Benchnotes Volume 10

Mazda/Ford G4A Part 1

Produced by AAMCO Transmissions, Inc.

AAMCO Technical Services Department

Special Thanks to:

Greg Catanzaro

Richard Roth

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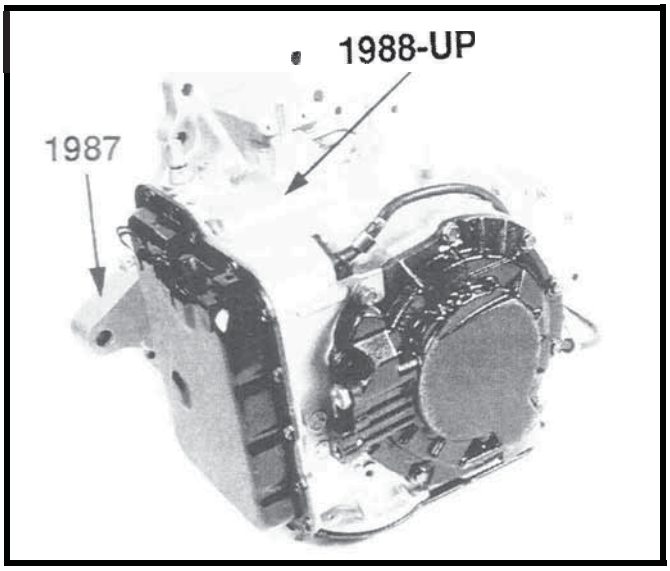
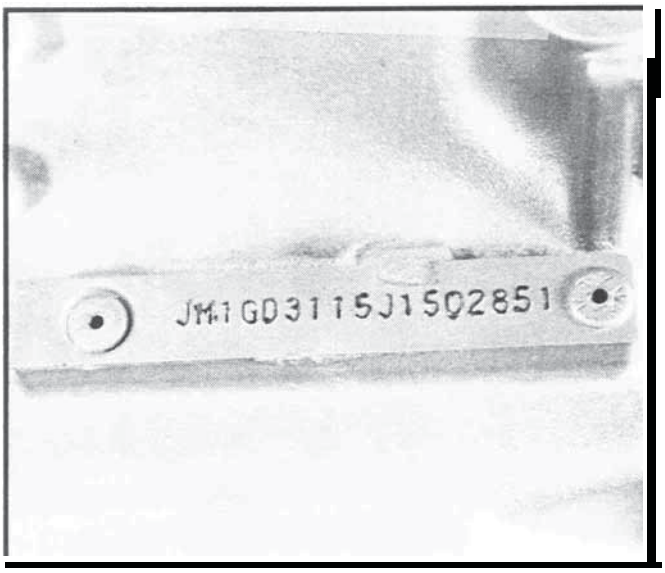
Mazda Unit ID



ID Number Location



The Mazda ID Number tells you:

1. **Manufacturer**
2. **Model**
3. **Body Style**
4. **Year**
5. **Engine Codes**

J M I G D 3 1 1 5 J 1 502851

1. Manufacturer

M or Y = Mazda

2. **Model**

GC = **626**	BF = 323
GD = MX6, 626	BG = Protege
GD = 626	BJ = 323
GE= 626	BK = 323
GH = 626	BL = 323 (Van)
GJ = 626	BW = 323 (S/W)
GK = 626	GB = 626

3. **Body Style**

21 = 2 Door Sedan	35= 2 Door Conv
22= 4 Door Sedan	43= 2 Door Coupe
23= 3 Door Hatchbk	46 = 4 Door HT
24= 5 Door Hatchbk	52 = Wagon
31 = 2 Door Coupe	62= 4 Door Wagon/Van
33= 2 Door Coupe	

4. Year

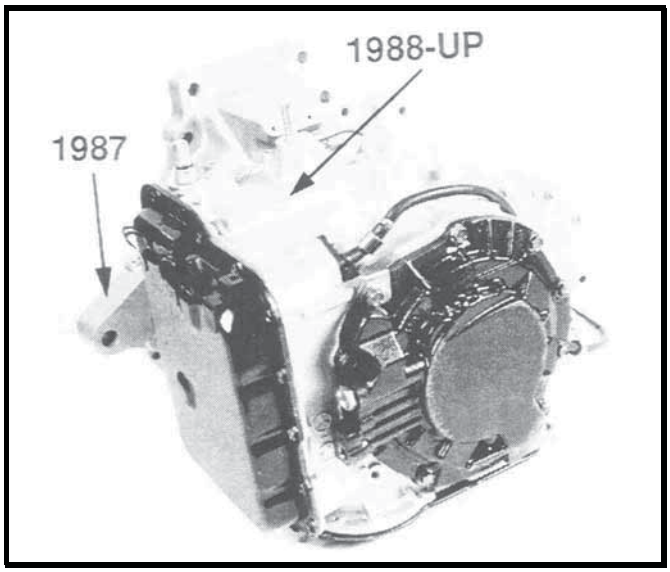
H= 1987
J= 1988
K= 1989
L = 1990
M = 1991
N = 1992
P = 1993

5. **Engine Codes**

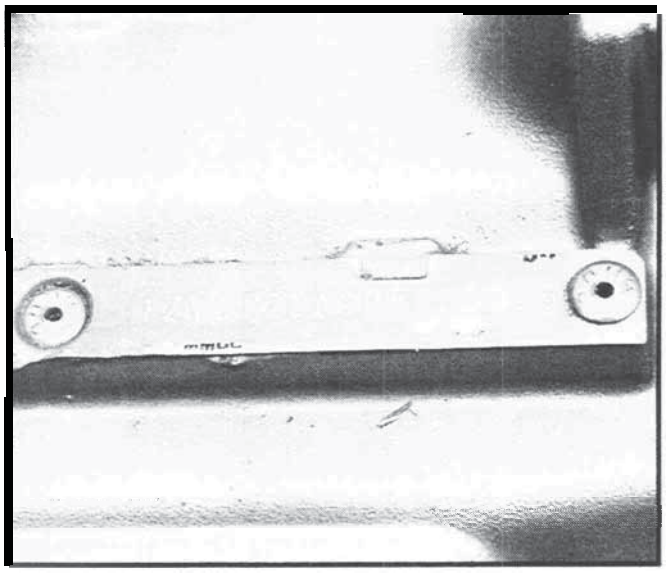
1987-92
1 or A = 2.2L Non-Turbo
2 or B = 2.2L Non-Turbo
3 or C = 2.2L Turbo
4 or D = 2.2L Turbo

1993-UP
A = 2.5L V6
C = 2.OL

Ford Unit ID



ID Number Location



The Ford ID Number tells you:

1. **Manufacturer**
2. **Model & Body Style**
3. **Year**
4. **Engine**

1 Z VC T 20 A 9 P 513

1. Manufacturer

Z = Ford

3. Year

K= 1989
L= 1990
M= 1991
N = 1992
P = 1993

2. Model & Body Style

20= Probe GL, 3 Door Sedan
21 = Probe LX, 3 Door Sedan
22= Probe GT, 3 Door Sedan
01 = Capri Base 2 Door Convertible
03= Capri XR2 2 Door Convertible

4. **Engine Codes**

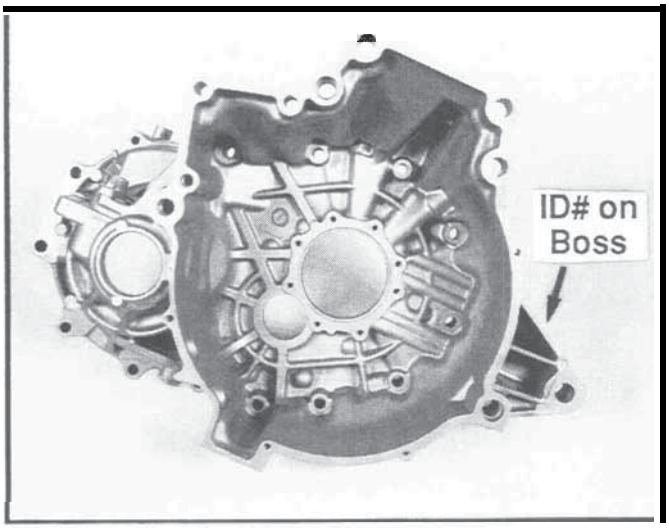
A = 2.OL SEFI
B = 2.5L V6 SEFI
C = 2.2L MPFI Turbo
L = 2.2L MPFI Non-Turbo
U = 3.OL V6 MPFI

Ford/Mazda Bell Housing ID

IMPORTANT **These cases are NOT interchangeable.**

There are seven different bell housing sections:

1987 **G4A-EL 2.2L**
1988-89 G4A-HL 1.6L
1988-UP Non-turbo 2.2L
1988-UP Turbo 2.2L
1989-UP 3.OL V6
1993-UP G4A-FEL 2.5 V6
1993-only G4A-FEL 2.OL

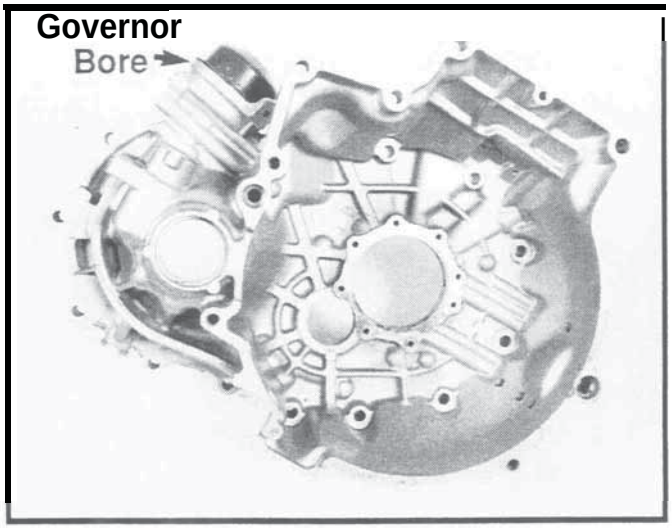


1987 G4A-EL 2.2L

Easy ID: ID# on boss.

No mounting boss near axle.

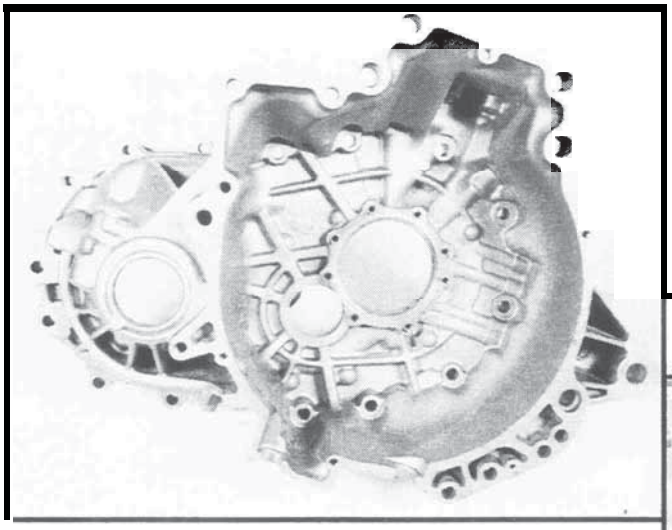
No mounting on bottom of case.



1988-1989 G4A-HL **1.6L**

Easy ID: Look for governor bore on top of the case.

Ford/Mazda Bell Housing ID continued

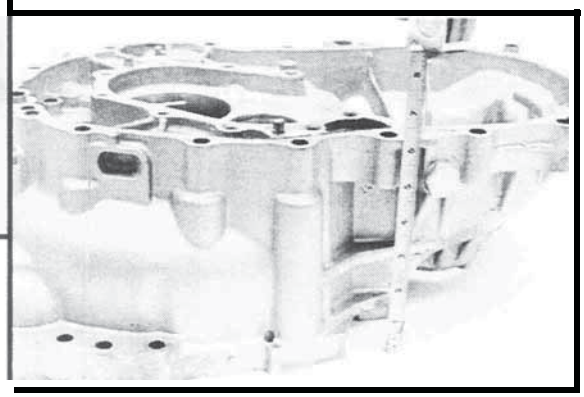


1988-92 G4A-EL Non-turbo 2.2L

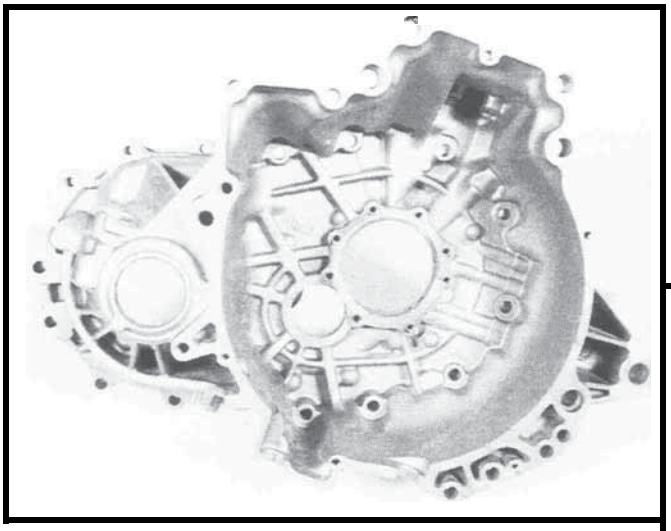
Has mounting boss near axle.

Has mounting boss on bottom of case.

Height of case is 6¼"



NOTE **Be careful! Both the 2.2 Turbo and Non-Turbo bell housings look identical. The big difference is the height of the bell housing.**

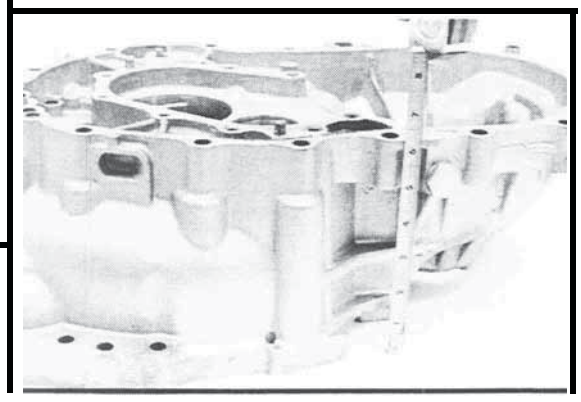


1988-92 G4A-EL **Turbo 2.2L**

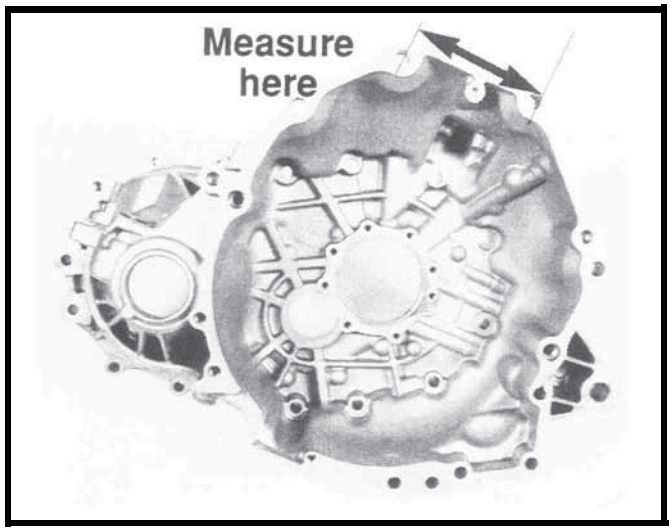
Has mounting boss near axle.

Has mounting boss on bottom of case.

Height of case is 6⅛"



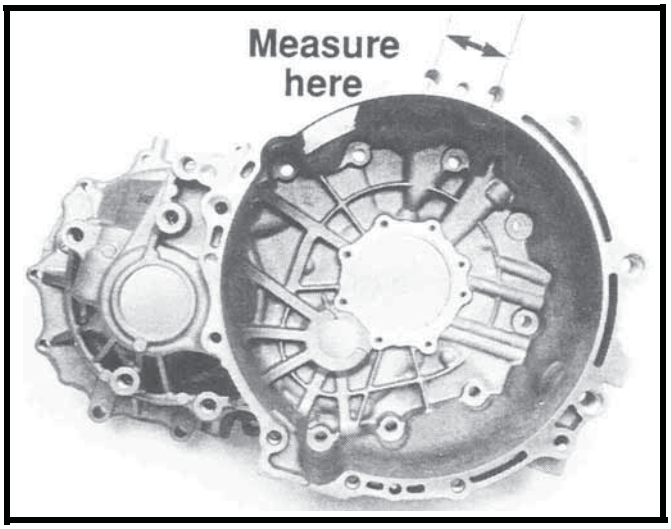
Ford/Mazda Bell Housing ID continued



1989-92 G4A-EL 3.OL V6

Measure the top two bolt holes.

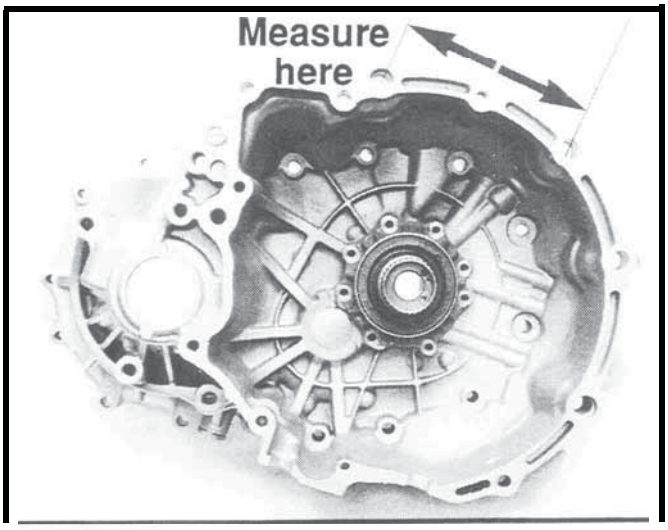
Center to center 4 7/8".



1993-UP G4A-FEL 2.5L V6

Measure the top two bolt holes.

Center to center 2 1/8".



1993-UP G4A-FEL 2.OL

Measure the top two bolt holes.

Center to center 6 1/2".

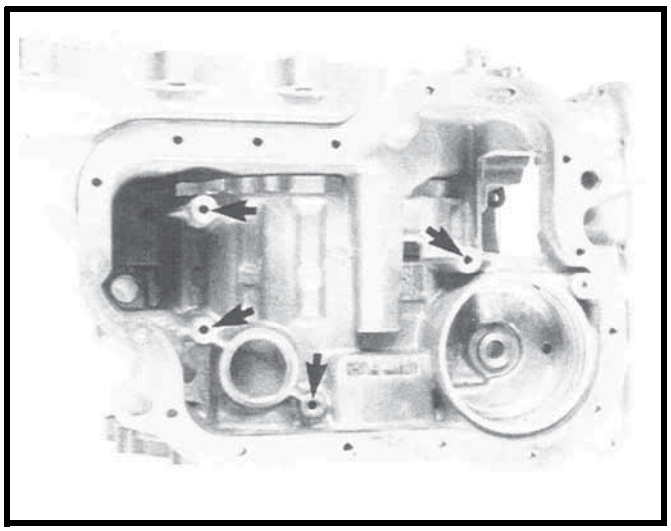
Main Case ID Without Tag All Units

IMPORTANT **The main cases are not interchangeable.**

How to ID parts on the shelf or units with out tags.

There are five different main cases.

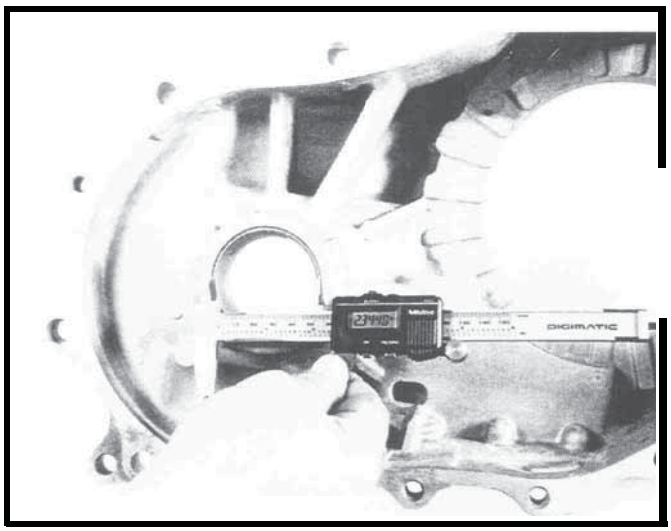
1987-only G4A-EL 2.2L
1988-89 **G4A-HL** 1.6L
1988-92 Non-Turbo G4A-EL 2.2L
1988-92 Turbo 2.2L & 3.OL V6 G4A-EL
1993-UP 2.OL & 2.5L G4A-FEL



1987-only G4A-EL

Uses four mounting bolts for the filter.

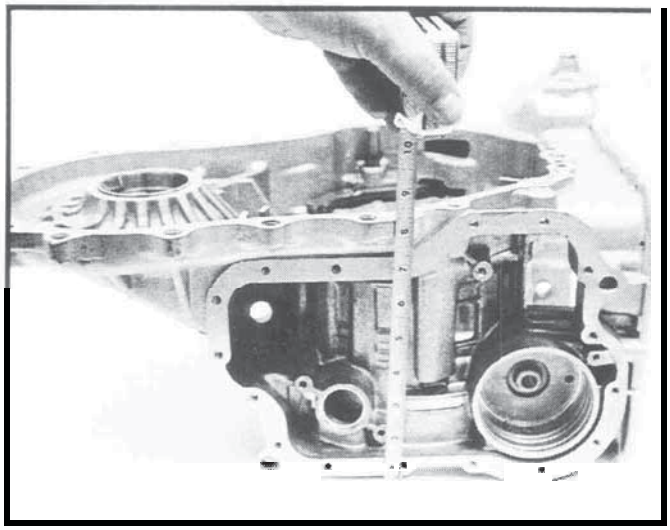
All other years use three bolts.



1988-89 G4A-HL

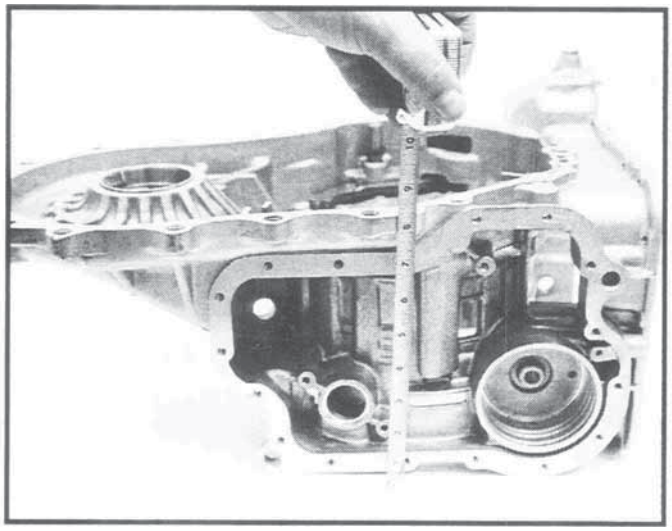
Measure the outside diameter of the differential bearing race. The HL race is about 2.344". The EL& FEL races are about 2.660".

Main Case **ID Without Tag All** Units continued



1988-92 **Non-Turbo G4A-EL 2.2L**

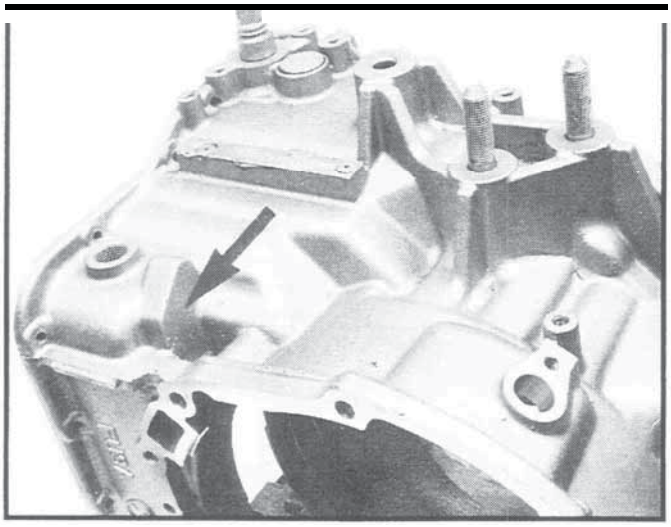
Case is **8“** tall.



1988-92 Turbo 2.2L & 3.OL V6 G4A-EL

Case is 8¼" tall.

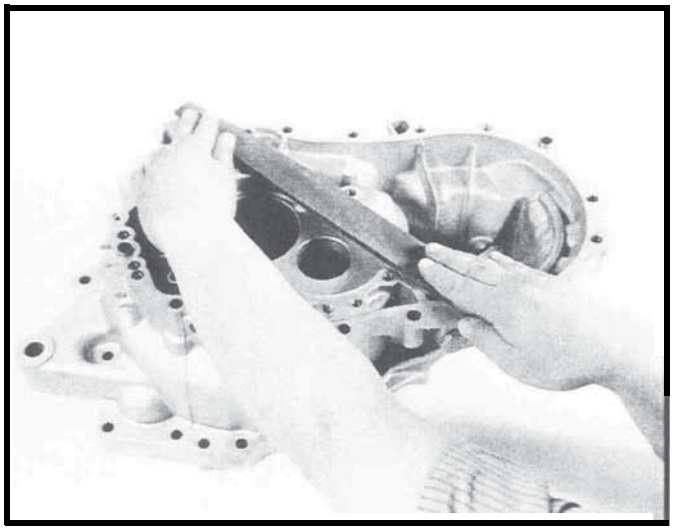
Case is taller because most of the Turbo parts are a little bit taller than the Non-Turbo.



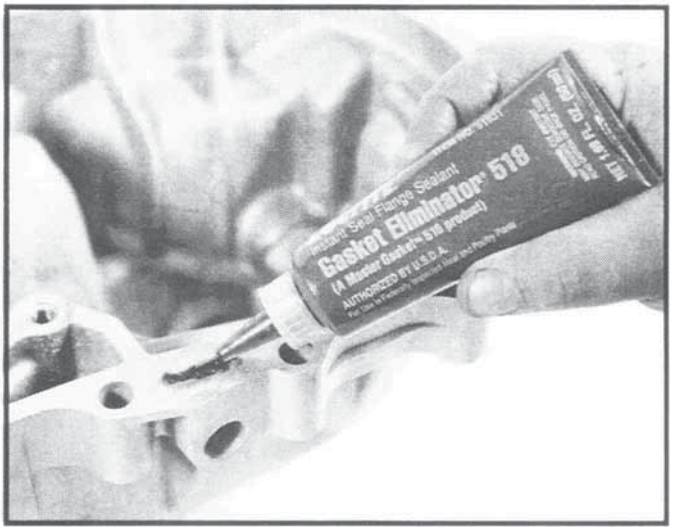
1993-UP G4A-FEL 2.OL & 2.5L

Easy ID: Has no hole for T.V. cable.

Case Preparation All Units

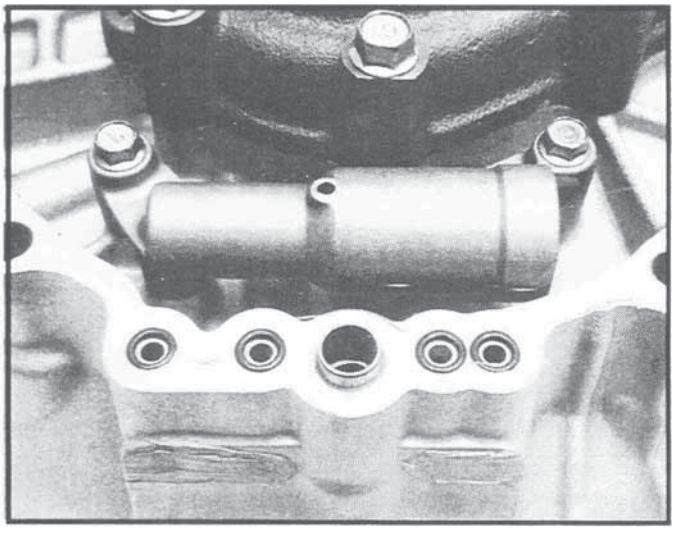


Always flat file the case halves.



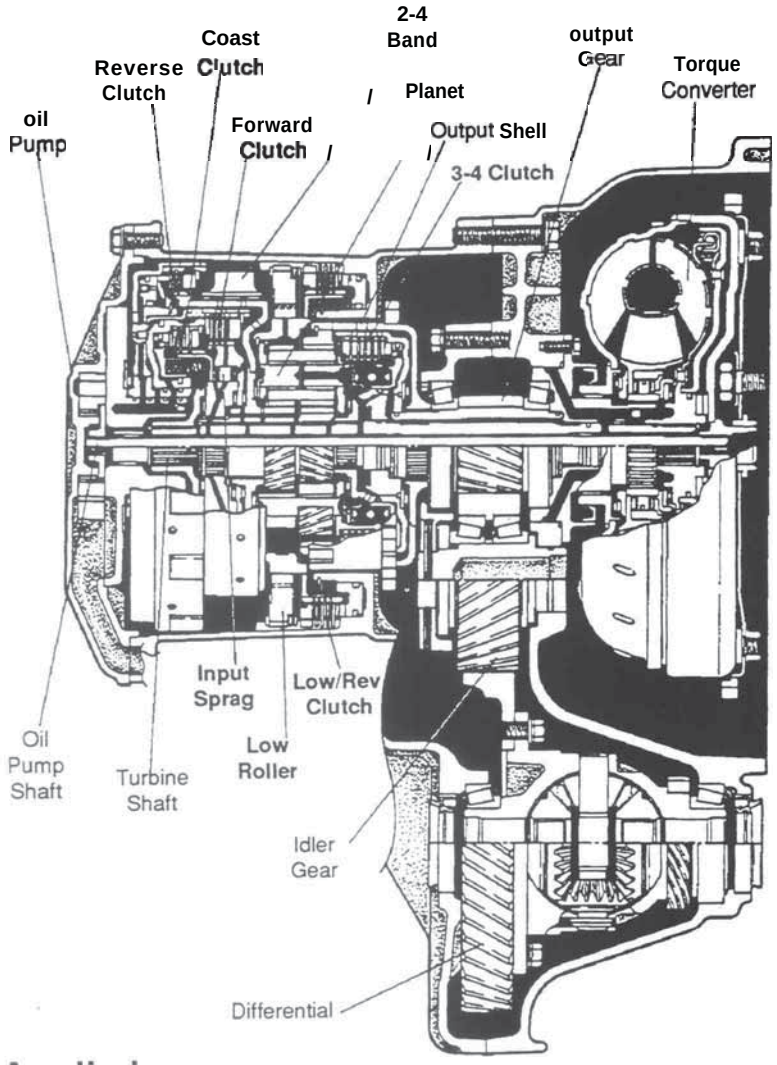
Do not use silicone to seal the case halves. Use an anaerobic sealer like Locktite518 Gasket Eliminator.

Silicone can contaminate the valve body and it tends to keep the case halves slightly separated which can affect differential bearing preload.



The case halves and the 2-3 accumulator are sealed with rubber O-rings. Always replace them.

Clutch and Band Application Chart All Units



▒ Applied

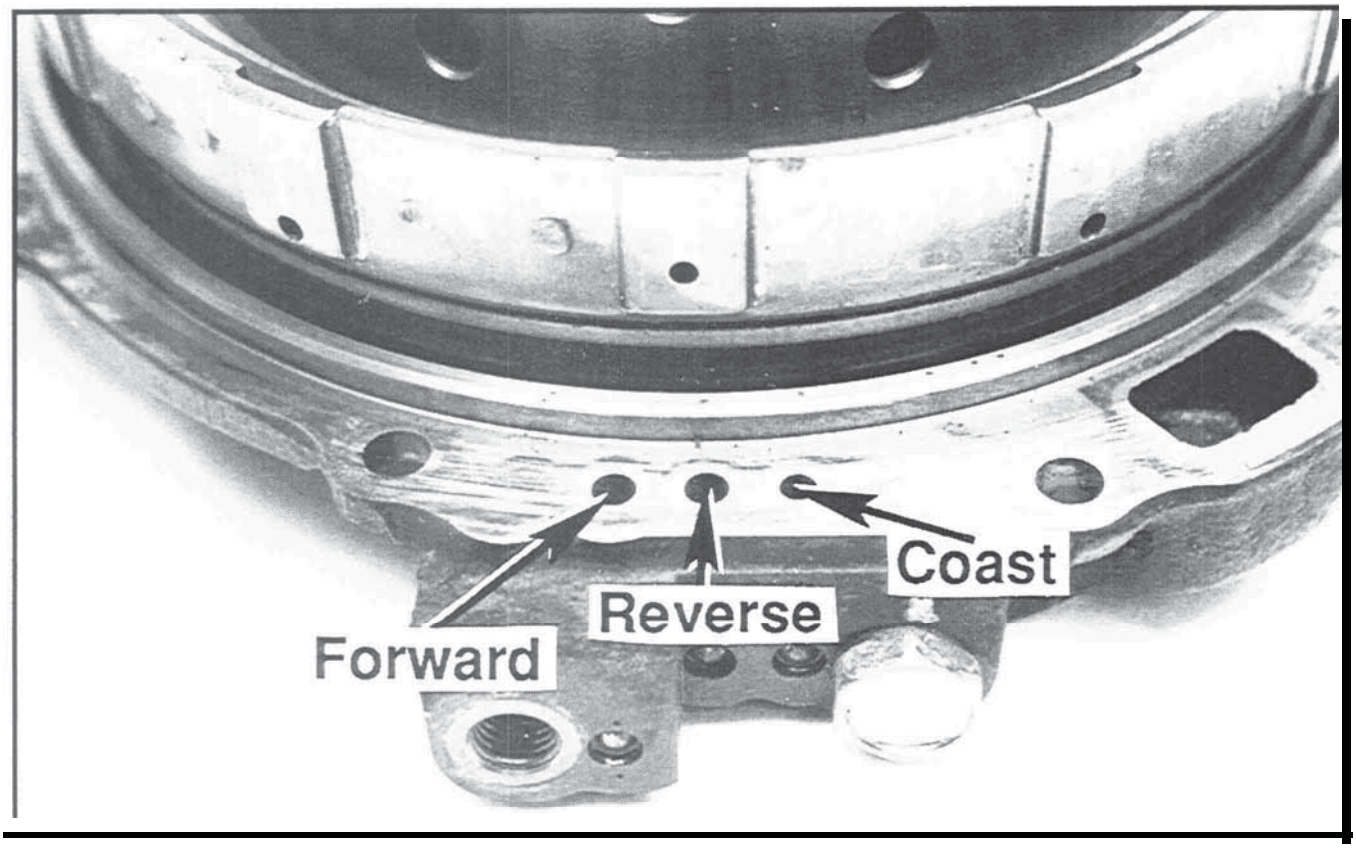
Gear Range		Forward Clutch	Coast Clutch	3-4 Clutch	Reverse Clutch	Low/Rev. Clutch	2-4 Band	Input Sprag	Low Roller
Reverse					▒	▒			
D	1st	▒						▒	▒
	2nd	▒					▒	▒	
	3rd	▒	▒	▒				▒	
	4th	▒		▒			▒		
2	2nd	▒	▒				▒	▒	
	3rd	▒	▒	▒				▒	
1	1st	▒	▒			▒		▒	
	2nd	▒	▒				▒	▒	

Quick Reference Application Chart All Units

Gear Range		Clutches On	Band On	Sprag On
Reverse		REV., L/R		
D	1st	FWD		Input/Low
	2nd	FWD	2-4	Input
	3rd	FWD. 3-4.Coast		Input
	4th	FWD. 3-4	2-4	
2	2nd	FWD, Coast	2-4	Input
	3rd	FWD, Coast,3-4		Input
1	1st	FWD. Coast		Input
	2nd	FWD, Coast	2-4	Input

NOTE This layout is easy to use during a roadtest.

Input Drum Air Check All Units

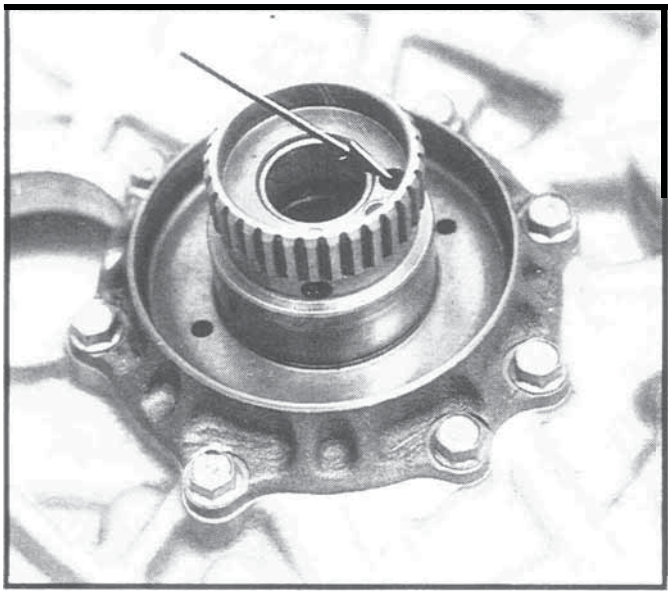


Air check the input drum like this:

1. Squirt oil into an apply passage.
2. Blow low pressure air into the apply passage.
3. Listen for a good solid air check.

NOTE **If you have put an orifice in the reverse input piston, you will hear an air leak from the orifice. This is normal—but the clutch should still apply quickly. (For "orifice" installation see "Input Drum Mods" page 51).**

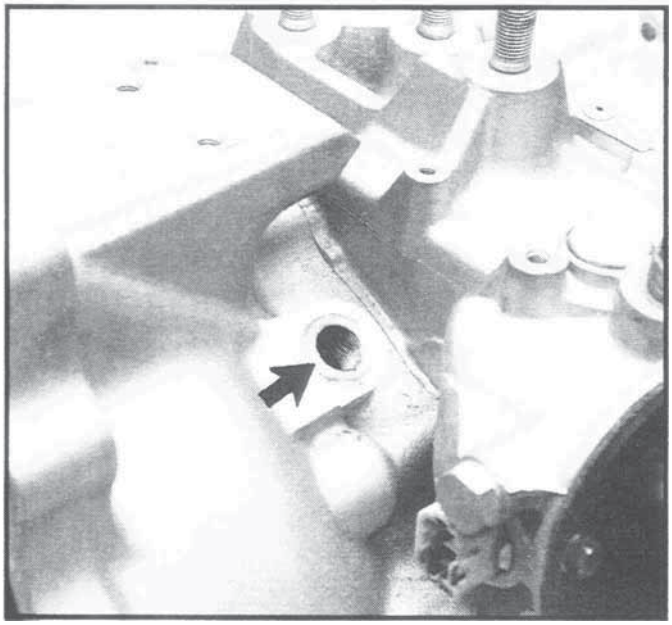
Stator Air Check All Units



If the unit had a lot of metal or friction material, air check the stator.

Here's how to check the cooler passage in the stator for blockage:

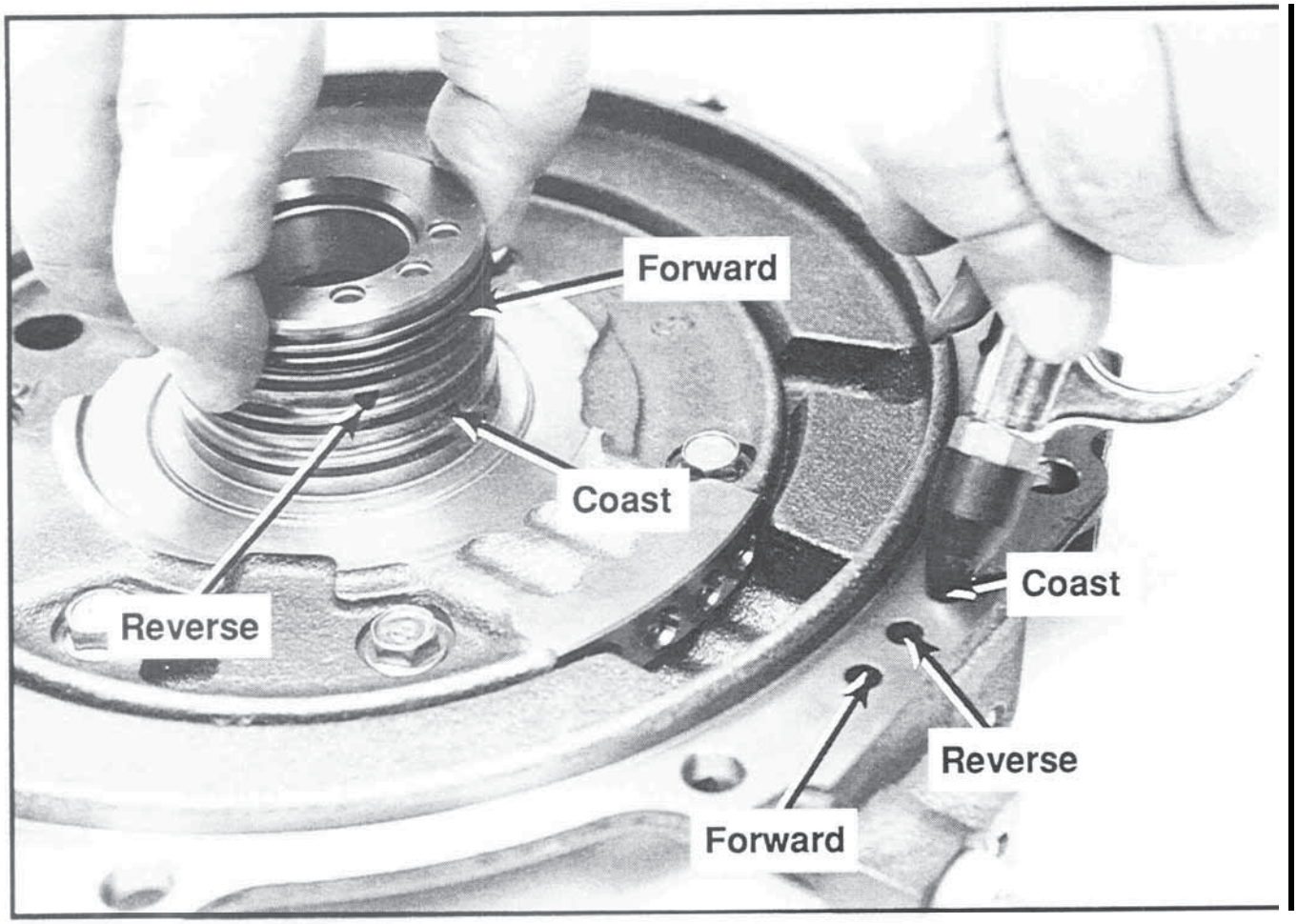
Blow low pressure air into hole shown in picture.



Air must come out at front cooling line in picture.

If air does not come out, you have a blockage in the stator. Clear the passage or replace the stator.

Pump Air Check All Units



Here's how to check the pump for cross leaks:

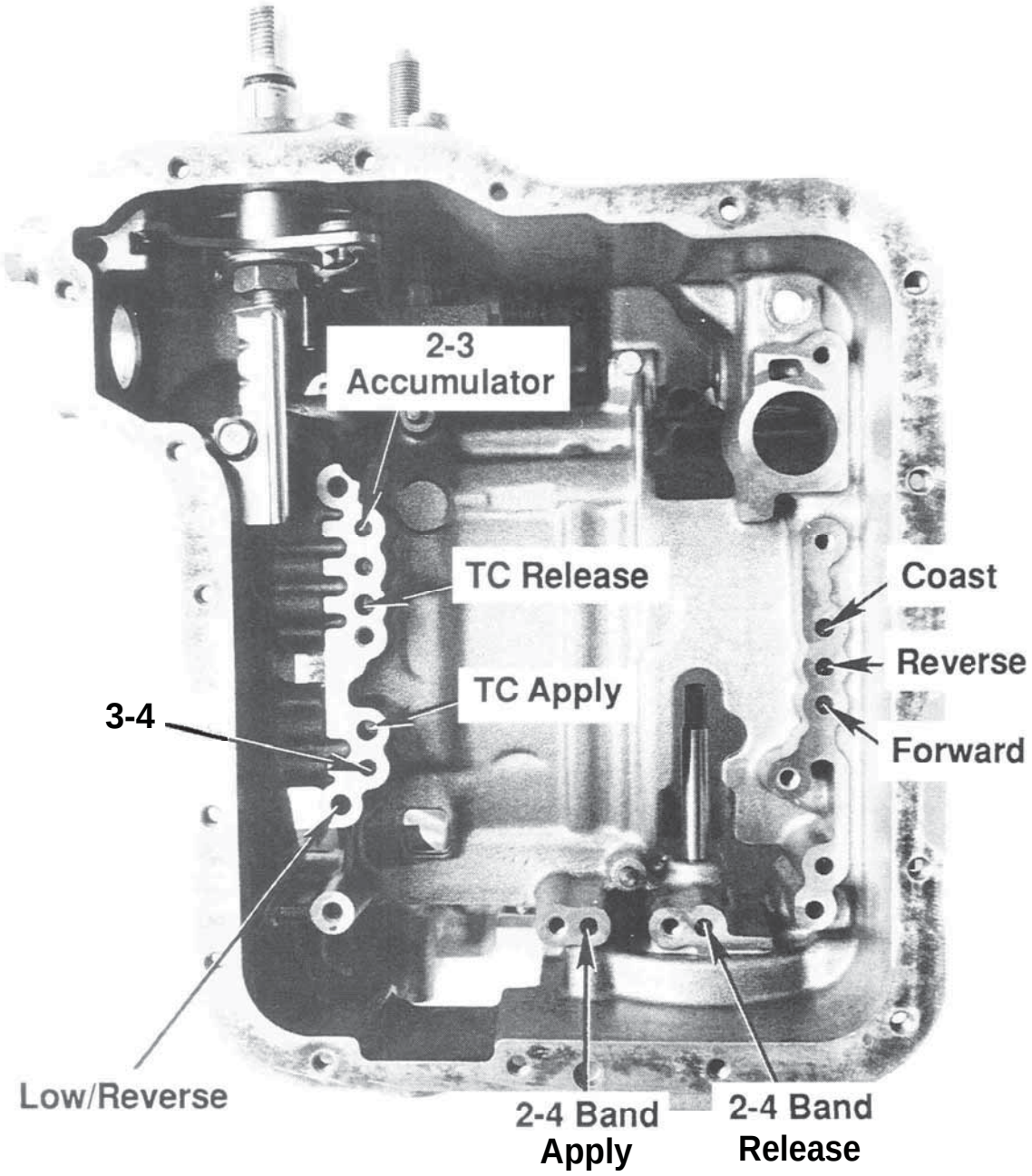
1. Use a rubber O-ring to block the clutch feed hole between the sealing rings.
2. Squirt oil into an apply passage.
3. Blow low pressure air into one of the apply holes.
5. Listen for a cross leak. Feel for air coming out of one of the other apply holes.

Crossleaks can be caused by:

Leaks around the 4 rubber O-rings in the pump. (See "Pump" section page 32).

Pump cover is warped or torqued wrong (See "Pump" section page 31).

Case Air Check All Units

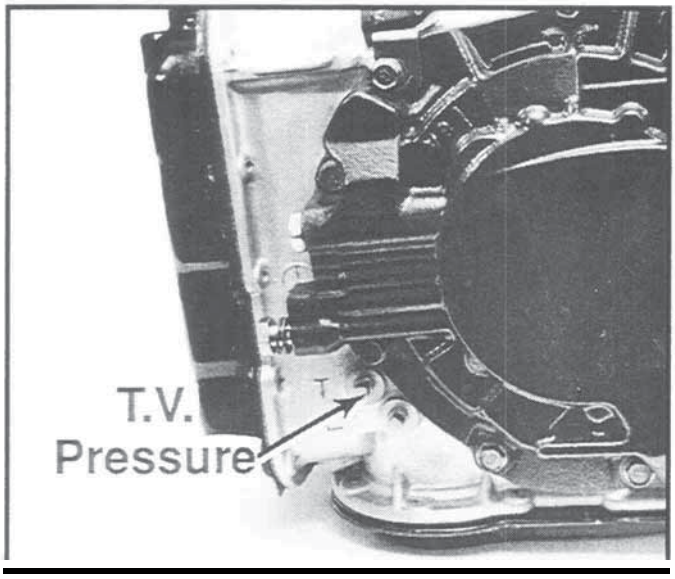


Air check case like this:

1. Squirt oil into an apply passage.
2. Blow low pressure air into the apply passage.
3. Listen for a good solid air check.

NOTE **If you have put an orifice in the reverse input piston, you will hear an air leak from the orifice. This is normal—but the clutch should still apply quickly. (For "orifice" installation see "Input Drum Mods" page 51).**

Pressure Checks All Units



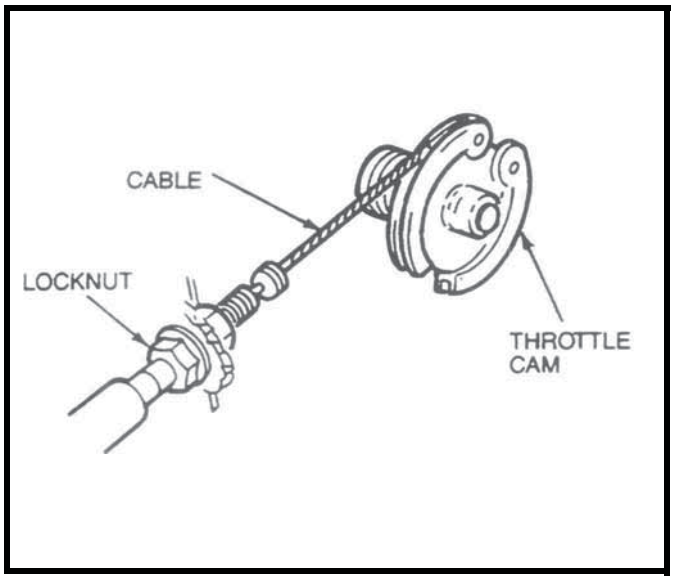
T.V. Pressure-G4A-EL &HL

Must always be adjusted.

IMPORTANT **Don't skip this step if you want your unit to work right and not come back.**

USE A PRESSURE GAUGE!

TV Pressure	Drive
Idle, hot	6-13 psi
Stall, hot	65-85 psi

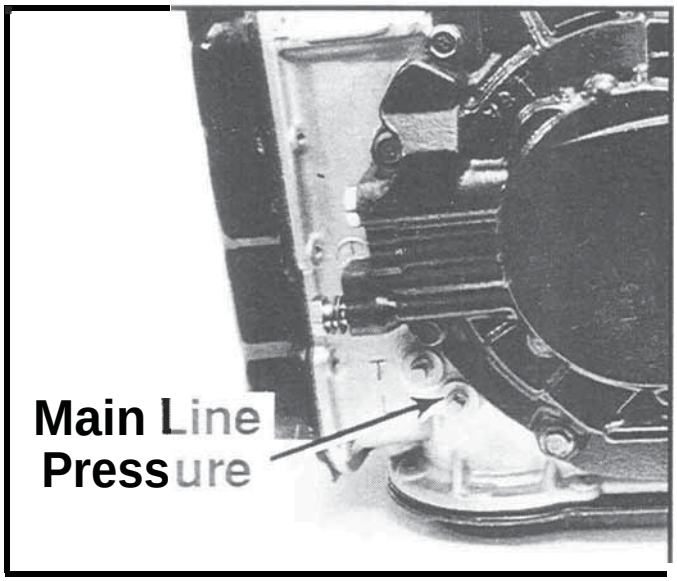


T.V. Pressure should be 13 psi in Drive at idle.

Here's how to adjust TV pressure:

1. Connect a 0-100 psi gauge to the T.V. pressure tap.
2. Start the engine, and run until it's hot.
3. Loosen the lock nuts on the T.V. cable.
4. Push the cable into raise pressure. Pull it out to lower the pressure.
5. Don't remove pressure gauge.
6. Drive the car and make sure the T.V. pressure rises.

Pressure Checks **All** Units continued



Main Line Pressure G4A-EL &HL

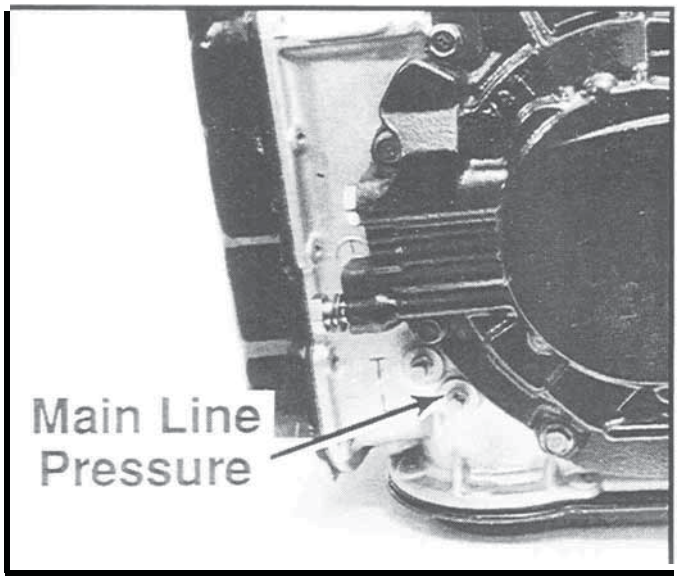
If T.V. pressure is right, main line pressure should be right.

If main line is low and T.V. pressure is right, you may have a problem with the filter, P.R. or slide regulator valve, or pump.

If main line is high, check for stuck P.R. or T.V. boost valve or wrong VB gaskets.

G4A-EL & HL Mainline Pressure Chart

Line Pressure	D, 2, L	Reverse
Idle, hot	47-71 psi	87-137 psi
Stall, hot	127-151 psi	242-292 psi



Main Line Pressure G4A-FEL

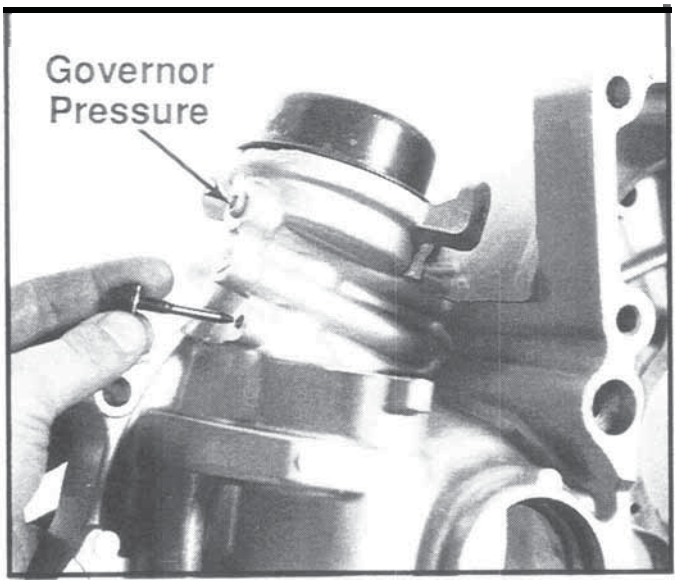
If main line is low you may have a problem with the filter, P.R. or slide regulator valve, or pump.

If main line is high, check for stuck P.R. boost valve or bad EPC solenoid. Also check for no voltage to EPC solenoid.

G4A-FEL Mainline Pressure Chart

Line Pressure	D, 2, L	Reverse
Idle, hot	60-78 psi	110-146 psi
Stall, hot	160-170 psi	276-294 psi

HL Governor Pressure Check



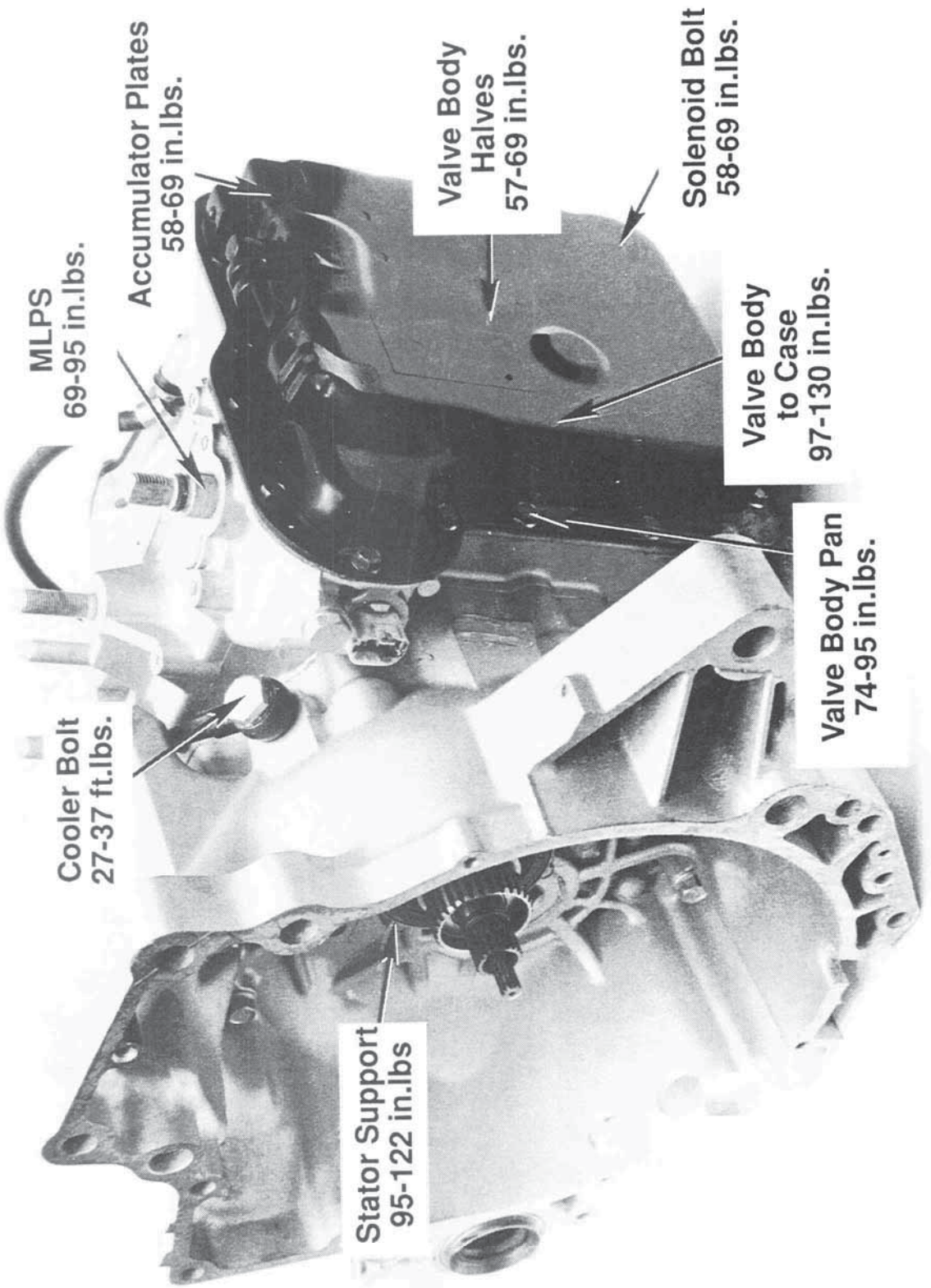
Governor Pressure should be about 1 psi for every 1 mph.

For example, at 30 mph you should have about 30 psi of governor pressure.

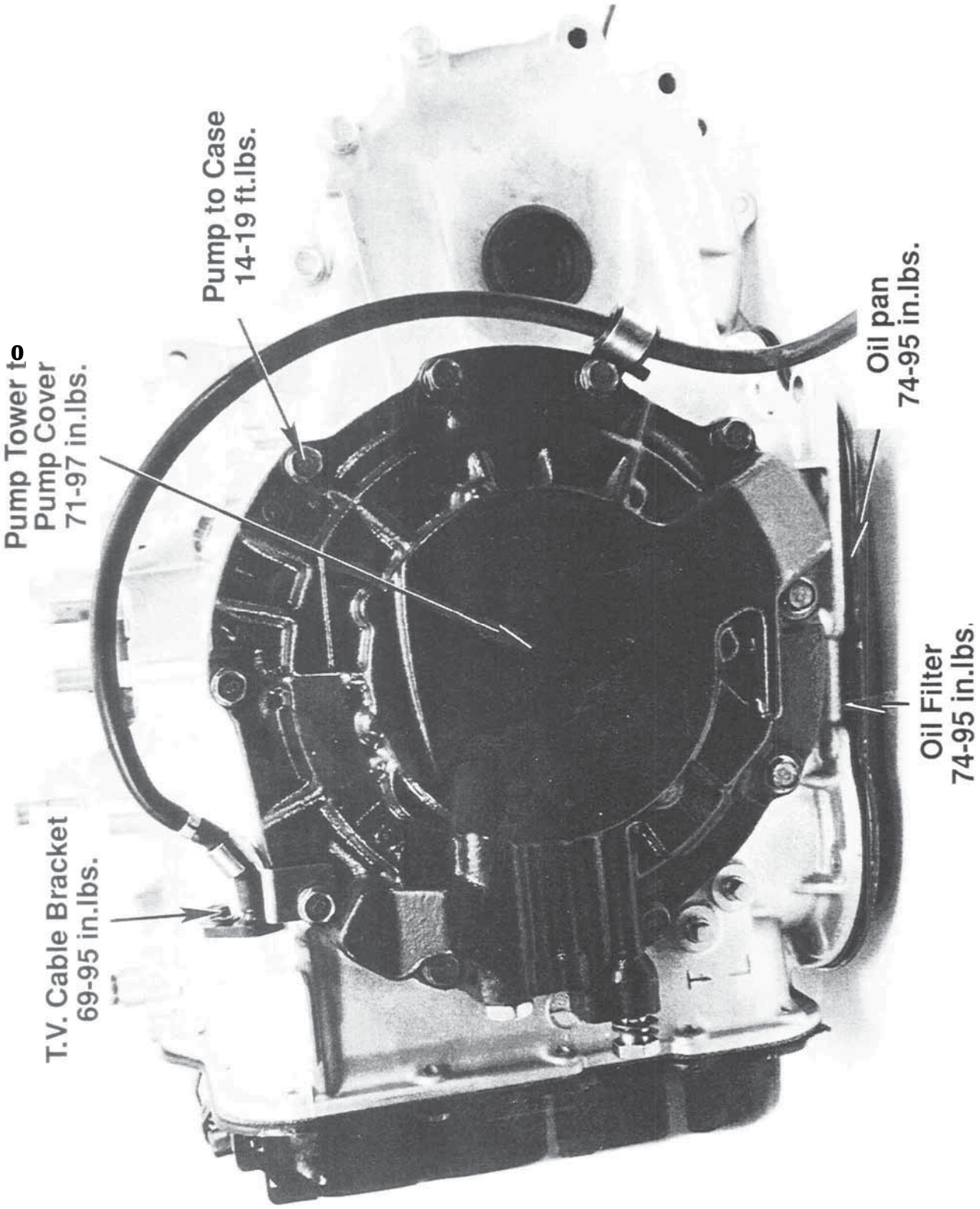
Notes:

Notes:

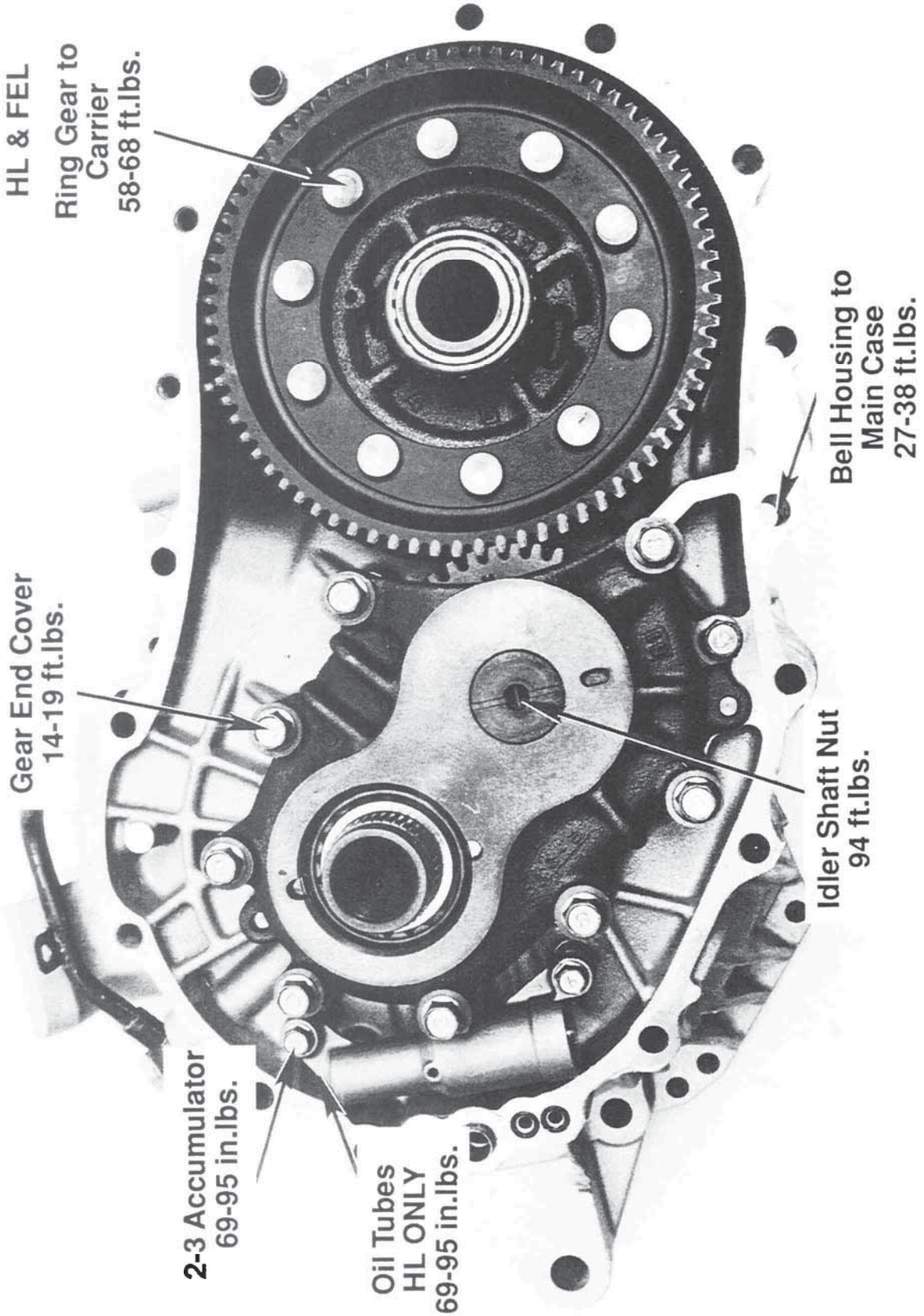
Torque Specifications All Units



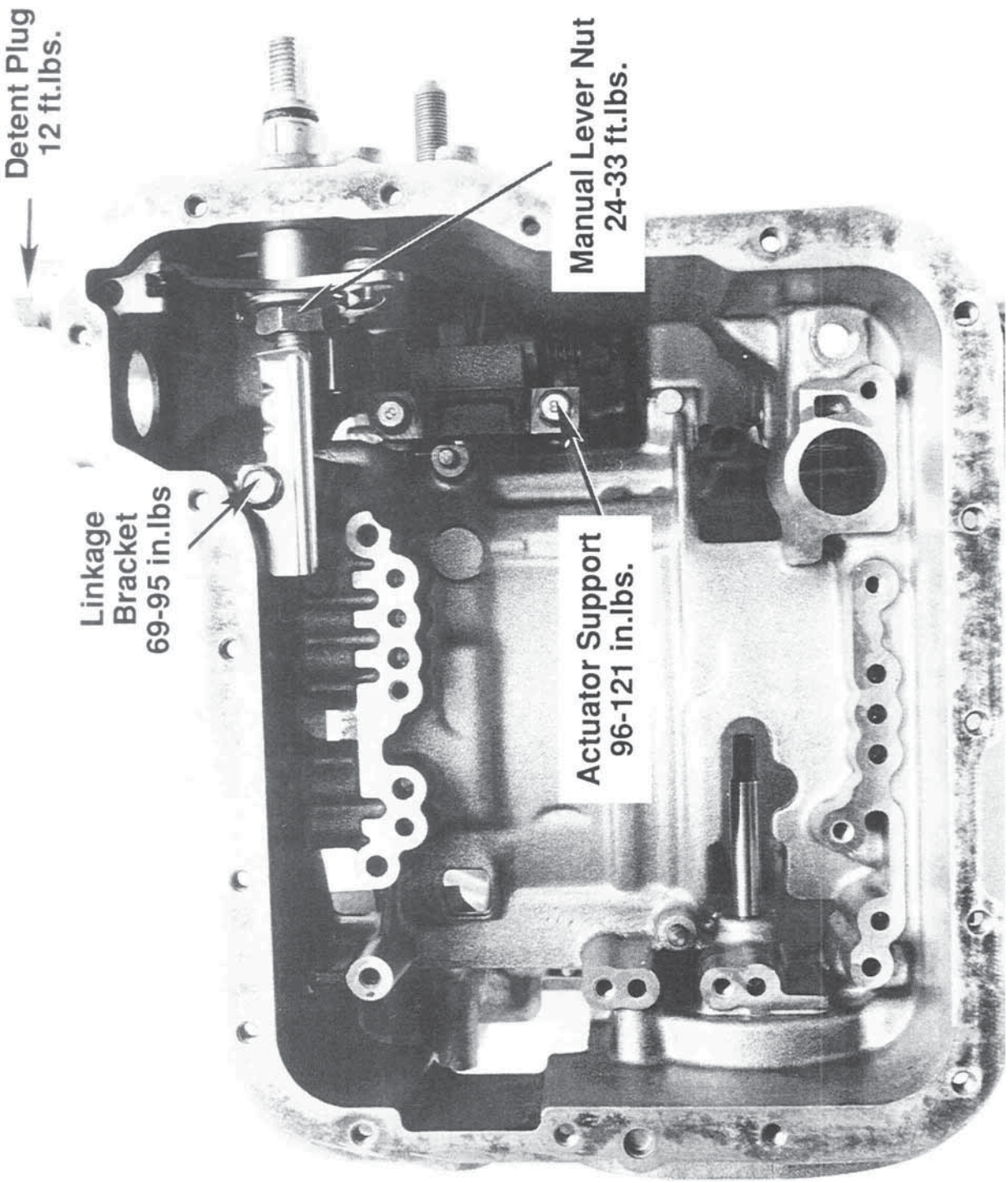
Torque Specifications **All Units** continued



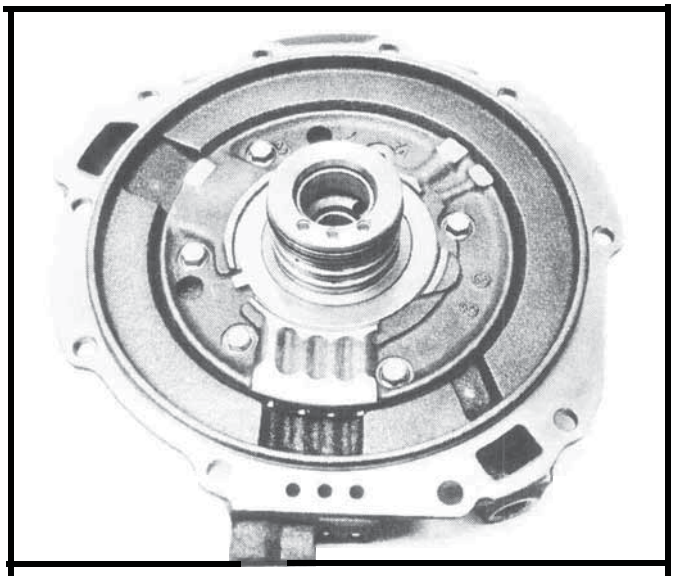
Torque Specifications **All Units** continued



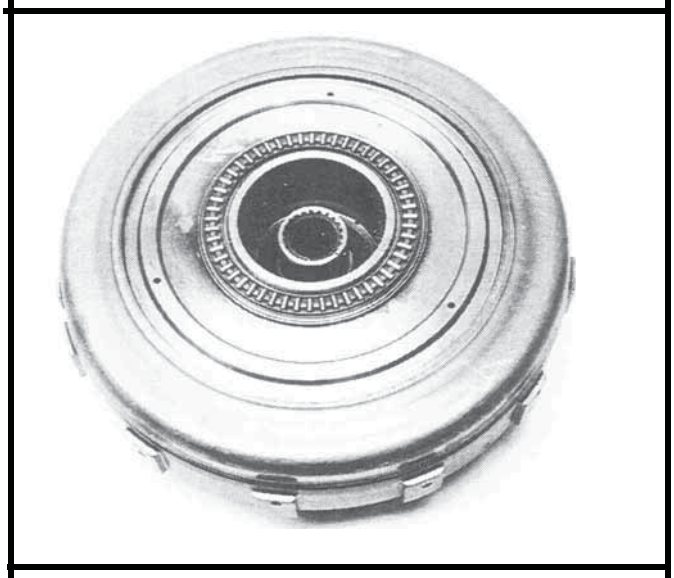
Torque Specifications All Units continued



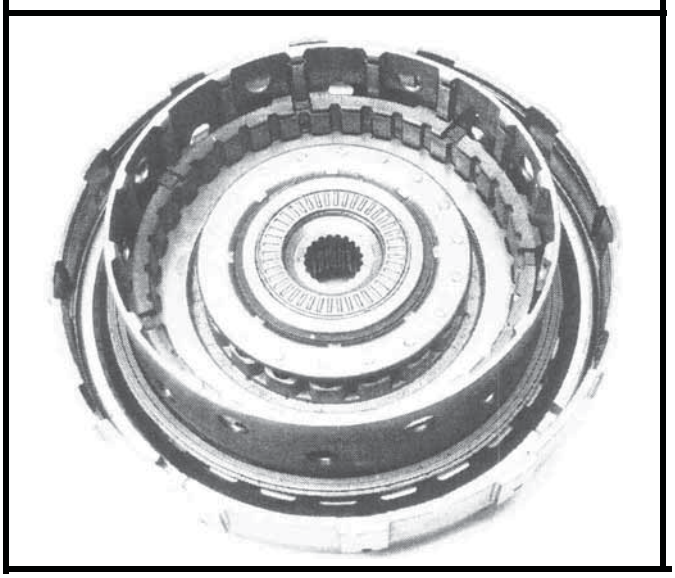
Thrust Washer & Needle Bearing Location



Oil Pump Selective Thrust Washer

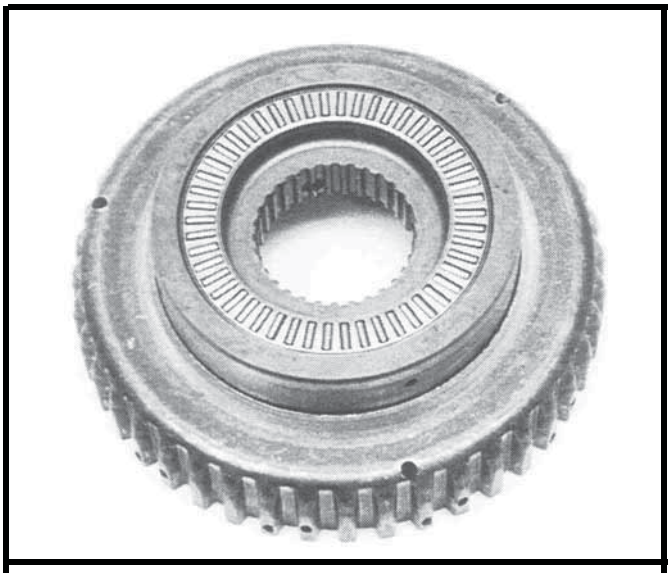


Input Drum Needle Bearing

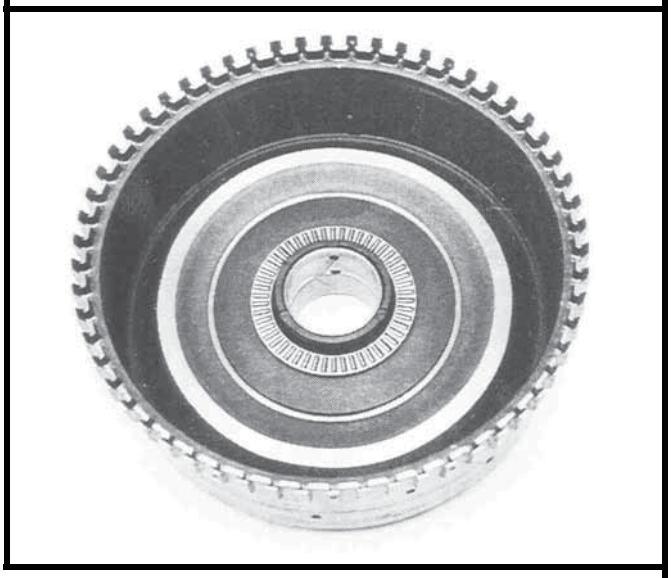


Input Clutch Needle Bearing

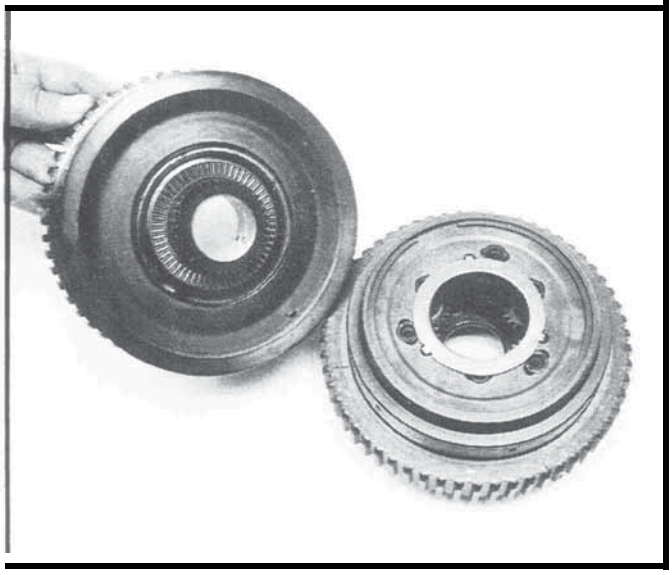
Thrust Washer & Needle Bearing Location continued



Input Sprag Inner Race Needle Bearing



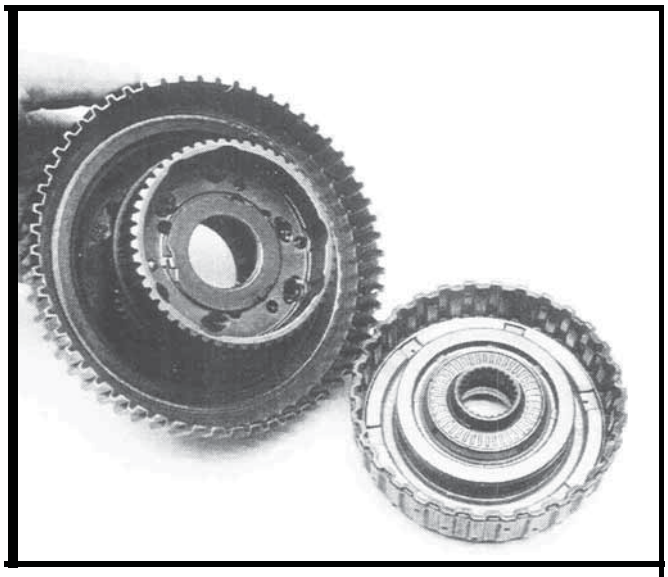
Input Sprag Outer Race Needle Bearing



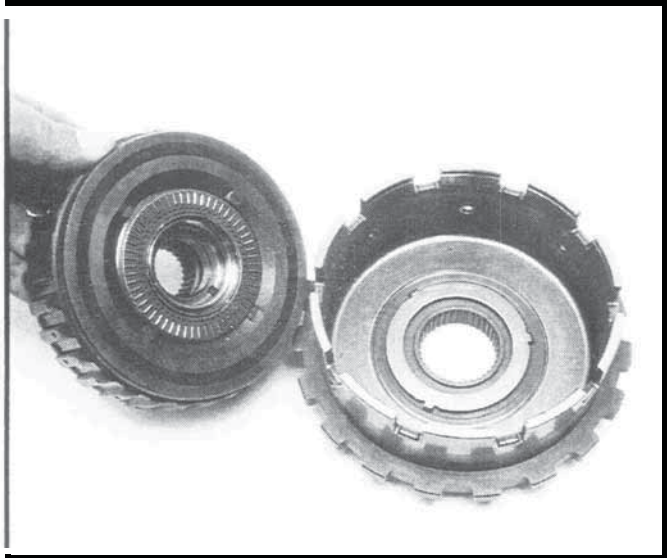
2-4 **Drum Needle Bearing**

Planetary Front Thrust Washer

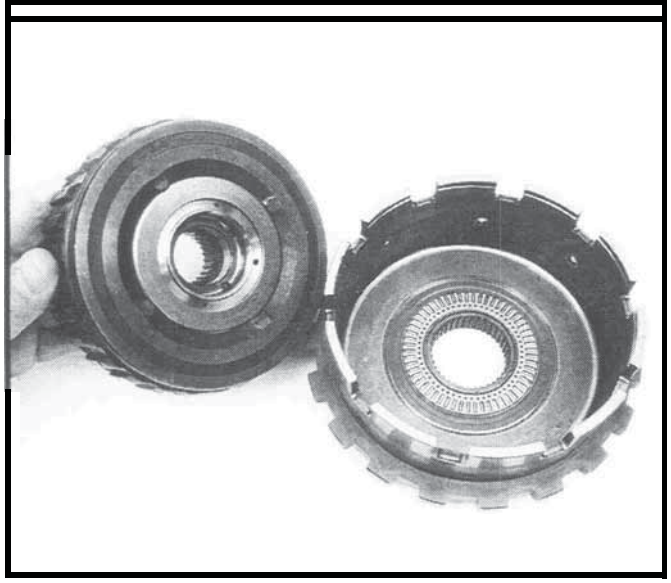
Thrust Washer **& Needle** Bearing Location continued



Rear Planetary Thrust Washer
3-4 Clutch Needle Bearing



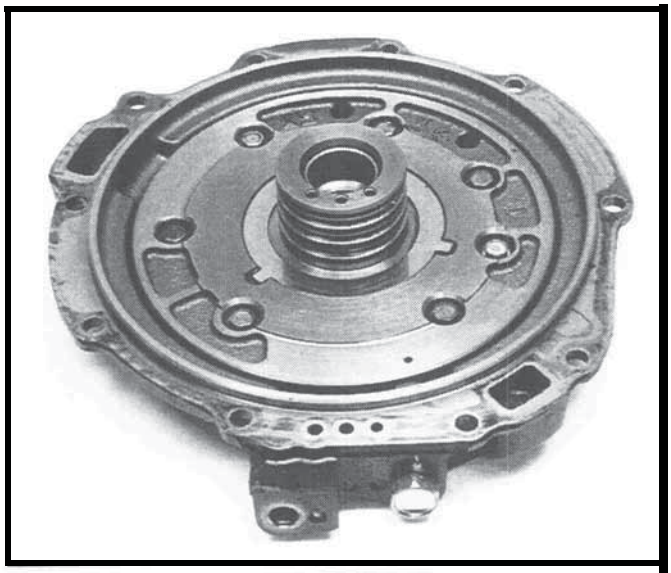
1987-92 G4A-EL & HL
3-4 Drum Needle Bearing
Rear Ring Gear Thrust Washer



1993-UP G4A-FEL
3-4 Drum Thrust Washer
Rear Ring Gear Needle Bearing

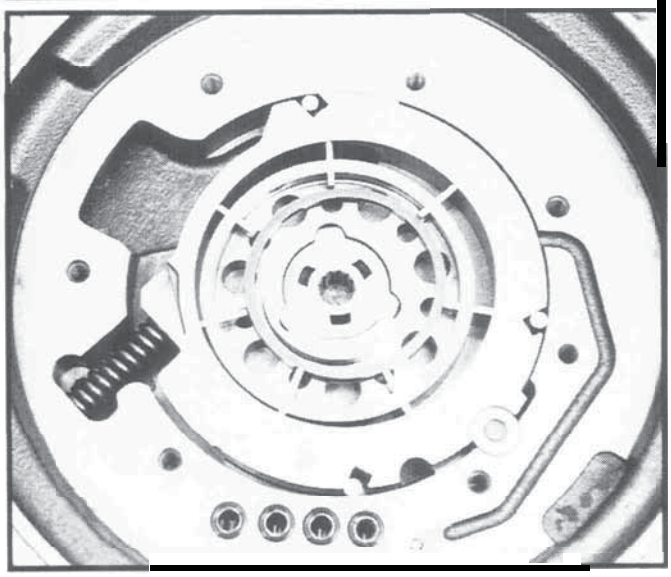
Notes:

EL & HL Pump Disassembly

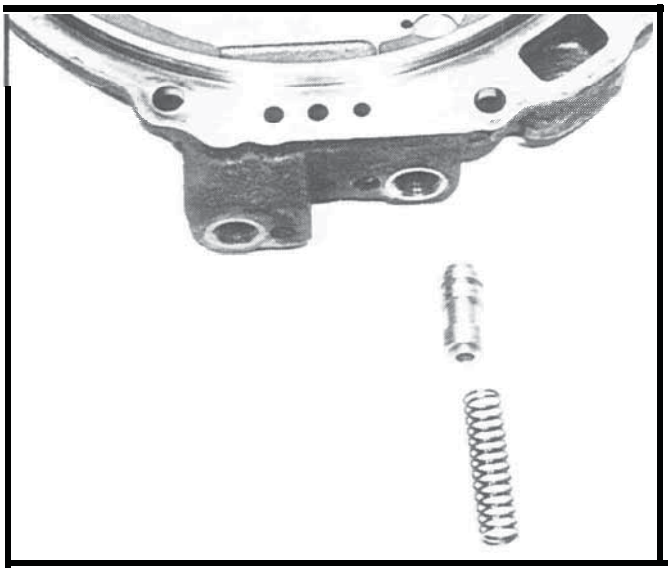


Here's how to disassemble the pump without losing parts.

1. Remove the seven 10mm bolts.
2. Gently tap the ring tower with a wooden or rubber hammer handle.
3. Carefully lift the cover off.



4. This is what you will see.



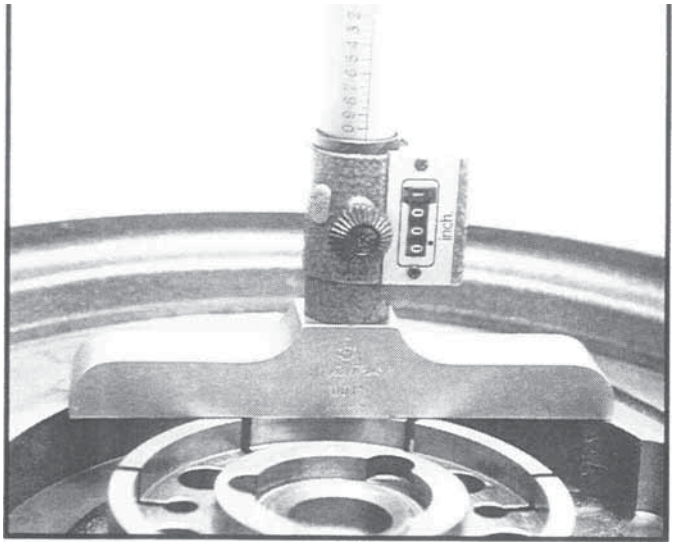
IMPORTANT

Prevent low line pressure! ALWAYS remove the slide regulator valve before you clean the pump.

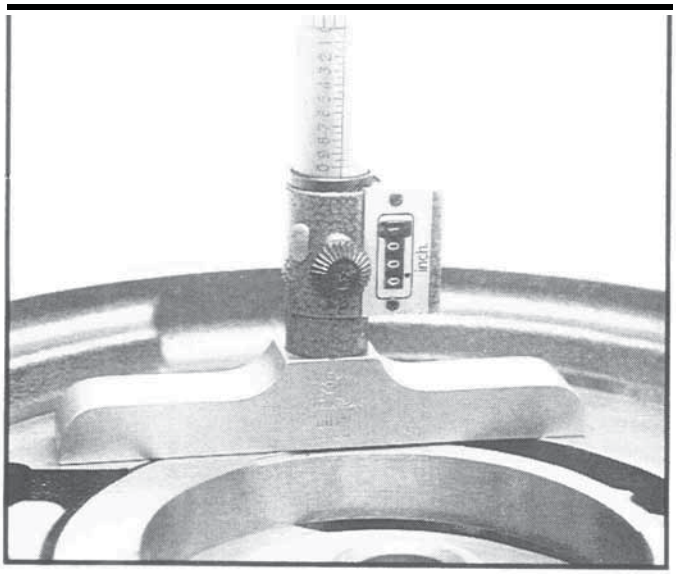
EL & HL Pump Clearance

IMPORTANT **Don't skip this part if you want this unit to work right and not come back.**

CHECK PUMP CLEARANCE!



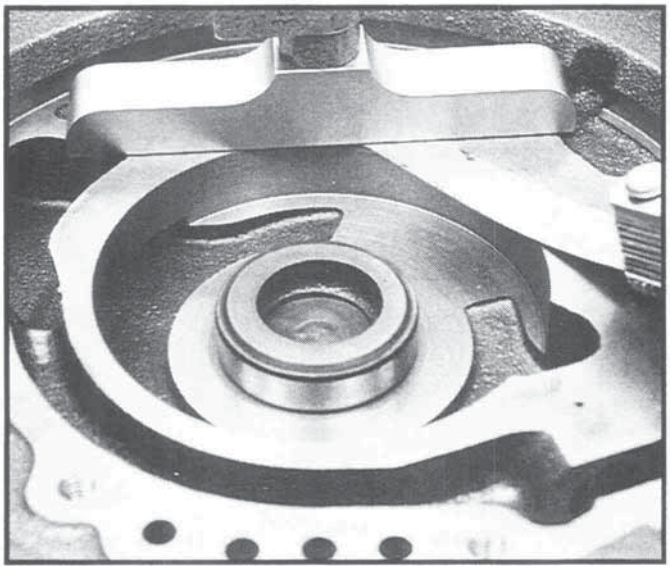
Check the rotor side clearance. The rotor must turn freely when the pump is assembled but the clearance must be tight. No more than 1 ½ thousandths.



Check the slide side clearance. The slide must move freely when the pump is assembled but the clearance must be tight. No more than 3 thousandths.

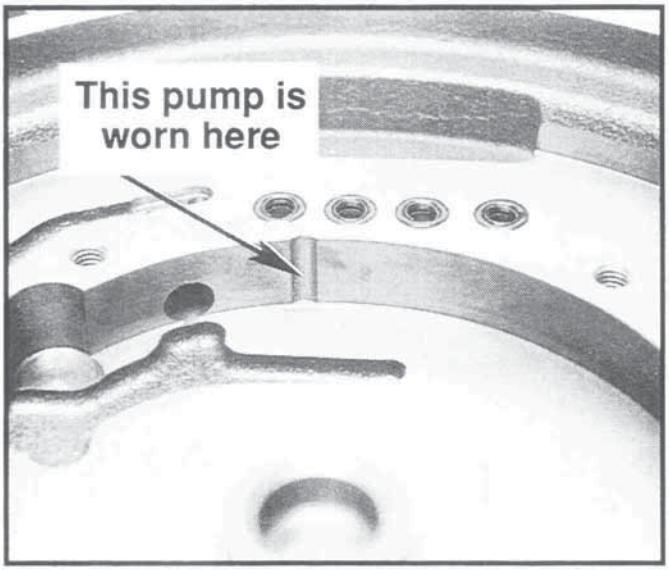
NOTE **The factory wants this pump to be tight.**

EL & HL Pump Clearance continued



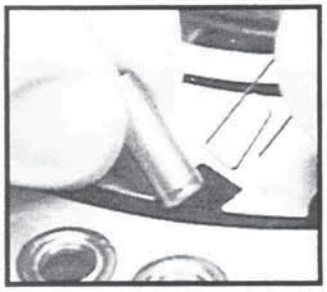
Check the pump body for warpage. The body should be as flat as possible.

Use a straight edge-maximum aHowed warp is .0015“ (1 ½ thousandths).



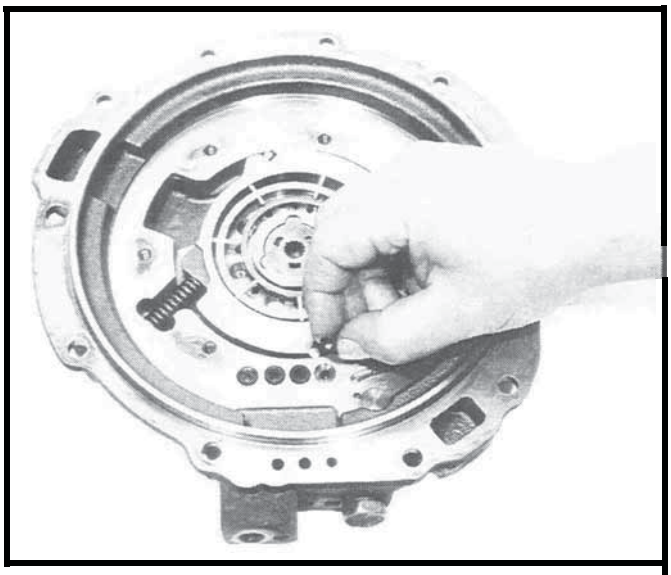
Look at the slide rollers. Make sure there are no flat spots on them. Look at the pump pocket where the rollers ride. If the pocket is worn, replace the pump body.

If the rollers are worn, the pump will be bad.



IMPORTANT Reusing a worn pump will cause this unit to fail real fast!

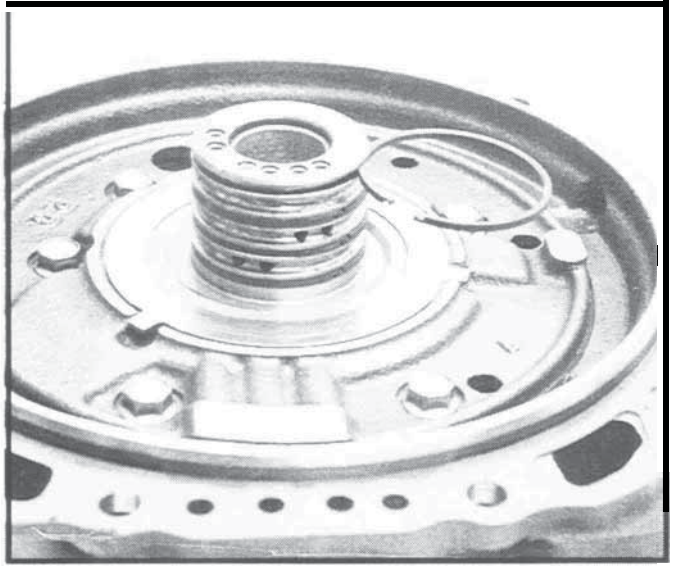
EL & HL Pump Modifications



Always replace original style O-rings and expanders with 10A-1000 (included in AAMCO Banner and Master Assembly Sets).

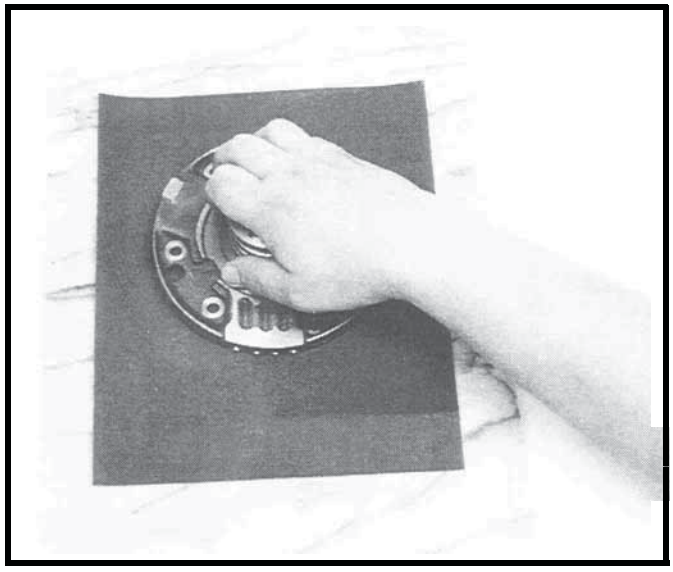
Install the seals with the steel side down.

NOTE **These seals will not fit 1987 pump bodies. use the O-rings and expanders in the kit.**



Always use metal oil control rings on the pump support. Metal rings come in the AAMCO Banner and Master Assembly Sets. Ring kit Part# 6A-9442

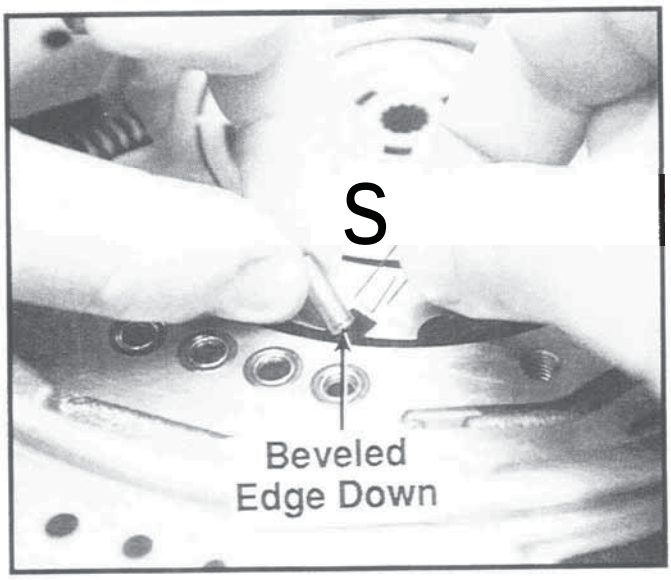
NOTE **Sand the clutch drum where the steel rings ride with 180-220 grit sandpaper.**



Always flat sand the back of the pump tower.

EL & HL Pump Assembly Tips

Here's how to get the pump back together:

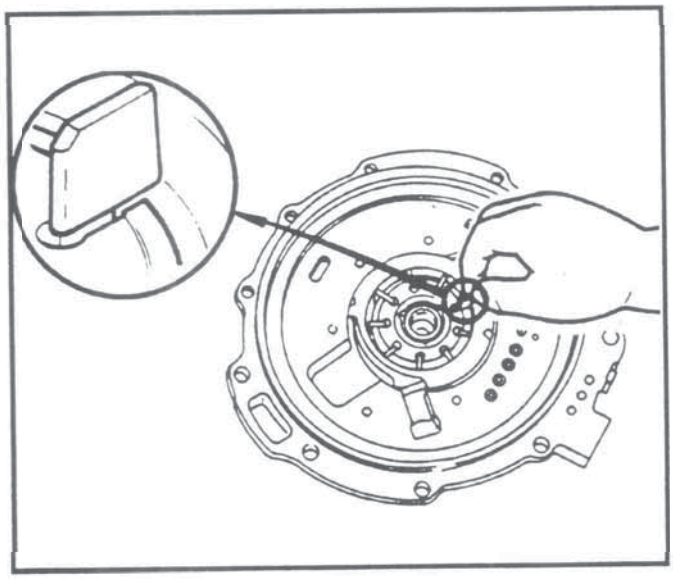


Install the slide and slide pivot.

Install the three slide rollers and tension springs.

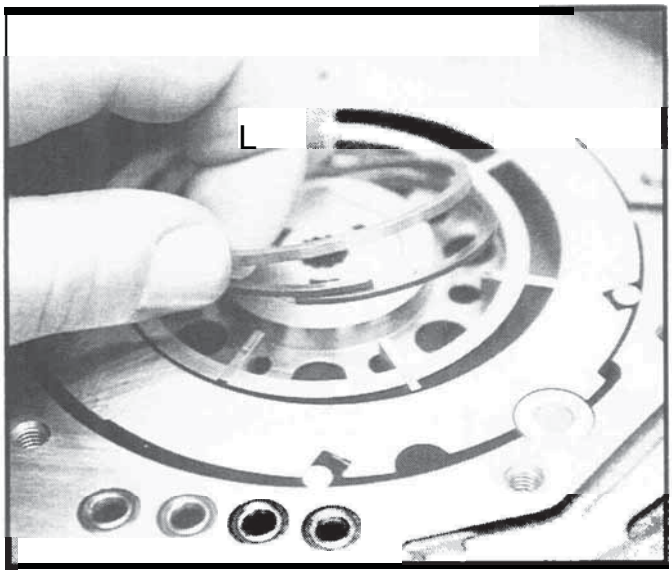
The rollers go in beveled edge down.

NOTE **Install the tension springs as shown.**



Install the vanes, beveled side facing the center of the rotor.

EL & HL Pump Assembly **Tips** continued



Install the split ring first and then the solid ring on top of it.

IMPORTANT **Always prelube the pump with ATF and torque to 71-97 in.lbs.!**

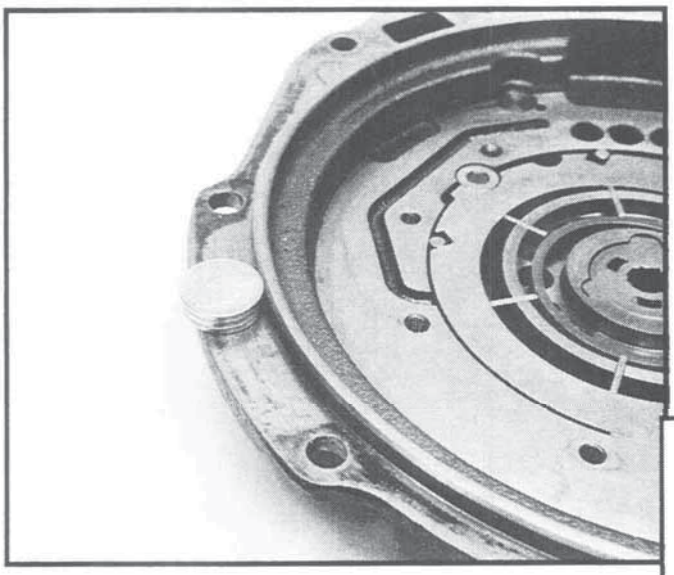
Notes:

EL & HL Body Pump ID

IMPORTANT **Pump bodies are NOT interchangeable.**

There are three different pump bodies:

1987-only
1988-1992 Non-Turbo
1988-1992 Turbo & 3.OL V6



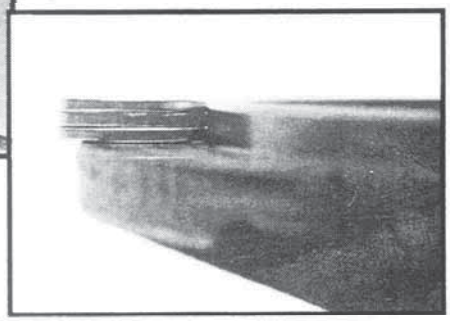
Here's how to tell if the body is early or late:

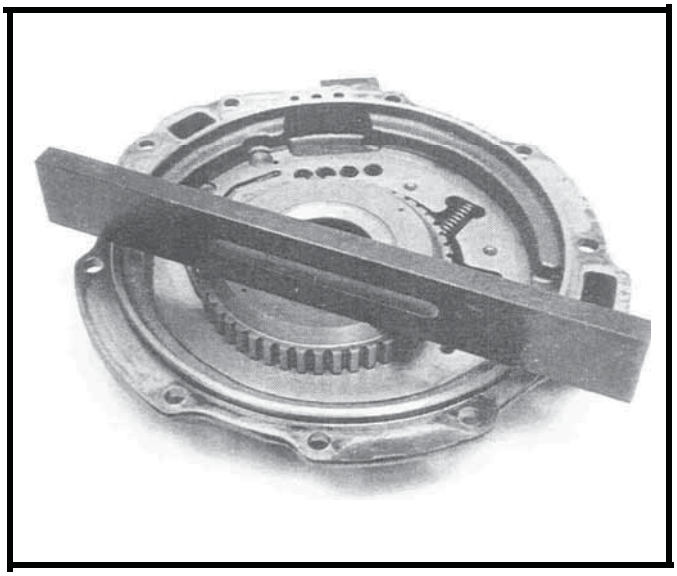
1987-only G4A-EL

Five nickels will be flush with the pump ledge.

1988-1992 **All models**

Three nickels will be flush with the pump ledge.

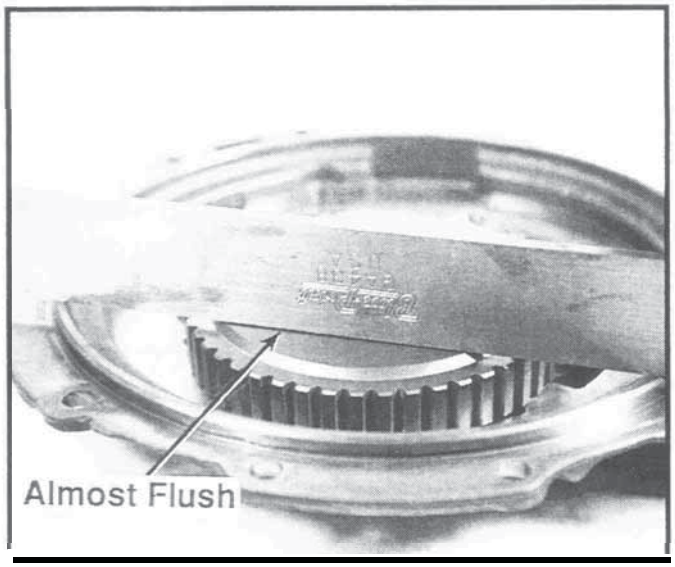




Here's how to tell if the 1988-1992 pump body is Turbo or Non-Turbo.

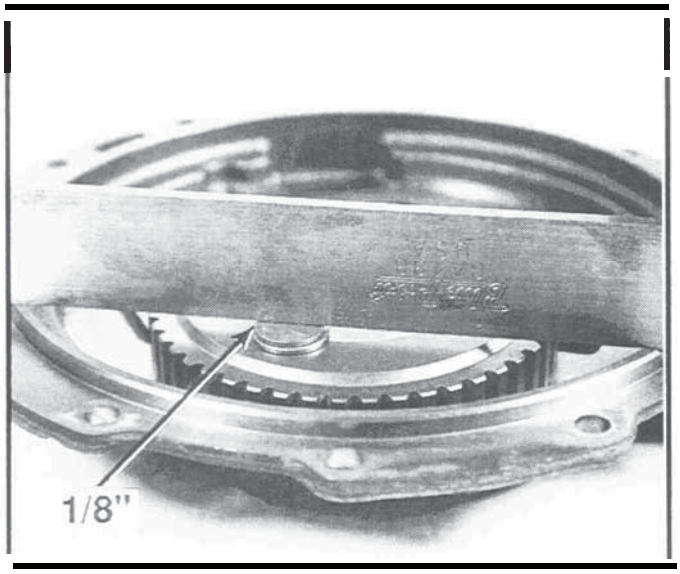
1. Use the input sprag outer race from a G4A.
2. Put the race open-side down into the pump body.
3. Lay a straight edge across the pump body and **race.**

EL & HL Pump **Body ID** continued



Non-Turbo Body

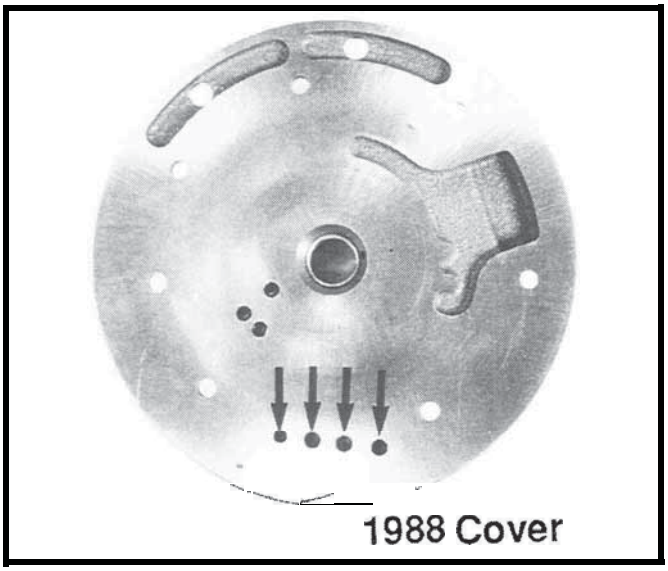
If the race is almost flush with the straight edge, it's a Non-Turbo.



Turbo& 3.OL V6 Body

If the clearance between the race and straight edge is about 1/8" (a nickel and a penny) it is a Turbo pump body.

EL & HL Pump Cover ID


1988 Cover

There are only two different pump covers:

1987-only

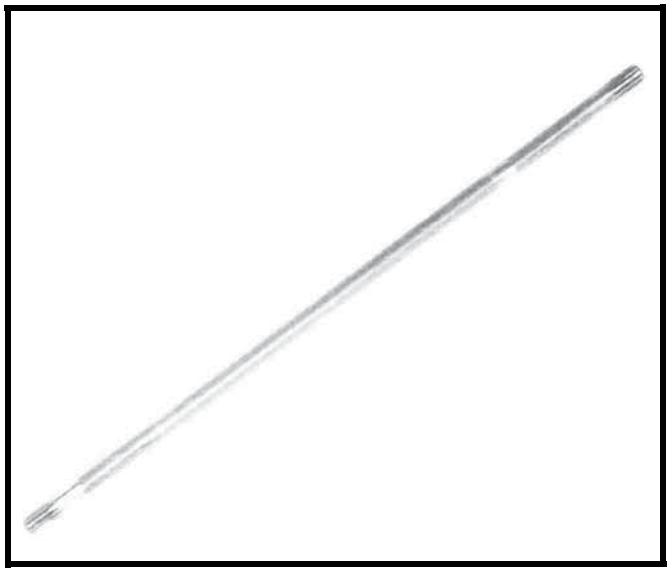
The 1987 cover is black and the four clutch feed holes are the same size.

1988-1992 EL& HL

The 1988-1992 cover is silver and has one small and three large diameter feed holes.

NOTE **All 1988-1992 EL & HL pump covers are interchangeable.**

EL & HL Pump **Driveshaft** ID



There are two different pump driveshafts.

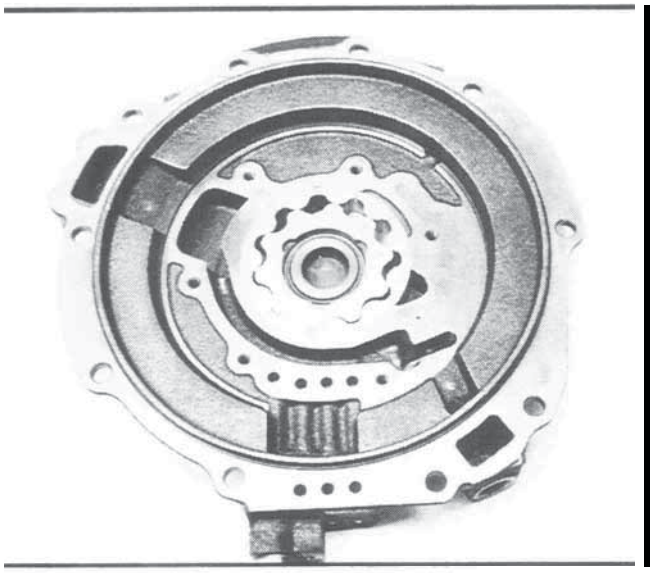
Non-turbo

145/16" long.

Turbo & 3.OL V6

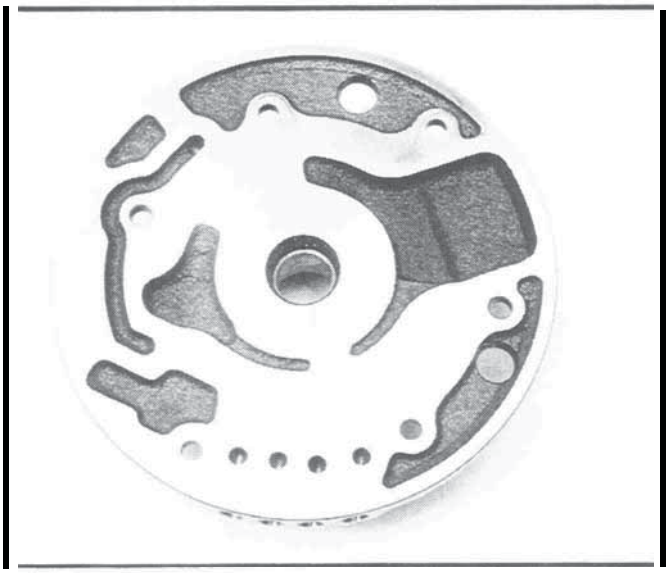
$14\frac{3}{4}$" long.

FEL Pump ID



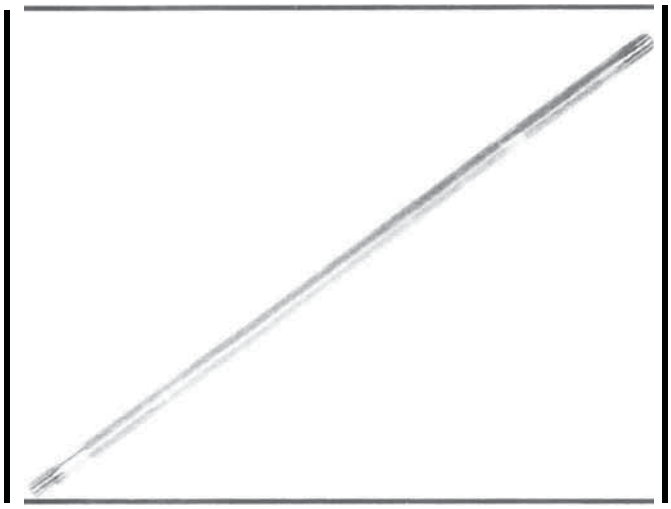
Pump Body ID is easy!

If you have a rotor type pump body, it is a G4A-FEL.



Pump Cover ID

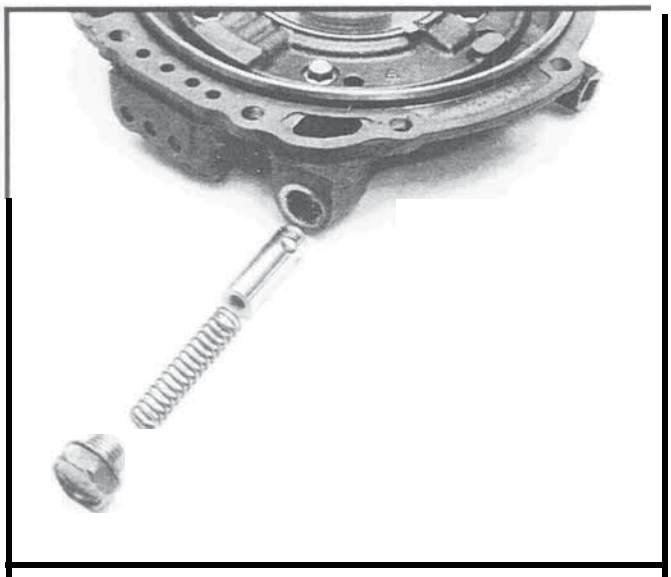
Just match back of pump cover to this picture.



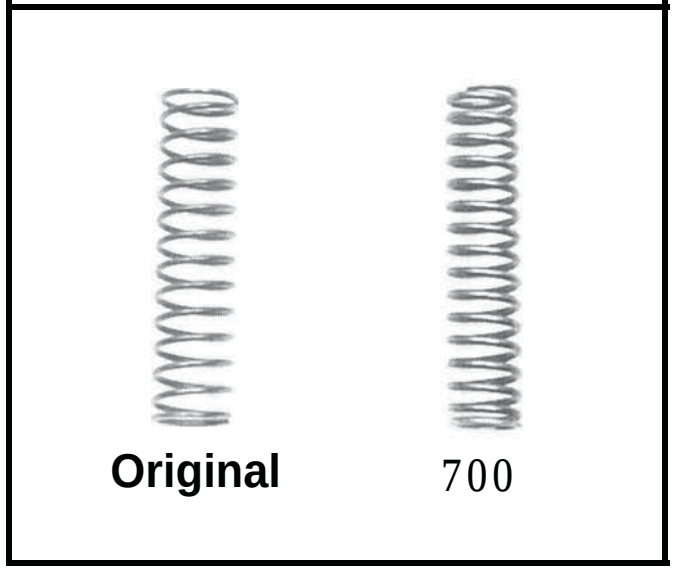
Pump Driveshaft

There is only one. **It** is 145/1; long.

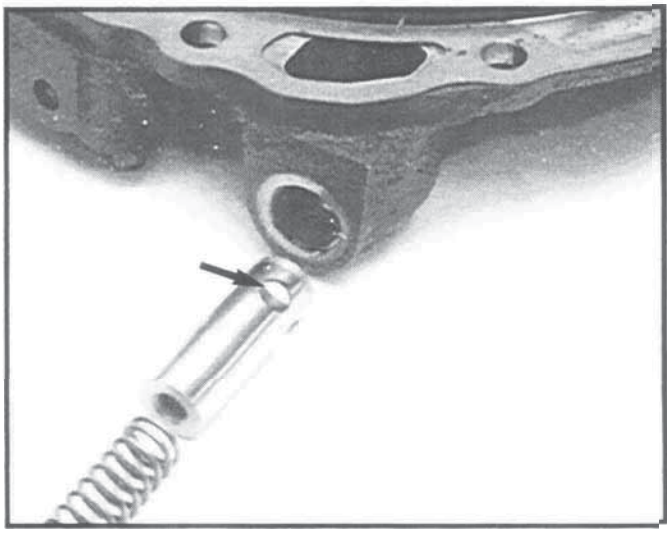
FEL Pump Modifications



1. Always remove the discharge valve and spring from the pump body **before** you put it in the cleaning machine. If it goes through the cleaner, the valve will stick and you will have line pressure problems.

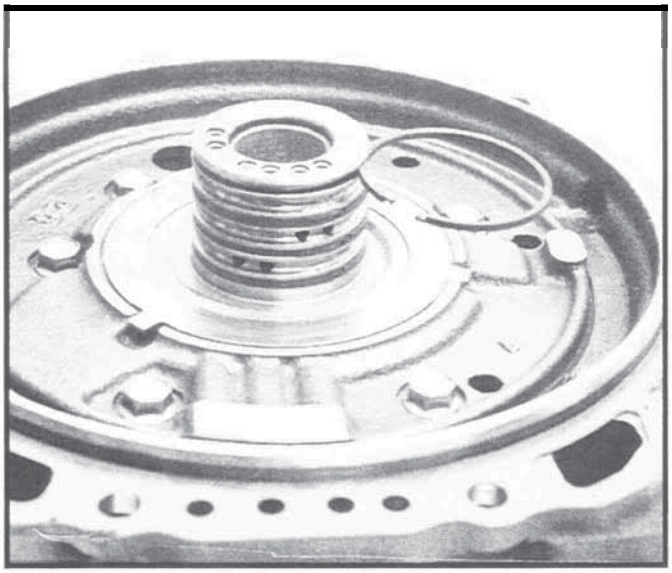


2. To avoid low pressure problems, replace the factory spring with a T.V. plunger spring from a 700. The 700 spring is stronger and will help keep the valve from sticking in a low pressure position.



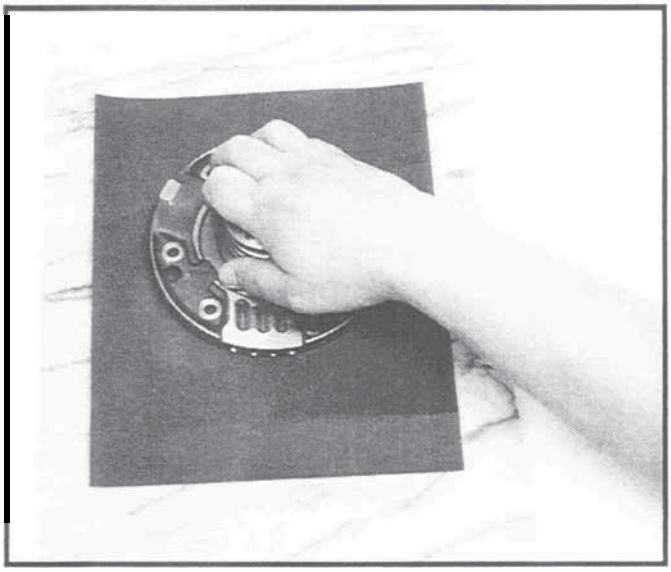
3. When you put the valve back in, the end with the 4 holes goes into the pump **first.** Make sure the valve moves freely in the bore and doesn't hang up in any way.

FEL Pump Modifications continued



4. Always use metal rings on the pump tower.

   The metal ring kit is AAMCO Part# 6A-9442.

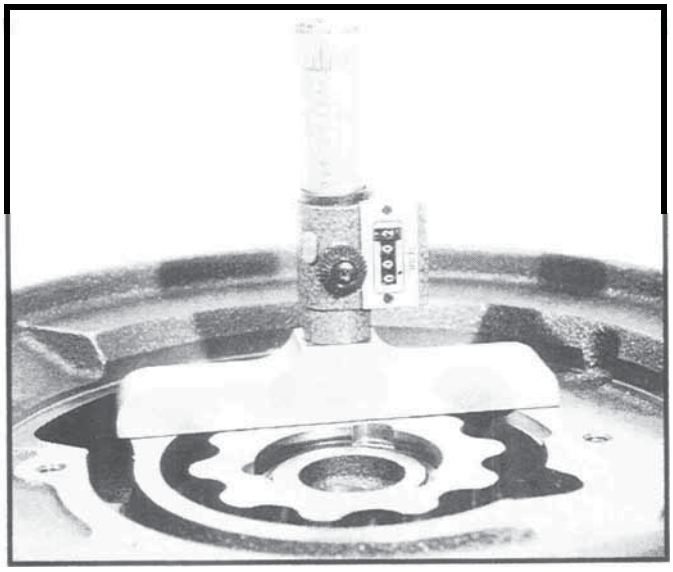


5. Always flat sand the back of the pump tower.

FEL Pump Clearance

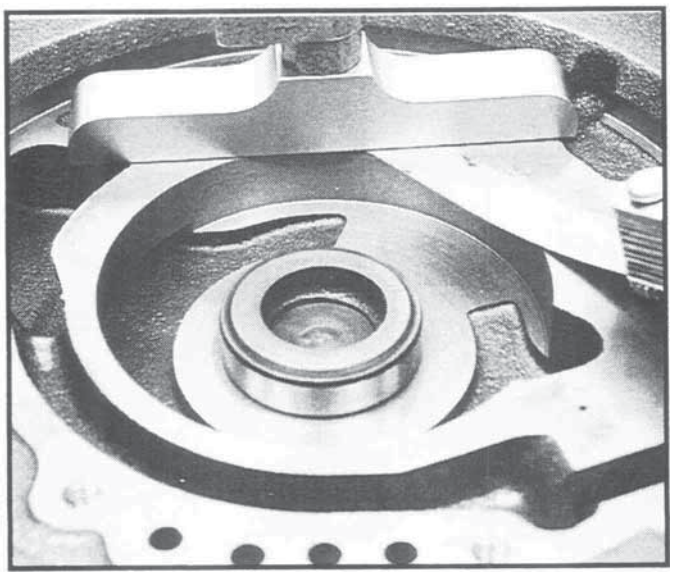
IMPORTANT **Don't skip this part if You want this unit to work right and not come back.**

CHECK PUMP CLEARANCE!



Check the inner and outer gear side clearance. The gears must turn freely when the pump is assembled but the clearance must be tight. No more than 2 thousandths.

NOTE **The factory wants this pump to be tight.**



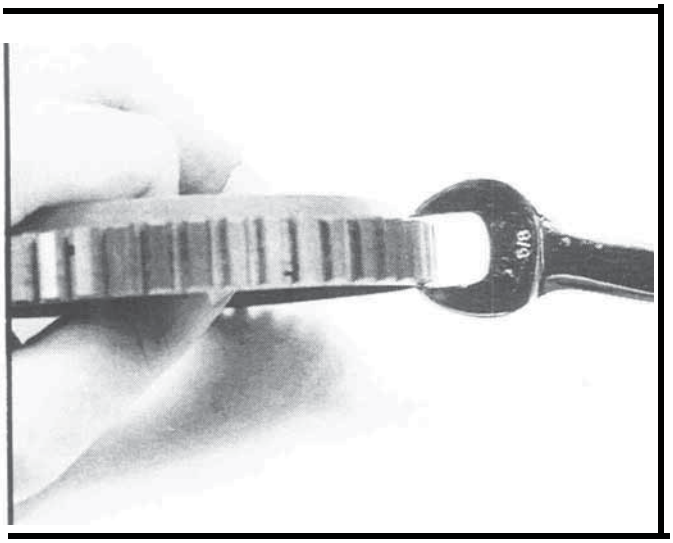
Check the pump body for warpage. The body should be as flat as possible.

Use a straight edge-Maximum allowed warp is .0015" (1 ½ thousandths).

IMPORTANT **Always prelube the pump with ATF and torque to 71-97 in.lbs.!**

Notes:

Input Sprag ID All Units

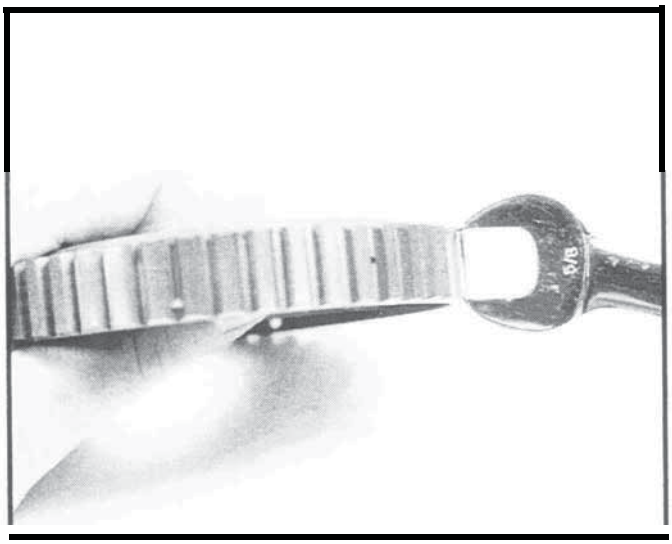


There are two different outer races. One for Turbo & 3.OL V6 and one for Non-Turbo.

The only difference is the height of the forward clutch splines. The Turbo splines are taller because the Turbo has **4** frictions.
The Non-Turbo has 3 frictions.

1987-UP All Non-Turbo

A 5/8" open end wrench will fit over forward clutch splines as shown.

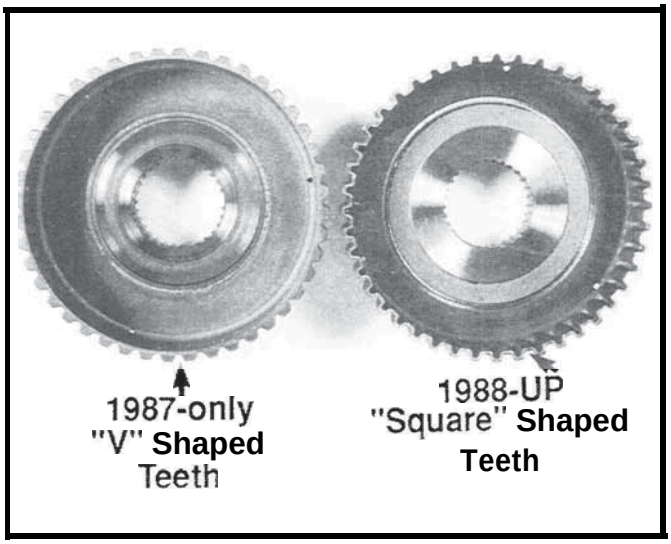


1988-92 **Turbo & 3.OL V6**

The teeth are taller.

A 5/8" wrench will NOT fit over forward clutch teeth.

NOTE **Sand sprag races with 80-100 grit sand paper.**



There are two different inner races. One for the early coast clutch frictions with the "V" shaped teeth and one for the late coast clutch frictions with the "square" shaped teeth.

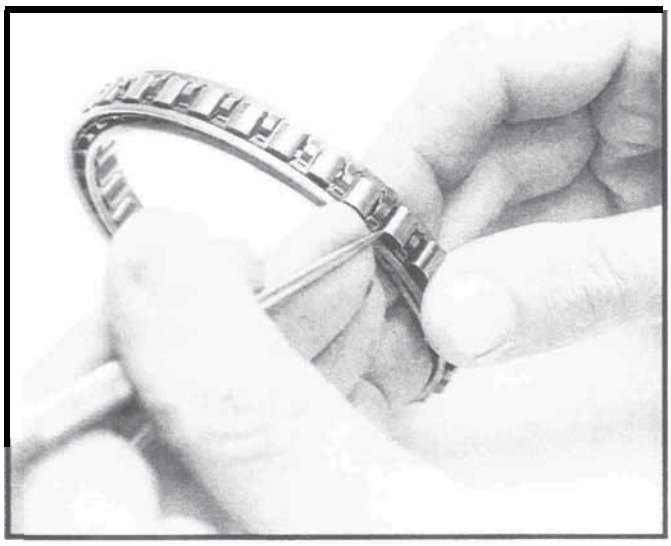
1987-only

For frictions with "V" shaped teeth frictions.

1988-UP All units

For frictions with "Square" shaped teeth frictions.

Input Sprag ID All Units continued

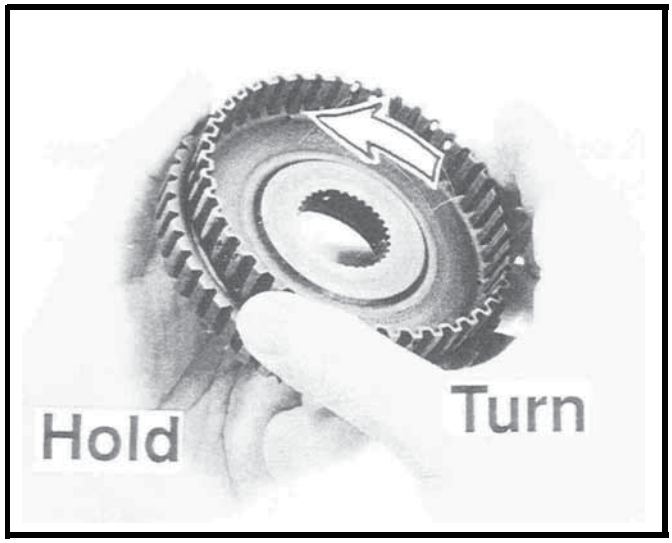


Sprag Element

There is only one sprag element. It fits everything.

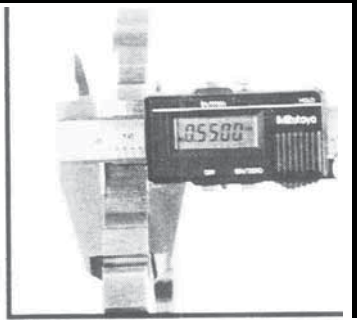
This sprag has a high failure rate.

1. Inspect leading edge of sprag for wear. Less than 1/1 6“, means it’s good.



Sprag Rotation

Low Roller ID All Units



There are three outer races:

Be careful when swapping parts.

1987-only

.654" thick.

1988-89 **all models**

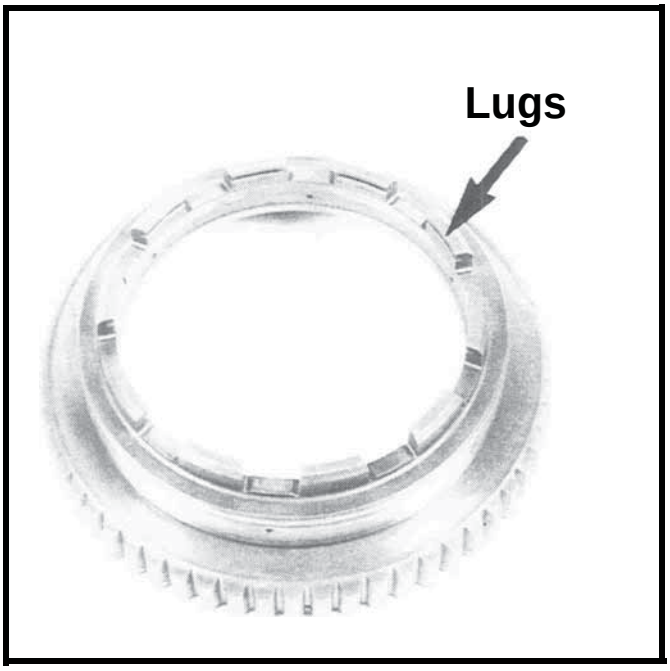
.550" thick.

1990-UP all models

.520" thick.

The .520" thick outer race has to be used with a .030" waved anti-rattle spring. This unit, this race and spring will then be .550" thick and can be used in the 1988-89 cases.

If you use the .550" thick race in the 1990-UP case, you may or may not hear a rattling noise.



There are two different inner races

IMPORTANT **Inner races are NOT interchangeable.**

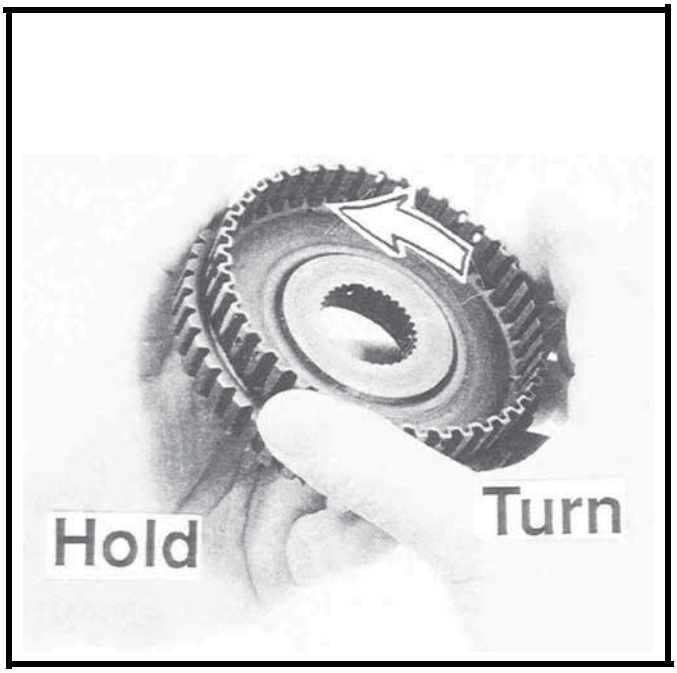
1987-only

Has 10 planet lugs and "V" shaped teeth

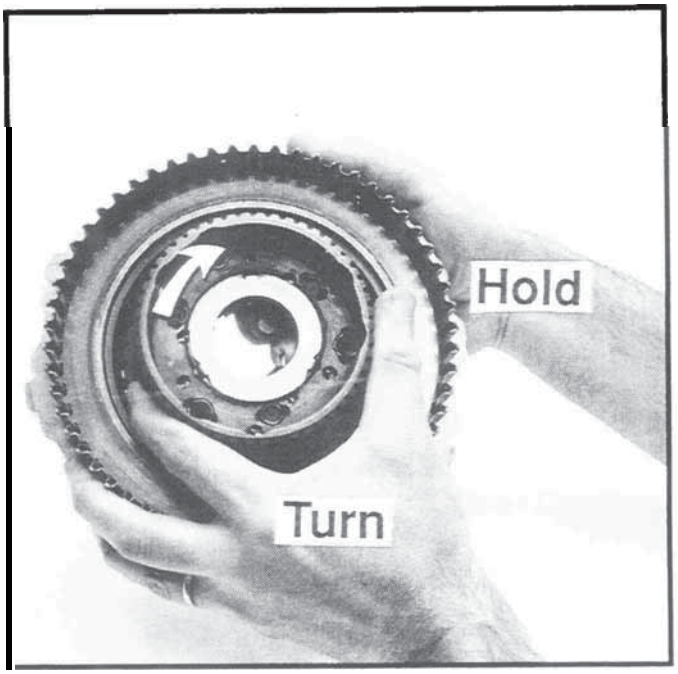
1988-UP all units

Has 39 planet lugs and "square" shaped teeth

Sprag Rotation All Units



Input Sprag



Low Roller Clutch

NOTE **Sand sprag races with 80-100 grit sand paper.**