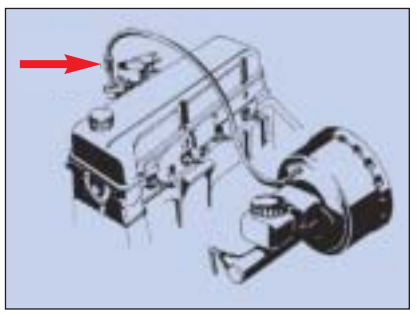
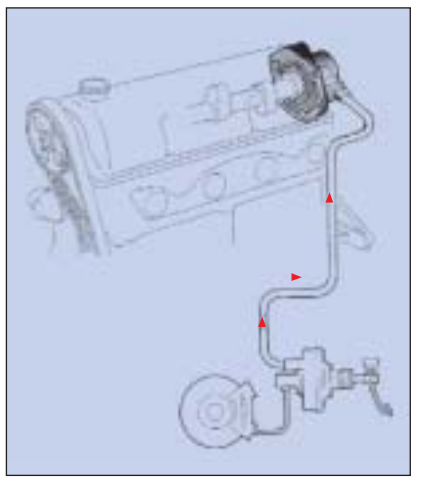
Tips for the workshop …

… from the ATE Training Centre

A brake booster has to be replaced a second time after just a few weeks. This is a repeated complaint in day-to-day shop operation.


Examine check valve


Brake booster system incl. vacuum pump

Every time, our diagnosis reads: the new brake booster was ruined in no time at all because of an installation error. Our advice: never replace a brake booster without replacing the check valve too!

What usually destroys a brake booster?

There are two possibilities:

1. Fuel gets into the brake booster. Between brake booster and internal combustion engine there is a check valve. Firstly, it is supposed to prevent the vacuum in the brake booster from being reduced as soon as the engine of the vehicle is shut off. Secondly, it is intended to prevent fuel vapours from getting into the brake booster and condensing there, so that the gasoline destroys the folding diaphragm.

2. Oil gets into the brake booster via the check valve. This happens specifically when the vacuum pump of a diesel is defective and the brake booster sucks in the oil. In both cases the check valve must be replaced together with the brake booster. If oil gets into the brake booster in diesel-powered cars, the vacuum pump and the connecting hose to the brake booster absolutely must be replaced.

How can the defective brake booster be checked?

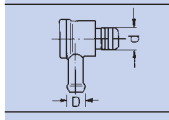
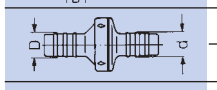
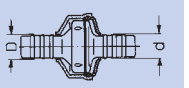
First try to establish the cause of the defect. Sniff at the vacuum connection of the brake booster, for example. Does it smell of gasoline? You can detect oil residues with the naked eye.

Our recommendation:

There are only three basic types of check valves. They are very cheap in comparison with the cost of a complaint. Stock these three types so that, whatever happens, you are prepared.

By the way, our parts packages always include installation instructions, and often red slips containing special pointers. It is absolutely essential that you observe them to avoid unnecessary complaints.

Types of check valves

	D	d	ATE Order No.	Abbr. No.
	12,4	16,5	**03.6118-7305.2**	990032
	11,8	11,8	**24.7718-7301.2**	990024
	13	13	**03.6118-7307.2**	990033
	13	13	**03.6118-7307.3**	990034

Wheel sensor

The wheel sensor system in sophisticated electronic brake systems (EBS) – for example ABS, TCS, EDL and ESP – has the task of supplying wheel speed information to the respective control unit. The more precise the information supplied by the system, the better and more comfortable the controlling action and the particular electronic brake system, will be.

The passive (inductive) sensor

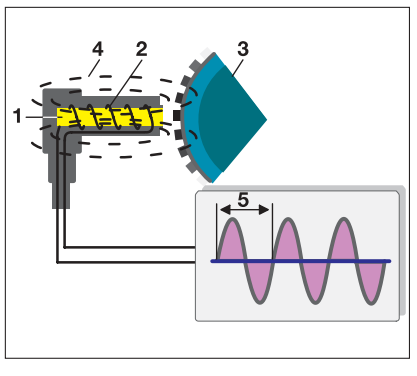
In the early days of ABS systems it was enough for wheel sensors to supply a usable sensor signal at about 7 km/h. But with the expansion of ABS to include TCS, EDL and ESP functions it was necessary to develop sensor systems which supply a usable signal at very low speeds. The passive sensor was developed to an extent that it could pick up speeds from 3 km/h upwards – but that marked its limits.

The active (magneto-resistive) sensor

The new generation of active sensors is capable for the first time of registering speeds starting at 0 km/h.

The fine difference

If we compare the two sensor systems, we note that with the passive sensor we have been generating a sinusoidal signal up to now. This was converted into a square wave signal in the ABS control unit because this is the only signal the control unit can use for its calculations. This sub-system in the ABS control unit in which the conversion of the sinusoidal signal into a square wave signal took place can be pictured as having been transferred to the active sensor. This means that the active sensor supplies a square wave signal at its output that can be used directly by the ABS control unit for its calculations. The analysis of the sensor signal for slip, wheel speed and vehicle speed remains unchanged.



Design and operation of the passive sensor

The inductive wheel sensor consists of a bar magnet (1) surrounded by a coil (2). The two ends of the coil are connected with the control unit of the ABS. The toothed wheel (3) of the sensor is attached to the wheel hub or axle shaft.

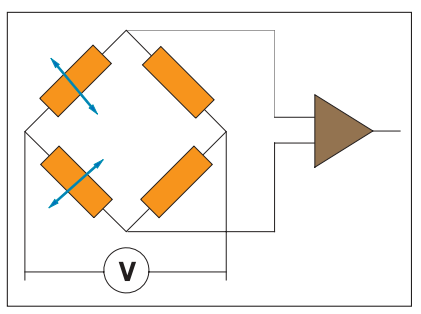
As the car wheel turns, this toothed wheel deforms (intersects) the magnetic field lines (4) of the sensor, generating (inducing) a sinusoidal voltage in the wheel sensor. The constant alternation of tooth and gap gives rise to a frequency which is transmitted to the ABS control unit. The frequency (5) is dependent on the rotational speed of the wheel.

Design and operation of the active sensor

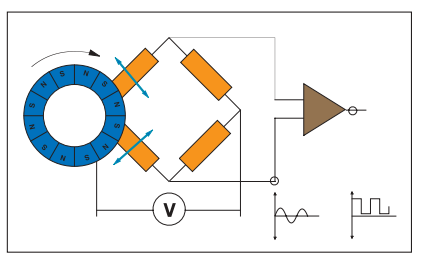
The magneto-resistive sensor is made up of:

- four resistors whose resistance can be changed magnetically,
- voltage supply and
- electronic analysis system (amplifier/comparator).

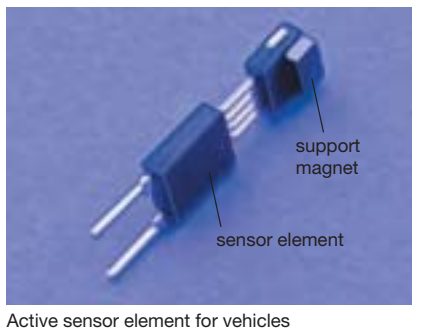
In measuring technology, the principle of measuring by the four resistors is known as the Wheatstone Bridge or resistance comparison bridge. The sensor system needs a toothed sensor wheel or an encoder wheel in order to function. When the vehicle is in motion the toothed wheel passes over two of the resistors, detuning the Wheatstone Bridge and generating a sinusoidal signal. The electronic analysis system transforms the sinusoidal signal into a square wave signal. This signal can then be directly processed by the ABS control unit.



Design of active sensor



Active sensor, operating principle



Active sensor element for vehicles with encoder wheel


Encoder wheel


Active wheel sensor for axial pick-up


Active wheel sensor for radial pick-up

How to check wheel sensor systems

1. Passive sensors


Testing of passive sensor

The methods for testing these sensors are sufficiently well known. With the multimeter we check:

- the resistance of the sensors;
- the sensor voltage at one revolution per second or on a brake dynamometer.

The sensor lead to the control unit is checked for:

- signal passage,
- shorting to positive or chassis;

the toothed sensor wheel for:

- damage,
- presence of all teeth.

2. Active sensors

These cannot be measured the same way as passive sensors because they have to be supplied with voltage to operate.

The active sensor can be comprehensively tested only with the sensor tester.

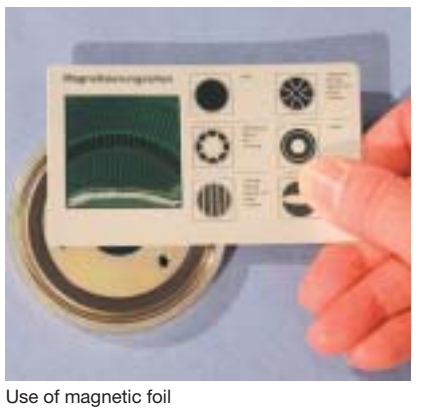
With the sensor tester you can determine

- output current 7 or 14 mV;
- the number of teeth or north/south poles;
- air gap too large or too small;
- shorting to positive or chassis and
- the frequency, produced by an oscillator.


Sensor tester used on dismantled active sensor

It is a very easy matter to use the tester: You connect the installed active sensor to the tester and turn the wheel of the vehicle. All results will be shown by a display and two light-emitting diodes. A sensor which has been removed from the vehicle can also be tested. But to do this you have to move a magnet towards or away from the active sensor to cause a change from red to yellow light-emitting diode. This change indicates that the sensor is in working order.

How to check the encoder wheel


Use of magnetic foil

The easiest way to test the encoder wheel is to remove it from the vehicle and apply the magnetic foil to it. The magnetic foil makes the magnetic north and south poles visible, enabling you immediately to detect any defects in the structure.