THE SURE CURE®

sonnax®

4L60-E

Part No. SC-4L60E

Transmission Reconditioning Kit

FULL COMPATIBILITY:

- **Full compatibility in units 1995 – Up with PWM/EC³ (electronically controlled capacity clutch) control**
- **Identified by: 13-pin case connector, PWM/TCC solenoid and PWM pump (5 solenoids)**

PARTIAL COMPATIBILITY:

- **All components in this kit can be used in '93-'94 non PWM units except TCC apply valve installed in pump.**
- **Identified by: 12-pin case connector, only having a 3-2 solenoid in valve body (4 solenoids)**

REQUIRED TOOLS:

The following Sonnax tools are required for complete installation of this kit:

- **77917-TL PR Valve Reamer Kit (step 10)**
- **77754-TL AFL Valve Reamer Kit (step 25)**
- **77754-R2 TCC Regulator Valve Reamer (step 27)**

REASSEMBLY PARTS

4 Endplay Shims

5 D-ring Servo Seals

PUMP CARD

1 Boost Valve Assembly & Spacer (U.S. Pat. No. 6,619,323)

1 TCC Apply Valve Kit

1 Oversized Pressure Regulator Valve

1 Pump Pivot Pin

1 Teflon® Coated Pump Bushing

VALVE BODY CARD

1 Accumulator Spring

1 Servo Check Valve

2 Accumulator Pistons: 2nd, 4th with steel balls for plugging pin (Patent Pending)

8 Imidized Checkballs

1 TCC Regulator Valve Assembly

1 Actuator Feed Limit Valve Assembly (U.S. Pat. No. 6,634,377)

1 Valve Body Retainer

2 Forward or Reverse Abuse Valve Bore Plugs

1 3-4 Relay Valve End Plug

NOTES:

- **Detailed reaming instructions supplied with the reamer.**

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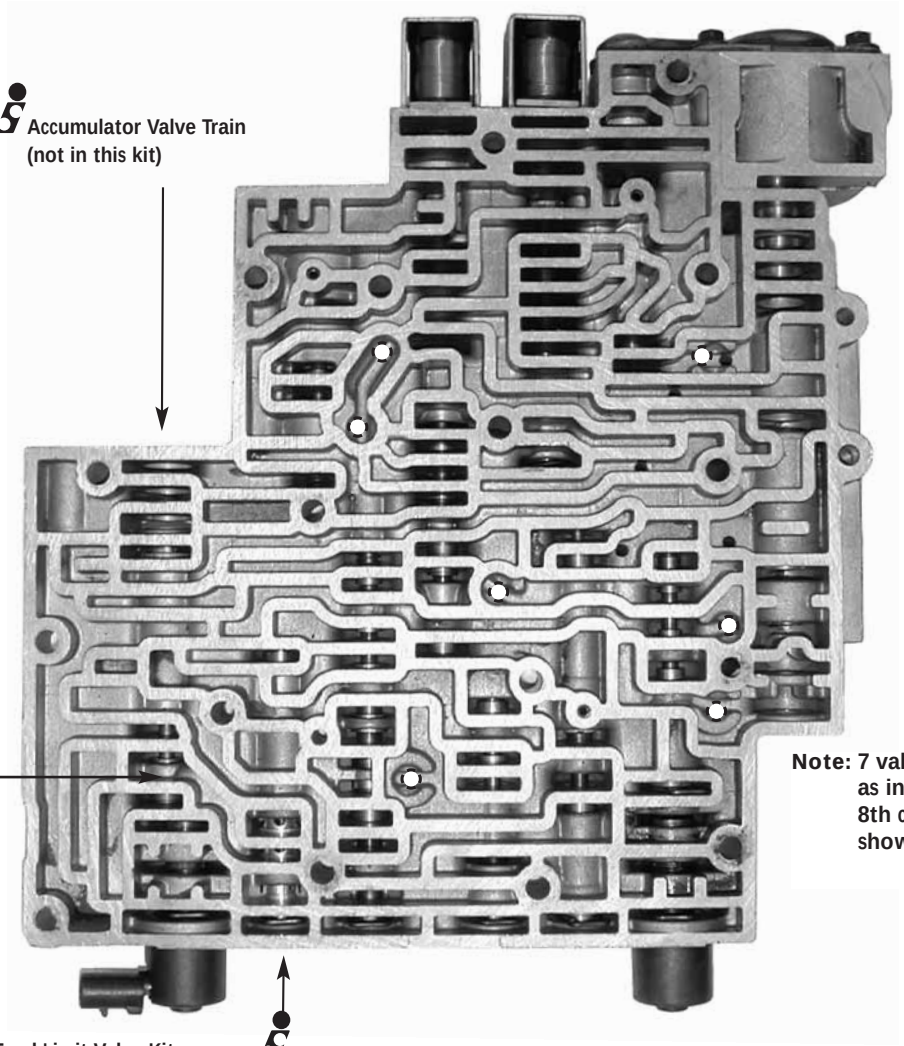
CHECK BALL & VALVE BODY PART LOCATIONS



Note: 7 valve body checkball locations as indicated above.
8th checkball location is in case as shown in step #13.

Sure Cure Fast Version

If you need to get this job out the door in a hurry, then just follow highlighted steps below. The other steps are repair information (to help prevent NO GOs and CBs) & OEM part numbers that you can read at your convenience.

1. Bearing and planetary inspection
2. Case and bore prep
3. Servo seals
4. Pressure Regulator Valve
5. Boost Valve
6. Pump body
7. Pump cover
8. TCC apply valve inspection
9. TCC apply valve installation
10. Pinless accumulator pistons
11. Servo check valve
12. Separator plate modification
13. Checkball
14. Forward Abuse Bore Plug
17. AFL valve (tool required)
18. Separator plate modification
19. TCC regulator valve (tool required)
20. Reverse Servo Abuse Bore Plug
21. 3-4 Relay Valve End Plug
22. 3-2 Downshift Abuse Plug

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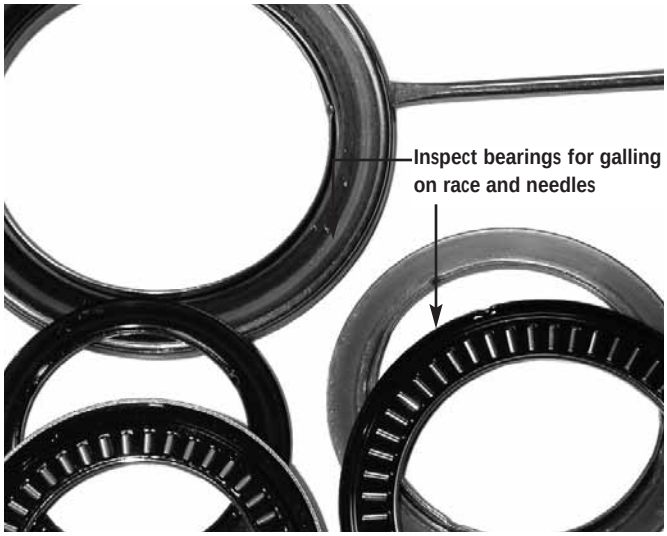
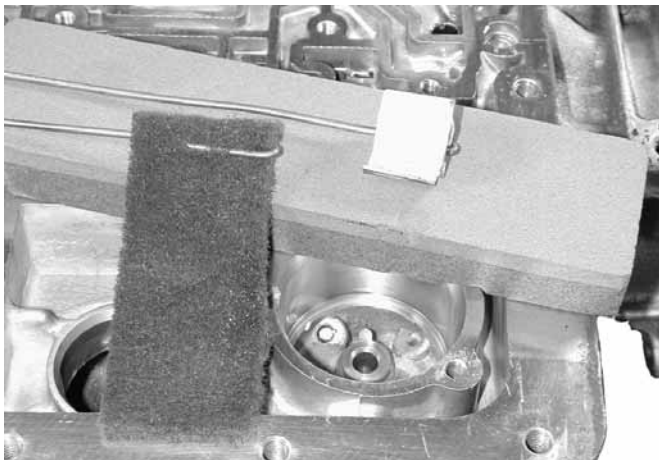
STEP 1 BEARING & PLANETARY INSPECTION (REASSEMBLY PARTS)



Note: Bearings can easily be pried open at the crimp.
Ask for Torrington™ Bearing Kit **SBK-G12.**

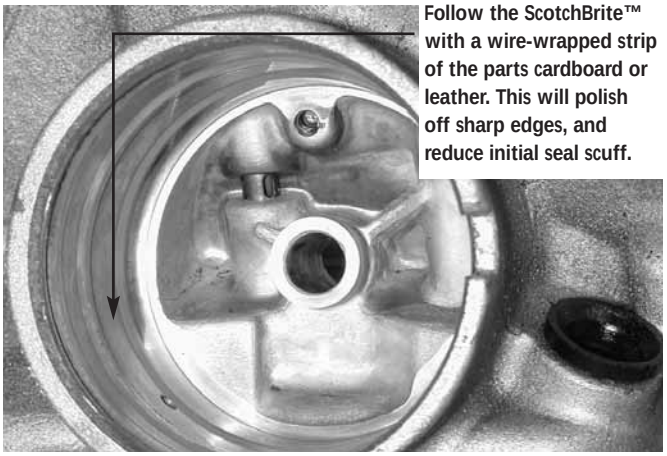
Inspect planet pins and endplay.
No side to side movement

STEP 2 PREPARE CASE, SERVO AND ACCUMULATOR BORES



Use a fine grit stone to remove high spots on case and valve body.

Scuff the accumulator(s) and servo bore with Red ScotchBrite™.
A stiff wire or rod wrapped with material can be spun in a drill.



Follow the ScotchBrite™ with a wire-wrapped strip of the parts cardboard or leather. This will polish off sharp edges, and reduce initial seal scuff.

Note: Viton® seals require a surface that retains fluid to ensure long life.

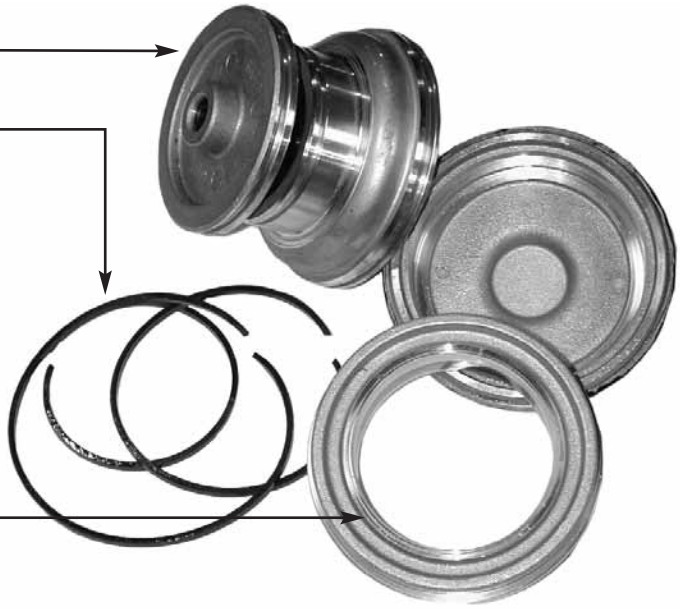
PREP SURFACES BEFORE CLEANING AND FINISH WITH SOLVENT.

STEP 3 SERVO SEALS

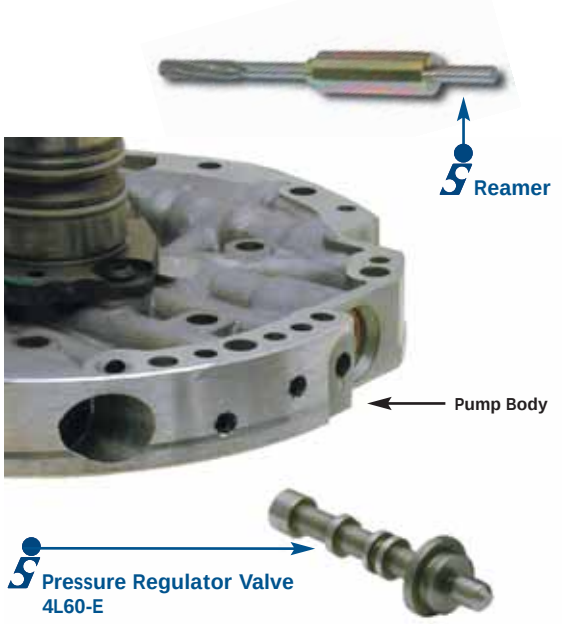
Install Viton® Servo D-ring seals.

Discard OEM Teflon®

Prepare the seal surfaces
on cover and inner housing
as mentioned in previous step.



STEP 4 REAM & INSTALL PRESSURE REGULATOR VALVE

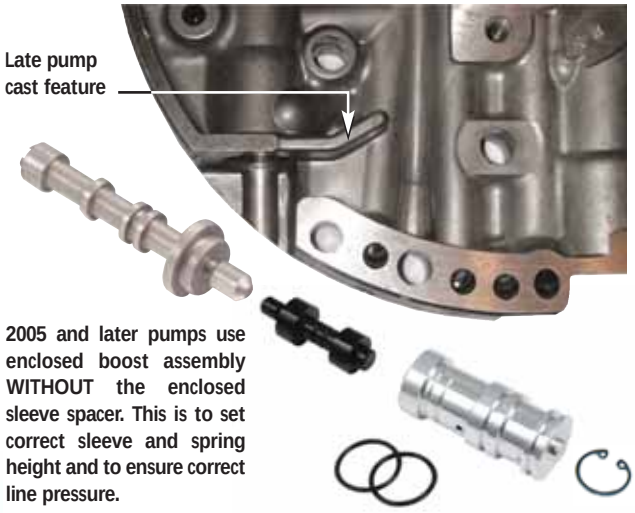


Reaming Instructions

1. Remove and discard the OEM pressure regulator valve.
2. Clamp the pump housing securely to a bench.
3. Install the reamer and guide 77917-TL as shown in the figure above.
4. Flood the valve bore and reamer flutes with cutting fluid (Tap Magic™, kerosene, etc.).
5. Using a "low" RPM (500-600) drill, carefully ream the valve bore. Maintain a constant moderate clockwise rotation and apply steady forward pressure until the reamer reaches the bottom of the valve bore. The reamer should cut easily. Continue to turn the reamer clockwise as it is removed from the bore. Ream one pass only.
6. Remove any debris and burrs from the bore. Lubricate and install the Sonnax replacement valve.

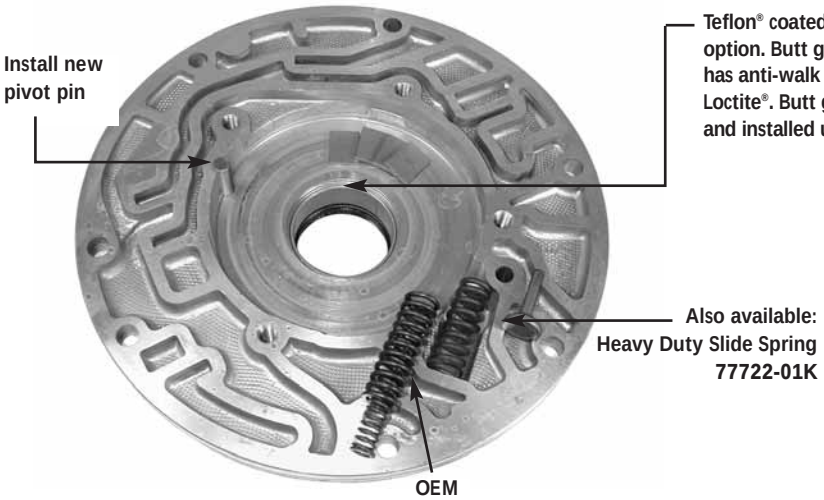
STEP 5 BOOST VALVE

Pre-2005 pumps use enclosed boost assembly WITH the enclosed sleeve spacer. This is to set correct sleeve and spring height and to ensure correct line pressure.



2005 and later pumps use enclosed boost assembly WITHOUT the enclosed sleeve spacer. This is to set correct sleeve and spring height and to ensure correct line pressure.

STEP 6 PUMP BODY PARTS INSTALLATION



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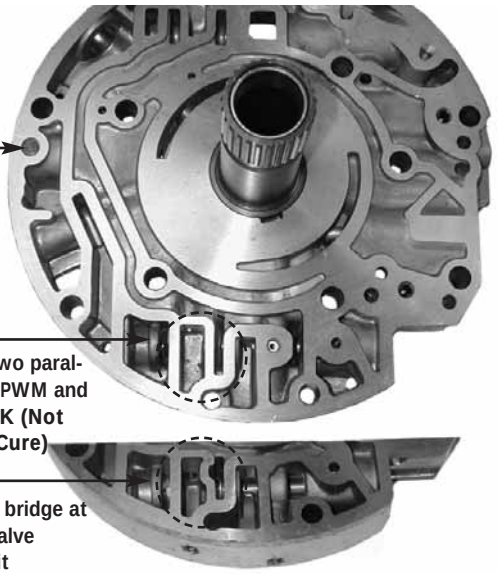
STEP 7 PUMP COVER IDENTIFICATION

Remove the relief rivet and clean ball and seat. With severe contamination, reform the seat by tapping ball into it.

Note: Don't forget to replace filter o-ring.



Non PWM
If the casting has two parallel webs, it is NON PWM and takes valve **77805-K (Not included in Sure Cure)**

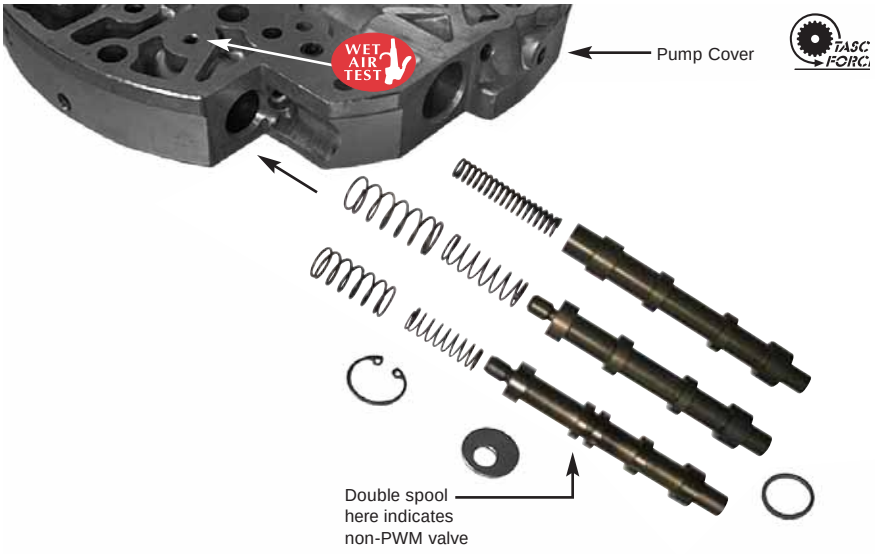
PWM
If the casting has a bridge at this location, use valve **77805E-K** in this kit (See also Step 13).

P/N 77805-K is not in this kit!

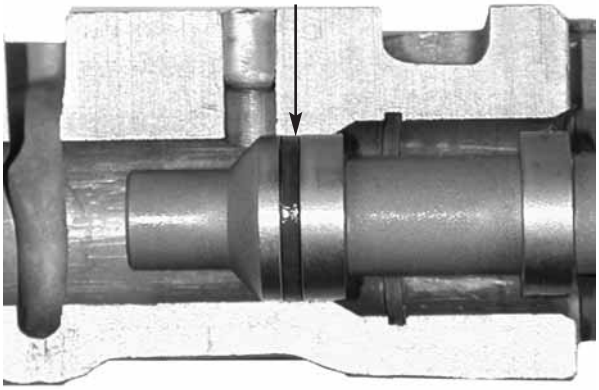
STEP 8 TCC APPLY VALVE IDENTIFICATION

Photo at right shows the 3 different OEM 4L60 and 4L60-E TCC apply valves. Oil circuits differ, so it is critical NOT TO MISMATCH PWM versus non-PWM valves. OEM valve materials can be steel or aluminum, and should not be used for identification. A double spool at the indicated location can be used to determine PWM versus non-PWM valves.

Sonnax kit 77805E-K, included, can be used in both early and late PWM applications. Discard OEM valve and spring(s), and replace with complete valve and seal kit.

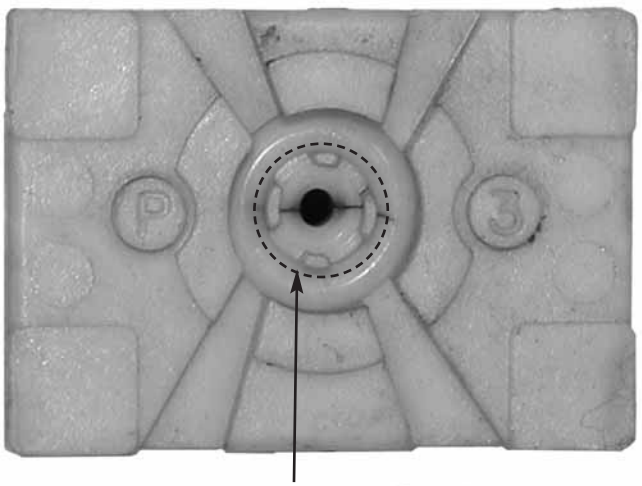


STEP 9 TCC VALVE INSTALLATION



Teflon® seal supplied must be stretched to install into valve groove. Resize with finger pressure, pre-lube, then resize by inverting into bore.

Insert 1/8" or up to seal only. Let it stand for a few minutes.



Inspect the TCC solenoid seat for cracks.

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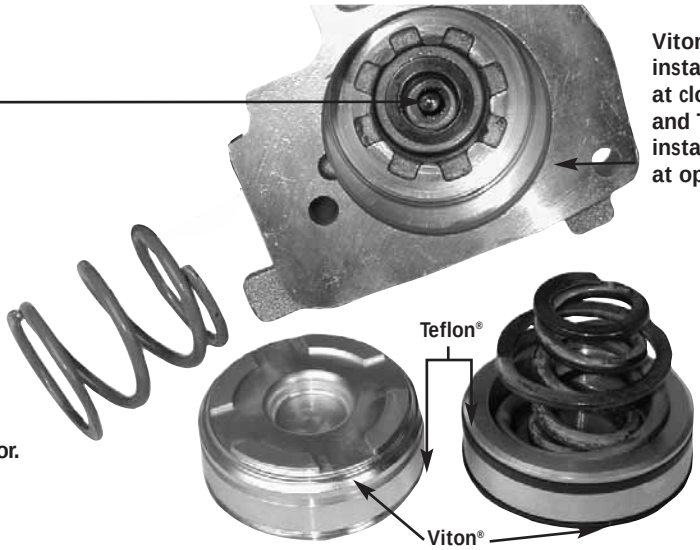
STEP 10 PINLESS SONNAX ACCUMULATOR PISTONS

OEM pin must be driven from cover.

Plug pin holes by driving either the large or small steel checkballs into the hole. Lightly stake the pin bore after installing the ball.



Reassembly:

Pre-1994 - 4th piston - Install dome into case with spring in pocket.

1-2 piston - Install dome into accumulator body followed by purple spring.

1994 later - 4th piston - Install dome into case. Some units do not have a spring for 4th accumulator. If OEM had a spring, install into piston pocket.

1-2 piston – Install spring(s) into accumulator body, set piston pocket opening onto spring, dome toward plate. (Patent Pending)

STEP 11 SERVO CHECK VALVE

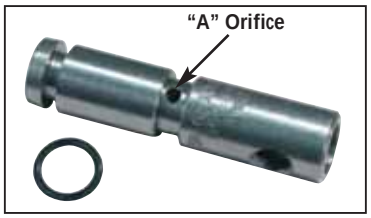
Note: Before installing servo release check valve, make sure the 3rd accumulator checkball capsule is in the case and there are no leaks. Replace a leaking capsule with OEM p/n 8634400.

If necessary adjust orifice "A" in valve to match servo being used (see info to right).

Tapered end goes in first. Valve must be driven flush with case surface and must be tight.

Install into case (see step 12).

Adjust separator plate orifice "C" to match vehicle (see step 19).



77701-076
U.S. Pat. No. 5,536,221

UPDATE

Some case bores may be oversized. Use o-ring on check valve for these bores only. If valve goes into bore without resistance, install the o-ring.

Adjust "A" orifice to suit servo:

If the last 3 casting numbers are 553 or 554, or any servo with 2.312 to 2.520" small diameter piston, check valve installs "as is."

If the last 3 digits are 093, or the servo is a one-piece aftermarket; enlarge the orifice –A- (at center groove) to .120" -.125" or use #31 drill bit.

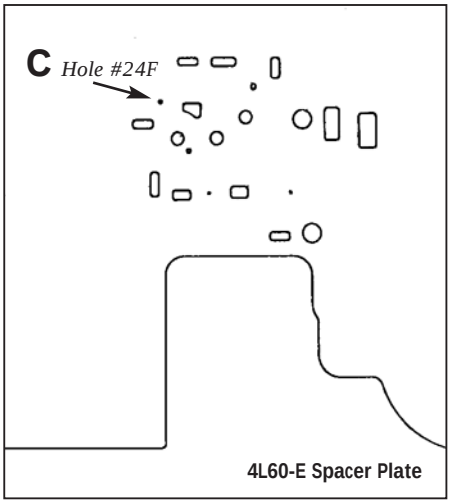
STEP 12 SEPARATOR PLATE 3-4 CLUTCH FEED IMPROVEMENT

Set up the plate to match your vehicle needs: A larger separator plate feed hole-C- will result in a shorter 2-3 shift. Too large, and a bumpy 2-3 will result. Locate the 3-4 clutch feed –C- orifice in your plate.

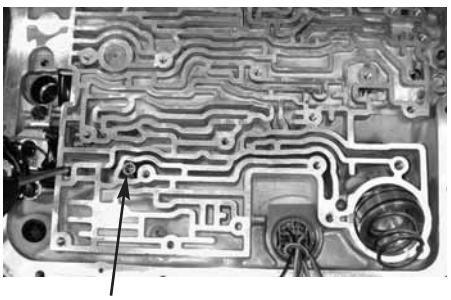
"C" - Transmission 4L60-E

Application	Orifice Dia.
Light Duty	.090"
Regular Duty	.100"
Heavy Duty	.115"
Performance	.130"

You can remove the check valve by threading it (5/16" x 18") and using a bolt-on slide hammer or #5 easy out.



The Sonnax check valve will be installed with the OEM 3rd accumulator check valve (OEM part #8634400).



The check valve Installs on top of the OEM 3rd accumulator capsule.

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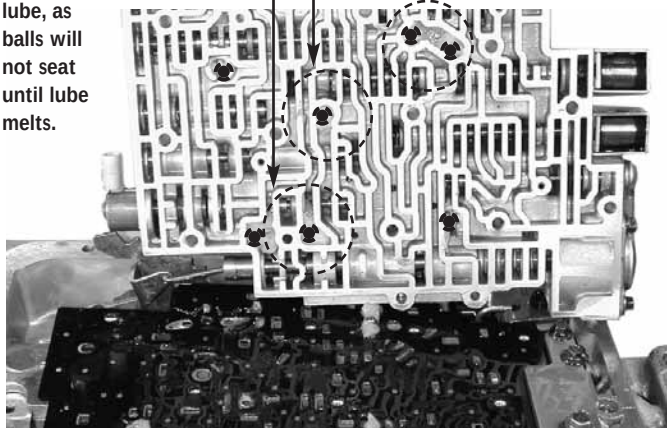
STEP 13 CHECKBALLS AND ASSEMBLY TIPS

WET AIR TEST Non-PWM

If you are installing this kit in the vehicle, checkballs must be loaded into valve body.

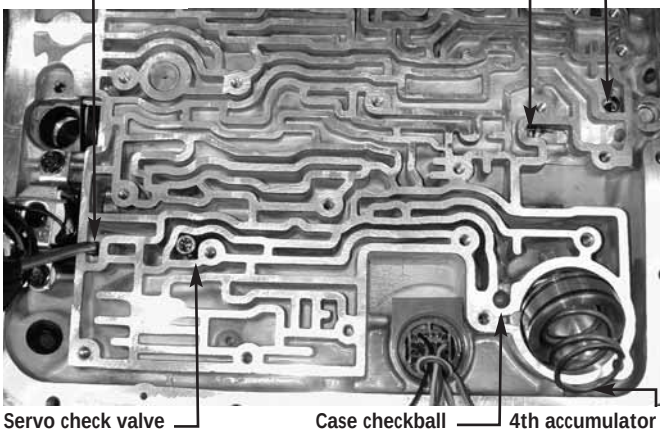
Valve body checkball locations shown here and picture of checkball and valve body part locations shown before Step 1.

Do not use excessive lube, as balls will not seat until lube melts.



Supply 12 volts to TCC solenoid and WAT here. TCC valve in pump will stroke.

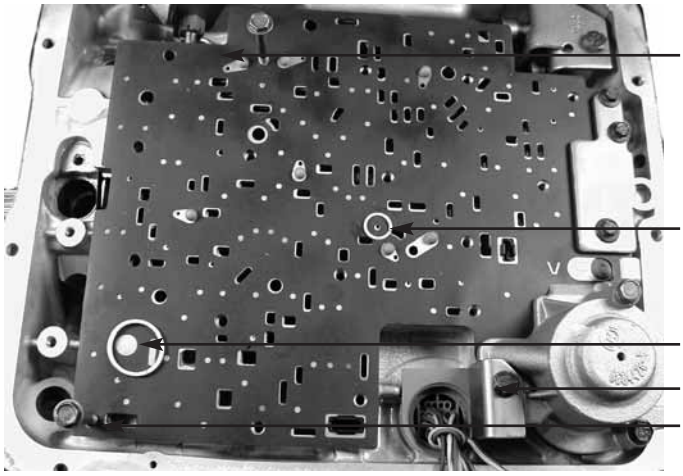
Drill bit used to check low-reverse clutch clearance (clutch clearance on spec sheet). WET AIR TEST



Servo check valve from step 11

Case checkball

4th accumulator pre-assembled



Note checkball locations

Orifice "C" for check valve modification in step 20

Plate with holes is PWM

Plate without holes is not PWM

Case connector retainer #**77980-01K**

Note alignment holes in plate

STEPS 14-22 STEPS 14 TO 22 INDICATED BY NUMBER ON VALVE BODY

STEP 14:

With forward accumulator cover still off, remove low-overrun valve and roll pin.

Pull out the divider plug and replace with abuse bore plug in kit.

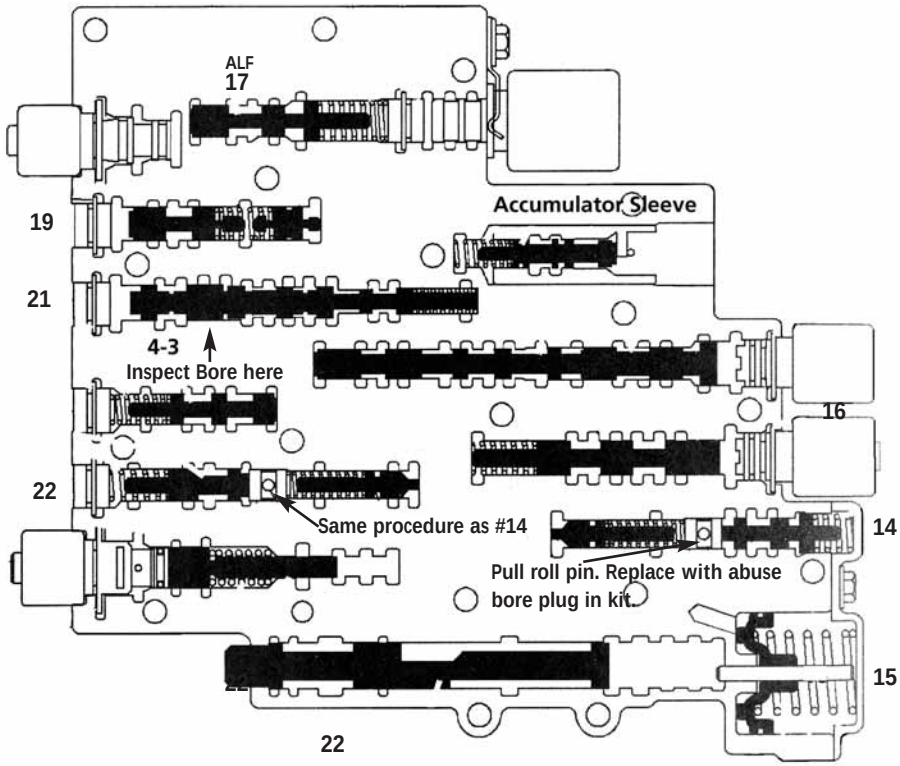
STEP 15:

Reassemble forward accumulator.

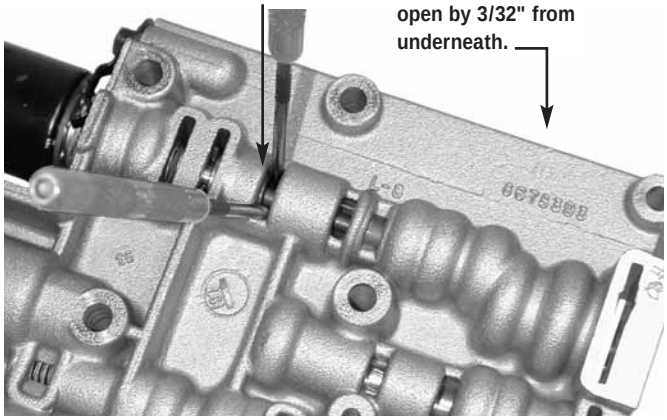
STEP 16:

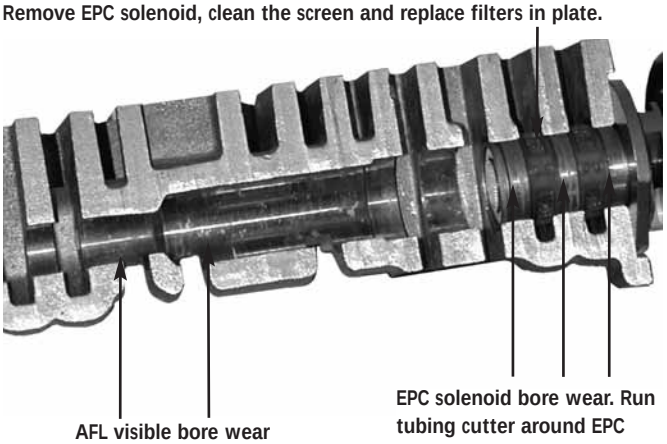
Update shift solenoids, replace o-rings.

Solenoid information in specifications.

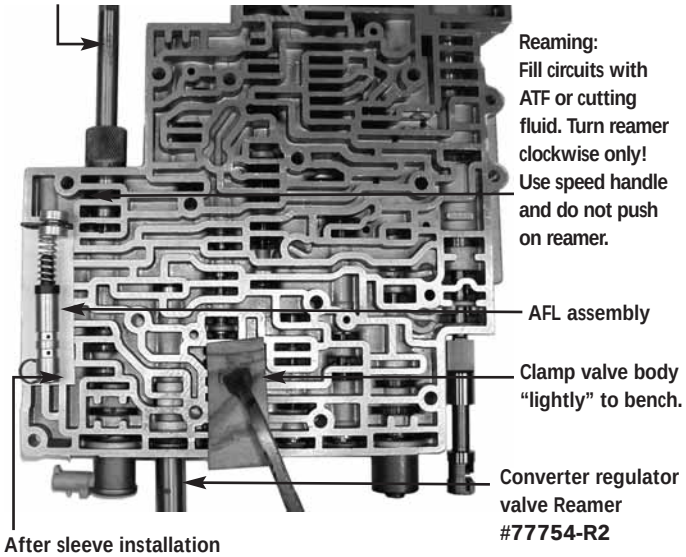


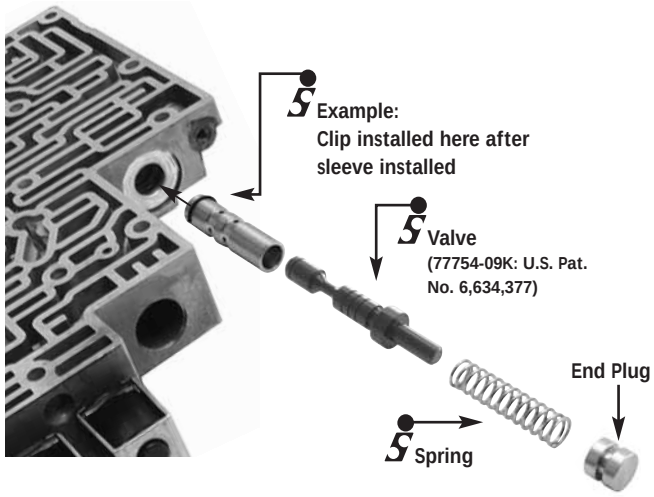
STEP 17 AFL BORE INSPECTION AND REPAIR



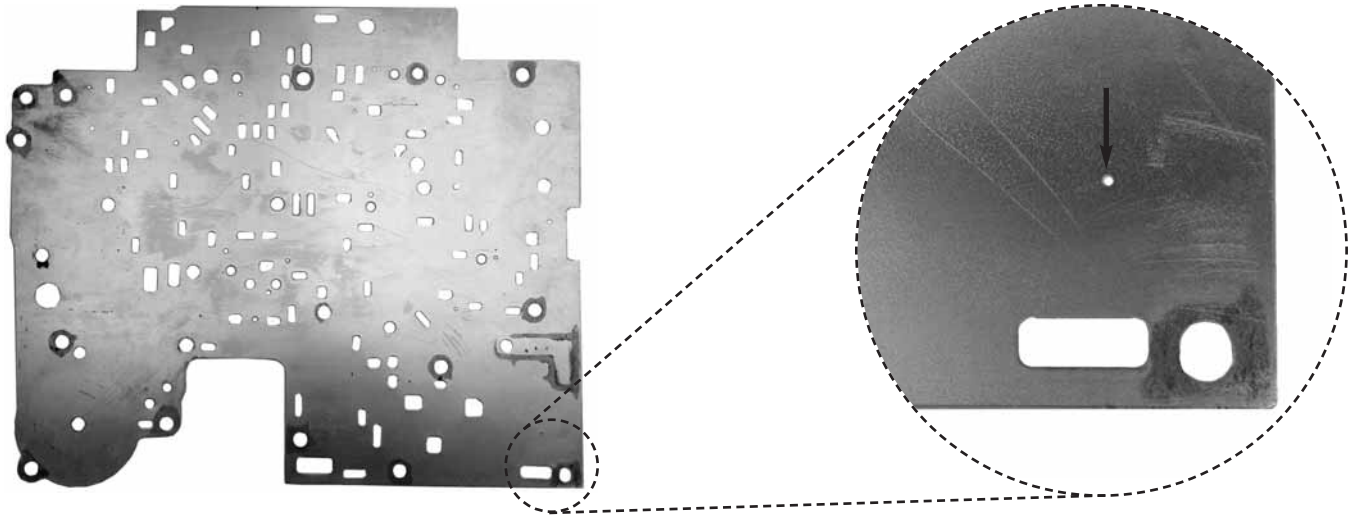


Note: Reamer kit **77754-TL** required. Also works on 4L80-E. 4L60-E uses marked reamer and guide. No pre-drilling required.





STEP 18 AFL BALANCE HOLE MODIFICATION



When AFL valve & sleeve are installed, the AFL balance hole in plate must be opened with drill supplied in reamer kit.

Enlarge the indicated balance AFL orifice to .052" with the drill bit supplied in reamer kit.

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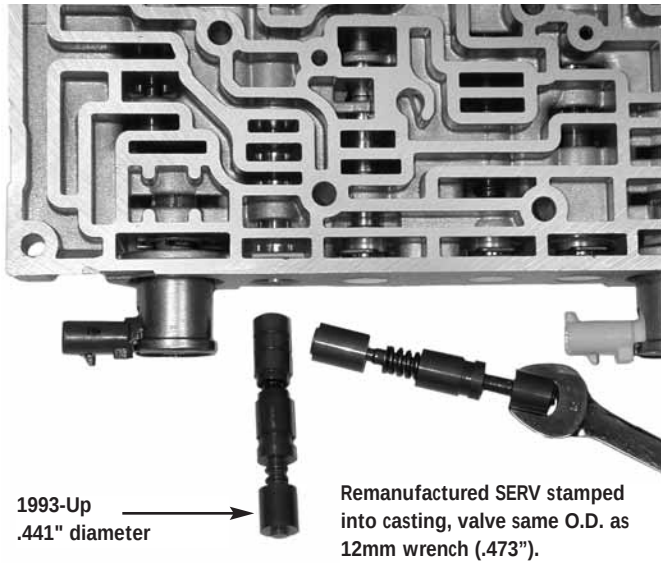
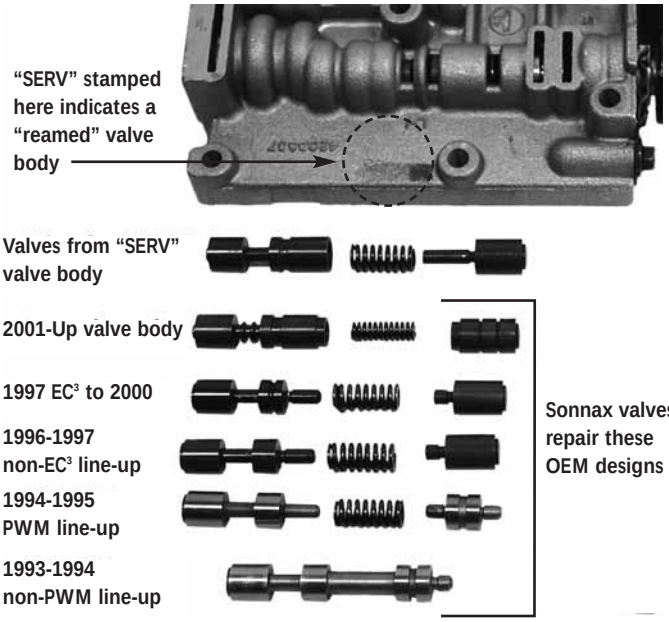
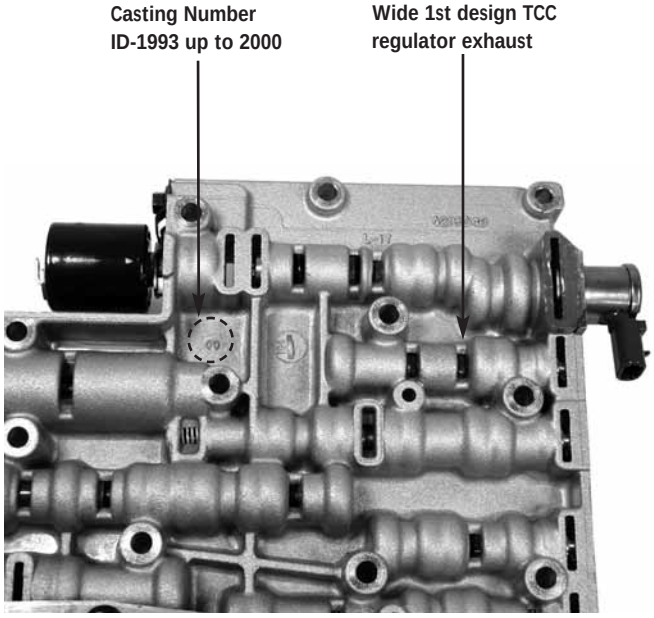
STEP 19 CONVERTER REGULATOR VALVE DESIGN VARIATIONS:

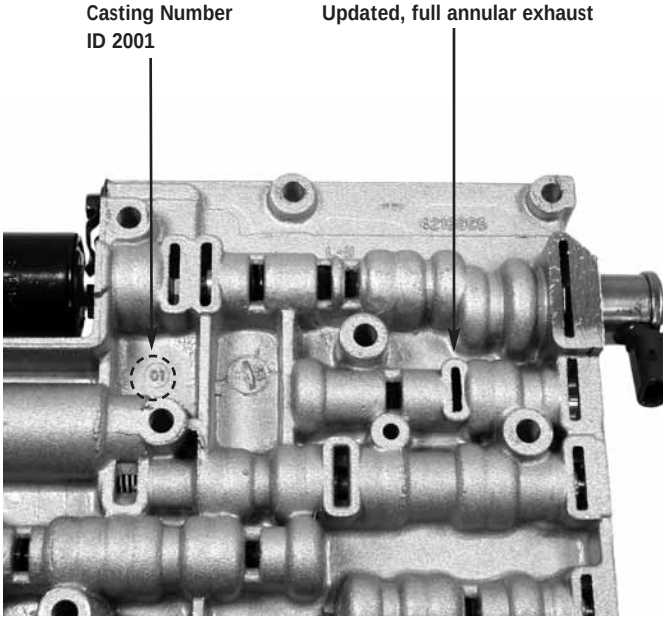


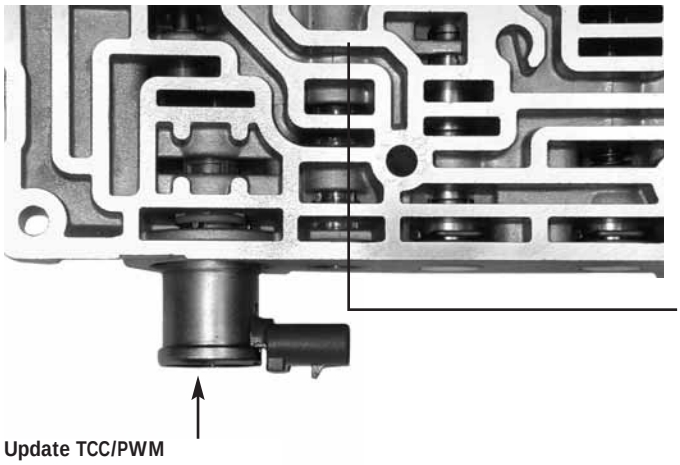
1993-Up
.441" diameter

Remanufactured SERV stamped into casting, valve same O.D. as 12mm wrench (.473").
DO NOT ATTEMPT TO RE-REAM A SERV VALVE BODY WITH **77754-R2**









Update TCC/PWM
Solenoid to GM P/N 24212690

Remove OEM converter regulator valve
Ream this bore with **77754-R2** (sold separately)
Lightly clamp to bench, this side up.
Fill circuits with ATF/ cutting fluid.
Turn reamer with speed handle.
Ream, turning clockwise only.
Blow chips free before removal.
Never turn counterclockwise!
If tight assembly, repeat with 500 RPM drill.

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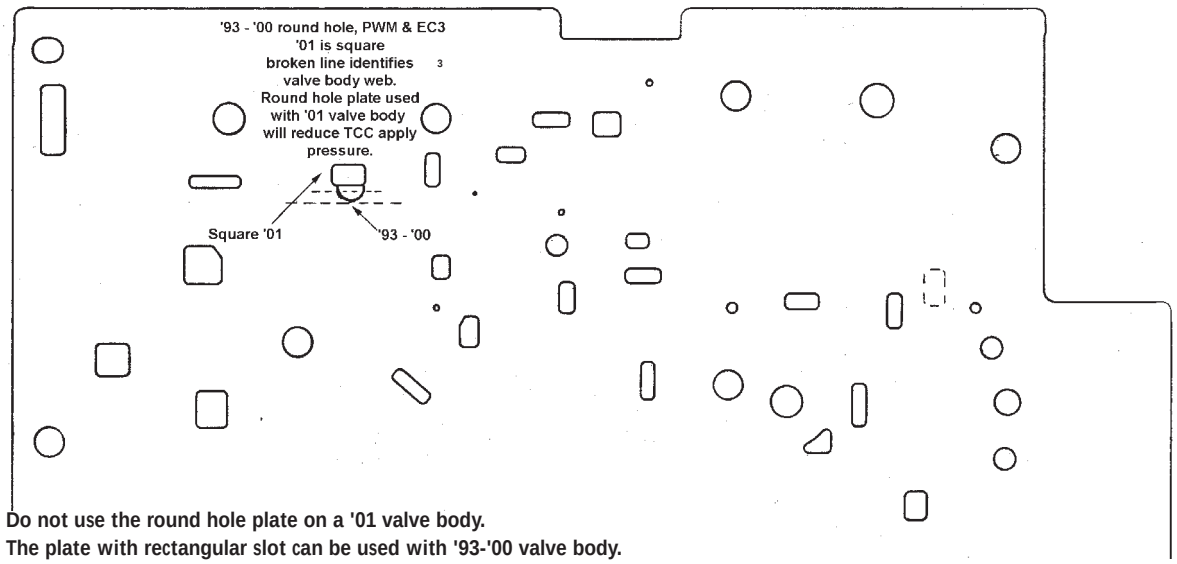
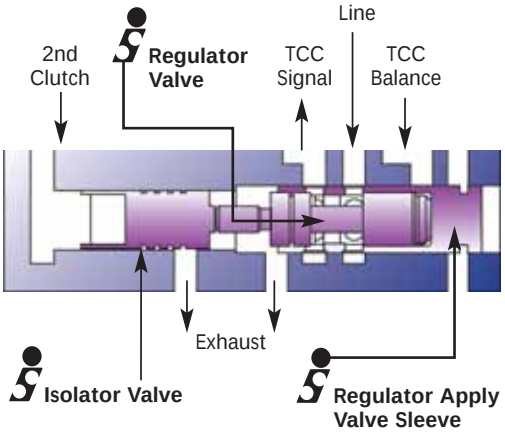
STEP 20 NEW PLATE & VALVE APPLICATION

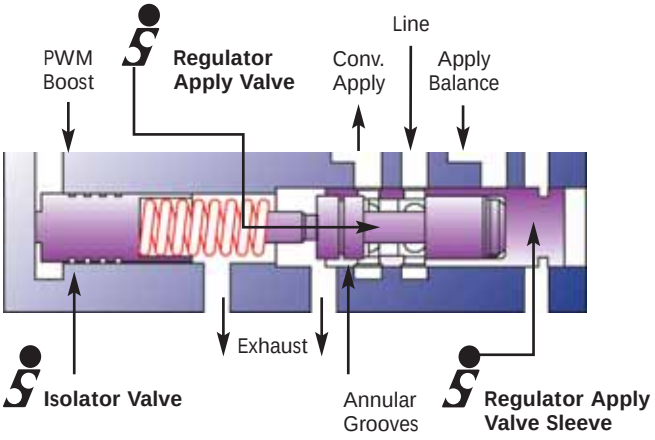


Do not use the round hole plate on a '01 valve body.
The plate with rectangular slot can be used with '93-'00 valve body.

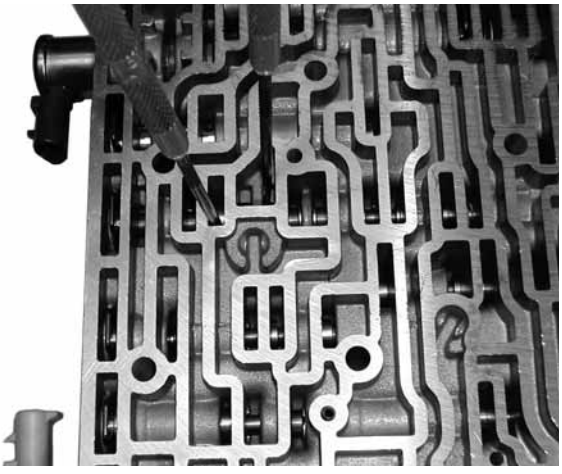
Sonnax installed - Non-PWM



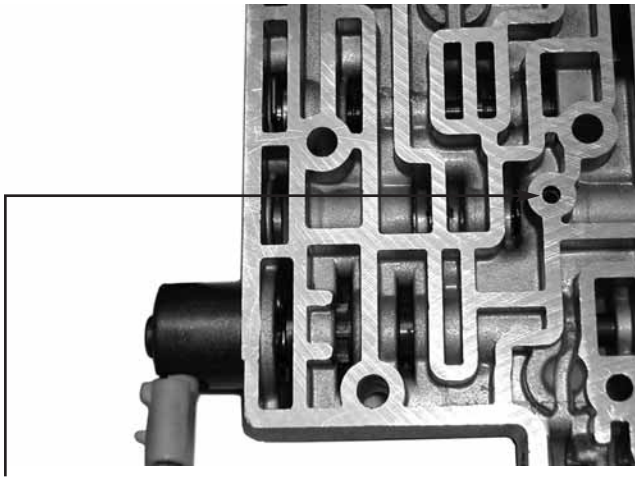
Sonnax installed - PWM



STEPS 21-22 BORE INSPECTION (LEFT: 3-4 RELAY, RIGHT: 3-2 DOWNSHIFT)



21. Inspect bore for wear at the 3-4 valve using wiggle test as shown. Replace end plug with o-ringed end plug provided.



22. Remove 3-2 downshift assembly to remove the inner plug and replace with abuse plug provided.

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Specifications and Rebuild Information:

R & R INFORMATION:

Cooler return line: Top line

Correct Sonnaflow® readings: 1.5-1.7 GPM TCC off, 2.0-2.6 TCC applied

Fluid capacity: Pan removal 5 qts. overhaul 11 qts

Cold climate (-20f. or more) fluid suggestion: 100% synthetic ATF or blend 50%

Suggested system fluid change on all PWM controlled converters: 40,000 miles

Line pressure: P-N-OD idle 55 Max. EPC 190
R idle 64 Max EPC 320 (Average 270-300)

An effective line pressure and pump output test is:

Reverse 600-750 RPM, with maximum EPC

Line pressure should obtain 270 psi, and not drop more than 20 psi or create an unstable gauge.

CONVERTER IDENTIFICATION:

Bolt-on bell housing height on large 300mm converter: 7"

298mm converter height: (hub set on bench to pad surface) 5.875"

300mm converter height: (hub set on bench to pad surface) 6.500"

Year	Converter control	OEM friction material	Converter Code
'93-'94	on-off	paper	
'95-'96	PWM	composition carbon	G.H,L
'97 W cars 3.4	EC³	woven carbon	N,P,F
'97 298mm truck	PWM	composition carbon	G,H,L
'98 all	EC³	woven carbon	N,P,F
'98-2000	EC³	woven carbon	B,A

CRITICAL TORQUE AND ASSEMBLY SPECIFICATIONS:

Valve body and accumulator to case	06-10 ft. lbs
Pump body	15-20 ft. lbs
Pump to case	15-20 ft. lbs.
Bell housing to case	48-55 ft. lbs. (Sonnax Torx bit #77000-HBK)

OEM CLUTCH/BAND CLEARANCE, ENDPLAY SPECIFICATIONS:

Forward clutch	.030" - .063"
3-4 clutch	.035" - .083"
Reverse input	.040" - .076"
Low-reverse clutch component stack on bench	1.15"- 1.18"

"Rule of thumb for unspecified clutch" allow .010" clearance per friction
(Note: Picture 19 Drill bit inserted between clutches with separator plate off, is used to verify low-reverse clearance.)

Servo travel:	.075-.125" (band must freewheel over drum when turning output shaft)
Pump slide clearance	.0008"-.0020"
Pump vane clearance	.002" max.
3rd accumulator check ball tube to case depth	1.653"
Planet side gear clearance	.024" max.
Endplay	.005" to .036" total unit (combined)

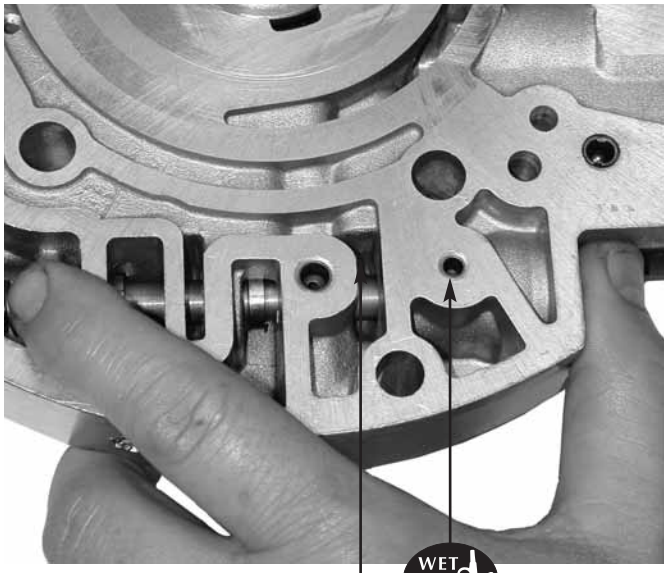
ELECTRICAL:

	OHM Readings	GM P/N's
Shift solenoid	20-40 ohms	10478131
TCC PWM solenoid	10-15 ohms	24212690
3-2 downshift solenoid	20-31 ohms	24212327 ('96 on, 93-95 PWM 9-13)
EPC solenoid resistance	3.5-8 ohms	24209276
TCC solenoid resistance	20-40 ohms	N/A

Shift solenoid firing order: 1st gear both on , 2nd 2-3 on, 3rd both off, 4th 1-2 on

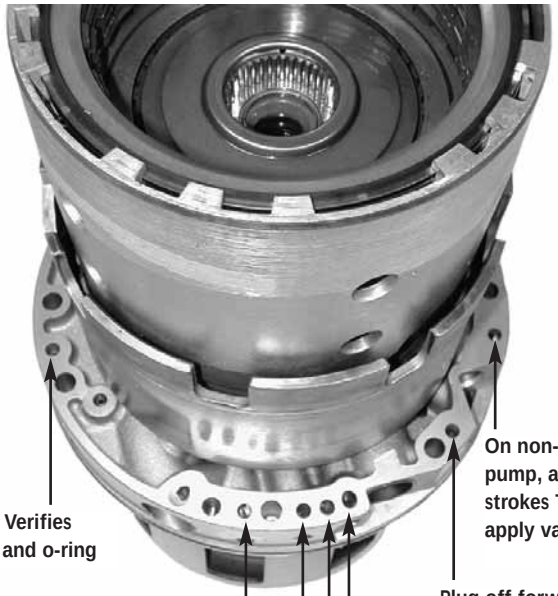
Transmission temperature sensor under approximately 100 ohms inhibits 4th, and brings TCC on after 1-2 shift.

WET AIR TESTS



Use ATF here to identify leakage

Test at
Orifice Plug



WAT: Verifies
filter and o-ring

On non-PWM
pump, air psi
strokes TCC
apply valve.

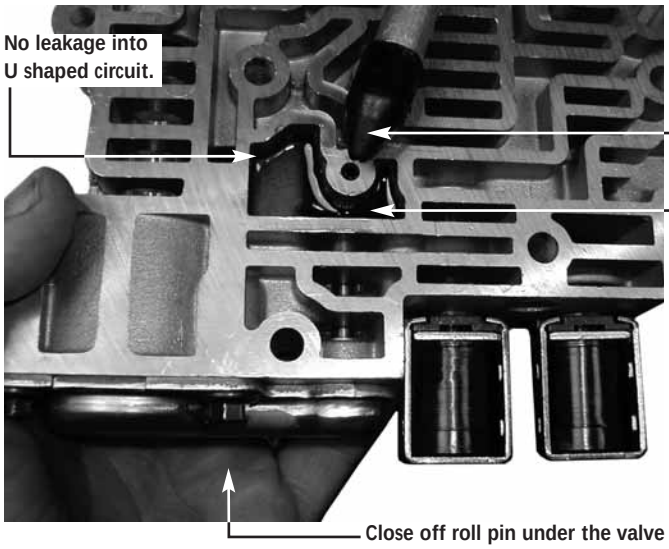
Reverse:
No checkball leaks
No leaks at torque signal

Plug off forward,
WAT overruns,
No 3-4 piston
movement!

3-4 clutch: Overrun,
no piston movement

Forward clutch,
No 3-4 apply!

Torque signal:
No leakage from reverse



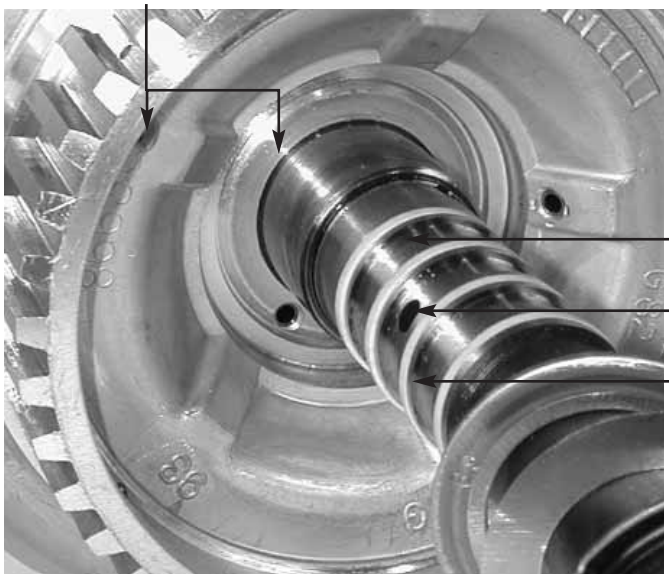
No leakage into
U shaped circuit.

Pressurize roll pin
from machined side.

Place fluid into the
U-shaped cavity over
lo-overrun valve.

Close off roll pin under the valve
body w/finger.

When WAT 3-4 clutch:
No oil loss at checkball,
or base of shaft.

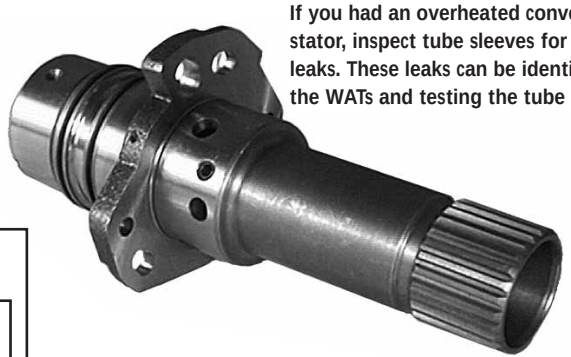


3-4 Clutch

Forward

Overrun Clutch

Stator Inspection:
If you had an overheated converter or stator, inspect tube sleeves for cross leaks. These leaks can be identified by the WATs and testing the tube by itself.



Note: A 100% leak tested shaft, 77918S-K or 77918S-1K, are available from Sonnax.

2005 & later stator shafts are not interchangeable with 2004 & earlier shafts.

07/21/04

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