











# Automatic Transmissions and Transaxles, 7e










## Chapter 6 Power Flow Through Transmission Gear Sets

### 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 <b>ASE and ASE Education (NATEF)</b> .
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"><li>1. Prepare for ASE Automatic Transmissions (A2) certification test content area "A" (General Transmission and Transaxle Diagnosis).</li><li>2. Explain how power can be transferred through planetary gear sets to produce the various ratios.</li><li>3. Discuss the Simpson gear set and identify the different types of Simpson gear trains.</li><li>4. Discuss the Ravigneaux gear set.</li><li>5. Explain the operation of the LePelletier gear train.</li></ol>
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 7<sup>th</sup> Edition Chapter Images found on Jim's web site @ [www.jameshalderman.com](http://www.jameshalderman.com)**  
**DOWNLOAD CHP 6: Chapter Images**

ICONS	Ch06 Power Flow Thru Gear Sets
           	<p><b>1. SLIDE 1 Power Flow Through Transmission Gear Sets</b></p> <p>Check for <b>ADDITIONAL VIDEOS &amp; ANIMATIONS</b>  @ <a href="http://www.jameshalderman.com/">http://www.jameshalderman.com/</a>  <b>WEB SITE IS CONSTANTLY UPDATED</b></p> <p><u><b>Videos</b></u></p> <p>At the beginning of this class, you can download the crossword puzzle &amp; Word Search from <a href="http://www.jameshalderman.com/books_a2.html">http://www.jameshalderman.com/books_a2.html</a> to familiarize your class with the terms in this chapter &amp; then discuss them</p> <p><b>DOWNLOAD Crossword Puzzle</b>  <b>DOWNLOAD Word Search Puzzle</b></p> <p><b>2. SLIDE 2 EXPLAIN FIGURE 6-1</b> A typical planetary gear set showing the terms that are used to describe each member.</p> <p><b>3. SLIDE 3 EXPLAIN FIGURE 6-2</b> A typical planetary gear set showing the planet carrier which supports all of the pinion gears (also called planet pinion gears).</p> <p><b>4. SLIDE 4 EXPLAIN FIGURE 6-3</b> A typical planetary gear set showing the components and the action/reaction that occurs.</p> <p><b>EXPLAIN CHART 6-1</b></p> <p><b>EXPLAIN FREQUENTLY ASKED QUESTION: Which Companies Build Automatic Transmissions?</b></p> <p><b>DEMONSTRATION: SHOW PLANETARY GEAR SET. ID PARTS: SUN GEAR, PLANETARY CARRIER, &amp; RING (ANNULUS) GEAR</b></p>

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	<p><b>SAFETY</b> 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</p>
	<p><a href="#">PGS 1, Reduction (View) (Download)</a>  <a href="#">PGS 2, Rev Reduction (View) (Download)</a>  <a href="#">PGS 3, Reduction (View) (Download)</a>  <a href="#">PGS 4, Rev OD (View) (Download)</a>  <a href="#">PGS 5, OD (View) (Download)</a>  <a href="#">PGS 6, OD (View) (Download)</a>  <a href="#">PGS 7, Direct Drive (View) (Download)</a></p>
	<p><b>HANDS-ON TASK:</b> HAVE THE STUDENTS IDENTIFY PARTS ON PLANETARY GEAR SET. GRADE THEM ON THEIR ABILITY TO CORRECTLY IDENTIFY PARTS INCLUDING SUN GEAR, PLANETARY CARRIER, &amp; RING (ANNULUS) GEAR</p>
	<p><b>DEMONSTRATION:</b> USING A PLANETARY GEAR SET, DEMONSTRATE FOR STUDENTS WHEN 3 GEARS ARE USED AND WHEN 2<sup>ND</sup> GEAR MOVED IN DRIVEN GEAR BECOMES DRIVE GEAR TO 3<sup>RD</sup> GEAR</p>
	<p><b>DISCUSSION:</b> DISCUSS WHAT AN INPUT MEMBER, A REACTION MEMBER, AND OUTPUT MEMBER ARE. ARE THESE MEMBERS ALWAYS THE SAME IN A PLANETARY GEAR SET?</p>
 <p>QUESTION</p>	<p>5. SLIDE 5 EXPLAIN FIGURE 6-4 A Simpson planet gear set is composed of two ring gears and two planet carrier assemblies that share one sun gear.</p>
	<p><b>EXPLAIN CHART 6-2</b></p>
	<p><a href="#">Power Flow, Simpson Geartrain (View) (Download)</a>  <a href="#">Power Flow, Simpson Geartrain + Overdrive (View) (Download)</a></p>
	<p><b>HANDS-ON TASK:</b> 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</p>
	<p></p>



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	<p><b>WHEN A GEAR REDUCTION, A 1:1 RATIO, OR AN OVERDRIVE WILL OCCUR.</b></p> <p>6. <b>SLIDE 6 EXPLAIN FIGURE 6–5</b> 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.</p>
	<p><b>DISCUSSION: DISCUSS RAVIGNEAUX GEAR SET, LAPELLETIER GEAR SET, &amp; SIMPSON GEAR SET. ADVANTAGES &amp; DISADVANTAGES OF DIFFERENT GEAR SETS? IS A PLANETARY GEAR CAPABLE OF PRODUCING AN OVERDRIVE?</b></p>
	<p>7. <b>SLIDE 7 EXPLAIN FIGURE 6–6</b> gear ratio through a planetary gear set depends on which part is driven, which part is held, and which part is the output. The formula used to calculate ratio is included with each illustration. Each gear set uses a 40-tooth sun gear &amp; 77-tooth ring gear.</p>
	<p><b>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</b></p>
	<p><b>DISCUSSION: DISCUSS AUTOMATIC TRANSAXLES. WHAT DOES AN AUTOMATIC TRANSAXLE INCLUDE? IN WHAT APPLICATIONS CAN AUTOMATIC TRANSAXLES BE USED?</b></p>
	<p><b>DISCUSSION: DISCUSS AUTOMATIC TRANSMISSION USED IN HONDA OR A SATURN. WHAT IS DIFFERENT ABOUT THIS TYPE OF AUTOMATIC TRANSMISSION?</b></p>
	<p><b>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 TRANSMISSION USING PLANETARY GEARSETS.</b></p>
	<p><b><u><a href="#">Honda 4-Speed Automatic Transaxle (View)</a></u> <b><u><a href="#">(Download)</a></u></b></b></p>

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**1<sup>ST</sup> GEAR SIMPSON**



**2<sup>ND</sup> GEAR SIMPSON**



**3<sup>RD</sup> GEAR SIMPSON**

8. **SLIDE 8 EXPLAIN FIGURE 6–6** The parking pawl engages and locks the output shaft to the transmission case.
9. **SLIDE 9 EXPLAIN FIGURE 6–8** When the control rod is moved, the locking cam pushes the pawl into engagement with the parking gear.
10. **SLIDE 10 EXPLAIN FIGURE 6–9** Common symbols used in the transmission schematics to illustrate the various parts.
11. **SLIDE 11 EXPLAIN FIGURE 6–10** Type 1 gear set is a three-speed Simpson gear train that uses bands to hold the sun gear and reaction carrier. Note that the reaction carrier can also be held by a one-way clutch.
12. **SLIDE 12 EXPLAIN FIGURE 6–11** The one-way clutch of this type 1 gear set serves as the reaction member in first gear with the gear selector in Drive (D1). The low-reverse band is applied in manual first (M1) to allow engine compression braking.
13. **SLIDE 13 EXPLAIN FIGURE 6–12** In drive low (D1), the front ring gear is driven while the rear carrier is held by the one-way clutch. **b** A reverse reduction occurs in the front unit. **c** A reverse reduction occurs in the rear unit.

[Power Flow, Simpson Geartrain \(View\) \(Download\)](#)  
[Power Flow, Simpson Geartrain + Overdrive \(View\) \(Download\)](#)

14. **SLIDE 14 EXPLAIN FIGURE 6–13** In second gear, the ring gear is driven while the sun gear is held, and the planet gears walk around the sun gear and force the carrier to revolve at a reduced speed.
15. **SLIDE 15 EXPLAIN FIGURE 6–14** In third gear, both driving clutches are applied so two members (the ring and sun gears) of the same gear set are driven. This locks the gears and produces a 1:1 gear ratio.
16. **SLIDE 16 EXPLAIN FIGURE 6–15** In reverse, the sun gear is driven while the carrier is held. The planet gears act as idlers and cause the ring gear to revolve in a reverse direction at a reduced speed.

## ICONS



## Ch06 Power Flow Thru Gear Sets









17. **SLIDE 17 EXPLAIN FIGURE 6–16** The full-throttle shift sequence for a type 1 transmission showing the apply devices and the output shaft speed at the 1–2 and 2–3 upshifts. Reverse is also shown.
18. **SLIDE 18 EXPLAIN FIGURE 6–17** Types 5, 6, 7, and 8 gear sets illustrate the different four-speed gear train arrangements that combine a Simpson three-speed gear set with an overdrive unit.
19. **SLIDE 19 EXPLAIN FIGURE 6–18** The full-throttle shift sequence for a type 6 transmission showing the apply devices and the output shaft speed at the 1–2, 2–3, and 3–4 upshifts, plus reverse
20. **SLIDE 20 EXPLAIN FIGURE 6–19** Types 9, 10, 11, and 12 gear sets illustrate the different three- and four-speed gear train arrangements that use a single Ravigneaux gear set.

[Power Flow, Ravigneaux Four-Speed \(View\)](#)  
[\(Download\)](#)

[Power Flow, 6T70/6F50 \(View\) \(Download\)](#)

### EXPLAIN FREQUENTLY ASKED QUESTION: How Was the Powerglide Different?

21. **SLIDE 21 EXPLAIN FIGURE 6–20** When a Powerglide is in low gear, the low band is applied to hold the low sun gear stationary. At this time, the long pinions will be driven by the input sun gear and walk around the low sun gear to drive the carrier.
22. **SLIDE 22 EXPLAIN FIGURE 6–21** The full-throttle shift sequence for a type 12 transmission showing the apply devices and the output shaft speed at the 1–2, 2–3, and 3–4 upshifts and reverse.
23. **SLIDE 23 EXPLAIN FIGURE 6–22a** A schematic view of a type 13, LePelletier six-speed gear set. **b** A clutch application chart.
24. **SLIDE 24 EXPLAIN FIGURE 6–23** A type 13 shift sequence.

ICONS	Ch06 Power Flow Thru Gear Sets
	<p><a href="#"><u>Power Flow, Lepelletier Six-Speed (View)</u></a>  <a href="#"><u>(Download)</u></a></p>
	<p>25. <b>SLIDE 25 EXPLAIN FIGURE 6–24</b> A schematic view of a type 14, GM 4L60-E four-speed gear set.</p>
	<p><a href="#"><u>Power Flow, Overdrive Four-Speed #1 (View)</u></a>  <a href="#"><u>(Download)</u></a></p>
<p>TYPE 14</p>	<p><a href="#"><u>Power Flow, Overdrive Four-Speed #2 (View)</u></a>  <a href="#"><u>(Download)</u></a></p>
	<p><a href="#"><u>Power Flow, Overdrive Four-Speed #3 (View)</u></a>  <a href="#"><u>(Download)</u></a></p>
	<p>26. <b>SLIDE 26 EXPLAIN FIGURE 6–25</b> The full-throttle shift sequence for a type 14, 4L60 transmission showing the apply devices and the output shaft speed at the 1–2, 2–3, and 3–4 upshifts and reverse.</p> <p><b>AS A PROFESSIONAL RECOMMENDATION, MOST SCHOOLS HAVE A 4L65-E TRANSMISSION. YOU SHOULD SHOW POWERFLOW LIKE FIG 6-24 WITH THE ACTUAL IRON ON A BENCH</b></p>
	<p>27. <b>SLIDE 27 EXPLAIN FIGURE 6–26</b> The full-throttle shift sequence for a type 15, 41TE transmission showing the apply devices and the output shaft speed at the 1–2, 2–3, and 3–4 upshifts and reverse.</p>
	<p>28. <b>SLIDE 28 EXPLAIN FIGURE 6–27</b> A schematic view of a type 16, GM 4T60 four-speed gear set. The Ford AX4N gear set is similar.</p>
	<p><b>EXPLAIN CHART 6-3</b></p> <p>29. <b>SLIDE 29 EXPLAIN FIGURE 6–28</b> A schematic view of a type 17, Ford CD4E four-speed gear set.</p> <p>30. <b>SLIDE 30 EXPLAIN FIGURE 6–29</b> (a) A schematic view of (a) a type 18, joint venture six-speed gear set and (b) a clutch application chart..</p> <p>31. <b>SLIDE 31 EXPLAIN FIGURE 6–30</b> shift sequence for type 19, 4-speed transmission showing the apply devices.</p>
	<p><a href="#"><u>Honda 4-Speed Automatic Transaxle (View)</u></a>  <a href="#"><u>(Download)</u></a></p> <p><a href="#"><u>Power Flow, Allison 1000, 5-Speed (View)</u></a>  <a href="#"><u>(Download)</u></a></p> <p><a href="#"><u>Power Flow, Two-Mode Hybrid Transmission (View)</u></a></p>

<b>ICONS</b>	<b>Ch06 Power Flow Thru Gear Sets</b>
	<a href="#"><u>(Download)</u></a> <a href="#"><u>Power Flow, Toyota A 750E (View) (Download)</u></a> <a href="#"><u>Power Flow, ZF 8HP (View) (Download)</u></a>