CHART 128–1

Selected samples of automatic transmission fluid and some applications. Always check service information for proper specified fluid when servicing any automatic transmissions/transaxles.

Figure 128-1

Automatic transmission fluid is routed from the torque converter, where most of the heat is generated, to the radiator where it is cooled. The fluid then returns to the transmission/transaxle to lubricate the bearings and bushings.
Figure 128-2: A cutaway of a typical radiator showing the automatic transmission cooler. The heat from the automatic transmission fluid is transferred to the engine coolant. The engine coolant also warms the fluid as soon as it flows through the radiator.

Figure 128-3: Engine coolant from the engine block flows through the passages in the cooler/warmer, and then through the thermo valve to the upper radiator tank. The thermo valve uses a wax element-type valve to control the flow of engine coolant through the case-mounted cooler/warmer. The thermo valve improves the ATF warm-up times and maintains ATF temperature within the optimum operating range between 170° and 190°F (77° and 88°C).

Figure 128-4 (a): Gear-type pump.
Figure 128-4 (b) Gerotor-type pump.

Figure 128-4 (c) Vane-type pump.

Figure 128-5 When pressure on the face of the pressure regulator valve overcomes spring force, the valve moves to open the exhaust port.
Figure 128-6 The variable pump is at the maximum output position until the regulator valve moves enough to decrease volume by rotating the slide against the force of the priming spring. The position of the pump constantly varies depending on the needs of the transmission/transaxle and driving conditions.

Figure 128-7 The pressure control solenoid controls the mainline pressure, which is in turn controlled by the powertrain control module (PCM) or the transmission control module (TCM), by applying pressure to the spring side of the pressure regulator valve.

Figure 128-8 Gear set members are attached to a drum and are held stationary when the band is applied.
Transmission bands come in several designs and thicknesses.

**Figure 128-9**

A servo uses hydraulic pressure to move a piston, which applies a band.

**Figure 128-10**

One end of a band is held stationary, and the other end is attached to the servo.

**Figure 128-11**
Figure 128-12: An exploded view of a multiple-plate clutch pack assembly.

Figure 128-13: A typical clutch pack assembly.

Figure 128-14: Hydraulic fluid under pressure enters the clutch housing and exerts a force on the clutch piston. The clutch piston forces the steel plates and the friction plates together, creating a shift.
Figure 128-15. In a holding clutch, one set of discs engages splines on the transmission case and the other set engages splines on the drum. By applying the clutch, the drum is locked to the case.

Figure 128-16. An integral accumulator is combined with a servo in a single bore in the transmission housing.

Figure 128-17. (a) Roller one-way clutch in the locked (held) position. Note how the rollers are wedged into the ramp that is machined into the outer support. (b) Roller one-way clutch in released (free) position. When the inner roller clutch race rotates faster than the outer support, the rollers move out of the wedge and are free to rotate, thereby unlocking the one-way clutch.
Figure 128-18  (a) The sprag in the holding (locked) position. Note how the long portion of the sprag is wedged between the inner and outer races. (b) The sprag in the released position. The inner race is free to rotate faster than the outer race.

Figure 128-19  A partially cutaway valve body from a General Motors 4T40-E transaxle.

Figure 128-20  A typical upper valve body showing the fluid passages ("worm holes").
Electronically controlled automatic transmissions/transaxles use solenoids located in the valve body to control line pressure and to open and close passages in the valve body to control shifts.

Check balls are used in the valve body to allow hydraulic circuits to share a common passage.

A rooster comb is the detent that helps retain the manual valve in the various positions in the valve body.
Figure 128-24 The manual valve is a spool valve that is moved by the shift linkage. All valves in the valve body have sharp edges on the lands. Any dirt in the valve body area can cause shifting problems due to the close tolerances between the valve and the bore in the valve body.

Freely Asks Question: What is a Spool Valve?

A spool valve is named after a spool of thread. A spool of thread is wooden and a spool valve used in an automatic transmission is aluminum or steel. The ridges (larger diameter) of the spool valve fit closely into a smooth bore in the valve body and are used to direct the flow of automatic transmission fluid.

- The larger diameter sections of the spool valve are called lands.
- The smaller diameter sections of the valve are called grooves or valleys.
- The fluid is blocked by the lands and flows through the grooves or valleys.

SEE FIGURE 128-24.

Figure 128-25 The throttle valve (TV) cable on a 4T-60.
A vacuum modulator moves the modulator valve depending on the vacuum of the engine. A heavy load on the engine causes the vacuum to be lower than when the engine is operating under a light load. The spool valve applies mainline pressure to the boost sleeve of the pressure regulator valve which causes the mainline pressure to increase.

A governor assembly is used on older hydraulically controlled automatic transmissions/transaxles to control shift points based on vehicle speed.

Shift valves move when there is a difference in pressure. In a hydraulically controlled automatic transmission, the shift valves compare governor pressure force against throttle valve (TV) pressure force to determine when to upshift or downshift.
Figure 128-29 A transmission range switch on a rear-wheel-drive automatic transmission mounted directly to the side of the case of the unit and accessible from underneath the vehicle.

Figure 128-30 Speed sensors are used by the powertrain control module (PCM) or the transmission control module (TCM) to control shifts and detect faults such as slippage when the two speeds do not match the predefined ratios for each gear commanded.

Figure 128-31 (a) An example of a solenoid valve installed in a valve body assembly.
Figure 128-31 (b) An example of a solenoid valve installed in a valve body assembly.

CHART 128–2
In this example, the vehicle would start out and remain in third gear if there was a fault with the computer or wiring.

<table>
<thead>
<tr>
<th>Gear Range</th>
<th>Solenoid A</th>
<th>Solenoid B</th>
</tr>
</thead>
<tbody>
<tr>
<td>First gear</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Second gear</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>Third gear</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Fourth gear</td>
<td>ON</td>
<td>OFF</td>
</tr>
</tbody>
</table>

CHART 128–3
In this example, the vehicle would start out and remain in second gear if there was a fault with the computer or wiring.

<table>
<thead>
<tr>
<th>Gear Range</th>
<th>Solenoid A</th>
<th>Solenoid B</th>
</tr>
</thead>
<tbody>
<tr>
<td>First gear</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Second gear</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Third gear</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>Fourth gear</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>
TECH TIP: Parking Brake Before Parking Pawl

To prevent possible damage to the transmission/transaxle case or other internal components, most experts agree that the parking brake should be applied before placing the gear selector into the park position, especially when parking on a hill. This procedure keeps the weight of the vehicle from being exerted entirely on the parking pawl and makes it easier to move the gear selector out of the park position.
Figure 128-33  A GM 4L60-E torque (power) flow in overdrive second gear.

Figure 128-34  A GM 4L60-E torque (power) flow in overdrive third gear.

Figure 128-35  A GM 4L60-E torque (power) flow in overdrive fourth gear.
Figure 128-36  A GM 4L60-E torque (power) flow in reverse.