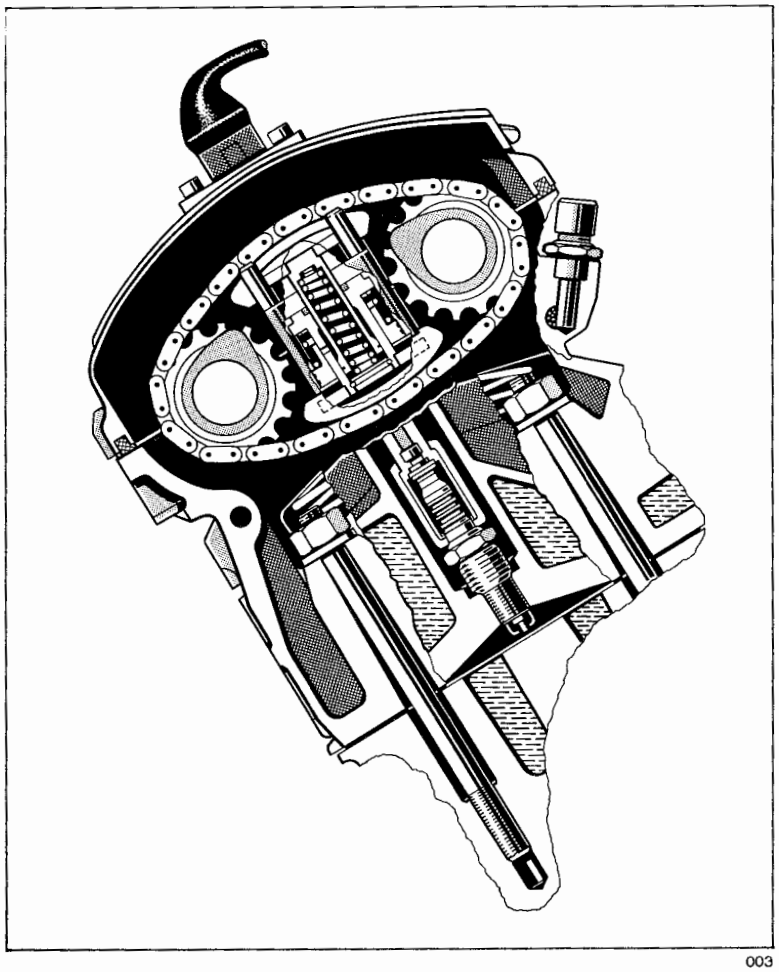
VarioCam Inlet Camshaft Adjustment

VarioCam, a feature that adjusts setting of the inlet camshaft at 1,500 rpm* and 5,500 rpm, respectively, has a particularly important impact on engine output, excellent torque and favorable exhaust gas composition.
At engine speeds below 1,500 rpm, a small overlap of the inlet valve to exhaust valve lift curves is achieved.



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One particular benefit of this system is that the hydrocarbon contents (HC contents) in the exhaust ahead of the catalytic converter are particularly low.
As soon as the engine exceeds the 1,500 rpm threshold*, the inlet camshaft is readjusted by approx. 7.5 deg. (i.e. approx. 15 deg. when measured at the crankshaft).
Adjustment towards greater overlap of the inlet and exhaust valve lift curves results in an increase of engine torque by up to 8 Nm (6 ft.lb.).
At engine speeds above 5,500 rpm, the inlet camshaft is readjusted back to the basic timing (as at idle). This is due to the twin-scroll bypass intake system. Retarded closing of the inlet valves provides for an extended flow of the air drawn in into the cylinder, thus producing a supercharging effect since the flow is not interrupted. This improves the cylinder charge and produces an increase of output by approx. 4 kW (3 hp).

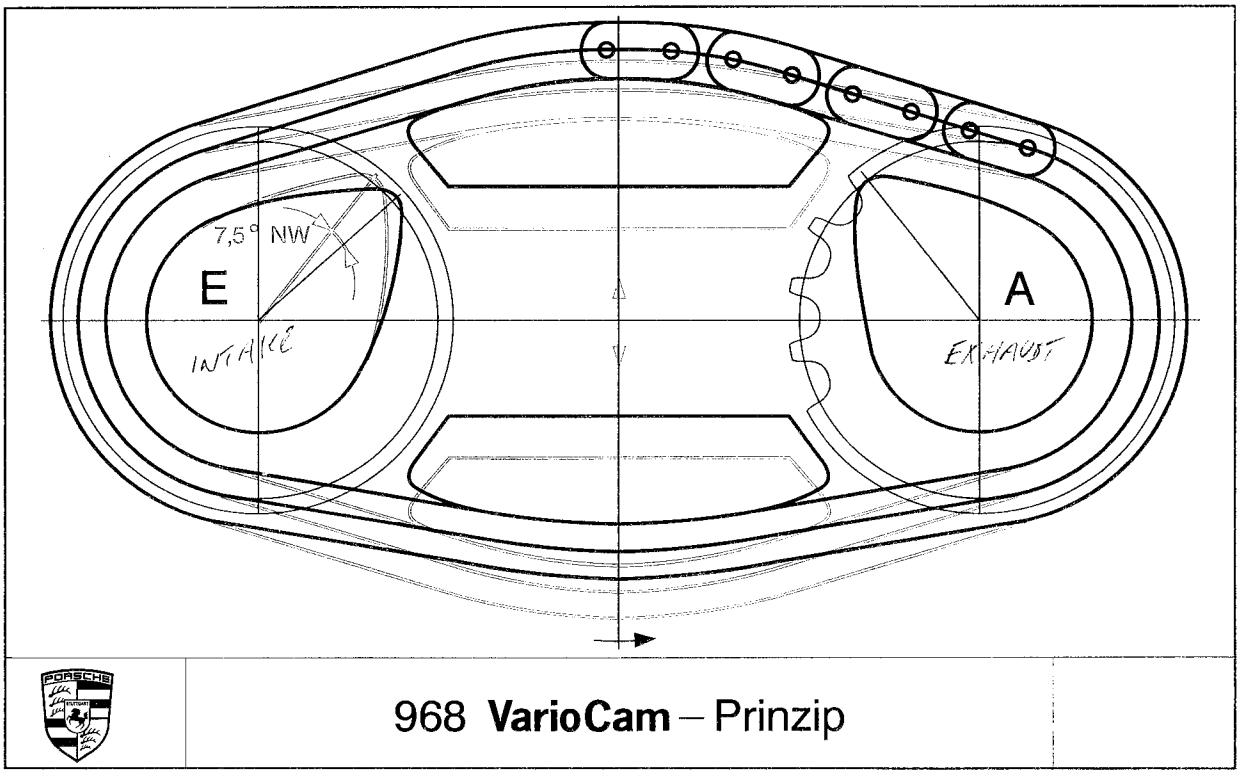
* As the eingine oil temperature increases, the value of 1,500 rpm is increased to 2,000 rpm (at $t_{oil} \approx$ 120 deg. C/248° F) and approx. 2,800 rpm (at $t_{oil} \approx$ 130 deg. C/266° F).

VarioCam

The complete adjuster device of the inlet camshaft is located in the chain tensioner (arrow) between the exhaust and the inlet camshaft.

The exhaust camshaft (1) is driven across a toothed belt (2) by the crankshaft.

Chain sprockets (3 and 4) and roller chain (5) drive the inlet camshaft (6).



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EZW

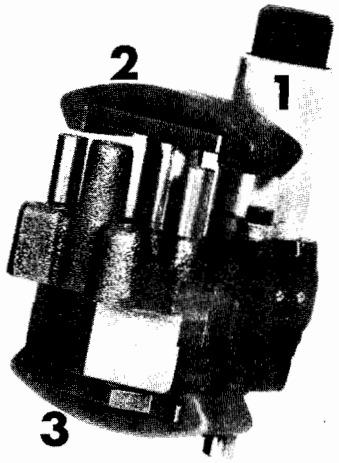
E = Inlet camshaft		**Basic setting**	
A = Exhaust camshaft		**Torque setting**	

The chain between both camshafts allows the chain tensioner to raise and lower the chain links between the camshafts.

The basic setting (shown in black) at engine speeds below 1,500 rpm and above 5,500 rpm occupies the upper position: the inlet camshaft is set to "small overlap" (retarded inlet start).

If the chain tensioner is lowered due to hydraulic action (shown in red), timing is advanced and larger overlaps between "exhaust valve closes" and "inlet valve opens" result.

Adjustment of the chain tensioner is performed by hydraulic pressure cylinders and spring packs. Switchover pulses to the solenoid (1) are produced by the DME control unit.
Basic setting: deenergized, both sliders 2 and 3 "at top".



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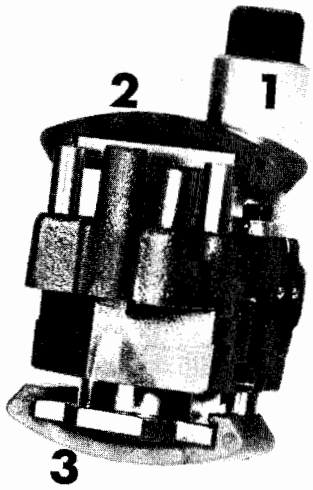
A solenoid (1) is actuated by the DME control unit, engine oil pressure forces both sliders (2 and 3) "down". This corresponds to the "high torque" setting in the middle rpm range.



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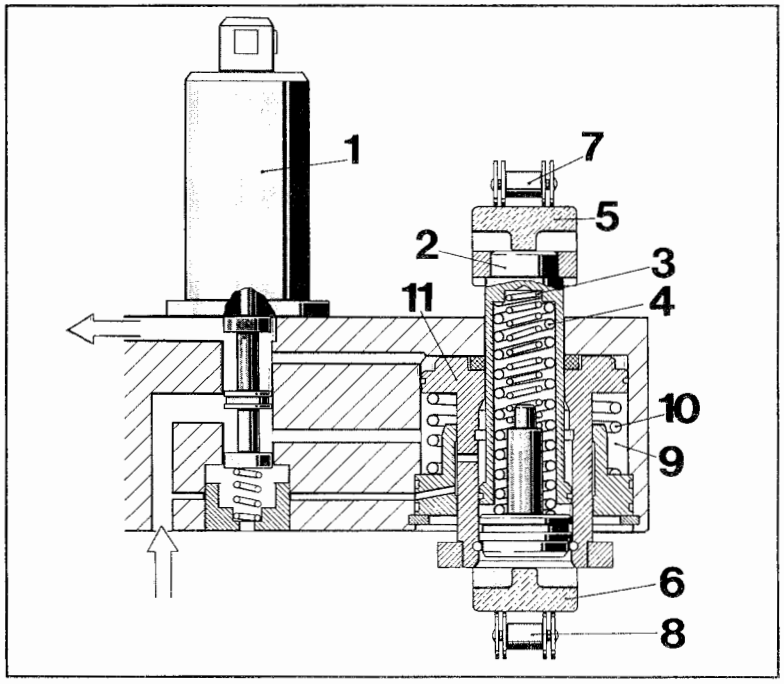
Chain Tensioner in Basic Setting

Solenoid (1) deenergized.
Oil pressure (red) fills interior of chain tensioner (2) and supports force of springs (3) and (4). Both tensioner blades (5) and (6) rest on roller chain links (7) and (8).
Oil pressure (light red) is also fed into the annular chamber (9) and supports spring (10).
Piston (11) remains at top.
Non-pressurized excess oil (green) is diverted.



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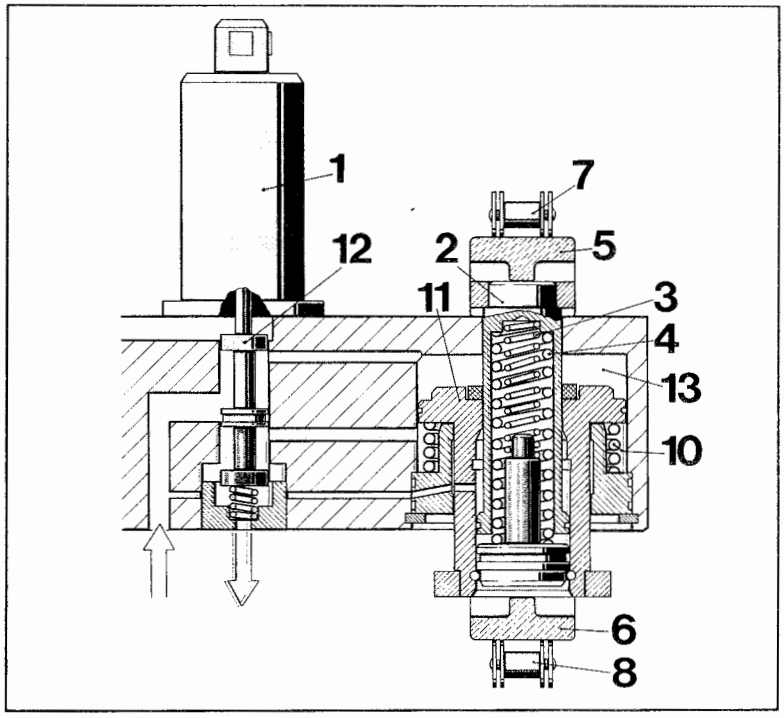
Engine oil pressure

Pressurized oil in chain tensioner

Return line, non-pressurized

Chain Tensioner in "High Torque" Position

Solenoid (1) is energized and forces control piston (12) down. Oil pressure (red) fills and tensions the chain tensioner. Oil pressure (light red) now also enters the large annular chamber (13) and forces the complete actuator with piston (11) down, overcoming the force of spring (10) at the same time.
Non-pressurized excess oil (green) is diverted.



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