ASE 2 - Automatic Transmission & Transaxle

Module 3
Power Flow
Acknowledgements

General Motors, the IAGMASEP Association Board of Directors, and Raytheon Professional Services, GM’s training partner for GM’s Service Technical College wish to thank all of the people who contributed to the GM ASEP/BSEP curriculum development project 2002-3. This project would not have been possible without the tireless efforts of many people. We acknowledge:

• The IAGMASEP Association members for agreeing to tackle this large project to create the curriculum for the GM ASEP/BSEP schools.
• The IAGMASEP Curriculum team for leading the members to a single vision and implementation.
• Direct contributors within Raytheon Professional Services for their support of translating a good idea into reality. Specifically, we thank:

  – Chris Mason and Vince Williams, for their leadership, guidance, and support.
  – Media and Graphics department under Mary McClain and in particular, Cheryl Squicciarini, Diana Pajewski, Lesley McCowey, Jeremy Pawelek, & Nancy DeSantis.
  – For his help on the Automatic Transmission curriculum volume, Subject Matter Expert, Bob Hayes, for his wealth of knowledge.

Finally, we wish to recognize the individual instructors and staffs of the GM ASEP/BSEP Colleges for their contribution for reformatting existing General Motors training material, adding critical technical content and the sharing of their expertise in the GM product. Separate committees worked on each of the eight curriculum areas. For the work on this volume, we thank the members of the Automatic Transmission committee:

  – George Aiken, Raytheon
  – Jerry Darnell, Guilford Technical Community College
  – Rick Frazier, Owens Community College
  – Stevon Gregory, Oklahoma State University - Okmulgee
  – Sumner Huckaby, Greenville Technical College
  – Marvin Johnson, Brookhaven College
  – Scott Main, Shoreline Community College
  – Tim McCluskey, Dakota County Technical College
  – Larry Thomas, College of Southern Nevada
## Contents

**Module 3 – Power Flow**

Acknowledgements ........................................................................................................ 2
Introduction .................................................................................................................. 4
Objectives .................................................................................................................... 4

- Range Reference Chart for the 4L60E ........................................................................... 5
- Range Reference Chart for the 4T65E ........................................................................... 6
- Exercise 3-1 .................................................................................................................. 8
- Exercise 3-2 .................................................................................................................. 8
- Exercise 3-3 .................................................................................................................. 9
- Exercise 3-4 .................................................................................................................. 9
- Exercise 3-5 .................................................................................................................. 10
- Exercise 3-6 .................................................................................................................. 10
- Exercise 3-7 .................................................................................................................. 11
- Exercise 3-8 .................................................................................................................. 12
- Exercise 3-9 .................................................................................................................. 13
- Exercise 3-10 ............................................................................................................... 14
Introduction

Power flow is used for quick diagnosis before you remove the transmission from the vehicle. Diagnosis may include but not limited to:

i. Clutch pack failure (slipping or chattering)
ii. Bearing or component noise
iii. Hydraulic problems

Objectives

After this module you will be able to perform diagnosis using the range reference chart for the related transmission assembly.

NATEF Area II. A.

Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.
### Range Reference Chart for the 4L60E

#### Range Reference Chart

<table>
<thead>
<tr>
<th>RANGE</th>
<th>GEAR</th>
<th>Shift Solenoid Valves</th>
<th>2-4 Band</th>
<th>Reverse Input Clutch</th>
<th>Overrun Clutch</th>
<th>Forward Clutch</th>
<th>Forward SHAC Cl Assembly</th>
<th>3-4 Clutch</th>
<th>Low Roller Clutch</th>
<th>Low Rev Clutch</th>
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<tbody>
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<td>Applied</td>
<td>Holding</td>
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</tr>
</tbody>
</table>

* **Note:** 1-2 and 2-3 shift solenoid operation and the shift valve positioning in P, R, N ranges are a function of the input to the solenoids from the VSS. Under normal operating conditions, the solenoids are on in P, R, N.

**A Manual Second - First gear condition is only available on some models. Otherwise, this condition is electronically prevented.**

**A Manual Second and Manual First - Solenoid operation is a result of PCM calibration. Some calibrations will allow all three gears under extreme conditions.**
# Range Reference Chart for the 4T65E

## Range Reference Chart

<table>
<thead>
<tr>
<th>RANGE</th>
<th>GEAR</th>
<th>1-2, 3-4 Shift Solenoid Value</th>
<th>2-3 Shift Solenoid Value</th>
<th>4th Clutch</th>
<th>Reverse Band</th>
<th>2nd Clutch</th>
<th>3rd Clutch</th>
<th>3rd Sprag Clutch</th>
<th>Input Clutch</th>
<th>Input Sprag Clutch</th>
<th>2/1 Band</th>
<th>1/2 Support Roller Clutch</th>
<th>Forward Band</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>*</td>
<td>*</td>
<td>*</td>
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<tr>
<td>D</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>APPLIED</td>
<td>HOLDING</td>
<td>HOLDING</td>
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<td>HOLDING</td>
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<td>OVERRUN</td>
<td>*</td>
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<tr>
<td>R</td>
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<td>OFF</td>
<td>OFF</td>
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<td>APPLIED</td>
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<td>HOLDING</td>
<td>HOLDING</td>
<td>APPLIED</td>
<td>*</td>
<td>*</td>
<td>OVERRUN</td>
<td>APPLIED</td>
<td>APPLIED</td>
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<td>1</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>APPLIED</td>
<td>HOLDING</td>
<td>APPLIED</td>
<td>HOLDING</td>
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<td>APPLIED</td>
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<td>APPLIED</td>
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<tr>
<td>2</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>APPLIED</td>
<td>HOLDING</td>
<td>APPLIED</td>
<td>APPLIED</td>
<td>APPLIED</td>
<td>APPLIED</td>
<td>APPLIED</td>
<td>APPLIED</td>
<td>APPLIED</td>
<td></td>
</tr>
</tbody>
</table>

*APPLIED OR HOLDING WITH NO LOAD (NOT TRANSMITTING TORQUE)*

ON = SOLENOID ENERGIZED
OFF = SOLENOID DE-ENERGIZED

*THE SOLENOID'S STATE FOLLOWS A SHIFT PATTERN WHICH DEPENDS UPON VEHICLE SPEED, THROTTLE POSITION AND SELECTED GEAR RANGE.*
Use the Hydra-Matic 4L60E Technician’s Guide for the following:

Figure 10 shows all the clutch packs and one-way clutches used in the 4L60E Transmission. Use this chart to aid in preliminary diagnosis.

For example:

**If you had a condition that the transmission had no 4th gear.**

Start your diagnosis by finding what components are working in that gear.

In overdrive range 4th gear, the Forward clutch pack and 3-4 clutch pack is applied, and the 2-4 band is applied. Also note the shift solenoid status.

Next, you will need to find what gears will apply clutch packs that will defeat the one-way clutches. Manual gears selection work well for this.

In 4th gear there are not any one-way clutches that are locked.

Next, place the gear selection in Manual 2nd and check to see if the vehicle moves and feels solid; most likely the 2-4 band is functioning.

Select OD and drive the vehicle fast enough to obtain 4th gear. Shift the trans between manual third and OD. If the transmission feels like it down shifted slightly then the 3-4 clutches may be slipping.

Next, drive approx. 40MPH in manual 3rd, allow vehicle to decelerate and downshift to manual 2nd. If the downshift feels solid then the 2-4 band is functioning.

Disassembly will be required to inspect parts. Start with the 3-4 clutch pack assembly, then the 2-4 band servo, band and drum surface.

The forward clutch will not be at fault due to the fact that it is not a holding component in OD 4th gear.

Note to perform an accurate diagnosis the fluid level and condition must be verified and set to specification.

Also, the transmission line PSI must be checked.
Exercise 3-1

A customer states the vehicle has no reverse and is very noisy when the vehicle shifts to second gear. The vehicle was towed to the shop.

Use the range reference chart to determine your preliminary diagnosis.

Record your steps for diagnosis.
1. 
2. 
3. 
4. 
5. 
6. 

What is the most likely problem with this transmission?

Exercise 3-2

A customer states the vehicle has No Engine Braking when the vehicle is manually downshifted in any gear.

Use the range reference chart to determine your preliminary diagnosis.

Record your steps for diagnosis.
1. 
2. 
3. 
4. 
5. 
6. 

What is the most likely problem with this transmission?
Exercise 3-3
A customer states the vehicle has no reverse. The vehicle will move forward in OD,D,2,1.

Use the range reference chart to determine your preliminary diagnosis.

Record your steps for diagnosis.
1. 
2. 
3. 
4. 
5. 
6. 

What is the most likely problem with this transmission?

Exercise 3-4
A customer states the vehicle will not move forward in OD and D ranges, but will move when selected to Manual 2 and Manual 1. Reverse works. The vehicle was towed to the shop.

Use the range reference chart to determine your preliminary diagnosis.

Record your steps for diagnosis.
1. 
2. 
3. 
4. 
5. 
6. 

What is the most likely problem with this transmission?
Use the Hydra-Matic 4T65E Technician’s Guide for the following.

**Exercise 3-5**

A customer states the vehicle No 4th gear. Reverse works. The vehicle was towed to the shop.

Use the range reference chart to determine your preliminary diagnosis.

Record your steps for diagnosis.
1. ______________________________________________________
2. ______________________________________________________
3. ______________________________________________________
4. ______________________________________________________
5. ______________________________________________________
6. ______________________________________________________

What is the most likely problem with this transmission?

**Exercise 3-6**

A customer states the vehicle will not move Forward or Reverse. The vehicle was towed to shop.
- Fluid level and condition is ok
- Line PSI is as per specification

Use the range reference chart determine your preliminary diagnosis.

Record your steps for diagnosis.
1. ______________________________________________________
2. ______________________________________________________
3. ______________________________________________________
4. ______________________________________________________
5. ______________________________________________________
6. ______________________________________________________

What is the most likely problem with this transmission?
Exercise 3-7

A customer states the vehicle will not upshift. Reverse works.

- Fluid level and condition is ok and fluid condition is dark
- Line PSI is as per specification

Use the range reference chart determine your preliminary diagnosis.

Record your steps for diagnosis.

1. ______________________________________________________
2. ______________________________________________________
3. ______________________________________________________
4. ______________________________________________________
5. ______________________________________________________
6. ______________________________________________________

What is the most likely problem with this transmission?
**Exercise 3-8**

With the 4T65E transmission provided:

- Stackup the powertrain as shown and demonstrate the powerflow in 1st, 2nd, 3rd, 4th and Reverse Range

<table>
<thead>
<tr>
<th>Range</th>
<th>Instructor Initial</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Gear</td>
<td>_________________</td>
</tr>
<tr>
<td>Second Gear</td>
<td>_________________</td>
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<tr>
<td>Third Gear</td>
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<tr>
<td>Fourth Gear</td>
<td>_________________</td>
</tr>
<tr>
<td>Reverse Gear</td>
<td>_________________</td>
</tr>
</tbody>
</table>

Student has demonstrated the above task.

Instructor Signature_________________________________________
Exercise 3-9

With the 4T65E transmission provided:

- Stackup the powertrain as shown and demonstrate the powerflow in 1st, 2nd, 3rd, 4th and Reverse

<table>
<thead>
<tr>
<th>Range</th>
<th>Instructor Initial</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Gear</td>
<td>________________</td>
</tr>
<tr>
<td>Second Gear</td>
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<tr>
<td>Third Gear</td>
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<tr>
<td>Fourth Gear</td>
<td>________________</td>
</tr>
<tr>
<td>Reverse Gear</td>
<td>________________</td>
</tr>
</tbody>
</table>

Student has demonstrated the above task.

Instructor Signature_________________________________________
Exercise 3-10

Read each question carefully and choose the correct response. Questions to be numbered sequentially and answers indented - for example.

1. In a 4T65E transmission the 2-1 band is applied in
   a. all forward gears
   b. manual 1st and 2nd
   c. both a & b
   d. neither a or b

2. In a 4L60E transmission the lo roller clutch is holding in
   a. OD 1st, 2nd, and 3rd
   b. manual 1st only
   c. all 1st gear ranges
   d. reverse gear only

3. The forward sprag in a 4L60E overruns in 4th gear because
   a. the input shaft is driving faster than the output shaft
   b. the output shaft is driving the input sun faster than the forward clutch
   c. the lo roller is freewheeling
   d. the forward clutch is applied

4. The second clutch pack in the 4T65E drives the
   a. reaction carrier
   b. input sprag
   c. input carrier
   d. final drive sun shaft

5. In the 4T65E, the input clutch is applied in
   a. all gear ranges
   b. 3rd and 4th only
   c. manual ranges only
   d. all ranges except 3rd & 4th