Washer, plain	4
9	S-602	Washer, plain	12
10	S-608	Lockwasher	4
11	S-604	Lockwasher	16
12	S-200	Nut	4
13	S-223	Nut	12
		WATER TUBES	
		All Models	
14	3000285	Tube, water outlet	1
15	3000260	Assembly, water inlet tube	1
16	3000322	Tube, water make up	1
		MOUNTING PARTS	
17	S-904-A	Bushing, pipe	1
18	S-932-B	Nipple, pipe	1
19	61554	Hose	1
20	200517	Hose	1
21	67185	Hose	2
22	3008838	Hose	2
	AS0502600SS	Hose	1
24	43828-A	Clamp, hose	4
25	43828-D	Clamp, hose	4
26	43828-F	Clamp, hose	4
27	3008470	Pipe, plug	1
	120437	Elbow	1
	143950	Adapter, flexible hose	1
	201351	Strap, binding	1
	3007600	Tag, warning	1
		FAN GUARD	
		All Models	
32	3000310	Guard, fan (fuel pump side)	1
33	3000319	Guard, fan (exhaust side)	1
34	3000311	Guard, rear fan (fuel pump side)	1
35	3000320	Guard, rear fan (exhaust side)	1
36	3000309	Guard, fan (top, fuel pump side)	1
37	3000318	Guard, fan (top, exhaust side)	1
38	3000316	Clip, fan guard mounting	2
39	3000323	Bracket, fan guard mounting	1
40	3001171	Nut, spotweld	3
41	212294	Shroud, fan (N-855)	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		MOUNTING PARTS	
43	S-112	Capscrew	10
44	S-168-C	Capscrew	22
45	S-113	Capscrew	2
46	S-117	Capscrew	6
47	S-140	Capscrew	2
48	S-109	Capscrew	8
49	S-602	Washer, plain	24
50	S-631	Washer, plain	22
51	S-604	Lockwasher	24
52	S-600	Lockwasher	22
53	S-608	Lockwasher	2
54	S-610	Lockwasher	2
55	S-224	Nut	4
56	S-223	Nut	8
		FAN	
	203646	Fan	1
	66440-1	Spacer	
	3010595	Capscrew	1
		FAN DRIVE BELT	
	178682	Belt, fan drive	2
57	3000366	Isolator, rubber	2
58	3000367	Plate, isolator	1
59	3000363	Isolator, rubber	2
60	3000361	Plate, isolator	1

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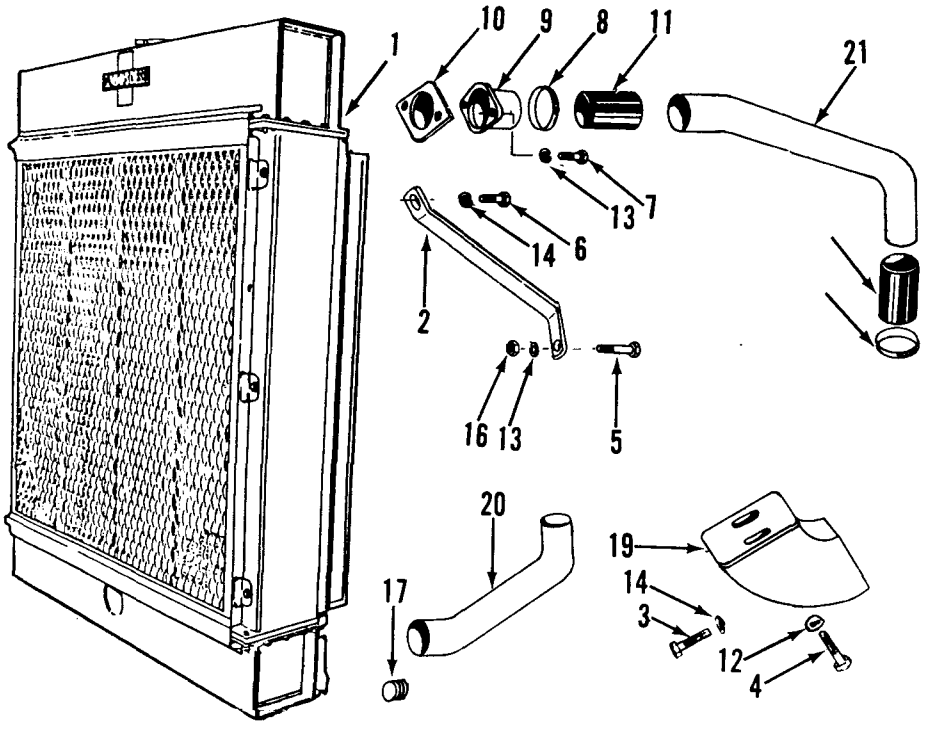

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		RADIATOR N-855-P190, N-855-P220, N-855-P250	
1	3016351	Assembly, radiator	1
	11172	Shroud, radiator	1
		MOUNTING PARTS	
	116935	Adapter, hose	2
2	70173	Bracket	1
4	S-127-C	Capscrew (7/16" - 14 x 3 3/4")	4
3	S-125	Capscrew (1/2" - 13 x 2")	8
	69793	Capscrew (3/8" - 24 x 3/4")	1
5	S-145	Capscrew (1/2" - 13 x 1 1/4")	2
6	S-169	Capscrew (1/2" - 13 x 1")	2
7	S-172-B	Capscrew (3/8" - 16 x 1 1/8")	4
8	43828-D	Clamp, hose	8
8	43828-A	Clamp, hose	4
	107460	Clamp, hose	1
9	68270	Connection, radiator	2
	S-904-A	Bushing, pipe	1
10	9221	Gasket, water inlet connection	2
	200517	Hose	2
11	67185	Hose	4
	AS0502800SS	Hose	1
12	S-603	Lockwasher (5/8")	4
13	S-604	Lockwasher (3/8")	5
	S-605	Lockwasher (5/16")	6
14	S-608	Lockwasher (1/2")	12
	S-932-B	Nipple, pipe	1
16	S-200	Nut (1/2")	2
	S-205	Nut	1
17	3008469	Plug, pipe (3/4")	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		MOUNTING PARTS (Cont.d)	
	S-107	Screw, hex (5/16" - 18 x 3/4")	6
	201351	Strap, binding	2
19	43585	Support, radiator	2
	211235	Tube, radiator lower	1
20	3000260	Tube, water inlet	1
21	102228	Tube, water outlet	1
	208765	Tube, filler	1
	S-602	Washer, plain (13/32")	1
	S-626	Washer, flat	6
		FAN	
	S-105	Capscrew (3/8" - 16 x 3 1/2")	6
	215184	Fan (N-855-P220, N-855-P250)	1
	20961	Fan (N-855-P190)	1
	S-604	Lockwasher (3/8")	6
	67012-1	Spacer	2
		FAN GUARD	
	43727	Guard, fan	1
	S-114	Capscrew (1/4" - 20 x 3/4")	8
	S-631	Lockwasher (9/32")	8
	S-600	Washer, plain (1/4")	8
		FAN DRIVE BELT	
	178617	Belt, fan drive	2

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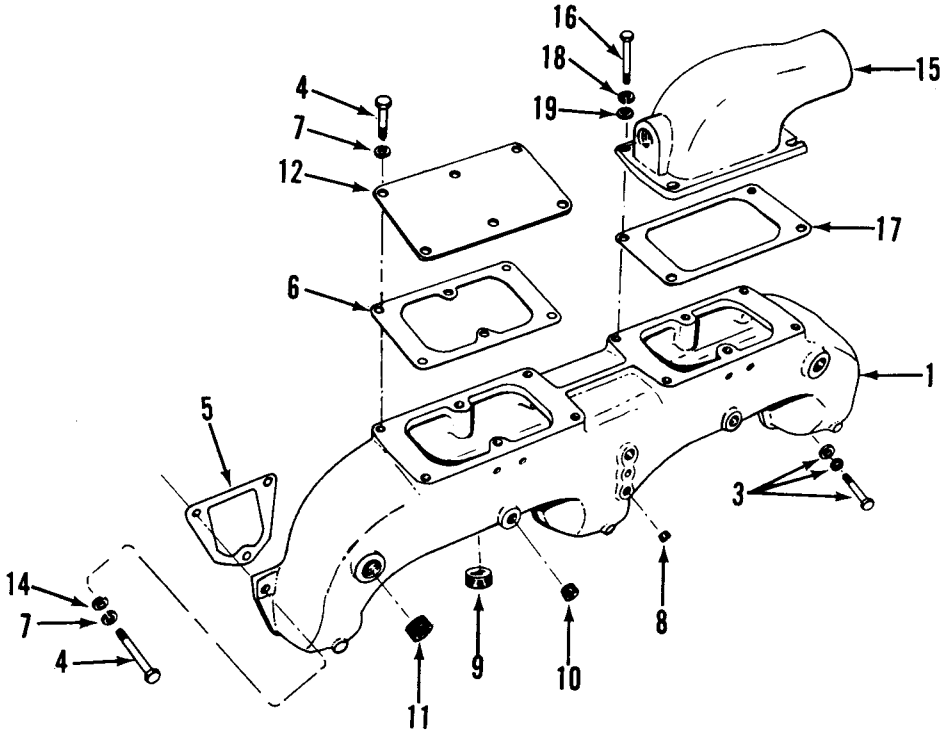

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		INTAKE MANIFOLD	
		All Models except: N-855-P190, N-855-P220, N-855-P250	
1	141761	Manifold, air intake	1
3	3011716	Capscrew (3/8" - 16 x 1 3/8")	3
4	S-112	Capscrew (3/8" - 16 x 1")	12
5	3008591	Gasket	3
6	149819	Gasket	1
7	S-604	Lockwasher (3/8")	12
8	S-911-B	Plug, pipe (1/8")	1
9	S-962	Plug, pipe (1")	1
10	S-910-B	Plug, pipe (1/4")	3
11	S-915-A	Plug, pipe (1/2")	2
12	144257	Plate, cover	1
14	S-602	Washer plain	6
		NT-855-P190, N-855-P220, N-855-P250	
		Same as above except:	
	141895	Manifold, air intake	1
		AIR INTAKE CONNECTION	
		All Models except: N-855-P190, N-855-P220, N-855-P250	
15	135893	Connection, intake	1
16	3011715	Capscrew (3/8" - 16 x 1 3/16")	4
17	3012972	Gasket	1
18	S-604	Lockwasher (3/8")	4
19	108330	Washer (13/32")	2
	S-962	Plug, pipe (1")	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		N-855-P190, N-855-P220, N-855-P250	
		Same as above except:	
	155250	Connection, intake	1
	3012972	Gasket	1
	S-901	Plug, pipe	1
	3011715	Screw and washer (3/8" - 16 x 1 3/16")	4
		OPTIONAL	
		GLOW PLUG	
	125880	Adapter, nozzle	1
	139474	Decal	1
	68139	Elbow, hose	1
	67946	Gasket, copper	1
	68812	Glow plug	1
	118273	Gasket, glow plug	1
	68178-1	Lockplate, nozzle	1
	69215	Nozzle	1
	68061-A	O-ring	1
	43468	Pin, groove	1
	100046	Primer, hand	1
	68813	Resistor, preheater	1
	S-1213	Screw, resistor	2
	S-600	Lockwasher (1/4")	2
	S-224	Nut (1/4")	2

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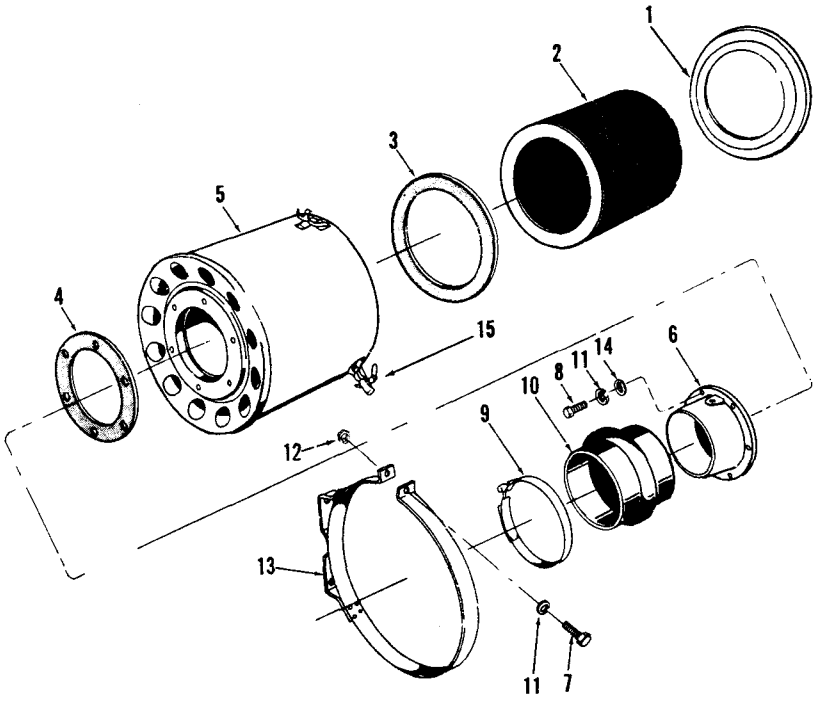

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		AIR CLEANER N-855-P190, N-855-P220, N-855-P250	
	106833	Cleaner, air (Dry Type)	1
1	107135	Cover, shell	1
2	AF-253	Element	1
3	107136	Gasket, element	1
4	107137	Gasket, flange	1
5	107134	Shell, cleaner	1
15	122121	Spring	3
		MOUNTING PARTS	
6	106126	Adapter, air cleaner	1
	157670	Bracket	1
7	S-111	Capscrew (5/16" - 18 x 1 1/2")	2
	S-117	Capscrew (3/8" - 16 x 3/4")	4
	S-186-A	Capscrew	1
8	S-115	Capscrew (5/16" - 18 x 7/8")	6
9	125741	Clamp, "T" bolt	4
	105313	Elbow	1
10	103808	Hose, flexible	1
	S-603	Lockwasher (5/8")	1
	S-604	Lockwasher (3/8")	4
11	S-605	Lockwasher (5/16")	8
12	S-221	Nut (5/16")	2
	S-223	Nut (3/8")	4
13	105916	Strap, air cleaner	2
	180112	Tube, air inlet	1
	S-658	Washer, plain (5/8")	1
14	S-626	Washer, plain	6

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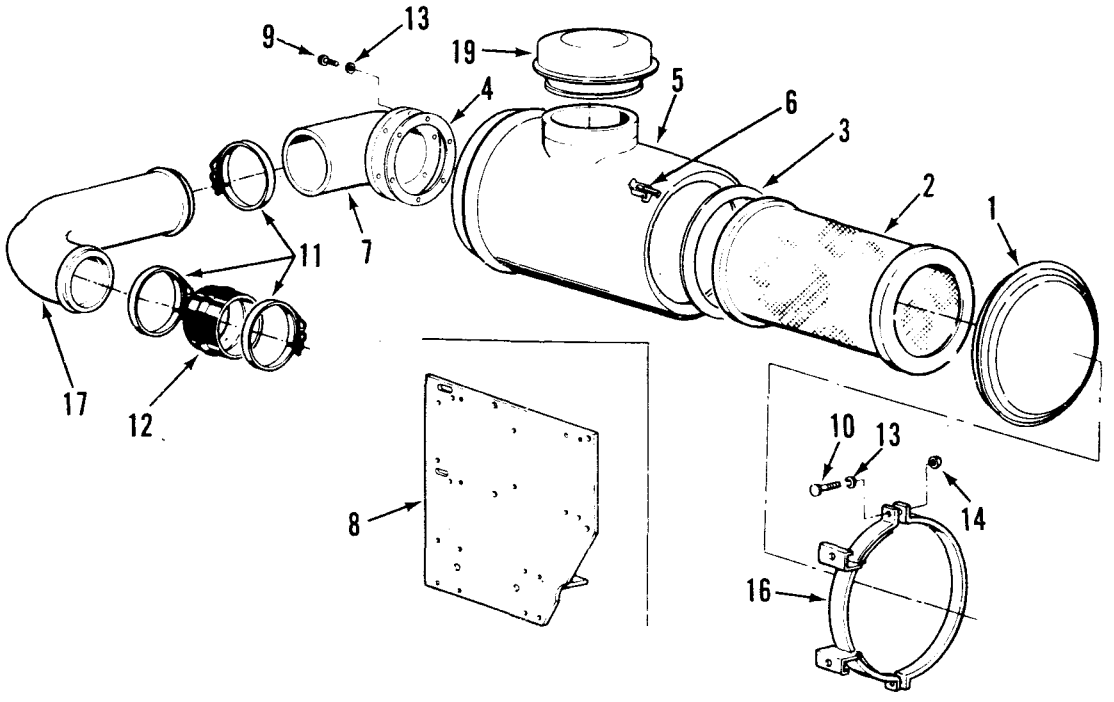

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		AIR CLEANER N-855-P235	
	106832	Cleaner, air	1
1	107135	Cover	1
2	3001690	Element	1
3	107136	Gasket, element	1
4	107137	Gasket, flange	1
5	107139	Shell	1
6	122121	Spring	3
		MOUNTING PARTS	
7	105402	Adapter	1
8	3000289	Bracket	1
10	S-112	Capscrew (3/8" - 16 x 1")	4
9	S-102	Capscrew (5/16" - 18 x 1")	6
	S-186-A	Capscrew	2
	108605	Capscrew (1/2" - 13 x 5 1/2")	2
11	125741	Clamp, hose	4
12	103808	Hose	2
13	S-604	Lockwasher (3/8")	4
	S-603	Lockwasher (5/8")	2
	S-605	Lockwasher (5/16")	6
	S-608	Lockwasher (1/2")	2
14	S-223	Nut (3/8")	4
16	105916	Strap	2
17	3000296	Tube, air cleaner	1
	S-658	Washer (5/8")	2
19	195873	Cap, air cleaner	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D

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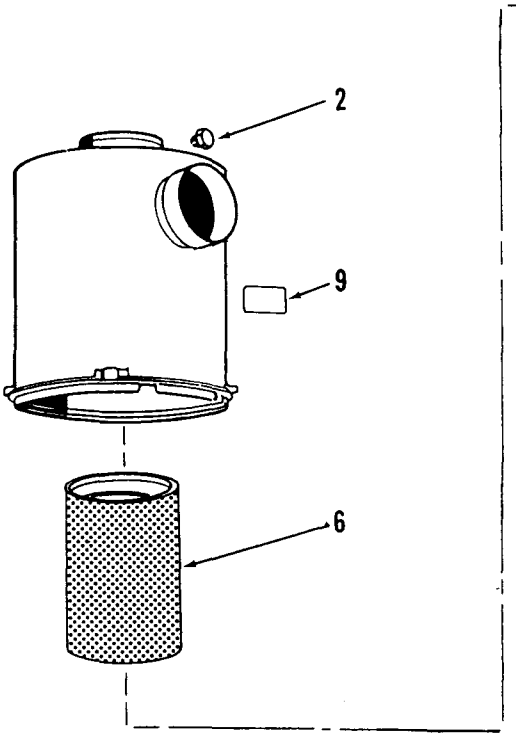
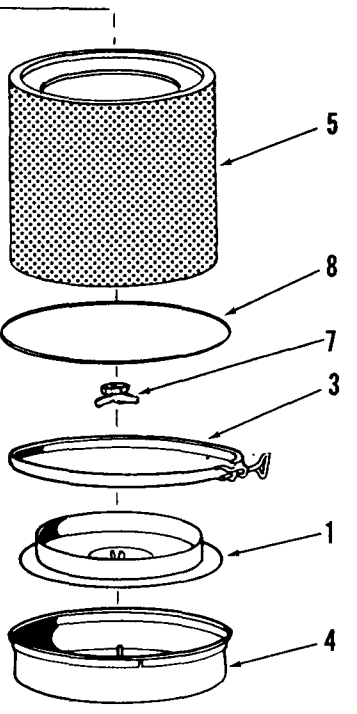
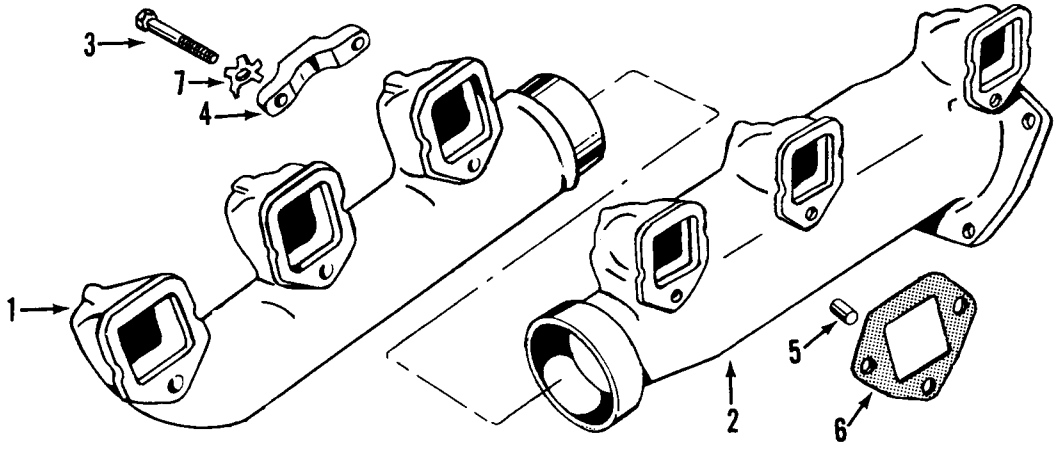


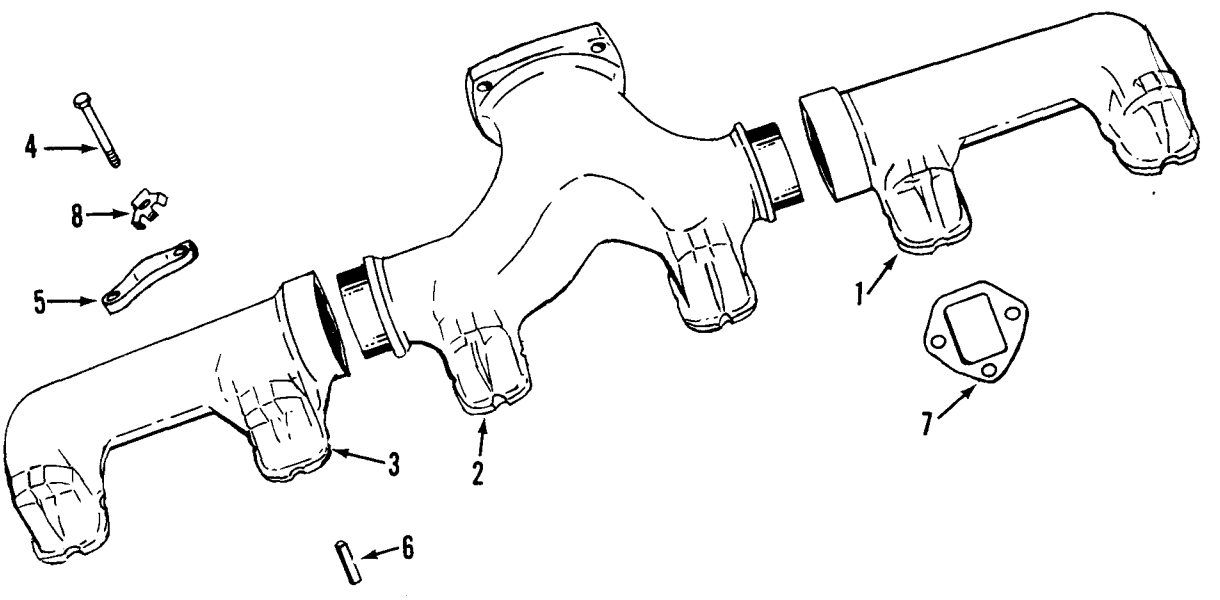


REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		AIR CLEANER N-855-C220, N-855-C235	
	204637	Cleaner, air	1
1	204641	Baffle	1
2	150768	Cap, restriction	1
3	150771	Clamp, cup	1
4	204642	Cup assembly	1
5	204638	Element, primary	1
6	204639	Element, safety	1
7	204635	Nut	1
8	133763	O-ring	1
9	204643	Plate	1
		MOUNTING PARTS	
	S-111	Capscrew	2
	125741	Clamp, "T" bolt	3
1	195878	Cap	1
	152026	Clamp, "T" bolt	1
	103808	Hose, rubber hump	2
	S-605	Lockwasher	2
	S-221	Nut	2
	151614	Reducer	1
	197220	Strap	2

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D



REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.	REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		EXHAUST MANIFOLD NH-230, NHC-250					
1	214705	Manifold, exhaust (front)	1				
2	185586	Manifold, exhaust (rear)	1				
3	200908	Capscrew	12				
4	200919	Clamp	6				
5	105199	Dowel	6				
6	142234	Gasket	6				
7	114638	Lockplate	12				



REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		EXHAUST MANIFOLD	
		All Models except: NH-230, NHC-250	
1	213317	Manifold, exhaust (front)	1
2	133027	Manifold, exhaust (center)	1
3	194925	Manifold, exhaust (rear)	1
4	200908	Capscrew	12
5	200919	Clamp	6
6	105199	Dowel	6
7	142234	Gasket	6
8	114638	Lockplate	12
		N-855-P190, N-855-P220, N-855-P235, N-855-P250	
	ADD		
	62543	Flange, exhaust	1
	S-160-B	Capscrew (1/2" - 20 x 2 1/2")	4
	139266	Gasket, exhaust flange	1
	S-267	Nut (1/2")	4

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D

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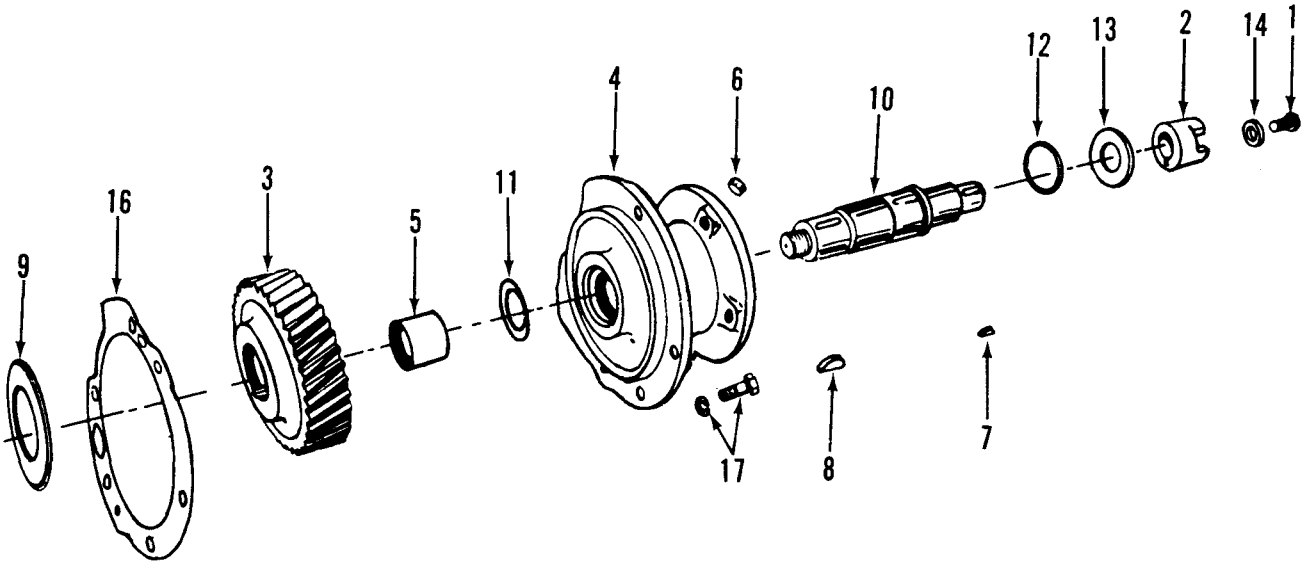
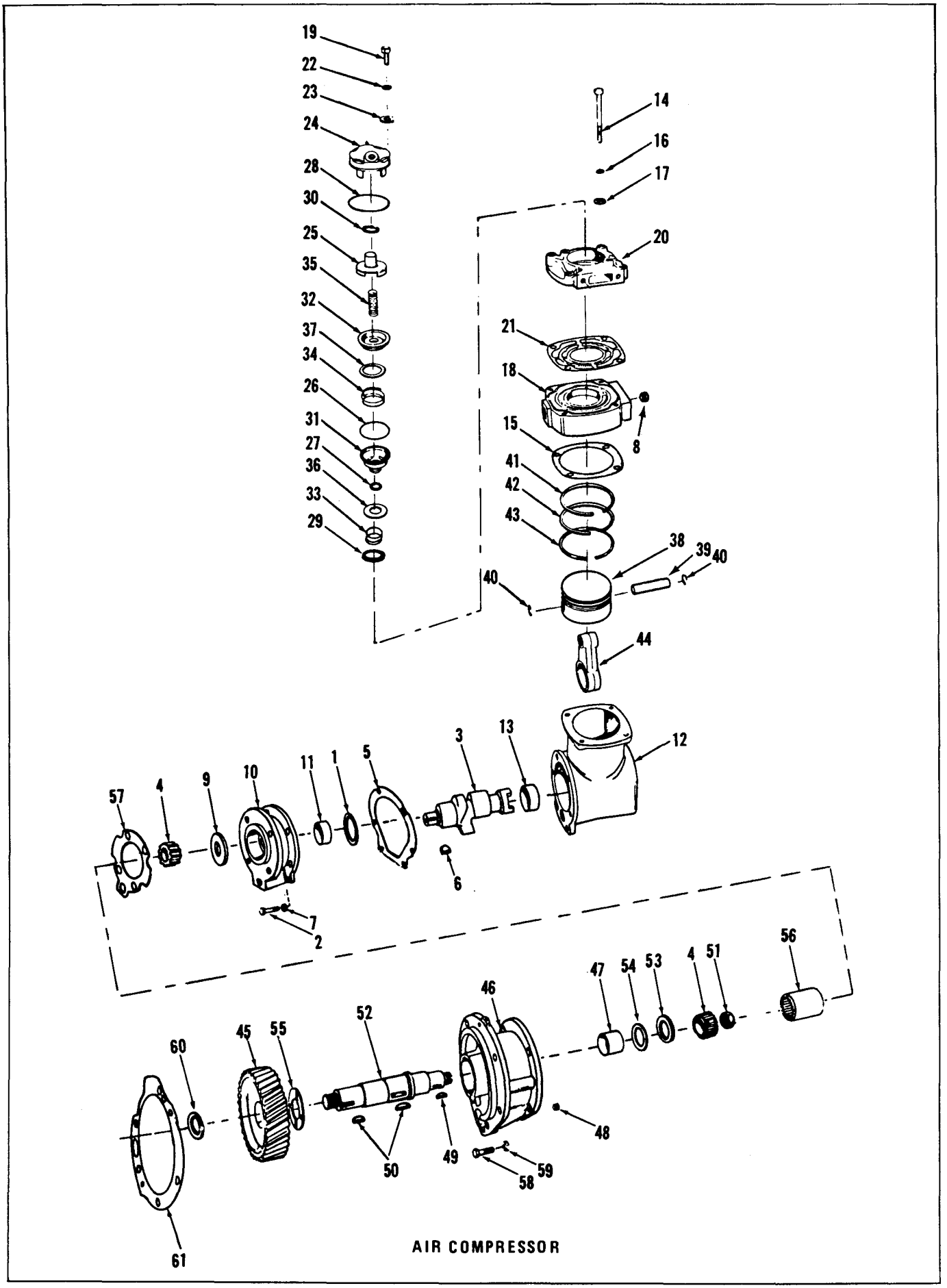


REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.	REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		FUEL PUMP DRIVE					
		All Models except: NH-230, NHC-250					
	3005129	Drive, fuel pump	1				
1	129510	Capscrew	1				
2	3000175	Coupling	1				
3	121933	Gear, drive	1				
4	AR-45728	Housing (3002170)	1				
5	116391	Bushing, housing	1				
6	S-911-B	Plug, pipe (1/8")	2				
7	69550	Key, shaft	2				
8	S-316	Key, shaft	1				
10	3000171	Shaft, drive	1				
11	116388	Washer, thrust	1				
12	116389	Washer, thrust	1				
13	3014103	Washer, clamping	1				
14	170664	Washer	1				
16	200809	Gasket	1				
17	3010590	Lockwasher assembly (7/16" - 20 x 1 1/8")	5				
9	3200287	Slinger	1				
	3010919	Pin, roll	2				

PARTS INDENTED ARE INCLUDED IN THE PART UNDER WHICH THEY ARE INDENTED



AIR COMPRESSOR

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		AIR COMPRESSOR - COUPLING DRIVEN NH-230, NHC-250	
	3018527	Compressor, air	1
1	188040	Bearing, thrust	A/R
1	188042	Bearing, thrust .002" oversize	A/R
1	188044	Bearing, thrust .004" oversize	A/R
2	3010596	Capscrew (3/8" - 16 x 1 1/4")	4
3	AR-10922	Crankshaft, compressor (3000167)	1
4	3000174	Coupling, half	1
5	176027	Gasket, support	1
	139761	Plug, pipe	1
	S-965-E	Plug, pipe	1
8	3008468	Plug, pipe (1/2")	1
9	211622	Washer, thrust	1
10	3005152	Support	1
12	BM-98685	Crankcase (176025)	1
13	147610	Bushing, crankshaft	1
14	S-155-A	Capscrew	4
15	154018	Gasket	1
16	S-605	Lockwasher (5/16")	4
	136403	Nameplate	1
	160047	Nameplate	1
	S-2286	Screw, nameplate	6
17	S-626	Washer, plain	4
18	AR-13108	Head, compressor (218793)	1
19	S-115	Capscrew (5/16" - 18 x 7/8")	2
20	153964	Cover	1
21	154996	Gasket	1
22	S-605	Lockwasher (5/16")	1
23	109557	Washer	2
	AR-04154	Valve assembly	1
24	185847	Body, unloader valve	1
25	191037	Cap, unloader	1
26	211315	O-ring, intake valve	1
27	128085	O-ring, exhaust valve	1
28	128086	O-ring, unloader valve	1
29	183429	Plate, wear	1
30	127936	Seal, unloader cap	1
31	144714	Seat, exhaust valve	1
32	145028	Seat, intake valve	1
33	128080	Spring, exhaust valve	1
34	190334	Spring, intake valve	1
35	217557	Spring, unloader valve	1
36	127940	Valve, exhaust	1
37	144948	Valve, intake	1
	BM-77410	Piston assembly	1
38	165430	Piston	1
39	119810	Pin	1
40	119859	Ring, snap	2
44	3011900	Rod, assembly	1
	AR-73350	Ring set	1
41	650330	Ring, compression	1
42	187350	Ring, compression	1
43	180810	Ring, oil control	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		MOUNTING PARTS	
	202356	Bracket, compressor support	1
	S-904-A	Bushing, pipe	1
	S-120-A	Capscrew (3/8" - 24 x 7/8")	1
	212752	Capscrew	1
	S-102	Capscrew (5/16" - 18 x 1")	1
	S-111	Capscrew (5/16" - 18 x 1 1/2")	1
	103009	Capscrew (7/16" - 14 x 1 1/4")	4
	206326	Capscrew	4
56	199349	Coupling, drive	1
	S-1002-A	Connector, flexible tube	1
	196281	Connection, air inlet	1
	43828-A	Clamp, hose	4
	S-1005-A	Elbow	3
57	3005962	Gasket, housing to support	1
	200817	Gasket, fuel pump to air compressor	1
	157911	Gasket, air intake connection	1
	61554	Hose	2
	S-604	Lockwasher (3/8")	3
	S-605	Lockwasher (5/16")	2
	S-610	Lockwasher (7/16")	8
	S-932-B	Nipple, pipe	1
	204904	Tube, air supply	1
	204897	Tube, water inlet	1
	204899	Tube, water outlet	1
	S-602	Washer, plain (13/32")	3
	S-626	Washer, plain	2
	S-622	Washer, plain (15/32")	4
		ACCESSORY DRIVE	
	3005136	Drive, accessory	1
	3000173	Capscrew	1
4	3000174	Coupling, half	1
45	142689	Gear	1
	3010919	Pin, roll	1
46	AR-45724	Housing (3002171)	1
47	116391	Bearing	1
48	S-911-B	Plug, pipe (1/8")	2
49	S-316	Key, crankshaft	1
50	69550	Key, crankshaft	2
51	191517	Nut	1
52	3000171	Shaft	1
53	3014103	Washer, clamping	1
54	116389	Washer, thrust	1
55	116388	Washer, thrust	1
	170664	Washer, plain	1
		MOUNTING PARTS	
58	3010590	Capscrew and lockwasher (7/16" - 20 x 1 1/8")	5
50	69550	Key	1
61	200809	Gasket	1
60	3008947	Seal	1
	3010919	Pin, roll	1

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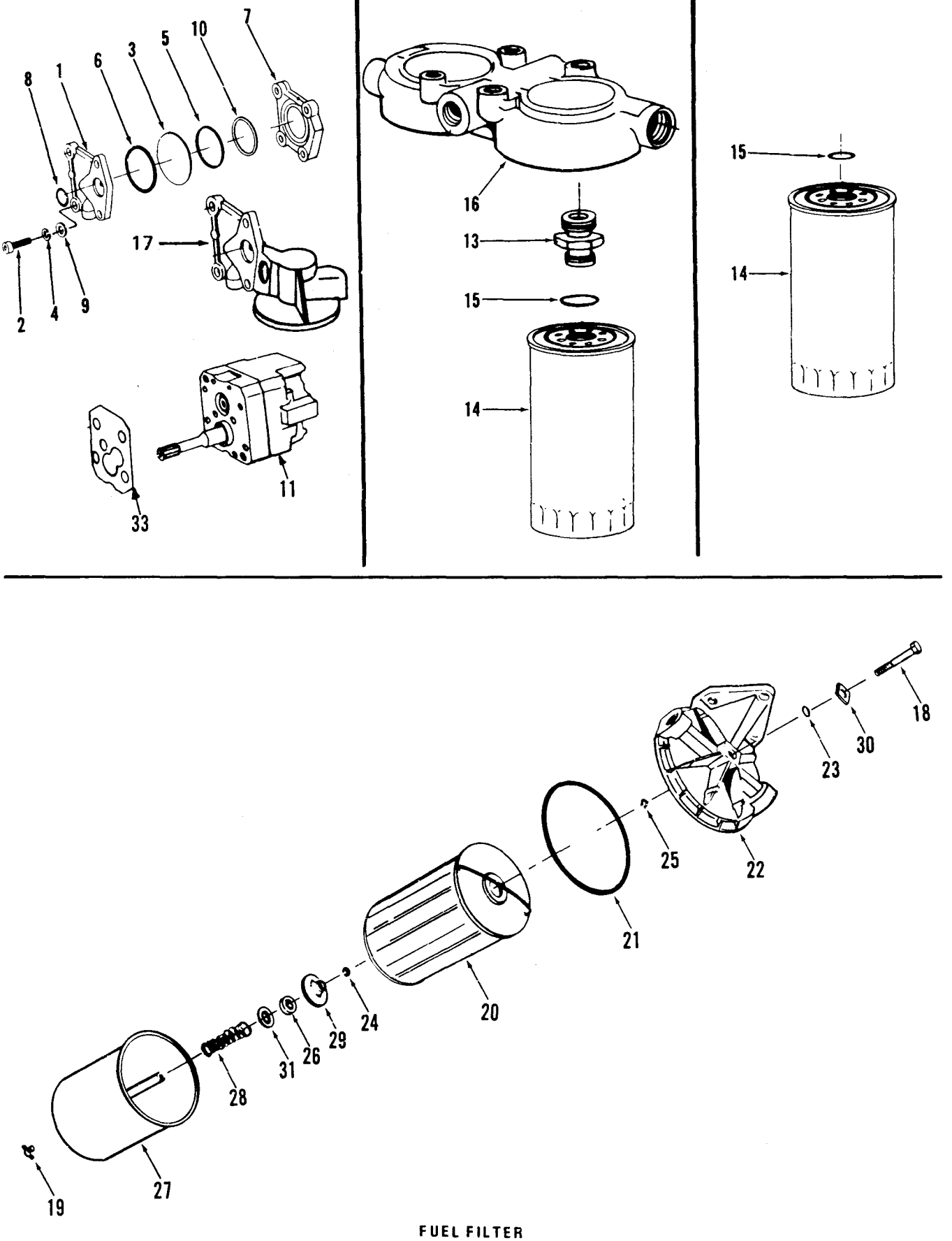
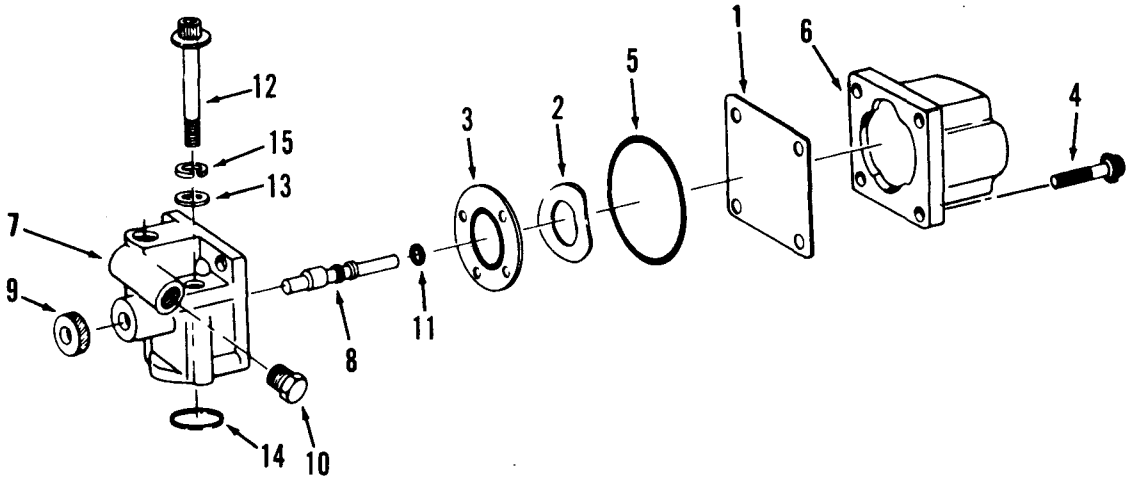


FUEL FILTER

P Application

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		PT FUEL SYSTEM	
		Each Cummins PT Fuel Pump is calibrated to obtain the best performance and fuel economy for your engine. Your Cummins Distributor or Dealer has the special tools required for complete rebuild and calibration. **Caution:** Do not disturb the fuel pressure settings or the throttle screw settings, as serious damage to your engine may result.	
		Only PT Fuel System parts which can be replaced without pump calibration are listed here. Your Cummins Distributor will record the specific part number of your complete PT Fuel Pump in the front of this catalog.	
		FUEL PUMP DAMPER	
		All Models except: NH-230, NHC-250	
	BM-76340	Damper, fuel pump	1
1	153336	Body, damper	1
2	S-105-C	Capscrew	2
3	202897	Diaphragm	1
4	S-600	Lockwasher (1/4")	2
5	139998	O-ring	1
6	100099	O-ring	1
7	153338	Plate	1
	133538	Screw, socket	2
8	151900	Seal, damper to gear pump	1
9	70704	Washer, plain	4
10	160514	Washer, nylon	1
	181466	Washer, lock	2
		FUEL FILTER, HEAD & DAMPER NH-230, NHC-250	
	AR-12219	Damper and head assembly	1
2	100129	Capscrew	1
2	133538	Capscrew	2
2	193838	Capscrew	1
4	181466	Lockwasher	4
5	213079	O-ring	1
6	151900	O-ring	1
17	215787	Head assembly (205451)	1
9	70704	Washer, plain	4
	154711	Filter, fuel	1
14	154709	Cartridge FF-105	1
15	255622	Gasket, cover	1
	129859	Connector, elbow	2
	AS1002840SS	Hose	1
		GEAR PUMP	
		All Models	
11	BM-97500	Gear, pump	1
33	210647	Gasket, pump	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		FUEL FILTER N-855-C220, N-855-C235, N-855-P235, N-855-L3	
	AR-12642	Filter, fuel	1
13	126516	Bolt, center	2
16	212013	Head, filter	1
15	255622	Seal, cartridge	2
14	156172	Cartridge	2
		MOUNTING PARTS	
	3003749	Bracket, fuel filter	1
	S-122-C	Capscrew (9/16" - 18 x 7/8")	2
	S-103-D	Capscrew (3/8" - 16 x 1 1/4")	4
	129859	Connector, elbow	1
	S-604	Lockwasher (3/8")	2
	S-609	Lockwasher (9/16")	2
	AS1001800SS	Hose	1
		FUEL FILTER	
		N-855-P190, N-855-P220, N-855-P250	
	151940	Filter, fuel	1
18	121960	Capscrew, head to shell	1
19	S-962-E	Cock, drain	1
	190707	Decal, filter	1
20	FF-108	Element	1
21	151881	Gasket, head to shell	1
22	251128	Head, filter	1
23	134736	O-ring, capscrew	1
24	135169	Ring, grip capscrew	1
25	251131	Ring, grip post	1
26	151884	Seal, pilot	1
27	251091	Shell and post	1
28	151885	Spring, filter	1
29	151920	Support, filter element	1
30	251081	Washer, capscrew	1
31	S-658	Washer, plain (5/8")	1
	129859	Connection, elbow	2
		MOUNTING PARTS	
	167221	Bracket, fuel filter	1
	137797	Capscrew	1
	S-108-A	Capscrew (7/16" - 20 x 1 3/4")	2
	3011716	Capscrew and lockwasher (3/8" - 16 x 1 3/8")	3
	AS1002400SS	Hose	1
	S-604	Lockwasher (3/8")	1
	S-610	Lockwasher (7/16")	2
	S-223	Nut (3/8")	3
	68368-B	Spacer	1
	64709	Spacer	2
	S-602	Washer, plain (13/32")	5
		MOUNTING PARTS N-855-P235	
	3011380	Bracket, fuel filter	1
	S-108-A	Capscrew (7/16" - 20 x 1 3/4")	2
	S-120-A	Capscrew (3/8" - 24 x 7/8")	1
	3010596	Capscrew (3/8" - 16 x 1 1/4")	4
	S-604	Lockwasher (3/8")	1
	S-610	Lockwasher (7/16")	2
	S-602	Washer, plain (13/32")	1
	129859	Elbow	1
	203850	Elbow	1
	AS1002200SS	Hose	1



REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		FUEL SHUT-OFF VALVE	
		All Models except: NH-230, NHC-250	
	AR-05535	Valve, solenoid (24 volt)	1
1	129839	Shield, fuel	1
2	129768	Spring	1
3	129827	Valve	1
4	187556	Capscrew, coil to housing	4
5	129888	O-ring, coil to housing	1
6	134074	Coil	1
	BM-65725	Housing, solenoid to valve	1
7	129826	Housing	1
8	3000266	Shaft, override	1
9	129838	Knob	1
10	70295	Plug, pipe	1
11	190876	O-ring	1
		NH-230, NHC-250	
		Same as above except:	
	OMIT		
	AR-05535	Valve, solenoid (24 volt)	
	134074	Coil	
	ADD		
	BM-69973	Valve, solenoid (12 volt)	1
	134072	Coil	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		MOUNTING PARTS	
		All Models	
12	S-189-C	Capscrew	2
13	67684	Washer, plain	2
14	154087	O-ring	1
15	181466	Lockwasher	2

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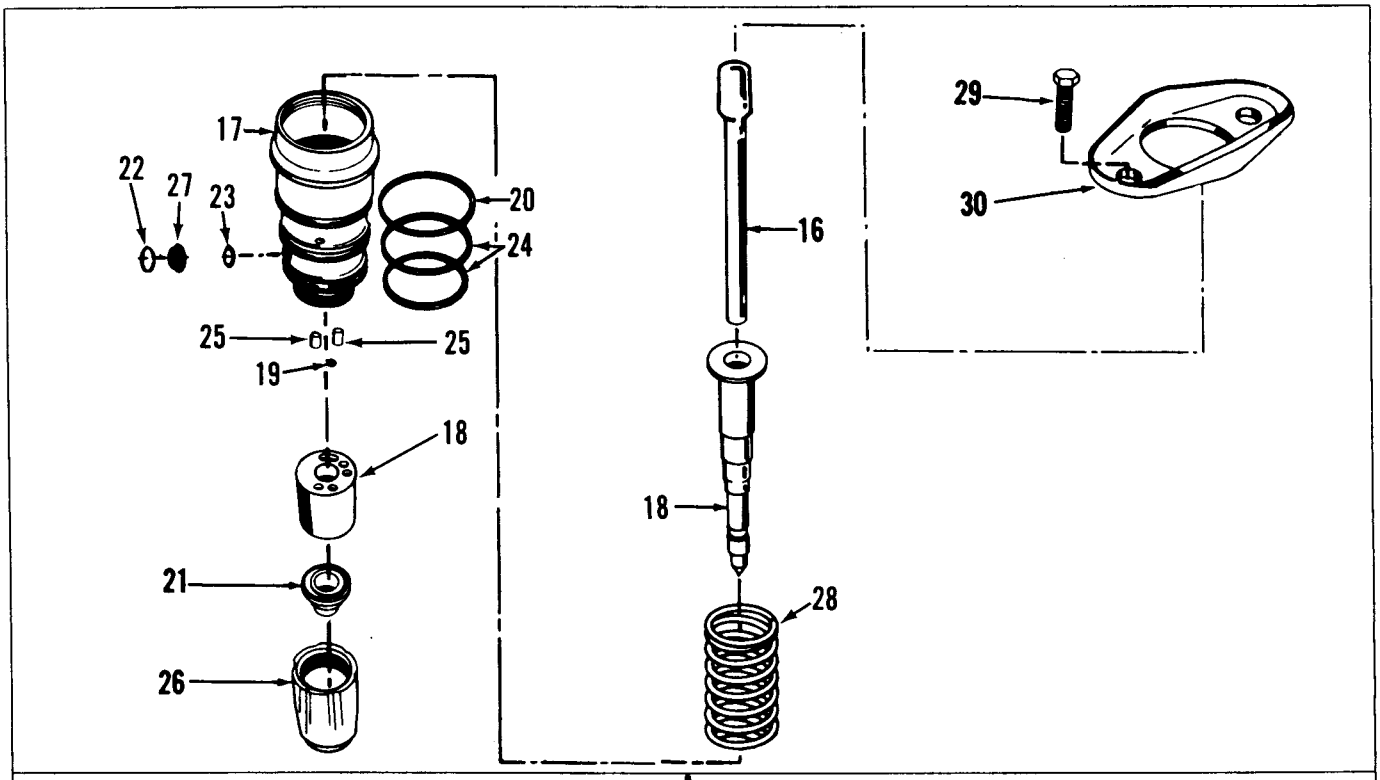
REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		FUEL TUBING NH-230, NHC-250	
	137796	Capscrew	2
	S-156	Capscrew	2
	70772	Capscrew, springtite	8
	3007025	Clamp, half	4
	180372	Clip, tube	2
	S-1027	Coupling, tube	1
	147100	Crossover, fuel	2
	181213	Elbow	2
	S-600	Lockwasher (1/4")	2
	S-604	Lockwasher (3/8")	2
	131026	O-ring	8
	203863	Tee, fuel by-pass	1
	216128	Tube, fuel supply	1
	3003582	Tube, fuel by-pass	1
	3003578	Tube, fuel drain	1
	215218	Support, fuel	2
	S-631	Washer, plain (9/32")	1
		N-855-C220, N-855-C235	
	203850	Adapter, straight	1
	147100	Crossover, fuel	2
	70772	Capscrew, springtite	8
	137796	Capscrew	2
	3007025	Clamp, half	4
	180372	Clip, tube	2
	S-1027	Coupling, tube	1
	181213	Elbow, tube	2
	S-600	Lockwasher (1/4")	2
	S-604	Lockwasher (3/8")	2
	131026	O-ring	8
	S-1315	Screw	2
	S-156	Screw	2
	3013166	Tube, fuel supply	1
	3003580	Tube, fuel by-pass	1
	3003578	Tube, fuel drain	1
	203863	Tee, fuel by-pass	1
	S-251	Nut	2
	215128	Support	2
	S-631	Washer, plain (9/32")	2
		N-855-P190, N-855-P220, N-855-P250	
	70772	Capscrew, springtite	8
	137796	Capscrew	2
	3007025	Clip, tube	2
	180372	Clip, tube	1
	S-1028	Coupling, tube	1
	147100	Crossover, fuel	2
	203848	Elbow, connector	1
	181213	Elbow, tube	2
	S-604	Lockwasher (3/8")	2
	131026	O-ring	8
	210554	Tube, fuel supply	1
	210003	Tube, fuel by-pass	1
	212978	Tube, fuel drain	1
	203862	Tee, fuel by-pass	1
	S-602	Washer, plain (13/32")	2
	S-923-E	Draincock	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		N-855-P235	
	70772	Capscrew, springtite	8
	137796	Capscrew	2
	3007025	Clamp, half	4
	180372	Clip, tube	2
	S-1027	Coupling, tube	1
	147100	Crossover, fuel	2
	203848	Elbow, connector	1
	181213	Elbow, tube	2
	S-604	Lockwasher (3/8")	2
	S-251	Nut	2
	131026	O-ring	8
	S-1315	Screw	2
	3013166	Tube, fuel supply	1
	3013197	Tube, fuel by-pass	1
	3013195	Tube, fuel drain	1
	203862	Tee, fuel by-pass	1
	S-631	Washer, plain (9/32")	2
	215218	Support	2



REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		INJECTOR	
		All Models except: N-855-P190	
	AR-40126	Injector	6
16	191916	Link, injector	6
	AR-40154	Injector (less link)	6
17	185139	Adapter	6
19	167157	Ball, check	6
21	208423	Cup	6
22	174299	Clip	6
23	173086	Gasket	6
20	101754	O-ring	6
24	193736	O-ring	12
25	203426	Pin, spirol	12
26	185138	Retainer, cup	6
27	3008706	Screen	6
28	166009	Spring	6
18	3011965	Coupling, plunger and barrel assembly	6
		N-855-P190	
		Same as above except:	
	3017324	Injector assembly	6
		MOUNTING PARTS	
29	165006	Capscrew	12
30	191218	Clamp, injector	6

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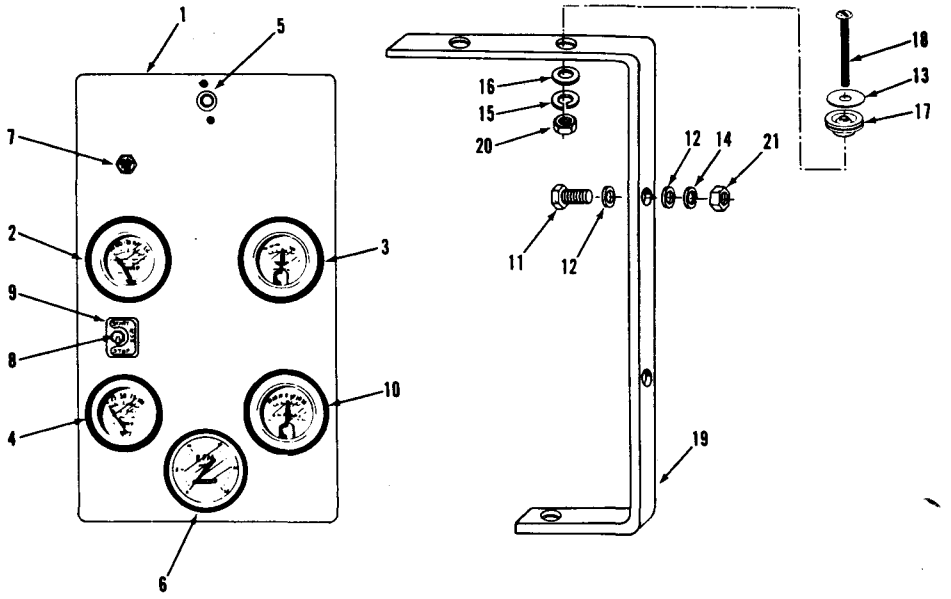

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		INSTRUMENT PANEL (Engine) N-855-P190, N-855-P220 N-855-P235, N-855-P250	
1	179056	Panel, instrument	1
	AS0401400MS	Hose	1
2	41627-R	Gauge, water temperature	1
3	44118	Gauge, oil temperature	1
	68139	Elbow, hose	1
	180371	Clamp, tube (P-235 only)	4
	180372	Clamp, tube (P-235 only)	1
4	66733	Gauge, oil pressure	1
	3011012	Plug, instrument panel	1
	69504	Screw, round head	2
5	69486	Breaker, circuit	1
	196893	Breaker, circuit (P235 only)	
	68880	Adapter, shock	1
	70310	Screw	6
6	113310	Hourmeter	1
7	66501	Switch, starter push	1
8	102057	Switch, starting	1
9	118367	Plate, indicator switch	1
	S-129	Capscrew (3/8" - 24 x 1")	2
10	66741	Ammeter	1
11	S-151-C	Capscrew (9/16" - 18 x 1")	4
12	S-602	Washer (13/32")	2
13	S-603-A	Washer	3
14	S-604	Lockwasher (3/8")	2
	S-609	Lockwasher (9/16")	4
15	S-607	Lockwasher (3/16")	3
16	102484	Washer, plain	3
17	102486	Isolator, vibration	3
18	108078	Screw	3
19	170939	Bracket, instrument panel (P235 only)	1
20	216198	Locknut	3
	3000281	Support, instrument panel (P235 only)	1

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		INSTRUMENT PANEL (Engine) (Cont'd.)	
	S-1047-A	Elbow	1
	S-1059	Coupling, tube	1
	213229	Capacitor	1
21	S-223	Nut (3/8")	1
		TERMINAL BLOCK N-855-P190, N-855-P220, N-855-P250	
	218901	Block, terminal	1
	175617	Bracket	1
	218902	Marker	1
	S-257	Nut	2
	S-1319	Screw	2
	108078	Screw	2
	S-607	Washer (3/16")	2
	103089	Washer	2
		N-855-P235	
	21890	Block, terminal	1
	3000283	Bracket	1
	218902	Marker	1
	S-224	Nut (1/4")	4
	S-105	Screw (3/8" - 16 x 3 1/2")	4
	S-1330	Screw	2
	S-600	Washer (1/4")	4
	S-607	Washer (3/16")	2
		ENGINE WIRING N-855-P235	
	3010990	Wiring, engine	1
	3010987	Wiring, engine	1
	3010988	Wiring, engine	1
	3010989	Wiring, engine	1
	3010991	Wiring, engine	1

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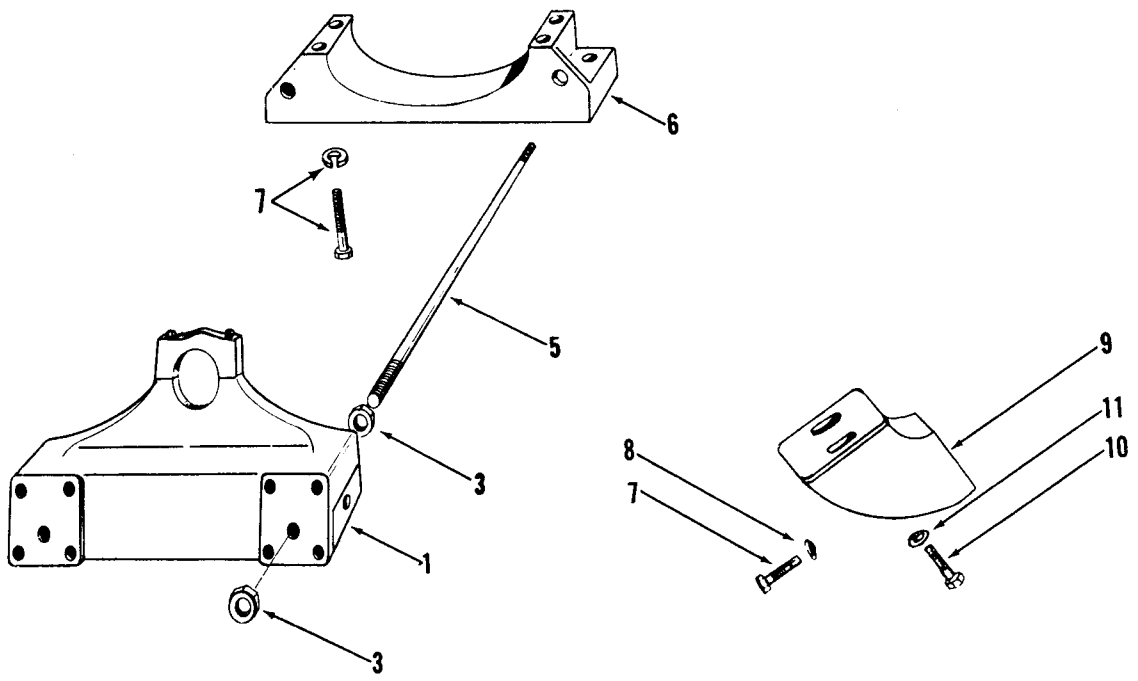

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		FRONT ENGINE SUPPORT N-855-P190, N-855-P220, N-855-P250	
1	BM-36230	Support, front	1
	108602	Capscrew	2
	63231-A	Support, front	1
	157864	Support, front	1
	S-608	Washer (1/2")	2
3	S-218	Nut	8
5	43586	Rod, tie	2
		FRONT ENGINE SUPPORT N-855-C220, N-855-C235, N-855-L3	
	214306	Support, front engine	1
	212754	Capscrew	2
	213456	Capscrew	4
	203760	Washer	2
	3000082	Washer	8
		N-855-P235	
	212301	Support, front engine	1
	3010591	Capscrew (7/16" - 20 x 3")	2
	212754	Capscrew	2
	3012480	Screw, washer (7/16" - 20 x 1 1/8")	4
	S-610	Washer (7/16")	2
	70880	Washer	2

REF. NO.	PART NUMBER	PART NAME	NO. REQ'D
		FLYWHEEL HOUSING SUPPORT N-855-P190, N-855-P220, N-855-P250	
6	21082	Support, flywheel housing	1
7	3012483	Capscrew (1/2" - 13 x 2")	4
		RADIATOR SUPPORT N-855-P190, N-855-P220, N-855-P250	
9	43585	Support, radiator	2
	43584	Brace	2
	70173	Bracket	1
7	S-125	Capscrew (1/2")	8
10	S-127-C	Capscrew	4
	S-145	Capscrew (1/2" - 13 x 1 1/4")	2
	S-169	Capscrew (1/2" - 13 x 1")	2
11	S-603	Lockwasher (5/8")	4
8	S-608	Lockwasher (1/2")	12
	S-200	Nut (1/2")	2

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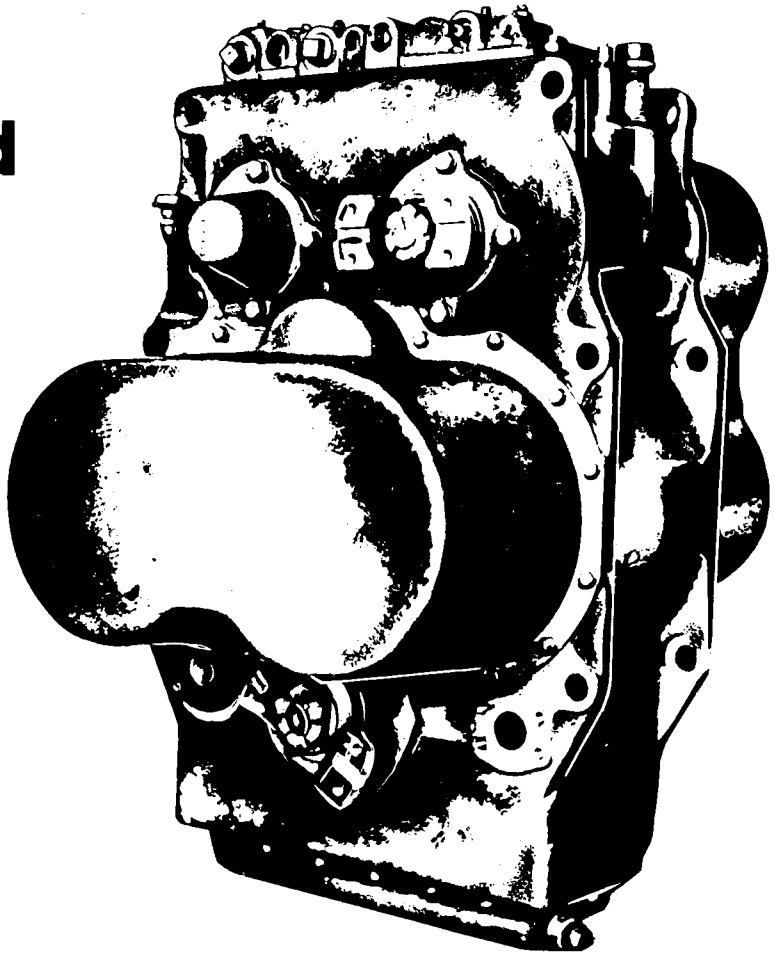
REF. NO.	PART NUMBER	PART NAME	NO. REQ'D.
		FLYWHEELS, RING GEARS AND FLYWHEEL HOUSINGS	
		Flywheels, flywheel housings and ring gears have been designed to adapt the Cummins Diesel to hundreds of different installations. For this reason, These assemblies are not listed.	
		Your Cummins Distributor will record flywheel, flywheel housing and ring gear part numbers in the front of this catalog.	
		GASKET SETS	
	AR-06762	Engine gasket set	1
	BM-77915	Cylinder head gasket set	1
	BM-68356	Fuel pump gasket set	1
		ELECTRICAL EQUIPMENT	
		Electrical equipment is not manufactured by the Cummins Engine Company, Inc. Complete service for electrical equipment may be obtained from the manufacturers: The Leece-Neville Company at Cleveland, Ohio; or from their service stations. Address of nearest service station may be obtained from the manufacturer.	
		Note: Electrical Equipment not furnished on Automotive engines.	
		ALTERNATOR N-855-P190, N-855-P220, N-855-P250	
	211232	Alternator	1
	183752	Bracket, alternator	1
	178568	Belt, "V"	
	3010595	Capscrew and lockwasher (3/8" - 16 x 1")	3
	3010596	Capscrew (3/8" - 16 x 1 1/4")	1
	S-119-C	Capscrew (7/16" - 20 x 3 1/4")	1
	183754	Link, adjusting	1
	108330	Washer, plain	2
	3009716	Nut	1
	S-223	Nut (3/8")	1
	183755	Pulley, alternator	1
	70057	Shim, adjusting	A/R
	70057-A	Shim, adjusting	A/R
	203760	Washer, plain	2
	217365	Strap, alternator ground	
		ALTERNATOR MOUNTING PARTS N-855-C220, N-855-C250, N-855-L3, N-855-P235	
	218505	Bracket, alternator	1
	178440	Belt, alternator	2
	158829	Capscrew	1
	S-116-C	Capscrew (7/16" - 20 x 3 1/2")	1
	S-120	Capscrew (3/8" - 16 x 1 3/4")	1
	S-125	Capscrew (1/2" - 13 x 2")	2
	3010596	Capscrew (3/8" - 16 x 1 1/4")	1
	212738	Nut	1
	213326	Pulley, alternator	1
	S-604	Lockwasher (3/8")	1
	203535	Link, alternator	2
	9245	Spacer, starter	1
	66945	Spacer, throttle	1
	203310	Washer	3
		STARTER N-855-C220, N-855-C235, N-855-P235, N-855-L3	
	135162	Motor, starting (12 volt)	1
	153581	Capscrew	3
	S-603	Lockwasher (5/8")	3
	9245	Spacer	1
	217364	Strap, starter ground	1
		N-855-P190, N-855-P220, N-855-P250	
	43604	Motor, starting (24 volt)	1
	153581	Capscrew	3
	S-603	Lockwasher (5/8")	3
	9245	Spacer	1
	217364	Strap, starter ground	1
		VOLTAGE REGULATOR N-855-P190, N-855-P220, N-855-P250	
	211233	Regulator, voltage (24 volt)	1
	111436	Bracket	1
	S-600	Lockwasher (1/4")	6
	111923	Mount, flexible	3
	S-224	Nut (1/4")	6
		MAGNETIC SWITCH N-855-P235	
	216537	Switch, magnetic	1
	S-188-C	Capscrew (1/4" - 20 x 1/2")	4
	S-258	Nut (1/4")	2
	S-600	Lockwasher (1/4")	2
	S-691	Washer	2
	3015216	Bracket, magnetic switch	1
		MAGNETIC SWITCH N-855-P190, N-855-P220, N-855-P250	
	118848	Switch, magnetic	1
	S-167-A	Capscrew (1/4" - 20 x 7/8")	2
	S-600	Lockwasher (1/4")	2
	S-224	Nut (1/4")	2
	3003918	Bracket	1
		INDEX HOLE COVER	
		All Models	
	70657	Cover, index hole	1
	104925	Gasket	1
	3001646	Screw, self-tapping	2

5000 powershift transmission

maintenance & service manual

4 speed



CLARK Axle and Transmission Divisions

SM 54 (Revised 1-80)

FOREWORD

Φ

This manual has been prepared to provide the customer and the maintenance personnel with information and instructions on the maintenance and repair of the 5,000 Series Transmission Assembly.

Extreme care has been exercised in the design, selection of materials and manufacture of these units. The slight outlay in personal attention and cost required to provide regular and proper lubrication, inspection at stated intervals, and such adjustments as may be indicated will be reimbursed many times in low cost operation and trouble free service.

In order to become familiar with the various parts of the transmission, its principle of operation, trouble shooting and adjustments, it is urged that the mechanic study the instructions in this manual carefully and use it as a reference when performing maintenance and regular operations.

Whenever repair or replacement of component parts is required, only Clark-approved parts as listed in the applicable parts manual should be used. Use of "will-fit" or non-approved parts may endanger proper operation and performance of the equipment. The Clark Equipment Company does not warrant repair or replacement parts, nor failures resulting from the use thereof, which are not supplied by or approved by the Clark Equipment Company. IMPORTANT: **Always furnish the Distributor with the transmission serial and model number when ordering parts.**

TABLE OF CONTENTS

NOTE: Metric Dimensions Shown in Brackets [ ].

The transmission portion of the power train enacts an important role in delivering engine power to the driving wheels. In order to properly maintain and service these units it is important to first understand their function and how they operate.

The transmission and torque converter function together and operate through a common hydraulic system. To obtain maximum serviceability they have been designed and built as separate units. It is necessary, however, to consider both units in the study of their function and operation.

To supplement the text below, and for references use therewith, the following illustrations are provided:

Fig. A — Front and Rear View, Shaft Identification
Fig. B — Transmission Case and Internal Tubing
Fig. C — Control Cover Assembly
Fig. D — Output Shaft Group — "O"
Fig. E — Idler Shaft Group — "I"
Fig F — Input and Forward Drive Shaft Group—"F"
Fig. G — Reverse Drive Shaft Group — "R"
Fig. H — 2nd and 4th Drive Shaft Group — "A"
Fig. I — 1st and 3rd Drive Shaft Group — "B"
Fig. J — External Oil Flow—Converter and Transmission.

HOW THE UNITS OPERATE —

With the engine running, the converter charging pump draws oil from the transmission sump and directs it through oil filters to the regulating valve located on top of the transmission. From the regulating valve it is then directed through the control cover on the transmission to the converter and to the transmission clutches.

The pressure regulating valve mounted on the top of the transmission remains closed until required pressure is delivered to the transmission for actuating the direction and speed clutches. This regulator valve consists of a hardened valve spool operating in a closely fitted bore. The valve spool is backed up by a spring to hold the valve spool against its seat until the oil pressure builds up to the specified pressure. The valve spool then moves toward the spring until a port is exposed along the side of the bore. The oil can then flow through this port into a distributor which directs the oil into the converter inlet port.

After entering the converter, the oil is directed through the stator support to the converter cavity and exits between the turbine shaft and converter support. The oil then passes through an oil distributor which directs the oil out of the converter by way of a down stream regulator valve and then to the oil cooler. After leaving the cooler the oil is directed through a hose to the lubricating oil inlet on the transmission, then through a series of tubes to the transmission, bearings, and clutches. The oil then returns to the transmission sump.

A safety valve is built in the transmission control cover and will open to bypass oil only if an excessive pressure is built up due to a blocked passage.

The rear compartment of the converter unit also houses the converter output shaft. A flexible hose provides an overflow to the transmission sump.

The three members of the torque converter are composed of a series of blades. The blades are curved in such a manner as to force the oil to circulate from the impeller to the turbine, through the reaction member again into the impeller. This circulation causes the turbine to turn in the same direction as the impeller. Oil enters the inner side of the impeller and exits from the outer side into the outer side of the turbine. It then exits from the inner side of the turbine and after passing through the reaction member, again enters the inner side of the impeller.

Converter "Stall" is achieved whenever the turbine and impeller shaft are stationary and the engine is operating at full power or wide open throttle. CAUTION: Do not maintain "Stall" for more than 30 seconds at a time. Excessive heat will be generated and may cause converter or transmission seal damage.

In converters equipped with Lock-up clutches, a hydraulic clutch, similar to the transmission clutches is used to "lock" the engine mechanically to the output shaft. This is accomplished by hydraulic pressure actuating the lock-up clutch which in turn locks the impeller cover to the turbine hub. During lock-up the converter turns at 1 to 1 speed ratio.

The down stream regulator valve on the converter consists of a valve body and regulator spool. The spool is backed up by a spring to hold the valve until converter oil pressure builds up to specified pressure. The valve is used to maintain a given converter pressure to insure proper performance under all conditions.

The control valve assembly on the transmission consists of a valve body with selector valve spools connected to the steering column by exterior linkage. A detent ball and spring in the selector spool provides four positions, one position for each speed range. A detent ball and spring in the direction spool provides three positions, one each for forward, neutral, and reverse.

On certain models, this valve also contains a shut-off valve spool operated by an air or hydraulic cylinder located on the control cover. This valve is connected to the brake system by a hose line. When the wheel brakes are applied, air or hydraulic fluid enters the valve and overcomes a spring force. This forces the spool to shift over and block pressure from entering the directional clutches. In this manner a "neutral" is established without moving the control levers.

With the engine running and the directional control lever in neutral position, oil pressure is blocked at the control valve, and the transmission is in neutral. Movement of the forward and reverse spool will direct oil, under pressure, to either the forward or reverse direction clutch as desired, and the opposite one is open to relieve pressure.

The direction or speed clutch assembly consists of a drum with internal gear teeth and a bore to receive a hydraulically actuated piston. A piston is inserted into the bore of the drum. The piston is "oil tight" by the use of sealing rings. A friction disc with internal teeth is inserted into the drum and rests against the piston. Next, a disc with splines at the outer diameter is inserted. Discs are alternated until the required total is achieved. After inserting the last disc, a series of springs and pins are assembled in such a manner that these springs rest on teeth of the piston. A heavy back-up plate is then inserted and secured by a snap ring. A hub with I.D. and O.D. splines is inserted into the splines of discs with teeth on the inner diameter and a splined shaft extending through the clutch support. This hub is retained by a snap ring. The discs and inner shaft are free to increase in speed or rotated in the opposite direction as long as no pressure is present in the direction or speed clutch.

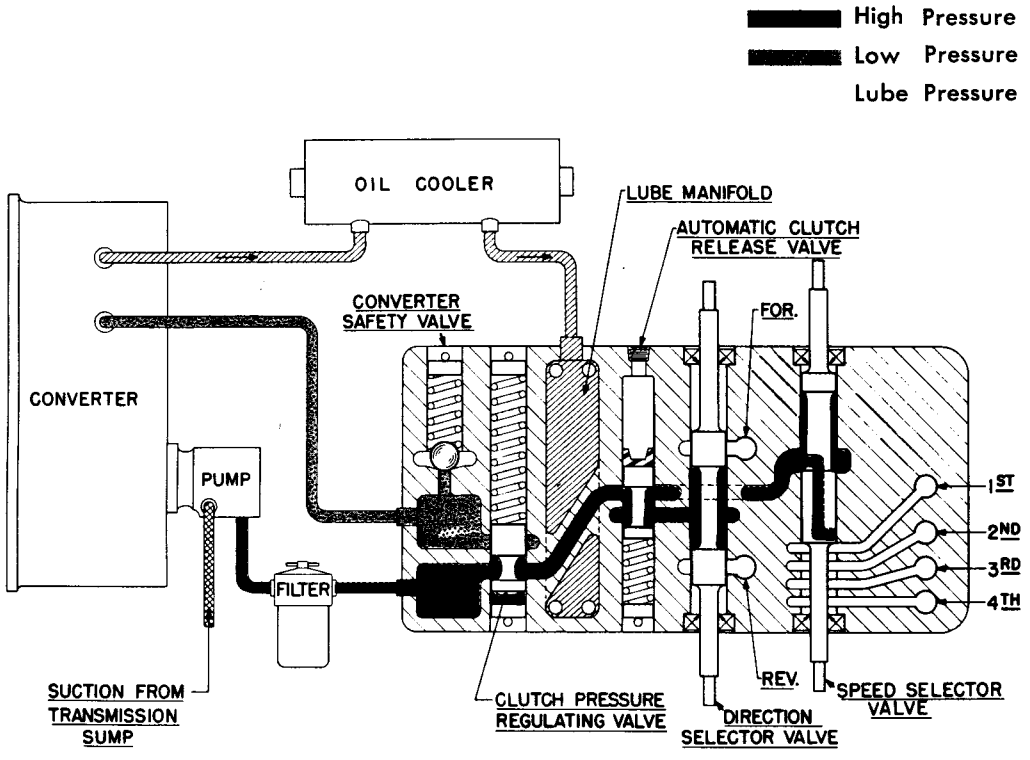
To engage the clutch, as previously stated, the control valve is placed in the desired position. This allows oil under pressure to flow from the control cover valve, through a tube in the transmission case, to a chosen clutch. Once into the drum, oil is directed through a drilled hole into the rear side of the piston bore. Pressure of the oil forces the piston and discs over against the heavy back-up plate. The discs, with teeth on the outer diameter, clamping against discs, with teeth on inner diameter, enables the clutch drum and drive shaft to be locked together and allows them to turn as a unit.

There are bleed balls in the clutch drums which allow quick escape for oil when the pressure to the piston is released.

The transmission gear train consists of six shafts: (1) Input Shaft, (2) Reverse Shaft, (3) Idler Shaft, (4) First and Third Shaft, (5) Second and Fourth Shaft, (6) Output Shaft.

A screen mounted in a frame is positioned on the bottom of the transmission case, to screen out any foreign material. This screen is covered by the sump pan. This pan is provided with magnets to catch any metallic particles.

Some transmissions may have an axle declutching unit as optional equipment, this unit consists of a split output shaft with a sliding splined sleeve to engage or disengage the axle. This is accomplished by manually shifting a lever in the operator's compartment which is mechanically connected to the shift fork on the clutching unit sliding sleeve. This unit, of course, is only used on the four wheel drive machine. On the front drive only or the rear wheel drive only, the output shaft is a one piece type and an output flange assembled only on the required end.



TRANSMISSION CONTROL COVER INTERNAL OILFLOW

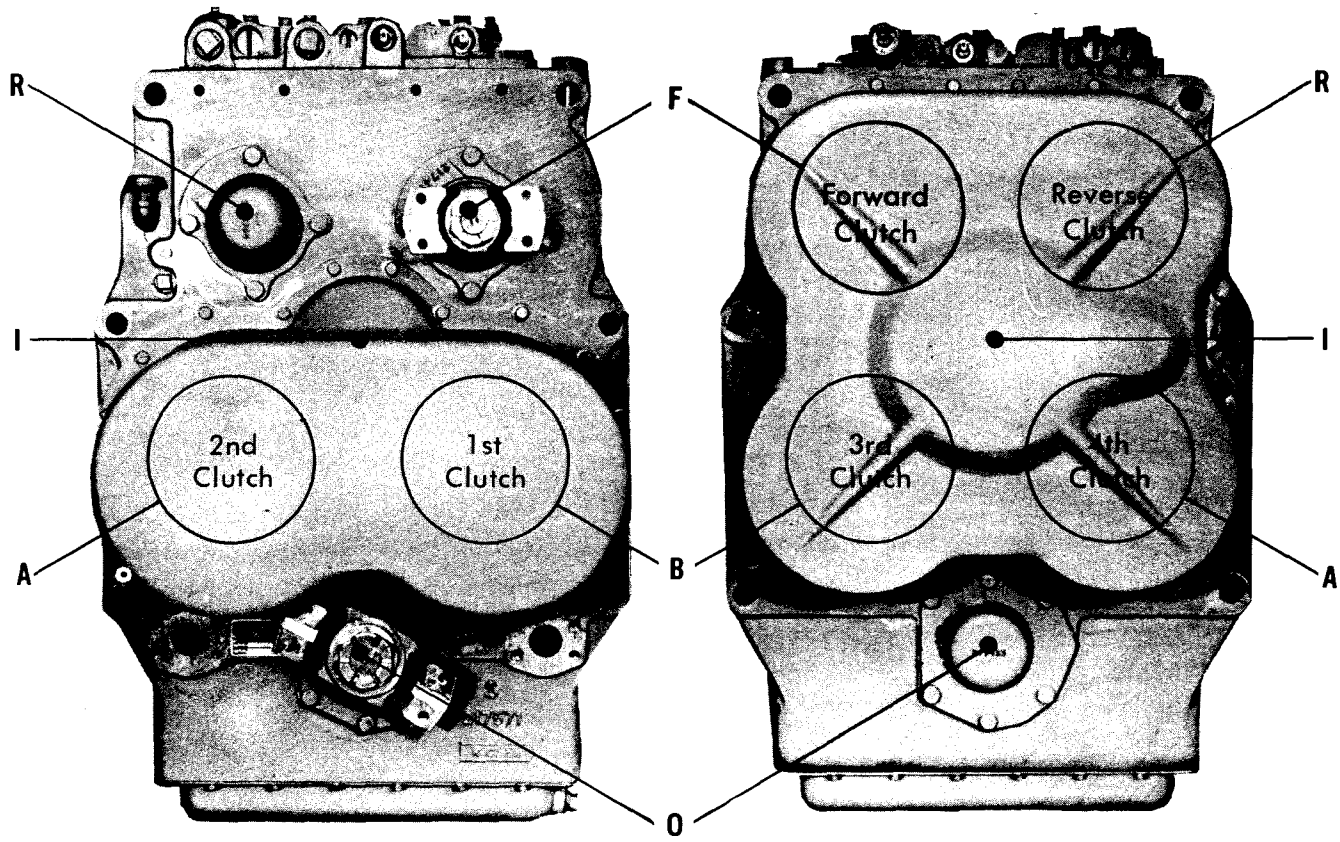


FIG. A—TRANSMISSION ASSEMBLY SHAFT IDENTIFICATION

For purpose of identification, illustration above indicates by alphabetical designation the individual shaft group location in transmisson. Code to alphabetical designation is given below. Alphabetical designation also appears in heading of each shaft group covered in parts listings herein.

A—Second & Fourth Drive Shaft Group

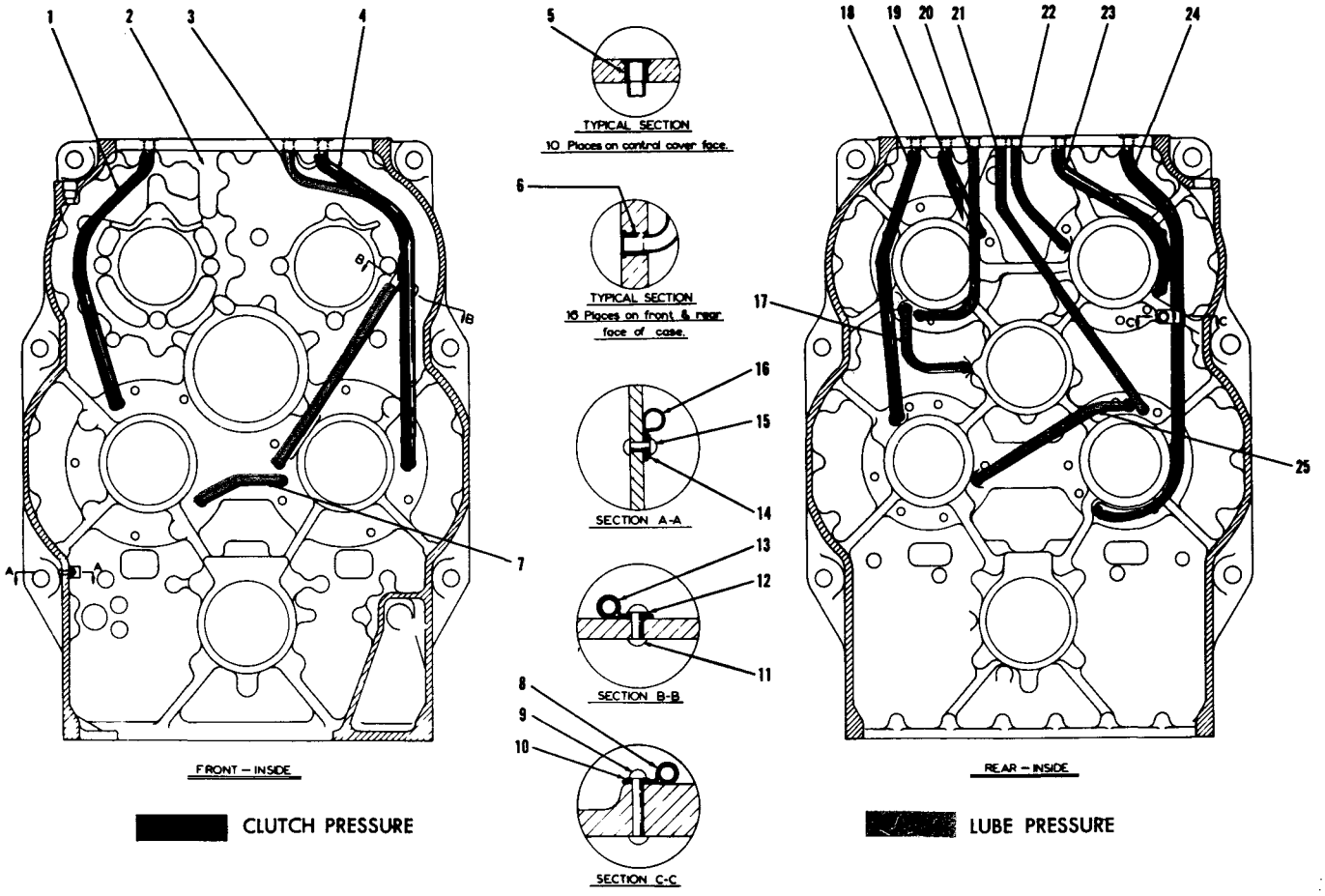
B—First & Third Drive Shaft Group

F—Input Drive Shaft & Forward Clutch Group

I—Idler Shaft Group

O— Output Shaft & Disconnect Assembly Group

R—Reverse Drive Shaft Group



5000 SERIES CASE ASSEMBLY

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	1st Clutch Pressure Tube	1	14	Washer	1
2	Transmission Case	1	15	Rivet	1
3	2nd Clutch Lube Tube	1	16	Dip Stick Tube Clip	1
4	2nd Clutch Pressure Tube	1	17	Reverse to Idler Crossover Lube Tube	1
5	Tube Sleeve	8	18	4th Clutch Pressure Tube	1
6	Tube Sleeve	18	19	Reverse Clutch Pressure Tube	1
7	2nd and 1st Cross Over Lube Tube	1	20	Reverse Clutch Lube Tube	1
8	Tube Clip	1	21	3rd Clutch Lube Tube	1
9	Rivet	1	22	Input Lube Tube	1
10	Washer	1	23	Input Clutch Pressure Tube	1
11	Rivet	1	24	3rd Clutch Pressure Tube	1
12	Washer	1	25	3rd to 4th Crossover Lube Tube	1
13	Tube Clip	1			

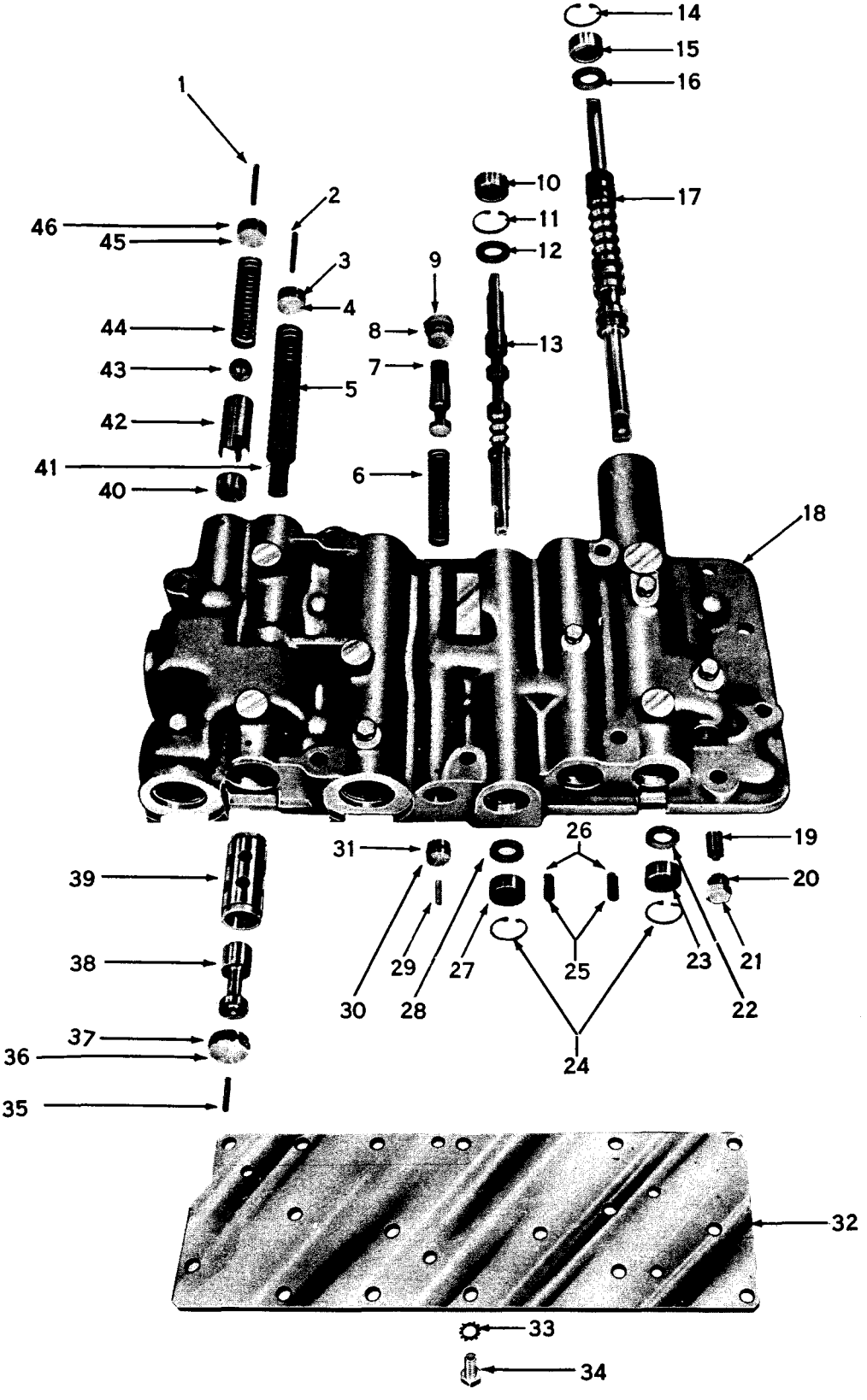

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FIG. C — CONTROL COVER GROUP

ITEM	DESCRIPTION	QTY.
1	Spring Stop Roll Pin	1
2	Spring Stop Roll Pin	1
3	Spring Stop "O" Ring	1
4	Spring Stop	1
5	Regulator Valve Spring (Outer)	1
6	Shut-off Valve Spool Spring	1
7	Shut-off Valve Spool	1
8	Shut-off Valve Hole Plug "O" Ring	1
9	Shut-off Valve Hole Plug	1
10	Valve Oil Seal	1
11	Valve Stop Snap Ring	1
12	Valve Stop Washer	1
13	Forward and Reverse Selector Valve	1
14	Valve Stop Snap Ring	1
15	Valve Oil Seal	1
16	Valve Stop Washer	1
17	Speed Selector Valve Assembly	1
18	Control Cover	1
19	Shuttle Valve	1
20	Shuttle Valve "O" Ring	1
21	Shuttle Valve Plug	1
22	Valve Stop Washer	1
23	Valve Oil Seal	1
24	Valve Stop Snap Ring	1
25	Poppet Spring	2
26	Poppet Ball	2
27	Valve Oil Seal	1
28	Valve Stop Washer	1
29	Spring Stop Roll Pin	1
30	Spring Stop	1
31	Spring Stop "O" Ring	1
32	Control Cover Plate	1
33	Control Cover Plate Screw Lockwasher	17
34	Control Cover Plate Screw	17
35	Spring Stop Roll Pin	1
36	Valve Stop	1
37	Valve Stop "O" Ring	1
38	Regulator Valve Spool	1
39	Regulator Valve Spool Sleeve	1
40	Safety Valve Seat	1
41	Regulator Valve Spring (Inner)	1
42	Safety Valve Spacer	1
43	Safety Valve Ball	1
44	Safety Valve Spring	1
45	Spring Stop	1
46	Spring Stop "O" Ring	1

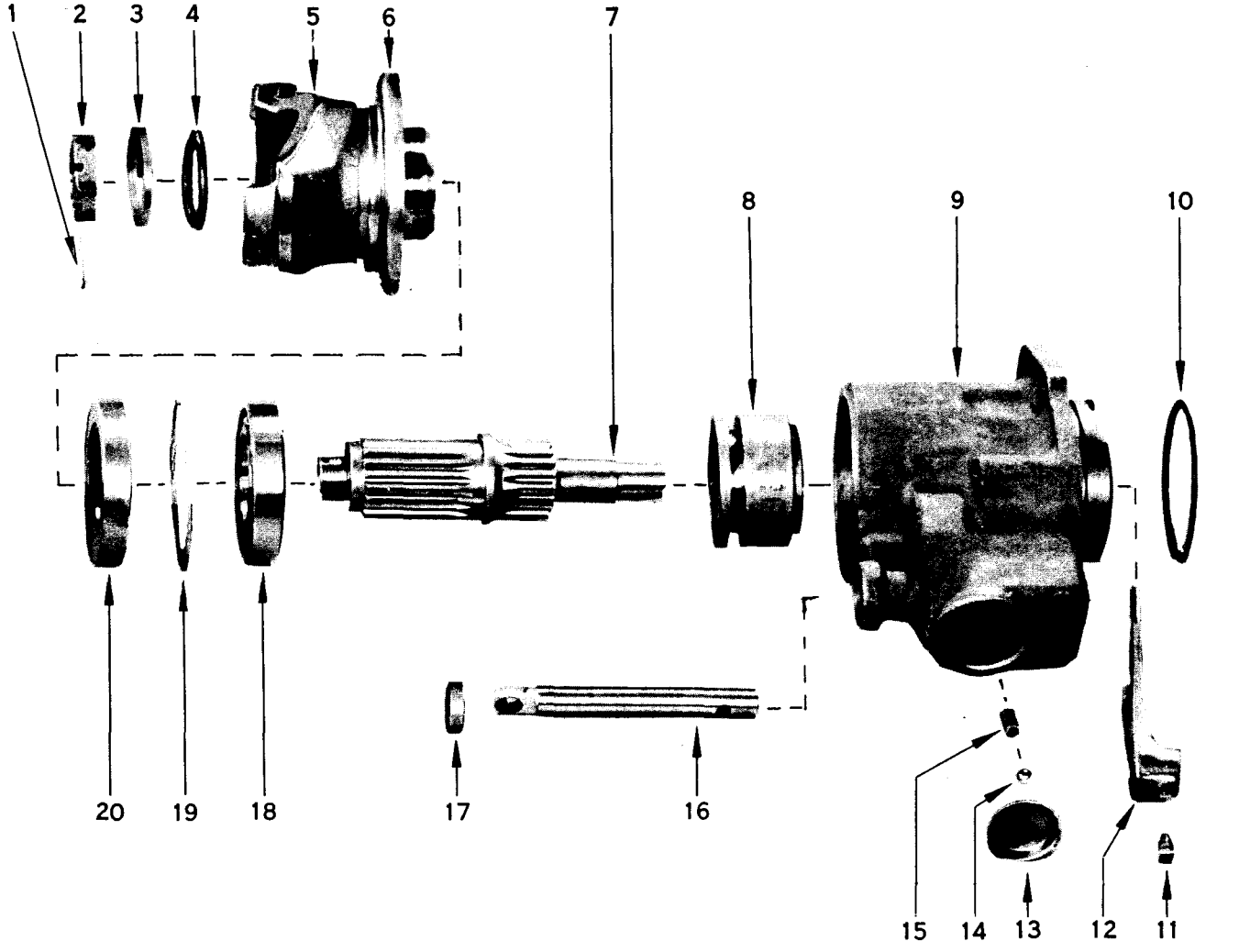


FIG. D DISCONNECT ASSEMBLY "O"

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Flange Nut Cotter	1	11	Shift Fork Lock Screw	1
2	Flange Nut	1	12	Shift Fork	1
3	Flange Washer	1	13	Housing Plug	1
4	Flange "O" Ring	1	14	Detent Ball	1
5	Companion Flange	1	15	Detent Spring	1
6	Companion Flange Deflector	1	16	Shift Rail	1
7	Disconnect Shaft	1	17	Shift Rail Oil Seal	1
8	Disconnect Shift Hub	1	18	Shaft Bearing	1
9	Disconnect Housing	1	19	Shaft Bearing Retainer Ring	1
10	Disconnect Housing "O" Ring	1	20	Companion Flange Oil Seal	1

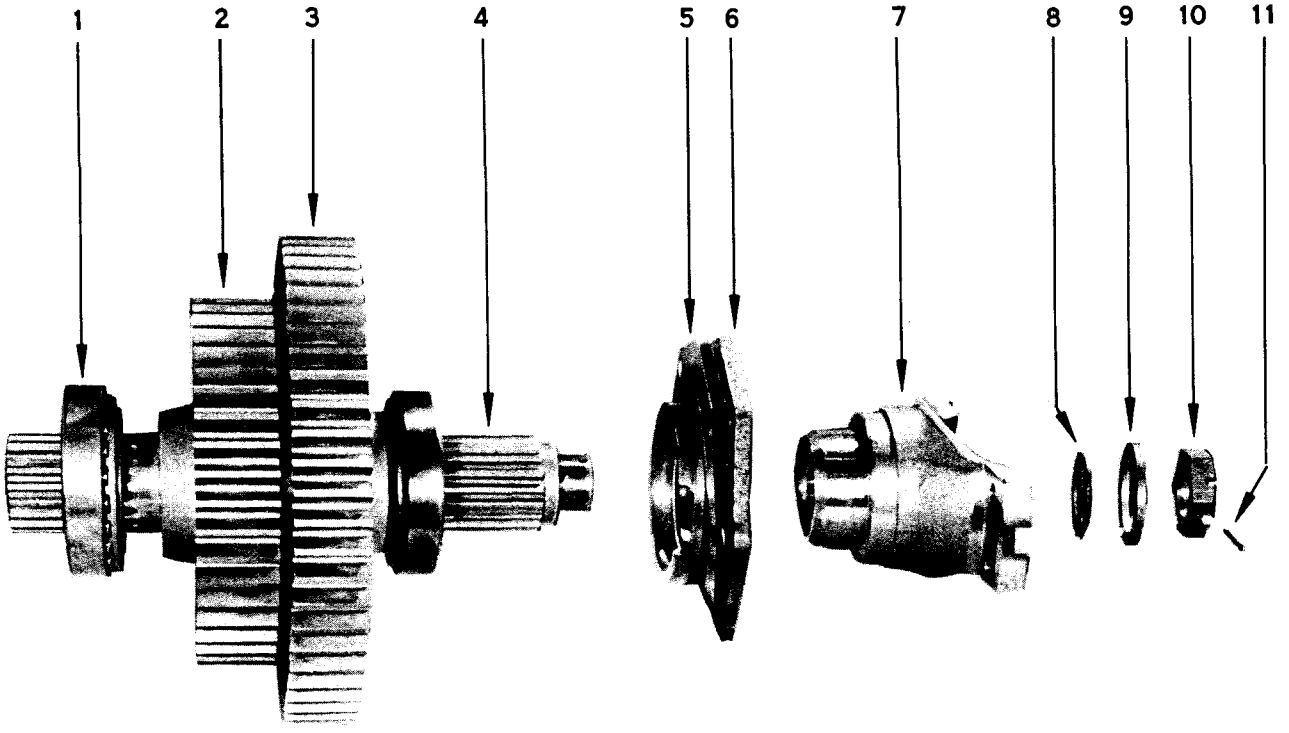
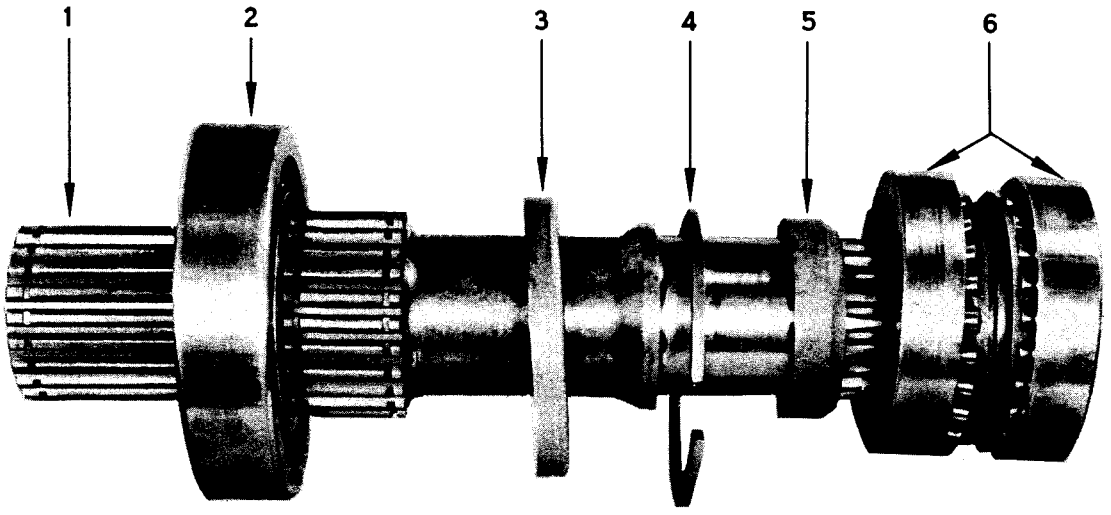


FIG. D OUTPUT SHAFT GROUP "O"

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Output Shaft Taper Bearing	2	7	Companion Flange	1
2	Output Shaft Gear	1	8	Flange "O" Ring	1
3	Output Shaft Gear	1	9	Flange Washer	1
4	Output Shaft	1	10	Flange Nut	1
5	Bearing Cap Shims		11	Flange Nut Cotter	1
6	Bearing Cap	1			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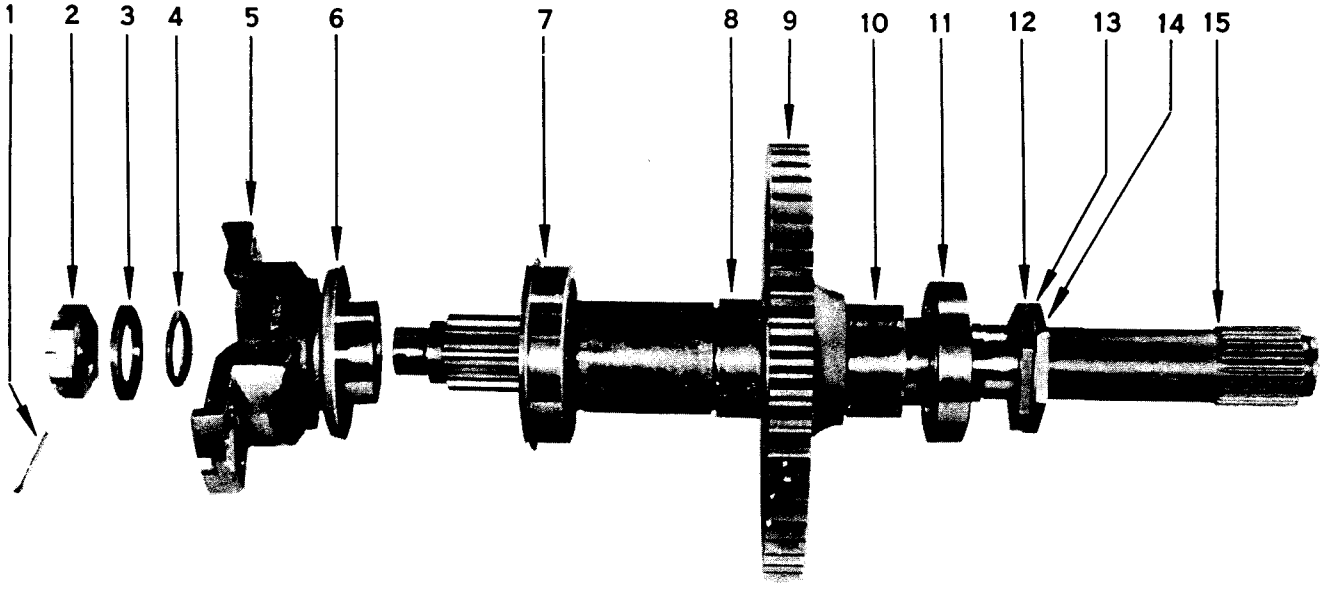
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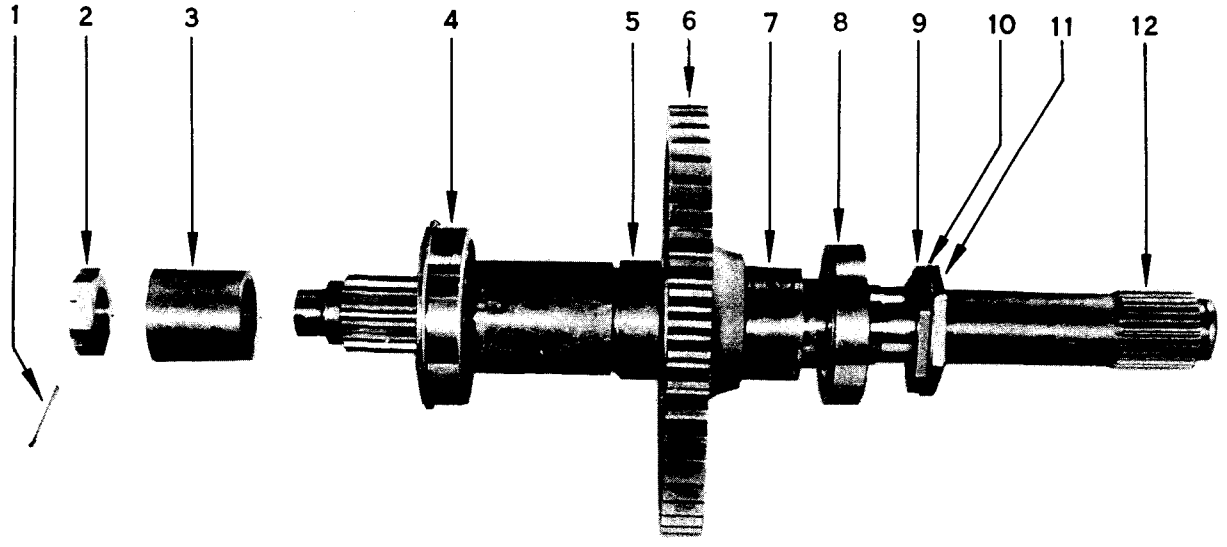
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FIG. E IDLER SHAFT GROUP "I"

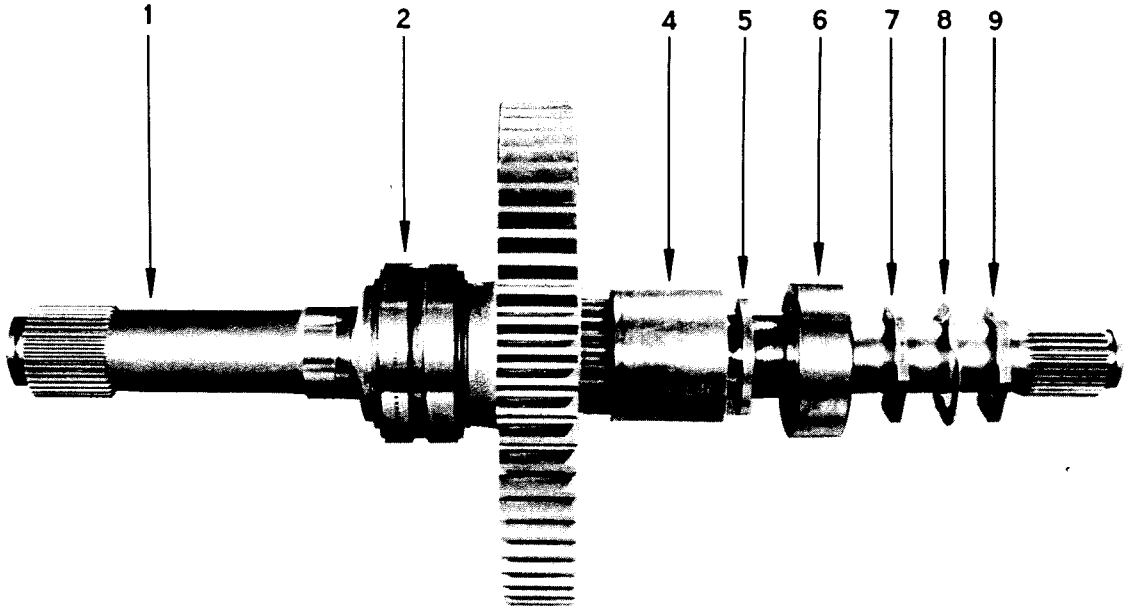
ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Idler Shaft	1	4	Inner Bearing Cup Locating Ring	1
2	Idler Shaft Roller Bearing	1	5	Tapered Bearing Spacer	1
3	Oil Baffle	1	6	Tapered Bearing	2

FIG F INPUT SHAFT GROUP "F"

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Flange Nut Cotter	1	9	Input Gear	1
2	Flange Nut	1	10	Gear Spacer (Long)	1
3	Flange Nut Washer	1	11	Input Shaft Rear Bearing	1
4	Flange Nut "O" Ring	1	12	Bearing Lock Nut (Inner)	1
5	Companion Flange	1	13	Bearing Nut Lock	1
6	Companion Flange Deflector	1	14	Bearing Lock Nut (Outer)	1
7	Input Shaft Front Bearing	1	15	Input Shaft	1
8	Gear Spacer (Short)	1			

FIG. G REVERSE SHAFT GROUP "R"

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Nut Cotter	1	7	Gear Spacer (Long)	1
2	Nut	1	8	Reverse Shaft Rear Bearing	1
3	Bearing Spacer	1	9	Bearing Lock Nut (Inner)	1
4	Reverse Shaft Front Bearing	1	10	Bearing Nut Lock	1
5	Gear Spacer (Short)	1	11	Bearing Lock Nut (Outer)	1
6	Reverse Gear	1	12	Reverse Shaft	1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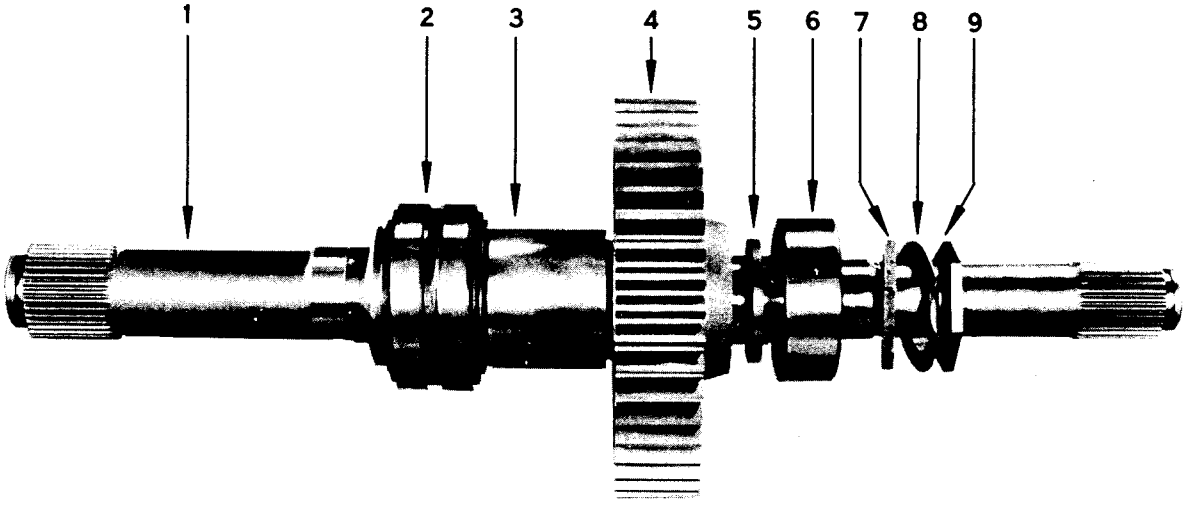
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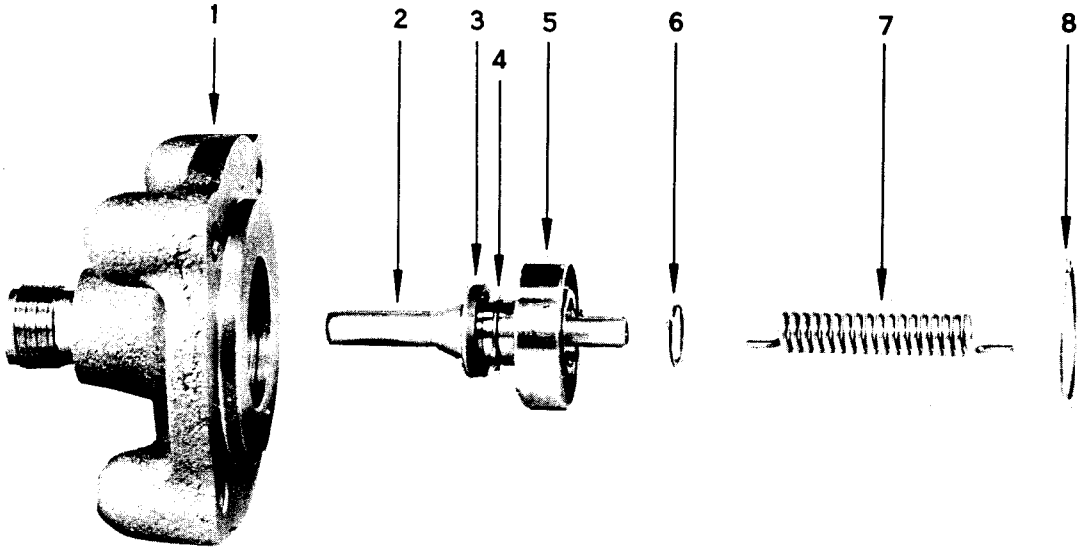
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FIG. H 2nd and 4th SHAFT GROUP "A"

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	2nd and 4th Shaft	1	6	Roller Bearing (Rear)	1
2	Tapered Bearing Assembly (Front)	1	7	Bearing Lock Nut (Inner)	1
3	2nd and 4th Shaft Gear	1	8	Bearing Nut Lock	1
4	Gear Spacer (Long)	1	9	Bearing Lock Nut (Outer)	1
5	Gear Spacer (Short)	1			

FIG. I 1st and 3rd SHAFT GROUP "B"

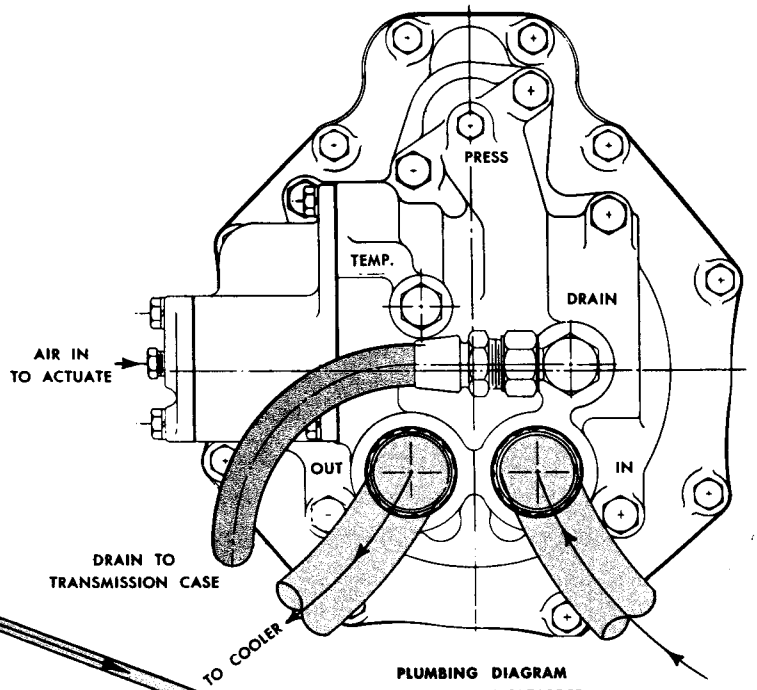
ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	1st and 3rd Shaft	1	6	Roller Bearing (Rear)	1
2	Tapered Bearing Assembly (Front)	1	7	Bearing Lock Nut (Inner)	1
3	Gear Spacer (Long)	1	8	Bearing Nut Lock	1
4	1st and 3rd Shaft Gear	1	9	Bearing Lock Nut (Outer)	1
5	Gear Spacer (Short)	1			

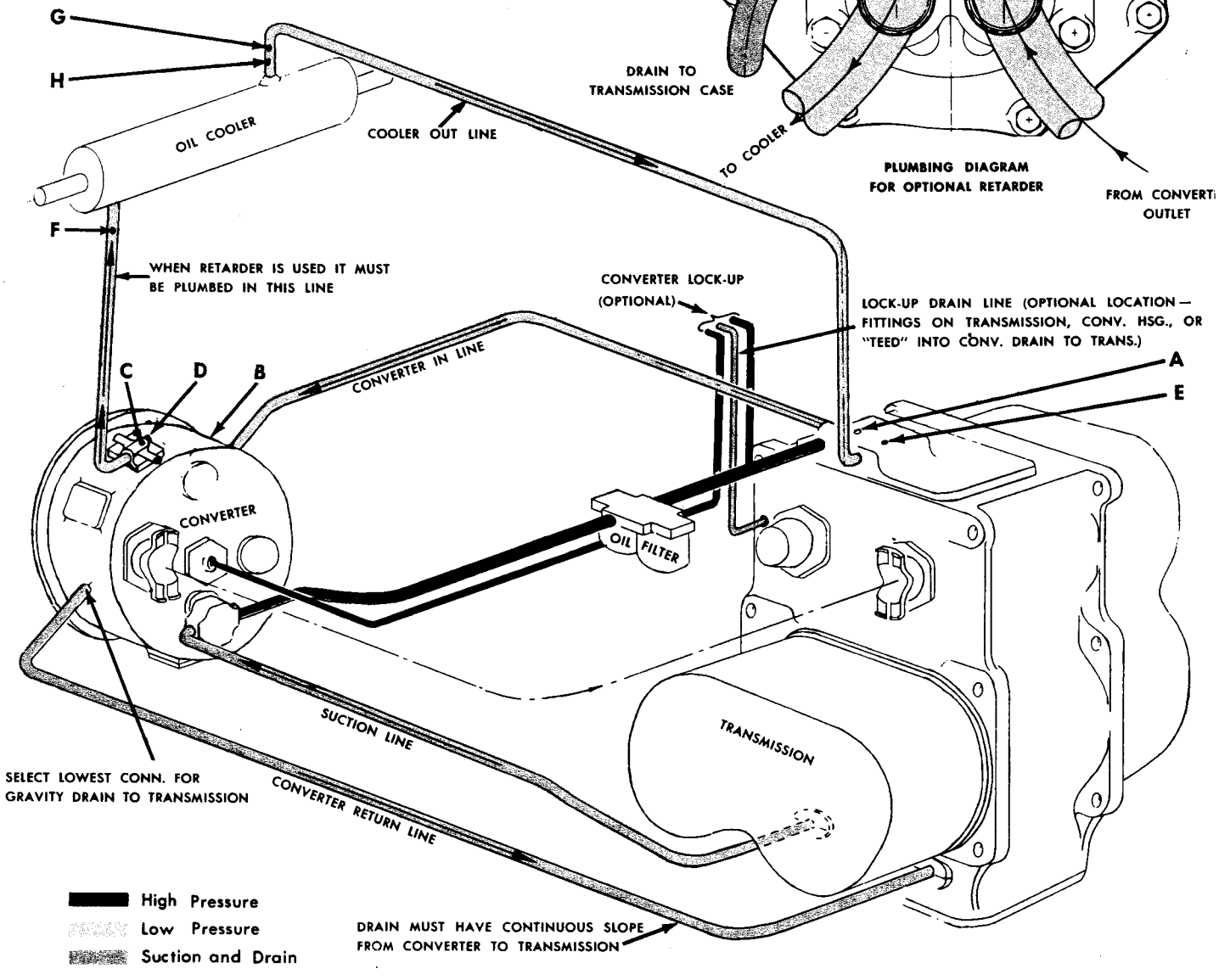
SPEEDOMETER DRIVE GROUP

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Speedometer Drive Housing	1	5	Speedometer Drive Bearing	1
2	Speedometer Drive Shaft	1	6	Bearing Snap Ring	1
3	Drive Shaft Oil Seal	1	7	Speedometer Drive Spring	1
4	Bearing Snap Ring	1	8	Bearing Snap Ring	1

FIG J CHECK POINTS

A. CLUTCH PRESSURE
B. CONVERTER INLET
C. CONVERTER OUTLET
D. CONVERTER TEMPERATURE CONNECTION
E. LUBE PRESSURE
F. COOLER INLET PRESSURE
G. COOLER OUTLET PRESSURE
H. COOLER OUTLET TEMPERATURE





OVERHAUL OF TRANSMISSION ASSEMBLY

CAUTION: Cleanliness is of extreme importance and an absolute must in the repair and overhaul of this unit. Before attempting any repairs, the exterior of the unit must be thoroughly cleaned to prevent the possibility of dirt and foreign matter entering the mechanism.

The instructions contained herein cover the disassembly and reassembly of the transmission in a sequence that would normally be followed after the unit has been removed from the machine and is to be completely overhauled.

DISASSEMBLY OF THE TRANSMISSION

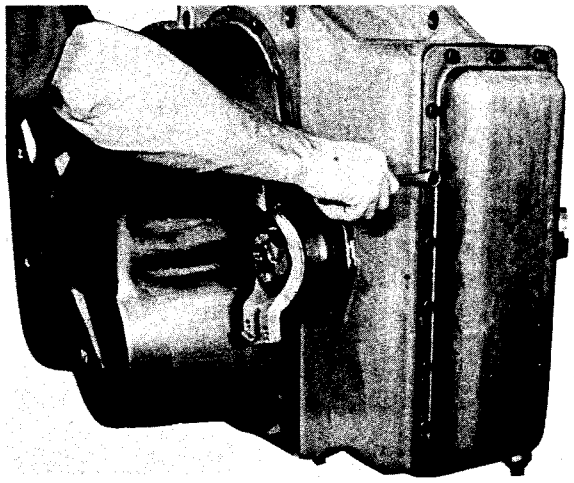


Figure 1
Remove sump pan bolts.

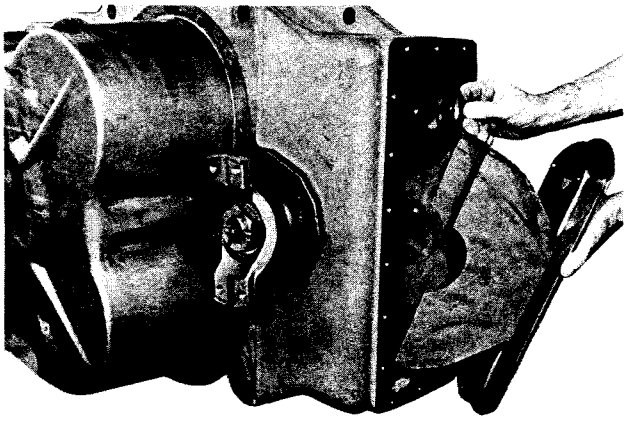


Figure 3
Remove sump screen bolts and sump screen.

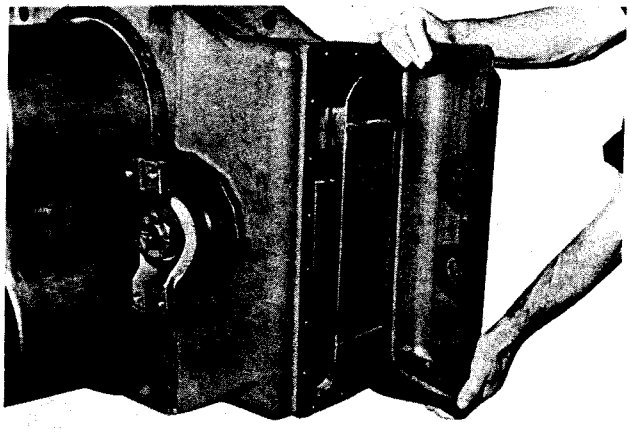


Figure 2
Remove sump pan and magnets.

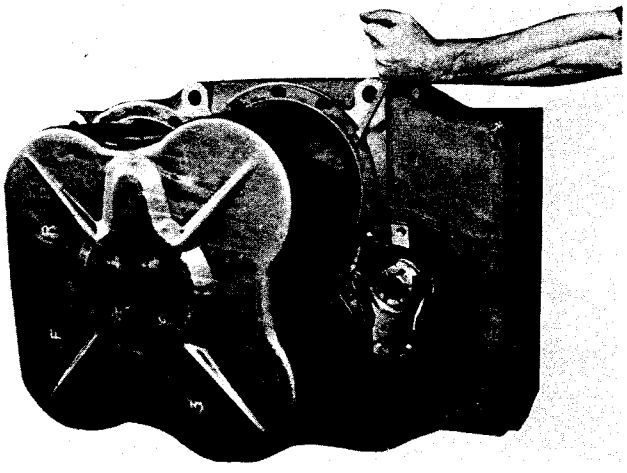


Figure 4
Remove forward, reverse, 3rd and 4th clutch cover bolts.

CLARK

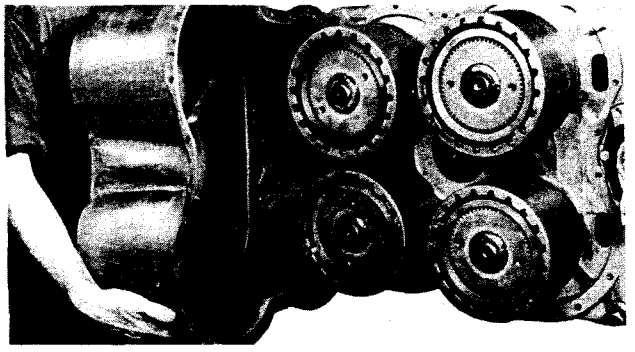


Figure 5

Remove clutch cover.

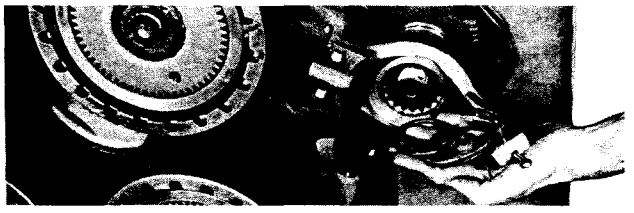


Figure 6

Lock transmission gears with a soft bar and remove output flange nut, "O" ring, washer and flange.

CLUTCH DISASSEMBLY

A product improvement has been made that incorporates taper bearings in the input, reverse, 3rd and 4th clutch drums. Follow the same procedure as explained in Figures 7 thru 13 to disassemble input, reverse, 3rd and 4th clutch. If taper roller bearings are used, mark each part removed to match with the clutch support. These parts must be reassembled on the same support they were removed from. If taper bearings, clutch support or clutch drum are to be replaced, reassemble with new parts as explained on pages 49 and 50. If ball bearings are used follow procedure explained in the service manual.

NOTE: All clutches are disassembled in a similar manner. Clutch shown being disassembled is 4th speed.

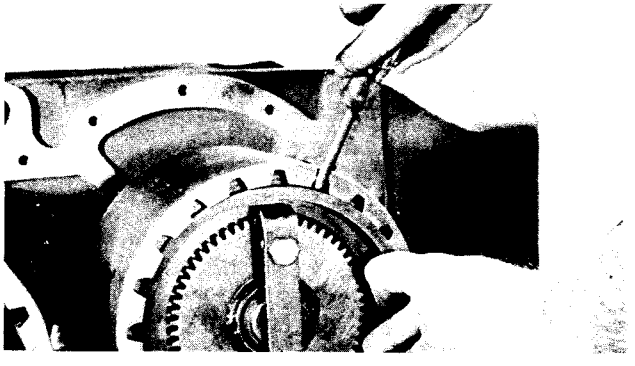


Figure 7

Depress end plate and remove retainer ring.

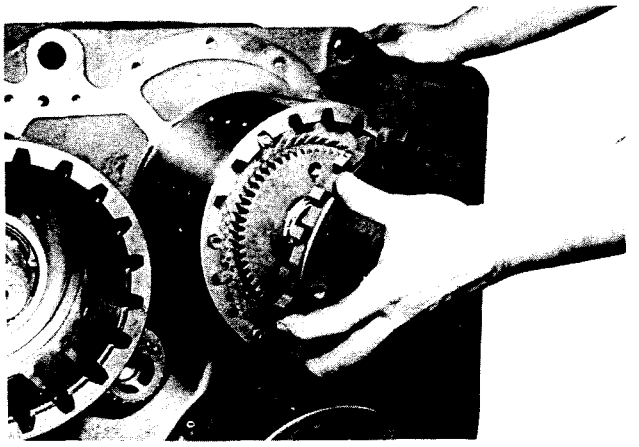


Figure 8

Remove end plate.

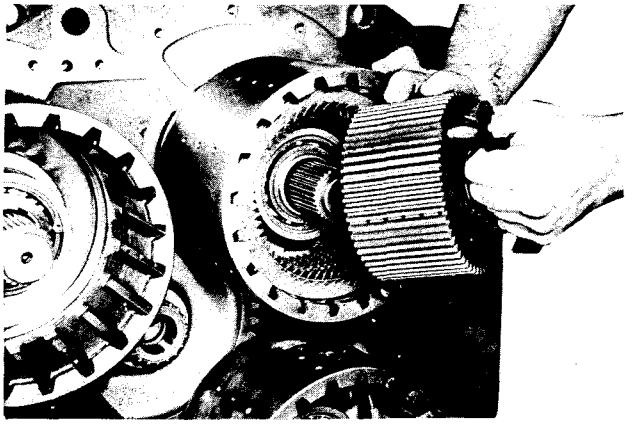


Figure 9

Remove clutch disc hub retainer ring. Remove clutch disc hub.

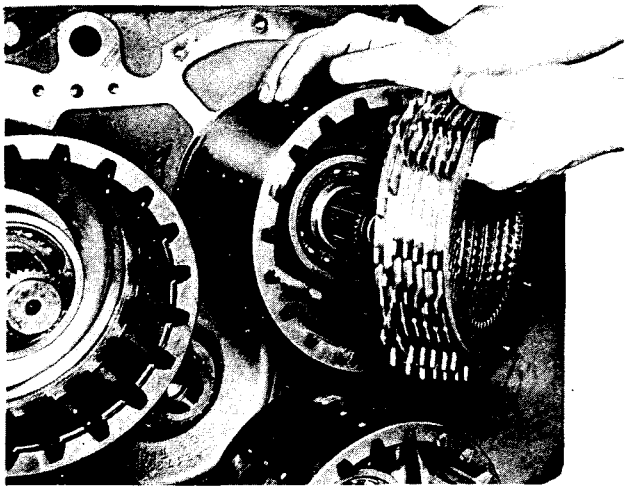


Figure 10

Remove release springs, guide pins, and inner and outer clutch disc. (See Note, Figure 30).

CLARK

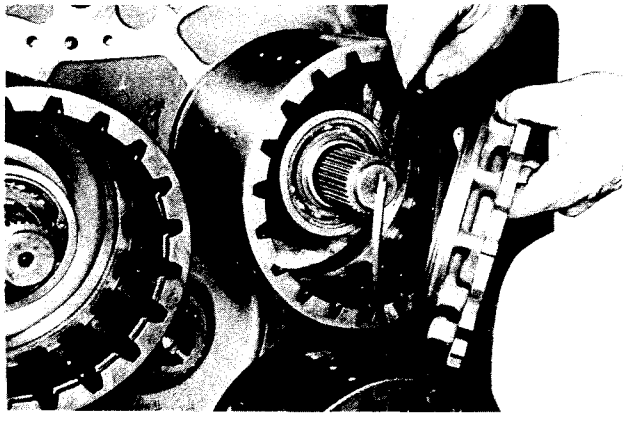


Figure 11

Remove clutch piston and piston outer sealing ring.

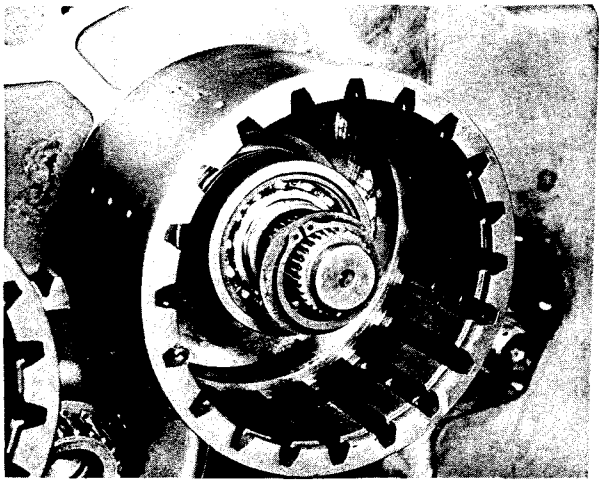


Figure 12

Remove clutch drum retainer ring and retainer washer.

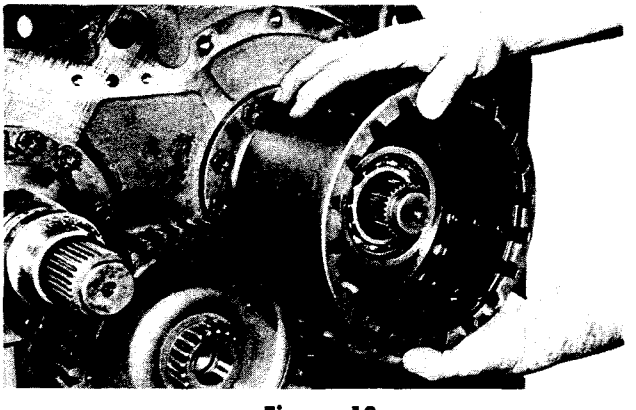


Figure 13

Remove clutch drum and bearing assembly.

NOTE: If clutch drum hub gear, support bearings, or piston ring outer race, are to be replaced, use Figure 14 through 18; if replacement is not necessary disregard and continue on with Figure 19.

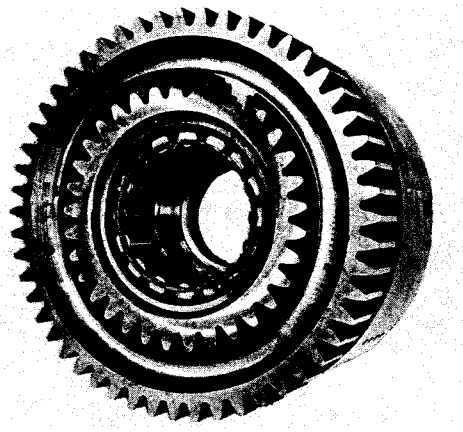


Figure 14

Remove clutch drum hub gear retainer ring. (1st and 2nd clutch only.)

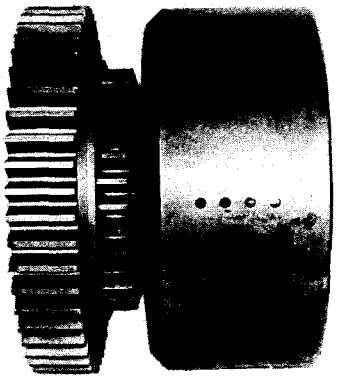


Figure 15

Remove clutch drum hub gear (1st and 2nd clutch only).

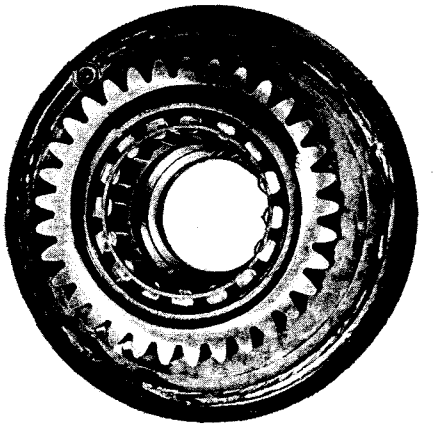


Figure 16

Remove drum support roller bearing retainer ring.

CLARK

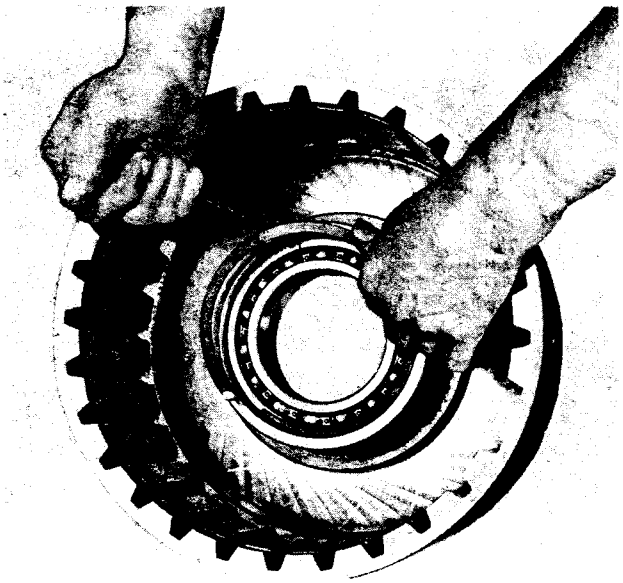


Figure 17

Remove drum support ball bearing retainer ring. Press or drive roller and ball bearing from clutch drum.

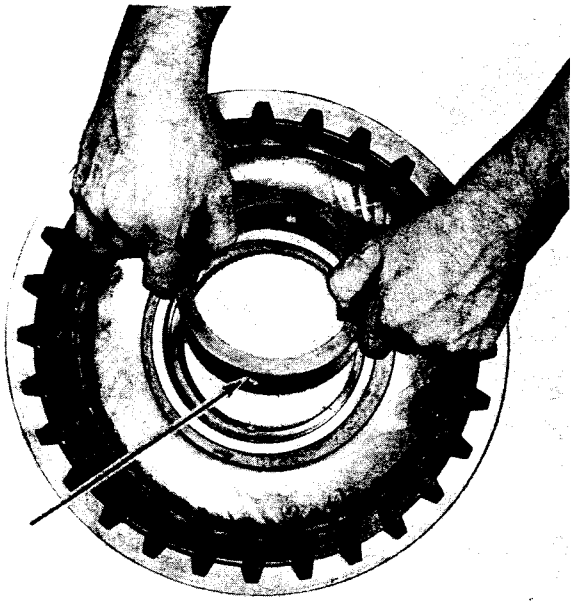


Figure 18

Press piston ring outer race from clutch drum. **CAUTION:** Do not lose lock ball (see arrow).

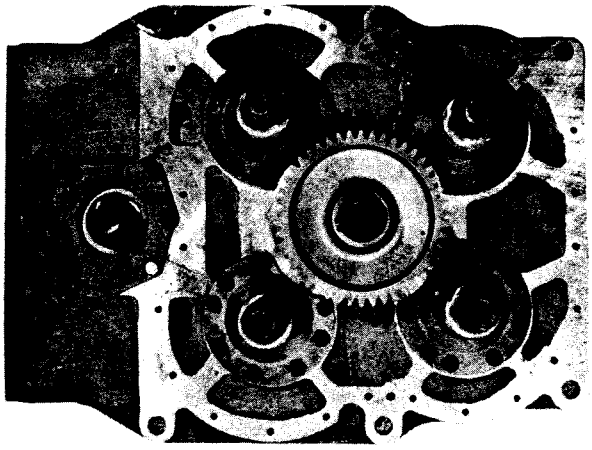


Figure 19

Idler gear and clutch support access.

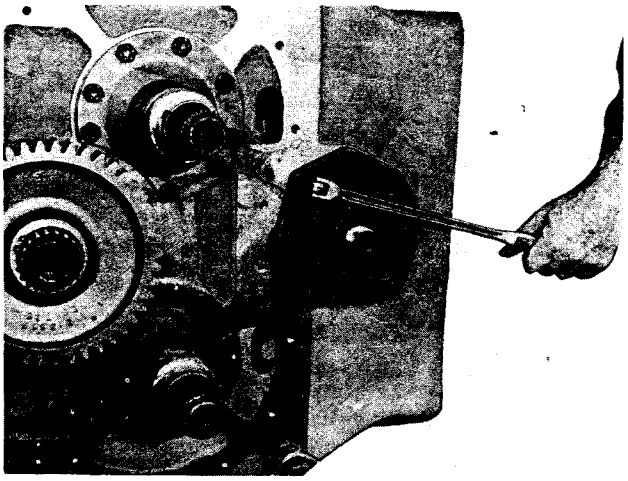


Figure 20

Remove output shaft bearing cap bolts.

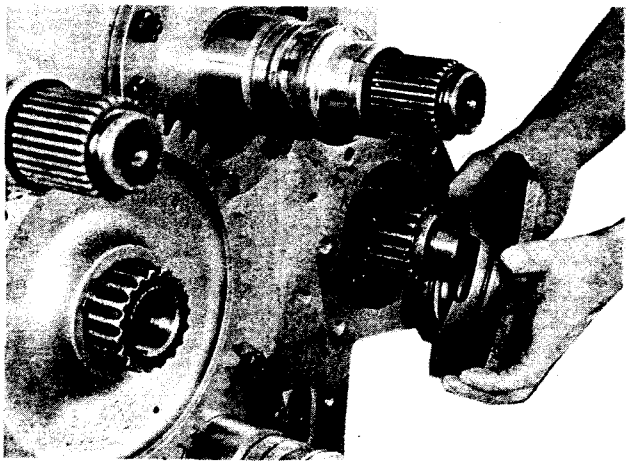


Figure 21

Remove output shaft bearing cap.

CLARK

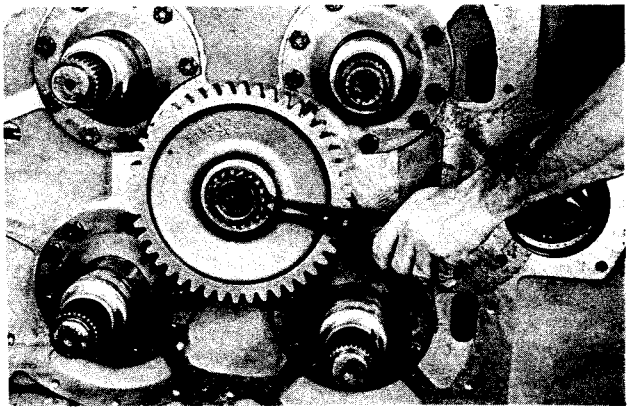


Figure 22

Remove idler gear retainer ring.

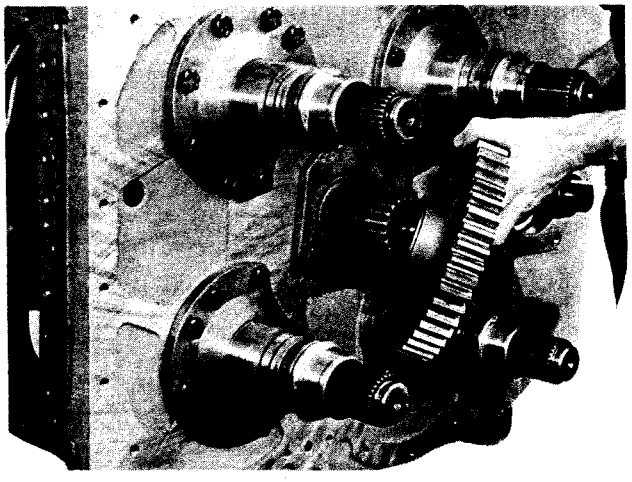


Figure 23

Remove idler gear.

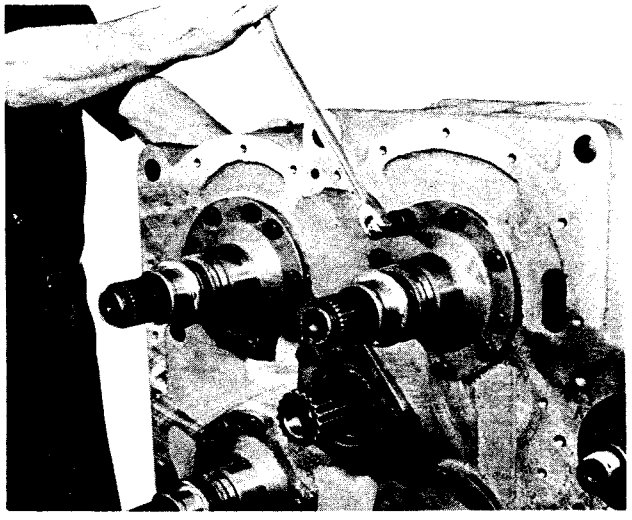


Figure 24

Remove clutch support bolt.

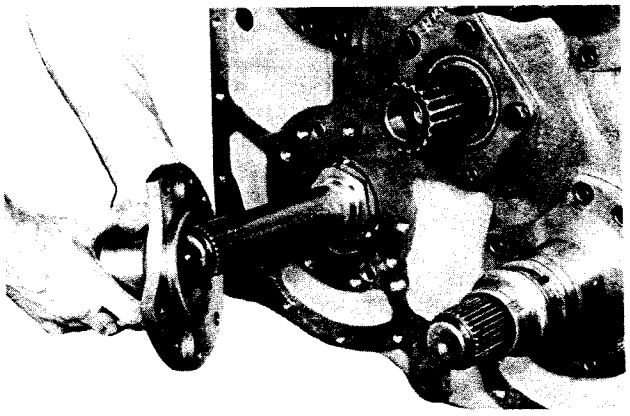


Figure 25

Remove clutch support.

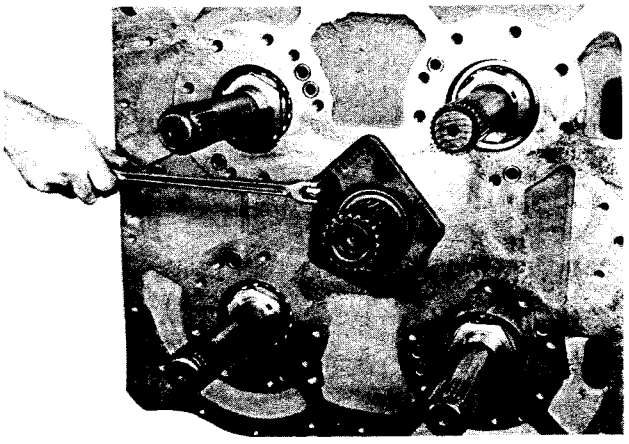


Figure 26

Remove idler shaft bearing cap bolts.

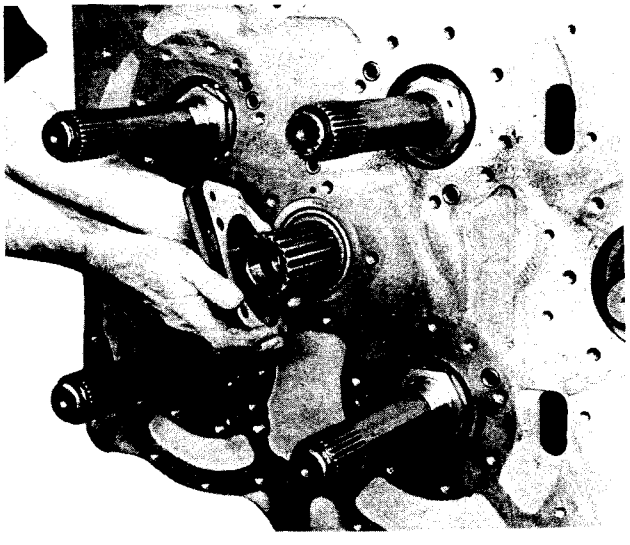


Figure 27

Remove idler shaft bearing cap and shims.

CLARK

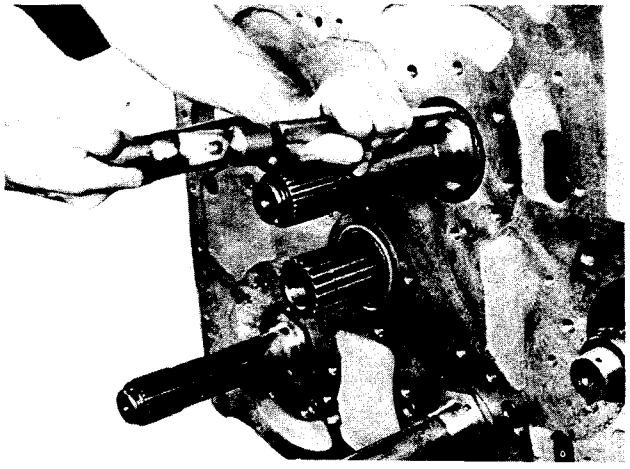


Figure 28

Straighten tangs on bearing nut lock.

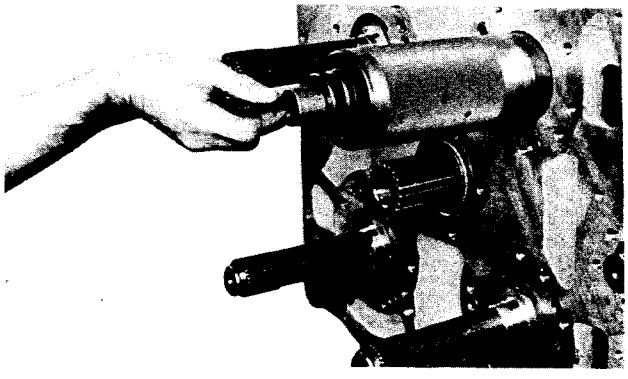


Figure 29

Lock transmission gears with a soft bar and remove the outer lock nut, nut lock, and inner lock nut.

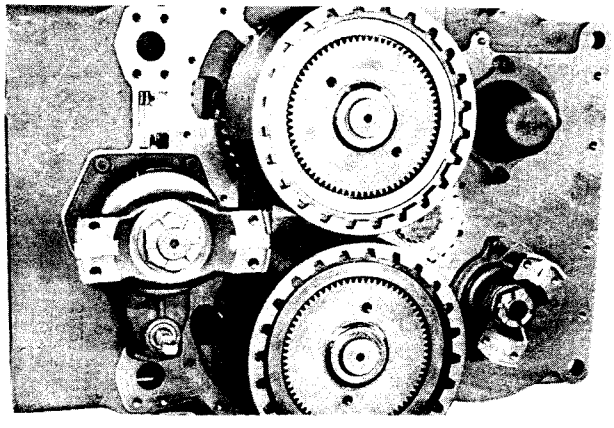


Figure 30

1st and 2nd clutch cover removed. Proceed with clutch disassembly as explained in previous text (Figure 7 through Figure 18). **NOTE: The friction discs in the low clutch has a higher co-efficient rating than the friction discs in the other clutches, therefore the discs must not be mixed.**

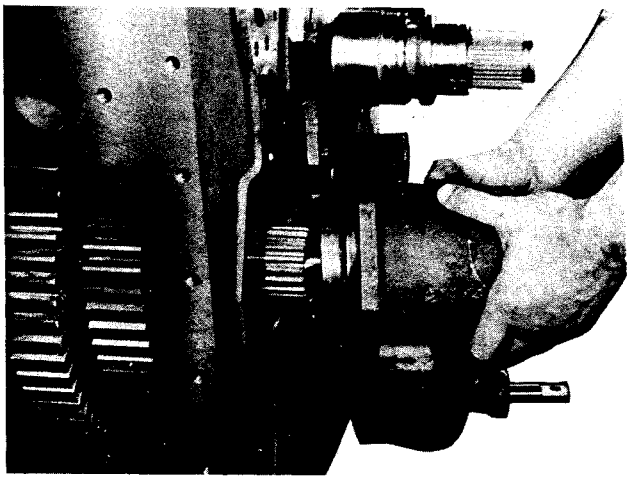


Figure 31

Remove disconnect housing bolts and housing assembly.

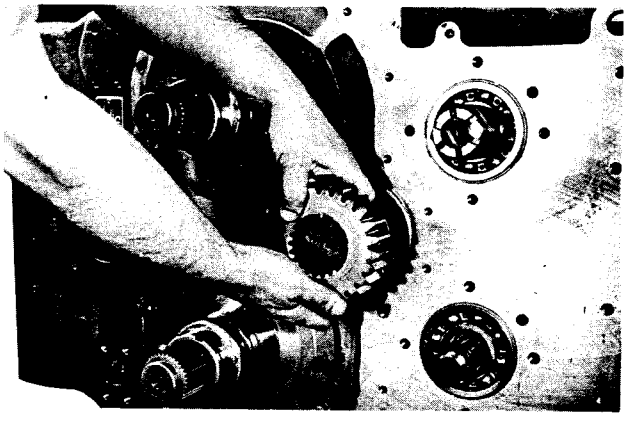


Figure 32

Remove idler gear retainer rings and idler gear.

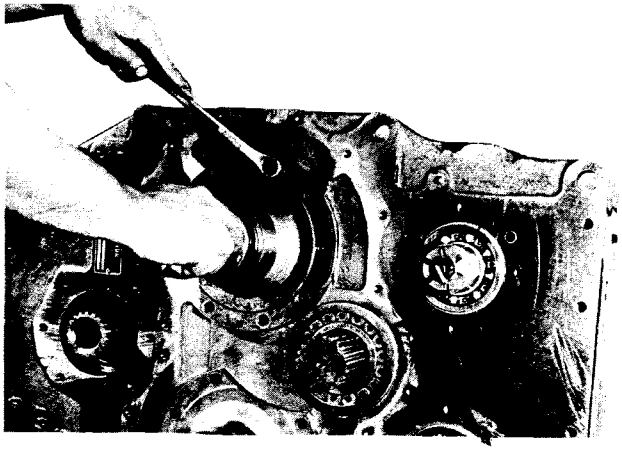


Figure 33

Remove 1st and 2nd clutch support bolts and clutch supports.

CLARK

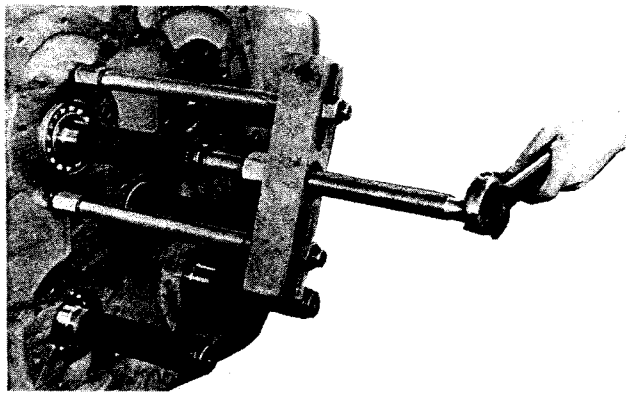


Figure 34

Using a suitable pusher tool, remove the reverse shaft, pushing from the lock nut side. Remove gears and spacers from inside case.

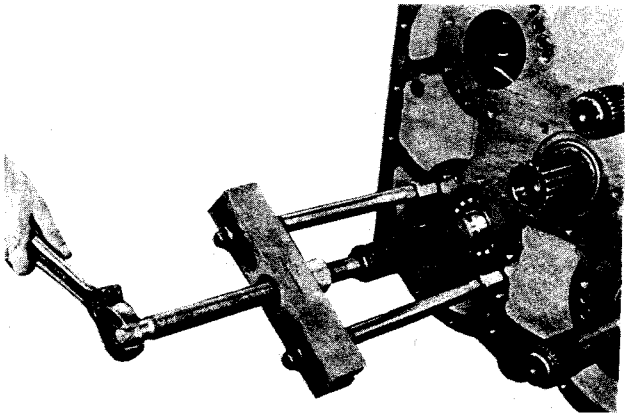


Figure 35

Using a suitable pusher tool, remove the input shaft, pushing from the lock nut side. Remove gears and spacers from inside case.

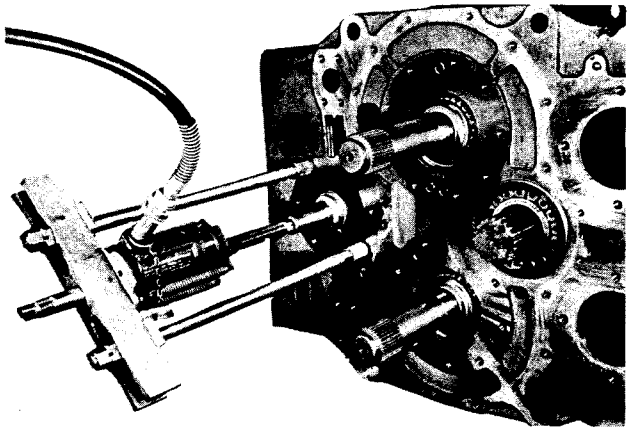


Figure 36

Press output shaft from case. Output shaft may be removed from either side.

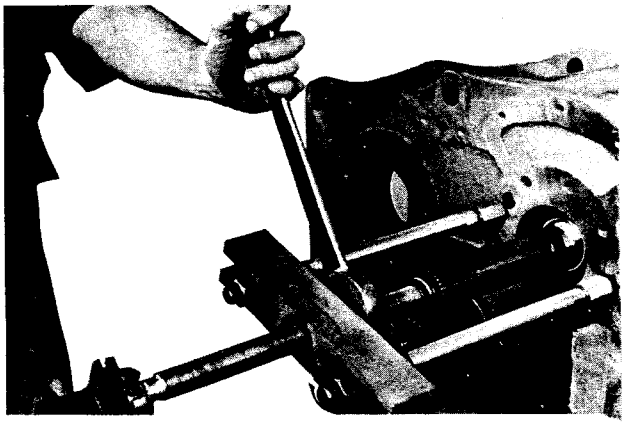


Figure 37

Using a suitable pusher tool, remove the 2nd and 4th shaft, pushing from the lock nut side. Remove gears and spacers from inside case.

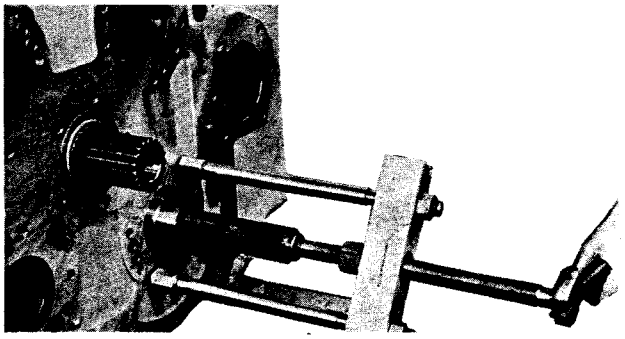


Figure 38

Using a suitable pusher tool, remove the 1st and 3rd shaft, pushing from the lock nut side. Remove gears and spacers from inside case.

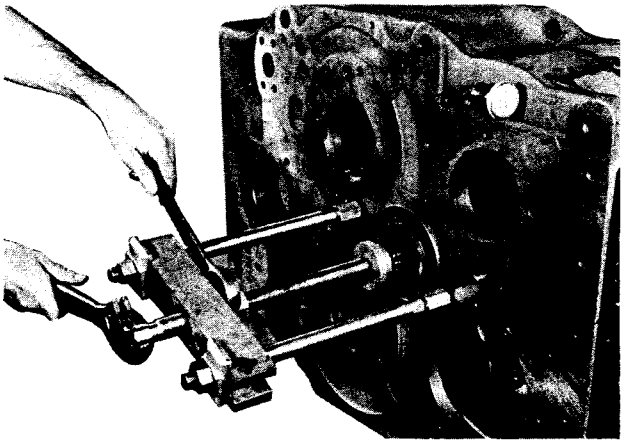


Figure 39

Remove idler shaft by pushing shaft out until double cone bearing and outer bearing race are exposed on opposite side.

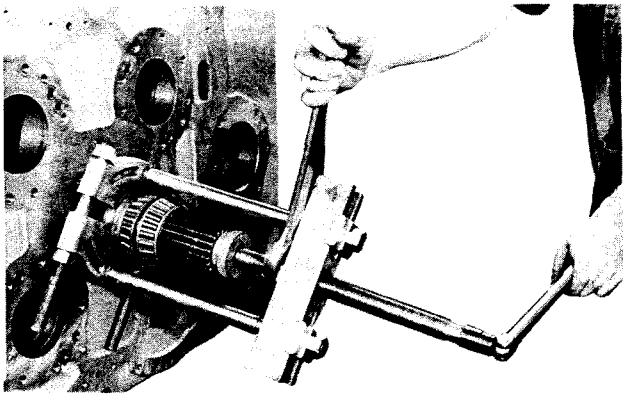


Figure 40

Using a suitable puller, remove double cone bearing from idler shaft. From cone bearing side push idler shaft and roller bearing from case.

DISASSEMBLY OF CONTROL COVER

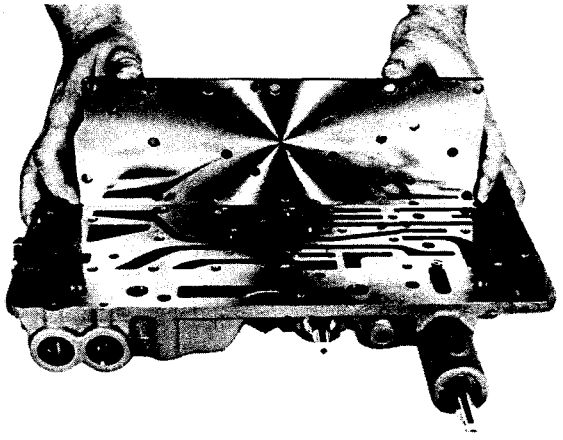


Figure 41

Remove bolts from oil circuit plate. Remove oil circuit plate. **CAUTION:** Do not lose detent springs.

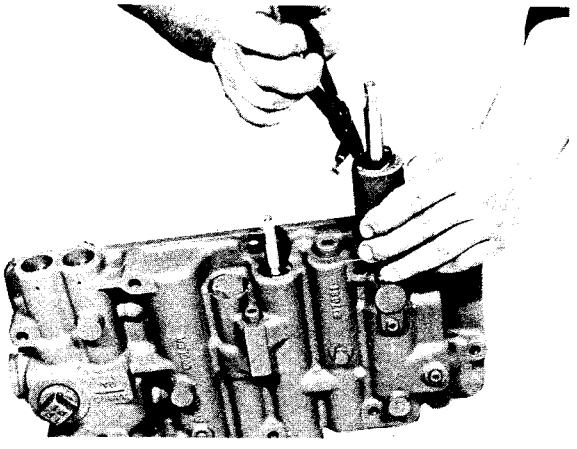


Figure 42

Remove speed selector valve assembly retainer ring.

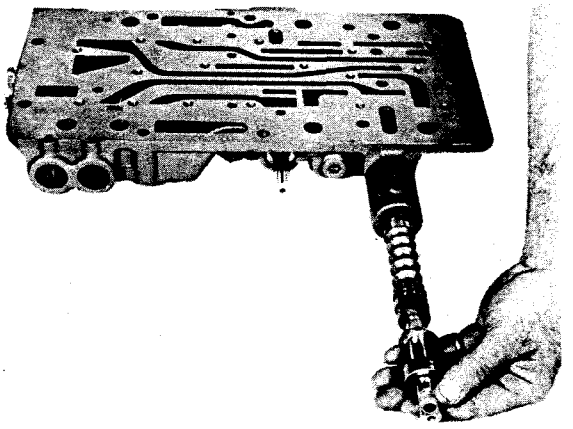


Figure 43

Tap lightly on opposite end of speed selector valve. Valve and valve oil seal will come out together.

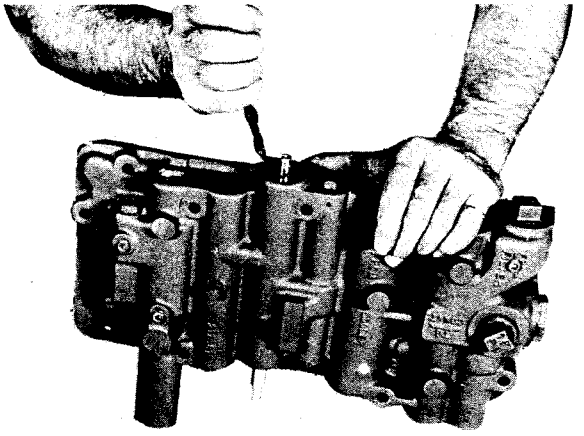


Figure 44

Remove forward and reverse selector valve retainer ring.

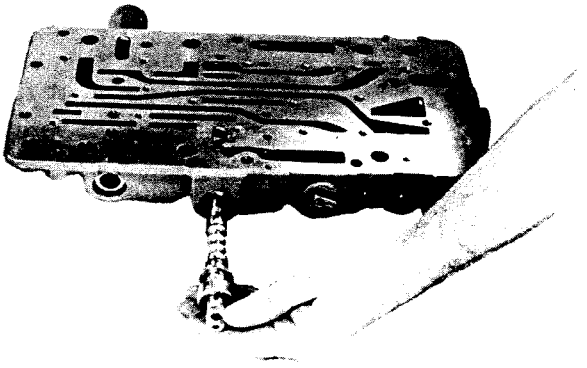


Figure 45

Tap lightly on opposite end of forward and reverse selector valve. Valve and valve oil seal will come out together.

CLARK

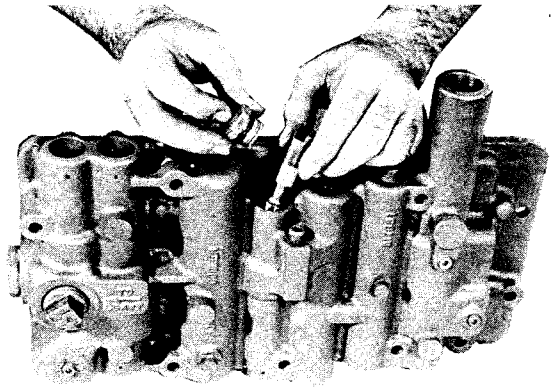


Figure 46

Remove shut-off valve plug and "O" ring. Remove shut-off valve.

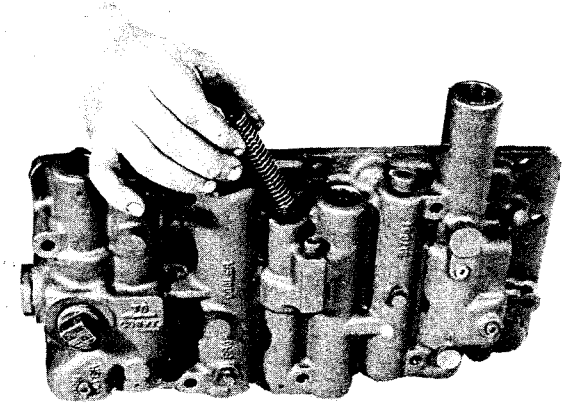


Figure 47

Remove shut-off valve spring.

CAUTION: When removing roll pins, it is recommended a press be used to depress valve stop, valve and spool springs.

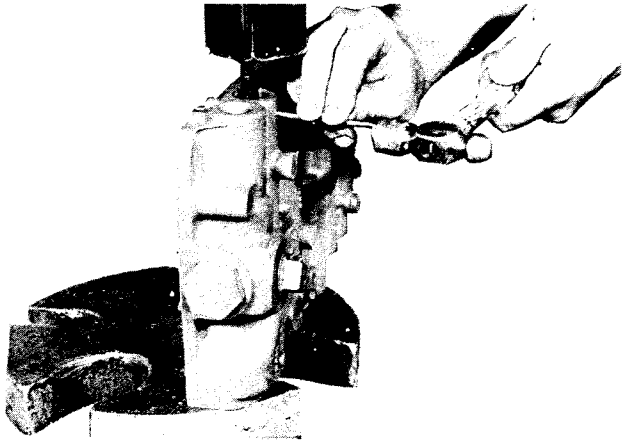


Figure 48

Depress regulating valve spring stop and spring. Remove roll pin.

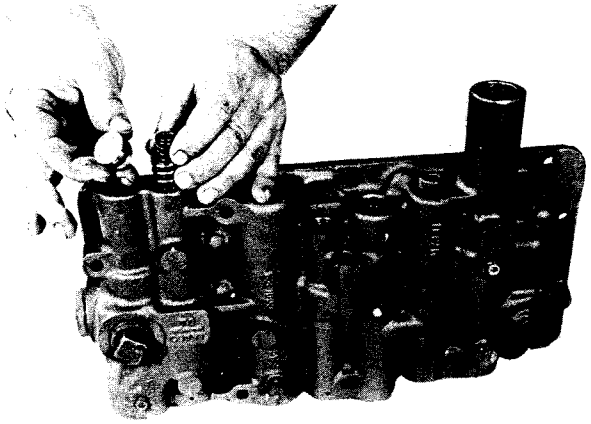


Figure 49

Release press slowly. Springs will push spring stop from control housing. Remove spring stop and inner and outer spring.

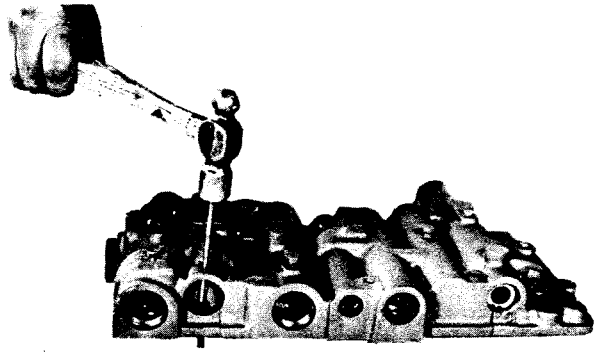


Figure 50

Remove roll pin on opposite end. Depressing valve stop is not necessary as the springs were removed in Figure **49**

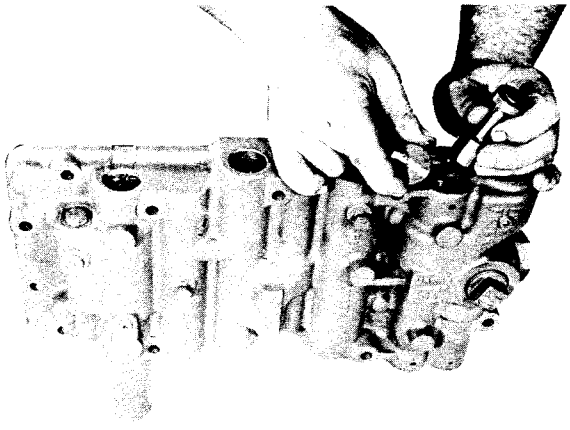


Figure 51

Remove regulating valve stop and valve from control housing.

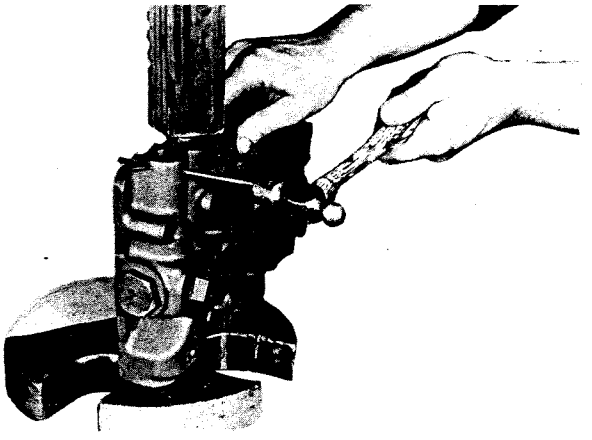


Figure 52

Depress safety valve spring and spring stop.

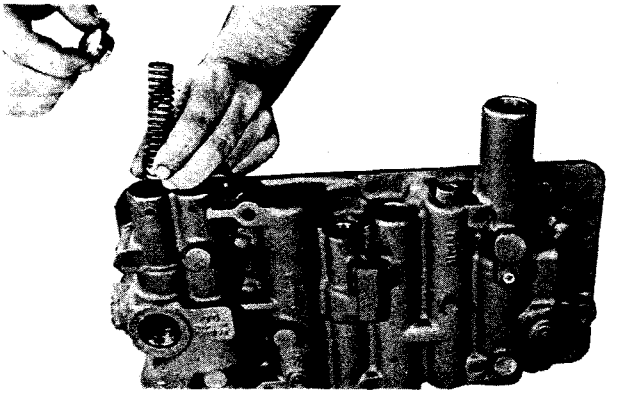


Figure 53

Remove safety valve spring stop, valve spring, and safety ball valve.

TRANSMISSION INTERNAL TUBING

These tubes are not to be removed unless damaged. They should, however, be cleaned and checked for leaks when transmission is disassembled. The tubes are divided into two groups. The high pressure or clutch pressure lines and the low or lubricating pressure lines.

When necessary to replace any tubes, tool CE-805 is required. The procedure for using tool is as follows:

1. Install tubing in housing with end flush with case.
2. Slide collar over end of tube and press into bore of case.

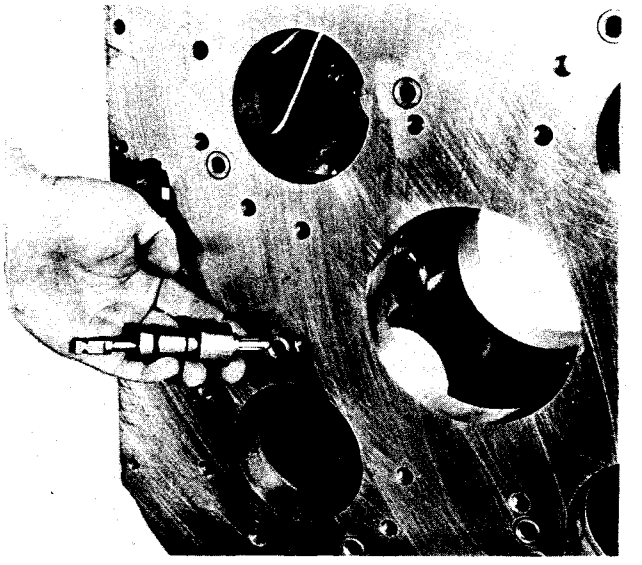


Figure 54

Pull mandrel on tool all the way back and insert tool in tube.

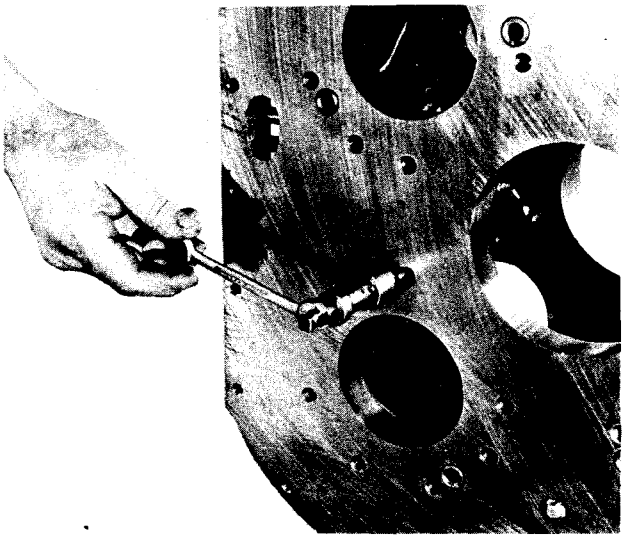


Figure 55

Turn mandrel with hand until tool is firmly seated in tube. Using a 3/8" wrench, turn mandrel as far as possible.

Use this procedure to install all tubes in housing.

Principle of Tool

Tool has roller which expands when mandrel is inserted. As mandrel is turned, the rollers expand against the internal bore of tubing. This forces tube to expand against collar which has a groove on inside diameter: When tube is expanded into this groove it is locked into position.

Cleaning and Repair of Tool

This tool is a precision instrument and must be treated as such. After each use, remove mandrel and rollers and flush tool with cleaning solvent. Inspect rollers and mandrel for chips and flaking. If rollers or mandrel need to be replaced, they may be purchased from **Air Tool Division, Dresser Industries, Inc., 302 S. Center St., Springfield, Ohio 45501. Phone 513-323-4981. Attn: Order Dept.**

CLEANING AND INSPECTION

CLEANING

Clean all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and slushed up and down slowly until all old lubricant and foreign material is dissolved and parts are thoroughly cleaned.

CAUTION: Care should be exercised to avoid skin rashes, fire hazards and inhalation of vapors when using solvent type cleaners.

Bearings

Remove bearings from cleaning fluid and strike larger side of cone flat against a block of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. Dry bearings using moisture-free compressed air. Be careful to direct air stream across bearing to avoid spinning. Do not spin bearings when drying. Bearings may be rotated slowly by hand to facilitate drying process.

Housings

Clean interior and exterior of housings, bearing caps, etc., thoroughly. Cast parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts do not have ground or polished surfaces. Parts should remain in solution long enough to be thoroughly cleaned and heated. This will aid the evaporation of the cleaning solution and rinse water. Parts cleaned in solution tanks must be thoroughly rinsed with clean water to remove all traces of alkali. Cast parts may also be cleaned with steam cleaner.

CAUTION: Care should be exercised to avoid inhalation of vapors and skin rashes when using alkali cleaners.

All parts cleaned must be thoroughly dried immediately by using moisture-free compressed air or soft, lintless absorbent wiping rags free of abrasive materials such as metal filings, contaminated oil or lapping compound.

INSPECTION

The importance of careful and thorough inspection of all parts cannot be overstressed. Replacement of all parts showing indication of wear or stress will eliminate costly and avoidable failures at a later date.

Bearings

Carefully inspect all rollers, cages and cups for wear, chipping or nicks to determine fitness of bearings for further use. Do not replace a bearing cone or cup individually without replacing the mating cup or cone at the same time. After inspection, dip bearings in Automatic Transmission Fluid and wrap in clean lintless cloth or paper to protect them until installed.

Oil Seals, Gaskets, Etc.

Replacement of spring load oil seals, "O" rings, metal sealing rings, gaskets and snap rings is more economical when unit is disassembled than premature overhaul to replace these parts at a future time. Further loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing members should be handled carefully, particularly when being installed. Cutting, scratching, or curling under of lip of seal seriously impairs its efficiency. Apply a thin coat of Permatex No. 2 on the outer diameter of the oil seal to assure an oil tight fit into the retainer. When assembling new metal type sealing rings, same should be lubricated with coat of chassis grease to stabilize rings in their grooves for ease of assembly of mating members. Lubricate all "O" rings and seals with Automatic Transmission Fluid before assembly.

Gears and Shafts

If magna-flux process is available, use process to check parts. Examine teeth on all gears carefully for wear, pitting, chipping, nicks, cracks or scores. If gear teeth show spots where case hardening is worn through or cracked, replace with new gear. Small nicks may be removed with suitable hone. Inspect shafts and quills to make certain they are not sprung, bent, or splines twisted, and that shafts are true.

Housing, Covers, etc.

Inspect housings, covers and bearing caps to be certain they are thoroughly cleaned and that mating surfaces, bearing bores, etc., are free from nicks or burrs. Check all parts carefully for evidence of cracks or condition which would cause subsequent oil leaks or failures.

REASSEMBLY OF TRANSMISSION

Instructions given below on reassembly of components of transmission assembly are given in the sequence that must be followed in rebuilding. Principle of operations cited and views shown are similar and parallel on all shafts. The various drive shafts are assembled in the following order:

1. Idler Shaft —"I"
2. First and Third Shaft —"B"
3. Second and Fourth Shaft —"A"
4. Output Shaft —"O"
5. Reverse Shaft —"R"
6. Input Shaft — "F"

REASSEMBLY OF IDLER SHAFT

Figure 56

If transmission case was changed, install idler bearing cup locating ring. Install oil baffle in idler bearing bore. This must be done from inside the case and flange of the oil baffle must be 1/8" [3, 175mm] from the bearing cup locating ring. Install idler shaft inner cone bearing cup in transmission case.

Press roller bearing on idler shaft. Install bearing and shaft in case, opposite side of inner bearing cup. On taper bearing end of shaft install bearing spacer.

CAUTION: This spacer has a taper on the outer edge. This taper must go toward taper bearing. If installed wrong the large idler gear snap ring will not seat in ring groove.

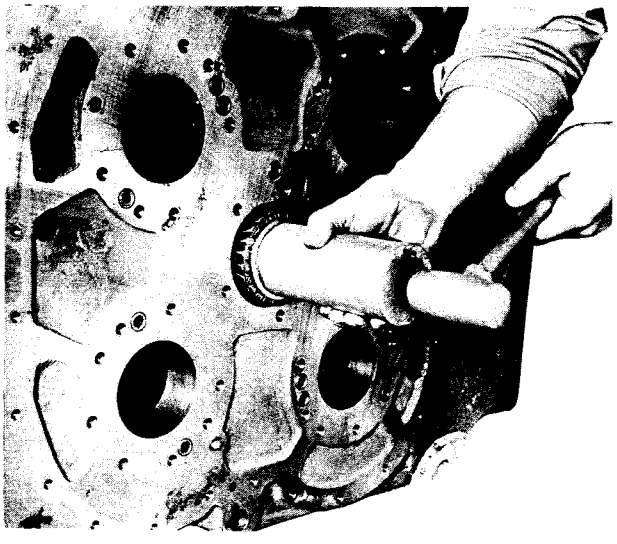


Figure 57

Install inner taper bearing on shaft with large diameter of taper outward.

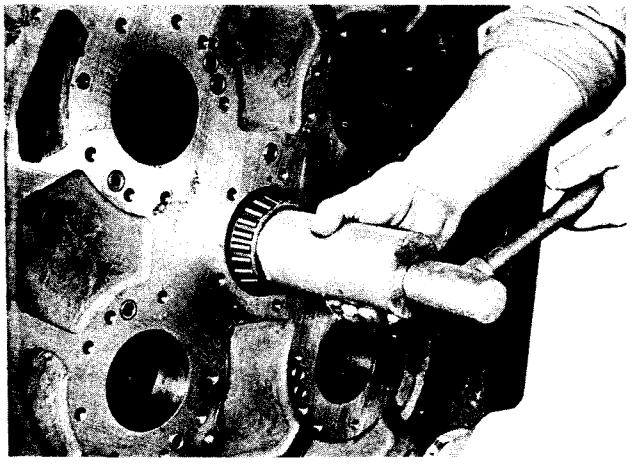


Figure 58

Install outer taper bearing on shaft with large diameter inward.

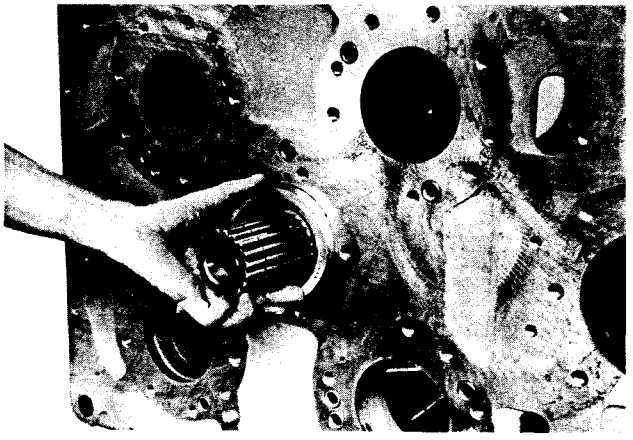


Figure 59

Install outer taper bearing cup on idler shaft.

Figure 60

Drive outer taper bearing cup against outer taper bearing.

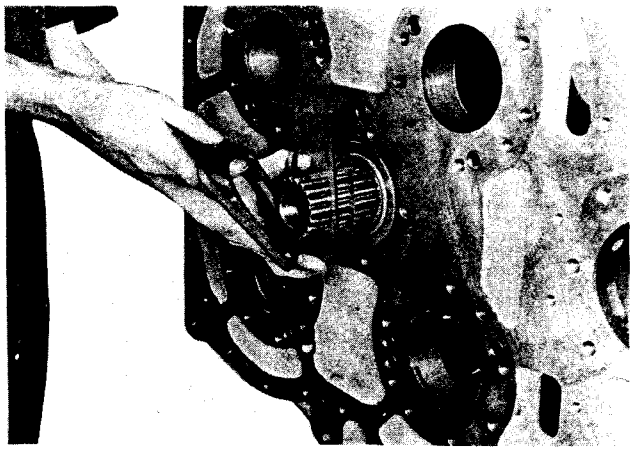


Figure 61

Install idler shaft bearing cap and shims.

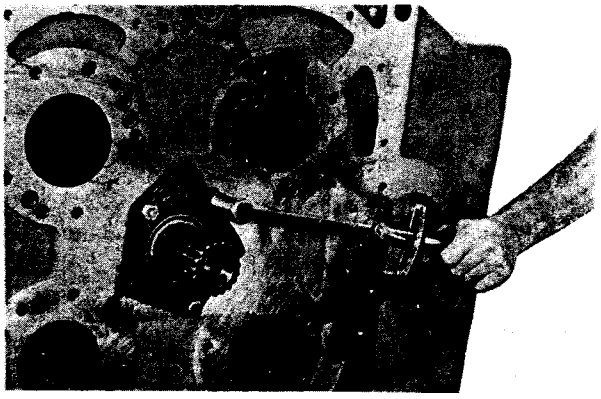


Figure 62

Install bearing cap bolts, torque bolts 47 to 65 ft. lbs. [6,5 - 8,9 m.kg].

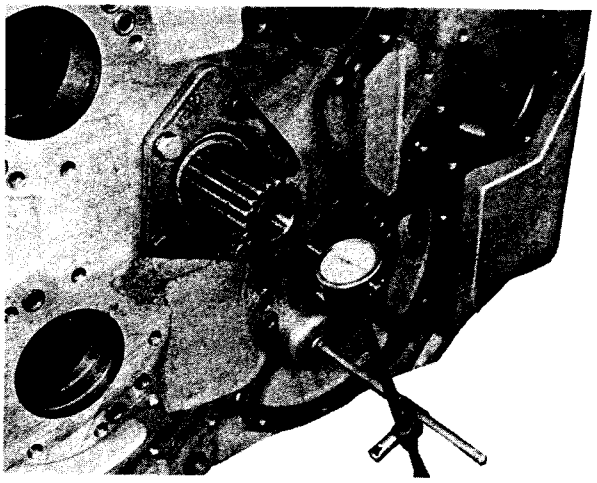


Figure 63

Adjust idler shaft taper bearing by adding or omitting shims. Check adjustment as shown in Figure 63. Adjust taper bearings .0 to .003 [0,000 - 0,076 mm] end play.

CLARK

REASSEMBLY OF 1st AND 3rd SHAFT

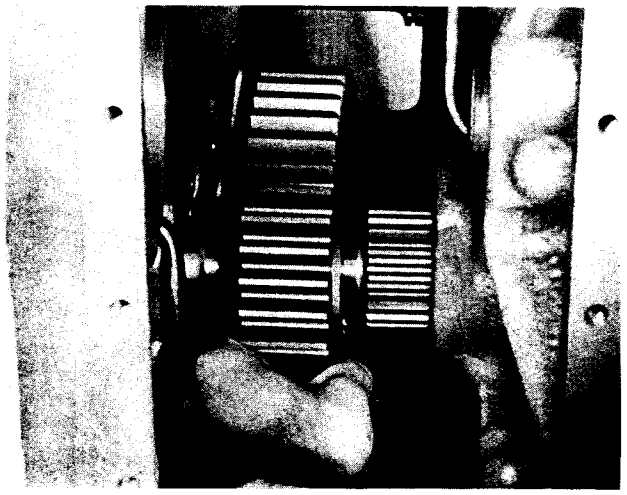


Figure 64

Press 1st and 3rd double taper bearing assembly on 1st and 3rd shaft. **CAUTION:** These bearings are in matched sets and under no circumstances can any of the four (4) parts be changed or mixed up with another bearing.

Position 1st and 3rd gear in transmission case. Install long gear spacer on shaft and against taper bearing assembly.

Insert shaft into bore of case and through 1st and 3rd gear. See Figure 64.

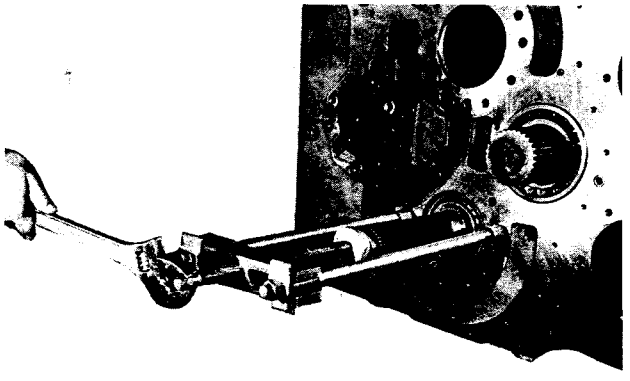


Figure 65

Push shaft assembly in case until taper bearing shoulders against locating ring in bore of case. Do not remove shaft pusher.

CLARK

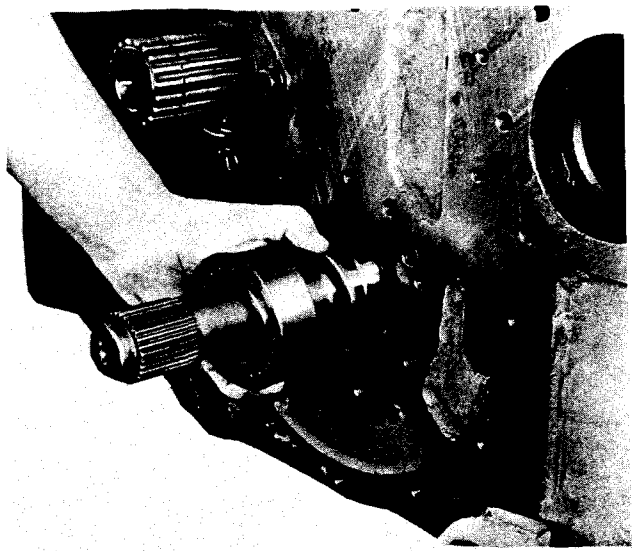


Figure 66

On opposite end of shaft install short spacer against 1st and 3rd gear. Install roller bearing as shown in Figure 66.

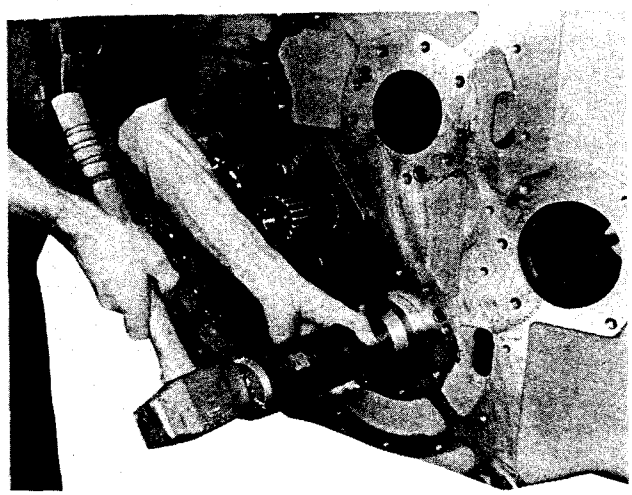


Figure 67

Drive bearing in place. **NOTE:** Bearing must be driven in tight. Check long spacer on shaft. When spacer can not be turned by hand, stack up between the front and rear bearing is tight. **DO NOT** attempt to draw bearing up tight with bearing lock nuts. Remove shaft pusher. This was left on only to hold shaft while installing roller bearing.

REASSEMBLY OF 2nd AND 4th SHAFT

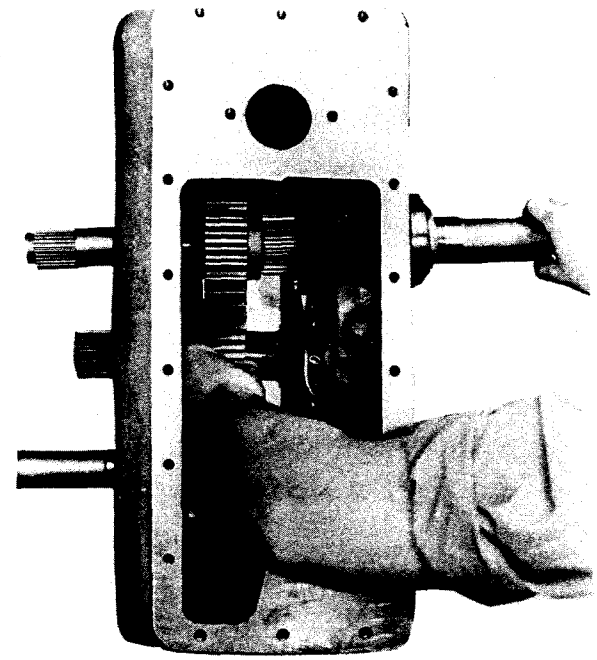


Figure 68

Press 2nd and 4th double taper bearing assembly on 2nd and 4th shaft. **CAUTION:** These bearings are in matched sets and under no circumstances can any of the four (4) parts be changed or mixed with another bearing.

Position 2nd and 4th gear in transmission case with long offset of gear hub toward front of case (input side). Insert shaft into bore of case and through 1st and 3rd gear. See Figure 68.

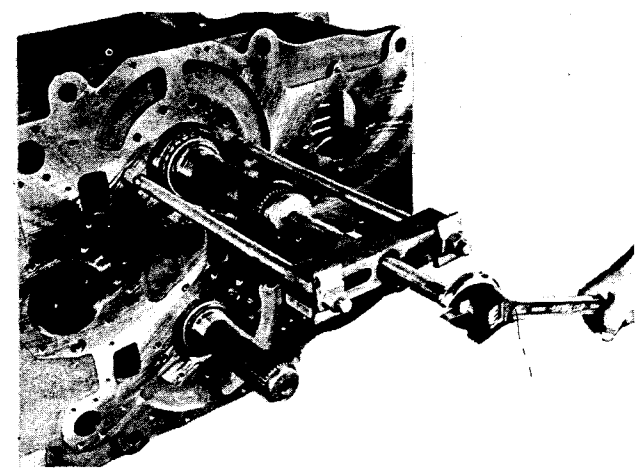


Figure 69

Push shaft assembly in case until taper bearing shoulders against locating ring in bore of case. Do not remove shaft pusher.

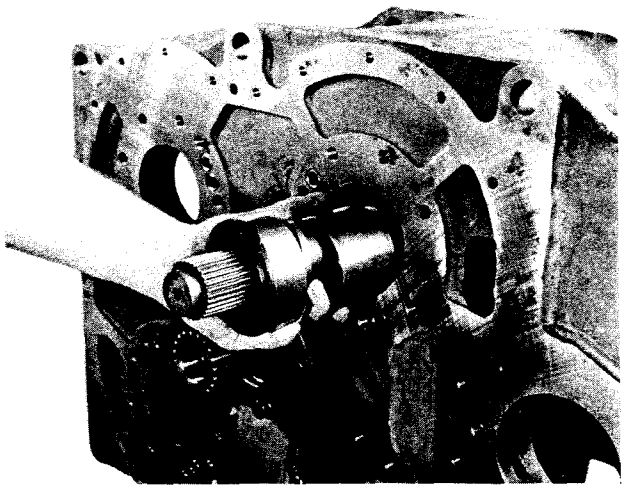


Figure 70

On opposite end of shaft, install long gear spacer on shaft and against 2nd and 4th gear. Install short spacer on shaft against long spacer. Install roller bearing and drive in place. **NOTE:** Bearing must be driven in tight. Check long spacer on shaft. When spacer can not be turned by hand, stack up between the front and rear bearing is tight. **DO NOT** attempt to draw bearing up tight with bearing lock nuts. Remove shaft pusher. This was left on only to hold shaft while installing roller bearing.

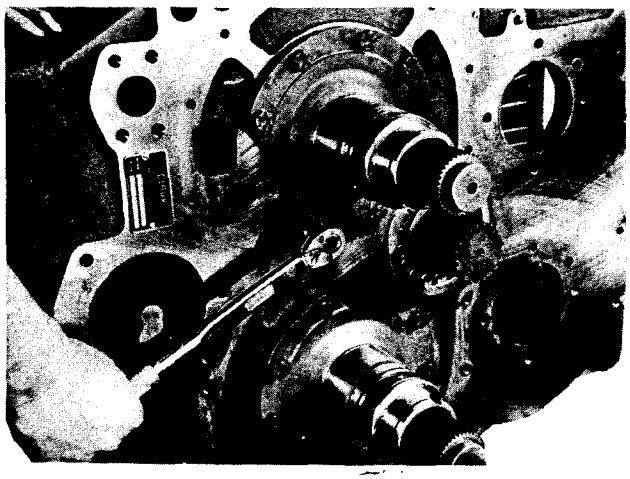


Figure 71

Install 1st and 2nd clutch supports. Align holes in clutch supports with holes in transmission case and install self locking bolts. Tighten bolts 70 to 85 ft. lbs. torque [9, 7 - 11, 7 m.kg].

On 1st and 2nd clutch supports only install new sealing ring expander spring and oil sealing ring on support. **NOTE:** Expander spring gap to be 180° from sealing ring hook joint.

CLARK

REASSEMBLY OF THE OUTPUT SHAFT

Assembly of the output shaft is optional. In the following illustrations the threaded end of the shaft is to the rear of the case, with the disconnect assembly toward the input side.

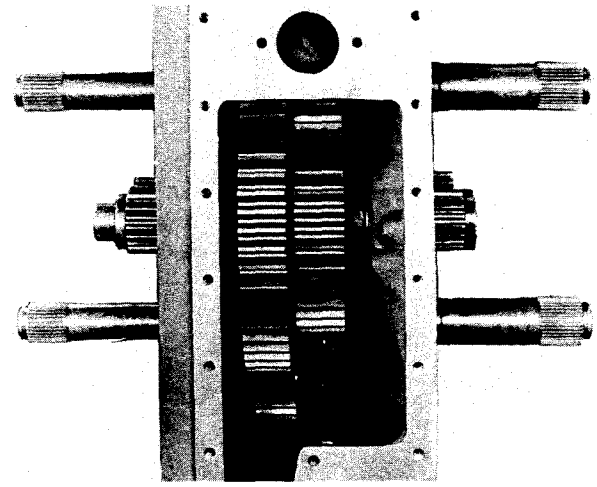


Figure 72

Press taper bearing (large diameter of taper inward) over threaded end of output shaft against shoulder on shaft. Position small output gear in transmission case to the input side (front) with longer offset of gear hub to the front. Position large output gear in transmission case to the rear with longer offset of gear hub to the rear. Insert output shaft through the rear bore of case and through large and small output gears. Figure 72 shows proper stack up of gears. Block output shaft and install front taper bearing (large diameter of taper inward) on output shaft until bearing shoulders against small output gear. Install bearing cups over front and rear bearings.

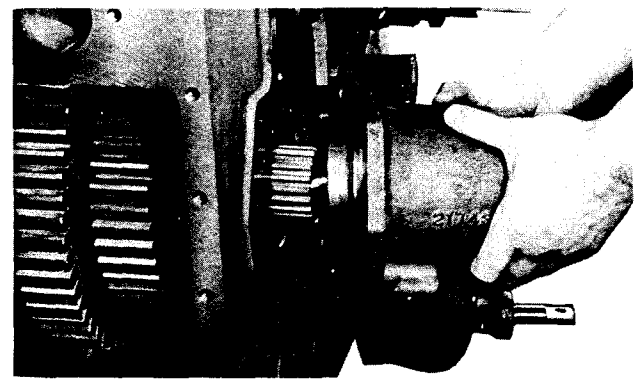


Figure 73

Install new "O" ring on disconnect housing. Lubricate "O" ring with automatic transmission fluid. Install disconnect assembly on output shaft.

CLARK

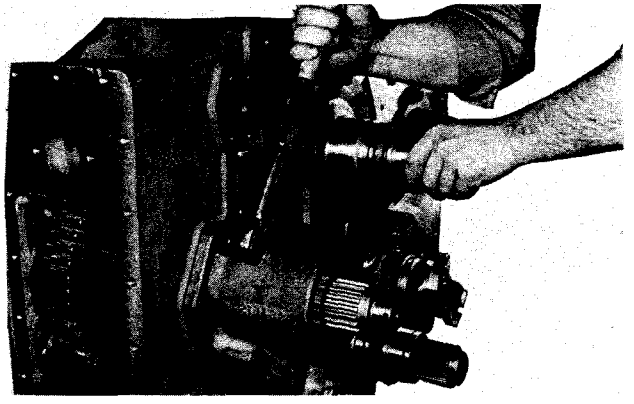


Figure 74

Secure disconnect assembly to transmission case with bolts and lockwashers. Tighten 47 to 55 ft. lbs. torque. [6, 5 - 7, 6 m.kg]

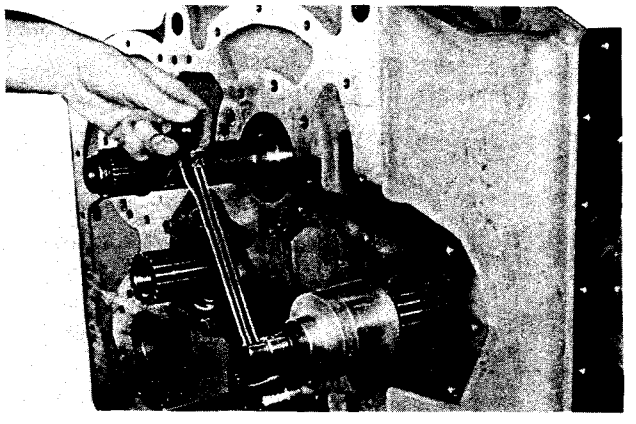


Figure 75

Install flange nut on threaded end of output shaft. Use an inch lb. torque wrench on the flange nut. Determine the amount of torque required to turn output shaft and gear train.

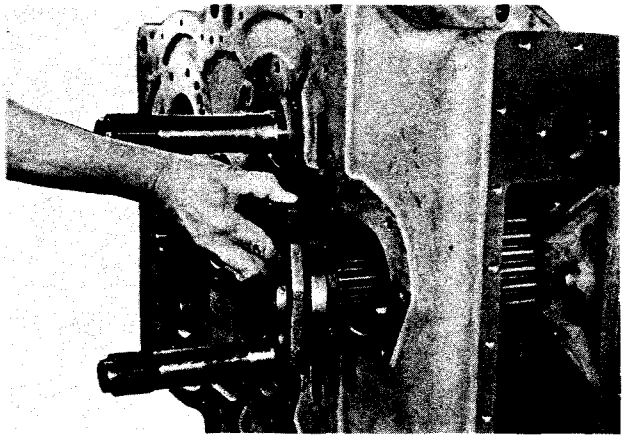


Figure 76

Install bearing cap, "O" ring and shims to transmission case.

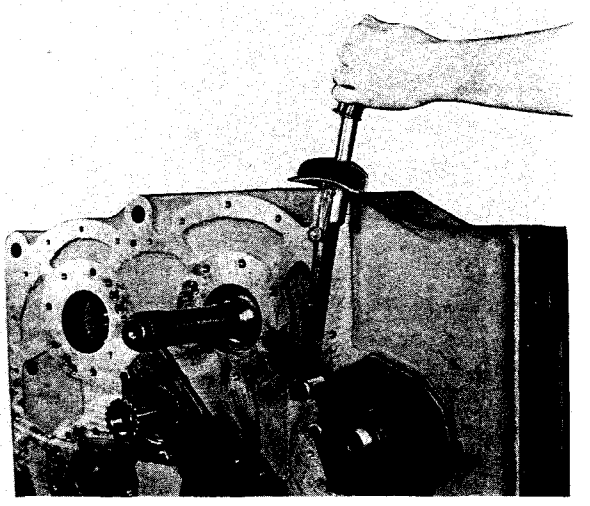


Figure 77

Install bearing cap bolts and lock washers. Tighten 47 to 55 ft. lbs. torque [6, 5 - 7, 6 m.kg].

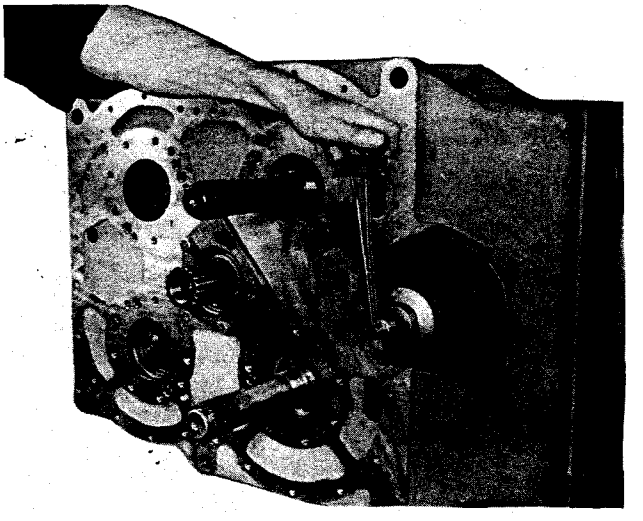


Figure 78

With an inch lb. torque wrench turn output shaft and gear train. Add or remove bearing cap shims to adjust preload. When bearings are properly adjusted, it will take 6 to 8 inch lbs. [0, 07 - 0, 09 m.kg] more to turn gear train than it did before bearing cap was installed.

REASSEMBLY OF INPUT AND REVERSE SHAFT

CLARK

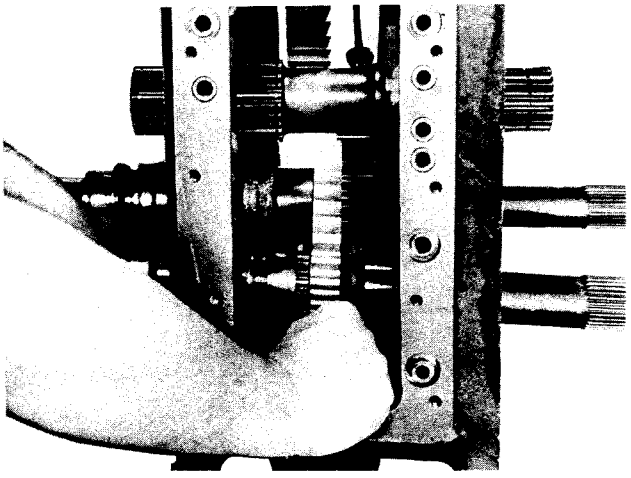


Figure 79

Press roller bearing on threaded end of input shaft. Install short spacer on shaft opposite threaded end. Position input gear in case with longer offset of gear to the rear. Install input shaft and bearing into front case bore and through input gear. Push bearing and shaft in case bore until bearing snap ring shoulders against transmission case. Do not remove shaft pusher. Install large spacer on shaft against input gear. Drive rear roller in place. **NOTE:** Bearing must be driven in tight. Check gear spacer on shaft. When spacer can not be turned by hand, stack up between input gear spacer and rear roller bearing is tight. **DO NOT** attempt to draw bearings up tight with bearing lock nuts. Remove shaft pusher.

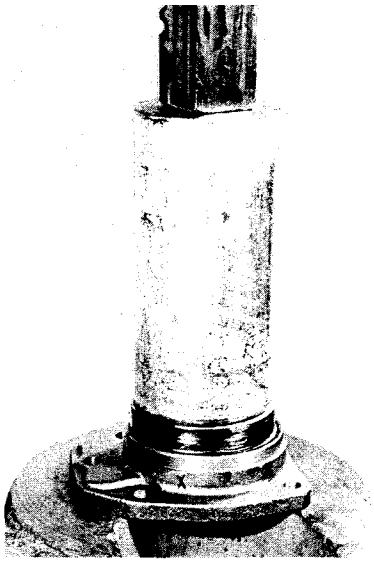


Figure 80

Apply a thin coat of Permatex No. 2 on the outer diameter of the input shaft oil seal. Press seal, lip of seal inward, into input shaft bearing cap.

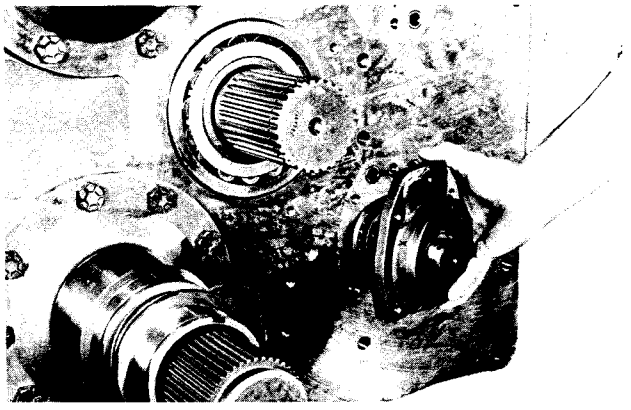


Figure 81

Install bearing cap and seal assembly on input shaft.

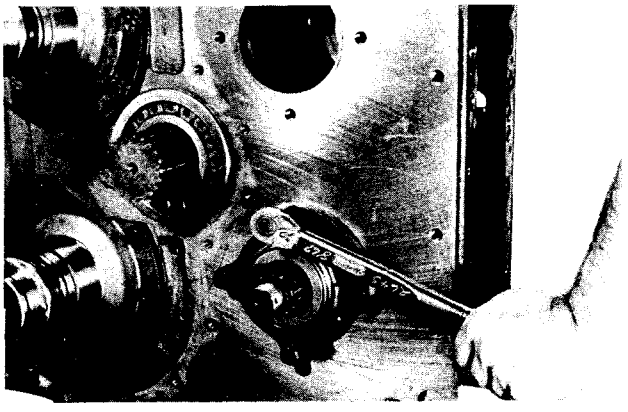


Figure 82

Install bearing cap bolts and lock washers. Torque bolts 47 to 55 ft. lbs. torque [6, 5 - 7, 6 m.kg].

Install companion flange, flange "O" ring, washer and flange nut. Tighten nut 150 to 175 ft. lbs. torque [20, 8 - 24, 1 m.kg].

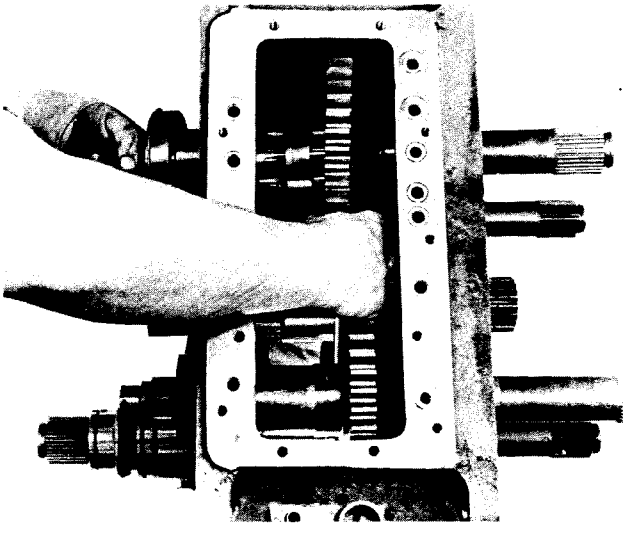


Figure 83

Assemble the reverse shaft the same as the input shaft (Figure 79). Install reverse shaft bearing spacer, washer and nut. Lock gears with a soft bar and tighten reverse nut 150 to 175 ft. lbs. torque [20,8 - 24,1 m.kg]. Install nut cotter. Place new gasket on reverse shaft. Install bolts and lock washers, tighten 47 to 55 ft. lbs. torque [6,5 - 7,6 m.kg].

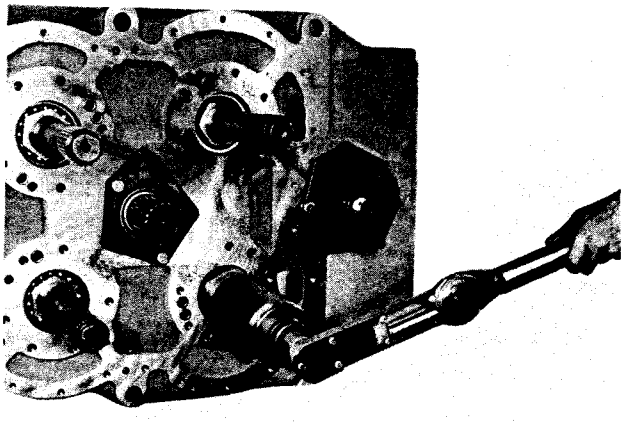


Figure 84

Lock gears using a soft bar, and install bearing inner lock nut (all four shafts). Tighten lock nuts 175 to 200 ft. lbs. torque [24,2 - 27,6 m.kg]. Install nut locks and outer lock nuts. Tighten outer lock nuts 175 to 200 ft. lbs. torque [24,2 - 27,6 m.kg].

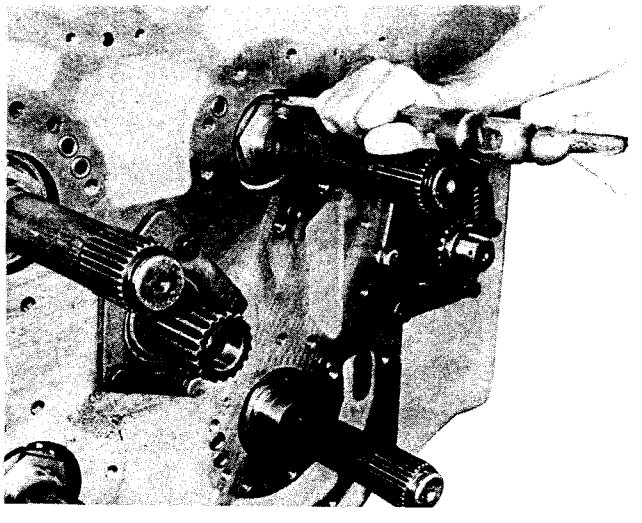


Figure 85

Bend a portion of the nut lock over one flat of the inner lock nut. Bend a portion of the nut lock over one flat of the outer lock nut.

If taper roller bearings are used in the input, reverse, 3rd and 4th clutch drums, follow procedure explained on pages 49 and 50 before installing clutch supports.

If ball bearings are used, proceed with Figure 86.

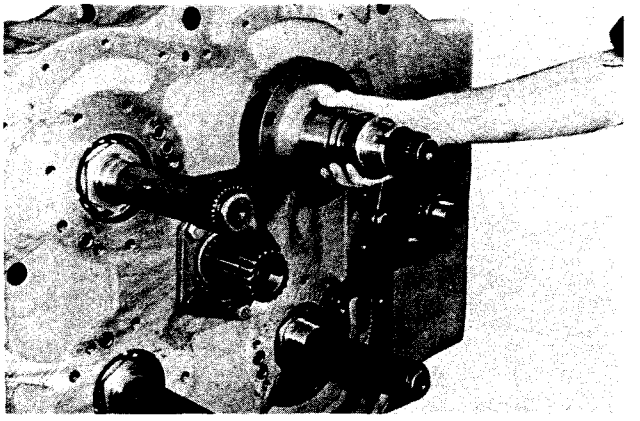


Figure 86

Install clutch supports. Align holes in clutch supports with holes in transmission case and install self locking bolts.

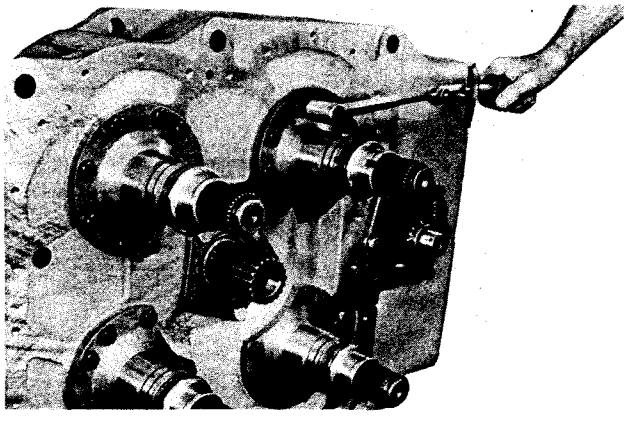


Figure 87

Tighten bolts 70-85 ft. lbs. torque [9, 7 - 11, 7 m.kg].

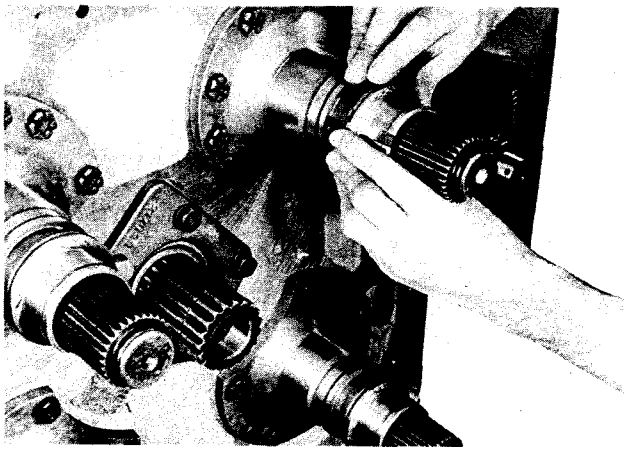


Figure 88

Install new clutch support piston rings. Lock rings in position. Lubricate piston rings with automatic transmission fluid.

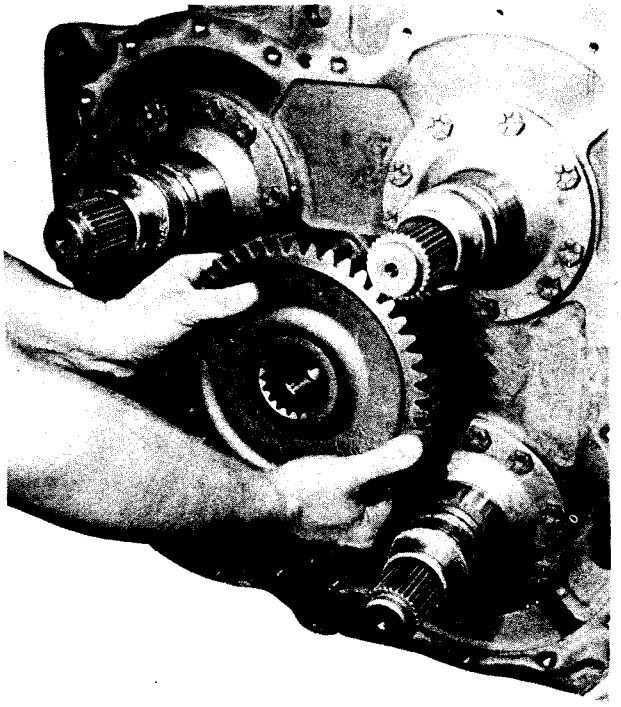


Figure 89

Install large idler gear on idler shaft with longer offset of gear hub inward.

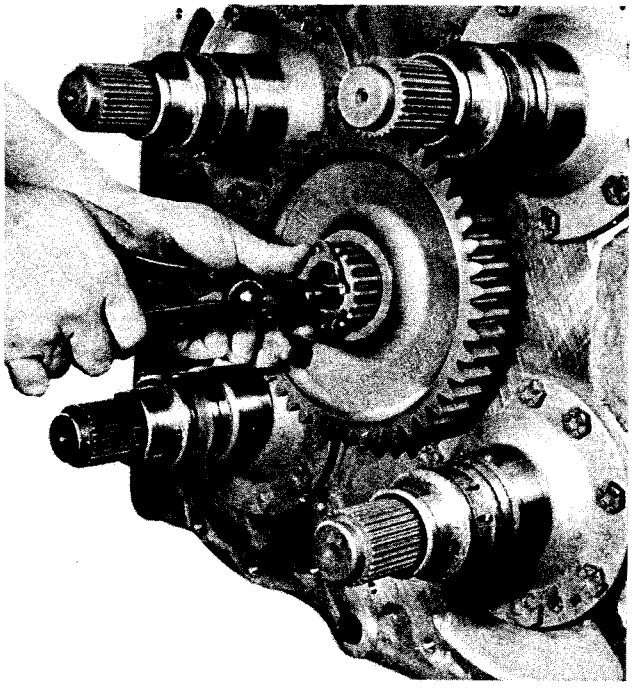


Figure 90

Install idler gear retainer ring.

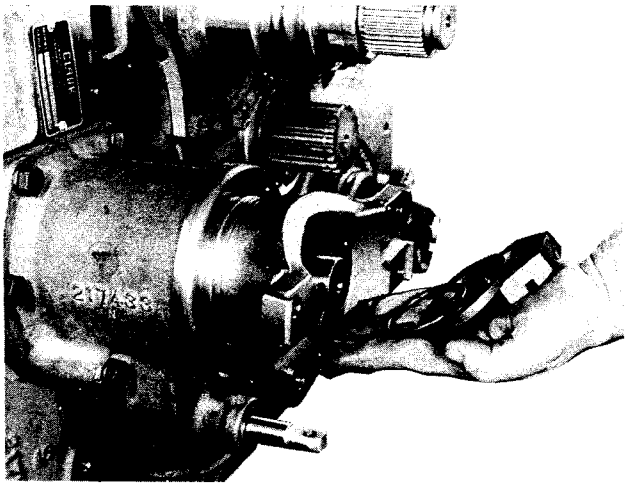


Figure 91

Install disconnect flange nut "O" ring, nut washer and flange nut.

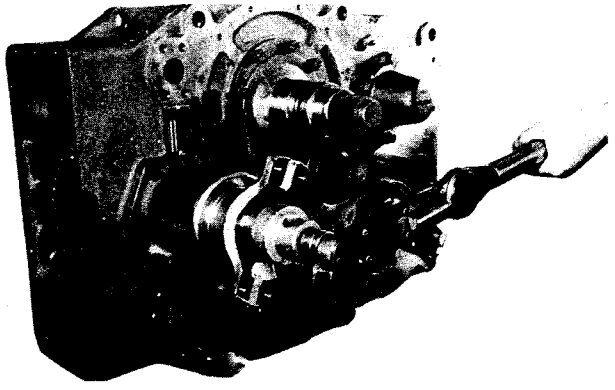


Figure 92

Lock gears with a soft bar and tighten flange nut 250 to 300 ft. lbs. torque [34, 6 - 41, 4 m.kg].

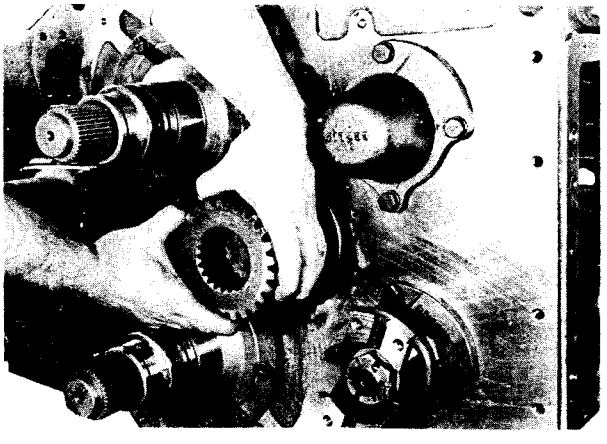


Figure 93

Install small idler gear on idler shaft with longer offset of gear inward.

REASSEMBLY OF CLUTCHES

NOTE: All clutches are assembled in a similar manner. However, the 1st and 2nd speed clutches have a clutch drum hub gear and retainer ring.

For input, reverse, 3rd and 4th clutch drum taper bearing installation see pages 49 and 50.

Clutch being assembled in the following illustrations is the 1st speed.

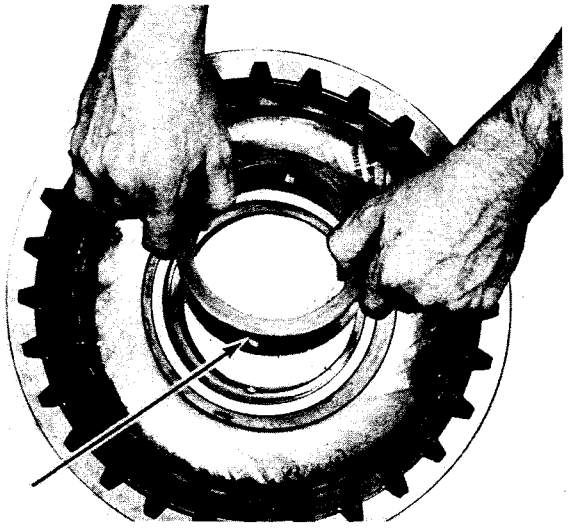


Figure 94

Insert lock ball in clutch piston ring outer race. Press outer race and ball in clutch drum. Outer race must be pressed from flush to 1/64" [0, 40 mm] below shoulder in clutch drum.

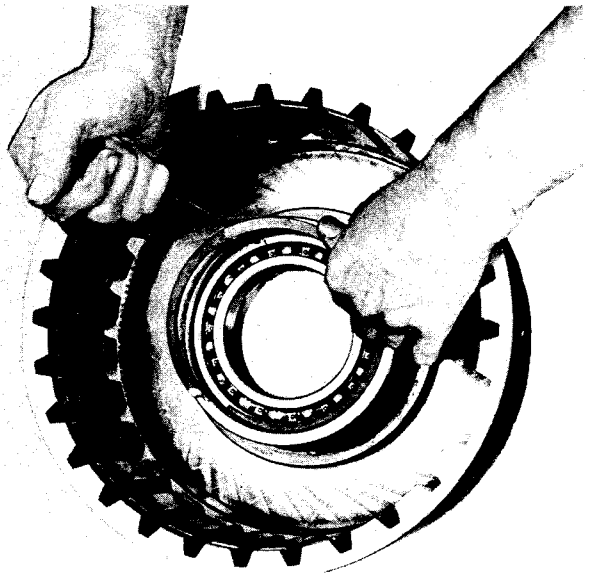


Figure 95

Press support ball bearing in clutch drum and secure with bearing retainer ring.

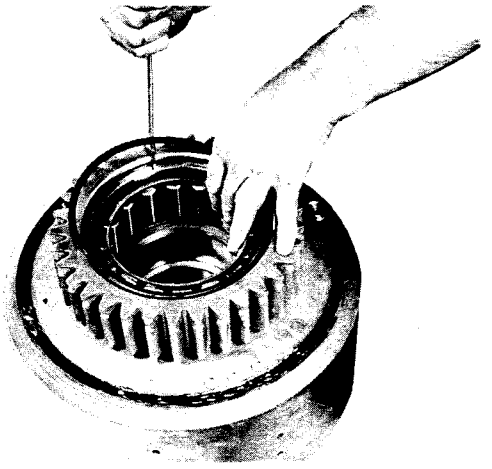


Figure 96

From rear end of clutch drum, press support roller bearing in drum. Secure with retainer ring.

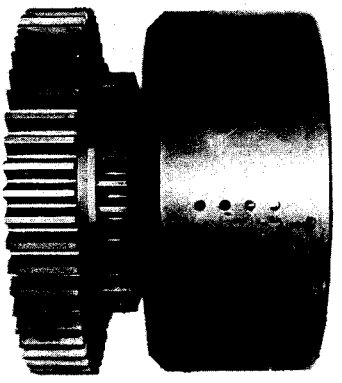


Figure 97

Press clutch drum hub gear on clutch drum with longer offset of gear hub inward. **NOTE:** Clutch drum hub gear is used only on the 1st and 2nd clutch.

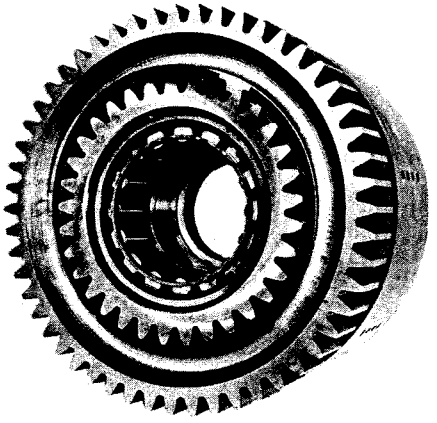


Figure 98

Secure clutch drum hub gear with retainer ring.

CLARK

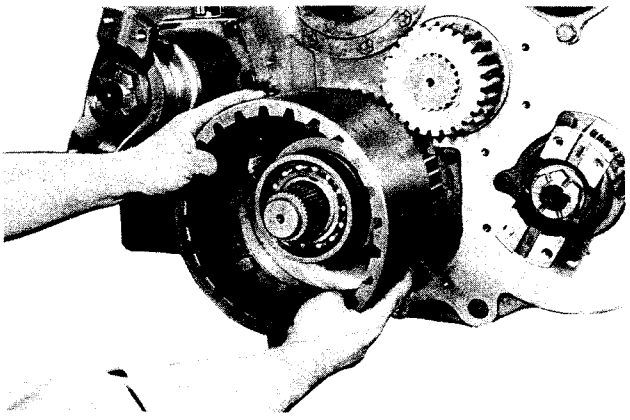


Figure 99

Install clutch drum assembly on clutch support. **CAUTION:** Do not damage clutch support piston rings.

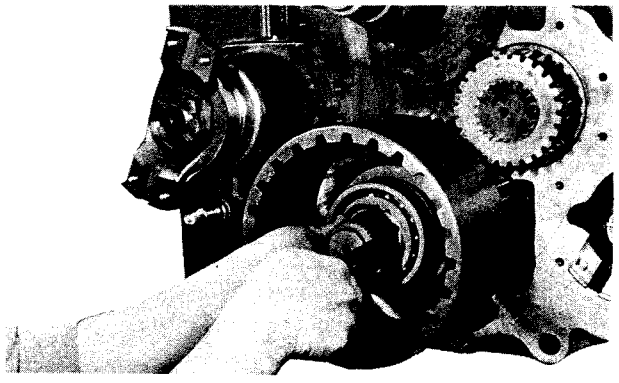


Figure 100

Install clutch drum hub bearing washer and washer retainer ring.

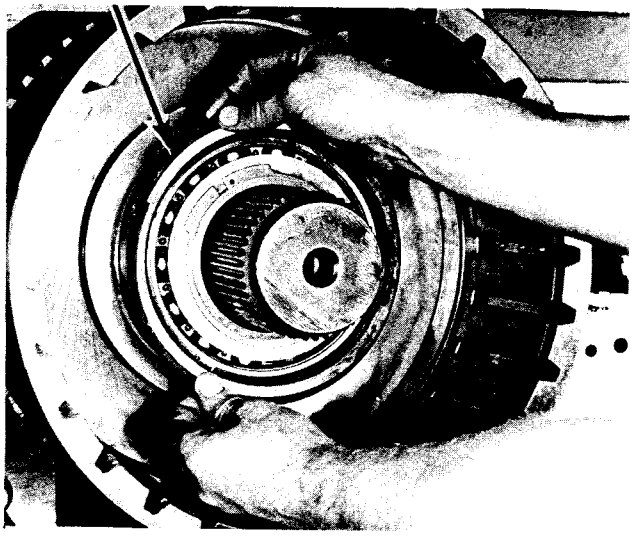


Figure 101

Install clutch piston inner sealing ring. Lubricate piston ring with automatic transmission fluid.

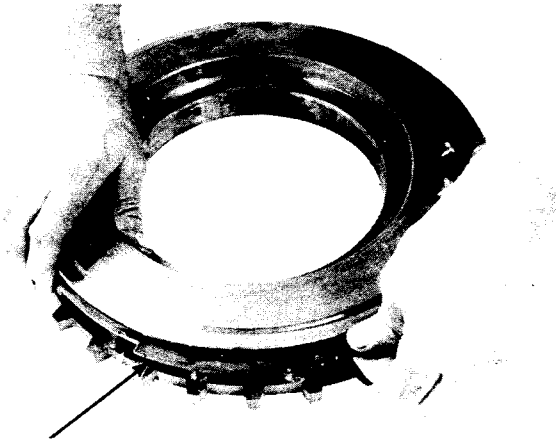


Figure 102

Install clutch piston outer piston ring. Lubricate piston ring with automatic transmission fluid.

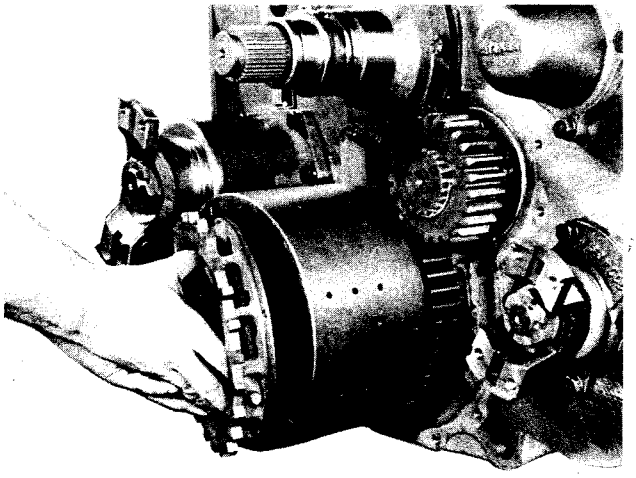


Figure 103

Slide clutch piston into position in clutch drum. **CAUTION:** Do not damage inner and outer piston rings.

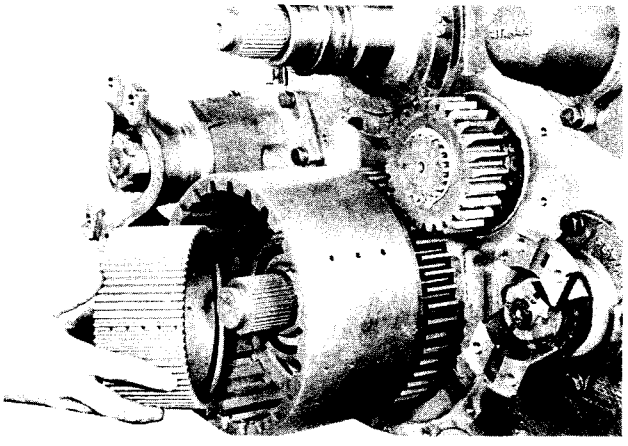


Figure 104

Install clutch disc hub in clutch drum.

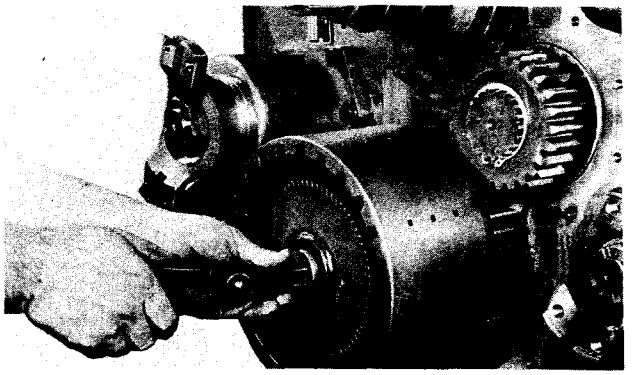


Figure 105

Install disc hub retainer ring.

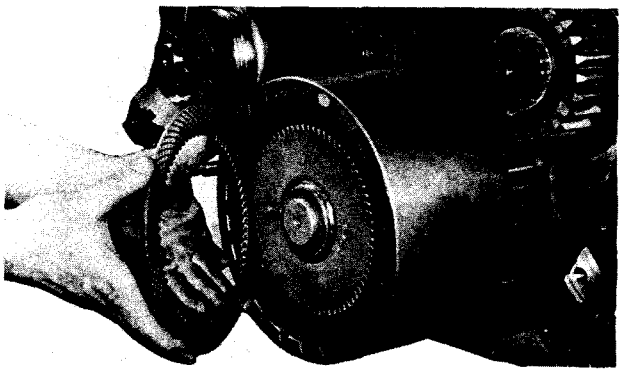


Figure 106

Install one inner clutch disc (spline teeth on inner diameter) on disc hub and against the clutch piston.

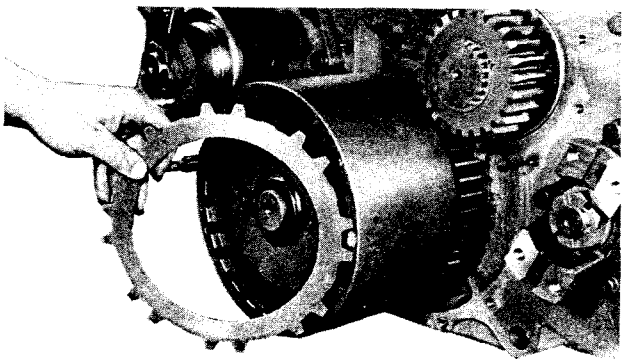


Figure 107

Install one outer clutch disc (spline teeth on outer diameter) in clutch drum. **NOTE:** The outer disc has teeth missing on the outer diameter. This is to allow passage for the clutch release springs. Insert two or more release springs in drum and against the teeth of the clutch piston. Install next inner disc. Alternate clutch discs, outer against inner, and always align the teeth on each outer disc with the teeth on the preceding outer disc. If assembly is correct each release spring is against a tooth on the clutch piston and you start with an inner disc and end with an inner disc.

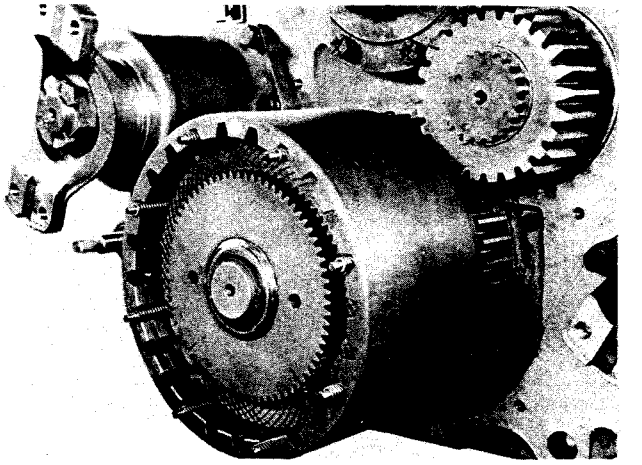


Figure 108

Insert all release springs and guide pins in clutch drum.

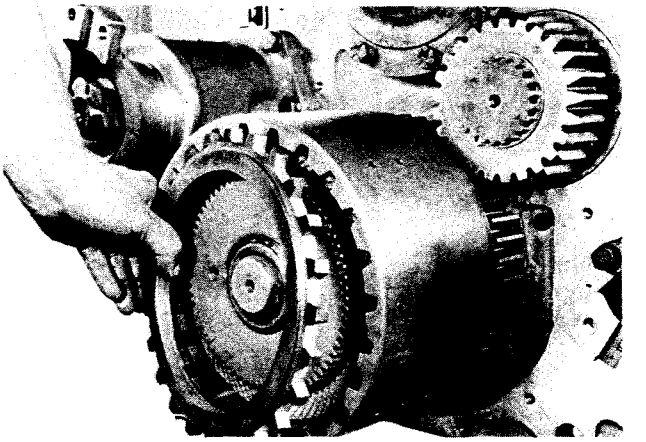


Figure 109

Install clutch disc end plate.

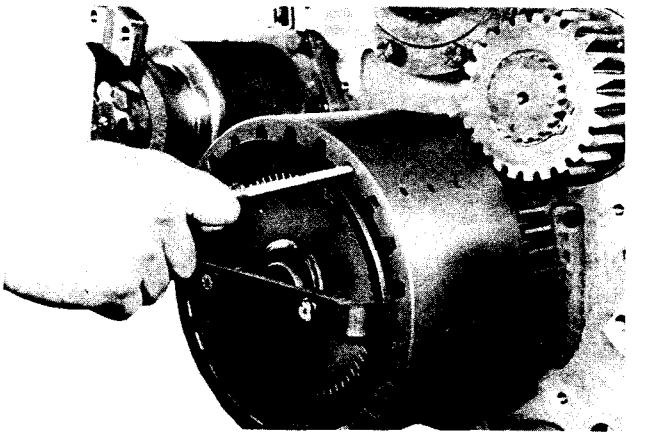


Figure 110

Compress clutch disc end plate and install end plate retainer ring.

Use the same procedure to assemble all clutches.

CLARK

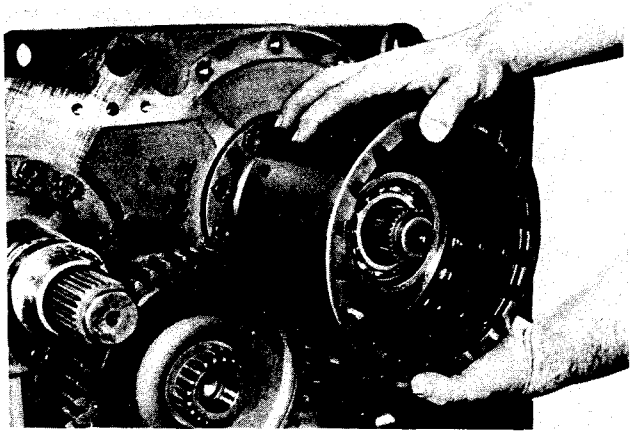


Figure 111

Install input, reverse, 3rd and 4th clutches as explained in Figures 94 through 96 and 99 through 110.

NOTE: If clutch drum taper bearings are used, install drum, washer and selected snap rings on the specific drum support these parts were matched with, then proceed with Figures 99 thru 110.

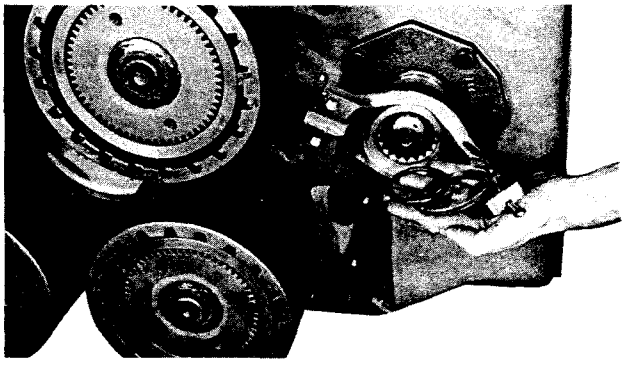


Figure 112

Install companion flange, flange "O" ring, washer and nut.

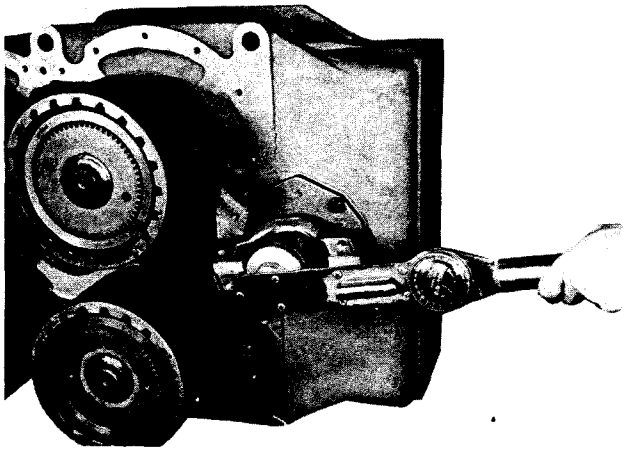


Figure 113

Tighten flange nut 250 to 300 ft. lbs. torque. [34, 6 - 41, 4 m.kg]

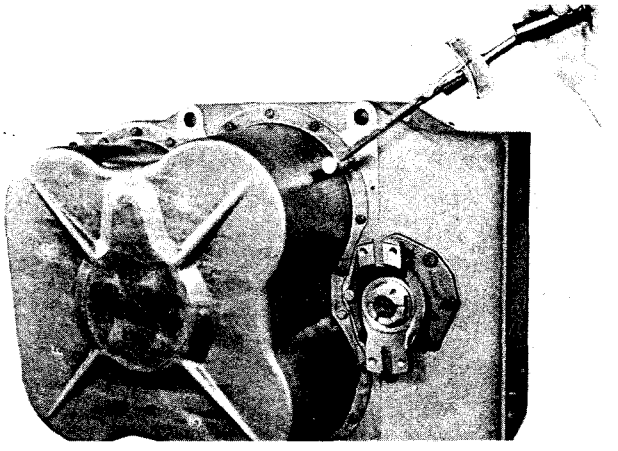


Figure 114

Install new gaskets on clutch covers. Align holes in clutch covers with holes in transmission case. Install bolts and lockwashers. Tighten 20 to 25 ft. lbs. torque. [2, 8 - 3, 4 m.kg]

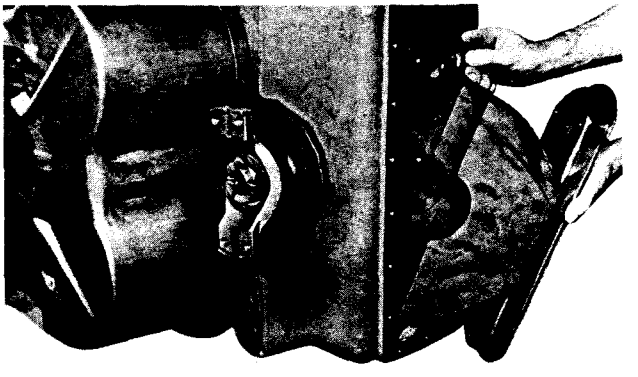


Figure 115

Install new gasket on sump screen opening. Install sump screen in case and secure with bolts and lockwashers. Tighten 20 to 25 ft. lbs. torque [2, 8 - 3, 4 m.kg].

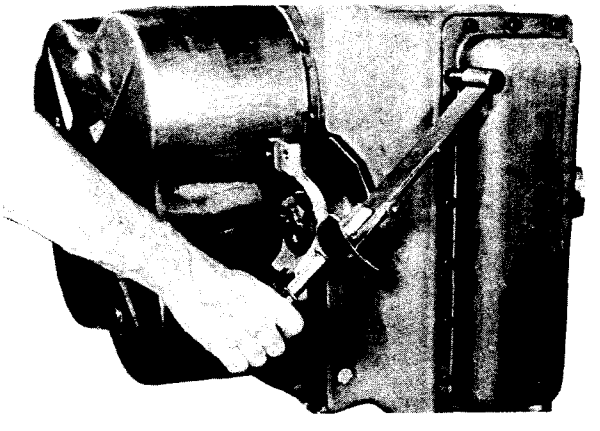


Figure 116

Install new gasket on sump pan. Set pan magnets over welded washers in sump pan. Install sump pan bolts and tighten 20 to 25 ft. lbs. torque [2,8 - 3, 4 m.kg].

REASSEMBLY OF CONTROL COVER

See Figure "C" for sequence of parts and parts identification. **NOTE:** Lubricate all valves, springs, "O" rings, sleeves and oil seals with a light coat of automatic transmission fluid.

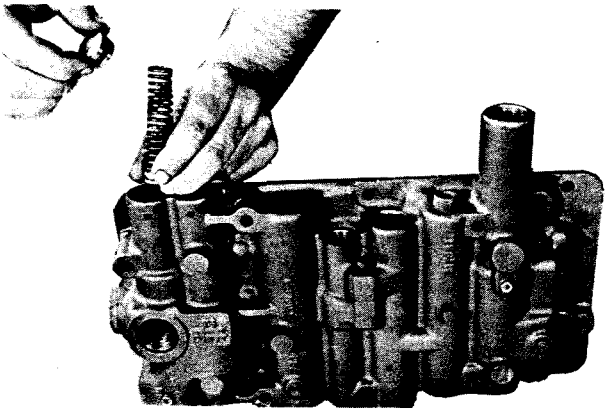


Figure 117

Install safety valve ball and spring in cover. With new "O" ring in position install spring stop on spring.

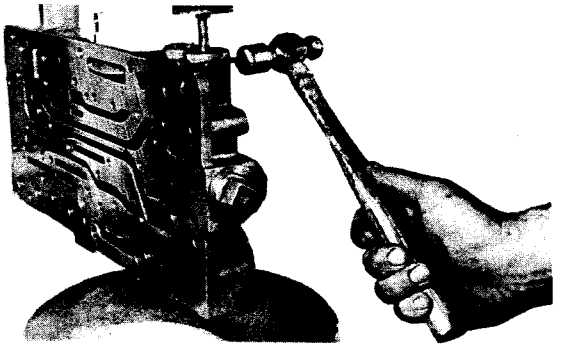


Figure 118

Depress spring stop and spring. Install spring stop roll pin.

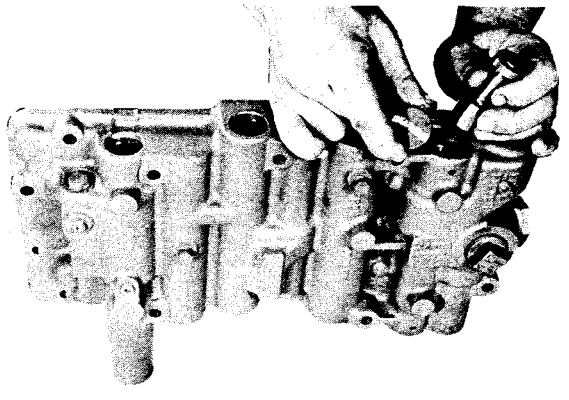


Figure 119

Install regulating valve spool in valve cover. Install new "O" ring on valve stop. Install valve stop in cover and retain with roll pin.

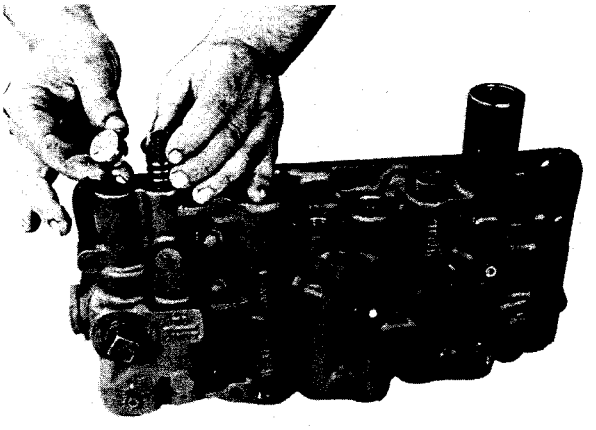


Figure 120

At opposite end of regulating valve install inner and outer valve spring. Install new "O" ring on spring stop. Install spring stop on springs.

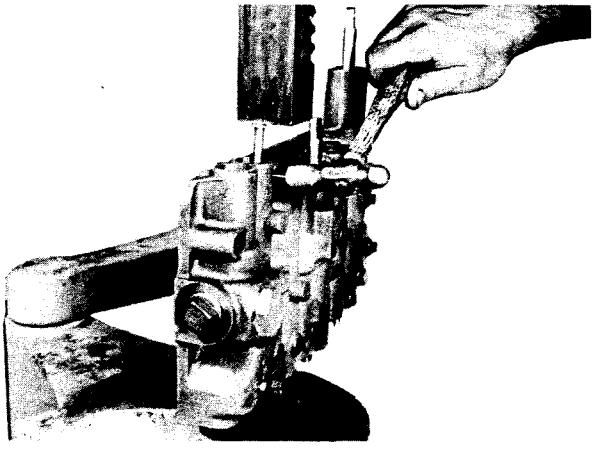


Figure 121

Depress spring stop and spring. Install spring stop roll pin.

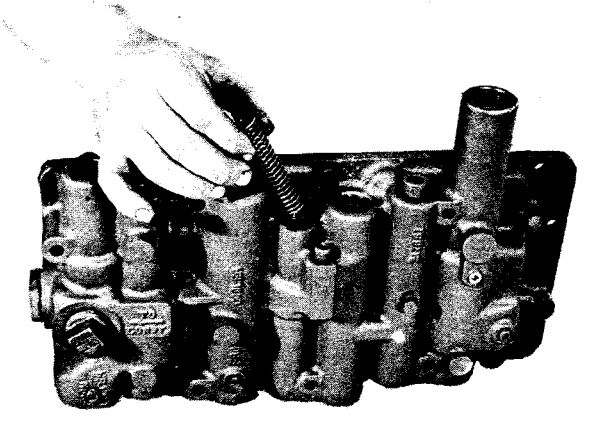


Figure 122

Install shut-off valve spring.

CLARK

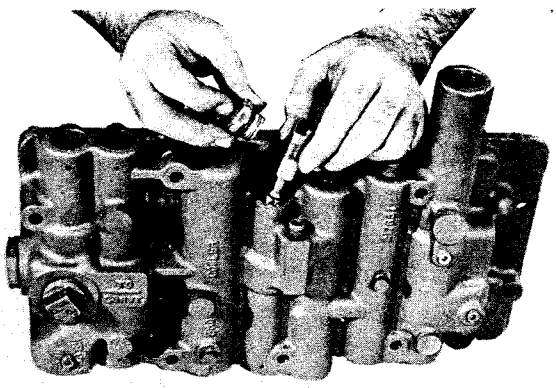


Figure 123
Install shut-off valve in housing. Depress valve and spring with valve plug. Tighten plug securely.

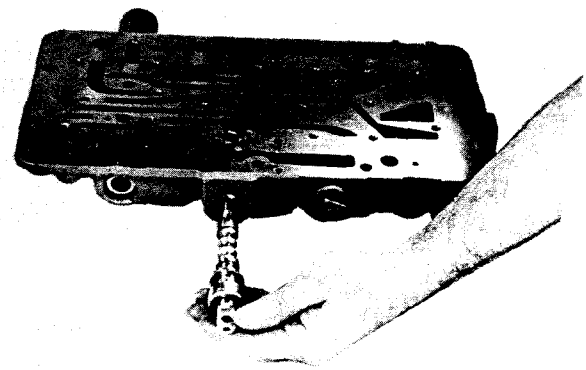


Figure 124
Install forward and reverse selector valve in housing. Install selector valve stop washer and oil seal on selector valve.

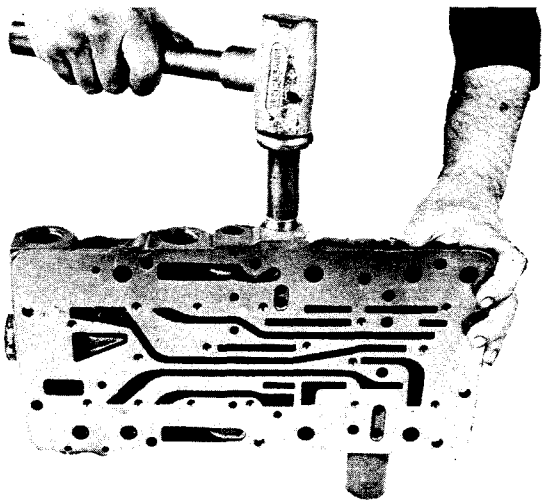


Figure 125
Apply a light coat of Permatex No. 2 on the outer diameter of a new selector valve oil seal. Install oil seal in housing.

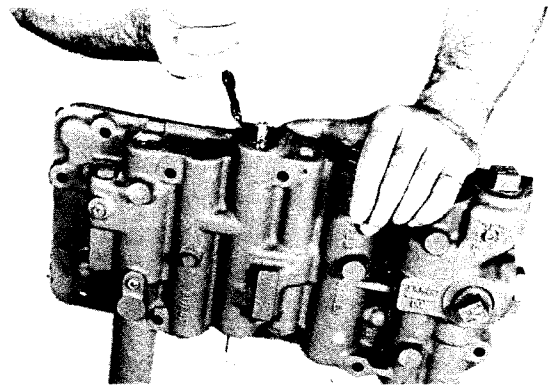


Figure 126
Install oil seal retainer ring.

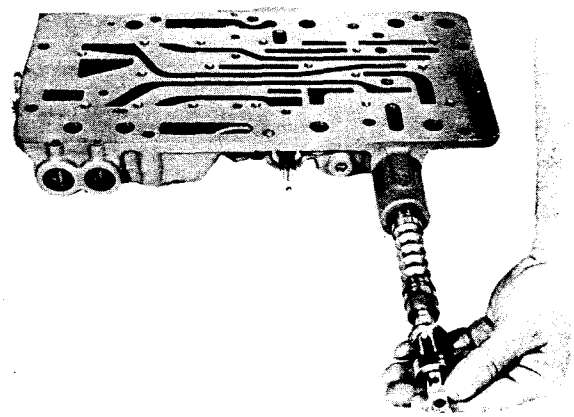


Figure 127
Install speed selector valve in housing. Install selector valve stop washer and oil seal on selector valve.

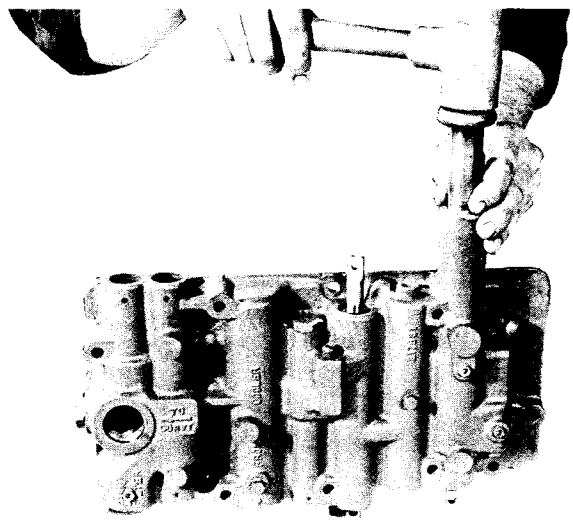


Figure 128
Apply a light coat of Permatex No. 2 on the outer diameter of a new selector valve oil seal. Install oil seal in housing.

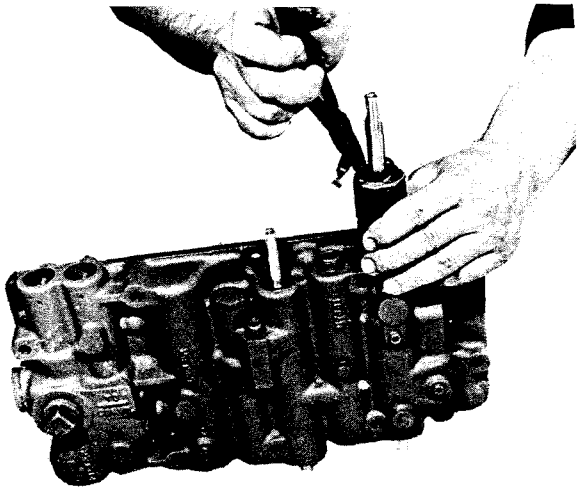


Figure 129
Install oil seal retainer ring.

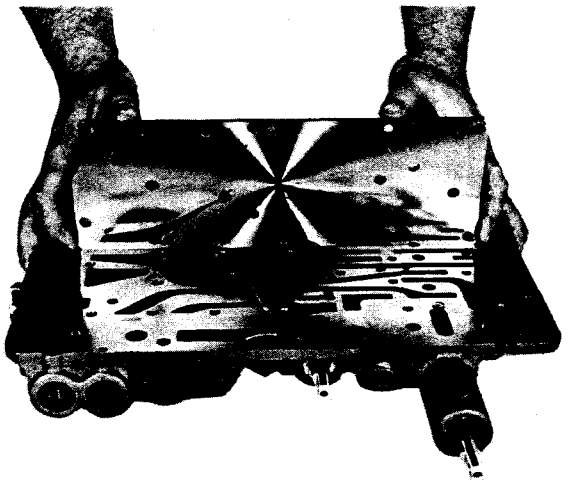


Figure 130
Install poppet balls and poppet springs in drilled ports in control cover. Install control cover plate. Secure with bolts and external shake proof washers. Tighten 10 to 15 lbs. torque [1, 4 - 2, 0 m.kg].

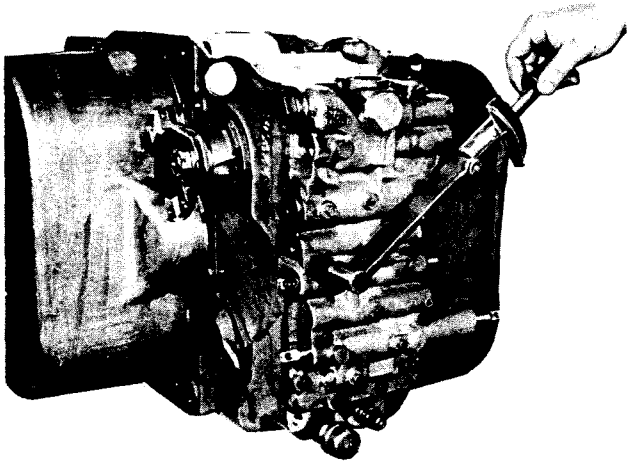


Figure 131
Using new control valve to case "O" rings and new gasket, install control cover assembly on transmission case. Secure with bolts and lockwashers. Tighten 20 to 25 ft. lbs. torque [2, 8 - 3, 4 m.kg].

SERVICING MACHINE AFTER TRANSMISSION OVERHAUL

The transmission, torque converter, and its allied hydraulic system are important links in the drive line between the engine and the wheels. The proper operation of either unit depends greatly on the condition and operation of the other; therefore, whenever repair or overhaul of one unit is performed, the balance of the system must be considered before the job can be considered completed.

After the overhauled or repaired transmission has been installed in the machine, the oil cooler, and connecting hydraulic system must be thoroughly cleaned. This can be accomplished in several manners and a degree of judgment must be exercised as to the method employed.

The following are considered the minimum steps to be taken:

1. Drain entire system thoroughly.

2. Disconnect and clean all hydraulic lines. Where feasible, hydraulic lines should be removed from machine for cleaning.

3. Replace oil filter elements, cleaning out filter cases thoroughly.

4. The oil cooler must be thoroughly cleaned. The cooler should be "back flushed" with oil and compressed air until all foreign material has been removed. Flushing in direction of normal oil flow will not adequately clean the cooler. If necessary, cooler assembly should be removed from machine for cleaning, using oil, compressed air and steam cleaner for that purpose. **DO NOT** use flushing compounds for cleaning purposes.

5. On remote mounted torque converters remove drain plug from torque converter and inspect interior of converter housing, gears, etc. If presence of considerable foreign material is noted, it will be necessary that converter be removed, disassembled and cleaned thoroughly. It is realized this entails extra labor; however, such labor is a minor cost compared to cost of difficulties which can result from presence of such foreign material in the system.

6. Reassemble all components and use only type oil recommended in lubrication section. Fill transmission through filler opening until fluid comes up to **LOW** mark on transmission dipstick. **NOTE:** If the dipstick is not accessible oil level check plugs are provided.

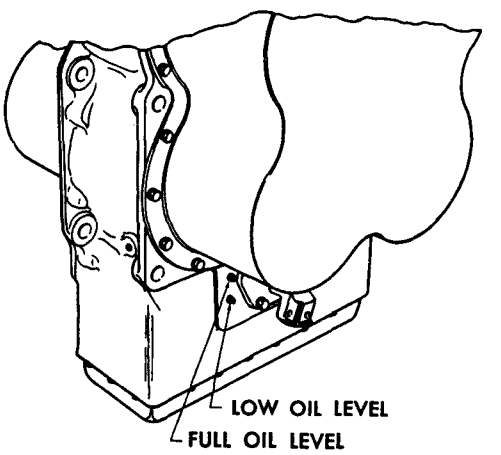
   Remove **LOWER** check plug, fill until oil runs from **LOWER** oil hole. Replace filler and level plug.

   Run engine two minutes at 500-600 RPM to prime torque converter and hydraulic lines. Recheck level of fluid in transmission with engine running at idle (500-600 RPM).

   Add quantity necessary to bring fluid level to **LOW** mark on dipstick or runs freely from **LOWER** oil level check plug hole. Install oil level plug or dipstick. Recheck with hot oil (180-200° F.) [82, 2-93, 3° C].

   Bring oil level to **FULL** mark on dipstick or runs freely from **UPPER** oil level plug.

7. Recheck all drain plugs, lines, connections, etc., for leaks and tighten where necessary.



SPECIFICATIONS AND SERVICE DATA—POWER SHIFT TRANSMISSION AND TORQUE CONVERTER

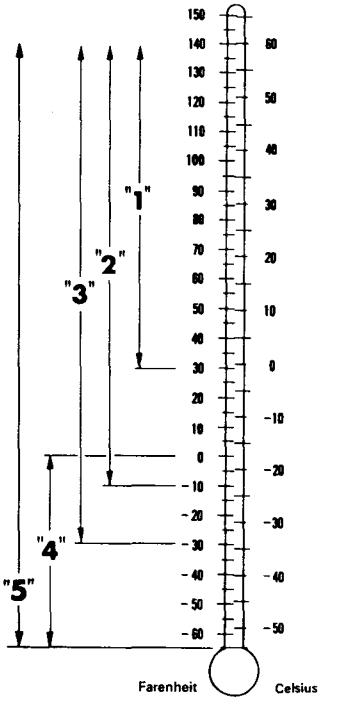
CONVERTER OUT PRESSURE	Converter outlet oil temp. 180°-200° F. [82,3°-93,3° C]. Transmission in **NEUTRAL**. Operating specifications: 55 P.S.I. [3,9 KG/cm²] minimum pressure at 2000 R.P.M. engine speed **AND** a maximum of 70 P.S.I. [4,92 Kg/cm²] outlet pressure with engine operating at no-load governed speed.
CONTROLS	Forward and Reverse — Manual Speed Selection — Manual
CLUTCH TYPE	Multiple discs, hydraulically actuated, spring released, automatic wear compensation and no adjustment. All clutches oil cooled and lubricated.
CLUTCH INNER DISC	Friction.
CLUTCH OUTER DISC	Steel
OIL FILTRATION	Full flow oil filter safety by-pass, also strainer screen in sump at bottom of transmission case.
CLUTCH PRESSURE	180-220 p.s.i. [12,7-15,4 kg/cm²] — With parking brake set (see note), oil temperature 180 - 200° F. [82,2-93,3° C], engine at idle (400 to 600 RPM), shift thru direction and speed clutches. **All clutch pressure must be equal within 5 psi. [0,4 kg/cm²]. If clutch pressure varies in any one clutch more than 5 psi. [0,4 kg/cm²] repair clutch.** **NOTE: Never use service brakes while making clutch pressure checks. Units having brake actuated declutching in forward and/or reverse will not give a true reading.** **ALWAYS USE PARKING BRAKE WHEN MAKING CLUTCH PRESSURE CHECKS.**

LUBRICATION

TYPE OF OIL	See Lube Chart.
CAPACITY	Consult Operator's Manual on applicable machine model for system capacity. Torque Converter, Transmission and allied hydraulic system must be considered as a whole to determine capacity.
CHECK PERIOD	Check oil level DAILY with engine running at 500-600 RPM and oil at 180 to 200° F. [82,2, - 93, 3° C]. Maintain oil level to **FULL** mark.
DRAIN PERIOD	Every 250 hours, change oil filter element. Every 500 hours, drain and refill system as follows: Drain with oil at 150 to 200° F. [65, 6 - 93, 3° C]. (a) Drain transmission and remove sump screen. Clean screen thoroughly and replace, using new gaskets. (b) Drain oil filters, remove and discard filter elements. Clean filter shells and install new elements. (c) Refill transmission to **LOW** mark. (d) Run engine at 500-600 RPM to prime converter and lines. (e) Recheck level with engine running at 500-600 RPM and add oil to bring level to **LOW** mark. When oil temperature is hot (180-200°F.) [82, 2-93, 3°C] make final oil level check. **BRING OIL LEVEL TO FULL MARK.**

RECOMMENDED LUBRICANTS FOR CLARK POWER SHIFTED TRANSMISSION AND TORQUE CONVERTERS

Prevailing Ambient Temperature



"1"	C-3 Grade 30 ENGINE OIL Grade 30 API-SE or CD
"2"	(1) MIL-L-2104C Grade 10 (2) C-2 or C-3 Grade 10-W (3) ENGINE OIL Grade 10 API-SE or CD
"3"	DEXRON*
"4"	MIL-L-46167
"5"	CONOCO Polor Start DN — 600 Fluid

NOTE:

Oil groups 2 & 3 may be used to lower ambient temperatures when sump preheaters are used.

Oil group 4 should be used only up to ambient temperature shown.

Contact Clark Transmission Division for lubrication to be used as initial fill in new modulated shift transmissions.

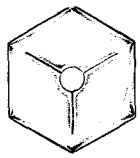
CAUTION: Dexron II* is not compatible with graphitic clutch plate friction material. Dexron II* can not be used in the 3000, 4000, 5000, 8000 or 16000 series power shift transmissions, or the HR28000 series having converter lock-up, or the C270 series converter having lock-up.

*Dexron is a registered trademark of General Motors Corporation.

TORQUE IN (LBS.—FT.)
BOLTS, CAPSCREWS, STUDS AND NUTS

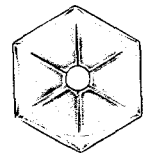
Grade 5 Identification, 3 Radial Dashes 120° Apart on Head of Bolt

Grade 8 Identification, 6 Radial Dashes 60° Apart on Head of Bolt



Grade 5

LUBRICATED OR PLATED



Grade 8

Nominal Thread Size	FINE THREADS	COARSE THREADS	FINE THREADS	COARSE THREADS
3/8	26-29 [3,6-4,0m.kg]	23-25 [3,2-3,4m.kg]	37-41 [5,1-5,6m.kg]	33-36 [4,6-4,9m.kg]
7/16	41-45 [5,7-6,2m.kg]	37-41 [5,1-5,6m.kg]	58-64 [8,0-8,8m.kg]	52-57 [7,2-7,8m.kg]
1/2	64-70 [8,8-9,6m.kg]	57-63 [7,9-8,7m.kg]	90-99 [12,4-13,6m.kg]	80-88 [11,-12,1m.kg]
9/16	91-100 [12,6-13,8m.kg]	82-90 [11,3-12,4m.kg]	128-141 [17,7-19,4m.kg]	115-127 [15,9-17,5m.kg]

PRESSURE AND OIL FLOW CHECK SPECIFICATIONS. ALL CHECKS MADE WITH HOT OIL (180 - 200° F.) [82,2 - 93,3° C.]

A.	Clutch Pressure at Transmission Control Cover	180 - 220 p.s.i. [12,7 - 15,4 kg/cm^2] at engine idle, each clutch and no more than 5 p.s.i. [0,4 kg/cm^2] variation between all clutches.
B.	Transmission to Converter Line	See External Oil Flow Diagram.
C.	Converter-Out Pressure	See Pressure and Oil Flow Checks.
D.	Temperature Gauge Connection	See External Oil Flow Diagram.
E.	Lubricating Pressure	25 p.s.i. [1,7 kg/cm^2] Maximum at High Free Idle.
	Converter Return Line	See External Oil Flow Diagram.
	Converter Pump Output	See Pump Chart.

TROUBLE SHOOTING GUIDE

The following data is presented as an aid to locating the source of difficulty in a malfunctioning unit. It is necessary to consider the torque converter charging pump, transmission, oil cooler and connecting oil lines as a complete system when running down the source of trouble since the proper operation of any unit therein depends greatly on the condition and operation of the others. By studying the principles of operation together with data in this section, it may be possible to correct any malfunction which may occur in the system.

TROUBLE SHOOTING PROCEDURE BASICALLY CONSISTS OF TWO CLASSIFICATIONS: MECHANICAL AND HYDRAULIC.

MECHANICAL CHECKS

Prior to checking any part of the system from a hydraulic standpoint, the following mechanical checks should be made.

1. A check should be made to be sure all control lever linkage is properly connected and adjusted at all connecting points.

2. Check shift levers and rods for binding or restrictions in travel that would prevent full engagement. Shift levers by hand at transmission case, if full engagement cannot be obtained, difficulty may be in control cover and valve assembly.

HYDRAULIC CHECKS

Before checking on the torque converter, transmission and allied hydraulic systems for pressures and rate of oil flow, it is essential that the following preliminary checks be made.

1. Check oil level in transmission. This should be done with oil temperatures of 180-200°F. [82,2-93,3°C.]. DO NOT ATTEMPT THESE CHECKS WITH COLD OIL. To bring the oil temperature to this specification it is necessary to either work the machine or "stall" out the converter. Where the former means is impractical, the latter means should be employed as follows:

Engage shift levers in forward and high speed and apply brakes. Accelerate engine half to three-quarter throttle.

Hold stall until desired converter outlet temperature is reached. CAUTION: FULL THROTTLE STALL SPEEDS FOR AN EXCESSIVE LENGTH OF TIME WILL OVERHEAT THE CONVERTER.

PRESSURE AND OIL FLOW CHECKS

Whenever improper performance is evident the following basic pressure and oil flow checks should be performed and recorded. It is also recommended that these checks be taken periodically as a preventative maintenance measure. Doing so will permit possible detection of difficulties in advance of actual breakdown, thus permitting scheduling of repair operation. Likewise, repair of minor difficulties can be made at considerably less cost and down-time than when delayed until major and complete breakdowns occur.

Analyzing the results of these checks by comparison with specifications and with each other will indicate in most cases the basic item or assembly in the system as the source of difficulty. Further checking of that assembly will permit isolation of the specific cause of trouble.

(SEE PLUMBING AND CHECK POINT DIAGRAM)

OIL PRESSURE AT **CONVERTER OUT** PORT.

Install hydraulic pressure gauge at **PRESSURE** connection on Converter Regulator Valve or at **CONVERTER OUT** pressure tap. (All models do not have pressure regulating valves.) Check and record oil pressure at 2000 **RPM** and at maximum speed (engine at full throttle) (see instructions on Stalling Converter previously listed).

CONVERTER MODEL	MINIMUM CONVERTER OUT PRESSURE	MAXIMUM CONVERTER OUT PRESSURE
C-5000	55 p.s.i. [3, 9 kg/cm^2]	70 p.s.i. [4, 9 kg/cm^2]
C-8000	55 p.s.i. [3, 9 kg/cm^2]	70 p.s.i. [4, 9 kg/cm^2]
C-16000	55 p.s.i. [3, 9 kg/cm^2]	70 p.s.i. [4, 9 kg/cm^2]

If a flow meter is available, install in line between converter charging pump and oil filters. Flow meter must be able to withstand 300 p.s.i. [21, 0 kg/cm^2].

Disconnect hose between pump and filter at filter end and using suitable fittings connect to pressure port of tester. Install hose between filter and tester, connecting same to reservoir port of tester.

DO NOT USE TESTER LOAD VALVE AT ANY TIME DURING TEST. When taking flow reading, all readings should be taken on the first (left) half of flow gauge. Whenever the needle shows on the right half of gauge, correct by switching to higher scale.

If a flow meter is not available for checking converter pump output, proceed with manual transmission and converter checks. If the converter shows leakage within specifications and clutch pressures (180 to 220 p.s.i.) [12, 7 - 15, 4 kg/cm^2] are all equal within 5 p.s.i. [0, 4 kg/cm^2] refer to paragraph on Low Converter Charging Pump Output.

PUMPS ARE RATED AT 2000 RPM—Refer to Vehicle Manufacture Manual for specific pump output.

NOMINAL PUMP RATINGS:	C-5000	C-8000	C-16000
	21 G.P.M.	21 G.P.M.	40 G.P.M.
	31 G.P.M.	31 G.P.M.	50 G.P.M.
		40 G.P.M.	65 G.P.M.

Pump output listed applies to a new pump in each case. A 20% tolerance below this figure is permissible; however, if pump output is more than 20% below specification the pump must be replaced and not rebuilt.

TRANSMISSION CLUTCH LEAKAGE

Check clutch pressures at low engine idle with oil at operating temperatures 180 - 200° F. [82, 2 - 93, 3° C]. Engine speed must remain constant during entire leakage check. Shift lever into forward 4 or 8 speeds. Record pressures. Shift lever in reverse and 1st. Record pressure. All pressure must be equal within 5 p.s.i. [0,4 kg/cm²] If clutch pressure varies in any one clutch more than 5 p.s.i. [0,4 kg/cm²], repair clutch.

If a flow meter is available install in line coming out of converter pump. See flow diagram for location of pressure on flow checks. Check pump volume at 2000 RPM and at low engine idle. Record readings. See pump volume specifications at 2000 RPM.

Install flow meter in the line coming from transmission to converter. Check oil volume at 2000 RPM and at low idle in the following speed selections. Record readings.

Forward — Low speed thru High Reverse — Low speed

Subtract readings in each speed from pump volume reading to get transmission clutch leakage.

Example:				
	Pump Volume at idle	8 gal.	Pump volume	8 gal.
	Forward—Low speed thru High	6 gal.	Forward — Low speed	6 gal.
	Reverse—Low speed	6 gal.	Clutch leakage	2 gal.

If clutch leakage varies more than 1 gal. from one clutch to another, repair clutch.

LEAKAGE IN TRANSMISSION CLUTCHES

Leakage in 3000 series must not exceed 4 gal. max.
Leakage in 5000 series must not exceed 4 gal. max.
Leakage in 8000 series must not exceed 6 gal. max.
Leakage in 16000 series must not exceed 7 gal. max.

CONVERTER LUBE FLOW

Disconnect CONVERTER DRAIN BACK line at transmission with engine running at 2000 RPM and measure oil into a gallon container. Measure oil leakage for 15 seconds and multiply the volume of oil by four to get gallons per minute leakage.

LEAKAGE IN CONVERTER

Leakage in C5000 series not to exceed 3 gal. max.
Leakage in C8000 series not to exceed 5 gal. max.
Leakage in C16000 series not to exceed 5 gal. max.

LOW CLUTCH PRESSURE WITH NORMAL CLUTCH LEAKAGE

CAUSE	REMEDY
1. Low Oil Level.	1. Fill to proper level.
2. Broken spring in transmission regulator valve.	2. Replace spring.
3. Clutch pressure regulator valve spool stuck in open position.	3. Clean valve spool and sleeve.
4. Faulty charging pump.	4. See paragraph on charging pump output.

LOW CLUTCH PRESSURE WITH EXCESSIVE CLUTCH LEAKAGE

1. Broken or worn clutch piston sealing rings.	1. Replace sealing rings.
2. Clutch drum bleed valve ball stuck in open position.	2. Clean bleed valve thoroughly.
3. Broken or worn sealing rings on clutch support.	3. Replace sealing rings.
4. Low converter charging pump output.	4. See paragraph on charging pump output.

LOW CONVERTER CHARGING PUMP OUTPUT

CAUSE	REMEDY
1. Low oil level.	1. Fill to proper level.
2. Sump screen plugged.	2. Clean screen and sump.
3. Air leaks at pump intake hose and connections or collapsed hose.	3. Tighten all connections or replace hose if necessary.
4. Defective oil pump.	4. Replace pump.

LOW FLOW THROUGH COOLER WITH LOW CONVERTER IN PRESSURE

1. Defective safety by-pass valve spring.	1. Replace spring.
2. Converter by-pass valve partially open.	2. Check for worn by-pass ball seat.
3. Excessive converter internal leakage. See paragraph E, check converter lube flow.	3. Remove, disassemble, and rebuild converter assembly, replacing all worn or damaged parts.
4. Broken or worn sealing rings in transmission clutches.	4. See paragraph on Clutch leakage.

LOW FLOW THROUGH COOLER WITH HIGH CONVERTER OUT PRESSURE

1. Plugged oil cooler. Indicated if transmission lube pressure is low.	1. Back flush and clean oil cooler.
2. Restricted cooler return line.	2. Clean out lines.
3. Lube oil ports in transmission plugged. Indicated if transmission lube pressure is high.	3. Check lube lines for restrictions.

OVERHEATING

1. Worn oil sealing rings. See paragraph E.	1. Remove, disassemble, and rebuild converter assembly.
2. Worn oil pump.	2. Replace.
3. Low oil level.	3. Fill to proper level.
4. Pump suction line taking air.	4. Check oil line connections and tighten securely.

NOISY CONVERTER

1. Worn coupling gears.	1. Replace.
2. Worn oil pump.	2. Replace.
3. Worn or damaged bearings.	3. A complete disassembly will be necessary to determine what bearing is faulty.

LACK OF POWER

1. Low engine RPM at converter stall.	1. Tune engine check governor.
2. See "Over-heating" and make same checks.	2. Make corrections as explained in "Over-Heating.

CLARK

The following information must be used in conjunction with the maintenance and service manual.

Forward, reverse, 3rd and 4th clutch drum taper bearing installation for the 5000 series power shift transmission.

NOTE: Do not install clutch support on transmission housing until proper stack up of parts in the clutch drum is achieved.

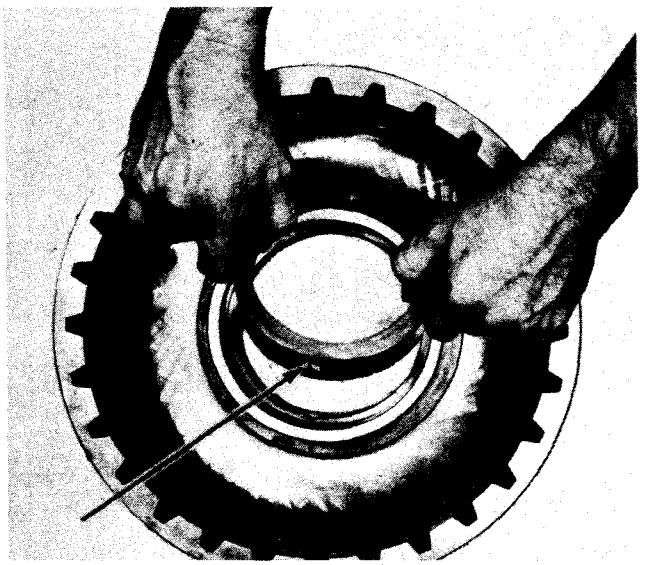


Figure A
Insert lock ball in clutch piston ring outer race. Press outer race and ball in clutch drum. Outer race must be pressed from flush to 1/64" below shoulder in clutch drum. Install the inner and outer taper bearing cups in the clutch drum.

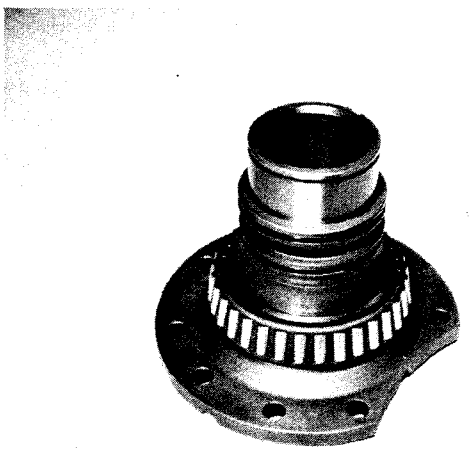


Figure B
Press inner taper bearing on clutch support.

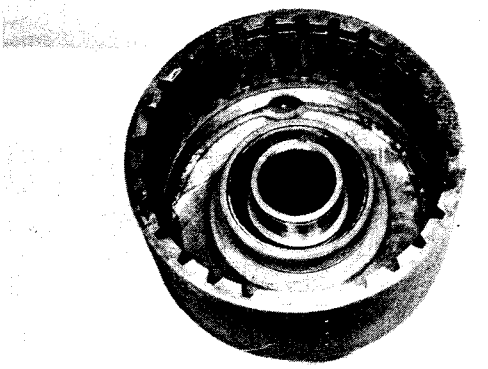


Figure C
Position clutch drum and cup assembly on clutch support.

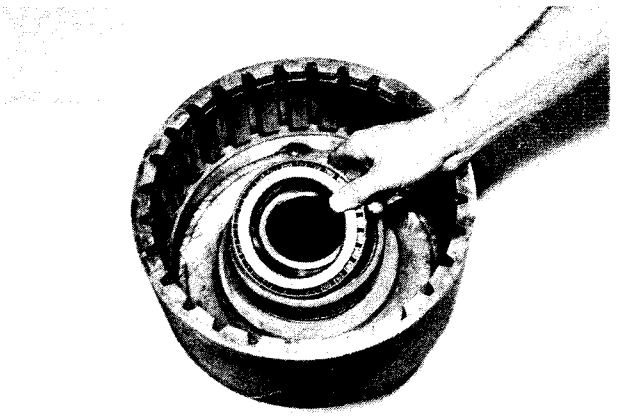


Figure D
Install outer taper bearing.

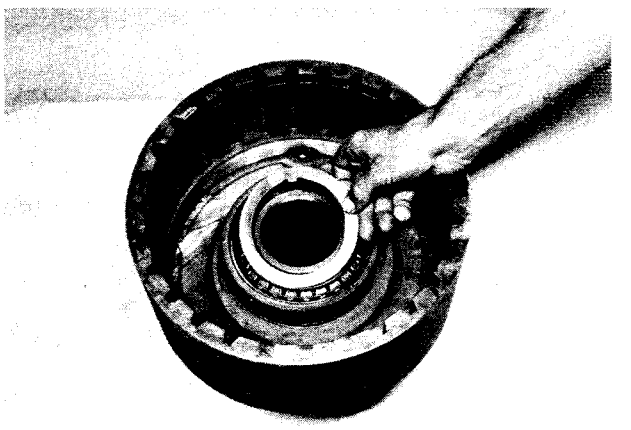


Figure E
Position outer bearing retainer washer on clutch support aligning tang on washer with notch on support.

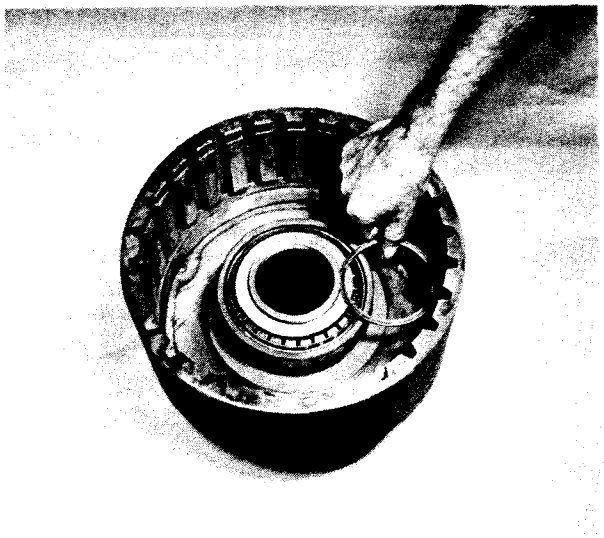


Figure F

Clutch drum retainer ring is selected at assembly for proper thickness. Variable thickness rings are used in snap ring grooves to assure proper taper bearing tightness. Check ring as shown for tight ring to bearing fit.

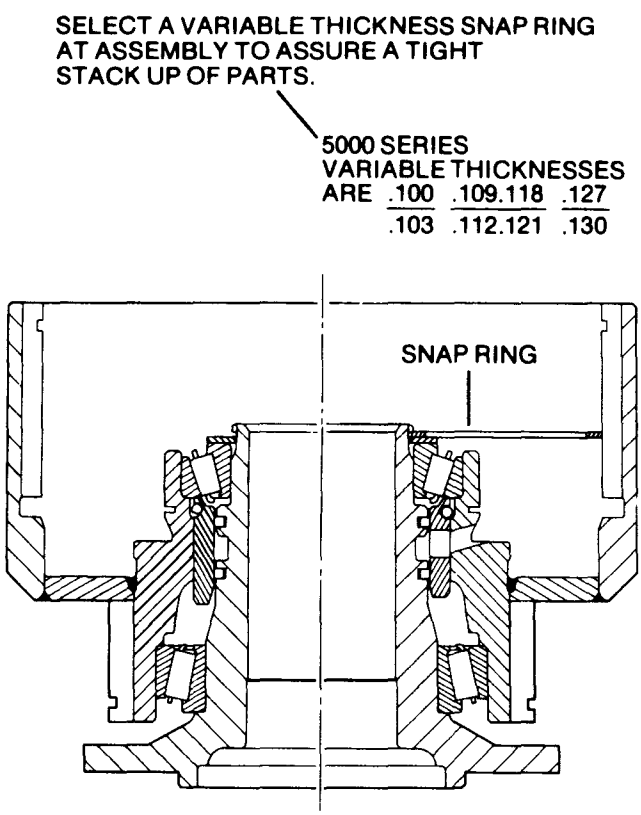


Figure G

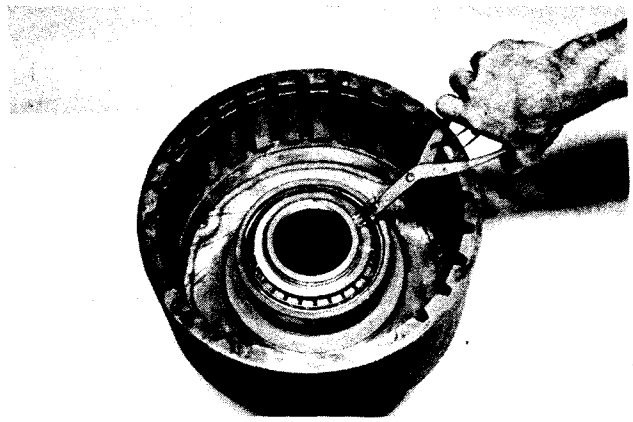


Figure H

Install retainer ring, being certain ring is in full position in ring groove. **NOTE:** Use ring that will give the tightest fit between washer and snap ring groove.

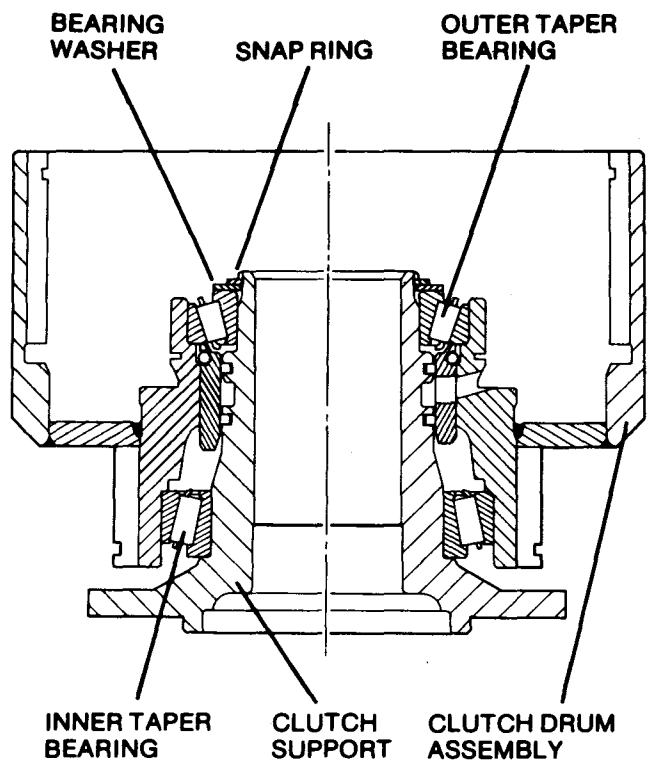


Figure I

CAUTION: After parts have been matched with each other do not mix with other clutch parts.

Remove retainer ring and washer. Remove drum assembly from clutch drum support.

Assemble clutch support on transmission housing as prescribed in the applicable maintenance manual. Assemble the clutch drum on the support using the same retainer washer and selected retainer ring that was chosen on the bench assembly.

Follow the manual for clutch reassembly.