


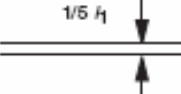
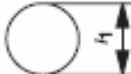
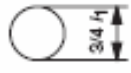
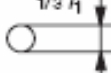

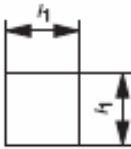

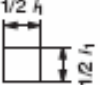
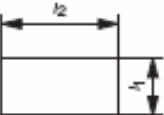
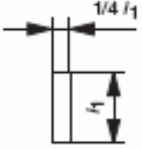

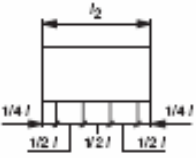
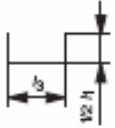
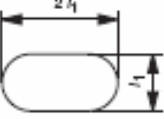


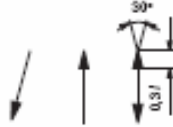









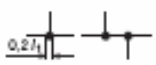




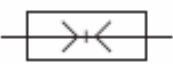


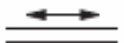






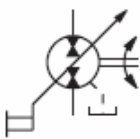


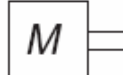
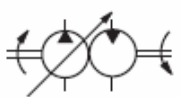

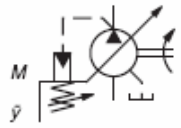
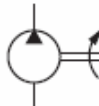
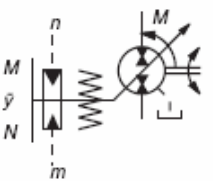
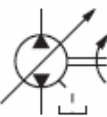
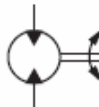
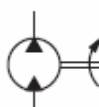
Basic symbols

<p>Basic symbols</p> <p><i>Lines</i></p> <p><i>Continuous</i> Main line, reverse current line, electrical line</p> <p><i>Dashed</i> Control line, drain line, transition position</p> <p><i>Chain dotted</i> To group two or more components in a sub-assembly.</p> <p><i>Double</i> Mechanical connection (shaft, lever, piston rod)</p> <p><i>Circle</i> Energy conversion units (pumps, motors)</p> <p>Measuring devices</p> <p>Check valves, rotary connections, mechanical pivots, rollers (always with centre point)</p> <p><i>Semi-circle</i> Motor or pump with limited angle of rotation (part-turn actuator)</p> <p><i>Square</i> Connections perpendicular to sides. Control elements Drive units (except for E motor)</p>	        	<p><i>Connections to corners of treatment devices</i> (filters, separators, lubricating devices, heat exchangers)</p> <p>Cushioning in actuators, weight in the accumulator</p> <p><i>Rectangle</i> Cylinders, valves</p> <p>Piston in cylinder</p> <p>Adjustment elements</p> <p>Spacing for pipe lines</p> <p><i>Open rectangle</i> Tank</p> <p><i>Oval</i> Pressure tank, accumulator, gas bottle</p>	       
--	--	--	--

Functional symbols			
<p>Functional symbols <i>Triangle</i> Shows direction of flow and operating medium</p> <p><i>Filled, hydraulic</i></p> <p><i>Open, pneumatic</i></p> <p>Arrows <i>Straight or slanted</i> Linear movement, path and direction of flow through a valve, direction of heat flow</p> <p><i>Curved</i> Rotational movement, direction of rotation viewed from shaft end</p> <p><i>Diagonal arrow</i> Adjustability in pumps, motors, springs, solenoids</p> <p>Various functional elements</p> <p>Electrical</p> <p>Closed path or port</p> <p>Linear electrical actuators acting in opposition</p> <p>Temperature display or temperature control</p> <p>Drive unit</p>	         <p>M</p>	<p>Spring</p> <p>Throttling</p> <p>Seat of check valve</p> <p>Pipes and pipe connections</p> <p>Connection</p> <p>Intersection</p> <p>Flexible line</p> <p><i>Connections</i> Breather connection continuous</p> <p>Limited with respect to time Open / closed</p> <p>Quick release coupling without mechanically opening check valve</p> <p>With mechanically opening check valve</p> <p>Angular and rotary connection with 1 way</p> <p>Mechanical parts</p> <p>Rod, linear movement</p> <p>Shaft, rotational movement</p> <p>Detent, maintains specified position</p>	             

Operational modes			
Operational modes General symbol		Actuation by means of pressurisation or pressure relief Directly acts on actuator	
Push button		By means of opposed control areas of different sizes	
Pull-out knob		Internal control channel	
Push button/pull-out knob		External control line	
Lever		Pneumatic/hydraulic operation	
Pedal, 1 direction of operation		2-stage hydraulic actuation	
Pedal, 2 directions of operation		2-stage electro-hydraulic actuation, external pilot oil supply	
Plunger		2-stage pneumatic-hydraulic operation, external pilot oil return	
Plunger with stroke limitation		2-stage electro-hydraulic actuation, spring centring of mid-position, external pilot oil supply and return	
Spring		2-stage electro-hydraulic actuation, pressure centring of mid-position, external pilot oil supply and return	
Roller tappet		External feedback of actual position of actuator	
Roller lever		Internal feedback of actual position of actuator	
Electrical, 1 winding			
Electrical, 2 windings which act in opposition to each other			
Electrical, 2 windings which act in opposition to each other and which may be steplessly adjusted			
2 parallel acting operators			

Energy sources

<p>Energy sources Hydraulic</p>			
<p>Pneumatic</p>		<p>Variable displacement pump/motor, manual adjustment 2 directions of flow, 2 directions of rotation, case drain port</p>	
<p>Electric motor</p>		<p>Hydraulic part-turn actuator</p>	
<p>Drive unit, except for electric motor</p>			
<p>Energy conversion and storage Hydraulic pumps and motors <i>Hydraulic pump, general</i></p>		<p>Hydraulic compact drive</p>	
<p>Hydraulic pump, general</p>		<p>Variable displacement pump with pressure compensator, 1 direction of flow, 1 direction of rotation, case drain port</p>	
<p>Fixed displacement pump, 1 direction of flow, 1 direction of rotation</p>		<p>Variable displacement pump/motor with pressure compensator, 2 directions of flow, 2 directions of rotation, case drain port</p>	
<p>Variable displacement pump, 2 directions of flow, 1 direction of rotation, case drain port</p>			
<p>Fixed displacement motor, 2 directions of flow, 2 directions of rotation</p>			
<p>Fixed displacement pump/motor, 1 direction of flow, 1 direction of rotation</p>			

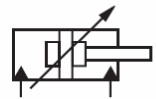
Hydraulic cylinders

Hydraulic cylinders

Single acting hydraulic cylinder, return stroke via pressurisation, piston chamber connected to tank



Double acting single rod hydraulic cylinder, adjustable cushioning at both ends of piston



Telescopic hydraulic cylinder, single acting



Telescopic hydraulic cylinder, double acting



Hydraulic accumulators
(only in an upright position)

Accumulators
(pre-charge not depicted)



Accumulator
with gas charging



Gas bottle



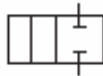
Open and closed loop control of energy

Open and closed loop control of energy
Directional control valve

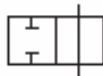
Valve with 2 switching positions and 1 transition position



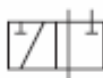
Valve with 2 switching positions, 2 ports, initial position (normally) closed, 2 directions of flow



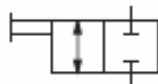
Valve with 2 switching positions, 2 ports, initial position (normally) open, 2 directions of flow



Valve with 2 switching positions, 3 ports, initial position (normally) open, 2 directions of flow



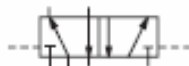
2/2 way directional control valve, 2 ports, 2 spool positions



3/2 way directional control valve, 3 ports, 2 spool positions, 1 transition position, solenoid operation, initial position defined by spring



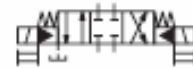
5/2 way directional control valve, 5 ports, 2 spool positions, actuated via pressurisation in both directions



4/3 way directional control valve, with a pilot stage, (detailed diagram) electro-hydraulically operated, 4 ports, 3 spool positions, spring centred mid-position, manual override, external pilot oil return



simplified diagram



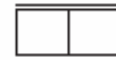
4/3 way directional control valve, with a pilot stage (detailed diagram) electro-hydraulically operated, 4 ports, 3 spool positions, pressure centred mid-position, main pilot valve also pressure-centred manual override, external pilot oil supply



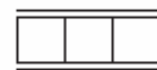
simplified diagram



Servo valves
Valve with 2 end positions and an infinite number of transition positions



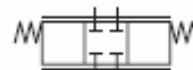
Valve with 3 defined positions and an infinite number of transition positions



Servo valve, negative overlap






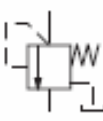
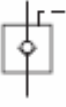
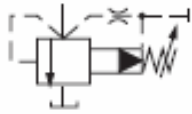

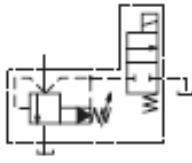

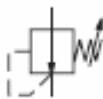
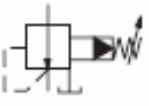
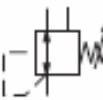
Servo valve, positive overlap









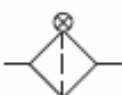







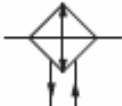


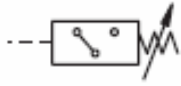

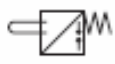
4/3 way servo valve (typical example)



Check valves/ Non-return valves

<p>Check valves/ Non-return valves Check valve, not loaded</p>		<p>Pressure control valves Pressure relief valve, directly operated, internal pilot oil supply</p>	
<p>Check valve, spring loaded</p>		<p>Pressure relief valve, directly operated, internal pilot oil supply external drain port</p>	
<p>Pilot operated check valve, without spring load Valve is held closed by control pressure</p>		<p>Pressure relief valve, pilot operated, internal pilot oil supply and internal pilot oil return</p>	
<p>Pilot operated check valve, with spring bias Valve is opened by control pressure</p>		<p>Pressure relief valve, pilot operated, electrically operated relief, internal pilot oil supply, external pilot oil return</p>	
<p>Shuttle valve</p>		<p>Pressure relief valve, 2-way pressure reducing valve, directly operated, internal pilot oil supply</p>	
		<p>2-way pressure reducing valve, pilot operated, internal pilot oil supply, external pilot oil return</p>	
		<p>3-way pressure reducing valve, directly operated, internal pilot oil supply</p>	

Fluid storage and treatment

<p>Fluid storage and treatment</p>		<p>Measuring devices and indicators</p>	
<p>Ventilated tank</p>		<p>Pressure indicator, general</p>	
<p>Closed tank, pre-charged</p>		<p>Pressure gauge</p>	
<p>Filter</p>		<p>Differential pressure gauge</p>	
<p>Filter with contamination indicator</p>		<p>Fluid level measuring device</p>	
<p>Separator</p>		<p>Thermometer</p>	
<p>Filter with separator</p>		<p>Flow indicator</p>	
<p>Treatment unit comprising: filter, separator, pressure reducing valve, pressure gauge and lubricator</p>		<p>Flow meter</p>	
<p>Cooler with the flow direction of the coolant</p>		<p>Tachometer</p>	
<p>Heater</p>		<p>Hydro-electric pressure switch</p>	
<p>Temperature controller</p>		<p>Limit switch</p>	
		<p>Analogue transformer</p>	