

PCM TRANSMISSION

SERVICE MANUAL

PLEASURECRAFT MARINE ENGINE GROUP

PCM TRANSMISSION MANUAL

IRM-40A TRANSMISSIONS

Introduction

This manual covers diagnosis, disassembly, inspection, repair and reassembly of the PCM IRM 40A (angle) 1.23:1 transmission.

The PCM IRM 40I (inline) 1:1 transmission utilizes the same procedures in diagnosis, disassembly, inspection, repair and reassembly as the IRM 40A (angle) with the exceptions noted and explained on page 33 of this manual.

The text of this manual which outlines repairs with step by step procedures is modified by notes which are essential to understanding the procedures. *ALWAYS READ THE ASSOCIATED NOTES, CAUTIONS, HINTS ETC. BEFORE PERFORMING THE REPAIR STEP.*

Eye protection must be used during all repair and cleaning operations. Use proper safety equipment and observe all safety precautions during all cleaning and repair operations.

Read all safety data sheets and observe all safety precautions that accompany the material and equipment being used during all repair and cleaning operations.

References in the text which follow the mention of a part (ie; adapter housing (T2-2 #113)) refer to illustrations which may be used to help identify the part referred to in the text. The T2-2 portion of the reference indicates the page in the PCM service parts book where the illustration may be found. The #113 portion of the reference indicates the reference number in the illustration on the specified page. The pages from the PCM service parts book which these references refer to are reproduced in appendix "T" of this manual.

Common items like muffin tins to hold small parts, cookie sheets for larger parts and cake pans for holding fluids are of great aids during repairs operations.

Holes in your work bench positioned so that the transmission to flywheel mounting holes line up with the bench holes can be used to hold the case in a secure position during torquing operations and eliminate the need for additional help to hold the case. A vise on the work bench is an indispensable tool to hold tools, parts and the case in position for disassembly, assembly torquing and testing.

IRM-40A TRANSMISSIONS

A. GENERAL INFORMATION

This PCM marine transmission series has been designed especially for high speed crafts and launches such as leisure boats, sport boats, patrol boats, police boats, pilot boats, etc. High Quality material and carefully dimensioned parts guarantee high reliability and long running life.

The multi-disc clutches employ steel/sinter bronze plates ensuring years of reliable service. The transmission case is delivered without oil. It can be stored in a dry and temperate environment for 6 months as the internal surfaces are rustproof.

The outer surfaces are painted with anti-rust lacquer and all fitting surfaces are protected by a strip film. Oil and water intakes are protected by plastic caps. All the calibrated devices (clutches and valves) are adjusted at the factory.

Operating Description

The transmission has been designed to operate constantly in forward and intermittently in reverse. The reverse function is performed through a planetary gear.

- Forward
The forward clutch is applied by the selector valve when it is placed in the forward position. Thus the engaged clutch connects the input shaft to the output shaft. Rotation is transmitted in the opposite direction at 1.523:1 or 1.260:1 speed ratio.
- Reverse
The reverse clutch is applied by the selector valve when it is placed in the reverse position. The engaged clutch locks the planetary gear carrier. Input

shaft rotation is transmitted to the output shaft ring gear through the three planetary pinions. Output shaft rotation is less than input shaft rotation at a 2.285:1 or 1.890 speed reduction ratio.

- Oil Sump
The transmission case is used as an oil sump. A permanent magnet, placed under the separation plate, removes steel particles from the oil, preventing damage to the hydraulic circuits.
- Hydraulic Circuit
Oil enters the pump suction passage and is directed to the control valve, where the pressure regulation valve is located. This valve reduces the delivery pressure of the pump to the desired clutch operating pressure. Excess oil under Low pressure is cooled by the oil cooler before being used for lubrication of the shafts and bearings. High pressure oil is used to engage the clutches. Oil direction is controlled by the position of the selector valve. The pressure regulation valve assures oil discharge to the sump in case of circuit over pressure. See Figure A1.

A1. TECHNICAL FEATURES.

Dry Weight 60.62 lbs (27.5 kg) without oil cooler

Axial roller bearings (B4) (B7) play (recommended) - mm 0.4 - 0.6

Teeth radial backlash between teeth (G15) (L13) 1.260:1 ratio - mm 1.147 - 0.200

Teeth radial backlash between teeth (G15) (L13) 1.523:1 ratio - mm 0.144 - 0.196

Output shaft coupling runout Maximum
Face .0015" Bore .0005"

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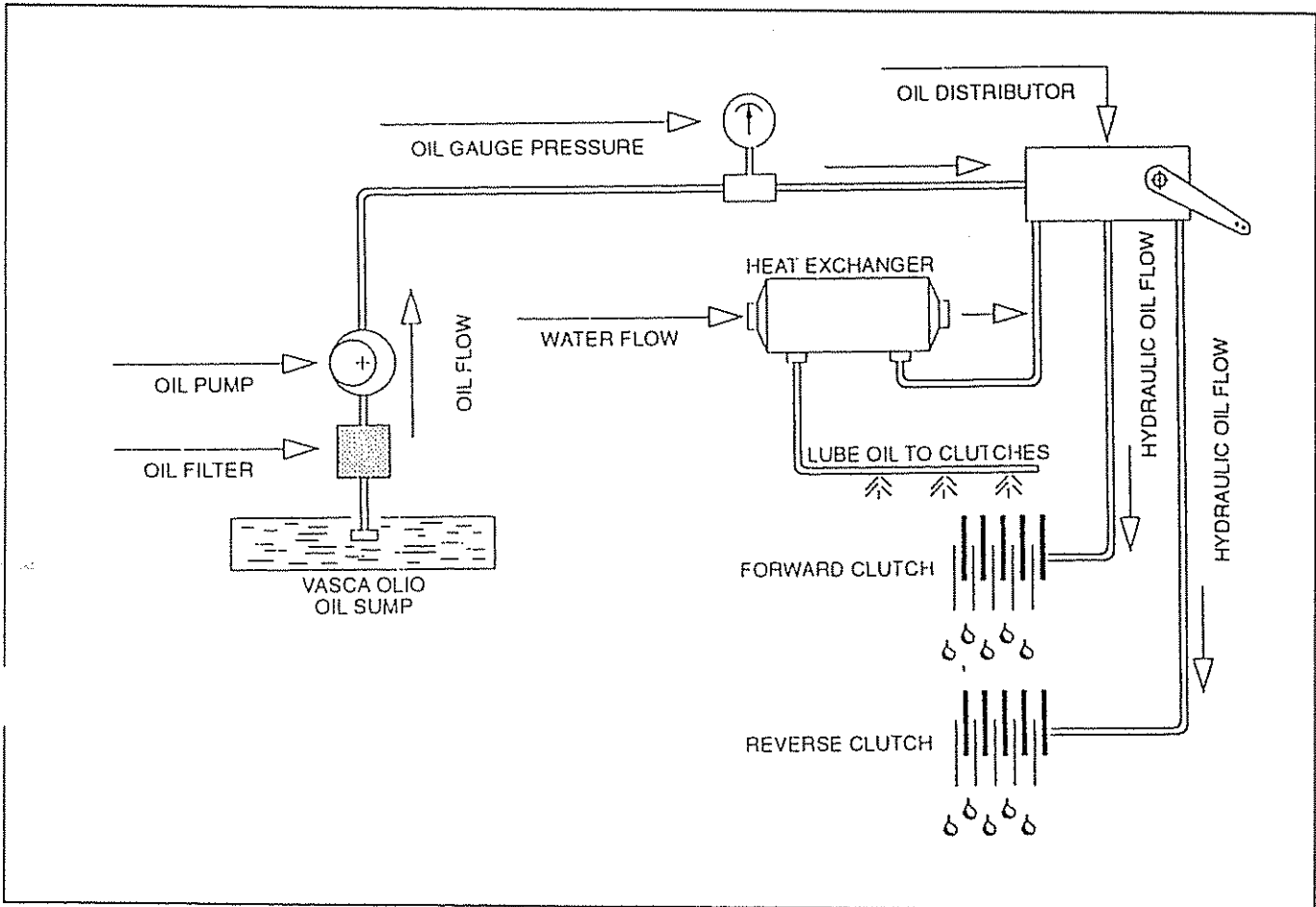


FIGURE A1. OIL FLOW SCHEMATIC

A2. TORQUE VALUES

<u>POS.</u>	<u>DESCRIPTION</u>	<u>TORQUE</u>
A4	M8 x 25 - 8.8	16 Ft-lb (22.5 Nm)
A6	M8 x 20 - 8.8	16 Ft-lb (22.5 Nm)
D19	M8 x 30 - 8.8	16 Ft-lb (22.5 Nm)
E2	M8 x 25 - 8.8	16 Ft-lb (22.5 Nm)

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A3. TROUBLESHOOTING

<u>PROBLEM</u>	<u>CAUSE</u>	<u>REMEDY</u>
<u>LEAKS</u>		
1) Leaks at pump or output shaft seal	1. Faulty seal 2. Misalignment 3. Rough surface on shaft 4. Defective drive plate	Replace seal Correct misalignment Replace shaft Replace drive plate
2) Leaks between bore and seal	1. Rough housing bore	Use sealant on OD of seal
3) Leaks at gaskets	1. Loose bolts 2. Face (s) not flat	Torque bolts to spec Replace defective part(s)
4) Loss of oil with no trace of missing oil	1. Oil leakage from oil cooler into cooling fluid	Replace cooler
5) Oil out of breather	1. High oil level 2. Water in oil of water and correct	Correct oil level Drain and replace oil & find source

MALFUNCTION IN FORWARD OR REVERSE

1) Low oil pressure	1. Regulator valve jammed 2. Internal leakage 3. Low oil level 4. Defective pump	Clean and polish valve Replace defective sealing rings Add oil Replace pump
2) No oil pressure	1. Internal leaks 2. Pump drive ball omitted 3. Defective pump 4. Regulator valve jammed 5. Defective drive plate	Replace defective parts Replace ball Replace pump Clean and polish valve Replace drive plate
3) High oil temperature	1. Cooler line defective 2. Regulator valve jammed 3. Restrictions in cooler lines 4. Defective cooler	Replace defective parts Clean and polish valve Back flush to remove restrictions Replace Cooler
4) Gears not meshed	1. Defective gear(s) in back portion of case	Replace defective part(s)
5) No line pressure	1. Heavy weight oil (90 2. Suction tube blocked	Remove and use proper oil weight Inspect pump suction path

MALFUNCTION IN REVERSE

1) Clutch drags or does not release	1. Warped clutch plate 2. Mechanical failure	Replace defective parts Replace defective parts
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- | | | |
|---------------------------|--|--|
| 2) Clutch does not apply | 1. Low Pressure
2. Defective parts | See Low Pressure (above).
Replace defective parts |
| 3) Harsh engagement | 1. High Pressure sticky valve
2. Engine idling too fast | Clean and polish regulator valve
Adjust engine idle |
| 4) Soft engagement | 1. Low pressure | See low pressure above |
| 5) Won't move or sluggish | 1. Forward Clutch seized | Replace defective parts |

MALFUNCTION IN FORWARD

- | | | |
|----------------------------|---|---|
| 1) Clutch drags | 1. Warped clutch plates | Replace plates |
| 2) Clutch does not release | 1. Mechanical failure | Replace defective parts |
| 3) Clutch does not apply | 1. Defective parts | Replace defective parts |
| 4) Harsh engagement | 1. High pressure sticky valve
2. High engine speed | Clean and polish regulator valve
Reduce engine RPM |
| 5) Soft engagement | 1. Low pressure | See low pressure above |
| 6) Won't move or sluggish | 1. Reverse clutch seized | Replace defective parts |

MISCELLANEOUS PROBLEMS

- | | | |
|----------------------------------|---|--|
| 1) Hydraulic noise or valve buzz | 1. Air in hydraulic circuit or low oil level
2. Sticky regulator valve | Check oil level and operate engine in neutral at 1200 RPM to remove air.
Clean/polish regulator valve |
| 2) Gear noise in forward | 1. Broken, pitted or cracked gear teeth in back portion of case | Replace defective gear |

MALFUNCTION IN NEUTRAL

- | | | |
|--|--|--|
| 1) Drives excessively in forward direction | 1. Warped forward clutch plates or mechanical failure of clutch
2. Exhaust blocked in control valve | Replace defective parts
Clean control valve |
| 2) Drives excessively in reverse direction | 1. Warped reverse clutch plates
2. Exhaust blocked in control valve | Replace defective parts
Clean control valve |
| 3) Oil drains back from cooler into transmission | 1. Improper cooler hookup | See installation drawing |

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A4. MAINTENANCE AND INSPECTIONS

OIL CAPACITY AND TYPE

Oil quantity (IRM 40A)

2 quarts (1.9 liters)

Oil type - Recommended

Mobil ATF 200 (ISO 46) or Mobil ATF
220 DEXRON IID (ISO 32)

Oil Temperature -

Maximum 88° C (190° F.)
Normal Operating 75 ± 5°C (167 ±
9°F)

Oil Pump Capacity -

Flow Rate; 5 gals. (19 liters) at 4500
RPM

Permissible speed range-

Minimum ; 700 RPM
Maximum ; 4500 RPM

Oil Pressure Values

Values at listed RPM input shaft speed and at normal oil operating temperature (75 ± 5°C (167 ± 9°F) with pressures checked at main line forward and reverse pressure points.

At 700 RPM
114 psi (8 bar) to 170 psi (12 bar)

At 1500 RPM
170 psi (12 bar) to 215 psi (15 bar)

At 5000 RPM
200 psi (14 bar) to 230 psi (16 bar)

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GENERAL INFORMATION

Transmission failures generally do not just happen there is usually a cause that may be outside the transmission. The cause can be as simple as a low oil level caused by overheating of the fluid or a leak or may even be traced to abuse or an accident. While the cause can usually be determined if necessary certain checks should always be made when repairing any transmission to insure customer satisfaction and eliminate come backs.

1. Always check the drive plate that is attached to the engine flywheel for;
 - a. Broken or loose springs or cracks in the spring cover if they are covered.
 - b. A loose hub.
 - c. A hub that is off center

The first two are usually determined visually but "c." must be determined by factory inspection or by wear signs in the transmission as follows.

If the tips of the drive gear of the front oil pump are causing wear to occur in the adapter housing and/or the pump housing (and conditions a. or b. are not present) the damper is probably off center and should be replaced.

Other things that can cause similar problems are the flywheel face not being machined properly or the flywheel housing not on center.

To check the flywheel face remove the drive plate and setup a dial indicator on the flywheel face. Rotate the engine by hand while watching the dial. If the total indicated runout of the flywheel face is off more than .005" it should be replaced.

To check the flywheel housing bore, mount a dial indicator on the flywheel face with the tip on the bore of the flywheel housing. Rotate the engine by hand while watching the dial. If the total indicated runout of the flywheel housing bore is off more than .008" the flywheel housing should be replaced.

2. The second condition that should always should be checked is the condition of the transmission oil cooler. You should always;
 - a. Flush the transmission oil circuit of the cooler.
 - b. Inspect the water chamber for foreign material and/or buildup that may block or reduce the cooling ability of the cooler.
 - c. Test the cooler for leaks, both in the oil and water chambers.

Repair or replace defective parts found.

3. Prior to removal of the transmission from the boat the alignment of the engine to the shaft should be checked and noted. A shaft that is out of alignment can cause numerous problems inside the transmission. Once the transmission is removed there is nothing to guarantee that the engine will return to the original location. Checking the alignment before removal documents a misalignment condition if it was present and allows your inspection to be more direct and through.

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4. Prior to transmission removal the oil pressure in neutral, forward and reverse should be tested to aid in diagnosis of any failure.

This may not be possible without disconnecting the propeller shaft from the transmission if the transmission is locked into gear. It is worth the effort however to make this test to determine if adequate pressure is available.

If there is not adequate pressure in one position (ie; forward) and the reverse pressure is proper, the indication is that there is a bleed off of pressure in the forward hydraulic circuit. The cause may be visually recognized during cleaning and inspection, as in the case of a broken sealing ring, or hidden as in the case of a hole in the case oil passage. Of course other conditions (ie; forward ok reverse low or no or high or low pressure in both) could occur which would demand careful inspection of the affected area to determine the cause of the problem and permit the resolution.

In any case the pressure test has alerted you to the fact that there is a hydraulic problem that must be located and corrected prior to reassembly of the transmission.

Caution ! *There have been 3 (three) control valve configurations used in the PCM transmissions. They are referred to as type 1 (one) type 2 (two) and type 3 (three).*

Type 1 (one) valve permits line pressure in neutral to be within the pressure test values listed. Type 2 (two) and Type 3 (three) have been redesigned to lower neutral line pressure to eliminate objectional hydraulic noise known as "regulator valve buzz". Line pressure in forward and reverse is not affected by the redesign of Type 2 (two) and Type 3 (three) valves.

Pressure testing should be performed as follows.

PT 1 The transmission oil should be at the temperature indicated in the specifications on page 5 (five).

PT 2 The oil level should be at or near the full mark of the dipstick.

There are 3 (three) 1/4" pressure checking locations on the PCM transmissions.

Two access plugs are located in the adapter housing forward of the neutral safety switch. The outboard plug is in the main line pressure passage. The plug to the right (when standing at the coupling end of the transmission) of the main line pressure passage plug is the reverse passage plug.

The forward passage plug is located on top of the case approximately 4 1/2" behind the neutral safety switch in the 3/4" wide rib that runs from the front to the back.

PT 3 Attach a gauge capable of reading 300 psi (20 bar) into the 1/4" pipe thread of the main line pressure port. Start the engine and note and record the gauge reading with the transmission in neutral. Shift the transmission into reverse note and record the gauge reading then into forward note and record the gauge reading.

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If the gauge reading is within the specifications listed on page 5 (five) for all 3 (three) lever positions the transmission has a Type 1 (one) control valve.

If the pressure during the neutral test is below 90 psi (6 bar) but the forward and reverse test are within the specifications listed on page 5 (five) the transmission has either a Type 2 (two) or Type 3 (three) control valve.

If the pressure is low in all control valve positions there is a problem in the intake system of the pump, the pressure relief valve or the pump assembly is worn.

If the pressure is high the pressure relief valve may be sticking or adjusted too high. Each washer under the pressure relief valve spring will raise the relief setting by approximately 20 psi (1 bar). Conversely the removal of a washer will lower the pressure by approximately 20 psi (1 bar).

PT 4 Attach a gauge capable of reading 300 psi (20 bar) into the 1/4" pipe thread of the reverse pressure port. Start the engine and note and record the gauge reading with the transmission in neutral. Shift the transmission into reverse note and record the gauge reading then into forward note and record the gauge reading.

PT 5 Attach a gauge capable of reading 300 psi (20 bar) into the 1/4" pipe thread of the forward pressure port. Start the engine and note and record the gauge reading with the transmission in neutral. Shift the transmission into reverse note and record the gauge reading then into forward note and record the gauge reading.

PT 6 Compare the readings from all 3 (three) tests. Variations greater than 5 psi (.3 bar) indicates a leakage within a circuit and should be used as a guide where to check for potential problems.

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Replacement of ALL seals and "O" rings is a requirement to insure a proper repair of any mechanical assembly. PCM has put together a gasket, seal and snap ring kit that contains the necessary parts to do a proper reassembly of all PCM transmissions. Be sure to have this kit on hand before beginning reassembly.

The PCM 40A series (1.23:1) requires that bearing preload for the intermediate shaft and output shaft be set using shims behind the bearing races. A complete selection of shims is necessary to properly adjust this preload and should be acquired prior to reassembly.

Certain special tools are also required for repair of the PCM transmissions. See the "Required tools" list and acquire the necessary tools prior to attempting the repair of the PCM transmission series.

Disassembly and re-assembly operations may be easily carried out on a work bench without the need of special support fixtures because of the transmission size and weight.

In order to insure repeated success in the repair of this transmission series certain special tools and procedures must be used. A tool kit PCM P/N RTK 0073 is available from the PCM parts department. This tool kit has been designed to insure the safety of the user and will provide the easiest and fastest method known to repair the PCM series of transmissions.

The methods employed during repair of the transmission including the work area and everyday tools and work habits is also important to insure repeated success.

You should begin with a clean hard surfaced work bench, preferably unpainted steel or aluminum, with a medium sized vise attached and ***nothing else on the bench***. This will insure that foreign material from the bench surface will not enter into the transmission during repair. Wooden benches and benches covered with cardboard should NOT be used for transmission repair.

As a component is removed from the transmission assembly it should be arranged on the work bench in the order and orientation that it was removed. This will allow the person doing the work to retrace their steps if they are distracted or called off the repair. Seals, "O" rings and gaskets should be included in the logical arrangement so they may be compared to the new replacement components to settle any uncertainty that may arise. DO NOT use the old seals "O" rings or gaskets for reassembly.

Cleaning of the transmission components should be done in a manner to preserve the arrangement of parts on the bench. Cleaning should be done in a safe non inflammable cleaning fluid with cleaning brushes. Gasket surfaces of the aluminum housings should not be scratched or gouged with scraping tools or oil leaks may occur after assembly. Small brass or stainless wire brushes (6 to 8 inch) are available at most hardware stores and work best to prevent housing problems. Cleaned parts should be blown dry with compressed air and ***NOT WIPED WITH RAGS OR PAPER TOWELS*** after cleaning.

Assembly should be performed on a clean dry bench. The aluminum transmission case makes it ***necessary that torque wrenches be used for bolt tightening***. Failure to properly torque the bolts could result in pulled threads which will necessitate thread repair or component replacement.

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DISASSEMBLY

PRIOR TO DISASSEMBLY

Before starting disassembly operations, *drain the lube oil from the transmission and clean the outside surfaces of the transmission.*

Prior to disassembly, if the output shaft will rotate, you should also check the coupling for excessive face and bore runout. If the coupling or output shaft is bent this test will eliminate the possibility of having to remove the coupling after assembly. See specifications on page # ?

You can find reference numbers, that relate to numbers indicated in the text, in the appendix of the manual . Tool reference numbers refer to illustrations which are shown in the appendix. These tools are recommended to assist disassembly and assembly procedures.

OIL PUMP DISASSEMBLY

1.1 Position the transmission on the bench so it is resting on it's bottom with the input shaft facing you.

1.2 Mark the pump (T2-2 #14) and adapter housing (T2-2 #113) with permanent alignment marks for reassembly purposes.

1.3 Using a 13 mm wrench remove 6 (six) M8x25 bolts (T2-2 #11) and washers that attach the pump assembly (T2-2 #14) to the adapter housing Figure B1.

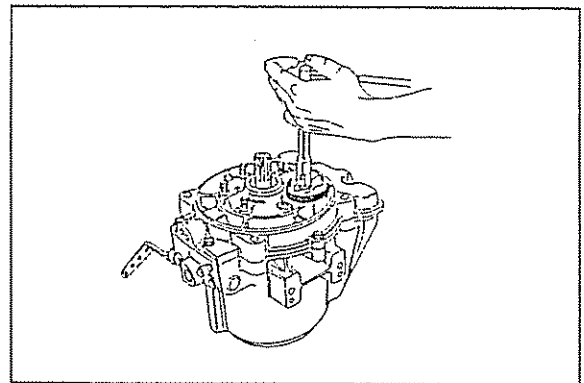


FIGURE B1

1.4 Remove "O" rings and oil seal. NOTE! Retain all used seals, "O" ring and gaskets until they are matched with new parts. After matching these parts will be replaced with new parts on re-assembly. See Figure B2.

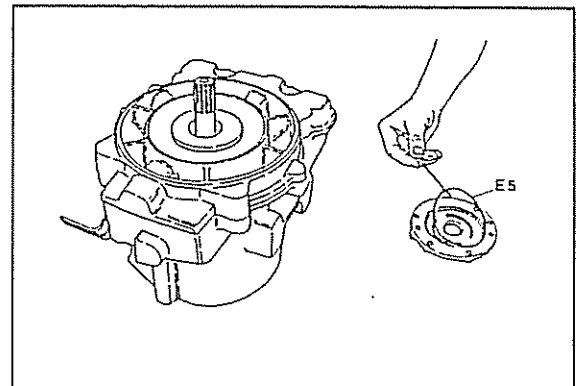


FIGURE B2

1.5 Remove pump drive and/or driven gear (T2-2 #10) from the input shaft (T3-2 #7).

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B2. ADAPTER HOUSING DISASSEMBLY

2.1. Use a pocket magnet to remove the pump drive ball (T3-2 #6) from input shaft. See Figure B3.

2.2. Remove the 6 (six) M8X30 bolts (T2-2 #53) and washers that attach the adapter housing (T2-2 #113) to the transmission case (T2-2 #1).

2.3. Position the transmission on the bench so it is resting on it's bottom with the input shaft facing you.

2.4 Remove the adapter housing (T2-2 #113) from the transmission case (T2-2 #1) by ***grasping the input shaft and pulling the shaft away from the transmission case. When the adapter housing separates from the case tilt the top of the adapter housing toward you to permit the oil pickup to clear the case lip. SEE NOTE BELOW BEFORE PROCEEDING.***

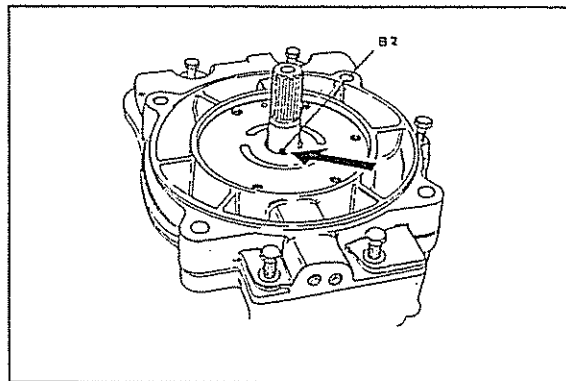


FIGURE B3

Note! The gasket and or the fit between the adapter housing and the main housing can cause the adapter housing to be difficult to separate from the main housing. If this condition exists during disassembly do not force any wedging type tool between the housings. Doing so could damage one or both housings and cause an oil leak or necessitate the replacement of a housing.

Disassembly in these cases can be achieved by ***LIGHTLY*** tapping the return fitting in the adapter housing with a dead blow hammer, until a gap large enough to ***SLIP***, without force, a putty knife or similar wide blade tool between the housings. The tool then can be used to gradually and evenly, side to side, separate the housings.

2.5 Remove the input shaft (T3-2 #7) from the adapter housing. The thrust bearings should remain with the shaft. Position the housing on the bench with the oil pickup away from you.

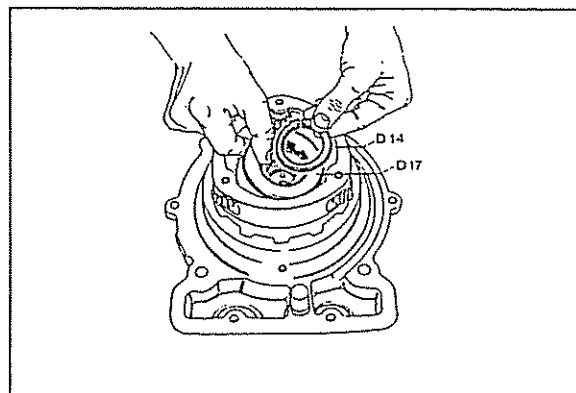


Figure B4

2.6 If the inner thrust bearing race (T3-2 #41) has remained on the forward clutch drum (T3-2 # 33A) remove it from the clutch drum. Do not attempt to remove the oil pickup tube from the adapter housing unless replacing either the tube or housing.

CAUTION! Care should be taken not to damage or reposition the oil pickup tube while working on the transmission.

2.7 Using a suitable pin style snap ring pliers, remove the retaining ring (T2-2 #56) that retains the washer (T3-2 #26) and planetary assembly (T3-2 #22) to the adapter housing and remove the complete planetary carrier. Figure B5.

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IMPORTANT! DO NOT REMOVE THE SNAP RING BELOW THE BRONZE RING AT THIS TIME.

2.5. Using a suitable screwdriver remove the snap ring (T3-2 #48) that retains the reverse clutch plates (T3-2 # 45 & 47) into the adapter housing, and then remove the pressure plate (T3-2 #29) and clutch pack (3 bronze plates and 3 steel plates). See Figure B5.

HINT! Being careful not to damage the oil pickup, plates can be removed quickly by turning the adapter housing face side down onto the bench.

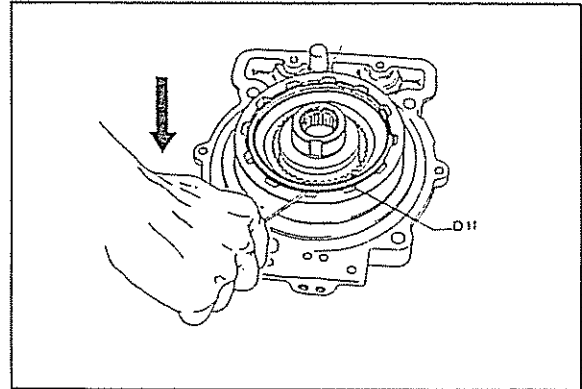


Figure B5

2.6 . Using tool No. RTK0073 in position #1 compress the reverse clutch spring retaining washer (T3-2 #26A) as follows. Figure B6. **IMPORTANT! Compress this spring only far enough to allow the snap ring to be removed. Excessive pressure on this washer could damage the washer or adapter housing.**

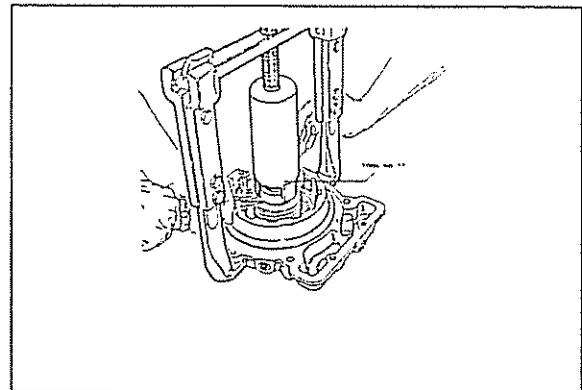


Figure B6

2.7 Thread one of the shouldered nuts in the tool kit onto one end of the 1/2" threaded rod to the point where the end of the rod is even with the top of the nut. Securely mount the nut into a vise.

2.8 Place a PCM P/N R096043 washer onto the threaded rod and place the adapter housing (T2-2 #113) with the tower and oil pickup facing up, onto the rod. Position the housing so it is centered relative to the rod.

2.9 Place tool RTK0073, in the #1 position, onto the threaded rod so that the recess in the washer plate rests onto the spring retaining washer (T3-2 #26A).

2.10 Thread the shoulder nut supplied in the tool kit onto the rod and tighten the nut 1/2 to 3/4 turn to compress the piston return spring (T3-2 #3) until the washer bottoms out on the tower shoulder.

IMPORTANT! Compress this spring only far enough to allow the retaining ring to be removed. Excessive pressure on the washer could damage the washer or adapter housing.

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2.11 Using 2 (two) suitable screw drivers positioned directly across from each other remove the bronze retaining bushing (T3-2 #25) from the tower. Figure B7.

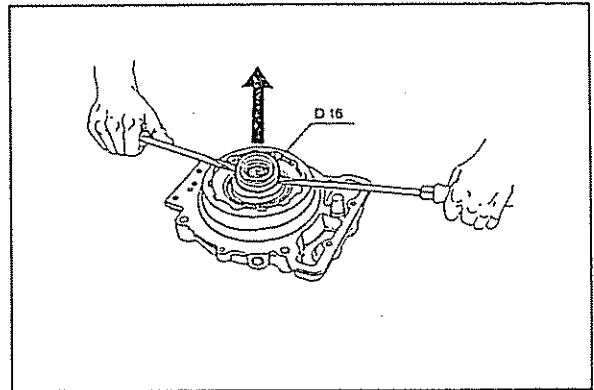


Figure B7

2.12 Using a suitable, pin type, snap ring pliers remove the snap ring (T3-2 #24).

2.13 **Hold the threaded rod to prevent it from turning** out of the nut secured in the vise and slowly release the compression on the spring until the spring is completely extended. Remove the tool, washer (T3-2 #26A) and spring (T3-2 #3) and adapter housing from the threaded rod.

2.14 Position the adapter housing on the bench so the top of the housing is closest to you. Remove the reverse piston (T3-2 #2) from the adapter housing by applying a quick blast of pressurized air, as shown in Figure B8, into the reverse apply port at the top of the adapter housing closest to center.

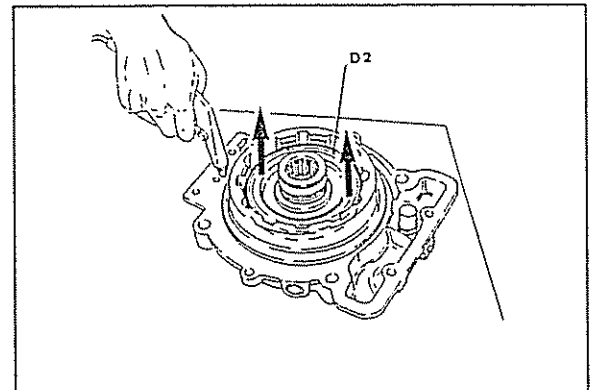


Figure B8

CAUTION! In some cases the piston you are removing may be propelled, with force, out of the cylinder. **DO NOT** position the housing in a manner that will allow the piston to strike any thing or person if this should occur. It is recommended that the housing be wrapped with a rag large and strong enough to restrain the piston before attempting to remove this piston.

If the piston sticks onto the tower clamp secure the adapter housing into a vise with soft jaws or lined with rags. Using two pair of long nose vice grip pliers clamped onto the raised inner ridge of the piston use an alternating pulling action to slowly work the piston from the adapter housing.

2.15 Remove the piston oil sealing rings. See Figure B9.

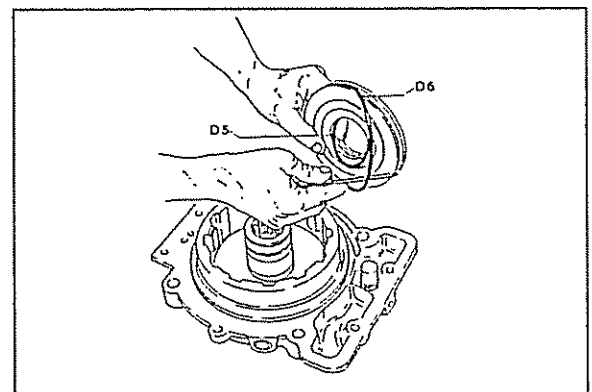


Figure B9

B3. TRANSMISSION CASE DISASSEMBLY

3.1. Position the case on the bench so the opening faces you. Using a pair of locking pliers pull the baffle plate from the case.

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3.2 Remove the debris magnet from the housing.

3.3 Remove the forward clutch pack retaining snap ring (T3-2 #48A) from the groove in the forward drum. Remove the pressure plate (T3-2 #29A), and clutch pack assembly (T3-2 # 54A & 47A) 4 (four) bronze and 4 (four) steel) from the drum. See Figure B10.

HINT! Plates can be removed quickly by turning the case face side down onto the bench.

3.4 Turn the transmission so that the output coupling flange (T5-2 #99) is up and facing toward you. Figure B12.

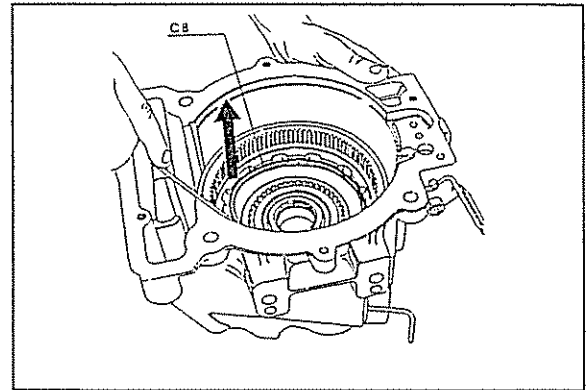


Figure B10

3.5 Using a suitable tool unlock the flange retaining nut (T5-2 #98) from the output shaft groove.

3.6 Using a 36mm socket remove the output shaft nut from the shaft. NOTE! If using a breaker bar to remove this nut the output flange will have to be held with a device that **WILL NOT** damage the flange. A more suitable method of removing the nut is an impact wrench that will overcome at least 150 lb. ft of torque. A 1 7/16" socket may also be used if a 36 mm socket is not available. Both sockets may require that the outside diameter be reduced slightly to fit into the coupling.

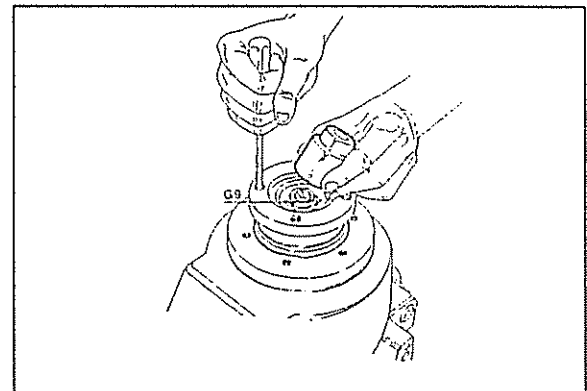


Figure B12

3.7 Remove the coupling and washer (T5-2 #100) from the output shaft. NOTE! A suitable puller may be required to perform this removal. Do not use a hammer to attempt removal of the coupling. HINT! If a suitable puller is not available, 2 (two) pieces of 3/8" threaded rod 3" long with 2 (two) nuts jammed tightly at one end may be used. Place the rods through the coupling straight across from each other and thread a nut onto each rod underneath the coupling. Tighten each nut to contact against the bottom side of the coupling then while holding the rod by the jammed nuts thread the nuts evenly up the rod to remove the coupling.

3.8 Using a 13 mm socket remove the 6 (six) M8x20 bolts (T5-2 #90), that attach the output shaft bearing retainer (T5-2 #104) to the rear housing (T5-2 #1A). HINT! The case may be held in place on the bench surface by placing 2 (two) 7/16" bolts, through the holes that mount the transmission to flywheel housing mounting holes, into holes drilled into the bench.

3.9 Using two of the retainer bolts (M8x20) in the retainer pull holes remove the retainer slowly and evenly from the rear housing.

3.10 Remove the "O" ring (T5-2 #107) from the outside diameter of the retainer and the shims (T5-2 # 92-95) from both the retainer (T5-2 #104) and the bearing race (T5-2 #97) in the rear housing.

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IMPORTANT! Upon removal the shim pack should be cleaned, blow dried and the thickness of the shim pack should be determined and recorded for reassembly purposes. Keep all the shims from this location together by taping them together or some other method to insure they are not lost.

3.11 Using a 13 mm socket remove the 10 (ten) M8x25 bolts (T5-2 #80) that attach the rear housing to the main case, from the case.

IMPORTANT! The case and rear housing are a matched assembly. If the rear housing is moved unevenly the dowel pin may crack the rear housing and make it necessary to replace the **ENTIRE main case and rear housing**.

3.12 The rear housing has 2 (two) threaded holes directly across the housing from the locating dowel pins. With the transmission positioned as directed in step 3.4, thread the "T" bolt supplied in RTK 0073 in the upper right hand threaded hole and one of the M8x30 (T2-2 #53) adapter housing retaining bolts in the lower left hand threaded hole until they contact the main case. Tighten the bolts evenly 1/4 turn at a time while **watching the housing at the dowel pin locations to insure even lift** until the rear housing is separated from the main case.

3.13 Remove and set aside the output shaft assembly (T5-2 #101).

3.14 Use RTK0073 in position #2 to remove the intermediate shaft assembly (T5-2 #89) from the clutch cylinder and drum (T3-2 #33A) as follows. Place the proper sized rod through the hole in the shaft. Thread a shoulder nut shoulder side up on the end of the rod inside the case. Place RTK0073 onto the rod and over the gear with the reduced diameter leg at the top. Thread a second nut on the rod from the top and tighten the nut to pull the shaft from the drum.

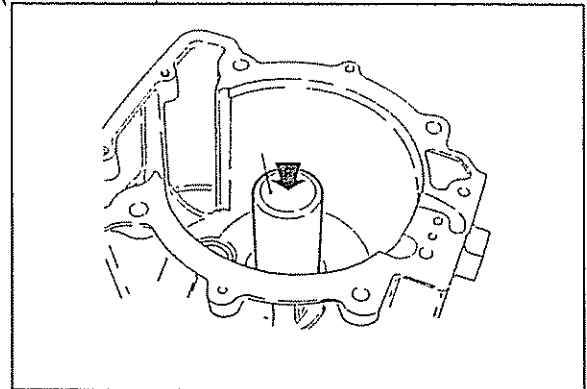


Figure B12

NOTE! There were more than 1 (one) design of intermediate shafts used. The type of shaft determines the method used to remove the shaft from the drum.

The shaft with a 1/2" hole straight through the center uses tool RTK0073 in position #2 and a 1/2" threaded rod through the center of the shaft to remove the shaft from the drum.

The shaft with a 3/8" hole straight through the center uses tool RTK0073 in position #2 and a 3/8" threaded rod through the center of the shaft to remove the shaft from the drum.

The shaft with 2 (two) 1/4" holes straight through the center uses tool RTK0073 in position #2 as a support for a press or drift removal of the shaft from the drum. Figure B12.

3.15 Remove the drum from the case, set the intermediate shaft aside.

3.16 Once the drum is removed from the case use tool RTK0073 in position #1 to compress the forward piston return spring until the washer bottoms out against the drum as follows. **IMPORTANT!**

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Compress this spring only far enough to allow the snap ring to be removed. Excessive pressure on this washer could damage the washer or adapter housing.

3.17 Thread one of the nuts in the tool kit onto one end of the 1/2" threaded rod then securely mount the nut into a vise.

3.18 Place a PCM P/N R096043 washer onto the threaded rod and place the drum (T3-2 #33A) with the tower facing up, onto the rod. Position the drum so it is centered relative to the rod.

3.19 Place tool RTK0073, in the #1 position, onto the threaded rod so that the recess in the washer plate rests onto the spring retaining washer (T3-2 #44).

3.20 Thread the shoulder nut supplied in the tool kit onto the rod and tighten the nut approximately 4 1/2 turns to compress the piston return spring (T3-2 #3A) until the washer bottoms out on the tower shoulder. **IMPORTANT! Compress this spring only far enough to allow the retaining ring to be removed. Excessive pressure on the washer could damage the washer or adapter housing.**

3.21 Remove the retaining ring (T3-2 #43) from the drum tower retaining ring groove and while holding the threaded rod stationary, slowly relax the spring compression being careful that the washer does not catch into the tower retaining ring groove. Remove the tool and parts from the drum and the drum from the rod and position the parts onto the bench.

3.22 Position the case with the opening up. Place the drum (T3-2 #33A0 and piston (T3-2 #2A) with the sealing rings (T3-2 #32) in the grooves of the drum, as they were when the drum was removed, into the transmission case.

3.23 Position the transmission case on the bench so that the front is facing you. Shift the control valve (T2-2 #62) into the forward operating position.

3.24 While standing to the side (not directly in front of the case) use a quick blast of compressed air directed into the main line pressure passage **first hole just to the left of the detent position** to remove the piston from the drum.

NOTE! When using compressed air to remove the piston two conditions are possible. First the piston may shoot out of the cylinder and second the piston may stick onto the tower after the seal between the cylinder and piston is broken. Standing to the side will prevent being struck by the piston should it shoot out of the cylinder.

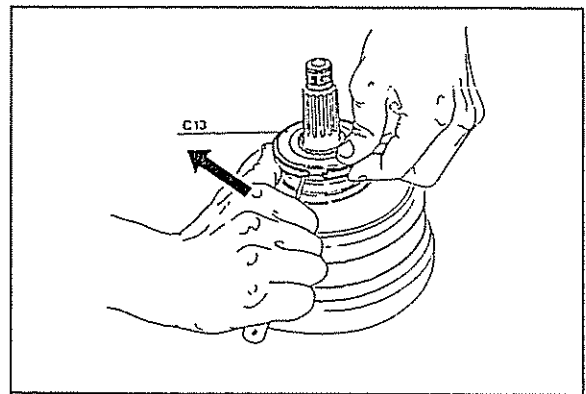


Figure B13

3.25 Remove the drum from the case.

If the piston is stuck onto the tower **remove the drum from the case** and clamp two pair of long nose vice grip pliers onto the raised inner ridge of the piston. Position the cylinder in a comfortable

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working position and, using a alternating pulling action, slowly work the piston from the cylinder.
HINT! Thread one of the nuts in the tool kit onto one end of a 4" long 1/2" threaded rod then securely mount the nut into a vise.

Place a PCM P/N R096043 washer onto the threaded rod and place the drum (T3-2 #33A) with the tower facing up, onto the rod.

Position the drum so it is centered relative to the rod. Place the forward thrust bearing race (T3-2 #54) on the drum tower and the centering sleeve (threaded side down) of RTK0073 onto the rod and through the washer.

Thread a nut onto the rod finger tight. This will retain the drum securely to permit removal of the piston.

3.25. Remove the sealing rings from the clutch drum, See Figure B13.

3.26 Remove the "O" rings from the piston.

B4. SHAFT DISASSEMBLY

Intermediate shaft disassembly may not be necessary if the condition of the shaft, gear and bearings can be determined to be serviceable through inspection. If disassembly is necessary;

4.1. Remove the spacer (T5-2 #81).

4.2 Remove the forward intermediate shaft bearing (T5-2 #82) with a suitable puller.

4.3 Remove the rear intermediate shaft bearing (T5-2 #88) with a suitable puller.

4.4 To replace the bearings use the proper arbors and a suitable press to install the bearing race securely against the shoulders of the intermediate shaft.

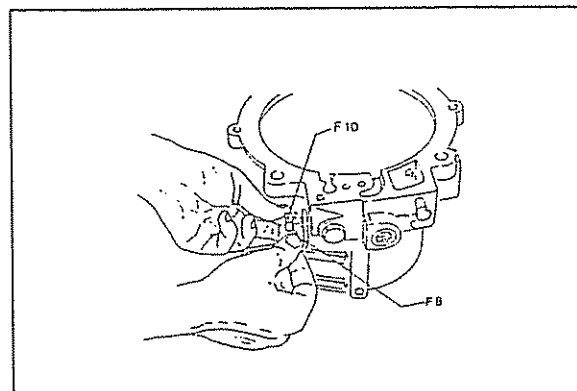


Figure B14

B5. CONTROL VALVE DISASSEMBLY

5.1. Using a 11/16" wrench remove the nut, (T2-2 #71) washer (T2-2 #70) and lever (T2-2 #69) from the control valve (T2-2 #62) . See Figure B14.

5.2. Remove the snap ring (T2-2 #68) that retains the control valve into the case. Attach the shift lever to the control valve and secure it in place with the nut. Rotate the valve back and forth while pulling **straight out** on the shift lever to remove the valve from the case. **Use care to prevent damaging control valve bore in the**

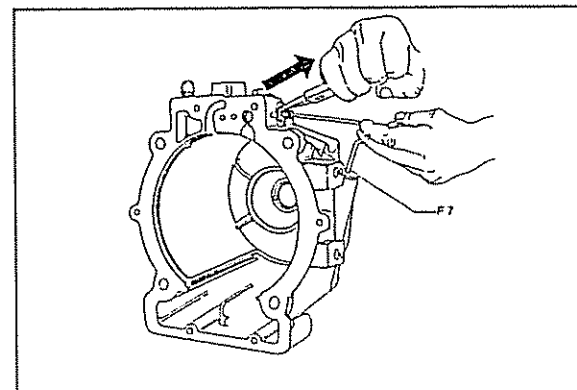


Figure B16

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case. Remove the nut, lever, bearing races and needle thrust bearing (T2-2 #66 & 67) from the control valve. See Figure B16.

5.3. Remove the "O" ring (T2-2 #63) and pressure regulator valve (T2-2 #61) from the control valve. Remove the pressure regulator spring (T2-2 #60) and washer(s) (T2-2 #59) from transmission case. **NOTE! There will be at least 1 (one) washer between the pressure regulator spring and the case to prevent the spring from wearing into the case. Each additional washer raises the oil pressure approximately 20 (twenty) PSI. You should always use the same number of washers on reassembly and check operating pressure after assembly.**

If pressure is not within specifications it will be necessary to adjust the pressure to the proper pressure as indicated in the specifications.

C1) CLEANING

Eye protection must be used during all cleaning operations. Use proper safety equipment and observe all safety precautions during all repair and cleaning operations.

Cleaning of the transmission components should be done in a manner to preserve the arrangement of parts on the bench.

All signs of sealer, gaskets and loctite must be removed from all parts including shafts.

Cleaning should be done in a safe non flammable cleaning fluid with cleaning brushes. Read all safety data sheets and observe all safety precautions that accompany the material and equipment being used during all repair and cleaning operations.

Gasket surfaces of the aluminum housings must not be scratched or gouged with scraping tools or oil leaks may occur after assembly. Small brass or stainless wire brushes (6 to 8 inch) are available at most hardware stores and work best to prevent housing problems.

Cleaned parts should be blown dry with compressed air and **NOT WIPED WITH RAGS OR PAPER TOWELS.**

CL 1 Clean hardened loctite from the intermediate shaft splines and the drum splines. **CAUTION! Be careful not to allow loctite chips to enter the roller bearings or misplace the spacer between the shaft bearing and the drum.**

CL 2. Carefully clean the parts such as gears, bearings and shafts with clean safe non flammable cleaning fluid with cleaning brushes.

CAUTION: Do NOT use steam or hot water to clean steel parts unless parts are protected with rust preventative material immediately after cleaning and or rinsing.

CL 3. Carefully clean all of the sealing surfaces so that all sealing agents and/or gaskets are completely removed from the surfaces.

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CL 4. Use compressed air to blow dry all parts. CAUTION! Be careful that small parts are not lost during the blow dry process.

CL 5 After removing parts from the work bench, clean the work bench area before returning the parts to the bench. After cleaning and drying reposition the parts in the original location and orientation they previously occupied on the work bench.

IMPORTANT! Do use protective eye wear when blowing parts dry.

Do not spin bearings with compressed air.

Do not use rags to clean or dry any parts.

C2. INSPECTION

NOTE! Only use PCM original spare parts for replacement of damaged components.

INS 1. Inspect all roller bearings and cups for signs of damage and excessive wear. If any bearing shows sign of excessive wear or damage, replace it with a new one. Do not remove any of the needle bearings unless they are defective. Removal of these bearings will destroy them and require that new bearings be installed.

INS 2. Inspect all gears for sign of wear or chipping of the teeth or other damage. Replace as required.

INS 3. Inspect all splined sections for signs of excessive wear or other damage.

INS 4. All old gaskets, seals, "O" rings and oil sealing rings must be replaced prior to assembly.

INS 5. Verify that the case breather is not damaged and working properly.

INS 6. Thoroughly inspect all castings for cracks, wear or deep scratches. Carefully inspect the area of the case where the sealing rings of the clutch drum contacts the case for grooves worn into the case by the sealing rings. A slight polishing of this area is normal but grooves that can be felt require replacement consideration. Replace parts that can not be repaired.

INS 7 Inspect all threaded components to ensure that threads are not damaged. Use the proper sized tap or die to repair threads. If threaded holes are damaged beyond rethreading , use Heli-Coil thread inserts or replace the components.

INS 8 Verify that the cooler inlet and outlet hoses are clear and undamaged. Verify that the oil pump suction tube is secured tightly into the housing and the oil pickup screen is clean and free of obstructions.

INS 9. Flush the oil passages of the transmission cooler. Inspect and if necessary, clean the water passages.

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INS 10. Inspect the sintered clutch disks (T3-2 #47) for wear and damage. Check each plate on a flat machined surface to determine if the plate is warped by pressing on the outer edge of the plate to determine if it will rock. Turn the plate over and again press on the outer edge. If the plate rocks it is defective and must be replaced. If the plate is burned or the original lubricating grooves cannot be seen on the surface of the disk, replace the disk.

INS 11 Inspect the steel plates (T3-2 #45) in the same manner as described in 2.10 with the following exception. The steel plates are manufactured with a .007" wave in their surface. These plates when placed against another steel plate and rotated one against the other will produce and eliminate a gap between them. This is normal and not a reason for replacement.

INS 12 Inspect the reverse planetary assembly (T3-2 #22) for damaged gears, gears that may be loose on their pins and pins that are not securely in place into the housing. Individual replacement of the 3 (three) gears in the planetary carrier is not recommended. Replace the assembly if defects are found.

INS 13 Inspect the forward clutch drum (T3-2 #33A) for a loose or out of position ring gear, damaged sealing ring (T3-2 #32) grooves, excessive wear in the clutch pack contact area and cracks at the base extension where the sealing ring grooves are located. Replace the assembly if defects other than the ring gear (T3-2 #33) out of position are found.

NOTE! If the ring gear is not in position in the drum it may be re inserted as follows.

Clean the drum and ring gear thoroughly with loctite cleaner.

Apply loctite to the splined area of the ring gear.

Position the splines of the ring gear on solid metal half way between the grooves that are in the drum, turn the drum over and press the ring into the drum until the face of the drum and the face of the ring gear are equal.

Stake the drum, in the same manner as was done in production, twice in between each of the old stake marks.

INS 14 Test the fit of the sealing rings (T3-2 #32) into the drum (T3-2 #33A) ring grooves at the rear of the drum, to insure that they are not binding throughout the full 360 degrees of each of the drum grooves as follows. Hold one side of a ring and insert the other side into a drum groove. Hold the ring while rotating the drum at least 360 degrees. The ring should not catch at any point. If it does catch the groove must be cleaned out until no catching occurs. Repeat the testing process with the other ring.

INS 15 Using a feeler gauge check the side clearance between the sealing rings and the drum grooves. If clearance is greater than .004" correction must be made. Normal clearance is .002".

INS 16 Check the input shaft (T3-2 #7) for damage at the seal and needle bearing surfaces and the gears for teeth damage and clutch pack contact area wear. Replace the part(s) if defects which are not repairable are found.

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INS 17 Inspect the oil pump drive gear (T2-2 #10) semi circular channel for damage where the gear is driven by the ball (T3-2 #6) inserted into the input shaft. Also inspect the input shaft ball depression for damage. If damage found in these areas is minimal (if the gear slides onto the input shaft and can be rotated 360 degrees with little effort) the parts may be used. If the damage to the parts requires extensive filing or grinding to fit properly the parts must be replaced.

INS 18 Inspect the output shaft coupling (T5-2 #99) for damage in the seal contact area and on the coupling face. The coupling runout will have to be checked after assembly unless it was checked prior to disassembly.

D. ASSEMBLY PROCEDURES

Replacement of ALL seals and "O" rings is a requirement to insure a proper repair of any mechanical assembly. PCM has put together a gasket, seal and snap ring kit (T3-1 #NI) that contains the necessary parts to do a proper reassembly of all PCM transmissions. Be sure to have this kit on hand before beginning reassembly.

The PCM 40A series (1.23:1) requires that bearing preload for the intermediate shaft and output shaft be set using shims behind the bearing races. A complete selection of shims (T5-2 #34 & #76 & #92) is necessary to properly adjust this preload and should be acquired prior to reassembly.

Certain special tools are also required for repair of the PCM transmissions. See the "Required tools" list and acquire the necessary tools prior to attempting the repair of the PCM transmission series.

NOTE! Use only original spare parts for replacement of damaged components.

D1. SELECTOR VALVE ASSEMBLY.

SVA 1. Turn the transmission case on the right side so that the control valve bore is facing up. Place the spring (T2-2 #60) and then the spring wear/pressure adjustment washers (T2-2 #59) onto the transmission dipstick and hold them in place while using the dipstick (T2-2 #73) to locate the washer depression in the case.

CAUTION! Each washer (T2-2 #59) raises the oil pressure approximately 20 (twenty) PSI. You should always use the same number of washers on reassembly and check operating pressure after assembly.

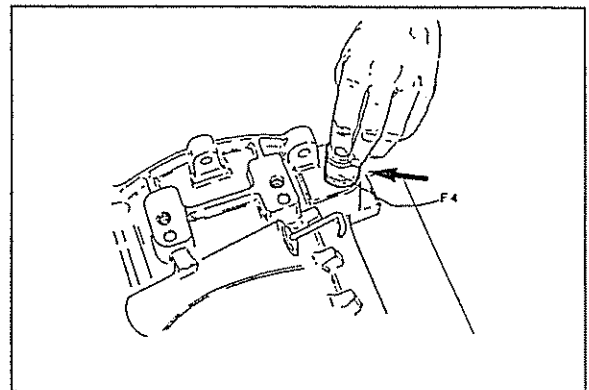


Figure D1

If pressure is not within specifications it will be necessary to adjust the pressure to the proper pressure as indicated in the specifications.

SVA 2 Release the spring and washers and use the dipstick to locate the spring and washers into the case depression. Replace the control valve "O" ring (T2-2 #63) and lubricate the outside with grease. **Do not use oil to lubricate "O" rings.**

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SVA 3 Apply just enough grease to the pressure relief piston (T2-2 #61) to retain it into the control valve (T2-2 #62) when the valve is held with the piston down.

SVA 4 Lubricate the valve with a light coating of transmission fluid. Position the valve so that the 3 (three) detent depressions are facing forward and install the control valve into the case .

CAUTION! Failure to position the valve properly will prevent the fluid from being directed to the clutches and cause the transmission to be inoperative.

SVA 5 Lubricate the control valve thrust bearing (T2-2 #66 & 67) with grease, assemble it so there is a thrust washer on each side of the bearing and place the assembly onto the control valve stem and press down on the assembly until it is below the case surface.

SVA 6 Determine which side of the retaining ring (T2-2 #68) is the sharp side and using a suitable pair of snap ring pliers inserted from the sharp side install the snap ring into the case. Press down on the snap ring until it snaps into the case groove.

SVA 7 Attach the shift lever (T2-2 #69), lock washer (T2-2 #70) and nut T2-2 #71) and tighten to 5 lb. ft. torque. Figure D2.

SVA 8 Operate the lever from forward to reverse noting the effort necessary to shift the lever. Correct any hard shifting conditions that may occur before proceeding.

NOTE! Maximum allowable shifting effort is 4 (four) pounds measured with a digital scale at the outermost hole of the shift lever.

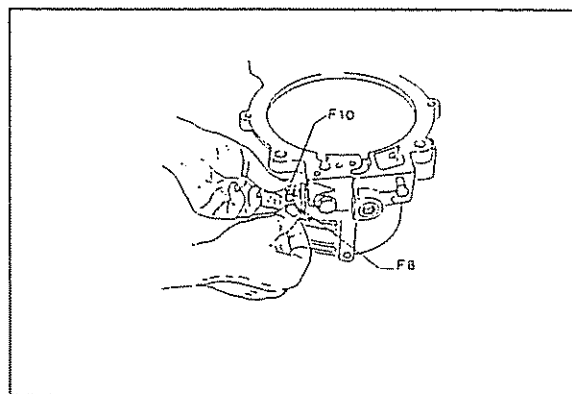


Figure D2

GEAR AND BEARING SETUP

The following assembly instructions presume that all parts have been properly cleaned and inspected as previously instructed. It is also presumed that the old bearings are being used or that new bearings have been installed. If the bearings need to be changed see NEW BEARING SETUP elsewhere in this manual.

Prior to assembly, lubricate all parts with a light coating of transmission fluid.

CBS 1 Position the transmission case face down on the bench.

CBS 2 Inspect the case and rear housing mating surfaces and the bearing cups in the case (T5-2 #82) and rear housing (T5-2 #88) for foreign material. Clean as necessary with solvent and compressed air.

CBS 3 Lubricate the cups by dipping a finger into transmission fluid and then rubbing the fluid onto the cup. Also lubricate the intermediate shaft bearings with transmission fluid.

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IMPORTANT! Prior to assembly, bearing cup and race assemblies of both shafts and case halves should be checked by placing each lubricated bearing into the cup and rotating the shaft quickly under shaft weight. While the bearing is spinning if it emits a rumbling noise the bearing is either bad or not clean. Reclean bearings that rumble and retest until the bearings run smoothly.

CBS 4 Place the intermediate shaft (T5-2 #89), with the splines down, into the large cup at the top of the case. Position the rear housing onto the case dowel pins and press the housing into contact with the case.

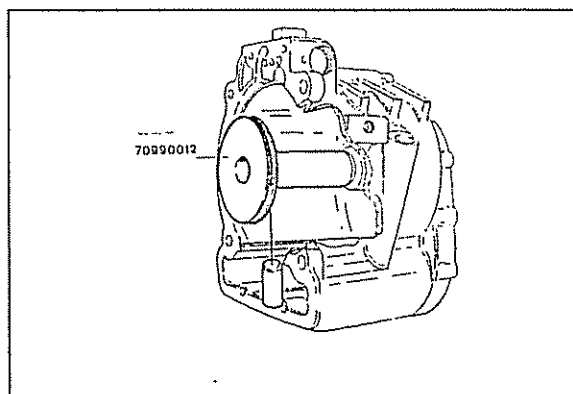
CBS 5 Insert a M8x25 bolts (T5-2 #80) with washer into each of the 2 (two) holes that are located directly across the intermediate shaft centerline and evenly torque the bolts to 16 lb. ft.. HINT! The case may be held in place on the bench surface by placing 2 (two) 7/16" bolts, through the holes that mount the transmission to flywheel housing mounting holes, into holes drilled into the bench.

CBS 6 Position the case so that you can rotate the intermediate shaft by hand and rotate the shaft until the resistance remains constant.

CBS 7 Set tool RTK0073 into position # 3 and while holding the input shaft gear through the output shaft opening slip it onto the intermediate shaft splines through the front of the case. A pin in the tool will index into the spline providing a positive connection between the tool and shaft. Rotate the tool several times to test this connection.

CBS 8 Wrap a piece of monofilament line, with a loop on each end, in the groove around the diameter of tool RTK0073 at least 3 (three) times. Using a digital hand held pull scale attached to the loose end of the line pull horizontally, with an even steady motion, the line while observing the reading on the scale.

CBS 9 The reading represents the bearing preload. New bearings should have a preload between 8 to 16 ounces. Old or used bearings should have a preload between 4 and 8 ounces. If preload is not within the specified rang it will have to be corrected. HINT! A bolt threaded into the case at the mount bracket mounting location may be secured into a vise to hold the case while performing this test.



CBS 10 Preload is adjusted through shimming the bearing cups. Adding to the shim thickness will increase preload and decreasing shim thickness will decrease bearing preload. A change of .001" shim thickness will result in 16 ounces of preload change with this bearing setup.

CBS 11 If bearing preload must be adjusted the shim (T5-2 #76-79) under the cup in the case should be changed.

CBS 12 Remove the cup from the case, clean the shims in solvent, blow them dry then

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determine the shim thickness.

CBS 13 Make the correction based upon the ratio specified in CBS 10, and re check the preload as directed in CBS 3 through CBS 8 above. Repeat this procedure until the proper preload is achieved.

CBS 14 Once the intermediate shaft preload is properly set the output shaft preload must be set in the same manner and to the same specification. To set the preload on the output shaft proceed as follows.

CBS 15 Remove the rear housing (T5-2 #1A) from the case (T2-2 #1) and set aside the intermediate shaft assembly in a clean secure location.

CBS 16 Inspect the bearing cups (T5-2 #103) in the case and rear housing (T5-2 #97) for foreign material and clean as necessary with compressed air.

CBS 17 Lubricate the cups by dipping a finger into transmission fluid and then rubbing the fluid onto the cup. Also lubricate the output shaft bearings with transmission fluid.

CBS 18 Place the output shaft (T5-2 #101), with the splines up, into the cup at the bottom of the case. Position the rear housing onto the case dowel pins and press the housing into contact with the case.

CBS 19 Insert a M8x25 bolts (T5-2 #90) with washer into the 4 (four) holes that are located directly across the output shaft centerline and evenly torque the bolts to 16 lb. ft..

CBS 20 Position the case so that you can rotate the output shaft by hand and rotate the shaft until the resistance remains constant. If resistance appears excessive turn the case so the front of the case is facing you and you can see the end of the output shaft. Using a large drift positioned on the end of the shaft, tap the drift lightly with a hammer to move the shaft toward the back. Check the output shaft rotation. Repeat this procedure until the output shaft rotates freely.

CBS 21 Position the transmission case so that the end of the output shaft (T5-2 #101) is up and facing you. Place the shim pack (T5-2 #92-95) which was removed and cleaned and blow dried on disassembly onto the bearing cup of the output shaft bearing.

CBS 22 The case has an opening located at about the 10 o clock position. The bearing/seal retainer (T5-2 #104) has a lubrication channel in the shim retaining diameter. Locate the channel to align with the case opening and insert the bearing/seal retainer into the cup bore of the case. Thread two M8x20 bolts (T5-2 #90) through the bearing/seal retainer into the rear housing and torque the bolts to 16 (sixteen) lb. ft.. NOTE! The "O" ring (T5-2 #107) does not have to be on the retainer for this test.

CBS 23 Remove the drive sleeve from the head piece of RTK0073 and thread the head piece of RTK0073 onto the output shaft and lock it in place with the centering guide sleeve. Rotate the output shaft several times to seat the bearings.

CBS 24 Wrap a piece of monofilament line, with a loop on each end, in the groove around the

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diameter of tool RTK0073 at least 3 (three) times. Using a digital hand held pull scale attached to the loose end of the line, pull on the line with an even steady motion, while observing the reading on the scale.

CBS 25 The bearing preload and adjustment procedures are the same as performed for the intermediate shaft assembly. If preload is not proper adjust the thickness of the bearing/seal retainer shim pack and proceed as previously instructed for the intermediate shaft setup.

CBS 26 After the output shaft preload has been properly adjusted remove the rear cover and set the shaft with it's shim pack in a clean secure location.

SUB ASSEMBLY

NOTE! The steps following require that the parts in the gasket, seal and snap ring kits (T3-1 #NI) be used in assembly. To insure a successful repair do not use the old gasket, seals and snap rings.

NOTE! The steps that follow require that the cleaning and inspection procedures previously outlined in this manual be performed before proceeding.

SA 1 Using solvent, clean the outside diameter of the front pump oil seal (T2-2 #8) of all lubricant with solvent. Blow dry the pieces with compressed air. Install the front pump oil seal into the front pump housing (T2-2 #14). After installation the seal lips should be lubricated liberally with grease.

SA 2 Apply a small amount of grease in the large "O" ring (T2-2 #4) retaining recess of the front pump housing (T2-2 #14) at 4 (four) 90 degree intervals and insert the large "O" ring into the groove. Apply a small amount of grease in retaining recess for the 2 (two) small "O" rings (T2-2 #105) and insert the small "O" rings into the recess. **CAUTION! Very small pieces of foreign material can cause pump problems. To insure that foreign material is removed from the pieces always blow off the pieces with compressed air prior to assembly wherever possible.**

SA 3 Lubricate the oil pump gears (T2-2 #14) with clean ATF and place them into the oil pump housing. Set the pump aside in a clean secure place.

SA 4 Install the large and small "O" rings (T3-2 #5 & 5A & 15 & 15A) of the forward (T3-2 #2A) and reverse piston (T3-2 #2) into the clean dry grooves (Do not lubricate the piston or "O" rings prior to installing) of the 2 (two) clutch pistons. Lubricate the exposed diameter of the "O" rings with grease (Not oil) and set the pistons aside in a clean secure place.

SA 5 Position the adapter housing (T2-2 #113) and clutch drum (T3-2 #33A) on the bench in front of you.

SA 6 Place a piston (the pistons are interchangeable) with ribbed side up onto the tower of the adapter housing and slowly force, by hand, the piston down the tower until it is close to the cylinder. Using RTK0073 in position #1 on the top of the piston and body weight force the piston

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down into the cylinder as far as it will go. If body weight is inadequate to perform this insertion a DEAD BLOW hammer (a steel hammer will damage the tool) may be used. HINT! After installation the piston outer edge will protrude above the cylinder *approximately* .130".

SA 7 Install the piston in the clutch drum using the procedure explained in the above step.

SA 8 Secure the nut on one end of the 1/2" threaded rod into a vise. Place a PCM P/N R096043 washer onto the rod and place the adapter housing (T2-2 #113) with the tower facing up and the oil pick up away from you, onto the rod. This will position the channel or ball in the adapter housing tower so it is facing you.

SA 9 Center the housing on the threaded rod.

SA 10 Place a clutch return spring (T3-2 #3) then 1 (one) of the 2 (two) retaining washers (T-2 #26) into position on top of the previously installed piston. If there is a ball inserted in the tower on the top side of the adapter the washer channel must be centered on the ball. If there is a channel in the tower of the adapter the washer tab must be centered in the channel.

SA 11 Place tool RTK0073 in the #1 assembled position onto the washer with the rod through the centering insert. Using the shoulder nut supplied in the kit slowly compress the spring while holding the rod from turning and guiding the washer over the tower while centering the channel on the ball, or tab into the channel, until the washer lightly bottoms out on the tower shoulder. NOTE! If the washer is not properly aligned it may be moved loosening the nut and rotating the tool to the aligned position if not jammed onto the tower shoulder then re-tighten the nut.

SA 12 Spread the round wire, washer lock ring (T3-2 #24) only enough to pass by the threaded rod and install it in the ring groove directly above the washer. CAUTION! Do not locate this ring in the first groove which is located near the top of the tower.

SA 13 Release the compression on the washer until there is approximately 1/4" clearance between the nut and the tool. Using a DEAD BLOW hammer (a steel hammer will damage the tool) tap the tool 3 (three) or 4 (four) times to insure that the retaining ring is securely into the groove. **WARNING! This retaining ring (T3-2 #24) is surrounded by and secured into place with the brass ring (T3-2 #25) which is installed next. Until the brass ring is in place the Adapter housing MUST be considered as potentially dangerous and not positioned so that injury could occur should the retaining ring slip out of position. Do NOT position the adapter housing in a direction pointing toward you or any other object that could be damaged by the unexpected and uncontrolled release of the piston return spring tension.**

SA 14 Remove the nut from the rod and the tool from the housing. Position the Adapter housing on the bench with the oil pickup away from you. Position the brass ring onto the tower with largest ID dimension down. If the bronze ring has an indexing channel and tab, align it with the ball in the tower and the channel in the washer.

SA 15 Place the remaining channeled or tabbed washer onto the brass ring and RTK0037 in position #1, on top of the washer. Using a DEAD BLOW hammer (a steel hammer will damage the tool) drive the washer and brass ring into place *until the top retaining ring groove is fully*

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exposed above the washer. Remove the tool and the washer.

SA 16 Dip the reverse clutch plates (T3-2 #45 & 47) and thick end plate (T3-2 #29) into ATF. Place the clutch plates into the adapter housing starting with 1 (one) of the 3 (three) waved steel plates. Continue by adding a brass plate then steel etc. and ending with the third brass plate.

SA 17 Place the thicker end plate on top of the clutch pack and insert the retaining ring (T3-2 #48) that holds the clutch pack into the adapter housing into it's groove.

SA 18 Using a feeler gauge check the clearance between the bottom of the retaining ring and top of the end plate. The proper clearance is between .025" and .055". Selective end plates (T3-2 #29) are available to adjust this clearance.

SA 19 Install the planetary assembly (T3-2 #22) into the reverse clutch pack by positioning the adapter housing in a vertical (oil pickup down) position on the bench. Grasp the planetary in one hand and the adapter housing in the other and insert the planetary hub splines into the clutch packs internal splines until the planetary hub (T3-2 #20) is approximately even with the bronze ring. NOTE! While inserting the hub a **light entry pressure** with rapid rotation back and forth should be the method employed for best results.

SA 20 When the planetary is fully inserted lay the adapter housing on the bench and install the tabbed or channelled washer onto the tower and then the retaining ring (T2-2 #56) with the sharp side facing out.

SA 21 Lightly grease the gasket surface of the adapter housing. While observing the correct gasket orientation, place the gasket (T2-2 #18) onto the housing (T2-2 #113). Set aside in a clean secure place.

SA 22 Place the forward clutch drum (T3-2 #33A) onto the threaded rod in a central location relative to the rod. Place the return spring (T3-2 #3A) and retaining washer (T3-2 #44) onto the previously installed piston.

SA 23 Place tool RTK0073 in assembled in position #1 on the washer with the centering insert in place. Thread the shouldered nut provided with in the tool kit, onto the threaded rod and tighten it, while guiding the washer over the tower, until the washer is bottomed out lightly on the tower shoulder.

SA 24 Spread flat lock ring (T3-2 #43) only enough to pass by the threaded rod and install it in the ring groove near the top of the drum tower directly above the washer(T3-2 #44).

SA 25 Release the compression on the washer until there is approximately 1/4" clearance between the nut and the tool. Using a DEAD BLOW hammer (a steel hammer will damage the tool) tap the tool 3 (three) or 4 (four) times to insure that the retaining ring is securely into the groove. Remove the nut from the rod and the tool from the housing.

SA 26 Test the fit of the sealing rings (T3-2 #32 into the drum (T3-2 #33A) ring grooves at the rear of the drum, to insure that they are not binding throughout the full 360 degrees of each of the drum grooves as follows. Hold one side of a ring and insert the other side into a drum

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groove. Hold the ring while rotating the drum at least 360 degrees. The ring should not catch at any point. If it does catch the groove must be cleaned out until no catching occurs. Repeat the testing process with the other ring.

SA 27 Using a feeler gauge check the side clearance between the sealing rings and the drum grooves. If clearance is greater than .004" correction must be made. Normal clearance is .002".

SA 28 When the test is completed successfully, install the sealing rings on the drum and secure the rings in place with the locks at the ring gap location.

SA 26 Install a new output shaft seal (T5-2 #102) into the bearing/shim retainer (T5-2 #104). Lubricate the seal lips with grease.

FINAL ASSEMBLY

FA 1 Clean the splines of the drum (T3-2 #33A) and the intermediate shaft (T5-2 #89) with loctite cleaner. Blow the splines dry with compressed air.

FA 2 Being careful not to allow the fluid to enter the spline area of the drum, lubricate the drum sealing rings (T3-2 #32) lightly with transmission fluid.

FA 3 Place RTK0073, in position #1, onto the bench head side up. Place the drum onto the centering insert of RTK0037. Turn the case open side down and place the case onto the drum. Fully insert the drum extension into the case.

FA 4 Check to insure that the spacer (T5-2 #81) is on the intermediate shaft. Apply a thin bead of bearing mount loctite near the end of the intermediate shaft splines. Place the intermediate shaft splines into the drum splines being careful not to allow loctite to get into the sealing ring area. **CAUTION!** Loctite in the sealing ring area could cause the rings to rotate in the housing and ruin the case.

FA 5 If the output shaft has a single hole through it's center insert the proper threaded rod through the shaft and centering insert of RTK0073. Place a R096043 washer through the opening of RTK0073 and then onto the threaded rod. Thread a shouldered nut with the shoulder up onto the rod below the washer. Thread a shouldered nut with the shoulder down onto the top end of the threaded rod and tighten the nuts to install the intermediate shaft, bearing and spacer assembly (T5-2 #89) into the clutch cylinder and drum (T3-2 #33A) until the shaft bottoms out on the drum. **IMPORTANT! DO NOT USE A WASHER BETWEEN THIS NUT AND THE SHAFT.**

NOTE! Once the nuts are tightened to the point of pulling the shaft partially into the drum, the case may be positioned so that the nut in the case may be reached to secure it from rotating.

If the shaft has the two hole design the shaft must be pressed into the drum while using RTK 0073 as a support.

NOTE! There were more than 1 (one) design of intermediate shafts used. The type of shaft

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determines the method used to install the shaft into the drum.

The shaft with a 1/2" hole straight through the center uses tool RTK0073 in position #1 and a 1/2" threaded rod through the center of the shaft to pull the shaft into the drum.

The shaft with a 3/8" hole straight through the center uses tool RTK0073 in position #1 and a 3/8" threaded rod through the center of the shaft to pull the shaft into the drum.

The shaft with 2 (two) 1/4" holes straight through the center uses tool RTK0073 in position #1 as a support for a press or drift installation of the shaft into the drum.

CAUTION! When installing the shaft into the drum **BE CERTAIN NOT TO** press on the cage of the rear bearing. To do so will destroy the bearing requiring it's replacement.

FA 6 When the shaft is fully installed into the drum there will be approximately 1/8" to 1/4" clearance between the forward bearing and the forward bearing cup. This clearance is eliminated once the case is lifted from the tool which was used to support the drum. The drum and shaft assembly will then be free to move back and forth until the rear housing is attached to the case.

Position the case so that the end of the intermediate shaft can be seen inside the clutch drum. Check to insure that the splines of the shaft and drum are approximately even with each other. If they are not even either, 1. the spacer has not been installed or 2. the shaft has not been sufficiently pressed into the drum. **IF THE SPLINES ARE UNEVEN CORRECTION OF THE PROBLEM MUST BE MADE PRIOR TO PROCEEDING.**

FA 7 Position the case face down on the bench so the gear and intermediate shaft is at the top.

FA 8 Lubricate all bearings with clean ATF and position the output shaft with the splines up, into the case lower bearing cup. Be careful that no oil is applied to the case to rear housing mating surface. If oil or grease is on this surface, clean it from the surface prior to proceeding.

FA 9 Apply a thin (1/16" to 1/8") bead of RTV sealer (supplied in the gasket and seal kit) to the mating surface of the rear housing (not the case). Spread the sealer evenly across the surface in a manner that would force any excess sealer away from the inside of the transmission.

FA 10 Position the rear housing (T5-2 #1A) onto the case dowel pins and press it into place.

FA 11 Insert the 10 (ten) M8x 25 bolts (T5-2 #80) with washers into the case. Tighten the bolts slowly to the point of light bolt to case contact. There should be no opening between the housing and case. Torque the bolts starting from the middle left then middle right. Work up one bolt on the left then down one bolt on the right then up one bolt on the right and down one bolt on the left until all bolts are torqued to 16 lb. ft.. **NOTE!** Holding the case during the tightening operation can be accomplished by drilling two holes into the workbench at the 7/16" bolt hole locations and dropping two bolts into those holes.

FA 12 Position the shim pack (T5-2 #92-95) onto the output shaft bearing cup. Position a new "O" ring (T5-2 #107) onto the outside diameter of the bearing/seal retainer. Locate the channel

PCM TRANSMISSION MANUAL

IRM-40A TRANSMISSIONS

into alignment with the case lubrication opening and insert the bearing/seal retainer into the housing.

FA 13 Insert the 6 (six) M8x20 bolts (T5-2 #90) with washers into the housing and tighten them to the point of contact. Torque the bolts in a crisis cross manner to a torque of 16 lb. ft...

FA 14 Install the shaft coupling (T5-2 #99) onto the output shaft (T5-2 #101). Coat one side of the coupling nut washer (T5-2 #100) 360 degrees with a thick (1/4" to 3/8" diameter) bead of RTV sealer and place the washer sealer side down onto the output shaft. Install the new output shaft nut (T5-2 #98) onto the output shaft and tighten the nut to 150 lb. ft.. Rotate the output shaft by hand to insure that backlash is present and bearing preload has not changed. If problems exist resolve them before proceeding.

FA 15 Using a suitable drift lock the nut into the output shaft groove.

FA 16 Position the transmission so that the case rests on the output shaft coupling and the opening is accessible for forward clutch plate insertion.

FA 17 Dip the forward clutch plates (T3-2 #45 & 47) and end plate (T3-2 #29) into ATF. Place the clutch plates into the forward drum starting with 1 (one) of the 4 (four) waved steel plates. Continue by adding a brass plate then steel etc. and ending with the fourth brass plate. Insert the thicker end plate and the retaining ring (T3-2 #48A) that holds the clutch pack into the forward drum.

FA 18 Using a feeler gauge check the clearance between the bottom of the retaining ring and top of the end plate. The proper clearance is between .025" and .055". Selective end plates (T3-2 #29A) are available to adjust this clearance.

FA 19 Install the circular magnet (T2-2 #30) in the retainer cast into the bottom of the case.

FA 20 Install the baffle plate (T2-2 #30), with the narrow end facing away from you, into the case (T2-2 #1) by forming it so that it enters the channels cast into the case. Once the baffle is entered into the channels use a dead blow hammer to tap the baffle into place, stopping when the edge of the baffle is just below the machined surface of the case.

FA 21 If the transmission uses a detent ball or plunger (T2-2 #64) insert the ball or plunger into the case. Insert the ball or plunger spring on top of the ball or plunger. If the case is designed to use the threaded in detent and it is functioning properly it requires no attention. If it is not functioning properly the malfunction must be corrected before proceeding.

FA 22 Position the transmission case on the bench so that it is resting on the bottom of the transmission with the opening facing you and near the edge of the bench.

FA 23 Lubricate the rollers of smaller front (T3-2 #55 & 55) and larger rear (T3-2 #41 & 42) input shaft thrust bearings with grease and place them onto the input shaft. The roller assembly (T3-2 #55 & 42) must be installed first followed by the flat steel race. Place the adapter housing into a vertical position on the bench and install the input shaft into the adapter housing.

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FA 24 After insuring that the gasket (T2-2 #18) between the adapter housing and the case and the rear thrust washer (T3-2 #41) are in place, grasp the input shaft and hold the adapter housing in a vertical position tilting the top of the adapter housing back slightly. Position the oil pickup over the raised lip of the case, then bring the adapter housing to a vertical position parallel with the case surface. Support the adapter housing with one hand while using light pressure against the shaft and enter the shaft into the drum bearing and the forward clutch plates. Twist the input shaft right then left rapidly while moving the shaft and housing toward the case.

As the input shaft enters each plate the adapter housing will close in on the case. When the adapter contacts the case it may not want to continue easily. If this occurs continue indexing the input shaft into the clutch plates *without attempting to force the adapter housing into the case*. Once the input shaft is fully indexed push the adapter housing into the case until it firmly contacts the case. **DO NOT PULL IN WITH BOLTS OR FORCE THE ADAPTER INTO THE CASE.**

FA 25 Install the 6 (six) M8x30 bolts (T2-2 #53) with washers through the adapter housing into the case. Tighten the bolts to the point of contacting the adapter housing. Cross tighten the bolts to a torque of 10 lb. ft then cross torque the bolts to a final torque of 16 lb. ft.. **HINT!** A bolt threaded into the case at the mount bracket mounting location may be secured into a vise to hold the case while torquing the bolts.

FA 26 Grasp the input shaft and check for free rotation of the shaft. Pull back and forth on the shaft to insure there is between 1/16 and 1/8" movement. If either condition is not present correction must be made before proceeding. Turn the input shaft so that the pump drive ball depression is on top. Insert the ball (T3-2 #6) into the shaft depression.

FA 27 Lubricate and install the oil pump center gear (T2-2 #10) onto the input shaft indexing the semi circular, **NOT THE SQUARE**, relief of the gear over the ball.

FA 28 Install a seal protector over the input shaft splines. Note If you do not have a seal protector wrap the input shaft with a **single layer** of masking tape.

FA 29 Check to see that the 3 (three) pump "O" rings are secured in place on the housing with grease and the oil pump outer gear is lubricated and installed into the pump housing (T2-2 #14).

FA 30 Locate the index mark that was made during disassembly in the proper position relative to the mark made on the case to align the pump to the case and slide the pump onto the input shaft. If the pump housing will not index into the gear mounted on the input shaft, rotate the shaft while holding the pump stationary until the gears index and the pump contacts the adapter housing. **IMPORTANT !! once the pump has contacted the adapter housing face DO NOT rotate the pump more than 1/8" in either direction. Rotation of the pump against the adapter face can cause the 2 (two) small "O" rings to be moved out of place causing a leak. If the pump is contacting the housing face and is out of position more than 1/8" pull the pump away from the adapter housing and rotate it into position before again contacting the adapter housing.**

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FA 31 Check bolt holes in pump for alignment with the threaded holes in the adapter housing. Align the holes as necessary (See IMPORTANT !! in step FA 27) and install the 6 (six) M8x25 bolts (T2-2 #11) with washers through the pump housing into the adapter housing. Tighten the bolts to the point of contacting the pump housing. Cross tighten the bolts to a torque of 10 lb. ft then cross torque the bolts to a final torque of 16 lb. ft.. Remove seal protector.

FA 32 Grasp the input shaft and check for free rotation of the shaft. Pull back and forth on the shaft to insure there is between 1/16 and 1/8" movement. If either condition is not present correction must be made before proceeding.

IRM-40A TRANSMISSIONS

IRM 40I (inline) VARIATIONS

The PCM IRM 40I (inline) 1:1 transmission utilizes the same procedures in diagnosis, disassembly, inspection, repair and reassembly as the IRM 40A (angle) with the following exceptions.

1. The output shaft nut (T4-2 #123) requires a 1 3/16" socket for removal.
2. The rear seal (T4-2 #121) is pressed directly into the case and is removed by using a pry bar through the seal opening.
3. The rear bearing (T4-2 #115) is a ball bearing and is retained into the case with a large snap ring. This snap ring (T4-2 #112) requires a heavy duty set of snap ring pliers to compress it for removal from the case.
4. Be certain to mark to identify or note the direction that the output shaft ball bearing was installed prior to removal from the case. The rear bearing is a thrust style ball bearing and must be installed the same direction that it was installed at the factory.
5. The output shaft (T4-2 #120) must be removed from the drum to use RTK0073 to compress the piston return spring. *NOTE! The output shaft is secured into the drum with hard non removal loctite as it is in the 1.23:1 transmission and must be cleaned in the same manner as the 1.23:1 unit.* This may be accomplished by positioning the drum on a sturdy bench open side down and driving it out with a dead blow hammer.
6. On assembly install the piston, return spring, washer and lock ring into the drum using RTK0073 in the same manner as directed for the 1.23:1 unit.
7. Clean the splines of the drum and output shaft, apply loctite and insert the shaft into the drum until the spline at the threaded end of the shaft is even with the rear splined surface of the drum.
8. Install the output shaft bearing into the case in the proper direction and install the snap ring.
9. Install the output shaft seal into the case.
10. Lubricate the sealing rings of the drum and insert it into the case.
11. Support the drum using RTK0073 in the same manner as directed for the 1.23:1 transmission.
12. Index the coupling with the output shaft spline and install the output shaft coupling onto the shaft and into the bearing.
13. Seal the washer and install, tighten and STAKE the output shaft nut in the same manner as directed for the 1.23:1 transmission.

IRM-40A TRANSMISSIONS

REQUIRED TOOLS

PCM PARTS

RTK0073

2 PCM P/N R096043 washer

COMMON HAND TOOLS

Work bench with a medium sized bench vise and metal top
Sockets; 36mm (1 7/16") for 1.23:1 or 30 mm (1 3/16") for 1:1
13mm (loose 1/2") socket
7/8" socket (deep)
2 lb. Dead blow hammer (MED)
33 oz Ball pein hammer (MED)
Steel drift set
Steel chisel set
1" Brass drift (optional)
1 1/16" combination wrench
Medium and Small Crescent wrench
Screw drivers
Wide thick blade putty knife
Small (6 to 8") wire (brass or stainless) wire brushes
Fine cut files small and large (optional)
Pocket magnet
Diagonal or side cutting pliers
Med. Channel lock pliers
3/16" and millimeter size allen wrenches
Monofilament 8-12# fish line or string
2 Pair 6" long nose locking pliers
3/8" reversible electric drill & drill bits
Grinding and cleaning tools for the drill

NOTE! All of the above listed common hand tools may not be necessary for all repairs and other common hand tools may be necessary in some instances. All of the above tools are necessary to insure that delays in the repair do not occur.

SPECIAL TOOLS

6" Dial or digital Vernier caliper or micrometers std. and depth 0-6 inches
Inch lb. torque wrench
Digital ounce graduated hand scale (Fish scale available at Wal Mart)
Impact wrench (air preferred) capable of 150 lb. ft. Minimum torque
Pin type, reversible, snap ring pliers (small, med. & large)
Lock ring & horseshoe washer pliers (flat end)
Oil pressure gauge (0-300 PSI) and necessary adapters.

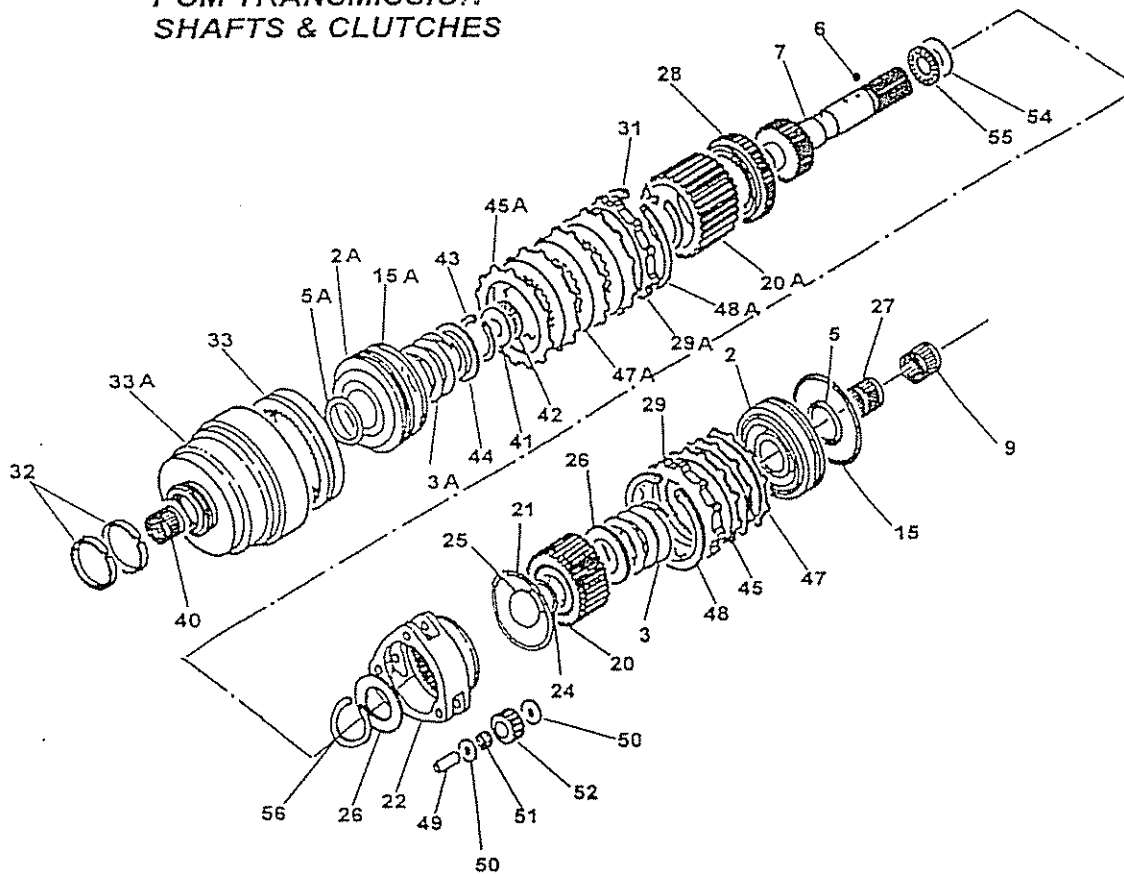
PCM TRANSMISSION (CASE & ADAPTER)

REF NO.	PART NUMBER	DESCRIPTION	QTY	APP	ROT
1	R 157016	Case Housing In Line	1	1:1 I/B, S/D	All
1	R 157017	Case Housing Reduction	1	1:2,1.5	All
4	R047187	O-Ring Pump Cover Large	1	All	All
8	R047185	Seal, Front Pump	1	All	All
10	R113048	Oil Pump Gear Set	1	All	All
11	RS6531	Bolt	6	All	All
12	R034034	Breather Vent	1	A/J	All
14	R070013	Co r, Front Pump	1	All	All
16	R074027	Oil Pickup Tube & Screen	1	1.2,1.5	All
16	R074028	Oil Pickup lube & Screen	1	1:1 I/B, S/D	All
17	RS3561	Plug	1	All	All
18	RM0208	Gasket	1	All	All
23	R012021	Magnet, Round	1	All	All
30	R012022	Baffle, Oil	1	1.2,1.5	All
30	R012020	Baffle, Oil	1	1:1 I/B, S/D	All
46	RS3539	Plug, 118 NPT	4	All	All
53	RS6532	Bolt	6	All	All
56	R048104	Retaining Ring (Pin Holes)	1	All	All
59	R169057	Shim	AR	All	All
60	R046042	Spring, Pressure Relief Valve	1	All	All
61	R035025	Valve, Pressure Relief	1	All	All
62	R035024	Valve, Control	1	All	All
63	R047184	O-Ring	1	All	All
64	R076006	Spring Plunger Assy.	1	All	All
NI	R046043	Spring Detent Plunger	1	All	All
NI	R076005	Plunger Detent	1	All	All
66	R096125	Thrust Washer	2	All	All
67	R067076	Thrust Bearing	1	All	All
68	R048101	Retaining Ring	1	All	All
69	R166019	Lever	1	All	All
69	R166018	Lever	1	All	All
70	RS7070	Lock Washer	1	All	All
71	RS7027	Nut	1	All	All
72	R082058	Roll Pin	1	All	All
73	R041060	Dipstick	1	1:1 I/B, S/D	All
73	R041059	Dipstick	1	1.2,1.5	All
74	R143046	Nameplate	1	All	All
75	R175054	Drive Screw	4	All	All
91	RS7049	Washer, Flat	28	All	All
105	R047186	O-Ring	2	All	All
106	RS3560	Plug	1	All	All
109	R047200	O-Ring	1	All	All
110	RS3559	Plug	1	All	All
NI	R153011	Neutral Safety Switch	1	All	All
111	R047190	O-Ring, Dipstick	2	All	All
112	R048112	Retainer	1	1:1 I/B, S/D	All
113	R079047	Adapter, Front Cover	1	All	All
NI	RK173058	Gasket & Seal Kit	1	1.2,1.5	All
NI	RK173059	Gasket & Seal Kit	1	1:1 I/B	All
NI	RK173060	Gasket & Seal Kit	1	S/D	All
NI	RK160014	Clutch Pack Kit	1	All	All

PCM TRANSMISSION (SHAFTS & CLUTCHES)

REF NO.	PART NUMBER	DESCRIPTION	QTY	APP	ROT
2	R161017	Piston, Clutch	2	All	All
3	R046044	Spring, Piston Return	2	All	All
5	R047189	O-Ring, Clutch Piston Inner	2	All	All
6	R165006	Steel Ball, Pump Drive	1	All	All
7	R058060	Input Shaft	1	All	All
9	R067079	Bearing, Input Shaft Support Front	1	All	All
15	R047188	O-Ring, Clutch Piston Outer	2	All	All
20	R162004	Hub, Clutch	2	All	All
21	R048106	Retaining Ring, Hub To Planetary Housing	1	All	All
22	R167008	Planetary Housing	1	All	All
24	R048103	Retaining Ring, Piston Spring	1	All	All
25	R051035	Bushing, Bronze Retainer	1	All	All
26	R096128	Washer, Tab	2	All	All
27	R067080	Bearing, Input Shaft Support Rear	1	All	All
28	R113050	Reverse Sun Gear	1	All	All
29	R160016	Pressure Plate	2	All	All
31	R048102	Retaining Ring, Clutch Hub	1	All	All
32	R048110	Ring, Oil Seal Drum To Case	2	All	All
33	R139011	Gear, Ring	1	All	All
33A	R163004	Clutch Cylinder & Drum Bare	1	All	All
NI	RA163004	Clutch Cylinder Assembly (Includes No. 33, 33A, and 40)	1	All	All
40	R067081	Bearing, Drum To Shaft Support	1	All	All
41	R096127	Thrust Washer, Intermediate Large	1	All	All
42	R067078	Thrust Bearing, Intermediate Large	1	All	All
43	R048108	Retaining Ring, Piston Spring	1	All	All
44	R048107	Retainer Spring	1	All	All
45	R160015	Clutch Separator Plate, Outer	7	All	All
47	R160014	Clutch Plate, Inner Spline	7	All	All
48	R048105	Retaining Ring, Clutch Pack	2	All	All
49	R082057	Pin, Planet Gear	3	All	All
50	R096129	Washer, Planet Gear	6	All	All
51	R067082	Bearing, Planet Gear	3	All	All
52	R113051	Gear Planet	3	All	All
54	R096126	Thrust Washer, Front Small Diameter	1	All	All
55	R067077	Thrust Bearing, Front Small Diameter	1	All	All
NI	RK173058	Gasket & Seal Kit	1	1.2 & 1.5	All
NI	RK173059	Gasket & Seal Kit	1	1: 1 I/B	All
NI	RK173060	Gasket & Seal Kit	1	S/D	All
NI	RK160014	Clutch Pack Kit	1	All	All

**PCM TRANSMISSION
SHAFTS & CLUTCHES**



PCM TRANSMISSION (1:1 REAR SECTION)

REF NO.	PART NUMBER	DESCRIPTION	QTY	APP	ROT
112	R048112	Retainer	1	1:1 IB & S/D	All
115	R067087	Bearing	1	1:1 I/B & S/D	All
116	R048113	Retainer	1	S/D	All
117	R069063	Plug	1	S/D	All
118	R058065	Shaft Output	1	S/D	All
119	R047193	Seal, Output Shaft	1	S/D	All
120	R058066	Shaft Output	1	1:1 IB	All
121	R047194	Seal, Coupling	1	1:1 IB	All
122	R096136	Washer, Coupling	1	1:1 IB	All
123	R017072	Nut, Coupling	1	1:1 IB	All
124	R148021	Coupling	1	1:1 IB	All
NI	RK173058	Gasket & Seal Kit	1	1.2 & 1.5	All
NI	RK173059	Gasket & Seal Kit	1	1:1 IB	All
NI	RK173060	Gasket & Seal Kit	1	S/D	All
NI	RK160014	Clutch Pack Kit	1	All	All

PCM TRANSMISSION
1:1 REAR SECTION

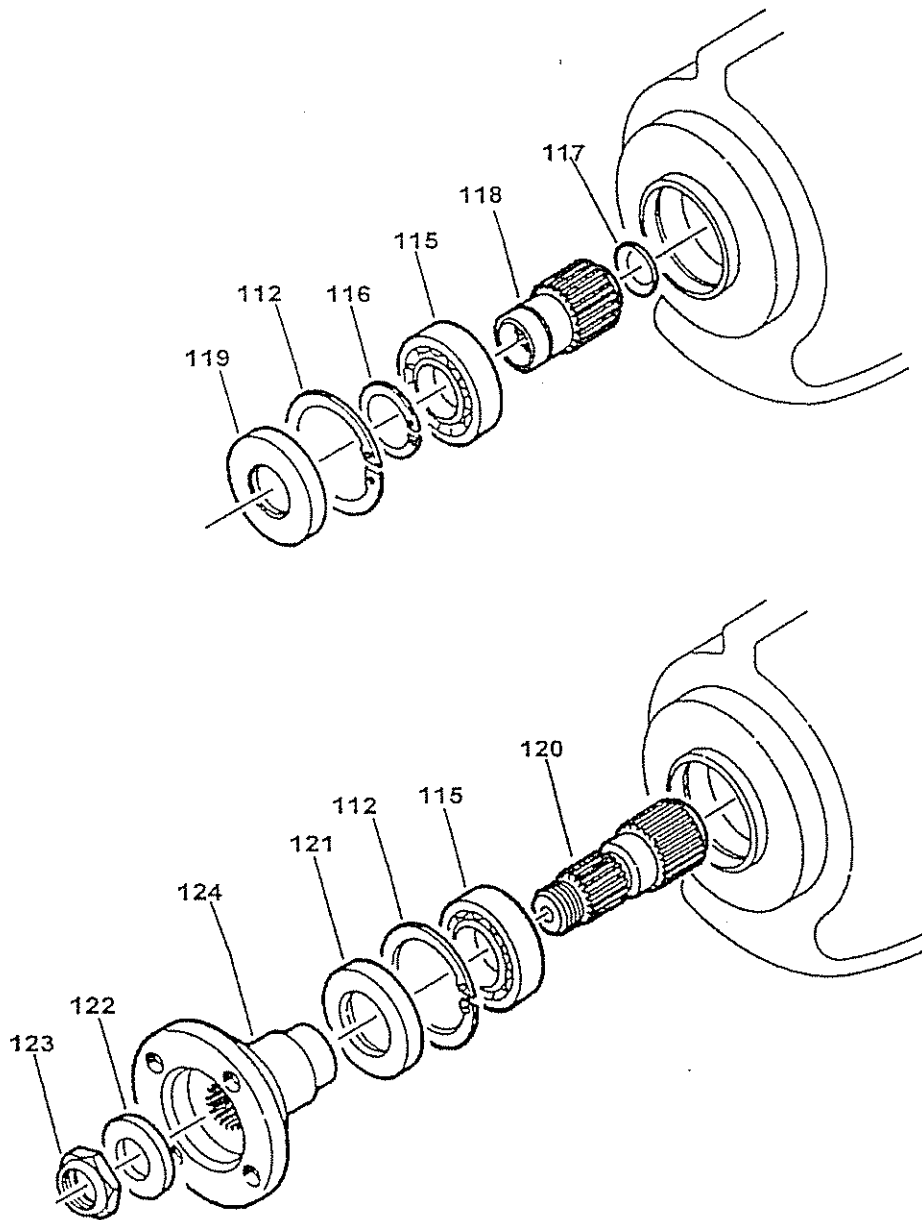


FIGURE T4

PCM TRANSMISSION (REDUCTION SECTION)

REF NO.	PART NUMBER	DESCRIPTION	QTY	APP	ROT
1A	N.S.S.	Part of R157017 (see REF # 1 Pg. T2-1)	NA	1.2 & 1.5	All
34	R169059A	Shim, .15mm	AR	All	All
35	R169059B	Shim, .20mm	AR	All	All
36	R169059C	Shim, .25mm	AR	All	All
37	R169059D	Shim, .30mm	AR	All	All
38	R169059E	Shim, .50mm	AR	All	All
76	R169058A	Shim, .15mm	AR	All	All
77	R169058B	Shim, .20mm	AR	All	All
78	R169058C	Shim, .25mm	AR	All	All
79	R169058D	Shim, .50mm	AR	All	All
80	RS6531	Bolt	10	All	All
81	R062066	Spacer	1	All	All
82	R067083	Bearing Intmed Shaft Front	1	All	All
83	R169059A	Shim, .15mm	AR	All	All
84	R169059B	Shim, .20mm	AR	All	All
85	R169059C	Shim, .25mm	AR	All	All
86	R169059D	Shim, .30mm	AR	All	All
87	R169059E	Shim, .50mm	AR	All	All
88	R067084	Bearing, Intmed Shaft Rear	1	All	All
89	R058061	Intermediate Shaft & Gear	1	1.2	All
89	R058067	Intermediate Shaft & Gear	1	1.5	All
90	RS6530	Bolt	6	All	All
91	RS7049	Washer	28	All	All
92	R169060A	Shim, .15mm	AR	All	All
93	R169060B	Shim, .20mm	AR	All	All
94	R169060C	Shim, .30mm	AR	All	All
95	R169060D	Shim, .50mm	AR	All	All
97	R067086	Bearing, Output Shaft Rear	1	All	All
98	R017078	Nut, Coupling	1	1.2 & 1.5	All
99	R148020	Coupling, Output Shaft	1	1.2 & 1.5	All
100	R096132	Washer, Coupling	1	1.2 & 1.5	All
101	R058062	Output Shaft & Gear	1	1.2	All
101	R058068	Output Shaft & Gear	1	1.5	All
102	R047191	Seal	1	1.2 & 1.5	All
103	R067085	Bearing, Output Shaft Forward	1	All	All
104	R048109	Retainer Seal	1	All	All
107	R047192	O-Ring, Retainer To Case	1	All	All
NI	R082059	Pin, Case Dowel	2	1.2 & 1.5	All
NI	RK173058	Gasket & Seal Kit	1	1.2 & 1.5	All
NI	RK173059	Gasket & Seal Kit	1	1:1 I/B	All
NI	RK173060	Gasket & Seal Kit	1	S/D	All
NI	RK160014	Clutch Pack Kit	1	AR	All

THE ILLUSTRATION FOR REFERENCE NUMBERS ON THIS PAGE WILL BE FOUND ON FIGURE T5

PCM TRANSMISSION
REDUCTION SECTION

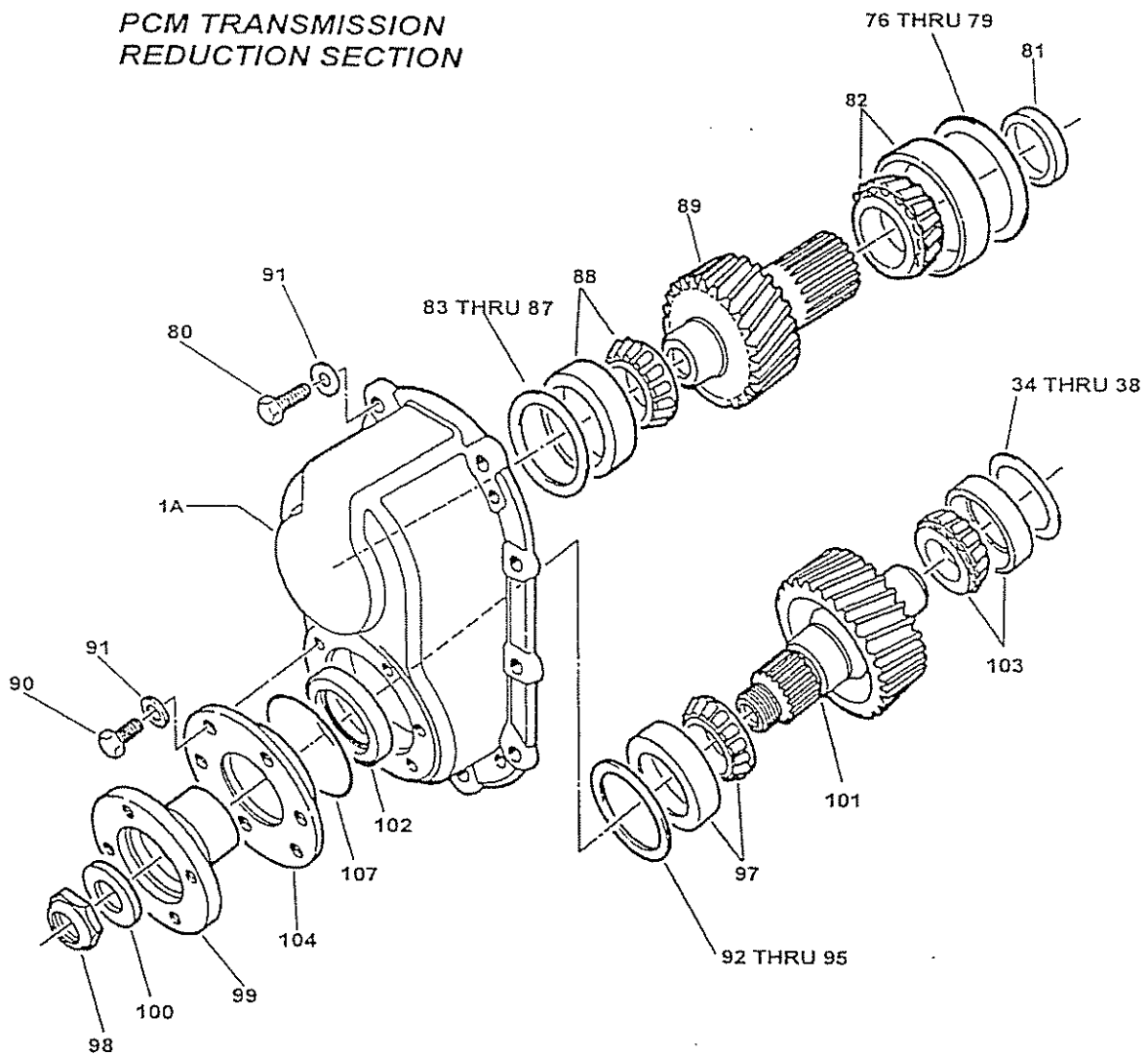


FIGURE T5

Bearing installation tools

All centering and pressing washers except for washer # 2 may be made from PCM P/N R096043 Mount washers.

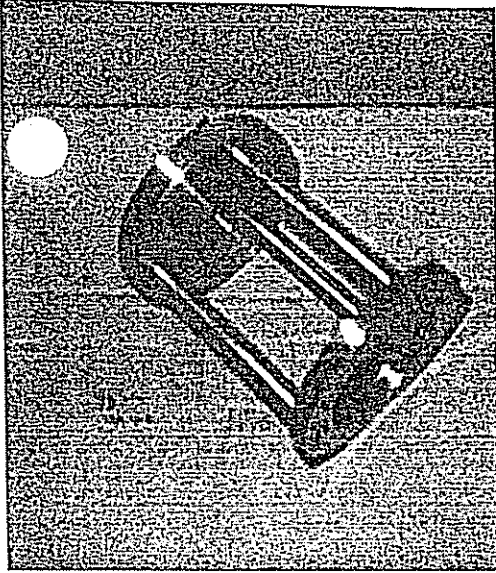
All washers have an I. D. of .643"

Washer #	O.D.	Use
1	2.820"	Remove large cup from case and center large cup to install.
2	3.145"	Press large cup into case.
3	2.550"	Center medium bearing cup.
4	2.427"	Press small race into case or rear housing.
5	2.243"	Center small race into case or rear housing.

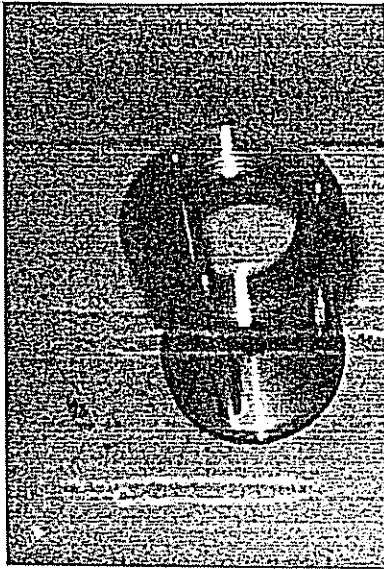
Washer # 5 is PCM P/N R096001 unmodified.

To use the washers as pressing tools mount the large washer than the smaller washer for the cup you are working on, onto the 5/8" part of a mount stud, either PCM P/N R095006 or R095002, and secure them in place with a 5/8" x 18 nut and suitable spacers. The stud can then be used as an arbor to press the cup into the housing.

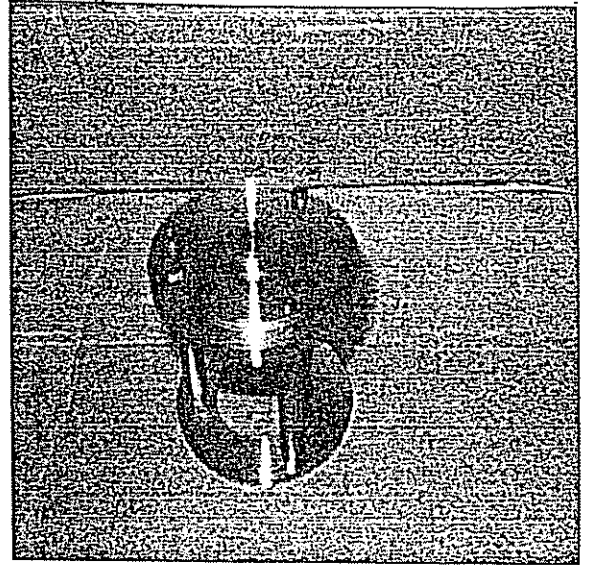
TRANSMISSION TOOL POSITIONS



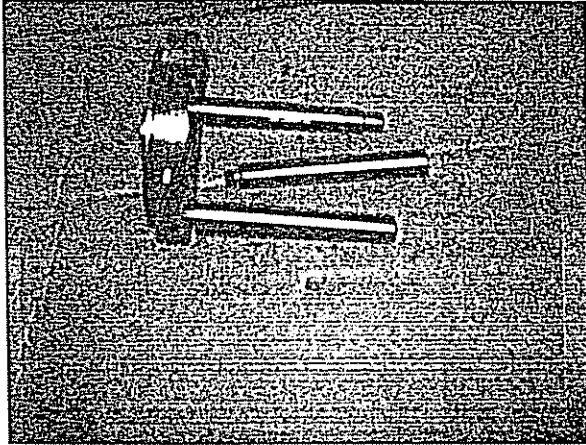
Position #1



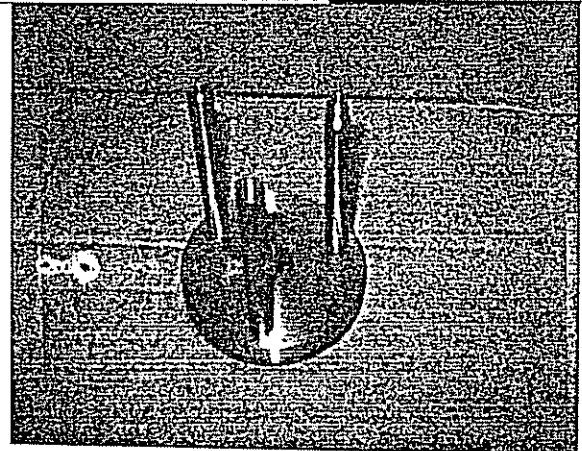
Position #1



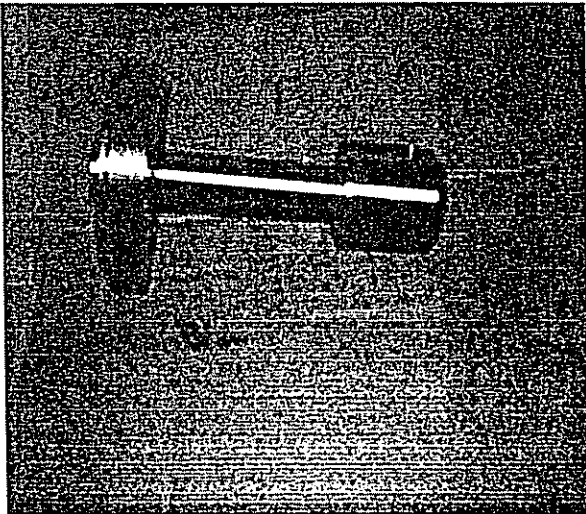
Position #1



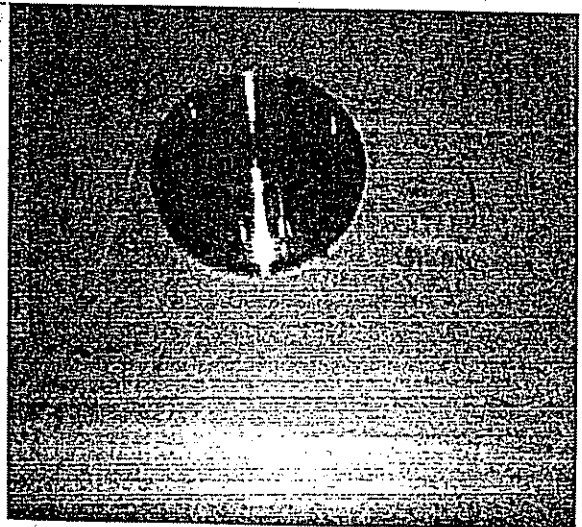
Position #2



Position #2



Position #3



Head Piece

PCM Inboard Engine Alignment Procedure

It is not our intention to instruct any manufacturer in the installation of our product unless requested to do so. Our methods are simply a reflection of our opinions formulated by our experience. Any method of installation that permits the engine to attach to the shaft in a manner that allows for proper alignment and a permanent placement of the engine in that position is considered proper.

Basic logic

The position of the Engine in the hull is controlled by the installed position of the strut relative to the shaft log. Proper installation of the propeller shaft into the boat hull in order to prevent mechanical failure and/or undesirable operating characteristics is the most critical factor in the installation of the engine. Though manufacturers differ in their methods the results desired are;

- a. The final installed angle of the strut and the shaft log must be the same.
- b. The shaft, with gravity caused sag neutralized, should enter and exit the shaft log at the center.
- c. The final position of the shaft should be as close to the center of the stringers as possible to permit proper engine positioning *without exceeding* the maximum allowable extension of the mount trunions.
- d. The stringer height must allow for proper installation *without bottoming out* the mount adjustment.

Variables to be considered

Manufacturing variables, other than assembly errors, that can affect shaft installation are;

- a. The shaft log outside diameter, inside the hull, should but may not be round and concentric with the center of the shaft log opening.
- b. The stuffing box should but may not have inside and outside diameters that are round and concentric.
- c. The stuffing box or stringers which should be located for an *engine centered* installation may have been improperly positioned during hull lay up.
- d. The shaft and the coupling which should be concentric within .001" are not properly matched or the coupling faces, shaft or transmission, exceed the allowable .005" runout.
- e. The propeller shaft is not straight or machined improperly. Consult shaft manufacturer for allowable variation relative to shaft size and length.

e. Mate the shaft coupling to the transmission coupling and while applying enough pressure to maintain the shaft in this position use a .003" feeler gauge to "feel" between the coupling surfaces. Turn the transmission coupling 90 degrees to the right and repeat the above. Repeat this procedure until you have checked the transmission coupling through four (4) 90 degree positions Repeat this procedure with the propeller shaft. The clearance should be .003" or less at all positions, when both couplings are rotated, for satisfactory alignment. If there is measurable clearance which changes position as either coupling is rotated, the coupling face is not at 90 degrees to the shaft or the shaft is bent. If this condition exceeds .005" it must be corrected because proper alignment is not possible as long as excessive runout is present.

e. Once it is determined that the couplings are good but alignment is improper the engine must then be moved into proper alignment with the shaft. Adjustments at all mounts may be necessary but if the engine is close to being in alignment most fine adjustments will come from front mount movement. If the gap is at the top or bottom of the coupling the front mounts may be raised or lowered to close the gap. If the gap is at the right or left side of the coupling the engine may be slid side ways right or left on the front mount trunions to close the gap. If the gap is at a 45 degree angle to the top or bottom or right to left the raising or lowering of the left front mount will change a gap at the top left or lower right side of the coupling and the right front mount will change a gap on the upper right and the lower left side. Vee drive alignment logic is reverse that stated in this paragraph.

f. Once the engine is in alignment lock all mount locking devices securely and recheck alignment. If alignment is off realign as necessary to insure proper alignment when all locking devices are securely locked in place.

g. Reconnect the shaft to the transmission and tighten the attaching bolts to the proper torque for the bolts being used.

h. If the Stuffing box was removed from the shaft log, tighten the packing nut hand tight, reposition the hose on the shaft log and tighten the hose clamps securely. Adjust the packing nut to it's proper tightness and lock the jam nut in place.

Common assembly errors

Assembly errors that can affect proper engine alignment are;

- a. The strut location relative to stuffing box is assembled at an improper vertical or horizontal angle.
- b. The engine is improperly positioned.
- c. The mounts are not properly secured to the stringers.
- d. The mount adjustment locks are not properly secured.

Alignment procedure

Engine alignment after installation should be made as follows.

- a. If the boat is out of the water inspect the hull, propeller, strut, rudder and shaft to determine if there is damage to these parts. Check strut bushing to shaft clearance for proper .003" to .007" clearance. If damage or wear is present correct the condition by repair or replacement of the damaged part(s).
- b. Disconnect the shaft coupling from the transmission coupling. If at separation, the shaft deflects excessively to the right, left or top under water components may be damaged or strut alignment may be off. If the boat is out of the water, loosen the stuffing box packing nut and disconnect the stuffing box hose from the shaft log. While neutralizing the gravity created shaft sag check the shaft entry and exit into the hull to insure that it is as close to center as possible. If entry is not proper correct before proceeding.
- c. Examine shaft and transmission couplings for burrs, dents, dings or other signs of damage. Correct as necessary.
- d. If after insuring that there is no shaft or under water hardware problem, the engine to shaft position is visually off, loosen the engine mount adjusting locks. Determine that the engine weight is evenly distributed onto all four (4) engine mounts and that no one mount is over stressed. If weight distribution is uneven, evenly distribute the engine weight before proceeding and maintain even weight distribution as adjustments are made. Using a suitable lifting or prying device move the engine into a position where, while supporting the shaft to offset the gravity created shaft sag, the vertical and horizontal center line of the shaft intersects the transmission coupling vertical and horizontal centerline. Rear mount adjustments are most useful in positioning shaft center line adjustments while front mount adjustments control finer adjustments.

