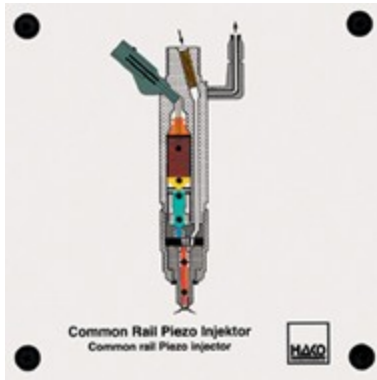


HAKO Overhead models - News



Order No. 476
Common rail piezo-injector

Functions:

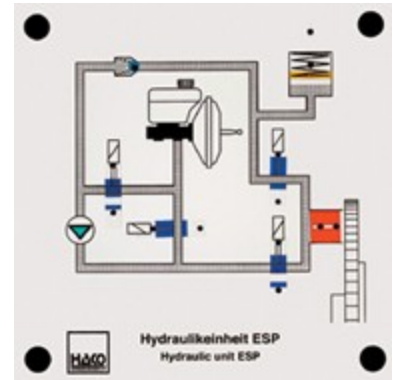
- extension of the actor module (piezo-layers)
- movement of the coupler module
- opening of the valve piston in the switching valve
- actuation of the nozzle needle and injection



Order No. 477
Operating unit Sensotronic brake control (SBC)

Functions:

- operation of the push-rod piston
- operation of the floating piston
- operation of the pistons in the brake pressure simulator



Order No. 474
Hydraulic unit ESP

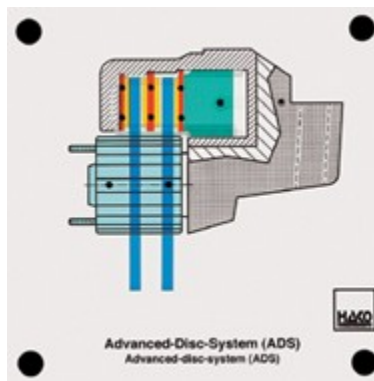
Functions:

- pressure build-up, hold pressure, relieve pressure
- switching of the solenoid valves
- movement of the non-return valve, the low-pressure storage plunger and brake plunger



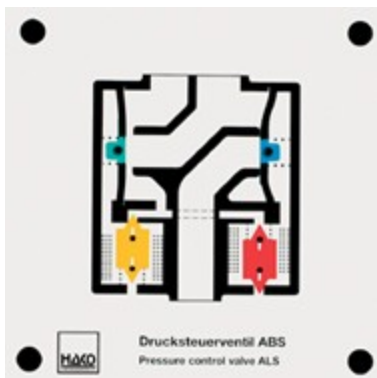
Order No. 473
Planetary axle wheel drive assembly

- function of the wheel drive assembly
- ratio in the planetary gear
- when you turn the axle shaft, you see how the wheel turns with a ratio of 1:4



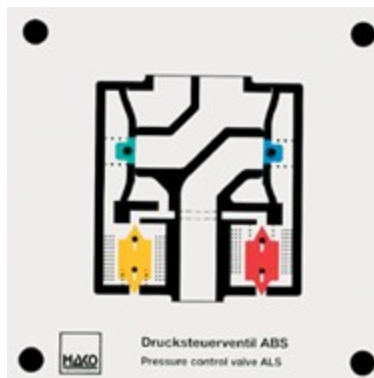
Order No. 475
Advanced disc system

- Latest brake system with 2 floating brake discs
- extension of the brake plunger
- application of the 3 brake pads to the brake discs
- displacement of the two brake disks

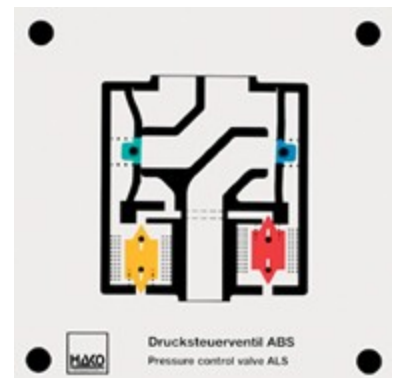


Order No. 480
Pressure control valve ALS

The pressure control valve is part of the anti-locking system for compressed air brake systems.



A pressure control valve has been assigned to each controlled wheel. It comprises 2 solenoid valves and 2 diaphragm valves, which enable the following ...



... control phases in the brake cylinders:

- Build up braking pressure
- Maintain braking pressure
- Reduce braking pressure

HAKO Overhead models - News



Order No. 484 Pneumatically actuated

disc brake (truck)
When the membrane cylinder is actuated, an eccentrically supported lever is pivoted. This lever displaces the bridge.



Firstly, the tight-hand brake pad is moved to the disk by the bridge. After this, the complete brake caliper is pulled to the right and the other brake pad moved to the disk.
Thanks to small springs integrated into the brake pads, ...



... the brake pads automatically release from the brake disk after each braking process on the model.



Order No. 483 Variable compression ratio

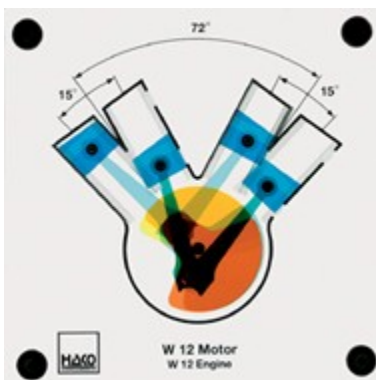
The crankshaft is supported on eccentric disks in the engine block. One toothed gear is moved via a lever and the ...



... eccentric disk turned in this way. The compression ratio is increased or reduced in this way.

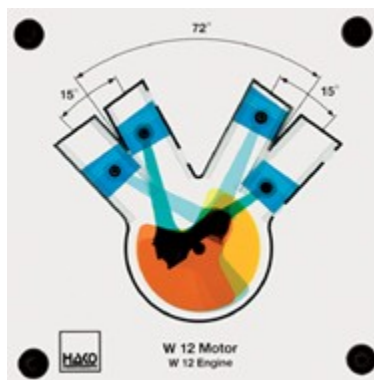


This can be seen very clearly when the crankshaft is turned.

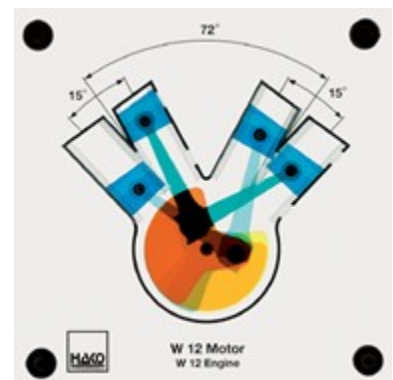


Order No. 478 W12 Engine

A disk of a W12 6.0 I engine of an Audi A8 was shown.
As a result of the bank angle of 72° and an ignition ...



... interval of 60°, the 6 crank pins of the cylinders opposite one another are offset by 12°. This is called a "split pin".



When the engine cranks, one sees the displacement of the plungers and the ignition order.

HAKO Overhead models - News

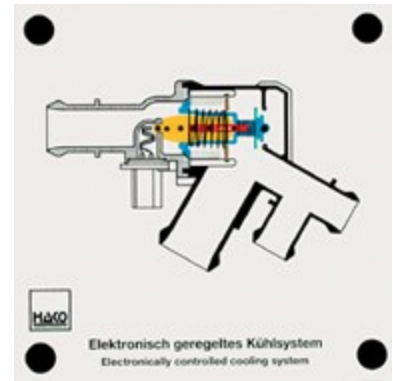


Order No. 479
Timing gears of a four-stroke engine

Instead of toothed belts or a chain, 10 spur gears are used to drive the injection pump, the camshaft and ...

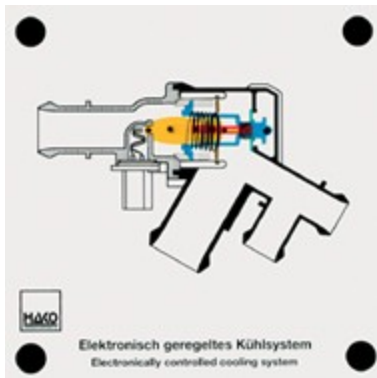


... the ancillaries. Injection pump and camshaft turn with half the crankshaft speed.

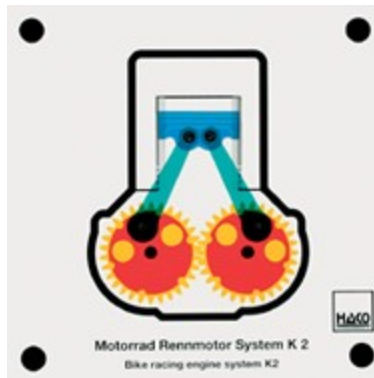


Order No. 481
Electronically controlled cooling

system
The development of an electronically controlled cooling system has the objective of controlling the operating temperature of the motor to a nominal value as a function of the load state.

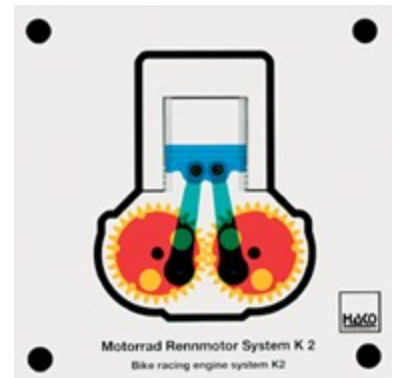


According to maps deposited in the engine control unit, an optimum operating temperature is controlled via the thermostat, which can be heated electrically, and the radiator fan phases.

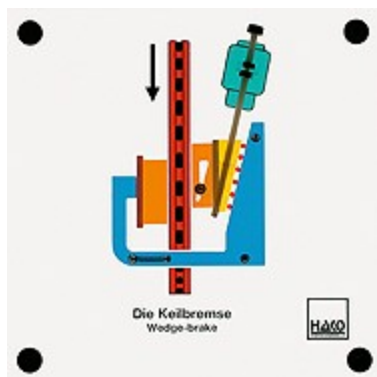


Order No. 482
Bike racing engine system K2

A one-cylinder engine which transmits its power onto two crankshafts via two connecting rods.

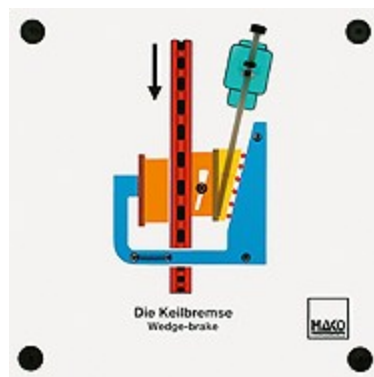


Good students can work the advantages of such an engine-transmission unit with instruction from the teacher.



Order No. 488
Wedge brake

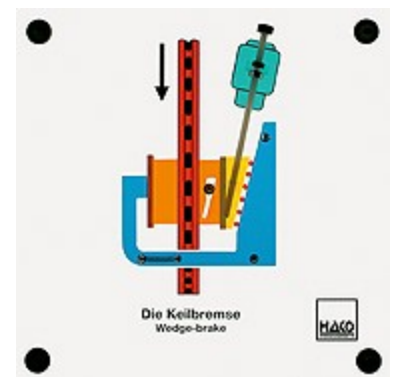
An electronically operated wedge will replace hydraulic brakes. Then hydraulic lines and hoses, brake fluid, fluid containers and brake booster will no longer be necessary. The brake pad is pulled downwards when it contracts the disk (servo effect, comparable with leading shoes on drum brakes).



In this way, the 12V vehicle electrics are completely sufficient for the operating engine. Further benefits: no blocking of the wheels, no pedal pulsing, quicker reactions.

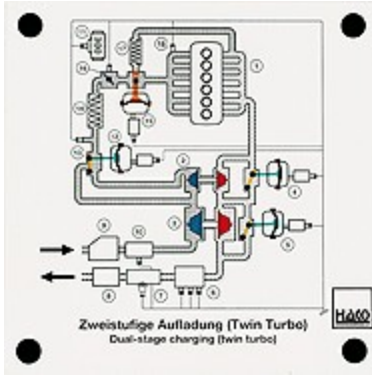
Demonstration:

- Movement of the floating brake caliper to the left and right



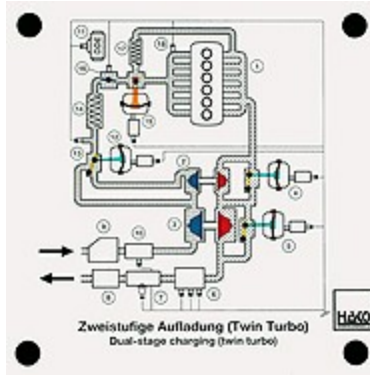
- Turn the threaded spindle, observe movement of the brake wedge until it has contact to the brake disc.
- When the threaded spindle is turned further, one sees how the floating brake caliper moves to the right and the other brake pad likewise makes contact with the brake disc.

HAKO Overhead models - News



Order No. 487
Dual-stage charging (twin-turbo)

In order to achieve optimum reaction from low speeds and also the bandwidth of maximum torque, two turbochargers connected in series (twin turbo) are frequently used nowadays.

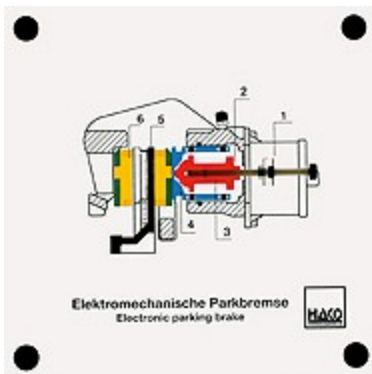


- Demonstration:
- Paths of the fresh and exhaust gas flow
 - Opening and closing of the turbine control flap (4)
 - Operation of the waste gate valve (5)
 - Opening and closing of the compressor bypass flap (2)
 - Operating the throttle valve (16)
 - Opening and closing of the exhaust gas recirculation valve (15)
 - Interaction of the various parts and components

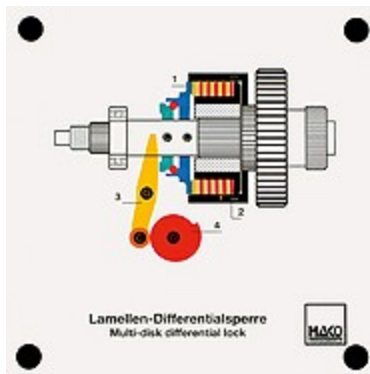


Order No. 494
Electronic parking brake

The parking brake is activated by pulling a switch. The conversion of the turning movement into a lifting movement on the brake piston is via a geared motor and a spindle. The cylinder pushes the brake piston onto the brake disk by the rotary movement of the spindle, the vehicle is secured against rolling away.

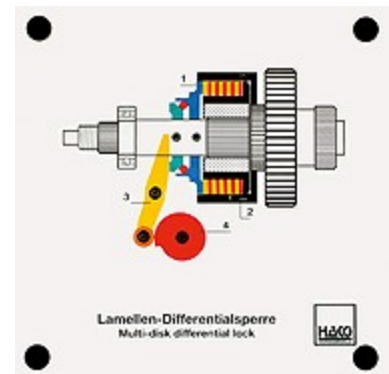


- Demonstration:
- Hydraulic brake function by displacement of the brake piston
 - Contact of the brake pad to the brake disk, braking function
 - Automatic release of the brake piston by letting it go
 - Turning of the threaded spindle, lifting movement of the cylinder until it puts the brake pad into contact with the brake disc. Braking function



Order No. 495
Multi-disc differential lock

Above all, four-wheel all-terrain vehicles now use electrically operated differential locks in the transfer case.



- Demonstration:
- Function of the differential lock
 - Turning of the radial cam
 - Movement of the reversing lever and stroke of the starter plate
 - Pressing the disc packages together
 - Electronically adjustable pressure on the discs, with the result that the lock works just without slip.

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Order No. 485 Demounting of pistons

Demonstration:

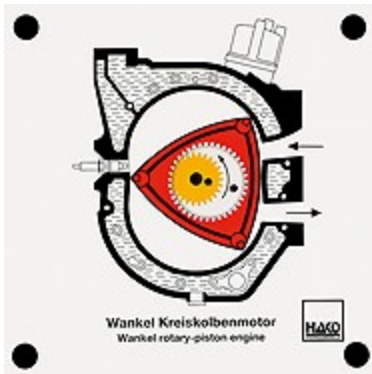
- Turn the crankshaft, observe the stroke of the piston
- Demount the connecting rod bearing cap with straight division (plug-in type connection).



- The connecting rod big end can not be demounted upwards through the cylinder (too wide), i.e. to dismount the piston, the crankshaft has to be removed.
- Push piston with connecting rod big end with inclined division into the cylinder
- Demount the connecting rod bearing cap (plug-in type connection)



- This connecting rod big end is narrower and can be demounted through the cylinder, i.e. the time-consuming demounting of the crankshaft is no longer necessary.

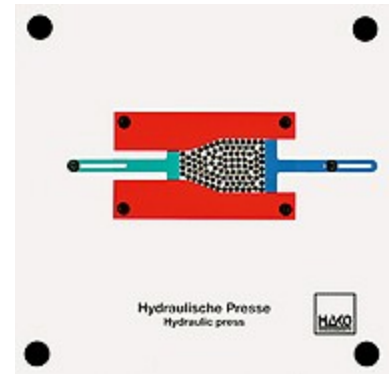


Order No. 486 Wankel rotary-piston engine 2

Original reconstruction of the Wankel engine in the RO 80 from NSU



- Demonstration:
- Rotation movement of the rotor
 - Function of eccentric shaft with gearing
 - Intake, compression, work, exhaust.



Order No. 492 Hydraulic Press

The basic principle of hydraulic presses has been shown



- Demonstration:
- Move the small piston to the inside. Large distance, small force.
 - Move the large piston to the inside. Small distance large force
 - Displacement of the small piston and simultaneous pressing against the large piston. One clearly notices the difference in force



Order No. 491 Transmission ratio (speed, number of teeth)

With this model, the interconnection between speed and number of teeth can be derived. The numbers of teeth are: pinion: $z=12$, toothed wheels: $z=24, 36$ and 48 teeth.



The bracket can be moved upwards by loosening a butterfly nut, with the result that the ratio of pinion and toothed wheel 1 can be demonstrated first.

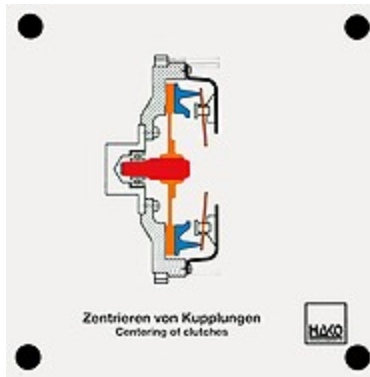
When the bracket has been moved down, the other speed ratios can be demonstrated.

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Order No. 490
Centring of clutches

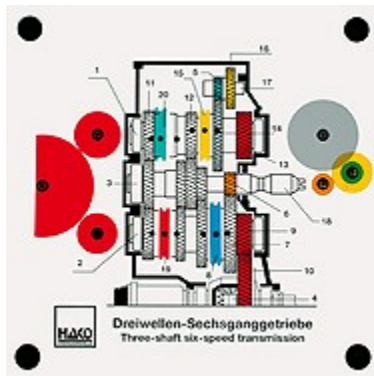
When the driving disc is replaced, it must be centred in the balance wheel at all costs.



Demonstration:
- Unscrew the pressure plate without centring (plug-in type connection). In mounting the transmission, the transmission input shaft can not be pushed into the guide bearing

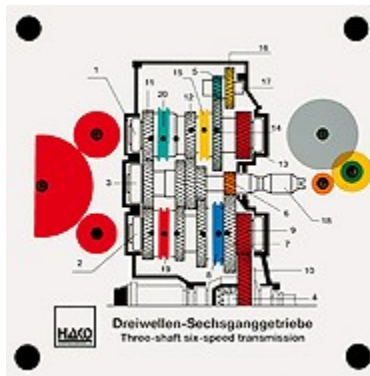


- Centring of the driving disc with a centring mandrel (red)
- The transmission input shaft can now easily be pushed into the guide bearing

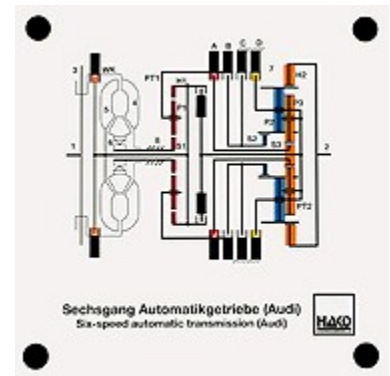


Order No. 489
Three-shaft six-speed transmission

This frontal transmission is used in the A class of Mercedes Benz. The double wheel (top right) and the differential with axle shafts (below) have been hinged to the outside. For better understanding, the corresponding toothed wheels on the left and right of the transmission have been shown in their correct positions with the matching colours.



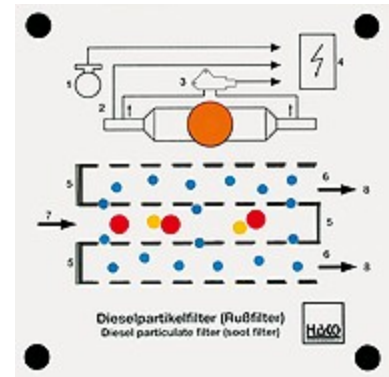
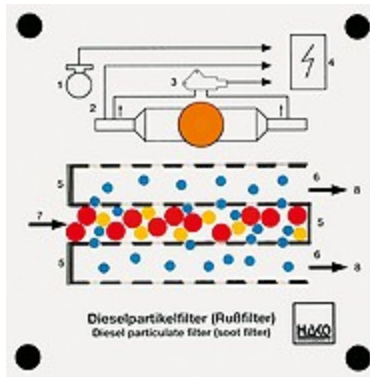
Demonstration:
- Search for the designations in question on the transmission (nos. 1 to 20)
- Displacement of the shifting sleeves and finding the flow of force in all gears
- Following the flow of force in the transmission section and the matching views:



Order No. 496
Six-speed automatic transmission (Audi)

Portrayal of flow of force of an automatic transmission with 2 sets of planetary wheels, converter with converter lockup clutch, hydraulic clutch A and B and brakes C and D. All clutches and brakes as well as the converter lockup clutch WK can be operated,

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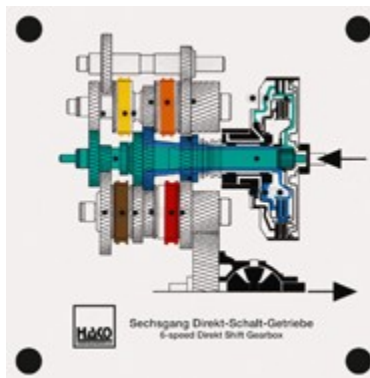
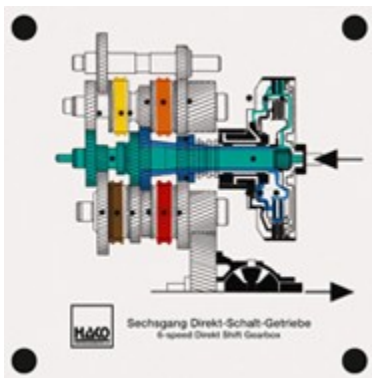
Order No. 493 Diesel particulate filter (soot filter)

with the result that the flow of force in all gears can be seen. In the operating instructions, you will find a shift matrix as well as a portrayal of flow of force in all gears (extensive description and drawing).

The particulate filter comprises a beehive-shaped ceramic body. It has been sub-divided into a number of small channels arranged in parallel, which have been arranged alternately.

The following gases are contained in the exhaust gas: carbon monoxide, carbon dioxide, nitrogen oxides, hydrocarbons, sulphur dioxide (all shown blue). Further, soot particles (red) and an additive (yellow).

- Demonstration:
- Insertion of the various gas and soot particles into the middle tube.
 - Gas particles can escape through the pores of the side wall into the two tubes next to this, whereas the soot and additive remain in the medium tube as a result of their size.
 - Gas particles can escape to the back into the exhaust pipe



Order no. 497

Six-speed direct shift transmission (VW)

Here, the advantages of a manual transmission have been ideally combined with the advantages of an automatic transmission. The following can be shown: engaging the 6 forward gears and the reverse gear. Engaging the inner and outer clutch. Thanks to the respective colour-coding of clutch 1 and drive shaft 1

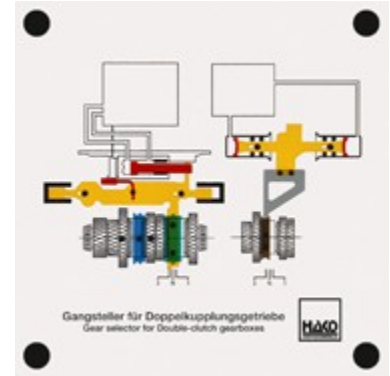
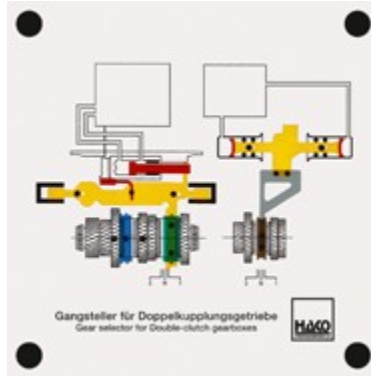
as well as clutch 2 and drive shaft 2 with their respective toothed wheels, the flow of force can easily be seen and understood in all gears. A very detailed operating manual with photos is included.

Order no. 498

7-speed duplex clutch transmission (VW)

The 7-speed duplex clutch transmission by VW is a further development of the six-speed direct shift transmission. The following can be shown: engaging the 7 forward gears and the reverse gear. Engaging the inner and outer clutch. Thanks to the respective colour-coding for clutch 1 and drive shaft 1 as well

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Order no. 499 Gear changing device for duplex clutch transmission

as clutch 2 and drive shaft 2 with their respective toothed wheels, the flow of force can easily be seen and understood in all gears. A very detailed operating manual with photos is included.

With direct shift transmission, the gearshift forks are operated hydraulically and not by gear linkage as with conventional transmissions. The gearshift forks are mounted with ball bearings in a cylinder. For gear shifting, the mechatronic system forces oil into the left or right cylinder. This possibility is

shown on the right-hand side of the model. The hydraulic piston is positioned directly on the shifter rail. On the left, an extra shift cylinder with gear changing piston has been installed, which is connected to the gearshift fork and takes this along for gear changing.



Order no. 502 Duplex clutch for direct shift transmission

The direct shift transmission is actually made up of two mutually independent transmissions. There is a multi-disc clutch assigned to each of these transmissions. The left-hand duplex clutch runs in the DST oil. Gears 1, 3, 5 and reverse are shifted via multi-disc clutch K1. Gears 2, 4, 6 are shifted via clutch

K2. The right-hand duplex clutch is made up of two conventional dry clutches combined to form a duplex clutch. Clutches K1 and K2 can be actuated in both duplex clutches. Thanks to the respective colour-coding the force transmission can be followed and understood.

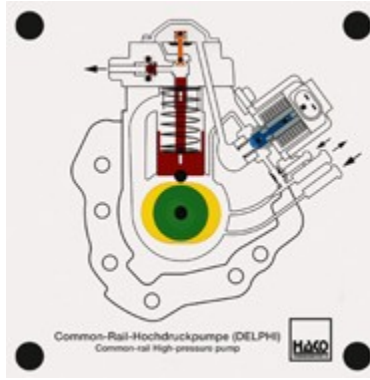
Order no. 503 Direct shift transmission for motor-bikes (Honda)

The mechanical six-speed transmission is divided into 2 separate transmissions with one clutch each, as it were. It has a divided transmission input shaft. Thanks to the blue/yellow colour-coding, the flow of force from the clutch to the individual gear wheels

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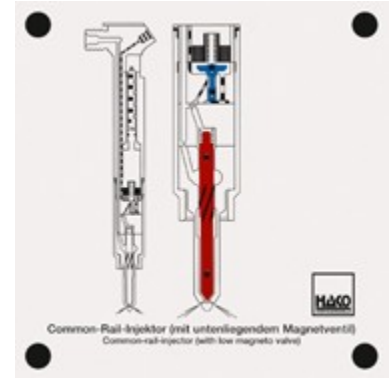


is easy to follow. Gears 1, 3 and 5 are located on the inner transmission shaft, gears 2, 4 and 6 on the outer transmission shaft. Both clutches of the duplex clutch can be actuated. All gears can be shifted by shifting the toothed wheels.



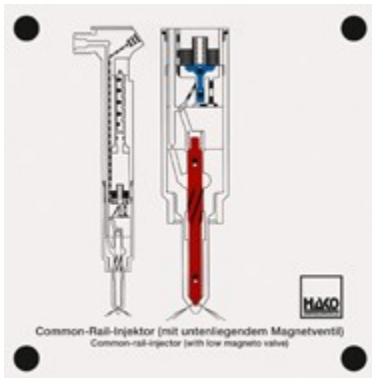
Order no. 504
Common rail high-pressure pump (DELPHI)

The following can be shown: how the drive shaft works with cam and roller tappet. Up and down movement of the pump piston with spring. How the inlet and outlet valves work. Intake and pumping stroke, function of the Venturi nozzle.



Order no. 505
Common rail injector (with bottom-mounted solenoid valve)

With this injector, the magnetic coil and the control valve have been installed low down. This does away with the long and slow valve control piston. This in turn results in much shorter shifting times for the solenoid valve. Demonstration: Injection valve in initial position,

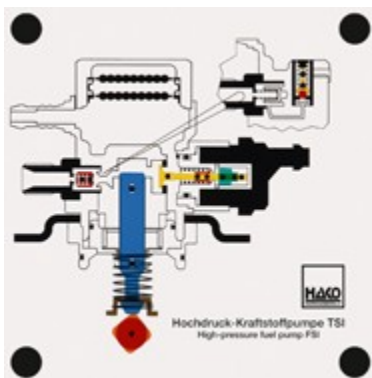


Order no. 506
Controlled oil pump (duocentric)

Start of injection phase 1 (control valve is lifted) Start of injection phase 2 (nozzle needle is lifted) End of injection phase 1 (spring closes control valve) End of injection phase 2 (nozzle needle is pushed back into place)

The controlled duocentric oil pump regulates the oil pressure to around 3.5 bar over the entire speed range. A control ring and control spring are responsible for regulating the pressure. Oil pressure less than 3.5 bar: The control spring presses the control ring against the oil pressure, the external rotor is turned and the space between internal and external

rotor is enlarged. Oil pumping increases, as does the oil pressure. Oil pressure greater than 3.5 bar: The oil pressure presses the control ring against the control spring. The rotor is turned back and the space between the internal and external rotor is reduced. As the oil quantity drops, so does the oil pressure.



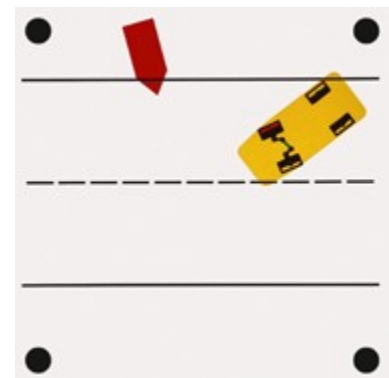
Order no. 500
High-pressure fuel pump TSI (FSI)

The following can be shown: How the inlet and outlet valves work. Up and down movement of the pump piston. How the pressure relief valve works. Fuel intake stroke, fuel recirculating, fuel pumping stroke.



Order no. 501-1, 501-2
Electronic Stability Program ESP

A small vehicle can be pushed on a straight road and a bend. The wheels of the front axle can be turned. Braking of the individual wheels can be simulated through flaps (red). The following situations can be presented: What does ESP do during: oversteering, understeering, driving errors, obstacle avoidance,



skidding movements etc.. The students consider which wheels have to be braked in which situation and why. The model makes it easy to understand how a motor vehicle behaves in critical situations with and without ESP.

Changes reserved!