

CITROËN TECHNICAL TRAINING

PRESENTATION OF THE AL4 AUTOMATIC TRANSMISSION

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DEVELOPMENT AND
TRAINING

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DOCUMENT SUMMARY

PRESENTATION OF THE AL4 AUTOMATIC TRANSMISSION

The aim of this document is to give a brief description of the design and operation of the electronically managed AL4 automatic transmission which offers precise, adaptive control as well as excellent gear changing quality.

The following subjects are dealt with in this document:

- Presentation of the transmission and various pieces of information,
- The selector control,
- Lubrication,
- The converter,
- The mechanism,
- The ECU,
- Auto-diagnostics,
- The electrical circuit,
- Unit maintenance.

AL4 AUTOMATIC TRANSMISSION

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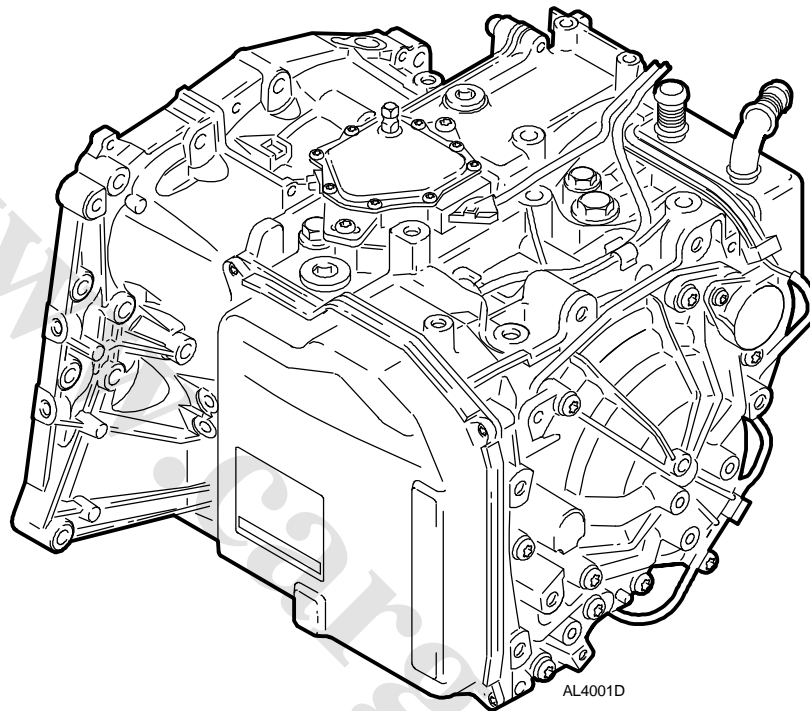
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AL4 AUTOMATIC TRANSMISSION

PRESENTATION - GENERAL

I - INTRODUCTION



- Electronically operated transverse automatic transmission.
- Four forward gears and one reverse gear.
- "Fuzzy logic" auto-adaptive ECU which controls the converter, gear changes and specific programs.
- The maximum torque capacity is 210 mN.
- Sealed transmission with reduced maintenance.
- Transmission oil cooled by heat exchanger.
- Current application: CITROËN XANTIA PHASE II vehicles with XU Petrol and Diesel engines.

AL4 AUTOMATIC TRANSMISSION

II - PRESENTATION

Transmission layout

- Hydraulic torque converter with lock-up device.
- Primary shaft.
- Two "Simpson 2" type epicyclic gear trains.
- Multiplate clutches.
- Multidisc and band brakes.
- Step down gear in central position.
- Differential with sealed outputs.

Control

This is performed by:

- the hydraulic unit,
- the ECU,
- a cable control.

Features

- Lock-up of 2nd, 3rd and 4th gears.
- Electronic control of all regulation and gear changing functions.
- Three programs offered to driver:
Auto adaptive - Sport - Snow
- Gears and programs displayed on dashboard.
- Cannot change up a gear in the no load position.
- User interface performed by a "stepped" selector grid with Shift-Lock safety function and program push buttons.
- "1st" imposed position selected using push button.
- Auto adaptive "Flash EEPROM" ECU.
- Downgraded operation in the event of a fault.
- Closed loop operation.
- On board diagnostics.
- Selector lever not in position P reminder buzzer.

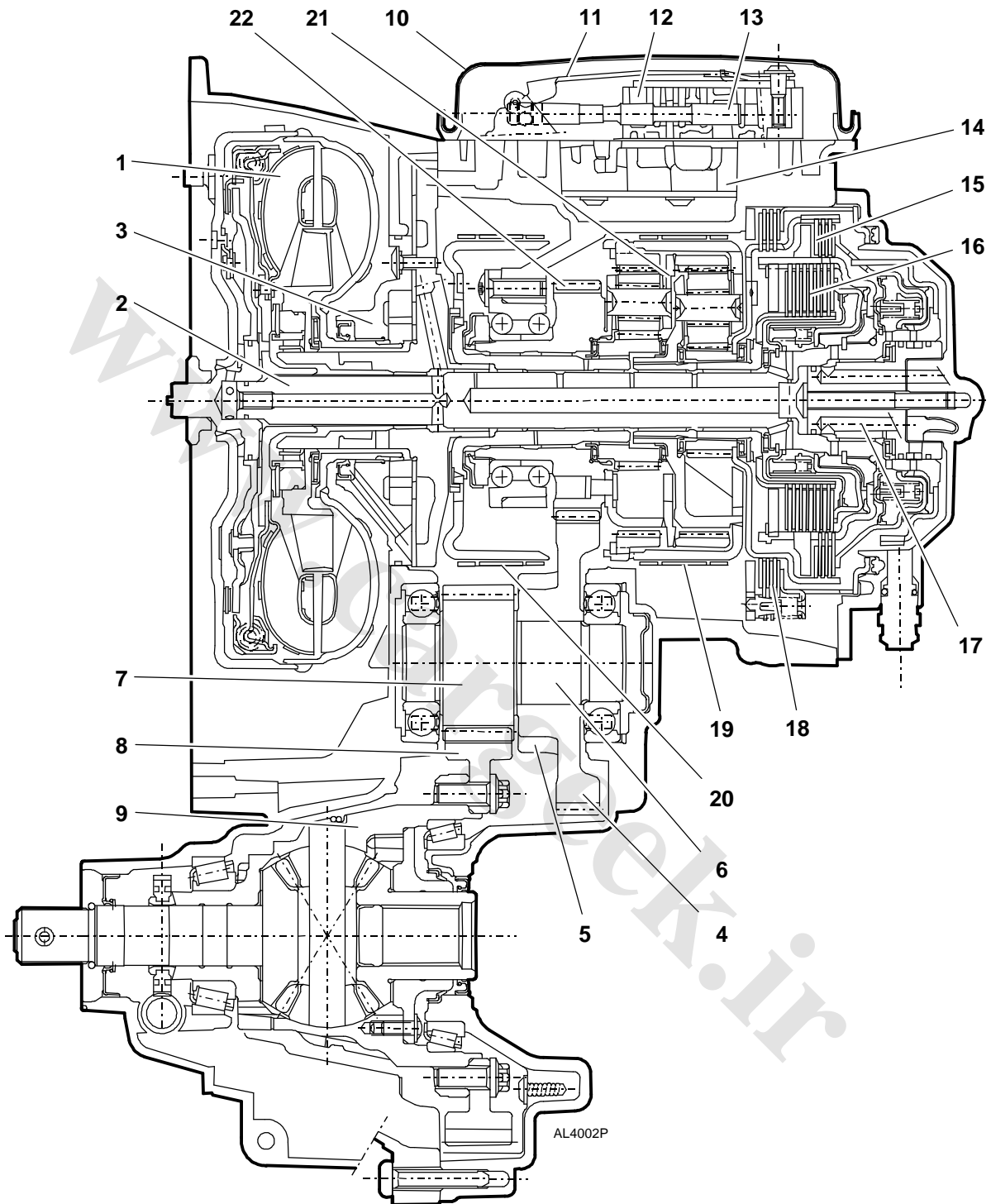
Important: The automatic transmission ECU is linked to the engine management ECU so as to obtain:

- good driving pleasure,
- efficient mechanical protection for transmission and engine,
- increased operating safety,
- compliance with antipollution standards.

AL4 AUTOMATIC TRANSMISSION

III - DESCRIPTION OF THE AL4 AUTOMATIC TRANSMISSION

A - CROSS SECTION



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B - PARTS LIST

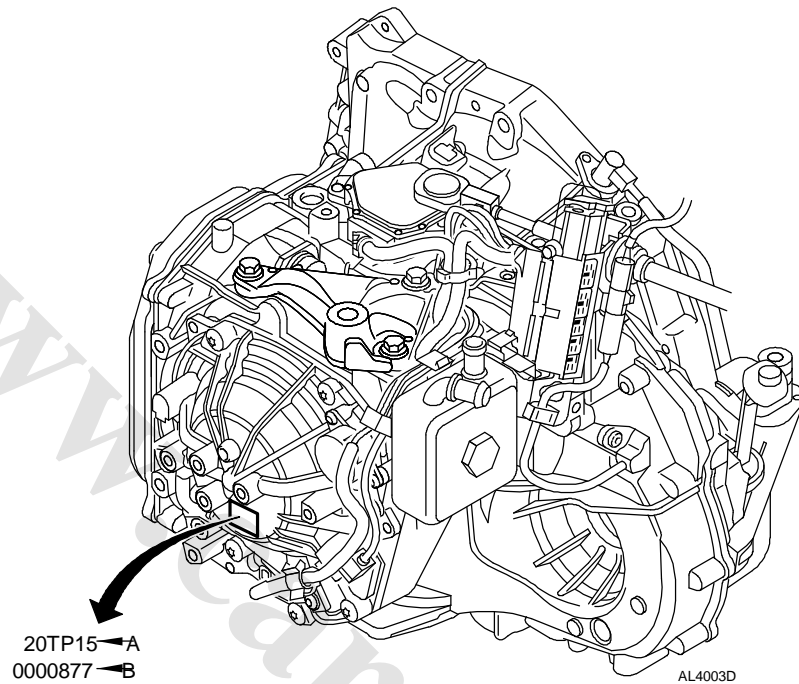
- 1 - Converter
- 2 - Input shaft
- 3 - Fitted oil pump
- 4 - Secondary pinion of step down gear
- 5 - Park wheel
- 6 - Secondary shaft
- 7 - Drive pinion
- 8 - Ring
- 9 - Differential unit
- 10 - Cover
- 11 - Adjustable plate
- 12 - Hydraulic distributor (DH)
- 13 - Manual valve
- 14 - Auxiliary hydraulic distributor (DHA)
- 15 - Clutch E1 (Reverse and 1st)
- 16 - Clutch E2 (2nd, 3rd, 4th)
- 17 - Hub
- 18- Brake F1 (4th)
- 19 - Brake F2 (Reverse)
- 20 - Brake F3 (1st and 2nd)
- 21 - Epicyclic gear train
- 22 - Primary pinion of step down gear

AL4 AUTOMATIC TRANSMISSION

IV - IDENTIFYING THE COMPONENTS OF THE AUTOMATIC TRANSMISSION

A - AUTOMATIC TRANSMISSION

The automatic transmission identification is engraved on the rear housing.

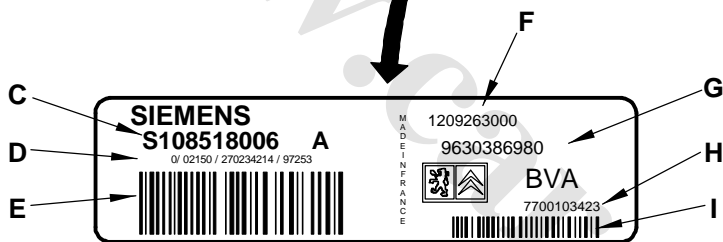
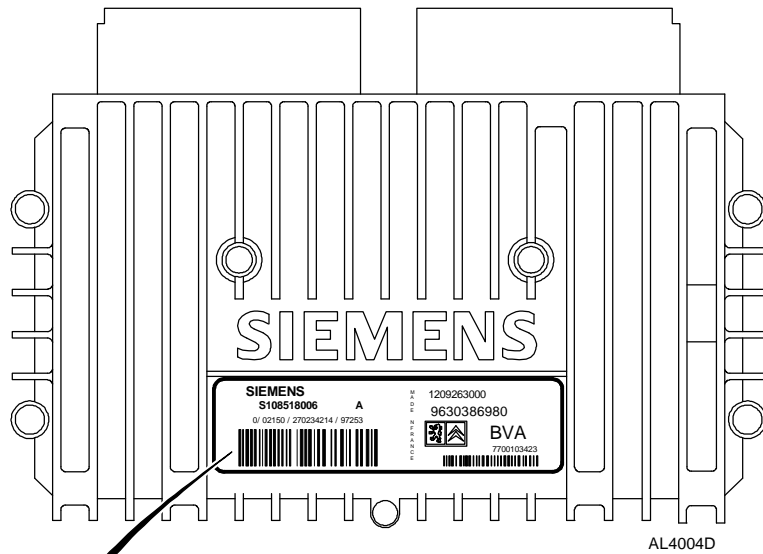


A - Component reference

B - Serial number

AL4 AUTOMATIC TRANSMISSION

B - ECU



- C - Siemens reference
- D - Siemens serial number
- E - Siemens number bar code
- F - Serial number
- G - Software version
- H - Hardware version
- I - Customer number bar code

AL4 AUTOMATIC TRANSMISSION

V - SPECIFICATIONS - SERVICING**A - FREQUENCY - CAPACITIES**

	XANTIA
Engine	XUD9 BTF/XU10J4R/XU7JP4
Transmission capacity	Approximately 6 litres
Draining capacity	Approximately 3 litres
Exclusive oil	CITROËN 97.36.22
Draining interval	Lubricated for life
Top-up interval	60 000 km
Transmission lubrication	Pressurised
Final drive lubrication	Pressurised
Weight	≈ 70 kg with oil and ECU
Torque capacity	210 mN from 2000 to 4500 rpm

B - GEARS

	XANTIA					
Engine	XUD9BTF			XU10J4R	XU7JP4	
Transmission type	20TP04			20TP05	20TP06	
Tyres - circumference	205/60R15 - 1.920 m			185/65R15-1.895m		
Gear ratios	Rd	Rdem	Vveh	Rd	Rdem	Vveh
1st	0.367	2.72	11.55	0.367	2.72	10.20
2nd	0.667	1.5	21.00	0.667	1.5	18.53
3rd	1	1	31.48	1	1	27.79
4th	1.407	0.71	44.30	1.407	0.71	39.10
Reverse	-0.407	-2.45	12.81	-0.407	-2.45	11.31
Step down gear	52x67			52x67		
Cylindrical torque	25x71			23x73		
Tachometric torque	24x20			24x20		

Speeds in km/h are given for 1000 rpm.

Rd = driveshaft ratio / Rdem = demultiplication ratio

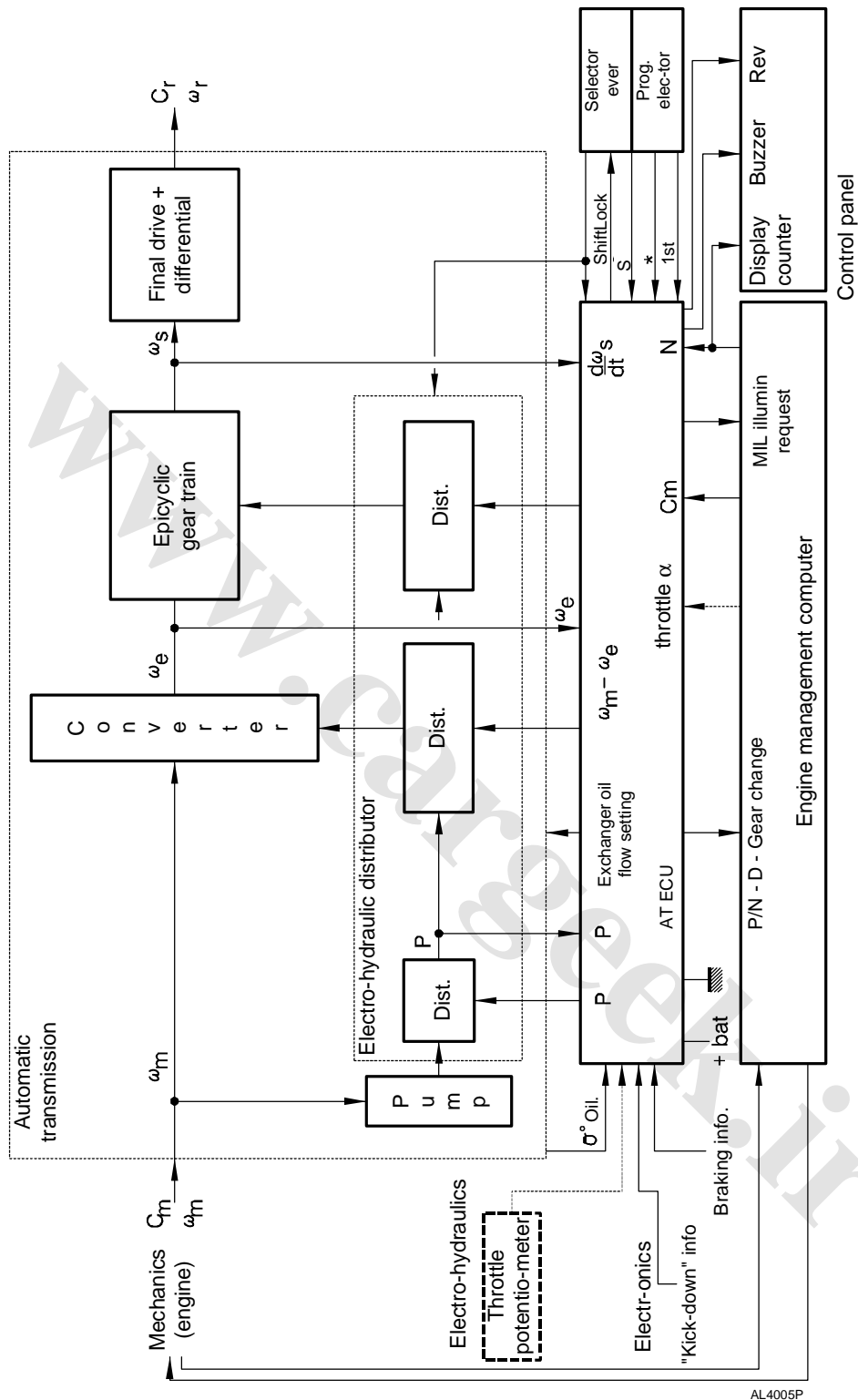
Vveh = Vehicle speed.

Internal gear change safety thresholds:

LEVER POSITION	SAFETY THRESHOLD	
3	113 km/h	155 km/h
2	73 km/h	103 km/h
2 + press on "1" button of program selector	35 km/h	48 km/h
R	15 km/h	19 km/h
R + foot on brake	25 km/h	34 km/h

AL4 AUTOMATIC TRANSMISSION

VI - LAYOUT OF THE AL4 AUTOMATIC TRANSMISSION



- | | |
|--------------------------------------|-------------------------------------|
| C_m = Engine torque | C_r = Torque at road wheels |
| ω_m = Engine speed | ω_e = Gear train input speed |
| ω_s = Gear train output speed | ω_r = Road wheel speed |

AL4 AUTOMATIC TRANSMISSION

VII - MISCELLANEOUS ADVICE

A - TOWING

The transmission is lubricated when the engine is running since this drives the transmission oil pump. Thus, when towing, the drive wheels must be raised off the ground. However, the vehicle may be towed with the drive wheels on the ground under exceptional circumstances and provided that the following conditions are complied with:

- the selector lever must be in position N,
- do not add any oil,
- do not exceed 50 km/h over a distance of 50 km.

B - DRIVING

Never drive with the ignition switched off.

Never push the vehicle to try and start it (not possible with automatic transmission).

Note: The automatic transmission is only lubricated when the engine is running.

C - OPERATIONS ON ELECTRICAL COMPONENTS

Never disconnect:

- the battery whilst the engine is running,
- the ECU whilst the ignition is switched on.

Before reconnecting a connector, check:

- the condition of the various contacts (bent, rusted...),
- that the mechanical locking device is present and check its condition.

During electrical inspections:

- the battery must be correctly charged,
- never use a power source greater than 16 V,
- never use a tell-tale light.

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D - OPERATIONS ON MECHANICAL COMPONENTS

Never place the transmission on the ground unprotected.

The converter retaining pin must be inserted when the transmission is removed.

The centring pin must be used to couple the transmission to the engine.

Remove the centring pin just before coupling the transmission to the engine.

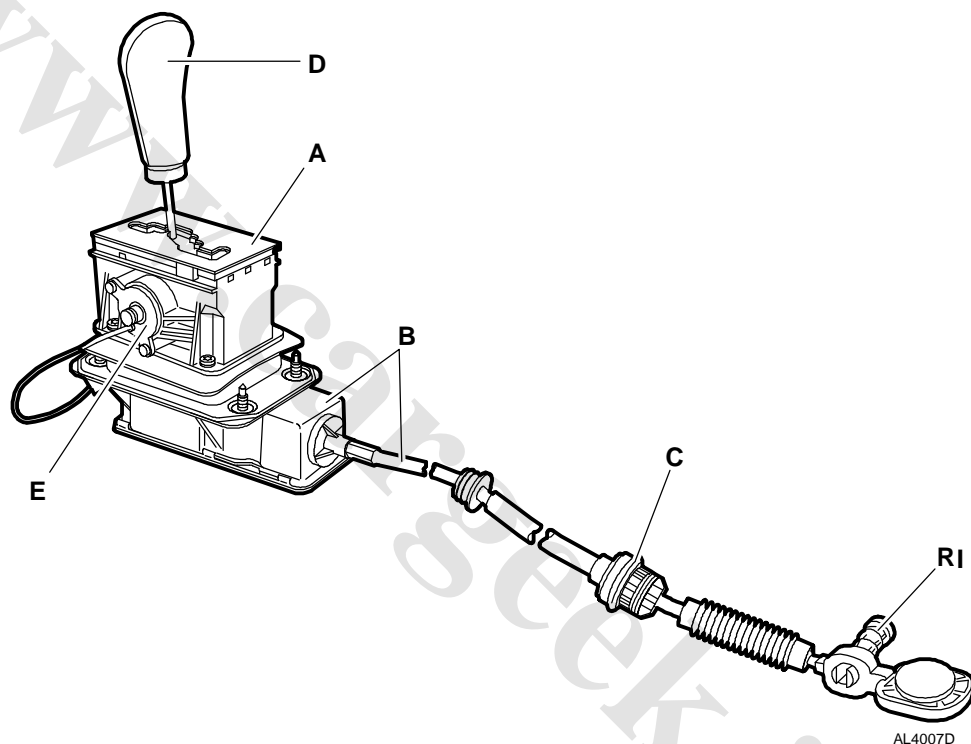
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SELECTOR CONTROL

I - SELECTOR LEVER

The selector lever, through the selector shaft (on the transmission), operates the multifunction switch and the manual valve on the hydraulic distributor.



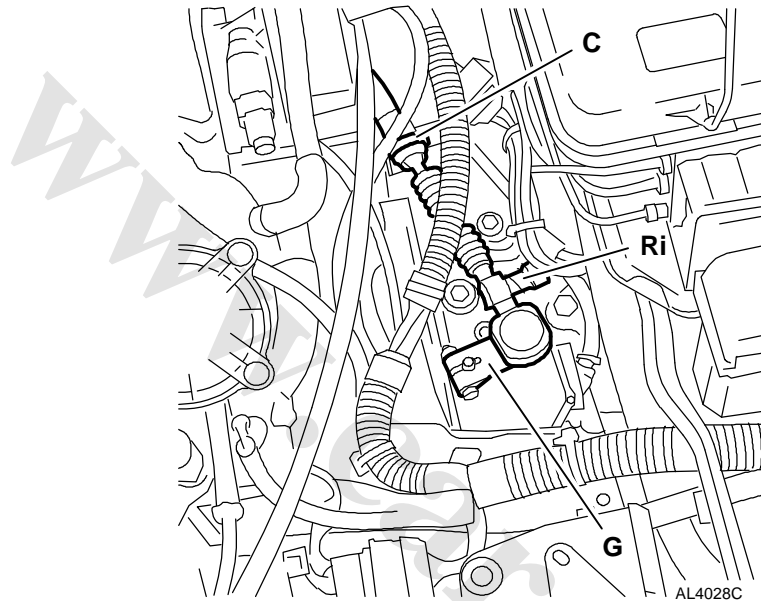
- A - Upper part
- B - Lower part
- C - Sleeve stop
- D - Control lever
- E - Locking plunger for the Shift-Lock function
- Ri - Initial setting

AL4 AUTOMATIC TRANSMISSION

The selector lever, located on the central console, has six positions laid out on an offset or "stepped" grid.

The lever has a mechanical safety device which is unlocked by exerting a radial action on the lever.

Note: The ignition must be switched on and the brake pedal pressed to unlock the selector lever from position P. This is the Shift-Lock function.



C - Sleeve stop

Ri - Initial setting

G - Control return with ball joint

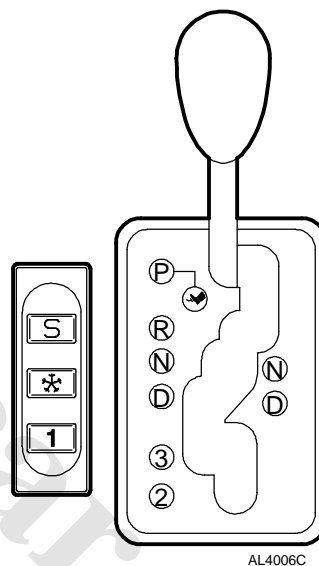
AL4 AUTOMATIC TRANSMISSION

II - PROGRAM SELECTOR

This is located on the central console next to the selector lever and has 3 push buttons.

The driver can therefore inform the ECU of his selection:

- desired program,
- 1st imposed → this is obtained by pressing the "1" button of the selector with the selector lever in position 2 on the grid.



Gears change automatically depending on vehicle speed and engine load in accordance with various gear changing laws. The gear changing laws are chosen by the ECU as a function of one of the three programs available to the driver.

The driver can select a program by pressing one of the "S" or "*" program selector buttons.

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The following three programs are available:

- autoadaptive or "normal" (no buttons pressed):

this is the basic program; the ECU adjusts the operation of the automatic transmission to the style of driving, the road and engine load; it promotes fuel economy,

- "Sport" (S button pressed):

this program promotes sporty driving to the detriment of consumption. Gears are still changed automatically,

- "Snow" (* button pressed):

this program is suited to driving on low adherence ground. In drive, this means that either first gear or first and second gears are no longer available and gears are changed down less frequently using a specific set of changing laws.

Furthermore, in the imposed positions 1, 2, 3, the "Snow" set of laws are used which take into account the restrictions relating to the chosen imposed position.

Note: Every time the ignition is switched off then on again, the ECU automatically switches to the "normal program" configuration.

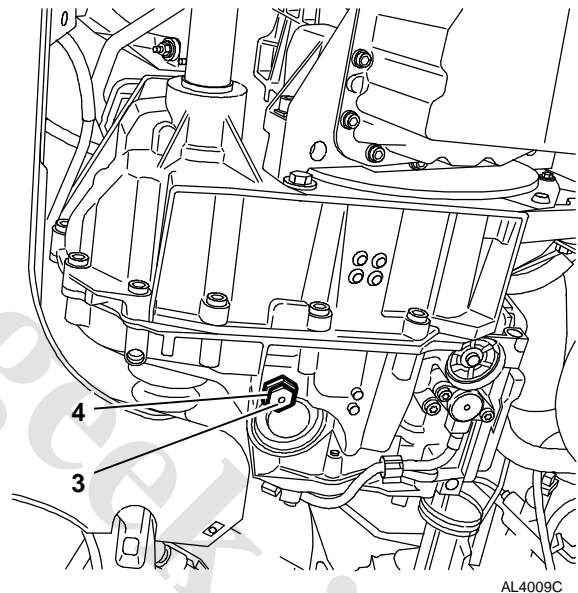
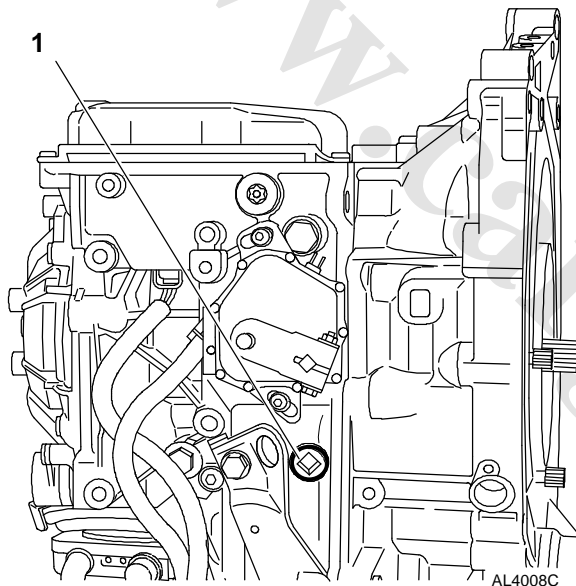
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CHECKING THE OIL LEVEL

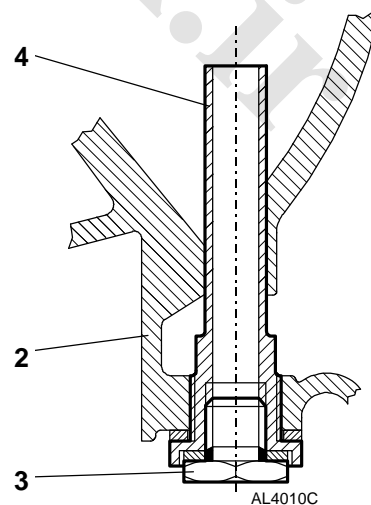
Check the oil level every 60 000 kms.

Prerequisites:

- vehicle on horizontal ground,
- check that the transmission is not in downgraded mode,
- remove the filler plug 1 and systematically add 0.5 litres of oil to the transmission,
- press the brake and change through all the gears,
- selector lever in position P,
- engine running at idle speed,
- oil temperature $60\text{ }^{\circ}\text{C} \begin{matrix} + 8 \\ - 2 \end{matrix}$.



- 1 - Filler plug
- 2 - Transmission housing
- 3 - Level plug
- 4 - Drain plug



AL4 AUTOMATIC TRANSMISSION

- Remove the level plug (3).
- If oil streams out then starts to drip → close the level plug and tighten to 2.4 mdaN.
- If oil drips out or does not flow at all → close the level plug (3), stop the engine, add 0.5 litres of oil to the transmission, repeat the level checking procedure, the oil level is correct if oil streams out and then starts to drip, close the level plug (3) and tighten to 2.4 mdaN close the filler plug (1) and tighten to 2.4 mdaN

Too much oil may have the following consequences:

- abnormal heating of the oil,
- oil leaks.

Too little oil may damage the transmission.

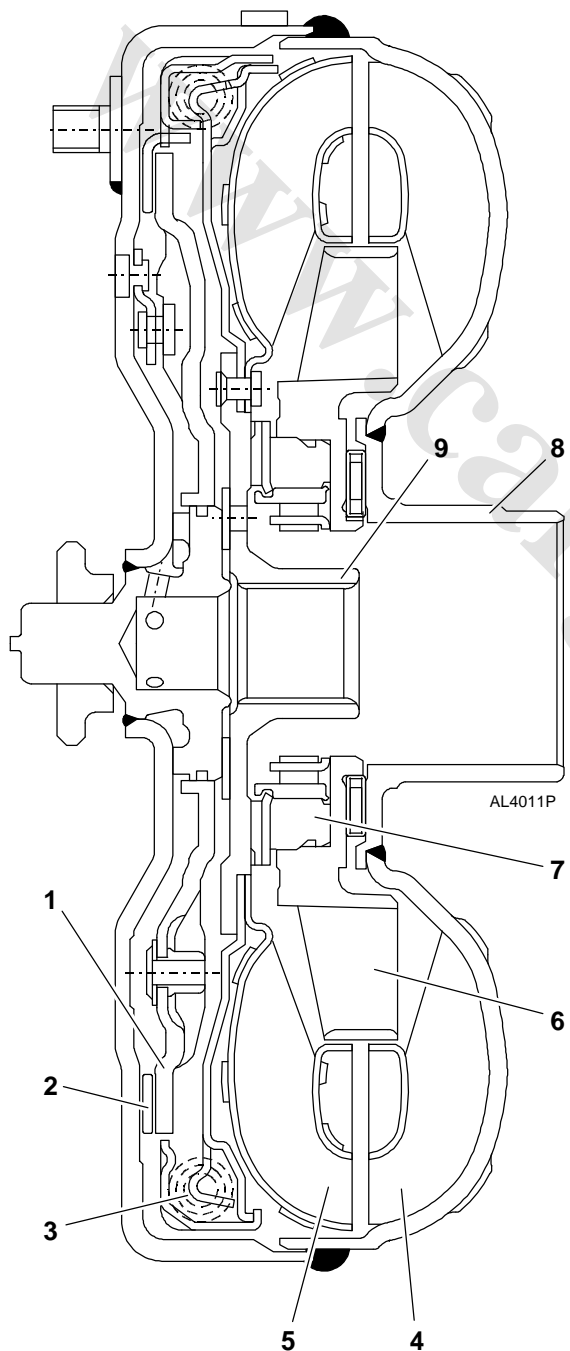
Note: An oil check is not included in the PDI nor the first service.

AL4 AUTOMATIC TRANSMISSION

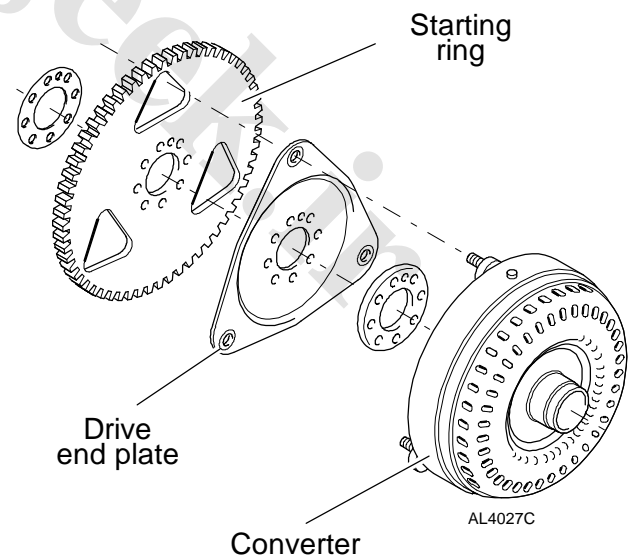
THE TORQUE CONVERTER

The AL4 automatic transmission is fitted with a standard torque converter which has an added lock-up device.

I- DESCRIPTION



- 1 - Lock-up piston
- 2 - Double sided friction plate
- 3 - Vibration damper
- 4 - Impeller
- 5 - Turbine
- 6 - Stator
- 7 - Free wheel
- 8 - Oil pump drive
- 9 - Automatic transmission input shaft drive



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The torque converter consists of:

- an impeller (4), linked to the engine,
- a turbine (5), linked to the transmission,
- a stator (6), fitted on the free wheel (7) and located between the impeller and the turbine,
- a lock-up device operated by the ECU which consists of a piston (1), a friction plate (2) and a vibration damper (3).

The converter is secured to the engine drive plate (end plate). Its role is to provide a flexible and automatic link between the engine and the transmission.

It has two operating phases:

- the converter phase where it multiplies the engine torque by up to 2.2 times,
- the coupling phase where it transmits the engine torque with an efficiency of 0.98 (1 if it is locked up).

II - CONVERTER LOCK-UP

A - GENERAL

The clutch is hydraulically operated by an electrovalve controlled by the ECU.

The clutch can be in one of two states:

- open state → normal converter operation,
- closed state where it connects the impeller and the turbine so as to transmit all of the engine torque → engine brake available, reduction in fuel consumption, cooling of automatic transmission oil.

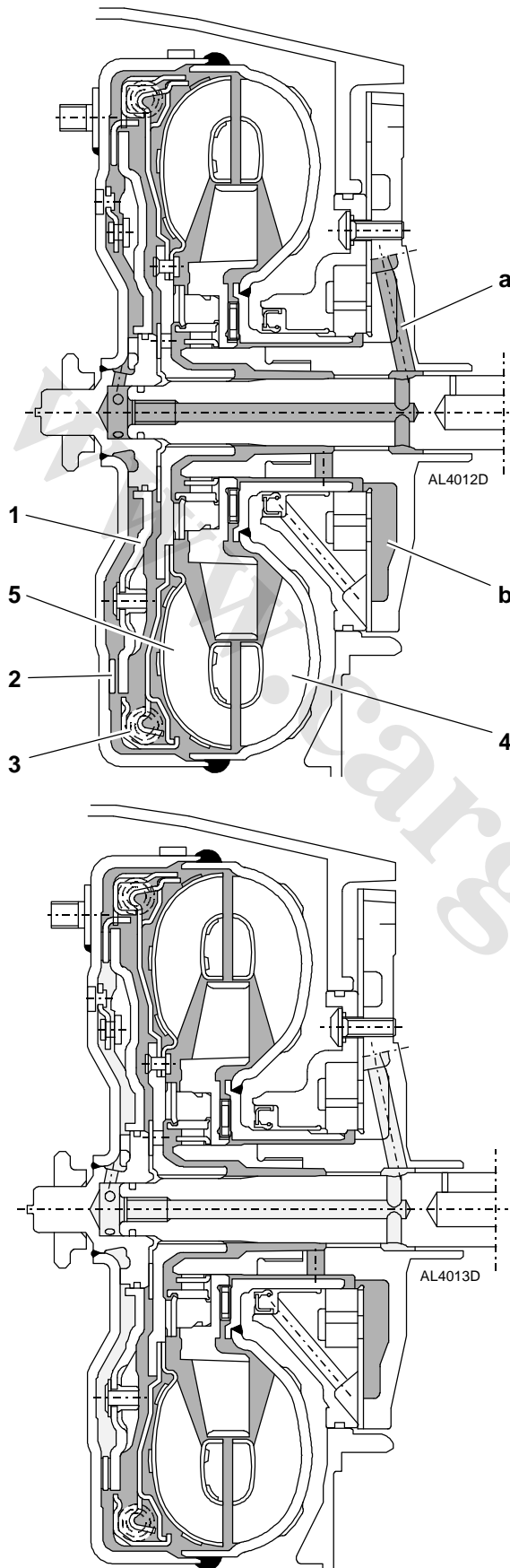
Lock-up is available on 2nd, 3rd and 4th gears (and 1st gear in rare cases).

The converter is locked up by inverting the direction of oil flow.

The ECU controls the two possible states of the lock-up using a set of memorised laws.

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B - OPERATING PRINCIPLE OF THE LOCK-UP



The lock-up piston (1) is used to connect the impeller (4) to the turbine (5) via the vibration damper (3) and the friction plate (2).

1 - Converter not locked up

In the unlocked mode, oil pressure arrives through the lock-up circuit (a) so as to free the lock-up piston from the clutch plate. The oil then supplies the converter and the spring through the converter circuit (b).

2 - Converter locked up

In the locked mode, the lock-up circuit (a) is connected to tank. The oil therefore arrives through the converter circuit (b) into the converter causing the lock-up piston to move. This allows the turbine to connect with the impeller via the vibration damper and double sided clutch plate.

Note: The lock-up piston is joined to the rotating impeller.

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THE EPICYCLIC GEAR TRAIN

I - DESCRIPTION

To provide the four forward gears and one reverse gear, the AL4 automatic transmission has a SIMPSON type epicyclic gear train.

This consists of two simple epicyclic gear trains connected together.

There are:

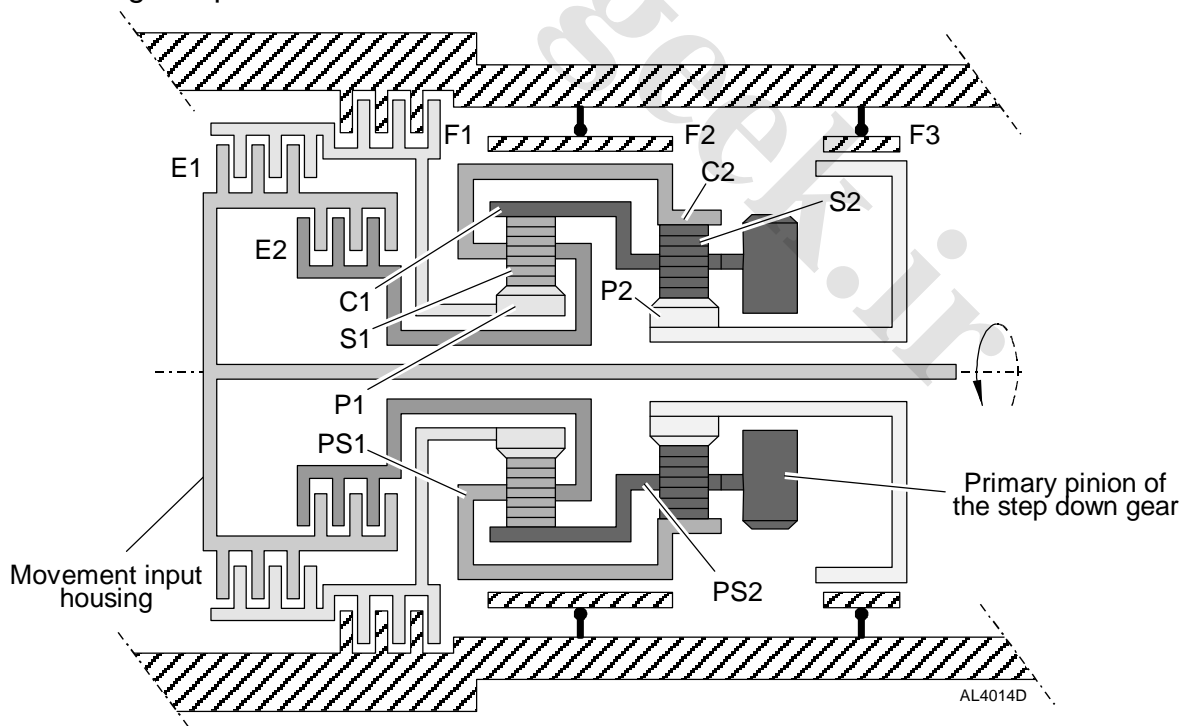
- two sunwheels P1 and P2,
- two sets of planet wheels S1 and S2,
- two planet wheel carriers PS1 and PS2,
- two rings C1 and C2.

The two gear trains are connected in the following manner:

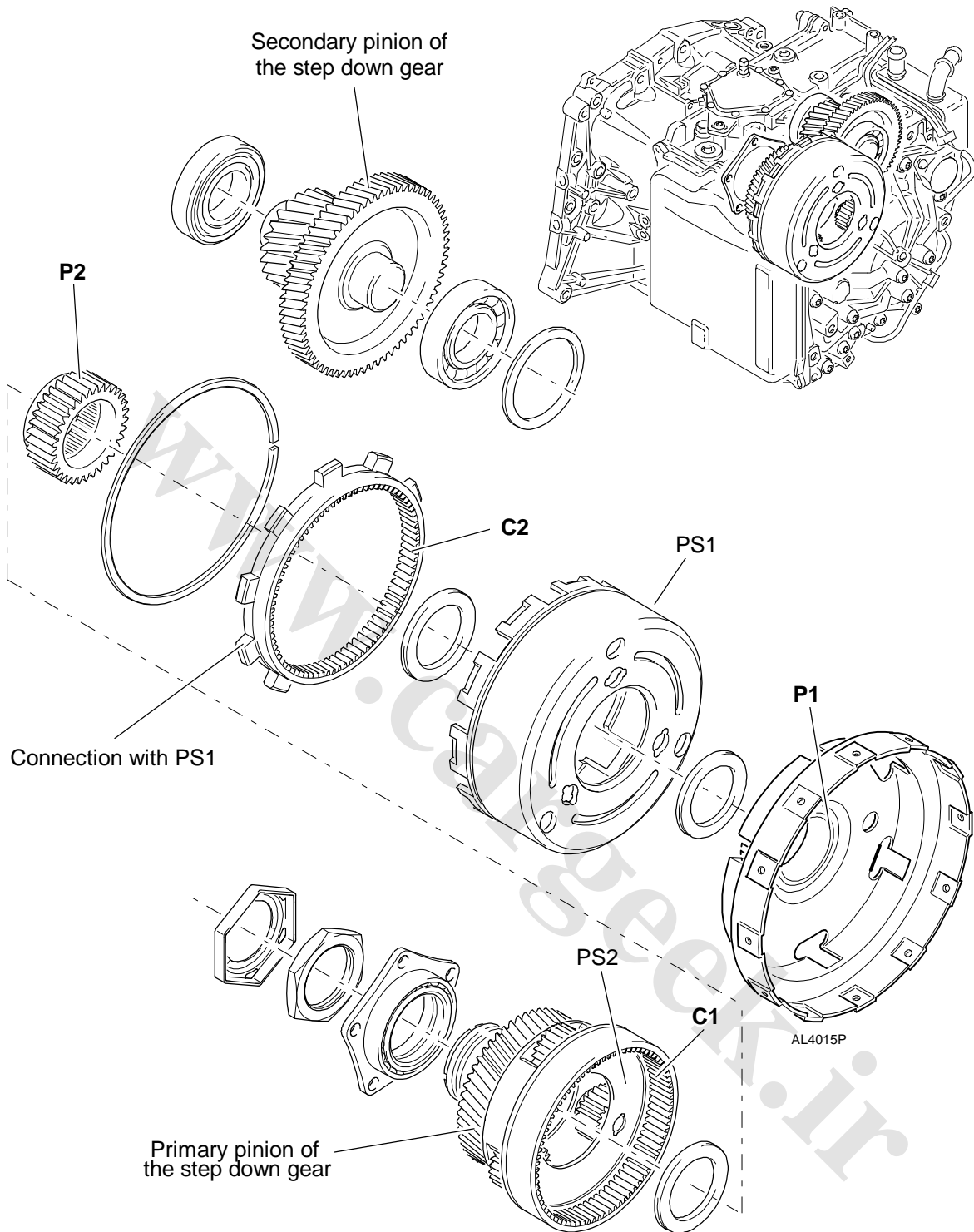
- planet wheel carrier PS1 and ring C2 are connected together,
- planet wheel carrier PS2 and ring C1 are connected together.

Gear train n°1 is located on the rear housing side.

Gear train n°2 is located on the converter side; the movement systematically exits through its planet wheel carrier PS2.



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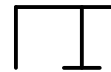
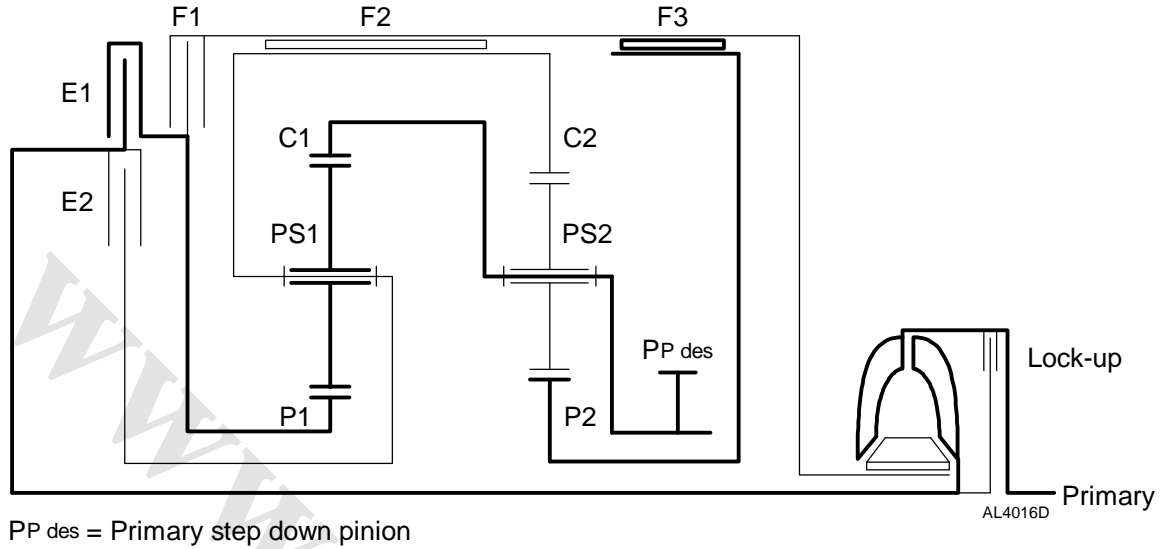
Gear train specifications

Sunwheel P1	33 teeth
Sunwheel P2	40 teeth
Planet wheel S1	21 teeth
Planet wheel S2	19 teeth
Ring C1	81 teeth
Ring C2	80 teeth

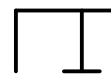
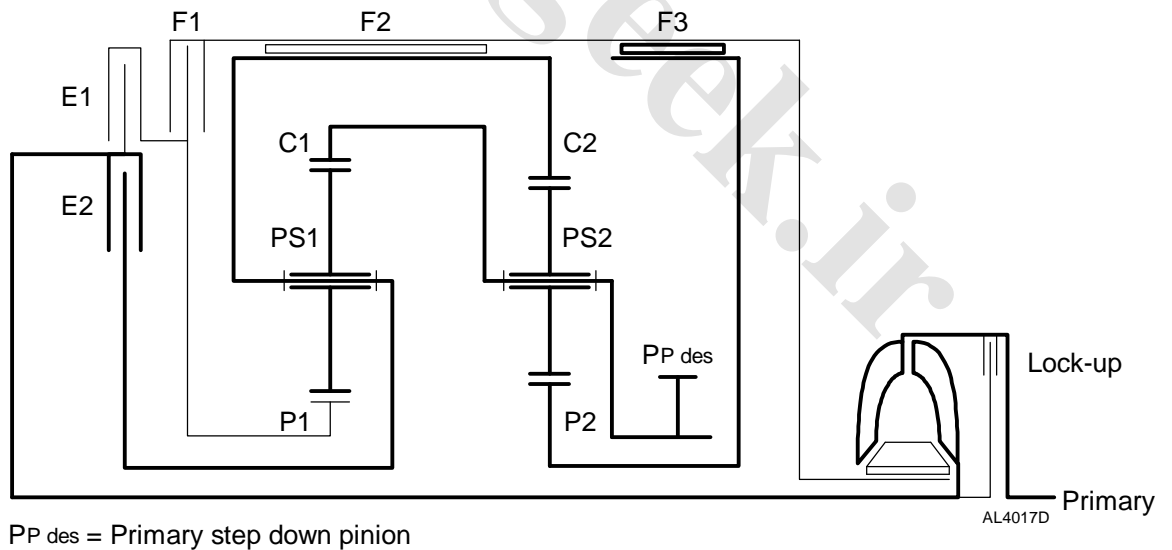
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II - OPERATING PRINCIPLE

1st gear

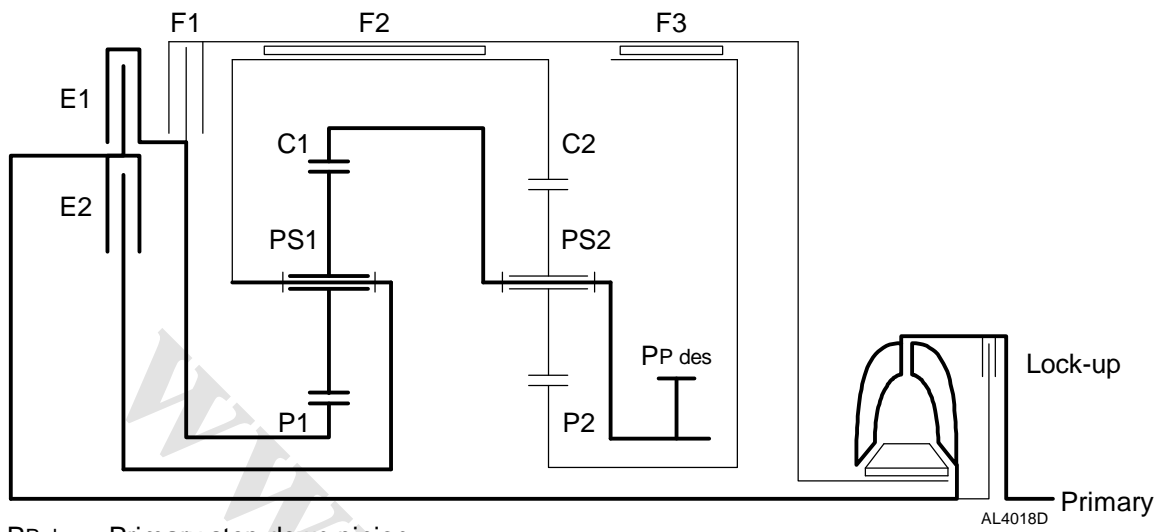


2nd gear

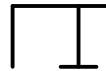


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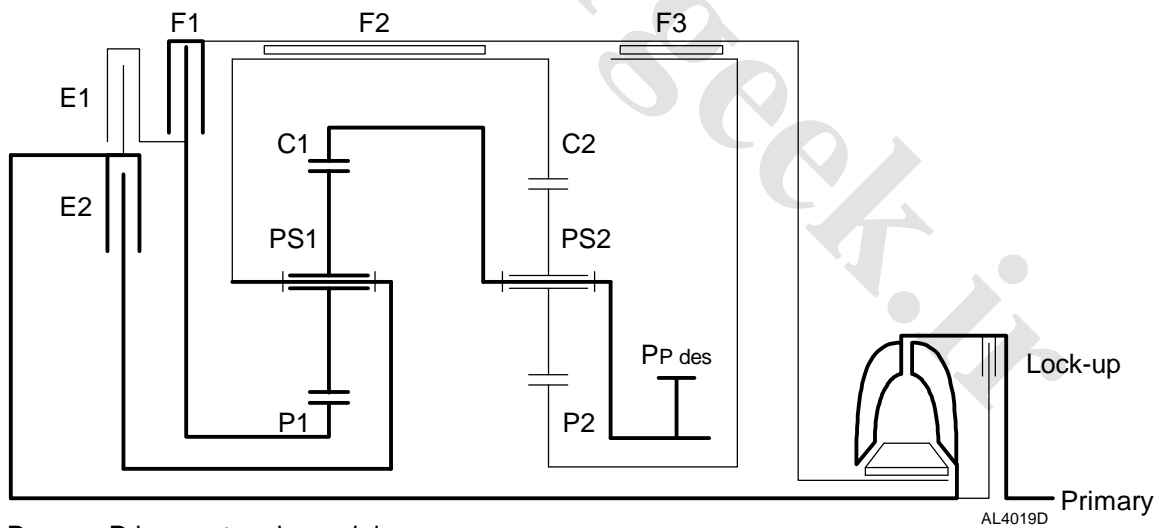
3rd gear



PP des = Primary step down pinion



4th gear



PP des = Primary step down pinion



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Reverse

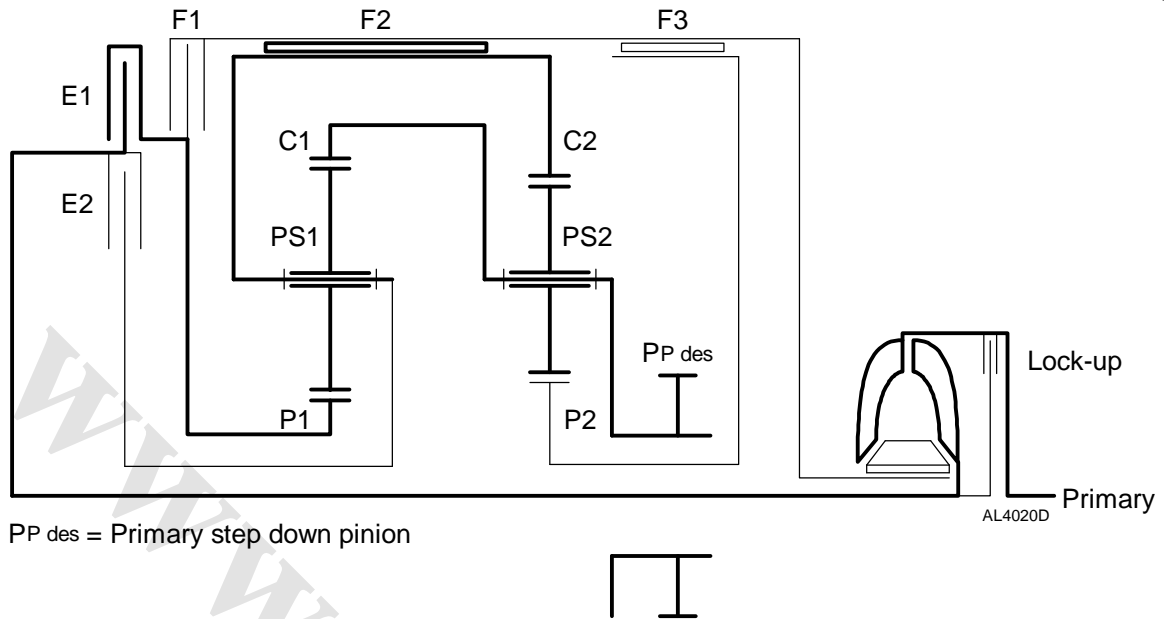


Table of moving parts

GEAR	DRIVING COMPONENT	REACTION COMPONENT	RATIO
1	P1	P2	2.72
2	PS1 - C2	P2	1.5
3	P1 and PS1 - C2	none	1
4	PS1 - C2	P1	0.71
Reverse	P1	PS1 - C2	2.45

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ECU

The ECU of the AL4 transmission is an autoadaptive and upgradable ECU with a 56 track Flash Eprom.

I - ECU FUNCTIONS

The ECU performs the following functions:

A - GEAR CHANGING LAWS

The ECU has 10 gear changing laws allowing the operation of the transmission to be altered to the driver's style of driving, to the chosen program and to the internal and external conditions.

The following laws are therefore obtained:

- 6 laws: for autoadaptivity,
- 1 law: for the snow program,
- 1 law: "unlocked" for low temperature operation,
- 1 law: for depollution when cold (heating),
- 1 law: for automatic transmission temperature protection.

B - PROGRAMS

The ECU manages three programs: autoadaptive, Sport and Snow (upon driver's request).

C - AUTO-ADAPTIVENESS

The ECU has an autoadaptive program which allows it to chose the law which will be the best suited to the following conditions from the ten laws listed above:

- driver's style of driving → 3 laws = "economic", "Medium", "Sport",
- road profile and vehicle load → 3 laws = "slight incline" (or "braking 1"), "sharp incline" (or "braking 2"), "decline",
- temperature,
- selected program.

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D - GEAR CHANGE UP PREVENTION DUE TO SUDDEN REMOVAL OF FOOT FROM ACCELERATOR

This function prevents the transmission from changing up to a higher gear when the foot is suddenly removed from the accelerator pedal; this allows the engine brake to be maintained whilst decelerating.

E - GEAR LOCKING FOLLOWING A LAW CHANGE

For reasons of safety and comfort, the transmission is prevented from changing up or down a gear too quickly if the law has just changed.

F - CHANGE DOWN

The ECU is totally responsible for changing down the gears as a function of engine load, vehicle speed and driving conditions. The ECU authorises a double change down (from 4th to 2nd and 3rd to 1st) or forces a single change down.

Furthermore, the ECU provides a change down function in the event of sustained braking in order to anticipate downward gear changes and so as to provide the engine brake.

G - MOMENTARY SWITCH TO SPORT PROGRAM

So as to provide better power take-up in the normal program, the ECU temporarily switches to a more sporty law when the accelerator pedal is suddenly pressed down.

H - KICKDOWN

The kickdown order is given by the automatic transmission ECU after the accelerator pedal is pressed down fully and depending on vehicle speed.

I - MANAGEMENT OF IMPOSED GEARS

The ECU is totally responsible for changing to imposed gears in terms of operation and safety (changing limits).

J - CONTROLLING THE LINE PRESSURE

The ECU works out the value of line pressure with closed loop feedback. The reference value is a function of the turbine torque to overcome.

AL4 AUTOMATIC TRANSMISSION

K - MANAGING GEAR CHANGES

When the ECU decides to change a gear, it must operate the various electrovalves involved in a precise order and in accordance with timers which are a function notably of the engine load and vehicle speed. This provides a good overlap between the receiver which is emptying and the one which is filling up.

L - OPERATING THE CONVERTER LOCK-UP CLUTCH

This function optimises the converter operation by locking it up to save fuel, to obtain engine braking, to encourage cooling of the transmission oil and to prevent slip. A law which depends on vehicle speed, throttle position and gear engaged is used to decide whether to lock the converter up or not.

M - TORQUE REDUCTION

This function is used to increase driving pleasure by reducing the engine torque when changing gear. This action consists of momentarily reducing the ignition advance in accordance with a pre-programmed table provided by the engine management computer.

N - IDLE SPEED COMPENSATION

This function is used to attenuate the dragging effect of the transmission when it is being driven through the engine management computer (idle reference speed).

O - AUTOMATIC TRANSMISSION PROTECTION

- Reverse gear safety: for vehicle speed > Threshold.
- Incorrect operations:
 - on the automatic transmission: change from N → D or N → R prohibited if N > threshold. The change is authorised if N < threshold or after a timer.

P - SHIFT-LOCK FUNCTION

This function locks the selector lever in position P when the ignition is switched on. The lever is unlocked by pressing the brake pedal.

AL4 AUTOMATIC TRANSMISSION

Q - CONTROL PANEL DISPLAY

The ECU informs the driver of the position of the selector lever and the choice of program using the liquid crystal display on the control panel.

The ECU may also warn the driver of a transmission problem by flashing the sport and snow display.

R - "OLD OIL" FUNCTION

Using the parameters of automatic transmission oil temperature and the time for which the oil is subject to a high temperature, the ECU increments an "old oil" counter. When this reaches the calibrated maximum value, the ECU orders the "Sport" and "Snow" warning lights to flash on the control panel to warn the driver that the automatic transmission oil needs changing.

S - SAFETY - DIAGNOSTIC

The ECU:

- permanently checks its supplies and that its sensors and actuators are operating correctly,
- validates and stores operating faults,
- talks with after-sales tools through line K,
- provides a downgraded mode,
- asks the engine management computer to illuminate the engine management light in the event of a fault leading to a deterioration in the level of vehicle pollution (only on fiscal level L4).

T - CONFIGURATION - DOWNLOADING

The ECU can be upgraded; its program can be updated by downloading.

The configuring operation is used to configure the automatic transmission ECU depending on the options which are not fitted to the vehicle.

U - OTHER FUNCTIONS

The following three functions, inherent to automatic transmission, are performed by the multifunction switch:

1 - Buzzer

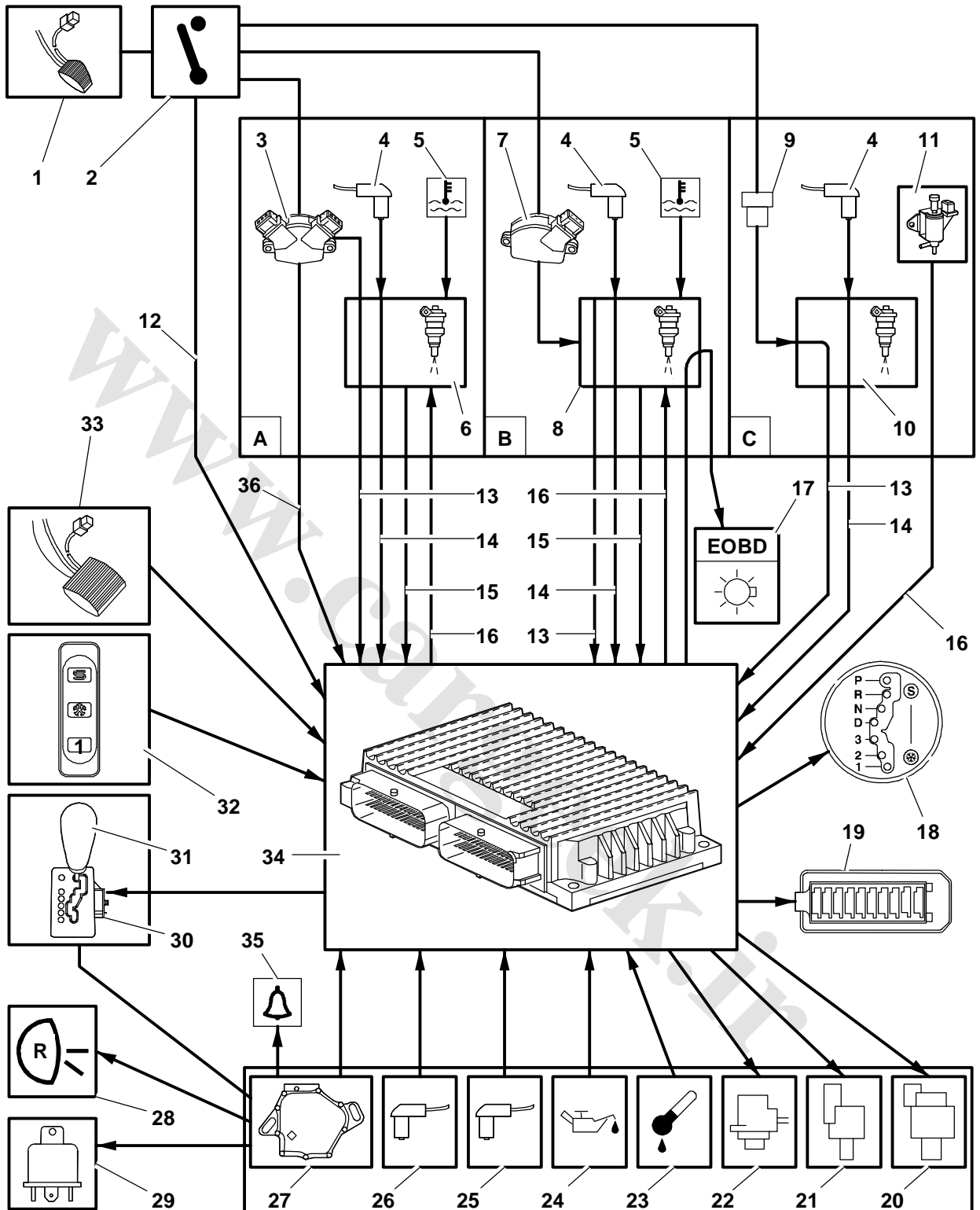
This tells the driver that he is leaving his vehicle without having put the selector lever in position P.

2 - Illumination of reversing lights in position R.

3 - Prevention from starting engine when not in positions P or N.

AL4 AUTOMATIC TRANSMISSION

II - OPERATING SUMMARY



AL4021P

Load information

- A - Petrol engine with double track potentiometer
- B - Petrol engine with single track potentiometer
- C - Diesel engine

AL4 AUTOMATIC TRANSMISSION

Parts list

REF.	DESCRIPTION
1	Accelerator pedal
2	Kickdown function on accelerator cable
3	Double track throttle potentiometer
4	TDC sensor
5	Engine coolant temperature probe
6	Petrol injection ECU
7	Single track throttle potentiometer
8	Petrol injection ECU
9	Potentiometer on injection pump load lever
10	Diesel injection ECU
11	Torque reduction electrovalve
12	Kickdown information
13	Engine load information
14	Engine speed + engine coolant temperature information
15	Engine torque information (provided by injection ECU)
16	Torque reduction request information + idle speed compensation request information
17	Illumination of EOBD light request information (only on versions with L4 depollution)
18	LED display (control panel)
19	Diagnostic socket
20	Sequence electrovalve
21	Pressure modulating electrovalve
22	Oil flow modulating electrovalve
23	Transmission oil temperature probe
24	Transmission oil pressure sensor
25	Transmission input speed sensor
26	Transmission output speed sensor
27	Multifunction switch
28	Reversing lights
29	Starter motor prevention relay
30	Shift lock actuator
31	Gear lever
32	Program selector (Sport, Snow, Normal, 1st imposed)
33	Brake pedal (braking information)
33	Stop switch
34	Automatic transmission ECU
35	Not in position P reminder buzzer
36	Throttle position information (throttle potentiometer)

AL4 AUTOMATIC TRANSMISSION

III - ECU CONNECTIONS

PIN N°	DESCRIPTION	COMMENTS
1	Output: supply (+) for sequence electrovalves (EVS1 to EVS6)	
2	Output: supply to electrovalve controlling flow in heat exchanger	
3	Output: air conditioning compressor cut-off command	not used
4	Output: display (on instrument panel)	
5	Output: torque reduction request /idle speed compensation	
6	/	depending on version
6	Output: illumination of EOBD light request information (*) (to engine management computer)	L4 version
7	Output: sequence electrovalve EVS3 (earth)	
8	Output: sequence electrovalve EVS4 (earth)	
9	Output: sequence electrovalve EVS2 (earth)	
10	Output: sequence electrovalve EVS1 (earth)	
11	Output: shift lock actuator control	
12	Output: heat exchanger oil flow electrovalve control (EPDE)	
13	Output: sequence electrovalve EVS5 (earth)	
14	Output: sequence electrovalve EVS6 (earth)	
15	Input: kickdown control	
16	Input: brake redundant contact (brake opening contact)	
17	L diagnostic line	
18	K diagnostic line	
19	Output: lock-up electrovalve	
20	Output: main pressure electrovalve	
21	/	
22	/	
22	Input: engine torque information	
23	/	
23	Throttle position information input (driver's wishes information)	
24	Supply (+) to oil pressure sensor	
25	Supply (-) to oil pressure sensor	
26	Supply (+) to modulating electrovalves (pressure EVM, lock-up EVM)	
27	Supply (+) to ECU	
28	Supply to ECU (common earth with engine management ECU)	
29 - 30	/	
31	Input: multifunction switch position S2 contact	

AL4 AUTOMATIC TRANSMISSION

PIN N°	DESCRIPTION	COMMENTS
32	Input: multifunction switch S3 contact	
33	Input: multifunction switch S4 contact	
34	Input: multifunction switch Parking/Neutral contact	
35	/	
36	Input: program selector, "1" button	
37	Input: multifunction switch S1 contact	
38 - 39	/	
40	Input: program selector: snow button	
41	Input: program selector, normal/sport button	
42	Electronic earth for multifunction switch	
43	Input: stop lights contact (brake closing contact)	
44	/	
45	Input: signal (+) from turbine speed sensor	
46	Input: signal (-) from turbine speed sensor	
47	Signal (-) from automatic transmission output speed sensor	
48	Signal (+) from automatic transmission output speed sensor	
49	Input: engine speed information (TDC)	
50	/	
51	Supply (-) for throttle potentiometer	double track potentiometer
51	/	
52	Supply (+) for throttle potentiometer	double track potentiometer
52	/	
53	Signal (-) from oil temperature probe	
54	Signal (+) from oil temperature probe	
55	Input: signal from line pressure sensor	
56	Input: signal from throttle potentiometer	
56	/	

EMC: engine management ECU - EOBD: European On Board Diagnosis

AL4 AUTOMATIC TRANSMISSION

AUTO-DIAGNOSTIC

I - FAULT WARNINGS

The appearance of certain faults in the system causes the SPORT and SNOW warning lights to flash.

The sport and snow warning lights flash in the following cases:

- when the transmission oil is too hot (extinguish when oil has cooled),
- when the transmission oil is old (oil counter value at calibrated maximum value),
- when there is a break in the serial link between the transmission ECU and the control panel.

The "SPORT" and "SNOW" warning lights flash if there is a fault on the following components or information:

- transmission ECU,
- ECU supply,
- oil pressure sensor,
- supply to sequence electrovalves (EVS1 to EV6),
- regulation fault in main hydraulic pressure,
- multifunction switch,
- sequence electrovalves (EVS1 to EV6),
- main pressure modulating electrovalve (pressure EVM),
- converter lock-up modulating electrovalve (lock-up EVM),
- oil flow electrovalve in heat exchanger,
- main hydraulic pressure electrovalve,
- accelerator pedal not programmed,
- input speed and output speed,
- input speed and engine speed,
- output speed and engine speed,
- engine speed information,
- pedal position,
- supply to analogue sensors.

AL4 AUTOMATIC TRANSMISSION

II - MEMORISED FAULTS / DOWNGRADED MODES

There are 6 levels of downgraded mode depending on the fault detected.

	FAULT FOUND	EFFECT
Level 1	- kick down input	no effect on operation of transmission
Level 2	- transmission oil temperature - engine torque information - display control - shift lock actuator	slight degradation in operation, impact on driving comfort
Level 3	- vehicle speed - lock-up modulating electrovalve - torque reduction output - pressure sensor - supply to sensors - brake switch input - heat exchanger flow modulating electrovalve (EPDE) - throttle position information supplied by the injection ECU and torque information missing	large degradation in operation of the transmission (reduced gear changing quality, loss of functions)
Level 4	- engine speed - transmission input speed sensor	large degradation in operation of the transmission (loss of functions, or downgraded functions)
Level 5	- throttle potentiometer information - engine torque information - multifunction switch (loss of reverse gear safety when driving) - supply to analogue sensors - pressure modulating electrovalve - main pressure regulation - heat exchanger oil flow modulating electrovalve control - input speed and output speed - input speed and engine speed - output speed and engine speed	Switches to 3rd hydraulic the next time the ignition is switched on. If the vehicle is in 4th gear, this gear is maintained and 3rd gear is automatically engaged the next time the ignition is switched on. This downgraded mode is called differed stopping mode
Level 6	- ECU not working - sequence electrovalves - supply to sequence electrovalves - accelerator pedal position not programmed	Switches to 3rd hydraulic. This downgraded mode is called stopping mode

Warning: Transmission in stopping mode: a loud bang may be felt when moving the lever from P ⇒ R or N ⇒ R.

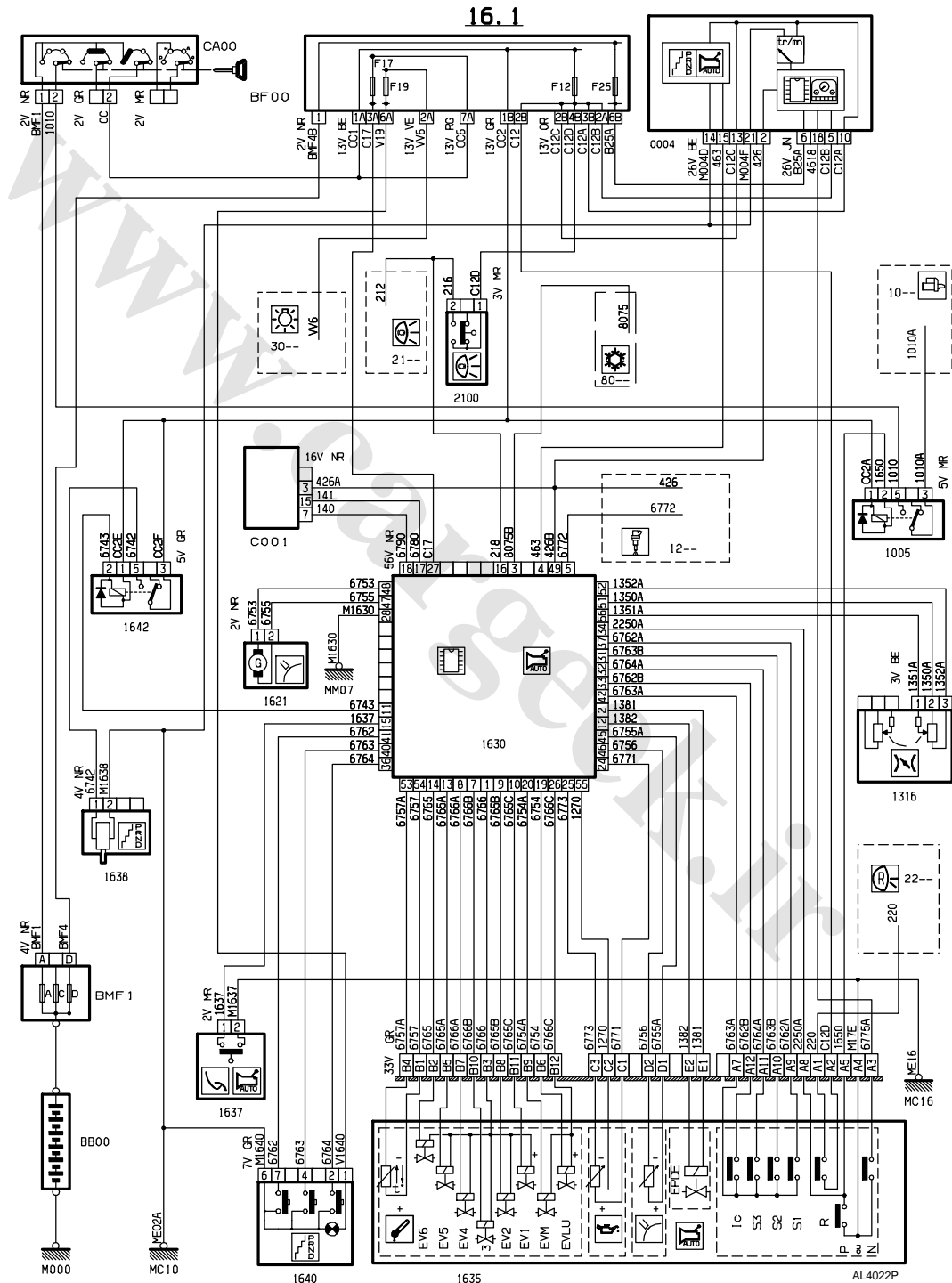
Warning: In hydraulic emergency mode, gear changing safety limits are no longer provided.

AL4 AUTOMATIC TRANSMISSION

WIRING DIAGRAM - XANTIA

PETROL ENGINE/WITHOUT CRUISE CONTROL

I- LAYOUT



AL4 AUTOMATIC TRANSMISSION

II - PARTS LIST

- BB00 - Battery
- BF00 - Passenger compartment fuse box
- BMF1 - Maxi fuse box
- C001 - Diagnostic socket
- CA00 - Ignition switch
- M000 - }
- MC10 - } Earths
- MC16 - }
- MM07 - }
- 0004 - Control panel
- 1005 - Starting prohibition relay
- 1316 - Throttle position sensor
- 1621 - Automatic transmission vehicle speed sensor
- 1630 - Automatic transmission ECU
- 1631 - Torque reduction electrovalve
- 1635 - Automatic transmission electro-hydraulic unit
- 1637 - Automatic transmission kickdown switch
- 1638 - Automatic transmission shift-lock actuator
- 1640 - Automatic transmission program selector
- 1642 - Shift lock control relay
- 2100 - Stop switch
- 7307 - Cruise control safety relay
- 10 - - - Starting function, current generation
- 12 - - - Injection supply function
- 21 - - - Stop lights function
- 22 - - - Reversing lights function
- 30 - - - Passenger compartment lighting function
- 73 - - - Cruise control function
- 80 - - - Air conditioning function

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AL4 AUTOMATIC TRANSMISSION

AFTER-SALES OPERATIONS

I - DOWNLOADING

This operation is to be performed in the following cases:

- when the automatic transmission ECU is updated,
- to adapt the automatic transmission ECU to an upgraded engine management computer,

The downloading operation must be followed by:

- a pedal programming operation,
- configuration,
- a road test.

IMPORTANT: The engine management computer must be upgraded every time the automatic transmission ECU is upgraded.

Following the procedure on the ELIT or PROXIA/LEXIA diagnostic tool to perform a downloading operation.

II - CONFIGURATION

This operation is to be performed in the following cases:

- replacement of ECU,
- downloading to ECU.

A new or newly downloaded ECU is always configured with the following three options:

- with or without shift lock,
- with or without air conditioning,
- with or without EOBD (L4 depollution standard).

The ECU configuration operation consists of preventing the options not fitted to the vehicle from being subject to the diagnostic procedure.

Follow the procedure on the ELIT or PROXIA/LEXIA diagnostic tool to perform a configuration operation.

AL4 AUTOMATIC TRANSMISSION

III - PEDAL PROGRAMMING

This operation is to be performed in the following cases:

- replacement of ECU,
- replacement of automatic transmission,
- updating by downloading,
- replacement or adjustment of accelerator cable,
- replacement of or downloading to engine management computer (XUD9BTF/XU7JP4/L4),
- replacement of throttle potentiometer,
- replacement of diesel injection pump.

Follow the procedure on the ELIT or PROXIA/LEXIA diagnostic tool to perform a pedal programming operation.

IV - INITIALISING THE "OLD OIL" COUNTER

This procedure will be active from update n°13 of the diagnostic tools. The aim of this operation is to tell the automatic transmission ECU that the transmission oil has just been changed.

V - UPDATING THE "OLD OIL" COUNTER

This procedure will be active from update n° 13 of the diagnostic tools. It consists of making the transmission ECU memorise the "old oil" counter should the ECU be replaced without changing the oil.

Note: If the oil counter cannot be read from an old ECU, change the transmission oil.

VI - TEST AFTER REPAIR WORK

The ECU permanently adapts itself to the transmission. Thus, when replacing the transmission, the ECU or another transmission component, a road test must be performed choosing a route which allows frequent gear changes and the use of all gears. All the programs should also be selected.

This test is absolutely essential so that the ECU can adapt itself to the transmission by comparing reference values with actual values. The difference recorded is then memorised to allow optimum gear changing quality.

AL4 AUTOMATIC TRANSMISSION

VII - CHANGING PARTS, OPERATIONS TO BE PERFORMED

COMPONENT REPLACED	OPERATION TO BE PERFORMED	COMMENTS
Transmission (1)	Adjust multifunction switch + Initialise old oil counter (2) + Road test	requires diagnostic tool + multimeter
Transmission oil	Initialise old oil counter (2)	requires diagnostic tool
Replace hydraulic distributor components (hydraulic distributor, electrovalves)	Adjust control inside transmission + Road test	special tool
Heat exchanger oil flow modulating electrovalve		Do not drain transmission Check oil level
Transmission input speed sensor		
Transmission output speed sensor		
Main pressure sensor		
Oil temperature probe	Remove hydraulic distributor	Requires transmission to be drained. Requires electrical harness inside transmission to be removed. Requires control inside transmission to be adjusted. Check oil level
Replace or adjust accelerator cable	Program accelerator pedal	Check operation of kickdown switch
Replace throttle potentiometer	Program pedal	requires diagnostic tool
Replace diesel injection pump (with potentiometer on load lever)	Program pedal	
Replace injection ECU	Program pedal	download automatic transmission ECU
Multifunction switch	Adjust switch	multimeter
Replace transmission ECU	Read old oil counter in old ECU (2), note the value + Configure new ECU + Update oil counter in new ECU from value stored in old one (2) (3) + Program accelerator pedal + Road test	download engine management computer

- (1) New transmissions are supplied filled with oil
- (2) Possible from update n° 13 of diagnostic tools
- (3) If the oil counter cannot be read from an old ECU, replace the transmission oil.

AL4 AUTOMATIC TRANSMISSION

VIII - AUTHORISED OPERATIONS DURING THE WARRANTY PERIOD

Transmission fitted

Authorised replacements:

- drain and fill oil,
- download/configure ECU,
- program pedal,
- initialise/update "old oil" counter,
- hydraulic distributor cover seal,
- selector shaft seal,
- driveshaft seals,
- seal between closing plate and transmission housing,
- gear selector control,
- heat exchanger and its seals,
- accessible plugs, support brackets and control pins,
- complete hydraulic distributor,
- electrovalves and pressure regulators on hydraulic distributor,
- speed sensors (turbine speed, engine speed, vehicle speed),
- transmission oil temperature probe,
- electrical harness inside transmission,
- TDC sensor,
- selector lever position switch,
- oil pressure sensor,
- relays,
- transmission ECU (*).

Note: If the oil in the transmission is burnt, always replace the heat exchanger.

(*) only after approval.

Transmission removed

Authorised replacements (depending on transmission architecture):

- torque converter,
- inter housing gasket,
- whole transmission (*).

IMPORTANT: When returning a transmission under warranty, return it with its heat exchanger.

(*) only after approval.

AL4 AUTOMATIC TRANSMISSION

The operating procedures for the various authorised operations are given in the corresponding after-sales document.

Replacing the whole AL4 transmission or its ECU must be subject to prior approval.

This approval is given by the Regional Headquarters for France. The point of sale fills in the "request for replacement approval" (copy enclosed) and sends this duly completed request to the Regional Headquarters. After being analysed, additional technical assistance will be proposed in order to complete the diagnostic or replacement approval will be faxed back to the point of sale on the approval request.

For UK, contact warranty department at Citroën UK or follow After Sales procedure for UK RHD vehicles.

IX - AUTOMATIC TRANSMISSION REPAIR BY THE CITROËN AUTOMATIC TRANSMISSION CENTRE, SOUTH WEST PARIS

Conditions

- The vehicle is not under contractual warranty (1 year).
- Preliminary checks (level and quality of oil, adjustments relating to transmission, etc...) and any repairs (repairs with or without removing transmission) must have been performed.

Procedure

- Send the centre the duly completed approval sheet by fax.
- Upon receiving the work request, the centre will specify its provisional repair time by telephone or fax.
- The centre will send the point of sale special packaging for transport purposes with blanks and the converter lock corresponding to the AL4 automatic transmission.
- Remove the transmission from the vehicle.
- Package the transmission (leave oil / water exchanger fitted) and attach the photocopy of the workshop customer work order, the approval request sheet and the works order.
- Send the transmission to the centre using GEFECO transport (specific procedure).
- Transmission will be returned by GEFECO after repair.
- Return empty special packaging to GEFECO with blanks and converter lock.

AL4 AUTOMATIC TRANSMISSION

**REQUEST FOR REPLACEMENT APPROVAL OR ASSISTANCE FOR
MB3/4HP20/AL4 AUTOMATIC TRANSMISSION**

Warranty start		Stamp
Vehicle type		
Engine type		
Transmission type		
ECU type		
V.I.N or DAM N°		
Transmission N°		
Mileage		
Date		

1) VEHICLE IMMOBILISED <input type="checkbox"/> YES <input type="checkbox"/> NO	Form completed by:	Telephone	Fax
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2) CUSTOMER complaint

3) OIL	appearance	<input type="checkbox"/> coloured	<input type="checkbox"/> oil burnt	<input type="checkbox"/> normal
Check at 80°C	level	<input type="checkbox"/> level insufficient	<input type="checkbox"/> level normal	<input type="checkbox"/> too much oil
Check at 60°C (AL4)				
Leak	Location	<input type="checkbox"/> dripping	<input type="checkbox"/> flowing	

For the next section, only complete relevant sections:

Accelerator pedal programmed (MB3 or AL4)	YES <input type="checkbox"/>	NO <input type="checkbox"/>
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4) OPERATING FAULT

<input type="checkbox"/> gears do not change	<input type="checkbox"/> slipping
<input type="checkbox"/> random changes	<input type="checkbox"/> slipping then knocking
<input type="checkbox"/> delay engaging N-D or N-R	<input type="checkbox"/> knocking
<input type="checkbox"/> problem in imposed gears	<input type="checkbox"/> no drive
	other

<input type="checkbox"/> when changing up	<input type="checkbox"/> sudden fault	<input type="checkbox"/> when driving	<input type="checkbox"/> stationary
<input type="checkbox"/> when changing down	<input type="checkbox"/> engine cold	<input type="checkbox"/> engine warm	
<input type="checkbox"/> progressive degradation	<input type="checkbox"/> occasionally		
<input type="checkbox"/> when changing gears	which ones ?		
<input type="checkbox"/> when changing lever position, state positions			
coherence between lever position/control panel display of P® 1		YES <input type="checkbox"/>	NO <input type="checkbox"/>

5) NOISE

conditions	<input type="checkbox"/> when driving	<input type="checkbox"/> when accelerating	<input type="checkbox"/> when decelerating	<input type="checkbox"/> stationary
type of noise	<input type="checkbox"/> metallic	<input type="checkbox"/> friction	<input type="checkbox"/> whining	<input type="checkbox"/> cyclic

6) MEMORISED FAULTS

Warning light flashing (if fitted): YES NO

Transmission ECU identification Engine ECU identification

Transmission:	Engine:
---------------	---------

7) POINT OF SALE COMMENTS: e.g. associated variables	8) RESPONSE TO APPROVAL REQUEST (Approval n°)
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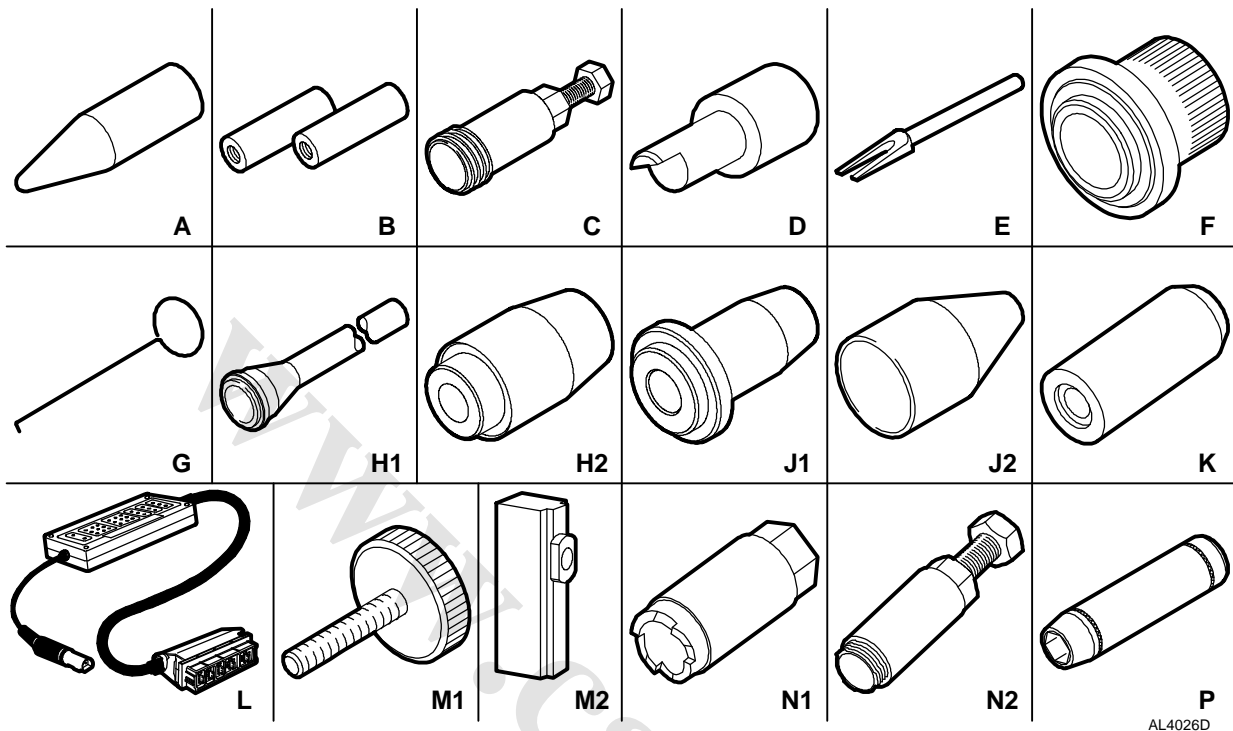
AL4 AUTOMATIC TRANSMISSION

Note: Above for France. For UK contact warranty department, Citroën UK Ltd.

AL4 AUTOMATIC TRANSMISSION

X - SPECIAL TOOLING

Box - () 0338



AL4026D

- A - Drift
- B - 2 sockets for removing-refitting converter
- C - Right hand driveshaft seal extractor
- D - Tool for holding converter
- E - Ball joint extractor
- F - Tool for fitting converter lip seal
- G - Hook for removing lip seal from converter
- H1 - Tool for fitting left hand driveshaft seal
- H2 - Guide for fitting left hand driveshaft seal
- J1 - Tool for fitting right hand differential output seal
- J2 - Guide for fitting right hand differential output seal
- K - Tool for fitting selector shaft seal
- L - Interface harness for checking AL4 automatic transmission
- M1 - Screw for setting internal selector control
- M2 - Shim for adjusting internal selector control
- N1 - Gear changing shaft seal extractor
- N2 - Gear changing shaft seal extractor
- P - Socket for removing transmission mounting

AL4 AUTOMATIC TRANSMISSION

XI - DIAGNOSTIC TOOLING

ELIT unit: 4125-T

This tool is used for:

- identifying ECUs,
- reading faults,
- erasing faults,
- measuring parameters,
- activating actuators,
- programming accelerator pedal,
- configuring ECUs,
- updating the ECU by downloading.

PROXIA station: 4165-T

This tool is used for:

- identifying ECUs,
- reading faults,
- erasing faults,
- measuring parameters,
- activating actuators,
- programming accelerator pedal,
- configuring ECUs,
- updating the ECU by downloading,
- consulting wiring diagrams.

AL4 AUTOMATIC TRANSMISSION

LEXIA station: 4171-T

This tool is used for:

- identifying ECUs,
- reading faults,
- erasing faults,
- measuring parameters,
- activating actuators,
- programming accelerator pedal,
- configuring ECUs,
- updating the ECU by downloading,
- consulting wiring diagrams.

Terminal box and harness: 4187-T

Using a voltmeter and an ohmmeter, this tool is used to check:

- sensors and actuators,
- automatic transmission harness.

AL4 AUTOMATIC TRANSMISSION

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AL4 AUTOMATIC TRANSMISSION