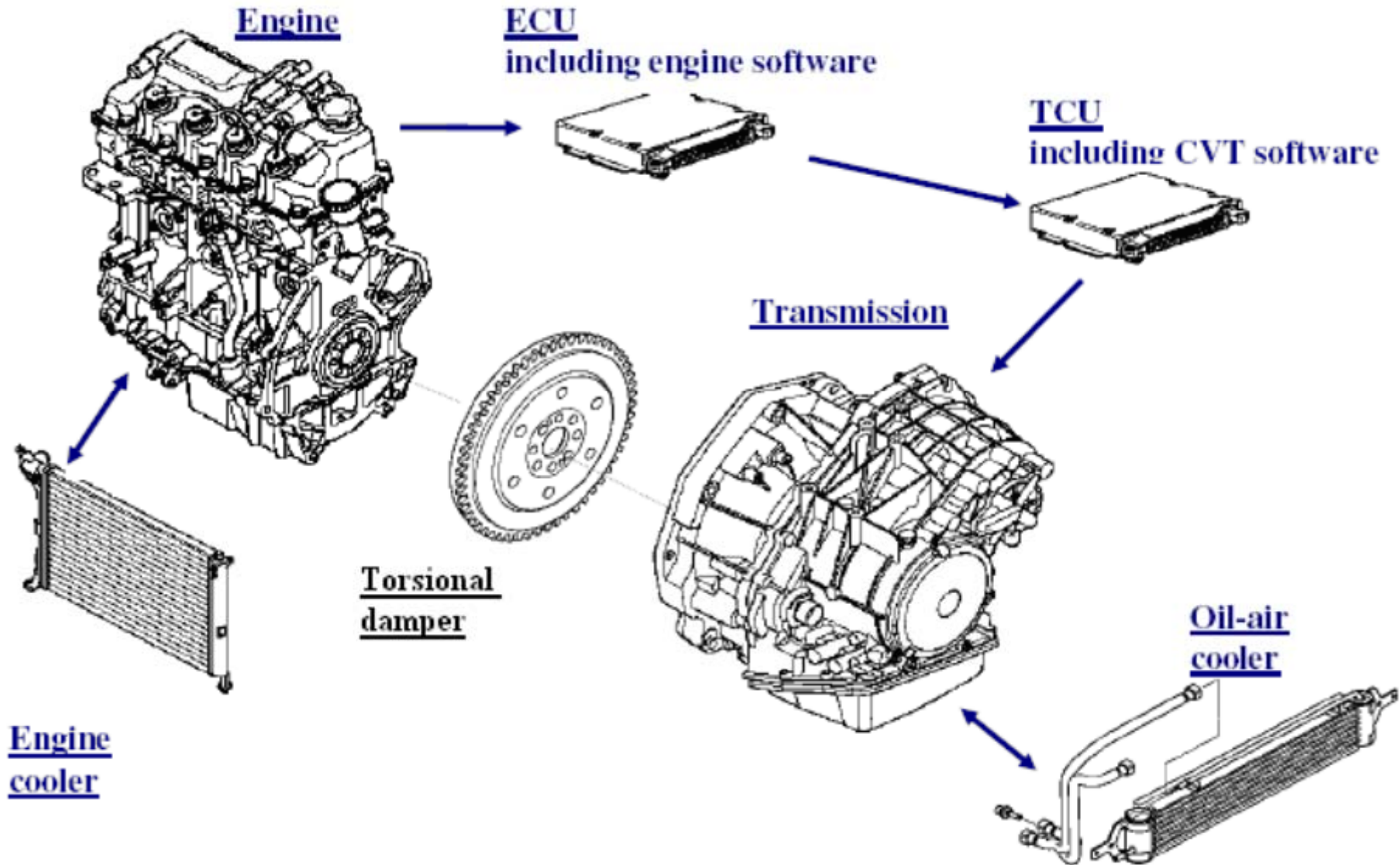


CVT (CONTINUOUSLY VARIABLE TRANSMISSION)

Date

Subject of the meeting

1

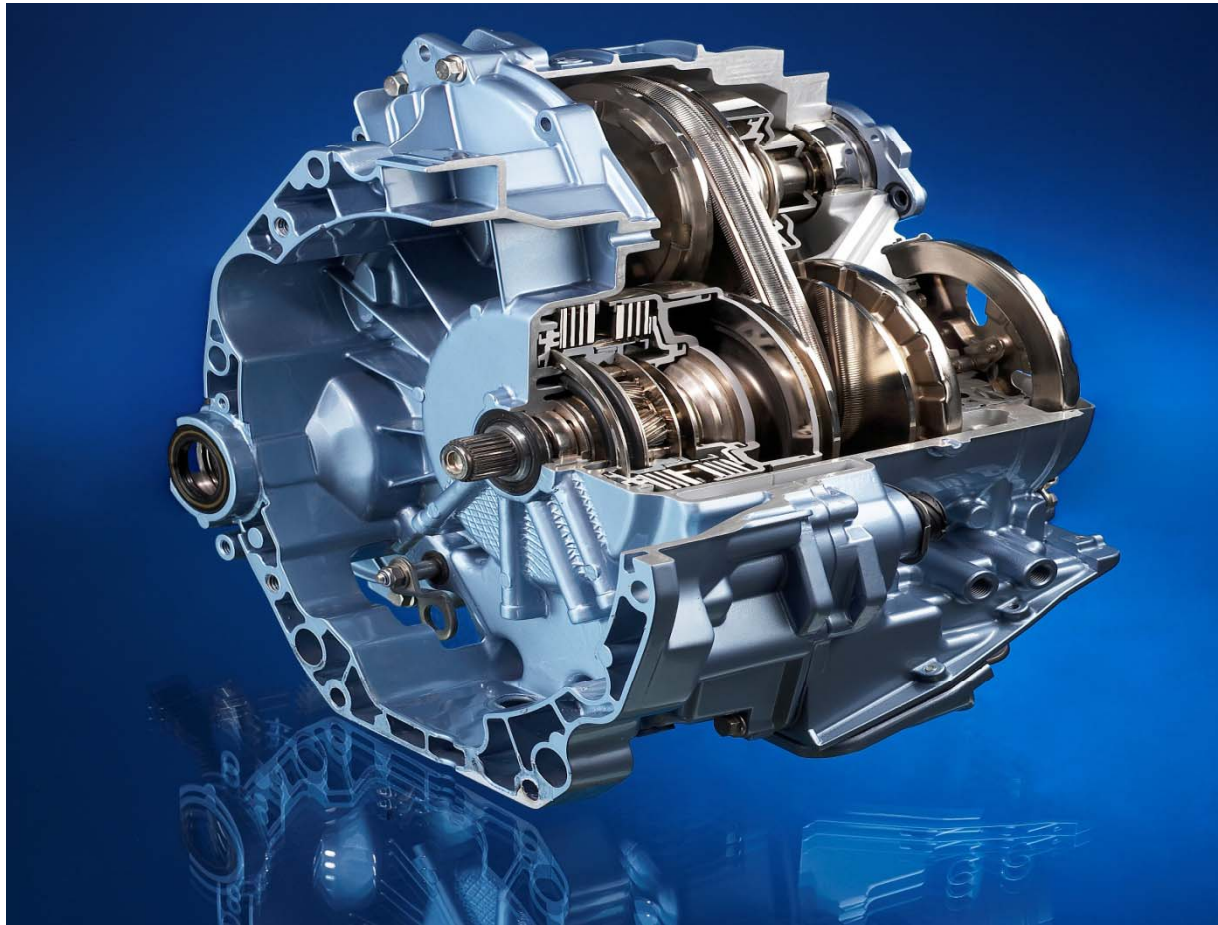


Date

Subject of the meeting

2

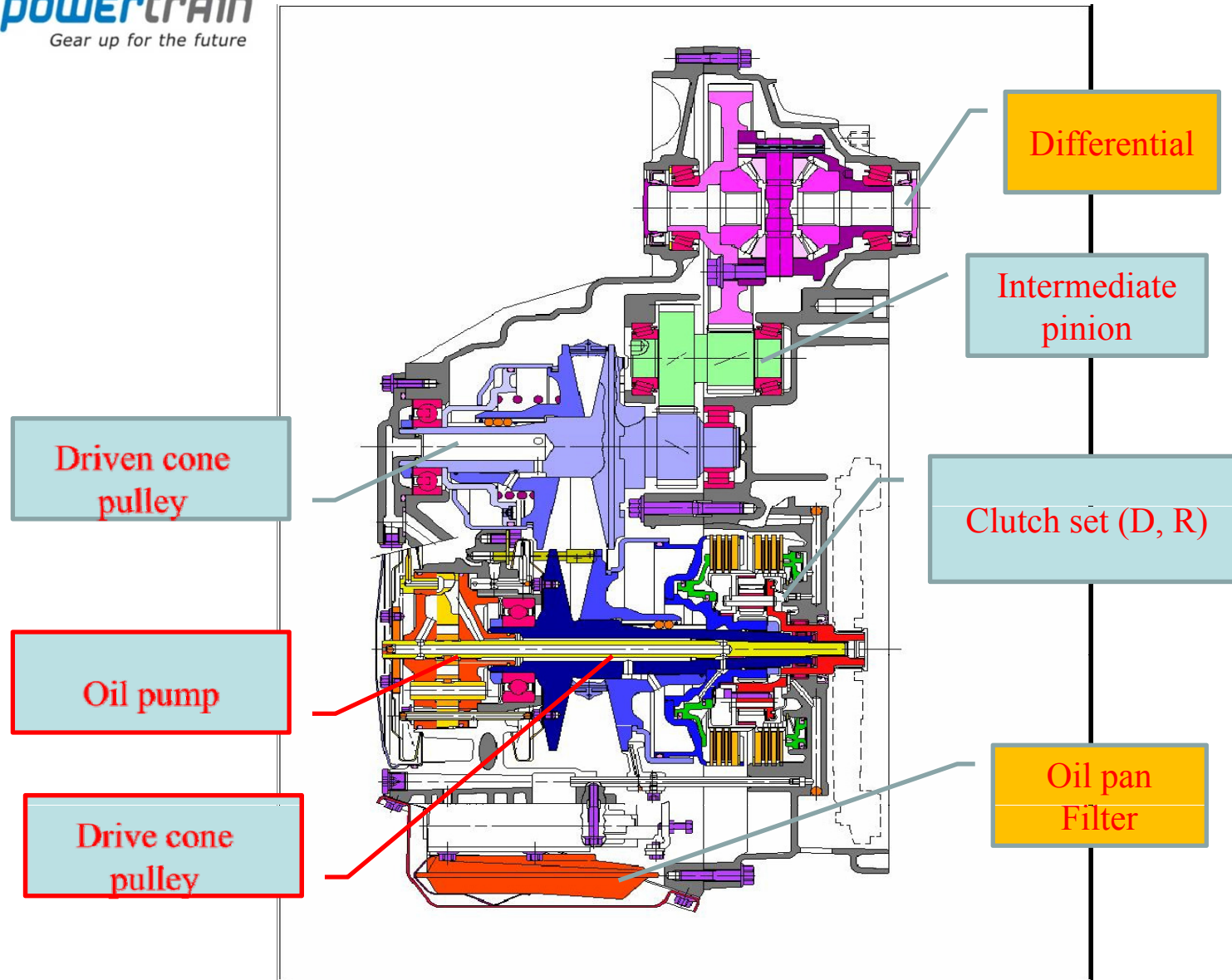
Mechanical system



Date

Subject of the meeting

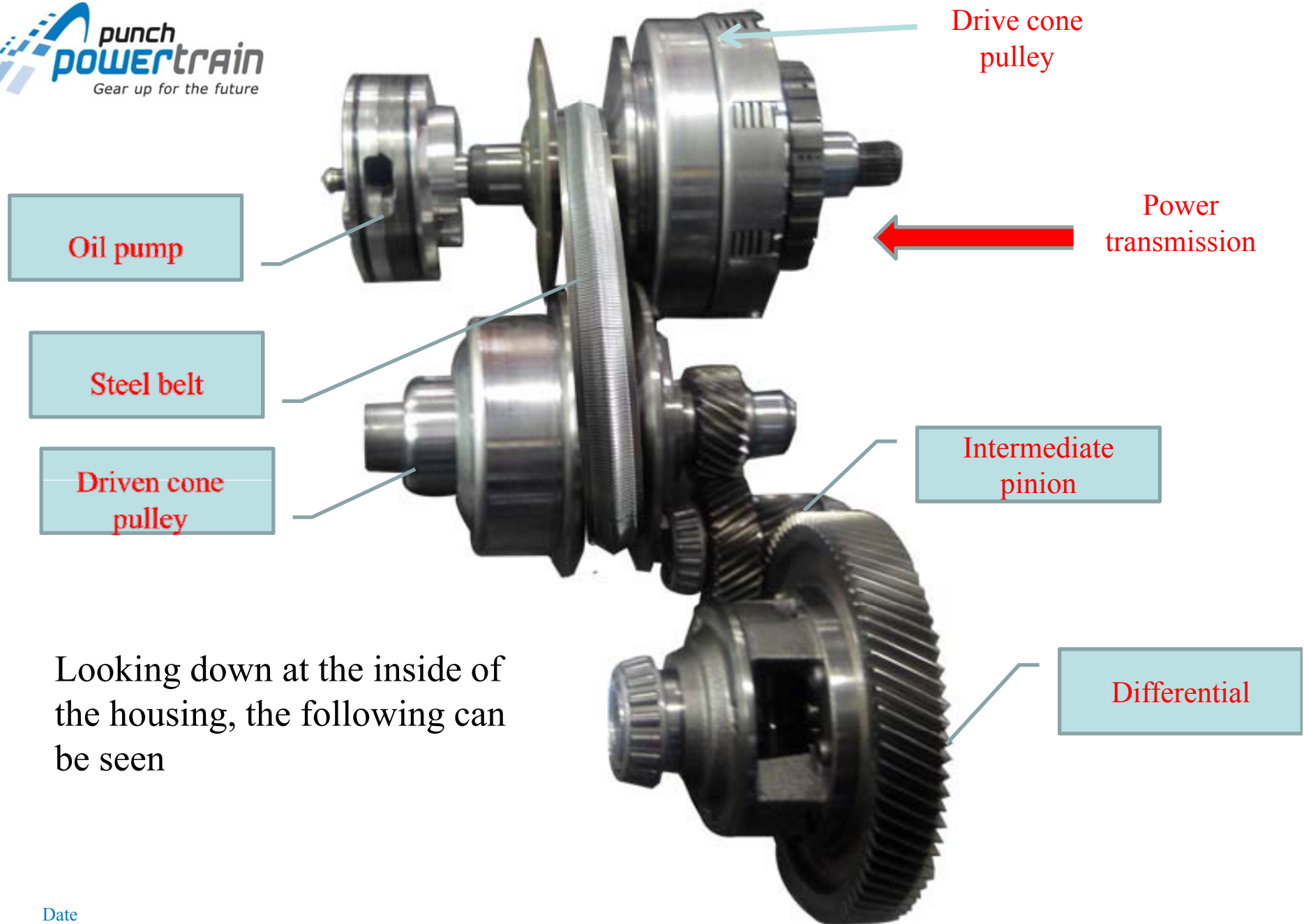
3



Date

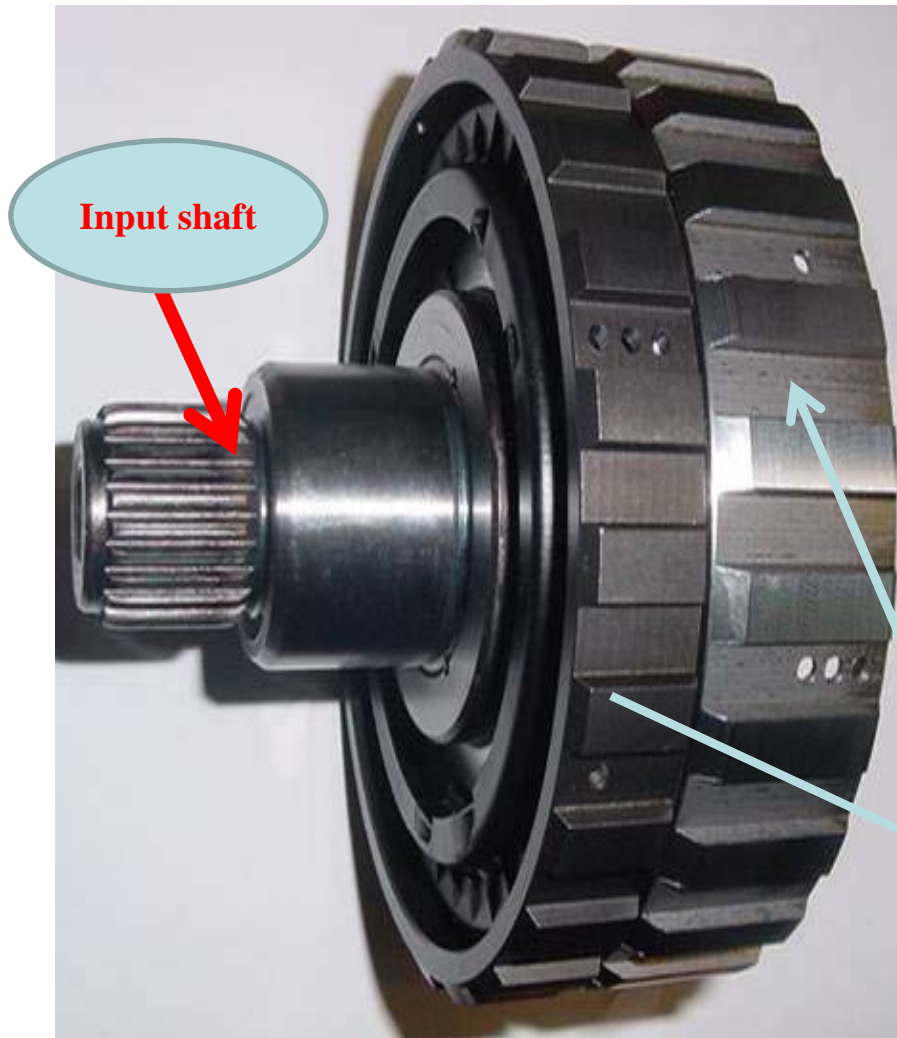
Subject of the meeting

4



Looking down at the inside of the housing, the following can be seen

Date



- Planetary gear set
- Main application: Reversing
- Principle: Engagement of the reverse gear ring with the reverse clutch, plus engagement of the internal gears, enables the drive cone pulley to reverse clockwise, thereby achieving the reversing action.

Date

Subject of the meeting

6



- When in D position, the planetary carrier acts as both input and output.
- When in R position, the planetary carrier acts as input, but the sun gear acts as output.
- Whether in D position or in R position, the clutch needs to be engaged through two processes.

Date

Subject of the meeting

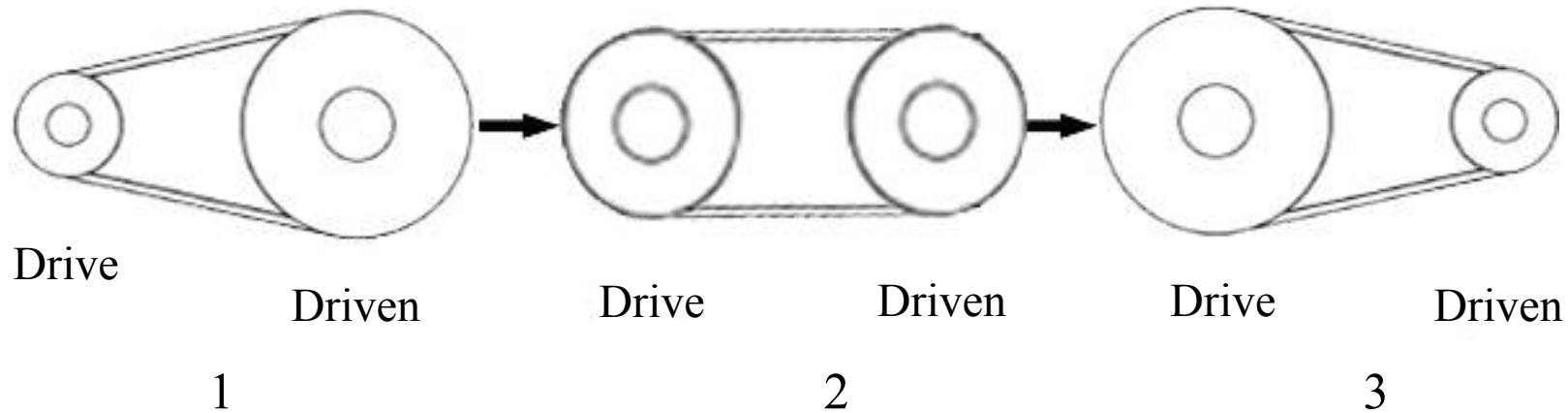
7

- Speed changing device: Driving wheel and steel belt
 - A pair of V-shaped cone pulleys connected by a steel band
 - For each set of cone pulley, one half is fixed and the other half is slidable.
 - The purpose of the steel band is to transfer power from one cone pulley to another.
 - The driven cone pulley's torque and speed depend on the steel band position.
 - The drive ratio achieved by the cone pulleys changes between 2.416:1 and 0.443:1.



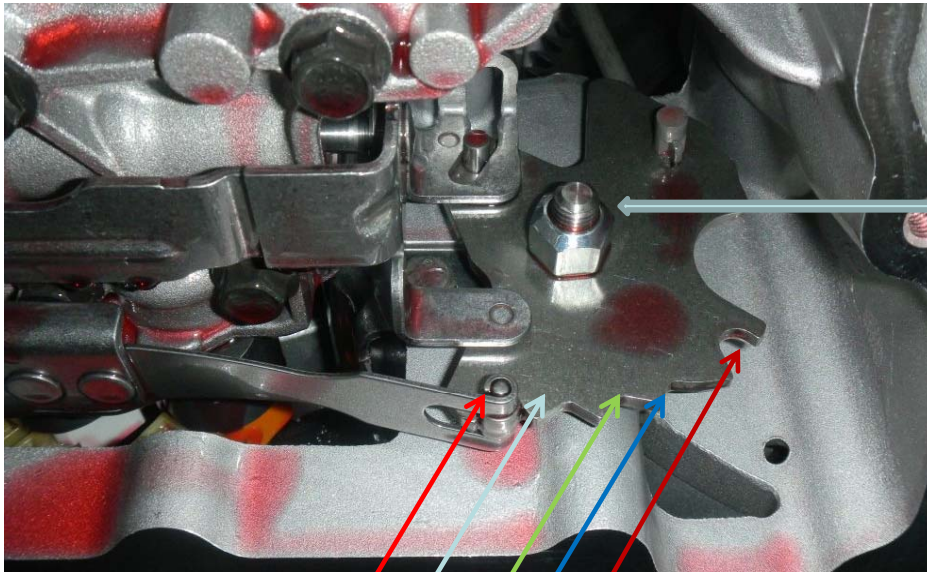
Change in drive ratio

- The process of change of the joint surface between the steel band and the cone pulleys when the drive cone pulley and driven cone pulley in CVT running to high speed from low speed



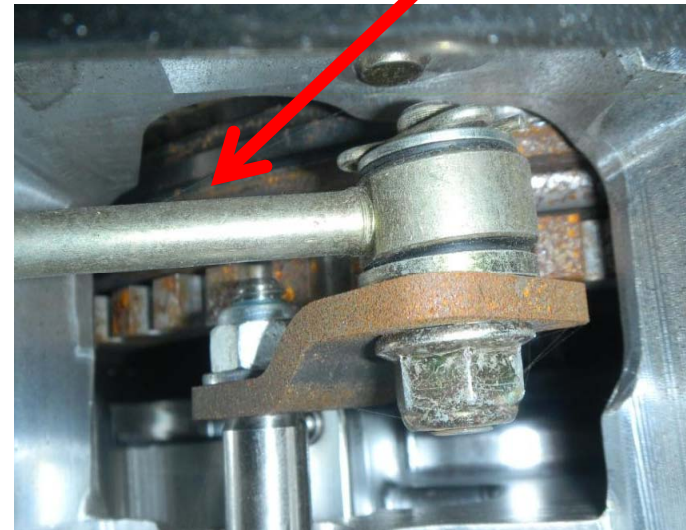
- Figure 1 At low speed, the initial state of the drive cone pulley and driven cone pulley

- Gearshift mechanism

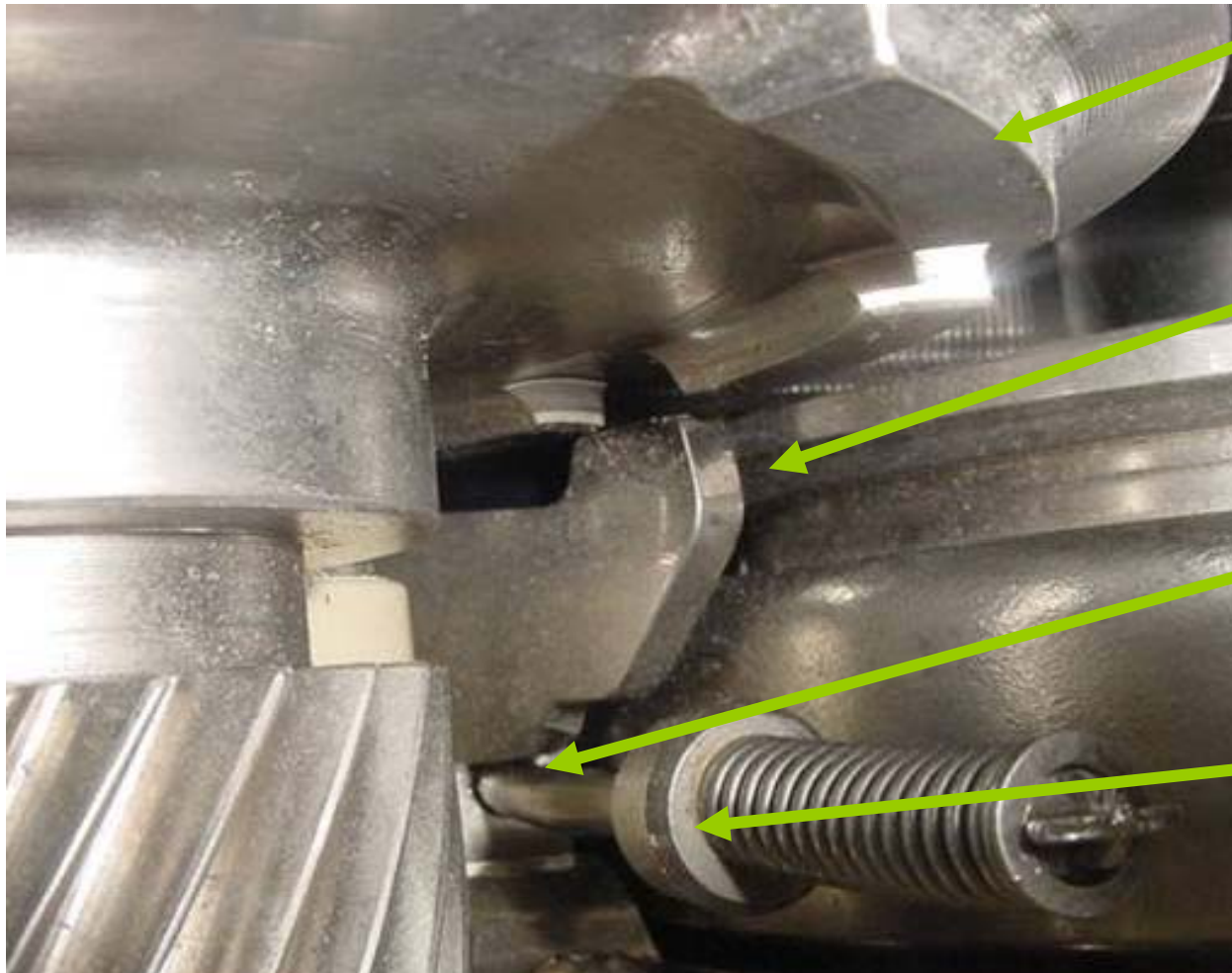


(M) D N R P

Gear shift shaft



- Parking mechanism: Released for driving.



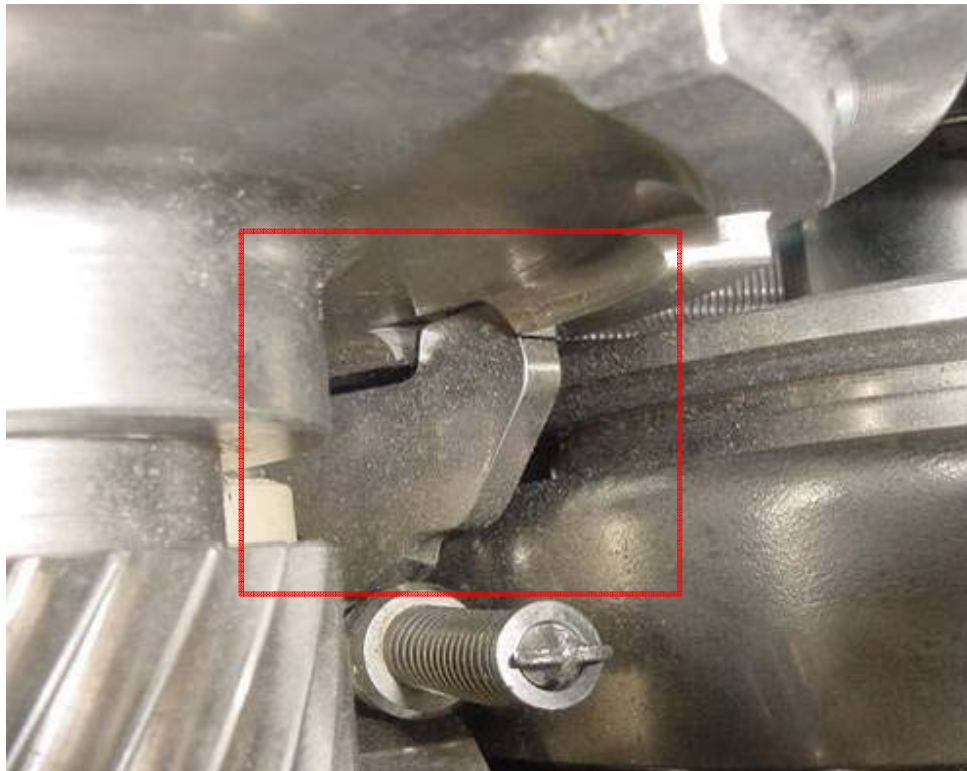
Ratchet for
driven cone
pulley

Parking pawl

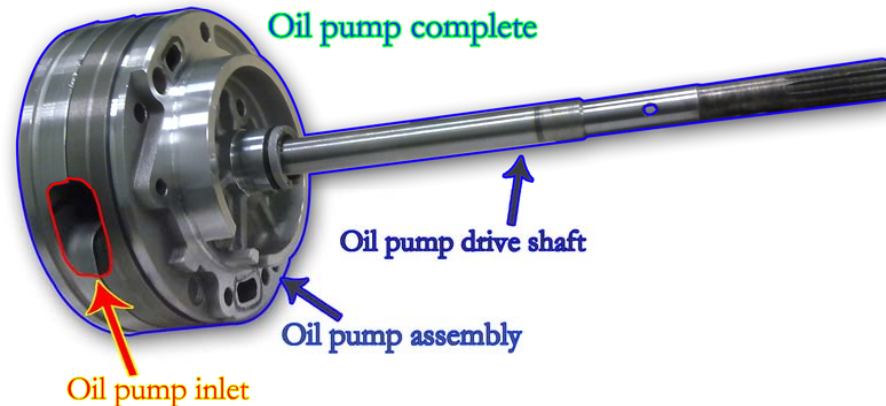
Parking pull-rod

Parking cone

- Parking mechanism: Parking brake is applied. Since the driven cone pulley is locked and the driven cone pulley is connected to its relay connection (including intermediate gear, differential, half shaft and wheel hub) through the gears with a fixed number of teeth, so once the driven cone pulley is locked, the wheels will be locked. [Damaged parking mechanism](#)



- Oil pump inside transmission



- The generation and cutoff of oil pressure depends on the engine starting and shutdown. When starting, the engine output shaft engages with the CVT input shaft to rotate. Then, the oil pump of the engine begins to operate, that is to say, the oil pump shaft begins to rotate to provide oil pressure each part (drive cone pulley, driven cone pulley, forward or backward clutch, steel band lubrication, hydraulic adjustment of valve body, and planetary gear lubrication) of the CVT.

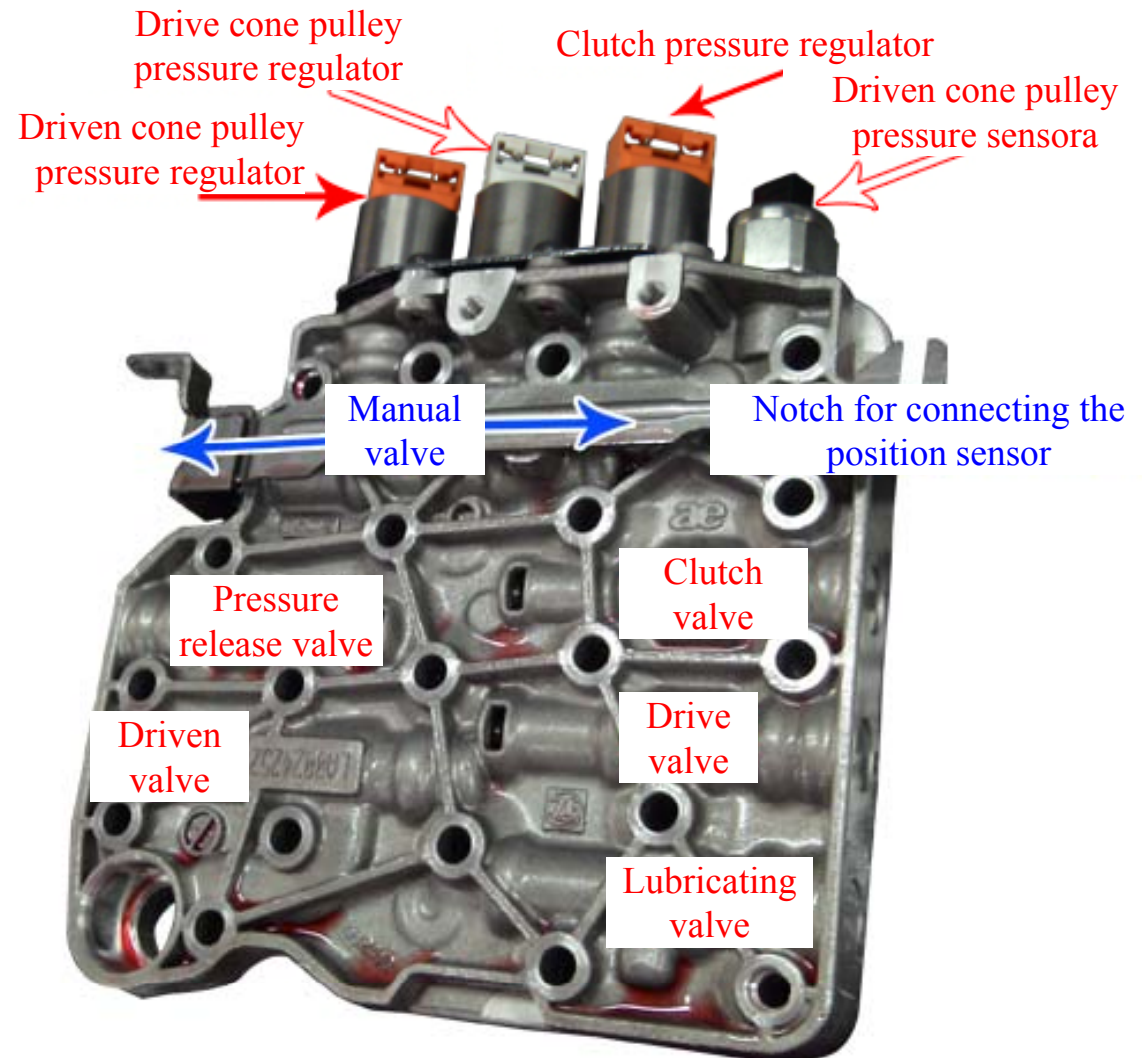
[Case\P1765 Fault.docx](#)

Date

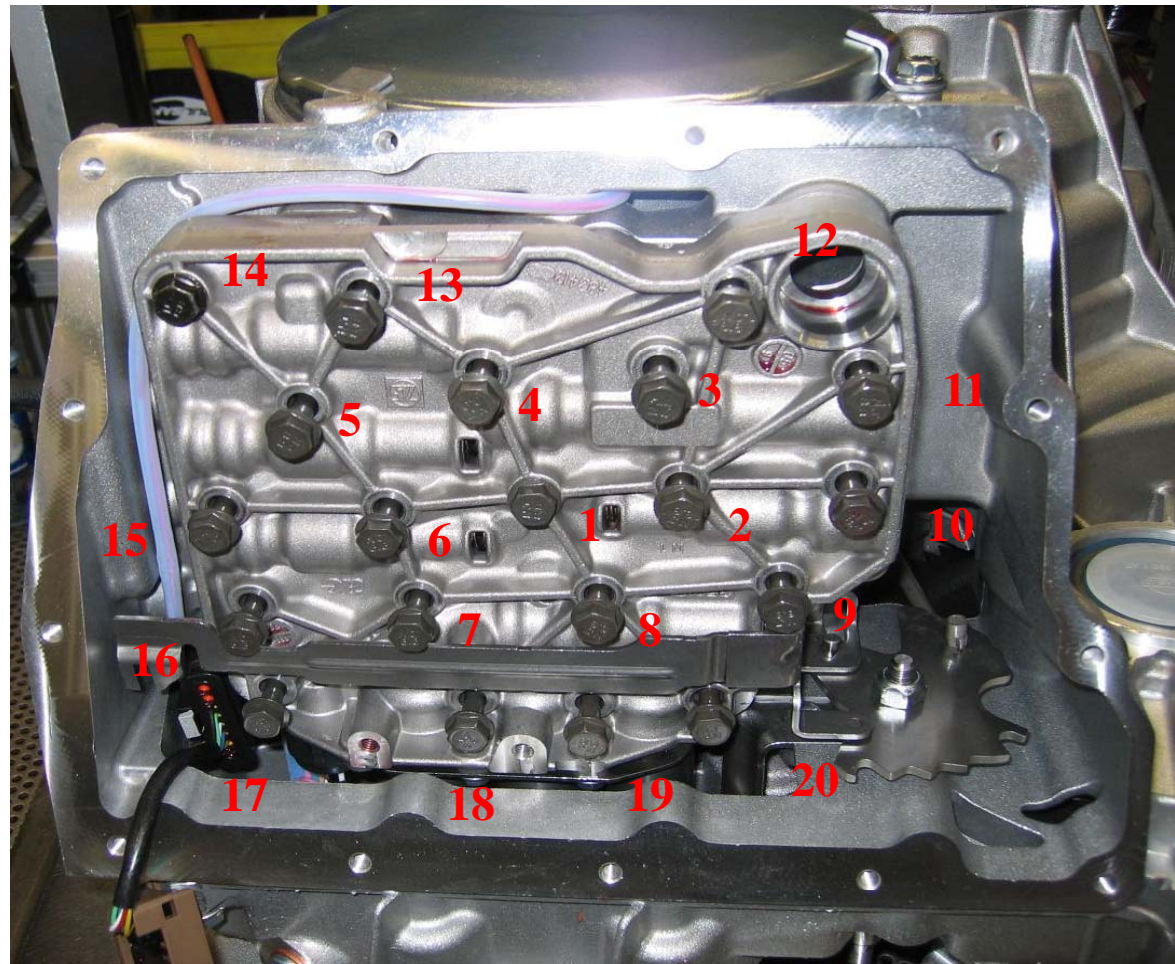
Subject of the meeting

14

- Hydraulic control unit
- Main applications:
- The vehicle speed will be adjusted and the oil pressure will be monitored through the computer board regulating the three regulators (drive cone pulley pressure regulator, driven cone pulley pressure regulator and clutch pressure regulator) and the sensor monitoring.
- Principle:
- Sliding the manual valve determines the gear position (Parking, Downshifting, Stop and Upshifting). However, the process of regulation of the three regulators determines whether the interior of the vehicle is normal by comparing the target value preset by the computer board with the actual value offered by the valve body when the vehicle driving.



- Hydraulic control unit (installation sequence)

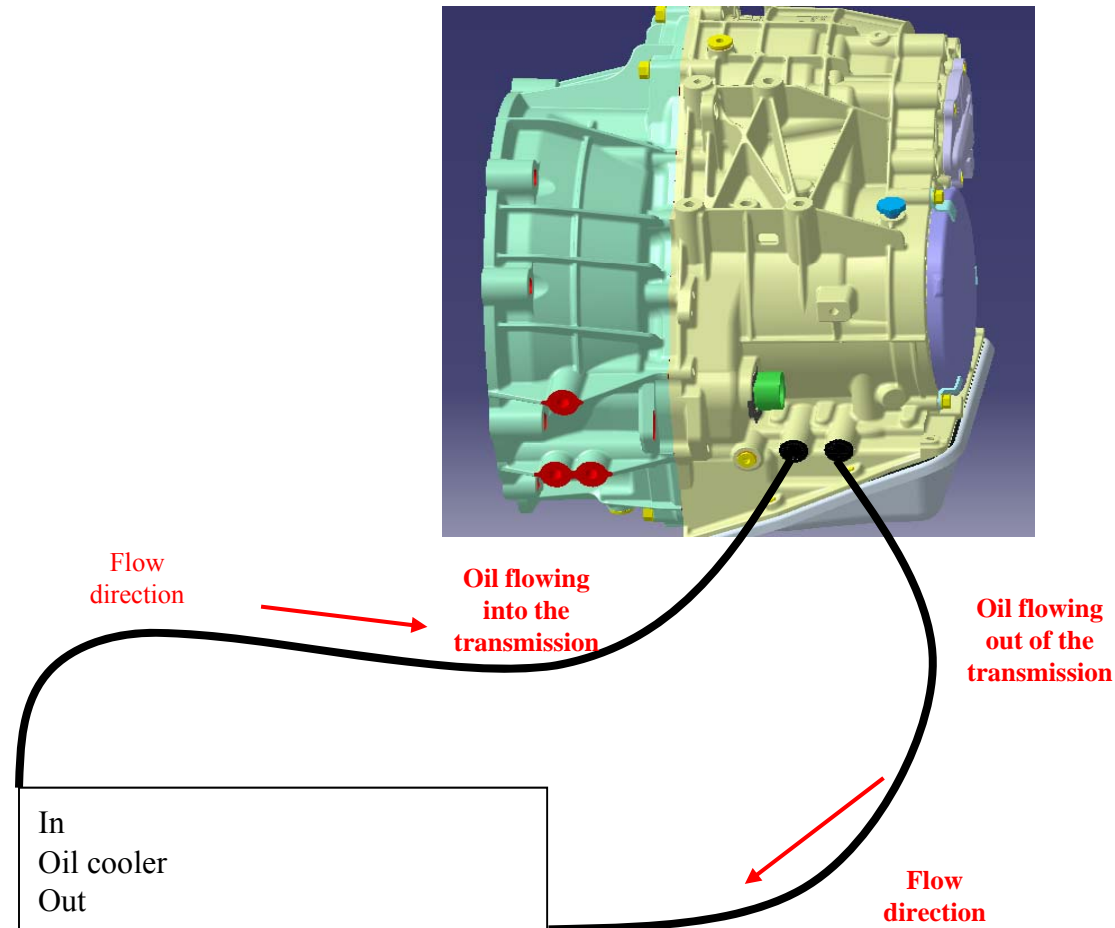




- Electronic control system and external connection

External connection

- Oil cooler interface
 - The oil from the transmission flows to the oil cooler and then returns to the transmission.
 - The oil cooler is mounted beside the engine radiator to keep the temperature below 120°C.



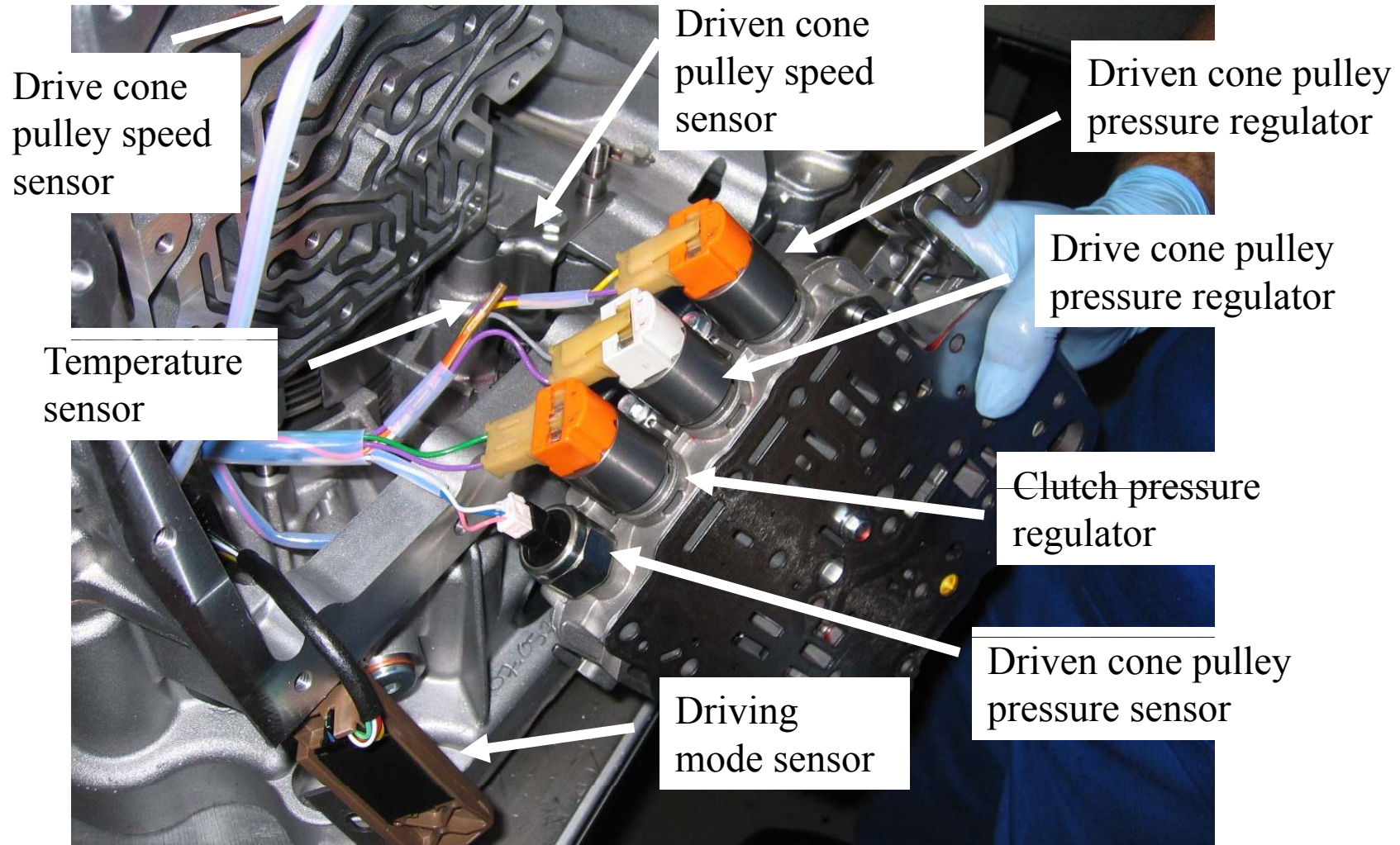
CVT data interface

- Main interfaces
 - 16-pin round interface: Terminal for CVT internal pressure regulating and monitoring components (valve, speed sensor, gear sensor).
External connection: Equipment of TCU and ECU to transmit the CVT command, so as to enable the TCU to exchange information with the transmission and to carry out the information.



AutoLibrary
Internally-connected sensor regulating components

- Transmission elements

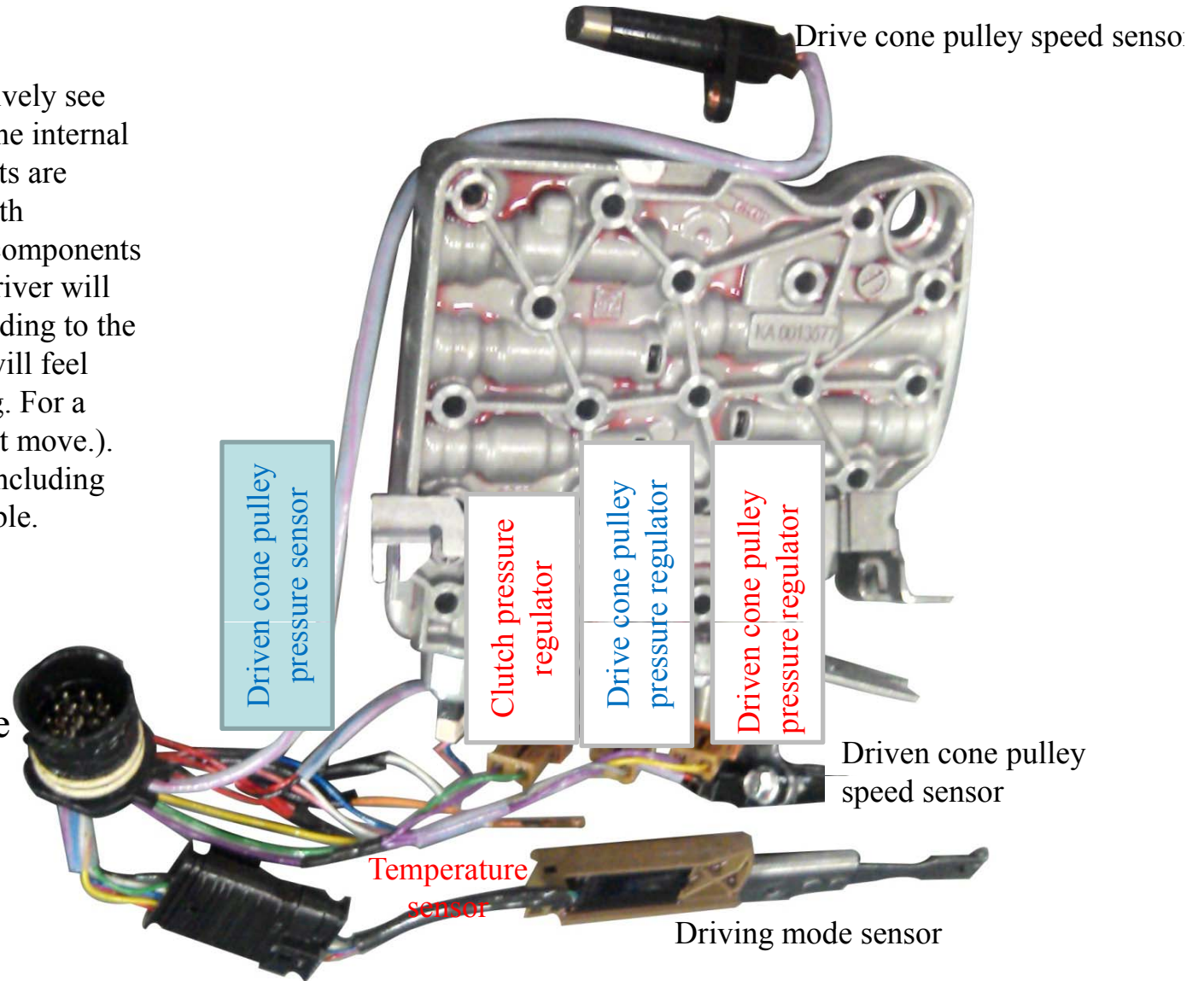


AutoLibrary

Internally-connected sensor regulating components

From this figure, we can intuitively see the components connected to the internal interfaces. All these components are sensing and regulating ones with hypersensitivity. If one of the components fails, to protect the CVT, the driver will be reminded to replace it according to the severity (For a mild one, you will feel rush when your vehicle driving. For a severe one, your vehicle cannot move.). Similarly, these components (including 16-pin interfaces) are replaceable.

16-pin round interface



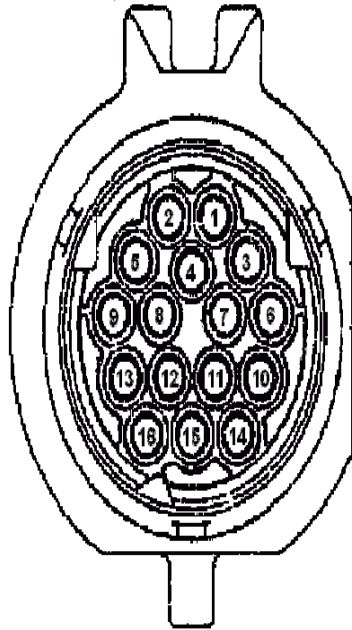
Date

Subject of the meeting

21

Main wire interface

Connector Layout (transmission side)

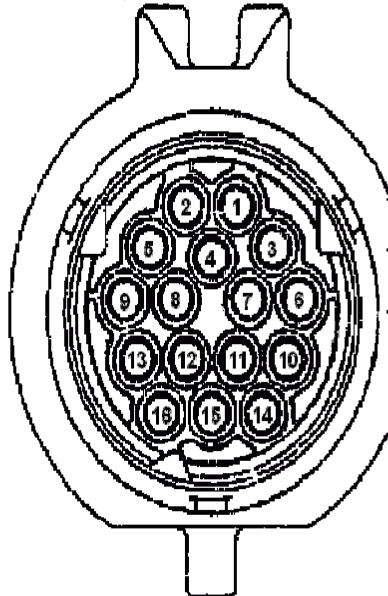


Pin assignment

| Pin | Signal | Pin | Signal |
|-----|---------------------|-----|-------------|
| 1 | supply valves (VHS) | 9 | supply_8,4V |
| 2 | EDS_1 | 10 | p_S2 |
| 3 | EDS_2 | 11 | n_ab |
| 4 | EDS_3 | 12 | n_S1 |
| 5 | oil temperature | 13 | DMS_A |
| 6 | DMS_GND | 14 | DMS_B |
| 7 | Sensor GND | 15 | DMS_C |
| 8 | supply_5V | 16 | DMS_D |

- **Pins of main connector for transmission**
- A. Pressure regulator
- Pins (2, 3, 4). The clutch resistance between **Pins 1 and 4** is about **5.2Ω**. The driving resistance between **Pins 1 and 2** is about **5.2Ω**. The driven resistance between **Pins 1 and 3** is about **5.2Ω**.
- It is the three pressure regulators' control and detection circuit. The current from the valve regulating wire (purple) (Interface 1) (divided into three lines) will be divided into three sections to the driving regulating wire (gray) (Interface 2), the driven regulating wire (yellow) (Interface 3) and the clutch regulating wire (green) (Interface 4), respectively, as current output.
- B. Oil temperature sensor
- The resistance between Pins 5 and 7 should be **942-1121Ω** at 20°C~40°C.
- Oil temperature sensor wire 5 (orange) The wire is a general grounding one used to connect the oil temperature sensor ground 7 (white) to the driven cone pulley pressure sensor.
- C. Driven cone pulley pressure sensor
- **8, 7, 10**, with a resistance of about **44300Ω**
- 7 represents the driven cone pulley pressure sensor grounding wire (white). **8** represents the driven cone pulley pressure sensor providing a voltage of **5V** (pink).
- 10 represents the driven cone pulley pressure sensor (blue).

Connector Layout (transmission side)



Pin assignment

| Pin | Signal | Pin | Signal |
|-----|---------------------|-----|-------------|
| 1 | supply valves (VHS) | 9 | supply_8,4V |
| 2 | EDS_1 | 10 | p_S2 |
| 3 | EDS_2 | 11 | n_ab |
| 4 | EDS_3 | 12 | n_S1 |
| 5 | oil temperature | 13 | DMS_A |
| 6 | DMS_GND | 14 | DMS_B |
| 7 | Sensor GND | 15 | DMS_C |
| 8 | supply_5V | 16 | DMS_D |

- D. Position sensor
- 9, 6, 13, 14, 15, 16
- 9 Supply wire (red) (providing 8.4V to DMS, driving cone pulley speed sensor and driven cone pulley speed sensor) 6 position sensor grounding wire (black upper)
- 13 DMS wire (white) 14 DMS wire (yellow) 15 DMS wire (blue) 16 DMS wire (green)
-
- E. Driven cone pulley speed sensor
- 11, 9 24.3 megohm (driven)
- 11 Driven cone pulley speed sensor wire (black lower), 9 Supply wire (red) (providing a voltage to DMS, driving cone pulley speed sensor and driven cone pulley speed sensor)
-
- F. Drive cone pulley speed sensor
- 12, 9 24.3 megohm (drive)
- 12 Driving cone pulley speed sensor wire (gray lower), 9 Supply wire (red) (providing a voltage to DMS, driving cone pulley speed sensor and driven cone pulley speed sensor)

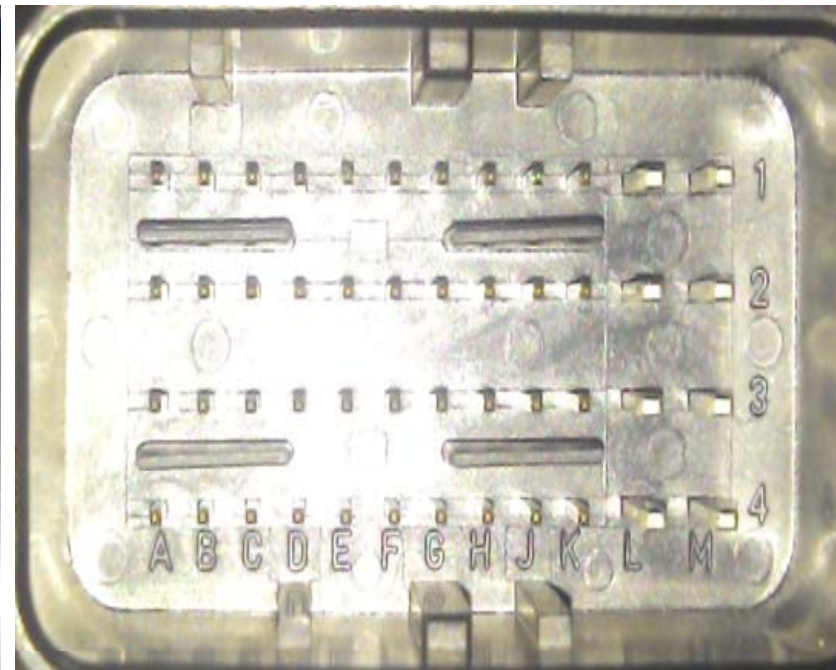
Electronic elements / connection

- TCU: Transmission control unit
- The resistance can not be measured

Control the transmission and the software operating.

The driving strategy is a part of the TCU software.

Usually, installed in the cab or elsewhere

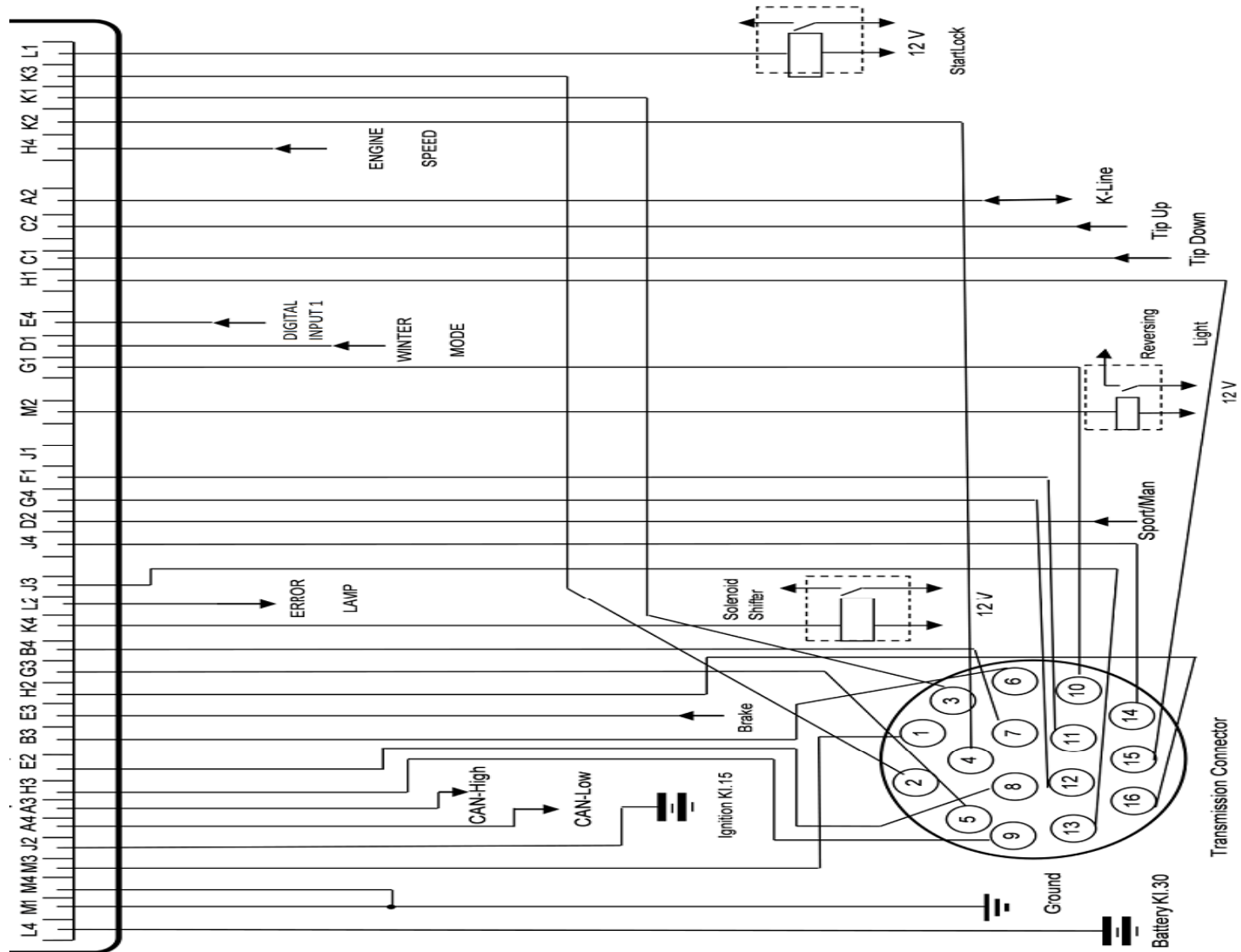


Electronic elements / connection

xTCU pin distribution

| Signal | xTCU pin |
|--|----------|
| Normally-on power KI.30 | L4 |
| Ignition power KI.15 | J2 |
| Grounding KI.31 | M1;M4 |
| VHSD1 (Power supply for actuator) | M3 |
| Power supply for speed and position sensors (8,4V) | H3 |
| Pressure sensor power (5V) | E2 |
| GND driving mode sensor | B3 |
| GND: sensor | B4 |
| Transmission oil temperature | G3 |
| N_Prim (Speed sensor for drive cone pulley) | G4 |
| N_ab (Driven cone pulley speed) | F1 |
| N_MOT (Engine speed signal) | H4 |
| DMS_A (Driving mode sensing signal) | J3 |
| DMS_B (Driving mode sensing signal) | J4 |
| DMS_C (Driving mode sensing signal) | H1 |
| DMS_D (Driving mode sensing signal) | H2 |

| | |
|--|----|
| Brake signal | E3 |
| Manual mode signal | D2 |
| Upshifting signal | C2 |
| Downshifting signal | C1 |
| Winter mode or SAT mode | D1 |
| P_S2 (Pressure of driven cone pulley) | G1 |
| Shifting lock (optional) | K4 |
| K-line | A2 |
| CAN-high speed | A3 |
| CAN-low speed | A4 |
| Starting lock | L1 |
| EDS1 (Driven cone pulley pressure regulator) | K3 |
| EDS2 (Drive cone pulley pressure regulator) | K1 |
| EDS3 (Clutch pressure regulator) | K2 |
| Reverse light relay | M2 |
| Signal input | E4 |
| Fault light | L2 |





- Maintenance of transmission

Basic information







- Towing
 - If the vehicle equipped with a VT2 transmission needs to be towed, make sure its front wheels are off the ground.
 - Out-of-operation of engine->no oil pressure-> rotation of driven cone pulley can cause the steel band to slip!!!



- Maintenance intervals
 - Replace at least every two years or 60,000km: Replace the oil filter+ oil
 - You can shorten the maintenance interval for the transmission to match the standard maintenance interval for your vehicle.



Oil specifications

| Oils | Fluids | Packaging |
|---|---|--|
| MOBIL-EZL799(A)↵ |  |  |
| IDEMITSU-CVTF-EX1↵ |  |  |
| PETRONAS Tutela Transmission CVT-PPT↵ |  |  |

Using other oil or modifying fuel system may result in the transmission damage which is not covered by the warranty.

[Case \ modified natural gas.docx](#)

Self-learning value

- Purpose: The purpose of self-learning is to make up for the tolerance of production process and guarantee smooth engagement of the transmission clutch, so that the vehicle starts smoothly. When the vehicle off the assembly line, the professional staff will perform offline self learning on the vehicle.
- If one of the following conditions occurs, be sure to remove it and renew the self-learning value.
 - 1.TCU software update (replacing the TCU assembly)
 - 2. Replace the transmission assembly.
 - 3. Replace the hydraulic control unit.



Updating clutch self-learning value

- To enable the self-learning process, make sure the following conditions are satisfied:
- Static
 - Accelerator pedal released
 - Stable engine **idling speed**
 - Stable engine torque
 - Applying the brakes
- Updating process

To update the clutch self-learning at a certain temperature, do the following.

1. Move the shift lever into N position and wait for 5 seconds.
2. Move the shift lever into D position and wait for about 45 seconds until you feel an obvious vehicle impact, and then move the shift lever into N position.
3. Wait for 5 seconds with the shift lever in N position, and then move the shift lever into R position. Similarly, wait for about 45 seconds until you feel an obvious vehicle impact, and then move the shift lever into N position.
4. Move the shift lever into D position from N position and wait for 5 seconds;
5. Move the shift lever into N position from D position and wait for 5 seconds.
6. Move the shift lever into R position from N position and wait for 5 seconds;
7. Move the shift lever into N position from R position;
8. Repeat Steps 4, 5, 6 and 7 for 3-5 times.

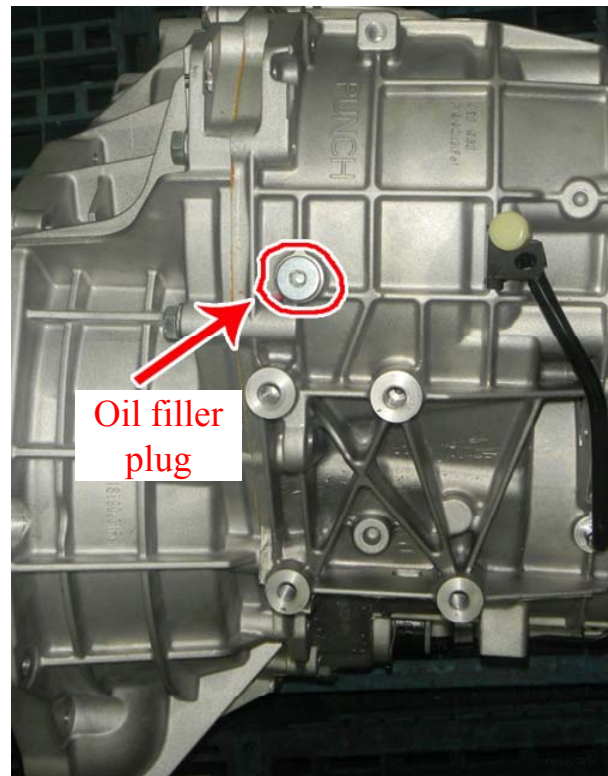
If the indicator light on the instrument panel goes out, this indicates the self-learning value has been completed. If the indicator light stays on, repeat the above steps!



- As you operate the transmission, the friction plates inside the transmission will be worn slightly. When you shift every time, the transmission will perform self-learning automatically, and this will make the self-learning value more perfect and the starting more smooth.
- If your vehicle cannot move or starts slowly when cold, the self-learning value needs to be improved. Do the following:
- Be sure to apply the brakes in the whole process. Move the shift lever into N position and wait for 5 seconds.
- Then, move the shift lever into D position and wait for 5 seconds.
- And then, move the shift lever into N position and wait for 5 seconds.
- Finally, move the shift lever into R position and wait for 5 seconds.
- The above is a circulation. This should be cycled for more than 10 times.

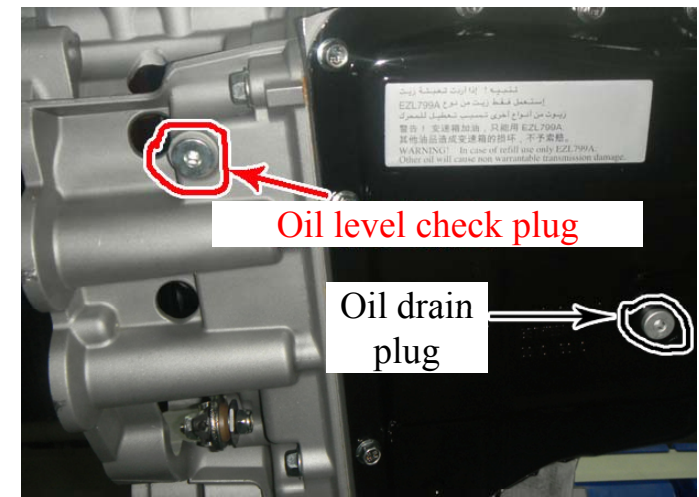
Checking the oil level

- - Remove oil filling bolt on upper end of the transmission.
- - Fill 0.5L oil into the transmission
- Reinstall the oil filler plug back and tighten it to the specified torque
- - The transmission temperature increases; drive carefully for at least 5 minutes or oil temperature is about 60°C.
- - Park the vehicle on a flat ground
- - Step on the brake
- - Wait for two seconds.
- - Shift the gear to P
- - **Keep the engine idling**



Checking the oil level

- - When the engine runs idly, remove oil level check bolt
- - Drain the oil properly (0.235L- 0.565L).
-
- The minimum oil flowing out from the transmission should be 0.235L. If less,
- **this indicates the original oil level is too low.**
- The maximum oil flowing out from the transmission should be 0.565L. If more,
- **this indicates the original oil level is too high.**
-
- All data shall be calculated at 60 degree.
-
- - Fix a **new** gasket to the drain bolt and tighten the bolt to **18-24Nm**.
- - Shut down the engine





- **Common Sounds**



SOUND FROM R GEAR

Sound description:

Put into reverse gear, keep the vehicle static, and you can hear low **whistle**.

This is **normal** sound when planetary wheel in the transmission works.



Driven cone pulley gear has noise

Sound description:

When accelerating from 60kph to 90kph, there is an obvious whistle. Release accelerator pedal, the noise reduces. Step accelerator pedal, the noise restores immediately.

The noise is similar to whistle. The noise becomes larger with the speed increase. This noise is normal. The noise comes from engagement of driven cone pulley and intermediate shaft gear.

Bearing noise

- Bearing noise:
- Description: This is a buzz when the vehicle traveling with D gear.
- The noise has two types of changes: 1. The noise increases with the engine speed; 2. The noise increases with the vehicle speed.



- Inspection method: Let your vehicle drive with D gear at a constant speed (constant throttle opening, with a vehicle speed of about 60km/h), and then shift to the S mode;
- The engine speed increases by about 500 rpm within 1-2 seconds. In this process, the vehicle speed keeps basically unchanged. If the noise increases with the engine speed, this indicates the bearing for the driving cone pulley has been damaged.
- In this whole process, keep the vehicle speed basically unchanged. If the noise increases with the engine speed, this indicates the bearing for the drive cone pulley has been damaged. (Principle: Because the drive cone pulley is connected to the engine, the noise from the drive cone pulley bearing will change with the engine speed.)

According to the bearing damage severity, if this happens, you had better have the drive cone pulley replaced.



Noise from water in transmission



Fault description:

Move the shift lever into D position or R position, and slowly release the brakes. You will hear a gurgle as long as the wheels move. If you press the accelerator pedal hard, you will hear continuous squeak at a vehicle speed between 10km/h-40km/h. The squeak disappears at a vehicle speed over 40km/h. In addition, some vehicles may have accompanying play. In this case, you can open the end cover for the driving cone pulley and check the end cover for **white milky liquid** or drop of water. If any, it is true that there is water in the transmission.



Method for processing:

Usually, the starting voice will disappear by changing the transmission oil once or twice. However, the squeak at 20km/h-40km/h still exists. In this case, you can apply the parking brake, move the shift lever into D position, and press the brake pedal and the accelerator pedal to enable the clutch friction plate temperature to rise for water draining. If in this process, a fault code appears, resulting in clutch disengagement due to high clutch temperature, this is not a fault but the self-protection function of the transmission.

Also, for water in the transmission, we can only offer this advice to the 4S shop because such case is not covered by the warranty.

Noise when in N or P position

- 1. This noise goes up with the engine speed (accelerate at neutral gear, the noise is larger)
 - First, check if the noise comes from the engine or the transmission
 - If it is located in the engine, check the engine
 - If it is located in the transmission, check if oil pump has abnormal noise
 - If the noise comes from the transmission, but not from oil pump, it may be noise of input shaft bearing or planetary gear set, it is necessary to replace the transmission.
- 2. The noise does not go up with the engine speed
 - This noise comes from other parts of the vehicle. Check vehicle components



Precautions

1. Do not move the shift lever into P position when driving.
2. Do not modify the fuel system.
3. Be sure to use the recommended transmission oil.
4. When encountering traffic lights, do not press the brake pedal and hold it there. Be sure to press the accelerator pedal and then move the shift lever into D position.
5. When installing the hydraulic control unit, be sure to rotate it from the middle to outward and tighten it to the specified torque. Avoid installing it diagonally.
6. Do not dismantle the transmission housing!!!



- When the vehicle breaks down, the maintenance personnel should use a diagnostic tester to read out the fault code, and look for the fault code in the service manual and remove the fault according to its instructions.



- THANK YOU