O1J CVT
Introduction

Presented by:
Steve Garrett
ATRA

Sponsored By:
Lwiggins@ATRA.com

* Connections
* Handout
* Questions
* Survey
Thanks

* A special thanks to Mike Souza and to Audi for help with the information for this presentation
“Audi Multitronic 01J”

Introduction
Introduction

Variable Automatic Gearbox designed by Audi.
Commonly known as Continuously Variable Transmission “CVT”.
Designated: Multitronic 01J
Vehicle application:
- 2004-09 A4 Cabriolet 1.8L / 2.0L L4 / 3.0L V6
- 2002-04 A6 3.0L V6
- 2005-09 3.2L V6

Features:
- No fluid coupling (torque converter) between engine and gearbox.
- Single flywheel damper unit (V6 engine).
- Dual-Mass flywheel damper (4 cylinder engine).
- One Forward multi-disc clutch (slipped @ standstill or hill hold).
- One Reverse multi-disc clutch (both act as starting clutches).
- Reverse rotation is created through a planetary gear train.
- Engine torque is transmitted to the final drive via a “variator” by an auxiliary reduction gear step.
- Steel chain instead of a belt driven.
- Electro-hydraulic control unit (valve body) and combined Electronic Control Module (located in the gearbox housing).
- Tiptronic function; provides 6 forward “speeds” for manual gear selection, performed by the driver through either the console shifter or steering wheel paddle buttons.
- Steeless ratio changes controlled by a “Variator” (two variable tapered pulleys and connecting chain) for optimal fuel utilization and driver comfort.
- Primary variable tapered drive pulley driven by engine torque.
- Secondary variable tapered driven pulley driven by steel chain.
Specifications

Designation: multitronic®01J
Factory designation: VL 30
Code: DZN
Max. transferable torque: max. 310 Nm
Range of ratios of the variator: 2.40 - 0.40
Spread: 6
Ratio of auxiliary reduction gear step: 51/46 = 1.109 : 1
Final drive ratio: 43/9 = 4.778 : 1
Operating pressure of oil pump: max. approx. 60 bar
Delivery rate of oil pump: 10 lpm @ 1000 rpm
ATF for multitronic®: G 052 180 A2
Axle oil for multitronic®: G 052 190 A2
Gear oil quantities:
ATF new filling (incl. ATF cooler and ATF filter) approx. 7.5 litres
ATF change approx. 4.5 litres
Axle oil approx. 1.3 litres
Gross weight (without flywheel): approx. 88 kg
Overall length: approx. 610 mm
Modes of Operation

• Tiptronic (6 speeds, manual control)
• Multitronic
**Shift Modes.**

AUTOMATIC: All 6 ratios are controlled by a preprogrammed strategy of the vehicle's onboard computer. The conditions that determine ratio change are controlled by driver input, such as accelerator pedal position in conjunction with traction resistance. The ratios are completed smoothly without any interruption.

Tiptronic Mode:
There are 6 defined shifting ratios for manual gear selection. The driver can choose handling dynamics to suit personal preference. This feature can be used on downhill grades, such as an engine braking effect controlled by selective downshifting. This feature will only allow a top speed in 5th gear. The 6th gear ratio is commanded for a more efficient fuel economy or overdrive. The “tiptronic mode” can be operated by the console shifter or shift paddles/buttons (optional) located on the steering wheel.
Flywheel Damper Assembly

No Torque Converter

Damper  Flywheel  6 Cyl.

Dual Mass Damper / Flywheel  4 Cyl.
Drive -Train Layout

- 1 FWD clutch
- 1 REV clutch
- 1 Planetary for REV
- 1-1 for REV
“Variator Function”
The variator allows for a smooth continuous reduction of ratio from standstill to maximum speed. The correct ratio is commanded for optimum speed range, engine performance and fuel economy. The variator consists of two pairs of tapered disc pulleys, one Primary pulley set (1) one Secondary pulley set (2) and a special chain that runs in the V-shaped gap between the two tapered pulley sets. The chain is the primary power element of the transmission. Primary pulley set (1) is driven by the engine via an auxiliary reduction gear step. Torque is transmitted through the chain to the secondary pulley set (2) and to the final drive. One of the tapered pulleys in each set is hydraulically controlled to variably adjust the chain track diameter and change the transmission ratio. Both pulleys sets must be controlled simultaneously so that the chain is always kept taut. The disc and chain contact pressure though all ratios must be in proportion to transmission torque in order to prevent slipping.
Variator Function

Audi multitronic

Engine

Starting clutch

Variator

Link-plate chain

Oil pump

Hydraulic control

Electronic control

Pulling away

Variator with Link-plate chain

Overdrive

your source for engineered solutions
Forward / Reverse Clutch & Planet Assembly

- Gearbox input shaft
- Ring gear
- Planetary gears
- Forward clutch/reverse clutch with planetary gear train
- Input pulley set 1 (auxiliary reduction gear step)
- Planet carrier
- Forward clutch
- Reverse clutch
Forward / Reverse Clutch Assembly

- Steel plates and lined plates on forward clutch
- Planet carrier with planetary gears
- Gearbox input shaft
- Sun gear
- Input pulley set 1 (auxiliary reduction gear step)
- Steel plates and lined plates on reverse clutch
- Ring gear
Communication

**Gearbox control unit**
- Specified engine torque
- Specified idling speed
- Enable adaptation
- Idling speed charge regulation
- Overrun shut-off support
- Clutch protection
- Clutch status
- Clutch torque
- Gearshift operation active/inactive
- Compressor switch off
- Selector lever position/drive position
- Vehicle road speed
- Shift indicator
- Currently engaged gear or target gear
- Coding in the engine control unit
- Emergency running program (Information on self-diagnosis)
- On-board diagnosis status

**Engine control unit**
- Engine speed
- Specified idling speed
- Actual engine torque
- Coolant temperature
- Kickdown information
- Accelerator pedal position
- Brake light switch
- Brake pedal switch
- Intake air temperature
- CCS status
- CCS specified road speed
- Altitude information
- Air conditioner compressor status
- Emergency running program (Information on self-diagnosis)

**ESP control unit**
- TCS request
- EBC request
- ABS application
- EDL intervention
- ESP intervention
- Wheel speed, front left
- Wheel speed, front right
- Wheel speed, rear left
- Wheel speed, rear right

You will find detailed information regarding the CAN bus in SSPs 186 and 213.
Multitronic Control Unit

No Movement / Delays

Metal Contamination

Contains:
* 3 PSC
* 2 press sensors
* Multi function Switch
* ISS, OSS
* TFT
Solenoid ID & Function

N88: Cooling Clutch & Safety Valve (Solenoid)
N215: Clutch Control Valve (Solenoid)
N216: Reduction Valve (Solenoid)
**Speed Sensor (Input) G182**

Multitronic Control Unit’s Dynamic Control Program (DRP)

Monitors Input Speed Sensor # 1 Signal From Pulley Set # 1 In Comparison To Output Speed & Engine RPM To Control The Amperage To The N216 Solenoid For Pulley Contact Pressure Control
Must use a scan tool to diagnose sensors.

Do not pry on sensors. Sometimes they are mistaken for seals.

G 182 = ISS
G 195/196 = OSS

Speed Sensor (Output) G195 & G196

Gearbox output speed senders G195 and G196

Gearbox input speed sender G182

Sender wheel for G195 and G196

Sender wheel for G182

32 Magnets

40 Magnets
2 Speed Sensors (Output)

By having them out of phase, the TCM can determine direction.

32 Magnets 25% Out of Phase

Signal from sender G195/G196

Forward

Reverse

Direction of rotation of sender wheel
Sensors (Hydraulic Pressure) G193 & G194

Clutch Pressure

G193
Monitors FWD and REV Clutch PSI

Contact Pressure

G194
Monitors contact PSI Regulated by the torque sensor
Switches (Multifunction) F125

Monitors Shifter Position for:
- Starter
- Reverse Lights
- P/N Shift Lock
- Clutch control Fwd/Rev/Neutral
- Locks ratio in REV

F125
(4 Hall Sensors (A B C D))
### Gearshift combinations

<table>
<thead>
<tr>
<th>Selector lever position</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Fault</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>between P-R</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>R</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Fault</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>between R-N</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>N</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fault</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>between N-D</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Fault</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Signal for shift indicator on multirem® - P, R, N, D

- **Test Instruments**
  - 5 Vdc
  - 50 mV/div

- **Auto-mode**
  - Trigger line

- **Selector lever position**
  - P
  - R
  - N
  - D
Switches (Multifunction) F125

- LED
- Tiptronic switch F189
- 3 Hall sensors (C, B, A)
- PCB for selector lever gate
- Selector lever gate
- Solenoid for Hall sensors
- 4 Hall sensors for selector lever position
Switches (Brake) F47

Engine control unit J220

Brake light switch F/F47

Selector lever lock solenoid N110 in the selector lever bracket

Gearbox control unit J217

Creep Control
Shifter Lock
Dynamic Control Program
Switches (No Kickdown Switch)

If the accelerator pedal module is replaced, the “kickdown” shift point must be readapted using capable scan tool software.

Spring Loaded Pressure Element (Kickdown Switch Feel) Monitors Pedal Position
Clutch Pressure Control

N215 solenoid Command
Based on Clutch pressure Load Calculation
And ratio
“Safety Shut Off” Activation

Position After “Safety Shut Off” Switched

In the event that actual clutch pressure becomes higher than the control pressure (due to a malfunction), the safety shut off function will exhaust clutch pressure. No matter where the manual valve is positioned.

“Overload Protection”
Trans Temperature Too High
Engine Will Be Forced
To Idle Until A Short Clutch Cooling System Time Period

Clutch Pressure
Becomes Higher
Than Control Pressure

Feed Blocked
Exhausted

Solenoid Pressure

“Vented into oil sump/depressurised”
“Clutch pressure”
“Supply pressure”
“Pilot control pressure”
“Control pressure”
“In the oil sump”
Creep Control

“Hill Hold” & “Micro Slip” Feature

Increased Clutch Pressure
Decrease In slip

When the vehicle is at a standstill the creep control function sets the clutch to a calibrated slip rate (torque). With the engine idling in drive (brakes released) the clutch slip functions the same as an automatic transmission torque converter.
The cooling oil is only directed to the clutch in use.
The torque sensor is a hydromechanical sensor located on pulley set 1. The sensor is compiled of 2 shells and 7 steel balls. One ramp shell is connected to the output gear the other splined onto the torque sensor piston attached to pulley set 1. This ramp shell and ball assembly statically and dynamically controls the contact pressure through torque sensor spaces. The 2 shells rotate towards each other. Forces from ramp shell 1 converts engine torque to ramp shell 2, pushing the torque sensor piston. This movement opens and closes the outlets to sensor space 1.
The “splash oil cover” is located on pulley set 2 to counteract the pressure build up in the pressure cylinder. At higher engine speeds.
The suction jet pump (entrainment pump) is mounted directly on the valve body driven by the input shaft. This is a crescent type pump that produces high pressure and volume with a small amount of oil. The suction entrainment pump is designed to supply the oil volume required for the clutch cooling at low pressure.
Valve body functions:
* Forward/Reverse clutch control
* Clutch pressure control (regulated)
* Clutch cooling
* Contact pressure control
* Gearbox control
* Splash oil
Hydraulic Control Unit (Valve Body)

* DBV1: Pressure Limiting valve (limits the pump pressure to max. 82 bar “blow off”)
* DBV2: Pressure Limiting valve 2
* Minimum Pressure valve (prevents air from being drawn into the oil pump during start up/when pump pressure is high valve opens and allows oil to flow from the oil return pipe to the suction side of the oil pump)
* VSTV: Pilot Pressure valve (supplies pressure control valves constant pressure of 5 bar)
* VSPV: Pressure control valve (system pressure (control and contact pressure))
* KKV: Clutch cooling valve
* KSV: Clutch control valve
Hydraulic Control Unit (Valve Body)

- VSBV volumetric flow rate limiting valve
- HS manual selector valve
- SIV safety valve
- Pressurising valve VSPV
- ÜV reduction valve
Fault Indicator

PRND Display Normal “Non Critical” No Noticeable Drive Ability Issues

PRND Display Inverted Still “Non Critical” Should Be Corrected As Soon As Possible

PRND Display “FLASHING” Critical Should Be Corrected Immediately Will Stop Operating
No Movement

May Not Make Noise
Variator Assembly With Chain $800.00
Technical Service Bulletin

MIL on, and/or Multitronic Transmission in Emergency Running Mode (DTC P0706 or P1793 in TCM)


<table>
<thead>
<tr>
<th>Model(s)</th>
<th>Year</th>
<th>VIN Range</th>
<th>Vehicle-Specific Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4</td>
<td>2002 - 2007</td>
<td>All</td>
<td></td>
</tr>
<tr>
<td>A4 Cabriolet</td>
<td>2003 - 2007</td>
<td>All</td>
<td>Automatic CVT (D1)</td>
</tr>
<tr>
<td>A6</td>
<td>2002 - 2004, 2008 - 2007</td>
<td>All</td>
<td></td>
</tr>
</tbody>
</table>

**Condition**

MIL on and/or vehicle in emergency running mode with gear indicator illumination inverted. DTC 17090 P0706 (Transm. Range Sensor Circ. Range/Performance) or DTC 18201 P1793 (Output Speed Sensor 2 Circ. No Signal).

**DTC 17090 / P0706 Range Sensor**

**Technical Background**

Not applicable.

**Production Solution**

Not applicable.

**Service**

Inverted

It is not necessary to receive an authorization number from the Technical Assistance Center for the repair described in this bulletin.

Attach VAS scan tool printouts to the repair order. Warranty requested documents received without VAS scan tool printouts will be denied payment.

If either DTC 17090 P0706 or 18201 P1793 is stored in the fault memory, replace Transmission Control Module. Refer to Group 38, Transmission Control Module (TCM) J217 Removing and Installing.

**Warranty**

Page 1 of 2
Technical Service Bulletin

No drive or delayed drive in "D" or "R" (DTC P1743/18151 may be stored in TCM)

38 07.01 Jan 9, 2007, 201328/1

<table>
<thead>
<tr>
<th>Model(s)</th>
<th>Year</th>
<th>VIN Range</th>
<th>Vehicle-Specific Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A6</td>
<td>2006-2007</td>
<td>All</td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td>2006</td>
<td>All</td>
<td>With Automatic CVT (01J)</td>
</tr>
<tr>
<td>A4 Cabriolet</td>
<td>2005-2006</td>
<td>All</td>
<td></td>
</tr>
</tbody>
</table>

Condition

DTC 18151 / P1743

No drive, or delayed drive when either D or R is selected. DTC P1743/18151 may be logged in TCM fault memory.

The vehicle does not start moving without accelerating. When accelerating, an increased engine speed is necessary to move the vehicle. In some cases there is no drive.

Technical Background

Some damaged seals installed in production.

The damaged seals may leak after a short operating period (less than 13,000 miles), causing a loss of transmission oil pressure.

This condition will not result in unintentional vehicle movement.


Production Solution

Improved production.

Service

It is not necessary to receive an authorization number from the Technical Assistance Center for the repair described in this bulletin.

Attach VAS scan tool printouts to the repair order. Warranty requested documents received without VAS scan tool printouts will be denied payment.

If fault P1743/18151 (clutch slip monitoring signal too large) is stored in the transmission fault memory, read MVB 44/1 and 45/1. If MVB 44/1 is 1000 mA and MVB 45/1 is above 12 bar, there is a problem with the axial seals. If MVB 45/1 is below 12 bar, this indicates a hydraulic problem. (See below for further analysis.)
No Drive / Delay In Drive

4 Seals

Valve Body Removed

Delay In Reverse

Front Cover Removed
Forward Clutch Tube
Reverse Clutch Tube
Reverse Clutch Tube

Forward Clutch Tube

Reverse clutch

Ring gear

Oil pressure for clutch
Torque flow

Pulley Set #1
Audi Has A TSB To Remove 2 Links (Drive Pins Out)

Without Removing The Differential With Special Press
Technical Service Bulletin


<table>
<thead>
<tr>
<th>Mode(s)</th>
<th>Year</th>
<th>VIN Range</th>
<th>Vehicle-Specific Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4</td>
<td>2002 – 2007</td>
<td>All</td>
<td></td>
</tr>
<tr>
<td>A4 Cabriolet</td>
<td>2003 – 2007</td>
<td>All</td>
<td></td>
</tr>
</tbody>
</table>

Condition

MIL on and/or vehicle in emergency running mode with gear indicator illumination inverted. DTC 17090-P0706 (Transm. Range Sensor Circ. Ranger Performance) or DTC 18201-P1793 (Output Speed Sensor 2 Circ. No Signal).

Technical Background

Not applicable.

Production Solution

Not applicable.

Service

It is not necessary to receive an authorization number from the Technical Assistance Center for the repair described in this bulletin.

Attach VAS scan tool printouts to the repair order. Warranty requested documents required when VAS scan tool printouts will be denied payment.

If either DTC 17090-P0706 or 18201-P1793 is stored in the fault memory, replace Transmission Control Module. Refer to Group 38, Transmission Control Module (TCM) J217 Removing and Installing.

Warranty

Page 1 of 2

© 2007 Audi of America, Inc.
All rights reserved. Information contained in this document is based on the latest information available at a standard printing, and is subject to error or change without notice. No part of this document may be reproduced without written permission of Audi of America, Inc., its affiliated companies and its licensors. All rights are reserved to make changes or corrections of any type in the document, at any time, at Audi's discretion, or in response to any errors, inaccuracies, inadvertent or otherwise.
Technical Service Bulletin

No drive or delayed drive in "D" or "R" (DTC P1743/18151 may be stored in TCM)

Condition

No drive, or delayed drive when either D or R is selected. DTC P1743/18151 may be logged in TCM fault memory.
The vehicle does not start moving without accelerating. When accelerating, an increased engine speed is necessary to move the vehicle. In some cases there is no drive.

Technical Background

Some damaged seals installed in production.
The damaged seals may leak after a short operating period (less than 13,000 miles), causing a loss of transmission oil pressure.
This condition will not result in unintentional vehicle movement.

Production Solution

Improved production.

Service

It is not necessary to receive an authorization number from the Technical Assistance Center for the repair described in this bulletin.
Attach VAS scan tool printouts to the repair order. Warranty requested documents received without VAS scan tool printouts will be denied payment.
If fault P1743/18151 (clutch slip monitoring signal too large) is stored in the transmission fault memory, read MV8 441 and 451. If MV8 441 is 1000 mA and MV8 451 is above 12 bar, there is a problem with the axial seals. If MV8 451 is below 12 bar, this indicates a hydraulic problem. (See below for further analysis.)

Increase Engine Speed For Movement

No Drive / Delay In Drive Or Reverse

DTC 18151 / P1743
Today’s Presentation
Sponsored By:

THANK YOU
Thanks For Attending

* Questions
* Survey

Thanks For Attending, See you during our Next ATRA webinar

Thanks to our supplier for the support