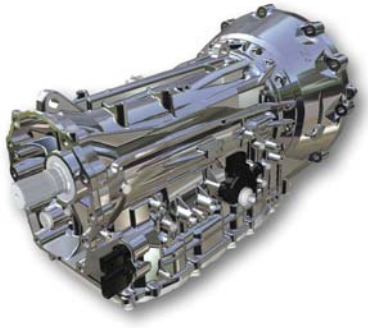
Self-Study Program 950113







Audi 8-Speed Automatic Transmission 0C8

Audi Academy

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Always check Technical Bulletins and the latest electronic repair literature for information that may supersede any information included in this booklet.

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The Self-Study Workbook provides introductory information regarding the design and function of new models, automotive components or technologies.

The Self-Study Workbook is not a Repair Manual!
All values given are intended as a guideline only.
Refer to the software version valid at the time of publication.

For maintenance and repair work, always refer to the current technical literature.

Reference



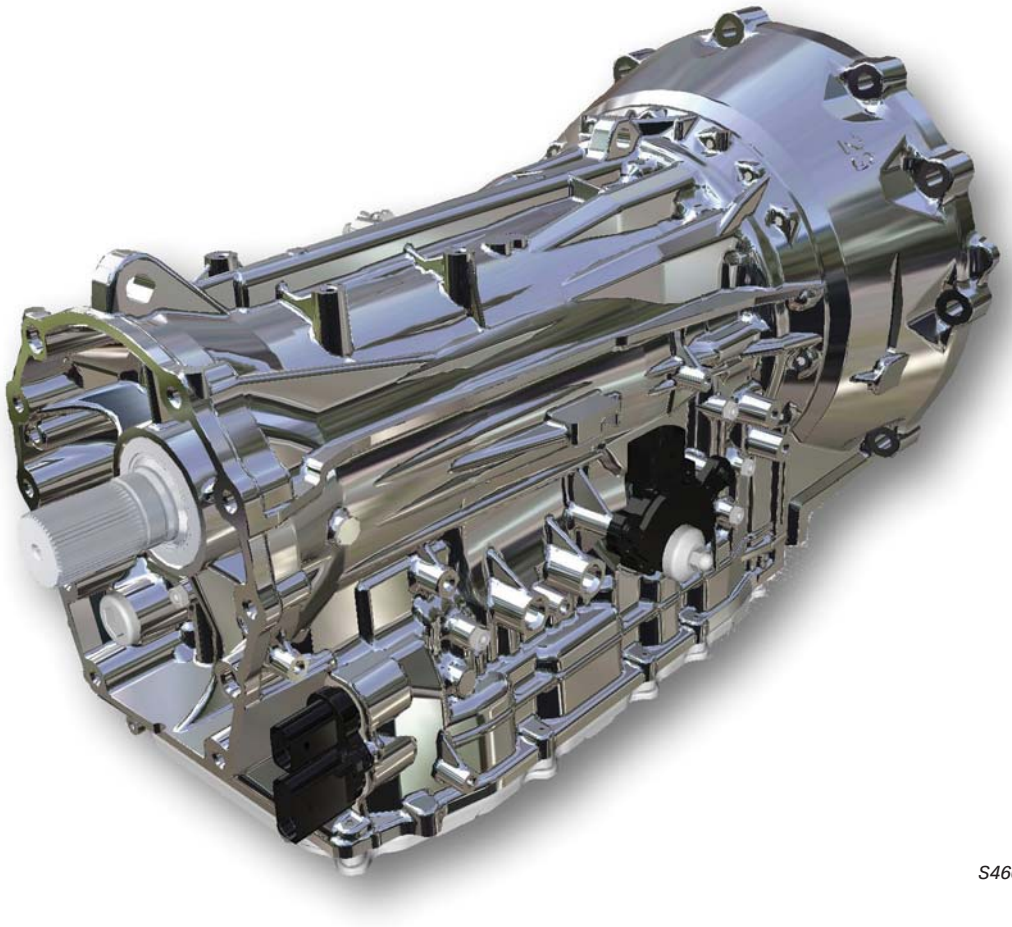
Note



Introduction

The 0C8 8-speed automatic transmission is based on the previous 09D automatic transmission. This transmission uses the same basic components and has added two more forward speeds, helping both performance and fuel consumption.

All 2011 Q7 vehicles will have the 0C8 8-speed automatic transmission.



S466_003

Introduction

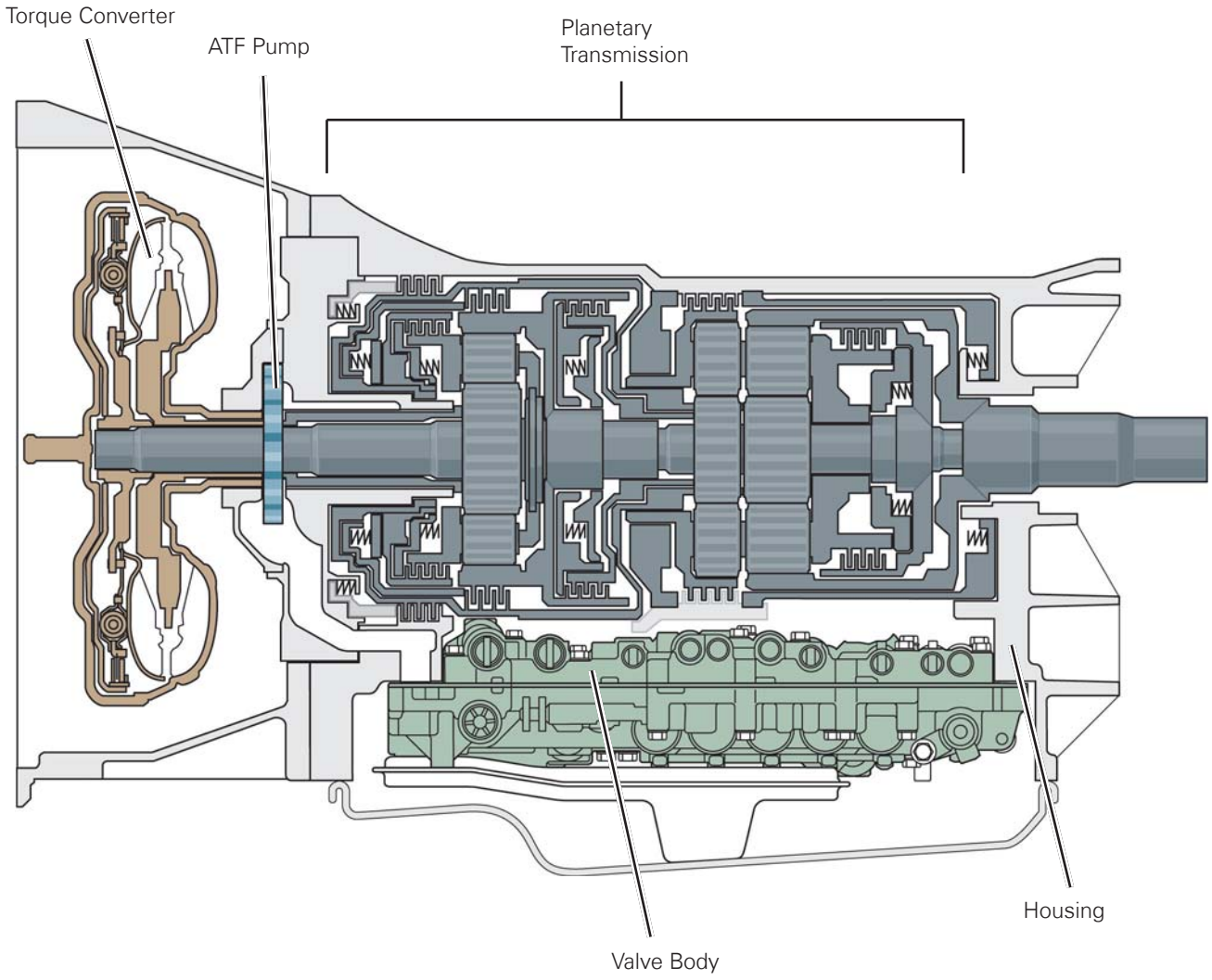
Technical Data

Developer/manufacturer	AISIN AW CO. LTD Japan
Designation	Automatic gearbox 0C8
Gearbox features	Electrohydraulically controlled 8-speed planetary gearbox with a single primary planetary gear set (planetary gearbox concept according to Lepelletier) Hydrodynamics torque converter with slip-controlled torque converter lock-up clutch
Control system	Hydraulic control unit (valve chest) in the sump with an external electronic control unit Dynamic shift program DSP with sperate sports program in "position S" and the "Tiptronic" shift program for changing gears manually
Torque	Depending on version up to 1000Nm
Achievement of top speed	Depending on engine in either 6th or 7th gear
Spread	7.17 to 7.25
ATF service	ATF refer to ELSA for service intervals
Weight	Depending on gearbox adaptation to the engine, between 91kg and 108kg
Emergency operations characteristics	In the case of faults which arise during vehicle operation: in gears 1-4 =3rd gear in gears 5-8 =7th gear as of restaring the vehicle, 3rd gear and reverse gear only

Transmission Design

The 8-speed automatic transmission consists of :

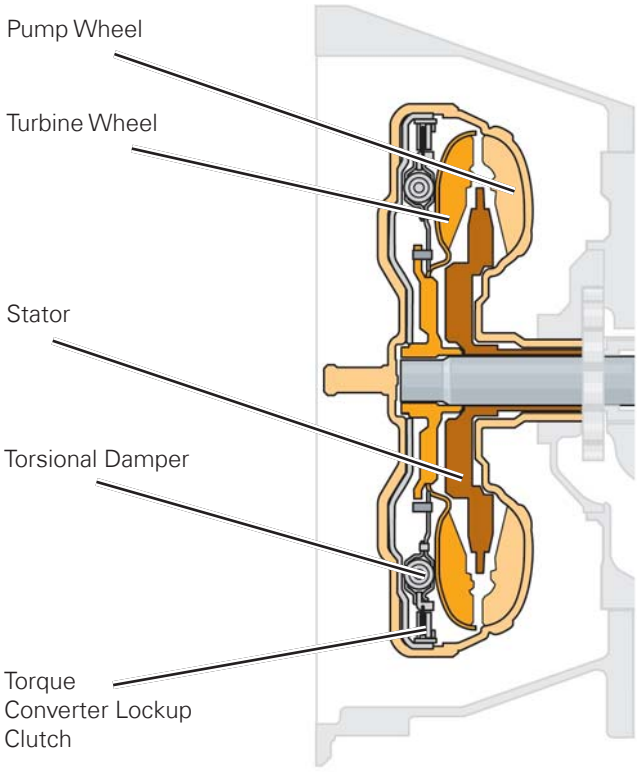
– The torque converter with lock-up clutch
– The ATF pump
– The valve body
– The Lepellitier planetary transmission configuration
– The transmission housing
– ATF preheater



S466_006

Transmission Design

The Torque Converter



S466_073

The hydro-mechanical torque converter is a fluid clutch. It is used both to transfer and multiply torque from the engine. It consists of a turbine, pump, stator and lock-up clutch.

Torsional dampers are installed in all torque converters. This allows the engine's torsional vibrations to be minimized.

Different torque converters will be used depending on the engine and drive characteristics.

The Connection between the Engine to the Torque Converter

The torque converter is connected to the different engines via three lugs. Depending on the engine, 3 or 6 bolts are required to connect the lugs to the engine.



3.0L V6 TDI

S466_214



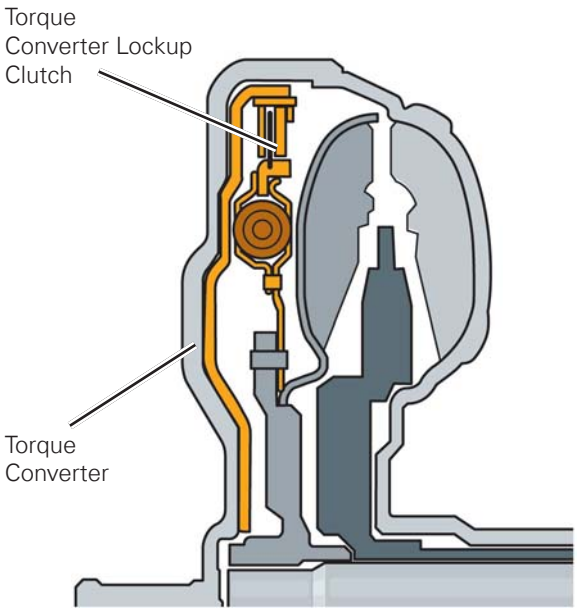
3.0L V6 FSI

S466_216

The Torque Converter Lock-up Clutch

The torque converter lock-up clutch is a hydraulic multi-plate clutch. It locks the torque converter's pump and turbine to eliminate slip.

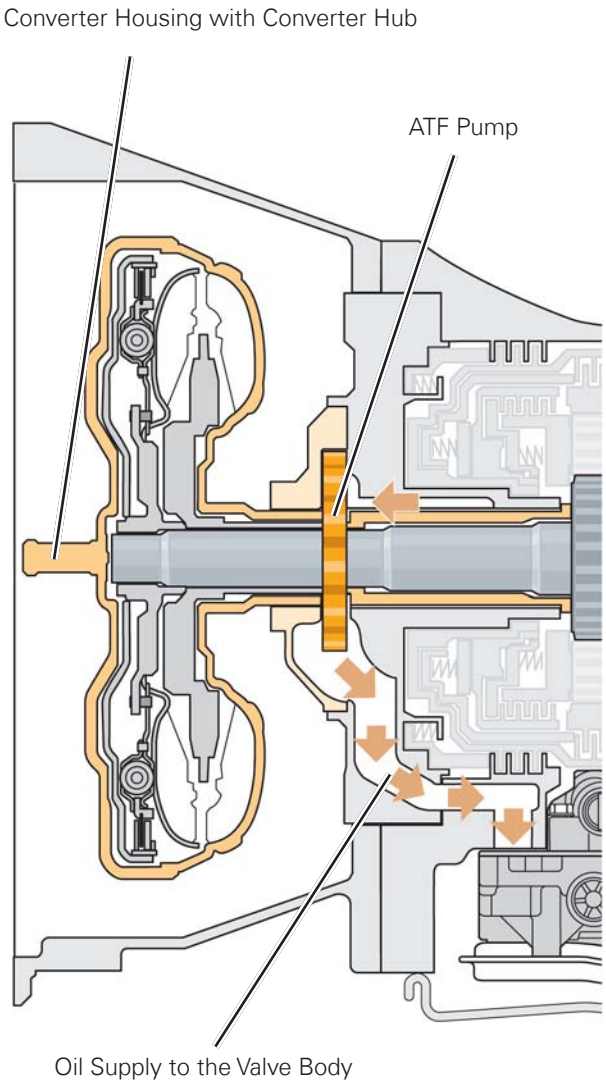
Depending on the vehicle operating status, this can be carried out at any time at engine speeds of over 1000 rpm.



S466_072

Transmission Design

The Oil Supply



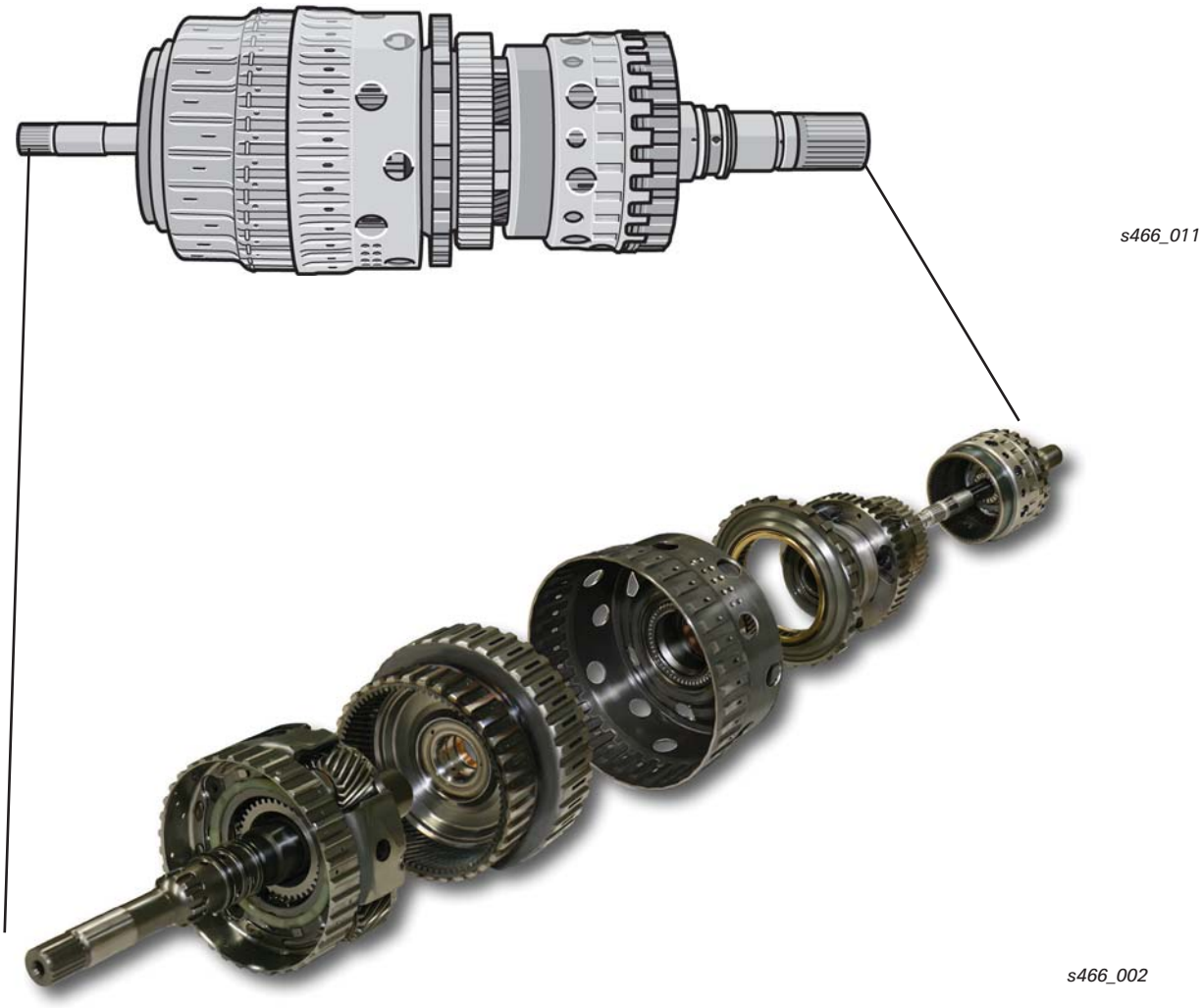
S466_007

The ATF Pump

In vehicles with combustion engine, the mechanical ATF pump (Automatic Transmission Fluid) is responsible for supplying the transmission with oil. It draws the ATF out of the oil pan, builds up the oil pressure and supplies the valve body with the hydraulic oil required for changing gears.

The oil pump is a crescent pump (duocentric oil pump). It is driven directly by the engine via the converter housing and the converter hub. When driven, the ATF pump's pinion drive plates engage in two grooves on the converter hub.

The Planetary Transmission



s466_011

s466_002

Design

The Lepellitier planetary gear set concept is based on a single planetary gear set (primary planetary transmission) and a downstream, double planetary gear set (Ravigneaux) with freewheeling capability.

The special feature of the Lepelletier planetary transmission is the fact that the double planetary gear set's sun gears and planet carrier are driven at different rotational speeds. These different input speeds create a large number of possible gear ratios.

In this transmission, the double planetary gear set's sun gears can be driven by the output speeds of the planet carrier or the annulus (ring gear) of the single planetary gear set. At the same time, the double planetary gear set's planet carrier runs at the transmission input speed. This configuration enables the use of two additional forward gears.

Four multi-plate clutches, two multi-disc brakes and the freewheel are used to operate the eight forward gears and one reverse gear.

Transmission Design

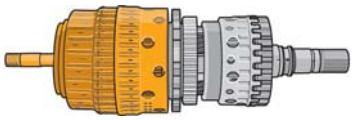
The Single Planetary Gear Set

The single planetary gear set is located in front of the double planetary gear set.

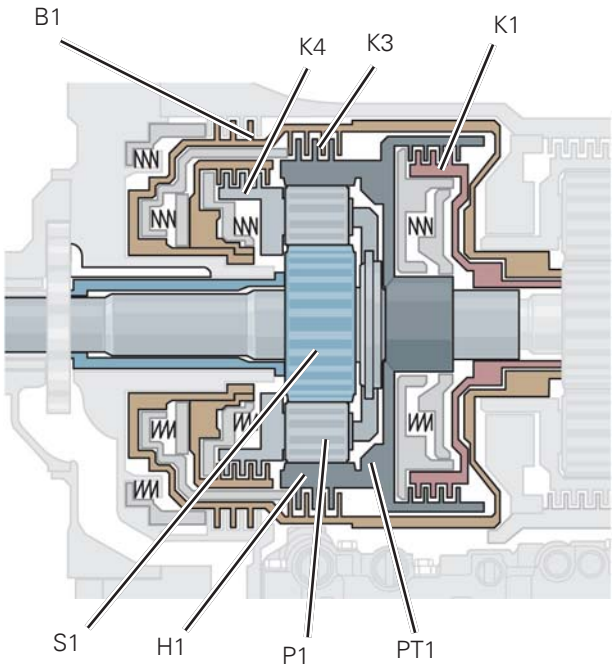
The single planetary gear set consists of:

– The stationary sun gear S1
– The planetary gears P1
– The planet carrier PT1
– The annulus H1
– The multi-plate clutches K1, K3 and K4
– The multi-disc brake B1

Either four or five planetary gear pairs are installed depending on the engine. These gears make the connection to the S1 and the H1. The engine torque is transmitted into the single planetary gear set via the transmission input shaft.



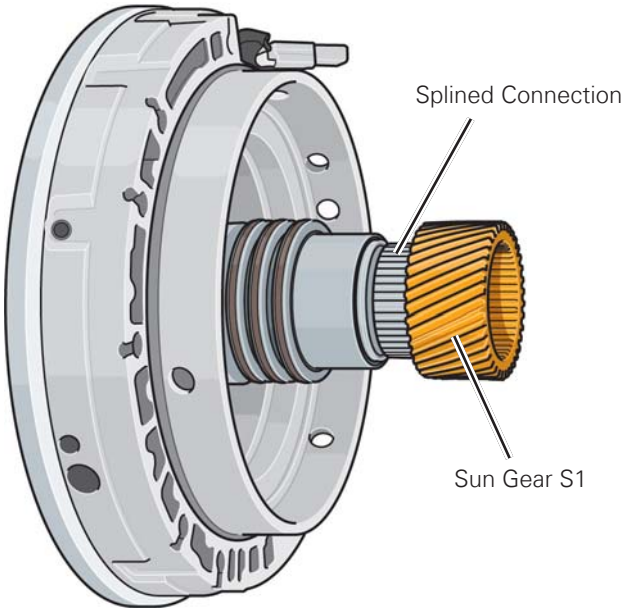
s466_013



s466_014

The Sun Gear S1

This is firmly joined to the mechanical ATF pump via a splined connection. As a result of this joint, the S1 is unable to rotate.

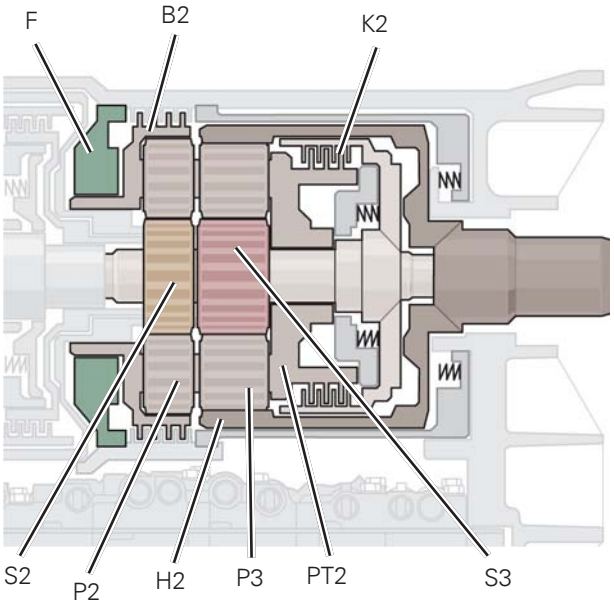


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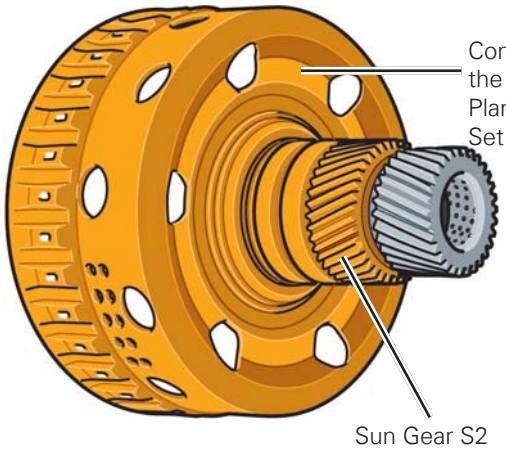
The Double Planetary Gear Set



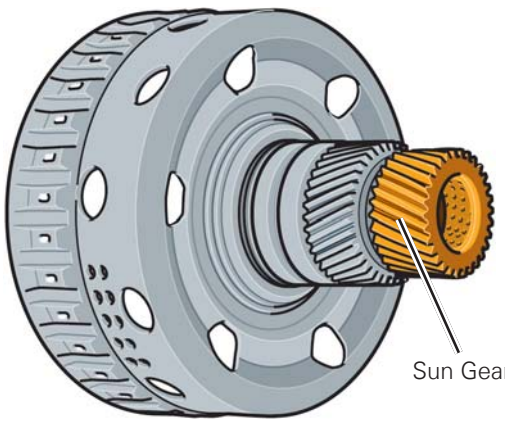
s466_012



s466_022



s466_035



s466_034

The double planetary gear set is attached to the single planetary gear set.

The engine torque is transmitted into the double planetary gear set via two routes:

The S2 and S3 transfer the torque via the single planetary gear set via K2 to PT2. The output to the transfer case goes from the H2 via the transmission output shaft. The double planetary gear set consists of:

– The sun gears S2 and S3
– The planetary gear sets P2 and P3
– The planet carrier PT2
– The annulus H2
– The multi-plate clutch K2
– The multi-disc brake B2 and
– The freewheel F

The Sun Gears S2 and S3

Both S2 and S3 can be rotated independently of each other. The axle of S3 runs through S2. Both sun gears can be driven at different rotational speeds.

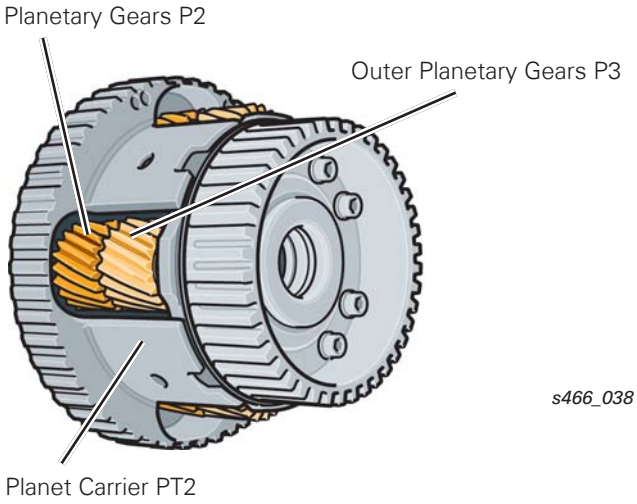
The Planetary Gears P2 and P3

Planetary gears P2 and outer planetary gears P3 are fitted together on one single shaft.

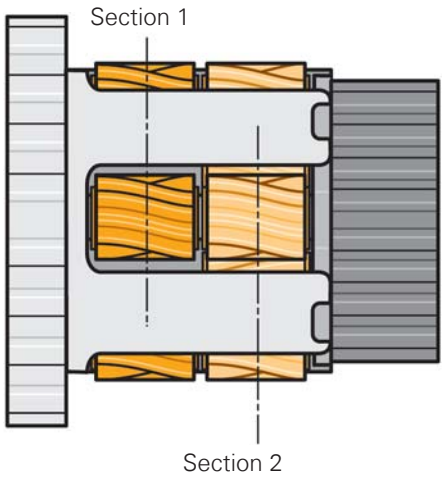
The torque from sun gear S2 is transferred to P2 and to the P3. Only the P3 are joined to annulus H2. These transfer the torque from S2 to H2.

The torque from S3 to the H2 is first transmitted to the P3. The P3 transfer the torque to the P3 and to the H2.

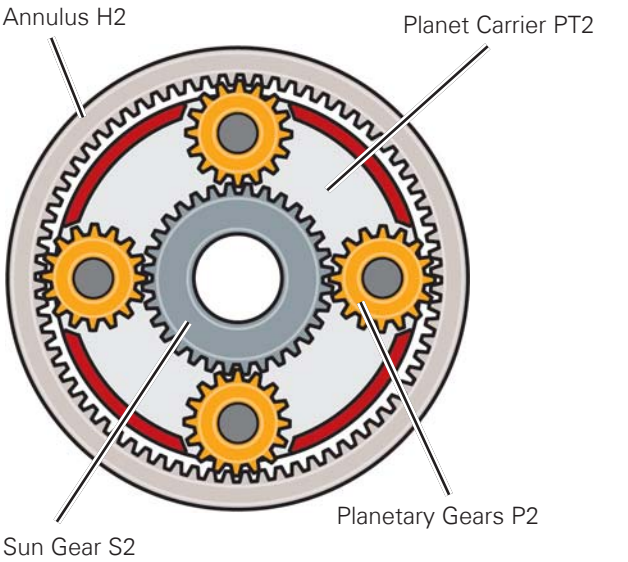
Depending on the engine, three or four P2 plus P3 planetary gears are used.



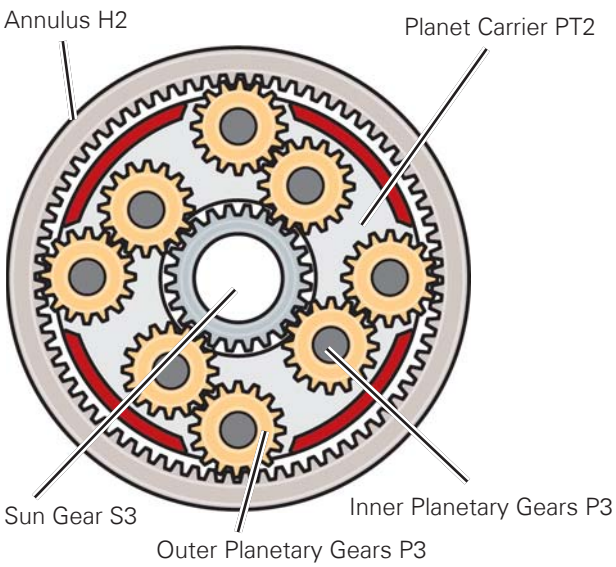
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s466_049



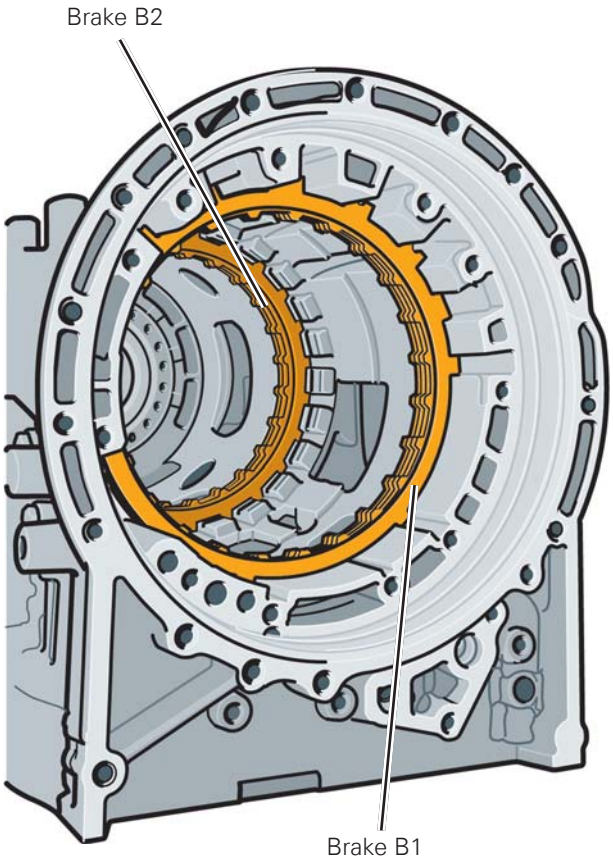
s466_050



s466_051

Brake B1

Brake B1 is keyed to the transmission housing. If the Automatic Transmission Pressure Regulating Valve N216 is supplied with current, the brake's discs are pressed together with hydraulic oil pressure. Under these conditions, the sun gear S2 is held.



Transmission Housing with the Discs of Brakes B1 and B2

Brake B2

B2 is keyed to the transmission housing. It is actuated via the valve body. No pressure regulating valve is required to control B2.

When closed, it holds the planet carrier PT2.

Note

The engine type determines the number of discs in the brakes. The number of discs can vary between 4 and 7 per brake.

Clutches K1, K2, K3 and K4

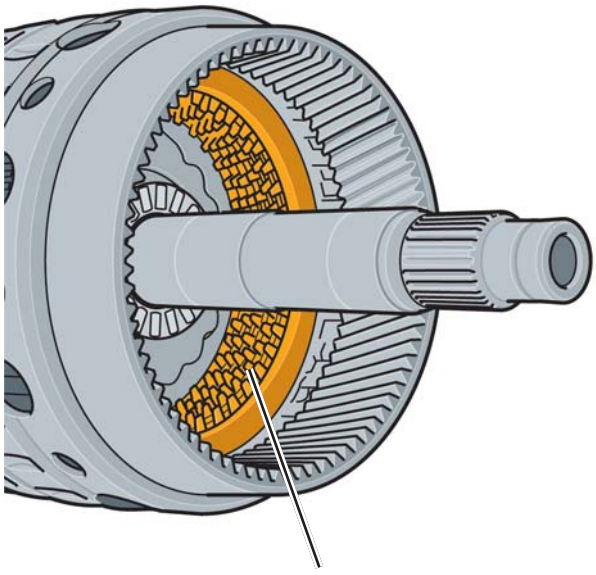
The clutches are opened or closed via the solenoid valves within the valve body. The following list shows the function that each clutch performs in its closed position:

1. K1 connects annulus H1 to sun gear S3.

2. K2 connects the turbine shaft to planet carrier PT2.

3. K3 connects annulus H1 to sun gear S2.

4. K4 connects planet carrier PT1 to sun gear S2.



s466_060

The Valve Body

The valve body is mounted to the bottom of the transmission housing. The clutches and brakes are controlled by the valve body using sliding valves.

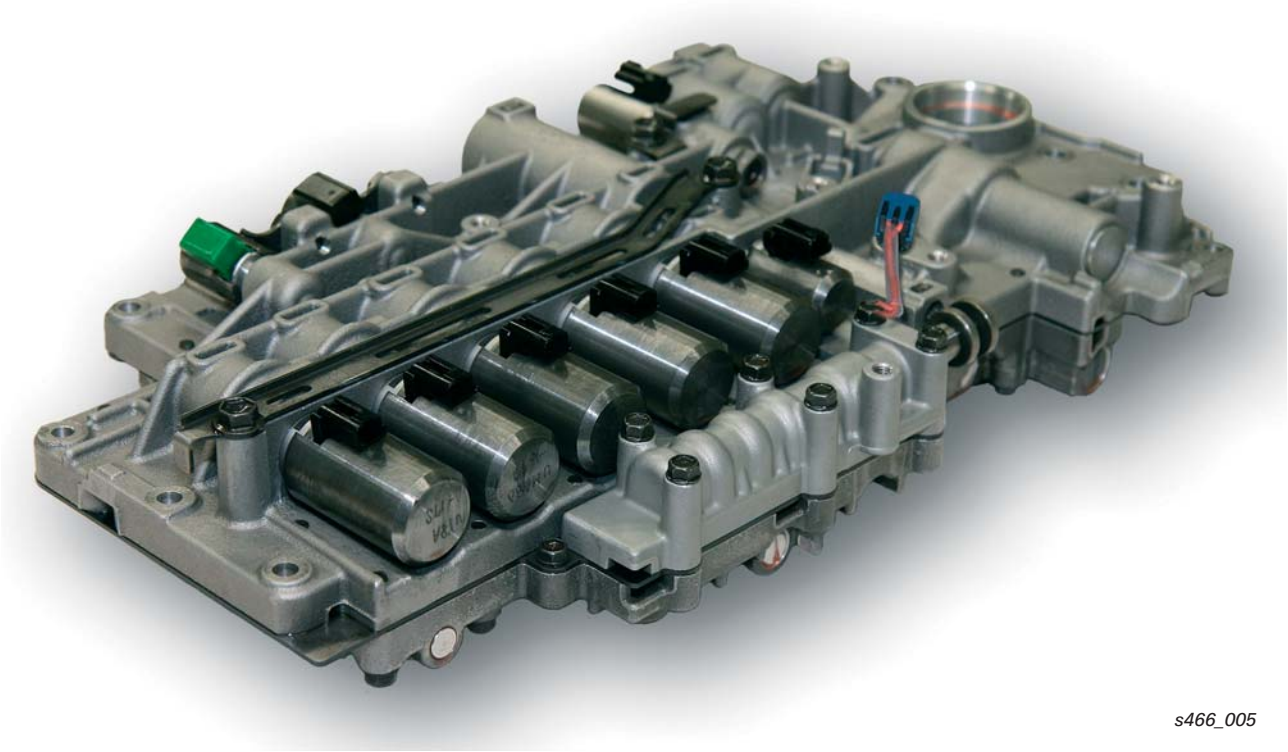
The slide valves are controlled by solenoid valves which are actuated by the Transmission Control Module J217.

In addition to the clutches and brakes, the valve body controls the torque converter clutch and the various pressures throughout the entire transmission (ex. main pressure, control pressure, converter pressure, lubrication pressure, etc.).

The valve body is responsible for the entire oil supply.

The valve body contains the following components:

- The mechanically actuated spool valve
- The hydraulic selector valves
- Two electrically controlled solenoid valves (3/2-way directional control valves)
- Seven electric pressure regulating valves (modulation valves) and
- The transmission oil temperature sensor

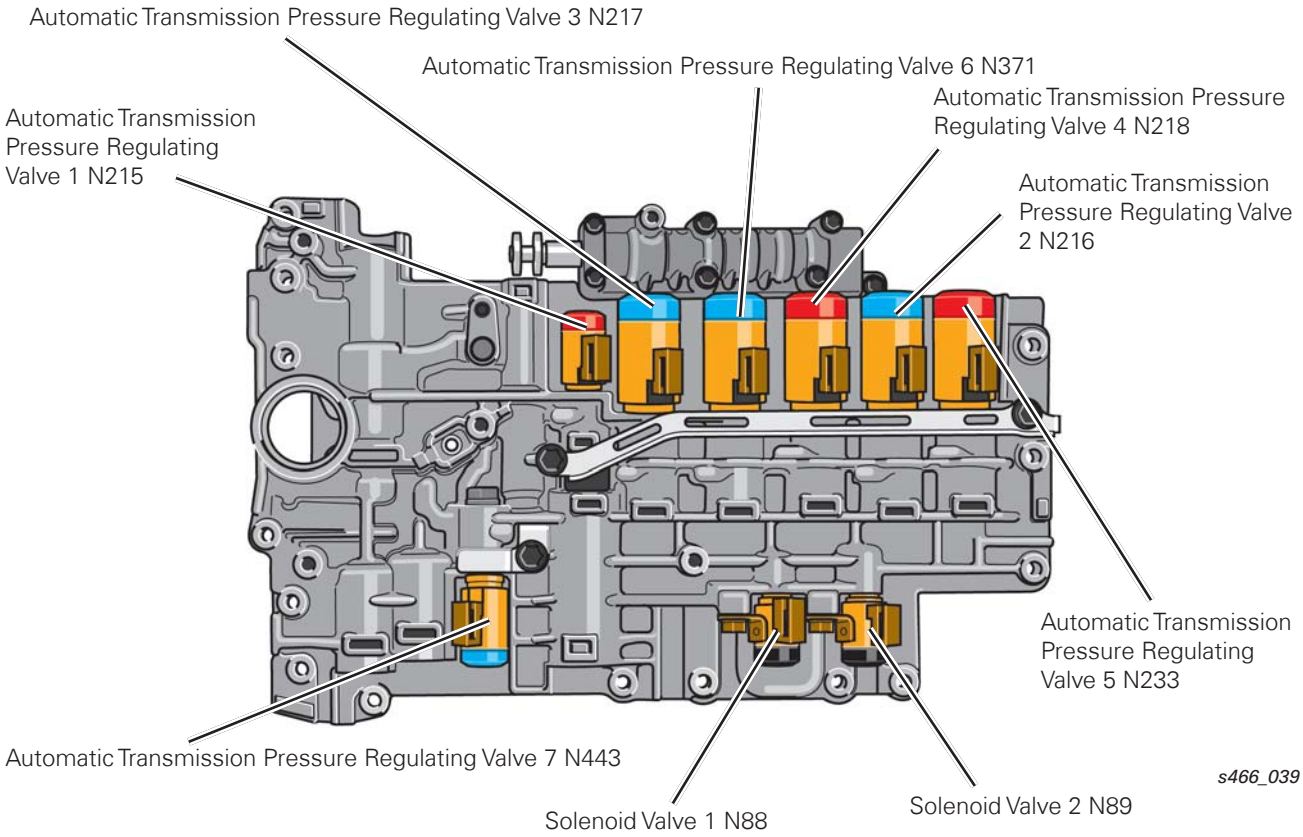


s466_005

Transmission Design

The Valves

The valve body contains three different types of solenoid valves.



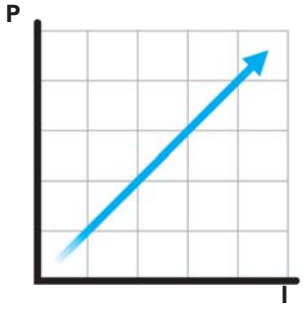
Pressure regulating valves with ascending characteristic curve

Pressure regulating valves with descending characteristic curve

Selector valves (ON/OFF valves)

Pressure Regulating Valve with Ascending Characteristic Curve

The more the pressure regulating valve is supplied with current, the higher the hydraulic pressure. If the pressure regulating valve is not supplied with current, no hydraulic pressure is present.

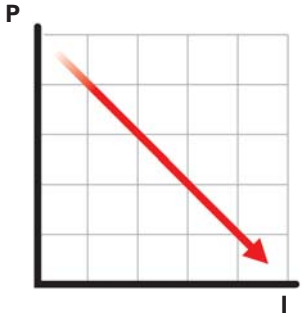


Pressure regulating valves with ascending characteristic curve (N216, N217, N371 and N443)

s466_040

Pressure Regulating Valve with Descending Characteristic Curve

The more the pressure regulating valve is supplied with current, the lower the hydraulic pressure. If the pressure regulating valve is not supplied with current, full hydraulic pressure is present.



Pressure regulating valves with descending characteristic curve (N215, N218 and N233)

s466_041

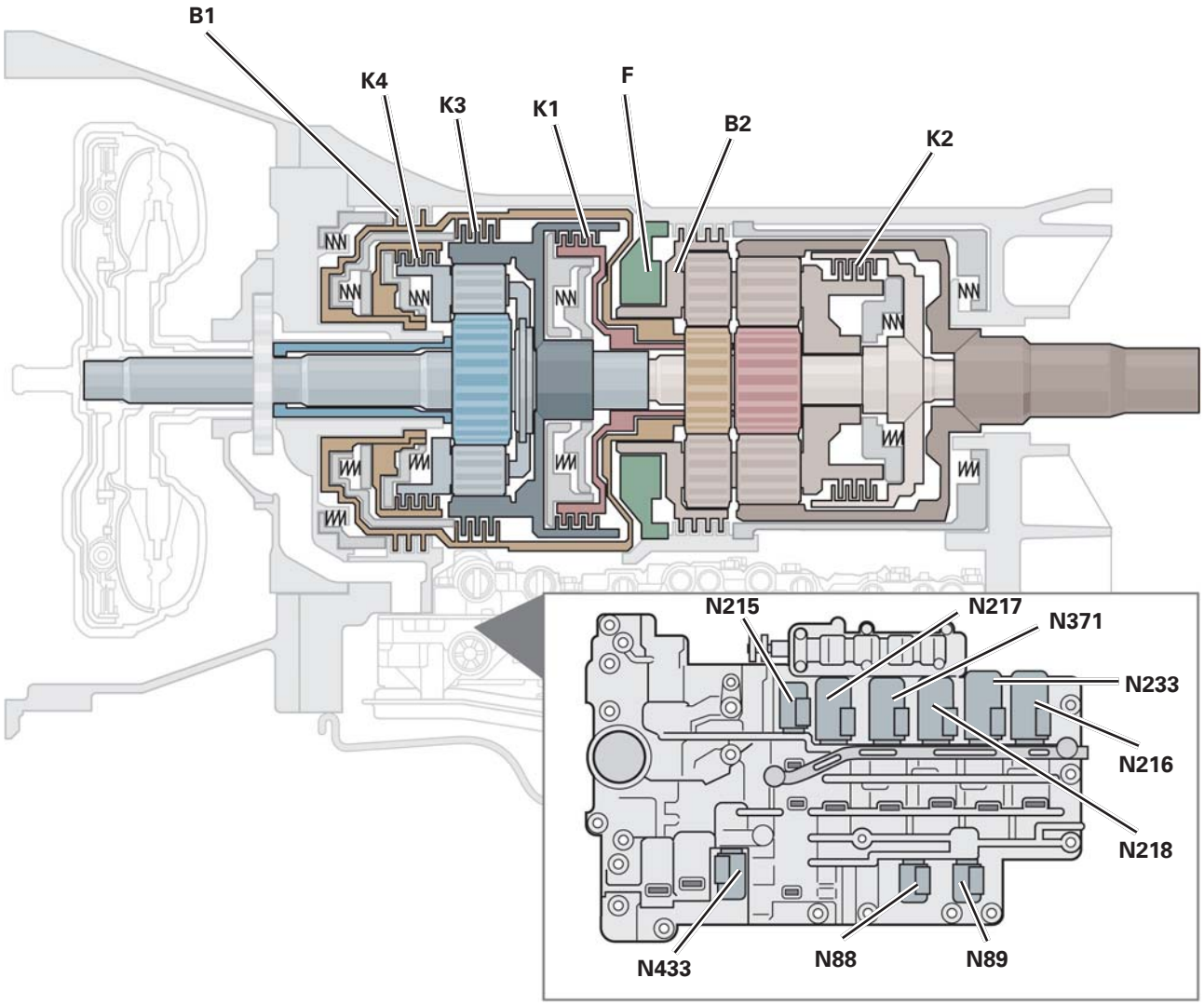
Functions of each of the solenoid valves:

Valve	**Function on application of current**	**Direct access to**	**Responsible for gears**
Automatic transmission pressure regulating valve 1 N215	Regulates the ATF pressure and forwards it either directly to clutches K2 and K3 or via solenoid valves N217, N371 and N216 to clutches K1 and K4 and to brake B1	Main pressure	R. 1st to 8th
Automatic transmission pressure regulating valve 3 N217	Supplies the ATF pressure to the plates of clutch K1, and the clutch is closed	Clutch K1	1st to 5th
Automatic transmission pressure regulating valve 4 N218	The ATF pressure on clutch K2 is relieved, and the clutch opens	Clutch K2	1st, engine brake 5th to 8th
Automatic transmission pressure regulating valve 5 N233	The ATF pressure on clutch K3 is relieved, and the clutch opens	Clutch K3	r, 3rd , 7th
Automatic transmisssion pressure regulating valve 6 N371	Supplies the ATF pressure to the plates of clutch K4, and the clutch is closed	Clutch K4	4th and 6th
Automatic transmission pressure regulating valve 2 N216	Supplies the ATF pressure to the plates of brake B1, and the brake is closed	Brake B1	2nd and 8th
Automatic tranmission pressure regulating valve 7 N443	Make ATF pressure available for the torque converter lock-up clutch		
Solenoid valve 1 N88	Partially supplied with current, supports pressure reduction in clutches K2 and K3		
Solenoid valve 2 N89	Only supplied with current in reverse gear when v > 7 km/h or 1st gear is engaged in Tiptronic. Prevents pressure reduction in clutches K2 and K3. Both valves operate in alternation		

Transmission Function

The Flow of Power

This is an extremely simplified diagram of the transmission. The torque paths of the individual gears will be explained in following pages. The valve body illustration shows which solenoid valves are actuated for each gear.



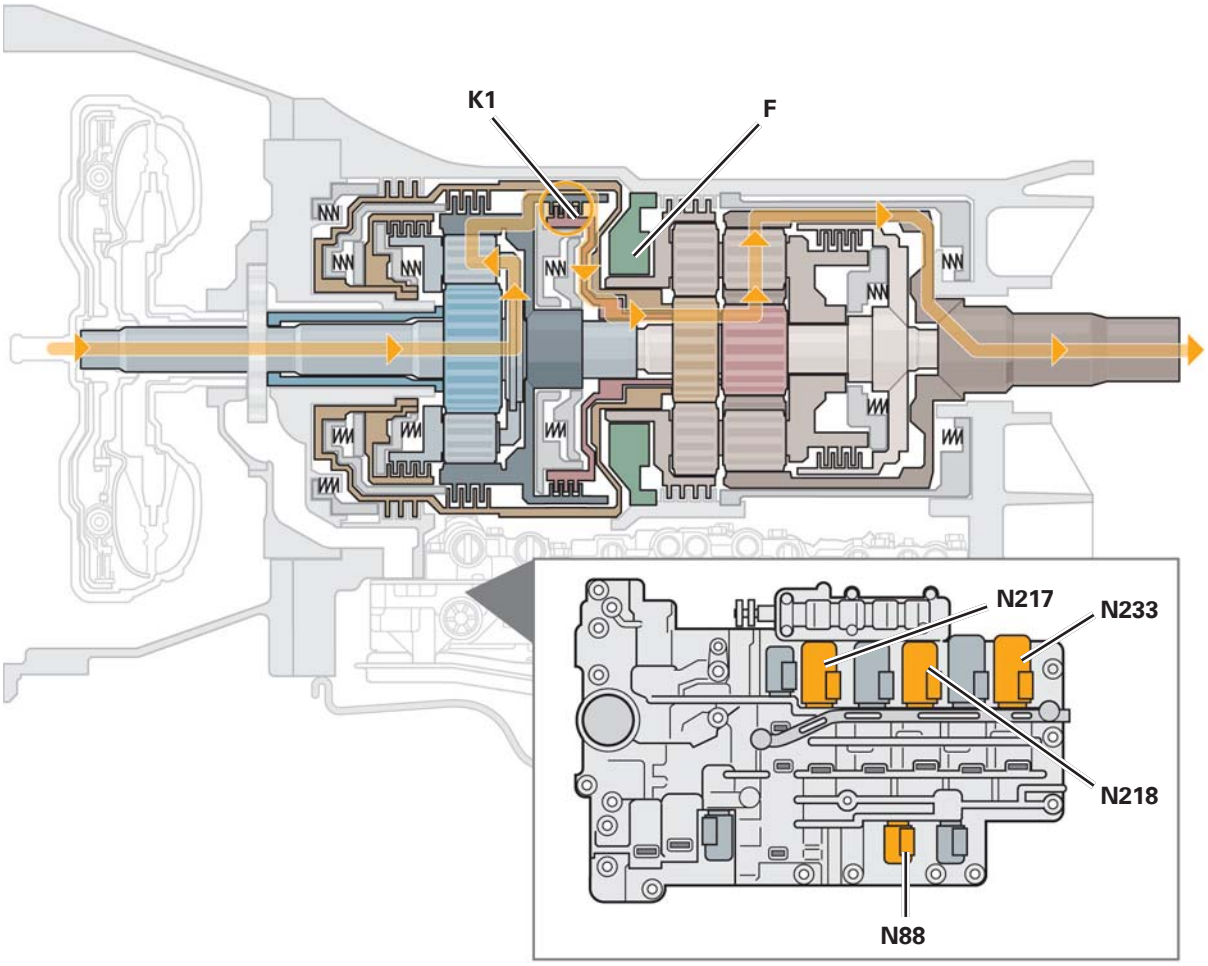
s466_017

Legend

N88 - Solenoid Valve 1
N89 - Solenoid Valve 2
N215 - Automatic Transmission Pressure Regulating Valve 1
N216 - Automatic Transmission Pressure Regulating Valve 2
N217 - Automatic Transmission Pressure Regulating Valve 3
N218 - Automatic Transmission Pressure Regulating Valve 4
N233 - Automatic Transmission Pressure Regulating Valve 5
N371 - Automatic Transmission Pressure Regulating Valve 6
N443 - Automatic Transmission Pressure Regulating Valve 7

K1 - Clutch 1
K2 - Clutch 2
K3 - Clutch 3
K4 - Clutch 4
B1 - Brake 1
B2 - Brake 2
F - Freewheel

1st Gear



s466_016

K1 Clutch and Freewheel F

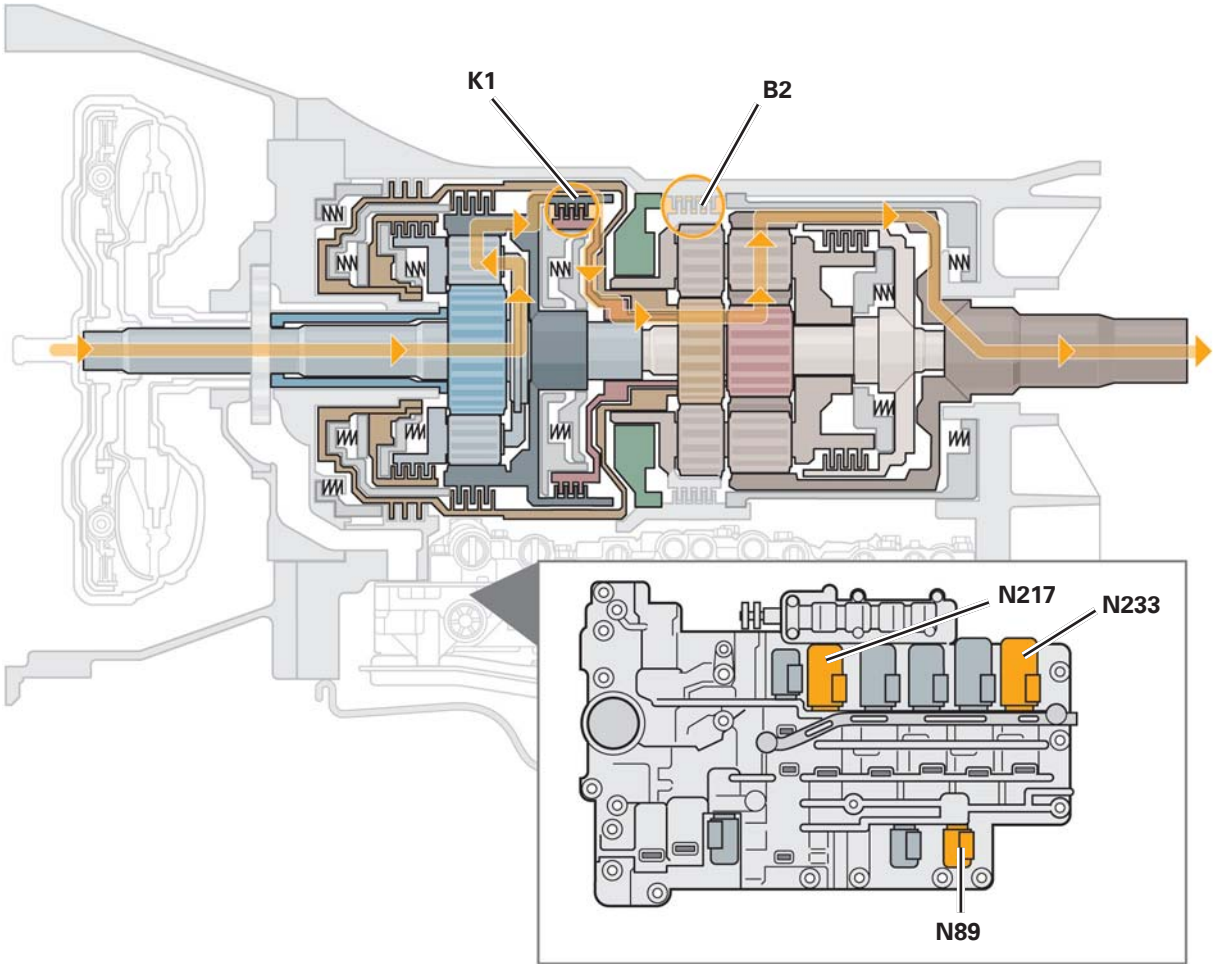
The turbine shaft drives the single planetary gear set's PT1 planet carrier. The PT1 drives the P1 planetary gears, which roll and are supported on the stationary S1 sun gear. The H1 annulus is driven.

The K1 clutch connects H1 to the S3 sun gear, transferring torque into the double planetary gear set. The freewheel blocks the PT2 planet carrier.

From S3, the torque is transferred to the inner P3 planetary gears and to the outer P3 planetary gears. Supported by PT2, the torque is then transferred to the H2. H2 is connected to the transmission output shaft.

Transmission Function

1st Gear (Tiptronic)



s466_018

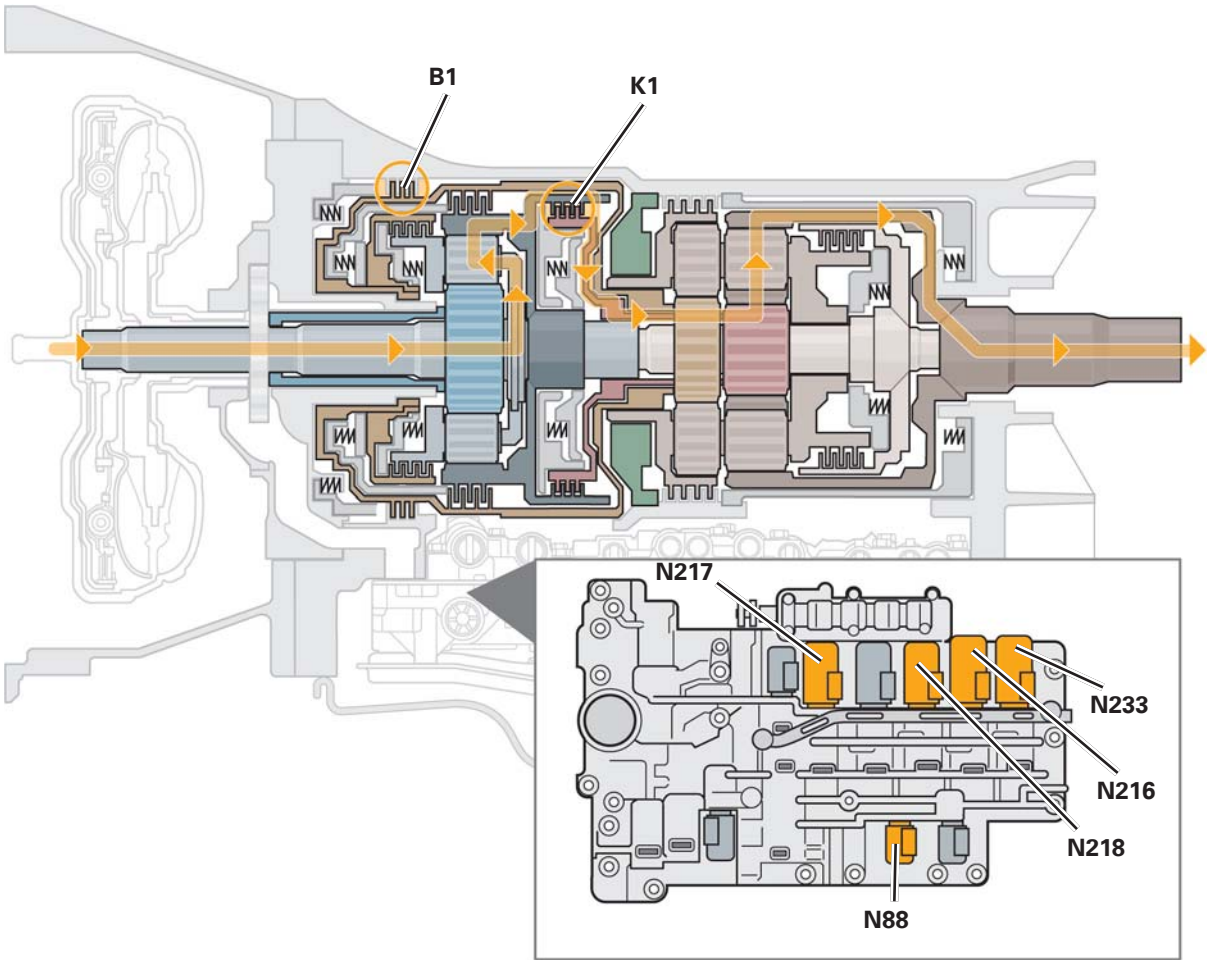
K1 Clutch and B2 Brake

The driver may request engine braking in 1st gear. This can be selected in Tiptronic mode. The torque path is the same as for 1st gear.

Use of the engine braking effect in 1st gear can only be enabled by closing the B2 brake.

Like the freewheel F, the B2 brake locks the PT2 planetary carrier. In contrast to the F, however, B2 holds the planet carrier PT2 in both rotational directions. This is necessary for Reverse and for engine braking in 1st gear.

2nd Gear



s466_019

K1 Clutch and B1 Brake

The turbine shaft drives the single planetary gear set's PT1 planet carrier. PT1 drives the P1 planetary gears, which roll and are supported on the stationary S1 sun gear. This causes the H1 annulus to be driven.

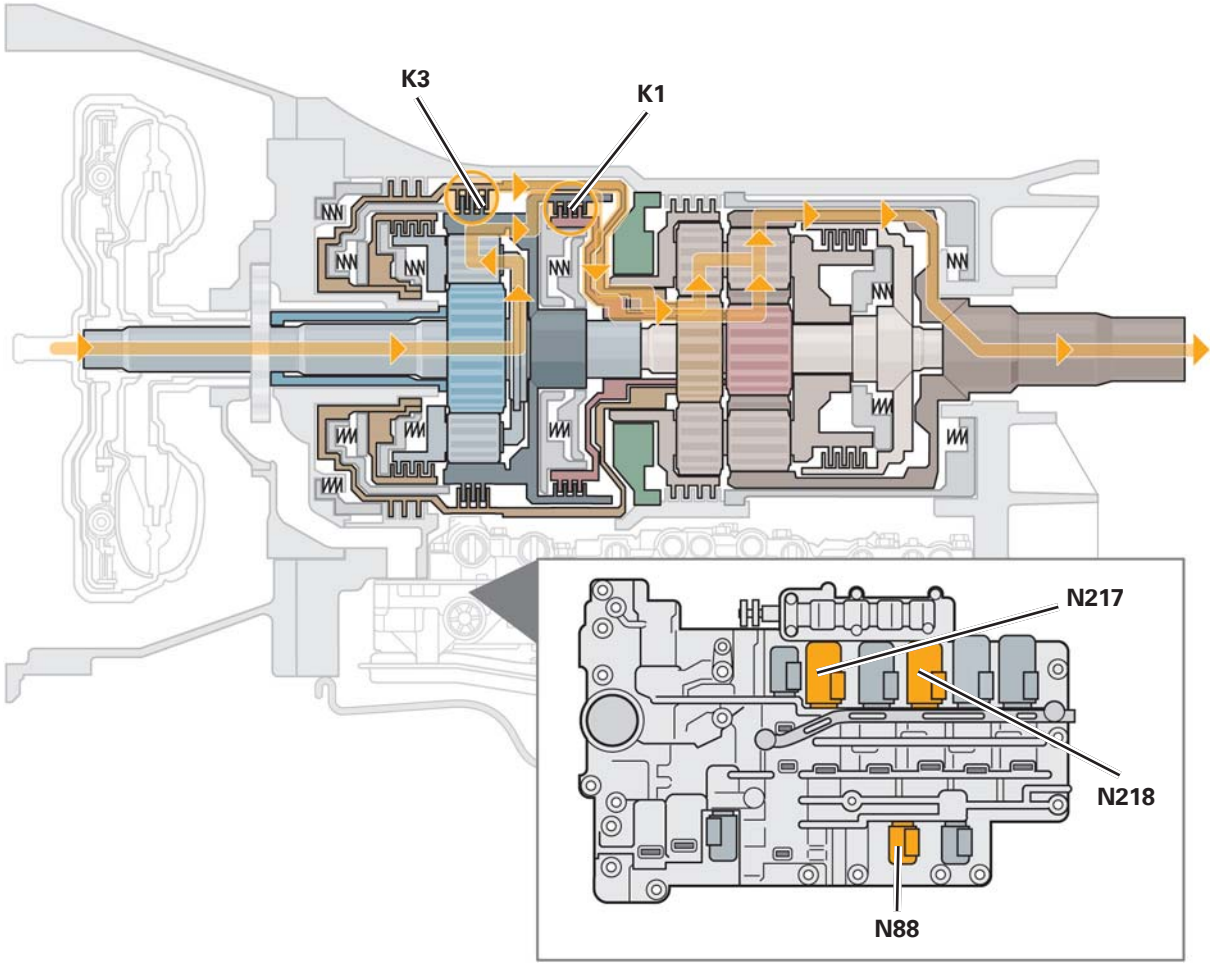
The K1 clutch connects the H1 to the S3 sun gear, transferring torque into the double planetary gear set.

The B1 brake locks the S2 sun gear. The S3 transfers torque to the P3 inner planetary gears and from there to the P3 outer planetary gears.

The P2 planetary gears roll on S2 and, together with the P3 outer planetary gears, drive H2.

Transmission Function

3rd Gear



s466_020

K1 and K3 Clutches

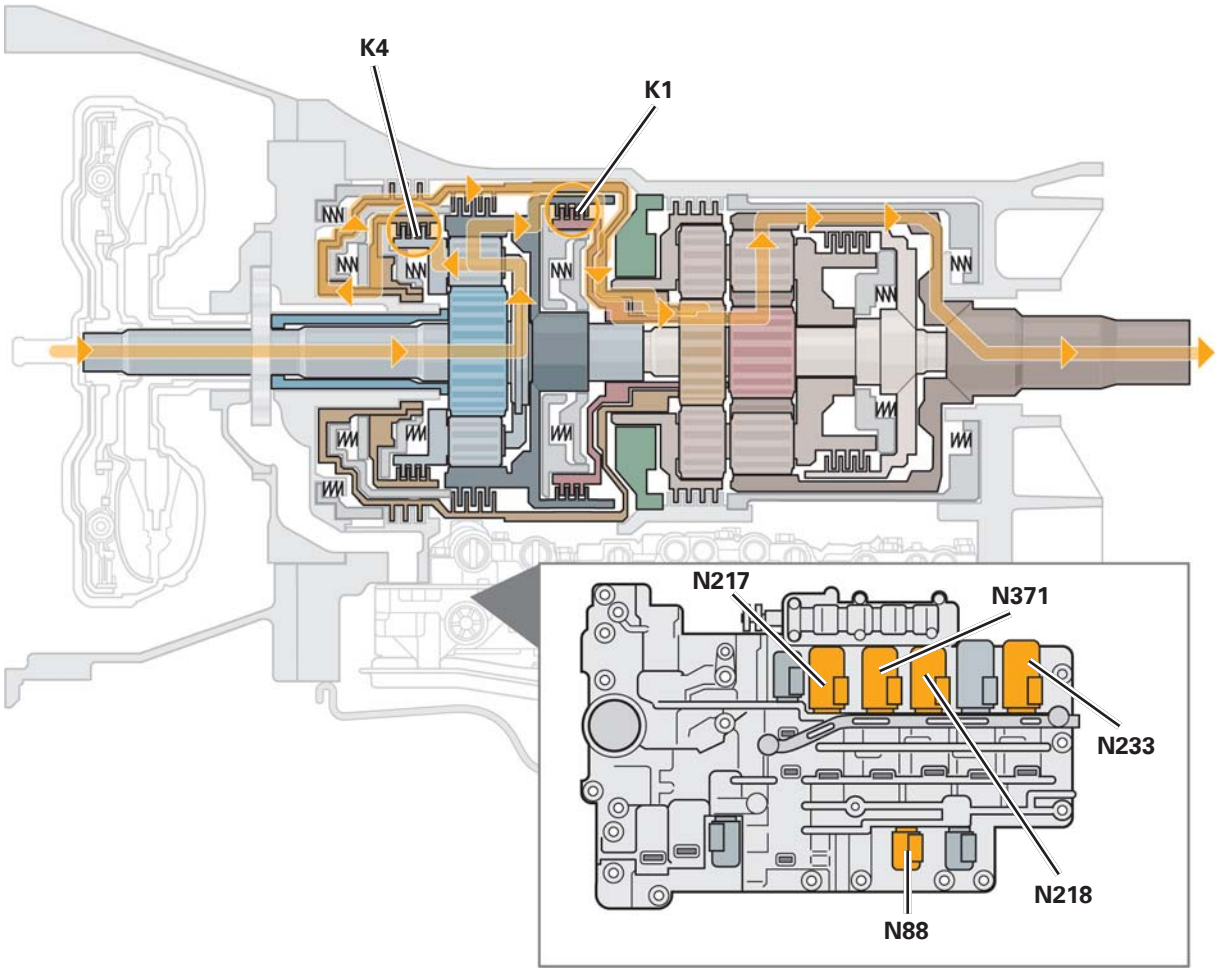
The turbine shaft drives the single planetary gear set's PT1 planet carrier. PT1 drives the P1 planetary gears, which roll and are supported on stationary S1 sun gear. This causes the H1 annulus to be driven.

The K1 clutch connects the H1 to the S3 small sun gear, transferring torque into the double planetary gear set.

The K3 clutch connects the H1 to the S2 large sun gear, transferring torque into the double planetary gear set.

The planetary gears P2 and P3 are held by K1 and K3. The PT2 planet carrier rotates along with S2 and S3. This causes the S2 and S3 to transfer torque to the H2 through PT2.

4th Gear



s466_021

K1 and K4 Clutches

The turbine shaft drives the single planetary gear set's PT1 planet carrier. PT1 drives P1 planetary gears, which roll and are supported on stationary S1 sun gear. This causes the H1 annulus to be driven.

The K1 clutch connects the H1 to the S3 sun gear, transferring torque into the double planetary gear set.

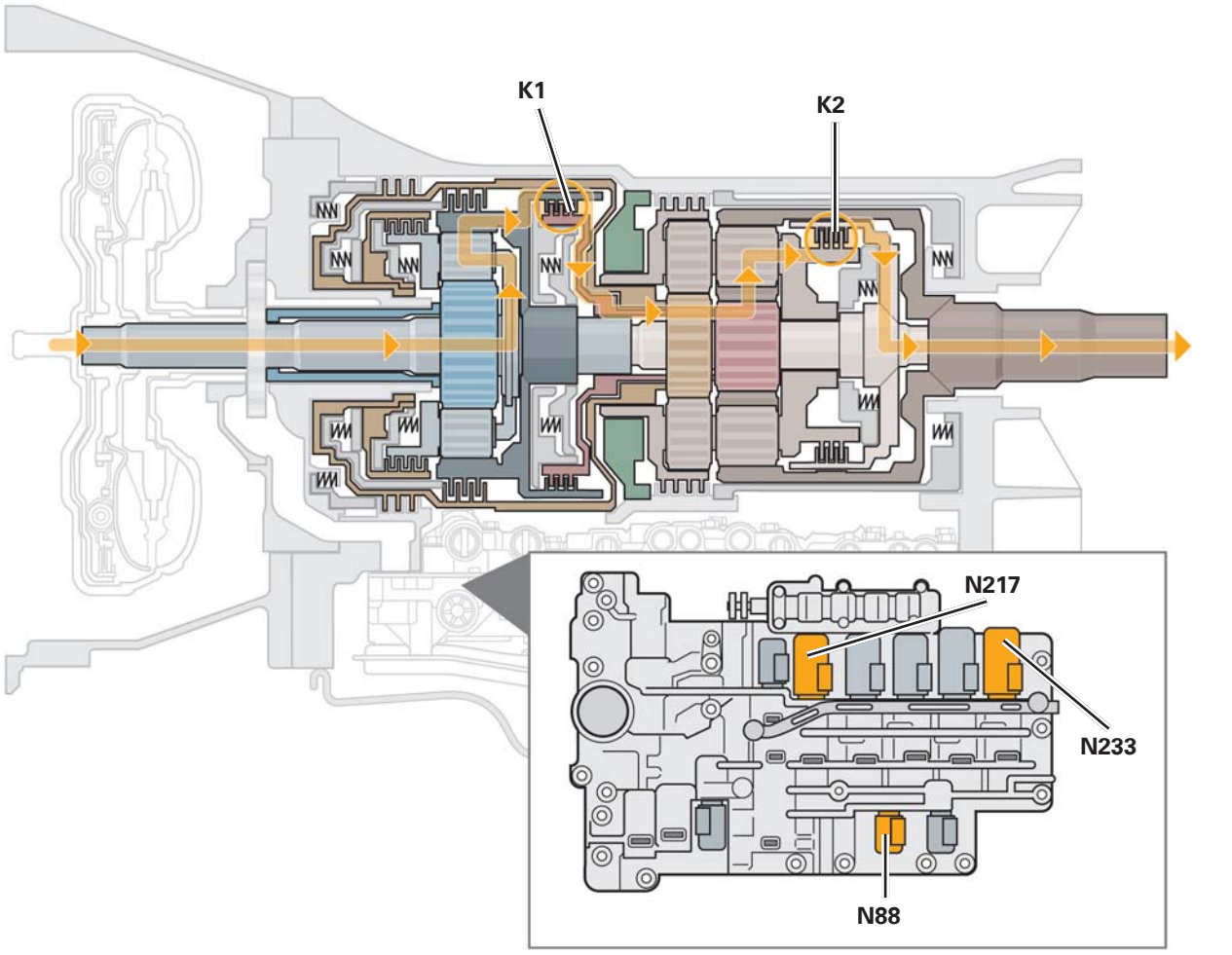
The K4 clutch connects PT1 to the S2 sun gear, transferring torque into the double planetary gear set.

The S3 is driven more slowly than S2.

Planetary gears P2 and P3 roll on S2, which is rotating faster, and drive the H2.

Transmission Function

5th Gear



s466_023

K1 and K2 Clutches

The turbine shaft drives the single planetary gear set's PT1 planet carrier and the K2 clutch outer plate carrier.

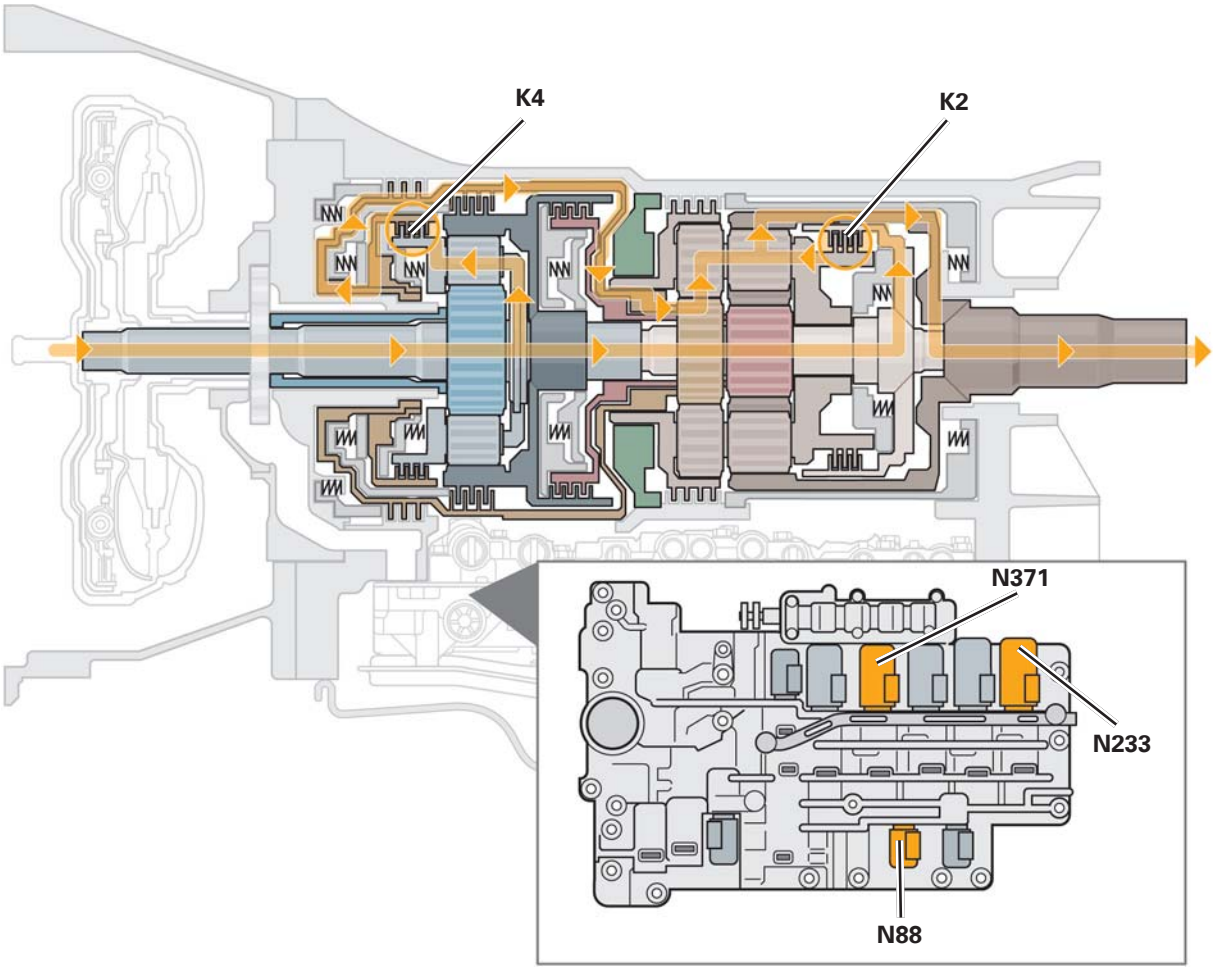
PT1 drives the P1 planetary gears, which roll and are supported on the stationary S1 sun gear. This causes the H1 annulus to be driven.

The K1 clutch connects H1 to the S3 sun gear, transferring torque into the double planetary gear set.

K2 connects the turbine shaft to the PT2 planet carrier, transferring torque into the double planetary gear set.

The PT2 planet carrier and the P3 inner and outer planetary gears drive the H2 annulus.

6th Gear



s466_024

K2 and K4 Clutches

The turbine shaft drives the single planetary gear set's PT1 planet carrier and the K2 clutch outer plate carrier.

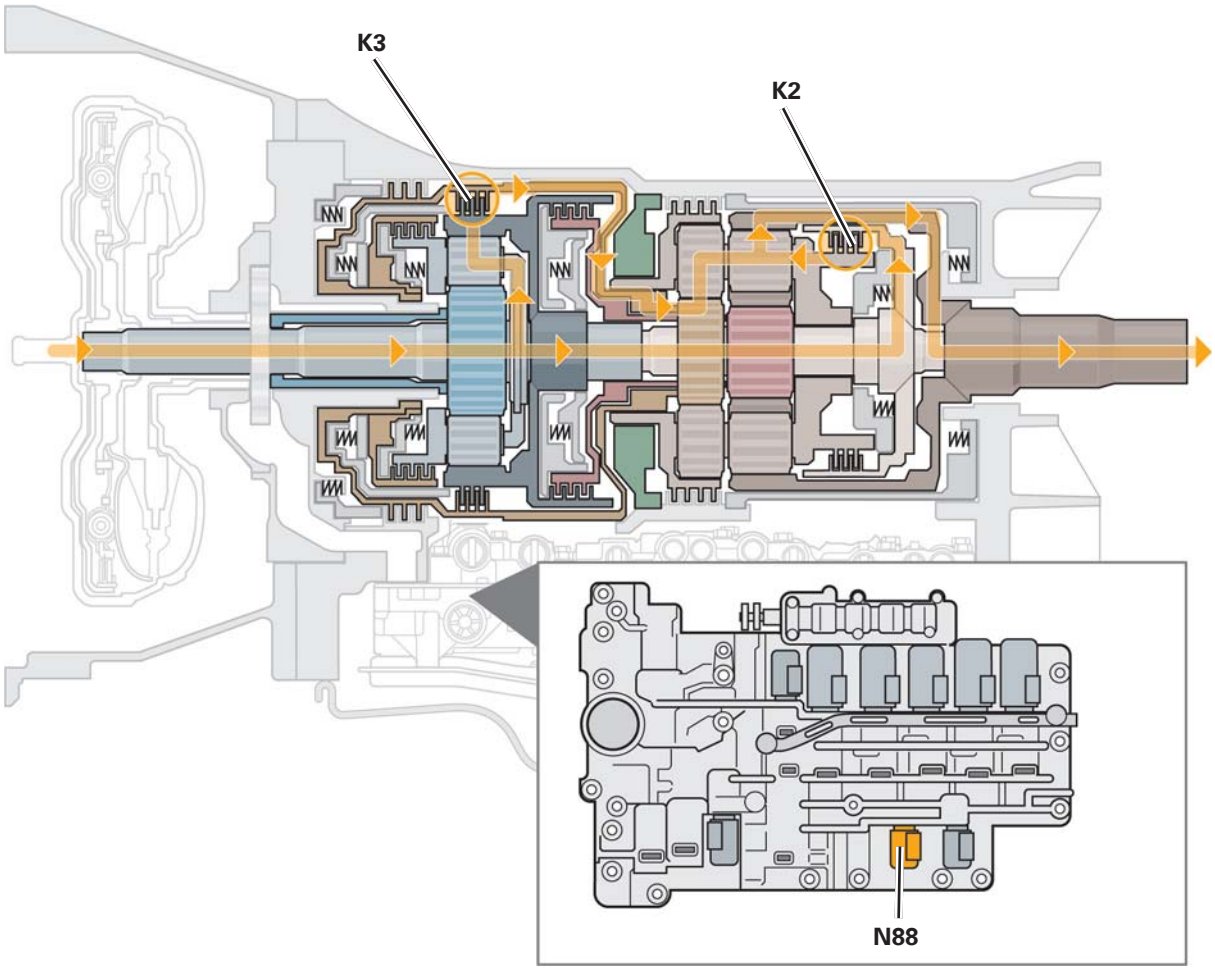
The K4 clutch connects PT1 to the S2 sun gear, transferring the torque into the double planetary gear set.

K2 connects the turbine shaft to the PT2 planet carrier, transferring the torque into the double planetary gear set.

S2 transfers the torque to the P2 planetary gears. PT2 then transfers the torque to the inner and the outer P3 planetary gears. The P2 and P3 planetary gears both drive the H2 annulus.

Transmission Function

7th Gear



s466_025

K2 and K3 Clutches

The turbine shaft drives the single planetary gear set's PT1 planet carrier and K2 clutch's outer plate carrier.

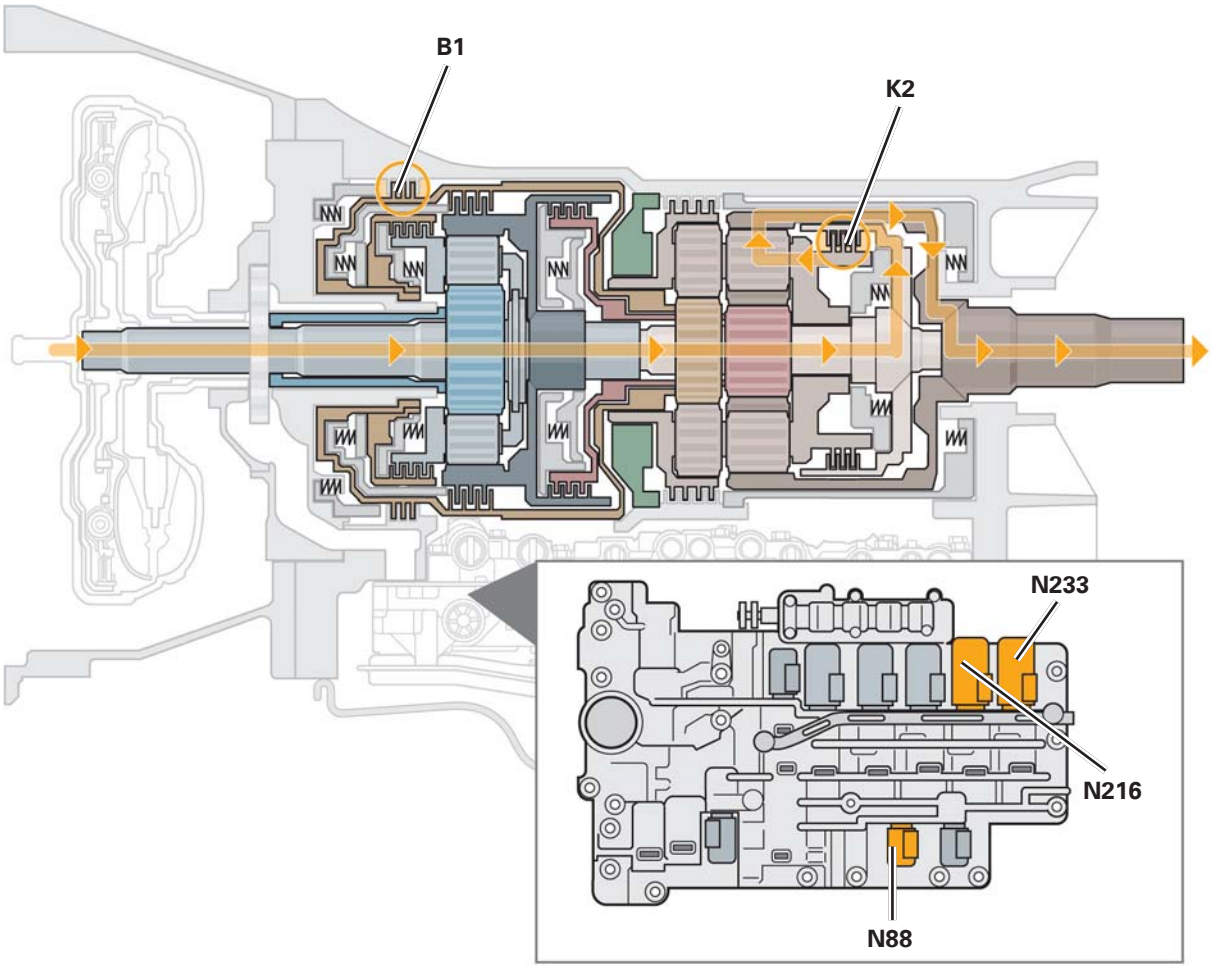
PT1 drives the P1 planetary gears, which roll and are supported on stationary S1 sun gear. This causes the H1 annulus to be driven.

The K3 clutch connects H1 to the S2 sun gear, transferring torque into the double planetary gear set.

K2 connects the turbine shaft to the PT2 planet carrier, transferring torque into the double planetary gear set.

The P2 and P3 planetary gears, which are jointly driven by S2 and PT2, drive the H2 annulus.

8th Gear



s466_026

K2 Clutch and B1 Brake

The B1 brake locks the S2 sun gear.

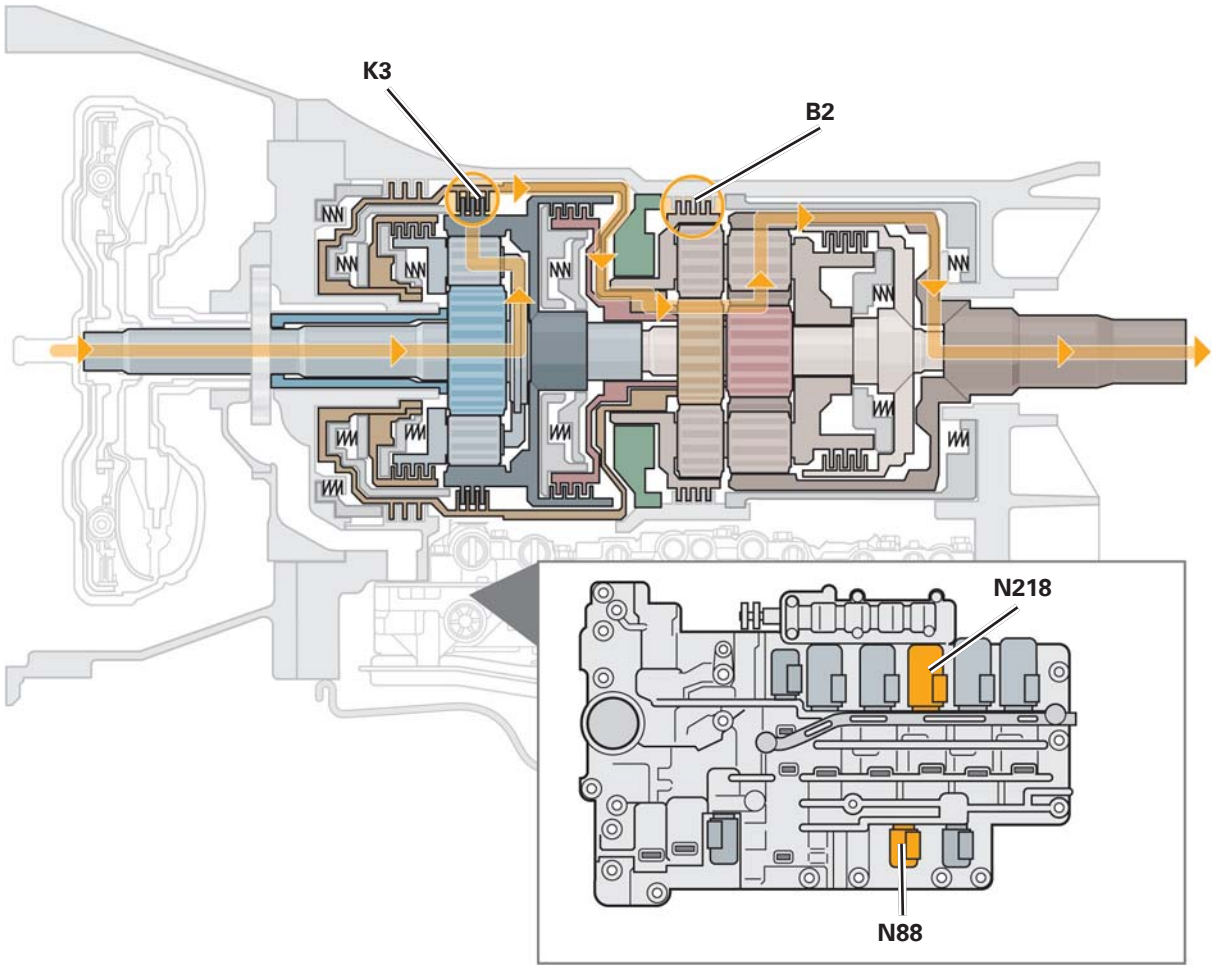
The K2 clutch connects the turbine shaft to the PT2 planet carrier of the double planetary gear set, transferring torque into the double planetary gear set.

The long P2 planetary gears roll on stationary S2 and, together with the P3 outer planetary gears, drive the H2 annulus.

The K1 and K3 clutches are open. The single planetary gear set is not involved in power transmission.

Transmission Function

Reverse Gear



s466_027

K3 Clutch and B2 Brake

The turbine shaft drives the single planetary gear set's PT1 planet carrier. PT1 drives the P1 planetary gears, which roll and are supported on stationary S1 sun gear. The H1 annulus is driven

The K3 clutch connects the H1 to the S2 sun gear, transferring torque into the double planetary gear set. In the double planetary gear set, the B2 brake locks the PT2 planet carrier.

Torque is then transferred from the S2 to P2 planetary gears and then to the P3 outer planetary gears.

Supported by PT2, the torque is transferred to the H2, which is connected to the output shaft. The H2 is driven in the opposite direction of engine rotation.

In Summary

The table shows which valves are actuated by the Transmission Control Module J217, and which clutches and brakes are closed as a result.

Gear	N217	N218	N233	N371	N216	N88	N89	K1	K2	K3	K4	B1	B2
1st	X	X	X			X		X					
1st tiptr.	X		X				X	X					X
2nd	X	X	X		X	X		X				X	
3rd	X	X						X		X			
4th	X	X	X	X		X		X			X		
5th	X		X			X		X	X				
6th			X	X		X			X		X		
7th						X			X	X			
8th			X		X	X			X			X	
R		X				X				X			X

Pressure regulating valves with ascending characteristic curve

Pressure regulating valves with descending characteristic curve

Selector valves

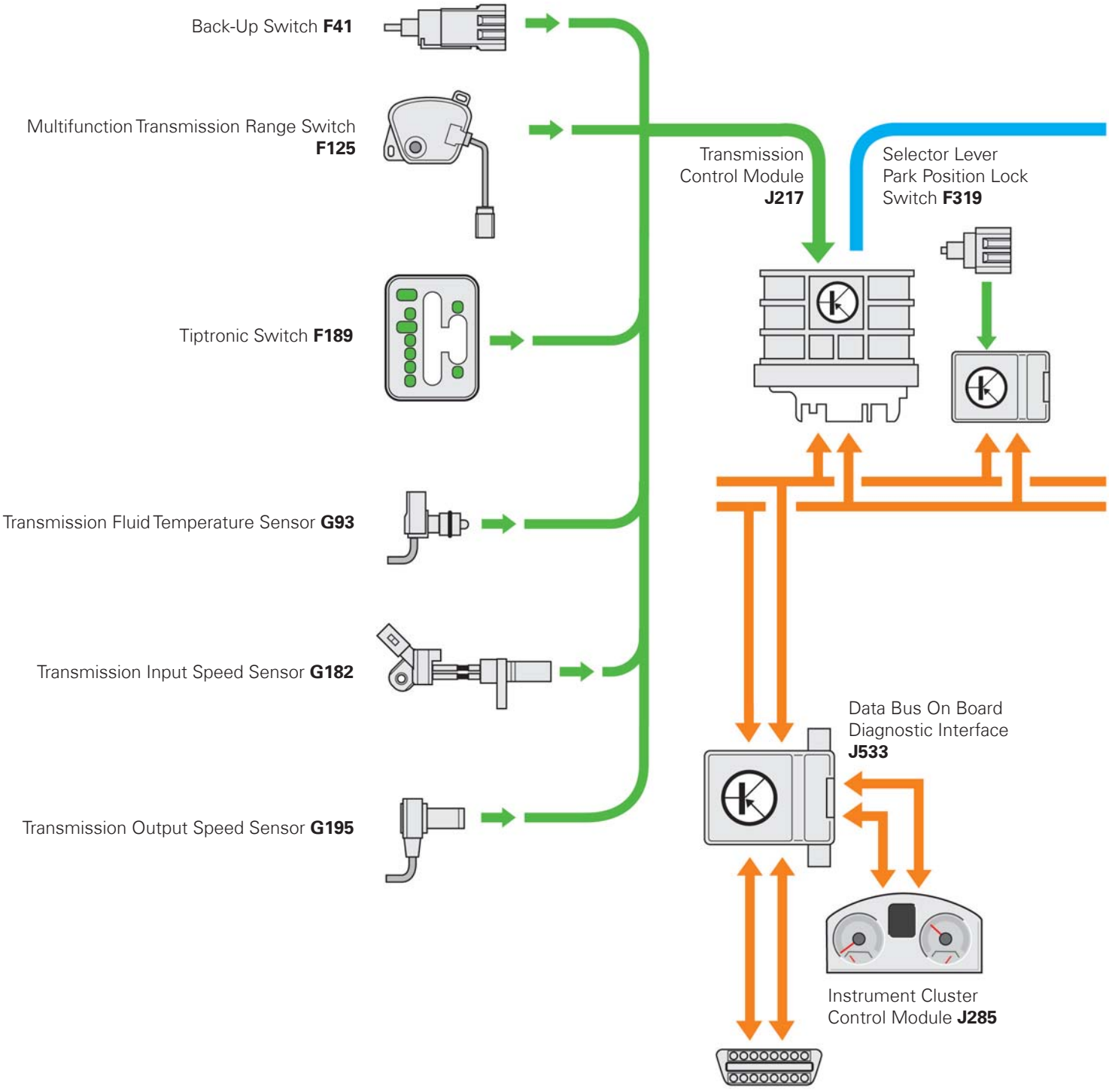
N88 Solenoid Valve 1
N89 Solenoid Valve 2
N216 Automatic Transmission Pressure Regulating Valve 2
N217 Automatic Transmission Pressure Regulating Valve 3
N218 Automatic Transmission Pressure Regulating Valve 4
N233 Automatic Transmission Pressure Regulating Valve 5
N371 Automatic Transmission Pressure Regulating Valve 6

K1 to K4 - Clutches 1 to 4
B1, B2 - Brakes 1 and 2

Transmission Management System

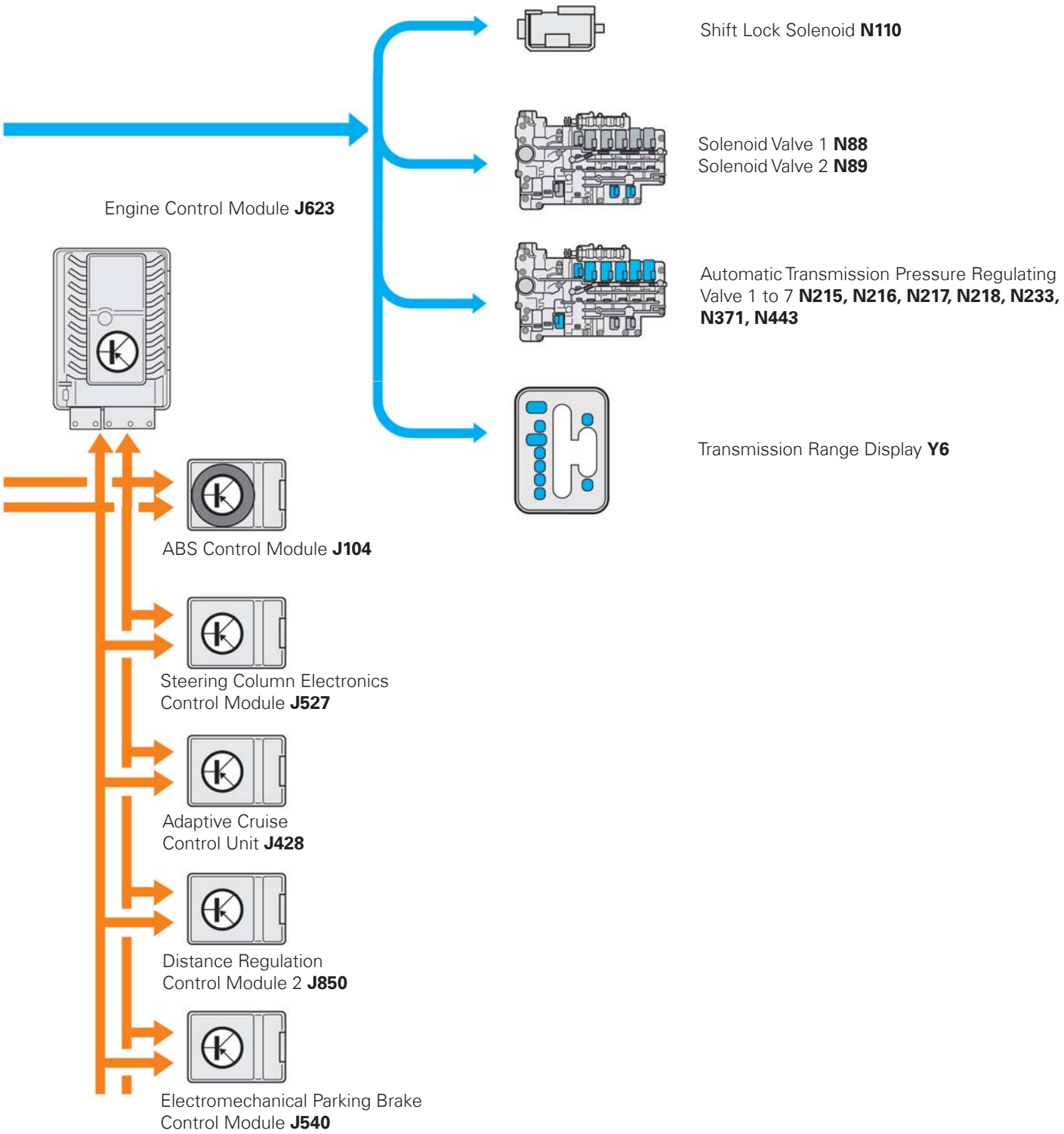
System Overview

Sensors



Transmission Management System

Actuators



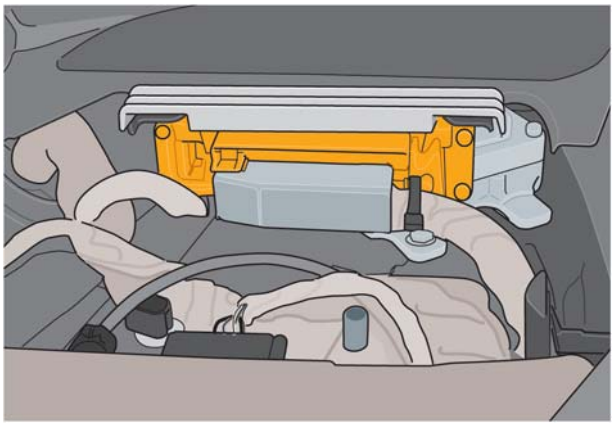
s466_074

The Transmission Control Module J217

The Transmission Control Module J217 is located under the right front seat. It is connected to the gateway via the powertrain CAN - bus.

J217 receives information from the sensors inside of the transmission and actuates the solenoid valves in the valve body.

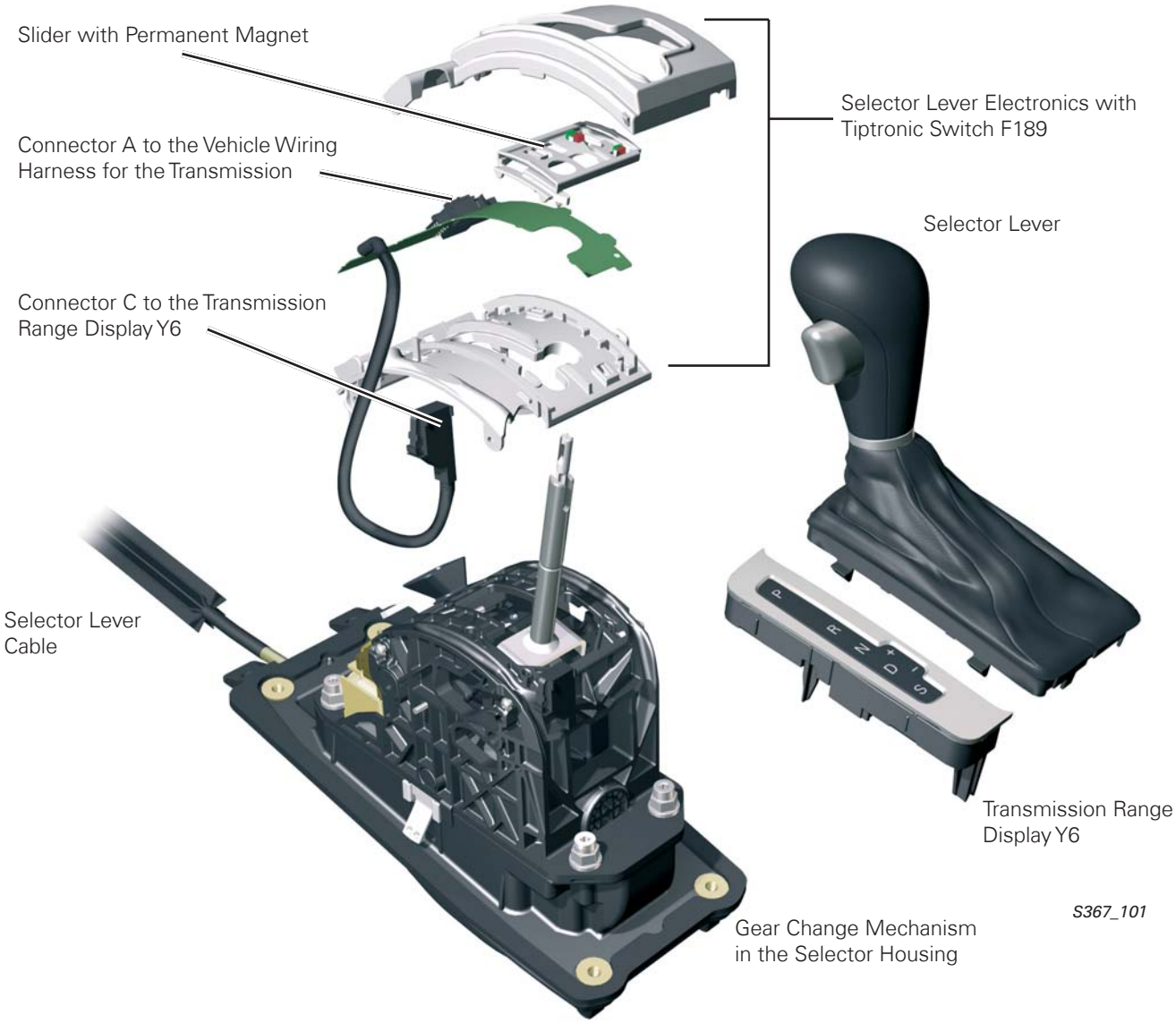
The dynamic shift program is also integrated into J217. It selects gear changes based on the operating status (aerodynamic drag and rolling resistance and driving style).



J217 under the right front seat

s466_061

The Selector Lever Module



Gear changes are actuated using the selector lever module. This module is equipped with both a mechanical connection to the automatic transmission via a Bowden cable and an electrical connection to the transmission management system.

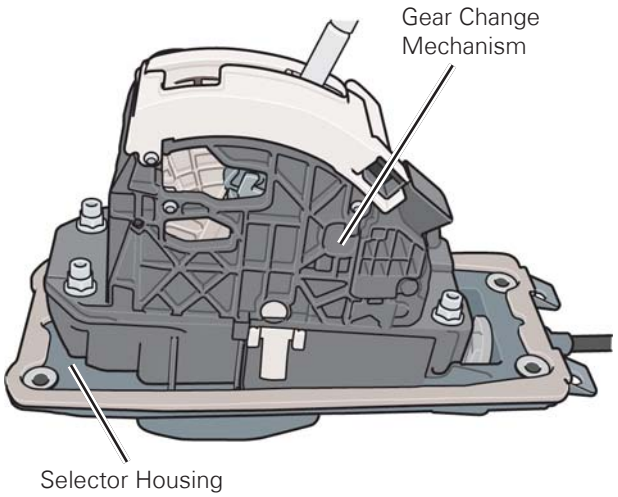
Bowden cable connection functions

- Parking lock actuation
- Actuation of the hydraulic control system's mechanically operated spool valve
- Actuation of the multifunction switch on the transmission

Electrical functions

- Ignition key withdrawal lock
- Actuation of the selector lever position display unit (via the transmission control unit)
- Tiptronic function
- Selector lever lock (P/N lock)

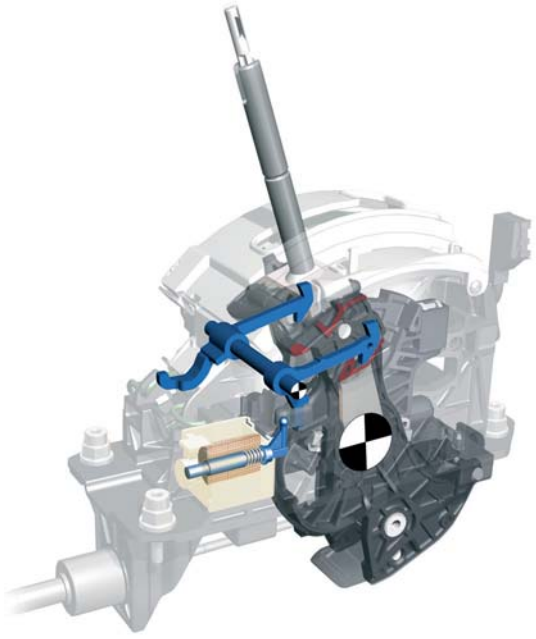
Electrical Components



s466_063

The Gear Change Mechanism

The gear change mechanism and the selector housing cannot be separated.



s466_054

Selector lever locks (P lock and P/N lock)

The selector lever lock is actuated when the ignition is switched ON and in the P and N positions during vehicle operation. When the ignition key is removed,the system is locked in the P position.

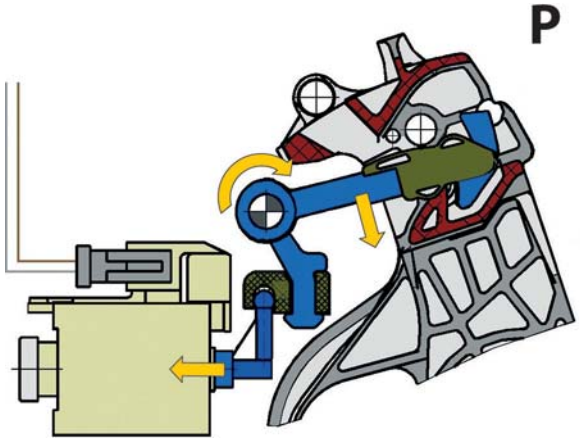
The locking mechanism enables the selector lever to be locked both when no current is supplied to the Shift Lock Solenoid N110 (P position) and when current is supplied (N position).

Lock in Selector Lever Position P

The selector lever locks in the P position because the locking lever automatically locks in this position.

If no current is supplied to Shift Lock Solenoid N110, the locking lever automatically drops into the P catch as soon as the selector lever is brought to the P position. This locking lever movement is engaged by a spring in the N110.

The N110 is supplied with current for unlocking purposes. As a result, the solenoid pushes the locking lever out of the P catch. In the event of a defect or a current failure, the selector lever remains locked. This can be released using the emergency release.

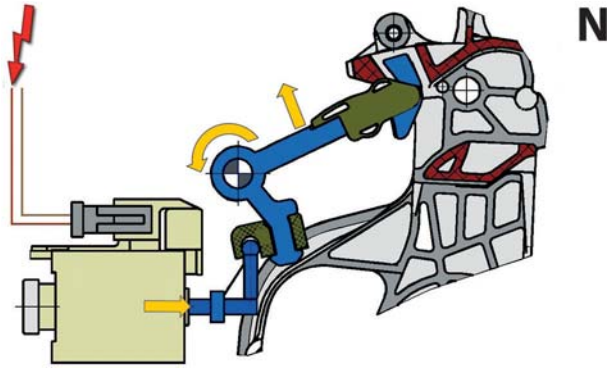


s466_055

Lock in Selector Lever Position N

If the selector lever is in the N position, the N110 is actuated. This presses the locking lever into the N catch with its upper hook and locks the selector lever.

In order to release the lock, the N110 is shut off and the locking lever drops down out of the catch.



s466_056

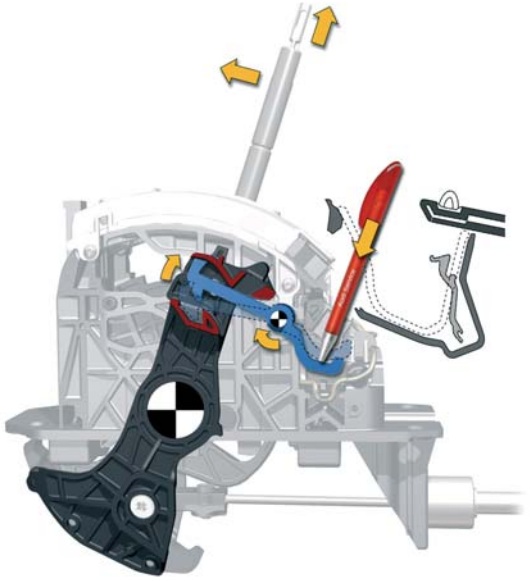
Electrical Components

Parking Lock Emergency Release

As the P lock is released only when solenoid N110 is activated, the selector lever remains locked in position "P" after a malfunction (e.g. dead battery, solenoid N110 not working, etc.).

An emergency unlocking lever on the left-hand side of the lock lever allows the vehicle to be moved in such a situation.

The emergency release mechanism can be accessed by removing the ashtray insert and the trim clip behind it. The lock lever can be unlocked by pressing down the emergency unlocking lever (e.g. using a ball point pen). At the same time, the button on the selector lever must be pushed and the selector lever pulled back.





Note

Secure the vehicle to prevent it from rolling before the selector lever is moved to the N position.



s466_059

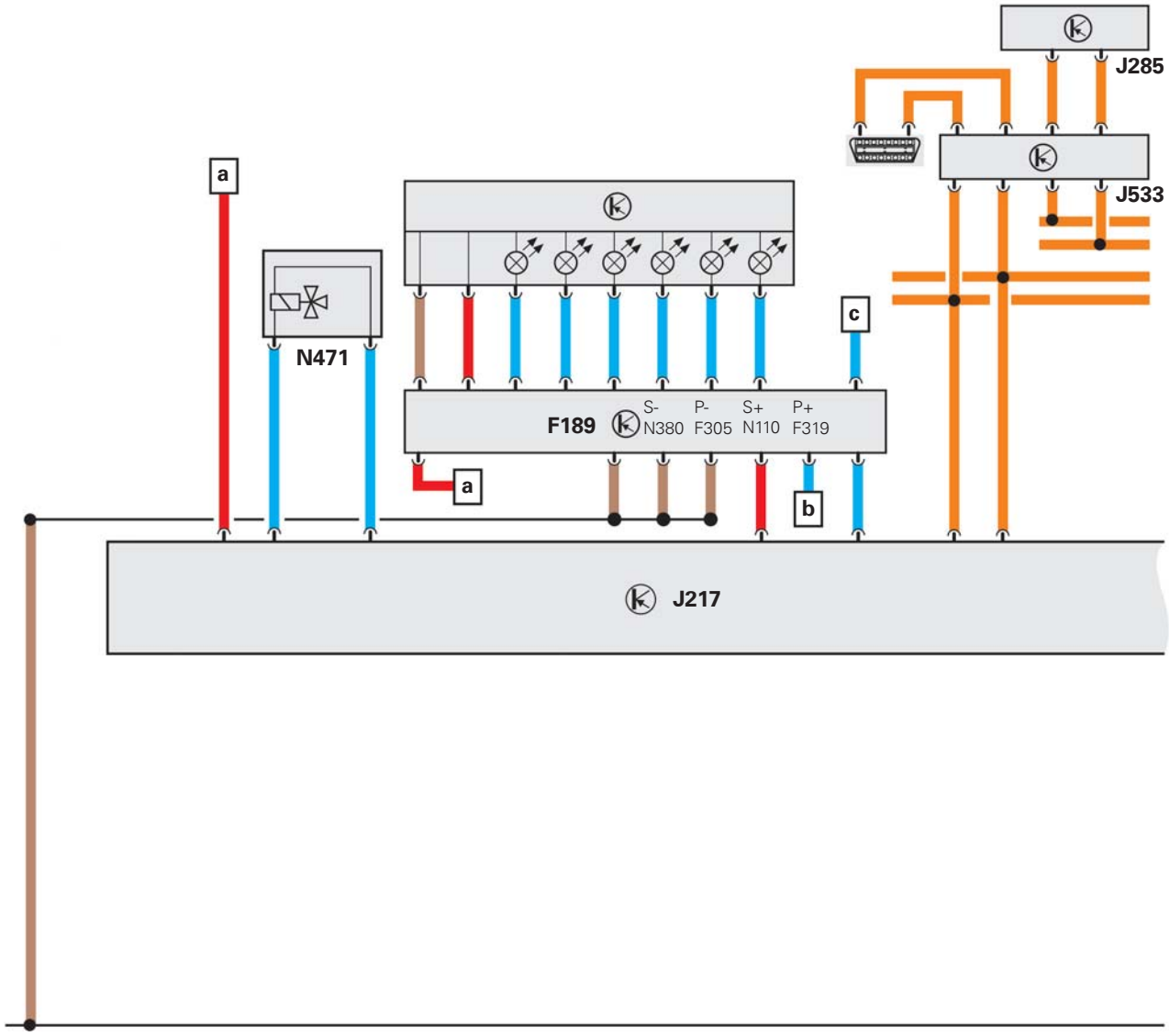
Transmission Range Display Y6

The selector lever position information comes directly from the transmission control unit as a frequency modulated rectangular signal (FMR signal).

The selector lever sensor system evaluates the signal and actuates the corresponding light-emitting diode in the Transmission Range Display Y6.

Notes

Functional Diagrams

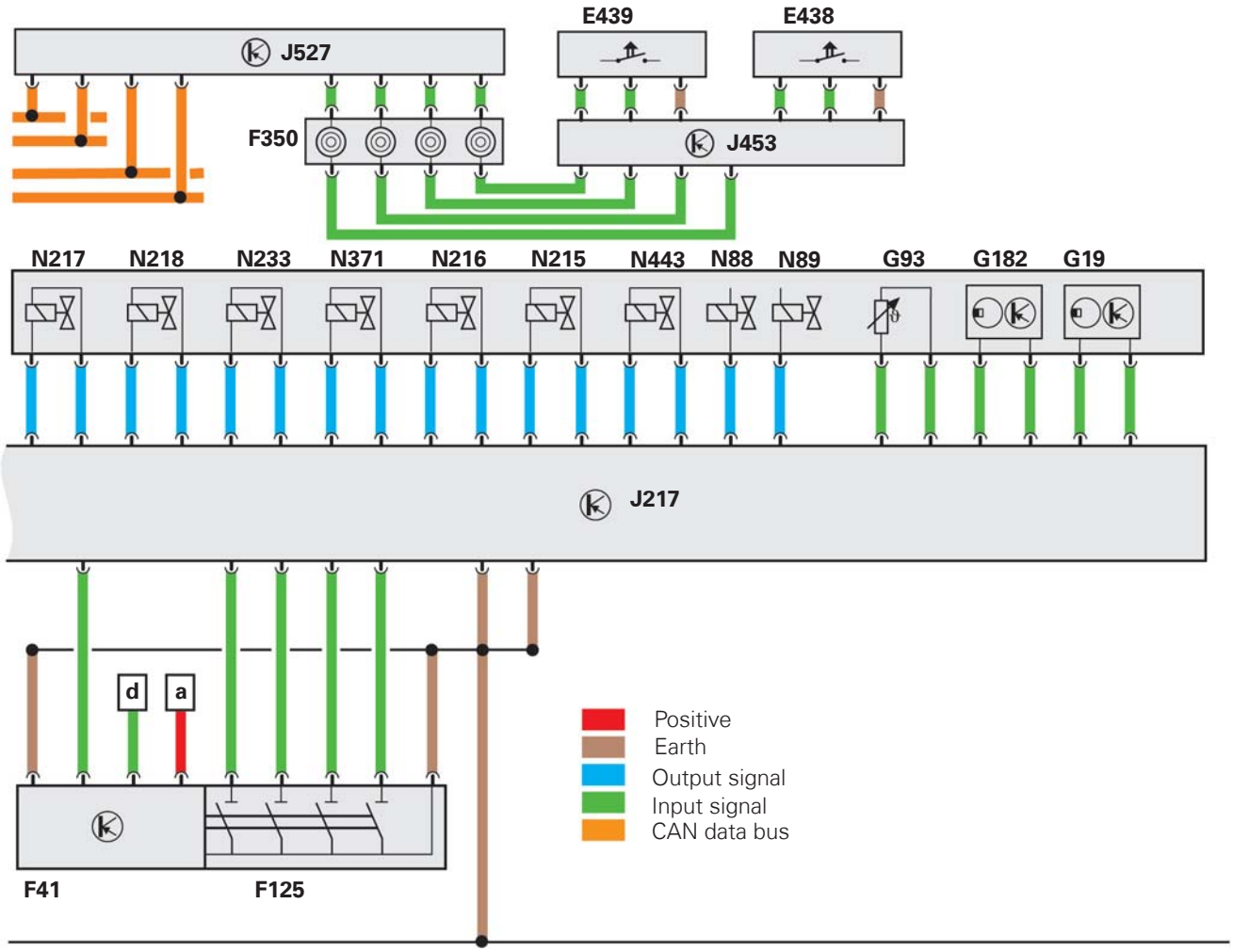


s466_081c

F189 Tiptronic Switch
F305 Transmission Park Selector Switch
F319 Selector Lever Park Position Lock Switch
J217 Transmission Control Module
J285 Instrument Cluster Control Module
J533 Data Bus On Board Diagnostic Interface
N110 Shift Lock Solenoid
N380 Selector Lever Park Position Solenoid
N471 Cooling Oil Valve
Y6 Transmission Range Display

a Fuse Holder C
b Connection to the Convenience System Central Control Module
c Connection to the Onboard Power Supply Control Module
d Connection to the Convenience System Central Control Module

Functional Diagrams



s466_081b

E438 Tiptronic Upshift Button on Steering Wheel
E439 Tiptronic Downshift Button on Steering Wheel
F41 Back-up Switch
F125 Multifunction Transmission Range Switch
F350 Spiral Spring
G93 Transmission Oil Temperature Sender
G182 Transmission Input Speed Sensor
G195 Transmission Output Speed Sensor
J453 Multifunction Steering Wheel Control Module
J527 Steering Column Electronics Control Module
N88 Solenoid Valve 1
N89 Solenoid Valve 2
N215 Automatic Transmission Pressure Regulating Valve 1
N216 Automatic Transmission Pressure Regulating Valve 2
N217 Automatic Transmission Pressure Regulating Valve 3
N218 Automatic Transmission Pressure Regulating Valve 4
N233 Automatic Transmission Pressure Regulating Valve 5
N371 Automatic Transmission Pressure Regulating Valve 6
N443 Automatic Transmission Pressure Regulating Valve 7

Notes

Knowledge Assessment

An online Knowledge Assessment (exam) is available for this Self-Study Workbook.

The Knowledge Assessment is required for Certification.

You can find this Knowledge Assessment at:

www.accessaudi.com

From the accessaudi.com Homepage:

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- Click on Course Catalog and select “950113 - Audi 8-Speed Automatic Transmission”

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Thank you for reading this Self-Study Workbook and taking the assessment.

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