INDEX
Imports

Imports (Slide)

ADVERTISER'S

AUTOMATIC TRANSMISSION SERVICE GROUP
9200 South Dadeland Boulevard Suite 720
Miami, Florida 33156
(305) 670-4161

"The Seminar to See for 2003"

Introduction

There use to be a time when someone mentioned the "Big 3," they would be referring to G.M., Ford and Chrysler. That reality is dissipating rapidly. The "Big 3" today could mean US, Japan and Europe. What really is a foreign or domestic vehicle these days? The Red and White manuals concentrated on bringing to you information pertaining to US manufacturers meaning G.M., Ford and Chrysler. This Blue Manual concentrates on bringing to you information pertaining to the Japanese and European manufacturers. Information on Mitsubishi, Mazda, Nissan, Isuzu,

WAYNE COLONNA
PRESIDENT

DALE ENGLAND
CEO

JIM DIAL
SR. TECHNICAL CONSULTANT

PETER LUBAN
TECHNICAL SUPERVISOR

ED KRUSE
TECHNICAL CONSULTANT

JON GLATSTEIN
TECHNICAL CONSULTANT

GREGORY LIPNICK
TECHNICAL CONSULTANT

GERALD CAMPBELL
TECHNICAL CONSULTANT

DAVID CHALKER
TECHNICAL CONSULTANT

JERRY GOTT
TECHNICAL CONSULTANT

STANTON ANDERSON
TECHNICAL CONSULTANT

MARIO ARISTIDES
LATIN TECHNICAL CONSULTANT

ROLAND ALVAREZ
TECHNICAL CONSULTANT

AUTOMATIC TRANSMISSION SERVICE GROUP
9200 S. DADELAND BLVD. SUITE 720
MIAMI, FLORIDA 33156
(305) 670-4161

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II CODE DEFINITIONS

COMPLAINT: When a VW/Audi vehicle is exhibiting a symptom or is in fail-safe, the technician, in many cases, is unable to communicate with the on-board diagnostics in order to retrieve codes.

CAUSE: The lack of aftermarket equipment, previously available to the technician, to allow access to vehicle on-board diagnostics such as, code retrieval, data lists and basic setting resets.

CORRECTION: With the OBD-II mandate beginning in 1996, it is possible to retrieve codes using the Generic OBD-II part of your scan tool. This will also allow access to the "freeze frame" and "pending code" categories which are diagnostic aids to help the technician retrieve codes and data.
There have also been recent developments which have made available, diagnostic tools which can communicate with VW/Audi vehicle modules which include pre-OBD-II diagnostics for codes and data.

Use the illustrations in figures 1 and 2 for diagnostic connector locations in all Volkswagen/Audi models equipped with 096, 097, 098, 01M, 01N and 01P transmissions.

Use the code definition charts in figures 3 to 12 for ECM codes for gasoline engine equipped vehicles.

Use the code definition charts in figures 13 to 15 for ECM codes for diesel engine equipped vehicles.

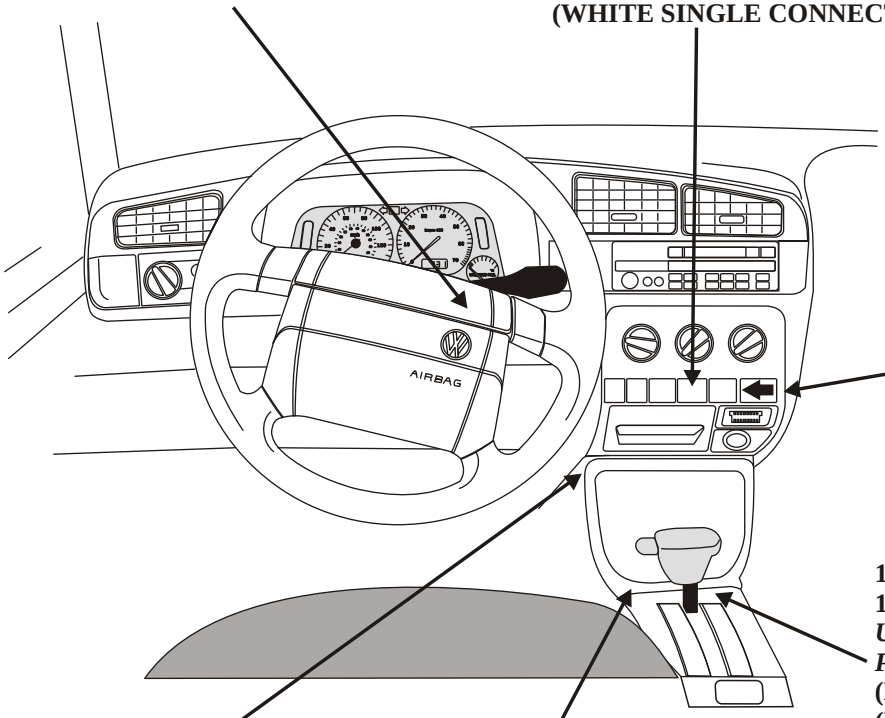
Use the code definition charts in figures 16 and 17 for TCM codes.

VOLKSWAGEN/AUDI 01M/01N/01P

VOLKSWAGEN
DIAGNOSTIC CONNECTOR LOCATIONS

1994 PASSAT, CORRADO
1995-97 PASSAT
NEXT TO STEERING COLUMN
IN DASH BELOW TACHOMETER,
FORWARD OF THE IGNITION SWITCH
REMOVE POP OFF PANEL
OBD-II 16 PIN CONNECTOR

1993 JETTA, GOLF CORRADO & CABRIOLET
BEHIND POP OUT PANEL BELOW HVAC CONTROLS
(BLACK SINGLE CONNECTOR)
(WHITE SINGLE CONNECTOR)



1994 JETTA & GOLF
1995-98 JETTA, GOLF & CABRIO
REMOVE ASHTRAY & SLIDE PANEL TO THE LEFT BELOW HVAC CONTROLS
OBD-II 16 PIN CONNECTOR

1990-92 ALL MODELS
1993 PASSAT
UNDER SHIFT LEVER INDICATOR PANEL INSIDE CENTER CONSOLE
(BLACK SINGLE CONNECTOR)
(WHITE SINGLE CONNECTOR)

1998-02 NEW BEETLE
BELOW CENTER OF DASH,
FORWARD OF THE SHIFT LEVER
OBD-II 16 PIN CONNECTOR

1999-02 CABRIO, GOLF, JETTA & GTI
REMOVE COVER BELOW RADIO
FORWARD OF THE SHIFT LEVER
OBD-II 16 PIN CONNECTOR

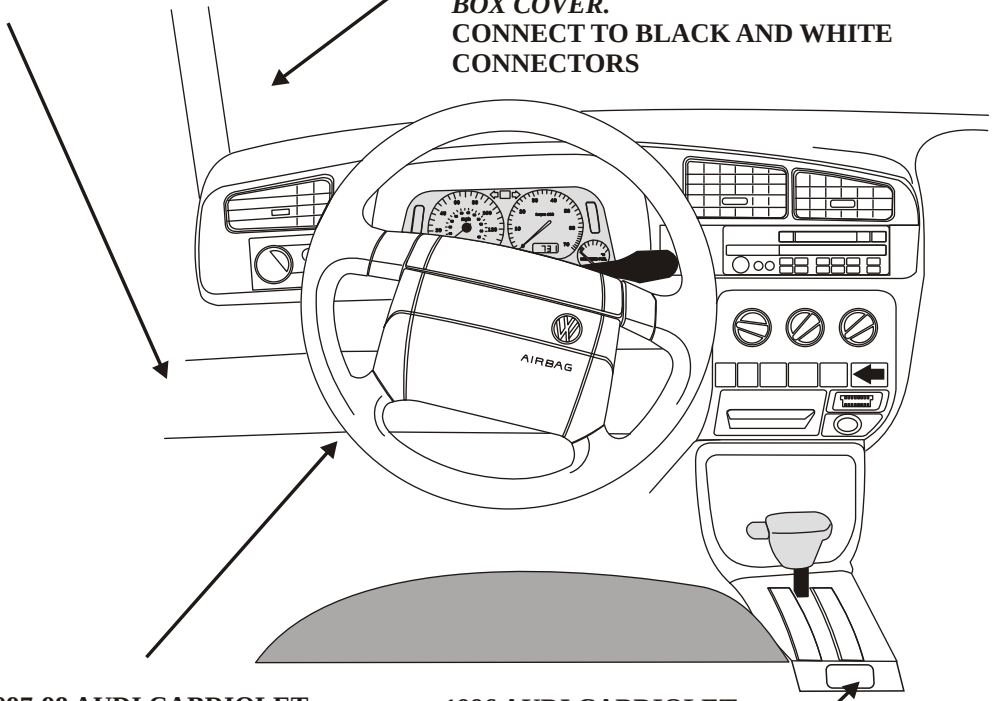
Figure 1

VOLKSWAGEN/AUDI 01M/01N/01P

AUDI & EUROVAN
DIAGNOSTIC CONNECTOR LOCATIONS

1994-02 EUROVANS
REMOVE STORAGE COMPARTMENT IN FRONT OF RELAY PLATE
(BLACK SINGLE CONNECTOR)
(WHITE SINGLE CONNECTOR)

1991-92 AUDI 80
1991-95 AUDI 90
1991 AUDI 100
1994-95 AUDI CABRIOLET
DRIVER SIDE OF ENGINE BAY, REMOVE AUXILIARY RELAY BOX COVER.
CONNECT TO BLACK AND WHITE CONNECTORS



1997-98 AUDI CABRIOLET
UNDER DRIVER SIDE DASH BELOW STEERING COLUMN
OBD-II 16 PIN CONNECTOR

1996 AUDI CABRIOLET
REMOVE CENTER CONSOLE ASHTRAY
OBD-II 16 PIN CONSOLE

Figure 2

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II ECM CODE DEFINITIONS

GASOLINE ENGINES

OBD-II CODE	ECM VAG CODE	CODE DEFINITIONS
P0102	16486	MAF or VAF Sensor
P0103	16487	MAF or VAF Sensor
P0106	N/A	MAP or BARO Pressure Sensor
P0107	16491	BARO Pressure Sensor Circuit Low
P0108	16492	MAP or BARO Pressure Sensor
P0112	16496	IAT Sensor Circuit Input Out Of Range
P0113	16497	IAT Sensor Circuit Input Out Of Range
P0116	16500	ECT Sensor Circuit Input Out Of Range
P0117	16501	ECT Sensor Circuit Input Low
P0118	16502	ECT Sensor Circuit Input Out Of Range
P0120	16504	Throttle Position Sensor "A" Circuit Malfunction
P0121	16505	Throttle/Pedal Position Sensor Circuit Fault
P0122	16506	Throttle/Pedal Position Sensor Circuit Input Low
P0123	16507	Throttle/Pedal Position Sensor Circuit Fault
P0125	16509	Insufficient ECT Temperature For Closed Loop Fuel Control
P0130	16509	Heated Oxygen Sensor - Bank 1 Sensor 1 Circuit Fault
P0131	16515	Heated Oxygen Sensor - Bank 1 Sensor 1 Input Low
P0132	16516	Heated Oxygen Sensor - Bank 1 Sensor 1 Input High
P0133	16517	Oxygen Sensor - Bank 1 Sensor 1 Slow Response
P0134	16518	Oxygen Sensor - Bank 1 Sensor 1 No Activity
P0135	16519	Oxygen Sensor Heater - Bank 1 Sensor 1 Malfunction
P0136	16520	Oxygen Sensor - Bank 1 Sensor 2 Circuit Fault
P0137	16521	Oxygen Sensor - Bank 1 Sensor 2 Input Low
P0138	16522	Oxygen Sensor - Bank 1 Sensor 2 Input High
P0139	16523	Oxygen Sensor - Bank 1 Sensor 2 Slow Response

Figure 3

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II ECM CODE DEFINITIONS

GASOLINE ENGINES

OBD-II CODE	ECM VAG CODE	CODE DEFINITIONS
P0138	16522	Oxygen Sensor - Bank 1 Sensor 2 Input High
P0139	16523	Oxygen Sensor - Bank 1 Sensor 2 Slow Response
P0140	16524	Oxygen Sensor - Bank 1 Sensor 2 No Activity
P0141	16525	Oxygen Sensor - Bank 1 Sensor 2 Heater Circuit Malfunction
P0150	16534	Oxygen Sensor - Bank 2 Sensor 1 Circuit Malfunction
P0151	16535	Oxygen Sensor - Bank 2 Sensor 1 Input Low
P0152	16536	Oxygen Sensor - Bank 2 Sensor 1 Input High
P0153	16537	Oxygen Sensor - Bank 2 Sensor 1 No Activity
P0154	16538	Oxygen Sensor - Bank 2 Sensor 1 Slow Response
P0156	16540	Oxygen Sensor - Bank 2 Sensor 2 Circuit Malfunction
P0157	16541	Oxygen Sensor - Bank 2 Sensor 2 Input Low
P0158	16542	Oxygen Sensor - Bank 2 Sensor 2 Input High
P0160	16544	Oxygen Sensor - Bank 2 Sensor 2 No Activity
P0170	*16544	Fuel Trim Malfunction
P0171	16555	System Too Lean Bank 1
P0172	16556	System Too Rich Bank 1
P0300	16684	Random Misfire Detected
P0301	16685	Cylinder No. 1 Misfire Detected
P0302	16686	Cylinder No. 2 Misfire Detected
P0303	16687	Cylinder No. 3 Misfire Detected
P0304	16688	Cylinder No. 4 Misfire Detected
P0305	16689	Cylinder No. 5 Misfire Detected
P0306	16690	Cylinder No. 6 Misfire Detected
P0321	17705	Engine Speed Sensor Circuit Fault
P0322	16706	Engine Speed Sensor No Signal
P0327	16711	Knock Sensor No. 1 Circuit Input Low

2.8L VR6, Engine Code AFP, GTI and Jetta Only

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II ECM CODE DEFINITIONS

GASOLINE ENGINES

OBD-II CODE	ECM VAG CODE	CODE DEFINITIONS
P0328	16712	Knock Sensor No. 1 Circuit Input High
P0332	16716	Knock Sensor No. 1 Circuit Input Low
P0333	16717	Knock Sensor No. 2 Circuit Input High
P0341	16575	Camshaft Position Sensor Circuit Fault
P0342	16726	Camshaft Position Sensor Circuit Input Low
P0343	16727	Camshaft Position Sensor Circuit Input High
P0411	16795	Secondary Air Injection System Incorrect Flow Detected
P0420	16804	Main Catalyst Efficiency Below Threshold
P0422	16806	Main Catalyst Efficiency Below Threshold Bank 1
P0432	16816	Main Catalyst Efficiency Below Threshold Bank 2
P0440	16824	Tank Vent System Malfunction
P0441	16825	EVAP Emission System Incorrect Purge Flow
P0442	16826	EVAP Emission System Small Leak Detected
P0445	*16839	EVAP Emission System Large Leak Detected
P0455	16839	EVAP Emission System Large Leak Detected
P0501	16885	Vehicle Speed Sensor Circuit Fault
P0506	16890	Idle RPM Too Low
P0507	16891	Idle RPM Too High
P0510	16894	Closed Throttle Position Switch Malfunction
P0560	16944	System Voltage Malfunction
P0562	16946	System Voltage Too Low
P0563	16947	System Voltage Too High
P0571	16955	Cruise/Brake Switch Circuit Malfunction
P0601	17985	ECM Check Sum Error
P0603	16987	ECM KAM Error
P0604	16988	ECM RAM Error

2.8L V6, Engine Code AHA, Passat Only

Figure 5

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II ECM CODE DEFINITIONS

GASOLINE ENGINES

OBD-II CODE	ECM VAG CODE	CODE DEFINITIONS
P0605	16989	ECM ROM Error
P0707	17091	Transmission Range Sensor Circuit Input Low
P0708	17092	Transmission Range Sensor Circuit Input High
P0715	17099	Turbine Speed Sensor Circuit Malfunction
P0722	17106	Output Speed Sensor Circuit No Signal
P0725	17109	Engine Speed Circuit Malfunction
P0748	17132	Pressure Control Solenoid Electrical Fault
P0753	17137	Shift Solenoid "A" Electrical Fault
P0758	17142	Shift Solenoid "B" Electrical Fault
P0763	17147	Shift Solenoid "C" Electrical Fault
P0768	17152	Shift Solenoid "D" Electrical Fault
P0773	17157	Shift Solenoid "E" Electrical Fault
P1102	17510	Heated Oxygen Sensor - Bank 1 Sensor 1 Short To Voltage
P1105	17513	Heated Oxygen Sensor - Bank 1 Sensor 1 Heater Short To Voltage
P1107	17515	Heated Oxygen Sensor - Bank 2 Sensor 1 Heater Short To Voltage
P1110	17518	Heated Oxygen Sensor - Bank 2 Sensor 2 Heater Short To Voltage
P1113	17521	Heated Oxygen Sensor 1 Heater Circuit Resistance Too High
P1115	17523	Heated Oxygen Sensor 1 Heater Circuit Short To Ground
P1116	17524	Heated Oxygen Sensor 1 Heater Circuit Open
P1117	17525	Heated Oxygen Sensor 2 Heater Circuit Short To Ground
P1118	17526	Heated Oxygen Sensor 2 Heater Circuit Open
P1127	17535	Long Term Fuel Trim Too Rich Bank 1
P1128	17536	Long Term Fuel Trim Too Lean Bank 1
P1129	17537	Long Term Fuel Trim Too Rich Bank 2
P1130	17538	Long Term Fuel Trim Too Lean Bank 2
P1136	17544	Long Term Fuel Trim Too Lean Bank 1

Figure 6

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II ECM CODE DEFINITIONS

GASOLINE ENGINES

OBD-II CODE	ECM VAG CODE	CODE DEFINITIONS
P1137	17545	Long Term Fuel Trim Too Rich Bank 1
P1138	17546	Long Term Fuel Trim Too Lean Bank 2
P1139	17547	Long Term Fuel Trim Too Rich Bank 2
P1141	17549	Load Calculation Cross Check Performance
P1171	17579	Throttle Position Potentiometer Circuit Fault
P1172	17580	Throttle Position Potentiometer Circuit Too Low
P1173	17581	Throttle Position Potentiometer Circuit Too High
P1176	17584	Heated Oxygen Sensor 2 Correction Limit Attained
P1177	17585	Heated Oxygen Sensor Correction Behind Catalyst Limit Attained Bank 2
P1196	17604	Heated Oxygen Sensor 1 Circuit Malfunction
P1197	17605	Heated Oxygen Sensor 1 Bank 2 Heater Circuit Electrical Fault
P1198	17606	Heated Oxygen Sensor 2 Bank 1 Heater Circuit Electrical Fault
P1199	17607	Heated Oxygen Sensor - Bank 2 Sensor 2 Heater Circuit Electrical Fault
P1213	17621	Cylinder No. 1 Fuel Injector Circuit Short To Voltage
P1214	17622	Cylinder No. 2 Fuel Injector Circuit Short To Voltage
P1215	17623	Cylinder No. 3 Fuel Injector Circuit Short To Voltage
P1216	17624	Cylinder No. 4 Fuel Injector Circuit Short To Voltage
P1217	17625	Cylinder No. 5 Fuel Injector Circuit Short To Voltage
P1218	17626	Cylinder No. 6 Fuel Injector Circuit Short To Voltage
P1225	17633	Cylinder No. 1 Fuel Injector Circuit Short To Ground
P1226	17634	Cylinder No. 2 Fuel Injector Circuit Short To Ground
P1227	17635	Cylinder No. 3 Fuel Injector Circuit Short To Ground
P1228	17636	Cylinder No. 4 Fuel Injector Circuit Short To Ground
P1229	17637	Cylinder No. 5 Fuel Injector Circuit Short To Ground
P1230	17638	Cylinder No. 6 Fuel Injector Circuit Short To Ground
P1237	17645	Cylinder No. 1 Fuel Injector Circuit Open

Figure 7

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II ECM CODE DEFINITIONS

GASOLINE ENGINES

OBD-II CODE	ECM VAG CODE	CODE DEFINITIONS
P1238	17646	Cylinder No. 2 Fuel Injector Circuit Open
P1239	17647	Cylinder No. 3 Fuel Injector Circuit Open
P1240	17648	Cylinder No. 4 Fuel Injector Circuit Open
P1241	17649	Cylinder No. 5 Fuel Injector Circuit Open
P1242	17650	Cylinder No. 6 Fuel Injector Circuit Open
P1250	17658	Fuel Level Too Low
P1300	17708	Fuel Related Misfire Detected
P1325	17733	Cylinder No. 1 Knock Control Limit Attained
P1326	17734	Cylinder No. 2 Knock Control Limit Attained
P1327	17735	Cylinder No. 3 Knock Control Limit Attained
P1328	17736	Cylinder No. 4 Knock Control Limit Attained
P1329	17737	Cylinder No. 5 Knock Control Limit Attained
P1330	17738	Cylinder No. 6 Knock Control Limit Attained
P1336	17744	Engine Torque Control Adaptation At Limit
P1337	17745	Camshaft Position Sensor Circuit Short To Ground
P1338	17746	Camshaft Position Sensor Circuit Short To Voltage
P1340	17748	Camshaft/Crankshaft Position Sensor Signals Out Of Sequence
P1341	17749	Ignition Coil Output Stage No. 1 Circuit Short To Ground
P1343	17751	Ignition Coil Output Stage No. 2 Circuit Short To Ground
P1345	17753	Ignition Coil Output Stage No. 3 Circuit Short To Ground
P1386	17794	ECM Internal Altitude Sensor Error
P1387	17795	ECM Internal Knock Control Circuit Error
P1391	17799	Camshaft Position Sensor No. 2 Circuit Short To Ground
P1392	17800	Camshaft Position Sensor No. 2 Circuit Open Or Short To Voltage
P1393	17801	Ignition Coil Output Stage No. 1 Circuit Malfunction
P1394	17802	Ignition Coil Output Stage No. 2 Circuit Malfunction

Figure 8

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II ECM CODE DEFINITIONS

GASOLINE ENGINES

OBD-II CODE	ECM VAG CODE	CODE DEFINITIONS
P1395	17803	Ignition Coil Output Stage No. 3 Circuit Malfunction
P1410	17818	EVAP Canister Purge Regulator Valve Short To Voltage
P1420	17828	Secondary Air Injection Control Electrical Malfunction
P1421	17829	Secondary Air Injection Circuit Short To Ground
P1422	17830	Secondary Air Injection Circuit Short To Voltage
P1424	17832	Secondary Air Injection System Leak Detected
P1425	17833	EVAP Canister Purge Regulator Valve Short To Ground
P1426	17834	EVAP Canister Purge Regulator Valve Circuit Open
P1432	17840	Secondary Air Injection Circuit Open
P1433	17841	Secondary Air Injection Pump Relay Circuit Open
P1434	17842	Secondary Air Injection Pump Relay Short To Voltage
P1435	17843	Secondary Air Injection Pump Relay Short To Ground
P1436	17844	Secondary Air Injection Pump Relay Circuit Malfunction
P1450	17858	Secondary Air Injection Solenoid Valve Circuit Short To Voltage
P1451	17859	Secondary Air Injection Solenoid Valve Circuit Short To Ground
P1452	17860	Secondary Air Injection Solenoid Valve Circuit Open
P1471	17879	EVAP Emission Leak Detection Pump Circuit Short To Voltage
P1472	17880	EVAP Emission Leak Detection Pump Circuit Short To Ground
P1473	17881	EVAP Emission Leak Detection Pump Circuit Open
P1475	17883	EVAP Emission Leak Detection Pump Circuit Malfunction
P1476	17884	EVAP Emission Leak Detection Pump System Insufficient Vacuum
P1477	17885	EVAP Emission Leak Detection Pump System Malfunction
P1478	17886	EVAP Emission Leak Detection Pump System Plugged
P1500	17908	Fuel Pump Relay Circuit Malfunction
P1501	17909	Fuel Pump Relay Circuit Short To Ground
P1502	17910	Fuel Pump Relay Circuit Short To Voltage

Figure 9

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II ECM CODE DEFINITIONS

GASOLINE ENGINES

OBD-II CODE	ECM VAG CODE	CODE DEFINITIONS
P1505	17913	Closed Throttle Position Switch Circuit Open
P1506	17914	Closed Throttle Position Switch Circuit Short To Ground
P1512	17920	Intake Manifold Change-Over Valve Circuit Short To Voltage
P1515	17923	Intake Manifold Change-Over Valve Circuit Short To Ground
P1516	17924	Intake Manifold Change-Over Valve Circuit Open
P1519	17927	Intake Camshaft Control Malfunction Bank 1
P1522	17930	Intake Camshaft Control Malfunction Bank 2
P1539	17947	Clutch Pedal Switch Signal Implausible
P1541	17949	Fuel Pump Relay Circuit Open
P1542	17950	Throttle Actuator Potentiometer Out Of Range
P1543	17951	Throttle Actuator Potentiometer Signal Too Low
P1544	17952	Throttle Actuator Potentiometer Signal Too High
P1545	17953	Throttle Position Control Malfunction
P1546	17954	Boost Pressure Control Valve Circuit Short To Voltage
P1547	17955	Boost Pressure Control Valve Circuit Short To Ground
P1548	17956	Boost Pressure Control Valve Circuit Open
P1555	17963	Charge Pressure Upper Limit Exceeded
P1556	17964	Charge Pressure Control Negative Deviation
P1557	17965	Charge Pressure Control Positive Deviation
P1558	17966	Throttle Actuator Electrical Malfunction
P1559	17967	Idle Speed Control Adaptation Malfunction
P1560	17968	Maximum Engine Speed Exceeded
P1564	17972	Idle Speed Control Throttle Position Adaptation Malfunction
P1565	17973	Idle Speed Control Throttle Position Lower Limit Not Attained
P1568	17976	Idle Speed Control Throttle Position Mechanical Malfunction
P1569	17977	Cruise Control Switch Signal Implausible

Figure 10

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II ECM CODE DEFINITIONS

GASOLINE ENGINES

OBD-II CODE	ECM VAG CODE	CODE DEFINITIONS
P1580	17988	Throttle Actuator Potentiometer Signal Malfunction
P1582	17990	Idle Adaptation At Limit
P1600	18008	ECM Power Supply Voltage Malfunction
P1602	18010	ECM Voltage Low
P1603	18011	ECM Internal Malfunction
P1606	18014	Rough Road Recognition From ABS Control Module
P1611	18019	MIL Circuit/TCM Short To Ground
P1612	18020	ECM Coding Incorrect
P1613	18021	MIL Call-Up Circuit Open Or Short To Voltage
P1624	18032	MIL Request Signal Active
P1626	18034	Data Bus Communications Signal Missing From TCM
P1630	18038	Accelerator Pedal Position Sensor No. 1 Signal Too Low
P1631	18039	Accelerator Pedal Position Sensor No. 1 Signal Too High
P1633	18041	Accelerator Pedal Position Sensor No. 2 Signal Too Low
P1634	18042	Accelerator Pedal Position Sensor No. 2 Signal Too High
P1639	18047	Accelerator Pedal Position Sensor Out Of Range
P1640	18048	ECM EEPROM Error
P1648	18056	Data Bus Communication Signal Malfunction
P1649	18057	Data Bus Communications Signal Missing From ABS
P1676	18084	Electronic Power Control Indicator Light Circuit Malfunction
P1677	18085	Electronic Power Control Indicator Light Circuit Short To Voltage
P1678	18086	Electronic Power Control Indicator Light Circuit Short To Ground
P1679	18087	Electronic Power Control Indicator Light Circuit Open
P1681	18089	ECM Programming Not Finished
P1690	18098	MIL Circuit Malfunction
P1691	18099	MIL Circuit Open

Figure 11

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II ECM CODE DEFINITIONS

GASOLINE ENGINES

OBD-II CODE	ECM VAG CODE	CODE DEFINITIONS
P1692	18100	MIL Circuit Short To Ground
P1693	18101	MIL Circuit Short To Voltage
P1778	18186	Solenoid EV7 Electrical Malfunction
P1780	18188	Engine Intervention Readable
P1851	18259	Data Bus Communications Signal Missing From ABS Control Module
P1854	18262	Data Bus Message Not Detected

Figure 12

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II ECM CODE DEFINITIONS

DIESEL ENGINES

OBD-II CODE	ECM VAG CODE	CODE DEFINITIONS
P0101	00553	MAF Sensor Signal Implausible
P0116	00522	ECT Sensor Out OF Range
P0121	00777	Throttle Position Sensor Out Of Range
P0123	00777	Throttle Position Sensor Circuit Short To Voltage
P0300	01162	Random Misfire Detected
P0301	01162	Cylinder No. 1 Misfire Detected
P0302	01162	Cylinder No. 2 Misfire Detected
P0303	01162	Cylinder No. 3 Misfire Detected
P0304	01162	Cylinder No. 4 Misfire Detected
P0321	00513	Engine Speed Sensor Circuit Out Of Range
P0322	00513	Engine Speed Sensor Circuit No Activity
P0380	01050	Glow Plug Monitor
P0501	00624	Vehicle Speed Sensor Circuit Out Of Range
P0560	00532	System Voltage Malfunction
P0605	65535	ECM Failure
P1144	00553	MAF Sensor Circuit Open Or Short To Ground
P1145	00553	MAF Sensor Circuit Short To Voltage
P1146	00553	MAF Sensor Voltage Supply Too High/Low
P1155	00519	IAT Sensor Circuit Short To Voltage
P1156	00519	IAT Sensor Circuit Open Or Short To Ground
P1157	00519	IAT Sensor Voltage Supply Too High/Low
P1160	00527	IAT Sensor Circuit Short To Ground
P1161	00527	IAT Sensor Circuit Open Or Short To Voltage
P1162	00539	Fuel Temperature Sensor Circuit Short To Ground
P1163	00539	Fuel Temperature Sensor Circuit Open Or Short To Voltage
P1245	00542	Needle Lift Sensor Circuit Short To Ground

Figure 13

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II ECM CODE DEFINITIONS

DIESEL ENGINES

OBD-II CODE	ECM VAG CODE	CODE DEFINITIONS
P1246	00542	Needle Lift Sensor Signal Implausible
P1247	00522	Needle Lift Sensor Signal Open Or Short To Voltage
P1248	00550	Injection Start Control Malfunction
P1251	01269	Cold Start Injector Circuit Short To Voltage
P1252	01269	Cold Start Injector Circuit Open Or Short To Ground
P1255	00522	ECT Sensor Circuit Short To Ground
P1256	00522	ECT Sensor Circuit Short To Voltage
P1354	00765	Modulating Piston Displacement Sensor Circuit Malfunction
P1402	01265	EGR Vacuum Regulator Solenoid Valve Circuit Short To Voltage
P1403	00560	EGR System Control Difference
P1441	01265	EGR Vacuum Regulator Solenoid Valve Circuit Open Or Short To Ground
P1537	01327	Fuel Cut-Off Valve Mechanical Malfunction
P1538	01327	Fuel Cut-Off Valve Circuit Open Or Short To Ground
P1540	00624	Vehicle Speed Sensor Signal Too High
P1546	01262	Wastegate By-Pass Regulator Valve Circuit Short To Voltage
P1549	01262	Wastegate By-Pass Regulator Valve Circuit Open Or Short To Ground
P1550	00575	Intake Manifold Pressure Control Difference
P1561	01268	Quality Adjuster Control Difference
P1562	01268	Quality Adjuster Upper Limit Attained
P1563	01268	Quality Adjuster Lower Limit Attained
P1612	01044	ECM Incorrect Coding
P1616	00626	Glow Plug Indicator Light Circuit Short To Voltage
P1617	00626	Glow Plug Indicator Light Circuit Open Or Short To Ground
P1618	01266	Glow Plug Relay Circuit Short To Voltage
P1619	01266	Glow Plug Relay Circuit Open Or Short To Ground
P1626	18034	Data Bus Message From TCM Implausible

Figure 14

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II ECM CODE DEFINITIONS

DIESEL ENGINES

OBD-II CODE	ECM VAG CODE	CODE DEFINITIONS
P1632	00777	Throttle Position Sensor Voltage Supply Too High/Low
P1693	00750	MIL Circuit Short To Voltage
P1694	00750	MIL Circuit Open Or Short To Ground
P1851	18259	Data Bus Message From ABS Control Module Implausible
P1854	18262	Data Bus Message Not Detected

Figure 15

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II TCM CODE DEFINITIONS

OBD-II CODE	TCM VAG CODE	CODE DEFINITIONS
P0120	00529	Engine RPM Signal Too High
P0700	65535	Transmission Control System Malfunction (MIL Request)
P0705	00293	Multi-Function Switch Signal Implausible (Transmission Range Switch)
P0715	00297	Transmission Vehicle Speed Sensor Signal Interrupted(Sun Gear Shell Sensor)
P0722	00281	Vehicle Speed Sensor Signal Interrupted (Output Shaft Speed Sensor)
P0725	00518	Throttle Position Sensor Signal Out Of Range
P0730	00652	Final Drive Ratio Signal Incorrect/Implausible (Gear Ratio Error)
P0740	01192	Torque Converter Clutch Malfunction (TCC Slip Excessive)
P0753	00258	Solenoid Valve EV1 (A) - N88 Electrical Fault
P0758	00260	Solenoid Valve EV2 (B) - N89 Electrical Fault
P0763	00262	Solenoid Valve EV3 (C) - N90 Electrical Fault
P0768	00264	Solenoid Valve EM4 (D) - N91 Electrical Fault
P0773	00266	Solenoid Valve EV5 (E) - N92 Electrical Fault
P0748	00268	Pressure Control Solenoid EM6 - N93 Electrical Fault
P0785	00270	Solenoid Valve EV7 (7) - N94 Electrical Fault
NA	00296	Kickdown Switch Electrical Fault
NA	00300	Transaxle Fluid Temperature Sensor Unidentified Malfunction (Circuit Fault)
NA	00526	Brake Lamp Switch Circuit Fault
NA	00532	B+ Supply Voltage Insufficient
NA	00543	Maximum Engine Speed Exceeded (Neutral Condition)
P1780	00545	Interruption Of Ignition Timing Signal Between ECM And TCM
NA	00549	Fuel Consumption Signal Implausible
NA	00596	Short Circuit Between Injector Wires
NA	00638	Interruption Of Throttle Position Sensor Signal Between ECM And TCM
NA	00641	ATF Temperature Signal Too High (Transmission Overheat Protection Program)
NA	00652	Transaxle Range Controller Signal Improper (Mechanical Gear Ratio Error)

Figure 16

VOLKSWAGEN/AUDI 01M/01N/01P

1996-2000 OBD-II TCM CODE DEFINITIONS

OBD-II CODE	TCM VAG CODE	CODE DEFINITIONS
NA	00660	Kickdown Switch/Throttle Position Sensor Signal Improper
NA	00668	B+ Supply Terminal 30 Open Or Short To Ground
NA	01044	Control Module Improperly Coded
NA	01192	Torque Converter Clutch Fault (TCC Slipping)
NA	01196	Engine/Transaxle Data Bus Signal Implausible
NA	01236	Shift Lock Solenoid Open Or Short To Ground
P1854/P1866	01312	CAN-Bus Drive Faulty No Communication (Hardware Defective Or Messages Missing)
P1850/P1855	01314	No Communication From ECM
NA	01316	No Communication From ABS Module
NA	65535	Transmission Control Module Faulty

Figure 17

VOLKSWAGEN/AUDI

MANUAL PROCEDURE FOR "RETURN TO BASIC SETTINGS"

COMPLAINT: Once a Volkswagen/Audi vehicle has been repaired, in many cases, the Transmission Module (TCM) or the Engine Control Module (ECM) does not allow proper vehicle operation.
The symptoms may be, the transmission stuck in "Failsafe" or erratic shifting accompanied by driveability complaints.

CAUSE: It is of primary importance to clear all previously stored trouble codes, this is NOT an option. It is recommended to use a scan tool or computer based program to do this. Both are available to the aftermarket. Disconnecting the battery to accomplish this is not recommended due to other systems that may be adversely effected such as radio theft codes or the vehicle 's theft deterrent system.
If no other method is available, disconnecting the battery for one minute will clear the codes.
NOTE: Some codes can be cleared on OBD-II equipped vehicles using the Generic area of the scan tool if specialty equipment is not available.

The next mandatory procedure that **MUST** be performed is the ***"Return To Basic Settings"*** which is the Throttle Position Sensor and Kickdown relearn settings that both the TCM and the ECM must have in order to send proper commands for engine and transmission operation.

The ***"Return To Basic Settings"*** **MUST** be performed if any of the following conditions exist:
1. Replacement of the ECM.
2. The engine has been changed.
3. Repair or replacement of the throttle housing.
4. Replacement or adjustment of the Throttle Position Sensor.
5. Replacement of the TCM.

CORRECTION: Use the following procedure on all VW/AUDI vehicles equipped with 096, 097,098, 01M, 01N or 01P transmissions, to manually reset the "Basic Settings":

1. Turn the ignition "ON", Do not start the engine.
2. Move the gear selector lever to the "D4" position.
3. Depress the accelerator pedal all the way to the floor and hold it there for 30 seconds. Make certain the carpet or floor mat is not in the way of the pedal.
4. After 30 seconds, move the gear selector lever back to "PARK".
5. Release the accelerator pedal.
6. Turn the ignition "OFF".
7. After completion of the above, drive the vehicle on the road and perform three individual upshift sequences and kickdown at light, medium and heavy throttle conditions.

NOTE: The systems will fine tune themselves over the next 50 to 75 miles of driving.

UNCONTROLLABLE HARSH 1-2 SHIFT
VW JETTA / PASSAT AND CABRIO

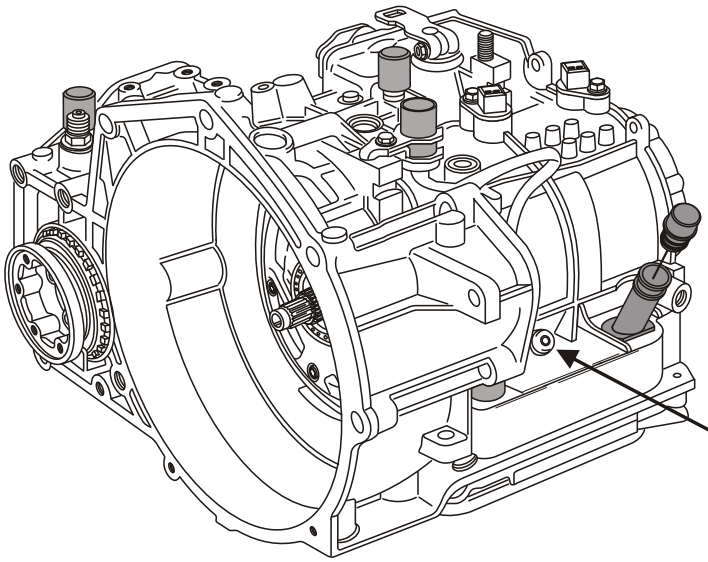
COMPLAINT: The vehicle comes into shop with a complaint of a harsh 1-2 upshift at all times. Other shifts may also be affected.

CAUSE: The TCMs in these vehicles have many problems. One of them is the task of energizing Solenoid "E" or EV5 which is momentarily turned on to cushion the 1-2 shift.
When the transmission is ready to make the 1-2 up shift, line pressure on throttle up rises to approximately 160 psi and then, drops back down to approximately 65 -70 when the 1-2 shift is going to take place. If the computer fails to energize the EV5 Solenoid to drop the pressure, the result will be, a harsh 1-2 up shift.

CORRECTION: Install a pressure gauge on the vehicle (See Figure 1). When the vehicle is in drive at idle, the minimum pressure should read approximately 60 psi. As you step into the throttle, the pressure should rise immediately to approximately 160 to 170 psi. As the transition of the shift takes place this pressure should drop back to about 65 psi as the shift is completed the pressure will rise again to 160 -170 psi. If the pressure drops on the 2-3 and 3-4 up shift and NOT on the 1-2, the EV5 solenoid may be mechanically faulty or the is an electrical concern with the solenoid or the TCM is faulty. The electrical solenoid concern or the fault TCM should generate VAG code 00266 or OBD-II code P0773.

65 PSI DURING THE 1-2 SHIFT

160-170 PSI IN GEAR



LINE PRESSURE SERVICE PORT

Figure 1

VOLKSWAGEN 01M

NO SECOND GEAR, NO FOURTH GEAR OR NO FORWARD MOVEMENT

COMPLAINT: The transmission may have no Second Gear, or no Fourth Gear, or may not move in any Forward Drive Gear.
When the pan is dropped, one or more small ***BROWN*** plugs are laying in the bottom of the pan.

CAUSE: Some 1996 VW Jetta, Golf and Passat models equipped with the 01M transmission, and built between August 1, 1995 and December 19, 1995 have valve bodies that were assembled with ***BROWN*** bore plugs in three locations.
Check the transmission build date that is located on the transmission case indicated in the illustration in figure 1 in order to determine if your transmission falls into this complaint category.
The example in the illustration in figure 1 is, 01 08 5.
01 = Build Day, Which is the First of the Month
08 = Build Month, which is August
5 = Build Year, Which is 1995.
The retaining lugs on each of these valve body bore plugs indicated by ***"A", "B" and "C"*** in figure 2, have broken allowing the plugs to protrude or fall completely out of the valve body due to tension of the valve spring pushing against the bore plug. The complaint will depend on which plug has broken, the location of which, are shown in figure 3.

VOLKSWAGEN 01M

NO SECOND GEAR, NO FOURTH GEAR OR NO FORWARD MOVEMENT

CORRECTION: A service kit is available from Volkswagen that provides four new bore plugs that are ***WHITE*** in stead of the previous ***BROWN*** plugs. The kit also provides a new "Check Plug" washer and a replacement "Locking Collar" for the oil fill tube.
The filter screen and pan gasket does NOT come in the kit, these items must be acquired separately.
The plugs are secured by pushing them in so the lug aligns with the notch in the valve body, and then turning them clockwise ¼ turn.

NOTE: The Volkswagen parts person may insist that this kit is not available, ***INSIST ON IT!***

IMPORTANT: There is available a ***complete*** service kit that provides ALL the plastic bore plugs that are needed to service the valve body from Southeast Parts which can be obtained from your parts distributor or call 800 -888-5489.

SERVICE INFORMATION:

Valve Body Bore Plug Repair Kit.....01M 398 998
Refer to Factory TSB.....3897-01
A Valve Body Bore Plug Service Kit will be available from Southeast Parts, check with your distributor for availability.

VOLKSWAGEN 01M

NO SECOND GEAR, NO FOURTH GEAR OR NO FORWARD MOVEMENT

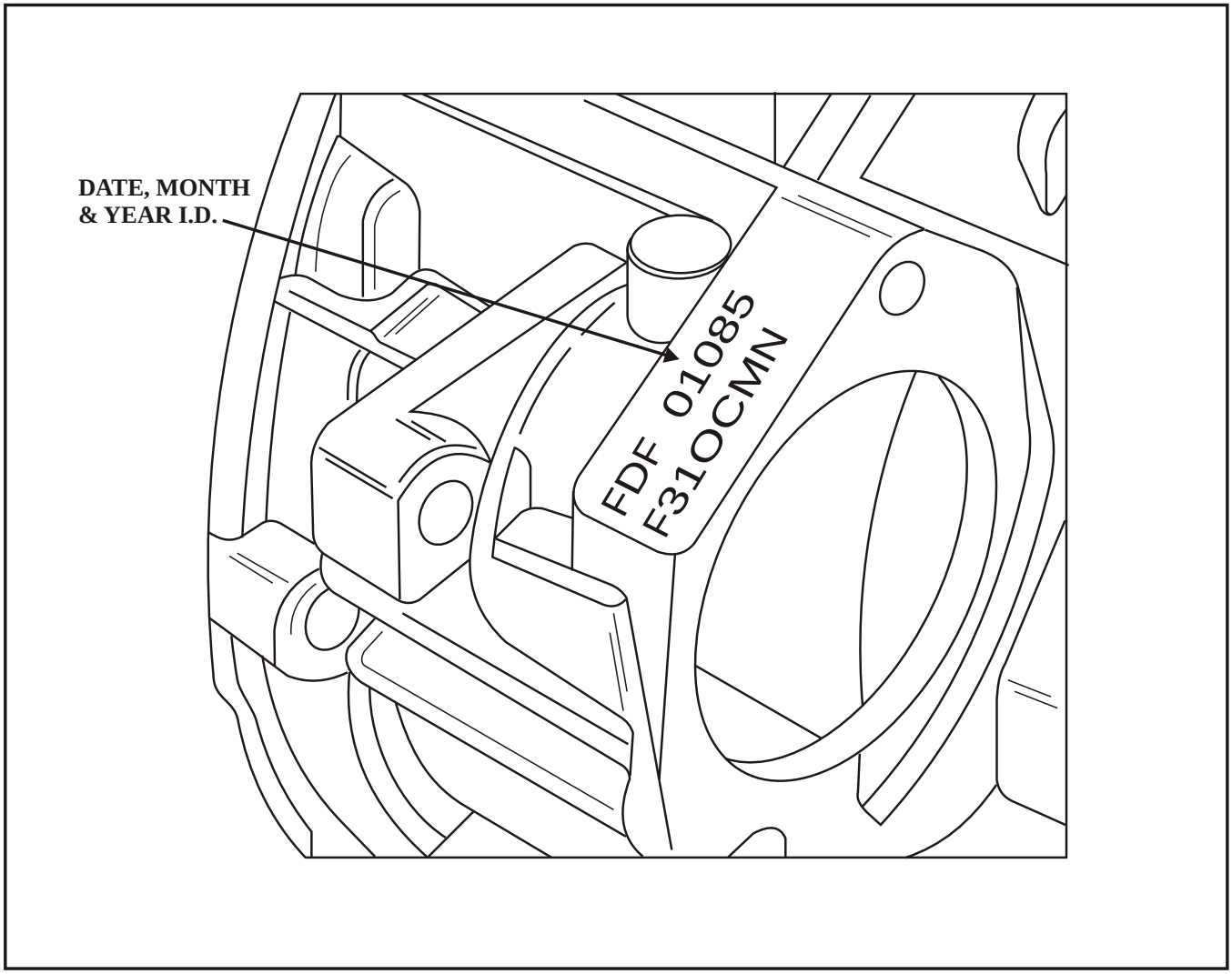
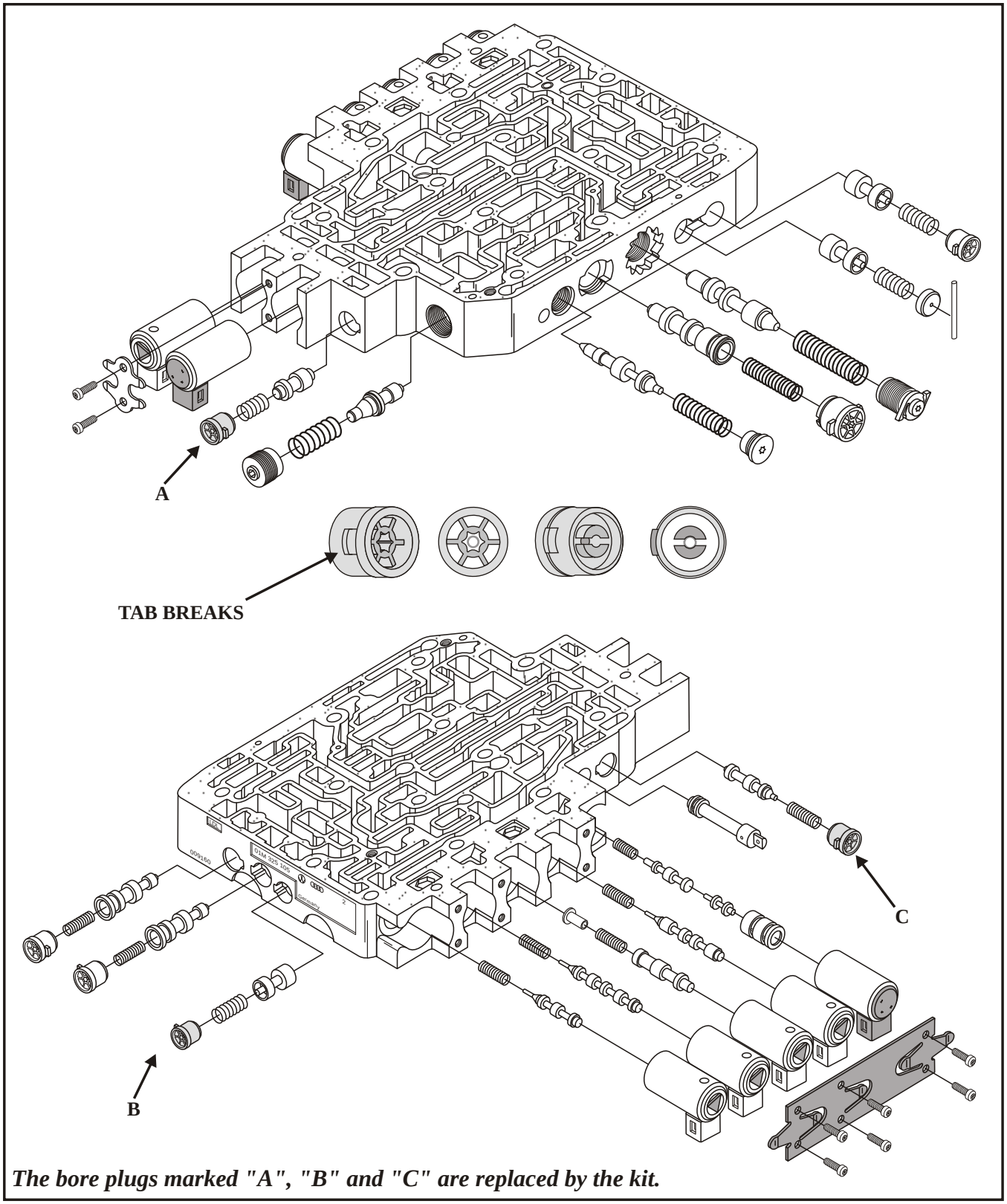


Figure 1

Southeast

VOLKSWAGEN 01M

NO SECOND GEAR, NO FOURTH GEAR OR NO FORWARD MOVEMENT



The bore plugs marked "A", "B" and "C" are replaced by the kit.

Figure 2

VOLKSWAGEN/AUDI "01M"
NO FORWARD OR SLIPS FORWARD

COMPLAINT: Before or after overhaul, vehicles equipped with the 01M transaxle may exhibit a "no forward" engagement or a slipping condition on take-off in first gear.

CAUSE: The cause may be, that the K1 (Forward) Piston is cracked, as shown in Figure 1, which can cause a loss of forward clutch pressure.

CORRECTION: Replace the K1 (Forward) Piston as part of every overhaul.

SERVICE INFORMATION:

At the time of this printing, the K1 (Forward) Piston is not sold, from Volkswagen, seperatly from the complete drum assembly. Aftermarket suppliers have available a "piston kit" to service the K1 drum as well as all of the other bonded pistons.

FORWARD PISTON INSPECTION

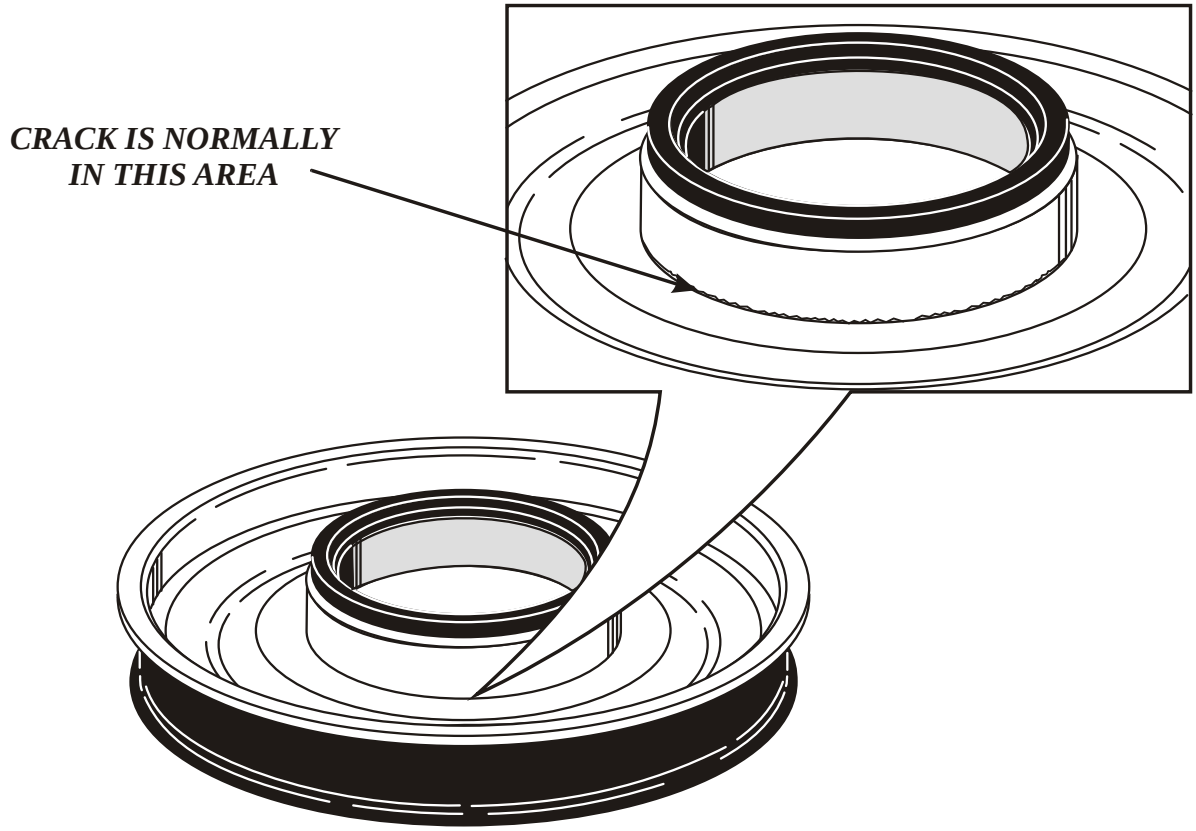


Figure 1

ISUZU, BMW, CADILLAC 4L30E

NO FOURTH GEAR, FAILSAFE, GEAR RATIO ERROR CODE STORED

COMPLAINT: After overhaul, the transmission has no 3-4 shift, shortly thereafter the transmission is in failsafe and a gear ratio error code is stored.
Gear Ratio Error Codes that can be stored are:
1990 - 93 Isuzu.....Code 41
1994 - 95 Isuzu.....Code 61
BMW.....Code 100
Cadillac Catera and all other OBD-II Compliant vehicles.....P0730

CAUSE: The Overrun Lockout Valve retainer was installed backwards, Refer to Figure 1, which prevents the valve from moving against the spring to allow fourth clutch feed oil from applying the fourth clutch.
The gear ratio error code is stored when fourth gear is commanded, but fourth gear does not occur.

CORRECTION: Install the Overrun Lockout Valve retainer as shown in Figure 2.

Many thanks to Mark Glasser from X-Pert Transmissions in Philadelphia, PA.

Rockland

ISUZU, BMW, CADILLAC 4L30E

NO FOURTH GEAR, FAILSAFE, GEAR RATIO ERROR CODE STORED

OVERRUN LOCKOUT VALVE ASSEMBLY

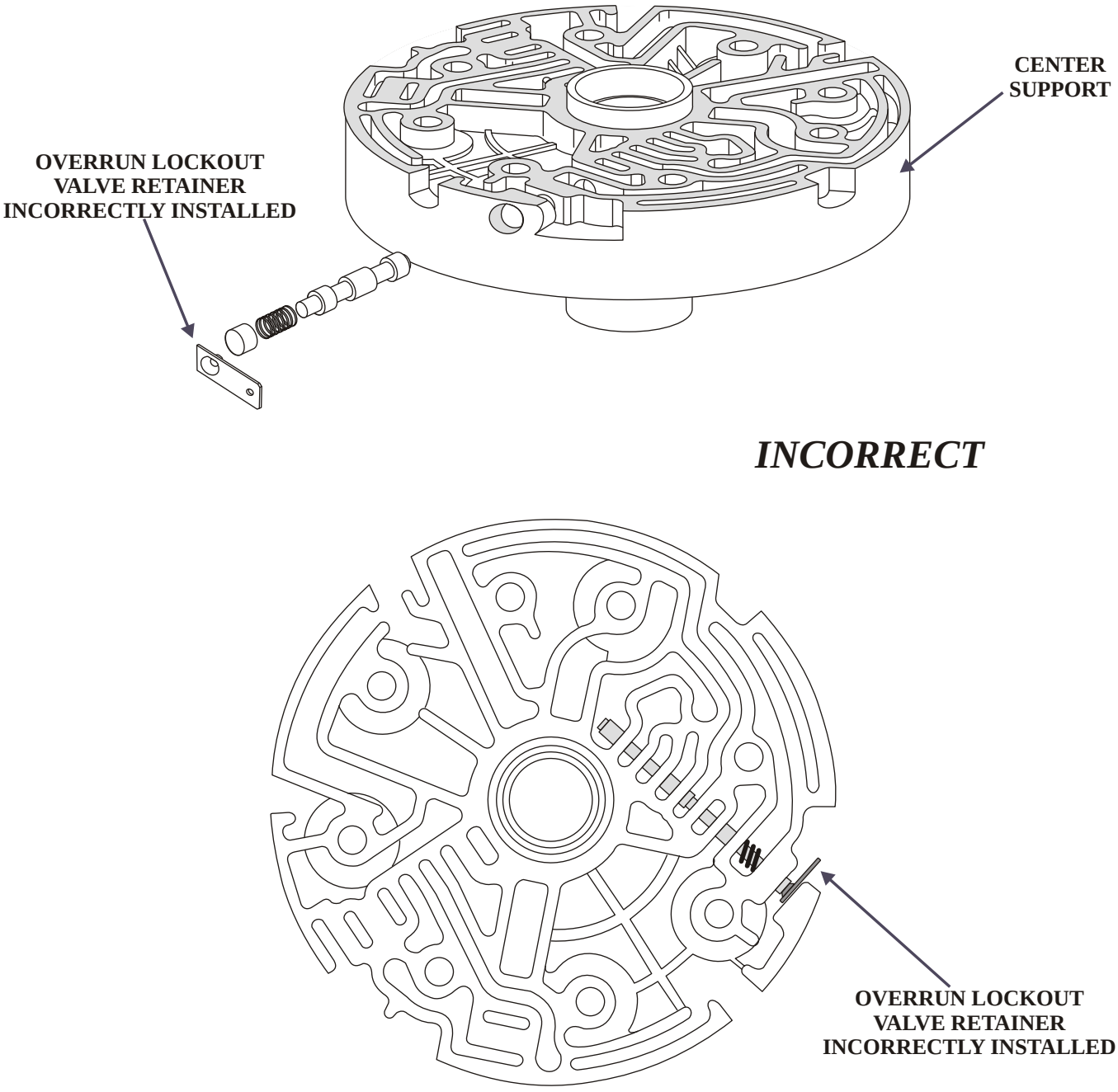
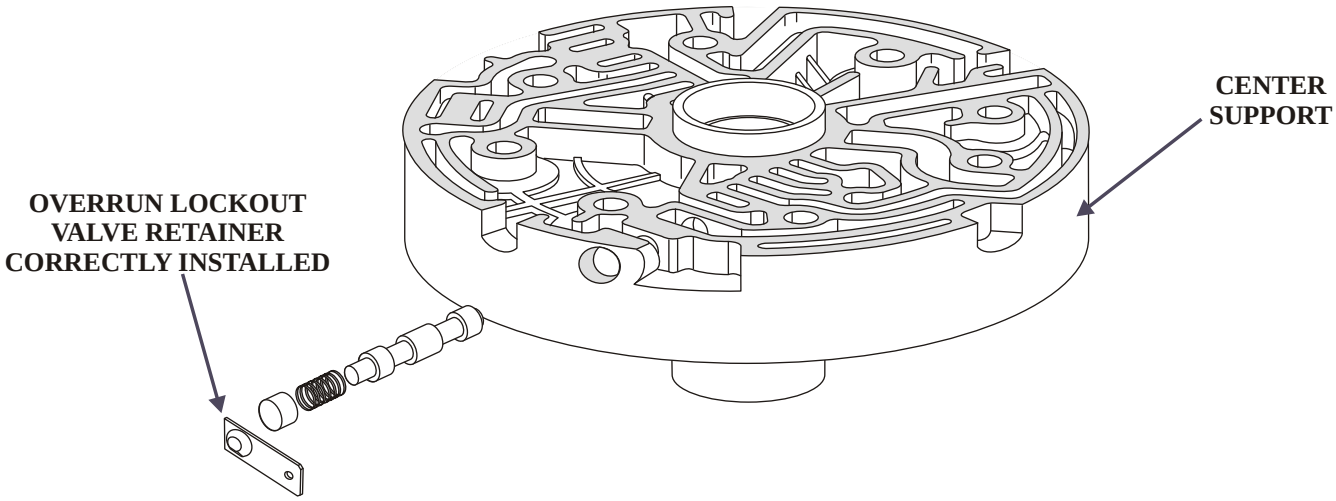


Figure 1

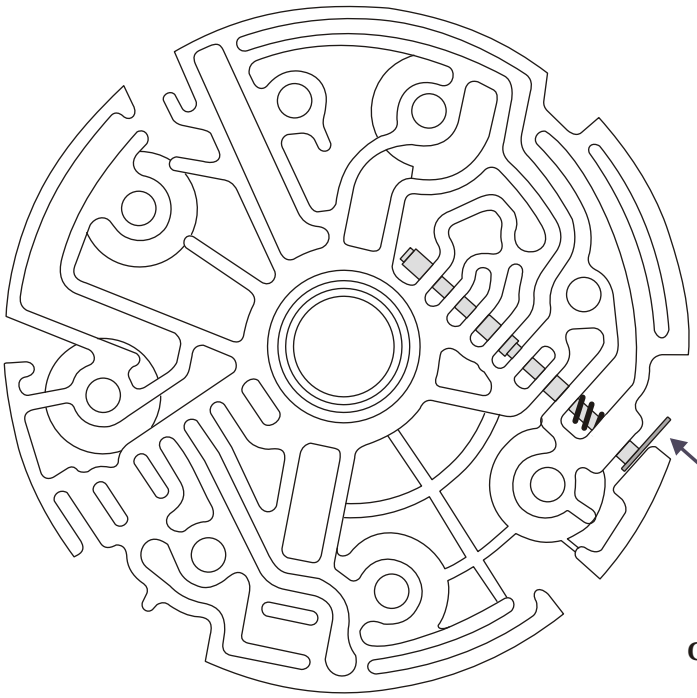
ISUZU, BMW, CADILLAC 4L30E

NO FOURTH GEAR, FAILSAFE, GEAR RATIO ERROR CODE STORED

OVERRUN LOCKOUT VALVE ASSEMBLY



CORRECT



BMW ZF5HP18 & 5HP30

ENGINE/TRANSMISSION ALIGNMENT DOWEL PINS

COMPLAINT: The transmission has been overhauled and installed back into the vehicle. shortly after the vehicle returns with a whining noise coming from the converter area. When the transmission is removed, stator shaft damage is evident. when the converter is cut open, internal converter damage is found.

CAUSE: The original engine/transmission alignment dowel pins are damaged as seen in figure 1. The installer was careless when installing the transmission back into the vehicle and smashed them by not carefully aligning the transmission with the dowel pins.
These dowel pins are easily destroyed because they are very thin which results in the transmission being off center causing the above complaints.

CORRECTION: Heavier alignment dowel pins are available (Refer to Figure 2) which are not so easily damaged.
Inform R&R staff to exercise care when installing either of these transmissions into a BMW.

SERVICE INFORMATION:
Heavy Duty Engine/Transmission Alignment Dowel Pins are available from Mario Aristides.....305-666-3544.

DAMAGED DOWEL PIN

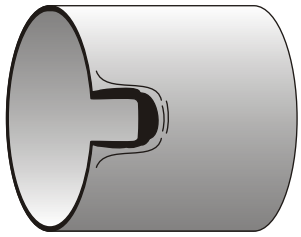


Figure 1

HEAVY DUTY DOWEL PIN

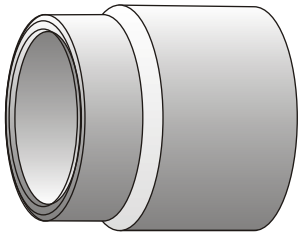


Figure 2

ZF-5HP-18 TRANSMISSION
NO POWER ON TAKE OFF, NEUTRALIZING, BIND UPS AND FAILSAFE

COMPLAINT: BMW's M3, 530i and 320i vehicles equipped with the ZF-5HP-18 transmission may exhibit a no power on take off complaint feeling as if the stator in the converter is defective. Other complaints may be sudden neutralizing, bind ups or failsafe.

CAUSE: It is not uncommon to find that the stator support in the pump cover has turned. Depending on the severity of the turn will determine the type of complaint.

CORRECTION: If the stator support has turned inside the cover, the assembly will need to be replaced. The replacement support and cover is called by ZF Industries as "The Intermediate Plate" (See Figure 1). The part is 1056-210-119 and lists for $ 524.45.

ZF'S INTERMEDIATE PLATE

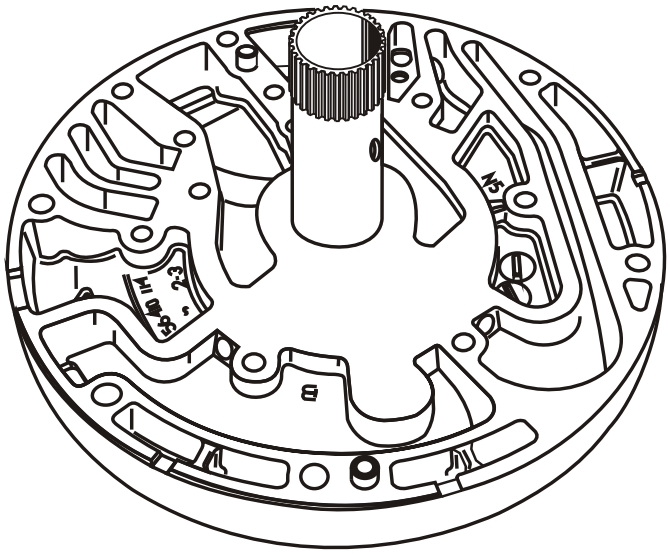


Figure 1

ZF AUTOMATIC TRANSMISSIONS
FACTORY DESIGNATED FLUID INFORMATION

ZF Industries recommends specific fluid for their automatic transmissions. If the incorrect fluid is used, it is possible that the friction's bonding agent to backing plate may deteriorate. The converter clutch is most prone to this negative reaction. The fluid recommendation can be easily determined by the color of the Transmission's Identification Tag. Refer to Figure 1 to view the Manufacturers Specified Fluid Application Chart for four speed transmissions, and figure 2 for five speed transmissions in order to select the correct recommended fluid.

When looking at this chart you will notice that Shell Fluid is used for only one application. We have noted that if the Black Tag 5 HP 30 has been rebuilt with new clutches and is being installed with a rebuilt Torque Converter where all the clutches are dry, the Esso Fluid LT71141 can be used in place of the Shell Fluid without any negative results. It is **not** recommended **at all** to mix Esso and Shell fluid in **any** application.

ZF's part number for a 20 Litre Container of Shell Fluid is 0671 090 149.

ZF's part number for a 20 Litre Container of Esso Fluid is 0671 090 166.

The Esso or Shell Fluid can be purchased through a ZF authorized distributor. To locate a Distributor near you, you can visit ZF's Passenger Car/Transmissions Distributor Locator on the WEB at:

http://www.zf-group.com/am/pc/pt/ampcpt06.phtml

Or Call 1(800) 660-2269

ZF TRANSMISSION FLUID REFERENCE CHART

4 SPEED TRANSMISSIONS				
APPLICATION	**MAKE**	**ID PLATE COLOR**	**FLUID**	**PART NUMBER**
4HP14	All Makes	Black	Dexron III	
4HP18	All Makes	Black	Dexron III	
4HP18E	All Makes	Black	Dexron III	
4HP18FLA	All Makes	Black	Dexron III	
4HP18FLE	All Makes	Black	Dexron III	
4HP20	All Makes	Green	Esso	LT 71141
4HP22	All Makes	Black	Dexron III	
4HP22A	All Makes	Black	Dexron III	
4HP22HL	Porsche	Black	Dexron III	
4HP24	All Makes	Black	Dexron III	
4HP24A	All Makes	Black	Dexron III	

Figure 1

5 SPEED TRANSMISSIONS				
APPLICATION	**MAKE**	**ID PLATE COLOR**	**FLUID**	**PART NUMBER**
5HP18	BMW	Black	Dexron III	
		Green	Esso	LT71141
5HP18A	BMW	Black	Dexron III	
5HP19	BMW	Green	Esso	LT71141
5HP19FL	Audi	Green	Esso	LT71141
	Porsche	Green	Esso	LT71141
	VW	Green	Esso	LT71141
5HP19FLA	Audi	Green	Esso	LT71141
5HP19HL	Porsche	Green	Esso	LT71141
5HP19HLA	Porsche	Green	Esso	LT71141
5HP24	BMW	Green	Esso	LT71141
	Jaguar	Green	Esso	LT71141
5HP24A	Audi	Green	Esso	LT71141
	VW	Green	Esso	LT71141
5HP30	Aston Martin	Green	Esso	LT71141
	Bentley	Green	Esso	LT71141
	BMW	Black	Shell	LA 2634
	BMW	Green	Esso	LT71141
	Rolls Royce	Green	Esso	LT71141

Figure 2

ZF5HP-19

2-3 UPSHIFT FLAIR

COMPLAINT: Audi or BMW vehicles, equipped with the ZF5HP-19FL, ZF5HP-19FLA or ZF5HP-19 may exhibit a condition of a 2-3 upshift flair.

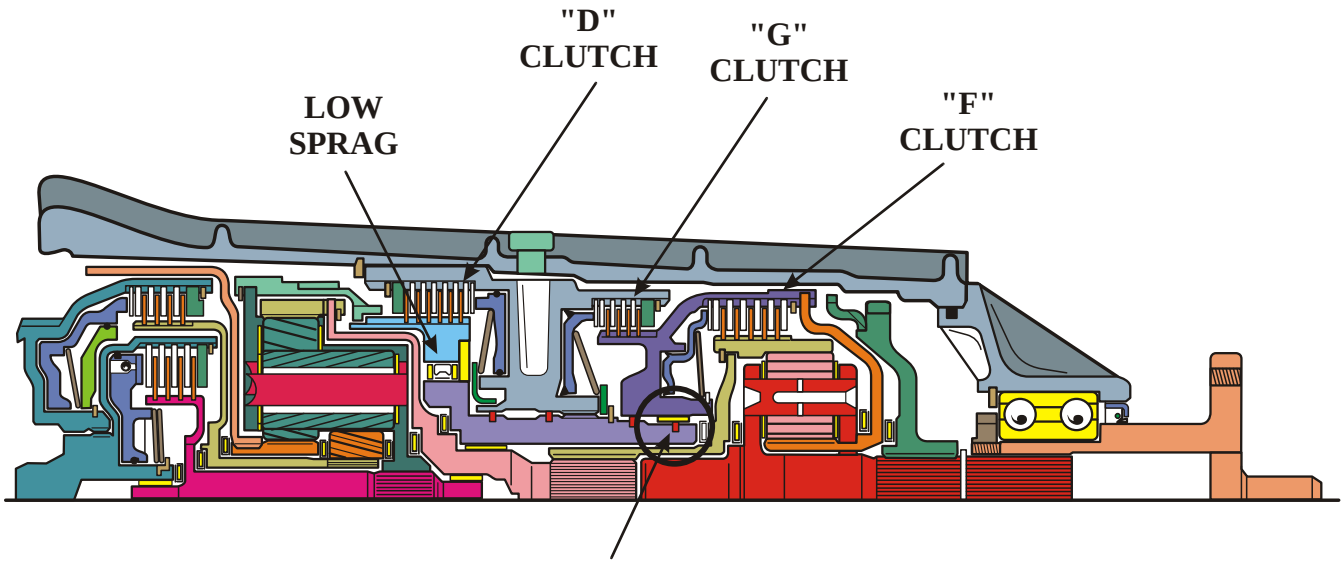
CAUSE: The cause may be, a loss of apply pressure to the F Clutch because of a sealing ring wearing into a bushing as shown in Figure 1.

CORRECTION: Replace the Low Sprag assembly and F Clutch drum with the updated parts as shown in Figure 1. This update replaces the bushing with a bearing which moves the first sealing ring into a direct contact with the F drum. If the 2-3 upshift flair persists after the sealing problem has been addresed, refer to Figure 2 to locate the "F" accumulator line-up, and install a .080" to .100" shim inside of the "F" accumulator piston. This will make the accumulator spring stronger and will help keep the "F" accumulator regulator valve from stroking so quickly.

SERVICE INFORMATION:

HUB AND LOW SPRAG ASSEMBLY (ZF part no. for BMW).....1060273035
HUB AND LOW SPRAG ASSEMBLY (ZF part no. for AUDI).....1060273013
F DRUM ASSEMBLY (ZF part no. ALL).....1060277010

ZF5HP-19 CROSS-SECTIONAL VIEW



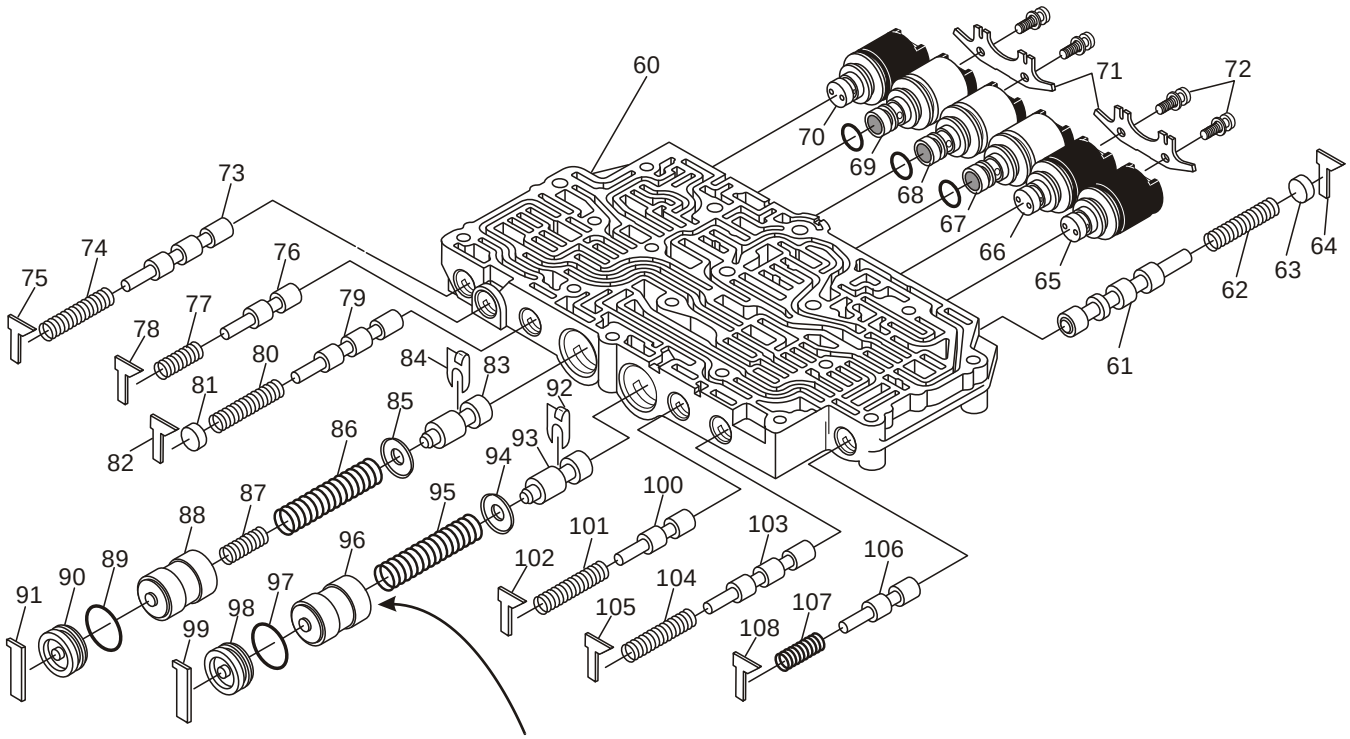
PREVIOUS DESIGN HAD SEALING RING FOR "F" CLUTCH RIDING ON THE SUPPORT BUSHING

NEW "F" DRUM ASSEMBLY WITH BEARING INSTEAD OF BUSHING 1060277010

NEW SPRAG ASSEMBLY 1060273013 (AUDI) OR 1060273035 (BMW)

Figure 1

ZF-5HP-19FL
LOWER REAR VALVE BODY



ADD A .080" TO .100" SHIM INSIDE OF THE PISTON

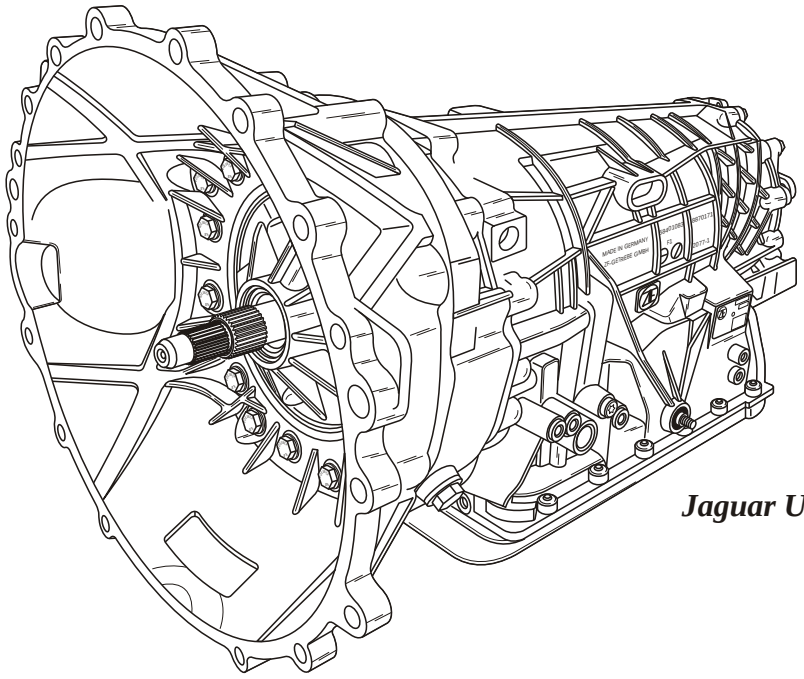
60. Lower Rear Valve Body
61. Number 1Shift Valve
62. Number 1Shift Valve Spring
63. Number 1Shift Valve Bore Plug
64. Number 1Shift Valve Retainer
65. MV-3 Solenoid (On-Off)
66. MV-2 Solenoid (On-Off)
67. EDS-3 Solenoid and "O" Ring (Pressure Regulating)
68. EDS-4 Solenoid and "O" Ring (Pressure Regulating)
69. EDS-2 Solenoid and "O" Ring (Pressure Regulating)
70. MV-1 Solenoid (On-Off)
71. Solenoid Retaining Brackets (2 Required)
72. Solenoid Retaining Bracket Screws (4 Required)
73. Traction Coast Valve
74. Traction Coast Valve Spring
75. Traction Coast Valve Train Retainer
76. TCC Release Regulator Valve
77. TCC Release Regulator Valve Spring
78. TCC Release Regulator Valve Train Retainer
79. Number 3 Shift Valve
80. Number 3 Shift Valve Spring
81. Number 3 Shift Valve Train Bore Plug
82. Number 3 Shift Valve Train Retainer
83. "D" Clutch Accumulator Regulator Valve
84. "D" Clutch Accumulator Regulator Valve Retainer
85. "D" Clutch Damper Valve Spring Seat
86. "D" Clutch Damper Valve Outer Spring
87. "D" Clutch Damper Valve Inner Spring
88. "D" Clutch Damper Valve
89. "D" Clutch Valve Train Bore Plug "O" Ring
90. "D" Clutch Valve Train Bore Plug
91. "D" Clutch Valve Train Bore Plug Retainer
92. "F" Clutch Accumulator Regulator Valve Retainer
93. "F" Clutch Accumulator Regulator Valve
94. "F" Clutch Damper Valve Spring Seat
95. "F" Clutch Damper Valve Spring
96. "F" Clutch Damper Valve
97. "F" Clutch Valve Train Bore Plug "O" Ring
98. "F" Clutch Valve Train Bore Plug
99. "F" Clutch Valve Train Bore Plug Retainer
100. Reverse Gear Valve
101. Reverse Gear Valve Spring
102. Reverse Gear Valve Train Retainer
103. Number 2 Shift Valve
104. Number 2 Shift Valve Spring
105. Number 2 Shift Valve Train Retainer
106. Pressure Reduction Valve
107. Pressure Reduction Valve Spring
108. Pressure Reduction Valve Train Retainer

Figure 2

Jaggi

ZF-5HP-24
PRELIMINARY INFORMATION

BMW 5 Series E39, 7 Series E38, 8 Series E31 ..... 95-Current
Jaguar XK8 (X100), ... 96-Current
Jaguar XJ8 (X300), ... 97-Current
Audi A8 (All Wheel Drive 5HP-24A) 96-Current



Jaguar Unit Shown

This transmission is manufactured in Germany by ZF and carries the BMW designation A5S 440Z.

The A5S 440Z is an electronically controlled, five speed automatic transmission with a lock-up clutch type torque converter. Three planetary gear sets (Wilson Gearing), three rotating multiple disc clutches, three multiple disc brake clutches, and one sprag clutch (Freewheel) are used to provide the five forward speeds and reverse.

Key to designation:

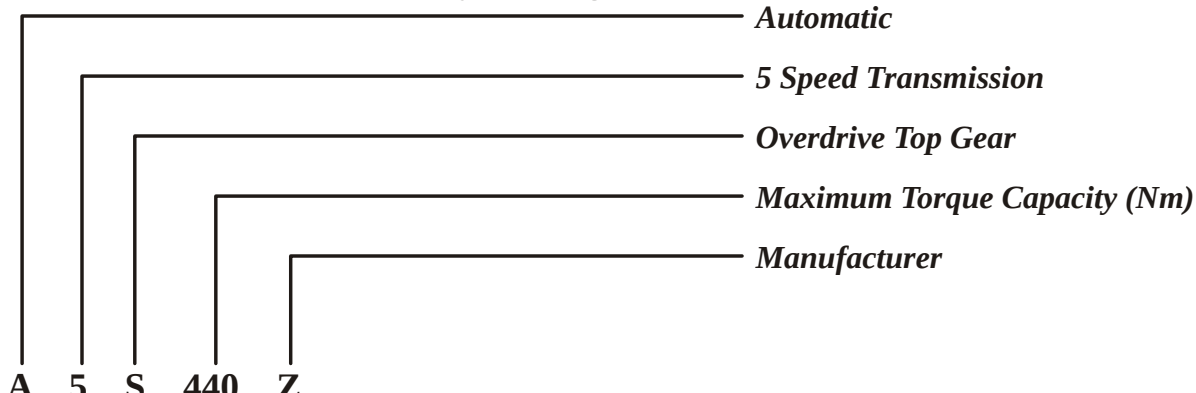


Figure 1

Refer to Figure 2 for Clutch and Band Application Chart.

Refer to Figure 3 for Manual Shift Lever Operation, and Failsafe Operation.

Refer to Figures 4, and 5 for Solenoid identification and both MV Solenoid Operation and EDS Solenoid Operation and Tests.

Refer to Figure 6 for wiring harness identification, internal wiring schematic, and transmission case connector pin identification and functions.

Refer to Figure 7 for Shift Solenoid Application chart. Notice that EDS 1 Solenoid is used for line pressure control, and MV-4 is used for converter clutch.

Refer to Figure 8 for EDS Solenoid "Principles of Operation", as some are normally open and some are normally closed.

Refer to Figure 9 for internal components resistance chart, with the pins identified for both the transmission case connector and the Electronic Control Unit.

Refer to Figure 10 for Upper Valve Body exploded view and identification of valves.

Refer to Figure 11 for Lower Front Valve Body exploded view and identification of valves.

Refer to Figure 12 for Lower Rear Valve Body exploded view and identification of valves.

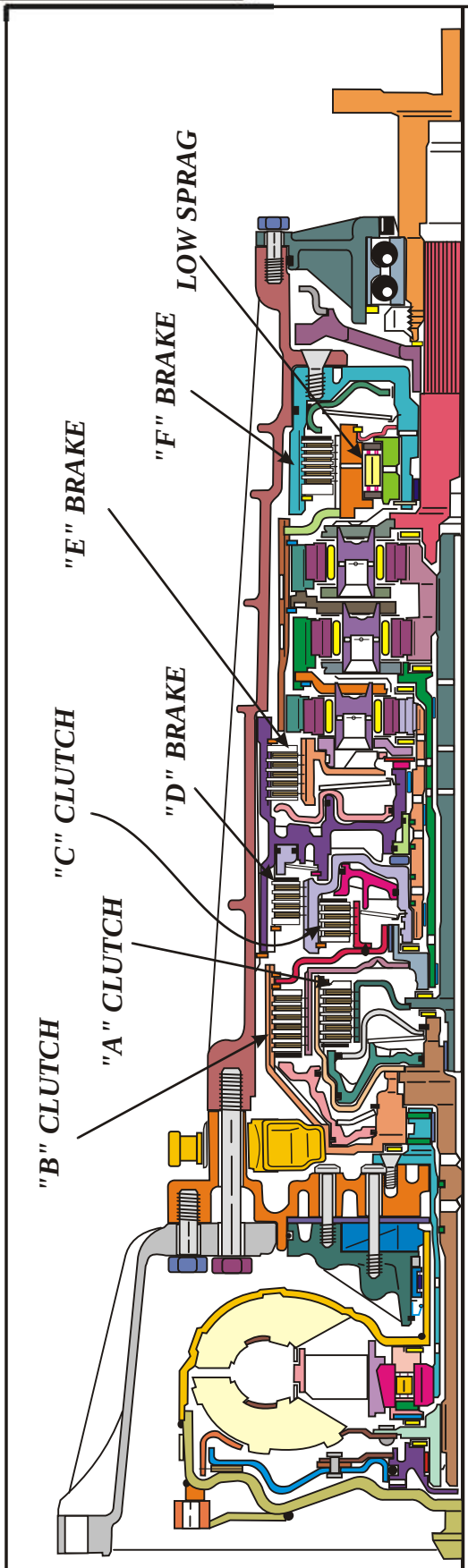
Refer to Figures 13, 14, and 15 for valve body retainer locations in the various valve bodies.

Refer to Figure 16 for Channel Plate screen location on the upper side.

Refer to Figure 17 for the locations of the orifices, checkballs, screens, and the check valves and springs that are located in the channel plate.

Refer to Figure 18 for external pressure tap locations in the main case

ZF-5HP-24



APPLICATION CHART

GEAR	"A" CLUT	"B" CLUT	"C" CLUT	"D" BRAK	"E" BRAK	"F" BRAK	LOW SPRAG	GEAR RATIO
PARK						ON		
REV			ON			ON		4.10:1
NEUT						ON		
D-1ST	ON						HOLD	3.57:1
D-2ND	ON				ON			2.20:1
D-3RD	ON			ON				1.51:1
D-4TH	ON	ON						1.00:1
D-5TH		ON		ON				0.80:1
M-1	ON					ON	HOLD	3.57:1

Figure 2

SELECTOR LEVER POSITIONS

P = ***Park,*** and should only be selected when the vehicle is at a standstill. First apply the hand brake, and then select the Park position with the manual lever. Refer to Figure 3.

R = ***Reverse,*** and should only be selected when the vehicle is at a standstill with engine at idle. Refer to Figure 3.

N = ***Neutral,*** and may be selected when the vehicle is at a standstill, but first applying the handbrake. May also be selected while vehicle is moving, to restart the engine or to counteract a skidding concern. Refer to Figure 3.

D = ***Drive,*** is the standard position for normal driving in the XE program (AGS) and provides automatic upshifts from 1st to 5th and automatic downshifts from 5th to 1st gear. The adaptive transmission control (AGS) system contains various driving programs such as Stop and Go, Trailer Towing, Mountain Driving, City Driving and Highway Driving (constant speed). These programs are selected by the Electronic Control Unit (ECU), which automatically modifies the transmissions shift characteristics according to rolling resistance, engine load, accelerator pedal movement and vehicle speed. The standard "Drive" position is position "1", as shown in Figure 3.

"S" - Program

The "S" Program is a performance oriented program, where the gear changing characteristics of the transmission are moved up to higher engine speeds. To select the "S" Program, the selector lever is shifted to the left-hand gate (position "2" in Figure 3), without moving shift lever towards plus or minus. The "S" Program provides automatic upshifts from 1st to 4th and automatic downshifts from 4th to 1st gear. 5th gear is inhibited when the "S" Program is selected.

"M" - Program

The "M" Program is a manual shift program which is activated by simply pushing the selector lever towards the minus sign for sequential downshifts and towards the plus sign for sequential upshifts, while the shift lever is in the left-hand gate (position "2" in Figure 3). It is possible to drive off in 1st gear, 2nd gear or 3rd gear, however, 4th gear can be manually selected only at a speed of approximately 40 km per hour and 5th gear at approximately 60 km per hour.

4th Gear, Select this position if the transmission tends to hunt between 5th-4th/4th-5th gears under certain driving conditions.

3rd Gear, Select this position if the transmission tends to hunt between 3rd and 5th gears under certain driving conditions. Also recommended for lengthy descents in mountainous areas.

2nd Gear, Select this position when driving over mountain passes with lengthy assents and desents.

1st Gear, This position can be selected for engine braking effect, depending on vehicle speed.

Typical BMW Shift Lever

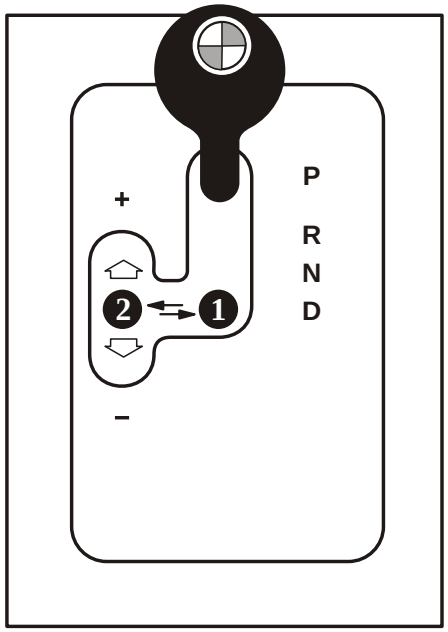


Figure 3

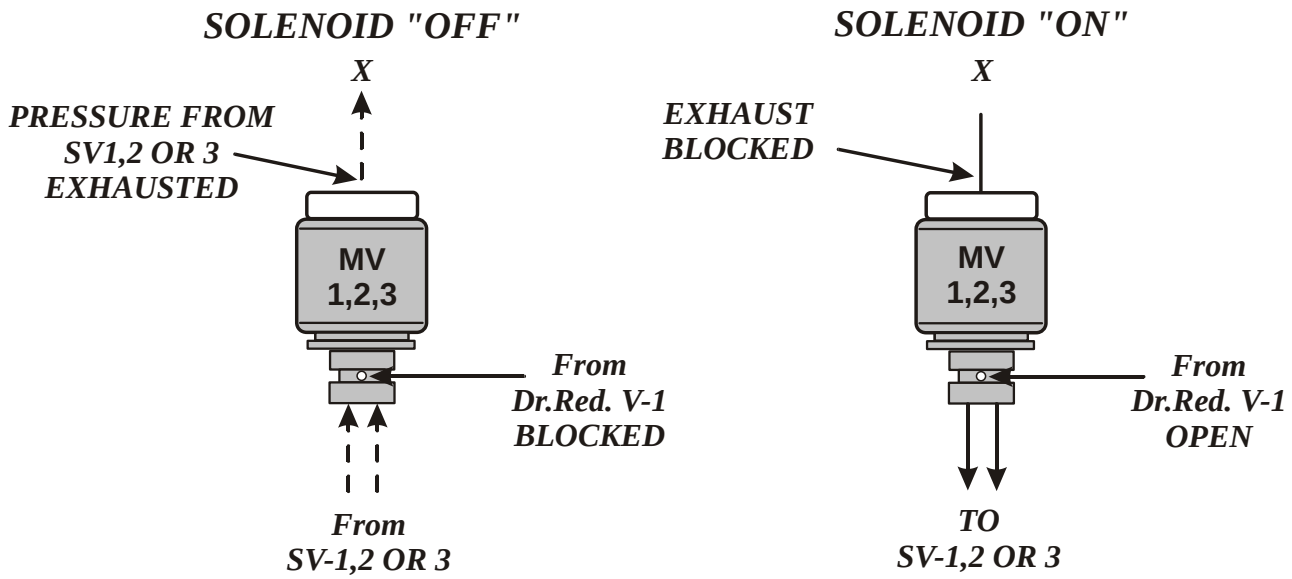
FAILSAFE OPERATION:

When a system fault is detected which would impair normal reliable operation, the transmission control module interrupts the power supply to Pin 12 at the transmission case connector. The transmission control module also alerts the driver of any faults by signaling the vehicles "check control" system. To enable the vehicle to be driven to a repair shop, the following manual gear selections are permitted:

Selector Lever Position	**P R N D 4 3 2**
Actual Gear Obtained	**P R N 5 5 5 5**

Independent

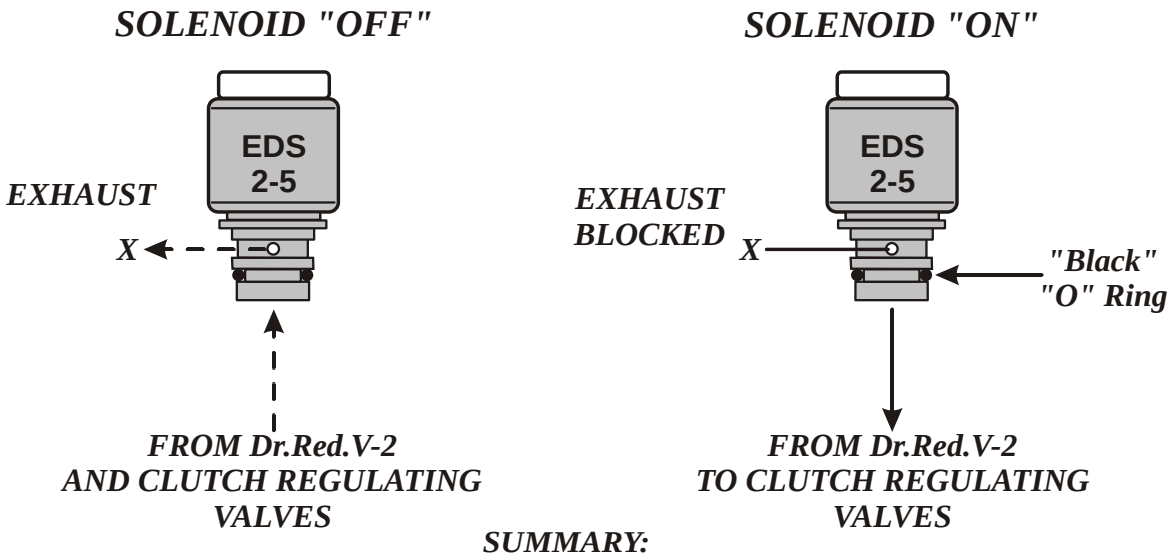
MV1, 2 AND 3



SUMMARY:

When MV 1, 2 or 3 is "OFF" Solenoid reducing pressure, from Dr.Red. V-1, is blocked by the solenoid and oil pressure from SV 1, 2 or 3 is exhausted at the rear of the solenoid. When MV 1, 2 or 3 is "ON" Solenoid reducing pressure, From Dr.Red. V-1, is open through the solenoid and is applied to SV 1, 2 or 3. The exhaust at the rear of the solenoid is closed.

EDS 2, 3, 4, 5,

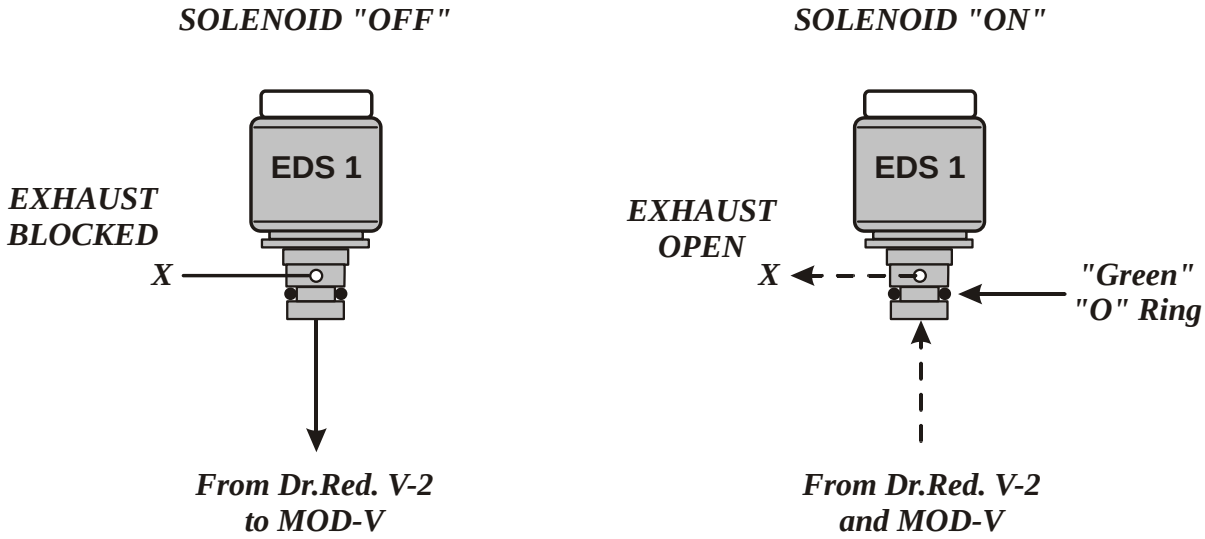


SUMMARY:

When EDS 2 thru 5 solenoids are "OFF" they exhaust orificed solenoid reducing pressure, from Dr. Red. V-2, and the oil pressure from the clutch regulating valves releasing them. When EDS 2 thru 5 solenoids are "ON" the exhaust is blocked by the solenoid and solenoid reducing pressure, from Dr. Red. V-2, is applied to operate clutch regulating valves.

Figure 4

EDS 1 (Line Pressure)

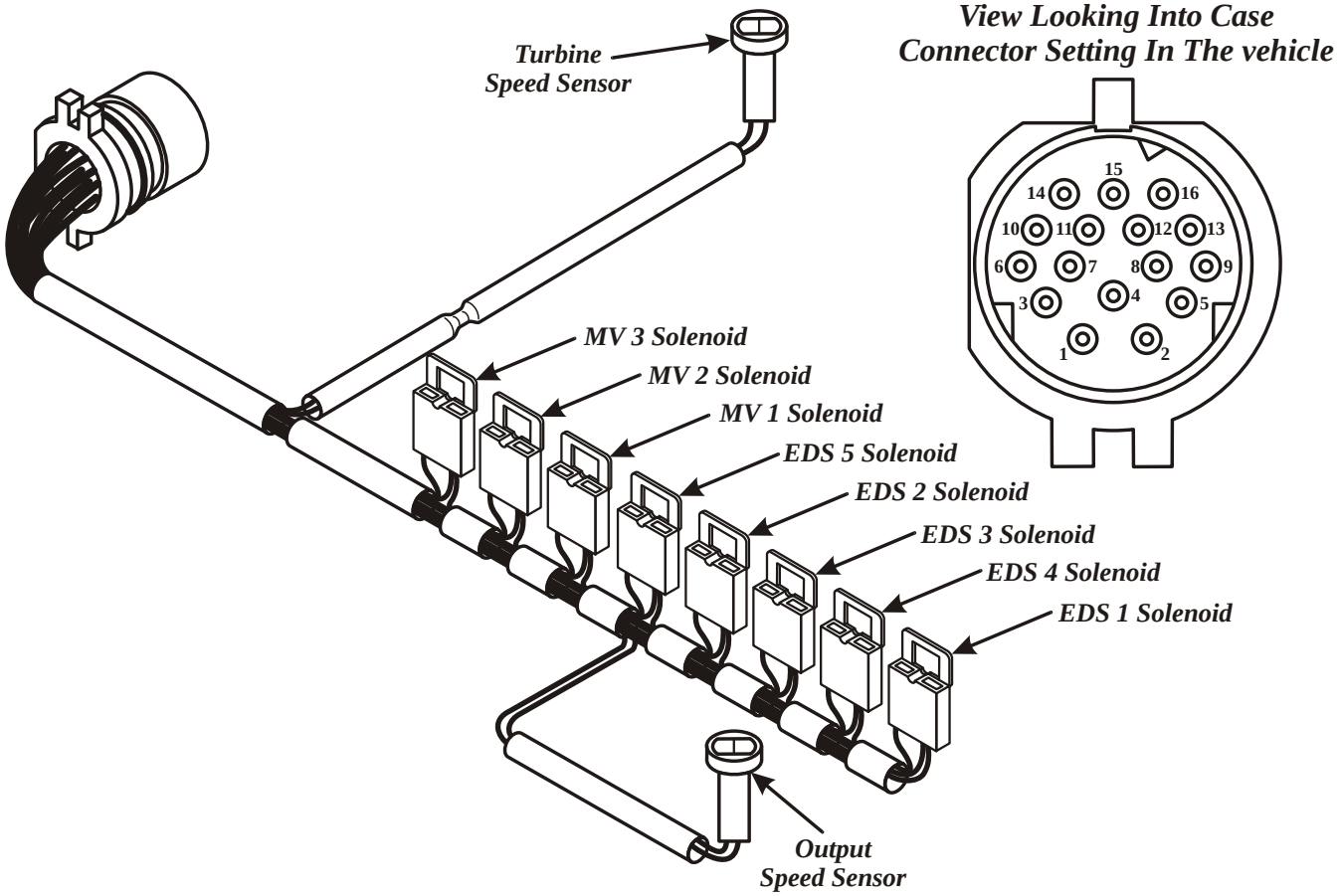


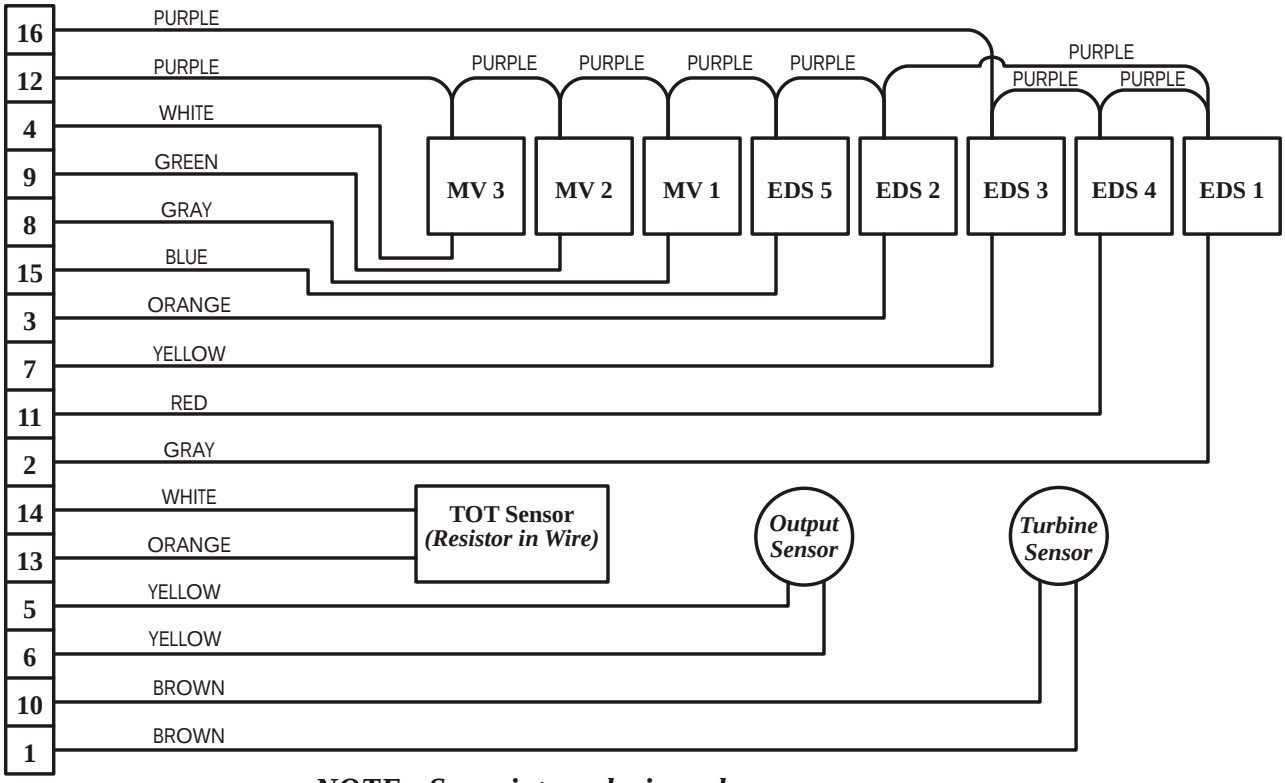
SUMMARY:

When EDS 1 solenoid is "OFF," solenoid reducing pressure, from Dr. Red. V-2, is high to MOD-V valve which creates high line pressure.
When EDS 1 solenoid is "ON," solenoid reducing pressure, from Dr. Red. V-2, is low to

Figure 5

ZF-5HP-24 INTERNAL WIRE SCHEMATIC





NOTE: Some internal wire colors may vary.

Figure 6

ZF-5HP-24 SOLENOID APPLICATION CHART

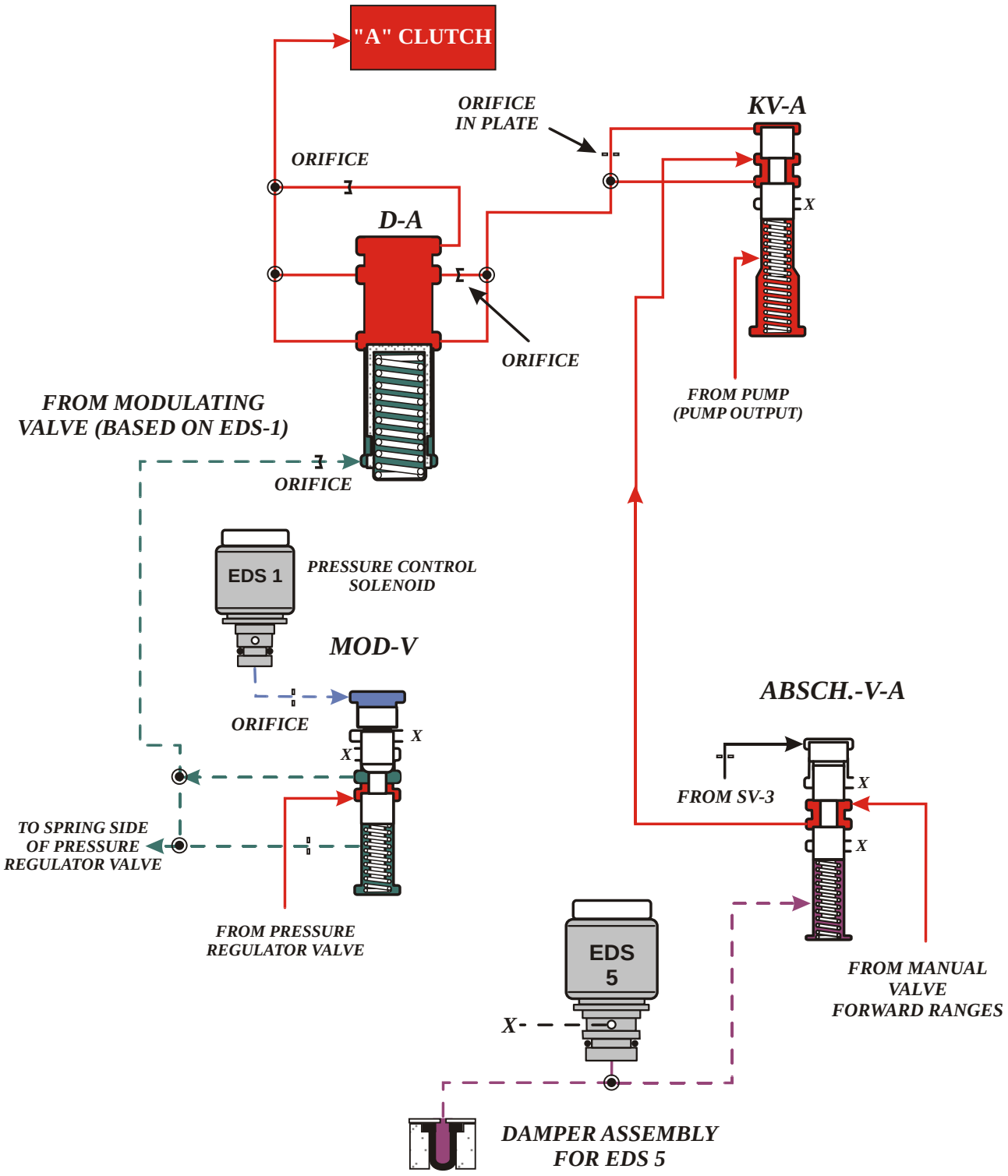
Selector Lever Position	*MV 1 Solenoid*	*MV 2 Solenoid*	*MV 3 Solenoid*	*EDS 1 Solenoid*	*EDS 2 Solenoid*	*EDS 3 Solenoid*	*EDS 4 Solenoid*	*EDS 5 Solenoid*	GEAR RATIO
PARK	**ON**		**ON**	**	-*	*		-*	
REVERSE		**ON**	⊛	**	*-	*		*-	**4.10:1**
NEUTRAL	**ON**		**ON**	**	-*	*		-*	
D-1ST	**ON**			**	*-	*		*-	**3.57:1**
D-2ND	**ON**	**ON**		**		*		*	**2.20:1**
D-3RD		**ON**		**		*			**1.51:1**
D-4TH		**ON**		**			-*-		**1.00:1**
D-5TH				**			-*-		**0.80:1**
D-5TH "TCC"				**			*		**0.80:1**

SOLENOID CHART LEGEND

Symbol	Description
ON	MV 1, MV 2 and MV 3 Solenoids are energized by the Electronic Transmission Control unit and have two functions. They are Open or Closed. Energized (On), there is pressure in circuit.
⊛	MV 3 is turned "ON" if reverse is selected at a high vehicle speed, to inhibit reverse engagement.
**	EDS 1 is used for line pressure control only, and operates from 0 to 0.8 amps. When the solenoid is "OFF" (0 amps), pressure is high. EDS 1 pressure is "Lowered" as the solenoid is modulated by the control unit.
*	EDS 2, EDS 3, EDS 4 and EDS 5 Solenoids are also pulse modulated but are exactly the opposite of EDS 1 Solenoid. When these solenoids are "ON" oil pressure in the hydraulic circuit is high, and when they are "OFF" pressure in the hydraulic circuit is low.
-*	Solenoid "OFF" (hydraulic pressure low), then Solenoid "ON" (hydraulic pressure high).
*-	Solenoid "ON" briefly (hydraulic pressure high), then Solenoid "OFF" (hydraulic pressure low). The pressure acts briefly on regulator valves to cushion clutch application.
-*-	EDS 4 Solenoid is used for Torque Converter Clutch apply and release only, and depends on throttle position and vehicle speed as to its application.

Figure 7

EDS-5 SOLENOID OPERATION



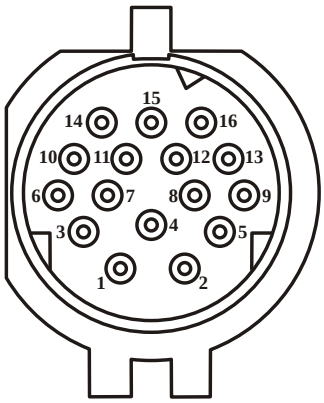
EDS 5 is used to prevent the ABSCH.-V-A, which is the switch valve for the A clutch, from stroking against its spring. Its use is mainly for forward engagement and a 5-4 downshift.

Figure 8

SOLENOID AND SENSOR RESISTANCE CHART

Solenoid	*Case Connector Pin Numbers* (− +)	*Resistance In Ohms*
MV 1	*8 and 12*	*30 - 34 Ω*
MV 2	*9 and 12*	*30 - 34 Ω*
MV 3	*4 and 12*	*30 - 34 Ω*
EDS 1	*2 and 12*	*5.2 - 6.8 Ω*
EDS 2	*3 and 12*	*6.2 - 7.8 Ω*
EDS 3	*7 and 12*	*6.2 - 7.8 Ω*
EDS 4	*11 and 12*	*6.2 - 7.8 Ω*
EDS 5	*15 and 12*	*6.2 - 7.8 Ω*
TOT	*13 and 14*	*1000 Ω at 25° C*
TSS	*1 and 10*	*292 - 358 Ω*
OSS	*5 and 6*	*292 - 358 Ω*

View Looking Into Case
Connector Setting In The vehicle



Electronic Control Unit Connector Pin Identification

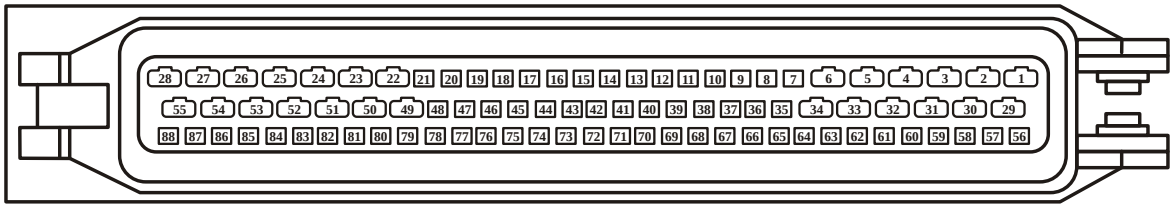
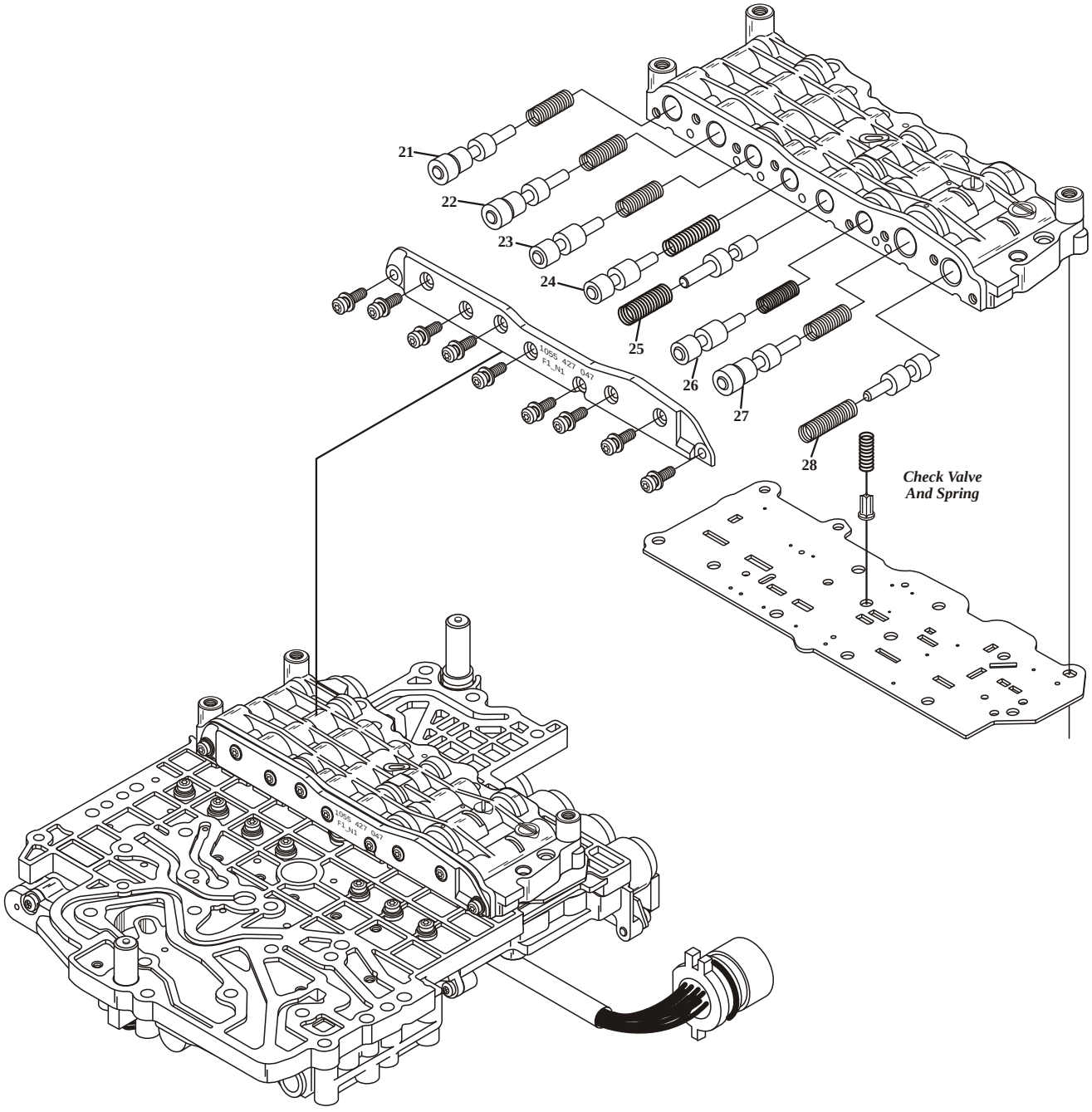


Figure 9

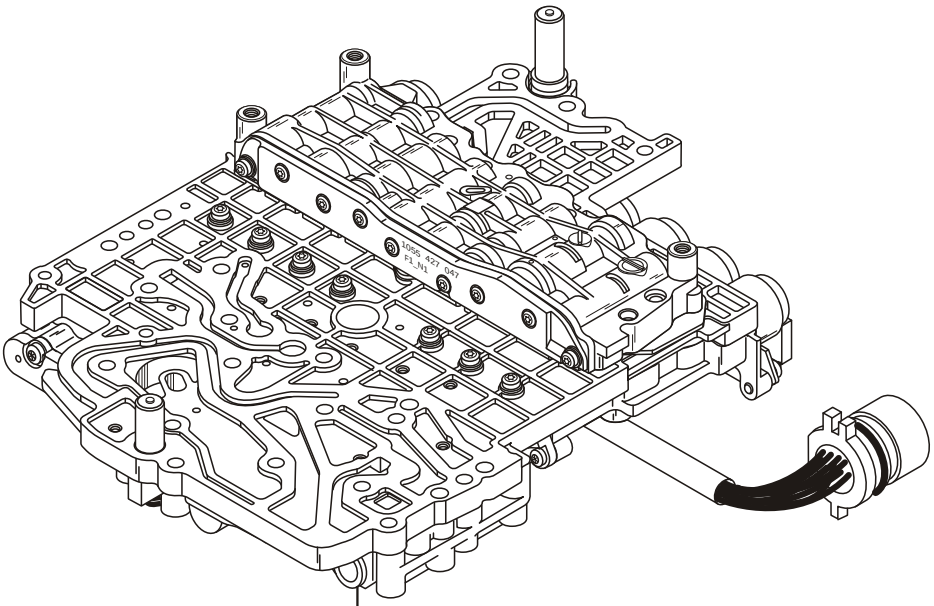
ZF-5HP-24 UPPER VALVE BODY



21. Clutch Valve "F" Line-Up (KV-F).
22. Clutch Valve "E" Line-Up KV-E).
23. Pressure Reducing Valve 1 (DR-V1).
24. Pressure Reducing Valve 2 (DR-V2).
25. Clutch Valve "B" Line-Up (KV-B).
26. Holding Valve "E" Line-Up (HV-E).
27. Switch Valve For "A" Clutch (ABSCH-V-A).

Figure 10

ZF-5HP-24 LOWER FRONT VALVE BODY



9. Manual Shift Valve (W-S).
10. Converter Clutch Apply Oil Control Valve (WK-V).
11. Converter Clutch Release Oil Control Valve (WD-V).
12. Main Pressure Regulator Valve Line-Up (HD-V).
13. Lubrication Valve (SCHM-V)
14. Modulating Valve Line-Up (MOD-V).
15. Holding Valve For "B" Clutch (HV-B).
16. Accumulator Valve For EDS 2 Solenoid (D-2).
17. Holding Valve For "D" Clutch (HV-D).
18. Accumulator Valve For EDS 4 Solenoid (D-4).
19. Accumulator Valve For EDS 3 Solenoid (D-3).

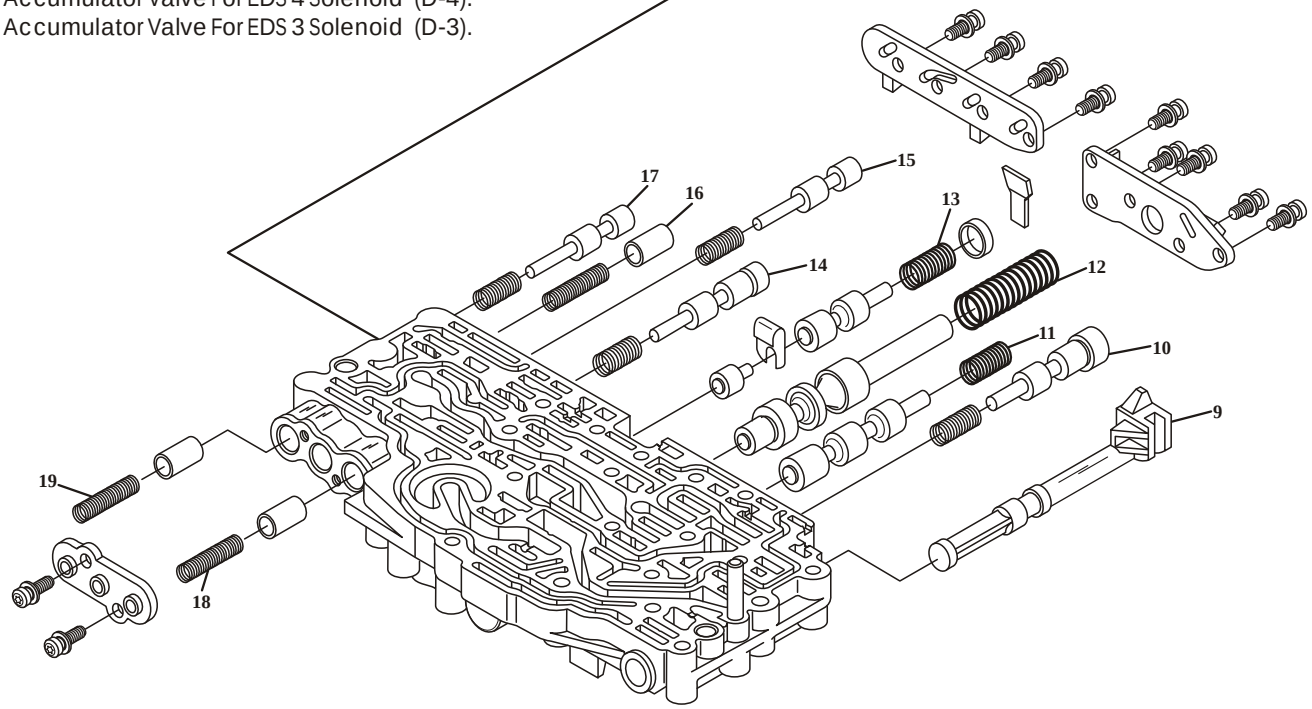
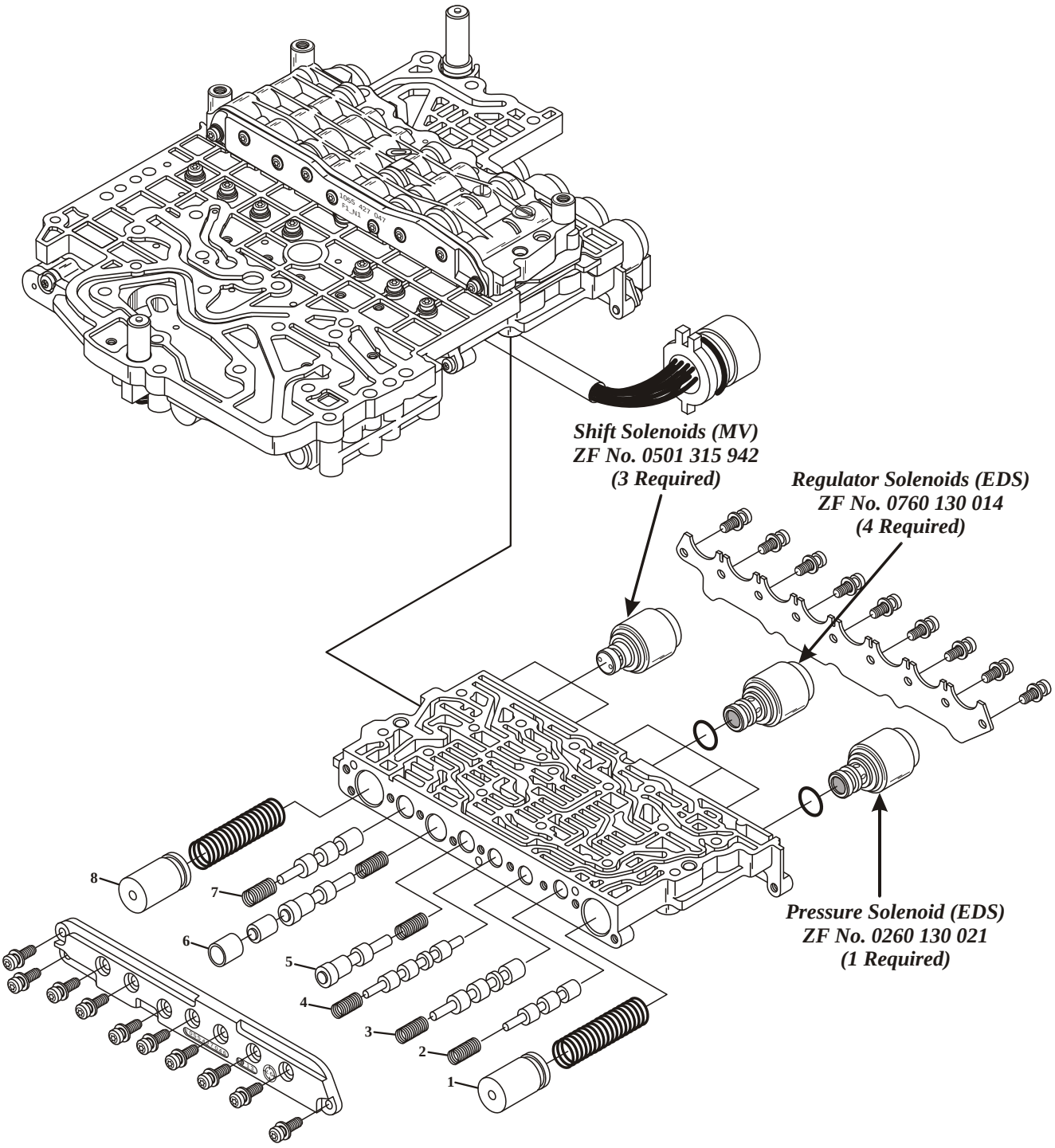


Figure 11

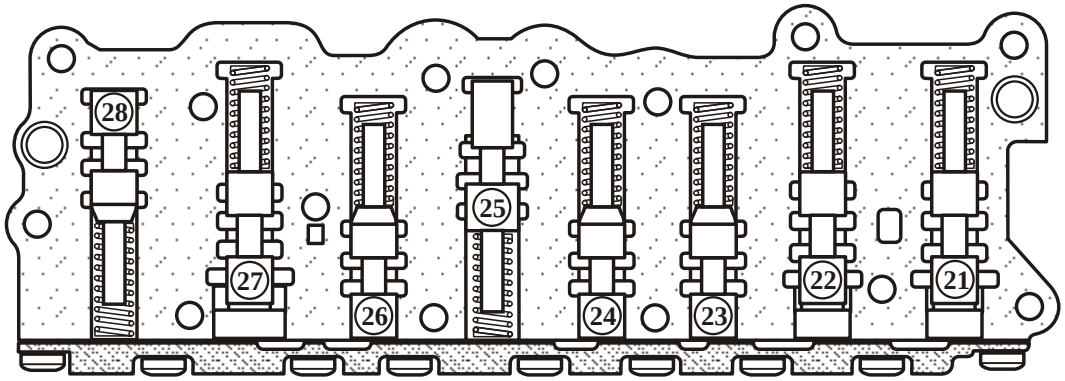
ZF-5HP-24 LOWER REAR VALVE BODY



1. "A" Clutch Accumulator Line-Up (D-A).
2. Shift Valve Number 1 (SV-1).
3. Shift Valve Number 2 (SV-2).
4. Shift Valve Number 3 (SV-3).
5. Switch Valve For "D" Clutch (ABSCH-V-D).
6. Clutch Valve "D" Line-Up (KV-D).
7. Reverse Gear Valve Line-Up (RG-V).

Figure 12

ZF 5HP-24 UPPER VALVE BODY



21. Clutch Valve "F" Line-Up (KV-F).
22. Clutch Valve "E2" Line-Up KV-E2).
23. MV Solenoid Regulator Valve (DR. Red.-V1).
24. EDS Solenoid Regulator Valve (DR. Red.-V2).
25. Clutch Valve "B" Line-Up (KV-B).
26. Clutch Valve "E1" Line-Up (KV-E1).
27. Switch Valve For "A" Clutch (ABSCH-V-A).

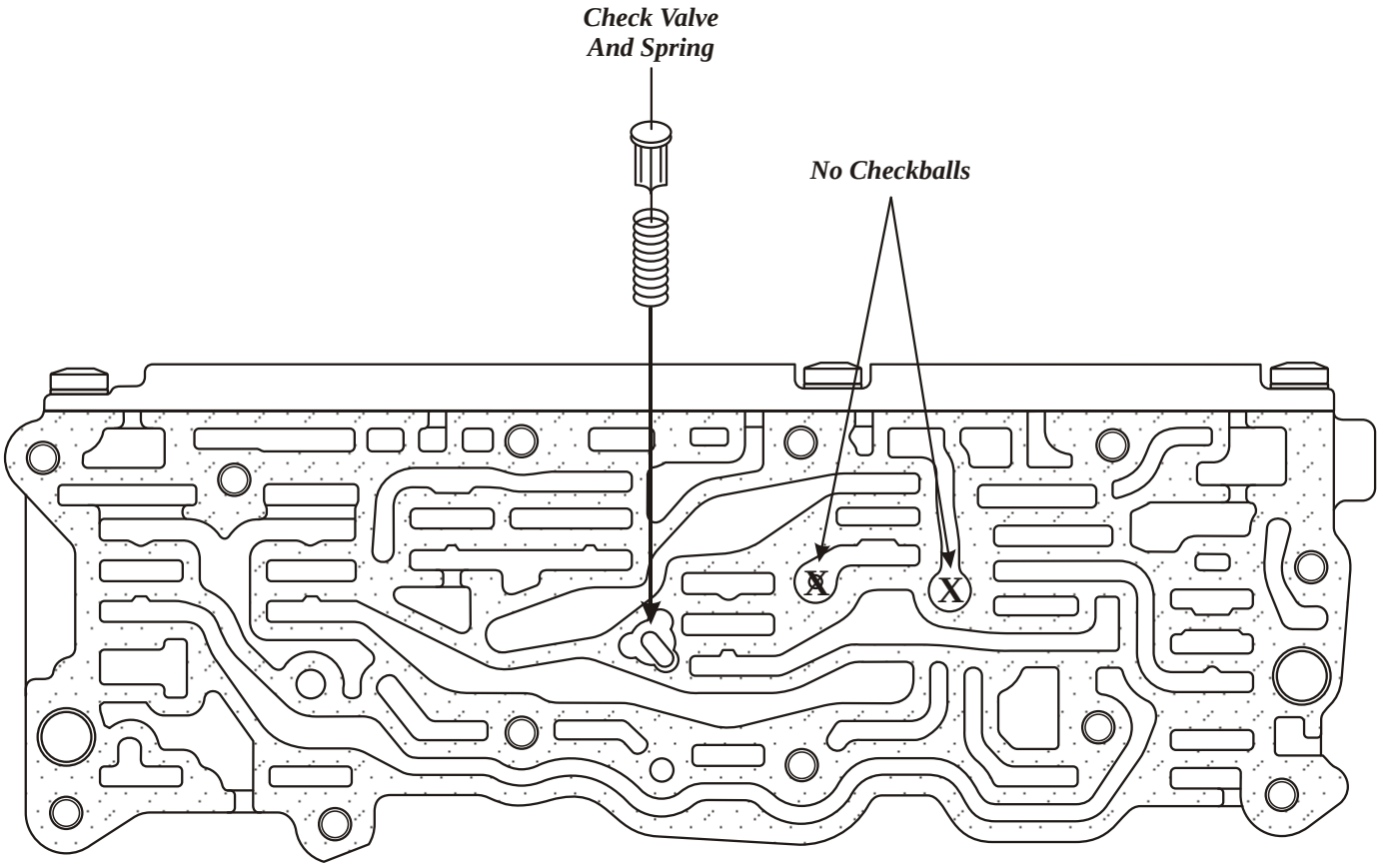


Figure 13

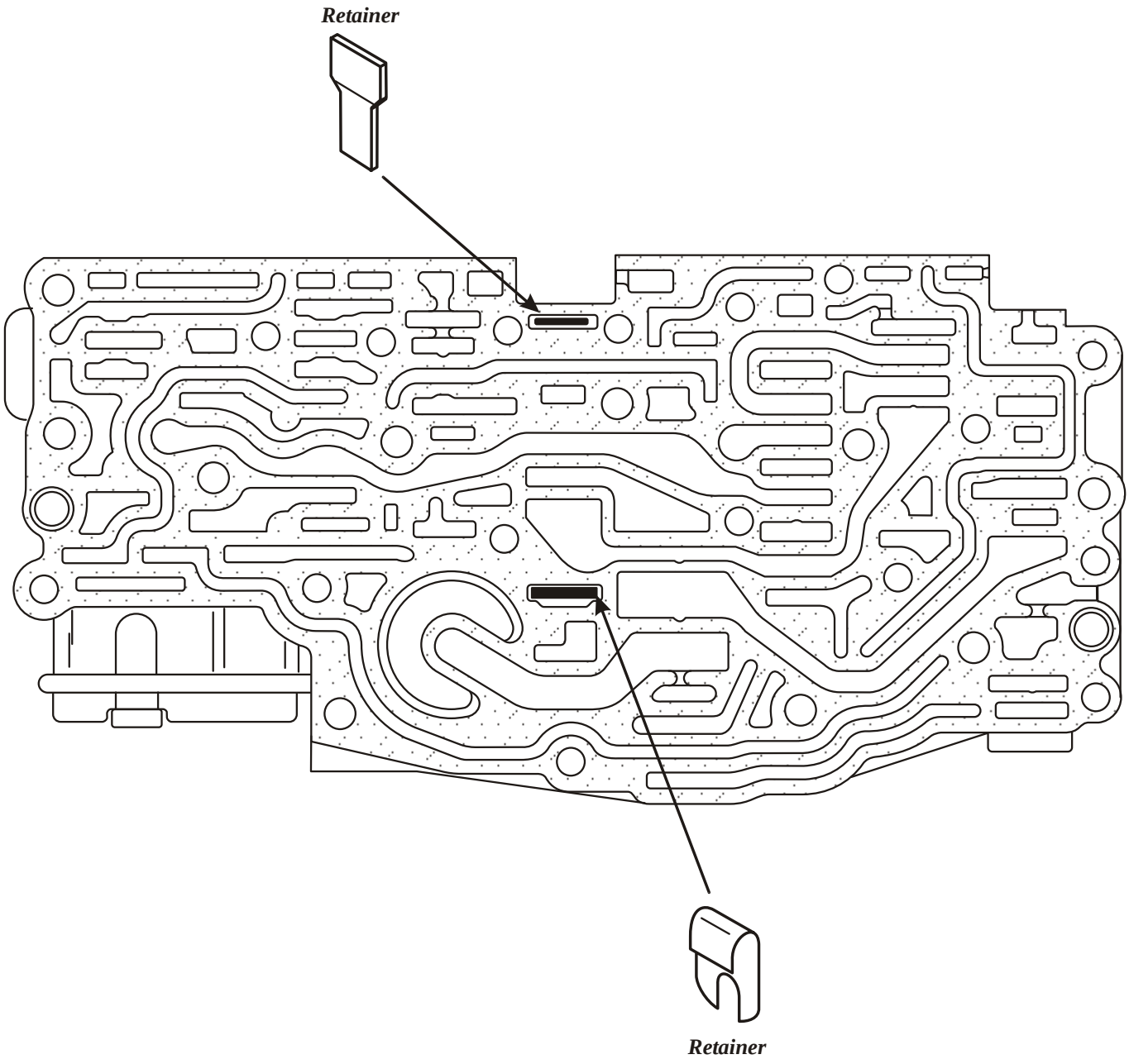
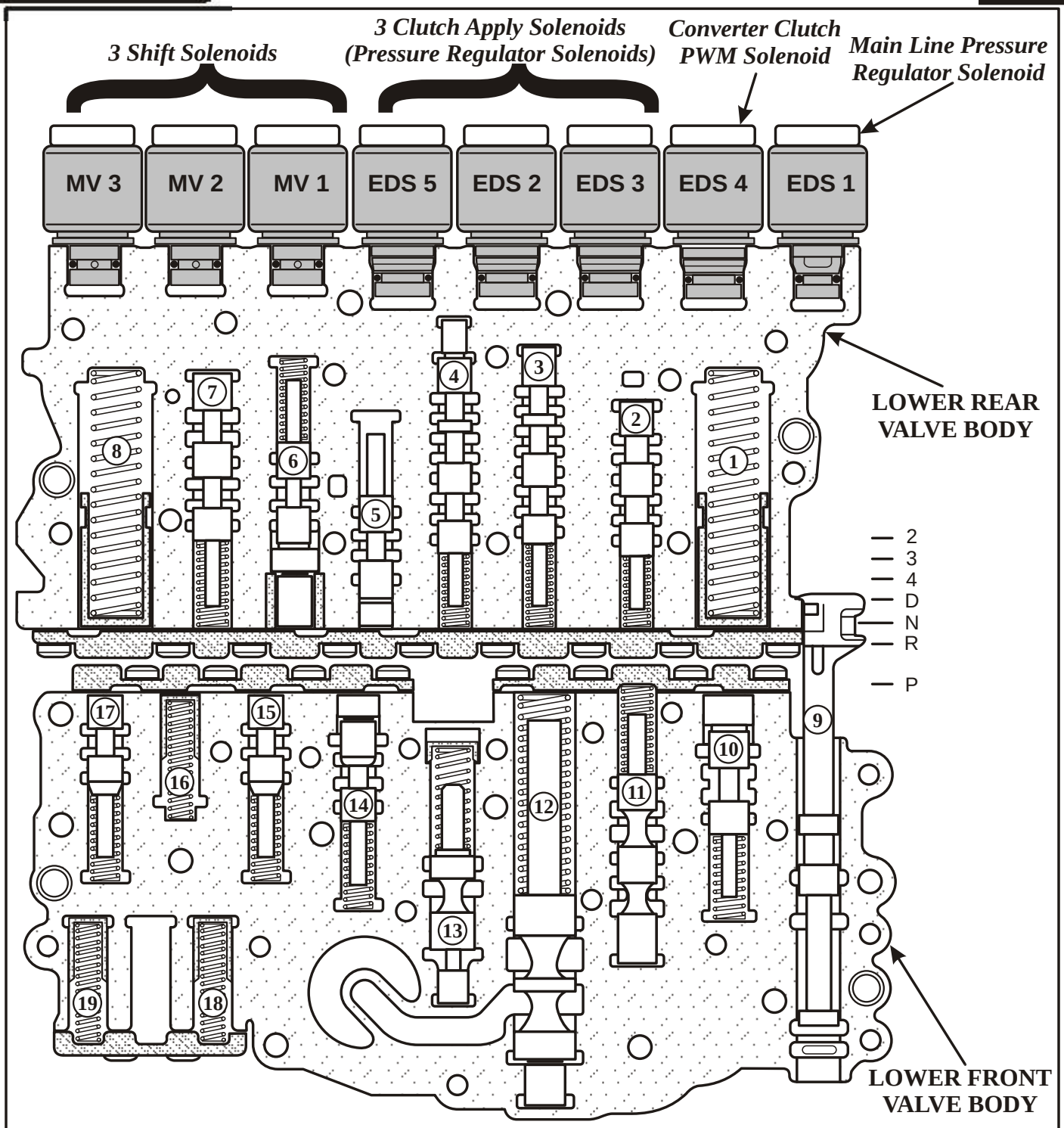


Figure 14



1. "A" Clutch Accumulator Line-Up (D-A).
2. Shift Valve Number 1 (SV-1).
3. Shift Valve Number 2 (SV-2).
4. Shift Valve Number 3 (SV-3).
5. Switch Valve For "D" Clutch (ABSCH-V-D).
6. Clutch Valve "D" Line-Up (KV-D).
7. Reverse Gear Valve Line-Up (RG-V).
8. "C" Clutch Accumulator Line-Up (D-C).
9. Manual Shift Valve (W-S).
10. Converter Clutch Apply Oil Control Valve (WK-V).
11. Converter Clutch Release Oil Control Valve (WD-V).
12. Main Pressure Regulator Valve Line-Up (HD-V).
13. Lubrication Valve (SCHM-V)
14. Modulating Valve Line-Up (MOD-V).
15. Main Regulator Valve For "B" Clutch (HV-B).
16. Accumulator Valve For EDS 2 Solenoid (D-2).
17. Main Regulator Valve For "D" Clutch (HV-D).
18. Accumulator Valve For EDS 4 Solenoid (D-4).
19. Accumulator Valve For EDS 3 Solenoid (D-3).

Figure 15

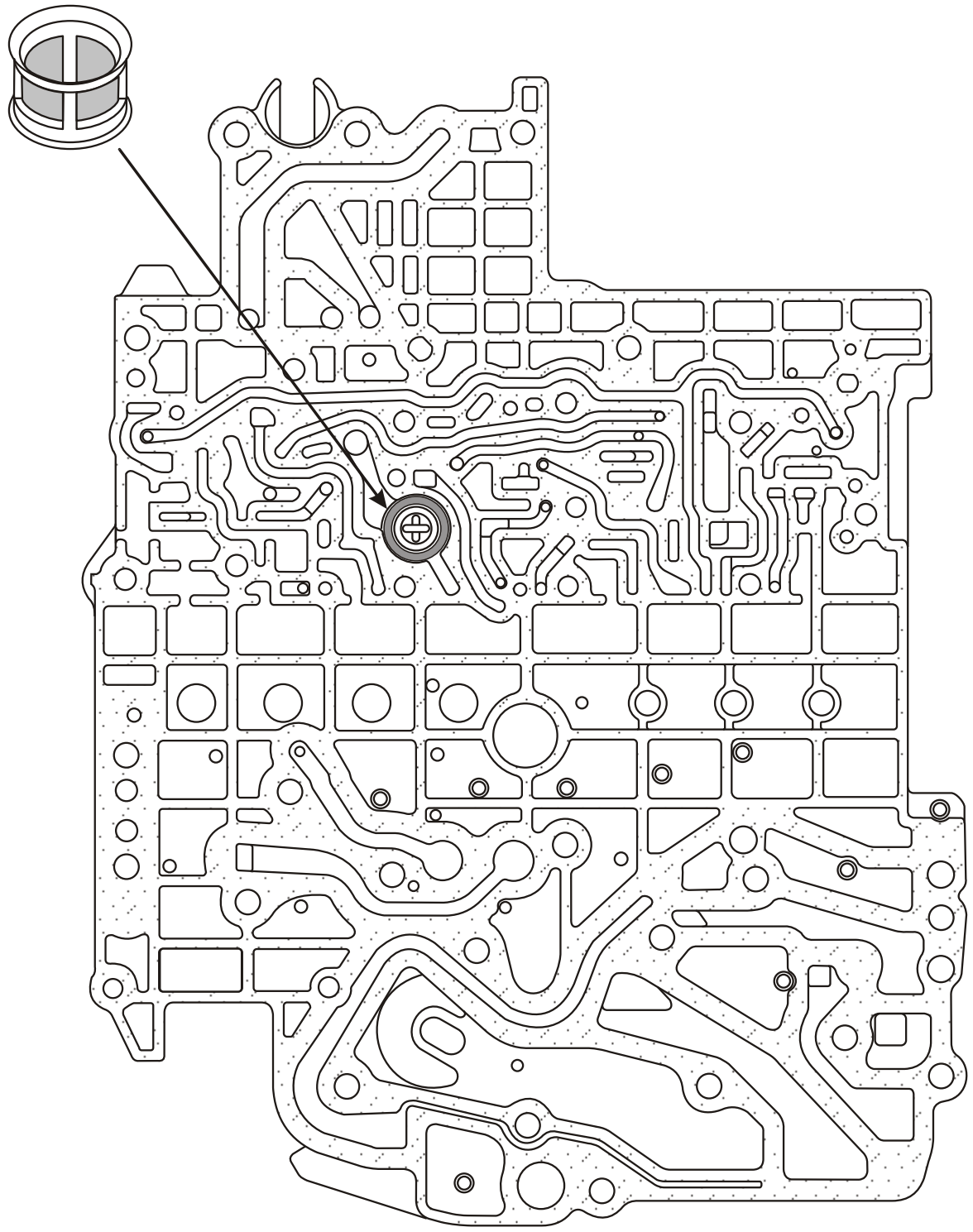


Figure 16

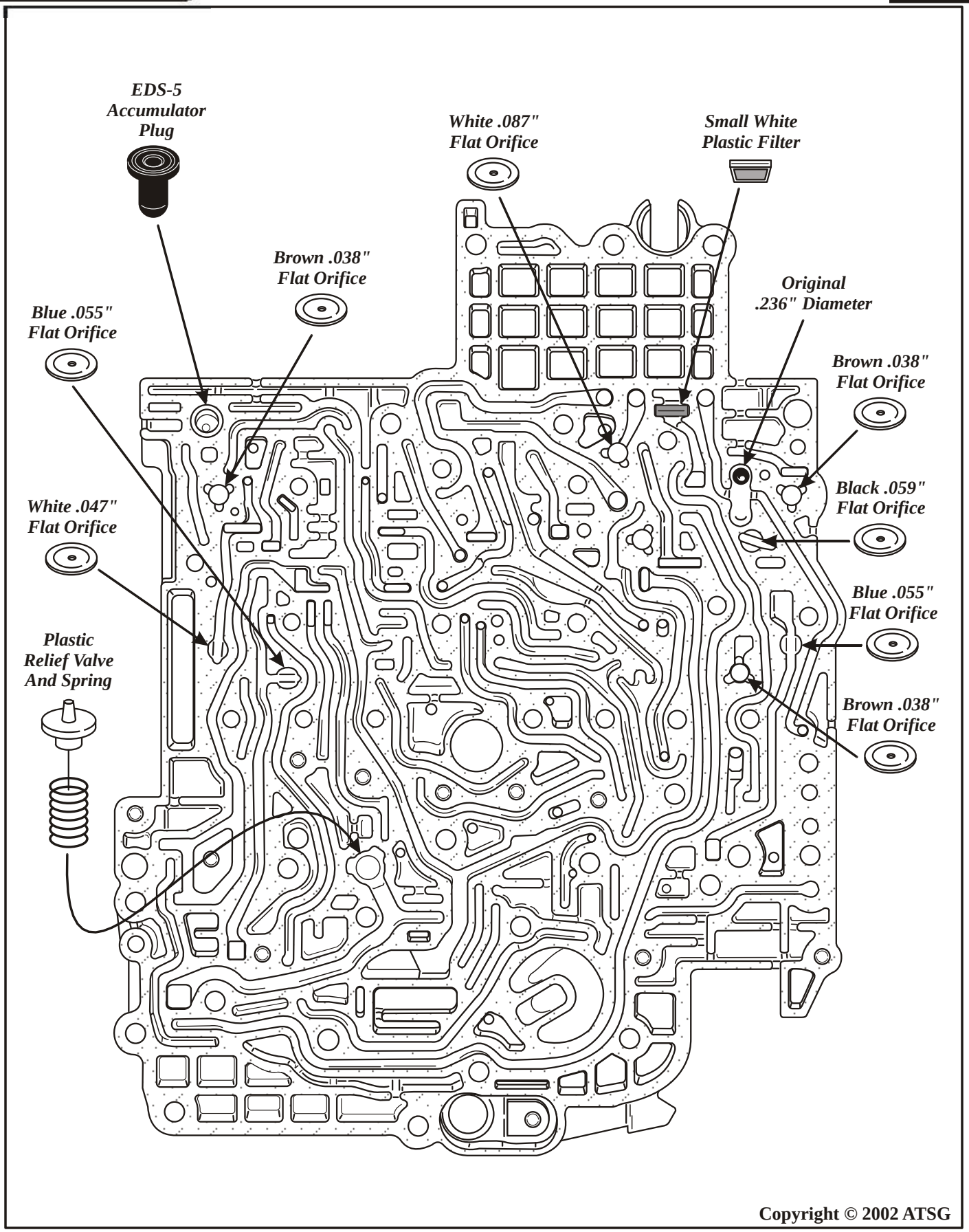


Figure 17

PRESSURE TAP LOCATIONS AND IDENTIFICATION

Jaguar Model Shown

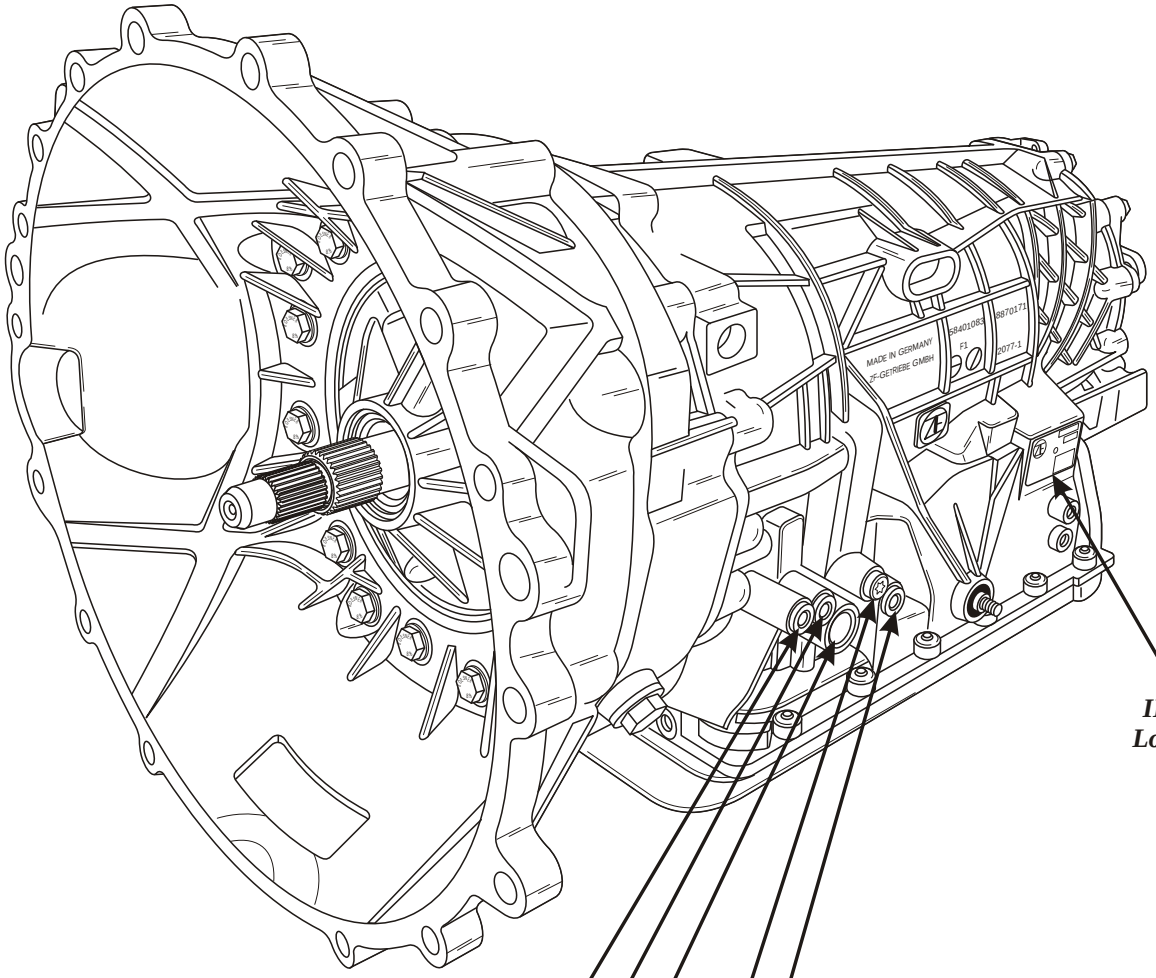


Figure 18

PUMP VOLUME CONTROL VALVE LOCATION

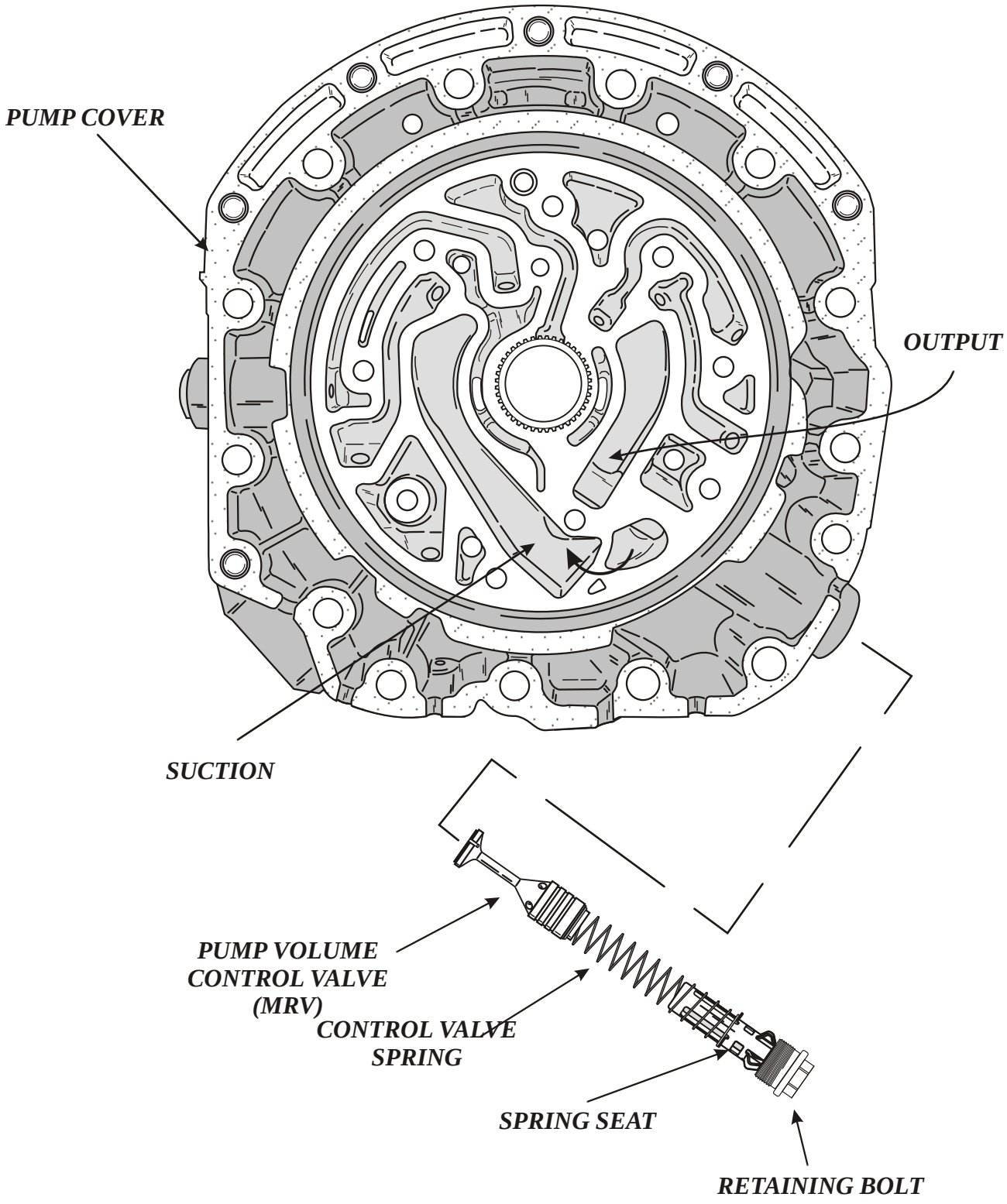
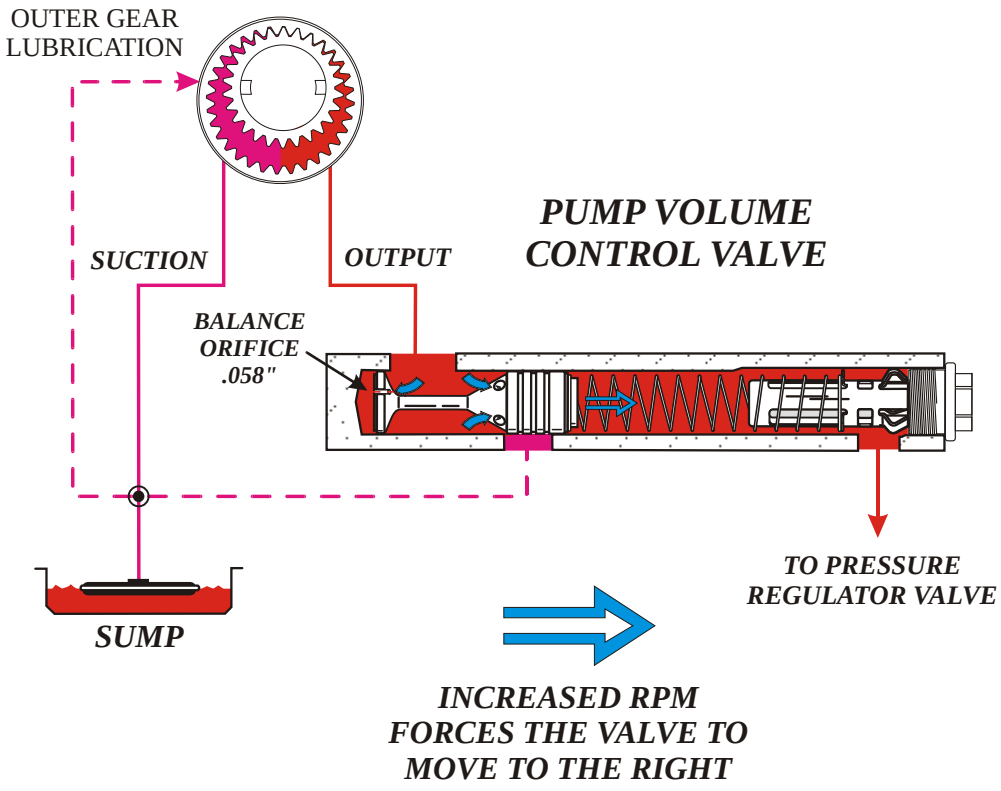


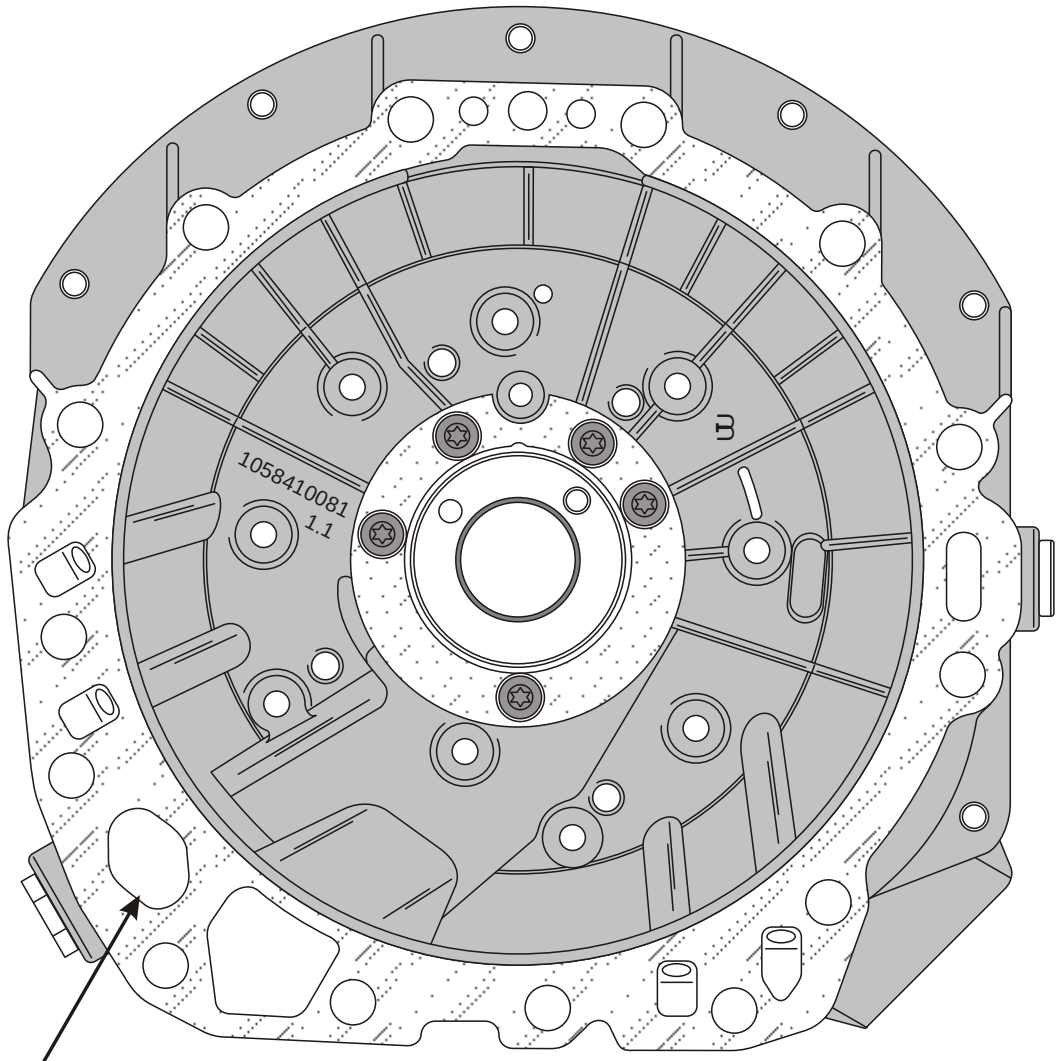
Figure 19

PUMP VOLUME CONTROL VALVE OPERATION



The Pump Volume Control Valve regulates the amount of oil volume to the Pressure Regulator Valve. As engine rpm. increases, pump output increases and forces the Pump Volume Control Valve to move to the right. This allows excess pump output to return to the sump, and a consistent amount of volume to be sent to the Pressure Regulator Valve.
The Pump Control Valve maintains 45 to 48 gallons per minute from 2000 to 6000 rpm.

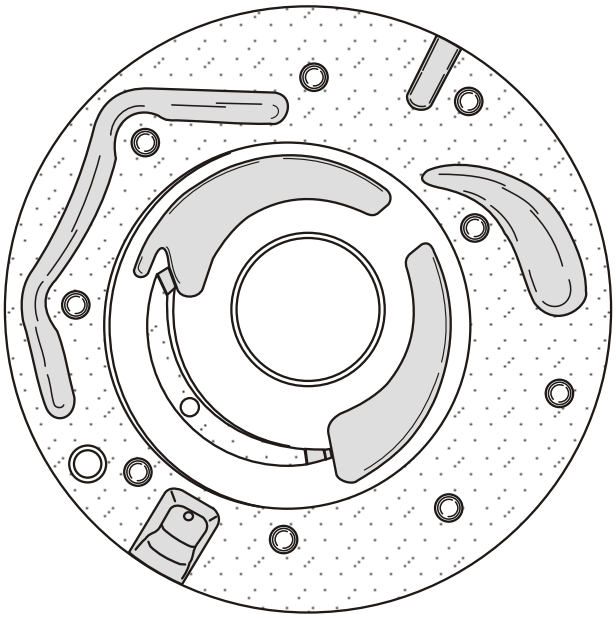
Figure 20



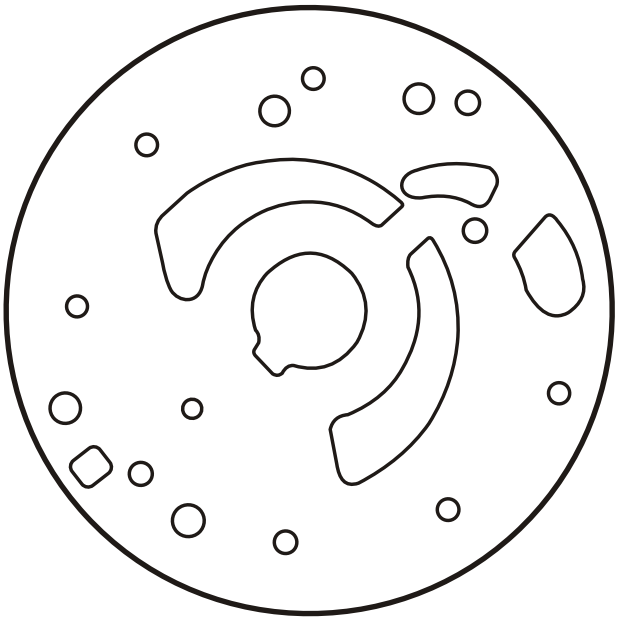
Output to Pressure Regulator Valve

Figure 21

**PUMP AND
PUMP PLATE**

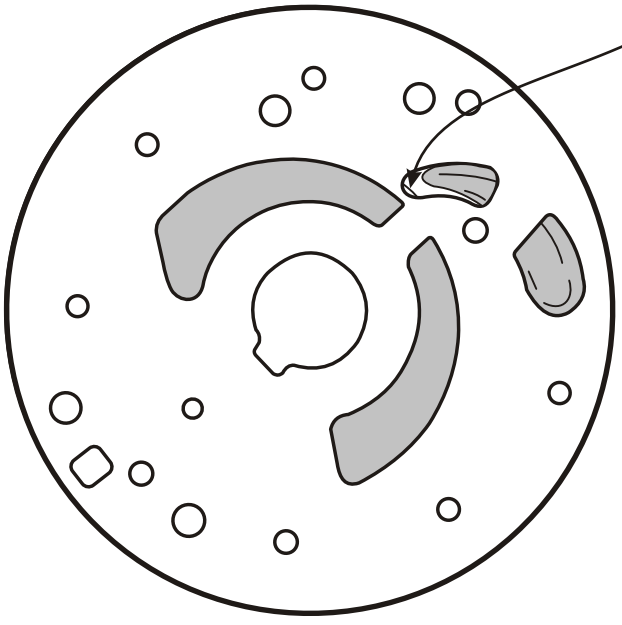


PUMP BODY



PUMP PLATE

***OUTER PUMP
GEAR LUBRICATION***



**PUMP PLATE INSTALLED
ON PUMP BODY**

Figure 22

DAEWOO LANOS, NUBIRA AND LEGANZA

P1336 - 58x CRANK TOOTH NOT LEARNED

COMPLAINT: After repairs, the vehicle may exhibit a variety of driveability complaints. The Malfunction Indicator Light may be illuminated with a variety of Diagnostic Trouble Codes stored in the computer's memory including P1336 - "58x Crank Tooth Not Learned."

CAUSE: Whenever any component that may affect the relationship between the crankshaft and the Crankshaft Position Sensor is removed or replaced, such as the sensors themselves or the Engine Control Module/Powertrain Control Module or battery is disconnected or replaced, poor driveability and various unrelated DTC's occur.

CORRECTION: A "Crankshaft Position Variation Learning Procedure" must be performed by the Dealer using their Scan 100 Tool. This procedure (The TEC Test Procedure) electronically aligns the Crankshaft Position Sensor to the crankshaft to correct for variations in Timing Belt length, camshaft and crankshaft pulleys.

HONDA M6HA, BAXA FAMILY
PRELIMINARY INFORMATION

The M6HA and BAXA family originated in the 1997 Honda Prelude and the 1998 model Honda Accord. Other members of this family include, MAXA, B7XA, MDWA, B7TA, B7YA, M7ZA, B6VA, M7WA. Although the designations and configurations for these transaxles are different, the shift strategy and clutch pack applications are exactly the same.

The clutch pack applications for these transmissions are as follows; the 1st clutch is on in 1st gear, the 2nd clutch is on in 2nd gear, the 3rd clutch is on in 3rd, and the 4th clutch is on in 4th. This family of transaxles have clutch to clutch gear change strategy. This requires precise shift timing on behalf of the Powertrain Control Module, to control the amount of overlap on each gear change. The PCM determines shift timing and shift feel, based on throttle position sensor, the amount of engine load on the vehicle, vehicle speed, shift lever position and various other sensors.

The PCM controls gear changes with Shift Control Solenoid "A" and "B." The PCM controls shift feel and shift overlap thru Clutch Pressure Control Solenoid "A" and "B" in conjunction with Shift Control Solenoid "C." The PCM uses the Mainshaft and Countershaft speed sensor information, along with the Vehicle Speed Sensor to calculate overlap on shifts as well as gear ratios. There are two different pressure modes that the PCM controls. The 1st is CPC mode (Clutch Pressure Control). This mode is used during a gear change. This reduced pressure mode makes it possible for two different clutch packs to be partially applied at the same time. The 2nd is Line Pressure Mode. This mode is used to hold the clutch that is applied, fully on. The 2nd and /or 3rd gear pressure switch, if so equipped, tells the PCM when the 2nd or 3rd clutch is starting to apply, or when that particular clutch is nearly released.

Refer to Figure 1, for identification of all Shift Control Solenoids,Clutch Pressure Control Solenoids, 2nd and 3rd gear Pressure Switches, Mainshaft and Countershaft speed sensors and component ohms chart.

Refer to Figure 2, for Solenoid application for Neutral and the engagement of the 1st clutch.

Refer to Figure 3, for Solenoid application for Driving in 1st gear and the 1st to 2nd gear transition.

Refer to Figure 4, for Solenoid application for Driving in 2nd gear and the 2nd to 3rd gear transition.

Refer to Figure 5, for Solenoid application for Driving in 3rd gear, 3rd to 4th gear transition, and Driving in 4th.

Refer to Figure 6, for Solenoid application for the Neutral to Reverse engagement and Driving in Reverse.

Refer to Figure 7, for Solenoid application for the Torque Converter Clutch apply stages.

Refer to Figure 8, for a description of Clutch Pressure Control Solenoid operation.

Refer to Figure 9, to check the mechanical function of Clutch Pressure Control Solenoid "A" and "B".

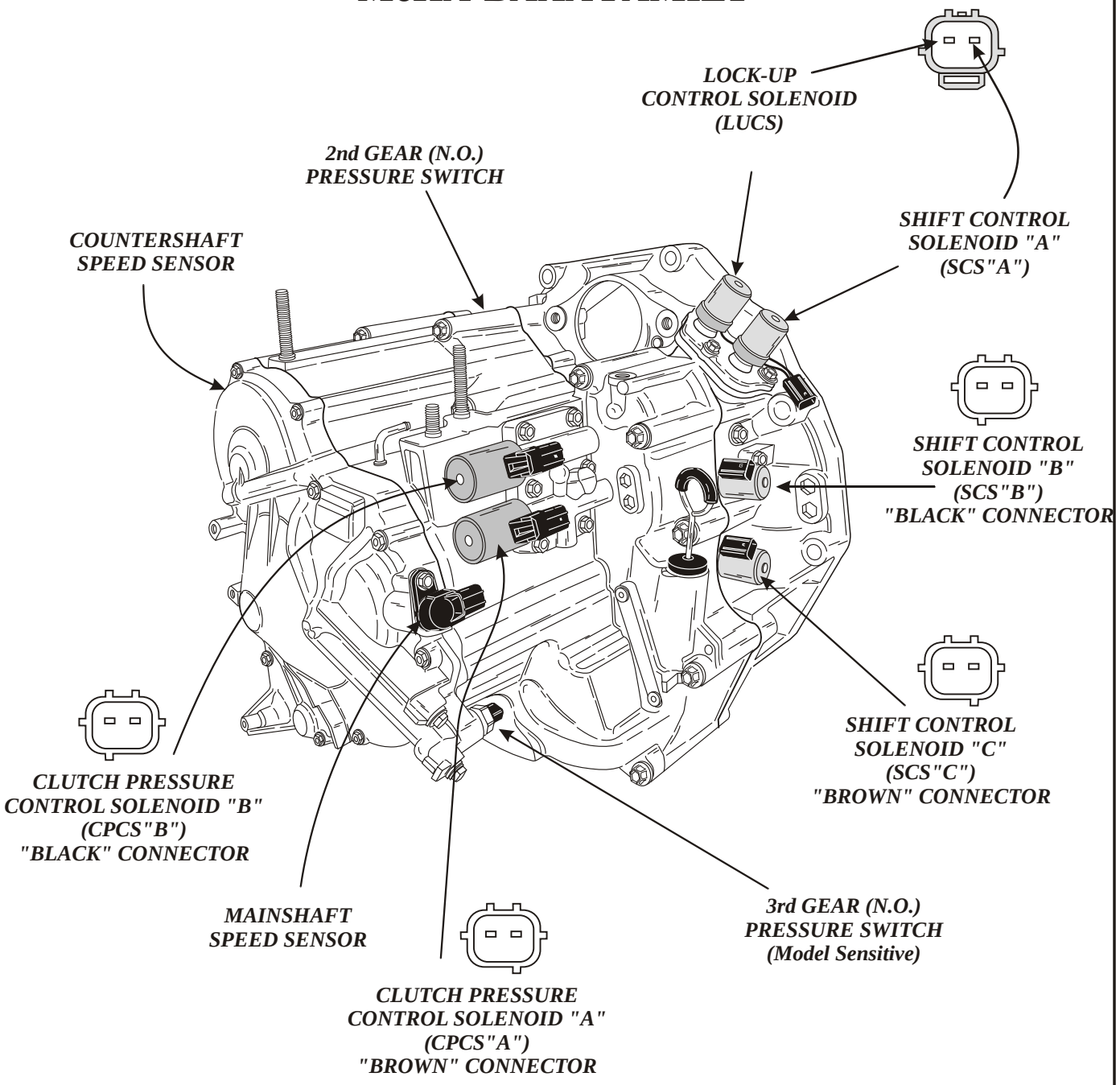
Refer to Figure 10, to check the mechanical function of Shift Control Solenoid "B" and "C".

Refer to Figure 11, to check mechanical function of Lock-up Control Solenoid and Shift Control Solenoid "A".

Refer to Figure 12, to check the mechanical operation of the 2nd and 3rd gear pressure switches.

Refer to Figure 13, for a Hydraulic Circuit diagram of the BAXA.

M6HA-BAXA FAMILY



COMPONENT	OHMS
Shift Control Solenoid "A" (SCS "A")	12-25
Shift Control Solenoid "B" (SCS "B")	12-25
Shift Control Solenoid "C" (SCS "C")	12-25
Clutch Pressure Control Solenoid "A" (CPCS "A")	5
Clutch Pressure Control Solenoid "B" (CPCS "B")	5
Countershaft Speed Sensor	400-600
Mainshaft Speed Sensor	400-600
Lock-Up Control Solenoid "C" (LUCS)	12-25

Figure 1

ENGAGEMENT FROM NEUTRAL TO D4 "1st" GEAR SOLENOID APPLICATION

NEUTRAL

Selector position	Gear	Pressure Mode	SCS "A"	SCS "B"	SCS "C"	CPCS "A"	CPCS "B"	LUCS
N	N	n/a	OFF	ON	OFF	OFF	OFF	OFF

NEUTRAL TO D4 - 1st GEAR TRANSITION

Selector position	Gear	Pressure Mode	SCS "A"	SCS "B"	SCS "C"	CPCS "A"	CPCS "B"	LUCS
D4	1st	CPC	ON	ON	ON	modulating	OFF	OFF

Summary: Shift Solenoids "A" and "C" are turned ON to connect 1st clutch apply oil to the spring side and center of CPC valve "A." Clutch Pressure Control Solenoid valve "A" oil modulates on the bore plug side of CPC valve "A" to control 1st clutch application. The 1st clutch is applied with reduced pressure, which is CPC mode.

D4 - 1st GEAR

Selector position	Gear	Pressure Mode	SCS "A"	SCS "B"	SCS "C"	CPCS "A"	CPCS "B"	LUCS
D4	1st	LINE	OFF	ON	ON	OFF	OFF	OFF

Summary: Shift Solenoid "A" is turned OFF which switches the port on Shift Valve "A" from CPC to Line Pressure. 1st Clutch pressure is now Line Pressure

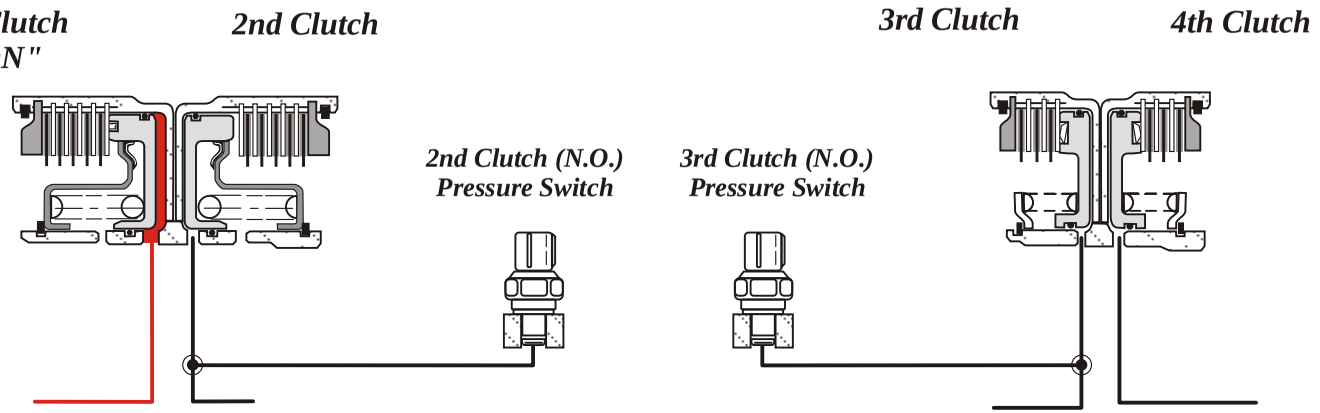


Figure 2

"1st" TO "2nd" UPSHIFT AND "2nd" GEAR SOLENOID APPLICATION

D4 - 1st GEAR

Selector position	Gear	Pressure Mode	SCS "A"	SCS "B"	SCS "C"	CPCS "A"	CPCS "B"	LUCS
D4	1st	LINE	OFF	ON	ON	OFF	OFF	OFF

D4 - 1st TO 2nd GEAR TRANSITION

Selector position	Gear	Pressure Mode	SCS "A"	SCS "B"	SCS "C"	CPCS "A"	CPCS "B"	LUCS
D4	2nd	CPC	ON	ON	ON	modulating	modulating	OFF

Summary: Shift Solenoids "A" and "C" are turned ON to connect 1st clutch apply oil to the spring side and center of CPC valve "A." Clutch Pressure Control Solenoid valve "A" oil modulates on the bore plug side of CPC valve "A" which turns 1st clutch pressure back to CPC mode. Clutch Pressure Control Solenoid valve"B" oil modulates on the bore plug side of CPC valve "B" which controls the application of the 2nd clutch.

D4 - 2nd GEAR

Selector position	Gear	Pressure Mode	SCS "A"	SCS "B"	SCS "C"	CPCS "A"	CPCS "B"	LUCS
D4	2nd	LINE	ON	ON	OFF	ON	ON	OFF

Summary: Shift Solenoid "C" is turned OFF which switches 2nd clutch pressure to Line pressure mode via the Manual valve, and connects the 1st clutch to an exhaust via Shift Valve "C." Clutch Pressure Control Solenoid valve "A" is turned on to block pressure from the bore plug side of CPC valve "A."

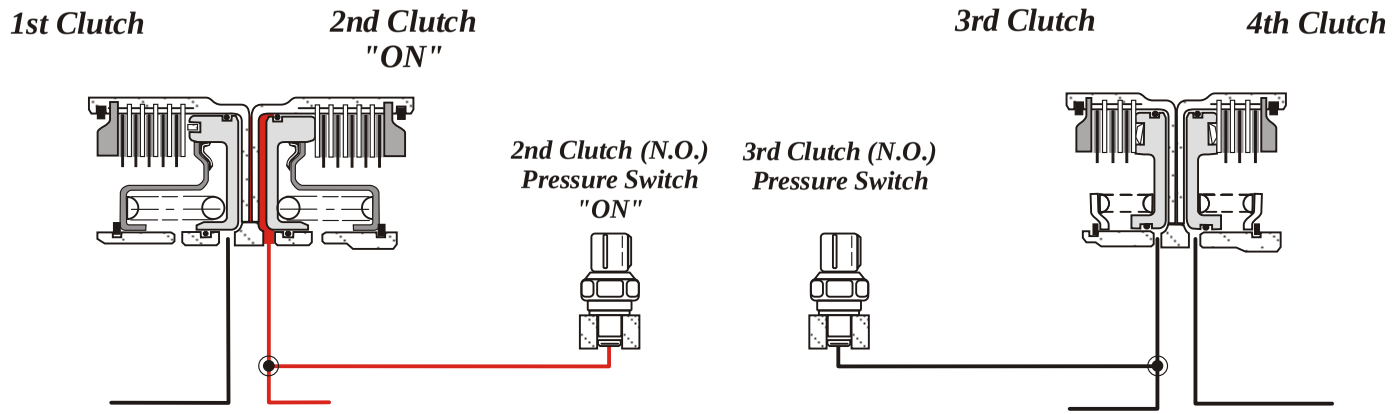


Figure 3

"2nd" TO "3rd" UPSHIFT AND "3rd" GEAR SOLENOID APPLICATION

D4 - 2nd GEAR

Selector position	Gear	Pressure Mode	SCS "A"	SCS "B"	SCS "C"	CPCS "A"	CPCS "B"	LUCS
D4	2nd	LINE	ON	ON	OFF	ON	ON	OFF

D4 - 2nd TO 3rd GEAR TRANSITION

Selector position	Gear	Pressure Mode	SCS "A"	SCS "B"	SCS "C"	CPCS "A"	CPCS "B"	LUCS
D4	3rd	CPC	ON	OFF	OFF	modulating	modulating	OFF

Summary: Shift Solenoid "B" is turned OFF, which strokes Shift Valve B, to connect the 2nd clutch back to CPC valve "B." 2nd clutch pressure is changed to CPC mode thru the modulation of Clutch Pressure Control Solenoid valve "B" acting on the bore plug side of CPC valve "B." Clutch Pressure Control Solenoid valve "A" acting on the bore plug side of CPC valve "A" controls the application of the 3rd clutch.

D4 - 3rd GEAR

Selector position	Gear	Pressure Mode	SCS "A"	SCS "B"	SCS "C"	CPCS "A"	CPCS "B"	LUCS
D4	3rd	LINE	ON	OFF	ON	OFF	OFF	OFF

Summary: Shift Solenoid "C" is turned ON which strokes Shift Valve "C" and switches 3rd clutch pressure to Line pressure mode via the Manual valve, and connects the 2nd clutch to an exhaust via Shift Valve "C."

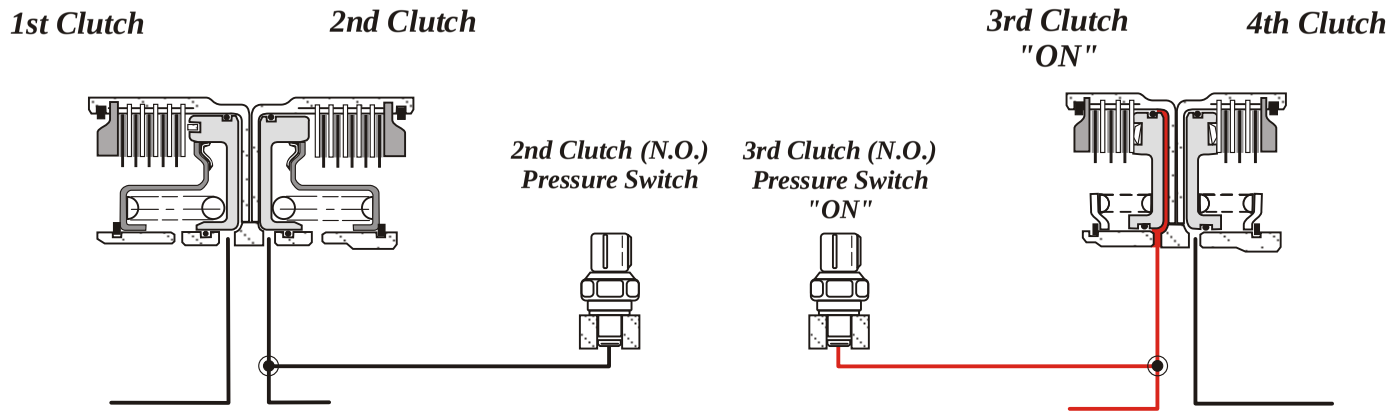


Figure 4

"3rd" TO "4th" UPSHIFT AND "4th" GEAR SOLENOID APPLICATION

D4 - 3rd GEAR

Selector position	Gear	Pressure Mode	SCS "A"	SCS "B"	SCS "C"	CPCS "A"	CPCS "B"	LUCS
D4	3rd	LINE	ON	OFF	ON	OFF	OFF	OFF

D4 - 3rd TO 4th GEAR TRANSITION

Selector position	Gear	Pressure Mode	SCS "A"	SCS "B"	SCS "C"	CPCS "A"	CPCS "B"	LUCS
D4	4th	CPC	OFF	OFF	ON	modulating	modulating	OFF

Summary: Shift Solenoid "A" is turned OFF, which strokes Shift Valve "A," to connect the 3rd clutch back to CPC valve "A"." 3rd clutch pressure is turned to CPC mode thru the modulation of Clutch Pressure Control Solenoid valve "A" acting on the bore plug side of CPC valve "A." Clutch Pressure Control Solenoid valve "B" oil acts on the bore plug side of CPC valve "B" which controls the application of the 4th clutch.

D4 - 4th GEAR

Selector position	Gear	Pressure Mode	SCS "A"	SCS "B"	SCS "C"	CPCS "A"	CPCS "B"	LUCS
D4	4th	LINE	OFF	OFF	OFF	ON	ON	OFF

Summary: Shift Solenoid "C" is turned OFF which strokes Shift valve "C." This switches 4th clutch pressure to Line pressure via the Manual valve. Clutch Pressure Control Solenoid valve "A" is ON to block pressure to the bore plug side of CPC valve "A." The 3rd clutch is connected to an exhaust via Shift Valve "C."

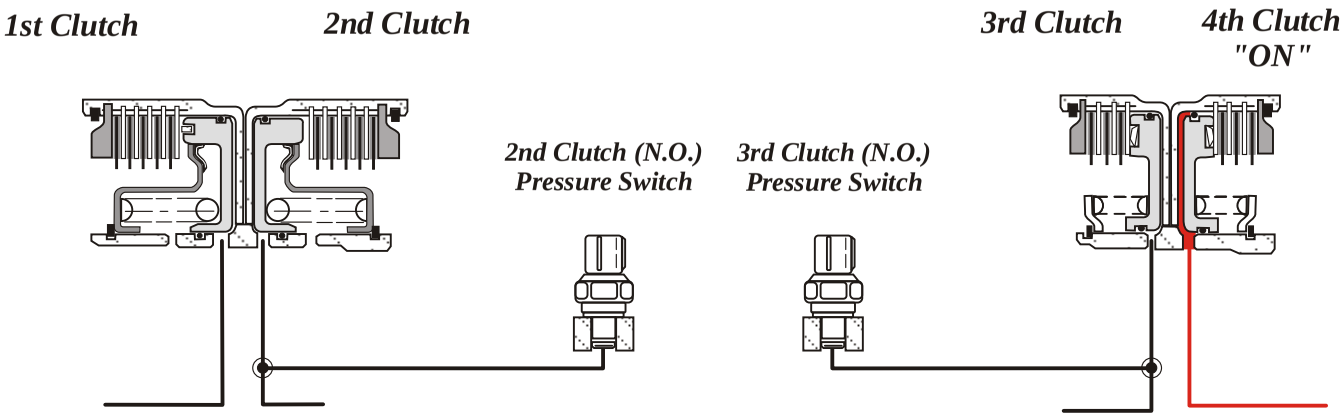


Figure 5

ENGAGEMENT FROM NEUTRAL TO REVERSE AND REVERSE SOLENOID APPLICATION

NEUTRAL

Selector position	*Gear*	*Pressure Mode*	*SCS "A"*	*SCS "B"*	*SCS "C"*	*CPCS "A"*	*CPCS "B"*	*LUCS*
N	*N*	*n/a*	*OFF*	*ON*	*OFF*	*OFF*	*OFF*	*OFF*

NEUTRAL TO REVERSE TRANSITION

Selector position	*Gear*	*Pressure Mode*	*SCS "A"*	*SCS "B"*	*SCS "C"*	*CPCS "A"*	*CPCS "B"*	*LUCS*
D4	*R*	*CPC*	*OFF*	*ON*	*ON*	*modulating*	*OFF*	*OFF*

Summary: Shift Solenoid "C" is ON which shuts off oil to the bore plug side of the Reverse CPC valve. Line Pressure is sent to the Reverse CPC valve which is controlled by the modulation of Clutch Pressure Control Solenoid valve "A". This controls the application of the 4th clutch via the Servo Valve and Manual Valve.

REVERSE

Selector position	*Gear*	*Pressure Mode*	*SCS "A"*	*SCS "B"*	*SCS "C"*	*CPCS "A"*	*CPCS "B"*	*LUCS*
D4	*R*	*LINE*	*OFF*	*ON*	*OFF*	*OFF*	*OFF*	*OFF*

Summary: Shift Solenoid "C" is turned OFF which strokes the Reverse CPC valve. This switches 4th clutch pressure from CPC mode to Line pressure mode via the Servo Valve and Manual Valve.

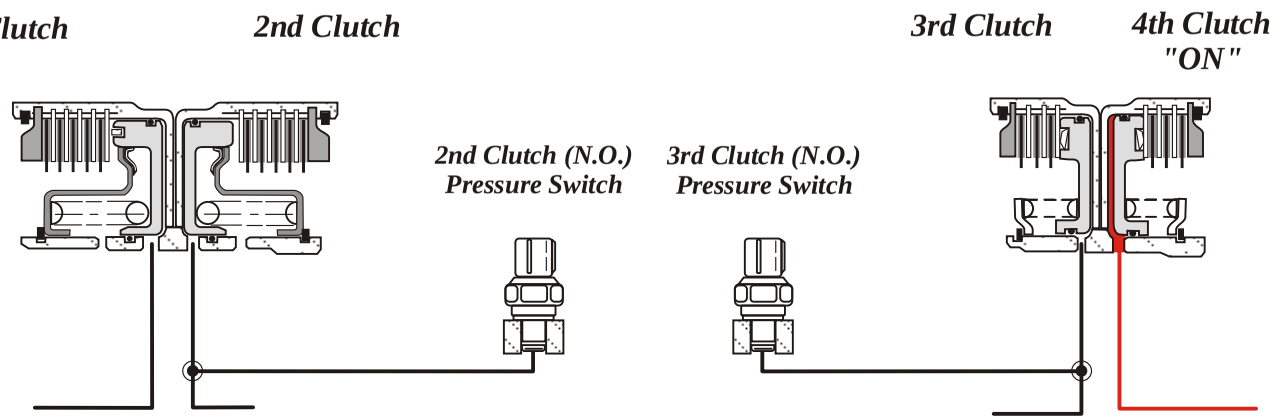


Figure 6

TORQUE CONVERTER CLUTCH ENGAGEMENT

D4 - 3rd GEAR-TCC APPLIED

Selector position	*Gear*	*Pressure Mode*	*SCS "A"*	*SCS "B"*	*SCS "C"*	*CPCS "A"*	*CPCS "B"*	*LUCS*
D4	*3rd*	*LINE*	*ON*	*OFF*	*ON*	*modulating*	*OFF*	*ON*

Summary: The Lock-up Control Solenoid is turned ON which drains the oil on the spring side of the Lock-up shift valve. The computer controls the switching of Partial, Half, and Full Converter Clutch application thru the modulation of the Clutch Pressure Control Solenoid valve "A" acting on the Lock-up timing and control valve. Example: When Clutch Pressure Control Solenoid valve "A" pressure is low, and the Lock-up Control Solenoid is ON, the Torque Converter Clutch is applied partially. When Clutch Pressure Control Solenoid valve "A" pressure is high, and the Lock-up Solenoid is ON, the Torque Converter Clutch is Fully Applied.

D4 - 4th GEAR-TCC APPLIED

Selector position	*Gear*	*Pressure Mode*	*SCS "A"*	*SCS "B"*	*SCS "C"*	*CPCS "A"*	*CPCS "B"*	*LUCS*
D4	*4th*	*LINE*	*OFF*	*OFF*	*OFF*	*ON*	*modulating*	*ON*

Summary: The Lock-up Control Solenoid is turned ON which drains the oil on the spring side of the Lock-up shift valve. The computer controls the switching of Partial, Half, and Full Converter Clutch application thru the modulation of the Clutch Pressure Control Solenoid valve "B" acting on the Lock-up timing and control valve. Example: When Clutch Pressure Control Solenoid valve "B" pressure is low, and the Lock-up Control Solenoid is ON, the Torque Converter Clutch is applied partially. When Clutch Pressure Control Solenoid valve "B" pressure is high, and the Lock-up Solenoid is ON, the Torque Converter Clutch is Fully Applied.

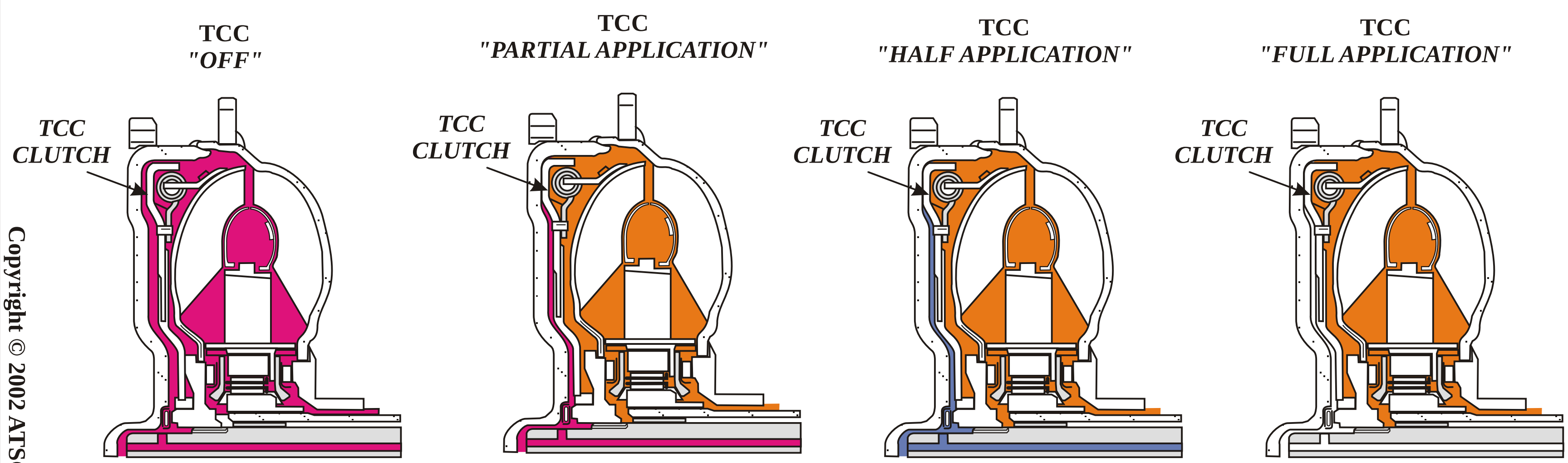
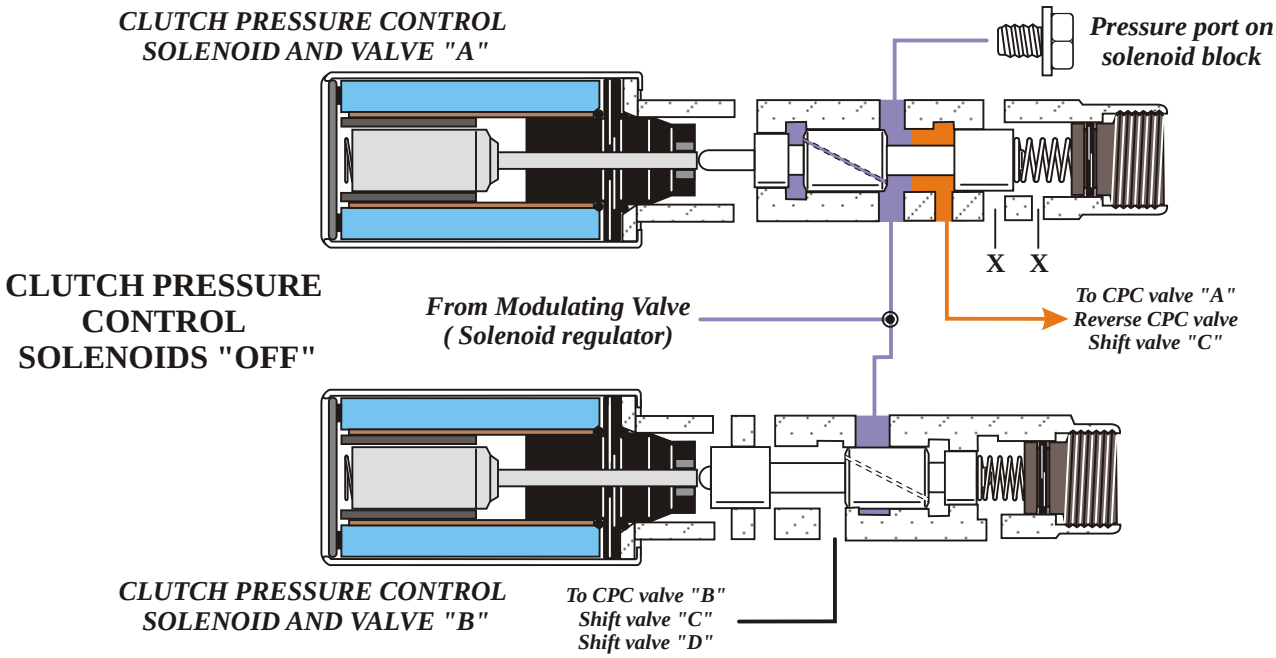


Figure 7

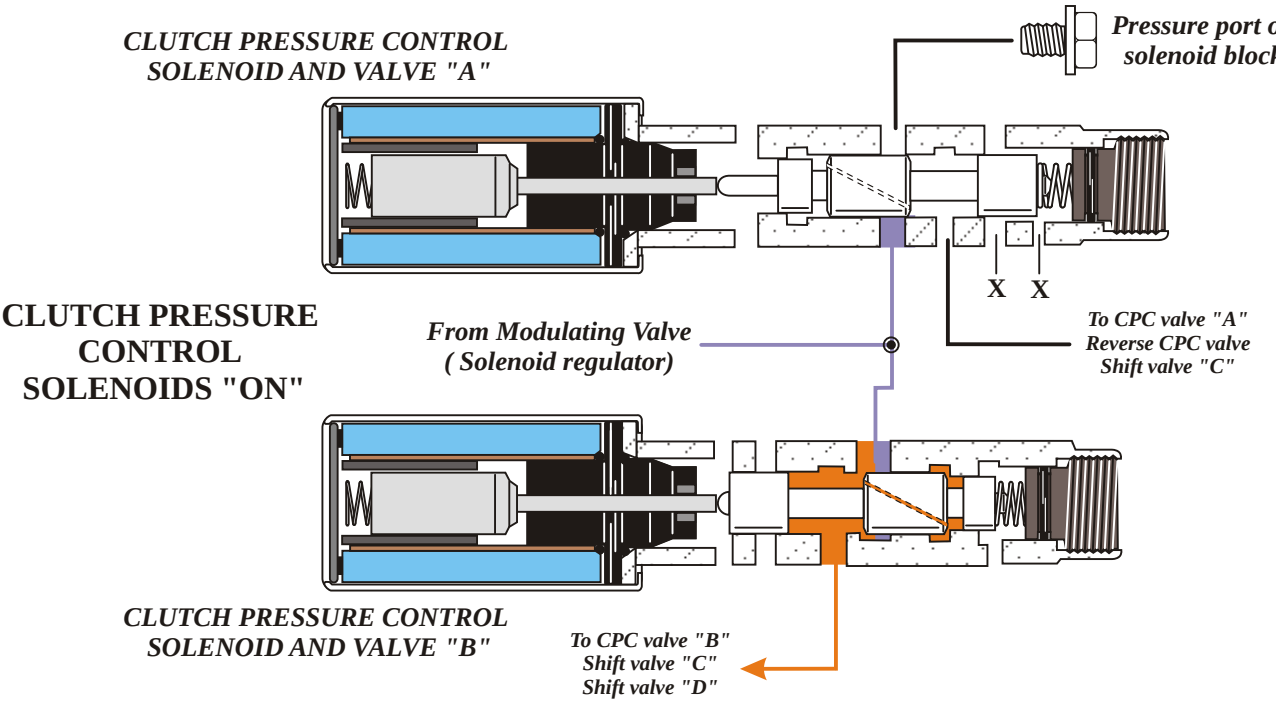
Transgo

CLUTCH PRESSURE CONTROL SOLENOID AND VALVE OPERATION "OFF"



Clutch Pressure Control Solenoid and Valve "A" supply modulating pressure to CPC valve "A", Reverse CPC valve and Shift valve "C" when "OFF."
Clutch Pressure Control Solenoid and Valve "B" shut off the supply of modulating pressure to CPC valve

CLUTCH PRESSURE CONTROL SOLENOID AND VALVE OPERATION "ON"

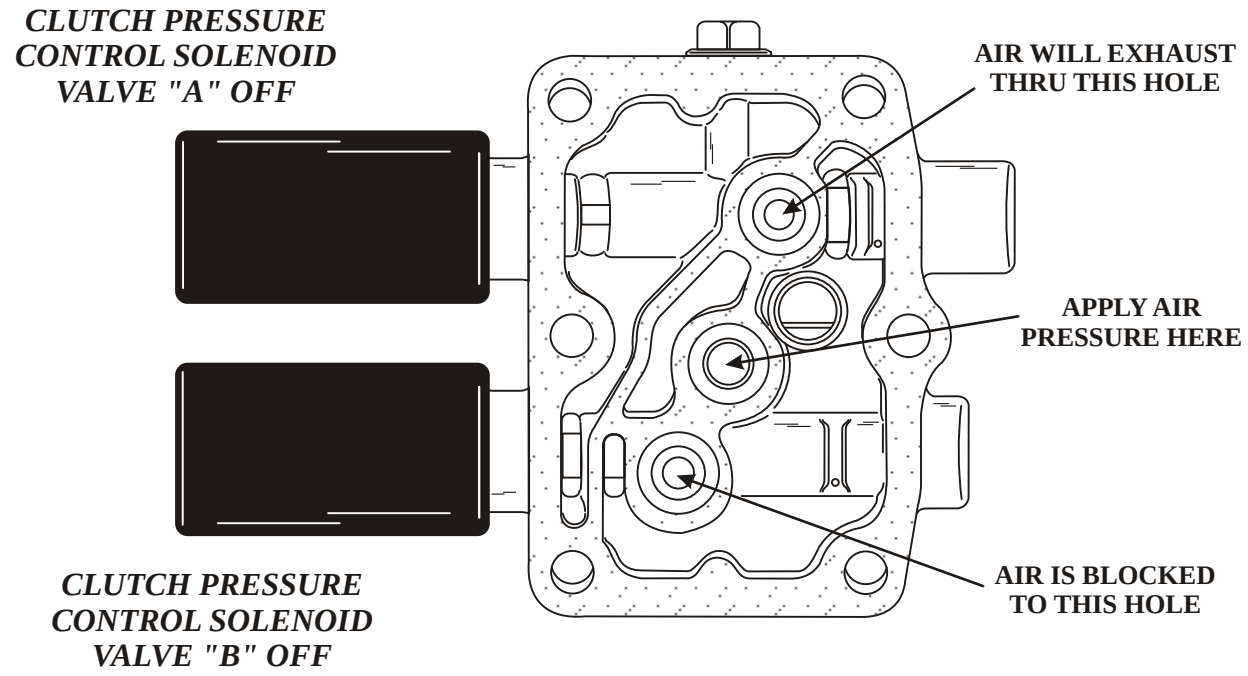


Clutch Pressure Control Solenoid and Valve "A" shut off the supply of modulating pressure to CPC valve "A", Reverse CPC valve and Shift valve "C" when "ON."
Clutch Pressure Control Solenoid and Valve "B" supply modulating pressure to CPC valve "B", Shift valve "C" and Shift Valve "D" when "ON."

Figure 8

SOLENOID CHECK AND OPERATION

CLUTCH PRESSURE CONTROL SOLENOID VALVES "A" AND "B" OFF



SOLENOID CHECK AND OPERATION

CLUTCH PRESSURE CONTROL SOLENOID VALVES "A" AND "B" ON

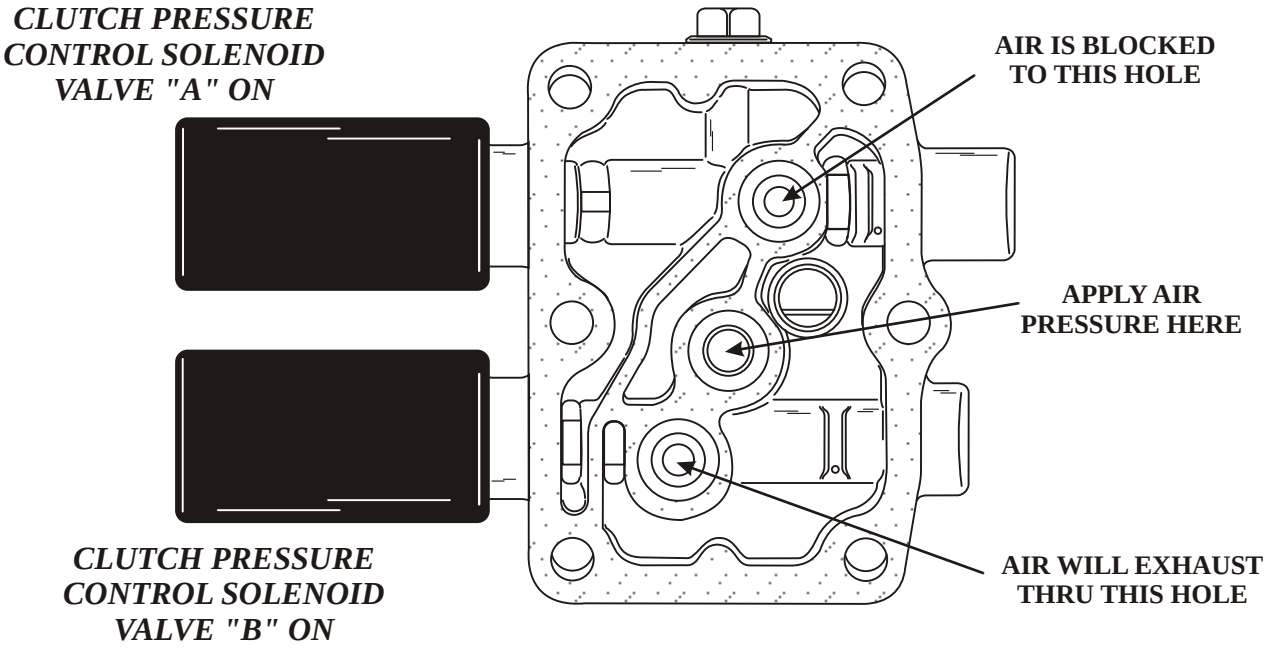
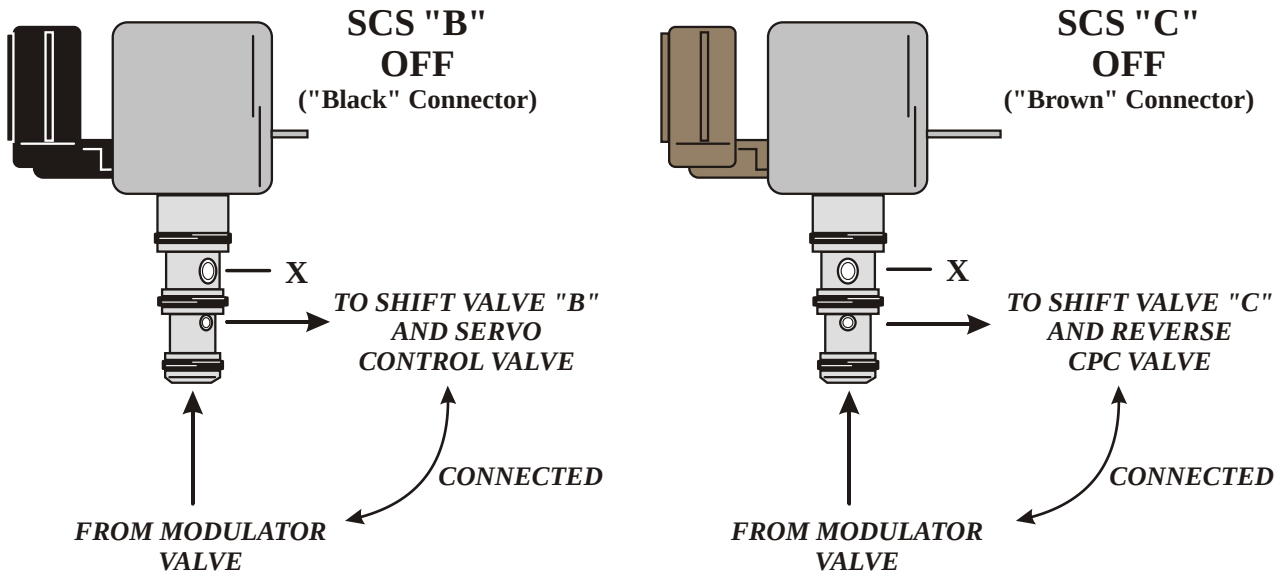


Figure 9

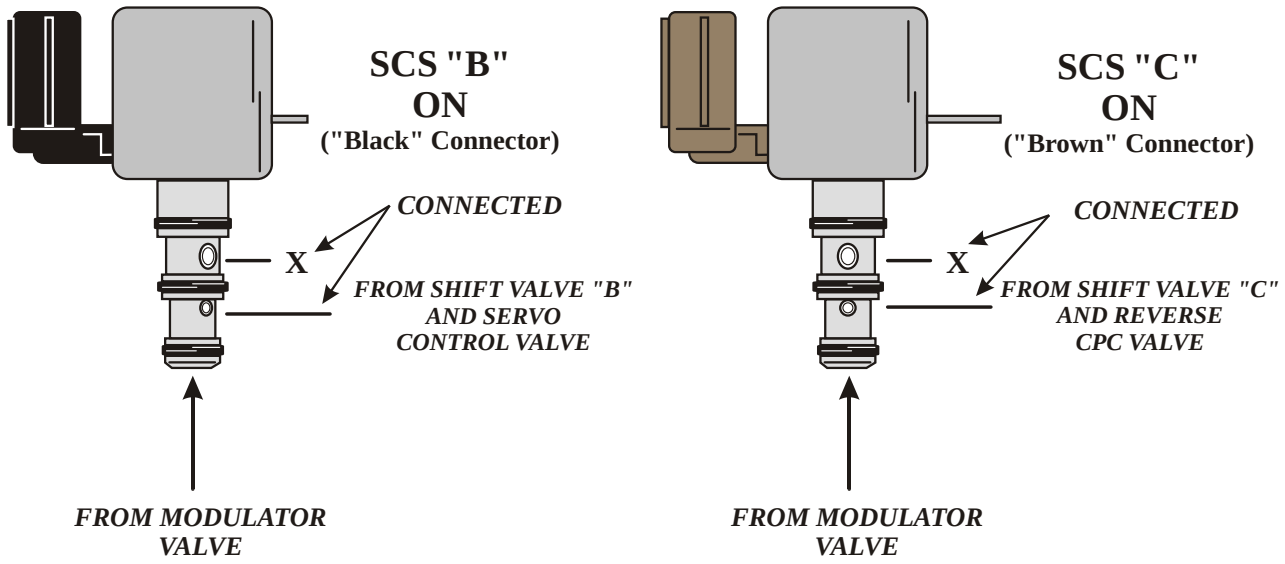
SOLENOID CHECK AND OPERATION

SHIFT CONTROL SOLENOID "B" AND "C" OFF



Summary: When Shift Control Solenoid "B" and "C" are OFF, oil from the Modulating valve is applied to stroke the valves that the solenoids control.

SHIFT CONTROL SOLENOID "B" AND "C" ON



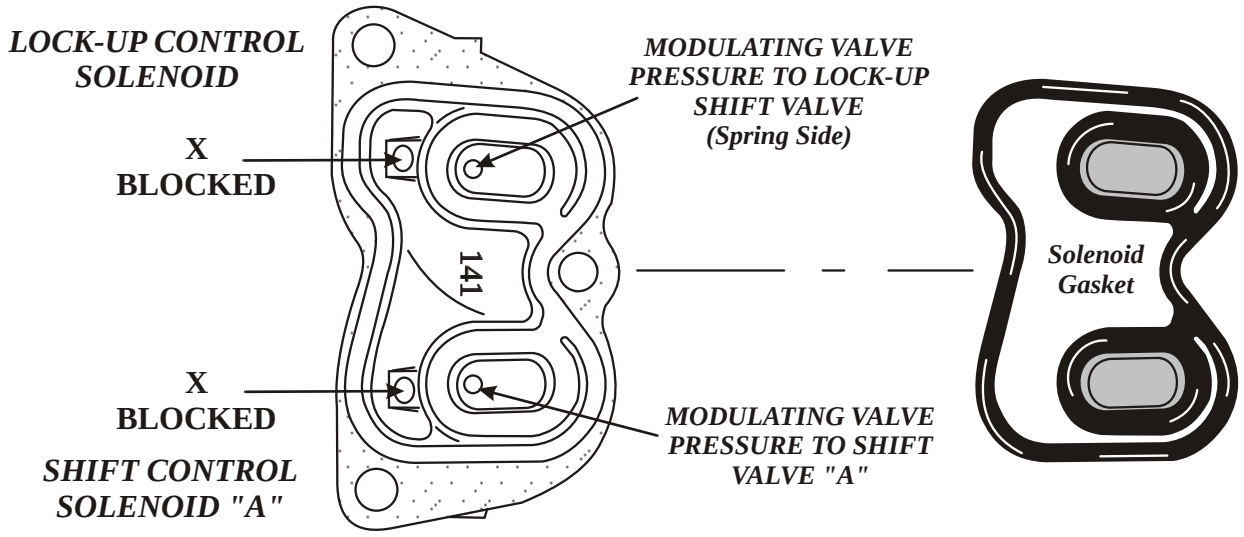
Summary: When Shift Control Solenoid "B" and "C" are ON, oil from the Modulating valve is blocked at the end of the solenoid. The valves, that the solenoids control, are connected to the exhaust at the top of the solenoid.

Figure 10

Rostra

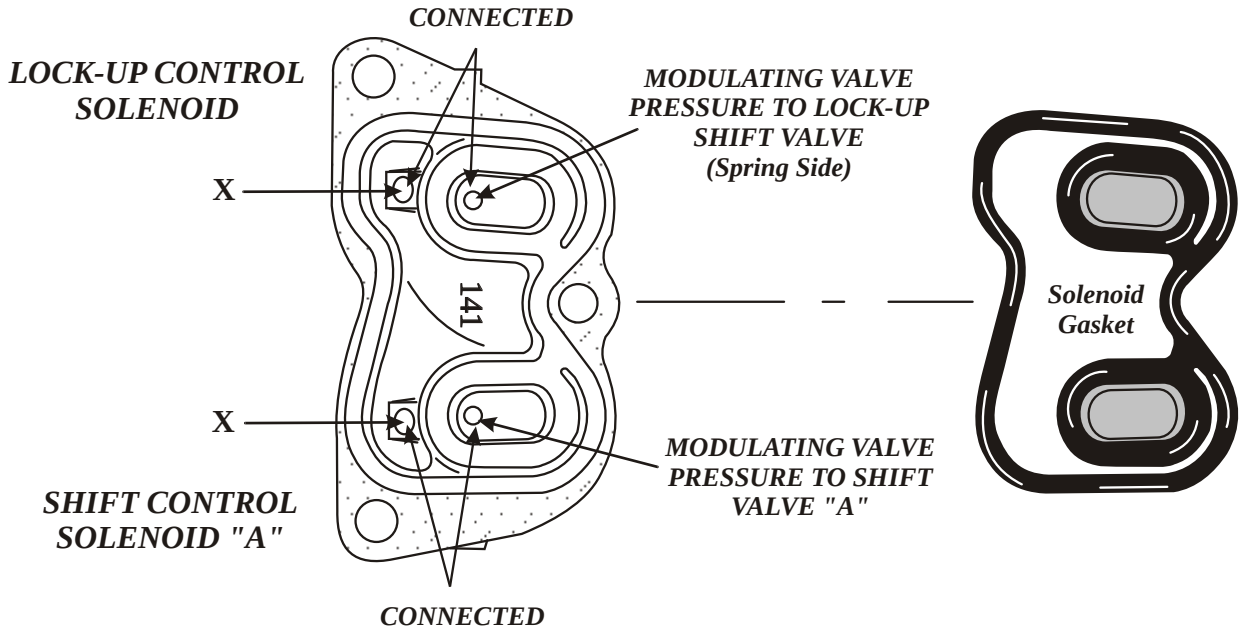
SOLENOID CHECK AND OPERATION

LOCK-UP CONTROL AND SHIFT CONTROL SOLENOID "A" OFF



When the Lock-up control Solenoid is OFF, Modulating Pressure is HIGH, which prevents the Lock-up Shift Valve from stroking.
When Shift Control Solenoid "A" is OFF, Modulating Pressure is HIGH, which strokes Shift Valve "A."

LOCK-UP CONTROL AND SHIFT CONTROL SOLENOID "A" ON

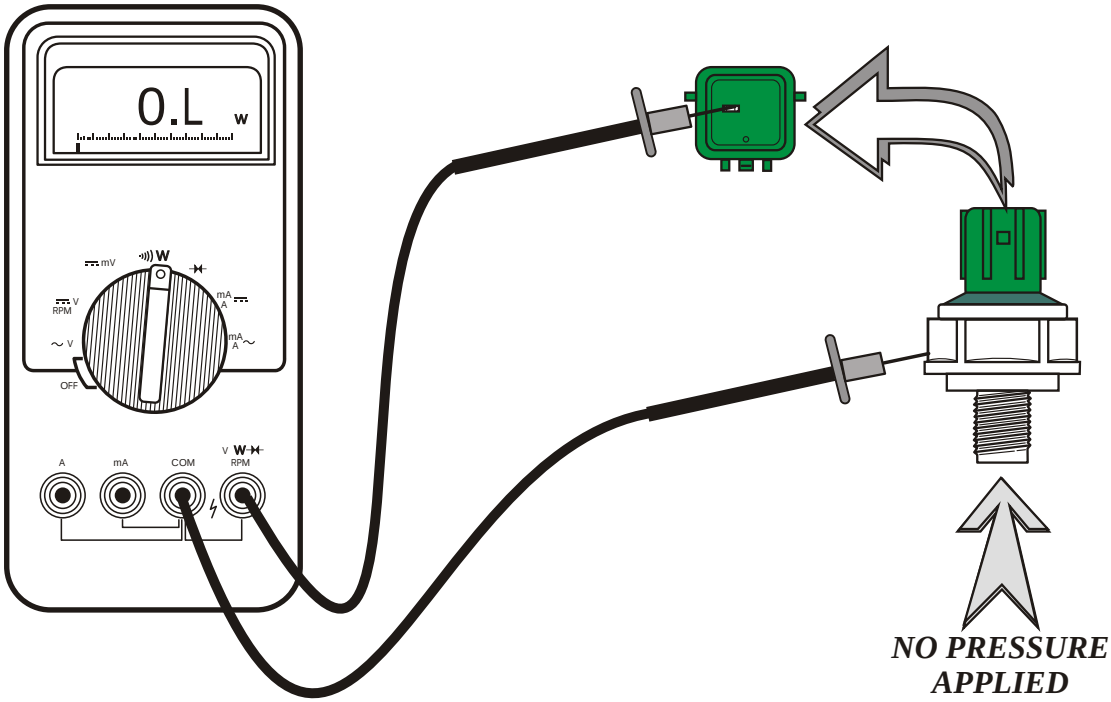


When the Lock-up control Solenoid is ON, Modulating Pressure is EXHAUSTED, which allows the Lock-up Shift Valve to stroke.
When Shift Control Solenoid "A" is ON, Modulating Pressure is EXHAUSTED, which allows Shift Valve "A" to be held to the right by its spring.

Figure 11

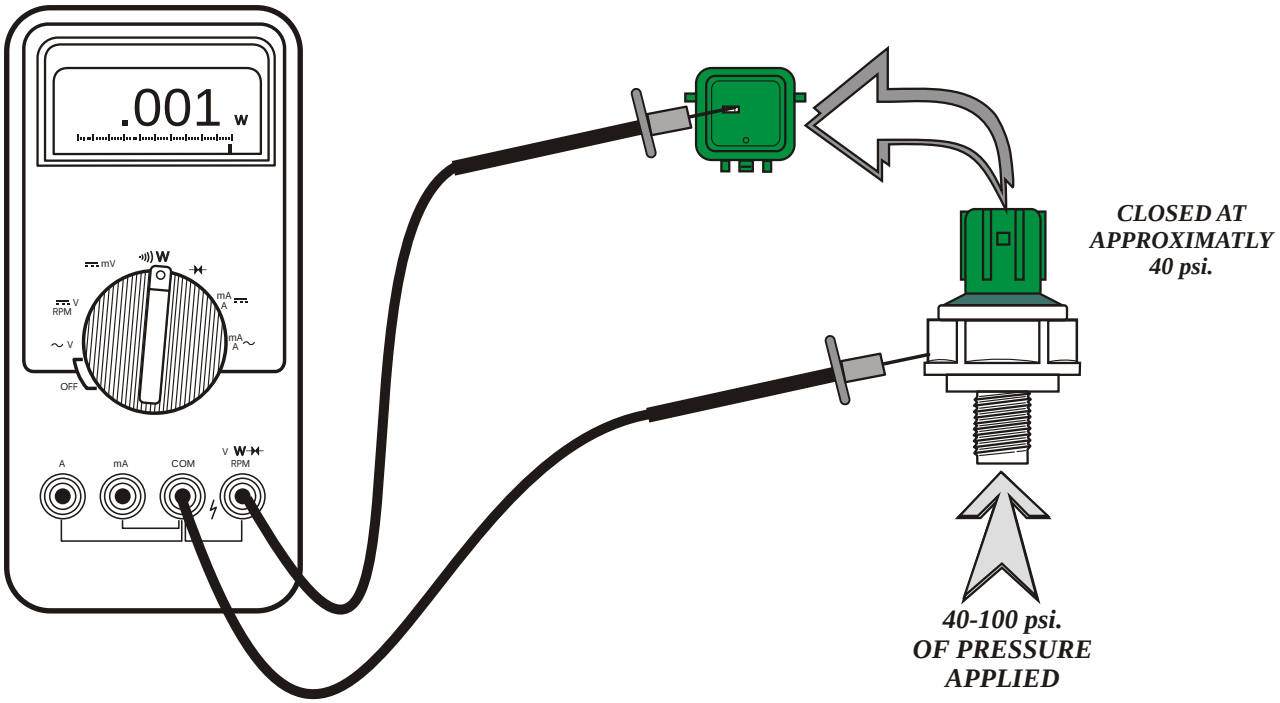
PRESSURE SWITCH CHECK AND OPERATION

2ND OR 3RD GEAR PRESSURE SWITCH "OFF"



SUMMARY: THE 2nd AND 3rd GEAR PRESSURE SWITCHES ARE "OPEN" WITH NO PRESSURE APPLIED

2ND OR 3RD GEAR PRESSURE SWITCH "ON"



SUMMARY: THE 2nd AND 3rd GEAR PRESSURE SWITCHES "CLOSE" WHEN 40-100 psi. OF PRESSURE IS APPLIED TO THE SWITCH.

Figure 12

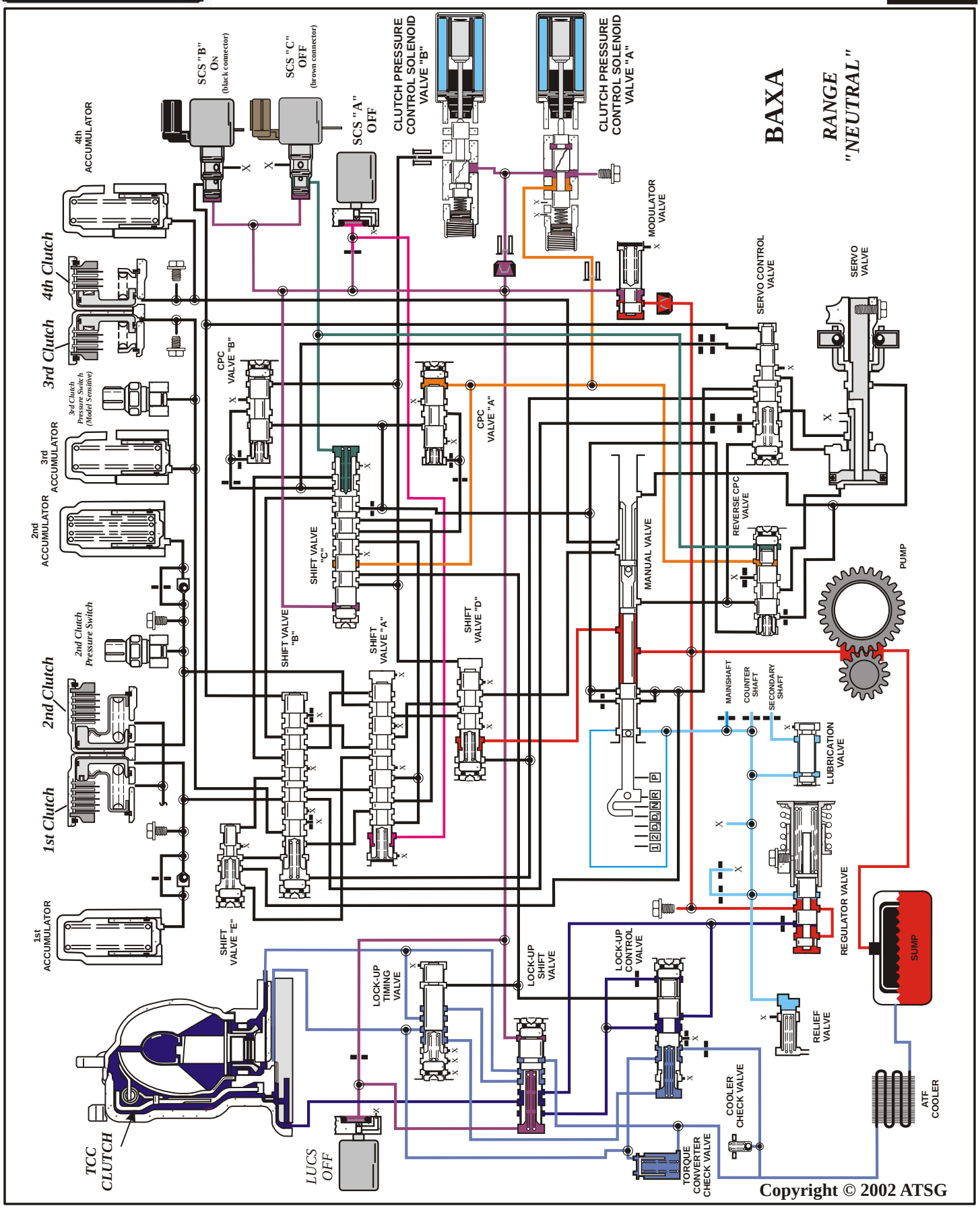

BAXA
RANGE
"NEUTRAL"
SCS "B" ON (black connector)
SCS "C" OFF (brown connector)
SCS "A" OFF
CLUTCH PRESSURE CONTROL SOLENOID VALVE "B"
CLUTCH PRESSURE CONTROL SOLENOID VALVE "A"
MODULATOR VALVE
SERVO CONTROL VALVE
SERVO VALVE
4th ACCUMULATOR
4th Clutch
3rd Clutch
3rd Clutch Pressure Switch (Model Sensitive)
3rd ACCUMULATOR
2nd ACCUMULATOR
2nd Clutch Pressure Switch
2nd Clutch
1st Clutch
1st ACCUMULATOR
CPC VALVE "B"
CPC VALVE "A"
SHIFT VALVE "C"
SHIFT VALVE "B"
SHIFT VALVE "A"
SHIFT VALVE "D"
SHIFT VALVE "E"
MANUAL VALVE
REVERSE CPC VALVE
PUMP
MAINSHAFT
COUNTER SHAFT
SECONDARY SHAFT
LUBRICATION VALVE
REGULATOR VALVE
SUMP
LOCK-UP TIMING VALVE
LOCK-UP SHIFT VALVE
LOCK-UP CONTROL VALVE
RELIEF VALVE
COOLER CHECK VALVE
ATF COOLER
TORQUE CONVERTER CHECK VALVE
TCC CLUTCH
LUCS OFF
P
R
N
D
2
1
Copyright © 2002 ATSG

Figure 13

HONDA CIVIC HX

DELAYED BANG ENGAGEMENT OR SHUDDER ON TAKE-OFF

COMPLAINT: 1996 to 1999 Honda Civic HX equipped with the Continuously Variable Transmission (CVT) may experience a delayed harsh engagement or a shudder on initial take-off in both drive and reverse.

CAUSE: Some of the common causes which produces this complaint would be:
1. A mechanically failed Start Clutch Solenoid (Figure 1).
2. Sticking Start Clutch Control Valve (Figure 1).
3. A leak in the Start Clutch Drum circuit (Figure 2).
4. A cracked Drive Pulley (Figure 2).
5. A stretched Steel Belt slipping in the pulleys (Figure 2).

CORRECTION: Check the Start Clutch pressure circuit with a pressure gauge. The tap location is provided in Figure 3. Honda does not publish pressure specifications for this tap but in checking good operational vehicles, there is seen 35 to 40 psi of pressure at idle while in Drive. At stall in drive, this pressure reached 120 to 130 psi. This will verify the integrity of the Start Clutch Solenoid, valve and drum. If this pressure is low, one of these items is faulty. If pressures are within specifications there may be pulley or steel belt problems.

Pulleys are known to crack causing a loss of squeeze pressure on the belts. Figure 3 illustrates the remaining pressure tap locations with pressure specifications in the chart shown in Figure 3. Pressure check both the Drive and Driven Pulleys. If one or both are low, an internal inspection will be needed. Many times the cracks in the pulleys can be seen. If the pressures are within specification, chances are the Steel Belt has stretched and will need to be replaced.

CAUTION: CHECKING PRESSURE ON THE PULLEYS CAN REACH 600 PSI OR GREATER. BE SURE TO USE AN APPROPRIATE GAUGE.

IMPORTANT NOTE:

When the TCM, Transmission Assembly, Start Clutch Assembly, Lower Valve Body or Engine is replaced or overhauled, the TCM must relearn the feedback signal for Start Clutch Control.
The procedure for the Start clutch relearn for 1996 and 1997-99 models can be found in figure 4

HONDA CIVIC HX
DELAYED BANG ENGAGEMENT

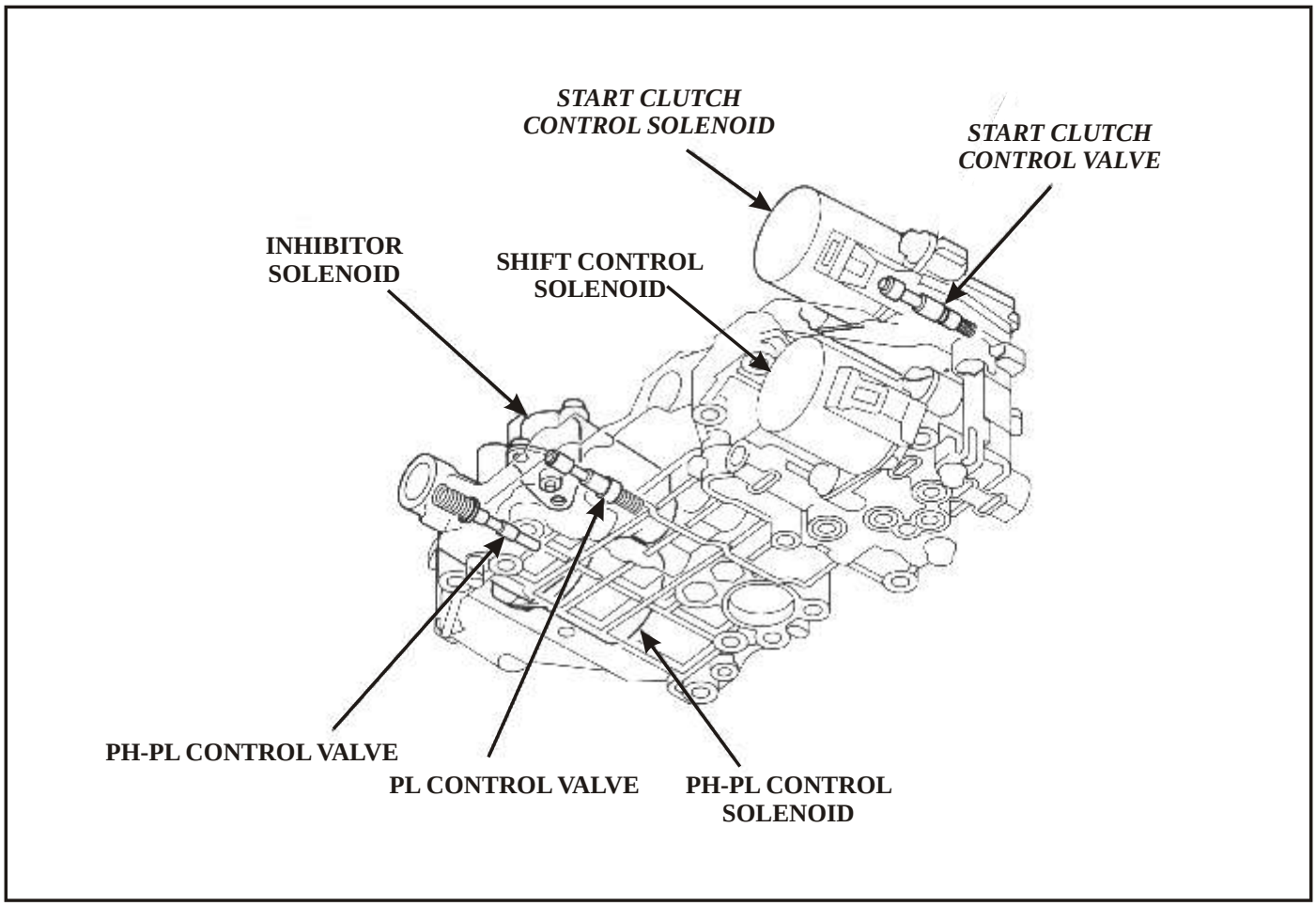


Figure 1

HONDA CIVIC HX
DELAYED BANG ENGAGEMENT

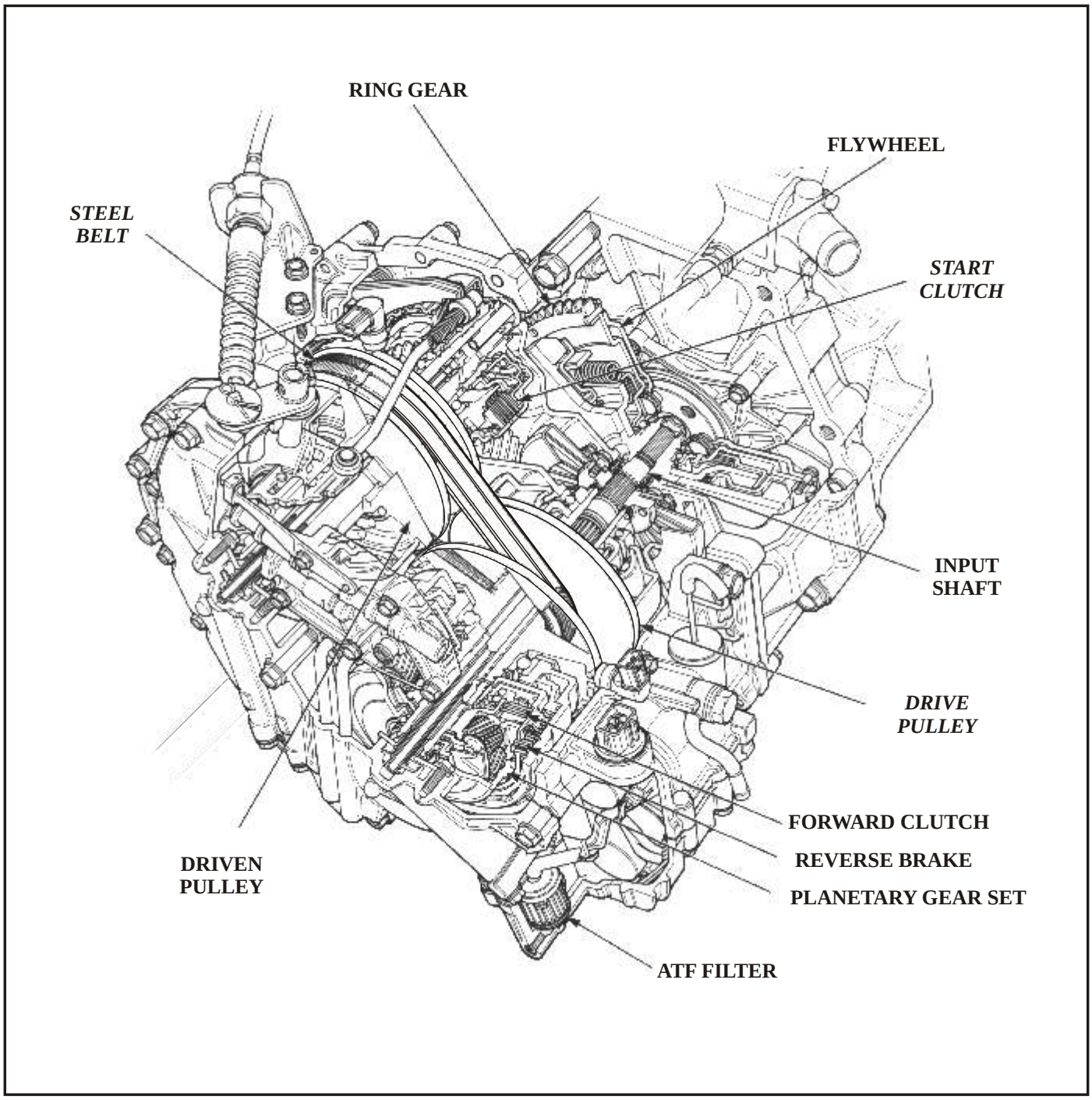


Figure 2

HONDA CIVIC HX

M4VA PRESSURE CHART

SHIFT LEVER POSITION	CIRCUIT PRESSURE	CONDITIONS	PRESSURE IN PSI
D	FORWARD CLUTCH	WHEELS FREE, ENGINE @ 1500 RPM	200 - 253
R	REVERSE BRAKE	WHEELS FREE, ENGINE @ 1500 RPM	200 - 253
N	DRIVE PULLEY	WHEELS FREE, ENGINE @ 1500 RPM	*30 - 100
N	DRIVEN PULLEY	WHEELS FREE, ENGINE @ 1500 RPM	210 - 330
N	LUBRICATION	WHEELS FREE, ENGINE @ 3000 RPM	ABOVE 30
D	START CLUTCH	IDLE	35 - 40
D	START CLUTCH	STALL	120 - 130

CAUTION: When transmission control system is in failsafe, drive pulley pressure may exceed 500 PSI

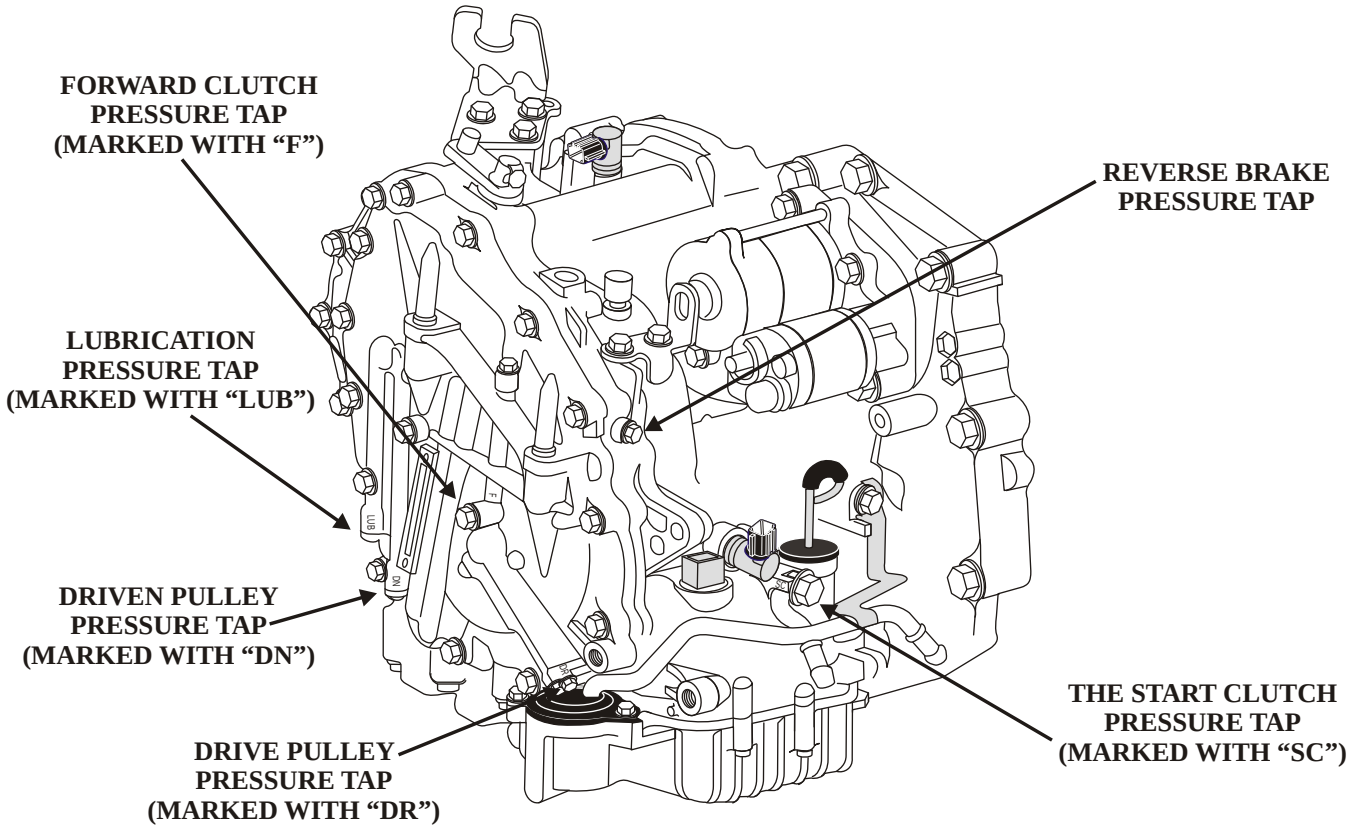


Figure 3

HONDA CIVIC HX

START CLUTCH RELEARN PROCEDURE

1996 MODEL ONLY:

1. Locate the Service Check Connector under the passenger side dash and jump the connector.
2. Start the engine, and warm it up to normal operating temperature, the radiator cooling fan should come on twice.
3. Fully depress the brake pedal and accelerator pedal for 20 seconds in the "D" position.
4. Release the accelerator pedal and shift into neutral or park. To store the engine negative pressure in memory, let the engine idle for one minute under the following conditions:
   ·Brake pedal depressed
   ·A/C switch OFF
   ·Headlight switch OFF
   ·Heater Fan switch OFF
   ·All accessories OFF
   NOTE: Begin step 4 within 60 seconds after the radiator fan goes off.
5. Shift into "D" position, and let the engine idle for 2 minutes to store the feedback signal in memory under the same conditions as in step 4.
6. Remove the jumper from the Service Check Connector.
   NOTE: The TCM will not store the feedback signal when transmission fluid temperature is below 104ºF (40ºC) even if coolant temperature reaches normal operating temperature. This procedure may have to be repeated until Start Clutch calibration is complete.

1997-99 MODELS:

The TCM (1997-98 Models0 and PCM (1999Model) memorize the Feedback Signal when you drive the vehicle as follows: ·Warm the engine to normal operating temperature.
·Shift into the "D" position.
·Turn OFF all electrical systems.
·Drive the vehicle to a speed of 37 mph (60 km/h).
·After vehicle speed reaches 37 mph (60 km/h), release the accelerator pedal for 5 seconds.

Figure 4

SPX

ISUZU NPR/GMC FORWARD TILTMASTER

STACKED SHIFTS

COMPLAINT: The transmission shifts early, there are no codes stored and the TPS signal is correct.

CAUSE: Vehicle Speed Sensor #1 shown in figure 1, which is located in the extension housing and excited by the park gear is responsible for the stacked shift complaint. The problem is, the speed sensor checked good, but is faulty.
Rather than just buy a speed sensor, there is a way to verify the VSS #1 fault.

CORRECTION: These vehicles also have a #2 Speed Sensor which is located in the instrument cluster (Refer to figure 2) on 1988-1995 models, or a gear driven speed sensor located in the extension housing (Refer to figure 3) on 1995½-1998 models.
The #2 VSS will take over the function of the #1 VSS should it fail.
Therefore, all one needs to do is disconnect the #1 VSS and let the #2 VSS take over.
Now, if the transmission shift timing is correct, you have verified that VSS #1 is causing the stacked shift complaint.

SERVICE INFORMATION:

VEHICLE SPEED SENSOR #1
Vehicle speed sensor #1 is located in the extension housing of the transmission, as seen in figure 1, and is excited by the parking gear. This Sensor is "hard wired" to the TCM. VSS #1 is an AC voltage generator and can be checked in AC volts or Hertz (Hz) as follows: 10mph = 4VAC; 30mph = 7VAC; 50mph = 11VAC.
10mph = 291Hz; 30mph = 750Hz; 50mph = 1200Hz.
The resistance of the sensor is 504-616 ohms.

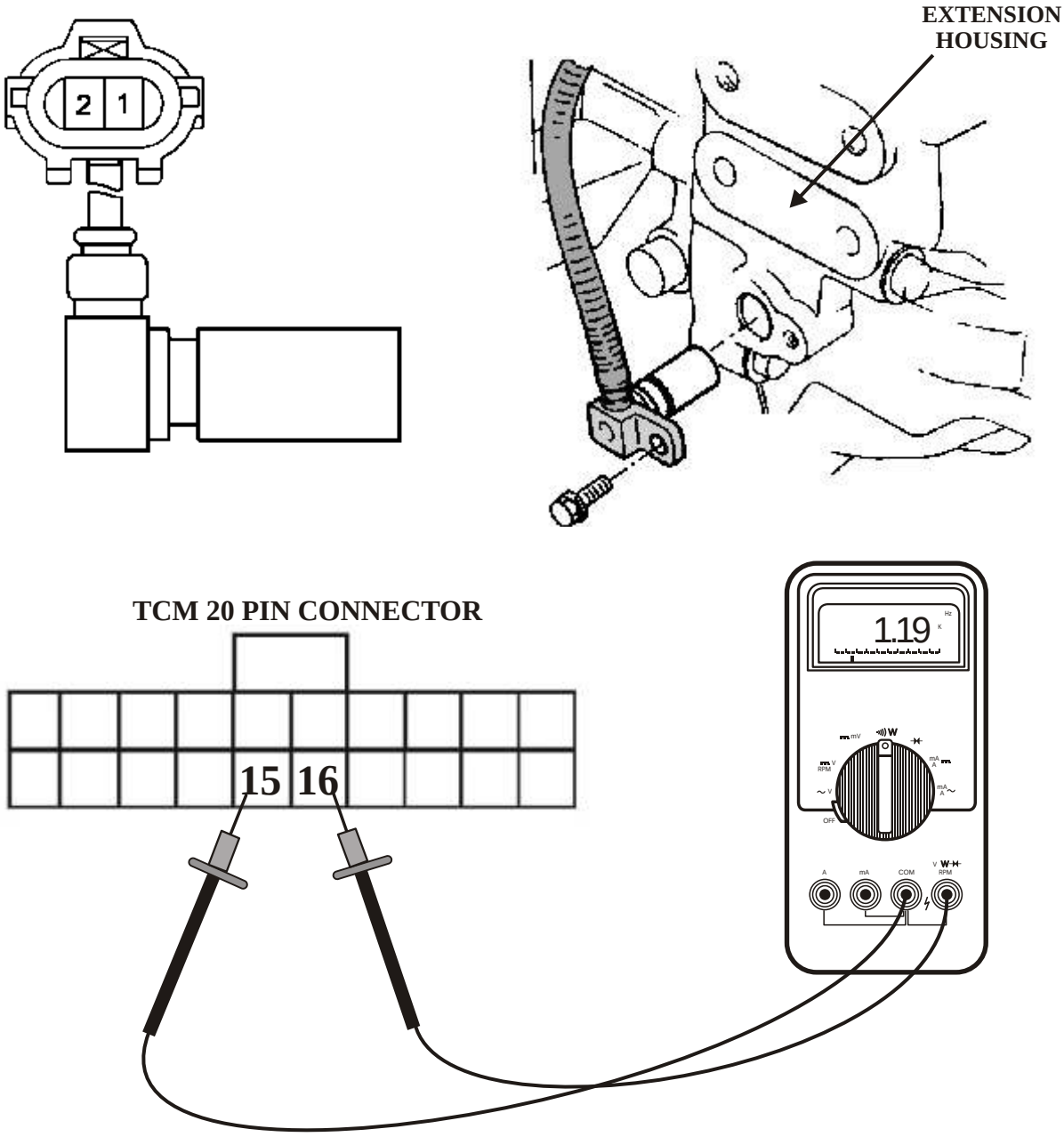
VEHICLE SPEED SENSOR #2 (1988-95)
Vehicle speed sensor #2, within these models years, is located in the speedometer head and is a reed switch type that is driven by the speedometer cable, as seen in figure 2. This sensor is best checked in DC volts at the TCM for a 0-5 volt pulse as the rear wheels are rotated slowly.
This type of sensor is a three wire type that receives a 5 volt voltage supply, a ground circuit and a 0-5 volt signal return. This sensor has ONLY the signal return wire going to the TCM.

VEHICLE SPEED SENSOR #2 (1995½ - 1998)
Beginning with the 1995½ model year VSS #2 was moved to the transmission extension housing and became a gear driven AC voltage generator, as seen in figure 3.
This sensor is "hard wired" to the TCM and can be checked in Hertz (Hz) as follows:10mph = 15Hz; 30mph = 33Hz; 50mph = 55Hz.

ISUZU NPR/GMC FORWARD TILTMASTER

STACKED SHIFTS

VEHICLE SPEED SENSOR #1



CHECK VSS #1 AC VOLTAGE OR HERTZ SIGNAL AT TCM 20 PIN CONNECTOR TERMINALS 15 & 16

Figure 1

ISUZU NPR/GMC FORWARD TILTMASTER

STACKED SHIFTS

VEHICLE SPEED SENSOR #2 IN SPEEDOMETER HEAD (1988-94)

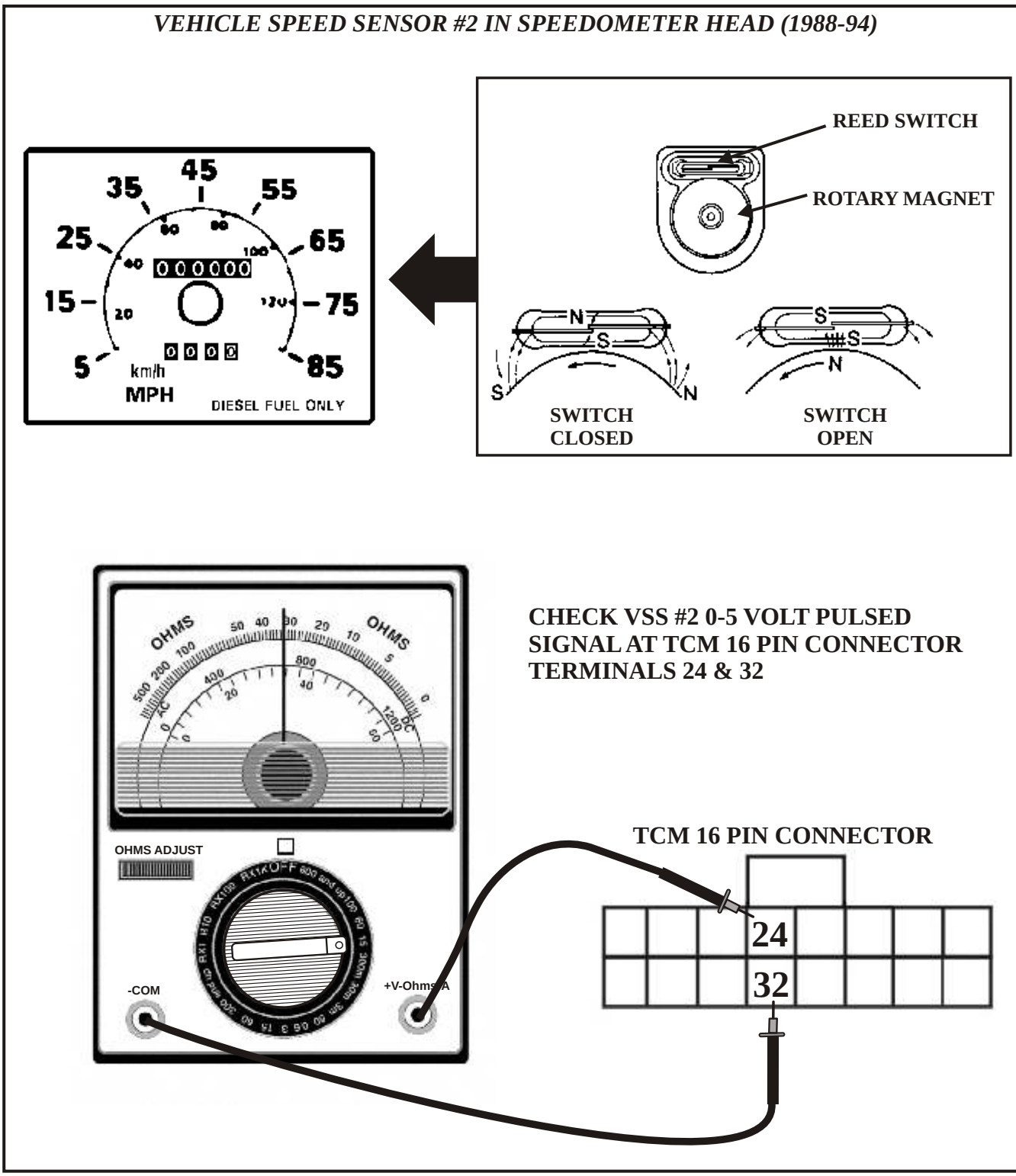
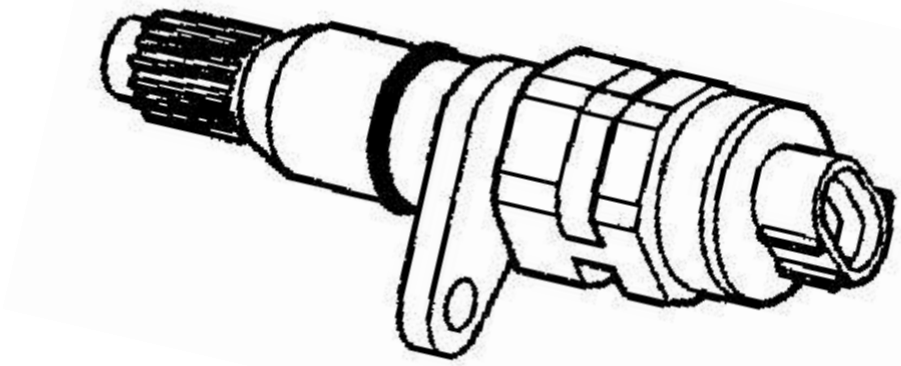


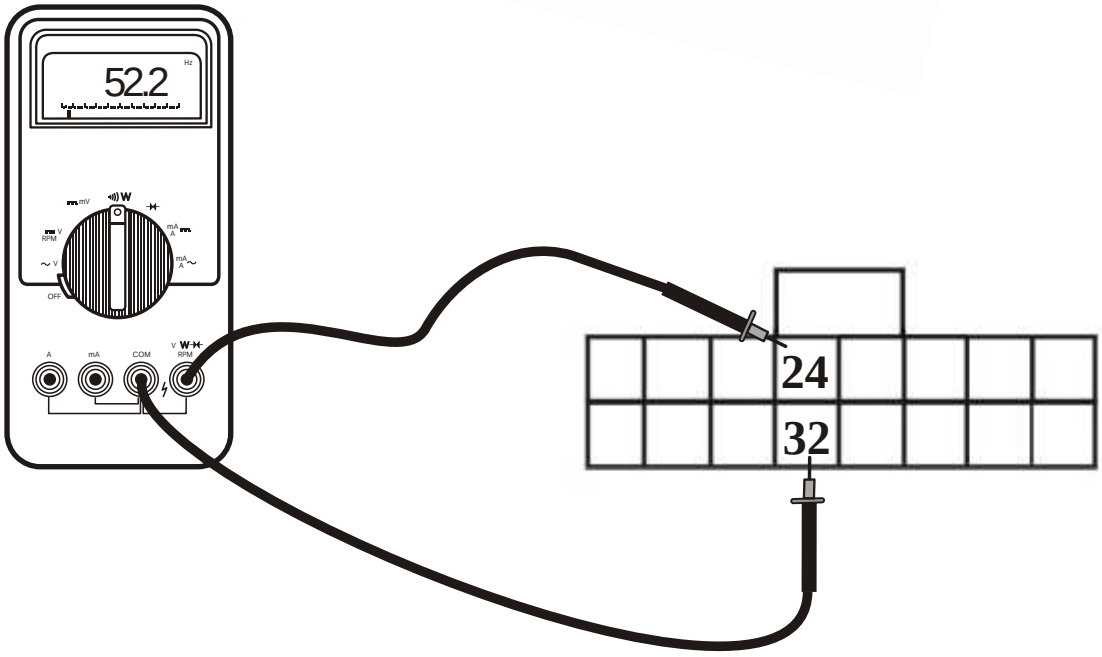
Figure 2

ISUZU NPR/GMC FORWARD TILTMASTER

STACKED SHIFTS

VEHICLE SPEED SENSOR #2 IN TRANSMISSION (1995½ - 1998)





CHECK VSS #2 AC VOLTAGE OR HERTZ SIGNAL AT TCM 20 PIN CONNECTOR TERMINALS 24 & 32

Figure 3

MAZDA R4A-EL

TURBINE SENSOR WIRE/CONNECTOR CONFIGURATION

COMPLAINT: During the removal of the transmission, it is not uncommon to get the Turbine Shaft Speed Sensor wiring harness tangled and snagged where the wires are pulled out of the connector (See Figure 1 for sensor location). When the technician attempts to repair the wiring, it is noticed that the wire colors on the sensor side of the connector do not match to that on the main harness connector making the proper connection unknown.

CORRECTION: Using Figure 2, the ***Red Wire*** in the sensor harness matches up with the ***Blue/Yellow*** wire in the main harness. The ***Black Wire*** in the sensor harness matches up with the ***Black/Green*** wire in the main harness. The ***White Wire*** in the sensor harness then matches up with the ***Blue/Green Wire*** in the main harness.

TURBINE SPEED SENSOR LOCATION

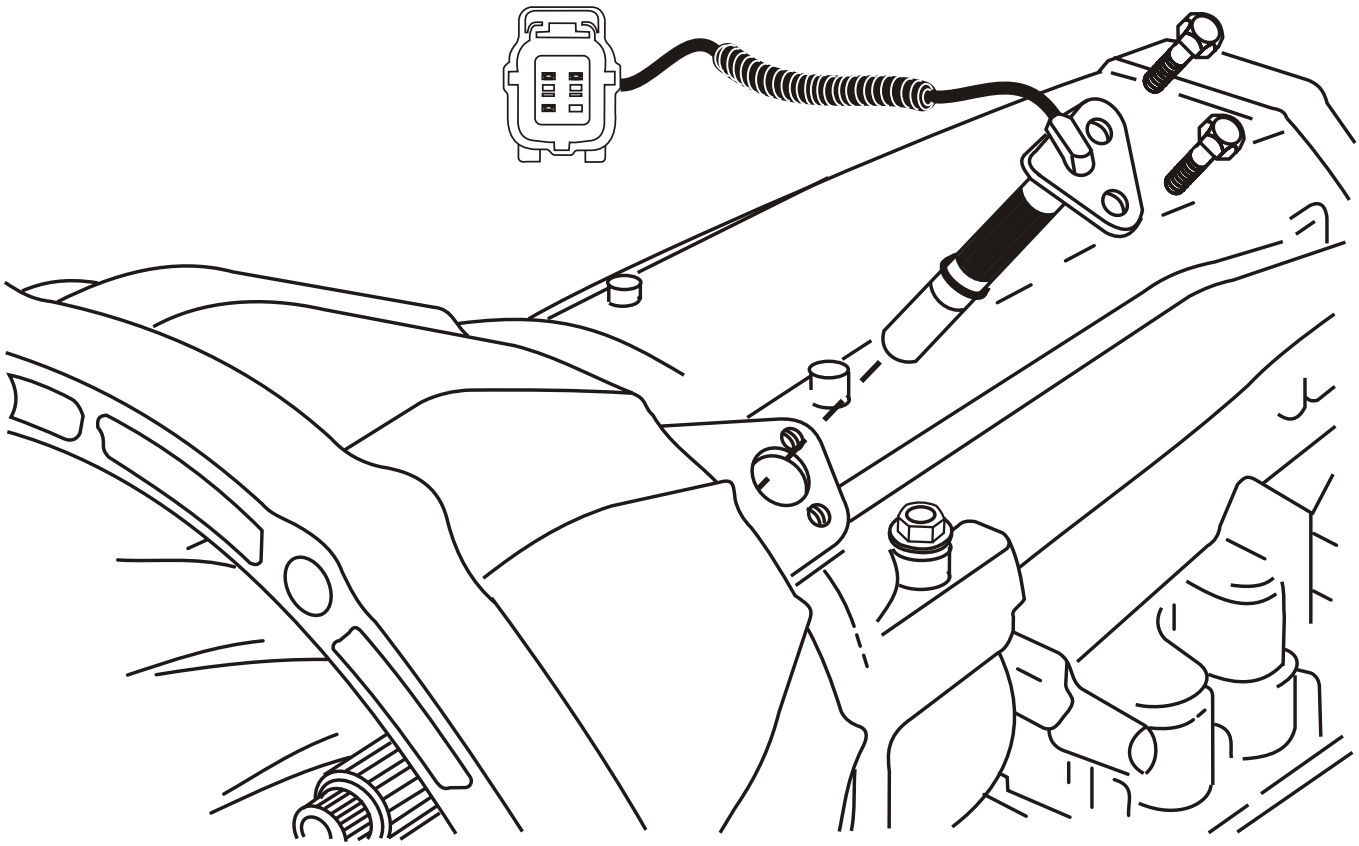


Figure 1

MAZDA R4A-EL

TURBINE SENSOR WIRE/CONNECTOR CONFIGURATION

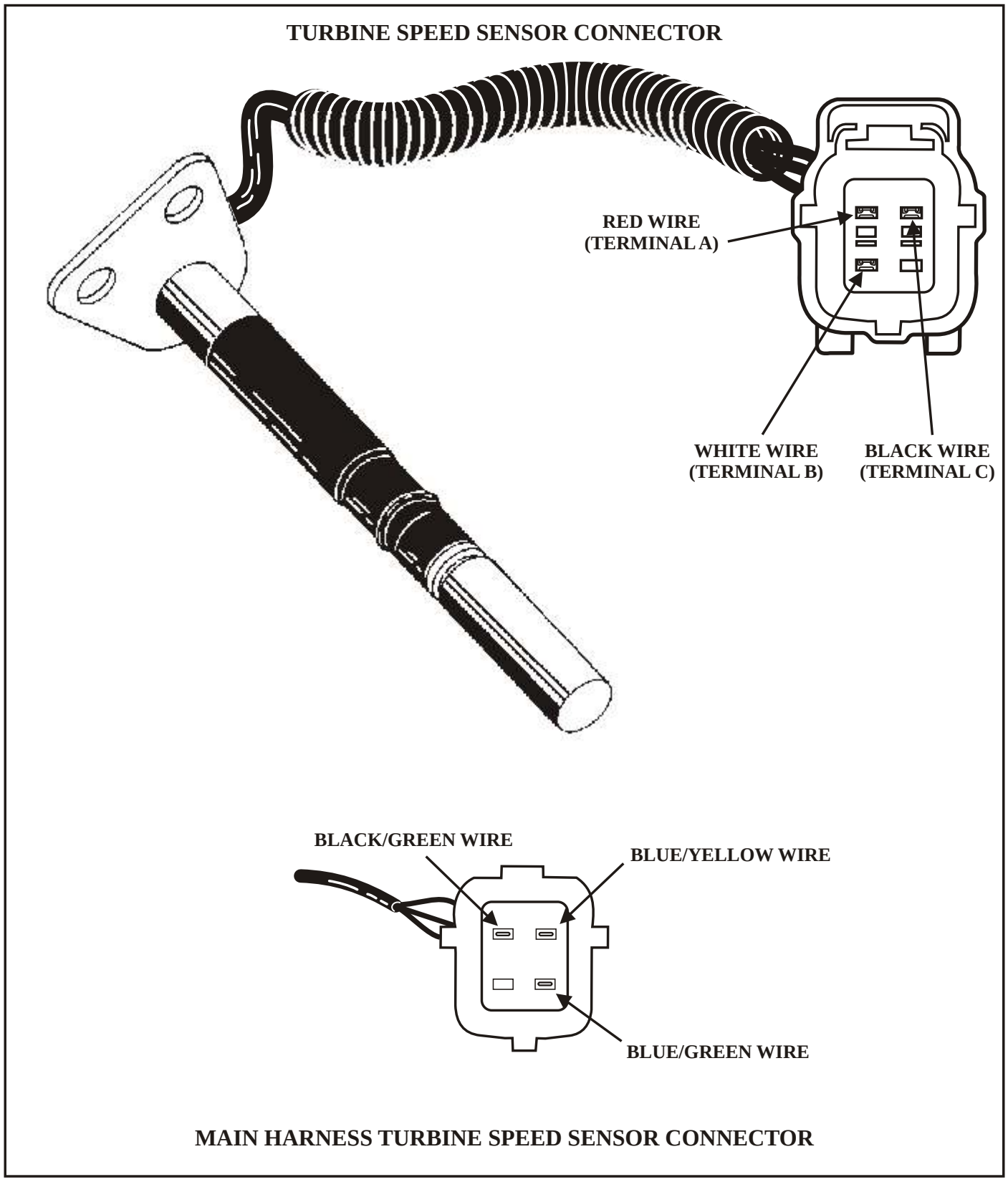


Figure 2

MAZDA/FORD

SNAP-ON SCAN TOOL VEHICLE IDENTIFICATION

COMPLAINT: When attempting to scan a Mazda vehicle equipped with Ford electronics, the scan tool indicates that no codes are stored even though the symptoms that are currently present obviously indicate that one or more codes ***ARE*** stored. The situation becomes more complex when it is realized that "data" is also not available.

CAUSE: As a result of vehicle model crossover, many of the Mazda car and truck models are actually FORD manufactured vehicles. Because of this, these Mazda vehicles will be equipped with Ford EEC-IV or EEC-V computers as well as domestic transmissions. Because of model crossover, identifying the vehicle as a Mazda to the scan tool, using the Asian Primary and Troubleshooter cartridges, will result in incorrect or no information from the scan tool.
Examples of model crossover are: Mazda Navajo=Ford Explorer
Mazda "B" 2, 3 and 4000 Series Trucks = Ford Ranger
Mazda 626 or MX6 = Ford Probe
Mazda Tribute = Ford Escape

CORRECTION: When identifying one of these vehicles for purposes of codes and data retrieval, use the Domestic Primary and Troubleshooter cartridges, then, using the chart in figure 1 for vehicles that require 3 # digit "VIN"identification, and the chart in Figure 2 for vehicles that require 4 digit "VIN" identification, enter the appropriate "VIN" digits indicated in these charts which will now provide access to computer diagnostics.

NOTE #1: 1995 & Later Mazda "B" Series Trucks identified as a Ford Ranger will provide more live data when using ***DOMESTIC*** Primary and Troubleshooter cartridges.

NOTE #2: Remember to utilize the "GENERIC OBD-II" and "FREEZE FRAME" categories on 1995 and later OBD-II equipped vehicles.

6.1 VERSION & EARLIER (3 DIGIT ID) DOMESTIC PRIMARY CARTRIDGE

MAZDA "VIN" NUMBERS			YEAR MODEL	VEHICLE MODEL	ENGINE SIZE	FORD "VIN" NUMBERS		
10th	*4th*	*8th*				*10th*	*5th*	*8th*
M	C	X	1991	NAVAJO	4.0L	M	U	X
N	C	X	1992	NAVAJO	4.0L	N	U	X
P	C	X	1993	NAVAJO	4.0L	P	U	X
R	C	X	1994	NAVAJO	4.0L	R	U	X
R	C/D	A	1994	B2300	2.3L	R	R	A
R	C/D	U	1994	B3000	3.0L	R	R	U
R	C/D	X	1994	B4000	4.0L	R	R	X
R	G	C	1994	626/MX6	2.0L	R	T	A
S	G	C	1995	626/MX6	2.0L	S	T	A

Figure 1

MAZDA/FORD

SNAP-ON SCAN TOOL VEHICLE IDENTIFICATION

6.7 VERSION & LATER (4 DIGIT ID) DOMESTIC PRIMARY CARTRIDGE

MAZDA "VIN" NUMBERS			YEAR MODEL	VEHICLE MODEL	ENGINE SIZE	FORD "VIN" NUMBERS			
10th	*4th*	*8th*				*10th*	*2nd*	*5th*	*8th*
M	C	X	1991	NAVAJO	4.0L	M	F	U	X
N	C	X	1992	NAVAJO	4.0L	N	F	U	X
P	C	X	1993	NAVAJO	4.0L	P	F	U	X
R	C	X	1994	NAVAJO	4.0L	R	F	U	X
R	C/D	A	1994	B2300	2.3L	R	F	R	A
R	C/D	U	1994	B3000	3.0L	R	F	R	U
R	C/D	X	1994	B4000	4.0L	R	F	R	X
[1]R	G	C	1994	626/MX6	2.0L	R	Z	*T	A
S	G	C	1995	626/MX6	2.0L	S	Z	*T	A
S	C/D	A	1995	B2300	2.3L	S	F	R	A
S	C/D	U	1995	B3000	3.0L	S	F	R	U
S	C/D	X	1995	B4000	4.0L	S	F	R	X
T	C/D	A	1996	B2300	2.3L	T	F	R	A
T	C/D	U	1996	B3000	3.0L	T	F	R	U
T	C/D	X	1996	B4000	4.0L	T	F	R	X
V	C/D	A	1997	B2300	2.3L	V	F	R	A
V	C/D	U	1997	B3000	3.0L	V	F	R	U
V	C/D	X	1997	B4000	4.0L	V	F	R	X
W	C/Y	C	1998	B2500	2.5L	W	F	R	C
W	C/Y/Z	U	1998	B3000	3.0L	W	F	R	U
W	C/Y/Z	X	1998	B4000	4.0L	W	F	R	X
X	C/Y	C	1999	B2500	2.5L	X	F	R	C
X	C	U	1999	B3000	3.0L	X	F	R	U
X	Y/Z	V	1999	B3000	3.0L FF[2]	X	F	R	V
X	C/D/Y/Z	X	1999	B4000	4.0L	X	F	R	X
Y	C/Y	C	2000	B2500	2.5L	Y	F	R	C
Y	C/Y/Z	U	2000	B3000	3.0L	Y	F	R	U
Y	Y	V	2000	B3000	3.0L FF[2]	Y	F	R	V
Y	C/Y/Z	X	2000	B4000	4.0L	Y	F	R	X
1	Y	C	2001	B2300	2.3L	1	F	R	C
1	Y	D	2001	B2500	2.5L	1	F	R	D
1	Y/Z	U	2001	B3000	3.0L	1	F	R	U
1	Y/Z	E	2001	B4000	4.0L	1	F	R	E

[1]When using a 6.7 or later version domestic primary cartridge, the 10th VIN digit will be used as is. The 2nd, 5th and 8th VIN digits will be "ZTA" on all 2.0L equipped Mazda 626/mx6.

[2]FF = Flex Fuel

****When using a '98 Domestic Primary Cartridge, use a "P" for the 5th digit for scan tool ID.***

Figure 2

MITSUBISHI/DAIMLER CHRYSLER
SCANNER ACCESS

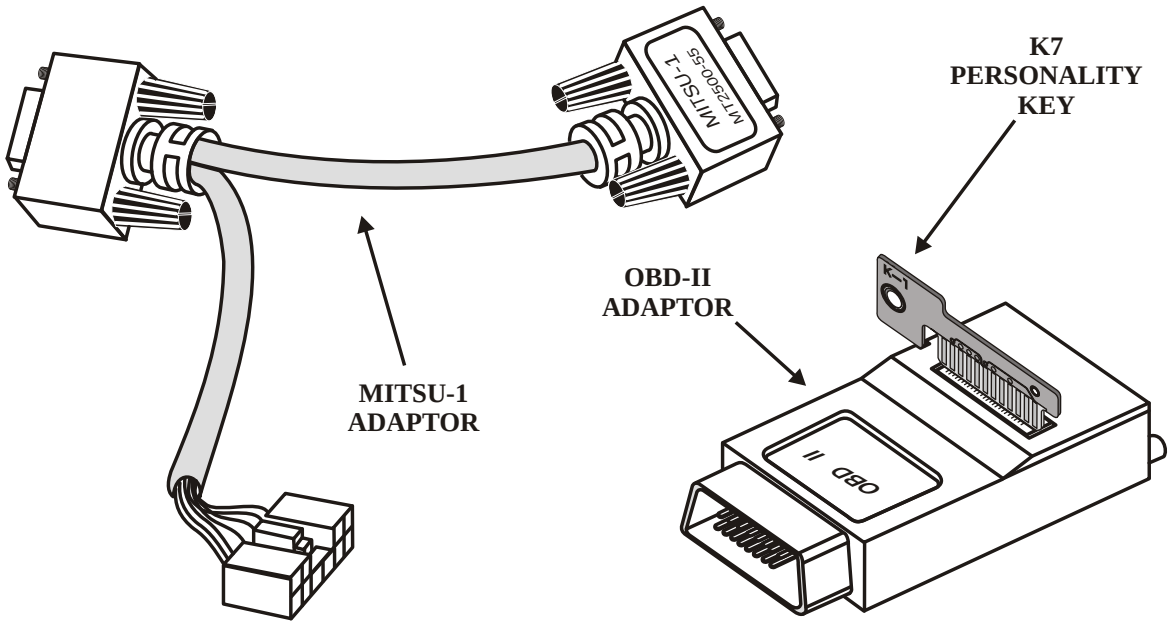
For the 1995 to 1998 Mitsubishi Eclipse non-turbo 2.0 liter with the Chrysler A604 transaxle, you gain access through the Chrysler partition of the Domestic Primary Cartridge. You must use the ***MITSU-1 ADAPTER*** that connects to both the Mitsubishi and OBD II diagnostic connector using personality key number 7 as seen in figure 1.

If you are using a 97 or 98 Primary Cartridge, enter these following Vehicle Identification Numbers:

10th digit = Use the vehicle's 10th digit VIN
5th digit = "U"

For those who have the 99 Primary Cartridge, use these following numbers:

10th digit = Use the vehicle's 10th digit VIN
2nd digit = "E"
3rd digit = "3"
8th digit = "Y"
5th digit = "U"



THE "MITSU-1 12 PIN ADAPTOR AND THE OBD-II 16 PIN ADAPTOR WITH THE K7 PERSONALITY KEY MUST BE USED TOGETHER IN ORDER TO COMMUNICATE WITH THE TRANSAXLE CONTROLLER

MITSUBISHI CODE RETRIEVAL

MISLEADING "P" CODES

COMPLAINT: Mitsubishi's onboard computer system presents transmission related "P" codes that are misleading causing needless unproductive diagnostic routines and repairs.

CAUSE: A simplified example that will serve as some type of reasonable explanation would be to look at code P1750. This code is defined to mean that any of the solenoid circuits are either open or shorted. If these solenoids and their respective wiring to the ECM prove good, then the ECM is defective.

Now if you looked at the two digit transmission code list you would see that codes 41 to 48 are individual codes for each type of circuit failure for each of the solenoids in the transmission. Yet code 49 is not an electrical fault code but rather it represents a mechanical failure of the converter clutch. It is this code that got brought over together with codes 41 to 48 on the ECM's look up table to be represented by the "P" code 1750.

If you have ever experienced installing into a vehicle the wrong gear ratio transmission, you also know that the result often times produces a TCC slip code that will not go away. So here is an example of a "P" code that could mislead a technician into changing solenoids, replace wiring or even replace the ECM when all along it was either some type of hydraulic/mechanical failure of the converter clutch, a slipping transmission, or the wrong transmission was installed.

One important additional note, a P0700 has been designated to mean many different possibilities. Definitions vary as much as meaning Relay Stuck Off to a Defective Computer. **What this code really means is that the ECM/PCM has received information that the TCM stored a code.** It is simply an MIL request light directing the technician to obtain two digit transmission codes.

CORRECTION: Never rely on OBDII codes for the transmission. Always use a analog volt meter and acquire the two digit transmission codes for greater diagnostic accuracy.

Use Figure 1 to see which terminals to connect the analog meter to for any year, make or model vehicle with a KM/F4 style unit. Use Figure 2 for the appropriate code list that matches the generation computer on the vehicle. To determine which generation computer is in the vehicle, use Figure 3 to locate the computer and Figure 4 to identify the computer.

MITSUBISHI CODE RETRIEVAL

MISLEADING "P" CODES

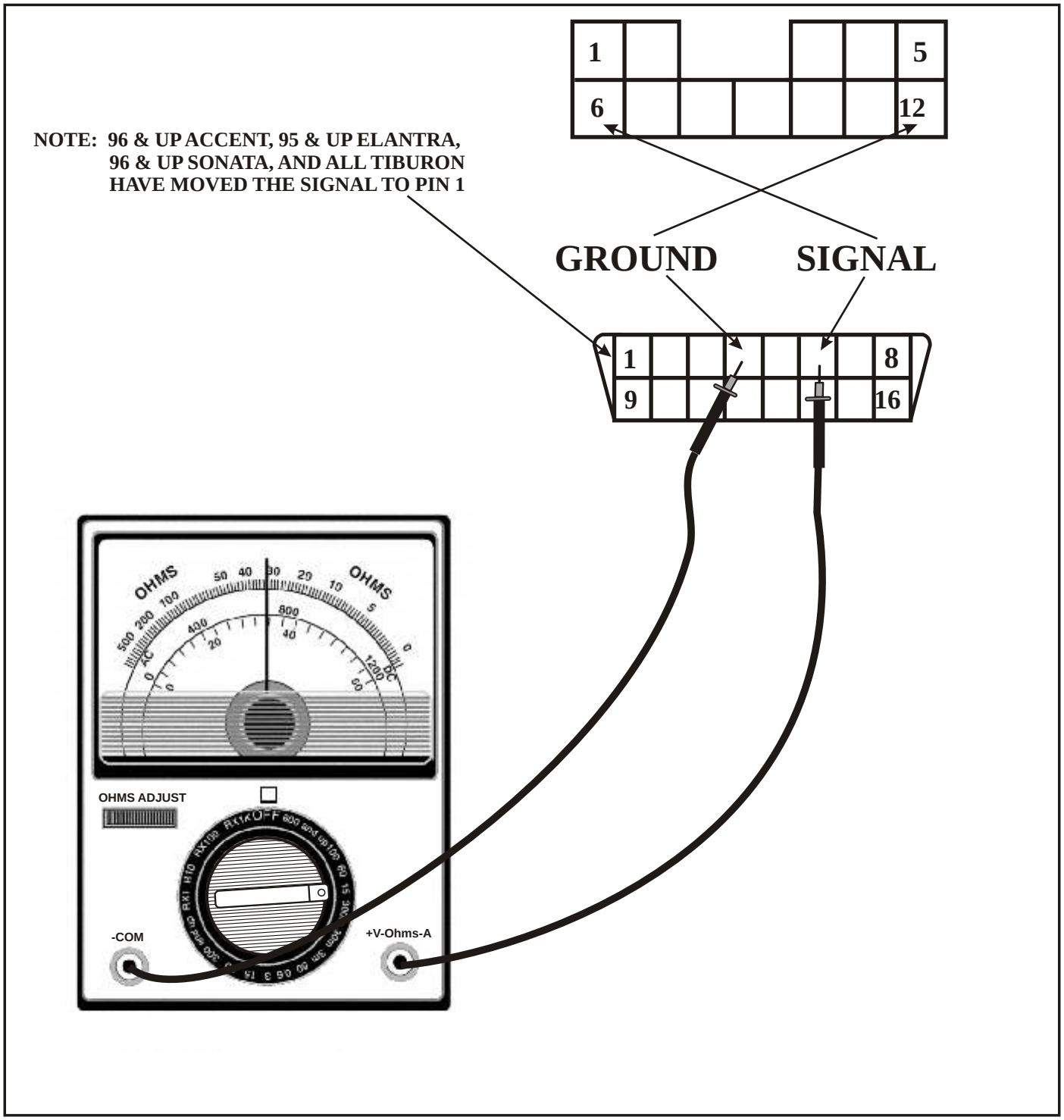


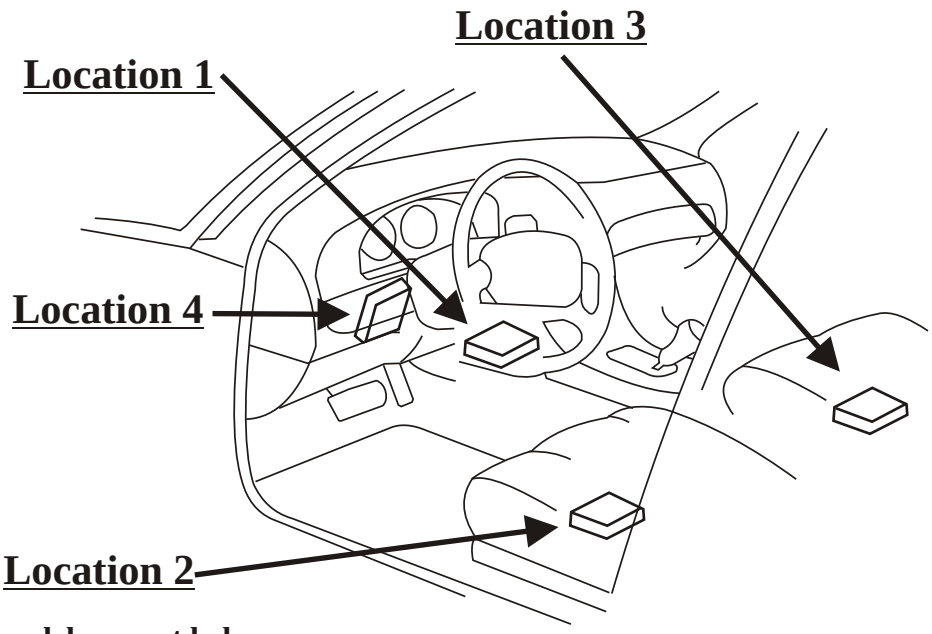
Figure 1

MISLEADING "P" CODES

1st Gen TC	2nd	3rd	4th	Meaning, Check (P0 code)
	21	11	11	TPS Output too high, TPS, Wiring, or adjustment (701)
	22	12	12	TPS Output too low, TPS, Wiring, or adjustment (702)
	23	13	13	TPS Signal out of range, TPS, Wiring, or adjustment (704)
	23	14	14	TPS Signal out of range, TPS, Wiring, or adjustment
	24	15	15	TOT Sensor open, TOT or wiring (712)
	na	16	16	TOT Sensor shorted, TOT or wiring (713)
	na	17	17	HIGH TOT open, TOT or wiring
	25	21	21	Band Servo Switch open, Switch or wiring (709)
	26	22	22	Band Servo Switch shorted, Switch or wiring (709)
$$$ $ $ $ $ $	27	23	23	TCM Not receiving Ignition signal, TCM, Ignition system, wiring (727)
	28	24	24	Accelerator Switch open, Switch or wiring (714)
	na	28	28	Stop Lamp Switch shorted, Switch or wiring
	na	31	31	Loss of Pulse Generator A signal, Generator, wiring, EMI, mechanical (717)
$$$ $ $$ $ $ $	33	32	32	Loss of Pulse Generator B signal, Generator, wiring, EMI, mechanical (722)
$$$ $$ $$ $$ $$ $$	31	na	na	Malfunction of TCM, Replace TCM
$$$ $$ $ $ $ $	32	na	na	Malfunction of TCM: First gear commanded at high speed, Replace TCM
	41	41	41	SS-A Open, Solenoid, wiring (752)
	42	42	42	SS-A Shorted, Solenoid, wiring (753)
	43	43	43	SS-B Open, Solenoid, wiring (757)
	44	44	44	SS-B Shorted, Solenoid, wiring (758)
	45	45	45	EPC Solenoid Open, Solenoid, wiring (747)
	46	46	46	EPC Solenoid Shorted, Solenoid, wiring (748)
	47	47	47	TCC Solenoid Open, Solenoid, wiring
	48	48	48	TCC Solenoid Shorted, Solenoid, wiring
$$$ $$ $$ $ $$ $	49	49	49	Lockup Problem, Hydraulic, Mechanical (740, 742, 743, 744)
	51	51	51	Wrong Ratio or slip in First, Hydraulic, Mechanical, Pulse Generator (731)
	52	52	52	Wrong Ratio or slip in Second, Hydraulic, Mechanical, Pulse Generator (732)
	53	53	53	Wrong Ratio or slip in Third, Hydraulic, Mechanical, Pulse Generator (733)
	54	54	54	Wrong Ratio or slip in Fourth, Hydraulic, Mechanical, Pulse Generator (734)
	na	59	59	Lockup chatter detected, Hydraulic
	na	61	61	Torque Reduction Request line, ECM, TCM, Wiring
	na	62	62	Torque Reduction Request line shorted, ECM, TCM, Wiring
	na	63	63	Torque Reduction Request line open, ECM, TCM, Wiring
	11	81	81	Limp mode caused by code 31
	12	82	82	Limp mode caused by code 32
	13	na	na	Limp mode caused by code 33
	14	83	83	Limp mode caused by code 41, 42
	15	84	84	Limp mode caused by code 43, 44
	16	85	85	Limp mode caused by code 45, 46
	17	86	86	Limp mode caused by code 51, 52, 53, 54
$$$ $ $ $$ $ $				SSA Not following computer command, Solenoid, hydraulic
$$$ $$ $ $$ $ $				SSB Not following computer command, Solenoid, hydraulic
$$$ $ $$ $$ $ $				Band Servo Switch malfunction, Switch or wiring
$$$ $$ $$ $$ $ $				Slip detected, see codes 51 to 54
$$$ $ $ $ $$ $				EPC Not following computer command, Solenoid, hydraulic
$$$ $$ $ $ $$ $				Engine RPM over 6500, RPM Signal
$$$ $ $$ $ $$ $				Sun Shell RPM over 6500, Pulse Generator

Figure 2

MISLEADING "P" CODES



Location 1: All models except below:
Forward of Console, almost to Firewall, flat on floor. TCM is NOT on edge, it is FLAT.

Location 2: 1994 Scoupe:
Under Driver Seat

Location 3:
1991 to 1993 & 1995 Scoupe; 1992 to 1995 Elantra; All years Excel and Precis:
Under Passenger Seat

Location 4:
1993 to 1996 Summit, Summit Wagon; 1996 to 1998 Elantra; 1995 to 1998 Sonata
All Years Accent & Tiburon:
On Firewall above steering column inside passenger compartment

Figure 3

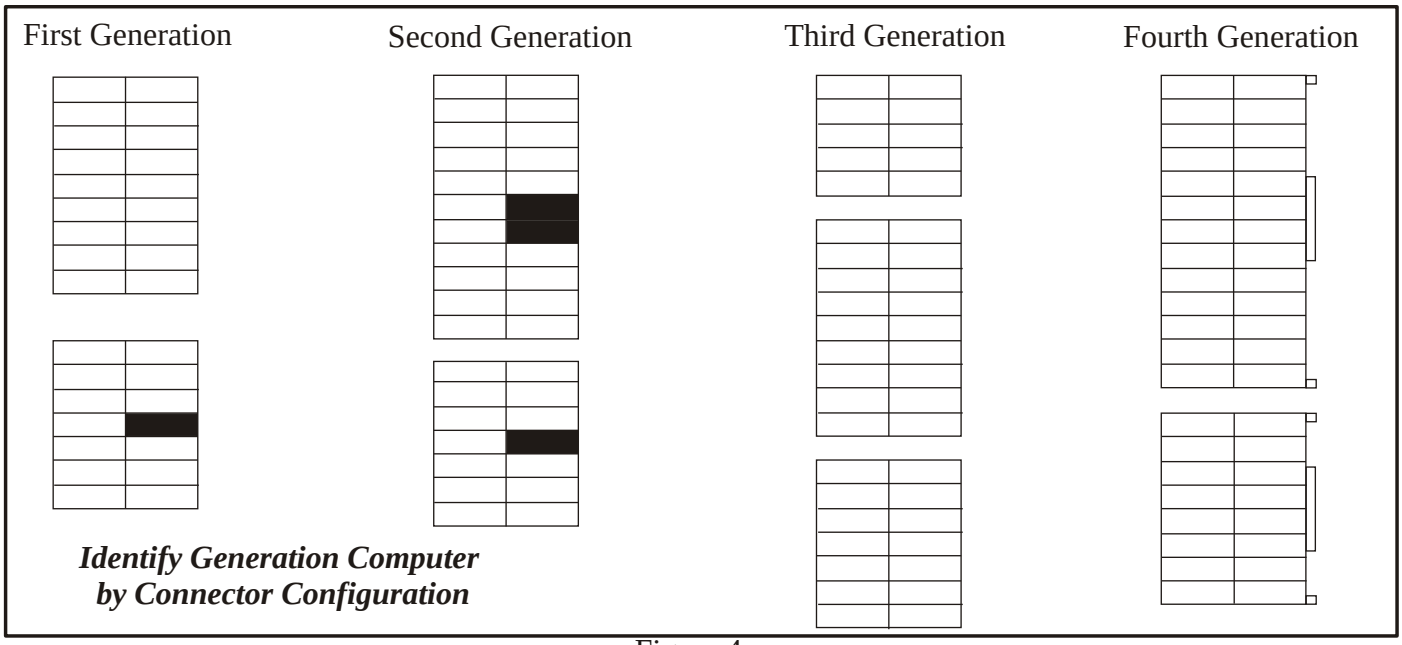


Figure 4

HYUNDAI A4AF3/A4BF2
PRELIMINARY INFORMATION

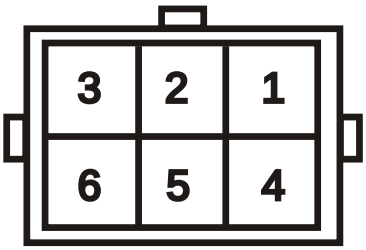
Since model year 2000 Hyundai has been using a new transaxle in the Accent, Elantra, and Tiburon. It is the A4AF3 for use with 1.5L engines, and the A4BF2 for use with 2.0L engines. These transaxles are almost identical to the A4AF1 and A4AF2 with several major exceptions. The A4AF1 and A4AF2, as well as the new A4AF3 and A4BF2 are almost identical to the KM series except that they are "backwards."

The big change is the addition of two solenoids (see Figure 4 for solenoid locations), a handful of valves, and an accumulator for the Forward (Rear) clutch. One of the solenoids is Pressure Control Solenoid B (PCSVB). The EPC is now referred to as Pressure Control Solenoid A (PCSVA). PCSB now directly controls the application of the Direct (Front) clutch/servo release circuit. The other new solenoid is Shift Control Solenoid C (SCSVC). When in first or second gear pressure to the servo apply side is controlled by PCSA as it has always been. For third and fourth gears SCSC causes full line pressure to remain on the apply side of the servo all the time, including during the shift. This gives PCSB far greater control over the direct clutch apply timing. This should take care of 2-3 flares, 4-3 bumps, delayed reverse engagement, and other timing issues related to the direct clutch. The new valves are only to support the new solenoid scheme. They are the Fail Safe Valve, the Control Switch Valve, and the High-Low Pressure Valve. The check balls remain the same as other KM style units.

With the addition of the new solenoids comes changes to the Diagnostic Trouble Codes. Although not as generalized as a code P1750 (Solenoid Pack Fault), the new codes do not specify if a solenoid circuit is open or shorted. It does specify which solenoid though. P0760 indicates a fault in the SCSC solenoid circuit, and P0765 is for the PCSB. Both will cause the MIL to light and a failsafe condition. See Figure 3 for a complete code list. The pin on the diagnostic connector used to manually retrieve codes with an analog voltmeter has moved to pin 1 (see Figure 5).

In addition to the code changes, changes were also made to the pinouts to accommodate the two new wires. The case connector is now six pins (See Figure 1). The computer appears identical to a fourth generation KM computer, but the pin assignments have changed (see Figure 2).

One other note. The A4AF3 and A4BF2 do still have creep mode, but there is no longer a separate switch to control it. Creep mode is now controlled by the computer using the TPS and VSS inputs. Further, the TPS signal is now routed THROUGH the ECM rather than being split to both the TCM and the ECM.



PIN #	ACCENT PINS	ACCENT WIRE	ELANTRA TIBURON	ELANTRA WIRE	TIBURON WIRE
1	SCSV-C	RED	DCCSV	BLU	BLU/YEL
2	PCSV-A	BRN	SCSV-A	PNK/WHT	GRN
3	PCSV-B	BLU/BLK	SCSV-B	BLU/WHT	BLU/BLK
4	SCSV-B	BLU	PCSV-B	RED/WHT	RED
5	SCSV-A	GRN/WHT	PCSV-A	YEL/BLK	YEL
6	DCCSV	WHT	SCSV-C	RED	RED/WHT

CASE CONNECTOR PINOUT AND VEHICLE WIRING HARNESS WIRE COLOR

Figure 1

HYUNDAI A4AF3/A4BF2

PRELIMINARY INFORMATION

***EPC-A (PCSVA)	14	1	Lockup Solenoid (DCCSV)
***EPC-B (PCSVB)	15	2	Shift Sol B (SCSVB)***
***Shift Sol A (SCSVA)	16	3	Shift Sol C (SCSVC)***
***NC	17	4	MIL Request Line
***Torque Red Req	18	5	ROM Pack Ctrl ***
NC	19	6	NC
***NC	20	7	Kickdown Servo Switch
TPS (via ECM)	21	8	A/C Switch
NC	22	9	K-Line (Diagnostic)
TFT Ground	23	10	NC
TFT Signal	24	11	L-Line (Diagnostic)
On with Ign	25	12	On with Ign
Ground	26	13	Ground

Battery	9	1	Park
VSS	10	2	Reverse
Pulse Generator B	11	3	Neutral
Pulse Generator B	12	4	Drive
Pulse Generator A	13	5	Second
Pulse Generator A	14	6	Low
Ground	15	7	O/D Enable
Tach (RPM)	16	8	NC

***** Indicates pins which have changed function from KM computer**

COMPUTER PINOUT

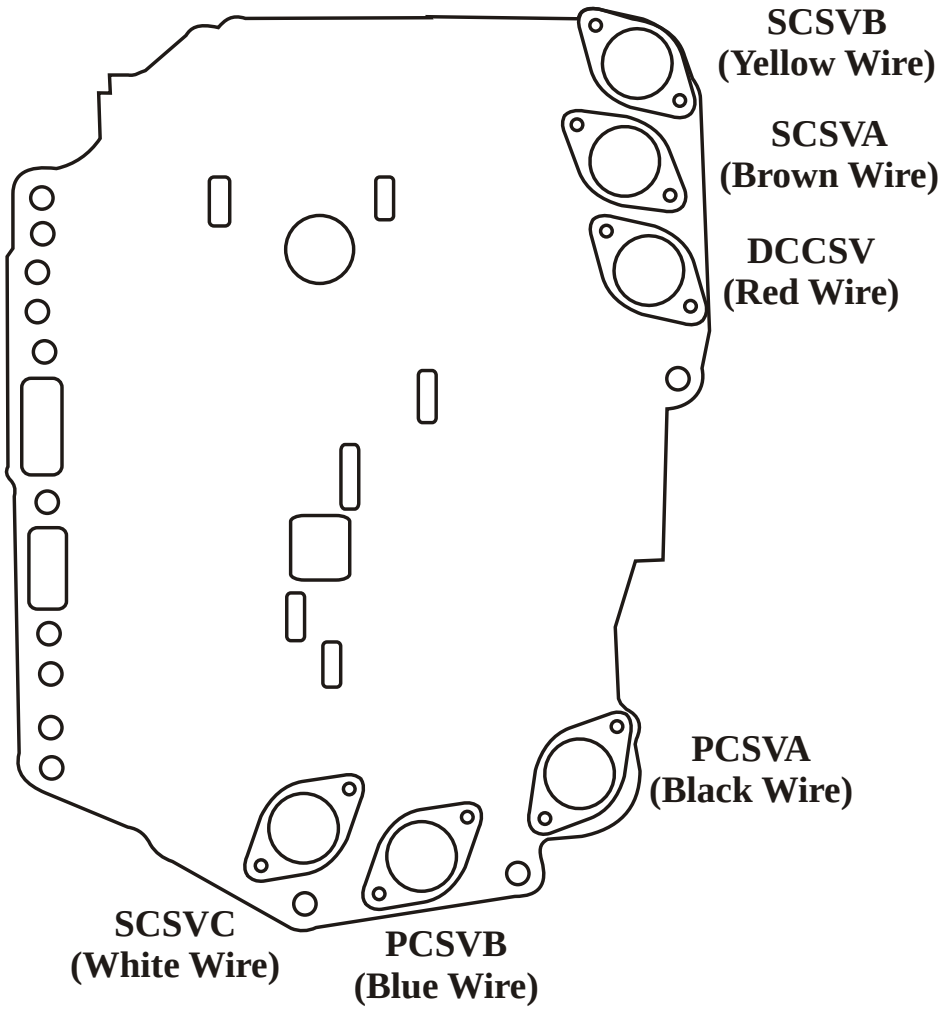
Figure 2

	ERROR CODES
P1703	TPS OPEN OR SHORTED
P0712	TFT OPEN CIRCUIT
P0713	TFT SHORT CIRCUIT
P1709	KICKDOWN SERVO SWITCH (SERVO COVER) OPEN OR SHORTED
P0707	LOSS OF ENGINE RPM SIGNAL
P0717	LOSS OF SIGNAL FROM PULSE GENERATOR A (END CLUTCH)
P0722	LOSS OF SIGNAL FROM PULSE GENERATOR B (DIFFERENTIAL)
P0750	SCSV-A OPEN OR SHORTED
P0755	SCSV-B OPEN OR SHORTED
P0760	SCSV-C OPEN OR SHORTED
P0707	PRNDL SWITCH OPEN CIRCUIT
P0708	PRNDL SWITCH SHORT CIRCUIT
P0745	PCSV-A OPEN OR SHORTED
P0765	PCSV-B OPEN OR SHORTED
P0743	DCCSV OPEN OR SHORTED
P0740	LOCKUP STUCK ON
P1744	SLIPPING OR ABNORMAL VIBRATION IN LOCKUP
P0731	SLIPPING OR INCORRECT RATIO WHEN COMMANDING FIRST GEAR
P0732	SLIPPING OR INCORRECT RATIO WHEN COMMANDING SECOND GEAR
P0733	SLIPPING OR INCORRECT RATIO WHEN COMMANDING THIRD GEAR
P0734	SLIPPING OR INCORRECT RATIO WHEN COMMANDING FOURTH GEAR
P1765	TORQUE REDUCTION REQUEST SIGNAL LINES (FROM TCM TO ECM)
P1766	TORQUE REDUCTION EXECUTION SIGNAL LINES (FROM ECM TO TCM)

Figure 3

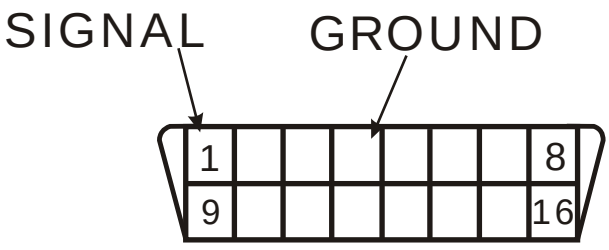
HYUNDAI A4AF3/A4BF2

PRELIMINARY INFORMATION



SOLENOID LOCATIONS

Figure 4

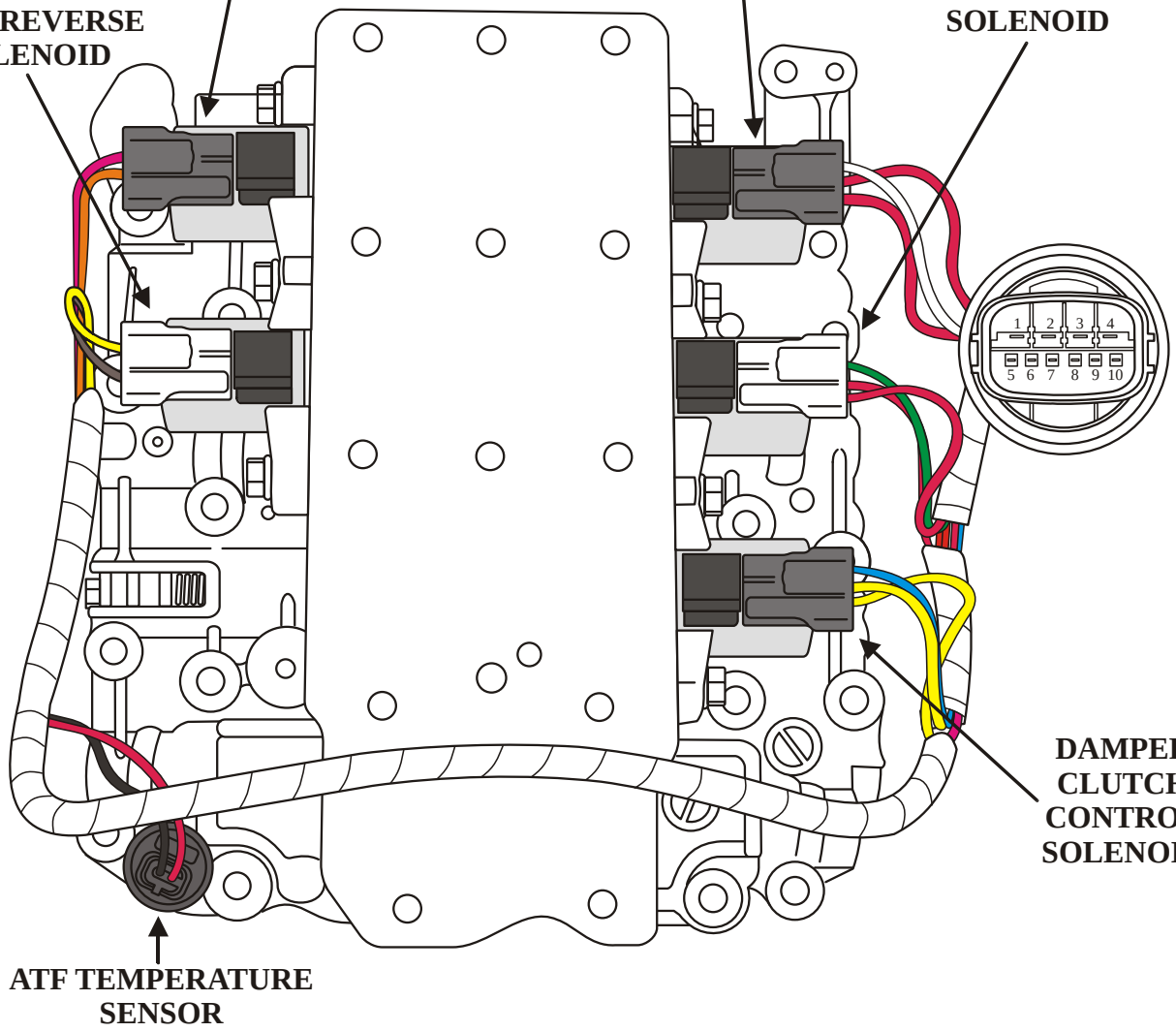


MANUAL TROUBLE CODE RETRIEVAL

Figure 5

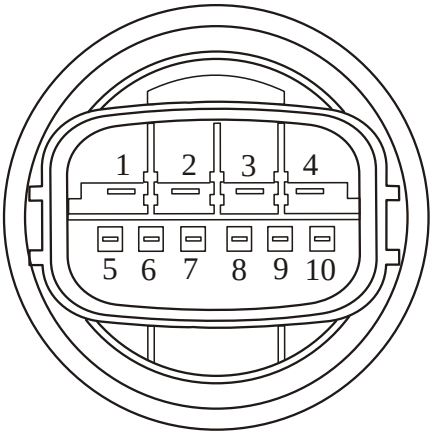
MITSUBISHI
F4A-41/42/51 SERIES TRANSAXLES
BENCH CHECKS

SOLENOID AND A.T.F. TEMP. SENSOR LOCATIONS



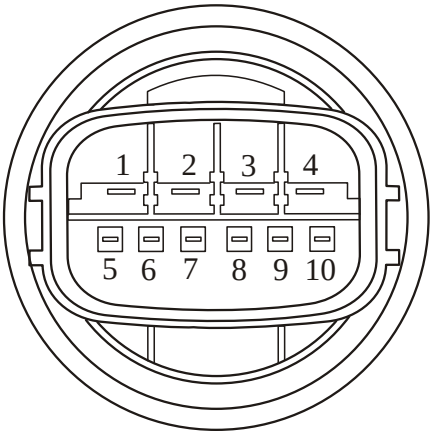
MITSUBISHI
F4A-41/42/51 SERIES TRANSAXLES

CASE CONNECTOR
TERMINAL LAYOUT AND DESIGNATIONS



TERMINAL NUMBER	WIRE COLOR	TERMINAL DESIGNATION
Terminal 1.	Yellow Wire	Power to T.C.C.. And L/R Sol.
Terminal 2.	Red Wire	Power to UD/2nd./OD Sol.
Terminal 3.	BLANK	BLANK
Terminal 4.	Blue Wire	Ground Wire T.C.C Sol.
Terminal 5.	Brown Wire	Ground Wire L/R Sol.
Terminal 6.	Orange Wire	Ground Wire OD Sol.
Terminal 7.	Green Wire	Ground Wire 2nd. Sol.
Terminal 8.	White Wire	Ground Wire UD. Sol.
Terminal 9.	Black Wire	Ground Wire ATF Temp. Sensor
Terminal 10.	Red Wire	Power to ATF Temp. Sensor

MITSUBISHI
F4A-41/42/51 SERIES TRANSAXLES



SOLENOID AND ATF TEMP. SENSOR RESISTANCE CHECKS

TERMINAL NUMBERS	ITEM CHECKED	INTERNAL WIRE COLOR	CONNECTOR COLOR	RESISTANCE
Terminals 1 and 4.	TCC Solenoid	Blue/ Yellow and Yellow	Black	Approximately 3.6 Ohms @ 72 °
Terminals 1 and 5.	L/R Solenoid	Brown and Yellow	White	Approximately 3.6 Ohms @ 72 °
Terminals 2 and 6.	OD Solenoid	Orange and Red	Black	Approximately 3.6 Ohms @ 72°
Terminals 2 and 7.	2nd. Solenoid	Green/Red and Red	White	Approximately 3.6 Ohms @ 72 °
Terminals 2 and 8.	UD Solenoid	White/Red and Red	Black	Approximately 3.6 Ohms @ 72 °
Terminals 9 and 10.	ATF Temp. Sensor	Orange and Red	Black	Approximately 9.05 k. Ohms @ 72°

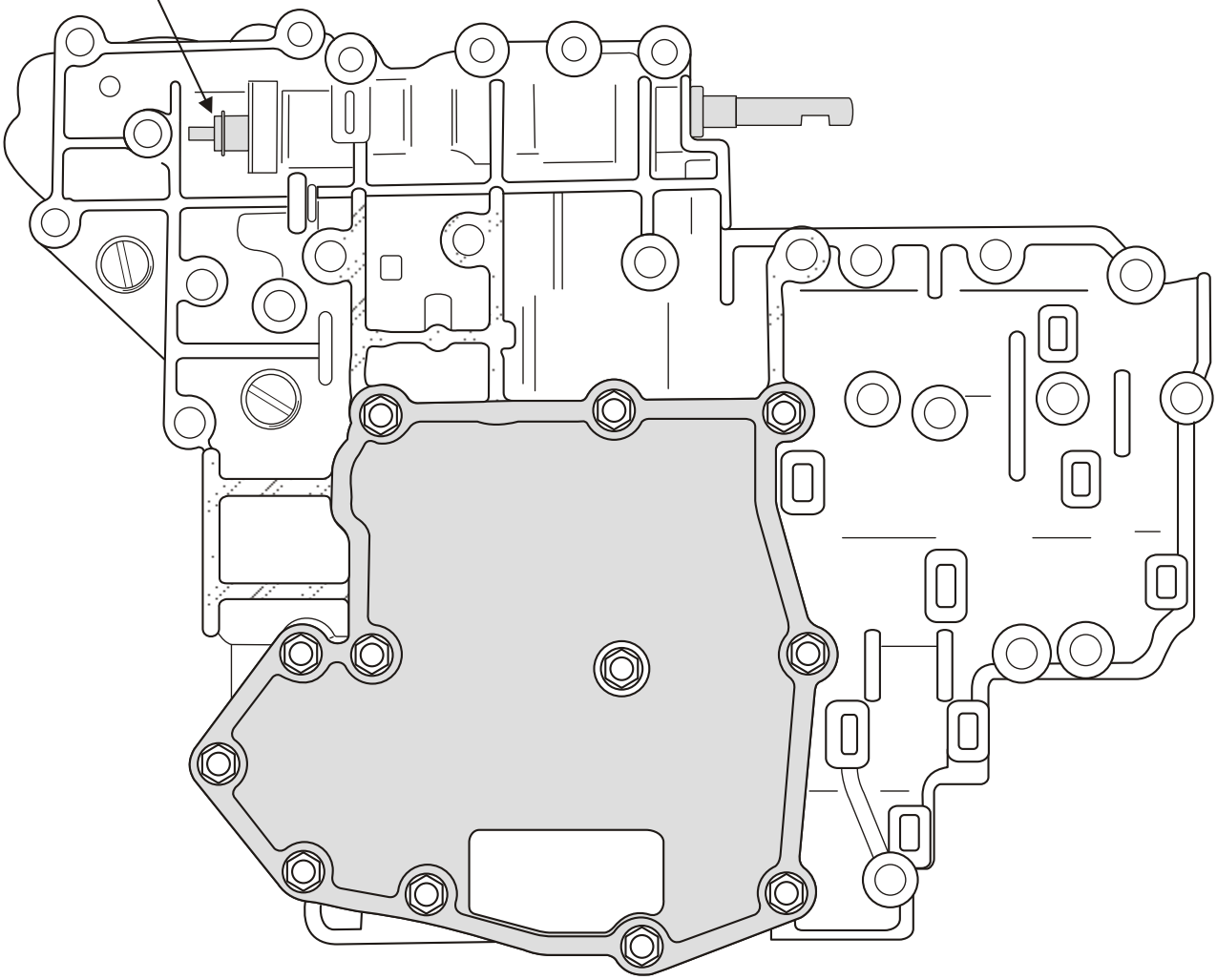
NISSAN RL4FO3A/V
WON'T UP-SHIFT WHEN WARM

COMPLAINT: Before or after an overhaul, a vehicle equipped with the RL4FO3A/V transaxle exhibits a no up-shift condition after warm-up.

CAUSE: One cause may be the throttle valve in the valve body assembly is becoming stuck, or sucked in hydraulically. It may be noticed that when this condition occurs, the throttle cable located by the throttle body shows excessive slack when examined.

CORRECTION: This condition is fairly simple to correct, as valve body removal is generally not needed. Remove the transmission oil pan and slide a 350/700 governor spring over the stem on the back side of the throttle valve as shown in Fig. 1.

Note throttle valve stuck in the full throttle position.



To correct this problem push a 350/700 governor spring onto the stem at the back of the TV valve.

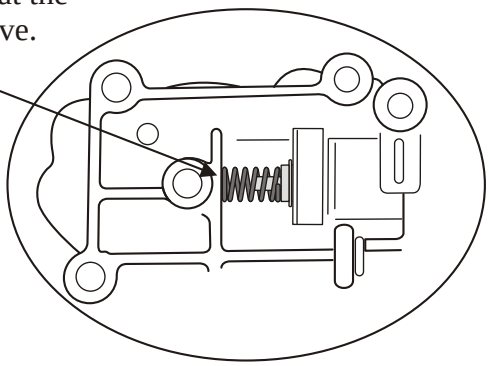


Figure 1

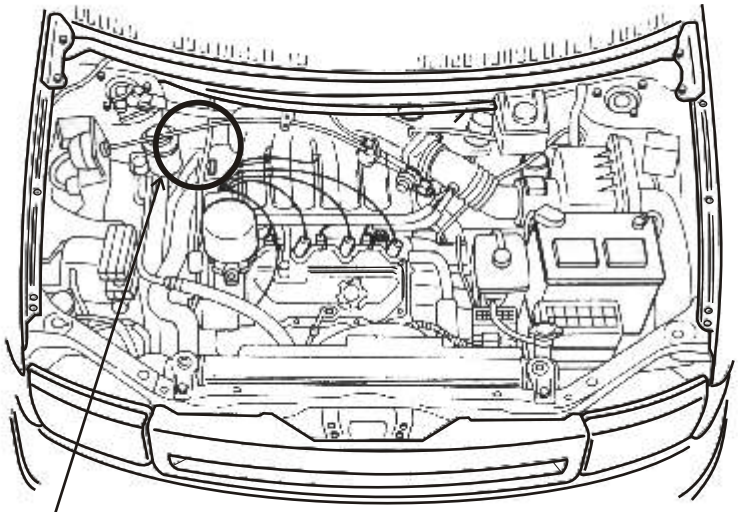
NISSAN QUEST/MERCURY VILLAGER
HARNESS FATIGUE

COMPLAINT: Persistent Throttle Position and/or Vehicle Speed Sensor codes. This complaint may also be accompanied with stored Air Flow Meter or EGR sensor codes in the engine computer. Intermittent Inhibitor Switch malfunctions may also be noticed.

CAUSE: Lower engine mounts have been known to soften or break allowing excessive engine rotation with increased torque. If this engine rotation condition is permitted to continue over a lengthy period of time, it allows for a junction in an engine compartment wiring harness containing the TPS, VSS, EGR, AFM and Inhibitor Switch wiring circuits to flex on a frequent basis (See Figure 1). As a result, these wires become fatigued and compromised producing erratic and chronic faults.

CORRECTION: Repair the mounts and the damaged wire or wires related to the complaint.

HARNESS FATIGUE



WIRING HARNESS FLEXES IN THIS LOCATION

TPS, VSS, INHIBITOR SWITCH AIR FLOW AND EGR SENSOR CONNECTORS

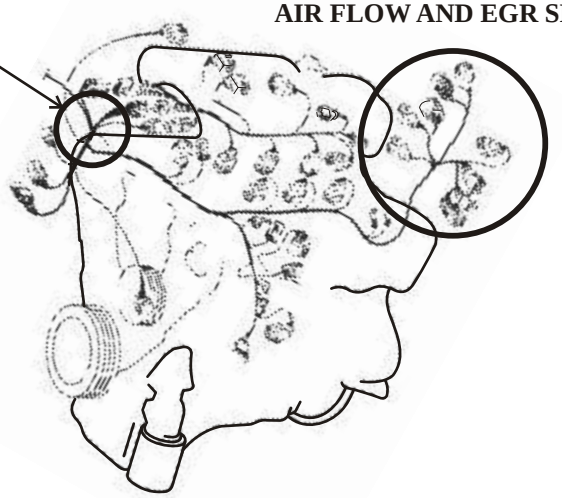


Figure 1

Wesco

TOYOTA 341E
VOLVO AW 30-40, 30-43LE

VALVE BODY IDENTIFICATION

COMPLAINT: The 341E type of valve bodies that are in various Toyota, Lexus and Volvo models appear very similar, but are very different and are not interchangeable.

CAUSE: The reason for this is that two of the valve bodies have four solenoids but only one has provisions for a throttle cable. The other valve body has five solenoids and no throttle cable. In addition to that, the solenoids may appear the same, but one controls line pressure while the other controls accumulator back pressure.

CORRECTION: The valve body in figure 1 is the 1993-97 Volvo 960 and 1997-98 S90 and V90 AW30-43LE which identifies the solenoids, checkball and small parts locations. These vehicles use a separate TCM to control the transmission.

The valve body in figure 4 is the 1993-98 Toyota Supra Turbo with the 2JZ-GTE engine only, 1998 Supra Non-Turbo and 1998-00 Lexus SC300. These vehicles use a PCM to control the transmission and the engine.

The valve body in figures 5, 6 and 7 is the Lexus 341E version which can be found various Lexus models from 1991-1997. Figures 5, 6 and 7 identify the solenoids, checkball and small parts location. This valve body also has four solenoids but uses a throttle cable for line pressure control. A PCM is used to control the transmission and the engine.

NOTE: All of the transmissions that use the above described valve bodies all have an Overdrive Direct Clutch Drum Speed Sensor.

VOLVO AW30-43, NO TV CABLE, 4 SOLENOIDS

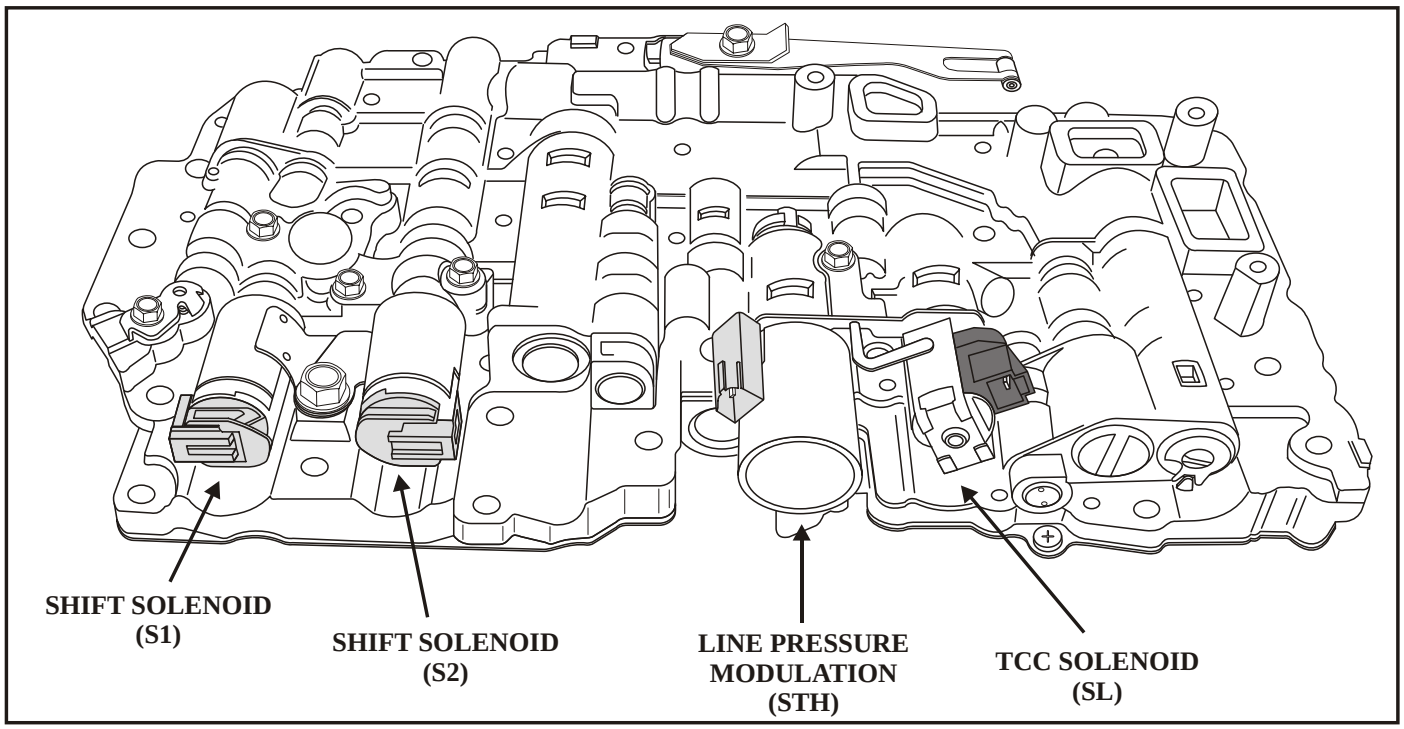


Figure 1

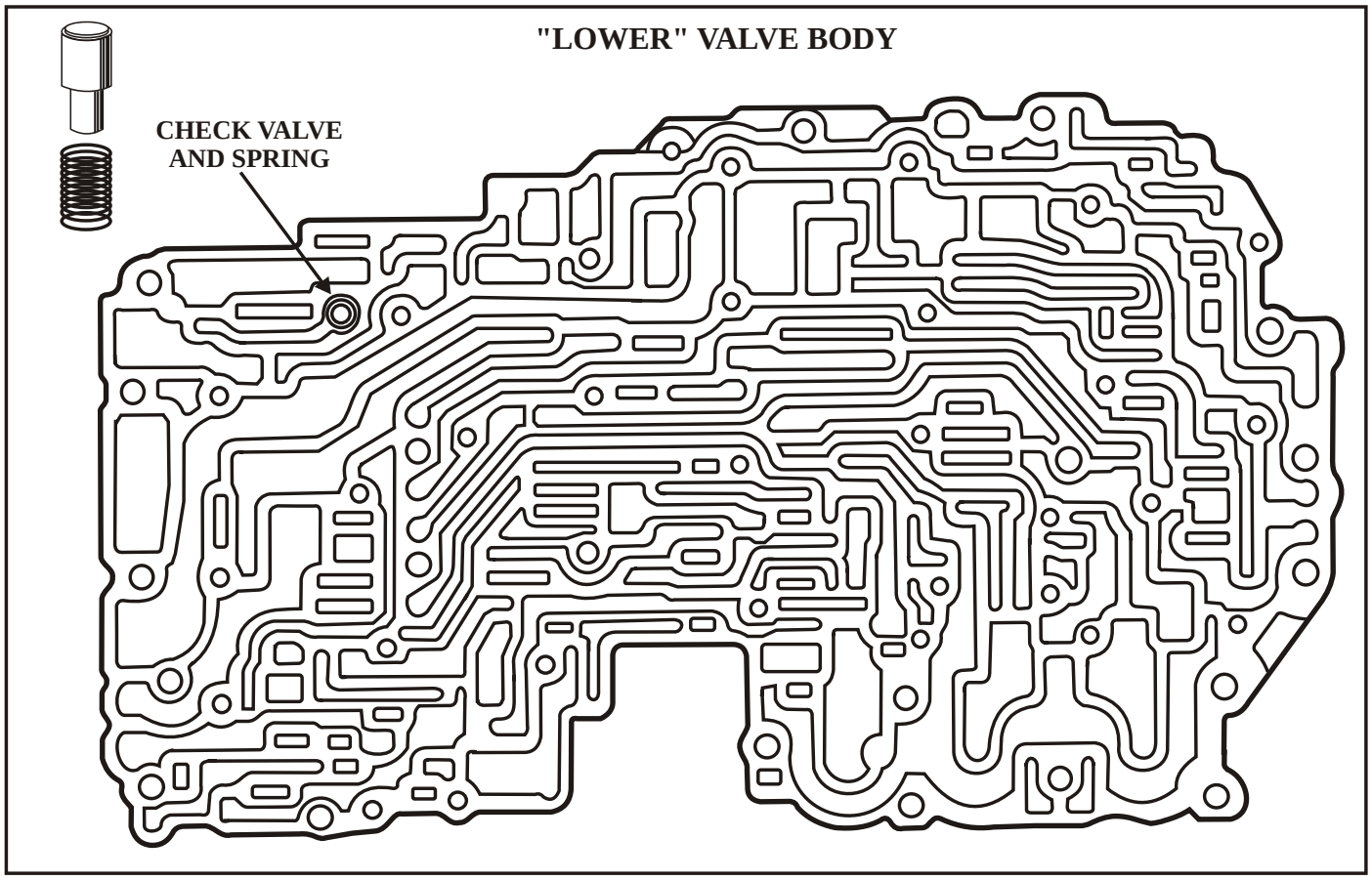


Figure 2

VOLVO AW30-43, NO TV CABLE, 4 SOLENOIDS

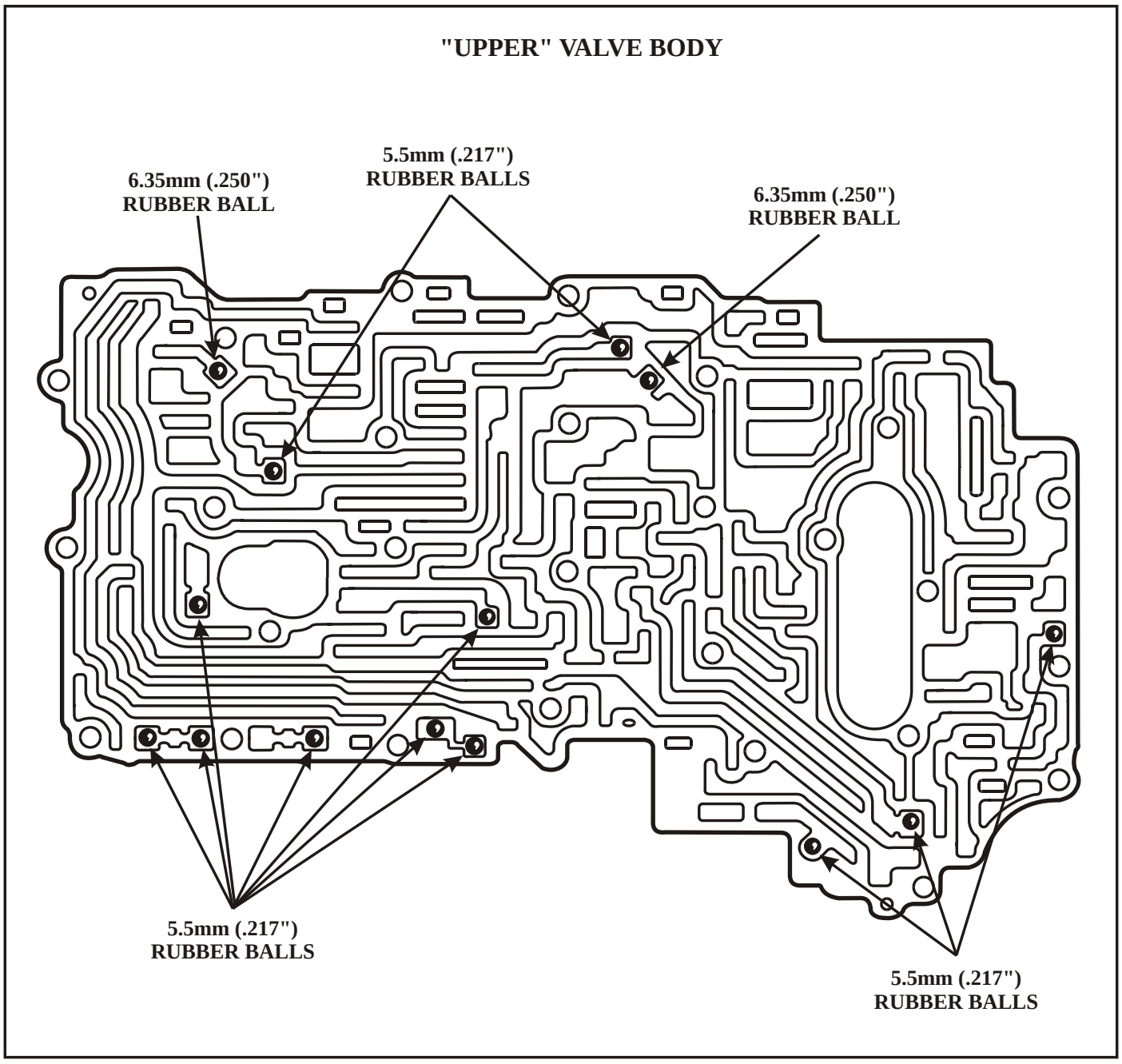
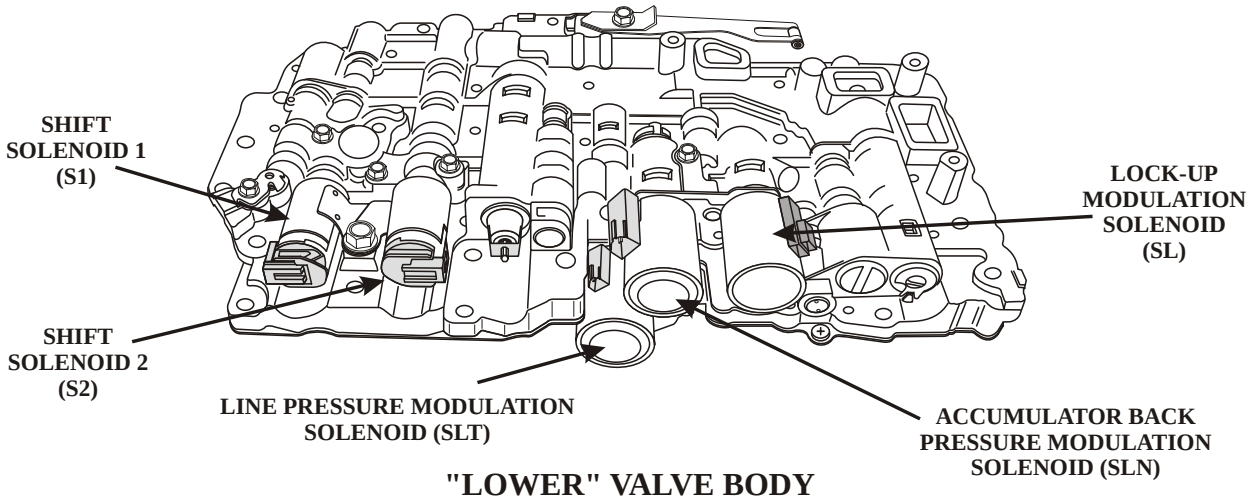
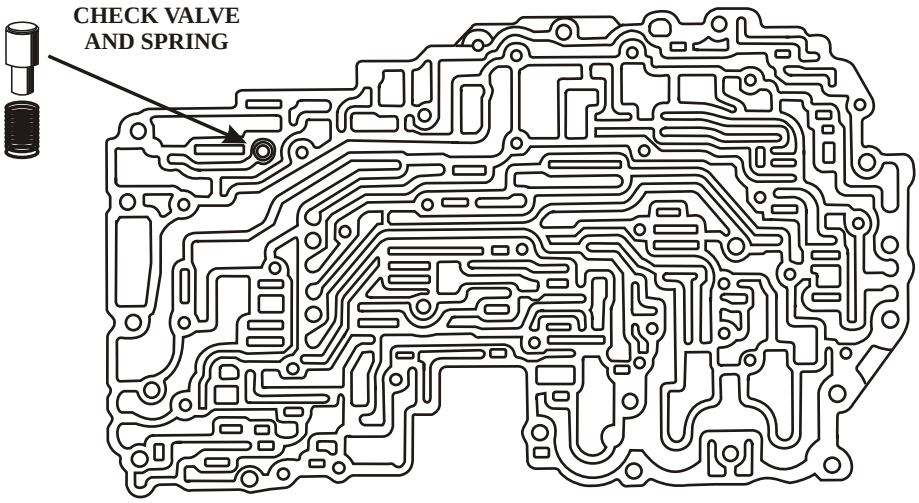


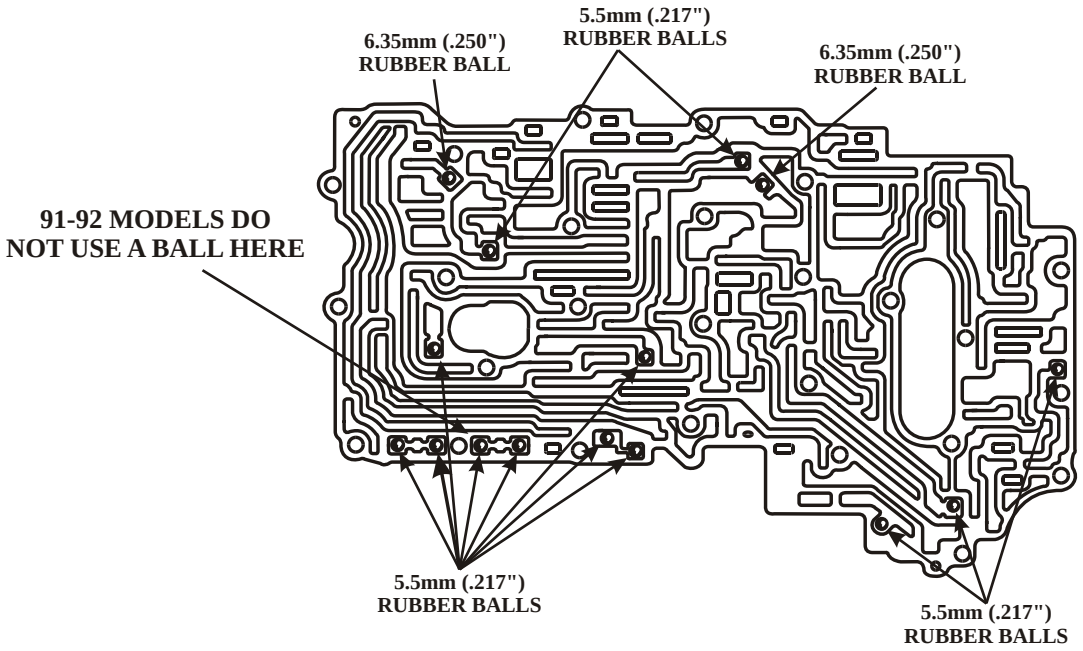
Figure 3

TOYOTA SUPRA 341E WITH 2JZ-GTE ENGINE
NO TV CABLE, 5 SOLENOIDS



"LOWER" VALVE BODY





"UPPER" VALVE BODY

Figure 4

LEXUS 341E, WITH TV CABLE, 4 SOLENOIDS

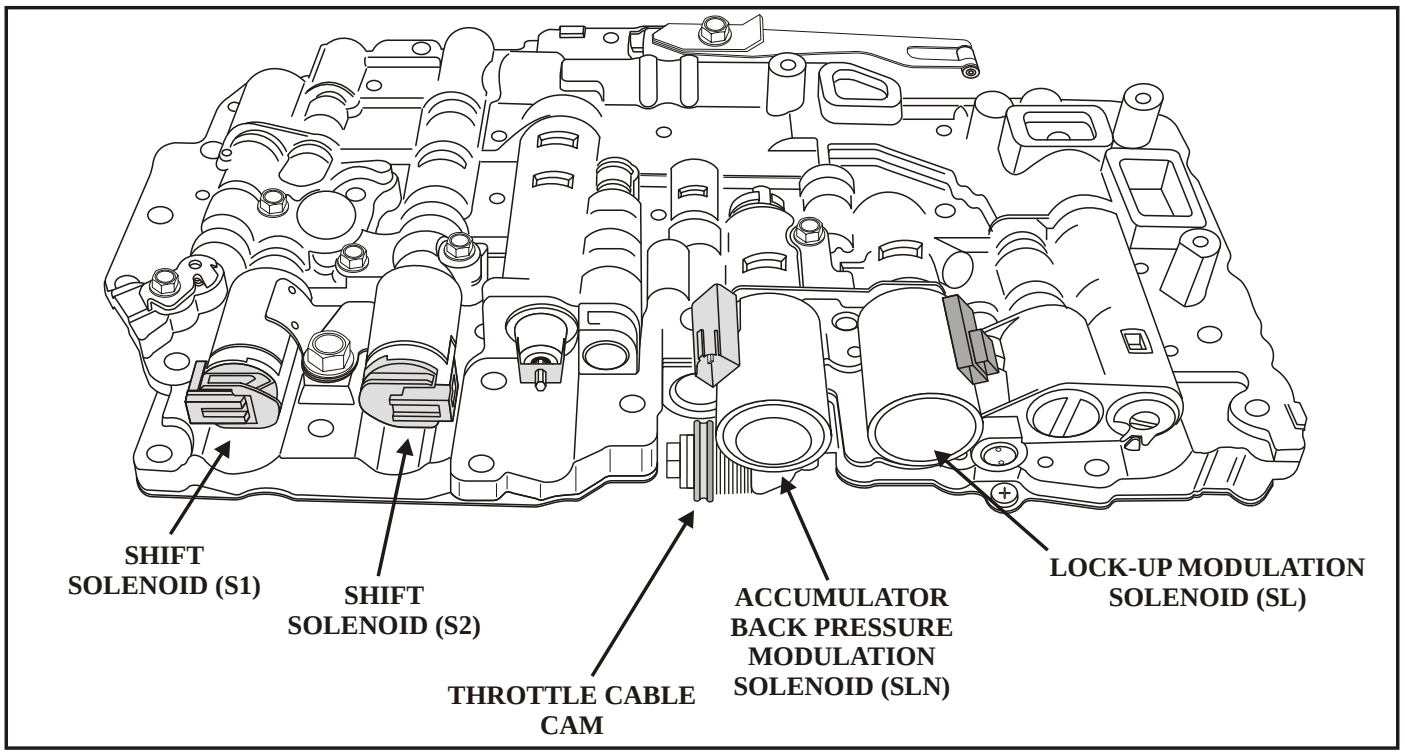


Figure 5

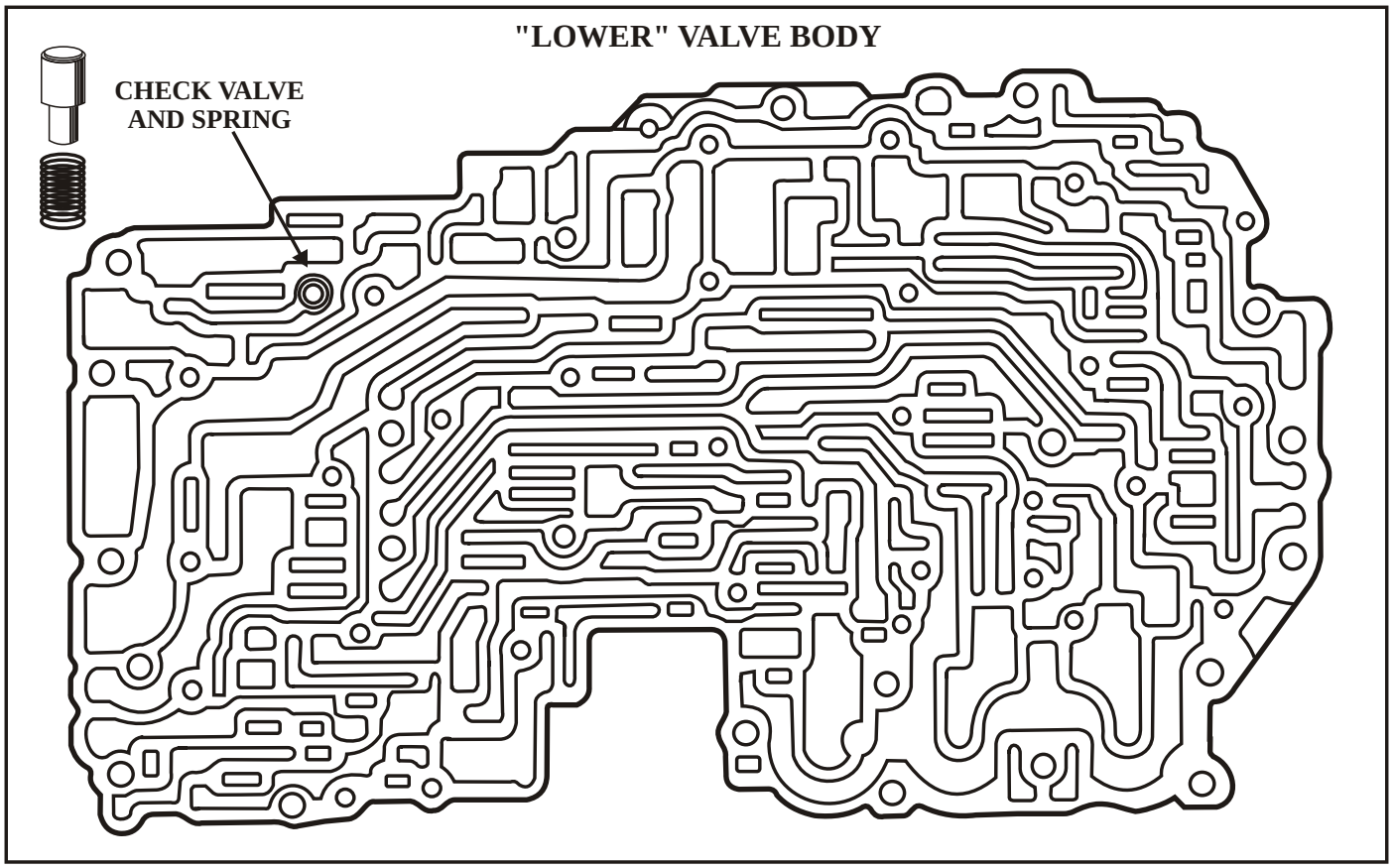


Figure 6

LEXUS 341E, WITH TV CABLE, 4 SOLENOIDS

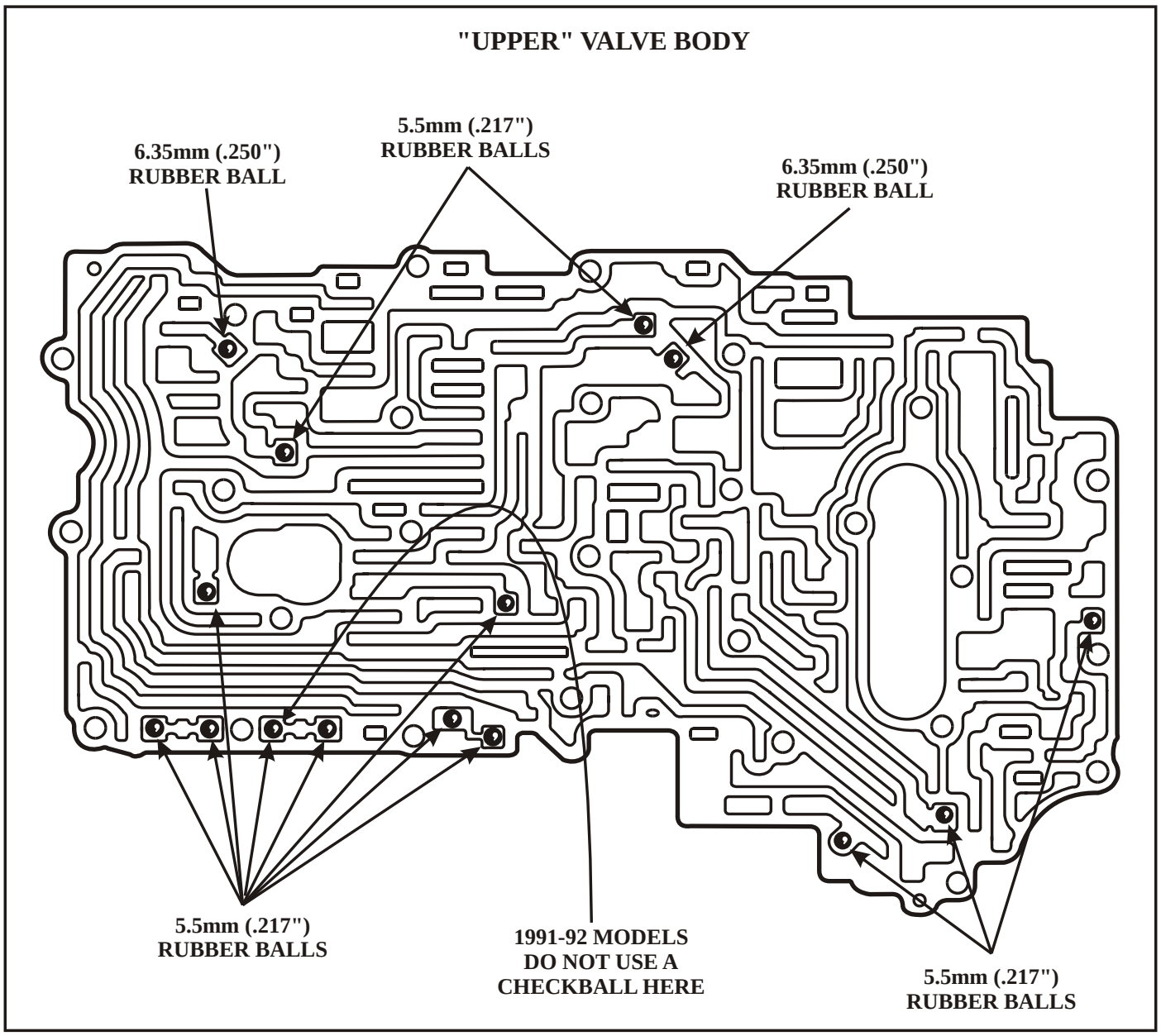


Figure 7

Raybestos

TTXE

Lubegard