

Sonnax Webinar

GM 6T40/45/50 (GF6) GEN I

Concerns and Repair Techniques



WELCOME TO THE

sonnax®

WELCOME

- **Connections**
- **Handout**
- **Questions**
- **Steve.Garrett@Sonnax.com**

- **Sonnax technical information available free of charge at www.sonnax.com “Tech Resources”**
- **“Tech Assistance” 1-800-843-2600**

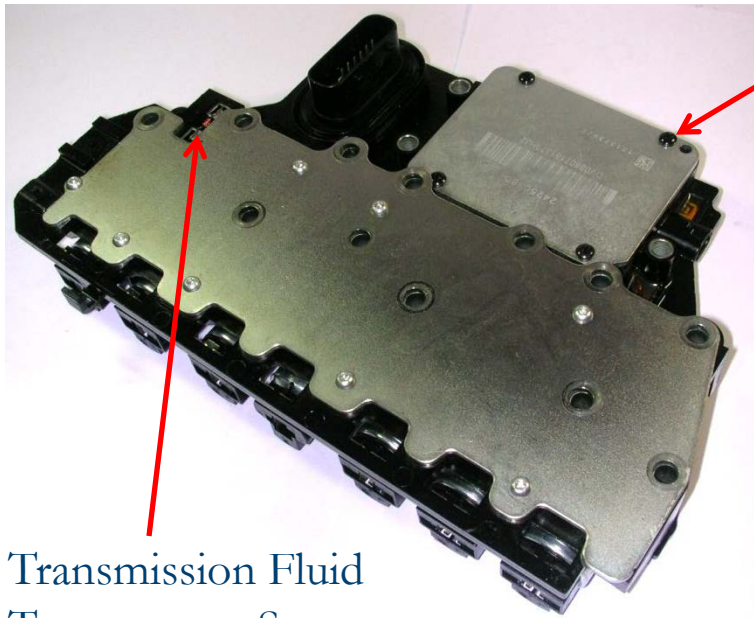
6T40 Usage

- Also known as the “GF6”
- Manufactured in multiple plants, USA, Asia
- One of the most widely used transmissions in the world
- Introduced in the Malibu in 2008, G6 and Aura in 2009
- Used in the Malibu, G6, Aura, La Crosse, Tosca, Epica, Equinox, Terrain, Astra, Regal, Aveo, Sonic, Trax, Onix, Encore, Captiva, Orlando
- Used behind Gas and Diesel engines
- Also available as a Hybrid application, (BAS) Belt/Alternator/Starter or (E Assist) Electronic Assist
- 3 generations used, GEN 1, GEN 2 and GEN 3 (6T41/6T46/6T51)

The 6T40 (GF6) Hydraulic System

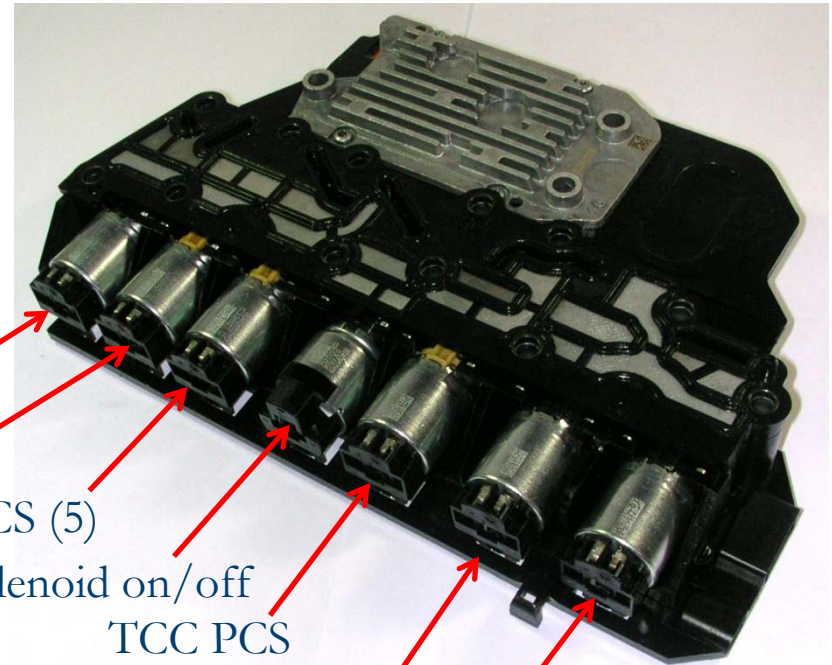
- **No conventional shift valves**
- **Multifunctional solenoids**
- **Compensator circuits (Clutch apply/release control)**
- **Internal TCM (TEHCM)**
- **Clutch to clutch shift control**

6T40 Control Solenoid Valve Body



TCM

Transmission Fluid
Temperature Sensor



Line PCS

2-6 PCS (4)

1-2-3-4 PCS (5)

Shift Solenoid on/off

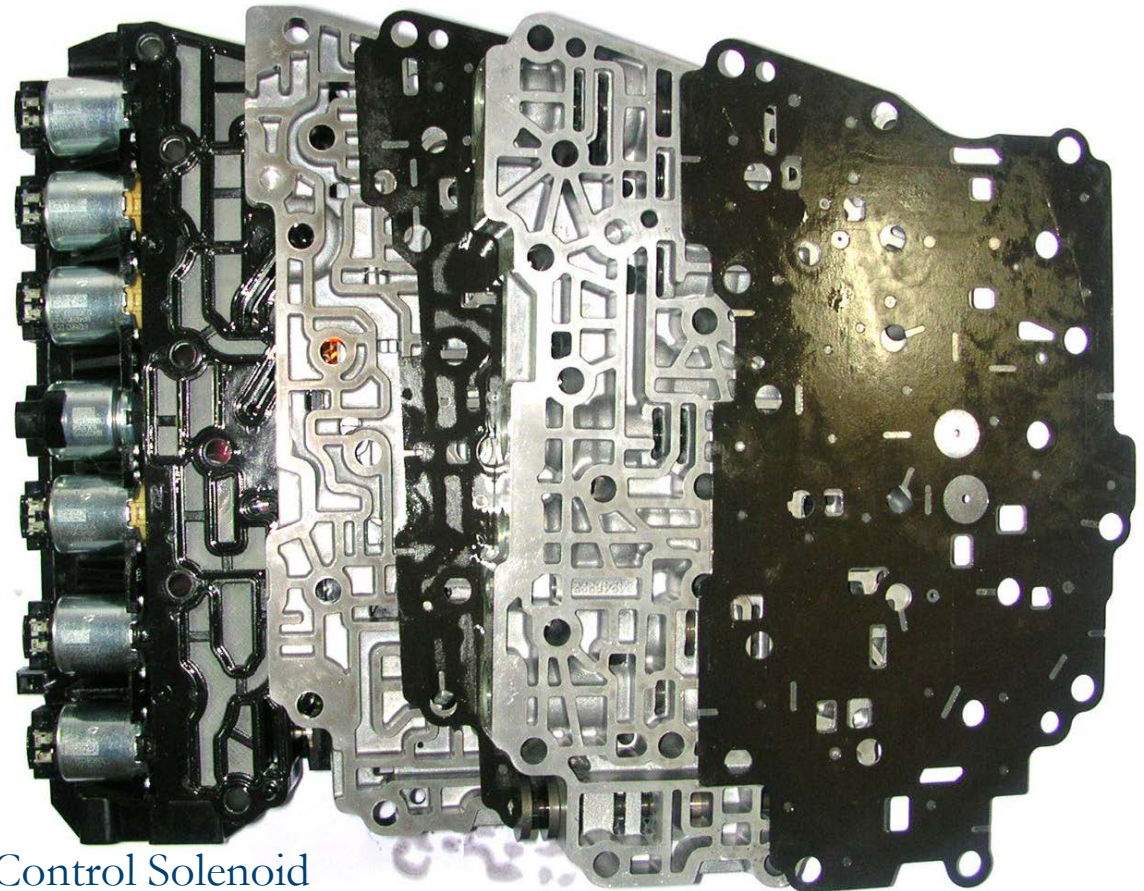
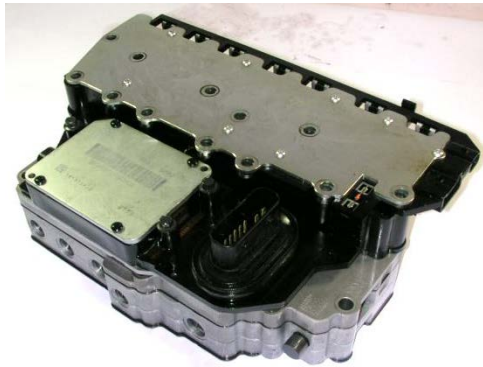
TCC PCS

3-5 Reverse PCS (2)

L/R 4-5-6 PCS (3)

6T40 Family

Valve Spacer Plate



Control Solenoid
Valve Body
(TEHCM)

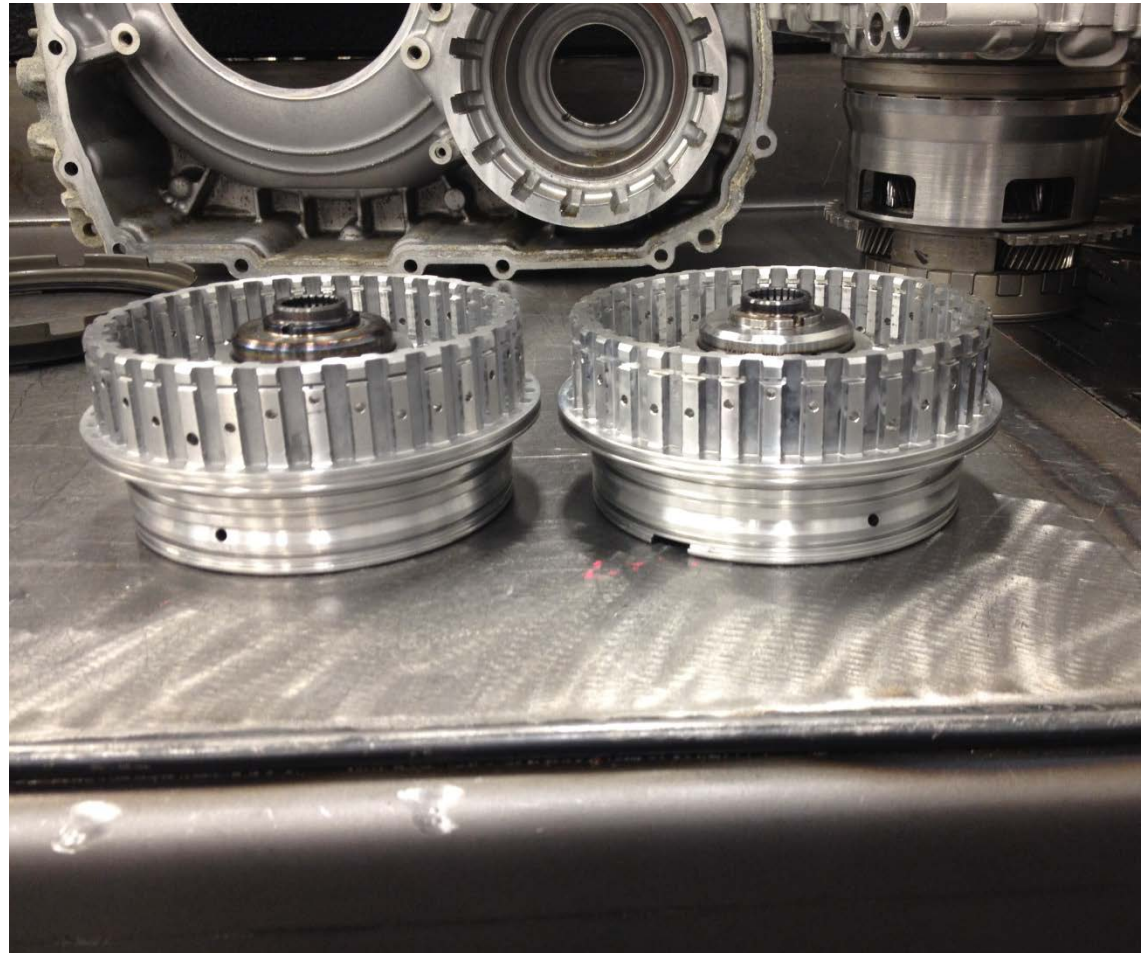
Control Valve
Body

3-5-R/4-5-6 Drum Update Mid-2010-Later, GEN 1 Only

An update occurred to the 3-5-R drum, snap ring and backing plate due to issues with snap ring retention.

The updated parts **CANNOT** be intermixed with the previous design parts.

The updated parts are available in a GM kit 24255922 but you will need to update all three parts. The kit includes all three parts needed.

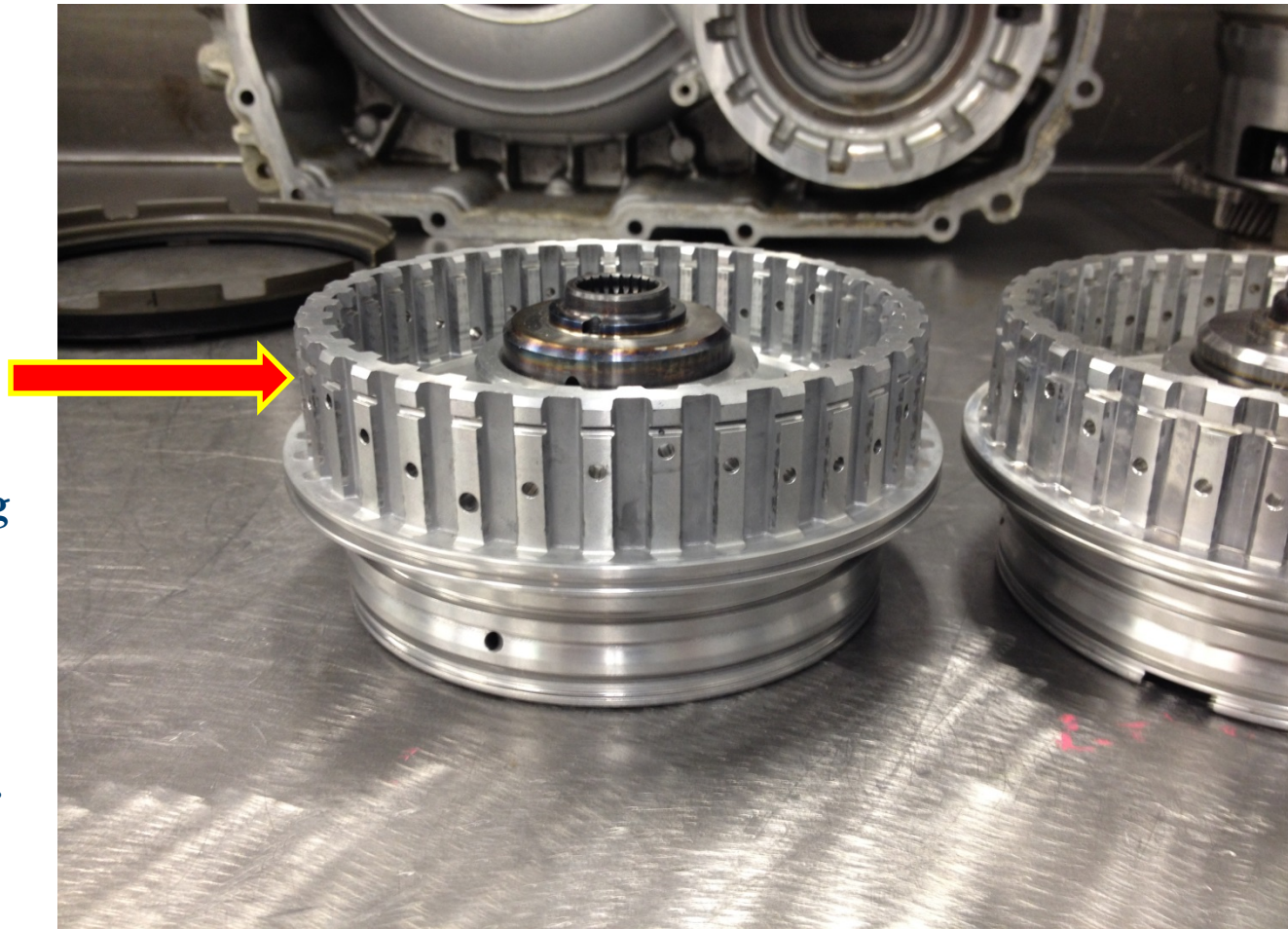


Updated 35R/456 Drum

Snap ring groove
2.38mm deep/2.0mm
tall on new design vs.
1.45mm deep/2mm tall
on previous design drum.

The snap ring and backing
plate were also changed
as part of this update.

Updated snap ring is now
1.6mm thick, 130.5mm dia.
vs. 1.5mm thick and
124mm dia.

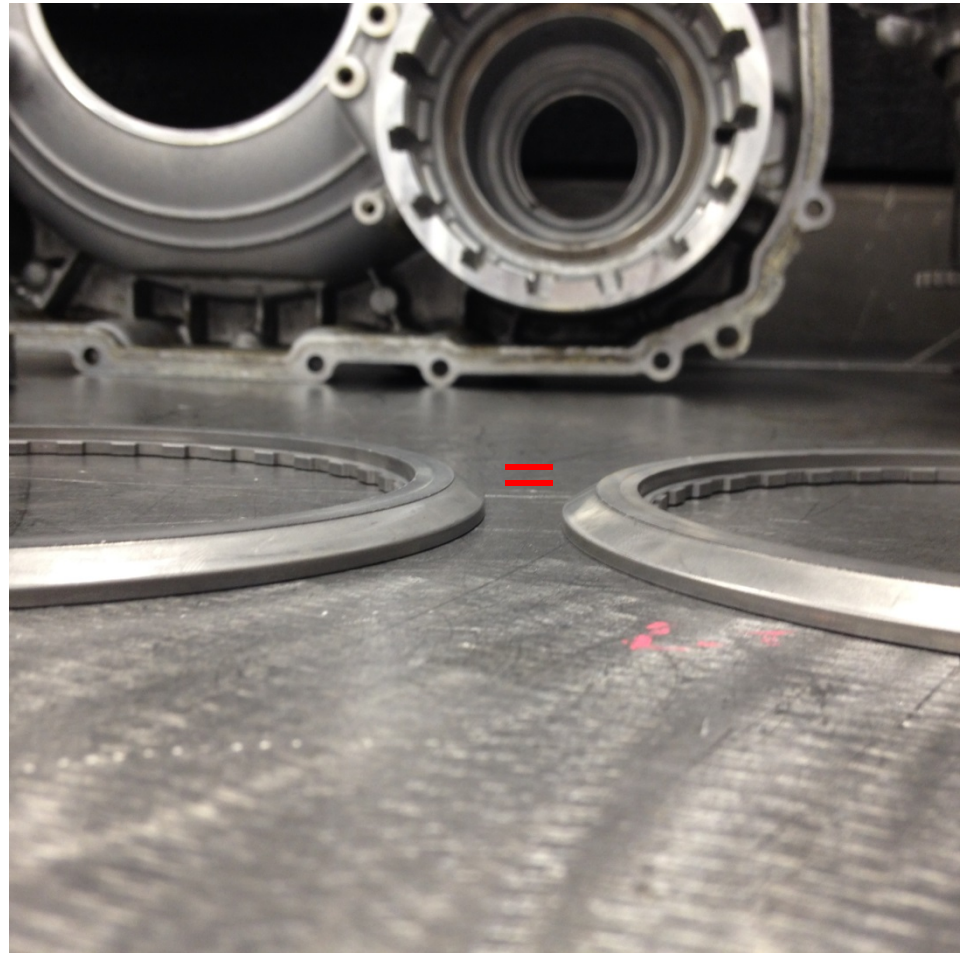


3-5-R Backing Plate Update

Updated mid-2010-later and previous design backing plates:

1st design lip was shorter (2.75mm tall) vs. 3.25mm tall on updated design.

The overall height of the plate remained the same: 6.25mm.



Previous Design 35R Piston

The previous design has 3 notches ID.



Updated 3-5-R Piston Updated 2012 Production 6T40/45/50 GEN 1

This update was due to wave plate durability issues.

The updated piston is designed to address the issue. This update will back service previous years.

The wave plate part number did not change.

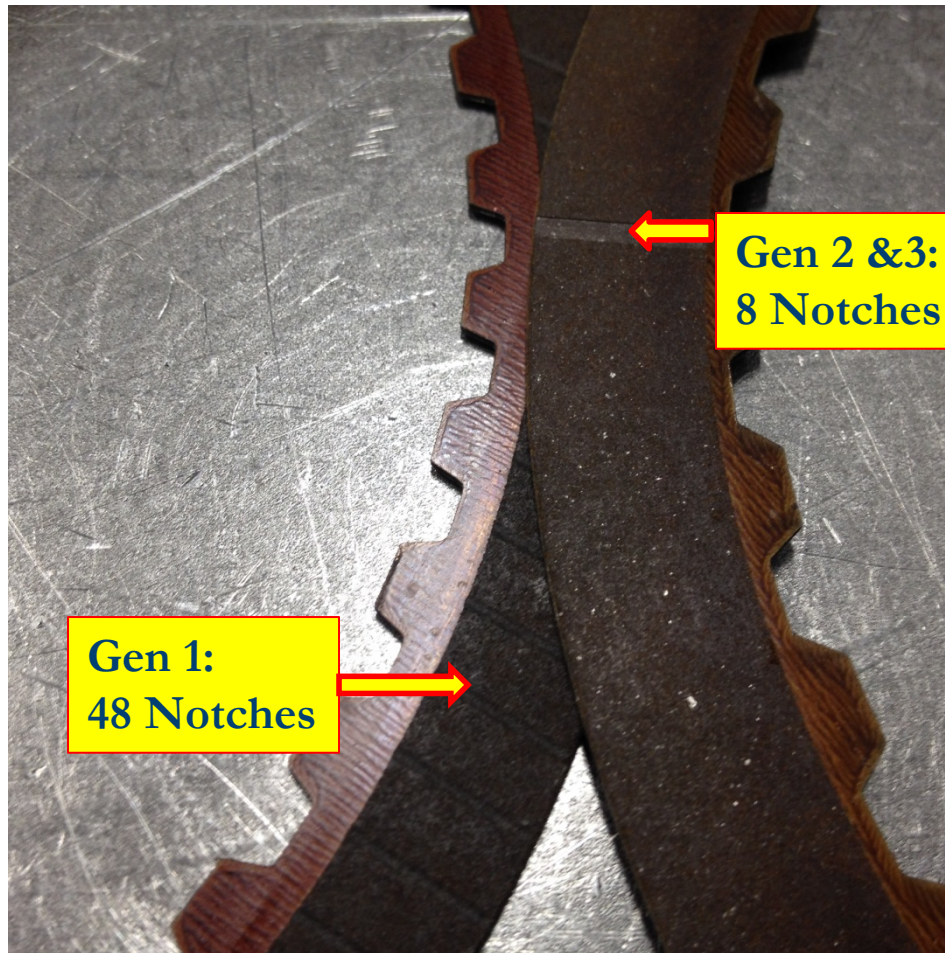


2-6 Clutch Friction Updates

Gen 1: 48 notches
in the disc

Gen 2 Interm, Gen 2
and Gen 3:
8 notches in the disc

The update was
introduced in the
Hybrid (BAS)
applications and
then moved to the
Non-hybrid
applications.



An updated
calibration was
also included with
this update.

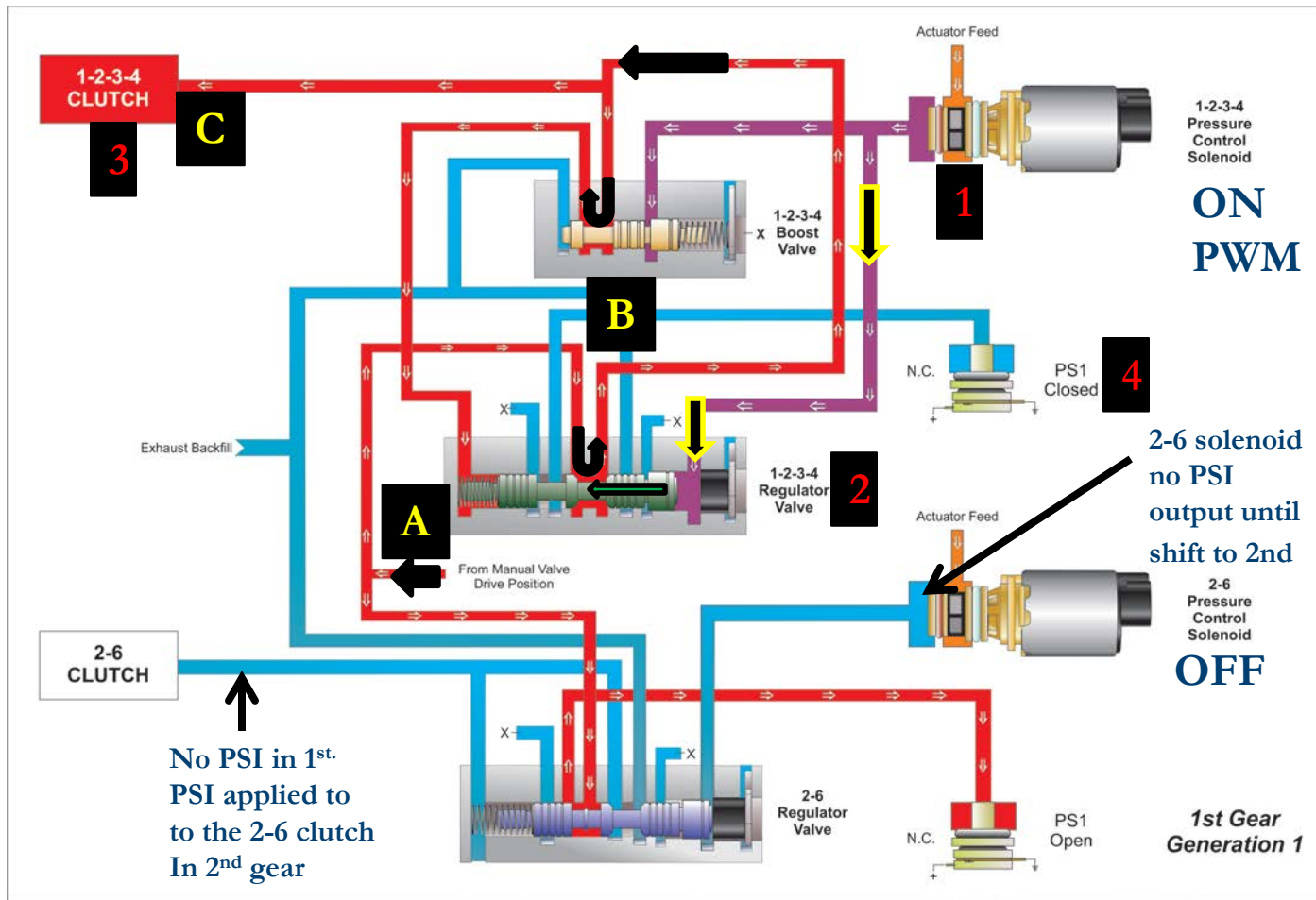
That is why GM
states that the
GEN 1 and
GEN 2/GEN 3
discs should not
be interchanged.

This update started
in 2012 and was
completed by SOP
2013

GEN 1, GEN 2, GEN 3 Differences

- Major differences between Generations 1, 2 and 3.
- Major Hydraulics/Valve Train and Friction component changes between Gen 1 and 2.
- Major pump and Hydraulic component changes between Gen 2 and 3.
- Many of the parts/components are **NOT** interchangeable between the generations.

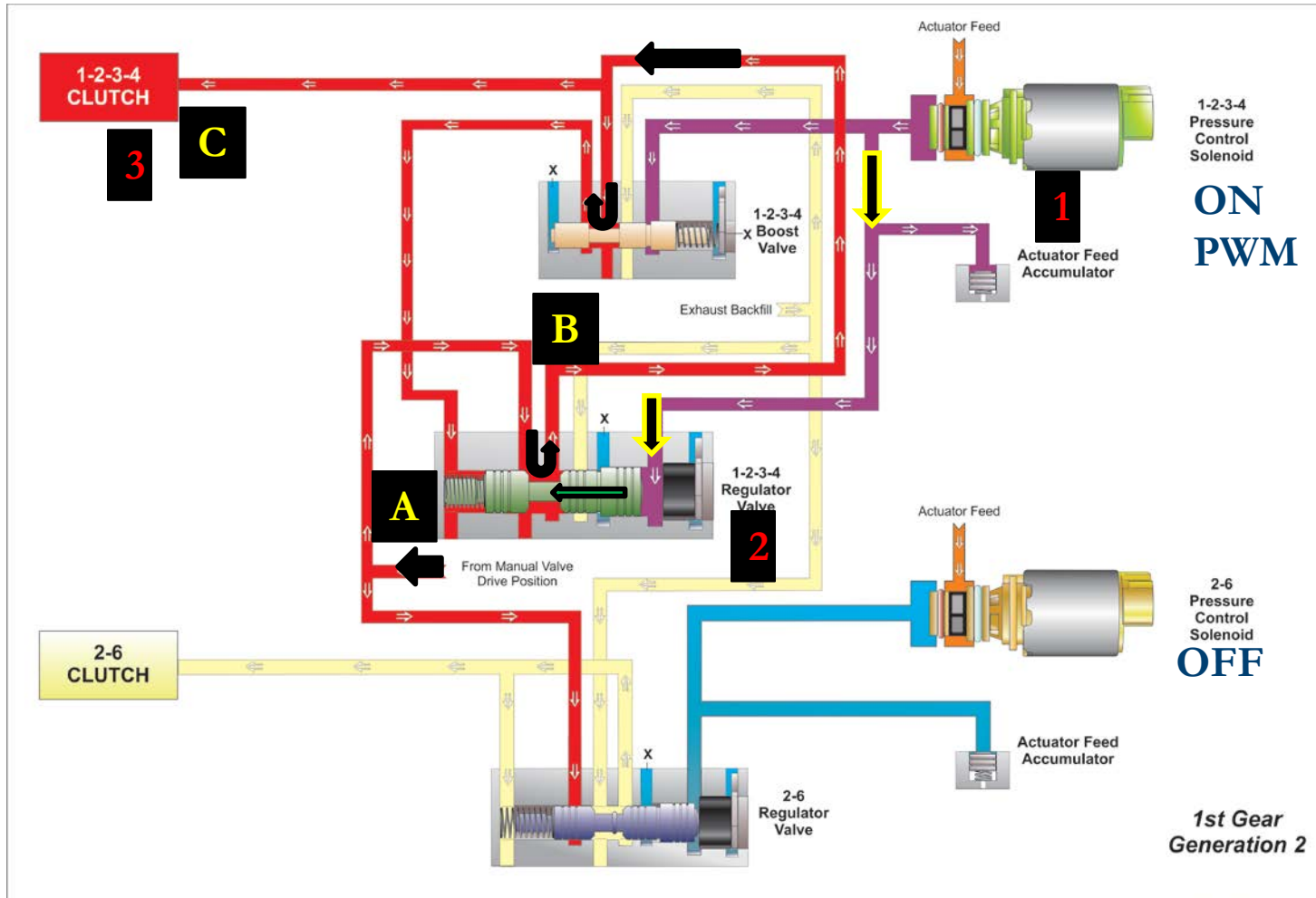
GEN 1



REPRESENT COMPONENT OPERATION SEQUENCE

LETTERS REPRESENT FLUID FLOW

GEN 2

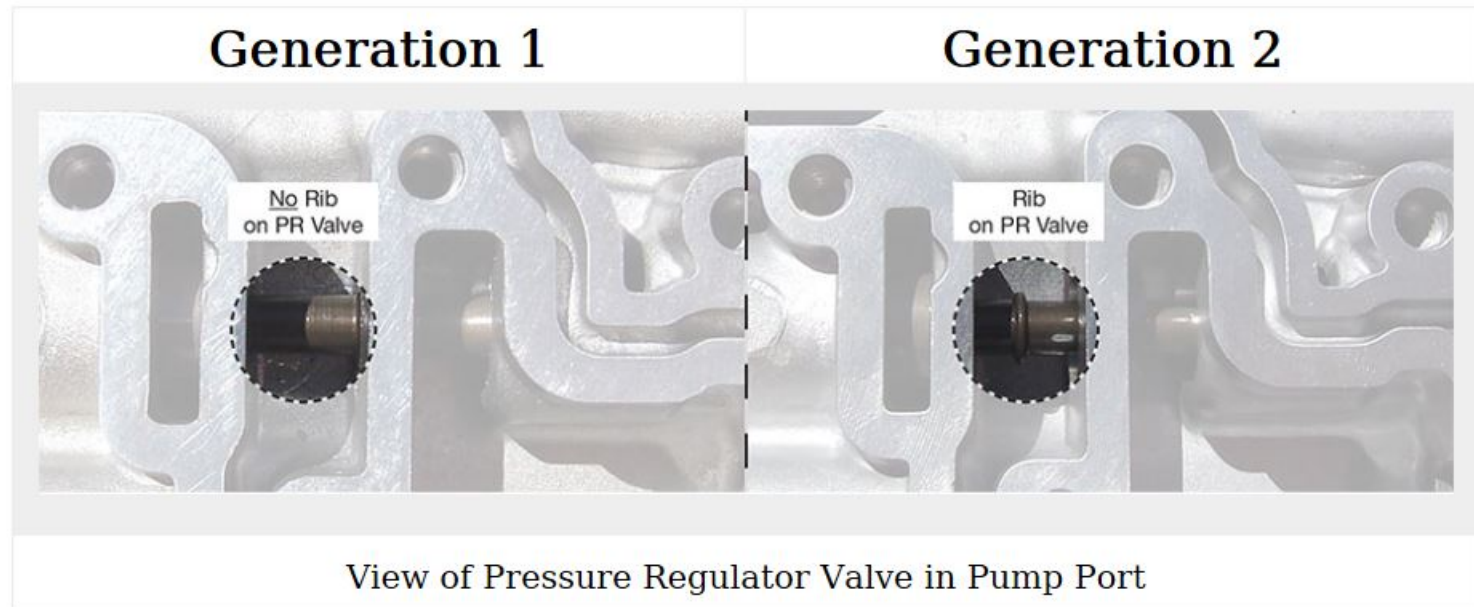


GEN 1, GEN 2 ID

Starting with 2012 SOP, some 6T40/45/50 applications received the GEN 2 updates. The following hydraulic components were changed:

- TEHCM:
 - No pressure switches
 - “Clutch Pulse Learn” used for adapts
 - Solenoids changed from VBS to VFS design
 - Filter plate screen count reduced
- Hydraulic updates for the GEN 2 include:
 - Manual valve
 - Clutch select valve
 - 1-2-3-4 boost valve
 - Rev-456 regulator valve
 - 2-6 valve
 - 1-2-3-4 regulator valve
 - TCC regulator apply valve
 - 3-5 Rev. regulator valve and actuator feed accumulator pistons were added
 - A variable clutch housing check ball was added
 - Control valve channel plate ball and spring were added and a default valve was added.
 - The compensator regulator valve eliminated.

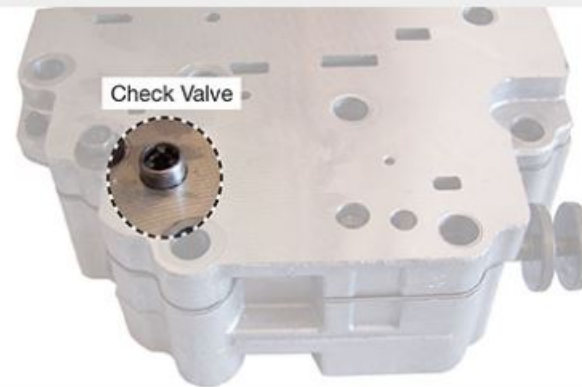
Refer To Pages 104-105 In The Volume 9 Transmission Catalog For Details



Generation 1

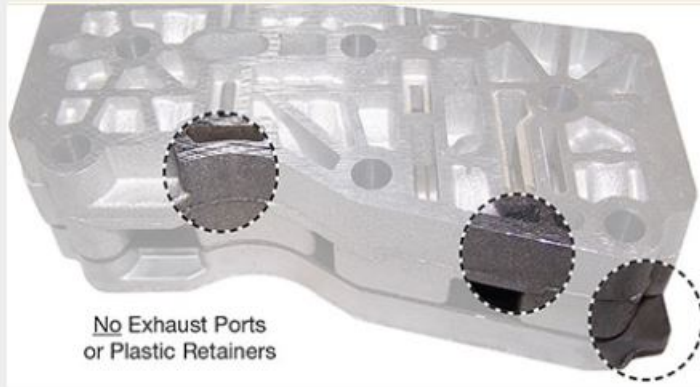


Generation 2

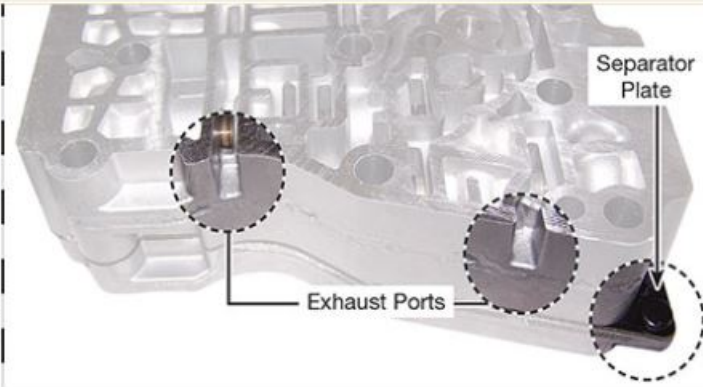


Valve Body, Upper Cover

Generation 1



Generation 2



Main Valve Body, Lower Side

Generation 1



Many screens in filter plate.

Generation 2

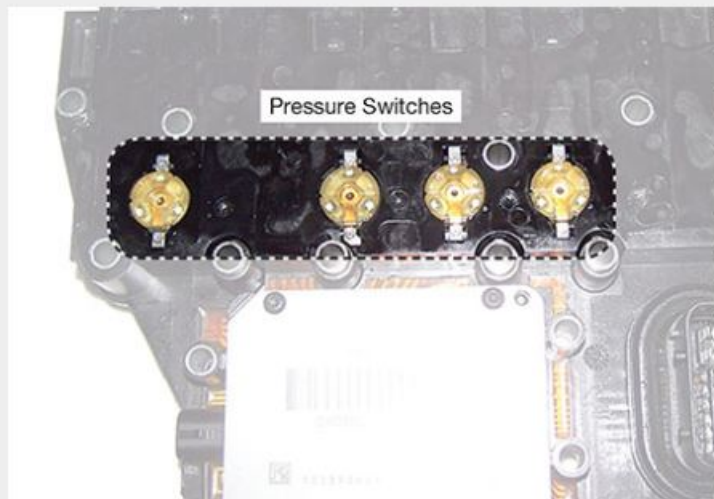


Three screens in filter plate.

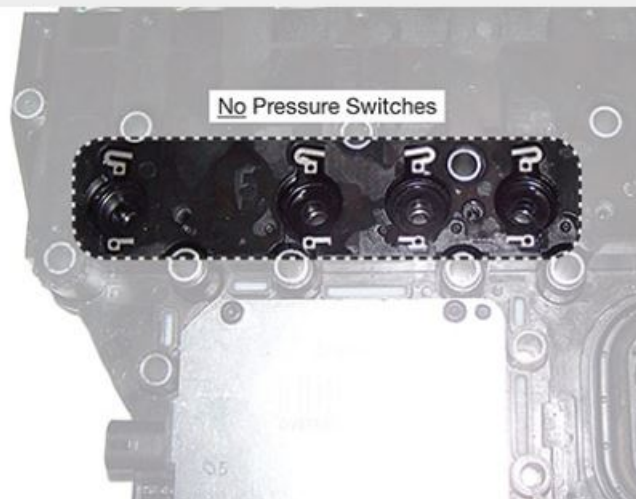
Note: Solenoid end cap color is not generationally significant.

TEHCM, Lower Side

Generation 1

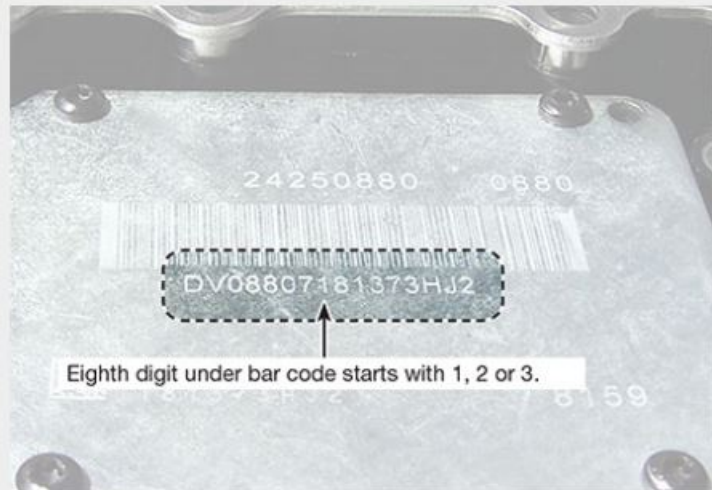


Generation 2



TEHCM, Upper Side

Generation 1



Eighth digit under bar code starts with 1, 2 or 3.

Generation 2

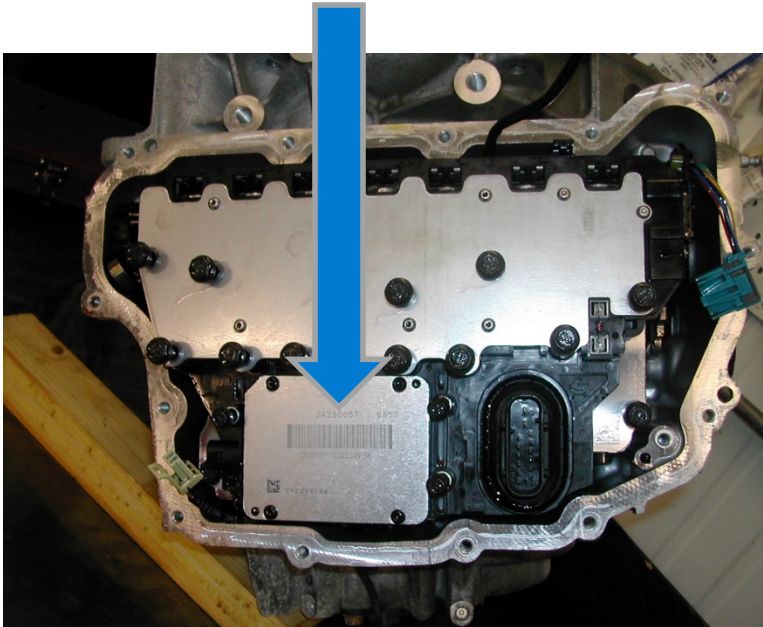


Eighth digit under bar code starts with B, C or D.

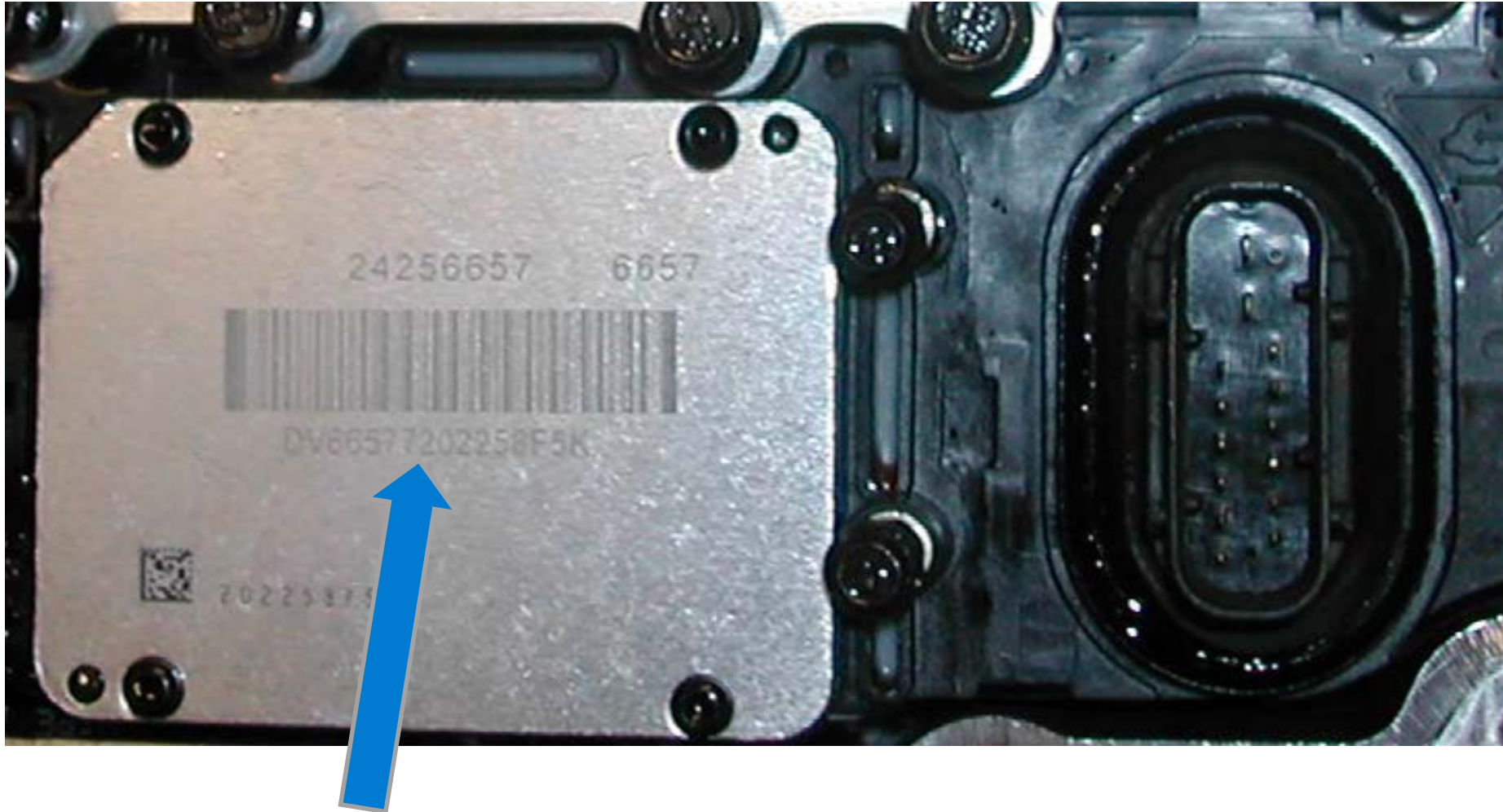
TEHCM ID Plate

GEN 2 ID Differences

- No TEHCM Pressure Switches
- Only 3 screens used in the filter plate
- TEHCM ID number changed



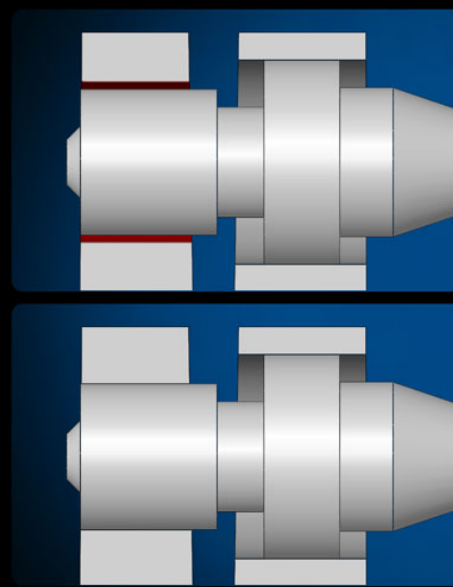
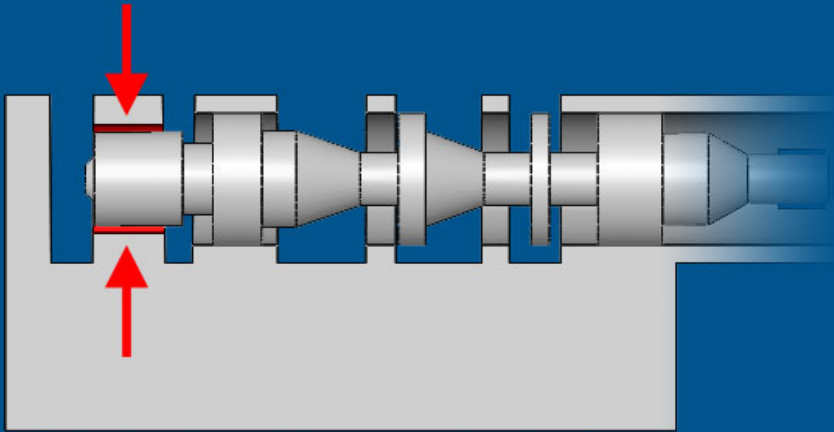
GEN 1, GEN 2 ID



8th position.....GEN 1 is a 1, 2 or 3 | GEN 2 is a B, C or D

6T40 Valve Body Wear Issues

Bore Wear



Worn Bore = Low Vacuum Reading



O.K. Bore = High Vacuum Reading

Valve body wear is common in all the GM 6 speed applications including the 6T40.

Vacuum Testing will allow you to identify the areas that are worn.

No Reaming Required

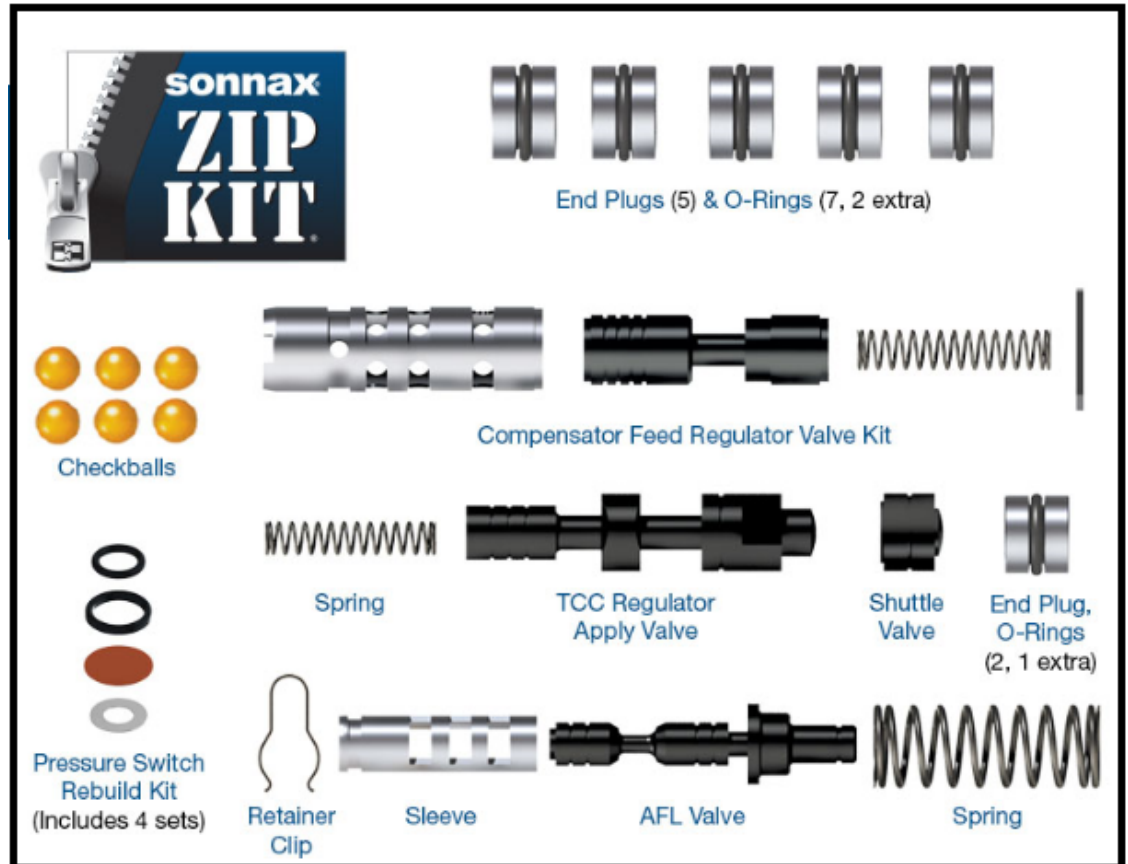
6T40/45/50 Zip Kit®

Part # 6T40-ZIP

Addresses numerous common shift issues.

Kits include:

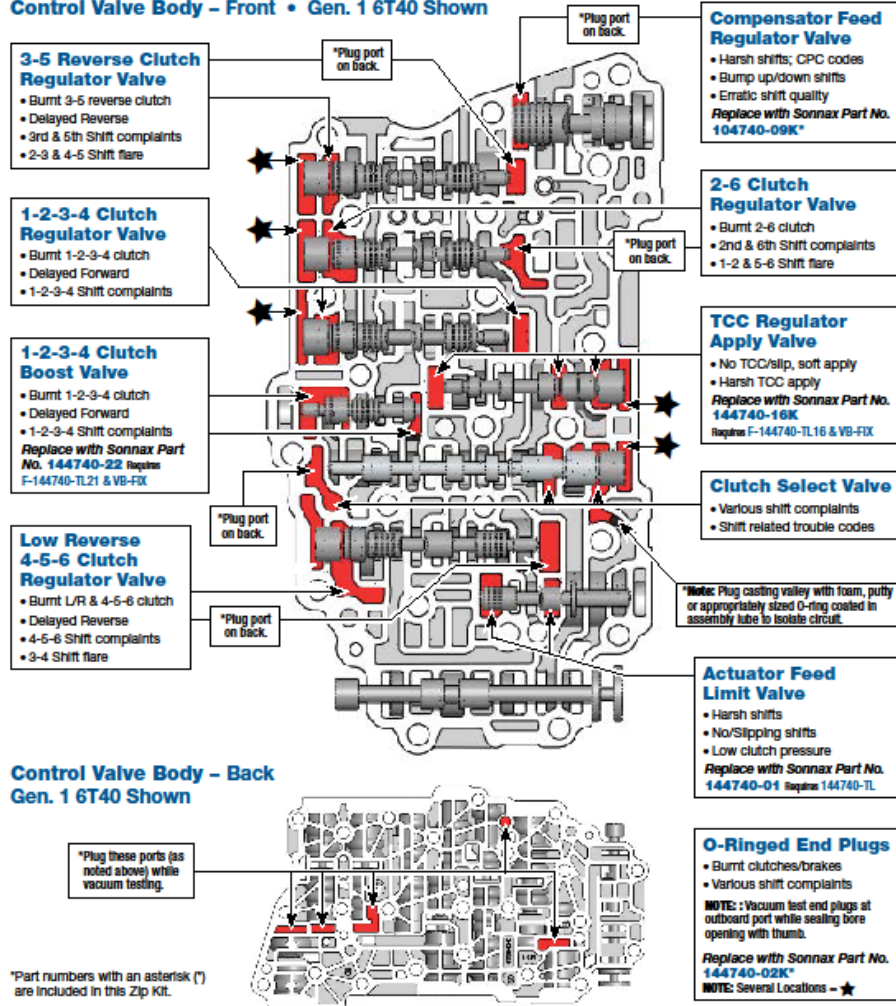
- Common repair parts
- Quick Guide & Tech Booklet
- Vacuum test information



Critical Wear Areas & Vacuum Test Locations

NOTE: OE valves are shown in rest position and should be tested in rest position unless otherwise indicated. Test locations are pointed to with an arrow. Springs are not shown for visual clarity. Low vacuum reading indicates wear and Sonnax parts noted for replacement.

Control Valve Body – Front • Gen. 1 6T40 Shown



Control Valve Body – Back Gen. 1 6T40 Shown

*Plug these ports (as noted above) while vacuum testing.

Part numbers with an asterisk () are included in this Zip Kit.

Vacuum Test Guides

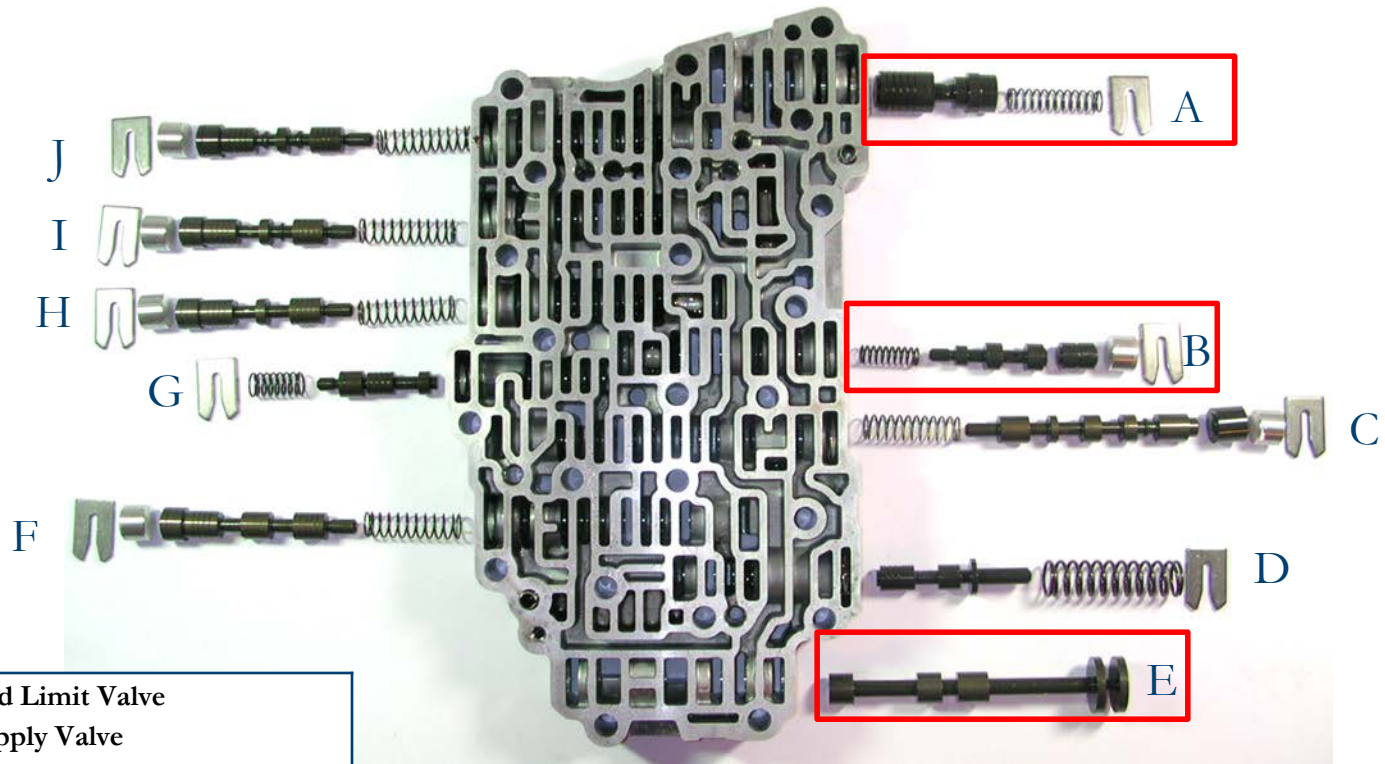
All ZIP kits include vacuum testing instructions.

Complete Sonnax vacuum test guides for a variety of units are available online at www.sonnax.com

Test guides will:

- Show you where to test
- ID symptoms
- Show the part numbers needed for the repair

GEN 1 6T40 Control Valve Body



- A Compensator Feed Limit Valve
- B TCC Regulator Apply Valve
- C Clutch Select Valve
- D Actuator Feed Limit Valve
- E Manual Valve
- F Reverse and 4-5-6 Clutch Regulator Valve
- G 1-2-3-4 Clutch Boost Valve
- H 1-2-3-4 Clutch Regulator Valve
- I 2-6 Clutch Regulator Valve
- J 3-5 Reverse Clutch Regulator Valve

Valve Train

- **Compensator Feed Regulator (Clutch dam reg, balance piston valve):**
Reduces line pressure to approximately 9 psi to feed the compensator circuits for the 3-5-R and 4-5-6 clutches. This pressure is used to help release the clutches, prevent centrifugal apply, as well as a control for shift feel...it effectively acts similar to an accumulator. Valve not used in GEN 2, back fill circuit used instead for compensator control.
- **TCC Regulator Valve:**
Uses PCS-TCC apply pressure to control the amount of oil pressure being fed to the torque converter during apply.
- **Manual Valve:**
Fed by line pressure and controlled by the driver as with other applications.

Worn TCC Regulator Valve

Symptoms:

- DTC P0741 and/or P0742 may set
- Harsh TCC apply
- Loss of fuel economy
- Low TCC apply pressure
- TCC slip excessive/no TCC
- Overheat

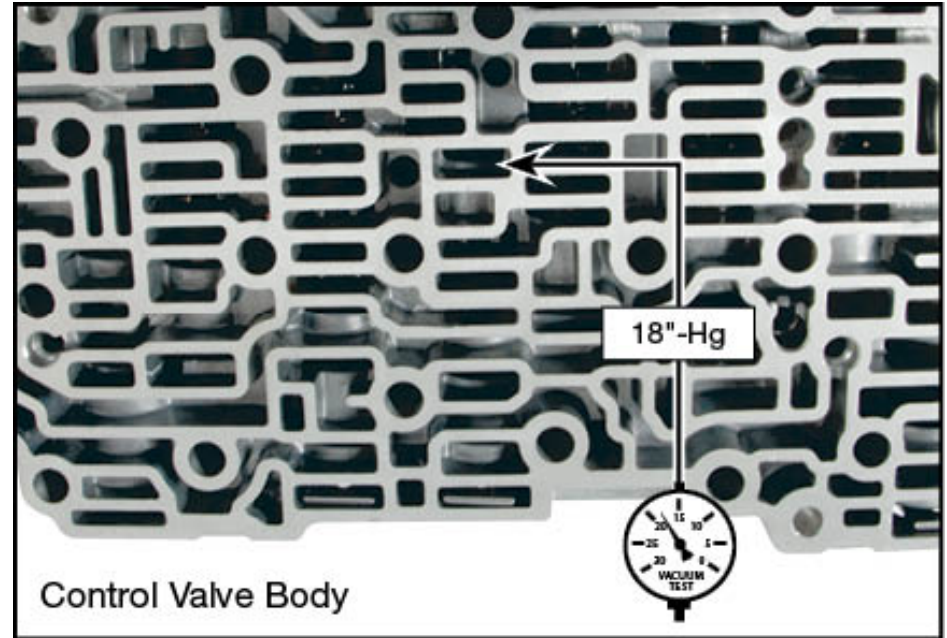
Locating a Worn TCC Regulator Valve

Wear Areas:

Bore wear or land wear may result in low TCC pressure. This can result in apply/release issues as well as TCC-related DTC's.

NOTE:

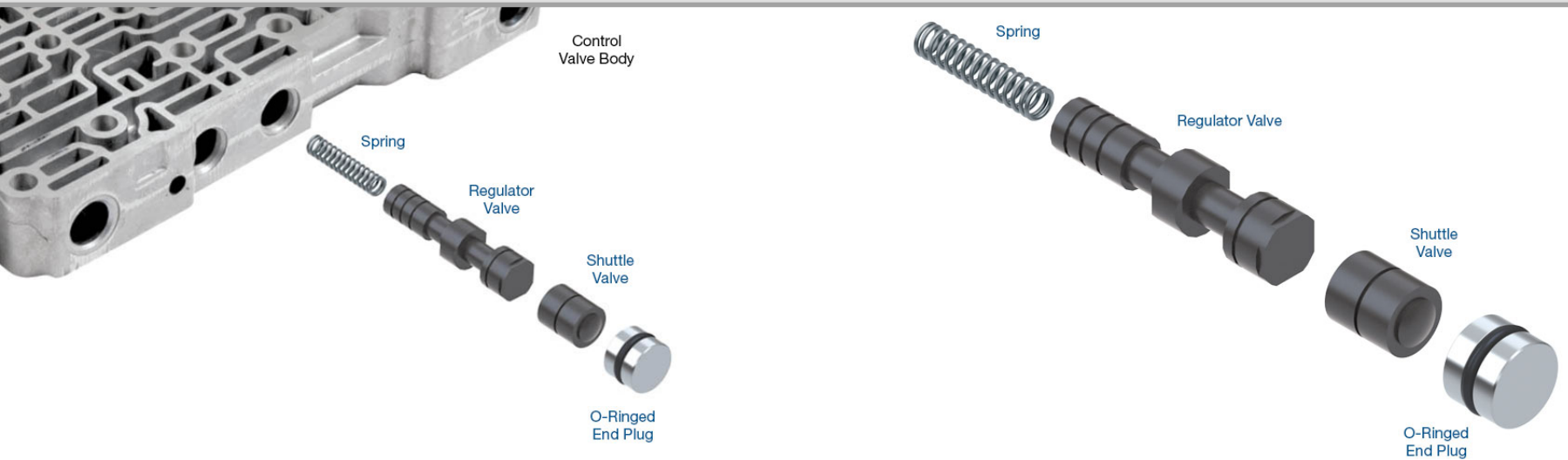
The complete vacuum test guide for the 6T40 Gen. 1 transmission is available at www.sonnax.com



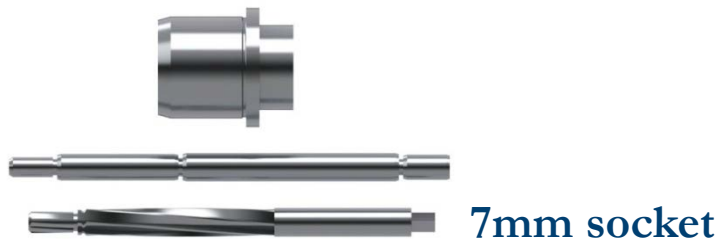
Vacuum Test Location

Worn TCC Regulator Valve 6T40/45/50 GEN 1

Solution: Part # 144740-16K



Use with Tool Kit F-144740-TL16



This tool kit requires the use of the VB-FIX.

Worn Compensator Feed Regulator Valve

Symptoms:

- Bump shifts
- Solenoid and/or ratio/slip codes
- Erratic shift quality
- Harsh shifts

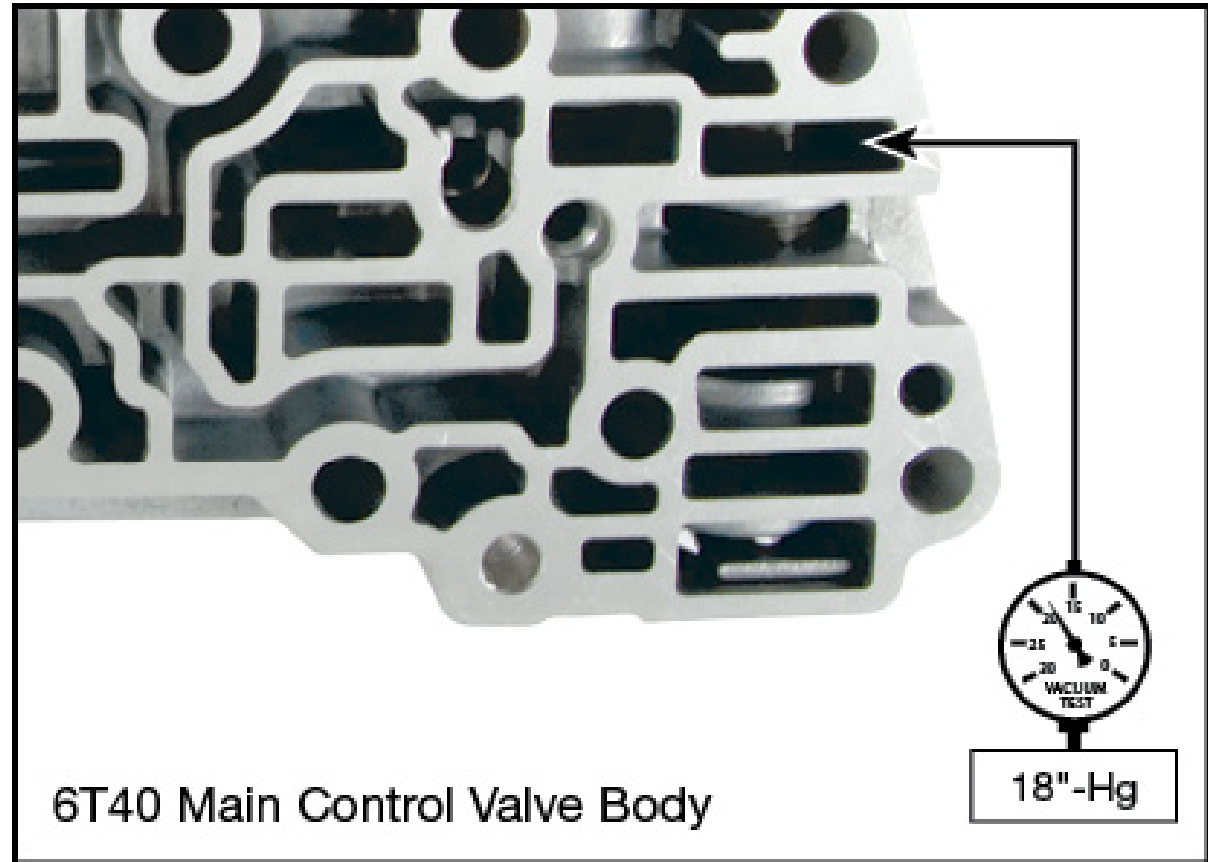
Locating a Worn Compensator Feed Regulator Valve

Wear Areas:

Bore wear or land wear may result in tie up on shifts or clutch damage.

NOTE:

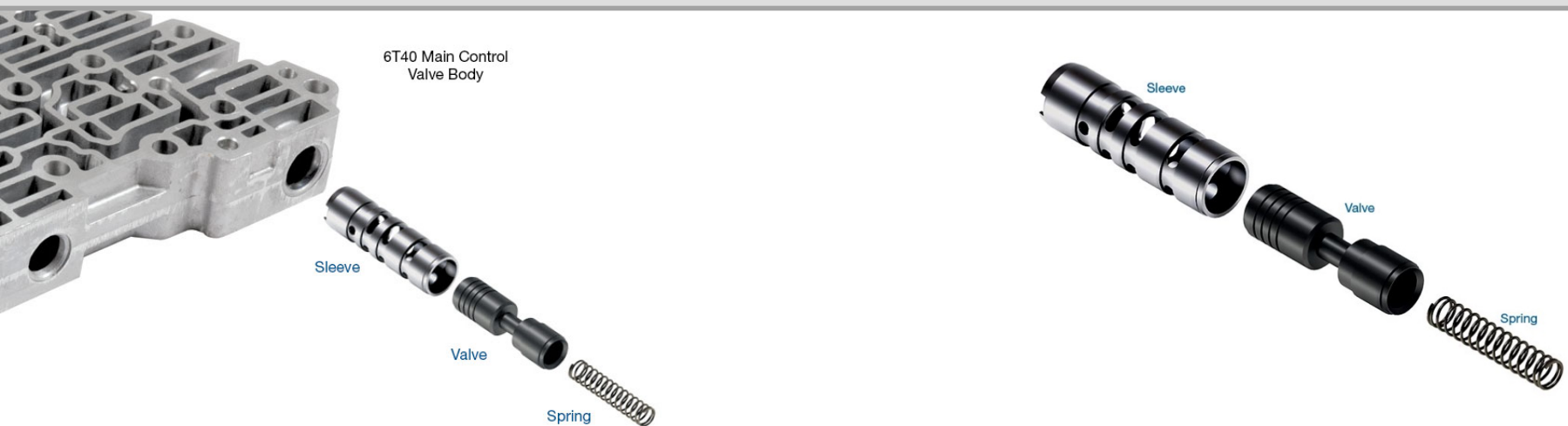
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Vacuum Test Location

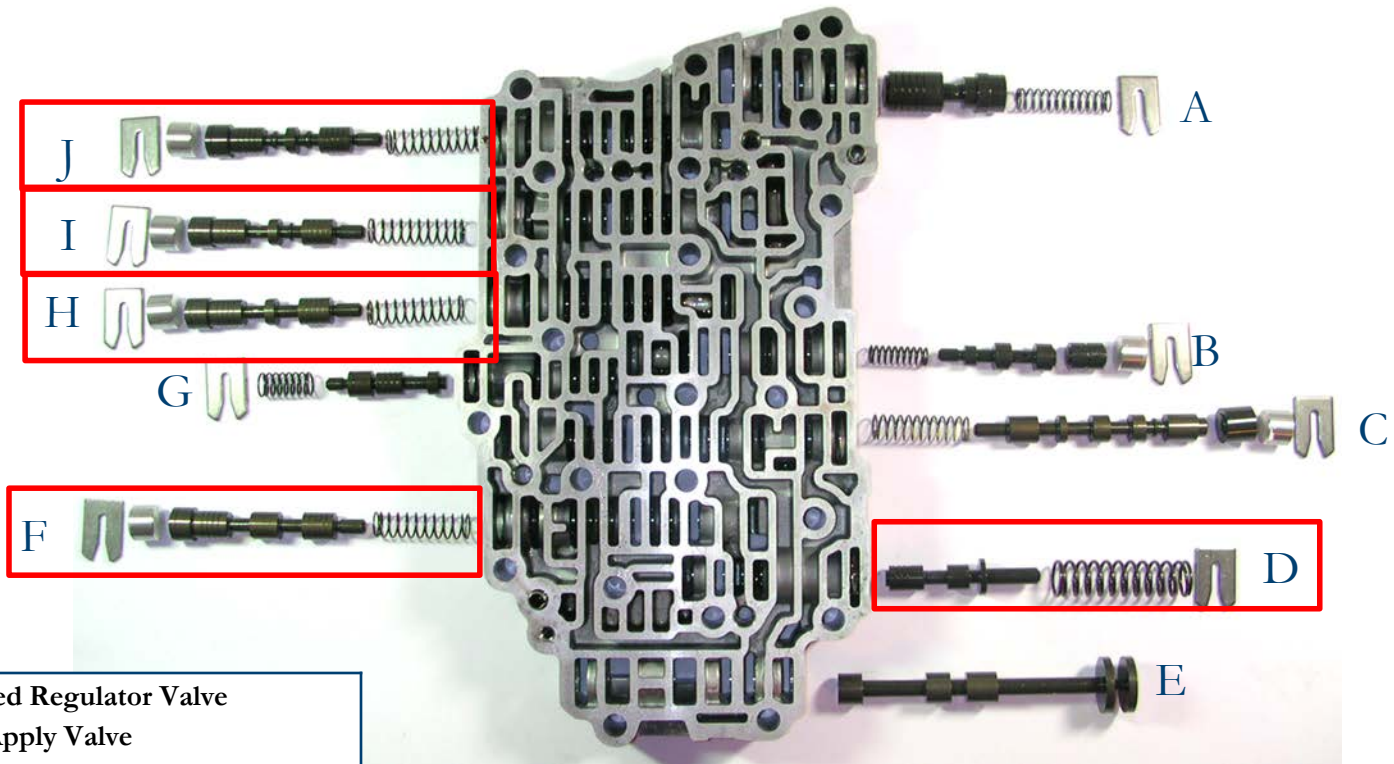
Worn Compensator Feed Regulator Valve 6T40/45/50 GEN 1, 6L80/90

Solution: Part # 104740-09K **NO REAMING REQUIRED**



This updated compensator feed regulator valve train design of Sonnax kit # 104740-09K can also be used on **6L80/6L90/6L50/6L45** applications.

GEN 1 6T40 Control Valve Body



- A Compensator Feed Regulator Valve
- B TCC Regulator Apply Valve
- C Clutch Select Valve
- D Actuator Feed Limit Valve
- E Manual Valve
- F Reverse and 4-5-6 Clutch Regulator Valve
- G 1-2-3-4 Clutch Boost Valve
- H 1-2-3-4 Clutch Regulator Valve
- I 2-6 Clutch Regulator
- J 3-5 Reverse Clutch Regulator Valve



6T40 Valve Train

- **Actuator Feed Limit (AFL):** Regulates pressure fed to the solenoids.
- **R1/456 Clutch Regulator:** Regulates R1/456 clutch feed pressure during P-R-N-1st-4th- 5th- 6th. In addition, the pressure from this valve is routed to pressure switch #4 on GEN 1 applications.
- **2-6 Cutch Regulator :** Regulates the 2-6 clutch feed during 2nd and 6th gear. Pressure also controls pressure switch #3 on GEN 1 applications.
- **3-5 Reverse Clutch Regulator:** Regulates the feed to the 3-5 R clutch. Pressure also controls pressure switch #2 on GEN 1 applications.
- **1-2-3-4 Clutch Regulator:** Regulates the 1-2-3-4 Clutch feed pressure during 1st, 2nd, 3rd and 4th gears. Pressure also controls the #1 pressure switch on GEN 1 applications.

Actuator Feed Limit (Solenoid Regulator Valve) Wear

Symptoms:

- Harsh shifts
- Low clutch apply pressure
- No 4th
- No 5th
- No 6th
- Slipping shifts
- Slip and/or adaptive DTC's

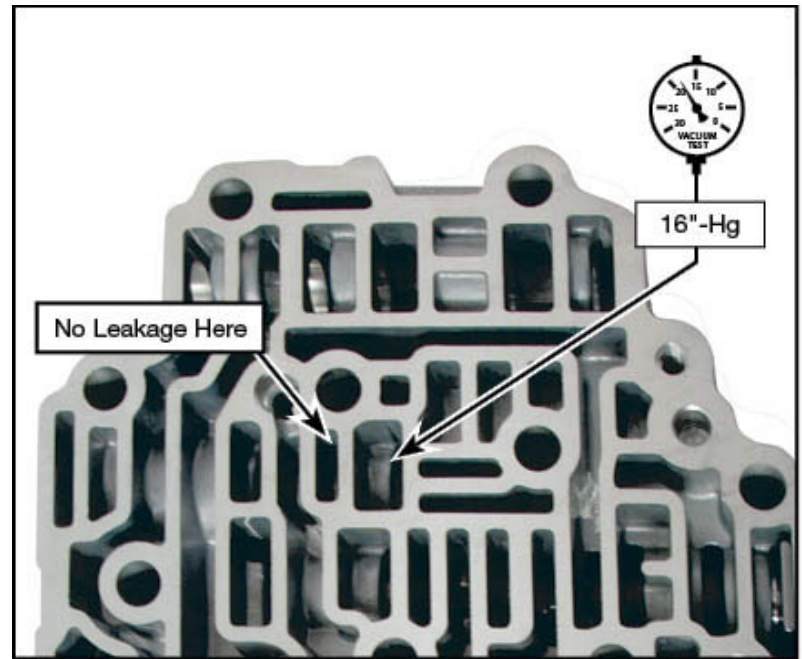
Locating A Worn AFL Valve

Wear Areas:

Bore wear or land wear may result in: Low solenoid feed pressure which will effect clutch operation. Eventually this will lead to clutch damage and slip/missing gears.

NOTE:

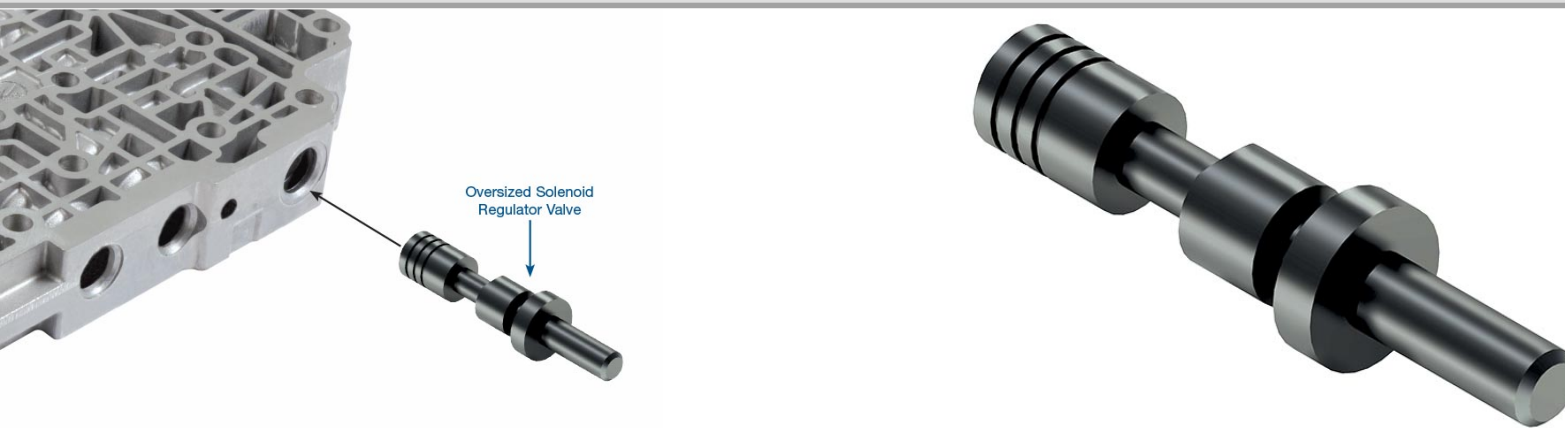
The complete vacuum test guide for the 6T40 Gen. 1 transmission is available at www.sonnax.com



Vacuum Test Location

AFL (Solenoid Regulator Valve) Wear 6T40/45/50 GEN 1

Solution: Part # 144740-01



Use with Tool Kit 144740-TL

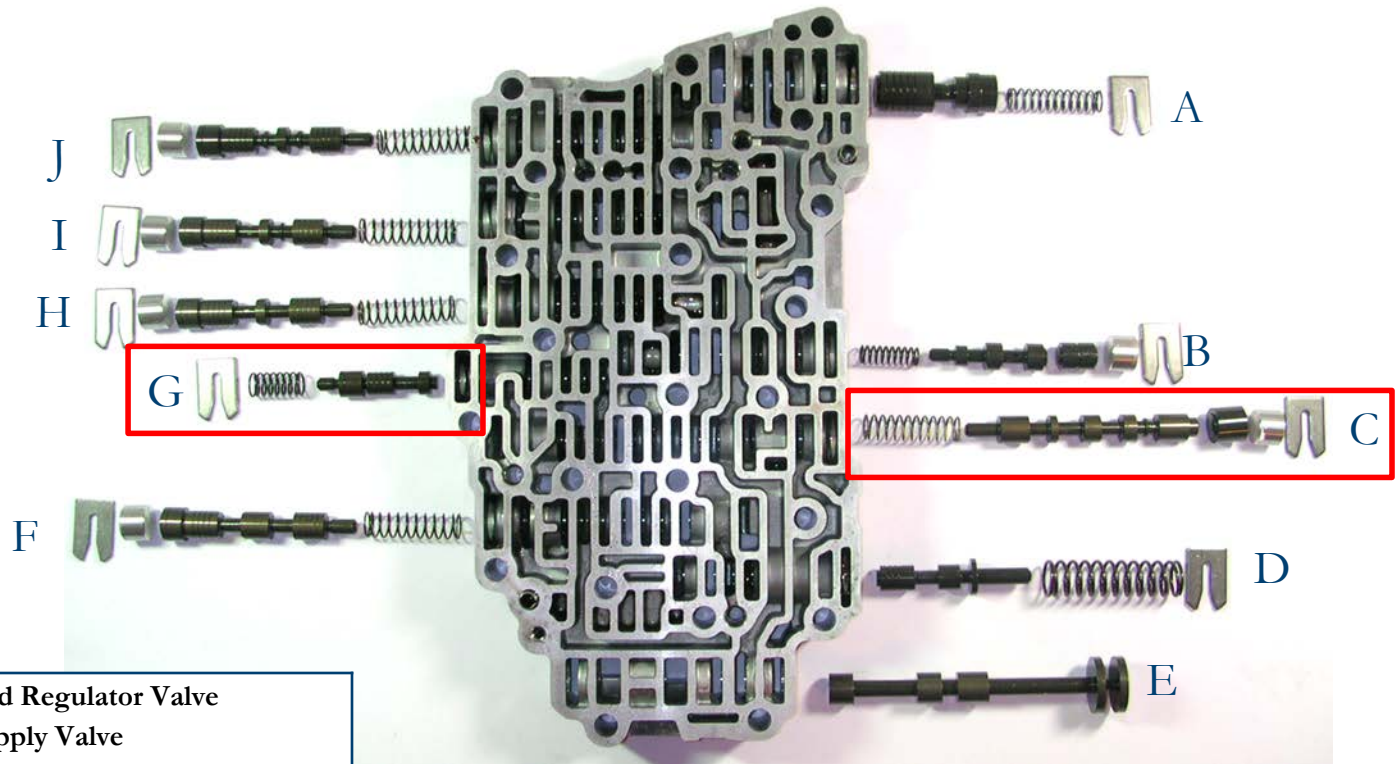


Note: The guide sleeve fits very snug in the VB bore.



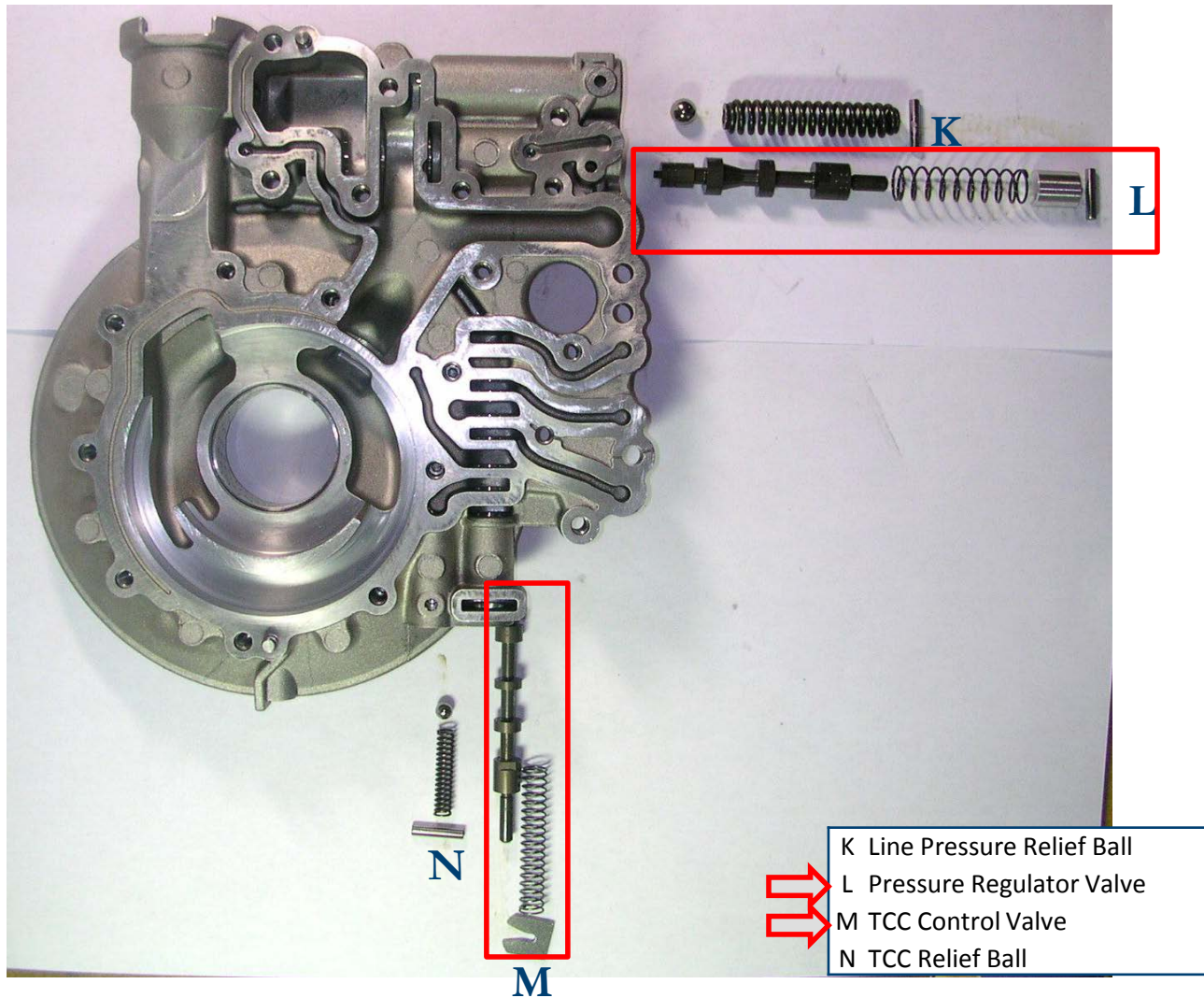
8mm socket or a 1/4" pipe plug socket (8-sided)

GEN 1 6T40 Control Valve Body



- A Compensator Feed Regulator Valve
- B TCC Regulator Apply Valve
- C Clutch Select Valve
- D Actuator Feed Limit Valve
- E Manual Valve
- F Reverse and 4-5-6 Clutch Regulator Valve
- G 1-2-3-4 Clutch Boost Valve
- H 1-2-3-4 Clutch Regulator Valve
- I 2-6 Clutch Regulator
- J 3-5 Reverse Clutch Regulator Valve

GEN 1 6T40 Pump Body



6T40 Valve Train

- **1-2-3-4 Clutch Boost Valve:** PSI is boosted to the clutch when solenoid pressure reaches 684kpa (99 PSI). Pressure at the clutch will be equal to line pressure when boosted.
- **Clutch Select Valve:** This valve is controlled by the On/OFF solenoid to control the operation of the 3-5-R, 4-5-6, TCC and Low/Rev clutches and their control valves. (Basically this valve enables Reverse and M1 engine braking.)
- **Pressure Regulator:** Controls main line pressure.
- **TCC Control:** Controls TCC apply/release.

Worn Pressure Regulator Valve

Symptoms:

- Burnt clutches
- Erratic line pressure
- Low converter & lube flow
- Overheating
- Poor shift quality
- TCC apply & release concerns
- Slip/Adapt DTC's Set

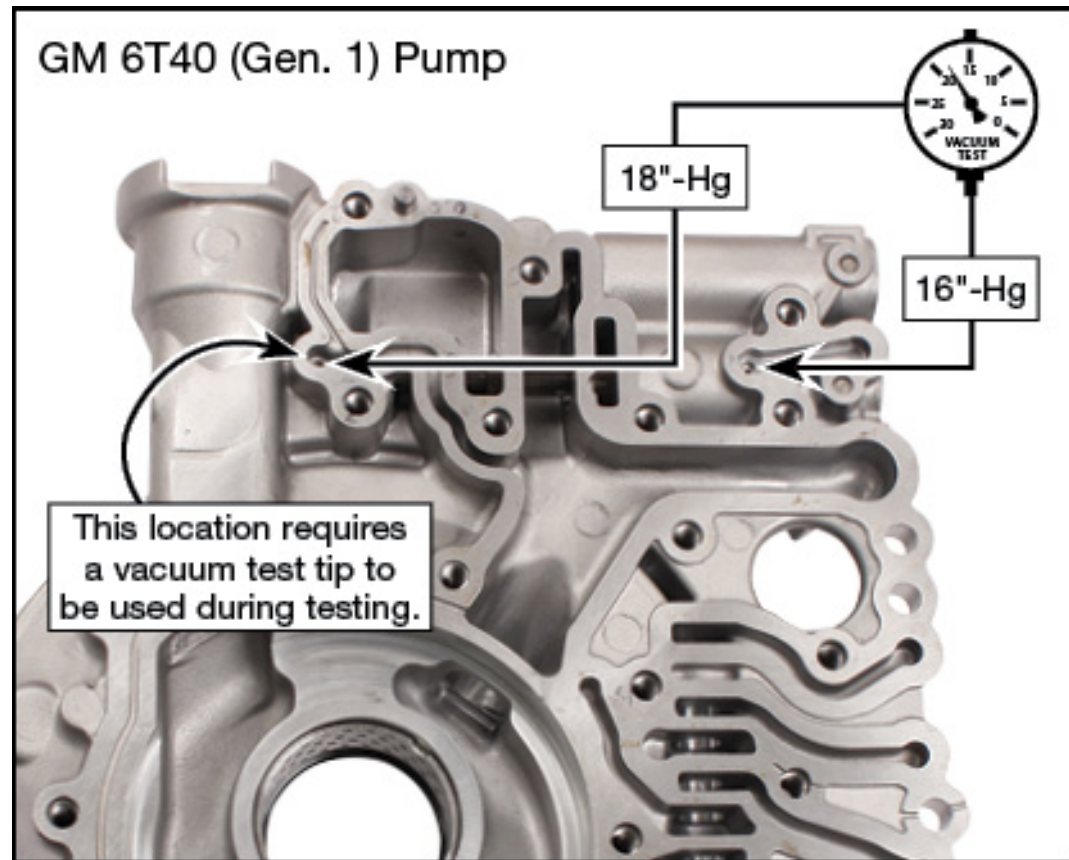
Locating a Worn PR Valve

Wear areas:

- Balance spool end, results in erratic line psi, high line psi, low cooler/converter flow.
- Outboard spool end, results in low Line psi, slipping, adapt DCT's, slip DTC's, soft shifts, burned clutches.

NOTE:

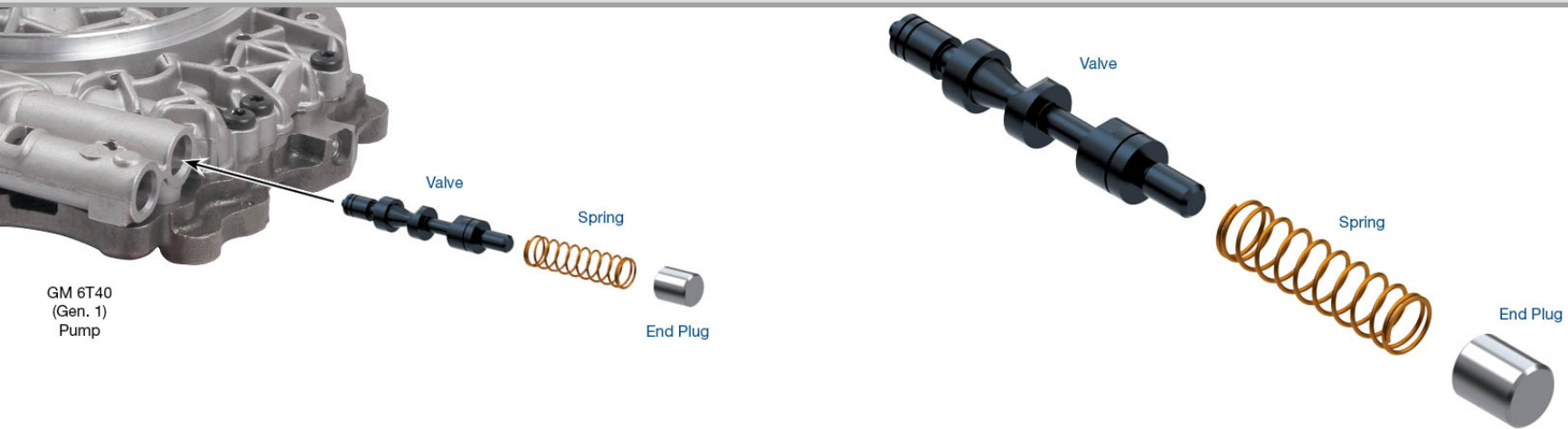
The complete vacuum test guide for the 6T40 Gen. 1 transmission is available at www.sonnax.com



Vacuum Test Location

Worn Pressure Regulator Valve 6T40/45/50 GEN 1

Solution: Part # 144510-01K



Use with Tool Kit #F-144510-TLC

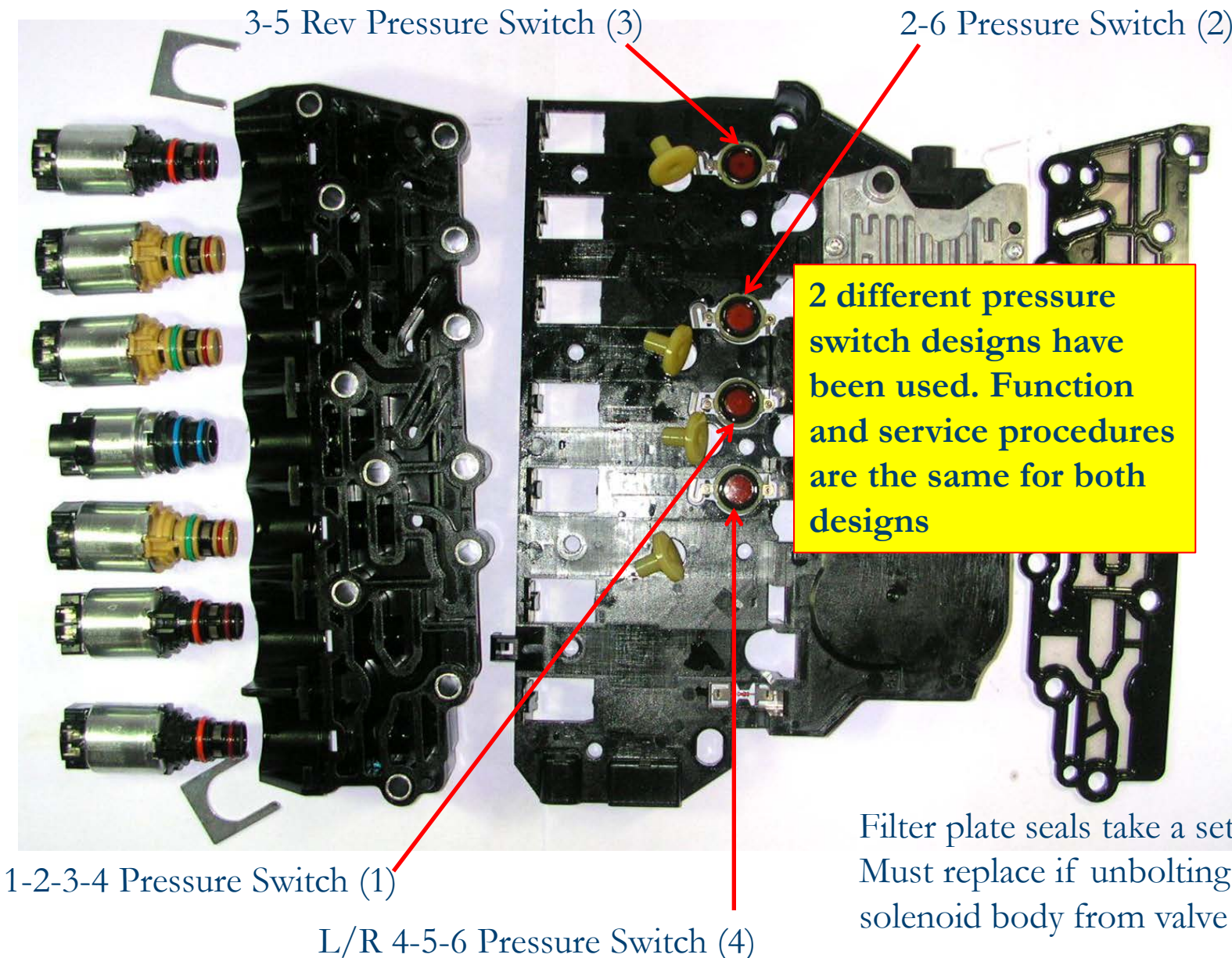


Carbide Reamer



This tool kit requires the **VB-FIX**.
NOTE: You **MUST** use 1/2" or thicker spacer plate between pump body and **VB-FIX**

12mm socket or a 3/8" pipe plug socket (8 sided)



3-5 Rev Pressure Switch (3)

2-6 Pressure Switch (2)

2 different pressure switch designs have been used. Function and service procedures are the same for both designs

1-2-3-4 Pressure Switch (1)

L/R 4-5-6 Pressure Switch (4)

Filter plate seals take a set. Must replace if unbolting solenoid body from valve body.

Pressure Switches

TFP #	Clutch Monitored
1	1-2-3-4
2	3-5-REV
3	2-6
4	4-5-6 Lo/Rev

Function: Adaptive learning, diagnostics

Eliminated on GEN 2 and GEN 3 applications

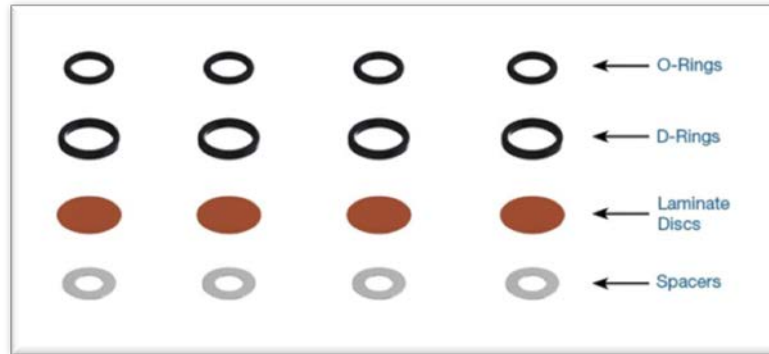
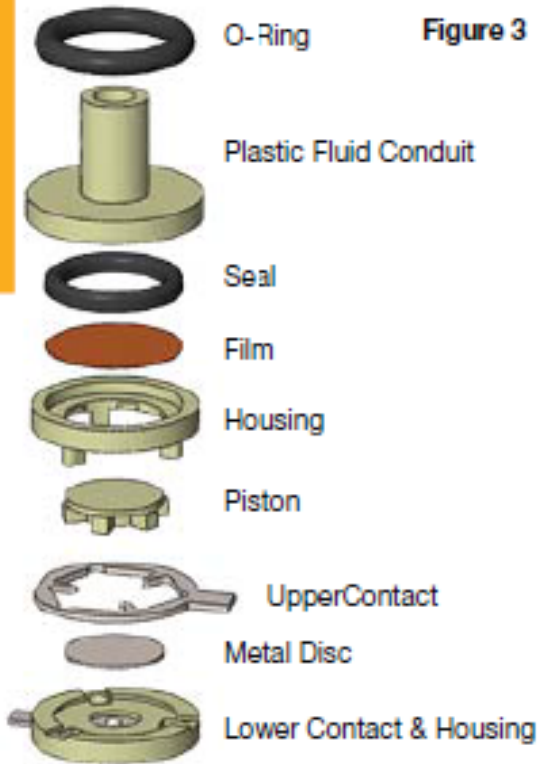
Pressure Switches

- Used in ALL GEN 1 TEHCMs
- Used for adaptive control calculations
- Very high failure rate, delamination, contamination. Previously required TEHCM replacement.
- 2 pressure switch designs used.
- Likely to set a P0752, P0872, P0877 and/or P0989 DTC.

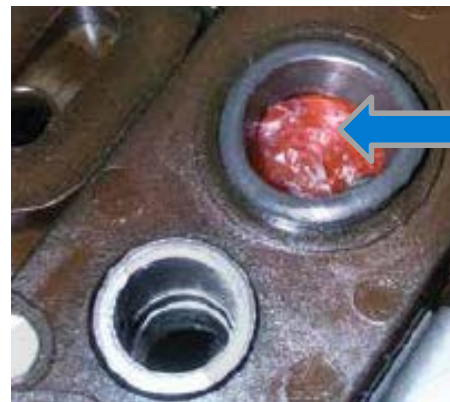
Pressure Switch Rebuild Kit

Solution: Part # 144510-09K **PATENT PENDING**

Exploded illustration of 6T40 series late-style pressure switch components.



Sonnax pressure switch rebuild kit



Delamination. Switch requires replacement. (6L80/6T70 switch shown, 6L80 part number 124740-28K)

Many Other Parts Are Available

GM
6T40 (Gen. 1),
6T45 (Gen. 1), **6T50** (Gen. 1)

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NOTE: Proper identification of this valve body and pump is critical. See unit page at www.sonnax.com for identification guide.



Zip Kit®
6T40-ZP
This Sonnax kit is also available, see www.sonnax.com for details.

1 144740-16K 
Oversized TCC Regulator Valve Kit
Helps cure:
• Harsh/No TCC Apply
• Codes 741, 742
Note: Requires tool kit F-144740-TL6 & the VB-FIX reaming fixture.

2 144510-05K 
Oversized TCC Control Valve Kit
Helps cure:
• TCC apply/release complaints
• Low cooler flow
Note: Requires tool kit F-144510-TL5 & the VB-FIX reaming fixture.

3 144510-01K 
Oversized Pressure Regulator Valve Kit
Helps cure:
• Harsh/Soft shifts
• Burnt clutches
Note: Requires tool kit F-144510-TL3 & the VB-FIX reaming fixture.

4 144740-22 
Oversized Clutch Boost Valve
Helps cure:
• Slips/Harsh/Burnt clutches
• Delayed engagement
Note: Requires tool kit F-144740-TL22 & the VB-FIX reaming fixture.



Main Control Valve Body



Pump Assembly

5 
144510-09K Fits 4 locations
Pressure Switch Rebuild Kit
Helps cure:
• Codes 0752, 0872, 0877, 0989
• Shift concerns
Note: Patent Pending

6 
104740-09K
Compensator Feed Regulator Valve Kit
Helps cure:
• Bump/Harsh/Harsh shifts
• Burnt clutches

7 
144740-02K Fits 6 locations
O-Ringed End Plug Kit
Helps cure:
• Shift concerns
• Burnt clutches

8 
144740-01
Oversized AFL Valve
Helps cure:
• Solenoid codes
• Harsh/Slipping shifts
Note: Requires tool kit 144740-TL

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[Click on Sonnax part numbers to see more information.](#)

Viewer Questions & Answers

- **Q: Why does the Zip Kit® not fix all valve body wear issues?**
A: Sonnax Zip Kits are designed to address many of the most common issues associated with units that exhibit moderate wear. Units suffering from severe bore wear will require reaming and the installation of oversized valves, many of which Sonnax offers. [Click here](#) to learn more about Zip Kits.
- **Q: Can the vacuum test readings shown during the presentation be used on other valve bodies?**
A: No, those vacuum test readings are specific to this valve body. [Click here](#) to learn more about vacuum testing.
- **Q: You mentioned using vacuum testing on other components as well to check piston check balls, shafts and drums for cracks. What should the vacuum reading be?**
A: It should be equal to the maximum vacuum your pump will produce which is likely 25", but remember that value will vary with altitude and the health of your pump.
- **Q: What is the vacuum reading you should see when testing the valves demonstrated in the webinar?**
A: The vacuum readings shown on the webinar images provide the minimum vacuum readings you should be looking for. You can develop your own vacuum standards as well depending on your shop warranty requirements – like how much wear you feel comfortable with in a given bore before deciding a repair needs to be made.
- **Q: Can the vacuum test kit be used on different brands of transmissions?**
A: Yes, this kit is very versatile so you can use it on any transmission you want, whether you're checking valve bodies, checkball capsules, shafts and drums for cracks, etc. [Click here](#) to learn more about the vacuum test stand kit.