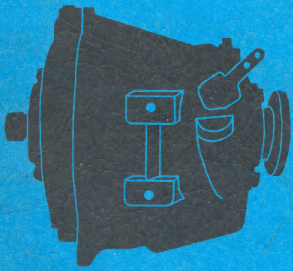
BORG WARNER

Velvet Drive Marine Transmission Service Manual Model 72C



Warner Gear

A Division of Borg-Warner Corporation

PRICE $2.50

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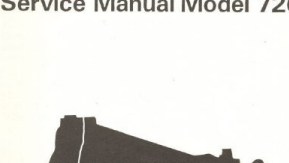
Service Manual Model 72C



This Service Manual is prepared and illustrated for the AS11-72C direct drive transmission, but it also contains supplementary information and illustrations which allow it to be used for the servicing of the other earlier model transmissions, AS11-72 and AS1-72.

Warner Gear

BORG WARNER

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FORM 11 (3/75) (5.5)
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IDENTIFICATION OF VELVET DRIVE* IN-LINE MODELS 70C, 71C, 72C & 73C

TRANS. ASSEMBLY NUMBER	INPUT TO OUTPUT SPEED RATIO		ROTATION (1)				PUMP SETTING (2)	PROPELLER REQUIRED (3)	OIL CAPACITY (4)						APPROX. TRANS. WEIGHT
			INPUT SHAFT	OUTPUT SHAFT					15° INCLINED		LEVEL				
	FORWARD	REVERSE	FORWARD	FORWARD	REVERSE				U.S. QTS.	LITERS	U.S. QTS.	LITERS	POUNDS	KGS.	
AS1-70C	1:1	1:1	CW	CW	CCW	LH	RH		1.3	1.23	1.8	1.70	92	41.7	
AS1-70CR	1:1	1:1	CCW	CCW	CW	RH	LH		1.3	1.23	1.8	1.70	92	41.7	
AS2-70C	1.92:1	1.92:1	CW	CW	CCW	LH	RH		2.7	2.56	2.8	2.37	142	64.4	
AS2-70CR	1.92:1	1.92:1	CCW	CCW	CW	RH	LH		2.7	2.56	2.5	2.37	142	64.4	
AS3-70C	2.10:1	2.10:1	CW	CW	CCW	LH	RH		2.7	2.56	2.5	2.37	142	64.4	
AS3-70CR	2.10:1	2.10:1	CCW	CCW	CW	RH	LH		2.7	2.56	2.5	2.37	142	64.4	
AS4-70C	2.57:1	2.57:1	CW	CW	CCW	LH	RH		2.7	2.56	2.5	2.37	142	64.4	
AS4-70CR	2.57:1	2.57:1	CCW	CCW	CW	RH	LH		2.7	2.56	2.5	2.37	142	64.4	
AS15-70C	2.91:1	2.91:1	CW	CW	CCW	LH	RH		2.7	2.56	2.5	2.37	142	64.4	
AS15-70CR	2.91:1	2.91:1	CCW	CCW	CW	RH	LH		2.7	2.56	2.5	2.37	142	64.4	
AS7-70C (5)	1.91:1	1.91:1	CW	CW	CCW	LH	LH		2.7	2.56	2.5	2.37	142	64.4	
AS7-70CR (5)	1.91:1	1.91:1	CCW	CW	CCW	RH	RH		2.7	2.56	2.5	2.37	142	64.4	
AS10-70C (7)	1:1	1:1	CW	CCW	CW	LH			1.7	1.61	2.1	1.99	95	43.1	
AS10-70CR(7)	1:1	1:1	CCW	CW	CCW	RH			1.7	1.61	2.1	1.99	95	43.1	
AS1-71C	1:1	1:1	CW	CW	CCW	LH	RH		1.3	1.23	1.8	1.70	95	43.1	
AS1-71CR	1:1	1:1	CCW	CCW	CW	RH	LH		1.3	1.23	1.8	1.70	95	43.1	
AS1-71CB (6)	1:1	1:1	CW	CW	CCW	LH	RH		1.3	1.23	1.8	1.70	95	43.1	
AS1-71CBR(6)	1:1	1:1	CCW	CCW	CW	RH	LH		1.3	1.23	1.8	1.70	95	43.1	
AS2-71C	1.92:1	1.92:1	CW	CW	CCW	LH	RH		2.7	2.56	2.5	2.37	145	65.8	
AS2-71CR	1.92:1	1.92:1	CCW	CCW	CW	RH	LH		2.7	2.56	2.5	2.37	145	65.8	
AS3-71C	2.10:1	2.10:1	CW	CW	CCW	LH	RH		2.7	2.56	2.5	2.37	145	65.8	
AS3-71CR	2.10:1	2.10:1	CCW	CCW	CW	RH	LH		2.7	2.56	2.5	2.37	145	65.8	
AS4-71C	2.57:1	2.57:1	CW	CW	CCW	LH	RH		2.7	2.56	2.5	2.37	145	65.8	
AS4-71CR	2.57:1	2.57:1	CCW	CCW	CW	RH	LH		2.7	2.56	2.5	2.37	145	65.8	
AS15-71C	2.91:1	2.91:1	CW	CW	CCW	LH	RH		2.7	2.56	2.5	2.37	145	65.8	
AS15-71CR	2.91:1	2.91:1	CCW	CCW	CW	RH	LH		2.7	2.56	2.5	2.37	145	65.8	
AS7-71C	1.91:1	1.91:1	CW	CW	CCW	LH	LH		2.7	2.56	2.5	2.37	145	65.8	
AS7-71CR	1.91:1	1.91:1	CCW	CW	CCW	RH	RH		2.7	2.56	2.5	2.37	145	65.8	
AS20-71C (7)	1:1	1:1	CW	CCW	CW	LH			1.7	1.61	2.1	1.99	98	44.5	
AS20-71CR(7)	1:1	1:1	CCW	CW	CCW	RH			1.7	1.61	2.1	1.99	98	44.5	
AS11-72C	1:1	1.10:1	CW	CW	CCW	LH	RH		1.7	1.61	2.1	1.99	109	49.4	
AS11-72CR	1:1	1.10:1	CCW	CCW	CW	RH	LH		1.7	1.61	2.1	1.99	109	49.4	
AS12-72C	1.52:1	1.68:1	CW	CW	CCW	LH	RH		2.8	2.65	2.7	2.56	154	69.9	
AS12-72CR	1.52:1	1.68:1	CCW	CCW	CW	RH	LH		2.8	2.65	2.7	2.56	154	69.9	
AS13-72C	2.10:1	2.31:1	CW	CW	CCW	LH	RH		2.8	2.65	2.7	2.56	154	69.9	
AS13-72CR	2.10:1	2.31:1	CCW	CCW	CW	RH	LH		2.8	2.65	2.7	2.56	154	69.9	
AS14-72C	2.57:1	2.83:1	CW	CW	CCW	LH	RH		2.8	2.65	2.7	2.56	154	69.9	
AS14-72CR	2.57:1	2.83:1	CCW	CCW	CW	RH	LH		2.8	2.65	2.7	2.56	154	69.9	
AS16-72C	2.91:1	3.20:1	CW	CW	CCW	LH	RH		2.8	2.65	2.7	2.56	154	69.9	
AS16-72CR	2.91:1	3.20:1	CCW	CCW	CW	RH	LH		2.8	2.65	2.7	2.56	154	69.9	
AS17-72C (8)	1.91:1	2.10:1	CW	CW	CCW	LH	LH		2.8	2.65	2.7	2.56	154	69.9	
AS17-72CR(8)	1.91:1	2.10:1	CCW	CW	CCW	RH	RH		2.8	2.65	2.7	2.56	154	69.9	
AS20-72C (7)	1:1	1.10:1	CW	CW	CCW	LH			1.7	1.61	2.1	1.99	112	50.8	
AS20-72CR(7)	1:1	1.10:1	CCW	CW	CCW	RH			1.7	1.61	2.1	1.99	112	50.8	
AS30-72C (7)	1:1	1.10:1	CW	CCW	CW	LH			1.7	1.61	2.1	1.99	116	52.6	
AS30-72CR(7)	1:1	1.10:1	CCW	CW	CCW	RH			1.7	1.61	2.1	1.99	116	52.6	
AS1-73C	1:1	88:1	CW	CW	CCW	LH	RH		1.5	1.42	1.6	1.51	135	61.2	
AS1-73CR	1:1	88:1	CCW	CCW	CW	RH	LH		1.5	1.42	1.1	1.51	135	61.2	
AS2-73C	1.5:1	1.32:1	CW	CW	CCW	LH	RH		2.2	2.08	2.0	1.89	185	83.9	
AS2-73CR	1.5:1	1.32:1	CCW	CCW	CW	RH	LH		2.2	2.08	2.0	1.89	185	83.9	
AS6-73C	3:1	2.64:1	CW	CW	CCW	LH	RH		2.2	2.08	2.0	1.89	185	83.9	
AS6-73CR	3:1	2.64:1	CCW	CCW	CW	RH	LH		2.2	2.08	2.0	1.89	185	83.9	
AS7-73C (5)	2:1	1.76:1	CW	CW	CCW	LH	LH		2.2	2.08	2.0	1.89	185	83.9	
AS7-73CR (5)	2:1	1.76:1	CCW	CW	CCW	RH	RH		2.2	2.08	2.0	1.89	185	83.9	

1) Input and output shaft rotation is described as clockwise (CW) or counter clockwise (CCW) when the observer is standing behind transmission coupling facing towards front or input shaft end of transmission.

2) Pump rotation is described when the observer is standing in front of transmission facing the pump. The arrow located nearest the top of pump face must point in the direction pump will be driven by the input shaft. IT SHOULD BE REALIZED THAT INDEXING THE PUMP FOR OPPOSITE ROTATION DOES NOT CAUSE OUTPUT SHAFT ROTATION TO BE REVERSED, but does permit the transmission to be used behind an opposite rotating engine.

CAUTION: The pump indexing on all assemblies except 2.10:1 reduction units is the only difference between C and CR units. The planetary gears and cage assembly used in C units is different than the one used in CR units in the 2.10:1 reduction units; therefore, indexing the pump for opposite rotation is not permitted on these assemblies. No warranty claims will be allowed for failures caused by improper pump indexing on 2.10:1 reduction units.

3) The propeller is described when the observer is standing behind the boat looking forward. A right hand (RH) prop will move the boat forward when rotated clockwise.

4) Transmission oil capacity only is given. Additional oil will be required for filling oil cooler and cooler lines.

5) All AS7 and AS17 reduction units are counter-rotating, i.e. the output shaft turns opposite to input shaft when the transmission is operated in forward.

6) The AS1-71CB and AS1-71CBR units are for heavier reverse duty and diesel applications.

7) Warner Gear supplies AS10-70C, AS10-70CR, AS20-71C, AS20-71CR, AS20-72C, AS20-72CR, AS30-70C and AS30-72CR units for use with stern drives, V-Drives or other auxiliary reduction gears. Contact the manufacturer of the supplementary gearing for details of the complete assembly.

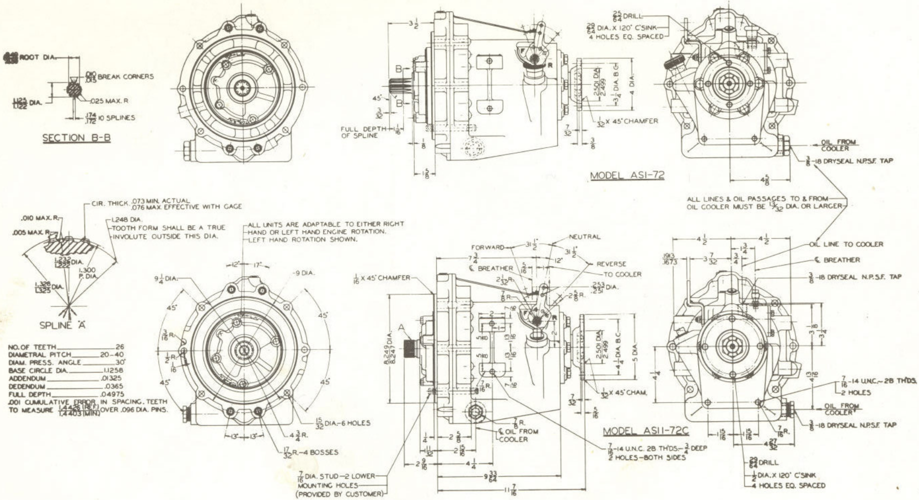
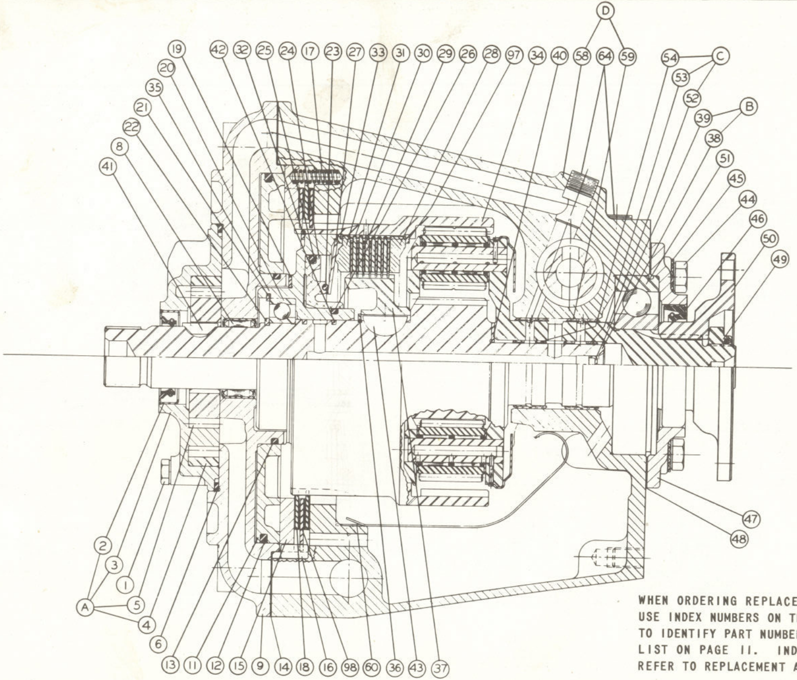
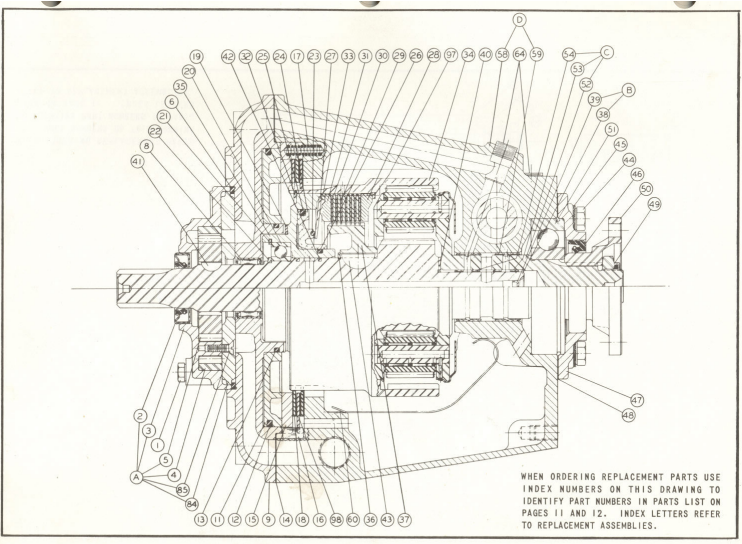


Fig. I Installation Drawing for All Model 72 Series Direct Drive Transmissions



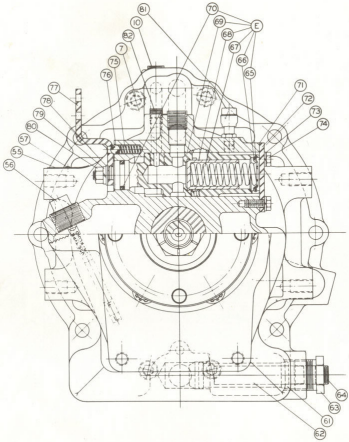
WHEN ORDERING REPLACEMENT PARTS USE INDEX NUMBERS ON THIS DRAWING TO IDENTIFY PART NUMBERS IN PARTS LIST ON PAGE 11. INDEX LETTERS REFER TO REPLACEMENT ASSEMBLIES.

Fig. 2 Cross Section of Model AS11-72C Transmission



WHEN ORDERING REPLACEMENT PARTS USE INDEX NUMBERS ON THIS DRAWING TO IDENTIFY PART NUMBERS IN PARTS LIST ON PAGES 11 AND 12. INDEX LETTERS REFER TO REPLACEMENT ASSEMBLIES.

Fig. 3 Cross Section of Model ASI-72 Transmission



WHEN ORDERING REPLACEMENT PARTS USE INDEX NUMBERS ON THIS DRAWING TO IDENTIFY PART NUMBERS IN PARTS LIST ON PAGE 11. INDEX LETTERS REFER TO REPLACEMENT ASSEMBLIES.

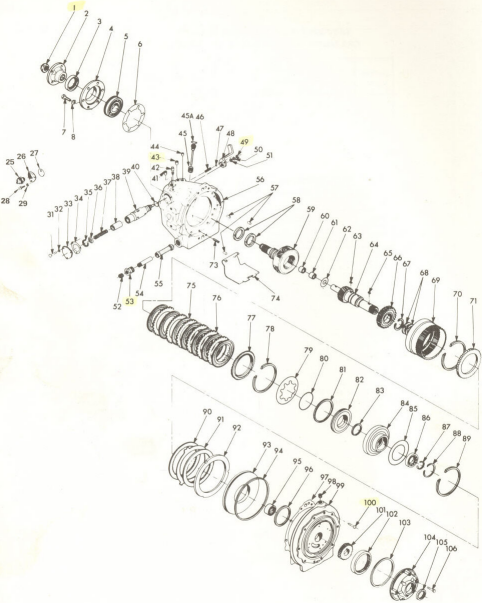
Fig. 4 Rear View and Section of AS11-72C Transmission

TEST SPECIFICATIONS FOR V-DRIVE, IN-LINE & CR2 UNITS HAVING BLACK SPRING (Part #71-242)

ENGINE RPM	NEUTRAL LINE				CLUTCH PRESSURE			
	PSI		K Pa		PSI		K Pa	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
200	–	–	–	–	70	–	94.9	–
500	115	135	792.9	930.8	115	135	792.9	938.8
2,000	–	–	–	–	125	160	861.8	1103.2

TEST SPECIFICATIONS FOR V-DRIVE, IN-LINE, & CR2 UNITS HAVING A WHITE SPRING (Part #72N-242)

ENGINE RPM	NEUTRAL LINE				CLUTCH PRESSURE			
	PSI		K Pa		PSI		K Pa	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
200	–	–	–	–	70	–	94.9	–
500	90	120	620.5	827.4	90	120	620.5	827.4
2,000	–	–	–	–	100	125	789.5	827.4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10-18-000-001

INDEX NO.	W.G. PART NO.	DESCRIPTION	NO. REQ.
1	4775L	Main shaft nut	1
2	4547AY	Coupling (10-18)	1
	4547BA	Coupling (10-17)	1
3	71C-110	Oil seal	1
4	72-7	Bearing retainer (10-18)	1
	71-7	Bearing retainer (10-17)	1
5	B309AGS	Annular bearing (10-18)	1
	B308AGS	Annular bearing (10-17)	1
6	72-147	Bearing retainer gasket (10-18)	1
	71-147	Bearing retainer gasket (10-17)	1
7	10-00-183-043	7/16-14 x 1-1/8 Hex head bolt (10-18)	6
	0000179859	7/16-14 x 1-1/8 Hex head bolt (10-17)	6
8	X2979DR	7/16 Lockwasher (10-18)	6
	0000103322	7/16 Lockwasher (10-17)	6
25	10-00-140-007	Neutral switch	1
N.I.	10-00-141-046	"O" Ring for switch	1
26	10-16-039-001	Valve cover	1
27	10-16-099-001	Switch cam	1
28	0000179796	1/4-20 Hex head bolt	3
29	0000103319	Lockwasher	3
31	0000179791	1/4-20 x 1/2 hex head bolt	3
33	71-4	Valve cover	1
34	71-14	Valve cover gasket	1
35	4821	Snap ring	1
N.I.	71-A244A	Valve & spring assembly	1
36	71-246	Valve spring retainer	1
37	71-242	Spring (black)	1
38	71-243	Pressure regulator valve	1
39	71-244A	Forward & reverse gear trans. valve	1
40	4804H	"O" Ring	1
41	10-00-191-002	3/8-18 Plastic plug	1
42	A4740G	Breather assembly	1
43	444866	3/8-18 Pipe plug	1
44	444687	1/8-27 Pipe plug	1
45	10-04-034-002	Dipstick tube	1
45A	10-13-059-001	Dipstick assembly (10-18)	1
	10-17-559-001	Dipstick assembly (10-17)	1
46	71-42	Poppet spring	1
47	453632	5/16 Steel ball	1
48	71-79B	Forward & reverse shift lever	1
49	115729	5/16-24 Hex nut	1
50	108579	5/16 Lockwasher	1
51	103340	Control lever washer	1
52	10-00-191-002	3/8-18 Plastic plug	1
53	4885B	Bushing	1
54	71C-84	Oil return tube	1
55	71C-A98A	Oil strainer assembly (10-18)	1
	71C-A98	Oil strainer assembly (10-17)	1
56	10-17-065-006	Case without bushing (10-17)	1
	10-18-565-001	Case without bushing (10-18)	1
57	R6-177	Dowel pin (10-18)	3
	71-87A	Dowel pin (10-17)	3
58	4806B	Sealing ring	4
59	71-A2*	Pinion cage & output shaft (10-18)	1
	71-A2*	Pinion cage & output shaft (10-18)	1
	10-17-659-012	Pinion cage & output shaft (10-17)	1
	10-18-659-006	Pinion cage & output shaft (10-18)	1
60	Kit A4867DD	2 Presized bushings	1
61	Kit A4867DD	2 Presized bushings	1
62	71-17	Thrust washer	1
63	0000124553	Woodruff key (10-18)	1
	000218211	Woodruff key (10-17)	1
64	72C-2A16	Drive gear & plug assembly (10-18)	1
	71C-3A16	Drive gear & plug assembly (10-17)	1
65	4873	Woodruff key	1
66	10-16-179-001	Forward clutch hub (10-18)	1
	71-40	Forward clutch hub (10-17)	1

INDEX NO.	W.G. PART NO.	DESCRIPTION	NO. REQ.
67	4495	Snap ring	1
68	4806J	Sealing ring	2
69	72-6	Ring gear (10-18)	1
	71-6	Ring gear (10-17)	1
70	4768	Snap ring selective .050-.054, green (10-18 only) .074-.078, orange	1-2
	4768A	.096-.100, white	1
	4768B	.084-.088, blue	1
	10-00-139-019		
71	5L-67	Clutch pressure plate	1
73	71-97	Pressure plate spring	11
74	71-140	Oil baffle (10-18)	1
	71B-140	Oil baffle (10-17)	1
75	12-A66	Clutch inner plate (10-18)	7
		Clutch inner plate (10-17)	5
76	3-176	Clutch plate (steel) (10-18)	6
		Clutch plate (steel) (10-17)	4
77	5C-175A	Clutch pressure plate	1
78	4755	Clutch spring snap ring	1
79	3-37	Clutch spring	1
80	5C-33	Clutch spring bearing ring	1
81	5L-36	Clutch ring	1
82	10-16-124-001	Forward clutch piston	1
83	5M-122	Sealing ring ("O" ring)	1
84	72-70	Forward clutch cylinder (10-18)	1
	71-70	Forward clutch cylinder (10-17)	1
85	71-15B	Thrust washer	1
86	B108A	Annular bearing (10-18)	1
	B107A	Annular bearing (10-17)	1
87	4559A	Snap ring (10-18)	1
	4734	Snap ring (10-17)	1
88	4766B	Snap ring (10-18)	1
	R6A-7½	Snap ring (10-17)	1
89	4822	Ring gear snap ring	1
90	10-17-666-001	Reverse clutch plate assembly	1-2
91	72-176	Outer clutch plate (10-18)	0-1
92	71-71	Reverse clutch pressure plate	1
93	71-35	Reverse clutch piston	1
94	4805A	Sealing ring	1
95	4840D	Needle bearing	1
96	4804G	Sealing ring	1
97	71-144B	Case & adapter gasket	1
98	444858	1/4 Pipe plug	1
99	71C-A8	Forward & reverse adapter	1
100	4911	3/8-16 x 1-1/4 Cap screw	4
N.I.	71C-A60	Pump assy. (inc. 101, 102, 104 & 105)	1
101	Not serviced	Pump drive gear (order assembly)	1
102	Not serviced	Pump driven gear (order assembly)	1
103	3-61	Pump gasket	1
104	Not serviced	Pump housing (order assembly)	1
105	10-00-044-014	Oil seal assembly	1
106	10-00-183-021	5/16-18 x 1-3/8 Hex head bolt	4
N.I.	71C-60	Pump assembly	1
N.I.	Kit A4867VV	2 Presized bushings	1

N.I. – NOT ILLUSTRATED *USED WITH BUSHINGS

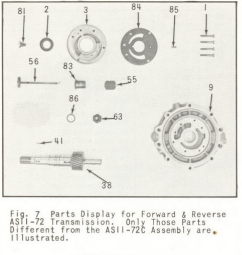


Fig. 7 Parts Display for Forward & Reverse ASI-72 Transmission. Only Those Parts Different from the ASII-72C Assembly are Illustrated.

ASII-72 PARTS LIST

INDEX NO.	PART NO.	PART NAME	NO. REQ'D
1	179825	5/16-18x1-7/8 HEX HEAD BOLT	4
A	71-A60	FRONT PUMP ASSEMBLY	1
INDEX PARTS 2,3,4,5,84, & 85 MUST BE ORDERED AS ABOVE ASSEMBLY. SEAL (INDEX NO. 2) IS AVAILABLE SEPARATELY FOR REPLACEMENT, OR IN SMALL PARTS KIT (A4867M). INDEX PARTS 84 & 85 MAY BE OBTAINED SEPARATELY.			
2	71-62	OIL SEAL ASSEMBLY	1
3	71-60	PUMP HOUSING	1
9	71-88	FORWARD & REVERSE ADAPTER	1
B	72-A16	DRIVE GEAR & PLUG ASSEMBLY	1
INDEX PARTS 38 & 39 MUST BE ORDERED AS ABOVE ASSEMBLY.			
38	72-16	DRIVE GEAR	1
41	431787	WOODRUFF KEY #61	1
55	4636EQ	NAME PLATE	1
56	3-2A195	OIL FILLER CAP & DIPSTICK ASSEMBLY	1
63	4885	BUSHING	1
81	47408	BREATHER ASSEMBLY	1
83	3-196	OIL FILLER TUBE	1
84	71-3	PUMP BACKING PLATE	1
85	110533	#10-24x3/4 FLAT HEAD MACHINE SCREW	1
86	120428	ANNULAR GASKET	1

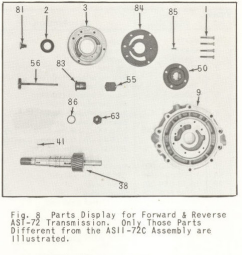
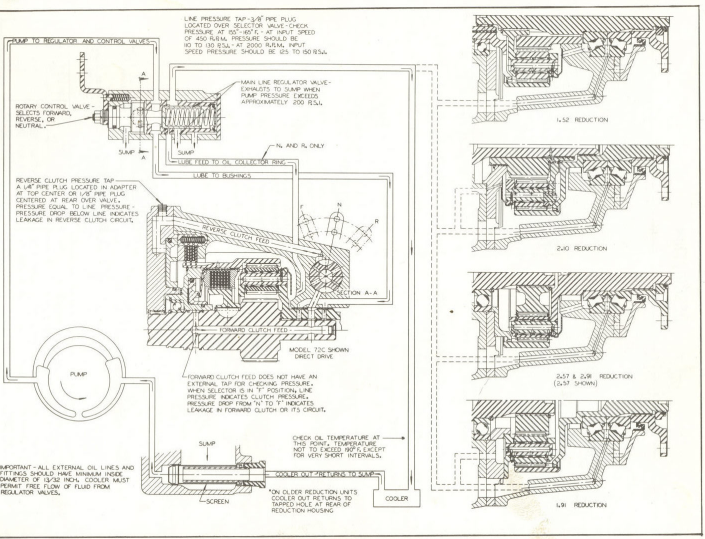


Fig. 8 Parts Display for Forward & Reverse ASI-72 Transmission. Only Those Parts Different from the ASII-72C Assembly are Illustrated.

ASI-72 PARTS LIST

INDEX NO.	PART NO.	PART NAME	NO. REQ'D
1	179825	5/16-18x1-7/8 HEX HEAD BOLT	4
A	71-A60	FRONT PUMP ASSEMBLY	1
INDEX PARTS 2,3,4,5,84, & 85 MUST BE ORDERED AS ABOVE ASSEMBLY. SEAL (INDEX NO. 2) IS AVAILABLE SEPARATELY FOR REPLACEMENT, OR IN SMALL PARTS KIT (A4867M). INDEX PARTS 84 & 85 MAY BE OBTAINED SEPARATELY.			
2	71-62	OIL SEAL ASSEMBLY	1
3	71-60	PUMP HOUSING	1
9	71-88	FORWARD & REVERSE ADAPTER	1
B	72-A16	DRIVE GEAR & PLUG ASSEMBLY	1
INDEX PARTS 38 & 39 MUST BE ORDERED AS ABOVE ASSEMBLY.			
38	72-16	DRIVE GEAR	1
41	431787	WOODRUFF KEY #61	1
50	4547BA	COUPLING	1
55	4636DR	NAME PLATE	1
56	3-2A195	OIL FILLER CAP & DIPSTICK ASSEMBLY	1
63	4885	BUSHING	1
81	47408	BREATHER ASSEMBLY	1
83	3-196	OIL FILLER TUBE	1
84	71-3	PUMP BACKING PLATE	1
85	110533	#10-24x3/4 FLAT HEAD MACHINE SCREW	1
86	120428	ANNULAR GASKET	1

NOTE: WHEN ORDERING PARTS FOR ASII-72 & ASI-72 TRANSMISSIONS, USE THE ASII-72C PARTS LIST TO IDENTIFY THOSE PARTS WHOSE INDEX NUMBERS ARE NOT LISTED IN THE ABOVE PARTS LIST. THE ABOVE ASII-72 & ASI-72 PARTS LIST SHOW ONLY THOSE PARTS WHICH DIFFER FROM THOSE IN ASII-72C. THE ONLY DIFFERENCE BETWEEN THE ORIGINAL ASII-72 & THE ASI-72 WAS THE SMALLER DIAMETER COUPLING (4547BA) USED ON OUTPUT SHAFT OF THE ASI-72.



LINE PRESSURE TAP-3/8" PIPE PLUG LOCATED OVER SELECTOR VALVE-CHECK PRESSURE AT 155°-165° F. - AT INPUT SPEED OF 450 R.P.M. PRESSURE SHOULD BE 110 TO 130 P.S.I. - AT 2000 R.P.M. INPUT SPEED PRESSURE SHOULD BE 125 TO 150 P.S.I.

MAIN LINE REGULATOR VALVE-EXHAUSTS TO SUMP WHEN PUMP PRESSURE EXCEEDS APPROXIMATELY 200 P.S.I.

ROTARY CONTROL VALVE-SELECTS FORWARD, REVERSE, OR NEUTRAL.

REVERSE CLUTCH PRESSURE TAP A 1/4" PIPE PLUG LOCATED IN ADAPTER AT TOP CENTER OR 1/8" PIPE PLUG CENTERED AT REAR OVER VALVE. PRESSURE EQUAL TO LINE PRESSURE - PRESSURE DROP BELOW LINE INDICATES LEAKAGE IN REVERSE CLUTCH CIRCUIT.

FORWARD CLUTCH FEED DOES NOT HAVE AN EXTERNAL TAP FOR CHECKING PRESSURE. WHEN SELECTOR IS IN "F" POSITION, LINE PRESSURE INDICATES CLUTCH PRESSURE. PRESSURE DROP FROM "N" TO "F" INDICATES LEAKAGE IN FORWARD CLUTCH OR ITS CIRCUIT.

CHECK OIL TEMPERATURE AT THIS POINT. TEMPERATURE NOT TO EXCEED 190° F. EXCEPT FOR VERY SHORT INTERVALS.

IMPORTANT - ALL EXTERNAL OIL LINES AND FITTINGS SHOULD HAVE MINIMUM INSIDE DIAMETER OF 13/32 INCH. COOLER MUST PERMIT FREE FLOW OF FLUID FROM REGULATOR VALVES.

*ON OLDER REDUCTION UNITS COOLER OUT RETURNS TO TAPPED HOLE AT REAR OF REDUCTION HOUSING

DESCRIPTION

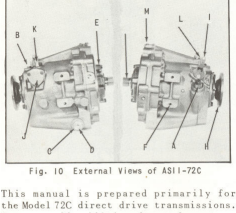


Fig. 10 External Views of ASII-72C

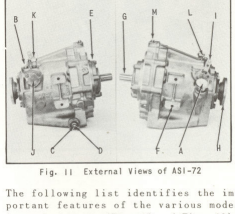


Fig. 11 External Views of ASI-72

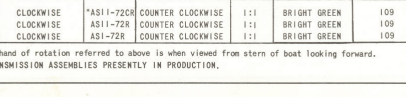
This manual is prepared primarily for the Model 72C direct drive transmissions. However, all additional supplementary descriptions and illustrations are included to allow it to be used for the Model 72 transmissions.

The material in this manual is also used in conjunction with the proper reduction gear manuals for servicing all 72, 72R, 72C and 72CR reduction gear transmissions.

The following list identifies the important features of the various model transmissions in (Fig. 10 and Fig. 11):

A. Oil Filler Cap & Dipstick Assembly
B. Oil Outlet to Cooler
C. Oil Inlet from Cooler
D. Oil Drain Plug
E. Oil Pump
F. Mounting Pads & Mounting Bolt Holes
G. Drive Gear
H. Output Shaft Flange
I. Shift Lever
J. Valve Cover
K. Breather
L. Main Line Pressure Tap
M. Reverse Clutch Pressure Tap

The following are the identification markings for the Warner Gear "VELVET DRIVE"® Marine Transmissions.



"A" MODEL	HAND OF ROTATION	"A" MODEL	HAND OF ROTATION	"B" RATIO	"C" COLOR	WEIGHT LBS., EMPTY
*ASII-72C	CLOCKWISE	*ASII-72CR	COUNTER CLOCKWISE	1:1	BRIGHT GREEN	109
ASII-72	CLOCKWISE	ASII-72R	COUNTER CLOCKWISE	1:1	BRIGHT GREEN	109
ASI-72	CLOCKWISE	ASI-72R	COUNTER CLOCKWISE	1:1	BRIGHT GREEN	109

The hand of rotation referred to above is when viewed from stern of boat looking forward.

*TRANSMISSION ASSEMBLIES PRESENTLY IN PRODUCTION.

The transmission consists of a planetary gear set, a forward clutch, a reverse clutch, an oil pump, and a pressure regulator and rotary control valve. All of these are contained in a cast iron housing along with necessary shafts and connectors, to provide forward, reverse and neutral operation. A direct drive ratio is used for all forward operation. In reverse the speed of the output shaft is reduced by a 1.10 ratio from that of the input shaft speed, and is in the opposite direction. Helical gearing is used to provide quieter operation than can be obtained with spur gearing.

The transmission is fast shifting to give the boat operator complete control of the vessel. Shifting is accomplished by the fore and aft movement of the shift lever, (Figs. 10 & 11). This movement rotates the control valve and directs oil under controlled pressure to the required channels.

Oil pressure is provided by the crescent type pump, the drive gear of which is keyed to the drive shaft and operates at transmission input speed to provide screened oil to the pressure regulator.

From the regulator valve the oil is directed through the proper circuits to the bushings and anti-friction bearings requiring lubrication. A flow of lubricant is present at the required parts whenever the front pump is turning and it should be noted that supply is positive in forward, neutral and reverse conditions.

The unit has seals to prevent escape of oil.

Both the input and output shafts are coaxial, with the input shaft splined for the installation of a drive damper, and the output shaft provided with a flange for connecting to the propeller shaft.

INSTALLATION PRECAUTIONS

TRANSMISSION OIL COOLER

The oil cooler must be properly connected to the transmission before the engine is cranked or started. Failure to properly connect the oil cooler will result in the blowing out of the forward clutch piston due to over pressurization. No Warranty claims due to this type failure will be allowed as this is the responsibility of the Boat Builder, Engine Manufacturer or Conversion Engine Manufacturer.

A cooler of sufficient size shall be used to assure that the maximum oil temperature of the transmission will not exceed 190°F. Failure to provide proper cooling may result in damage to the transmission from insufficient oil flows and pressures if the transmission is operated at temperatures above the maximum recommended.

The proper oil cooler inlet and outlet connections are shown in (Figs. 1,10, & 11).

Although the type of cooler used is optional, a selection of three different sized coolers are manufactured by Warner Gear for installation with these transmissions. Information regarding these coolers may be secured upon request from your local dealer.

CONTROL LEVER POSITION

The position of the control lever on transmission when in forward should be shifted to the point where it covers the letter "F" on the case casting, and is located in its proper position by the poppet ball. The Warranty is cancelled if the shift lever poppet spring and/or ball is permanently removed, or if the control lever is changed in any manner, or repositioned, or if linkage between remote control and transmission shift lever does not have sufficient travel in both directions. This does not apply to transmissions equipped with Warner Gear electrical shift control.

FRONT PUMP MOUNTING

Before mounting the transmission on the engine be sure that the pump is correctly installed. Orient the pump mounting bolt holes and arrows indicating direction of rotation to correspond with the direction of rotation required by the engine. If the pump is not installed for the proper rotation the pump will not produce oil pressure to operate the transmission when engine is started.

LUBRICATION RECOMMENDATIONS

TRANSMISSION FLUID

Dexron®II, Type F, and other hydraulic transmission fluids which meet the Detroit Diesel Allison Type C3 specifications are recommended for use in all Velvet Drive® marine transmissions.

Lubricating oils which are recommended for use in diesel engines and also meet Detroit Allison Type C3 specifications may be used if the engine speed does not exceed 3000 RPM. SAE #30 is preferred. SAE #40 is acceptable if high operating temperatures are to be encountered. Multiviscosity oils such as 10W-40 are not acceptable. The first choice is an oil which falls in the SAE-API service Class "CD." The second choice would be an oil which falls in the SAE-API service Class "CC."

The equivalent DOD mil specs are:

"CD" Mil-L-2104B
"CC" Mil-L-45199

The new C3 specifications were developed by Detroit Diesel Allison Division of General Motors to outline the requirements of an oil suitable for use in their heavy duty hydraulic automatic and powershift transmissions. The oil companies should be able to provide information as to the suitability of their product for use in a given application.

FILLING THE TRANSMISSION

NOTE: Be sure the cooler is properly installed and the transmission contains oil before cranking or starting engine.

Fill the transmission prior to starting the engine and immediately after the engine starts add oil to maintain the oil level near the full mark. This method for filling the transmission minimizes the possibility of pumping air into the hydraulic system.

CHECKING THE OIL LEVEL

External cooler circuit variations, such as length of lines, size of lines, cooler size, and the position in which the cooler is mounted, all affect the amount of oil required to fill the transmission. Oil will sometimes drain back into the transmission from the cooler and cooler lines, when cooler and lines are improperly installed. It is important that oil level checks on all new installations be made immediately after the engine has been shut off and before the oil has had a chance to drain back.

Oil, which drains from the oil cooler and cooler lines, will raise the oil level in the transmission. Oil level for each installation, which is to be checked prior to starting the engine can be established by properly filling the unit and observing the level after drain back.

The dipstick assembly need not be threaded into the case to determine the oil level. It need only be inserted into the case until the cap or plug rests on the surface surrounding the oil filler hole.

The transmission should be checked periodically to assure proper oil level, and oil should be added if necessary.

CHANGING OIL

It is recommended that the transmission oil be changed once each season. After draining oil from the unit, the removable oil screen should be thoroughly cleaned before refilling the transmission with the recommended oil.

OIL PRESSURES

Transmission line pressure should be between 110-150 PSI at engine speeds between 450 and 2000 RPM at normal operating temperatures of 150-175°F.

When operating the transmission at low temperatures or excessive speeds pressures of 200-250 PSI may be obtained.

A maximum transmission oil temperature of 190°F. is recommended.

OIL CAPACITY

TRANSMISSION MODEL	*TRANSMISSION OIL CAPACITY (QUARTS)	
	LEVEL	15° INCLINED
AS11-72C or CR	2.1	1.7

***NOTE:** DOES NOT INCLUDE CAPACITY NEEDED FOR TRANSMISSION COOLER AND OIL LINES.

TRANSMISSION — OPERATION

FORWARD

Move the transmission shift lever to the extreme forward position where the spring-loaded ball enters the chamfered hole in the side of the shift lever and properly locates it in the "forward" position, (Fig. 12). With the shift lever so located, oil at regulated pressure flows from the control valve into porting in the transmission case, output shaft, drive gear, and then into the cavity behind the piston in the forward clutch cylinder. The resulting movement of the forward clutch piston and the lever action of the clutch spring forces the multiple discs of the forward clutch together and, with the aid of the forward clutch hub, locks the input shaft to the ring gear. This in turn prevents rotation of the planetary pinions about their own axes and thus locks the input shaft, ring gear and output shaft together, causing them to rotate as a solid concentric coupling. In this way, input shaft speed and direction of rotation are transmitted directly to the output shaft.

NEUTRAL

Move the transmission shift lever to the center position where the spring-loaded ball enters the chamfered hole in the side of the shift lever and properly locates it in the "neutral" position, (Fig. 12). With the shift lever so located, flow of pressurized oil to the clutches is blocked at the control valve. The clutches are also vented, by a different portion of the control valve, to the sump area inside the transmission case and thus free-running open clutches are insured.

REVERSE

Move the transmission shift lever to the extreme rearward position where the spring-loaded ball enters the chamfered hole in the side of the shift lever

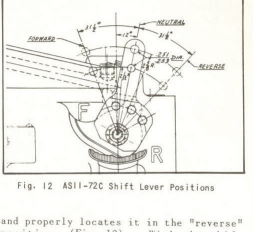


Fig. 12 ASII-72C Shift Lever Positions

and properly locates it in the "reverse" position, (Fig. 12). With the shift lever so located, oil at regulated pressure flows from the control valve into porting in the transmission case, thence back to the adapter and into the reverse clutch cavity. The resulting movement of the reverse clutch piston and the reverse clutch pressure plate locks the reverse clutch plate to the transmission case. The stationary reverse clutch plate, through splined connectors, thus prevents rotation of the ring gear. With the ring gear held and the sun gear rotating at input speed, the pinions of the compound planetary gearset are free to rotate about their own axes and reverse the direction of rotation of the pinion carrier and output shaft.

SHIFTING

Except in an emergency, shift from forward to reverse below high idle engine speeds (approximately 1000 RPM). This will prevent damage or abuse of the marring gear which might necessitate its early repair.

DISASSEMBLY OF TRANSMISSION

NOTE: Tear down procedure should not begin until the transmission exterior and work area have been thoroughly cleaned.

OIL DRAINING PROCEDURE

1. Remove oil filler plug located below the shift lever on rear left side of transmission case.

2. If space permits, place container having approximately three (3) quart capacity under drain cap, located as shown in (Fig.13). Unscrew the drain plug and cooler return tube assembly, reach into the opening with a suitable tool, and remove the strainer assembly, (Fig. 74). Allow oil to drain into pan.

DISASSEMBLY OF VALVE AND SPRING ASSEMBLY FROM TRANSMISSION

3. Remove three (3) hex head bolts, lockwashers, valve cover and valve cover gasket, as shown in (Fig. 71).

4. Remove shift lever and associated parts, (Fig. 72).

5. Tap with soft hammer on exposed threaded shaft, upon which shift lever was mounted, and pull valve and spring assembly out of case from right side, (Fig. 70).

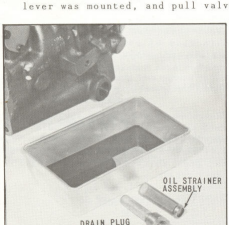


Fig. 13 Draining Transmission Oil

6. Place valve and spring assembly in a suitable holder, (Fig. 68). Depress the valve spring retainer and valve spring until the snap ring is free to be removed. The components of the valve and spring assembly can now be removed in the order shown in (Fig. 67).

NOTE: The control valve assembly can also be disassembled by using an arbor press with suitable tools as shown in (Fig. 69).

REMOVAL OF FRONT PUMP ASSEMBLY

7. Remove the four (4) front pump attaching bolts, (Fig. 66), place a protective covering over splines to prevent damage to seal lip, and lift pump assembly squarely up and over the protruding input shaft, (Fig. 64).

8. Remove pump drive gear, front pump gasket, and Woodruff key, (Fig. 63).

NOTE: Two different pump assemblies are used. One includes a backing plate which must be removed before the gears are exposed. For additional information and description see pages 33 and 41-44.

9. For the pump assembly with the backing plate, remove the one (1) flat head machine screw, (Fig. 93) and lift backing plate to expose gears.

10. Mark gears to identify for proper relocation of gear faces during reassembly, (Figs. 62 and 91). (Figs. 59 and 88) show views of the different front pump parts when completely disassembled.

DISASSEMBLY OF ADAPTER AND REVERSE CLUTCH PISTON

11. Remove the four (4) cap screws (12 point head), (Fig. 58). Lift the adapter and reverse clutch piston, (Fig. 57). If necessary, tap the adapter with a soft hammer to remove.

    CAUTION: The reverse clutch pressure plate may stick momentarily to the reverse clutch piston. To avoid damage, prevent pressure plate from dropping.

12. Force compressed air into reverse clutch cavity while holding piston, as shown in (Fig. 14) and piston will pop up out of reverse clutch cavity.

13. Remove sealing rings as shown in (Figs. 54 and 55).

REMOVAL OF THRUST WASHER, REVERSE CLUTCH PRESSURE PLATE, PRESSURE PLATE SPRINGS, DOWEL PINS AND CLUTCH PLATES

14. Thrust washer can now be lifted from position shown in (Fig. 53).

15. Remove clutch pressure plate shown in (Fig. 53), and then lift out the remaining clutch plates (Fig. 52).

16. The twelve (12) pressure plate springs and the three (3) dowel pins can now be removed, (Fig. 51).

DISASSEMBLY OF DRIVE GEAR AND CLUTCH ASSEMBLY

17. Grasp the exposed front end of the input gear and lift straight up; drive gear and cFutch assembly parts easily lift out of opening in front, (Fig. 50).

18. Remove thrust washer located between drive gear and planetary carrier, (Fig. 49).

19. Stand drive gear and clutch assembly in suitable fixture and remove internal & external snap rings at ball bearing from the drive gear and clutch cylinder, (Figs. 47 and 48). Do not permit drive gear to move forward after the above snap rings are removed.

20. While holding the ring gear, tap the front end of the drive gear with soft hammer. The drive gear and forward clutch hub assembly will pass through the ring gear and forward clutch assembly to come out of the rear end of the ring gear, (Fig. 44).

DISASSEMBLY OF FORWARD CLUTCH

21. Remove bearing from clutch cylinder by tapping with soft blunt tool.

22. Remove ring gear snap ring, (Fig. 38).

23. While holding ring gear, tap with soft blunt tool on exposed face of forward clutch cylinder inside of ring gear. Forward clutch cylinder will move forward to disassemble out of front of ring gear. After removing the clutch spring and the clutch spring snap ring, all parts of the forward clutch can be disassembled as shown in (Figs. 29, 30, 31, 32 & 33).

24. Piston can be removed from forward clutch cylinder to position in (Fig. 36) by applying compressed air to clutch cavity through one of three (3) holes in inside diameter of forward clutch cylinder, while other holes are blocked.

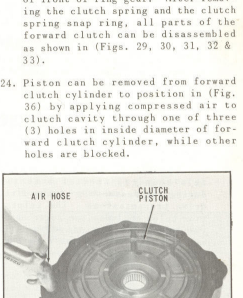


Fig. 14 Disassembling Reverse Clutch Piston from Adapter

25. Remove forward clutch sealing rings, as shown in (Figs. 34 & 35).

REMOVAL OF PINION CAGE AND OUTPUT SHAFT ASSEMBLY FROM TRANSMISSION CASE

26. Remove main shaft nut shown in (Fig. 28).

27. Using bearing puller, pull coupling from output shaft.

28. Remove six (6) hex head bolts and lockwashers, (Fig. 26).

29. Remove bearing retainer and gasket.

REMOVAL OF REAR BEARING

NOTE: The following paragraphs (30 & 31) describe alternate methods of removing the rear bearing. Either method is equally desirable.

30. Using bearing puller, grasp bearing by exposed groove in outside diameter and gently pull bearing from case, (Fig. 15).

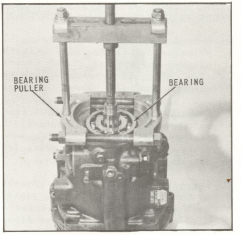


Fig. 15 Removing Bearing from Case

31. Place transmission, with front face down, on arbor press. Using suitable tool, press down on exposed end of output shaft until shaft is free of bearing inside diameter. Protect pinion cage and output shaft from damage from fall during this operation.

REASSEMBLY PRECAUTIONS

The following list contains a number of assembly problems which it is felt requires special attention during the reassembly of the direct drive transmissions. The information below includes the locations in the manual where information and instructions are available on these important assembly features.

1. Installation of proper pinion cage and output shaft assembly in transmission cases without bushings (Page 45, Paragraphs 18 & 19).

2. Selection of the proper clutch spring snap ring, (Page 25, Paragraph 23).

3. Selection of the proper ring gear snap ring, (Page 26, Paragraph 30).

4. Installation of the proper selective snap ring, (Page 27, Paragraphs 32 and 33).

5. Installation of adapter on transmission case should follow the procedures outlined, (Page 32, Paragraph 59), for tightening the capscrews. If bolts are not alternately tightened a small amount, damage can result to the needle bearing and its input shaft race.

6. Protection of pump seal during assembly of pump assembly over input drive gear, (Page 34, Paragraph 68).

7. Mounting pump to correspond to the engine rotation, (Page 35, Paragraph 70).

8. Check input shaft to insure that it rotates freely when turned by hand after transmission is assembled (Page 35, Paragraph 72).

INSPECTION AND GENERAL INSTRUCTIONS

1. Cleanliness is absolutely necessary during assembly to insure proper functioning of transmission. Transmission case passages should always have pipe plugs removed to allow for thorough cleaning. When available, use compressed air to dry parts before they are assembled. Do not wipe parts with rags to clean or dry them as lint from the cloth may cause erratic valve action.

2. Inspect all parts for damage or wear. Replace defective parts.

3. All gaskets, oil seals and rubber sealing rings should be replaced except in relatively new units. Judgement should then be exercised as to the need for replacing these parts.

4. Oil seals and bearings are best installed by using an arbor press, suitable fixtures, and tools to properly align parts being assembled. Hammering seals and bearings into position can severly damage parts.

5. Automatic transmission fluid type "A" suffix "A" should be used to lubricate parts as they are assembled. Petroleum jelly may be used on gaskets or other parts that must be held in position during assembly. All rubber parts will slide more freely if lubricated.

6. Tighten all bolts and screws evenly to the recommended torque, (See page 54).

ASSEMBLY OF TRANSMISSION

ASSEMBLING OIL SEAL IN BEARING RETAINER

1. Inspect rubber lip of seal for cracks, holes or brittle condition of rubber lip material.

2. Place front face of bearing retainer on arbor press table. Apply a suitable sealant to the outside diameter of seal before installing squarely into bore of housing with seal lip positioned as shown in (Fig. 16). Caution should be observed to insure that too much sealant is not used.

3. Using arbor press and suitable tool, as shown in (Fig. 17), press the oil seal into the bearing retainer until the rear face of the oil seal is flush with the rear face of the bearing retainer.

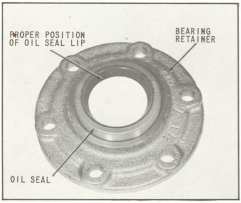


Fig. 16 Installing Oil Seal

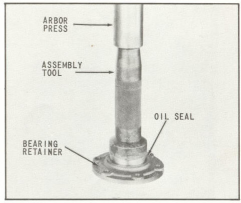


Fig. 17 Pressing Oil Seal in Retainer

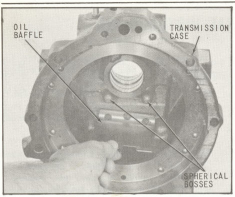


Fig. 18 Installing Oil Baffle

INSTALLATION OF THE BAFFLE IN THE TRANSMISSION CASE

4. Place oil baffle inside transmission case with curved portion below cast spherical bosses in case as shown in (Fig. 18).

5. Position front end of baffle so that center of baffle rests on top of the boss at front center of transmission case and the turned down corners of the baffle are located below the cast spherical bosses at the front of transmission case. Snap baffle into position by lifting up on curved portion so that the two large holes are located firmly on the spherical bosses at rear of transmission case as shown in (Fig. 19).

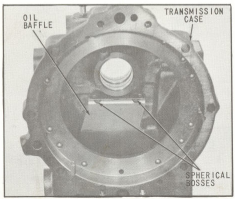


Fig. 19 Baffle Properly Installed

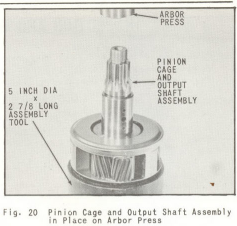


Fig. 20 Pinion Cage and Output Shaft Assembly in Place on Arbor Press

INSTALLATION OF PINION CAGE AND OUTPUT SHAFT ASSEMBLY IN THE TRANSMISSION CASE

6. Place the pinion cage and output shaft assembly on a 5 inch diameter by 2-7/8 long assembly tool, which in turn is mounted on an arbor press, as indicated in (Fig. 20).

   NOTE: If the transmission case does not have bronze bushings for the output shaft journal, use only the output shafts of the design with three oil grooves as shown in (Fig. 21). See page 45 (paragraphs 18 & 19), for further information.

7. Place the transmission case over the pinion cage and output shaft assemb-

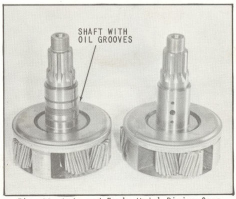


Fig. 21 Late and Early Model Pinion Cage and Output Shaft

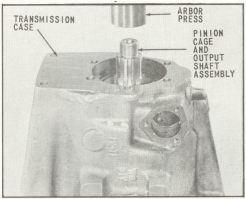


Fig. 22 Case Assembled over Pinion Cage and Output Shaft Assembly and Assembly Tool

ly so transmission case rests squarely on arbor press table which is supporting assembly tool (Fig. 22).

8. Inspect the bearing bore for possible dirt or burrs.

9. Inspect the rear bearing for scored or damaged balls and races and for loose or cracked ball retainer. Replace the bearing with a new part if damage is detected.

10. Inspect the bearing for presence of dirt. If dirt is present, wash bearing until clean and lubricate with automatic transmission fluid, type "A", suffix "A", before assembly.

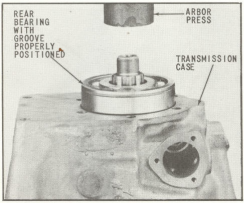


Fig. 23 Bearing Properly Positioned on Transmission Case

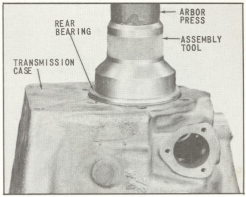


Fig. 24 Rear Bearing Pressed in Place

11. With the groove on the outside diameter of the bearing located toward the rear of the transmission, as shown in (Fig. 23), place the bearing over the projecting output shaft and squarely in the bearing bore.

12. Using an assembly tool designed to press evenly on the bearing outer and inner races, press bearing down until seated against shaft or case shoulder, (Fig. 24).

13. Place bearing retainer gasket on rear of transmission case as shown in (Fig. 25). Gasket may be coated with petroleum jelly for easier assembly.

14. Place bearing retainer in place on rear of case as shown in (Fig. 26).

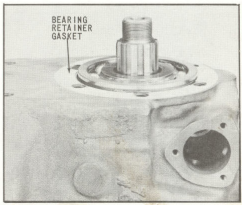


Fig. 25 Bearing Retainer Gasket in Place

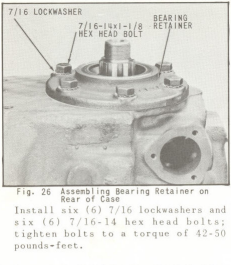


Fig. 26 Assembling Bearing Retainer on Rear of Case

Install six (6) 7/16 lockwashers and six (6) 7/16-14 hex head bolts; tighten bolts to a torque of 42-50 pounds-feet.

15. Inspect and lubricate the hub diameter of rear coupling which runs in contact with the rubber lip of oil seal. If this surface is scratched or burred, replace the part with a new piece to prevent seal-lip damage and subsequent oil leakage.

16. After lubricating the splined portion of coupling, assemble the splined coupling onto the externally splined portion of the output shaft. When the coupling has been aligned squarely on the output shaft and hand assembly has proceeded as far as possible, place a suitable tool on the coupling, (Fig. 27), and gently press the coupling with arbor

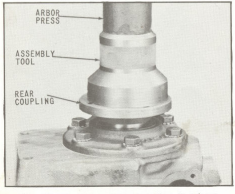


Fig. 27 Pressing Rear Coupling in Place

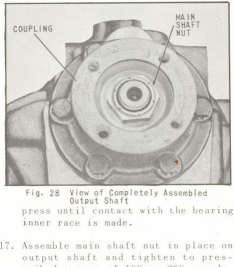


Fig. 28 View of Completely Assembled Output Shaft

press until contact with the bearing inner race is made.

17. Assemble main shaft nut in place on output shaft and tighten to prescribed torque of 100 to 200 pounds-feet. This should bring inner race of bearing solidly in contact with the shoulder on output shaft and eliminate any detectable end play in the coupling and output shaft combination, (Fig. 28).

ASSEMBLY OF THE FORWARD CLUTCH INTO THE RING GEAR

18. Place the ring gear on a clean surface with the external teeth up, as shown in (Fig. 29).

19. Remove all dirt and solid particles from the shoulder inside the gear formed by the top of the internal helical gear, (Fig. 29).

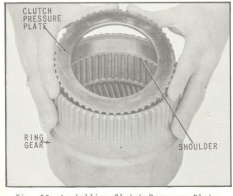


Fig. 29 Installing Clutch Pressure Plate

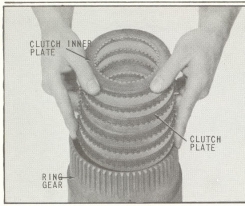


Fig. 30 Installing Forward Clutch Plates

20. With the smoothly ground face in the upward position, install the clutch pressure plate (rear) in the ring gear, as shown in (Fig. 29). Assembly is complete when the clutch pressure plate is firmly and squarely seated on the shoulder at the bottom of the internal splines.

21. Lubricate seven (7) clutch inner plates and six (6) outer clutch plates, arrange and assemble, as shown in (Fig. 30).

22. Install clutch pressure plate (front) with flat face down in contact with clutch plate, as shown in (Fig. 31).

23. Install clutch spring snap ring (Fig. 32). This snap ring seats on the internal splines, and does not assemble into a snapring groove.

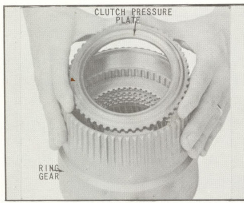


Fig. 31 Installing Clutch Pressure Plate

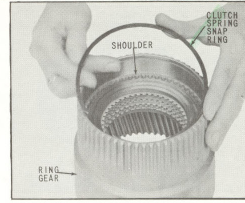


Fig. 32 Installing Clutch Spring Snap Ring

CAUTION: BE SURE YOU HAVE THE PROPER SNAP RING. THE CLUTCH SPRING SNAP RING IS .090 TO .093 INCHES THICK AND HAS A FREE DIAMETER OF 5-19/32 + 1/16 INCHES.

24. With the concave side of the clutch spring down, install in ring gear, as shown in (Fig. 33). Assembly is complete when the clutch spring is seated firmly and squarely on clutch snap ring.

25. Assemble on the forward clutch piston, the clutch spring bearing ring and a lubricated clutch sealing ring, as shown in (Fig. 34). Inspect the inside diameter of the forward clutch piston having contact with the sealing ring; remove all

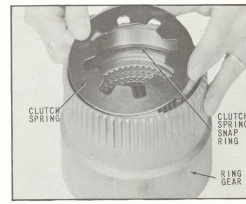


Fig. 33 Installing Clutch Spring

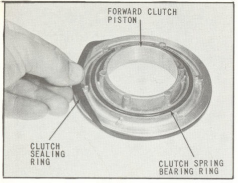


Fig. 34 Installing Clutch Sealing Ring

burrs or scratches and lubricate before assembly.

26. Install in forward clutch cylinder a well lubricated sealing ring, (Fig. 35). Lubricate entire forward clutch cylinder before continuing assembly.

27. After aligning the assembled forward clutch piston squarely on the assembled forward clutch cylinder, press the clutch piston into the forward clutch cylinder, as shown in (Fig. 36). This is a hand assembly and should not require pounding by hammer or pressing on arbor press. Assembly is complete when piston "bottoms" in forward clutch cylinder.

28. Place the combined parts, as assembled in steps 18 through 24 inclusive, on a suitable support which has been placed on an arbor press,

Fig. 35 Installing Sealing Ring

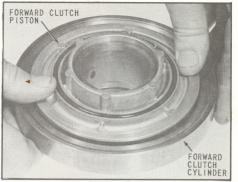


Fig. 36 Installing Forward Clutch Piston

(Fig. 37). Center the clutch spring in the ring gear.

29. Place the parts assembled in steps 25 through 27 inclusive into the open top of the assembly described in step 28, (Fig. 37). Place a suitable assembly tool squarely on top of the forward clutch cylinder and press down with the arbor press until the forward clutch cylinder is firmly seated on the snap ring and the groove for the snap ring is fully exposed. Check, by looking into rear of ring gear, to be sure that the clutch spring bearing ring is properly assembled on the forward clutch piston.

30. While maintaining load from arbor press, assemble ring gear snap ring, (Fig. 38). Tap ring while in place to insure full seating of ring in groove.

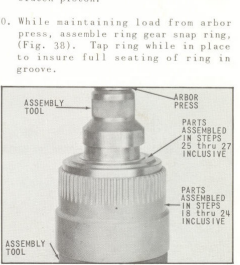


Fig. 37 Pressing Forward Clutch Hub into Ring Gear

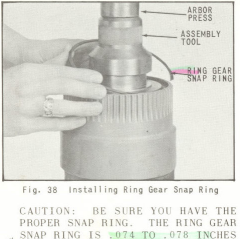


Fig. 38 Installing Ring Gear Snap Ring

CAUTION: BE SURE YOU HAVE THE PROPER SNAP RING. THE RING GEAR SNAP RING IS .074 TO .078 INCHES THICK AND HAS A FREE DIAMETER OF 5-7/8 + 1/16 INCHES.

31. Place the forward clutch and ring gear assembly steps (18) thru (30) inclusive on an arbor press with the assembly supported on the face of the ring gear as shown in (Figure 39).

32. Place a suitable assembly tool in the arbor press to apply force on the clutch pressure plate compressing the clutch plates and clutch pressure plate against the clutch snap ring. The gap between the clutch pressure plate and the shoulder of the snap ring groove in the ring gear can then be measured with a feeler gauge as shown in (Fig. 39).

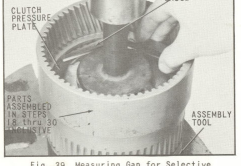


Fig. 39 Measuring Gap for Selective Snap Ring

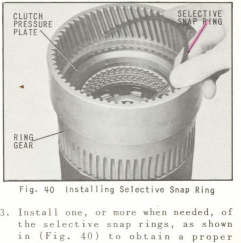


Fig. 40 Installing Selective Snap Ring

33. Install one, or more when needed, of the selective snap rings, as shown in (Fig. 40) to obtain a proper clutch plate clearance of .040-.065.

CAUTION: Be sure the proper snap ring is used. The 'Selective Snap Ring' has a free diameter of 5-11/16 +1/16 inches. These rings are variable in thickness and are color coded as follows: Green-.050 to .054 inches thick; Orange-.074 to .078 inches thick; White-.096 to .100 inches thick.

ASSEMBLY OF FORWARD CLUTCH HUB AND SEALING RINGS ON DRIVE GEAR

34. Place the forward clutch hub on a suitable support placed on an arbor press in the position shown in (Fig. 41).

35. Assemble Woodruff key in the keyway provided on the drive gear, (Fig. 41).

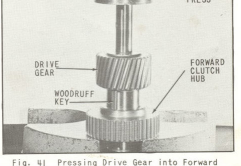


Fig. 41 Pressing Drive Gear into Forward Clutch Hub

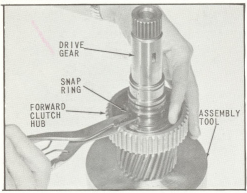


Fig. 42 Installing Clutch Hub Snap Ring

36. Lubricate the outside diameter of the drive gear on that area which presses into the forward clutch hub.

37. Install the drive gear and Woodruff key squarely into the forward clutch hub, being careful to align the Woodruff key with the mating keyway in the forward clutch hub,(Fig. 41). Press the drive gear into the forward clutch hub until the gear "bottoms" on the face of the forward clutch hub and the groove for the snap ring is fully uncovered.

38. Invert the parts referred to in step 34 and install snap ring in the groove provided, (Fig. 42). Tap ring after assembly with suitable tool to insure full seating in groove.

39. Install two (2) forward clutch sealing rings in grooves provided on drive gear, (Fig. 43). After installing rings in groove, hook ends and turn rings to insure freedom of rotation.

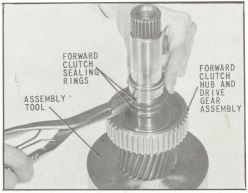


Fig. 43 Installing Forward Clutch Sealing Rings on Drive Gear

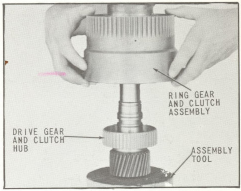


Fig. 44 Assembling Ring Gear and Clutch Assembly on Drive Gear

ASSEMBLING DRIVE GEAR AND CLUTCH ASSEMBLY

40. With drive gear and clutch hub in assembly tool as shown in (Figs. 42 and 43), place ring gear and forward clutch assembly over drive gear as shown in (Fig. 44).

41. Lower ring gear and clutch assembly until internal teeth of clutch plates begin to engage teeth on forward clutch hub. Rotate ring gear to align teeth of plates with teeth on clutch hub. Do not force ring gear, as damage to teeth on plates will result. When ring gear and clutch are in correct position, rear end of ring gear should be against the assembly tool or "flush" with the rear thrust face of drive gear,

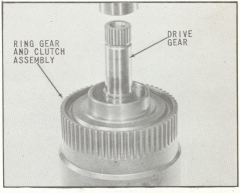


Fig. 45 Assembling Ring Gear and Clutch Assembly on Drive Gear

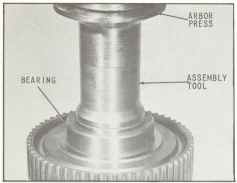


Fig. 46 Pressing Clutch Bearing in Place

as shown in (Fig. 45). Do not remove drive gear and clutch assembly from assembly tool or move drive gear forward until steps 42, 43 and 44 are completed. Any movement of the drive gear forward will result in the clutch plates becoming disengaged with clutch hub and sealing rings moving out of position.

42. Place aligned parts and assembly tool in place on arbor press. Place bearing over protruding drive gear and squarely into bore at front of forward clutch cylinder; press bearing down with arbor press until bearing is fully seated on shoulder and snap ring grooves in front of bearing are exposed (Fig. 46).

43. Install external snap ring on drive gear, (Fig. 47).

44. Install internal snap ring in clutch cylinder, (Fig. 48).

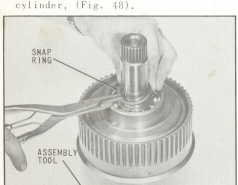


Fig. 47 Installing Snap Ring

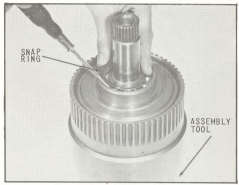


Fig. 48 Installing Snap Ring

INSTALLATION OF DRIVE GEAR AND CLUTCH ASSEMBLY, REVERSE CLUTCH PLATE, AND REVERSE CLUTCH PRESSURE PLATE IN TRANSMISSION CASE

45. Place the parts assembled in steps 1 through 17 inclusive, on a smooth, clean surface in the upright position indicated in (Fig. 49). In this position, the rear face of rear coupling will provide sufficient base to enable assembly to proceed.

46. Coat the drive gear thrust washer with petroleum jelly and assemble into pinion cage and output shaft assembly, as shown in (Fig. 49). Center the washer carefully over bore provided for rear of drive gear.

47. After lubricating the rear end of the drive gear and checking centered position of the thrust washer, install the drive gear and clutch assembly into the case and pinion

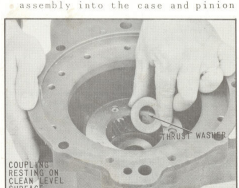


Fig. 49 Installing Thrust Washer

cage and output shaft assembly, (Fig. 50). Care and proper centering must be exercised at this point to prevent damage to the bushings when the rear diameter of the drive gear enters the output shaft.

48. Install the twelve (12) pressure plate springs in the holes provided in the reverse clutch cavity, (Fig. 51). The holes should be free from dirt and all springs should be firmly seated.

49. Coat the three (3) dowel pins with petroleum jelly and assemble them in the three (3) grooves provided at the outside diameter of the reverse clutch cavity, (Fig. 51). Assembly

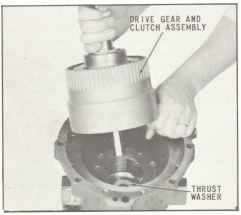


Fig. 50 Installing Drive Gear and Clutch Assembly

is complete when the dowel pin is firmly seated on end and into the groove, as far as groove contour will permit.

50. Install one of the reverse clutch plates over the exposed splined teeth of the ring gear. Install the outer clutch plate with the odd shaped lug located as shown in (Figure 52) to obtain the proper spacing with reference to the springs. Install the second reverse clutch plate on top of the outer clutch plate and over the exposed splined teeth of the ring gear.

51. Install the reverse clutch pressure plate with the twelve (12) holes in

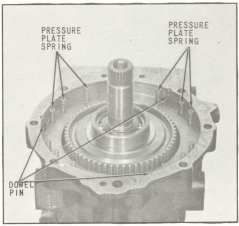


Fig. 51 Installation of Twelve (12) Pressure Plate Springs and Three (3) Dowel Pins

the downward position. Align the cast slot in the pressure plate with the large oil hole in the front face of the transmission case, (Fig. 53). Since the twelve (12) pressure plate springs are not evenly spaced, the slot and oil hole alignment are required to locate the pressure plate with relation to the pressure plate springs, (Fig. 52). A properly assembled reverse pressure plate will appear as shown in (Fig. 53). If pressure plate does not drop down to position, approximately flush with transmission case front face, check the three (3) dowel pins for possible misalignment.

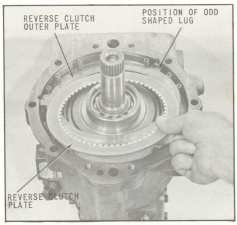


Fig. 52 Installing Reverse Clutch Plates

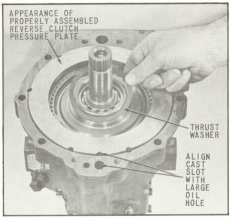


Fig. 53 Installing Thrust Washer and Reverse Clutch Pressure Plate

52. Coat thrust washer with petroleum jelly and assemble, as shown in (Fig. 53).

ASSEMBLY OF REVERSE CLUTCH PISTON INTO ADAPTER

53. After checking adapter for the following, place it on clean surface in position, shown in (Fig. 54).

    (a) Clean needle bearing assembly, properly installed and free from damage.

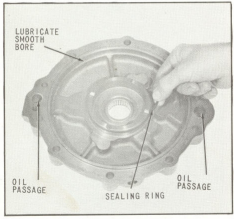


Fig. 54 Assembling Sealing Ring

    (b) Oil passages free from presence of dirt and obstruction.

    (c) Reverse clutch cavity outer wall, smooth clean surface free from scratches or burrs and coated generously with petroleum jelly.

    Coat sealing ring with petroleum jelly and install in groove of adapter hub, as shown in (Fig. 54).

54. After lubricating sealing ring with petroleum jelly, assemble in groove of reverse clutch piston, as shown in (Fig. 55).

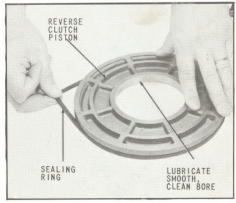


Fig. 55 Assembling Sealing Ring

55. Examine inside diameter of reverse clutch piston for smooth clean surface free from scratches or burrs and coat generously with petroleum jelly.

56. Place the reverse clutch piston, as assembled in step 54 on the adapter, as assembled in step 53, (Fig. 56). Press down on reverse clutch piston while pulling a smooth, clean screwdriver blade around the exposed portion of the sealing ring. This will aid the chamfered bore in the adapter to compress the sealing ring into the groove in the outside diameter of the piston. Assembly can be completed by using hand pressure until piston has "bottomed" in reverse clutch cavity.

Exposed face of clutch piston should be flush with adjacent surrounding surface on adapter when assembly is completed.

ASSEMBLY OF ADAPTER AND REVERSE CLUTCH PISTON ONTO TRANSMISSION CASE

57. With parts assembled, in steps 1 through 52 inclusive, resting on the rear face of coupling, coat the exposed front of the transmission case with petroleum jelly and assemble in place the case and adapter gasket, (Fig. 57).

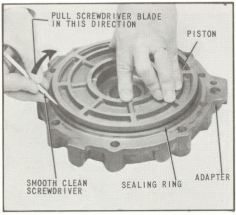


Fig. 56 Installing Reverse Clutch Piston in Adapter

58. Lift combined parts assembled in steps 53 through 56 inclusive, above parts assembled in steps 1 through 52 inclusive, as shown in (Fig. 57). Align the oil holes as indicated in (Fig. 57), then lower the reverse clutch piston and adapter assembly squarely onto the input gear and transmission case.

59. When the shoulder on the rear of the adapter has entered the mating bore in the reverse clutch cavity, located in the front of the transmission case, and a check of the gap between case and adapter indicates the

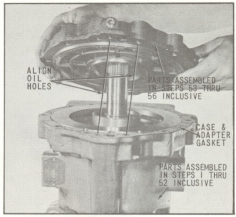


Fig. 57 Assembling Adapter and Reverse Clutch Assembly onto Case

adapter is squarely in place, install the four (4) cap screws, as shown in (Fig. 58). The adapter can now be pulled down squarely, until contact with the case is made, by alternately tightening the cap screws a small amount and checking frequently for binding. When adapter is pulled down as far as possible, tighten the four (4) cap screws to 27 to 37 pounds-feet torque.

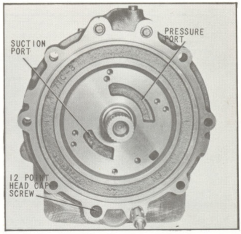


Fig. 58 Mounting Adapter to Case

63. After seal is assembled, lubricate the pump housing with the proper transmission oil and place as shown in (Fig. 62). Install lubricated driven pump gear with identification mark as shown in (Fig. 62).

MOUNTING FRONT PUMP ON TRANSMISSION

64. Place parts assembled in steps 1 through 59 inclusive as shown in (Fig. 58), after inspecting the adapter face for dirt and obstructions.

65. Lubricate and install front pump gasket, (Fig. 63).

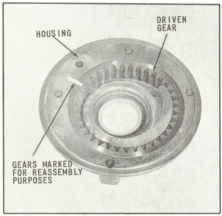


Fig. 62 Installing Pump Driven Gear

66. Install Woodruff key, (Fig. 63).

NOTE: Check (Fig. 87) to determine that proper key and shaft are used.

67. Install the pump drive gear on the input shaft, with one of the Woodruff key slots in drive gear mating with the Woodruff key on the input shaft, (Fig. 63).

NOTE: The two pump gears should be assembled so that the same gear faces are matched with the machined face of the pump housing as found at disassembly. Marks should have been applied at disassembly to insure proper reassembly, (Page 18, paragraph 10).

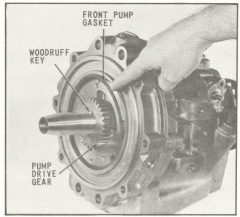


Fig. 63 Installing Pump Drive Gear Key and Front Pump Gasket

68. Cover the splined portion of the input drive gear with a suitable tool to protect the rubber lip on the seal during the assembly of the remaining front pump parts, (Fig. 63).

69. With the pump driven gear properly installed in the front pump housing, assemble the housing and pump driven gear squarely over the protruding input shaft and assembly tool. A slight rotation of the pump housing and pump driven gear will allow engagement of pump gear teeth, (Fig. 64).

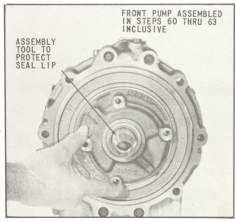


Fig. 64 Installing Pump over Seal Protector

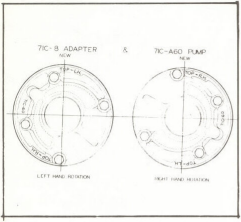


Fig. 65 Orientation Markings for Present 7IC-A60 Pump on the 7IC-8 Adapter

70. Orient the pump mounting bolt holes and arrow indicating direction of rotation to correspond with the direction of rotation required by the engine, (Fig. 65). If not installed for the proper rotation the pump will not produce oil pressure to operate the transmission when engine is started.

NOTE: WITH THE EXCEPTION OF THE 2.10/1 REDUCTION GEAR THE ORIENTATION OF THE PUMP ON THE TRANSMISSION MAY BE CHANGED FOR INSTALLATION ON ENGINES WITH ROTATION OPPOSITE TO THAT FOR WHICH THE TRANSMISSION WAS ORIGINALLY ASSEMBLED. THE HAND OF ROTATION OF THE PUMP ON A 2.10/1 TRANSMISSION SHOULD ALWAYS AGREE WITH ORIGINAL FACTORY INSTALLATION AND MUST NOT BE CHANGED.

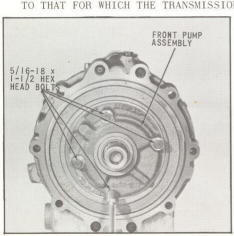


Fig. 66 Mounting Front Pump to Adapter

71. With the pump assembled squarely against the adapter and pump gasket, and the seal assembly tool removed, install four (4) 5/16-18 hex head bolts, (Fig. 66). Tighten hex head bolts evenly to torque of 17-22 pounds-feet.

72. Check freedom of rotation of pump gears in pump housing by rotating the input shaft. If the pump will not rotate freely, disassemble the pump and check for foreign material in the pump. Any dirt particles on the adapter face will also tend to cock the pump when mounted on the adapter and cause it to seize.

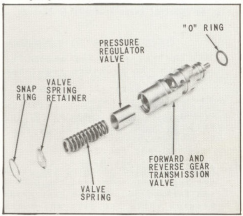


Fig. 67 Exploded View of Valve and Spring Assembly

ASSEMBLING VALVE AND SPRING ASSEMBLY

73. Collect the valve and spring assembly components, as shown in (Fig. 67), on a clean surface and note carefully the following:

(a) The hollow portion of the pressure regulator valve faces the valve spring.

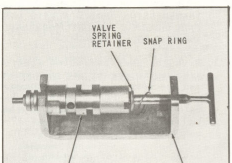


Fig. 68 Control Valve Assembly in Fixture

(b) The valve spring assembles into the pressure regulator valve.

(c) The concave portion of the valve spring retainer assembles over the valve spring.

74. After carefully checking the pressure regulator valve and the bore in the forward and reverse gear transmission valve for dirt and burrs, assemble all valve and spring components shown in (Fig. 67).

75. Place the assembled parts in a suitable assembly fixture, (Fig. 68). Turning handle of threaded plunger, compress the regulator valve spring until the groove for the snap ring in the pressure regulator valve is fully exposed. Install snap ring shown in (Fig. 69). The "O" ring shown in (Fig. 67) should be installed on end of valve.

NOTE: The control valve assembly can also be assembled by using an arbor press with suitable tools, as shown in (Fig. 69).

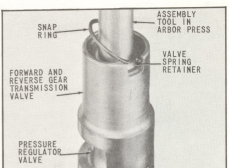


Fig. 69 Installation of Snap Ring

INSTALLATION OF THE VALVE AND SPRING ASSEMBLY IN THE TRANSMISSION CASE

76. Place parts assembled in steps 1 through 72 inclusive, on clean flat surface. Into the opening provided high on the right-rear side of the transmission case, place the valve and spring assembly, threaded end entering first, (Fig. 70). This is a hand assembly and is completed when the valve and spring assembly "bottoms" against the shoulder in the case bore.

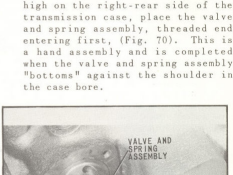


Fig. 70 Installation of Valve and Spring Assembly

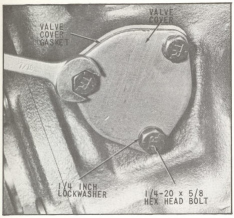


Fig. 71 Assembly of Valve Cover

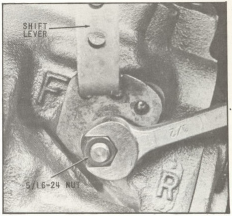


Fig. 73 Shift Lever Assembled

77. To insure neutral positioning of valve and easier assembly of lever, align .369-.376 width slot in valve with bottom 1/4-20 bolt hole in valve cover face of case as shown in (Fig. 70).

78. Assemble the valve cover gasket, valve cover, lockwashers and hex head bolts as indicated in (Fig. 71). Torque hex head bolts to 8-11 pounds-feet.

ASSEMBLY OF SHIFT LEVER

79. Assemble shift lever and related parts in the order shown in (Fig. 72). Torque the hex nut 8 to 11 pounds-feet, (Fig. 73). Rotation of the valve and spring assembly through the forward, neutral and reverse positions should require no more than fingertip effort. If valve binds in rotation, remove and inspect.

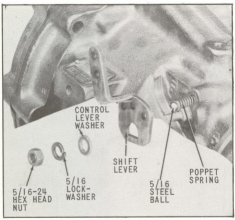


Fig. 72 Assembly of Shift Lever and Related Parts

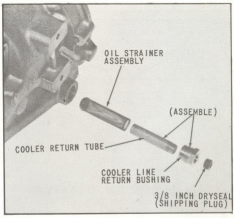


Fig. 74 Installing Oil Strainer & Cooler Return Tube & Bushing Assembly

INSTALLATION OF OIL STRAINER ASSEMBLY AND OIL DRAIN PLUG INTO TRANSMISSION CASE

80. Assemble the oil strainer assembly, cooler line return bushing and cooler return tube assembly in the order shown in (Fig. 74). The screen end of the oil strainer assembly should be approximately 1/2 inch below the face of the case when the assembly is correctly installed.

81. Tighten cooler line return and oil drain bushing to recommended torque of 25 to 35 pounds feet.

INSTALLATION OF MISCELLANEOUS TRANSMISSION PARTS

82. Install the breather assembly as shown in (Fig. 75). Do not hammer on the top of the breather assembly illustrated as this will damage the sealing element. For installation of other type breather assemblies see page 41, (paragraphs 3 & 4) for instructions.

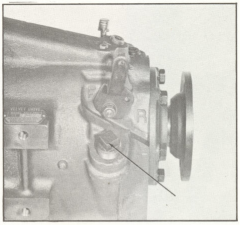


Fig. 76 Installation of Dip Stick Assembly

83. Install the dipstick assembly as shown in (Fig. 76) and tighten to a torque sufficient only to prevent oil leakage (approximately 10-15 pounds-feet).

84. Install 3/8-18, 1/4-18 and 1/8-27 dryseal plugs, (Fig. 77) and torque to values indicated on page 54.

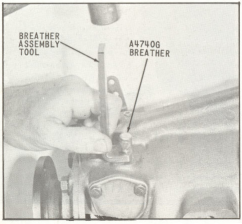


Fig. 75 Installation of Breather Assembly

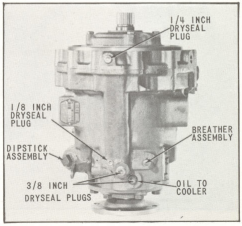


Fig. 77 Installation of Miscellaneous Pipe Plugs

ASSEMBLY OF NEUTRAL SWITCH KIT

1. Unscrew three (3) hex head bolts, remove valve cover and gasket, as shown in (Fig. 71). Discard valve cover, gasket, hex head bolts and lockwashers.

2. Shift control lever into neutral position, see page 17 (Fig. 12). Assemble gasket provided in neutral switch kit. Assemble neutral switch cam, making sure to align tang "A" on cam with slot "B" in valve, as shown in (Fig. 79). Neutral switch cam correctly assembled as shown in (Fig. 80).

3. Assemble valve cover and neutral switch with neutral switch located between two (2) top 1/4-20 bolts, as shown in (Fig. 81). Use the three (3) 1/4-20-7/8 inch long hex head bolts provided in neutral switch kit. Tighten hex head bolts to recommended torque of 8 to 11 pounds-feet and assemble starter solenoid wires to switch.

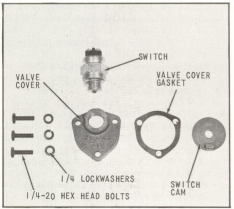


Fig. 78 Neutral Switch Parts

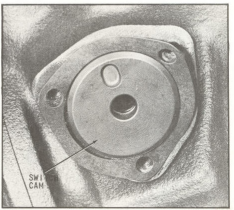


Fig. 80 Neutral Switch Cam in Correct Position

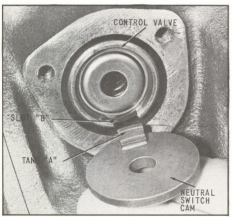


Fig. 79 Assembly of Neutral Switch

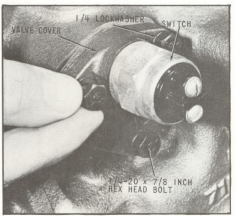


Fig. 81 Neutral Switch Correctly Assembled

SPECIAL INFORMATION AND INSTRUCTIONS
MODEL 72C TRANSMISSIONS

NOTE: It may be found that in a Model 72C transmission assembly a number of components may vary from the description and illustrations presented in the preceding portion of this manual. This results from changes which have been made since the first introduction of this model. In this section the information and description is presented for those features which are no longer incorporated in the current production models.

NSTALLATION OF OIL FILLER CAP ND DIP STICK ASSEMBLY

. Place oil filler cap and dipstick assembly in the oil filler tube provided on rear left side of transmission case, (Fig. 82). Push down on filler cap and dipstick until assembly "bottoms" on tube, then turn cap to right as far as cap screw permits.

NSTALLATION OF OIL STRAINER SSEMBLY AND OIL DRAIN PLUG INTO RANSMISSION CASE

NOTE: The 72C transmissions formerly used a cooler return bushing with threads other than the tapered dryseal pipe threads now used. This installation with the (4885) cooler return bushing, (Fig. 83), required a copper annular gasket (120428) to prevent leakage. Oil strainer (71-A98C) was also formerly used in this assembly, but has now been replaced with oil strainer 71C-A98A, which is fully interchangeable. The two bushings are not interchangeable and the correct parts must be assembled as illustrated in (Fig. 74) or (Fig. 83). Those installations requiring the use of the parts in (Fig. 83) can be easily identified by the machined face on the case boss as indicated.

2. Assemble the oil strainer assembly, annular gasket, and cooler return line bushing in the order shown in (Fig. 83). The end of the strainer will be approximately 7/16 inch below the outside machined surface of the case, when inserted in the case to its full depth. Mount the annular gasket on the cooler return bushing and tighten in the case.

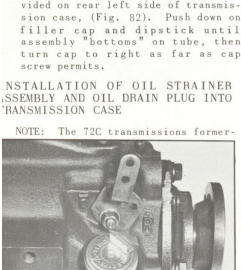


Fig. 82 Installation of Oil Filler Cap and Dipstick Assembly

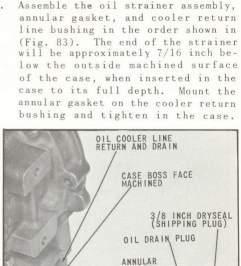


Fig. 83 Installation of Oil Strainer Assembly and Cooler Line Return Bushing

INSTALLATION OF BREATHER ASSEMBLY

3. In addition to the breather assembly shown in (Fig. 75), other breather assemblies will be found in use as illustrated in (Fig. 84) and (Fig. 85). These illustrations demonstrate the manner in which the breather assemblies are installed.

4. The breather in(Fig. 85)is supplied for those installations where a pressure type breather replaces the breather shown in (Fig. 84). This breather is used with an internally threaded bushing which presses into the case before the installation of the threaded breather assembly.

ASSEMBLY OF FRONT PUMP

NOTE: The following instructions are for the assembly of the front pump with a backing plate,(Fig. 88). This pump can be used with either of the two different adapter housings, but it should normally be found assembled on the one shown in (Fig. 86). Any of the various versions of the input shafts may be used with this pump, but the proper key must always be used with each shaft. See (Fig. 87) for comparison of the installation of the two pump assemblies. and information on the other related parts.

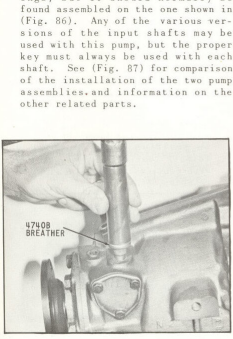


Fig. 84 Installation of Breather Assembly

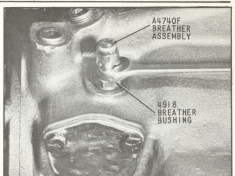


Fig. 85 Adapting Breather Assemblies

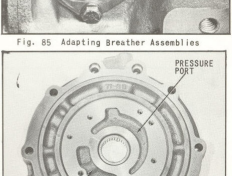


Fig. 86 Pump Porting in 71B-8 Adapter

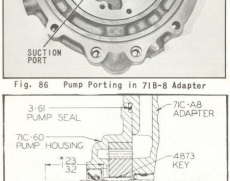


Fig. 87 Illustration of the Installation of the Two Types of Pump Assemblies and Their Related Parts

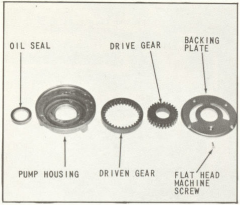


Fig. 88 Front Pump Parts with Backing Plate, Assembly 71-1A60

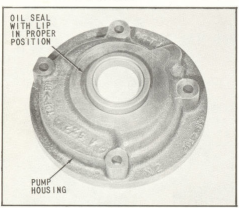


Fig. 89 Installing Oil Seal

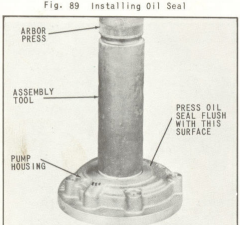


Fig. 90 Pressing Oil Seal

5. Collect the parts shown in (Fig. 88) and check carefully for the following:

   (a) Scoring in gear pockets, crescent, backing plate and gear faces.

   (b) Dents and burrs on both faces of backing plate.

   (c) Oil seal lip for brittle condition, cracks and cuts. Oil seal outside diameter for dents or scratches.

   (d) Gear teeth for burrs.

6. Place pump housing squarely on arbor press table. Apply a suitable sealant to the outside diameter of seal before installing squarely into bore of housing with seal lip positioned as shown in (Fig. 89). Caution should be observed to insure that too much sealant is not used, that any excess is wiped away after the seal is installed, and that the sealant does not get on the sealing element.

7. Using an arbor press and suitable tool, press seal into housing until front face of seal is flush with front face of pump housing, (Fig. 90).

8. Place housing, lubricated with automatic transmission fluid type "A", suffix "A", and complete with seal in position shown in (Fig. 91). Install lubricated gears as shown, with reassembly identification marks matched, (Fig. 91).

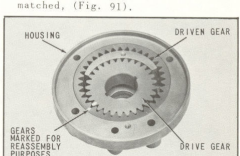


Fig. 91 Installing Pump Gears

9. Inspect both faces of backing plate for dirt, lubricate and assemble, as shown in (Fig. 92).

10. Install the flat head machine screw and tighten to final torque of 25 to 35 pounds-inch, (Fig. 93). Check rotation of gears as assembled in pump housing; disassemble and inspect if gears do not turn freely.

MOUNTING FRONT PUMP ON TRANSMISSION

11. Place assembled transmission on rear face of coupling in upright position, as shown in (Fig. 94). Inspect upper exposed adapter face for dirt and obstructions, then lubricate and install front pump gasket.

12. Install Woodruff key.

    NOTE: Check (Fig. 87) to determine that proper key and shaft are used.

13. Use a suitable tool to cover the splined portion of the input shaft and thereby protect the rubber lip on the oil seal during assembly of front pump, (Fig. 94).

14. After checking the following items, place the front pump assembly, steps 5 through 10 inclusive, squarely down over the protruding input shaft and assembly tool, (Fig. 94).

    (a) Alignment of Woodruff key slot in drive gear with mating Woodruff key on the input shaft.

    (b) Orientation of pump mounting bolt holes and direction of rotation arrow, depending on desired direction of input rotation, (Fig. 95 or Fig. 96).

    (c) Freedom of rotation of pump gears in housing.

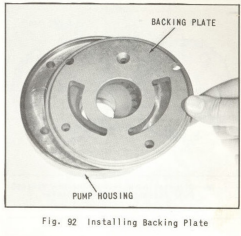


Fig. 92 Installing Backing Plate

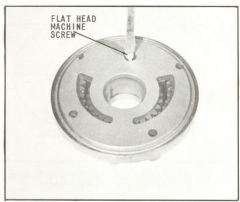


Fig. 93 Installing Flat Head Machine Screw through Backing Plate

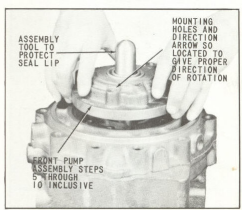


Fig. 94 Mounting Front pump

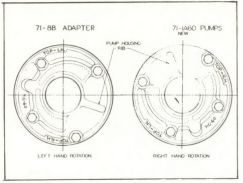


Fig. 95 Orientation Markings for New 71-IA60 Pump Assembly on 71-8B Adapter

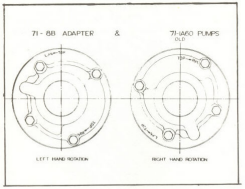


Fig. 96 Orientation Markings for Old 71-IA60 Pump Assembly on 71-8B Adapter

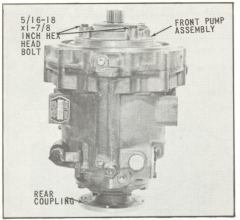


Fig. 97 Bolting Front Pump Assembly

NOTE: The location of the markings on the 71-60 pump housing identifying the orientation of the pump assembly on the adapter for right or left hand rotation will vary depending upon which pump assemblies and adapters are used.

The newer pump assembly with backing plate, identified by the rib on the pump housing, will be properly mounted when the marking on the pump housing appears as shown in(Fig. 95), when mounted on the 71-8B adapter, (Fig. 86). If the same pump were mounted on the new adapter 71C-8, (Fig. 58), the pump markings would be identical to those illustrated for the new 71C-A60 pump assembly in (Fig. 65).

The older pump assembly with backing plate, identified by the absence of the rib on the 71-60 pump housing, would appear as illustrated in (Fig. 96) when mounted on the old 71-8B adapter (Fig. 86). This older pump assembly with backing plate could also be mounted on the new 71C-8 adapter (Fig. 58), but this has not been illustrated as no original factory installations were made in this manner.

15. With front pump assembly resting squarely on gasket and seal assembly tool removed, install four (4) 1-7/8 long hex head bolts, (Fig. 97). Tighten hex head bolts evenly to torque of 17 to 22 pounds-feet.

ELIMINATION OF REGULATOR VALVE BUZZ

16. New pressure regulator valves (71-243) have a relief at the outer diameter at the closed end for the elimination of regulator valve buzz, (Fig. 98).. If a transmission should have a valve buzz and contains a 71-243 pressure regulator valve which does not have the relief, the valve should be replaced, or reoperated as illustrated.

DRIVE GEAR AND PLUG ASSEMBLIES

17. The two methods of sealing the end of the drive gear are illustrated in (Fig. 99). Sketch "B" illustrates the method now used and sketch "A" the method formerly used. The two drive gear assemblies, varying only in the method of sealing the end of the shaft, are fully interchangeable.

PINION CAGE AND OUTPUT SHAFT ASSEMBLY

18. Pinion cage and output shaft assembly has been supplied with three oil grooves around the shaft diameter as shown in (Fig. 100). This shaft can be used to replace any shafts. However, shafts without the grooves must not be used with those forward and reverse transmission cases supplied without the 71-28B bushings.

FORWARD AND REVERSE GEAR TRANSMISSION CASE AND BUSHING ASSEMBLY

19. Two versions of the transmission case have been supplied; one includes bronze bushings for the output shaft journal, the other is designed for use without the bushings. These two versions of the transmission case are completely interchangeable, except that the case without bushings cannot be used with the output shaft assemblies which do not have the oil groove (Fig. 100). Information regarding the service replacement of case bushings can be found on page 51, (Fig. 106). If it becomes necessary to replace a case of the design without bushings because of worn journals, it can be returned to your engine supplier. He can return the case to Warner Gear for reoperation and installation of bushings and can furnish information concerning the cost of this service.

ADAPTER CAPSCREWS

20. The 3/8-16x1-1/4 hex socket capscrews (138243) formerly used to fasten the adapter to the transmission case have now been replaced with a twelve (12)point capscrew (4911) which has better locking characteristics. The two types are completely interchangeable.

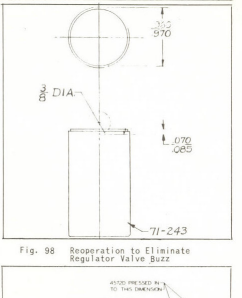


Fig. 98 Reoperation to Eliminate Regulator Valve Buzz

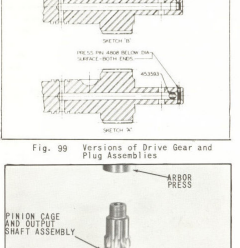


Fig. 99 Versions of Drive Gear and Plug Assemblies

Fig. 100 Pinion Cage and Output Shaft Assembly with Oil Grooves

SPECIAL INFORMATION AND INSTRUCTIONS
MODEL 72 TRANSMISSIONS

NOTE: Except for the discussions and illustrations on the features included in this section all other information concerning the Model 72 Transmissions may be found in preceding sections of the manual containing information for the assembly or disassembly of the Model 72C Transmission, or in the special supplementary section for these transmissions, pages 40 to 45.

INSTALLATION OF BREATHER ASSEMBLY

1. Assemble the screw-in type breather assembly as shown in (Fig. 101).

ASSEMBLY OF FRONT PUMP

2. The pump assembly for the Model 72 transmission (71-A60) contains a different seal than the pump assembly with backing plate for the Model 72C (71-1A60). They are identical in all other respects. Therefore, when assembling the front pump assembly 71-A60 follow the information in (paragraphs 5-15) pages 41 to 44, with the exception that the seal should be pressed into the pump housing until front face of seal is 1/8 inch above front face of pump housing, (Fig. 102).

3. On some early production Model 72 transmissions the overall height of the pump housing between faces measured 1-7/8 inches instead of 1-5/8 on all other latter pump assemblies. For any pump housing having the 1-7/8 inch dimension, assemble the seal 1/8 inch below appropriate pump face.

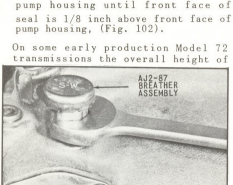


Fig. 101 Installation of Breather Assembly

SELECTION OF REVERSE CLUTCH PLATES

4. On early Model 72 transmissions the case cavity depth for the reverse clutch parts measured only .780-.784. These units require replacement clutch parts different from those specified for present production transmissions and should be ordered as specified below:

INDEX NO.	PART NO.	PART NAME	NO. REQ'D
16	71-87	DOWEL PIN	3
18	72-A66	REVERSE CLUTCH PLATE	2
98	72-176	OUTER REVERSE CLUTCH PLATE	1

DRIVE GEAR & PLUG ASSEMBLY

5. The drive gear assembly has a different input drive spline. For other instructions see page 45, (paragraph 17).

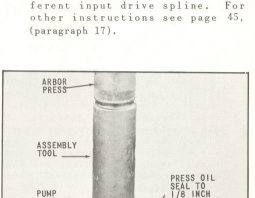


Fig. 102 Pressing Oil Seal

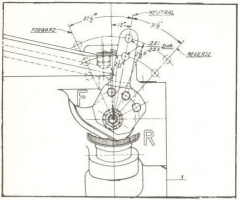


Fig. 103 ASI-72 Shift Lever Positions

ASSEMBLY OF SHIFT LEVER

6. For assembly of shift lever see page 37, (paragraph 79). The assembly procedure is the same for the Model 72 Transmissions as that described and illustrated for the Model 72C. Although the present shift lever (71-79B), (Fig. 12), can be substituted for the lever shown in (Fig. 103), it would change the travel of the control linkage for shifts between "Neutral" and "Forward" positions, see (Fig. 12) and (Fig. 103).

SELECTION OF OUTPUT SHAFT COUPLING

7. Early Model 72 transmissions used a smaller diameter coupling (4547BA) than the present coupling (4547AY). Order the correct part to replace the one used on your transmission. This will avoid any installation problem concerning the mating part (Coupling-Rear Half) which would arise from their difference in size and bolts used for assembly. See parts list, page 12, for additional information.

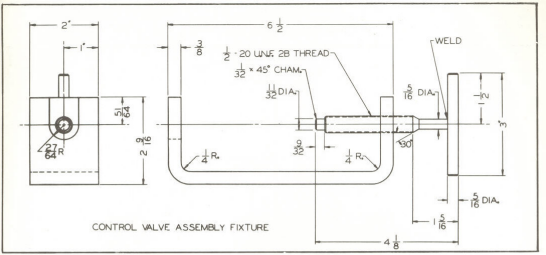
COOLER RETURN TO TRANSMISSION

8. On the Model 72 transmissions it is now recommended that the cooler oil flow be returned to the transmission case as shown in (Fig. 1). Transmissions with the cooler flow returning in a manner other than that now recommended need not be changed. However, the arrangement now recommended conforms to practices followed on other transmission installations and permits better control of the cooler return oil flow to the pump suction.

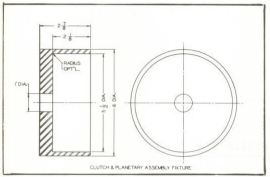
NOTE: If cooler return flow is changed to the new location be sure that the oil strainer installed is similar to the one illustrated in (Fig. 83). The old strainer assembly with one end enclosed would block the flow of the cooler return oil.

TORQUE SPECIFICATIONS

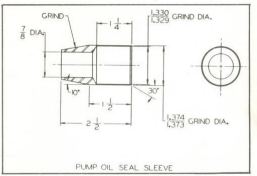
PART NUMBER	DESCRIPTION	APPLICATION	TORQUE LBS.- FT.
179822	5/16-18 x 1-1/2 HEX HEAD BOLT	PUMP TO ADAPTER	17-22
4911	3/8-16 x 1-1/4 12 POINT CAPSCREW	ADAPTER TO CASE	27-37
179793	1/4-20 x 5/8 HEX HEAD BOLT	VALVE COVER TO CASE	8-11
115729	5/16-24 NUT	SHIFT LEVER TO VALVE	8-11
4737Q	7/16-14 x 1-1/8 HEX HEAD BOLT	BEARING RETAINER TO CASE	27-32
4775L	1-20 NUT	OUTPUT SHAFT NUT	100-200
4885B	3/4-14 BUSHING	COOLER RETURN TO CASE	25-35
444687	1/8-27 DRYSEAL PIPE PLUG	CASE	7-12
444858 } OPT'L. 444860 }	1/4-18 DRYSEAL PIPE PLUG	ADAPTER	12-20
444866	3/8-18 DRYSEAL PIPE PLUG	CASE	17-27
71-A195	3/4-14 PIPE PLUG	DIPSTICK ASS'Y. INTO CASE	10-15



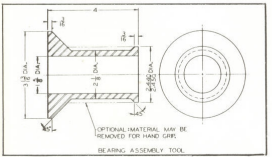
CONTROL VALVE ASSEMBLY FIXTURE



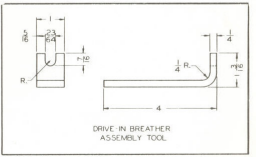
CLUTCH & PLANETARY ASSEMBLY FIXTURE



PUMP OIL SEAL SLEEVE



BEARING ASSEMBLY TOOL



DRIVE IN BREATHER ASSEMBLY TOOL

The assembly tool drawings shown on this page are included to illustrate how these tools may be made. Most will provide convenience in assembling and disassembling the transmission and their functions may be performed by the substitution of other objects or procedures. However, the use of the oil pump assembly tool, or other means of protecting the seal lip, is a necessity.

The drawings are provided as a convenience.

WARNER GEAR DOES NOT MANUFACTURE OR SELL ANY OF THE TOOLS ILLUSTRATED.