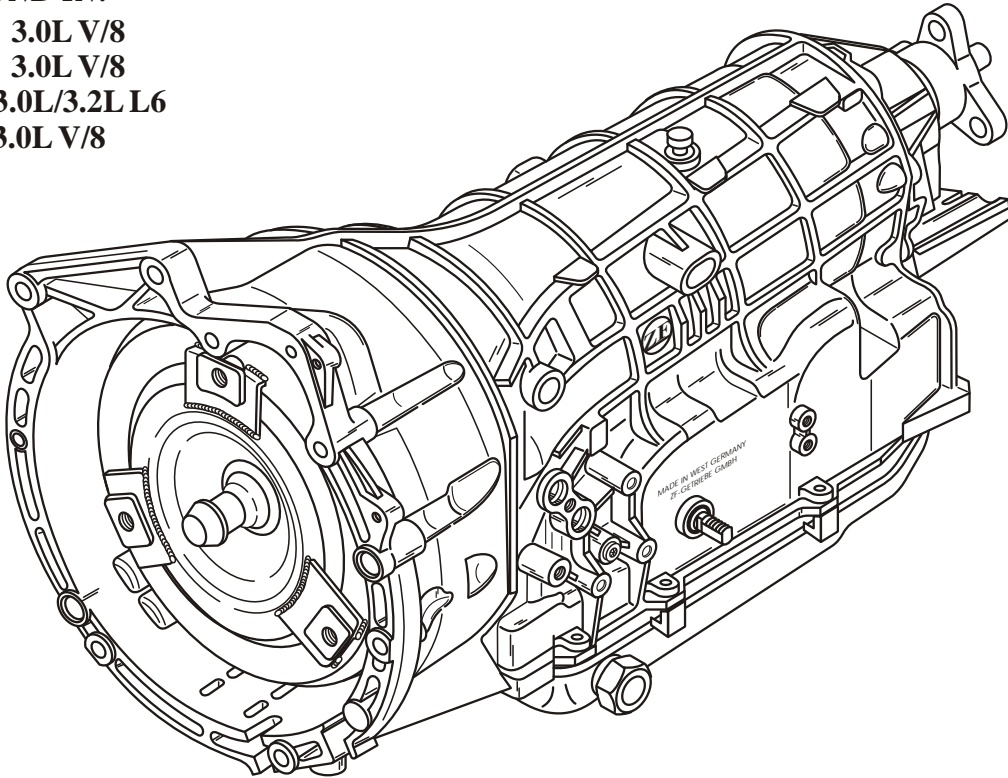


BMW ZF-5HP-18 PRELIMINARY INFORMATION

FOUND IN:

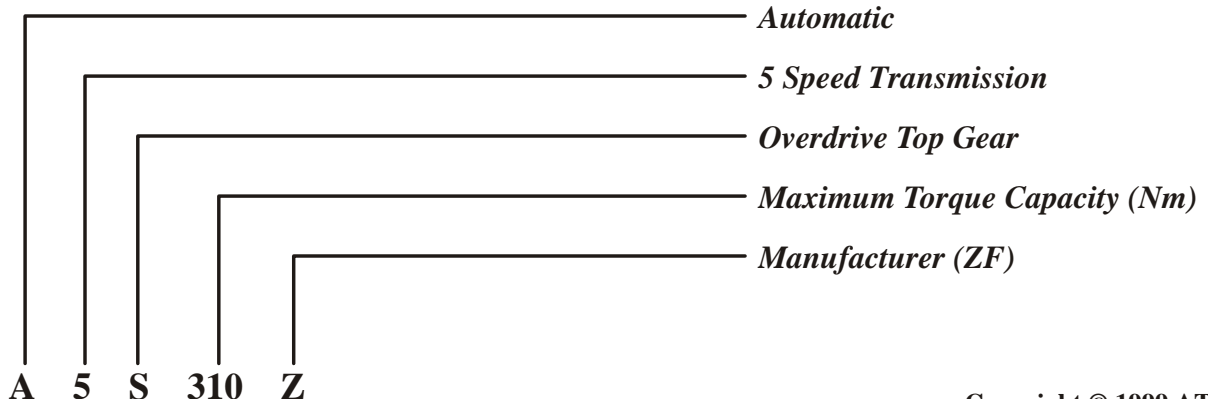
93-94 320i 3.0L V/8
93-95 530i 3.0L V/8
95-98 M3 3.0L/3.2L L6
730 3.0L V/8



This transmission is manufactured in Germany by ZF and carries the BMW designation A5S 310Z.

The A5S 310Z (ZF-5HP-18) is an electronically controlled, five speed automatic transmission with a lock-up clutch type torque converter. Two planetary gear sets, one Ravigneaux gear set and one standard planetary gear set on the output side, four rotating multiple disc clutches, three multiple disc brake clutches, one brake band, and two sprag clutches (Freewheels) are used to provide the five forward speeds and reverse.

Key to designation:



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Figure 1



Technical Service Information

Refer to Figure 2 for Clutch and Band Application Chart.

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

Refer to Figure 4 for both MV Solenoid Operation and EDS Solenoid Operation and Tests.

Refer to Figure 5 for Shift Solenoid Application chart and their locations. Notice that the MV 6 Solenoid is used only for Converter Clutch application and that it is identified by a White connector on the solenoid, where all the others are Black. Notice also that EDS 1 Solenoid is used for line pressure control. MV 4 and MV 5 Solenoids are used only for downshifts.

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

Refer to Figure 7 for identification and internal components resistance chart.

Refer to Figure 8 and 9 for retrieving trouble codes and the Trouble Code charts.

Refer to Figure 10 for Solenoid and Sensor resistance chart with the pins identified for both the case connector and the Transmission Control Unit connector.

Refer to Figure 11 for case passage identification to air check this unit before installation of the valve body assembly.

Refer to Figure 12 for pressure tap locations on the case, and notice that some cases you must drill and tap for access to a particular pressure.

Refer to Figure 13 for exploded view of the Upper Front Valve Body with valves identified.

Refer to Figure 14 for speed sensor locations on the channel plate.

Refer to Figure 15 for exploded view of the Solenoid Valve Body with valves identified. Notice that there is an "O" ring on the adjustment screw that goes in the groove.

Refer to Figure 16 for exploded view of the Lower Rear Valve Body with the valves identified.

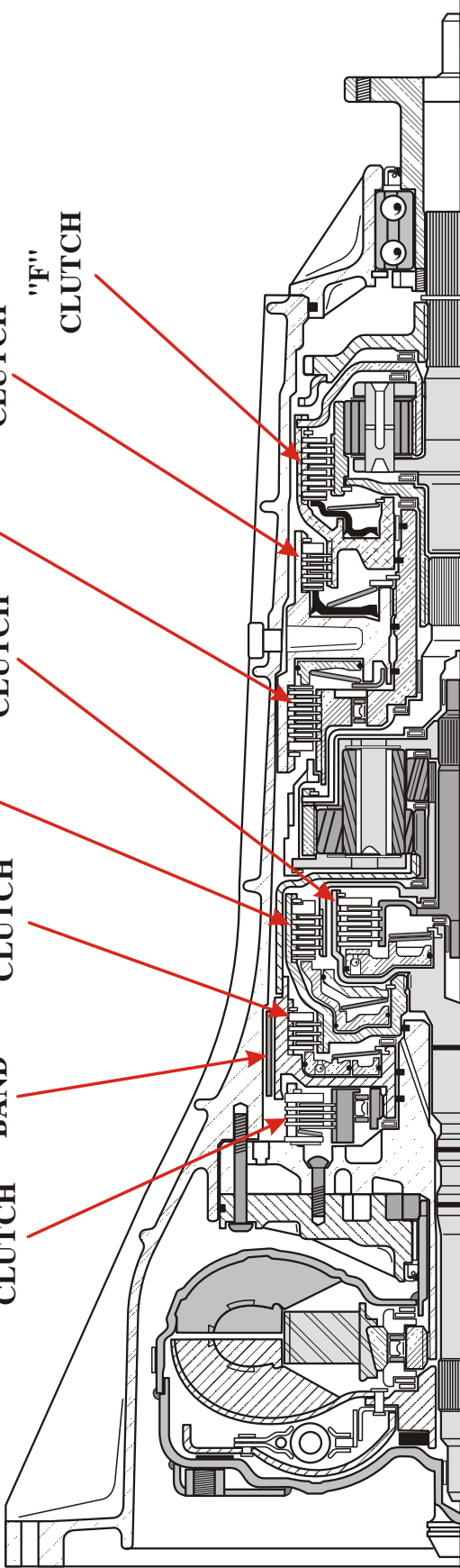
Refer to Figure 17 for exploded view of the Lower Front Valve Body with the valves identified.

Refer to Figures 18 thru 21 for the retaining clip locations in the various valve bodies.

Refer to Figure 22 for the locations of the orifices, checkballs, screens, and the check valves and springs that are located in the channel plate.

CLUTCH AND BAND APPLICATION CHART

"C1" CLUTCH
"C2" BAND
"B" CLUTCH
"A" CLUTCH
"D" CLUTCH
"E" CLUTCH
"G" CLUTCH
"F" CLUTCH



| RANGE | "A" CLUT | "B" CLUT | "C1" CLUT | "C2" BAND | "INT" SPRAG | "D" CLUT | "LOW" SPRAG | "E" CLUT | "F" CLUT | "G" CLUT | CONV CLUT | GEAR RATIO |
|---------|---|----------|-----------|-----------|-------------|----------|-------------|----------|----------|----------|-----------|------------|
| Park | | | | | | | | | | ON | | |
| Reverse | | ON | | | | ON | | | | ON | | 4.08 |
| Neutral | | | | | | | | | | ON | | |
| "D"-1st | ON | | | | | | HOLD | | | ON | | 3.66 |
| "D"-2nd | ON | | ON | ON | HOLD | | | | | ON | | 1.99 |
| "D"-3rd | ON | | ON | ON | HOLD | | | | ON | | * | 1.40 |
| "D"-4th | ON | | ON | | | | | ON | ON | | * | 1.00 |
| "D"-5th | | | ON | ON | | | | ON | ON | | * | 0.74 |
| "4" | Same as above, Automatic Shift 1st thru 4th, 5th gear is inhibited. | | | | | | | | | | | |
| "3" | Same as above, Automatic Shift 1st thru 3rd, 4th and 5th gear are inhibited. | | | | | | | | | | | |
| "2" | Same as above, Automatic Shift 1st thru 2nd, 3rd, 4th and 5th gear are inhibited. | | | | | | | | | | | |

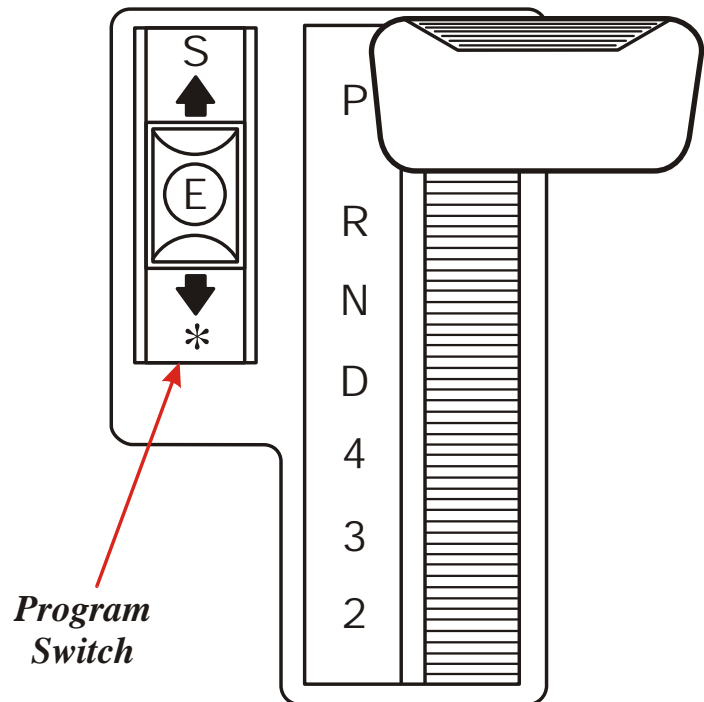
*Converter Clutch may be ON or OFF depending on vehicle speed and throttle position.

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Figure 2

SELECTOR LEVER

- P = Park
- R = Reverse
- N = Neutral
- D = Automatic Shift 1st thru 5th gear.
- 4 = Automatic Shift 1st thru 4th gear.
5th gear is locked out.
- 3 = Automatic Shift 1st thru 3th gear.
4th and 5th gear are locked out.
- 2 = Automatic Shift 1st thru 2th gear.
3rd, 4th and 5th gear are locked out.



The "Program Switch" can be used to select one of three programs.

E = **ECONOMY (Fuel Efficient Driving Style)**

The "E" program is activated every time the engine is started. Once the engine has been started, either Sport or Winter programs can be selected with the Program Switch. The transmission changes automatically from 1st thru 5th gear in any throttle position up to full throttle. When throttle position is in the kick-down range, the transmission changes automatically from 1st thru 4th gears. The change into 5th gear is a forced upshift and occurs just before engine speed reaches the upper limit for controlled cut-back.

S = **SPORT (Full Exploitation of Engine Performance)**

The "S" program is performance oriented and must be re-selected every time the engine is started. The transmission changes automatically from 1st thru 4th gear regardless of throttle position. The change into 5th gear is a forced upshift and occurs just before engine speed reaches the upper limit for controlled cut-back.

* = **WINTER (Manual Shifts)**

The "Winter" program provides manual shifts and is designed for situations of driving on snow or ice, driving on mountain roads or towing a trailer. The driver has the same free choice of gears as with a manual transmission, as the transmission remains in the gear selected with the selector lever. This makes it possible to utilize the engines full braking power. The transmission never changes into 1st or 5th gears in the "Winter" mode.

FAILSAFE OPERATION:

When a system fault is detected which would impair normal reliable operation, the transmission control module interrupts the power supply to Pin 13 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:

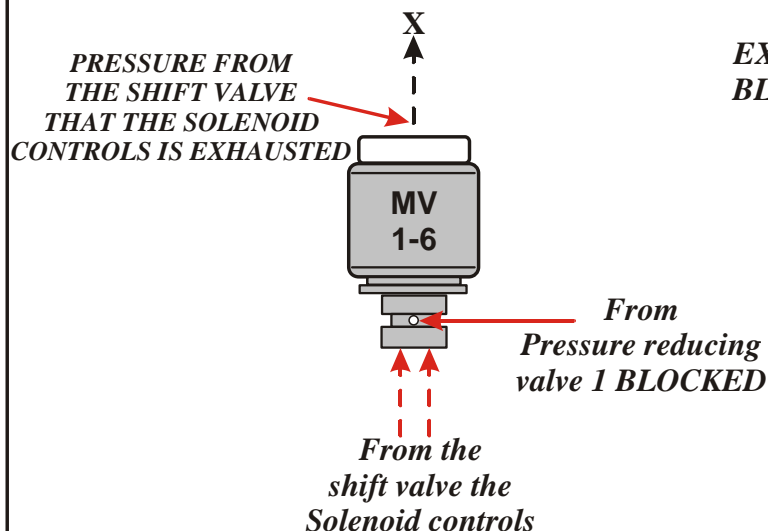
| <i>Selector Lever Position</i> | P | R | N | D | 4 | 3 | 2 |
|--------------------------------|---|---|---|---|---|---|---|
| <i>Actual Gear Obtained</i> | P | R | N | 4 | 4 | 4 | 4 |

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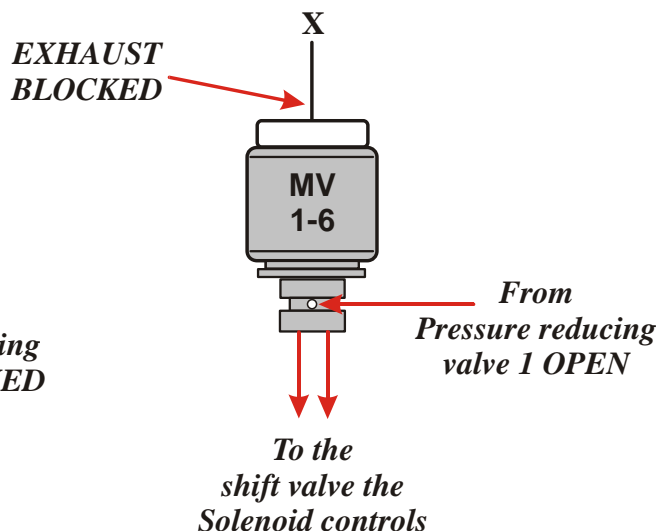
Figure 3

MV1-MV6

SOLENOID "OFF"



SOLENOID "ON"



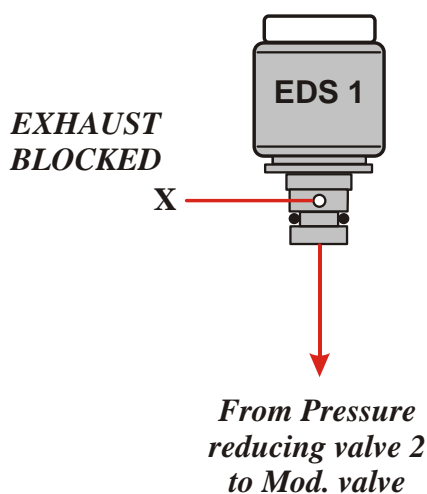
SUMMARY:

When MV 1 thru 6 is in the "OFF" state, Solenoid reducing pressure, from Pressure reducing valve 1, is blocked by the solenoid and oil pressure from the valve that the solenoid controls is exhausted at the rear of the solenoid.

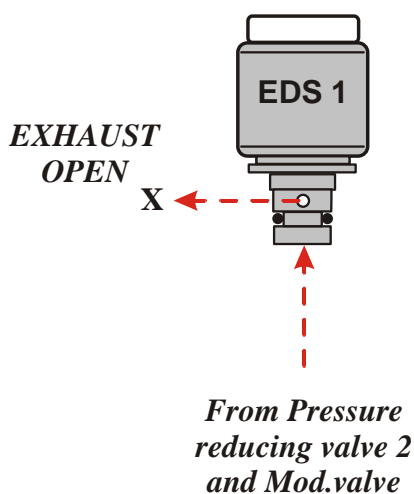
When MV 1 thru 6 is in the "ON" state, Solenoid reducing pressure, from Pressure reducing valve 1, is open through the solenoid and is applied to the valve that the solenoid controls. The exhaust at the rear of the solenoid is closed.

EDS 1

SOLENOID "OFF"



SOLENOID "ON"



SUMMARY:

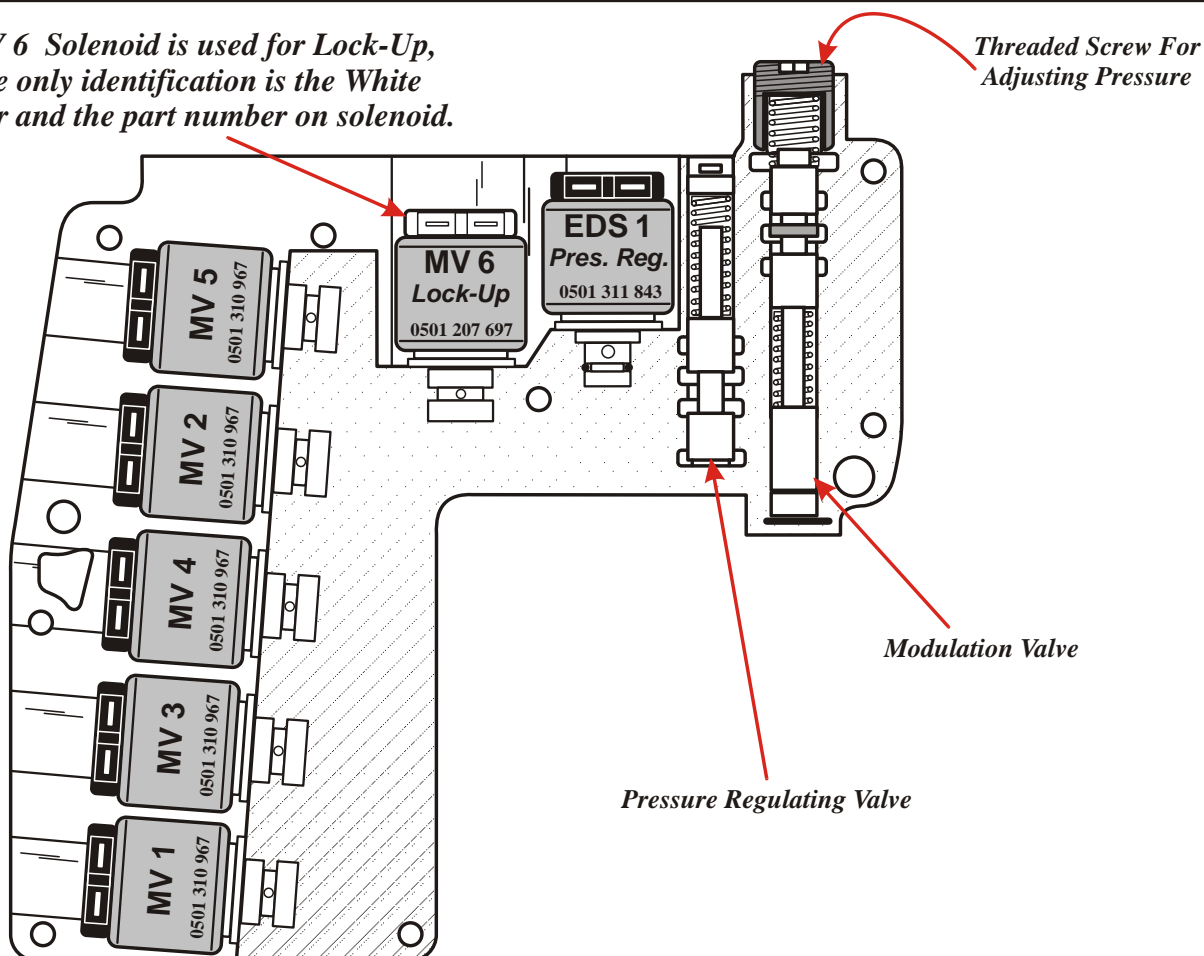
When EDS 1 solenoid is "OFF," solenoid reducing pressure, from Pressure reducing valve 2, is high to the Modulating valve which creates high line pressure.

When EDS 1 solenoid is "ON," solenoid reducing pressure, from Pressure reducing valve 2, is low to the Modulating valve which creates low line pressure.

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Figure 4

The MV 6 Solenoid is used for Lock-Up, and the only identification is the White connector and the part number on solenoid.



| RANGE | SHIFT SOLENOID APPLICATION CHART | | | | | | | RATIO |
|-------------------|----------------------------------|------|------|------|------|------|-------|-------------|
| | MV 1 | MV 2 | MV 3 | MV 4 | MV 5 | MV 6 | EDS 1 | |
| <i>Park</i> | ON | ON | ON | | | | ** | |
| <i>Reverse</i> | ON | ON | | | | | ** | 4.08 |
| <i>Neutral</i> | ON | ON | ON | | | | ** | |
| <i>"D"-1st</i> | ON | ON | ON | | | | ** | 3.66 |
| <i>"D"-2nd</i> | | ON | ON | | | | ** | 1.99 |
| <i>"D"-3rd</i> | | | ON | | | * | ** | 1.40 |
| <i>"D"-4th</i> | | | | | | * | ** | 1.00 |
| <i>"D"-5th</i> | ON | | | | | * | ** | 0.74 |
| <i>"D", 3-2</i> | | | | ON | | | ** | |
| <i>"D", 5-4</i> | | | | | ON | | ** | |
| <i>"Failsafe"</i> | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 1.00 |

* Converter Clutch may be ON or OFF depending on vehicle speed and throttle position.

** Line Pressure is Modulating, depending on vehicle speed and throttle position.

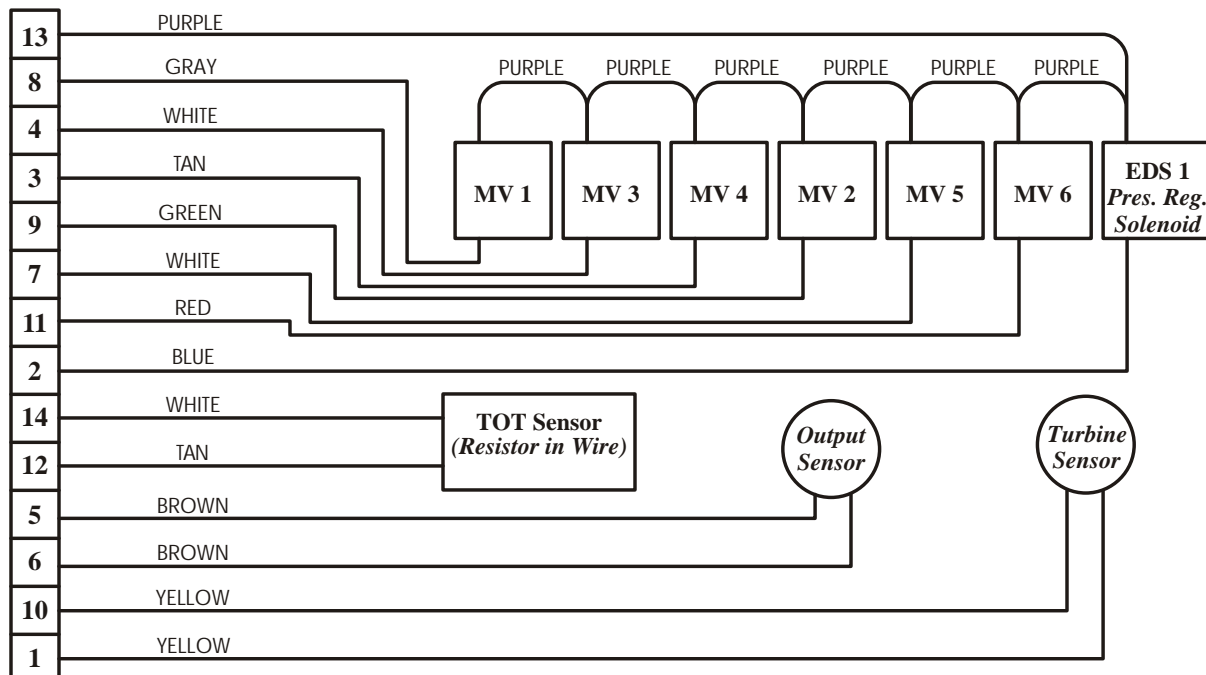
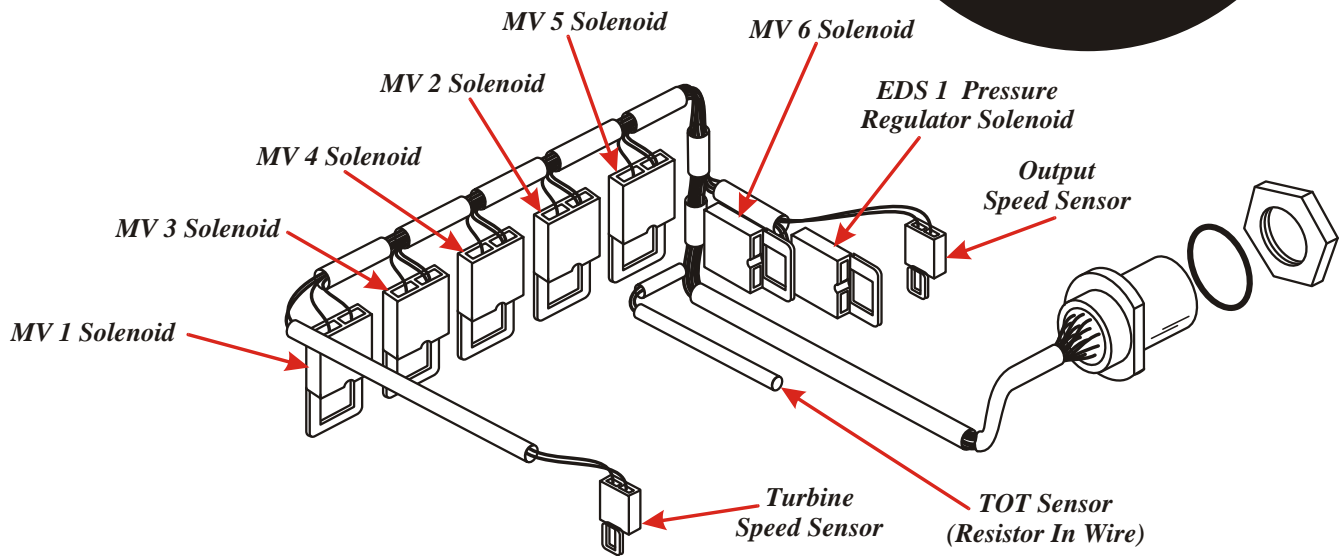
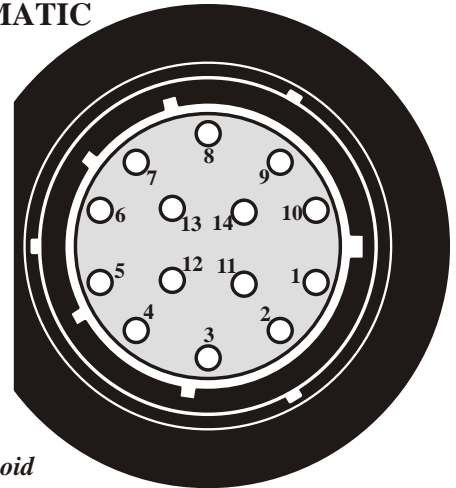
Note: MV 4 and MV 5 are used only on downshifts.

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Figure 5

ZF-5HP-18 INTERNAL WIRE SCHEMATIC

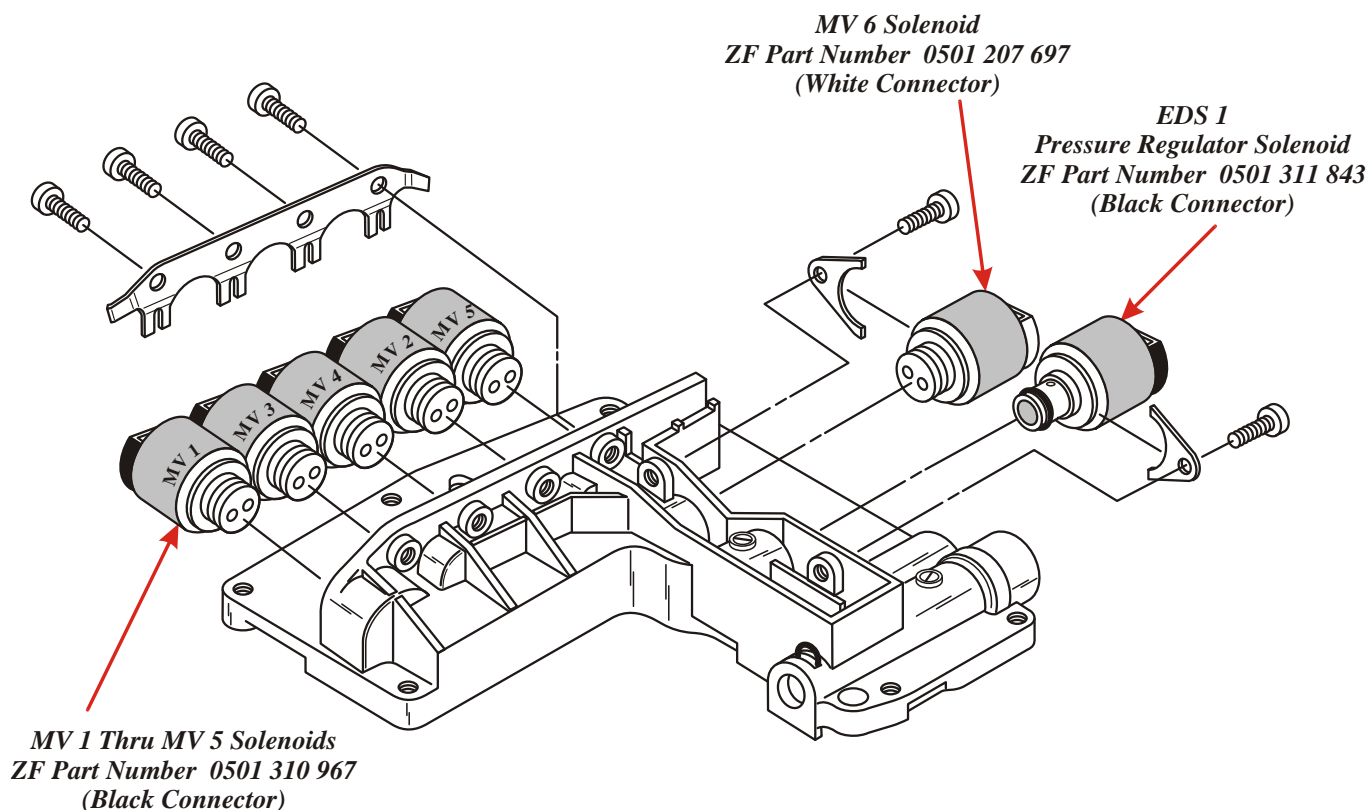
*View Looking Into Case
Connector Setting In The vehicle*



NOTE: Some internal wire colors may vary.

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Figure 6



| COMPONENT | RESISTANCE | PART NUMBER |
|-------------------------|------------------|--------------|
| MV 1 Solenoid | 30 - 34 Ohms | 0501 310 967 |
| MV 2 Solenoid | 30 - 34 Ohms | 0501 310 967 |
| MV 3 Solenoid | 30 - 34 Ohms | 0501 310 967 |
| MV 4 Solenoid | 30 - 34 Ohms | 0501 310 967 |
| MV 5 Solenoid | 30 - 34 Ohms | 0501 310 967 |
| MV 6 Solenoid | 30 - 34 Ohms | 0501 207 697 |
| EDS 1 Pres Reg Solenoid | 5.2 - 6.8 Ohms | 0501 311 843 |
| Input Speed Sensor | 265 Ohms (72° F) | 0501 311 086 |
| Output Speed Sensor | 265 Ohms (72° F) | 0501 311 086 |
| Trans Temp Sensor | 970 Ohms (72° F) | N/A |



Technical Service Information

RETRIEVING FAULT CODES

The BMW Diagnostic Tool is **required** to retrieve the fault codes that are stored in the control unit. The diagnostic tool has the ability to retrieve codes, clear codes and activate individual components, and is adaptable to 3 Series, 5 Series, 7 Series and 8 Series vehicles equipped with 4HP-22/24, 4L30-E, 5HP-18, 5HP-19, and 5HP-30. The BMW Diagnostic Tool can be purchased from:

Mario Aristides Phone - (305) 666-3544, Fax - (305) 666-8238

BMW ZF-5HP-18 FAULT CODE CHART

| Code | Description (Pin No's Refer To TCM) | Possible Causes |
|-----------------------|---|---|
| 02 | Park-Neutral Lock Solenoid - Pin 2 | Break or short in wiring, or defective solenoid |
| 03 | MV 5 Solenoid - Pin 3 | Break or short in wiring, or defective solenoid |
| 04 | MV 6 Solenoid (Lock-Up) - Pin 4 | Break or short in wiring, or defective solenoid |
| 05 | EDS 1 Solenoid (Pres. Reg.) - Pin 5 | Break or short in wiring, or defective solenoid |
| 08 | Selector Lever Position L2 - Pin 8 | Vehicle acceleration detected while selector lever in P or N position, or engine has been started even though trans control unit has not detected a selector lever position of P or N |
| 09 | Selector Lever Position L3/L4 - Pins 37 and 9 | Engine has been started even though trans control unit has not detected a selector lever position of P or N |
| 0C | Program Selector Switch - Pins 12, 13 and 45 | Short in wiring, or more than one program selector switch input is applied to ground |
| 10 | Turbine Shaft Speed Sensor, Pins 16 and 44 | No input, or incorrect engine speed information |
| 12 | Kickdown Switch - Pin 18 | Shorted to Ground |
| 13 | ASC Monitoring - Pin 19 | ASC operation has been detected while selector lever was in Park or Neutral position |
| 16 | TOT Sensor - Pins 21 and 22 | Resistance of TOT Sensor not within permissible range |
| 1A | Battery Voltage Supply - Pin 26 | Break in wiring |
| 1E | MV 1 Solenoid - Pin 30 | Break or short in wiring, or defective winding in solenoid |
| 1F | MV 4 Solenoid - Pin 31 | Break or short in wiring, or defective winding in solenoid |
| 20 | MV 3 Solenoid - Pin 32 | Break or short in wiring, or defective winding in solenoid |
| 21 | MV 2 Solenoid - Pin 33 | Break or short in wiring, or defective winding in solenoid |
| 23 | Throttle Position Sensor - Pin 35 | Break or short in wiring, or defective sensor |
| 24 | Selector Lever Position L1 - Pin 36 | Break or short in wiring, or defective sensor |
| 2A | Output Speed Sensor signal - Pins 13 and 42 | No input, or incorrect engine speed information |
| 2b | Engine Speed Signal - Pin 43 | Questionable signal, or break or short in wiring |
| 35 | Power Supply to transmission - Pin 52 | Break or short in wiring, or defective TCU |
| Copyright © 1999 ATSG | | |

Figure 8

BMW ZF-5HP-18 FAULT CODE CHART

| Code | Description (Pin No's Refer To TCM) | Possible Causes |
|-------------|--|--|
| 36 | Power Supply - Pin 54 | Power Supply less than 9 volts at engine speeds greater than 1600 RPM |
| 64 | Speed Monitoring | Faulty Speed Sensor signal, or slip in Transmission |
| 65 | EPROM - Checksum | Program memory in Transmission Control Unit faulty |
| 66 | Incorrect Program Checksum | Program memory in Transmission Control Unit faulty |
| 67 | Transmission Relay - Pin 52 | Pickup and dropout times too long |
| 68 | Engine Temp Sensor - Pin 35 | Break or Short in wiring, or defective CTS |
| 69 | Throttle Position Sensor - Pin 35 | TCU detected questionable TPS signal |
| 6E | Basic Data Record | TCU has not programmed |
| 96 | CAN Timeout 1 | CAN signal not sent during initialization (Ignition On) |
| 97 | CAN Timeout 2 | CAN signal not sent during operation |
| 98 | CAN Bus monitoring | Values in CAN RAM are not updated |
| 99 | CAN status fault | Control units with different CAN statuses are installed on CAN bus |
| 9A | CAN throttle valve information | DME detects faulty throttle valve signal |
| 9B | CAN load signal information | DME detects faulty load signal |
| 9C | CAN engine intervention | DME cannot carry out reduction in engine torque desire by the EGS, or DME has different requirements compared to other CAN users |
| 9D | CAN engine temperature info | DME detects faulty engine temperature signal |
| 9E | CAN engine speed information | DME detects faulty engine speed signal |

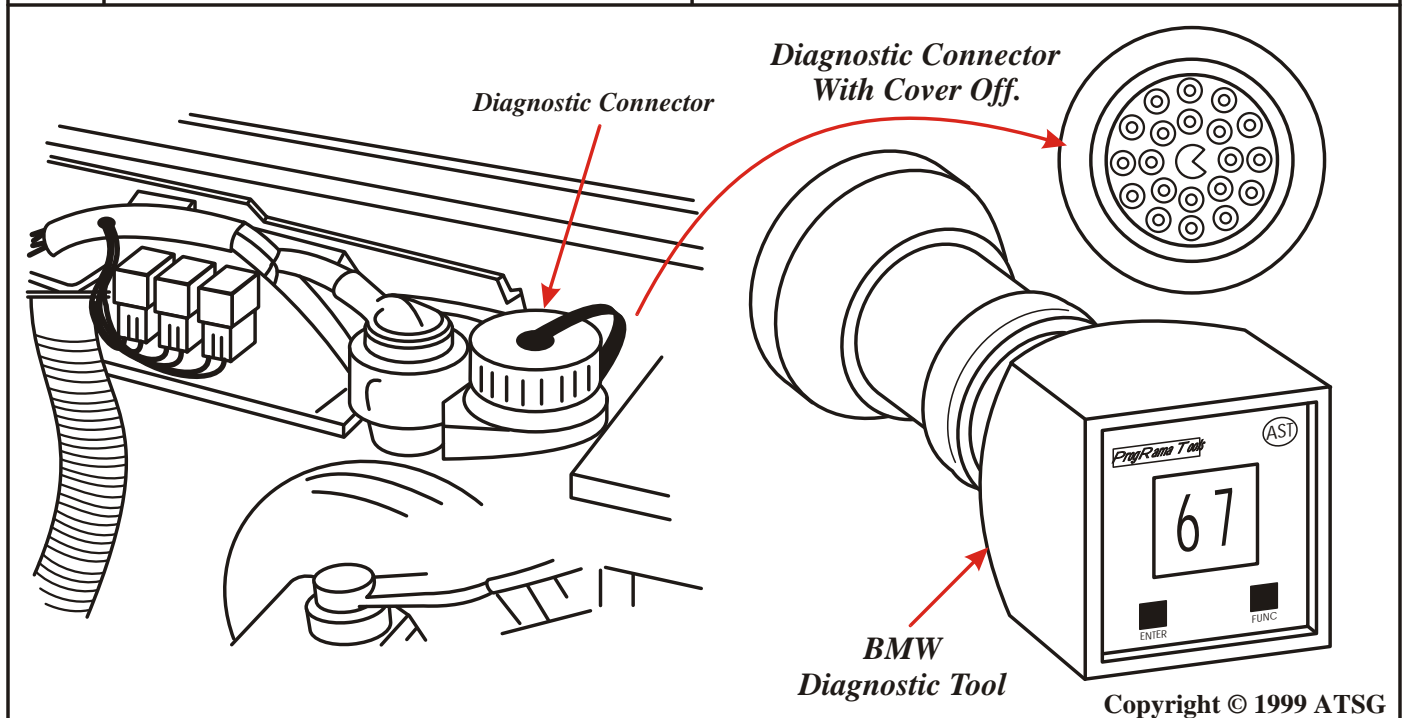
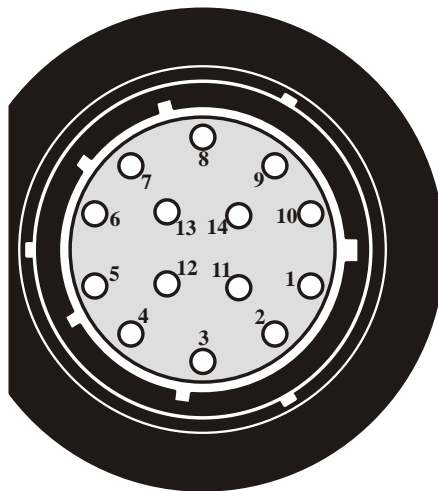


Figure 9

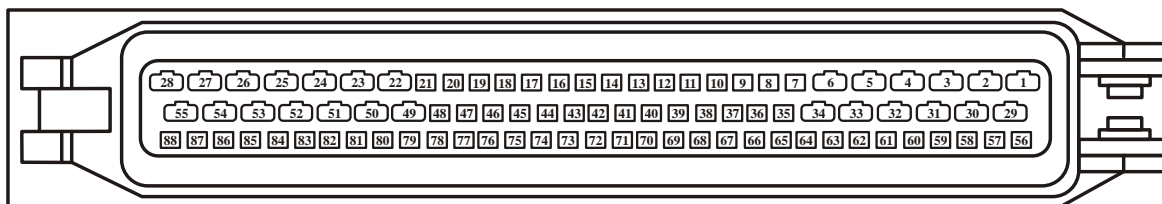
SOLENOID AND SENSOR RESISTANCE CHART

| <i>Solenoid</i> | <i>Case Connector Pin Numbers - +</i> | <i>Control Unit Connector Pin Numbers - +</i> | <i>Resistance In Ohms</i> |
|-----------------|---|---|--|
| MV 1 | 8 and 13 | 30 and 52 | 30 - 34 Ω |
| MV 2 | 9 and 13 | 33 and 52 | 30 - 34 Ω |
| MV 3 | 4 and 13 | 32 and 52 | 30 - 34 Ω |
| MV 4 | 3 and 13 | 31 and 52 | 30 - 34 Ω |
| MV 5 | 7 and 13 | 3 and 52 | 30 - 34 Ω |
| MV 6 | 11 and 13 | 4 and 52 | 30 - 34 Ω |
| EDS 1 | 2 and 13 | 5 and 52 | 5.2 - 6.8 Ω |
| | | | |
| TOT | 12 and 14 | 21 and 22 | 970 Ω at 72°F |
| TSS | 1 and 10 | 44 and 16 | 265 Ω (72°F) |
| OSS | 5 and 6 | 14 and 42 | 265 Ω (72°F) |

*View Looking Into Case
Connector Setting In The vehicle*



Electronic Control Unit Connector Pin Identification



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Figure 10

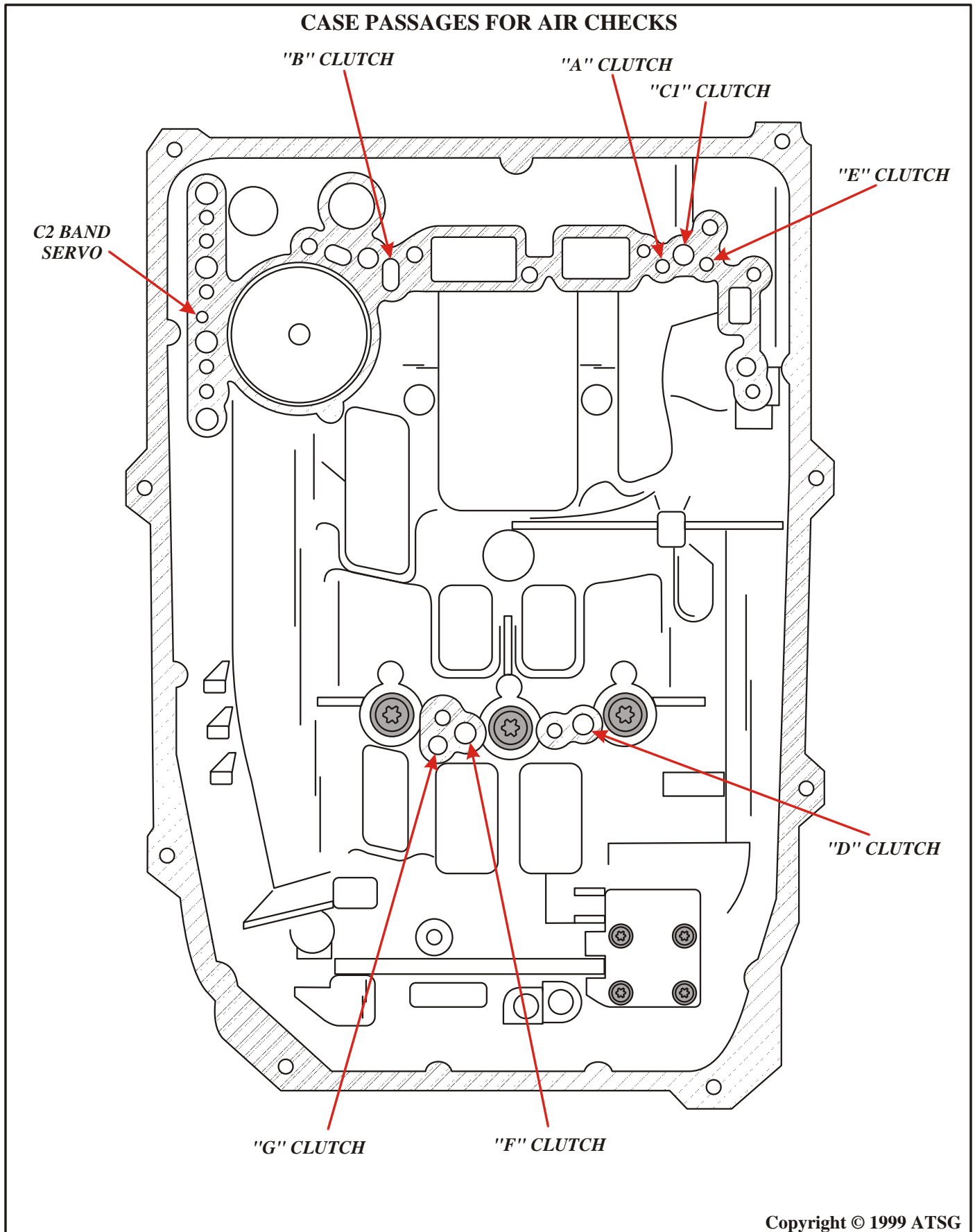
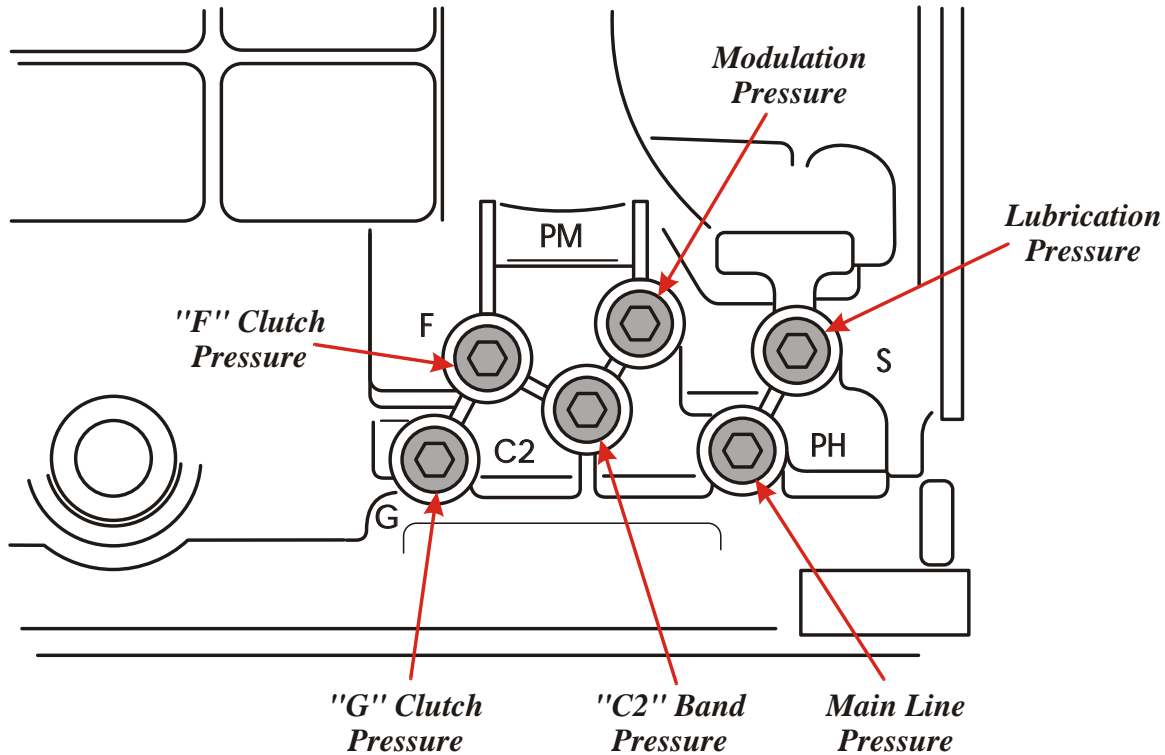


Figure 11

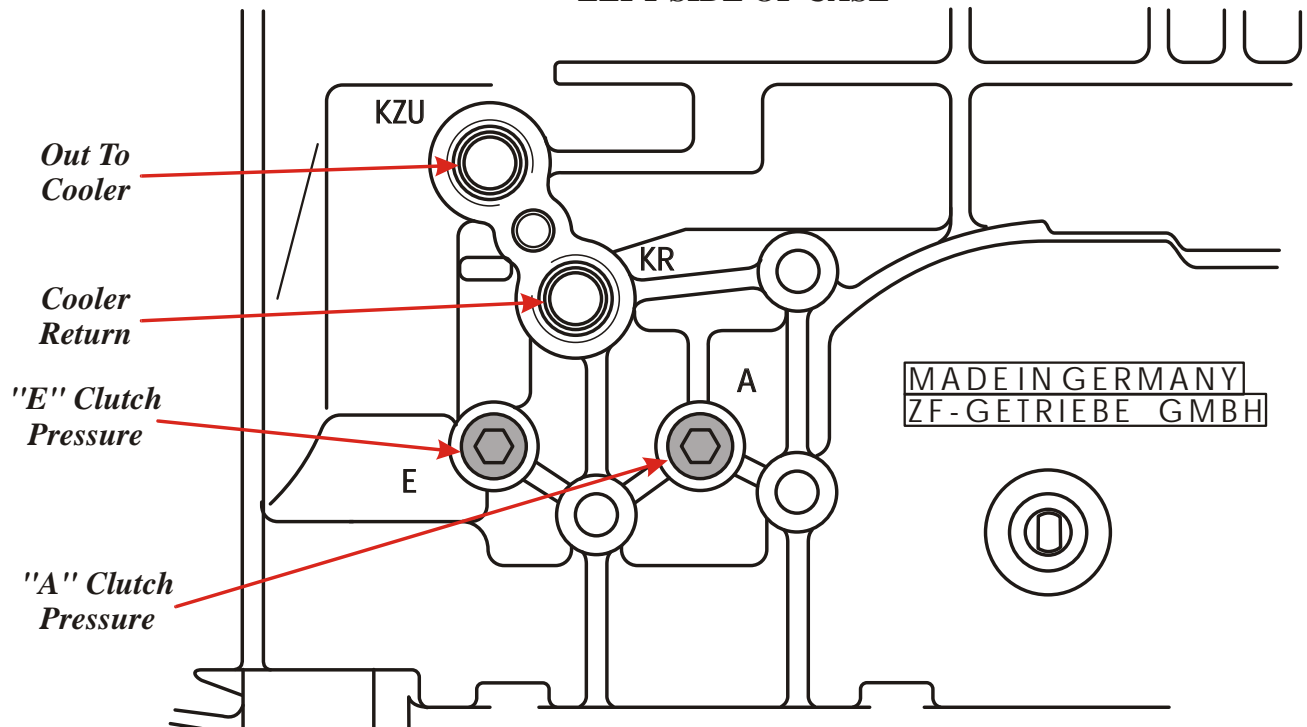
PRESSURE TAP LOCATIONS

RIGHT SIDE OF CASE

Note: Some cases you must drill and tap for access.



LEFT SIDE OF CASE

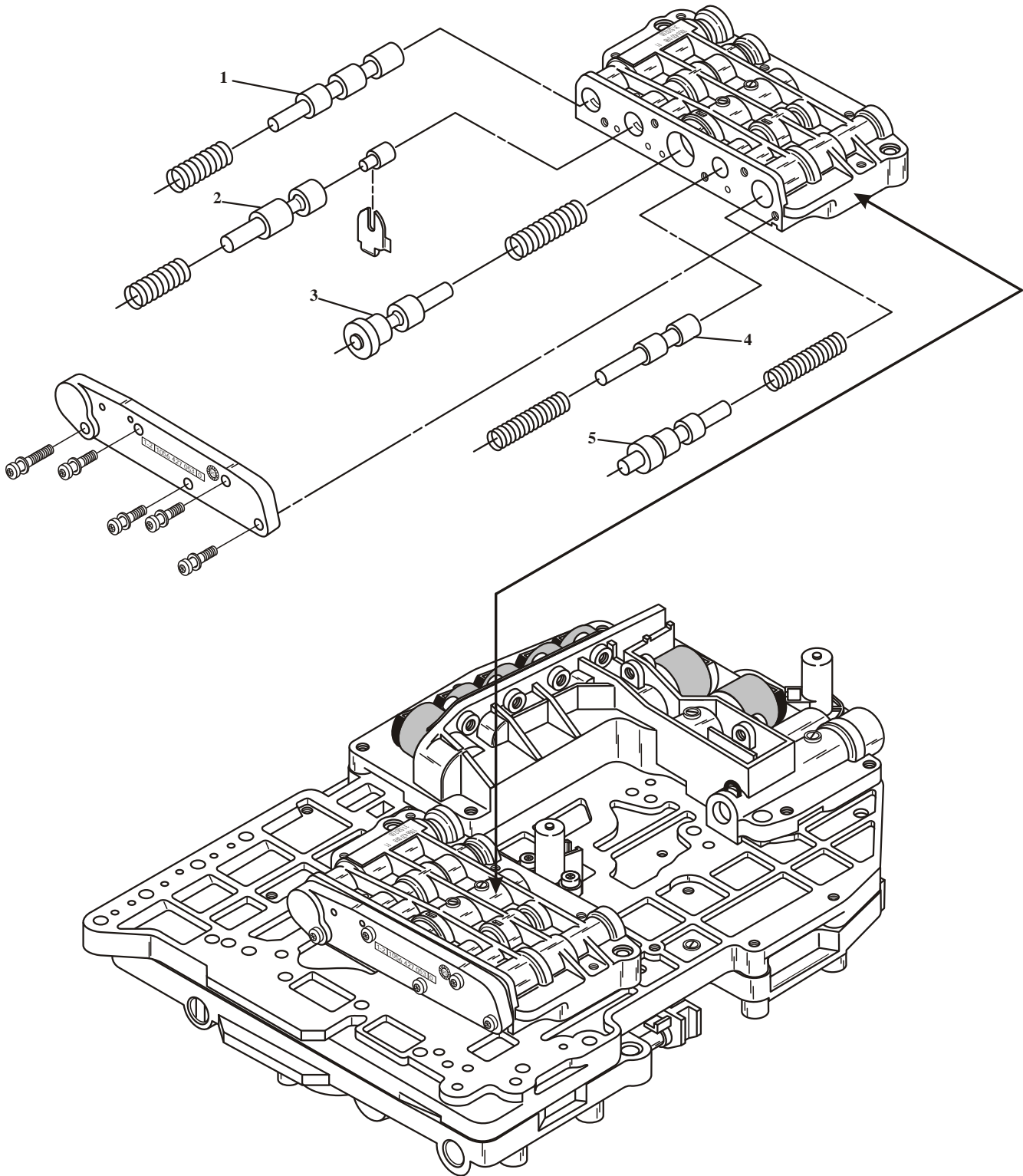


Note: Some cases you must drill and tap for access.

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Figure 12

UPPER FRONT VALVE BODY

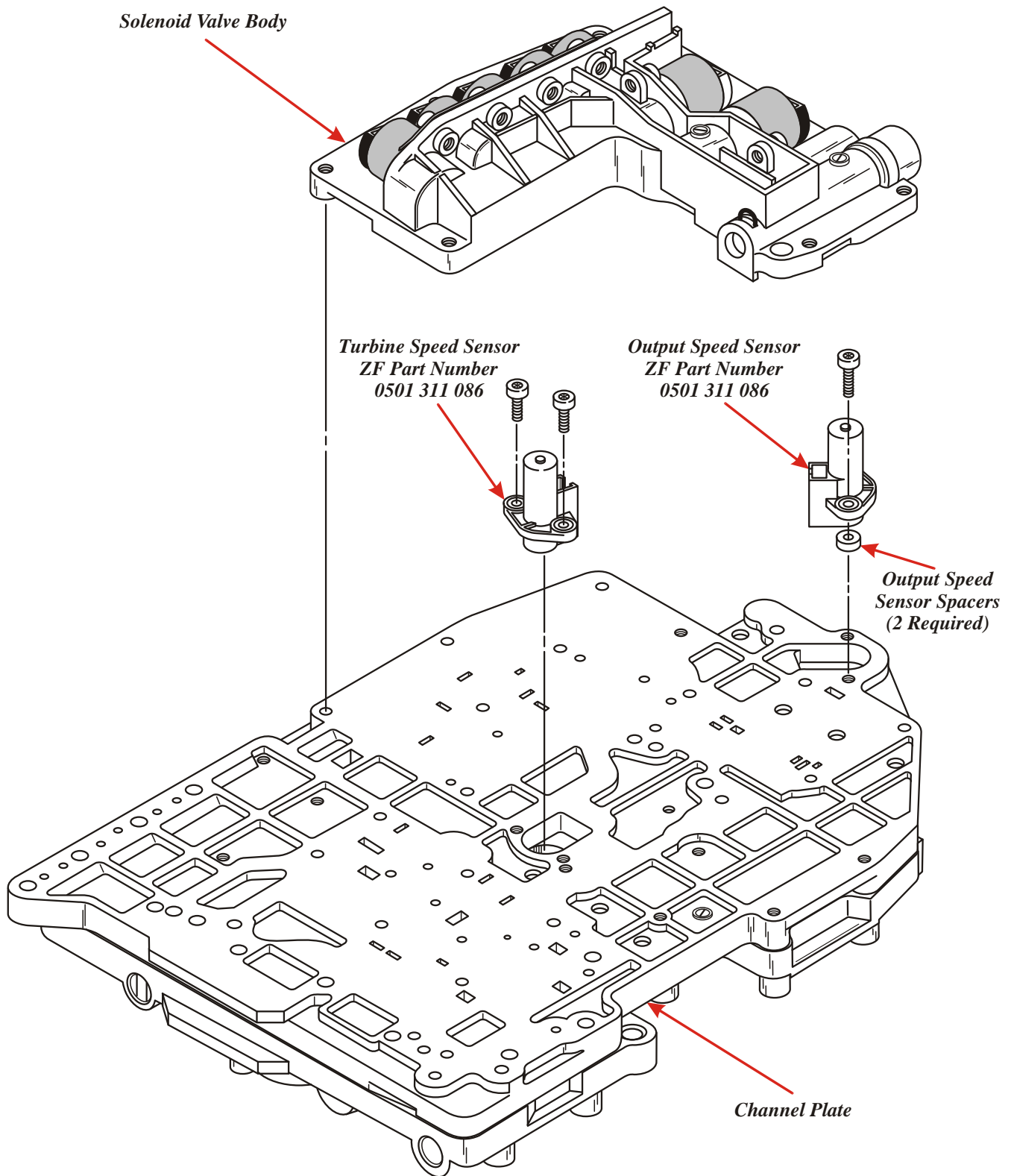


- 1. Torque Converter Valve
- 2. Lubrication Valve Train
- 3. Lock-Up Control Valve
- 4. 5-4 Traction Valve

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Figure 13

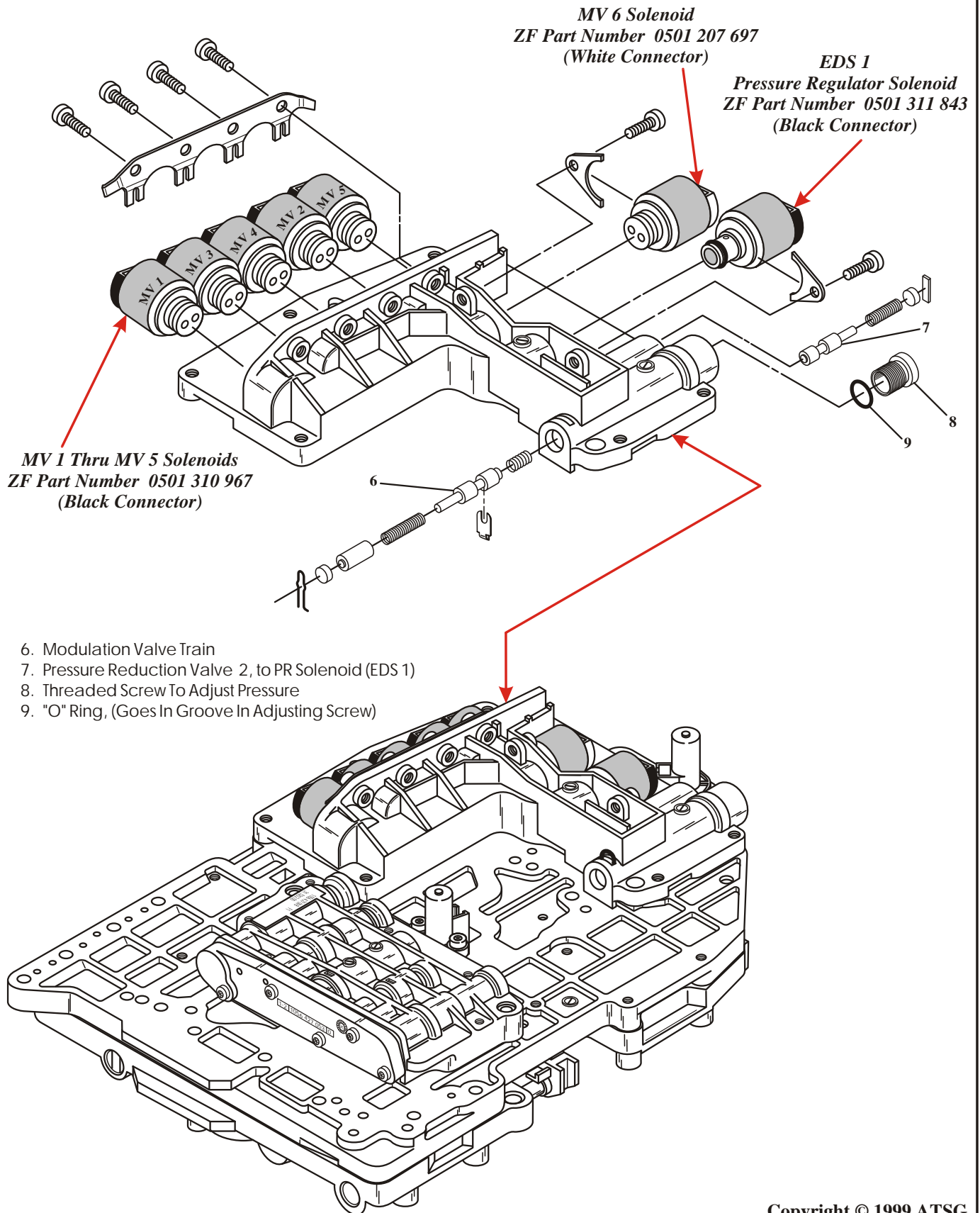
SOLENOID BODY, SPEED SENSORS AND CHANNEL PLATE



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Figure 14

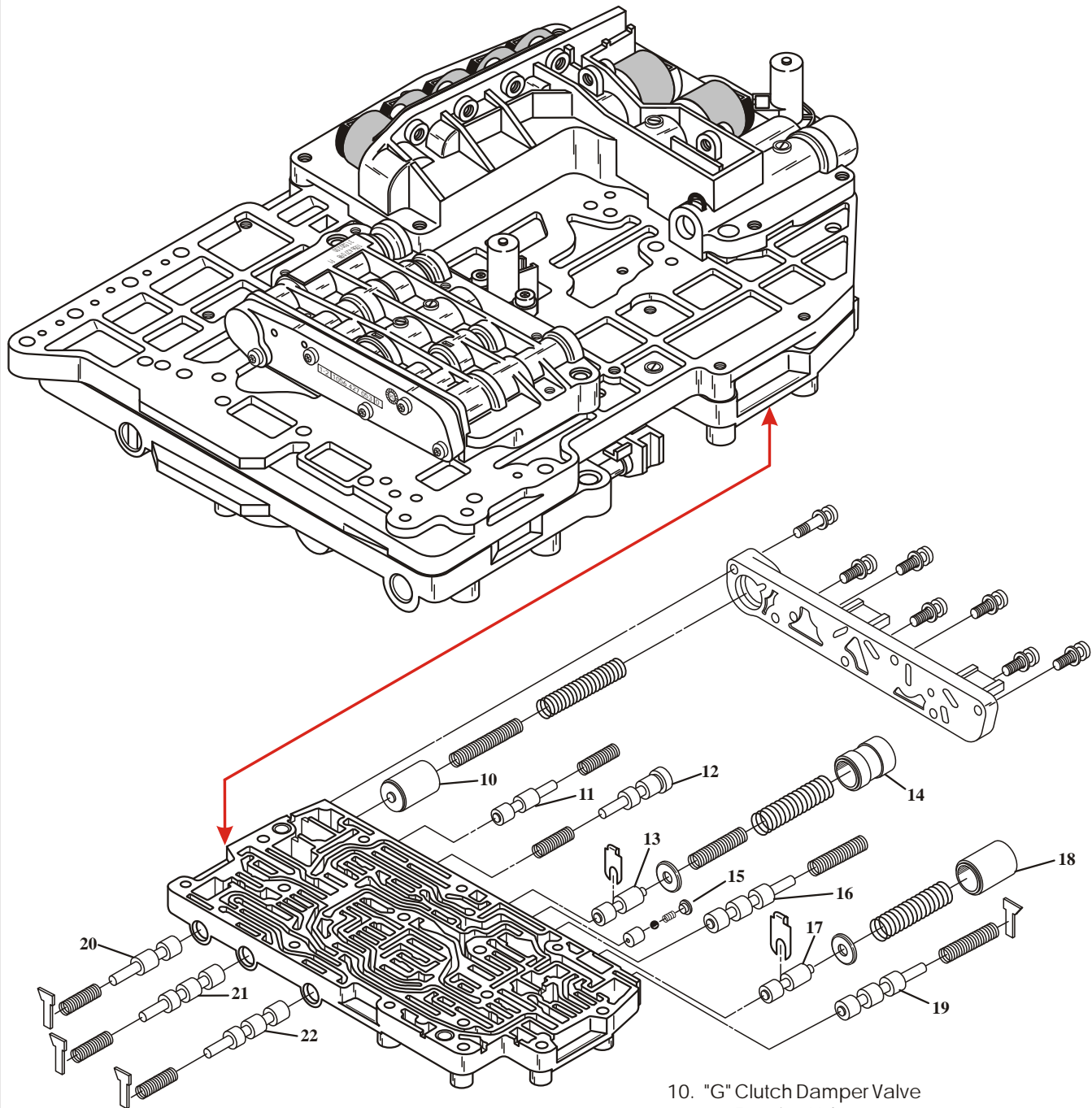
SOLENOID VALVE BODY



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Figure 15

LOWER REAR VALVE BODY

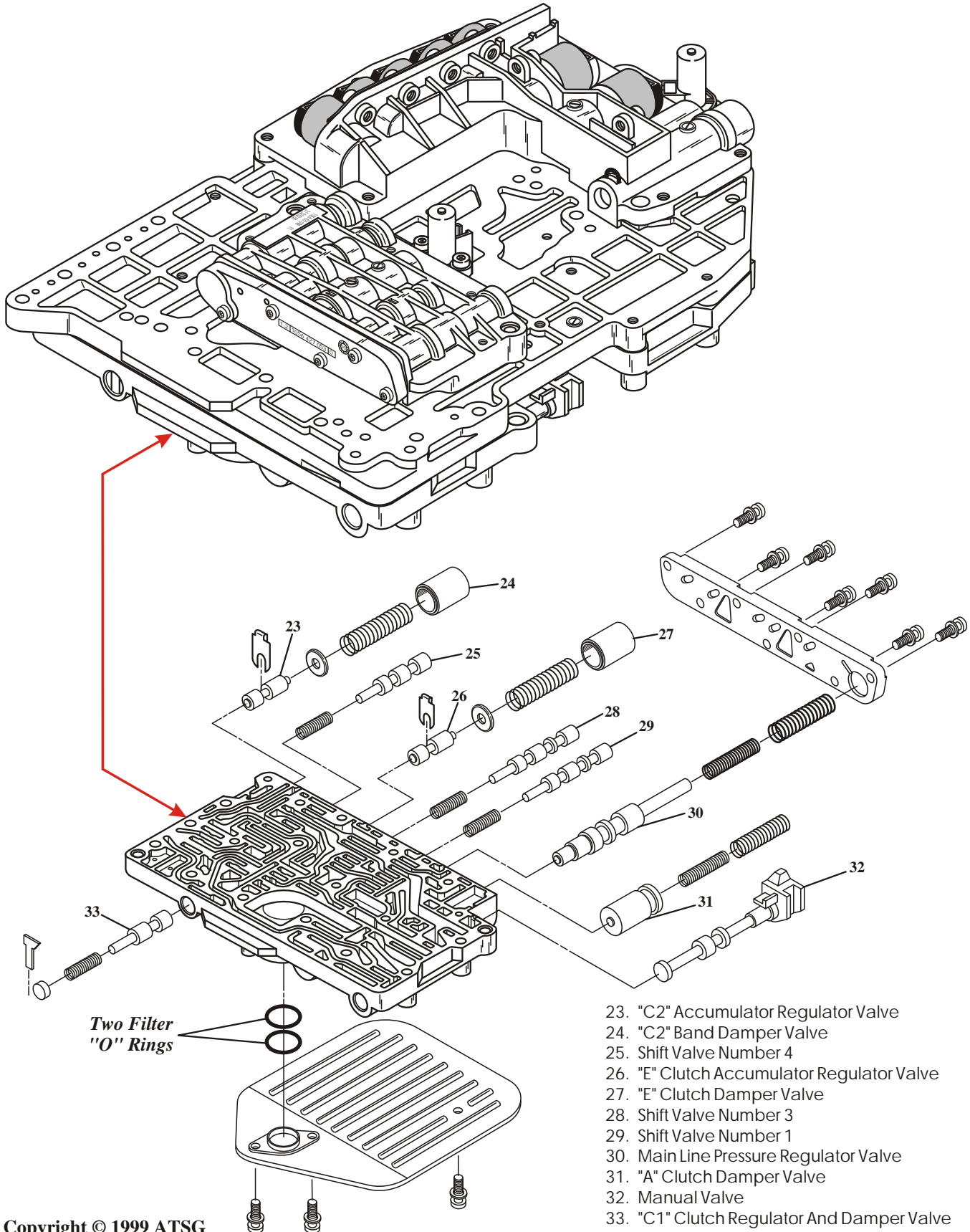


- 10. "G" Clutch Damper Valve
- 11. 3-2 Traction Valve
- 12. 2-3 Traction Valve
- 13. "D" Clutch Accumulator Regulator Valve
- 14. "D" Clutch Damper Valve
- 15. "D" Clutch One-Way Check Valve Assembly
- 16. Reverse Lock-Out Valve
- 17. "F" Clutch Accumulator Regulator Valve
- 18. "F" Clutch Damper Valve
- 19. Shift Valve Number 2
- 20. Pressure Reduction Valve For MV 1 thru MV 6
- 21. Traction Coast Valve Number 2
- 22. Traction Coast Valve Number 1

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Figure 16

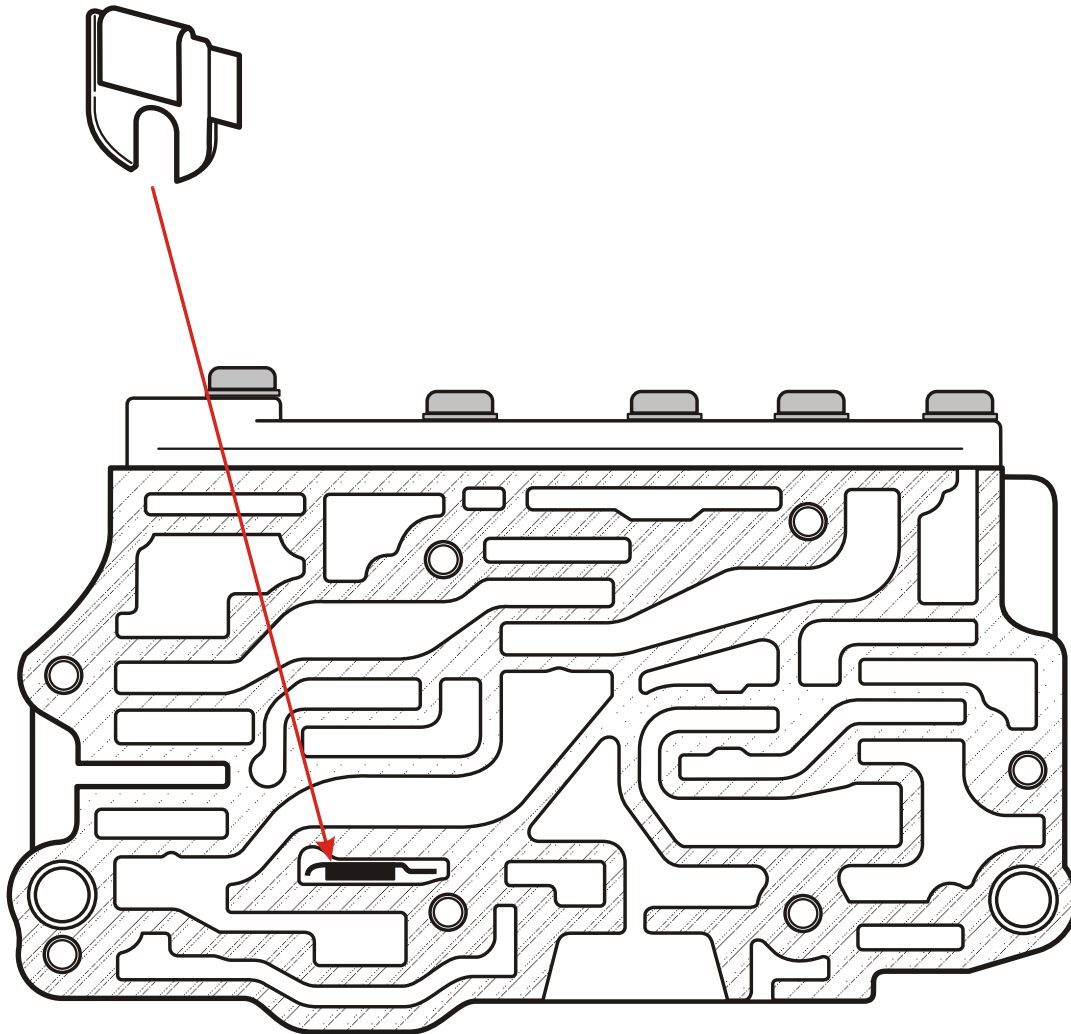
LOWER FRONT VALVE BODY



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Figure 17

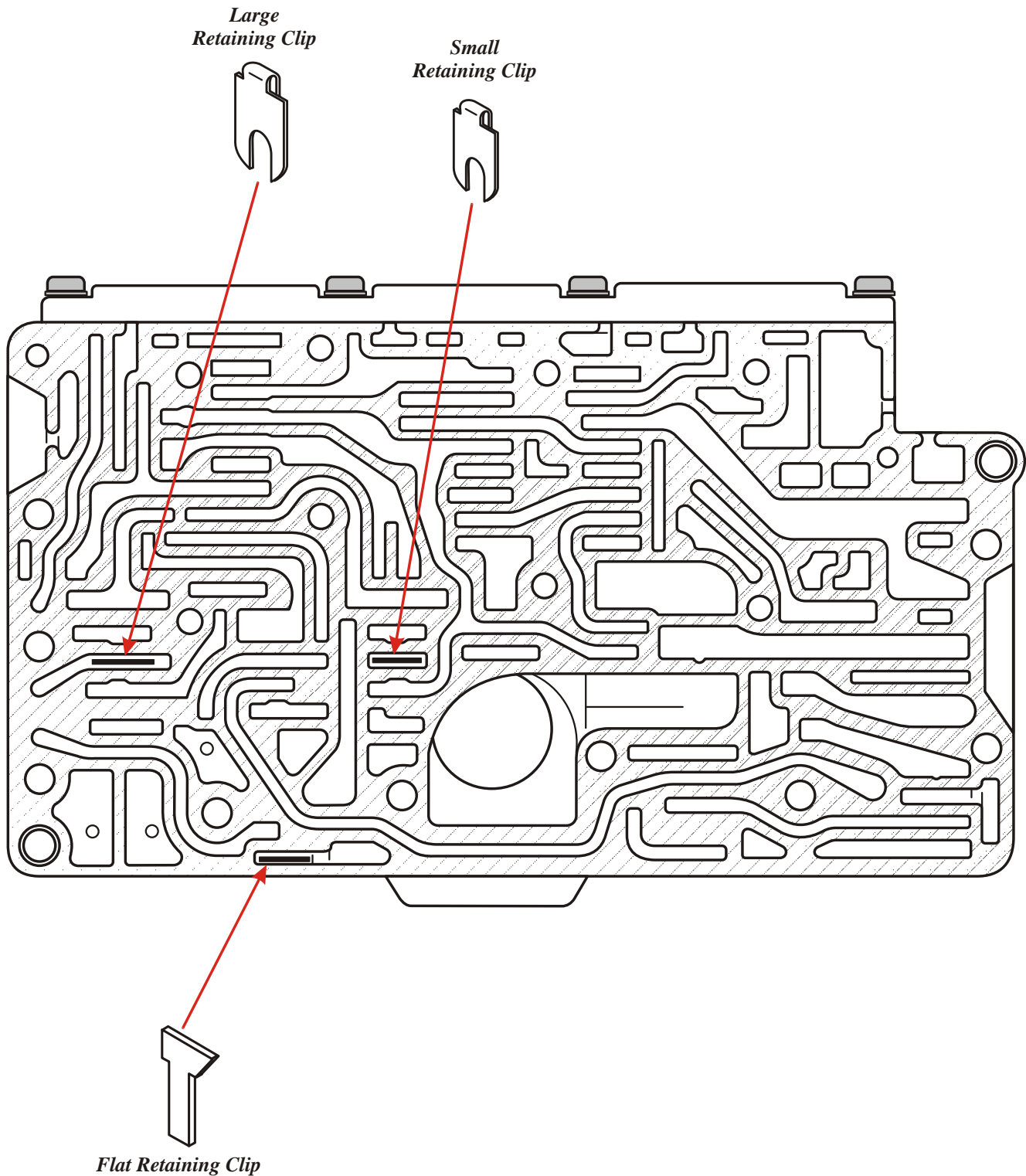
UPPER FRONT VALVE BODY CLIP LOCATIONS



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Figure 18

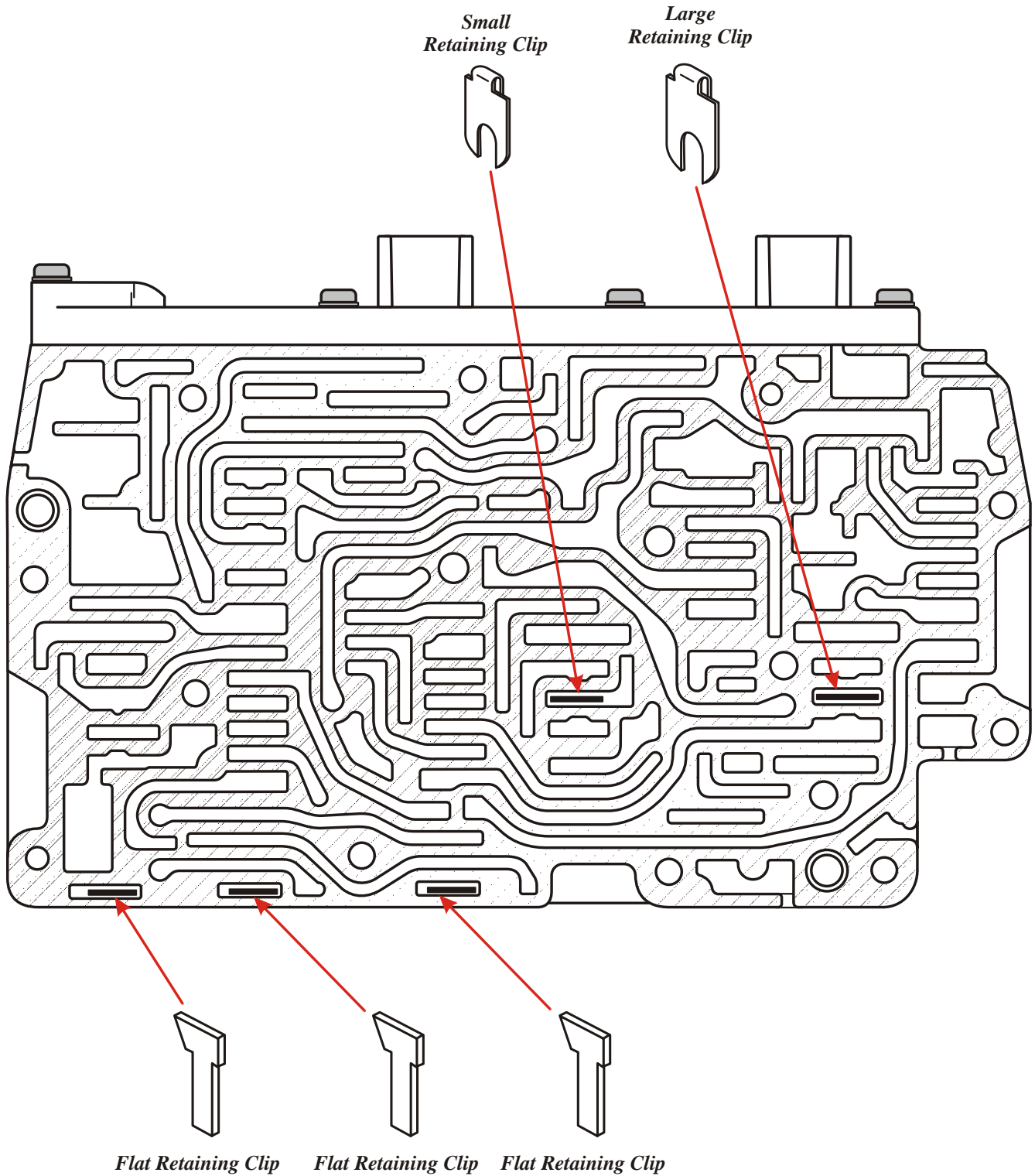
LOWER FRONT VALVE BODY CLIP LOCATIONS



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Figure 19

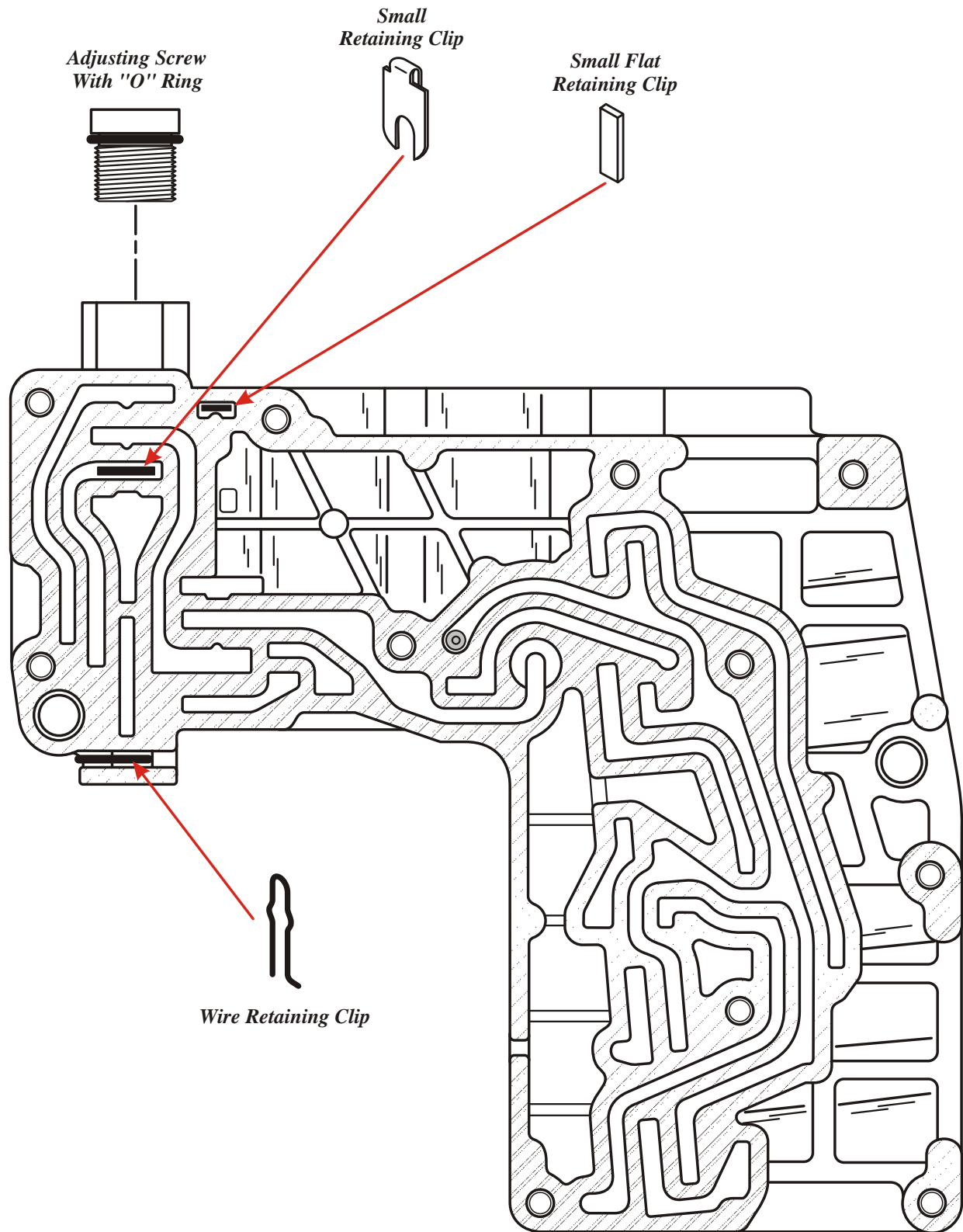
LOWER REAR VALVE BODY CLIP LOCATIONS



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Figure 20

SOLENOID VALVE BODY CLIP LOCATIONS



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Figure 21

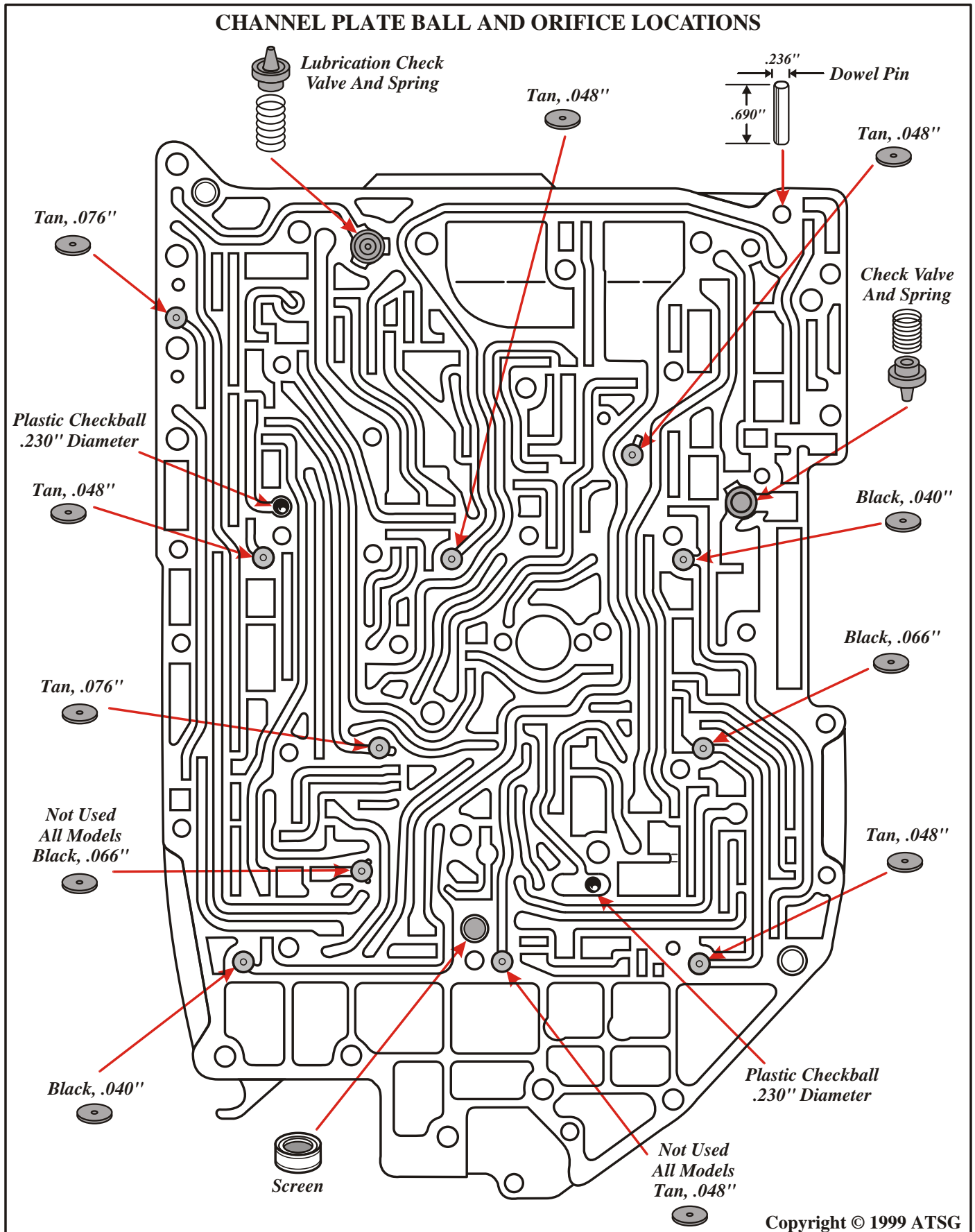


Figure 22