

Press Release

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Finely tuned heart of Volvo AWD technology has distinctive beat

BACKGROUND

The technology that transfers power to the rear drive wheels in the Volvo XC70 Cross Country may look like the same all-wheel drive system that is in the Volvo V50 T5 AWD, but it is the clever tuning of the system to the different vehicles that makes Volvo AWD both predictable and safe.

The Volvo all-wheel drive system, installed as standard equipment or as an available option in the all-new S40 sedan and V50 sports wagon, S60 sports sedan, V70 wagon, S80 luxury sedan and the popular XC70 and XC90, looks virtually identical in every application. And while the computer-controlled unit that transfers power back and forth between the front and rear wheels has the same part number, in fact it has six different “personalities” depending on the vehicle in which it is installed.

The system, created by Haldex of Sweden, uses a mechanical pump, control valve and “wet” multi-plate clutch to distribute the power to the rear wheels. When front and rear wheels are rotating at the same speed, no power is transferred to the rear wheels. The instant that the front wheels begin to lose traction and spin, the system introduces power to the rear. A small auxiliary electrical pump is used to “pre-pressurize” the system so that power transfer can occur almost instantly. The difference in rotational speed between the slipping front wheels and the rear wheels causes the main pump (located at the rear differential) to force highly pressurized oil to the wet clutch plates in the rear differential, pushing the plates together to transfer power to the rear wheels.

The system is controlled by a computer module mounted on the rear differential that activates the electric pump and oil control valve. The differential module communicates with the engine control module (ECM) and brake control module via the car's Multiplex network to determine when the front (driven) wheels begin to lose traction and to anticipate different driving situations.

Because it is used in vehicles as different as the XC90 and the S40, with their different weight, wheelbase, track and other characteristics, Volvo engineers determined it was essential that the system be tuned to the specific vehicle. The engineers' goal was to not only maintain predictable handling for each vehicle whether or not the AWD system was active, their objective was also to maintain consistent and predictable handling among all the various vehicles.

Since the first Volvo with AWD was introduced, the handling characteristics have been the same. The cars were designed to have a slight “understeer” in extreme cornering situations, regardless of the AWD system's activity. The engineers reasoned that a slight understeer was safer for most drivers whether the vehicle is equipped with AWD or not. But that meant that the rate and amount of power transfer to the rear wheels had to differ in each application.

The solution was six different software parameters programmed into the electronic control unit of the Haldex coupling. Once installed, the coupler controller determines which car it is in, then selects and uses the software parameters for that car to run the AWD system.

There are different software parameters for XC90, S80 AWD and S60 AWD, while the V70 and

XC70 share programming and the new S40 and V50 also get unique parameters. The S60 R and V70 R performance cars have their own programming (the system in the S60 R and V70 R works with the revolutionary Four-C electronically controlled chassis to create a handling profile slightly different than on the other variants). The new XC90 V8 uses a slightly different Haldex system with an enhancement called InstantTrac.

Using the software parameters for the specific car, the electronic control module opens and closes the valve, which controls oil flow between the pump and the wet clutch pack. The valve opens when the module detects a loss of traction. The controller measures the amount of wheelspin (and resultant difference in rotational speed between front and rear wheels) and determines how far the valve opens and the amount of oil pressure applied to the wet clutch by the pump, which in turn dictates how much power is transferred to the rear wheels in each model.

By measuring front wheel spin, throttle position and other data, the system can determine how quickly to distribute power, and how much power to distribute. When accelerating on a difficult surface like snow, for example, the rear wheels can be engaged quickly with maximum power transfer. During a low speed cornering or parking maneuver the system knows that the difference in speed between the wheels does not require the rear wheels to be engaged. As a result, the inertia other systems experience in similar circumstances is avoided.

In normal driving, with the AWD system inactive, 95 per cent of power is delivered to the front wheels. Depending on the vehicle, the traction and other factors, the system can transfer up to 95 per cent of the power to the rear wheels.

The performance of the system is also speed-related. The faster the vehicle is traveling, the less the need for the electric pump to pre-pressurize the system.

Best of all, the Volvo AWD operates completely automatically, independent of the driver. Many drivers will never know that a clever AWD system with multiple personalities has just helped them around a slippery corner.

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