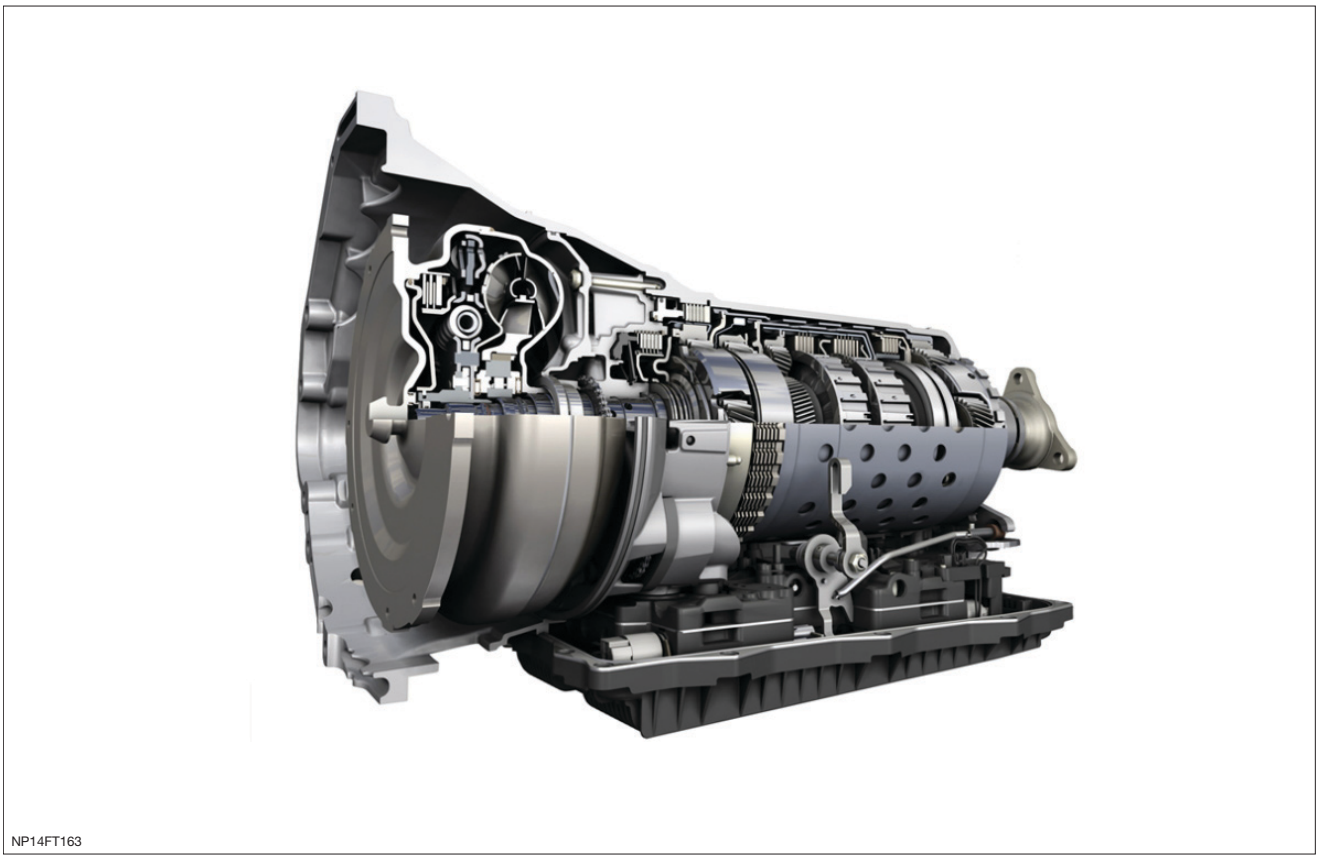
8-Speed Automatic Transmission Overview

The Jaguar F-TYPE uses the ZF 8HP 'QuickShift' automatic transmission. Uniquely for its market sector, this provides the F-TYPE with 8 speeds. This allows the gear ratios to be placed more closely together, with the ratios being shorter than would be used on a passenger sedan.



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The end result is a sportier gearbox, with 8 closely-spaced gears. This means less of an engine speed drop during gear changes, which keeps the engine within its most effective speed range for longer.

ZF 8HP Gear Ratios

Gear	1st	2nd	3rd	4th	5th	6th	7th	8th	Reverse
Ratio	4.714 : 1	3.143 : 1	2.106 : 1	1.667 : 1	1.285 : 1	1.000 : 1	0.839 : 1	0.667 : 1	3.317 : 1

A slightly longer final drive ratio on the F-TYPE and F-TYPE S, vs. the F-TYPE V8 S, gears the cars slightly more towards fuel economy rather than the outright performance of the V8 S model.

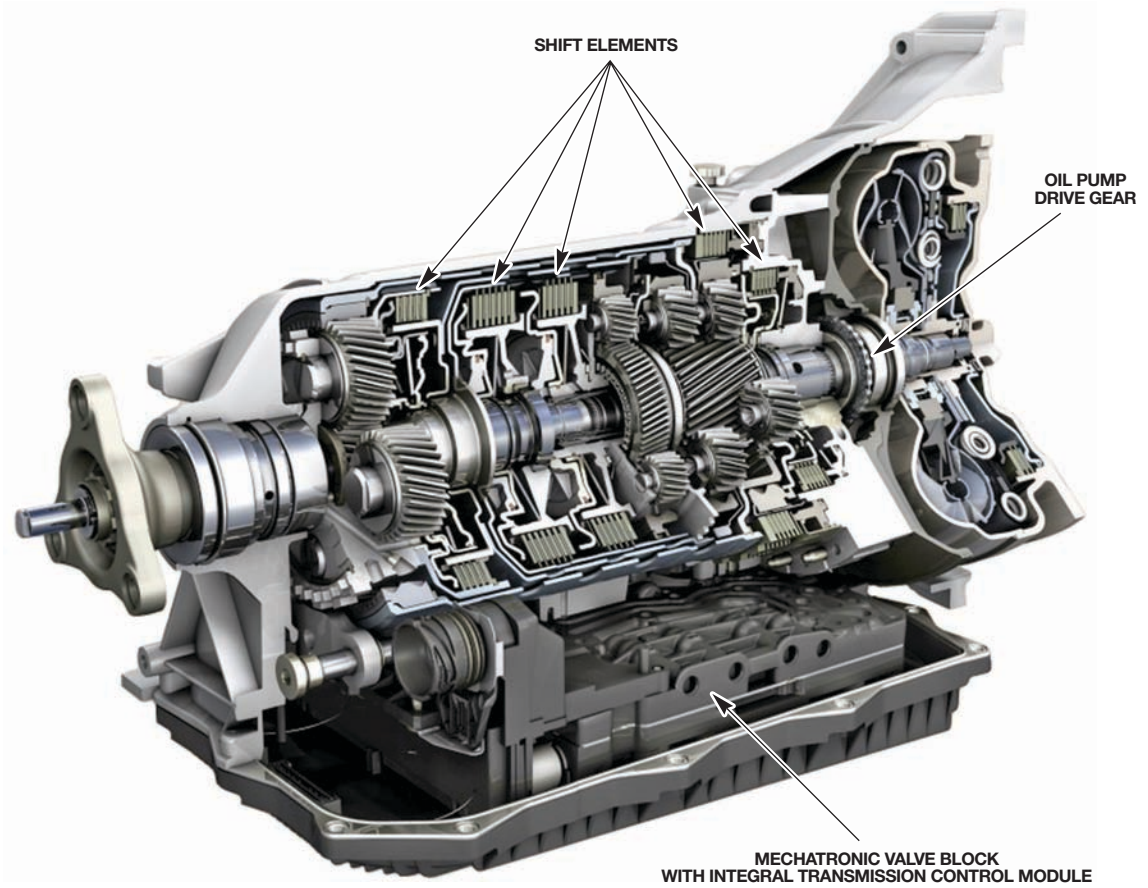
Final Drive Ratios

F-TYPE	F-TYPE S	F-TYPE V8 S
3.15 : 1	3.31 : 1	2.56 : 1

The V6 models in particular possess free-revving engines with power and torque curves aimed at delivering a performance feel.

This is used in conjunction with the F-TYPE's sequential feel gearshift – achieved using steering-wheel mounted paddles or the Jaguar Sport Shift lever – which makes the F-TYPE extremely involving and enjoyable to drive.

Great attention to detail has been paid to the shift plan of the gearbox, with just five shifting elements (three clutch and two brake) to achieve eight forward speeds and one reverse. Additionally, only two shifting elements are ever open in any gear: the fewer open shifting elements, the fewer number of components there are rotating relative to one another. This results in an overall reduction in frictional drag, which – when coupled with a new high efficiency oil pump, low friction gears and associated components – further increases the efficiency of the gearbox.



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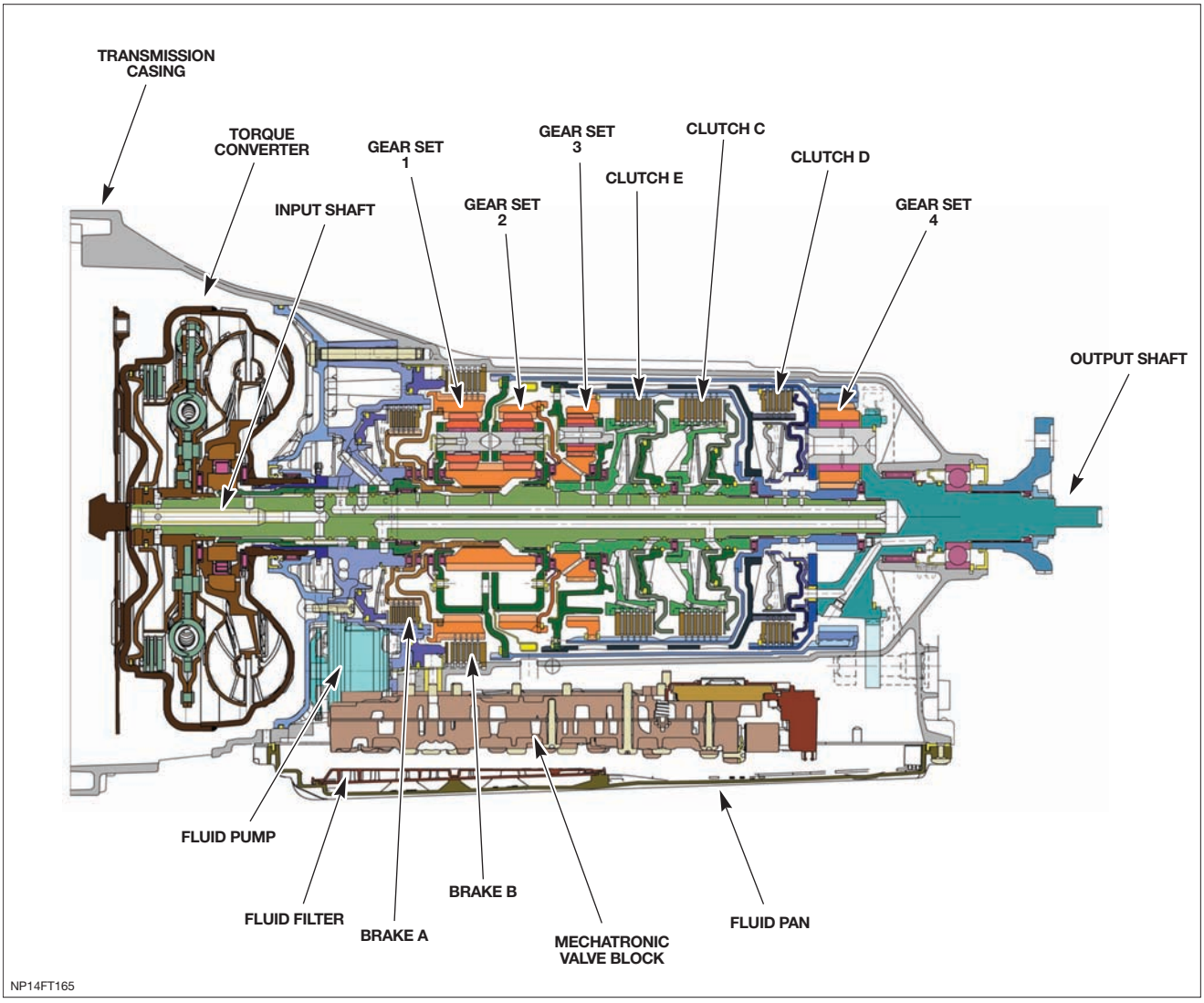
NOTE: The ZF 8HP transmission uses Shell L12108 transmission fluid (Jaguar part # JDE26444); the fluid specified for use with 6-speed transmissions is NOT compatible with the 8-speed unit.

Component Description

The main casing contains the following major components:

- Input shaft
- Output shaft
- Mechatronic valve block – containing the solenoids, speed sensors, and TCM
- Three rotating multiplate drive clutches
- Two fixed multiplate brake clutches
- Four planetary gear trains

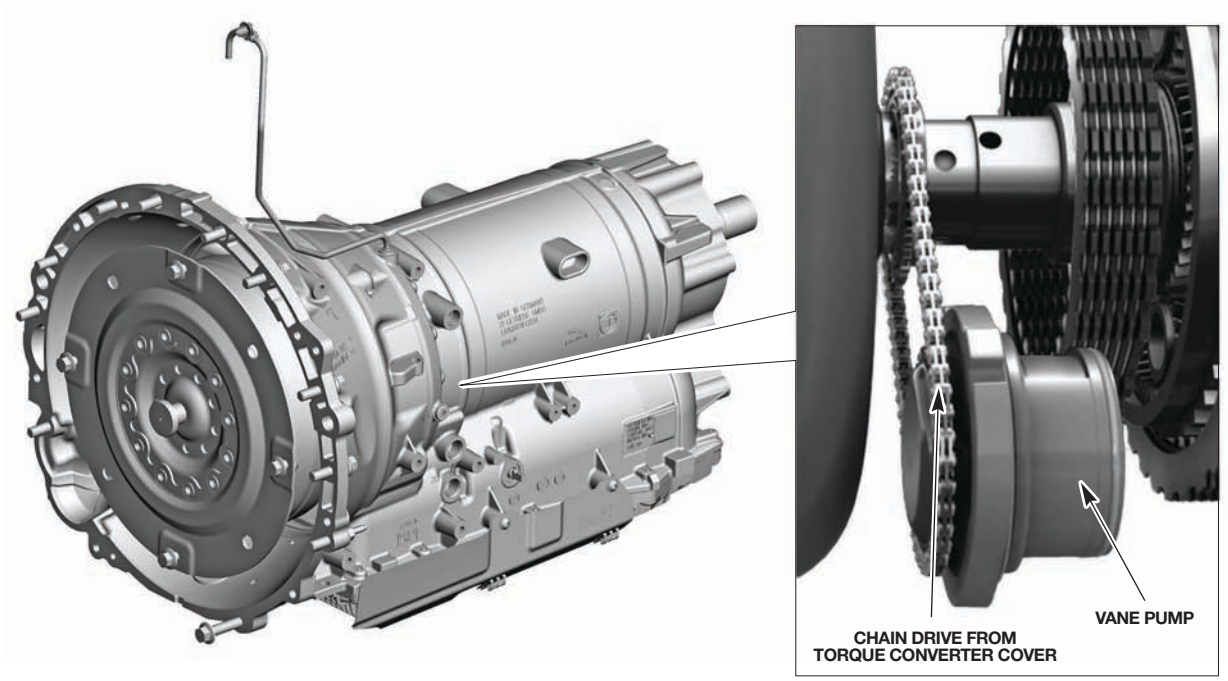
Transmission Sectional View



Automatic Transmission Fluid Pump

The Automatic Transmission Fluid (ATF) pump is an integral part of the transmission, used to supply hydraulic pressure for the operation of the control valves and clutches, to pass the fluid through the transmission cooler, and to lubricate the gears and shafts.

The ZF 8HP70 ATF pump is a double-stroke vane type pump, located below the transmission input shaft. The pump is driven by a chain drive from a sprocket located on the input shaft, with a delivery rate of 50 cc per revolution. The drive sprocket is driven at engine speed through a splined connection in the torque converter shell.



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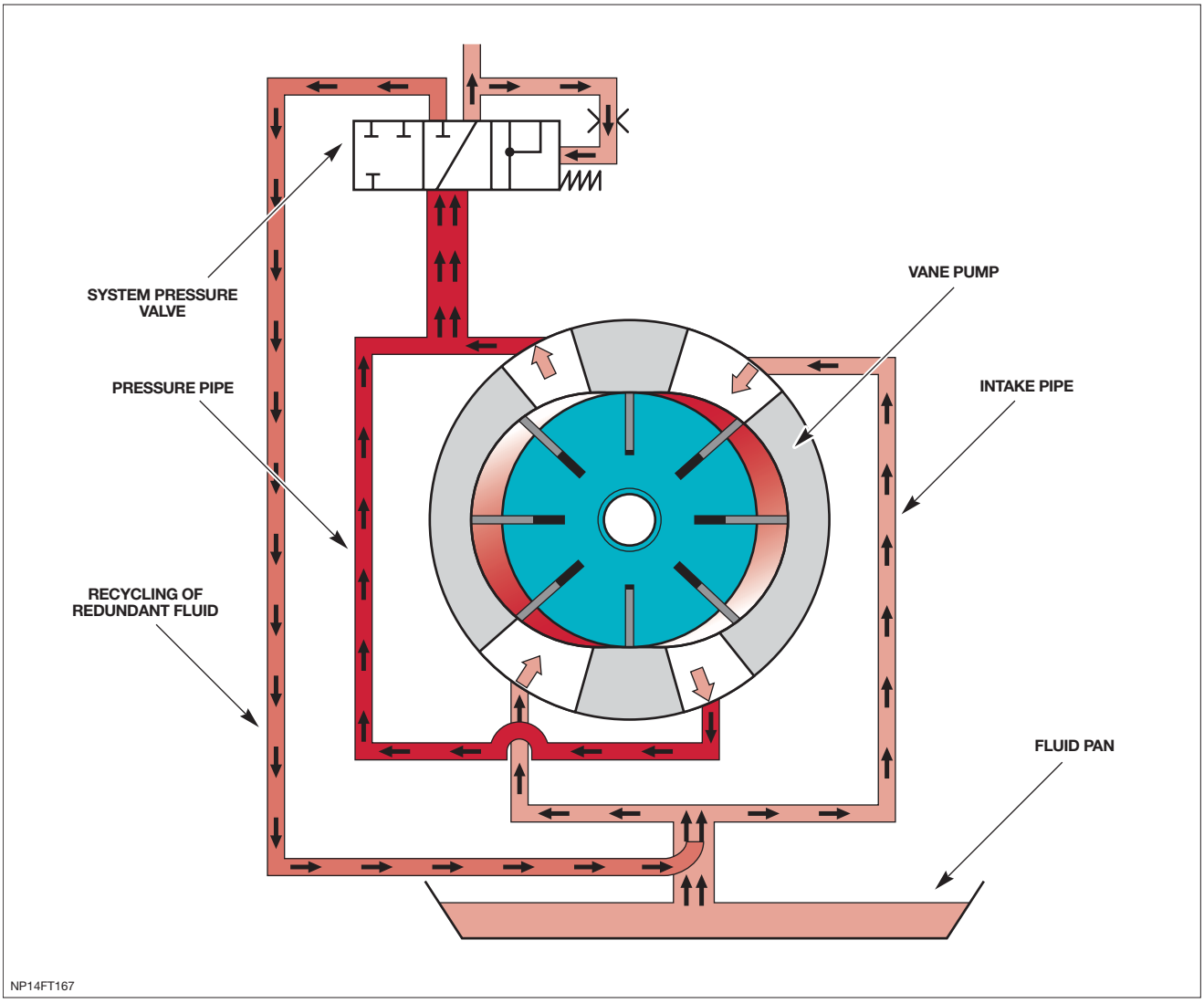
ATF Pump Operation



The ATF pump comprises a sprocket, a rear cover with bearing, a front cover with bearing, a cylinder, a rotor shaft, and a rotor with vanes. A pressure relief valve is fitted in the pressure outlet gallery from the pump but is not an integral part of the pump itself.

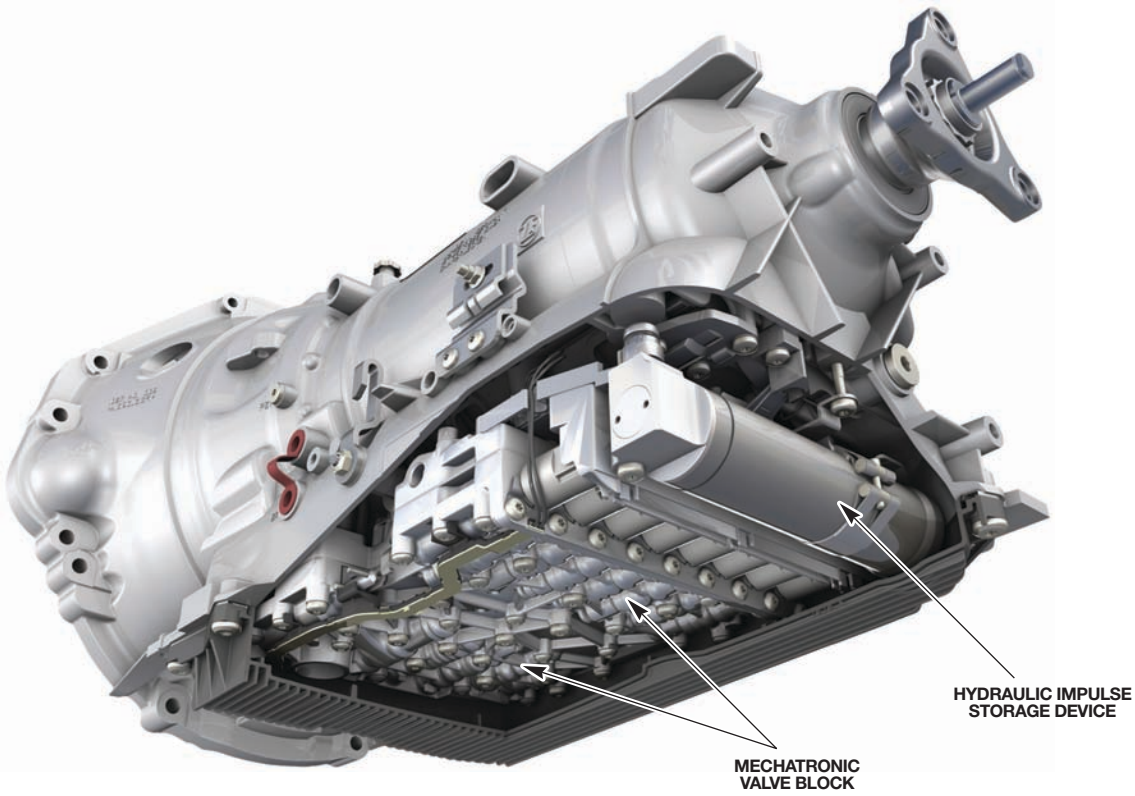
A sprocket is located around the transmission input shaft. Splines on the torque converter nose and the sprocket ensure a positive drive. A simplex chain transmits the rotation of the torque converter cover into rotation of the pump rotor shaft via a second sprocket fitted to the rotor shaft. The gearing of the two sprockets rotates the pump rotor shaft at a speed slightly higher than the RPM of the torque converter cover, which is directly connected to the engine crank.

The pump contains 12 vanes attached to the rotor, which rotate within the cam-shaped cylinder. As the vanes rotate, the eccentricity of the central hole in the cylinder causes the space between the vanes to increase. This causes a depression between the vanes and fluid is drawn into the space between the vanes via a suction port connected to the fluid pan.

Hydraulic Impulse Storage Device (HIS)

The F-TYPE is equipped with Intelligent Stop Start (ISS). Following an ECO Stop, the vehicle must be able to restart and drive away within a very short period of time (less than 400ms from the point of the engine starting). This presents a challenge with an automatic transmission.

When the engine shuts off during an ECO Stop, the automatic transmission fluid (ATF) pump is not producing pressure. In this state, the line pressure falls to zero and all brake and clutch shift elements unlock. However, when the vehicle restarts, immediate oil pressure is needed to engage the three shift elements required to select 1st gear. The ATF pump is therefore supplemented by the addition of an oil storage system – the Hydraulic Impulse Storage (HIS) Device – to provide immediate positive engagement.



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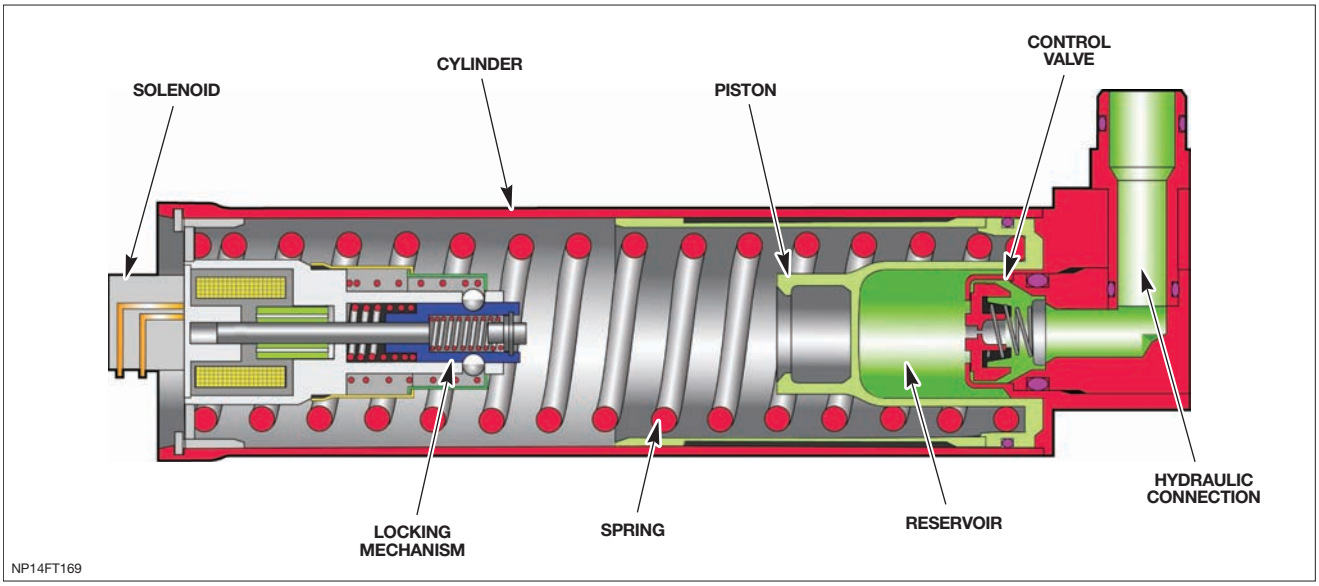
Hydraulic Impulse Storage (HIS) Review

The Hydraulic Impulse Storage (HIS) device is an electromechanical component designed to accumulate and store automatic transmission fluid until it is required by the shift elements of the gearbox. When required, the HIS releases the hydraulic fluid under pressure, the discharge of which is controlled electronically by the solenoid affixed to the end of the component.

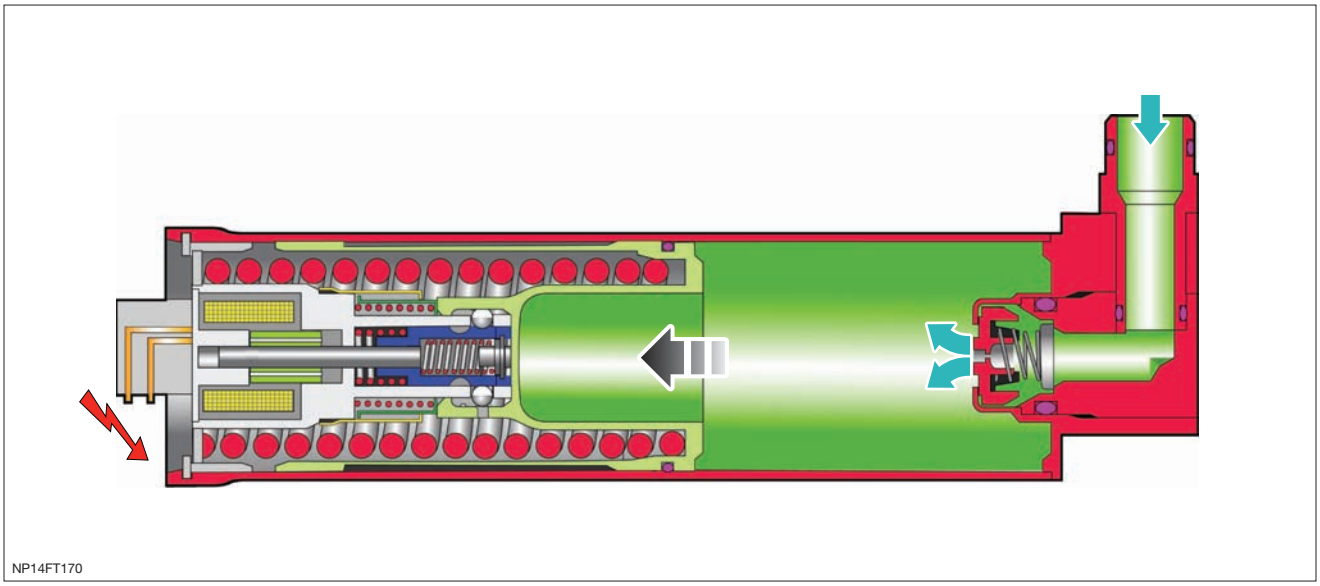
HIS Device – Discharged State



From the moment that the HIS is operated and the fluid is released, the shifting elements are subjected to hydraulic line pressure; this is then built further and maintained by the operation of the ATF pump once the engine is running.

While the engine is running, the ATF pump is producing line pressure and the HIS is recharged and made ready for the next starting process. The inlet to the HIS is via a restriction; this is necessary to ensure that the transmission line pressure is not compromised during the recharging of the HIS. A full hydraulic recharge takes approximately 5 seconds (when fluid temperature is 68°F / 20°C).

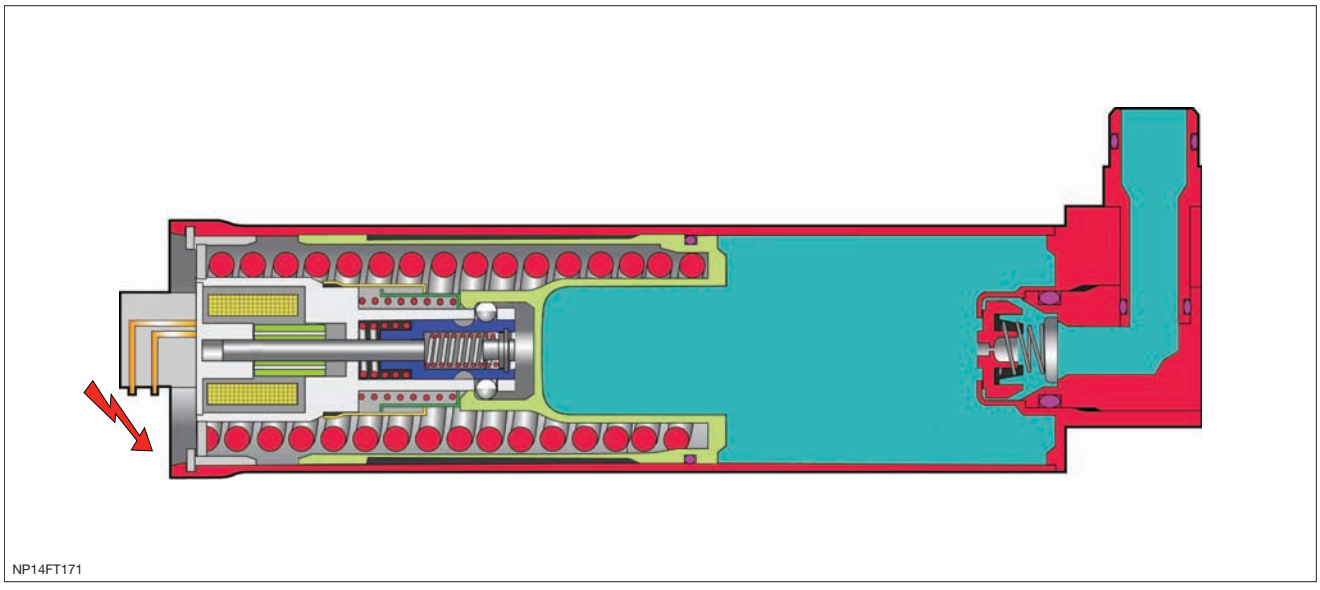
HIS Charging



Charging Phase Sequence:

- Engine running
- Oil pressure provided by ATF Pump
- ATF enters reservoir restriction valve
- Piston forced back against tension of spring
- Solenoid is energized

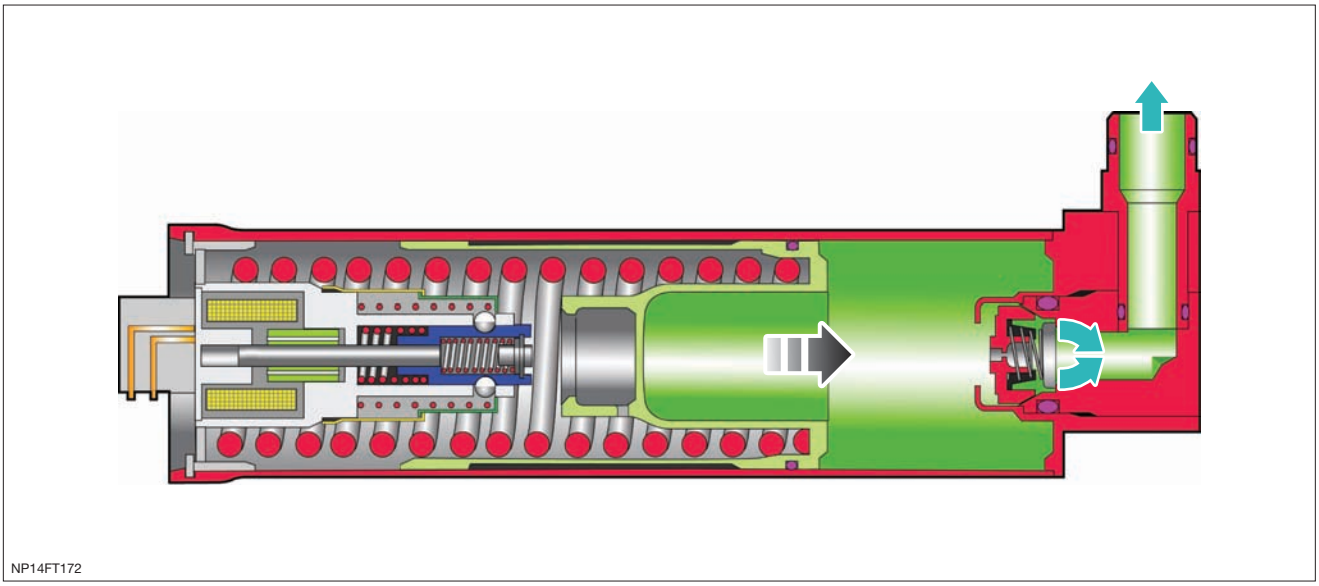
HIS Charged / Engine Off / Pressure Held



Charged / Engine Off / Pressure Held Sequence:

- Engine not running (ECO Stop)
- ATF not producing pressure
- Line pressure 0 bar
- Piston locked against mechanism
- Holding current applied to solenoid
- Oil volume within HIS reservoir maintained ready for ECO Start

HIS Discharged / Engine Starting



Discharged, Engine Starting Sequence:

- Engine starting (ECO Start)
- ATF pump not producing sufficient pressure
- Solenoid holding current switched off
- Locking mechanism released
- Spring tension forces piston down cylinder pushing out the volume of ATF
- Process is completed between 300 – 350 ms

Once the engine is started, the ATF pump produces flow and pressure to provide seamless transmission shift element engagement.

Principles of Operation

Transmission Idle Control (TIC)

When a vehicle fitted with a conventional automatic transmission comes to a standstill, if drive remains selected the vehicle has a tendency to 'creep' unless the brake pedal is firmly held or the park brake is applied. This is due to the relatively small amount of torque transmitted by the torque converter.

In order to accommodate the additional drag caused by the transmission, throttle angle and/or fuel injector duration must be increased to maintain an acceptable idle. This has the adverse effect of increasing fuel consumption and emission levels (including CO2).

The 8HP70 transmission overcomes this through the use of Transmission Idle Control (TIC). When the vehicle comes to a stop (brakes applied), the internal shift elements of the transmission are decoupled, disconnecting the power flow through the gearbox and eliminating the drag normally associated with such a condition.

TIC Enable Criteria:

- Engine at idle
- Vehicle at a standstill (wheel speed zero)
- Brake pedal applied

TIC Inhibit Criteria:

- Output shaft speed detected
- ATF temperature below 68°F (20°C)
- ATF temperature above 212°F (100°C)
- Gradient above 20%
- Accelerator pedal pressed
- Brake pedal not pressed