AUTO A/C TECH-SUPPORT - VARIABLE SWASHPLATE COMPRESSOR

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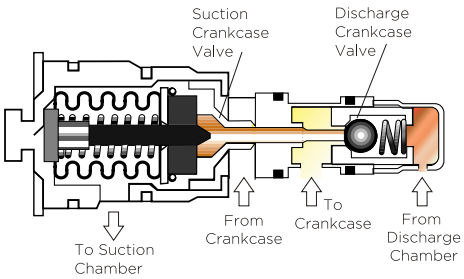
When a belt-driven Swashplate piston air conditioning compressor engages, a noticeable knock occurs and there is a reduction in engine power. This can be eliminated by keeping the compressor engaged all the time and controlling refrigerant flow by varying the displacement of the compressor. This is known as a Variable Swashplate Compressor - a variation of the swashplate compressor which incorporates a control valve. The control valve senses the suction pressure and adjusts the swashplate angle, shortening or lengthening the piston stroke (and therefore the output of the compressor) to suit evaporator requirements.

The Variable Swashplate Compressor is an axial piston design, with the pistons driven by a wobble plate or a swash plate. The swashplate angle is controlled with linkage and springs, which are adjusted by changing the refrigerant pressure in the compressor housing.

A control valve with ports and passages that connect to the suction (low-side) and discharge (high-side) chambers of the compressor head is utilized. When the compressor housing pressure is increased, pressure on the back side of the pistons keeps them "higher" in their bores, closer to the cylinder head. This reduces the angle of the swash plate and shortens the stroke, reducing displacement. When the compressor housing pressure decreases, a spring pushes the adjusting linkage away from the cylinder head, increasing plate angle and lengthening the piston stroke to increase displacement.

Two different types of control valve are used; mechanical and electronic. The mechanical valve has a precision diaphragm that senses low-side pressure. When the cabin is warm, evaporator temperature increases, which increases low-side pressure and collapses the diaphragm. A port opens to vent compressor housing pressure to the suction side of the compressor head. This decreases compressor housing pressure and increases piston stroke which will increase refrigerant flow through the system. As evaporator temperature decreases, so does low-side pressure. The diaphragm expands to close the low-side vent port and at the same time open a port that admits high-side pressure into the compressor housing. The higher compressor housing pressure reduces piston stroke and the volume of refrigerant flow.



A commonly used style of mechanical displacement control valve is actually two valves in the same body. When low-side pressure is high, the bellows collapse (towards the left). The cone valve opens and pressure vents from the compressor housing through the by-pass hole and to the suction side of the compressor head, reducing compressor housing pressure. When low-side pressure is low, the bellows expands to close the cone valve and open the ball valve. Pressure vents from the discharge cavity (high-side) to the compressor housing, increasing housing pressure.

Some systems utilize a pulse-width-modulated solenoid valve to control housing pressure, based on information from temperature and pressure sensors and a computer controlling the valve's duty cycle, compressor displacement can be used to control evaporator temperature, rather than the other way around.

ELECTRONIC CONTROL VALVE TESTER

A common question that arises is how to test the performance of an AC system where the compressor has an electronic control valve, as it can be running at anywhere from 1% to 100% capacity.

To enable this, a control valve tester has been developed which allows the technician to issue variable commands to the control valve, check the input signal from the vehicles computer and check the resistance of the control valve itself.

Control Valve Tester
TO-19300