

Automatic Transmissions and Transaxles, 7e

Chapter 4 Hydraulic Control Valves and Solenoids

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers Automatic Transmissions and Transaxles 7th Edition. It correlates material to task lists specified by ASE and ASE Education (NATEF) .
Motivate Learners	Explain how the knowledge of how something works translates into the ability to use that knowledge to figure why the engine does not work correctly and how this saves diagnosis time, which translates into more money.
State the learning objectives for the chapter or course you are about to cover and explain this is what they should be able to do as a result of attending this session or class.	Explain the chapter learning objectives to the students. <ol style="list-style-type: none">1. Prepare for ASE Automatic Transmissions (A2) certification test content area "A" (General Transmission and Transaxle Diagnosis).2. Describe the types and operation of automatic transmission/transaxle valves.3. Discuss accumulators and orifices as used in an automatic transmission/transaxle hydraulic system.4. Explain the operation of automatic transmission solenoids.5. Describe how a pressure control solenoid (PCS) controls fluid pressure
Establish the Mood or Climate	Provide a <i>WELCOME</i> , Avoid put downs and bad jokes.
Complete Essentials	Restrooms, breaks, registration, tests, etc.
Clarify and Establish Knowledge Base	Do a round robin of the class by going around the room and having each student give their backgrounds, years of experience, family, hobbies, career goals, or anything they want to share.

NOTE: This lesson plan is based on automatic Transmissions & Transaxle 7th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com
DOWNLOAD CHP 4: Chapter Images

ICONS



Ch04 Hydraulic Control Valves & Solenoids

1. SLIDE 1 Hydraulic Control Valves and Solenoids

Check for **ADDITIONAL VIDEOS & ANIMATIONS**
@ <http://www.jameshalderman.com/>
WEB SITE IS CONSTANTLY UPDATED

Videos

At the beginning of this class, you can download the crossword puzzle & Word Search from http://www.jameshalderman.com/books_a2.html to familiarize your class with the terms in this chapter & then discuss them

DOWNLOAD Crossword Puzzle

DOWNLOAD Word Search Puzzle

2. **SLIDE 2 EXPLAIN FIGURE 4-1** governor assembly is used on older hydraulically controlled automatic transmissions/transaxles to control shift points based on vehicle speed.

DISCUSSION: HOST A DISCUSSION ON HOW A HYDRAULIC GOVERNOR FUNCTIONS AND HOW IT COMPARES TO ELECTRONIC SHIFT VALVES

3. **SLIDE 3 EXPLAIN FIGURE 4-2** The throttle valve (TV) cable on a 4L60 transmission

4. **SLIDE 4 EXPLAIN FIGURE 4-3** 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.

5. **SLIDE 5 EXPLAIN FIGURE 4-4** (a) As the speed increases, governor pressure increases and is applied to the 1-2 shift valve. (b) When the 1-2 shift valve moves, the fluid is directed to 2nd clutch and the shift is completed.

ICONS



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[Hydraulic Controlled Manual Shifts \(View\)](#) [\(Download\)](#)

6. **SLIDE 6 EXPLAIN FIGURE 4-5** (a) When a clutch applies, fluid pressure rises gradually until the circuit is filled and the piston strokes to take up the clearance; then there is a rapid increase to line pressure. (b) An accumulator can be placed into the circuit to slow this pressure rise and soften clutch application.
7. **SLIDE 7 EXPLAIN FIGURE 4-6** A check valve is opened by fluid flow in one direction (left) and closes when the fluid tries to flow in the reverse direction
8. **SLIDE 8 EXPLAIN FIGURE 4-7** Check balls are used in the valve body to allow hydraulic circuits to share a common passage

DEMONSTRATION: DEMO PLACEMENT OF THE CHECK BALLS IN A VALVE BODY

PASCAL'S LAW OR PRINCIPLE: FLUID PRESSURE IS TRANSMITTED UNDIMINISHED IN ALL DIRECTIONS.

9. **SLIDE 9 EXPLAIN FIGURE 4-8** When fluid flows through this shuttle valve from port B to port C, the check ball moves over to close port A (left). Fluid flow from port A will close port B (right).
10. **SLIDE 10 EXPLAIN FIGURE 4-9** (a) An orifice will cause a pressure drop as fluid flows through; (b) when the flow stops, the pressure on both sides of the orifice will be the same.

[BASIC HYDRAULIC SYSTEM \(VIEW\) \(DOWNLOAD\)](#) [PRESSURE REGULATOR VALVE \(VIEW\)](#) [\(DOWNLOAD\)](#)

11. **SLIDE 11 EXPLAIN FIGURE 4-10** typical automatic transmission solenoid showing the coil assembly where the magnetic field and the metering ball and plunger that works against the force of the spring.
12. **SLIDE 12 EXPLAIN FIGURE 4-11 (a)** In this example, the solenoid is commanded off, metering ball is off its seat and allows fluid to flow. (b) When the solenoid is on, the metering ball is seated preventing



fluid flow.

- 13. **SLIDE 13 EXPLAIN FIGURE 4–12** Shift solenoids are commanded on and off by the PCM/TCM as needed to make a shift.
- 14. **SLIDE 14 EXPLAIN FIGURE 4–13** scope waveform showing the opening of a solenoid using a current clamp around the solenoid feed wire. The hump is created when the core of the solenoid moves which creates a slight counter electromotive force (EMF) causing the slight hump in the current waveform

**EXPLAIN FREQUENTLY ASKED QUESTION:
What is a “pintle hump”?**

EXPLAIN TECH TIP: Look for PUN or TUN

DEMONSTRATION: DEMO CHECKING THE OPENIN OF A SHIFT SOLENOID USING A SCOPE

**[Shift Solenoid Operation \(View\) \(Download\)](#)
[Simple Electronic Controlled Shifts \(View\) \(Download\)](#)**

- 15. **SLIDE 15 EXPLAIN FIGURE 4–14** A linear solenoid is pulse-width modulated plus the spool valve moves in proportion to the pulse-width signal form the PCM/TCM.
- 16. **SLIDE 16 EXPLAIN FIGURE 4–15** The TCM controls the EPC solenoid to change the pressure regulator valve to adjust line pressure.
- 17. **SLIDE 17 EXPLAIN FIGURE 4–16** 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.

[EPC Solenoid \(View\) \(Download\)](#)

- 18. **SLIDE 18 EXPLAIN FIGURE 4–17** A typical valve body showing some of the valves and solenoids as well as the clips and pins used to retain the parts in the valve body.

ICONS	Ch04 Hydraulic Control Valves & Solenoids
 	<p>DEMONSTRATION: DEMO DISASSEMBLY OF A VALVE BODY</p> <p><u>Assemble Valve Body (Download)</u></p>