

# GENERAL ENGINEERING



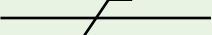





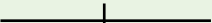














## HYDRAULIC & PNEUMATIC SYMBOLS

### HYDRAULIC & PNEUMATIC SYMBOLS

ISO 1219-1 covers graphic symbols for both hydraulic and pneumatic equipment. For circuit diagram layout rules see BS ISO 1219-2.

For port identification and operator marking see ISO 9461 (Hydraulic) or BS ISO 5599 (Pneumatic).

#### Graphic symbols for fluid power systems

	Supply lines, return lines, component enclosure, symbol enclosure
	Pilot (control) line, drain line, flushing line, bleed line
	Electrical control line
	Frame for several components
	Hose assembly
	Drain to tank
	Return to tank
	Connection of two fluid lines (indicated by the connection point ●)
	Two fluid lines crossing (no connection)
  	Hydraulic source of energy
  	Pneumatic source of energy
	Valve control - solenoid
	Valve control - Proportional solenoid
	Valve control - Lever
	Valve control - Pedal
	Valve control - Electro-hydraulic (pilot operated DCV)
	Valve control - Spring
	Valve control - Pneumatic spring
	Valve control - Manual override

## SYSTEMS OF UNITS & CONVERSIONS

### Graphic symbols for fluid power systems

	Hydraulic pump Fixed displacement, one direction of rotation, one direction of flow, internal case drain
	Hydraulic pump Variable displacement, one direction of rotation, two directions of flow, external case drain
	Hydraulic motor Fixed displacement, one direction of rotation, internal case drain
	Hydraulic motor Variable displacement, bi-directional rotation, external case drain

	Compressor: clockwise rotation
	Air motor: one direction of rotation
	1. Diaphragm accumulator 2. Bladder accumulator 3. Piston accumulator 4. Back-up bottle 5. Air reservoir [pressurised]

### Directional control valves (DCV's)

	2/2 Valve (2 ports, 2 positions)
	3/2 Valve (3 ports, 2 positions)
	3/2 Poppet valve (reversible flow, leak-free closure)
	4/2 Valve (4 ports, 2 positions)
	5/2 Valve (5 ports, 2 positions)

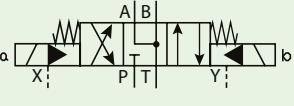
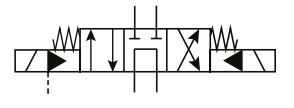
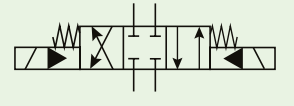
### Direct operated (by solenoid) DCV's

	4/2 "spring return" or "spring offset" DCV
	4/2 "detented" or "impulse" DCV
	4/3 spring centred DCV (open centre spool)
	"force controlled" or "non-feedback" proportional DCV (shown with integral amplifier)

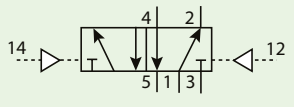
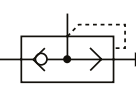
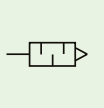
# GENERAL ENGINEERING

## HYDRAULIC & PNEUMATIC SYMBOLS

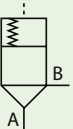
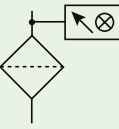
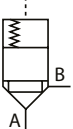

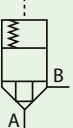

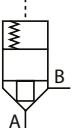
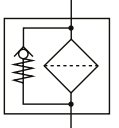
Port and solenoid identification for hydraulic valves according to ISO 9461  
 Electro-hydraulic ("pilot operated" or "two-stage") DCV's. Solenoid operated pilot stage (A and B).  
 Spring centred main stage (various spool configurations shown).

	External pilot supply (X), external pilot drain (Y)
	External pilot supply, internal pilot drain
	Internal pilot supply, internal pilot drain

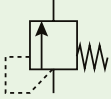
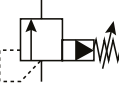
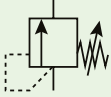
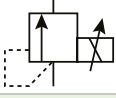
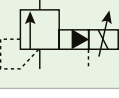




Port identification for pneumatic valves according to ISO 11727






	Direct operated (by pneumatic pilot) 5/2 DCV
	Pneumatic quick-exhaust valve with possibility of connection to the exhaust port
	Pneumatic exhaust silencer with no possibility of connection to the outlet port

2/2 cartridge valves ("slip in valves" or "logic elements")

	Pressure control, normally closed, area ratio: 1		Filter with optical clogging indicator
	Directional control, area ratio: >0.5		Filter with bypass (the enclosure indicates that the component has two or more main functions that are connected to each other)
	Directional control, area ratio: <0.5		Cooler (with no indication of the cooling fluid flow path)
	Directional control, area ratio: <0.5 (with damping nose or throttle nose)		Heater (with no indication of the heat exchange fluid flow path)




# GENERAL ENGINEERING HYDRAULIC & PNEUMATIC SYMBOLS







	Direct operated ("single-stage") relief valve with adjustable spring
	Pilot operated ("two-stage") relief valve
	Direct operated sequence valve (external spring chamber drain)
	Direct operated proportional relief valve (solenoid acts directly on valve poppet)
	Pilot operated proportional relief valve (external pilot drain)
	Direct operated proportional relief valve (solenoid acts on valve poppet via spring - this type of valve is often equipped with a stroke transducer)
	Direct operated reducing valve
	Pilot operated reducing valve
	Direct operated 3-way reducing valve ("reducing/relieving" valve)

	Check valve without spring (symbol often used for valves with only a light spring)
	Check valve with spring (spring is drawn if its rating is significant)
	Pilot to open check valve ("PO check valve")
	Vented (or "4 port") pilot to open check valve
	Quick connect coupling (this symbol also used for pressure test points)

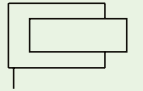
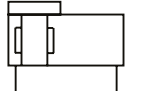
# GENERAL ENGINEERING

## HYDRAULIC & PNEUMATIC SYMBOLS

	Throttle valve with adjustable opening
	Pressure compensated and temperature (viscosity) compensated flow control valve with fixed setting
	Pressure compensated and temperature (viscosity) compensated flow control valve with adjustable setting and reverse flow check valve

	Normally open isolation valve (ball valve, gate valve, globe valve etc. or a fully open needle valve)
	Normally closed isolation valve (ball valve, gate valve, globe valve etc. or a fully closed needle valve)
	3 way ball valve ("L" configuration)
	3 way ball valve ("T" configuration)
	3 way ball valve ("inverted T" configuration)
	4 way ball valve ("X" configuration)






### Cylinders (linear actuators)

	Double-acting cylinder (single rod)
	Cylinder with adjustable cushions at each end of stroke
	Single-acting ("plunger") cylinder
	"Rodless" cylinder [band type] with non-adjustable cushioning

# GENERAL ENGINEERING HYDRAULIC & PNEUMATIC SYMBOLS

## Compressed air preparation

	Filter with separator with manual drain
	Filter with separator with automatic drain
	Air dryer
	Lubricator

	Permanent magnet
	Stroke transducer (as used on proportional valves with position feedback)
	Stroke limiter (adjustable)
	Stroke limiter (fixed setting)
	Flowmeter (type of output not shown)