COMPONENT LOCATOR

DISASSEMBLED VIEWS (6L80)

Case and Associated Parts

Fig. 1: Case And Associated Parts
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Torque Converter Assembly
2	Torque Converter (with Fluid Pump) Housing Assembly - Model Dependent
3	Bolt, M10 x 50 mm
4	Torque Converter Housing Access Hole Cover - Model Dependent

Callout	Component Name
5	A/Trans Fluid Pump Seal
6	Torque Converter Housing Locator Pin
7	A/Trans Case Assembly
9	A/Trans Connector Seal
10	A/Trans Connector (O-ring) Seal
11	A/Trans Electrical Connector Passage Sleeve
12	A/Trans Case Plug
13	Output Shaft Bushing
14	Output Shaft Seal Assembly - 4WD Models
16	Bolt, M10 x 40 mm - Model Dependent
18	A/Trans Fluid Pump Seal Assembly
19	A/Trans Fluid Pump Seal Assembly
20	Center Support Fluid Passage Seal Assembly
21	Control (with Body and Valve) Valve Assembly
22	Bolt, M5 x 73 mm
23	Bolt, M6 x 14.5 mm
24	Manual Shaft Detent Assembly
25	A/Trans Fluid Filter Seal Assembly
26	A/Trans Fluid Filter Assembly
27	A/Trans Fluid Pan Gasket
28	A/Trans Fluid Pan Magnet
29	A/Trans Fluid Pan Assembly
30	Bolt, M6 x 20 mm
32	Torque Converter Housing Access Hole Cover
33	A/Trans Case Extension Seal - 2WD Models
34	A/Trans Case Extension - 2WD Models
35	Prop Shaft Front Slip Yoke Bushing - 2WD Models
36	Prop Shaft Front Slip Yoke Oil Seal - 2WD Models

Clutch Assemblies and Associated Parts

Fig. 2: Clutch Assemblies And Associated Parts
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
51	1-2-3-4 and 3-5 Reverse Clutch Assembly
52	Input Carrier Assembly
53	Input Sun Gear
54	Input Sun Gear Thrust Bearing

Callout	Component Name
55	Input Sun Gear Thrust Washer
56	4-5-6 (w/ Turbine Shaft) Clutch Assembly
57	Turbine Shaft Thrust Bearing Assembly
58	4-5-6 Clutch (w/ Output Carrier Shaft and Dampener) Hub Assembly
59	4-5-6 Clutch Hub Thrust Bearing Assembly
60	Output Carrier Inner Sun Gear Shaft (Front) Bushing
61	1-2-3-4 Clutch (w/ Output Carrier Inner Sun Gear Shaft) Hub Assembly
62	Output Carrier Inner Sun Gear Shaft Bushing
63	1-2-3-4 Clutch Hub Thrust Bearing Assembly
64	2-6 and 3-5 Reverse Clutch (w/ Output Carrier Outer Sun Gear Shaft) Hub Assembly
65	2-6 and 3-5 Reverse Clutch Hub Thrust Bearing Assembly
66	Center Support Retaining Ring
67	Center (w/ 2-6 Low and Reverse Clutch) Support Assembly
68	Output Carrier Assembly
69	Output Carrier Thrust Bearing Assembly
70	Output Shaft Assembly - Model Dependent
71	Output Shaft Thrust Bearing Assembly

Torque Converter (w/Fluid Pump) Housing Assembly

Fig. 3: Torque Converter (w/Fluid Pump) Housing Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
200	Torque Converter Fluid Seal Retaining Ring
201	Torque Converter Fluid Seal Assembly
202	Line Pressure Test Hole Plug
203	Torque Converter Housing - Model Dependent
204	A/Trans Vent Pipe
205	Trans Fluid Cooler Pipe Fitting Seal
206	Torque Converter Bushing
207	A/Trans Fluid Pump Vane Ring
208	A/Trans Fluid Pump Rotor Guide
209	A/Trans Fluid Pump Slide Fluid Seal Ring

Callout	Component Name
210	A/Trans Fluid Pump Slide (O-ring) Seal
211	A/Trans Fluid Pump Slide Outer Spring
212	A/Trans Fluid Pump Slide
213	A/Trans Fluid Pump Slide Seal
214	A/Trans Fluid Pump Slide Seal Support
215	A/Trans Fluid Pump Slide Pivot Pin
216	A/Trans Fluid Pump Vane
217	A/Trans Fluid Pump Rotor
218	Turbine Shaft Front Bushing
219	A/Trans Fluid Pump Cover Assembly
220	Converter Feed Limit Valve
221	Converter Feed Limit Valve Spring
222	Valve Spring Retainer
223	Pressure Relief Ball Valve Spring Pin
224	Pressure Relief Ball Valve Spring
225	Pressure Relief Ball Valve
226	TCC Control Valve Spring
227	TCC Control Valve
228	Turbine Shaft Rear Bushing
229	1-2-3-4 and 3-5 Reverse Clutch Housing Thrust Washer
230	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Ring
231	Bolt, M6 x 40 mm
232	A/Trans Fluid Pump Locator Pin
233	Pressure Regulator Valve
234	Pressure Regulator Valve Outer Spring
235	Pressure Regulator Valve Inner Spring
236	Isolator Valve
237	Isolator Valve Sleeve
238	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Ring - Inner O-Ring (Qty: 3) - Model Dependent

Control (with Body and Valve) Valve Assembly

Fig. 4: Control (with Body And Valve) Valve Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
301	Bolt, M5 x 36 mm
302	Bolt, M6 x 20 mm
303	A/Trans Input and Output Speed Sensor Assembly - Model Dependent
304	Control Valve Upper Body Assembly

Callout	Component Name
305	Control Valve Body Spacer (w/ Gasket) Plate Assembly
306	Control Valve Body Ball Check Valve
307	Control Valve Lower Body Assembly
308	A/Trans Manual Shift Shaft Position Switch Assembly
309	Bolt, M5 x 45 mm
310	Bolt, M5 x 55 mm
311	Filter Plate Assembly
312	Bolt, M5 x 53 mm
314	Control Solenoid (w/ Body and TCM) Valve Assembly
315	A/Trans Manual Shaft Position Switch Wiring Harness Clip
316	A/Trans Input and Output Speed Sensor Wiring Harness Clip - Model Dependent

Upper Control Valve Body Assembly

Fig. 5: Upper Control Valve Body Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
313	Control Valve Body Locator Pin
321	Control Valve Upper Body
322	Control Valve Body Locator Pin
323	Retainer
324	Actuator Feed Limit Valve Spring
325	Actuator Feed Limit Valve
326	Clutch Regulator Valve Spring
327	CBR1/4-5-6 Clutch Regulator Valve
328	Clutch Regulator Valve Bore Plug
329	Clutch Boost Valve
330	Clutch Boost Valve Spring
334	2-6 Clutch Regulator Valve
335	2-6 Clutch Regulator Valve Gain Valve
336	3-5 Reverse Clutch Regulator Valve
337	1-2-3-4 Clutch Regulator Valve
338	Shuttle Valve

Lower Control Valve Body Assembly

Fig. 6: Lower Control Valve Body Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
323	Retainer
328	Clutch Regulator Valve Bore Plug
338	Shuttle Valve
351	Control Valve Lower Body
352	Clutch Select Solenoid Valve 3
353	TCC Regulator Apply Valve Spring
354	Manual Valve
355	TCC Regulator Apply Valve
356	Clutch Piston Dam Feed Regulator Valve

Callout	Component Name
357	Clutch Piston Dam Feed Regulator Valve Spring
358	Clutch Select Solenoid Valve Spring
359	Clutch Select Solenoid Valve 2

1-2-3-4 and 3-5 Reverse Clutch Assembly

Fig. 7: 1-2-3-4 And 3-5 Reverse Clutch Assembly

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
400	3-5 Reverse Clutch Backing Plate Retaining Ring
401	3-5 Reverse Clutch Backing Plate
402	3-5 Reverse Clutch Plate Assembly
403	3-5 Reverse Clutch Plate
404	3-5 Reverse Clutch (Waved) Plate
405	3-5 Reverse Clutch Apply Ring
407	1-2-3-4 Clutch Backing Plate
408	1-2-3-4 Clutch Plate Assembly
409	1-2-3-4 Clutch Plate
410	1-2-3-4 Clutch (Waved) Plate
411	1-2-3-4 Clutch Piston Dam Retaining Ring
412	1-2-3-4 Clutch Piston Dam Assembly
413	1-2-3-4 Clutch Spring
414	1-2-3-4 Clutch Piston
415	1-2-3-4 Clutch Piston Housing Retaining Ring
416	1-2-3-4 Clutch Piston Seal
417	1-2-3-4 Clutch Piston Housing
418	3-5 Reverse Clutch Piston Dam (O-ring) Seal
419	3-5 Reverse Clutch Piston Inner Seal
420	3-5 Reverse Clutch Spring
421	3-5 Reverse Clutch Piston
422	3-5 Reverse Clutch Piston Outer Seal
423	1-2-3-4 Clutch Piston Inner Seal
424	1-2-3-4 Clutch Piston Housing Seal
425	1-2-3-4 Clutch Piston Housing Seal
426	1-2-3-4 and 3-5 Reverse Clutch Housing Rear Bushing
427	1-2-3-4 and 3-5 Reverse Clutch Housing Assembly
428	1-2-3-4 and 3-5 Reverse Clutch Bearing Assembly
429	1-2-3-4 Clutch Backing Plate Retaining Ring

4-5-6 (w/Turbine Shaft) Clutch Assembly

Fig. 8: 4-5-6 (w/Turbine Shaft) Clutch Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
431	4-5-6 Clutch Backing Plate Retaining Ring
432	4-5-6 Clutch Backing Plate
433	4-5-6 Clutch Plate Assembly
434	4-5-6 Clutch Plate
435	4-5-6 Clutch (Waved) Plate
436	4-5-6 Clutch Piston Dam Retaining Ring
437	4-5-6 Clutch Piston Dam Assembly
438	4-5-6 Clutch Spring

Callout	Component Name
439	4-5-6 Clutch Piston Assembly
440	Output Carrier Shaft Housing Bushing
441	4-5-6 (w/Turbine Shaft) Housing Assembly
442	Turbine Shaft Fluid Seal Ring
443	Turbine Shaft (O-ring) Seal

2-6 Clutch Assembly

Fig. 9: 2-6 Clutch Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
450	2-6 Clutch Backing Plate Retaining Ring

Callout	Component Name
451	2-6 Clutch Backing Plate
452	2-6 Clutch Plate Assembly
453	2-6 Clutch Plate
454	2-6 Clutch (Waved) Plate
455	2-6 Clutch Spring Retaining Ring
456	2-6 Clutch Spring
457	2-6 Clutch Piston Assembly
458	Output Carrier Outer Sun Gear Shaft (Front) Bushing
459	Center Support Assembly
460	Output Carrier Outer Sun Gear Shaft Rear Bushing

Low and Reverse Clutch Assembly

Fig. 10: Low and Reverse Clutch Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
459	Center Support Assembly
461	Low and Reverse Clutch Backing Plate Retaining Ring
462	Low and Reverse Clutch Backing Plate
463	Low and Reverse Clutch Plate Assembly

Callout	Component Name
464	Low and Reverse Clutch Plate
465	Low and Reverse Clutch (Waved) Plate
466	Low and Reverse Clutch Spring Retaining Ring
467	Low Clutch Sprag Assembly
468	Low Clutch Sprag Seal
469	Low and Reverse Clutch Spring
470	Low and Reverse Clutch Piston Assembly

4-5-6 Clutch Hub Assembly

Fig. 11: 4-5-6 Clutch Hub Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
475	4-5-6 Clutch (w/ Output Carrier Shaft) Hub Assembly
476	4-5-6 Clutch Dampener
477	4-5-6 Clutch Dampener Apply Plate
478	4-5-6 Clutch Dampener Retaining Ring

Output Carrier Assembly

Fig. 12: Output Carrier Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
485	Center Support Roller Bearing Assembly
486	Output Carrier Front Sun Gear Thrust Bearing Assembly
487	Output Carrier Front Sun Gear
488	Output Carrier Front Sun Gear Rear Thrust Bearing Assembly
489	Output Carrier Rear Sun Gear
490	Output Carrier
491	Output Carrier Rear Sun Gear Thrust Bearing Assembly - Captured

Output Shaft Assembly

Fig. 13: Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
493	Output Internal Gear Assembly - Model Dependent
494	Output Carrier Internal Gear Retaining Ring
495	Output Carrier Internal Front Gear
496	Output Carrier Internal Gear Spacer
497	Output Carrier Internal Rear Gear
498	Output Carrier Bushing
499	Output Shaft Assembly - Model Dependent

Park System Components

Fig. 14: Park System Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
12	A/Trans Case Plug
500	Park Pawl Shaft
501	Park Pawl Spring
502	Park Pawl

Callout	Component Name
503	Park Pawl Actuator Assembly
504	Manual Shaft Detent Lever Hub Pin
505	Manual Shaft Detent Lever Assembly
506	Manual Shift Shaft Pin
507	Manual Shift Shaft Seal
508	Manual Shift Shaft
509	Park Pawl Actuator Guide
510	Park Pawl Actuator Guide (O-ring) Seal
511	Park Pawl Actuator Guide Pin

DISASSEMBLED VIEWS (6L90)

Case and Associated Parts

Fig. 15: Case And Associated Parts
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Torque Converter Assembly
2	Torque Converter (with Fluid Pump) Housing Assembly - Model Dependent
3	Bolt, M10 x 50 mm
4	Torque Converter Housing Access Hole Cover - Model Dependent

Callout	Component Name
5	A/Trans Fluid Pump Seal
6	Torque Converter Housing Locator Pin
7	A/Trans Case Assembly
9	A/Trans Connector Seal
10	A/Trans Connector (O-ring) Seal
11	A/Trans Electrical Connector Passage Sleeve
12	A/Trans Case Plug
13	Output Shaft Bushing
14	Output Shaft Seal Assembly - 4WD Models
16	Bolt, M10 x 40 mm - Model Dependent
18	A/Trans Fluid Pump Seal Assembly
19	A/Trans Fluid Pump Seal Assembly
20	Center Support Fluid Passage Seal Assembly
21	Control (with Body and Valve) Valve Assembly
22	Bolt, M5 x 73 mm
23	Bolt, M6 x 14.5 mm
24	Manual Shaft Detent Assembly
25	A/Trans Fluid Filter Seal Assembly
26	A/Trans Fluid Filter Assembly
27	A/Trans Fluid Pan Gasket
28	A/Trans Fluid Pan Magnet
29	A/Trans Fluid Pan Assembly
30	Bolt, M6 x 20 mm
32	Torque Converter Housing Access Hole Cover
33	A/Trans Case Extension Seal - 2WD Models
34	A/Trans Case Extension - 2WD Models
35	Prop Shaft Front Slip Yoke Bushing - 2WD Models
36	Prop Shaft Front Slip Yoke Oil Seal - 2WD Models

Clutch Assemblies and Associated Parts

Fig. 16: Clutch Assemblies and Associated Parts
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
51	1-2-3-4 and 3-5 Reverse Clutch Assembly
52	Input Carrier Assembly
53	Input Sun Gear
54	Input Sun Gear Thrust Bearing

Callout	Component Name
55	Input Sun Gear Thrust Washer
56	4-5-6 (w/ Turbine Shaft) Clutch Assembly
57	Turbine Shaft Thrust Bearing Assembly
58	4-5-6 Clutch (w/ Output Carrier Shaft and Dampener) Hub Assembly
59	4-5-6 Clutch Hub Thrust Bearing Assembly
60	Output Carrier Inner Sun Gear Shaft (Front) Bushing
61	1-2-3-4 Clutch (w/ Output Carrier Inner Sun Gear Shaft) Hub Assembly
62	Output Carrier Inner Sun Gear Shaft Bushing
63	1-2-3-4 Clutch Hub Thrust Bearing Assembly
64	2-6 and 3-5 Reverse Clutch (w/ Output Carrier Outer Sun Gear Shaft) Hub Assembly
65	2-6 and 3-5 Reverse Clutch Hub Thrust Bearing Assembly
66	Center Support Retaining Ring
67	Center (w/ 2-6 Low and Reverse Clutch) Support Assembly
68	Output Carrier Assembly
69	Output Carrier Thrust Bearing Assembly
70	Output Shaft Assembly - Model Dependent
71	Output Shaft Thrust Bearing Assembly

Torque Converter (w/Fluid Pump) Housing Assembly

Fig. 17: Torque Converter (w/Fluid Pump) Housing Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
200	Torque Converter Fluid Seal Retaining Ring
201	Torque Converter Fluid Seal Assembly
202	Line Pressure Test Hole Plug
203	Torque Converter Housing - Model Dependent
204	A/Trans Vent Pipe
205	Trans Fluid Cooler Pipe Fitting Seal
206	Torque Converter Bushing
207	A/Trans Fluid Pump Vane Ring
208	A/Trans Fluid Pump Rotor Guide
209	A/Trans Fluid Pump Slide Fluid Seal Ring

Callout	Component Name
210	A/Trans Fluid Pump Slide (O-ring) Seal
211	A/Trans Fluid Pump Slide Outer Spring
212	A/Trans Fluid Pump Slide
213	A/Trans Fluid Pump Slide Seal
214	A/Trans Fluid Pump Slide Seal Support
215	A/Trans Fluid Pump Slide Pivot Pin
216	A/Trans Fluid Pump Vane
217	A/Trans Fluid Pump Rotor
218	Turbine Shaft Front Bushing
219	A/Trans Fluid Pump Cover Assembly
220	Converter Feed Limit Valve
221	Converter Feed Limit Valve Spring
222	Valve Spring Retainer
223	Pressure Relief Ball Valve Spring Pin
224	Pressure Relief Ball Valve Spring
225	Pressure Relief Ball Valve
226	TCC Control Valve Spring
227	TCC Control Valve
228	Turbine Shaft Rear Bushing
229	1-2-3-4 and 3-5 Reverse Clutch Housing Thrust Washer
230	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Ring
231	Bolt, M6 x 40 mm
232	A/Trans Fluid Pump Locator Pin
233	Pressure Regulator Valve
234	Pressure Regulator Valve Outer Spring
235	Pressure Regulator Valve Inner Spring
236	Isolator Valve
237	Isolator Valve Sleeve
238	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Ring - Inner O-Ring (Qty: 3) - Model Dependent

Control (with Body and Valve) Valve Assembly

Fig. 18: Control (with Body And Valve) Valve Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
301	Bolt, M5 x 36 mm
302	Bolt, M6 x 20 mm
303	A/Trans Input and Output Speed Sensor Assembly - Model Dependent
304	Control Valve Upper Body Assembly

Callout	Component Name
305	Control Valve Body Spacer (w/ Gasket) Plate Assembly
306	Control Valve Body Ball Check Valve
307	Control Valve Lower Body Assembly
308	A/Trans Manual Shift Shaft Position Switch Assembly
309	Bolt, M5 x 45 mm
310	Bolt, M5 x 55 mm
311	Filter Plate Assembly
312	Bolt, M5 x 53 mm
314	Control Solenoid (w/ Body and TCM) Valve Assembly
315	A/Trans Manual Shaft Position Switch Wiring Harness Clip
316	A/Trans Input and Output Speed Sensor Wiring Harness Clip - Model Dependent

Upper Control Valve Body Assembly

Fig. 19: Upper Control Valve Body Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
313	Control Valve Body Locator Pin
321	Control Valve Upper Body
322	Control Valve Body Locator Pin
323	Retainer
324	Actuator Feed Limit Valve Spring
325	Actuator Feed Limit Valve
326	Clutch Regulator Valve Spring
327	CBR1/4-5-6 Clutch Regulator Valve
328	Clutch Regulator Valve Bore Plug
329	Clutch Boost Valve
330	Clutch Boost Valve Spring
334	2-6 Clutch Regulator Valve
335	2-6 Clutch Regulator Valve Gain Valve
336	3-5 Reverse Clutch Regulator Valve
337	1-2-3-4 Clutch Regulator Valve
338	Shuttle Valve

Lower Control Valve Body Assembly

Fig. 20: Lower Control Valve Body Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
323	Retainer
328	Clutch Regulator Valve Bore Plug
338	Shuttle Valve
351	Control Valve Lower Body
352	Clutch Select Solenoid Valve 3
353	TCC Regulator Apply Valve Spring
354	Manual Valve
355	TCC Regulator Apply Valve
356	Clutch Piston Dam Feed Regulator Valve

Callout	Component Name
357	Clutch Piston Dam Feed Regulator Valve Spring
358	Clutch Select Solenoid Valve Spring
359	Clutch Select Solenoid Valve 2

1-2-3-4 and 3-5 Reverse Clutch Assembly

Fig. 21: 1-2-3-4 And 3-5 Reverse Clutch Assembly

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
400	3-5 Reverse Clutch Backing Plate Retaining Ring
401	3-5 Reverse Clutch Backing Plate
402	3-5 Reverse Clutch Plate Assembly
403	3-5 Reverse Clutch Plate
404	3-5 Reverse Clutch (Waved) Plate
405	3-5 Reverse Clutch Apply Ring
407	1-2-3-4 Clutch Backing Plate
408	1-2-3-4 Clutch Plate Assembly
409	1-2-3-4 Clutch Plate
410	1-2-3-4 Clutch (Waved) Plate
411	1-2-3-4 Clutch Piston Dam Retaining Ring
412	1-2-3-4 Clutch Piston Dam Assembly
413	1-2-3-4 Clutch Spring
414	1-2-3-4 Clutch Piston
415	1-2-3-4 Clutch Piston Housing Retaining Ring
416	1-2-3-4 Clutch Piston Seal
417	1-2-3-4 Clutch Piston Housing
418	3-5 Reverse Clutch Piston Dam (O-ring) Seal
419	3-5 Reverse Clutch Piston Inner Seal
420	3-5 Reverse Clutch Spring
421	3-5 Reverse Clutch Piston
422	3-5 Reverse Clutch Piston Outer Seal
423	1-2-3-4 Clutch Piston Inner Seal
424	1-2-3-4 Clutch Piston Housing Seal
425	1-2-3-4 Clutch Piston Housing Seal
426	1-2-3-4 and 3-5 Reverse Clutch Housing Rear Bushing
427	1-2-3-4 and 3-5 Reverse Clutch Housing Assembly
428	1-2-3-4 and 3-5 Reverse Clutch Bearing Assembly
429	1-2-3-4 Clutch Backing Plate Retaining Ring

4-5-6 (w/Turbine Shaft) Clutch Assembly

Fig. 22: 4-5-6 (W/Turbine Shaft) Clutch Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
431	4-5-6 Clutch Backing Plate Retaining Ring
432	4-5-6 Clutch Backing Plate
433	4-5-6 Clutch Plate Assembly
434	4-5-6 Clutch Plate
435	4-5-6 Clutch (Waved) Plate
436	4-5-6 Clutch Piston Dam Retaining Ring
437	4-5-6 Clutch Piston Dam Assembly
438	4-5-6 Clutch Spring

Callout	Component Name
439	4-5-6 Clutch Piston Assembly
440	Output Carrier Shaft Housing Bushing
441	4-5-6 (w/Turbine Shaft) Housing Assembly
442	Turbine Shaft Fluid Seal Ring
443	Turbine Shaft (O-ring) Seal

2-6 Clutch Assembly

Fig. 23: 2-6 Clutch Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
450	2-6 Clutch Backing Plate Retaining Ring

Callout	Component Name
451	2-6 Clutch Backing Plate
452	2-6 Clutch Plate Assembly
453	2-6 Clutch Plate
454	2-6 Clutch (Waved) Plate
455	2-6 Clutch Spring Retaining Ring
456	2-6 Clutch Spring
457	2-6 Clutch Piston Assembly
458	Output Carrier Outer Sun Gear Shaft (Front) Bushing
459	Center Support Assembly
460	Output Carrier Outer Sun Gear Shaft Rear Bushing

Low and Reverse Clutch Assembly

Fig. 24: Low And Reverse Clutch Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
459	Center Support Assembly
461	Low and Reverse Clutch Backing Plate Retaining Ring
462	Low and Reverse Clutch Backing Plate
463	Low and Reverse Clutch Plate Assembly

Callout	Component Name
464	Low and Reverse Clutch Plate
465	Low and Reverse Clutch (Waved) Plate
466	Low and Reverse Clutch Spring Retaining Ring
467	Low Clutch Sprag Assembly
468	Low Clutch Sprag Seal
469	Low and Reverse Clutch Spring
470	Low and Reverse Clutch Piston Assembly

4-5-6 Clutch Hub Assembly

Fig. 25: 4-5-6 Clutch Hub Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
475	4-5-6 Clutch (w/ Output Carrier Shaft) Hub Assembly
476	4-5-6 Clutch Dampener
477	4-5-6 Clutch Dampener Apply Plate
478	4-5-6 Clutch Dampener Retaining Ring

Output Carrier Assembly

Fig. 26: Output Carrier Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
485	Center Support Roller Bearing Assembly
486	Output Carrier Front Sun Gear Thrust Bearing Assembly
487	Output Carrier Front Sun Gear
488	Output Carrier Front Sun Gear Rear Thrust Bearing Assembly
489	Output Carrier Rear Sun Gear
490	Output Carrier
491	Output Carrier Rear Sun Gear Thrust Bearing Assembly - Captured

Output Shaft Assembly

Fig. 27: Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
493	Output Internal Gear Assembly - Model Dependent
494	Output Carrier Internal Gear Retaining Ring
495	Output Carrier Internal Front Gear
496	Output Carrier Internal Gear Spacer
497	Output Carrier Internal Rear Gear
498	Output Carrier Bushing
499	Output Shaft Assembly - Model Dependent

Park System Components

Fig. 28: Park System Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
12	A/Trans Case Plug
500	Park Pawl Shaft
501	Park Pawl Spring
502	Park Pawl

Callout	Component Name
503	Park Pawl Actuator Assembly
504	Manual Shaft Detent Lever Hub Pin
505	Manual Shaft Detent Lever Assembly
506	Manual Shift Shaft Pin
507	Manual Shift Shaft Seal
508	Manual Shift Shaft
509	Park Pawl Actuator Guide
510	Park Pawl Actuator Guide (O-ring) Seal
511	Park Pawl Actuator Guide Pin

COMPONENT LOCATION (6L50/80/90)

Fig. 29: Transmission Component Locations (6L50/80/90)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Torque Converter Assembly
2	Torque Converter (with Fluid Pump) Housing Assembly
21	Control (with Body and Valve) Valve Assembly
51	1-2-3-4 and 3-5 Reverse Clutch Assembly
52	Input Carrier Assembly
53	Input Sun Gear
56	4-5-6 (w/Turbine Shaft) Clutch Assembly
58	4-5-6 Clutch (w/Output Carrier Shaft and Dampener) Hub Assembly
61	1-2-3-4 Clutch (w/Output Carrier Inner Sun Gear Shaft) Hub Assembly
64	2-6 and 3-5 Reverse Clutch (w/Output Carrier Outer Sun Gear Shaft) Hub Assembly
67	Center (w/2-6 Low and Reverse Clutch) Support Assembly
68	Output Carrier Assembly
70	Output Shaft Assembly
303	A/Trans Input and Output Speed Sensor Assembly
402	3-5 Reverse Clutch Plate Assembly
408	1-2-3-4 Clutch Plate Assembly
452	2-6 Clutch Plate Assembly
463	Low and Reverse Clutch Plate Assembly
467	Low Clutch Sprag Assembly
487	Output Carrier Front Sun Gear
489	Output Carrier Rear Sun Gear
495	Output Carrier Internal Front Gear
497	Output Carrier Internal Rear Gear
502	Park Pawl
503	Park Pawl Actuator Assembly
505	Manual Shaft Detent Lever Assembly
508	Manual Shift Shaft

BUSHING, BEARING, AND WASHER LOCATIONS

Fig. 30: Transmission Bushing, Bearing And Washer Locations
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
13	Output Shaft Bushing
35	Prop Shaft Front Slip Yoke Bushing
54	Input Sun Gear Thrust Bearing
55	Input Sun Gear Thrust Washer

Callout	Component Name
57	Turbine Shaft Thrust Bearing Assembly
59	4-5-6 Clutch Hub Thrust Bearing Assembly
60	Output Carrier Inner Sun Gear Shaft (Front) Bushing
62	Output Carrier Inner Sun Gear Shaft Bushing
63	1-2-3-4 Clutch Hub Thrust Bearing Assembly
65	2-6 and 3-5 Reverse Clutch Hub Thrust Bearing Assembly
69	Output Carrier Thrust Bearing Assembly
71	Output Shaft Thrust Bearing Assembly
206	Torque Converter Bushing
218	Turbine Shaft Front Bushing
228	Turbine Shaft Rear Bushing
229	1-2-3-4 and 3-5 Reverse Clutch Housing Thrust Washer
426	1-2-3-4 and 3-5 Reverse Clutch Housing Rear Bushing
428	1-2-3-4 and 3-5 Reverse Clutch Bearing Assembly
440	Output Carrier Shaft Housing Bushing
458	Output Carrier Outer Sun Gear Shaft (Front) Bushing
460	Output Carrier Outer Sun Gear Shaft Rear Bushing
485	Center Support Roller Bearing Assembly
486	Output Carrier Front Sun Gear Thrust Bearing Assembly
488	Output Carrier Front Sun Gear Rear Thrust Bearing Assembly
491	Output Carrier Rear Sun Gear Thrust Bearing - Captured
498	Output Carrier Bushing

SEAL LOCATIONS

Fig. 31: Transmission Seal Locations
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
5	A/Trans Fluid Pump Seal
9	A/Trans Connector Seal
10	A/Trans Connector (O-ring) Seal
14	Output Shaft Seal Assembly - 4WD Models

Callout	Component Name
18	A/Trans Fluid Pump Seal Assembly
19	A/Trans Fluid Pump Seal Assembly
20	Center Support Fluid Passage Seal Assembly
25	A/Trans Fluid Filter Seal Assembly
27	A/Trans Fluid Pan Gasket
33	A/Trans Case Extension Seal - 2WD Models
36	Prop Shaft Front Slip Yoke Oil Seal - 2WD Models
201	Torque Converter Fluid Seal Assembly
209	A/Trans Fluid Pump Slide Fluid Seal Ring
210	A/Trans Fluid Pump Slide (O-ring) Seal
213	A/Trans Fluid Pump Slide Seal
230	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Ring
238	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Rings - Inner O-rings
412	1-2-3-4 Clutch Piston Dam Assembly
416	1-2-3-4 Clutch Piston Seal
418	3-5 Reverse Clutch Piston Dam (O-ring) Seal
419	3-5 Reverse Clutch Piston Inner Seal
422	3-5 Reverse Clutch Piston Outer Seal
423	1-2-3-4 Clutch Piston Inner Seal
424	1-2-3-4 Clutch Piston Housing Seal
425	1-2-3-4 Clutch Piston Housing Seal
437	4-5-6 Clutch Piston Dam Assembly
439	4-5-6 Clutch Piston Assembly
442	Turbine Shaft Fluid Seal Ring
443	Turbine Shaft (O-ring) Seal
457	2-6 Clutch Piston Assembly
468	Low Clutch Sprag Seal
470	Low and Reverse Clutch Piston Assembly
507	Manual Shift Shaft Seal
510	Park Pawl Actuator Guide (O-ring) Seal

BALL CHECK VALVE LOCATIONS

Fig. 32: Ball Check Valve Locations
Courtesy of GENERAL MOTORS COMPANY

I.D.	Input Oil	Input Oil	Output Oil
1	Drive 1-6	DRV B	CB26/C1234 FD
2	Sol 1	Reverse (Park)	CSV2 Enable
3	Sol 2	C456	CSV3 Enable
4	PS4	C456	CSV2 Latch
5	Drive 1-6	C35R Rev FD	C35R Supply
6	CB26/C1234 FD	-	C1234 FD
7	C35R Supply	-	C35R FD
8	CBR1/CBR FD	-	CBR 1

Automatic Transmission - 6L80 (MYC) or 6L90 (MYD) - Description and Operation - Escalade, Suburban, Tahoe, Yukon

DESCRIPTION AND OPERATION

DEFINITIONS AND ABBREVIATIONS

Throttle Positions

Engine Braking

A condition where the engine is used to slow the vehicle by manually downshifting during a zero throttle coastdown.

Full Throttle Detent Downshift

A quick apply of the accelerator pedal to its full travel, forcing a downshift.

Heavy Throttle

Approximately 3/4 of accelerator pedal travel, 75 percent throttle position.

Light Throttle

Approximately 1/4 of accelerator pedal travel, 25 percent throttle position.

Medium Throttle

Approximately 1/2 of accelerator pedal travel, 50 percent throttle position.

Minimum Throttle

The least amount of throttle opening required for an upshift.

Wide Open Throttle (WOT)

Full travel of the accelerator pedal, 100 percent throttle position.

Zero Throttle Coastdown

A full release of the accelerator pedal while the vehicle is in motion and in drive range.

Shift Condition Definitions

Bump

A sudden and forceful apply of a clutch or a band.

Chuggle

A bucking or jerking. This condition may be most noticeable when the converter clutch is engaged. It is similar to the feel of towing a trailer.

Delayed

A condition where a shift is expected but does not occur for a period of time. This could be described as a clutch or band engagement that does not occur as quickly as expected during a part throttle or wide open throttle apply of the accelerator, or during manual downshifting to a lower range. This term is also defined as LATE or EXTENDED.

Double Bump - Double Feel

Two sudden and forceful applies of a clutch or a band.

Early

A condition where the shift occurs before the car has reached proper speed. This condition tends to labor the engine after the upshift.

End Bump

A firmer feel at the end of a shift than at the start of the shift. This is also defined as END FEEL or SLIP BUMP.

Firm

A noticeably quick apply of a clutch or band that is considered normal with a medium to heavy throttle. This apply should not be confused with HARSH or ROUGH.

Flare

A quick increase in engine RPM along with a momentary loss of torque. This most generally occurs during a shift. This condition is also defined as SLIPPING.

Harsh - Rough

A more noticeable apply of a clutch or band than FIRM. This condition is considered undesirable at any throttle position.

Hunting

A repeating quick series of upshifts and downshifts that causes a noticeable change in engine RPM, such as a 4-3-4 shift pattern. This condition is also defined as BUSYNESS.

Initial Feel

A distinctly firmer feel at the start of a shift than at the finish of the shift.

Late

A shift that occurs when the engine RPM is higher than normal for a given amount of throttle.

Shudder

A repeating jerking condition similar to CHUGGLE but more severe and rapid. This condition may be most noticeable during certain ranges of vehicle speed.

Slipping

A noticeable increase in engine RPM without a vehicle speed increase. A slip usually occurs during or after initial clutch or band apply.

Soft

A slow, almost unnoticeable clutch or band apply with very little shift feel.

Surge

A repeating engine related condition of acceleration and deceleration that is less intense than CHUGGLE.

Tie-Up

A condition where two opposing clutch and/or bands are attempting to apply at the same time causing the engine to labor with a noticeable loss of engine RPM.

Noise Conditions

Drive Link Noise

A whine or growl that increases or fades with vehicle speed, and is most noticeable under a light throttle acceleration. It may also be noticeable in PARK or NEUTRAL operating ranges with the vehicle stationary.

Final Drive Noise

A hum related to vehicle speed which is most noticeable under a light throttle acceleration.

Planetary Gear Noise

A whine related to vehicle speed, which is most noticeable in FIRST gear, SECOND gear, FOURTH gear or REVERSE. The condition may become less noticeable, or go away, after an upshift.

Pump Noise

A high pitched whine that increases in intensity with engine RPM. This condition may also be noticeable in all operating ranges with the vehicle stationary or moving.

Torque Converter Noise

A whine usually noticed when a vehicle is stopped, and the transmission is in DRIVE or REVERSE. The noise will increase with engine RPM.

Driver Shift Control

Driver shift control (DSC) allows the driver to change gears similar to a manual transmission.

Transmission Abbreviations

A/C

Air Conditioning

AC

Alternating Current

AT

Automatic Transmission

CCDIC

Climate Control Driver Information Center

DC

Direct Current

DIC

Driver Information Center

DLC

Data Link Connector

DMM

Digital Multimeter

DSC:

Driver Shift Control

DTC

Diagnostic Trouble Code

EBTCM

Electronic Brake/Traction Control Module

ECCC

Electronically-Controlled Capacity Clutch

ECT

Engine Coolant Temperature

EMI

Electromagnetic Interference

IAT

Intake Air Temperature

IGN

Ignition

IMS

Internal Mode Switch

ISS

Input Speed Sensor

MAP

Manifold Absolute Pressure

MIL

Malfunction Indicator Lamp

NC

Normally Closed

NO

Normally Open

OBD

On Board Diagnostic

OSS

Output Speed Sensor

PC

Pressure Control

PCM

Powertrain Control Module

PCS

Pressure Control Solenoid

PS

Pressure Switch

PWM

Pulse Width Modulation

RPM

Revolutions Per Minute

SS

Shift Solenoid

STL

Service Transmission Lamp

TAP

Transmission Adaptive Pressure

TCC

Torque Converter Clutch

TFP

Transmission Fluid Pressure

TFT

Transmission Fluid Temperature

TP

Throttle Position

VSS

Vehicle Speed Sensor

WOT

Wide Open Throttle

TRANSMISSION IDENTIFICATION INFORMATION

Fig. 1: Transmission Identification Label
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Model Year
2	Model Code
3	Transmission Family
4	Transmission Assembly Number
5	Julian date
6	Sequential Serial Number
7	Source Code
8	Broadcast Code
9	Bar Code
10	Transmission I.D.

Callout	Component Name
11	Calender Year
12	Machine Readable Matrix
13	Production Shift

TRANSMISSION GENERAL DESCRIPTION

The Hydra-matic 6-Speed RWD is a fully automatic, 6-speed, rear-wheel drive, electronic-controlled transmission. It consists primarily of a 4-element torque converter, an integral fluid pump and converter housing, a single and double planetary gear set, friction and mechanical clutch assemblies, and a hydraulic pressurization and control system. There are four variants of the transmission, all based on torque capacity. Architecture is common between the variants, and component differences are primarily related to size.

The 4-element torque converter contains a pump, a turbine, a pressure plate splined to the turbine, and a stator assembly. The torque converter acts as a fluid coupling to smoothly transmit power from the engine to the transmission. It also hydraulically provides additional torque multiplication when required. The pressure plate, when applied, provides a mechanical direct drive coupling of the engine to the transmission.

The planetary gear sets provide the 6 forward gear ratios and reverse. Changing gear ratios is fully automatic and is accomplished through the use of a transmission control module (TCM) located inside the transmission. The TCM receives and monitors various electronic sensor inputs and uses this information to shift the transmission at the optimum time.

The TCM commands shift solenoids and variable bleed pressure control solenoids to control shift timing and feel. The TCM also controls the apply and release of the torque converter clutch which allows the engine to deliver the maximum fuel efficiency without sacrificing vehicle performance. All the solenoids, including the TCM, are packaged into a self-contained control solenoid valve assembly.

The hydraulic system primarily consists of a vane-type pump, 2 control valve body assemblies, converter housing and case. The pump maintains the working pressures needed to stroke the clutch pistons that apply or release the friction components. These friction components, when applied or released, support the automatic shifting qualities of the transmission.

The friction components used in this transmission consist of 5 multiple disc clutches. The multiple disc clutches combine with one mechanical sprag clutch to deliver 7 different gear ratios, 6 forward and one reverse, through the gear sets. The gear sets then transfer torque through the output shaft.

The transmission may be operated in any of the following gear ranges:

PARK (P)

This position locks the rear wheels and prevents the vehicle from rolling either forward or backward. PARK is the best position to use when starting the vehicle. Because the transmission utilizes a shift lock control system, it is necessary to fully depress the brake pedal before shifting

out of PARK. For safety reasons, use the parking brake in addition to the PARK position.

REVERSE (R)

This position allows the vehicle to be operated in a rearward direction.

NEUTRAL (N)

This position allows the engine to be started and operated while driving the vehicle. If necessary, you may select this position in order to restart the engine with the vehicle moving. This position should also be used when towing the vehicle.

DRIVE (D)

Drive range should be used for all normal driving conditions for maximum efficiency and fuel economy. Drive range allows the transmission to operate in each of the 6 forward gear ratios. Downshifts to a lower gear, or higher gear ratio, are available for safe passing by depressing the accelerator or by manually selecting a lower gear in the manual mode range.

MANUAL MODE (M)

This position allows the driver to select a range of gears appropriate for current driving conditions. Refer to the vehicle owner's manual for specific manual mode information.

TRANSMISSION COMPONENT AND SYSTEM DESCRIPTION

The mechanical components of the 6-Speed RWD are as follows:

- A torque converter with an electronically controlled capacity clutch (ECCC). ECCC was developed to reduce the possibility of noise, vibration, or chuggle caused by TCC apply. In a torque converter with ECCC, the pressure plate does not always fully lock to the torque converter cover. Instead, the pressure plate maintains a small amount of slippage. In RWD 6-Speed transmissions, this slippage can range from 0-50 RPM. Full lockup (0 RPM slip) is still available on some applications. TCC may apply in 2nd, 3rd, 4th, 5th, or 6th gears. The specific TCC apply points and the amount of clutch slippage are determined by a number of operating conditions, including throttle position, vehicle speed, gear, as well as specific vehicle application. Transmission fluid temperature will also affect TCC apply points.
- Vane-type fluid pump assembly
- 1-2-3-4 and 3-5 Reverse clutch assembly
- Input sun gear and carrier assembly
- 4-5-6 clutch assembly with turbine shaft

- 4-5-6 clutch hub assembly
- 1-2-3-4 clutch hub assembly
- 2-6 and 3-5 reverse clutch hub assembly
- Center support assembly, with 2-6 clutch assembly, and low and Reverse clutch assembly
- Low clutch sprag assembly
- A double planetary output carrier assembly
- Output shaft assembly
- Control valve body assembly

The electrical components of the 6-Speed RWD are as follows:

- Input and output speed sensor assembly
- Manual shift shaft position switch
- Control solenoid valve assembly, which contains the following components:
    - Transmission control module (TCM)
    - 5 variable bleed line pressure control (PC) solenoids
    - Transmission fluid pressure (TFP) switch assembly
    - Torque converter clutch (TCC) pressure control solenoid
    - 2 shift solenoids

For more information, refer to **Electronic Component Description**.

SHIFT STABILIZATION DESCRIPTION AND OPERATION

Shift stabilization is a function within the vehicle's software/calibration that determines if and when to prevent upshifts under load. The purpose of shift stabilization is to reduce shift busyness during conditions that would otherwise produce frequent upshifts and downshifts, such as trailering, operating on grades or at higher altitudes.

Shift stabilization calculates the required torque at the wheels in the current gear as well as the maximum torque available at the wheels in the next higher gear. If the torque in the higher gear is not sufficient, the transmission will remain in the current gear. If the torque in the higher gear is greater than or equal to the required torque, then an upshift is allowed.

Shift stabilization is active in normal driving mode, cruise mode, and in tow/haul mode. However, shift stabilization will be disabled during high

throttle maneuvers, and may be disengaged momentarily if the cruise control "decrease" button is tapped or held, or if a significant "bump" in the road is encountered.

MANUAL MODE DESCRIPTION AND OPERATION

Transmission Gear Shift Lever

Manual Mode operation can be entered into when the shift lever is place in Manual (M) position. When manual mode is selected, the letter M of the PRNDM display will illuminate to indicate the transmission is in manual mode.

Transmission Manual Shift Switch - Up/Down

The transmission manual shift switch is mounted on the transmission gear shift lever handle. The manual shift switch is a momentary type that has three positions. The three positions are neutral or open, plus (+) for upshifts and minus (-) for downshifts. When selecting a gear, a number 1 through 6 for 6L transmission and 1 through 8 for 8L transmissions, will be displayed next to the letter M on the instrument panel, to indicate the current gear the operator has selected.

The transmission manual shift switch is an input signal to the body control module. The upshift or downshift signal commands are processed and sent out on the serial data line from the body control module to the engine control module and transmission control module.

Transmission Control Module

In manual mode, the Transmission Control Module will always have final authority of when to allow an upshift or downshift. The Transmission Control Module only allows an upshift or downshift into the appropriate gear based on engine RPM, vehicle speed and other control parameters. The transmission will not automatically downshift to the next lower gear if it would cause an engine over speed condition or an upshift if it would result in too low of engine RPM.

If the Transmission Control Module prevents an upshift or downshift for any reason, a SHIFT DENIED message will be displayed on the instrument cluster.

Manual Mode Shifting Operation

1. With the engine running, place the shift lever in Manual (M) position. The letter M of PRNDM display will illuminate to indicate Manual Mode. A number will be illuminated next to the letter M to indicate the current gear selected.
2. Momentary pressing the Transmission Manual Shift Switch - plus (+) will command the transmission to the next higher gear. The current number indicated on the PRNDM display will change to a number to indicate the gear that the vehicle operator has selected, and if conditions are appropriate, commands the Transmission Control Module to upshift to that gear.
3. Momentary pressing the Transmission Manual Shift Switch - minus (-) will command the transmission to the next lower gear. The current

number indicated on the PRNDM display will change to a number to indicate the gear that the vehicle operator has selected, and if conditions are appropriate, commands the Transmission Control Module to downshift to that gear.

4. To exit Manual Mode, place the shift lever in Drive (D) position.

TOW/HAUL MODE DESCRIPTION AND OPERATION

Tow/haul mode is a function within the vehicle's software/calibration that optimizes transmission gear selection for operation during towing or with heavy loads. This optimization includes improving acceleration performance during launches, reducing shift busyness, assisting brake performance and speed control during engine braking situations, and improving vehicle speed control while requiring less throttle pedal activity.

In general, tow/haul mode maintains lower gears longer and increases shift pressures. It is designed to be most effective when the vehicle and trailer combined weight is at least 75% of the vehicle's Gross Combined Weight Rating (GCWR). Operation of tow/haul in a lightly loaded or non-loaded vehicle will not cause damage. However, there is no benefit to the selection of tow/haul when the vehicle is unloaded, and use of tow/haul mode during unloaded driving conditions will decrease fuel economy and may generate shift feel concerns.

TRANSMISSION ADAPTIVE FUNCTIONS

The Hydra-MaticÂ® 6-Speed RWD transmission utilizes a line pressure control system during upshifts to compensate for the normal wear of transmission components. As the apply components within the transmission wear or change over time, shift time (the time required to apply a clutch) increase or decreases. In order to compensate for these changes, the transmission control module (TCM) adjusts the pressure commands to the various PC solenoids, to maintain the originally calibrated shift timing. The automatic adjusting process is referred to as "adaptive learning" and it is used to ensure consistent shift feel plus increase transmission durability. The TCM monitors the A/T input speed sensor (ISS) and the A/T output speed sensor (OSS) during commanded shifts to determine if a shift is occurring too fast (harsh) or too slow (soft) and adjusts the corresponding pressure control (PC) solenoid signal to maintain the set shift feel.

The purpose of the adapt function is to automatically compensate the shift quality for the various vehicle shift control systems. The adapt function is a continuous process that will help to maintain optimal shift quality throughout the life of the vehicle.

TRANSMISSION INDICATORS AND MESSAGES

The following transmission-related indicators and messages may be displayed on the Instrument Panel Cluster (IPC). For a complete listing and description of all vehicle indicators and messages, refer to **Indicator/Warning Message Description and Operation** .

"TRANSMISSION HOT IDLE ENGINE"

This message is displayed when the TCM detects a transmission fluid temperature (TFT) equal to or greater than 132Â°C (270Â°F) for 5 seconds.

"SERVICE TRANSMISSION"

This message displays when there is a problem with the transmission.

ELECTRONIC COMPONENT DESCRIPTION

The control solenoid (w/body and TCM) valve assembly contains the following components:

- Transmission control module (TCM)
- Clutch pressure control solenoids (Clutch PC Sol)
- Shift solenoids (SS)
- Line pressure control solenoid (Line PC Sol)
- Torque converter clutch pressure control solenoid (TCC PC Sol)
- Transmission fluid temperature sensor (TFT Sensor)
- TCM temperature sensor
- Power-up temperature sensor
- Transmission fluid pressure switches (TFP Sw)

These components are not serviced separately. The control solenoid (w/body and TCM) valve assembly utilizes a lead-frame system to connect these components electrically to the TCM. No wires are used for these components. The control solenoid (w/body and TCM) valve assembly bolts directly to the lower and upper valve body assemblies inside the transmission. The control solenoid (w/body and TCM) valve assembly connects to the engine harness 16-way connector via a pass-thru sleeve.

Control Solenoid (W/Body and TCM) Valve Assembly

Fig. 2: Control Solenoid (W/Body and TCM) Valve Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Line Pressure Control (PC) Solenoid
2	Torque Converter Clutch (TCC) Pressure Control (PC) Solenoid
3	Shift Solenoid (SS) 2
4	16 Pin Connector
5	Pressure Control (PC) Solenoid 3
6	Transmission Fluid Pressure (TFP) Switch 5
7	Pressure Control (PC) Solenoid 4
8	Pressure Control (PC) Solenoid 2
9	Transmission Fluid Pressure (TFP) Switch 3
10	Transmission Fluid Pressure (TFP) Switch 1
11	Transmission Fluid Pressure (TFP) Switch 4
12	Pressure Control (PC) Solenoid 5
13	Shift Solenoid (SS) 1

Internal Mode Switch (IMS)

Fig. 3: Identifying Internal Mode Switch (IMS)
Courtesy of GENERAL MOTORS COMPANY

The transmission manual shift shaft switch assembly is a sliding contact switch attached to the manual shift shaft inside the transmission case. The five inputs to the TCM from the transmission manual shift shaft switch assembly indicate the transmission gear selector lever position. This information is used for engine controls as well as determining the transmission shift patterns. The state of each input is available for display on the scan tool. The five input parameters represented are Signal A, Signal B, Signal C, Signal P (Parity) and Signal N (P/N Start).

Input Speed Sensor (ISS)

Fig. 4: Identifying Input Speed Sensor (ISS)
Courtesy of GENERAL MOTORS COMPANY

The input speed sensor (ISS) is a hall-effect type sensor. The ISS mounts to the control valve upper body assembly and connects to the control solenoid valve assembly through a wire harness and connector. The sensor faces the 1-2-3-4 and 3-5-R clutch housing machined teeth surface. The sensor receives 8.3-9.3 volts on the ISS/OSS Supply Voltage circuit from the TCM. As the 1-2-3-4 and 3-5-R clutch housing rotates, the sensor

produces a signal frequency based on the machined surface of the 1-2-3-4 and 3-5-R clutch housing. This signal is transmitted through the ISS signal circuit to the control solenoid valve assembly. The control solenoid valve assembly uses the ISS signal to determine line pressure, transmission shift patterns, torque converter clutch (TCC) slip speed and gear ratio.

Output Speed Sensor (OSS)

Fig. 5: Identifying Output Speed Sensor (OSS)
Courtesy of GENERAL MOTORS COMPANY

The output speed sensor (OSS) is a hall-effect type sensor. The OSS mounts to the control valve upper body assembly and connects to the control solenoid valve assembly through a wire harness and connector. The sensor faces the output shaft machined teeth surface. The sensor receives 8.3-9.3 volts on the ISS/OSS supply voltage circuit from the TCM. As the output shaft rotates, the sensor produces a signal frequency based on the machined surface of the output shaft. This signal is transmitted through the OSS signal circuit to the TCM. The TCM uses the OSS signal to determine line pressure, transmission shift patterns, torque converter clutch (TCC) slip speed and gear ratio.

AUTOMATIC TRANSMISSION INLINE 16-WAY CONNECTOR DESCRIPTION

Fig. 6: Identifying Automatic Transmission Inline 16-Way Connector
Courtesy of GENERAL MOTORS COMPANY

The transmission electrical connector is an important part of the transmission operating system. Any interference with the electrical connection can cause the transmission to set diagnostic trouble codes or affect proper operation. The following items can affect the electrical connection:

- Bent pins in the connector from rough handling during connection and disconnection
- Wires backing away from the pins or coming uncrimped, in the external wiring harness
- Dirt contamination entering the connector when disconnected
- Transmission fluid leaking into the connector, wicking up into the external wiring harness and degrading the wire insulation
- Moisture intrusion in the connector
- Low pin retention in the external connector from excessive connection and disconnection of the wiring connector assembly
- Pin corrosion from contamination
- Damaged connector assembly

Remember the following points:

- Limit twisting or wiggling the connector during removal. Bent pins can occur.
- Do not pry the connector off with a screwdriver or other tool.
- Whenever the transmission external wiring connector is disconnected from the internal harness and the engine is operating, DTCs will set. Clear these DTCs after reconnecting the external connector.

Use the following procedure to disconnect the engine side of the 16-way connector from the transmission side:

1. Unlock the slide lock on the engine wiring harness connector.
2. Rotate the connector lever counterclockwise and remove the connector from the electrical connector passage sleeve.

Use the following procedure to reconnect the engine side of the 16-way connector to the transmission side:

1. Orient the alignment slot on the engine side of the connector with the alignment tab on the electrical connector passage sleeve.
2. Slide the engine side connector through the electrical connector passage sleeve and into the transmission side connector.
3. Rotate the connector lever clockwise until the connector is fully seated.
4. Lock the slide lock on the connector.

PARK - ENGINE RUNNING

When the gear selector lever is in the Park (P) position, fluid is drawn into the pump through the transmission fluid filter assembly, from the transmission fluid pan assembly. Line pressure is then directed to the following valves:

Fluid Pressure Directed in Preparation for a Shift

Manual Valve

Mechanically controlled by the gear selector lever, the manual valve is in the Park (P) position and prevents line pressure from the pressure regulator valve from entering the reverse and drive circuits.

CBR1/C456 Pressure Control (PC) Solenoid 3

The CBR1/C456 pressure control solenoid (PCS) is energized (HIGH) allowing actuator feed limit fluid to enter the PCS CBR1/C456 CL fluid circuit. PCS CBR1/C456 CL fluid is then routed through orifice #31 to the 4-5-6 clutch boost valve and through orifice #39 to the CBR1/ C456 clutch regulator valve.

CBR1/C456 Clutch Regulator Valve

PCS CBR1/C456 CL fluid at the CBR1/C4-5-6 clutch regulator valve moves the valve against CBR1/C4-5-6 clutch regulator spring force and CBR1/FDBK fluid. This allows line pressure to pass through the valve and enter the CBR1/456CL FD circuit. CBR1/456CL FD is then routed to clutch select valve 2.

Shift Solenoid 1

Shift solenoid 1 is energized (ON) allowing actuator feed limit fluid to enter the solenoid 1 circuit. Solenoid 1 fluid is routed to the #2 ball check valve and through orifice #10 to the torque converter clutch (TCC) regulator valve and shuttle valve (SHTL).

TCC Regulator Valve and Shuttle Valve

Solenoid 1 fluid is routed to the TCC regulator valve and shuttle valve and moves the valve against TCC regulator valve spring force.

#2 Ball Check Valve

Solenoid 1 fluid seats the #2 ball check valve against the reverse fluid passage and fluid is forced through orifice #22 into the CSV2 enable fluid circuit.

Clutch Select Valve 2

CSV2 enable fluid is routed to the clutch select valve 2 and moves the valve against clutch select valve 2 spring force. This allows CBR1/456 CL FD fluid to pass through the valve and enter the CBR1/CBR FD circuit. CBR1/CBR FD fluid is then routed: to clutch select valve 3, into the CBR1 fluid circuit and, through orifice #49 where it enters the CBR fluid circuit and an exhaust passage at the clutch select valve 3 (this fluid is intended to keep the low and reverse clutch full of fluid but not pressurized). CBR1 fluid is then routed to the low & reverse clutch assembly in preparation for a shift into low or reverse gear.

Shift Solenoid 2

Shift solenoid 2 is energized (ON) allowing actuator feed limit fluid to enter the solenoid 2 fluid circuit and is then routed to the #3 ball check valve.

3-5 Reverse Clutch Regulator Valve

Actuator feed limit fluid is routed through the valve and into the PS1 fluid passage. PS1 fluid is then sent to the normally closed #1 pressure switch and opens the switch.

#3 Ball Check Valve

Solenoid 2 fluid seats the #3 ball check valve against 456 CL fluid passage and fluid is forced through orifice #20 into the CSV3 enable fluid circuit. CSV3 enable fluid is then routed to the clutch select valve 3.

Clutch Select Valve #3

CSV3 enable fluid moves the clutch select valve 3 against clutch select valve 3 spring force. CBR fluid at the clutch select valve 3 passes through the valve and exhausts.

Park- Engine Running

Fig. 7: Park-- Engine Running Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

REVERSE

When the gear selector lever is moved to the Reverse (R) position (from the Park position) the normally high C35R pressure control solenoid 2 is commanded ON and the following changes occur in the transmission's hydraulic and electrical systems:

Fluid Pressure Directed in Preparation for a Shift

Manual Valve

With the manual valve in the reverse position, line pressure is directed into the reverse fluid circuit to the #2 ball check valve and clutch select valve 3.

#2 Ball Check Valve

Reverse fluid seats the #2 ball check valve against the solenoid 1 fluid passage and fluid is forced through orifice #22 into the CSV2 enable circuit.

Clutch Select Valve 2

CSV2 enable fluid, present at the valve from Park position, continues to hold the clutch select valve 2 against clutch select valve 2 spring force.

Low and Reverse Clutch Applies

Clutch Select Valve 3

Reverse fluid from the manual valve is routed to clutch select valve 3 to combine with clutch select valve 3 spring force to keep the valve in the off position. This allows reverse fluid to pass through the valve and enter the 3-5 clutch reverse feed circuit. The 3-5 clutch reverse feed fluid from the clutch select valve 3 is also routed to #5 ball check valve. CBR1/CBR FD fluid is also directed through the clutch select valve 3 to the low and reverse clutch assembly.

Low and Reverse Clutch

CBR and CBR1 fluid pressures are routed to both the inner and outer areas of the low and reverse clutch piston to hold the piston against spring force and hold the low and reverse clutch plates. The clutch was already applied in Park, but is applied with more holding capacity in Reverse (both piston areas are pressurized).

#5 Ball Check Valve

The 3-5 clutch reverse feed fluid seats #5 ball check valve against the drive 1-6 circuit allowing 3-5 clutch reverse feed fluid to enter the 3-5 reverse supply circuit. The 3-5 reverse supply fluid is then routed to #7 ball check valve and through orifice #25 where it enters the 3-5 reverse feed circuit. The 3-5 reverse feed passes through orifice #46 and then is routed to the 3-5 reverse clutch regulator valve.

3-5 Reverse Clutch Applies

C35R Pressure Control Solenoid 2

The C35R pressure control solenoid 2 is energized (HIGH) allowing actuator feed limit fluid to enter the PCS 3-5 reverse clutch circuit. PCS 3-5 reverse clutch fluid is then routed through orifice #48 to the 3-5 reverse clutch regulator valve and through orifice #40 to the 3-5 reverse boost valve.

3-5 Reverse Clutch Regulator Valve

PCS 3-5 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 3-5 reverse

clutch feedback fluid. This allows 3-5 reverse feed to pass through the valve and enter the 3-5 reverse clutch circuit. The 3-5 reverse clutch fluid is then routed to the 3-5 reverse clutch and the 3-5 reverse boost valve. PS1 fluid from pressure switch 1 exhausts through the valve allowing the switch to close.

3-5 Reverse Boost Valve

PCS 3-5 reverse clutch fluid pressure acts on a differential area moving the 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 3-5 reverse clutch fluid passes through the valve and enters the 3-5 reverse clutch feedback circuit. As PCS 3-5 reverse clutch fluid pressure is increased to a given value, the 3-5 reverse clutch boost valve opens the 3-5 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 3-5 clutch reverse feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch

The 3-5 reverse clutch fluid enters the 1-2-3-4 and reverse clutch housing to move the piston against spring force and compensator feed fluid to apply the 3-5 reverse clutch plates.

Reverse

Fig. 8: Reverse Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

NEUTRAL - ENGINE RUNNING

When the gear selector is moved to the Neutral (N) position, the hydraulic and electrical system operation is identical to Park (P) range. However, if Neutral is selected after the vehicle was operating in Reverse (R), the normally high C35R pressure control solenoid 2 is commanded OFF and the following changes would occur in the hydraulic system:

3-5 Reverse Clutch Releases

Manual Valve

The manual valve is moved to the Neutral position and blocks line pressure from entering the reverse and drive fluid circuits. The reverse fluid from the #2 ball check valve and clutch select valve 3 is opened to an exhaust passage at the manual valve.

C35R Pressure Control Solenoid 2

The C35R pressure control solenoid 2 is commanded OFF allowing PCS 3-5 reverse clutch fluid from the 3-5 reverse clutch boost valve and 3-5 reverse clutch regulator valve to exhaust.

3-5 Reverse Clutch Boost Valve

The 3-5 reverse boost valve spring force moves the valve to allow 3-5 reverse clutch feedback fluid from the 3-5 reverse clutch regulator valve to enter the 3-5 reverse clutch circuit and exhaust.

3-5 Reverse Clutch Regulator Valve

The 3-5 reverse clutch regulator valve spring force moves the valve to allow 3-5 reverse clutch fluid from the 3-5 reverse clutch and clutch select valve 2 to pass through the valve and enter the exhaust backfill fluid circuit. The 3-5 reverse clutch fluid then enters the exhaust backfill fluid circuit and is routed through orifice #30 to the exhaust backfill pressure relief valve where excess pressure is exhausted.

3-5 Reverse Clutch

The 3-5 reverse clutch spring force combined with a force from the compensator moves the 3-5 reverse clutch piston to release the 3-5 reverse clutch plates and force 3-5 reverse clutch fluid to exhaust from the 1-2-3-4 and 3-5 reverse clutch housing. The 3-5 reverse clutch fluid is then routed to the 3-5 reverse clutch regulator valve allowing the 3-5 reverse clutch to release.

Clutch Select Valve 3

When reverse fluid exhausts through the manual valve, CSV3 enable fluid moves the valve against clutch select valve 3 spring force. The 3-5 reverse feed fluid is routed around #7 ball check valve and into the 3-5 reverse supply circuit. The 3-5 reverse supply fluid is routed around #5 ball check valve and into the 3-5 clutch reverse feed circuit and exhausts at the clutch select valve 3.

Neutral- Engine Running

Fig. 9: Neutral-- Engine Running Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIRST GEAR ENGINE BRAKING

When the gear selector lever is moved to the Drive (D) range from the Neutral (N) position, the transmission will provide engine braking. In this operating range, the normally-low C1234 pressure control solenoid 5 is commanded ON and in the engine braking mode the following changes occur within the hydraulic circuits:

Fluid Pressure is Directed to the 1-2-3-4 Clutch and the Low and Reverse Clutch to Provide Engine Braking

Manual Valve

The manual valve is moved to the Drive (D) position and allows line fluid pressure to enter the drive fluid circuit. Drive fluid is then routed to the clutch select valve 2.

Clutch Select Valve 2

Drive fluid at the clutch select valve 2 passes through the valve and enters the drive brake circuit. Drive brake fluid is then routed to the clutch select valve 3.

Clutch Select Valve 3

Drive brake fluid at the clutch select valve 3 passes through the valve and enters the Drive B fluid circuit. Drive B fluid is then routed to #1 ball check valve.

#1 Ball Check Valve

Drive B fluid seats the #1 ball check valve against drive 1-6 fluid to force drive B fluid into the CB26/C1234 feed passage. CB26/C1234 feed fluid is routed to the #6 ball check valve, through orifice #43 and, to the 2-6 clutch regulator valve. CB26/C1234 feed fluid passes through the 2-6 clutch regulator valve and enters the pressure switch 3 (PS3) fluid circuit. PS3 fluid is then routed to the normally closed pressure switch 3 and opens the switch.

#6 Ball Check Valve

CB26/C1234 feed fluid seats the #6 ball check valve against the 1234 clutch feed passage forcing CB26/C1234 feed fluid through orifice #32 before entering the 1234 clutch feed circuit. The 1234 clutch feed fluid is routed through orifice #33 and then to the 1-2-3-4 clutch regulator valve.

1-2-3-4 Clutch Applies

C1234 Pressure Control Solenoid 5

The C1234 pressure control solenoid 5 is commanded ON allowing actuator feed limit fluid to enter the PCS1234 clutch fluid circuit. PCS1234 clutch fluid is then routed through orifice #35 to the 1-2-3-4 clutch regulator valve. PCS1234 clutch fluid is also routed through orifice #29 and then to the 1-2-3-4 clutch boost valve.

1-2-3-4 Clutch Regulator Valve

PCS1234 clutch fluid moves the 1-2-3-4 clutch regulator valve against 1-2-3-4 clutch regulator valve spring force to allow 1234 clutch feed fluid to pass through the valve and enter the 1234 clutch fluid circuit. The 1234 clutch fluid is then routed to the 1234 clutch boost valve and the 1-2-3-4 clutch.

1-2-3-4 Clutch Boost Valve

PCS1234 clutch fluid pressure acts on a differential area moving the 1234 clutch boost valve against the 1234 clutch boost valve spring. The 1234 clutch fluid passes through the valve and enters the 1234 clutch feedback circuit. As PCS 1234 clutch fluid pressure is increased to a given value, the 1234 clutch boost valve opens the 1234 clutch feedback circuit to exhaust. This results in the 1234 clutch regulator valve moving to the full feed position sending full 26 CL/1234 CL feed pressure (full line pressure) to the clutch.

1-2-3-4 Clutch

The 1234 clutch fluid enters the 1234 clutch housing to move the piston against spring force and compensator feed fluid to apply the 1-2-3-4 clutch plates.

Drive Range, First Gear Engine Braking

Fig. 10: Drive Range, First Gear Engine Braking Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIRST GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, throttle position sensor and other vehicle sensors to determine the precise moment to deenergize or "turn off" shift solenoid 1 and command OFF the normally-high CBR1/C456 pressure control solenoid 3.

Low & Reverse Clutch Releases

Shift Solenoid 1

When shift solenoid 1 is "turned OFF", CSV2 enable fluid from the clutch select valve 2 passes by the #2 ball check valve and enters the solenoid 1 fluid circuit. Solenoid 1 fluid from the #2 ball check valve and TCC regulator valve is then routed to the solenoid where it exhausts.

Clutch Select Valve 2

Clutch select valve 2 (CSV2) enable fluid is exhausted from the clutch select valve 2 and clutch select valve 2 spring force moves the valve to the released position. With clutch select valve 2 in the released position, drive fluid from the manual valve passes through the valve and enters the drive 1-6 fluid circuit. Drive 1-6 fluid then feeds all clutch regulator valves and the TCC regulator valve.

CBR1/C456 Pressure Control Solenoid 3

The CBR1/C456 pressure control solenoid 3 is commanded OFF allowing PCS CBR1/C456 fluid from the CBR1/C456 clutch regulator valve and 456 clutch boost valve to exhaust.

CBR1/C456 Clutch Regulator Valve

CBR1/C456 clutch regulator valve spring force moves the valve to exhaust the CBR1/456 clutch feed circuit and allow drive 1-6 fluid to enter the PS5 fluid circuit. PS5 fluid is then routed to the normally-closed pressure switch 5 and opens the switch. PS5 fluid is also routed to the #4 ball check valve and flows into the CSV2 latch fluid circuit.

#4 Ball Check Valve

PS5 fluid pressure seats the #4 ball check valve against the 456 clutch fluid circuit. PS5 fluid is then directed into the CSV2 latch fluid circuit and routed to the clutch select valve 2. CSV2 latch fluid combines with clutch select valve 2 spring force and holds the valve in this position during all 6 forward gear ranges.

#5 Ball Check Valve

Drive 1-6 fluid pressure seats the #5 ball check valve against the 35 clutch reverse feed fluid passage. Drive 1-6 fluid is then directed into the 35R supply fluid circuit which is routed to the #7 ball check valve and orifice #25.

#7 Ball Check Valve

The 35R supply fluid seats the #7 ball check valve against the 35R feed fluid passage to force 35R supply fluid through orifice #25 before entering the 35R feed circuit. The 35R feed fluid is then routed to the 3-5 reverse clutch regulator valve.

Low and Reverse Clutch

Low and reverse clutch spring force moves the low and reverse clutch piston which forces clutch braking (CBR) and CBR1 fluid out of the center support. CBR fluid is routed to the clutch select valve 3 where it exhausts. CBR1 fluid is routed to the clutch select valve 2 where it exhausts. The low and reverse clutch is in the released position.

Drive Range, First Gear

Fig. 11: Drive Range, First Gear Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, SECOND GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-low pressure control solenoid 4.

Second Clutch Applies

CB26 Pressure Control Solenoid 4

The CB26 pressure control solenoid 4 is commanded ON, allowing actuator feed limit fluid to enter the pressure control solenoid (PCS) 26 clutch fluid circuit. PCS 26 clutch fluid is then routed through orifice #44 to the 2-6 clutch regulator gain valve.

2-6 Clutch Regulator Gain Valve

The 2-6 clutch regulator gain valve allows the gain (valve input to output pressure magnification factor) of the 2-6 clutch regulator valve to be different for a 1-2 shift verses a 5-6 shift. For a 1-2 shift, PCS 26 clutch fluid pressure acts on a differential area resulting in the "high gain" pressure output.

2-6 Clutch Regulator Valve

PCS 26 clutch fluid moves the 2-6 clutch regulator / gain valve assembly against the 2-6 clutch regulator valve spring force to allow 26 clutch/1234 clutch feed fluid to pass through the valve. The 26 clutch/1234 clutch feed fluid is routed into the 26 clutch fluid circuit where it passes through orifice #41 and then to the spring end of the 2-6 clutch regulator valve, and to the 2-6 clutch within the center support.

2-6 Clutch

The 26 clutch fluid from the 2-6 clutch regulator valve is routed through the center support and to the 2-6 clutch piston assembly. The 26 clutch fluid pressure moves the piston against 2-6 clutch spring force to apply the 2-6 clutch plates.

Drive Range, Second Gear

Fig. 12: Drive Range, Second Gear Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, THIRD GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command OFF the normally-low CB26 pressure control solenoid 4. At the same time the C35R pressure control solenoid 2 is also commanded ON to regulate 3-5 clutch apply.

3-5 Reverse Clutch Applies

C35R Pressure Control Solenoid 2

The C35R pressure control solenoid 2 is commanded ON allowing actuator feed fluid to enter the pressure control solenoid (PCS) 35 reverse clutch

fluid circuit. PCS 35 reverse clutch fluid is routed through orifice #48 and then to the 3-5 reverse clutch regulator valve. PCS 35 reverse clutch fluid is also routed through orifice #40 and then to the 3-5 reverse clutch boost valve.

3-5 Reverse Clutch Boost Valve

PCS 35 reverse clutch fluid pressure acts on a differential area moving the 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 35 reverse clutch fluid passes through the valve and enters the 35 reverse clutch feedback circuit. As PCS 35 reverse clutch fluid pressure is increased to a given value, the 3-5 reverse clutch boost valve opens the 35 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 35 reverse clutch feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch Regulator Valve

PCS 35 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 35 reverse clutch feedback fluid. This allows 35 reverse feed to pass through the valve and enter the 35 reverse clutch circuit. The 35 reverse clutch fluid is then routed to the 3-5 reverse clutch, the 3-5 reverse boost valve and the clutch select valve 2. When the 3-5 reverse clutch regulator valve is in this position, PS1 fluid from the pressure switch 1 exhausts through the valve allowing the switch to close.

3-5 Reverse Clutch

The 35 reverse clutch fluid enters the 1-2-3-4 and 3-5 reverse clutch housing to move the piston against spring force combined with force from the compensator to apply the 3-5 reverse clutch plates.

2-6 Clutch Releases

CB26 Pressure Control Solenoid 4

The CB26 pressure control solenoid 4 is commanded OFF allowing PCS 26 clutch fluid from the 2-6 clutch regulator valve to exhaust. The 26 clutch/1234 clutch feed fluid at the 2-6 clutch regulator valve passes through the valve and enters the PS3 fluid circuit. PS3 fluid is then routed to pressure switch 3 and opens the normally-closed switch.

2-6 Clutch Regulator Valve

The 2-6 clutch regulator valve spring force moves the valve to allow 26 clutch fluid from the 2-6 clutch to pass through the valve and enter the exhaust backfill fluid circuit.

2-6 Clutch

The 2-6 clutch spring force moves the 2-6 clutch piston to release the 2-6 clutch plates and forces 26 clutch fluid to exhaust from the center support.

The 26 clutch fluid is routed through the 2-6 clutch regulator valve where it enters the exhaust backfill fluid circuit and is routed through orifice #30 to the exhaust backfill pressure relief valve where excess pressure is exhausted.

Drive Range, Third Gear

Fig. 13: Drive Range, Third Gear Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, THIRD GEAR DEFAULT

If the transmission is in 1st, 2nd or 3rd gear during a transmission electrical component failure, the transmission will default to 3rd gear. All solenoids will default to their normal state. If the torque converter clutch was applied, it will release. This default action will enable the vehicle to be safely driven to a service center.

1-2-3-4 Clutch Stays Applied

Shift Solenoid 2

Shift solenoid 2 defaults to it's normally-closed state (OFF), and SOL 2 fluid exhausts through the solenoid.

Clutch Select Valve 3

Solenoid 2 fluid pressure no longer holds the clutch select valve 3 open. When the valve moves back to the closed position, it opens the 1234 clutch default fluid circuit, and 1234 default fluid is routed to the 1-2-3-4 clutch regulator valve.

1-2-3-4 Clutch Regulator Valve

With the absence of PCS 1234 clutch fluid, due to the default state of the C1234 pressure control solenoid 5, the 1-2-3-4 regulator valve would close from spring force. However, the 1234 clutch default fluid enters behind the 1-2-3-4 regulator shuttle valve and keeps the valve in the open position.

1-2-3-4 Clutch

With the 1-2-3-4 clutch regulator valve still held in the open position, the 1-2-3-4 clutch will stay applied.

3-5 Reverse Clutch Applied or Applies

C35R Pressure Control Solenoid 2

The normal state for the C35R pressure control solenoid 2 is ON, therefore PSC 35 reverse clutch fluid will still be routed to the 3-5 reverse clutch regulator valve and the 3-5 reverse clutch boost valve.

3-5 Reverse Clutch Regulator Valve

PCS 3-5 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 3-5 reverse clutch feedback fluid. This allows 3-5 reverse feed to pass through the valve and enter the 3-5 reverse clutch circuit. 3-5 reverse clutch fluid is then routed to the 3-5 reverse clutch, the 3-5 reverse boost valve and the clutch select valve 2. When the 3-5 reverse clutch regulator valve is in this position, PS1 fluid from the pressure switch 1 exhausts through the valve, allowing the switch to close.

3-5 Reverse Clutch Boost Valve

PCS 3-5 reverse clutch fluid pressure acts on a differential area moving the 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 3-5 reverse clutch fluid passes through the valve and enters the 3-5 reverse clutch feedback circuit. As PCS 3-5 reverse clutch fluid pressure is increased to a given value, the 3-5 reverse clutch boost valve opens the 3-5 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 3-5 reverse clutch feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch

The 3-5 reverse clutch fluid enters the 1-2-3-4 and 3-5 reverse clutch housing to move the piston against spring force combined with force from the compensator to apply the 3-5 reverse clutch plates.

Drive Range, Third Gear Default

Fig. 14: Drive Range, Third Gear Default Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FOURTH GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command OFF the normally-high C35R pressure control solenoid 2. At the same time the normally-low CBR1/C456 pressure control solenoid 3 is commanded ON to regulate 4-5-6 clutch apply.

4-5-6 Clutch Applies

CBR1/C456 Pressure Control Solenoid 3

The CBR1/C456 pressure control solenoid 3 (PCS) is commanded ON allowing actuator feed fluid to enter the PCS CBR1/456 clutch fluid circuit. PCS CBR1/456 clutch fluid is routed through orifice #39 to the CBR1/C456 clutch regulator valve and, through orifice #31 to the CBR1/C456 clutch boost valve.

CBR1/C456 Clutch Regulator Valve

PCS CBR1/456 clutch fluid moves the CBR1/C456 clutch regulator valve against CBR1/C456 clutch regulator valve spring force to allow line fluid to pass through the valve an enter the CBR1/456 clutch feed circuit. CBR1/456 clutch feed is then routed to the 4-5-6 clutch boost valve and clutch select valve 2.

4-5-6 Clutch Boost Valve

PCS CBR1/456 clutch fluid pressure acts on a differential area moving the CBR1/456 clutch boost valve against the CBR1/456 clutch boost valve spring. CBR1/456 clutch fluid passes through the valve and enters the CBR1/456 clutch feedback circuit. As PCS CBR1/456 clutch fluid pressure is increased to a given value, the CBR1/456 clutch boost valve opens the CBR1/456 clutch feedback circuit to exhaust. This results in the CBR1/456 clutch regulator valve moving to the full feed position, sending full line pressure to the clutch.

Clutch Select Valve 2

CBR1/456 clutch feed fluid passes through the clutch select valve 2 and enters the 456 clutch feed circuit. The 456 clutch feed fluid is routed to the clutch select valve 3 where it passes through the valve and enters the 456 clutch fluid circuit. The 456 clutch fluid is routed to the 4-5-6 clutch, the 2-6 clutch regulator gain valve and to the #3 ball check valve. The 456 clutch fluid seats the #3 ball check valve against solenoid 2 fluid passage and directed into the CSV3 enable fluid circuit where it is routed through orifice #20 and to clutch select valve 3.

4-5-6 Clutch

The 456 clutch fluid enters the 4-5-6 clutch housing to move the piston against spring force, combined with force from the compensator to apply the 4-5-6 clutch plates.

3-5 Reverse Clutch Releases

C35R Pressure Control Solenoid 2

The C35R pressure control solenoid 2 is commanded OFF, allowing PCS 35 reverse clutch fluid from the 3-5 reverse clutch boost valve and the 3-5

reverse clutch regulator valve to exhaust through the solenoid.

3-5 Reverse Clutch Boost Valve

The 3-5 reverse boost valve spring force moves the valve to allow 35 reverse clutch feedback fluid from the 3-5 reverse clutch regulator valve to enter the 35 reverse clutch fluid circuit and exhaust.

3-5 Reverse Clutch Regulator Valve

The 3-5 reverse clutch regulator valve spring force moves the valve to allow 35 reverse clutch fluid from the 3-5 reverse clutch to pass through the valve and enter the exhaust backfill fluid circuit. The 35 reverse clutch fluid then enters the exhaust backfill fluid circuit and is routed through orifice #30 to the exhaust backfill pressure relief valve where excess pressure is exhausted.

3-5 Reverse Clutch

The 3-5 reverse clutch spring force combined with force from the compensator move the 3-5 reverse clutch piston to release the 3-5 clutch plates and forces 35 reverse clutch fluid to exhaust from 1- 2-3-4 and 3-5 reverse clutch housing. The 35 reverse clutch fluid is then routed to the 3-5 reverse clutch regulator valve and exhausted.

Drive Range, Fourth Gear

Fig. 15: Drive Range, Fourth Gear Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIFTH GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-high C35R pressure control solenoid 2. At the same time the normally-low C1234 pressure control solenoid 5 is commanded OFF.

3-5 Reverse Clutch Applies

C35R Pressure Control Solenoid 2

The C35R pressure control solenoid 2 is commanded ON, allowing actuator feed fluid to enter the PCS 35 reverse clutch fluid circuit. PCS 35 reverse clutch fluid is routed through orifice #48 and then to the 3-5 reverse clutch regulator valve. PCS 35 reverse clutch fluid is also routed through orifice

#40 and then to the 3-5 reverse clutch boost valve.

3-5 Reverse Clutch Boost Valve

PCS 35 reverse clutch fluid pressure acts on a differential area moving the PCS 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 35 reverse clutch fluid passes through the valve and enters the 35 reverse clutch feedback circuit. As PCS 35 reverse clutch fluid pressure is increased to a given value, the 3-5 reverse clutch boost valve opens the 35 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 35 reverse clutch feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch Regulator Valve

PCS 35 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 35 reverse clutch feedback fluid. This allows 35 reverse feed to pass through the valve and enter the 35 reverse clutch circuit. The 35 reverse clutch fluid is then routed to the 3-5 reverse clutch, the 3-5 reverse boost valve and the clutch select valve 2. When the 3-5 reverse clutch regulator valve is in this position, PS1 fluid from the pressure switch 1 exhausts through the valve allowing the switch to close.

Clutch Select Valve 2

The 35 reverse clutch fluid passes through the clutch select valve 2 and enters the 1234 clutch default feed fluid circuit. The 1234 clutch default feed fluid is then routed to the clutch select valve 3.

3-5 Reverse Clutch

The 35 reverse clutch fluid enters the 1-2-3-4 and 3-5 reverse clutch housing to move the piston against spring force combined with force from the compensator to apply the 3-5 reverse clutch plates.

1-2-3-4 Clutch Releases

C1234 Pressure Control Solenoid 5

The C1234 pressure control solenoid 5 is commanded OFF, allowing PCS 1234 clutch fluid from the 1-2-3-4 clutch regulator valve and 1-2-3-4 clutch boost valve to exhaust.

1-2-3-4 Clutch Regulator Valve

The 1-2-3-4 clutch regulator valve spring force moves the valve to allow 1234 clutch feed fluid from the 1-2-3-4 clutch to pass through the valve and enter the exhaust backfill fluid circuit. The 1234 clutch fluid the enters the exhaust backfill fluid circuit and is routed through orifice #30 to the exhaust backfill pressure relief valve where excess pressure is exhausted. Also, 1234 clutch regulator valve spring force moves the valve to allow

1234 clutch feed fluid to pass through the valve and enter the PS4 fluid circuit. PS4 fluid is then routed to pressure switch 4 and opens the normally-closed switch.

1-2-3-4 Clutch Boost Valve

The 1-2-3-4 clutch boost valve spring force moves the valve to allow 1234 clutch feedback fluid from the 1-2-3-4 clutch regulator valve to enter the 1234 clutch circuit and exhaust.

1-2-3-4 Clutch

The 1-2-3-4 clutch spring force combined with force from the compensator moves the 1-2-3-4 clutch piston to release the clutch plates and force 1234 clutch fluid from the 1-2-3-4 and 3-5 reverse clutch housing. The 1234 clutch fluid is routed through the 1-2-3-4 clutch regulator valve where it enters the exhaust backfill fluid circuit.

Drive Range, Fifth Gear

Fig. 16: Drive Range, Fifth Gear Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIFTH GEAR DEFAULT

If the transmission is in 4th, 5th or 6th gear during a transmission electrical component failure, the transmission will default to 5th gear. All solenoids will default to their normal state. If the torque converter clutch was applied, it will release. The transmission will stay in 5th gear default range until the ignition has been turned off or transmission shifted to reverse. When the vehicle is restarted, and shifted back into drive, the transmission will then operate in the 3rd gear default range. This default action will enable the vehicle to be safely driven to a service center.

3-5 Reverse Clutch Applies

C35R Pressure Control Solenoid 2

The C35R pressure control solenoid 2 defaults to ON, allowing actuator feed fluid to enter the pressure control solenoid (PCS) 35 reverse clutch fluid circuit. PCS 35 reverse clutch fluid is routed through orifice #48 and then to the 3-5 reverse clutch regulator valve. PCS 35 reverse clutch fluid is also routed through orifice #40 and then to the 3-5 reverse clutch boost valve.

3-5 Reverse Clutch Boost Valve

PCS 3-5 reverse clutch fluid pressure acts on a differential area moving the PCS 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 3-5 reverse clutch fluid passes through the valve and enters the 3-5 reverse clutch feedback circuit. As PCS 3-5 reverse clutch fluid pressure is increased to a given value, the 3-5 reverse clutch boost valve opens the 3-5 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 3-5 reverse clutch feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch Regulator Valve

PCS 3-5 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 3-5 reverse clutch feedback fluid. This allows 3-5 reverse feed to pass through the valve and enter the 3-5 reverse clutch circuit. The 3-5 reverse clutch fluid is then routed to the 3-5 reverse clutch, the 3-5 reverse boost valve and the clutch select valve 2. When the 3-5 reverse clutch regulator valve is in this position, PS1 fluid from the pressure switch 1 exhausts through the valve, allowing the switch to close.

3-5 Reverse Clutch

The 3-5 reverse clutch fluid enters the 1-2-3-4 and 3-5 reverse clutch housing to move the piston against spring force combined with force from the compensator to apply the 3-5 reverse clutch plates.

Clutch Select Valve 3

Once the clutch select valve 3 is moved to the ON position in 4th gear, it will remain in this position throughout the 5th gear default range, until the ignition has been turned OFF. When the ignition is OFF, fluid will exhaust from the valve, thus when the vehicle is restarted, the transmission will then be in the 3rd gear default range.

1-2-3-4 Clutch Releases or 2-6 Clutch Releases

C1234 Pressure Control Solenoid 5

If the transmission was in 4th gear when an electrical condition commands a protection mode, the C1234 pressure control solenoid 5 defaults to the OFF position, allowing PCS 1234 clutch fluid from the 1-2-3-4 clutch, the 1-2-3-4 clutch regulator valve and 1- 2-3-4 clutch boost valve to exhaust.

2-6 CB26 Pressure Control Solenoid 4

If the transmission was in 6th gear when an electrical condition commands a protection mode, the CB26 pressure control solenoid 4 defaults to the OFF position, allowing PCS 26 clutch fluid from the 2-6 clutch regulator valve, and the 2-6 clutch to exhaust.

Torque Converter Clutch Releases

TCC Pressure Control Solenoid

The torque converter clutch (TCC) pressure control solenoid will default to it's normal state, OFF. PCS TCC fluid will exhaust from the TCC control valve, and spring force will shuttle the valve to the off position. TCC apply fluid will then be routed to the cooler, and TCC release fluid will be routed to the torque converter for complete TCC release.

Drive Range, Fifth Gear Default

Fig. 17: Drive Range, Fifth Gear Default Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, SIXTH GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-low CB26 pressure control solenoid 4 (PCS). At the same time the normally-high C35R pressure control solenoid 2 is commanded OFF.

2-6 Clutch Applies

CB26 Pressure Control Solenoid 4

The CB26 pressure control solenoid 4 is commanded ON, allowing actuator feed fluid to enter the PCS 26 clutch fluid circuit. PCS 26 fluid is routed through orifice #44 and then to the 2-6 clutch regulator gain valve.

2-6 Clutch Regulator Gain Valve

The 2-6 clutch regulator gain valve allows the gain (valve input to output pressure magnification factor) of the 2-6 clutch regulator valve to be different for a 1-2 shift verses a 5-6 shift. For a 5-6 shift PCS 26 clutch fluid pressure passes through the hollow valve and only acts on the 26 regulator valve area, resulting in the "low gain" pressure output.

2-6 Clutch Regulator Valve

PCS 26 clutch fluid moves the 2-6 clutch regulator/gain valve assembly against the 2-6 clutch regulator valve spring force to allow 26 clutch/1234 clutch feed fluid to pass through the valve. The 26 clutch/1234 clutch feed fluid is routed into the 26 clutch fluid circuit where it passes through orifice #41 and then to the spring end of the 2-6 clutch regulator valve, and to the 2-6 clutch within the center support.

2-6 Clutch

The 26 clutch fluid from the 2-6 clutch regulator valve is routed through the center support and to the 2-6 clutch piston assembly. The 26 clutch fluid pressure moves the piston against 2-6 clutch spring force to apply the 2-6 clutch plates.

3-5 Clutch Releases

C35R Pressure Control Solenoid 2

The C35R pressure control solenoid 2 is commanded OFF, allowing PCS 35 reverse clutch fluid from the 3-5 reverse clutch boost valve and the 3-5 reverse clutch regulator valve to exhaust through the solenoid.

3-5 Reverse Clutch Boost Valve

The 3-5 reverse boost valve spring force moves the valve to allow 35 reverse clutch feedback fluid from the 3-5 reverse clutch regulator valve to enter the 35 reverse clutch circuit and exhaust.

3-5 Reverse Clutch Regulator Valve

The 3-5 reverse clutch regulator valve spring force moves the valve to allow 35 reverse clutch fluid from the 3-5 reverse clutch to pass through the valve and enter the exhaust backfill fluid circuit. The 35 reverse clutch fluid then enters the exhaust backfill fluid circuit and is routed through orifice #30 to the exhaust backfill pressure relief valve where excess pressure is exhausted.

3-5 Reverse Clutch

The 3-5 reverse clutch spring force combined with force from the compensator move the 3-5 reverse clutch piston to release the 3-5 clutch plates and

forces 35 reverse clutch fluid to exhaust from 1-2-3-4 and 3-5 reverse clutch housing. The 35 reverse clutch fluid is then routed to the 3-5 reverse clutch regulator valve where it enters the exhaust backfill circuit.

Drive Range, Sixth Gear

Fig. 18: Drive Range, Sixth Gear Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

FLUID PASSAGES

Torque Converter Housing- Fluid Pump Cover Side

Fig. 19: Torque Converter Housing - Fluid Pump Cover Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
4	Converter Feed
5	Converter Feed Limit
6	TCC Release

Callout	Component Name
7	TCC Apply
8	Cooler Feed
9	Center Lube
10	Regulator Apply
38	PCS TCC
49	PCS Line
51	Exhaust
52	Void
55	Vent
56	Torque Converter Seal Drainback

Fluid Pump Cover- Torque Converter Housing Side

Fig. 20: Fluid Pump Cover - Torque Converter Housing Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Suction
2	Line
4	Converter Feed
5	Converter Feed Limit
6	TCC Release
7	TCC Apply
8	Cooler Feed
9	Center Lube
10	Regulator Apply
38	PCS TCC
49	PCS Line
51	Exhaust
52	Void
55	Vent

Fluid Pump Cover - Case Side

Fig. 21: Fluid Pump Cover - Case Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Suction
2	Line
9	Center Lube
10	Regulator Apply
11	Compensator Feed
14	3-5 Reverse Clutch
26	1-2-3-4 Clutch
34	4-5-6 Clutch
38	PCS TCC
49	PSC Line

Callout	Component Name
51	Exhaust
52	Empty
55	Ventilate

Case- Top Channel Plate Side

Fig. 22: Case - Top Channel Plate Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
9	Center Lube
29	CBR1 (Manual 1st)
30	CBR (Reverse)

Callout	Component Name
46	26 Clutch
52	Void

Control Valve Upper Body Assembly - Case Side

Fig. 23: Control Valve Upper Body Assembly - Case Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
9	Center Lube
10	Regulator Apply
11	Compensator Feed

Callout	Component Name
14	3-5 Reverse Clutch
26	1-2-3-4 Clutch
29	CBR1 (Manual 1st)
30	CBR (Reverse)
34	4-5-6 Clutch
38	PCS TCC
46	2-6 Clutch
49	PCS Line
51	Exhaust
52	Empty

Control Valve Upper Body Assembly - Bottom Channel Plate Side

Fig. 24: View Of Control Valve Upper Body Assembly - Bottom Channel Plate Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
9	Center Lube
10	Regulator Apply
11	Compensator Feed
12	Actuator Feed Limit
13	Reverse
14	3-5 Reverse Clutch
15	3-5 Reverse Clutch Feedback
16	CSV2 Enable
17	Solenoid 1
19	CSV3 Enable
21	Drive 1-6
24	1-2-3-4 Clutch DFLT
25	1-2-3-4 Clutch Feed
26	1-2-3-4 Clutch
27	1-2-3-4 Clutch Feedback
29	CBR1
30	CBR
31	CBR1/4-5-6 Clutch Feed
32	CBR1 Feedback
34	4-5-6 Clutch
35	CSV2 Latch
37	3-5 Reverse Feed
38	PCS TCC
39	PCS 1-2-3-4 Clutch
40	PS4
41	PS1
42	PS3

Callout	Component Name
43	PS5
44	2-6 Clutch/1-2-3-4CL Feed
45	PCS 3-5 Rev Clutch
46	2-6 Clutch
47	PCS 2-6 Clutch
48	PCS CBR1/4-5-6 Clutch
49	PCS Line
50	Exhaust BF
51	Exhaust
52	Empty
53	3-5 Rear Feed

Control Valve Upper Body Assembly - Control Solenoid Valve Assembly Side

Fig. 25: Control Valve Upper Body Assembly - Control Solenoid Valve Assembly Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
12	Actuator Feed Limit
17	Solenoid 1
18	Solenoid 2
38	PCS TCC
39	PCS 1-2-3-4 Clutch
40	PS4
41	PS1
42	PS3
43	PS5
45	PCS 3-5 Rev Clutch
47	PCS 2-6 Clutch
48	PCS CBR1/4-5-6 Clutch
49	PCS Line
51	Exhaust
52	Empty

Control Valve Lower Body Assembly - Control Valve Upper Body Assembly Side

Fig. 26: Control Valve Lower Body Assembly - Control Valve Upper Body Assembly Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
9	Center Lube
10	Regulator Apply
11	Compensator Feed
12	Actuator Feed Limit
13	Reverse
14	3-5 Reverse Clutch
15	3-5 Reverse Clutch Feedback
16	CSV2 Enable
17	Solenoid 1

Callout	Component Name
18	Solenoid 2
19	CSV3 Enable
20	Drive
21	Drive 1-6
22	Drive Brake
23	1-2-3-4 Clutch DFLT Feed
24	1-2-3-4 Clutch DFLT
25	1-2-3-4 Clutch Feed
26	1-2-3-4 Clutch
27	1-2-3-4 Clutch Feedback
28	CBR1/CBR Feed
29	CBR1
30	CBR
31	CBR1/4-5-6 Clutch Feed
32	CBR1 Feedback
33	4-5-6 Clutch Feed
34	4-5-6 Clutch
35	CSV2 Latch
36	Drive Brake
37	3-5 Reverse Feed
38	PCS TCC
39	PCS 1-2-3-4 Clutch
40	PS4
41	PS1
42	PS3
43	PS5
44	2-6 Clutch/1-2-3-4 CL Feed
45	PCS 3-5 Rev Clutch
46	2-6 Clutch
47	PCS 2-6 Clutch

Callout	Component Name
48	PCS CBR1/4-5-6 Clutch
49	PSC Line
50	Exhaust BF
51	Exhaust
52	Empty
54	3-5 Clutch Reverse Feed

Control Valve Body Spacer Plate Assembly - Bottom Channel Plate Side

Fig. 27: Control Valve Body Spacer Plate Assembly - Bottom Channel Plate Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
2	Line
8	Cooler Feed
9	Center Lube
10	Regulator Apply
11	Compensator Feed
12	Actuator Feed Limit
13	Reverse
14	3-5 Reverse Clutch
15	3-5 Reverse Clutch Feedback
16	CSV2 Enable
17	Solenoid 1
18	Solenoid 2
19	CSV3 Enable
21	Drive 1-6
24	1-2-3-4 Clutch DFLT
25	1-2-3-4 Clutch Feed
26	1-2-3-4 Clutch
27	1-2-3-4 Clutch Feedback
28	CBR1/CBR Feed
29	CBR1
30	CBR
31	CBR1/4-5-6 Clutch Feed
32	CBR1 Feedback
34	4-5-6 Clutch
35	CSV2 Latch
36	Drive Brake
37	3-5 Reverse Feed
38	PCS TCC
39	PCS 1-2-3-4 Clutch
40	PS4

Callout	Component Name
41	PS1
42	PS3
43	PS5
44	2-6 Clutch/1-2-3-4 CL Feed
45	PCS 3-5 Rev Clutch
46	2-6 Clutch
47	PCS 2-6 Clutch
48	PCS CBR1/4-5-6 Clutch
49	PCS Line
50	Exhaust BF
51	Exhaust
53	3-5 Rear Feed
54	3-5 Clutch Reverse Feed

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC P0601, P0603, P0604, OR P062F: CONTROL MODULE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0601

Control Module Read Only Memory Performance

DTC P0603

Control Module Long Term Memory Reset

DTC P0604

Control Module Random Access Memory Performance

DTC P062F

Control Module Long Term Memory Performance

Circuit/System Description

This is an internal fault detection of the control solenoid valve assembly. This fault is carried out inside the Transmission Control Module and no external circuits are involved.

Conditions for Running the DTC

DTC P0601, P0603, P0604, or P062F is not set.

Conditions for Setting the DTC

P0601

- The read only memory has detected an incorrect program or calibration checksum error.
- This condition has been present 5 or more times within a 16 count time period.

P0603

- The TCM has detected a long term memory checksum error during power up.
- This DTC runs continuously.

P0604

- The TCM has detected a single word failure with the random access memory.
- This condition has been present 5 or more times within a 16 count time frame.

P062F

- The TCM has detected the non-volatile memory is incorrect during power-down.
- This DTC runs continuously.

Action Taken When the DTC Sets

P0601, P0603, P0604, and P062F

- The high side driver is turned Off.
- The TCC is turned Off.
- The TCM request maximum line pressure.
- The ECM reduces engine torque based on transmission input speed.
- Neutral idle is inhibited.
- Tap Up/Down is inhibited.

- Tow/Haul mode is inhibited.

Conditions for Clearing the DTC

DTCs P0601, P0603, P0604, and P062F are Type A DTCs.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

Electronic Component Description

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Ignition OFF for one minute. Ignition ON.
2. Verify with a scan tool that DTC P0601, P0603, P0604, or P062F is not set.
   - **If any of the DTCs set**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If none of the DTCs set**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
   - **If the DTC sets**

     Replace the Q8 Control Solenoid Valve Assembly

   - **If the DTC does not set**
5. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0634: CONTROL MODULE OVERTEMPERATURE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC P0634

Control Module Overtemperature

Circuit/System Description

The transmission control module temperature sensor is located inside of the control solenoid valve assembly which has no serviceable parts. The Transmission Control Module monitors the Transmission Control Module sensor for over temperature protection.

Conditions for Running the DTC

- Ignition voltage is between 8.6-32 V.
- The TCM internal temperature is between 0-170Â°C (32-338Â°F) for 0.25 s.

Conditions for Setting the DTC

Condition 1

The internal temperature of the TCM is greater than 142Â°C (288Â°F) for 5 s.

Condition 2

- Ignition voltage is 18 V or greater for 2 s.
- The internal temperature of the TCM is greater than 50Â°C (122Â°F) for 2 s.

Action Taken When the DTC Sets

- DTC P0634 is a Type A DTC.
- TCM disables TAP Up/Down shift operation.
- TCM enables torque management.
- TCM limits the transmission to Reverse and 4th or 5th gear operation.
- TCM inhibits manual shifting of forward gears.
- TCM commands maximum line pressure.
- TCM turns Off.

Conditions for Clearing the DTC

DTC P0634 is a Type A DTC.

Diagnostic Aids

During a road test, the TCM temperature should steadily increase to a normal operating temperature, then stabilize.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

Electronic Component Description

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Verify the transmission fluid level and condition is correct. Refer to **Transmission Fluid Level and Condition Check**.
    - **If the transmission fluid level and condition is not correct**

      Repair as necessary.

    - **If the transmission fluid level and condition is correct**
2. Operate the vehicle until normal engine temperature is reached.
3. Verify with a scan tool the ECT Sensor parameter is less than 125Â°C (257Â°F).
    - **If greater than 125Â°C (257Â°F)**

      Refer to **Symptoms - Engine Cooling** .

    - **If less than 125Â°C (257Â°F)**
4. Verify the scan tool Transmission Control Module Temperature is less than 142Â°C (287Â°F).
    - **If greater than 142Â°C (287Â°F)**

      Inspect the transmission fluid lines for being misrouted, kinked, or damage. Repair or replace as necessary. If the transmission fluid lines are OK, replace the Q8 Control Solenoid Valve Assembly.

    - **If less than 142Â°C (287Â°F)**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
    - **If the DTC sets**

      Replace the Q8 Control Solenoid Valve Assembly.

    - **If the DTC does not set**
7. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.

- **Control Module References** for Control Solenoid Valve Assembly replacement, programming, and setup.

DTC P0658 OR P0659: ACTUATOR HIGH CONTROL CIRCUIT GROUP 1

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0658

Actuator High Control Circuit Group 1 Low Voltage

DTC P0659

Actuator High Control Circuit Group 1 High Voltage

Circuit/System Description

The Transmission Control Module high side driver 1 is located inside of the control solenoid valve assembly which has no serviceable parts. The high side driver 1 provides power to the Transmission Control Module pressure control solenoids and shift solenoids. This fault is handled inside the Transmission Control Module and no external circuits are involved.

Conditions for Running the DTC

P0658

- Ignition voltage is between 8.6-32 V.
- High side driver 1 is On.
- DTC P0658 is not set.

P0659

- DTC P0659 is not set.
- Ignition switch transitions from OFF to ON position.

Conditions for Setting the DTC

P0658

The Transmission Control Module detects an internal open or short to ground on the high side driver 1 for 1 s.

P0659

The Transmission Control Module detects an internal short to voltage on the high side driver 1 circuit for 1 s after engine start.

Action Taken When the DTC Sets

P0658

- DTC P0658 is a Type A DTC.
- The TCM turns OFF high side driver.
- The TCM turns OFF all solenoids.
- The TCM commands maximum line pressure.
- The TCM freezes transmission adaptive functions.
- The TCM commands the TCC OFF.
- The TCM inhibits the TAP Up/Down function.
- The TCM inhibits manual shifting of forward gears.
- The TCM limits the transmission to Reverse and 5th gear.

P0659

DTC P0659 is a Type C DTC.

Conditions for Clearing the DTC

- DTC P0658 is a Type A DTC.
- DTC P0659 is a Type C DTC.

Diagnostic Aids

When DTC P0658 sets, the line pressure control solenoid, and pressure control solenoids 2 and 3, will default to maximum pressure. This results in maximum line pressure to the 3-5 reverse clutch, low/reverse clutch and the 4-5-6 clutch assemblies.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**
- **Electronic Component Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Engine running and the gear selector lever is in the park position.
2. Verify the scan tool High Side Driver 1 parameter displays ON.
   - **If ON is not displayed**

     Refer to Circuit/System Testing.

   - **If ON is displayed**
3. Engine Running and the gear selector lever is in the park position.
4. Verify the scan tool parameters listed below do not display Malfunction.
   - High Side Driver 1 Circuit High Voltage Test Status
   - High Side Driver 1 Circuit Open Test Status
   - High Side Driver 1 Circuit Low Voltage Test Status
   - **If Malfunction is displayed**

     Refer to Circuit/System Testing.

   - **If Malfunction is not displayed**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
7. All OK.

Circuit/System Testing

NOTE: **You must perform the Circuit/System Verification first.**

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Replacement** .

2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
    - **If contaminated**

      Repair as necessary.

    - **If not contaminated**
3. Verify the resistance is within the specified range for each solenoid. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
    - **If resistance is not within range**

      Replace the Q8 Control Solenoid Valve Assembly.

    - **If resistance is within range**
4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect **DT-47825-10** jumper harness between the vehicle wire harness electrical connector, and the Q8 Control Solenoid Valve Assembly electrical connector. Ignition ON.
6. Verify the scan tool parameters do not display Malfunction.
    - High Side Driver 1 Circuit High Voltage Test Status
    - High Side Driver 1 Circuit Open Test Status
    - High Side Driver 1 Circuit Low Voltage Test Status
    - **If Malfunction is displayed**

      Replace the Q8 Control Solenoid Valve Assembly.

    - **If Malfunction is not displayed**
7. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0667, P0668, OR P0669: CONTROL MODULE TEMPERATURE SENSOR

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0667

Control Module Temperature Sensor Performance

DTC P0668

Control Module Temperature Sensor Circuit Low Voltage

DTC P0669

Control Module Temperature Sensor Circuit High Voltage

Circuit/System Description

The Transmission Control Module temperature sensor is located inside of the control solenoid valve assembly which has no serviceable parts. The Transmission Control Module temperature sensor provides the temperature of the Transmission Control Module substrate. This temperature reading is used in various diagnostic routines in the Transmission Control Module software. This fault is handled inside the Transmission Control Module and no external circuits are involved.

Conditions for Running the DTC

DTC P0667

- DTC: P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0658, P0668, P0669, P06AD, P06AE, P0716, P0712, P0713, P0717, P0722, P0723, P0962, P0963, P0966, P0967, P0970, P0971, P215C, P2720, P2721, P2729, or P2730 is not set.
- Engine speed is 400-7, 500 RPM or greater for 5 s.
- Ignition voltage is between 8.6-32 V.

- Brake torque is not active.
- Engine torque signal is valid.
- Throttle position signal is valid.

DTC P0668

- Engine speed is 400-7, 500 RPM or greater for 5 s.
- Ignition voltage is between 8.6-32 V.

DTC P0669

- DTC P0716, P0717, P0722 or P0723 is not set.
- Engine speed is 400-7, 500 RPM or greater for 5 s.
- Ignition voltage is between 8.6-32 V.

Conditions for Setting the DTC

P0667

- The TCM detects a 20-50Â°C (36-90Â°F) or greater difference between the transmission fluid temperature and the TCM substrate temperature, which depends on the average of the transmission fluid temperature, TCM substrate temperature, and the TCM power up temperature.
- The TCM detects a 8-10Â°C (14-18Â°F) or greater difference between the TCM power up temperature and the TCM substrate temperature, which depends on the average of the transmission fluid temperature, the TCM substrate temperature, and the TCM power up temperature.
- The above conditions have to be met for 5 min.

P0668

The TCM internal temperature is -249Â°C (-416Â°F) or less for 1 min.

P0669

The TCM internal temperature is 249Â°C (480Â°F) or greater for 1 min.

Action Taken When the DTC Sets

- DTCs P0667, P0668, and P0669 are Type B DTCs.

- The TCM defaults to a calculated value for the substrate temperature based on the TCM power up temperature.

Conditions for Clearing the DTC

DTCs P0667, P0668, and P0669 are Type B DTCs.

Diagnostic Aids

During a road test, the TCM temperature should steadily increase to a normal operating temperature, and then stabilize.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Electronic Component Description**
- **Transmission General Description**
- **Transmission Component and System Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Engine idling at normal operating temperature.
2. Verify the scan tool Transmission Control Module Temperature parameter is between -247 and +247Â°C (-412 and +477Â°F).
   - **If not between -247 and +247Â°C (-412 and +477Â°F)**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If between -247 and +247Â°C (-412 and +477Â°F)**
3. Verify the scan tool Transmission Control Module temperature parameter increases greater than 2Â°C (3.5Â°F) after operating the vehicle at 64 km/h (40 mph) for 10 minutes.
   - **If the temperature does not increase greater than 2Â°C (3.5Â°F)**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If the temperature does increase greater than 2Â°C (3.5Â°F)**
4. Verify the scan tool Transmission Control Module Temperature and the Transmission Fluid Temperature parameters are within 10Â°C (18Â°F) of each other.
   - **If the temperature is not within 10Â°C (18Â°F)**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If the temperature is within 10Â°C (18Â°F)**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
   - **If the DTC sets**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If the DTC does not set**

7. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P06AC, P06AD, OR P06AE: CONTROL MODULE POWER UP TEMPERATURE SENSOR

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P06AC

Control Module Power Up Temperature Sensor Performance

DTC P06AD

Control Module Power Up Temperature Sensor Circuit Low Voltage

DTC P06AE

Control Module Power Up Temperature Sensor Circuit High Voltage

Circuit/System Description

The Transmission Control Module power up temperature sensor is located inside of the control solenoid valve assembly which has no serviceable parts. The Transmission Control Module power up temperature sensor provides the temperature of the Transmission Control Module when the Transmission Control Module power is on. This temperature reading is used in various shifting and diagnostic routines and also to protect the control solenoid valve assembly and Transmission Control Module. This fault is handled inside the Transmission Control Module and no external circuits are involved.

Conditions for Running the DTC

P06AC

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0658, P0668, P0669, P06AD, P06AE, P0716, P0712, P0713, P0717, P0722, P0723, P0962, P0963, P0966, P0967, P0970, P0971, P215C, P2720, P2721, P2729, or P2730 is not set.
- Engine speed is between 400-7, 500 RPM for 5 s.
- Ignition voltage is between 8.6-32 V.
- Brake torque is not active.
- Engine speed is valid.
- Throttle position is valid.
- Transmission input speed sensor signal is 200 RPM or less.
- Engine throttle position signal is 30 percent or greater.
- Vehicle speed is 8 km/h (5 mph) or less.

P06AD

- DTC P06AD, P0716, P0717, P0722 or P0723 is not set.
- Engine speed is between 400-7, 500 RPM for 5 s.
- Ignition voltage is between 8.6-32 V.

P06AE

- DTC P06AE is not set.
- Engine speed is 400 RPM or greater for 5 s.
- Ignition voltage is between 8.6-32 V.

Conditions for Setting the DTC

P06AC

- The TCM detects a 8-10Â°C (14-18Â°F) or greater difference between the TCM substrate temperature and TCM power up temperature, which depends on the average of transmission fluid temperature, TCM substrate temperature, and TCM power up temperature.

- The TCM detects a 20-50Â°C (36-90Â°F) or greater difference between the transmission fluid temperature and TCM power up temperature, which depends on the average of transmission fluid temperature, TCM substrate temperature, and TCM power up temperature.
- The above conditions have to be met for 5 min within a 6 min period.

P06AD

The TCM power up temperature is -59Â°C (-74Â°F) or less for 1 min.

P06AE

The TCM power up temperature is 164Â°C (327Â°F) or greater for 1 min.

Action Taken When the DTC Sets

- DTCs P06AC, P06AD, and P06AE are Type B DTCs.
- The TCM defaults the TCM power up temperature to the TCM substrate temperature with an offset value.

Conditions for Clearing the DTC

DTCs P06AC, P06AD, and P06AE are Type B DTCs.

Diagnostic Aids

During a road test, the TCM Power-Up temperature should steadily increase to a normal operating temperature, and then stabilize.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

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- **Connector Repairs**
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- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Ignition ON, clear the DTCs with a scan tool.
2. Operate the vehicle at 64 km/h (40 mph) for 10 min.
3. Verify DTC P06AC, P06AD or P06AE is not set.
    - **If any of the DTCs set**

      Replace the Q8 Control Solenoid Valve Assembly.

    - **If none of the DTCs set**
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
5. Verify the DTC does not set.
    - **If the DTC sets**

Replace the Q8 Control Solenoid Valve Assembly.

- **If the DTC does not set**

6. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0711-P0713: TRANSMISSION FLUID TEMPERATURE SENSOR

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0711

Transmission Fluid Temperature Sensor Performance

DTC P0712

Transmission Fluid Temperature Sensor Circuit Low Voltage

DTC P0713

Transmission Fluid Temperature Sensor Circuit High Voltage

Circuit/System Description

The transmission fluid temperature sensor is located inside of the Transmission Control Module assembly which has no serviceable parts. The transmission fluid temperature sensor provides transmission fluid temperature information to the Transmission Control Module. This fault is handled inside the Transmission Control Module and no external circuits are involved.

Conditions for Running the DTC

P0711

- DTCs: P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0658, P0668, P0669, P06AD, P06AE, P0716, P0712, P0713, P0717, P0722, P0723, P0962, P0963, P0966, P0967, P0970, P0971, P215C, P2720, P2721, P2729, or P2730 is not set.
- Ignition voltage is between 8.6-32 V.
- The engine speed is 400-7, 500 RPM or greater for 5 s.
- The vehicle speed is 8 km/h (5 mph) or greater for 5 min.
- The accelerator pedal position signal is valid.
- The engine torque signal is valid.

P0712

- DTC P0712, P0716, P0717, P0722, or P0723 is not set.
- The engine speed is greater than 400-7, 500 RPM for 5 s.
- Ignition voltage is between 8.6-32 V.

P0713

- DTC P0713, P0716, P0717, P0722, or P0723 is not set.
- The engine speed is greater than 400-7, 500 RPM for 5 s.
- Ignition voltage is between 8.6-32 V.

Conditions for Setting the DTC

P0711

- The TCM detects a 20-50Â°C (36-90Â°F) or greater difference between the transmission fluid temperature and the TCM substrate temperature, which depends on the average of the transmission fluid temperature, the TCM substrate temperature, and the TCM power up temperature.
- The TCM detects a 20-50Â°C (36-90Â°F) or greater difference between the transmission fluid temperature and the power up temperature, which depends on the average of the transmission fluid temperature, the TCM substrate temperature, and the TCM power up temperature.
- The above conditions have to be met for 5 min within a 6 min time period.

P0712

The transmission fluid temperature is -74Â°C (-101Â°F) or less for 1 min.

P0713

The transmission fluid temperature is 174Â°C (345Â°F) or greater for 1 min.

Action Taken When the DTC Sets

- DTCs P0711, P0712, and P0713 are Type B DTCs.
- The TCM freezes transmission adaptive functions.
- The TCM allows the vehicle to operate in transmission protection mode.
- The TCM defaults to the TCM temperature with an offset.

Conditions for Clearing the DTC

DTCs P0711, P0712, and P0713 are Type B DTCs.

Diagnostic Aids

During a road test, the transmission fluid temperature should steadily increase to a normal operating temperature, and then stabilize.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Electronic Component Description**
- **Transmission General Description**

- **Transmission Component and System Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825 Control Solenoid Test Plate

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Engine idling at normal operating temperature.
2. Verify the scan tool Transmission Fluid Temperature parameter is between -74 and +174Â°C (-101 and +345Â°F).
   - **If not between -74 and +174Â°C (-101 and +345Â°F)**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If between -74 and +174Â°C (-101 and +345Â°F)**
3. Verify the scan tool Transmission Fluid Temperature parameter increases greater than 2Â°C (3.5Â°F) after operating the vehicle at 64 km/h (40 mph) for 10 minutes.
   - **If the temperature does not increase greater than 2Â°C (3.5Â°F)**

     Replace the Q8 Control Solenoid Valve Assembly.

- **If the temperature does increase greater than 2Â°C (3.5Â°F)**

4. Verify the scan tool Transmission Fluid Temperature and the Transmission Control Module Temperature parameters are within 20Â°C (68Â°F) of each other.
   - **If the temperatures are not within 20Â°C (68Â°F)**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If the temperatures are within 20Â°C (68Â°F)**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
   - **If the DTC sets**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If the DTC does not set**
7. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0716 OR P0717: INPUT SPEED SENSOR

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0716

Input Speed Sensor Performance

DTC P0717

Input Speed Sensor Circuit No Signal

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
<p01> V Reference	P0716, P0717	P0716, P0717	-	P0716
Signal	P0716, P0717	P0716, P0717	P0716, P0717	P0716

Typical Scan Tool Data

ISS Signal

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running, normal operating temperature **Parameter Normal Range:** 450-7000 RPM			
<p01> V Reference	0 RPM	0 RPM	-
ISS Signal	0 RPM	0 RPM	0 RPM

ISS/OSS Supply Voltage

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Key ON, Engine OFF or Engine running, normal operating temperature **Parameter Normal Range:** OK			
<p01> V Reference	Out of Range	OK	Out of Range
Signal	OK	OK	OK

Circuit/System Description

The automatic transmission input and output speed sensor (ISS and OSS) assembly each are part of a single harness. The ISS is a hall-effect type sensor. The ISS/OSS mounts to the control valve upper body assembly. The ISS sensor end faces the splines on the 1-2-3-4 and 3-5-R clutch housing outside diameter surface. The sensor receives 9 volts on the ISS/OSS supply voltage circuit from the control solenoid valve assembly. As the 1-2-3-4 and 3-5-R clutch housing rotates, the sensor produces a signal frequency based on the splines on the clutch housing outside diameter surface. This signal is transmitted through the ISS signal circuit to the control solenoid valve assembly. The control solenoid valve assembly uses the ISS signal to

determine line pressure, transmission shift patterns, torque converter clutch (TCC) slip speed and gear ratio.

Conditions for Running the DTC

P0716

- DTC P0101, P0102, P0103, P0121, P0122, P0123, P0717, P0752, P0753, or P0974 is not set.
- The engine speed is 400-7, 500 RPM or greater for 5 s.
- The engine torque signal is valid.
- Engine torque is between 0 N.m (0 lb ft) and 8191.88 N.m (6042.01 lb ft).
- Ignition voltage is between 9-17.5 V.
- The vehicle speed is greater than 10 km/h (6.21 mph).
- The throttle position signal must be valid.

P0717

- DTC P0101, P0102, P0103, P0722 or P0723 is not set.
- The engine speed is 400-7, 500 RPM or greater for 5 s.
- Ignition voltage is between 9-17.5 V.
- The engine torque signal is valid.
- The vehicle speed is greater than 16 km/h (10 mph).
- The engine torque is between 50 N.m (37 lb ft) and 8191.88 N.m (6042.01 lb ft).

Conditions for Setting the DTC

P0716

The TCM detects the transmission input speed sensor signal dropped greater than 900 RPM for 1 s.

P0717 - Condition 1

The TCM detects the transmission input shaft speed is less than 67 RPM for 5 s.

P0717 - Condition 2

The TCM detects that P0722 set and the transmission input speed is less than 653 RPM for 5 s.

Action Taken When the DTC Sets

P0716

- DTC P0716 is a Type A DTC.
- The high side driver is turned Off.
- The TCM commands TCC Off.
- The ECM reduces engine torque based on transmission input speed.
- The TCM inhibits Tap Up/Down.
- The TCM inhibits manual shifting of forward gears.
- The TCM inhibits Tow/Haul mode.

P0717

- DTC P0717 is a Type A DTC.
- The TCM inhibits shift adaptive functions.
- The TCM commands maximum line pressure.
- The ECM reduces engine torque based on transmission input speed.
- The TCM inhibits neutral idle.
- The TCM inhibits Tap Up/Down function.
- The TCM inhibits manual shifting of forward gears.
- The TCM inhibits manual shifting of forward gears.
- The TCM commands neutral gear if the output speed sensor signal is 1, 500 RPM or greater.
- The TCM commands second gear if the output speed sensor signal is less than 1, 500 RPM.

Conditions for Clearing the DTC

DTC P0716 and P0717 are Type A DTCs.

Diagnostic Aids

Inspect the ISS/OSS, harness, connector, and control solenoid valve assembly for metallic debris and the 1-2-3-4 and 3-5-R clutch housing splines on

the outside diameter surface for damage or misalignment. Proper torque of the ISS/OSS mounting bolt is critical to proper speed signal operation.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

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- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **DT-47825-10** Jumper Harness
- **J-38522** Variable Signal Generator

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool ISS/OSS Supply Voltage parameter displays OK.
   - **If OK is not displayed**

     Refer to Circuit/System Testing.

   - **If OK is displayed**
3. Engine idling in park position.
4. Verify the scan tool Transmission ISS parameter varies with engine RPM and does not drop out.
   - **If the Transmission ISS does not vary with engine speed or drops out**

     Refer to Circuit/System Testing.

   - **If the Transmission ISS does vary with engine speed and does not drop out**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
7. All OK.

Circuit/System Testing

1. Ignition Off, remove the Q8 Control Solenoid Valve Assembly.
2. Connect the **DT-47825-10** Jumper Harness between the vehicle wire harness electrical connector and the Q8 Control Solenoid Valve Assembly electrical connector.
3. Disconnect the B14A/B14C Transmission Input and Output Speed Sensor harness connector X3 at the Q8 Control Solenoid Valve Assembly. Ignition ON.
4. Test for 8.8-9.2 V between the 9 V reference circuit terminal B at the Q8 Control Solenoid Valve Assembly and ground.

- **If not between 8.8-9.2 V**

  Replace the Q8 Control Solenoid Valve Assembly.

- **If between 8.8-9.2 V**

5. Ignition Off, connect the red lead of the **J-38522** Variable Signal Generator to the ISS signal circuit terminal A at the Q8 Control Solenoid Valve Assembly and ground at the transmission case.
6. Set the **J-38522** Variable Signal Generator to the following specifications:
   - Signal Switch to 8 V
   - Frequency switch to 300
   - Duty cycle switch to the 50 or the Normal position
7. Ignition On.
8. Verify the scan tool Transmission ISS parameter is between 760-785 RPM.
   - **If not between 760-785 RPM**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If between 760-785 RPM**
9. Verify there is no damage or misalignment with the machined teeth on the 1-2-3-4 and 3-5 clutch housing.
   - **If the machined surfaces are damaged or misaligned**

     Repair or replace as necessary.

   - **If the machined surfaces are not damaged or misaligned**
10. Replace the B14A/B14C Transmission Input and Output Speed Sensor.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- Perform the **Input and Output Speed Sensor Replacement** .
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup
- Perform the **Control Solenoid Valve and Transmission Control Module Assembly Input Shaft Speed/Output Shaft Speed Input Test**.

DTC P071A: TRANSMISSION TOW MODE SWITCH CIRCUIT

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC P071A

Transmission Tow Mode Switch Circuit

Circuit/System Description

Tow/haul mode enables the operator to achieve enhanced shift performance when towing or hauling a load. When tow/haul mode is selected, the tow/haul switch input signal to the body control module (BCM) is momentarily toggled from 12 volts to zero volts. The BCM then sends a signal out on the serial data line to the transmission control module (TCM) to increase transmission line pressure and extend the time between upshifts. Selecting the tow/haul switch again disables tow/haul mode and returns the transmission to a normal shift pattern.

Conditions for Running the DTC

- DTC P1762 is not set.
- The engine speed is greater than 400 RPM for 5 seconds.
- The ignition voltage is 8.6 volts or greater.

Conditions for Setting the DTC

The Tow/Haul Mode switch remains closed, in a low voltage condition, for 10 seconds.

Action Taken When the DTC Sets

DTC P071A is a Type C DTC.

Conditions for Clearing the DTC

DTC P071A is a Type C DTC.

Diagnostic Aids

If the electrical circuit tests are OK and the shift pattern is not occurring, there may be a mechanical/hydraulic condition that prevents operation. Refer to **Symptoms - Automatic Transmission**.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, cycle the S74 Tow/Haul Mode switch while observing the Tow/Haul switch parameter on the scan tool in the Transmission Controls Data list. The S74 Tow/Haul Mode switch parameter should change states from Inactive to Active with each cycle of the switch.

- **If the Tow/Haul Mode switch parameter does not change from Inactive to Active**

  Refer to Circuit/System Testing.

- **If the Tow/Haul Mode switch parameter does change from Inactive to Active**

2. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
3. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
4. All OK.

Circuit/System Testing

1. Ignition OFF, transmission in Park. Disconnect the S3 transmission shift lever electrical connector.
2. Ignition OFF, test for less than 1 Ω between terminal 2 on the S3 transmission shift lever vehicle harness connector and ground at the battery negative post.
   - **If 1 Ω or greater**
   1. Ignition OFF.
   2. Test for less than 1 Ω in the ground circuit wire, end to end.
      - If 1 Ω or greater, repair the open/high resistance in the wire circuit.
      - If less than 1 Ω, repair the open/high resistance in the ground connection or the terminal connection at the S3 transmission shift lever.
   - **If less than 1 Ω**
3. Ignition ON, test for greater than 11 volts on the signal circuit terminal 1 on the S3 transmission shift lever vehicle harness connector and ground at the battery negative post.
   - **If less than 11 volts**
   1. Ignition OFF.
   2. Test for less than 1 Ω in the signal circuit wire, end to end.
      - If 1 Ω or greater, repair the open/high resistance in the signal circuit wire.

    - If less than 1 Ω, repair the open/high resistance in either terminals on the signal circuit wire.
  - **If greater than 11 volts**
4. Ignition OFF, test for less than 3 ohms between terminal 1 and terminal 2 on the S3 transmission shift lever component harness connector while depressing the S74 Tow/Haul Mode switch button.
  - **If greater than 3 Ω**

    Replace the S3 transmission shift lever assembly.

  - **If less than 3 Ω**
5. If all circuits test normal, replace the K9 body control module.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Automatic Transmission Range Selector Lever Replacement**
- **Control Module References** for BCM replacement, programming, and setup.

DTC P0722 OR P0723: OUTPUT SPEED SENSOR

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0722

Output Speed Sensor Circuit No Signal

DTC P0723

Output Speed Sensor Circuit Intermittent

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
9 V Reference	P0722, P0723	P0722, P0723	-	P0723
Signal	P0722, P0723	P0722, P0723	P0722, P0723	P0723

Typical Scan Tool Data

Output Speed Sensor (OSS) Signal

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Engine running, normal operating temperature **Parameter Normal Range:** 0-7000 RPM			
9 V Reference	0 RPM	0 RPM	0-7000 RPM
OSS Signal	0 RPM	0 RPM	0 RPM

ISS/OSS Supply Voltage

Circuit	Open/High Resistance	Short to Voltage
Operating Conditions: Key ON, engine OFF or engine running **Parameter Normal Range:** OK		
9 V Reference	OK	Out of Range
Signal	Out of Range	-

Circuit/System Description

The automatic transmission input and output speed sensor (ISS and OSS) assembly each are part of a single harness. The OSS is a hall-effect type sensor. The ISS/OSS mounts to the control valve upper body assembly. The sensor end faces the output shaft housing machined slots. The sensor receives 9 volts on the ISS/OSS supply voltage circuit from the control solenoid valve assembly. As the output shaft rotates, the sensor produces a signal frequency based on the machined slots of the output shaft housing. This signal is transmitted through the OSS signal circuit to the control solenoid valve assembly. The control solenoid valve assembly uses the OSS signal to determine line pressure, transmission shift patterns, torque converter clutch (TCC) slip speed and gear ratio.

Conditions for Running the DTC

P0722

- DTC P0101, P0102, P0103, P0121, P0122, P0123, P0716, P0717, or P0723 is not set.
- Ignition voltage is between 9-17.5 V.
- The transmission fluid temperature is -40Â°C (-40Â°F) or greater.
- The engine speed is 400-7, 500 RPM or greater for 5 s.
- The engine torque signal is valid.
- The engine torque is 50 N.m (36.87 lb ft) or greater.
- Accelerator pedal position signal is valid.
- The throttle position signal is valid.
- The throttle position is 8 percent or greater.

P0723

- DTC P0101, P0102, P0103, P0121, P0122, P0123, P0973, P0974, P0976, or P0977 is not set.
- Ignition voltage is between 9-17.5 V.
- The engine speed is 400-7, 500 RPM for 5 s.
- Greater than 5 s since the last transmission upshift or downshift.
- The TCM must receive a valid torque signal from the ECM.
- Accelerator pedal position signal is valid.

Conditions for Setting the DTC

P0722

The transmission output speed is 35 RPM or less for 4.5 s.

P0723

- The transmission output speed is greater than 105 RPM.
- The TCM detects the transmission output speed dropped is greater than 650 RPM for 1.5 s.
- The transmission is in a forward drive gear.

Action Taken When the DTC Sets

P0722

- DTC P0722 is a Type A DTC.
- The TCM turns Off the TCC.
- The TCM commands maximum line pressure.
- The ECM reduces engine torque based on input speed.
- The TCM inhibits Tap up/Down function.
- The TCM inhibits manual shifting of all forward gears.
- The TCM commands neutral gear if the output speed sensor signal is 1, 350 RPM or greater.
- The TCM commands 2nd gear if the output speed sensor signal is less than 1, 350 RPM.

P0723

- DTC P0723 is a Type A DTC.
- The high side driver is turned OFF.
- The TCM inhibits TCC.
- The TCM commands maximum line pressure.
- The ECM reduces engine torque based on the signal from the input speed sensor signal.
- The TCM inhibits neutral idle.
- The TCM inhibits Tap up/Down function.
- The TCM inhibits manual shifting.

Conditions for Clearing the DIC/DTC

DTCs P0722 and P0723 are Type A DTCs.

Diagnostic Aids

Inspect the ISS/OSS, harness, connector and control solenoid valve assembly for metallic debris and output shaft housing machined slots for damage or misalignment. Proper torque of the ISS/OSS mounting bolt is critical to proper speed sensor operation.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

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Electrical Information Reference

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- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **DT-47825-10** Jumper Harness
- **J-38522** Variable Signal Generator

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool ISS/OSS Supply Voltage parameter displays OK.
    - **If OK is not displayed**

Refer to Circuit/System Testing.

- **If OK is displayed**

3. Road test the vehicle.
4. Verify the scan tool Transmission OSS parameter changes with vehicle speed and does not drop while operating the vehicle within 16-32 km/h (10-20 mph).
   - **If the Transmission OSS does not vary with engine speed or drops out**

     Refer to Circuit/System Testing.

   - **If the Transmission OSS does vary with engine speed and does not drop out**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
7. All OK.

Circuit/System Testing

1. Ignition Off, remove the Q8 Control Solenoid Valve Assembly.
2. Connect the **DT-47825-10** Jumper Harness between the vehicle wire harness electrical connector and the Q8 Control Solenoid Valve Assembly electrical connector.
3. Disconnect the B14A/B14C Transmission Input and Output Speed Sensor harness connector X3 at the Q8 Control Solenoid Valve Assembly. Ignition ON.
4. Test for 8.8-9.2 V between the 9 V reference circuit terminal B at the Q8 Control Solenoid Valve Assembly and ground.
   - **If not between 8.8-9.2 V**

     Replace the Q8 Control Solenoid Valve Assembly

   - **If between 8.8-9.2 V**

5. Ignition Off, connect the red lead of the **J-38522** Variable Signal Generator to the signal circuit terminal C at the Q8 Control Solenoid Valve Assembly and ground at the transmission case.
6. Set the **J-38522** Variable Signal Generator to the following specifications:
    - Signal Switch to 8 V
    - Frequency switch to 300
    - Duty cycle switch to the 50 or the Normal position
7. Ignition On.
8. Verify the scan tool Transmission OSS parameter is between 495-505 RPM.
    - **If not between 495-505 RPM**

      Replace the Q8 Control Solenoid Valve Assembly.

    - **If between 495-505 RPM**
9. Verify there is no damage or misalignment with the machined slots on the Output Shaft Assembly.
    - **If the machined slots are damaged or misaligned**

      Repair or replace as necessary.

    - **If the machined slots are not damaged or misaligned**
10. Replace the B14A/B14C Transmission Input and Output Speed Sensor.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- Perform the **Input and Output Speed Sensor Replacement** .
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.
- Perform the **Control Solenoid Valve and Transmission Control Module Assembly Input Shaft Speed/Output Shaft Speed Input Test**.

DTC P0741 OR P0742: TORQUE CONVERTER CLUTCH (TCC) SYSTEM

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

NOTE: **The DTCs listed below set due to a transmission hydraulic/mechanical condition. Perform the Circuit/System Verification and Circuit/System Testing to identify the cause.**

DTC P0741

Torque Converter Clutch (TCC) System - Stuck Off - Transmission Hydraulic/Mechanical Performance

DTC P0742

Torque Converter Clutch (TCC) System - Stuck On - Transmission Hydraulic/Mechanical Performance

Circuit/System Description

The torque converter clutch (TCC) pressure control solenoid is part of the control solenoid valve assembly which has no serviceable parts. The TCC pressure control solenoid is a normally low pressure control solenoid. The TCC pressure control solenoid regulates transmission fluid to the TCC regulator valve in the lower valve body and the TCC control valve in the pump cover. When vehicle operating conditions are appropriate to apply the converter clutch, the Transmission Control Module will increase TCC pressure control current flow (duty cycle) to the TCC solenoid. The TCC pressure control solenoid directs fluid pressure to move the TCC control valve to the apply position, and moves the TCC regulator apply valve to the regulating position. The TCC regulator valve regulates TCC apply fluid pressure proportional to TCC solenoid pressure. When the TCC is fully applied, the engine is coupled directly to the transmission. TCC release is accomplished by the Transmission Control Module decreasing current flow to the TCC pressure control solenoid. This results in decreasing the apply pressure which allows the TCC control valve to move to the release position. The Transmission Control Module calculates torque converter slip speed based on engine speed and transmission input shaft speed.

Conditions for Running the DTC

P0741

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, P0742, P2763, or P2764 is not set.
- Ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.
- The transmission fluid temperature is -6.6 to +130Â°C (+20 to +266Â°F).

- The accelerator pedal position signal is valid.
- The throttle position is greater than 8 percent.
- The TCM must receive a valid torque signal from the ECM.
- The engine torque is greater than 50 N.m (36 lb ft).
- The TCC is commanded ON and PWM duty cycle is greater than 60 percent for 5 s.
- The gear ratios listed below should be in range when the specific gear while the TCC is On:
    - The 2nd gear ratio is between 2.20-2.53.
    - The 3rd gear ratio is between 1.44-1.65.
    - The 4th gear ratio is between 1.07-1.23.
    - The 5th gear is between 0.79-0.91.
    - The 6th gear is between 0.62-0.72.

P0742

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, P0741, P2763, or P2764 is not set.
- DTC P0742 has not passed this key ON.
- Ignition voltage is between 8.6-32 V.
- The engine speed is 400-7, 500 RPM for 5 s.
- The transmission fluid temperature is -6.6 to +130Â°C (+20 to +266Â°F).
- The accelerator pedal position signal is valid.
- The throttle position is greater than 8 percent.
- The TCM must receive a valid torque signal from the ECM.
- The engine torque is greater than 115 N.m (85 lb ft).
- The vehicle speed is greater than 16 km/h (10 mph).
- The gear ratio is between 0.62-1.63.
- The commanded gear is 2nd.
- The TCC is commanded OFF.

Conditions for Setting the DTC

P0741

- The TCC Pressure is greater than 750 Kpa (109 PSI) for 6 s.
- The TCM detects TCC slip greater than 130 RPM for 5 s when the TCC is commanded ON. This condition must occur 2 times.

P0742

- The TCM detects the TCC slip between -50 and +13 RPM for 6 s when the TCC is commanded OFF.
- The above condition must occur 2 times.

Action Taken When the DTC Sets

P0741

- DTC P0741 is a Type B DTC.
- The TCM inhibits TCC.
- The TCM inhibits high gear in hot mode.
- The TCM freezes transmission adaptive functions.

P0742

- DTC P0742 is a Type A DTC.
- The TCM disables neutral idle.
- The TCM enables high gear in hot mode.
- The TCM freezes transmission adaptive functions.

Conditions for Clearing the DIC/DTC

- DTC P0741 is a Type B DTC.
- DTC P0742 is a Type A DTC.

Diagnostic Aids

Before performing a road test, configure and setup the scan tool for snapshot mode. This will allow you to display, monitor, and verify multiple transmission data parameters at one time, after the road test.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Electronic Component Description**
- **Transmission Component and System Description**
- **Transmission General Description**
- **Park - Engine Running**
- **Reverse**
- **Neutral - Engine Running**
- **Drive Range, First Gear Engine Braking**
- **Drive Range, First Gear**
- **Drive Range, Second Gear**
- **Drive Range, Third Gear**
- **Drive Range, Third Gear Default**
- **Drive Range, Fourth Gear**
- **Drive Range, Fifth Gear**
- **Drive Range, Fifth Gear Default**
- **Drive Range, Sixth Gear**
- **Fluid Passages**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825 Control Solenoid Test Plate

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

NOTE: **If other DTCs are set, diagnose those DTCs first.**

1. Engine idling in Park position, with parking brake applied and drive wheels chocked.
2. Verify the transmission fluid level and condition is correct. Refer to **Transmission Fluid Level and Condition Check**.
   - **If the transmission fluid level and condition is not correct**

     Repair as necessary.

   - **If the transmission fluid level and condition is correct**
3. Ignition ON, clear the Transmission Control Module DTCs with a scan tool.

NOTE: **During the road test, the Transmission Control Module must see 2 attempts at Torque Converter lockup.**

4. Verify the transmission operation performs as indicated in the road test instructions and DTCs P0741 or P0742 did not set. Refer to **Road Test**.
   - **If DTC P0741 or P0742 set**

     Refer to Circuit/System Testing.

   - **If DTC P0741 or P0742 did not set**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

- **If the DTC does not set**

7. All OK.

Circuit/System Testing

1. Verify the transmission line pressures are within the specified ranges. Refer to **Line Pressure Check**.
   - **If pressures are not within range**

     Refer to **Fluid Pressure High or Low**.

   - **If pressures are within range**
2. Ignition OFF. Remove the Q8 Control Solenoid Valve Assembly.
3. Verify a pressure change occurs for each solenoid when performing the solenoid test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**.
   - **If a pressure change does not occur**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If a pressure change does occur**
4. Verify the conditions listed below do not exist. Carefully inspect each component for that condition. Repair or replace as necessary.

P0741 or P0742 - A/Trans Fluid Pump cover Assembly (219)

- TCC Control Valve (227) stuck/sticking - debris, binding, damaged valve, or scored bore.
- Converter Feed Limit Valve (220) stuck/sticking - debris, binding, damaged valve, or scored bore.
- Pressure Regulator Valve (233) stuck/sticking - debris, binding, damaged valve, or scored bore.
- Turbine Shaft Bushings (218), (228) damaged or loose.
- Leak between stator/tower assembly and cover.

P0741 - 4-5-6 (w/Turbine Shaft) Housing Assembly (441)

TCC Turbine Shaft O-ring Seal (443) damaged or leaking.

P0741 - Torque Converter Assembly (1)

- TCC friction material debonded or excessively worn.

- One way stator clutch distressed.
- Internal leak - missing or damaged seal.
- Overheated due to lack of lubrication/cooler flow.

P0741 or P0742 - Lower Control Valve Body Assembly (351)

- TCC Regulator Apply Valve (355) stuck/sticking - debris, binding, damaged valve, or scored bore. Bore plug (328) undersized or leaking.
- Clutch Select Valve 2 (352) stuck/sticking - debris, binding, damaged valve, or scored bore.

P0741 or P0742 - Q8 Control Solenoid Valve Assembly (314)

TCM incorrectly reporting high OSS, causing early TCC apply or late TCC release.

P0742 - A/Trans Input and Output Speed Sensor Assembly (303)

Incorrect, high, OSS signal, causing early TCC apply or late TCC release.

P0741 - Control Solenoid Valve Assembly (21)

A/Trans Fluid Pump Seal Assembly (18) damaged or leaking.

P0741 - Torque Converter Diagnosis

Refer to **No Torque Converter Clutch Apply**.

P0742 - Torque Converter Diagnosis

Refer to **No Torque Converter Clutch Release**.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0751 OR P0752: SHIFT SOLENOID VALVE 1 PERFORMANCE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

NOTE: **The DTCs listed below set due to a transmission hydraulic/mechanical condition. Perform the Circuit/System Verification and Circuit/System Testing to identify the cause.**

DTC P0751

Shift Solenoid Valve 1 Performance - Stuck Off - Transmission Hydraulic/Mechanical Performance

DTC P0752

Shift Solenoid Valve 1 Performance - Stuck On - Transmission Hydraulic/Mechanical Performance

Circuit/System Description

The shift solenoid 1 is part of the control solenoid valve assembly which has no serviceable parts. The control solenoid valve assembly is attached to the lower control valve body. The solenoid operates by the Transmission Control Module opening or closing the ground circuit. With the solenoid circuit grounded (solenoid on), the internal plunger and metering ball block the exhaust fluid creating signal fluid pressure. The signal fluid acts against the clutch select valve 2 to overcome the valve spring force moving it to the apply position, allowing the shift. The shift solenoid 1 is commanded ON in Park, Reverse, Neutral and Drive 1 Engine Braking, and commanded OFF in Drive 1-6 gear ranges.

Conditions for Running the DTC

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- Ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.
- The internal mode switch range is not PARK, NEUTRAL or REVERSE.
- High Side Driver is enabled.
- The transmission fluid temperature is -6.6Â°C (20.12Â°F).

- Accelerator pedal position signal is valid.
- The throttle position signal is valid.
- The output shaft speed is 0 RPM or greater.
- The TCM must receive a valid torque signal from the ECM.

Conditions for Setting the DTC

P0751

- 1st gear is commanded.
- TCM detects a gear ratio of 1.09-1.20.
- Gear slip is greater than 400 RPM for 2 s.
- The above conditions have to occur 8 times to set.

P0752

- 3rd gear is commanded.
- Transmission has achieved 1st or 2nd gear.
- Gear slip is 400 RPM for 1.5 s.
- TCM commands 4th gear if the above condition exist and detects a gear ratio of 3.82-4.22 for 1.5 s.
- The above conditions have to occur 5 times.

Action Taken When the DTC Sets

P0751

- DTC P0751 is a Type B DTC.
- TCM inhibits 1st gear.
- TCM inhibits neutral idle.

P0752

- DTC P0752 is a Type A DTC.
- TCM freezes transmission adaptive functions.

- TCM commands maximum line pressure.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM commands second gear if output is less than 1, 350 RPM, or neutral if output speed is 1, 350 RPM or greater.
- TCM inhibits neutral idle.

Conditions for Clearing the DTC

- DTC P0751 is a Type B DTC.
- DTC P0752 is a Type A DTC.

Diagnostic Aids

Before performing a road test, configure and setup the scan tool for snapshot mode. This will allow you to display, monitor, and verify multiple transmission data parameters at one time, after the road test.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Electronic Component Description**
- **Transmission General Description**
- **Transmission Component and System Description**
- **Park - Engine Running**
- **Reverse**
- **Neutral - Engine Running**

- **Drive Range, First Gear Engine Braking**
- **Drive Range, First Gear**
- **Drive Range, Second Gear**
- **Drive Range, Third Gear**
- **Drive Range, Third Gear Default**
- **Drive Range, Fourth Gear**
- **Drive Range, Fifth Gear**
- **Drive Range, Fifth Gear Default**
- **Drive Range, Sixth Gear**
- **Fluid Passages**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **DT-47825** Control Solenoid Test Plate
- **J 21867** Pressure Gauge

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

NOTE: **If other DTCs are set, diagnose those DTCs first.**

1. Engine idling in Park position, with parking brake applied and drive wheels chocked.
2. Verify the transmission fluid level and condition is correct. Refer to **Transmission Fluid Level and Condition Check**.
   - **If the transmission fluid level and condition is not correct**

     Repair as necessary.

- **If the transmission fluid level and condition is correct**

3. From a stop, accelerate to 72 km/h (45 mph) with the scan tool Calculated Throttle Position greater than 20 percent. Perform this test 8 times.
4. Verify DTC P0751 or P0752 did not set.
   - **If DTC P0751 or P0752 set**

     Refer to Circuit/System Testing.

   - **If DTC P0751 or P0752 did not set**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
7. All OK.

Circuit/System Testing

1. Verify the transmission line pressures are within the specified ranges. Refer to **Line Pressure Check**.
   - **If line pressures are not within range**

     Refer to **Fluid Pressure High or Low**.

   - **If line pressures are within range**
2. Ignition OFF. Remove the Q8 Control Solenoid Valve Assembly.
3. Verify a pressure change occurs for each solenoid when performing the solenoid test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**.
   - **If a pressure change does not occur for each solenoid**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If a pressure change does occur for each solenoid**
4. Verify the mechanical conditions listed below do not exist. Carefully inspect each component for that condition. Repair or replace as necessary.

P0751 or P0752 - Lower Control Valve Body

Clutch select valve 2 stuck - debris, sediment, binding or scored bore or valve damage.

P0751 - Lower Control Valve Body

Bore Plug - Clutch Select Valve 2, Leaking, undersized bore plug, or damaged.

P0751 - Upper Control Valve Body

- Check Ball #2 missing, damaged, or leaking.
- Check Ball #2 Seat damaged or leaking.

P0751 or P0752 - Q8 Control Solenoid Valve Assembly

Shift Solenoid 1:

- O-ring seals leaking.
- Control signal fluid supply leak - valve body filter plate assembly cracked or damaged gasket seal.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0756: SHIFT SOLENOID VALVE 2 PERFORMANCE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

NOTE: **The DTCs listed below set due to a transmission hydraulic/mechanical condition. Perform the Circuit/System**

Verification and Circuit/System Testing to identify the cause.

DTC P0756

Shift Solenoid Valve 2 Performance - Stuck Off - Transmission Hydraulic/Mechanical Performance

Circuit/System Description

The shift solenoid valve 2 is part of the control solenoid valve assembly which has no serviceable parts. The control solenoid valve assembly is attached to the lower control valve body. The solenoid operates by the Transmission Control Module opening or closing the ground circuit. With the solenoid circuit grounded (solenoid on), the internal plunger and metering ball block the exhaust fluid creating signal fluid pressure. The signal fluid acts against the clutch select valve 3 to overcome the valve spring force moving it to the apply position, allowing the shift. The shift solenoid 2 is commanded OFF in Reverse, and commanded ON in Park, Neutral, Drive 1 Engine Braking, and Drive 1-6 gear ranges.

Conditions for Running the DTC

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- Ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.
- High Side Driver 1 is enabled.
- The Throttle Position signal voltage is valid.
- Throttle position is 0.5 percent or greater.
- Transmission fluid temperature is -6.6Â°C (20.12Â°F) or greater.
- The Transmission Output Speed is 67 RPM or greater.

Conditions for Setting the DTC

- Commanded gear is 1st locked.
- Transmission gearbox slip is 400 RPM for 10 s.
- The transmission commands 2nd gear if the above condition exists and detects a ratio of 2.72-3.01 for 1 s.
- The above condition has to occur 3 times.

Action Taken When the DTC Sets

- The TCM freezes the shift adapts function.
- The TCM commands maximum line pressure.
- The TCM inhibits neutral idle.
- The TCM inhibits Tap Up/Down function.
- The TCM inhibits Tow/Haul function.
- The TCM commands Neutral if the transmission output speed is 1, 350 RPM or greater.
- The TCM commands 2nd gear if the transmission output speed is less than 1, 350 RPM.

Conditions for Clearing the DTC

DTC P0756 is a Type A DTC.

Diagnostic Aids

Before performing a road test, configure and setup the scan tool for snapshot mode. This will allow you to display, monitor, and verify multiple transmission data parameters at one time, after the road test.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Electronic Component Description**
- **Transmission Component and System Description**
- **Transmission General Description**
- **Park - Engine Running**
- **Reverse**

- Neutral - Engine Running
- Drive Range, First Gear Engine Braking
- Drive Range, First Gear
- Drive Range, Second Gear
- Drive Range, Third Gear
- Drive Range, Third Gear Default
- Drive Range, Fourth Gear
- Drive Range, Fifth Gear
- Drive Range, Fifth Gear Default
- Drive Range, Sixth Gear
- Fluid Passages

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **DT-47825** Control Solenoid Test Plate
- **J 21867** Pressure Gauge

For equivalent regional tools, refer to Special Tools .

Circuit/System Verification

NOTE: **If other DTCs are set, diagnose those DTCs first.**

1. Engine idling in Park position, with parking brake applied and drive wheels chocked.
2. Verify the transmission fluid level and condition is correct. Refer to Transmission Fluid Level and Condition Check.
    - **If the transmission fluid level and condition is not correct**

Repair as necessary.

- **If the transmission fluid level and condition is correct**

3. Ignition ON, clear the Transmission Control Module DTCs with a scan tool.

NOTE: **During the road test, the Transmission Control Module has to see 3 attempts at a 1 through 6 gear shift change.**

4. Verify the transmission operation performs as indicated in the road test instructions and DTC P0756 did not set. Refer to **Road Test**.
   - **If DTC P0756 is set**

     Refer to Circuit/System Testing.

   - **If DTC P0756 did not set**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
7. All OK.

Circuit/System Testing

1. Verify the transmission line pressures are within the specified ranges. Refer to **Line Pressure Check**.
   - **If pressures are not within range**

     Refer to **Fluid Pressure High or Low**.

   - **If pressures are within range**
2. Ignition OFF. Remove the Q8 Control Solenoid Valve Assembly.
3. Verify a pressure change occurs for each solenoid when performing the solenoid test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**.

- **If a pressure change does not occur**

  Replace the Q8 Control Solenoid Valve Assembly.

- **If a pressure change does occur**

4. Verify the conditions listed below do not exist. Carefully inspect each component for that condition. Repair or replace as necessary.

P0756 - Lower Control Valve Body (351)

Clutch select valve 3 stuck off - debris, sediment, binding or scored bore.

P0756 - Lower Control Valve Body (351)

Bore Plug - Clutch Select Valve 3 leaking, undersized bore plug, damaged.

P0756 - Upper Control Valve Body (304)

- Check Ball #3 missing, damaged, leaking.
- Check Ball #3 Spacer plate seat damaged, leaking.

P0756 - Q8 Control Solenoid Valve Assembly (314)

Shift Solenoid (SS) 2:

- O-ring seals leaking.
- Control signal fluid supply leak - valve body filter plate assembly cracked or damaged gasket seal.

P0756 - 1-2-3-4 and 3-5-R Clutch Housing Assembly (51)

1-2-3-4 clutch backing plate retaining ring not seated, causing the piston to over travel and cut the 1-2-3-4 clutch piston seal.

P0756 - Fluid Pump Cover Assembly

Fluid pump cover vanes and fluid pump rotor broken.

P0756 - Low Clutch Sprag Assembly

Broken or incapable of holding torque.

P0756 - Pump Seal

Seal is cut, torn causing a leak due to pump speed and capacity.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0776 OR P0777: PRESSURE CONTROL SOLENOID VALVE 2

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

NOTE: **The DTCs listed below set due to a transmission hydraulic/mechanical condition. Perform the Circuit/System Verification and Circuit/System Testing to identify the cause.**

DTC P0776

Pressure Control Solenoid Valve 2 - Stuck Off - Transmission Hydraulic/Mechanical Performance

DTC P0777

Pressure Control Solenoid Valve 2 - Stuck On - Transmission Hydraulic/Mechanical Performance

Circuit/System Description

The clutch pressure control solenoid valve 2 is part of the control solenoid valve assembly, which has no serviceable parts. The pressure control solenoid valve 2 regulates transmission fluid pressure to the 3-5-Reverse clutch regulator valve which controls pressure to the 3-5-Reverse clutch. The Transmission Control Module calculates gear ratio based on the RPM signals from the input speed sensor (ISS) and the output speed sensor (OSS). The Transmission Control Module compares the expected transmission gear ratio to the calculated gear ratio for each commanded gear.

Conditions for Running the DTC

P0776

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- The ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.
- The transmission temperature is -6.6Â°C (20.12Â°F) or greater.
- The throttle position signal is valid.
- High side driver is enabled.
- The transmission output speed sensor is 67 RPM or greater or the accelerator pedal position sensor is 0.5 percent or greater.

P0777

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- The ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.
- The transmission temperature is -6.6Â°C (20.12Â°F) or greater.
- The throttle position signal is valid.
- High side driver is enabled.
- The transmission output speed sensor is 67 RPM or greater or the accelerator pedal position sensor is 0.5 percent or greater.

Conditions for Setting the DTC

P0776

The Transmission Control Module has detected an incorrect gear ratio or neutral condition when the 3-5-R clutch is commanded ON. This condition must occur 3 times.

P0777

The Transmission Control Module has detected an incorrect gear ratio change when the 3-5-R clutch is commanded OFF during a shift or when 3rd gear ratio is detected in 1st gear. This condition must occur 3 times.

Action Taken When the DTC Sets

P0776

- DTC P0776 is a Type A DTC.
- The TCM commands maximum line pressure.
- The TCM inhibits Tow/Haul mode.
- The TCM freezes transmission adaptive functions.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits Manual Up/Down Shift with the shift selector.
- The TCM inhibits auto grade braking.
- The TCM limits the transmission to 2nd gear if the output speed sensor signal is less than 1, 400 RPM. No upshift will occur.
- The TCM limits the transmission to 4th gear if the output speed sensor signal is 1, 400 RPM or greater.

P0777

- DTC P0777 is a Type A DTC.
- The TCM commands maximum line pressure.
- The TCM inhibits Tow/Haul mode.
- The TCM freezes transmission adaptive functions.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits Manual Up/Down Shift with the shift selector.
- The TCM limits the transmission to Reverse gear and 3rd gear operation.
- The TCM inhibits auto grade braking.

Conditions for Clearing the DIC/DTC

DTCs P0776 and P0777 are Type A DTCs.

Diagnostic Aids

Before performing a road test, configure and setup the scan tool for snapshot mode. This will allow you to display, monitor, and verify multiple transmission data parameters at one time, after the road test.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Electronic Component Description**
- **Transmission General Description**
- **Transmission Component and System Description**
- **Park - Engine Running**
- **Reverse**
- **Neutral - Engine Running**
- **Drive Range, First Gear Engine Braking**
- **Drive Range, First Gear**
- **Drive Range, Second Gear**
- **Drive Range, Third Gear**
- **Drive Range, Third Gear Default**
- **Drive Range, Fourth Gear**
- **Drive Range, Fifth Gear**
- **Drive Range, Fifth Gear Default**
- **Drive Range, Sixth Gear**
- **Fluid Passages**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **DT-47825** Control Solenoid Test Plate
- **J 21867** Pressure Gauge

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

NOTE: **If other DTCs are set, diagnose those DTCs first.**

1. Engine idling in Park position, with parking brake applied and drive wheels chocked.
2. Verify the transmission fluid level and condition is correct. Refer to **Transmission Fluid Level and Condition Check**.
   - **If the transmission fluid level and condition is not correct**

     Repair as necessary.

   - **If the transmission fluid level and condition is correct**
3. Ignition ON, clear the Transmission Control Module DTCs with a scan tool.
4. Verify the transmission operation performs as indicated in the road test instructions and DTCs P0776 or P0777 did not set. Refer to **Road Test**.
   - **If DTCs P0776 or P0777 are set**

     Refer to Circuit/System Testing.

   - **If DTCs P0776 or P0777 did not set**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

- **If the DTC does not set**

7. All OK.

Circuit/System Testing

NOTE: **You must perform the Circuit/System Verification first.**

1. Verify the transmission line pressures are within the specified ranges. Refer to **Line Pressure Check**.
   - **If pressures are not within range**

     Refer to **Fluid Pressure High or Low**.

   - **If pressures are within range**
2. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
3. Verify a pressure change occurs for each solenoid when performing the solenoid test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**.
   - **If a pressure change does not occur**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If a pressure change does occur**
4. Verify the conditions listed below do not exist. Carefully inspect each component for that condition. Repair or replace as necessary.

P0776 - Control Valve Upper Body Assembly (304)

3-5-R Regulator Valve (336) stuck/sticking - debris, binding, damaged valve, or scored bore.

P0776 or P0777 - Q8 Control Solenoid Valve Assembly (314)

- O-ring seals leaking.
- Valve body filter plate assembly cracked, blocked or damaged gasket seal.

P0776 or P0777 - Control Valve Upper Body Assembly (304)

- Actuator feed limit circuit supply fluid to solenoids restricted or not available, debris or sediment blockage.
- B-R-1/4-5-6 clutch regulator valve (327) not in the applied position - debris, binding, damaged valve, or scored bore.

- 4-5-6 clutch boost valve (329) not exhausting - debris, binding, damaged valve, or scored bore.

P0776 or P0777 - Torque Converter (w/Fluid Pump) Housing Assembly (2)

Fluid pump housing vanes/rotor/slide damaged/scored.

P0776 or P0777 - A/Trans Fluid Pump Cover Assembly (219)

Isolator valve (236) stuck/sticking - debris, binding, damaged valve, or scored bore.

P0776 - 1-2-3-4 and 3-5-R Clutch Housing Assembly (51)

3-5-R clutch backing plate retaining ring (400) not seated.

P0776 or P0777 - 1-2-3-4 and 3-5-R Clutch Housing Assembly (51)

1-2-3-4 clutch backing plate retaining ring (429) not seated, causing clutch pack/piston over travel.

P0776 - 4-5-6 Hub/ Shaft Assembly (58)

4-5-6 Hub/Shaft - broken hub weld.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0796 OR P0797: PRESSURE CONTROL SOLENOID VALVE 3

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

NOTE: **The DTCs listed below set due to a transmission hydraulic/mechanical condition. Perform the Circuit/System Verification and Circuit/System Testing to identify the cause.**

DTC P0796

Pressure Control Solenoid Valve 3 - Stuck Off - Transmission Hydraulic/Mechanical Performance

DTC P0797

Pressure Control Solenoid Valve 3 - Stuck On - Transmission Hydraulic/Mechanical Performance

Circuit/System Description

The clutch pressure control solenoid 3 is part of the control solenoid valve assembly, which has no serviceable parts. The Clutch Pressure Control Solenoid 3 regulates transmission fluid pressure to the CBR1/C 4-5-6 clutch regulator valve which controls pressure to the low/reverse clutch and the 4-5-6 clutch. The Transmission Control Module calculates gear ratio based on the RPM signals from the input speed sensor (ISS) and the output speed sensor (OSS). The Transmission Control Module compares the expected transmission gear ratio to the calculated gear ratio for each commanded gear.

Conditions for Running the DTC

P0796

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- The ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.
- The transmission temperature is -6.6Â°C (20.12Â°F) or greater.
- The throttle position signal is valid.
- High side driver is enabled.
- The transmission output speed sensor signal is 67 RPM or greater or the accelerator pedal position sensor signal is 0.5 percent or greater.

P0797

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.

- The ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.
- The transmission temperature is -6.6Â°C (20.12Â°F) or greater.
- The throttle position signal is valid.
- High side driver is enabled.
- The transmission output speed sensor signal is 67 RPM or greater or the accelerator pedal position sensor signal is 0.5 percent or greater.

Conditions for Setting the DTC

P0796

The Transmission Control Module has detected an incorrect gear ratio or neutral condition when the low and reverse clutch and the 4-5-6 clutch is commanded ON. This condition must occur 3 times.

P0797

The Transmission Control Module has detected an incorrect gear ratio change when the low and reverse clutch and the 4-5-6 clutch is commanded OFF during a shift or when 4th gear ratio is detected in 1st gear. This condition must occur 3 times.

Action Taken When the DTC Sets

P0796

- DTC P0796 is a Type A DTC.
- The TCM commands maximum line pressure.
- The TCM inhibits Tow/Haul mode.
- The TCM freezes transmission adaptive functions.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits Manual Up/Down Shift with the shift selector.
- The TCM limits the transmission to Reverse gear and 2nd gear operation.
- The TCM inhibits neutral idle.
- The TCM inhibits auto grade braking.
- The TCM limits the transmission to neutral gear if the output speed sensor signal is 1, 350 RPM or greater.
- The TCM limits the transmission to 2nd gear if the output speed sensor signal is less than 1, 350 RPM. No upshift will occur.

P0797

- DTC P0797 is a Type A DTC.
- The TCM commands maximum line pressure.
- The TCM inhibits Tow/Haul mode.
- The TCM freezes transmission adaptive functions.
- The ECM/TCM enables torque management.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits Manual Up/Down Shift with the shift selector.
- The TCM limits the transmission to Reverse gear and 4th gear operation.

Conditions for Clearing the DIC/DTC

DTCs P0796 and P0797 are Type A DTCs.

Diagnostic Aids

Before performing a road test, configure and setup the scan tool for snapshot mode. This will allow you to display, monitor, and verify multiple transmission data parameters at one time, after the road test.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

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- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

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- **Reverse**
- **Neutral - Engine Running**
- **Drive Range, First Gear Engine Braking**
- **Drive Range, First Gear**
- **Drive Range, Second Gear**
- **Drive Range, Third Gear**
- **Drive Range, Third Gear Default**
- **Drive Range, Fourth Gear**
- **Drive Range, Fifth Gear**
- **Drive Range, Fifth Gear Default**
- **Drive Range, Sixth Gear**
- **Fluid Passages**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **DT-47825** Control Solenoid Test Plate
- **J 21867** Pressure Gauge

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

NOTE: **If other DTCs are set, diagnose those DTCs first.**

1. Engine idling in Park position, with parking brake applied and drive wheels chocked.

2. Verify the transmission fluid level and condition is correct. Refer to **Transmission Fluid Level and Condition Check**.
   - **If the transmission fluid level and condition is not correct**

     Repair as necessary.

   - **If the transmission fluid level and condition is correct**
3. Ignition ON, clear the Transmission Control Module DTCs with a scan tool.
4. Verify the transmission operation performs as indicated in the road test instructions and DTCs P0796 or P0797 did not set. Refer to **Road Test**.
   - **If DTC P0796 or P0797 set**

     Refer to Circuit/System Testing.

   - **If DTC P0796 or P0797 did not set**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
7. All OK.

Circuit/System Testing

1. Verify the transmission line pressures are within the specified ranges. Refer to **Line Pressure Check**.
   - **If pressures are not within range**

     Refer to **Fluid Pressure High or Low**.

   - **If pressures are within range**
2. Ignition OFF. Remove the Q8 Control Solenoid Valve Assembly.
3. Verify a pressure change occurs for each solenoid when performing the solenoid test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**.
   - **If a pressure change does not occur for each solenoid**

Replace the Q8 Control Solenoid Valve Assembly.

- **If a pressure change does occur for each solenoid**

4. Verify the conditions listed below do not exist. Carefully inspect each component for that condition. Repair or replace as necessary.

P0796 or P0797 - Control Valve Upper Body Assembly (304)

4-5-6 Regulator Valve (327) stuck/sticking - debris, binding, damaged valve, or scored bore.

P0796 - 4-5-6 Clutch Housing Assembly (441)

Turbine Shaft Seals (442) damaged or leaking.

P0796 or P0797 - Q8 Control Solenoid Valve Assembly (314)

- O-ring seals leaking.
- Valve body filter plate assembly cracked, blocked or damaged gasket seal.

P0796 or P0797 - Control Valve Lower Body Assembly (307)

Clutch select valve (352) stuck/ sticking - debris, binding, damaged valve, or scored bore.

P0796 - 4-5-6 Clutch Housing Assembly (441)

4-5-6 Clutch Piston Assembly (439) damaged/ leaking.

P0796 - Transmission Cooling/Lubrication

- Restriction/leak in OAC, oil to air, cooler/radiator.
- Restricted/leaking/kinked/damaged transmission oil cooler lines.
- Restriction/leak in transmission fluid pump assembly.

P0796 - Torque Converter (w/Fluid Pump) Housing Assembly (2)

- Fluid pump housing vanes/rotor/slide damaged/scored.
- Fluid pump or torque converter overstressed due to high temperature.

P0796 - 4-5-6 Hub/Shaft Assembly (58)

4-5-6 Hub/Shaft - broken hub weld.

P0796 - Automatic Transmission Fluid Filter Assembly (26)

Oil filter (26) or filter seal (25) loose or damaged.

P0796 - 1-2-3-4 and 3-5-R Clutch Housing Assembly (51)

1-2-3-4 Clutch Backing Plate Retaining Ring (429) not seated/oriented, causing clutch pack/piston over travel.

P0796 - Control (with body and valve) Valve Assembly (21)

Valve Body to Pump Transfer Seal Assembly (18) damaged/leaking.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0815, P0816, P0826, OR P1876: UP AND DOWN SHIFT SWITCH

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0815

Upshift Switch Circuit

DTC P0816

Downshift Switch Circuit

DTC P0826

Up and Down Shift Switch Circuit

DTC P1876

Up and Down Shift Enable Switch Circuit Low Voltage

Diagnostic Fault Information

Driver Shift Request

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Tap Up/Tap Down Switch Signal Circuit	0 V	0 V	5-12 V	-

Circuit/System Description

The driver shift request (DSR) allows the driver to select the desired range of gears for current driving conditions. The DSR shift system is activated when the gear selector is in the manual position. The DSR system is deactivated in all other range positions. Pressing the plus (+) switch once will command the body control module (BCM) to signal the transmission control module (TCM) to upshift to the next high gear. Pressing the minus (-) switch once will command the BCM to signal the TCM to downshift to the next lowest or previous gear. The TCM will not allow a downshift if the transmission is compromised by over-speeding. The automatic transmission manual shift switch is comprised of three different resistors values in series and two switches. The BCM supplies a 12 volt circuit to the automatic transmission manual shift switch. The signal circuit varies the voltage back to the body control module depending on which switch is depressed.

Conditions for Running the DTC

P0815, P0816 or P0826

- DTC P0815, P0816, P0826, P182E, P1876, P1877, P1915 or P1761 is not set.
- The ignition voltage is 8.6 volts or greater.
- The engine speed is 400 RPM or greater for 5 seconds.

P1876

- DTC U0100, P0815, P0816, P0826, P1825, P1876 or P1915 is not set.

- The ignition voltage is 8.6 volts or greater.
- The engine speed is 400 RPM or greater for 5 seconds.

Conditions for Setting the DTC

P0815 - Condition 1

The BCM detects a stuck ON Tap Up switch for 1 second in Park or Neutral.

P0815 - Condition 2

The BCM detects a stuck ON Tap Up switch for 10 minutes in any forward gear.

P0816 - Condition 1

The BCM detects a stuck ON Tap Down switch for 1 second in Park or Neutral.

P0816 - Condition 2

The BCM detects a stuck ON Tap Down switch for 10 minutes in any forward gear.

P0826

The BCM detects an invalid voltage on the TAP up/down signal circuit for 1 minute.

P1876

The BCM detects a TAP Enable Switch request 3 times when not in M (D6) range for 2 seconds.

Action Taken When the DTC Sets

- DTCs P0815, P0816, P0826, and P1876 are Type C DTCs.
- The BCM disables TAP shift operation.

Conditions for Clearing the DTC

DTCs P0815, P0816, P0826, and P1876 are Type C DTCs.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Circuit/System Verification

1. Ignition ON, place the S3 Transmission Shift Lever in manual mode range position.
2. Verify with a scan tool, the Driver Shift Control Mode parameter displays Active.
    - **If the parameter does not display Active**

      Refer to Circuit/System Testing.

    - **If the parameter does display Active**
3. Verify with a scan tool, the Driver Shift Request parameter displays Upshift, when momentarily pressing the plus (+) switch.
    - **If the parameter does not display Upshift**

Refer to Circuit/System Testing.

- **If the parameter does display Upshift**

4. Verify with a scan tool, the Driver Shift Request parameter displays Downshift, when momentarily pressing the minus (-) switch.
   - **If the parameter does not display Downshift**

     Refer to Circuit/System Testing.

   - **If the parameter does display Downshift**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure records data.
6. Verify the DTC does set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
7. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF. Disconnect the harness connector at the S3 Transmission Shift Lever. It may take up to 2 min. for all vehicle systems to power down.
2. Test for less than 5 Ω between the ground circuit terminal C and ground.
   - **If greater than 5 Ω**
   1. Ignition OFF.
   2. Test for less than 2 Ω in the ground circuit wire end to wire end.
      - If 2 Ω or greater, repair the open/high resistance in the wire circuit.
      - If less than 2 Ω, repair the open/high resistance in the ground connection.
   - **If less than 5 Ω**
3. Ignition OFF.
4. Test for less than 1 V on the signal circuit terminal D at the S3 Transmission Shift Lever harness connector.
   - **If greater than 1 V**

1. Ignition OFF.
2. Disconnect the X3 harness connector at the K9 Body Control Module. Ignition ON.
3. Test for less than 1 V on the signal circuit terminal D at the S3 Transmission Shift Lever harness connector and ground.
    - If 1 V or greater, repair the short to B+/Ignition in the signal circuit.
    - If less than 1 V, replace the K9 Body Control Module.

- **If less than 1 V**

5. Ignition ON.
6. Test for 11.6-12.4 V on the signal circuit terminal D at the S3 Transmission Shift Lever harness connector and ground.

- **If not between 11.6-12.4 V**

1. Ignition OFF.
2. Disconnect the X3 harness connector at the K9 Body Control Module.
3. Test for less than 2 Ω in the signal circuit wire end to wire end.
    - If greater than 2 Ω, repair the open/high resistance in the wire circuit.
    - If less than 2 Ω, replace the K9 Body Control Module.

- **If between 11.6-12.4 V**

7. Test or replace the S3 Transmission Shift Lever.

Component Testing

1. Perform the Circuit/System Verification and Circuit/System Testing first.
2. Ignition OFF.
3. Disconnect the S3 Transmission Shift Lever harness connector.
4. Test for 6110-6140 Ω between terminals C and D on the S3 Transmission Shift Lever.

- **If not within the specified range**

  Replace the S3 Transmission Shift Lever.

- **If within the specified range**

5. Test for 610-650 Ω between terminals C and D on the S3 Transmission Shift Lever, while holding down the plus (+) switch.

- **If not within the specified range**

Replace the S3 Transmission Shift Lever.

- **If within the specified range**

6. Test for 1990-2020 Ω between terminals C and D on the S3 Transmission Shift Lever, while holding the minus (-) switch.
   - **If not within the specified range**

     Replace the S3 Transmission Shift Lever.

   - **If within the specified range**
7. All OK.

Repair Instructions

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- Perform the **Diagnostic Repair Verification** after completing the repair.
- Refer to **Control Module References** for BCM replacement, programming, and setup.
- Replace the RSM shift switch. Refer to **Range Selector Lever Cable Lever Replacement (N33, N37)** **Range Selector Lever Cable Lever Replacement (N38)** .

DTC P0842 OR P0843: TRANSMISSION FLUID PRESSURE SWITCH 1

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0842

Transmission Fluid Pressure Switch 1 Circuit Low Voltage

DTC P0843

Transmission Fluid Pressure Switch 1 Circuit High Voltage

Circuit/System Description

The Transmission Fluid Pressure Switch 1 is part of the control solenoid valve assembly which has no serviceable parts. The Transmission Control Module supplies a signal circuit to the Transmission Fluid Pressure Switch 1. The Transmission Fluid Pressure Switch 1 has an internal case ground. Transmission Fluid Pressure Switch 1 is normally closed or LOW. When oil pressure is present at the Transmission Fluid Pressure Switch 1, the switch is open or HIGH. The normally high clutch pressure control (PC) solenoid 2 controls pressure to the 3-5 reverse clutch regulator valve. The Transmission Control Module monitors the Transmission Fluid Pressure Switch 1 to determine the position of the 3-5 reverse clutch regulator valve. When the 3-5 reverse clutch is commanded OFF, pressure is present on the Transmission Fluid Pressure Switch 1. When the 3-5 reverse clutch is commanded ON, the 3-5 reverse clutch regulator valve moves and pressure to the Transmission Fluid Pressure Switch 1 is exhausted through the 3-5 reverse clutch regulator valve.

Conditions for Running the DTC

P0842 or P0843

- DTC P0711, P0712, P0713, P0716, P0717, P0722, P0723, P0751, P0742, P0756, P0757, P0973, P0974, P0976, P0977, P1915, or P182E is not set.
- Ignition voltage is between 8.6-32 V.
- The transmission fluid temperature is -6.6Â°C (20.12Â°F).
- Engine speed is between 400-7, 500 RPM for 5 s.
- The high side driver is commanded ON.
- The engine speed is 550 RPM or greater in Drive 1-6 range.

Conditions for Setting the DTC

P0842

The Transmission Control Module detects that the Transmission Fluid Pressure Switch 1 signal voltage remains LOW after the 3-5-R clutch transitions from a HIGH pressure state to a LOW pressure state. The Transmission Control Module counts each incident. The DTC sets when 25 counts are accumulated.

P0843

The Transmission Control Module detects that the Transmission Fluid Pressure Switch 1 signal voltage remains HIGH after the 3-5-R clutch transitions from a LOW pressure state to a HIGH pressure state. The Transmission Control Module counts each incident. The DTC sets when 24 counts are accumulated.

Action Taken When the DTC Sets

- DTCs P0842 and P0843 are Type C DTCs.
- The Transmission Control Module freezes transmission adaptive functions for the 3-5-Reverse clutch.

Conditions for Clearing the DTC

DTCs P0842 and P0843 are Type C DTCs.

Diagnostic Aids

A Transmission Fluid Pressure Switch may malfunction due to normal debris in the transmission fluid causing a Transmission Fluid Pressure Switch DTC to intermittently set. This type of condition should not be immediately noticeable to a customer, as the switch outputs are used for shift adaptive pressure and do not cause transmission symptoms unless the switch malfunctions continuously for an extended period of time.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
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Description and Operation

- **Electronic Component Description**
- **Transmission General Description**
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Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**

- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tool Reference

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Engine idling in Park with parking brake applied, and drive wheels chocked.
2. Verify the scan tool Transmission Fluid Pressure Switch 1 parameter displays the correct values for each gear range while placing the gear select lever in Park, Reverse, and Neutral position. Refer to **Transmission Fluid Pressure Switch Logic** for the correct gear range states.
   - **If the correct states are not displayed**

     Refer to Circuit/System Testing.

   - **If the correct states are displayed**
3. Place the gear select lever in Drive range.
4. Verify the scan tool Transmission Fluid Pressure Switch 1 parameter displays the correct states when allowing the transmission to shift from 1 through 6 gears. Refer to **Transmission Fluid Pressure Switch Logic** for the correct gear range states.
   - **If the correct states are not displayed**

     Refer to Circuit/System Testing.

   - **If the correct states are displayed**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.

- **If the DTC sets**

  Refer to Circuit/System Testing.

- **If the DTC does not set**

7. All OK.

Circuit/System Testing

NOTE: **You must perform the Circuit/System Verification first.**

1. Ignition OFF. Remove the Q8 Control Solenoid Valve Assembly.
2. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
3. Connect the **DT-47825-10** jumper harness between the vehicle wire harness electrical connector and the Q8 control solenoid valve assembly electrical connector. Ignition ON.
4. Verify the scan tool parameters listed below change states when gently pushing on each Transmission Fluid Pressure Switch with the eraser end of a pencil.
   - Transmission Fluid Pressure Switch 1
   - Transmission Fluid Pressure Switch 3
   - Transmission Fluid Pressure Switch 4
   - Transmission Fluid Pressure Switch 5
   - **If any parameter does not change**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If all parameters change**
5. Verify the channel plate, spacer plate, and filter plate do not have a restricted or blocked orifice. Repair or replace as necessary.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Solenoid Valve and Transmission Control Module Assembly Replacement** .
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0850-P0852: PARK/NEUTRAL POSITION SWITCH

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0850

Park/Neutral Position Switch Circuit

DTC P0851

Park/Neutral Position Switch Circuit Low Voltage

DTC P0852

Park/Neutral Position Switch Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Park/Neutral Signal	P0850/P0851	P0850/P0852	P0850/P0852	-

Typical Scan Tool Data

PNP Switch

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Engine running, normal operating temperature, range selector in Park. **Parameter Normal Range:** 12 Volts = In-Gear, 0 Volts = Park/Neutral			
Park/Neutral Signal	Park/Neutral	In-Gear	In-Gear

Circuit/System Description

The transmission manual shift shaft switch assembly, also known as the internal mode switch, is a sliding contact switch attached to the manual shift shaft inside the transmission case. The park/neutral position switch is integrated into the internal mode switch and connects to the Transmission Control Module lead-frame through a short wire harness. The circuit uses the Transmission Control Module as a pass-through connector only.

The Park/Neutral Signal is sent from the park/neutral switch directly to the engine control module (ECM) and is used for engine start enable.

Conditions for Running the DTC

- Ignition voltage is between 11-18 volts.
- Engine Speed is 1000 RPM or greater.
- TP is 8 percent or greater.
- Engine torque is 75 N.m (55 lb ft) or greater.
- Vehicle speed is 10 km/h (6 mph) or greater.

Conditions for Setting the DTC

P0850 or P0851

The ECM detects the Park/Neutral switch signal equals 0 V, Low, when the IMS reports a Drive range.

P0852

The ECM detects the Park/Neutral switch signal equals 12 V, High, when the IMS reports a Park/Neutral range.

Action Taken When the DTC Sets

- DTC P0850, P0851, and P0852 are Type C DTCs.
- The ECM uses IMS Range for engine start-up.

Conditions for Clearing the DTC

DTC P0850, P0851, and P0852 are Type C DTCs.

Reference Information

Schematic Reference

- **Automatic Transmission Controls Schematics**

- **Engine Controls Schematics**

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**
- **Electronic Component Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Verify the range selector cable is adjusted correctly. Refer to **Range Selector Lever Cable Adjustment** .

- **If the cable adjustment is not OK**

  Adjust, repair or replace as necessary.

- **If the cable adjustment is OK**

2. Ignition ON.
3. Verify the scan tool Engine Control Module Park/Neutral Position Switch parameter displays Park/Neutral when in Park or Neutral and In-Gear when in Reverse or Drive Range.
   - **If Park/Neutral or In-Gear is not displayed**

     Refer to Circuit/System Testing.

   - **If Park/Neutral or In-Gear is displayed**
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
5. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
6. All OK.

Circuit/System Testing

NOTE: **You must perform Circuit/System Verification first.**

1. Ignition OFF, disconnect the X1 harness connector at the Q8 Control Solenoid Valve Assembly on the automatic transmission.
2. Install the **DT-47825-10** jumper harness to the X1 vehicle harness connector.
3. Test for less than 5 Ω between the ground circuit terminal 5 at the **DT-47825-10** jumper harness and ground at the transmission case.
   - **If 5 Ω or greater**

     1. Ignition OFF.
     2. Test for less than 2 Ω in the ground circuit from wire end to wire end.

     - If 2 Ω or greater, repair the open/high resistance in the circuit.

- If less than 2 Ω, repair the open/high resistance in the ground connection.
- **If less than 5 Ω**

4. Ignition ON.
5. Test for 11-13 V between the signal circuit terminal 3 at the **DT-47825-10** jumper harness and ground at the transmission case.
   - **If not between 11-13 V**
   1. Ignition OFF, disconnect the X1harness connector at the K20 Engine Control Module.
   2. Test for infinite resistance between the Park/Neutral signal circuit terminal 3 at the **DT-47825-10** jumper harness and ground at the transmission case.
      - If less than infinite resistance, repair the short to ground in the signal circuit.
      - If infinite resistance.
   3. Test for less than 2 Ω in the Park/Neutral signal circuit wire end to wire end.
   - If 2 Ω or greater, repair the open/high resistance in the signal circuit.
   - If less than 2 Ω, replace the K20 Engine Control Module.
   - **If between 11-13 V**
6. Ignition OFF, disconnect the **DT-47825-10** jumper harness from the X1 vehicle harness connector.
7. Connect the **DT-47825-10** jumper harness to the Q8 Control Solenoid Valve Assembly harness connector at the transmission case.
8. Remove the transmission fluid pan.
9. Disconnect the B15 Transmission Internal Mode Switch electrical connector from the Q8 Control Solenoid Valve Assembly.
10. Test for less than 2 Ω between the ground circuit terminal 5 and terminal A at the B15 Transmission Internal Mode Switch connector on the Q8 Control Solenoid Valve Assembly.
    - **If 2 Ω or greater**

      Replace the Q8 control solenoid valve assembly.

    - **If less than 2 Ω**
11. Ignition OFF.
12. Connect the **DT-47825-10** jumper harness to the X1 vehicle harness connector.
13. Ignition ON.
14. Test for 11-13 V between terminal F at the B15 Transmission Internal Mode Switch connector on the Q8 Control Solenoid Valve Assembly and ground at the transmission case.

- **If not between 11-13 V**

  Replace the Q8 control solenoid valve assembly.

- **If between 11-13 V**

15. Connect a 3 A fused jumper wire between terminal F at the B15 Transmission Internal Mode Switch on the Q8 Control Solenoid Valve Assembly and ground at the transmission case.
16. Verify the scan tool Engine Control Module Park/Neutral Position Switch parameter displays Park/Neutral.
    - **If Park/Neutral is not displayed**

      Replace the K20 Engine Control Module.

    - **If Park/Neutral is displayed**
17. Replace the B15 Transmission Internal Mode Switch.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- Refer to **Control Module References** for Control Solenoid Valve Assembly replacement, programming, and setup.

NOTE: **If the IMS switch has been replaced, inspect the valve body detent spring to be sure it is centered over the detent lever. This prevents the detent spring from hitting the IMS switch.**

- **Manual Shift Shaft Position Switch Replacement** for IMS replacement.

DTC P0872 OR P0873: TRANSMISSION FLUID PRESSURE SWITCH 3

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0872

Transmission Fluid Pressure Switch 3 Circuit Low Voltage

DTC P0873

Transmission Fluid Pressure Switch 3 Circuit High Voltage

Circuit/System Description

The Transmission Fluid Pressure Switch 3 is part of the control solenoid valve assembly which has no serviceable parts. The Transmission Control Module supplies a signal circuit to the Transmission Fluid Pressure Switch 3. The Transmission Fluid Pressure Switch 3 has an internal case ground. Transmission Fluid Pressure Switch 3 is normally closed or LOW. When oil pressure is present at the Transmission Fluid Pressure Switch 3, the switch is open or HIGH. The normally low clutch pressure control (PC) solenoid 4 controls pressure to the 2-6 clutch regulator valve. The Transmission Control Module monitors the Transmission Fluid Pressure Switch 3 to determine the position of the 2-6 clutch regulator valve. When the 2-6 clutch is commanded OFF, pressure is present on the Transmission Fluid Pressure Switch 3. When the 2-6 clutch is commanded ON, the 2-6 clutch regulator valve moves and pressure is exhausted through the 2-6 clutch regulator valve.

Conditions for Running the DTC

P0872 or P0873

- DTC P0711, P0712, P0713, P0716, P0717, P0722, P0723, P0751, P0742, P0756, P0757, P0973, P0974, P0976, P0977, P1915, or P182E is not set.
- Ignition voltage is between 8.6-32 V.
- The transmission fluid temperature is -6.6Â°C (20.12Â°F).
- Engine speed is between 400-7, 500 RPM for 5 s.
- The high side driver is commanded ON.
- The engine speed is 550 RPM or greater in Drive 1-6 range.

Conditions for Setting the DTC

P0872

The Transmission Control Module detects that the Transmission Fluid Pressure Switch 3 signal voltage remains LOW after the 2-6 clutch transitions from a HIGH pressure state to a LOW pressure state. The Transmission Control Module counts each incident. The DTC sets when 10 counts are accumulated.

P0873

The Transmission Control Module detects that the Transmission Fluid Pressure Switch 3 signal voltage remains HIGH after the 2-6 clutch transitions from a LOW pressure state to a HIGH pressure state. The Transmission Control Module counts each incident. The DTC sets when 15 counts are accumulated.

Action Taken When the DTC Sets

- DTCs P0872 and P0873 are Type C DTCs.
- The Transmission Control Module freezes transmission adaptive functions for the 2-6 clutch.

Conditions for Clearing the DTC

DTCs P0872 and P0873 are Type C DTCs.

Diagnostic Aids

A Transmission Fluid Pressure Switch may malfunction due to normal debris in the transmission fluid causing a Transmission Fluid Pressure Switch DTC to intermittently set. This type of condition should not be immediately noticeable to a customer, as the switch outputs are used for shift adaptive pressure and do not cause transmission symptoms unless the switch malfunctions continuously for an extended period of time.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Electronic Component Description**
- **Transmission General Description**
- **Transmission Component and System Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Engine idling in Park with parking brake applied, and drive wheels chocked.
2. Verify the scan tool Transmission Fluid Pressure Switch 3 parameter displays the correct values for each gear range while placing the gear select lever in Park, Reverse, and Neutral position. Refer to **Transmission Fluid Pressure Switch Logic** for the correct gear range states.
   - **If the correct states are not displayed**

     Refer to Circuit/System Testing.

   - **If the correct states are displayed**
3. Place the gear select lever in Drive range.
4. Verify the scan tool Transmission Fluid Pressure Switch 3 parameter displays the correct states when allowing the transmission to shift from 1 through 6 gears. Refer to **Transmission Fluid Pressure Switch Logic** for the correct gear range states.
   - **If the correct states are not displayed**

Refer to Circuit/System Testing.

- **If the correct states are displayed**

5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
7. All OK.

Circuit/System Testing

NOTE: **You must perform the Circuit/System Verification first.**

1. Ignition OFF. Remove the Q8 Control Solenoid Valve Assembly.
2. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
3. Connect the **DT-47825-10** jumper harness between the vehicle wire harness electrical connector and the Q8 Control Solenoid Valve Assembly electrical connector. Ignition ON.
4. Verify the scan tool parameters listed below change states when gently pushing on each Transmission Fluid Pressure Switch with the eraser end of a pencil.
   - Transmission Fluid Pressure Switch 1
   - Transmission Fluid Pressure Switch 3
   - Transmission Fluid Pressure Switch 4
   - Transmission Fluid Pressure Switch 5
   - **If any parameter does not change**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If all parameters change**
5. Verify the channel plate, spacer plate, and filter plate do not have a restricted or blocked orifice. Repair or replace as necessary.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Solenoid Valve and Transmission Control Module Assembly Replacement** .
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0877 OR P0878: TRANSMISSION FLUID PRESSURE SWITCH 4

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0877

Transmission Fluid Pressure Switch 4 Circuit Low Voltage

DTC P0878

Transmission Fluid Pressure Switch 4 Circuit High Voltage

Circuit/System Description

The Transmission Fluid Pressure Switch 4 is part of the control solenoid valve assembly which has no serviceable parts. The Transmission Control Module supplies a signal circuit to the Transmission Fluid Pressure Switch 4. The Transmission Fluid Pressure Switch 4 has an internal case ground. Transmission Fluid Pressure Switch 4 is normally closed or LOW. When oil pressure is present at the Transmission Fluid Pressure Switch 4, the switch is open or HIGH. The normally LOW pressure control solenoid 5 controls pressure to the 1-2-3-4 clutch regulator valve. The Transmission Control Module monitors the Transmission Fluid Pressure Switch 4 to determine the position of the 1-2-3-4 clutch regulator valve. When the 1-2-3-4 clutch is commanded OFF, pressure is present on the Transmission Fluid Pressure Switch 4. When the 1-2-3-4 clutch is commanded ON, the 1-2-3-4 clutch regulator valve moves and pressure to the Transmission Fluid Pressure Switch is exhausted through the 1-2-3-4 clutch regulator valve.

Conditions for Running the DTC

P0877 or P0878

- DTC P0711, P0712, P0713, P0716, P0717, P0722, P0723, P0751, P0742, P0756, P0757, P0973, P0974, P0976, P0977, P1915, or P182E is not set.
- Ignition voltage is between 8.6-32 V.
- The transmission fluid temperature is -6.6Â°C (20.12Â°F).
- Engine speed is between 400-7, 500 RPM for 5 s.
- The high side driver is commanded ON.
- The engine speed is 550 RPM or greater in Drive 1-6 range.

Conditions for Setting the DTC

P0877

The Transmission Control Module detects that the Transmission Fluid Pressure Switch 4 signal voltage remains LOW after the 1-2-3-4 clutch transitions from a HIGH pressure state to a LOW pressure state. The Transmission Control Module counts each incident. The DTC sets when 5 counts are accumulated.

P0878

The Transmission Control Module detects that the Transmission Fluid Pressure Switch 4 signal voltage remains HIGH after the 1-2-3-4 clutch transitions from a LOW pressure state to a HIGH pressure state. The Transmission Control Module counts each incident. The DTC sets when 6 counts are accumulated.

Action Taken When the DTC Sets

- DTCs P0877 and P0878 are Type C DTCs.
- The Transmission Control Module freezes transmission adaptive functions for the 1-2-3-4 clutch.

Conditions for Clearing the DTC

DTCs P0877 and P0878 are Type C DTCs.

Diagnostic Aids

A Transmission Fluid Pressure Switch may malfunction due to normal debris in the transmission fluid causing a Transmission Fluid Pressure Switch DTC to intermittently set. This type of condition should not be immediately noticeable to a customer, as the switch outputs are used for shift adaptive

pressure and do not cause transmission symptoms unless the switch malfunctions continuously for an extended period of time.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Electronic Component Description**
- **Transmission General Description**
- **Transmission Component and System Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Engine idling in Park with parking brake applied, and drive wheels chocked.
2. Verify the scan tool Transmission Fluid Pressure Switch 4 parameter displays the correct values for each gear range while placing the gear select lever in Park, Reverse, and Neutral position. Refer to **Transmission Fluid Pressure Switch Logic** for the correct gear range states.
   - **If the correct states are not displayed**

     Refer to Circuit/System Testing.

   - **If the correct states are displayed**
3. Place the gear select lever in Drive range.
4. Verify the scan tool Transmission Fluid Pressure Switch 4 parameter displays the correct states when allowing the transmission to shift from 1 through 6 gears. Refer to **Transmission Fluid Pressure Switch Logic** for the correct gear range states.
   - **If the correct states are not displayed**

     Refer to Circuit/System Testing.

   - **If the correct states are displayed**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
7. All OK.

Circuit/System Testing

NOTE: **You must perform the Circuit/System Verification first.**

1. Ignition OFF. Remove the Q8 Control Solenoid Valve Assembly.

2. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
3. Connect the **DT-47825-10** jumper harness between the vehicle wire harness electrical connector, and the Q8 Control Solenoid Valve Assembly electrical connector. Ignition ON.
4. Verify the scan tool parameters listed below change states when gently pushing on each Transmission Fluid Pressure Switch with the eraser end of a pencil.
   - Transmission Fluid Pressure Switch 1
   - Transmission Fluid Pressure Switch 3
   - Transmission Fluid Pressure Switch 4
   - Transmission Fluid Pressure Switch 5
   - **If any parameter does not change**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If all parameters change**
5. Verify the channel plate, spacer plate, and filter plate do not have a restricted or blocked orifice. Repair or replace as necessary.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Solenoid Valve and Transmission Control Module Assembly Replacement** .
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0961-P0963: LINE PRESSURE CONTROL SOLENOID VALVE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0961

Line Pressure Control Solenoid Valve Performance

DTC P0962

Line Pressure Control Solenoid Valve Control Circuit Low Voltage

DTC P0963

Line Pressure Control Solenoid Valve Control Circuit High Voltage

Circuit/System Description

The line pressure control solenoid is part of the control solenoid valve assembly which has no serviceable parts. The normally high line pressure control solenoid regulates and directs the pressure control solenoid oil pressure to the isolator/pressure regulator valve. Increasing pressure control solenoid line pressure increases transmission line pressure. The Transmission Control Module varies the current to the line pressure control solenoid through a low side driver. Decreasing the current to the line pressure control solenoid increases line pressure control solenoid oil pressure by closing OFF the solenoid exhaust port. Increasing the current to the line pressure control solenoid decreases line pressure control oil pressure by opening the solenoid exhaust port. Line pressure control solenoid power is supplied by the Transmission Control Module through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected the high side driver will reset.

Conditions for Running the DTC

P0961, P0962, or P0963

- The engine speed is between 400-7, 500 RPM for 5 s.
- The ignition voltage is between 8.6-32 V.

Conditions for Setting the DTC

P0961

The Transmission Control Module detects an internal electrical malfunction of the line pressure control solenoid where the measured line pressure control solenoid current does not equal the commanded line pressure control solenoid current for 5 s.

P0962

The Transmission Control Module detects a short to ground or an open/high resistance on the line pressure control solenoid control circuit for 2 s.

P0963

The Transmission Control Module detects a short to voltage on the line pressure control solenoid control circuit for 5 s.

Action Taken When the DTC Sets

P0961

- DTC P0961 is a Type B DTC.
- The TCM freezes transmission adaptive functions.
- The TCM commands maximum line pressure.

P0962

- DTC P0962 is a Type A DTC.
- The TCM turns the high side driver OFF.
- The TCM inhibits the torque converter clutch (TCC).
- The TCM commands maximum line pressure.
- The TCM freezes transmission adaptive functions.
- The TCM inhibits powertrain braking.
- The ECM/TCM request a reduction in engine torque based on input speed.
- The TCM inhibits Tap Up/Down function.
- The TCM inhibits manual shifting or forward gears.
- The TCM inhibits auto grade braking.
- The TCM inhibits neutral idle.

P0963

- DTC P0963 is a Type B DTC.
- The TCM freezes transmission adaptive functions.
- The TCM commands maximum line pressure.

Conditions for Clearing the DIC/DTC

- DTCs P0961 and P0963 are Type B DTCs.
- DTC P0962 is a Type A DTC.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**
- **Electronic Component Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Engine running in Park position, parking brake applied, place the gear select lever in each gear position for 2-3 s. Return the gear select lever to the Park position.
2. Verify the scan tool parameters listed below do not display Malfunction:
   - Line Pressure Control Solenoid Valve Performance Test Status
   - Line Pressure Control Solenoid Valve Control Circuit High Voltage Test Status
   - Line Pressure Control Solenoid Valve Control Circuit Low Voltage Test Status
   - **If Malfunction is displayed**

     Refer to Circuit/System Testing.

   - **If Malfunction is not displayed**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
5. All OK.

Circuit/System Testing

NOTE: **You must perform the Circuit/System Verification first.**

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
   - **If contaminated**

Clean as necessary.

- **If not contaminated**

3. Verify the resistance is within the specified range for each solenoid. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
   - **If resistance is not within range**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If resistance is within range**
4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect **DT-47825-10** jumper harness between the vehicle wire harness electrical connector and the Q8 Control Solenoid Valve Assembly electrical connector. Ignition ON.
6. Verify the scan tool the parameters listed below do not display Malfunction:
   - Line Pressure Control Solenoid Valve Performance Test Status
   - Line Pressure Control Solenoid Valve Control Circuit High Voltage Test Status
   - Line Pressure Control Solenoid Valve Control Circuit Low Voltage Test Status
   - **If Malfunction is displayed**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If Malfunction is not displayed**
7. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0965-P0967: PRESSURE CONTROL SOLENOID VALVE 2

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0965

Pressure Control Solenoid Valve 2 Performance

DTC P0966

Pressure Control Solenoid Valve 2 Control Circuit Low Voltage

DTC P0967

Pressure Control Solenoid Valve 2 Control Circuit High Voltage

Circuit/System Description

The pressure control solenoid 2 is part of the control solenoid valve assembly which has no serviceable parts. The normally high pressure control solenoid 2 regulates and directs the pressure control solenoid 2 oil pressure to the 3-5 reverse clutch regulator valve and 3-5 reverse clutch boost valve. Increasing pressure control solenoid 2 pressure increases pressure to the 3-5 reverse clutch. The Transmission Control Module varies the current to the pressure control solenoid 2 through a low side driver. Decreasing the current to the pressure control solenoid 2 increases pressure control solenoid 2 oil pressure by closing OFF the solenoid exhaust port. Increasing the current to the pressure control solenoid 2 decreases pressure control solenoid 2 oil pressure by opening the solenoid exhaust port. Pressure control solenoid 2 power is supplied by the Transmission Control Module through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected, the high side driver will reset.

Conditions for Running the DTC

- The ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.

Conditions for Setting the DTC

P0965

The Transmission Control Module detects an internal electrical performance malfunction of the clutch pressure control solenoid 2 control circuit where the measured clutch pressure control solenoid 2 current does not equal the commanded clutch pressure control solenoid 2 current for 5 s.

P0966

The Transmission Control Module detects a short to ground on the clutch pressure control solenoid 2 control circuit for 1 s.

P0967

The Transmission Control Module detects an open or short to voltage on the clutch pressure control solenoid 2 control circuit, for 1 s.

Action Taken When the DTC Sets

P0965

- DTC P0965 is a Type C DTC.
- The TCM freezes transmission adaptive functions on the 3-5 Reverse clutch.

P0966

- DTC P0966 is a Type A DTC.
- The TCM turns OFF the high side driver.
- The TCM forces TCC OFF.
- The TCM freezes transmission adaptive functions.
- The TCM commands maximum line pressure.
- The TCM enables Torque management.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits manual shifting of forward gears.
- The TCM limits the transmission to Reverse and 3rd or 5th gear operation.

P0967

- DTC P0967 is a Type A DTC.
- The TCM limits the transmission to 3rd gear or reverse gear operation.
- The TCM forces TCC OFF.

- The TCM freezes transmission adaptive functions.
- The TCM commands maximum line pressure.
- The TCM enables Torque management.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits manual shifting of forward gears.

Conditions for Clearing the DTC

- DTC P0965 is a Type C DTC.
- DTCs P0966 and P0967 are Type A DTCs.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

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- **Electronic Component Description**

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- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Operate the vehicle in drive range. Allow the vehicle to shift through all forward gear ranges.
2. Verify the scan tool parameters listed below do not display Malfunction
   - Pressure Control Solenoid Valve 2 Performance Test Status
   - Pressure Control Solenoid Valve 2 Control Circuit High Voltage Test Status
   - Pressure Control Solenoid Valve 2 Control Circuit Low Voltage Test Status
   - **If Malfunction is displayed**

     Refer to Circuit/System Testing.

   - **If Malfunction is not displayed**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
5. All OK.

Circuit/System Testing

NOTE: **You must perform the Circuit/System Verification first.**

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
   - **If contaminated**

     Clean as necessary

   - **If not contaminated**
3. Verify the resistance is within the specified range for each solenoid. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
   - **If resistance is not within range**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If resistance is within range**
4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect **DT-47825-10** jumper harness between the vehicle wire harness electrical connector and the Q8 Control Solenoid Valve Assembly electrical connector. Ignition ON.
6. Verify the scan tool parameters listed below do not display Malfunction:
   - Pressure Control Solenoid Valve 2 Performance Test Status
   - Pressure Control Solenoid Valve 2 Control Circuit High Voltage Test Status
   - Pressure Control Solenoid Valve 2 Control Circuit Low Voltage Test Status
   - **If Malfunction is displayed**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If Malfunction is not displayed**
7. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup

DTC P0969-P0971: PRESSURE CONTROL SOLENOID VALVE 3

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0969

Pressure Control Solenoid Valve 3 Performance

DTC P0970

Pressure Control Solenoid Valve 3 Control Circuit Low Voltage

DTC P0971

Pressure Control Solenoid Valve 3 Control Circuit High Voltage

Circuit/System Description

The pressure control solenoid 3 is part of the control solenoid valve assembly which has no serviceable parts. The normally high pressure control solenoid 3 regulates and directs the pressure control solenoid 3 oil pressure to the 4-5-6 clutch regulator valve and 4-5-6 clutch boost valve. Increasing pressure control solenoid 3 oil pressure increases oil pressure to the 4-5-6 clutch assembly. The Transmission Control Module varies the current to the pressure control solenoid 3 through a low side driver. Decreasing the current to the pressure control solenoid 3 increases pressure control solenoid 3 oil pressure by closing OFF the solenoid exhaust port. Increasing the current to the pressure control solenoid 3 decreases pressure control solenoid 3 oil pressure by opening the solenoid exhaust port. Pressure control solenoid 3 power is supplied by the Transmission Control Module through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected the high side driver will reset.

Conditions for Running the DTC

- The ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.

Conditions for Setting the DTC

P0969

The Transmission Control Module detects an internal electrical malfunction on the pressure control solenoid 3 control circuit where the measured pressure control solenoid 3 current does not equal the commanded clutch pressure control solenoid 3 current for 5 s.

P0970

The Transmission Control Module detects a short to ground on the pressure control solenoid 3 control circuit for 1 s.

P0971

The Transmission Control Module detects an open or short to voltage on the pressure control solenoid 3 control circuit for 1 s.

Action Taken When the DTC Sets

P0969

- DTC P0969 is a Type C DTCs.
- The TCM freezes transmission adaptive functions to the low and reverse clutch and 4-5-6 clutch.

P0970 and P0971

- DTC P0970 and P0971 are Type A DTCs.
- The TCM limits the transmission to Reverse and 3rd or 5th gear operation.
- The TCM turns the high side driver OFF.
- The TCM forces TCC OFF.
- The TCM freezes transmission adaptive functions.
- The TCM commands maximum line pressure.
- The TCM enables Torque management.

- The TCM inhibits TAP Up/Down function.
- The TCM inhibits manual shifting of forward gears.

Conditions for Clearing the DTC

- DTC P0969 is a Type C DTCs.
- DTCs P0970 and P0971 are Type A DTCs.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

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Description and Operation

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- **Transmission Component and System Description**
- **Electronic Component Description**

Electrical Information Reference

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- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Operate the vehicle in drive range. Allow the vehicle to shift through all forward gear ranges.
2. Verify the scan tool parameters listed below do not display Malfunction:
   - Pressure Control Solenoid Valve 3 Performance Test Status
   - Pressure Control Solenoid Valve 3 Control Circuit High Voltage Test Status
   - Pressure Control Solenoid Valve 3 Control Circuit Low Voltage Test Status
   - **If Malfunction is displayed**

     Refer to Circuit/System Testing.

   - **If Malfunction is not displayed**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
5. All OK.

Circuit/System Testing

NOTE: **You must perform the Circuit/System Verification first.**

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.

2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
    - **If contaminated**

      Clean as necessary

    - **If not contaminated**
3. Verify the resistance is within the specified range for each solenoid. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
    - **If resistance is not within range**

      Replace the Q8 Control Solenoid Valve Assembly.

    - **If resistance is within range**
4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect **DT-47825-10** jumper harness between the vehicle wire harness electrical connector and the Q8 Control Solenoid Valve Assembly electrical connector. Ignition ON.
6. Verify the scan tool parameters do not display Malfunction:
    - Pressure Control Solenoid Valve 3 Performance Test Status
    - Pressure Control Solenoid Valve 3 Control Circuit High Voltage Test Status
    - Pressure Control Solenoid Valve 3 Control Circuit Low Voltage Test Status
    - **If Malfunction is displayed**

      Replace the Q8 Control Solenoid Valve Assembly.

    - **If Malfunction is not displayed**
7. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0973 OR P0974: SHIFT SOLENOID VALVE 1 CONTROL

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0973

Shift Solenoid Valve 1 Control Circuit Low Voltage

DTC P0974

Shift Solenoid Valve 1 Control Circuit High Voltage

Circuit/System Description

The shift solenoid 1 is part of the control solenoid valve assembly which has no serviceable parts. The shift solenoid 1 is a normally closed ON/OFF solenoid and is controlled by the Transmission Control Module through a low side driver. When the shift solenoid 1 is energized, shift solenoid 1 fluid pressure is directed to the clutch select valve 2. Power to the shift solenoid 1 is supplied by the Transmission Control Module through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected, the high side driver will reset.

Conditions for Running the DTC

P0973 or P0974

- DTCs P0973 or P0974 is not set.
- The ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.

Conditions for Setting the DTC

P0973

The control solenoid valve assembly detects an internal low voltage electrical malfunction of the shift solenoid 1 control circuit when the shift solenoid 1 is commanded OFF for 2 seconds.

P0974

The control solenoid valve assembly detects an internal high voltage electrical malfunction of the shift solenoid 1 control circuit when the shift solenoid 1 is commanded ON for 2 seconds.

Action Taken When the DTC Sets

P0973

- DTC P0973 is a Type A DTC.
- The TCM forces the torque converter clutch (TCC) OFF.
- The TCM commands maximum line pressure.
- The TCM freezes transmission adaptive functions.
- The TCM enables Torque Management.
- The TCM inhibits TAP function.
- The TCM inhibits manual shifting of forward gears.
- The TCM inhibits Tow/Haul mode.
- The TCM inhibits neutral idle.
- The TCM commands neutral gear if the output speed sensor signal is 1350 RPM or greater.
- The TCM commands 2nd gear if the output speed sensor signal is less than 1350 RPM. No upshift allowed.

P0974

- DTC P0974 is a Type B DTC.
- The TCM inhibits 1st gear.
- The TCM inhibits neutral idle.

Conditions for Clearing the DIC/DTC

- DTC P0973 is a Type A DTC.
- DTC P0974 is a Type B DTC.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
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Electrical Information Reference

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- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Engine Running, place the gear selector in Reverse for 5 seconds and then idle the vehicle in Park for 5 seconds.
2. Verify the scan tool parameters listed below do not display Malfunction:
   - Shift Solenoid Valve 1 Control Circuit High Voltage Test Status
   - Shift Solenoid Valve 1 Control Circuit Open Test Status
   - Shift Solenoid Valve 1 Control Circuit Low Voltage Test Status
   - **If Malfunction is displayed**

     Refer to Circuit/System Testing.

   - **If Malfunction is not displayed**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
5. All OK.

Circuit/System Testing

NOTE: **You must perform the Circuit/System Verification first.**

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
   - **If contaminated**

     Clean as necessary.

   - **If not contaminated**
3. Verify the resistance is within the specified range for each solenoid. Refer to **Control Solenoid Valve and Transmission Control Module**

Assembly Inspection.

- **If resistance is not within range**

  Replace the Q8 Control Solenoid Valve Assembly.

- **If resistance is within range**

4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect **DT-47825-10** jumper harness between the vehicle wire harness electrical connector, and the Q8 Control Solenoid Valve Assembly electrical connector. Ignition ON.
6. Verify the scan tool parameters listed below do not display Malfunction:
   - Shift Solenoid Valve 1 Control Circuit High Voltage Test Status
   - Shift Solenoid Valve 1 Control Circuit Open Test Status
   - Shift Solenoid Valve 1 Control Circuit Low Voltage Test Status
   - **If Malfunction is displayed**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If Malfunction is not displayed**
7. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- Before replacing the TCM, perform the **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0976 OR P0977: SHIFT SOLENOID VALVE 2 CONTROL

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0976

Shift Solenoid Valve 2 Control Circuit Low Voltage

DTC P0977

Shift Solenoid Valve 2 Control Circuit High Voltage

Circuit/System Description

The shift solenoid 2 is part of the control solenoid valve assembly which has no serviceable parts. The shift solenoid 2 is a normally closed ON/OFF solenoid and is controlled by the Transmission Control Module through a low side driver. When the shift solenoid 2 is energized, shift solenoid 2 fluid pressure is directed to the clutch select valve 3. Power to the shift solenoid 2 is supplied by the Transmission Control Module through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected, the high side driver will reset.

Conditions for Running the DTC

P0976 or P0977

- DTCs P0976 or P0977 is not set.
- The ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.

Conditions for Setting the DTC

P0976

The Transmission Control Module detects an internal low voltage electrical malfunction of the shift solenoid 2 control circuit when the shift solenoid 2 is commanded OFF for 2 seconds.

P0977

The Transmission Control Module detects an internal high voltage electrical malfunction of the shift solenoid 2 control circuit when the shift solenoid 2 is commanded ON for 2 seconds.

Action Taken When the DTC Sets

P0976

- DTC P0976 is a Type C DTC.
- The TCM freezes transmission adaptive functions.

P0977

- DTC P0977 is a Type A DTC.
- The TCM freezes transmission adaptive functions.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits manual shifting of forward gears.
- The TCM commands maximum line pressure.
- The TCM inhibits powertrain braking.
- The TCM inhibits neutral idle.
- The TCM inhibits auto grade braking.
- The TCM inhibits Tow/Haul function.
- The TCM commands neutral gear if the output speed sensor signal is 1, 350 RPM or greater.
- The TCM commands 2nd gear if the output speed sensor signal is less than 1, 350 RPM. No upshift allowed.

Conditions for Clearing the DIC/DTC

- DTC P0976 is a Type C DTC.
- DTC P0977 is a Type A DTC.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

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- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Engine Running, place the gear selector in Reverse for 5 seconds and then idle the vehicle in Park for 5 seconds.
2. Verify the scan tool parameters listed below do not display Malfunction:
    - Shift Solenoid Valve 2 Control Circuit High Voltage Test Status
    - Shift Solenoid Valve 2 Control Circuit Open Test Status
    - Shift Solenoid Valve 2 Control Circuit Low Voltage Test Status
    - **If Malfunction is displayed**

Refer to Circuit/System Testing.

- **If Malfunction is not displayed**

3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
5. All OK.

Circuit/System Testing

NOTE: **You must perform the Circuit/System Verification first.**

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
   - **If contaminated**

     Clean as necessary.

   - **If not contaminated**
3. Verify the resistance is within the specified range for each solenoid. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
   - **If resistance is not within range**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If resistance is within range**
4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect **DT-47825-10** jumper harness between the vehicle wire harness electrical connector, and the Q8 Control Solenoid Valve Assembly electrical connector. Ignition ON.

6. Verify the scan tool parameters listed below do not display Malfunction:
    - Shift Solenoid Valve 2 Control Circuit High Voltage Test Status
    - Shift Solenoid Valve 2 Control Circuit Open Test Status
    - Shift Solenoid Valve 2 Control Circuit Low Voltage Test Status
    - **If Malfunction is displayed**

      Replace the Q8 Control Solenoid Valve Assembly.

    - **If Malfunction is not displayed**
7. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- Before replacing the TCM, perform the **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P0989 OR P0990: TRANSMISSION FLUID PRESSURE SWITCH 5

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0989

Transmission Fluid Pressure Switch 5 Circuit Low Voltage

DTC P0990

Transmission Fluid Pressure Switch 5 Circuit High Voltage

Circuit/System Description

The Transmission Fluid Pressure Switch 5 is part of the control solenoid valve assembly which has no serviceable parts. The Transmission Control Module supplies a signal circuit to the Transmission Fluid Pressure Switch 5. The Transmission Fluid Pressure Switch 5 has an internal case ground. Transmission Fluid Pressure Switch 5 is normally closed or LOW. When oil pressure is present at the Transmission Fluid Pressure Switch 5, the switch is open or HIGH. The normally high pressure control solenoid 3 controls pressure to the CBR1/4-5-6 clutch regular valve. The Transmission Control Module monitors the Transmission Fluid Pressure Switch 5 signal circuit to determine the position of the CBR1/4-5-6 clutch regulator valve. When the 4-5-6 clutch is commanded OFF, pressure is present on the Transmission Fluid Pressure Switch 5. When the 4-5-6 clutch is commanded ON, the CBR1/4-5-6 clutch regulator valve moves and pressure to the Transmission Fluid Pressure Switch 5 is exhausted through the CBR1/4-5-6 clutch regulator valve.

Conditions for Running the DTC

P0989 or P0990

- DTC P0711, P0712, P0713, P0716, P0717, P0722, P0723, P0751, P0742, P0756, P0757, P0973, P0974, P0976, P0977, P1915, or P182E is not set.
- The ignition voltage is between 8.6-32 V.
- The transmission fluid is -6.6Â°C (20.12Â°F) or greater.
- The engine speed is between 400-7, 500 RPM for 5 s.
- The high side driver is commanded ON.
- The engine speed is 550 RPM or greater in Drive 1-6 range.

Conditions for Setting the DTC

P0989

The Transmission Control Module detects that the Transmission Fluid Pressure Switch 5 signal voltage remains LOW after the 4-5-6 clutch transitions from a HIGH pressure state to a LOW pressure state. The Transmission Control Module counts each incident. The DTC sets when 18 counts are accumulated.

P0990

The Transmission Control Module detects that the Transmission Fluid Pressure Switch 5 signal voltage remains HIGH after the 4-5-6 clutch transitions from a LOW pressure state to a HIGH pressure state. The Transmission Control Module counts each incident. The DTC sets when 15 counts are accumulated.

Action Taken When the DTC Sets

- DTCs P0989 and P0990 are Type C DTCs.
- The Transmission Control Module freezes transmission adaptive functions for the 4-5-6 clutch.

Conditions for Clearing the DTC

DTCs P0989 and P0990 are Type C DTCs.

Diagnostic Aids

A Transmission Fluid Pressure Switch may malfunction due to normal debris in the transmission fluid causing a Transmission Fluid Pressure Switch DTC to intermittently set. This type of condition should not be immediately noticeable to a customer, as the switch outputs are used for shift adaptive pressure and do not cause transmission symptoms unless the switch malfunctions continuously for an extended period of time.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

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- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Engine idling in Park with parking brake applied, and drive wheels chocked.
2. Verify the scan tool Transmission Fluid Pressure Switch 5 parameter displays the correct values for each gear range while placing the gear select lever in Park, Reverse, and Neutral position. Refer to **Transmission Fluid Pressure Switch Logic** for the correct gear range states.
   - **If the correct states are not displayed**

     Refer to Circuit/System Testing.

   - **If the correct states are displayed**
3. Place the gear select lever in Drive range.
4. Verify the scan tool Transmission Fluid Pressure Switch 5 parameter displays the correct states when allowing the transmission to shift from 1 through 6 gears. Refer to **Transmission Fluid Pressure Switch Logic** for the correct gear range states.
   - **If the correct states are not displayed**

     Refer to Circuit/System Testing.

   - **If the correct states are displayed**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.

- **If the DTC sets**

  Refer to Circuit/System Testing.

- **If the DTC does not set**

7. All OK.

Circuit/System Testing

NOTE: **You must perform the Circuit/System Verification first.**

1. Ignition OFF. Remove the Q8 Control Solenoid Valve Assembly.
2. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
3. Connect the **DT-47825-10** jumper harness between the vehicle wire harness electrical connector and the Q8 Control Solenoid Valve Assembly electrical connector. Ignition ON.
4. Verify the scan tool parameters listed below change states when gently pushing on each Transmission Fluid Pressure Switch with the eraser end of a pencil.
   - Transmission Fluid Pressure Switch 1
   - Transmission Fluid Pressure Switch 3
   - Transmission Fluid Pressure Switch 4
   - Transmission Fluid Pressure Switch 5
   - **If any parameter does not change**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If all parameters change**
5. Verify the channel plate, spacer plate, and filter plate do not have a restricted or blocked orifice. Repair or replace as necessary.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Solenoid Valve and Transmission Control Module Assembly Replacement** .
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P1761: UP AND DOWN SHIFT SWITCH SIGNAL MESSAGE COUNTER INCORRECT

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC P1761

Up and Down Shift Switch Signal Message Counter Incorrect

Circuit/System Description

The driver shift request, also known as the TAP Up/Downshift manual shift function, allows the driver to select the desired range of gears for current driving conditions. The driver shift request shift system is activated when the gear selector is in the manual position. The driver shift request system is deactivated in all other range positions. When driver shift request is selected, a signal is sent to the Body Control Module and the also to the Transmission Control Module. Each time a signal is sent, an internal counter in the Body Control Module and Transmission Control Module increments. Both counters must have the same value. This code sets when the rolling count value of the Transmission Control Module does not match the same rolling count value sent from the Body Control Module.

Conditions for Running the DTC

The engine run time is greater than 5 s.

Conditions for Setting the DTC

The TCM detects an error in the rolling count value that does not match with the BCM.

Action Taken When the DTC Sets

- DTC P1761 is a Type C DTC.
- The TCM disables TAP Shift operation.

Conditions for Clearing the DTC

DTC P1761 is a Type C DTC.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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Description and Operation

Electronic Component Description

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE:

- **DTC P1761 is an informational DTC.**
- **Diagnose all other K9 Body Control Module DTCs prior to DTC P1761.**

1. Verify there are no other K9 Body Control Module or communication DTCs set.
   - **If a DTC is set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

- **If a DTC is not set**

2. Complete the diagnosis by looking for a CAN fault. Refer to **Scan Tool Does Not Communicate with High Speed GMLAN Device** .
   - **If a CAN circuit fault is found**

     Repair as necessary.

   - **If a CAN circuit fault is not found**
3. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup

DTC P1762: TRANSMISSION MODE SWITCH SIGNAL MESSAGE COUNTER INCORRECT

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC P1762

Transmission Mode Switch Signal Message Counter Incorrect

Circuit/System Description

The Body Control Module is constantly sending the Engine Control Module and Transmission Control Module serial data messages with information regarding transmission mode switch activation. The Transmission Control Module sets this code when it detects a discrepancy in the structure of the message causing the signal message integrity to be questioned.

Conditions for Running the DTC

- The engine speed is between 400-7, 500 RPM for 5 s.
- No other CAN errors are present.

Conditions for Setting the DTC

The TCM detects an error in the rolling count value that does not match with the BCM.

Action Taken When the DTC Sets

- DTC P1762 is a Type C DTC.
- The TCM inhibits TAP Shift operation.

Conditions for Clearing the DTC

DTC P1762 is a Type B DTC.

Reference Information

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Circuit/System Verification

NOTE:

- **DTC P1762 is an informational DTC.**
- **Diagnose all other K71 Transmission Control Module or K20 Engine Control Module DTCs prior to DTC P1762.**

1. Verify there are no other K71 Transmission Control Module or K20 Engine Control Module DTCs set.
   - **If a DTC is set**

     Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

   - **If a DTC is not set**
2. Complete the diagnosis by looking for a CAN fault. Refer to **Scan Tool Does Not Communicate with High Speed GMLAN Device** .

- **If a CAN circuit fault is found**

  Repair as necessary.

- **If a CAN circuit fault is not found**

3. All OK.

DTC P182E OR P1915: INTERNAL MODE SWITCH

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P182E

Internal Mode Switch Indicates - Invalid Range

DTC P1915

Internal Mode Switch Does Not Indicate Park/Neutral During Start

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal A	P182E	P1915	P1915	P182E, P1915
Signal B	P1915	P182E	P182E	P182E, P1915
Signal C	P1915	P182E	P182E	P182E, P1915
Signal P	P182E	P1915	P1915	P182E, P1915
Ground	-	P182E	P182E	P182E, P1915

Typical Scan Tool Data

IMS A/B/C/P

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON, range selector in Park			
Signal A	LOW	High	High
Signal B	LOW	High	High
Signal C	LOW	High	High
Signal P	LOW	High	High

Circuit/System Description

The manual shift detent lever with shaft position switch assembly or internal mode switch assembly is a sliding contact switch attached to the control valve body within the transmission. The 4 inputs to the Transmission Control Module from the switch indicate which position is selected by the transmission manual shaft. The input voltage at the Transmission Control Module is high when the switch is open and low when the switch is closed to ground. The state of each input is displayed on the scan tool. The input parameters represented are transmission range signal A, Signal B, signal C, and signal P.

The park/neutral position switch is integrated into the transmission internal mode switch. The circuit uses the Transmission Control Module as a pass-through connection only.

The park/neutral signal is sent from the park/neutral switch directly to the engine control module and is used only for engine start enable.

Conditions for Running the DTC

P182E

- DTCs: P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0401, P042E, P0716, P0717, P0722, P0723, P07C0, P07BF, P077C or P077D is not set.
- The engine speed is between 400-7, 500 RPM.
- The ignition voltage is between 8.6-32 V.
- Engine torque signal is valid.

P1915

- DTC P0722 or P0723 is not set.
- The transmission output shaft speed is less than 90 RPM.

- The ignition voltage is between 8.6-32 V.

Conditions for Setting the DTC

P182E

The IMS does not indicate a valid Park, Reverse, Neutral or Drive Range gear position for 7 seconds.

P1915

The manual shift shaft IMS switch assembly does not indicate Park or Neutral during the following sequence:

- The engine speed is less than 50 RPM for more than 1 second.
- The engine speed is 50-480 RPM for more than 1 second.
- The engine speed is greater than 525 RPM for more than 2 seconds.
- The transmission input shaft speed is 200 RPM or greater.

Action Taken When the DTC Sets

- DTCs P182E and P1915 are Type A DTCs.
- The TCM commands maximum line pressure.
- The TCM turns off the high side driver.
- The TCM freezes transmission adaptive functions.
- The TCM defaults the transmission to third gear if the current gear is 1st, 2nd, or 3rd; or fifth gear if the current gear is 4th, 5th, or 6th gear.
- The TCM inhibits TCC.
- The TCM inhibits Tap up and Tap down functions.

Conditions for Clearing the DTC

DTCs P182E and P1915 are Type A DTCs.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Description and Operation

- **Electronic Component Description**
- **Transmission General Description**
- **Transmission Component and System Description**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify DTC P0850, P0851 or P0852 is set.
    - **If any of the DTCs are set**

      Refer to **DTC P0850-P0852**.

    - **If none of the DTCs are set**
2. Verify the range selector cable is adjusted correctly. Refer to **Range Selector Lever Cable Adjustment** .
    - **If the cable adjustment is not OK**

Adjust, repair or replace as necessary.

- **If the cable adjustment is OK**

3. Ignition ON.
4. Verify the scan tool parameter matches the Transmission Internal Mode Switch Logic table for each gear position. Refer to **Transmission Internal Mode Switch Logic** .
   - **If the parameter does not match**

     Refer to Circuit/System Testing.

   - **If the parameter matches**
5. Verify the scan tool engine control module Park/Neutral Switch parameter displays Park/Neutral with the gear shift lever in Park or Neutral and In Gear when in Reverse or Drive.
   - **If Park/Neutral or In Gear is not displayed**

     Refer to Circuit/System Testing.

   - **If Park/Neutral or In Gear is displayed**
6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
7. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
8. All OK.

Circuit/System Testing

NOTE: **You must perform Circuit/System Verification first.**

1. Ignition OFF, remove the automatic transmission fluid pan. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement** .
2. Disconnect the B15 Transmission Internal Mode Switch connector at the Q8 Control Solenoid Valve Assembly. Ignition ON.
3. Verify the scan tool transmission control module Internal Mode Switch A/B/C/P parameter displays High High High High.

- **If High High High High is not displayed**

  Replace the Q8 Control solenoid Valve Assembly.

- **If High High High High is displayed**

4. Verify the scan tool Engine Control Module Park/Neutral Position Switch parameter displays In Gear.
   - **If In Gear is not displayed**
   1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
   2. Test for infinite resistance between the neutral start signal circuit and ground at the vehicle harness K20 Engine Control Module connector.
   - If less than infinite resistance, repair the short to ground on the circuit.
   - If infinite resistance, replace the K20 Engine Control Module.
   - **If In Gear is displayed**
5. Install a 3 A fused jumper wire between the low reference circuit terminal A and each signal circuit listed below one at a time at the Q8 Control Solenoid Valve Assembly:
   - Signal A - terminal E
   - Signal B - terminal D
   - Signal C - terminal C
   - Signal P - terminal B
6. Verify the scan tool Transmission Control Module A/B/C/P displays 1 Low and 3 High when a signal circuit is grounded.
   - **If 1 Low and 3 High is not displayed**

     Replace the Q8 control solenoid valve assembly.

   - **If 1 Low and 3 High is displayed**
7. Connect a 3 A fused jumper wire between Park/Neutral switch signal circuit terminal F and low reference circuit terminal A at the Q8 Control Solenoid Valve Assembly.
8. Verify the scan tool engine control module Park/Neutral Position Switch parameter displays Park/Neutral.
   - **If Park/Neutral is not displayed**
   1. Ignition OFF, disconnect the connector at the K20 Engine Control Module.
   2. Test for less than 2 Ω in the signal circuit wire end to wire end.

- If 2 Ω or greater, repair the open/high resistance in the wire circuit.
- If less than 2 Ω, replace the K20 Engine Control Module.

- **If Park/Neutral is displayed**

9. Replace the B15 Transmission Internal Mode Switch.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- Perform the **Control Solenoid Valve and Transmission Control Module Assembly Inspection** before replacing any internal transmission components.
- **Manual Shift Shaft Position Switch Replacement** for internal mode switch (IMS) replacement
- Refer to **Control Module References** for Control Solenoid Valve Assembly replacement, programming, and setup.

DTC P2714 OR P2715: PRESSURE CONTROL SOLENOID VALVE 4

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

NOTE: **The DTCs listed below set due to a transmission hydraulic/mechanical condition. Perform the Circuit/System Verification and Circuit/System Testing to identify the cause.**

DTC P2714

Pressure Control Solenoid Valve 4 - Stuck Off - Transmission Hydraulic/Mechanical Performance

DTC P2715

Pressure Control Solenoid Valve 4 - Stuck On - Transmission Hydraulic/Mechanical Performance

Circuit/System Description

The clutch pressure control solenoid 4 is part of the control solenoid valve assembly, which has no serviceable parts. The Clutch Pressure Control Solenoid 4 regulates transmission fluid pressure to the 2-6 clutch regulator valve which controls pressure to the 2-6 clutch. The Transmission Control Module calculates gear ratio based on the RPM signals from the input speed sensor (ISS) and the output speed sensor (OSS). The Transmission Control Module compares the expected transmission gear ratio to the calculated gear ratio for each commanded gear.

Conditions for Running the DTC

P2714

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- The ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.
- The transmission temperature is -6.6Â°C (20.12Â°F) or greater.
- The throttle position signal is valid.
- High side driver is enabled.
- The transmission output speed sensor signal is 67 RPM or greater or the accelerator pedal position sensor signal is 0.5 percent or greater.

P2715

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- The ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.
- The transmission temperature is -6.6Â°C (20.12Â°F) or greater.
- The throttle position signal is valid.
- High side driver is enabled.
- The transmission output speed sensor signal is 67 RPM or greater or the accelerator pedal position sensor signal is 0.5 percent or greater.

Conditions for Setting the DTC

P2714

The Transmission Control Module has detected an incorrect gear ratio or neutral condition when the 2-6 clutch is commanded ON. This condition

must occur 3 times.

P2715

The Transmission Control Module has detected an incorrect gear ratio change when the 2-6 clutch is commanded OFF during a shift or when 2nd gear ratio is detected in 1st gear. This condition must occur 3 times.

Action Taken When the DTC Sets

P2714

- DTC P2714 is a Type A DTC.
- The TCM commands maximum line pressure.
- The TCM inhibits Tow/Haul mode.
- The TCM freezes transmission adaptive functions.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits Manual Up/Down Shift with the shift selector.
- The TCM inhibits powertrain braking.
- The TCM inhibits neutral idle.
- The TCM inhibits Tow/Haul mode.
- The TCM limits the transmission to Reverse gear and 3rd gear operation.

P2715

- DTC P2715 is a Type A DTC.
- The TCM commands maximum line pressure.
- The TCM inhibits Tow/Haul mode.
- The TCM freezes transmission adaptive functions.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits Manual Up/Down Shift with the shift selector.
- The TCM inhibits powertrain braking.
- The TCM inhibits neutral idle.
- The TCM inhibits Tow/Haul mode.

- The TCM limits the transmission to neutral gear if the output speed sensor signal is 1, 350 RPM or greater.
- The TCM limits the transmission to 2nd gear if the output speed sensor signal is less than 1, 350 RPM. No upshift will occur.

Conditions for Clearing the DIC/DTC

DTCs P2714 and P2715 are Type A DTCs.

Diagnostic Aids

Before performing a road test, configure and setup the scan tool for snapshot mode. This will allow you to display, monitor, and verify multiple transmission data parameters at one time, after the road test.

Reference Information

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Description and Operation

- **Electronic Component Description**
- **Transmission General Description**
- **Transmission Component and System Description**
- **Park - Engine Running**
- **Reverse**
- **Neutral - Engine Running**
- **Drive Range, First Gear Engine Braking**

- **Drive Range, First Gear**
- **Drive Range, Second Gear**
- **Drive Range, Third Gear**
- **Drive Range, Third Gear Default**
- **Drive Range, Fourth Gear**
- **Drive Range, Fifth Gear**
- **Drive Range, Fifth Gear Default**
- **Drive Range, Sixth Gear**
- **Fluid Passages**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **DT-47825** Control Solenoid Test Plate
- **DT-47825-10** Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

NOTE: **If other DTCs are set, diagnose those DTCs first.**

1. Engine idling in Park position, with parking brake applied and drive wheels chocked.
2. Verify the transmission fluid level and condition is correct. Refer to **Transmission Fluid Level and Condition Check**.
   - **If the transmission fluid level and condition is not correct**

     Repair as necessary.

- **If the transmission fluid level and condition is correct**

3. Ignition ON, clear the TCM DTCs.
4. Verify the transmission operation performs as indicated in the road test instructions and DTCs P2714 or P2715 did not set. Refer to **Road Test**.
   - **If DTCs P2714 or P2715 are set**

     Refer to Circuit/System Testing.

   - **If DTCs P2714 or P2715 did not set**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
7. All OK.

Circuit/System Testing

1. Verify the transmission line pressures are within the specified ranges. Refer to **Line Pressure Check**.
   - **If pressures are not within range**

     Refer to **Fluid Pressure High or Low**.

   - **If pressures are within range**
2. Ignition OFF. Remove the Q8 Control Solenoid Valve Assembly.
3. Verify a pressure change occurs for all solenoids when performing the solenoid test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**.
   - **If a pressure change does not occur**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If a pressure change does occur**
4. Verify the conditions listed below do not exist. Carefully inspect each component for that condition. Repair or replace as necessary.

P2714 or P2715 - Control Valve Upper Body Assembly (304)

2-6 clutch regulator valve (334) stuck/sticky - debris, binding, damaged valve, or scored bore.

P2714 - Q8 Control Solenoid Valve Assembly (314)

Refer to document PIP 4304A. DTC P2714 may be set with DTC P0878.

P2714 or P2715 - Q8 Control Solenoid Valve Assembly (314)

- Control signal fluid supply leak-valve body filer plate assembly cracked or damage gasket seal.
- O-ring seals leaking.

P2714 or P2715 - Center (w/2-6 and Low/Rev Clutch) Support Assembly (67)

- 2-6 clutch return spring retaining ring (455) not seated in groove.
- 2-6 clutch piston assembly - seal damaged or leaking.
- 2-6 clutch plates (451-453) worn or damaged.
- Center support transfer seal assembly (20) incorrectly installed.

P2714 - 1-2-3-4 and 3-5-R Clutch Housing Assembly (51)

- 1-2-3-4 clutch backing plate retaining ring (429) not seated/oriented correctly.
- 1-2-3-4 clutch piston (414) - seals damaged or leaking.
- 1-2-3-4 clutch piston (414) - cracked or damaged.

P2714 - 4-5-6 (w/turbine shaft) Clutch Assembly (56)

- Turbine shaft fluid seal rings (442) damaged or leaking.
- 4-5-6 clutch piston assembly (439) - seals damaged or leaking.

P2714 - A/Trans Fluid Pump Cover Assembly (219)

Pump tower seals (230) damaged or leaking.

P2714 - Torque Converter (w/fluid pump) Housing Assembly (2)

Fluid pump housing/vanes/rotor/slide damaged/scored.

P2714 - A/Trans Fluid Filter Assembly (26)

Oil filter (26) or filter seal (25) loose or damaged.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P2719-P2721: PRESSURE CONTROL SOLENOID 4

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P2719

Pressure Control Solenoid 4 System Performance

DTC P2720

Pressure Control Solenoid 4 Control Circuit Low Voltage

DTC P2721

Pressure Control Solenoid 4 Control Circuit High Voltage

Circuit/System Description

The pressure control solenoid 4 is part of the control solenoid valve assembly which has no serviceable parts. The normally low pressure control solenoid 4 regulates and directs oil pressure to the 2-6 clutch regulator valve. Increasing pressure control solenoid 4 pressure increases pressure to the

2-6 clutch regulator valve. The Transmission Control Module varies the current to the pressure control solenoid 4 through a low side driver. Increasing the current to pressure control solenoid 4 increases oil pressure by closing OFF the solenoid exhaust port. Decreasing the current to pressure control solenoid 4 decreases oil pressure by opening the exhaust port. Pressure control solenoid 4 power is supplied by the Transmission Control Module through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected the high side driver will reset.

Conditions for Running the DTC

P2719, P2720, or P2721

- DTC P2719, P2720, or P2721 is not set.
- The ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.
- The clutch PC solenoid 4 is commanded ON.

Conditions for Setting the DTC

P2719

The Transmission Control Module detects an internal electrical malfunction on the pressure control solenoid 4 control circuit where the measured pressure control solenoid 4 current does not equal the commanded pressure control solenoid 4 current for 5 s.

P2720

The Transmission Control Module detects a short to ground on the pressure control solenoid 4 control circuit for 1 s.

P2721

The Transmission Control Module detects an open or short to voltage on the pressure control solenoid 4 control circuit for 1 s.

Action Taken When the DTC Sets

P2719

- DTC P2719 is a Type C DTC.
- The TCM freezes transmission adaptive functions.

P2720

- DTC P2720 is a Type A DTC.
- The TCM freezes transmission adaptive functions.
- The TCM commands maximum line pressure.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits manual shifting of forward gears.
- The TCM inhibits engine braking.
- The TCM inhibits neutral idle.
- The TCM inhibits auto grade braking.
- The TCM inhibits Tow/Haul function.
- The TCM commands neutral gear when the output speed sensor signal is 1, 350 RPM or greater.
- The TCM commands second gear when the output speed sensor signal is less than 1, 350 RPM.

P2721

- DTC P2721 is a Type A DTC.
- The TCM freezes transmission adaptive functions.
- The TCM commands maximum line pressure.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits manual shifting of forward gears.
- The TCM inhibits engine braking.
- The TCM inhibits neutral idle.
- The TCM inhibits auto grade braking.
- The TCM inhibits Tow/Haul function.
- The TCM commands 3rd gear.

Conditions for Clearing the DTC

- DTC P2719 is a Type C DTC.
- DTCs P2720 and P2721 are Type A DTCs.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**
- **Electronic Component Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Operate the vehicle in drive range. Allow the vehicle to shift through all forward gear ranges.
2. Verify the scan tool parameters listed below do not display Malfunction:
   - Pressure Control Solenoid Valve 4 Performance Test Status
   - Pressure Control Solenoid Valve 4 Control Circuit High Voltage Test Status
   - Pressure Control Solenoid Valve 4 Control Circuit Low Voltage Test Status
   - **If Malfunction is displayed**

     Refer to Circuit/System Testing.

   - **If Malfunction is not displayed**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
5. All OK.

Circuit/System Testing

NOTE: **You must perform the Circuit/System Verification first.**

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
   - **If contaminated**

     Clean as necessary.

   - **If not contaminated**
3. Verify the resistance is within the specified range for each solenoid. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.

- **If resistance is not within range**

  Replace the Q8 Control Solenoid Valve Assembly.

- **If resistance is within range**

4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect **DT-47825-10** jumper harness between the vehicle wire harness electrical connector and the Q8 Control Solenoid Valve Assembly electrical connector. Ignition ON.
6. Verify the scan tool parameters do not display Malfunction:
   - Pressure Control Solenoid Valve 4 Performance Test Status
   - Pressure Control Solenoid Valve 4 Control Circuit High Voltage Test Status
   - Pressure Control Solenoid Valve 4 Control Circuit Low Voltage Test Status
   - **If Malfunction is displayed**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If Malfunction is not displayed**
7. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P2723 OR P2724: PRESSURE CONTROL SOLENOID VALVE 5

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

NOTE: **The DTCs listed below set due to a transmission hydraulic/mechanical condition. Perform the Circuit/System Verification and Circuit/System Testing to identify the cause.**

DTC P2723

Pressure Control Solenoid Valve 5 - Stuck Off - Transmission Hydraulic/Mechanical Performance

DTC P2724

Pressure Control Solenoid Valve 5 - Stuck On - Transmission Hydraulic/Mechanical Performance

Circuit/System Description

The clutch pressure control solenoid 5 is part of the control solenoid valve assembly, which has no serviceable parts. The Clutch Pressure Control Solenoid 5 regulates transmission fluid pressure to the 1-2-3-4 clutch regulator valve which controls pressure to the 1-2-3-4 clutch. The Transmission Control Module calculates gear ratio based on the RPM signals from the input speed sensor (ISS) and the output speed sensor (OSS). The Transmission Control Module compares the expected transmission gear ratio to the calculated gear ratio for each commanded gear.

Conditions for Running the DTC

P2723

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- The ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.
- The transmission temperature is -6.6Â°C (20.12Â°F) or greater.
- The throttle position signal is valid.
- High side driver is enabled.
- The transmission output speed sensor signal is 67 RPM or greater or the accelerator pedal position sensor signal is 0.5 percent or greater.

P2724

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- The ignition voltage is between 8.6-32 V.

- The engine speed is between 400-7, 500 RPM for 5 s.
- The transmission temperature is -6.6Â°C (20.12Â°F) or greater.
- The throttle position signal is valid.
- High side driver is enabled.
- The transmission output speed sensor signal is 67 RPM or greater or the accelerator pedal position sensor signal is 0.5 percent or greater.

Conditions for Setting the DTC

P2723

The Transmission Control Module has detected an incorrect gear ratio or neutral condition when the 1-2-3-4 clutch is commanded ON. This condition must occur 3 times.

P2724

The Transmission Control Module has detected an incorrect gear ratio change when the 1-2-3-4 clutch is commanded OFF during a shift. This condition must occur 3 times.

Action Taken When the DTC Sets

P2723

- DTC P2723 is a Type A DTC.
- The TCM commands maximum line pressure.
- The TCM inhibits Tow/Haul mode.
- The TCM freezes transmission adaptive functions.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits Manual Up/Down Shift with the shift selector.
- The TCM inhibits powertrain braking.
- The ECM/TCM request a reduced amount of engine torque based on transmission input speed.
- The TCM inhibits neutral idle.
- The TCM inhibits auto grade braking.
- The TCM limits the transmission to Reverse gear and 5th gear operation.

P2724

- DTC P2724 is a Type A DTC.
- The TCM commands maximum line pressure.
- The TCM freezes transmission adaptive functions.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits Manual Up/Down Shift with the shift selector.
- The TCM inhibits powertrain braking.
- The TCM inhibits neutral idle.
- The TCM inhibits auto grade braking.
- The TCM inhibits Tow/Haul function.
- The TCM limits the transmission to 4th gear if the output speed sensor signal is 1, 400 RPM or greater.
- The TCM limits the transmission to 2nd gear if the output speed sensor signal is less than 1, 400 RPM. No upshift will occur.

Conditions for Clearing the DIC/DTC

DTCs P2723 and P2724 are Type A DTCs.

Diagnostic Aids

Before performing a road test, configure and setup the scan tool for snapshot mode. This will allow you to display, monitor, and verify multiple transmission data parameters at one time, after the road test.

Reference Information

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**

- **Wiring Repairs**

Description and Operation

- **Electronic Component Description**
- **Transmission General Description**
- **Transmission Component and System Description**
- **Park - Engine Running**
- **Reverse**
- **Neutral - Engine Running**
- **Drive Range, First Gear Engine Braking**
- **Drive Range, First Gear**
- **Drive Range, Second Gear**
- **Drive Range, Third Gear**
- **Drive Range, Third Gear Default**
- **Drive Range, Fourth Gear**
- **Drive Range, Fifth Gear**
- **Drive Range, Fifth Gear Default**
- **Drive Range, Sixth Gear**
- **Fluid Passages**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **DT-47825** Control Solenoid Test Plate
- **DT-47825-10** Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

NOTE: **If other DTCs are set, diagnose those DTCs first.**

1. Engine idling in Park position, with parking brake applied and drive wheels chocked.
2. Verify the transmission fluid level and condition is correct. Refer to **Transmission Fluid Level and Condition Check**.
   - **If the transmission fluid level and condition is not correct**

     Repair as necessary.

   - **If the transmission fluid level and condition is correct**
3. Ignition ON, clear the Transmission Control Module DTCs with a scan tool.
4. Verify the transmission operation performs as indicated in the road test instructions and DTCs P2723 or P2724 did not set. Refer to **Road Test**.
   - **If DTCs P2723 or P2724 are set**

     Refer to Circuit/System Testing.

   - **If DTCs P2723 or P2724 did not set**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
7. All OK.

Circuit/System Testing

1. Verify the transmission line pressures are within the specified ranges. Refer to **Line Pressure Check**.
   - **If pressures are not within range**

Refer to **Fluid Pressure High or Low**.

- **If pressures are within range**

2. Ignition OFF. Remove the Q8 Control Solenoid Valve Assembly.
3. Verify a pressure change occurs for each solenoid when performing the solenoid test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**.
   - **If a pressure change does not occur**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If a pressure does occur**
4. Verify the conditions listed below do not exist. Carefully inspect each component for that condition. Repair or replace as necessary.

P2723 or P2724 - Control Valve Upper Body Assembly (304)

1-2-3-4 Clutch Regulator Valve (337) stuck/sticking - debris, binding, damaged valve, or scored bore.

P2723 - Q8 Control Solenoid Valve Assembly (314)

Refer to document PIP 4304A. DTC P2723 may be set with DTC P0878.

P2723 or P2724 - Q8 Control Solenoid Valve Assembly (314)

- O-ring seal leaking.
- Valve body filter plate assembly cracked, blocked, or damaged gasket seal.

P2723 - Control Valve Upper Lower Assembly (351)

Clutch Select Valve 3 (352) stuck/sticking - debris, binding, damaged valve, or scored bore.

P2723 - A/Trans Fluid Pump Cover Assembly (219)

Pump Tower Seals (230) damaged/leaking.

P2723 - 1-2-3-4 and 3-5-R Clutch Housing Assembly (51)

- 1-2-3-4 Clutch Piston (414) cracked/damaged/leaking.

- Housing/hub weld cracked/leaking.
- 1-2-3-4 Clutch Backing Plate Retaining Ring (429) not seated/oriented, causing clutch pack/piston over travel.

P2723 - Control (with body and valve) Valve Assembly (21)

Valve Body to Pump Transfer Seal Assembly (19) damaged/leaking.

P2723 - Torque Converter (w/Fluid Pump) Housing Assembly (2)

- Fluid pump housing vanes/rotor/slide damaged/scored.
- Fluid pump or torque converter overstressed due to high temperatures.

P2723 - Automatic Transmission Fluid Filter Assembly (26)

Oil filter (26) or filter seal (25) loose or damaged.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P2728-P2730: PRESSURE CONTROL (PC) SOLENOID VALVE 5

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P2728

Pressure Control (PC) Solenoid Valve 5 Performance

DTC P2729

Pressure Control (PC) Solenoid Valve 5 Control Circuit Low Voltage

DTC P2730

Pressure Control (PC) Solenoid Valve 5 Control Circuit High Voltage

Circuit/System Description

The pressure control solenoid 5 is part of the control solenoid valve assembly which has no serviceable parts. The normally low pressure control solenoid 5 regulates and directs oil pressure to the 1-2-3-4 clutch regulator valve and 1-2-3-4 clutch boost valve. Increasing pressure control solenoid 5 pressure increases pressure to the 1-2-3-4 clutch. The Transmission Control Module varies the current to the pressure control solenoid 5 through a low side driver. Increasing the current to pressure control solenoid 5 increases oil pressure by closing OFF the solenoid exhaust port. Decreasing the current to pressure control solenoid 5 decreases oil pressure by opening the exhaust port. Pressure control solenoid 5 power is supplied by the Transmission Control Module through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected, the high side driver will reset.

Conditions for Running the DTC

P2728, P2729, or P2730

- DTCs P2728, P2729, or P2730 is not set.
- The ignition voltage is between 8.6-32 V.
- The engine speed is between 400-7, 500 RPM for 5 s.
- The pressure control solenoid valve 5 is commanded ON.

Conditions for Setting the DTC

P2728

The Transmission Control Module detects an internal electrical performance malfunction of the clutch pressure control solenoid valve 5 control circuit where the measured clutch pressure control solenoid valve 5 current does not equal the commanded clutch pressure control solenoid valve 5 current for 5 s.

P2729

The Transmission Control Module detects a short to ground on the clutch pressure control solenoid valve 5 control circuit for 1 s.

P2730

The Transmission Control Module detects an open or short to voltage on the clutch pressure control solenoid valve 5 control circuit for 1 s.

Action Taken When the DTC Sets

P2728

- DTC P2728 is a Type C DTC.
- The TCM freezes transmission adaptive functions.

P2729

- DTC P2729 is a Type A DTC.
- The TCM freezes transmission adaptive functions.
- The TCM commands maximum line pressure.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits engine braking.
- The TCM inhibits neutral idle.
- The TCM cancels Tow/Haul mode function.
- The TCM inhibits auto grade braking.
- The TCM commands neutral gear if output speed sensor signal is 1, 350 RPM or greater.
- The TCM commands 2nd gear if output speed sensor signal is less than 1, 350 RPM.

P2730

- DTC P2730 is a Type A DTC.
- The TCM forces TCC OFF.
- The TCM commands maximum line pressure.
- The TCM inhibits TAP Up/Down function.
- The TCM turns OFF the high side driver.
- The TCM inhibits engine braking.
- The ECM commands a reduction in engine torque based on input form the speed sensor.
- The TCM inhibits neutral idle.
- The TCM inhibits manual shifting.

- The TCM inhibits auto grade braking.
- The TCM inhibits Tow/Haul function.

Conditions for Clearing the DTC

- DTC P2728 is a Type C DTC.
- DTCs P2729 and P2730 are Type A DTCs.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**
- **Electronic Component Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Operate the vehicle in drive range. Allow the transmission to shift through all forward gear ranges.
2. Verify the scan tool parameters listed below do not display Malfunction:
   - Pressure Control Solenoid Valve 5 Performance Test Status
   - Pressure Control Solenoid Valve 5 Control Circuit High Voltage Test Status
   - Pressure Control Solenoid Valve 5 Control Circuit Low Voltage Test Status
   - **If Malfunction is displayed**

     Refer to Circuit/System Testing.

   - **If Malfunction is not displayed**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
5. All OK.

Circuit/System Testing

NOTE: **You must perform the Circuit/System Verification first.**

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.

2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
    - **If contaminated**

      Clean as necessary.

    - **If not contaminated**
3. Verify the resistance is within the specified range for each solenoid. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
    - **If resistance is not within range**

      Replace the Q8 Control Solenoid Valve Assembly

    - **If resistance is within range**
4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect **DT-47825-10** jumper harness between the vehicle wire harness electrical connector and the Q8 Control Solenoid Valve Assembly electrical connector. Ignition ON.
6. Verify the scan tool parameters listed below do not display Malfunction:
    - Pressure Control Solenoid Valve 5 Performance Test Status
    - Pressure Control Solenoid Valve 5 Control Circuit High Voltage Test Status
    - Pressure Control Solenoid Valve 5 Control Circuit Low Voltage Test Status
    - **If Malfunction is displayed**

      Replace the Q8 Control Solenoid Valve Assembly.

    - **If Malfunction is not displayed**
7. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P2762, P2763, OR P2764: TORQUE CONVERTER CLUTCH (TCC) PRESSURE CONTROL SOLENOID VALVE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P2762

Torque Converter Clutch (TCC) Pressure Control Solenoid Valve Performance

DTC P2763

Torque Converter Clutch (TCC) Pressure Control Solenoid Valve Control Circuit High Voltage

DTC P2764

Torque Converter Clutch (TCC) Pressure Control Solenoid Valve Control Circuit Low Voltage

Circuit/System Description

The torque converter clutch (TCC) pressure control solenoid is part of the control solenoid valve assembly which has no serviceable parts. The normally low TCC pressure control solenoid regulates oil pressure to the TCC regulator valve and TCC control valve. Increasing TCC pressure control solenoid oil pressure increases oil pressure to the torque converter to apply the clutch. The Transmission Control Module varies the current to the TCC pressure control solenoid through a low side driver. Increasing current to the TCC pressure control solenoid increase oil pressure by closing OFF the solenoid exhaust port. Decreasing current to the TCC pressure control solenoid decreases oil pressure by opening up the solenoid exhaust port. The TCC pressure control solenoid power is supplied by the Transmission Control Module through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected, the high side driver will reset.

Conditions for Running the DTC

P2762

- DTC P2762 is not set.

- The engine speed is between 400-7, 500 RPM for 5 s.
- The ignition voltage is between 8.6-32 V.

P2763

- DTCs P2763, P0658, or P0659 is not set.
- The engine speed is between 400-7, 500 RPM for 5 s.
- The ignition voltage is between 8.6-32 V.
- The high side driver is enabled.

P2764

- DTC P2764, P0658, or P0659 is not set.
- The engine speed is between 400-7, 500 RPM for 5 s.
- The ignition voltage is between 8.6-32 V.
- The high side driver is enabled.

Conditions for Setting the DTC

P2762

The Transmission Control Module detects an internal electrical performance malfunction of the TCC pressure control solenoid control circuit where the measured TCC pressure control solenoid current does not equal the commanded TCC pressure control solenoid current for 5 s.

P2763

The Transmission Control Module detects an open/high resistance or short to voltage on the TCC pressure control solenoid control circuit for 5 s.

P2764

The Transmission Control Module detects a short to ground on the TCC pressure control solenoid control circuit for 1 min.

Action Taken When the DTC Sets

P2762

DTC P2762 is a Type C DTC.

P2763

- DTC P2763 is a Type B DTC.
- The TCM inhibits TCC.
- The TCM commands maximum line pressure.
- The TCM freezes transmission adaptive functions.
- The TCM enables Torque management.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits manual shifting of forward gears.
- The TCM inhibits 6th gear in hot mode operation.

P2764

- DTC P2764 is a Type A DTC.
- The TCM turns off the high side driver.
- The TCM inhibits TCC.
- The TCM freezes transmission adaptive functions.
- The TCM commands maximum line pressure.
- The TCM inhibits TAP Up/Down function.
- The TCM inhibits Manual Up/Down Shift with the shift selector.
- The TCM inhibits neutral idle.
- The ECM reduces engine torque based on input speed.

Conditions for Clearing the DIC/DTC

- DTC P2762 is a Type C DTC.
- DTC P2763 is a Type B DTC.
- DTC P2764 is a Type A DTC.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**
- **Electronic Component Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Operate the vehicle in drive range and ensure TCC is commanded ON for 1 minute.

2. Verify the scan tool parameters listed below do not display Malfunction:
   - TCC Pressure Control Solenoid Valve Performance Test Status
   - TCC Pressure Control Solenoid Valve Control Circuit High Voltage Test Status
   - TCC Pressure Control Solenoid Valve Control Circuit Low Voltage Test Status
   - **If Malfunction is displayed**

     Refer to Circuit/System Testing.

   - **If Malfunction is not displayed**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
   - **If the DTC sets**

     Refer to Circuit/System Testing.

   - **If the DTC does not set**
5. All OK.

Circuit/System Testing

NOTE: **You must perform the Circuit/System Verification first.**

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
   - **If contaminated**

     Clean as necessary.

   - **If not contaminated**
3. Verify the resistance is within the specified range for each solenoid. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
   - **If resistance is not within range**

Replace the Q8 Control Solenoid Valve Assembly.

- **If resistance is within range**

4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect **DT-47825-10** jumper harness between the vehicle wire harness electrical connector and the Q8 Control Solenoid Valve Assembly electrical connector. Ignition ON.
6. Verify the scan tool parameters do not display Malfunction:
   - TCC Pressure Control Solenoid Valve Performance Test Status
   - TCC Pressure Control Solenoid Valve Control Circuit High Voltage Test Status
   - TCC Pressure Control Solenoid Valve Control Circuit Low Voltage Test Status
   - **If Malfunction is displayed**

     Replace the Q8 Control Solenoid Valve Assembly.

   - **If Malfunction is not displayed**
7. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission related repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P2771: FOUR WHEEL DRIVE (4WD) SWITCH CIRCUIT (NQF, NQH)

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC P2771

Four Wheel Drive (4WD) Switch Circuit

Circuit/System Description

On vehicles equipped with 4 wheel drive, the output speed sensor is on the transfer case. The instrument panel mounted transfer case shift control switch consist of a 2HI position, 4HI and 4 Low. The transfer case shift control module continuously monitors the signal to determine the position selected by the vehicle operator. The transfer case shift control module sends the status of the transfer case range out on the serial data line to other control modules. The transmission control module (TCM) monitors the status of the transfer range. When the transfer case is in the 4 Low range, the TCM multiples the transfer case output shaft speed by the transfer case ratio in 4 Low to determine the transmission output shaft speed. The TCM uses this information to provide earlier upshifts and also to prevent an over-speed condition in 4 Low.

Conditions for Running the DTC

- The engine speed is greater than 200 RPM.
- The transmission output speed is greater than 60 RPM.
- The transmission fluid temperature is between 20Â°C (68Â°F) and 130Â°C (266Â°F).
- Shift is complete and range attained is not neutral.
- DTC P0721, P0722, or P2771 is not set.

Conditions for Setting the DTC

Condition 1

Transfer case four wheel drive switch indicates high range and the calculated transfer case range is low for 5 seconds.

Condition 2

Transfer case four wheel drive switch indicates low range and the calculated transfer case range is high for 5 seconds.

Action Taken When the DTC Sets

- DTC P2771 is a Type B DTC.
- The TCM detects four wheel drive high and low range with calculated speed ratios.

Conditions for Clearing the DTC

DTC P2771 is a Type B DTC.

Reference Information

Schematic Reference

- For RP0 = NP0: **Transfer Case Control Schematics**
- For RP0 = NQH: **Transfer Case Control Schematics**
- **Automatic Transmission Controls Schematics**

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, transmission in Neutral, place the transfer case shift control switch in the 2 HI position.
2. Verify the 2 high indicator light on the switch is ON and not flashing.
    - **If the 2 high indicator light is flashing or is not ON**

      Refer to Circuit/System Testing.

    - **If 2 high indicator light is ON and not flashing**

3. Verify the scan tool TCM 4WD Low parameter displays Disabled.
    - **If Disabled is not displayed**

      Refer to Circuit/System Testing.

    - **If Disabled is displayed**
4. Place the transfer case shift control switch in the 4 Low position.
5. Verify the 4WD low indicator light is ON and not flashing.
    - **If the 4WD low indicator light is flashing or is not ON**

      Refer to Circuit/System Testing.

    - **If the 4WD low indicator light is ON and not flashing**
6. Operate the vehicle within the Conditions for Running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
7. Verify the DTC does not set.
    - **If the DTC sets**

      Refer to Circuit/System Testing.

    - **If the DTC does not set**
8. All OK.

Circuit/System Testing

1. Verify no other DTCs are set.
    - **If other DTCs are set**

      Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

    - **If no other DTCs are set**
2. Refer to **Symptoms - Transfer Case**

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for Transmission Control Module replacement, setup, and programming

SYMPTOMS - AUTOMATIC TRANSMISSION

IMPORTANT:

Use the symptom tables only if the following conditions are met:

- Refer to **Diagnostic Starting Point - Vehicle** .
- There are no DTCs set.
- The control modules can communicate via the serial data link.
- Review the system operation in order to familiarize yourself with the system functions. Refer to **Transmission General Description** , and **Transmission Component and System Description** .

Visual/Physical Inspection

Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** .

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- Fluid Diagnosis
  - **Transmission Fluid Level and Condition Check**
  - **Fluid Pressure High or Low**
  - **Automatic Transmission Fluid Leaks**
  - **Fluid Leak Diagnosis**
- Noise and Vibration Diagnosis
  - **Whine/Growl Noise That Changes with Vehicle Speed**
  - **Whine/Growl Noise That Changes with Vehicle Speed**
  - **Noise in First or Reverse Gear**

    - Noise in First, Second, Third, Fourth, Fifth, or Reverse Gear
    - Noise in First, Second, Sixth, or Reverse Gear
    - Noise in Second or Sixth Gear
    - Noise During 3-4 or 4-3 Shifts
    - Noise in Fourth, Fifth, or Sixth Gear
    - Vibration
    - Flex Plate/Torque Converter Vibration Test
    - Noise and Vibration Analysis
- Range Performance Diagnosis
    - No Park or Drive
    - No Drive in All Ranges
    - No Reverse Gear
- Shift Quality Feel Diagnosis
    - Harsh Garage Shift
    - Harsh, Soft, Delayed or Slipping First or Reverse Gear
    - Harsh, Soft, Delayed or Slipping 1-2-3-4 Shift
    - Harsh, Soft, Delayed or Slipping 4-5-6 Shift
    - Harsh, Soft, Delayed or Slipping Third, Fifth, or Reverse Gear
    - Harsh, Soft, Delayed or Slipping Second or Sixth Gear
- Shift Pattern
    - No First Gear
    - No First and Reverse Gears
    - No First, Second, Third, and Fourth Gear
    - No Second and Sixth Gear
    - No Fourth, Fifth, and Sixth Gear
    - No Third, Fifth, and Reverse Gear
- Torque Converter Diagnosis
    - Torque Converter Diagnosis
    - No Torque Converter Clutch Apply

    - **No Torque Converter Clutch Release**
- Symptom Not Found or No Symptom Detected
    - **Transmission Fluid Level and Condition Check**
    - **Road Test**
    - **Line Pressure Check**

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY INSPECTION

During transmission manufacturing and assembly, small pieces of material may become dislodged. This may also happen after the transmission has been in operation for a period of time. Because the transmission control solenoid valve assembly is continually immersed in transmission oil, material particles or slivers of metallic debris may become deposited on the control solenoid valve assembly. Often this material is very small and can be hard to see. For this reason, it is important that the control solenoid valve assembly be thoroughly inspected.

A thorough inspection of the control solenoid valve assembly should include the following:

- Clean inspection area - Like all transmission service work, cleanliness is very important. Be sure the area where you are inspecting is free of dust and dirt. Have non-glossy white or lightly colored paper down on the inspection surface. This will enhance the lighting and help to see particles that have come from the control solenoid valve assembly.
- Lighting - Good lighting is necessary for a thorough inspection. If shop lighting is limited, use natural light. A second source of lighting, such as a penlight, is helpful for close examination. A magnifying glass can also be helpful to see into difficult places.
- Cleaning - Clean shop air may be used for spot cleaning as long as the debris can be removed with out it becoming lodged somewhere else. It is best to rinse or flush particles away with GM Brake Parts Cleaner. Do not use a cloth rag to wipe the control solenoid valve assembly, as it could leave lint behind.

Control Solenoid Valve Assembly Housing and Filter Plate

Fig. 1: View Of Control Solenoid (w/Body & TCM) Valve Assembly Housing & Filter Plate
Courtesy of GENERAL MOTORS COMPANY

NOTE: **At the end of the inspection process where debris is found, it is required the transmission fluid and filter be replaced. Any time the control solenoid valve assembly has been removed, it is mandatory the filter plate assembly (3) be replaced.**

1. Inspect the control solenoid valve assembly housing (1) for damage, cracks, or parting seam (4) separation. Inspect all housing lock tabs (2). Any defect will need to be evaluated for critical operation. Ensure all screws along the control solenoid valve assembly housing are present. Remove and closely examine the filter plate assembly (3) for sediment or debris attached to the screen. If sediment or debris is found on the filter screen, be sure to inspect the solenoid supply or control ports that correspond to location of the debris on the filter plate screen. Inspect the filter plate gasket for proper sealing. If poor sealing is found, be sure to inspect the affected solenoid fluid port entrance and exit for sediment or debris deposits. Thoroughly flush the solenoid cavity with GM Brake Parts Cleaner and replace the filter plate assembly (3). It is not necessary to remove all clutch plate soot from the entire surface of the control solenoid valve assembly housing. Inspect the control solenoid valve assembly filter plate retaining tabs (7). Broken or missing tabs do not require the control solenoid valve assembly be replaced.

The filter plate can still be adequately aligned using the bolt hole sleeves. Early design control solenoid valve assembly use four filter plate retaining tabs (7).

2. Examine the 16-way connector (5) cavity for material that could make contact between the electrical pins. Also, look for bent or loose connector pins and ensure the connector lock (6) is functioning and is in good condition.

Control Solenoid Valve Assembly Inspection - Solenoids, Sensors, and Contacts

Fig. 2: View Of Control Solenoid (w/Body & TCM) Valve Assembly Inspection - Solenoids, Sensors & Contacts
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Pressure Control Solenoid 3 (PCS3)
2	Pressure Control Solenoid 4 (PCS4)
3	Pressure Control Solenoid 2 (PCS2)
4	Shift Solenoid 2 (SS2)
5	Torque Converter Clutch (TCC) Solenoid
6	Pressure Control Solenoid 5 (PCS5)
7	Pressure Control Solenoid 1 (PCS1)
8	Shift Solenoid 1 (SS1)
9	Transmission Fluid Temperature (TFT) Sensor
10	Input Speed Sensor/Output Speed Sensor (ISS/OSS) Connector
11	Pressure Control Solenoid 3 (PCS3) Contact Lead
12	Pressure Control Solenoid 4 (PCS4) Contact Lead
13	Pressure Control Solenoid 2 (PCS2) Contact Lead
14	Shift Solenoid 2 (SS2) Contact Lead
15	Torque Converter Clutch (TCC) Solenoid Contact Lead
16	Pressure Control Solenoid 5 (PCS5) Contact Lead
17	Pressure Control Solenoid 1 (PCS1) Contact Lead
18	Shift Solenoid 1 (SS1) Contact Lead
19	Internal Mode Switch (IMS) Connector
20	Metallic Slivers, Debris or Sediment

1. With the filter plate removed, the control solenoid valve assemblies (1-8) can be inspected. Closely examine the solenoid electrical contact lead solder connections (11-18). Look for material that could make contact between the electrical leads. This is where material particles, metallic slivers, debris or sediment (20) can collect. Carefully inspect all sixteen solenoid electrical contact leads (11-18) for build up of material that could form an electrical short. Inspect the solenoid contact leads (11-18) for terminal separation or weak solder joints. Thoroughly flush away all debris with GM Brake Parts Cleaner.
2. Inspect the transmission fluid temperature (TFT) sensor (9), the input speed sensor/output speed sensor (ISS/OSS) connector (10), and the internal mode switch (IMS) connector (19). Look inside the connector cavities for material that could make contact between the electrical pins. Also look for bent or loose electrical pins. If the TFT sensor (9) is heavily coated with clutch soot, rinse with GM Brake Parts Cleaner.
3. Check the resistance of the solenoids at room temperature and verify with the following table. If the resistance is not within the expected range, carefully inspect the solenoid contact leads.

Solenoid Resistance

Solenoid Name	Illustration Number of Solenoid Lead	Expected Resistance (Ohms)
Pressure Control Solenoid 3 (PCS3)	11	4.5-5.5 Ω
Pressure Control Solenoid 4 (PCS4)	12	4.5-5.5 Ω
Pressure Control Solenoid 2 (PCS2)	13	4.5-5.5 Ω
Shift Solenoid 2 (SS2)	14	23.5-24.5 Ω
Torque Converter Clutch (TCC) Solenoid	15	4.5-5.5 Ω
Pressure Control Solenoid 5 (PCS5)	16	4.5-5.5 Ω
Pressure Control Solenoid 1 (PCS1)	17	4.5-5.5 Ω
Shift Solenoid 1 (SS1)	18	23.5-24.5 Ω

Control Solenoid Valve Assembly Supply and Control Fluid Inspection

Fig. 3: View Of Control Solenoid (w/Body & TCM) Valve Assembly Supply & Control Fluid Inspection

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Shift Solenoid 1 Supply Port
2	Shift Solenoid 1 Control Port
3	Line Pressure Control Solenoid 1 Control Port
4	Line Pressure Control Solenoid 1 Supply Port
5	Pressure Control Solenoid 5 Supply Port
6	Pressure Control Solenoid 5 Control Port
7	TCC Pressure Control Solenoid Control Port
8	TCC Pressure Control Solenoid Supply Port
9	Shift Solenoid 2 Supply Port
10	Shift Solenoid 2 Control Port
11	Pressure Control Solenoid 2 Control Port
12	Pressure Control Solenoid 2 Supply Port
13	Pressure Control Solenoid 4 Supply Port
14	Pressure Control Solenoid 4 Control Port
15	Pressure Control Solenoid 3 Control Port
16	Pressure Control Solenoid 3 Supply Port
17	Transmission Fluid Pressure (TFP) Switch 5
18	Transmission Fluid Pressure (TFP) Switch 3
19	Transmission Fluid Pressure (TFP) Switch 1
20	Transmission Fluid Pressure (TFP) Switch 4
21	TFP Switch Membrane
22	TFP Switch Gasket

1. With the filter plate removed, the control solenoid valve fluid supply and control ports (1-16) can be inspected. Solenoid openings are identified in the illustration. Inspect the following supply and control opening for material particles, metallic slivers, debris, or sediment. Look into solenoid fluid supply openings 1, 4, 5, 8, 9, 12, 13, and 16. Look inside the solenoid fluid control ports 2, 3, 6, 7, 10, 11, 14 and 15. If sediment or debris is found in any one of these port openings, look for holes or tears in the filter plate screen. The filter plate gasket may be leaking caused by a torn gasket, poor sealing, or a deformed plate. As necessary, thoroughly flush away all debris in the supply and control fluid ports with GM Brake Parts Cleaner.

2. Inspect the four transmission fluid pressure (TFP) switches (17-20) for trapped debris or sediment. Any sediment or debris found under a switch membrane requires the control solenoid valve assembly to be replaced. Check all TFP switch membranes (21) for cracks, cuts or pin holes. Ensure all TFP switch gaskets (22) are secure and are not deformed, torn, or improperly seated. As necessary, thoroughly rinse debris and sediment from the top of the switches. It is not necessary to remove the clutch plate soot from the entire surface of the control solenoid valve assembly housing.

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY INPUT SHAFT SPEED/OUTPUT SHAFT SPEED INPUT TEST

Special Tools

- **DT-47825-10** Jumper Harness
- **J 35616** GM-Approved Terminal Test Kit
- **J 38522** Variable Signal Generator

Fig. 4: Identifying J 35616 And J 38522
Courtesy of GENERAL MOTORS COMPANY

The purpose of this test is to provide a simulated input/output speed sensor (ISS/OSS) signal to the control solenoid valve assembly ISS/OSS input circuits.

Transmission Input Speed Sensor

1. Ignition OFF, connect the **DT-47825-10** jumper harness between the vehicle wire harness electrical connector, and the control solenoid valve assembly electrical connector.
2. Disconnect the ISS/OSS wiring harness connector X3 (1) from the control solenoid valve assembly.
3. Ignition ON, test for 8.3-9.3 volts between the ISS/OSS voltage circuit terminal B on the control solenoid valve assembly and ground at the transmission case.
   - If not within the specified range, replace the control solenoid valve assembly. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Replacement** .
4. Using the **J 35616** terminal test kit, connect the **J 38522** variable signal generator red lead to the ISS signal circuit terminal A on the TCM.
5. Connect the black lead from the **J 38522** variable signal generator to ground at the transmission case.
6. Set the **J 38522** variable signal generator to 5 volts, the frequency to 300, and the percent duty cycle to 50 or the normal position.
7. Ignition ON, verify with a scan tool the Transmission ISS parameter is between 760-785 RPM.
   - If not within the specified range, replace the control solenoid valve assembly. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Replacement** .

Transmission Output Speed Sensor

1. Ignition OFF, connect the **DT-47825-10** jumper harness between the vehicle wire harness electrical connector, and the control solenoid valve assembly electrical connector.
2. Disconnect the ISS/OSS wiring harness connector X3 (1) from the control solenoid valve assembly.
3. Ignition ON, test for 8.3-9.3 volts between the ISS/OSS voltage circuit terminal B on the control solenoid valve assembly and ground at the transmission case.
   - If not within the specified range, replace the control solenoid valve assembly. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Replacement** .
4. Using the **J 35616** terminal test kit, connect the **J 38522** variable signal generator red lead to the OSS signal circuit terminal C on the TCM.
5. Connect the black lead from the **J 38522** variable signal generator to ground at the transmission case.

6. Set the **J 38522** variable signal generator to 5 volts, the frequency to 300, and the percent duty cycle to 50 or the normal position.
7. Ignition ON, verify with a scan tool the Transmission OSS parameter is between 495-505 RPM.
    - If not within the specified range, replace the control solenoid valve assembly. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Replacement** .

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY SOLENOID PERFORMANCE TEST

Special Tools

DT-47825 Control Solenoid Test Plate

The purpose of this procedure is to test the operation of the control solenoid valve assembly for a stuck open or stuck closed solenoid. The **DT-47825** control solenoid test plate bolts to the mounting surface of the control solenoid valve assembly. Pressurized air is routed into the aluminum test block, through the control solenoid valve assembly, and back to the gauge on the test block.

A pressure gauge is used to measure the pressurized air through the solenoid control ports. When a solenoid is commanded ON with the scan tool, pressurized air flows through the solenoid control port and displays on the pressure gauge. When the solenoid is commanded OFF with the scan tool, there is no pressurized air flow through the solenoid control port to the pressure gauge. The recommended shop air pressure for this test is 620.5-690.4 Kpa (90-100 psi).

Control Solenoid Valve Assembly with Control Solenoid Test Plate

Fig. 5: View Of Control Solenoid (w/Body & TCM) Valve Assembly With Control Solenoid Test Plate
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Filter Plate Assembly
2	Control Solenoid Valve Assembly
3	DT-47825 Control Solenoid Test Plate
4	Air Connection Port
5	Transmission 16-Way Pass-Through Connector
6	Electrical Connector Slide Lock
7	A/Trans Manual Shift Shaft Position Switch Assembly Electrical Connector
8	A/Trans Manual Shift Shaft Position Switch Assembly
9	Bolt M6 x 14.5

NOTE: **To avoid solenoid overheating and possible internal damage, do not continuously operate the solenoid for more than 2 minutes at a time.**

The TCM will normally cycle some of the transmission solenoids ON and OFF to keep the solenoid passages clean and clear. This is a normal function and may cause the valves to cycle open and closed quickly when the TCM is powered up. This can make the pressure gauge needle flicker or move from high and low as the valves open and close, allowing air to exit the ports where the pressure gauge is not connected.

WARNING: **Use of eye goggles is necessary to prevent personal injury.**

WARNING: **To avoid transmission fluid contact with exposed skin, use shop towels to cover the test plate parts in order to prevent fluid from being released into the air, as any remaining transmission fluid in the control solenoid valve assembly will be forced out, and bodily injury may occur.**

It is necessary to drain the control solenoid valve assembly of all remaining transmission fluid before attaching the test plate. Use caution when attaching air to the test plate, as any residual transmission fluid in the control solenoid valve assembly will be forced out. Use shop towels to cover the test plate ports in order to prevent fluid from being released into the air.

Preliminary Procedures

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the transmission fluid pan and filter. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement** .
3. Remove the transmission electrical connector. Refer to **Automatic Transmission Electrical Connector Passage Sleeve Replacement** .
4. Remove the control solenoid valve assembly from the transmission. Refer to **Control Valve Lower Body and Upper Body Replacement** .
5. Ensure that the manual shift shaft position switch is disconnected and removed before performing the test. Failure to disconnect the switch will cause inaccurate test results and possible misdiagnosis.

Solenoid Testing Procedure

Fig. 6: Identifying Solenoid Testing Procedure
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Regulated Air Supply
2	Test Ports
3	Scan Tool
4	Test Pressure Gauge
5	Electrical Connector Sleeve

CAUTION: Do not probe any circuit with a multi-meter. Resistance tests across the serial data bus circuits will damage the TCM.

CAUTION: The TCM connector sleeve allows the test tool harness to be correctly orientated for electrical operation

of the TCM. Do not connect the test harness to the TCM without using the connector sleeve. Failure to use the sleeve could allow the test harness to be incorrectly positioned which will result in permanent TCM damage.

1. Align and install the electrical connector sleeve to the control solenoid valve assembly and secure with the connector slide lock.
2. If necessary, clean each side of the filter plate assembly and install the filter plate assembly back on the control solenoid valve assembly. Clean the mounting surface of the **DT-47825** control solenoid test plate.
3. Bolt the **DT-47825** control solenoid test plate to the control solenoid valve assembly mounting surface. Use the bolts and washers supplied with the tool to attach the test block. Tighten the bolts to 5 N.m (44 lb in).
4. Connect the test harness supplied with the **DT-47825** control solenoid test plate to the vehicle harness and to the TCM. Engage the connector locks.
5. Connect shop air to the **DT-47825** control solenoid test plate air inlet. Do not exceed the recommended air pressure of 620.5-689.4 Kpa (90-100 psi).
6. Connect the test pressure gauge to the test port for the solenoid to be tested.
7. With the ignition ON and the scan tool communicating with the vehicle, command the solenoid to be tested ON and OFF. Watch the air pressure gauge for a change as you command the solenoid. Refer to Control Solenoid Valve Assembly Solenoid Performance Test Plate to Component Identification for correct solenoid function and test plate port connections for the solenoid being tested.
8. The solenoid should allow air pressure to flow when commanded ON and prevent air pressure flow when commanded OFF. The test results are read on the pressure gauge.
9. Command the solenoid valve ON and OFF several times to determine the condition of the solenoid in question. Release the test air pressure from the pressure gauge between solenoid tests.

Control Solenoid Valve Assembly Solenoid Performance Test Plate to Component Identification

Solenoid	Test Plate Port	Commanded State	
		ON	OFF
PC Solenoid 2, 3-5 Rev. CL	C	Full pressure to gauge	No pressure to gauge
PC Solenoid 3, 4-5-6 Low Rev CL	A	Full pressure to gauge	No pressure to gauge
PC Solenoid 4, 2-6 CL	B	Full pressure to gauge	No pressure to gauge
PC Solenoid 5, 1-2-3-4 CL	F	Full pressure to gauge	No pressure to gauge
Shift Solenoid 1	H	Full pressure to gauge	No pressure to gauge
Shift Solenoid 2	D	Full pressure to gauge	No pressure to gauge
TCC PC Solenoid	E	Full pressure to gauge	No pressure to gauge

Solenoid	Test Plate Port	Commanded State	
		ON	OFF
Line PC Solenoid	G	Command to highest setting, full pressure to gauge	Command to lowest setting, below 620.5 Kpa (90 psi) to gauge

RESET TRANSMISSION ADAPTS

The Reset Transmission Adapts is a procedure for automatic transmissions in which the shift pressure learn values of each individual clutch is reset to zero or a base calibrated value, in the transmission control module (TCM).

Once the transmission adapts are set to zero or a calibrated value, the vehicle is then road test under various drive cycle events for the TCM to relearn shift pressure values for the best possible shift feel in all gear ranges.

The Reset Transmission Adapts procedure must be performed when one of the following repairs have been made to the transmission. Failure to perform the procedure after one of the following repairs may result in poor transmission performance, DTCs being set, or customer dissatisfaction.

- Transmission internal service, repair or overhaul
- Valve body repair or replacement
- Control solenoid valve assembly replacement
- Any service/repair in response to a shift quality concern

1. Install any components or connectors that have been removed or replaced during diagnosis.
2. Perform any adjustments, programming or setup procedures that are required when a component or module is removed or replaced.
3. Clear the DTCs.
4. Ignition OFF, all vehicle systems OFF, this may take up to 2 minutes.

NOTE: **Do not cycle or turn the ignition switch OFF until directed to do so below.**

5. Ignition ON, engine running, with a scan tool Reset Transmission Adapts.
6. Perform the **Road Test**.
7. Ignition OFF for 2 minutes.

TOW/HAUL SWITCH/INDICATOR ALWAYS ON OR INOPERATIVE

Fig. 7: View Of Tow/Haul Switch/Indicator
Courtesy of GENERAL MOTORS COMPANY

Circuit/System Description

The Tow/Haul Mode indicator bulb on the instrument cluster is supplied 12 volts and ground by the instrument cluster module. When the Tow/Haul mode is selected, the body control module will send a request on the serial data communication line to the instrument cluster module to turn ON the Tow/Haul indicator. Pressing and releasing the Tow/Haul Switch again will turn OFF the indicator and return the transmission to normal shifting.

Diagnostic Aids

If the electrical circuit checks are OK and the tow/haul shift pattern is not occurring, there may be a mechanical/hydraulic condition that prevents tow/haul operation. Refer to **Symptoms - Automatic Transmission**.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition OFF, monitor the instrument cluster.
2. Ignition ON, verify the Tow/Haul mode indicator momentarily illuminates, during the instrument cluster bulb check.
   - **If the Tow/Haul indicator does not illuminate or is always ON**

     Refer to Circuit/System Testing.

   - **If the Tow/Haul indicator does illuminate and is not always ON**
3. Verify with a scan tool the Tow/Haul switch parameter changes from Inactive to Active and back to Inactive with each cycle of the switch.
   - **If the parameter does not change states**

     Refer to Circuit/System Testing.

   - **If the parameter does change states**
4. Verify the Tow/Haul indicator on the instrument cluster turns ON and OFF with each switch activation.
   - **If the indicator does not turn ON and OFF**

     Refer to Circuit/System Testing.

   - **If the indicator turns ON and OFF**
5. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF. Disconnect the harness connector at the S3 Transmission Shift Lever. It may take up to 2 min. for all vehicle systems to power down.
2. Test for less than 5 Ω between the ground circuit terminal 2 and ground.
    - **If greater than 5 Ω**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ground circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, repair the open/high resistance in the ground connection.
    - **If less than 5 Ω**
3. Ignition OFF.
4. Test for less than 1 V on the signal circuit terminal 1 at the S3 Transmission Shift Lever harness connector.
    - **If greater than 1 V**
    1. Ignition OFF.
    2. Disconnect the X3 harness connector at the K9 Body Control Module. Ignition ON.
    3. Test for less than 1 V on the signal circuit terminal 1 at the S3 Transmission Shift Lever harness connector and ground.
        - If 1 V or greater, repair the short to B+/Ignition in the signal circuit.
        - If less than 1 V, replace the K9 Body Control Module.
    - **If less than 1 V**
5. Ignition ON.
6. Test for 11.6-12.4 V on the signal circuit terminal 1 at the S3 Transmission Shift Lever harness connector and ground.
    - **If not between 11.6-12.4 V**
    1. Ignition OFF.
    2. Disconnect the X3 harness connector at the K9 Body Control Module.
    3. Test for less than 2 Ω in the signal circuit end to end.
        - If greater than 2 Ω, repair the open/high resistance in the circuit.
        - If less than 2 Ω, replace the K9 Body Control Module.
    - **If between 11.6-12.4 V**
7. Refer to **Symptoms - Data Communications**

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Body Control Module (BCM) assembly replacement. Refer to **Control Module References** for replacement, setup, and programming.

TRANSMISSION FLUID LEVEL AND CONDITION CHECK

This procedure checks the transmission fluid level, as well as the condition of the fluid itself.

CAUTION: Always use the proper automatic transmission fluid listed. Using incorrect automatic transmission fluid may damage the vehicle.

Before checking the fluid level, perform the following:

1. Start the engine and park the vehicle on a level surface. Keep the engine running.
2. Apply the parking brake and place the shift lever in PARK (P).
3. Depress the brake pedal and move the shift lever through each gear range, pausing for about 3 seconds in each range. Then, move the shift lever back to PARK (P).
4. Allow the engine to idle 500-800 rpm for at least 1 minute. Slowly release the brake pedal.
5. Keep the engine running and observe the transmission fluid temperature (TFT) using the Driver Information Center (DIC) or a scan tool.
6. Using the TFT reading, determine and perform the appropriate check procedure. If the TFT reading is not within the required temperature ranges, allow the vehicle to cool, or operate the vehicle until the appropriate TFT is reached.

Cold Check Procedure

NOTE: Use this procedure only as a reference to determine if the transmission has enough fluid to be operated safely until a hot check procedure can be made. The hot check procedure is the most accurate method to check the fluid level. Perform the hot check procedure at the first opportunity. Use this cold check procedure to check fluid level when the TFT is between 80Â°F and 90Â°F (27Â°C and 32Â°C).

1. Locate the transmission dipstick at the rear of the engine compartment, on the passenger's side of the vehicle.
2. Flip the handle up, and then pull out the dipstick and wipe it with a clean rag or paper towel.
3. Install the dipstick by pushing it back in all the way, wait three seconds and then pull it back out again.

NOTE: Always check the fluid level at least twice. Consistent readings are important to maintaining proper fluid

level. If inconsistent readings are noted, inspect the transmission vent assembly to ensure it is clean and unclogged.

4. Check both sides of the dipstick, and read the lower level. Repeat the check procedure to verify the reading.
5. Inspect the color of the fluid on the dipstick. Refer to Fluid Condition Inspection in this procedure.
6. If the fluid level is below the COLD check band, add only enough fluid as necessary to bring the level into the COLD band. It does not take much fluid, generally less than one pint (0.5L). Do not overfill.
7. If the fluid level is in the acceptable range, push the dipstick back in all the way, then flip the handle down to lock the dipstick in place.
8. Perform a hot check at the first opportunity after the transmission reaches a normal operating temperature between 160Â°F to 200Â°F (71Â°C to 93Â°C).

Hot Check Procedure

NOTE: **Use this procedure to check the transmission fluid level when the TFT is between 160Â°F and 200Â°F (71Â°C and 93Â°C). The hot check procedure is the most accurate method to check the fluid level. The hot check should be performed at the first opportunity in order to verify the cold check. The fluid level rises as fluid temperature increases, so it is important to ensure the transmission temperature is within range.**

1. Locate the transmission dipstick at the rear of the engine compartment, on the passenger's side of the vehicle.
2. Flip the handle up, and then pull out the dipstick and wipe it with a clean rag or paper towel.
3. Install the dipstick by pushing it back in all the way, wait three seconds and then pull it back out again.

NOTE: **Always check the fluid level at least twice. Consistent readings are important to maintaining proper fluid level. If inconsistent readings are noted, inspect the transmission vent assembly to ensure it is clean and unclogged.**

4. Check both sides of the dipstick, and read the lower level. Repeat the check procedure to verify the reading.
5. Inspect the color of the fluid on the dipstick. Refer to Fluid Condition Inspection.
6. A safe operating fluid level is within the HOT crosshatch band on the dipstick. If the fluid level is not within the HOT band, and the TFT is between 160Â°F and 200Â°F (71Â°C and 93Â°C), add or drain fluid as necessary to bring the level into the HOT band. If the fluid level is low, add only enough fluid to bring the level into the HOT band. It does not take much fluid, generally less than one pint (0.5L). Do not overfill. Also, if the fluid level is low, inspect the transmission for leaks. Refer to **Fluid Leak Diagnosis**.
7. If the fluid level is in the acceptable range, push the dipstick back in all the way, then flip the handle down to lock the dipstick in place.
8. If applicable and if the vehicle is equipped, reset the transmission oil life monitor only if the fluid was changed.

Fluid Condition Inspection

Inspect the fluid color. The fluid should be red or dark brown.

- If the fluid color is very dark or black and has a burnt odor, inspect the fluid and inside of the bottom pan for excessive metal particles or other debris. A small amount of "friction" material in the bottom pan is a "normal" condition. If large pieces and/or metal particles are noted in the fluid or bottom pan, flush the oil cooler and cooler lines and overhaul the transmission. If there are no signs of transmission internal damage noted, replace the fluid filter assembly, repair the oil cooler, and flush the cooler lines.
- Fluid that is cloudy or milky or appears to be contaminated with water indicates engine coolant or water contamination. Refer to **Engine Coolant/Water in Transmission**.

LINE PRESSURE CHECK

Fig. 8: View Of Transmission Fluid Pressure Gage
Courtesy of GENERAL MOTORS COMPANY

Special Tools

GE 21867 Pressure Gauge

For equivalent regional tools, refer to **Special Tools** .

WARNING: **Keep the brakes applied at all times in order to prevent unexpected vehicle motion. Personal injury may result if the vehicle moves unexpectedly.**

1. Install a scan tool.
2. Start the engine.
3. Inspect the transmission for the proper fluid level. Refer to **Transmission Fluid Level and Condition Check**.
4. Use the scan tool to inspect for any active or stored diagnostic trouble codes.
5. Inspect the manual linkage at the transmission for proper function.
6. Turn the engine OFF.

NOTE: **You may need to remove or disconnect components in order to gain access to the transmission line pressure test hole plug.**

7. Remove the line pressure test hole plug.
8. Install the **GE 21867** pressure gauge.
9. Access the Scan Tool Transmission Output Controls for the Line PC Solenoid.
10. Start the engine.

NOTE: **In order to achieve accurate line pressure readings, the following procedure should be performed at least three times.**

The values displayed on the scan tool screen will not match the actual pressures indicated on the pressure gauge.

Control the Line PC Solenoid in PARK or NEUTRAL with the engine speed at approximately 1500 RPM and the TFT between 35-55Â°C (95-131Â°F). This protects the clutches from extreme high or low line pressures and ensures a consistent pump capacity.

11. Use the scan tool to increase and decrease line pressure, allowing the pressure to stabilize between increments.
12. Compare the pressure readings on the gauge with the table below.
13. If the pressure readings on the gauge are erratic, or are more than 10% greater or less than the range specified in the table below, refer to **Fluid Pressure High or Low**.
14. Turn the engine OFF.

15. Remove the **GE 21867** pressure gauge.

CAUTION: Refer to Fastener Caution .

16. Install the line pressure test hole plug. Tighten the pressure plug to 11 N.m (97 lb in).

Line Pressure

Scan tool Line PC Solenoid Commanded State (KPa)	Approximate line pressure shown on pressure gauge @ 1500 RPM	
	Kpa	PSI
None	310-550	45-80
200	655-900	95-130
400	1100-1310	160-190
600	1520-1725	220-250
800	1860-2070	270-300

ROAD TEST

The following test provides a method of evaluating the condition of the automatic transmission. The test is structured so that most driving conditions would be achieved. The test is divided into the following parts:

- Electrical Function Check
- Upshift Control and Torque Converter Clutch (TCC) Apply
- Part Throttle Step-In Downshifts
- Manual Downshifts
- Coasting Downshifts
- Manual Gear Range Selection
  - REVERSE
  - Driver Shift Control

NOTE: Complete the test in the sequence given. Incomplete testing cannot guarantee an accurate evaluation.

Before the road test, ensure the following:

- The engine is performing properly.

- Transmission fluid level is correct. Refer to **Transmission Fluid Level and Condition Check**.
- Tire pressure is correct.

During the road test:

- Perform the test only when traffic conditions permit.
- Operate the vehicle in a controlled, safe manner.
- Observe all traffic regulations.
- View the scan tool data while conducting this test.

  Take along qualified help in order to operate the vehicle safely.

- Observe any unusual sounds or smells.

After the road test, check the following:

- Inspect for proper transmission fluid level. Refer to **Transmission Fluid Level and Condition Check**.
- Inspect for any diagnostic trouble codes (DTCs) that may have set during the testing. Refer to the applicable DTC.
- Monitor the scan tool data for any abnormal readings or data.
- Inspect for fluid leaks. Refer to **Fluid Leak Diagnosis**.

Electrical Function Check

Perform this procedure first in order to ensure the electronic transmission components are functioning properly. If these components are not checked, a simple electrical condition could be misdiagnosed.

1. Connect the scan tool.
2. Ensure the gear selector is in PARK and set the parking brake.
3. Start the engine.
4. Verify that the following scan tool data can be obtained and is functioning properly.

   Refer to **Control Module References** for typical data values. Data that is questionable may indicate a concern.

   - Engine Speed
   - Transmission ISS

- Transmission OSS
- Vehicle Speed
- IMS
- Commanded Gear
- Gear Ratio
- Line PC Sol. Pressure Cmd.
- Brake Switch
- ECT, Engine Data List
- Trans. Fluid Temp.
- TCM Temperature
- Calc. Throttle Position
- Ignition Voltage
- TFP Switch 1
- TFP Switch 3
- TFP Switch 4
- TFP Switch 5
- PC Sol. 2 Pressure Cmd.
- PC Sol. 3 Pressure Cmd.
- PC Sol. 4 Pressure Cmd.
- PC Sol. 5 Pressure Cmd.
- Shift Solenoid 1
- Shift Solenoid 2
- TCC PC Sol. Duty Cycle
- TCC Slip Speed

5. Check the garage shifts.
    1. Apply the brake pedal and ensure the parking brake is set.
    2. Move the gear selector through the following ranges:
        1. PARK to REVERSE
        2. REVERSE to NEUTRAL

3. NEUTRAL to DRIVE
4. DRIVE to REVERSE
5. REVERSE to DRIVE

3. Pause 2 to 3 seconds in each gear position.
4. Verify the gear engagements are immediate (less than 2 seconds to complete if trans fluid temperature is above 20Â°C) and not harsh. Note that these shifts may be almost imperceptible in some applications. Using the scan tool to monitor Transmission ISS achieving 0 rpm can be used to check delay in these cases.

NOTE: **Harsh engagement may be caused by any of the following conditions:**

- **High engine idle speed-Compare engine idle speed to desired idle speed.**
- **Incorrect line pressure-Investigate Line PC Sol. Pressure Cmd. kPa (psi), also perform Line Pressure Check.**
- **A default condition caused by certain DTCs that result in maximum line pressure to prevent clutch slippage.**
- **Incomplete adapting or incorrect adapting-Repeat maneuver multiple times to see if shift quality improves. If it does not, refer to the service procedures for Harsh Garage Shift, and for Harsh, Soft, Delayed or Slipping First or Reverse Gear.**

NOTE: **Delayed engagement may be caused by any of the following conditions:**

- **Low idle speed-Compare engine idle speed to desired idle speed.**
- **Low fluid level**
- **Incorrect line pressure-Investigate Line PC Sol. Pressure Cmd. kPa (psi), also perform Line Pressure Check.**
- **Cold transmission fluid temperature (TFT)-Use the scan tool to determine TFT.**
- **Selector linkage-Inspect and adjust as necessary.**
- **Incomplete adapting or incorrect adapting-Repeat maneuver multiple times to see if delay improves. If it does not, refer to the service procedures for Harsh, Soft, Delayed or Slipping First or Reverse Gear.**

6. Monitor transmission range on the scan tool, transmission data list.
   1. Apply the brake pedal and ensure the parking brake is set.

2. Move the gear selector through all ranges.
3. Pause 2 to 3 seconds in each range.
4. Return gear selector to PARK.
5. Verify that all selector positions match the scan tool display.

7. Check throttle position input.
    1. Apply the brake pedal and ensure the parking brake is set.
    2. Ensure the gear selector is in PARK.
    3. Monitor the scan tool Calc. Throttle Position while increasing and decreasing engine speed with the throttle pedal. The scan tool Calc. Throttle Position percentage should increase and decrease with engine speed.

If any of the above checks do not perform properly, record the result for reference after completion of the road test.

Upshift Control and Torque Converter Clutch (TCC) Apply

The TCM calculates the upshift points based primarily on 2 inputs: throttle position and vehicle speed. When the TCM determines that conditions are met for a shift to occur, the TCM commands the shift by varying current to the appropriate PC solenoids to control oncoming and offgoing clutch pressures.

Perform the following steps:

1. Monitor the following scan tool parameters:
    - Calc. Throttle Position
    - Vehicle Speed
    - Engine Speed
    - Transmission ISS
    - Transmission OSS
    - Commanded Gear
    - TCC PC Sol. Pressure Cmd.
    - TCC Slip Speed
    - TFP Switch 1
    - TFP Switch 3
    - TFP Switch 4

- TFP Switch 5
- PC Sol. 2 Pressure Cmd.
- PC Sol. 3 Pressure Cmd.
- PC Sol. 4 Pressure Cmd.
- PC Sol. 5 Pressure Cmd.
- Shift Solenoid 1 and 2

2. Place the gear selector in the DRIVE position.
3. Accelerate the vehicle using a steady throttle position between 15 and 20 percent. Hold the throttle steady.
4. As the transmission upshifts, there should be a noticeable shift feel or engine speed change within 1 to 2 seconds of the commanded gear change. The PC solenoid pressure command should change to "YES" for the oncoming clutch and the PC solenoid pressure command should change to "NO" for the offgoing clutch.
5. Note any harsh, soft or delayed shifts or slipping. Note any noise or vibration.
6. The TCC feel may not be noticeable. In many applications the TCC will apply after the 1-2 shift and TCC events will not be easily detected using engine speed.

NOTE: **This transmission is equipped with an electronically controlled capacity clutch (ECCC), which allows operation of the clutch without fully locking to the torque converter cover. The clutch maintains a small amount of slippage, approximately 20 RPM, in 2nd, 3rd, 4th, 5th, and 6th gears, depending on the vehicle application. ECCC was developed to reduce the possibility of noise, vibration or chuggle caused by TCC apply. Full lockup is available at highway speeds on some applications.**

7. Monitor TCC PC solenoid pressure command while driving and check TCC slip speed when the pressure command indicates that the TCC is commanded to apply:

   When the TCC applies, slip speed should be controlled to below 100 RPM when the transmission is not shifting and the throttle is held steady. If the TCC slip exceeds this value for more than 6 seconds after the TCC PC Sol. Pressure Command indicates that the TCC is commanded on:

   - Check for DTCs.
   - Refer to **Torque Converter Diagnosis**.

Part Throttle Step-In Downshifts

1. Place the gear selector in the DRIVE position.
2. Accelerate the vehicle at light throttle (5-15 percent) until 3rd gear is just achieved.

3. Quickly increase throttle angle until commanded gear indicates that a downshift to 2nd gear is commanded.
4. Verify that the transmission downshifts within 2 seconds of the throttle movement.
5. Repeat steps 2 to 4 at higher speed to achieve 4th gear and then step in to command a 4th gear to 3rd gear downshift.
6. Repeat steps 2 to 4 at higher speed to achieve 5th gear and then step in to command a 5th to 4th gear downshift.
7. Repeat steps 2 to 4 at higher speed to achieve 6th gear and then step in to command a 6th gear to 5th gear downshift.
8. Note any harsh, soft or delayed shifts or slipping. Note any noise or vibration.

Manual Downshifts

Manual downshift testing is not required since all vehicles equipped with the 6L45/50/80/90 are also equipped with some form of Driver Shift Control (DSC). The TCM will automatically override DSC downshifts to protect the transmission from damage.

Coasting Downshifts

1. Place the gear selector in the DRIVE position.
2. Accelerate the vehicle to 6th gear with the TCC applied.
3. Release the throttle and apply the brakes.
4. Verify that the downshifts occur as commanded by monitoring gear ratio, which should change after commanded gear changes.

Manual Gear Range Selection

This application does not utilize manual forward gear ranges.

Reverse

Perform the following test using a 10-15 percent throttle position.

1. With the vehicle stopped, move the gear selector to REVERSE.
2. Slowly accelerate the vehicle.
3. Verify that there is no noticeable slip, noise or vibration.

Driver Shift Control (DSC)

Refer to the owner's manual for specific instructions on the type of DSC available in this application. Utilize the DSC to ensure that the transmission responds appropriately to driver's commands. The TCM will upshift automatically when maximum engine speed is achieved and will protect from any downshift which may cause excessive engine RPMs.

TORQUE CONVERTER DIAGNOSIS

Torque Converter Stator

The torque converter stator roller clutch can have 2 different malfunctions.

- The stator assembly freewheels in both directions.
- The stator assembly remains locked up in both directions.

Poor Acceleration at Low Speed - Stator Roller Clutch Freewheels at All Times

If the stator is freewheeling at all times, the vehicle tends to have poor acceleration from a standstill and at speeds below 48-55 km/h (30-34 mph). At speeds above 48-55 km/h (30-34 mph), the vehicle may act normally.

For poor acceleration at low speeds, you should first determine that the exhaust system is not blocked, and the transmission is in First gear when starting out. If the engine freely accelerates to high RPM in NEUTRAL, you can assume that the engine and the exhaust system are normal. Check for poor performance in DRIVE and REVERSE to help determine if the stator is freewheeling at all times.

Poor Acceleration at High Speed - Stator Roller Clutch is Locked Up at All Times

If the stator is locked up at all times, performance is normal when accelerating from a standstill. Engine RPM and vehicle speed are limited or restricted at speeds above 48-55 km/h (30-34 mph). Visual examination of the converter may reveal a blue color from overheating.

Torque Converter Bearing Noise

NOTE: **Do not confuse this noise with pump whine noise, which is usually noticeable in all gear ranges. Pump whine will vary with line pressure.**

Torque converter whine is noticed when the vehicle is stopped and the transmission is in DRIVE or REVERSE. This noise will increase as you increase the engine RPM. The noise will stop when the vehicle is moving or when you apply the torque converter clutch, because there is no slip speed across the bearings.

Perform a stall test to verify that the noise is actually coming from the torque converter:

1. Place your foot on the brake.
2. Put the gear selector in DRIVE.

CAUTION: **You may damage the transmission if you depress the accelerator for more than 6 seconds.**

3. Depress the accelerator to approximately 1, 200 RPM for no more than six seconds.

A torque converter noise will increase under this load.

Torque Converter Clutch

The torque converter clutch (TCC) is applied by fluid pressure, which is controlled by a TCC pressure control (PC) solenoid. This solenoid is part of the control solenoid valve assembly, which is located inside the automatic transmission assembly. The solenoid is controlled through a combination of computer controlled switches and sensors. Electronically controlled capacity clutch (ECCC) is controlled slip across the TCC.

Torque Converter Clutch Shudder

The key to diagnosing torque converter clutch (TCC) shudder is to note when it happens and under what conditions. TCC shudder should only occur during the apply, release, or ECCC conditions of the converter clutch. Shudder should never occur after the TCC is fully locked (approximately 0 RPM slip).

If Shudder Occurs During TCC Apply, Release, and ECCC

If the shudder occurs while the TCC is applying, the problem can be within the transmission or the torque converter. Something is causing one of the following conditions to occur:

- The clutch is not engaging completely.
- The clutch is not releasing completely.
- The clutch is releasing and applying rapidly and continuously.

One of the following conditions may be causing the TCC Shudder to occur:

- Leaking turbine shaft/TCC seals
- A restricted release orifice
- A distorted clutch or converter cover due to long flexplate to converter bolts
- Defective friction material on the TCC plate

If Shudder Occurs After TCC has Locked

Engine problems may go unnoticed under light throttle and load, but they become noticeable after the TCC has locked when going up a hill or accelerating.

Refer to **Symptoms - Engine Controls** in order to avoid misdiagnosis of TCC shudder and the unnecessary disassembly of a transmission or the

unnecessary replacement of a torque converter.

Torque Converter Vibration Test

NOTE: **The Noise and Vibration Analysis procedure should be performed prior to performing this test.**

Isolating Vibration

NOTE: **Some engine/transmission combinations cannot be balanced in this manner due to restricted access or limited clearances between the torque converter bolts and the engine.**

To isolate and correct a flexplate or torque converter vibration:

1. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration.
2. Turn the engine OFF.
3. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the torque converter access cover and the bolts (if equipped).
5. Mark the relationship of the torque converter to the flexplate.
6. Rotate the torque converter to inspect for defects or missing balance weights.
7. Index the converter according to "Indexing Torque Converter" procedure located within this procedure.
8. If the vibration remains, it is most likely caused by the engine.
9. Refer to "Torque Converter Replacement Guide" located within this procedure.

Indexing Torque Converter

To determine and correct a torque converter vibration, the following procedure may have to be performed several times to achieve the best possible torque converter to flexplate balance.

1. Remove the torque converter bolts.
2. Rotate the torque converter one bolt position from the original marked position.

Fig. 9: View Of Torque Converter Hub In Engine Crankshaft
Courtesy of GENERAL MOTORS COMPANY

CAUTION: **When installing the torque converter to the flexplate, make sure to use specified bolts. DO NOT use longer bolts. Using longer bolts will result in deformation of the torque converter cover and cause internal damage.**

CAUTION: **Refer to Fastener Caution .**

3. Align the torque converter pilot (2) in the engine crankshaft (3). Install the torque converter to flexplate bolts, and tighten according to **Fastener Specifications (Off Vehicle)** **Fastener Specifications (On Vehicle)** .
4. Lower the vehicle.
5. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration.

   Repeat this procedure until the best possible balance is obtained.

6. Install the torque converter access cover and bolts (if equipped) and tighten according to **Fastener Specifications (Off Vehicle)** **Fastener Specifications (On Vehicle)** .

Torque Converter Replacement Guide

Condition	Action
• Transmission Fluid Oxidized/Discolored • Clutch Fiber Material	Do not replace the torque converter. Refer to **Transmission Fluid Level and Condition Check**.
Transmission Fluid Contaminated with Metal Particles	**NOTE:** **Do not replace the torque converter for clutch system or gearset component damage. Fine metallic debris or clutch plate material that is suspended in the fluid will not**

Condition	Action
	cause damage to the internal torque converter components nor any internal transmission components.
Harsh Gear Shifts	Do not replace the torque converter. Refer to **Symptoms - Automatic Transmission**.
Noise-Whine	• Refer to **Symptoms - Automatic Transmission**. • Do not replace the torque converter if noise is present in Neutral/Park. Refer to **Symptoms - Engine Mechanical** .
Vibration-Out of Balance	Refer to Torque Converter Vibration Test in this procedure.
No Drive/Slips in Drive	Do not replace the torque converter until completing all engine and transmission diagnostics.
Idle Surge/Rough Idle	Do not replace the torque converter. Refer to **Symptoms - Engine Controls** .
TCC Apply/Release Shudder	Do not replace the torque converter. Refer to Torque Converter Clutch Shudder in this procedure.
TCC Chuggle	Do not replace the torque converter. Refer to **Symptoms - Engine Controls** .
DTC P0741-TCC Stuck OFF/High Slip-Intermittent Only	Do not replace the torque converter. Refer to **DTC P0741 or P0742** diagnostic table.
DTC P0741-TCC Stuck OFF/High Slip	Do not replace the torque converter. Refer to **DTC P0741 or P0742** diagnostic table.
DTC P0742-TCC Stuck ON	Do not replace the torque converter. Refer to **DTC P0741 or P0742** diagnostic table.

Condition	Action
Transmission Fluid Contaminated with Sludge/Metal Particles as a result of: • Engine Coolant/Oil • Pump damage • Drive sprocket support damage • Turbine/stator shaft damage • Internal converter damage with no damage found in the transmission	Replace the torque converter.
Poor Acceleration above 48 km/h (30 mph) - Good Launch	Do not replace the torque converter until completing all engine and transmission diagnostics. • Refer to Torque Converter Stator in this procedure. • Refer to **Symptoms - Engine Controls** .
Poor Launch - Good Acceleration above 48 km/h (30 mph)	Do not replace the torque converter until completing all engine and transmission diagnostics. • Refer to Torque Converter Stator in this procedure. • Refer to **Symptoms - Engine Controls** .
Stripped Converter Bolt Holes	• Replace the torque converter. • Inspect flexplate and refer to **Lower Engine Noise, Regardless of Engine Speed** .
Torque Converter Pilot Damaged	Replace the torque converter.
Torque Converter Hub surface is damaged - scored, raised/transferred metal.	Replace the torque converter.
External Leaks in the weld areas - hub, lug or closure weld.	Replace the torque converter.
Broken/Cracked Flexplate	Replace the torque converter.
Torque Converter Discolored/Overheated	Replace the torque converter.

FLEX PLATE/TORQUE CONVERTER VIBRATION TEST

Isolating Vibration

CAUTION: Some engine/transaxle combinations cannot be balanced in this manner due to restricted access or limited clearances between the torque converter bolts and the engine. Ensure that the bolts do not bottom out in the lug nuts or the torque converter cover which could dent and cause internal damage.

To isolate and correct a flywheel or torque converter vibration, separate the torque converter from the flywheel to determine if vibration is in the engine or transmission.

1. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration.
2. Turn the engine OFF.
3. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the transmission converter cover bolts and the cover.
5. Mark the relationship of the converter to the flywheel.
6. Remove the bolts attaching the converter to the flywheel.
7. Slide the torque converter away from the flywheel.
8. Rotate the flywheel and torque converter to inspect for defects or missing balance weights.
9. Lower the vehicle.
10. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration. Refer to **Diagnostic System Check - Vehicle** .
11. Turn the engine OFF.

Indexing Torque Converter

To determine and correct a torque converter vibration, the following procedure may have to be performed several times to achieve the best possible torque converter to flywheel balance.

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Rotate the torque converter one bolt position.

Fig. 10: View Of Torque Converter Hub In Engine Crankshaft
Courtesy of GENERAL MOTORS COMPANY

3. Align the torque converter hub (2) in the engine crankshaft (3) and install the torque converter to flywheel bolts.
4. Lower the vehicle.
5. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration. Refer to **Noise and Vibration Analysis**.

Repeat this procedure until you obtain the best possible balance.

6. Install the transmission converter cover bolts and the cover.

BUSHING AND MATING SHAFT INSPECTION

NOTE: **Proper bushing and corresponding mating shaft inspection should be performed before replacing the bushing, shaft, and in some cases, the component which houses the bushing. Thoroughly clean and dry the bushing and shaft surfaces before inspecting for damage.**

Any of the following bushing conditions require replacement of the bushing and/or housing:

- Discoloration due to heat distress
- Misalignment or displacement of bushing as a result of spinning in housing
- Medium to heavy scoring that can be easily detected with fingernail. Light scoring is a normal condition.
- Debris embedded into the bushing lining material
- Obvious damage, including excessive and uneven wear
- Excessive polishing. Minor polishing of the bushing is an indication of normal wear and does not require replacement.

Any of the following conditions require replacement of the bushing's mating shaft:

- Discoloration due to heat distress
- Rough surface finish that can be easily detected with finger
- Obvious shaft abnormalities, including warping or uneven surfaces
- Obvious damage or cracking

VIBRATION

Checks	Causes
Lug bolts for the Torque Converter (1)	Inspect for loose torque converter (1) lug bolts.
Input Sun Gear Thrust Washer (55)	Inspect for wear or damage.
Turbine Shaft Thrust Bearing Assembly (57)	Inspect for wear or damage.
2-6 and 3-5-R Clutch Hub Thrust Bearing Assembly (65)	Inspect the bearing for wear or damage.

Checks	Causes
Output Carrier Assembly (68)	• Inspect the carrier assembly for damaged pinion gears, thrush washers, pins, and rollers. • Inspect for a worn or damaged center support roller bearing assembly (485). • Inspect for damaged thrust bearings (486, 488). • Inspect the carrier assembly for damaged output carrier rear sun gear thrust bearing (captured).
Output Carrier Thrust Bearing Assembly (69)	Inspect the bearing for wear or damage.
Output Shaft Thrust Bearing Assembly (71)	Inspect the bearing for wear or damage.
1-2-3-4 Clutch Hub Thrust Bearing Assembly (63)	Inspect the bearing for wear or damage.
Turbine Shaft Thrust Bearing Assembly (57)	Inspect the bearing for wear or damage.
Clutch Select Solenoid Valve Spring (353)	Inspect for broken spring within the lower valve body in the torque converter clutch regulator apply valve line up (355).

NOISE AND VIBRATION ANALYSIS

A noise or vibration that is noticeable when the vehicle is in motion MAY NOT be the result of the transmission.

If noise or vibration is noticeable in PARK and NEUTRAL with the engine at idle, but is less noticeable as RPM increases, the cause may be from poor engine performance.

- Vibration may also be caused by a small amount of water inside the converter.
- Inspect the tires for the following conditions:
  - Uneven wear
  - Imbalance
  - Mixed sizes
  - Mixed radial and bias ply
- Inspect the suspension components for the following conditions:
  - Alignment wear or damage
  - Loose fasteners

    - Driveline damage or wear
- Inspect the engine and transmission mounts for damage and loose bolts.
- Inspect the transmission case mounting holes for the following conditions:
    - Missing bolts, nuts, and studs
    - Stripped threads
    - Cracks
- Inspect the flywheel for the following conditions:
    - Missing or loose bolts
    - Cracks
    - Imbalance
- Inspect the torque converter for the following conditions:
    - Missing or loose bolts or lugs
    - Missing or loose balance weights
    - Imbalance caused by heat distortion or fluid contamination

WHINE/GROWL NOISE THAT CHANGES WITH VEHICLE SPEED

Checks	Causes
2-6 and 3-5-R Clutch Hub Thrust Bearing Assembly (65)	Inspect the bearing for wear or damage.
Output Carrier Assembly (68)	• Inspect the carrier assembly for damaged pinion gears, thrust washers, pins, and rollers. • Inspect for a damaged center support roller bearing assembly (485). • Inspect for damaged thrust bearings (486, 488). • Inspect for damaged sun gears (487, 489). • Inspect the carrier assembly for damaged output carrier rear sun gear thrust bearing (captured). • Inspect for damaged or stripped splines on the output carrier assembly.
Output Carrier Thrust Bearing Assembly (69)	Inspect the bearing for wear or damage.

Checks	Causes
Output Shaft Assembly (70)	• Inspect for damaged internal gears (495, 497). • Inspect the output carrier bushing (498) for damage or wear.
Output Shaft Thrust Bearing Assembly (71)	Inspect the bearing for wear or damage.
Input Sun Gear Thrust Washer (55)	Inspect the washer for wear or damage.
Input Sun Gear Thrust Bearing (54)	Inspect the bearing for wear or damage.
Input Sun Gear (53)	Inspect for spline wear or damage.
Input Carrier Assembly (52)	Inspect the carrier assembly for damaged pinion gears, thrust washers, pins, and rollers.
1-2-3-4 Clutch Hub Thrust Bearing Assembly (63)	Inspect the bearing for wear or damage.
2-6 and 3-5-R Clutch (with Output Carrier Outer Sun Gear Shaft) Hub Assembly (64)	Inspect the output carrier inner sun gear shaft bushings (60 and 62) for damage or wear.
Turbine Shaft Thrust Bearing Assembly (57)	Inspect the bearing for wear or damage.
Fluid Filter Assembly (26)	• Inspect for damaged or restricted fluid filter assembly (26) • Inspect for damaged fluid filter seal assembly (25) or improper sealing interface (leaks, fluid aeration).
Automatic Transmission Fluid Pump Seal (5)	Inspect for worn or damaged seal.
Transmission Fluid Level	Inspect to ensure the transmission fluid is at the proper level. **Transmission Fluid Level and Condition Check**

WHINE/GROWL NOISE THAT CHANGES WITH ENGINE SPEED

Checks	Causes
Transmission Fluid Level	Inspect to ensure the transmission fluid is at the proper level. **Transmission Fluid Level and Condition Check**

NOISE IN FIRST OR REVERSE GEAR

Checks	Causes
Center Support with 2-6 Low and Reverse Clutch Assembly (67)	• Inspect for damaged or worn low and reverse clutch plates (463-465). • Inspect for damaged low and reverse clutch backing plate (462). Inspect for worn

Checks	Causes
	splines on backing plate. • Inspect for damaged low and reverse clutch backing plate retaining ring (461). • Inspect for damaged low and reverse clutch piston assembly (470), spring (469), spring retaining ring (466), and center support assembly (459). • Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise. • Inspect for cut, worn, or damaged low clutch sprag seal (468).
Output Carrier Assembly (68)	Inspect for damaged or stripped splines on the output carrier assembly.

NOISE IN FIRST, SECOND, THIRD, FOURTH, FIFTH, OR REVERSE GEAR

Checks	Causes
Input Carrier Assembly (52)	Inspect thrust washers, pinion gears, and pins for wear or damage.
Input Sun Gear (53)	Inspect for damaged sun gear.
1-2-3-4 and 3-5-R Clutch Assembly (51)	Inspect for worn or damaged clutch bearing (428).

NOISE IN FIRST, SECOND, SIXTH, OR REVERSE GEAR

Checks	Causes
Center Support with 2-6 Low and Reverse Clutch Assembly (67)	Inspect for worn or damaged output carrier outer sun gear shaft front and rear bushings (458 and 460).
Output Carrier Assembly (68)	Inspect for a worn or damaged center support roller bearing assembly (485).

NOISE IN SECOND OR SIXTH GEAR

Checks	Causes
Center Support with 2-6 Low and Reverse Clutch Assembly (67)	• Inspect for damaged or worn output carrier outer sun gear shaft front bushing (458). • Inspect for damaged or worn output carrier outer sun gear shaft rear bushing (460). • Inspect for damaged 2-6 clutch backing plate (451). Inspect for worn splines on backing plate.

Checks	Causes
	• Inspect for damaged 2-6 clutch backing plate retaining ring (450). • Inspect for damaged 2-6 clutch piston assembly (457), spring (456), retaining ring (455), and center support assembly (459).

NOISE DURING 3-4 OR 4-3 SHIFTS

Checks	Causes
4-5-6 Clutch (with Output Carrier Shaft and Dampener) Hub Assembly (58)	• Inspect hub assembly (475), dampener (476), and apply plate (477) for wear or damage. • Inspect for damaged or worn 4-5-6 clutch backing plate (432).

NOISE IN FOURTH, FIFTH, OR SIXTH GEAR

Checks	Causes
Input Sun Gear Thrust Washer (55)	Inspect for wear or damage.
Turbine Shaft Thrust Bearing Assembly (57)	Inspect for wear or damage.
4-5-6 Clutch (with Output Carrier Shaft and Dampener) Hub Assembly (58)	• Inspect for damaged or worn 4-5-6 clutch backing plate (432). • Inspect for improper selective 4-5-6 clutch backing plate retaining ring (431).

CLUTCH PLATE DIAGNOSIS

Composition Plates

Dry the plates and inspect the plates for the following conditions:

- Pitting
- Flaking
- Delamination-splitting or separation of bonded clutch material
- Wear
- Glazing

- Cracking
- Charring
- Chips or metal particles embedded in the lining

Replace a composition plate which shows any of these conditions.

Steel Plates

Wipe the plates dry and check the plates for heat discoloration. If the surfaces are smooth, even if color smear is indicated, you can reuse the plate. If the plate is discolored with heat spots or if the surface is scuffed, replace the plate.

Causes of Burned Clutch Plates

The following conditions can result in a burned clutch plate:

- Incorrect usage of clutch or apply plates
- Engine coolant or water in the transmission fluid
- A cracked clutch piston
- Damaged or missing seals
- Low line pressure
- Valve body conditions
    - The valve body face is not flat.
    - Porosity is between channels.
    - The valve bushing clips are improperly installed.
    - The checkballs are misplaced.
- The TeflonÂ® seal rings are worn or damaged.

ENGINE COOLANT/WATER IN TRANSMISSION

CAUTION: The antifreeze or water will deteriorate the seals, gaskets and the glue that bonds the clutch material to the pressure plate. Both conditions may cause damage to the transmission.

If antifreeze or water has entered the transmission, perform the following:

1. Disassemble the transmission.

2. Replace all of the rubber type seals. The coolant will attack the seal material which will cause leakage.
3. Replace the composition-faced clutch plate assemblies. The facing material may separate from the steel center portion.
4. Replace all of the nylon parts - washers.
5. Replace the torque converter.
6. Thoroughly clean and rebuild the transmission, using new gaskets and oil filter.
7. Flush the cooler lines after the transmission cooler has been properly repaired or replaced.

FLUID LEAK DIAGNOSIS

General Method

1. Verify that the leak is transmission fluid.

CAUTION: **Do not clean using brake cleaner or other reactive solvents as these solvents can damage rubber gaskets, seals and bushings.**

2. Thoroughly clean the suspected leak area using a rag.

NOTE: **Do not idle vehicle, this will not actuate transmission systems, and do not drive the vehicle on the freeway as this will splatter oil inhibiting leak diagnosis.**

3. Operate the vehicle for 15-20 minutes under city driving conditions until normal operating temperatures are reached.
4. Park the vehicle over clean paper or cardboard.
5. Shut OFF the engine.
6. Look for fluid spots on the paper.
7. Make the necessary repairs.

Powder Method

CAUTION: **Do not clean using brake cleaner or other reactive solvents as these solvents can damage rubber gaskets, seals and bushings.**

1. Thoroughly clean the suspected leak area using a rag.
2. Apply an aerosol type powder, such as foot powder, to the suspected leak area.

NOTE: **Do not idle vehicle, this will not actuate transmission systems, and do not drive the vehicle on the freeway as this will splatter oil inhibiting leak diagnosis.**

3. Operate the vehicle for 15-20 minutes under city driving conditions until normal operating temperatures are reached.
4. Shut OFF the engine.
5. Inspect the suspected leak area.
6. Trace the leak path through the powder in order to find the source of the leak.
7. Make the necessary repairs.

Dye and Black Light Method

A fluid dye and black light kit is available from various tool manufacturers.

1. Follow the manufacturer's instructions in order to determine the amount of dye to use.
2. Detect the leak with the black light.
3. Make the necessary repairs.

Find the Cause of the Leak

Pinpoint the leak and trace the leak back to the source. You must determine the cause of the leak in order to repair the leak properly. For example, if you replace a gasket, but the sealing flange is bent, the new gasket will not repair the leak. You must also repair the bent flange. Before you attempt to repair a leak, check for the following conditions, and make repairs as necessary:

Gaskets

- Fluid level/pressure is too high
- Plugged vent or drain-back holes
- Improperly tightened fasteners
- Dirty or damaged threads
- Warped flanges or sealing surface
- Scratches, burrs, or other damage to the sealing surface
- Damaged or worn gasket
- Cracking or porosity of the component
- Improper sealant used, where applicable

- Incorrect gasket

Seals

- Fluid level/pressure is too high
- Plugged vent or drain-back holes
- Damaged seal bore
- Damaged or worn seal
- Improper installation
- Cracks in component
- Manual or output shaft surface is scratched, nicked, or damaged
- Loose or worn bearing causing excess seal wear

Possible Points of Fluid Leaks

Transmission Oil Pan

- Incorrectly tightened oil pan bolts
- Improperly installed or damaged oil pan gasket
- Damaged oil pan or mounting face
- Incorrect oil pan gasket

Case Leak

- Damaged vehicle speed sensor seal
- Damaged manual shaft seal
- Loose or damaged oil cooler connector fittings
- Worn or damaged propeller shaft oil seal
- Loose line pressure pipe plug
- Porous casting warped torque converter housing

Leak at the Torque Converter End

- Converter leak in the weld area

- Converter seal lip cut. Check the converter hub for damage
- Converter seal bushing moved forward and damaged
- Converter seal garter spring missing from the seal
- Porous casting of the transmission case or the oil pump

Leak at the Vent Pipe

- Overfilled system
- Water or coolant in the fluid; The fluid will appear milky
- Transmission case porous
- Incorrect fluid level indicator
- Plugged vent
- Drain-back holes plugged
- Mispositioned oil pump to case gasket, if equipped

Leak Inspection Points

Fig. 11: Leak Inspection Points
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Automatic Transmission Electrical Connector Passage Sleeve
2	Line Pressure Test Hole Plug
3	Converter Housing to Case Joint
4	Trans Fluid Cooler Pipe Fitting Seals

Callout	Component Name
5	Manual Shift Shaft Seal
6	Automatic Transmission Vent Pipe
7	Transmission Case Assembly
8	A/Trans Case Extension Seal - 2WD Models
9	Prop Shaft Front Slip Yoke Oil Seal - 2WD Models
10	A/Trans Fluid Pan Gasket
11	Torque Converter Fluid Seal Assembly
12	Torque Converter Assembly
13	Case Extension to Case Joint
14	Output Shaft Seal Assembly - 4WD Models

CASE POROSITY REPAIR

Some external leaks are caused by case porosity in non-pressurized areas. You can usually repair these leaks with the transmission in the vehicle.

1. Thoroughly clean the area to be repaired with a cleaning solvent. Air dry the area.

WARNING: Epoxy adhesive may cause skin irritations and eye damage. Read and follow all information on the container label as provided by the manufacturer.

2. Using instructions from the manufacturer, mix a sufficient amount of an epoxy to make the repair.
3. While the transmission case is still hot, apply the epoxy. You can use a clean, dry soldering acid brush to clean the area and also to apply the epoxy cement. Make certain that the area to be repaired is fully covered.
4. Allow the epoxy cement to cure for three hours before starting the engine.
5. Repeat the fluid leak diagnosis procedures.

AUTOMATIC TRANSMISSION FLUID LEAKS

Checks	Causes
Torque Converter (1)	Inspect for damage, cracks at the lug, hub and seal welds.
Torque Converter Housing (203)	• Verify leak is ATF and not oil from rear of engine. • Inspect for housing porosity or damage.

Checks	Causes
	• Inspect for worn or damaged torque converter seal (201). • Inspect for loose line pressure plug. • Inspect cooler line attachment for loose bolt, worn or damaged seal, or leak at line to boss joint. • Inspect vent pipe attachment to housing and hose. • Verify torque of housing to case bolts.
Automatic Transmission Fluid Pump Seal (5)	Inspect for cut, wear, or damage.
Case Assembly	• Inspect for porosity or damage. • Inspect manual shaft seal. • Inspect control wiring input sleeve seals. • Inspect rear case plugs (12) (4WD/AWD only, 4WD may also be cast over).
Extension Assembly	• Verify oil is from transmission and not transfer case assembly (4WD/AWD). • Inspect extension seal assembly (inner seal behind boot - 2WD only). • Inspect extension to case seal (2WD only).
Pan Assembly	• Inspect the pan assembly for damage. • Inspect gasket for damage or wear. • Inspect case and pan for damage and flatness at gasket interface area.
Cooler Lines/Coolers	• Inspect and follow cooler lines to front radiator and external coolers. • Some vehicles may have rear differential external and internal coolers.

SHIFT INDICATOR INDICATES WRONG GEAR SELECTION

Checks	Causes
Shift Cable	• Inspect for damage. • Verify proper attachment to shifter.

Checks	Causes
	• Verify cable is locked into shifter bracket. • Verify cable is properly attached to the transmission. • Verify that the cable is locked into the transmission bracket. • Verify proper shift cable adjustment.
Manual Shaft	• Verify shift lever is properly attached to the manual shaft. • Verify manual shaft is not twisted or damaged.
Manual Shift Detent Lever with Shaft Position Switch Assembly, IMS	Verify proper operation. Refer to **Transmission Internal Mode Switch Logic** .

NO PARK OR DRIVE

Checks	Causes
Output Shaft Assembly (70)	Inspect for a broken or damaged output shaft. Inspect for worn splines.
Case Assembly	• Inspect for broken or damaged case. • Inspect for broken or bent park pawl actuator. • Inspect for broken or missing park pawl actuator guide pin or manual shaft pin. • Inspect for broken, loose or misaligned park pawl guide. • Inspect for binding or broken park pawl or actuator assembly.
Manual Shift Detent Lever Assembly (511)	Inspect for broken or disengaged manual valve detent.

HARSH GARAGE SHIFT

Checks	Causes
NOTE: **On cold days, approximately 32Â°F (0Â°C) or colder, the**	

Checks	Causes
transmission is designed to shift differently. The transmission uses a warm-up mode shift schedule until the engine reaches normal operating temperature. While the transmission is in warm-up mode, it is normal for transmission upshifts to be delayed or held longer. This feature improves heater performance by giving quicker vehicle warm-ups.	
Engine	Elevated engine RPM - Verify correct engine operating rpm per application.
A/Trans Fluid Pump Cover Assembly (219)	• Inspect for damaged, stuck, sticky pressure regulator valve (233) and springs (234 and 235).

Checks	Causes
	• Inspect for damaged, stuck, sticky isolator valve (236) and sleeve (237).
Control Solenoid (w/Body and TCM) Valve Assembly (314)	• Incorrect or inadequate adapt activity - Perform **Reset Transmission Adapts** procedure. • Incorrect TCM temperature reporting - Monitor TCM temperature using Tech 2. • Line pressure control solenoid incorrect pressure.
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for damaged 1-2-3-4 clutch piston (414), piston housing (417), spring (413), and dam assembly (412). • Inspect for cut, worn, or damaged 1-2-3-4 clutch piston seal (416), inner seal (423), and housing seals (424 and 425). • Inspect for improper selective 1-2-3-4 clutch backing plate retaining ring (429). • Inspect for damaged 3-5-R clutch piston (421), apply ring (405), and spring (420). • Inspect for cut, worn, or damaged 3-5-R clutch piston dam O-ring seal (418), inner seal (419), and outer seal (422). • Inspect for improper selective 3-5-R clutch backing plate retaining ring (400).

NO DRIVE IN ALL RANGES

Checks	Causes
A/Trans Fluid Pan Assembly (29)	Verify proper fluid level and condition, inspect transmission assembly for leaks.
Torque Converter (with Fluid Pump) Housing Assembly (2)	Inspect for damaged or scored pump housing (203), cover (219), rotor (217), slide (212), and vanes (216).
Fluid Filter Assembly (26)	• Inspect for damaged or restricted fluid filter assembly (26). • Inspect for damaged fluid filter seal assembly (25) or improper sealing interface, leaks, and fluid aeration.
Automatic Transmission Fluid Pump Seal (5)	Inspect for worn or damaged seal.
A/Trans Cooling/Lubrication System	Inspect transmission oil cooler (radiator) and cooler line seals for restrictions, damage, kinks, or leaks.

Checks	Causes
Torque Converter Assembly (1)	Inspect for overheating (blued), ballooning, leaks, or other damage.
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect clutch pack retaining rings (400 and 429) for proper installation. • Inspect housing and clutch pistons and seals for damage or leaks.
Control Valve Lower Body Assembly (351)	• Inspect for stuck, sticky or damaged clutch select valve (352). • Inspect for stuck checkballs.
Manual Valve (354)	Inspect the manual valve detent lever assembly (505) and connection to the manual valve (354).
A/Trans Manual Shift Shaft Position Switch Assembly (308)	Inspect the switch assembly (308) and connection to the manual valve (354).
A/Trans Manual Shift Shaft Position Switch Assembly (308)	Inspect PRNDL commands to and from vehicle using GDS 2.
Control Solenoid (w/Body and TCM) Valve Assembly (314)	Inspect PRNDL commands to and from vehicle using GDS 2.
A/Trans Fluid Pump (Transfer) Seal Assembly (19)	Inspect for damage or leaks.
Output Shaft Assembly (499)	Inspect for spline wear or damage.
Output Carrier Assembly (490)	• Inspect the carrier assembly for damaged pinion gears, thrust washers, pins, and rollers. • Inspect for damaged thrust bearings (486 and 488). • Inspect for damaged sun gears (487 and 489). • Inspect the carrier assembly for damaged output carrier rear sun gear thrust bearing (captured).
Low Clutch Sprag Assembly (467)	Inspect for excessive wear or damage.
Input Carrier Assembly (52)	Inspect carrier assembly for damaged pinion gears, thrust washers, pins, and rollers.
Input Sun Gear (53)	Inspect for spline wear or damage.
Control Valve Upper Body Assembly (304)	Inspect for sticking, damaged, or worn 1-2-3-4 clutch regulator valve (337).

NO FIRST GEAR

Checks	Causes
A/Trans Fluid Pan Assembly (29)	Verify proper fluid level and condition, inspect transmission assembly for leaks.
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise. • Inspect for damaged low and reverse clutch piston assembly (470), spring (469), spring retaining ring (466), and center support assembly (459). • Inspect for damaged or worn low and reverse clutch plates (463-465). • Inspect for damaged low and reverse clutch backing plate retaining ring (461). • Inspect for cut, worn, or damaged low clutch sprag seal (468).
Control Valve Upper Body Assembly (304)	• Inspect for sticking, damaged, or worn 1st/Rev and 4-5-6 clutch regulator valve (327) and spring (326). • Inspect for sticking, damaged, or worn #2 ball check valve. • Inspect for sticking, damaged, or worn #3 ball check valve. • Inspect for sticking, damaged, or worn 1-2-3-4 clutch regulator valve (337).
Control Valve Lower Body Assembly (307)	• Inspect for sticking, damaged, or worn clutch select valve 2 (352) and spring (353). • Inspect for sticking, damaged, or worn clutch select valve 3 (352) and spring (353).
Center Support Fluid Passage Seal Assembly (20)	• Inspect for worn, cut, or damaged seals. • Inspect for proper seal (20) size (6L45/50E MYA/MYB) vs (6L80/90E MYC/MYD).

NO FIRST AND REVERSE GEARS

Checks	Causes
A/Trans Fluid Pan Assembly (29)	Verify proper fluid level and condition, inspect transmission assembly for leaks.
Control Valve Upper Body Assembly (304)	Inspect for sticking, damaged, or worn 1st/rev and 4-5-6 clutch regulator valve (327) and spring (326).
Control Valve Lower Body Assembly (307)	Inspect for sticking, damaged, or worn clutch select valve 3 (352) and spring (353).
Control Valve Lower Body Assembly (307)	Inspect for sticking, damaged, or worn clutch select valve 2 (352) and spring (353).

Checks	Causes
Control Valve Upper Body Assembly (304)	Inspect for sticking, damaged, or worn #2 ball check valve
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged low and reverse clutch piston assembly (470), spring (469), spring retaining ring (466), and center support assembly (459). • Inspect for damaged or worn low and reverse clutch plates (463-465). • Inspect for damage low and reverse clutch backing plate retaining ring (461). • Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise. • Inspect for cut, worn, or damaged low clutch sprag seal (468).
Center Support Fluid Passage Seal Assembly (20)	• Inspect for worn, cut, or damaged seals. • Inspect for proper seal (20) size (6L45/50E MYA/MYB) vs (6L80/90E MYC/MYD).
Pump Cover (219)	Inspect for sticking or damaged TCC control valve (227).

HARSH, SOFT, DELAYED OR SLIPPING FIRST OR REVERSE GEAR

Checks	Causes
NOTE: **On cold days, approximately 32Â°F (0Â°C) or colder, the transmission is designed to shift differently. The transmission uses a warm-up mode shift schedule until**	

Checks	Causes
the engine reaches normal operating temperature. While the transmission is in warm-up mode, it is normal for transmission upshifts to be delayed or held longer. This feature improves heater performance by giving quicker vehicle warm-ups.	
A/Trans Fluid Pan Assembly (29)	Verify proper fluid level and condition, inspect transmission assembly for leaks.
Control Valve Upper Body Assembly (304)	• Inspect for sticking, damaged, or worn 1-R/4-5-6 clutch regulator valve (327) and spring (326). • Inspect for damaged or sticking #2 ball check valve.
Control Valve Lower Body Assembly (307)	Inspect for sticking, damaged, or worn clutch select valve 3 (352) and spring (353).
Control Valve Lower Body Assembly (307)	Inspect for sticking, damaged, or worn clutch select valve 2 (352) and spring (353).
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged low and reverse clutch piston assembly (470), spring (469), spring retaining ring (466), and center support assembly (459). • Inspect for damaged or worn low and reverse clutch plates (463 and 465). • Inspect for damaged low and reverse clutch backing plate retaining ring (461).

Checks	Causes
	• Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise. • Inspect for cut, worn, or damaged low clutch sprag seal (468).
Control Solenoid (w/Body and TCM) Valve Assembly (314)	• Perform solenoid valve assembly function test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**. • Incorrect or inadequate adapt activity - Perform **Reset Transmission Adapts** procedure.
A/Trans Fluid Pump Cover Assembly (219)	• Inspect for damaged, stuck, sticky pressure regulator valve (233) and spring (234 and 235). • Inspect for damaged, stuck, sticky isolator valve (236) and sleeve (237).
Center Support Fluid Passage Seal Assembly (20).	• Inspect for worn, cut, or damaged seals. • Inspect for proper seal (20) size (6L45/50E MYA/MYB) vs (6L80.90E MYC/MYD).

NO FIRST, SECOND, THIRD, AND FOURTH GEAR

Checks	Causes
A/Trans Fluid Pan Assembly (29)	Verify proper fluid level and condition, inspect transmission assembly for leaks.
Control Valve Upper Body Assembly (304)	Inspect for sticking, damaged, or worn 1-2-3-4 clutch regulator valve (337) and spring (326).
Control Solenoid (w/Body and TCM) Valve Assembly (314)	• Inspect for contamination or debris. • Pressure control solenoid 5 commanded/failed LOW (off) or leaking - Perform solenoid valve assembly function test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**.
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect clutch pack retaining ring (429) for proper installation. If the retaining ring is out of the groove the following parts must be replaced: 1-2-3-4 and 3-5-R clutch housing (427), 1-2-3-4 and 3-5-R clutch bearing assembly (428) and the 1-2-3-4

Checks	Causes
	clutch backing plate retaining ring. • Inspect for a cracked or damaged 1-2-3-4 clutch piston (414), piston housing (417), spring (413), and dam assembly (412). • Inspect for cut, worn, or damaged 1-2-3-4 clutch piston seal (416), inner seal (423), and housing seals (424 and 425). • Inspect for improper selective 1-2-3-4 clutch backing plate retaining ring (429).
Fluid Filter Assembly (26)	• Inspect for damaged or restricted fluid filter assembly (26). • Inspect for damaged fluid filter seal assembly (25) or improper sealing interface, leaks, and fluid aeration.
Torque Converter (with Fluid Pump) Housing Assembly (2)	Inspect for damaged or scored pump housing (203), cover (219), rotor (217), slide (212) and vanes (216).
Torque Converter (with Fluid Pump) Housing Assembly (2)	Inspect for damaged or leaking 1-2-3-4 and 3-5-R clutch fluid seal rings (230).
Center (w/2-6 Low and Reverse Clutch) Support Assembly (67)	Inspect for worn or damaged low clutch sprag assembly (467).
A/Trans Fluid Pump (Transfer) Seal Assembly (19)	Inspect for damage or leaks.
1-2-3-4 Clutch (with Output Carrier Inner Sun Gear Shaft) Hub Assembly (61)	Inspect for damaged splines on the hub assembly.

HARSH, SOFT, DELAYED OR SLIPPING 1-2-3-4 SHIFT

Checks	Causes
NOTE: **On cold days, approximately 32Â°F (0Â°C) or colder, the transmission is designed to**	

Checks	Causes
shift differently. The transmission uses a warm-up mode shift schedule until the engine reaches normal operating temperature. While the transmission is in warm-up mode, it is normal for transmission upshifts to be delayed or held longer. This feature improves heater performance by giving quicker vehicle warm-ups.	
A/Trans Fluid Pan Assembly (29)	Verify proper fluid level and condition, inspect transmission assembly for leaks.
Control Valve Upper Body Assembly (304)	• Inspect for sticking, damaged, or worn 1-2-3-4 clutch regulator valve (337) and spring (326). • Inspect for damaged or stuck #1 ball check valve.

Checks	Causes
Control Solenoid (w/Body and TCM) Valve Assembly (314)	• Inspect for contamination or debris. • Pressure control solenoid 5 commanded/failed LOW (off) or leaking - Perform solenoid valve assembly function test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**. • Incorrect or inadequate adapt activity - Perform **Reset Transmission Adapts** procedure. • Line pressure control solenoid incorrect pressure.
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for damaged 1-2-3-4 clutch piston (414), piston housing (417), spring (413), and dam assembly (412). • Inspect for cut, worn, or damaged 1-2-3-4 clutch piston seal (416), inner seal (423), and housing seals (424 and 425). • Inspect 3-5 reverse clutch housing for cracked weld. • Inspect for improper selective 1-2-3-4 clutch backing plate retaining ring (429). • Inspect for damaged 3-5-R clutch piston (421), apply ring (405), and spring (420). • Inspect for cut, worn, or damaged 3-5-R clutch piston dam O-ring seal (418), inner seal (419), and outer seal (422). • Inspect for improper selective 3-5-R clutch backing plate retaining ring (400).
Torque Converter (with Fluid Pump) Housing Assembly (2)	Inspect for damaged or leaking 1-2-3-4 and 3-5-R clutch fluid seal rings (230).
A/Trans Fluid Pump Cover Assembly (219)	• Inspect for damaged, stuck, sticky pressure regulator valve (233) and springs (234 and 235). • Inspect for damaged, stuck, sticky isolator valve (236) and sleeve (237).
Torque Converter (with Fluid Pump) Housing Assembly (2)	Inspect for damaged or scored pump housing (203), cover (219), rotor (217), slide (212) and vanes (216).
Fluid Filter Assembly (26)	• Inspect for damaged or restricted fluid filter assembly (26). • Inspect for damaged fluid filter seal assembly (25) or improper sealing interface, leaks, and fluid aeration.

NO SECOND AND SIXTH GEAR

Checks	Causes
A/Trans Fluid Pan Assembly (29)	Verify proper fluid level and condition, inspect transmission assembly for leaks.
Control Valve Upper Body Assembly (304)	Inspect for sticking, damaged, or worn 2-6 clutch regulator valve (334) and spring (326).
Control Solenoid (w/Body and TCM) Valve Assembly (314)	Pressure control solenoid 4 commanded/failed LOW (off) or leaking - Perform solenoid valve assembly function test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**.
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for proper installation of the 2-6 clutch return spring retaining ring (455). • Inspect for damaged 2-6 clutch piston assembly (457), spring (456), retaining ring (455), and center support housing (459). • Inspect for worn or damaged 2-6 clutch plates (451-453).
Center Support Fluid Passage Seal Assembly (20)	• Inspect for worn, cut, or damaged seals. • Inspect for proper seal (20) size (6L45/50E MYA/MYB) vs (6L80/90E MYC/MYD).

HARSH, SOFT, DELAYED OR SLIPPING SECOND OR SIXTH GEAR

Checks	Causes
NOTE: **On cold days, approximately 32Â°F (0Â°C) or colder, the transmission is designed to shift differently. The transmission uses a warm-up mode shift schedule until**	

Checks	Causes
the engine reaches normal operating temperature. While the transmission is in warm-up mode, it is normal for transmission upshifts to be delayed or held longer. This feature improves heater performance by giving quicker vehicle warm-ups.	
A/Trans Fluid Pan Assembly (29)	Verify proper fluid level and condition, inspect transmission assembly for leaks.
Control Valve Upper Body Assembly (304)	• Inspect for sticking, damaged or worn 2-6 clutch regulator valve (334) and spring (326). • Inspect for damaged or sticking #6 ball check valve.
Control Solenoid (w/Body and TCM) Valve Assembly (314)	• Pressure Control Solenoid 4 commanded/failed LOW (off) or leaking - Perform solenoid valve assembly function test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**. • Incorrect or inadequate adapt activity - Perform **Reset Transmission Adapts** procedure.

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for proper installation of the 2-6 clutch return spring retaining ring (455). • Inspect for damaged 2-6 clutch piston assembly (457), spring (456), retaining ring (455), and center support assembly (459). • Inspect for worn or damaged 2-6 clutch plates (451-453).
A/Trans Fluid Pump Cover Assembly (219)	• Inspect for damaged, stuck, sticky pressure regulator valve (233) and springs (234 and 235). • Inspect for damaged, stuck, sticky isolator valve (236) and sleeve (237).
Center Support Fluid Passage Seal Assembly (20)	• Inspect for worn, cut, or damaged seals. • Inspect for proper seal (20) size (6L45/50E MYA/MYB) vs (6L80/90E MYC/MYD).

NO THIRD, FIFTH, AND REVERSE GEAR

Checks	Causes
A/Trans Fluid Pan Assembly (29)	Verify proper fluid level and condition, inspect transmission assembly for leaks.
Control Valve Upper Body Assembly (304)	• Inspect for sticking, damaged, or worn 3-5-R regulator valve (336) and valve spring (326). • Inspect for damaged or stuck #7 ball check valve.
Control Valve Lower Body Assembly (307)	Inspect for worn, damaged, or sticking clutch select solenoid valve 3 (352) and valve spring (353).
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for proper installation of 3-5-R clutch backing plate retaining ring (400). • Inspect for worn, damaged, or leaking clutch bearing seal assembly (428). • Inspect for damaged or worn 3-5-R clutch plates (401-404). • Inspect for damaged 3-5-R clutch piston (421), apply ring (405), and spring (420). • Inspect for cut, worn, or damaged 3-5-R clutch piston dam O-ring seal (418), inner seal (419), and outer seal (422). • Inspect for improper selective 3-5-R clutch backing plate retaining ring (400).

Checks	Causes
Control Solenoid (w/Body and TCM) Valve Assembly (314)	Pressure control solenoid 2 commanded/failed HIGH (off) or leaking - Perform solenoid valve assembly function test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**.
A/Trans Fluid Pump (Transfer) Seal Assembly (19)	Inspect for damage or leaks.

HARSH, SOFT, DELAYED OR SLIPPING THIRD, FIFTH, OR REVERSE GEAR

Checks	Causes
NOTE: **On cold days, approximately 32Â°F (0Â°C) or colder, the transmission is designed to shift differently. The transmission uses a warm-up mode shift schedule until the engine reaches normal operating temperature. While the transmission is in warm-up mode, it is normal for transmission**	

Checks	Causes
upshifts to be delayed or held longer. This feature improves heater performance by giving quicker vehicle warm-ups.	
A/Trans Fluid Pan Assembly (29)	Verify proper fluid level and condition, inspect transmission assembly for leaks.
Control Valve Upper Body Assembly (304)	• Inspect for sticking, damaged, or worn 3-5-R regulator valve (336) and valve spring (326). • Inspect for damaged or stuck #7 ball check valve.
Control Valve Lower Body Assembly (307)	Inspect for worn, damaged, or sticking clutch select solenoid valve 3 (352) and valve spring (353).
Control Solenoid (w/Body and TCM) Valve Assembly (314)	• Pressure control solenoid 2 commanded/failed HIGH (off) or leaking - Perform solenoid valve assembly function test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**. • Incorrect or inadequate adapt activity - Perform **Reset Transmission Adapts** procedure.
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for proper installation of 3-5-R clutch backing plate retaining ring (400). • Inspect for worn, damaged, or leaking clutch bearing seal assembly (428). • Inspect for damaged or worn 3-5-R clutch plates (401-404). • Inspect for damaged 3-5-R clutch piston (421), apply ring (405), and spring (420). • Inspect 3-5 reverse clutch housing for cracked weld. • Inspect for cut, worn, or damaged 3-5-R clutch piston dam O-ring seal (418), inner seal (419), and outer seal (422).

Checks	Causes
	• Inspect for improper selective 3-5-R clutch backing plate retaining ring (400).
A/Trans Fluid Pump Cover Assembly (219)	• Inspect for damaged, stuck, sticky pressure regulator valve (233) and springs (234 and 235). • Inspect for damaged, stuck, sticky isolator valve (236) and sleeve (237).
A/Trans Fluid Pump (Transfer) Seal Assembly (19)	Inspect for damage or leaks.

NO FOURTH, FIFTH, AND SIXTH GEAR

Checks	Causes
A/Trans Fluid Pan Assembly (29)	Verify proper fluid level and condition, inspect transmission assembly for leaks.
Control Valve Upper Body Assembly (304)	Inspect for sticking, damaged, or worn R-1/4-5-6 clutch regulator valve (327) and spring (326).
4-5-6 (with Turbine Shaft) Clutch Assembly (56)	• Inspect for cut, worn, or damaged turbine shaft fluid seal rings (442). • Inspect for damaged piston (439), piston dam (437), dam retaining ring (436), and clutch spring (438). • Inspect for worn or damaged 4-5-6 clutch plates (432-435). • Inspect for damaged or leaking clutch housing (441). • Inspect for improper selective 4-5-6 clutch backing plate retaining ring (431). • Inspect for damaged or distorted turbine shaft.
A/Trans Fluid Pump Seal Assembly (18)	Inspect for cut, leaking, or damaged seal.
4-5-6 Clutch (with Output Carrier Shaft and Dampener) Hub Assembly (58)	• Inspect the shaft for damage or wear. • Inspect the hub assembly (475), dampener (476), and apply plate (477) for wear or damage.
A/Trans Cooling/Lubrication System	Inspect transmission oil cooler (radiator) and cooler lines/seals for restrictions, damage, kinks or leaks.

Checks	Causes
Control Solenoid (w/Body and TCM) Valve Assembly (314)	Pressure control solenoid 3 commanded/failed HIGH (off) or leaking - Perform solenoid valve assembly function test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**.
Torque Converter (with Fluid Pump) Housing Assembly (2)	• Inspect for damaged or scored pump housing (203), cover (219), rotor (217), slide (212), and vanes (216). • Inspect for damaged or porous pump cover assembly (219). Inspect pump surfaces for flatness. • Inspect for excessive fluid pump rotor (217) clearance or damage. Ensure proper selective rotor is being utilized.
Output Shaft Assembly (70)	Inspect for damaged or stripped splines on the output shaft.

HARSH, SOFT, DELAYED OR SLIPPING 4-5-6 SHIFT

Checks	Causes
NOTE: **On cold days, approximately 32Â°F (0Â°C) or colder, the transmission is designed to shift differently. The transmission uses a warm-up mode shift schedule until the engine reaches normal operating**	

Checks	Causes
temperature. While the transmission is in warm-up mode, it is normal for transmission upshifts to be delayed or held longer. This feature improves heater performance by giving quicker vehicle warm-ups.	
A/Trans Fluid Pan Assembly (29)	Verify proper fluid level and condition, inspect transmission assembly for leaks.
Control Valve Upper Body Assembly (304)	• Inspect for sticking, damaged, or worn 1-R/4-5-6 clutch regulator valve (327) and spring (326). • Inspect for damaged or sticking #3 and #4 ball check valves.
Control Valve Lower Body Assembly (307)	Inspect for worn, damaged, or sticking clutch select solenoid valve 2 (352) and valve spring (353).
Control Solenoid (w/Body and TCM) Valve Assembly (314)	• Pressure Control Solenoid 3 commanded/failed HIGH (off) or leaking - Perform solenoid valve assembly function test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**. • Incorrect or inadequate adapt activity - Perform **Reset Transmission Adapts** procedure.
4-5-6 (with Turbine Shaft) Clutch Assembly (56)	• Inspect for cut, worn, or damaged turbine shaft fluid seal rings (442). • Inspect for damaged piston (439), piston dam (437), dam retaining ring (436), and

Checks	Causes
	clutch spring (438). • Inspect for damaged or worn 4-5-6 clutch plates (432-435). • Inspect for damage or leaking clutch housing (441). • Inspect for improper selective 4-5-6 clutch backing plate retaining ring (431). • Inspect for damaged or distorted turbine shaft.
A/Trans Fluid Pump Seal Assembly (18)	Inspect for cut, leaking, or damaged seal.
4-5-6 Clutch (with Output Carrier Shaft and Dampener) Hub Assembly (58)	• Inspect shaft for damage or wear. • Inspect hub assembly (475), dampener (476), and apply plate (477) for wear or damage.
A/Trans Fluid Pump Cover Assembly (219)	• Inspect for damaged, stuck, sticky pressure regulator valve (233) and springs (234 and 235). • Inspect for damaged, stuck, sticky isolator valve (236) and sleeve (237).

NO TORQUE CONVERTER CLUTCH APPLY

Checks	Causes
Torque Converter Assembly (1)	Diagnose torque converter for possible internal damage. Refer to **Torque Converter Diagnosis**.
Fluid Pump Cover Assembly (219)	• Inspect for worn, damaged, or sticking converter feed limit valve (220) and spring (221). • Inspect for worn, damaged, or sticking TCC control valve (227) and spring (226). • Inspect for damaged stator shaft.
Control Valve Lower Body Assembly (307)	Inspect for worn, damaged, or sticking torque converter clutch (TCC) regulator apply valve (355). Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
4-5-6 (with Turbine Shaft) Clutch Assembly (56)	• Inspect for damaged turbine shaft. • Inspect for damaged turbine shaft O-ring seal.

NO TORQUE CONVERTER CLUTCH RELEASE

Checks	Causes
Torque Converter Assembly (1)	Diagnose torque converter for possible internal damage. Refer to **Torque Converter Diagnosis**.
Fluid Pump Cover Assembly (219)	• Inspect for worn, damaged, or sticking converter feed limit valve (220) and spring (221). • Inspect for worn, damaged, or sticking torque converter clutch (TCC) control valve (227) and spring (226).
Control Valve Lower Body Assembly (307)	Inspect for worn, damaged, or sticking TCC regulator apply valve (355).

HARSH TORQUE CONVERTER CLUTCH APPLY, OR INOPERATIVE OR NO ELECTRONICALLY CONTROLLED CAPACITY CLUTCH CONTROL

Checks	Causes
NOTE: **On cold days, approximately 32Â°F (0Â°C) or colder, the transmission is designed to shift differently. The transmission uses a warm-up mode shift schedule until the engine reaches normal operating temperature.**	

Checks	Causes
While the transmission is in warm-up mode, it is normal for transmission upshifts to be delayed or held longer. This feature improves heater performance by giving quicker vehicle warm-ups.	
Torque Converter Assembly (1)	• Inspect for leaking or damaged torque converter clutch hub seal. • Diagnose torque converter assembly for possible internal damage. Refer to **Torque Converter Diagnosis**.
Clutch Select Solenoid Valve Spring (353)	Inspect for broken spring within the lower valve body in the torque converter clutch regulator apply valve line up (355).

NO REVERSE GEAR

Checks	Causes
A//Trans Fluid Pan Assembly (29)	Verify proper fluid level and condition, inspect transmission assembly for leaks.
Control Valve Upper Body Assembly (304)	• Inspect for sticking, damaged, or worn 3-5-R regulator valve (336) and valve spring (326). • Inspect for damaged or missing #5 ball check valve.

Checks	Causes
Control Valve Lower Body Assembly (307)	Inspect for worn, damaged, or sticking clutch select solenoid valve 3 (352) and valve spring (353).
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for proper installation of 3-5-R clutch backing plate retaining ring (400). • Inspect for worn, damaged, or leaking clutch bearing seal assembly (428). • Inspect for damaged or worn 3-5-R clutch plates (401-404). • Inspect for damaged 3-5-R clutch piston (421), apply ring (405), and spring (420). • Inspect for cut, worn, or damaged 3-5-R clutch piston dam O-ring seal (418), inner seal (419), and outer seal (422). • Inspect for improper selective 3-5-R clutch backing plate retaining ring (400).
Torque Converter (with Fluid Pump) Housing Assembly (2)	• Inspect for worn or damaged 1-2-3-4 and 3-5-R clutch fluid seal rings (230). • Inspect for damaged or scored pump housing (203), cover (219), rotor (217), slide (212), and vanes (216). • Inspect for damaged or porous pump cover assembly (219). Inspect pump surfaces for flatness. • Inspect for excessive fluid pump rotor (217) clearance or damage. Ensure proper selective rotor is being utilized.
Center Support Fluid Passage Seal Assembly (20), A/Trans Fluid Pump Seal Assemblies (18 and 19)	• Inspect for worn, cut, or damaged seals. • Inspect for proper seal (20) size (6L45/50E MYA/MYB) vs (6L80/90E MYC/MYD).
Center (w/2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged or leaking low and reverse clutch piston assembly (470). • Inspect for damaged or worn low and reverse clutch plates (462-465). • Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise.
2-6 and 3-5-R Clutch (with Output Carrier Outer Sun Gear Shaft) Hub Assembly (64)	Inspect for damaged or distorted shaft on hub assembly.
Output Shaft Assembly (70)	Inspect for damaged or stripped splines on the output shaft.

FLUID PRESSURE HIGH OR LOW

Checks	Causes
Torque Converter Housing with Fluid Pump Assembly (2)	• Inspect for worn, sticking, or damaged pressure regulator valve (233). • Inspect for worn, sticking, or damaged pressure regulator valve outer spring (234). • Inspect for worn, sticking, or damaged pressure regulator valve inner spring (235). • Inspect for worn, sticking, or damaged isolator valve (236) and sleeve (237). • Inspect for worn, sticking, or damaged pressure relief ball valve (225). • Inspect for worn, sticking, or damaged pressure relief ball valve spring (224). • Inspect for damaged or porous pump cover assembly (219). Inspect for pump surfaces not flat. • Inspect for excessive fluid pump rotor (217) clearance or damage. Ensure proper selective rotor is being utilized. • Inspect for damaged fluid pump slide (212). Ensure proper selective slide is being utilized. • Inspect for worn, sticking, or damaged fluid pump slide outer spring (211). • Inspect for worn or damaged fluid pump slide seal (213), seal support (214), pivot pin (215), fluid seal ring (209), and O-ring seal (210). • Inspect for worn or damaged fluid pump vane rings (207) and rotor guide (208). • Inspect fluid filter assembly (26) for torque converter friction material.
Control Valve Upper Body Assembly (321)	• Inspect for worn, sticking, or damaged actuator feed limit valve (325) and spring (324). • Inspect for worn, sticking, or damaged clutch boost valve (329) and spring (330).
Control Valve (w/Body and TCM) Valve Assembly	Inspect for leaking or damaged filter plate assembly seals (16). Verify VBS operation in not stuck high or low.
Fluid Filter Assembly (26)	• Inspect for damaged or restricted fluid filter assembly (26). • Inspect for damaged fluid filter seal assembly (25).

NO TORQUE CONVERTER CLUTCH SLIP WITH TORQUE CONVERTER CLUTCH ENGAGED

Checks	Causes
Clutch Select Solenoid Valve Spring (353)	Inspect for broken spring within the lower valve body in the torque converter clutch regulator apply valve line up (355).

REPAIR INSTRUCTIONS - OFF VEHICLE

TORQUE CONVERTER REMOVAL AND HOLDING FIXTURE INSTALLATION

Fig. 1: Torque Converter And Holding Fixture
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Torque Converter Assembly

Callout	Component Name
2	Transmission Case Assembly **NOTE:** **1. Rotate the transmission so that the converter housing is up and secure with locking pin.** **2. Allow any remaining transmission fluid to drain from the case extension.** **Special Tools** • **DT 47605** Holding Fixture Adapter • **DT 47605** Holding Fixture • **J 3289-20** Holding Fixture Base Assembly • **J 8763-B** Holding Fixture For equivalent regional tools, refer to **Special Tools** .

CASE EXTENSION ASSEMBLY REMOVAL

Fig. 2: Case Extension Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Bolt M10 x 40 (Qty: 6)
2	Case Extension
3	Case Extension Seal

TRANSMISSION FLUID PAN, FILTER AND ELECTRICAL CONNECTOR PASSAGE SLEEVE REMOVAL (6L80)

Fig. 3: Fluid Pan, Fluid Filter And Electrical Connector Passage Sleeve Component View (6L80)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Bolt M6 x 20 (Qty: 18)
2	Fluid Pan Assembly
3	Fluid Pan Gasket

Callout	Component Name
	NOTE:
4	Fluid Filter Assembly **The fluid pan gasket is** **CAUTION:** **Inspect the gasket to determine if it may be reused. If the gasket is stuck to the case or pan, it should be replaced.** **Pull the fluid filter assembly straight out to avoid damage. Do not bend or twist the filter neck.**
5	Fluid Filter Seal Assembly **CAUTION:** **Do not damage the case sealing surface when removing the filter seal assembly.** **NOTE:** **Use a screwdriver or snap ring pliers.**
6	Electrical Connector Slide Lock **CAUTION:**

Callout	Component Name
	Pull up on the electrical connector slide lock to avoid damage to the connector.
7	Electrical Connector Passage Sleeve **NOTE:** **Engage DT 47715 electrical connector passage sleeve remover/installer on sleeve and pull straight out.** **Special Tools** • **DT 47715** Electrical Connector Passage Sleeve Remover/Installer • **J 42183** Driver Handle For equivalent regional tools, refer to **Special Tools** .

CONTROL VALVE BODY ASSEMBLY REMOVAL

Fig. 4: Control Valve Body Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Bolt M5 x 73 (Qty: 6) **NOTE:**

Callout	Component Name
	Do not remove all the bolts in the control valve body assembly. Remove only the bolts indicated. **Special Tool** **DT-48285** Valve Body Torx Plus Socket (if applicable) For equivalent regional tools, refer to **Special Tools** .
2	Control Valve Body Assembly **CAUTION:** **Use care when handling the control valve body assembly. If dropped, damage to the internal components of the control solenoid valve assembly, including the transmission control**

Callout	Component Name
	module (TCM), may result.
3	Fluid Pump Seal Assembly **CAUTION:** **Use care when removing the seal assemblies to avoid damaging the valve body seal bores.** **CAUTION:** **Refer to Seal Reuse Caution .**
4	Fluid Pump Seal Assembly **CAUTION:** **Use care when removing the seal assemblies to avoid damaging the valve body seal bores.**

Callout	Component Name
	CAUTION: **Refer to Seal Reuse Caution .**
5	Center Support Fluid Passage Seal Assembly **CAUTION:** **Use care when removing the seal assemblies to avoid damaging the case seal bores.** **CAUTION:** **Refer to Seal Reuse Caution .**

TORQUE CONVERTER HOUSING WITH FLUID PUMP REMOVAL

Fig. 5: Torque Converter Housing With Fluid Pump
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **The valve body assembly**	

Callout	Component Name
must be removed prior to removing the torque converter (with fluid pump) housing assembly. Failure to ensure this will cause severe damage to both fluid pump seal assemblies. Also, the load of the valve body pushing on the seals, which in turn push on the pump, may prevent proper pump installation into the case. Refer to control valve body assembly removal.	

Callout	Component Name
1	Turbine Shaft (O-ring) Seal
2	Bolt M10 x 50 (Qty: 9)
3	Torque Converter (With Fluid Pump) Housing Assembly
4	Fluid Pump Seal

1-2-3-4 AND 3-5 REVERSE CLUTCH ASSEMBLY AND 4-5-6 CLUTCH ASSEMBLY REMOVAL (6L50/80/90)

Fig. 6: 1-2-3-4 And 3-5 Reverse Clutch Assembly And 4-5-6 Clutch Assembly (6L50/80/90)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	1-2-3-4 and 3-5 Reverse Clutch Assembly and 4-5-6 (With Turbine Shaft) Clutch Assembly
2	Turbine Shaft Thrust Bearing Assembly

Callout	Component Name
3	4-5-6 Clutch (With Output Carrier Shaft and Dampener) Hub Assembly
4	4-5-6 Clutch Hub Thrust Bearing Assembly
5	1-2-3-4 Clutch (With Output Carrier Inner Sun Gear Shaft) Hub Assembly
6	1-2-3-4 Clutch Hub Thrust Bearing Assembly
7	2-6 and 3-5 Reverse Clutch (With Output Carrier Outer Sun Gear Shaft) Hub Assembly
8	2-6 and 3-5 Reverse Clutch Hub Thrust Bearing Assembly
9	1-2-3-4 and 3-5 Reverse Clutch Assembly
10	Input Carrier Assembly
11	Input Sun Gear
12	Input Sun Gear Thrust Bearing
13	Input Sun Gear Thrust Washer
14	4-5-6 (With Turbine Shaft) Clutch Assembly

CENTER SUPPORT, OUTPUT CARRIER AND OUTPUT SHAFT REMOVAL (6L80/6L90)

Fig. 7: Center Support, Output Carrier And Output Shaft (6L80/6L90)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Center Support Retaining Ring **WARNING:** **Use care when removing or installing the retaining ring. Ensure the J 45126 and DT**

Callout	Component Name
	47773 are installed properly onto the retaining ring or bodily injury may occur. **NOTE:** **To release tension on the retaining ring, place the retaining ring flat on the floor and step on it, then remove the tool.** **Special Tools** • **DT 47773** Snap Ring Pliers Adapter Set • **J 45126** Snap Ring Pliers For equivalent regional tools, refer to **Special Tools** .
2	Center (with 2-6 Low and Reverse Clutch) Support Assembly
3	Output Carrier Assembly and Output Shaft Assembly **CAUTION:** **Ensure the DT 47786 is**

Callout	Component Name
	completely threaded into the output shaft assembly. Due to the weight of the assembly, incomplete threading may cause the assembly to break free from the DT 47786, causing component damage. **Special Tool** **DT 47786** Output Carrier/Shaft Lifting Tool For equivalent regional tools, refer to **Special Tools** .
4	Output Shaft Thrust Bearing Assembly

MANUAL SHIFT SHAFT AND PARKING SYSTEM COMPONENTS OVERHAUL (6L80/6L90)

Fig. 8: Manual Shift Shaft And Parking System Components (6L80/6L90)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Manual Shaft Detent Lever Hub Pin **CAUTION:**

Callout	Component Name
	Refer to Pin Reuse Caution .
2	Manual Shift Shaft Pin **CAUTION:** **Refer to Pin Reuse Caution .**
3	Manual Shift Shaft **CAUTION:** **Ensure the manual shift shaft seal is replaced before installing the shaft. Installing the seal after the shaft may cause damage to the seal, resulting in fluid leaks and transmission damage.** **NOTE:** **Refer to Manual Shift**

Callout	Component Name
	Shaft Seal Replacement.
4	Manual Shaft Detent Lever Assembly
5	Park Pawl Actuator Assembly
6	Park Pawl Actuator Guide Pin **CAUTION:** **Refer to Pin Reuse Caution .** **NOTE:** **Use a large pair of side cutters to "walk" the pin out.**
7	Park Pawl Actuator Guide
8	Park Pawl Actuator Guide (O-ring) Seals **CAUTION:** **Refer to Seal Reuse Caution .**
9	Park Pawl **NOTE:** **Inspect for damage only. Do not remove. The park pawl is not a**

Callout	Component Name
	serviceable component.
10	Park Pawl Spring **NOTE:** **Inspect for damage only. Do not remove. The park pawl spring is not a serviceable component.**

MANUAL SHIFT SHAFT SEAL REPLACEMENT

Fig. 9: Manual Shift Shaft Seal
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Procedure
1	Manual Shift Shaft Seal **CAUTION:** **Do not damage the case bore during removal of the manual shift shaft seal.**

Callout	Component Procedure
	CAUTION: **When installing the seal, ensure the seal lip is firmly seated against the case bore surface. Do not allow the seal lip to be crushed, or a leak may result.** **CAUTION:** **Refer to Seal Reuse Caution .** **Special Tools** • **DT 47770** Seal Installer • **DT 45201** Cooler Line Seal Remover For equivalent regional tools, refer to **Special Tools** .

OUTPUT SHAFT SEAL REPLACEMENT (AWD MODELS ONLY)

Fig. 10: Output Shaft Seal (AWD Models Only)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Output Shaft Seal Assembly **CAUTION:** **Refer to Seal Reuse Caution .** **Special Tool** • **EN 37212** Front Output Shaft Seal Installer (6L50) • **DT 38693** Seal Installer (6L80)

Callout	Component Name
	• **EN 45000** Seal Remover For equivalent regional tools, refer to **Special Tools** .

CASE INSPECTION

Fig. 11: Transmission Case Inspection Points
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **After cleaning the**	

Callout	Component Name
transmission components, allow to air dry. Do not use cloth or paper towels in order to dry any transmission components. Lint from the towels can cause component failure. **CAUTION:** **Do not reuse cleaning solvents. Previously used solvents may deposit sediment which may damage the component.**	

Preliminary Procedures

1. Thoroughly clean the transmission case assembly, including case threads, with clean solvent.
2. Clean gasket sealing surfaces. Remove all residual gasket material.
3. Inspect all threaded holes. If necessary, repair any thread damage.

Callout	Component Name
1	Front Case Sealing Surface
2	Manual Shift Shaft Seal **NOTE:** **Refer to Manual Shift Shaft Seal Replacement.**
3	Center Support Fluid Passage Seal Bores
4	Fluid Pan Sealing Surface
5	Case Plugs
6	Output Shaft Bushing or Bearing (model specific)
7	Rear Case Sealing Surface
8	Fill Tube Bore
9	Electrical Connector Passage Sleeve Bore

OUTPUT SHAFT DISASSEMBLE (6L80/6L90)

Fig. 12: Output Shaft Components (6L80/6L90)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
NOTE: This procedure only applies to the first design output shaft assembly. If you are disassembling a second	

Callout	Component Name
design output shaft assembly (output internal gear assembly), refer to Output Internal Gear Disassemble (6L80/6L90) **NOTE:** **Inspect each component and replace as necessary.**	
1	Output Carrier Internal Gear Retaining Ring
2	Output Carrier Assembly
3	Output Carrier Internal Front Gear
4	Output Carrier Internal Gear Retaining Ring
5	Output Carrier Internal Gear Spacer
6	Output Carrier Internal Rear Gear
7	Output Carrier Thrust Bearing Assembly
8	Output Shaft Assembly

OUTPUT INTERNAL GEAR DISASSEMBLE (6L80/6L90)

Fig. 13: Output Internal Gear And Carrier (6L80/6L90)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
NOTE: **Inspect each component and replace as necessary.**	
1	Output Carrier Assembly
2	Output Carrier Thrust Bearing Assembly
3	Output Internal Gear Assembly

OUTPUT SHAFT ASSEMBLE (6L80/6L90)

Fig. 14: Output Shaft Component View (6L80/6L90)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
NOTE: **This procedure only applies to the first design output shaft assembly. If you have a**	

Callout	Component Name
second design output shaft assembly (output internal gear assembly), refer to Output Carrier to Output Internal Gear Assemble (6L80/6L90).	
1	Output Carrier Internal Rear Gear **CAUTION:** **Install the gear chamfer side down. Failure to install the gear chamfer side down may result in transmission damage.**
2	Output Gear Internal Gear Spacer
3	Output Carrier Internal Gear Retaining Ring **NOTE:**

Callout	Component Name
	Do not install the output carrier internal front gear and retaining ring yet. These components will be installed during assembly of the output carrier to the output shaft.

OUTPUT CARRIER ASSEMBLY OVERHAUL (6L80)

Fig. 15: Output Carrier Assembly (6L80)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Output Carrier Front Sun Gear Thrust Bearing Assembly
2	Center Support Roller Bearing **CAUTION:** **Do not reuse the center support roller bearing. Install a NEW center**

Callout	Component Name
	support roller bearing. Reusing an old bearing may result in damage to the output carrier. **NOTE:** **The thick side of the bearing shell faces up.** **Special Tools** • **DT 47857** Bearing Installer • **J 6125-B** Slide Hammer • **J 8092** Driver Handle • **J 23129** Universal Seal Remover For equivalent regional tools, refer to **Special Tools** .
3	Output Carrier Front Sun Gear **CAUTION:** **Install the gear chamfer side up. Failure to install the gear**

Callout	Component Name
	chamfer side up may result in transmission damage.
4	Output Carrier Front Sun Gear Rear Thrust Bearing Assembly
5	Output Carrier Rear Sun Gear **CAUTION:** **Install the gear chamfer side up. Failure to install the gear chamfer side up may result in transmission damage.**
6	Output Carrier Rear Sun Gear Bearing Assembly **NOTE:** **Inspect for damage only. Do not remove. The bearing assembly is not a serviceable component.**

OUTPUT CARRIER ASSEMBLY OVERHAUL (6L90)

Fig. 16: Output Carrier Assembly (6L90)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Output Carrier Front Sun Gear Thrust Bearing Assembly
2	Center Support Roller Bearing **CAUTION:** **Do not reuse the center support roller bearing. Install a NEW center**

Callout	Component Name
	support roller bearing. Reusing an old bearing may result in damage to the output carrier. **NOTE:** **The thick side of the bearing shell faces up.** **Special Tools** • **DT 47857** Bearing Installer • **J 8092** Driver Handle • **J 45124** Removal Bridge • **DT 47865** Bearing Remover For equivalent regional tools, refer to **Special Tools** .
3	Output Carrier Front Sun Gear **CAUTION:** **Install the gear chamfer side up. Failure to install the gear**

Callout	Component Name
	chamfer side up may result in transmission damage.
4	Output Carrier Front Sun Gear Rear Thrust Bearing Assembly
5	Output Carrier Rear Sun Gear **CAUTION:** **Install the gear chamfer side up. Failure to install the gear chamfer side up may result in transmission damage.**
6	Output Carrier Rear Sun Gear Bearing Assembly **NOTE:** **Inspect for damage only. Do not remove. The bearing assembly is not a serviceable component.**

OUTPUT CARRIER TO OUTPUT SHAFT ASSEMBLE (6L80/6L90)

Fig. 17: Output Carrier To Output Shaft (6L80/6L90)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Output Carrier Thrust Bearing Assembly
2	Output Carrier Internal Front Gear **CAUTION:** **Install the gear flat side down. Failure to install the gear flat side down may**

Callout	Component Name
	result in transmission damage.
3	Output Shaft Assembly
4	Output Carrier Internal Gear Retaining Ring **NOTE:** **Grasp the output shaft and carrier with both hands to turn over.**

OUTPUT CARRIER TO OUTPUT INTERNAL GEAR ASSEMBLE (6L80/6L90)

Fig. 18: Output Carrier To Output Internal Gear (6L80/6L90)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Output Carrier Thrust Bearing Assembly
2	Output Carrier Assembly
3	Output Internal Gear Assembly **NOTE:** **Grasp the output shaft and carrier with both hands to**

Callout	Component Name
	turn over.

2-6 CLUTCH OVERHAUL (6L80)

2-6 Clutch Plates Removal

Fig. 19: 2-6 Clutch Plates
Courtesy of GENERAL MOTORS COMPANY

2-6 Clutch Plates Removal

Callout	Component Name
1	2-6 Clutch Backing Plate Retaining Ring
2	2-6 Clutch Backing Plate
3	2-6 Clutch Plate Assembly (Qty: 5)

Callout	Component Name
4	2-6 Clutch Plate (Qty: 5)
5	2-6 Clutch (Waved) Plate

2-6 Clutch Piston Replacement

Fig. 20: 2-6 Clutch Piston
Courtesy of GENERAL MOTORS COMPANY

2-6 Clutch Piston Replacement

Callout	Component Name
1	2-6 Clutch Spring Retaining Ring **NOTE:**

Callout	Component Name
	Ensure the DT 47761 spring compressor is centered over the clutch spring. **Special Tool** **DT 47761** Clutch Spring Compressor For equivalent regional tools, refer to **Special Tools** .
2	2-6 Clutch Spring **CAUTION:** **Ensure the spring tabs are facing down during installation and that the tabs fit between the teeth on the piston. Failure to do so may cause damage to the clutch assembly.**
3	2-6 Clutch Piston Assembly

Callout	Component Name
	NOTE:

2-6 Clutch Plates Installation

It may be necessary to apply air to the appl passage order to unseat t piston.

Fig. 21: 2-6 Clutch Plates
Courtesy of GENERAL MOTORS COMPANY

2-6 Clutch Plates Installation

Callout	Component Name
1	2-6 Clutch (Waved) Plate
2	2-6 Clutch Plates (Qty: 5) **NOTE:**

Callout	Component Name
	Alternate between steel and fiber clutch plates.
3	2-6 Clutch Plate Assembly (Qty: 5) **NOTE:** **Alternate between steel and fiber clutch plates.**
4	2-6 Clutch Backing Plate
5	2-6 Clutch Backing Plate Retaining Ring **CAUTION:** **When installed, the open end of the snap ring must orient away from the slotted and scalloped areas of the center support assembly. Ideal orientation location should be at**

Callout	Component Name
	the 3 o'clock or 9 o'clock position of the center support, when facing the pan side of the case. Orienting the snap ring opening with either the scalloped or slotted areas of the center support may cause transmission damage. **Procedure** Be sure to install the retaining ring gap at the 9 o'clock or 3 o'clock position, as indicated by the arrows.
6	2-6 Clutch Apply Passage **NOTE:** **Apply air to verify proper installation of all 2-6 clutch components.**

2-6 CLUTCH OVERHAUL (6L90)

2-6 Clutch Plates Removal

Fig. 22: 2-6 Clutch Plates
Courtesy of GENERAL MOTORS COMPANY

2-6 Clutch Plates Removal

Callout	Component Name
1	2-6 Clutch Backing Plate Retaining Ring
2	2-6 Clutch Backing Plate
3	2-6 Clutch Plate Assembly (Qty: 6)
4	2-6 Clutch Plate (Qty: 6)
5	2-6 Clutch (Waved) Plate

2-6 Clutch Piston Replacement

Fig. 23: 2-6 Clutch Piston
Courtesy of GENERAL MOTORS COMPANY

2-6 Clutch Piston Replacement

Callout	Component Name
1	2-6 Clutch Spring Retaining Ring **NOTE:** **Ensure the DT 47761 spring compressor is centered over the clutch**

Callout	Component Name
	spring. **Special Tool** **DT 47761** Clutch Spring Compressor For equivalent regional tools, refer to **Special Tools** .
2	2-6 Clutch Spring **CAUTION:** **Ensure the spring tabs are facing down during installation and that the tabs fit between the teeth on the piston. Failure to do so may cause damage to the clutch assembly.**
3	2-6 Clutch Piston Assembly **NOTE:** **It may be necessary to apply air to the apply passage in order to**

Callout	Component Name
	unseat the piston.

2-6 Clutch Plates Installation

Fig. 24: 2-6 Clutch Plates
Courtesy of GENERAL MOTORS COMPANY

2-6 Clutch Plates Installation

Callout	Component Name
1	2-6 Clutch (Waved) Plate
2	2-6 Clutch Plates (Qty: 6) **NOTE:**

Callout	Component Name
	Alternate between steel and fiber clutch plates.
3	2-6 Clutch Plate Assembly (Qty: 6) **NOTE:** **Alternate between steel and fiber clutch plates.**
4	2-6 Clutch Backing Plate
5	2-6 Clutch Backing Plate Retaining Ring **CAUTION:** **When installed, the open end of the snap ring must orient away from the slotted and scalloped areas of the center support assembly. Ideal orientation location should be at**

Callout	Component Name
	the 3 o'clock or 9 o'clock position of the center support, when facing the pan side of the case. Orienting the snap ring opening with either the scalloped or slotted areas of the center support may cause transmission damage. **Procedure** Be sure to install the retaining ring gap at the 9 o'clock or 3 o'clock position, as indicated by the arrows.
6	2-6 Clutch Apply Passage **NOTE:** **Apply air to verify proper installation of all 2-6 clutch components.**

Low and Reverse Clutch Plate Removal

Fig. 25: Low And Reverse Clutch Plate
Courtesy of GENERAL MOTORS COMPANY

Low and Reverse Clutch Plate Removal

Callout	Component Name
1	Low and Reverse Clutch Backing Plate Retaining Ring
2	Low and Reverse Clutch Backing Plate
3	Low and Reverse Clutch Plate Assembly (Qty: 5)
4	Low and Reverse Clutch Plate (Qty: 5)
5	Low and Reverse Clutch (Waved) Plate

Low and Reverse Clutch Piston Removal

Fig. 26: Low And Reverse Clutch Piston
Courtesy of GENERAL MOTORS COMPANY

Low and Reverse Clutch Piston Removal

Callout	Component Name
1	Low and Reverse Clutch Spring Retaining Ring **CAUTION:** **Ensure the DT 47779 contacts the sprag assembly and not the sprag**

Callout	Component Name
	retaining ring. Damage to the sprag may result. **Special Tool** **DT 47779** Clutch Spring Compressor For equivalent regional tools, refer to **Special Tools** .
2	Low Clutch Sprag Assembly **NOTE:** **A blue colored ring may be present on the outer splines of the low clutch sprag assembly. This is a normal condition caused by heat treating during manufacturing and does not indicate need for replacement.**
3	Low and Reverse Clutch Spring
4	Low and Reverse Clutch Piston Assembly

Callout	Component Name
	NOTE:
5	Low Clutch Sprag Seal **It may be necessary to** **CAUTION:** **the apply** **Refer to Seal Reuse Caution .** **passage in order to unseat the piston.**

Low and Reverse Clutch Piston Installation

Fig. 27: Low And Reverse Clutch Piston
Courtesy of GENERAL MOTORS COMPANY

Low and Reverse Clutch Piston Installation

Callout	Component Name
1	Low and Reverse Clutch Piston Assembly **NOTE:** **Lubricate the inner and outer sealing surfaces of the piston assembly with automatic transmission fluid (ATF) in order to ease installation into the center support assembly.**
2	Low Clutch Sprag Seal **CAUTION:** **Refer to Seal Reuse Caution .** **NOTE:** **Apply ATF to the DT 47780 low clutch sprag seal cone to ease**

Callout	Component Name
	seal installation. **Special Tool** **DT 47780** Low Clutch Sprag Seal Cone For equivalent regional tools, refer to **Special Tools** .
3	Low and Reverse Clutch Spring **CAUTION:** **Ensure the spring tabs are facing up during installation. Failure to do so may cause damage to the clutch assembly.**
4	Low Clutch Sprag Assembly **NOTE:** • **Verify that the low clutch sprag is operating correctly. Refer to the illustration for proper**

Callout	Component Name
	freewheel direction. • **Ensure the missing splines on the sprag assembly are aligned with the missing splines on the center support hub.**
5	Low and Reverse Clutch Spring Retaining Ring **CAUTION:** **Ensure the DT 47779 contacts the sprag assembly and not the sprag retaining ring. Damage to the sprag may result.** **CAUTION:**

Callout	Component Name
	The retaining ring gap must be aligned with the 3 missing splines on the center support hub. Failure to do so may cause damage to the clutch assembly. **Special Tools** • **DT 47778-1** Low Clutch Sprag Retaining Ring Cone • **DT 47778-2** Low Clutch Sprag Retaining Ring Pusher • **DT 47779** Clutch Spring Compressor For equivalent regional tools, refer to **Special Tools** .

Low and Reverse Clutch Plate Installation

Fig. 28: Low And Reverse Clutch Plate
Courtesy of GENERAL MOTORS COMPANY

Low and Reverse Clutch Plate Installation

Callout	Component Name
1	Low and Reverse Clutch (Waved) Plate
2	Low and Reverse Clutch Plate (Qty: 5)
3	Low and Reverse Clutch Plate Assembly (Qty: 5)
4	Low and Reverse Clutch Backing Plate
5	Low and Reverse Clutch Backing Plate Retaining Ring **NOTE:** **Apply air to verify proper**

Callout	Component Name
	installation of all low and reverse clutch components.

LOW AND REVERSE CLUTCH OVERHAUL (6L90)

Low and Reverse Clutch Plate Removal

Fig. 29: Low And Reverse Clutch Plate
Courtesy of GENERAL MOTORS COMPANY

Low and Reverse Clutch Plate Removal

Callout	Component Name
1	Low and Reverse Clutch Backing Plate Retaining Ring
2	Low and Reverse Clutch Backing Plate
3	Low and Reverse Clutch Plate Assembly (Qty: 6)
4	Low and Reverse Clutch Plate (Qty: 6)
5	Low and Reverse Clutch (Waved) Plate

Low and Reverse Clutch Piston Removal

Fig. 30: Low And Reverse Clutch Piston
Courtesy of GENERAL MOTORS COMPANY

Low and Reverse Clutch Piston Removal

Callout	Component Name

Callout	Component Name
1	Low and Reverse Clutch Spring Retaining Ring **CAUTION:** **Ensure the DT 47779 contacts the sprag assembly and not the sprag retaining ring. Damage to the sprag may result.** **Special Tool** **DT 47779** Clutch Spring Compressor For equivalent regional tools, refer to **Special Tools** .
2	Low Clutch Sprag Assembly **NOTE:** **A blue colored ring may be present on the outer splines of the low clutch sprag assembly. This is a normal condition caused by**

Callout	Component Name
	heat treating during manufacturing and does not indicate need for replacement.
3	Low and Reverse Clutch Spring
4	Low and Reverse Clutch Piston Assembly **NOTE:** **It may be necessary to apply air to the apply passage in order to unseat the piston.**
5	Low Clutch Sprag Seal **CAUTION:** **Refer to Seal Reuse Caution .**

Low and Reverse Clutch Piston Installation

Fig. 31: Low And Reverse Clutch Piston
Courtesy of GENERAL MOTORS COMPANY

Low and Reverse Clutch Piston Installation

Callout	Component Name
1	Low and Reverse Clutch Piston Assembly **NOTE:** **Lubricate the inner and outer sealing surfaces of the piston assembly**

Callout	Component Name
	with automatic transmission fluid (ATF) in order to ease installation into the center support assembly.
2	Low Clutch Sprag Seal **CAUTION:** **Refer to Seal Reuse Caution .** **NOTE:** **Apply ATF to the DT 47780 low clutch sprag seal cone to ease seal installation.** **Special Tool** **DT 47780** Low Clutch Sprag Seal Cone For equivalent regional tools, refer to **Special Tools** .
3	Low and Reverse Clutch Spring **CAUTION:**

Callout	Component Name
	Ensure the spring tabs are facing up during installation. Failure to do so may cause damage to the clutch assembly.
4	Low Clutch Sprag Assembly **NOTE:** • **Verify that the low clutch sprag is operating correctly. Refer to the illustration for proper freewheel direction.** • **Ensure the missing splines on the sprag assembly are aligned**

Callout	Component Name
	with the missing splines on the center support hub.
5	Low and Reverse Clutch Spring Retaining Ring **CAUTION:** **Ensure the DT 47779 contacts the sprag assembly and not the sprag retaining ring. Damage to the sprag may result.** **CAUTION:** **The retaining ring gap must be aligned with the 3 missing splines on the center support hub.**

Callout	Component Name
	Failure to do so may cause damage to the clutch assembly. **Special Tools** • **DT 47778-1** Low Clutch Sprag Retaining Ring Cone • **DT 47778-2** Low Clutch Sprag Retaining Ring Pusher • **DT 47779** Clutch Spring Compressor For equivalent regional tools, refer to **Special Tools** .

Low and Reverse Clutch Plate Installation

Fig. 32: Low And Reverse Clutch Plate
Courtesy of GENERAL MOTORS COMPANY

Low and Reverse Clutch Plate Installation

Callout	Component Name
1	Low and Reverse Clutch (Waved) Plate
2	Low and Reverse Clutch Plate (Qty: 6)
3	Low and Reverse Clutch Plate Assembly (Qty: 6)
4	Low and Reverse Clutch Backing Plate
5	Low and Reverse Clutch Backing Plate Retaining Ring **NOTE:** **Apply air to verify proper**

Callout	Component Name
	installation of all low and reverse clutch components.

LOW AND REVERSE CLUTCH BACKING PLATE RETAINING RING MEASUREMENT

Fig. 33: Low And Reverse Clutch Backing Plate Retaining Ring Measurement
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures	

Callout	Component Name
1. Install **DT-47868-1** pack travel weight and **DT-47868-4** travel weight adapter onto the low and reverse clutch backing plate. 2. Attach the **GE 8001** dial indicator set to the **GE 26900-13** magnetic base and zero out the dial indicator on the **DT-47868-1** pack travel weight. **Special Tools** • **DT-47868-1** Pack Travel Weight • **DT-47868-4** Clutch Travel Weight Adapter • **GE 8001** Dial Indicator Set • **GE 26900-13** Magnetic Base For equivalent regional tools, refer to **Special Tools** .	
1	Low and Reverse Backing Plate Retaining Ring **NOTE:** **Apply compressed air to the apply passage hole, at least 3 times and observe the dial indicator measurement each time. This action "fluffs" the clutch plates to ensure an accurate measurement. Refer to Clutch**

Callout	Component Name
	Backing Plate Retaining Ring Specifications (6L80) Clutch Backing Plate Retaining Ring Specifications (6L90) .

4-5-6 CLUTCH DAMPENER OVERHAUL (6L50/80/90)

Fig. 34: 4-5-6 Clutch Dampener (6L50/80/90)

Callout	Component Name
NOTE: **6L45 models DO NOT include a 4-5-6 clutch dampener.**	
1	4-5-6 Clutch Dampener Retaining Ring **CAUTION:** **Ensure the retaining ring is fully seated when installed. Using a screwdriver, fully seat the retaining ring into the groove by pushing on the inside diameter around the whole circumference. If the retaining ring is not fully seated, transmission damage will result.**

Callout	Component Name
2	4-5-6 Clutch Dampener Apply Plate
3	4-5-6 Clutch Dampener **NOTE:** **Dry and inspect the clutch dampener for the following conditions:** • **Pitting** • **Flaking** • **Delamination** • **Wear** • **Glazing** • **Cracking** **If any of these conditions are found, replace the dampener.**

4-5-6 CLUTCH OVERHAUL (6L80/6L90)

4-5-6 Clutch Plates Removal

Fig. 35: 4-5-6 Clutch Plates (6L80/6L90)
Courtesy of GENERAL MOTORS COMPANY

4-5-6 Clutch Plates Removal

Callout	Component Name
1	4-5-6 Clutch Backing Plate Retaining Ring
2	4-5-6 Clutch Backing Plate
3	4-5-6 Clutch Plate Assembly • 6L80 - Qty: 6 • 6L90 - Qty: 7
4	4-5-6 Clutch Plate • 6L80 - Qty: 6

Callout	Component Name
	• 6L90 - Qty: 7
5	4-5-6 Clutch (Waved) Plate

4-5-6 Clutch Piston Removal

Fig. 36: 4-5-6 Clutch Piston
Courtesy of GENERAL MOTORS COMPANY

4-5-6 Clutch Piston Removal

Callout	Component Name
1	4-5-6 Clutch Piston Dam Retaining Ring **CAUTION:**

Callout	Component Name
	Use care when compressing the 4-5-6 clutch piston assembly, spring and dam assembly. Compressing the dam assembly too much may damage it. **CAUTION:** **Refer to Retaining Ring Reuse Caution .** **Special Tool** **J 43074** Clutch Spring Compressor For equivalent regional tools, refer to **Special Tools** .
2	4-5-6 Clutch Piston Dam Assembly **NOTE:** **It may be necessary to apply air pressure to remove the**

Callout	Component Name
	dam and piston.
3	4-5-6 Clutch Spring
4	4-5-6 Clutch Piston Assembly **NOTE:** **It may be necessary to apply air pressure to remove the piston.**

Turbine Shaft Fluid Seal Ring Replacement

Fig. 37: Turbine Shaft Fluid Seal Ring
Courtesy of GENERAL MOTORS COMPANY

Turbine Shaft Fluid Seal Ring Replacement

Callout	Component Name
Preliminary Procedures • Inspect the turbine shaft fluid passages and splines. • Clean any plugged passages.	
1	Turbine Shaft Fluid Seal Ring (Qty: 3) **CAUTION:** **Do not use old seal**

Callout	Component Name
	rings. Install NEW seal rings. Reusing old seal rings may cause internal transmission leaks and transmission damage. CAUTION: Size the fluid seal rings for at least 5 minutes after installation to obtain proper seal ring size. Failure to do so may cause internal transmission leaks and transmission damage. NOTE: Adjust the turn screw

Callout	Component Name
	on DT 47768-1 Seal Protector and install the bottom seal ring first. **Special Tools** • **DT 47768-1** Seal Protector • **DT 47768-2** Seal Pusher • **DT 47768-3** Seal Sizer For equivalent regional tools, refer to **Special Tools** .

4-5-6 Clutch Piston Installation

Fig. 38: 4-5-6 Clutch Piston
Courtesy of GENERAL MOTORS COMPANY

4-5-6 Clutch Piston Installation

Callout	Component Name
1	4-5-6 Clutch Piston Assembly
2	4-5-6 Clutch Spring **CAUTION:** **Ensure the spring tabs are facing up during installation. Failure to do**

Callout	Component Name
	so may cause damage to the clutch assembly.
3	4-5-6 Clutch Piston Dam Assembly **NOTE:** **Lubricate the inner and outer sealing surfaces of the dam assembly with automatic transmission fluid (ATF) in order to ease installation into the piston.**
4	4-5-6 Clutch Piston Dam Retaining Ring **CAUTION:** **Use care when compressing the 4-5-6 clutch piston assembly, spring and**

Callout	Component Name
	dam assembly. Compressing the dam assembly too much may damage it. **CAUTION:** **Refer to Retaining Ring Reuse Caution .** **NOTE:** **Apply air to verify proper installation of all 4-5-6 clutch components. The piston should apply and release smoothly.** **Special Tool** **J 43074** Clutch Spring Compressor For equivalent regional tools, refer to **Special Tools** .

4-5-6 Clutch Plates Installation

Fig. 39: 4-5-6 Clutch Plates
Courtesy of GENERAL MOTORS COMPANY

4-5-6 Clutch Plates Installation

Callout	Component Name
1	4-5-6 Clutch (Waved) Plate
2	4-5-6 Clutch Plate • 6L80 - Qty: 6 • 6L90 - Qty: 7
3	4-5-6 Clutch Plate Assembly • 6L80 - Qty: 6 • 6L90 - Qty: 7

4-5-6 CLUTCH BACKING PLATE RETAINING RING MEASUREMENT

Fig. 40: 4-5-6 Clutch Backing Plate Retaining Ring Measurement
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Preliminary Procedures

1. Install the clutch assembly into a hole in the workbench
2. Zero out the dial indicator on the **DT 47868-1** pack travel weight.

Special Tools

- **DT 47868-1** Pack Travel Weight
- **GE 8001** Dial Indicator Set

Callout	Component Name
• **GE 26900-13** Magnetic Base For equivalent regional tools, refer to **Special Tools** .	
1	4-5-6 Clutch Apply Passage **NOTE:** **While using one finger to block the top passage hole on the turbine shaft, apply compressed air to the opposite top passage hole, and observe the dial indicator measurement. Refer to Clutch Backing Plate Retaining Ring Specifications (6L80) Clutch Backing Plate Retaining Ring Specifications (6L90) to determine the correct retainer.**

1-2-3-4 AND 3-5 REVERSE CLUTCH OVERHAUL (6L45/6L50/6L80/6L90)

1-2-3-4 and 3-5 Reverse Clutch Plates Removal

Fig. 41: 1-2-3-4 And 3-5 Reverse Clutch Plates
Courtesy of GENERAL MOTORS COMPANY

1-2-3-4 and 3-5 Reverse Clutch Plates Removal

Callout	Component Name
1	3-5 Reverse Clutch Backing Plate Retaining Ring
2	3-5 Reverse Clutch Backing Plate
3	3-5 Reverse Clutch Plate Assembly **Procedure** • Remove Qty: 4 plates - 6L45/6L50/6L80

Callout	Component Name
	• Remove Qty: 4 or 5 plates - Model Dependent - 6L90
4	3-5 Reverse Clutch Plate **Procedure** • Remove Qty: 4 plates - 6L45/6L50/6L80 • Remove Qty: 4 or 5 plates - Model Dependent - 6L90
5	3-5 Reverse Clutch (Waved) Plate
6	3-5 Reverse Clutch Apply Ring
7	1-2-3-4 Clutch Backing Plate Retaining Ring
8	1-2-3-4 Clutch Backing Plate
9	1-2-3-4 Clutch Plate Assembly **Procedure** • Remove Qty: 5 plates - 6L45/6L50/6L80 • Remove Qty: 5 or 6 plates - Model Dependent - 6L90
10	1-2-3-4 Clutch Plate **Procedure** • Remove Qty: 5 plates - 6L45/6L50/6L80 • Remove Qty: 5 or 6 plates - Model Dependent - 6L90
11	1-2-3-4 Clutch (Waved) Plate

1-2-3-4 Clutch Piston Removal

Fig. 42: 1-2-3-4 Clutch Piston
Courtesy of GENERAL MOTORS COMPANY

1-2-3-4 Clutch Piston Removal

Callout	Component Name
1	1-2-3-4 Clutch Piston Dam Retaining Ring **CAUTION:** **Use care when compressing the 1-2-3-4 clutch spring and dam assembly.**

Callout	Component Name
	Compressing the dam assembly too much may damage it. **CAUTION:** **Refer to Retaining Ring Reuse Caution .** **Special Tool** **DT 38734** Intermediate Spring Compressor Adapter For equivalent regional tools, refer to **Special Tools** .
2	1-2-3-4 Clutch Piston Dam Assembly
3	1-2-3-4 Clutch Spring
4	1-2-3-4 Clutch Piston **Procedure** Inspect the 1-2-3-4 clutch piston for cracking and replace if damaged. **NOTE:** • **It may be necessary to apply air to the apply passage in order to remove the**

Callout	Component Name
	piston. Install the 1-2-3-4 clutch housing onto the torque converter (with fluid pump) housing assembly in order to apply air. • After air is applied, it may be necessary to turn the housing assembly upside down and carefully tap the housing against a flat surface in order to release the piston.

3-5 Reverse Clutch Piston Removal

Fig. 43: 3-5 Reverse Clutch Piston
Courtesy of GENERAL MOTORS COMPANY

3-5 Reverse Clutch Piston Removal

Callout	Component Name
Preliminary Procedures 1. Install the 1-2-3-4 and 3-5 reverse clutch housing assembly onto the torque converter (with fluid pump) housing assembly. 2. Apply hand pressure on the 1-2-3-4 clutch piston housing while applying compressed air to the apply passage in order to unseat the 3-5 reverse clutch piston.	
1	1-2-3-4 Clutch Piston Housing Retaining Ring

Callout	Component Name
	CAUTION: **Refer to Retaining Ring Release Caution .** **Special Tool** **DT 47867** Adjustable Clutch Spring Compressor For equivalent regional tools, refer to **Special Tools** .
2	1-2-3-4 Clutch Piston Housing
3	3-5 Reverse Clutch Spring
4	3-5 Reverse Clutch Piston **NOTE:** **It may be necessary to turn the housing assembly upside down and carefully tap the housing against a flat surface in order to release the piston.**

3-5 Reverse Clutch Air Bleed Inspection (6L80/6L90)

Fig. 44: 3-5 Reverse Clutch Air Bleed Inspection (6L80/6L90)
Courtesy of GENERAL MOTORS COMPANY

3-5 Reverse Clutch Air Bleed Inspection (6L80/6L90)

Callout	Component Name
1	1-2-3-4 and 3-5 Reverse Clutch Housing Assembly **Procedure** Ensure the air bleed passage is clear and free from obstructions by using a fine wire and also compressed air.

3-5 Reverse Clutch Housing Inspection Disassembled

Fig. 45: Inspecting 3-5 Reverse Clutch Housing
Courtesy of GENERAL MOTORS COMPANY

3-5 Reverse Clutch Housing Inspection Disassembled

Callout	Component Name
1	1-2-3-4 and 3-5 Reverse Clutch Housing Assembly **Procedure** 1. Apply soap compound to weld area of housing. 2. Hold thumb over the air bleed passage. 3. For disassembled 1-2-3-4 and 3-5 reverse clutch housing spray compressed air onto the housing/hub joint and inspect weld area for bubbles. 4. If bubbles are detected a new housing is required.

3-5 Reverse Clutch Housing Inspection Assembled

Fig. 46: Inspecting 3-5 Reverse Clutch Housing
Courtesy of GENERAL MOTORS COMPANY

3-5 Reverse Clutch Housing Inspection Assembled

Callout	Component Name
1	1-2-3-4 and 3-5 Reverse Clutch Housing Assembly **Procedure** 1. Apply soap compound to weld area of housing. 2. Hold thumb over the air bleed passage. 3. For fully assembled 1-2-3-4 and 3-5 reverse clutch housing spray compressed air into the 3-5R clutch feed hole and inspect weld area for bubbles.

Callout	Component Name
	4. If bubbles are detected a new housing is required.

1-2-3-4 and 3-5 Reverse Clutch Piston Seals Replacement

Fig. 47: 1-2-3-4 And 3-5 Reverse Clutch Piston Seals
Courtesy of GENERAL MOTORS COMPANY

1-2-3-4 and 3-5 Reverse Clutch Piston Seals Replacement

Callout	Component Name

Callout	Component Name
CAUTION: **Refer to Seal Reuse Caution .** **Preliminary Procedure** Lubricate all seals with automatic transmission fluid (ATF) prior to installation.	
1	1-2-3-4 Clutch Piston Seal
2	3-5 Reverse Clutch Piston Dam (O-Ring) Seal
3	3-5 Reverse Clutch Piston Inner Seal
4	1-2-3-4 Clutch Piston Housing
5	3-5 Reverse Clutch Piston Outer Seal
6	3-5 Reverse Clutch Piston
7	1-2-3-4 Clutch Piston Inner Seal **CAUTION:** **Do not install a NEW 1-2-3-4 clutch piston inner seal yet. A special tool used to install the 1-2-3-4 clutch piston housing retaining ring may damage the seal if the seal is installed**

Callout	Component Name
	prior to installing the retaining ring. Refer to 3-5 Reverse Clutch Piston Installation.
8	1-2-3-4 Clutch Piston Housing Seal
9	1-2-3-4 Clutch Piston Housing Seal

3-5 Reverse Clutch Piston Installation

Fig. 48: 3-5 Reverse Clutch Piston

3-5 Reverse Clutch Piston Installation

Callout	Component Name
1	3-5 Reverse Clutch Piston
2	3-5 Reverse Clutch Spring **CAUTION:** **Ensure the clutch spring is centered on the piston with the tabs facing up. Failure to do so may cause damage to the clutch assembly.**
3	1-2-3-4 Clutch Piston Housing
4	1-2-3-4 Clutch Piston Housing Retaining Ring **CAUTION:** **Before using the DT 47782-2, push the retaining ring over the DT 47782-1 by hand so that the ring is positioned**

Callout	Component Name
	below the tapered area of the DT 47782-1. If the ring is positioned above the tapered area when it is being installed, the ring will become lodged between both tools and damage to the tools, retaining ring, and piston housing will result. CAUTION: Refer to Retaining Ring Reuse Caution . CAUTION: Push the retaining ring down

Callout	Component Name
	over the cone until the ring seats firmly in the retaining ring groove. The retaining ring will make a distinctive click sound when it seats. Failure to properly seat the retaining ring may cause damage to the 3-5 reverse clutch assembly. **NOTE:** Use a screwdriver in order to verify the retaining ring is fully seated into

Callout	Component Name
	the groove. It may appear as though the retaining ring is not fully seated, since the groove is shallow by design. However, this shallow interface is normal. **Special Tools** • **DT 47782-1** Retaining Ring Cone • **DT 47782-2** Retaining Ring Installer For equivalent regional tools, refer to **Special Tools** .
5	1-2-3-4 Clutch Piston Inner Seal **CAUTION:** **Install a NEW seal and orientate as shown. Failure to do so may cause internal transmission**

Callout	Component Name
	leaks and damage to the transmission.

1-2-3-4 Clutch Piston Installation

Fig. 49: 1-2-3-4 Clutch Piston
Courtesy of GENERAL MOTORS COMPANY

1-2-3-4 Clutch Piston Installation

Callout	Component Name
1	1-2-3-4 Clutch Piston

Callout	Component Name
2	1-2-3-4 Clutch Spring **CAUTION:** **Ensure the clutch spring is centered on the piston with the tabs facing up. Failure to do so may cause damage to the clutch assembly.**
3	1-2-3-4 Clutch Piston Dam Assembly **NOTE:** **Lubricate the inner and outer surfaces of the dam assembly with ATF in order to ease installation into the piston. Install the tabs facing up.**

Callout	Component Name
4	1-2-3-4 Clutch Piston Dam Retaining Ring **CAUTION:** **Use care when compressing the 1-2-3-4 clutch spring and dam assembly. Compressing the dam assembly too much may damage it.** **CAUTION:** **Refer to Retaining Ring Reuse Caution .** **Special Tool** **DT 38734** Intermediate Spring Compressor Adapter For equivalent regional tools, refer to **Special Tools** .

1-2-3-4 Clutch Plate Installation

Fig. 50: 1-2-3-4 Clutch Plate
Courtesy of GENERAL MOTORS COMPANY

1-2-3-4 Clutch Plate Installation

Callout	Component Name
1	1-2-3-4 Clutch (Waved) Plate **CAUTION:** **Ensure an opening between the external splines of the waved plate is**

Callout	Component Name
	centered over the missing snap ring groove punch in the housing. Failure to do so may cause damage to the clutch assembly.
2	1-2-3-4 Clutch Plate **CAUTION:** **Ensure all clutch plates are centered in the housing. When installing the first steel clutch plate, ensure an opening between the external splines is centered over the missing snap ring**

Callout	Component Name
	groove punch in the housing. Align the external splines of each remaining steel clutch plate with the first steel clutch plate. Failure to do so may cause damage to the clutch assembly. **Procedure** • Install Qty: 5 plates - 6L45/6L50/6L80 • Install Qty: 5 or 6 plates - Model Dependent - 6L90
3	1-2-3-4 Clutch Plate Assembly **Procedure** • Install Qty: 5 plates - 6L45/6L50/6L80 • Install Qty: 5 or 6 plates - Model Dependent - 6L90
4	1-2-3-4 Clutch Backing Plate **CAUTION:**

Callout	Component Name
	Align the external splines of the backing plate with the external splines of the steel clutch plates. Failure to do so may cause damage to the clutch assembly. **CAUTION:** **Ensure the 1-2-3-4 Clutch Backing Plate is installed correctly to prevent mechanical damage.** **Procedure** If the plate has UP stamped on it, install that side up. If the plate has 3 circle marks spaced 120 degrees apart stamped on it, install that side up. If no identification marks are present, install sharp edge up, chamfer side down.
5	1-2-3-4 Clutch Backing Plate Retaining Ring

Callout	Component Name
	CAUTION: **Depending on the housing configuration, align the retaining ring gap with the missing snap ring groove punch in housing the offse punch in housing. Failure t so may c damage the clutc assembl**

Procedure

After the retaining ring is installed, determine clutch piston travel in order to verify if the correct selective retaining ring is being used. Refer to **1-2-3-4 Clutch Backing Plate Retaining Ring Measurement**.

3-5 and Reverse Clutch Plate Installation

Fig. 51: 3-5 And Reverse Clutch Plate
Courtesy of GENERAL MOTORS COMPANY

3-5 and Reverse Clutch Plate Installation

Callout	Component Name

Callout	Component Name
1	3-5 Reverse Clutch Apply Ring **CAUTION:** **Ensure apply ring legs are positioned into the 3-5 reverse clutch piston. Failure to do so may cause damage to the 3-5 reverse clutch assembly.**
2	3-5 Reverse Clutch (Waved) Plate
3	3-5 Reverse Clutch Plate **Procedure** • Install Qty: 4 plates - 6L45/6L50/6L80 • Install Qty: 4 or 5 plates - Model Dependent - 6L90
4	3-5 Reverse Clutch Plate Assembly **Procedure** • Install Qty: 4 plates - 6L45/6L50/6L80 • Install Qty: 4 or 5 plates - Model Dependent - 6L90
5	3-5 Reverse Clutch Backing Plate

Callout	Component Name
6	3-5 Reverse Clutch Backing Plate Retaining Ring **CAUTION:** **Depending on the housing configuration, align the retaining ring gap with the missing snap ring groove punch in the housing or the offset punch in the housing. Failure to do so may cause damage to the clutch assembly.** **Procedure** 1. After retaining ring is installed check 1-2-3-4 and 3-5 reverse clutch housing for weld leak. Refer to 3-5 Reverse Clutch Housing Inspection Assembled earlier in this procedure. 2. After the retaining ring is installed, determine clutch piston travel in order to verify if the correct selective retaining ring is being used. Refer to **3-5 Reverse Clutch Backing Plate Retaining Ring Measurement (6L80/6L90)**.

1-2-3-4 and 3-5 Reverse Clutch Bearing Assembly Replacement

Fig. 52: 1-2-3-4 And 3-5 Reverse Clutch Bearing Assembly
Courtesy of GENERAL MOTORS COMPANY

1-2-3-4 and 3-5 Reverse Clutch Bearing Assembly Replacement

Callout	Component Name
1	3-5 Reverse Clutch Bearing **CAUTION:** **Install the NEW bearing assembly with the seal side up. Improper**

Callout	Component Name
	installation of the bearing may cause damage to the transmission. **CAUTION:** **Do not use a hammer or other striking tool that may cause damage to the bearing and housing. Use care to ensure the bearing is installed slowly and evenly using an arbor press supporting the inner hub. Do not support by the housing or fracture will result.** **CAUTION:**

Callout	Component Name
	Do not reuse the bearing. Install a NEW bearing. Reusing an old bearing may cause damage to the transmission. **Procedure** Install the bearing flush to 0.3 mm (0.012 in) below the thrust surface. **Special Tools** • **DT 47865** Bearing Remover • **DT 47866** Bearing Installer • **DT 45124** Removal Bridge For equivalent regional tools, refer to **Special Tools** .

1-2-3-4 CLUTCH BACKING PLATE RETAINING RING MEASUREMENT

Fluid Passage Plug Kit Installation

Fig. 53: Fluid Passage Plug Kit
Courtesy of GENERAL MOTORS COMPANY

Fluid Passage Plug Kit Installation

Callout	Component Name
Special Tools **DT-49291** Clutch Travel Air Passage Plug Kit	
1	Compensator Feed Fluid Passage - Outer **Procedure** Install the tapered oval fluid passage plug DT-49291-4 which is part of **DT-49291** clutch travel air passage plug kit, into the compensator feed fluid passage hole on the 1-2-3-4 and 3-5 reverse clutch support assembly. **NOTE:** **The**

Callout	Component Name
	compensator feed fluid passage hole is the top outer hole on the 1-2-3-4 and 3-5 reverse clutch support assembly.
2	Compensator Feed Fluid Passage - Inner **Procedure** Install the round fluid passage plug DT-49291-5 which is part of **DT-49291** clutch travel air passage plug kit, into the compensator feed fluid passage hole inside the 1-2-3-4 and 3-5 reverse clutch support assembly. **NOTE:** **The compensator feed fluid passage hole is the middle inner hole in the 1-2-3-4 and 3-5 reverse clutch support assembly.**
3	1-2-3-4 and 3-5 Reverse Clutch Housing Assembly **Procedure** 1. Ensure that the 1-2-3-4 clutch plates, backing plate and retaining ring are installed.

Callout	Component Name
	2. Install the 1-2-3-4 and 3-5 reverse clutch housing onto the torque converter (with fluid pump) housing assembly. 3. Install the applicable plug kit sleeve DT-49291-2 (6L80/6L90) or DT-49291-3 (6L45/6L50), cap DT-49291-1, bolt, washer and nut which are all part of **DT-49291** clutch travel air passage plug kit.

Apply Compressed Air and Measurement

Fig. 54: Measuring 1-2-3-4 Clutch Backing Plate Retaining Ring
Courtesy of GENERAL MOTORS COMPANY

Apply Compressed Air and Measurement

Callout	Component Name
Preliminary Procedures	

Callout	Component Name
1. Install the **DT 47868-2** base adapter onto the torque converter housing. 2. Install **DT 47868-1** travel weight and **DT-47868-3** travel weight adapter onto the 1-2-3-4 clutch backing plate. 3. Install the **GE 26900-13** magnetic base onto **DT 47868-2** base adapter. 4. Attach the **GE 8001** dial indicator set to the **GE 26900-13** magnetic base. **Special Tools** • **DT 47868-1** Clutch Pack Travel Weight • **DT 47868-2** Magnetic Base Adapter • **DT-47868-3** Clutch Travel Weight Adapter • **GE 8001** Dial Indicator Set • **GE 26900-13** Magnetic Base For equivalent regional tools, refer to **Special Tools** .	
1	Compensator Feed Fluid Passage **Procedure** 1. Apply compressed air to the compensator feed fluid passage. 2. Zero out the dial indicator **J 8001** dial indicator set.
2	1-2-3-4 Clutch Apply Passage **Procedure** While Applying compressed air to the compensator feed fluid passage, simultaneously apply compressed air to the 1-2-3-4 clutch apply passage. Do this at least 3 times and observe the dial indicator measurement each time. Refer to **Clutch Backing Plate Retaining Ring Specifications (6L80)** **Clutch Backing Plate Retaining Ring Specifications (6L90)** .

3-5 REVERSE CLUTCH BACKING PLATE RETAINING RING MEASUREMENT (6L80/6L90)

Fig. 55: Measuring 3-5 Reverse Clutch Backing Plate Retaining Ring (6L80/6L90)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Preliminary Procedures

1. Install the 1-2-3-4 and 3-5 reverse clutch housing with the 1-2-3-4 and 3-5 reverse clutch plates installed, onto the torque converter housing.
2. Install the **DT 47868-2** magnetic base adapter onto the torque converter housing.
3. Install **DT 47868-1** clutch pack travel weight onto the 3-5 reverse clutch backing plate.
4. Install the **J 26900-13** magnetic base onto **DT 47868-2** magnetic base adapter.
5. Attach the **J 8001** dial indicator set to the **J 26900-13** magnetic base and zero out the dial indicator on the **DT 47868-1** clutch pack travel weight.

Callout	Component Name
Special Tools • **DT 47868-1** Clutch Pack Travel Weight • **DT 47868-2** Magnetic Base Adapter • **J 8001** Dial Indicator Set • **J 26900-13** Magnetic Base For equivalent regional tools, refer to **Special Tools** .	
1	3-5 Reverse Clutch Apply Passage **NOTE:** **Apply compressed air to the apply passage hole, and observe the dial indicator measurement. Refer to Clutch Backing Plate Retaining Ring Specifications (6L80) Clutch Backing Plate Retaining Ring Specifications (6L90) .**

TORQUE CONVERTER HOUSING WITH FLUID PUMP DISASSEMBLE

Fig. 56: Torque Converter Housing With Fluid Pump
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **Do not loosen or remove the 6 bolts securing the clutch support to the pump cover**	

Callout	Component Name
assembly. These bolts have been installed and torqued only after specific clutch support rotational requirements have been met. If the clutch support is not installed properly, damage to the transmission will occur.	
1	1-2-3-4 and 3-5 Reverse Clutch Housing Thrust Washer
2	Bolt M6 x 40 (Qty: 13)
3	Fluid Pump Cover Assembly
4	Fluid Pump Vane Ring
5	Fluid Pump Rotor
6	Fluid Pump Vanes (Qty: 13)
7	Fluid Pump Rotor Guide
8	Fluid Pump Vane Ring
9	Fluid Pump Slide Outer Spring
10	Fluid Pump Slide
11	Fluid Pump Slide (O-Ring) Seal
12	Fluid Pump Slide Fluid Seal Ring
13	Fluid Pump Slide Seal

Callout	Component Name
14	Fluid Pump Slide Seal Support
15	Fluid Pump Slide Pivot Pin

FLUID PUMP COVER CLEANING AND INSPECTION

Fig. 57: Fluid Pump Cover Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
WARNING: **Valve springs can be tightly**	

Callout	Component Name
compressed. Use care when removing retainers and plugs. Personal injury could result. **Preliminary Procedure** Clean and inspect all components and machined surfaces.	
1	Pressure Regulator Valve Train
2	Converter Feed Limit Valve Train
3	Pressure Relief Ball Valve and Spring
4	TCC Control Valve and Spring
5	A/Trans Fluid Pump Locator Pin

1-2-3-4 AND 3-5 REVERSE CLUTCH FLUID SEAL RING INSTALLATION (6L80/6L90)

Fig. 58: 1-2-3-4 And 3-5 Reverse Clutch Fluid Seal Ring (6L80/6L90)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **Do not use old seal rings. Install NEW seal rings. Reusing old seal rings may cause internal transmission**	

Callout	Component Name
leaks and transmission damage.	
1	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Rings - Inner O-ring (Qty: 3)
2	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Rings - Outer (Qty: 3)

TORQUE CONVERTER HOUSING CLEANING AND INSPECTION

Fig. 59: Torque Converter Housing Cleaning And Inspection
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures	

Callout	Component Name
1. Thoroughly clean the torque converter housing assembly, including threads, with clean solvent. 2. Clean sealing surfaces. 3. Inspect all threaded holes. If necessary, repair any thread damage.	
1	Line Pressure Test Hole Plug **CAUTION:** **Use care when tightening the line pressure test hole plug. Do not use a socket extension, which could cause side-loading and potentially crack the transmission case assembly.** **CAUTION:** **Refer to Fastener Caution .** **Tighten** 11 N.m (97 lb in)
2	A/Trans Vent Pipe

Callout	Component Name
3	Trans Fluid Cooler Pipe Fitting Seal **CAUTION:** **Refer to Seal Reuse Caution .** **NOTE:** **Refer to Transmission Fluid Cooler Pipe Seal Replacement.**
4	Torque Converter Bushing

TORQUE CONVERTER FLUID SEAL REPLACEMENT

Fig. 60: Torque Converter Fluid Seal
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Torque Converter Fluid Seal Retaining Ring
2	Torque Converter Fluid Seal Assembly **NOTE:** **The seal can be installed by hand.** **Special Tool** **EN 45000** Seal Remover

Callout	Component Name
	For equivalent regional tools, refer to **Special Tools** .

TRANSMISSION FLUID COOLER PIPE SEAL REPLACEMENT

Fig. 61: Transmission Fluid Cooler Pipe Seal
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
1	Trans Fluid Cooler Pipe Fitting Seals (Qty: 2) **Special Tools** • **DT 47770** Seal Installer • **DT 45201** Cooler Line Seal Remover For equivalent regional tools, refer to **Special Tools** .

FLUID PUMP SELECTIVE MEASUREMENT

Fig. 62: Fluid Pump Components & Bolt Tightening Sequence
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Clean and inspect all components and machined surfaces. 2. After cleaning the transmission components, allow to air dry. Do not use cloth or paper towels in order to dry any transmission components.	
1	Fluid Pump Slide **Procedure** 1. Install an existing and/or undamaged pump slide. 2. Place gauging plastic in three locations on the pump slide surface facing the pump cover, up.
2	Fluid Pump Slide Pivot Pin
3	Fluid Pump Rotor Guide **NOTE:** **Align the rotor guide tabs to the notches on the bottom of the rotor.**
4	Fluid Pump Rotor **Procedure** 1. Install an existing and/or undamaged pump rotor. 2. Place gauging plastic in three locations on the pump rotor surface facing the pump cover, up.
5	Fluid Pump Cover Assembly
6	Fluid Pump Cover Bolts M6 x 40 (Qty: 13) **CAUTION:**

Callout	Component Name
	Refer to **Fastener Caution** . **Procedure** 1. Hand tighten the bolts. 2. Tighten the fluid pump cover bolts in the sequence shown. 3. Remove the pump cover bolts and the pump cover. 4. Using the measuring device provided with the gauging plastic kit, measure the gauging plastic on the rotor and the slide, see inset drawings. Choose the correct selective rotor and or slide, based on the slide and rotor to fluid pump body end play specifications. Refer to **Fluid Pump Selective Specifications** . 5. Remove the gauging plastic and clean the rotor and slide surfaces. **Tighten** 11 N.m (97 lb in)

TORQUE CONVERTER HOUSING WITH FLUID PUMP ASSEMBLE

Fig. 63: Torque Converter Housing With Fluid Pump
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Fluid Pump Slide Fluid Seal Ring
2	Fluid Pump Slide (O-Ring) Seal
3	Fluid Pump Slide Pivot Pin
4	Fluid Pump Slide Seal Support **NOTE:** **The seal support is circular. The seal is rectangular.**

Callout	Component Name
5	Slide Seal
6	Fluid Pump Slide **NOTE:** **If installing a NEW pump slide into the torque converter housing, ensure to properly select the correct rotor and slide before performing this procedure. Refer to Fluid Pump Selective Measurement, and Fluid Pump Selective Specifications .**
7	Fluid Pump Slide Outer Spring
8	Fluid Pump Vane Ring
9	Fluid Pump Rotor Guide **CAUTION:**

Callout	Component Name
	Align the rotor guide tabs to the notches on the bottom of the rotor. Failure to do so may cause transmission damage.
10	Fluid Pump Rotor **NOTE:** **If installing a NEW pump rotor into the torque converter housing, ensure to properly select the correct rotor and slide before performing this procedure. Refer to Fluid Pump Selective Measurement, and Fluid**

Callout	Component Name
	Pump Selective Specifications .
11	Fluid Pump Vanes (Qty: 13)
12	Fluid Pump Vane Ring

FLUID PUMP COVER INSTALLATION

Fig. 64: Fluid Pump Cover And Bolt Tightening Sequence
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
Preliminary Procedure **NOTE:** **Do not use abrasive cleaning pads that can remove material or leave abrasive residue in the parts.** **NOTE:** **Do not immerse the pump cover in a parts cleaner with used solvent that can leave dirt/grit /residue in the parts.** Inspect the service pump cover and pressure regulator valve for signs of rust inhibitor (RI) that may prevent the pressure regulator from operating properly before installing the pump cover. Excessive RI can be removed with solvent, light penetrating oil or carburetor cleaner.	
1	Fluid Pump Cover Assembly
2	Fluid Pump Cover Bolts M6 x 40 (Qty: 13) **NOTE:**

Callout	Component Name
	Hand tighten only.
3	Alignment Tool and Bolt **CAUTION:** **Refer to Fastener Caution .** **Procedure** 1. Center the **DT 46664** pump cover alignment tool around the fluid pump cover assembly in the 9 o'clock position and tighten the alignment bolt. 2. Tighten the fluid pump cover bolts in the sequence shown. **Tighten** 11 N.m (97 lb in) **Special Tools** **DT 46664** Pump Cover Alignment Tool For equivalent regional tools, refer to **Special Tools** .
4	1-2-3-4 and 3-5 Reverse Clutch Housing Thrust Washer **NOTE:** **Install a NEW washer. Do NOT reuse the old washer.**

CONTROL VALVE BODY ASSEMBLY DISASSEMBLE

Input and Output Speed Sensor Assembly Removal

Fig. 65: Input And Output Speed Sensor Assembly
Courtesy of GENERAL MOTORS COMPANY

Input and Output Speed Sensor Assembly Removal

Callout	Component Name
1	Bolt M6 x 20 (Qty: 2)
2	Speed Sensor Electrical Connector **NOTE:** **Release the connector lock before disconnecting.**
3	A/Trans Input and Output Speed Sensor Assembly

Callout	Component Name
4	A/Trans Input and Output Speed Sensor Wiring Harness Clip (Qty: 2) **NOTE:** **Inspect the clips and replace if damaged.**

Manual Shaft Detent Assembly and Manual Shift Shaft Position Switch Removal

Fig. 66: Manual Shaft Detent Assembly And Manual Shift Shaft Position Switch
Courtesy of GENERAL MOTORS COMPANY

Manual Shaft Detent Assembly and Manual Shift Shaft Position Switch Removal

Callout	Component Name
1	Bolt M6 x 14.5
2	Manual Shaft Detent Assembly
3	Bolt M5 x 55
4	A/Trans Manual Shift Shaft Position Switch Assembly Electrical Connector **NOTE:** **Release the connector lock before disconnecting.**
5	A/Trans Manual Shift Shaft Position Switch Assembly

Control Solenoid Valve Assembly Removal

Fig. 67: Control Solenoid Valve Assembly
Courtesy of GENERAL MOTORS COMPANY

Control Solenoid Valve Assembly Removal

Callout	Component Name
1	Bolt M5 x 53 (Qty: 2)
2	Bolt M5 x 55 (Qty: 4)
3	Bolt M5 x 45 (Qty: 5)
4	Control Solenoid (w/Body and TCM) Valve Assembly **CAUTION:** **Use care when handling the control valve body assembly. If dropped, damage to the control solenoid valve body assembly internal components, including the transmission control module (TCM), may result.**
5	Filter Plate Assembly **CAUTION:**

Callout	Component Name
	Use care when removing or installing the filter plate assembly. A broken or missing retaining tab may not adequately secure the filter plate to the control solenoid valve assembly, resulting in possible damage or contamination. **CAUTION:** **Discard the filter plate. Replace with a NEW filter plate. Reusing an old filter plate may cause damage to the control solenoid valve assembly.**

Upper and Lower Valve Bodies Disassemble

Fig. 68: Upper And Lower Valve Bodies
Courtesy of GENERAL MOTORS COMPANY

Upper and Lower Valve Bodies Disassemble

Callout	Component Name
1	Bolt M5 x 36 (Qty: 12)
2	Bolt M5 x 45 (Qty: 5)
3	Bolt M5 x 55
4	Control Valve Lower Body Assembly **Procedure** **NOTE:**

Callout	Component Name
	Separate the upper and lower valve bodies by carefully prying at the point indicated. Refer to Control Valve Lower Body Assembly Cleaning and Inspection
5	Control Valve Body Spacer (w/Gasket) Plate Assembly **CAUTION:** **Do not use the old spacer plate. Install a NEW spacer plate. Reusing an old spacer plate may cause internal transmission leaks and transmission damage.**

Callout	Component Name
6	Control Valve Body Ball Check Valve (Qty: 8) **NOTE:** **Note the position of the ball check valves.**
7	Control Valve Upper Body Assembly **NOTE:** **For additional information regarding the control valve upper body assembly. Refer to Control Valve Upper Body Assembly Cleaning and Inspection**

CONTROL VALVE LOWER BODY ASSEMBLY CLEANING AND INSPECTION

Fig. 69: Control Valve Lower Body Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
WARNING: **Valve springs can be tightly compressed. Use care when removing retainers and plugs. Personal**	

Callout	Component Name
injury could result. CAUTION: After cleaning the transmission components, allow to air dry. Do not use cloth or paper towels in order to dry any transmission components. Lint from the towels can cause component failure. CAUTION: Do not reuse cleaning solvents. Previously used solvents may deposit sediment which may damage the component.	

Callout	Component Name
Preliminary Procedure Clean and inspect all valve components and the valve body. The control valve lower body is replaceable only as an assembly.	
1	Clutch Piston Dam Feed Regulator Valve Train
2	Clutch Select Solenoid Valve 3 Train
3	Clutch Select Solenoid Valve 2 Train
4	Manual Valve
5	TCC Regulator Apply Valve Train

CONTROL VALVE UPPER BODY ASSEMBLY CLEANING AND INSPECTION

Fig. 70: Control Valve Upper Body Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
WARNING: **Valve springs can be tightly compressed. Use care when removing retainers and plugs. Personal injury could result.** **CAUTION:** **Do not remove the exhaust backfill pressure relief retainer, spring, or ball valve (refer to arrow in above illustration for location). The retainer is set to a precise depth. Replacement**	

Callout	Component Name
of this retainer could cause internal transmission damage. CAUTION: After cleaning the transmission components, allow to air dry. Do not use cloth or paper towels in order to dry any transmission components. Lint from the towels can cause component failure. CAUTION: Do not reuse cleaning solvents. Previously used solvents may deposit	

Callout	Component Name
sediment which may damage the component. **Preliminary Procedure** Clean and inspect all valve components, locating pins, and the valve body. The control valve upper body is replaceable only as an assembly.	
1	Clutch Boost Valve Train
2	1-2-3-4 Clutch Regulator Valve Train
3	3-5 Reverse Clutch Regulator Valve Train
4	Clutch Boost Valve Train
5	2-6 Clutch Regulator Valve Train
6	Clutch Boost Valve Train
7	CBR1/4-5-6 Clutch Regulator Valve Train
8	Actuator Feed Limit Valve Train
9	Control Valve Body Locator Pin
10	Control Valve Body Locator Pin
11	Control Valve Body Locator Pin

CONTROL VALVE BODY ASSEMBLY ASSEMBLE

Upper to Lower Control Valve Body Assembly Assemble

Fig. 71: Upper To Lower Control Valve Body Assembly
Courtesy of GENERAL MOTORS COMPANY

Upper to Lower Control Valve Body Assembly Assemble

Callout	Component Name
1	Control Valve Body Ball Check Valve (Qty: 8) **CAUTION:** **Do not use any type of grease or other material to hold the check ball**

Callout	Component Name
	valves in place during assembly. Grease will cause the valves to not operate properly, resulting in damage to the transmission. **NOTE:** **For additional information regarding ball check valve location. Refer to Ball Check Valve Locations**
2	Control Valve Body Spacer (w/Gasket) Plate Assembly **CAUTION:** **Do not use the old spacer plate. Install a NEW spacer plate. Reusing an**

Callout	Component Name
	old spacer plate may cause internal transmission leaks and transmission damage.
3	Control Valve Lower Body Assembly **NOTE:** **Turn the valve body assembly over after installing to upper body.**
4	Bolt M5 x 36 (Qty: 12) **CAUTION:** **Refer to Fastener Caution .** **Procedure** Tighten the bolts in the sequence shown. **Tighten** 8 N.m (71 lb in).

Filter Plate Installation

Fig. 72: Filter Plate
Courtesy of GENERAL MOTORS COMPANY

Filter Plate Installation

Callout	Component Name
1	Filter Plate Assembly **CAUTION:** **Use care when handling the control valve body assembly. If dropped,**

Callout	Component Name
	damage to the control solenoid valve body assembly internal components, including the transmission control module (TCM), may result. **CAUTION:** Discard the filter plate. Replace with a NEW filter plate. Reusing an old filter plate may cause damage to the control solenoid valve assembly. **NOTE:** Use care when removing or

Callout	Component Name
	installing the filter plate assembly. However, if a retaining tab is broken or missing, do not replace the control solenoid valve assembly. The filter plate assembly can still be adequately aligned.

Control Solenoid Valve Assembly Installation

Fig. 73: Control Solenoid Valve Assembly
Courtesy of GENERAL MOTORS COMPANY

Control Solenoid Valve Assembly Installation

Callout	Component Name
1	Control Solenoid (w/Body and TCM) Valve Assembly **NOTE:** **Note the locator pin on the control valve lower body assembly while**

Callout	Component Name
	aligning the control solenoid valve assembly.
2	Bolt M5 x 53 (Qty: 2) **NOTE:** **Hand tighten only.**
3	Bolt M5 x 55 (Qty: 4) **NOTE:** **Hand tighten only.**
4	Bolt M5 x 45 (Qty: 5) **NOTE:** **Hand tighten only.**

Manual Shift Shaft Position Switch Installation

Fig. 74: Manual Shift Shaft Position Switch
Courtesy of GENERAL MOTORS COMPANY

Manual Shift Shaft Position Switch Installation

Callout	Component Name
1	A/Trans Manual Shift Shaft Position Switch Assembly
2	Manual Valve Link **NOTE:** **Align the switch activator slide with the manual valve link.**

Callout	Component Name
3	Bolt M5 x 55 **NOTE:** **Hand tighten only.**
4	A/Trans Manual Shift Shaft Position Switch Harness Clip **NOTE:** **The wiring harness clip on the manual shift shaft position switch does not need to be replaced if damaged or missing. The clip functions only as a manufacturing assembly aid to keep the harness clear during an automated bolt installation process. If the clip is damaged, simply remove and discard.**

Callout	Component Name
5	A/Trans Manual Shift Shaft Position Switch Electrical Connector **NOTE:** **Connect and lock the manual shift shaft position switch electrical connector to the control solenoid valve assembly.**

Valve Body, Control Solenoid Torque Sequence

Fig. 75: Valve Body, Control Solenoid Bolt Torque Sequence
Courtesy of GENERAL MOTORS COMPANY

Valve Body, Control Solenoid Torque Sequence

Callout	Component Name
CAUTION: **Bolt torque sequencing is critical to the proper function of the control solenoid valve assembly.**	

Callout	Component Name
Failure to follow the required sequencing may result in transmission malfunction. **Preliminary Procedure** 1. Hand tighten the last 6 bolts before final torque sequence. 2. The 2 "heat sink" bolts must be tightened last.	
1	Bolts M5 x 45 (Qty: 5)
2	Bolt M5 x 55 **CAUTION:** **Refer to Fastener Caution .** **Procedure** Tighten all 18 bolts in the sequence shown. **Tighten** 8 N.m (71 lb in).

Control Solenoid Valve Assembly Contact Gap Inspection

Fig. 76: Inspecting Control Solenoid Valve Assembly Contact Gap
Courtesy of GENERAL MOTORS COMPANY

Control Solenoid Valve Assembly Contact Gap Inspection

Callout	Component Name
1	Control Solenoid (w/Body and TCM) Valve Assembly **NOTE:** **Inspect the contact area between the "heat sink" area of the control solenoid**

Callout	Component Name
	valve assembly and the valve body. There should be no visible gap. If a gap exists, loosen all 18 bolts and retighten in the required sequence.

Input and Output Speed Sensor Assembly Installation

Fig. 77: Input and Output Speed Sensor Assembly
Courtesy of GENERAL MOTORS COMPANY

Input and Output Speed Sensor Assembly Installation

Callout	Component Name
1	A/Trans Input and Output Speed Sensor Wiring Harness Clip (Qty: 2)
2	A/Trans Input and Output Speed Sensor Assembly

Callout	Component Name
3	Bolt M6 x 20 (Qty: 2) **CAUTION:** **Refer to** **Fastener Caution .** **Tighten** 12 N.m (106 lb in)

CENTER SUPPORT, OUTPUT CARRIER AND OUTPUT SHAFT INSTALLATION (6L80/6L90)

Fig. 78: Center Support, Output Carrier And Output Shaft (6L80/6L90)

Callout	Component Name
1	Output Shaft Thrust Bearing Assembly
2	Output Carrier Assembly and Output Shaft Assembly **CAUTION:** **Apply automatic transmission fluid (ATF) to the inside diameter of the output shaft seal before installing the output shaft assembly into the case. Failure to lube the seal may cause the seal to roll during output shaft installation, which will result in transmission damage.** **CAUTION:** **Ensure the DT 47786 is**

Callout	Component Name
	completely threaded into the output shaft assembly. Due to the weight of the assembly, incomplete threading may cause the assembly to break free from the DT 47786, causing component damage. **Special Tools** **DT 47786** Output Carrier/Shaft Lifting Tool
3	Center Support Assembly **NOTE:** • **When the center support assembly is properly installed, the fluid**

Callout	Component Name
	passages should align with the fluid passage seal bores in the case assembly. • **It may be necessary to rotate the output shaft by hand in order to fully install the center support assembly.**
4	Center Support Retaining Ring **WARNING:** **Use care when removing or installing the retaining ring. Ensure the J 45126 and DT 47773 are**

Callout	Component Name
	installed properly onto the retaining ring or bodily injury may occur. **CAUTION:** **Ensure the retaining ring is installed with the tapered side up, and in the 9 o'clock position from the pan side of the case. Failure to properly install the retaining ring will cause transmission damage.** **Special Tools** • **DT 47773** Snap Ring Pliers Adapter Set • **J 45126** Snap Ring Pliers

1-2-3-4 AND 3-5 REVERSE CLUTCH ASSEMBLY AND 4-5-6 CLUTCH ASSEMBLY INSTALLATION (6L80/6L90)

Fig. 79: 1-2-3-4 And 3-5 Reverse Clutch Assembly And 4-5-6 Clutch Assembly (6L80/6L90)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	2-6 and 3-5 Reverse Clutch Hub Thrust Bearing Assembly
2	2-6 and 3-5 Reverse Clutch (with Output Carrier Outer Sun Gear Shaft) Hub Assembly
3	1-2-3-4 Clutch Hub Thrust Bearing Assembly
4	1-2-3-4 Clutch (with Output Carrier Inner Sun Gear Shaft) Hub Assembly
5	4-5-6 Clutch Hub Thrust Bearing Assembly
6	4-5-6 Clutch (with Output Carrier Shaft and Dampener) Hub Assembly **NOTE:**

Callout	Component Name
	Refer to 4-5-6 Clutch Dampener Overhaul (6L50/80/90) for complete inspection.
7	Turbine Shaft Thrust Bearing Assembly
8	4-5-6 (with Turbine Shaft) Clutch Assembly
9	Input Sun Gear Thrust Bearing **NOTE:** **Thrust bearing snaps onto input carrier assembly.**
10	Input Sun Gear Thrust Washer
11	Input Carrier Assembly **NOTE:** **The spline on the input carrier installs up into the 1-2-3-4 and 3-5 reverse clutch housing.**
12	Input Sun Gear
13	1-2-3-4 and 3-5 Reverse Clutch Assembly

Callout	Component Name
	NOTE: **Wiggle the DT 47781 clutch assembly installer in order to align the 1-2-3-4 and 3-5 reverse clutch plates with the external splines of the 4-5-6 clutch assembly. To verify that the 1-2-3-4 and 3-5 reverse clutch assembly is fully installed, lift up on the turbine shaft. There should not be any noticeable slack.**

Special Tool

DT 47781 C1234 35R Clutch Assembly Installer

For equivalent regional tools, refer to **Special Tools** .

TORQUE CONVERTER HOUSING WITH FLUID PUMP INSTALLATION

Fig. 80: Torque Converter Housing With Fluid Pump (With Tightening Sequence)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	NEW Fluid Pump Seal
2	Torque Converter (with Fluid Pump) Housing Assembly **CAUTION:**

Callout	Component Name
	Ensure the turbine shaft (O-ring) seal is not installed prior to installing the torque converter housing assembly. The seal may become cut or damaged during installation of the torque converter housing assembly.
3	Bolts M10 x 50 (Qty: 9) **CAUTION:** **Refer to Fastener Caution .** **Procedure** Tighten in the sequence shown. **Tighten** 72 N.m (53 lb ft)
4	NEW Turbine Shaft (O-Ring) Seal

PROPELLER SHAFT FRONT SLIP YOKE OIL SEAL REPLACEMENT

Fig. 81: Output Shaft Seal Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Output Shaft Seal Assembly **Special Tools** • **DT-48021** Seal Installer (6L90) • **J 8092** Driver Handle (6L90) • **J 38869** Output Shaft Seal Installer (6L80) • **J 45000** Seal Remover

CONTROL VALVE BODY ASSEMBLY INSTALLATION

Fig. 82: Control Valve Body Assembly (With Tightening Sequence)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	NEW Fluid Pump Seal Assembly
2	NEW Fluid Pump Seal Assembly

Callout	Component Name
3	NEW Center Support Fluid Passage Seal Assembly **NOTE:** **There are two different designs for the Center Support Fluid Passage Seal. The design for 6L45/50 (MYA/MYB) models utilizes tabs. The design for 6L80/90 (MYC/MYD) models does not have tabs.**
4	Control Valve Body Assembly **CAUTION:** **The control valve body assembly needs to be lowered into place vertically, with no lateral**

Callout	Component Name
	movement. Lateral movement can damage the pass through connector pins and/or the oil transfer seals. **NOTE:** **Align the manual shift shaft position switch activator slide with the detent lever guide pin.**
5	Bolts M5 x 73 (Qty: 6) **CAUTION:** **Refer to Fastener Caution .** **Procedure** Tighten in the sequence shown. **Tighten**

Callout	Component Name
	8 N.m (71 lb in). **Special Tool** **DT-48285** Valve Body Torx Plus Socket (if applicable) For equivalent regional tools, refer to **Special Tools** .

AUTOMATIC TRANSMISSION ELECTRICAL CONNECTOR PASSAGE SLEEVE INSTALLATION

Fig. 83: Automatic Transmission Electrical Connector Passage Sleeve
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	NEW Automatic Transmission Wiring Connector Seal
2	NEW Automatic Transmission Wiring Connector Seal - O-Ring (Qty: 2)

Callout	Component Name
3	Electrical Connector Passage Sleeve **CAUTION:** **Orientate the alignment tab inside the passage sleeve with the slot in the electrical connector of the control solenoid valve assembly. Push the sleeve straight into the case bore and connector. Do NOT rotate the sleeve at any time. Ensure the sleeve is fully seated into the case. When the sleeve is properly installed, the distance from the case surface**

Callout	Component Name
	to the end of the sleeve should be 14-16 mm. Even though the correct electrical connections may still be maintained, failure to ensure proper installation of the sleeve may result in a fluid leak around the sleeve lip seal and into the sleeve cavity. **Specification** 14-16 mm **Special Tools** • **DT 47715** Electrical Connector Passage Sleeve Remover/Installer • **EN 42183** Driver Handle For equivalent regional tools, refer to **Special Tools** .

Callout	Component Name
4	Electrical Connector Slide Lock **NOTE:** **Push down on the electrical connector slide lock to ensure proper installation.**

FLUID FILTER AND MANUAL SHIFT DETENT ASSEMBLY INSTALLATION

Fig. 84: Fluid Filter And Manual Shift Detent Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Manual Shaft Detent Spring **CAUTION:** **Ensure the manual shaft detent assembly roller is centered over the manual shaft detent lever assembly. Failure to center the roller may cause hard or no shift lever operation.**
2	Manual Shaft Detent Spring Bolt M6 x 14.5 **CAUTION:** **Refer to Fastener Caution .** **Tighten** 12 N.m (106 lb in).

Callout	Component Name
3	Fluid Filter Seal **NOTE:** **Install a NEW seal.** **Special Tools** • **DT 47848** Seal Installer • **EN 42183** Driver Handle For equivalent regional tools, refer to **Special Tools** .
4	Fluid Filter **NOTE:** **Install a NEW filter.**

TRANSMISSION FLUID PAN INSTALLATION (6L80)

Fig. 85: Transmission Fluid Pan And Bolt Tightening Sequence (6L80)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Fluid Pan Gasket **NOTE:** **The fluid pan gasket is reusable. Inspect the gasket to determine if it may be reused. If the**

Callout	Component Name
	gasket is stuck to the case or pan, it should be replaced.
2	Fluid Pan Assembly
3	Fluid Pan Bolts M6 x 20 (Qty: 18) **CAUTION:** **Refer to Fastener Caution .** **Procedure** Tighten in sequence shown. **Tighten** 9 N.m (80 lb in)

CASE EXTENSION ASSEMBLY INSTALLATION

Fig. 86: Case Extension Assembly And Bolt Tightening Sequence
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	NEW Case Extension Seal
2	Case Extension
3	Bolts M10 x 40 (Qty: 6) **CAUTION:** **Refer to Fastener Caution .** **Procedure**

Callout	Component Name
	Tighten in sequence shown. **Tighten** 55 N.m (41 lb ft)

TORQUE CONVERTER INSTALLATION AND HOLDING FIXTURE REMOVAL

Fig. 87: Torque Converter And Holding Fixture
Courtesy of GENERAL MOTORS COMPANY

Callout	Procedure
Preliminary Procedure Rotate the transmission so that the fluid pan assembly is down.	
1	Transmission Case Assembly

Callout	Procedure
	Special Tools • **DT 47605** Holding Fixture • **J 3289-20** Holding Fixture Base Assembly • **J 8763-B** Holding Fixture For equivalent regional tools, refer to **Special Tools** .
2	Torque Converter Assembly

REPAIR INSTRUCTIONS - ON VEHICLE

WIRE TO WIRE REPAIR - AUTOMATIC TRANSMISSION

Special Tools

- **EL-38125-10** Splice Sleeve Crimping Tool (non GMNA)
- **J-38125-5A** Ultra Torch Special Tool
- **J-38125-8** Splice Sleeve Crimping Tool (GMNA)

For equivalent regional tools, refer to **Special Tools** .

WARNING: **In order to reduce the risk of personal injury, loss of high voltage isolation to ground and higher system impedance, do not attempt to repair any HV wiring, connector, or terminal that is damaged. High voltage coaxial type cables are not repairable. Never attempt to repair a coaxial type cable. The entire cable/harness or component must be replaced. In order to maintain system integrity and personal safety, never attempt to repair any high voltage wiring, cables, or terminals. Performing this procedure on high voltage circuits may result in serious injury or death.**

NOTE: **If the wiring harness internal to the transmission is damaged, the wiring harness must be replaced. The use of splice sleeves in an attempt to repair the internal transmission wires, connectors, or terminals could result in performance issues.**

NOTE: **Do not splice wires in Door Harness Grommets.**

NOTE: **The DuraSeal splice sleeves have the following 2 critical features:**

- **A special heat shrink sleeve environmentally seals the splice. The heat shrink sleeve contains a sealing adhesive inside.**
- **A cross hatched (knurled) core crimp provides the necessary low resistance contact integrity for these sensitive, low energy circuits.**

Use only DuraSeal splice sleeves to form a one-to-one splice on all types of insulation except high voltage and specialty cables. Use DuraSeal splice sleeves where there are special requirements such as moisture sealing. Follow the instructions below in order to splice copper wire using DuraSeal splice sleeves.

Splice Sleeve Selection

Splice Sleeve Color	Crimp Tool Nest Color		Wire Gauge mm^2 /(AWG)
	3 Crimp Nests	4 Crimp Nests	
Salmon (Yellow-Pink) 19300089	Red (1) or Red/Green (1)	Red (2)	0.22-0.8/(18-26)
Blue 19168447	Blue (2)	Blue (3)	1.0-2.0/(14-16)
Yellow 19168448	Yellow (3)	Yellow (4)	3.0-5.0/(10-12)

NOTE: **You must perform the following procedures in the listed order. Repeat the procedure if any wire strands are damaged. You must obtain a clean strip with all of the wire strands intact.**

1. Open the harness by removing any tape:
   - Use a sewing seam ripper, available from sewing supply stores, in order to cut open the harness in order to avoid wire insulation damage.
   - Use the DuraSeal splice sleeves on all types of insulation except Tefzel and coaxial.
   - Do not use the crimp and DuraSeal splice sleeve to form a splice with more than 2 wires coming together.
2. Cut as little wire off the harness as possible. You may need the extra length of wire in order to change the location of a splice.

   Adjust splice locations so that each splice is at least 40 mm (1.5 in) away from the other splices, harness branches, or connectors.

3. Strip the insulation:
   - When adding a length of wire to the existing harness, use the same size wire as the original wire.
   - Perform one of the following items in order to find the correct wire size:
     - Find the wire on the schematic and convert to regional wiring gauge size.
     - If you are unsure of the wire size, begin with the largest opening in the wire stripper and work down until achieving a clean strip of the insulation.
   - Strip approximately 5.0 mm (0.20 in) of insulation from each wire to be spliced.
   - Do not nick or cut any of the strands. Inspect the stripped wire for nicks or cut strands.

- If the wire is damaged, repeat this procedure after removing the damaged section.

4. For high temperature wiring, slide a section of high temperature SCT1 shrink tubing down the length of wire to be spliced. Ensure that the shrink tubing will not interfere with the splice procedure.
5. Select the proper DuraSeal splice sleeve according to the wire size. Refer to the above table at the beginning of the repair procedure for the color coding of the DuraSeal splice sleeves and the crimp tool nests.

Fig. 1: Splice Sleeve Crimping Tool With 4 Crimp Nests

Courtesy of GENERAL MOTORS COMPANY

6. The **EL-38125-10** splice sleeve crimping tool has four crimp nests. The largest crimp nest (4) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (3) is used for crimping 14 and 16 gauge wires. The third largest crimp nest (2) is used for crimping 18 and 20 gauge wires. The smallest crimp nest (1) is used for crimping 22 to 26 gauge wires. The crimp nests are referenced in the table (farther above) under the crimp tool nest color.

Fig. 2: Splice Sleeve Crimping Tool With 3 Crimp Nests

Courtesy of GENERAL MOTORS COMPANY

7. The **J-38125-8** splice sleeve crimping tool has three crimp nests. The largest crimp nest (3) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (2) is used for crimping 14 and 16 gauge wires. The smallest crimp nest (1) is used for crimping 18 to 20 gauge wires. The crimp nests are referenced in the table (farther above) under the crimp tool nest color.
8. Use the splice sleeve crimp tool in order to position the DuraSeal splice sleeve in the proper color nest of the splice sleeve crimp tool. For the four crimp nest tool, use the three largest crimp nests to crimp the splice sleeves. For the three crimp nest tool, use all three crimp nests to crimp the splice sleeves. Use the four and three crimp tool diagrams (above) and the table (farther above) to match the splice sleeve with the correct crimp nest. The crimp tool diagram callout numbers match the numbers in the table (under crimp tool nest color).

Fig. 3: Identifying DuraSeal Splice Sleeve
Courtesy of GENERAL MOTORS COMPANY

9. Place the DuraSeal splice sleeve in the nest. Ensure that the crimp falls midway between the end of the barrel and the stop. The sleeve has a stop (3) in the middle of the barrel (2) in order to prevent the wire (1) from going further. Close the hand crimper handles slightly in order to firmly hold the DuraSeal splice sleeve in the proper nest.

Fig. 4: Crimped DuraSeal Splice Sleeve
Courtesy of GENERAL MOTORS COMPANY

10. Insert the wire into the splice sleeve barrel until the wire hits the barrel stop. Refer to **Folded-Over Wire Repair** for splicing wires of 0.35 mm or less (22, 24, 26 gauge sizes) and for splicing wires of different gauges.

11. Tightly close the handles of the crimp tool until the crimper handles open when released.

    The crimper handles will not open until you apply the proper amount of pressure to the DuraSeal splice sleeve. Repeat steps 4 and 6 for the opposite end of the splice.

Fig. 5: Heated Splice Sleeve
Courtesy of GENERAL MOTORS COMPANY

12. Using the heat torch, apply heat to the crimped area of the barrel.
13. Start in the middle and gradually move the heat barrel to the open ends of the tubing:
    - The tubing will shrink completely as the heat is moved along the insulation.
    - A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.

Weatherpack™ Wiring Repair

NOTE: **Some replacement pigtail connectors may be delivered without the terminated leads installed into the connector. For Weatherpack™ connectors, all terminated leads included in the package should to be installed into the connector. If the connector end view shows that a terminal is not occupied, the extra terminated lead(s) need to be installed and the end(s) sealed using a DuraSeal splice sleeve and taped back into the harness.**

1. Insert the wire into the splice sleeve barrel until the wire hits the barrel stop. Refer to **Folded-Over Wire Repair** for splicing wires of 0.35 mm or less (22, 24, 26 gauge sizes) and for splicing wires of different gauges.

Fig. 6: Tightly Close Handles Of Crimp Tool
Courtesy of GENERAL MOTORS COMPANY

2. Tightly close the handles of the crimp tool until the crimper handles open when released.

   The crimper handles will not open until you apply the proper amount of pressure to the DuraSeal splice sleeve. Holding the DuraSeal with one

hand gently tug on the wire to ensure it is crimped in the DuraSeal.

3. Using the heat torch, apply heat to the crimped area of the barrel.

Fig. 7: Heat To Crimped Area Of Barrel
Courtesy of GENERAL MOTORS COMPANY

4. Start in the middle and gradually move the heat barrel to the open ends of the tubing:
    - The tubing will shrink completely as the heat is moved along the insulation.
    - A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.

Fig. 8: Taping Extra Terminated Leads Back Into Harness
Courtesy of GENERAL MOTORS COMPANY

5. Tape the extra terminated lead(s) back into the harness.

High Temperature Wiring Repairs

Use the following procedures to perform high temperature wiring repairs:

1. Center the high temperature SCT1 shrink tube over the DuraSeal splice sleeve.
2. Using the heat torch, apply heat to the high temperature heat shrink tubing.
3. Gradually move the heat from the center to the open end of the tubing:
    - The tubing will shrink completely as the heat is moved along the insulation.
    - A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.
4. Replace any reflective tape and clips that may have been removed during the repair.

CONNECTOR RECONNECTION - AUTOMATIC TRANSMISSION

Special Tools

EL-35616 Terminal Test Probe Kit

For equivalent regional tools, refer to **Special Tools** .

When the condition is not currently present, but is indicated in DTC history, the cause may be intermittent. An intermittent may also be the cause when there is a customer complaint, but the symptom cannot be duplicated. Refer to the Symptom Table of the system that is suspect of causing the condition before trying to locate an intermittent condition.

Most intermittent conditions are caused by faulty electrical connections or wiring. Inspect for the following items:

- Wiring broken inside the insulation
- Poor connection between the male and female terminal at a connector
- A terminal not seated all the way into the connector body
- Poor terminal to wire connection - Some conditions which fall under this description are poor crimps, poor solder joints, crimping over the wire insulation rather than the wire itself, and corrosion in the wire to terminal contact area, etc.
- Pierced or damaged insulation can allow moisture to enter the wiring causing corrosion. The conductor can corrode inside the insulation, with little visible evidence. Look for swollen and stiff sections of wire in the suspect circuits.
- Wiring which has been pinched, cut, or its insulation rubbed through may cause an intermittent open or short as the bare area touches other

wiring or parts of the vehicle.

- Wiring that comes in contact with hot or exhaust components
- Refer to **Inducing Intermittent Fault Conditions** in order to duplicate the conditions required, in order to verify the customer concern.
- Refer to **Testing for Electrical Intermittents** for test procedures to detect intermittent open, high resistance, short to ground, and short to voltage conditions.
- Refer to **Scan Tool Snapshot Procedure** for advanced intermittent diagnosis and Vehicle Data Recorder operation.

Testing for Terminal Fretting

Some intermittent conditions can be caused by wire terminal fretting corrosion. Fretting corrosion is a build-up of insulating, oxidized wear debris that can form when there is a small motion between electrical contacts. The oxidized wear debris can pile up enough at the electrical contact spots that the electrical resistance across the connection increases. Movement between the contacting surfaces as small as 10 to 100 microns can cause fretting. To put this in perspective, a sheet of paper is about 100 microns thick, so fretting motion is small and hard to see. Vibration and thermal expansion/contraction are the main sources that create fretting motion. Since vehicles vibrate and can experience large temperature swings, they are a good source for fretting motion. Tin, copper, nickel, and iron surfaces are all susceptible to fretting corrosion. Fretting corrosion can be difficult to see but it looks like small, dark smudges on the terminals contact surface.

To correct a fretting condition disconnect the suspect connector and add dielectric grease/lubricant (Nyogel 760G or equivalent, meeting GM specification 9986087) to both sides of the connector terminals. Then reconnect the connector and wipe away any excess lubricant. This will correct the additional terminal contact resistance due to the terminal fretting corrosion.

Testing for Proper Terminal Contact

It is important to test terminal contact at the component and any inline connectors before replacing a suspect component. Mating terminals must be inspected to ensure good terminal contact. A poor connection between the male and female terminal at a connector may be the result of contamination or deformation.

Contamination may be caused by the connector halves being improperly connected. A missing or damaged connector seal, damage to the connector itself, or exposing the terminals to moisture and dirt can also cause contamination. Contamination, usually in the underhood or underbody connectors, leads to terminal corrosion, causing an open circuit or intermittently open circuit.

Deformation is caused by probing the mating side of a connector terminal without the proper adapter. Always use the **EL-35616** kit when probing connectors. Other causes of terminal deformation are improperly joining the connector halves, or repeatedly separating and joining the connector halves. Deformation, usually to the female terminal contact tang, can result in poor terminal contact causing an open or intermittently open circuit.

Testing for Proper Terminal Contact in Bussed Electrical Centers

It is very important to use the correct test adapter when testing for proper terminal contact of fuses and relays in a bussed electrical center. Use the **EL-35616** kit to test for proper terminal contact. Failure to use the **EL-35616** kit can result in improper diagnosis of the bussed electrical center.

Follow the procedure below in order to test terminal contact:

1. Separate the connector halves.
2. Visually inspect the connector halves for contamination. Contamination may result in a white or green build-up within the connector body or between terminals. This causes high terminal resistance, intermittent contact, or an open circuit. An underhood or underbody connector that shows signs of contamination should be replaced in its entirety: terminals, seals, and connector body.
3. Using an equivalent male terminal/terminated lead, verify that the retention force is significantly different between a known good terminal and the suspect terminal. Replace the female terminal in question.

Flat Wire Connectors

There are no serviceable parts for flat wire connectors on the harness side or the component side.

Follow the procedure below in order to test terminal contact:

1. Remove the component in question.
2. Visually inspect each side of the connector for signs of contamination. Avoid touching either side of the connector as oil from your skin may be a source of contamination as well.
3. Visually inspect the terminal bearing surfaces of the flat wire circuits for splits, cracks, or other imperfections that could cause poor terminal contact. Visually inspect the component side connector to ensure that all of the terminals are uniform and free of damage or deformation.
4. Insert the appropriate adapter into the flat wire harness connector in order to test the circuit in question.

Control Module/Component Voltage and Grounds

Poor voltage or ground connections can cause widely varying symptoms.

- Test all control module voltage supply circuits. Many vehicles have multiple circuits supplying voltage to a control module. Other components in the system may have separate voltage supply circuits that may also need to be tested. Inspect connections at the module/component connectors, fuses, and any intermediate connections between the voltage source and the module/component. A test lamp or a DMM may indicate that voltage is present, but neither tests the ability of the circuit to carry sufficient current. Operate the component to test the ability of the circuit to carry sufficient current. Refer to **Circuit Testing** , and **Power Distribution Schematics** .
- Test all control module ground and system ground circuits. The control module may have multiple ground circuits. Other components in the system may have separate grounds that may also need to be tested. Inspect grounds for clean and tight connections at the grounding point.

Inspect the connections at the component and in splice packs, where applicable. Operate the component to test the ability of the circuit to carry sufficient current. Refer to **Circuit Testing** , and **Ground Distribution Schematics** .

Temperature Sensitivity

- An intermittent condition may occur when a component/connection reaches normal operating temperature. The condition may occur only when the component/connection is cold, or only when the component/connection is hot.
- Freeze Frame, Failure Records, Snapshot, or Vehicle Data Recorder data may help with this type of intermittent condition, where applicable.
- If the intermittent is related to heat, review the data for a relationship with the following:
  - High ambient temperatures
  - Underhood/engine generated heat
  - Circuit generated heat due to a poor connection, or high electrical load
  - Higher than normal load conditions, towing, etc.
- If the intermittent is related to cold, review the data for the following:
  - Low ambient temperatures - In extremely low temperatures, ice may form in a connection or component. Inspect for water intrusion.
  - The condition only occurs on a cold start.
  - The condition goes away when the vehicle warms up.
- Information from the customer may help to determine if the trouble follows a pattern that is temperature related.
- If temperature is suspected of causing an intermittent fault condition, attempt to duplicate the condition. Refer to **Inducing Intermittent Fault Conditions** in order to duplicate the conditions required.

Electromagnetic Interference and Electrical Noise

Some electrical components/circuits are sensitive to electromagnetic interference or other types of electrical noise. Inspect for the following conditions:

- A mis-routed harness that is too close to high voltage/high current devices such as secondary ignition components, motors, generator etc. - These components may induce electrical noise on a circuit that could interfere with normal circuit operation.
- Electrical system interference caused by a malfunctioning relay, or a control module driven solenoid or switch - These conditions can cause a sharp electrical surge. Normally, the condition will occur when the malfunctioning component is operating.
- Installation of non-factory or aftermarket add on accessories such as lights, 2-way radios, amplifiers, electric motors, remote starters, alarm systems, cell phones, etc. - These accessories may create interference in other circuits while operating and the interference would disappear when the accessory is not operating. Refer to **Checking Aftermarket Accessories** .

- Test for an open diode across the A/C compressor clutch and for other open diodes. Some relays may contain a clamping diode.
- The generator may be allowing AC noise into the electrical system.

Incorrect Control Module

- There are only a few situations where reprogramming a control module is appropriate:
  - A new service control module is installed.
  - A control module from another vehicle is installed.
  - Revised software/calibration files have been released for this vehicle.

NOTE: **DO NOT re-program the control module with the SAME software/calibration files that are already present in the control module. This is not an effective repair for any type of concern.**

- Verify that the control module contains the correct software/calibration. If incorrect programming is found, reprogram the control module with the most current software/calibration. Refer to **Control Module References** for replacement, setup, and programming.

TRANSMISSION FLUID FILLER TUBE AND SEAL REPLACEMENT

Removal Procedure

Fig. 9: Transmission Oil Level Indicator
Courtesy of GENERAL MOTORS COMPANY

1. Unlock the transmission oil level indicator.
2. Remove the transmission oil level indicator.

NOTE: **Tie the engine wiring harness, between the oil level indicator tube and engine, to the engine, so when installing the new oil level indicator tube the harness will not get caught on the oil level indicator tube.**

3. Raise the vehicle.
4. Support the transmission with a suitable jack.
5. Remove the transmission crossmember. Refer to **Transmission Support Crossmember Replacement (2WD)** **Transmission Support Crossmember Replacement (4WD)** .
6. Remove the transmission oil level indicator tube bracket nut.
7. Remove the exhaust heat shield from the transmission. Refer to **Transmission Heat Shield Replacement**.
8. Lower rear of transmission to allow for clearance to remove transmission oil level indicator tube.
9. Remove the transmission oil level indicator tube from the transmission.
10. Raise rear of transmission to allow for clearance to remove transmission oil level indicator tube from vehicle.

Fig. 10: Oil Level Indicator Tube And Seal
Courtesy of GENERAL MOTORS COMPANY

11. Remove the oil level indicator tube (1) and seal (2) assembly.
12. Remove the seal (2) from the oil level indicator tube (1).

Installation Procedure

Fig. 11: Oil Level Indicator Tube And Seal
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Lightly oil the seal to aid in the installation into the transmission case.**

1. Install a seal (2) to the indicator tube (1).
2. Install the oil level indicator tube (1) and seal (2) assembly.

3. Lower rear of transmission to allow for clearance to install transmission oil level indicator tube into the transmission.
4. Seat the oil level indicator tube seal into the transmission, then seat the oil level indicator tube.

CAUTION: Refer to Fastener Caution .

5. While holding the oil level indicator tube down into the transmission, install transmission oil level indicator tube bracket nut. Tighten the nut to 22 N.m (16 lb ft).
6. Install the exhaust heat shield to the transmission. Refer to **Transmission Heat Shield Replacement**.
7. Raise rear of transmission to install transmission crossmember.
8. Install the transmission crossmember. Refer to **Transmission Support Crossmember Replacement (2WD)** **Transmission Support Crossmember Replacement (4WD)** .
9. Remove the jack.
10. Lower the vehicle.

Fig. 12: Transmission Oil Level Indicator
Courtesy of GENERAL MOTORS COMPANY

11. Install the transmission oil level indicator.
12. Lock the transmission oil level indicator.

RANGE SELECTOR LEVER CABLE REPLACEMENT

Fig. 13: Range Selector Lever Cable Retainer On Steering Column
Courtesy of GENERAL MOTORS COMPANY

WARNING: **The automatic transaxle range selector cable is made out of two cable sections. After initial connection never separate the two metal couplings from one another. Integrity of the connection of the two metal couplings will be lost if separation of the two metal couplings occurs. When servicing the transaxle**

remove the cable at the automatic transaxle range selector lever and at the automatic transaxle range selector cable bracket. If either section of the cable needs to be replaced, replace both of the cable sections. Loss of connection integrity of the two metal couplings can cause loss of transaxle shift control which could result in personal injury.

1. Position the steering column shift lever to the park position.
2. Remove the instrument panel knee bolster. Refer to **Instrument Panel Knee Bolster Replacement (Chevrolet / GMC)** **Instrument Panel Knee Bolster Replacement (Cadillac)** .
3. Remove the left front side door sill garnish molding. Refer to **Front Side Door Sill Garnish Molding Replacement** .
4. Pull back the carpet and insulation around the driver area.
5. Remove the retainer securing the cable to the steering column.

Fig. 14: Cable, Steering Column Ball Stud And Steering Column Bracket
Courtesy of GENERAL MOTORS COMPANY

6. Remove the cable end from the steering column ball stud.
7. Depress the tangs and remove the cable from the steering column bracket.

Fig. 15: Range Selector Cable
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Avoid unnecessary twisting/bending of the range selector cable when removing the cable from the support.**

8. Remove the range selector cable from the support.

Fig. 16: Cable Grommet And Floor Panel
Courtesy of GENERAL MOTORS COMPANY

9. Remove the cable grommet from the floor panel.
10. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

Fig. 17: Cable Clips And Floor Panel Reinforcement
Courtesy of GENERAL MOTORS COMPANY

11. Remove the clips on the cable from the floor panel reinforcement.
12. Ensure the transmission manual shaft is positioned in mechanical park.
13. Remove the cable clip on the transfer case, if equipped.

Fig. 18: Range Selector Cable And Retainer
Courtesy of GENERAL MOTORS COMPANY

NOTE: **DO NOT pry the cable end from the lever ball stud. Replacement of the range selector cable requires a NEW control lever.**

14. Remove the range selector cable (2) and the transmission range selector lever as an assembly.
15. Remove the retainer (1) that secures the cable to the bracket.
16. Depress the tangs and remove the cable from the bracket.
17. Remove the transmission range selector cable from the vehicle.

Installation Procedure

1. Install the transmission range selector cable to the vehicle.

Fig. 19: Range Selector Cable And Retainer
Courtesy of GENERAL MOTORS COMPANY

2. Ensure that the transmission manual shaft lever is in the mechanical park position.
3. Align and install the range selector cable (2) to the bracket.
4. Install the retainer (1) that secures the cable to the bracket.
5. Install the NEW range selector lever to the transmission. Refer to **Automatic Transmission Range Selector Lever Replacement**

WARNING: After installing the transmission range selector shift cable, pull up and push down on ALL connections to verify that the connections are fully seated and properly engaged. Failure to perform this task can result in the vehicle not being able to shift into PARK causing potential vehicle damage and bodily injury.

6. Install the range selector cable end to the transmission range selector lever ball stud.
7. Install the cable clip on the transfer case, if equipped.

Fig. 20: Cable Clips And Floor Panel Reinforcement
Courtesy of GENERAL MOTORS COMPANY

8. Install the clips on the cable to the floor panel reinforcement.
9. Lower the vehicle and ensure that the steering column shift lever is still in the park position.

Fig. 21: Cable Grommet And Floor Panel
Courtesy of GENERAL MOTORS COMPANY

10. Install the cable grommet to the floor panel.

Fig. 22: Range Selector Cable
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Avoid unnecessary twisting/bending of the range selector cable when installing the cable to the support.**

11. Install the range selector cable to the support.

Fig. 23: Cable, Steering Column Ball Stud And Steering Column Bracket
Courtesy of GENERAL MOTORS COMPANY

12. Install the cable to the steering column bracket.
13. Ensure the tangs fully engage into the steering column bracket.
14. Install the cable end to the steering column ball stud.

Fig. 24: Range Selector Lever Cable Retainer On Steering Column
Courtesy of GENERAL MOTORS COMPANY

15. Install the retainer securing the cable to the steering column.
16. Position the carpet and insulation around the driver area.
17. Install the left front side door sill garnish molding. Refer to **Front Side Door Sill Garnish Molding Replacement** .
18. Install the instrument panel knee bolster. Refer to **Instrument Panel Knee Bolster Replacement (Chevrolet / GMC)** **Instrument Panel**

Knee Bolster Replacement (Cadillac) .

19. Test the transmission for proper shift operation.
20. If all of the gear positions cannot be achieved, adjust the cable. Refer to **Range Selector Lever Cable Adjustment**.

RANGE SELECTOR LEVER CABLE ADJUSTMENT

Fig. 25: Aligning Outside Diameter Of Transmission End With Inside Diameter Of Shifter End
Courtesy of GENERAL MOTORS COMPANY

1. Ensure that the steering column shift lever is in the park (P) position.
2. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Ensure that the transmission manual shaft lever is in the park (P) position.
4. Grasp the shift cable shifter end (1) in the left hand and the shift cable transmission end (2) in the right hand.
5. Align the outside diameter of the transmission end (2) with the inside diameter of the shifter end (1).

Fig. 26: Engaging Inner Wire And Locking Both Wires Together

Courtesy of GENERAL MOTORS COMPANY

6. Push the end of the transmission cable (3) inside the shifter end until the blue spring (2) on the transmission end (3) is fully compressed, this will engage the inner wire and lock both wires together.

Fig. 27: Adjusting Cable Tension
Courtesy of GENERAL MOTORS COMPANY

NOTE: **DO NOT hold the transmission end (1) during this operation, this will result in a mis-adjusted cable.**

7. Release the transmission end (3) and allow the spring (2) to tension/adjust the cable system.
8. Pull the white cover (5) on the shifter end (1) back.
9. Push the natural colored lock button (4) down to engage the locking teeth on the transmission end (3).

Fig. 28: Cover And Lock
Courtesy of GENERAL MOTORS COMPANY

10. Release the white cover (1).
11. Verify the white cover (1) conceals the natural colored lock (2).
12. If the white cover (1) does not conceal the natural colored lock (2), the shift cable must be re-adjusted. Refer to cable re-adjustment below.
13. Lower the vehicle.
14. Test the transmission for proper shift operation.
15. If all of the gear positions cannot be achieved, the shift cable must be re-adjusted. Refer to cable re-adjustment below.

Cable Re-Adjustment

Fig. 29: Cover And Lock
Courtesy of GENERAL MOTORS COMPANY

1. Place the steering column shift lever back into the park (P) position.
2. Raise the vehicle.
3. Ensure that the transmission manual shaft lever is in the park (P) position.

4. Pull the white cover (1) back to expose the natural colored lock (2). Under the lock (2), insert a flat-bladed screwdriver under the lock ramp located at the top of the lock. The lock will pop up, and the transmission end will move slightly away from the shifter end.

Fig. 30: Engaging Inner Wire And Locking Both Wires Together
Courtesy of GENERAL MOTORS COMPANY

5. Push the end of the transmission end (3) inside the shifter end (1) until the blue spring (2) on the transmission end (3) is fully compressed, this will engage the inner wire and lock both wires together.

Fig. 31: Adjusting Cable Tension
Courtesy of GENERAL MOTORS COMPANY

NOTE: **DO NOT hold the transmission end (1) during this operation, this will result in a mis-adjusted cable.**

6. Release the transmission end (3) and allow the spring (2) to tension/adjust the cable system.
7. Pull the white cover (5) on the shifter end (1) back.

8. Push the natural colored lock button (4) down to engage the locking teeth on the transmission end (3).

Fig. 32: Cover And Lock
Courtesy of GENERAL MOTORS COMPANY

9. Release the white cover (1).
10. Verify the white cover (1) conceals the natural colored lock (2).

RANGE SELECTOR LEVER CABLE BRACKET REPLACEMENT

Fig. 33: Range Selector Lever Cable Bracket
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures	
1. Apply the park brake. 2. Shift the transmission into neutral. 3. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** . 4. Remove the transmission range selector cable from the range selector cable bracket. Refer to **Range Selector Lever Cable Replacement**.	

Callout	Component Name
1	Transmission Range Selector Cable Bracket Bolt (Qty: 2) **CAUTION:** **Refer to** **Fastener Caution .** **Tighten** 22 N.m (16 lb ft)
2	Transmission Range Selector Cable Bracket

AUTOMATIC TRANSMISSION RANGE SELECTOR LEVER REPLACEMENT

Fig. 34: Automatic Transmission Range Selector Lever
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Preliminary Procedures

1. Apply the park brake.
2. Shift the transmission into neutral.
3. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .

WARNING:
After installing the transmission range selector shift cable, pull up and push down on ALL connections to verify that the connections are fully seated and properly engaged. Failure to perform this task can result in the vehicle not being able to shift into PARK

Callout	Component Name
causing potential vehicle damage and bodily injury. 4. Disconnect the transmission range selector cable from the range selector cable lever ball stud.	
1	Transmission Range Selector Cable Lever Nut **WARNING:** **Hold the transmission range selector lever while removing or installing the lever retaining nut. Failure to hold the lever can cause damage to the transmission internal park system components which could allow the vehicle to roll when placed in the**

Callout	Component Name
	park position. **CAUTION:** **Refer to Fastener Caution .** **Tighten** 25 N.m (18 lb ft)
2	Transmission Range Selector Cable Lever

TRANSMISSION HEAT SHIELD REPLACEMENT

Fig. 35: Transmission Heat Shield
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .	
1	Transmission Heat Shield Bolt (Qty: 2) **CAUTION:** **Refer to** **Fastener Caution** . **Tighten** 17 N.m (13 lb ft)
2	Transmission Heat Shield

AUTOMATIC TRANSMISSION FLUID PRESSURE TEST HOLE PLUG REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

Fig. 36: Oil Pressure Test Plug
Courtesy of GENERAL MOTORS COMPANY

2. Clean the surrounding area of the oil pressure test plug.
3. Remove the oil pressure test plug.

Installation Procedure

Fig. 37: Oil Pressure Test Plug
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Component Fastener Tightening Caution .

1. Install the oil pressure test plug and tighten to 11 N.m (97 lb in).
2. Check the transmission fluid level (fill if necessary). Refer to **Transmission Fluid Level and Condition Check** .

3. Lower the vehicle.

AUTOMATIC TRANSMISSION ELECTRICAL CONNECTOR PASSAGE SLEEVE REPLACEMENT

Fig. 38: Automatic Transmission Electrical Connector Passage Sleeve
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **Orientate the alignment tab inside the passage sleeve with the slot in**	

Callout	Component Name
the electrical connector of the control solenoid valve assembly. Push the sleeve straight into the case bore and connector. Do NOT rotate the sleeve at any time. Ensure the sleeve is fully seated into the case. When the sleeve is properly installed, the distance from the case surface to the end of the sleeve should be 14-16 mm. Even though the correct electrical connections may still be	

Callout	Component Name
maintained, failure to ensure proper installation of the sleeve may result in a fluid leak around the sleeve lip seal and into the sleeve cavity. **Preliminary Procedures** 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the transmission oil pan. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement**. 3. Remove the transmission heat shield. Refer to **Transmission Heat Shield Replacement**. 4. Disconnect the vehicle wire harness electrical connector from the transmission electrical connector passage sleeve.	
1	Electrical Connector Slide Lock **NOTE:** **Pull down on the slide lock to remove the sleeve. Push up on the slide lock after sleeve installation.**

Callout	Component Name
2	Electrical Connector Passage Sleeve **NOTE:** • **Use the DT-47715 electrical connector passage sleeve remover/installer and J-42183 driver handle to remove and install the electrical connector passage sleeve.** • **The distance (a) from the case surface to the end of the sleeve should be 14-16 mm.** **Special Tools** • **DT-47715** Electrical Connector Passage Sleeve Remover/Installer • **J-42183** Driver Handle Equivalent regional tools:**Special Tools**
3	O-Ring Seal (Qty: 2) **NOTE:**

Callout	Component Name
	Use a NEW O-ring seal.
4	Lip Seal **NOTE:** **Use a NEW lip seal.**

AUTOMATIC TRANSMISSION FLUID, FLUID PAN AND/OR FILTER REPLACEMENT

Fig. 39: Fluid, Fluid Pan, Fluid Pan Tightening Sequence & Filter Component View
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **Use DexronÂ® VI transmission fluid only. Failure to use the proper fluid may result in transmission internal damage.** **Preliminary Procedures** 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Disconnect and lower the catalytic converter. Refer to **Three-Way Catalytic Converter Replacement** . 3. Place a suitable drain pan under the transmission.	
1	Transmission Fluid Pan Bolt (Qty: 18) **CAUTION:** **Refer to Fastener Caution .** **Procedure** Tighten the bolts in the sequence shown. **Tighten** 9 N.m (80 lb in)
2	Transmission Fluid Pan Assembly **Procedure**

Callout	Component Name
	1. Check the condition of the draining fluid. Refer to **Transmission Fluid Level and Condition Check** . 2. Fill the transmission with the proper fluid. Refer to **Transmission General Specifications** . 3. Fill the transmission with the proper amount of transmission fluid. Refer to **Approximate Fluid Capacities** , and **Transmission Fluid Level and Condition Check** .
3	Transmission Fluid Pan Gasket **Procedure** The fluid pan gasket is reusable. Inspect the gasket to determine if it may be reused.
4	NEW Fluid Filter Assembly **Procedure** Pull the fluid filter assembly straight out. Do not bend or twist the filter neck.
5	NEW Fluid Filter Seal Assembly **CAUTION:** **Do not damage the case sealing surface when removing the filter seal assembly.** **Procedure** 1. Use a screwdriver or snap ring pliers to remove the filter seal. 2. Use the **DT-47848** seal installer and the **J-42183** driver handle to install the filter seal. 3. Lubricate the filter seal with transmission fluid before installing the filter. **Special Tools** • **DT-47848** Seal Installer • **J-42183** Driver Handle

Callout	Component Name
	For equivalent regional tools, refer to **Special Tools** .

TRANSMISSION MOUNT INSPECTION

CAUTION: In order to avoid oil pan damage and possible engine failure, insert a block of wood that spans the width of the oil pan bottom between the oil pan and the jack support.

1. Raise the transmission/transaxle in order to remove the weight from the transmission/transaxle mount and create slight tension in the rubber.
2. Observe the transmission/transaxle mount while raising the transmission/transaxle. Replace the transmission/transaxle mount if the transmission/transaxle mount exhibits any of the following conditions:

   NOTE: Black paint on the rubber will crack with time, this does not constitute a failure.

   - The hard rubber surface is covered with heat check cracks.
   - The rubber is separated from the metal plate of the transmission/transaxle mount.
   - The rubber is split through the center of the transmission/transaxle mount.
3. If there is movement between the metal plate of the transmission/transaxle mount and its attaching points, lower the transmission/transaxle on the transmission/transaxle mount. Tighten the bolts or nuts attaching the transmission/transaxle mount to the frame or transmission/transaxle mount bracket.

TRANSMISSION MOUNT REPLACEMENT (TWO WHEEL DRIVE)

Fig. 40: Transmission Mount (2WD)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Support the transmission with a transmission jack.	

Callout	Component Name
1	Transmission Mount to Crossmember Nut **CAUTION:** **Refer to** **Fastener Caution .** **Tighten** 55 N.m (41 lb ft)
2	Transmission Mount Bolt (Qty: 2) **Tighten** 67 N.m (49 lb ft)
3	Transmission Mount **Procedure** Raise the transmission with the transmission jack just enough to remove the transmission mount.

TRANSMISSION MOUNT REPLACEMENT (FOUR WHEEL DRIVE)

Fig. 41: Transmission Mount (4WD)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Support the transmission with a transmission jack.	

Callout	Component Name
1	Transmission Mount to Crossmember Nut (Qty: 2) **CAUTION:** **Refer to** **Fastener Caution .** **Tighten** 55 N.m (41 lb ft)
2	Transmission Mount Bolt (Qty: 2) **Tighten** 67 N.m (49 lb ft)
3	Transmission Mount **Procedure** Raise the transmission with the transmission jack just enough to remove the transmission mount.

CASE EXTENSION AND GASKET REPLACEMENT

Fig. 42: Case Extension and Gasket
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Remove the propeller shaft. Refer to **Rear Propeller Shaft Replacement (1500)** **Rear Propeller Shaft Replacement (Heavy Duty)** **Rear Propeller Shaft Replacement (M5U, 2WD)** . 2. Remove the transmission mount. Refer to **Transmission Mount Replacement (Two Wheel Drive)Transmission Mount Replacement (Four Wheel Drive)**.	
1	Extension Case Fastener (Qty: 6) **CAUTION:**

Callout	Component Name
	Refer to Fastener Caution . **Tighten** 55 N.m (41 lb ft)
2	Extension Case **NOTE:** **Remove or replace the O-ring, if necessary.**

TRANSMISSION OUTPUT SHAFT SEAL REPLACEMENT (FOUR WHEEL DRIVE)

Fig. 43: Transmission Output Shaft Seal (4WD)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the transfer case adapter from the transmission. Refer to **Transfer Case Adapter Replacement** .	
1	Output Shaft Seal **Procedure** 1. Use the **J-6125-B** hammer and **J-36825-A** remover to remove the seal. Use care in order to avoid damaging the output shaft bushing. 2. Lubricate the seal with clean transmission fluid. 3. Use the **DT-50648** installer to install the seal.

Callout	Component Name
	Special Tools • **DT-50648** Case Seal Installer • **J-6125-B** Slide Hammer with Adaptor • **J-36825-A** Output Shaft Oil Seal Remover For equivalent regional tools, refer to **Special Tools** .

PROPELLER SHAFT FRONT SLIP YOKE OIL SEAL REPLACEMENT (TWO WHEEL DRIVE)

Fig. 44: Propeller Shaft Front Slip Yoke Oil Seal (2WD)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the propeller shaft. Refer to **Rear Propeller Shaft Replacement (1500)** **Rear Propeller Shaft Replacement (Heavy Duty)** **Rear Propeller Shaft Replacement (M5U, 2WD)** .	
1	Propeller Shaft Front Slip Yoke Oil Seal **Special Tools** • **DT-48021** Seal Installer (6L90) • **GE-8092** Driver Handle (6L90) • **J-38869** Output Shaft Seal Installer (6L80) • **J-45000** Seal Remover For equivalent regional tools, refer to **Special Tools** .

MANUAL SHIFT SHAFT AND SEAL REPLACEMENT

Fig. 45: Manual Shift Shaft And Seal
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Preliminary Procedures

1. Remove the automatic transmission range select lever. Refer to **Automatic Transmission Range Selector Lever Replacement**.
2. If equipped with four wheel drive, remove the front propeller shaft. Refer to **Front Axle Propeller Shaft Replacement (NPO)** **Front Axle Propeller Shaft Replacement (NQH)** **Front Axle Propeller Shaft Replacement (Heavy Duty)** .
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the transmission fluid pan. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement**.
5. Remove the control valve body. Refer to **Control Valve Lower Body and Upper Body Replacement**.

Callout	Component Name
1	Manual Shift Shaft Pin **Procedure** 1. Discard the pin. Replace with NEW pin. 2. "Walk" the pin out using side cutters.
2	Manual Shaft Detent Lever Hub Pin **Procedure** 1. Discard the pin. Replace with NEW pin. 2. "Walk" the pin out using side cutters.
3	Manual Shift Shaft **NOTE:** **The manual shaft must be removed to replace the manual shaft seal.**
4	Manual Shift Shaft Seal **Procedure** 1. Use the **J-45201** cooler line seal remover to remove the seal from the transmission case. 2. Use the **DT-47770** seal installer to install the seal into the transmission case. **Special Tools** • **DT-47770** Seal Installer • **J-45201** Cooler Line Seal Remover

Callout	Component Name
	For equivalent regional tools, refer to **Special Tools** .

MANUAL SHIFT DETENT LEVER AND PARK PAWL ACTUATOR REPLACEMENT

Fig. 46: Manual Shift Detent Lever And Park Pawl Actuator
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Remove the automatic transmission range select lever. Refer to **Automatic Transmission Range Selector Lever Replacement**. 2. Remove the valve body. Refer to **Control Valve Lower Body and Upper Body Replacement**.	

MANUAL SHIFT SHAFT POSITION SWITCH REPLACEMENT

Fig. 47: Manual Shift Shaft Position Switch
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the transmission fluid pan and filter. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement**.	
1	Manual Shift Shaft Position Switch Assembly Electrical Connector **NOTE:**

Callout	Component Name
	• **Release the connector lock before disconnecting. Engage the connector lock after connecting.** • **The wiring harness clip near the connector does not need to be replaced if broken or missing. The clip is used during manufacturing to keep the wire harness clear during an automated bolt installation process. If the clip is damaged, simply remove and discard.**
2	Manual Shift Shaft Position Switch Assembly Bolts **CAUTION:**

Callout	Component Name
	Refer to **Fastener Caution** . **Tighten** 12 N.m (106 lb in) **Special Tool** **DT-48285** Valve Body Torx Plus Socket For equivalent regional tools, refer to **Special Tools** .
3	Manual Shift Shaft Position Switch Assembly **Procedure** Align the switch activator slide with the manual valve link.

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY REPLACEMENT

Removal Procedure

Fig. 48: Transmission Oil Pan And Filter
Courtesy of GENERAL MOTORS COMPANY

NOTE: **The valve body must be removed from the transmission to replace the control solenoid valve and transmission control module assembly.**

1. Remove the upper and lower control valve body assembly. Refer to **Control Valve Lower Body and Upper Body Replacement**.
2. Remove the transmission oil pan and filter. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement**.
3. Remove the electrical connector passage sleeve. Refer to **Automatic Transmission Electrical Connector Passage Sleeve Replacement**.

Fig. 49: Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

4. Disconnect the speed sensor electrical connector (2) from the control solenoid valve assembly.

5. Turn the control valve body assembly over.

Fig. 50: Manual Shift Shaft Position Switch Connector
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Release the connector lock before disconnecting.**

6. Disconnect the manual shift shaft position switch connector (4) from the control solenoid valve assembly.

7. Remove the bolt (3) and remove the manual shift shaft position switch assembly.

Fig. 51: Control Valve Body Assembly
Courtesy of GENERAL MOTORS COMPANY

8. Remove the 2 bolts (1) from the "heat sink" side of the control solenoid valve assembly.

Fig. 52: Control Solenoid Valve Assembly To Control Valve Body Assembly Bolts
Courtesy of GENERAL MOTORS COMPANY

9. Remove the 5 bolts (2) and the 4 bolts (1) securing the control solenoid valve assembly to the control valve body assembly.

Fig. 53: Control Valve Body Assembly
Courtesy of GENERAL MOTORS COMPANY

10. Remove the control valve body assembly.

CAUTION: Use care when removing or installing the filter plate assembly. A broken or missing retaining tab may not adequately secure the filter plate to the control solenoid valve assembly, resulting in possible damage or contamination.

11. Carefully remove and discard the filter plate assembly (5).

Installation Procedure

Fig. 54: Filter Plate Assembly
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Inspect the 4 filter plate retaining tabs on the control solenoid valve assembly. A broken or missing tab**

may not adequately secure the filter plate to the control solenoid valve assembly.

1. Install a NEW filter plate assembly (1).

Fig. 55: Control Solenoid Valve Assembly Bolts
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Note the locator pin on the control valve lower body assembly.**

2. Align the control solenoid valve assembly (1) to the control valve lower body assembly.
3. Install the 2 bolts (2), through the "heat sink" side of the control solenoid valve assembly (1). Hand tighten only.

Fig. 56: Control Solenoid Valve Assembly To Control Valve Body Assembly Bolts
Courtesy of GENERAL MOTORS COMPANY

4. Install the 4 bolts (1) and 5 bolts (2) securing the control solenoid valve assembly to the control valve lower body assembly. Hand tighten only.

Fig. 57: Manual Shift Shaft Position Switch Assembly
Courtesy of GENERAL MOTORS COMPANY

5. Install the manual shift shaft position switch assembly (1). Align the switch activator slide with the manual valve link. Secure with 1 bolt (3). Hand tighten only.

NOTE: **The wiring harness clip (4) on the manual shift shaft position switch does not need to be replaced if damaged or missing. The clip functions only as a manufacturing assembly aid to keep the harness clear**

during an automated bolt installation process. If the clip is damaged, simply remove and discard.

6. Connect and lock the manual shift shaft position switch electrical connector (5) to the control solenoid valve assembly and attach the wiring harness clip (4).

Fig. 58: Control Solenoid Valve Assembly Bolt Tightening Sequence
Courtesy of GENERAL MOTORS COMPANY

CAUTION: **Bolt torque sequencing is critical to the proper function of the control solenoid valve assembly. Failure to follow the required sequencing may result in transmission malfunction.**

CAUTION: **Refer to Fastener Caution .**

NOTE: **When following the tightening sequence, skip over bolts 10, 11, 12, 13 and 15. These bolts are not removed for this procedure.**

7. Tighten all bolts in the sequence shown. The 2 "heat sink" bolts (17, 18) must be tightened last.

   Tighten bolts to 8 N.m (71 lb in).

Fig. 59: Control Solenoid Valve Assembly
Courtesy of GENERAL MOTORS COMPANY

8. Inspect the contact area between the "heat sink" area of the control solenoid valve assembly (1) and the valve body. There should be no visible gap. If a gap exists, loosen all 18 bolts and retighten in the sequence shown.

Fig. 60: Identifying Speed Sensor Wiring Harness Clips
Courtesy of GENERAL MOTORS COMPANY

9. Inspect the 2 input and output speed sensor wiring harness clips (1) for damage. Replace if damaged.

Fig. 61: Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

10. Connect the speed sensor electrical connector (2) to the control solenoid valve assembly.

Fig. 62: Valve Body Assembly
Courtesy of GENERAL MOTORS COMPANY

11. Install the upper and lower control valve body assembly. Refer to **Control Valve Lower Body and Upper Body Replacement**.
12. Install the electrical connector passage sleeve. Refer to **Automatic Transmission Electrical Connector Passage Sleeve Replacement**.

Fig. 63: Transmission Oil Pan And Filter
Courtesy of GENERAL MOTORS COMPANY

13. Install the transmission oil pan and filter. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement**.
14. If a NEW TCM has been installed into the vehicle, the NEW module needs to be reprogrammed. Refer to **Service Programming System (SPS)** .

NOTE: **The Service Fast Learn Adapts procedure must be performed when one of the following repairs have been made to the vehicle. Failure to perform the procedure after one of the following repairs may result in poor transmission performance, as well as transmission DTCs being set:**

- **Transmission internal service/overhaul**
- **Valve body repair or replacement**
- **Control solenoid valve assembly replacement**
- **TCM software/calibration update**
- **Any service in response to a shift quality concern**

15. Perform the Reset Transmission Adapts. Refer to **Reset Transmission Adapts** .

CONTROL VALVE LOWER BODY AND UPPER BODY REPLACEMENT

Fig. 64: Control Valve Lower Body And Upper Body

Callout	Component Name
Preliminary Procedure Remove the transmission electrical connector. Refer to **Automatic Transmission Electrical Connector Passage Sleeve Replacement**.	
1	Manual Shaft Detent Bolt **CAUTION:** **Refer to** **Fastener Caution** . **Tighten** 12 N.m (106 lb in)
2	Manual Shaft Detent Assembly
3	Control Valve Assembly Bolt (Qty: 6) **Procedure** 1. Use **DT-48285** valve body torx plus socket. 2. Do not remove all the bolts in the control valve body assembly. Remove only the bolts indicated. 3. Tighten in specified sequence. **Tighten** 8 N.m (71 lb in) **Special Tool** **DT-48285** Valve Body Torx Plus Socket (if applicable) For equivalent regional tools, refer to **Special Tools** .
4	Control Valve Assembly
5	Fluid Pump Seal **Procedure** Discard seal and replace with new.

Callout	Component Name
6	Fluid Pump Seal **Procedure** Discard seal and replace with new.
7	Center Support Fluid Passage Seal **Procedure** 1. Discard seal and replace with new. 2. It is recommended that transmission adaptive pressure (TAP) information be reset. Transmission performance may be affected as new TAP values are learned. Refer to **Reset Transmission Adapts** . 3. If replacing the control valve body assembly, remove the **Control Solenoid Valve and Transmission Control Module Assembly Replacement**, and the **Manual Shift Shaft Position Switch Replacement**.

INPUT AND OUTPUT SPEED SENSOR REPLACEMENT

Fig. 65: Input And Output Speed Sensor
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the transmission fluid pan and filter. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement**. 3. Remove the upper and lower valve body assembly. Refer to **Control Valve Lower Body and Upper Body Replacement**.	
1	Speed Sensor Electrical Connector
2	Input and Output Speed Sensor Assembly Bolt (Qty: 2) **CAUTION:**

Callout	Component Name
	Refer to **Fastener Caution** . **Tighten** 12 N.m (106 lb in)
3	Input and Output Speed Sensor Assembly Clips (Qty: 2) **Procedure** Inspect the wiring harness clips for damage. Replace if necessary.
4	Input and Output Speed Sensor Assembly

TRANSMISSION CONVERTER COVER REPLACEMENT

Fig. 66: Transmission Converter Cover
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .	
1	Torque Converter Cover Bolt **CAUTION:** **Refer to** **Fastener Caution** . **Tighten** 12 N.m (106 lb in)
2	Torque Converter Cover **Procedure** Remove the starter. Refer to **Starter Replacement (L83, L86)** **Starter Replacement (L96)** .
3	Torque Converter Cover Bolt **Tighten** 12 N.m (106 lb in)
4	Torque Converter Cover

TRANSMISSION REPLACEMENT

Special Tools

J-21366 Converter Holding Strap

For equivalent regional tools, refer to **Special Tools** .

Removal Procedure

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (Dual Battery)** **Battery Negative Cable Disconnection and Connection (Single Battery)** .

2. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Remove the rear propeller shaft. Refer to **Rear Propeller Shaft Replacement (1500)** **Rear Propeller Shaft Replacement (Heavy Duty)** **Rear Propeller Shaft Replacement (M5U, 2WD)** .
4. If the vehicle is equipped with a transfer case, remove the front propeller shaft. Refer to **Front Axle Propeller Shaft Replacement (NPO)** **Front Axle Propeller Shaft Replacement (NQH)** **Front Axle Propeller Shaft Replacement (Heavy Duty)** .

Fig. 67: Torque Converter Access Plug
Courtesy of GENERAL MOTORS COMPANY

5. Remove the torque converter access plug.

Fig. 68: Left Flywheel Inspection Cover
Courtesy of GENERAL MOTORS COMPANY

6. Remove the left flywheel inspection cover.
7. Remove the starter motor. Refer to **Starter Replacement (L83, L86)** **Starter Replacement (L96)** .

Fig. 69: Right Flywheel Inspection Cover
Courtesy of GENERAL MOTORS COMPANY

8. Remove the right flywheel inspection cover.
9. Remove the steering gear skid shield. Refer to **Steering Gear Skid Shield Replacement** .

10. Mark the relationship of the flywheel to the torque converter for reassembly.

Fig. 70: Flywheel To Torque Converter Bolts
Courtesy of GENERAL MOTORS COMPANY

11. Remove the flywheel to torque converter bolts.
12. Support the transmission with a transmission jack.
13. Remove the transmission crossmember. Refer to **Transmission Support Crossmember Replacement (2WD)** **Transmission Support**

Crossmember Replacement (4WD) .

14. Remove the transmission mount. Refer to **Transmission Mount Replacement (Two Wheel Drive)Transmission Mount Replacement (Four Wheel Drive)**.
15. Remove the catalytic converter pipe. Refer to **Three-Way Catalytic Converter Replacement** .
16. Lower the transmission to gain access to the top and sides of the transmission.
17. Remove the transfer case, if equipped. Refer to **Transfer Case Assembly Replacement** , for the MP 3010-NP0 transfer case or **Transfer Case Assembly Replacement** for the MP 3023/3024-NQH transfer case.

Fig. 71: Transmission Heat Shield And Bolts
Courtesy of GENERAL MOTORS COMPANY

18. Remove the 2 bolts securing the heat shield to the transmission.
19. Remove the transmission heat shield.

Fig. 72: Range Selector Cable And Retainer
Courtesy of GENERAL MOTORS COMPANY

NOTE: **DO NOT pry the cable end from the lever ball stud. Replacement of the range selector cable requires a NEW control lever.**

20. Remove the range selector cable (2) and the transmission range selector lever as an assembly.
21. Remove the retainer (1) that secures the cable to the bracket.

Fig. 73: Transmission Wiring Harness And Retainers
Courtesy of GENERAL MOTORS COMPANY

22. Disconnect the transmission vent hose.
23. Disconnect the transmission electrical connector by pulling the white plastic tab, located on the connector circular ring (approximately 15 x 15 mm), outward and then rotate the circular ring of the connector counterclockwise. When the circular ring is disengaged, pull the connector straight out. Outward means away from transmission centerline, counterclockwise is looking at connector from rear of transmission.

24. Remove the wire harness from the transmission.

Fig. 74: Bolt Securing Fuel Line Bracket To Left Side Of Transmission
Courtesy of GENERAL MOTORS COMPANY

25. Remove the bolt that secures the fuel line bracket to the left side of the transmission.

Fig. 75: Oil Cooling Lines And Bolt
Courtesy of GENERAL MOTORS COMPANY

26. Disconnect the transmission oil cooler lines (1) from the transmission. Refer to **Transmission Fluid Cooler Inlet and Outlet Pipe Replacement (L83 MYC)** **Transmission Fluid Cooler Inlet and Outlet Pipe Replacement (L86 M5U)** .
27. Plug the transmission oil cooler line connectors in the transmission case.
28. Remove the transmission dipstick tube retaining nut.

29. Reposition the transmission dipstick tube.
30. Remove the vent tube bracket retaining nut on the back of the transmission at the engine.
31. Reposition the vent tube bracket.
32. Remove the transmission cooler line bracket retaining nut and reposition.
33. Remove the fuel line bracket nut on the back of the transmission at the engine and reposition the fuel line bracket.
34. Secure the transmission to the jack using the appropriate strap.

Fig. 76: Transmission Bolts
Courtesy of GENERAL MOTORS COMPANY

35. Remove the 8 bolts securing the transmission to the engine.
36. Pull the transmission straight back.
37. Install the **J-21366** converter holding strap onto the transmission bell housing to retain the torque converter.
38. Remove the transmission from the vehicle while simultaneously removing the fluid level indicator tube.
39. Flush the transmission cooler lines. Refer to **Transmission Fluid Cooler Flushing and Flow Test (6L80 or 6L90)** **Transmission Fluid Cooler Flushing and Flow Test (8L90)** .

Installation Procedure

1. Install the **J-21366** converter holding strap onto the transmission bell housing to retain the torque converter.
2. Support the transmission with a transmission jack.
3. Raise the transmission into place while simultaneously installing the fluid indicator tube.
4. Remove the **J-21366** converter holding strap from the transmission.
5. Slide the transmission straight onto the locating pins while lining up the marks on the flywheel and the torque converter.

   The torque converter must rotate freely by hand.

Fig. 77: Transmission Bolts
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

6. Install the 8 bolts securing the transmission to the engine and tighten to 50 N.m (37 lb ft).
7. Unstrap the transmission from the jack.

8. Position the fuel line bracket to the back of the engine at the transmission and install the nut. Tighten the nut to 10 N.m (89 lb in).
9. Position the vent tube bracket to the back of the engine at the transmission.
10. Install the vent tube bracket retaining nut and tighten to 10 N.m (89 lb in).
11. Position the transmission dipstick tube and seal into the transmission.
12. Install the dipstick tube retaining fastener and tighten to 10 N.m (89 lb in).
13. Remove the plugs in the oil cooler lines in the transmission case.

Fig. 78: Oil Cooling Lines And Bolt
Courtesy of GENERAL MOTORS COMPANY

14. Connect the oil cooler lines (1) to the transmission. Refer to **Transmission Fluid Cooler Inlet and Outlet Pipe Replacement (L83 MYC)** **Transmission Fluid Cooler Inlet and Outlet Pipe Replacement (L86 M5U)** .
15. Install the bolt that secures the fuel line bracket to the transmission and tighten to 10 N.m (89 lb in).
16. Install the wire harness to the transmission.
17. Connect the transmission electrical connector to the transmission.

Fig. 79: Transmission Wiring Harness And Retainers
Courtesy of GENERAL MOTORS COMPANY

18. Connect the transmission vent hose.

Fig. 80: Range Selector Cable And Retainer
Courtesy of GENERAL MOTORS COMPANY

19. Install the range selector cable (2) and the transmission range selector lever as an assembly.
20. Install the retainer (1) that secures the cable to the bracket.

Fig. 81: Transmission Heat Shield And Bolts
Courtesy of GENERAL MOTORS COMPANY

21. Install the transmission heat shield.
22. Install the 2 bolts securing the heat shield to the transmission and tighten to 17 N.m (13 lb ft).
23. Install the transfer case, if equipped. Refer to **Transfer Case Assembly Replacement** , for the MP 3010-NP0 transfer case or **Transfer Case Assembly Replacement** for the MP 3023/3024-NQH transfer case.

24. Raise the transmission in place using the jack.
25. Install the catalytic converter pipe. Refer to **Three-Way Catalytic Converter Replacement** .
26. Install the transmission mount. Refer to **Transmission Mount Replacement (Two Wheel Drive)Transmission Mount Replacement (Four Wheel Drive)**.
27. Install the transmission crossmember. Refer to **Transmission Support Crossmember Replacement (2WD)** **Transmission Support Crossmember Replacement (4WD)** .
28. Remove the transmission jack.

Fig. 82: Flywheel To Torque Converter Bolts
Courtesy of GENERAL MOTORS COMPANY

29. From the torque converter access hole, push the torque converter forward to seat the converter pilot in the crank bore.
30. If reusing the torque converter bolts, clean the bolt threads and apply sealant. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .
31. Install the flywheel to torque converter bolts and tighten to 65 N.m (48 lb ft).
32. Install the steering gear skid shield. Refer to **Steering Gear Skid Shield Replacement** .

Fig. 83: Right Flywheel Inspection Cover
Courtesy of GENERAL MOTORS COMPANY

33. Install the right flywheel inspection cover and bolt. Tighten the bolt to 12 N.m (106 lb in).
34. Install the starter motor. Refer to **Starter Replacement (L83, L86)** **Starter Replacement (L96)** .

Fig. 84: Left Flywheel Inspection Cover
Courtesy of GENERAL MOTORS COMPANY

35. Install the left flywheel inspection cover and bolt. Tighten the bolt to 12 N.m (106 lb in).

Fig. 85: Torque Converter Access Plug
Courtesy of GENERAL MOTORS COMPANY

36. Install the torque converter access plug.
37. If the vehicle is equipped with a transfer case, install the front propeller shaft. Refer to **Front Axle Propeller Shaft Replacement (NPO)**

Front Axle Propeller Shaft Replacement (NQH) **Front Axle Propeller Shaft Replacement (Heavy Duty)** .

38. Install the rear propeller shaft. Refer to **Rear Propeller Shaft Replacement (1500)** **Rear Propeller Shaft Replacement (Heavy Duty)** **Rear Propeller Shaft Replacement (M5U, 2WD)** .
39. Lower the vehicle.
40. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (Dual Battery)** **Battery Negative Cable Disconnection and Connection (Single Battery)** .
41. Check the transmission fluid level and fill if necessary. Refer to **Transmission Fluid Level and Condition Check** .
42. If a NEW TCM has been installed into the vehicle, the NEW module needs to be reprogrammed. Refer to **Service Programming System (SPS)** .

NOTE: **The Service Fast Learn Adapts procedure must be performed when one of the following repairs have been made to the vehicle. Failure to perform the procedure after one of the following repairs may result in poor transmission performance, as well as transmission DTCs being set:**

- **Transmission internal service/overhaul**
- **Valve body repair or replacement**
- **Control solenoid valve assembly replacement**
- **TCM software/calibration update**
- **Any service in response to a shift quality concern**

43. Perform the Reset Transmission Adapts. Refer to **Reset Transmission Adapts** .

TORQUE CONVERTER REPLACEMENT

Fig. 86: Torque Converter
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the transmission. Refer to **Transmission Replacement**.	
1	Converter Holding Strap **WARNING:** **The torque converter must be held to the torque converter**

Callout	Component Name
	housing by a retaining device such as shipping brackets. Without the retaining device, the torque converter may slide forward, disengaging the oil pump, or may fall completely out of the transmission causing personal injury and/or property damage. **Special Tools** **DT-21366** Converter Holding Strap For equivalent region tools, refer to **Special Tools** .
2	Torque Converter Assembly **Procedure** 1. Place a drain pan under the front of the transmission. 2. Use care not to damage the torque converter seal during the installation procedure. 3. Spin the torque converter to engage the turbine shaft splines in the torque converter hub, the stator shaft splines in the

Callout	Component Name
	stator race and to engage the drive flats on the converter pump hub with the oil pump drive gear. **NOTE:** **Lubricate the converter pump hub OD and the torque converter seal with clean transmission fluid.**

TORQUE CONVERTER FLUID SEAL REPLACEMENT

Fig. 87: Torque Converter Fluid Seal
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the torque converter. Refer to **Torque Converter Replacement**.	
1	Torque Converter Fluid Seal Assembly **NOTE:** **The seal can be installed by hand.** **Special Tools**

Callout	Component Name
	• **EN-23129** Seal Remover • **J-6125-1B** Slide Hammer For equivalent regional tools, refer to **Special Tools** .

SCHEMATIC WIRING DIAGRAMS

AUTOMATIC TRANSMISSION CONTROLS WIRING SCHEMATICS

Module Power, Ground, Serial Data and MIL

Fig. 1: Module Power, Ground, Serial Data and MIL

Courtesy of GENERAL MOTORS COMPANY

Fluid Temperature and Speed Sensors, Valve Position, Pressure and Shift Controls

Fig. 2: Fluid Temperature and Speed Sensors, Valve Position, Pressure and Shift Controls
Courtesy of GENERAL MOTORS COMPANY

Internal Mode Switch and Tap Up/Tap Down

Fig. 3: Internal Mode Switch and Tap Up/Tap Down
Courtesy of GENERAL MOTORS COMPANY

SPECIFICATIONS

FASTENER SPECIFICATIONS (OFF VEHICLE)

Application	Ref No.*	Quantity	Size	Specification	
				Metric	English
Case Extension to Case Assembly	16	6	M10x1.5x40	55 N.m	41 lb ft
Control Solenoid Valve Assembly and Control Valve Lower Body Assembly to Control Valve Upper Body Assembly	310	6	M5x0.8x55	8 N.m	71 lb in
Control Solenoid Valve Assembly and Control Valve Lower Body Assembly to Control Valve Upper Body Assembly	309	10	M5x0.8x45	8 N.m	71 lb in
Control Solenoid Valve Heat Sink to Valve Body	312	2	M5x0.8x53	8 N.m	71 lb in
Control Valve Upper Body Assembly to Control Valve Lower Body Assembly	301	12	M5x0.8x36	8 N.m	71 lb in
Control (with Body and Valve) Valve Assembly to Case Assembly	22	6	M5x0.8x73	8 N.m	71 lb in
Fluid Pan Assembly to Case Assembly	30	18	M6x1.0x20	9 N.m	80 lb in
Fluid Pump Cover Assembly to Torque Converter Housing	231	13	M6 1.0x40	11 N.m	97 lb in
Input and Output Speed Sensor Assembly to Control Valve Upper Body Assembly	302	2	M6x1.0x20	12 N.m	106 lb in

Application	Ref No.*	Quantity	Size	Specification	
				Metric	English
Line Pressure Test Hole Plug to Torque Converter Housing	202	1	1/8-27 NPTF	11 N.m	97 lb in
Manual Shaft Detent Assembly to Valve Body	23	1	M6x1.0x14.5	12 N.m	106 lb in
Torque Converter Housing Assembly to Case Assembly	3	9	M10x1.5x50	72 N.m	53 lb ft
*Reference number refers to the component callout number in Disassembled Views					

FASTENER SPECIFICATIONS (ON VEHICLE)

Single Use Non-Threaded Fasteners/Components

NOTE:

All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.

Application
Case Extension Gasket
Transmission Output Shaft Seal
Propeller Shaft Front Slip Yoke Oil Seal
Torque Converter Fluid Seal

Single Use Threaded Fastener/Component Tightening Specifications

NOTE:

All fasteners/components listed in this table MUST BE

DISCARDED and replaced with NEW after removal.

Application	Specification
	Metric (English)
Transmission Mount to Transmission Bolts- 4WD HD*	
• First Pass	45 N.m (33 lb ft)
• Final Pass:	50 Degrees

Reusable Threaded Fastener Tightening Specifications

NOTE:

All fasteners listed in this table can be reused after removal.

Application	Specification
	Metric (English)
Auxiliary Fluid Cooler Bolts	12 N.m (106 lb in)
Case Extension Housing Bolts	55 N.m (41 lb ft)
Control Valve Assembly Bolts	8 N.m (71 lb in)
Control Solenoid Valve and Transmission Control Module Assembly Bolts	8 N.m (71 lb in)
Floor Shift Control Indicator Screw	2.5 N.m (22 lb in)
Floor Shift Control Lever Bolt	9 N.m (80 lb in)
Floor Shift Control Lever Knob Screw	6 N.m (53 lb in)
Fluid Filler Tube Nut	18 N.m (13 lb ft)
Fuel Pipe Bracket Screw	9 N.m (80 lb in)
Flywheel Inspection Cover Bolts- Left	12 N.m (106 lb in)
Flywheel Inspection Cover Bolts- Right	12 N.m (106 lb in)
Heat Shield to Transmission Bolts	17 N.m (13 lb ft)

NOTE:

All fasteners listed in this table can be reused after removal.

Application	Specification Metric (English)
Input and Output Speed Sensor Assembly Bolts	12 N.m (106 lb in)
Manual Shaft Detent Bolt	12 N.m (106 lb in)
Manual Shift Shaft Position Switch Assembly Bolts	12 N.m (106 lb in)
Oil Level Indicator Tube Bracket Nut	22 N.m (17 lb ft)
Oil Pressure Test Plug	11 N.m (97 lb in)
Torque Converter Cover Bolts	12 N.m (106 lb in)
Torque Converter to Flex Plate Bolts	65 N.m (48 lb ft)
Transmission to Engine Bolts	50 N.m (37 lb ft)
Transmission Electrical Harness Retaining Screw	9 N.m (80 lb in)
Transmission Fluid Cooler Pipe Bracket Bolt	22 N.m (17 lb ft)
Transmission Fluid Pan Bolts	9 N.m (80 lb in)
Transmission Mount to Crossmember Nuts- HD	107 N.m (79 lb ft)
Transmission Mount to Crossmember Nuts- LD	55 N.m (40 lb ft)
Transmission Mount to Transmission Bolts- LD and 2WD HD	67 N.m (50 lb ft)
Transmission Range Selector Cable Bracket Bolt	22 N.m (17 lb ft)
Transmission Range Selector Cable Lever Nut	25 N.m (18 lb ft)

APPROXIMATE FLUID CAPACITIES

Application	Specification	
	Metric	English
Pan Removal and Filter Replacement - Approximate Capacity (6L80/6L90)	5.7 liters	6.0 quarts
Overhaul - Approximate Capacity (6L80/6L90)	9.9 liters	10.5 quarts
Complete Trans System - Approximate Capacity (6L80)	11.5 liters	12.2 quarts

Application	Specification	
	Metric	English
Complete Trans System (Heavy Duty Cooling) - Approximate Capacity (6L80/6L90)	11.7 liters	12.4 quarts

TRANSMISSION GENERAL SPECIFICATIONS

Name	6L45	6L50	6L80	6L90
RPO Codes	MYA	MYB	MYC	MYD
Production Location	Silao, Mexico; Strasbourg, France; Toledo, OH (USA)	Silao, Mexico; Strasbourg, France; Toledo, OH (USA)	Silao, Mexico; Strasbourg, France; Toledo, OH (USA)	Silao, Mexico; Strasbourg, France; Toledo, OH (USA)
Transmission Drive	Rear Wheel Drive	Rear Wheel Drive	Rear Wheel Drive	Rear Wheel Drive
1st Gear Ratio	4.065	4.065	4.027	4.027
2nd Gear Ratio	2.371	2.371	2.364	2.364
3rd Gear Ratio	1.551	1.551	1.532	1.532
4th Gear Ratio	1.157	1.157	1.152	1.152
5th Gear Ratio	0.853	0.853	0.852	0.852
6th Gear Ratio	0.674	0.674	0.667	0.667
Reverse	3.200	3.200	3.064	3.064
Torque Converter Size - Diameter of Torque Converter Turbine	240/258 mm	245/258 mm	258/300 mm	300 mm
Pressure Taps	Line Pressure	Line Pressure	Line Pressure	Line Pressure
Transmission Fluid Type	DEXRON VIÂ®	DEXRON VIÂ®	DEXRON VIÂ®	DEXRON VIÂ®
Transmission Type: 6	Six Forward Gears	Six Forward Gears	Six Forward Gears	Six Forward Gears
Transmission Type: L	Longitude Mount	Longitude Mount	Longitude Mount	Longitude Mount
Transmission Type: 50	Product Series	Product Series	Product Series	Product Series
Position Quadrant	P, R, N, D, M	P, R, N, D, M	P, R, N, D, S	P, R, N, D, M
Case Material	Die Cast Aluminum	Die Cast Aluminum	Die Cast Aluminum	Die Cast Aluminum
Transmission Net Weight (Approximate)	75-78 kg (165-172 lb)	90 kg (198 lb)	95.1-103.7 kg (209.7-228.6 lb)	110 kg (243 lb)
Maximum Trailer Towing Capacity	Refer to applicable	Refer to applicable	N/A	Refer to applicable

Name	6L45	6L50	6L80	6L90
	owner's manual	owner's manual		owner's manual

ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS

Application	Type of Material	GM Part Number	
		United States	Canada
Automatic Transmission Fluid	DEXRONÂ®VI	88861037	19264717
Torque Converter Bolts	LOCTITE 242	12345382	10953489

FLUID PUMP SELECTIVE SPECIFICATIONS

Size Classification	Thickness (mm)	Thickness (in)

NOTE:

- **Rotor and slide must be chosen from the same size classification as the oil pump body.**
- **Allowable rotor and slide to fluid pump body end play is as follows:**

  Specification

  - **Slide to Fluid Pump Body End Play - 0.020-0.051 mm (0.0008-0.0020 in)**
  - **Rotor to Fluid Pump Body**

Size Classification	Thickness (mm)	Thickness (in)
End Play - 0.020-0.051 mm (0.0008-0.0020 in)		
The fluid pump assembly has selective rotor and slide components. These components are chosen based on pump body dimensions. Fluid pump rotor and slide components are available in three size classifications (1, 2, 3) with the following tolerances:		
Rotor Selection		
1	17.948-17.961	0.7066-0.7071
2	17.961-17.974	0.7071-0.7076
3	17.974-17.987	0.7076-0.7081
Slide Selection		
1	17.948-17.961	0.7066-0.7071
2	17.961-17.974	0.7071-0.7076
3	17.974-17.987	0.7076-0.7081

CLUTCH BACKING PLATE RETAINING RING SPECIFICATIONS (6L80)

3-5 Reverse Clutch

Clutch Pack Travel Specification - 1.21-1.79 mm (0.048-0.070 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
NOTE: **After measuring clutch pack travel, determine if the measurement is within the**		

Clutch Pack Travel Specification - 1.21-1.79 mm (0.048-0.070 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
specification. If the measurement is not within the specification, measure the thickness of the existing retaining ring, and then choose a thicker or thinner retaining ring that will bring the measurement within specification.		
1.61-1.71 mm	0.063-0.067 in	Gray
1.88-1.98 mm	0.074-0.078 in	Light Green
2.15-2.25 mm	0.085-0.089 in	Yellow
2.42-2.52 mm	0.095-0.099 in	None
2.69-2.79 mm	0.106-0.110 in	Purple

1-2-3-4 Clutch

Clutch Pack Travel Specification - 1.53-1.99 mm (0.060-0.078 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
NOTE:		

Clutch Pack Travel Specification - 1.53-1.99 mm (0.060-0.078 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
After measuring clutch pack travel, determine if the measurement is within the specification. If the measurement is not within the specification, measure the thickness of the existing retaining ring, and then choose a thicker or thinner retaining ring that will bring the measurement within specification.		
2.42-2.52 mm	0.095-0.099 in	None
2.69-2.79 mm	0.106-0.110 in	Purple
2.96-3.06 mm	0.117-0.120 in	Light Blue
3.23-3.33 mm	0.127-0.131 in	Orange

Clutch Pack Travel Specification - 1.53-1.99 mm (0.060-0.078 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
3.50-3.60 mm	0.138-0.142 in	White

4-5-6 Clutch

Clutch Pack Travel Specification - 1.28-1.89 mm (0.050-0.074 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	

NOTE:

After measuring clutch pack travel, determine if the measurement is within the specification. If the measurement is not within the specification, measure the thickness of the existing retaining ring, and then choose a thicker or thinner retaining ring that will bring the

Clutch Pack Travel Specification - 1.28-1.89 mm (0.050-0.074 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
measurement within specification.		
1.60-1.70 mm	0.063-0.067 in	Yellow
2.02-2.12 mm	0.080-0.083 in	None
2.44-2.54 mm	0.096-0.100 in	Purple

Low/Reverse Clutch

Clutch Pack Travel Specification - 1.30-2.07 mm (0.051-0.081 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
NOTE: **After measuring clutch pack travel, determine if the measurement is within the specification. If the measurement is not within the specification, measure the thickness of the existing retaining ring, and**		

Clutch Pack Travel Specification - 1.30-2.07 mm (0.051-0.081 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
then choose a thicker or thinner retaining ring that will bring the measurement within specification.		
1.85-1.95 mm	0.073-0.077 in	Yellow
2.26-2.36 mm	0.089-0.093 in	None
2.67-2.77 mm	0.105-0.109 in	Purple

CLUTCH BACKING PLATE RETAINING RING SPECIFICATIONS (6L90)

3-5 Reverse Clutch

Clutch Pack Travel Specification - 1.50-2.08 mm (0.059-0.082 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
NOTE: **After measuring clutch pack travel, determine if the measurement is within the specification. If the measurement**		

Clutch Pack Travel Specification - 1.50-2.08 mm (0.059-0.082 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
is not within the specification, measure the thickness of the existing retaining ring, and then choose a thicker or thinner retaining ring that will bring the measurement within specification.		
1.61-1.71 mm	0.063-0.067 in	Gray
1.88-1.98 mm	0.074-0.078 in	Light Green
2.15-2.25 mm	0.085-0.089 in	Yellow
2.42-2.52 mm	0.095-0.099 in	None
2.69-2.79 mm	0.106-0.110 in	Purple

1-2-3-4 Clutch

Clutch Pack Travel Specification - 1.79-2.25 mm (0.070-0.089 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
NOTE: **After measuring clutch pack**		

Clutch Pack Travel Specification - 1.79-2.25 mm (0.070-0.089 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
travel, determine if the measurement is within the specification. If the measurement is not within the specification, measure the thickness of the existing retaining ring, and then choose a thicker or thinner retaining ring that will bring the measurement within specification.		
2.42-2.52 mm	0.095-0.099 in	None
2.69-2.79 mm	0.106-0.110 in	Purple
2.96-3.06 mm	0.117-0.120 in	Light Blue
3.23-3.33 mm	0.127-0.131 in	Orange
3.50-3.60 mm	0.138-0.142 in	White

4-5-6 Clutch

Clutch Pack Travel Specification - 1.18-1.79 mm (0.059-0.082 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
NOTE: **After measuring clutch pack travel, determine if the measurement is within the specification. If the measurement is not within the specification, measure the thickness of the existing retaining ring, and then choose a thicker or thinner retaining ring that will bring the measurement within specification.**		
1.60-1.70 mm	0.063-0.067 in	Yellow
2.02-2.12 mm	0.080-0.083 in	None
2.44-2.54 mm	0.096-0.100 in	Purple

Low/Reverse Clutch

Clutch Pack Travel Specification - 1.56-2.22 mm (0.061-0.087 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
NOTE: **After measuring clutch pack travel, determine if the measurement is within the specification. If the measurement is not within the specification, measure the thickness of the existing retaining ring, and then choose a thicker or thinner retaining ring that will bring the measurement within specification.**		
1.85-1.95 mm	0.073-0.077 in	Yellow
2.26-2.36 mm	0.089-0.093 in	None

Clutch Pack Travel Specification - 1.56-2.22 mm (0.061-0.087 in)		
Retaining Ring Thickness		O.D. Color
Metric	English	
2.67-2.77 mm	0.105-0.109 in	Purple

RANGE REFERENCE

Range Reference Table

Range	Park	Reverse	Neutral	Drive						
				1st Braking	1st	2nd	3rd	4th	5th	6th
1-2-3-4 Clutch	-	-	-	Applied	Applied	Applied	Applied	Applied	-	-
3-5 Reverse Clutch	-	Applied	-	-	-	-	Applied	-	Applied	-
4-5-6 Clutch	-	-	-	-	-	-	-	Applied	Applied	Applied
2-6 Clutch	-	-	-	-	-	Applied	-	-	-	Applied
Low and Reverse Clutch	Applied*	Applied	Applied*	Applied	-	-	-	-	-	-
Low Clutch Sprag	-	-	-	Holding	Holding	-	-	-	-	-
* = Applied with NO load										

SHIFT SOLENOID VALVE STATE AND GEAR RATIO

Gear	Shift SOL 1	Shift SOL 2	1-2-3-4 CL PC SOL 5 N.L.	2-6 CL PC SOL 4 N.L.	3-5 REV CL PC SOL 2 N.H.	LOW REV 4-5-6 CL PC SOL 3 N.H.	6L45 6L50 Gear Ratio	6L80 6L90 Gear Ratio
Park	ON	ON	OFF	OFF	OFF	ON	-	-
Reverse	ON	OFF	OFF	OFF	ON	ON	3.200	3.064
Neutral	ON	ON	OFF	OFF	OFF	ON	-	-
1st Braking	ON	ON	ON	OFF	OFF	ON	4.065	4.027
1st	OFF	ON	ON	OFF	OFF	OFF	4.065	4.027

Gear	Shift SOL 1	Shift SOL 2	1-2-3-4 CL PC SOL 5 N.L.	2-6 CL PC SOL 4 N.L.	3-5 REV CL PC SOL 2 N.H.	LOW REV 4-5-6 CL PC SOL 3 N.H.	6L45 6L50 Gear Ratio	6L80 6L90 Gear Ratio
2nd	OFF	ON	ON	ON	OFF	OFF	2.371	2.364
3rd	OFF	ON	ON	OFF	ON	OFF	1.551	1.532
4th	OFF	ON	ON	OFF	OFF	ON	1.157	1.152
5th	OFF	ON	OFF	OFF	ON	ON	0.853	0.852
6th	OFF	ON	OFF	ON	OFF	ON	0.674	0.667

For shift solenoids 1 and 2, "ON" = Solenoid Energized (Pressurized) "OFF" = Solenoid De-energized (No Pressure).
For pressure control solenoids, "ON" = Pressurized, "OFF" = No Pressure

TRANSMISSION FLUID PRESSURE SWITCH LOGIC

Transmission Fluid Pressure (TFP) Switch Logic

Gear	TFP Switch States			
	TFP SW1	*TFP SW3	TFP SW4	TFP SW5
Park	High	Low	Low	Low
Reverse	Low	Low	Low	Low
Neutral	High	Low	Low	Low
Drive 1st - Engine Braking	High	High	Low	Low
Drive 1st	High	High	Low	High
Drive 2nd	High	Low	Low	High
Drive 3rd	Low	High	Low	High
Drive 4th	High	High	Low	Low
Drive 5th	Low	High	High	Low
Drive 6th	High	High	High	Low
Drive 6th (Possible additional gear state)	High	Low	High	Low

High = 12V (Switch Open or Pressurized)
Low = 0V (Switch Closed or No Pressure)
Note: All TFP switches are normally closed (NC)
*TFP switch 2 does not exist

TRANSMISSION INTERNAL MODE SWITCH LOGIC

Gear Selector Position	Signal A	Signal B	Signal C	Signal P
Park	LOW	HI	HI	LOW
Park/Reverse	LOW	LOW	HI	LOW
Reverse	LOW	LOW	HI	HI
Reverse/Neutral	HI	LOW	HI	HI
Neutral	HI	LOW	HI	LOW
Neutral/Drive 6	HI	LOW	LOW	LOW
Drive 6	HI	LOW	LOW	HI
Drive 6/Drive 4	LOW	LOW	LOW	HI
Drive 4	LOW	LOW	LOW	LOW
Drive 4/Drive 3	LOW	HI	LOW	LOW
Drive 3	LOW	HI	LOW	HI
Drive 3/Drive 2	HI	HI	LOW	HI
Drive 2	HI	HI	LOW	LOW
Open	HI	HI	HI	HI
Invalid	HI	HI	HI	LOW
Invalid	LOW	HI	HI	HI

HI = Ignition voltage
LOW = 0 volts

TRANSMISSION PARTS KIT SPECIFICATIONS

A/Trans Fluid Filter Kit

Fig. 1: Automatic Transmission Fluid Filter Kit
Courtesy of GENERAL MOTORS COMPANY

A/Trans Fluid Filter Kit

Callout	Quantity	Component Name
25	1	A/Trans Fluid Filter Seal Assembly
26	1	A/Trans Fluid Filter Assembly

A/Trans Fluid Pump Rotor Package

Fig. 2: Automatic Transmission Fluid Pump Rotor Package
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Callouts with boxes around them indicate part is included in the service kit. Callouts without boxes are shown for relationship purposes only.**

A/Trans Fluid Pump Rotor Package

Callout	Quantity	Component Name

Callout	Quantity	Component Name
5	1	A/Trans Fluid Pump Seal
9	1	A/Trans Connector Seal
10	2	A/Trans Connector (O-Ring) Seal
18	1	A/Trans Fluid Pump Seal Assembly
19	1	A/Trans Fluid Pump Seal Assembly
20	1	Center Support Fluid Passage Seal Assembly
201	1	Torque Converter Fluid Seal Assembly
205	2	A/Trans Fluid Cooler Pipe Fitting
207	1	A/Trans Fluid Pump Vane Ring
208	1	A/Trans Fluid Pump Rotor Guide
209	1	A/Trans Fluid Pump Slide Fluid Seal Ring
210	1	A/Trans Fluid Pump Slide (O-Ring) Seal
211	1	A/Trans Fluid Pump Slide Outer Spring
213	1	A/Trans Fluid Pump Slide Seal
214	1	A/Trans Fluid Pump Slide Seal Support
215	1	A/Trans Fluid Pump Slide Pivot Pin
216	13	A/Trans Fluid Pump Vane
217	1	A/Trans Fluid Pump Rotor
230	3	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Ring
238	3	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Ring
443	1	Turbine Shaft (O-Ring) Seal

A/Trans Service Seal Kit

Fig. 3: Automatic Transmission Service Seal Kit
Courtesy of GENERAL MOTORS COMPANY

A/Trans Service Seal Kit

Callout	Quantity	Component Name
5	1	A/Trans Fluid Pump Seal
9	1	A/Trans Connector Seal
10	2	A/Trans Connector (O-Ring) Seal

Callout	Quantity	Component Name
18	1	A/Trans Fluid Pump Seal Assembly
19	1	A/Trans Fluid Pump Seal Assembly
20	1	Center Support Fluid Passage Seal Assembly
33	1	A/Trans Case Extension Seal
36	1	Prop Shaft Front Slip Yoke Oil Seal
201	1	Torque Converter Fluid Seal Assembly
205	2	A/Trans Fluid Cooler Pipe Fitting Seal
209	1	A/Trans Fluid Pump Slide Fluid Seal Ring
210	1	A/Trans Fluid Pump Slide (O-Ring) Seal
213	1	A/Trans Fluid Pump Slide Seal
214	1	A/Trans Fluid Pump Slide Seal Support
230	3	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Ring
306	7	Control Valve Body Ball Check Valve
311	1	Control Solenoid Valve Filter Plate Assembly
411	1	1-2-3-4 Clutch Piston Dam Retaining Ring
415	1	1-2-3-4 Clutch Piston Housing Retaining Ring
418	1	3-5 Reverse Clutch Piston Dam (O-Ring) Seal
419	1	3-5 Reverse Clutch Piston Inner Seal
423	1	1-2-3-4 Clutch Piston Inner Seal
424	1	1-2-3-4 Clutch Piston Housing Seal
425	1	1-2-3-4 Clutch Piston Housing Seal
442	3	Turbine Shaft Fluid Seal Ring
443	1	Turbine Shaft (O-Ring) Seal
468	1	Low Clutch Sprag Seal
478	1	4-5-6 Clutch Dampener Retaining Ring
507	1	Manual Shift Shaft Seal
510	2	Park Pawl Actuator Guide (O-Ring) Seal

Clutch Plate Package

Fig. 4: Clutch Plate Package
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Callouts with boxes around them indicate part is included in the service kit. Callouts without boxes are shown for relationship purposes only.**

Clutch Plate Package

Callout	Quantity	Component Name

Callout	Quantity	Component Name
402	4	3-5 Reverse Clutch Plate Assembly
408	5	1-2-3-4 Clutch Plate Assembly
433	6	4-5-6 Clutch Plate Assembly
434	6	4-5-6 Clutch Plate
452	5	2-6 Clutch Plate Assembly
453	5	2-6 Clutch Plate
463	5	Low and Reverse Clutch Plate Assembly

A/Trans Electrical Connector Passage Sleeve Seal Kit

Fig. 5: Automatic Transmission Electrical Connector Passage Sleeve Seal Kit
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Callouts with boxes around them indicate part is included in the service kit. Callouts without boxes are shown for relationship purposes only.**

A/Trans Electrical Connector Passage Sleeve Seal Kit

Callout	Quantity	Component Name
9	1	A/Trans Connector Seal
10	2	A/Trans Connector (O-Ring) Seal

A/Trans Control Solenoid Valve Assembly Seal Kit

Fig. 6: Automatic Transmission Control Solenoid Valve Assembly Seal Kit
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Callouts with boxes around them indicate part is included in the service kit. Callouts without boxes are shown for relationship purposes only.**

A/Trans Control Solenoid Valve Assembly Seal Kit

Callout	Quantity	Component Name
9	1	A/Trans Connector Seal
10	2	A/Trans Connector (O-Ring) Seal
18	1	A/Trans Fluid Pump Seal Assembly
19	1	A/Trans Fluid Pump Seal Assembly
20	1	Center Support Fluid Passage Seal Assembly

A/Trans Clutches Seal Kit

Fig. 7: Automatic Transmission Clutches Seal Kit
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Callouts with boxes around them indicate part is included in the service kit. Callouts without boxes are shown for relationship purposes only.**

A/Trans Clutches Seal Kit

Callout	Quantity	Component Name
418	2	3-5 Reverse Clutch Piston Dam (O-Ring) Seal
419	2	3-5-Reverse Clutch Piston Inner Seal
423	1	1-2-3-4 Clutch Piston Inner Seal
424	1	1-2-3-4 Clutch Piston Housing Seal
425	1	1-2-3-4 Clutch Piston Housing Seal
468	1	Low Clutch Sprag Seal

A/Trans Fluid Pump Cover Package

Fig. 8: Automatic Transmission Fluid Pump Cover Package
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Callouts with boxes around them indicate part is included in the service kit. Callouts without boxes are shown for relationship purposes only.**

A/Trans Fluid Pump Cover Package

Callout	Quantity	Component Name

Callout	Quantity	Component Name
5	1	A/Trans Fluid Pump Seal
9	1	A/Trans Connector Seal
10	2	A/Trans Connector (O-Ring) Seal
18	1	A/Trans Fluid Pump Seal Assembly
19	1	A/Trans Fluid Pump Seal Assembly
20	1	Center Support Fluid Passage Seal Assembly
201	1	Torque Converter Fluid Seal Assembly
205	2	A/Trans Fluid Cooler Pipe Fitting
219	1	A/Trans Fluid Pump Cover Assembly
229	1	1-2-3-4 and 3-5 Reverse Clutch Housing Thrust Washer
230	3	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Ring
443	1	Turbine Shaft (O-Ring) Seal

Low Clutch Sprag Kit

Fig. 9: Low Clutch Sprag Kit
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Callouts with boxes around them indicate part is included in the service kit. Callouts without boxes are shown for relationship purposes only.**

Low Clutch Sprag Kit

Callout	Quantity	Component Name
466	1	Low Clutch Sprag Seal
467	1	Low Clutch Sprag Assembly
468	1	Low Clutch Sprag Seal

Control Solenoid Valve Filter Plate Kit

Fig. 10: Control Solenoid Valve Filter Plate Kit
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Callouts with boxes around them indicate part is included in the service kit. Callouts without boxes are shown for relationship purposes only.**

Control Solenoid Valve Filter Plate Kit

Callout	Quantity	Component Name

Callout	Quantity	Component Name
9	1	A/Trans Connector Seal
10	2	A/Trans Connector (O-Ring) Seal
18	1	A/Trans Fluid Pump Seal Assembly
19	1	A/Trans Fluid Pump Seal Assembly
20	1	Center Support Fluid Passage Seal Assembly
306	7	Control Valve Body Ball Check Valve
311	1	Filter Plate Assembly

Retaining Ring Package

Fig. 11: Retaining Ring Package
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Callouts with boxes around them indicate part is included in the service kit. Callouts without boxes are shown for relationship purposes only.**

Retaining Ring Package

Callout	Quantity	Component Name
411	1	1-2-3-4 Clutch Piston Dam Retaining Ring
415	1	1-2-3-4 Clutch Piston Housing Retaining Ring
478	1	4-5-6 Clutch Dampener Retaining Ring

1-2-3-4& 3-5 Reverse Clutch Fluid Seal Ring Kit

Fig. 12: 1-2-3-4 And 3-5 Reverse Clutch Fluid Seal Ring Kit
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Callouts with boxes around them indicate part is included in the service kit. Callouts without boxes are shown**

for relationship purposes only.

1-2-3-4& 3-5 Reverse Clutch Fluid Seal Ring Kit

Callout	Quantity	Component Name
230	3	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Ring
238	3	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Ring

1-2-3-4& 3-5 Reverse Clutch Kit

Fig. 13: 1-2-3-4 And 3-5 Reverse Clutch Kit
Courtesy of GENERAL MOTORS COMPANY

1-2-3-4& 3-5 Reverse Clutch Kit

Callout	Quantity	Component Name
427	1	1-2-3-4 and 3-5 Reverse Clutch Housing Assembly
428	1	1-2-3-4 and 3-5 Reverse Clutch Bearing Assembly

Manual Shift Shaft Hole Plug

Fig. 14: Manual Shift Shaft Hole Plug
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Callouts with boxes around them indicate part is included in the service kit. Callouts without boxes are shown for relationship purposes only.**

Manual Shift Shaft Hole Plug

Callout	Quantity	Component Name
11	1	Manual Shift Shaft Hole Plug

TRANSMISSION

Shift Lock Control - Escalade, Suburban, Tahoe, Yukon

SPECIFICATIONS

FASTENER SPECIFICATIONS

Application	Specification	
	Metric	English
Automatic Transmission Control Bolt (N38)	10 N.m	89 lb in
Automatic Transmission Control Bracket Bolt (N38)	10 N.m	89 lb in

SCHEMATIC WIRING DIAGRAMS

SHIFT LOCK CONTROL WIRING SCHEMATICS

Shift Lock Control

n, ...

Fig. 1: Shift Lock Control
Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC B270A: PARK LOCK SOLENOID CONTROL CIRCUIT SHORT

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptors

DTC B270A 01

Park Lock Solenoid Control Circuit Short to Battery

DTC B270A 02

Park Lock Solenoid Control Circuit Short to Ground

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Fuse B+	1	1	-	-
Control	B270A 02, 1	1	B270A 01, 2	-
Ground	-	1	-	-

1. Transmission shift lever will not move from PARK with the brake pedal applied.
2. Transmission shift lever will move from PARK without the brake pedal applied.

Circuit/System Description

The body control module controls the transmission shift lock control solenoid actuator by providing a battery positive voltage to the solenoid when the brake pedal is applied. The body control module monitors the voltage and current flow of the control circuit.

Conditions for Running the DTC

- Ignition ON / Vehicle in Service Mode.
- Brake pedal is applied.
- Transmission is in the PARK position.
- DTC runs continuously once the above conditions are met.

Conditions for Setting the DTC

B270A 01

The body control module detects a short to voltage in the transmission shift lock control solenoid actuator control circuit for 1 s.

B270A 02

The body control module detects a short to ground in the transmission shift lock control solenoid actuator control circuit for 1 s.

Action Taken When the DTC Sets

The body control module will not attempt to enable the voltage supply circuit of the transmission shift lock control solenoid actuator until the next key cycle.

Conditions for Clearing the DTC

- A current DTC B270A will clear when the malfunction is no longer present and the ignition switch is cycled.
- A history DTC will clear after 100 ignition cycles with no current DTC active during the 100 ignition cycles.

Reference Information

Schematic Reference

- **Body Control System Schematics**
- **Shift Lock Control Schematics**

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Automatic Transmission Shift Lock Control Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON / Vehicle in Service Mode.
2. Verify the scan tool Brake Pedal Applied parameter changes from Inactive to Active when the brake pedal is applied.
   - **If the parameter does not change**

     Refer to **Stop Lamps Malfunction**

   - **If the parameter changes**
3. Verify the transmission shift lever moves out of the PARK position when the brake pedal is applied.
   - **If the transmission shift lever does not move out of the PARK position**

     Refer to Circuit/System Testing.

   - **If the transmission shift lever does move out of the PARK position**

     All OK.

Circuit/System Testing

1. Ignition OFF, scan tool disconnected, all doors closed, all accessories OFF, open and close drivers door, disconnect the harness connector at the M7 Transmission Shift Lock Control Solenoid Actuator. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal B and ground.
   - **If 10 Ω or greater**
   1. Ignition OFF.
   2. Test for less than 2 Ω in the ground circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 2 Ω, repair the open/high resistance in the ground connection.
   - **If less than 10 Ω**
3. Ignition ON / Vehicle in Service Mode, connect a test lamp between the control circuit terminal A and the ground circuit terminal B.
4. Verify the test lamp turns ON and OFF when commanding the Brake Transmission Shift Interlock Solenoid Actuator Command parameter with

a scan tool.

- **If the test lamp is always OFF**

1. Ignition OFF, disconnect the harness connector at the K9 Body Control Module.
2. Test for infinite resistance between the control circuit and ground.
    - If less than infinite resistance, repair the short to ground on the circuit.
    - If infinite resistance
3. Test for less than 2 Ω in the control circuit end to end.
    - If 2 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 2 Ω
4. Ignition ON / Vehicle in Service Mode.
5. Verify a test lamp illuminates between each B+ and ignition circuit terminal at the control module harness connector.
    - If the test lamp does not illuminate, repair the circuit or fuse as necessary.
    - If the test lamp illuminates at each B+ and ignition circuit, replace the K9 Body Control Module.

- **If the test lamp is always ON**

1. Ignition OFF, disconnect the harness connector at the K9 body control module, Ignition ON / Vehicle in Service Mode.
2. Test for less than 1 V between the control circuit and ground.
    - If 1 V or greater, repair the short to voltage on the circuit.
    - If less than 1 V, replace the K9 Body Control Module.

- **If the test lamp turns ON and OFF**

5. Test or replace the M7 Transmission Shift Lock Control Solenoid Actuator.

Component Testing

1. Ignition OFF, disconnect the harness connector at M7 Transmission Shift Lock Control Solenoid Actuator.
2. Install a 3 A fused jumper wire between the control terminal A and 12 V. Momentarily install a jumper wire between the ground terminal B and ground.
3. Verify the M7 Transmission Shift Lock Control Solenoid Actuator turns on and off/clicks, etc.
    - **If the M7 Transmission Shift Lock Control Solenoid Actuator does not turn on and off/clicks, etc**

      Replace the M7 Transmission Shift Lock Control Solenoid Actuator.

- **If the M7 Transmission Shift Lock Control Solenoid Actuator does turn on and off/clicks, etc**

4. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Refer to **Automatic Transmission Shift Lock Control Actuator Replacement (N33, N37)Automatic Transmission Shift Lock Control Actuator Replacement (N38)**
- Refer to **Control Module References** for control module replacement, programming, and setup.

SYMPTOMS - AUTOMATIC TRANSMISSION SHIFT LOCK CONTROL

NOTE: **The following steps must be completed before using the symptom tables.**

1. Perform the **Diagnostic System Check - Vehicle** before using the Symptom Tables in order to verify that all of the following are true:
   - There are no DTCs set.
   - The control modules can communicate via the serial data link.
2. Review the system operation in order to familiarize yourself with the system functions. Refer to **Automatic Transmission Shift Lock Control Description and Operation**.

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the automatic transmission shift lock control. Refer to **Checking Aftermarket Accessories** .
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections**

Symptom List

Refer to a symptom diagnostic procedure in order to diagnose the symptom:

Transmission Control Lever Malfunction

TRANSMISSION CONTROL LEVER MALFUNCTION

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Fuse B+	1	1	-	-
Control	B270A 02, 1	1	B270A 01, 2	-
Ground	-	1	-	-

1. Transmission shift lever will not move from PARK with the brake pedal applied.
2. Transmission shift lever will move from PARK without the brake pedal applied.

Circuit/System Description

The body control module controls the shift lock solenoid by providing battery voltage to the shift lock control solenoid. The body control module utilizes a smart driver to control the voltage supplied to the shift lock solenoid. The smart driver monitors the voltage and current flow of the control circuit.

Reference Information

Schematic Reference

- **Body Control System Schematics**
- **Shift Lock Control Schematics**

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Automatic Transmission Shift Lock Control Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON / Vehicle in Service Mode.
2. Verify the scan tool Brake Pedal Applied parameter changes from Inactive to Active when the brake pedal is applied.
   - **If the parameter does not change**

     Refer to Stop Lamps Malfunction

   - **If the parameter changes**
3. Verify the transmission shift lever moves out of the PARK position when the brake pedal is applied.
   - **If the transmission shift lever does not move out of the PARK position**

     Refer to Circuit/System Testing.

   - **If the transmission shift lever does move out of the PARK position**

     All OK.

Circuit/System Testing

1. Ignition OFF, scan tool disconnected, all doors closed, all accessories OFF, open and close drivers door, disconnect the harness connector at the M7 Transmission Shift Lock Control Solenoid Actuator. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal B and ground.

- **If 10 Ω or greater**

1. Ignition OFF.
2. Test for less than 2 Ω in the ground circuit end to end.
    - If 2 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 2 Ω, repair the open/high resistance in the ground connection.

- **If less than 10 Ω**

3. Ignition ON / Vehicle in Service Mode, connect a test lamp between the control circuit terminal A and the ground circuit terminal B.
4. Verify the test lamp turns ON and OFF when commanding the Brake Transmission Shift Interlock Solenoid Actuator Command parameter with a scan tool.

- **If the test lamp is always OFF**

1. Ignition OFF, disconnect the harness connector at the K9 Body Control Module.
2. Test for infinite resistance between the control circuit and ground.
    - If less than infinite resistance, repair the short to ground on the circuit.
    - If infinite resistance
3. Test for less than 2 Ω in the control circuit end to end.
    - If 2 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 2 Ω
4. Ignition ON / Vehicle in Service Mode.
5. Verify a test lamp illuminates between each B+ and ignition circuit terminal at the control module harness connector.
    - If the test lamp does not illuminate, repair the circuit or fuse as necessary.
    - If the test lamp illuminates at each B+ and ignition circuit, replace the K9 Body Control Module.

- **If the test lamp is always ON**

1. Ignition OFF, disconnect the harness connector at the K9 body control module, ignition ON.
2. Test for less than 1 V between the control circuit and ground.
    - If 1 V or greater, repair the short to voltage on the circuit.
    - If less than 1 V, replace the K9 Body Control Module.

- **If the test lamp turns ON and OFF**

5. Test or replace the M7 Transmission Shift Lock Control Solenoid Actuator.

Component Testing

1. Ignition OFF, disconnect the harness connector at M7 Transmission Shift Lock Control Solenoid Actuator.
2. Install a 3 A fused jumper wire between the control terminal A and 12 V. Momentarily install a jumper wire between the ground terminal B and ground.
3. Verify the M7 Transmission Shift Lock Control Solenoid Actuator turns on and off/clicks, etc.
   - **If the M7 Transmission Shift Lock Control Solenoid Actuator does not turn on and off/clicks, etc**

     Replace the M7 Transmission Shift Lock Control Solenoid Actuator.

   - **If the M7 Transmission Shift Lock Control Solenoid Actuator does turn on and off/clicks, etc**
4. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Refer to **Automatic Transmission Shift Lock Control Actuator Replacement (N33, N37)Automatic Transmission Shift Lock Control Actuator Replacement (N38)**
- Refer to **Control Module References** for control module replacement, programming, and setup

REPAIR INSTRUCTIONS

AUTOMATIC TRANSMISSION SHIFT LOCK CONTROL ACTUATOR REPLACEMENT (N33, N37)

Removal Procedure

Fig. 2: Automatic Transmission Shift Lock Control Actuator
Courtesy of GENERAL MOTORS COMPANY

1. Disable the SIR system. Refer to **SIR Disabling and Enabling** .
2. Remove the knee bolster. Refer to **Instrument Panel Knee Bolster Replacement (Chevrolet / GMC)** **Instrument Panel Knee Bolster Replacement (Cadillac)** .
3. Put the shift lever clevis into the neutral position.

4. Disconnect the electrical connector.
5. Using a small screwdriver, pry the automatic transmission shift lock control actuator away from the steering column jacket and the cable shift cam.
6. Remove the shift lock control actuator.

Installation Procedure

Fig. 3: Automatic Transmission Shift Lock Control Actuator

Courtesy of GENERAL MOTORS COMPANY

1. Firmly install the shift lock control actuator onto the steering column jacket and the cable shift cam.
2. Connect the electrical connector.
3. Place the shift lever clevis into the neutral position.

Fig. 4: Adjusting Automatic Transmission Shift Lock Control Actuator
Courtesy of GENERAL MOTORS COMPANY

4. Adjust the shift lock control actuator (with the shift lever clevis in the neutral position) in the following way:
    1. Pull out the tab (1) on the adjuster block side (2) of the shift lock control actuator.
    2. Press on the adjuster block (2) to compress the internal adjuster spring which disengages the adjuster teeth. Slide the adjuster block (2) as far away from the actuator as possible.
5. Place the shift lever into the park position.
6. Lock the adjuster block (2) in place by pushing in on the tab (1).
7. Inspect the shift lock control actuator for the following items:
    1. The shift lock control actuator must lock the shift lever clevis when the shift lever clevis is put into the park position.
    2. Depress the brake pedal to move the shift lever out of the park position.
    3. The actuator will be energized.
    4. Readjust the shift lock control actuator if needed.
8. Install the knee bolster. Refer to **Instrument Panel Knee Bolster Replacement (Chevrolet / GMC)** **Instrument Panel Knee Bolster Replacement (Cadillac)** .
9. Enable the SIR system. Refer to **SIR Disabling and Enabling** .

AUTOMATIC TRANSMISSION SHIFT LOCK CONTROL ACTUATOR REPLACEMENT (N38)

Fig. 5: Transmission Control (N38)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

WARNING:

Refer to SIR Warning .

Preliminary Procedures

1. Remove steering column. Refer to **Steering Column Replacement (N38)**
2. Remove range selector lever cable lever. Refer to **Range Selector Lever Cable Lever Replacement (N38)**

NOTE:

Callout	Component Name
When equipped with the N38 steering column, the automatic transmission shift lock control actuator is service as part of the automatic transmission control. It is NOT serviced separately.	
1	Automatic Transmission Control Bracket Bolt **CAUTION:** **Refer to Fastener Caution .** **Tighten** 10 N.m (89 lb in)
2	Automatic Transmission Control Bolt (Qty: 3) **Tighten** 10 N.m (89 lb in)
3	Automatic Transmission Control **Procedure**

Callout	Component Name
	1. Disconnect the electrical connectors. 2. Transfer components as necessary.

DESCRIPTION AND OPERATION

AUTOMATIC TRANSMISSION SHIFT LOCK CONTROL DESCRIPTION AND OPERATION

The automatic transmission shift lock control system is a safety device that prevents an inadvertent shift out of PARK when the engine is running. The driver must press the brake pedal before moving the shift lever out of the PARK position. The system consists of the following components:

- The automatic transmission shift lock solenoid (serviced as the automatic transmission shift lock actuator), as well as the body control module (BCM) and the engine control module (ECM). The shift lock solenoid is located within the floor shift control assembly with vehicles equipped with floor shift.
- The BCM controls the voltage to the shift lock control solenoid through the shift lock control solenoid controlled voltage circuit. The following conditions must be met before the BCM will remove voltage from the shift lock solenoid:
  - The ignition is in the ON position.
  - The engine control module (ECM) sends an input via GMLAN serial data to the BCM indicating the transmission is in the PARK position.
  - The BCM determines the brake pedal is applied according the brake pedal position.

Since the shift lock control solenoid is permanently grounded, the BCM supplies voltage to the automatic transmission shift lock control solenoid, mechanically locking the shift lever in the PARK position as the solenoid energizes. When the brake pedal is applied, the BCM turns the control voltage output of the shift lock control solenoid OFF, de-energizing the shift lock control solenoid. The de-energized solenoid releases the mechanical lock allowing the driver to move the shift lever out of the PARK position. When the transmission is out of the PARK position, the shift lock control solenoid remains de-energized.

During remote start operation, the BCM will energize the shift lock control circuit, locking the shift lever in the PARK position.

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TRANSMISSION

Transfer Case - MP 3010 (NP0) - Escalade, Suburban, Tahoe, Yukon

SPECIFICATIONS

FASTENER SPECIFICATIONS

Application	Specification	
	Metric	English
Transfer Case Actuator Shaft Position Sensor Bolt/Screw	9 N.m	80 lb in
Transfer Case Adapter Bolt	50 N.m	37 lb ft
Transfer Case Bolts (Qty: 17)	25 N.m	18 lb ft
Transfer Case Nut	50 N.m	37 lb ft
Transfer Case Oil Drain Plug	18 N.m	13 lb ft
Transfer Case Oil Fill Plug	18 N.m	13 lb ft
Transfer Case 2/4 Wheel Drive Actuator Bolt/Screw	18 N.m	13 lb ft
Vehicle Speed Sensor Assembly	17 N.m	13 lb ft

APPROXIMATE FLUID CAPACITIES

Application	Specification	
	Metric	English
Transfer Case- MP 3010-NP0		
DEXRONÂ®VI	1.5 liters	1.6 quarts

ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS

Application	Type of Material	GM Part Number	
		United States	Canada
Transfer Case	DEXRONÂ®VI	88861037	19264717
Transfer Case Oil Drain Plug	Sealant	12346004	10953480
Transfer Case Oil Fill Plug	Sealant	12346004	10953480

Application	Type of Material	GM Part Number	
		United States	Canada
Transfer Case Rear Case Half to Transfer Case Front Half Assembly	Sealant	88861417 12378521	88861418
Transfer Case Vent	Sealant	12377901	10953504
Vehicle Speed Sensor - O-Ring - Seal	DEXRONÂ®VI	88861037	19264717

SCHEMATIC WIRING DIAGRAMS

TRANSFER CASE CONTROL WIRING SCHEMATICS

Power, Ground and Shift Controls

Fig. 1: Power, Ground and Shift Controls

Courtesy of GENERAL MOTORS COMPANY

Transfer Case Controls

Fig. 2: Transfer Case Controls

Courtesy of GENERAL MOTORS COMPANY

Front Axle Controls

ade...

Fig. 3: Front Axle Controls
Courtesy of GENERAL MOTORS COMPANY

COMPONENT LOCATOR

TRANSFER CASE DISASSEMBLED VIEW

Case Half Components

Fig. 4: Case Half Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Transfer Case Front Output Shaft Seal
2	Transfer Case Vent
3	Transfer Case Input Shaft Seal
4	Transfer Case Input Shaft Bearing Outer Retaining Ring
5	Transfer Case Stud
6	Transfer Case Front Half
7	Transfer Case Half Locating Pin
7	Transfer Case Half Locating Pin
8	Transfer Case Input Shaft Bearing Assembly
9	Transfer Case Input Shaft Inner Retaining Ring

Callout	Component Name
10	Transfer Case Rear Output Shaft Rear Bearing Outer Retaining Ring
11	Vehicle Speed Sensor Assembly
12	Vehicle Speed Sensor - O-Ring - Seal
13	Transfer Case Rear Half
14	Transfer Case Access Hole Plug
15	Transfer Case - Harness - Bracket
16	Transfer Case Half Bolt/Screw
17	Transfer Case Rear Output Shaft Bushing
18	Transfer Case Rear Output Shaft Seal
19	Transfer Case Actuator Shaft Position Sensor Bolt/Screw
20	Transfer Case Actuator Shaft Position Sensor Assembly
21	Transfer Case Actuator Shaft Position Sensor - O-Ring - Seal
22	Transfer Case Two/Four Wheel Drive Actuator Bolt/Screw
23	Transfer Case Two/Four Wheel Drive Actuator Assembly
24	Transfer Case Two/Four Wheel Drive Actuator Seal
25	Transfer Case Oil Drain Plug
26	Transfer Case Oil Fill Plug
27	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Assembly
28	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Assembly

Internal Components

Fig. 5: Internal Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Transfer Case Input Shaft
2	Transfer Case Input Shaft Pilot Bearing Assembly
3	Transfer Case Rear Output Shaft Assembly
4	Transfer Case Front Output Shaft Drive Chain Assembly
5	Transfer Case Front Output Shaft Drive Sprocket
6	Transfer Case Front Output Shaft Drive Sprocket Bearing Assembly
7	Transfer Case Front Output Shaft Drive Sprocket Spacer - Rear
8	Transfer Case Front Output Shaft Drive Sprocket Retaining Ring
9	Transfer Case Oil Pump Assembly
10	Transfer Case Rear Output Shaft Speed Reluctor Wheel

Callout	Component Name
11	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring
12	Transfer Case Rear Output Shaft Rear Bearing Assembly
13	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring
14	Propeller Shaft Oil Seal Sleeve
15	Propeller Shaft Sleeve Seal
16	Transfer Case Oil Pump Suction Pipe Seal
17	Transfer Case Oil Pump Suction Pipe
18	Transfer Case Two/Four Wheel Drive Actuator Cam Retaining Ring
19	Transfer Case Two/Four Wheel Drive Actuator Cam Spacer
20	Transfer Case Two/Four Wheel Drive Actuator Cam
21	Transfer Case Control Actuator Shaft
22	Transfer Case Actuator Shaft Gear
23	Transfer Case Front Output Shaft Rear Bearing Assembly
24	Transfer Case Front Output Shaft Driven Sprocket Spacer
25	Transfer Case Front Output Shaft Driven Sprocket
26	Transfer Case Front Output Shaft Hole Plug
27	Transfer Case Front Output Shaft
28	Transfer Case Front Output Shaft Front Bearing Assembly

Clutch Components

Fig. 6: Clutch Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Transfer Case Rear Output Shaft
2	Transfer Case Control Actuator Lever Thrust Bearing Assembly
3	Transfer Case Control Lever
4	Transfer Case Control Actuator Lever Bearing Assembly
5	Transfer Case Control Actuator Lever Ball (Qty: 3)
6	Transfer Case Control Actuator Lever Assembly
7	Transfer Case Control Actuator Lever Thrust Bearing Assembly
8	Transfer Case Control Actuator Lever Washer
9	Transfer Case Four Wheel Drive Clutch Pressure - Apply - Plate
10	Transfer Case Four Wheel Drive Clutch Pressure Plate Spring (Qty: 4)
11	Transfer Case Four Wheel Drive Clutch Pressure - Steel - Plate (Qty: 7)
12	Transfer Case Four Wheel Drive Clutch Pressure - Friction - Plate (Qty: 8)
13	Transfer Case Four Wheel Drive Clutch Hub
14	Transfer Case Four Wheel Drive Clutch Shim
15	Transfer Case Two/Four Wheel Drive Clutch Retaining Ring
16	Transfer Case Front Output Shaft Drive Sprocket Spacer - Front

Callout	Component Name
17	Transfer Case Four Wheel Drive Clutch Housing Retaining Ring
18	Transfer Case Four Wheel Drive Clutch Housing

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC B0770: AWD INDICATOR CIRCUIT SHORT

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category

DTC Descriptors

DTC B0770 01

AWD Indicator Circuit Short to Battery

DTC B0770 06

AWD Indicator Circuit Short to Ground or Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Indicator Dimming Control	B0770 06, B0775 06, B0780 06, B0785 06	B0770 06, B0775 06, B0780 06, B0785 06	-
AWD Indicator Control Circuit	B0770 06	B0770 06	B0770 01

Circuit/System Description

The all wheel drive (AWD/4WD Auto) indicator circuit consists of a light emitting diode (LED) feed circuit, a LED and a LED control circuit. The indicator dimming control circuit is the LED feed circuit and continuously supplies B+ to the 2WD HI, 4WD Auto, 4WD HI, and 4WD LO LEDs. When the AWD mode has been selected by the driver, the transfer case shift control module (TCCM) provides a ground through the AWD indicator control circuit illuminating the LED.

The TCCM tests the AWD indicator circuit for unexpected voltage by monitoring the B+ supplied by the BCM on the indicator dimming control circuit by grounding the AWD indicator control circuit for 2 seconds during the Bulb Test at key ON.

Conditions for Running the DTC

B0770 01

- Ignition ON
- System voltage 10-18 V
- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the AWD indicator is commanded ON.

B0770 06

- Ignition ON
- System voltage 10-18 V
- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the AWD indicator is commanded OFF.

Conditions for Setting the DTC

B0770 01

The TCCM detects 3.4 V or greater on the AWD indicator control circuit when the AWD indicator is commanded ON.

B0770 06

The TCCM detects 1.6 V or less for 1.5 seconds on the AWD indicator control circuit when the AWD indicator is commanded OFF.

Action Taken When the DTC Sets

Normal operation, the SERVICE 4WD indicator is not commanded ON. Driver is informed of fault via bulb inspection.

Conditions for Clearing the DTC

- The transfer case shift control module clears the DTC once the condition for setting the DTC is no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- A TRUE B+ has enough current to light a test light.
- A DIAGNOSTIC B+ is a low current circuit that DOES NOT have enough current to light a test light.
- A short to ground on the AWD indicator control circuit will cause the AWD indicator to remain ON at all times.
- An open or high resistance on the AWD indicator control circuit will cause the AWD indicator to be inoperative during the 2 second bulb inspection.
- An open in the indicator dimming control circuit will cause the 2WD HI, AWD, 4WD HI and 4WD LO mode indicators to be inoperative during the 2 second bulb inspection.
- **EL-49741** harness is a good source for 9 V.
- **EL-49742** harness is a good source for B+ and ground.
- With key REMOVED - opening a door puts a true B+ on the indicator dimming control circuit, TCSCS X1 pin 4. Other possible voltages are listed below:
  - Door open, key removed - indicator dimming control circuit voltage = true B+.
  - Door open, key in, key OFF - indicator dimming control circuit voltage = true B+.
  - Door open, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
  - All doors closed, key OFF - indicator dimming control circuit voltage = B+ (high current - enough to light a test light).
  - All doors closed, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
  - Key ON, engine OFF. Place a shop light on the DRL sensor. When the DRL sensor commands the headlights OFF, the indicator dimming control circuit voltage, TCSCS X1 pin 4, will go from a diagnostic B+ to a true B+.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J-35616** GM-Approved Terminal Test Kit

For equivalent regional tools, refer to Special Tools.

Circuit/System Verification

Key ON, engine OFF. The TCCM runs a 2 second bulb test on all indicators of the TCSCS at key ON.

Circuit/System Testing

NOTE: **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J-35616 GM terminal test kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**

1. Remove key. Disconnect the X1 connector at the transfer case shift control switch (TCSCS).
2. Door open, key ON, engine OFF.
3. Using the L-BU probe J-35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the indicator dimming control circuit, TCSCS X1 pin 4 and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
    - If the voltage is less than the specified range, test the affected circuit for an open/high resistance, short to ground, or short to voltage. If

all circuits and connections test normal, test the body control module (BCM) for proper operation.

4. Using the L-BU probes J-35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the indicator dimming control circuit, TCSCS X1 pin 4 and the AWD indicator control circuit, TSCSC X1 pin 7.
   - If the voltage is less than the specified range, test the AWD indicator control circuit for an open/high resistance or short to power. If all circuits and connections test normal, test the TCCM for proper operation.
5. Key OFF. Using the L-BU probe J-35616-64B, test for greater than 10 Ω between the indicator dimming control circuit, TCSCS X1 pin 4 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
6. Using the L-BU probe J-35616-64B, test for greater than 10 Ω between the 4WD HI indicator control circuit, TCSCS X1 pin 7 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
7. Test the TCSCS for proper operation.

Component Testing

BCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Using the L-BU probe J-35616-64B, connect a test light between the indicator dimming control circuit, TCSCS harness X1 pin 4 and a good ground.
3. Key ON, engine OFF. The test light should be dull or OFF.
   - If the test light is bright, test the indicator dimming control circuit for a short to voltage condition. If all circuits and connections test normal, replace the BCM.

NOTE: **When the DRL sensor turns the headlights OFF the indicator dimming control circuit voltage, TCSCS X1 pin 4, will go from a diagnostic B+ to a true B+.**

4. Place a shop light on the DRL sensor. When the headlights go out the test light should illuminate brightly.
   - If the test light is dull or OFF, test the indicator dimming control circuit for an open/high resistance or short to ground condition. If all circuits and connections test normal, replace the BCM.

TCCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Key ON, engine OFF.
3. Using the L-BU probe J-35616-64B, test for 4.5-5.5 V between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground.
   - If the voltage is greater than the specified range, test the 5-volt reference circuit for a short to voltage. If all circuits and connections test normal, replace the TCCM.
   - If the voltage is less than the specified range, test the 5-volt reference circuit for an open/high resistance or short to ground. If all circuits and connections test normal, replace the TCCM.
4. Using the L-BU probes J-35616-64B, connect a test light between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground. The test light should illuminate dimly.
   - If the test light does not illuminate, obtain a different test light and repeat step 4.
5. Key OFF. Wait 30 seconds for the TCCM to shut down.

NOTE: **The TCCM must see the added resistance of the test light on the control circuit at key ON or the TCCM will shut the control circuit drivers OFF. Volt meters will not work for this test.**

6. Using the L-BU probes J-35616-64B, connect a test light between the TCSCS harness as specified below for the LED control circuit being tested.
7. Key ON, engine OFF.
8. Using the Special Function ability of the scan tool, command the affected LED ON and OFF. The test light should turn OFF and ON as commanded.
   - If the test light remains illuminated when commanded OFF, test the affected control circuit for a short to ground. If all circuits and connections test normal, replace the TCCM.
   - If the test light remains OFF when commanded ON, test the affected control circuit for an open/high resistance or short to voltage. If all circuits and connections test normal, replace the TCCM.

Mode	2WD HI	4WD Auto	4WD HI	4WD LO	N
5-V Reference (pin)	11	11	11	11	11
Indicator Control Circuit (pin)	8	7	9	10	3

TCSCS

1. Using the L-BU probes J-35616-65B, connect the **EL-49741** 9 V+ power source harness to the TCSCS as specified below for the LED being tested. Connecting the harness in the opposite pins will not illuminate the LED.

2. Connect a 9 V battery to the **EL-49741** harness.
3. Verify that only the indicator being tested illuminates.
    - If the indicator does not illuminate when tested or the incorrect indicator illuminates, replace the TCSCS.

EL49741 Wire Color	2WD HI	4WD Auto	4WD HI	4WD LO	N
Red (pin)	4	4	4	4	2
Black (pin)	8	7	9	10	3

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Transfer Case Selector Switch Replacement (Chevrolet / GMC)Transfer Case Selector Switch Replacement (Cadillac)**
- Refer to **Control Module References** for TCCM replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset**

DTC B0775: 4WD HI INDICATOR CIRCUIT SHORT

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptors

DTC B0775 01

4WD HI Indicator Circuit Short to Battery

DTC B0775 06

4WD HI Indicator Circuit Short to Ground or Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Indicator Dimming Control	B0770 06, B0775 06, B0780 06, B0785 06	B0770 06, B0775 06, B0780 06, B0785 06	-
4WD HI Indicator Control Circuit	B0775 06	B0775 06	B0775 01

Circuit/System Description

The 4WD HI indicator circuit consists of a light emitting diode (LED) feed circuit, a LED and a LED control circuit. The indicator dimming control circuit is the LED feed circuit and continuously supplies B+ to the 2WD HI, 4WD Auto, 4WD HI and 4WD LO LEDs. When the 4WD HI mode has been selected by the driver, the transfer case shift control module (TCCM) provides a ground through the 4 HI indicator control circuit illuminating the LED.

The TCCM tests the 4WD HI indicator circuit for unexpected voltage by monitoring the B+ supplied by the BCM on the indicator dimming control circuit by grounding the 4WD HI indicator control circuit for 2 seconds during the Bulb Test at key ON.

Conditions for Running the DTC

B0775 01

- Ignition ON
- System voltage 10-18 V
- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the 4WD HI indicator is commanded ON.

B0775 06

- Ignition ON
- System voltage 10-18 V
- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the 4WD HI indicator is commanded OFF.

Conditions for Setting the DTC

B0775 01

The TCCM detects 3.4 V or greater on the 4WD HI indicator control circuit when the 4WD HI indicator is commanded ON.

B0775 06

The TCCM detects 1.6 V or less for 1.5 seconds on the 4WD HI indicator control circuit when the 4WD HI indicator is commanded OFF.

Action Taken When the DTC Sets

Normal operation, the SERVICE 4WD indicator is not commanded ON. Driver is informed of fault via bulb inspection.

Conditions for Clearing the DTC

- The TCCM clears the DTC once the condition for setting the DTC is no longer present.
- A history DTC clears after 40 consecutive warm-up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- A TRUE B+ has enough current to light a test light.
- A DIAGNOSTIC B+ is a low current circuit that DOES NOT have enough current to light a test light.
- A short to ground on the 4WD HI indicator control circuit will cause the 4WD HI indicator to remain ON at all times.
- An open or high resistance on the 4WD HI indicator control circuit will cause the 4WD HI indicator to be inoperative during the 2 second bulb inspection.
- An open in the indicator dimming control circuit will cause the 2WD HI, 4WD Auto, 4WD HI and 4WD LO mode indicators to be inoperative during the 2 second bulb inspection.
- **EL-49741** harness is a good source for 9 V.
- **EL-49742** harness is a good source for B+ and ground
- With key REMOVED - opening a door puts a true B+ on the indicator dimming control circuit, TCSCS X1 pin 4. Other possible voltages are listed below:
    - Door open, key removed - indicator dimming control circuit voltage = true B+.
    - Door open, key in, key OFF - indicator dimming control circuit voltage = true B+.
    - Door open, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
    - All doors closed, key OFF - indicator dimming control circuit voltage = B+ (high current - enough to light a test light).

- All doors closed, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
- Key ON, engine OFF. Place a shop light on the DRL sensor. When the DRL sensor commands the headlights OFF, the indicator dimming control circuit voltage, TCSCS X1 pin 4, will go from a diagnostic B+ to a true B+.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J-35616** GM-Approved Terminal Test Kit

For equivalent regional tools, refer to **Special Tools**.

Circuit/System Verification

Key ON, engine OFF. The TCCM runs a 2 second bulb test on all indicators of the TCSCS at key ON.

Circuit/System Testing

NOTE: **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J-35616 GM terminal test kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**

1. Remove key. Disconnect the X1 connector at the transfer case shift control switch (TCSCS).
2. Door, open, key ON, engine OFF. Using the L-BU probe J-35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the indicator dimming control circuit, TCSCS X1 pin 4 and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - If the voltage is less than the specified range, test the affected circuit for an open/high resistance, short to ground or short to voltage. If all circuits and connections test normal, test the body control module (BCM) for proper operation.
3. Using the L-BU probes J-35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the indicator dimming control circuit, TCSCS X1 pin 4 and the 4WD HI indicator control circuit, TSCSC X1 pin 9.
   - If the voltage is less than the specified range, test the 4WD HI indicator control circuit for an open/high resistance or short to power. If all circuits and connections test normal, test the TCCM for proper operation.
4. Key OFF. Using the L-BU probe J-35616-64B, test for greater than 10 Ω between the indicator dimming control circuit, TCSCS X1 pin 4 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
5. Using the L-BU probe J-35616-64B, test for greater than 10 Ω between the 4WD HI indicator control circuit, TCSCS X1 pin 9 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
6. Test the TCSCS for proper operation.

Component Testing

BCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Using the L-BU probe J-35616-64B, connect a test light between the indicator dimming control circuit, TCSCS harness X1 pin 4 and a good ground.
3. Key ON, engine OFF. The test light should be dull or OFF.
   - If the test light is bright, test the indicator dimming control circuit for a short to voltage condition. If all circuits and connections test normal, replace the BCM.

NOTE: **When the DRL sensor turns the headlights OFF the indicator dimming control circuit voltage, TCSCS X1 pin 4, will go from a diagnostic B+ to a true B+.**

4. Place a shop light on the DRL sensor. When the headlights go out the test light should illuminate brightly.
   - If the test light is dull or OFF, test the indicator dimming control circuit for an open/high resistance or short to ground condition. If all circuits and connections test normal, replace the BCM.

TCCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Key ON, engine OFF.
3. Using the L-BU probe J-35616-64B, test for 4.5-5.5 V between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground.
   - If the voltage is greater than the specified range, test the 5-volt reference circuit for a short to voltage. If all circuits and connections test normal, replace the TCCM.
   - If the voltage is less than the specified range, test the 5-volt reference circuit for an open/high resistance or short to ground. If all circuits and connections test normal, replace the TCCM.
4. Using the L-BU probes J-35616-64B, connect a test light between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground. The test light should illuminate dimly.
   - If the test light does not illuminate, obtain a different test light and repeat step 4.
5. Key OFF. Wait 30 seconds for the TCCM to shut down.

NOTE: **The TCCM must see the added resistance of the test light on the control circuit at key ON or the TCCM will shut the control circuit drivers OFF. Volt meters will not work for this test.**

6. Using the L-BU probes J-35616-64B, connect a test light between the TCSCS harness as specified below for the LED control circuit being tested.
7. Key ON, engine OFF.
8. Using the Special Function ability of the scan tool, command the affected LED ON and OFF. The test light should turn OFF and ON as commanded.
   - If the test light remains illuminated when commanded OFF, test the affected control circuit for a short to ground. If all circuits and connections test normal, replace the TCCM.
   - If the test light remains OFF when commanded ON, test the affected control circuit for an open/high resistance or short to voltage. If all circuits and connections test normal, replace the TCCM.

Mode	2WD HI	4WD Auto	4WD HI	4WD LO	N
5-V Reference (pin)	11	11	11	11	11
Indicator Control Circuit (pin)	8	7	9	10	3

TCSCS

1. Using the L-BU probes J-35616-65B, connect the **EL-49741** 9 V+ power source harness to the TCSCS as specified below for the LED being tested. Connecting the harness in the opposite pins will not illuminate the LED.
2. Connect a 9 V battery to the **EL-49741** harness.
3. Verify that only the indicator being tested illuminates.
    - If the indicator does not illuminate when tested or the incorrect indicator illuminates, replace the TCSCS.

EL49741 Wire Color	2WD HI	4WD Auto	4WD HI	4WD LO	N
Red (pin)	4	4	4	4	2
Black (pin)	8	7	9	10	3

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Transfer Case Selector Switch Replacement (Chevrolet / GMC)Transfer Case Selector Switch Replacement (Cadillac)**
- Refer to **Control Module References** for TCSCM replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset**

DTC B0785: 2WD HI INDICATOR CIRCUIT SHORT

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptors

DTC B0785 01

2WD HI Indicator Circuit Short to Battery

DTC B0785 06

2WD HI Indicator Circuit Short to Ground or Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Indicator Dimming Control	B0770 06, B0775 06, B0780 06, B0785 06	B0770 06, B0775 06, B0780 06, B0785 06	-
2WD HI Indicator Control Circuit	B0785 06	B0785 06	B0785 01

Circuit/System Description

The 2WD HI indicator circuit consists of a light emitting diode (LED) feed circuit, a LED and a LED control circuit. The indicator dimming control circuit is the LED feed circuit and continuously supplies B+ to the 2WD HI, 4WD Auto, 4WD HI and 4WD LO LEDs. When the 2WD HI mode has been selected by the driver, the transfer case shift control module (TCCM) provides a ground through the 2WD HI indicator control circuit illuminating the LED.

The TCCM tests the 2WD HI indicator circuit for unexpected voltage by monitoring the B+ supplied by the BCM on the indicator dimming control circuit by grounding the 2WD HI indicator control circuit for 2 seconds during the Bulb Test at key ON.

Conditions for Running the DTC

B0785 01

- Ignition ON
- System voltage 10-18 V
- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the 2WD HI indicator is commanded ON.

B0785 06

- Ignition ON
- System voltage 10-18 V

- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the 2WD HI indicator is commanded OFF.

Conditions for Setting the DTC

B0785 01

The TCCM detects 3.4 V or greater on the 2WD HI indicator control circuit when the 2WD HI indicator is commanded ON.

B0785 06

The TCCM detects 1.6 V or less for 1.5 seconds on the 2WD HI indicator control circuit when the 2WD HI indicator is commanded OFF.

Action Taken When the DTC Sets

Normal operation, the SERVICE 4WD indicator is not commanded ON. Driver is informed of fault via bulb inspection.

Conditions for Clearing the DTC

- The TCCM clears the DTC once the condition for setting the DTC is no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- A TRUE B+ has enough current to light a test light.
- A DIAGNOSTIC B+ is a low current circuit that DOES NOT have enough current to light a test light.
- A short to ground on the 2WD HI indicator control circuit will cause the 2WD HI indicator to remain ON at all times.
- An open or high resistance will cause the 2WD HI indicator to be inoperative during the 2 second bulb inspection.
- An open in the indicator dimming control circuit will cause the 2WD HI, 4WD Auto, 4WD HI and 4WD LO mode indicators to be inoperative during the 2 second bulb inspection.
- **EL-49741** harness is a good source for 9 V.
- **EL-49742** harness is a good source for B+ and ground.
- With key REMOVED - opening a door puts a true B+ on the indicator dimming control circuit, TCSCS X1 pin 4. Other possible voltages are listed below:

- Door open, key removed - indicator dimming control circuit voltage = true B+.
- Door open, key in, key OFF - indicator dimming control circuit voltage = true B+.
- Door open, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
- All doors closed, key OFF - indicator dimming control circuit voltage = B+ (high current - enough to light a test light).
- All doors closed, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
- Key ON, engine OFF. Place a shop light on the DRL sensor. When the DRL sensor commands the headlights OFF, the indicator dimming control circuit voltage, TCSCS X1 pin 4, will go from a diagnostic B+ to a true B+.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J-35616** GM-Approved Terminal Test Kit

For equivalent regional tools, refer to **Special Tools**.

Circuit/System Verification

Key ON, engine OFF. The TCCM runs a 2 second bulb test on all indicators of the TCSCS at key ON.

Circuit/System Testing

NOTE: **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J-35616 GM terminal test kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**

1. Remove key. Disconnect the X1 connector at the transfer case shift control switch (TCSCS).
2. Door open, key ON, engine OFF. Using the L-BU probe J-35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the indicator dimming control circuit, TCSCS X1 pin 4 and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - If the voltage is less than the specified range, test the affected circuit for an open/high resistance, short to ground or short to voltage. If all circuits and connections test normal, test the body control module (BCM) for proper operation.
3. Using the L-BU probes J-35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the indicator dimming control circuit, TCSCS X1 pin 4 and the 2WD HI indicator control circuit, TSCSC X1 pin 8.
   - If the voltage is less than the specified range, test the 2WD HI indicator control circuit for an open/high resistance or short to power. If all circuits and connections test normal, test the TCCM for proper operation.
4. Key OFF. Using the L-BU probe J-35616-64B, test for greater than 10 Ω between the indicator dimming control circuit, TCSCS X1 pin 4 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
5. Using the L-BU probe J-35616-64B, test for greater than 10 Ω between the 2WD HI indicator control circuit, TCSCS X1 pin 8 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
6. Test the TCSCS for proper operation.

Component Testing

BCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Using the L-BU probe J-35616-64B, connect a test light between the indicator dimming control circuit, TCSCS harness X1 pin 4 and a good

ground.

3. Key ON, engine OFF. The test light should be dull or OFF.
   - If the test light is bright, test the indicator dimming control circuit for a short to voltage condition. If all circuits and connections test normal, replace the BCM.

NOTE: **When the DRL sensor turns the headlights OFF the indicator dimming control circuit voltage, TCSCS X1 pin 4, will go from a diagnostic B+ to a true B+.**

4. Place a shop light on the DRL sensor. When the headlights go out the test light should illuminate brightly.
   - If the test light is dull or off, test the indicator dimming control circuit for an open/high resistance or short to ground condition. If all circuits and connections test normal, replace the BCM.

TCCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Key ON, engine OFF.
3. Using the L-BU probe J-35616-64B, test for 4.5-5.5 V between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground.
   - If the voltage is greater than the specified range, test the 5-volt reference circuit for a short to voltage. If all circuits and connections test normal, replace the TCCM.
   - If the voltage is less than the specified range, test the 5-volt reference circuit for an open/high resistance or short to ground. If all circuits and connections test normal, replace the TCCM.
4. Using the L-BU probes J-35616-64B, connect a test light between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground. The test light should illuminate dimly.
   - If the test light does not illuminate, obtain a different test light and repeat step 4.
5. Key OFF. Wait 30 seconds for the TCCM to shut down.

NOTE: **The TCCM must see the added resistance of the test light on the control circuit at key ON or the TCCM will shut the control circuit drivers OFF. Volt meters will not work for this test.**

6. Using the L-BU probes J-35616-64B, connect a test light between the TCSCS harness as specified below for the LED control circuit being tested.
7. Key ON, engine OFF.
8. Using the Special Function ability of the scan tool, command the affected LED ON and OFF. The test light should turn OFF and ON as

commanded.

- If the test light remains illuminated when commanded OFF, test the affected control circuit for a short to ground. If all circuits and connections test normal, replace the TCCM.
- If the test light remains OFF when commanded ON, test the affected control circuit for an open/high resistance or short to voltage. If all circuits and connections test normal, replace the TCCM.

Mode	2WD HI	4WD Auto	4WD HI	4WD LO	N
5-V Reference (pin)	11	11	11	11	11
Indicator Control Circuit (pin)	8	7	9	10	3

TCSCS

1. Using the L-BU probes J-35616-65B, connect the **EL-49741** 9 V+ power source harness to the TCSCS as specified below for the LED being tested. Connecting the harness in the opposite pins will not illuminate the LED.
2. Connect a 9 V battery to the **EL-49741** harness.
3. Verify that only the indicator being tested illuminates.
   - If the indicator does not illuminate when tested or the incorrect indicator illuminates, replace the TCSCS.

EL49741 Wire Color	2WD HI	4WD Auto	4WD HI	4WD LO	N
Red (pin)	4	4	4	4	2
Black (pin)	8	7	9	10	3

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Transfer Case Selector Switch Replacement (Chevrolet / GMC)Transfer Case Selector Switch Replacement (Cadillac)**
- Refer to **Control Module References** for TCSCM replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset**

DTC B2725, P0698, OR P0699: TRANSFER CASE RANGE SELECTION SWITCH CIRCUIT/5V REFERENCE 3 CIRCUIT VOLTAGE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptor

DTC B2725 03

Transfer Case Range Selection Switch Circuit Low Voltage

DTC B2725 07

Transfer Case Range Selection Switch Circuit High Voltage

DTC B2725 08

Transfer Case Range Selection Switch Circuit Performance - Signal Invalid

DTC P0698

5V Reference 3 Circuit Low Voltage

DTC P0699

5V Reference 3 Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Invalid
5-Volt Reference	B2725 03, B2725 08, or P0698	B2725 03, B2725 08, or P0698	B2725 07, B2725 08, or P0699	B2725 08, P0698, or P0699
Four Wheel Drive	B2725 03 or B2725 08	B2725 03 or B2725 08	B2725 07 or B2725 08	B2725 08

Circuit/System Description

The transfer case shift control switch allows the driver to select between 5 ranges. The transfer case control module supplies a regulated 5 volts to the switch through the 5-volt reference circuit. The current travels through the specific resistor of the currently selected range - each range has its own resistor. The current is then returned to the transfer case control module through the four wheel drive switch signal circuit.

The transfer case control module continuously monitors the switch signal circuit to determine whether a range change has been requested by the driver.

The NQH transfer case has the following 5 ranges:

- 2WD
- 4WD/AWD Automatic
- 4WD High/Locked
- 4WD Low
- Neutral

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- No DTC P0562 or P0563.

Conditions for Setting the DTC

The transfer case control module monitors the voltage on 5V reference and 4WD switch signal circuits every 10 ms.

B2725 03

When the low side driver is ON, the transfer case control module measures less than 0.3 volts on the Four Wheel Drive Switch Signal circuit.

B2725 07

When the low side driver is ON, the transfer case control module measures greater than 4.65 volts on the Four Wheel Drive Switch Signal circuit.

B2725 08

When the low side driver is ON, the transfer case control module measures an invalid voltage on the Four Wheel Drive Switch Signal circuit.

P0698

When the ignition is ON, the transfer case control module measures less than 4.75 volts on the Transfer Case Sensor Reference Voltage 3 circuit.

P0699

When the ignition is ON, the transfer case control module measures greater than 5.25 volts on the Transfer Case Sensor Reference Voltage 3 circuit.

Action Taken When the DTC Sets

- DTC P0698 and P0699 are type A DTC's.
- All shifting is disabled.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- DTC P0698 and P0699 are type A DTC's.
- The transfer case control module clears the DTC once the condition for setting the DTC is no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

EL-49742 harness is a good source for B+ and ground.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J-35616** GM-Approved Terminal Test Kit

For equivalent regional tools, refer to **Special Tools**.

Circuit/System Verification

1. Verify that all range selections of the S77 transfer case shift control switch match the following parameters in the Data Display feature of the scan tool:
   - Transfer Case Commanded Position
   - Transfer Case Range
   - Transfer Case Range Selection Switch State
   - The corresponding Range Indicator light
   - ***If NOT all of the parameters match the S77 transfer case shift control switch position***

     Refer to Circuit/System Testing.

   - ***If ALL of the parameters match the S77 transfer case shift control switch position***
2. Verify that the sensor reference voltage 3 and transfer case range selection switch voltage fall within the below ranges for all range selections of the S77 transfer case shift control switch.
   - ***If NOT all voltages match the specified ranges***

     Refer to Circuit/System Testing.

   - ***If ALL voltages match the specified ranges***
3. Verify DTC B2725, P0698, or P0699 is only set as a history DTC.
   - ***If any of the DTCs are set as current***

     Refer to Circuit/System Testing.

- ***If any of the DTCs are only set as history***

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

4. Visually inspect each connector terminal of the K69 transfer case control module X1 connector and the S77 transfer case shift control switch connector for damage or corrosion. Repair as necessary.
5. Clear DTC 2725, P0698, or P0699 from history.
6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If any of the DTCs are set***

     Refer to Circuit/System Testing.

   - ***If none of the DTCs set***
7. All OK.

Transfer Case Range	Transfer Case Sensor Reference Voltage 3	Transfer Case Range Selection Switch (V)		Range Actuator Position Sensor (Â°)	
		Range	Nominal	Range	Nominal
2WD	4.7-5.3 V	1.8-2.2 V	2.0 V	33-43Â°	38Â°
4WD/AWD Automatic	4.7-5.3 V	4.10-4.59 V	4.38 V	87-204Â°	146Â°
4WD High/Locked	4.7-5.3 V	2.8-3.2 V	3.0 V	110-204Â°	146Â°
4WD Low	4.7-5.3 V	1.3-1.7 V	1.5 V	-69Â° to -140Â°	-90Â°
Neutral	4.7-5.3 V	2.3-2.7 V	2.5 V Held 1.5 V Released	-5Â° to +5Â°	0Â°

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the S77 transfer case shift control switch.
2. ON, engine OFF.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J-35616 GM terminal test kit. Use of an improper test probe may deform the**

terminal, resulting in intermittent open conditions.

- **Testing for steps 3-5 is performed on the S77 transfer case shift control switch harness connector using the L-BU probes J-35616-64B.**

3. Test for 4.75-5.25 V between the 5-Volt reference circuit, terminal 11 and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - ***If less than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the 5-Volt reference circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between 5-Volt reference circuit terminal 11 and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the 5-Volt reference circuit terminal 11 and all other terminals of the S77 transfer case shift control switch harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

        Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

   - ***If greater than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the 5-Volt reference circuit terminal 11 and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.
      - If less than 1 V
   3. Test for greater than 10 Ω between the 5-Volt reference circuit, terminal 11 and all other terminals of the S77 transfer case shift control switch harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

4. 5-Volt reference circuit and K69 transfer case control module OK.
5. Test for 4.75-5.25 V between the 5-Volt reference circuit, terminal 11, and the switch signal circuit, terminal 12.
   - ***If less than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the switch signal circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between switch signal circuit and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the switch signal circuit, terminal 12 and all other terminals of the S77 transfer case shift control switch harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

      Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

   - ***If greater than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the switch signal circuit, terminal 12 and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.
      - If less than 1 V
   3. Test for greater than 10 Ω between the switch signal circuit, terminal 12 and all other terminals of the S77 transfer case shift control switch harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

      Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

6. Switch signal circuit and K69 transfer case control module OK.

Component Testing

S77 Transfer Case Shift Control Switch

1. Ignition OFF. Remove the S77 transfer case shift control switch. Refer to **Transfer Case Selector Switch Replacement (Chevrolet / GMC)Transfer Case Selector Switch Replacement (Cadillac)**.

NOTE: **Testing for Step 2 is performed on the component using the L-BU probe J-35616-65B.**

2. Measure the resistance for each of the range positions of the S77 transfer case shift control switch between the 5-volt reference circuit, terminal 11, and the switch signal circuit terminal 12.
   - ***If the resistance is outside the specified ranges***

     Replace the S77 transfer case shift control switch. Refer to **Transfer Case Selector Switch Replacement (Chevrolet / GMC)Transfer Case Selector Switch Replacement (Cadillac)**.

   - ***If the resistance is within the specified ranges***
3. S77 transfer case shift control switch OK.

S77 Transfer Case Range Selection Switch	Range	Nominal
2WD	1475-1550 Ω	1515 Ω
4WD/AWD Automatic	110-175 Ω	140 Ω
4WD High/Locked	625-700 Ω	665 Ω
4WD Low	2230-2400 Ω	2345 Ω
Neutral	990-1050 Ω	1020 Ω

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Transfer Case Selector Switch Replacement (Chevrolet / GMC)Transfer Case Selector Switch Replacement (Cadillac)** for S77 transfer case shift control switch replacement
- Refer to **Control Module References** for K69 transfer case control module replacement, setup, and programming

- Refer to **Transfer Case High/Low Clutch Reset** for Range Actuator Learn procedure

DTC C0306 OR C0381: RANGE ACTUATOR CONTROL CIRCUIT/RANGE ACTUATOR SYSTEM PERFORMANCE HIGH TEMPERATURE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptors

DTC C0306 01

Range Actuator Control Circuit Short to Battery

DTC C0306 02

Range Actuator Control Circuit Short to Ground

DTC C0306 04

Range Actuator Control Circuit Short to Open

DTC C0306 54

Range Actuator Control Circuit High Temperature

DTC C0381 54

Range Actuator System Performance High Temperature

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Performance
Transfer Case Motor Clockwise Control	C0306 02	C0306 04	C0306 01	C0306 54 or C0381 54

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Performance
Transfer Case Motor Counter-Clockwise Control	C0306 02	C0306 04	C0306 01	C0306 54 or C0381 54

Circuit/System Description

The A16 Transfer Case Motor, also known as the transfer case range actuator, is a bi-directional, permanent magnet, DC motor. When energized, through the transfer case clockwise circuit or transfer case counter-clockwise circuit, the ground is provided by the opposing motor control circuit which becomes grounded through the transfer case control module ground circuit. The transfer case range actuator, through a series of gears, rotates the transfer case control actuator shaft which moves the transfer case two/four wheel drive actuator cam and transfer case high/low shift fork in order to shift the transfer case between the following modes or ranges:

- 2WD
- 4WD/AWD Automatic
- 4WD High/Locked
- 4WD Low
- Neutral

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- No DTC P0562 or P0563.
- Transfer case range actuator not performing a requested range change (C0306 01, C0306 02, and C0306 04 only).
- DTC C0306 and C0381 run continuously within the enabling conditions.

Conditions for Setting the DTC

C0306 01

Voltage on the transfer case clockwise circuit or the transfer case counter-clockwise circuit is greater than 5.60 V.

C0306 02

Voltage on the transfer case clockwise circuit or the transfer case counter-clockwise circuit is less than 1.9 V.

C0306 04

Voltage on the transfer case clockwise circuit is 2.7-4.5 V, and the voltage on the transfer case counter-clockwise circuit is 0.5-4.5 V.

C0306 54

The calculated temperature of the transfer case range actuator H-bridge in the transfer case control module is greater than a predetermined value.

C0381 54

The calculated temperature of the transfer case range actuator is greater than a predetermined value.

Action Taken When the DTC Sets

- All shifting disabled.
- Front axle disengages if thermal model exceeded.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- The transfer case control module clears the DTC once the conditions for setting the DTC are no longer present.
- A history DTC clears after 40 consecutive warm-up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- It is possible to have windings inside the motor shorted to the case resulting in a short to ground causing this DTC to set.
- The default actions for C0321 may set C0306.
- **EL-49741** harness is a good source for 9 V.
- **EL-49742** harness is a good source for B+ and ground.
- The transfer case drain plug is a good source for ground.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J-35616** GM-Approved Terminal Test Kit

For equivalent regional tools, refer to **Special Tools**.

Circuit/System Verification

1. Verify DTC C0321 in NOT set.
    - **If DTC C0321 is set**

      diagnose it first. Refer to **DTC C0321 or C0326**.

    - ***If DTC C0321 is NOT set***
2. Verify that all of the following scan tool parameters display OK.
    - Range Actuator Control Circuit High Voltage Test Status
    - Range Actuator Control Circuit Low Voltage Test Status
    - Range Actuator Control Circuit Open Voltage Test Status

- Range Actuator Control Circuit Shorted Test Status
- ***If any of the parameters do NOT display OK***

  Refer to Circuit/System Testing.

- ***If all of the parameters display OK***

3. Verify that for all range selections of the S77 transfer case shift control switch, the Range Actuator Current parameter increases or decreases during the shift and then returns to 0.0 A after shifting.
   - ***If the Range Actuator Current parameter does NOT perform as described***

     Refer to Circuit/System Testing.

   - ***If the Range Actuator Current parameter DOES perform as described***
4. Verify DTC C0306 or C0381 is only set as a history DTC.
   - **If C0306 or C0381 is set as current**

     Refer to Circuit/System Testing.

   - **If C0306 or C0381 is only set as history**

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

5. Visually inspect each connector terminal of the K69 transfer case control module X3 connector and the A16 transfer case motor connector for damage or corrosion. Repair as necessary.
6. Clear DTC C0306 or C0381 from history.
7. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - **If DTC C0306 or C0381 sets**

     Refer to Circuit/System Testing.

   - **If DTC C0306 or C0381 does not set**
8. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the A16 transfer case motor, also known as the transfer case range actuator.
2. Ignition ON, engine OFF.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J-35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 3-5 is performed on the A16 transfer case motor harness connector using the PU probes J-35616-4A.**

3. Test for 1.0-2.5 V between the transfer case motor counter-clockwise control circuit terminal D and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - ***If less than the specified range***
   1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the transfer case motor counter-clockwise control circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between transfer case motor counter-clockwise control circuit terminal D and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the transfer case motor counter-clockwise control circuit terminal D and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

        Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

   - ***If greater than the specified range***
   1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the transfer case motor counter-clockwise control circuit terminal D and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.

- If less than 1 V

3. Test for greater than 10 Ω between the transfer case motor counter-clockwise control circuit, terminal D and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

4. Transfer case motor counter-clockwise control circuit and K69 transfer case control module OK.
5. Test for 3.0-4.5 V between the transfer case motor clockwise control circuit terminal A, and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.

- **If less than the specified range**

1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in the transfer case motor clockwise control circuit end to end.
   - If 10 Ω or greater, repair the open/high resistance in the circuit.
   - If less than 10 Ω
3. Test for infinite resistance between transfer case motor clockwise control circuit terminal A and a good ground.
   - If less than infinite resistance, repair the short to ground in the circuit.
   - If infinite resistance
4. Test for greater than 10 Ω between the transfer case motor clockwise control circuit terminal A and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset** .

- **If greater than the specified range**

1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
2. Test for less than 1 V between the transfer case motor clockwise control circuit terminal A and a good ground.
   - If 1 V or greater, repair the short to voltage in the circuit.

- If less than 1 V

3. Test for greater than 10 Ω between the transfer case motor clockwise control circuit, terminal A and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset** .

- **If within the specified range**

6. Transfer case motor counter-clockwise control circuit, transfer case motor clockwise control circuit and K69 transfer case control module OK.

Component Testing

A16 Transfer Case Motor (Transfer Case Range Actuator)

1. Remove the A16 transfer case motor from transfer case. Using a paint pen or marker, place indexing marks on the A16 transfer case motor drive gear and the mounting surface of the A16 transfer case motor.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J-35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 2-11 is performed on the A16 transfer case motor harness connector using the PU probes J-35616-5.**

2. Attach the red lead from one of the **EL-49741** harnesses to the battery positive voltage terminal of the A16 transfer case motor, terminal B.
3. Attach the black lead from this same jumper harness to the transfer case lock solenoid control terminal of the A16 transfer case motor, terminal C.
4. Attach a 9-volt battery to this harness (not included). You should hear the A16 transfer case motor unlock.
   - ***If you do NOT hear the A16 transfer case motor unlock***

     replace the A16 transfer case motor and perform the Range Actuator Learn procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**, and **Transfer Case High/Low Clutch Reset**.

   - ***If you DO hear the A16 transfer case motor unlock***
5. Attach the red lead from the other **EL-49741** jumper harness to the transfer case motor clockwise control circuit of the A16 transfer case

motor, terminal A.

6. Attach the black lead from this same jumper harness to the transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D.
7. Touch the battery terminals of the 9-volt battery to the battery terminals of the jumper harness. This should rotate the A16 transfer case motor drive gear in either a clockwise or counter-clockwise rotation depending on battery orientation.
   - If the A16 transfer case motor drive gear does not perform as described

     replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**, and **Transfer Case High/Low Clutch Reset**.

   - ***If The A16 transfer case motor drive gear performs as described***
8. Verify 0.3-40 Ω resistance between the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A and the transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D.
   - ***If NOT 0.3-40 Ω***

     replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**, and **Transfer Case High/Low Clutch Reset**.

   - ***If 0.3-40 Ω***
9. Test for infinite resistance between the following circuits and the A16 transfer case motor case:
   - Transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A
   - Transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D
   - ***If less than infinite resistance***

     replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**, and **Transfer Case High/Low Clutch Reset**.

   - ***If infinite resistance***
10. Test for infinite resistance between the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A and all other terminals on the A16 transfer case motor harness X1 except the transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D.
    - ***If less than infinite resistance***

      replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive**

Actuator Replacement, and **Transfer Case High/Low Clutch Reset**.

- ***If infinite resistance***

11. Test for infinite resistance between the transfer case motor counter-clockwise control circuit of the A16 Transfer Case Motor, terminal D. and all other terminals on the TCEM harness X1 except the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A.
    - ***If less than infinite resistance***

      replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**, and **Transfer Case High/Low Clutch Reset**.

    - ***If infinite resistance***
12. A16 transfer case motor OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Control Module References** for K69 transfer case control module replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset**
- Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**

DTC C0321 OR C0326: RANGE ACTUATOR LOCK CONTROL CIRCUIT/RANGE ACTUATOR LOCK CONTROL SYSTEM PERFORMANCE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptors

DTC C0321 01

Range Actuator Lock Control Circuit Short to Battery

DTC C0321 02

Range Actuator Lock Control Circuit Short to Ground

DTC C0321 04

Range Actuator Lock Control Circuit Open

DTC C0326 58

Range Actuator Lock Control System Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Performance
Battery Positive Voltage	-	DTC C0321 04	-	-
Transfer Case Lock Solenoid Control	DTC C0321 02	DTC C0321 04	DTC C0321 01	DTC C0326 58

Circuit/System Description

The transfer case range actuator is also known as the transfer case motor, transfer case encoder motor, or transfer case two/four wheel drive actuator assembly.

The transfer case range actuator lock solenoid is part of the transfer case range actuator and cannot be serviced separately.

The transfer case control module controls the transfer case range actuator lock solenoid. The transfer case range actuator lock solenoid is released by being energized. This is accomplished by grounding the transfer case lock solenoid control circuit during range changes, and 4WD/AWD Automatic mode. Locking action is applied when power or ground are taken away from the lock solenoid, preventing the transfer case range actuator from moving. The system is capable of providing 2WD, 4WD High/Locked, 4WD Low, and Neutral without the need of additional vehicle power to hold the transfer case in these positions.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- A state change from lock solenoid engaged to lock solenoid disengaged, or lock solenoid disengaged to lock solenoid engaged, has occurred more than 10 times - DTC C0321 only.

- DTC C0321 and C0326 run continuously within the enabling conditions.

Conditions for Setting the DTC

C0321 01

When the low side driver is ON, the transfer case control module measures greater than 8.5 volts on the Transfer Case Lock Solenoid Control circuit.

C0321 02

When the low side driver is OFF, the transfer case control module measures less than 2.0 volts on the Transfer Case Lock Solenoid Control circuit.

C0321 04

When the low side driver is OFF, the transfer case control module measures between 2.5-5.5 volts on the Transfer Case Lock Solenoid Control circuit.

C0326 58

Transfer case range actuator position correction after a brake slipping event was unsuccessful 10 times. A slipping event is defined as a torque error between the torque requested and the actual torque calculated from motor position being greater than a predetermined amount.

Action Taken When the DTC Sets

C0321

- Lock does not disengage.
- All shifting disabled.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

C0326 58

- Normal operation/slip correction unless thermal limits of transfer case four wheel drive clutch, transmission control module or transfer case range actuator have been exceeded.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- The transfer case control module clears the DTC once the conditions for setting the DTC are no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- The underhood fuse block supplies B+ on the battery positive voltage circuit and reads the voltage back on the transfer case lock solenoid control circuit.
- The system tests the transfer case lock solenoid circuits by checking for unwanted voltage. If the transfer case control module detects a low voltage return when a high voltage is expected, or a high voltage return when a low voltage is expected, the DTC is logged.
- The default actions for C0321 may set C0306.
- **EL-49741** harness is a good source for 9 V.
- **EL-49742** harness is a good source for B+ and ground.
- The transfer case drain plug is a good source for ground.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J-35616** GM-Approved Terminal Test Kit

For equivalent regional tools, refer to **Special Tools**.

Circuit/System Verification

1. Verify that all of the following scan tool parameters display OK.
   - Range Actuator Lock Control Circuit High Voltage Test Status
   - Range Actuator Lock Control Circuit Low Voltage Test Status
   - Range Actuator Lock Control Circuit Open Test Status
   - ***If any of the parameters do NOT display OK***

     Refer to Circuit/System Testing.

   - ***If all of the parameters display OK***
2. Using the transfer case Range Actuator Lock function of the Control Functions feature of the scan tool, command the transfer case range actuator lock ON and OFF. You should be able to hear the range actuator lock engage and disengage.
   - ***If you are unable to hear the range actuator lock engaging and disengaging***

     Refer to Circuit/System Testing.

   - ***If you are able to hear the range actuator lock engaging and disengaging***
3. Verify DTC P0321 or P0326 is only set as a history DTC.
   - ***If any of the DTCs are set as current***

     Refer to Circuit/System Testing.

   - ***If any of the DTCs are only set as history***

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

4. Visually inspect each connector terminal of the K69 transfer case control module X1 connector and the A16 transfer case motor connector for damage or corrosion. Repair as necessary.
5. Clear DTC P0321 or P0326 from history.
6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If any of the DTCs are set***

     Refer to Circuit/System Testing.

   - ***If none of the DTCs set***
7. All OK.

Circuit/System Testing

1. Verify that the 4WD TREC fuse, X50A Fuse Block - Underhood fuse 6, and the Accessory/Run Crank fuse, X51L Fuse Block - Instrument Panel Left - fuse 31, are not open.
   - ***If the 4WD TREC fuse is open***

     Test the battery positive voltage, K69 transfer case control module harness X3 terminal C, for a short to ground.

   - ***If the Accessory/Run Crank fuse is open***

     Test the Accessory/Run Crank voltage circuit, K69 transfer case control module harness X2 terminal 4, for a short to ground.

   - ***If neither fuse is open***
2. Ignition ON, engine OFF.
3. Disconnect the harness connector at the A16 transfer case range actuator.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J-35616 Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 3-5 is performed on the A16 transfer case motor harness connector using the PU probes J-35616-4A.**

4. Test for B+ (+0.0/-1.0 V) between the battery positive voltage circuit, A16 transfer case range actuator harness terminal B, and a good ground.

- ***If the voltage is less than B+ (+0.0/-1.0 V)***

1. Ignition OFF, disconnect the X2 harness connector at the X50A Fuse Block - Underhood.
2. Test for less than 10 Ω in battery positive voltage circuit end to end.
    - If 10 Ω or greater, repair the open/high resistance in the circuit.
    - ***If less than 10 Ω***
3. Test for infinite resistance between battery positive voltage circuit and a good ground.
    - If less than infinite resistance, repair the short to ground in the circuit.
    - If infinite resistance
4. Test for infinite resistance between the battery positive voltage circuit, A16 transfer case motor harness terminal B, and all other terminals of the A16 transfer case motor harness connector.
    - If less than infinite resistance, repair the shorted together condition in the affected circuits.
    - If infinite resistance, replace the K69 transfer case control module and perform the Range Actuator Learn procedure. The Range Actuator Learn procedure is also known as the Transfer Case High/Low Clutch Reset procedure.

      Refer to **Transfer Case Control Module Replacement**.

- ***If the voltage is B+ (+0.0/-1.0 V)***

5. Test for a 4.0-5.0 V diagnostic voltage between the transfer case lock solenoid control circuit, A16 Transfer Case Motor terminal C, and a good ground.
    - ***If the voltage is greater than the specified range***
    1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
    2. Ignition ON, engine OFF.
    3. Test for less than 1 V between the transfer case lock solenoid control circuit and a good ground.
        - If 1 V or greater, repair the short to voltage on the circuit.
        - If less than 1 V
    4. Test for infinite resistance between the transfer case lock solenoid control circuit, A16 transfer case motor harness connector terminal C and all other terminals of the A16 transfer case motor harness connector.
        - If less than infinite resistance, repair the shorted together condition in the affected circuits.
        - If infinite resistance, replace the K69 transfer case control module and perform the Range Actuator Learn procedure. The Range Actuator Learn procedure is also known as the Transfer Case High/Low Clutch Reset procedure.

Refer to **Transfer Case Control Module Replacement**.

- ***If the voltage is less than the specified range***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in the transfer case lock solenoid control circuit end to end.
   - If 10 Ω or greater, repair the open/high resistance in the circuit.
   - If less than 10 Ω
3. Test for infinite resistance transfer case lock solenoid control circuit, A16 transfer case motor harness connector terminal C and a good ground.
   - If less than infinite resistance, repair the short to ground in the circuit.
   - If infinite resistance
4. Test for infinite resistance between the transfer case lock solenoid control circuit, A16 transfer case motor harness connector terminal C and all other terminals of the A16 transfer case motor harness connector.
   - If less than infinite resistance, repair the shorted together condition in the affected circuits.
   - If infinite resistance, replace the K69 transfer case control module and perform the Range Actuator Learn procedure. The Range Actuator Learn procedure is also known as the Transfer Case High/Low Clutch Reset procedure.

     Refer to **Transfer Case Control Module Replacement**.

- ***If the voltage is within the specified range***

6. Battery Positive Voltage circuit and Transfer Case Lock Solenoid Control circuit OK.

Component Testing

A16 Transfer Case Motor (Transfer Case Range Actuator)

NOTE: **Circuit/System Testing must be performed first.**

1. Remove the A16 transfer case motor from transfer case. Using a paint pen or marker, place indexing marks on the A16 transfer case motor drive gear and the mounting surface of the A16 transfer case motor.
2. Install the **EL-49742** harness.
3. Using a PU probe J-35616-5, attach the red lead of the **EL-49742** jumper harness to the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A. The transfer case motor clockwise control circuit is also known as the motor control A circuit.

4. Using a PU probe J-35616-5, touch the black lead of the **EL-49742** jumper harness to the transfer case motor counter clockwise control circuit of the A16 transfer case motor, terminal D. The transfer case motor counter clockwise control circuit is also known as the motor control B circuit. The A16 transfer case motor drive gear should not rotate.
    - ***If the A16 transfer case motor drive gear rotates***

      Replace the A1 transfer case motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**.

    - ***If the A16 transfer case motor drive gear does NOT rotate***
5. Using a PU probe J-35616-5, attach the red lead of the **EL-49741** harness to the battery positive voltage terminal of the A16 transfer case motor, terminal B.
6. Using a PU probe J-35616-5, attach the black lead of the **EL-49741** jumper harness to the transfer case lock solenoid control terminal of the A16 transfer case motor, terminal C.
7. Attach a 9-volt battery to the **EL-49741** harness (not included). You should hear the A16 transfer case motor unlock.
    - ***If you do not hear the A16 transfer case motor unlock***

      Replace the A16 transfer case motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**.

    - ***If you do hear the A16 transfer case motor unlock***
8. Touch the black lead of the **EL-49742** jumper harness to the transfer case motor counter clockwise control circuit of the A16 transfer case motor, terminal D. The A16 transfer case motor drive gear should rotate.
    - ***If the A16 transfer case motor drive gear does NOT rotate***

      Replace the A16 transfer case motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**.

    - ***If the A16 transfer case motor drive gear does rotate***
9. Using the PU probes J 35616-5, test for between 10-30 Ω between the battery positive voltage circuit A16 transfer case motor, terminal B and the transfer case lock solenoid control circuit A16 transfer case motor terminal C.
    - ***If outside the specified range***

      Replace the A16 transfer case motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**.

    - ***If within the specified range***
10. Using the PU probes J-35616-5, test for infinite resistance between the following circuits and the A16 transfer case motor case.
    - Battery positive voltage circuit A16 transfer case motor, terminal B.

- Transfer case lock solenoid control circuit A16 transfer case motor, terminal C.
- ***If less than infinite resistance***

  Replace the A16 transfer case motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**.

- ***If infinite resistance***

11. Using the PU probes J-35616-5, test for infinite resistance between the battery positive voltage circuit A16 transfer case motor, terminal B and all other terminals on the A16 transfer case motor except the transfer case lock solenoid control circuit, terminal C.
    - ***If less than the infinite resistance***

      Replace the A16 transfer case motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**.

    - ***If infinite resistance***
12. Using the PU probes J-35616-5, test for infinite resistance between the transfer case lock solenoid control circuit A16 transfer case motor, terminal C and all other terminals of the TCEM X1 except the battery positive voltage circuit A16 transfer case motor, terminal B.
    - ***If less than infinite resistance***

      Replace the A16 transfer case motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**.

    - ***If infinite resistance***
13. A16 transfer case motor OK.

K69 Transfer Case Control Module

NOTE:

- **Circuit/System Testing must be performed first.**
- **Transfer case control module's need to be programmed when replaced. If after programming the K69 transfer case control module comes back as "NO COMM", try reprogramming again. (Internet/vehicle bandwidth load may cause the programming activity to fail.)**

1. Ignition OFF. Disconnect the harness connector at the A16 transfer case motor.
2. Ignition ON, engine OFF. Install **EL-49742** harness.
3. Block wheels. Parking brake engaged. Transmission in Neutral.
4. Using the PU probes J-35616-4A, connect a test lamp between the battery positive voltage circuit, A16 transfer case motor harness terminal B and the ground terminal of **EL-49742** harness, black terminal. The test light should illuminate.

- ***If the test light does not illuminate***

1. Ignition OFF, disconnect the X2 harness connector at the X50A Fuse Block - Underhood.
2. Test for less than 10 Ω in battery positive voltage circuit end to end.
    - If 10 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 10 Ω
3. Test for infinite resistance between battery positive voltage circuit, A16 transfer case motor harness terminal B, and a good ground.
    - If less than infinite resistance, repair the short to ground in the circuit.
    - If infinite resistance
4. Test for infinite resistance between the battery positive voltage circuit, A16 transfer case motor harness terminal B, and all other terminals of the A16 transfer case motor harness connector.
    - If less than infinite resistance, repair the shorted together condition in the affected circuits.
    - If infinite resistance, replace the K69 transfer case control module and perform the Range Actuator Learn procedure. The Range Actuator Learn procedure is also known as the Transfer Case High/Low Clutch Reset procedure. Refer to **Transfer Case Control Module Replacement**.

- ***If the test light does illuminate***

5. Using the PU probes J-35616-4A, connect a test lamp between the battery positive voltage circuit, A16 transfer case motor harness terminal B and the transfer case lock solenoid control circuit, A16 transfer case motor harness terminal C. The test light should not illuminate.

- ***If the test light illuminates***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for infinite resistance between the transfer case lock solenoid control circuit, A16 transfer case motor harness terminal C, and a good ground.
    - If less than infinite resistance, repair the short to ground in the circuit.
    - If infinite resistance
3. Test for infinite resistance between the transfer case lock solenoid control circuit, A16 transfer case motor harness terminal C, and all other terminals of the A16 transfer case motor harness connector.
    - If less than infinite resistance, repair the shorted together condition in the affected circuits.
    - If infinite resistance, replace the K69 transfer case control module and perform the Range Actuator Learn procedure. The Range Actuator Learn procedure is also known as the Transfer Case High/Low Clutch Reset procedure. Refer to **Transfer Case Control Module Replacement**.

- ***If the test light does not illuminate***

6. Using the Transfer Case Lock function of the Control Function feature of the scan tool, command the transfer case lock ON and OFF. When the lock is commanded ON, release solenoid de-energized, the test light should not illuminate. When the lock is commanded OFF, release solenoid energized, the test light should illuminate.
   - ***If the test light stays ON when the lock is commanded ON***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
   2. Test for infinite resistance between the transfer case lock solenoid control circuit, A16 transfer case motor harness terminal C, and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   3. Test for infinite resistance between the transfer case lock solenoid control circuit, A16 transfer case motor harness terminal C, and all other terminals of the A16 transfer case motor harness connector.
      - If less than infinite resistance, repair the shorted together condition in the affected circuits.
      - If infinite resistance, replace the K69 transfer case control module and perform the Range Actuator Learn procedure. The Range Actuator Learn procedure is also known as the Transfer Case High/Low Clutch Reset procedure. Refer to **Transfer Case Control Module Replacement**.
   - ***If the test light does not illuminate when the lock is commanded OFF***
   1. Ignition OFF, disconnect the X harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the transfer case lock solenoid control circuit, end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure. The Range Actuator Learn procedure is also known as the Transfer Case High/Low Clutch Reset procedure. Refer to **Transfer Case Control Module Replacement**.
   - ***If the test light illuminates when the lock is commanded OFF and turns OFF when the lock is commended ON***
7. K69 transfer case motor OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Control Module References** for transfer case control module replacement, setup, and programming.
- Refer to **Transfer Case High/Low Clutch Reset** for Range Actuator Learn procedure.
- Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** for transfer case motor/transfer case range actuator replacement.

DTC C0364 OR C0379: FRONT AXLE SYSTEM/FRONT AXLE SWITCH CIRCUIT

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptors

DTC C0364 01

Front Axle System Short to Battery

DTC C0364 02

Front Axle System Short to Ground

DTC C0364 04

Front Axle System Open Circuit

DTC C0379 08

Front Axle Switch Circuit Signal Invalid

DTC C0379 58

Front Axle Switch Circuit System Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Invalid
Run/Crank Ignition 1 Voltage	Trans Ign 1 fuse, underhood fuse block - Open	C0364 04 if set when in 2WD High or C0379 08 if set when in 4WD High	-	C0379 58

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Invalid
Four Wheel Drive Wheel Lock Indicator	C0379 08 or C0379 58	C0364 04, C0379 08, or C0379 58	C0379 58	C0379 58
Front Axle Actuator Control	C0364 02	C0364 04 if set when in 2WD High or C0379 08 if set when in 4WD High	C0364 01	C0379 58
Ground	-	C0364 04 if set when in 2WD High or C0379 08 if set when in 4WD High	-	C0379 58

Circuit/System Description

The front axle control circuit consists of an electric motor actuator which engages and disengages the front axle. The front axle engagement actuator consists of a permanent magnetic motor, a worm gear controlled plunger, a front axle switch and an electronic control circuit within the actuator assembly.

The front axle engagement actuator contains the following circuits:

- A Run/Crank Ignition 1 Voltage circuit
- A Four Wheel Drive Wheel Lock Indicator circuit
- An Front Axle Actuator Control circuit
- A ground circuit

When a shift to 4WD Auto, 4WD High, or 4WD Low is requested, the transfer case control module engages the front axle by grounding the front axle actuator control circuit through a current limiting driver.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- No DTC P0562 or P0563.

- DTC C0364 and C0379 run continuously within the enabling conditions.

Conditions for Setting the DTC

C0364 01

Voltage on the front axle actuator control circuit is greater than 8.5 V.

C0364 02

Voltage on the front axle actuator control circuit is less than 0.2 V.

C0364 04

Voltage on the front axle actuator control circuit is between 2.5-5.5 V.

C0379 08

The transfer case control module detects a change in voltage on the four wheel drive wheel lock indicator circuit and no change in voltage on the front axle actuator control circuit.

C0379 58

5 s after a range change, the transfer case control module compares the commanded state of the front axle (Front Axle Engagement Actuator Command parameter) to the monitored state of the front axle (Front Axle Feedback Switch parameter). If the command state differs from the monitored state for more than a predetermined amount of time, the DTC sets.

Action Taken When the DTC Sets

C0364 01 and C0364 04

- The front axle remains disengaged at all times.
- Transfer case normal operation.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.
- The range indicator for the current range shall illuminate.

C0364 02

- The front axle remains engaged at all times.
- Transfer case normal operation.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.
- The range indicator for the current range shall illuminate.

C0379 08

- The front axle remains in current mode.
- Transfer case normal operation.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.
- The range indicator for the current range shall illuminate.

C0379 58

- The front axle remains in current mode.
- Transfer case normal operation.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.
- The range indicator for the current range shall illuminate.

Conditions for Clearing the DTC

- The K69 transfer case control module clears the DTC once the conditions for setting the DTC are no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- Other failures on the run/crank ignition 1 voltage circuit may cause erratic behavior on the front axle control signal circuit.
- The transfer case fill/drain plugs are good sources for ground.
- A TRUE B+ carries enough current to light a test light.
- A DIAGNOSTIC B+ is a low current circuit that DOES NOT carry.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J-35616** GM-Approved Terminal Test Kit

For equivalent regional tools, refer to **Special Tools**.

Circuit/System Verification

1. Verify that the F40UA, TCCM/HDLP fuse is NOT open (X50A underhood fuse block).
    - ***If the F40UA TCCM/HDLP fuse is OPEN***

      Refer to Circuit/System Testing.

    - ***If the F40UA TCCM/HDLP fuse is NOT OPEN***
2. Verify that the following parameters match each other for all range selections of the S77 transfer case shift control switch. You should also be able to hear the M26 front axle engagement actuator engaging and disengaging.
    - Front Axle Engagement Actuator Command

- Front Axle Feedback Switch
- ***If the parameters do NOT match each other***

  Refer to Circuit/System Testing.

- ***If the parameters DO match each other***

3. Verify that all of the following scan tool parameters display OK.
   - Front Axle Engagement Actuator Control Circuit High Voltage Test Status
   - Front Axle Engagement Actuator Control Circuit Low Voltage Test Status
   - Front Axle Engagement Actuator Control Circuit Open Voltage Test Status
   - ***If any of the parameters do NOT display OK***

     Refer to Circuit/System Testing.

   - ***If all of the parameters display OK***
4. Verify that for all range selections of the S77 transfer case shift control switch, the Range Actuator Current parameter increases or decreases during the shift and then returns to 0.0 A after shifting.
   - ***If the Range Actuator Current parameter does NOT perform as described***

     Refer to Circuit/System Testing.

   - ***If the Range Actuator Current parameter DOES perform as described***
5. Verify DTC C0364 or C0379 is only set as a history DTC.
   - ***If DTC C0364 or C0379 is as current***

     Refer to Circuit/System Testing.

   - ***If DTC C0364 or C0379 is only set as history***

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

6. Visually inspect each connector terminal of the K69 transfer case control module X1 connector and the M26 front axle engagement actuator connector for damage or corrosion. Repair as necessary.
7. Clear DTC C0364 or C0379 from history.

8. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If DTC C0364 or C0379 sets***

     Refer to Circuit/System Testing.

   - ***If DTC C0364 or C0379 does not set***
9. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the M26 front axle engagement actuator.
2. Ignition ON, engine OFF.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J-35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 3-11 is performed on the M26 front axle engagement actuator harness connector using the BL probes J-35616-64B.**

3. Test for a True B+ (+0.0/-1.0 V) between the ignition 1 voltage circuit terminal 1 and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - ***If less than B+ (+0.0/-1.0 V)***
   1. Ignition OFF, remove the F40UA fuse, X50A fuse block - underhood.

      or

      Disconnect the X2 harness connector at the X50A fuse block - underhood.

   2. Test for less than 10 Ω in the run/crank ignition 1 voltage circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between the run/crank ignition 1 voltage circuit, terminal 1 and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.

- If less than infinite resistance, repair the short to ground condition in the circuit.
- If greater than 10 Ω

4. Test for greater than 10 Ω between run/crank ignition 1 voltage circuit, terminal 1 and all other terminals of the M26 front axle engagement actuator.
   - If 10 Ω or less, repair the short together condition in the affected circuits.
   - If greater than 10 Ω
5. Ignition ON.
6. Test for a less than 1.0 V between the run/crank ignition 1 voltage circuit, terminal 1, and a good ground such as the ground terminal of the **EL-49742** harness, black terminal.
   - If 1.0 V or greater, repair the short to voltage in the circuit.
   - If less than 1 V, replace the KR73 ignition main relay. Refer to X50A fuse block - underhood label.

- ***If B+ (+0.0/-1.0 V)***

4. Ignition 1 voltage circuit OK.
5. Test for a true B+ (+0.0/-1.0 V) between the ground circuit, terminal 4, and the run/crank ignition 1 voltage circuit, terminal 1 or the B+ terminal of the **EL-49742** harness, red terminal.

- ***If less than the B+ (+0.0/-1.0 V)***

1. Ignition OFF, disconnect the grounding bolt G110. Refer to **Ground Views** .
2. Test for less than 10 Ω in the ground circuit end to end.
   - If 10 Ω or greater, repair the open/high resistance in the circuit.
   - If less than 10 Ω
3. Test for infinite resistance between the ground circuit, terminal 4 and a good ground such as the ground terminal of the **EL-49742** harness, black terminal.
   - If 10 Ω or less, repair the short to ground condition in the circuit.
   - If greater than 10 Ω
4. Test for infinite resistance between ground circuit, terminal 4 and all other terminals of the M26 front axle engagement actuator harness connector.
   - If 1 Ω or less, repair the short together condition in the affected circuits.
   - If greater than 1 Ω
5. Ignition ON.
6. Test for a less than 1.0 V between the ground circuit, terminal 4, and a good ground such as the ground terminal of the **EL-49742**

harness, black terminal.

- If 1.0 V or greater, repair the short to voltage in the circuit.
- If less than 1 V, clean the G110 grounding surface. Refer to **Testing for Intermittent Conditions and Poor Connections** .

- ***If B+***

6. Ground circuit OK.
7. Test for a diagnostic B+ (+0.0/-1.0 V) between the four wheel drive wheel lock indicator circuit, terminal 3, and the run/crank ignition 1 voltage circuit, terminal 1 or the B+ terminal of the **EL-49742** harness, red terminal.

- ***If less than B+ (+0.0/-1.0 V)***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in four wheel drive wheel lock indicator circuit end to end.
   - If 10 Ω or greater, repair the open/high resistance in the circuit.
   - If less than 10 Ω
3. Test for infinite resistance between the four wheel drive wheel lock indicator circuit, terminal 3 and a good ground such as the ground terminal of the **EL-49742** harness, black terminal.
   - If less than infinite resistance, repair the short to ground condition in the circuit.
   - If greater than 10 Ω
4. Test for infinite resistance between four wheel drive wheel lock indicator circuit, terminal 3 and all other terminals of the M26 front axle engagement actuator harness connector.
   - If less than infinite resistance, repair the short together condition in the affected circuits.
   - If greater than 10 Ω
5. Ignition ON.
6. Test for a less than 1.0 V between the four wheel drive wheel lock indicator circuit, terminal 3, and a good ground such as the ground terminal of the **EL-49742** harness, black terminal.
   - If 1.0 V or greater, repair the short to voltage in the circuit.
   - If less than 1 V, replace the K69 transfer case control module. Refer to **Transfer Case Control Module Replacement**.

- ***If B+***

8. Four wheel drive wheel lock indicator circuit OK.
9. Test for 2.8 to 4.8 V between the test points: Front Axle Actuator Control & Chassis Ground

- ***If less than 2.8 V***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in front axle actuator control circuit end to end.
   - If 10 Ω or greater, repair the open/high resistance in the circuit.
   - If less than 10 Ω
3. Test for greater than 10 Ω between the front axle actuator control circuit, terminal 2 and a good ground such as the ground terminal of the **EL-49742** harness, black terminal.
   - If 10 Ω or less, repair the short to ground condition in the circuit.
   - If greater than 10 Ω
4. Test for greater than 1 Ω between front axle actuator control circuit, terminal 2 and all other terminals of the M26 front axle engagement actuator harness connector.
   - If 1 Ω or less, repair the short together condition in the affected circuits.
   - If greater than 1 Ω

- ***If greater than 4.8 V***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for greater than 5Ω between front axle actuator control circuit, terminal 2 and all other terminals of the M26 front axle engagement actuator harness connector.
   - If 5Ω or less, repair the short together condition in the affected circuits.
   - If greater than 5Ω
3. Ignition ON.
4. Test for a less than 1.0 V between the front axle actuator control circuit, terminal 2, and a good ground such as the ground terminal of the **EL-49742** harness, black terminal.
   - If 1.0 V or greater, repair the short to voltage in the circuit.
   - If less than 1 V, replace the K69 transfer case control module. Refer to **Transfer Case Control Module Replacement** .

- ***If between 2.8 and 4.8 V***

10. The run/crank ignition 1 voltage circuit, the front axle switch signal circuit, the front axle control circuit, the ground circuit, and the K69 transfer case control module are OK.

Component Testing

M26 Front Axle Engagement Actuator

NOTE:

- **Circuit/System Testing must be performed before Component Testing.**
- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J-35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 3-4 is performed on the M26 front axle engagement actuator harness connector using the BL probes J-35616-65B.**

1. Ignition OFF. Disconnect the connector at the front axle engagement actuator.
2. Remove the M26 front axle engagement actuator.
3. Connect the M26 front axle engagement actuator connector. Position the M26 front axle engagement actuator so that it is visible from the side of the vehicle.
4. Using the Front Axle Engagement Actuator control function of the scan tool, command the front axle to engage and disengage. When commanded to engage, the plunger on the M26 front axle engagement actuator should extend. When commanded to disengage, the plunger should retract.
   - ***If the M26 front axle engagement actuator does NOT perform as described***

     replace the M26 front axle engagement actuator. Refer to **Front Drive Axle Actuator Replacement (8.25 Inch LD Axle)** **Front Drive Axle Actuator Replacement (9.25 Inch HD Axle)** .

   - ***If the M26 front axle engagement actuator DOES perform as described***
5. Refer to **Front Axle Will Not Engage**, or **Front Axle Will Not Disengage**.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Control Module References** for transfer case control module replacement, setup, and programming
- Refer to **Transfer Case Selector Switch Replacement (Chevrolet / GMC)Transfer Case Selector Switch Replacement (Cadillac)**
- Refer to **Four-Wheel Drive Does Not Engage**
- Refer to **Four-Wheel Drive Does Not Disengage**
- Refer to **Front Drive Axle Actuator Replacement (8.25 Inch LD Axle)** **Front Drive Axle Actuator Replacement (9.25 Inch HD Axle)**

DTC C0374: GENERAL SYSTEM PERFORMANCE TEMPERATURE HIGH

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptor

DTC C0374 54

General System Performance Temperature High

Diagnostic Fault Information

Transfer Case Encoder Motor Brake

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Invalid
Battery Positive Voltage Pin B	-	C0321 04	-	-
Lock Solenoid Control Pin C	C0321 02	C0321 04	C0321 01	C0321 08

Wheel Speed Sensors

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Front Wheel Speed Sensor 12 Volt Reference	C0035 00	C0035 00	-	C0035 5A
Left Front Wheel Speed Sensor Signal	C0035 00	C0035 00	C0035 00	C0035 5A
Right Front Wheel Speed Sensor 12 Volt Reference	C0040 00	C0040 00	-	C0040 5A
Right Front Wheel Speed Sensor Signal	C0040 00	C0040 00	C0040 00	C0040 5A
Left Rear Wheel Speed Sensor 12 Volt Reference	C0045 00	C0045 00	-	C0045 5A
Left Rear Wheel Speed Sensor Signal	C0045 00	C0045 00	C0045 00	C0045 5A
Right Rear Wheel Speed Sensor 12 Volt Reference	C0050 00	C0050 00	-	C0050 5A
Right Rear Wheel Speed Sensor Signal	C0050 00	C0050 00	C0050 00	C0050 5A

Circuit/System Description

The general system performance DTC sets based on a thermal module within the transfer case shift control module (TCCM) software. The components included in this thermal model are the motor driver within the TCCM, the transfer case shift motor, and the clutch inside the transfer case.

This fault occurs when one of the three components included in the thermal model surpass the upper limits of this model indicating possible damage to the transfer case or other driveline components. This DTC detects an over temperature condition base on a thermal model.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- DTC C0379 is not set.
- Vehicle speed > 5 kph (3 mph)

Conditions for Setting the DTC

This DTC sets if one of three components: motor driver inside the TCCM, transfer case clutch, or the shift motor, exceed the thermal model within the software for the module.

Action Taken When the DTC Sets

- All range and mode changes disabled until thermal model indicates temperature acceptable.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- The TCCM clears the DTC once the conditions for setting the DTC are no longer present.
- A history DTC clears after 40 consecutive warm-up cycles without a fault present.
- History and current DTCs can be cleared using a scan tool.

Diagnostic Aids

- The TCCM provides a reference voltage of 1.25-3.75 V on the motor B circuit for diagnostic purposes.
- It is possible to have windings inside the motor short to the case resulting in a short to ground.
- A problem where the front axle actuator is unable to mechanically engage can cause this DTC to set.
- A worn transfer case clutch can cause this DTC to set.

- A motor brake not holding can cause this DTC to set.
- Faulty wheel speed sensors can cause this DTC to set. When driving at a steady speed, the scan tool should display the same values for the following data parameters in the electronic brake control module (EBCM):
  - Left and right front wheel speed sensors
  - Left and right rear wheel speed sensors

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Transfer Case Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON, engine OFF.
2. Install a scan tool.
3. Ensure no other ECBM or TCCM codes are set.

- If any other EBCM or TCCM DTC's are set, diagnose them first.

Circuit/System Testing

1. Engage parking brake.
2. Block rear wheels.
3. Lift front wheels.
4. Key ON, engine OFF. Install scan tool.
5. Transfer case in 2WD HI. Transmission in Neutral.
6. Mechanical binding. - Using the Special Functions capability of the scan tool, engage the front axle. While holding one front tire stationary, spin the other tire. The front propshaft should turn.
   - If the front propshaft does not turn, inspect the front axle clutch fork for mechanical binding.
7. Wheel speed sensors. - Take the vehicle on a short test drive on a smooth and level road. Using the Data Display function of the ECBM feature of the scan tool, verify that the front and rear wheel speeds sensors display do not vary or become intermittent.
   - If while driving at a steady speed the RPM values vary or becomes intermittent, check the EBCM for wheel speed DTC's. Wheel speed DTC's diagnostics are in antilock brake systems.
8. Transfer case encoder motor brake. - Using a scan tool, clear DTC's. Shift the vehicle to 2WD HI. Monitor the transfer case motor amperage parameter in the Data Display feature of the scan tool. Using the transfer case shift control switch, command the transfer case to the 4WD HI mode. The transfer case motor amperage should increase while the motor is shifting and then return to 0 amps within 5 seconds or less.
   - If the amperage stays high longer than 5 seconds, this indicates the brake is not holding. Replace the transfer case motor.
9. Transfer case clutch integrity. - Shift the vehicle into 4WD HI and take it for a test drive. Clear the DTC if possible. Monitor front and rear wheel speeds using the EBCM data display. Under heavy acceleration the front and rear wheel speeds should be similar.
   - If the front wheel speeds are much lower, this indicates a weak clutch and a transfer case tear down and inspection will be required.
10. If all prior evaluations test normal, reprogram the TCCM and perform the ATC Motor Learn procedure in the Special Functions feature of the scan tool or the **Transfer Case High/Low Clutch Reset** procedure in the service manual.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Control Module References** for TCSCM replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset** for Motor Learn Procedure
- Refer to **Four-Wheel Drive Does Not Engage**

- Refer to **Front Drive Axle Clutch Fork Inspection**
- Refer to **Transfer Case Assembly Replacement**

DTC C0387: UNABLE TO COMPLETE SHIFT

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptor

DTC C0387 00

Unable to Complete Shift

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Circuit/Component Timeout
Unable to Complete Shift	-	-	-	C0387 00
Transfer Case Motor Clockwise Control	C0306 02	C0306 04	C0306 01	C0306 54 or C0381 54
Transfer Case Motor Counter-Clockwise Control	C0306 02	C0306 04	C0306 01	C0306 54 or C0381 54

Circuit/System Description

The A16 Transfer Case Motor, also known as the transfer case range actuator, is a bi-directional, permanent magnet, DC motor. When energized, through the transfer case clockwise circuit or transfer case counter-clockwise circuit, the ground is provided by the opposing motor control circuit which becomes grounded through the transfer case control module ground circuit. The transfer case range actuator, through a series of gears, rotates the transfer case control actuator shaft which moves the transfer case two/four wheel drive actuator cam and transfer case high/low shift fork in order to shift the transfer case between the following modes or ranges:

- 2WD
- 4WD/AWD Automatic

- 4WD High/Locked
- 4WD Low
- Neutral

If the shift lever detent shaft were to bind, or there was a mechanical failure, or the transfer case clockwise circuit and the transfer case counter-clockwise circuit were shorted together, the shift would not be completed. This will cause the DTC to set in order to protect system components from damage.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- No DTC P0562 or P0563.
- DTC C0387 runs continuously.

Conditions for Setting the DTC

A shift request was received but could not be completed within 15 seconds.

Action Taken When the DTC Sets

- All shifting disabled.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- The transfer case control module clears the DTC once the conditions for setting the DTC no longer exist.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- The transfer case clockwise circuit shorting to the transfer case counter-clockwise circuit could cause this DTC to set.
- It is possible to have windings inside the transfer case motor shorted to the case resulting in a short to ground causing this DTC to set.
- The default actions for C0321 may set C0387.
- **EL-49741** harness is a good source for 9 V.

- **EL-49742** harness is a good source for B+ and ground.
- The transfer case fill and drain plugs are a good source for ground.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J-35616** GM-Approved Terminal Test Kit

For equivalent regional tools, refer to **Special Tools**.

Circuit/System Verification

1. Verify that the TREC fuse, and the Miscellaneous IGN fuse, underhood fuse block, are NOT open.
    - **If the TREC fuse is OPEN**

Test the battery positive voltage circuit, K69 transfer case control module harness X3, terminal C, for a short to ground. Refer to **Testing for Short to Ground** .

- **If the Miscellaneous IGN fuse is OPEN**

  Test the ignition 1 voltage circuit, K69 transfer case control module harness X2, terminal 6, for a short to ground. Refer to **Testing for Short to Ground** .

- **If the TREC fuse and the Miscellaneous IGN fuse are NOT open**

2. Ignition ON, engine OFF.
3. Verify no other DTC's are set. If any other DTC's are set, diagnose them first.
4. Verify DTC C0387 is only set as a history DTC.
   - **If DTC C0387 is set as current**

     Refer to Circuit/System Testing.

   - **If DTC C0387 is set as history**

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

5. Visually inspect each connector terminal of the K69 transfer case control module and the A16 transfer case motor connector for damage or corrosion. Repair as necessary.
6. Clear DTC C0387 from history.
7. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - **If DTC C0387 sets**

     Refer to Circuit/System Testing.

   - **If DTC C0387 does not set**
8. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the A16 transfer case motor, also known as the transfer case range actuator.

2. Ignition ON, engine OFF.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J-35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 3-5 is performed on the A16 transfer case motor harness connector using the PU probes J 35616-4A.**

3. Test for 1.0-2.5 V between the transfer case motor counter-clockwise control circuit terminal D and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - **If less than the specified range**
   1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the transfer case motor counter-clockwise control circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between transfer case motor counter-clockwise control circuit terminal D and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the transfer case motor counter-clockwise control circuit terminal D and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.
   - **If greater than the specified range**
   1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the transfer case motor counter-clockwise control circuit terminal D and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.
      - If less than 1 V
   3. Test for greater than 10 Ω between the transfer case motor counter-clockwise control circuit, terminal D and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.

- If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

- **If within the specified range**

4. Transfer case motor counter-clockwise control circuit and K69 transfer case control module OK.
5. Test for 3.0-4.5 V between the transfer case motor clockwise control circuit terminal A, and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.

- **If less than the specified range**

1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in the transfer case motor clockwise control circuit end to end.
   - If 10 Ω or greater, repair the open/high resistance in the circuit.
   - If less than 10 Ω
3. Test for infinite resistance between transfer case motor clockwise control circuit terminal A and a good ground.
   - If less than infinite resistance, repair the short to ground in the circuit.
   - If infinite resistance
4. Test for greater than 10 Ω between the transfer case motor clockwise control circuit terminal A and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset** .

- **If greater than the specified range**

1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
2. Test for less than 1 V between the transfer case motor clockwise control circuit terminal A and a good ground.
   - If 1 V or greater, repair the short to voltage in the circuit.
   - If less than 1 V
3. Test for greater than 10 Ω between the transfer case motor clockwise control circuit, terminal A and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset** .

- **If within the specified range**

6. Transfer case motor counter-clockwise control circuit, transfer case motor clockwise control circuit and K69 transfer case control module OK.

Component Testing

A16 Transfer Case Motor (Transfer Case Range Actuator)

1. Remove the A16 transfer case motor from transfer case. Using a paint pen or marker, place indexing marks on the A16 transfer case motor drive gear and the mounting surface of the A16 transfer case motor.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J-35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 2-11 is performed on the A16 transfer case motor harness connector using the PU probes J 35616-5.**

2. Attach the red lead from one of the **EL-49741** harnesses to the battery positive voltage terminal of the A16 transfer case motor, terminal B.
3. Attach the black lead from this same jumper harness to the transfer case lock solenoid control terminal of the A16 transfer case motor, terminal C.
4. Attach a 9-volt battery to this harness (not included). You should hear the A16 transfer case motor unlock.
   - **If you do NOT hear the A16 transfer case motor unlock**

     Replace the A16 transfer case motor and perform the Range Actuator Learn procedure.

   - **If you DO hear the A16 transfer case motor unlock**
5. Attach the red lead from the other **EL-49741** jumper harness to the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A.
6. Attach the black lead from this same jumper harness to the transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D.
7. Touch the battery terminals of the 9-volt battery to the battery terminals of the jumper harness. This should rotate the A16 transfer case motor drive gear in either a clockwise or counter-clockwise rotation depending on battery orientation.
   - **If the A16 transfer case motor drive gear does not perform as described**

     Replace the A16 transfer case motor and perform the Range Actuator Learn Procedure.

- **If The A16 transfer case motor drive gear performs as described**

8. Verify 0.3-40 Ω resistance between the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A and the transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D.
   - **If NOT 0.3-40 Ω**

     Replace the A16 transfer case motor and perform the Range Actuator Learn Procedure.

   - **If 0.3-40 Ω**
9. Test for infinite resistance between the following circuits and the A16 transfer case motor case:
   - Transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A
   - Transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D
   - **If less than infinite resistance**

     Replace the A16 transfer case motor and perform the Range Actuator Learn Procedure.

   - **If infinite resistance**
10. Test for infinite resistance between the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A and all other terminals on the A16 transfer case motor harness except the transfer case motor counter-clockwise control circuit of the A16 Transfer Case Motor, terminal D.
    - **If less than infinite resistance**

      Replace the A16 transfer case motor and perform the Range Actuator Learn Procedure.

    - **If infinite resistance**
11. Test for infinite resistance between the transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D. and all other terminals on the transfer case range actuator harness except the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A.
    - **If less than infinite resistance**

      Replace the A16 transfer case motor and perform the Range Actuator Learn Procedure.

    - **If infinite resistance**
12. A16 transfer case motor OK.
13. Inspect the transfer case shift detent lever shaft for a binding condition.

- **If binding**

  Remove the transfer case and repair the binding condition. Refer to **Transfer Case Shudder or Binding**.

- **If not binding**

14. Refer to **Symptoms - Transfer Case**, and **Front Axle Will Not Disengage**.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Transfer Case Disassemble**
- Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**
- Refer to **Transfer Case High/Low Clutch Reset** .
- Refer to **Transfer Case Control Module Replacement**

DTC C038D: RANGE ACTUATOR - POSITION NOT LEARNED

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptor

DTC C038D 00

Range Actuator - Position Not Learned

Circuit/System Description

- This is an internal programing fault detection of the transfer case control module. No external circuits are involved.
- This DTC is set anytime a transfer case control module is replaced or reprogrammed.
- The Range Actuator Learn procedure must be performed in order for the transfer case control module to learn current clutch tolerance based on clutch stackup and accumulated clutch wear.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- DTC C038D runs at Engine ON.

Conditions for Setting the DTC

The Range Actuator Learn procedure for a new or reprogrammed transfer case control module has not been performed.

Action Taken When the DTC Sets

- All shifting disabled until the Range Actuator Learn procedure has been performed.
- The SERVICE 4WD indicator illuminates.
- No mode position LED's illuminated.

Conditions for Clearing the DTC

The transfer case control module only clears the DTC once the Range Actuator Learn procedure has been successfully performed.

Diagnostic Aids

The default actions for other transfer case DTC's can cause C038D to set.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX 3

Description and Operation

Transfer Case Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Engine ON. Let engine run for at least 1 minute.
2. Ignition OFF for at least 30 seconds to allow for the complete shutdown of the K69 Transfer Case Control Module.
3. Engine ON.
4. Verify that no other transfer case DTC's are set.
   - ***If any other transfer case DTC's are set***

     Diagnose it first. Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

   - ***If no other transfer case DTC's are set***
5. Verify that DTC C038D is not set.
   - ***If DTC C038D is set***

     Perform the Range Actuator Learn procedure. Refer to **Transfer Case High/Low Clutch Reset**.

   - ***If DTC C038D is NOT set***
6. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Refer to **Transfer Case High/Low Clutch Reset** for Range Actuator Learn Procedure

DTC C0392, P0642, OR P0643: TRANSFER CASE RANGE POSITION SENSOR CIRCUIT/5V REFERENCE 1 VOLTAGE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptors

DTC C0392 08

Transfer Case Range Position Sensor Circuit Performance - Signal Invalid

DTC C0392 28

Transfer Case Range Position Sensor Circuit - Incorrect Frequency

DTC P0642 00

5V Reference 1 Low Voltage

DTC P0643 00

5V Reference 1 High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Invalid
Rotational Position Sensor Circuit (Rotary Position Sensor Signal)	C0392 08	C0392 08	C0392 08	C0392 08 or C0392 28
5-Volt Reference (Rotary Position Sensor Supply 5V/Sensor Reference Voltage 1)	P0642	P0643	P0643	C0392 08 or C0392 28
Low Reference (Rotary Position Sensor Return)	-	C0392 08	-	C0392 08 or C0392 28

Circuit/System Description

The transfer case control module receives input from the transfer case B227 Gear Position Sensor, also known as the range position sensor or the rotational position sensor. The gear position sensor receives a 5-volt reference signal from the transfer case control module. In return the gear position sensor sends the transfer case control module a variable pulse width modulated signal indicating the position of the transfer case. The gear position sensor works in conjunction with the range actuator position sensor, inside the A16 Transfer Case Motor, also known as the transfer case range actuator, to confirm transfer case position. The gear position sensor is more sensitive than the range actuator position sensor and is able to indicate to the transfer case control module the exact position of the transfer case between range changes. It is also able to show how much clutch activation is being commanded at any time.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- No DTC P0562 or P0563.
- No DTC P0652, P0653, or C0397 - C0392 only.
- DTC C0392, P0642 and P0643 run continuously within the enabling conditions.

Conditions for Setting the DTC

C0392 08

- The transfer case control module detects a transfer case range position sensor voltage that does not constantly change, but remains low, <0.25 V, indicating a short to ground.

  Or

- The transfer case control module detects a gear position sensor voltage that does not constantly change, but remains high, >6.0 V, indicating a short to voltage.

C0392 28

The transfer case control module does not receive a sensor reference voltage 1 circuit, also known as the 5V reference 1 circuit, of 4.8-5.2 volts.

P0642

The transfer case control module detects less than 4.8 V on the transfer case reference voltage 1 circuit, also known as the 5V reference 1 circuit.

P0643

The transfer case control module detects greater than 5.2 V on the transfer case sensor reference voltage 1 circuit, also known as the 5V reference 1 circuit.

Action Taken When the DTC Sets

- DTC C398 disabled.
- All shifting disabled.
- Clutch torque increased to maximum torque.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- The transfer case control module clears the DTC once the conditions for setting the DTC are no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- **EL-49742** harness is a good source for B+ and ground.
- The transfer case drain plug is a good source for ground.
- Typical Gear Position Sensor parameter values:
  - 2WD = 33-43Â°
  - 4WD/AWD Automatic = 87-204Â°
  - 4WD High/Locked = 110-204Â°
  - 4WD Low = -140Â° to -69Â°
  - Neutral = -5Â° to +5Â°

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J-35616** GM-Approved Terminal Test Kit

For equivalent regional tools, refer to **Special Tools**.

Circuit/System Verification

1. Verify that all range selections of the S77 transfer case shift control switch match the following parameters in the Data Display feature of the scan tool:
    - Range Actuator Position
    - Transfer Case Commanded Position
    - Transfer Case Range
    - ***If NOT all of the parameters match the S77 transfer case shift control switch position***

      Refer to Circuit/System Testing.

    - ***If ALL of the parameters match the S77 transfer case shift control switch position***
2. Verify that for all range selections of the S77 transfer case shift control switch, the Transfer Case Range Position Sensor parameter and the

Range Actuator Position Sensor parameter track within 5 degrees of each other.

- ***If the parameters do NOT track within 5 degrees of each other***

  Refer to Circuit/System Testing.

- ***If the parameters DO track within 5 degrees of each other***

3. Verify DTC C0392, P0642, or P0643 is only set as a history DTC.
   - ***If any of the DTCs are set as current***

     Refer to Circuit/System Testing.

   - ***If any of the DTCs are only set as history***

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

4. Visually inspect each connector terminal of the K69 transfer case control module X1 connector and the B227 gear position sensor connector for damage or corrosion. Repair as necessary.
5. Clear DTC C0392, P0642, or P0643 from history.
6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If any of the DTCs are set***

     Refer to Circuit/System Testing.

   - ***If none of the DTCs set***
7. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B227 gear position sensor, also known as the rotational position sensor.
2. Ignition ON, engine OFF.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J-35616 Kit. Use of an improper test probe may deform the terminal, resulting**

in intermittent open conditions.

- **Testing for steps 3-7 is performed on the B227 gear position sensor harness connector using the GY probes J-35616-2A.**

3. Test for 4.8-5.2 V between the 5-Volt reference circuit, terminal B and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - ***If less than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the 5-Volt reference circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between 5-Volt reference circuit terminal B and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the 5-Volt reference circuit terminal B and all other terminals of the B227 gear position sensor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

        Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

   - ***If greater than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the 5-Volt reference circuit terminal B and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.
      - If less than 1 V
   3. Test for greater than 10 Ω between the 5-Volt reference circuit, terminal B and all other terminals of the B227 gear position sensor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

4. 5-Volt reference circuit and K69 transfer case control module OK.
5. Test for 4.8-5.2 V between the 5-Volt reference circuit, terminal B, and the low reference circuit, terminal A.

- ***If less than the specified range***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in the low reference circuit end to end.
   - If 10 Ω or greater, repair the open/high resistance in the circuit.
   - If less than 10 Ω
3. Test for infinite resistance between low reference circuit and a good ground.
   - If less than infinite resistance, repair the short to ground in the circuit.
   - If infinite resistance
4. Test for greater than 10 Ω between the low reference circuit, terminal A and all other terminals of the B227 gear position sensor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

- ***If greater than the specified range***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
2. Test for less than 1 V between the switch signal circuit, terminal A and a good ground.
   - If 1 V or greater, repair the short to voltage in the circuit.
   - If less than 1 V
3. Test for greater than 10 Ω between the switch signal circuit, terminal A and all other terminals of the B227 gear position sensor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

6. Low reference circuit and K69 transfer case control module OK.
7. Test for 4.8-5.2 V between the rotational position sensor circuit, terminal C and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - ***If less than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the rotational position sensor circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between rotational position sensor circuit terminal C and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the rotational position sensor circuit terminal C and all other terminals of the B227 gear position sensor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

        Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

   - ***If greater than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the rotational position sensor circuit terminal C and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.
      - If less than 1 V
   3. Test for greater than 10 Ω between the rotational position sensor circuit, terminal C and all other terminals of the B227 gear position sensor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

        Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

8. Rotational position sensor circuit and K69 transfer case control module OK.

Component Testing

B227 Gear Position Sensor

1. Key OFF. Disconnect the connector at the B227 gear position sensor.
2. Remove the B227 gear position sensor from the transfer case.
3. Connect the B227 gear position sensor.
4. Verify that the Transfer Case Range Position Sensor parameter sweeps between -146Â° and 204Â° while rotating the center locating tab of the B227 gear position sensor.
   - ***If the Transfer Case Range Position Sensor parameter does NOT sweep between -146Â° and 204Â°***

     Replace the B227 gear position sensor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Position Sensor Replacement**.

   - ***If the Transfer Case Range Position Sensor parameter DOES sweep between -146Â° and 204Â°***
5. B227 gear position sensor OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Control Module References** for K69 transfer case control module replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset**
- Refer to **Transfer Case Two/Four Wheel Drive Actuator Position Sensor Replacement**

DTC C0396, C039E, P0652, OR P0653: RANGE ACTUATOR POSITION SENSOR CIRCUIT VOLTAGE/RANGE ACTUATOR POSITION SENSOR DIRECTION SIGNAL CIRCUIT VOLTAGE/5V REFERENCE 2 CIRCUIT VOLTAGE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptors

DTC C0396 03

Range Actuator Position Sensor Circuit Low Voltage

DTC C0396 07

Range Actuator Position Sensor Circuit High Voltage

DTC C039E 03

Range Actuator Position Sensor Direction Signal Circuit Low Voltage

DTC C039E 07

Range Actuator Position Sensor Direction Signal Circuit High Voltage

DTC P0652

5V Reference 2 Circuit Low Voltage

DTC P0653

5V Reference 2 Circuit Low Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Invalid
Incremental Encoder Sensor (8 V) Supply	P0652	C0387 58 or C038D 00 (C0398 when shifting between ranges)	P0653	-
Incremental Encoder Impulse Signal	C0396 03	C0396 07	C0396 07	-
Incremental Encoder Direction Signal	C039E 03	C039E 07	C039E 07	-
Incremental Encoder Sensor Return/Low Reference	-	C0396 03	-	-

Circuit/System Description

The transfer case control module receives input from the range actuator position sensor and the transfer case range position sensor. Both sensors send this information as voltage signals which are converted to degrees and rotational direction by the transfer case control module software. If the two sensors disagree by greater than a predetermined amount the DTC will set.

The range actuator position sensor receives an 8 volt reference signal from the transfer case control module. In return the range actuator position sensor sends the transfer case control module a variable pulse width modulated signal indicating the position of the transfer case and a range actuator position direction signal. The range actuator position sensor, inside the A16 transfer case motor, also known as the transfer case range actuator, works in conjunction with the range position sensor to confirm transfer case position. The range actuator position sensor is more sensitive than the transfer case range position sensor and is able to indicate to the transfer case control module the exact position of the transfer case between range changes. It is also able to show how much clutch activation is being commanded at any time.

The transfer case range position sensor, also known as the transfer case two/four wheel drive actuator position sensor, receives a 5 volt reference signal from the K69 transfer case control module and sends back a continuously variable pulse width modulated signal to the K69 transfer case control module. This continuously variable signal indicates the position of the transfer case actuator.

The range actuator position sensor is more sensitive than the transfer case range position sensor, but needs to reference the transfer case range position sensor value at ignition ON and mode changes. The transfer case range position sensor is an absolute sensor. The K69 transfer case control module synchronizes the range actuator position sensor with the transfer case range position sensor at ignition ON and mode changes.

The range actuator position sensor is an integral part of the A16 Transfer Case Motor and cannot be replaced independently.

The transfer case range position sensor, also known as the B227 gear position sensor, is an independently replaceable part.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- No DTC P0562 or P0563.
- DTC C0396, C039E, P0652 and P0653 run continuously within the enabling conditions.

Conditions for Setting the DTC

C0396 03

Voltage on the sensor reference voltage 2 circuit, also known as the incremental encoder sensor (8 V) supply circuit, is 7.2-8.5 V, and voltage received by incremental encoder impulse signal circuit less than 0.35 V.

C0396 07

Voltage on the sensor reference voltage 2 circuit is 7.2-8.5 V, and voltage on incremental encoder impulse signal circuit greater than 4.6 V.

C039E 03

Voltage on the sensor reference voltage 2 circuit is 1.5-9.0 V, and voltage received by incremental encoder direction signal circuit less than 0.35 V.

C039E 07

Voltage on the sensor reference voltage 2 circuit is 1.5-9.0 V, and voltage on incremental encoder direction circuit greater than 4.5 V.

P0652

Voltage on sensor reference voltage 2 circuit less than 7.2 V.

P0653

Voltage on sensor reference voltage 2 circuit greater than 8.5 V.

Action Taken When the DTC Sets

The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

C0396 03 and C039E 03

- All shifting disabled.
- Clutch torque increased to maximum torque capacity during range shift from AWD, 4WD Low, and 4WD High only.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

C0396 07 and C039E 07

- All shifting disabled.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.
- Sensor reference voltage 2 circuit shut OFF.

P0652

- All shifting disabled.
- Clutch torque increased to maximum torque capacity during range shift from AWD, 4WD Low, and 4WD High only.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

P0653

- All shifting disabled.
- Clutch torque increased to maximum torque capacity during range shift from AWD, 4WD Low, and 4WD High only.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- The transfer case shift control module clears the DTC once the conditions for setting the DTC are no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- The range actuator position sensor and the transfer case range position sensor both show position in degrees, and should track each other. Monitor these sensors for erratic or unreasonable readings.
- If the range actuator position sensor is determined to be bad, the entire transfer case range actuator (transfer case motor) will have to be replaced as the range actuator position sensor is part of the transfer case range actuator and cannot be replaced independently.
- The transfer case fill and drain plugs are good sources for ground.
- Typical Gear Position Sensor parameter values:
  - 2WD = 33-43Â°
  - 4WD/AWD Automatic = 87-204Â°
  - 4WD High/Locked = 110-204Â°
  - 4WD Low = -140Â° to -69Â°
  - Neutral = -5Â° to +5Â°

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

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Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J-35616** GM-Approved Terminal Test Kit

For equivalent regional tools, refer to **Special Tools**.

Circuit/System Verification

1. Verify that all range selections of the S77 transfer case shift control switch match the following parameters in the Data Display feature of the scan tool:
    - Range Actuator Position
    - Transfer Case Commanded Position
    - Transfer Case Range
    - ***If NOT all of the parameters match the S77 transfer case shift control switch position***

      Refer to Circuit/System Testing.

- ***If ALL of the parameters match the S77 transfer case shift control switch position***

2. Verify that for all range selections of the S77 transfer case shift control switch, the Transfer Case Range Position Sensor parameter and the Range Actuator Position Sensor parameter track within 5 degrees of each other.
   - ***If the parameters do NOT track within 5 degrees of each other***

     Refer to Circuit/System Testing.

   - ***If the parameters DO track within 5 degrees of each other***
3. Verify DTC C0396, C039E, P0652, or P0653 is only set as a history DTC.
   - ***If any of the DTCs are set as current***

     Refer to Circuit/System Testing.

   - ***If any of the DTCs are only set as history***

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

4. Visually inspect each connector terminal of the K69 transfer case control module X1 connector and the A16 transfer case motor connector for damage or corrosion. Repair as necessary.
5. Clear DTC C0396, C039E, P0652, or P0653 from history.
6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If any of the DTCs are set***

     Refer to Circuit/System Testing.

   - ***If none of the DTCs set***
7. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the A16 transfer case motor, also known as the transfer case range actuator.
2. Ignition ON, engine OFF.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J-35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 3-9 is performed on the A16 transfer case motor harness connector using the PU probes J-35616-4A.**

3. Test for 7.2-8.5 V between the incremental encoder sensor (8 V) supply circuit terminal G and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - ***If less than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the incremental encoder sensor (8 V) supply circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between incremental encoder sensor (8 V) supply circuit terminal G and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the incremental encoder sensor (8 V) supply circuit terminal G and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

        Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

   - ***If greater than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the incremental encoder sensor (8 V) supply circuit terminal G and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.
      - If less than 1 V
   3. Test for greater than 10 Ω between the incremental encoder sensor (8 V) supply circuit, terminal G and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.

- If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

  Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

4. Incremental encoder sensor (8 V) supply circuit and K69 transfer case control module OK.
5. Test for 7.2-8.5 V between the incremental encoder sensor (8 V) supply circuit, terminal G, and the low reference circuit, terminal H.
   - ***If less than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the low reference circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between low reference circuit terminal H and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the low reference circuit, terminal H and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

        Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

   - ***If greater than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the low reference circuit, terminal H and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.
      - If less than 1 V
   3. Test for greater than 10 Ω between the low reference circuit, terminal H and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

6. Low reference circuit and K69 transfer case control module OK.
7. Test for 6.0-7.0 V between the incremental encoder impulse signal circuit, terminal E and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - ***If less than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the incremental encoder impulse signal circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between incremental encoder impulse signal circuit terminal E and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the incremental encoder impulse signal circuit terminal E and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

      Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

   - ***If greater than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the incremental encoder impulse signal circuit terminal E and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.
      - If less than 1 V
   3. Test for greater than 10 Ω between the incremental encoder impulse signal circuit terminal E and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

8. Incremental encoder impulse signal circuit and K69 transfer case control module OK.
9. Test for 6.0-7.0 V between the incremental direction signal circuit, terminal F and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - ***If less than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the incremental direction impulse signal circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between incremental encoder direction signal circuit terminal F and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the incremental encoder direction signal circuit terminal F and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

      Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

   - ***If greater than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the incremental encoder direction signal circuit terminal F and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.
      - If less than 1 V
   3. Test for greater than 10 Ω between the incremental encoder direction signal circuit terminal F and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

10. Incremental encoder direction signal circuit and K69 transfer case control module OK.
11. Replace the A16 transfer case motor.

    Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Control Module References** for K69 transfer case control module replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset**
- Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** for A16 transfer case motor replacement

DTC C0397: TRANSFER CASE CLUTCH/TRANSFER CASE RANGE POSITION SENSOR OVER TRAVEL

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptor

DTC C0397 54

Transfer Case Clutch High Temperature

DTC C0397 58

Transfer Case Clutch Performance

DTC C0397 4B (if equipped)

Transfer Case Clutch Calibration Not Learned

DTC C0397 F3

Transfer Case Clutch Worn Out Clutch

DTC C0397 F4

Transfer Case Range Position Sensor Over Travel

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Performance
Transfer Case Clutch Performance	-	-	-	C0397 54, C0397 58, C0397 4B, C0397 F3, or C0397 F4

Circuit/System Description

In 4WD/AWD Automatic range, the transfer case control module monitors the front and rear wheel speed sensors for slip. If the transfer case control module detects slip, and is unable to correct for a difference between the front and rear speed sensors, it will command the transfer case to apply the clutch. In addition, the transfer case control module tests for clutch pack wear by performing a high side kiss point check at power down and comparing it to the transfer case range actuator position sensor reading.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-8 V.
- No DTC P0562 or P0563.

C0397 54

- No C0379 01, C0379 04 or C0379 08 for thermal model.
- Vehicle speed greater than 5 km/h (3 MPH) and all wheel speeds at same speed.
- DTC C0397 54 runs continuously.

C0397 58

- Transfer case control module is NOT in shutdown mode due to thermal protection.
- DTC C0397 58 runs continuously.

C0397 4B

- Transfer case range: must begin in 4WD High/Locked and then be requested to shift to 4WD/AWD Automatic or 2WD.
- Only run during power down kiss point learn request.

C0397 F3

Only run during power down kiss point learn request.

C0397 F4

Only run during power down kiss point learn request.

Conditions for Setting the DTC

C0397 54

The transfer case control module has determined that the transfer case calculated clutch temperature model has exceeded the maximum allowable temperature for the second time.

C0397 58

The transfer case control module has detected that the transfer case clutch has failed to reach the desired output torque after three attempts.

C0397 4B

The transfer case control module has determined that the power down kiss point learn has failed 20 times in a row.

C0397 F3

The transfer case control module has determined that the maximum clutch wear out limit has been exceeded.

C0397 F4

The transfer case control module has detected that the transfer case range actuator position sensor, or the transfer case range position sensor has exceeded the upper/lower over travel limits.

Action Taken When the DTC Sets

- Shifting is still possible but in a reduced capacity which may cause undesirable slip correction events.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

C0397 54

Front axle disengaged.

C0397 58

Shifting disabled.

C0397 4B

- Max torque commanded for 4WD/AWD Automatic.
- The default actions for C0397 4B will cause DTC C038D to set.

C0397 F3

- Shifting disabled.
- Front axle disengaged.

C0397 F4

- Shifting disabled.
- Front axle disengaged.

Conditions for Clearing the DTC

- The transfer case control module clears the DTC once the condition for setting the DTC no longer exists.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.
- Only cleared by a successful kiss point learn. (DTC C0397 F3).
- Only cleared by the successful execution of the **Transfer Case High/Low Clutch Reset** procedure. (DTC C0397 F4).

Diagnostic Aids

- A stuck transfer case motor lock can cause C0397 58 to set.

- Faulty wheel speed sensors can cause DTC C0397 58 or C0397 F3 to set. When driving at a steady speed, the scan tool should display the same values for the following data parameters in the electronic brake control module:
  - Left and right front wheel speed sensors
  - Left and right rear wheel speed sensors

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON, engine OFF.
2. Install a scan tool.
3. Verify no other K17 Electronic Brake Control Module or K69 Transfer Case Control Module DTCs are set.
   - ***If any other K17 Electronic Brake Control Module Or K69 Transfer Case Control Module DTC's are set***

     diagnose them first.

   - ***If no other K17 Electronic Brake Control Module Or K69 Transfer Case Control Module DTC's are set***

4. Verify DTC C0397 is only set as a history DTC.
   - ***If DTC C0397 is set as current***

     Refer to Circuit/System Testing.

   - ***If DTC C0397 is set as history***
5. Clear DTC C0397 from history.
6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If DTC C0397 sets***

     Refer to Circuit/System Testing.

   - ***If DTC C0397 does not set***
7. All OK.

Circuit/System Testing

1. Install scan tool.
2. Wheel speed sensors:
   1. Take the vehicle on a short test drive on a smooth and level road.
   2. Verify that, when at a steady speed, all of the front and rear speed sensors parameters do not vary or become intermittent.
   - ***If while driving at a steady speed the RPM values vary or become intermittent***

     check the K17 Electronic Brake Control Module for wheel speed DTC's. Wheel speed DTC diagnostics are in antilock brake systems.

   - ***If all of the front and rear speed sensors parameters do not vary or become intermittent***
3. Transfer case clutch integrity:
   1. Shift the vehicle into 4WD High/Locked and take it for a test drive. Clear the DTC if possible.
   2. Verify that while under heavy acceleration that the front and rear wheel speeds are similar.
   - ***If the front wheel speeds are much lower***

     this indicates a weak clutch and a transfer case disassembly and inspection will be required. Refer to **Transfer Case Disassemble**.

- ***If the front and rear wheel speeds are similar***

4. A16 transfer case motor - brake/lock:
    1. Clear DTC's. Using the S77 Transfer Case Shift Control Switch function of the scan tool, shift the vehicle to 2WD range.
    2. Monitor the Transfer Case Motor Amperage parameter in the Data Display feature of the scan tool.
    3. Using the S77 Transfer Case Shift Control Switch function of the scan tool, command the transfer case to the 4WD High/Locked range.
    4. Verify that the Transfer Case Motor Amperage parameter increases while the motor is shifting, and then returns to 0 amps within 5 seconds or less.
    - ***If the amperage stays high longer than 5 seconds***

      this indicates the brake is not holding. Replace the A16 Transfer Case Motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**.

    - ***If the amperage increases while the motor is shifting, and then return to 0 amps within 5 seconds or less***
5. Mechanical binding:
    1. Engage parking brake.
    2. Block rear wheels.
    3. Lift front wheels.
    4. Ignition ON, engine OFF. Install scan tool.
    5. Transfer case in 2WD. Transmission in Neutral.
    6. Using the Front Axle Engagement Actuator control function, engage the front axle.
    7. Verify that the front prop shaft turns while holding one front tire stationary and spinning the other tire.
    - ***If the front prop shaft does not turn***

      inspect the front axle clutch fork for mechanical binding. Refer to **Four-Wheel Drive Does Not Disengage** .

    - ***If the front prop shaft turns***
6. If all prior evaluations test normal:
    1. Reprogram the K69 Transfer Case Control Module. Refer to **Control Module References** .
    2. Perform the Range Actuator Learn procedure in the Control Functions feature of the scan tool. Refer to **Transfer Case High/Low Clutch Reset**.
7. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.

- ***If DTC C0397 sets***

  replace the K69 Transfer Case Control Module and perform the Range Actuator Learn procedure. Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**.

- ***If DTC C0397 does not set***

8. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Control Module References** for K69 Transfer Case Control Module replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset** for Range Actuator Learn Procedure
- Refer to **Four-Wheel Drive Does Not Engage**

DTC C0398: RANGE ACTUATOR POSITION - RANGE POSITION CORRELATION

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptor

DTC C0398 00

Range Actuator Position - Range Position Correlation

Typical Scan Tool Data

Range/Parameter	2WD	4WD/AWD Automatic	4WD High/Locked	4WD Low	Neutral
Range Actuator Position Sensor (Â°)	33Â° to 43Â°	87Â° to 204Â°	110Â° to 204Â°	-69Â° to -140Â°	-5Â° to +5Â°
Sensor Reference Voltage 2 (V)	7.75-8.25 V	7.75-8.25 V	7.75-8.25 V	7.75-8.25 V	7.75-8.25 V

Range/Parameter	2WD	4WD/AWD Automatic	4WD High/Locked	4WD Low	Neutral
Range Actuator Position Sensor (V)	0.6-0.8 V or 3.7-4.1 V	0.6-0.8 V or 3.7-4.1 V	3.7-4.1 V	3.7-4.1 V	0.6-0.8 V or 3.7-4.1 V
Transfer Case Range Position Sensor (Â°)	33Â° to 43Â°	87Â° to 204Â°	110Â° to 204Â°	-69Â° to -140Â°	-5Â° to +5Â°

Circuit/System Description

The transfer case range actuator position sensor is also known as the incremental position sensor. The transfer case range actuator position sensor is an integral part of the A16 Transfer Case Motor and cannot be replaced independently. The A16 Transfer Case Motor is also known as the transfer case range actuator.

The B227 Gear Position Sensor is also known as the transfer case range position sensor, the two/four wheel drive actuator position sensor, or the rotational position sensor. The B227 Gear Position Sensor is an absolute sensor and is an independently replaceable part.

Both sensors send transfer case range position information to the transfer case control module as voltage signals, which is then converted to degrees by the transfer case control module software. If the two sensors disagree by greater than a predetermined amount, the DTC will set.

The range actuator position sensor is more sensitive than the B227 Gear Position Sensor, but needs to reference the B227 Gear Position Sensor value at ignition ON and range changes.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- No P0562 or P0563.
- DTC C0398 runs continuously.

Conditions for Setting the DTC

The range actuator position sensor and the range position sensor are both showing valid positions, but differ by greater than a predetermined amount when NO range change is in progress.

Action Taken When the DTC Sets

- Shifting disabled.

- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.
- Maximum clutch torque commanded when in 4WD High/Locked, 4WD/AWD Automatic, or 4WD Low, and during range shifts.

Conditions for Clearing the DTC

DTC 0398 can only be cleared by using a scan tool to clear codes twice consecutively.

Diagnostic Aids

- The range actuator position sensor and the range position sensor both show position in degrees. Monitor these parameters for erratic or unreasonable readings.
- An ignition ON, engine OFF sequence with transfer case motor removed, but still attached to the harness, may cause C0398 00 to set.
- Repeatedly commanding the transfer case range actuator forward or reverse without pressing the exit button between commands, to return to the "none" state, can result in incorrect readings.
- DTC C0398 is a latching DTC. This means that it stays current even with cycling the ignition ON & OFF. DTC 0398 can only be cleared by using a scan tool to clear codes twice consecutively. The first command to clear codes unlatches the DTC. The second command to clear codes clears the DTC.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON, engine OFF.
2. Connect a scan tool.
3. Monitor the Range Actuator Position Sensor and Range Position Sensor parameters on the scan tool. Using the S77 Transfer Case Shift Control Switch, shift the transfer case into all ranges. The Range Actuator Position Sensor parameter and Range Position Sensor parameter should track each other.
   - ***If the Range Actuator Position Sensor parameter and Range Position Sensor parameter do NOT track each other within 7 degrees***

     Refer to Circuit/System Testing.

   - ***If the Range Actuator Position Sensor parameter and Range Position Sensor parameter DO track each other within 7 degrees***
4. All OK.

Circuit/System Testing

1. Verify DTC C0392, P0642, P0643 (B227 Gear Position Sensor, also known as range position sensor), or C0396, C039E, P0652, P0653 (range actuator position sensor) is not set.
   - ***If any of the DTCs are set***

     Refer to **Diagnostic Trouble Code (DTC) List - Vehicle**

   - ***If none of the DTCs are set***
2. Go to Component Testing.

Component Testing

NOTE: **Order of component testing is important.**

1. B227 Gear Position Sensor (also known as Range Position Sensor)
   1. Ignition OFF. Disconnect the B227 Gear Position Sensor connector. Remove the B227 Gear Position Sensor. Inspect the mating surface for damage. Replace if damage is found.
   2. Rotate the B227 Gear Position Sensor tab to the lock position. Reconnect the B227 Gear Position Sensor.
   3. Ignition ON, engine OFF.

4. While monitoring the Range Position Sensor parameter on the scan tool, push in the locking tab and rotate the B227 Gear Position Sensor tab. In the lock position the Range Position Sensor parameter should read 33-43Â°. Upon rotating the range position sensor tab, the Range Position Sensor parameter should display a sweep from -146 to +204 degrees.
   - If the Range Position Sensor parameter does not display as described, replace the B227 Gear Position Sensor.

     Refer to **Transfer Case Two/Four Wheel Drive Actuator Position Sensor Replacement**.

   - If the Range Position Sensor parameter does display as described
5. Using a wide, flat blade screwdriver in the B227 Gear Position Sensor mounting slot, attempt to rotate the transfer case control actuator shaft. The shaft should not turn.
   - If the shaft can be turned, then internal damage has occurred to the transfer case control actuator shaft or mating gears. Refer to **Transfer Case Disassemble** and inspect and repair as necessary.
   - If the shaft can not be turned
6. B227 Gear Position Sensor OK.

2. A16 Transfer Case Motor - Range Actuator Position Sensor
   1. Remove the A16 Transfer Case Motor from transfer case. Using a paint pen or marker, place indexing marks on the A16 Transfer Case Motor drive gear and the mounting surface of the A16 Transfer Case Motor.
   2. Attach the A16 Transfer Case Motor to the A16 Transfer Case Motor connector.
   3. Ignition ON, engine OFF.

NOTE: **Pressing the exit button on the scan tool between commanding the Transfer Case Motor Control forward and reverse is critical to proper diagnosis. Pressing the exit button changes the commanded state to NONE. If you DO NOT press the exit button between changing directions, the Range Actuator Position Sensor parameter may not update. When this happens you have to command the new direction a second time in order for the scan tool to update. Repeatedly changing directions may cause the Range Actuator Position Sensor parameter to flip between the extremes, -150Â° and +360Â° or -360Â° and +360. Depending on software level the lower extreme is either -150Â° or -360Â°.**

   4. While monitoring the Range Actuator Position Sensor parameter, command the transfer case range actuator forward using the Transfer Case Motor Control function of the scan tool. After 10 seconds the Range Actuator Position Sensor parameter should read -150Â°, -360Â° or +360Â°. Push the exit button on the scan tool once to return the commanded state to NONE. Command the transfer case range actuator reverse. After 10 seconds the Range Actuator Position Sensor parameter should read +360Â°, -360Â° or -150Â°.
      - If the Range Actuator Position Sensor parameter does not display as described, repeat step 2. If the Range Actuator Position Sensor parameter continues to not display as described, replace the A16 Transfer Case Motor.

- If the Range Actuator Position Sensor parameter displays as described

5. Ignition OFF for at least 3 minutes. Install the A16 Transfer Case Motor.
6. Ignition ON, engine OFF. The K69 Transfer Case Control Module should relearn the transfer case range actuator position, and the Transfer Case Position parameter should display a valid range.
   - If the Transfer Case Position parameter displays Invalid, perform the Range Actuator Learn procedure. Refer to **Transfer Case High/Low Clutch Reset**.
   - If the Transfer Case Position parameter displays a valid range
7. A16 Transfer Case Motor - Range Actuator Position Sensor OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)**
- Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement**
- Refer to **Transfer Case Two/Four Wheel Drive Actuator Position Sensor Replacement**
- Refer to **Transfer Case High/Low Clutch Reset** for Range Actuator Learn Procedure

DTC C0550: ELECTRONIC CONTROL UNIT (ECU) FAILURE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptors

DTC C0550 37

Electronic Control Unit (ECU) Performance Watchdog Failure

DTC C0550 39

Electronic Control Unit (ECU) Internal Electronic Failure

Diagnostic Fault Information

Circuit	Watchdog/Safety Failure	Internal Electronic Failure
Electronic Control Unit Malfunction	DTC C0550 37	DTC C0550 39

Circuit/System Description

This is an internal fault detection of the transfer case shift control module (TCCM). This fault is handled inside the TCCM. No external circuits are involved.

At each power-up, the TCCM runs a self-test on the following:

- EEPROM Checksum
- ROM Checksum
- RAM Checksum
- RAM Malfunction

Conditions for Running the DTC

- The TCM runs the program to detect an internal condition at key ON. The only requirements are voltage and ground.
- Ignition ON.
- System voltage 10.5-18.0 V

Conditions for Setting the DTC

- The random access memory (RAM) of the TCCM has failed an operational test indicating that some portions of RAM are not functional.
- The read only memory (ROM) or the masked ROM of the TCCM has failed the Checksum test indicating that the data is not currently valid.
- The critical operational parameters stored in the EEPROM of the TCCM have failed the Checksum test indicating invalid data.

Action Taken When the DTC Sets

- The encoder motor will be deactivated for the remainder of the current ignition cycle.
- The transfer case shift control switch will illuminate the current mode position LED.
- No further mode changes shall be allowed.
- The TCCM will store freeze frame data.

- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- The TCCM will clear the DTC once the conditions for setting the DTC no longer exist.
- A history DTC will clear after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- DTC P0550 detects the wrong copy of non-volatile memory in RAM or a RAM read/write failure.
- DTC P0550 detects a non-volatile memory write error.
- DTC P0550 detects a corruption of the EPROM/Flash memory.
- When attempting to set TCCM internal DTCs, let the engine run for at least 1 minute and then shut the engine OFF for 30 seconds. Following this procedure will allow for a complete TCCM shutdown. Reprogram the TCCM and retest the DTC to see if the DTC resets.
- A low voltage condition can sometimes falsely set this DTC. Attempt to clear this DTC and retest.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Transfer Case Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**

- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Engine running. Let the engine run for at least 1 minute.
2. Ignition OFF for at least 30 seconds to allow for the complete shutdown of the TCCM.
3. Ignition ON, verify that DTC C0550 is not set.
    - If DTC C0550 sets, reprogram the TCCM. If the DTC resets, replace the TCCM. Perform the ATC motor learn procedure.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Control Module References** for TCSCM replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset**

DTC C0569: SYSTEM CONFIGURATION ERROR CALIBRATION NOT LEARNED

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptor

DTC C0569 4B

System Configuration Error Calibration Not Learned

Circuit/System Description

- This is an internal fault detection of the transfer case control module. No external circuits are involved.
- This DTC is set anytime a transfer case control module is replaced or reprogrammed.

- The Range Actuator Learn procedure must be performed in order for the transfer case control module to learn current clutch tolerance based on clutch stack-up and accumulated clutch wear.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.

Conditions for Setting the DTC

The Range Actuator Learn procedure for a new or reprogrammed transfer case control module has not been performed.

Action Taken When the DTC Sets

- Range shifting is disabled until the Range Actuator Learn procedure has been performed.
- The SERVICE 4WD indicator illuminates.
- No Range position LED's illuminated.

Conditions for Clearing the DTC

The transfer case control module clears the DTC once the Range Actuator Learn procedure has been successfully performed.

Diagnostic Aids

The default actions for C0306, C0321, C0387, C0392, C0396, C0397 or C0398 may cause C0569 to set.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**

- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON, engine ON. Let engine run for at least 1 minute.
2. Ignition OFF for at least 30 seconds to allow for the complete shutdown of the K69 Transfer Case Control Module.
3. Ignition ON, engine OFF.
4. Verify that no other transfer case DTC's are set.
   - ***If any other transfer case DTC's are set***

     diagnose them first.

   - ***If no other transfer case DTC's are set***
5. Verify that DTC C0569 is not set.
   - ***If DTC C0569 is set***

     perform the Range Actuator Learn procedure. Refer to **Transfer Case High/Low Clutch Reset**.

   - ***If DTC C0569 is not set***
6. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Refer to **Transfer Case High/Low Clutch Reset**

DTC C0896: DEVICE VOLTAGE RANGE THRESHOLD

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptors

DTC C0896 03

Device Voltage Range Below Threshold

DTC C0896 07

Device Voltage Range Above Threshold

Circuit/System Description

The transfer case shift control module (TCCM) monitors the battery voltage feed to the TCCM. This DTC detects if the battery voltage is out of range. This could indicate a vehicle wide issue in which all electrical components would be affected, or it could be TCCM specific due to poor power or ground connections.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18.5 V.

Conditions for Setting the DTC

System voltage above 18.5 V or below 10.5 V and a mode shift is requested.

Action Taken When the DTC Sets

- Shifting disabled until battery voltage is within specification.
- Mode indicator will illuminate current mode.

Conditions for Clearing the DTC

- The TCCM clears the DTC once the conditions for setting the DTC are no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.

- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- Any mode shift requested when the battery voltage is below 12 V may set this DTC.
- Improperly connecting the cables during a jump start can cause C0896 07 to set.
- The **Transfer Case High/Low Clutch Reset** procedure may need to be performed after repair.
- **EL-49742** harness is a good source for B+ and ground.
- A key OFF, key ON cycle may be needed to enable mode shifting.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

EL-49742 Battery Voltage B+ and Ground Source Harness

For equivalent regional tools, refer to **Special Tools**.

Circuit/System Verification

1. Verify that the TREC fuse, and the Miscellaneous IGN fuse, underhood fuse block, are NOT open.
   - If the TREC fuse is open, test the battery positive voltage circuit, TCCM harness X3 pin C, for a short to ground.
   - If the Miscellaneous IGN fuse is open, test the Ignition 1 voltage circuit, TCCM harness X2 pin 6, for a short to ground.
2. Ignition ON, engine OFF.
3. Using the Freeze Frame feature of the scan tool, review the Battery Voltage parameter when the DTC sets. The voltage should be above 12.0 V.
   - If the voltage is above 18.5 V, this is likely a vehicle issue such as an alternator problem, or the vehicle has been hooked up improperly during a jump start. Refer to **Symptoms - Engine Electrical** .
4. Using the Transfer Case Data Display feature of the scan tool, monitor the Battery Voltage parameter. The voltage should be above 12.0 V.
   - If the voltage is below 12.0 V, ensure that the battery is fully charged and working properly. Refer to **Battery Inspection/Test** , and **Battery Electrical Drain/Parasitic Load Test** .
5. While monitoring the Battery Voltage parameter, start the engine. Rev the engine to greater than 3000 RPM. The voltage should remain stable and below 18.5 V.
   - If the voltage is unstable or is greater than 18.5 V, ensure that the charging system is working properly. Refer to **Charging System Test** .

Circuit/System Testing

NOTE: **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J-35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**

1. Key OFF. Disconnect the X3 harness connector at the TCCM.
2. Measure the voltage at the battery. The voltage should be above 12.0 V.
   - If the voltage is below 12.0 V, ensure that the battery is fully charged and working properly. Refer to **Battery Inspection/Test** , and **Battery Electrical Drain/Parasitic Load Test** .
3. Install **EL-49742** harness. Test for B+ (+0.0/-0.5 V) between the 12 volt terminal (red) and the ground terminal (black) of **EL-49742** harness.
   - If the voltage is less than the specified value, a vehicle wide issue is indicated. Inspect the battery positive circuit wire routing for chafed wires or damaged inline harness connectors that could cause unexpected voltage drops.
4. Using the purple probe J-35616-4A, test for B+ (+0.0/-0.5 V) between the battery positive voltage circuit, TCCM X3 pin C, and the ground terminal of **EL-49742** harness, black terminal.
   - If the voltage is less than the specified range, test the battery positive voltage circuit for an open/high resistance or short to ground.

5. Using the purple probes J-35616-4A, test for B+ (+0.0/-0.5 V) between the battery positive voltage circuit, TCCM X3 pin C, and the ground circuit TCCM X3 pin D.
    - If the voltage is less than the specified range, test the ground circuit for an open/high resistance, short to ground or short together condition.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Transfer Case High/Low Clutch Reset**
- Refer to **Battery Inspection/Test**
- Refer to **Battery Electrical Drain/Parasitic Load Test**
- Refer to **Charging System Test**

DTC P0601, P0602, P0604, P0606, P062F, OR P064F: CONTROL MODULE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptors

DTC P0601

Control Module Read Only Memory Performance

DTC P0602

Control Module Not Programed

DTC P0604

Control Module Random Access Memory Performance

DTC P0606 00

Control Module Processor Performance

DTC P0606 37 (if equipped)

Control Module Processor Performance Software Malfunction

DTC P062F

Control Module Long Term Memory Performance

DTC P064F

Control Module Long Term Memory Performance

Circuit/System Description

This is an internal fault detection of the transfer case control module. This fault is handled inside the transfer case control module. No external circuits are involved.

At each power-up, the transfer case control module runs a self-test on the following:

- EEPROM Checksum
- ROM Checksum
- RAM Checksum
- RAM Malfunction
- Missing, incorrect or invalid software

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18.0 V
- Diagnostic runs continuously

Conditions for Setting the DTC

The transmission control module has detected an internal malfunction.

P0601

The read only memory (ROM), or the masked ROM, of the transfer case control module has failed the Checksum test indicating that the data is not currently valid.

P0602

No application/calibration software found or calibration incompatible with application.

P0604

The random access memory (RAM) of the transfer case control module has failed an operational test indicating that some portions of RAM are non-functional.

P0606 00

The transfer case control module has failed an operational test indicating a processor performance failure.

P0606 37 (if equipped)

The transfer case control module has detected a software malfunction (Watchdog Failure).

P062F

The critical operational parameters stored in the EEPROM of the transfer case control module have failed the Checksum test indicating invalid data.

P064F

The transfer case control module has detected an invalid calibration.

Action Taken When the DTC Sets

- The encoder motor will be deactivated for the remainder of the current ignition cycle.
- The transfer case shift control switch will illuminate the current mode position LED.
- No further mode changes shall be allowed.
- The transfer case control module will store freeze frame data.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.
- The SERVICE AWD indicator will not illuminate - P062F only.
- Default Long Term Memory Values will be used - P062F only.

Conditions for Clearing the DTC

- DTCs P0601, P0602, P0604, P0606, P062F and P064F are Type C DTCs.
- The transfer case control module will clear the DTC once the conditions for setting the DTC no longer exist.
- A history DTC will clear after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- DTC P0601 detects a non-volatile memory write error (ROM).
- DTC P0602 indicates that the transmission control module is not programed.
- DTC P0604 detects the wrong copy of non-volatile memory in RAM or a RAM read/write failure.
- DTC P0606 00 detects a processor performance failure.
- DTC P0606 37 detects a software malfunction.
- DTC P062F detects a corruption of the EPROM/Flash memory.
- DTC P064F detects an invalid calibration.
- Low voltage or a momentary loss of power or ground to the transfer case control module may cause a DTC to set. Verify the following:
    - The battery cables are clean and tight, and the battery is fully charged. Refer to **Battery Inspection/Test** .
    - The transfer case control module ground circuits do not have an open or high resistance.
    - The transfer case control module power circuits do not have an open, short to ground, or high resistance.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Transfer Case Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition OFF for at least 1 minute to allow for the complete shutdown of the K69 transfer case control module. Engine ON.
2. Verify that DTC P0601, DTC P0602, DTC P0604, DTC P0606, DTC P062F or DTC P064F is only set as a history DTC.
   - ***If any of the DTC's are set as current***
   1. Program the K69 transfer case control module. Refer to **Control Module References** .
   2. Verify none of the DTC's reset.
      - If any of the DTC's reset, replace the K69 transfer case control module. Refer to **Control Module References** .
      - If none of the DTC's reset
   3. All OK.
   - ***If any of the DTC's are set as history***

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

3. Visually inspect each connector terminal of the K69 transfer case control module connector for damage or corrosion. Repair as necessary.
4. Clear DTC P0601, DTC P0602, DTC P0604, DTC P0606, DTC P062F, or DTC P064F from history.
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If any of the DTC's set***

     Replace the K69 Transfer Case Control Module and perform the Range Actuator Learn procedure. Refer to **Transfer Case Control Module Replacement**, and **Transfer Case High/Low Clutch Reset**

- ***If none of the DTC's set***

6. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Control Module References** for K69 transfer case control module replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset** for Range Actuator Learn Procedure

DTC P185F OR P279A-P279C: TRANSFER CASE/FOUR WHEEL DRIVE (4WD) NEUTRAL RANGE PERFORMANCE

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: **Diagnostic System Check - Vehicle**
- Review the description of Strategy Based Diagnosis: **Strategy Based Diagnosis**
- An overview of each diagnostic category can be found here: **Diagnostic Procedure Instructions**

DTC Descriptor

NOTE: **This procedure may also diagnose malfunctions that are not detected by a DTC.**

DTC P185F

Transfer Case Shift Pending Signal Not Plausible - If equipped

DTC P279A

Transfer Case High Range Incorrect Ratio

DTC P279B

Transfer Case Low Range Incorrect Ratio - If equipped

DTC P279C

Four Wheel Drive (4WD) Neutral Range Performance - If equipped

Circuit/System Description

The ECM uses the following two ways to determine if the transfer case is in 4WD Low, 4WD High or Neutral.

1. Compare the transmission output speed sensor (Transmission OSS) to the transfer case output speed sensor (Transfer Case OSS - parameter name inside ECM) (B115 Vehicle Speed Sensor - component code name in Schematics) in order to calculate transfer case range.
2. Use a LAN message sent by the transfer case shift control module to the ECM.

The ECM uses this message to determine motor torque required and transmission shifting.

The internal fault detection is handled inside the control module. No external circuit diagnosis is involved.

Conditions for Running the DTC

- Engine = Running - For greater than 5 s
- Vehicle Speed = 10 to 200 km/h (6 to 124 MPH)

DTCs run continuously when the above condition is met.

Conditions for Setting the DTC

- If the first way and second way of determining transfer case range (see circuit/description above) do not match while in 4WD Low, 4WD High or Neutral, then the DTC is set.
- The ECM has detected 32 fail counts out of 400 samples.

Actions Taken When the DTC Sets

DTCs P17D4, P185F, P279A, P279B, P279C are Type B DTCs.

Conditions for Clearing the DTC

DTCs P17D4, P185F, P279A, P279B, P279C are Type B DTCs.

Diagnostic Aids

- Misalignment, debris or poor connections on the transmission output speed sensor or the transfer case vehicle speed sensor can cause this DTC to set.
- Verify that the following scan tool data can be obtained and is functioning properly while Operating the vehicle within the Conditions for Running the DTC. Data that is questionable may indicate a concern.

Refer to: **Control Module References** for typical data values.

- Transmission OSS
- Transmission Gear
- Transfer Case OSS (K20)/B115 Vehicle Speed Sensor (Transfer Case Control Schematics)

- The Actions Taken for P279A may set DTC P16F3.
- DTC P279A, P279B, or P279C may set before P0502, P0503, P0721, P0722, P0723, P077C, P077D, P2160, P2161.
- When attempting to set ECM internal DTCs, run the engine for at least 1 min, and then shut the engine off for 2 min. Following this procedure will allow for a complete ECM shutdown. Program the ECM with the latest software version and retest the DTC to see if the DTC resets.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition On / Vehicle In Service Mode & Engine Off
2. Verify DTC P0502, P0503, P0721, P0722, P0723, P077C, P077D, P2160, P2161 is not set.
   - **If any of the DTCs are set Refer to: Diagnostic Trouble Code (DTC) List - Vehicle**
   - **If none of the DTCs are set**
3. Ignition On - Engine Running - Greater than 1 min

   NOTE: **It may take up to 2 min for all vehicle systems to power down.**

4. Ignition/Vehicle Off, key out of the ignition/keyless start transmitter 1 m (3 ft) from the vehicle, and all vehicle systems Off.

   - Greater than 2 min

5. Ignition On / Vehicle In Service Mode & Engine Off
6. Verify DTC P17D4, P185F, P279A, P279B, P279C is only set as a history DTC.
   - **If any of the DTCs are set Refer to: Circuit/System Testing**
   - **If any of the DTCs are set as history Refer to Diagnostic Aids before proceeding with Circuit/System Testing.**
   - **If none of the DTCs are set**
7. Clear All Vehicle DTCs
8. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
9. Verify DTC P17D4, P185F, P279A, P279B, P279C is not set.
   - **If the DTC is set**

     Refer to: Circuit/System Testing

   - **If the DTC is not set**
10. All OK.

Circuit/System Testing

1. Monitor the scan tool parameter: 4WD Low Signal - (K20)
2. Operate the component: S77 Transfer Case Shift Control Switch - 4WD Low
3. Verify the scan tool parameter: 4WD Low Signal = Enabled

- **If the parameter does not display the following: Enabled**

  Test or replace the component: Transfer Case Assembly

- **If the parameter displays the following: Enabled**

4. Operate the component: S77 Transfer Case Shift Control Switch - 2WD
5. Verify the scan tool parameter: 4WD Low Signal Disabled
   - **If the parameter does not display the following: Disabled**

     Test or replace the component: Transfer Case Assembly

   - **If the parameter displays the following: Disabled**
6. Program the ECM.
7. Operate the component: S77 Transfer Case Shift Control Switch - 4WD High/Locked
8. Operate the vehicle within the Conditions for Running the DTC.
9. Verify the DTC does not set.
   - **If the DTC sets**

     Replace the component: K20 Engine Control Module

   - **If the DTC does not set**
10. Operate the component: S77 Transfer Case Shift Control Switch - 4WD Low
11. Operate the vehicle within the Conditions for Running the DTC.
12. Verify the DTC does not set.
    - **If the DTC sets**

      Replace the component: K20 Engine Control Module

    - **If the DTC does not set**
13. Operate the component: S77 Transfer Case Shift Control Switch - Neutral
14. Operate the vehicle within the Conditions for Running the DTC.
15. Verify the DTC does not set.
    - **If the DTC sets**

Replace the component: K20 Engine Control Module

- **If the DTC does not set**

16. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: **Diagnostic Repair Verification**

For control module replacement, programming, and setup refer to: **Control Module References**

Refer to **Transfer Case Assembly Replacement**

DTC P17D4, P185F OR P279A-P279C: TRANSFER CASE/FOUR WHEEL DRIVE (4WD) NEUTRAL RANGE PERFORMANCE (L83)

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: **Diagnostic System Check - Vehicle**
- Review the description of Strategy Based Diagnosis: **Strategy Based Diagnosis**
- An overview of each diagnostic category can be found here: **Diagnostic Procedure Instructions**

DTC Descriptor

NOTE: **This procedure may also diagnose malfunctions that are not detected by a DTC.**

DTC P17D4

Transfer Case Neutral Range Detected in High or Low Range - If equipped

DTC P185F

Transfer Case Shift Pending Signal Not Plausible - If equipped

DTC P279A

Transfer Case High Range Incorrect Ratio

DTC P279B

Transfer Case Low Range Incorrect Ratio - If equipped

DTC P279C

Four Wheel Drive (4WD) Neutral Range Performance - If equipped

Circuit/System Description

The ECM uses the following two ways to determine if the transfer case is in 4WD Low, 4WD High or Neutral.

1. Compare the transmission output speed sensor (Transmission OSS) to the transfer case output speed sensor (Transfer Case OSS - parameter name inside ECM) (B115 Vehicle Speed Sensor - component code name in Schematics) in order to calculate transfer case range.
2. Use a LAN message sent by the transfer case shift control module to the ECM.

The ECM uses this message to determine motor torque required and transmission shifting.

The internal fault detection is handled inside the control module. No external circuit diagnosis is involved.

Conditions for Running the DTC

- Engine = Running - For greater than 5 s
- Vehicle Speed = 10 to 200 km/h (6 to 124 MPH)

DTCs run continuously when the above condition is met.

Conditions for Setting the DTC

- If the first way and second way of determining transfer case range do not match while in 4WD Low, 4WD High or Neutral, then the DTC is set.
- The ECM has detected 32 fail counts out of 400 samples.

DTCs run continuously when the above condition is met.

Actions Taken When the DTC Sets

DTCs P17D4, P185F, P279A, P279B, P279C are Type B DTCs.

Conditions for Clearing the DTC

DTCs P17D4, P185F, P279A, P279B, P279C are Type B DTCs.

Diagnostic Aids

- Misalignment, debris or poor connections on the transmission output speed sensor or the transfer case vehicle speed sensor can cause this DTC to set.
- Verify that the following scan tool data can be obtained and is functioning properly while operating the vehicle within the Conditions for Running the DTC. Data that is questionable may indicate a concern.
  - Transmission OSS
  - Transfer Case OSS (K20)/B115 Vehicle Speed Sensor (Transfer Case Control Schematics)
- Internal transmission mechanical faults can set these DTC's
- The Actions Taken for P279A may set DTC P16F3.
- DTC P279A, P279B, or P279C may set before P0502, P0503, P0721, P0722, P0723, P077C, P077D, P2160, P2161.
- When attempting to set ECM internal DTCs, run the engine for at least 1 min, and then shut the engine off for 2 min. Following this procedure will allow for a complete ECM shutdown. Program the ECM with the latest software version and retest the DTC to see if the DTC resets.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

NOTE: **Please first be sure to review the Diagnostic Aids before continuing further.**

1. Ignition On / Vehicle In Service Mode - Engine Off
2. Verify DTC P0502, P0503, P0721, P0722, P0723, P077C, P077D, P2160, P2161 is not set.
   - **If any of the DTCs are set** Refer to: **Diagnostic Trouble Code (DTC) List - Vehicle**
   - **If none of the DTCs are set**
3. Ignition On - Engine Running - Greater than 1 min

   NOTE: **It may take up to 2 min for all vehicle systems to power down.**

4. Ignition/Vehicle Off, key out of the ignition/keyless start transmitter 1 m (3 ft) from the vehicle, and all vehicle systems Off.

   - Greater than 2 min

5. Ignition On / Vehicle In Service Mode & Engine Off
6. Verify DTC P17D4, P185F, P279A, P279B, P279C is only set as a history DTC.
   - **If any of the DTCs are set as current.** Refer to: Circuit/System Testing
   - **If any of the DTCs are only set as history.** Refer to Diagnostic Aids before proceeding with Circuit/System Testing.
   - **If none of the DTCs are set**
7. Clear All Vehicle DTCs
8. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
9. When operating the vehicle within the Conditions for Running the DTC, monitor the following parameters (they should match each other and show a smooth/steady curve when viewed in graph form):
   - Transmission OSS
   - Transfer Case OSS (K20)/B115 Vehicle Speed Sensor (Transfer Case Control Schematics)
   - **If the above parameters do not match or are not smooth**

Refer to: **Diagnostic Trouble Code (DTC) List - Vehicle** DTC P0720/P722 for Transmission OSS or DTC P2160/P2161 for Transfer Case OSS (K20)/B115 Vehicle Speed Sensor (Transfer Case Control Schematics)

- **If the above parameters match and are smooth**

10. Verify DTC P17D4, P185F, P279A, P279B, P279C is not set.
    - **If the DTC is set**

      Refer to: Circuit/System Testing

    - **If the DTC is not set**
11. All OK.

Circuit/System Testing

1. Monitor the scan tool parameter: 4WD Low Range Indicator Command
2. Operate the component: S77 Transfer Case Shift Control Switch - 4WD Low
3. Verify the scan tool parameter: 4WD Low Range Indicator Command = On
    - **If the parameter does not display the following:** On

      Repair or replace the component: Transfer Case Assembly

      Refer to:**Transfer Case Assembly Replacement**

    - **If the parameter displays the following:** On
4. Operate the component: S77 Transfer Case Shift Control Switch - 2WD
5. Verify the scan tool parameter: 4WD Low Range Indicator Command = Off
    - **If the parameter does not display the following:** Off

      Repair or replace the component: Transfer Case Assembly

      Refer to:**Transfer Case Assembly Replacement** .

    - **If the parameter displays the following:** Off
6. Operate the component: S77 Transfer Case Shift Control Switch - 4WD High/Locked
7. Verify the scan tool parameter: 4WD Low Range Indicator Command = Off

- **If the parameter does not display the following:** Off

  Repair or replace the component: Transfer Case Assembly

  Refer to:**Transfer Case Assembly Replacement** .

- **If the parameter displays the following:** Off

8. Operate the component: S77 Transfer Case Shift Control Switch - Neutral
9. Verify the scan tool parameter: 4WD Low Range Indicator Command = Off
   - **If the parameter does not display the following:** Off

     Repair or replace the component: Transfer Case Assembly

     Refer to:**Transfer Case Assembly Replacement** .

   - **If the parameter displays the following:** Off
10. Clear DTCs
11. Operate the vehicle within the Conditions for Running the DTC.
12. Verify the DTC does not set.
    - **If the DTC sets**

    1. Program the ECM.
    2. Operate the vehicle within the Conditions for Running the DTC.
    3. Verify the DTC does not set.
       - **If the DTC sets**

       Replace the component: K20 Engine Control Module

       1. Program the ECM.
       2. Operate the vehicle within the Conditions for Running the DTC.

          NOTE: **Internal damaged components may cause this DTC to set.**

       3. Verify the DTC does not set.
          - **If the DTC sets**

Repair or replace as necessary - Transfer Case

- **If the DTC does not set**

13. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: **Diagnostic Repair Verification**

For control module replacement, programming, and setup refer to: **Control Module References**

DTC P2160 OR P2161: VEHICLE SPEED SENSOR (VSS) 2 CIRCUIT (2-WIRE)

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptors

DTC P2160

Vehicle Speed Sensor (VSS) 2 Circuit Low Voltage

DTC P2161

Vehicle Speed Sensor (VSS) 2 Circuit Intermittent

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
VSS Supply Voltage	P2160, P2161	P2160, P2161	P2160, P2161	P2161
VSS Signal	P2160, P2161	P2160, P2161	P2160, P2161	P2161

Circuit/System Description

The vehicle speed sensor (VSS) provides vehicle speed information to the engine control module (ECM). The VSS is a permanent magnet generator.

The sensor is mounted in the transfer case facing the rear internal gear which is splined to the output shaft assembly. As the output shaft and internal gear rotate, the toothed rotor of the internal gear produces AC voltage as the rotor teeth pass through the magnetic field of the sensor. The AC voltage level and the number of pulses increase as the speed of the vehicle increases. The ECM converts the voltage to vehicle speed. The ECM uses the output shaft speed signal to determine shift timing, as well as transfer case range.

Conditions for Running the DTC

P2160

- No input speed sensor (ISS) DTCs P0716 or P0717.
- No output speed sensor (OSS) DTCs P0722 or P0723.
- No vehicle speed sensor (VSS) DTCs P2160 or P2161.
- The throttle position is greater than 5 percent and less than 99 percent.
- The transmission is not in Reverse Inhibit state.
- The transmission is not in PARK or NEUTRAL.
- The transmission is not performing garage shifting.
- No engine torque, throttle position, and turbine speed DTCs.
- The engine torque is greater than 60 N.m (44 lb ft) and less than 8192 N.m (6042 lb ft).
- The input speed is greater than 1000 RPM and less than 7500 RPM.

P2161

- The transmission is not performing garage shifting.
- The transmission is not in Reverse Inhibit state.
- The transmission is not in PARK or NEUTRAL.
- The engine speed is 1000 RPM or greater.
- No crank sensor or P2160 DTCs.

Conditions for Setting the DTC

P2160

- No speed signal from the transfer case speed sensor.
- The transfer case output shaft speed is 50 RPM or less.

P2161

- Loss of speed signal from the transfer case speed sensor.
- Output speed signal is increasing: current transfer case speed signal - last valid output speed greater than 475 RPM.
- Output speed signal is decreasing: current transfer case speed signal - last valid output speed less than 255 RPM.

Action Taken When the DTC Sets

- DTCs P2160 and P2161 are Type B DTCs.
- The TCM commands maximum line pressure.
- The TCM freezes transmission adaptive functions.
- The TCM calculates vehicle speed from the automatic transmission input shaft speed sensor and commanded gear.
- The Actions Taken for DTC P2160 or P6161 may set DTC P16F3.

Conditions for Clearing the DTC

DTCs P2160 and P2161 are Type B DTCs.

Diagnostic Aids

- The transfer case drain plug provides a good ground point.
- The **EL-49742** harness provides a good source for 12 V and ground.
- Inspect the rear internal gear teeth for damage.
- Visually inspect the VSS for cracks or damage.
- Ensure the VSS is properly torqued to the transfer case housing.
- This diagnostic relates to the VSS located in the transfer case and not the OSS located within the transmission.

Reference Information

Schematic Reference

- **Transfer Case Control Schematics**
- **Engine Controls Schematics** for 5.3L (L83) or 6.2L (L86)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Transfer Case Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J-35616** GM-Approved Terminal Test Kit

For equivalent regional tools, refer to **Special Tools**.

Circuit/System Verification

1. Raise and support the drive wheels.
2. Start and idle the engine.
3. Place the transmission in DRIVE.
4. Monitor VSS on the scan tool under engine data.
5. The VSS on the scan tool should be greater than 100 RPM.

Circuit/System Testing

1. Key OFF. Let sit for 2 minutes to ensure that the ECM shuts down.
2. Disconnect the X1 connector from the VSS. Using the J 35616-2A GY probes, test for less than 0.1 V between the following circuits and a good ground.
   - VSS high signal circuit, VSS harness X1 pin A.
   - VSS low signal circuit, VSS harness X1 pin B.
     - If the voltage is greater than the specified value, test the affected circuit for a short to voltage. If all circuits and connections test normal, test the ECM for proper operation.
3. Key ON, engine OFF. Test for a diagnostic 2-3 V (low current) between the following circuits and a good ground.
   - VSS high signal circuit, VSS harness X1 pin A.
   - VSS low signal circuit, VSS harness X1 pin B.
     - If the voltage is less than the specified value, test the affected circuit for an open/high resistance, short to ground or short together. If all circuits and connections test normal, test the ECM for proper operation.
     - If the voltage is greater than the specified value, test the affected circuit for a short to voltage. If all circuits and connections test normal, test the ECM for proper operation.
4. Test the VSS for proper operation.

Component Testing

VSS

1. Key OFF.
2. Disconnect the X1 connector from the VSS. Using the J-35616-3 GY probes, test for 1200-2140 Ω between the VSS high signal circuit, VSS pin A, and the VSS low signal circuit, VSS pin B.
   - If the resistance is outside the specified value, replace the VSS.
3. Test for greater than 10 M Ω between the following circuits and a good ground.
   - VSS high signal circuit, VSS pin A.
   - VSS low signal circuit, VSS pin B.
     - If the resistance is below the specified value, Replace the VSS.
4. Block the front wheels. Raise and support the driver's side rear wheel. While rotating the raised wheel by hand, test for greater than 0.4 V AC between the VSS high signal circuit, VSS pin A, and the VSS low signal circuit, VSS harness pin B. The passenger side rear wheel takes more effort to turn. If both drive wheels are raised and unblocked, twice the effort will be required to reach 0.4 V AC. If the vehicle is sufficiently supported to safely place the transmission in neutral, less effort will be required to turn the raised wheel.

- If the AC voltage is below the specified value, replace the VSS.

ECM

1. Remove key from the ignition. Let sit for 2 minutes to ensure ECM shut down
2. Disconnect the X1 connector from the ECM. Using the J-35616-64B L-BU probes, test for 1200-2140 Ω between the VSS high signal circuit, ECM X1, pin 71 and the VSS low signal circuit, ECM X1, pin 72.
   - If the resistance is below the specified value, test the affected circuits for being shorted together. If all circuits and connections test normal, test the VSS for proper operation.
   - If the resistance is above the specified value, test the affected circuits for open/high resistance condition. If all circuits and connections test normal, test the VSS for proper operation.
3. Using the J-35616-64B L-BU probes, test for greater than 1 M Ω between the following circuits and a good ground.
   - VSS high signal circuit, ECM harness X1 pin 71.
   - VSS low signal circuit, ECM harness X1 pin 72.
     - If the resistance is below the specified value, test the affected circuit for being shorted to ground. If all circuits and connections test normal, test the VSS for proper operation.
4. Reprogram the ECM. If the DTC continues to set, replace the ECM.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Ensure that the VSS is 500 RPM or greater for 3 seconds and does not change more than 500 RPM or greater for 3 seconds.
- Refer to **Vehicle Speed Sensor Replacement**
- Refer to **Control Module References** for ECM replacement, setup, and programming

SYMPTOMS - TRANSFER CASE

IMPORTANT:

- Perform the **Diagnostic System Check - Vehicle** before using the symptom tables in order to verify the following statements are true:
  - There are no diagnostic trouble codes (DTCs) set.
  - The control modules can communicate via the serial data link.
- Review the system operation in order to familiarize yourself with the system functions. Refer to **Transfer Case Description**

and Operation.

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the automatic transfer case system. Refer to **Checking Aftermarket Accessories** .
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the automatic transfer case for the proper fluid level.

Intermittent

Faulty electrical connections or wiring may cause intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** .

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **Front Axle Will Not Engage**
- **Front Axle Will Not Disengage**
- **Transfer Case Shift Control Switch Inoperative**
- **No Correction for Slip in All-Wheel Drive Mode**
- **Transfer Case Shift Control Switch Indicator Always On - Two or More**
- **Transfer Case Shift Control Switch Indicator Inoperative - One or More**
- **Service Indicator Always On**
- **Transfer Case Popping Noise**
- **Transfer Case Banging Noise**
- **Transfer Case Whine or Rumble Noise**
- **Transfer Case Growl or Grinding Noise**
- **Transfer Case Grating Noise**
- **Transfer Case Clunk in 2HI Only**
- **Transfer Case Clunk in 4HI**
- **Transfer Case Clunk During Acceleration and Deceleration**

- **Transfer Case Shudder or Binding**
- **Transfer Case Leak Diagnosis**

FRONT AXLE WILL NOT ENGAGE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

Circuit/System Description

The front axle control circuit consists of an electric motor actuator which engages and disengages the front axle. The front axle actuator motor consists of a permanent magnetic motor, a worm gear controlled plunger, a front axle switch and an electronic control circuit within the actuator assembly.

The front axle actuator consists of the following circuits:

- The front axle control circuit, which is also connected to the transfer case shift control module
- The front axle switch circuit, which is also connected to the transfer case shift control module
- An ignition 3 voltage circuit
- A ground circuit

When a shift to AUTO 4WD, 4HI, or 4LO is requested, the transfer case shift control module engages the front axle by grounding the front axle control circuit through a current limiting driver.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Testing

1. If this is occurring without DTC C0379 setting it is likely related to a mechanical issue. Refer to **Four-Wheel Drive Does Not Engage** .
2. If no mechanical issue is found replace the front axle actuator.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Control Module References** for TCSCM replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset**
- Refer to **Four-Wheel Drive Does Not Engage**
- Refer to **Four-Wheel Drive Does Not Disengage**
- Refer to **Front Drive Axle Actuator Replacement (8.25 Inch LD Axle)** **Front Drive Axle Actuator Replacement (9.25 Inch HD Axle)**

FRONT AXLE WILL NOT DISENGAGE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

Circuit/System Description

The front axle control circuit consists of an electric motor actuator which engages and disengages the front axle. The front axle actuator motor consists of a permanent magnetic motor, a worm gear controlled plunger, a front axle switch and an electronic control circuit within the actuator assembly.

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Reference Information

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- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Testing

1. If this is occurring without DTC C0379 setting it is likely related to a mechanical issue. Refer to **Four-Wheel Drive Does Not Disengage** .
2. If no mechanical issue is found replace the front axle actuator.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Control Module References** for TCSCM replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset**
- Refer to **Four-Wheel Drive Does Not Engage**
- Refer to **Four-Wheel Drive Does Not Disengage**
- Refer to **Front Drive Axle Actuator Replacement (8.25 Inch LD Axle)** **Front Drive Axle Actuator Replacement (9.25 Inch HD Axle)**

TRANSFER CASE SHIFT CONTROL SWITCH INOPERATIVE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

Circuit/System Description

The active transfer case mode switch circuit consists of 5 modes. The transfer case shift control module supplies 5 volts to the switch through the 5-volt reference circuit. The current travel through the resistor of the currently active mode. The current is then returned to the transfer case shift control module through the switch signal circuit.

The transfer case shift control module constantly monitors this signal voltage to determine the condition of the mode switch circuit.

When each of the modes are selected they complete a circuit through their own specific resistor. The transfer case shift control module continuously monitors the switch input to determine whether the Neutral, AWD, 2HI, 4HI, or 4LO mode was selected by the driver.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Diagnostic Aids

If the 5-volt reference or the switch signal wire are shorted to ground the scan tool can show up to 7.5 volts.

Circuit/System Testing

1. Review the scan tool data list mode switch selected and select difference mode with the transfer case shift control switch. Does the mode switch selected parameter on the scan tool change as you change modes on the switch?
2. If the modes change according to the scan tool replace the transfer case control module, reprogram, complete the motor learn procedure. If the modes on the scan tool not change replace the switch.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Transfer Case Selector Switch Replacement (Chevrolet / GMC)Transfer Case Selector Switch Replacement (Cadillac)**
- Refer to **Control Module References** for TCSCM replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset**

NO CORRECTION FOR SLIP IN ALL-WHEEL DRIVE MODE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

Circuit/System Description

When transfer case is in auto 4WD mode the transfer case control module monitors the front wheel speeds and the rear wheel speeds. When a noticeable difference between the front and rear is seen the transfer case control module sends a PWM voltage to the motor so it can apply the clutch in order to correct a slip condition. The slip conditions is the difference in speed between the front and rear axles. The module has a thermal model based system so when the slip correction can not be made when a large percentage PWM signal has been sent, it will disable the system to prevent damage to the clutches.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Diagnostic Aids

Erratic wheel speed sensors can cause this condition to occur. Monitor the wheel speeds using the EBCM scan tool data list.

Circuit/System Testing

1. Monitor the wheel speed sensors using the EBCM scan tool data list. If the wheel speeds are erratic or there is a large difference between front and rear then diagnose and repair as necessary. Check for EBCM DTCs as they have likely set for wheel speed performance.
2. If nothing is found with wheel speed performance then the clutches may be excessively warn. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** .

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)**

TRANSFER CASE SHIFT CONTROL SWITCH INDICATOR ALWAYS ON - TWO OR MORE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

Circuit/System Description

The indicator circuits consists of an interior lights dimming circuit and an indicator control circuit. When a mode has been selected, current is supplied to the indicator by the interior lights dimming circuit, traveling through the indicator LED, at which time the transfer case shift control module supplies the ground through the indicator lamp control circuit.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**

- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Diagnostic Aids

A short to ground on the indicator control circuit will cause the indicator to remain on at all times.

Circuit/System Testing

1. With in ignition off disconnect connector X1 at the transfer case control module and turn the ignition on. If the affected indicator goes out replace the transfer case control module, program, and perform the motor learn procedure.
2. If the affected indicator did not go out check for a short to ground on the affected indicator control circuit. If this checks as good then replace the transfer case shift control switch.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Transfer Case Selector Switch Replacement (Chevrolet / GMC)Transfer Case Selector Switch Replacement (Cadillac)**
- Refer to **Control Module References** for TCSCM replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset**

TRANSFER CASE SHIFT CONTROL SWITCH INDICATOR INOPERATIVE - ONE OR MORE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

Circuit/System Description

The indicator circuits consists of an interior lights dimming circuit and an indicator control circuit. When a mode has been selected, current is

supplied to the indicator by the interior lights dimming circuit, traveling through the indicator LED, at which time the transfer case shift control module supplies the ground through the indicator lamp control circuit.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Diagnostic Aids

A short to ground on the indicator control circuit will cause the indicator to remain on at all times.

Circuit/System Testing

1. With in ignition off disconnect connector X1 at the transfer case control module and turn the ignition on. With a jumper wire probe the indicator control circuit of the affected indicator and take the other end of the jumper to ground. If the indicator comes on then replace the transfer case control module, program, and perform the motor learn procedure
2. If the affected indicator did not come on then check the indicator control circuit for an open or high resistance. If the circuit checks good then replace the transfer case shift control switch.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Transfer Case Selector Switch Replacement (Chevrolet / GMC)Transfer Case Selector Switch Replacement (Cadillac)**
- Refer to **Control Module References** for TCSCM replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset**

SERVICE INDICATOR ALWAYS ON

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

Circuit/System Description

If the service indicator needs to be turned on the transfer case shift control module sends a signal via LAN to the instrument panel asking the I/P to command the Service 4WD indicator.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Testing

1. If the Service 4WD indicator is on and there are no DTCs check the fuse for the transfer case as this would cause the transfer case control module to drop off the LAN causing a service indicator.
2. If the fuse is good check the module power and grounds for proper connections as this could cause the same thing as a blown fuse.
3. If this checks OK then check all other U codes that may be set against the transfer case shift control module such as I/P, BCM, PCM, and follow the proper U code diagnostic.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Refer to **Control Module References** for TCSCM replacement, setup, and programming
- Refer to **Transfer Case High/Low Clutch Reset**

TRANSFER CASE HIGH/LOW CLUTCH RESET

Using a Scan Tool

1. Key ON, engine OFF.
2. Select the Module Setup heading on the scan tool, under transfer case control module.
3. Select the Range Actuator Learn procedure.
4. When the Range Actuator Learn procedure is initiated you should hear the motor engage, indicating a successful learn procedure.

Using The Transfer Case Shift Control Switch

NOTE: **The Learn procedure is performed with the ignition in the ACCESSORY position. The shift to transfer case NEUTRAL procedure uses this same procedure, but with the key in the RUN position.**

1. Key OFF for at least 30 s.
2. Engage parking brake.
3. Place transmission in Neutral.
4. Turn the S77 Transfer Case Shift Control Switch to the 2WD HI position for at least 5 s.
5. Turn the S77 Transfer Case Shift Control Switch clockwise past the 4WD HI position until it stops and hold for at least 30 s.

6. An audible noise from the A16 Transfer Case Encoder Motor should occur, indicating a successful learn procedure.

TRANSFER CASE POPPING NOISE

Cause	Correction
DEFINITION: a faulty internal transfer case component that causes a light popping noise in the transfer case. A light popping type noise that occurs when shifting, and quits after the shift is completed would be considered normal. When shifting out of 4HI in a mode shift, there may be a delay and a popping may be heard when the 4HI clutch disengages. 1. Compare the noise to a similar vehicle to see if a normal condition. 2. Identify the source of the noise using chassis ears and refer to the appropriate service manual section. 3. Note specifics such as when the noise is present (2HI, 4HI, or 4LO). 4. Note if the noise relative to vehicle speed, is noisy on turns, or other specifics. 5. If the source of the noise is the transfer case, inspect for the correct fluid level. 6. Inspect the drain plug for large metal deposits. Small metal flakes and fine metal dust on the plug magnet are to be considered normal. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Transmission or transfer case mounts loose or damaged	Repair or replace the mounts as required
Propeller shaft center support bearing loose or damaged (as applicable)	Replace the center support bearing as required. Refer to **Symptoms - Propeller Shaft** .
Propeller shaft universal joints worn	Replace the universal joints as required. Refer to **Symptoms - Propeller Shaft** .
Suspension components worn	Replace the suspension components as required. Refer to **Noise Diagnosis - Front Suspension** , or **Noise Diagnosis - Rear Suspension** .
Front axle actuator shift noise	**NOTE:** **When shifting from 2WD-to-4WD or 4WD-to-2WD, the front axle actuator may be heard**

Cause	Correction
	engaging or disengaging and the axle internal components shifting. This is to be considered a normal condition. Shift from 2WD-to-4WD and from 4WD-to-2WD to determine if the noise source is the front axle to determine if this is a normal condition.
Transfer case drive and driven sprockets worn or a stretched chain causing a chain jump condition	**NOTE:** • **A chain jump condition may cause a banging noise and can only occur with the vehicle in 4WD.** • **A chain jump condition may be caused by water intrusion into the transfer case and**

Cause	Correction
	deterioration of the transfer case fluid. Water intrusion conditions may occur in extreme off road conditions or in situations where under-vehicle power washing occurs. 1. Inspect the oil for water intrusion and/or fluid discoloration and contamination. 2. Inspect the vent hose for proper routing and connection to the transfer case. 3. Inspect for damages internal components. Refer to **Drive Chain, Drive Sprocket, and Driven Sprocket Cleaning and Inspection**. 4. Replace the chain and sprockets as required. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**.

TRANSFER CASE BANGING NOISE

Cause	Correction
A faulty internal transfer case component that causes a loud banging noise in the transfer case.	

Cause	Correction
1. Compare the noise to a similar vehicle to see if a normal condition. 2. Identify the source of the noise using chassis ears and refer to the appropriate service manual section. 3. Note specifics such as when the noise is present (2HI, 4HI, or 4LO). 4. Note if the noise is relative to vehicle speed, is noisy on turns, or other specifics. 5. If the source of the noise is the transfer case, inspect for the correct fluid level. 6. Inspect the drain plug for large metal deposits. Small metal flakes and fine metal dust on the plug magnet are to be considered normal. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Transmission or transfer case mounts loose or damaged	Repair or replace the mounts as required
Propeller shaft center support bearing loose or damaged (as applicable)	Replace the center support bearing as required. Refer to **Symptoms - Propeller Shaft** .
Propeller shaft universal joints worn	Replace the universal joints as required. Refer to **Symptoms - Propeller Shaft** .
Suspension components worn	Replace the Suspension components as required. Refer to **Noise Diagnosis - Front Suspension** , or **Noise Diagnosis - Rear Suspension** .
Transfer case rear output shaft bushing worn	**NOTE:** **A worn bushing and or slip yoke may also create a clunk type noise and may be indicated by a leaking rear output shaft seal.** Replace the rear output shaft bushing and propeller shaft slip yoke as required.

Cause	Correction
Transfer case drive and driven sprockets worn or a stretched chain causing a chain jump condition	**NOTE:** • **A chain jump condition may cause a banging noise and can only occur with the vehicle in 4WD.** • **A chain jump condition may be caused by water intrusion into the transfer case and deterioration of the transfer case fluid. Water intrusion conditions may occur in extreme off road conditions or in situations**

Cause	Correction
	where under-vehicle power washing occurs. 1. Inspect the oil for water intrusion and/or fluid discoloration and contamination. 2. Inspect the vent hose for proper routing and connection to the transfer case. 3. Inspect for damaged internal components. Refer to **Drive Chain, Drive Sprocket, and Driven Sprocket Cleaning and Inspection**. 4. Replace the chain and sprockets as required. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**.

TRANSFER CASE WHINE OR RUMBLE NOISE

Cause	Correction
DEFINITION: A faulty internal transfer case component that causes a whine or rumbling noise in the transfer case. 1. Compare the noise to a similar vehicle to see if a normal condition. 2. Identify the source of the noise using chassis ears and refer to the appropriate service manual section. 3. Note specifics such as when the noise is present (2HI, 4HI, or 4LO). 4. Note if the noise relative to vehicle speed, is noisy on turns, or other specifics. 5. If the source of the noise is the transfer case, inspect for the correct fluid level. 6. Inspect the drain plug for large metal deposits. Small metal flakes and fine metal dust on the plug magnet are to be considered normal. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Tire noise	**NOTE:** **A high pitch**

Cause	Correction
	whine or low pitch rumble noise that increases as vehicle speed increases may be caused by tires that are, unevenly inflated, unevenly worn or have an aggressive tread pattern. Rotate or substitute tires and retest. Refer to **Tire and Wheel Inspection** .
Propeller shaft center support bearing worn (as applicable)	**NOTE:** **A high pitch whine or low pitch rumble noise that increases as vehicle speed increases may be caused by a worn center support**

Cause	Correction
	bearing. Replace the center support bearing as required. Refer to **Symptoms - Propeller Shaft** .
Propeller shaft universal joints worn	**NOTE:** **A high pitch whine or low pitch rumble noise that increases as vehicle speed increases may be caused by worn universal joints.** Replace the universal joints as required. Refer to **Symptoms - Propeller Shaft**
Front or rear axle bearings worn	**NOTE:** • **A high pitch whine or low pitch rumble noise that increases as vehicle speed increase may be caused by worn**

Cause	Correction
	axle bearings. • **To determine if the noise is front axle related, remove the front propeller shaft and retest.** Repair or replace the axle as required. Refer to **Symptoms - Front Drive Axle** , or **Symptoms - Rear Drive Axle** .
Transmission rear output shaft bearing worn	**NOTE:** **A high pitch whine or low pitch rumble noise that increases as transmission output shaft speed increases may be caused by a worn transmission output shaft bearing.**

Cause	Correction
	Repair or replace the transmission as required. Refer to **Symptoms - Automatic Transmission** .
Transfer case fluid level low	**NOTE:** **A high pitch whine or low pitch rumble noise that increases as transmission output shaft speed increases may be caused by a low transfer case fluid level.** Fill the transfer case to the correct fluid level and retest.

Cause	Correction
Transfer case input shaft bearing worn	**NOTE:** **A high pitch whine or low pitch rumble noise that increases as transmission output shaft speed increases may be caused by a worn transfer case input shaft bearing.** Replace the bearing as required. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**.
Transfer case rear output shaft bushing worn	**NOTE:** • **An excessively worn bushing may be indicated by a leaking rear output shaft seal.** • **A high pitch whine or low pitch**

Cause	Correction
	rumble noise that increases as vehicle speed increases may be caused by a worn transfer case rear output shaft bushing. Replace the rear output shaft bushing and propeller shaft slip yoke as required. Refer to **Transfer Case Rear Extension Bushing Replacement**.
Transfer case front or rear output shaft bearings worn	**NOTE:** **A high pitch whine or low pitch rumble noise that increases with road speed may be caused by the front or rear output shaft bearing.** Replace the bearings as required. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**.

TRANSFER CASE GROWL OR GRINDING NOISE

Cause	Correction
DEFINITION: A faulty internal transfer case component that causes a low pitch growl or grinding noise in the transfer case while the vehicle is turning left or right or in a four wheel drive mode. A low pitch growl noise with the vehicle in 4HI is to be considered normal. Heavy duty NQH transfer case applications are noisier by design in 4HI than are the light duty applications. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Tire wear	**NOTE:** **A growl noise that increases as vehicle speed increases may be caused by tires that are unevenly worn, unevenly inflated, or have an aggressive tread pattern.** Rotate or substitute tires and retest. Refer to **Tire and Wheel Inspection** .
Propeller shaft center support bearing worn (as applicable)	**NOTE:** **A growl or grinding noise that increases as vehicle speed increase**

Cause	Correction
	may be caused by a worn center support bearing. Replace the center support bearing as required. Refer to **Symptoms - Propeller Shaft** .
Propeller shaft universal joints worn	**NOTE:** **A growl or grinding noise that increases as vehicle speed increase may be caused by worn universal joints.** Replace the universal joints as required. Refer to **Symptoms - Propeller Shaft**
Front or rear axle bearings worn	**NOTE:** • **A growl or grinding noise that increases as vehicle speed increase may be caused**

Cause	Correction
	by worn axle bearings. • **To determine if the noise is front axle related, remove the front propeller shaft and retest.** Repair or replace the axle as required. Refer to **Symptoms - Front Drive Axle** , or **Symptoms - Rear Drive Axle** .
Transmission rear output shaft bearing worn	**NOTE:** **A growl or grinding noise that increases as transmission output shaft speed increases may be caused by a worn transmission output shaft bearing.**

Cause	Correction
	Replace transmission components as required. Refer to **Symptoms - Automatic Transmission** .
Transfer case fluid level low	**NOTE:** **A growl or grinding noise that increases as transmission output shaft speed increases may be caused by a low transfer case fluid level.** Fill the transfer case to the correct fluid level and retest.
Transfer case input shaft bearing worn	**NOTE:** **A high pitch whine or low pitch rumble noise that increases as transmission output shaft speed increases may be caused by a worn transfer case input shaft bearing.**

Cause	Correction
	Replace the bearing as required. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**.
Transfer case rear output shaft bushing worn	**NOTE:** • **An excessively worn bushing may be indicated by a leaking rear output shaft seal.** • **A growl or grinding noise that increases as vehicle speed increases may be caused by a worn transfer case rear output shaft bushing.** Replace the rear output shaft bushing and propeller shaft slip yoke as required. Refer to **Transfer Case Rear Extension Bushing Replacement**.
Transfer case front or rear output shaft bearings worn	**NOTE:**

Cause	Correction
	A high pitch whine or low pitch rumble noise that increases with road speed may be caused by the front or rear output shaft bearing. Replace the bearings as required. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**.

TRANSFER CASE GRATING NOISE

Cause	Correction
DEFINITION: A faulty internal transfer case component that causes a grating noise in the transfer case while in the AWD or 4HI mode. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Broken clutch apply plate	1. Inspect for a broken clutch apply plate. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**. 2. Replace the apply plate and the transfer case components that are damaged from debris. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**.
Faulty control actuator lever thrust bearings	1. Inspect for faulty control actuator lever thrust bearings. Refer to **Two/Four Wheel Drive Shift Components Cleaning and Inspection**. 2. Recondition the transfer case components that are damaged from debris. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**.

TRANSFER CASE CLUNK IN 2HI ONLY

Cause	Correction
DEFINITION: A faulty internal transfer case component that causes a clunk that is heard or felt during acceleration or deceleration with the transfer case in 2HI mode only. 1. Compare the noise to a similar vehicle to see if a normal condition. 2. Identify the source of the noise using chassis ears and refer to the appropriate service manual section. 3. Note specifics such as when the noise is present (2HI, 4HI, or 4LO). 4. Note if the noise relative to vehicle speed, is noisy on turns, or other specifics. 5. If the source of the noise is the transfer case, inspect for the correct fluid level. 6. Inspect the drain plug for large metal deposits. Small metal flakes and fine metal dust on the plug magnet are to be considered normal. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Transmission or transfer case mounts loose or damaged	Repair or replace the mounts as required
Rear propeller shaft center support bearing loose or damaged (as applicable)	Replace the center support bearing as required. Refer to **Symptoms - Propeller Shaft** .
Rear propeller shaft universal joints worn	Replace the universal joints as required. Refer to **Symptoms - Propeller Shaft** .
Transfer case rear output shaft bushing worn	**NOTE:** **An excessively worn bushing may be indicated by a leaking rear output shaft seal.** Replace the rear output shaft bushing and propeller shaft slip yoke as required
Suspension components worn	Replace the suspension components as required. Refer to **Noise Diagnosis - Front Suspension** , or **Noise Diagnosis - Rear Suspension** .
Front axle actuator shift noise	**NOTE:**

Cause	Correction
	When shifting from 2WD-to-4WD or 4WD-to-2WD, the front axle actuator may be heard engaging or disengaging and the axle internal components shifting. This is to be considered a normal condition. Shift from 2WD-to-4WD and from 4WD-to-2WD to determine if the noise source is the front axle to determine if this is a normal condition.
Rear output shaft spline-to-propeller shaft slip yoke spline - excessive clearance	**NOTE:** **A clunk condition in 2WD heard when the vehicle comes to a stop or from a stop-to-acceleration situation may be caused by**

Cause	Correction
	excessive clearance between of the splines of the rear output shaft and propeller shaft slip yoke. Replace the following components: • Rear output shaft. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**. • Propeller shaft slip yoke. Refer to **Propeller Shaft Slip Yoke Replacement** .
Transfer case rear output shaft rear bearing retaining ring incorrectly installed	1. Inspect for the following: • Improperly installed rear output shaft rear bearing outer retaining ring. The snap ring is to be installed completely into the OD groove of the bearing. • Excessive wear or damaged retaining ring groove in the rear case half 2. Repair or replace the following components as required: • Properly install a new rear output shaft rear bearing outer retaining ring. • Replace the rear case half if the retaining ring groove is excessively worn. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**.

TRANSFER CASE CLUNK IN 4HI

Cause	Action
DEFINITION: During acceleration or deceleration, a clunk is heard or felt in the transfer case while in the 4HI range only. 1. Compare the noise to a similar vehicle and see if a normal condition. 2. Identify the source of the noise using chassis ears and refer to the appropriate service manual section.	

Cause	Action
3. Note specifics such as when the noise is present (2HI or 4HI). 4. Note if the noise relative to vehicle speed, is noisy on turns, during acceleration, stops, or other specifics. 5. If the source of the noise is the transfer case, inspect for the correct fluid level. 6. Inspect the drain plug for large metal deposits. Small metal flakes and fine metal dust on the plug magnet are to be considered normal. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Tire pressure uneven	**NOTE:** **A clunk condition that occurs when performing slow speed turns in 4WD may be caused by low or uneven tire pressure.** 1. Set the tires to the recommended vehicle tire pressure for evaluation to see if the noise goes away. 2. Upon completion of the test, reset the tire pressure to the correct pressure as recommended on the tire.
Transmission or transfer case mounts loose or damaged	Repair or replace the mounts as required
Propeller shaft center support bearing worn (as applicable)	Replace the center support bearing as required. Refer to **Symptoms - Propeller Shaft** .
Propeller shaft universal joints worn	Replace the universal joints as required. Refer to **Symptoms - Propeller Shaft** .
Front axle actuator shift noise	**NOTE:**

Cause	Action
	When shifting from 2WD-to-4WD or 4WD-to-2WD, the front axle actuator may be heard engaging or disengaging and the axle internal components shifting. This is to be considered a normal condition. Shift from 2WD-to-4WD and from 4WD-to-2WD to determine if the noise source is the front axle to determine if this is a normal condition.
Suspension components worn	Replace the suspension components as required. Refer to **Noise Diagnosis - Front Suspension** , or **Noise Diagnosis - Rear Suspension** .
4WD gear noise	**NOTE:** **A growl or clunk that occurs with vehicle in 4WD at low speed in a tight turning radius situation may be caused by**

Cause	Action
	the gears and chain and is to be considered a normal condition and an operating characteristic of a 4WD system. Operate the vehicle in 4WD performing low speed left or right turns to confirm a transfer case gear noise.
Transfer case rear output shaft rear bearing retaining ring - incorrectly installed	1. Inspect for the following: • Improperly installed rear output shaft rear bearing outer retaining ring. The snap ring is to be installed completely into the OD groove of the bearing. • Excessive wear or damaged retaining ring groove in the rear case half 2. Repair or replace the following components AS REQUIRED: • Properly install a new rear output shaft rear bearing outer retaining ring. • Replace the rear case half if the retaining ring groove is excessively worn. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**.

TRANSFER CASE CLUNK DURING ACCELERATION AND DECELERATION

Cause	Correction
DEFINITION: During acceleration or deceleration, a clunk is heard or felt in the transfer case when it is in AWD mode. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Incorrect fluid level or incorrect fluid	1. Inspect the transfer case for the correct fluid level. 2. Inspect the transfer case for the correct type of fluid. Refer to **Approximate Fluid Capacities**.

Cause	Correction
	3. Flush the transfer case and fill with the correct fluid, if required. Refer to **Transfer Case Fluid Replacement**.
Excessive clearance between the slip yoke and the rear output shaft	1. Inspect for the following conditions: • Worn slip yoke splines • Worn rear output shaft splines 2. Repair or replace the following components if faulty: • Replace the slip yoke, if required. Refer to **Propeller Shaft Slip Yoke Replacement**. • Replace the rear output shaft, if required. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**.
Excessive clearance between the slip yoke and the rear bushing	1. Inspect for the following conditions: • Worn rear bushing • Worn slip yoke bushing journal 2. Repair or replace the following components if faulty: • Replace the slip yoke, if required. Refer to **Propeller Shaft Slip Yoke Replacement**. • Replace the rear bushing if worn. Refer to **Transfer Case Rear Extension Bushing Replacement**.

TRANSFER CASE SHUDDER OR BINDING

Cause	Correction
DEFINITION: When in the AWD mode, a shudder is felt during acceleration or a crow-hop or binding while turning, which may cause tire scuffing. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Oil breakdown or contamination	Flush the transfer case and fill with the correct fluid. Refer to **Transfer Case Fluid Replacement**.

Cause	Correction
Incorrect transfer case fluid	Flush the transfer case and fill with the correct fluid. Refer to **Transfer Case Fluid Replacement**.
Burrs on the clutch hub slots	1. Inspect the clutch disc tab slots in the clutch hub for burrs or notches. Refer to **Two/Four Wheel Drive Shift Components Cleaning and Inspection**. 2. De-burr the hub slots. If the hub slots are excessively notched, replace the clutch hub. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**.

TRANSFER CASE LEAK DIAGNOSIS

Cause	Correction
DEFINITION: A visible indication of an external fluid leak from the transfer case. Review the **Symptoms - Transfer Case** and perform the necessary inspections. See below for suggested diagnostic method(s).	

Special Tools

- **GE 28431-6** Fluorescent Oil Dye
- **GE 28428-E** High Intensity Black Light Kit

For equivalent regional tools, refer to **Special Tools**.

Fluorescent Dye Method

1. Add **GE 28431-6** Fluorescent dye to the transmission or transfer case to determine the source of the leak.
2. Operate the vehicle.
3. Inspect for the presence of dye within the oil leak using the **GE 28428-E** High Intensity Black Light Kit. A presence or non-presence of dye within the oil leak will indicate which component is the source of the leak.

Powder Method

CAUTION:
Do not clean using brake cleaner or other

Cause	Correction
reactive solvents as these solvents can damage rubber gaskets, seals and bushings. 1. Thoroughly clean the suspected leak area using a rag. 2. Apply an aerosol type leak tracing powder to the suspected leak area. **NOTE:** **Do not drive the vehicle on the freeway as this will splatter oil inhibiting leak diagnosis.** 3. Operate the vehicle for 15-20 minutes under city driving conditions until normal operating temperatures are reached. 4. Shut OFF the engine. 5. Inspect the suspected leak area. 6. Trace the leak path through the powder in order to find the source of the leak.	
Transfer case overfill condition (wet cavity applications)	**NOTE:** • **Wet cavity adapter applications**

Cause	Correction

	include transmission RPOs M99/M30/M70.
	• **Dry cavity adapter applications include transmission RPOs MYC/MYD.**
	• **If a transfer case overfill condition is present in a wet cavity adapter application, and the fluid level within the transmission is low, the source of the leak may be a faulty transfer case input shaft oil seal.**
	
	1. Inspect for a transfer case for an overfill condition
	  1. Add **j-28431-6** Fluorescent Dye to the transmission to determine if the transfer case input shaft oil seal is the cause of the overfill.
	  2. Operate the vehicle

Cause	Correction
	3. Inspect the transfer case fluid for presence of dye within the oil using the **j-28428-E** High Intensity Black Light Kit. 2. If fluorescent dye is present within the transfer case fluid, replace the transfer case input shaft oil seal. Refer to **Input Shaft Seal Replacement**.
Transfer case adapter leak - (dry cavity applications)	**NOTE:** • **Dry cavity adapter applications (transmission RPOs MYC/MYD) with a leak at the adapter weep hole location may caused by either a leaking transmission rear output shaft oil seal or a leaking transfer case input shaft oil seal. The adapter gasket is not the source of the leak.** • **Wet cavity adapter applications (transmission**

Cause	Correction
	RPOs M99/M30/M70) with a leak may be caused by a leaking adapter gasket, adapter damage, or porosity. 1. Inspect for a restricted vent hose assembly. Repair as required. 2. Add **J-28431-6** Fluorescent Dye to the transmission to determine the source of the leak. 3. Operate the vehicle 4. Inspect the adapter weep hole for a fluid leak and for traces of dye within the oil using the **J-28428-E** High Intensity Black Light Kit. 5. If fluorescent dye is present within the fluid leak, replace the transmission rear output shaft seal. 6. If fluorescent dye is not present within the fluid leak, replace the transfer case input shaft oil seal. Refer to **Input Shaft Seal Replacement**
Transfer case adapter leak and/or adapter gasket leak - (wet cavity applications)	**NOTE:** • **Wet cavity adapter applications (transmission RPOs M99/M30/M70) with a leak may be caused by a**

Cause	Correction
	leaking adapter gasket, adapter damage, or porosity. • **Dry cavity adapter applications (transmission RPOs MYC/MYD) with a leak at the adapter weep hole location may caused by either a leaking transmission rear output shaft oil seal or a leaking transfer case input shaft oil seal. Neither the adapter or the gasket is the source of the leak.** 1. Inspect for a restricted vent hose assembly. Repair as required. 2. Inspect for a leaking wet cavity adapter gasket, adapter damage, or porosity. Replace the adapter or gasket as required. Refer to **Transfer Case Adapter Replacement**.

REPAIR INSTRUCTIONS - ON VEHICLE

TRANSFER CASE SELECTOR SWITCH REPLACEMENT (CHEVROLET / GMC)

Fig. 7: Transfer Case Selector Switch (Chevrolet / GMC)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove instrument panel accessory bezel. Refer to **Instrument Panel Accessory Bezel Replacement (Chevrolet / GMC)** .	
1	Transfer Case Selector Switch **Procedure** Using the appropriate tool gently depress tabs to remove the switch from the bezel.

TRANSFER CASE SELECTOR SWITCH REPLACEMENT (CADILLAC)

Fig. 8: Transfer Case Selector Switch (Cadillac)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove instrument panel accessory bezel. Refer to **Instrument Panel Accessory Bezel Replacement (Cadillac)** .	
1	Transfer Case Selector Switch **Procedure** Using the appropriate tool gently depress tabs to remove the switch from the bezel.

TRANSFER CASE CONTROL MODULE REPLACEMENT

Fig. 9: Transfer Case Shift Control Module
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the knee bolster. Refer to **Instrument Panel Knee Bolster Replacement (Chevrolet / GMC)** **Instrument Panel Knee Bolster Replacement (Cadillac)** .	
1	Transfer Case Shift Control Module **Procedure** 1. Disconnect the electrical connector. 2. Remove the module from the module bracket by releasing the retaining tabs. 3. If installing a new module, perform the transfer case shift control module programing and setup. Refer to **Control**

Callout	Component Name
	Module References .

TRANSFER CASE SHIELD REPLACEMENT

Fig. 10: Transfer Case Shield
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .	
1	Transfer Case Shield Bolt

Callout	Component Name
	CAUTION: **Refer to Fastener Tightening Caution .** 20 N.m (15 lb ft)
2	Transfer Case Shield

TRANSFER CASE FLUID REPLACEMENT

Fig. 11: Transfer Case Drain Plug And Fill Plug
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the transfer case shield, if equipped. Refer to **Transfer Case Shield Replacement** .	
1	Transfer Case Drain Plug **CAUTION:** **Refer to Component Fastener Tightening Caution .** **Procedure** 1. Allow the transfer case to drain completely. 2. Apply sealant to the plug threads. Refer to **Adhesives, Fluids, Lubricants, and Sealers**. **NOTE:** **Use only hand tools to remove and install the drain plug.** **Tighten** 18 N.m (13 lb ft)
2	Transfer Case Fill Plug **Procedure** 1. Fill the transfer case to the bottom of the fill plug hole with transfer case fluid. Refer to **Adhesives, Fluids,**

Callout	Component Name
	Lubricants, and Sealers. 2. Apply sealant to the plug threads. Refer to Adhesives, Fluids, Lubricants, and Sealers. **NOTE:** **Use only hand tools to remove and install the fill plug.** **Tighten** 18 N.m (13 lb ft)

DRAIN PLUG REPLACEMENT

Fig. 12: Transfer Case Drain Plug And Fill Plug
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the transfer case shield, if equipped. Refer to **Transfer Case Shield Replacement** .	
1	Transfer Case Drain Plug **CAUTION:** **Refer to** **Component**

Callout	Component Name
	Fastener Tightening Caution . **Procedure** 1. Allow the transfer case to drain completely. 2. Apply sealant to the plug threads. Refer to **Adhesives, Fluids, Lubricants, and Sealers**. **NOTE:** **Use only hand tools to remove and install the drain plug.** **Tighten** 18 N.m (13 lb ft)

Callout	Component Name
2	Transfer Case Fill Plug **Procedure** 1. Fill the transfer case to the bottom of the fill plug hole with transfer case fluid. Refer to **Adhesives, Fluids, Lubricants, and Sealers**. 2. Apply sealant to the plug threads. Refer to **Adhesives, Fluids, Lubricants, and Sealers**. **NOTE:** **Use only hand tools to remove and install the fill plug.** **Tighten** 18 N.m (13 lb ft)

FILL PLUG REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

Fig. 13: Transfer Case Fill Plug
Courtesy of GENERAL MOTORS COMPANY

2. Remove the fill plug (1).

Installation Procedure

Fig. 14: Transfer Case Fill Plug
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Component Fastener Tightening Caution .

1. Install the fill plug (1) and tighten to 18 N.m (13 lb ft).
2. Lower the vehicle.

TRANSFER CASE TWO/FOUR WHEEL DRIVE ACTUATOR POSITION SENSOR REPLACEMENT

Fig. 15: Transfer Case Two/Four Wheel Drive Actuator Position Sensor
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .	
1	Two/Four Wheel Drive Actuator Position Sensor Bolt (Qty: 2) **CAUTION:** **Refer to Fastener Caution .**

Callout	Component Name
	Tighten 9 N.m (80 lb in)
2	Two/Four Wheel Drive Actuator Position Sensor **Procedure** Disconnect the electrical connector.
3	Two/Four Wheel Drive Actuator Position Sensor O-Ring Seal **Procedure** Lightly lubricate the O-ring with clean. Refer to **Adhesives, Fluids, Lubricants, and Sealers**.

TRANSFER CASE TWO/FOUR WHEEL DRIVE ACTUATOR REPLACEMENT

Fig. 16: Transfer Case Two/Four Wheel Drive Actuator
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .	
1	Two/Four Wheel Drive Actuator Bolt (Qty: 4) **CAUTION:** **Refer to Fastener Caution .** **Tighten** 18 N.m (13 lb ft)
2	Two/Four Wheel Drive Actuator **Procedure** Disconnect the electrical connector.
3	Two/Four Wheel Drive Actuator Seal **Procedure** 1. Use **J-45278** seal remover and **J-23907** slide hammer to remove the seal from the actuator. 2. Use the **J-44907** bearing installer to install the seal to the actuator. **NOTE:** **Remove the seal from the actuator ONLY if seal replacement is necessary.** **Special Tools** • **J-23907** Slide Hammer • **J-44907** Bearing Installer

Callout	Component Name
	• **J-45278** Seal Remover For equivalent regional tools, refer to **Special Tools**.

VEHICLE SPEED SENSOR REPLACEMENT

Fig. 17: Vehicle Speed Sensor
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .	

Callout	Component Name
2. Remove the transfer case shield, if equipped. Refer to **Transfer Case Shield Replacement** .	
1	Vehicle Speed Sensor **CAUTION:** **Refer to** **Component Fastener Tightening Caution** . **Procedure** Disconnect vehicle speed sensor electrical connector. **Tighten** 17 N.m (13 lb ft)
2	Vehicle Speed Sensor O-Ring **Procedure** Lightly lubricate the O-ring with clean transfer case fluid. Refer to **Adhesives, Fluids, Lubricants, and Sealers**.

FRONT OUTPUT SHAFT SEAL REPLACEMENT

Special Tools

- **DT-50649** Seal Installer
- **J-8092** Driver Handle

For equivalent regional tools, refer to **Special Tools** .

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the transfer case shield, if equipped. Refer to **Transfer Case Shield Replacement** .
3. Remove the front propeller shaft. Refer to **Front Axle Propeller Shaft Replacement (NP0)** **Front Axle Propeller Shaft Replacement (Heavy Duty)** .

Fig. 18: Front Output Shaft Slinger And Oil Seal
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Remove the front output shaft seal in two pieces using the following procedure.**

4. Insert a screwdriver between the metal inner and metal outer portions of the seal.
5. Pry upward in multiple locations working the metal inner portion of the seal off the shaft until removed.
6. Once the inner metal portion is removed, insert a screwdriver between the outer diameter metal flange of the seal and the housing.
7. Drive the screwdriver inward in multiple locations, the outer portion of the seal will be distorted and can easily be removed from the housing.

Installation Procedure

Fig. 19: Front Output Shaft Oil Seal And Installer
Courtesy of GENERAL MOTORS COMPANY

1. Using the **J-8092** driver handle and **DT-50649** installer (2) install the front output shaft oil seal (1) to the transfer case.

Fig. 20: Front Output Shaft Oil Slinger And Installer
Courtesy of GENERAL MOTORS COMPANY

NOTE: **The new design front output shaft oil slinger can be installed onto all current and prior model year applications, providing the new design front output shaft seal is also installed. Refer to Transfer Case Description and Operation .**

2. Using the **J-8092** driver handle and **DT-50649** installer (2) install the front output shaft oil slinger (1) to the transfer case.

3. Install the front propeller shaft. Refer to **Front Axle Propeller Shaft Replacement (NP0)** **Front Axle Propeller Shaft Replacement (Heavy Duty)** .
4. Install the transfer case shield, if equipped. Refer to **Transfer Case Shield Replacement** .
5. Lower the vehicle.

REAR OUTPUT SHAFT SEAL REPLACEMENT

Fig. 21: Rear Output Shaft Seal
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **Do not damage the**	

Callout	Component Name
sealing surfaces of the transfer cases or the shafts when prying the seals for removal. Damaging the sealing surface may cause leakage or require replacement of the damaged component.	
Preliminary Procedure Remove the rear propeller shaft. Refer to **Rear Propeller Shaft Replacement (1500)** **Rear Propeller Shaft Replacement (Heavy Duty)** **Rear Propeller Shaft Replacement (M5U, 2WD)** .	
1	Transfer Case Output Shaft Seal **Procedure** 1. Remove the seal using an appropriate tool. 2. Install the seal with the notch at the top and the weep hole at the bottom. **NOTE:** **Use the appropriate seal installer depending on application.**

Callout	Component Name
	Special Tools • **DT-48210** Seal Installer • **GE-8092** Driver Handle For equivalent regional tools, refer to **Special Tools**.

TRANSFER CASE REAR EXTENSION BUSHING REPLACEMENT

Fig. 22: Transfer Case Rear Extension Bushing
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **Refer to Transfer Case Seal Removal Caution .** **Preliminary Procedure** Remove the transfer case rear output shaft seal. Refer to **Rear Output Shaft Seal Replacement** .	
1	Transfer Case Rear Output Shaft Bushing **Procedure** 1. Install the finger section of the **J-45380** transfer case rear bushing remover and installer in front of the bushing. 2. Install the forcing tube assembly into the finger section. Ensure the forcing screw is backed out. 3. Using a wrench on the forcing screw, remove the bushing. 4. Remove the old bushing from the **J-45380** transfer case rear bushing remover and installer. 5. Install the NEW bushing on the finger section of the **J-45380** transfer case rear bushing remover and installer. 6. Install the finger section to the forcing tube assembly of the **J-45380** transfer case rear bushing remover and installer. 7. Position the bushing and tool to the rear case half. 8. Install the bushing until the tool bottoms on the rear case half. **NOTE:** • **Only remove the bushing if faulty.** • **If the bushing was removed,**

Callout	Component Name
	a new bushing must be installed. • **Ensure the bushing is installed squarely into the bushing bore.** **Special Tools** **J-45380** Transfer Case Rear Bushing Remover and Installer For equivalent regional tools, refer to **Special Tools**.

TRANSFER CASE ASSEMBLY REPLACEMENT

Fig. 23: Transfer Case Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Preliminary Procedures

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the transfer case shield, if equipped. Refer to **Transfer Case Shield Replacement** .
3. Remove the rear propeller shaft. Refer to **Rear Propeller Shaft Replacement (1500)** **Rear Propeller Shaft Replacement (Heavy Duty)** **Rear Propeller Shaft Replacement (M5U, 2WD)** .
4. Remove the front propeller shaft. Refer to **Front Axle Propeller Shaft Replacement (NP0)** **Front Axle Propeller Shaft Replacement (Heavy Duty)** .
5. Drain the fluid from the transfer case. Refer to **Transfer Case Fluid Replacement** .

Callout	Component Name
6. Disconnect the electrical connectors and remove the electrical harness from the transfer case. 7. Disconnect the vent hose at the transfer case. 8. Remove the crossmember. Refer to **Transmission Support Crossmember Replacement (4WD)** . 9. Remove the transmission mount. Refer to **Transmission Mount Replacement (Four Wheel Drive)** for the 6L45/6L50/6L80/6L90 transmission.	
1	Transfer Case Nut (Qty: 6) **CAUTION:** **Refer to Fastener Caution .** **Tighten** 50 N.m (37 lb ft)
2	Transfer Case **Procedure** 1. If installing a new or repaired transfer case, perform the Transfer Case High/Low Clutch reset. Refer to **Transfer Case High/Low Clutch Reset** . 2. Transfer parts as necessary.
3	Transfer Case Gasket **Procedure** 1. Install a NEW gasket without the use of any type of sealant or lubricant. 2. Apply lubricant meeting GM Specification 9985830 to the input shaft splines. Refer to **Adhesives, Fluids, Lubricants, and Sealers**.

TRANSFER CASE ADAPTER REPLACEMENT

Fig. 24: Transfer Case Adapter
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Remove the transfer case. Refer to **Transfer Case Assembly Replacement**. 2. Remove the transmission mount. Refer to **Transmission Mount Replacement (Four Wheel Drive)** for the 6L45/6L50/6L80/6L90 transmission.	
1	Transfer Case
2	Gasket
3	Transfer Case Adapter Bolt (Qty: 6)

Callout	Component Name
	CAUTION: **Refer to Fastener Caution .** Tighten 50 N.m (37 lb ft)
4	Extension Housing
5	Seal **NOTE:** **Seal is only used for the 4L60-E transmission and should be replaced when the adapter is removed. Do Not use any type of sealant or adhesive in place of or with the seal.**

INPUT SHAFT SEAL REPLACEMENT

Fig. 25: Input Shaft Seal
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **Do not damage the sealing surfaces of the transfer cases or the shafts when prying the seals for**	

Callout	Component Name
removal. Damaging the sealing surface may cause leakage or require replacement of the damaged component. **Preliminary Procedure** Remove the transfer case. Refer to **Transfer Case Assembly Replacement** .	
1	Transfer Case Nut **Procedure** Use transfer case nuts to secure transfer case to assembly fixture **J-45759** assembly fixture. **Special Tools** **J-45759** Assembly Fixture For equivalent regional tools, refer to **Special Tools**.
2	Transfer Case **Procedure** Insert the transfer case and assembly fixture into the bench holding fixture **J-3289-20** holding fixture and secure with pivot pin. **Special Tools** **J-3289-20** Holding Fixture For equivalent regional tools, refer to **Special Tools**.
3	Transfer Case Input Shaft Seal **Procedure** 1. Remove the seal using an appropriate tool. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** . 2. Install the seal using **J 42738** seal installer.

Callout	Component Name
	NOTE: • **Ensure the bore of the front case half is free of dirt, oil, and cleaning solvent.** • **Double lip input shaft oil seals are used on ap w ac ca** • **Si in oi us ap w ac ca w tr ar in w sp po th facing inward towards the**

Special Tools
J-42738 Seal Installer
For equivalent regional tools, refer to **Special Tools**.

REPAIR INSTRUCTIONS - OFF VEHICLE

TRANSFER CASE DISASSEMBLE

Transfer Case Holding Fixture Installation

Fig. 26: Transfer Case Holding Fixture

Courtesy of GENERAL MOTORS COMPANY

Transfer Case Holding Fixture Installation

Callout	Component Name
1	Transfer Case Nuts **Special Tools** **J-45759** Assembly Fixture For equivalent regional tools, refer to **Special Tools**.
2	Transfer Case **Special Tools** **J-3289-20** Holding Fixture
3	Pivot Pin **NOTE:** • **Always secure with the pivot pin after rotating.** • **The transfer case can be rotated 360 degrees to facilitate repair.**

Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor, and Vehicle Speed Sensor Removal

Fig. 27: Transfer Case Components
Courtesy of GENERAL MOTORS COMPANY

Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor, and Vehicle Speed Sensor Removal

Callout	Component Name
1	Transfer Case Actuator Shaft Position Sensor Bolt/Screw
2	Transfer Case Actuator Shaft Position Sensor Assembly
3	Transfer Case Actuator Shaft Position Sensor O-ring Seal
4	Transfer Case Two/Four Wheel Drive Actuator Bolt/Screw
5	Transfer Case Two/Four Wheel Drive Actuator Assembly
6	Transfer Case Oil Drain Plug
7	Transfer Case Oil Fill Plug
8	Transfer Case Vent

Callout	Component Name
	NOTE:
9	Vehicle Speed Sensor Assembly
10	Vehicle Speed Sensor O-ring Seal
11	Transfer Case Access Hole Plugs (Qty: 2)

Remove ONLY if the vent pipe is damaged.

Rear Output Shaft Seal and Bushing Removal

Fig. 28: Rear Output Shaft Seal And Bushing
Courtesy of GENERAL MOTORS COMPANY

Rear Output Shaft Seal and Bushing Removal

Callout	Component Name
1	Transfer Case Rear Output Shaft Seal

Callout	Component Name
	CAUTION: **Refer to Transfer Case Seal Removal Caution .**
2	Transfer Case Rear Output Shaft Bushing **NOTE:** **Follow the steps below for use of the J-45380 remover/installer.** **Procedure** 1. Only remove the bushing if faulty. Refer to **Transfer Case Rear Half Cleaning and Inspection**. 2. Install the finger section of the **J-45380** remover/installer in front of the bushing. 3. Install the tube and forcing screw assembly into the finger section. Ensure the forcing screw is backed out. 4. Using a wrench on the forcing screw, remove the bushing. **Special Tools** **J-45380** Transfer Case Rear Bushing Remover and Installer

Transfer Case Rear Case Half Removal

Fig. 29: Transfer Case Rear Case Half
Courtesy of GENERAL MOTORS COMPANY

Transfer Case Rear Case Half Removal

Callout	Component Name
1	Transfer Case Bolts (Qty: 17)
2	Transfer Case Bracket
3	Transfer Case Rear Case Half **CAUTION:** **Refer to** **Machined Surface Damage**

Callout	Component Name
	Caution . **NOTE:** • **Use opposing pry bars at casting bosses to spread the case.** • **Use snap ring pliers to release the transfer case rear output shaft outer retaining ring from the transfer case rear output shaft rear bearing assembly.**

Oil Pump Suction Pipe and Actuator Shaft Gear Removal

Fig. 30: Oil Pump Suction Pipe and Actuator Shaft Gear
Courtesy of GENERAL MOTORS COMPANY

Oil Pump Suction Pipe and Actuator Shaft Gear Removal

Callout	Component Name
1	Transfer Case Actuator Shaft Gear
2	Transfer Case Oil Pump Suction Pipe
3	Transfer Case Oil Pump Suction Pipe Seal

Propeller Shaft Oil Seal Sleeve Removal

Fig. 31: Propeller Shaft Oil Seal Sleeve
Courtesy of GENERAL MOTORS COMPANY

Propeller Shaft Oil Seal Sleeve Removal

Callout	Component Name
1	Propeller Shaft Oil Seal Sleeve **NOTE:** • **Discard the propeller shaft oil seal sleeve.**

Callout	Component Name
	The sleeve cannot be reused and must be replaced. Install NEW during assembly. • **Use the 3/8 x 24 in threaded rods for propeller shaft oil seal sleeve removal.** **Special Tools** • **DT-22912-B** Split Plate Bearing Puller • **DT-50802** Threaded Rod Kit • **GE-8433-1** Puller Bar For equivalent regional tools, refer to **Special Tools**.

Actuator Shaft and Cam Assembly, Drive Chain, and Rear Output Shaft Assembly Removal

Fig. 32: Actuator Shaft and Cam Assembly, Drive Chain, and Rear Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Actuator Shaft and Cam Assembly, Drive Chain, and Rear Output Shaft Assembly Removal

Callout	Component Name
1	Transfer Case Rear Output Shaft Assembly **NOTE:** **Mount the assembly into a soft-jaw vice or holding fixture for disassembly.**

Callout	Component Name
2	Transfer Case Actuator Shaft and Cam Assembly
3	Transfer Case Front Output Shaft Drive Chain Assembly

Rear Output Shaft Assembly Disassemble

Fig. 33: Rear Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Rear Output Shaft Assembly Disassemble

Callout	Component Name
1	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring
2	Transfer Case Rear Output Shaft Rear Bearing Assembly **NOTE:**

Callout	Component Name
	Use an arbor press or suitable puller to remove the bearing from the rear output shaft.
3	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring
4	Transfer Case Rear Output Shaft Speed Reluctor Wheel
5	Transfer Case Oil Pump Assembly
6	Transfer Case Front Output Shaft Drive Sprocket Retaining Ring
7	Transfer Case Front Output Shaft Drive Sprocket Spacer - Rear
8	Transfer Case Front Output Shaft Drive Sprocket
9	Transfer Case Four Wheel Drive Clutch Housing Retaining Ring
10	Transfer Case Four Wheel Drive Clutch Housing
11	Transfer Case Front Output Shaft Drive Sprocket Bearing Assembly (Qty: 2) **Procedure** Only remove the bearing if faulty. Refer to **Drive Chain, Drive Sprocket, and Driven Sprocket Cleaning and Inspection**.
12	Transfer Case Front Output Shaft Drive Sprocket Spacer - Front
13	Transfer Case Two/Four Wheel Drive Clutch Retaining Ring
14	Transfer Case Four Wheel Drive Clutch Shim
15	Transfer Case Four Wheel Drive Clutch Hub
16	Transfer Case Four Wheel Drive Clutch Pressure - Friction - Plate (Qty: 8)
17	Transfer Case Four Wheel Drive Clutch Pressure - Steel - Plate (Qty: 7)
18	Transfer Case Four Wheel Drive Clutch Pressure Plate Spring (Qty: 4)
19	Transfer Case Four Wheel Drive Clutch Pressure - Apply - Plate
20	Transfer Case Control Actuator Lever Washer
21	Transfer Case Control Actuator Lever Thrust Bearing Assembly

Callout	Component Name
22	Transfer Case Control Actuator Lever Assembly **NOTE:** **Refer to Service Parts Release Usage Change - NQH/NP0 Control Actuator Levers in the New Product Information**
23	Transfer Case Control Actuator Lever Ball (Qty: 3)
24	Transfer Case Control Actuator Lever Bearing Assembly
25	Transfer Case Control Lever
26	Transfer Case Control Actuator Lever Thrust Bearing Assembly
27	Transfer Case Rear Output Shaft

Input Shaft Oil Seal Removal

Fig. 34: Input Shaft Oil Seal
Courtesy of GENERAL MOTORS COMPANY

Input Shaft Oil Seal Removal

Callout	Component Name
1	Input Shaft Oil Seal **CAUTION:** **Refer to Machined Surface Damage Caution .** **Procedure**

Callout	Component Name
	1. Drill a pilot hole, as required, and insert a self-tapping screw into the body of the seal. 2. Use a plier or slide hammer type tool to remove the seal from the bore.

Input Shaft Assembly Removal

Fig. 35: Input Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Input Shaft Assembly Removal

Callout	Component Name
1	Transfer Case Input Shaft Seal
2	Transfer Case Input Shaft Bearing Outer Retaining Ring
3	Transfer Case Input Shaft

Callout	Component Name
4	Transfer Case Input Shaft Pilot Bearing Assembly **Procedure** Only remove the bearing if faulty. Refer to **Front Output Shaft and Input Shaft Cleaning and Inspection**.
5	Transfer Case Input Shaft Inner Retaining Ring
6	Transfer Case Input Shaft Bearing Assembly

Front Output Shaft Assembly Removal

Fig. 36: Front Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Front Output Shaft Assembly Removal

Callout	Component Name
1	Transfer Case Front Output Shaft Oil Slinger - Model Dependent

Callout	Component Name
	NOTE: **Refer to Interim Model Year Design Change - NQF/NQG /NQH/NP0 Front Output Shaft, Deflector, Seal in the New Product Information.**
2	Transfer Case Front Output Shaft Seal **Procedure** 1. Remove the front output shaft seal in two pieces using the following procedure. 2. Insert a screwdriver between the metal inner and metal outer portions of the seal. 3. Pry upward in multiple locations working the metal inner portion of the seal off the shaft until removed. 4. Once the inner metal portion is removed, insert a screwdriver between the outer diameter metal flange of the seal and the housing. 5. Drive the screwdriver inward in multiple locations, the outer portion of the seal will be distorted and can easily be removed from the housing.
3	Transfer Case Front Case Half **NOTE:** **Place the front case half on an arbor press.**

Callout	Component Name
4	Transfer Case Front Output Shaft Assembly **NOTE:** **Press the front output shaft assembly from the front case half using an arbor press or soft-face hammer.**

TRANSFER CASE FRONT HALF CLEANING AND INSPECTION

Fig. 37: Transfer Case Front Half Cleaning And Inspection Points
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **Refer to Machined Surface Damage Caution .** **Preliminary Procedure** 1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated.	

Callout	Component Name
2. Clean the front case half in cleaning solvent and air dry. 3. Remove any sealant from the sealing surface.	
1	Transfer Case Front Half Assembly **NOTE:** **Inspect for cracks, broken areas, or other damage. The component must be replaced if damage is found.**
2	Transfer Case Front Output Shaft Front Bearing Bore **NOTE:** **Replace the front case half assembly if a bearing has spun or if cracks are detected.**
3	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Bore **NOTE:** **Replace the front case half**

Callout	Component Name
	assembly if a bearing has spun or if cracks are detected.
4	Transfer Case Studs (Qty: 6) **NOTE:** **Replace any damaged studs**
5	Transfer Case Input Shaft Bearing Bore **NOTE:** **Replace the front case half assembly if a bearing has spun or if cracks are detected.**
6	Case Sealing Surface **NOTE:** **Repair small scratches or nicks with a soft stone.**
7	Transfer Case Thread Bolt Holes **NOTE:**

Callout	Component Name
	Repair any damaged threads.
8	Transfer Case Locating Pin Holes **NOTE:** **Replace the front case half assembly if the locating pin holes are out of round or damaged.**
9	Transfer Case Locating pins (Qty: 2) **NOTE:** **Repair or replace loose, missing, or damaged locating pins.**
10	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Assembly **Procedure** Replace the bearing if roughness, brinelling, or pitting is detected. Refer to **Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Replacement - Front**.

TRANSFER CASE REAR HALF CLEANING AND INSPECTION

Fig. 38: Transfer Case Rear Half Cleaning And Inspection Points
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **Refer to Machined Surface Damage Caution .** **Preliminary Procedure** 1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated.	

Callout	Component Name
2. Clean the rear case half in cleaning solvent and air dry. 3. Remove any sealant from the sealing surface.	
1	Transfer Case Rear Case Half Assembly **NOTE:** **Inspect for cracks, broken areas, or other damage. The component must be replaced if damage is found.**
2	Transfer Case Rear Output Shaft Rear Bearing Outer Retaining Ring Groove **NOTE:** **Replace the rear case half assembly if the groove is worn.**
3	Vehicle Speed Sensor Threads **NOTE:** **Replace the rear case half assembly if the speed**

Callout	Component Name
	sensor threads are damaged.
4	Transfer Case Rear Output Shaft Rear Bearing Bore **NOTE:** **Replace the rear case half assembly if a bearing has spun or if cracks are detected.**
5	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Bore **NOTE:** **Replace the front case half assembly if a bearing has spun or if cracks are detected.**
6	Case Sealing Surface **NOTE:** **Repair small scratches or nicks with a soft stone.**

Callout	Component Name
7	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Assembly **Procedure** Replace the bearing if roughness, brinelling, or pitting is detected. Refer to **Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Replacement - Rear**.
8	Transfer Case Front Output Shaft Rear Bearing Bore **NOTE:** **Replace the rear case half assembly if a bearing has spun or if cracks are detected.**
9	Transfer Case Locating Pin Holes **NOTE:** **Replace the rear case half assembly if the locating pin holes are out of round or damaged.**
10	Transfer Case Rear Output Shaft Bushing **Procedure** 1. Replace the bushing if it is damaged or worn. Refer to **Transfer Case Disassemble**, and **Transfer Case Assemble**. 2. If the bushing is removed, inspect the bushing bore for signs of spinning. Replace the rear case half assembly if the bushing has spun.

OIL PUMP CLEANING AND INSPECTION

Fig. 39: Transfer Case Oil Pump Cleaning And Inspection Points
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated. 2. Clean all components in cleaning solvent and air dry.	
1	Transfer Case Oil Pump Assembly **NOTE:**

Callout	Component Name
	Replace the oil pump assembly if end play is evident or if there is any sign of binding. End play can be measured by inserting a feeler gauge between the outer rotor and housing. If the end play is greater than 0.1 mm (0.004 in), replace the oil pump assembly. Do not disassemble the oil pump. The oil pump is serviced as an assembly.
2	Transfer Case Oil Pump Suction Pipe **NOTE:** **Replace the**

Callout	Component Name
	oil pump suction pipe if the screen is embedded with debris.

REAR OUTPUT SHAFT CLEANING AND INSPECTION

Fig. 40: Rear Output Shaft Cleaning And Inspection Points
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure	

Callout	Component Name
1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated. 2. Clean all components in cleaning solvent and air dry.	
1	Transfer Case Rear Output Shaft Splines **NOTE:** **Witness marks at the location of the yoke are normal.**
2	Transfer Case Oil Pump and Rear Output Shaft Speed Reluctor Wheel Engagement Splines **NOTE:** **Witness marks at the location of the components are normal.**
3	Transfer Case Front Output Shaft Drive Sprocket Bearing Surface **NOTE:** **Inspect for scoring, brinelling, pitting, or excessive wear.**
4	Transfer Case Two/Four Wheel Drive Clutch Hub Engagement Splines **NOTE:**

Callout	Component Name
	Witness marks at the location of the hub is normal.
5	Transfer Case Control Actuator Lever Bearing Surface **NOTE:** **Inspect for scoring, brinelling, pitting, or excessive wear.**
6	Transfer Case Control Actuator Lever Thrust Bearing Surface **NOTE:** **Inspect for scoring, brinelling, pitting, or excessive wear.**
7	Transfer Case Engagement Splines **NOTE:** **Witness marks at the location of the splines is normal.**
8	Transfer Case Input Shaft Pilot Bearing Surface

Callout	Component Name
	NOTE:
9	Oil galleries **Inspect for scoring, pitting, or excessive wear.** **NOTE: Compressed air may be necessary to clean the oil galleries.**

FRONT OUTPUT SHAFT AND INPUT SHAFT CLEANING AND INSPECTION

Fig. 41: Front Output Shaft And Input Shaft Cleaning And Inspection Points

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated. 2. Clean all components in cleaning solvent and air dry.	
1	Transfer Case Input Shaft Seal Surface **NOTE:** **Inspect for pitting, excessive wear, or damage.**
2	Transfer Case Input Shaft Bearing Surface **NOTE:** **Inspect for excessive wear, damage, or if the bearing has spun on the shaft.**
3	Transfer Case Input Shaft Pilot Bearing Surface **NOTE:** **If the bearing is removed, inspect for excessive**

Callout	Component Name
	wear, damage, or if the bearing has spun in the bore.
4	Transfer Case Input Shaft Splines **NOTE:** **Witness marks at the location of the splines are normal.**
5	Transfer Case Input Shaft Pilot Bearing Assembly **Procedure** Replace the bearing if roughness, brinelling, or pitting is detected. Refer to **Input Shaft Pilot Bearing Replacement**.
6	Transfer Case Front Output Shaft Front Bearing Assembly **Procedure** Replace the bearing if roughness, brinelling, or pitting is detected. Refer to **Front Output Shaft Front and Rear Bearing Replacement**.
7	Transfer Case Front Output Shaft Seal Surface **NOTE:** **Inspect for pitting, excessive wear, or damage.**
8	Transfer Case Front Output Shaft Front Bearing Surface **NOTE:** **If the bearing is**

Callout	Component Name
	removed, inspect for excessive wear, damage, or if the bearing has spun on the shaft.
9	Transfer Case Front Output Shaft Driven Sprocket Engagement Splines **NOTE:** **Witness marks at the location of the sprocket is normal.**
10	Transfer Case Front Output Shaft Rear Bearing Surface **NOTE:** **If the bearing is removed, inspect for excessive wear, damage, or if the bearing has spun on the shaft.**
11	Transfer Case Front Output Shaft Hole Plug **Procedure** Replace the plug if removed. Refer to **Front Output Shaft Front and Rear Bearing Replacement**.
12	Transfer Case Front Output Shaft Rear Bearing Assembly **Procedure**

Callout	Component Name
	Replace the bearing if roughness, brinelling, or pitting is detected. Refer to **Front Output Shaft Front and Rear Bearing Replacement**.

DRIVE CHAIN, DRIVE SPROCKET, AND DRIVEN SPROCKET CLEANING AND INSPECTION

Fig. 42: Drive Chain, Drive Sprocket, And Driven Sprocket Cleaning And Inspection Points
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated. 2. Replace any components if damage is found in this procedure. The sprockets must be replaced as a pair.	

Callout	Component Name
3. Clean all components in cleaning solvent and air dry.	
1	Transfer Case Front Output Shaft Drive Sprocket Bearing Assembly **Procedure** Replace the bearings if roughness, brinelling, or pitting is detected. Refer to **Front Output Shaft Drive Sprocket Bearing Replacement**.
2	Transfer Case Front Output Shaft Drive Sprocket Bearing Bore **NOTE:** **If the bearing is removed, inspect for excessive wear, damage, or if the bearing has spun in the bore.**
3	Transfer Case Four Wheel Drive Clutch Housing Engagement Teeth **NOTE:** **Inspect the engagement teeth for chips or excessive wear.**
4	Transfer Case Front Output Shaft Drive Sprocket **NOTE:** • **Inspect for chipped**

Callout	Component Name
	teeth, excessively worn gear surfaces, and debris embedded in the root of the teeth. • **Witness marks at the location of the chain is normal.**
5	Transfer Case Front Output Shaft Driven Sprocket **NOTE:** • **Inspect for chipped teeth, excessively worn gear surfaces, and debris embedded in the root of the teeth.** • **Witness marks at the location of**

Callout	Component Name
	the chain is normal.
6	Transfer Case Front Output Shaft Drive Chain Assembly **NOTE:** **Inspect for loose link pins, binding or stiff links, debris embedded in the links, or worn teeth surfaces.**

HIGH/LOW SHIFT COMPONENTS CLEANING AND INSPECTION

Fig. 43: High/Low Shift Components Cleaning And Inspection Points
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated. 2. Clean all components in cleaning solvent and air dry.	
1	Transfer Case Actuator Cam Retaining Ring **NOTE:** **Inspect the ring for wear**

Callout	Component Name
	or damage.
2	Transfer Case Actuator Cam Spacer **NOTE:** **Inspect the spacer for wear or damage.**
3	Transfer Case Actuator Cam **NOTE:** **Inspect the cam for wear on the roller surface and damage to the splines. Witness marks on the splines are normal.**
4	Transfer Case Control Actuator Shaft **NOTE:** **Inspect the shaft splines for excessive wear. The component must be replaced if damage is**

Callout	Component Name
	found.
5	Transfer Case Actuator Shaft Gear Teeth **NOTE:** • **Inspect for chipped teeth, excessively worn gear surfaces, and debris embedded in the root of the teeth.** • **Inspect the shaft splines for excessive wear. Witness marks on the splines are normal.**

TWO/FOUR WHEEL DRIVE SHIFT COMPONENTS CLEANING AND INSPECTION

Fig. 44: Two/Four Wheel Drive Shift Components Cleaning And Inspection Points
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated. 2. Clean all components in cleaning solvent and air dry, except the clutch plates.	
1	Transfer Case Control Actuator Thrust Bearing **NOTE:** **Replace the bearing if**

Callout	Component Name
	roughness, brinelling, or pitting is detected.
2	Transfer Case Control Actuator Lever Thrust Bearing Surface **NOTE:** • **Refer to Service Parts Release Usage Change - NQH/NP0 Control Actuator Levers in the New Product Information** • **Inspect for pitting, excessive wear, or damage.**
3	Transfer Case Control Actuator Lever Bearing Surface **NOTE:** **Inspect for pitting, excessive wear, or damage.**

Callout	Component Name
4	Transfer Case Control Lever Arm **NOTE:** **Inspect for excessive wear or damage.**
5	Transfer Case Control Actuator Lever Ball Ramps **NOTE:** **Inspect for pitting, excessive wear, or damage.**
6	Transfer Case Control Actuator Lever Bearing **NOTE:** **Replace the bearing if roughness, brinelling, or pitting is detected.**
7	Transfer Case Control Actuator Lever Balls **NOTE:** **Replace the bearings if roughness or pitting is detected.**

Callout	Component Name
8	Transfer Case Control Actuator Lever Ball Ramps **NOTE:** **Inspect for pitting, excessive wear, or damage.**
9	Transfer Case Control Actuator Lever Bearing **NOTE:** **Replace the control actuator lever assembly if roughness, brinelling, or pitting is detected.**
10	Transfer Case Control Actuator Lever Bearing Surface **NOTE:** **Inspect for pitting, excessive wear, or damage.**
11	Transfer Case Control Actuator Thrust Bearing **NOTE:** **Replace the bearing if**

Callout	Component Name
	roughness, brinelling, or pitting is detected.
12	Transfer Case Control Actuator Lever Washer **NOTE:** **Inspect for pitting, excessive wear, or damage.**
13	Transfer Case Four Wheel Drive Clutch Pressure (Apply) Plate Washer Surface **NOTE:** **Inspect for pitting, excessive wear, or damage.**
14	Transfer Case Four Wheel Drive Clutch Pressure (Apply) Plate Surface **NOTE:** **Inspect for excessive wear, cracks, or damage.**
15	Transfer Case Four Wheel Drive Clutch Pressure Plate Springs **NOTE:** **Inspect the springs for cracks.**

Callout	Component Name
16	Transfer Case Four Wheel Drive Clutch Pressure (Friction) Plates **NOTE:** **Inspect for worn, grooved, burnt, or flaking friction material, or warped friction plates.**
17	Transfer Case Four Wheel Drive Clutch Pressure (Steel) Plates **NOTE:** **Inspect for worn or warped steel plates.**
18	Transfer Case Four Wheel Drive Clutch Hub Bearing Surface **NOTE:** **Inspect for pitting, excessive wear, or damage.**
19	Transfer Case Four Wheel Drive Clutch Hub Teeth **NOTE:** **Inspect for excessive**

Callout	Component Name
	wear or damage. Excessive wear can be identified by steps in the teeth.
20	Transfer Case Four Wheel Drive Clutch Hub Friction Plate Surface **NOTE:** **Inspect for excessive wear, cracks, or damage.**
21	Transfer Case Front Output Shaft Drive Sprocket Engagement Teeth **NOTE:** **Inspect the engagement teeth for excessive looseness on the front output shaft drive sprocket.**
22	Transfer Case Four Wheel Drive Clutch Housing Teeth **NOTE:** **Inspect for excessive wear or damage.**

Callout	Component Name
	Excessive wear can be identified by steps in the teeth.
23	Transfer Case Four Wheel Drive Clutch Hub Splines **NOTE:** **Inspect the splines for excessive looseness on the rear output shaft.**
24	Transfer Case Two/Four Wheel Drive Actuator Cam **NOTE:** **Inspect the cam lobes for wear or roughness.**
25	Transfer Case Two/Four Wheel Drive Actuator Cam Spacer **NOTE:** **Inspect the spacer for wear or roughness.**

TRANSFER CASE FOUR WHEEL DRIVE ACTUATOR LEVER SHAFT BEARING REPLACEMENT - FRONT

Fig. 45: Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing - Front
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Ensure the bearing is installed squarely into the bearing bore.	
1	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Assembly **Procedure** 1. Ensure the printing on the bearing is facing upward. 2. A suitable adapter is required to use with the **J 8092** driver. 3. Press the bearing until the bearing bottoms on the front case half. **Special Tools**

Callout	Component Name
	• **J 2619-01** Slide Hammer • **J 8092** Universal Driver • **J 44737** Shift Rail Bearing Remover For equivalent regional tools, refer to **Special Tools**.

TRANSFER CASE FOUR WHEEL DRIVE ACTUATOR LEVER SHAFT BEARING REPLACEMENT - REAR

Fig. 46: Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing - Rear
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
Preliminary Procedure Ensure the bearing is installed squarely into the bearing bore.	
1	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Assembly **Procedure** 1. Ensure the printing on the bearing is facing upward. 2. A suitable adapter is required to use with the **J 8092** driver to install. 3. Press the bearing until the bearing bottoms on the rear case half. **Special Tools** **J 8092** Universal Driver For equivalent regional tools, refer to **Special Tools**.

INPUT SHAFT PILOT BEARING REPLACEMENT

Fig. 47: Input Shaft Pilot Bearing
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Ensure the bearing is installed squarely into the input shaft bore.	
1	Transfer Case Input Shaft Pilot Bearing **Procedure** 1. Using a suitable adapter and an arbor press, remove the input shaft pilot bearing by going through the front of the input gear. 2. Install the bearing using the small side of the **DT-48212** bearing installer. 3. Press the bearing until the tool bottoms on the input shaft.

Callout	Component Name
	Special Tools • **DT-48212** Input Shaft Pilot Bearing Installer • **J 8092** Universal Driver For equivalent regional tools, refer to **Special Tools**.

FRONT OUTPUT SHAFT FRONT AND REAR BEARING REPLACEMENT

Fig. 48: Front Output Shaft Front And Rear Bearing
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
Preliminary Procedure 1. Ensure the bearings are installed squarely on the front output shaft. 2. Using a suitable adapter and an arbor press, remove the bearing assemblies from the front output shaft.	
1	Transfer Case Front Output Shaft Rear Bearing Assembly **NOTE:** **Using a suitable adapter and an arbor press, install the bearing until the bearing bottoms against the spacer.**
2	Transfer Case Front Output Shaft Front Bearing Assembly **NOTE:** **Using a suitable adapter and an arbor press, install the bearing until the bearing bottoms on the front output shaft.**

Callout	Component Name
3	Transfer Case Front Output Shaft Hole Plug **Procedure** 1. Using a suitable adapter and an arbor press, remove the front output shaft hole plug by going through the front of the front output shaft. 2. Install the plug using the large side of the **DT-48212** bearing installer. 3. Press the plug until the tool bottoms on the front output shaft. **Special Tools** • **DT-48212** Input Shaft Pilot Bearing Installer • **J 8092** Universal Driver For equivalent regional tools, refer to **Special Tools**.

FRONT OUTPUT SHAFT DRIVE SPROCKET BEARING REPLACEMENT

Fig. 49: Front Output Shaft Drive Sprocket Bearing
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Using the **J 35512** bearing installer and an arbor press, remove the bearing assemblies from the drive sprocket. 2. Ensure the bearings are installed squarely into the drive sprocket bore. 3. Install the bearings from the top with the clutch teeth facing down. **Special Tools J 35512** Inner Pinion Bearing Installer	
1	Transfer Case Front Output Shaft Drive Sprocket Bearing Assembly - Front **Procedure**

Callout	Component Name
	1. Install the bearing using the long side of the **DT-48211** bearing installer. 2. Ensure the flat edge of the bearing is facing upward. 3. Using an arbor press or hammer, install the bearing until the tool bottoms on the drive sprocket. **Special Tools** • **DT-48211** Drive Sprocket Bearing Installer • **J 8092** Universal Driver • **J 35512** Inner Pinion Bearing Installer For equivalent regional tools, refer to **Special Tools**.
2	Transfer Case Front Output Shaft Drive Sprocket Bearing Assembly - Rear **Procedure** 1. Install the bearing using the short side of the **DT-48211** bearing installer. 2. Ensure the flat edge of the bearing is facing upward. 3. Using an arbor press or hammer, install the bearing until the tool bottoms on the drive sprocket. **Special Tools** • **DT-48211** Drive Sprocket Bearing Installer • **J 8092** Universal Driver • **J 35512** Inner Pinion Bearing Installer For equivalent regional tools, refer to **Special Tools**.

TRANSFER CASE ASSEMBLE

Input Shaft Assembly Installation

Fig. 50: Input Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Input Shaft Assembly Installation

Callout	Component Name
1	Transfer Case Input Shaft Bearing Assembly
2	Transfer Case Input Shaft Inner Retaining Ring
3	Transfer Case Input Shaft
4	Transfer Case Input Shaft Bearing Outer Retaining Ring

Measuring Clutch Pack Height

Fig. 51: Measuring Clutch Pack Height
Courtesy of GENERAL MOTORS COMPANY

Measuring Clutch Pack Height

Callout	Component Name
Preliminary Procedure 1. The **DT-48213** gauge applies a predetermined amount of pressure to the clutch pack in order to properly measure the clutch pack height. Do not use any other method than what is outlined below. 2. Micrometers or depth gauges may also be used in conjunction with the **DT-48213** gauge to measure the clutch pack height. 3. Two variations are available to measure clutch pack height, outside measurement or inside measurement. Either variation will determine the correct height.	
1	Transfer Case Four Wheel Drive Clutch Pressure - Friction - Plates (Qty: 8) **Procedure**

Callout	Component Name
	Install the friction and steel clutch plates into the **DT-48213** gauge, alternating until 8 friction plates and 7 steel plates are installed. **Special Tools** **DT-48213** Clutch Pack Height Gauge For equivalent regional tools, refer to **Special Tools**.
2	Transfer Case Four Wheel Drive Clutch Pressure - Steel - Plates (Qty: 7) **Procedure 1 - Outside Measurement:** 1. Tighten the **DT-48213** gauge until the upper portion of the tool contacts the lower portion of the tool. The screw will be flush with the bottom surface of the tool to indicate the tool has fully compressed the clutch plates. 2. Using an outside caliper, measure the total combined height of the clutch pack and the **DT-48213** gauge, dimension a. Subtract the thickness of both the upper and lower portion of the **DT-48213** gauge, 14 mm (0.551 in), and record the results. 3. Repeat the process in 2 additional locations, 120 degrees from each other. 4. The average of the 3 measurements is the clutch pack height. **Procedure 2 - Inside Measurement:** 1. Install the friction and steel clutch plates into the **DT-48213** gauge, alternating until 8 friction plates and 7 steel plates are installed. 2. Tighten the **DT-48213** gauge until the upper portion of the tool contacts the lower portion of the tool. The screw will be flush with the bottom surface of the tool to indicate the tool has fully compressed the clutch plates. 3. Using an inside caliper, measure the height of the clutch pack, dimension b, and record the results. 4. Repeat the process in 2 additional locations, 120 degrees from each other. 5. The average of the 3 measurements is the clutch pack height. **Special Tools** **DT-48213** Clutch Pack Height Gauge For equivalent regional tools, refer to **Special Tools**.

Clutch Assembly Installation

Fig. 52: Clutch Assembly
Courtesy of GENERAL MOTORS COMPANY

Clutch Assembly Installation

Callout	Component Name
1	Transfer Case Rear Output Shaft
2	Transfer Case Control Actuator Lever Thrust Bearing Assembly
3	Transfer Case Control Lever **NOTE:** **Refer to Service Parts Release**

Callout	Component Name
	Usage Change - NQH/NP0 Control Actuator Levers in the New Product Information
4	Transfer Case Control Actuator Lever Bearing Assembly
5	Transfer Case Control Actuator Lever Ball (Qty: 3)
6	Transfer Case Control Actuator Lever Assembly **NOTE:** **Refer to Service Parts Release Usage Change - NQH/NP0 Control Actuator Levers in the New Product Information**
7	Transfer Case Control Actuator Lever Thrust Bearing Assembly
8	Transfer Case Control Actuator Lever Washer
9	Transfer Case Four Wheel Drive Clutch Pressure - Apply - Plate **NOTE:** **Ensure the control actuator**

Callout	Component Name
	lever washer is seated into the apply plate groove.
10	Transfer Case Four Wheel Drive Clutch Pressure Plate Spring (Qty: 4)
11	Transfer Case Four Wheel Drive Clutch Hub
12	Transfer Case Four Wheel Drive Clutch Shim **Procedure** • Use a 3 mm (0.118 in) shim as a base to do the initial measurements with, this shim may be changed in the following steps depending on the results of the stack clearance. • Use the original shim if reassembling a transfer case. This shim may be changed in the following steps depending on the results of the stack clearance.
13	Transfer Case Two/Four Wheel Drive Clutch Retaining Ring **NOTE:** **If the clutch shim is not seated against the retaining ring, replace the clutch pressure plate springs.**

Measuring/Adjusting Clutch Assembly Height

Fig. 53: Measuring/Adjusting Clutch Assembly Height
Courtesy of GENERAL MOTORS COMPANY

Measuring/Adjusting Clutch Assembly Height

Callout	Component Name
1	Clutch Assembly **Procedure:** 1. Using an inside caliper, measure the height of the clutch assembly in the location shown and record the results. 2. Repeat the process in 2 additional locations, 120 degrees from each other. 3. The average of the 3 measurements is the clutch assembly height. 4. A 3.1 mm (0.122 in) clearance +/- 0.1 mm (0.004 in) is necessary between the clutch pack height and the assembly height. It may be necessary to replace the clutch shim with a thicker shim or a thinner shim, to achieve the proper

Callout	Component Name
	clearance in the clutch. 5. Subtract the clutch pack height from the clutch assembly height. The difference should be between 3.0 mm (0.118 in) and 3.2 mm (0.126 in) clearance. **NOTE:** • **A variety of shims are available to properly adjust the clearance height of the clutch assembly.** • **An inside micrometer may also be used to measure the clutch assembly height.**

Clutch Pressure Plate Installation

Fig. 54: Clutch Pressure Plate
Courtesy of GENERAL MOTORS COMPANY

Clutch Pressure Plate Installation

Callout	Component Name
1	Transfer Case Control Actuator Lever Washer
2	Transfer Case Four Wheel Drive Clutch Pressure - Apply - Plate
3	Transfer Case Four Wheel Drive Clutch Pressure Plate Spring (Qty: 4)
4	Transfer Case Four Wheel Drive Clutch Pressure Plate
5	Transfer Case Four Wheel Drive Clutch Hub
6	Transfer Case Four Wheel Drive Clutch Shim
7	Transfer Case Two/Four Wheel Drive Clutch Retaining Ring

Rear Output Shaft Assembly

Fig. 55: Rear Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Rear Output Shaft Assembly

Callout	Component Name
1	Transfer Case Front Output Shaft Drive Sprocket Spacer - Front
2	Transfer Case Four Wheel Drive Clutch Housing
3	Transfer Case Front Output Shaft Drive Sprocket

Callout	Component Name
4	Transfer Case Four Wheel Drive Clutch Housing Retaining Ring
5	Transfer Case Front Output Shaft Drive Sprocket Spacer - Rear
6	Transfer Case Front Output Shaft Drive Sprocket Retaining Ring **NOTE:** **Ensure the retaining ring is installed into the correct retaining ring groove on the rear output shaft.**
7	Transfer Case Oil Pump Assembly
8	Transfer Case Rear Output Shaft Speed Reluctor Wheel
9	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring
10	Transfer Case Rear Output Shaft Rear Bearing Assembly **NOTE:** • **Use an arbor press or suitable installer to install the bearing to the rear output shaft.** • **Ensure the**

Callout	Component Name
	retaining ring groove in the outer race is positioned toward the rear.
11	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring
12	Propeller Shaft Oil Seal Sleeve
13	Propeller Shaft Sleeve Seal

Propeller Shaft Oil Seal Sleeve Installation

Fig. 56: Propeller Shaft Oil Seal Sleeve
Courtesy of GENERAL MOTORS COMPANY

Propeller Shaft Oil Seal Sleeve Installation

Callout	Component Name
1	Propeller Shaft Oil Seal Sleeve **NOTE:** • **Press the sleeve onto the shaft until the tool contacts the end of the rear output shaft. Install a NEW sleeve during assembly.** • **The sleeve is to be installed without the seal.** • **A properly installed sleeve**

Callout	Component Name
	should not contact the rear bearing snap ring. **Procedure** 1. Using **DT-51083** sleeve installer and a press install the propeller shaft oil seal sleeve. 2. Inspect for a 3.7-4.3 mm (0.14-0.17 in) gap (a) between the sleeve and the snap ring. **Special Tools** **DT-51083** Sleeve Installer For equivalent regional tools, refer to **Special Tools**.
2	Propeller Shaft Sleeve Seal

Actuator Shaft and Cam Assembly, and Rear Output Shaft Assembly Installation

Fig. 57: Actuator Shaft and Cam Assembly, and Rear Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Actuator Shaft and Cam Assembly, and Rear Output Shaft Assembly Installation

Callout	Component Name
Preliminary Procedure Load all 3 components simultaneously.	
1	Transfer Case Actuator Shaft and Cam Assembly
2	Transfer Case Rear Output Shaft Assembly

Front Output Shaft Assembly, Drive Chain, Actuator Shaft Gear, and Oil Pump Suction Pipe Installation

Fig. 58: Front Output Shaft Assembly, Drive Chain, Actuator Shaft Gear, and Oil Pump Suction Pipe
Courtesy of GENERAL MOTORS COMPANY

Front Output Shaft Assembly, Drive Chain, Actuator Shaft Gear, and Oil Pump Suction Pipe Installation

Callout	Component Name
1	Transfer Case Front Output Shaft Drive Chain Assembly **Procedure** Install the chain with darkened links up onto the shaft.
2	Transfer Case Front Output Shaft Assembly **Procedure** Install the front output shaft and chain assembly into the front case half while engaging the chain with the drive sprocket.
3	Transfer Case Actuator Shaft Gear
4	Transfer Case Oil Pump Suction Pipe Seal

Callout	Component Name
	NOTE:
5	Transfer Case Oil Pump Suction Pipe • **Use a NEW seal.** • **Lubricate th ea in** • **In se pi to th in pu**

Transfer Case Rear Case Half Installation

Fig. 59: Transfer Case Rear Case Half
Courtesy of GENERAL MOTORS COMPANY

Transfer Case Rear Case Half Installation

Callout	Component Name
1	Transfer Case Front Half **CAUTION:**

Callout	Component Name
	Apply the proper amount of sealant to the transfer case (front half) sealing surface when assembling the transfer case. Excessive amounts of sealant can plug the oil pump screen, resulting in internal component failure. **Procedure** 1. Ensure both sealing surfaces of the front and rear case halves are free of dirt, oil and cleaning solvent. 2. Apply a 2 mm (0.078 in) bead of sealant to the front case half. Use sealer GM P/N 88861417/12378521 (Canadian P/N 88861418), or equivalent.
2	Transfer Case Rear Case Half **NOTE:** • **Ensure the transfer**

Callout	Component Name
	case rear output shaft outer retaining ring is in place and aligned prior to mating case halves. • Use snap ring pliers to open the transfer case rear output shaft outer retaining ring for the transfer case rear output shaft rear bearing assembly. • Insert a rubber coated screwdriver into the speed sensor hole and lift up

Callout	Component Name
	on the reluctor wheel to engage the retaining ring with the rear bearing assembly.
3	Transfer Case Bracket
4	Transfer Case Bolt (Qty: 17) **CAUTION:** **Refer to Fastener Caution .** **NOTE:** **Tighten bolts by hand, do not use an air gun.** **Tighten** 25 N.m (18 lb ft)

Rear Output Shaft Seal and Bushing Installation

Fig. 60: Rear Output Shaft Seal And Bushing
Courtesy of GENERAL MOTORS COMPANY

Rear Output Shaft Seal and Bushing Installation

Callout	Component Name
1	Transfer Case Rear Output Shaft Bushing **Procedure** 1. Follow the steps for use of the **J-45380** remover/installer. 2. Install the bushing on the finger section of the **J-45380** remover/installer. 3. Install the finger section to the main body of the **J-45380** remover/installer. 4. Position the bushing and tool to the rear case half. 5. Press the bushing until the tool bottoms on the rear case half.

Callout	Component Name
	NOTE: • **If the bushing was removed, a new bushing must be installed.** • **Ensure the bushing is installed squarely into the bushing bore.** **Special Tools** **J-45380** Transfer Case Rear Bushing Remover and Installer
2	Transfer Case Rear Output Shaft Seal **NOTE:** **Align the notch on the seal between the rear output bearing retaining ring access**

Callout	Component Name
	holes, this will position the weep hole down. **Special Tools** • **DT-48210** Seal Installer • **J-8092** Driver Handle For equivalent regional tools, refer to **Special Tools**.

Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor, and Vehicle Speed Sensor Installation

Fig. 61: Access Hole Plugs, Fill And Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor And Vehicle Speed Sensor
Courtesy of GENERAL MOTORS COMPANY

Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor, and Vehicle Speed Sensor Installation

Callout	Component Name
1	Transfer Case Actuator Shaft Position Sensor O-ring Seal **Procedure** Lightly lubricate the O-ring with clean DEXRONÂ®VI.
2	Transfer Case Actuator Shaft Position Sensor Assembly
3	Transfer Case Actuator Shaft Position Sensor Bolt/Screw **CAUTION:** **Refer to** **Fastener Caution .** **Tighten** 9 N.m (80 lb in)
4	Transfer Case Two/Four Wheel Drive Actuator Assembly
5	Transfer Case Two/Four Wheel Drive Actuator Bolt/Screw **Tighten** 18 N.m (13 lb ft)
6	Transfer Case Oil Drain Plug **CAUTION:** **Refer to** **Component Fastener Tightening Caution .** **Procedure**

Callout	Component Name
	Apply pipe sealant GM P/N 12346004 (Canadian P/N 10953480) to the oil drain plug before installation. **Tighten** 18 N.m (13 lb ft)
7	Transfer Case Oil Fill Plug **Procedure** Apply pipe sealant GM P/N 12346004 (Canadian P/N 10953480) to the oil fill plug before installation. **Tighten** 18 N.m (13 lb ft)
8	Transfer Case Vent **Procedure** Apply retaining compound GM P/N 12377901 (Canadian P/N 10953504) to the vent pipe before installation, if removed during disassembly.
9	Vehicle Speed Sensor O-ring Seal **Procedure** Lightly lubricate the O-ring with clean DEXRONÂ®VI.
10	Vehicle Speed Sensor Assembly **Tighten** 17 N.m (13 lb ft)
11	Transfer Case Access Hole Plug (Qty: 2)

Input Shaft Seal and Front Output Shaft Seal Installation

Fig. 62: Input Shaft Seal And Front Output Shaft Seal
Courtesy of GENERAL MOTORS COMPANY

Input Shaft Seal and Front Output Shaft Seal Installation

Callout	Component Name
1	Transfer Case Input Shaft Seal **Procedure** Use the **DT-50648-A** or **J-42738** . Refer to Input Shaft Seal Installer Revisions in **New Product Information** . **NOTE:** • **Ensure the bore of the front case half is free of dirt,**

Callout	Component Name
	oil, and cleaning solvent. • **Double lip input shaft oil seals are used on applications with a WET adapter cavity and with 4 speed transmission RPOs M30/M70 /MW7/M99/ML9 only.** • **Single lip input shaft oil seals are used on applications with a DRY adapter cavity and with 6 speed transmission RPOs MYC/MYD only, and are to be installed with the spring portion of the seal facing**

Callout	Component Name
	inward towards the internals of the transfer case. **Special Tools** • **DT-50648-A** Seal Installer • **J-36183** Input and Output Shaft Press Tube • **J-36184** Press Tube Reducer • **J-42738** Seal Installer For equivalent regional tools, refer to **Special Tools**.
2	Transfer Case Front Output Shaft Seal **Special Tools** • **J-8092** Driver Handle • **DT-50649** Seal Installer For equivalent regional tools, refer to **Special Tools**.
3	Transfer Case Front Output Shaft Oil Slinger - Model Dependent **Procedure** The new design front output shaft oil slinger can be installed onto all current and prior model year Magna NQF, NQG, NQH, and NP0 applications providing the new design front output shaft is also installed. Refer to **New Product Information**. **Special Tools** • **J-8092** Driver Handle

Callout	Component Name
	• **DT-50649** Seal Installer For equivalent regional tools, refer to **Special Tools**.
4	Transfer Case Assembly **Procedure** Remove from **J-3289-20** Holding Fixture and remove the **J-45759** Assembly Fixture from the transfer case. **Special Tools** • **J-3289-20** Holding Fixture • **J-45759** Assembly Fixture For equivalent regional tools, refer to **Special Tools**.

DESCRIPTION AND OPERATION

TRANSFER CASE IDENTIFICATION

Fig. 63: Transfer Case Identification Label
Courtesy of GENERAL MOTORS COMPANY

The transfer case identification label information contains the following information:

1. Magna Powertrain (1)
2. Features: Code for Product Technology (2)
    - 12: Part time - manual - Synchronizer
    - 16: Part time - electric - Synchronizer
    - 30: Wet clutch - electro-mechanic actuation
3. Number of speeds (3)
4. Size - Low Range - Skid torque rating (4)
    - 0: N/A

- 1: 1-800 N.m (0.74-590 lb ft)
- 2: 800-1000 N.m (590-738 lb ft)
- 3: 1000-1200 N.m (738-885 lb ft)
- 4: 1200-1400 N.m (885-1033 lb ft)
- 5: 1400-1600 N.m (1033-1180 lb ft)
- 6: 1600-1800 N.m (1180-1328 lb ft)

5. Appendix (5) i.e. ATC

TRANSFER CASE DESCRIPTION AND OPERATION

The Magna Powertrain (MP) model 3010 RPO NP0 transfer case is a 1 speed automatic, active transfer case (ATC). The MP 3010 ATC provides 3 modes, Auto 4WD, 4HI, and 2HI. The Auto 4WD position allows the capability of an active transfer case, which provides the benefits of on-demand torque biasing wet clutch and easy vehicle tuning through software calibrations. The software calibrations allow more features, such as flexible adapt ready position and clutch preload torque levels. The technology allows for vehicle speed dependent clutch toque levels to enhance the performance of the system. For example, the system is calibrated to provide 0-6.78 N.m (0-5 lb ft) of clutch torque during low speed, low engine torque operation, and predetermined higher torque for 40 km/h (25 mph) and greater. This prevents crow-hop and binding at low speeds and provides higher torque biases at higher vehicle speeds, in order to enhance stability.

Transfer Case Shift Control Switch

Fig. 64: Transfer Case Shift Control Switch
Courtesy of GENERAL MOTORS COMPANY

The MP 3010 ATC transfer case features a 3 mode shift control switch located on the instrument panel. When the ignition key is in the RUN position, the transfer case shift control module monitors the transfer case shift control switch to determine if the driver desires a new mode position. At a turn of the transfer case shift control switch, the lamp of the new desired position begins flashing to inform the driver that the transfer case shift control module has received the request for a new mode position. The lamp continues to flash until all shifting criteria has been met and the new mode position has been reached, or has been engaged. Once the mode position is fully active, the switch indicator lamp for the new position remains ON

constantly. During normal driving situations, the transfer case can operate in the Auto 4WD mode. In the Auto 4WD mode, the transfer case shift control module monitors rear wheel slip speed, based on the inputs from the wheel speed sensors and/or vehicle speed sensor. When the vehicle experiences a rear wheel slip condition, the transfer case shift control module sends a pulse width modulated (PWM) signal to an electronic motor, which is the transfer case 2/4 wheel drive actuator assembly. This actuator rotates the transfer case control actuator shaft, applying a clutch. The clutch is designed to deliver a variable amount of torque, normally delivered to the rear wheels, and transfers it to the front wheels. Torque is ramped up to the front wheels until the front wheels speed sensor values equals that of the rear wheel speed sensors and/or vehicle speed sensor. Torque is ramped down to the front wheels. The process would repeat if rear wheel slip is detected again.

The MP 3010 TC transfer case has the added feature of also providing the driver with 2 manual mode positions:

- 4HI - 4 Wheel Drive High Mode
- 2HI - 2 Wheel Drive High Mode

2WD Mode Power Flow

Fig. 65: 2WD Mode Power Flow

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Input Shaft
2	Control Actuator Lever
3	Clutch Pack
4	Drive Chain
5	Rear Output Shaft
6	Actuator Shaft Gear
7	Front Output Shaft
8	Actuator Cam

Fig. 66: 2WD Mode Power Flow Components
Courtesy of GENERAL MOTORS COMPANY

When the MP 3010 ATC is in the 2WD mode, the power flows from the transmission (1) to the input shaft (2). The input shaft (2) is splined to the rear output shaft (3). The rear output shaft (3) delivers the power flow to the rear propshaft (4). The position of the control actuator shaft (6) allows no clutch (5) engagement.

4HI Mode Power Flow

Fig. 67: 4HI Mode Power Flow
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Input Shaft
2	Control Actuator Lever
3	Clutch Pack
4	Drive Chain
5	Rear Output Shaft
6	Actuator Shaft Gear
7	Front Output Shaft
8	Actuator Cam

Fig. 68: 4HI Mode Power Flow Components
Courtesy of GENERAL MOTORS COMPANY

In the 4HI mode, the power flow to the rear propshaft (9) is the same as it is in the 2WD mode. To deliver power flow to the front propshaft (15) during the 4HI position, the transfer case control module commands the 2/4 wheel drive actuator assembly (13) to apply the clutch to a calibrated torque. The 2/4 wheel drive actuator assembly (13) turns the control actuator shaft. A brake in the 2/4 wheel drive actuator assembly (13) holds the control actuator shaft in the full clutch position. The control actuator shaft is cam designed and the cam action moves the control actuator lever (12). The control actuator lever (12) pivots against the control lever (17) and moves toward the clutch pressure plate (4), to engage the clutch (5). As more

pressure is applied to the clutch pressure plate (4), the clutch discs (5) are compressed. Using inner clutch discs, which are engaged with the clutch hub, and the outer clutch discs, which are engaged with the clutch housing (6), the power flow is delivered to the clutch housing (6). The clutch hub is splined to the rear output shaft (8), and the clutch housing (6) rotates on a needle bearing on the rear output shaft (8). The chain drive sprocket (7) is splined to the clutch housing (6). The power flows from the drive sprocket (7), through the chain (10), to the chain driven sprocket. The driven sprocket is splined to the front output shaft (14). The power flow is delivered to the front propshaft (15) through the front output shaft (14).

4HI Auto Mode Power Flow

Fig. 69: 4HI Auto Mode Power Flow
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Input Shaft
2	Control Actuator Lever
3	Clutch Pack

Callout	Component Name
4	Drive Chain
5	Rear Output Shaft
6	Actuator Shaft Gear
7	Front Output Shaft
8	Actuator Cam

Fig. 70: 4HI Mode Power Flow Components
Courtesy of GENERAL MOTORS COMPANY

In the 4HI Auto mode, the power flow to the rear propshaft (9) is the same as it is in the 2WD mode. To deliver power flow to the front propshaft (15) during the 4HI position, the transfer case control module commands the 2/4 wheel drive actuator assembly (13) to apply the clutch to a calibrated torque. The 2/4 wheel drive actuator assembly (13) rotates the control actuator shaft to the correct torque level positions. Rotating the control actuator shaft to the various positions changes the clutch torque level. The control actuator shaft is cam designed and the cam action moves the control actuator lever (12). The control actuator lever (12) pivots against the control lever (17) and moves toward the clutch pressure plate (4), to engage the clutch (5). As more pressure is applied to the clutch pressure plate (4), the clutch discs (5) are compressed. Using inner clutch discs, which are engaged with the clutch hub, and the outer clutch discs, which are engaged with the clutch housing (6), the power flow is delivered to the clutch housing (6). The clutch hub is splined to the rear output shaft (8), and clutch housing (6) rotates on a needle bearing on the rear output shaft (8). The chain drive sprocket (7) is splined to the clutch housing (6). The power flows from the drive sprocket (7), through the chain (10), to the chain driven sprocket. The driven sprocket is splined to the front output shaft (14). The power flow is delivered to the front propshaft (15) through the front output shaft (14). When a difference of front wheel speed to rear wheel speed is recognized, the transfer case control module commands for more or less clutch torque.

Service 4 Wheel Drive Message

The Service 4 Wheel Drive Message is a display within the driver information center (DIC) and cannot be serviced separately. This message is used to inform the driver that a transfer case system condition has occurred. The Service 4 Wheel Drive Message is controlled by the transfer case shift control module via GMLAN.

Transfer Case Two/Four Wheel Drive Incremental Sensor

The incremental sensor is mounted within the transfer case actuator and is replaced as an assembly. The incremental sensor converts the shift detent lever shaft position, representing a mode, into an electrical signal input to the transfer case shift control module. The module detects what position the transfer case is in by monitoring the voltage returned on the incremental encoder impulse signal circuit. This voltage translates into AUTO 4WD, 2HI, and 4HI or in transition between gears.

Transfer Case Two/Four Wheel Drive Actuator Assembly

Fig. 71: Transfer Case Two/Four Wheel Drive Actuator Assembly
Courtesy of GENERAL MOTORS COMPANY

The transfer case two/four wheel drive actuator assembly consists of a permanent magnet DC motor and gear reduction assembly. It is located on the left hand side, driver's side, of the transfer case. When activated, it turns the shift detent lever shaft of the transfer case, clockwise or counterclockwise, to shift the transfer case. The motor/encoder is controlled with a PWM signal by the transfer case shift control module. This circuit

consists of a driver on both the Motor A and Motor B circuits. The encoder motor is bi-directional in order to allow the motor to shift the transfer case from 2HI to 4HI positions.

Transfer Case Actuator Shaft Position Sensor Assembly

Fig. 72: Transfer Case Actuator Shaft Position Sensor Assembly
Courtesy of GENERAL MOTORS COMPANY

This sensor works in conjunction with the incremental sensor and shows transfer case position in degrees.

Transfer Case Motor Lock

The transfer case motor lock is used to provide a 2HI and 4HI feature. When the lock circuit is energized, the transfer case encoder motor is allowed to turn. When the transfer case is placed 2HI or 4HI the motor lock circuit is de-energized and the lock is applied. This assures that the transfer case remains in the current gear position until a new gear position is requested. When AUTO 4WD is selected, the motor lock remains applied until an adaptive mode, torque being applied to the front propshaft, is required. During an adaptive mode the motor lock circuit is energized and the motor lock is released, enabling the encoder motor to turn and apply or release torque at the front propshaft.

Transfer Case Shift Control Module

Fig. 73: Transfer Case Shift Control Module
Courtesy of GENERAL MOTORS COMPANY

The transfer case shift control module uses the vehicle identification number (VIN) for calculations based on axle ratio, transmission, tire size, and engine size. For StabiliTrak applications, when the vehicle is in AUTO 4WD mode, the transfer case shift control module monitors the wheel speed via the four wheel speed sensors in order to detect wheel slippage. For non-StabiliTrak applications, when the vehicle is in AUTO 4WD mode, the transfer case shift control module monitors the wheel speed via the two front wheel speed sensors and the vehicle speed sensor in order to detect slippage. When wheel slippage is detected, the module applies a clutch pack contained inside the transfer case. This clutch pack is used to lock-in and

apply the front propshaft, transferring torque to the front wheels. The clutch pack is applied by a motor/encoder assembly. When slip is no longer detected by the transfer case shift control module, the clutch is no longer applied.

Vehicle Speed Sensor (VSS)

There is a VSS mounted to the transfer case on the rear output shaft. The VSS is a PM generator. The PM generator produces a AC voltage. The AC voltage and frequency increases as speed increases. The VSS is an input to the powertrain control module (PCM). The PCM sends this information to the transfer case shift control module via the GM LAN serial data bus.

NEW PRODUCT INFORMATION

The purpose of New Product Information is to document, important product changes which occur either model year-to-model year or interim model year.

Changes may include one or more of the following items:

- Specification Changes
- New sealants and/or adhesives
- Disassembly and assembly procedure revisions
- Mechanical and diagnostic procedure revisions
- New special tools required
- Interim model year design changes
- A component comparison from the previous model year

2017 NQF/NQG - Interim Model Year Design Change - DT-51204 - New Design Case Separating Tool

Fig. 74: 2017 NQF/NQG - Interim Model Year Design Change - DT-51204 - New Design Case Separating Tool
Courtesy of GENERAL MOTORS COMPANY

For 2017MY super heavy duty NQF/NQG transfer cases with diesel engine and Alison transmission, one pair of the transfer case case-half separating flanges have been removed to address in-vehicle packaging concerns.

With the removal of the case separating flanges, a new design tool has been developed. **DT-51204** Case Separating Tool has been created to assist the technician when performing disassembly of the transfer case. The new design tool is to be used in conjunction with **GE-02619-A** Slide Hammer when separating the case halve.

NQF/NQG with MW7 Transmission Interim Model Year Design Change - Front Case Half - Addition of Transmission Extension Housing Seal and New Design Gasket

Fig. 75: NQF/NQG With MW7 Transmission Interim Model Year Design Change - Front Case Half
Courtesy of GENERAL MOTORS COMPANY

Interim MY, a new design seal (2) has been added to the rear of transmission extension housing and front of transfer case interface. A new design gasket (1) is to be used in conjunction with the new seal. The purpose of the seal is to control and limit the amount of transmission fluid that enters the wet-cavity area.

Earlier applications do not have the seal. When servicing an older application that does not have the seal, it is recommended to install the new seal and new design gasket prior to reassembly.

The new gasket is required when using the new seal. When installed, the seal should be fully seated against front of the Transfer case (3).

2015 NQF/NQG - Interim Model Year Design Change (RPO-AVF) - Digital Speed Sensor

Fig. 76: 2015 NQF/NQG - Interim Model Year Design Change (RPO-AVF) - Digital Speed Sensor
Courtesy of GENERAL MOTORS COMPANY

1. Vehicle Speed Sensor - Non-Digital Assembly
2. Vehicle Speed Sensor - Non-Digital Assembly Seal (O-ring)
3. Vehicle Speed Sensor - Digital Assembly Bolt
4. Vehicle Speed Sensor - Digital Assembly
5. Vehicle Speed Sensor - Digital Assembly Seal (O-ring)

The RPO-AVF designation was used interim 2015 MY to provide a break-point for a variety of changes that occurred for K-truck applications. The transfer case digital speed sensor change is just one of many within the RPO-AVF designation. Refer to applicable service bulletins for additional information.

Interim 2015 model year for Magna HD NQF and NQG transfer case applications with Duramax engine and Allison transmission (RPO-MW7), a NEW design digital speed sensor (4) is to be implemented.

Non-AVF applications will continue to use the threaded-into-the-rear case design speed sensor (1). Applications with RPO AVF will include a non-threaded push-into-the-bore design speed sensor (4) that is retained by a bolt (3).

To differentiate between digital speed sensor (4) and non-digital speed sensor (1) applications, the RPO AVF is used to identify digital sensor applications.

2015 NQH-HD Model Year Design Change - Addition of a NQH Transfer Case with HD Internal Components

Fig. 77: 2015 NQH-HD Model Year Design Change - Addition Of NQH Transfer Case With HD Internal Components
Courtesy of GENERAL MOTORS COMPANY

Beginning in 2015 model year for 3500 series SUV only, a HD version of the NQH transfer case will be available. Changes include, but not limited to:

- Six pinion planetary carrier
- HD drive chain and sprockets

- HD rear output shaft

2014 NQH/NQG-LD Model Year Design Change - Addition of a Tuned Vibration Adapter (dampener) for V-6 Engine RPO LV3 Applications

Fig. 78: Tuned Vibration Adapter (Dampener)
Courtesy of GENERAL MOTORS COMPANY

Beginning in 2014 model year for V-6 engine RPO LV3 applications, a dampener (1) has been added to the exterior of the NQH and NQG-LD transfer cases.

2013 Input Shaft Seal Installer Revisions

Fig. 79: 2013 Input Shaft Seal Installer Revisions
Courtesy of GENERAL MOTORS COMPANY

Beginning July 2013, a NEW input shaft seal installer has been identified for Magna transfer case applications (all model years and all RPOs). The new seal installer is identified as **DT-50648-A** Seal Installer (4). The **DT-50648-A** Seal Installer is to be used in place of **J-42738** Seal Installer (3), as well as **J-36183** Press Tube (1) and **J- 36184** Press Tube Reducer (2). **J-42738** Seal Installer is to be discontinued and no longer available.

2012 Interim Model Year Design Change - NQF/NQG/NQH Front Case Half Assembly, Input Shaft, Planetary Carrier High/Low Clutch

Interim 2012 model year for Magna light-duty and heavy-duty transfer case RPOs NQF/NQG/NQH, a second-design front case half assembly, planetary internal gear, gear retaining ring, locking plate, thrust washer-front, input shaft, pilot bearing, thrust washer-rear, high/low planetary carrier, and high/low clutch were implemented into second-design assemblies.

The second-design light duty (LD), heavy duty (HD), and super-heavy duty (SHD) applications have a reduced OD dimension carrier and the second-design planetary internal gear has a reduced ID dimension. The planetary internal gear is a press-fit non-serviceable component and must be serviced with the front case half assembly. In service it is possible that a new or remanufactured transfer case may contain first or second-design content.

If a second-design transfer case has been installed into a vehicle that originally contained a first-design assembly, TCCM reprogramming is not required.

Assembly and Component Identification

Fig. 80: Transfer Case Assembly Bar Code Label
Courtesy of GENERAL MOTORS COMPANY

1. Check the transfer case assembly bar code label (1) to determine if the assembly contains first or second design components. Refer to: Magna Transfer Case Bar Code Label and the Production Assembly Breakpoints Table.

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Fig. 81: Separated Case Halves
Courtesy of GENERAL MOTORS COMPANY

2. Separate the case halves. Refer to: **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** .

Fig. 82: Rear Output Shaft Assembly And High/Low Clutch
Courtesy of GENERAL MOTORS COMPANY

3. Remove the rear output shaft assembly (1) and the high/low clutch (2).

Fig. 83: Oil Drain Holes
Courtesy of GENERAL MOTORS COMPANY

4. Inspect the rear face of the input shaft. (LD)

   A light duty assembly with first design components can be identified by an input shaft with 2 oil drain holes (1) 180 degrees apart.

   A light duty assembly with second design components can be identified by an input shaft with 3 oil drain holes 120 degrees apart.

Fig. 84: Oil Drain Holes
Courtesy of GENERAL MOTORS COMPANY

5. Inspect the rear face of the input shaft. (HD)

   A heavy duty assembly with first design components can be identified by an input shaft with 2 oil drain holes (1) 180 degrees apart.

   A heavy duty assembly with second design components can be identified by an input shaft with 3 oil drain holes 120 degrees apart.

6. Refer to: Appropriate Parts Identification Table.

Magna Transfer Case Bar Code Label

The design level and component content of the transfer case can be determined by referencing the assembly part number located on the identification label.

Fig. 85: Magna Transfer Case Bar Code Label
Courtesy of GENERAL MOTORS COMPANY

1. Component Identifier
2. GM Broadcast Code
3. Supplier Code
4. Production Year
5. Julian Date of the Year
6. Assembly Line Number
7. Sequential Number
8. GM Assembly Part Number

Production Assembly Breakpoints

First Design Assembly PN	Second Design Assembly PN	RPO	Approximate Production Breakpoint	Vehicle/Transmission RPO
24256476	24261560	NP0	March 2012	K100 / MYC
24256475	24261517	NQH	January 2012	K200 / MYD
24256474	24261516	NQH	January 2012	K100 / M99
24256473	24261515	NQH	January 2011	K100 / M30

First Design Assembly PN	Second Design Assembly PN	RPO	Approximate Production Breakpoint	Vehicle/Transmission RPO
24256472	24261514	NQH	December 2011	K100 / MYC
24257578	24261513	NQF	December 2011	K200 / MYD
24257577	24261512	NQF	January 2012	K200 / 300 / MW7
24257576	24261511	NQF	December 2011	K200 / 300 / MYD
24257581	24261510	NQG	January 2011	K200 / MYD / +Z49
24257580	24261509	NQG	January 2012	K200 / 300 / MW7
24257579	24261508	NQG	December 2011	K200 / 300 / MYD / -Z49
24252685	24261507	NQG	December 2011	K100 / M30
24252684	24261506	NQG	January 2011	K100 / MYC

Magna Light Duty NQG/NQH/NP0 - First Design

Fig. 86: Magna Light Duty NQG/NQH/NP0 - First Design
Courtesy of GENERAL MOTORS COMPANY

Magna Light Duty NQG/NQH/NP0 - First Design			
Callout	**Description**	**GM PN**	**Service Usage**
1	Front Case Half Assembly - w/gear (2) and ring 3)	19132998	NQH
1	Front Case Half Assembly - w/gear (2) and ring (3)	19133000	NQG
1	Front Case Half Assembly - w/o gear (2) and ring (3)	19255999	NP0
2	High/Low Internal Gear - Not serviceable - part of case assembly	NO/PN	NQG/NQH
3	High/Low Internal Gear Retaining Ring	19133009	NQG/NQH
4	High/Low Planetary Carrier Retaining Ring	19132997	NQG/NQH
5	High/Low Locking Plate - Single tab design	19132996	NQG/NQH
6	Thrust Washer - Front - No tab design	19132995	NQG/NQH
7	Input Shaft Assembly - w/pilot bearing	19132977	NQG/NQH - w/M30
7	Input Shaft Assembly - w/pilot bearing	19132978	NQH - w/M99
			NQG/ NQH - w/MYC
7	Input Shaft Assembly - w/pilot bearing	19255997	NP0 - w/MYC
8	Pilot Bearing	19132983	NQG/NQH/NP0
9	Thrust Washer - Rear - No tab design	19132995	NQG/NQH
10	High/Low Planetary Carrier Assembly - Three pinion design	19132986	NQG/NQH

Magna Light Duty NQG/NQH/NP0 - First Design			
Callout	**Description**	**GM PN**	**Service Usage**
11	High/Low Clutch	19260068	NQG/NQH - w/M30
11	High/Low Clutch	19260067	NQG/NQH w/MYC and NQH w/M99

Magna Light Duty NQG/NQH/NP0 - Second Design

Fig. 87: Magna Light Duty NQG/NQH/NP0 - Second Design
Courtesy of GENERAL MOTORS COMPANY

Magna Light Duty NQG/NQH/NP0 - Second Design			
Callout	**Description**	**GM PN**	**Service Usage**
1	Front Case Half Assembly - w/gear (2) and ring (3)	19299077	NQH

Magna Light Duty NQG/NQH/NP0 - Second Design			
Callout	**Description**	**GM PN**	**Service Usage**
1	Front Case Half Assembly - w/gear (2) and ring (3)	19299078	NQG
1	Front Case Half Assembly - w/o gear (2) and ring (3)	19299076	NP0 **NOTE:** **The second design NP0 front case half assembly is interchangeable with first design**
2	High/Low Internal Gear - Not serviceable - part of case assembly	NO/PN	NQG/NQH
3	High/Low Internal Gear Retaining Ring	14037953	NQG/NQH
4	High/Low Planetary Carrier Retaining Ring	15547397	NQG/NQH
5	High/Low Locking Plate - three tab design	19300745	NQG/NQH
6	Thrust Washer - Front - No tab design	12470959	NQG/NQH
7	Input Shaft Assembly - w/pilot bearing	19299085	NQG/NQH - w/M30
7	Input Shaft Assembly - w/pilot bearing	19299088	NQH - w/M99
			NQG/NQH - w/MYC
7	Input Shaft Assembly - w/pilot bearing	19255997	NP0-w/MYC
8	Pilot Bearing	19132983	NQG/NQH/NP0
9	Thrust Washer - Rear - Three tab design	19300746	NQG/NQH

Magna Light Duty NQG/NQH/NP0 - Second Design			
Callout	**Description**	**GM PN**	**Service Usage**
10	High/Low Planetary Carrier Assembly - Three pinion design	19299090	NQG/NQH
11	High/Low Clutch	19299092	NQG/NQH - w/M30
11	High/Low Clutch	19299093	NQG/NQH w/MYC and NQH w/M99

Magna Heavy Duty NQF/NQG/NQH - First Design

Fig. 88: Magna Heavy Duty NQF/NQG/NQH - First Design
Courtesy of GENERAL MOTORS COMPANY

NOTE: **2007-10MY Heavy Duty NQF transfer case assemblies were only produced with first-design content. Service 2007-10MY Heavy Duty NQG transfer case service assemblies may contain either first or second design content.**

Magna Heavy Duty NQF/NQG/NQH - First Design			
Callout	**Description**	**GM PN**	**Service Usage**
1	Front Case Half Assembly w/gear (2) and ring (3)	19257420	2011-13 NQF
1	Front Case Half Assembly w/gear (2) and ring (3)	19133000	2007-10 NQG
1	Front Case Half Assembly w/gear (2) and ring (3)	19259038	2011-13 NQG
1	Front Case Half Assembly w/gear (2) and ring (3)	19132998	2007-13 NQH
2	High/Low Internal Gear - Not serviceable - part of case assembly	NO/PN	NQF/NQG/NQH
3	High/Low Internal Gear Retaining Ring	19133009	NQF/NQG/NQH
4	High/Low Planetary Carrier Retaining Ring	19132997	NQF/NQG/NQH
5	High/Low Locking Plate - Single tab design	19132996	NQF/NQG/NQH
6	Thrust Washer - No tab design - Front	19132995	NQF/NQG/NQH
7	Input Shaft Assembly w/pilot bearing	19132979	NQH w/MYD
			07-10MY NQF/NQG w/MYD and MW7
7	Input Shaft Assembly - w/pilot bearing	19257419	2007-13 NQF/NQG w/MYD
7	Input Shaft Assembly - w/pilot bearing	19259039	2011-13 NQF/NQG w/MW7
8	Pilot Bearing	19259040	2011-13MY NQF/NQG w/MW7
8	Pilot Bearing	19132984	2007-10MY NQF/NQG/NQH - w/MW7 / MYD
			2007-13 NQH w/MYD
			2011-13 NQF/NQG w/MYD

Magna Heavy Duty NQF/NQG/NQH - First Design			
Callout	**Description**	**GM PN**	**Service Usage**
9	Thrust Washer - No tab design - Rear	19132995	NQG/NQH
			2011-13 NQF
10	High/Low Planetary Carrier Assembly - Five pinion design	19132987	NQG/NQH
			2011-13 NQF
11	High/Low Clutch	19260067	NQG/NQH
			2011-13 NQF

Magna Heavy Duty NQF/NQG/NQH - Second Design

Fig. 89: Magna Heavy Duty NQF/NQG/NQH - Second Design
Courtesy of GENERAL MOTORS COMPANY

Magna Heavy Duty NQF/NQG/NQH - Second Design			
Callout	**Description**	**GM PN**	**Service Usage**
1	Front Case Half Assembly w/gear (2) and ring (3)	19299079	2011-13 NQF
1	Front Case Half Assembly w/gear (2) and ring (3)	19299078	2007-10 NQG
1	Front Case Half Assembly w/gear (2) and ring (3)	19299080	2011-13 NQG
1	Front Case Half Assembly w/gear (2) and ring (3)	19299077	2007-13 NQH
2	High/Low Internal Gear - Not serviceable - part of case assembly	NO/PN	NQF/NQG/NQH
3	High/Low Internal Gear Retaining Ring	14037953	NQF/NQG/NQH
4	High/Low Planetary Carrier Retaining Ring	15547397	NQF/NQG/NQH
5	High/Low Locking Plate - Two tab design	15664905	NQF/NQG/NQH
6	Thrust Washer - No tab design - Front	12470959	NQF/NQGF/NQH
7	Input Shaft Assembly - w/pilot bearing	19299086	NQH w/MYD
			07-10MY NQG w/MYD and MW7
7	Input Shaft Assembly - w/pilot bearing	19299087	2011-13 NQF/NQG w/MYD
7	Input Shaft Assembly - w/pilot bearing	19299089	2011-13 NQF/NQG w/MW7
8	Pilot Bearing	19259040	2011-13MY NQF/NQG w/MW7
8	Pilot Bearing	19132984	2007-10MY NQF/NQG/NQH - w/MW7 / MYD
			2007-13 NQH w/MYD
			2011-13 NQF/NQG w/MYD
9	Thrust Washer - Two tab design	15547390	NQG/NQH

Magna Heavy Duty NQF/NQG/NQH - Second Design			
Callout	**Description**	**GM PN**	**Service Usage**
	- Rear		2011-13 NQF
10	High/Low Planetary Carrier Assembly - Six pinion design	19299091	NQG/NQH
			2011-13 NQF
11	High/Low Clutch	19299093	NQG/NQH
			2011-13 NQF

Front Case Half Identification

Fig. 90: Front Case Half
Courtesy of GENERAL MOTORS COMPANY

The first design front case half assembly can be identified as having an internal gear that is a 94 tooth design with an inside diameter (a) of 148.5 mm (5.85 in).

The second design front case half assembly can be identified as having an internal gear that is a 91 tooth design with an inside diameter (a) of 142 mm (5.59 in).

Input Shaft Identification

Fig. 91: Input Shaft
Courtesy of GENERAL MOTORS COMPANY

The first design input shaft can be identified as a 56 tooth design with an outside diameter (a) of 91.4 mm (3.60 in) and two oil drain holes 180 degrees apart.

The second design input shaft can be identified as a 53 tooth design with an outside diameter (a) of 87.50 mm (3.44 in) and three oil drain holes 120 degrees apart.

High/Low Planetary Carrier Assembly Identification

Fig. 92: Light-Duty 3-Pinion High/Low Planetary Carrier (First And Second Design)
Courtesy of GENERAL MOTORS COMPANY

The first-design light-duty 3-pinion high/low planetary carrier (1) can be identified as having a 30 tooth design with an inside diameter (a) of 61.3 mm (2.41 in). In addition, the first-design carrier can also be identified by the presence of a recessed washer pocket (3) at the rear thrust washer location.

The second-design light-duty 3-pinion high/low planetary carrier (2) can be identified as having a 29 tooth design with an inside diameter (b) of 60.2 mm (2.37 in). In addition, the second-design carrier can also be identified by the lack of a recessed washer pocket (4) at the rear thrust washer location.

Fig. 93: Heavy-Duty 5-Pinion High/Low Planetary Carrier And Heavy-Duty 6-Pinion High/Low Planetary Carrier
Courtesy of GENERAL MOTORS COMPANY

The first-design heavy-duty 5-pinion high/low planetary carrier (1) can be identified as having 5 pinions and a 30 tooth design with an inside diameter (a) of 61.3 mm (2.41 in).

The second-design heavy-duty 6-pinion high/low planetary carrier (2) can be identified as having 6 pinions and a 29 tooth design with an inside diameter (b) of 60.2 mm (2.37 in).

High/Low Clutch

Fig. 94: High/Low Clutch
Courtesy of GENERAL MOTORS COMPANY

The first design high/low clutch can be identified as having a 30 tooth design with a gear tooth outside diameter (a) of 65.50 mm (2.58 in).

The second design high/low clutch can be identified as having a 29 tooth design with a gear tooth outside diameter (a) of 63.25 mm (2.49 in).

Component Replacement - Light Duty Conversion from First Design to Second Design

Fig. 95: Light Duty Conversion From First Design To Second Design
Courtesy of GENERAL MOTORS COMPANY

It is possible to repair a first-design assembly using second-design components. Refer to the parts catalog and the Parts Identification Tables above for component part number clarification.

When servicing a first-design LD assembly with LD second-design components, the following components MUST be replaced as a group:

1. Front Case Half Assembly - with internal gear and retaining ring
2. Locking Plate
3. Thrust Washer (front)
4. Input Shaft
5. Pilot Bearing
6. Thrust Washer (rear)

7. Planetary Carrier Assembly
8. High/Low Clutch

Component Replacement - Heavy Duty Conversion from First Design to Second Design

Fig. 96: Heavy Duty Conversion From First Design To Second Design
Courtesy of GENERAL MOTORS COMPANY

It is possible to repair a first-design HD assembly using second-design HD components. Refer to the parts catalog and the Parts Identification Tables above for component part number clarification.

When servicing a first-design HD assembly with HD second-design components, the following components MUST be replaced as a group:

1. Front Case Half Assembly - with internal gear and retaining ring
2. Locking Plate

3. Thrust Washer (front)
4. Input Shaft
5. Pilot Bearing
6. Thrust Washer (rear)
7. Planetary Carrier Assembly
8. High/Low Clutch

Production Changes Summary

For production the following transfer cases variations were produced:

- 2007-12i Magna LD NQG/NQH - produced with first-design content. First design service components are available. A second-design assembly may be used for back-service in a first-design application.
- 2007-10 Magna HD NQF - produced with only first-design content. Service components are available.
- 2007-10 Magna HD NQG - produced with only first-design content. Service assemblies may contain either first or second design content. Both first and second design service components are available.
- 2007-12i Magna HD NQH - produced with first-design content. First design service components are available. A second-design assembly may be used for back-service in a first-design application.
- 2011-12i Magna SHD NQF/NQG - produced with first design content. First design service components are available. A second-design assembly may be used for back-service in a first-design application.
- 2012i-13 Magna LD NQG/NQH - produced with second-design content. Second design service components are available.
- 2012i-13 Magna HD NQH - produced with second-design content. Second design service components are available
- 2012i-13 Magna SHD NQF/NQG - produced with second-design content. Second design service components are available

2012 Interim Model Year Design Change - NQG High/Low Shift Fork, Fork Pad, and High/Low Clutch

Fig. 97: High/Low Shift Fork, Fork Pad And High/Low Clutch (First And Second Designs)
Courtesy of GENERAL MOTORS COMPANY

Interim 2012 model year the High/Low shift fork, fork pad, and High/Low clutch design changed. The first design forks (2) can be identified as having three flat un-notched fork pad areas with three separate fork pads (1). The second design forks (4) can be identified as having a half-round shaped pad area with three notches for pad orientation and installation and upper and lower half-round fork pads (3). The second design shift fork (4) and pads (3) are the only design available for service and must be used with the second design High/Low clutch.

Fig. 98: OD Rear Flange (First And Second Designs)

Courtesy of GENERAL MOTORS COMPANY

Interim 2012 model year the High/Low shift fork, fork pad, and High/Low clutch design changed. The first design high/low clutch (1) can be identified by having a 73 mm (2.87 in) OD rear flange (2). The second design high/low clutch (3) can be identified by having a 76 mm (2.99 in) OD rear flange (4).

For service:

- The first design 73 mm (2.87 in) high/low clutch may NOT be used with the second design fork and pad.
- The second design 76 mm (2.99 in) high/low clutch must be used with the second design fork and fork pad.
- The second design 76 mm (2.99 in) high/low clutch may also be used with the first design fork and pad if first design fork replacement is not required.

2011 Interim Model Year Design Change - NQF/NQG HD and SHD Design Change - Main shaft, pin, and thrust washer

Fig. 99: NQF/NQG HD And SHD Design Change - Main Shaft, Pin, And Thrust Washer

Courtesy of GENERAL MOTORS COMPANY

Beginning in 2011 model year for NQF / NQG HD and SHD applications, an anti-rotation main-shaft pin (2) was added to the design as well as a design change to thrust washer (11). The new design is to prohibit the rotation of the thrust washer (11). Components of this design are not to be used for back service.

2011 Interim Model Year Design Change - NQF/NQG/NQH/NP0 Front Output Shaft, Deflector, Seal

Fig. 100: NQF/NQG/NQH/NP0 Front Output Shaft, Deflector, Seal
Courtesy of GENERAL MOTORS COMPANY

Interim 2011 model year, a new design front output shaft deflector (3) was implemented into production for second design NQF-HD/SHD and NQG-HD applications. First design 2011 model year NQF and NQG applications can be identified as not having the deflector on the front output shaft.

For service, the new design front output shaft, deflector, and new design seal may be installed on current and prior model year Magna NQF-HD/SHD, NQG-LD/HD, NQH-LD/HD, and NP0 applications providing the new design front output shaft is also installed. The front output shaft

deflector is to be installed using **GE-8092** driver handle (1) and **DT-50649** seal installer (2).

Fig. 101: New Design Deflector And Output Shaft
Courtesy of GENERAL MOTORS COMPANY

The NEW design deflector (1) can be installed onto all current and prior model year Magna RPOs NQF, NQG, NQH, and NP0 applications providing the NEW design front output shaft (2) is also installed. Second design front output shafts can be identified by the machined area on the OD output end of the shaft (2). First design front output shafts can be identified by the dust boot clamp groove located (3) at the OD output end of the shaft. The NEW design slinger will NOT install onto the first design shafts.

2010 Service Parts Release Usage Change - NQH/NP0 Control Actuator Levers

Fig. 102: NQH/NP0 Control Actuator Levers
Courtesy of GENERAL MOTORS COMPANY

Light Duty (LD) 2007-2010 MP3023-NQH and 2010 MP3010-NP0 production transfer cases are built with LD control actuator levers (3 and 6) and are used with 13 mm (0.52 in) diameter control actuator lever balls (5)

Heavy duty (HD) 2007-10 MP3024-NQH production transfer cases are built with HD control actuator levers (3 and 6) and are used with Heavy 10 mm (0.39 in) control actuator lever balls.

When replacement of one or both of the LD control actuator levers is required, it is necessary to replace both of the levers and all three balls with the HD components as a set. It is also necessary to re-measure and adjust clutch pack clearances as required and to perform the Transfer Case High/Low Clutch Reset. Refer to Measuring/Adjusting Clutch Assembly Height in Transfer Case Assemble, Transfer Case Description and Operation and Transfer Case High/Low Clutch Reset. Heavy duty (HD) components are the only parts available for service.

2009 Interim Model Year Design Change - NQF Two/Four Wheel Drive Actuator Cam and Shaft

Fig. 103: NQF Two/Four Wheel Drive Actuator Cam And Shaft (First And Second Designs)
Courtesy of GENERAL MOTORS COMPANY

Interim 2009 model year, the high/low control actuator shaft and two/four wheel drive actuator cam designs were revised with a relocation of the shaft flange. First design 2009 transfer cases were built with first design high/low control actuator shaft (5) and cam (3). Second design 2009 transfer cases were built with second design high/low control actuator shaft (5) and cam (3). When replacing a first design control actuator shaft or cam, the second design shaft (5) and cam (3) must be installed. The second design parts are the only parts available for service.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/Description

Illustration	Tool Number/Description
	DT-35512 J-35512 Inner Pinion Bearing Installer
	DT-42738 J-42738 Seal Installer
	DT-44737 J-44737 Shift Rail Bearing Remover

Illustration	Tool Number/Description
	DT-44907 J-44907 Bearing Installer
	DT-45380 J-45380 Transfer Case Rear Bushing Remover and Installer
	DT-45759 J-45759 Assembly Fixture

Illustration	Tool Number/Description
	DT-48022 Output Bushing Installer
	DT-48209 Bushing Remover
	DT-48210 Seal Installer

Illustration	Tool Number/Description
	DT-48211 Drive Sprocket Bearing Installer
	DT-48212 Input Shaft Pilot Bearing Installer
	DT-48213 Clutch Pack Height Gauge

Illustration	Tool Number/Description
	DT-50648-A Seal Installer
	DT-50649 Seal Installer
	EL-49741 9V + Power Source Harness

Illustration	Tool Number/Description
	EL-49742 Battery Voltage B+ and Ground Source Harness
	GE-8092 J-8092 Driver Handle
	GE-02619-A J-02619-A Slide Hammer

Illustration	Tool Number/Description
	GE-3289-20 J-3289-20 Holding Fixture
	J-45278 Seal Remover

eserved.

TRANSMISSION

Transfer Case - MP 3023/3024 (NQH) - Specifications - Escalade, Suburban, Tahoe, Yukon

SPECIFICATIONS

FASTENER SPECIFICATIONS

Application	Specification	
	Metric	English
Two/Four Wheel Drive Actuator Position Sensor Bolt (Qty: 2)	6 N.m	53 lb in
Transfer Case to Adapter Nuts	50 N.m	37 lb ft
Transfer Case Adapter to Transmission Bolts	50 N.m	37 lb ft
Transfer Case Adapter Bolt	50 N.m	37 lb ft
Transfer Case Bolts (Qty: 17)	25 N.m	18 lb ft
Transfer Case Nut	50 N.m	37 lb ft
Transfer Case Oil Drain Plug	18 N.m	13 lb ft
Transfer Case Oil Fill Plug	18 N.m	13 lb ft
Transfer Case Shift Fork Shaft Guide Screw	5 N.m	44 lb in
Transfer Case 2/4 Wheel Drive Actuator Bolt/Screw	18 N.m	13 lb ft
Vehicle Speed Sensor Assembly	17 N.m	13 lb ft

APPROXIMATE FLUID CAPACITIES

Application	Specification	
	Metric	English
Transfer Case - MP 3023/3024 - NQH		
DEXRONÂ®VI	1.5 liters	1.6 quarts

ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS

Application	Type of Material	GM Part Number	
		United States	Canada

Application	Type of Material	GM Part Number	
		United States	Canada
Transfer Case	DEXRONÂ®VI	88861037	19264717
Transfer Case Oil Drain Plug	Sealant	12346004	10953480
Transfer Case Oil Fill Plug	Sealant	12346004	10953480
Transfer Case Rear Case Half to Transfer Case Front Half Assembly	Sealant	12346141	89022195
Transfer Case Shift Fork Shaft Guide Screw	Threadlocker	19332211	10953488
Transfer Case Vent	Sealant	12377901	10953504
Vehicle Speed Sensor - O-ring - Seal	DEXRONÂ®VI	88861037	19264717

.

TRANSMISSION

Transfer Case - MP 3023/3024 (NQH) - Diagnostic Information and Procedures - Escalade, Suburban, Tahoe, Yukon

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC B0770: AWD INDICATOR

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category

DTC Descriptors

DTC B0770 01

AWD Indicator Circuit Short to Battery

DTC B0770 06

AWD Indicator Circuit Short to Ground or Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Indicator Dimming Control	B0770 06, B0775 06, B0780 06, B0785 06	B0770 06, B0775 06, B0780 06, B0785 06	-
AWD Indicator Control Circuit	B0770 06	B0770 06	B0770 01

Circuit/System Description

The all wheel drive (AWD/4WD Auto) indicator circuit consists of a light emitting diode (LED) feed circuit, a LED and a LED control circuit. The indicator dimming control circuit is the LED feed circuit and continuously supplies B+ to the 2WD HI, 4WD Auto, 4WD HI, and 4WD LO LEDs. When the AWD mode has been selected by the driver, the transfer case shift control module (TCCM) provides a ground through the AWD indicator control circuit illuminating the LED.

The TCCM tests the AWD indicator circuit for unexpected voltage by monitoring the B+ supplied by the BCM on the indicator dimming control circuit by grounding the AWD indicator control circuit for 2 seconds during the Bulb Test at key ON.

Conditions for Running the DTC

B0770 01

- Ignition ON
- System voltage 10-18 V
- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the AWD indicator is commanded ON.

B0770 06

- Ignition ON
- System voltage 10-18 V
- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the AWD indicator is commanded OFF.

Conditions for Setting the DTC

B0770 01

The TCCM detects 3.4 V or greater on the AWD indicator control circuit when the AWD indicator is commanded ON.

B0770 06

The TCCM detects 1.6 V or less for 1.5 seconds on the AWD indicator control circuit when the AWD indicator is commanded OFF.

Action Taken When the DTC Sets

Normal operation, the SERVICE 4WD indicator is not commanded ON. Driver is informed of fault via bulb inspection.

Conditions for Clearing the DTC

- The transfer case shift control module clears the DTC once the condition for setting the DTC is no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- A TRUE B+ has enough current to light a test light.
- A DIAGNOSTIC B+ is a low current circuit that DOES NOT have enough current to light a test light.
- A short to ground on the AWD indicator control circuit will cause the AWD indicator to remain ON at all times.
- An open or high resistance on the AWD indicator control circuit will cause the AWD indicator to be inoperative during the 2 second bulb inspection.
- An open in the indicator dimming control circuit will cause the 2WD HI, AWD, 4WD HI and 4WD LO mode indicators to be inoperative during the 2 second bulb inspection.
- **EL-49741** harness is a good source for 9 V.
- **EL-49742** harness is a good source for B+ and ground.
- With key REMOVED - opening a door puts a true B+ on the indicator dimming control circuit, TCSCS X1 pin 4. Other possible voltages are listed below:
  - Door open, key removed - indicator dimming control circuit voltage = true B+.
  - Door open, key in, key OFF - indicator dimming control circuit voltage = true B+.
  - Door open, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
  - All doors closed, key OFF - indicator dimming control circuit voltage = B+ (high current - enough to light a test light).
  - All doors closed, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
  - Key ON, engine OFF. Place a shop light on the DRL sensor. When the DRL sensor commands the headlights OFF, the indicator dimming control circuit voltage, TCSCS X1 pin 4, will go from a diagnostic B+ to a true B+.

Reference Information

Schematic Reference

Transfer Case Control Schematics

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Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J 35616** GM-Approved Terminal Test Kit

Circuit/System Verification

Key ON, engine OFF. The TCCM runs a 2 second bulb test on all indicators of the TCSCS at key ON.

Circuit/System Testing

NOTE: **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 GM terminal test kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**

1. Remove key. Disconnect the X1 connector at the transfer case shift control switch (TCSCS).
2. Door open, key ON, engine OFF.
3. Using the L-BU probe J 35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the indicator dimming control circuit, TCSCS X1 pin 4 and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - If the voltage is less than the specified range, test the affected circuit for an open/high resistance, short to ground, or short to voltage. If all circuits and connections test normal, test the body control module (BCM) for proper operation.
4. Using the L-BU probes J 35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the indicator dimming control circuit, TCSCS X1 pin 4

and the AWD indicator control circuit, TSCSC X1 pin 7.

- If the voltage is less than the specified range, test the AWD indicator control circuit for an open/high resistance or short to power. If all circuits and connections test normal, test the TCCM for proper operation.

5. Key OFF. Using the L-BU probe J 35616-64B, test for greater than 10 Ω between the indicator dimming control circuit, TCSCS X1 pin 4 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
6. Using the L-BU probe J 35616-64B, test for greater than 10 Ω between the 4WD HI indicator control circuit, TCSCS X1 pin 7 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
7. Test the TCSCS for proper operation.

Component Testing

BCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Using the L-BU probe J 35616-64B, connect a test light between the indicator dimming control circuit, TCSCS harness X1 pin 4 and a good ground.
3. Key ON, engine OFF. The test light should be dull or OFF.
   - If the test light is bright, test the indicator dimming control circuit for a short to voltage condition. If all circuits and connections test normal, replace the BCM.

NOTE: **When the DRL sensor turns the headlights OFF the indicator dimming control circuit voltage, TCSCS X1 pin 4, will go from a diagnostic B+ to a true B+.**

4. Place a shop light on the DRL sensor. When the headlights go out the test light should illuminate brightly.
   - If the test light is dull or OFF, test the indicator dimming control circuit for an open/high resistance or short to ground condition. If all circuits and connections test normal, replace the BCM.

TCCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.

2. Key ON, engine OFF.
3. Using the L-BU probe J 35616-64B, test for 4.5-5.5 V between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground.
   - If the voltage is greater than the specified range, test the 5-volt reference circuit for a short to voltage. If all circuits and connections test normal, replace the TCCM.
   - If the voltage is less than the specified range, test the 5-volt reference circuit for an open/high resistance or short to ground. If all circuits and connections test normal, replace the TCCM.
4. Using the L-BU probes J 35616-64B, connect a test light between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground. The test light should illuminate dimly.
   - If the test light does not illuminate, obtain a different test light and repeat step 4.
5. Key OFF. Wait 30 seconds for the TCCM to shut down.

NOTE: **The TCCM must see the added resistance of the test light on the control circuit at key ON or the TCCM will shut the control circuit drivers OFF. Volt meters will not work for this test.**

6. Using the L-BU probes J 35616-64B, connect a test light between the TCSCS harness as specified below for the LED control circuit being tested.
7. Key ON, engine OFF.
8. Using the Special Function ability of the scan tool, command the affected LED ON and OFF. The test light should turn OFF and ON as commanded.
   - If the test light remains illuminated when commanded OFF, test the affected control circuit for a short to ground. If all circuits and connections test normal, replace the TCCM.
   - If the test light remains OFF when commanded ON, test the affected control circuit for an open/high resistance or short to voltage. If all circuits and connections test normal, replace the TCCM.

Mode	2WD HI	4WD Auto	4WD HI	4WD LO	N
5-V Reference (pin)	11	11	11	11	11
Indicator Control Circuit (pin)	8	7	9	10	3

TCSCS

1. Using the L-BU probes J 35616-65B, connect the **EL-49741** 9 V+ power source harness to the TCSCS as specified below for the LED being tested. Connecting the harness in the opposite pins will not illuminate the LED.
2. Connect a 9 V battery to the **EL-49741** harness.

3. Verify that only the indicator being tested illuminates.
    - If the indicator does not illuminate when tested or the incorrect indicator illuminates, replace the TCSCS.

EL49741 Wire Color	2WD HI	4WD Auto	4WD HI	4WD LO	N
Red (pin)	4	4	4	4	2
Black (pin)	8	7	9	10	3

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Transfer Case Selector Switch Replacement (Chevrolet / GMC)** **Transfer Case Selector Switch Replacement (Cadillac)**
- **Control Module References** for TCCM replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**

DTC B0775: 4WD HI INDICATOR

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC B0775 01

4WD HI Indicator Circuit Short to Battery

DTC B0775 06

4WD HI Indicator Circuit Short to Ground or Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Indicator Dimming Control	B0770 06, B0775 06,	B0770 06, B0775 06, B0780	-

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
	B0780 06, B0785 06	06, B0785 06	
4WD HI Indicator Control Circuit	B0775 06	B0775 06	B0775 01

Circuit/System Description

The 4WD HI indicator circuit consists of a light emitting diode (LED) feed circuit, a LED and a LED control circuit. The indicator dimming control circuit is the LED feed circuit and continuously supplies B+ to the 2WD HI, 4WD Auto, 4WD HI and 4WD LO LEDs. When the 4WD HI mode has been selected by the driver, the transfer case shift control module (TCCM) provides a ground through the 4 HI indicator control circuit illuminating the LED.

The TCCM tests the 4WD HI indicator circuit for unexpected voltage by monitoring the B+ supplied by the BCM on the indicator dimming control circuit by grounding the 4WD HI indicator control circuit for 2 seconds during the Bulb Test at key ON.

Conditions for Running the DTC

B0775 01

- Ignition ON
- System voltage 10-18 V
- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the 4WD HI indicator is commanded ON.

B0775 06

- Ignition ON
- System voltage 10-18 V
- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the 4WD HI indicator is commanded OFF.

Conditions for Setting the DTC

B0775 01

The TCCM detects 3.4 V or greater on the 4WD HI indicator control circuit when the 4WD HI indicator is commanded ON.

B0775 06

The TCCM detects 1.6 V or less for 1.5 seconds on the 4WD HI indicator control circuit when the 4WD HI indicator is commanded OFF.

Action Taken When the DTC Sets

Normal operation, the SERVICE 4WD indicator is not commanded ON. Driver is informed of fault via bulb inspection.

Conditions for Clearing the DTC

- The TCCM clears the DTC once the condition for setting the DTC is no longer present.
- A history DTC clears after 40 consecutive warm-up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- A TRUE B+ has enough current to light a test light.
- A DIAGNOSTIC B+ is a low current circuit that DOES NOT have enough current to light a test light.
- A short to ground on the 4WD HI indicator control circuit will cause the 4WD HI indicator to remain ON at all times.
- An open or high resistance on the 4WD HI indicator control circuit will cause the 4WD HI indicator to be inoperative during the 2 second bulb inspection.
- An open in the indicator dimming control circuit will cause the 2WD HI, 4WD Auto, 4WD HI and 4WD LO mode indicators to be inoperative during the 2 second bulb inspection.
- **EL-49741** harness is a good source for 9 V.
- **EL-49742** harness is a good source for B+ and ground
- With key REMOVED - opening a door puts a true B+ on the indicator dimming control circuit, TCSCS X1 pin 4. Other possible voltages are listed below:
    - Door open, key removed - indicator dimming control circuit voltage = true B+.
    - Door open, key in, key OFF - indicator dimming control circuit voltage = true B+.
    - Door open, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
    - All doors closed, key OFF - indicator dimming control circuit voltage = B+ (high current - enough to light a test light).
    - All doors closed, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.

- Key ON, engine OFF. Place a shop light on the DRL sensor. When the DRL sensor commands the headlights OFF, the indicator dimming control circuit voltage, TCSCS X1 pin 4, will go from a diagnostic B+ to a true B+.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

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Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J 35616** GM-Approved Terminal Test Kit

Circuit/System Verification

Key ON, engine OFF. The TCCM runs a 2 second bulb test on all indicators of the TCSCS at key ON.

Circuit/System Testing

NOTE: **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 GM terminal test kit. Use of an improper test probe may deform the terminal,**

resulting in intermittent open conditions.

1. Remove key. Disconnect the X1 connector at the transfer case shift control switch (TCSCS).
2. Door, open, key ON, engine OFF. Using the L-BU probe J 35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the indicator dimming control circuit, TCSCS X1 pin 4 and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - If the voltage is less than the specified range, test the affected circuit for an open/high resistance, short to ground or short to voltage. If all circuits and connections test normal, test the body control module (BCM) for proper operation.
3. Using the L-BU probes J 35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the indicator dimming control circuit, TCSCS X1 pin 4 and the 4WD HI indicator control circuit, TSCSC X1 pin 9.
   - If the voltage is less than the specified range, test the 4WD HI indicator control circuit for an open/high resistance or short to power. If all circuits and connections test normal, test the TCCM for proper operation.
4. Key OFF. Using the L-BU probe J 35616-64B, test for greater than 10 Ω between the indicator dimming control circuit, TCSCS X1 pin 4 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
5. Using the L-BU probe J 35616-64B, test for greater than 10 Ω between the 4WD HI indicator control circuit, TCSCS X1 pin 9 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
6. Test the TCSCS for proper operation.

Component Testing

BCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Using the L-BU probe J 35616-64B, connect a test light between the indicator dimming control circuit, TCSCS harness X1 pin 4 and a good ground.
3. Key ON, engine OFF. The test light should be dull or OFF.
   - If the test light is bright, test the indicator dimming control circuit for a short to voltage condition. If all circuits and connections test normal, replace the BCM.

NOTE: **When the DRL sensor turns the headlights OFF the indicator dimming control circuit voltage, TCSCS X1**

pin 4, will go from a diagnostic B+ to a true B+.

4. Place a shop light on the DRL sensor. When the headlights go out the test light should illuminate brightly.
   - If the test light is dull or OFF, test the indicator dimming control circuit for an open/high resistance or short to ground condition. If all circuits and connections test normal, replace the BCM.

TCCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Key ON, engine OFF.
3. Using the L-BU probe J 35616-64B, test for 4.5-5.5 V between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground.
   - If the voltage is greater than the specified range, test the 5-volt reference circuit for a short to voltage. If all circuits and connections test normal, replace the TCCM.
   - If the voltage is less than the specified range, test the 5-volt reference circuit for an open/high resistance or short to ground. If all circuits and connections test normal, replace the TCCM.
4. Using the L-BU probes J 35616-64B, connect a test light between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground. The test light should illuminate dimly.
   - If the test light does not illuminate, obtain a different test light and repeat step 4.
5. Key OFF. Wait 30 seconds for the TCCM to shut down.

NOTE: **The TCCM must see the added resistance of the test light on the control circuit at key ON or the TCCM will shut the control circuit drivers OFF. Volt meters will not work for this test.**

6. Using the L-BU probes J 35616-64B, connect a test light between the TCSCS harness as specified below for the LED control circuit being tested.
7. Key ON, engine OFF.
8. Using the Special Function ability of the scan tool, command the affected LED ON and OFF. The test light should turn OFF and ON as commanded.
   - If the test light remains illuminated when commanded OFF, test the affected control circuit for a short to ground. If all circuits and connections test normal, replace the TCCM.
   - If the test light remains OFF when commanded ON, test the affected control circuit for an open/high resistance or short to voltage. If all circuits and connections test normal, replace the TCCM.

Mode	2WD HI	4WD Auto	4WD HI	4WD LO	N
5-V Reference (pin)	11	11	11	11	11
Indicator Control Circuit (pin)	8	7	9	10	3

TCSCS

1. Using the L-BU probes J 35616-65B, connect the **EL-49741** 9 V+ power source harness to the TCSCS as specified below for the LED being tested. Connecting the harness in the opposite pins will not illuminate the LED.
2. Connect a 9 V battery to the **EL-49741** harness.
3. Verify that only the indicator being tested illuminates.
    - If the indicator does not illuminate when tested or the incorrect indicator illuminates, replace the TCSCS.

EL49741 Wire Color	2WD HI	4WD Auto	4WD HI	4WD LO	N
Red (pin)	4	4	4	4	2
Black (pin)	8	7	9	10	3

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Transfer Case Selector Switch Replacement (Chevrolet / GMC)** **Transfer Case Selector Switch Replacement (Cadillac)**
- **Control Module References** for TCSCM replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**

DTC B0780: 4WD LO INDICATOR

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC B0780 01

4WD LO Indicator Circuit Short to Battery

DTC B0780 06

4WD LO Indicator Circuit Short to Ground or Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Indicator Dimming Control	B0770 06, B0775 06, B0780 06, B0785 06	B0770 06, B0775 06, B0780 06, B0785 06	-
4WD LO Indicator Control Circuit	B0780 06	B0780 06	B0780 01

Circuit/System Description

The 4WD LO indicator circuit consists of a light emitting diode (LED) feed circuit, a LED and a LED control circuit. The indicator dimming control circuit is the LED feed circuit and continuously supplies B+ to the 2WD HI, 4WD Auto, 4WD HI and 4WD LO LEDs. When the 4WD LO mode has been selected by the driver, the transfer case shift control module (TCCM) provides a ground through the 4WD LO indicator control circuit illuminating the LED.

The TCCM tests the 4WD LO indicator circuit for unexpected voltage by monitoring the B+ supplied by the BCM on the indicator dimming control circuit by grounding the 4WD LO indicator control circuit for 2 seconds during the Bulb Test at key ON.

Conditions for Running the DTC

B0780 01

- Ignition ON
- System voltage 10-18 V
- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the 4WD LO indicator is commanded ON.

B0780 06

- Ignition ON
- System voltage 10-18 V

- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the 4WD LO indicator is commanded OFF.

Conditions for Setting the DTC

B0780 01

The TCCM detects 3.4 V or greater on the 4WD LO indicator control circuit when the 4WD LO indicator is commanded ON.

B0780 06

The TCCM detects 1.6 V or less for 1.5 seconds on the 4WD LO indicator control circuit when the 4WD LO indicator is commanded OFF.

Action Taken When the DTC Sets

Normal operation, the SERVICE 4WD indicator is not commanded ON. Driver is informed of fault via bulb inspection.

Conditions for Clearing the DTC

- The TCCM clears the DTC once the condition for setting the DTC is no longer present.
- A history DTC clears after 40 consecutive warm-up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- A TRUE B+ has enough current to light a test light.
- A DIAGNOSTIC B+ is a low current circuit that DOES NOT have enough current to light a test light.
- A short to ground on the 4WD LO indicator control circuit will cause the 4WD LO indicator to remain ON at all times.
- An open or high resistance will cause the 4WD LO indicator to be inoperative during the 2 second bulb inspection.
- An open in the indicator dimming control circuit will cause the 2WD HI, 4WD Auto, 4WD HI and 4WD LO mode indicators to be inoperative during the 2 second bulb inspection.
- **EL-49741** harness is a good source for 9 V.
- **EL-49742** harness is a good source for B+ and ground.
- With key REMOVED - opening a door puts a true B+ on the indicator dimming control circuit, TCSCS X1 pin 4. Other possible voltages are listed below:

- Door open, key removed - indicator dimming control circuit voltage = true B+.
- Door open, key in, key OFF - indicator dimming control circuit voltage = true B+.
- Door open, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
- All doors closed, key OFF - indicator dimming control circuit voltage = B+ (high current - enough to light a test light).
- All doors closed, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
- Key ON, engine OFF. Place a shop light on the DRL sensor. When the DRL sensor commands the headlights OFF, the indicator dimming control circuit voltage, TCSCS X1 pin 4, will go from a diagnostic B+ to a true B+.

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Schematic Reference

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Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J 35616** GM-Approved Terminal Test Kit

Circuit/System Verification

Key ON, engine OFF. The TCCM runs a 2 second bulb test on all indicators of the TCSCS at key ON.

Circuit/System Testing

NOTE: **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 GM terminal test kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**

1. Remove key. Disconnect the X1 connector at the transfer case shift control switch (TCSCS).
2. Door open, key ON, engine OFF. Using the L-BU probe J 35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the indicator dimming control circuit, TCSCS X1 pin 4 and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - If the voltage is less than the specified range, test the affected circuit for an open/high resistance, short to ground or short to voltage. If all circuits and connections test normal, test the body control module (BCM) for proper operation.
3. Using the L-BU probes J 35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the indicator dimming control circuit, TCSCS X1 pin 4 and the 4WD LO indicator control circuit, TSCSC X1 pin 10.
   - If the voltage is less than the specified range, test the 4WD LO indicator control circuit for an open/high resistance or short to power. If all circuits and connections test normal, test the TCCM for proper operation.
4. Key OFF. Using the L-BU probe J 35616-64B, test for greater than 10 Ω between the indicator dimming control circuit, TCSCS X1 pin 4 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
5. Using the L-BU probe J 35616-64B, test for greater than 10 Ω between the 4WD LO indicator control circuit, TCSCS X1 pin 10 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
6. Test the TCSCS for proper operation.

Component Testing

BCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Using the L-BU probe J 35616-64B, connect a test light between the indicator dimming control circuit, TCSCS harness X1 pin 4 and a good ground.

3. Key ON, engine OFF. The test light should be dull or OFF.
   - If the test light is bright, test the indicator dimming control circuit for a short to voltage condition. If all circuits and connections test normal, replace the BCM.

NOTE: **When the DRL sensor turns the headlights OFF the indicator dimming control circuit voltage, TCSCS X1 pin 4, will go from a diagnostic B+ to a true B+.**

4. Place a shop light on the DRL sensor. When the headlights go out the test light should illuminate brightly.
   - If the test light is dull or OFF, test the indicator dimming control circuit for an open/high resistance or short to ground condition. If all circuits and connections test normal, replace the BCM.

TCCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Key ON, engine OFF.
3. Using the L-BU probe J 35616-64B, test for 4.5-5.5 V between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground.
   - If the voltage is greater than the specified range, test the 5-volt reference circuit for a short to voltage. If all circuits and connections test normal, replace the TCCM.
   - If the voltage is less than the specified range, test the 5-volt reference circuit for an open/high resistance or short to ground. If all circuits and connections test normal, replace the TCCM.
4. Using the L-BU probes J 35616-64B, connect a test light between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground. The test light should illuminate dimly.
   - If the test light does not illuminate, obtain a different test light and repeat step 4.
5. Key OFF. Wait 30 seconds for the TCCM to shut down.

NOTE: **The TCCM must see the added resistance of the test light on the control circuit at key ON or the TCCM will shut the control circuit drivers OFF. Volt meters will not work for this test.**

6. Using the L-BU probes J 35616-64B, connect a test light between the TCSCS harness as specified below for the LED control circuit being tested.
7. Key ON, engine OFF.
8. Using the Special Function ability of the scan tool, command the affected LED ON and OFF. The test light should turn OFF and ON as commanded.

- If the test light remains illuminated when commanded OFF, test the affected control circuit for a short to ground. If all circuits and connections test normal, replace the TCCM.
- If the test light remains OFF when commanded ON, test the affected control circuit for an open/high resistance or short to voltage. If all circuits and connections test normal, replace the TCCM.

Mode	2WD HI	4WD Auto	4WD HI	4WD LO	N
5-V Reference (pin)	11	11	11	11	11
Indicator Control Circuit (pin)	8	7	9	10	3

TCSCS

1. Using the L-BU probes J 35616-65B, connect the **EL-49741** 9 V+ power source harness to the TCSCS as specified below for the LED being tested. Connecting the harness in the opposite pins will not illuminate the LED.
2. Connect a 9 V battery to the **EL-49741** harness.
3. Verify that only the indicator being tested illuminates.
   - If the indicator does not illuminate when tested or the incorrect indicator illuminates, replace the TCSCS.

EL49741 Wire Color	2WD HI	4WD Auto	4WD HI	4WD LO	N
Red (pin)	4	4	4	4	2
Black (pin)	7	9	9	10	3

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Transfer Case Selector Switch Replacement (Chevrolet / GMC)** **Transfer Case Selector Switch Replacement (Cadillac)**
- **Control Module References** for TCSCM replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**

DTC B0785: 2WD HI INDICATOR

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.

- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC B0785 01

2WD HI Indicator Circuit Short to Battery

DTC B0785 06

2WD HI Indicator Circuit Short to Ground or Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Indicator Dimming Control	B0770 06, B0775 06, B0780 06, B0785 06	B0770 06, B0775 06, B0780 06, B0785 06	-
2WD HI Indicator Control Circuit	B0785 06	B0785 06	B0785 01

Circuit/System Description

The 2WD HI indicator circuit consists of a light emitting diode (LED) feed circuit, a LED and a LED control circuit. The indicator dimming control circuit is the LED feed circuit and continuously supplies B+ to the 2WD HI, 4WD Auto, 4WD HI and 4WD LO LEDs. When the 2WD HI mode has been selected by the driver, the transfer case shift control module (TCCM) provides a ground through the 2WD HI indicator control circuit illuminating the LED.

The TCCM tests the 2WD HI indicator circuit for unexpected voltage by monitoring the B+ supplied by the BCM on the indicator dimming control circuit by grounding the 2WD HI indicator control circuit for 2 seconds during the Bulb Test at key ON.

Conditions for Running the DTC

B0785 01

- Ignition ON
- System voltage 10-18 V
- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.

- Circuit tested when the 2WD HI indicator is commanded ON.

B0785 06

- Ignition ON
- System voltage 10-18 V
- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the 2WD HI indicator is commanded OFF.

Conditions for Setting the DTC

B0785 01

The TCCM detects 3.4 V or greater on the 2WD HI indicator control circuit when the 2WD HI indicator is commanded ON.

B0785 06

The TCCM detects 1.6 V or less for 1.5 seconds on the 2WD HI indicator control circuit when the 2WD HI indicator is commanded OFF.

Action Taken When the DTC Sets

Normal operation, the SERVICE 4WD indicator is not commanded ON. Driver is informed of fault via bulb inspection.

Conditions for Clearing the DTC

- The TCCM clears the DTC once the condition for setting the DTC is no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- A TRUE B+ has enough current to light a test light.
- A DIAGNOSTIC B+ is a low current circuit that DOES NOT have enough current to light a test light.
- A short to ground on the 2WD HI indicator control circuit will cause the 2WD HI indicator to remain ON at all times.
- An open or high resistance will cause the 2WD HI indicator to be inoperative during the 2 second bulb inspection.

- An open in the indicator dimming control circuit will cause the 2WD HI, 4WD Auto, 4WD HI and 4WD LO mode indicators to be inoperative during the 2 second bulb inspection.
- **EL-49741** harness is a good source for 9 V.
- **EL-49742** harness is a good source for B+ and ground.
- With key REMOVED - opening a door puts a true B+ on the indicator dimming control circuit, TCSCS X1 pin 4. Other possible voltages are listed below:
  - Door open, key removed - indicator dimming control circuit voltage = true B+.
  - Door open, key in, key OFF - indicator dimming control circuit voltage = true B+.
  - Door open, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
  - All doors closed, key OFF - indicator dimming control circuit voltage = B+ (high current - enough to light a test light).
  - All doors closed, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
  - Key ON, engine OFF. Place a shop light on the DRL sensor. When the DRL sensor commands the headlights OFF, the indicator dimming control circuit voltage, TCSCS X1 pin 4, will go from a diagnostic B+ to a true B+.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J 35616** GM-Approved Terminal Test Kit

Circuit/System Verification

Key ON, engine OFF. The TCCM runs a 2 second bulb test on all indicators of the TCSCS at key ON.

Circuit/System Testing

NOTE: **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 GM terminal test kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**

1. Remove key. Disconnect the X1 connector at the transfer case shift control switch (TCSCS).
2. Door open, key ON, engine OFF. Using the L-BU probe J 35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the indicator dimming control circuit, TCSCS X1 pin 4 and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - If the voltage is less than the specified range, test the affected circuit for an open/high resistance, short to ground or short to voltage. If all circuits and connections test normal, test the body control module (BCM) for proper operation.
3. Using the L-BU probes J 35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the indicator dimming control circuit, TCSCS X1 pin 4 and the 2WD HI indicator control circuit, TSCSC X1 pin 8.
   - If the voltage is less than the specified range, test the 2WD HI indicator control circuit for an open/high resistance or short to power. If all circuits and connections test normal, test the TCCM for proper operation.
4. Key OFF. Using the L-BU probe J 35616-64B, test for greater than 10 Ω between the indicator dimming control circuit, TCSCS X1 pin 4 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
5. Using the L-BU probe J 35616-64B, test for greater than 10 Ω between the 2WD HI indicator control circuit, TCSCS X1 pin 8 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
6. Test the TCSCS for proper operation.

Component Testing

BCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Using the L-BU probe J 35616-64B, connect a test light between the indicator dimming control circuit, TCSCS harness X1 pin 4 and a good ground.
3. Key ON, engine OFF. The test light should be dull or OFF.
   - If the test light is bright, test the indicator dimming control circuit for a short to voltage condition. If all circuits and connections test normal, replace the BCM.

NOTE: **When the DRL sensor turns the headlights OFF the indicator dimming control circuit voltage, TCSCS X1 pin 4, will go from a diagnostic B+ to a true B+.**

4. Place a shop light on the DRL sensor. When the headlights go out the test light should illuminate brightly.
   - If the test light is dull or off, test the indicator dimming control circuit for an open/high resistance or short to ground condition. If all circuits and connections test normal, replace the BCM.

TCCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Key ON, engine OFF.
3. Using the L-BU probe J 35616-64B, test for 4.5-5.5 V between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground.
   - If the voltage is greater than the specified range, test the 5-volt reference circuit for a short to voltage. If all circuits and connections test normal, replace the TCCM.
   - If the voltage is less than the specified range, test the 5-volt reference circuit for an open/high resistance or short to ground. If all circuits and connections test normal, replace the TCCM.
4. Using the L-BU probes J 35616-64B, connect a test light between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground. The test light should illuminate dimly.
   - If the test light does not illuminate, obtain a different test light and repeat step 4.
5. Key OFF. Wait 30 seconds for the TCCM to shut down.

NOTE: **The TCCM must see the added resistance of the test light on the control circuit at key ON or the TCCM will shut the control circuit drivers OFF. Volt meters will not work for this test.**

6. Using the L-BU probes J 35616-64B, connect a test light between the TCSCS harness as specified below for the LED control circuit being tested.
7. Key ON, engine OFF.
8. Using the Special Function ability of the scan tool, command the affected LED ON and OFF. The test light should turn OFF and ON as commanded.
    - If the test light remains illuminated when commanded OFF, test the affected control circuit for a short to ground. If all circuits and connections test normal, replace the TCCM.
    - If the test light remains OFF when commanded ON, test the affected control circuit for an open/high resistance or short to voltage. If all circuits and connections test normal, replace the TCCM.

Mode	2WD HI	4WD Auto	4WD HI	4WD LO	N
5-V Reference (pin)	11	11	11	11	11
Indicator Control Circuit (pin)	8	7	9	10	3

TCSCS

1. Using the L-BU probes J 35616-65B, connect the **EL-49741** 9 V+ power source harness to the TCSCS as specified below for the LED being tested. Connecting the harness in the opposite pins will not illuminate the LED.
2. Connect a 9 V battery to the **EL-49741** harness.
3. Verify that only the indicator being tested illuminates.
    - If the indicator does not illuminate when tested or the incorrect indicator illuminates, replace the TCSCS.

EL49741 Wire Color	2WD HI	4WD Auto	4WD HI	4WD LO	N
Red (pin)	4	4	4	4	2
Black (pin)	8	7	9	10	3

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Transfer Case Selector Switch Replacement (Chevrolet / GMC)** **Transfer Case Selector Switch Replacement (Cadillac)**
- **Control Module References** for TCSCM replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**

DTC B0790: NEUTRAL INDICATOR

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC B0790 01

Neutral Indicator Circuit Short to Battery

DTC B0790 06

Neutral Indicator Circuit Short to Ground or Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Ignition 1 Voltage	B0790 06	B0790 06	-
Neutral Indicator Control Circuit	B0790 06	B0790 06	B0790 01

Circuit/System Description

The Neutral indicator circuit consists of a light emitting diode (LED) feed circuit, a LED and a LED control circuit. The Ignition 1 voltage circuit is the LED feed circuit and continuously supplies B+ to the Neutral LED. When the Neutral mode has been selected by the driver, the transfer case shift control module (TCCM) provides a ground through the Neutral indicator control circuit illuminating the LED.

The TCCM tests the Neutral indicator circuit for unexpected voltage by monitoring the B+ supplied by the BCM on the Ignition 1 voltage circuit by grounding the Neutral indicator control circuit for 2 seconds during the Bulb Test at key ON.

Conditions for Running the DTC

B0790 01

- Ignition ON

- System voltage 10-18 V
- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the Neutral indicator is commanded ON.

B0790 06

- Ignition ON
- System voltage 10-18 V
- Instrument panel lights not dimmed.
- Daylight running lights MUST be commanded ON.
- Circuit tested when the Neutral indicator is commanded OFF.

Conditions for Setting the DTC

B0790 01

The TCCM detects 3.4 V or greater on the AWD/4WD Auto indicator control circuit when the Neutral indicator is commanded ON.

B0790 06

The TCCM detects 1.6 V or less for 1.5 seconds on the AWD/4WD Auto indicator control circuit when the Neutral indicator is commanded OFF.

Action Taken When the DTC Sets

Normal operation, the SERVICE 4WD indicator is commanded ON for the remainder of the ignition cycle. Driver is also informed of fault via bulb inspection.

Conditions for Clearing the DTC

- The TCCM clears the DTC once the condition for setting the DTC no longer present.
- A history DTC clears after 40 consecutive warm-up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- A TRUE B+ has enough current to light a test light.

- A DIAGNOSTIC B+ is a low current circuit that DOES NOT have enough current to light a test light.
- A short to ground on the Neutral indicator control circuit will cause the Neutral indicator to remain ON at all times.
- An open or high resistance will cause the Neutral indicator to be inoperative during the 2 second bulb inspection.
- **EL-49741** harness is a good source for 9 V.
- **EL-49742** harness is a good source for B+ and ground.
- With key REMOVED - opening a door puts a true B+ on the indicator dimming control circuit, TCSCS X1 pin 4. Other possible voltages are listed below:
  - Door open, key removed - indicator dimming control circuit voltage = true B+.
  - Door open, key in, key OFF - indicator dimming control circuit voltage = true B+.
  - Door open, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
  - All doors closed, key OFF - indicator dimming control circuit voltage = B+ (high current - enough to light a test light).
  - All doors closed, key ON, engine OFF - indicator dimming control circuit voltage = diagnostic B+.
  - Key ON, engine OFF. Place a shop light on the DRL sensor. When the DRL sensor commands the headlights OFF, the indicator dimming control circuit voltage, TCSCS X1 pin 4, will go from a diagnostic B+ to a true B+.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J 35616** GM-Approved Terminal Test Kit

Circuit/System Verification

Key ON, engine OFF. The TCCM runs a 2 second bulb test on all indicators of the TCSCS at key ON.

Circuit/System Testing

NOTE: **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 GM terminal test kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**

1. Remove key. Disconnect the X1 connector at the transfer case shift control switch (TCSCS).
2. Key removed. Using the L-BU probe J 35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the Ignition 1 voltage circuit, TCSCS X1 pin 2 and a good ground (the ground terminal of the **EL-49742** harness, black terminal).
   - If the voltage is less than the specified range, test the affected circuit for an open/high resistance or short to ground. If all circuits and connections test normal, test the body control module (BCM) for proper operation.
3. Using the L-BU probes J 35616-64B, test for a diagnostic B+ (+0.0/-1.0 V) between the Ignition 1 voltage circuit, TCSCS X1 pin 2 and the Neutral indicator control circuit, TSCSC X1 pin 3.
   - If the voltage is less than the specified range, test the Neutral indicator control circuit for an open/high resistance or short to power. If all circuits and connections test normal, test the TCCM for proper operation.
4. Using the L-BU probe J 35616-64B, test for greater than 10 Ω between the Ignition 1 voltage circuit, TCSCS X1 pin 2 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.
5. Using the L-BU probe J 35616-64B, test for greater than 10 Ω between the Neutral indicator control circuit, TCSCS X1 pin 3 and all other pins of the TCSCS X1.
   - If the resistance is less than the specified range, test the affected circuits for a shorted together condition. If all circuits and connections test normal, test the TCCM for proper operation.

6. Test the TCSCS for proper operation.

Component Testing

BCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Using the L-BU probe J 35616-64B, connect a test lamp between the Ignition 1 voltage circuit, TCSCS harness X1 pin 2 and a good ground. The test light should be OFF.
   - If the test light is ON, test the Ignition 1 voltage circuit for a short to voltage condition. If all circuits and connections test normal, replace the BCM.
3. Key ON, engine OFF. The test light should illuminate brightly.
   - If the test light is dull or OFF, test the Ignition 1 voltage circuit for an open/high resistance or short to ground condition. If all circuits and connections test normal, replace the BCM.

TCCM

1. Key OFF. Disconnect the X1 connector at the TCSCS.
2. Key ON, engine OFF.
3. Using the L-BU probe J 35616-64B, test for 4.5-5.5 V between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground.
   - If the voltage is greater than the specified range, test the 5-volt reference circuit for a short to voltage. If all circuits and connections test normal, replace the TCCM.
   - If the voltage is less than the specified range, test the 5-volt reference circuit for an open/high resistance or short to ground. If all circuits and connections test normal, replace the TCCM.
4. Using the L-BU probes J 35616-64B, connect a test light between the 5-volt reference circuit, TCSCS harness X1 pin 11 and a good ground. The test light should illuminate dimly.
   - If the test light does not illuminate, obtain a different test light and repeat step 4.
5. Key OFF. Wait 30 seconds for the TCCM to shut down.

NOTE: **The TCCM must see the added resistance of the test light on the control circuit at key ON or the TCCM will shut the control circuit drivers OFF. Volt meters will not work for this test.**

6. Using the L-BU probes J 35616-64B, connect a test light between the TCSCS harness as specified below for the LED control circuit being tested.

7. Key ON, engine OFF.
8. Using the Special Function ability of the scan tool, command the affected LED ON and OFF. The test light should turn ON and OFF as commanded.
    - If the test light remains illuminated when commanded OFF, test the affected control circuit for a short to ground. If all circuits and connections test normal, replace the TCCM.
    - If the test light remains OFF when commanded ON, test the affected control circuit for an open/high resistance or short to voltage. If all circuits and connections test normal, replace the TCCM.

Mode	2WD HI	4WD Auto	4WD HI	4WD LO	N
5-V Reference (pin)	11	11	11	11	11
Indicator Control Circuit (pin)	8	7	9	10	3

TCSCS

1. Using the L-BU probes J 35616-65B, connect the **EL-49741** 9 V+ power source harness to the TCSCS as specified below for the LED being tested. Connecting the harness in the opposite pins will not illuminate the LED.
2. Connect a 9 V battery to the **EL-49741** harness.
3. Verify that only the indicator being tested illuminates.
    - If the indicator does not illuminate when tested or the incorrect indicator illuminates, replace the TCSCS.

EL49741 Wire Color	2WD HI	4WD Auto	4WD HI	4WD LO	N
Red (pin)	4	4	4	4	2
Black (pin)	8	7	9	10	3

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Transfer Case Selector Switch Replacement (Chevrolet / GMC)** **Transfer Case Selector Switch Replacement (Cadillac)**
- **Control Module References** for TCSCM replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**

DTC B2725, P0698, OR P0699: TRANSFER CASE RANGE SELECTION SWITCH/5V REFERENCE 3

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC B2725 03

Transfer Case Range Selection Switch Circuit Low Voltage

DTC B2725 07

Transfer Case Range Selection Switch Circuit High Voltage

DTC B2725 08

Transfer Case Range Selection Switch Circuit Performance - Signal Invalid

DTC P0698

5V Reference 3 Circuit Low Voltage

DTC P0699

5V Reference 3 Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Invalid
5-Volt Reference	B2725 03, B2725 08, or P0698	B2725 03, B2725 08, or P0698	B2725 07, B2725 08, or P0699	B2725 08, P0698, or P0699
Four Wheel Drive	B2725 03 or B2725 08	B2725 03 or B2725 08	B2725 07 or B2725 08	B2725 08

Circuit/System Description

The transfer case shift control switch allows the driver to select between 5 ranges. The transfer case control module supplies a regulated 5 volts to the switch through the 5-volt reference circuit. The current travels through the specific resistor of the currently selected range - each range has its own

resistor. The current is then returned to the transfer case control module through the four wheel drive switch signal circuit.

The transfer case control module continuously monitors the switch signal circuit to determine whether a range change has been requested by the driver.

The NQH transfer case has the following 5 ranges:

- 2WD
- 4WD/AWD Automatic
- 4WD High/Locked
- 4WD Low
- Neutral

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- No DTC P0562 or P0563.

Conditions for Setting the DTC

The transfer case control module monitors the voltage on 5V reference and 4WD switch signal circuits every 10 ms.

B2725 03

When the low side driver is ON, the transfer case control module measures less than 0.3 volts on the Four Wheel Drive Switch Signal circuit.

B2725 07

When the low side driver is ON, the transfer case control module measures greater than 4.65 volts on the Four Wheel Drive Switch Signal circuit.

B2725 08

When the low side driver is ON, the transfer case control module measures an invalid voltage on the Four Wheel Drive Switch Signal circuit.

P0698

When the ignition is ON, the transfer case control module measures less than 4.75 volts on the Transfer Case Sensor Reference Voltage 3 circuit.

P0699

When the ignition is ON, the transfer case control module measures greater than 5.25 volts on the Transfer Case Sensor Reference Voltage 3 circuit.

Action Taken When the DTC Sets

- DTC P0698 and P0699 are type A DTC's.
- All shifting is disabled.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- DTC P0698 and P0699 are type A DTC's.
- The transfer case control module clears the DTC once the condition for setting the DTC is no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

EL-49742 harness is a good source for B+ and ground.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**

- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J 35616** GM-Approved Terminal Test Kit

Circuit/System Verification

1. Verify that all range selections of the S77 transfer case shift control switch match the following parameters in the Data Display feature of the scan tool:
   - Transfer Case Commanded Position
   - Transfer Case Range
   - Transfer Case Range Selection Switch State
   - The corresponding Range Indicator light
   - ***If NOT all of the parameters match the S77 transfer case shift control switch position***

     Refer to Circuit/System Testing.

   - ***If ALL of the parameters match the S77 transfer case shift control switch position***
2. Verify that the sensor reference voltage 3 and transfer case range selection switch voltage fall within the below ranges for all range selections of the S77 transfer case shift control switch.
   - ***If NOT all voltages match the specified ranges***

     Refer to Circuit/System Testing.

   - ***If ALL voltages match the specified ranges***
3. Verify DTC B2725, P0698, or P0699 is only set as a history DTC.
   - ***If any of the DTCs are set as current***

Refer to Circuit/System Testing.

- ***If any of the DTCs are only set as history***

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

4. Visually inspect each connector terminal of the K69 transfer case control module X1 connector and the S77 transfer case shift control switch connector for damage or corrosion. Repair as necessary.
5. Clear DTC 2725, P0698, or P0699 from history.
6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If any of the DTCs are set***

     Refer to Circuit/System Testing.

   - ***If none of the DTCs set***
7. All OK.

Transfer Case Range	Transfer Case Sensor Reference Voltage 3	Transfer Case Range Selection Switch (V)		Range Actuator Position Sensor (Â°)	
		Range	Nominal	Range	Nominal
2WD	4.7-5.3 V	1.8-2.2 V	2.0 V	33-43Â°	38Â°
4WD/AWD Automatic	4.7-5.3 V	4.10-4.59 V	4.38 V	87-204Â°	146Â°
4WD High/Locked	4.7-5.3 V	2.8-3.2 V	3.0 V	110-204Â°	146Â°
4WD Low	4.7-5.3 V	1.3-1.7 V	1.5 V	-69Â° to -140Â°	-90Â°
Neutral	4.7-5.3 V	2.3-2.7 V	2.5 V Held 1.5 V Released	-5Â° to +5Â°	0Â°

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the S77 transfer case shift control switch.
2. ON, engine OFF.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 GM terminal test kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 3-5 is performed on the S77 transfer case shift control switch harness connector using the L-BU probes J 35616-64B.**

3. Test for 4.75-5.25 V between the 5-Volt reference circuit, terminal 11 and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - ***If less than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the 5-Volt reference circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between 5-Volt reference circuit terminal 11 and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the 5-Volt reference circuit terminal 11 and all other terminals of the S77 transfer case shift control switch harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

        Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

   - ***If greater than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the 5-Volt reference circuit terminal 11 and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.
      - If less than 1 V
   3. Test for greater than 10 Ω between the 5-Volt reference circuit, terminal 11 and all other terminals of the S77 transfer case shift control switch harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.

- If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

  Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

4. 5-Volt reference circuit and K69 transfer case control module OK.
5. Test for 4.75-5.25 V between the 5-Volt reference circuit, terminal 11, and the switch signal circuit, terminal 12.
   - ***If less than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the switch signal circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between switch signal circuit and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the switch signal circuit, terminal 12 and all other terminals of the S77 transfer case shift control switch harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

        Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

   - ***If greater than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the switch signal circuit, terminal 12 and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.
      - If less than 1 V
   3. Test for greater than 10 Ω between the switch signal circuit, terminal 12 and all other terminals of the S77 transfer case shift control switch harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

6. Switch signal circuit and K69 transfer case control module OK.

Component Testing

S77 Transfer Case Shift Control Switch

1. Ignition OFF. Remove the S77 transfer case shift control switch. Refer to **Transfer Case Selector Switch Replacement (Chevrolet / GMC)** **Transfer Case Selector Switch Replacement (Cadillac)** .

NOTE: **Testing for Step 2 is performed on the component using the L-BU probe J 35616-65B.**

2. Measure the resistance for each of the range positions of the S77 transfer case shift control switch between the 5-volt reference circuit, terminal 11, and the switch signal circuit terminal 12.
   - ***If the resistance is outside the specified ranges***

     Replace the S77 transfer case shift control switch. Refer to **Transfer Case Selector Switch Replacement (Chevrolet / GMC)** **Transfer Case Selector Switch Replacement (Cadillac)** .

   - ***If the resistance is within the specified ranges***
3. S77 transfer case shift control switch OK.

S77 Transfer Case Range Selection Switch	Range	Nominal
2WD	1475-1550 Ω	1515 Ω
4WD/AWD Automatic	110-175 Ω	140 Ω
4WD High/Locked	625-700 Ω	665 Ω
4WD Low	2230-2400 Ω	2345 Ω
Neutral	990-1050 Ω	1020 Ω

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Transfer Case Selector Switch Replacement (Chevrolet / GMC)** **Transfer Case Selector Switch Replacement (Cadillac)** for S77 transfer

case shift control switch replacement

- **Control Module References** for K69 transfer case control module replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset** for Range Actuator Learn procedure

DTC C0306 OR C0381: RANGE ACTUATOR CONTROL

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0306 01

Range Actuator Control Circuit Short to Battery

DTC C0306 02

Range Actuator Control Circuit Short to Ground

DTC C0306 04

Range Actuator Control Circuit Short to Open

DTC C0306 54

Range Actuator Control Circuit High Temperature

DTC C0381 54

Range Actuator System Performance High Temperature

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Performance

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Performance
Transfer Case Motor Clockwise Control	C0306 02	C0306 04	C0306 01	C0306 54 or C0381 54
Transfer Case Motor Counter-Clockwise Control	C0306 02	C0306 04	C0306 01	C0306 54 or C0381 54

Circuit/System Description

The A16 Transfer Case Motor, also known as the transfer case range actuator, is a bi-directional, permanent magnet, DC motor. When energized, through the transfer case clockwise circuit or transfer case counter-clockwise circuit, the ground is provided by the opposing motor control circuit which becomes grounded through the transfer case control module ground circuit. The transfer case range actuator, through a series of gears, rotates the transfer case control actuator shaft which moves the transfer case two/four wheel drive actuator cam and transfer case high/low shift fork in order to shift the transfer case between the following modes or ranges:

- 2WD
- 4WD/AWD Automatic
- 4WD High/Locked
- 4WD Low
- Neutral

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- No DTC P0562 or P0563.
- Transfer case range actuator not performing a requested range change (C0306 01, C0306 02, and C0306 04 only).
- DTC C0306 and C0381 run continuously within the enabling conditions.

Conditions for Setting the DTC

C0306 01

Voltage on the transfer case clockwise circuit or the transfer case counter-clockwise circuit is greater than 5.60 V.

C0306 02

Voltage on the transfer case clockwise circuit or the transfer case counter-clockwise circuit is less than 1.9 V.

C0306 04

Voltage on the transfer case clockwise circuit is 2.7-4.5 V, and the voltage on the transfer case counter-clockwise circuit is 0.5-4.5 V.

C0306 54

The calculated temperature of the transfer case range actuator H-bridge in the transfer case control module is greater than a predetermined value.

C0381 54

The calculated temperature of the transfer case range actuator is greater than a predetermined value.

Action Taken When the DTC Sets

- All shifting disabled.
- Front axle disengages if thermal model exceeded.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- The transfer case control module clears the DTC once the conditions for setting the DTC are no longer present.
- A history DTC clears after 40 consecutive warm-up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- It is possible to have windings inside the motor shorted to the case resulting in a short to ground causing this DTC to set.
- The default actions for C0321 may set C0306.
- **EL-49741** harness is a good source for 9 V.
- **EL-49742** harness is a good source for B+ and ground.
- The transfer case drain plug is a good source for ground.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J 35616** GM-Approved Terminal Test Kit

Circuit/System Verification

1. Verify DTC C0321 in NOT set.
    - **If DTC C0321 is set**

      diagnose it first. Refer to **DTC C0321 or C0326**.

    - ***If DTC C0321 is NOT set***
2. Verify that all of the following scan tool parameters display OK.
    - Range Actuator Control Circuit High Voltage Test Status
    - Range Actuator Control Circuit Low Voltage Test Status
    - Range Actuator Control Circuit Open Voltage Test Status

- Range Actuator Control Circuit Shorted Test Status
- ***If any of the parameters do NOT display OK***

  Refer to Circuit/System Testing.

- ***If all of the parameters display OK***

3. Verify that for all range selections of the S77 transfer case shift control switch, the Range Actuator Current parameter increases or decreases during the shift and then returns to 0.0 A after shifting.
   - ***If the Range Actuator Current parameter does NOT perform as described***

     Refer to Circuit/System Testing.

   - ***If the Range Actuator Current parameter DOES perform as described***
4. Verify DTC C0306 or C0381 is only set as a history DTC.
   - **If C0306 or C0381 is set as current**

     Refer to Circuit/System Testing.

   - **If C0306 or C0381 is only set as history**

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

5. Visually inspect each connector terminal of the K69 transfer case control module X3 connector and the A16 transfer case motor connector for damage or corrosion. Repair as necessary.
6. Clear DTC C0306 or C0381 from history.
7. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - **If DTC C0306 or C0381 sets**

     Refer to Circuit/System Testing.

   - **If DTC C0306 or C0381 does not set**
8. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the A16 transfer case motor, also known as the transfer case range actuator.
2. Ignition ON, engine OFF.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 3-5 is performed on the A16 transfer case motor harness connector using the PU probes J 35616-4A.**

3. Test for 1.0-2.5 V between the transfer case motor counter-clockwise control circuit terminal D and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - ***If less than the specified range***
   1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the transfer case motor counter-clockwise control circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between transfer case motor counter-clockwise control circuit terminal D and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the transfer case motor counter-clockwise control circuit terminal D and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

        Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

   - ***If greater than the specified range***
   1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the transfer case motor counter-clockwise control circuit terminal D and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.

- If less than 1 V

3. Test for greater than 10 Ω between the transfer case motor counter-clockwise control circuit, terminal D and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

4. Transfer case motor counter-clockwise control circuit and K69 transfer case control module OK.
5. Test for 3.0-4.5 V between the transfer case motor clockwise control circuit terminal A, and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.

- **If less than the specified range**

1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in the transfer case motor clockwise control circuit end to end.
   - If 10 Ω or greater, repair the open/high resistance in the circuit.
   - If less than 10 Ω
3. Test for infinite resistance between transfer case motor clockwise control circuit terminal A and a good ground.
   - If less than infinite resistance, repair the short to ground in the circuit.
   - If infinite resistance
4. Test for greater than 10 Ω between the transfer case motor clockwise control circuit terminal A and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- **If greater than the specified range**

1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
2. Test for less than 1 V between the transfer case motor clockwise control circuit terminal A and a good ground.
   - If 1 V or greater, repair the short to voltage in the circuit.

- If less than 1 V

3. Test for greater than 10 Ω between the transfer case motor clockwise control circuit, terminal A and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- **If within the specified range**

6. Transfer case motor counter-clockwise control circuit, transfer case motor clockwise control circuit and K69 transfer case control module OK.

Component Testing

A16 Transfer Case Motor (Transfer Case Range Actuator)

1. Remove the A16 transfer case motor from transfer case. Using a paint pen or marker, place indexing marks on the A16 transfer case motor drive gear and the mounting surface of the A16 transfer case motor.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 2-11 is performed on the A16 transfer case motor harness connector using the PU probes J 35616-5.**

2. Attach the red lead from one of the **EL-49741** harnesses to the battery positive voltage terminal of the A16 transfer case motor, terminal B.
3. Attach the black lead from this same jumper harness to the transfer case lock solenoid control terminal of the A16 transfer case motor, terminal C.
4. Attach a 9-volt battery to this harness (not included). You should hear the A16 transfer case motor unlock.
   - ***If you do NOT hear the A16 transfer case motor unlock***

     replace the A16 transfer case motor and perform the Range Actuator Learn procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** , and **Transfer Case High/Low Clutch Reset**.

   - ***If you DO hear the A16 transfer case motor unlock***
5. Attach the red lead from the other **EL-49741** jumper harness to the transfer case motor clockwise control circuit of the A16 transfer case

motor, terminal A.

6. Attach the black lead from this same jumper harness to the transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D.
7. Touch the battery terminals of the 9-volt battery to the battery terminals of the jumper harness. This should rotate the A16 transfer case motor drive gear in either a clockwise or counter-clockwise rotation depending on battery orientation.
   - If the A16 transfer case motor drive gear does not perform as described

     replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** , and **Transfer Case High/Low Clutch Reset**.

   - ***If The A16 transfer case motor drive gear performs as described***
8. Verify 0.3-40 Ω resistance between the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A and the transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D.
   - ***If NOT 0.3-40 Ω***

     replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** , and **Transfer Case High/Low Clutch Reset**.

   - ***If 0.3-40 Ω***
9. Test for infinite resistance between the following circuits and the A16 transfer case motor case:
   - Transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A
   - Transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D
   - ***If less than infinite resistance***

     replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** , and **Transfer Case High/Low Clutch Reset**.

   - ***If infinite resistance***
10. Test for infinite resistance between the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A and all other terminals on the A16 transfer case motor harness X1 except the transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D.
    - ***If less than infinite resistance***

      replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive**

Actuator Replacement , and **Transfer Case High/Low Clutch Reset**.

- ***If infinite resistance***

11. Test for infinite resistance between the transfer case motor counter-clockwise control circuit of the A16 Transfer Case Motor, terminal D. and all other terminals on the TCEM harness X1 except the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A.
    - ***If less than infinite resistance***

      replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** , and **Transfer Case High/Low Clutch Reset**.

    - ***If infinite resistance***
12. A16 transfer case motor OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for K69 transfer case control module replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**
- **Transfer Case Two/Four Wheel Drive Actuator Replacement**

DTC C0321 OR C0326: RANGE ACTUATOR LOCK CONTROL

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0321 01

Range Actuator Lock Control Circuit Short to Battery

DTC C0321 02

Range Actuator Lock Control Circuit Short to Ground

DTC C0321 04

Range Actuator Lock Control Circuit Open

DTC C0326 58

Range Actuator Lock Control System Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Performance
Battery Positive Voltage	-	DTC C0321 04	-	-
Transfer Case Lock Solenoid Control	DTC C0321 02	DTC C0321 04	DTC C0321 01	DTC C0326 58

Circuit/System Description

The transfer case range actuator is also known as the transfer case motor, transfer case encoder motor, or transfer case two/four wheel drive actuator assembly.

The transfer case range actuator lock solenoid is part of the transfer case range actuator and cannot be serviced separately.

The transfer case control module controls the transfer case range actuator lock solenoid. The transfer case range actuator lock solenoid is released by being energized. This is accomplished by grounding the transfer case lock solenoid control circuit during range changes, and 4WD/AWD Automatic mode. Locking action is applied when power or ground are taken away from the lock solenoid, preventing the transfer case range actuator from moving. The system is capable of providing 2WD, 4WD High/Locked, 4WD Low, and Neutral without the need of additional vehicle power to hold the transfer case in these positions.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- A state change from lock solenoid engaged to lock solenoid disengaged, or lock solenoid disengaged to lock solenoid engaged, has occurred more than 10 times - DTC C0321 only.
- DTC C0321 and C0326 run continuously within the enabling conditions.

Conditions for Setting the DTC

C0321 01

When the low side driver is ON, the transfer case control module measures greater than 8.5 volts on the Transfer Case Lock Solenoid Control circuit.

C0321 02

When the low side driver is OFF, the transfer case control module measures less than 2.0 volts on the Transfer Case Lock Solenoid Control circuit.

C0321 04

When the low side driver is OFF, the transfer case control module measures between 2.5-5.5 volts on the Transfer Case Lock Solenoid Control circuit.

C0326 58

Transfer case range actuator position correction after a brake slipping event was unsuccessful 10 times. A slipping event is defined as a torque error between the torque requested and the actual torque calculated from motor position being greater than a predetermined amount.

Action Taken When the DTC Sets

C0321

- Lock does not disengage.
- All shifting disabled.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

C0326 58

- Normal operation/slip correction unless thermal limits of transfer case four wheel drive clutch, transmission control module or transfer case range actuator have been exceeded.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- The transfer case control module clears the DTC once the conditions for setting the DTC are no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.

- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- The underhood fuse block supplies B+ on the battery positive voltage circuit and reads the voltage back on the transfer case lock solenoid control circuit.
- The system tests the transfer case lock solenoid circuits by checking for unwanted voltage. If the transfer case control module detects a low voltage return when a high voltage is expected, or a high voltage return when a low voltage is expected, the DTC is logged.
- The default actions for C0321 may set C0306.
- **EL-49741** harness is a good source for 9 V.
- **EL-49742** harness is a good source for B+ and ground.
- The transfer case drain plug is a good source for ground.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J 35616** GM-Approved Terminal Test Kit

Circuit/System Verification

1. Verify that all of the following scan tool parameters display OK.
    - Range Actuator Lock Control Circuit High Voltage Test Status
    - Range Actuator Lock Control Circuit Low Voltage Test Status
    - Range Actuator Lock Control Circuit Open Test Status
    - ***If any of the parameters do NOT display OK***

      Refer to Circuit/System Testing.

    - ***If all of the parameters display OK***
2. Using the transfer case Range Actuator Lock function of the Control Functions feature of the scan tool, command the transfer case range actuator lock ON and OFF. You should be able to hear the range actuator lock engage and disengage.
    - ***If you are unable to hear the range actuator lock engaging and disengaging***

      Refer to Circuit/System Testing.

    - ***If you are able to hear the range actuator lock engaging and disengaging***
3. Verify DTC P0321 or P0326 is only set as a history DTC.
    - ***If any of the DTCs are set as current***

      Refer to Circuit/System Testing.

    - ***If any of the DTCs are only set as history***

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

4. Visually inspect each connector terminal of the K69 transfer case control module X1 connector and the A16 transfer case motor connector for damage or corrosion. Repair as necessary.
5. Clear DTC P0321 or P0326 from history.

6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If any of the DTCs are set***

     Refer to Circuit/System Testing.

   - ***If none of the DTCs set***
7. All OK.

Circuit/System Testing

1. Verify that the 4WD TREC fuse, X50A Fuse Block - Underhood fuse 6, and the Accessory/Run Crank fuse, X51L Fuse Block - Instrument Panel Left - fuse 31, are not open.
   - ***If the 4WD TREC fuse is open***

     Test the battery positive voltage, K69 transfer case control module harness X3 terminal C, for a short to ground.

   - ***If the Accessory/Run Crank fuse is open***

     Test the Accessory/Run Crank voltage circuit, K69 transfer case control module harness X2 terminal 4, for a short to ground.

   - ***If neither fuse is open***
2. Ignition ON, engine OFF.
3. Disconnect the harness connector at the A16 transfer case range actuator.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 3-5 is performed on the A16 transfer case motor harness connector using the PU probes J 35616-4A.**

4. Test for B+ (+0.0/-1.0 V) between the battery positive voltage circuit, A16 transfer case range actuator harness terminal B, and a good ground.
   - ***If the voltage is less than B+ (+0.0/-1.0 V)***
   1. Ignition OFF, disconnect the X2 harness connector at the X50A Fuse Block - Underhood.
   2. Test for less than 10 Ω in battery positive voltage circuit end to end.

- If 10 Ω or greater, repair the open/high resistance in the circuit.
- ***If less than 10 Ω***

3. Test for infinite resistance between battery positive voltage circuit and a good ground.
   - If less than infinite resistance, repair the short to ground in the circuit.
   - If infinite resistance
4. Test for infinite resistance between the battery positive voltage circuit, A16 transfer case motor harness terminal B, and all other terminals of the A16 transfer case motor harness connector.
   - If less than infinite resistance, repair the shorted together condition in the affected circuits.
   - If infinite resistance, replace the K69 transfer case control module and perform the Range Actuator Learn procedure. The Range Actuator Learn procedure is also known as the Transfer Case High/Low Clutch Reset procedure.

     Refer to **Transfer Case Control Module Replacement** .

- ***If the voltage is B+ (+0.0/-1.0 V)***

5. Test for a 4.0-5.0 V diagnostic voltage between the transfer case lock solenoid control circuit, A16 Transfer Case Motor terminal C, and a good ground.
   - ***If the voltage is greater than the specified range***

   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
   2. Ignition ON, engine OFF.
   3. Test for less than 1 V between the transfer case lock solenoid control circuit and a good ground.
      - If 1 V or greater, repair the short to voltage on the circuit.
      - If less than 1 V
   4. Test for infinite resistance between the transfer case lock solenoid control circuit, A16 transfer case motor harness connector terminal C and all other terminals of the A16 transfer case motor harness connector.
      - If less than infinite resistance, repair the shorted together condition in the affected circuits.
      - If infinite resistance, replace the K69 transfer case control module and perform the Range Actuator Learn procedure. The Range Actuator Learn procedure is also known as the Transfer Case High/Low Clutch Reset procedure.

        Refer to **Transfer Case Control Module Replacement** .

   - ***If the voltage is less than the specified range***

   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.

2. Test for less than 10 Ω in the transfer case lock solenoid control circuit end to end.
   - If 10 Ω or greater, repair the open/high resistance in the circuit.
   - If less than 10 Ω
3. Test for infinite resistance transfer case lock solenoid control circuit, A16 transfer case motor harness connector terminal C and a good ground.
   - If less than infinite resistance, repair the short to ground in the circuit.
   - If infinite resistance
4. Test for infinite resistance between the transfer case lock solenoid control circuit, A16 transfer case motor harness connector terminal C and all other terminals of the A16 transfer case motor harness connector.
   - If less than infinite resistance, repair the shorted together condition in the affected circuits.
   - If infinite resistance, replace the K69 transfer case control module and perform the Range Actuator Learn procedure. The Range Actuator Learn procedure is also known as the Transfer Case High/Low Clutch Reset procedure.

     Refer to **Transfer Case Control Module Replacement** .

- ***If the voltage is within the specified range***

6. Battery Positive Voltage circuit and Transfer Case Lock Solenoid Control circuit OK.

Component Testing

A16 Transfer Case Motor (Transfer Case Range Actuator)

NOTE: **Circuit/System Testing must be performed first.**

1. Remove the A16 transfer case motor from transfer case. Using a paint pen or marker, place indexing marks on the A16 transfer case motor drive gear and the mounting surface of the A16 transfer case motor.
2. Install the **EL-49742** harness.
3. Using a PU probe J 35616-5, attach the red lead of the **EL-49742** jumper harness to the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A. The transfer case motor clockwise control circuit is also known as the motor control A circuit.
4. Using a PU probe J 35616-5, touch the black lead of the **EL-49742** jumper harness to the transfer case motor counter clockwise control circuit of the A16 transfer case motor, terminal D. The transfer case motor counter clockwise control circuit is also known as the motor control B circuit. The A16 transfer case motor drive gear should not rotate.
   - ***If the A16 transfer case motor drive gear rotates***

Replace the A1 transfer case motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** .

- ***If the A16 transfer case motor drive gear does NOT rotate***

5. Using a PU probe J 35616-5, attach the red lead of the **EL-49741** harness to the battery positive voltage terminal of the A16 transfer case motor, terminal B.
6. Using a PU probe J 35616-5, attach the black lead of the **EL-49741** jumper harness to the transfer case lock solenoid control terminal of the A16 transfer case motor, terminal C.
7. Attach a 9-volt battery to the **EL-49741** harness (not included). You should hear the A16 transfer case motor unlock.
   - ***If you do not hear the A16 transfer case motor unlock***

     Replace the A16 transfer case motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** .

   - ***If you do hear the A16 transfer case motor unlock***
8. Touch the black lead of the **EL-49742** jumper harness to the transfer case motor counter clockwise control circuit of the A16 transfer case motor, terminal D. The A16 transfer case motor drive gear should rotate.
   - ***If the A16 transfer case motor drive gear does NOT rotate***

     Replace the A16 transfer case motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** .

   - ***If the A16 transfer case motor drive gear does rotate***
9. Using the PU probes J 35616-5, test for between 10-30 Ω between the battery positive voltage circuit A16 transfer case motor, terminal B and the transfer case lock solenoid control circuit A16 transfer case motor terminal C.
   - ***If outside the specified range***

     Replace the A16 transfer case motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** .

   - ***If within the specified range***
10. Using the PU probes J 35616-5, test for infinite resistance between the following circuits and the A16 transfer case motor case.
    - Battery positive voltage circuit A16 transfer case motor, terminal B.
    - Transfer case lock solenoid control circuit A16 transfer case motor, terminal C.
    - ***If less than infinite resistance***

      Replace the A16 transfer case motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** .

- ***If infinite resistance***

11. Using the PU probes J 35616-5, test for infinite resistance between the battery positive voltage circuit A16 transfer case motor, terminal B and all other terminals on the A16 transfer case motor except the transfer case lock solenoid control circuit, terminal C.
    - ***If less than the infinite resistance***

      Replace the A16 transfer case motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** .

    - ***If infinite resistance***
12. Using the PU probes J 35616-5, test for infinite resistance between the transfer case lock solenoid control circuit A16 transfer case motor, terminal C and all other terminals of the TCEM X1 except the battery positive voltage circuit A16 transfer case motor, terminal B.
    - ***If less than infinite resistance***

      Replace the A16 transfer case motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** .

    - ***If infinite resistance***
13. A16 transfer case motor OK.

K69 Transfer Case Control Module

NOTE:

- **Circuit/System Testing must be performed first.**
- **Transfer case control module's need to be programmed when replaced. If after programming the K69 transfer case control module comes back as "NO COMM", try reprogramming again. (Internet/vehicle bandwidth load may cause the programming activity to fail.)**

1. Ignition OFF. Disconnect the harness connector at the A16 transfer case motor.
2. Ignition ON, engine OFF. Install **EL-49742** harness.
3. Block wheels. Parking brake engaged. Transmission in Neutral.
4. Using the PU probes J 35616-4A, connect a test lamp between the battery positive voltage circuit, A16 transfer case motor harness terminal B and the ground terminal of **EL-49742** harness, black terminal. The test light should illuminate.
    - ***If the test light does not illuminate***

    1. Ignition OFF, disconnect the X2 harness connector at the X50A Fuse Block - Underhood.
    2. Test for less than 10 Ω in battery positive voltage circuit end to end.
        - If 10 Ω or greater, repair the open/high resistance in the circuit.

- If less than 10 Ω

3. Test for infinite resistance between battery positive voltage circuit, A16 transfer case motor harness terminal B, and a good ground.
   - If less than infinite resistance, repair the short to ground in the circuit.
   - If infinite resistance
4. Test for infinite resistance between the battery positive voltage circuit, A16 transfer case motor harness terminal B, and all other terminals of the A16 transfer case motor harness connector.
   - If less than infinite resistance, repair the shorted together condition in the affected circuits.
   - If infinite resistance, replace the K69 transfer case control module and perform the Range Actuator Learn procedure. The Range Actuator Learn procedure is also known as the Transfer Case High/Low Clutch Reset procedure. Refer to **Transfer Case Control Module Replacement** .

- ***If the test light does illuminate***

5. Using the PU probes J 35616-4A, connect a test lamp between the battery positive voltage circuit, A16 transfer case motor harness terminal B and the transfer case lock solenoid control circuit, A16 transfer case motor harness terminal C. The test light should not illuminate.

- ***If the test light illuminates***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for infinite resistance between the transfer case lock solenoid control circuit, A16 transfer case motor harness terminal C, and a good ground.
   - If less than infinite resistance, repair the short to ground in the circuit.
   - If infinite resistance
3. Test for infinite resistance between the transfer case lock solenoid control circuit, A16 transfer case motor harness terminal C, and all other terminals of the A16 transfer case motor harness connector.
   - If less than infinite resistance, repair the shorted together condition in the affected circuits.
   - If infinite resistance, replace the K69 transfer case control module and perform the Range Actuator Learn procedure. The Range Actuator Learn procedure is also known as the Transfer Case High/Low Clutch Reset procedure. Refer to **Transfer Case Control Module Replacement** .

- ***If the test light does not illuminate***

6. Using the Transfer Case Lock function of the Control Function feature of the scan tool, command the transfer case lock ON and OFF. When the lock is commanded ON, release solenoid de-energized, the test light should not illuminate. When the lock is commanded OFF, release solenoid energized, the test light should illuminate.

- ***If the test light stays ON when the lock is commanded ON***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.

2. Test for infinite resistance between the transfer case lock solenoid control circuit, A16 transfer case motor harness terminal C, and a good ground.
    - If less than infinite resistance, repair the short to ground in the circuit.
    - If infinite resistance
3. Test for infinite resistance between the transfer case lock solenoid control circuit, A16 transfer case motor harness terminal C, and all other terminals of the A16 transfer case motor harness connector.
    - If less than infinite resistance, repair the shorted together condition in the affected circuits.
    - If infinite resistance, replace the K69 transfer case control module and perform the Range Actuator Learn procedure. The Range Actuator Learn procedure is also known as the Transfer Case High/Low Clutch Reset procedure. Refer to **Transfer Case Control Module Replacement** .

- ***If the test light does not illuminate when the lock is commanded OFF***

1. Ignition OFF, disconnect the X harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in the transfer case lock solenoid control circuit, end to end.
    - If 10 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure. The Range Actuator Learn procedure is also known as the Transfer Case High/Low Clutch Reset procedure. Refer to **Transfer Case Control Module Replacement** .

- ***If the test light illuminates when the lock is commanded OFF and turns OFF when the lock is commended ON***

7. K69 transfer case motor OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for transfer case control module replacement, setup, and programming.
- **Transfer Case High/Low Clutch Reset** for Range Actuator Learn procedure.
- **Transfer Case Two/Four Wheel Drive Actuator Replacement** for transfer case motor/transfer case range actuator replacement.

DTC C0364 OR C0379: FRONT AXLE SYSTEM

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0364 01

Front Axle System Short to Battery

DTC C0364 02

Front Axle System Short to Ground

DTC C0364 04

Front Axle System Open Circuit

DTC C0379 08

Front Axle Switch Circuit Signal Invalid

DTC C0379 58

Front Axle Switch Circuit System Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Invalid
Run/Crank Ignition 1 Voltage	Trans Ign 1 fuse, underhood fuse block - Open	C0364 04 if set when in 2WD High or C0379 08 if set when in 4WD High	-	C0379 58
Four Wheel Drive Wheel Lock Indicator	C0379 08 or C0379 58	C0364 04, C0379 08, or C0379 58	C0379 58	C0379 58
Front Axle Actuator Control	C0364 02	C0364 04 if set when in 2WD High or	C0364 01	C0379 58

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Invalid
		C0379 08 if set when in 4WD High		
Ground	-	C0364 04 if set when in 2WD High or C0379 08 if set when in 4WD High	-	C0379 58

Circuit/System Description

The front axle control circuit consists of an electric motor actuator which engages and disengages the front axle. The front axle engagement actuator consists of a permanent magnetic motor, a worm gear controlled plunger, a front axle switch and an electronic control circuit within the actuator assembly.

The front axle engagement actuator contains the following circuits:

- A Run/Crank Ignition 1 Voltage circuit
- A Four Wheel Drive Wheel Lock Indicator circuit
- An Front Axle Actuator Control circuit
- A ground circuit

When a shift to 4WD Auto, 4WD High, or 4WD Low is requested, the transfer case control module engages the front axle by grounding the front axle actuator control circuit through a current limiting driver.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- No DTC P0562 or P0563.
- DTC C0364 and C0379 run continuously within the enabling conditions.

Conditions for Setting the DTC

C0364 01

Voltage on the front axle actuator control circuit is greater than 8.5 V.

C0364 02

Voltage on the front axle actuator control circuit is less than 0.2 V.

C0364 04

Voltage on the front axle actuator control circuit is between 2.5-5.5 V.

C0379 08

The transfer case control module detects a change in voltage on the four wheel drive wheel lock indicator circuit and no change in voltage on the front axle actuator control circuit.

C0379 58

5 s after a range change, the transfer case control module compares the commanded state of the front axle (Front Axle Engagement Actuator Command parameter) to the monitored state of the front axle (Front Axle Feedback Switch parameter). If the command state differs from the monitored state for more than a predetermined amount of time, the DTC sets.

Action Taken When the DTC Sets

C0364 01 and C0364 04

- The front axle remains disengaged at all times.
- Transfer case normal operation.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.
- The range indicator for the current range shall illuminate.

C0364 02

- The front axle remains engaged at all times.
- Transfer case normal operation.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.
- The range indicator for the current range shall illuminate.

C0379 08

- The front axle remains in current mode.
- Transfer case normal operation.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.
- The range indicator for the current range shall illuminate.

C0379 58

- The front axle remains in current mode.
- Transfer case normal operation.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.
- The range indicator for the current range shall illuminate.

Conditions for Clearing the DTC

- The K69 transfer case control module clears the DTC once the conditions for setting the DTC are no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- Other failures on the run/crank ignition 1 voltage circuit may cause erratic behavior on the front axle control signal circuit.
- The transfer case fill/drain plugs are good sources for ground.
- A TRUE B+ carries enough current to light a test light.
- A DIAGNOSTIC B+ is a low current circuit that DOES NOT carry sufficient current to illuminate a test light

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J 35616** GM-Approved Terminal Test Kit

Circuit/System Verification

1. Verify that the F40UA, Trans Ign fuse, is NOT open (X50A underhood fuse block).
    - ***If the F40UA fuse is OPEN***

      refer to Circuit/System Testing

    - ***If the F40UA fuse is NOT OPEN***
2. Verify that the following parameters match each other for all range selections of the S77 transfer case shift control switch. You should also be able to hear the M26 front axle engagement actuator engaging and disengaging.
    - Front Axle Engagement Actuator Command
    - Front Axle Feedback Switch
    - ***If the parameters do NOT match each other***

      refer to Circuit/System Testing

    - ***If the parameters DO match each other***
3. Verify that all of the following scan tool parameters display OK.

- Front Axle Engagement Actuator Control Circuit High Voltage Test Status
- Front Axle Engagement Actuator Control Circuit Low Voltage Test Status
- Front Axle Engagement Actuator Control Circuit Open Voltage Test Status
- ***If any of the parameters do NOT display OK***

  refer to Circuit/System Testing

- ***If all of the parameters display OK***

4. Verify that for all range selections of the S77 transfer case shift control switch, the Range Actuator Current parameter increases or decreases during the shift and then returns to 0.0 A after shifting.
   - ***If the Range Actuator Current parameter does NOT perform as described***

     refer to Circuit/System Testing

   - ***If the Range Actuator Current parameter DOES perform as described***
5. Verify DTC C0364 or C0379 is only set as a history DTC.
   - ***If DTC C0364 or C0379 is as current***

     refer to Circuit/System Testing

   - ***If DTC C0364 or C0379 is only set as history***

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

6. Visually inspect each connector terminal of the K69 transfer case control module X1 connector and the M26 front axle engagement actuator connector for damage or corrosion. Repair as necessary.
7. Clear DTC C0364 or C0379 from history.
8. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If DTC C0364 or C0379 sets***

     refer to Circuit/System Testing

   - ***If DTC C0364 or C0379 does not set***

9. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the M26 front axle engagement actuator.
2. Ignition ON, engine OFF.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 3-11 is performed on the M26 front axle engagement actuator harness connector using the BL probes J 35616-64B.**

3. Test for a True B+ (+0.0/-1.0 V) between the ignition 1 voltage circuit terminal 1 and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - ***If less than B+ (+0.0/-1.0 V)***
   1. Ignition OFF, remove the F40UA fuse, X50A fuse block - underhood.

      or

      Disconnect the X2 harness connector at the X50A fuse block - underhood.

   2. Test for less than 10 Ω in the run/crank ignition 1 voltage circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between the run/crank ignition 1 voltage circuit, terminal 1 and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
      - If less than infinite resistance, repair the short to ground condition in the circuit.
      - If greater than 10 Ω
   4. Test for greater than 10 Ω between run/crank ignition 1 voltage circuit, terminal 1 and all other terminals of the M26 front axle engagement actuator.
      - If 10 Ω or less, repair the short together condition in the affected circuits.
      - If greater than 10 Ω

5. Ignition ON.
6. Test for a less than 1.0 V between the run/crank ignition 1 voltage circuit, terminal 1, and a good ground such as the ground terminal of the **EL-49742** harness, black terminal.
    - If 1.0 V or greater, repair the short to voltage in the circuit.
    - If less than 1 V, replace the KR73 ignition main relay. Refer to X50A fuse block - underhood label.

- ***If B+(+0.0/-1.0 V)***

4. Ignition 1 voltage circuit OK.
5. Test for a true B+ (+0.0/-1.0 V) between the ground circuit, terminal 4, and the run/crank ignition 1 voltage circuit, terminal 1 or the B+ terminal of the **EL-49742** harness, red terminal.

- ***If less than the B+ (+0.0/-1.0 V)***

1. Ignition OFF, disconnect the grounding bolt G110. Refer to **Ground Views** .
2. Test for less than 10 Ω in the ground circuit end to end.
    - If 10 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 10 Ω
3. Test for infinite resistance between the ground circuit, terminal 4 and a good ground such as the ground terminal of the **EL-49742** harness, black terminal.
    - If 10 Ω or less, repair the short to ground condition in the circuit.
    - If greater than 10 Ω
4. Test for infinite resistance between ground circuit, terminal 4 and all other terminals of the M26 front axle engagement actuator harness connector.
    - If 1 Ω or less, repair the short together condition in the affected circuits.
    - If greater than 1 Ω
5. Ignition ON.
6. Test for a less than 1.0 V between the ground circuit, terminal 4, and a good ground such as the ground terminal of the **EL-49742** harness, black terminal.
    - If 1.0 V or greater, repair the short to voltage in the circuit.
    - If less than 1 V, clean the G110 grounding surface. Refer to **Testing for Intermittent Conditions and Poor Connections** .

- ***If B+***

6. Ground circuit OK.
7. Test for a diagnostic B+ (+0.0/-1.0 V) between the four wheel drive wheel lock indicator circuit, terminal 3, and the run/crank ignition 1

voltage circuit, terminal 1 or the B+ terminal of the **EL-49742** harness, red terminal.

- ***If less than B+ (+0.0/-1.0 V)***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in four wheel drive wheel lock indicator circuit end to end.
    - If 10 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 10 Ω
3. Test for infinite resistance between the four wheel drive wheel lock indicator circuit, terminal 3 and a good ground such as the ground terminal of the **EL-49742** harness, black terminal.
    - If less than infinite resistance, repair the short to ground condition in the circuit.
    - If greater than 10 Ω
4. Test for infinite resistance between four wheel drive wheel lock indicator circuit, terminal 3 and all other terminals of the M26 front axle engagement actuator harness connector.
    - If less than infinite resistance, repair the short together condition in the affected circuits.
    - If greater than 10 Ω
5. Ignition ON.
6. Test for a less than 1.0 V between the four wheel drive wheel lock indicator circuit, terminal 3, and a good ground such as the ground terminal of the **EL-49742** harness, black terminal.
    - If 1.0 V or greater, repair the short to voltage in the circuit.
    - If less than 1 V, replace the K69 transfer case control module. Refer to **Transfer Case Control Module Replacement** .

- ***If B+***

8. Four wheel drive wheel lock indicator circuit OK.
9. Test for 2.8 to 4.8V between the test points:Front Axle Actuator Control &Chassis Ground

- ***If less than 2.8 V***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in front axle actuator control circuit end to end.
    - If 10 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 10 Ω
3. Test for greater than 10 Ω between the front axle actuator control circuit, terminal 2 and a good ground such as the ground terminal of the **EL-49742** harness, black terminal.

- If 10 Ω or less, repair the short to ground condition in the circuit.
- If greater than 10 Ω

4. Test for greater than 1 Ω between front axle actuator control circuit, terminal 2 and all other terminals of the M26 front axle engagement actuator harness connector.
   - If 1 Ω or less, repair the short together condition in the affected circuits.
   - If greater than 1 Ω

- ***If greater than 4.8 V***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for greater than 5Ω between front axle actuator control circuit, terminal 2 and all other terminals of the M26 front axle engagement actuator harness connector.
   - If 5Ω or less, repair the short together condition in the affected circuits.
   - If greater than 5Ω
3. Ignition ON.
4. Test for a less than 1.0 V between the front axle actuator control circuit, terminal 2, and a good ground such as the ground terminal of the **EL-49742** harness, black terminal.
   - If 1.0 V or greater, repair the short to voltage in the circuit.
   - If less than 1 V, replace the K69 transfer case control module. Refer to **Transfer Case Control Module Replacement** .

- ***If between 2.8 and 4.8 V***

10. The run/crank ignition 1 voltage circuit, the front axle switch signal circuit, the front axle control circuit, the ground circuit, and the K69 transfer case control module are OK.

Component Testing

M26 Front Axle Engagement Actuator

NOTE:

- **Circuit/System Testing must be performed before Component Testing.**
- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 3-4 is performed on the M26 front axle engagement actuator harness connector using the BL probes J 35616-65B.**

1. Ignition OFF. Disconnect the connector at the front axle engagement actuator.
2. Remove the M26 front axle engagement actuator.
3. Connect the M26 front axle engagement actuator connector. Position the M26 front axle engagement actuator so that it is visible from the side of the vehicle.
4. Using the Front Axle Engagement Actuator control function of the scan tool, command the front axle to engage and disengage. When commanded to engage, the plunger on the M26 front axle engagement actuator should extend. When commanded to disengage, the plunger should retract.
   - ***If the M26 front axle engagement actuator does NOT perform as described***

     replace the M26 front axle engagement actuator. Refer to **Front Drive Axle Actuator Replacement (8.25 Inch LD Axle)** **Front Drive Axle Actuator Replacement (9.25 Inch HD Axle)** .

   - ***If the M26 front axle engagement actuator DOES perform as described***
5. Refer to **Front Axle Will Not Engage**, or **Front Axle Will Not Disengage**.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for transfer case control module replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**
- **Four-Wheel Drive Does Not Engage**
- **Four-Wheel Drive Does Not Disengage**
- **Front Drive Axle Actuator Replacement (8.25 Inch LD Axle)** **Front Drive Axle Actuator Replacement (9.25 Inch HD Axle)**

DTC C0374: GENERAL SYSTEM PERFORMANCE TEMPERATURE HIGH

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0374 54

General System Performance Temperature High

Diagnostic Fault Information

Transfer Case Encoder Motor Brake

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Invalid
Battery Positive Voltage Pin B	-	C0321 04	-	-
Lock Solenoid Control Pin C	C0321 02	C0321 04	C0321 01	C0321 08

Wheel Speed Sensors

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Front Wheel Speed Sensor 12 Volt Reference	C0035 00	C0035 00	-	C0035 5A
Left Front Wheel Speed Sensor Signal	C0035 00	C0035 00	C0035 00	C0035 5A
Right Front Wheel Speed Sensor 12 Volt Reference	C0040 00	C0040 00	-	C0040 5A
Right Front Wheel Speed Sensor Signal	C0040 00	C0040 00	C0040 00	C0040 5A
Left Rear Wheel Speed Sensor 12 Volt Reference	C0045 00	C0045 00	-	C0045 5A
Left Rear Wheel Speed Sensor Signal	C0045 00	C0045 00	C0045 00	C0045 5A
Right Rear Wheel Speed Sensor 12 Volt Reference	C0050 00	C0050 00	-	C0050 5A
Right Rear Wheel Speed Sensor Signal	C0050 00	C0050 00	C0050 00	C0050 5A

Circuit/System Description

The general system performance DTC sets based on a thermal module within the transfer case shift control module (TCCM) software. The components included in this thermal model are the motor driver within the TCCM, the transfer case shift motor, and the clutch inside the transfer case.

This fault occurs when one of the three components included in the thermal model surpass the upper limits of this model indicating possible damage to the transfer case or other driveline components. This DTC detects an over temperature condition base on a thermal model.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- DTC C0379 is not set.
- Vehicle speed > 5 kph (3 mph)

Conditions for Setting the DTC

This DTC sets if one of three components: motor driver inside the TCCM, transfer case clutch, or the shift motor, exceed the thermal model within the software for the module.

Action Taken When the DTC Sets

- All range and mode changes disabled until thermal model indicates temperature acceptable.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- The TCCM clears the DTC once the conditions for setting the DTC are no longer present.
- A history DTC clears after 40 consecutive warm-up cycles without a fault present.
- History and current DTCs can be cleared using a scan tool.

Diagnostic Aids

- The TCCM provides a reference voltage of 1.25-3.75 V on the motor B circuit for diagnostic purposes.
- It is possible to have windings inside the motor short to the case resulting in a short to ground.
- A problem where the front axle actuator is unable to mechanically engage can cause this DTC to set.
- A worn transfer case clutch can cause this DTC to set.
- A motor brake not holding can cause this DTC to set.
- Faulty wheel speed sensors can cause this DTC to set. When driving at a steady speed, the scan tool should display the same values for the following data parameters in the electronic brake control module (EBCM):
    - Left and right front wheel speed sensors
    - Left and right rear wheel speed sensors

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Transfer Case Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON, engine OFF.
2. Install a scan tool.
3. Ensure no other ECBM or TCCM codes are set.
    - If any other EBCM or TCCM DTC's are set, diagnose them first.

Circuit/System Testing

1. Engage parking brake.
2. Block rear wheels.
3. Lift front wheels.
4. Key ON, engine OFF. Install scan tool.

5. Transfer case in 2WD HI. Transmission in Neutral.
6. Mechanical binding. - Using the Special Functions capability of the scan tool, engage the front axle. While holding one front tire stationary, spin the other tire. The front propshaft should turn.
    - If the front propshaft does not turn, inspect the front axle clutch fork for mechanical binding.
7. Wheel speed sensors. - Take the vehicle on a short test drive on a smooth and level road. Using the Data Display function of the ECBM feature of the scan tool, verify that the front and rear wheel speeds sensors display do not vary or become intermittent.
    - If while driving at a steady speed the RPM values vary or becomes intermittent, check the EBCM for wheel speed DTC's. Wheel speed DTC's diagnostics are in antilock brake systems.
8. Transfer case encoder motor brake. - Using a scan tool, clear DTC's. Shift the vehicle to 2WD HI. Monitor the transfer case motor amperage parameter in the Data Display feature of the scan tool. Using the transfer case shift control switch, command the transfer case to the 4WD HI mode. The transfer case motor amperage should increase while the motor is shifting and then return to 0 amps within 5 seconds or less.
    - If the amperage stays high longer than 5 seconds, this indicates the brake is not holding. Replace the transfer case motor.
9. Transfer case clutch integrity. - Shift the vehicle into 4WD HI and take it for a test drive. Clear the DTC if possible. Monitor front and rear wheel speeds using the EBCM data display. Under heavy acceleration the front and rear wheel speeds should be similar.
    - If the front wheel speeds are much lower, this indicates a weak clutch and a transfer case tear down and inspection will be required.
10. If all prior evaluations test normal, reprogram the TCCM and perform the ATC Motor Learn procedure in the Special Functions feature of the scan tool or the **Transfer Case High/Low Clutch Reset** procedure in the service manual.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for TCSCM replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset** for Motor Learn Procedure
- **Four-Wheel Drive Does Not Engage**
- **Front Drive Axle Clutch Fork Inspection**
- **Transfer Case Assembly Replacement**

DTC C0387: UNABLE TO COMPLETE SHIFT

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.

- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0387 00

Unable to Complete Shift

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Circuit/Component Timeout
Unable to Complete Shift	-	-	-	C0387 00
Transfer Case Motor Clockwise Control	C0306 02	C0306 04	C0306 01	C0306 54 or C0381 54
Transfer Case Motor Counter-Clockwise Control	C0306 02	C0306 04	C0306 01	C0306 54 or C0381 54

Circuit/System Description

The A16 Transfer Case Motor, also known as the transfer case range actuator, is a bi-directional, permanent magnet, DC motor. When energized, through the transfer case clockwise circuit or transfer case counter-clockwise circuit, the ground is provided by the opposing motor control circuit which becomes grounded through the transfer case control module ground circuit. The transfer case range actuator, through a series of gears, rotates the transfer case control actuator shaft which moves the transfer case two/four wheel drive actuator cam and transfer case high/low shift fork in order to shift the transfer case between the following modes or ranges:

- 2WD
- 4WD/AWD Automatic
- 4WD High/Locked
- 4WD Low
- Neutral

If the shift lever detent shaft were to bind, or there was a mechanical failure, or the transfer case clockwise circuit and the transfer case counter-clockwise circuit were shorted together, the shift would not be completed. This will cause the DTC to set in order to protect system components from damage.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- No DTC P0562 or P0563.
- DTC C0387 runs continuously.

Conditions for Setting the DTC

A shift request was received but could not be completed within 15 seconds.

Action Taken When the DTC Sets

- All shifting disabled.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- The transfer case control module clears the DTC once the conditions for setting the DTC no longer exist.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- The transfer case clockwise circuit shorting to the transfer case counter-clockwise circuit could cause this DTC to set.
- It is possible to have windings inside the transfer case motor shorted to the case resulting in a short to ground causing this DTC to set.
- The default actions for C0321 may set C0387.
- **EL-49741** harness is a good source for 9 V.
- **EL-49742** harness is a good source for B+ and ground.
- The transfer case fill and drain plugs are a good source for ground.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J 35616** GM-Approved Terminal Test Kit

Circuit/System Verification

1. Verify that the TREC fuse, and the Miscellaneous IGN fuse, underhood fuse block, are NOT open.
   - **If the TREC fuse is OPEN**

     Test the battery positive voltage circuit, K69 transfer case control module harness X3, terminal C, for a short to ground. Refer to Testing for Short to Ground .

   - **If the Miscellaneous IGN fuse is OPEN**

     Test the ignition 1 voltage circuit, K69 transfer case control module harness X2, terminal 6, for a short to ground. Refer to Testing for Short to Ground .

   - **If the TREC fuse and the Miscellaneous IGN fuse are NOT open**
2. Ignition ON, engine OFF.
3. Verify no other DTC's are set. If any other DTC's are set, diagnose them first.
4. Verify DTC C0387 is only set as a history DTC.

- **If DTC C0387 is set as current**

  Refer to Circuit/System Testing.

- **If DTC C0387 is set as history**

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

5. Visually inspect each connector terminal of the K69 transfer case control module and the A16 transfer case motor connector for damage or corrosion. Repair as necessary.
6. Clear DTC C0387 from history.
7. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - **If DTC C0387 sets**

     Refer to Circuit/System Testing.

   - **If DTC C0387 does not set**
8. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the A16 transfer case motor, also known as the transfer case range actuator.
2. Ignition ON, engine OFF.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 3-5 is performed on the A16 transfer case motor harness connector using the PU probes J 35616-4A.**

3. Test for 1.0-2.5 V between the transfer case motor counter-clockwise control circuit terminal D and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - **If less than the specified range**

1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in the transfer case motor counter-clockwise control circuit end to end.
   - If 10 Ω or greater, repair the open/high resistance in the circuit.
   - If less than 10 Ω
3. Test for infinite resistance between transfer case motor counter-clockwise control circuit terminal D and a good ground.
   - If less than infinite resistance, repair the short to ground in the circuit.
   - If infinite resistance
4. Test for greater than 10 Ω between the transfer case motor counter-clockwise control circuit terminal D and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- **If greater than the specified range**

1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
2. Test for less than 1 V between the transfer case motor counter-clockwise control circuit terminal D and a good ground.
   - If 1 V or greater, repair the short to voltage in the circuit.
   - If less than 1 V
3. Test for greater than 10 Ω between the transfer case motor counter-clockwise control circuit, terminal D and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- **If within the specified range**

4. Transfer case motor counter-clockwise control circuit and K69 transfer case control module OK.
5. Test for 3.0-4.5 V between the transfer case motor clockwise control circuit terminal A, and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - **If less than the specified range**

1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in the transfer case motor clockwise control circuit end to end.
   - If 10 Ω or greater, repair the open/high resistance in the circuit.
   - If less than 10 Ω
3. Test for infinite resistance between transfer case motor clockwise control circuit terminal A and a good ground.
   - If less than infinite resistance, repair the short to ground in the circuit.
   - If infinite resistance
4. Test for greater than 10 Ω between the transfer case motor clockwise control circuit terminal A and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- **If greater than the specified range**

1. Ignition OFF, disconnect the X3 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
2. Test for less than 1 V between the transfer case motor clockwise control circuit terminal A and a good ground.
   - If 1 V or greater, repair the short to voltage in the circuit.
   - If less than 1 V
3. Test for greater than 10 Ω between the transfer case motor clockwise control circuit, terminal A and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- **If within the specified range**

6. Transfer case motor counter-clockwise control circuit, transfer case motor clockwise control circuit and K69 transfer case control module OK.

Component Testing

A16 Transfer Case Motor (Transfer Case Range Actuator)

1. Remove the A16 transfer case motor from transfer case. Using a paint pen or marker, place indexing marks on the A16 transfer case motor drive gear and the mounting surface of the A16 transfer case motor.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 2-11 is performed on the A16 transfer case motor harness connector using the PU probes J 35616-5.**

2. Attach the red lead from one of the **EL-49741** harnesses to the battery positive voltage terminal of the A16 transfer case motor, terminal B.
3. Attach the black lead from this same jumper harness to the transfer case lock solenoid control terminal of the A16 transfer case motor, terminal C.
4. Attach a 9-volt battery to this harness (not included). You should hear the A16 transfer case motor unlock.
   - **If you do NOT hear the A16 transfer case motor unlock**

     Replace the A16 transfer case motor and perform the Range Actuator Learn procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** , and **Transfer Case High/Low Clutch Reset**.

   - **If you DO hear the A16 transfer case motor unlock**
5. Attach the red lead from the other **EL-49741** jumper harness to the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A.
6. Attach the black lead from this same jumper harness to the transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D.
7. Touch the battery terminals of the 9-volt battery to the battery terminals of the jumper harness. This should rotate the A16 transfer case motor drive gear in either a clockwise or counter-clockwise rotation depending on battery orientation.
   - **If the A16 transfer case motor drive gear does not perform as described**

     Replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** , and **Transfer Case High/Low Clutch Reset**.

   - **If The A16 transfer case motor drive gear performs as described**
8. Verify 0.3-40 Ω resistance between the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A and the transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D.
   - **If NOT 0.3-40 Ω**

Replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** , and **Transfer Case High/Low Clutch Reset**.

- **If 0.3-40 Ω**

9. Test for infinite resistance between the following circuits and the A16 transfer case motor case:
   - Transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A
   - Transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D
   - **If less than infinite resistance**

     Replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** , and **Transfer Case High/Low Clutch Reset**.

   - **If infinite resistance**
10. Test for infinite resistance between the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A and all other terminals on the A16 transfer case motor harness except the transfer case motor counter-clockwise control circuit of the A16 Transfer Case Motor, terminal D.
    - **If less than infinite resistance**

      Replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** , and **Transfer Case High/Low Clutch Reset**.

    - **If infinite resistance**
11. Test for infinite resistance between the transfer case motor counter-clockwise control circuit of the A16 transfer case motor, terminal D. and all other terminals on the transfer case range actuator harness except the transfer case motor clockwise control circuit of the A16 transfer case motor, terminal A.
    - **If less than infinite resistance**

      Replace the A16 transfer case motor and perform the Range Actuator Learn Procedure. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** , and **Transfer Case High/Low Clutch Reset**.

    - **If infinite resistance**
12. A16 transfer case motor OK.
13. Inspect the transfer case shift detent lever shaft for a binding condition.
    - **If binding**

Remove the transfer case and repair the binding condition. Refer to **Transfer Case Shudder or Binding**.

- **If not binding**

14. Refer to **Symptoms - Transfer Case**, and **Transfer Case Will Not Shift**.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Transfer Case Two/Four Wheel Drive Actuator Replacement**
- **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)**

DTC C038D: RANGE ACTUATOR - POSITION NOT LEARNED

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C038D 00

Range Actuator - Position Not Learned

Circuit/System Description

- This is an internal programing fault detection of the transfer case control module. No external circuits are involved.
- This DTC is set anytime a transfer case control module is replaced or reprogrammed.
- The Range Actuator Learn procedure must be performed in order for the transfer case control module to learn current clutch tolerance based on clutch stackup and accumulated clutch wear.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.

- DTC C038D runs at Engine ON.

Conditions for Setting the DTC

The Range Actuator Learn procedure for a new or reprogrammed transfer case control module has not been performed.

Action Taken When the DTC Sets

- All shifting disabled until the Range Actuator Learn procedure has been performed.
- The SERVICE 4WD indicator illuminates.
- No mode position LED's illuminated.

Conditions for Clearing the DTC

The transfer case control module only clears the DTC once the Range Actuator Learn procedure has been successfully performed.

Diagnostic Aids

The default actions for other transfer case DTC's can cause C038D to set.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Transfer Case Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**

- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Engine ON. Let engine run for at least 1 minute.
2. Ignition OFF for at least 30 seconds to allow for the complete shutdown of the K69 Transfer Case Control Module.
3. Engine ON.
4. Verify that no other transfer case DTC's are set.
   - ***If any other transfer case DTC's are set***

     Diagnose it first. Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

   - ***If no other transfer case DTC's are set***
5. Verify that DTC C038D is not set.
   - ***If DTC C038D is set***

     perform the Range Actuator Learn procedure. Refer to **Transfer Case High/Low Clutch Reset**.

   - ***If DTC C038D is NOT set***
6. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Transfer Case High/Low Clutch Reset for Range Actuator Learn Procedure

DTC C0392, P0642, OR P0643: TRANSFER CASE RANGE POSITION SENSOR/5V REFERENCE 1

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0392 08

Transfer Case Range Position Sensor Circuit Performance - Signal Invalid

DTC C0392 28

Transfer Case Range Position Sensor Circuit - Incorrect Frequency

DTC P0642 00

5V Reference 1 Low Voltage

DTC P0643 00

5V Reference 1 High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Invalid
Rotational Position Sensor Circuit (Rotary Position Sensor Signal)	C0392 08	C0392 08	C0392 08	C0392 08 or C0392 28
5-Volt Reference (Rotary Position Sensor Supply 5V/Sensor Reference Voltage 1)	P0642	P0643	P0643	C0392 08 or C0392 28
Low Reference (Rotary Position Sensor Return)	-	C0392 08	-	C0392 08 or C0392 28

Circuit/System Description

The transfer case control module receives input from the transfer case B227 Gear Position Sensor, also known as the range position sensor or the rotational position sensor. The gear position sensor receives a 5-volt reference signal from the transfer case control module. In return the gear position

sensor sends the transfer case control module a variable pulse width modulated signal indicating the position of the transfer case. The gear position sensor works in conjunction with the range actuator position sensor, inside the A16 Transfer Case Motor, also known as the transfer case range actuator, to confirm transfer case position. The gear position sensor is more sensitive than the range actuator position sensor and is able to indicate to the transfer case control module the exact position of the transfer case between range changes. It is also able to show how much clutch activation is being commanded at any time.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- No DTC P0562 or P0563.
- No DTC P0652, P0653, or C0397 - C0392 only.
- DTC C0392, P0642 and P0643 run continuously within the enabling conditions.

Conditions for Setting the DTC

C0392 08

- The transfer case control module detects a transfer case range position sensor voltage that does not constantly change, but remains low, <0.25 V, indicating a short to ground.

  Or

- The transfer case control module detects a gear position sensor voltage that does not constantly change, but remains high, >6.0 V, indicating a short to voltage.

C0392 28

The transfer case control module does not receive a sensor reference voltage 1 circuit, also known as the 5V reference 1 circuit, of 4.8-5.2 volts.

P0642

The transfer case control module detects less than 4.8 V on the transfer case reference voltage 1 circuit, also known as the 5V reference 1 circuit.

P0643

The transfer case control module detects greater than 5.2 V on the transfer case sensor reference voltage 1 circuit, also known as the 5V reference 1

circuit.

Action Taken When the DTC Sets

- DTC C398 disabled.
- All shifting disabled.
- Clutch torque increased to maximum torque.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- The transfer case control module clears the DTC once the conditions for setting the DTC are no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- **EL-49742** harness is a good source for B+ and ground.
- The transfer case drain plug is a good source for ground.
- Typical Gear Position Sensor parameter values:
  - 2WD = 33-43Â°
  - 4WD/AWD Automatic = 87-204Â°
  - 4WD High/Locked = 110-204Â°
  - 4WD Low = -140Â° to -69Â°
  - Neutral = -5Â° to +5Â°

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J 35616** GM-Approved Terminal Test Kit

Circuit/System Verification

1. Verify that all range selections of the S77 transfer case shift control switch match the following parameters in the Data Display feature of the scan tool:
   - Range Actuator Position
   - Transfer Case Commanded Position
   - Transfer Case Range
   - ***If NOT all of the parameters match the S77 transfer case shift control switch position***

     Refer to Circuit/System Testing.

   - ***If ALL of the parameters match the S77 transfer case shift control switch position***
2. Verify that for all range selections of the S77 transfer case shift control switch, the Transfer Case Range Position Sensor parameter and the Range Actuator Position Sensor parameter track within 5 degrees of each other.
   - ***If the parameters do NOT track within 5 degrees of each other***

     Refer to Circuit/System Testing.

- ***If the parameters DO track within 5 degrees of each other***

3. Verify DTC C0392, P0642, or P0643 is only set as a history DTC.
   - ***If any of the DTCs are set as current***

     Refer to Circuit/System Testing.

   - ***If any of the DTCs are only set as history***

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

4. Visually inspect each connector terminal of the K69 transfer case control module X1 connector and the B227 gear position sensor connector for damage or corrosion. Repair as necessary.
5. Clear DTC C0392, P0642, or P0643 from history.
6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If any of the DTCs are set***

     Refer to Circuit/System Testing.

   - ***If none of the DTCs set***
7. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B227 gear position sensor, also known as the rotational position sensor.
2. Ignition ON, engine OFF.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 3-7 is performed on the B227 gear position sensor harness connector using the GY probes J 35616-2A.**

3. Test for 4.8-5.2 V between the 5-Volt reference circuit, terminal B and a good ground, such as the ground terminal of the **EL-49742** harness,

black terminal.

- ***If less than the specified range***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in the 5-Volt reference circuit end to end.
    - If 10 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 10 Ω
3. Test for infinite resistance between 5-Volt reference circuit terminal B and a good ground.
    - If less than infinite resistance, repair the short to ground in the circuit.
    - If infinite resistance
4. Test for greater than 10 Ω between the 5-Volt reference circuit terminal B and all other terminals of the B227 gear position sensor harness connector.
    - If 10 Ω or less, repair the shorted together condition in the affected circuits.
    - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

      Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- ***If greater than the specified range***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
2. Test for less than 1 V between the 5-Volt reference circuit terminal B and a good ground.
    - If 1 V or greater, repair the short to voltage in the circuit.
    - If less than 1 V
3. Test for greater than 10 Ω between the 5-Volt reference circuit, terminal B and all other terminals of the B227 gear position sensor harness connector.
    - If 10 Ω or less, repair the shorted together condition in the affected circuits.
    - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

      Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

4. 5-Volt reference circuit and K69 transfer case control module OK.
5. Test for 4.8-5.2 V between the 5-Volt reference circuit, terminal B, and the low reference circuit, terminal A.

- ***If less than the specified range***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in the low reference circuit end to end.
    - If 10 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 10 Ω
3. Test for infinite resistance between low reference circuit and a good ground.
    - If less than infinite resistance, repair the short to ground in the circuit.
    - If infinite resistance
4. Test for greater than 10 Ω between the low reference circuit, terminal A and all other terminals of the B227 gear position sensor harness connector.
    - If 10 Ω or less, repair the shorted together condition in the affected circuits.
    - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

      Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- ***If greater than the specified range***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
2. Test for less than 1 V between the switch signal circuit, terminal A and a good ground.
    - If 1 V or greater, repair the short to voltage in the circuit.
    - If less than 1 V
3. Test for greater than 10 Ω between the switch signal circuit, terminal A and all other terminals of the B227 gear position sensor harness connector.
    - If 10 Ω or less, repair the shorted together condition in the affected circuits.
    - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

      Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

6. Low reference circuit and K69 transfer case control module OK.
7. Test for 4.25-5.2 V between the rotational position sensor circuit, terminal C and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.

- ***If less than the specified range***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in the rotational position sensor circuit end to end.
    - If 10 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 10 Ω
3. Test for infinite resistance between rotational position sensor circuit terminal C and a good ground.
    - If less than infinite resistance, repair the short to ground in the circuit.
    - If infinite resistance
4. Test for greater than 10 Ω between the rotational position sensor circuit terminal C and all other terminals of the B227 gear position sensor harness connector.
    - If 10 Ω or less, repair the shorted together condition in the affected circuits.
    - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

      Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- ***If greater than the specified range***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
2. Test for less than 1 V between the rotational position sensor circuit terminal C and a good ground.
    - If 1 V or greater, repair the short to voltage in the circuit.
    - If less than 1 V
3. Test for greater than 10 Ω between the rotational position sensor circuit, terminal C and all other terminals of the B227 gear position sensor harness connector.
    - If 10 Ω or less, repair the shorted together condition in the affected circuits.
    - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

      Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

8. Rotational position sensor circuit and K69 transfer case control module OK.

Component Testing

B227 Gear Position Sensor

1. Key OFF. Disconnect the connector at the B227 gear position sensor.
2. Remove the B227 gear position sensor from the transfer case.
3. Connect the B227 gear position sensor.
4. Verify that the Transfer Case Range Position Sensor parameter sweeps between -146Â° and 204Â° while rotating the center locating tab of the B227 gear position sensor.
   - ***If the Transfer Case Range Position Sensor parameter does NOT sweep between -146Â° and 204Â°***

     Replace the B227 gear position sensor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Position Sensor Replacement** .

   - ***If the Transfer Case Range Position Sensor parameter DOES sweep between -146Â° and 204Â°***
5. B227 gear position sensor OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for K69 transfer case control module replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**
- **Transfer Case Two/Four Wheel Drive Actuator Position Sensor Replacement**

DTC C0396, C039E, P0652, OR P0653: RANGE ACTUATOR POSITION SENSOR/5V REFERENCE 2

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0396 03

Range Actuator Position Sensor Circuit Low Voltage

DTC C0396 07

Range Actuator Position Sensor Circuit High Voltage

DTC C039E 03

Range Actuator Position Sensor Direction Signal Circuit Low Voltage

DTC C039E 07

Range Actuator Position Sensor Direction Signal Circuit High Voltage

DTC P0652

5V Reference 2 Circuit Low Voltage

DTC P0653

5V Reference 2 Circuit Low Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Invalid
Incremental Encoder Sensor (8 V) Supply	P0652	C0387 58 or C038D 00 (C0398 when shifting between ranges)	P0653	-
Incremental Encoder Impulse Signal	C0396 03	C0396 07	C0396 07	-
Incremental Encoder Direction Signal	C039E 03	C039E 07	C039E 07	-
Incremental Encoder Sensor Return/Low Reference	-	C0396 03	-	-

Typical Scan Tool Data

Range Actuator / Incremental Position Sensor	2WD High	4WD Auto	4WD High	4WD Low	Neutral
NQH (Â°)	25Â° to 45Â°	30Â° to 210Â°	110Â° to 210Â°	-150Â° to -55Â°	-10Â° to +10Â°

Range Actuator / Incremental Position Sensor	2WD High	4WD Auto	4WD High	4WD Low	Neutral
NQF (Â°)	180 to 230Â°	-	100Â° to 125Â°	-130Â° to -60Â°	-15Â° to +10Â°

Circuit/System Description

The transfer case control module receives input from the range actuator position sensor and the transfer case range position sensor. Both sensors send this information as voltage signals which are converted to degrees and rotational direction by the transfer case control module software. If the two sensors disagree by greater than a predetermined amount the DTC will set.

The range actuator position sensor receives an 8 volt reference signal from the transfer case control module. In return the range actuator position sensor sends the transfer case control module a variable pulse width modulated signal indicating the position of the transfer case and a range actuator position direction signal. The range actuator position sensor, inside the A16 transfer case motor, also known as the transfer case range actuator, works in conjunction with the range position sensor to confirm transfer case position. The range actuator position sensor is more sensitive than the transfer case range position sensor and is able to indicate to the transfer case control module the exact position of the transfer case between range changes. It is also able to show how much clutch activation is being commanded at any time.

The transfer case range position sensor, also known as the transfer case two/four wheel drive actuator position sensor, receives a 5 volt reference signal from the K69 transfer case control module and sends back a continuously variable pulse width modulated signal to the K69 transfer case control module. This continuously variable signal indicates the position of the transfer case actuator.

The range actuator position sensor is more sensitive than the transfer case range position sensor, but needs to reference the transfer case range position sensor value at ignition ON and mode changes. The transfer case range position sensor is an absolute sensor. The K69 transfer case control module synchronizes the range actuator position sensor with the transfer case range position sensor at ignition ON and mode changes.

The range actuator position sensor is an integral part of the A16 Transfer Case Motor and cannot be replaced independently.

The transfer case range position sensor, also known as the B227 gear position sensor, is an independently replaceable part.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- No DTC P0562 or P0563.
- DTC C0396, C039e, P0652 and P0653 run continuously within the enabling conditions.

Conditions for Setting the DTC

C0396 03

Voltage on the sensor reference voltage 2 circuit, also known as the incremental encoder sensor (8 V) supply circuit, is 7.2-8.5 V, and voltage received by incremental encoder impulse signal circuit less than 0.35 V.

C0396 07

Voltage on the sensor reference voltage 2 circuit is 7.2-8.5 V, and voltage on incremental encoder impulse signal circuit greater than 4.6 V.

C039E 03

Voltage on the sensor reference voltage 2 circuit is 1.5-9.0 V, and voltage received by incremental encoder direction signal circuit less than 0.35 V.

C039E 07

Voltage on the sensor reference voltage 2 circuit is 1.5-9.0 V, and voltage on incremental encoder direction circuit greater than 4.5 V.

P0652

Voltage on sensor reference voltage 2 circuit less than 7.2 V.

P0653

Voltage on sensor reference voltage 2 circuit greater than 8.5 V.

Action Taken When the DTC Sets

The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

C0396 03 and C039E 03

- All shifting disabled.
- Clutch torque increased to maximum torque capacity during range shift from AWD, 4WD Low, and 4WD High only.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

C0396 07 and C039E 07

- All shifting disabled.

- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.
- Sensor reference voltage 2 circuit shut OFF.

P0652

- All shifting disabled.
- Clutch torque increased to maximum torque capacity during range shift from AWD, 4WD Low, and 4WD High only.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

P0653

- All shifting disabled.
- Clutch torque increased to maximum torque capacity during range shift from AWD, 4WD Low, and 4WD High only.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- The transfer case shift control module clears the DTC once the conditions for setting the DTC are no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- The range actuator position sensor and the transfer case range position sensor both show position in degrees, and should track each other. Monitor these sensors for erratic or unreasonable readings.
- If the range actuator position sensor is determined to be bad, the entire transfer case range actuator (transfer case motor) will have to be replaced as the range actuator position sensor is part of the transfer case range actuator and cannot be replaced independently.
- The transfer case fill and drain plugs are good sources for ground.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- **EL-49741** 9 V+ Power Source Harness
- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J 35616** GM-Approved Terminal Test Kit

Circuit/System Verification

1. Verify that all range selections of the S77 transfer case shift control switch match the following parameters in the Data Display feature of the scan tool:
    - Range Actuator Position
    - Transfer Case Commanded Position
    - Transfer Case Range
    - ***If NOT all of the parameters match the S77 transfer case shift control switch position***

      Refer to Circuit/System Testing.

    - ***If ALL of the parameters match the S77 transfer case shift control switch position***
2. Verify that for all range selections of the S77 transfer case shift control switch, the Transfer Case Range Position Sensor parameter and the Range Actuator Position Sensor parameter track within 5 degrees of each other.
    - ***If the parameters do NOT track within 5 degrees of each other***

Refer to Circuit/System Testing.

- ***If the parameters DO track within 5 degrees of each other***

3. Verify DTC C0396, C039E, P0652, or P0653 is only set as a history DTC.
   - ***If any of the DTCs are set as current***

     Refer to Circuit/System Testing.

   - ***If any of the DTCs are only set as history***

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

4. Visually inspect each connector terminal of the K69 transfer case control module X1 connector and the A16 transfer case motor connector for damage or corrosion. Repair as necessary.
5. Clear DTC C0396, C039E, P0652, or P0653 from history.
6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If any of the DTCs are set***

     Refer to Circuit/System Testing.

   - ***If none of the DTCs set***
7. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the A16 transfer case motor, also known as the transfer case range actuator.
2. Ignition ON, engine OFF.

NOTE:

- **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**
- **Testing for steps 3-9 is performed on the A16 transfer case motor harness connector using the PU probes J 35616-4A.**

3. Test for 7.2-8.5 V between the incremental encoder sensor (8 V) supply circuit terminal G and a good ground, such as the ground terminal of the **EL-49742** harness, black terminal.
   - ***If less than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the incremental encoder sensor (8 V) supply circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between incremental encoder sensor (8 V) supply circuit terminal G and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the incremental encoder sensor (8 V) supply circuit terminal G and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

        Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.
   - ***If greater than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the incremental encoder sensor (8 V) supply circuit terminal G and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.
      - If less than 1 V
   3. Test for greater than 10 Ω between the incremental encoder sensor (8 V) supply circuit, terminal G and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

        Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.
   - ***If within the specified range***
4. Incremental encoder sensor (8 V) supply circuit and K69 transfer case control module OK.

5. Test for 7.2-8.5 V between the incremental encoder sensor (8 V) supply circuit, terminal G, and the low reference circuit, terminal H.
   - ***If less than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
   2. Test for less than 10 Ω in the low reference circuit end to end.
      - If 10 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 10 Ω
   3. Test for infinite resistance between low reference circuit terminal H and a good ground.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance
   4. Test for greater than 10 Ω between the low reference circuit, terminal H and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

        Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.
   - ***If greater than the specified range***
   1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
   2. Test for less than 1 V between the low reference circuit, terminal H and a good ground.
      - If 1 V or greater, repair the short to voltage in the circuit.
      - If less than 1 V
   3. Test for greater than 10 Ω between the low reference circuit, terminal H and all other terminals of the A16 transfer case motor harness connector.
      - If 10 Ω or less, repair the shorted together condition in the affected circuits.
      - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

        Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.
   - ***If within the specified range***
6. Low reference circuit and K69 transfer case control module OK.
7. Test for 6.0-7.0 V between the incremental encoder impulse signal circuit, terminal E and a good ground, such as the ground terminal of the

EL-49742 harness, black terminal.

- ***If less than the specified range***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in the incremental encoder impulse signal circuit end to end.
   - If 10 Ω or greater, repair the open/high resistance in the circuit.
   - If less than 10 Ω
3. Test for infinite resistance between incremental encoder impulse signal circuit terminal E and a good ground.
   - If less than infinite resistance, repair the short to ground in the circuit.
   - If infinite resistance
4. Test for greater than 10 Ω between the incremental encoder impulse signal circuit terminal E and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- ***If greater than the specified range***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
2. Test for less than 1 V between the incremental encoder impulse signal circuit terminal E and a good ground.
   - If 1 V or greater, repair the short to voltage in the circuit.
   - If less than 1 V
3. Test for greater than 10 Ω between the incremental encoder impulse signal circuit terminal E and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

8. Incremental encoder impulse signal circuit and K69 transfer case control module OK.
9. Test for 6.0-7.0 V between the incremental direction signal circuit, terminal F and a good ground, such as the ground terminal of the **EL-49742**

harness, black terminal.

- ***If less than the specified range***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module.
2. Test for less than 10 Ω in the incremental direction impulse signal circuit end to end.
   - If 10 Ω or greater, repair the open/high resistance in the circuit.
   - If less than 10 Ω
3. Test for infinite resistance between incremental encoder direction signal circuit terminal F and a good ground.
   - If less than infinite resistance, repair the short to ground in the circuit.
   - If infinite resistance
4. Test for greater than 10 Ω between the incremental encoder direction signal circuit terminal F and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- ***If greater than the specified range***

1. Ignition OFF, disconnect the X1 harness connector at the K69 transfer case control module. Ignition ON, Engine OFF.
2. Test for less than 1 V between the incremental encoder direction signal circuit terminal F and a good ground.
   - If 1 V or greater, repair the short to voltage in the circuit.
   - If less than 1 V
3. Test for greater than 10 Ω between the incremental encoder direction signal circuit terminal F and all other terminals of the A16 transfer case motor harness connector.
   - If 10 Ω or less, repair the shorted together condition in the affected circuits.
   - If greater than 10 Ω, replace the K69 transfer case control module and perform the Range Actuator Learn procedure.

     Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

- ***If within the specified range***

10. Incremental encoder direction signal circuit and K69 transfer case control module OK.
11. Replace the A16 transfer case motor.

Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** .

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for K69 transfer case control module replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**
- **Transfer Case Two/Four Wheel Drive Actuator Replacement** for A16 transfer case motor replacement

DTC C0397: TRANSFER CASE CLUTCH

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0397 54

Transfer Case Clutch High Temperature

DTC C0397 58

Transfer Case Clutch Performance

DTC C0397 4B (if equipped)

Transfer Case Clutch Calibration Not Learned

DTC C0397 F3

Transfer Case Clutch Worn Out Clutch

DTC C0397 F4

Transfer Case Range Position Sensor Over Travel

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Performance
Transfer Case Clutch Performance	-	-	-	C0397 54, C0397 58, C0397 4B, C0397 F3, or C0397 F4

Circuit/System Description

In 4WD/AWD Automatic range, the transfer case control module monitors the front and rear wheel speed sensors for slip. If the transfer case control module detects slip, and is unable to correct for a difference between the front and rear speed sensors, it will command the transfer case to apply the clutch. In addition, the transfer case control module tests for clutch pack wear by performing a high side kiss point check at power down and comparing it to the transfer case range actuator position sensor reading.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-8 V.
- No DTC P0562 or P0563.

C0397 54

- No C0379 01, C0379 04 or C0379 08 for thermal model.
- Vehicle speed greater than 5 km/h (3 MPH) and all wheel speeds at same speed.
- DTC C0397 54 runs continuously.

C0397 58

- Transfer case control module is NOT in shutdown mode due to thermal protection.
- DTC C0397 58 runs continuously.

C0397 4B

- Transfer case range: must begin in 4WD High/Locked and then be requested to shift to 4WD/AWD Automatic or 2WD.
- Only run during power down kiss point learn request.

C0397 F3

Only run during power down kiss point learn request.

C0397 F4

Only run during power down kiss point learn request.

Conditions for Setting the DTC

C0397 54

The transfer case control module has determined that the transfer case calculated clutch temperature model has exceeded the maximum allowable temperature for the second time.

C0397 58

The transfer case control module has detected that the transfer case clutch has failed to reach the desired output torque after three attempts.

C0397 4B

The transfer case control module has determined that the power down kiss point learn has failed 20 times in a row.

C0397 F3

The transfer case control module has determined that the maximum clutch wear out limit has been exceeded.

C0397 F4

The transfer case control module has detected that the transfer case range actuator position sensor, or the transfer case range position sensor has exceeded the upper/lower over travel limits.

Action Taken When the DTC Sets

- Shifting is still possible but in a reduced capacity which may cause undesirable slip correction events.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

C0397 54

Front axle disengaged.

C0397 58

Shifting disabled.

C0397 4B

- Max torque commanded for 4WD/AWD Automatic.
- The default actions for C0397 4B will cause DCT C038D to set.

C0397 F3

- Shifting disabled.
- Front axle disengaged.

C0397 F4

- Shifting disabled.
- Front axle disengaged.

Conditions for Clearing the DTC

- The transfer case control module clears the DTC once the condition for setting the DTC no longer exists.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.
- Only cleared by a successful kiss point learn. (DTC C0397 F3).
- Only cleared by the successful execution of the **Transfer Case High/Low Clutch Reset** procedure. (DTC C0397 F4).

Diagnostic Aids

- A stuck transfer case motor lock can cause C0397 58 to set.
- Faulty wheel speed sensors can cause DTC C0397 58 or C0397 F3 to set. When driving at a steady speed, the scan tool should display the same values for the following data parameters in the electronic brake control module:
    - Left and right front wheel speed sensors
    - Left and right rear wheel speed sensors

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON, engine OFF.
2. Install a scan tool.
3. Verify no other K17 Electronic Brake Control Module or K69 Transfer Case Control Module DTCs are set.
   - ***If any other K17 Electronic Brake Control Module Or K69 Transfer Case Control Module DTC's are set***

     diagnose them first.

   - ***If no other K17 Electronic Brake Control Module Or K69 Transfer Case Control Module DTC's are set***
4. Verify DTC C0397 is only set as a history DTC.
   - ***If DTC C0397 is set as current***

     refer to Circuit/System Testing.

   - ***If DTC C0397 is set as history***

5. Clear DTC C0397 from history.
6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If DTC C0397 sets***

     refer to Circuit/System Testing.

   - ***If DTC C0397 does not set***
7. All OK.

Circuit/System Testing

1. Install scan tool.
2. Wheel speed sensors:
   1. Take the vehicle on a short test drive on a smooth and level road.
   2. Verify that, when at a steady speed, all of the front and rear speed sensors parameters do not vary or become intermittent.
   - ***If while driving at a steady speed the RPM values vary or become intermittent***

     check the K17 Electronic Brake Control Module for wheel speed DTC's. Wheel speed DTC diagnostics are in antilock brake systems.

   - ***If all of the front and rear speed sensors parameters do not vary or become intermittent***
3. Transfer case clutch integrity:
   1. Shift the vehicle into 4WD High/Locked and take it for a test drive. Clear the DTC if possible.
   2. Verify that while under heavy acceleration that the front and rear wheel speeds are similar.
   - ***If the front wheel speeds are much lower***

     this indicates a weak clutch and a transfer case disassembly and inspection will be required. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** .

   - ***If the front and rear wheel speeds are similar***
4. A16 transfer case motor - brake/lock:
   1. Clear DTC's. Using the S77 Transfer Case Shift Control Switch function of the scan tool, shift the vehicle to 2WD range.
   2. Monitor the Transfer Case Motor Amperage parameter in the Data Display feature of the scan tool.
   3. Using the S77 Transfer Case Shift Control Switch function of the scan tool, command the transfer case to the 4WD High/Locked range.

4. Verify that the Transfer Case Motor Amperage parameter increases while the motor is shifting, and then returns to 0 amps within 5 seconds or less.
   - ***If the amperage stays high longer than 5 seconds***

     this indicates the brake is not holding. Replace the A16 Transfer Case Motor. Refer to **Transfer Case Two/Four Wheel Drive Actuator Replacement** .

   - ***If the amperage increases while the motor is shifting, and then return to 0 amps within 5 seconds or less***
5. Mechanical binding:
   1. Engage parking brake.
   2. Block rear wheels.
   3. Lift front wheels.
   4. Ignition ON, engine OFF. Install scan tool.
   5. Transfer case in 2WD. Transmission in Neutral.
   6. Using the Front Axle Engagement Actuator control function, engage the front axle.
   7. Verify that the front prop shaft turns while holding one front tire stationary and spinning the other tire.
   - ***If the front prop shaft does not turn***

     inspect the front axle clutch fork for mechanical binding. Refer to **Four-Wheel Drive Does Not Disengage** .

   - ***If the front prop shaft turns***
6. If all prior evaluations test normal:
   1. Reprogram the K69 Transfer Case Control Module. Refer to **Control Module References** .
   2. Perform the Range Actuator Learn procedure in the Control Functions feature of the scan tool. Refer to **Transfer Case High/Low Clutch Reset**.
7. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If DTC C0397 sets***

     replace the K69 Transfer Case Control Module and perform the Range Actuator Learn procedure. Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**.

   - ***If DTC C0397 does not set***

8. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for K69 Transfer Case Control Module replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset** for Range Actuator Learn Procedure
- **Four-Wheel Drive Does Not Engage**

DTC C0398: RANGE ACTUATOR POSITION - RANGE POSITION CORRELATION

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0398 00

Range Actuator Position - Range Position Correlation

Typical Scan Tool Data

Range/Parameter	2WD	4WD/AWD Automatic	4WD High/Locked	4WD Low	Neutral
Range Actuator Position Sensor (Â°)	33Â° to 43Â°	87Â° to 204Â°	110Â° to 204Â°	-69Â° to -140Â°	-5Â° to +5Â°
Sensor Reference Voltage 2 (V)	7.75-8.25 V	7.75-8.25 V	7.75-8.25 V	7.75-8.25 V	7.75-8.25 V
Range Actuator Position Sensor (V)	0.6-0.8 V or 3.7-4.1 V	0.6-0.8 V or 3.7-4.1 V	3.7-4.1 V	3.7-4.1 V	0.6-0.8 V or 3.7-4.1 V
Transfer Case Range Position Sensor (Â°)	33Â° to 43Â°	87Â° to 204Â°	110Â° to 204Â°	-69Â° to -140Â°	-5Â° to +5Â°

Circuit/System Description

The transfer case range actuator position sensor is also known as the incremental position sensor. The transfer case range actuator position sensor is an integral part of the A16 Transfer Case Motor and cannot be replaced independently. The A16 Transfer Case Motor is also known as the transfer case range actuator.

The B227 Gear Position Sensor is also known as the transfer case range position sensor, the two/four wheel drive actuator position sensor, or the rotational position sensor. The B227 Gear Position Sensor is an absolute sensor and is an independently replaceable part.

Both sensors send transfer case range position information to the transfer case control module as voltage signals, which is then converted to degrees by the transfer case control module software. If the two sensors disagree by greater than a predetermined amount, the DTC will set.

The range actuator position sensor is more sensitive than the B227 Gear Position Sensor, but needs to reference the B227 Gear Position Sensor value at ignition ON and range changes.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.
- No P0562 or P0563.
- DTC C0398 runs continuously.

Conditions for Setting the DTC

The range actuator position sensor and the range position sensor are both showing valid positions, but differ by greater than a predetermined amount when NO range change is in progress.

Action Taken When the DTC Sets

- Shifting disabled.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.
- Maximum clutch torque commanded when in 4WD High/Locked, 4WD/AWD Automatic, or 4WD Low, and during range shifts.

Conditions for Clearing the DTC

DTC 0398 can only be cleared by using a scan tool to clear codes twice consecutively.

Diagnostic Aids

- The range actuator position sensor and the range position sensor both show position in degrees. Monitor these parameters for erratic or

unreasonable readings.

- An ignition ON, engine OFF sequence with transfer case motor removed, but still attached to the harness, may cause C0398 00 to set.
- Repeatedly commanding the transfer case range actuator forward or reverse without pressing the exit button between commands, to return to the "none" state, can result in incorrect readings.
- DTC C0398 is a latching DTC. This means that it stays current even with cycling the ignition ON & OFF. DTC 0398 can only be cleared by using a scan tool to clear codes twice consecutively. The first command to clear codes unlatches the DTC. The second command to clear codes clears the DTC.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON, engine OFF.
2. Connect a scan tool.
3. Monitor the Range Actuator Position Sensor and Range Position Sensor parameters on the scan tool. Using the S77 Transfer Case Shift Control Switch, shift the transfer case into all ranges. The Range Actuator Position Sensor parameter and Range Position Sensor parameter should track each other.

- ***If the Range Actuator Position Sensor parameter and Range Position Sensor parameter do NOT track each other within 7 degrees***

  refer to Circuit/System Testing.

- ***If the Range Actuator Position Sensor parameter and Range Position Sensor parameter DO track each other within 7 degrees***

4. All OK.

Circuit/System Testing

1. Verify DTC C0392, P0642, P0643 (B227 Gear Position Sensor, also known as range position sensor), or C0396, C039E, P0652, P0653 (range actuator position sensor) is not set.
   - ***If any of the DTCs are set***

     Refer to **Diagnostic Trouble Code (DTC) List - Vehicle**

   - ***If none of the DTCs are set***
2. Go to Component Testing.

Component Testing

NOTE: **Order of component testing is important.**

1. B227 Gear Position Sensor (also known as Range Position Sensor)
   1. Ignition OFF. Disconnect the B227 Gear Position Sensor connector. Remove the B227 Gear Position Sensor. Inspect the mating surface for damage. Replace if damage is found.
   2. Rotate the B227 Gear Position Sensor tab to the lock position. Reconnect the B227 Gear Position Sensor.
   3. Ignition ON, engine OFF.
   4. While monitoring the Range Position Sensor parameter on the scan tool, push in the locking tab and rotate the B227 Gear Position Sensor tab. In the lock position the Range Position Sensor parameter should read 33-43Â°. Upon rotating the range position sensor tab, the Range Position Sensor parameter should display a sweep from -146 to +204 degrees.
      - If the Range Position Sensor parameter does not display as described, replace the B227 Gear Position Sensor.

        Refer to **Transfer Case Two/Four Wheel Drive Actuator Position Sensor Replacement** .

      - If the Range Position Sensor parameter does display as described
   5. Using a wide, flat blade screwdriver in the B227 Gear Position Sensor mounting slot, attempt to rotate the transfer case control actuator

shaft. The shaft should not turn.

- If the shaft can be turned, then internal damage has occurred to the transfer case control actuator shaft or mating gears. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** and inspect and repair as necessary.
- If the shaft can not be turned

6. B227 Gear Position Sensor OK.

2. A16 Transfer Case Motor - Range Actuator Position Sensor
   1. Remove the A16 Transfer Case Motor from transfer case. Using a paint pen or marker, place indexing marks on the A16 Transfer Case Motor drive gear and the mounting surface of the A16 Transfer Case Motor.
   2. Attach the A16 Transfer Case Motor to the A16 Transfer Case Motor connector.
   3. Ignition ON, engine OFF, clear DTC's.

NOTE: **Pressing the exit button on the scan tool between commanding the Range Actuator clockwise and counter-clockwise is critical to proper diagnosis. Pressing the exit button changes the commanded state to NONE. If you DO NOT press the exit button between changing directions, the Range Actuator Position Sensor parameter may not update. When this happens you have to command the new direction a second time in order for the scan tool to update. Repeatedly changing directions may cause the Range Actuator Position Sensor parameter to flip between the extremes, -150Â° and +360Â° or -360Â° and +360. Depending on software level the lower extreme is either -150Â° or -360Â°.**

   4. While monitoring the Range Actuator Position Sensor parameter, command the Range Actuator clockwise using the Range Actuator function of the scan tool. After 10 seconds the Range Actuator Position Sensor parameter should read -150Â°, -360Â° or +360Â°. Push the exit button on the scan tool once to return the commanded state to NONE. Command the transfer case Range Actuator counter-clockwise. After 10 seconds the Range Actuator Position Sensor parameter should read +360Â°, -360Â° or -150Â°.
      - If the Range Actuator Position Sensor parameter does not display as described, repeat step 2. If the Range Actuator Position Sensor parameter continues to not display as described, replace the A16 Transfer Case Motor.
      - If the Range Actuator Position Sensor parameter displays as described
   5. Ignition OFF for at least 3 minutes. Install the A16 Transfer Case Motor.
   6. Ignition ON, engine OFF. The K69 Transfer Case Control Module should relearn the transfer case range actuator position, and the Transfer Case Position parameter should display a valid range.
      - If the Transfer Case Range parameter displays Invalid, perform the Range Actuator Learn procedure. Refer to **Transfer Case High/Low Clutch Reset**.
      - If the Transfer Case Range parameter displays a valid range

7. A16 Transfer Case Motor - Range Actuator Position Sensor OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)**
- **Transfer Case Two/Four Wheel Drive Actuator Replacement** for A16 Transfer Case Motor replacement.
- **Transfer Case Two/Four Wheel Drive Actuator Position Sensor Replacement** for B227 Gear Position Sensor replacement.
- **Transfer Case High/Low Clutch Reset** for Range Actuator Learn Procedure

DTC C0550: ELECTRONIC CONTROL UNIT (ECU)

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0550 37

Electronic Control Unit (ECU) Performance Watchdog Failure

DTC C0550 39

Electronic Control Unit (ECU) Internal Electronic Failure

Diagnostic Fault Information

Circuit	Watchdog/Safety Failure	Internal Electronic Failure
Electronic Control Unit Malfunction	DTC C0550 37	DTC C0550 39

Circuit/System Description

This is an internal fault detection of the transfer case shift control module (TCCM). This fault is handled inside the TCCM. No external circuits are involved.

At each power-up, the TCCM runs a self-test on the following:

- EEPROM Checksum
- ROM Checksum
- RAM Checksum
- RAM Malfunction

Conditions for Running the DTC

- The TCM runs the program to detect an internal condition at key ON. The only requirements are voltage and ground.
- Ignition ON.
- System voltage 10.5-18.0 V

Conditions for Setting the DTC

- The random access memory (RAM) of the TCCM has failed an operational test indicating that some portions of RAM are not functional.
- The read only memory (ROM) or the masked ROM of the TCCM has failed the Checksum test indicating that the data is not currently valid.
- The critical operational parameters stored in the EEPROM of the TCCM have failed the Checksum test indicating invalid data.

Action Taken When the DTC Sets

- The encoder motor will be deactivated for the remainder of the current ignition cycle.
- The transfer case shift control switch will illuminate the current mode position LED.
- No further mode changes shall be allowed.
- The TCCM will store freeze frame data.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.

Conditions for Clearing the DTC

- The TCCM will clear the DTC once the conditions for setting the DTC no longer exist.
- A history DTC will clear after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- DTC P0550 detects the wrong copy of non-volatile memory in RAM or a RAM read/write failure.
- DTC P0550 detects a non-volatile memory write error.
- DTC P0550 detects a corruption of the EPROM/Flash memory.
- When attempting to set TCCM internal DTCs, let the engine run for at least 1 minute and then shut the engine OFF for 30 seconds. Following this procedure will allow for a complete TCCM shutdown. Reprogram the TCCM and retest the DTC to see if the DTC resets.
- A low voltage condition can sometimes falsely set this DTC. Attempt to clear this DTC and retest.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Transfer Case Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Engine running. Let the engine run for at least 1 minute.
2. Ignition OFF for at least 30 seconds to allow for the complete shutdown of the TCCM.

3. Ignition ON, verify that DTC C0550 is not set.
    - If DTC C0550 sets, reprogram the TCCM. If the DTC resets, replace the TCCM. Perform the ATC motor learn procedure.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for TCSCM replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**

DTC C0569: SYSTEM CONFIGURATION ERROR CALIBRATION NOT LEARNED

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0569 4B

System Configuration Error Calibration Not Learned

Circuit/System Description

- This is an internal fault detection of the transfer case control module. No external circuits are involved.
- This DTC is set anytime a transfer case control module is replaced or reprogrammed.
- The Range Actuator Learn procedure must be performed in order for the transfer case control module to learn current clutch tolerance based on clutch stack-up and accumulated clutch wear.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18 V.

Conditions for Setting the DTC

The Range Actuator Learn procedure for a new or reprogrammed transfer case control module has not been performed.

Action Taken When the DTC Sets

- Range shifting is disabled until the Range Actuator Learn procedure has been performed.
- The SERVICE 4WD indicator illuminates.
- No Range position LED's illuminated.

Conditions for Clearing the DTC

The transfer case control module clears the DTC once the Range Actuator Learn procedure has been successfully performed.

Diagnostic Aids

The default actions for C0306, C0321, C0387, C0392, C0396, C0397 or C0398 may cause C0569 to set.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON, engine ON. Let engine run for at least 1 minute.
2. Ignition OFF for at least 30 seconds to allow for the complete shutdown of the K69 Transfer Case Control Module.
3. Ignition ON, engine OFF.
4. Verify that no other transfer case DTC's are set.
   - ***If any other transfer case DTC's are set***

     diagnose them first.

   - ***If no other transfer case DTC's are set***
5. Verify that DTC C0569 is not set.
   - ***If DTC C0569 is set***

     perform the Range Actuator Learn procedure. Refer to **Transfer Case High/Low Clutch Reset**.

   - ***If DTC C0569 is not set***
6. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Transfer Case High/Low Clutch Reset

DTC C0896: DEVICE VOLTAGE RANGE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0896 03

Device Voltage Range Below Threshold

DTC C0896 07

Device Voltage Range Above Threshold

Circuit/System Description

The transfer case shift control module (TCCM) monitors the battery voltage feed to the TCCM. This DTC detects if the battery voltage is out of range. This could indicate a vehicle wide issue in which all electrical components would be affected, or it could be TCCM specific due to poor power or ground connections.

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18.5 V.

Conditions for Setting the DTC

System voltage above 18.5 V or below 10.5 V and a mode shift is requested.

Action Taken When the DTC Sets

- Shifting disabled until battery voltage is within specification.
- Mode indicator will illuminate current mode.

Conditions for Clearing the DTC

- The TCCM clears the DTC once the conditions for setting the DTC are no longer present.
- A history DTC clears after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- Any mode shift requested when the battery voltage is below 12 V may set this DTC.
- Improperly connecting the cables during a jump start can cause C0896 07 to set.
- The **Transfer Case High/Low Clutch Reset** procedure may need to be performed after repair.
- **EL-49742** harness is a good source for B+ and ground.
- A key OFF, key ON cycle may be needed to enable mode shifting.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

EL-49742 Battery Voltage B+ and Ground Source Harness

Circuit/System Verification

1. Verify that the TREC fuse, and the Miscellaneous IGN fuse, underhood fuse block, are NOT open.
    - If the TREC fuse is open, test the battery positive voltage circuit, TCCM harness X3 pin C, for a short to ground.
    - If the Miscellaneous IGN fuse is open, test the Ignition 1 voltage circuit, TCCM harness X2 pin 6, for a short to ground.
2. Ignition ON, engine OFF.
3. Using the Freeze Frame feature of the scan tool, review the Battery Voltage parameter when the DTC sets. The voltage should be above 12.0 V.
    - If the voltage is above 18.5 V, this is likely a vehicle issue such as an alternator problem, or the vehicle has been hooked up improperly during a jump start. Refer to **Symptoms - Engine Electrical** .
4. Using the Transfer Case Data Display feature of the scan tool, monitor the Battery Voltage parameter. The voltage should be above 12.0 V.
    - If the voltage is below 12.0 V, ensure that the battery is fully charged and working properly. Refer to **Battery Inspection/Test** , and

Battery Electrical Drain/Parasitic Load Test .

5. While monitoring the Battery Voltage parameter, start the engine. Rev the engine to greater than 3000 RPM. The voltage should remain stable and below 18.5 V.
   - If the voltage is unstable or is greater than 18.5 V, ensure that the charging system is working properly. Refer to Charging System Test .

Circuit/System Testing

NOTE: **When test probing harness terminals, it is imperative to use the proper test probe from the most current version of the J 35616 GM-Approved Terminal Test Kit. Use of an improper test probe may deform the terminal, resulting in intermittent open conditions.**

1. Key OFF. Disconnect the X3 harness connector at the TCCM.
2. Measure the voltage at the battery. The voltage should be above 12.0 V.
   - If the voltage is below 12.0 V, ensure that the battery is fully charged and working properly. Refer to Battery Inspection/Test , and Battery Electrical Drain/Parasitic Load Test .
3. Install **EL-49742** harness. Test for B+ (+0.0/-0.5 V) between the 12 volt terminal (red) and the ground terminal (black) of **EL-49742** harness.
   - If the voltage is less than the specified value, a vehicle wide issue is indicated. Inspect the battery positive circuit wire routing for chafed wires or damaged inline harness connectors that could cause unexpected voltage drops.
4. Using the purple probe J 35616-4A, test for B+ (+0.0/-0.5 V) between the battery positive voltage circuit, TCCM X3 pin C, and the ground terminal of **EL-49742** harness, black terminal.
   - If the voltage is less than the specified range, test the battery positive voltage circuit for an open/high resistance or short to ground.
5. Using the purple probes J 35616-4A, test for B+ (+0.0/-0.5 V) between the battery positive voltage circuit, TCCM X3 pin C, and the ground circuit TCCM X3 pin D.
   - If the voltage is less than the specified range, test the ground circuit for an open/high resistance, short to ground or short together condition.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Transfer Case High/Low Clutch Reset
- Battery Inspection/Test
- Battery Electrical Drain/Parasitic Load Test
- Charging System Test

DTC P0601, P0602, P0604, P0606, P062F, OR P064F: CONTROL MODULE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0601

Control Module Read Only Memory Performance

DTC P0602

Control Module Not Programed

DTC P0604

Control Module Random Access Memory Performance

DTC P0606 00

Control Module Processor Performance

DTC P0606 37 (if equipped)

Control Module Processor Performance Software Malfunction

DTC P062F

Control Module Long Term Memory Performance

DTC P064F

Control Module Long Term Memory Performance

Circuit/System Description

This is an internal fault detection of the transfer case control module. This fault is handled inside the transfer case control module. No external circuits are involved.

At each power-up, the transfer case control module runs a self-test on the following:

- EEPROM Checksum
- ROM Checksum
- RAM Checksum
- RAM Malfunction
- Missing, incorrect or invalid software

Conditions for Running the DTC

- Ignition ON.
- System voltage 10.5-18.0 V
- Diagnostic runs continuously

Conditions for Setting the DTC

The transmission control module has detected an internal malfunction.

P0601

The read only memory (ROM), or the masked ROM, of the transfer case control module has failed the Checksum test indicating that the data is not currently valid.

P0602

No application/calibration software found or calibration incompatible with application.

P0604

The random access memory (RAM) of the transfer case control module has failed an operational test indicating that some portions of RAM are non-functional.

P0606 00

The transfer case control module has failed an operational test indicating a processor performance failure.

P0606 37 (if equipped)

The transfer case control module has detected a software malfunction (Watchdog Failure).

P062F

The critical operational parameters stored in the EEPROM of the transfer case control module have failed the Checksum test indicating invalid data.

P064F

The transfer case control module has detected an invalid calibration.

Action Taken When the DTC Sets

- The encoder motor will be deactivated for the remainder of the current ignition cycle.
- The transfer case shift control switch will illuminate the current mode position LED.
- No further mode changes shall be allowed.
- The transfer case control module will store freeze frame data.
- The SERVICE 4WD indicator remains illuminated for the remainder of the current ignition cycle.
- The SERVICE AWD indicator will not illuminate - P062F only.
- Default Long Term Memory Values will be used - P062F only.

Conditions for Clearing the DTC

- DTCs P0601, P0602, P0604, P0606, P062F and P064F are Type C DTCs.
- The transfer case control module will clear the DTC once the conditions for setting the DTC no longer exist.
- A history DTC will clear after 40 consecutive warm up cycles without a fault present.
- History DTCs can be cleared using a scan tool.

Diagnostic Aids

- DTC P0601 detects a non-volatile memory write error (ROM).
- DTC P0602 indicates that the transmission control module is not programed.
- DTC P0604 detects the wrong copy of non-volatile memory in RAM or a RAM read/write failure.

- DTC P0606 00 detects a processor performance failure.
- DTC P0606 37 detects a software malfunction.
- DTC P062F detects a corruption of the EPROM/Flash memory.
- DTC P064F detects an invalid calibration.
- Low voltage or a momentary loss of power or ground to the transfer case control module may cause a DTC to set. Verify the following:
  - The battery cables are clean and tight, and the battery is fully charged. Refer to **Battery Inspection/Test** .
  - The transfer case control module ground circuits do not have an open or high resistance.
  - The transfer case control module power circuits do not have an open, short to ground, or high resistance.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Transfer Case Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition OFF for at least 1 minute to allow for the complete shutdown of the K69 transfer case control module. Engine ON.
2. Verify that DTC P0601, DTC P0602, DTC P0604, DTC P0606, DTC P062F or DTC P064F is only set as a history DTC.
   - ***If any of the DTC's are set as current***
   1. Program the K69 transfer case control module. Refer to **Control Module References** .
   2. Verify none of the DTC's reset.
      - If any of the DTC's reset, replace the K69 transfer case control module. Refer to **Control Module References** .
      - If none of the DTC's reset
   3. All OK.
   - ***If any of the DTC's are set as history***

NOTE: **After inspection, apply Nyogel lubricant 760G to each connector terminal. Ensure each connector and CPA is correctly seated.**

3. Visually inspect each connector terminal of the K69 transfer case control module connector for damage or corrosion. Repair as necessary.
4. Clear DTC P0601, DTC P0602, DTC P0604, DTC P0606, DTC P062F, or DTC P064F from history.
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. The DTC should not set.
   - ***If any of the DTC's set***

     Replace the K69 Transfer Case Control Module and perform the Range Actuator Learn procedure. Refer to **Transfer Case Control Module Replacement** , and **Transfer Case High/Low Clutch Reset**

   - ***If none of the DTC's set***
6. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for K69 transfer case control module replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset** for Range Actuator Learn Procedure

DTC P185F OR P279A-P279C: TRANSFER CASE RANGE /FOUR WHEEL DRIVE (4WD) NEUTRAL RANGE PERFORMANCE

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: **Diagnostic System Check - Vehicle**
- Review the description of Strategy Based Diagnosis: **Strategy Based Diagnosis**
- An overview of each diagnostic category can be found here: **Diagnostic Procedure Instructions**

DTC Descriptor

NOTE: **This procedure may also diagnose malfunctions that are not detected by a DTC.**

DTC P185F

Transfer Case Shift Pending Signal Not Plausible - If equipped

DTC P279A

Transfer Case High Range Incorrect Ratio

DTC P279B

Transfer Case Low Range Incorrect Ratio - If equipped

DTC P279C

Four Wheel Drive (4WD) Neutral Range Performance - If equipped

Circuit/System Description

The ECM uses the following two ways to determine if the transfer case is in 4WD Low, 4WD High or Neutral.

1. Compare the transmission output speed sensor (Transmission OSS) to the transfer case output speed sensor (Transfer Case OSS - parameter name inside ECM) (B115 Vehicle Speed Sensor - component code name in Schematics) in order to calculate transfer case range.
2. Use a LAN message sent by the transfer case shift control module to the ECM.

The ECM uses this message to determine motor torque required and transmission shifting.

The internal fault detection is handled inside the control module. No external circuit diagnosis is involved.

Conditions for Running the DTC

- Engine=Running-For greater than 5 s
- Vehicle Speed =10 to 200 km/h (6 to 124 MPH)

DTCs run continuously when the above condition is met.

Conditions for Setting the DTC

- If the first way and second way of determining transfer case range (see circuit/description above) do not match while in 4WD Low, 4WD High or Neutral, then the DTC is set.
- The ECM has detected 32 fail counts out of 400 samples.

Actions Taken When the DTC Sets

DTCs P17D4, P185F, P279A, P279B, P279C are Type B DTCs.

Conditions for Clearing the DTC

DTCs P17D4, P185F, P279A, P279B, P279C are Type B DTCs.

Diagnostic Aids

- Misalignment, debris or poor connections on the transmission output speed sensor or the transfer case vehicle speed sensor can cause this DTC to set.
- Verify that the following scan tool data can be obtained and is functioning properly while Operating the vehicle within the Conditions for Running the DTC. Data that is questionable may indicate a concern.

  Refer to:**Control Module References** for typical data values.

  - Transmission OSS
  - Transmission Gear
  - Transfer Case OSS (K20)/B115 Vehicle Speed Sensor(Transfer Case Control Schematics)
- The Actions Taken for P279A may set DTC P16F3.
- DTC P279A, P279B, or P279C may set before P0502, P0503, P0721, P0722, P0723, P077C, P077D, P2160, P2161.
- When attempting to set ECM internal DTCs, run the engine for at least 1 min, and then shut the engine off for 2 min. Following this procedure will allow for a complete ECM shutdown. Program the ECM with the latest software version and retest the DTC to see if the DTC resets.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition Â» On / Vehicle Â» In Service Mode &Engine Â» Off
2. Verify DTC P0502, P0503, P0721, P0722, P0723, P077C, P077D, P2160, P2161 is not set.
    - **If any of the DTCs are setRefer to: Diagnostic Trouble Code (DTC) List - Vehicle**
    - **If none of the DTCs are set**
3. Ignition On - Engine Running - Greater than 1 min

    NOTE: **It may take up to 2 min for all vehicle systems to power down.**

4. Ignition/Vehicle Off, key out of the ignition/keyless start transmitter 1 m (3 ft) from the vehicle, and all vehicle systems Off.

    Greater than 2 min

5. Ignition Â» On / Vehicle Â» In Service Mode & Engine Â» Off
6. Verify DTC P17D4, P185F, P279A, P279B, P279C is only set as a history.
   - **If any of the DTCs are setRefer to: Circuit/System Testing**
   - **If any of the DTCs are set as historyRefer to Diagnostic Aids before proceeding with Circuit/System Testing.**
   - **If none of the DTCs are set**
7. Clear All Vehicle DTCs
8. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
9. Verify DTC P17D4, P185F, P279A, P279B, P279C is not set.
   - **If the DTC is set**

     Refer to: Circuit/System Testing

   - **If the DTC is not set**
10. All OK.

Circuit/System Testing

1. Monitor the scan tool parameter:4WD Low Signal - (K20)
2. Operate the component:S77 Transfer Case Shift Control Switch - 4WD Low
3. Verify the scan tool parameter:4WD Low Signal =Enabled
   - **If the parameter does not display the following:Enabled**

     Test or replace the component: Transfer Case Assembly

   - **If the parameter displays the following:Enabled**
4. Operate the component:S77 Transfer Case Shift Control Switch - 2WD
5. Verify the scan tool parameter:4WD Low Signal Disabled
   - **If the parameter does not display the following:Disabled**

     Test or replace the component:Transfer Case Assembly

   - **If the parameter displays the following: =Disabled**

6. Program the ECM.
7. Operate the component:S77 Transfer Case Shift Control Switch - 4WD High/Locked
8. Operate the vehicle within the Conditions for Running the DTC.
9. Verify the DTC does not set.
    - **If the DTC sets**

      Replace the component:K20 Engine Control Module

    - **If the DTC does not set**
10. Operate the component:S77 Transfer Case Shift Control Switch - 4WD Low
11. Operate the vehicle within the Conditions for Running the DTC.
12. Verify the DTC does not set.
    - **If the DTC sets**

      Replace the component:K20 Engine Control Module

    - **If the DTC does not set**
13. Operate the component:S77 Transfer Case Shift Control Switch -Neutral
14. Operate the vehicle within the Conditions for Running the DTC.
15. Verify the DTC does not set.
    - **If the DTC sets**

      Replace the component:K20 Engine Control Module

    - **If the DTC does not set**
16. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: **Diagnostic Repair Verification**

For control module replacement, programming, and setup refer to: **Control Module References**

Transfer Case Assembly Replacement

DTC P185F OR P279A-P279C: TRANSFER CASE RANGE / FOUR WHEEL DRIVE (4WD) NEUTRAL RANGE (L83)

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: **Diagnostic System Check - Vehicle**
- Review the description of Strategy Based Diagnosis: **Strategy Based Diagnosis**
- An overview of each diagnostic category can be found here: **Diagnostic Procedure Instructions**

DTC Descriptor

NOTE: **This procedure may also diagnose malfunctions that are not detected by a DTC.**

DTC P17D4

Transfer Case Neutral Range Detected in High or Low Range - If equipped

DTC P185F

Transfer Case Shift Pending Signal Not Plausible - If equipped

DTC P279A

Transfer Case High Range Incorrect Ratio

DTC P279B

Transfer Case Low Range Incorrect Ratio -If equipped

DTC P279C

Four Wheel Drive (4WD) Neutral Range Performance -If equipped

Circuit/System Description

The ECM uses the following two ways to determine if the transfer case is in 4WD Low, 4WD High or Neutral.

1. Compare the transmission output speed sensor (Transmission OSS) to the transfer case output speed sensor (Transfer Case OSS - parameter name inside ECM) (B115 Vehicle Speed Sensor - component code name in Schematics) in order to calculate transfer case range.
2. Use a LAN message sent by the transfer case shift control module to the ECM.

The ECM uses this message to determine motor torque required and transmission shifting.

The internal fault detection is handled inside the control module. No external circuit diagnosis is involved.

Conditions for Running the DTC

- Engine=Running - For greater than 5 s
- Vehicle Speed =10 to 200 km/h (6 to 124 MPH)

DTCs run continuously when the above condition is met.

Conditions for Setting the DTC

- If the first way and second way of determining transfer case range do not match while in 4WD Low, 4WD High or Neutral, then the DTC is set.
- The ECM has detected 32 fail counts out of 400 samples.

DTCs run continuously when the above condition is met.

Actions Taken When the DTC Sets

DTCs P17D4, P185F, P279A, P279B, P279C are Type B DTCs. are Type B DTCs.

Conditions for Clearing the DTC

DTCs P17D4, P185F, P279A, P279B, P279C are Type B DTCs

Diagnostic Aids

- Misalignment, debris or poor connections on the transmission output speed sensor or the transfer case vehicle speed sensor can cause this DTC to set.
- Verify that the following scan tool data can be obtained and is functioning properly while operating the vehicle within the Conditions for Running the DTC. Data that is questionable may indicate a concern.
    - Transmission OSS
    - Transfer Case OSS<(K20)/B115?Vehicle Speed Sensor(Transfer Case Control Schematics)
- Internal transmission mechanical faults can set these DTC's
- The Actions Taken for P279A may set DTC P16F3.

- DTC P279A, P279B, or P279C may set before P0502, P0503, P0721, P0722, P0723, P077C, P077D, P2160, P2161.
- When attempting to set ECM internal DTCs, run the engine for at least 1 min, and then shut the engine off for 2 min. Following this procedure will allow for a complete ECM shutdown. Program the ECM with the latest software version and retest the DTC to see if the DTC resets.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

NOTE: **Please first be sure to review the Diagnostic Aids before continuing further.**

1. Ignition Â» On / Vehicle Â» In Service Mode & Engine Â» Off
2. Verify DTC P0502, P0503, P0721, P0722, P0723, P077C, P077D, P2160, P2161 is not set. is not set.
    - **If any of the DTCs are set** Refer to:**Diagnostic Trouble Code (DTC) List - Vehicle**
    - **If none of the DTCs are set**

3. Ignition On - Engine Running & Greater than 1 min

NOTE: **It may take up to 2 min for all vehicle systems to power down.**

4. Ignition/Vehicle Off, key out of the ignition/keyless start transmitter 1 m (3 ft) from the vehicle, and all vehicle systems Off.

   - Greater than 2 min

5. Ignition Â» On / Vehicle Â» In Service Mode & Engine Â» Off
6. Verify DTC P17D4, P185F, P279A, P279B, P279C is only set as a history DTC.
   - **If any of the DTCs are set as current.** Refer to: Circuit/System Testing
   - **If any of the DTCs are only set as history.** Refer to Diagnostic Aids before proceeding with Circuit/System Testing.
   - **If none of the DTCs are set**
7. Clear All Vehicle DTCs
8. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
9. When operating the vehicle within the Conditions for Running the DTC, monitor the following parameters (they should match each other and show a smooth/steady curve when viewed in graph form):
   - Transmission OSS
   - Transfer Case OSS(K20)/B115Vehicle Speed Sensor(Transfer Case Control Schematics)
   - **If the above parameters do not match or are not smooth**

     Refer to: **Diagnostic Trouble Code (DTC) List - Vehicle** DTC P0720/P722 for Transmission OSS or DTC P2160/P2161 for Transfer Case OSS(K20)/B115 Vehicle Speed Sensor(Transfer Case Control Schematics)

   - **If the above parameters match and are smooth**
10. Verify DTC P17D4, P185F, P279A, P279B, P279C is not set.
    - **If the DTC is set**

      Refer to: Circuit/System Testing

    - **If the DTC is not set**
11. All OK.

Circuit/System Testing

1. Monitor the scan tool parameter:4WD Low Range Indicator Command
2. Operate the component:S77 Transfer Case Shift Control Switch& 4WD Low
3. Verify the scan tool parameter:4WD Low Range Indicator Command=On
   - **If the parameter does not display the following:** On

     Repair or replace the component: Transfer Case Assembly

     Refer to:**Transfer Case Assembly Replacement**

   - **If the parameter displays the following:** On
4. Operate the component:S77 Transfer Case Shift Control Switch - 2WD
5. Verify the scan tool parameter:4WD Low Range Indicator Command = Off
   - **If the parameter does not display the following:** Off

     Repair or replace the component: Transfer Case Assembly

     Refer to:**Transfer Case Assembly Replacement** .

   - **If the parameter displays the following:** Off
6. Operate the component:S77 Transfer Case Shift Control Switch - 4WD High/Locked
7. Verify the scan tool parameter:4WD Low Range Indicator Command =Off
   - **If the parameter does not display the following:** Off

     Repair or replace the component: Transfer Case Assembly

     Refer to:**Transfer Case Assembly Replacement** .

   - **If the parameter displays the following:** Off
8. Operate the component:S77 Transfer Case Shift Control Switch - Neutral
9. Verify the scan tool parameter:4WD Low Range Indicator Command =Off
   - **If the parameter does not display the following:** Off

     Repair or replace the component: Transfer Case Assembly

Refer to:**Transfer Case Assembly Replacement** .

- **If the parameter displays the following:** Off

10. Clear DTCs
11. Operate the vehicle within the Conditions for Running the DTC.
12. Verify the DTC does not set.
    - **If the DTC sets**

    1. Program the ECM.
    2. Operate the vehicle within the Conditions for Running the DTC.
    3. Verify the DTC does not set.
        - **If the DTC set**

        Replace the component:K20 Engine Control Module

        1. Program the ECM.
        2. Operate the vehicle within the Conditions for Running the DTC.

        NOTE: **Internal damaged components may cause this DTC to set.**

        3. Verify the DTC does not set.
            - **If the DTC sets**

            Repair or replace as necessary - Transfer Case

    - **If the DTC does not set**

13. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: **Diagnostic Repair Verification**

For control module replacement, programming, and setup refer to: **Control Module References**

DTC P2160 OR P2161 (2-WIRE): VEHICLE SPEED SENSOR (VSS) 2

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P2160

Vehicle Speed Sensor (VSS) 2 Circuit Low Voltage

DTC P2161

Vehicle Speed Sensor (VSS) 2 Circuit Intermittent

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
VSS Supply Voltage	P2160, P2161	P2160, P2161	P2160, P2161	P2161
VSS Signal	P2160, P2161	P2160, P2161	P2160, P2161	P2161

Circuit/System Description

The vehicle speed sensor (VSS) provides vehicle speed information to the engine control module (ECM). The VSS is a permanent magnet generator. The sensor is mounted in the transfer case facing the rear internal gear which is splined to the output shaft assembly. As the output shaft and internal gear rotate, the toothed rotor of the internal gear produces AC voltage as the rotor teeth pass through the magnetic field of the sensor. The AC voltage level and the number of pulses increase as the speed of the vehicle increases. The ECM converts the voltage to vehicle speed. The ECM uses the output shaft speed signal to determine shift timing, as well as transfer case range.

Conditions for Running the DTC

P2160

- No input speed sensor (ISS) DTCs P0716 or P0717.
- No output speed sensor (OSS) DTCs P0722 or P0723.

- No vehicle speed sensor (VSS) DTCs P2160 or P2161.
- The throttle position is greater than 5 percent and less than 99 percent.
- The transmission is not in Reverse Inhibit state.
- The transmission is not in PARK or NEUTRAL.
- The transmission is not performing garage shifting.
- No engine torque, throttle position, and turbine speed DTCs.
- The engine torque is greater than 60 N.m (44 lb ft) and less than 8192 N.m (6042 lb ft).
- The input speed is greater than 1000 RPM and less than 7500 RPM.

P2161

- The transmission is not performing garage shifting.
- The transmission is not in Reverse Inhibit state.
- The transmission is not in PARK or NEUTRAL.
- The engine speed is 1000 RPM or greater.
- No crank sensor or P2160 DTCs.

Conditions for Setting the DTC

P2160

- No speed signal from the transfer case speed sensor.
- The transfer case output shaft speed is 50 RPM or less.

P2161

- Loss of speed signal from the transfer case speed sensor.
- Output speed signal is increasing: current transfer case speed signal - last valid output speed greater than 475 RPM.
- Output speed signal is decreasing: current transfer case speed signal - last valid output speed less than 255 RPM.

Action Taken When the DTC Sets

- DTCs P2160 and P2161 are Type B DTCs.
- The TCM commands maximum line pressure.

- The TCM freezes transmission adaptive functions.
- The TCM calculates vehicle speed from the automatic transmission input shaft speed sensor and commanded gear.

Conditions for Clearing the DTC

DTCs P2160 and P2161 are Type B DTCs.

Diagnostic Aids

- The transfer case drain plug provides a good ground point.
- The **EL-49742** harness provides a good source for 12 V and ground.
- Inspect the rear internal gear teeth for damage.
- Visually inspect the VSS for cracks or damage.
- Ensure the VSS is properly torqued to the transfer case housing.
- This diagnostic relates to the VSS located in the transfer case and not the OSS located within the transmission.

Reference Information

Schematic Reference

- **Transfer Case Control Schematics**
- **Engine Controls Schematics** for 5.3L (L83) or 6.2L (L86)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Transfer Case Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**

- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **EL-49742** Battery Voltage B+ and Ground Source Harness
- **J 35616** GM-Approved Terminal Test Kit

Circuit/System Verification

1. Raise and support the drive wheels.
2. Start and idle the engine.
3. Place the transmission in DRIVE.
4. Monitor the Transfer Case OSS parameter on the scan tool under engine data.
5. The Transfer Case OSS parameter on the scan tool should be greater than 100 RPM.

Circuit/System Testing

1. Key OFF. Let sit for 2 minutes to ensure that the ECM shuts down.
2. Disconnect the X1 connector from the VSS. Using the J 35616-2A GY probes, test for less than 0.1 V between the following circuits and a good ground.
    - VSS high signal circuit, VSS harness X1 pin A.
    - VSS low signal circuit, VSS harness X1 pin B.
        - If the voltage is greater than the specified value, test the affected circuit for a short to voltage. If all circuits and connections test normal, test the ECM for proper operation.
3. Key ON, engine OFF. Test for a diagnostic 2-3 V (low current) between the following circuits and a good ground.
    - VSS high signal circuit, VSS harness X1 pin A.
    - VSS low signal circuit, VSS harness X1 pin B.

- If the voltage is less than the specified value, test the affected circuit for an open/high resistance, short to ground or short together. If all circuits and connections test normal, test the ECM for proper operation.
- If the voltage is greater than the specified value, test the affected circuit for a short to voltage. If all circuits and connections test normal, test the ECM for proper operation.

4. Test the VSS for proper operation.

Component Testing

VSS

1. Key OFF.
2. Disconnect the X1 connector from the VSS. Using the J 35616-3 GY probes, test for 1200-2140 Ω between the VSS high signal circuit, VSS pin A, and the VSS low signal circuit, VSS pin B.
   - If the resistance is outside the specified value, replace the VSS.
3. Test for greater than 10 M Ω between the following circuits and a good ground.
   - VSS high signal circuit, VSS pin A.
   - VSS low signal circuit, VSS pin B.
     - If the resistance is below the specified value, Replace the VSS.
4. Block the front wheels. Raise and support the driver's side rear wheel. While rotating the raised wheel by hand, test for greater than 0.4 V AC between the VSS high signal circuit, VSS pin A, and the VSS low signal circuit, VSS harness pin B. The passenger side rear wheel takes more effort to turn. If both drive wheels are raised and unblocked, twice the effort will be required to reach 0.4 V AC. If the vehicle is sufficiently supported to safely place the transmission in neutral, less effort will be required to turn the raised wheel.
   - If the AC voltage is below the specified value, replace the VSS.

ECM

1. Remove key from the ignition. Let sit for 2 minutes to ensure ECM shut down
2. Disconnect the X2 connector from the ECM. Using the J 35616-64B L-BU probes, test for 1200-2140 Ω between the VSS high signal circuit, ECM X2, pin 6 and the VSS low signal circuit, ECM X2, pin 7.
   - If the resistance is below the specified value, test the affected circuits for being shorted together. If all circuits and connections test normal, test the VSS for proper operation.
   - If the resistance is above the specified value, test the affected circuits for open/high resistance condition. If all circuits and connections test normal, test the VSS for proper operation.

3. Using the J 35616-64B L-BU probes, test for greater than 1 M Ω between the following circuits and a good ground.
    - VSS high signal circuit, ECM harness X1 pin 6.
    - VSS low signal circuit, ECM harness X1 pin 7.
        - If the resistance is below the specified value, test the affected circuit for being shorted to ground. If all circuits and connections test normal, test the VSS for proper operation.
4. Reprogram the ECM. If the DTC continues to set, replace the ECM.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Ensure that the VSS is 500 RPM or greater for 3 seconds and does not change more than 500 RPM or greater for 3 seconds.
- **Vehicle Speed Sensor Replacement**
- **Control Module References** for ECM replacement, setup, and programming

SYMPTOMS - TRANSFER CASE

IMPORTANT:

- Perform the **Diagnostic System Check - Vehicle** before using the symptom tables in order to verify the following statements are true:
    - There are no diagnostic trouble codes (DTCs) set.
    - The control modules can communicate via the serial data link.
- Review the system operation in order to familiarize yourself with the system functions. Refer to **Transfer Case Description and Operation** .

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the automatic transfer case system. Refer to **Checking Aftermarket Accessories** .
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the automatic transfer case for the proper fluid level.

Intermittent

Faulty electrical connections or wiring may cause intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** .

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **Front Axle Will Not Engage**
- **Front Axle Will Not Disengage**
- **Transfer Case Shift Control Switch Inoperative**
- **No Correction for Slip in All-Wheel Drive Mode**
- **Transfer Case Shift Control Switch Indicator Always On - Two or More**
- **Transfer Case Shift Control Switch Indicator Inoperative - One or More**
- **Service Indicator Always On**
- **Transfer Case High/Low Clutch Reset**
- **Transfer Case Popping Noise**
- **Transfer Case Banging Noise**
- **Transfer Case Whine or Rumble Noise**
- **Transfer Case Growl or Grinding Noise**
- **Transfer Case Grating Noise**
- **Transfer Case Clunk in 2HI Only**
- **Transfer Case Clunk in 4HI**
- **Transfer Case Clunk in 4LO**
- **Transfer Case Shudder or Binding**
- **Transfer Case Will Not Shift**
- **Transfer Case Jumps Out of Gear**
- **Transfer Case Leak Diagnosis**

FRONT AXLE WILL NOT ENGAGE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The front axle control circuit consists of an electric motor actuator which engages and disengages the front axle. The front axle actuator motor consists of a permanent magnetic motor, a worm gear controlled plunger, a front axle switch and an electronic control circuit within the actuator assembly.

The front axle actuator consists of the following circuits:

- The front axle control circuit, which is also connected to the transfer case shift control module
- The front axle switch circuit, which is also connected to the transfer case shift control module
- An ignition 3 voltage circuit
- A ground circuit

When a shift to AUTO 4WD, 4HI, or 4LO is requested, the transfer case shift control module engages the front axle by grounding the front axle control circuit through a current limiting driver.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Testing

1. If this is occurring without DTC C0379 setting it is likely related to a mechanical issue. Refer to **Four-Wheel Drive Does Not Engage** .
2. If no mechanical issue is found replace the front axle actuator.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for TCSCM replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**
- **Four-Wheel Drive Does Not Engage**
- **Four-Wheel Drive Does Not Disengage**
- **Front Drive Axle Actuator Replacement (8.25 Inch LD Axle)** **Front Drive Axle Actuator Replacement (9.25 Inch HD Axle)**

FRONT AXLE WILL NOT DISENGAGE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The front axle control circuit consists of an electric motor actuator which engages and disengages the front axle. The front axle actuator motor consists of a permanent magnetic motor, a worm gear controlled plunger, a front axle switch and an electronic control circuit within the actuator assembly.

The front axle actuator consists of the following circuits:

- The front axle control circuit, which is also connected to the transfer case shift control module
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- An ignition 3 voltage circuit
- A ground circuit

When a shift to AUTO 4WD, 4HI, or 4LO is requested, the transfer case shift control module engages the front axle by grounding the front axle control circuit through a current limiting driver.

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Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Testing

1. If this is occurring without DTC C0379 setting it is likely related to a mechanical issue. Refer to **Four-Wheel Drive Does Not Disengage** .
2. If no mechanical issue is found replace the front axle actuator.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for TCSCM replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**
- **Four-Wheel Drive Does Not Engage**
- **Four-Wheel Drive Does Not Disengage**

- Front Drive Axle Actuator Replacement (8.25 Inch LD Axle) Front Drive Axle Actuator Replacement (9.25 Inch HD Axle)

TRANSFER CASE SHIFT CONTROL SWITCH INOPERATIVE

Diagnostic Instructions

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

Circuit/System Description

The active transfer case mode switch circuit consists of 5 modes. The transfer case shift control module supplies 5 volts to the switch through the 5-volt reference circuit. The current travel through the resistor of the currently active mode. The current is then returned to the transfer case shift control module through the switch signal circuit.

The transfer case shift control module constantly monitors this signal voltage to determine the condition of the mode switch circuit.

When each of the modes are selected they complete a circuit through their own specific resistor. The transfer case shift control module continuously monitors the switch input to determine whether the Neutral, AWD, 2HI, 4HI, or 4LO mode was selected by the driver.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information.

Diagnostic Aids

If the 5-volt reference or the switch signal wire are shorted to ground the scan tool can show up to 7.5 volts.

Circuit/System Testing

1. Review the scan tool data list mode switch selected and select difference mode with the transfer case shift control switch. Does the mode switch selected parameter on the scan tool change as you change modes on the switch?
2. If the modes change according to the scan tool replace the transfer case control module, reprogram, complete the motor learn procedure. If the modes on the scan tool not change replace the switch.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Transfer Case Selector Switch Replacement (Chevrolet / GMC)** **Transfer Case Selector Switch Replacement (Cadillac)**
- **Control Module References** for TCSCM replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**

NO CORRECTION FOR SLIP IN ALL-WHEEL DRIVE MODE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

When transfer case is in auto 4WD mode the transfer case control module monitors the front wheel speeds and the rear wheel speeds. When a noticeable difference between the front and rear is seen the transfer case control module sends a PWM voltage to the motor so it can apply the clutch in order to correct a slip condition. The slip conditions is the difference in speed between the front and rear axles. The module has a thermal model based system so when the slip correction can not be made when a large percentage PWM signal has been sent, it will disable the system to prevent damage to the clutches.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Diagnostic Aids

Erratic wheel speed sensors can cause this condition to occur. Monitor the wheel speeds using the EBCM scan tool data list.

Circuit/System Testing

1. Monitor the wheel speed sensors using the EMCM scan tool data list. If the wheel speeds are erratic or there is a large difference between front and rear then diagnose and repair as necessary. Check for EBCM DTCs as they have likely set for wheel speed performance.
2. If nothing is found with wheel speed performance then the clutches may be excessively warn. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** .

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Transfer Case Disassemble (Light Duty) **Transfer Case Disassemble (Heavy Duty)**

TRANSFER CASE SHIFT CONTROL SWITCH INDICATOR ALWAYS ON - TWO OR MORE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The indicator circuits consists of an interior lights dimming circuit and an indicator control circuit. When a mode has been selected, current is supplied to the indicator by the interior lights dimming circuit, traveling through the indicator LED, at which time the transfer case shift control module supplies the ground through the indicator lamp control circuit.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Diagnostic Aids

A short to ground on the indicator control circuit will cause the indicator to remain on at all times.

Circuit/System Testing

1. With in ignition off disconnect connector X1 at the transfer case control module and turn the ignition on. If the affected indicator goes out replace the transfer case control module, program, and perform the motor learn procedure.
2. If the affected indicator did not go out check for a short to ground on the affected indicator control circuit. If this checks as good then replace the transfer case shift control switch.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Transfer Case Selector Switch Replacement (Chevrolet / GMC)** **Transfer Case Selector Switch Replacement (Cadillac)**
- **Control Module References** for TCSCM replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**

TRANSFER CASE SHIFT CONTROL SWITCH INDICATOR INOPERATIVE - ONE OR MORE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The indicator circuits consists of an interior lights dimming circuit and an indicator control circuit. When a mode has been selected, current is supplied to the indicator by the interior lights dimming circuit, traveling through the indicator LED, at which time the transfer case shift control module supplies the ground through the indicator lamp control circuit.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Diagnostic Aids

A short to ground on the indicator control circuit will cause the indicator to remain on at all times.

Circuit/System Testing

1. With in ignition off disconnect connector X1 at the transfer case control module and turn the ignition on. With a jumper wire probe the indicator control circuit of the affected indicator and take the other end of the jumper to ground. If the indicator comes on then replace the transfer case control module, program, and perform the motor learn procedure
2. If the affected indicator did not come on then check the indicator control circuit for an open or high resistance. If the circuit checks good then replace the transfer case shift control switch.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Transfer Case Selector Switch Replacement (Chevrolet / GMC)** **Transfer Case Selector Switch Replacement (Cadillac)**
- **Control Module References** for TCSCM replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**

SERVICE INDICATOR ALWAYS ON

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.

- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

If the service indicator needs to be turned on the transfer case shift control module sends a signal via LAN to the instrument panel asking the I/P to command the Service 4WD indicator.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Testing

1. If the Service 4WD indicator is on and there are no DTCs check the fuse for the transfer case as this would cause the transfer case control module to drop off the LAN causing a service indicator.
2. If the fuse is good check the module power and grounds for proper connections as this could cause the same thing as a blown fuse.
3. If this checks OK then check all other U codes that may be set against the transfer case shift control module such as I/P, BCM, PCM, and follow the proper U code diagnostic.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for TCSCM replacement, setup, and programming
- **Transfer Case High/Low Clutch Reset**

TRANSFER CASE HIGH/LOW CLUTCH RESET

Using a Scan Tool

1. Ignition ON, engine OFF.
2. Select the Module Setup heading on the scan tool, under transfer case control module.
3. Select the Range Actuator Learn procedure.
4. When the Range Actuator Learn procedure is initiated an audible noise from the A16 Transfer Case Motor should occur, indicating a successful learn procedure.

Using The Transfer Case Shift Control Switch

NOTE: **The Range Actuator Learn procedure is performed with the ignition in the ACCESSORY position. The shift to transfer case NEUTRAL procedure uses this same procedure, but with the key in the RUN position.**

1. Ignition OFF for at least 30 s.
2. Engage parking brake.
3. Place transmission in Neutral.
4. Turn the S77 Transfer Case Shift Control Switch to the 2WD High position for at least 5 s. The 2WD High indicator may not illuminate.
5. Turn the S77 Transfer Case Shift Control Switch clockwise past the 4WD Low position to the neutral request position and hold for at least 30 s.
6. An audible noise from the A16 Transfer Case Motor should occur, indicating a successful learn procedure.

TRANSFER CASE POPPING NOISE

Cause	Correction
Definition: A faulty internal transfer case component that causes a light popping noise in the transfer case. A light popping type noise that occurs when shifting, and quits after the shift is completed would be considered normal. When shifting out of 4 HI in a mode shift, there may be a delay and a popping may be heard when the HI/LO clutch disengages.	

Cause	Correction
1. Compare the noise to a similar vehicle to see if a normal condition. 2. Identify the source of the noise using chassis ears and refer to the appropriate service manual section. 3. Note specifics such as when the noise is present (2HI, 4HI, OR 4LO). 4. Note if the noise relative to vehicle speed, is noisy on turns, or other specifics. 5. If the source of the noise is the transfer case, inspect for the correct fluid level. 6. Inspect the drain plug for large metal deposits. Small metal flakes and fine metal dust on the plug magnet are to be considered normal. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Transmission or transfer case mounts loose or damaged	Repair or replace the mounts as required
Propeller shaft center support bearing loose or damaged (as applicable)	Replace the center support bearing as required. Refer to **Symptoms - Propeller Shaft** .
Propeller shaft universal joints worn	Replace the universal joints as required. Refer to **Symptoms - Propeller Shaft** .
Suspension components worn	Replace the suspension components as required. Refer to **Noise Diagnosis - Front Suspension** , or **Noise Diagnosis - Rear Suspension** .
Front axle actuator shift noise	**NOTE:** **When shifting from 2WD-to-4WD or 4WD-to-2WD, the front axle actuator may be heard engaging or disengaging and the axle internal components shifting. This is to be**

Cause	Correction
	considered a normal condition. Shift from 2WD-to-4WD and from 4WD-to-2WD to determine if the noise source is the front axle to determine if this is a normal condition.
Transfer case drive and driven sprockets worn or a stretched chain causing a chain jump condition	**NOTE:** • **A chain jump condition may cause a banging noise and can only occur with the vehicle in 4WD.** • **A chain jump condition may be caused by water intrusion into the transfer case and deterioration of the transfer case fluid. Water intrusion conditions**

Cause	Correction
	may occur in extreme off road conditions or in situations where under-vehicle power washing occurs. 1. Inspect the oil for water intrusion and/or fluid discoloration and contamination. 2. Inspect the vent hose for proper routing and connection to the transfer case. 3. Inspect for damaged internal components. Refer to **Drive Chain, Drive Sprocket, and Driven Sprocket Cleaning and Inspection** . 4. Replace the chain and sprockets as required. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .

TRANSFER CASE BANGING NOISE

Cause	Correction
A faulty internal transfer case component that causes a loud banging noise in the transfer case.	1. Compare the noise to a similar vehicle to see if a normal condition. 2. Identify the source of the noise using chassis ears and refer to the appropriate service manual section. 3. Note specifics such as when the noise is present (2HI, 4HI, or 4LO). 4. Note if the noise is relative to vehicle speed, is noisy on turns, or other specifics. 5. If the source of the noise is the transfer case, inspect for the correct fluid level.

Cause	Correction
6. Inspect the drain plug for large metal deposits. Small metal flakes and fine metal dust on the plug magnet are to be considered normal. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Transmission or transfer case mounts loose or damaged	Repair or replace the mounts as required
Propeller shaft center support bearing loose or damaged (as applicable)	Replace the center support bearing as required. Refer to **Symptoms - Propeller Shaft** .
Propeller shaft universal joints worn	Replace the universal joints as required. Refer to **Symptoms - Propeller Shaft** .
Suspension components worn	Replace the Suspension components as required. Refer to **Noise Diagnosis - Front Suspension** , or **Noise Diagnosis - Rear Suspension** .
Transfer case rear output shaft bushing worn	**NOTE:** **A worn bushing and or slip yoke may also create a clunk type noise and may be indicated by a leaking rear output shaft seal.** Replace the rear output shaft bushing and propeller shaft slip yoke as required.
Transfer case shift fork pads broken	Replace the shift fork and pads as required. Refer to **High/Low Shift Components Cleaning and Inspection** .
Transfer case drive and driven sprockets worn or a stretched chain causing a chain jump condition	**NOTE:** • **A chain jump condition may cause a**

Cause	Correction
	banging noise and can only occur with the vehicle in 4WD. • A chain jump condition may be caused by water intrusion into the transfer case and deterioration of the transfer case fluid. Water intrusion conditions may occur in extreme off road conditions or in situations where under-vehicle power washing occurs.

Cause	Correction
	1. Inspect the oil for water intrusion and/or fluid discoloration and contamination. 2. Inspect the vent hose for proper routing and connection to the transfer case. 3. Inspect for damaged internal components. Refer to **Drive Chain, Drive Sprocket, and Driven Sprocket Cleaning and Inspection** . 4. Replace the chain and sprockets as required. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .

TRANSFER CASE WHINE OR RUMBLE NOISE

Cause	Correction
DEFINITION: A faulty internal transfer case component that causes a high pitch whine or low pitch rumbling noise in the transfer case. A high pitch whine or rumble noise with the vehicle in 4LO is to be considered normal. Heavy duty NQH transfer case applications are noisier by design in 4WD mode than are lighter duty applications. Compare the noise to a similar vehicle to see if a normal condition. 1. Identify the source of the noise using chassis ears and refer to the appropriate service manual section. 2. Note specifics such as when the noise is present (2HI, 4HI, OR 4LO). 3. Note if the noise relative to vehicle speed, is noisy on turns, or other specifics. 4. If the source of the noise is the transfer case, inspect for the correct fluid level. 5. Inspect the drain plug for large metal deposits. Small metal flakes and fine metal dust on the plug magnet are to be considered normal. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
TIRE NOISE	**NOTE:** **A high pitch whine or low pitch rumble noise that increases as vehicle speed increases**

Cause	Correction
	may be caused by tires that are, unevenly inflated, unevenly worn or have an aggressive tread pattern. Rotate or substitute tires and retest. Refer to **Tire and Wheel Inspection** .
Propeller shaft center support bearing worn (as applicable)	**NOTE:** **A high pitch whine or low pitch rumble noise that increases as vehicle speed increases may be caused by a worn center support bearing.** Replace the center support bearing as required. Refer to **Symptoms - Propeller Shaft** .
Propeller shaft universal joints worn	**NOTE:** **A high pitch whine or low pitch rumble**

Cause	Correction
	noise that increases as vehicle speed increases may be caused by worn universal joints. Replace the universal joints as required. Refer to **Symptoms - Propeller Shaft** .
Front or rear axle bearings worn	**NOTE:** • **A high pitch whine or low pitch rumble noise that increases as vehicle speed increase may be caused by worn axle bearings.** • **To determine if the noise is front axle**

Cause	Correction
	related, remove the front propeller shaft and retest. Repair or replace the axle as required. Refer to **Symptoms - Front Drive Axle** , or **Symptoms - Rear Drive Axle** .
Transmission rear output shaft bearing worn	**NOTE:** **A high pitch whine or low pitch rumble noise that increases as transmission output shaft speed increases may be caused by a worn transmission output shaft bearing.** Repair or replace the transmission as required. Refer to **Symptoms - Automatic Transmission** .
Transfer case fluid level low	**NOTE:** **A high pitch whine or low pitch rumble noise that increases as**

Cause	Correction
	transmission output shaft speed increases may be caused by a low transfer case fluid level. Fill the transfer case to the correct fluid level and retest.
Transfer case input shaft bearing worn	**NOTE:** **A high pitch whine or low pitch rumble noise that increases as transmission output shaft speed increases may be caused by a worn transfer case input shaft bearing.** Replace the bearing as required. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .
Transfer case rear output shaft bushing worn	**NOTE:** • **An excessively**

Cause	Correction
	worn bushing may be indicated by a leaking rear output shaft seal. • **A high pitch whine or low pitch rumble noise that increases as vehicle speed increases may be caused by a worn transfer case rear output shaft bushing.** Replace the rear output shaft bushing and propeller shaft slip yoke as required. Refer to **Rear Output Shaft Bushing Replacement (Light Duty)** **Rear Output Shaft Bushing Replacement (Heavy Duty)** .
Transfer case front or rear output shaft bearings worn	**NOTE:** **A high pitch whine or low**

Cause	Correction
	pitch rumble noise that increases with road speed may be caused by the front or rear output shaft bearing. Replace the bearings as required. To **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .
Transfer case planetary carrier gears worn	**NOTE:** • **A high pitch whine or low pitch rumble noise that increases in 2HI only may be caused by worn or damaged planetary gears and ring gear**

Cause	Correction
	damage. • **A whine noise that occurs in either 2HI or 4HI may be caused by worn planetary gear needle bearings or shafts.** • **A high pitch whine that occurs in 4LO may be caused by worn planetary gears or annulus gear. Repair as required** 1. Inspect for the following: • Chipped, bent, or deformed teeth

Cause	Correction
	• Planetary gear needle bearings worn • Planetary gear thrust washers cracked or missing • Seized or binding planetary gears 2. Replace the planetary components as required.

TRANSFER CASE GROWL OR GRINDING NOISE

Cause	Correction
DEFINITION: A faulty internal transfer case component that causes a low pitch growl or grinding noise in the transfer case while the vehicle is turning left or right or in a four wheel drive mode. A low pitch growl noise with the vehicle in 4LO or 4HI is to be considered normal. Heavy duty NQH transfer case applications are noisier by design in 4HI than are the light duty applications. 1. Compare the noise to a similar vehicle to see if a normal condition. 2. Identify the source of the noise using chassis ears and refer to the appropriate service manual section. 3. Note specifics such as when the noise is present (2HI, 4HI, OR 4LO). 4. Note if the noise relative to vehicle speed, is noisy on turns, or other specifics. 5. If the source of the noise is the transfer case, inspect for the correct fluid level. 6. Inspect the drain plug for large metal deposits. Small metal flakes and fine metal dust on the plug magnet are to be considered normal. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Tire wear	**NOTE:** **A growl noise that increases as vehicle speed increases may be caused by tires that are**

Cause	Correction
	unevenly worn, unevenly inflated, or have an aggressive tread pattern. Rotate or substitute tires and retest. Refer to **Tire and Wheel Inspection** .
Propeller shaft center support bearing worn (as applicable)	**NOTE:** **A growl or grinding noise that increases as vehicle speed increase may be caused by a worn center support bearing.** Replace the center support bearing as required. Refer to **Symptoms - Propeller Shaft** .
Propeller shaft universal joints worn	**NOTE:** **A growl or grinding noise that increases as vehicle speed increase may be**

Cause	Correction
	caused by worn universal joints. Replace the universal joints as required. Refer to **Symptoms - Propeller Shaft** .
Front or rear axle bearings worn	**NOTE:** • **A growl or grinding noise that increases as vehicle speed increases may be caused by worn axle bearings.** • **To determine if the noise is front axle related, remove the front propeller shaft and retest.**

Cause	Correction
	Repair or replace the axle as required. Refer to **Symptoms - Front Drive Axle** , or **Symptoms - Rear Drive Axle** .
Transmission rear output shaft bearing worn	**NOTE:** **A growl or grinding noise that increases as transmission output shaft speed increases may be caused by a worn transmission output shaft bearing.** Replace transmission components as required. Refer to **Symptoms - Automatic Transmission** .
Transfer case fluid level low	**NOTE:** **A growl or grinding noise that increases as transmission output shaft speed increases may be caused by a low transfer case fluid level.**

Cause	Correction
	Fill the transfer case to the correct fluid level and retest.
Transfer case input shaft bearing worn	**NOTE:** **A high pitch whine or low pitch rumble noise that increases as transmission output shaft speed increases may be caused by a worn transfer case input shaft bearing.** Replace the bearing as required. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .
Transfer case rear output shaft bushing worn	**NOTE:** • **An excessively worn bushing may be indicated by a leaking rear output shaft seal.** • **A growl or grinding**

Cause	Correction
	noise that increases as vehicle speed increases may be caused by a worn transfer case rear output shaft bushing. Replace the rear output shaft bushing and propeller shaft slip yoke as required. Refer to **Rear Output Shaft Bushing Replacement (Light Duty)** **Rear Output Shaft Bushing Replacement (Heavy Duty)** .
Transfer case front or rear output shaft bearings worn	**NOTE:** **A high pitch whine or low pitch rumble noise that increases with road speed may be caused by the front or rear output shaft bearing.** Replace the bearings as required. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .

Cause	Correction
Transfer case shift fork pads broken or missing	**NOTE:** **A growl, rattle, or grinding noise that occurs when a shift is commanded may be caused by broken or missing shift fork pads which may lead to incomplete engagement of the synchronizer teeth. Refer to High/Low Shift Components Cleaning and Inspection .** Replace the shift forks and pads as required. Refer to **Transfer Case Disassemble (Light Duty) Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty) Transfer Case Assemble (Heavy Duty)** .
Transfer case range sleeve or input shaft gears worn	A growl or grinding noise that occurs when a shift is commanded may be caused by worn range sleeve gears and incomplete engagement. Repair or replace as required.

Cause	Correction
Transfer case planetary carrier gears worn	**NOTE:** • **A high pitch whine or low pitch rumble noise that increases in 2HI only may be caused by worn or damaged planetary gears and ring gear damage.** • **A whine noise that occurs in either 2HI or 4HI may be caused by worn planetary gear needle bearings**

Cause	Correction
	or shafts. • **A high pitch whine that occurs in 4LO may be caused by worn planetary gears or annulus gear. Repair as required** 1. Inspect for the following: • Chipped, bent, or deformed teeth • Planetary gear needle bearings worn • Planetary gear thrust washers cracked or missing • Seized or binding planetary gears Refer to **High/Low Planetary Carrier Cleaning and Inspection (Light Duty)** **High/Low Planetary Carrier Cleaning and Inspection (Heavy Duty)** 2. Replace the planetary components as required.

TRANSFER CASE GRATING NOISE

Cause	Correction
DEFINITION: A faulty internal transfer case component that causes a grating noise in the transfer case while in the AWD, 4HI, or 4LO	

Cause	Correction
mode. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Broken clutch apply plate	1. Inspect for a broken clutch apply plate. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** . 2. Replace the apply plate and the transfer case components that are damaged from debris. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .
Faulty control actuator lever thrust bearings	1. Inspect for faulty control actuator lever thrust bearings. Refer to **Two/Four Wheel Drive Shift Components Cleaning and Inspection** . 2. Recondition the transfer case components that are damaged from debris. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .

TRANSFER CASE CLUNK IN 2HI ONLY

Cause	Correction
DEFINITION: During acceleration or deceleration, a clunk is heard or felt in the transfer case while in the 2HI mode. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Incorrect fluid level or incorrect fluid	1. Inspect the transfer case for the correct fluid level. 2. Inspect the transfer case for the correct type of fluid. Refer to **Approximate Fluid Capacities** . 3. Flush the transfer case and fill with the correct fluid, if required. Refer to **Transfer Case Fluid Replacement** .
Excessive clearance between the slip yoke and the rear output shaft	1. Inspect for the following conditions: • Worn slip yoke splines • Worn rear output shaft splines

Cause	Correction
	2. Repair or replace the following components if faulty: • Replace the slip yoke, if required. Refer to **Rear Propeller Shaft Replacement (1500)** **Rear Propeller Shaft Replacement (Heavy Duty)** **Rear Propeller Shaft Replacement (M5U, 2WD)** . • Replace the rear output shaft, if required. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .

Excessive clearance between the slip yoke and the rear bushing	1. Inspect for the following conditions:
	• Worn rear bushing
	• Worn slip yoke bushing journal
	2. Repair or replace the following components if faulty:
	• Replace the slip yoke, if required. Refer to **Rear Propeller Shaft Replacement (1500)** **Rear Propeller Shaft Replacement (Heavy Duty)** **Rear Propeller Shaft Replacement (M5U, 2WD)** .
	• Replace the rear bushing if worn.
	  • For light duty vehicles, refer to **Transfer Case Rear Extension Bushing Replacement** .
	  • For heavy duty vehicles, refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .

Input shaft thrust washers	1. Inspect for worn or missing input shaft thrust washers. 2. Replace the thrust washers as required. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .
Worn high speed teeth on the high/low clutch	1. Inspect for worn high speed teeth on the high/low clutch. Refer to **High/Low Shift Components Cleaning and Inspection** . 2. Replace the high/low clutch if worn. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)**

Cause	Correction
	Transfer Case Assemble (Heavy Duty) .
Rear output shaft rear bearing outer retaining ring	1. Inspect for the following conditions: • Properly installed rear output shaft rear bearing outer retaining ring • Excessive wear or damaged retaining ring groove in the rear case half 2. Repair or replace the following components if found faulty. • Properly install a new rear output shaft rear bearing outer retaining ring. • Replace the rear case half if the retaining ring groove is excessively worn. Refer to Transfer Case Disassemble (Light Duty) Transfer Case Disassemble (Heavy Duty) , and Transfer Case Assemble (Light Duty) Transfer Case Assemble (Heavy Duty) .

TRANSFER CASE CLUNK IN 4HI

Cause	Action
DEFINITION: During acceleration or deceleration, a clunk is heard or felt in the transfer case while in the 4HI range only. 1. Compare the noise to a similar vehicle and see if a normal condition. 2. Identify the source of the noise using chassis ears and refer to the appropriate service manual section. 3. Note specifics such as when the noise is present (2HI, 4HI, OR 4LO). 4. Note if the noise relative to vehicle speed, is noisy on turns, during acceleration, stops, or other specifics. 5. If the source of the noise is the transfer case, inspect for the correct fluid level. 6. Inspect the drain plug for large metal deposits. Small metal flakes and fine metal dust on the plug magnet are to be considered normal. Review the Symptoms - Transfer Case and perform the necessary inspections.	
Tire pressure uneven	**NOTE:** **A clunk condition that occurs**

Cause	Action
	when performing slow speed turns in 4WD may be caused by low or uneven tire pressure. 1. Set the tires to the recommended vehicle tire pressure for evaluation to see if the noise goes away. 2. Upon completion of the test, reset the tire pressure to the correct pressure as recommended on the tire.
Transmission or transfer case mounts loose or damaged	Repair or replace the mounts as required
Propeller shaft center support bearing worn (as applicable)	Replace the center support bearing as required. Refer to **Symptoms - Propeller Shaft** .
Propeller shaft universal joints worn	Replace the universal joints as required. Refer to **Symptoms - Propeller Shaft**
Front axle actuator shift noise	**NOTE:** **When shifting from 2WD-to-4WD or 4WD-to-2WD, the front axle actuator may be heard engaging or disengaging and the axle internal components**

Cause	Action
	shifting. This is to be considered a normal condition. Shift from 2WD-to-4WD and from 4WD-to-2WD to determine if the noise source is the front axle to determine if this is a normal condition.
SUSPENSION COMPONENTS WORN	REPLACE THE SUSPENSION COMPONENTS AS REQUIRED. REFER TO **Noise Diagnosis - Front Suspension** , OR **Noise Diagnosis - Rear Suspension** .
4WD gear noise	**NOTE:** **A growl or clunk that occurs with vehicle in 4WD at low speed in a tight turning radius situation may be caused by the gears and chain and is to be considered a normal condition and an operating characteristic of a 4WD system.** Operated the vehicle in 4WD performing low speed left or right turns to confirm a transfer case

Cause	Action
	gear noise.
Transfer case planetary carrier gears worn	**NOTE:** • **A clunk in 4HI noise that increases in 2HI only may be caused by worn or damaged planetary gears and ring gear damage.** • **A clunk in noise that occurs in either 2HI or 4HI may be caused by worn planetary gear needle bearings or shafts.** • **A clunk**

Cause	Action
	that occurs in 4LO may be caused by worn planetary gears or annulus gear. Repair as required. 1. Inspect the following: • Chipped, bent, or deformed teeth • Planetary gear needle bearings worn • Planetary gear thrust washers cracked or missing • Seized or binding planetary gears Refer to **High/Low Planetary Carrier Cleaning and Inspection (Light Duty)** **High/Low Planetary Carrier Cleaning and Inspection (Heavy Duty)** . 2. Replace the planetary components as required.
Transfer case rear output shaft rear bearing retaining ring- incorrectly installed	1. Inspect for the following: • Improperly installed rear output shaft rear bearing outer retaining ring. The snap ring is to be installed completely into the OD groove of the bearing. • Excessive wear or damaged retaining ring groove in the rear case half 2. Repair or replace the following components AS REQUIRED: • Properly install a new rear output shaft rear bearing outer retaining ring. • Replace the rear case half if the retaining ring groove is excessively worn. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy**

Cause	Action
	Duty) , and Transfer Case Assemble (Light Duty) Transfer Case Assemble (Heavy Duty) .

TRANSFER CASE CLUNK IN 4LO

Cause	Correction
DEFINITION: During acceleration or deceleration, a clunk is heard or felt in the transfer case while in the 4LO range only. It is typical for the vehicle to exhibit significant engagement noise and bump when shifting between Four-Wheel Drive Low and Four-Wheel Drive High ranges or from transfer case N (Neutral) with the engine running. 1. Review the correct owners manual shifting procedures with the customer. 2. Compare the noise to a similar vehicle and see if a normal condition. 3. Identify the source of the noise using chassis ears and refer to the appropriate service manual section. 4. Note specifics such as when the noise is present (2HI, 4HI, OR 4LO). 5. Note if the noise relative to vehicle speed, is noisy on turns, during acceleration, stops, or other specifics. 6. If the source of the noise is the transfer case, inspect for the correct fluid level. 7. Inspect the drain plug for large metal deposits. Small metal flakes and fine metal dust on the plug magnet are to be considered normal. Review the Symptoms - Transfer Case and perform the necessary inspections.	
Tire pressure uneven	**NOTE:** **A clunk condition that occurs when performing slow speed turns in 4WD may be caused by low or uneven tire**

Cause	Correction
	pressure. 1. Check the tire pressure and adjust as required to the value recommended by the label on the vehicle. 2. Road test the vehicle
Transmission or transfer case mounts loose or damaged	Repair or replace the mounts as required
Propeller shaft center support bearing worn (as applicable)	Replace the center support bearing as required. Refer to **Symptoms - Propeller Shaft** .
Propeller shaft universal joints worn	Replace the universal joints as required. Refer to **Symptoms - Propeller Shaft** .
Front axle actuator shift noise	**NOTE:** **When shifting from 2WD-to-4WD or 4WD-to-2WD, the front axle actuator may be heard engaging or disengaging and the axle internal components shifting. This is to be considered a normal condition.** Shift from 2WD-to-4WD and from 4WD-to-2WD to determine if the noise source is the front axle to determine if this is a normal condition.

Cause	Correction
Suspension components worn	Replace the suspension components as required. Refer to **Noise Diagnosis - Front Suspension** , or **Noise Diagnosis - Rear Suspension** .
Tire scuffing noise	**NOTE:** **A growl or clunk that occurs with vehicle in 4WD at low speed in a tight turning radius situation may be caused by a tire scuffing type noise and is to be considered a normal condition and operating characteristic of a part-time 4WD system.** Operated the vehicle in 4WD performing low speed left and right turns to confirm a tire scuffing type noise.
Transfer case planetary carrier gears worn	**NOTE:** • **A clunk in 4HI noise that increases**

Cause	Correction
	in 2HI only may be caused by inspect for worn or damaged planetary gears and ring gear damage. • A clunk in noise that occurs in either 2HI or 4HI may be caused by worn planetary gear needle bearings or shafts. • A clunk that occurs in 4LO may be caused

Cause	Correction
	by worn planetary gears or annulus gear. Repair as required 1. Inspect for the following: • Chipped, bent, or deformed teeth • Planetary gear needle bearings worn • Planetary gear thrust washers cracked or missing • Seized or binding planetary gears 2. Replace the planetary components as required.

TRANSFER CASE CLUNK DURING ACCELERATION AND DECELERATION

Cause	Correction
DEFINITION: During acceleration or deceleration, a clunk is heard or felt in the transfer case when it is in AWD mode. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Incorrect fluid level or incorrect fluid	1. Inspect the transfer case for the correct fluid level. 2. Inspect the transfer case for the correct type of fluid. Refer to **Approximate Fluid Capacities** . 3. Flush the transfer case and fill with the correct fluid, if required. Refer to **Transfer Case Fluid Replacement** .
Excessive clearance between the slip yoke and the rear output shaft	1. Inspect for the following conditions: • Worn slip yoke splines • Worn rear output shaft splines 2. Repair or replace the following components if faulty:

Cause	Correction
	• Replace the slip yoke, if required. Refer to **Rear Propeller Shaft Replacement (1500)** **Rear Propeller Shaft Replacement (Heavy Duty)** **Rear Propeller Shaft Replacement (M5U, 2WD)** . • Replace the rear output shaft, if required. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .

Excessive clearance between the slip yoke and the rear bushing	1. Inspect for the following conditions:
	• Worn rear bushing
	• Worn slip yoke bushing journal
	2. Repair or replace the following components if faulty:
	• Replace the slip yoke, if required. Refer to **Rear Propeller Shaft Replacement (1500)** **Rear Propeller Shaft Replacement (Heavy Duty)** **Rear Propeller Shaft Replacement (M5U, 2WD)** .
	• Replace the rear bushing if worn.
	  • For light duty vehicles, refer to **Rear Output Shaft Seal Replacement** .
	  • For heavy duty vehicles, refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .

TRANSFER CASE SHUDDER OR BINDING

Cause	Correction
DEFINITION: When in the AWD mode, a shudder is felt during acceleration or a crow-hop or binding while turning, which may cause tire scuffing. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Oil breakdown or contamination	Flush the transfer case and fill with the correct fluid. Refer to **Transfer Case Fluid Replacement** .
Incorrect transfer case fluid	Flush the transfer case and fill with the correct fluid. Refer to **Transfer Case Fluid Replacement** .

Cause	Correction
Burrs on the clutch hub slots	1. Inspect the clutch disc tab slots in the clutch hub for burrs or notches. Refer to **Two/Four Wheel Drive Shift Components Cleaning and Inspection** . 2. De-burr the hub slots. If the hub slots are excessively notched, replace the clutch hub. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .

TRANSFER CASE WILL NOT SHIFT

Cause	Correction
DEFINITION: The transfer case will not shift from 2 wheel drive to 4 wheel drive or there is a gear clashing when shifting from hi to lo modes. When shifting from 2HI or 4HI to 4LO, the transmission must be in neutral and the vehicle speed below 3 mph. 1. Review the correct owners manual shifting procedures with the customer. 2. Inspect for the correct fluid level. 3. Inspect the drain plug for large metal deposits. Small metal flakes and fine metal dust on the plug magnet are to be considered normal. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Front axle actuator	**NOTE:** • **A transfer case that will not shift into 4WD may be caused by the front axle actuator.** • **If the symptoms occur during cold temperatures,**

Cause	Correction
	flush and fill the front axle with synthetic fluid. Refer to Front Axle Lubricant Level Inspection (8.25 Inch LD Axle) Front Axle Lubricant Level Inspection (9.25 Inch HD Axle) . 1. Perform the **Diagnostic System Check - Vehicle** before using the symptom tables, in order to verify the following conditions are true: • There are no diagnostic trouble codes (DTCs) present. • The control modules can communicate via the serial data link. 2. Inspect for an intermittent. Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** . Some symptoms may be caused by loose wiring. Test the system after moving or connecting harnesses, but before replacing parts. Refer to **Four-Wheel Drive Does Not Engage** .
Electrical system	1. Perform the **Diagnostic System Check - Vehicle** before using the symptom tables, in order to verify the following conditions are true: • There are no diagnostic trouble codes (DTCs) present. • The control modules can communicate via the serial data link.

Cause	Correction
	2. Inspect for an intermittent. Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** . Some symptoms may be caused by loose wiring. Test the system after moving or connecting harnesses, but before replacing parts. Refer to **Four-Wheel Drive Does Not Engage** .
Transfer case shift fork pads broken or missing	**NOTE:** **A growl, rattle, or grinding noise that occurs when a shift is commanded may be caused by broken or missing shift fork pads which may lead to incomplete engagement of the high/low clutch teeth. Refer to High/Low Shift Components Cleaning and Inspection .** Replace the shift forks and pads as required. Refer to **Transfer Case Disassemble (Light Duty)**

Cause	Correction
	Transfer Case Disassemble (Heavy Duty) , and Transfer Case Assemble (Light Duty) Transfer Case Assemble (Heavy Duty) .
Transfer case high/low clutch gear tooth damage	**NOTE:** **Excessive gear tooth damage may cause a will not shift or gear clash when shifting condition.** 1. Inspect the gear teeth for excessive damage. Refer to High/Low Shift Components Cleaning and Inspection . 2. Inspect the splines of the high/low clutch and rear output shaft to ensure the clutch moves freely on the shaft. 3. Replace components as required.
Clutch pack	A worn clutch pack may set a DTC and disable shifting. Refer to Diagnostic System Check - Vehicle .
Shift levers and shift components	**NOTE:** • **An incorrect technician repair using mismatched heavy duty (HD) and light duty (LD) shift levers and shift lever balls may**

Cause	Correction
	lead to a will not shift condition. Refer to Transfer Case Description and Operation for additional shift lever and shift lever ball information. • **Apply plate installed incorrectly after a service overhaul.** • **Worn shift lever components may set a DTC and disable shifting.** Refer to **Diagnostic System Check - Vehicle** .
Rear output shaft snap ring broken or out of position	**NOTE:** **A broken or mis-**

Cause	Correction
	positioned rear output shaft snap ring may lead to a will not shift condition. Inspect for a broken or mis-positioned rear output shaft snap ring.
Transfer case high/low planetary carrier assembly	**NOTE:** **In situations where there is excessive input shaft gear teeth wear, it may not be possible to engage 4LO.** 1. Inspect the planetary gears and high/low internal gear for wear or damage. Refer to **High/Low Planetary Carrier Cleaning and Inspection (Light Duty)** **High/Low Planetary Carrier Cleaning and Inspection (Heavy Duty)** . 2. Inspect the input shaft gear teeth for wear or damage 3. Replace components as required.

TRANSFER CASE JUMPS OUT OF GEAR

Cause	Correction
DEFINITION: Loss of the transfer case drive torque during deceleration, acceleration or under load or the transfer case jumps out of gear and into a neutral position. 1. Inspect for the correct fluid level.	

Cause	Correction
2. Inspect the drain plug for large metal deposits. Small metal flakes and fine metal dust on the plug magnet are to be considered normal. Review the **Symptoms - Transfer Case** and perform the necessary inspections.	
Transfer case control actuator lever bearing	Inspect for a worn or damaged control actuator lever and/or bearing Replace components as required.
Transfer case Actuator motor brake	**NOTE:** • **The actuator motor brake may lead to a will not shift or jumps out of gear condition** • **If the condition is caused by a brake electrical condition, a DTC will be set.** • **If the condition is caused by a brake electrical**

Cause	Correction
	condition, a DTC will be set. Inspect the electrical system for a properly operating actuator motor.
Rear output shaft snap ring broken or out of position	**NOTE:** **A broken or out-of-positioned rear output shaft snap ring may lead to a will-not-shift or jumps-out-of-gear condition.** Inspect for a broken or out-of-position rear output shaft snap ring.
Transfer case shift fork broken or fork pads broken or missing	**NOTE:** **A growl, rattle, or grinding noise that occurs when a shift is commanded may be caused by broken or missing shift fork pads**

Cause	Correction
	which may lead to incomplete engagement of the high/low clutch teeth. Refer to High/Low Shift Components Cleaning and Inspection . Replace the shift forks and pads as required. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .

TRANSFER CASE LEAK DIAGNOSIS

Cause	Correction
DEFINITION: A visible indication of an external fluid leak from the transfer case. Review the **Symptoms - Transfer Case** and perform the necessary inspections. See below for suggested diagnostic method(s).	
Special Tools **GE-28431-6** Fluorescent Oil Dye **GE-28428-E** High Intensity Black Light Kit For equivalent regional tools, refer to **Special Tools** . **Fluorescent Dye Method** 1. Add **GE-28431-6** Fluorescent dye to the transmission or transfer case to determine the source of the leak. 2. Operate the vehicle. 3. Inspect for the presence of dye within the oil leak using the **GE-28428-E** High Intensity Black Light Kit. A presence or non-presence	

Cause	Correction

of dye within the oil leak will indicate which component is the source of the leak.

Powder Method

CAUTION:
Do not clean using brake cleaner or other reactive solvents as these solvents can damage rubber gaskets, seals and bushings.

1. Thoroughly clean the suspected leak area using a rag.
2. Apply an aerosol type leak tracing powder to the suspected leak area.

NOTE:
Do not drive the vehicle on the freeway as this will splatter oil inhibiting leak diagnosis.

3. Operate the vehicle for 15-20 minutes under city driving conditions until normal operating temperatures are reached.

Cause	Correction
4. Shut OFF the engine. 5. Inspect the suspected leak area. 6. Trace the leak path through the powder in order to find the source of the leak.	
Transfer case adapter leak	**NOTE:** **Dry cavity adapter applications (transmission RPOs MYC/MYD) with a leak at the adapter weep hole location may caused by either a leaking transmission rear output shaft oil seal or a leaking transfer case input shaft oil seal. The adapter gasket is not the source of the leak.** 1. Inspect for a restricted vent hose assembly. Repair as required. 2. Add **GE-28431-6** Fluorescent dye to the transmission to determine the source of the leak. 3. Operate the vehicle

Cause	Correction
	4. Inspect the adapter weep hole for a fluid leak and for traces of dye within the oil using the **GE-28428-E** High intensity black light kit. 5. If fluorescent dye is present within the fluid leak, replace the transmission rear output shaft seal. 6. If fluorescent dye is not present within the fluid leak, replace the transfer case input shaft oil seal. Refer to **Input Shaft Seal Replacement** .
Vent hose leak	1. Inspect the transfer case for an overfill condition. Refer to **Transfer Case Fluid Replacement** . 2. Inspect for a loose, disconnected, restricted, or damaged vent hose assembly. 3. Replace components as required.
Drain plug or fill plug leak	1. Inspect for the correct amount and type of sealer on the plugs. Refer to **Adhesives, Fluids, Lubricants, and Sealers** . 2. Install the correct sealer onto the threads of the plugs and tighten to the correct torque value. Refer to **Transfer Case Fluid Replacement** .
Rear output shaft bearing snap ring access hole plugs leak	Replace the access hole plugs as required.
Vehicle speed sensor (VSS) leak	1. Remove the VSS. Refer to **Vehicle Speed Sensor Replacement** . 2. Inspect the VSS for the following conditions: • Cross threaded • Cut or damaged VSS O-ring seal • VSS over tightened causing deformation of the sensor 3. Replace the VSS O-ring seal or sensor as required.
Propeller shaft slip yoke cup plug leak	1. Inspect for a leaking cup plug in the rear of the propeller shaft slip yoke 2. Replace the yoke assembly as required.
Rear output shaft oil seal leak	1. Inspect for a restricted vent hose assembly. Repair as required.

Cause	Correction
	2. Inspect for a transfer case for an overfill condition. 3. Inspect for a leaking rear output shaft oil seal. Refer to **Rear Output Shaft Seal Replacement** . 4. Inspect the propeller shaft slip yoke sealing surface for excessive wear, rust, or other damage. Minor abrasions may be repaired using very fine emery cloth sandpaper. Refer to **Symptoms - Propeller Shaft** . 5. Inspect the rear output shaft bushing for excessive wear. Refer to **Transfer Case Rear Extension Bushing Replacement** . 6. Replace components as required.
Front output shaft oil seal leak	1. Inspect for a restricted vent hose assembly. Repair as required. 2. Inspect for a transfer case for an overfill condition. 3. Inspect for a leaking front output shaft oil seal. Refer to **Front Output Shaft Seal Replacement** . 4. Replace components as required.
Actuator shaft position sensor or O-ring seal leak	1. Inspect the sensor for porosity or a cut or damaged O-ring seal. 2. Replace components as required.
Two/four wheel drive actuator seal leak	1. Inspect for a leaking two/four wheel drive actuator motor seal leak. 2. Replace the motor and seal assembly as required.
Front case half-to-rear case half seam leak	Disassemble the transfer case and Reseal the case halves. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** , and **Transfer Case Assemble (Light Duty)** **Transfer Case Assemble (Heavy Duty)** .
Case leak	1. Inspect for a cracked case half or case porosity. 2. Add **GE-28431-6** Fluorescent Dye to the transfer case. 3. Operate the vehicle 4. Inspect the transfer case fluid leak for presence of dye within the oil using the **GE-28428-E** High Intensity Black Light Kit. Refer to **Transfer Case Disassemble (Light**

Cause	Correction
	Duty) Transfer Case Disassemble (Heavy Duty) , and Transfer Case Assemble (Light Duty) Transfer Case Assemble (Heavy Duty) .

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TRANSMISSION

Transfer Case - MP 3023/3024 (NQH) - Repair Instructions - Off Vehicle - Escalade, Suburban, Tahoe, Yukon

REPAIR INSTRUCTIONS - OFF VEHICLE

TRANSFER CASE DISASSEMBLE (LIGHT DUTY)

Transfer Case Holding Fixture Installation

Fig. 1: Transfer Case Holding Fixture
Courtesy of GENERAL MOTORS COMPANY

Transfer Case Holding Fixture Installation

Callout	Component Name

Callout	Component Name
1	Transfer Case Nuts **Special Tools** **J-45759** Assembly Fixture For equivalent regional tools, refer to **Special Tools** .
2	Transfer Case **Special Tools** **J-3289-20** Holding Fixture
3	Pivot Pin **NOTE:** • **Always secure with the pivot pin after rotating.** • **The transfer case can be rotated 360 degrees to facilitate repair.**

Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor, and Vehicle Speed Sensor Removal

Fig. 2: Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor and Vehicle Speed Sensor
Courtesy of GENERAL MOTORS COMPANY

Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor, and Vehicle Speed Sensor Removal

Callout	Component Name
1	Transfer Case Actuator Shaft Position Sensor Bolt/Screw
2	Transfer Case Actuator Shaft Position Sensor Assembly
3	Transfer Case Actuator Shaft Position Sensor O-Ring Seal
4	Transfer Case Two/Four Wheel Drive Actuator Bolt/Screw
5	Transfer Case Two/Four Wheel Drive Actuator Assembly
6	Transfer Case Oil Drain Plug
7	Transfer Case Oil Fill Plug
8	Transfer Case Vent

Callout	Component Name
	NOTE:
9	Vehicle Speed Sensor Assembly
10	Vehicle Speed Sensor O-Ring Seal
11	Transfer Case Access Hole Plugs (Qty: 2)
12	Transfer Case Vibration Dampener Nut- Model Dependent **NOTE:** **During nut removal if the stud rotates, use a second tool to retain the stud.**
13	Transfer Case Vibration Dampener - Model Dependent
14	Transfer Case Vibration Dampener Stud - Model Dependent **NOTE:** **Note the location and length of the studs for reassembly.**

Remove ONLY if the vent pipe is damaged.

Rear Output Shaft Seal and Bushing Removal

Fig. 3: View Of Transfer Case Rear Output Shaft Seal & Bushing
Courtesy of GENERAL MOTORS COMPANY

Rear Output Shaft Seal and Bushing Removal

Callout	Component Name
1	Transfer Case Rear Output Shaft Seal **CAUTION:** **Refer to Transfer Case Seal Removal Caution .**
2	Transfer Case Rear Output Shaft Bushing Follow the steps below for use of the **J-45380** remover/installer.

Callout	Component Name
	Procedure 1. Only remove the bushing if faulty. Refer to **Transfer Case Rear Half Cleaning and Inspection**. 2. Install the finger section of the **J-45380** remover/installer in front of the bushing. 3. Install the tube and forcing screw assembly into the finger section. Ensure the forcing screw is backed out. 4. Using a wrench on the forcing screw, remove the bushing. **Special Tools** **J-45380** Transfer Case Rear Bushing Remover and Installer

Transfer Case Rear Case Half Removal

Fig. 4: View Of Transfer Case Halves, Bracket & Bolts

Courtesy of GENERAL MOTORS COMPANY

Transfer Case Rear Case Half Removal

Callout	Component Name
1	Transfer Case Bolts (Qty: 17)
2	Transfer Case Bracket
3	Transfer Case Rear Case Half **CAUTION:** **Refer to Machined Surface Damage Caution .** **NOTE:** • **Use opposing pry bars at casting bosses to spread the case.** • **Use snap ring pliers to release the transfer case rear output shaft outer retaining ring from**

Callout	Component Name
	the transfer case rear output shaft rear bearing assembly.

Oil Pump Suction Pipe and Actuator Shaft Gear Removal

Fig. 5: View Of Oil Pump Suction Pipe, Seal & Actuator Shaft Gear
Courtesy of GENERAL MOTORS COMPANY

Oil Pump Suction Pipe and Actuator Shaft Gear Removal

Callout	Component Name
1	Transfer Case Actuator Shaft Gear
2	Transfer Case Oil Pump Suction Pipe
3	Transfer Case Oil Pump Suction Pipe Seal

Shift Fork Assembly, Drive Chain, and Rear Output Shaft Assembly Removal

Fig. 6: View Of Shift Fork Assembly, Drive Chain, & Rear Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Shift Fork Assembly, Drive Chain, and Rear Output Shaft Assembly Removal

Callout	Component Name
1	Transfer Case Rear Output Shaft Assembly

Callout	Component Name
	NOTE:
2	Transfer Case High/Low Shift Fork Assembly
3	Transfer Case High/Low Clutch
4	Transfer Case Front Output Shaft Drive Chain Assembly

Mount the assembly into a soft-jaw vice or holding fixture for disasser

Rear Output Shaft Assembly Disassemble

Fig. 7: Rear Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Rear Output Shaft Assembly Disassemble

Callout	Component Name
1	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring

Callout	Component Name
2	Transfer Case Rear Output Shaft Rear Bearing Assembly **NOTE:** **Use an arbor press or suitable puller to remove the bearing from the rear output shaft.**
3	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring - Present on Non-Hybrid Applications Only
4	Transfer Case Rear Output Shaft Speed Reluctor Wheel
5	Transfer Case Oil Pump Assembly
6	Transfer Case Front Output Shaft Drive Sprocket Retaining Ring
7	Transfer Case Front Output Shaft Drive Sprocket Spacer - Rear
8	Transfer Case Front Output Shaft Drive Sprocket
9	Transfer Case Four Wheel Drive Clutch Housing Retaining Ring
10	Transfer Case Four Wheel Drive Clutch Housing
11	Transfer Case Front Output Shaft Drive Sprocket Bearing Assembly (Qty: 2) **Procedure** Only remove the bearing if faulty. Refer to **Drive Chain, Drive Sprocket, and Driven Sprocket Cleaning and Inspection**.
12	Transfer Case Front Output Shaft Drive Sprocket Spacer - Front
13	Transfer Case Two/Four Wheel Drive Clutch Retaining Ring
14	Transfer Case Four Wheel Drive Clutch Shim
15	Transfer Case Four Wheel Drive Clutch Hub
16	Transfer Case Four Wheel Drive Clutch Pressure - Friction - Plate (Qty: 8)
17	Transfer Case Four Wheel Drive Clutch Pressure - Steel - Plate (Qty: 7)
18	Transfer Case Four Wheel Drive Clutch Pressure Plate Spring (Qty: 4)
19	Transfer Case Four Wheel Drive Clutch Pressure - Apply - Plate
20	Transfer Case Control Actuator Lever Washer

Callout	Component Name
21	Transfer Case Control Actuator Lever Thrust Bearing Assembly
22	Transfer Case Control Actuator Lever Assembly **NOTE:** **Refer to Service Parts Release Usage Change - NQH/NPO Control Actuator Levers in the New Product Information .**
23	Transfer Case Control Actuator Lever Ball (Qty: 3)
24	Transfer Case Control Actuator Lever Bearing Assembly
25	Transfer Case Control Lever
26	Transfer Case Control Actuator Lever Thrust Bearing Assembly
27	Transfer Case Rear Output Shaft

Input Shaft Oil Seal Removal

Fig. 8: Input Shaft Oil Seal
Courtesy of GENERAL MOTORS COMPANY

Input Shaft Oil Seal Removal

Callout	Component Name
1	Input Shaft Oil Seal **CAUTION:** **Refer to Machined Surface Damage Caution .** **Procedure**

Callout	Component Name
	1. Drill a pilot hole, as required, and insert a self-tapping screw into the body of the seal. 2. Use a plier or slide hammer type tool to remove the seal from the bore.

Input Shaft and Planetary Assembly Removal

Fig. 9: Input Shaft and Planetary Assembly
Courtesy of GENERAL MOTORS COMPANY

Input Shaft and Planetary Assembly Removal

Callout	Component Name
1	Transfer Case Input Shaft Seal
2	Transfer Case Input Shaft Bearing Outer Retaining Ring

Callout	Component Name
	WARNING:
3	Transfer Case Input Shaft/Planetary Assembly **Do not rotate the transfer and holding fixture with the retaining ring removed. Rotating may cause the input shaft/planetary assembly to fall from the transfer case, resulting in personal injury.** **NOTE:** **Refer to Interim Model Year Design Change - NQF/NQG/NQH Front Case Half Assembly, Input Shaft, Planetary Carrier High/Low Clutch in the New Product Information .**
4	Transfer Case High/Low Planetary Carrier Retaining Ring
5	Transfer Case High/Low Locking Plate
6	Transfer Case Planetary Carrier Sun Gear Thrust Washer
7	Transfer Case Input Shaft
8	Transfer Case Input Shaft Pilot Bearing Assembly **Procedure** Only remove the bearing if faulty. Refer to **Front Output Shaft and Input Shaft Cleaning and Inspection**.
9	Transfer Case Planetary Carrier Sun Gear Thrust Washer
10	Transfer Case High/Low Planetary Carrier Assembly
11	Transfer Case Input Shaft Inner Retaining Ring
12	Transfer Case Input Shaft Bearing Assembly

Front Output Shaft Assembly Removal

Fig. 10: View Of Transfer Case Front Half, Output Shaft Assembly & Seal
Courtesy of GENERAL MOTORS COMPANY

Front Output Shaft Assembly Removal

Callout	Component Name
1	Transfer Case Front Output Shaft Oil Slinger - Model Dependent **NOTE:** **Refer to Interim Model Year Design Change - NQF/NQG /NQH/NPO**

Callout	Component Name
	Front Output Shaft, Deflector, Seal in the New Product Information .
2	Transfer Case Front Output Shaft Seal **Procedure** 1. Insert a screwdriver between the metal inner and metal outer portions of the seal. 2. Pry upward in multiple locations working the metal inner portion of the seal off the shaft until removed. 3. Once the inner metal portion is removed, insert a screwdriver between the outer diameter metal flange of the seal and the housing. 4. Drive the screwdriver inward in multiple locations, the outer portion of the seal will be distorted and can easily be removed from the housing. **NOTE:** **Remove the front output shaft seal in two pieces using the following procedure.**
3	Transfer Case Front Case Half **NOTE:** **Place the front case half on an arbor press.**

Callout	Component Name
4	Transfer Case Front Output Shaft Assembly **NOTE:** **Press the front output shaft assembly from the front case half using an arbor press or soft-face hammer.**

TRANSFER CASE DISASSEMBLE (HEAVY DUTY)

Transfer Case Holding Fixture Installation

Fig. 11: Transfer Case Holding Fixture
Courtesy of GENERAL MOTORS COMPANY

Transfer Case Holding Fixture Installation

Callout	Component Name
1	Transfer Case Nuts **Special Tools** **DT-45759** Assembly Fixture For equivalent regional tools, refer to **Special Tools** .
2	Transfer Case **Special Tools** **GE-3289-20** Holding Fixture For equivalent regional tools, refer to **Special Tools** .
3	Pivot Pin

Callout	Component Name
	NOTE:

- **Always secure wit piv pin rota**
- **The tra cas car rota 360 deg to fac rep**

Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor, and Vehicle Speed Sensor Removal

Fig. 12: Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor, and Vehicle Speed Sensor
Courtesy of GENERAL MOTORS COMPANY

Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor, and Vehicle Speed Sensor Removal

Callout	Component Name
1	Transfer Case Actuator Shaft Position Sensor Bolt/Screw
2	Transfer Case Actuator Shaft Position Sensor Assembly
3	Transfer Case Actuator Shaft Position Sensor O-ring Seal
4	Transfer Case Two/Four Wheel Drive Actuator Bolt/Screw

Callout	Component Name
5	Transfer Case Two/Four Wheel Drive Actuator Assembly
6	Transfer Case Oil Drain Plug
7	Transfer Case Oil Fill Plug
8	Transfer Case Vent **NOTE:** **Remove ONLY if the vent pipe is damaged.**
9	Vehicle Speed Sensor Assembly
10	Vehicle Speed Sensor O-ring Seal
11	Transfer Case Access Hole Plugs (Qty: 2)

Rear Output Shaft Seal and Bushing Removal

Fig. 13: View Of Transfer Case Rear Output Shaft Seal & Bushing
Courtesy of GENERAL MOTORS COMPANY

Rear Output Shaft Seal and Bushing Removal

Callout	Component Name
1	Transfer Case Rear Output Shaft Seal **CAUTION:** **Refer to Transfer Case Seal Removal Caution .**
2	Transfer Case Rear Output Shaft Bushing Follow the steps below for use of the **DT-48734** remover/installer.

Callout	Component Name
	Procedure 1. Install the finger section of the **DT-48734** remover/installer in front of the bushing. 2. Install the tube and forcing screw assembly into the finger section. Ensure the forcing screw is backed out. 3. Using a wrench on the forcing screw, remove the bushing. **NOTE:** **Only remove the bushing if faulty. Refer to Transfer Case Rear Half Cleaning and Inspection.** **Special Tools** **DT-48734** Extension Housing Bushing Replacer For equivalent regional tools, refer to **Special Tools** .

Transfer Case Rear Case Half Removal

Fig. 14: View Of Transfer Case Halves, Bracket & Bolts
Courtesy of GENERAL MOTORS COMPANY

Transfer Case Rear Case Half Removal

Callout	Component Name
1	Transfer Case Bolts (Qty: 17)
2	Transfer Case Bracket
3	Transfer Case Rear Case Half **CAUTION:** **Refer to** **Machined Surface Damage**

Callout	Component Name
	Caution . **NOTE:** • **Use opposing pry bars at casting bosses to spread the case.** • **Use snap ring pliers to release the transfer case rear output shaft outer retaining ring from the transfer case rear output shaft rear bearing assembly.**

Oil Pump Suction Pipe and Actuator Shaft Gear Removal

Fig. 15: View Of Oil Pump Suction Pipe, Seal & Actuator Shaft Gear
Courtesy of GENERAL MOTORS COMPANY

Oil Pump Suction Pipe and Actuator Shaft Gear Removal

Callout	Component Name
1	Transfer Case Actuator Shaft Gear
2	Transfer Case Oil Pump Suction Pipe
3	Transfer Case Oil Pump Suction Pipe Seal

Shift Fork Assembly, Drive Chain, and Rear Output Shaft Assembly Removal

Fig. 16: View Of Shift Fork Assembly, Drive Chain, & Rear Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Shift Fork Assembly, Drive Chain, and Rear Output Shaft Assembly Removal

Callout	Component Name
1	Transfer Case Rear Output Shaft Assembly **NOTE:** **Mount the assembly into a soft-jaw vice or holding fixture for disassembly.**

Callout	Component Name
2	Transfer Case High/Low Shift Fork Assembly
3	Transfer Case High/Low Clutch
4	Transfer Case Front Output Shaft Drive Chain Assembly

Rear Output Shaft Assembly Disassemble

Fig. 17: Rear Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Rear Output Shaft Assembly Disassemble

Callout	Component Name
1	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring
2	Transfer Case Rear Output Shaft Rear Bearing Assembly

Callout	Component Name
	NOTE:
3	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring - Present on Non-Hybrid Applications Only
4	Transfer Case Rear Output Shaft Speed Reluctor Wheel
5	Transfer Case Oil Pump Assembly
6	Transfer Case Front Output Shaft Drive Sprocket Retaining Ring
7	Transfer Case Front Output Shaft Drive Sprocket Spacer - Rear
8	Transfer Case Front Output Shaft Drive Sprocket
9	Transfer Case Four Wheel Drive Clutch Housing Retaining Ring
10	Transfer Case Four Wheel Drive Clutch Housing
11	Transfer Case Front Output Shaft Drive Sprocket Bearing Assembly (Qty: 2) **NOTE:** **Only remove the bearing if faulty. Refer to Drive Chain, Drive Sprocket, and Driven Sprocket Cleaning and Inspection.**
12	Transfer Case Front Output Shaft Drive Sprocket Spacer - Front
13	Transfer Case Two/Four Wheel Drive Clutch Retaining Ring
14	Transfer Case Four Wheel Drive Clutch Shim
15	Transfer Case Four Wheel Drive Clutch Hub
16	Transfer Case Four Wheel Drive Clutch Pressure - Friction - Plate (Qty: 8)
17	Transfer Case Four Wheel Drive Clutch Pressure - Steel - Plate (Qty: 7)
18	Transfer Case Four Wheel Drive Clutch Pressure Plate Spring (Qty: 4)
19	Transfer Case Four Wheel Drive Clutch Pressure - Apply - Plate

Use an arbor press or suitable puller to remove the bearing from the rear output shaft.

Callout	Component Name
20	Transfer Case Control Actuator Lever Washer
21	Transfer Case Control Actuator Lever Thrust Bearing Assembly
22	Transfer Case Control Actuator Lever Assembly **NOTE:** **Refer to Service Parts Release Usage Change - NQH/NPO Control Actuator Levers in the New Product Information .**
23	Transfer Case Control Actuator Lever Ball (Qty: 3)
24	Transfer Case Control Actuator Lever Bearing Assembly
25	Transfer Case Control Lever
26	Transfer Case Control Actuator Lever Thrust Bearing Assembly
27	Transfer Case Rear Output Shaft

Input Shaft Oil Seal Removal

Fig. 18: Input Shaft Oil Seal
Courtesy of GENERAL MOTORS COMPANY

Input Shaft Oil Seal Removal

Callout	Component Name
1	Input Shaft Oil Seal **CAUTION:** **Refer to Machined Surface Damage Caution .** **Procedure**

Callout	Component Name
	1. Drill a pilot hole, as required, and insert a self-tapping screw into the body of the seal. 2. Use a plier or slide hammer type tool to remove the seal from the bore.

Input Shaft and Planetary Assembly Removal

Fig. 19: Input Shaft and Planetary Assembly
Courtesy of GENERAL MOTORS COMPANY

Input Shaft and Planetary Assembly Removal

Callout	Component Name
1	Transfer Case Input Shaft Seal
2	Transfer Case Input Shaft Bearing Outer Retaining Ring

Callout	Component Name
	WARNING:
3	Transfer Case Input Shaft/Planetary Assembly
4	Transfer Case High/Low Planetary Carrier Retaining Ring
5	Transfer Case High/Low Locking Plate
6	Transfer Case Planetary Carrier Sun Gear Thrust Washer
7	Transfer Case Input Shaft
8	Transfer Case Input Shaft Pilot Bearing Retaining Ring
9	Transfer Case Input Shaft Pilot Bearing Assembly **NOTE:** **Only remove the bearing if faulty. Refer to Front Output Shaft and Input Shaft Cleaning and Inspection.**
10	Transfer Case Planetary Carrier Sun Gear Thrust Washer
11	Transfer Case High/Low Planetary Carrier Assembly
12	Transfer Case Input Shaft Inner Retaining Ring
13	Transfer Case Input Shaft Bearing Assembly

Do not rotate the transfer case and holding fixture with the retaining ring removed. Rotating may cause the shaft/planetary assembly to fall from the transfer case, resulting in personal injury.

Front Output Shaft Assembly Removal

Fig. 20: Front Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Front Output Shaft Assembly Removal

Callout	Component Name
1	Transfer Case Front Output Shaft Seal **Procedure** 1. Insert a screwdriver between the metal inner and metal outer portions of the seal. 2. Pry upward in multiple locations working the metal inner portion of the seal off the shaft until removed. 3. Once the inner metal portion is removed, insert a screwdriver between the outer diameter metal flange of the seal and the housing. 4. Drive the screwdriver inward in multiple locations, the outer portion of the seal will be distorted and can easily be

Callout	Component Name
	removed from the housing. **NOTE:** **Remove the front output shaft seal in two pieces using the following procedure.**
2	Transfer Case Front Case Half **NOTE:** **Place the front case half on an arbor press.**
3	Transfer Case Front Output Shaft Assembly **NOTE:** **Press the front output shaft assembly from the front case half using an arbor press or soft-face hammer.**

TRANSFER CASE FRONT HALF CLEANING AND INSPECTION

Fig. 21: Transfer Case Front Half Cleaning and Inspection
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **Refer to Machined Surface Damage Caution .**	
Preliminary Procedure	
• Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated.	

Callout	Component Name
• Clean the front case half in cleaning solvent and air dry. • Remove any sealant from the sealing surface.	
1	Transfer Case Front Half Assembly **NOTE:** **Inspect for cracks, broken areas, or other damage. The component must be replaced if damage is found.**
2	Transfer Case Front Output Shaft Front Bearing Bore **NOTE:** **Replace the front case half assembly if a bearing has spun or if cracks are detected.**
3	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Bore **NOTE:** **Replace the front case half**

Callout	Component Name
	assembly if a bearing has spun or if cracks are detected.
4	Transfer Case Studs (Qty: 6) **NOTE:** **Replace any damaged studs**
5	Transfer Case Input Shaft Bearing Bore **NOTE:** **Replace the front case half assembly if a bearing has spun or if cracks are detected.**
6	Case Sealing Surface **NOTE:** **Repair small scratches or nicks with a soft stone.**
7	Transfer Case Thread Bolt Holes **NOTE:**

Callout	Component Name
	Repair any damaged threads.
8	Transfer Case Locating Pin Holes **NOTE:** **Replace the front case half assembly if the locating pin holes are out of round or damaged.**
9	Transfer Case Locating pins (Qty: 2) **NOTE:** **Repair or replace loose, missing, or damaged locating pins.**
10	Transfer Case High/Low Internal Gear **NOTE:** **Replace the front case half assembly if the gear is loose in the**

Callout	Component Name
	case, or if the gear teeth are chipped or embedded with debris.
11	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Assembly **Procedure** Replace the bearing if roughness, brinelling, or pitting is detected. Refer to **Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Replacement - Front**.

TRANSFER CASE REAR HALF CLEANING AND INSPECTION

Fig. 22: Transfer Case Rear Half Cleaning And Inspection Areas

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **Refer to Machined Surface Damage Caution .** **Preliminary Procedure** • Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated. • Clean the rear case half in cleaning solvent and air dry. • Remove any sealant from the sealing surface.	
1	Transfer Case Rear Case Half Assembly **NOTE:** **Inspect for cracks, broken areas, or other damage. The component must be replaced if damage is found.**
2	Transfer Case Rear Output Shaft Rear Bearing Outer Retaining Ring Groove **NOTE:**

Callout	Component Name
	Replace the rear case half assembly if the groove is worn.
3	Vehicle Speed Sensor Threads **NOTE:** **Replace the rear case half assembly if the speed sensor threads are damaged.**
4	Transfer Case Rear Output Shaft Rear Bearing Bore **NOTE:** **Replace the rear case half assembly if a bearing has spun or if cracks are detected.**
5	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Bore **NOTE:** **Replace the front case**

Callout	Component Name
	half assembly if a bearing has spun or if cracks are detected.
6	Case Sealing Surface **NOTE:** **Repair small scratches or nicks with a soft stone.**
7	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Assembly **NOTE:** **Replace the bearing if roughness, brinelling, or pitting is detected. Refer to Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Replacement - Rear.**
8	Transfer Case Front Output Shaft Rear Bearing Bore **NOTE:**

Callout	Component Name
	Replace the rear case half assembly if a bearing has spun or if cracks are detected.
9	Transfer Case Locating Pin Holes **NOTE:** **Replace the rear case half assembly if the locating pin holes are out of round or damaged.**
10	Transfer Case Rear Output Shaft Bushing **NOTE:** • **Replace the bushing if it is damaged or worn. Refer to Transfer Case Disassemble (Light Duty)Transfer Case Disassemble**

Callout	Component Name
	(Heavy Duty), and Transfer Case Assemble (Light Duty)Transfer Case Assemble (Heavy Duty). • If the bushing is removed, inspect the bushing bore for signs of spinning. Replace the rear case half assembly if the bushing has spun.

OIL PUMP CLEANING AND INSPECTION

Fig. 23: View Of Transfer Case Oil Pump Assembly & Suction Pipe
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated. 2. Clean all components in cleaning solvent and air dry.	
1	Transfer Case Oil Pump Assembly **NOTE:** **Replace the oil pump**

Callout	Component Name
	assembly if end play is evident or if there is any sign of binding. End play can be measured by inserting a feeler gauge between the outer rotor and housing. If the end play is greater than 0.1 mm (0.004 in), replace the oil pump assembly. Do not disassemble the oil pump. The oil pump is serviced as an assembly.
2	Transfer Case Oil Pump Suction Pipe **NOTE:** **Replace the oil pump suction pipe**

Callout	Component Name
	if the screen is embedded with debris.

REAR OUTPUT SHAFT CLEANING AND INSPECTION

Fig. 24: View Of Rear Output Shaft Inspection Points
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated.	

Callout	Component Name
2. Clean all components in cleaning solvent and air dry.	
1	Transfer Case Rear Output Shaft Splines **NOTE:** **Witness marks at the location of the yoke are normal.**
2	Transfer Case Oil Pump and Rear Output Shaft Speed Reluctor Wheel Engagement Splines **NOTE:** **Witness marks at the location of the components are normal.**
3	Transfer Case Front Output Shaft Drive Sprocket Bearing Surface **NOTE:** **Inspect for scoring, brinelling, pitting, or excessive wear.**
4	Transfer Case Two/Four Wheel Drive Clutch Hub Engagement Splines **NOTE:** **Witness marks at the**

Callout	Component Name
	location of the hub is normal.
5	Transfer Case Control Actuator Lever Bearing Surface **NOTE:** **Inspect for scoring, brinelling, pitting, or excessive wear.**
6	Transfer Case Control Actuator Lever Thrust Bearing Surface **NOTE:** **Inspect for scoring, brinelling, pitting, or excessive wear.**
7	Transfer Case High/Low Clutch Engagement Splines **NOTE:** **Witness marks at the location of the high/low clutch is normal.**
8	Transfer Case Input Shaft Pilot Bearing Surface **NOTE:**

Callout	Component Name
	Inspect for scoring, brinelling, pitting, or excessive wear.
9	Oil Galleries **NOTE:** **Compressed air may be necessary to clean the oil galleries.**

FRONT OUTPUT SHAFT AND INPUT SHAFT CLEANING AND INSPECTION

Fig. 25: Front Output Shaft and Input Shaft Cleaning and Inspection
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated. 2. Clean all components in cleaning solvent and air dry.	
1	Transfer Case Input Shaft Seal Surface **NOTE:** **Inspect for pitting,**

Callout	Component Name
	excessive wear, or damage.
2	Transfer Case Input Shaft Bearing Surface **NOTE:** **Inspect for excessive wear, damage, or if the bearing has spun on the shaft.**
3	Transfer Case Input Shaft Planetary Teeth **NOTE:** **Inspect for broken, damaged, or debris embedded in the root of the teeth.**
4	Transfer Case Input Shaft Pilot Bearing Surface **NOTE:** **If the bearing is removed, inspect for excessive wear, damage, or if**

Callout	Component Name
	the bearing has spun in the bore.
5	Transfer Case High/Low Clutch Engagement Teeth **NOTE:** **Inspect the engagement teeth for chips or excessive wear.**
6	Transfer Case Input Shaft Pilot Bearing Assembly **Procedure** Replace the bearing if roughness, brinelling, or pitting is detected. Refer to **Input Shaft Pilot Bearing Replacement (Light Duty)Input Shaft Pilot Bearing Replacement (Heavy Duty)**.
7	Transfer Case Input Shaft Pilot Bearing Assembly Retaining Ring (HD only)
8	Transfer Case Front Output Shaft Front Bearing Assembly **Procedure** Replace the bearing if roughness, brinelling, or pitting is detected. Refer to **Front Output Shaft Front and Rear Bearing Replacement**.
9	Transfer Case Front Output Shaft Seal Surface **NOTE:** **Inspect for pitting, excessive wear, or damage.**
10	Transfer Case Front Output Shaft Front Bearing Surface **NOTE:**

Callout	Component Name
	If the bearing is removed, inspect for excessive wear, damage, or if the bearing has spun on the shaft.
11	Transfer Case Front Output Shaft Driven Sprocket Engagement Splines **NOTE:** **Witness marks at the location of the sprocket is normal.**
12	Transfer Case Front Output Shaft Rear Bearing Surface **NOTE:** **If the bearing is removed, inspect for excessive wear, damage, or if the bearing has spun on the shaft.**
13	Transfer Case Front Output Shaft Hole Plug **Procedure** Replace the plug if removed. Refer to **Front Output Shaft Front and Rear Bearing Replacement**.

Callout	Component Name
14	Transfer Case Front Output Shaft Rear Bearing Assembly **Procedure** Replace the bearing if roughness, brinelling, or pitting is detected. Refer to **Front Output Shaft Front and Rear Bearing Replacement**.

DRIVE CHAIN, DRIVE SPROCKET, AND DRIVEN SPROCKET CLEANING AND INSPECTION

Fig. 26: Drive Chain, Drive Sprocket, and Driven Sprocket Cleaning and Inspection
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be	

Callout	Component Name
repaired, replace the component or sub-component as indicated. 2. Replace any components if damage is found in this procedure. The sprockets must be replaced as a pair. 3. Clean all components in cleaning solvent and air dry.	
1	Transfer Case Front Output Shaft Drive Sprocket Bearing Assembly **Procedure** Replace the bearings if roughness, brinelling, or pitting is detected. Refer to **Front Output Shaft Drive Sprocket Bearing Replacement**.
2	Transfer Case Front Output Shaft Drive Sprocket Bearing Bore **NOTE:** **If the bearing is removed, inspect for excessive wear, damage, or if the bearing has spun in the bore.**
3	Transfer Case Four Wheel Drive Clutch Housing Engagement Teeth **NOTE:** **Inspect the engagement teeth for chips or excessive wear.**
4	Transfer Case Front Output Shaft Drive Sprocket **NOTE:**

Callout	Component Name
	• **Inspect for chipped teeth, excessively worn gear surfaces, and debris embedded in the root of the teeth.** • **Witness marks at the location of the chain is normal.**
5	Transfer Case Front Output Shaft Driven Sprocket **NOTE:** • **Inspect for chipped teeth, excessively worn gear surfaces, and debris embedded in the root of the teeth.** • **Witness marks at**

Callout	Component Name
	the location of the chain is normal.
6	Transfer Case Front Output Shaft Drive Chain Assembly **NOTE:** **Inspect for loose link pins, binding or stiff links, debris embedded in the links, or worn teeth surfaces.**

HIGH/LOW PLANETARY CARRIER CLEANING AND INSPECTION (LIGHT DUTY)

Fig. 27: View Of High/Low Planetary Carrier Inspection Points
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated. 2. Clean all components in cleaning solvent and air dry. Do not spin the planetary gears with compressed air. 3. The high/low planetary carrier is only serviced as an assembly.	
1	Transfer Case High/Low Clutch Engagement Teeth **NOTE:**

Callout	Component Name
	Inspect the engagement teeth for chips or excessive wear.
2	Transfer Case Planetary Carrier Sun Gear Thrust Washer Surface **NOTE:** **Inspect the thrust washer surface for scoring or excessive wear.**
3	Transfer Case High/Low Planetary Carrier Pinion Gear Thrust Washer **NOTE:** **Inspect for a thrust washer being on each side of the planetary gears.**
4	Transfer Case High/Low Planetary Pinion Gear **NOTE:** **Inspect for broken, damaged, or debris**

Callout	Component Name
	embedded in the root of the teeth.

HIGH/LOW PLANETARY CARRIER CLEANING AND INSPECTION (HEAVY DUTY)

Fig. 28: High/Low Planetary Carrier Cleaning and Inspection
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure • Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated.	

Callout	Component Name
• Clean all components in cleaning solvent and air dry. Do not spin the planetary gears with compressed air. • The high/low planetary carrier is only serviced as an assembly.	
1	Transfer Case High/Low Clutch Engagement Teeth **NOTE:** **Inspect the engagement teeth for chips or excessive wear.**
2	Transfer Case Planetary Carrier Sun Gear Thrust Washer Surface **NOTE:** **Inspect the thrust washer surface for scoring or excessive wear.**
3	Transfer Case High/Low Planetary Carrier Pinion Gear Thrust Washer **NOTE:** **Inspect for a thrust washer being on each side of the planetary gears.**

Callout	Component Name
4	Transfer Case High/Low Planetary Pinion Gear **NOTE:** **Inspect for broken, damaged, or debris embedded in the root of the teeth.**

HIGH/LOW SHIFT COMPONENTS CLEANING AND INSPECTION

Fig. 29: High/Low Shift Components Cleaning and Inspection

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated. 2. Clean all components in cleaning solvent and air dry.	
1	Transfer Case High/Low Clutch Inner Splines **NOTE:** **Inspect the inner splines for excessive looseness on the rear output shaft.**
2	Transfer Case High/Low Clutch Teeth **NOTE:** **Inspect the engagement teeth for chips or excessive wear.**
3	Transfer Case High/Low Shift Fork Collar **NOTE:** **Inspect the shift fork collar for wear.**

Callout	Component Name
4	Transfer Case High/Low Shift Fork Pads **NOTE:** **Inspect the pads for wear.**
5	Transfer Case High/Low Shift Fork **Procedure** Inspect for cracks, broken areas, or other damage. The component must be replaced if damage is found. Refer to **High/Low Shift Fork Replacement**.
6	Transfer Case Control Actuator Shaft **Procedure** Inspect the shaft splines for excessive wear. The component must be replaced if damage is found. Refer to **High/Low Shift Fork Replacement**.
7	Transfer Case Actuator Shaft Gear Splines **NOTE:** **Witness marks at the location of the splines is normal.**
8	Transfer Case Actuator Shaft Gear Teeth **NOTE:** **Inspect for chipped teeth, excessively worn gear surfaces, and debris embedded in**

Callout	Component Name
	the root of the teeth.
9	Transfer Case High/Low Shift Fork Pin **Procedure** Inspect the pin for wear. The component must be replaced if damage is found. Refer to **High/Low Shift Fork Replacement**.
10	Transfer Case High/Low Shift Fork Spring Assembly **Procedure** Inspect the cam lobes for wear or roughness. The component must be replaced if damage is found. Refer to **High/Low Shift Fork Replacement**.
11	Transfer Case Shift Fork Spring **Procedure** Inspect the spring for breakage. The component must be replaced if damage if found. Refer to **High/Low Shift Fork Replacement**.

TWO/FOUR WHEEL DRIVE SHIFT COMPONENTS CLEANING AND INSPECTION

Fig. 30: Two/Four Wheel Drive Shift Components Cleaning and Inspection
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Inspect all components or sub-components and perform any repair procedure necessary to fix the damage. If the damage cannot be repaired, replace the component or sub-component as indicated. 2. Clean all components in cleaning solvent and air dry, except the clutch plates.	
1	Transfer Case Control Actuator Thrust Bearing **NOTE:** **Replace the bearing if**

Callout	Component Name
	roughness, brinelling, or pitting is detected.
2	Transfer Case Control Actuator Lever Thrust Bearing Surface **NOTE:** • **Inspect for pitting, excessive wear, or damage.** • **Refer to Service Parts Release Usage Change - NQH/NPO Control Actuator Levers in the New Product Information .**
3	Transfer Case Control Actuator Lever Bearing Surface **NOTE:** **Inspect for pitting, excessive wear, or**

Callout	Component Name
	damage.
4	Transfer Case Control Lever Arm **NOTE:** **Inspect for excessive wear or damage.**
5	Transfer Case Control Actuator Lever Ball Ramps **NOTE:** **Inspect for pitting, excessive wear, or damage.**
6	Transfer Case Control Actuator Lever Bearing **NOTE:** **Replace the bearing if roughness, brinelling, or pitting is detected.**
7	Transfer Case Control Actuator Lever Balls **NOTE:** **Replace the bearings if roughness or pitting is detected.**

Callout	Component Name
8	Transfer Case Control Actuator Lever Ball Ramps **NOTE:** **Inspect for pitting, excessive wear, or damage.**
9	Transfer Case Control Actuator Lever Bearing **NOTE:** **Replace the control actuator lever assembly if roughness, brinelling, or pitting is detected.**
10	Transfer Case Control Actuator Lever Bearing Surface **NOTE:** **Inspect for pitting, excessive wear, or damage.**
11	Transfer Case Control Actuator Thrust Bearing **NOTE:** **Replace the bearing if**

Callout	Component Name
	roughness, brinelling, or pitting is detected.
12	Transfer Case Control Actuator Lever Washer **NOTE:** **Inspect for pitting, excessive wear, or damage.**
13	Transfer Case Four Wheel Drive Clutch Pressure (Apply) Plate Washer Surface **NOTE:** **Inspect for pitting, excessive wear, or damage.**
14	Transfer Case Four Wheel Drive Clutch Pressure (Apply) Plate Surface **NOTE:** **Inspect for excessive wear, cracks, or damage.**
15	Transfer Case Four Wheel Drive Clutch Pressure Plate Springs **NOTE:** **Inspect the springs for cracks.**

Callout	Component Name
16	Transfer Case Four Wheel Drive Clutch Pressure (Friction) Plates **NOTE:** **Inspect for worn, grooved, burnt, or flaking friction material, or warped friction plates.**
17	Transfer Case Four Wheel Drive Clutch Pressure (Steel) Plates **NOTE:** **Inspect for worn or warped steel plates.**
18	Transfer Case Four Wheel Drive Clutch Hub Bearing Surface **NOTE:** **Inspect for pitting, excessive wear, or damage.**
19	Transfer Case Four Wheel Drive Clutch Hub Teeth **NOTE:** **Inspect for excessive**

Callout	Component Name
	wear or damage. Excessive wear can be identified by steps in the teeth.
20	Transfer Case Four Wheel Drive Clutch Hub Friction Plate Surface **NOTE:** **Inspect for excessive wear, cracks, or damage.**
21	Transfer Case Front Output Shaft Drive Sprocket Engagement Teeth **NOTE:** **Inspect the engagement teeth for excessive looseness on the front output shaft drive sprocket.**
22	Transfer Case Four Wheel Drive Clutch Housing Teeth **NOTE:** **Inspect for excessive wear or damage.**

Callout	Component Name
	Excessive wear can be identified by steps in the teeth.
23	Transfer Case Four Wheel Drive Clutch Hub Splines **NOTE:** **Inspect the splines for excessive looseness on the rear output shaft.**
24	Transfer Case Two/Four Wheel Drive Actuator Cam **Procedure** Inspect the cam lobes for wear or roughness. Refer to **High/Low Shift Fork Replacement** if damage is found.
25	Transfer Case Two/Four Wheel Drive Actuator Cam Spacer **Procedure** Inspect the spacer for wear or roughness. Refer to **High/Low Shift Fork Replacement** if damage is found.

REAR OUTPUT SHAFT BUSHING REPLACEMENT (LIGHT DUTY)

Fig. 31: View Of Rear Output Shaft Bushing
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Ensure the bushing is installed squarely into the bushing bore.	
1	Transfer Case Rear Output Shaft Bushing **TIP:** Press the bushing until the tool bottoms on the rear case half. **Special Tools** • **GE-8092** Driver Handle • **DT-48022** Output Bushing Installer • **DT-48209** Bushing Remover

Callout	Component Name
	For equivalent regional tools, refer to **Special Tools** .

REAR OUTPUT SHAFT BUSHING REPLACEMENT (HEAVY DUTY)

Fig. 32: View Of Rear Output Shaft Bushing
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Ensure the bushing is installed squarely into the bushing bore.	
1	Transfer Case Rear Output Shaft Bushing **Procedure** Press the bushing until the tool bottoms on the rear case half.

Callout	Component Name
	Special Tools • **DT-48022** Output Bushing Installer • **DT-48209** Bushing Remover • **GE-8092** Driver Handle For equivalent regional tools, refer to **Special Tools** .

TRANSFER CASE FOUR WHEEL DRIVE ACTUATOR LEVER SHAFT BEARING REPLACEMENT - FRONT

Fig. 33: Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing - Front
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Ensure the bearing is installed squarely into the bearing bore.	
1	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Assembly **Procedure** 1. Ensure the printing on the bearing is facing upward. 2. A suitable adapter is required to use with the **J 8092** driver. 3. Press the bearing until the bearing bottoms on the front case half. **Special Tools** • **J 2619-01** Slide Hammer • **J 8092** Universal Driver • **J 44737** Shift Rail Bearing Remover For equivalent regional tools, refer to **Special Tools** .

TRANSFER CASE FOUR WHEEL DRIVE ACTUATOR LEVER SHAFT BEARING REPLACEMENT - REAR

Fig. 34: Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing - Rear
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Ensure the bearing is installed squarely into the bearing bore.	
1	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Assembly **Procedure** 1. Ensure the printing on the bearing is facing upward. 2. A suitable adapter is required to use with the **J 8092** driver to install. 3. Press the bearing until the bearing bottoms on the rear case half.

Callout	Component Name
	Special Tools **J 8092** Universal Driver For equivalent regional tools, refer to **Special Tools** .

INPUT SHAFT PILOT BEARING REPLACEMENT (LIGHT DUTY)

Fig. 35: View Of Transfer Case Input Shaft Pilot Bearing
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Ensure the bearing is installed squarely into the input shaft bore.	
1	Transfer Case Input Shaft Pilot Bearing

Callout	Component Name
	Procedure 1. Using a suitable adapter and an arbor press, remove the input shaft pilot bearing by going through the front of the input gear. 2. Install the bearing using the small side of the **DT-48212** bearing installer. 3. Press the bearing until the tool bottoms on the input shaft. **Special Tools** • **DT-48212** Input Shaft Pilot Bearing Installer • **GE-8092** Universal Driver For equivalent regional tools, refer to **Special Tools** .

INPUT SHAFT PILOT BEARING REPLACEMENT (HEAVY DUTY)

Fig. 36: View Of Input Shaft Pilot Bearing, Retaining Ring & Special Tool
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Ensure the bearing is installed squarely into the input shaft bore.	
1	Transfer Case Input Shaft Pilot Bearing Retaining Ring **NOTE:** **The pilot bearing retaining ring must be removed and installed**

Callout	Component Name
	before and after the pilot bearing is replaced.
2	Transfer Case Input Shaft Pilot Bearing **NOTE:** • **Using a suitable adapter and an arbor press, remove the input shaft pilot bearing by going through the front of the input shaft.** • **Install the bearing using the large side of the DT-48212 bearing installer.**

Callout	Component Name
	• **Press the bearing until the tool bottoms on the input shaft.** **Special Tools** • **DT-48212** Input Shaft Pilot Bearing Installer • **GE-8092** Universal Driver For equivalent regional tools, refer to **Special Tools** .

FRONT OUTPUT SHAFT FRONT AND REAR BEARING REPLACEMENT

Fig. 37: Front Output Shaft Front & Rear Bearing
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Ensure the bearings are installed squarely on the front output shaft. 2. Using a suitable adapter and an arbor press, remove the bearing assemblies from the front output shaft.	
1	Transfer Case Front Output Shaft Rear Bearing Assembly **NOTE:** **Using a suitable adapter and**

Callout	Component Name
	an arbor press, install the bearing until the bearing bottoms against the spacer.
2	Transfer Case Front Output Shaft Front Bearing Assembly **NOTE:** **Using a suitable adapter and an arbor press, install the bearing until the bearing bottoms on the front output shaft.**
3	Transfer Case Front Output Shaft Hole Plug **Procedure** 1. Using a suitable adapter and an arbor press, remove the front output shaft hole plug by going through the front of the front output shaft. 2. Install the plug using the large side of the **DT-48212** bearing installer. 3. Press the plug until the tool bottoms on the front output shaft. **Special Tools** • **DT-48212** Input Shaft Pilot Bearing Installer

Callout	Component Name
	• **J 8092** Universal Driver For equivalent regional tools, refer to **Special Tools** .

FRONT OUTPUT SHAFT DRIVE SPROCKET BEARING REPLACEMENT

Fig. 38: View Of Front Output Shaft Drive Sprocket Bearing Assemblies & Special Tools
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure	
1. Using the **J 35512** bearing installer and an arbor press, remove the bearing assemblies from the drive sprocket.	

Callout	Component Name
2. Ensure the bearings are installed squarely into the drive sprocket bore. 3. Install the bearings from the top with the clutch teeth facing down.	
1	Transfer Case Front Output Shaft Drive Sprocket Bearing Assembly - Front **Procedure** 1. Install the bearing using the long side of the **DT-48211** bearing installer. 2. Ensure the flat edge of the bearing is facing upward. 3. Using an arbor press or hammer, install the bearing until the tool bottoms on the drive sprocket. **Special Tools** • **DT-48211** Drive Sprocket Bearing Installer • **J 8092** Universal Driver • **J 35512** Inner Pinion Bearing Installer For equivalent regional tools, refer to **Special Tools** .
2	Transfer Case Front Output Shaft Drive Sprocket Bearing Assembly - Rear **Procedure** 1. Install the bearing using the short side of the **DT-48211** bearing installer. 2. Ensure the flat edge of the bearing is facing upward. 3. Using an arbor press or hammer, install the bearing until the tool bottoms on the drive sprocket. **Special Tools** • **DT-48211** Drive Sprocket Bearing Installer • **J 8092** Universal Driver • **J 35512** Inner Pinion Bearing Installer

HIGH/LOW SHIFT FORK REPLACEMENT

Fig. 39: View Of High/Low Shift Fork & Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Transfer Case High/Low Shift Fork Pin **NOTE:** **Drive the pin out using a drift punch and hammer.**
2	Transfer Case High/Low Shift Fork

Callout	Component Name
	NOTE:
3	Transfer Case High/Low Shift Fork Spring Assembly **NOTE:** The component must be replaced if the following conditions exist. • **Assemble with the cut corners of the spring assembly facing the shift fork.** • **The cam lobes are worn or rough** • **The spring is broken** **Inspect for wear or damage in the spring seat locations. The component must be replaced if damage is found.**
4	Transfer Case Two/Four Wheel Drive Actuator Cam Retaining Ring
5	Transfer Case Two/Four Wheel Drive Actuator Cam Spacer
6	Transfer Case Two/Four Wheel Drive Actuator Cam
7	Transfer Case High/Low Shift Fork - Service - Pin

Callout	Component Name
	NOTE:
8	Transfer Case Shift Fork Shaft Guide Screw **CAUTION:** Refer to Fastener Caution. **Procedure** Apply threadlock GM P/N 12345493 (Canadian P/N 10953488), or equivalent, to the screw threads. **Tighten** 5 N.m (44 lb·in).

TRANSFER CASE ASSEMBLE (LIGHT DUTY)

Input Shaft and Planetary Assembly Installation

- **Apply a small amount of threadlock GM P/N 12345493 (Canadian P/N 10953488), or equivalent, to the shaft of the pin before installation.**
- **Press the pin into the control actuator shaft using a brass drift until bottom.**

Fig. 40: Input Shaft and Planetary Assembly
Courtesy of GENERAL MOTORS COMPANY

Input Shaft and Planetary Assembly Installation

Callout	Component Name
1	Transfer Case Input Shaft Bearing Assembly
2	Transfer Case Input Shaft Inner Retaining Ring
3	Transfer Case High/Low Planetary Carrier Assembly
4	Transfer Case Planetary Carrier Sun Gear Thrust Washer
5	Transfer Case Input Shaft
6	Transfer Case Planetary Carrier Sun Gear Thrust Washer
7	Transfer Case High/Low Locking Plate
8	Transfer Case High/Low Planetary Carrier Retaining Ring

Callout	Component Name
9	Transfer Case Input Shaft/Planetary Assembly **NOTE:** **Refer to Interim Model Year Design Change - NQF/NQG/NQH Front Case Half Assembly, Input Shaft, Planetary Carrier High/Low Clutch in the New Product Information.**
10	Transfer Case Input Shaft Bearing Outer Retaining Ring

Measuring Clutch Pack Height

Fig. 41: Measuring Clutch Pack Height
Courtesy of GENERAL MOTORS COMPANY

Measuring Clutch Pack Height

Callout	Component Name
Preliminary Procedure 1. The **DT-48213** gauge applies a predetermined amount of pressure to the clutch pack in order to properly measure the clutch pack height. Do not use any other method than what is outlined below. 2. Micrometers or depth gauges may also be used in conjunction with the **DT-48213** gauge to measure the clutch pack height. 3. Two variations are available to measure clutch pack height, outside measurement or inside measurement. Either variation will determine the correct height.	
1	Transfer Case Four Wheel Drive Clutch Pressure - Friction - Plate (Qty: 8) **Procedure**

Callout	Component Name
	Install the friction and steel clutch plates into the **DT-48213** gauge, alternating until 8 friction plates and 7 steel plates are installed. **Special Tools** **DT-48213** Clutch Pack Height Gauge For equivalent regional tools, refer to **Special Tools** .
2	Transfer Case Four Wheel Drive Clutch Pressure - Steel - Plate (Qty: 7) **Procedure 1 - Outside Measurement:** 1. Tighten the **DT-48213** gauge until the upper portion of the tool contacts the lower portion of the tool. The screw will be flush with the bottom surface of the tool to indicate the tool has fully compressed the clutch plates. 2. Using an outside caliper, measure the total combined height of the clutch pack and the **DT-48213** gauge, dimension a. Subtract the thickness of both the upper and lower portion of the **DT-48213** gauge, 14 mm (0.551 in), and record the results. 3. Repeat the process in 2 additional locations, 120 degrees from each other. 4. The average of the 3 measurements is the clutch pack height. **Procedure 2 - Inside Measurement:** 1. Install the friction and steel clutch plates into the **DT-48213** gauge, alternating until 8 friction plates and 7 steel plates are installed. 2. Tighten the **DT-48213** gauge until the upper portion of the tool contacts the lower portion of the tool. The screw will be flush with the bottom surface of the tool to indicate the tool has fully compressed the clutch plates. 3. Using an inside caliper, measure the height of the clutch pack, dimension b, and record the results. 4. Repeat the process in 2 additional locations, 120 degrees from each other. 5. The average of the 3 measurements is the clutch pack height. **Special Tools** **DT-48213** Clutch Pack Height Gauge

Clutch Assembly Installation

Fig. 42: View Of Clutch Components
Courtesy of GENERAL MOTORS COMPANY

Clutch Assembly Installation

Callout	Component Name
1	Transfer Case Rear Output Shaft
2	Transfer Case Control Actuator Lever Thrust Bearing Assembly
3	Transfer Case Control Lever **NOTE:** **Refer to Service Parts Release**

Callout	Component Name
	Usage Change - NQH/NPO Control Actuator Levers in the New Product Information..
4	Transfer Case Control Actuator Lever Bearing Assembly
5	Transfer Case Control Actuator Lever Ball (Qty: 3)
6	Transfer Case Control Actuator Lever Assembly
7	Transfer Case Control Actuator Lever Thrust Bearing Assembly
8	Transfer Case Control Actuator Lever Washer
9	Transfer Case Four Wheel Drive Clutch Pressure - Apply - Plate **NOTE:** **Ensure the control actuator lever washer is seated into the apply plate groove.**
10	Transfer Case Four Wheel Drive Clutch Pressure Plate Spring (Qty: 4)
11	Transfer Case Four Wheel Drive Clutch Hub
12	Transfer Case Four Wheel Drive Clutch Shim **Procedure** 1. Use a 3 mm (0.118 in) shim as a base to do the initial measurements with, this shim may be changed in the following steps depending on the results of the stack clearance. 2. Use the original shim if reassembling a transfer case. This shim may be changed in the following steps depending on

Callout	Component Name
	the results of the stack clearance.
13	Transfer Case Two/Four Wheel Drive Clutch Retaining Ring **NOTE:** **If the clutch shim is not seated against the retaining ring, replace the clutch pressure plate springs.**

Measuring/Adjusting Clutch Assembly Height

Fig. 43: Measuring/Adjusting Clutch Assembly Height
Courtesy of GENERAL MOTORS COMPANY

Measuring/Adjusting Clutch Assembly Height

Callout	Component Name
1	Clutch Assembly **Procedure:** 1. Using an inside caliper, measure the height of the clutch assembly in the location shown and record the results. 2. Repeat the process in 2 additional locations, 120 degrees from each other. 3. The average of the 3 measurements is the clutch assembly height. 4. A 3.1 mm (0.122 in) clearance +/- 0.1 mm (0.004 in) is necessary between the clutch pack height and the assembly height. It may be necessary to replace the clutch shim with a thicker shim or a thinner shim, to achieve the proper

Callout	Component Name
	clearance in the clutch. 5. Subtract the clutch pack height from the clutch assembly height. The difference should be between 3.0 mm (0.118 in) and 3.2 mm (0.126 in) clearance. **NOTE:** • **A variety of shims are available to properly adjust the clearance height of the clutch assembly.** • **An inside micrometer may also be used to measure the clutch assembly height.**

Clutch Pressure Plate Installation

Fig. 44: View Of Clutch Pressure Plates & Components
Courtesy of GENERAL MOTORS COMPANY

Clutch Pressure Plate Installation

Callout	Component Name
1	Transfer Case Control Actuator Lever Washer
2	Transfer Case Four Wheel Drive Clutch Pressure - Apply - Plate
3	Transfer Case Four Wheel Drive Clutch Pressure Plate Spring (Qty: 4)
4	Transfer Case Four Wheel Drive Clutch Pressure Plates
5	Transfer Case Four Wheel Drive Clutch Hub
6	Transfer Case Four Wheel Drive Clutch Shim
7	Transfer Case Two/Four Wheel Drive Clutch Retaining Ring **Procedure** The **Transfer Case High/Low Clutch Reset** must be performed after the transfer case is installed in the vehicle.

Rear Output Shaft Assembly

Fig. 45: Rear Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Rear Output Shaft Assembly

Callout	Component Name
1	Transfer Case Front Output Shaft Drive Sprocket Spacer - Front
2	Transfer Case Four Wheel Drive Clutch Housing
3	Transfer Case Front Output Shaft Drive Sprocket
4	Transfer Case Four Wheel Drive Clutch Housing Retaining Ring
5	Transfer Case Front Output Shaft Drive Sprocket Spacer - Rear
6	Transfer Case Front Output Shaft Drive Sprocket Retaining Ring

Callout	Component Name
	NOTE:
7	Transfer Case Oil Pump Assembly
8	Transfer Case Rear Output Shaft Speed Reluctor Wheel
9	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring - Present on Non-Hybrid Applications Only
10	Transfer Case Rear Output Shaft Rear Bearing Assembly **Procedure:** 1. Use an arbor press or suitable installer to install the bearing to the rear output shaft. 2. Ensure the retaining ring groove in the outer race is positioned toward the rear.
11	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring

Ensure the retaining ring is installed into the correct retaining ring groove on the rear output shaft.

Shift Fork Assembly, and Rear Output Shaft Assembly Installation

Fig. 46: Shift Fork Assembly, and Rear Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Shift Fork Assembly, and Rear Output Shaft Assembly Installation

Callout	Component Name
Preliminary Procedure Load all 3 components simultaneously.	
1	Transfer Case High/Low Shift Fork Assembly
2	Transfer Case High/Low Clutch
3	Transfer Case Rear Output Shaft Assembly

Front Output Shaft Assembly, Drive Chain, Actuator Shaft Gear, and Oil Pump Suction Pipe Installation

Fig. 47: View Of Front Output Shaft Assembly, Drive Chain, Actuator Shaft Gear, Oil Pump Suction Pipe & Seal
Courtesy of GENERAL MOTORS COMPANY

Front Output Shaft Assembly, Drive Chain, Actuator Shaft Gear, and Oil Pump Suction Pipe Installation

Callout	Component Name
1	Transfer Case Front Output Shaft Assembly, Transfer Case Front Output Shaft Drive Chain Assembly **Procedure** 1. Install the chain with darkened links up. 2. Install the front output shaft assembly into the front case half while engaging the chain with the drive sprocket.
2	Transfer Case Actuator Shaft Gear
3	Transfer Case Oil Pump Suction Pipe Seal

Callout	Component Name
	Procedure: 1. Lubricate the seal to ease installation. 2. Install the seal to the pipe prior to inserting the pipe into the pump. **NOTE:** **Use a NEW seal.**
4	Transfer Case Oil Pump Suction Pipe O-ring
5	Transfer Case Oil Pump Suction Pipe

Transfer Case Rear Case Half Installation

Fig. 48: View Of Transfer Case Rear Case Half, Bracket, Bolts & Sealer

Courtesy of GENERAL MOTORS COMPANY

Transfer Case Rear Case Half Installation

Callout	Component Name
1	Transfer Case Front Case Half **CAUTION:** **Apply the proper amount of sealant to the transfer case (front half) sealing surface when assembling the transfer case. Excessive amounts of sealant can plug the oil pump screen, resulting in internal component failure.** **Procedure** 1. Ensure both sealing surfaces of the front and rear case halves are free of dirt, oil, and cleaning solvent. 2. Apply a 2 mm (0.078 in) bead of sealant to the front case half.Refer to:**Adhesives, Fluids, Lubricants, and Sealers** . **NOTE:**

Callout	Component Name
	Ensure both sealing surfaces of the front and rear case halves are free of dirt, oil and cleaning solvent.
2	Transfer Case Rear Case Half **NOTE:** • **Ensure the transfer case rear output shaft outer retaining ring is in place and aligned prior to mating case halves.** • **Use snap ring pliers to open the transfer case rear output shaft outer retaining**

Callout	Component Name
	ring for the transfer case rear output shaft rear bearing assembly. • **Insert a rubber coated screwdriver into the speed sensor hole and lift up on the reluctor wheel to engage the retaining ring with the rear bearing assembly.**
3	Transfer Case Bracket
4	Transfer Case Bolt (Qty: 17) **CAUTION:** **Refer to Fastener Caution .** **NOTE:**

Callout	Component Name
	Tighten bolts by hand, do not use an air gun. **Tighten** 25 N.m (18 lb ft)

Rear Output Shaft Seal and Bushing Installation

Fig. 49: Rear Output Shaft Seal and Bushing
Courtesy of GENERAL MOTORS COMPANY

Rear Output Shaft Seal and Bushing Installation

Callout	Component Name
1	Transfer Case Rear Output Shaft Bushing Follow the steps below for use of the **J-45380** remover/installer. **Procedure** 1. Follow the steps for use of the **J-45380** remover/installer. 2. Install the bushing on the finger section of the **J-45380** remover/installer. 3. Install the finger section to the main body of the **J-45380** remover/installer. 4. Position the bushing and tool to the rear case half. 5. Press the bushing until the tool bottoms on the rear case half. **NOTE:** • **If the bushing was removed, a new bushing must be installed.** • **Ensure the bushing is installed squarely into the bushing bore.** **Special Tools**

Callout	Component Name
	J-45380 Transfer Case Rear Bushing Remover and Installer
2	Transfer Case Rear Output Shaft Seal **NOTE:** **Align the notch on the seal between the rear output bearing retaining ring access holes, this will position the weep hole down.** **Special Tools** • **DT-48210** Seal Installer • **J-8092** Driver Handle

Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor, and Vehicle Speed Sensor Installation

Fig. 50: Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor and Vehicle Speed Sensor
Courtesy of GENERAL MOTORS COMPANY

Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor, and Vehicle Speed Sensor Installation

Callout	Component Name
1	Two/Four Wheel Drive Actuator Position Sensor O-Ring Seal **Procedure:** Lightly lubricate the O-ring with clean DEXRONÂ®VI.
2	Two/Four Wheel Drive Actuator Position Sensor
3	Two/Four Wheel Drive Actuator Position Sensor Bolt (Qty: 2) **Tighten** 6 N.m (53 lb in)
4	Transfer Case Two/Four Wheel Drive Actuator Assembly

Callout	Component Name
5	Transfer Case Two/Four Wheel Drive Actuator Bolt/Screw **Tighten** 18 N.m (13 lb ft)
6	Transfer Case Oil Drain Plug **CAUTION:** **Refer to Component Fastener Tightening Caution .** **Procedure:** Apply pipe sealant to the oil drain plug before installation. Refer to:**Adhesives, Fluids, Lubricants, and Sealers** . **Tighten** 18 N.m (13 lb ft)
7	Transfer Case Oil Fill Plug **Procedure:** Apply pipe sealant to the oil fill plug before installation. Refer to:**Adhesives, Fluids, Lubricants, and Sealers** . **Tighten** 18 N.m (13 lb ft)
8	Transfer Case Vent **Procedure:** Apply retaining compound to the vent pipe before installation, if removed during disassembly. Refer to:**Adhesives, Fluids, Lubricants, and Sealers** .
9	Vehicle Speed Sensor O-Ring Seal **Procedure:** Lightly lubricate the O-ring with clean DEXRONÂ®VI.
10	Vehicle Speed Sensor Assembly **Tighten** 17 N.m (13 lb ft)
11	Transfer Case Access Hole Plug (Qty: 2)

Callout	Component Name
12	Transfer Case Vibration Dampener Stud - Model Dependent **Tighten** 22 N.m (16 lb ft)
13	Transfer Case Vibration Dampener - Model Dependent
14	Transfer Case Vibration Dampener Nut - Model Dependent **Tighten** 22 N.m (16 lb ft)

Input Shaft Seal and Front Output Shaft Seal Installation

Fig. 51: View Of Transfer Case Assembly, Input Shaft Seal & Front Output Shaft Seal
Courtesy of GENERAL MOTORS COMPANY

Input Shaft Seal and Front Output Shaft Seal Installation

Callout	Component Name
1	Transfer Case Input Shaft Seal **Procedure** Use the **DT-50648-A** or **J-42738** . Refer to Input Shaft Seal Installer Revisions in **New Product Information** . **NOTE:** • **Ensure the bore of the front case half is free of dirt, oil, and cleaning solvent.** • **Double lip input shaft oil seals are used on applications with a WET adapter cavity and with 4 speed transmission RPOs M30/M70 /MW7/M99/ML9 only.** • **Single lip input shaft oil seals are used on applications with a DRY adapter cavity and with 6**

Callout	Component Name
	speed transmission RPOs MYC/MYD only, and are to be installed with the spring portion of the seal facing inward towards the internals of the transfer case. **Special Tools** • **DT-50648-A** Seal Installer • **J-36183** Input and Output Shaft Press Tube • **J-36184** Press Tube Reducer • **J-42738** Seal Installer
2	Transfer Case Front Output Shaft Seal **Special Tools** • **DT-50649** Seal Installer • **J-8092** Driver Handle
3	Transfer Case Front Output Shaft Oil Slinger - Model Dependent **NOTE:**

Callout	Component Name
	Refer to Interim Model Year Design Change - NQF/NQG /NQH/NPO Front Output Shaft, Deflector, Seal in the New Product Information. **Special Tools** • **J-8092** Driver Handle • **DT-50649** Seal Installer
4	Transfer Case Assembly **Procedure** Remove from **J-3289-20** Holding Fixture and remove the **J-45759** Assembly Fixture from the transfer case. **Special Tools** • **J-3289-20** Holding Fixture • **J-45759** Assembly Fixture

TRANSFER CASE ASSEMBLE (HEAVY DUTY)

Input Shaft and Planetary Assembly Installation

Fig. 52: Input Shaft and Planetary Assembly
Courtesy of GENERAL MOTORS COMPANY

Input Shaft and Planetary Assembly Installation

Callout	Component Name
1	Transfer Case Input Shaft Bearing Assembly
2	Transfer Case Input Shaft Inner Retaining Ring
3	Transfer Case High/Low Planetary Carrier Assembly
4	Transfer Case Planetary Carrier Sun Gear Thrust Washer
5	Transfer Case Input Shaft Pilot Bearing Retaining Ring
6	Transfer Case Input Shaft Pilot Bearing Assembly
7	Transfer Case Input Shaft
8	Transfer Case Planetary Carrier Sun Gear Thrust Washer
9	Transfer Case High/Low Locking Plate

Callout	Component Name
10	Transfer Case High/Low Planetary Carrier Retaining Ring
11	Transfer Case Input Shaft/Planetary Assembly
12	Transfer Case Input Shaft Bearing Outer Retaining Ring

Measuring Clutch Pack Height

Fig. 53: Measuring Clutch Pack Height
Courtesy of GENERAL MOTORS COMPANY

Measuring Clutch Pack Height

Callout	Component Name
Preliminary Procedure • The **DT-48213** gauge applies a predetermined amount of pressure to the clutch pack in order to properly measure the clutch pack	

Callout	Component Name
height. Do not use any other method than what is outlined below. • Micrometers or depth gauges may also be used in conjunction with the **DT-48213** gauge to measure the clutch pack height. • Two variations are available to measure clutch pack height, outside measurement or inside measurement. Either variation will determine the correct height.	
1	Transfer Case Four Wheel Drive Clutch Pressure - Friction - Plate (Qty: 8) **NOTE:** **Install the friction and steel clutch plates into the DT-48213 gauge, alternating until 8 friction plates and 7 steel plates are installed.** **Special Tools** **DT-48213** Clutch Pack Height Gauge For equivalent regional tools, refer to **Special Tools** .
2	Transfer Case Four Wheel Drive Clutch Pressure - Steel - Plate (Qty: 7) **Procedure 1 - Outside Measurement:** 1. Tighten the **DT-48213** gauge until the upper portion of the tool contacts the lower portion of the tool. The screw will be flush with the bottom surface of the tool to indicate the tool has fully compressed the clutch plates. 2. Using an outside caliper, measure the total combined height of the clutch pack and the **DT-48213** gauge, dimension a. Subtract the thickness of both the upper and lower portion of the **DT-48213** gauge, 14 mm (0.551 in), and record the results.

Callout	Component Name
	3. Repeat the process in 2 additional locations, 120 degrees from each other. 4. The average of the 3 measurements is the clutch pack height. **Procedure 2 - Inside Measurement:** 1. Tighten the **DT-48213** gauge until the upper portion of the tool contacts the lower portion of the tool. The screw will be flush with the bottom surface of the tool to indicate the tool has fully compressed the clutch plates. 2. Using an inside caliper, measure the height of the clutch pack, dimension b, and record the results. 3. Repeat the process in 2 additional locations, 120 degrees from each other. 4. The average of the 3 measurements is the clutch pack height. **NOTE:** **Install the friction and steel clutch plates into the DT-48213 gauge, alternating until 8 friction plates and 7 steel plates are installed.** **Special Tools** **DT-48213** Clutch Pack Height Gauge For equivalent regional tools, refer to **Special Tools** .

Clutch Assembly Installation

Fig. 54: View Of Clutch Components
Courtesy of GENERAL MOTORS COMPANY

Clutch Assembly Installation

Callout	Component Name
1	Transfer Case Rear Output Shaft
2	Transfer Case Control Actuator Lever Thrust Bearing Assembly
3	Transfer Case Control Lever **NOTE:** **Refer to Service Parts Release**

Callout	Component Name
	Usage Change - NQH/NPO Control Actuator Levers in the New Product Information .
4	Transfer Case Control Actuator Lever Bearing Assembly
5	Transfer Case Control Actuator Lever Ball (Qty: 3)
6	Transfer Case Control Actuator Lever Assembly
7	Transfer Case Control Actuator Lever Thrust Bearing Assembly
8	Transfer Case Control Actuator Lever Washer
9	Transfer Case Four Wheel Drive Clutch Pressure - Apply - Plate **NOTE:** **Ensure the control actuator lever washer is seated into the apply plate groove.**
10	Transfer Case Four Wheel Drive Clutch Pressure Plate Spring (Qty: 4)
11	Transfer Case Four Wheel Drive Clutch Hub
12	Transfer Case Four Wheel Drive Clutch Shim **NOTE:** • **Use a 3 mm (0.118 in) shim as a base to**

Callout	Component Name
	do the initial measurements with, this shim may be changed in the following steps depending on the results of the stack clearance. • **Use the original shim if reassembling a transfer case. This shim may be changed in the following steps depending on the results of the stack clearance.**
13	Transfer Case Two/Four Wheel Drive Clutch Retaining Ring **NOTE:** **If the clutch shim is not seated against the retaining**

Callout	Component Name
	ring, replace the clutch pressure plate springs.

Measuring/Adjusting Clutch Assembly Height

Fig. 55: Measuring/Adjusting Clutch Assembly Height
Courtesy of GENERAL MOTORS COMPANY

Measuring/Adjusting Clutch Assembly Height

Callout	Component Name
1	Clutch Assembly

Callout	Component Name
	Procedure: 1. Using an inside caliper, measure the height of the clutch assembly in the location shown and record the results. 2. Repeat the process in 2 additional locations, 120 degrees from each other. 3. The average of the 3 measurements is the clutch assembly height. 4. A 3.1 mm (0.122 in) clearance +/- 0.1 mm (0.004 in) is necessary between the clutch pack height and the assembly height. It may be necessary to replace the clutch shim with a thicker shim or a thinner shim, to achieve the proper clearance in the clutch. 5. Subtract the clutch pack height from the clutch assembly height. The difference should be between 3.0 mm (0.118 in) and 3.2 mm (0.126 in) clearance. **NOTE:** • **A variety of shims are available to properly adjust the clearance height of the clutch assembly.** • **An inside micrometer may also be used to measure the clutch assembly height.**

Clutch Pressure Plate Installation

Fig. 56: View Of Clutch Pressure Plates & Components
Courtesy of GENERAL MOTORS COMPANY

Clutch Pressure Plate Installation

Callout	Component Name
1	Transfer Case Control Actuator Lever Washer
2	Transfer Case Four Wheel Drive Clutch Pressure - Apply - Plate
3	Transfer Case Four Wheel Drive Clutch Pressure Plate Spring (Qty: 4)
4	Transfer Case Four Wheel Drive Clutch Pressure Plates
5	Transfer Case Four Wheel Drive Clutch Hub
6	Transfer Case Four Wheel Drive Clutch Shim
7	Transfer Case Two/Four Wheel Drive Clutch Retaining Ring **NOTE:**

Callout	Component Name
	The Transfer Case High/Low Clutch Reset must be performed after the transfer case is installed in the vehicle.

Rear Output Shaft Assembly

Fig. 57: Rear Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Rear Output Shaft Assembly

Callout	Component Name
1	Transfer Case Front Output Shaft Drive Sprocket Spacer - Front
2	Transfer Case Four Wheel Drive Clutch Housing
3	Transfer Case Front Output Shaft Drive Sprocket
4	Transfer Case Four Wheel Drive Clutch Housing Retaining Ring
5	Transfer Case Front Output Shaft Drive Sprocket Spacer - Rear
6	Transfer Case Front Output Shaft Drive Sprocket Retaining Ring **NOTE:** **Ensure the retaining ring is installed into the correct retaining ring groove on the rear output shaft.**
7	Transfer Case Oil Pump Assembly
8	Transfer Case Rear Output Shaft Speed Reluctor Wheel
9	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring - Present on Non-Hybrid Applications Only
10	Transfer Case Rear Output Shaft Rear Bearing Assembly **NOTE:** • **Use an arbor press or suitable installer to install**

Callout	Component Name
	the bearing to the rear output shaft. • **Ensure the retaining ring groove in the outer race is positioned toward the rear.**
11	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring

Shift Fork Assembly, and Rear Output Shaft Assembly Installation

Fig. 58: Shift Fork Assembly, and Rear Output Shaft Assembly
Courtesy of GENERAL MOTORS COMPANY

Shift Fork Assembly, and Rear Output Shaft Assembly Installation

Callout	Component Name
Preliminary Procedure Load all 3 components simultaneously.	
1	Transfer Case High/Low Shift Fork Assembly
2	Transfer Case High/Low Clutch
3	Transfer Case Rear Output Shaft Assembly

Front Output Shaft Assembly, Drive Chain, Actuator Shaft Gear, and Oil Pump Suction Pipe Installation

Fig. 59: View Of Front Output Shaft Assembly, Drive Chain, Actuator Shaft Gear, Oil Pump Suction Pipe & Seal
Courtesy of GENERAL MOTORS COMPANY

Front Output Shaft Assembly, Drive Chain, Actuator Shaft Gear, and Oil Pump Suction Pipe Installation

Callout	Component Name
1	Transfer Case Front Output Shaft Assembly, Transfer Case Front Output Shaft Drive Chain Assembly **NOTE:** • **Install the chain with darkened links up.** • **Install**

Callout	Component Name
	the front output shaft assembly into the front case half while engaging the chain with the drive sprocket.
2	Transfer Case Actuator Shaft Gear
3	Transfer Case Oil Pump Suction Pipe Seal **NOTE:** • **Use a NEW seal.** • **Lubricate the seal to ease installation.** • **Install the seal to the pipe prior to inserting the pipe into the pump.**
4	Transfer Case Oil Pump Suction Pipe O-ring
5	Transfer Case Oil Pump Suction Pipe

Transfer Case Rear Case Half Installation

Fig. 60: View Of Transfer Case Rear Case Half, Bracket, Bolts & Sealer
Courtesy of GENERAL MOTORS COMPANY

Transfer Case Rear Case Half Installation

Callout	Component Name
1	Sealer - Refer to:**Adhesives, Fluids, Lubricants, and Sealers** . **CAUTION:** **Apply the proper amount of sealant to the transfer**

Callout	Component Name
	case (front half) sealing surface when assembling the transfer case. Excessive amounts of sealant can plug the oil pump screen, resulting in internal component failure. **NOTE:** • **Ensure both sealing surfaces of the front and rear case halves are free of dirt, oil and cleaning solvent.** • **Apply a**

Callout	Component Name
	2 mm (0.078 in) bead of sealant to the front case half.
2	Transfer Case Rear Case Half **NOTE:** • **Ensure the transfer case rear output shaft outer retaining ring is in place and aligned prior to mating case halves.** • **Use snap ring pliers to open the transfer case rear output shaft outer retaining**

Callout	Component Name
	ring for the transfer case rear output shaft rear bearing assembly. • **Insert a rubber coated screwdriver into the speed sensor hole and lift up on the reluctor wheel to engage the retaining ring with the rear bearing assembly.**
3	Transfer Case Bracket
4	Transfer Case Bolt (Qty: 17) **CAUTION:** **Refer to Fastener Caution .** **NOTE:**

Callout	Component Name
	Tighten bolts by hand, do not use an air gun. **Tighten** 25 N.m (18 lb ft)

Rear Output Shaft Seal and Bushing Installation

Fig. 61: Rear Output Shaft Seal and Bushing
Courtesy of GENERAL MOTORS COMPANY

Rear Output Shaft Seal and Bushing Installation

Callout	Component Name
Preliminary Procedures The following procedure is for the light duty application, for the heavy duty and super heavy duty applications. Refer to **Rear Output Shaft Bushing Replacement (Light Duty)Rear Output Shaft Bushing Replacement (Heavy Duty)**.	
1	Transfer Case Rear Output Shaft Bushing Follow the steps below for use of the **DT-48734** remover/installer. **Procedure** 1. Install the bushing on the finger section of the **DT-48734** remover/installer. 2. Install the finger section to the main body of the **DT-48734** remover/installer. 3. Position the bushing and tool to the rear case half. 4. Press the bushing until the tool bottoms on the rear case half. **NOTE:** • **If the bushing was removed, a new bushing must be installed.** • **Ensure the bushing is installed squarely into the bushing bore.** • **Follow the steps for use of the J-45380 remover/installer.** **Special Tools**

Callout	Component Name
	DT-48734 Transfer Case Rear Bushing Remover and Installer For equivalent regional tools, refer to **Special Tools** .
2	Transfer Case Rear Output Shaft Seal **NOTE:** **Align the notch on the seal between the rear output bearing retaining ring access holes, this will position the weep hole down.** **Special Tools** • **DT-48021** Seal Installer • **GE-8092** Driver Handle For equivalent regional tools, refer to **Special Tools** .

Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor, and Vehicle Speed Sensor Installation

Fig. 62: View Of Access Hole Plugs, Fill & Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor & Vehicle Speed Sensor
Courtesy of GENERAL MOTORS COMPANY

Access Hole Plugs, Fill and Drain Plug, Vent, 2/4 Wheel Drive Actuator, Actuator Shaft Position Sensor, and Vehicle Speed Sensor Installation

Callout	Component Name
1	Transfer Case Actuator Shaft Position Sensor O-ring Seal **NOTE:** **Lightly lubricate the O-ring with clean DEXRONÂ®VI.**

Callout	Component Name
2	Transfer Case Actuator Shaft Position Sensor Assembly
3	Transfer Case Actuator Shaft Position Sensor Bolt/Screw **Tighten** 9 N.m (80 lb in)
4	Transfer Case Two/Four Wheel Drive Actuator Assembly
5	Transfer Case Two/Four Wheel Drive Actuator Bolt/Screw **Tighten** 18 N.m (13 lb ft)
6	Transfer Case Oil Drain Plug **CAUTION:** **Refer to Component Fastener Tightening Caution .** **NOTE:** **Apply pipe sealant to the oil drain plug before installation. Refer to:Adhesives, Fluids, Lubricants, and Sealers .** **Tighten** 18 N.m (13 lb ft)
7	Transfer Case Oil Fill Plug

Callout	Component Name
	NOTE: **Apply pipe sealant to the oil fill plug before installation.** **Tighten** 18 N.m (13 lb ft)
8	Transaxle Vent **NOTE:** **Apply retaining compound to the vent pipe before installation, if removed during disassembly. Refer to:** Adhesives, Fluids, Lubricants, and Sealers **.**
9	Vehicle Speed Sensor O-ring Seal **NOTE:** **Lightly lubricate the O-ring with clean DEXRONÂ®VI.**
10	Vehicle Speed Sensor Assembly **Tighten** 17 N.m (13 lb ft)
11	Transfer Case Access Hole Plug (Qty: 2)

Input Shaft Seal and Front Output Shaft Seal Installation

Fig. 63: Input Shaft Seal and Front Output Shaft Seal
Courtesy of GENERAL MOTORS COMPANY

Input Shaft Seal and Front Output Shaft Seal Installation

Callout	Component Name
1	Transfer Case Input Shaft Seal **NOTE:** • **Ensure the bore of the front case half is free of dirt, oil, and**

Callout	Component Name
	cleaning solvent. • **Double lip input shaft oil seals are used on applications with a WET adapter cavity and with 4 speed transmission RPOs M30/M70 /MW7/M99/ML9 only.** • **Single lip input shaft oil seals are used on applications with a DRY adapter cavity and with 6 speed transmission RPOs MYC/MYD only, and are to be installed with the spring portion of the seal facing inward**

Callout	Component Name
	towards the internals of the transfer case. **Special Tools** **DT-50648-A** Seal Installer For equivalent regional tools, refer to **Special Tools** .
2	Transfer Case Front Output Shaft Seal **Special Tools** • **DT-50649** Seal Installer • **GE-8092** Driver Handle For equivalent regional tools, refer to **Special Tools** .
3	Transfer Case Assembly **Procedure** Remove from **GE-3289-20** Holding Fixture and remove the **DT-45759** Assembly Fixture from the transfer case. **Special Tools** • **GE-3289-20** Holding Fixture • **DT-45759** Assembly Fixture For equivalent regional tools, refer to **Special Tools** .

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TRANSMISSION

Transfer Case - MP 3023/3024 (NQH) - Repair Instructions - On Vehicle - Escalade, Suburban, Tahoe, Yukon

REPAIR INSTRUCTIONS - ON VEHICLE

TRANSFER CASE SELECTOR SWITCH REPLACEMENT (CHEVROLET / GMC)

Fig. 1: Transfer Case Selector Switch (Chevrolet / GMC)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure	
Remove instrument panel accessory bezel. Refer to **Instrument Panel Accessory Bezel Replacement (Chevrolet / GMC)** .	

Callout	Component Name
1	Transfer Case Selector Switch **Procedure** Using the appropriate tool gently depress tabs to remove the switch from the bezel.

TRANSFER CASE SELECTOR SWITCH REPLACEMENT (CADILLAC)

Fig. 2: Transfer Case Selector Switch (Cadillac)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove instrument panel accessory bezel. Refer to **Instrument Panel Accessory Bezel Replacement (Cadillac)** .	

Callout	Component Name
1	Transfer Case Selector Switch **Procedure** Using the appropriate tool gently depress tabs to remove the switch from the bezel.

TRANSFER CASE CONTROL MODULE REPLACEMENT

Fig. 3: Transfer Case Shift Control Module
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the knee bolster. Refer to **Instrument Panel Knee Bolster Replacement (Chevrolet / GMC)** **Instrument Panel Knee Bolster Replacement (Cadillac)** .	

Callout	Component Name
1	Transfer Case Shift Control Module **Procedure** 1. Disconnect the electrical connector. 2. Remove the module from the module bracket by releasing the retaining tabs. 3. If installing a new module, perform the transfer case shift control module programing and setup. Refer to **Control Module References** .

TRANSFER CASE SHIELD REPLACEMENT

Fig. 4: Transfer Case Shield

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .	
1	Transfer Case Shield Bolt **CAUTION:** **Refer to** **Fastener Caution .** **Tighten** 20 N.m (15 lb ft)
2	Transfer Case Shield

TRANSFER CASE FLUID REPLACEMENT

Fig. 5: Transfer Case Drain Plug And Fill Plug
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the transfer case shield, if equipped. Refer to **Transfer Case Shield Replacement**.	
1	Transfer Case Drain Plug **CAUTION:** **Refer to** **Component**

Callout	Component Name
	Fastener Tightening Caution . **Procedure** 1. Allow the transfer case to drain completely. 2. Apply sealant to the plug threads. Refer to **Adhesives, Fluids, Lubricants, and Sealers** . **NOTE:** **Use only hand tools to remove and install the drain plug.** **Tighten** 18 N.m (13 lb ft)

Callout	Component Name
2	Transfer Case Fill Plug **Procedure** 1. Fill the transfer case to the bottom of the fill plug hole with transfer case fluid. Refer to **Adhesives, Fluids, Lubricants, and Sealers** . 2. Apply sealant to the plug threads. Refer to **Adhesives, Fluids, Lubricants, and Sealers** . **NOTE:** **Use only hand tools to remove and install the fill plug.** **Tighten** 18 N.m (13 lb ft)

DRAIN PLUG REPLACEMENT

Fig. 6: Transfer Case Drain Plug And Fill Plug
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the transfer case shield, if equipped. Refer to **Transfer Case Shield Replacement**.	
1	Transfer Case Drain Plug **CAUTION:** **Refer to** **Component**

Callout	Component Name
	Fastener Tightening Caution . **Procedure** 1. Allow the transfer case to drain completely. 2. Apply sealant to the plug threads. Refer to **Adhesives, Fluids, Lubricants, and Sealers** . **NOTE:** **Use only hand tools to remove and install the drain plug.** **Tighten** 18 N.m (13 lb ft)

Callout	Component Name
2	Transfer Case Fill Plug **Procedure** 1. Fill the transfer case to the bottom of the fill plug hole with transfer case fluid. Refer to **Adhesives, Fluids, Lubricants, and Sealers** . 2. Apply sealant to the plug threads. Refer to **Adhesives, Fluids, Lubricants, and Sealers** . **NOTE:** **Use only hand tools to remove and install the fill plug.** **Tighten** 18 N.m (13 lb ft)

FILL PLUG REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

Fig. 7: Transfer Case Fill Plug And Transfer Case Drain Plug
Courtesy of GENERAL MOTORS COMPANY

2. Remove the fill plug (1).

Installation Procedure

Fig. 8: Transfer Case Fill Plug And Transfer Case Drain Plug
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Component Fastener Tightening Caution .

1. Install the fill plug (1) and tighten to 18 N.m (13 lb ft).
2. Lower the vehicle.

TRANSFER CASE TWO/FOUR WHEEL DRIVE ACTUATOR POSITION SENSOR REPLACEMENT

Fig. 9: Transfer Case Two/Four Wheel Drive Actuator Position Sensor
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure	
Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .	

Callout	Component Name
1	Two/Four Wheel Drive Actuator Position Sensor Bolt (Qty: 2) **CAUTION:** **Refer to Fastener Caution .** **Tighten** 6 N.m (53 lb in)
2	Two/Four Wheel Drive Actuator Position Sensor
3	Two/Four Wheel Drive Actuator Position Sensor O-Ring Seal **Procedure** Lightly lubricate the O-ring with clean transfer case fluid. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .

TRANSFER CASE TWO/FOUR WHEEL DRIVE ACTUATOR REPLACEMENT

Fig. 10: Transfer Case Two/Four Wheel Drive Actuator
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .	
1	Two/Four Wheel Drive Actuator Bolt (Qty: 4) **CAUTION:** **Refer to** **Fastener** **Caution** .

Callout	Component Name
	Tighten 18 N.m (13 lb ft)
2	Two/Four Wheel Drive Actuator
3	Two/Four Wheel Drive Actuator Seal **Procedure** 1. Use **J-45278** seal remover and **J-23907** slide hammer to remove the seal from the actuator. 2. Use the **J-44907** bearing installer to install the seal to the actuator. **NOTE:** **Remove the seal from the actuator ONLY if seal replacement is necessary.** **Special Tools** • **J-23907** Slide Hammer • **J-44907** Bearing Installer • **J-45278** Seal Remover For equivalent regional tools, refer to **Special Tools** .

VEHICLE SPEED SENSOR REPLACEMENT

Fig. 11: Vehicle Speed Sensor
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the transfer case shield, if equipped. Refer to **Transfer Case Shield Replacement**.	
1	Vehicle Speed Sensor **CAUTION:** **Refer to** **Component**

Callout	Component Name
	Fastener Tightening Caution . **Procedure** Disconnect vehicle speed sensor electrical connector. **Tighten** 17 N.m (13 lb ft)
2	Vehicle Speed Sensor O-Ring **Procedure** Lightly lubricate the O-ring with clean transfer case fluid. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .

FRONT OUTPUT SHAFT SEAL REPLACEMENT

Special Tools

- **J-8092** Driver Handle
- **DT-50649** Seal Installer

For equivalent regional tools, refer to **Special Tools** .

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the transfer case shield, if equipped. Refer to **Transfer Case Shield Replacement**.
3. Remove the front propeller shaft. Refer to **Front Axle Propeller Shaft Replacement (NQH)** **Front Axle Propeller Shaft Replacement (Heavy Duty)** .

NOTE: **Remove the front output shaft seal in two pieces using the following procedure.**

Fig. 12: Front Output Shaft Slinger And Oil Seal
Courtesy of GENERAL MOTORS COMPANY

4. Insert a screwdriver between the metal inner and metal outer portions of the seal.
5. Pry upward in multiple locations working the metal inner portion of the seal off the shaft until removed.
6. Once the inner metal portion is removed, insert a screwdriver between the outer diameter metal flange of the seal and the housing.
7. Drive the screwdriver inward in multiple locations, the outer portion of the seal will be distorted and can easily be removed from the housing.

Installation Procedure

Fig. 13: Front Output Shaft Oil Seal And Installer
Courtesy of GENERAL MOTORS COMPANY

1. Using the **J-8092** driver handle and **DT-50649** installer (2) install the front output shaft oil seal (1) to the transfer case.

Fig. 14: Front Output Shaft Oil Slinger And Installer
Courtesy of GENERAL MOTORS COMPANY

NOTE: **The new design front output shaft oil slinger can be installed onto all current and prior model year applications, providing the new design front output shaft seal is also installed. Refer to Transfer Case Description and Operation .**

2. Using the **J-8092** driver handle and **DT-50649** installer (2) install the front output shaft oil slinger (1) to the transfer case.

3. Install the front propeller shaft. Refer to **Front Axle Propeller Shaft Replacement (NQH)** **Front Axle Propeller Shaft Replacement (Heavy Duty)** .
4. Install the transfer case shield, if equipped. Refer to **Transfer Case Shield Replacement**.
5. Lower the vehicle.

REAR OUTPUT SHAFT SEAL REPLACEMENT

Fig. 15: Rear Output Shaft Seal
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the rear propeller shaft. Refer to **Rear Propeller Shaft Replacement (1500)** **Rear Propeller Shaft Replacement (Heavy Duty)** **Rear Propeller Shaft Replacement (M5U, 2WD)** .	

Callout	Component Name
1	Transfer Case Output Shaft Seal **Procedure** 1. Remove the seal using a flat-bladed tool. 2. Install the seal with the notch at the top and the weep hole at the bottom. **NOTE:** **Use the appropriate seal installer depending on application.** **Special Tools** • **DT-48021** Seal Installer (Heavy Duty) • **DT-48210** Seal Installer (Light Duty) • **GE-8092** Driver Handle For equivalent regional tools, refer to **Special Tools** .

TRANSFER CASE REAR EXTENSION BUSHING REPLACEMENT

Fig. 16: Transfer Case Rear Extension Bushing
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **Refer to Transfer Case Seal Removal Caution .**	
Preliminary Procedure Remove the transfer case rear output shaft seal. Refer to **Rear Output Shaft Seal Replacement**.	
1	Transfer Case Rear Output Shaft Bushing

Callout	Component Name
	Procedure 1. Install the finger section of the **DT-48734** transfer case rear bushing remover and installer (heavy duty) or **J-45380** transfer case rear bushing remover and installer (light duty) in front of the bushing. 2. Install the forcing tube assembly into the finger section. Ensure the forcing screw is backed out. 3. Using a wrench on the forcing screw, remove the bushing. 4. Remove the old bushing from the **DT-48734** transfer case rear bushing remover and installer (heavy duty) or **J-45380** transfer case rear bushing remover and installer (light duty). 5. Install the NEW bushing on the finger section of the **DT-48734** transfer case rear bushing remover and installer (heavy duty) or **J-45380** transfer case rear bushing remover and installer (light duty). 6. Install the finger section to the forcing tube assembly of the **DT-48734** transfer case rear bushing remover and installer (heavy duty) or **J-45380** transfer case rear bushing remover and installer (light duty). 7. Position the bushing and tool to the rear case half. 8. Install the bushing until the tool bottoms on the rear case half. **NOTE:** • **Use the appropriate bushing tool depending on application.** • **Only remove the bushing if faulty.** • **If the bushing was removed, a new**

Callout	Component Name
	bushing must be installed. • **Ensure the bushing is installed squarely into the bushing bore.** **Special Tools** • **DT-48734** Transfer Case Rear Bushing Remover and Installer (Heavy Duty) • **J-45380** Transfer Case Rear Bushing Remover and Installer (Light Duty) For equivalent regional tools, refer to **Special Tools** .

TRANSFER CASE ASSEMBLY REPLACEMENT

Fig. 17: Transfer Case Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Preliminary Procedures

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the transfer case shield, if equipped. Refer to **Transfer Case Shield Replacement**.
3. Remove the rear propeller shaft. Refer to **Rear Propeller Shaft Replacement (1500)** **Rear Propeller Shaft Replacement (Heavy Duty)** **Rear Propeller Shaft Replacement (M5U, 2WD)** .
4. Remove the front propeller shaft. Refer to **Front Axle Propeller Shaft Replacement (NQH)** **Front Axle Propeller Shaft Replacement (Heavy Duty)** .
5. Drain the fluid from the transfer case. Refer to **Transfer Case Fluid Replacement**.

Callout	Component Name
6. Disconnect the electrical connectors and remove the electrical harness from the transfer case. 7. Remove the crossmember. Refer to **Transmission Support Crossmember Replacement (4WD)** . 8. Remove the transmission mount. Refer to **Transmission Mount Replacement (Four Wheel Drive)** .	
1	Transfer Case Nut **CAUTION:** **Refer to Fastener Caution .** **Tighten** 50 N.m (37 lb ft)
2	Transfer Case **Procedure** **NOTE:** **If installing a new or repaired transfer case, perform the Transfer Case High/Low Clutch reset. Refer to Transfer Case High/Low Clutch Reset**

Callout	Component Name
	. 1. Install a NEW gasket without the use of any type of sealant or lubricant. 2. For MYC and MYD transmissions (dry cavity) applications only, apply lubricant meeting GM Specification 9985830 to the input shaft splines. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .

TRANSFER CASE ADAPTER REPLACEMENT

Fig. 18: Transfer Case Adapter
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
Preliminary Procedure 1. Remove the transfer case. Refer to **Transfer Case Assembly Replacement**. 2. Remove the transmission mount. Refer to **Transmission Mount Replacement (Four Wheel Drive)** for the 6L45/6L50/6L80/6L90.	
1	Transfer Case
2	Gasket
3	Transfer Case Adapter Bolt (Qty: 6) **CAUTION:** **Refer to Fastener Caution .** **Tighten** 50 N.m (37 lb ft)
4	Extension Housing
5	Seal **NOTE:** **Seal is only used for the 4L60-E transmission and should be replaced when the adapter is removed. Do Not use any type of sealant or adhesive in**

Callout	Component Name
	place of or with the seal.

INPUT SHAFT SEAL REPLACEMENT

Fig. 19: Input Shaft Seal
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: **Do not** **damage the**	

Callout	Component Name
sealing surfaces of the transfer cases or the shafts when prying the seals for removal. Damaging the sealing surface may cause leakage or require replacement of the damaged component.	
Preliminary Procedure Remove the transfer case. Refer to **Transfer Case Assembly Replacement**.	
1	Transfer Case Nut **Procedure** Use transfer case nuts to secure transfer case to assembly fixture **J 45759** assembly fixture. **Special Tools** **J 45759** Assembly Fixture For equivalent regional tools, refer to **Special Tools** .
2	Transfer Case **Procedure** Insert the transfer case and assembly fixture into the bench holding fixture **J 3289-20** holding fixture and secure with pivot pin. **Special Tools** **J 3289-20** Holding Fixture For equivalent regional tools, refer to **Special Tools** .

Callout	Component Name
3	Transfer Case Input Shaft Seal **Procedure** 1. Remove the seal using an appropriate tool. Refer to **Transfer Case Disassemble (Light Duty)** **Transfer Case Disassemble (Heavy Duty)** . 2. Install the seal using **J 42738** seal installer. **NOTE:** • **Ensure the bore of the front case half is free of dirt, oil, and cleaning solvent.** • **Double lip input shaft oil seals are used on applications with a WET adapter cavity.** • **Single lip input shaft oil seals are used on applications with a DRY adapter cavity and with 6 speed transmission**

Callout	Component Name
	and are to be installed with the spring portion of the seal facing inward towards the internals of the transfer case. **Special Tools** **J 42738** Seal Installer For equivalent regional tools, refer to **Special Tools** .

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TRANSMISSION

Transfer Case - MP 3023/3024 (NQH) - Schematic and Routing Diagrams - Transfer Case Control Schematics - Escalade, Suburban, Tahoe, Yukon

SCHEMATIC WIRING DIAGRAMS

TRANSFER CASE CONTROL WIRING SCHEMATICS

Power, Ground and Shift Controls

Fig. 1: Power, Ground and Shift Controls

Courtesy of GENERAL MOTORS COMPANY

Transfer Case Controls

Fig. 2: Transfer Case Controls
Courtesy of GENERAL MOTORS COMPANY

Front Axle Controls

Fig. 3: Front Axle Controls
Courtesy of GENERAL MOTORS COMPANY

TRANSMISSION

Transfer Case - MP 3023/3024 (NQH) - Component Locator - Escalade, Suburban, Tahoe, Yukon

COMPONENT LOCATOR

TRANSFER CASE DISASSEMBLED VIEW (LIGHT DUTY)

Case Half Components

Fig. 1: Case Half Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Transfer Case Front Output Shaft Seal

Callout	Component Name
2	Transfer Case Vent
3	Transfer Case Input Shaft Seal
4	Transfer Case Input Shaft Bearing Outer Retaining Ring
5	Transfer Case Stud
6	Transfer Case Front Half
7	Transfer Case Half Locating Pin
7	Transfer Case Half Locating Pin
8	Transfer Case Input Shaft Bearing Assembly
9	Transfer Case Input Shaft Inner Retaining Ring
10	Transfer Case High/Low Internal Gear
11	Transfer Case High/Low Internal Gear Retaining Ring
12	Transfer Case Rear Output Shaft Rear Bearing Outer Retaining Ring
13	Vehicle Speed Sensor Assembly
14	Vehicle Speed Sensor - O-Ring - Seal
15	Transfer Case Rear Half
16	Transfer Case Access Hole Plug
17	Transfer Case - Harness - Bracket
18	Transfer Case Half Bolt/Screw
19	Transfer Case Rear Output Shaft Bushing
20	Transfer Case Rear Output Shaft Seal
21	Transfer Case Actuator Shaft Position Sensor Bolt/Screw
22	Transfer Case Actuator Shaft Position Sensor Assembly
23	Transfer Case Actuator Shaft Position Sensor - O-Ring - Seal
24	Transfer Case Two/Four Wheel Drive Actuator Bolt/Screw
25	Transfer Case Two/Four Wheel Drive Actuator Assembly
26	Transfer Case Two/Four Wheel Drive Actuator Seal
27	Transfer Case Oil Drain Plug
28	Transfer Case Oil Fill Plug
29	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Assembly
30	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Assembly

Internal Components

Fig. 2: Internal Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Transfer Case High/Low Planetary Carrier Retaining Ring
2	Transfer Case High/Low Locking Plate

Callout	Component Name
3	Transfer Case Planetary Carrier Sun Gear Thrust Washer
4	Transfer Case Input Shaft
5	Transfer Case Input Shaft Pilot Bearing Assembly
6	Transfer Case Planetary Carrier Sun Gear Thrust Washer
7	Transfer Case High/Low Planetary Carrier Assembly
8	Transfer Case High/Low Clutch
9	Transfer Case High/Low Shift Fork Pad
10	Transfer Case High/Low Shift Fork
11	Transfer Case High/Low Shift Fork Spring Assembly
12	Transfer Case Two/Four Wheel Drive Actuator Cam Retaining Ring
13	Transfer Case Two/Four Wheel Drive Actuator Cam Spacer
14	Transfer Case Two/Four Wheel Drive Actuator Cam
15	Transfer Case Control Actuator Shaft
16	Transfer Case High/Low Shift Fork Pin
17	Transfer Case Actuator Shaft Gear
18	Transfer Case Rear Output Shaft Assembly
19	Transfer Case Front Output Shaft Drive Chain Assembly
20	Transfer Case Front Output Shaft Drive Sprocket
21	Transfer Case Front Output Shaft Drive Sprocket Bearing Assembly
22	Transfer Case Front Output Shaft Drive Sprocket Spacer - Rear
23	Transfer Case Front Output Shaft Drive Sprocket Retaining Ring
24	Transfer Case Oil Pump Assembly
25	Transfer Case Rear Output Shaft Speed Reluctor Wheel
26	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring - Present on Non-Hybrid Applications Only
27	Transfer Case Rear Output Shaft Rear Bearing Assembly
28	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring
29	Transfer Case Oil Pump Suction Pipe Seal
30	Transfer Case Oil Pump Suction Pipe
31	Transfer Case Front Output Shaft Rear Bearing Assembly
32	Transfer Case Front Output Shaft Driven Sprocket Spacer

Callout	Component Name
33	Transfer Case Front Output Shaft Driven Sprocket
34	Transfer Case Front Output Shaft Hole Plug
35	Transfer Case Front Output Shaft
36	Transfer Case Front Output Shaft Front Bearing Assembly

Clutch Components

Fig. 3: Clutch Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Transfer Case Rear Output Shaft
2	Transfer Case Control Actuator Lever Thrust Bearing Assembly
3	Transfer Case Control Lever
4	Transfer Case Control Actuator Lever Bearing Assembly
5	Transfer Case Control Actuator Lever Ball (Qty: 3)
6	Transfer Case Control Actuator Lever Assembly
7	Transfer Case Control Actuator Lever Thrust Bearing Assembly
8	Transfer Case Control Actuator Lever Washer
9	Transfer Case Four Wheel Drive Clutch Pressure - Apply - Plate

Callout	Component Name
10	Transfer Case Four Wheel Drive Clutch Pressure Plate Spring (Qty: 4)
11	Transfer Case Four Wheel Drive Clutch Pressure - Steel - Plate (Qty: 7)
12	Transfer Case Four Wheel Drive Clutch Pressure - Friction - Plate (Qty: 8)
13	Transfer Case Four Wheel Drive Clutch Hub
14	Transfer Case Four Wheel Drive Clutch Shim
15	Transfer Case Two/Four Wheel Drive Clutch Retaining Ring
16	Transfer Case Front Output Shaft Drive Sprocket Spacer - Front
17	Transfer Case Four Wheel Drive Clutch Housing Retaining Ring
18	Transfer Case Four Wheel Drive Clutch Housing

TRANSFER CASE DISASSEMBLED VIEW (HEAVY DUTY)

Case Half Components

Fig. 4: Case Half Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Transfer Case Front Output Shaft Seal
2	Transfer Case Vent
3	Transfer Case Input Shaft Seal
4	Transfer Case Input Shaft Bearing Outer Retaining Ring
5	Transfer Case Stud
6	Transfer Case Front Half
7	Transfer Case Half Locating Pin
7	Transfer Case Half Locating Pin
8	Transfer Case Input Shaft Bearing Assembly
9	Transfer Case Input Shaft Inner Retaining Ring
10	Transfer Case High/Low Internal Gear
11	Transfer Case High/Low Internal Gear Retaining Ring
12	Transfer Case Rear Output Shaft Rear Bearing Outer Retaining Ring
13	Vehicle Speed Sensor Assembly
14	Vehicle Speed Sensor - O-Ring - Seal
15	Transfer Case Rear Half
16	Transfer Case Access Hole Plug
17	Transfer Case - Harness - Bracket
18	Transfer Case Half Bolt/Screw
19	Transfer Case Rear Output Shaft Bushing
20	Transfer Case Rear Output Shaft Seal
21	Transfer Case Actuator Shaft Position Sensor Bolt/Screw
22	Transfer Case Actuator Shaft Position Sensor Assembly
23	Transfer Case Actuator Shaft Position Sensor - O-Ring - Seal
24	Transfer Case Two/Four Wheel Drive Actuator Bolt/Screw
25	Transfer Case Two/Four Wheel Drive Actuator Assembly
26	Transfer Case Two/Four Wheel Drive Actuator Seal
27	Transfer Case Oil Drain Plug

Callout	Component Name
28	Transfer Case Oil Fill Plug
29	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Assembly
30	Transfer Case Four Wheel Drive Actuator Lever Shaft Bearing Assembly

Internal Components (Heavy Duty-Second Design)

Fig. 5: Internal Components (Heavy Duty-Second Design)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Transfer Case High/Low Planetary Carrier Retaining Ring
2	Transfer Case High/Low Locking Plate
3	Transfer Case Planetary Carrier Sun Gear Thrust Washer
4	Transfer Case Input Shaft
5	Transfer Case Input Shaft Pilot Bearing Assembly
6	Transfer Case Input Shaft Pilot Bearing Retaining Ring
7	Transfer Case Planetary Carrier Sun Gear Thrust Washer
8	Transfer Case High/Low Planetary Carrier Assembly
9	Transfer Case High/Low Clutch
10	Transfer Case High/Low Shift Fork Pad
11	Transfer Case High/Low Shift Fork
12	Transfer Case High/Low Shift Fork Spring Assembly
13	Transfer Case Two/Four Wheel Drive Actuator Cam Retaining Ring
14	Transfer Case Two/Four Wheel Drive Actuator Cam Spacer
15	Transfer Case Two/Four Wheel Drive Actuator Cam
16	Transfer Case Control Actuator Shaft
17	Transfer Case High/Low Shift Fork Pin
18	Transfer Case Actuator Shaft Gear
19	Transfer Case Rear Output Shaft Assembly
20	Transfer Case Front Output Shaft Drive Chain Assembly
21	Transfer Case Front Output Shaft Drive Sprocket
22	Transfer Case Front Output Shaft Drive Sprocket Bearing Assembly
23	Transfer Case Front Output Shaft Drive Sprocket Spacer - Rear
24	Transfer Case Front Output Shaft Drive Sprocket Retaining Ring
25	Transfer Case Oil Pump Assembly
26	Transfer Case Rear Output Shaft Speed Reluctor Wheel
27	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring - Present on Non-Hybrid Applications Only
28	Transfer Case Rear Output Shaft Rear Bearing Assembly
29	Transfer Case Rear Output Shaft Rear Bearing Retaining Ring

Callout	Component Name
30	Transfer Case Oil Pump Suction Pipe Seal
31	Transfer Case Oil Pump Suction Pipe
32	Transfer Case Front Output Shaft Rear Bearing Assembly
33	Transfer Case Front Output Shaft Driven Sprocket Spacer
34	Transfer Case Front Output Shaft Driven Sprocket
35	Transfer Case Front Output Shaft Hole Plug
36	Transfer Case Front Output Shaft
37	Transfer Case Front Output Shaft Front Bearing Assembly

Clutch Components

Fig. 6: Clutch Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Transfer Case Rear Output Shaft
2	Transfer Case Control Actuator Lever Thrust Bearing Assembly
3	Transfer Case Control Lever
4	Transfer Case Control Actuator Lever Bearing Assembly
5	Transfer Case Control Actuator Lever Ball (Qty: 3)

Callout	Component Name
6	Transfer Case Control Actuator Lever Assembly
7	Transfer Case Control Actuator Lever Thrust Bearing Assembly
8	Transfer Case Control Actuator Lever Washer
9	Transfer Case Four Wheel Drive Clutch Pressure - Apply - Plate
10	Transfer Case Four Wheel Drive Clutch Pressure Plate Spring (Qty: 4)
11	Transfer Case Four Wheel Drive Clutch Pressure - Steel - Plate (Qty: 7)
12	Transfer Case Four Wheel Drive Clutch Pressure - Friction - Plate (Qty: 8)
13	Transfer Case Four Wheel Drive Clutch Hub
14	Transfer Case Four Wheel Drive Clutch Shim
15	Transfer Case Two/Four Wheel Drive Clutch Retaining Ring
16	Transfer Case Front Output Shaft Drive Sprocket Spacer - Front
17	Transfer Case Four Wheel Drive Clutch Housing Retaining Ring
18	Transfer Case Four Wheel Drive Clutch Housing

.

TRANSMISSION

Transmission Cooling - Escalade, Suburban, Tahoe, Yukon

SPECIFICATIONS

FASTENER SPECIFICATIONS

Application	Specification	
	Metric	English
Transmission Fluid Cooler Pipe Connector Bolt	22 N.m	16 lb ft
Transmission Fluid Cooler Pipe Connector	20 N.m	15 lb ft
Transmission Oil Cooler Fitting	24 N.m	18 lb ft

DIAGNOSTIC INFORMATION AND PROCEDURES

TRANSMISSION FLUID COOLER FLUSHING AND FLOW TEST (6L80 OR 6L90)

GM studies indicate that plugged or restricted transmission oil coolers and pipes cause insufficient transmission lubrication and elevated operating temperatures which can lead to premature transmission failure. Many repeat repair cases could have been prevented by following published procedures for transmission oil cooler flushing and flow checking. This procedure includes flow checking and flushing the auxiliary transmission oil cooler, if equipped.

NOTE: **Use the DT-45096 transmission oil cooling system flush and flow test tool or equivalent to flush and flow test the transmission oil cooler and the oil cooler pipes after the transmission is removed for repairs.**

Only use the appropriate GM automatic transmission fluid when doing a repair on a GM transmission.

If the fluid in the **DT-45096** transmission oil cooling system flush and flow test tool is different than what is used in the transmission, after performing the flush and flow test, use compressed air to blow the residual transmission fluid out of the oil cooler and lines.

Time allowance for performing the cooler flow checking and flushing procedure has been included in the appropriate labor time guide operations since the 1987 model year. The service procedure steps for oil cooler flushing and flow testing are as follows:

Cooler Flow Check and Flushing Steps

1. Machine Set-up
2. Determine Minimum Flow Rate
3. Back Flush
4. Forward Flush
5. Flow Test
6. Code Recording Procedure
7. Clean-up

Special Tools

- **DT-45096** Transmission Oil Cooling System Flush and Flow Test Tool
- **DT-45096-30** Transmission Cooler Flush Adapter
- **J-35944-200A** Cooler Flushing Adapter
- Shop air supply with water/oil filters, regulator and pressure gauge - minimum 90 psi
- Eye protection
- Rubber gloves

Machine Set-up

Fig. 1: View Of Main Power Switch & Main Function Switch
Courtesy of GENERAL MOTORS COMPANY

1. Verify that the main power switch (1) is in the OFF position.
2. Place the main function switch (2) in the IDLE position.

Fig. 2: Connecting To 12V DC Power Source
Courtesy of GENERAL MOTORS COMPANY

3. Connect **DT-45096** transmission oil cooling system flush and flow test tool to the vehicle 12V DC power source by connecting the red battery clip to the positive, +, battery post on the vehicle and connect the negative lead to a known good chassis ground.

4. Turn the main power switch to the ON position.

Fig. 3: Filling Supply Tank With Transmission Fluid
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Do not overfill the supply vessel. Damage to the unit may result. To verify the fluid level, view the LCD screen display while filling the unit, to ensure the fluid level does not exceed 30 L (32 qt).

5. Fill the supply tank with the appropriate GM automatic transmission fluid through the fill port.
6. Reinstall and tighten the fill cap.

Fig. 4: Applying Shop Air Supply Hose To J 45096 Quick-Disconnect
Courtesy of GENERAL MOTORS COMPANY

7. Connect a shop air supply hose to the quick-disconnect on the rear panel marked SUPPLY AIR.

Determine Minimum Flow Rate

Fig. 5: Identifying Machine Display Of Automatic Transmission Fluid Temperature
Courtesy of GENERAL MOTORS COMPANY

1. From the machine display, identify the temperature of the automatic transmission fluid that is stored in the supply vessel of **DT-45096** flush and flow test tool.

Fig. 6: Identifying Transmission Oil Cooler Metal Composition
Courtesy of GENERAL MOTORS COMPANY

2. Determine whether the transmission oil cooler is steel or aluminum by using a magnet (1) at the cooler flange (2) at the radiator.
3. Refer to the table below. Using the temperature from step 1, locate on either the Steel MINIMUM Flow Rate table or the Aluminum MINIMUM Flow Rate table the minimum flow rate in gallons per minutes (GPM). Record the minimum flow rate in GPMs and the supply fluid temperature for further reference.

Example

- Fluid temperature: 75Â°F
- Cooler type: Steel

  The MINIMUM flow rate for this example would be 0.8 GPM.

4. Inspect transmission oil cooler lines for damage or kinks that could cause restricted oil flow. Repair as needed and refer to the appropriate GM service manual procedures.

***Minimum Flow Rate in Gallons Per Minute (gpm)**

Temperature Range	Aluminum
65 - 77Â°F	0.5 gpm
78 - 86Â°F	0.6 gpm
87 - 94Â°F	0.7 gpm
95 - 101Â°F	0.8 gpm
102 - 105Â°F	0.9 gpm
106 - 108Â°F	1.0 gpm
109 - 112Â°F	1.1 gpm
113 - 115Â°F	1.2 gpm
116 - 118Â°F	1.3 gpm
119 - 120Â°F	1.4 gpm

*A measured flow rate that is 0.1 gpm lower than the minimum flow rate specification does not necessarily indicate a failed cooling system. Variation in fluid temperature, air pressure and the tool rounding variation can cause a lower minimum flow reading.

Back Flush Procedure

Fig. 7: Cooler Flushing Adapters
Courtesy of GENERAL MOTORS COMPANY

1. If equipped with bypass valve, disconnect the oil cooler lines from the bypass valve.
2. If equipped with bypass valve, connect the **J-35944-200A** cooler flushing adapter (1) to the vehicle transmission oil cooler supply and return lines at the transmission.

Fig. 8: Cooler Flush Adapters
Courtesy of GENERAL MOTORS COMPANY

3. If not equipped with the bypass valve, connect the **DT-45096-30** cooler flush adapter (1) to the vehicle transmission oil cooler supply and return lines at the transmission.

Fig. 9: Black Supply Hose
Courtesy of GENERAL MOTORS COMPANY

4. Connect the black supply hose (1) to the return line, bottom connector of the transmission, and the clear waste hose (2) to the feed line, top connector of the transmission, to the vehicle cooler lines. This is the reverse flow - backflush direction.

Fig. 10: View Of Main Function Switch FLUSH Position
Courtesy of GENERAL MOTORS COMPANY

5. Turn the main function switch to the FLUSH position. Allow the machine to operate for 30 seconds.

Fig. 11: View Of Main Function Switch IDLE Position
Courtesy of GENERAL MOTORS COMPANY

6. Turn the main function switch to the IDLE position and allow the supply vessel pressure to dissipate.

Forward Flush

Fig. 12: Supply And Waste Hoses
Courtesy of GENERAL MOTORS COMPANY

1. Disconnect the supply and waste hoses from the vehicle cooler lines. Reverse the supply hose (2) and waste hose (1) to provide a normal flow direction.

Fig. 13: View Of Main Function Switch FLUSH Position
Courtesy of GENERAL MOTORS COMPANY

2. Turn the main function switch to the FLUSH position and allow machine to operate for 30 seconds.

Flow Test

Fig. 14: View Of Main Function Switch FLOW Position
Courtesy of GENERAL MOTORS COMPANY

NOTE: **If the flow rate is less than 0.5 gpm, the LCD displays an error message. Refer to the Troubleshooting section of the operation manual.**

1. Turn the main function switch to the FLOW position and allow the oil to flow for 15 seconds. Observe and note the flow rate; this is the TESTED flow rate.
2. Compare the TESTED flow rate to the MINIMUM flow rate information previously recorded.
   - If the TESTED flow rate is equal to or greater than the MINIMUM flow rate recorded, the oil cooling system is functioning properly. Perform Code Recording Procedure.
   - If the TESTED flow rate is less than the MINIMUM flow rate previously recorded, repeat the back flush and forward flush procedures.
3. If the TESTED flow rate is less than the MINIMUM flow rate after the second test, perform Code Recording Procedure.
   1. Replace the transmission oil cooler.
   2. Reconnect supply and waste hoses to the cooler lines in the normal flow direction. Perform Flow Test.
   3. Perform Code Recording Procedure.

Code Recording Procedure

Fig. 15: View Of Main Function Switch CODE Position
Courtesy of GENERAL MOTORS COMPANY

1. Turn the main function switch to the CODE position.

NOTE:

- **If power is interrupted prior to the recording of the seven-character code, the code will be lost and the flow rate test will need to be repeated.**
- **The flow test must run for a minimum of 8-10 seconds and be above 0.5 GPM for a code to be generated.**

2. Record TESTED flow rate, temperature, cycle and seven-character flow code information on repair order.

Clean-up

Fig. 16: View Of Main Power Switch & Main Function Switch
Courtesy of GENERAL MOTORS COMPANY

1. Turn the main function switch (2) to the IDLE position and allow the supply vessel pressure to dissipate.
2. Turn the main power switch (1) to the OFF position.

NOTE:

- **A small amount of water may drain from the bottom of the unit when the air supply is disconnected. This is a normal operation of the built-in water separator.**
- **If the fluid in the DT-45096 transmission oil cooling system flush and flow test tool is different than what is used in the transmission, use compressed air to blow the residual transmission fluid out of the oil cooler and lines.**

3. Disconnect the supply and waste hoses and the 12-volt power source from the vehicle.

Fig. 17: Applying Shop Air Supply Hose To J 45096 Quick-Disconnect
Courtesy of GENERAL MOTORS COMPANY

4. Disconnect the air supply hose from **DT-45096** flush and flow test tool.
5. Remove the **DT-45096-30** or the **J-35944-200A** adapters.

6. Dispose of the waste automatic transmission fluid in accordance with all applicable federal, state, and local requirements.

TRANSMISSION FLUID COOLER FLUSHING AND FLOW TEST (ALLISON)

GM studies indicate that plugged or restricted transmission oil coolers and pipes cause insufficient transmission lubrication and elevated operating temperatures which can lead to premature transmission failure. Many repeat repair cases could have been prevented by following published procedures for transmission oil cooler flushing and flow checking. This procedure includes flow checking and flushing the auxiliary transmission oil cooler, if equipped.

NOTE: **Use the DT-45096 transmission oil cooling system flush and flow test tool or equivalent to flush and flow test the transmission oil cooler and the oil cooler pipes after the transmission is removed for repairs.**

Only use the appropriate GM automatic transmission fluid when doing a repair on a GM transmission.

If the fluid in the **DT-45096** transmission oil cooling system flush and flow test tool is different than what is used in the transmission, after performing the flush and flow test, use compressed air to blow the residual transmission fluid out of the oil cooler and lines.

Time allowance for performing the cooler flow checking and flushing procedure has been included in the appropriate labor time guide operations since the 1987 model year. The service procedure steps for oil cooler flushing and flow testing are as follows:

Cooler Flow Check and Flushing Steps

1. Machine Set-up
2. Determine Minimum Flow Rate
3. Back Flush
4. Forward Flush
5. Flow Test
6. Code Recording Procedure
7. Clean-up

Special Tools

- **DT-45096** Transmission Oil Cooling System Flush and Flow Test Tool
- **DT-45096-23** TransFlow Adapters or equivalent.
- Shop air supply with water/oil filters, regulator and pressure gauge - minimum 90 psi

- Eye protection
- Rubber gloves

For equivalent regional tools, refer to **Special Tools**.

Machine Set-up

Fig. 18: View Of Main Power Switch & Main Function Switch
Courtesy of GENERAL MOTORS COMPANY

1. Verify that the main power switch (1) is in the OFF position.
2. Place the main function switch (2) in the IDLE position.

Fig. 19: Connecting To 12V DC Power Source
Courtesy of GENERAL MOTORS COMPANY

3. Connect **DT-45096** flush and flow test tool to the vehicle 12V DC power source by connecting the red battery clip to the positive, +, battery post on the vehicle and connect the negative lead to a known good chassis ground.

4. Turn the main power switch to the ON position.

Fig. 20: Filling Supply Tank With Transmission Fluid
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Do not overfill the supply vessel. Damage to the unit may result. To verify the fluid level, view the LCD screen display while filling the unit, to ensure the fluid level does not exceed 30 L (32 qt).

5. Fill the supply tank with the appropriate GM automatic transmission fluid through the fill port.
6. Reinstall and tighten the fill cap.

Fig. 21: Applying Shop Air Supply Hose To J 45096 Quick-Disconnect
Courtesy of GENERAL MOTORS COMPANY

7. Connect a shop air supply hose to the quick-disconnect on the rear panel marked SUPPLY AIR.

Determine Minimum Flow Rate

Fig. 22: Identifying Machine Display Of Automatic Transmission Fluid Temperature
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Due to the large size of the oil cooling system components and the flow capacity of the DT-45096 flush and flow test tool, the fluid temperature in excess of 100 degrees Fahrenheit can cause inaccurate flow**

readings.

1. From the machine display, identify the temperature of the automatic transmission fluid that is stored in the supply vessel of **DT-45096** flush and flow test tool.
2. Refer to the table below. Using the temperature from step 1, locate on MINIMUM Flow Rate table the minimum flow rate in gallons per minute. Record the minimum flow rate in gallons per minute and the supply fluid temperature for further reference.

   Example

   - Fluid temperature: 75Â°F
   - The MINIMUM flow rate for this example would be 1.7 gpm.
3. Inspect transmission oil cooler lines for damage or kinks that could cause restricted oil flow. Repair as needed and refer to the appropriate GM service manual procedures.

***Minimum Flow Rate in Gallons Per Minute**

Temperature Range	Steel
65 - 66Â°F	0.7 gpm
67 - 71Â°F	1.0 gpm
72 - 74Â°F	1.2 gpm
75 - 79Â°F	1.3 gpm
80 - 82Â°F	1.4 gpm
83 - 86Â°F	1.5 gpm
87 - 92Â°F	1.6 gpm
93 - 96Â°F	1.7 gpm
97 - 101Â°F	1.8 gpm
102 - 104Â°F	1.9 gpm
105 - 109Â°F	2.0 gpm
110 - 112Â°F	2.1 gpm
113 - 116Â°F	2.2 gpm
117 - 119Â°F	2.3 gpm
120 + Â°F	2.4 gpm

*A measured flow rate that is 0.1 gpm lower than the minimum flow rate specification does not necessarily indicate a failed cooling system.

Variation in fluid temperature, air pressure and the tool rounding variation can cause a lower minimum flow reading.

Back Flush Procedure

Fig. 23: Transmission Fluid Cooler Bypass Valve
Courtesy of GENERAL MOTORS COMPANY

1. Connect the **DT-45096-23** adapters (1) to the transmission fluid cooler supply and return lines at the transmission fluid cooler bypass valve (2),

if equipped.

Fig. 24: Black Supply Hose And Clear Waste Hose
Courtesy of GENERAL MOTORS COMPANY

2. Connect the black supply hose (1) to the return line, top connector of the transmission, and the clear waste hose (2) to the supply line, bottom connector of the transmission, to the vehicle cooler lines. This is the reverse flow - backflush direction.

Fig. 25: View Of Main Function Switch FLUSH Position
Courtesy of GENERAL MOTORS COMPANY

3. Turn the main function switch to the FLUSH position. Allow the machine to operate for 30 seconds.

Fig. 26: View Of Main Function Switch IDLE Position
Courtesy of GENERAL MOTORS COMPANY

4. Turn the main function switch to the IDLE position and allow the supply vessel pressure to dissipate.

Forward Flush

Fig. 27: Disconnecting Supply And Waste Hoses From Vehicle Cooler Line
Courtesy of GENERAL MOTORS COMPANY

1. Disconnect the supply and waste hoses from the vehicle cooler lines. Reverse the supply and waste hoses to provide a normal flow direction.

Fig. 28: View Of Main Function Switch FLUSH Position
Courtesy of GENERAL MOTORS COMPANY

2. Turn the main function switch to the FLUSH position and allow machine to operate for 30 seconds.

Flow Test

Fig. 29: View Of Main Function Switch FLOW Position
Courtesy of GENERAL MOTORS COMPANY

NOTE: **If the flow rate is less than 0.5 gallons per minute, the LCD displays an error message. Refer to the Troubleshooting section of the operation manual.**

1. Turn the main function switch to the FLOW position and allow the oil to flow for 15 seconds. Observe and note the flow rate; this is the TESTED flow rate.
2. Compare the TESTED flow rate to the MINIMUM flow rate information previously recorded.
   - If the TESTED flow rate is equal to or greater than the MINIMUM flow rate recorded, the oil cooling system is functioning properly. Perform Code Recording Procedure.
   - If the TESTED flow rate is less than the MINIMUM flow rate previously recorded, repeat the back flush and forward flush procedures.
3. If the TESTED flow rate is less than the MINIMUM flow rate after the second test, perform Code Recording Procedure.
   1. Replace the transmission oil cooler.
   2. Reconnect supply and waste hoses to the cooler lines in the normal flow direction. Perform Flow Test.
   3. Perform Code Recording Procedure.

Code Recording Procedure

Fig. 30: View Of Main Function Switch CODE Position
Courtesy of GENERAL MOTORS COMPANY

NOTE:

- **If power is interrupted prior to the recording of the seven-character code, the code will be lost and the flow rate test will need to be repeated.**

- **The flow test must run for a minimum of 8-10 seconds and be above 0.5 gallons per minute for a code to be generated.**

1. Turn the main function switch to the CODE position.
2. Record TESTED flow rate, temperature, cycle and seven-character flow code information on repair order.

Clean-up

Fig. 31: View Of Main Power Switch & Main Function Switch
Courtesy of GENERAL MOTORS COMPANY

1. Turn the main function switch (2) to the IDLE position and allow the supply vessel pressure to dissipate.
2. Turn the main power switch (1) to the OFF position.

NOTE:

- **A small amount of water may drain from the bottom of the unit when the air supply is disconnected. This is a normal operation of the built-in water separator.**
- **If the fluid in the DT-45096 transmission oil cooling system flush and flow test tool is different than what is used in the transmission, use compressed air to blow the residual transmission fluid out of the oil cooler and lines.**

3. Disconnect the supply and waste hoses and the 12-volt power source from the vehicle.

Fig. 32: Applying Shop Air Supply Hose To J 45096 Quick-Disconnect
Courtesy of GENERAL MOTORS COMPANY

4. Disconnect the air supply hose from **DT-45096** flush and flow test tool.
5. Remove the **DT-45096-23** adapters.

6. Dispose of the waste automatic transmission fluid in accordance with all applicable federal, state, and local requirements.

TRANSMISSION FLUID COOLER FLUSHING AND FLOW TEST (8L90)

GM studies indicate that plugged or restricted transmission oil coolers and pipes cause insufficient transmission lubrication and elevated operating temperatures which can lead to premature transmission failure. Many repeat repair cases could have been prevented by following published procedures for transmission oil cooler flushing and flow checking. This procedure includes flow checking and flushing the auxiliary transmission oil cooler, if equipped.

NOTE: **Use the DT-45096 transmission oil cooling system flush and flow test tool or equivalent to flush and flow test the transmission oil cooler and the oil cooler pipes after the transmission is removed for repairs.**

Only use the appropriate GM automatic transmission fluid when doing a repair on a GM transmission.

If the fluid in the **DT-45096** transmission oil cooling system flush and flow test tool is different than what is used in the transmission, after performing the flush and flow test, use compressed air to blow the residual transmission fluid out of the oil cooler and lines.

Time allowance for performing the cooler flow checking and flushing procedure has been included in the appropriate labor time guide operations since the 1987 model year. The service procedure steps for oil cooler flushing and flow testing are as follows:

Cooler Flow Check and Flushing Steps

1. Machine Set-up
2. Determine Minimum Flow Rate
3. Back Flush
4. Forward Flush
5. Flow Test
6. Code Recording Procedure
7. Clean-up

Special Tools

- **DT-45096** Transmission Oil Cooling System Flush and Flow Test Tool
- **DT-45096-30** Transmission Cooler Flush Adapter
- Shop air supply with water/oil filters, regulator and pressure gauge - minimum 90 psi

- Eye protection
- Rubber gloves

Machine Set-up

Fig. 33: View Of Main Power Switch & Main Function Switch
Courtesy of GENERAL MOTORS COMPANY

1. Verify that the main power switch (1) is in the OFF position.
2. Place the main function switch (2) in the IDLE position.

Fig. 34: Connecting To 12V DC Power Source
Courtesy of GENERAL MOTORS COMPANY

3. Connect **DT-45096** transmission oil cooling system flush and flow test tool to the vehicle 12V DC power source by connecting the red battery clip to the positive, +, battery post on the vehicle and connect the negative lead to a known good chassis ground.
4. Turn the main power switch to the ON position.

Fig. 35: Filling Supply Tank With Transmission Fluid
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Do not overfill the supply vessel. Damage to the unit may result. To verify the fluid level, view the LCD screen display while filling the unit, to ensure the fluid level does not exceed 30 L (32 qt).

5. Fill the supply tank with the appropriate GM automatic transmission fluid through the fill port.
6. Reinstall and tighten the fill cap.

Fig. 36: Applying Shop Air Supply Hose To J 45096 Quick-Disconnect
Courtesy of GENERAL MOTORS COMPANY

7. Connect a shop air supply hose to the quick-disconnect on the rear panel marked SUPPLY AIR.

Determine Minimum Flow Rate

Fig. 37: Identifying Machine Display Of Automatic Transmission Fluid Temperature

Courtesy of GENERAL MOTORS COMPANY

1. From the machine display, identify the temperature of the automatic transmission fluid that is stored in the supply vessel of **DT-45096** flush and flow test tool.

Fig. 38: Identifying Transmission Oil Cooler Metal Composition
Courtesy of GENERAL MOTORS COMPANY

2. Determine whether the transmission oil cooler is steel or aluminum by using a magnet (1) at the cooler flange (2) at the radiator.
3. Refer to the table below. Using the temperature from step 1, locate on either the Steel MINIMUM Flow Rate table or the Aluminum MINIMUM Flow Rate table the minimum flow rate in gallons per minutes (GPM). Record the minimum flow rate in GPMs and the supply fluid temperature for further reference.

   Example

   - Fluid temperature: 75Â°F
   - Cooler type: Steel

     The MINIMUM flow rate for this example would be 0.8 GPM.

4. Inspect transmission oil cooler lines for damage or kinks that could cause restricted oil flow. Repair as needed and refer to the appropriate GM service manual procedures.

***Minimum Flow Rate in Gallons Per Minute (gpm)**

Temperature Range	Aluminum
65 - 77Â°F	0.5 gpm
78 - 86Â°F	0.6 gpm
87 - 94Â°F	0.7 gpm
95 - 101Â°F	0.8 gpm
102 - 105Â°F	0.9 gpm
106 - 108Â°F	1.0 gpm
109 - 112Â°F	1.1 gpm
113 - 115Â°F	1.2 gpm
116 - 118Â°F	1.3 gpm
119 - 120Â°F	1.4 gpm

*A measured flow rate that is 0.1 gpm lower than the minimum flow rate specification does not necessarily indicate a failed cooling system. Variation in fluid temperature, air pressure and the tool rounding variation can cause a lower minimum flow reading.

Back Flush Procedure

Fig. 39: Cooler Flushing Adapter
Courtesy of GENERAL MOTORS COMPANY

1. If equipped with bypass valve, disconnect the oil cooler lines from the bypass valve.
2. If equipped with bypass valve, connect a commercially available barbed fitting and 1/2 inch ID rubber hose to the vehicle transmission oil cooler supply and return lines at the transmission.

Fig. 40: Cooler Flush Adapter
Courtesy of GENERAL MOTORS COMPANY

3. If not equipped with the bypass valve, connect the **DT-45096-30** cooler flush adapter (1) to the vehicle transmission oil cooler supply and return lines at the transmission.

Fig. 41: Black Supply Hose Aand Clear Waste Hos
Courtesy of GENERAL MOTORS COMPANY

4. Connect the black supply hose (1) to the return line, rear connector of the transmission, and the clear waste hose (2) to the feed line, front connector of the transmission, to the vehicle cooler lines. This is the reverse flow - backflush direction.

Fig. 42: View Of Main Function Switch FLUSH Position
Courtesy of GENERAL MOTORS COMPANY

5. Turn the main function switch to the FLUSH position. Allow the machine to operate for 30 seconds.

Fig. 43: View Of Main Function Switch IDLE Position
Courtesy of GENERAL MOTORS COMPANY

6. Turn the main function switch to the IDLE position and allow the supply vessel pressure to dissipate.

Forward Flush

Fig. 44: Supply Hose And Waste Hose
Courtesy of GENERAL MOTORS COMPANY

1. Disconnect the supply and waste hoses from the vehicle cooler lines. Reverse the supply hose (2) and waste hose (1) to provide a normal flow direction.

Fig. 45: View Of Main Function Switch FLUSH Position
Courtesy of GENERAL MOTORS COMPANY

2. Turn the main function switch to the FLUSH position and allow machine to operate for 30 seconds.

Flow Test

Fig. 46: View Of Main Function Switch FLOW Position
Courtesy of GENERAL MOTORS COMPANY

NOTE: **If the flow rate is less than 0.5 gpm, the LCD displays an error message. Refer to the Troubleshooting section of the operation manual.**

1. Turn the main function switch to the FLOW position and allow the oil to flow for 15 seconds. Observe and note the flow rate; this is the TESTED flow rate.
2. Compare the TESTED flow rate to the MINIMUM flow rate information previously recorded.
   - If the TESTED flow rate is equal to or greater than the MINIMUM flow rate recorded, the oil cooling system is functioning properly. Perform Code Recording Procedure.
   - If the TESTED flow rate is less than the MINIMUM flow rate previously recorded, repeat the back flush and forward flush procedures.
3. If the TESTED flow rate is less than the MINIMUM flow rate after the second test, perform Code Recording Procedure.
   1. Replace the transmission oil cooler.
   2. Reconnect supply and waste hoses to the cooler lines in the normal flow direction. Perform Flow Test.
   3. Perform Code Recording Procedure.

Code Recording Procedure

Fig. 47: View Of Main Function Switch CODE Position
Courtesy of GENERAL MOTORS COMPANY

1. Turn the main function switch to the CODE position.

NOTE:

- **If power is interrupted prior to the recording of the seven-character code, the code will be lost and the flow rate test will need to be repeated.**
- **The flow test must run for a minimum of 8-10 seconds and be above 0.5 GPM for a code to be generated.**

2. Record TESTED flow rate, temperature, cycle and seven-character flow code information on repair order.

Clean-up

Fig. 48: View Of Main Power Switch & Main Function Switch
Courtesy of GENERAL MOTORS COMPANY

1. Turn the main function switch (2) to the IDLE position and allow the supply vessel pressure to dissipate.
2. Turn the main power switch (1) to the OFF position.

NOTE:

- **A small amount of water may drain from the bottom of the unit when the air supply is disconnected. This is a normal operation of the built-in water separator.**
- **If the fluid in the DT-45096 transmission oil cooling system flush and flow test tool is different than what is used in the transmission, use compressed air to blow the residual transmission fluid out of the oil cooler and lines.**

3. Disconnect the supply and waste hoses and the 12-volt power source from the vehicle.

Fig. 49: Applying Shop Air Supply Hose To J 45096 Quick-Disconnect
Courtesy of GENERAL MOTORS COMPANY

4. Disconnect the air supply hose from **DT-45096** flush and flow test tool.
5. Remove the **DT-45096-30** or the hose adapters.

6. Dispose of the waste automatic transmission fluid in accordance with all applicable federal, state, and local requirements.

REPAIR INSTRUCTIONS

TRANSMISSION FLUID COOLER PIPE SEAL REPLACEMENT

Special Tools

- **DT-45201** Cooler Line Seal Remover
- **DT-47770** Seal Installer

For equivalent regional tools, refer to **Special Tools** .

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the left catalytic converter. Refer to Three-Way Catalytic Converter Replacement .

Fig. 50: View Of Oil Cooling Lines & Bolt
Courtesy of GENERAL MOTORS COMPANY

3. Remove the transmission fluid cooler pipe bolt (2) from the transmission.
4. Remove the transmission fluid cooler pipes from the transmission.

Fig. 51: Transmission Fluid Cooler Pipe Seals
Courtesy of GENERAL MOTORS COMPANY

5. Using **DT-45201** remover, remove the transmission fluid cooler pipe seals from the transmission.

Installation Procedure

Fig. 52: Transmission Fluid Cooler Pipe Seals
Courtesy of GENERAL MOTORS COMPANY

1. Using **DT-47770** installer, install the transmission fluid cooler pipe seals (1) in the transmission.

Fig. 53: View Of Oil Cooling Lines & Bolt
Courtesy of GENERAL MOTORS COMPANY

2. Install transmission fluid cooler pipes (1) the to the transmission.

CAUTION: Refer to Fastener Caution .

3. Install the transmission fluid cooler pipe bolt (2) to the transmission and tighten to 22 N.m (16 lb ft).

4. Install the left catalytic converter. Refer to Three-Way Catalytic Converter Replacement .
5. Lower the vehicle.
6. Check the transmission fluid level.

TRANSMISSION FLUID AUXILIARY COOLER INLET PIPE REPLACEMENT (L83 L86)

Fig. 54: Transmission Fluid Auxiliary Cooler Inlet Pipe (L83, L86)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Remove the front end upper tie bar support. Refer to **Front End Upper Tie Bar Support Replacement** . 2. Place a drain pan under the transmission fluid auxiliary cooler inlet pipes.	

Callout	Component Name
3. Cap the fittings and plug the holes when removing the transmission fluid auxiliary cooler inlet pipe.	
1	Transmission Fluid Auxiliary Cooler Inlet Pipe Retaining Ring (Qty: 2) **Procedure** Disconnect the quick connect fittings from the transmission fluid auxiliary cooler inlet pipe. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection**.
2	Transmission Fluid Auxiliary Cooler Inlet Pipe **Procedure** 1. Inspect the transmission fluid level. 2. Inspect for transmission fluid leaks.

TRANSMISSION FLUID AUXILIARY COOLER OUTLET PIPE REPLACEMENT (L83 L86)

Fig. 55: Transmission Fluid Auxiliary Cooler Outlet Pipe (L83, L86)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** . 2. Remove the front end upper tie bar support. Refer to **Front End Upper Tie Bar Support Replacement** . 3. Place a drain pan under the transmission fluid auxiliary cooler outlet pipes. 4. Cap the fittings and plug the holes when removing the transmission fluid auxiliary cooler outlet pipe.	
1	Transmission Fluid Auxiliary Cooler Outlet Pipe Retaining Ring (Qty: 2) **Procedure** Disconnect the quick connect fittings from the transmission fluid auxiliary cooler outlet pipe. Refer to **Transmission Fluid**

Callout	Component Name
	Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection.
2	Transmission Fluid Auxiliary Cooler Outlet Pipe **Procedure** 1. Inspect the transmission fluid level. 2. Inspect for transmission fluid leaks.

TRANSMISSION FLUID COOLER THERMAL BYPASS VALVE REPLACEMENT (L83 MYC)

Fig. 56: Transmission Fluid Cooler Thermal Bypass Valve (L83 MYC)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. **Lifting and Jacking the Vehicle** . 2. Place a drain pan under the Transmission Fluid Cooler Inlet and Outlet Pipe. 3. Remove the Transmission Fluid Cooler Inlet and Outlet Pipe from the bracket retainer at the right lower side of the transmission. 4. Transmission Fluid Cooler Inlet and Outlet Pipe@Transmission Fluid Cooler Thermal Bypass Valve -**Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** 5. Cap the fittings and plug the holes when removing the Transmission Fluid Cooler Inlet and Outlet Pipefrom the Transmission Fluid Cooler Thermal Bypass Valve.	
1	Transmission Fluid Cooler Pipe Connector Bolt **CAUTION:** **Refer to** **Fastener Caution .** **Tighten** 22 N.m (16 lb ft)
2	Transmission Fluid Cooler Pipe Fitting Seal **Procedure** Remove and discard the old transmission fluid cooler pipe fitting seal and replace with a new transmission fluid cooler pipe fitting seal.
3	Transmission Fluid Cooler Thermal Bypass Valve 1. Inspect the transmission fluid level. 2. Inspect for transmission fluid leaks.

TRANSMISSION FLUID COOLER THERMAL BYPASS VALVE REPLACEMENT (M5U)

Fig. 57: Transmission Fluid Cooler Thermal Bypass Valve (M5U)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. **Lifting and Jacking the Vehicle** 2. Place a drain pan under the vehicle. 3. Remove Transmission Fluid Cooler Inlet and Outlet Pipe@Transmission Fluid Cooler Thermal Bypass Valve **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** 4. Cap the opening to prevent contamination.	
1	Transmission Fluid Cooler Pipe Connector Bolt

Callout	Component Name
	CAUTION: **Refer to Fastener Caution .** **Tighten** 22 N.m (16 lb ft)
2	Transmission Fluid Cooler Pipe Fitting Seal **Procedure** 1. Remove and DISCARD the gasket. 2. Use a NEW gasket.
3	Transmission Fluid Cooler Thermal Bypass Valve **Procedure** 1. Fill and inspect the transmission fluid level. 2. Inspect for transmission fluid leaks.

TRANSMISSION FLUID COOLER PIPE CONNECTOR REPLACEMENT - AUXILIARY COOLER

Fig. 58: Transmission Fluid Cooler Pipe Connector - Auxiliary Cooler
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Place a drain pan under the transmission fluid cooler pipe. 2. Remove the transmission fluid cooler pipe from the auxiliary oil cooler. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection**. 3. Cap the fittings and plug the holes when removing the transmission fluid cooler pipe from the auxiliary oil cooler.	
1	Transmission Fluid Cooler Pipe Connector **CAUTION:**

Callout	Component Name
	Refer to Fastener Caution . **Procedure** 1. Inspect the transmission fluid level. 2. Inspect for transmission fluid leaks. **NOTE:** **The correct thread engagement is critical, hand start the fitting. Cross-threaded fittings can achieve proper tightness and still leak.** **Tighten** 20 N.m (15 lb ft)

TRANSMISSION FLUID COOLER PIPE CONNECTOR REPLACEMENT - RADIATOR (L83 L86)

Fig. 59: View Of Transmission Fluid Cooler Hose/Pipe Connector
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures **NOTE:** **Do not remove the upper and lower transmission fluid cooler inlet and**	

Callout	Component Name
outlet pipe oil cooler fittings from the radiator at the same time other wise the transmission fluid cooler inlet and outlet pipe oil cooler may fall inside the radiator end tank. 1. Drain the cooling system. **Cooling System Draining and Filling (Static Fill L96)** **Cooling System Draining and Filling (Vac N Fill L96)** **Cooling System Draining and Filling (Vac N Fill L83 L86)** **Cooling System Draining and Filling (Static Fill L83 L86)** . 2. Place a drain pan under the transmission fluid cooler inlet and outlet pipe. 3. Unclip the transmission fluid cooler inlet and outlet pipe from the retainer on the engine coolant fan rear shroud. 4. Remove the transmission fluid cooler inlet and outlet pipe from the oil cooler fittings on the radiator. **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection**. 5. Cap the fittings and plug the holes when removing the transmission fluid cooler pipes.	
1	Transmission Oil Cooler Fitting **CAUTION:** **Refer to Fastener Caution .** **Procedure**

Callout	Component Name
	1. Inspect the transmission fluid level. 2. Inspect for transmission fluid leaks. **NOTE:** **The correct thread engagement is critical, hand start the fitting. Cross-threaded fittings can achieve proper tightness and still leak.** **Tighten** 24 N.m (18 lb ft)

TRANSMISSION FLUID COOLER HOSE/PIPE QUICK-CONNECT FITTING DISCONNECTION AND CONNECTION

Special Tools

- **DT-28585** Universal Snap Ring Remover for the 5/8 inch Line
- **DT-41623-B** 3/8 inch Line Quick Release Tool

Removal Procedure

1. Remove the plastic cap from the quick connect fitting by pulling the cap back along the pipe.

Fig. 60: Generator Cooling Inlet Pipe
Courtesy of GENERAL MOTORS COMPANY

2. Install the **DT-41623-B** 3/8 inch line quick release tool onto the transmission oil cooler (TOC) pipe, or use the **DT-28585** universal snap ring remover for the 5/8 inch line.

Fig. 61: Sliding J 41623-B Toward Generator Cooling Inlet Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

3. Slide the **DT-41623-B** 3/8 inch line quick release tool toward the TOC pipe fitting, or use the **DT-28585** universal snap ring remover for the 5/8 inch line.

Fig. 62: Rotating J 41623-B On Coolant Pipe
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Rotate the DT-41623-B 3/8 inch line quick release tool to engage the TOC pipe fitting's retainer slots.**

The DT-41623-B 3/8 inch line quick release tool should be nearly flush with the fitting.

4. Connect the **DT-41623-B** 3/8 inch line quick release tool onto the TOC pipe fitting.

Fig. 63: Identifying Retainer Clip
Courtesy of GENERAL MOTORS COMPANY

5. Rotate the **DT-41623-B** 3/8 inch line quick release tool or use the **DT-28585** universal snap ring remover for the 5/8 inch line until the retainer clip (1) rises above the fitting retainer seat.

Fig. 64: Generator Cooling Inlet Pipe
Courtesy of GENERAL MOTORS COMPANY

6. Pull back on the TOC pipe to disengage the pipe from the TOC pipe fitting.
7. Remove the **DT-41623-B** 3/8 inch line quick release tool or the **DT-28585** universal snap ring remover for the 5/8 inch line from the TOC pipe.

Installation Procedure

Fig. 65: View Of Generator Cooling Inlet Pipe & Generator Cooling Inlet Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

NOTE: **Discard the TOC retaining clip and install a new retaining clip.**

1. Install the TOC pipe into the TOC pipe fitting.

   A distinct snap should be heard or felt when assembling the TOC pipe to the fitting.

2. Install the plastic cap onto the quick connect fitting. The plastic cap should snap onto fitting and spin freely by hand.
3. To ensure the cooler line is properly installed, give the cooler pipe a gentle pull.

TRANSMISSION FLUID COOLER INLET AND OUTLET PIPE REPLACEMENT (L83 MYC)

Removal Procedure

1. Place a drain pan under the transmission fluid cooler inlet and outlet pipe.
2. Remove the air cleaner assembly. **Air Cleaner Assembly Replacement**

Fig. 66: Transmission Fluid Cooler Inlet And Outlet Pipe Retainer
Courtesy of GENERAL MOTORS COMPANY

3. Remove the transmission fluid cooler inlet and outlet pipe retainer (1) from transmission fluid auxiliary cooler outlet pipe. **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection**.
4. Remove the transmission fluid cooler inlet and outlet pipe (2) from the transmission fluid auxiliary cooler outlet pipe.
5. Unclip the transmission fluid cooler inlet and outlet pipe from the engine coolant fan rear shroud.

6. Cap the fittings and plug the holes when removing the transmission fluid cooler inlet and outlet pipe.

Fig. 67: Transmission Fluid Cooler Inlet And Outlet Pipe Retainer
Courtesy of GENERAL MOTORS COMPANY

7. Remove the transmission fluid cooler inlet and outlet pipe retainer (1) from the radiator. **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection**.
8. Remove the transmission fluid cooler inlet and outlet pipe (2) from the radiator.

9. Unclip the transmission fluid cooler inlet and outlet pipe from the engine coolant fan rear shroud.
10. Raise and support the vehicle. **Lifting and Jacking the Vehicle** .
11. Remove the steering gear skid shield. **Steering Gear Skid Shield Replacement**

Fig. 68: Transmission Fluid Cooler Pipe Connector Bolt
Courtesy of GENERAL MOTORS COMPANY

12. Remove the transmission fluid cooler inlet and outlet pipe bolt (3) from the transmission.

13. Remove the transmission fluid cooler inlet and outlet pipe (2) from the transmission.
14. Remove and discard the old transmission fluid cooler pipe fitting seal (1) and replace with a new transmission fluid cooler pipe fitting seal.

Fig. 69: Transmission Fluid Cooler Inlet And Outlet Pipe And Retainer
Courtesy of GENERAL MOTORS COMPANY

15. Remove the transmission fluid cooler inlet and outlet pipe and retainer (1) from the transmission fluid cooler bracket (2).

Fig. 70: Transmission Fluid Cooler Inlet And Outlet Pipe
Courtesy of GENERAL MOTORS COMPANY

16. Remove the transmission fluid cooler inlet and outlet pipe (1) from the transmission fluid cooler pipe clip (2).

Fig. 71: Transmission Fluid Cooler Inlet And Outlet Pipe
Courtesy of GENERAL MOTORS COMPANY

17. Remove the transmission fluid cooler inlet and outlet pipe (1) from the vehicle.

Installation Procedure

Fig. 72: Transmission Fluid Cooler Inlet And Outlet Pipe
Courtesy of GENERAL MOTORS COMPANY

1. Install the transmission fluid cooler inlet and outlet pipe (1) to the vehicle.
2. install the transmission fluid cooler inlet and outlet pipe (1) to the transmission fluid cooler pipe clip (2).

Fig. 73: Transmission Fluid Cooler Inlet And Outlet Pipe And Retainer
Courtesy of GENERAL MOTORS COMPANY

3. Install the transmission fluid cooler inlet and outlet pipe and retainer (1) to the transmission fluid cooler bracket (2).

Fig. 74: Transmission Fluid Cooler Pipe Connector Bolt
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

4. Install a NEW transmission fluid cooler pipe fitting seal (1) to the transmission fluid cooler inlet and outlet pipe.
5. Install the transmission fluid cooler inlet and outlet pipe (2) to the transmission.

6. Install the transmission fluid cooler inlet and outlet pipe bolt (3) to the transmission and tighten to 22 N.m (16 lb ft).
7. Install the steering gear skid shield. **Steering Gear Skid Shield Replacement**
8. Lower the vehicle. **Lifting and Jacking the Vehicle**

Fig. 75: Transmission Fluid Cooler Inlet And Outlet Pipe Retainer
Courtesy of GENERAL MOTORS COMPANY

9. Install the transmission fluid cooler inlet and outlet pipe (2) to the radiator.

10. Clip the transmission fluid cooler inlet and outlet pipe to the engine coolant fan rear shroud.

Fig. 76: Transmission Fluid Cooler Inlet And Outlet Pipe Retainer
Courtesy of GENERAL MOTORS COMPANY

11. Install the transmission fluid cooler inlet and outlet pipe (2) from the transmission fluid auxiliary cooler outlet pipe.
12. Clip the transmission fluid cooler inlet and outlet pipe to the engine coolant fan rear shroud.
13. Install the air cleaner assembly. **Air Cleaner Assembly Replacement**

14. Inspect the transmission fluid level. **Transmission Fluid Level and Condition Check**
15. Inspect for transmission fluid leaks.

TRANSMISSION FLUID COOLER INLET AND OUTLET PIPE REPLACEMENT (L86 M5U)

Removal Procedure

1. Place a drain pan under the transmission fluid cooler inlet and outlet pipe.
2. Remove the air cleaner assembly. **Air Cleaner Assembly Replacement**

Fig. 77: Transmission Fluid Cooler Inlet And Outlet Pipe Retainer
Courtesy of GENERAL MOTORS COMPANY

3. Remove the transmission fluid cooler inlet and outlet pipe retainer (1) from transmission fluid auxiliary cooler outlet pipe. **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection**
4. Remove the transmission fluid cooler inlet and outlet pipe (2) from the transmission fluid auxiliary cooler outlet pipe.
5. Unclip the transmission fluid cooler inlet and outlet pipe from the engine coolant fan rear shroud.

6. Cap the fittings and plug the holes when removing the transmission fluid cooler inlet and outlet pipe.

Fig. 78: Transmission Fluid Cooler Inlet And Outlet Pipe Retainer
Courtesy of GENERAL MOTORS COMPANY

7. Remove the transmission fluid cooler inlet and outlet pipe retainer (1) from the radiator. **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection**
8. Remove the transmission fluid cooler inlet and outlet pipe (2) from the radiator.

9. Unclip the transmission fluid cooler inlet and outlet pipe from the engine coolant fan rear shroud.
10. Raise and support the vehicle. **Lifting and Jacking the Vehicle**
11. Remove the steering gear skid shield. **Steering Gear Skid Shield Replacement**

Fig. 79: Oil Cooler Lines
Courtesy of GENERAL MOTORS COMPANY

12. Remove the transmission fluid cooler inlet and outlet pipe bolt (1) from the transmission.
13. Remove the transmission fluid cooler inlet and outlet pipe (2) from the transmission.
14. Remove and discard the old transmission fluid cooler pipe fitting seal (3) and replace with a NEW transmission fluid cooler pipe fitting seal.

Fig. 80: Transmission Fluid Cooler Inlet And Outlet Pipe And Retainer
Courtesy of GENERAL MOTORS COMPANY

15. Remove the transmission fluid cooler inlet and outlet pipe and retainer (1) from the transmission fluid cooler bracket (2).

Fig. 81: Transmission Fluid Cooler Inlet And Outlet Pipe
Courtesy of GENERAL MOTORS COMPANY

16. Remove the transmission fluid cooler inlet and outlet pipe (1) from the transmission fluid cooler pipe clip (2).

Fig. 82: Transmission Fluid Cooler Inlet And Outlet Pipe
Courtesy of GENERAL MOTORS COMPANY

17. Remove the transmission fluid cooler inlet and outlet pipe (1) from the vehicle.

Installation Procedure

Fig. 83: Transmission Fluid Cooler Inlet And Outlet Pipe
Courtesy of GENERAL MOTORS COMPANY

1. Install the transmission fluid cooler inlet and outlet pipe (1) to the vehicle.
2. install the transmission fluid cooler inlet and outlet pipe (1) to the transmission fluid cooler pipe clip (2).

Fig. 84: Transmission Fluid Cooler Inlet And Outlet Pipe And Retainer
Courtesy of GENERAL MOTORS COMPANY

3. Install the transmission fluid cooler inlet and outlet pipe and retainer (1) to the transmission fluid cooler bracket (2).

Fig. 85: Oil Cooler Lines
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

4. Install a NEW transmission fluid cooler pipe fitting seal (3) to the transmission fluid cooler inlet and outlet pipe.

5. Install the transmission fluid cooler inlet and outlet pipe (2) to the transmission.
6. Install the transmission fluid cooler inlet and outlet pipe bolt (1) to the transmission and tighten to 22 N.m (16 lb ft).
7. Install the steering gear skid shield. **Steering Gear Skid Shield Replacement**
8. Lower the vehicle. **Lifting and Jacking the Vehicle**

Fig. 86: Transmission Fluid Cooler Inlet And Outlet Pipe Retainer
Courtesy of GENERAL MOTORS COMPANY

9. Install the transmission fluid cooler inlet and outlet pipe (2) to the radiator.
10. Clip the transmission fluid cooler inlet and outlet pipe to the engine coolant fan rear shroud.

Fig. 87: Transmission Fluid Cooler Inlet And Outlet Pipe Retainer
Courtesy of GENERAL MOTORS COMPANY

11. Install the transmission fluid cooler inlet and outlet pipe (2) from the transmission fluid auxiliary cooler outlet pipe.
12. Clip the transmission fluid cooler inlet and outlet pipe to the engine coolant fan rear shroud.

13. Install the air cleaner assembly. **Air Cleaner Assembly Replacement**
14. Inspect the transmission fluid level. **Transmission Fluid Level and Condition Check**
15. Inspect for transmission fluid leaks.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/ Description

Illustration	Tool Number/ Description
	DT 28585 J 28585 Snap Ring Remover

Illustration	Tool Number/ Description
	DT 41623-B J 41623-B Cooler Quick Connect Tool

Illustration	Tool Number/ Description
	DT 45096 J 45096 Transmission Oil Cooling System Flush and Flow Test Tool

Illustration	Tool Number/ Description
	DT 45096-30 J 45096-30 Cooler Flushing Adapter

Illustration	Tool Number/ Description
	J 35944-200A Cooler Flushing Adapter

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