Chapter 68

Automatic Transmission/ Transaxle Principles

Figure 68.1
A cutaway of a Chrysler PowerFlite two-speed automatic transmission used in the 1950s.
FIGURE 68.2 A torque converter is made up of three parts: The impeller is located at the transmission end and is driven by the engine. The turbine is located at the engine side and is driven by the fluid flow from the impeller and drives the input shaft of the transmission. The stator redirects the flow to improve efficiency and multiply torque.

FIGURE 68.3 The split rings help to direct the flow of fluid and improve the efficiency of the torque converter by reducing turbulence.

FIGURE 68.4 Two fans can be used to show how fluid, or air in the case of fans instead of automatic transmission fluid, can be used to transfer energy. If one fan is operating, the blades of the second fan will be rotated by the flow of air past the fan that is unplugged, causing the blades to rotate.
FIGURE 68.5 The torque converter bolts to the flexplate which is attached to the engine crankshaft and rotates at engine speed.

FIGURE 68.6 The flat sections that are cut into the hub of the torque converter are used to drive the fluid pump.

FIGURE 68.7 The internal splines inside the torque converter are connected to the splines on the stator support shaft and the turbine splines to the input shaft.
FIGURE 68.8 Torque multiplication occurs when fluid leaving the turbine strikes the front of the stator vane, which redirects it back to the impeller.

FIGURE 68.9 A stator contains a one-way roller clutch which locks it from rotating in one direction and allows it to rotate freely in the opposite direction.

FIGURE 68.10 An expanded view of a typical torque converter assembly, showing the torque converter cover (TCC).
FIGURE 68.11 Torque converter clutch friction material is determined by the vehicle manufacturer to provide the needed coefficient of friction needed. For example, many older units use paper-type friction material because they are fully applied or released, whereas most newer units use a synthetic material such as Kevlar® or carbon fiber because the torque converter clutch is pulsed on and off, therefore requiring a more robust material for long service life.

FIGURE 68.12 A cross-sectional view of a pulse-width-modulated (PWM) torque converter clutch. The powertrain control module (PCM) pulses the control solenoid which then controls the fluid flow to apply the torque converter clutch.

FIGURE 68.13 The gear selector is often called the "PRNDL," pronounced "prindle," regardless of the actual letters or numbers used.
FIGURE 68.14 A typical planetary gear set showing the terms that are used to describe each member.

FIGURE 68.15 A typical planetary gear set showing the planet carrier which supports all of the pinion gears (also called planet pinion gears).

FIGURE 68.16 Maximum reduction can be achieved by using the sun gear as the input, holding the ring gear and using the planet carrier as the output.
FIGURE 68.17 Minimum reduction can be achieved by using the ring gear as the input, holding the sun gear and using the planet carrier as the output.

FIGURE 68.18 Reverse can be achieved by using the sun gear as the input, holding the planet carrier and using the ring gear as the output.

CHART 68.2

<table>
<thead>
<tr>
<th>Input Gear</th>
<th>Planet</th>
<th>Ring Gear</th>
<th>Stage</th>
<th>Torque</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axle Drive</td>
<td>Input</td>
<td>Input</td>
<td>Axle</td>
<td>Increase</td>
<td>Input</td>
</tr>
<tr>
<td>Axle Drive</td>
<td>Input</td>
<td>Input</td>
<td>Brake</td>
<td>Decrease</td>
<td>Reverse</td>
</tr>
<tr>
<td>Axle Drive</td>
<td>Output</td>
<td>Output</td>
<td>Axle</td>
<td>Increase</td>
<td>Input</td>
</tr>
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<td>Brake</td>
<td>Decrease</td>
<td>Reverse</td>
</tr>
</tbody>
</table>

If two teeth are involved together, then the resulting output is 1:1, spin in the same direction as the input (direct drive). If one member is held (locked) then there is no output (brake).
A Simpson planet gear set is composed of two ring gears and two planet carrier assemblies that share one sun gear.

A Ravigneaux gear set is composed of two sun gears, one planet carrier that supports two sets of pinion gears, and a single ring gear.

On one style of transaxle the turbine shaft drives the input shaft through a drive chain assembly.
Another type of transaxle uses a chain to transfer torque from the output of the gear sets to the differential assembly (final drive).
FIGURE 68.25 A belt and pulley CVT uses variable width pulleys and a special chain to provide an infinite number of speed ratios.

FIGURE 68.26 Honda CVT belt construction.

FIGURE 68.27 Honda CVT power flow in park (P) and neutral (N).
FIGURE 68.28 Honda CVT operation in drive (D) or low (L).

FIGURE 68.29 Location of the Honda CVT start clutch.

FIGURE 68.30 The Honda CVT transmission control module (TCM) showing the inputs (sensors) on the left and the outputs on the right.
FIGURE 68.31 A dual-clutch automatic uses the best features of an automatic transmission without the power loss of a torque converter.

FIGURE 68.32 Dual-clutch automatic transmissions use two dry clutches. The larger clutch drives the odd-numbered gear ratios (first, third, and fifth) and the smaller clutch drives the even-numbered gear ratios (second, fourth, and sixth).