












Automotive Maintenance and Light Repair, 1ST Edition

Chapter 68 Automatic Transmission Parts & Operation

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers Automotive Maintenance and Light Repair . It correlates material to task lists specified by ASE and 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. <ul style="list-style-type: none">— Prepare for the ASE Automatic Transmission/Transaxle (A2) certification test content area “A” (General Transmission/Transaxle Diagnosis).— Explain how a torque converter can transmit and multiply engine torque.— Describe how a planetary gear set can be used for gear reduction and reverse.— Explain how continuously variable transmissions work.— Describe how a dual clutch automatic transmission works.
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.

ICONS	Ch68 Automatic Transmission Parts & OP
     QUESTION	<p>1. SLIDE 1 CH68 Automatic Transmission Parts & Operation</p> <p>2. SLIDES 2-3 EXPLAIN OBJECTIVES</p> <p>Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE REGULARLY UPDATED</p> <p>DISCUSSION: REFER TO CHART 68-1 TO TALK ABOUT CHANGES IN TRANSMISSIONS THROUGH THE YEARS. WHAT ARE THE MAJOR CHANGES THAT HAVE OCCURRED? ASK THE STUDENTS TO FIND THE DATE CLOSEST TO WHEN THEY WERE BORN AND DISCUSS WHAT MAJOR CHANGE WAS INTRODUCED AT THAT TIME.</p>
	<p>4. SLIDE 4 EXPLAIN BACKGROUND</p>
	<p>5. SLIDE 5 EXPLAIN CHART 68-1 Automatic transmission use, while available in some models much sooner, increased in great numbers in the 1950s.</p> <p>6. SLIDE 6 EXPLAIN CHART 68-1 (continued) Automatic transmission use, while available in some models much sooner, increased in great numbers in 950s.</p> <p>7. SLIDE 7 EXPLAIN Figure 68-1 cutaway of Chrysler PowerFlite 2-speed automatic transmission used in 1950s</p>
	<p>8. SLIDES 8-17 EXPLAIN Torque Converters</p> <p>18. SLIDE 18 EXPLAIN Figure 68-2 torque converter is made from 3 parts: Impeller is located at transmission end, attached to housing, driven by engine. Turbine is located at engine side and is driven by fluid flow from impeller & drives input shaft of transmission. Stator redirects flow to improve efficiency and multiply torque.</p> <p>19. SLIDES 19-20 EXPLAIN Torque Converters</p>
	<p>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)</p>
  QUESTION	<p>DISCUSSION: DISCUSS TORQUE CONVERTER ROLE IN AN AUTOMATIC TRANSMISSION. WHAT IS REASON FOR ALLOWING SLIPPAGE?</p>

ICONS

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DISCUSSION: DISCUSS FLUID COUPLINGS. WHAT IS DIFFERENCE BETWEEN A FLUID COUPLING AND A MECHANICAL COUPLING?

21. SLIDE 21 EXPLAIN Figure 68-3 The slip rings help 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 68-3

22. SLIDES 22-24 EXPLAIN Torque Converters
25. SLIDE 25 EXPLAIN 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 a second fan will be rotated by the flow of air past the fan that is unplugged, causing the blades to rotate.
26. SLIDES 27-27 EXPLAIN Torque Converters

Torque Converter Fluid Flows

Torque Converter Power Flows

DEMONSTRATION: TO DEMONSTRATE 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 68-4

HANDS-ON TASK: HAVE THE STUDENTS DOWNLOAD A TRANSMISSION SCHEMATIC FOR SPECIFIC TRANSMISSION OR TRANSAXLE AND EXPLAIN POWERFLOW FOR THAT SCHEMATIC TO THE CLASS.

28. SLIDE 28 EXPLAIN Figure 68-5 torque converter bolts to the flexplate which is attached to the engine crankshaft and rotates at engine speed.

DEMONSTRATION: SHOW EXAMPLES OF A FLEXPLATE & FLYWHEEL. HAVE THEM TALK ABOUT DIFFERENCES BETWEEN THE TWO. WHY DO THE FLEXPLATE AND FLYWHEEL NEED TO BE DIFFERENT?

ICONS

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QUESTION



QUESTION



QUESTION

DISCUSSION: WHILE SHOWING THE STUDENTS EXAMPLES OF FLEXPLATES & DISCUSS THE EXTERNAL GEAR WELDED TO THE FLEXPLATE. WHAT IS PURPOSE OF THIS GEAR? WHAT WILL HAPPEN IF THE GEAR GOES BAD?

NATEF MLR TASK A2A1 RESEARCH APPLICABLE VEHICLE AND SERVICE INFORMATION, FLUID TYPE, VEHICLE SERVICE HISTORY, SERVICE PRECAUTIONS, AND TECHNICAL SERVICE BULLETINS.

29. SLIDES 29-33 EXPLAIN Torque Converters

34. SLIDE 34 EXPLAIN Figure 68-6 The flat sections that are cut into the hub of the torque converter are used to drive the fluid pump.

35. SLIDES 35-39 EXPLAIN Torque Converters

40. SLIDE 40 EXPLAIN Figure 68-7 internal splines inside the torque converter are connected to the splines on the stator support shaft and turbine splines to the input shaft.

DEMONSTRATION: SHOW FRONT SEAL, STATOR SUPPORT, AND INPUT SHAFT OF AUTOMATIC TRANSMISSION. POINT OUT IMPORTANCE OF MAKING CERTAIN CONVERTER IS INSTALLED ALL THE WAY SO THAT SERIOUS DAMAGE DOES NOT RESULT. **FIGURES 68-5, 6, 7**

41. SLIDES 41-54 EXPLAIN Torque Converters

55. SLIDE 55 EXPLAIN Figure 68-8 Torque multiplication occurs when fluid leaving the turbine strikes the front of the stator vanes and is redirected back to the impeller.

DISCUSSION: DISCUSS HOW FLUID PUMP IN AN AUTOMATIC TRANSMISSION IS DRIVEN BY THE CONVERTER. IF POSSIBLE, SHOW THEM THE FLAT SECTIONS MACHINED IN THE TORQUE CONVERTER HUB THAT ARE USED TO DRIVE THE PUMP. WHAT ENSURES THAT THE FLUID PUMP SPINS ONLY WHEN THE ENGINE SPINS? **FIGURE 68-8**

DISCUSSION: DISCUSS DIFFERENT CONVERTER PHASES OF TORQUE CONVERTER OPERATION. WHAT ARE ROTARY FLOW, VORTEX FLOW, & TORQUE MULTIPLICATION? **FIGURE 68-8**

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DISCUSSION: DISCUSS COUPLING PHASE. HOW WILL COUPLING PHASE BE AFFECTED IF THE ONE-WAY CLUTCH (STATOR) FAILS? FIGURE 68-8

56. SLIDES 56-60 EXPLAIN Torque Converters

61. SLIDE 61 EXPLAIN Figure 68-9 stator contains a one-way roller clutch which locks it from rotating in one direction, allows it to rotate freely in opposite direction.

62. SLIDES 62-84 EXPLAIN Torque Converters

HANDS-ON TASK: HAVE STUDENTS CORRECTLY R & R A TORQUE CONVERTER. REMIND THEM OF THE IMPORTANCE OF INSTALLING TORQUE CONVERTER CORRECTLY. EVALUATE STUDENTS ON WHETHER THEY CAN IDENTIFY ALL OF PARTS INSIDE A TORQUE CONVERTER AND WHETHER THEY CORRECTLY INSTALL CONVERTER

TCC OPERATION

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[HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=CHECKING%20TORQUE%20CONVERTER%20CLUTCH%20\(TCC\)&CLIP=PANDC/CHET/2012/AUTOMOTIVE/TRANSMISSION/CHECKING_TORQUE%20CONVERTER_CLUTCH.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/TRANSMISSION/XML/CHECKING_TORQUE%20CONVERTER_CLUTCH.XML](http://media.pearsoncmg.com/ph/chet/chet_myLABS/akamai/template/video640x480.php?title=checking%20torque%20converter%20clutch%20(tcc)&clip=pandc/chet/2012/automotive/transmission/checking_torque%20converter_clutch.mov&caption=chet/chet_myLABS/akamai/2012/automotive/transmission/xml/checking_torque%20converter_clutch.xml)

Torque Converter Fluid Flows

Torque Converter Power Flows

TCC Operation








85. SLIDES 85-87 EXPLAIN Lockup Torque Converter

88. SLIDE 88 EXPLAIN Figure 68-10 An expanded view of a typical torque converter assembly showing the torque converter clutch (TCC)

DISCUSSION: DISCUSS PURPOSE AND FUNCTION OF LOCKUP TORQUE CONVERTER. WHAT ARE ADVANTAGES OF HAVING A LOCKUP OR TORQUE CONVERTER CLUTCH? FIGURE 68-10

89. SLIDES 89-91 EXPLAIN Lockup Torque Converter

92. SLIDE 92 EXPLAIN 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 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

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	<p>torque converter clutch is pulsed on and off, therefore requiring a more robust material for long service life.</p> <p>DEMONSTRATION: USING CUT-OPEN CONVERTERS FOR EXAMPLES, SHOW STUDENTS DIFFERENT TYPES OF CONVERTER CLUTCH MATERIAL. WHY WOULD <u>KEVLAR</u> AND CARBON FIBER BE NEEDED IN SOME APPLICATIONS? IF CUT-AWAYS ARE NOT AVAILABLE FOR</p> <p>DEMONSTRATION: REFER TO FIGURE 68–11</p>
	<p>93. SLIDES 93-94 EXPLAIN Lockup Torque Converter</p> <p>95. SLIDE 95 EXPLAIN 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.</p>
	<p>DISCUSSION: DISCUSS HOW ENGINE COMPUTER CONTROLS ARE USED TO CONTROL CONVERTER LOCKUP. HOW DO ENGINE PERFORMANCE ISSUES AFFECT TRANS. OPERATION? FIGURE 68–12</p>
	<p>DISCUSSION: DISCUSS CONVERTER CLUTCH CONTROL. WHAT REGULATES THE TIMING AND APPLICATION OF THE CLUTCH? HAVE THE STUDENTS TALK ABOUT IMPORTANCE OF USING THE CORRECT FLUID IN A TRANSMISSION WITH A LOCKUP TORQUE CONVERTER. WHAT ARE POSSIBLE CUSTOMER COMPLAINTS IF WRONG TYPE OF FLUID IS USED?</p>
	<p>DEMONSTRATION: SHOW HOW TO USE A SCAN TOOL TO CHECK & DIAGNOSE A TCC</p>
	<p>HANDS-ON TASK: BASED ON DEMO HAVE STUDENTS USE A SCAN TOOL TO CHECK & DIAGNOSE A TCC</p>
	<p>DISCUSSION: DISCUSS WHAT STALL SPEED IS. HOW DO DIFFERENT STALL SPEEDS AFFECT THE PERFORMANCE & EMISSIONS OF AN ENGINE?</p>

ICONS

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QUESTION



QUESTION

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)**

DEMONSTRATION: SHOW WHAT "CREEP" IS. THEN SHOW THEM HOW TO CHECK TORQUE CONVERTER STALL SPEED BY POWER BRAKING A VEHICLE & OBSERVING THE TACHOMETER. MAKE SURE THE STUDENTS UNDERSTAND THAT A STALL TEST SHOULD LAST FOR ONLY 5 SECONDS SO THAT TRANSMISSION OR TRANSAXLE IS NOT DAMAGED. AFTER A STALL TEST IS PERFORMED ENGINE SHOULD BE IDLED FOR A FEW MINUTES TO LET TRANSMISSION COOL DOWN.

WHEN STALL SPEED IS ABOUT 1/3 OF SPECIFICATION, IT IS AN INDICATOR THAT ONE-WAY (STATOR) CLUTCH IN CONVERTER IS BAD.

96. SLIDE 96 EXPLAIN Shift Modes

97. SLIDE 97 EXPLAIN Figure 68-13 gear selector is often called the "PRNDL," pronounced "prindle," regardless of the actual letters or numbers used.

98. SLIDES 98-108 EXPLAIN Shift Modes

TRANSMISSION RANGE SWITCH (T/R)

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[HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=CHECKING%20THE%20T/R%20SWITCH&CLIP=PANDC/CHET/2012/AUTOMOTIVE/AUTO_TRANSMISSION/A2T5.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/AUTO_TRANSMISSION/XML/A2T5.XML](http://media.pearsoncmg.com/ph/chet/chet_myLABS/akamai/template/video640x480.php?title=checking%20the%20t/r%20switch&clip=pandc/chet/2012/automotive/auto_transmission/a2t5.mov&caption=chet/chet_myLABS/akamai/2012/automotive/auto_transmission/xml/a2t5.xml)

1-2 Upshift, Minimum Throttle

2-3 Shift Valve, Coast Downshift

2-3 Shift Valve, Full Throttle Downshift

2-3 Shift Valve, Light Throttle Downshift

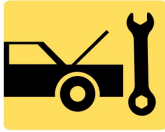
2-3 Shift Valve, Light Throttle Upshift

2-3 Shift Valve, Wide Open Throttle Upshift

2-3 Shift Valve

DISCUSSION: DISCUSS **SHIFT MODES** THAT MOST AUTOMATIC TRANSMISSIONS & TRANSAXLES INCLUDE. WHAT IS A COMMON NAME FOR A GEAR SELECTOR? **FIGURE 68-13**

ICONS



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DISCUSSION: DISCUSS IMPORTANCE OF OPERATING A VEHICLE IN THE PROPER **SHIFT MODE** AT THE PROPER TIME. WHICH GEARS ARE USED ON GENTLE, LONG, OR STEEP GRADES?

HANDS-ON TASK: PULSE WIDTH IS MEASURED IN HERTZ. HERTZ ARE OFTEN DISPLAYED IN MILLISECONDS. HOW MANY MILLISECONDS IN A SECOND? HAVE STUDENTS DETERMINE SPEED OF ELECTRICITY. UNDERSTANDING SPEED OF ELECTRICITY HELPS UNDERSTAND HOW ELECTRONICS CAN OPERATE SO FAST.

Hydraulic Controlled Manual Shifts

Hydraulic Shift Control

Manual Valve

Mechanical Diode

Manual Lever Position Switch (MLPS)

Normally Closed Solenoid 1

Normally Closed Solenoid 2

Shift Solenoid Operation

Shift Valve Forces

Shift Valve

Shuttle Valve

Simple Electronic Controlled Shifts

Simple Hydraulic Shifts



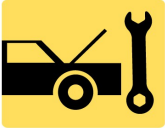





109. SLIDES 109-112 EXPLAIN Planetary Gear Sets

113. SLIDE 113 EXPLAIN Figure 68-14 A typical planter gear set showing the terms that are used to describe each member.

114. SLIDES 114-118 EXPLAIN Planetary Gear Sets

119. SLIDE 119 EXPLAIN Figure 68-15 A typical planetary gear set showing planet carrier which supports all of pinion gears (called planet pinion gears).

DEMONSTRATION: SHOW PLANETARY GEAR SET. ID PARTS: SUN GEAR, PLANETARY CARRIER, & RING (ANNULUS) GEAR

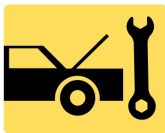
ICONS	Ch68 Automatic Transmission Parts & OP
   	<p><u>SAFETY CAUTION PARTS ON A PLANETARY GEAR SET CAN BE VERY SHARP AND CAN CAUSE PERSONAL INJURY. ALSO WARN STUDENTS THAT PLANETARY GEAR SETS HAVE MANY PINCH POINTS THAT ALSO CAN CAUSE INJURY</u></p> <p><u>HANDS-ON TASK: HAVE THE STUDENTS IDENTIFY PARTS ON PLANETARY GEAR SET. GRADE THEM ON THEIR ABILITY TO CORRECTLY IDENTIFY PARTS INCLUDING SUN GEAR, PLANETARY CARRIER, & RING (ANNULUS) GEAR</u></p> <p>120. SLIDES 120-124 EXPLAIN Planetary Gear Sets</p> <p>125. SLIDE 125 EXPLAIN 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.</p> <p>126. SLIDE 126 EXPLAIN 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.</p> <p>127. SLIDE 127 EXPLAIN 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.</p> <p>128. SLIDE 128 EXPLAIN Planetary Gear Sets</p>
   <p>QUESTION</p> 	<p><u>DEMONSTRATION: USING A PLANETARY GEAR SET, DEMONSTRATE FOR STUDENTS WHEN 3 GEARS ARE USED AND WHEN 2ND GEAR MOVED IN DRIVEN GEAR BECOMES DRIVE GEAR TO 3RD GEAR</u></p> <p><u>DISCUSSION: DISCUSS WHAT AN INPUT MEMBER, A REACTION MEMBER, AND OUTPUT MEMBER ARE. ARE THESE MEMBERS ALWAYS THE SAME IN A PLANETARY GEAR SET?</u></p> <p><u>HANDS-ON TASK: HAVE STUDENTS WORK IN GROUPS TO EXPERIMENT WITH A PLANETARY GEAR SET. ASK THEM TO HOLD AND DRIVE DIFFERENT PARTS OF THE GEAR SET TO SEE WHAT THE RESULTS WILL BE. ASK THEM TO DETERMINE WHEN A GEAR REDUCTION, A 1:1 RATIO, OR AN OVERDRIVE WILL OCCUR.</u></p>

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129. SLIDE 129 EXPLAIN CHART 68-2 If any two members are locked together, then the resulting output is 1:1 ratio in the same direction as the input (direct drive). If no member is held (locked) then there is no output (neutral).



HANDS-ON TASK: USING ON-LINE SERVICE INFORMATION, HAVE THE STUDENTS LOOK UP WHAT THE GEAR RATIOS FOR ALL FORWARD GEARS ARE IN AN SUV, A PICKUP, AND A COMPACT. ARE THERE ANY SIMILARITIES? ASK THEM TO REPORT THEIR FINDINGS TO CLASS



HANDS-ON TASK: USING CHART 68-2, HAVE THE STUDENTS DETERMINE WHAT INPUT MEMBER, REACTION MEMBER, & OUTPUT MEMBER WILL BE IN MAXIMUM REDUCTION & MAXIMUM INCREASE. HAVE THEM POINT OUT THESE PARTS ON PLANETARY GEAR SET



130. SLIDES 130-131 EXPLAIN Compound Planetary Gear Set

132. SLIDE 132 EXPLAIN Figure 68-19 A Simpson planet gear set is composed of two ring gears and two planet carrier assemblies that share one sun gear.

133. SLIDES 133-137 EXPLAIN Compound Planetary Gear Set

138. SLIDE 138 EXPLAIN Figure 68-20 Ravigneaux gear set is composed of two sun gears, one planet carrier that supports two sets of pinion gears, and a single ring gear.

139. SLIDES 139-142 EXPLAIN Compound Planetary Gear Set



DISCUSSION: DISCUSS AND COMPARE RAVIGNEAUX GEAR SET (FIGURE 68-20), LAPELLETIER GEAR SET, & SIMPSON GEAR SET. WHAT ARE ADVANTAGES AND DISADVANTAGES, IF ANY, OF DIFFERENT GEAR SETS? IS A PLANETARY GEAR CAPABLE OF PRODUCING AN OVERDRIVE?



HANDS-ON TASK: IDENTIFY WHAT MODEL OF TRANSMISSION OR TRANSAXLE (GM 4L80E) THEIR OWN OR THEIR PARENTS' VEHICLE HAS IN IT. HAVE THE STUDENTS DETERMINE WHAT THE NUMBERS AND LETTERS MEAN FOR VEHICLE

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143. SLIDE 143 EXPLAIN Automatic Transaxles

144. SLIDE 144 EXPLAIN Figure 68-21 On one style of transaxle the turbine shaft drives the input shaft through a drive chain assembly.

Power Flow, 6T70/6F50

Power Flow, Allison 1000, 5-Speed

Power Flow, Lepelletier Six-Speed

Power Flow, Overdrive Four-Speed #1

Power Flow, Overdrive Four-Speed #2

Power Flow, Overdrive Four-Speed #3

Power Flow, Ravigneaux Four-Speed

Power Flow, Simpson Geartrain

Power Flow, Simpson Geartrain + Overdrive

Power Flow, Two-Mode Hybrid Transmission

Power Flow, Toyota A 750E

DISCUSSION: HAVE THE STUDENTS TALK ABOUT AUTOMATIC TRANSAXLES. WHAT DOES AN AUTOMATIC TRANSAXLE INCLUDE? IN WHAT APPLICATIONS CAN AUTOMATIC TRANSAXLES BE USED? FIGURE 68-21

145. SLIDE 145 EXPLAIN Figure 68-22 Another transaxle uses a chain to transfer engine torque from output of the gear sets to differential assembly (final drive).

146. SLIDES 146-148 EXPLAIN Automatic Transaxles

149. SLIDE 149 EXPLAIN Figure 68-23 cutaway showing the final drive assembly of a transaxle.

DISCUSSION: DISCUSS FINAL DRIVE UNITS. WHAT DOES A FINAL DRIVE ASSEMBLY INCLUDE? FIGURE 68-22, 23

DEMONSTRATION: SHOW STUDENTS HOW TO DISASSEMBLE A TRANSAXLE FINAL DRIVE UNIT AND EXPLAIN THE PARTS.

HANDS-ON TASK: HAVE THE STUDENTS DISASSEMBLE A FINAL DRIVE UNIT & IDENTIFY THE PARTS USED POST-IT NOTES.

150. SLIDES 150-152 EXPLAIN Nonplanetary Gear Automatic Transaxles

153. SLIDE 153 EXPLAIN Figure 68-24 Honda non-

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planetary gear set type automatic transmission that uses helical cut gears instead of planetary gears. Hydraulically applied clutches as commanded by PCM with fluid flow controlled by shift solenoids to make the shifts

DISCUSSION: DISCUSS AUTOMATIC TRANSMISSION USED IN HONDA OR A SATURN. WHAT IS DIFFERENT ABOUT THIS TYPE OF AUTOMATIC TRANSMISSION? FIGURE 68-24

HANDS-ON TASK: HAVE THE STUDENTS LOCATE IN THE ON-LINE SERVICE INFORMATION, DETAILS ABOUT THE OPERATION OF A SATURN OR HONDA NON-PLANETARY TRANSAXLE AND HAVE THEM SELECT A SPOKESPERSON WHO WILL EXPLAIN THE ADVANTAGES AND DISADVANTAGES OF THIS DESIGN COMPARED TO A STANDARD AUTOMATIC TRANSAXLE USING PLANETARY GEARSETS.

Honda 4-Speed Automatic Transaxle

154. SLIDE 154 EXPLAIN Continuously Variable Transmission
155. SLIDE 155 EXPLAIN Figure 68-25 (a) A belt and pulley CVT uses variable width pulleys and a special chain to provide an infinite number of speed ratios.
156. SLIDE 156 EXPLAIN Figure 68-25 (b) A belt and pulley CVT uses variable width pulleys and a special chain to provide an infinite number of speed ratios.

**SHOW ANIMATION: CVT OPERATION
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[HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A14_ANIMATION/CHAPTER100 FIG 100 21/INDEX.HTM](http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/a14_animation/chapter100_fig_100_21/index.htm)

Hybrid Auto Transmission

157. SLIDES 157-158 EXPLAIN Continuously Variable Transmission

ICONS**Ch68 Automatic Transmission Parts & OP****DEMO**

DEMONSTRATION: USING A VARIABLE-SPEED DRILL PRESS, SHOW THAT BY CHANGING THE PULLEY DIAMETER, YOU CAN CHANGE THE SPEED OF DRILL. THIS WILL HELP THEM UNDERSTAND HOW A CONTINUOUSLY VARIABLE TRANSAXLE OPERATES. FIGURE 68-25

159. SLIDE 159 EXPLAIN Figure 68-26 Honda CVT belt construction.

160. SLIDES 160-161 EXPLAIN Continuously Variable Transmission

162. SLIDE 162 EXPLAIN Figure 68-27 Honda CVT power flow in park (P) and neutral (N).

163. SLIDES 163-168 EXPLAIN Continuously Variable Transmission



DISCUSSION: DISCUSS CVT VARIABLE DIAMETER PULLEYS. WHAT FUNCTION DO THESE PULLEYS DO THAT PLANETARY GEAR SETS PERFORM IN TRANSMISSIONS TRANSAXLES? FIGURE 68-25, 26, 27



169. SLIDE 169 EXPLAIN Figure 68-25 (a) A belt and pulley CVT uses variable width pulleys and a special chain to provide an infinite number of speed ratios.

170. SLIDE 170 EXPLAIN Figure 68-25 (b) A belt and pulley CVT uses variable width pulleys and a special chain to provide an infinite number of speed ratios.

171. SLIDES 171-174 EXPLAIN Continuously Variable Transmission



DISCUSSION: HAVE THE STUDENTS TALK ABOUT HOW A VEHICLE EQUIPPED WITH A CVT WILL DRIVE A LITTLE DIFFERENTLY THAN A VEHICLE WITH A CONVENTIONAL AUTOMATIC TRANSMISSION OR TRANSAXLE. WHAT ARE SOME DRIVING ADVANTAGES OF A CVT?


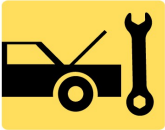














175. SLIDE 175 EXPLAIN Figure 68-28 Honda CVT operation in drive (D) or low (L).

176. SLIDE 176 EXPLAIN Continuously Variable Transmission



DISCUSSION: DISCUSS HONDA CVT USED AS PART OF HEV SYSTEM ON SOME HONDAS. WHY WOULD A CVT BE USED FOR A HYBRID VEHICLE? FIGURE 68-28. DISCUSS WHY A START CLUTCH

ICONS	Ch68 Automatic Transmission Parts & OP
	<p>IS NEEDED. WHAT DOES A START CLUTCH REPLACE IN AN AUTOMATIC TRANSMISSION?</p> <p>177. SLIDE 177 EXPLAIN Figure 68-29 Location of the Honda CVT start clutch.</p> <p>178. SLIDES 178-186 EXPLAIN CVT</p> <p>187. SLIDE 187 EXPLAIN Figure 68-30 The Honda CVT transmission control module (TCM) showing the inputs (sensors) on the left and the outputs on the right.</p> <p>188. SLIDES 188-190 EXPLAIN Continuously Variable Transmission</p>
	<p>HANDS-ON TASK: USE ON-LINE SERVICE INFO TO LOOK UP SERVICE PROCEDURES FOR A CVT TRANSMISSION. IS THERE A FILTER TO CHANGE? CAN THE FLUID BE EASILY CHANGED? DOES A CVT USE SPECIAL ATF? HAVE THEM LIST SERVICE PROCEDURES THEY FIND.</p>
	<p>191. SLIDES 191-196 EXPLAIN Dual Clutch Automatic Transmissions</p> <p>197. SLIDE 197 EXPLAIN Figure 68-31 dual clutch automatic uses best features of an automatic transmission without the power loss of a torque converter.</p>
	<p>DISCUSSION: STUDY AND TALK ABOUT FIGURE 68-31. WHICH PARTS DIFFER BETWEEN DUAL-CLUTCH AUTOMATIC TRANSMISSION & CONVENTIONAL AUTOMATIC TRANSMISSION THEY DISCUSSED EARLIER? CREATE A POWER LOSS COMPARISON BETWEEN A DUAL CLUTCH TRANS AND TORQUE CONVERTER TRANS.</p>
	<p>198. SLIDES 198-199 EXPLAIN Dual Clutch Automatic Transmissions</p> <p>200. SLIDE 200 EXPLAIN Figure 68-32 Dual clutch automatic transaxles that use two dry clutches. The larger clutch drives the odd number gear ratios (first, third, and fifth) and the smaller clutch drives the even numbered gear ratios (second, fourth, and sixth).</p>
	<p>201. SLIDES 201-206 EXPLAIN Dual Clutch Transmission</p>
	<p>Dual Clutch Transaxle Dual Clutch Transmission Hydraulic & Electronic Control 7-SPEED DUAL CLUTCH TRANSMISSION</p>

ICONS	Ch68 Automatic Transmission Parts & OP
	<p>DISCUSSION: HAVE STUDENTS TALK ABOUT THE OPERATION OF A DUAL-CLUTCH AUTOMATIC TRANSMISSION. WHAT TYPES OF VEHICLES USE DUAL DRY CLUTCHES? WHAT TYPE OF VEHICLES USE DUAL WET CLUTCHES?</p>
	<p>DISCUSSION: DISCUSS ADVANTAGES AND DISADVANTAGES OF A DUAL-CLUTCH AUTOMATIC TRANSMISSION. WHICH VEHICLES USE A DUAL CLUTCH AUTOMATIC TRANSMISSION?</p>
	<p>HANDS-ON TASK: USE ON-LINE SERVICE INFO TO LOOK UP HOW DUAL-CLUTCH TRANSAXLE OPERATES. DISCUSS WHAT THEY FOUND.</p>
	<p>HANDS-ON TASK: USE ON-LINE SERVICE INFO TO LOOK UP SERVICE PROCEDURES FOR A DUAL-CLUTCH TRANSMISSION. IS THERE A FILTER TO CHANGE? CAN THE FLUID BE EASILY CHANGED? DOES IT USE SPECIAL ATF? HAVE THEM LIST SERVICE PROCEDURES THEY FIND.</p>
	<p>DISCUSSION: DISCUSS HOW MANY ENGINE COMPUTER INPUTS ARE USED BY TRANSMISSION. LET THEM KNOW THAT ENGINE DRIVEABILITY ISSUES CAN AFFECT TRANSMISSION OPERATION. WHAT IS THE PURPOSE OF THE TCM?</p>
	<p>NATEF MLR TASK A1C1 DESCRIBE THE OPERATIONAL CHARACTERISTICS OF A CONTINUOUSLY VARIABLE TRANSMISSION (CVT).</p>
	<p>NATEF MLR TASK A1C2 DESCRIBE THE OPERATIONAL CHARACTERISTICS OF A HYBRID VEHICLE DRIVE TRAIN.</p>