Component Identification and Interchange

Center Support

Identify the type of center support in use. There are first design and second design supports. There are early and late versions of the first design. Most early and late first design supports share the same casting number, 8623138. The early first design support was used in all 1964 to mid-year 1969 models, and can be identified by measuring the width of the center support to case lugs. See Figure 5-56. The lug width will measure in @ approximately .370”, and it does not install into the transmission case with the center support to case anti fretting ring (657). See Figure 5-57. The late first design support was used in all late 1969 to early 1990 models, and can be identified by measuring the width of the center support to case lugs. The lug width will measure in @ approximately 330”, and the support installs into the transmission case in conjunction with the anti fretting ring. To accommodate the ring, the lug width was reduced the same amount as the ring width. The purpose of the ring is to insulate the support ledge in the transmission case from center support rearward thrust and radial movement that results in case damage. Without the ring, the support lugs tend to eat or fret the transmission case at the lug to ledge interface. Because early models do not have the ring, increased case wear results in this area. It is always recommended to update to the anti fretting ring/late first design center support combination on models not originally equipped with these components. The early first design support may be used with the anti fretting ring by machining .040” from the rear face of the case lugs. If you try to install the anti fretting ring with the early first design center support, you will not be able to properly install the center support bolt (79) or the beveled snap ring (645).
Note that all 1964 and 1965 models, as well as all 1966 to 1972 Cadillacs were fitted with a center support assembly void of a bleed orifice cup plug in the intermediate clutch piston cavity. See Figure 5-58. Note that these models also used twelve intermediate clutch release springs (648) instead of the usual three installed in all other models. Unlike later models, these supports are void of center support to case lugs in the casting at the area shown in Figure 5-59. Although the lugs are present on later model supports, the case has always been void of "receiver grooves" in that area. This alludes to the fact that it was easier to manufacture the support with all of the lugs rather than to "time" each support during the machining process.

Because the center support is filled from the bottom up, air tends to get trapped in the piston cavity when the circuit is exhausted or not charged with intermediate clutch oil. Without a bleed orifice, this trapped air acts as a variable accumulator in the circuit. This prevents maximum apply pressure from being reached during 1-2 upshifts, reducing intermediate clutch capacity, resulting in intermediate clutch slippage. For all 1966 models, with the exception of Cadillac, who followed suit for their 1973 models, a .020" bleed orifice cup plug was installed in the intermediate clutch piston cavity. The purpose of the bleed orifice cup plug is to purge trapped air from the intermediate clutch piston cavity during intermediate clutch application. Due to the tendency of the support void of the orifice cup plug to reduce clutch capacity and shift quality, its usage in any heavy duty or performance application is not recommended.

All TH400 transmissions produced after March 1, 1990 received a revised center support casting. This is known as the second design center support. The casting number for the
second design center support is 8678032. This is the same support used in all production 1991 to 1995 GM 4L80E transmissions. This support uses the anti fretting ring and the width of the lugs measures approximately .330”. The 8678032 casting has slight differences in non critical dimensions when compared to the 8623138 casting, however; they do not affect fit or function. The second design support also received a different center support to case bolt. This bolt is longer than the previous design and must be used with second design supports only. See Figure 5-60. When used with the anti fretting ring and proper center support to case bolt, the second design center support is fully interchangeable with both the early and late first design center supports.

![Figure 5-60](image)

Beginning on December 21, 1993, GM Goodwrench Replacement Transmissions fitted with the second design support received a revised case to center support service bolt. The bolt, yellow in color and coated with zinc chromate, has a tighter interference fit when installed in the support compared to the previous design. According to GM, the reaming of the threaded hole and the installation of the new bolt allowed the support to be serviced in the field, restoring thread interface integrity. See Figure 5-61. The service bolt and instruction sheet is available under GM Part Number 24202218. I have installed the bolt without reaming without encounter any functional problems.

![Figure 5-61](image)

There is a unique difference found when comparing the first and second design center supports. The first design center support uses 17 full width center support to case lugs. See Figure 5-62. The second design center support only uses two full width center support to case
lugs. See Figure 5-63. No technical information regarding the reasoning for the change has ever been made available. It is evident that the reduced lug count can allow increased radial movement between the center support to case interface under extreme loading conditions in Lo range.

![Intermediate Clutch Piston](image1)

**FIGURE 5-62**

![Intermediate Clutch Piston](image2)

**FIGURE 5-63**

**Intermediate Clutch Piston**
1964 to 1973, all TH400 transmissions were built with the cast aluminum intermediate clutch piston. See Figure 5-64. In 1974, the stamped steel intermediate clutch piston was introduced and used on some models, while the aluminum piston was used on others. See Figure 5-65. Use of the stamped steel piston continued until the end of the 1984 model year, at which time its use was discontinued. Note that unlike the aluminum piston, the steel piston is void of release spring pockets. To provide a means for locating the springs, the plastic intermediate clutch spring guide is used with the steel piston. Both intermediate clutch piston combinations are fully interchangeable. Steel piston usage in performance builds is not encouraged. With increased line pressure, it suffers from deflection and a narrow work surface, reducing clutch pack performance. The piston work surface is the area of the front face of the piston that contacts and pushes on the first steel in the clutch pack. Note the narrow work surface of the steel piston compared to the wide work surface of the aluminum type.

Installing 4L80E Intermediate Clutch Piston and or Wave Plate into the TH400

There are two types of production cast aluminum intermediate clutch pistons for the 4L80E. 1991-1995 models received part number 8661657 and are known as the early pistons. 1996 and up models received part number 24202553 and are known as the late pistons. Functional dimensions between the early 4L80E intermediate clutch piston and the TH400 stamped steel or cast aluminum piston are similar with one exception. As cast, the overall work surface height of the 4L80E piston measures .140”, compared to .155” with the TH400 piston. This will result in a .015” increase in intermediate clutch pack end clearance when retrofitting. This is no major cause of concern, and if necessary, clutch pack end clearance can be adjusted during final transmission assembly. All early 4L80E intermediate clutch pistons will retro-fit all TH400 transmissions. Late model 4L80E transmissions incorporate the use of a waved plate installed between the intermediate clutch piston and the first steel plate in the clutch pack as a cushioning device. See Figure 5-66.
Clutch piston dimension revisions accommodate the waved plate. Locating tabs on the inside diameter of the wave plate permit the locating of the waved plate to the counterbore of the piston. See Figure 5-67. The counterbore diameter was enlarged from 5.125” (common between all TH400 and early 4L80E intermediate clutch pistons), to 5.225”, providing the necessary clearance for the waved plates locating tabs. See Figure 5-68.

The piston overall work surface height was reduced from .140” to .090”, restoring clutch pack end clearance lost with the addition of the waved plate. This is where a potential problem can occur. Whenever installing a late 4L80E intermediate clutch piston into a TH400, the matching waved plate (684) must also be used. If not, the first steel plate in the clutch pack will not rest on the piston as intended. Instead, it will sit on top of the beveled center support to the case snap ring (645). See cut away view in Figure 5-69. This will result in excessive intermediate clutch piston travel and possible functional problems may result. When used as a set, the late 4L80E intermediate clutch piston and matching waved plate will retro-fit all TH400 transmissions. When pairing the 4L80E waved plate with a TH400 or early 4L80E intermediate clutch piston, the piston counterbore must be machined to the revised counterbore dimension.
Installing Late 4L80E Center Support Bushing into the TH400

Note how lube oil from the OEM TH400 sun gear shaft inside diameter can flow unobstructed to the lube oil feed slot in the OEM TH400 center support bushing. See Figure 5-70. Note how lube oil from the OEM TH400 sun gear shaft inside diameter to the smaller lube oil feed slot in the OEM center lube 4L80E is severely restricted. See Figure 5-71. This lube oil is what feeds the intermediate sprag and intermediate clutch pack. Interchange is not recommended.
COMPONENT UPGRADES AND MODIFICATIONS

Oversize Center Supports with Billet Intermediate Clutch Piston

With the increased demands placed on the TH400 transmission, it sometimes becomes necessary to increase the clamping force used to apply the intermediate clutch pack to maintain satisfactory torque capacity. In general, the clamping force acting on the multiple disc clutch pack, measured in pounds, is equal to the product of the clutch apply pressure times clutch piston surface area. Other factors such as piston lip seal drag and clutch release spring rate are at work as well but their affects are minimal on the product so they will not be explored here. Based on these principles it should be understood that there are two methods that may be used to increase clamping force. They are either increased clutch apply pressure or increased clutch piston surface area. One might ask ”Why not increase clutch apply pressure to increase the clamping force instead of installing a larger clutch apply piston?” The many possible answers to this question vary widely based on the intended application, but the explanation given herein is based solely on the use of an oversize intermediate clutch piston and center support in a TH400 transmission. If line pressure is raised to a point where the intermediate clutch has adequate clamping force, this increased pressure will be present in the entire hydraulic operating system. When introduced to the system, this increased pressure may needlessly compromise the integrity of additional components and/or reduce the systems operating efficiency. Also worth noting is that increases in line pressure result in linear increases in converter charge pressure and as such may raise converter charge pressure to an unacceptable level. At 200 psi line pressure, the OEM intermediate clutch piston will produce 3264 lbs. of clamping force. Boring out the intermediate clutch piston cavity and fitting it with a piston with a larger apply area allows the desired increase in intermediate clutch clamping force to be achieved without implementing any increases in line pressure. There are currently two versions of modified center supports available thru CK Performance to achieve the desired results. Part # 4CC/CCSA increases the clutch piston clamping force by 15.19%. At 200 psi line pressure, it will produce 3760 lbs. of clamping force. Its use is recommended for all applications over 750 foot pounds of torque. Part # 4CC/SCCSA increases the clutch piston clamping force by 25.61%. At 200 psi line pressure, it will produce 4100 lbs. of clamping force. Its use is recommended for all extreme duty applications. The use of modified center supports also has a place in applications where increased clamping force/clutch capacity is not the main objective. In the field, repeated reductions in line pressure have improved drag strip performance. Field testing netted gains of up to .2 seconds in some applications. Lower hydraulic system pressure values require less power draw on the engine, improving operating efficiency. This will result in more rear wheel horsepower and improved fuel economy in all applications. For example, the installation of # 4CC/SCCSA allows reductions in line pressure of up to 40 psi without any loss in intermediate clutch clamping force. In fact, with a hydraulic system pressure of 160 psi, the 4CC/SCCSA will produce more clamping force than a production support with a hydraulic system pressure of 200 psi.
Installation of Additional Intermediate Clutch Release Springs

Although the factory installed three intermediate clutch release springs (648) in most applications, there is a benefit to installing 12. To better understand the ideology behind this concept, the following information has been provided. During the final assembly of the center support you are instructed to check for proper operation of the intermediate clutch piston by applying 20 to 25 psi of compressed air to the intermediate clutch feed hole. It then states that a final check with full pressure would be performed during the final assembly of the transmission. Depending on the air compressor in use, full pressure will usually be close to 150 psi. This signifies that the piston is capable of overcoming the opposing release spring pressure to pump up and apply the clutch pack with either 20 psi or 150 psi. At lower pressure, clutch pack slippage during clutch application is increased. The use of additional springs permits maximum clutch apply pressure values to be reached in the intermediate clutch circuit before the intermediate clutch piston starts to move to apply the clutch pack. This results in a quicker, firmer shift with reduced slippage. It also speeds up intermediate clutch exhaust during forced or manual 2-1 downshifts.

Creating a Thrust Surface in the Front Face of the Center Support
Normal operating conditions result in the forward clutch housing assembly thrusting rearward into the mainshaft (681). In high load applications this rearward thrust can push the mainshaft with enough force to result in damage to the #22 thrust bearing assembly (686, 687, 688) and output shaft to case thrust and selective washers (695, 696). By creating a thrust surface in the front face of the center support, this rearward thrust can be cancelled out at the center support without making it to the mainshaft. The origin of this rearward thrust begins in the torque converter. Pressurized converter charge oil in the torque converter creates a force that acts on the front face of the input shaft (601). The amount of this force (measured in pounds) is calculated by multiplying converter charge pressure by the surface area of the front face of the input shaft. Typically, “corrected”* converter charge pressure in a high load application will be @ 60 psi. The surface area of a production input shaft is .785”. This combination results in 47.1 pounds of rearward force acting on the front face of the input shaft and forward clutch housing assembly. This force is then transmitted to the mainshaft at the interface between the forward clutch hub (616), and the mainshaft. This occurs because the front end of the mainshaft acts as a stop for the front end of the forward clutch hub. See Figure 5-72.

* Please note that the term “corrected” used in the above paragraph is referring to a converter charge circuit that has been modified to reduce dangerously high converter charge pressures using the techniques in this manual. If left uncorrected, converter charge pressure and rearward thrust values can be as much as double that of the given example.

From the mainshaft, the force is transmitted to the rear internal gear (685) and the #22 thrust bearing assembly (686, 687, 688), then to the output shaft (691) and on to the output shaft to case thrust and selective washers (695, 696), where it is finally grounded out at the transmission case. See Figure 5-73. In heavy duty and high load applications this can result in complete failure of the #22 thrust bearing assembly.
The solution is to remove rearward thrust from the forward clutch housing assembly to the mainshaft. This requires the creation of a thrust surface for the forward clutch housing assembly independent of the mainshaft. This is performed in two steps.

1. A thrust bearing assembly is installed between the front face of the forward clutch hub (616) and the front thrust surface of the direct clutch housing (633). This modification is shown in Chapter Three. This will divert rearward thrust being applied to the mainshaft to the direct clutch housing. This force is now transmitted to the sun gear shaft (664) at the interface between the direct clutch housing and sun gear shaft. This occurs because the front end of the sun gear shaft acts as a stop for the rear end of the direct clutch housing. See Figure 5-74. The force is then transferred from the sun gear shaft to the sun gear (665), on to the #21 thrust bearing assembly (682, 683, 684), followed by the rear internal gear (685), and returning back to the #22 thrust bearing assembly (686, 687, 688). See Figure 5-75. At this point we have done nothing more than reroute the rearward thrust we are trying to eliminate, back to the #22 thrust bearing assembly whose durability we are attempting to improve. However, because we have diverted rearward thrust into the direct clutch housing, the housing can now be grounded to the center support, diverting all rearward thrust into the support. Grounding the rear of the direct clutch housing to the center support removes all rearward thrust at the interface between the housing and the front of the sun gear shaft.
2. A bearing pocket is machined at the bottom of the snap ring boss recess and fitted with a thrust bearing, permitting the grounding of the direct clutch housing to the center support. See Figure 5-76. The pocket is machined to a depth of .375” measured from the front face of the boss and to an inside diameter of 2.125” and an outside diameter of 2.875”.
Selective shims installed between the thrust bearing and the bearing pocket “push” the direct clutch housing off the sun gear shaft stop permitting it to thrust against the center support. See Figures 5-77 and 5-78.

Clearance adjustment is covered during final transmission assembly. The thrust bearing and shim kit is available under CK Performance part # 400CC/TBAWSP, and a machined center support with thrust bearing and shim kit under CK Performance part # 400CC/RCSA.
ADDITIONAL RESOURCES

Center Support Cross Sectional View
<table>
<thead>
<tr>
<th>ILL. NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>646</td>
<td>RING, SNAP (INTERMEDIATE CLUTCH)</td>
</tr>
<tr>
<td>647</td>
<td>RETAINER, INTERMEDIATE CLUTCH SPRING</td>
</tr>
<tr>
<td>650</td>
<td>PISTON, INTERMEDIATE CLUTCH</td>
</tr>
<tr>
<td>651</td>
<td>SEAL, INTERMEDIATE CLUTCH (INNER)</td>
</tr>
<tr>
<td>652</td>
<td>SEAL, INTERMEDIATE CLUTCH (OUTER)</td>
</tr>
<tr>
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<td>RING, OIL SEAL (PUMP COVER)</td>
</tr>
<tr>
<td>654</td>
<td>SUPPORT, CENTER</td>
</tr>
<tr>
<td>656</td>
<td>WASHER, THRUST (SUPPORT/REACTION DRUM)</td>
</tr>
<tr>
<td>660</td>
<td>RACE, THRUST BEARING TO CENTER SUPPORT</td>
</tr>
<tr>
<td>661</td>
<td>BEARING, NEEDLE THRUST</td>
</tr>
<tr>
<td>662</td>
<td>RACE, THRUST BEARING TO CENTER SUPPORT</td>
</tr>
</tbody>
</table>
Center Support Exploded View - Early

Center Support Exploded View - Late

ILL. NO. DESCRIPTION
646 RING, SNAP (INTERMEDIATE CLUTCH)
647 RETAINER, INTERMEDIATE CLUTCH SPRING
648 SPRING, INTERMEDIATE CLUTCH RELEASE
649 GUIDE, INTERMEDIATE CLUTCH
650 PISTON, INTERMEDIATE CLUTCH
651 SEAL, INTERMEDIATE CLUTCH (INNER)
652 SEAL, INTERMEDIATE CLUTCH (OUTER)
653 RING, OIL SEAL (PUMP COVER)
654 SUPPORT, CENTER
655 BUSHING
Center Support Oil Passages

[Image of a mechanical component with labels]

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GM

Center Support Bleed Orifice

[Image of another mechanical component with labels]

A CONSTANT BLEED ORIFICE (APPROX. .020")
654 SUPPORT, CENTER

A

654