Automatic Transmissions and Transaxles, 7e

Chapter 5 Torque Converters

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 ASEEducation (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. 1. Prepare for ASE Automatic Transmissions (A2) certification test content area "A" (General Transmission and Transaxle Diagnosis). 2. Identify and describe the components of a torque converter. 3. Explain torque converter operation. 4. Discuss the parts and operation of torque converter clutches. 5. Describe the purpose and procedure of a stall test. 6. Discuss the service of torque converters.
Establish the Mood or Climate	Provide a *WELCOME,* 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 5: Chapter Images

ICONS	Ch05 TORQUE CONVERTERS
        	**1. SLIDE 1 TORQUE CONVERTERS** **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 5–1** cutaway of an eight speed automatic transmission showing the torque converter and the clutches needed to engage all eight forward speeds, plus reverse. 3. **SLIDE 3 EXPLAIN FIGURE 5–2** The torque converter bolts to the flexplate which is attached to the engine crankshaft and rotates at engine speed. 4. **SLIDE 4 EXPLAIN FIGURE 5–3** The split rings in the impeller and turbine help to direct the flow of fluid and improve the efficiency of the torque converter by reducing turbulence **DISCUSSION: DISCUSS HOW TORQUE CONVERTER DRIVES TRANSMISSION OIL PUMP. HOW DOES INNER PORTION OF FRONT PUMP COUPLE TO TORQUE CONVERTER HUB? FIG 5-3** **DISCUSSION: DISCUSS FLUID COUPLINGS. WHAT IS DIFFERENCE BETWEEN A FLUID COUPLING AND A MECHANICAL COUPLING?** 5. **SLIDE 5 EXPLAIN FIGURE 5–4** 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

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	energy. If one fan is operating, which represents the impeller, and the blades of a second fan (turbine) will be rotated by the flow of air past the fan that is unplugged, causing the blades to rotate.
	**DEMONSTRATION: SHOW HOW FLUID COUPLING IN CONVERTER WORKS, USE 2 FANS FACING EACH OTHER. TURN ONE FAN ON & HAVE THE STUDENTS OBSERVE OTHER FAN'S BLADES TURNING. FIGURE 5-4**
	**6. SLIDE 6 EXPLAIN FIGURE 5–5** torque converter is made from three parts: The impeller is located at the transmission end, attached to the housing, 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.
	**Torque Converter Fluid Flows (View) (Download)** **Torque Converter Power Flows (View) (Download)**
	**DEMONSTRATION: USING A CONVERTER THAT HAS BEEN CUT OPEN, SHOW VARIOUS PARTS INSIDE A TORQUE CONVERTER, INCLUDING THE IMPELLER, TURBINE, STATOR, ONE-WAY CLUTCH, AND CONVERTER CLUTCH (IF PRESENT)**
	**EXPLAIN FREQUENTLY ASKED QUESTION: What Is an Air-Cooled Torque Converter?**
	**DISCUSSION: DISCUSS DIFFERENT CONVERTER PHASES OF TORQUE CONVERTER OPERATION. WHAT ARE ROTARY FLOW, VORTEX FLOW, & TORQUE MULTIPLICATION? FIGURE 5-6**
	**7. SLIDE 7 EXPLAIN FIGURE 5–6** (a) The fluid flowing around the guide ring is called vortex flow. (b) The fluid flow around the converter is called rotary flow. **8. SLIDE 8 EXPLAIN FIGURE 5–7** The fluid flow from the turbine is turned in the same direction as the impeller by the stator vanes. **9. SLIDE 9 EXPLAIN FIGURE 5–8** 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.

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QUESTION	**DISCUSSION: DISCUSS COUPLING PHASE. HOW WILL COUPLING PHASE BE AFFECTED IF THE ONEWAY CLUTCH (STATOR) FAILS? FIGURE 5-8**
	EXPLAIN FREQUENTLY ASKED QUESTION: Did the ATX Transaxle Use a Different Torque Converter?
	10. SLIDE 10 EXPLAIN FIGURE 5–9 An expanded view of a typical torque converter assembly showing the torque converter clutch (TCC).
	11. SLIDE 11 EXPLAIN FIGURE 5–10 TCC releases fluid flows through the center of the turbine shaft to the front of the clutch disc (left). Pressure to apply the clutch enters between the converter hub and the stator support (right).
	12. SLIDE 12 EXPLAIN FIGURE 5–11 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 a 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.
	13. SLIDE 13 EXPLAIN FIGURE 5–12 The damper springs used in many torque converter clutches are similar to the damper springs used in clutch discs used with a manual transmission.
	TCC OPERATION (VIEW) (DOWNLOAD)
DEMO	**DEMONSTRATION: SHOW HOW TO USE A SCAN TOOL TO CHECK & DIAGNOSE A TCC**
	HANDS-ON TASK: BASED ON DEMO HAVE STUDENTS USE A SCAN TOOL TO CHECK & DIAGNOSE A TCC
Education Foundation	**ON-VEHICLE ASEEducation TASK: PERFORM LOCK-UP CONVERTER TESTS; DETERMINE NECESSARY ACTION**

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           	**EXPLAIN FREQUENTLY ASKED QUESTION: What Is a "Squashed Converter"?** 14. **SLIDE 14 EXPLAIN FIGURE 5–13a** Most torque converters have a round cross section. Some new transmissions use a shorter, elliptical, squashed converter that is about 13% shorter than a round style. **Torque Converter Fluid Flows (View) (Download)** **Torque Converter Power Flows (View) (Download)** **TCC OPERATION (VIEW) (DOWNLOAD)** 15. **SLIDE 15 EXPLAIN FIGURE 5–14** This 4-cylinder General Motors vehicle has a stall speed of about 2350 RPM. Notice that the gear selector is in drive and the speedometer is reading zero **DISCUSSION: DISCUSS WHAT STALL SPEED IS. HOW DO DIFFERENT STALL SPEEDS AFFECT THE PERFORMANCE & EMISSIONS OF AN ENGINE?** **DEMONSTRATION: OPTIONAL: PERFORM A CONVERTER STALL TEST ON A VEHICLE. HAVE STUDENTS LOOK UP WHAT THE RESULTS. ARE RESULTS WITHIN SPECIFICATION? REMIND STUDENTS THAT A STALL TEST CAN BE DANGEROUS IF THE BRAKES FAIL.** **DISCUSSION: DISCUSS TORQUE MULTIPLICATION QUALITIES OF A TORQUE CONVERTER. WHY DO HIGH-PERFORMANCE VEHICLES USE A SMALL DIAMETER CONVERTER?** **(ANS. SMALL DIAMETER RESULTS IN HIGHER STALL SPEEDS)** **WHEN STALL SPEED IS ABOUT 1/3 OF SPECIFICATION, IT IS AN INDICATOR THAT ONEWAY (STATOR) CLUTCH IS BAD.**

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DEMO	**DEMONSTRATION:** SHOW WHAT "CREEP" IS. THEN SHOW THEM HOW TO CHECK TORQUE CONVERTER STALL SPEED BY POWER BRAKING A VEHICLE & OBSERVING TACHOMETER. MAKE SURE THEY UNDERSTAND THAT A STALL TEST SHOULD LAST FOR ONLY 5 SECONDS SO THAT TRANSMISSION/TRANSAXLE IS NOT DAMAGED. AFTER A STALL TEST IS PERFORMED ENGINE SHOULD BE IDLED FOR A FEW MINUTES TO LET TRANSMISSION COOL DOWN.
	**ON-VEHICLE ASEEducation TASK: PERFORM STALL TEST; DETERMINE NECESSARY ACTION**
	
	**WARNING: Direct any bystanders away from the front or rear of the vehicle during a STALL TEST.**
	**EXPLAIN 2 FREQUENTLY ASKED QUESTIONS:** **What Is a High-Stall Speed Converter?**
	**16. SLIDES 16 EXPLAIN FIGURE 5–15** Visually check the pump drive notches or tangs for damage and the hub sealing surface for wear. **17. SLIDES 17 EXPLAIN FIGURE 5–16** A stator clutch can be checked by reaching into the hub so a finger contacts the splines. The splines should rotate in one direction but not in the other.
	**Commercial stator-holding tool may be used to check a one-way clutch. Tool can be inserted into groove in thrust washer on some stators to keep it & stator from rotating. Next, special one-way clutch-tool is inserted into stator splines, and torque wrench used to apply torque to tool & one-way clutch inner race. The one-way clutch should turn freely in CW direction, and it should lock and hold at least 10 foot pounds (14 N-m) of torque in a CCW**

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	direction. Do not apply any more torque than this because special tool can break. A torque converter with a faulty one-way clutch must be replaced.
	**18. SLIDES 18 EXPLAIN FIGURE 5–17** A quick end-play check can be made by gripping the turbine or stator splines and trying to move the turbine or stator in and out **19. SLIDES 19 EXPLAIN FIGURE 5–18** A leak-test fixture has been placed on the torque converter. It will be filled with ATF and then inspected for leaks.
	**ON-VEHICLE ASEEducation TASK: MEASURE TORQUE CONVERTER ENDPLAY; CHECK STATOR CLUTCH**
Education Foundation	
	**EXPLAIN CASE STUDY: The Case of the Blue Torque Converter**
	**EXPLAIN TECH TIP: Converter Drain-Back Test**
	**HANDS-ON TASK: HAVE STUDENTS CORRECTLY R & R TORQUE CONVERTER. REMIND THEM OF IMPORTANCE OF INSTALLING TORQUE CONVERTER CORRECTLY.**
	**20. SLIDES 20-37 DISCUSS INSTALLING A HIGH SPEED CONVERTER**