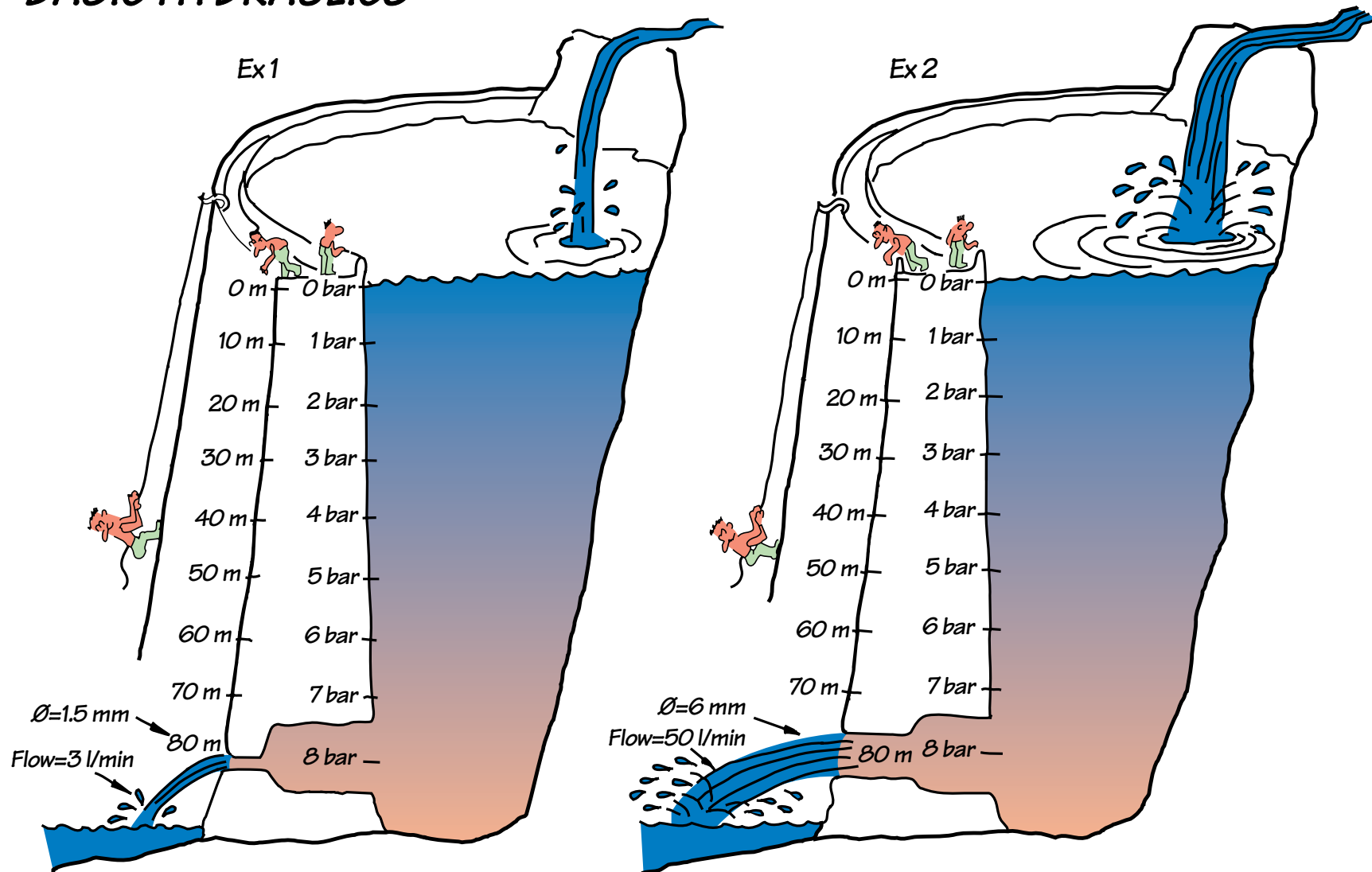


BASIC HYDRAULICS

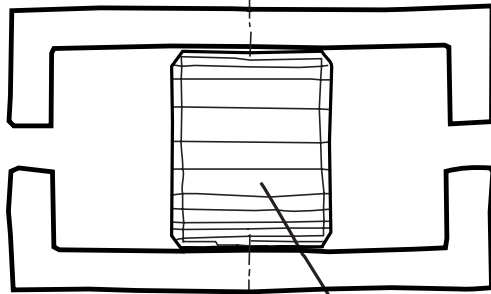


BASIC HYDRAULICS

$$F = P \times A$$

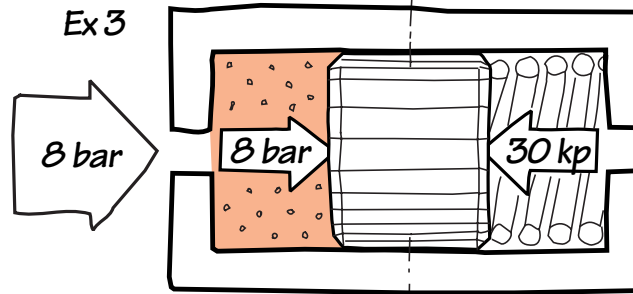
(kp) (bar) (cm²)

Ex1



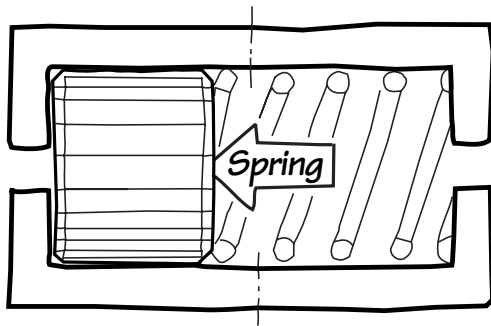
$$\varnothing 2.2 \text{ cm} = 3.8 \text{ cm}^2$$

Ex3

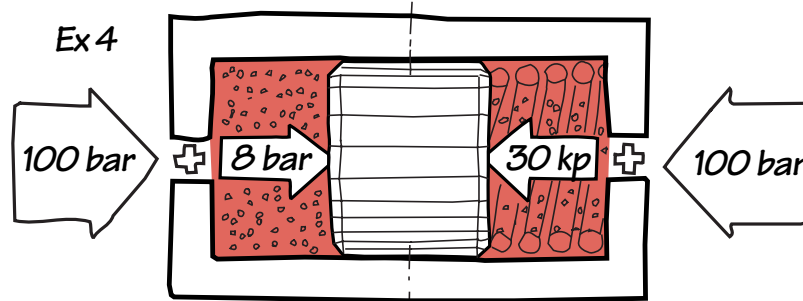


$$8 \text{ bar} \times 3.8 \text{ cm}^2 = 30 \text{ kp} \rightarrow \leftarrow 30 \text{ kp (spring)}$$

Ex2



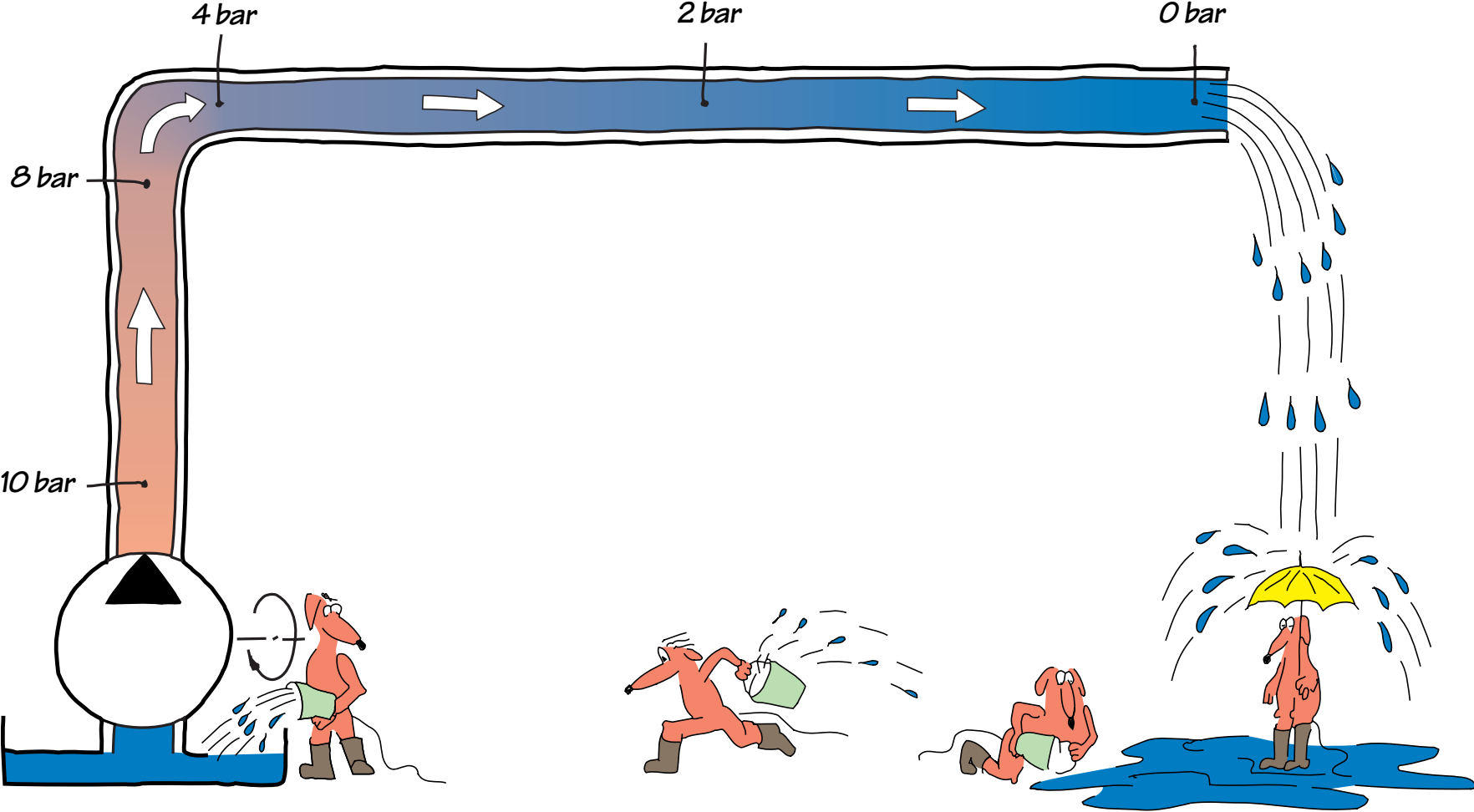
Ex4



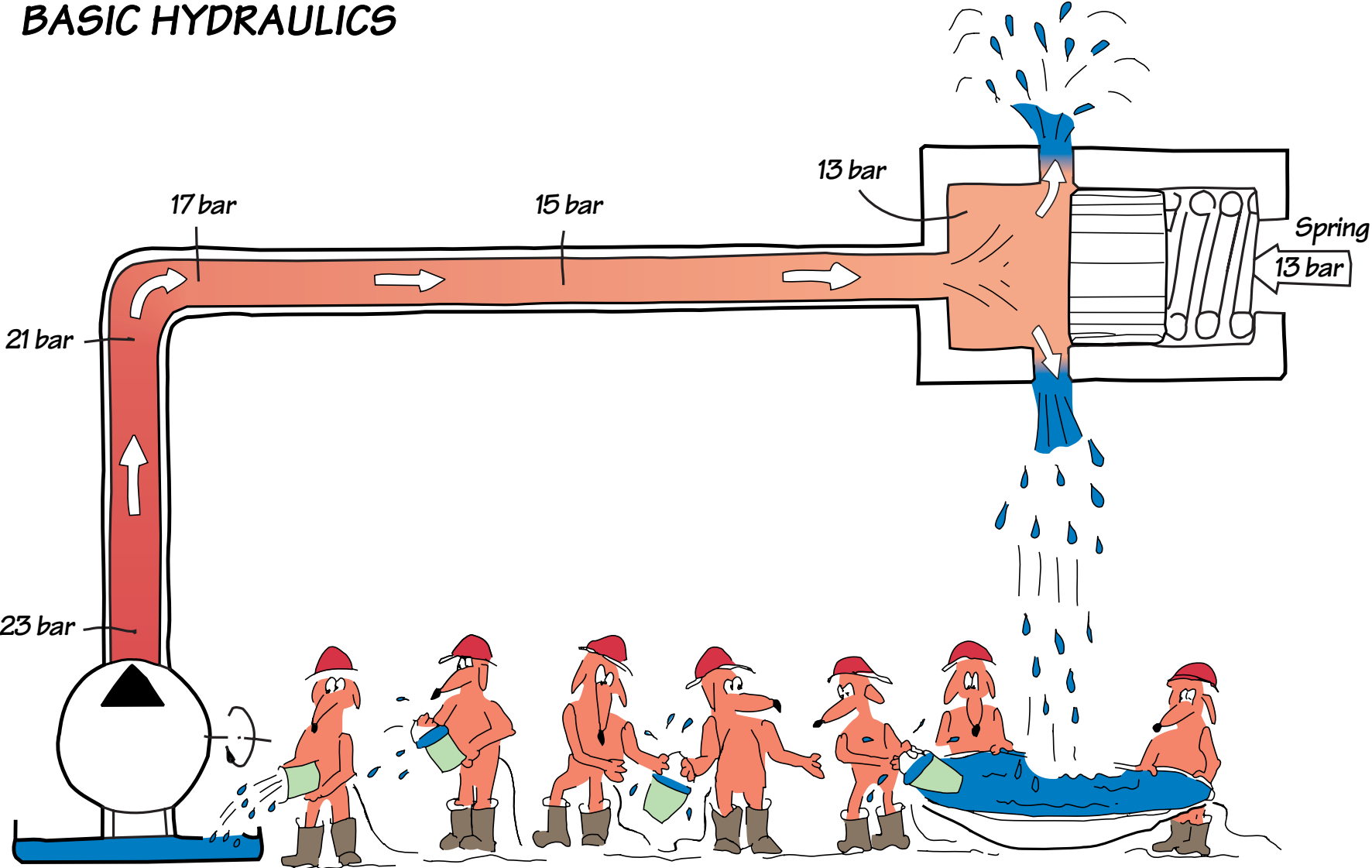
$$(100 \text{ bar} + 8 \text{ bar}) \times 3.8 \text{ cm}^2 = 410 \text{ kp} \rightarrow \leftarrow 30 \text{ kp} + (100 \text{ bar} \times 3.8 \text{ cm}^2) = 410 \text{ kp}$$



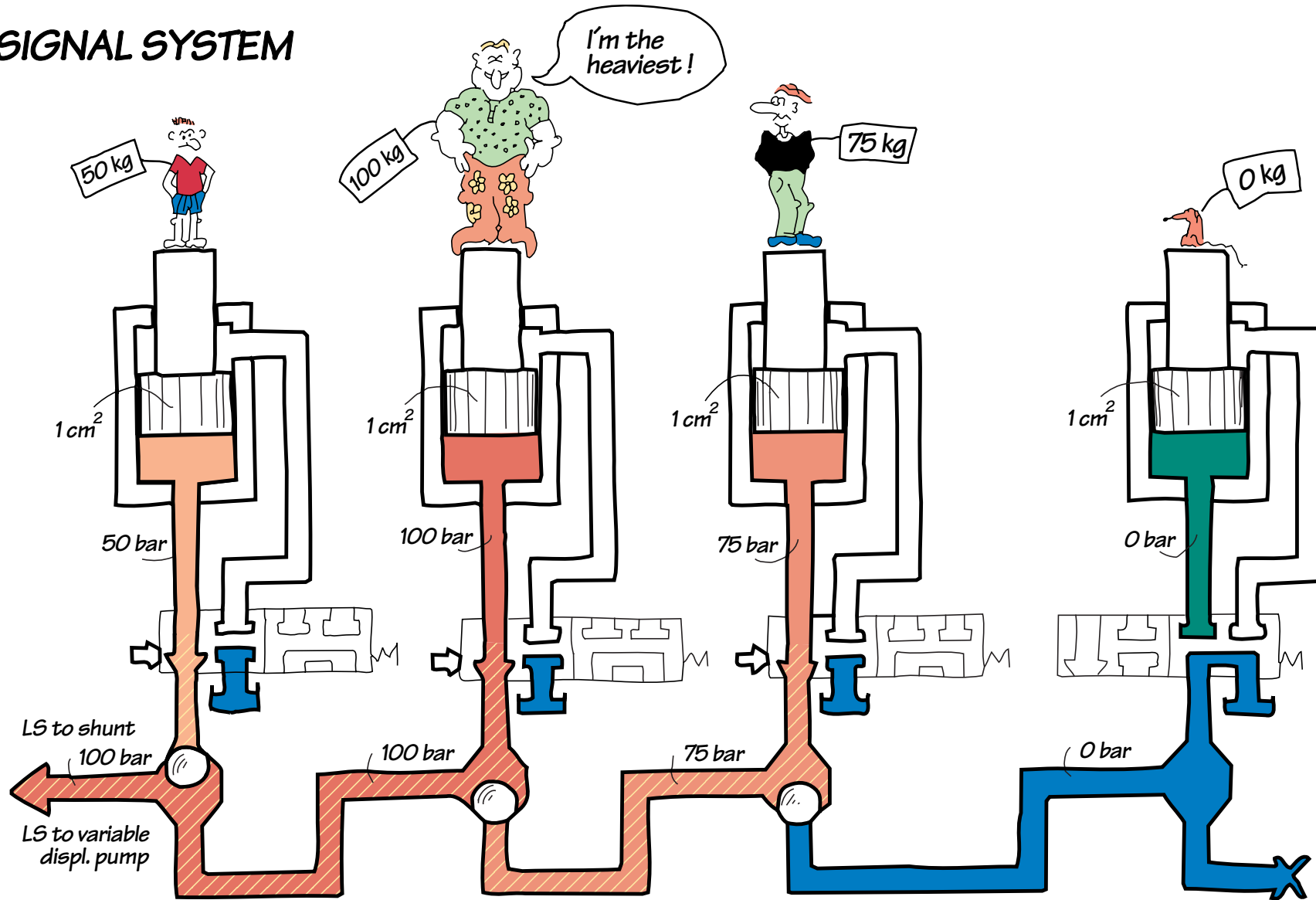
BASIC HYDRAULICS



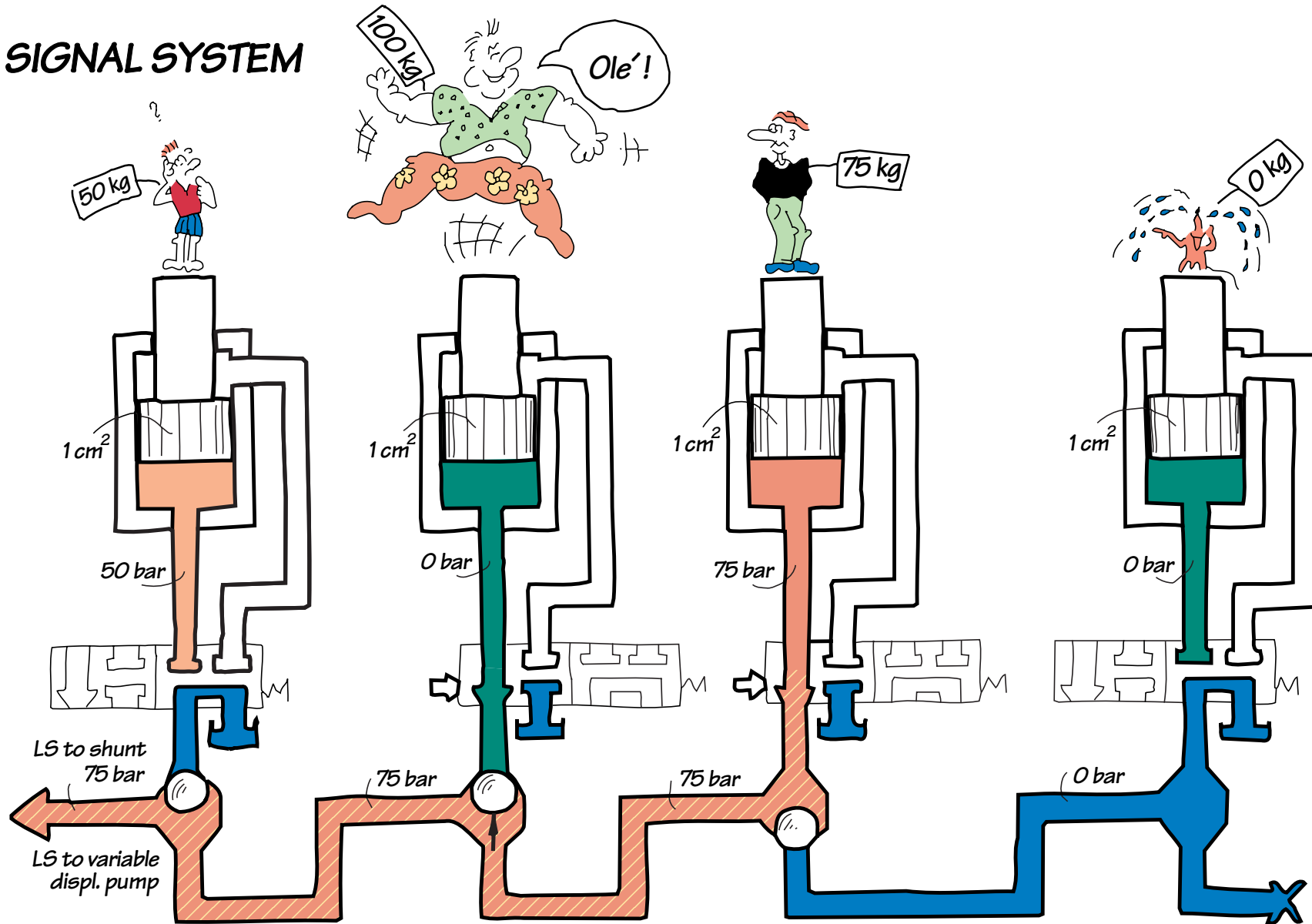
BASIC HYDRAULICS



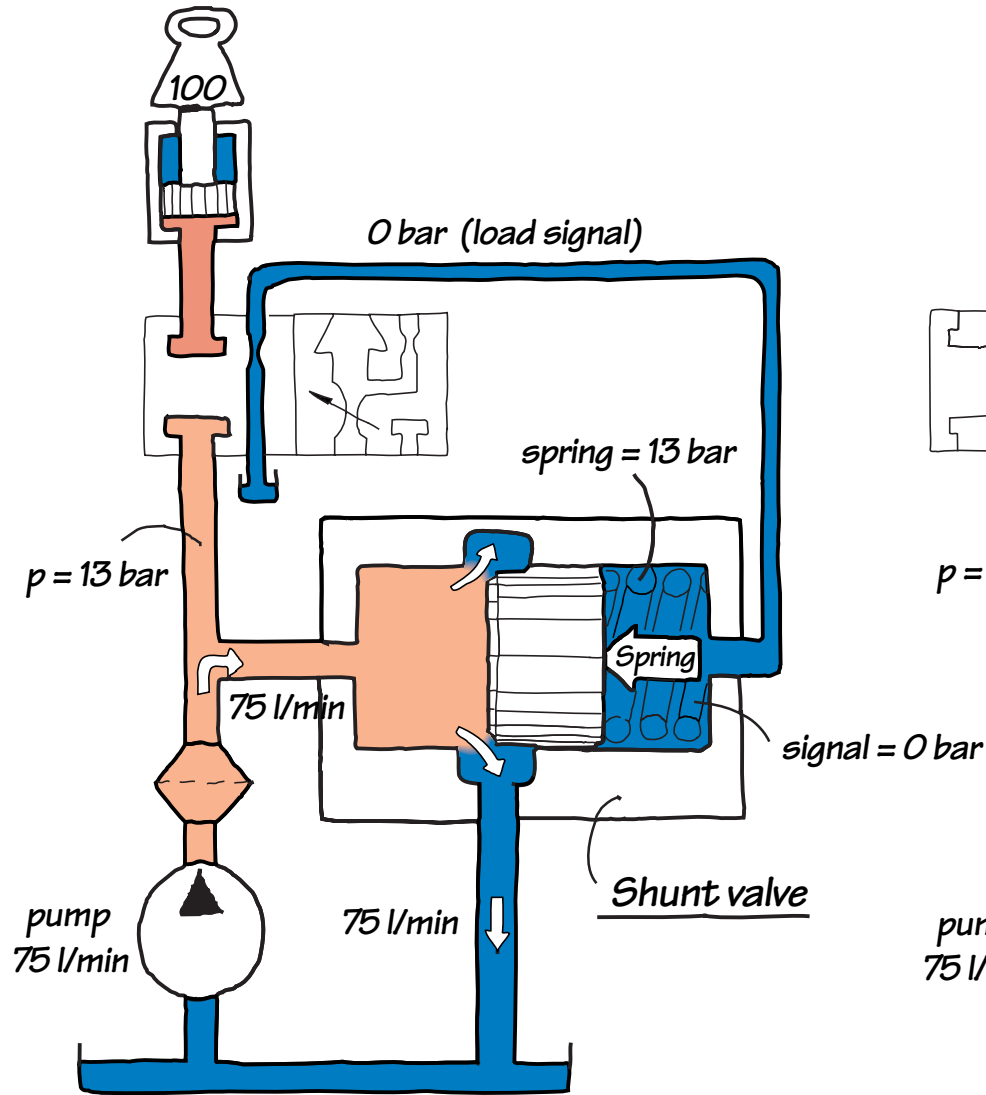
SIGNAL SYSTEM



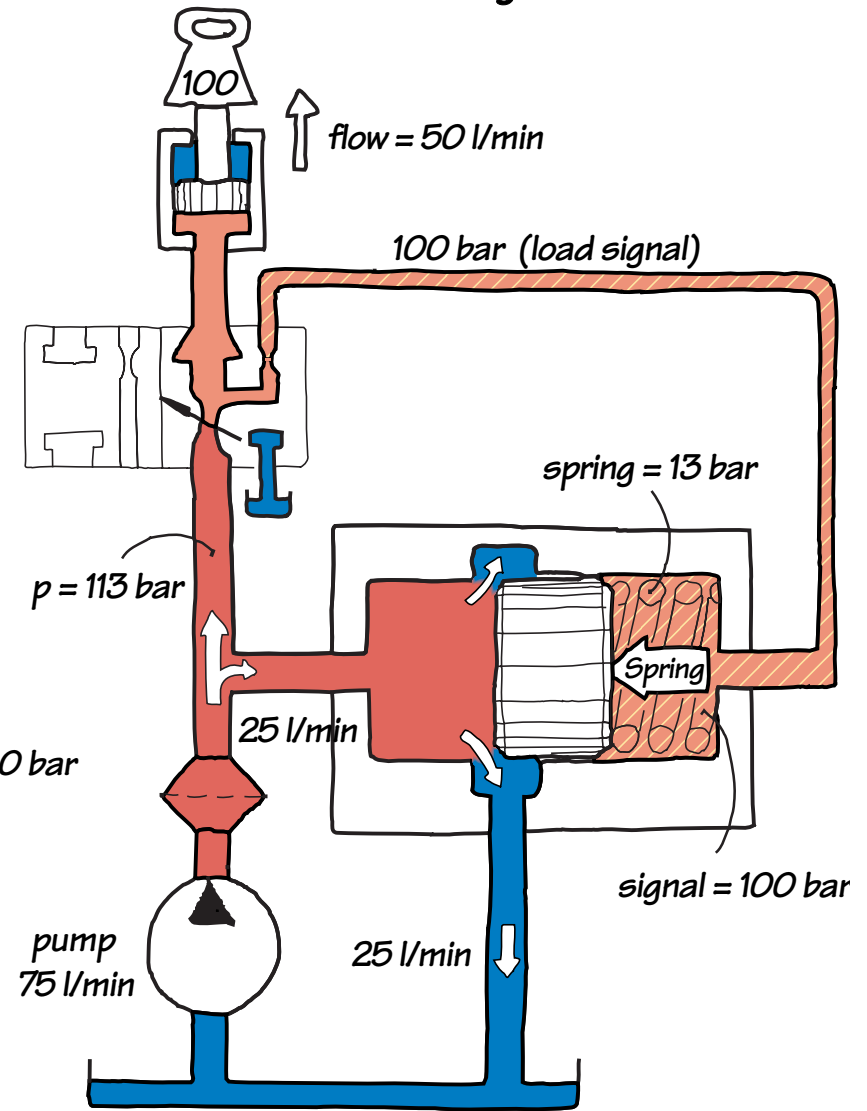
SIGNAL SYSTEM



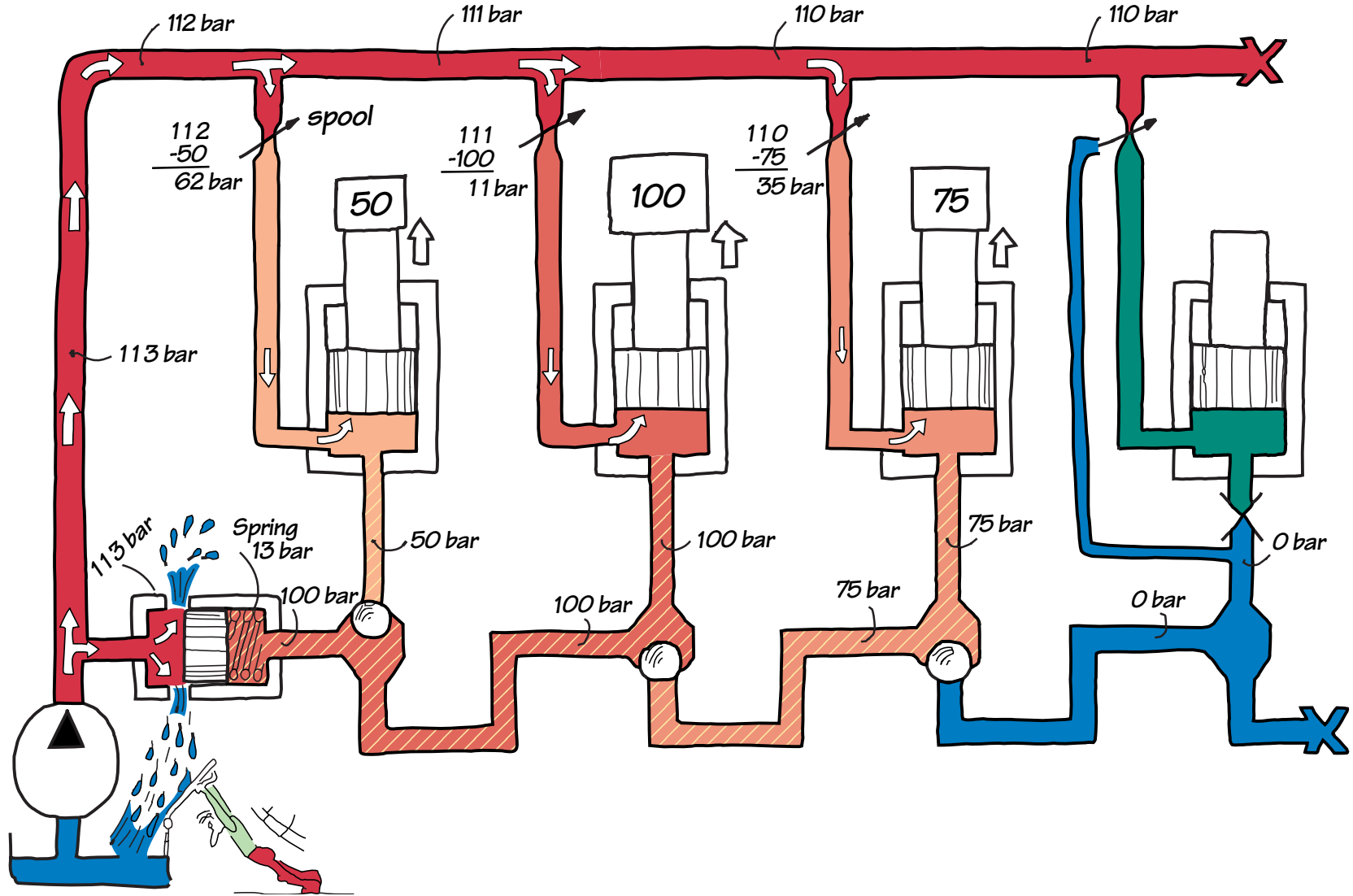
SHUNT VALVE Load signal 0 bar



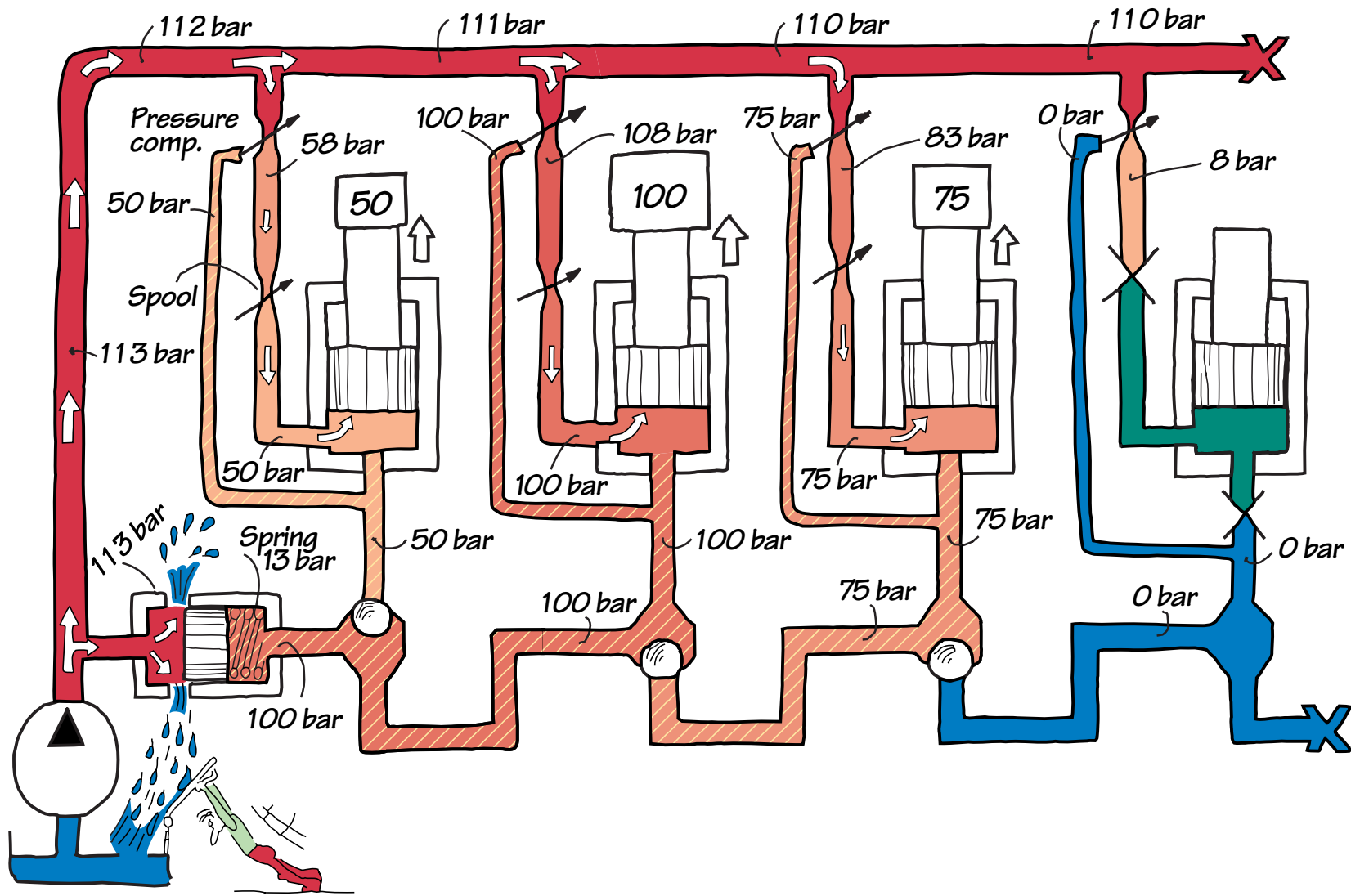
Load signal 100 bar



LOAD-SENSING VALVE

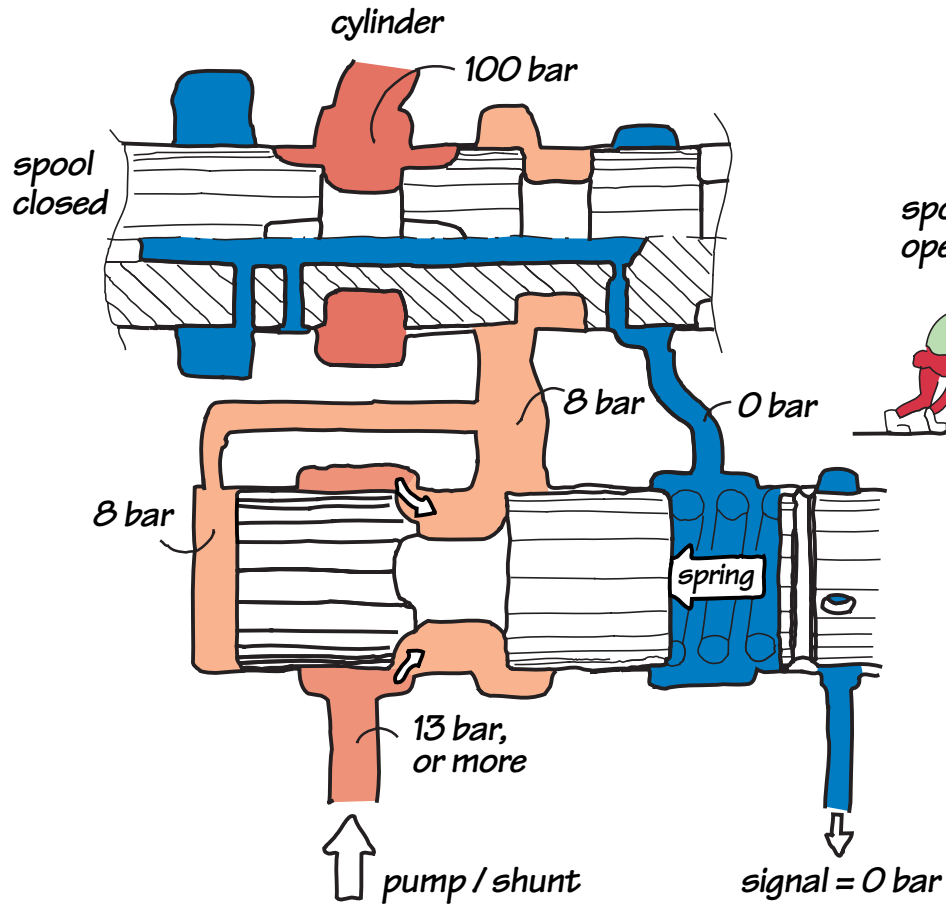


LOAD-SENSING VALVE WITH PRESSURE COMPENSATOR

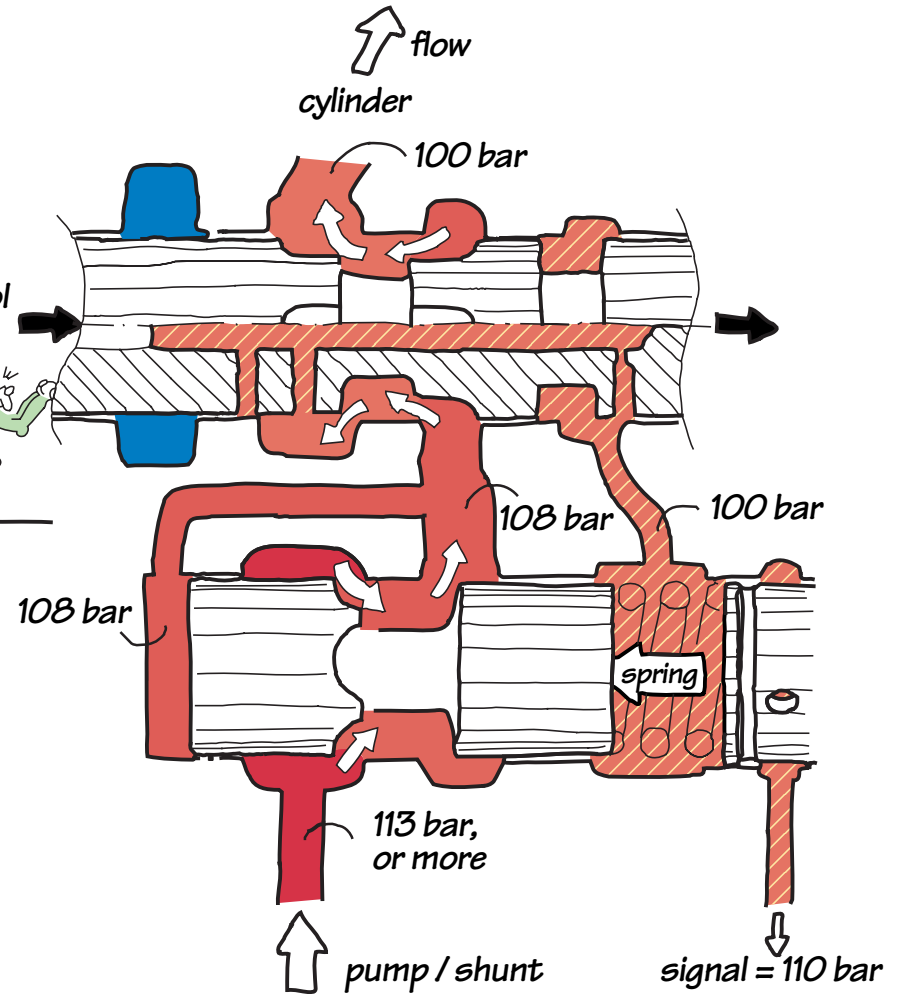


PRESSURE COMPENSATOR

Load signal 0 bar

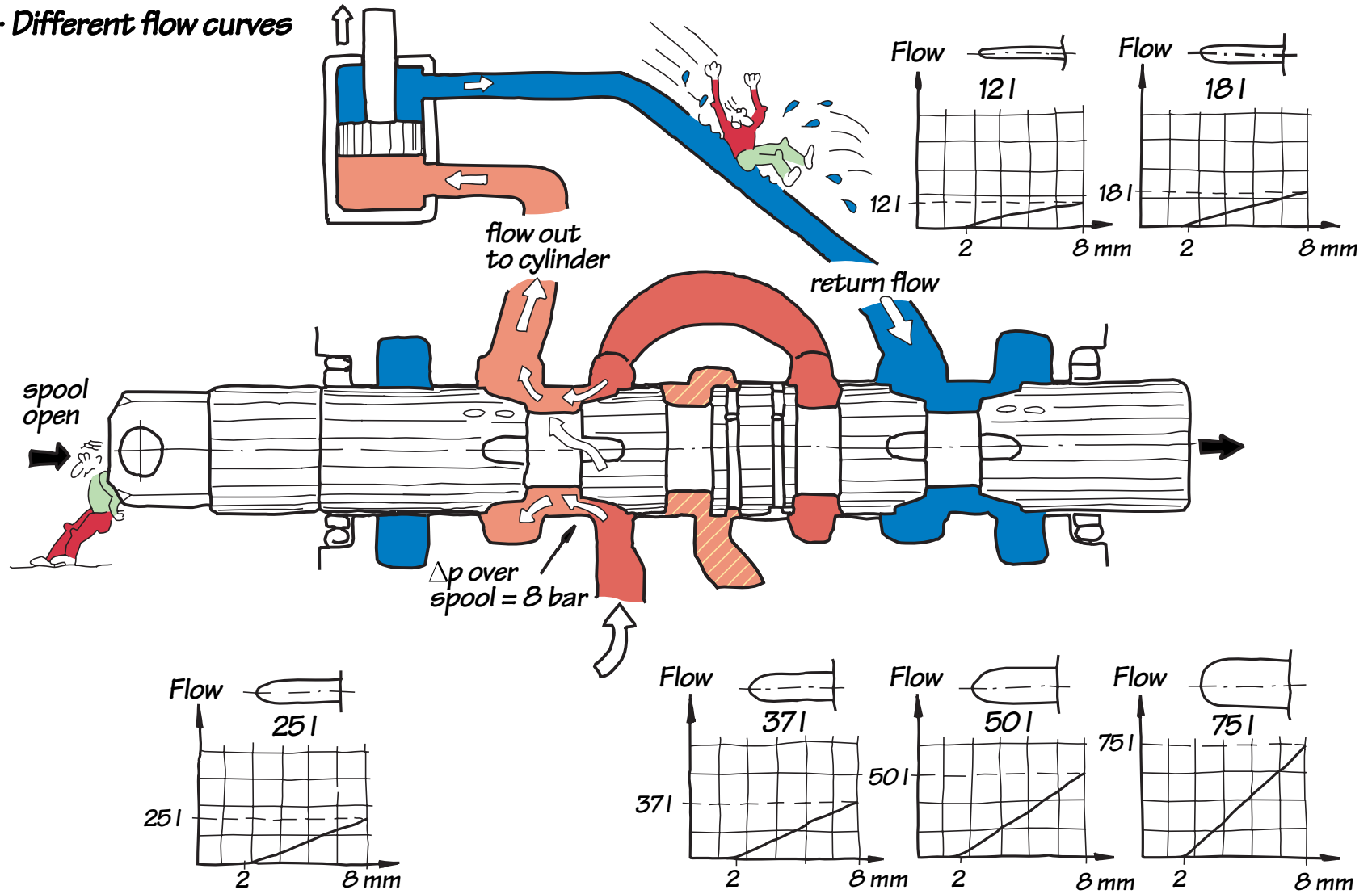


Load signal 100 bar

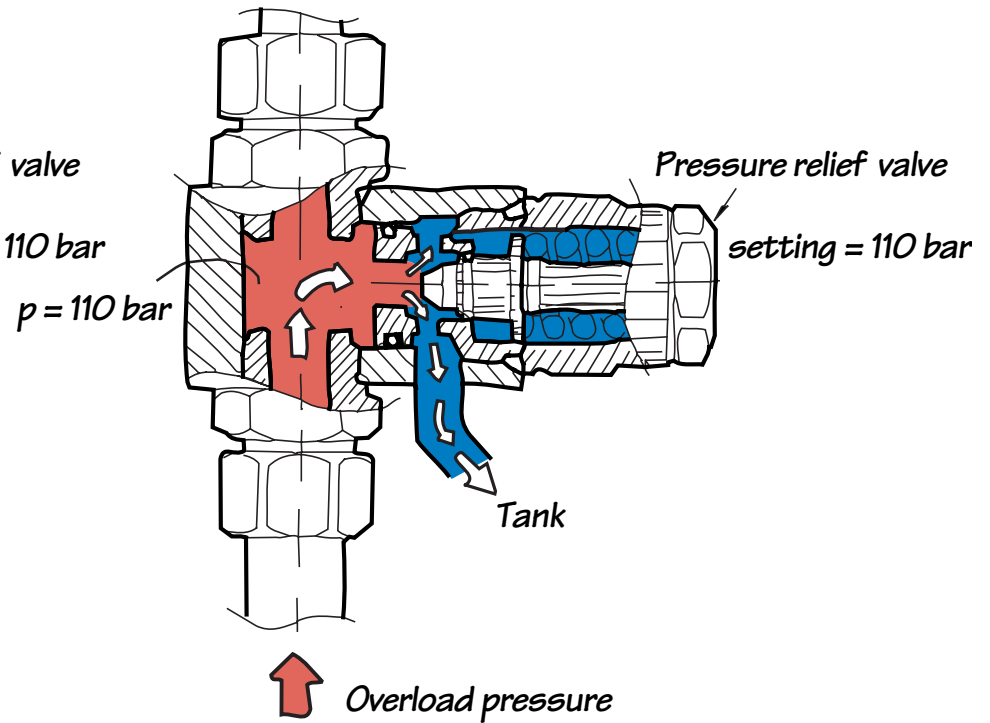
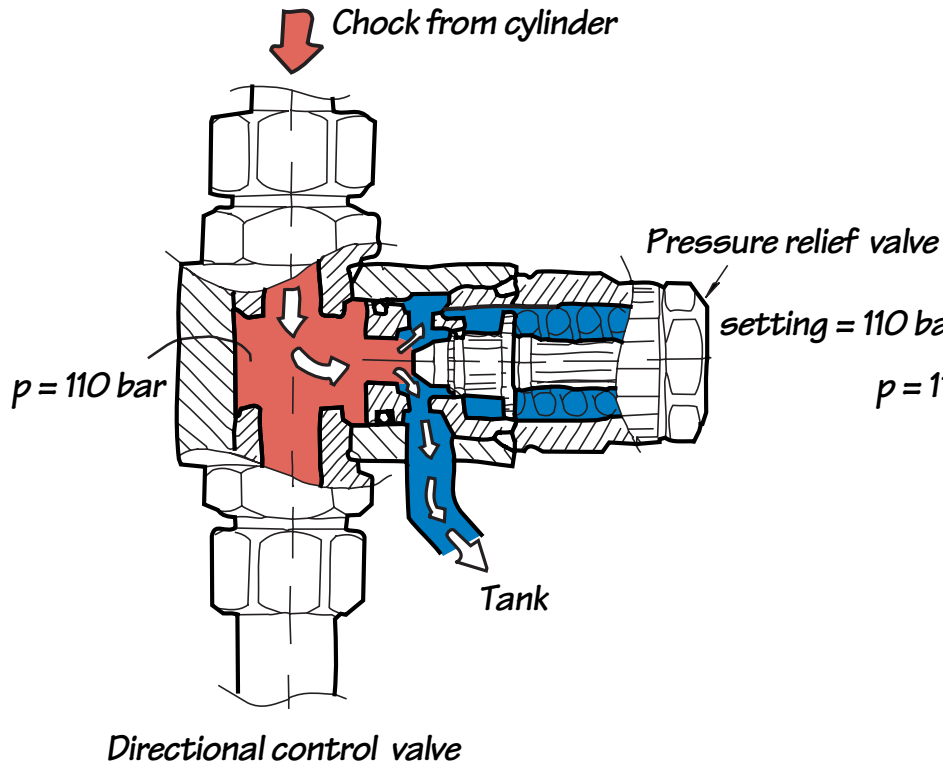
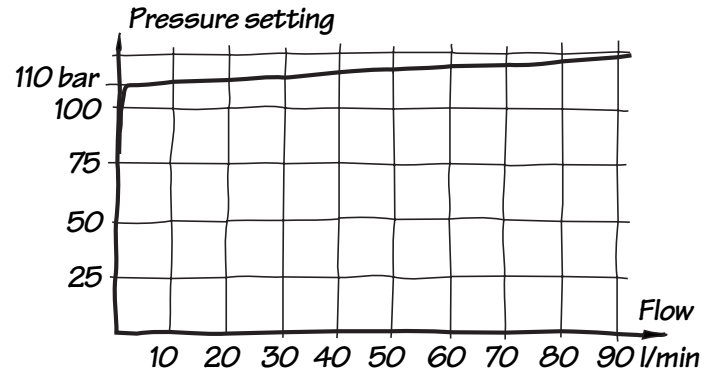


SPOOLS

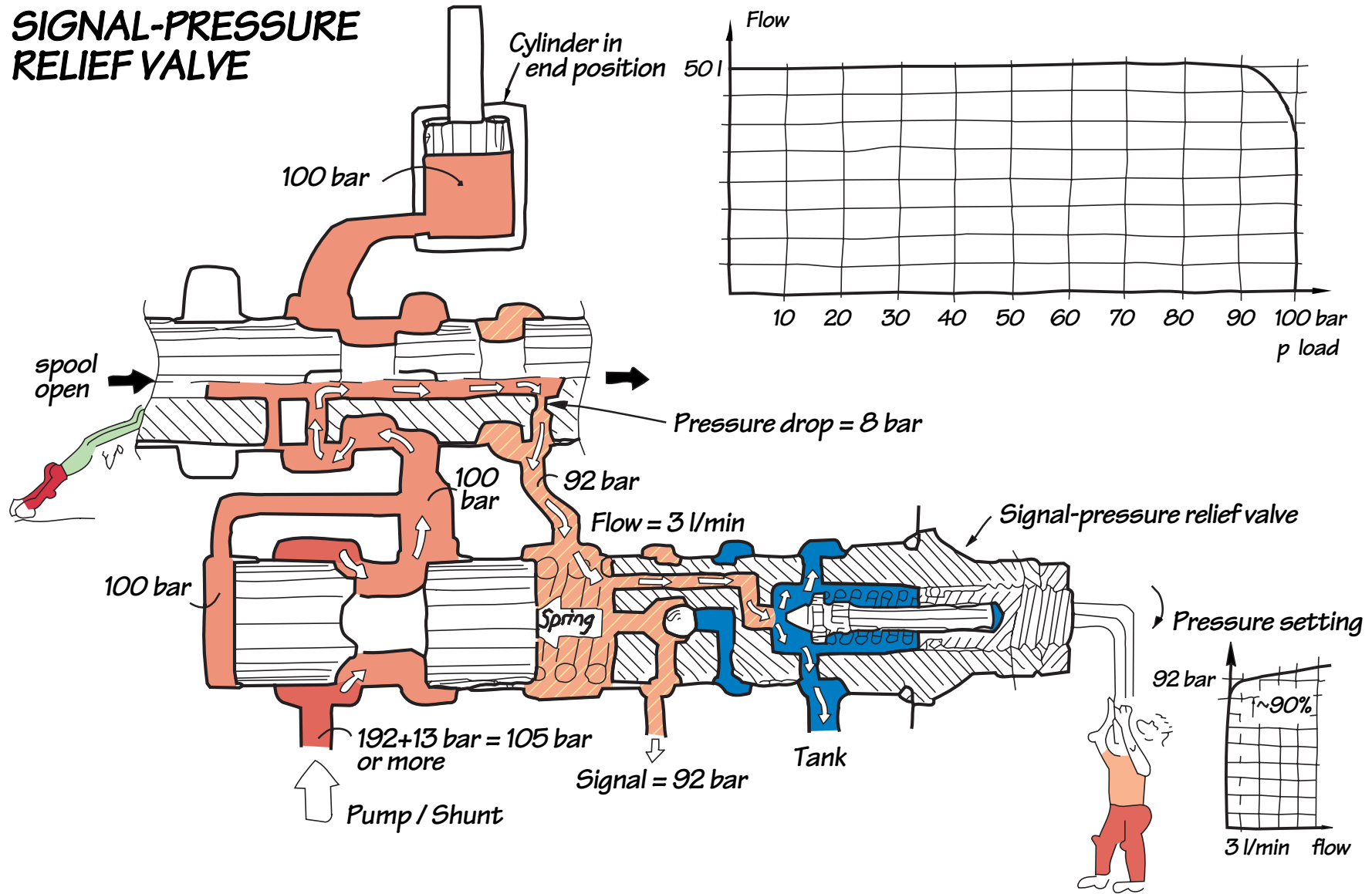
- Different flow curves



PRESSURE RELIEF VALVE (40-valve)

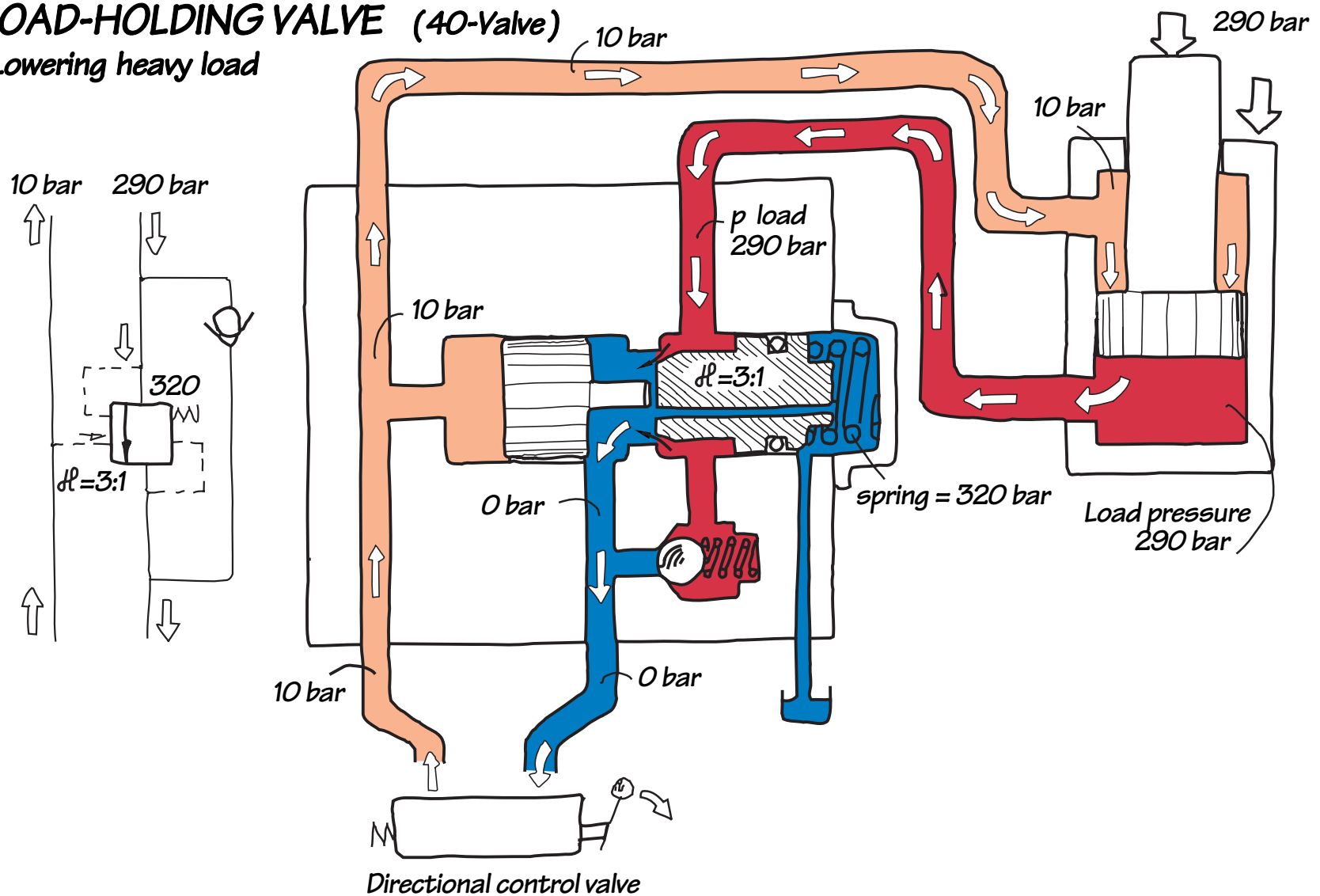


SIGNAL-PRESSURE RELIEF VALVE



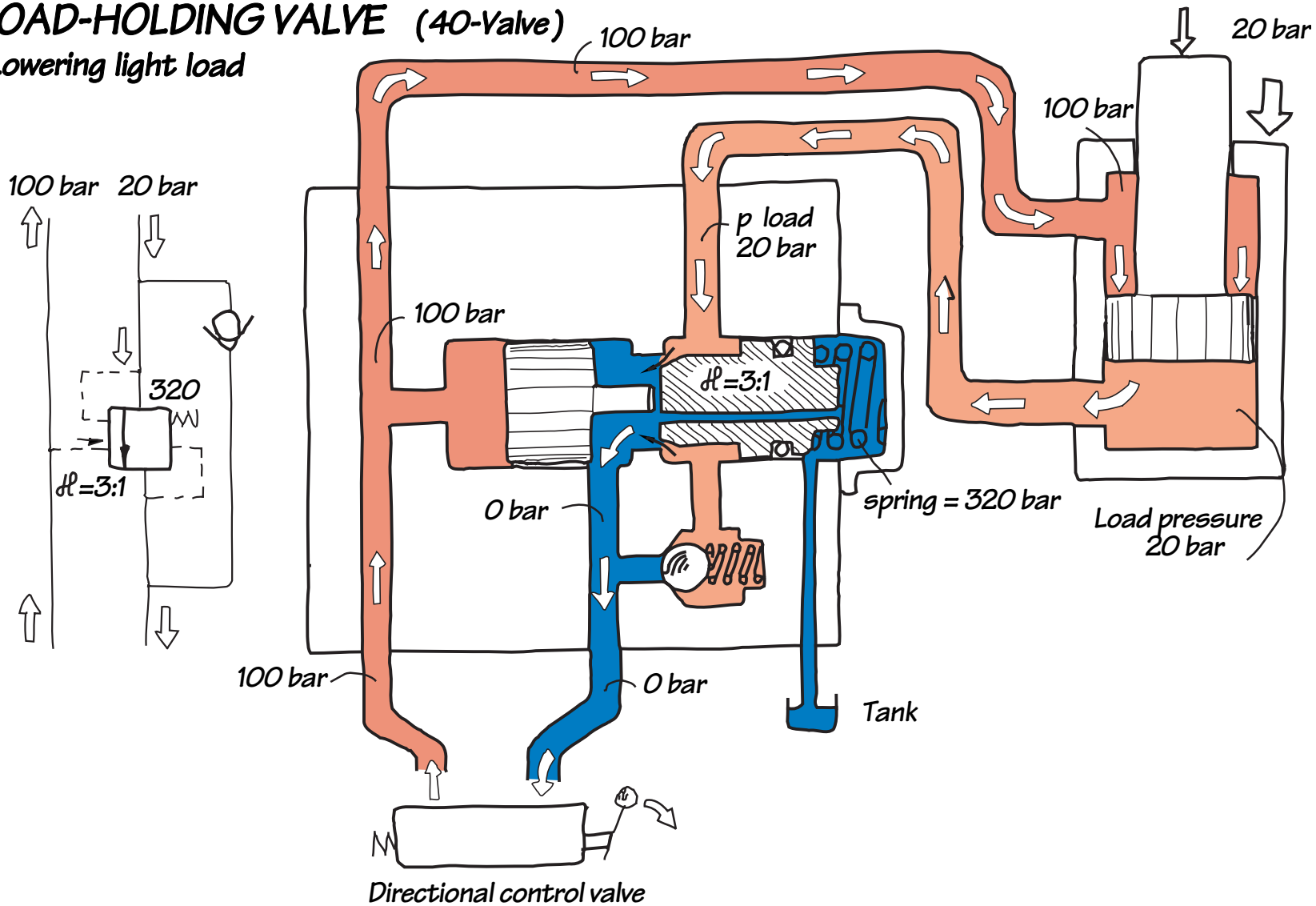
LOAD-HOLDING VALVE (40-Valve)

-Lowering heavy load



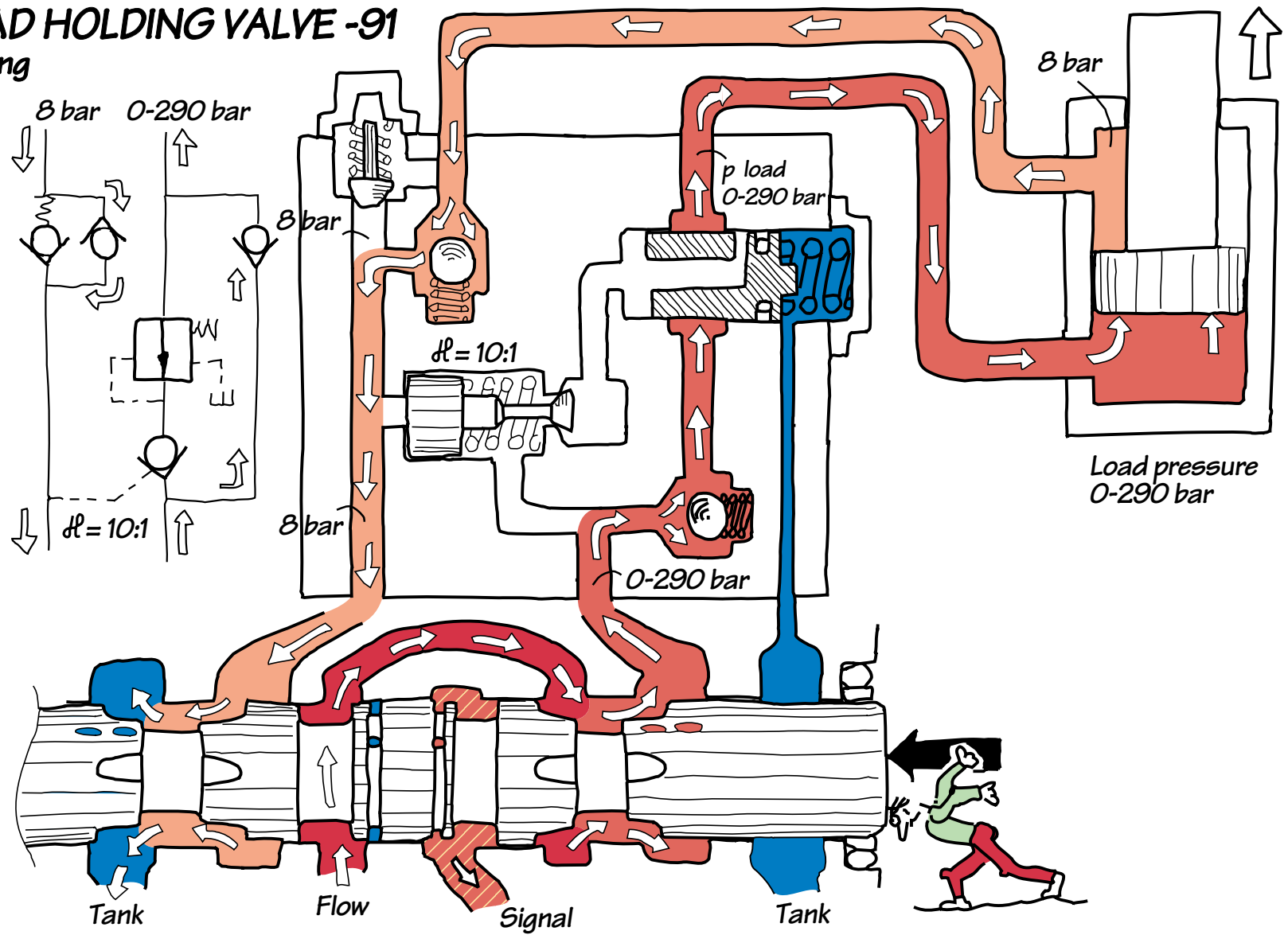
LOAD-HOLDING VALVE (40-Valve)

-Lowering light load



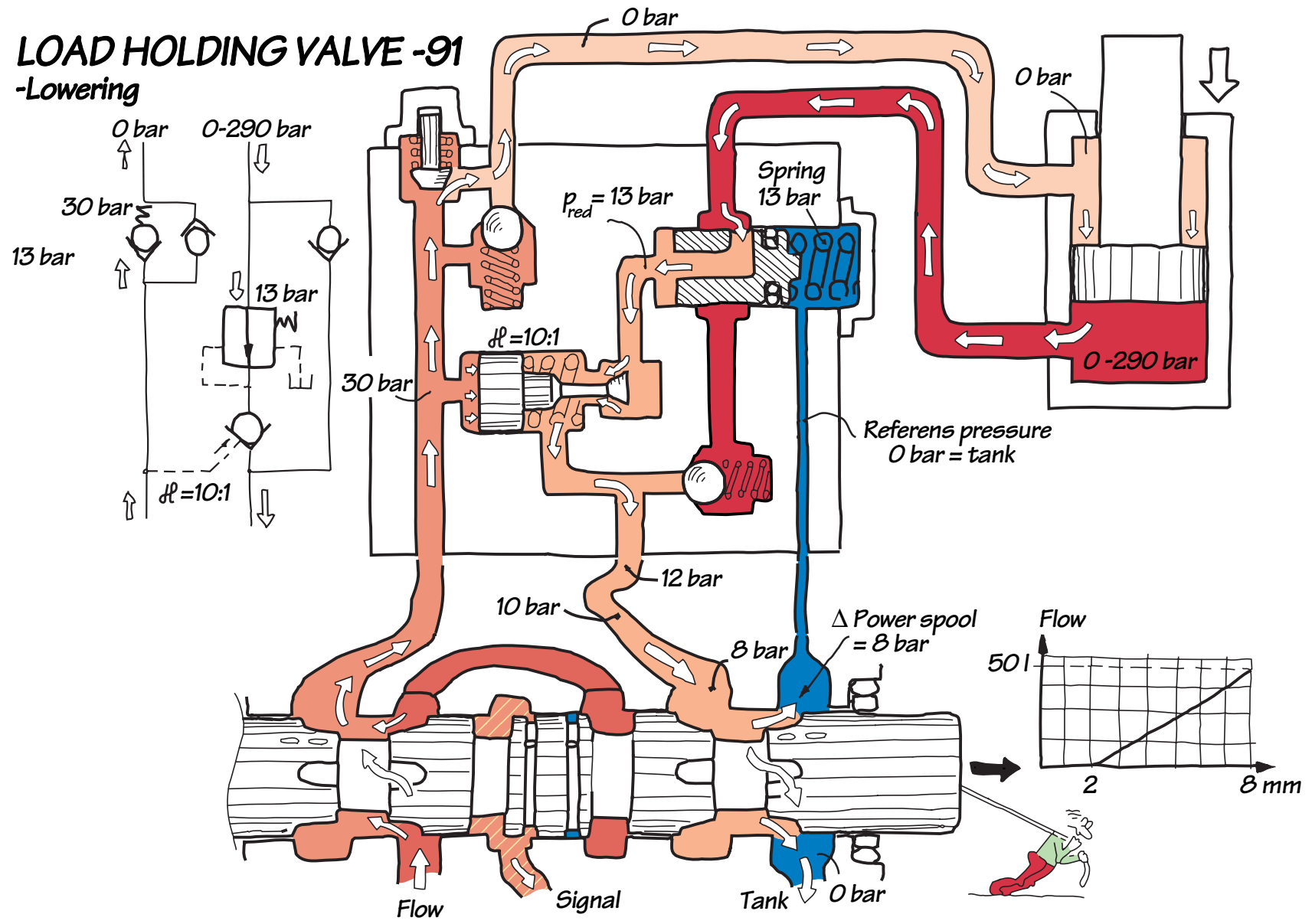
LOAD HOLDING VALVE -91

-Lifting

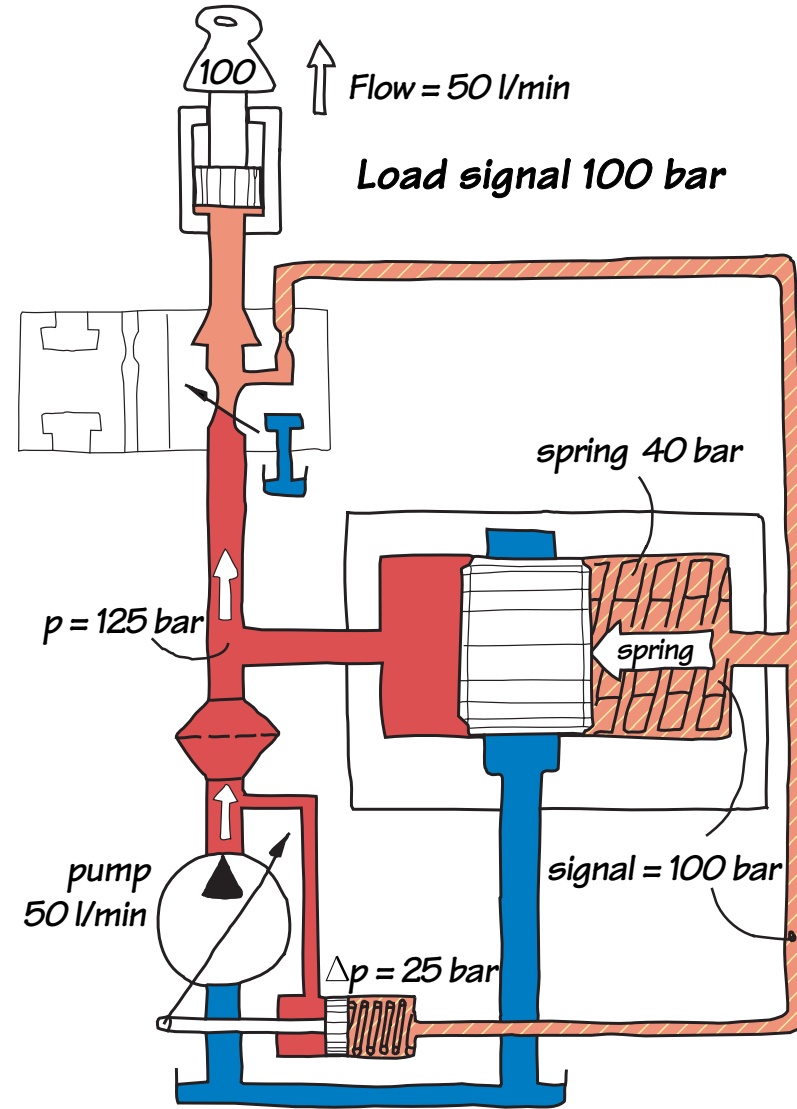
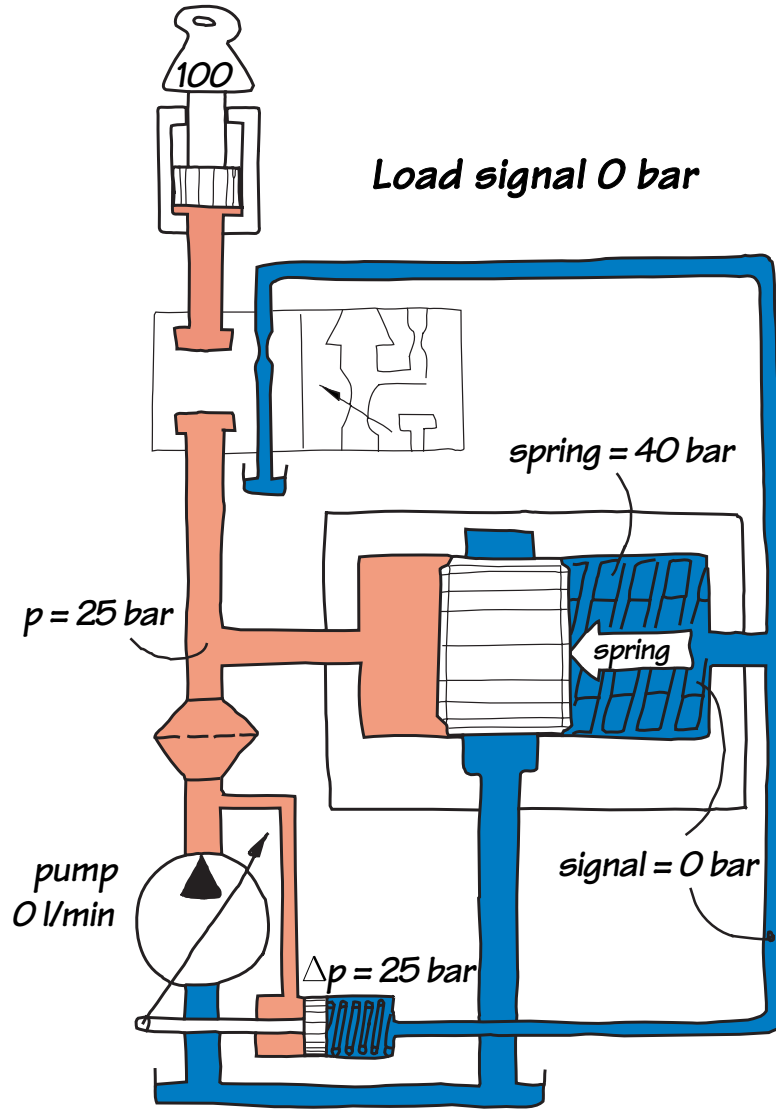


LOAD HOLDING VALVE -91

-Lowering

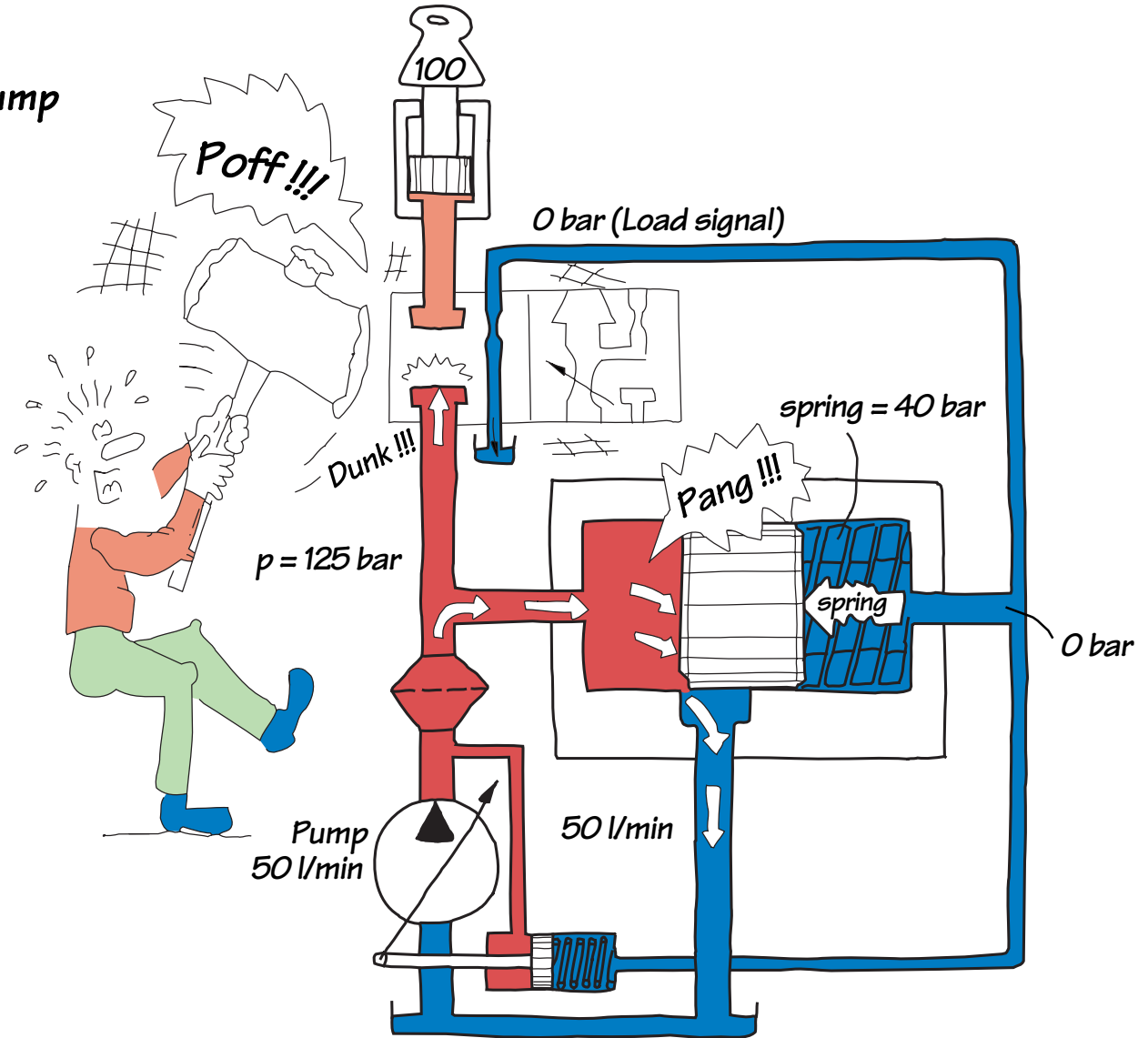


SHUNT FUNCTION Variable displacement pump

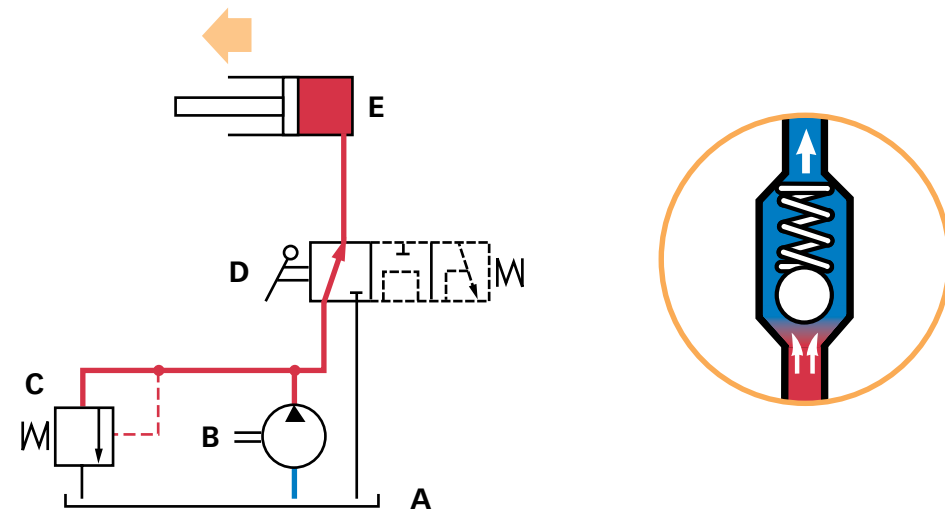
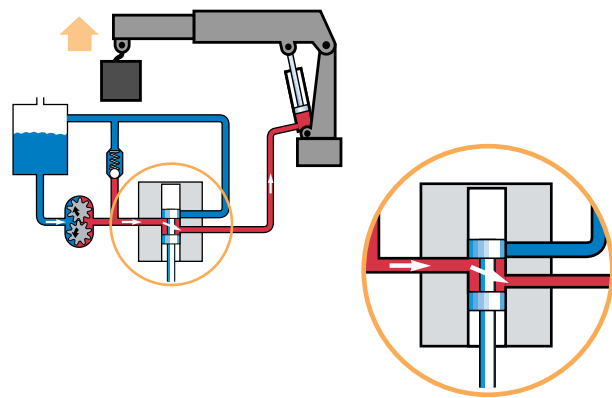
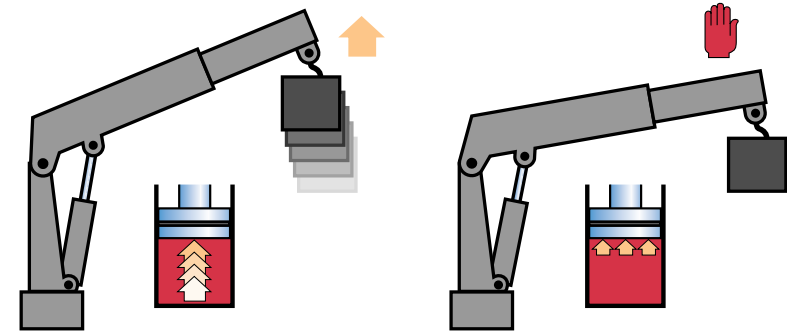
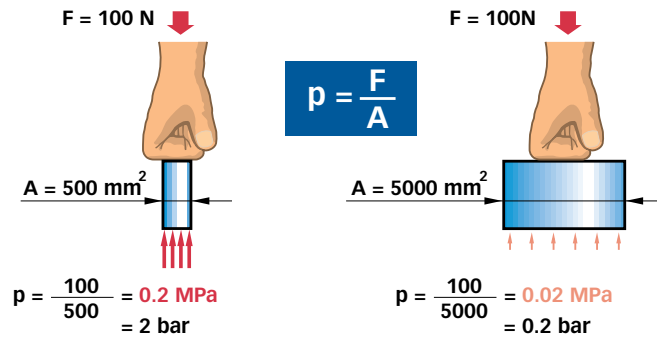


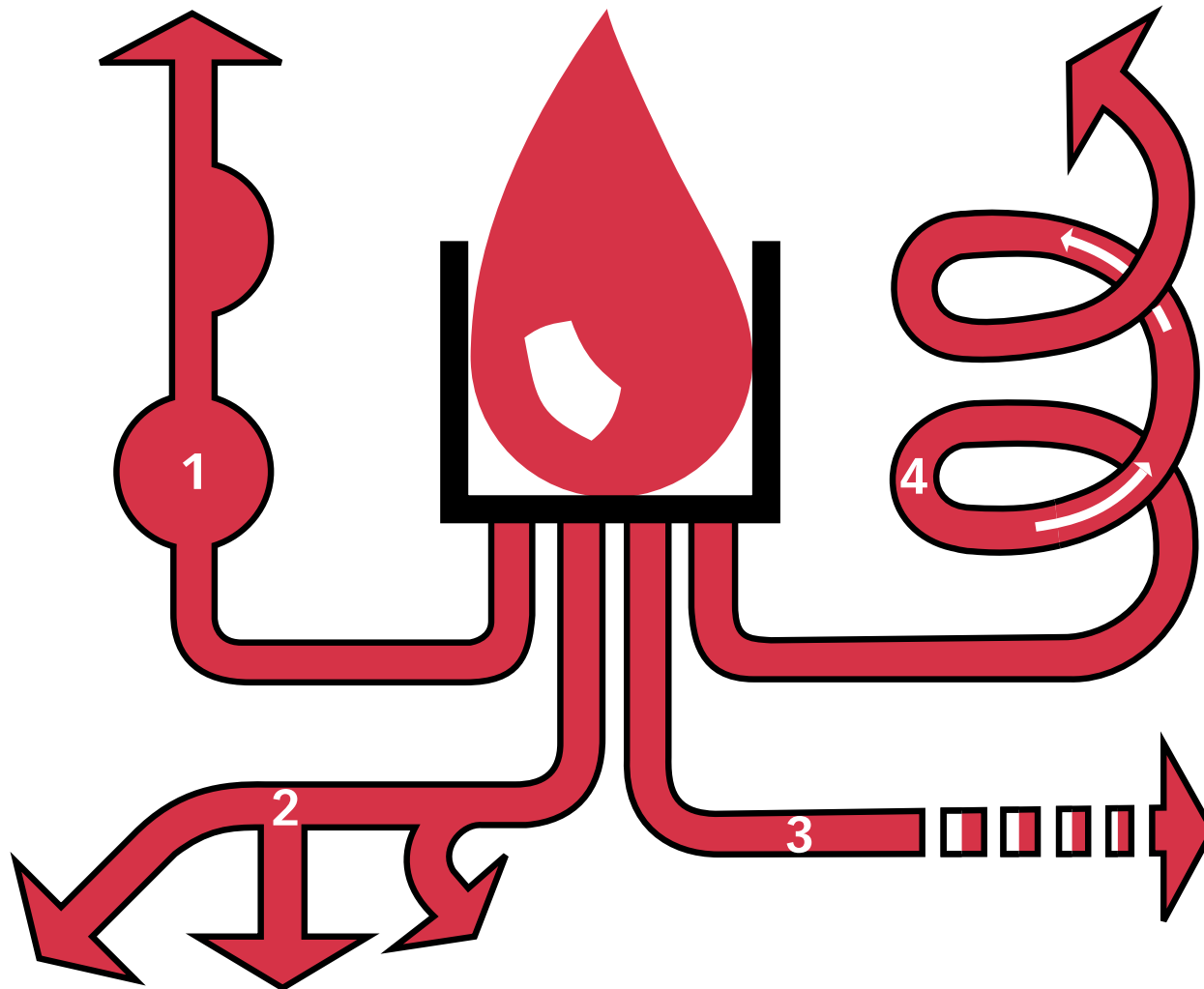
SHUNT FUNCTION

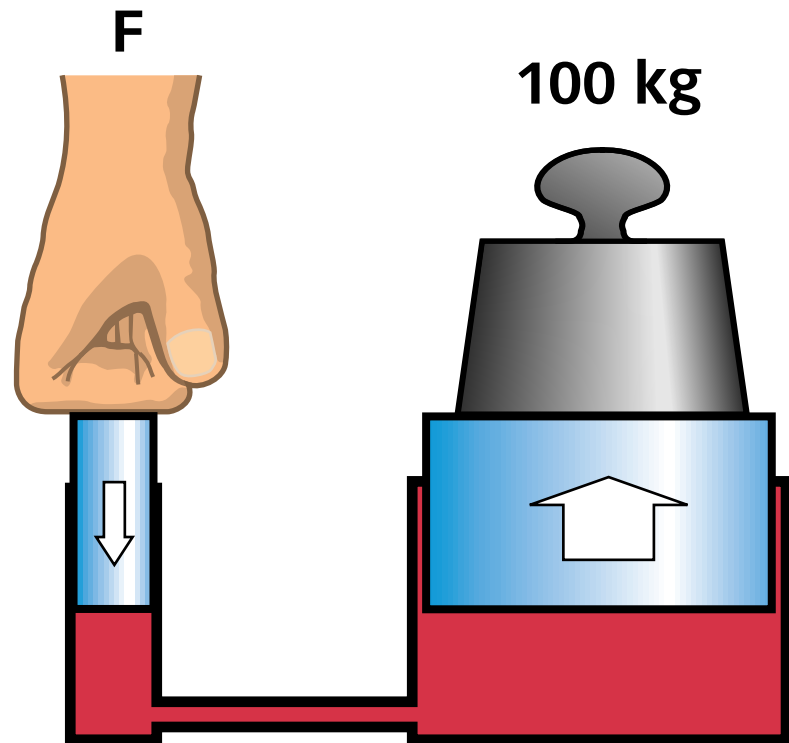
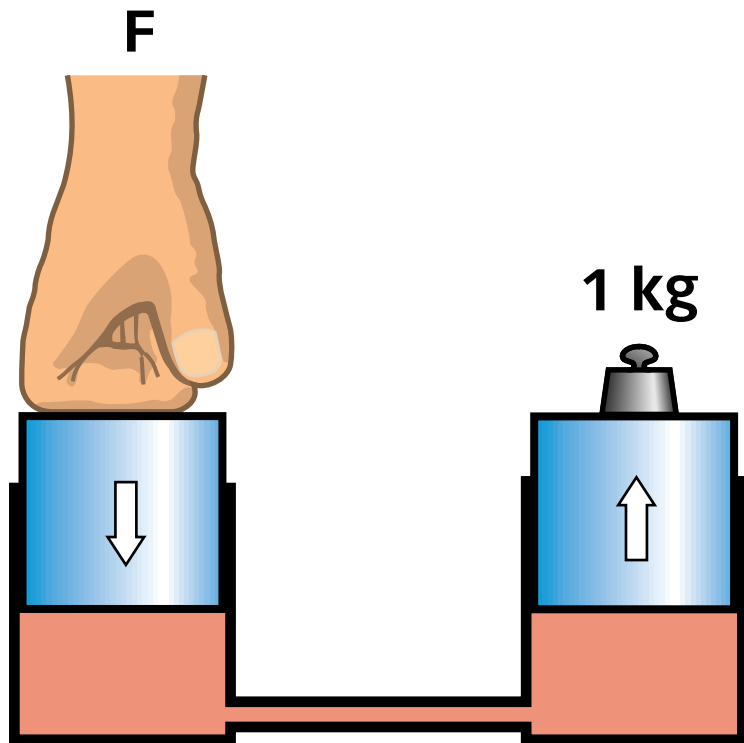
- Variable displacement pump
- Pressure relief valve



Basic Hydraulics





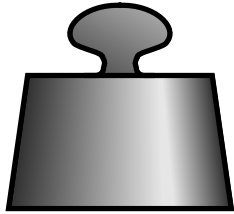


Features of types of energy transfer

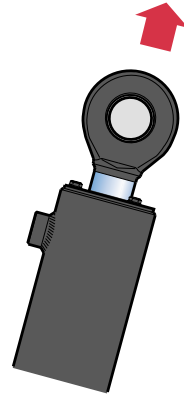
	Hydraulics	Pneumatics	Electrics	Mechanics
Energy source (Drive)	Electric motor Combulsion engine Accumulator	Electric motor Combulsion engine Pressure tank	Power supply Battery	Electric motor Combulsion engine Weight force Tension force (spring)
Energy transfer elements	Pipes and hoses	Pipes and hoses	Electrical cable, magnetic field	Mechanical parts Levers, shafts, etc
Energy carriers	Fluids	Air	Electrons	Rigid and elastic objects
Force density (Power density)	Large, high pressures, large forces, small flow	Relatively small, low pressures	Small, with respect to power weight Electric motor with hydraulic motor	Large, selection and distribution of requied flow is often not as good as in hydraulics
Smoot control (acceleration, deceleration)	Very good via pressure and flow	Good via pressure and flow	Good to very good electrical open loop and closed loop control	Good
Types of movement ≥ of outputs	Linear and rotary movements via hydraulic cylinders and hydraulic motors easily attainable	Linear and rotary movements via pneumatic cylinders and pneumatic motors easily attainable	Primarily rotary movement, linear movement: solenoid - small forces -short forces poss. linear motor	Linear and rotary movements



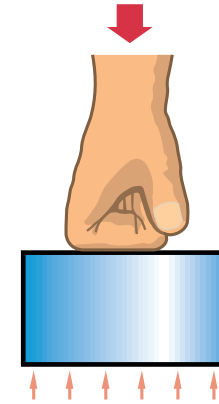
G kg



F N



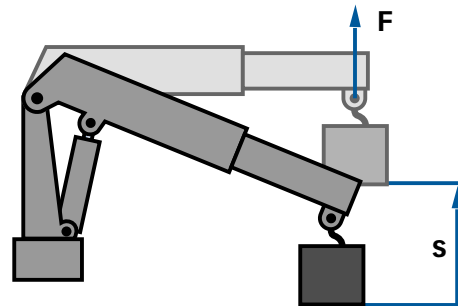
p MPa



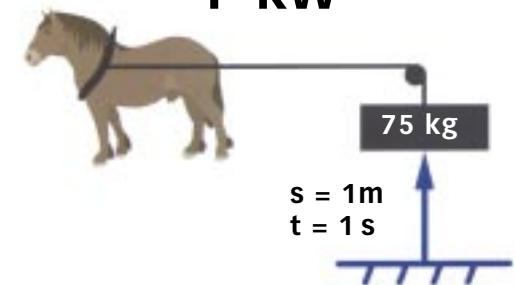
Q l/min



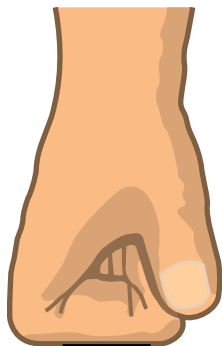
W Nm



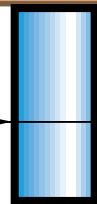
P kW



$F = 100 \text{ N}$



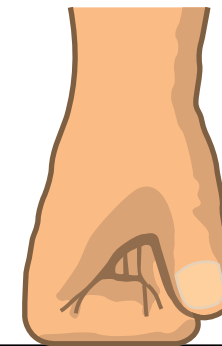
$A = 500 \text{ mm}^2$



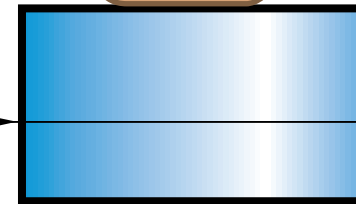
$$p = \frac{100}{500} = 0.2 \text{ MPa} \\ = 2 \text{ bar}$$

$$p = \frac{F}{A}$$

$F = 100 \text{ N}$

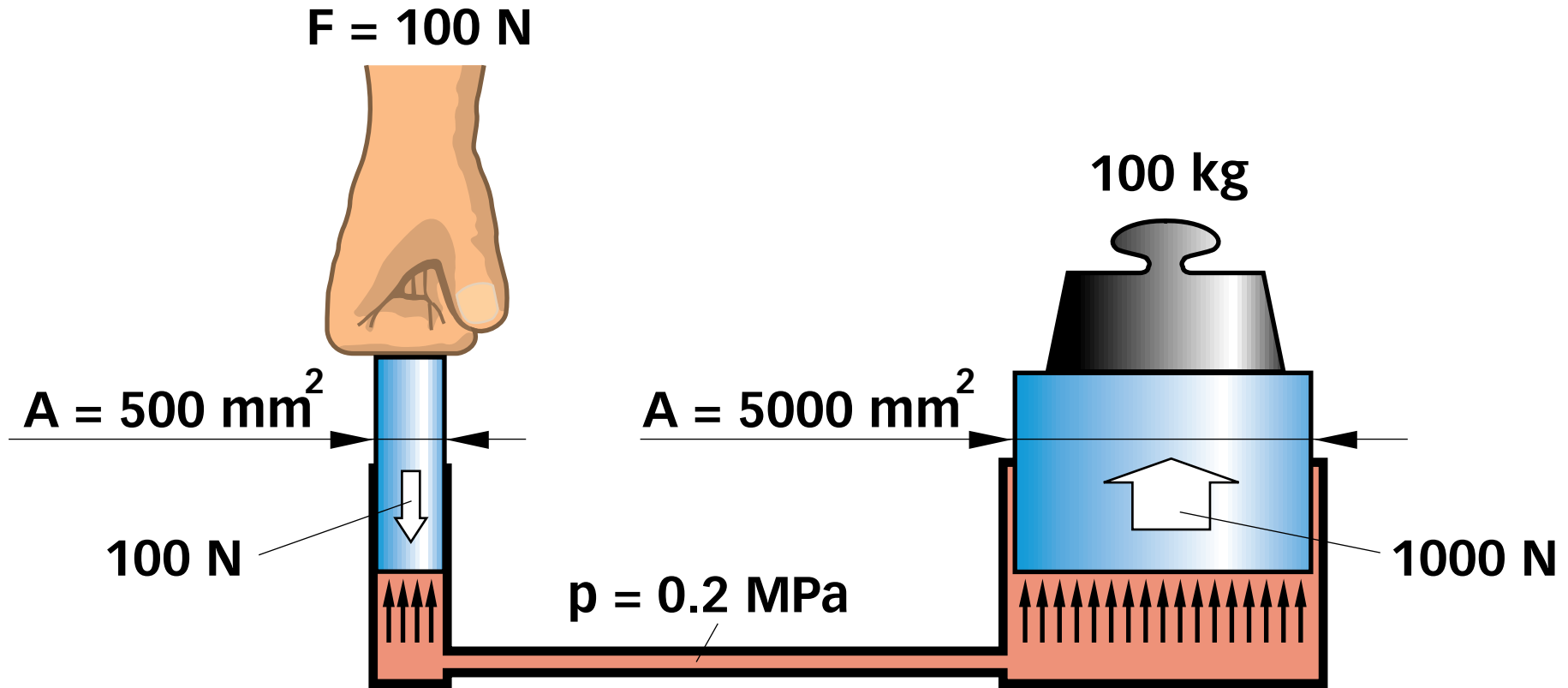


$A = 5000 \text{ mm}^2$



$$p = \frac{100}{5000} = 0.02 \text{ MPa} \\ = 0.2 \text{ bar}$$



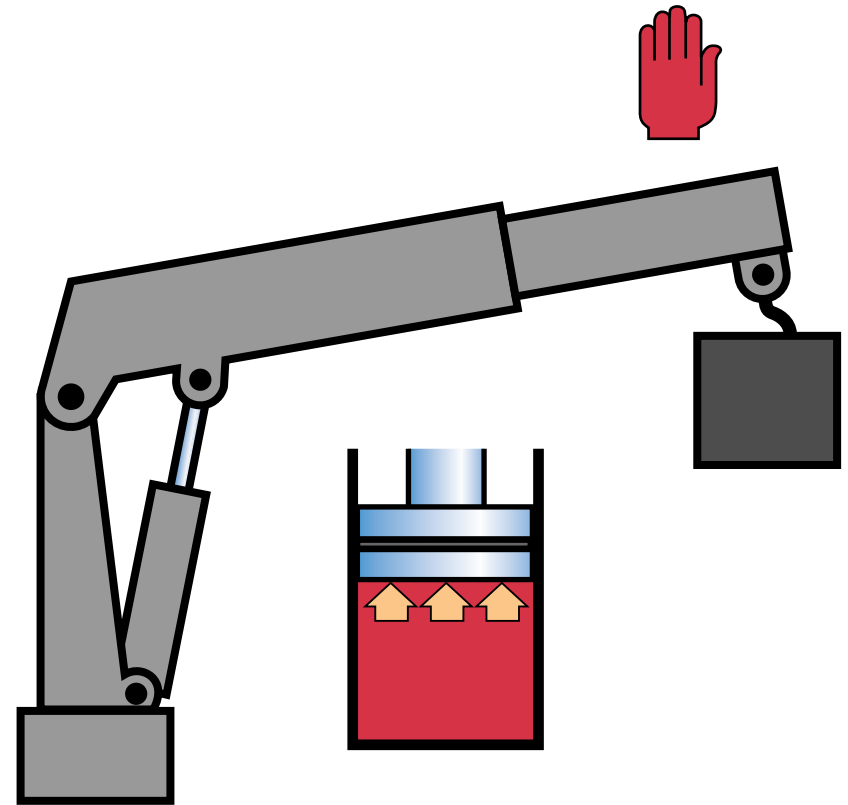
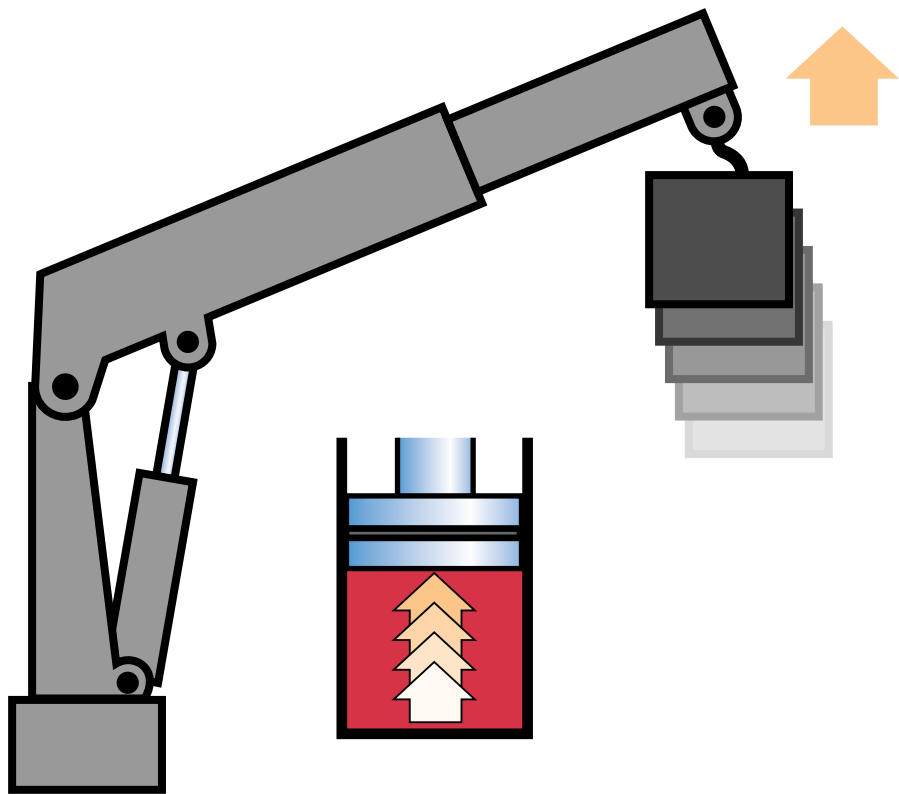


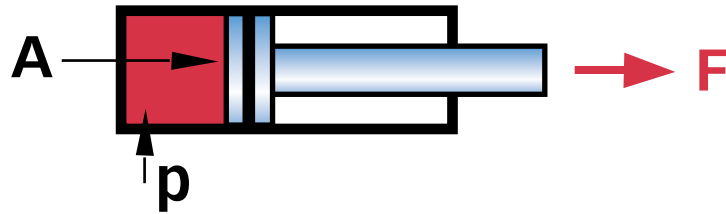
$$p = \frac{F}{A}$$

$$F = p \times A$$

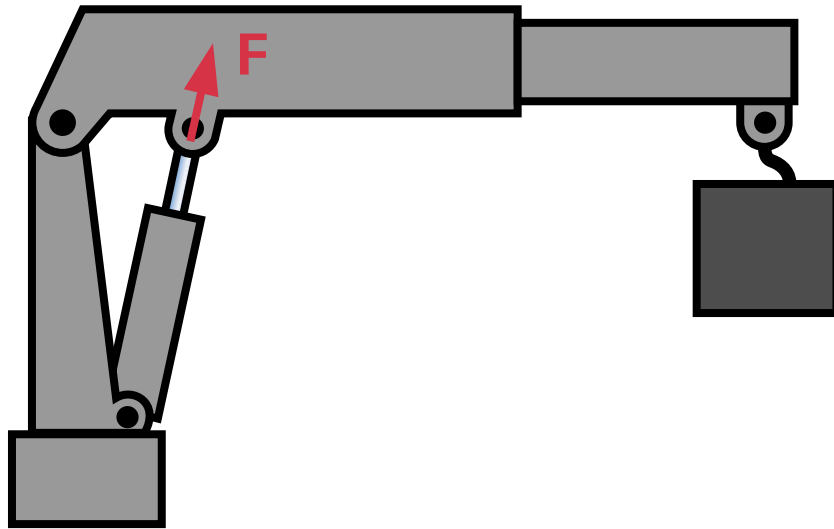
$$p = \frac{100}{500} = 0.2 \text{ MPa} \\ = 2 \text{ bar}$$

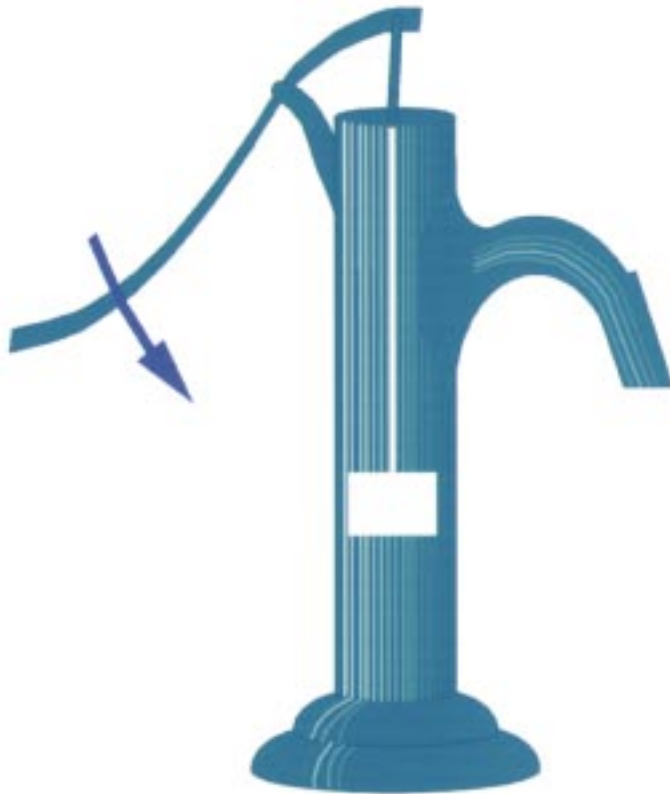
$$F = 0.2 \times 5000 = 1000 \text{ N}$$



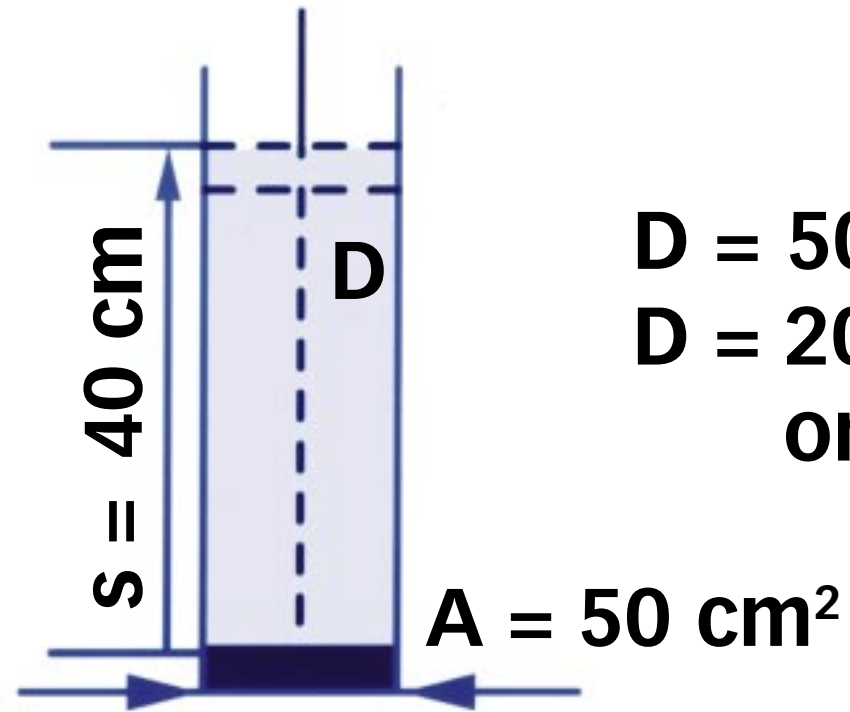


$$F = p \times A$$





$$D = A \times S$$

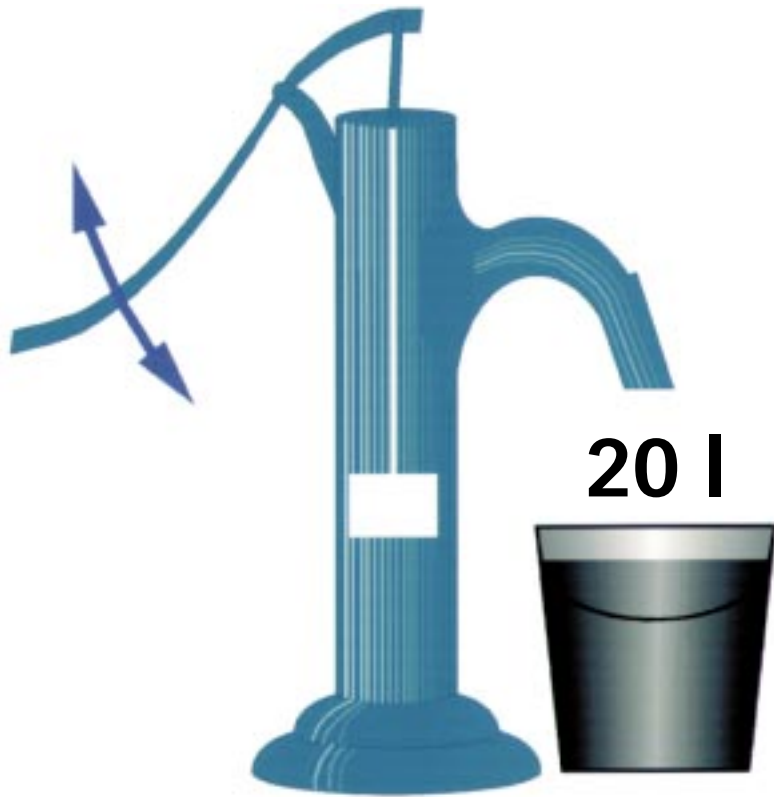


$$D = 50 \times 40$$

$$D = 2000 \text{ cm}^3$$

or 2 litres



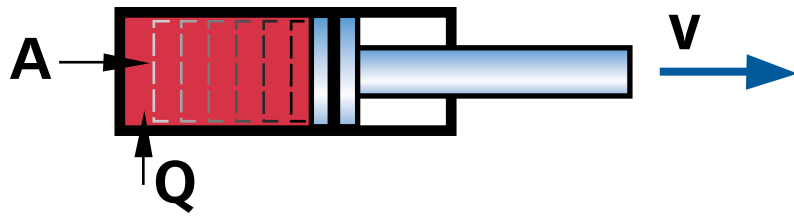


D = 2 l/stroke
n = 10 strokes/min

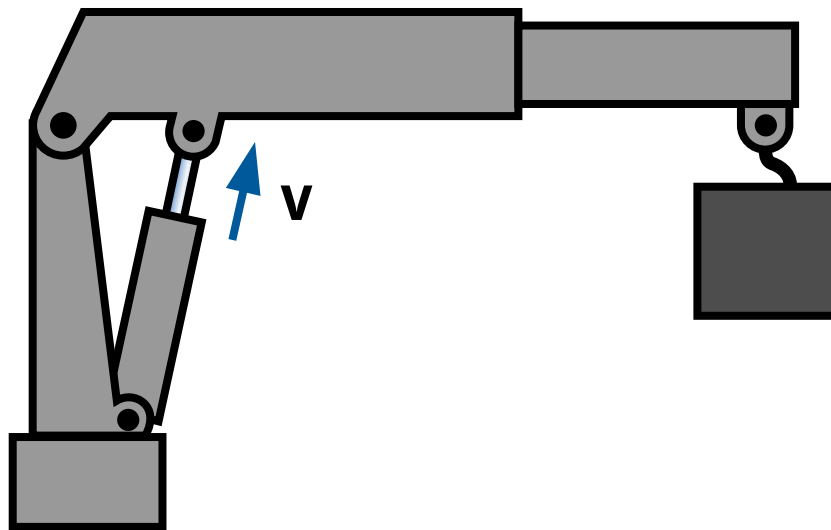
$$Q = D \times n$$

Q = 2 x 10
Q = 20 l/min





$$v = \frac{Q}{A}$$

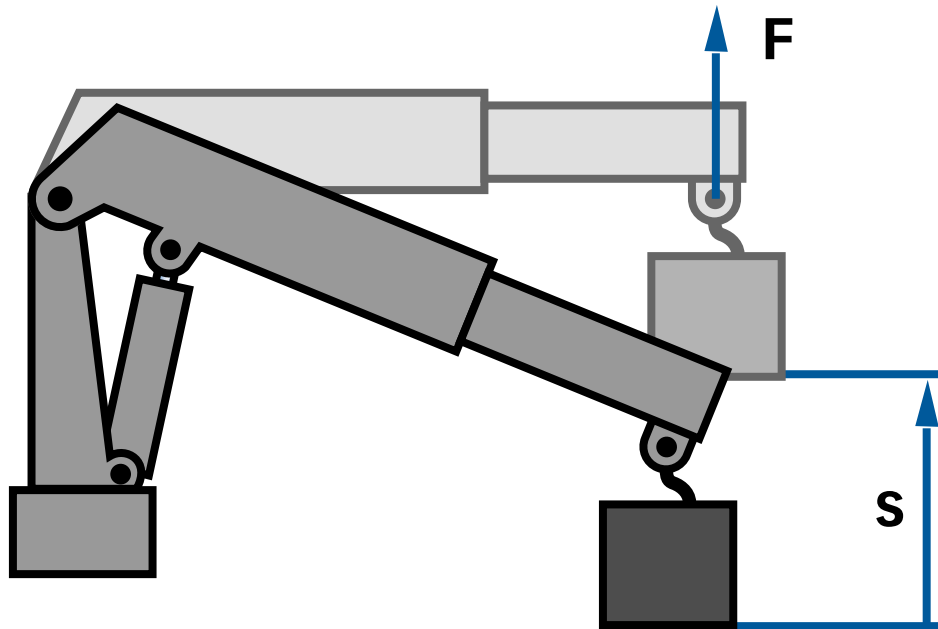


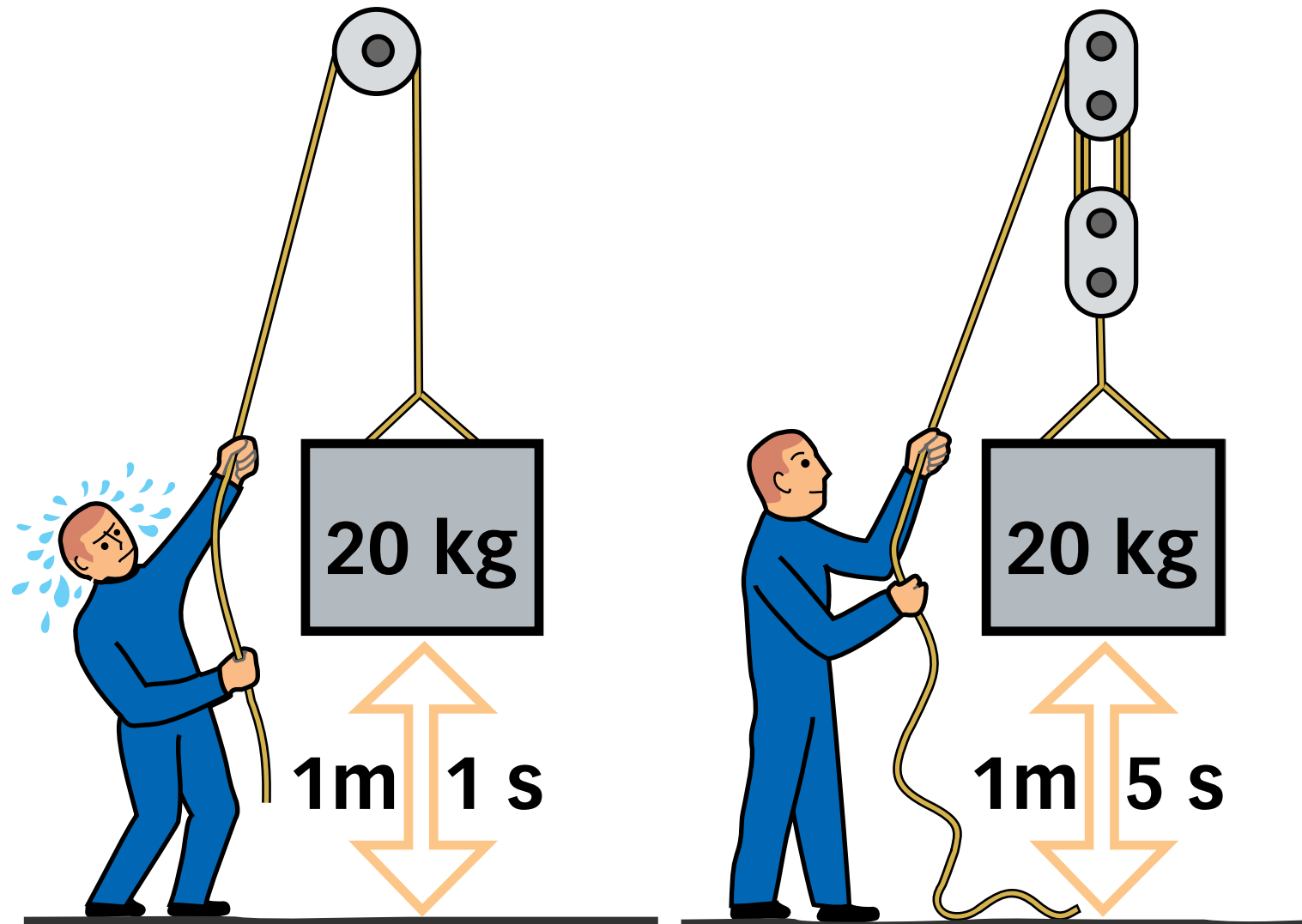
$$W = F \times S$$

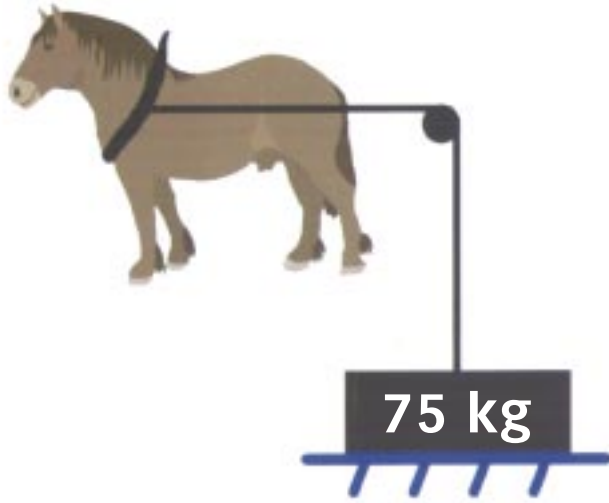
$$F = p \times A$$

$$W = p \times A \times S$$

$$D = A \times S$$

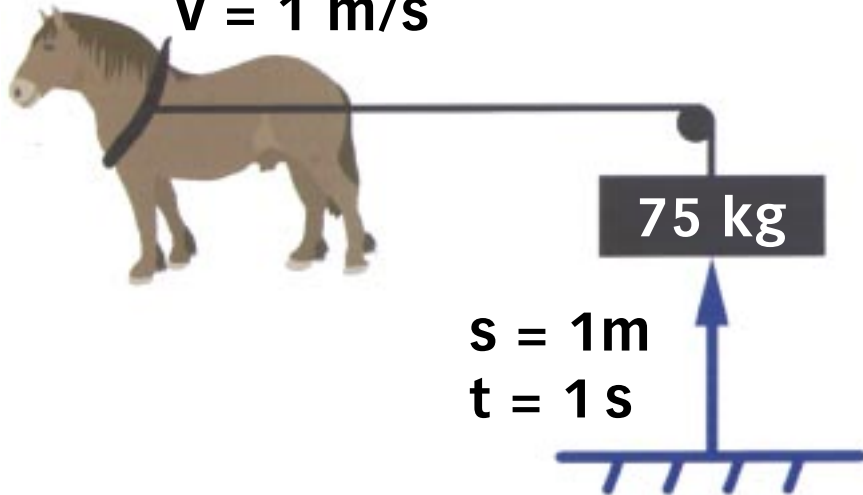


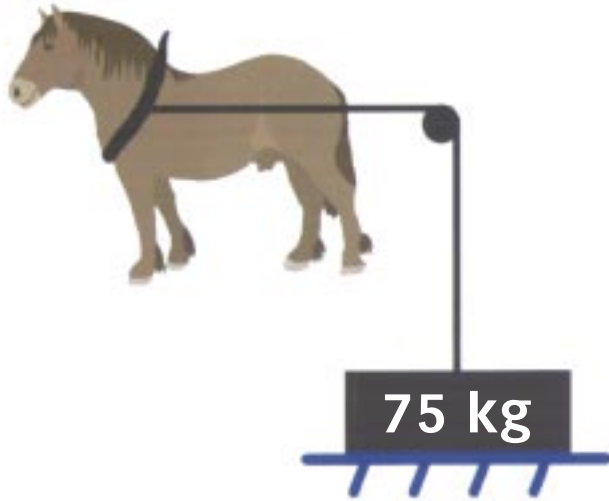




$$P = F \times v$$

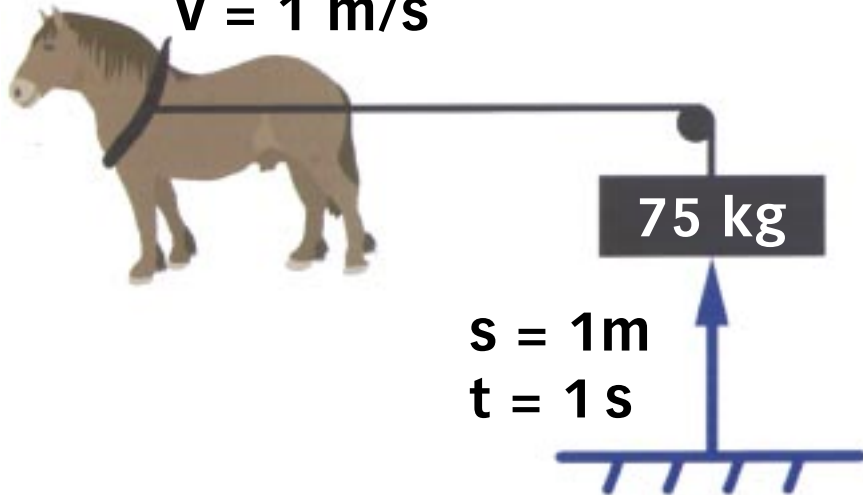
$$F = 75 \text{ kg} \times 9.81 = 736 \text{ N}$$
$$v = 1 \text{ m/s}$$





$$F = 75 \text{ kg} \times 9.81 = 736 \text{ N}$$

$$v = 1 \text{ m/s}$$



$$s = 1 \text{ m}$$

$$t = 1 \text{ s}$$

$$P = F \times v$$

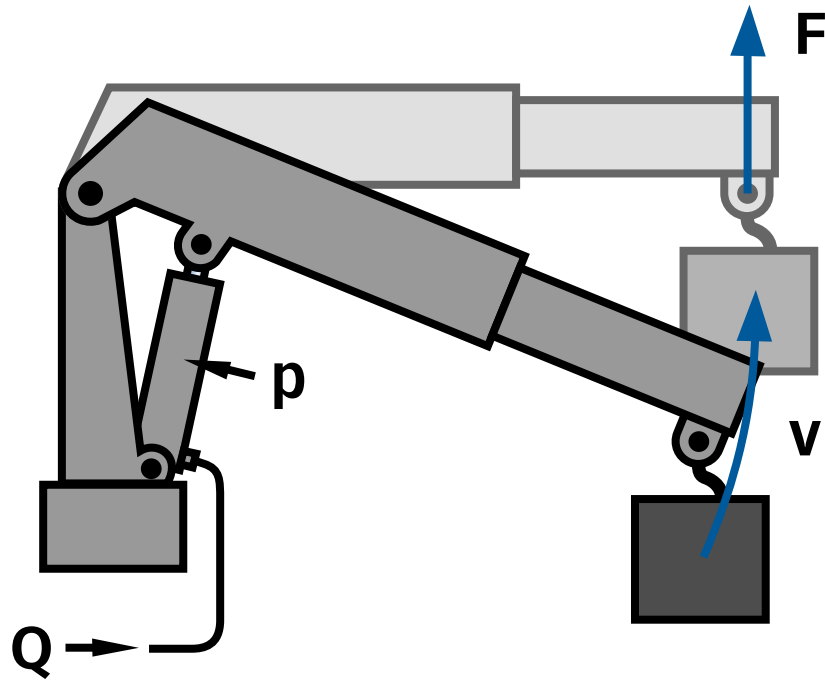
$$P = \frac{W}{t} \quad \left. \begin{array}{l} \\ W = F \times s \end{array} \right\} P = \frac{F \times s}{t}$$

$$P = F \times \frac{s}{t} \quad \left. \begin{array}{l} \\ \frac{s}{t} = v \end{array} \right\} P = F \times v$$

Example

$$P = 736 \times 1 = 736 \text{ W} = 1 \text{ hp}$$



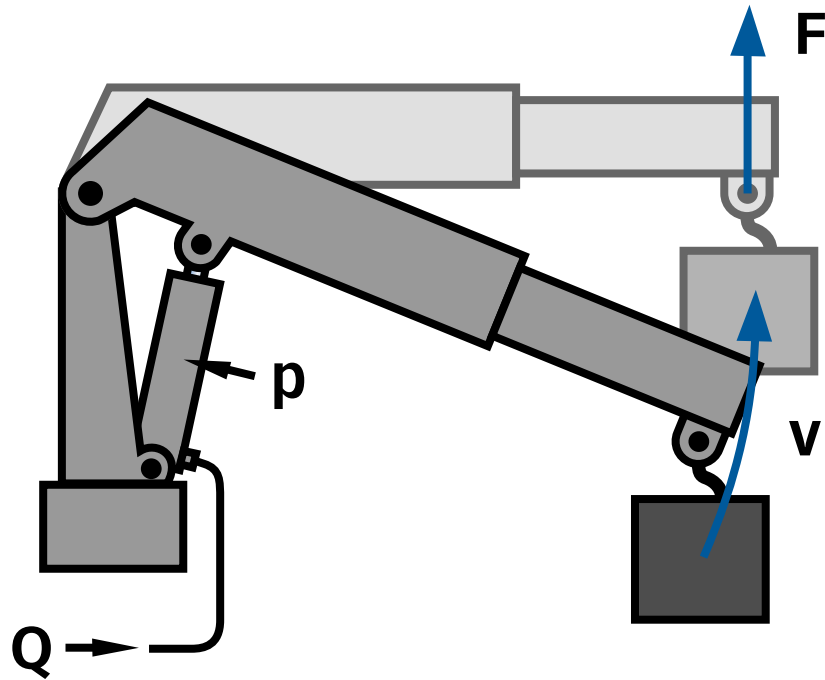


$$P = \frac{Q \times p}{60} \text{ kW}$$

1 m³ = 1000 dm³ (litres)

1 s = $\frac{1}{60}$ min





$1 \text{ m}^3 = 1000 \text{ dm}^3 \text{ (litres)}$

$1 \text{ s} = \frac{1}{60} \text{ min}$

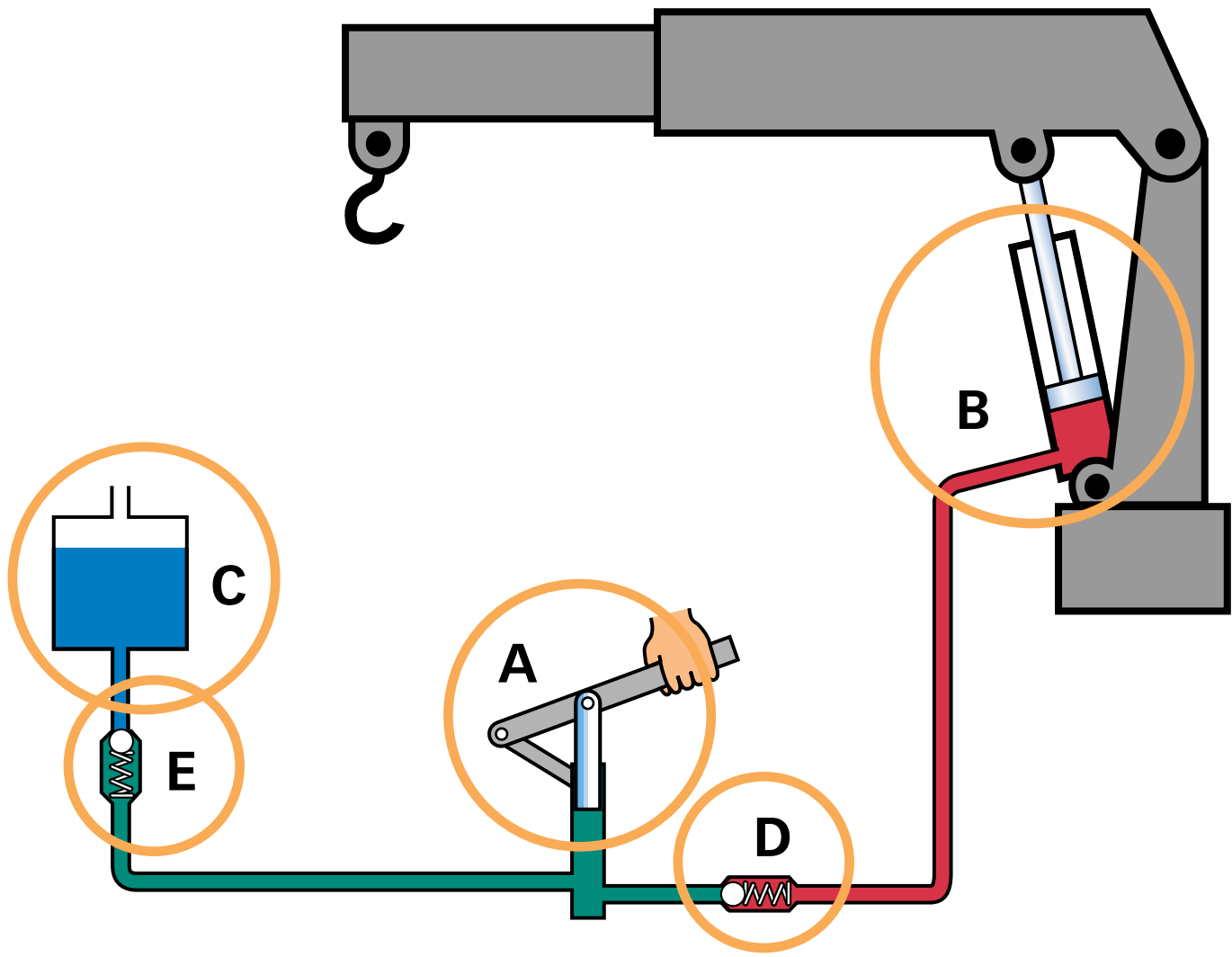
$$P = \frac{Q \times p}{60} \text{ kW}$$

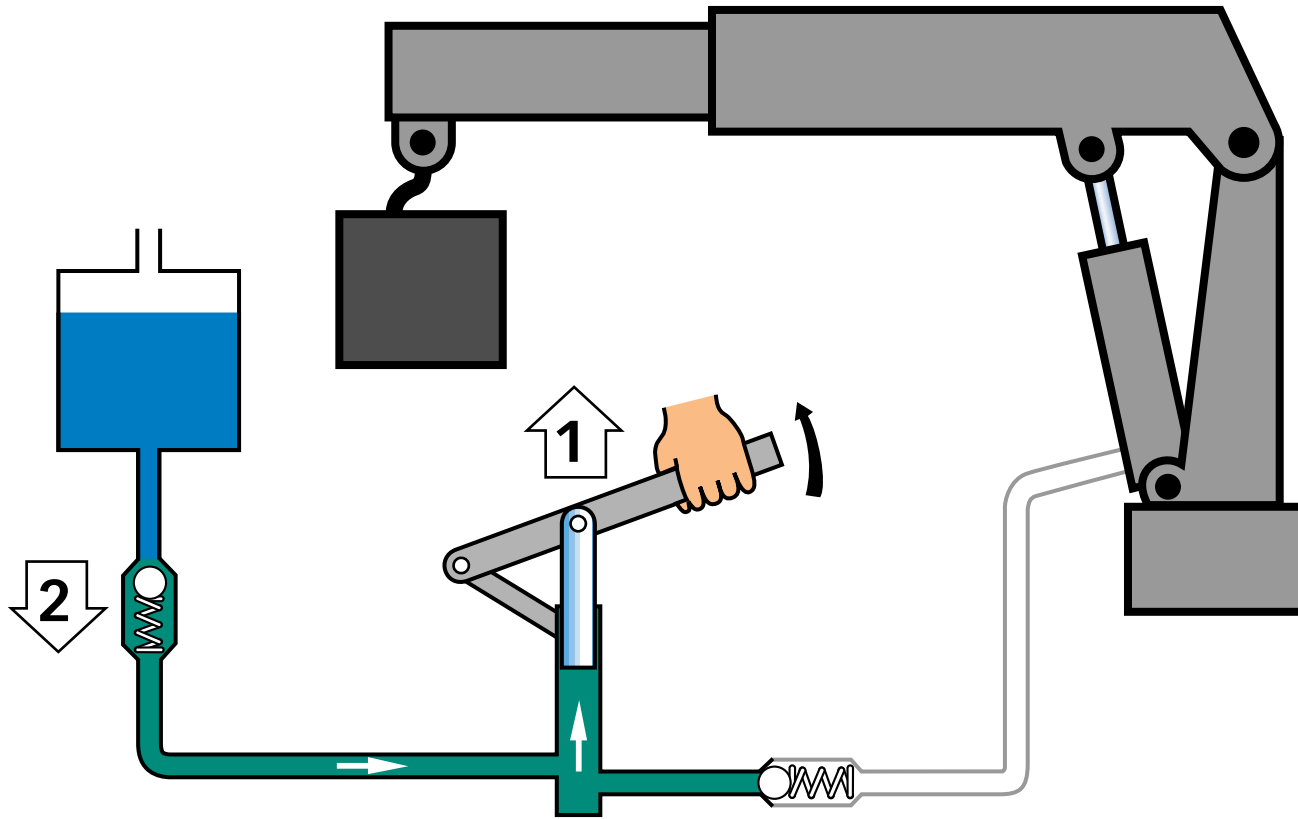
$$\left. \begin{aligned} P &= F \times v \\ F &= p \times A \\ v &= \frac{Q}{A} \end{aligned} \right\} P = p \times A \times \frac{Q}{A}$$

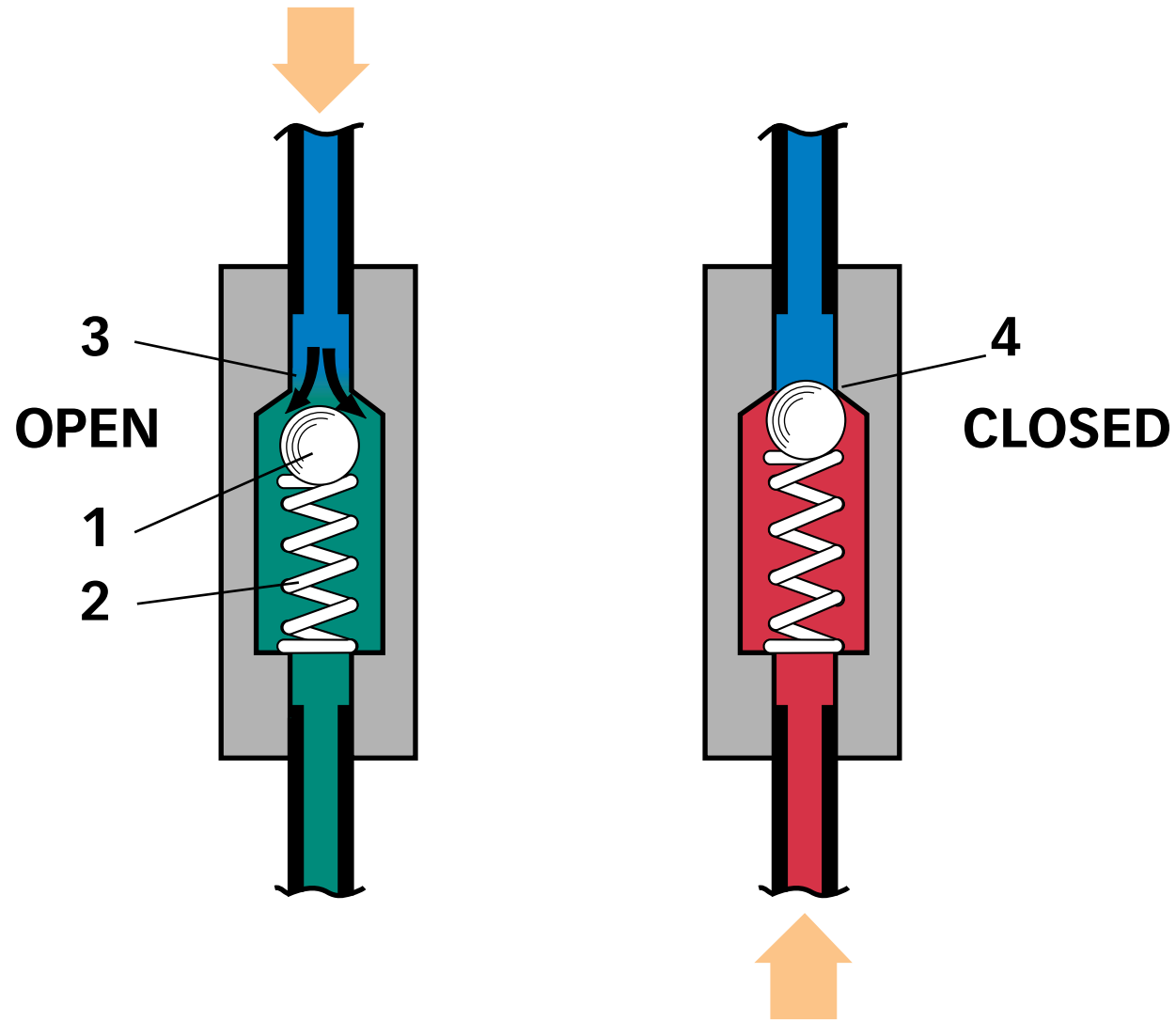
$$P = Q \times p$$

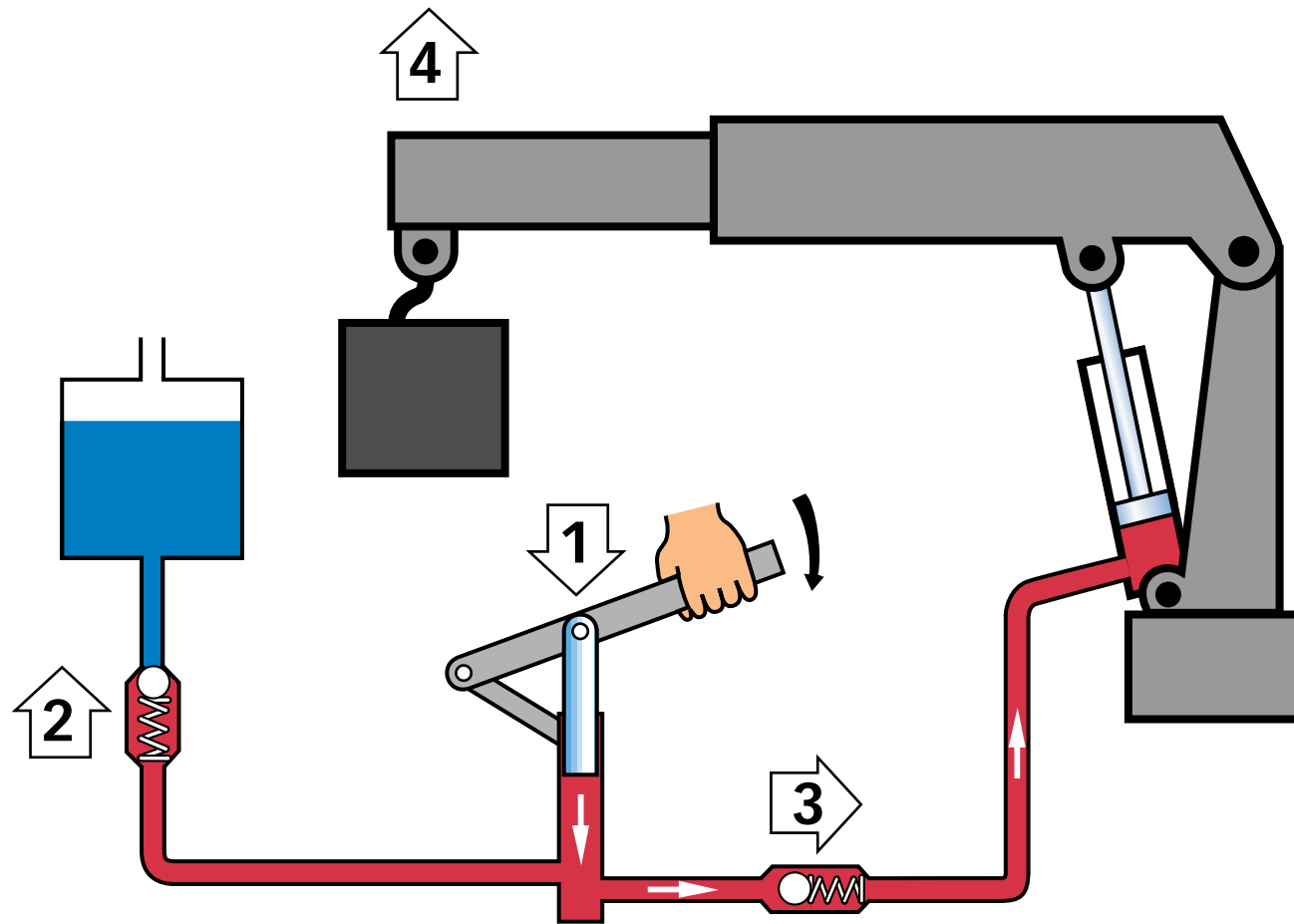
$$P = \frac{1000 \times Q \times p}{60} \text{ W}$$

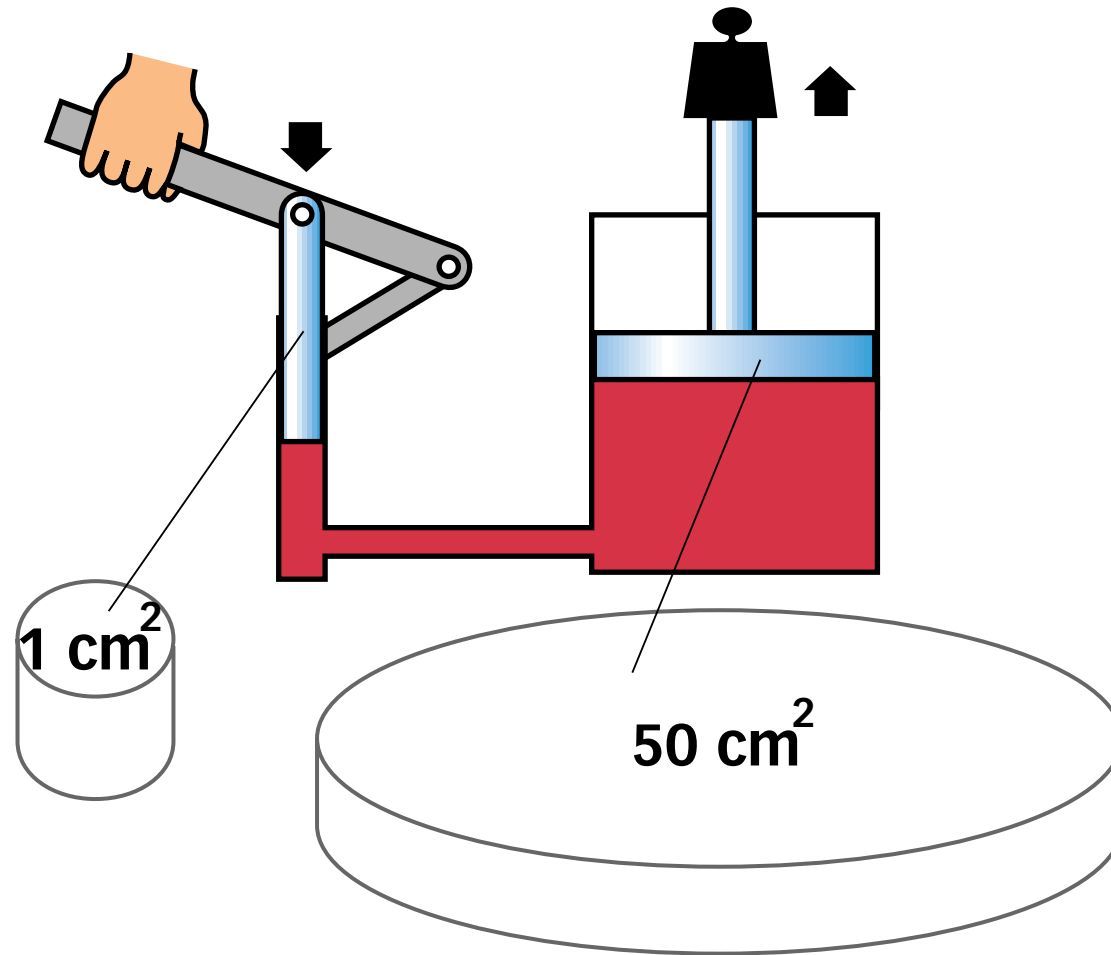


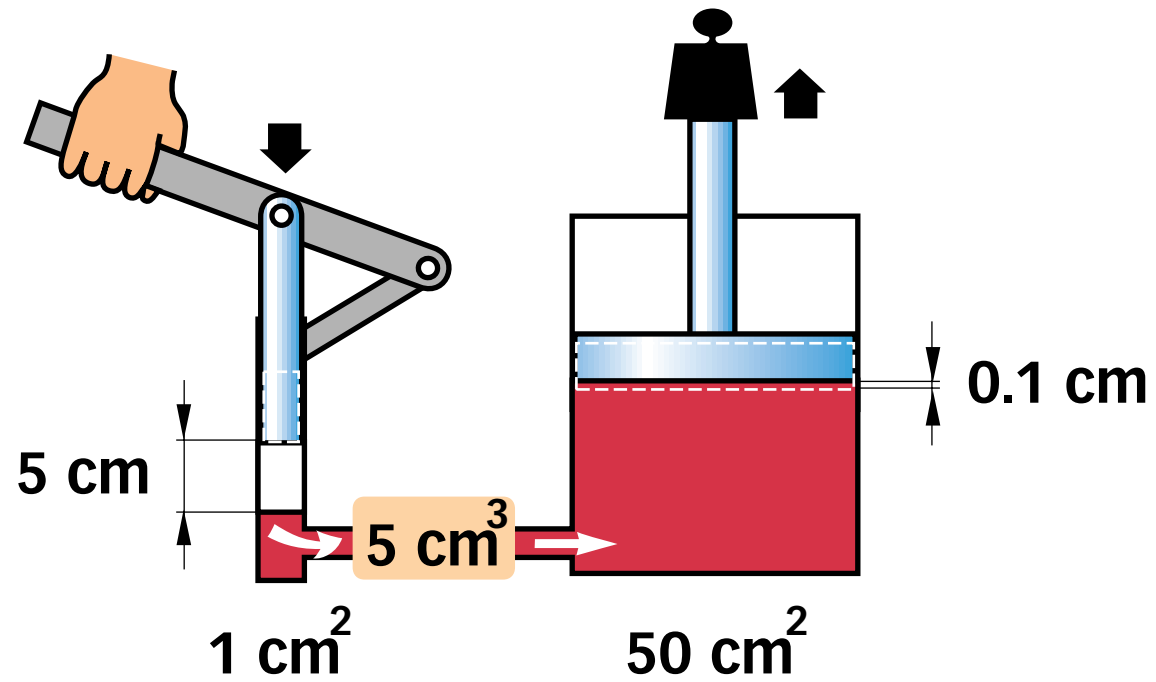


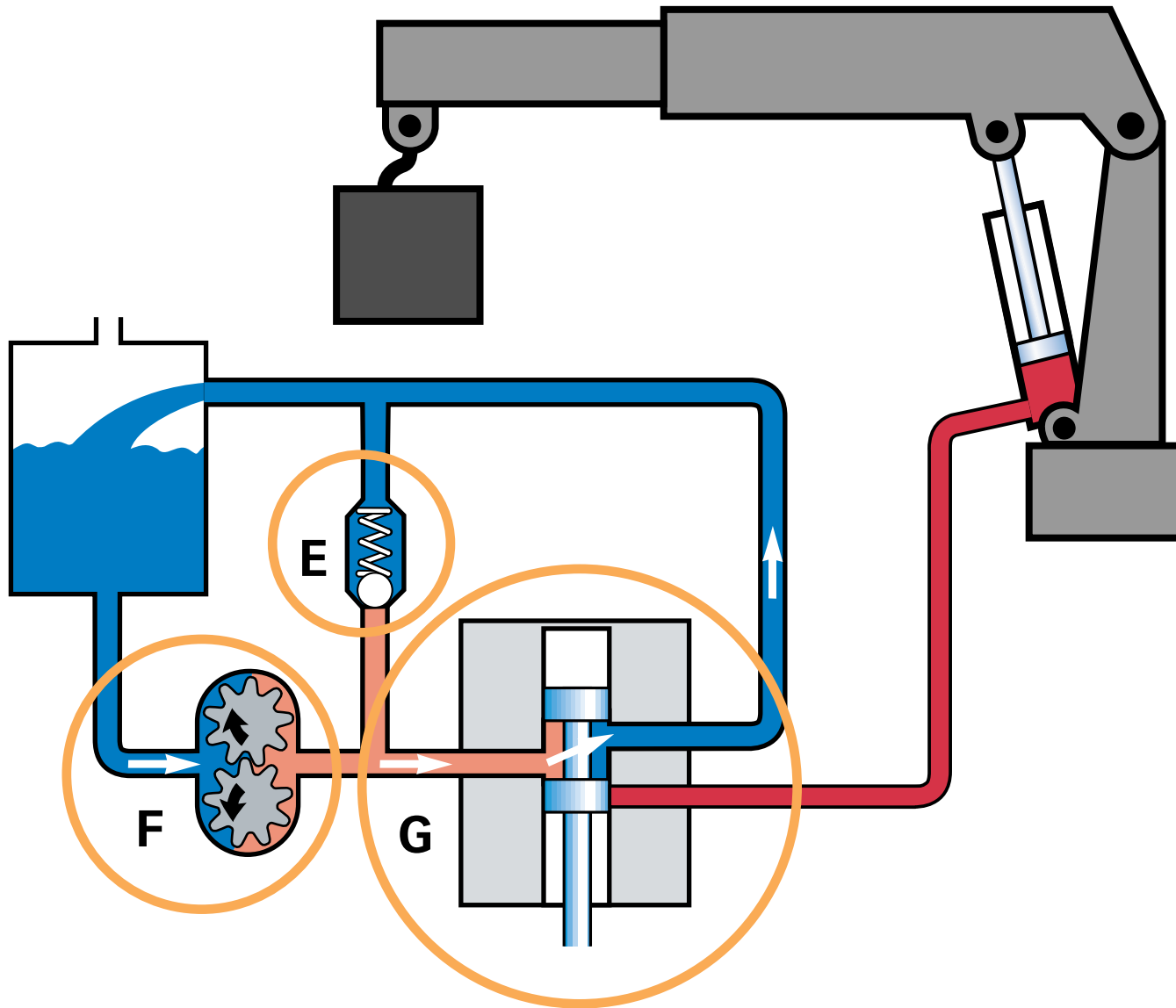


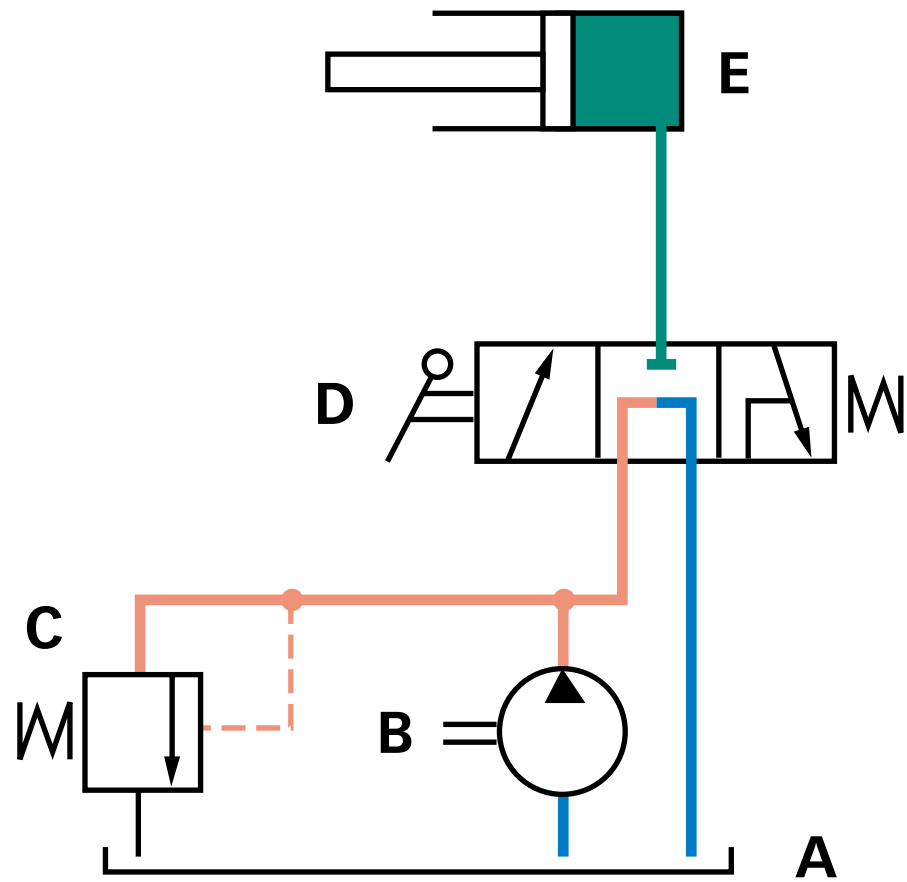


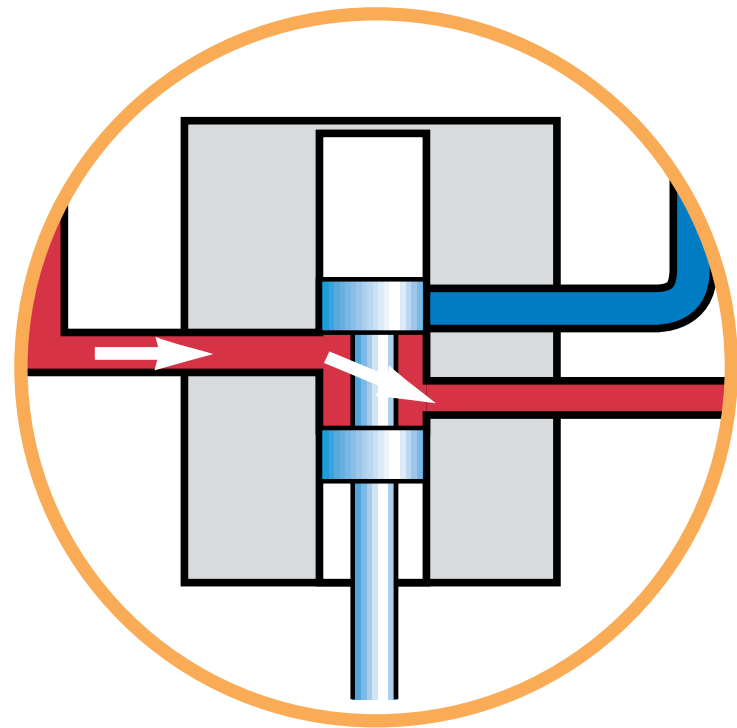
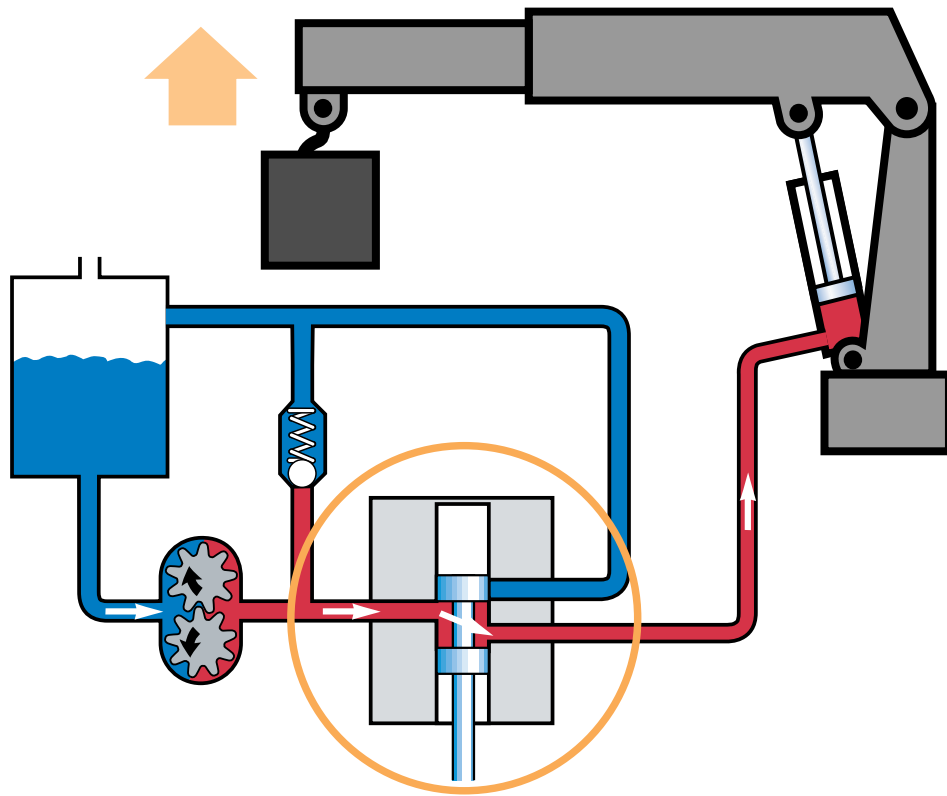


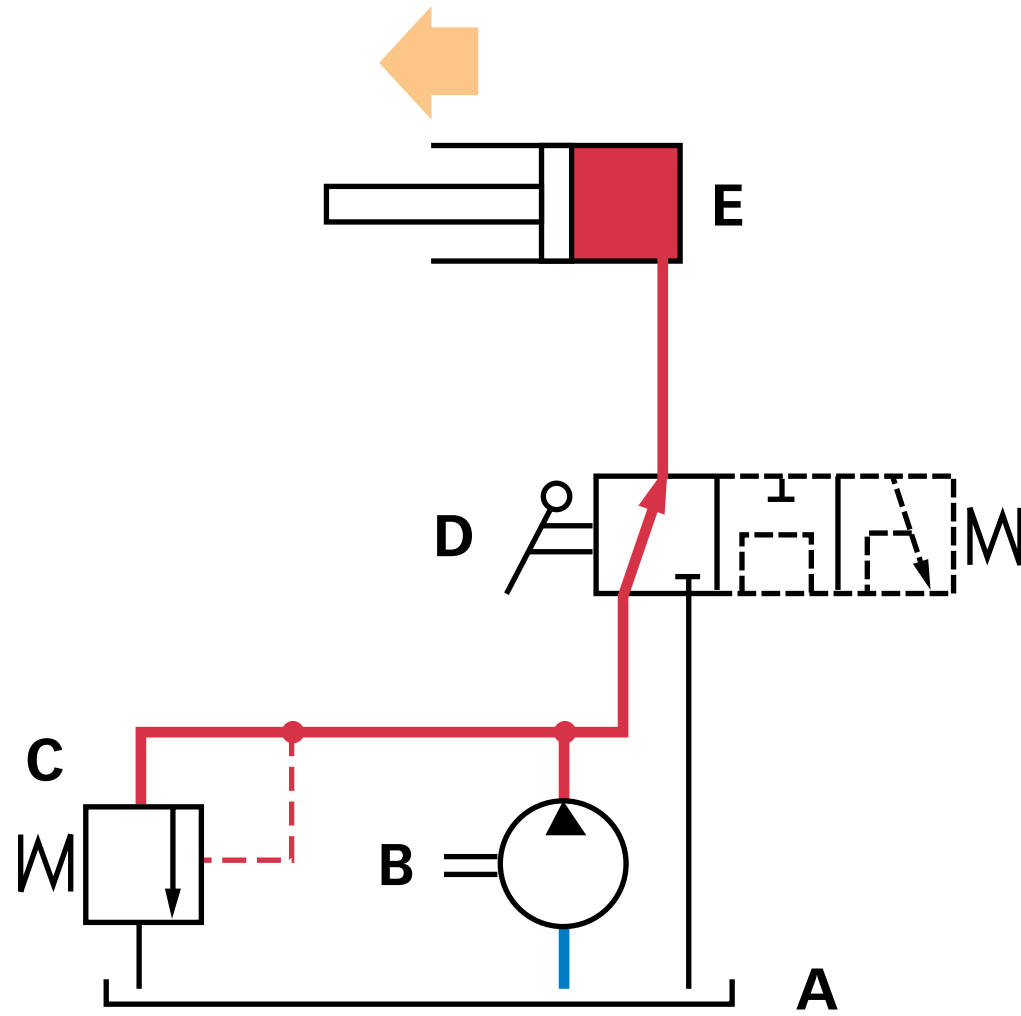


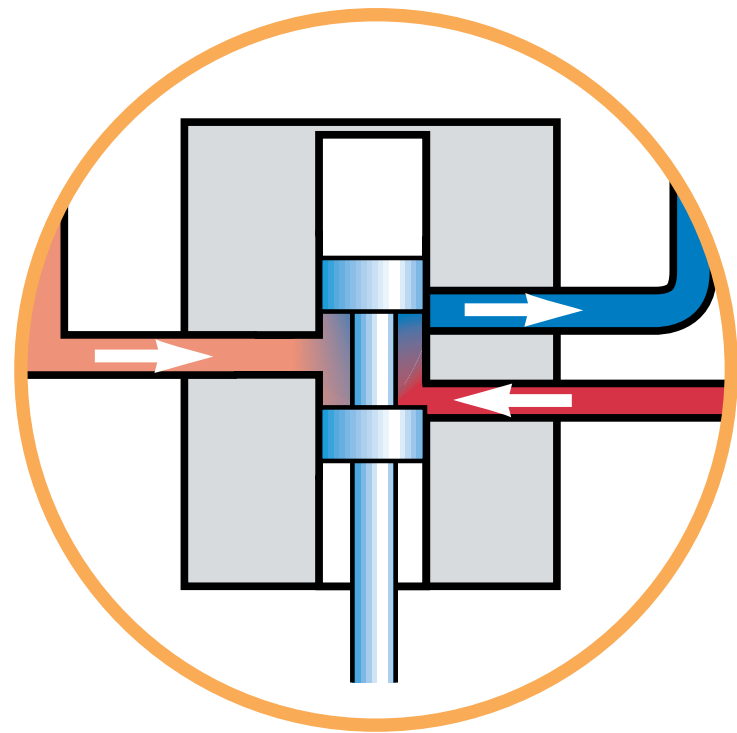
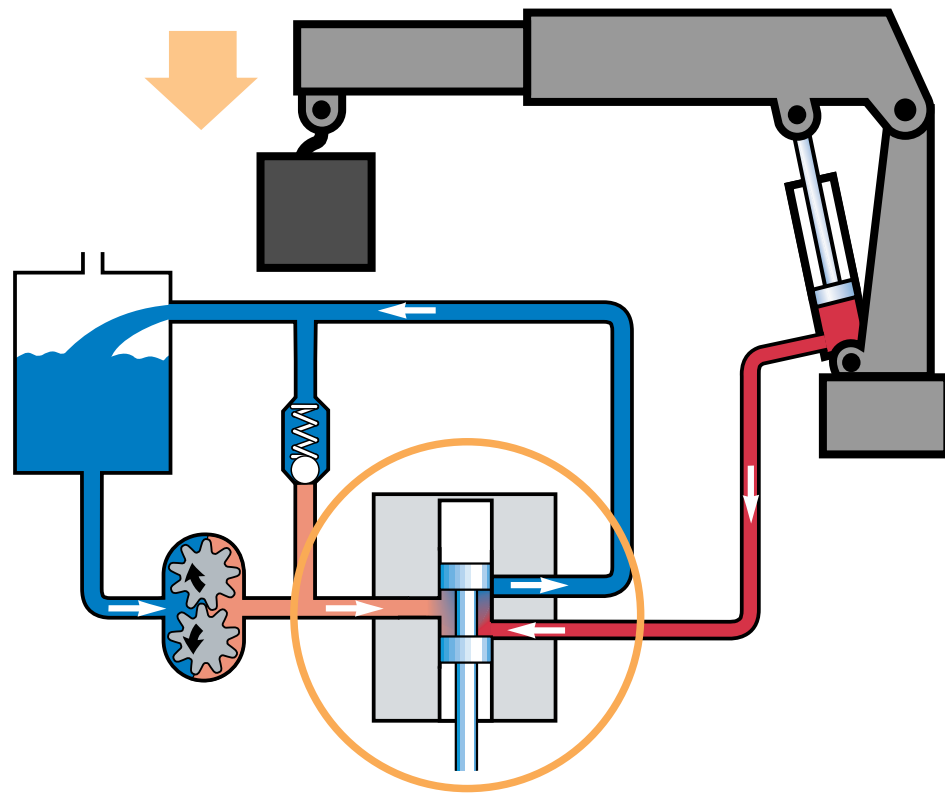


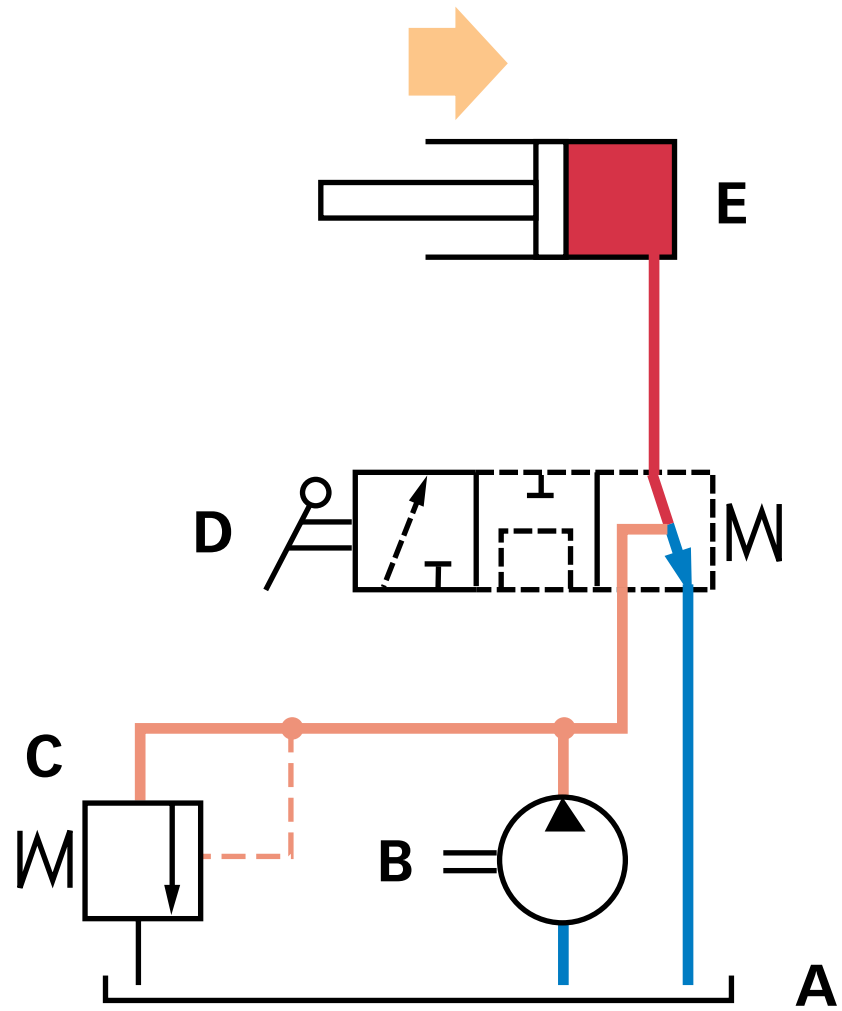


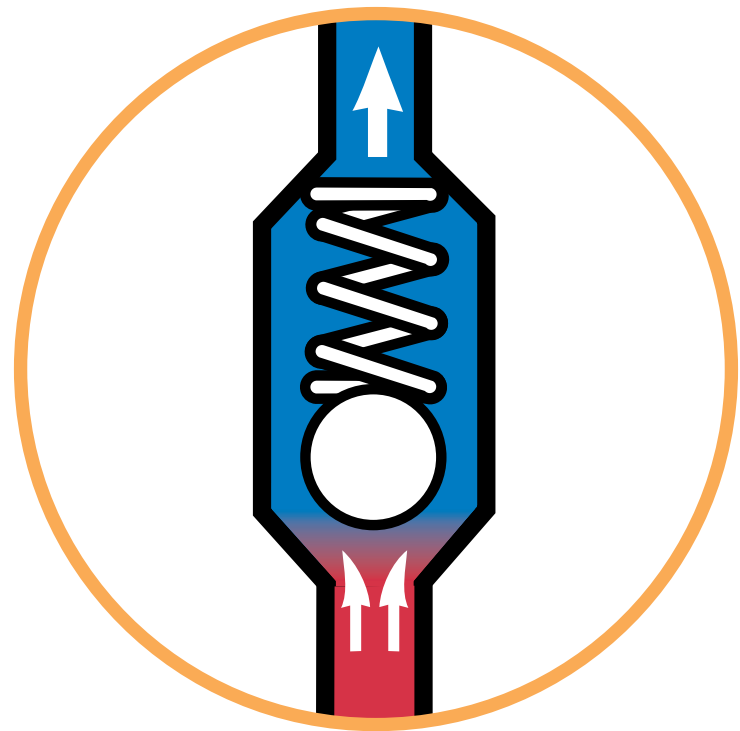
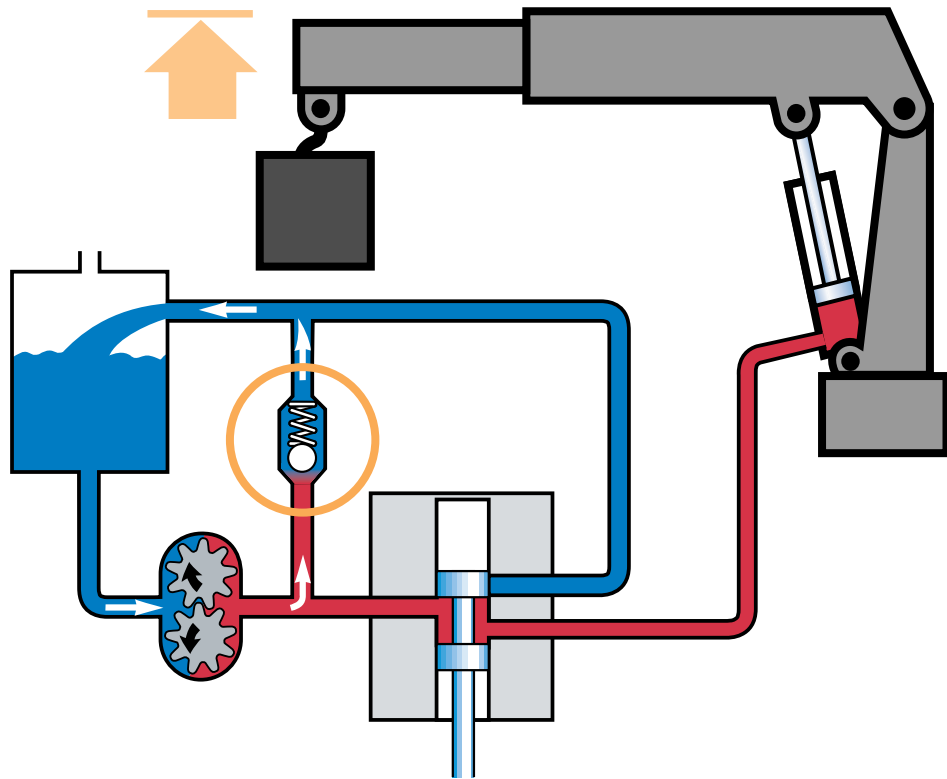


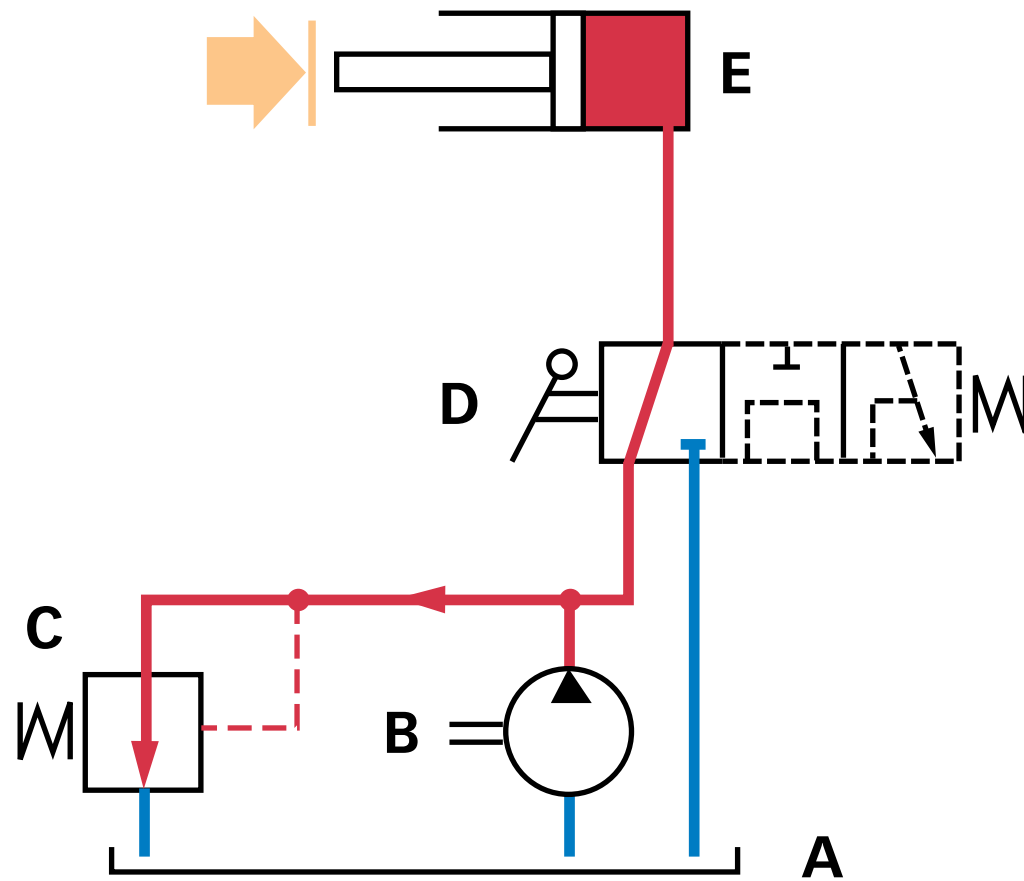


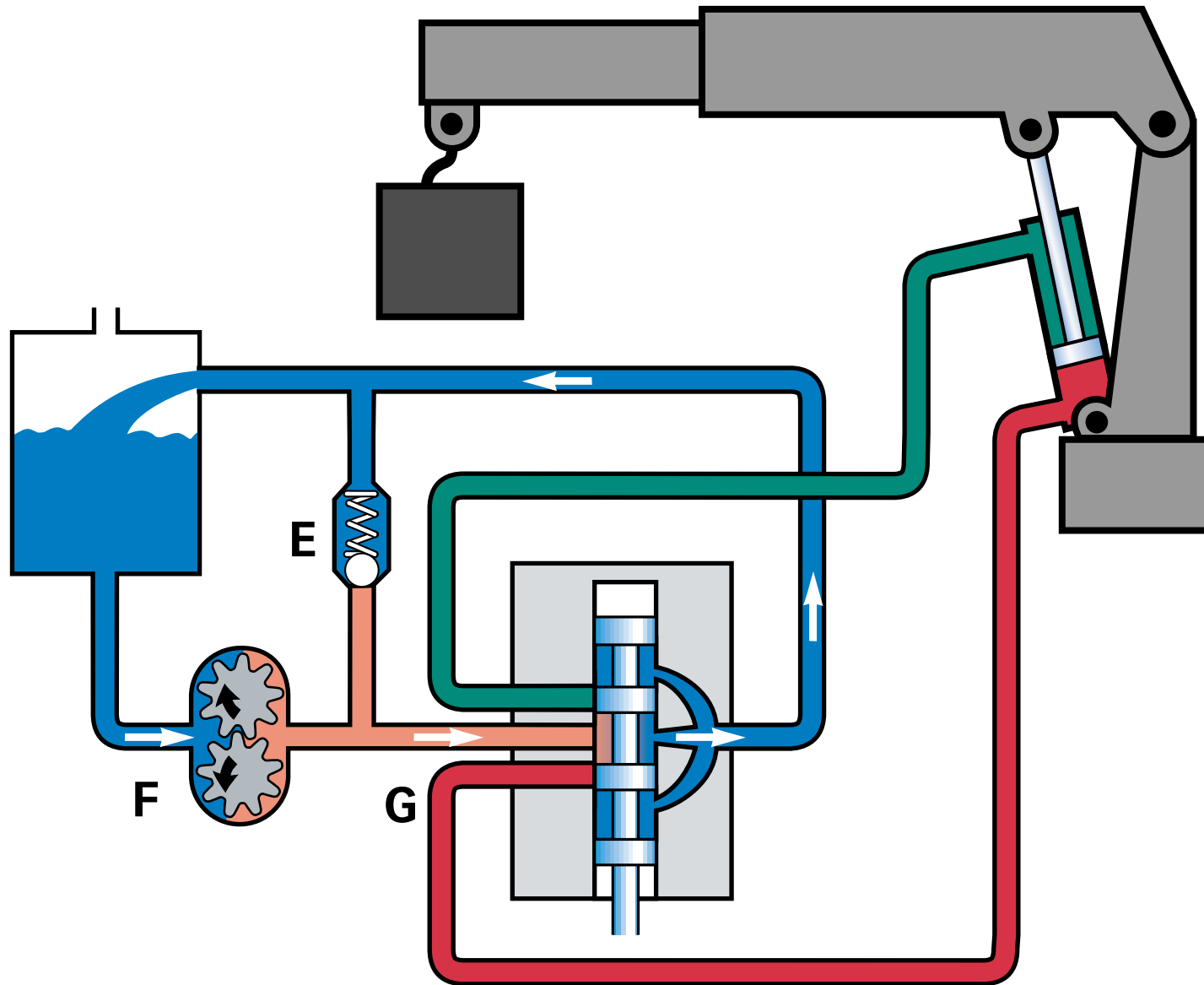


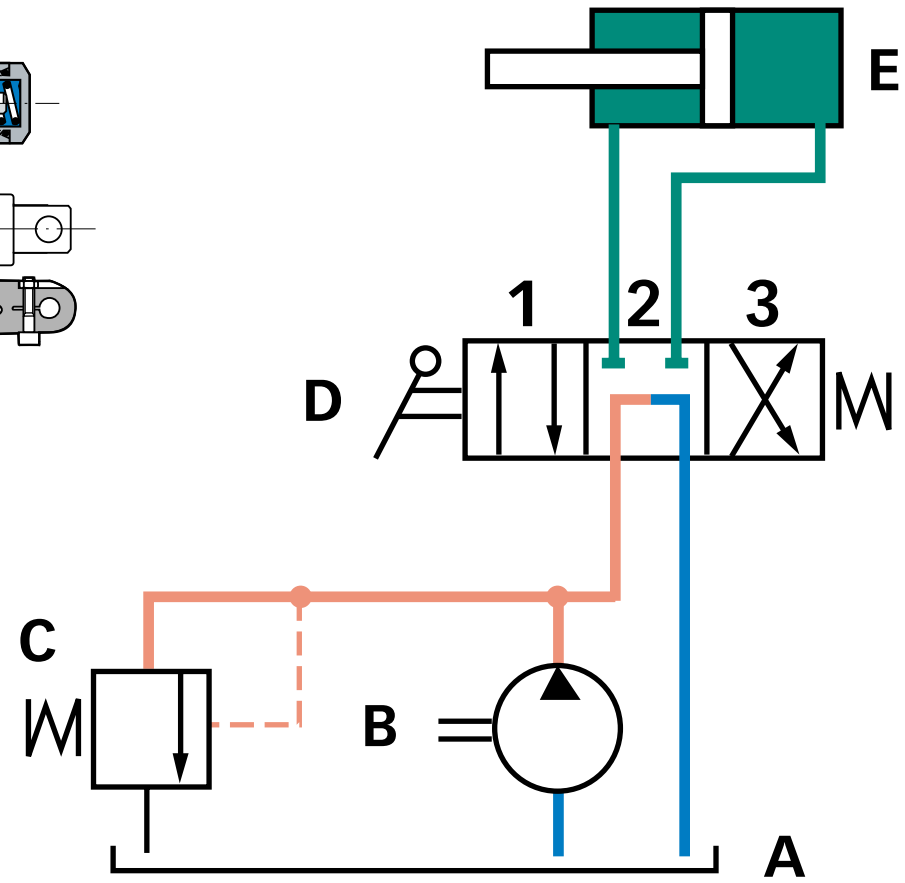
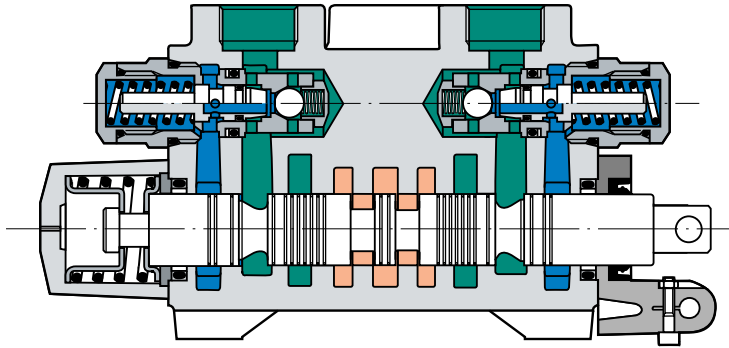


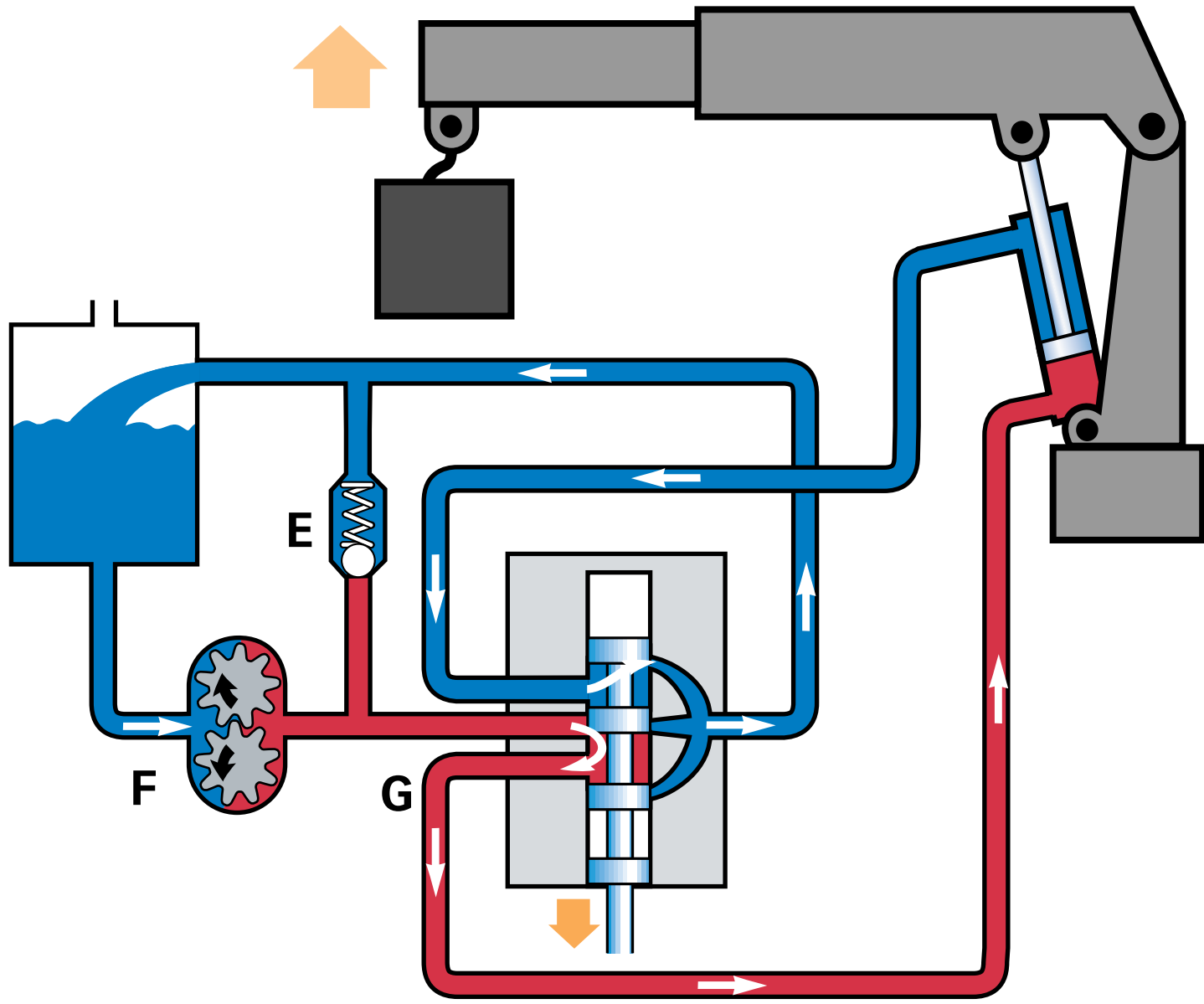


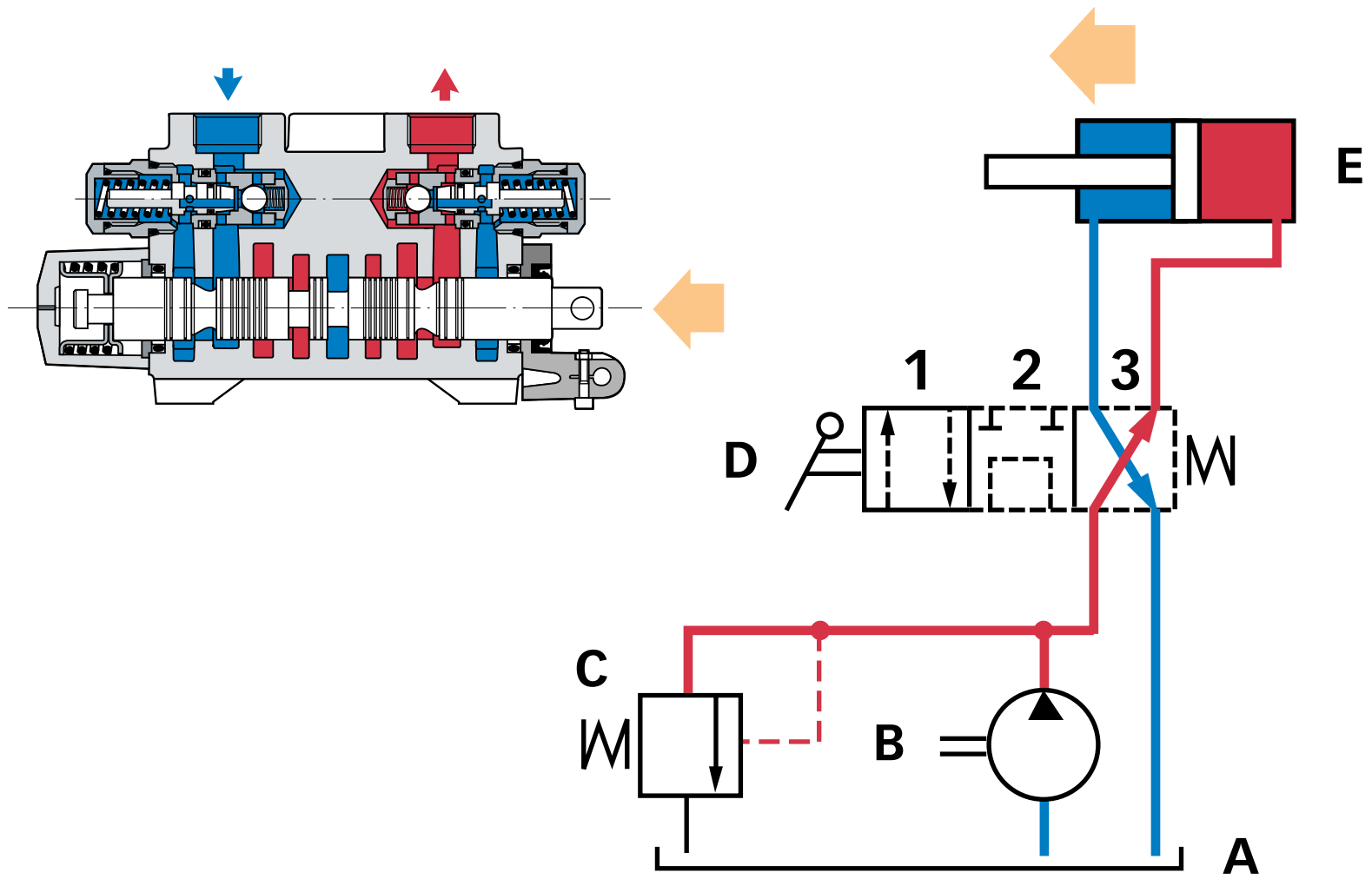


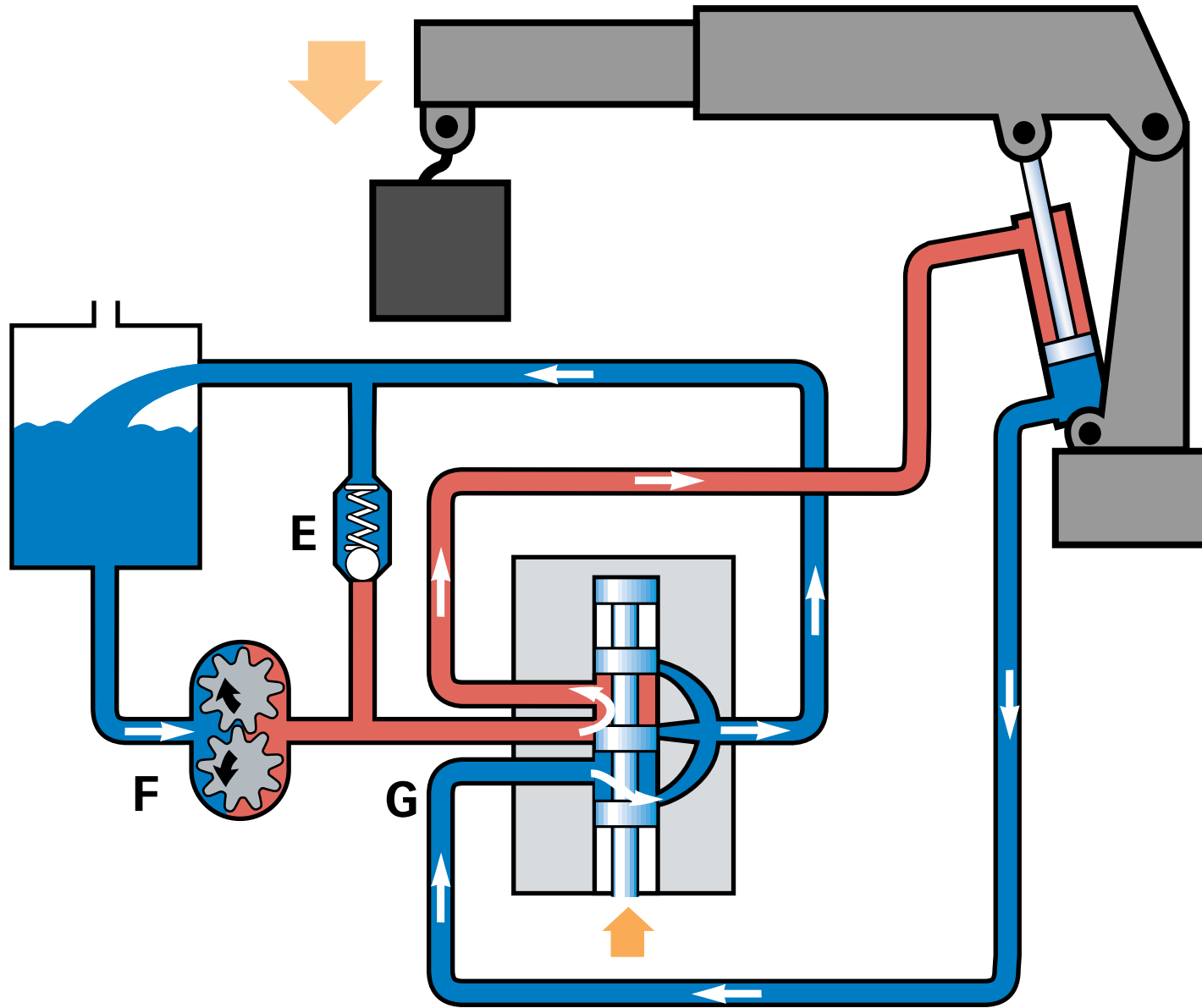


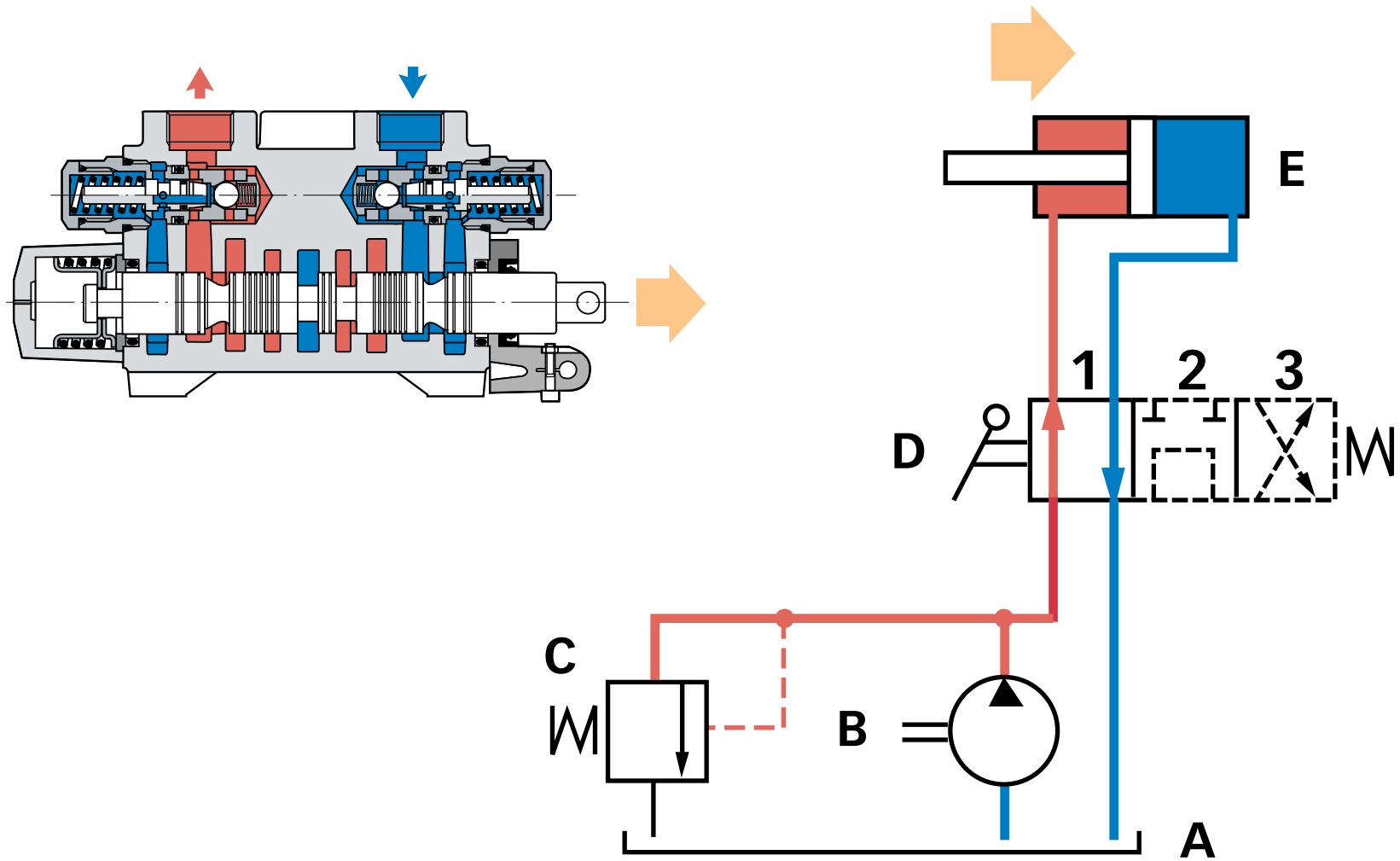


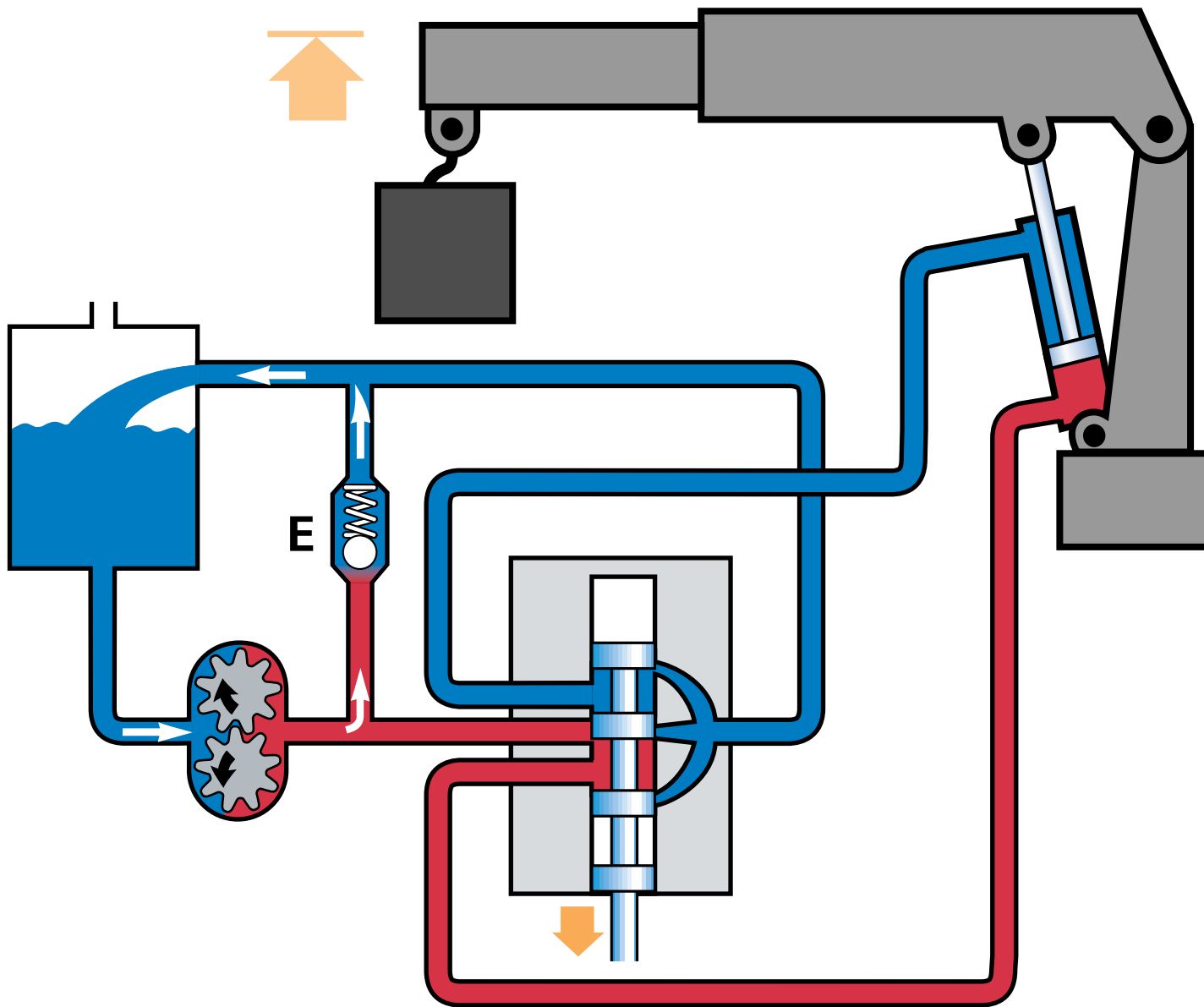


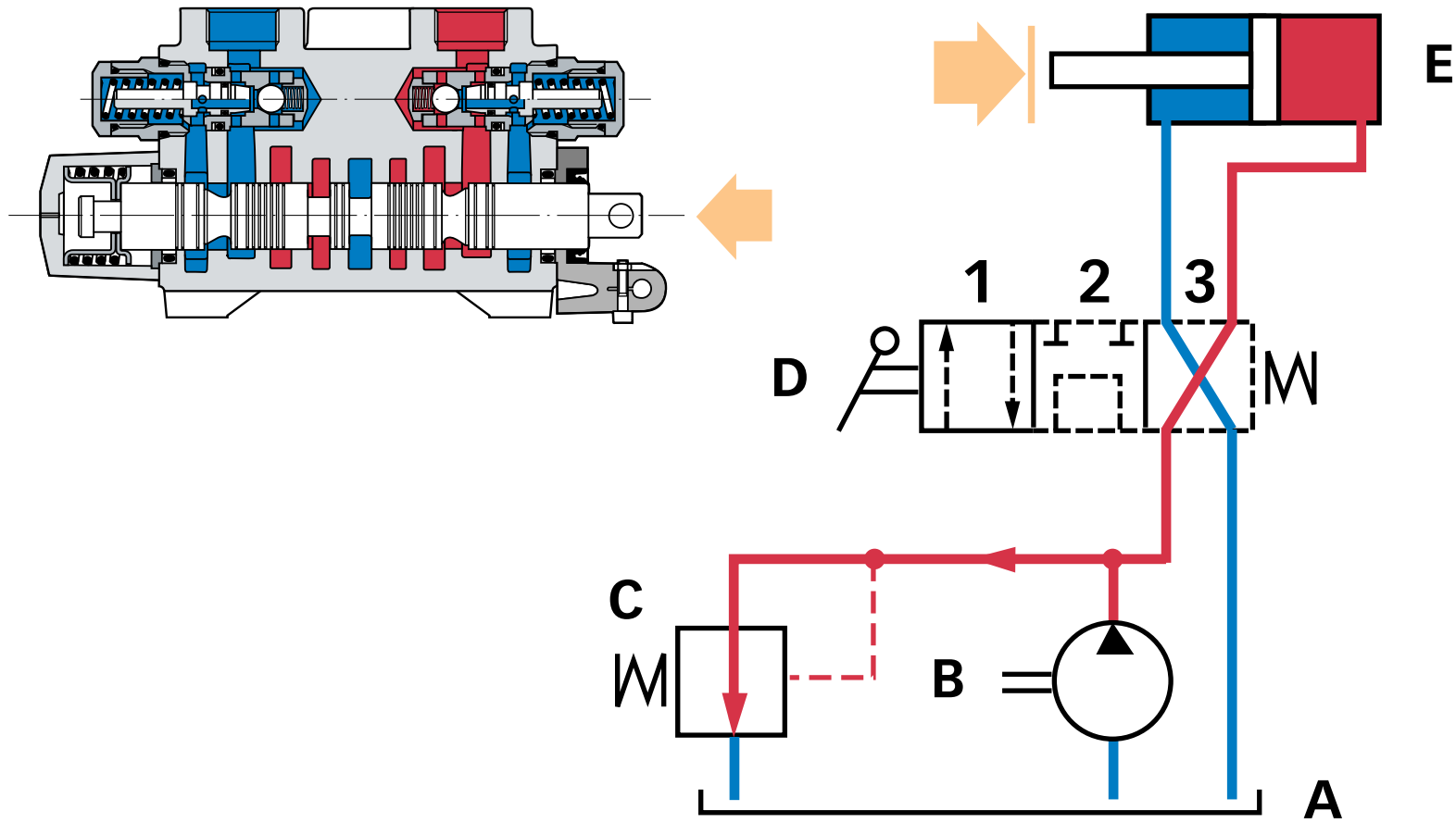




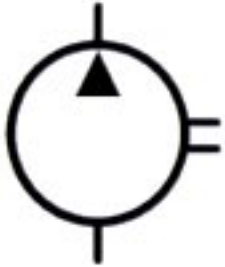




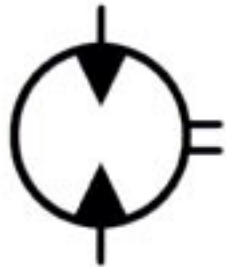




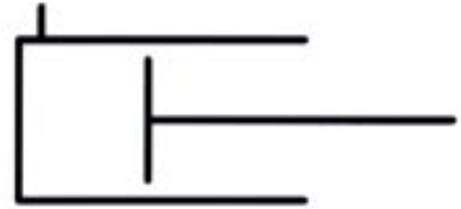
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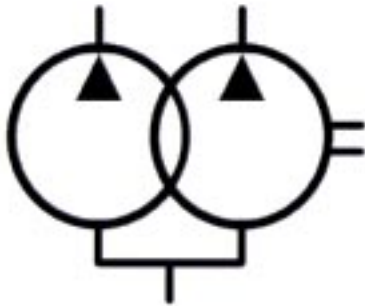
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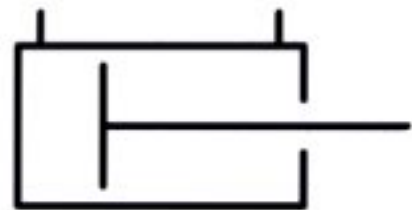
3.1



1.2

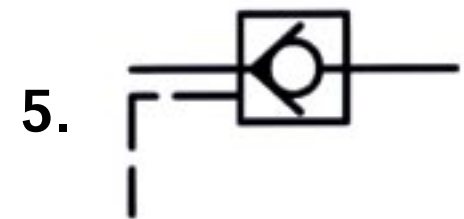
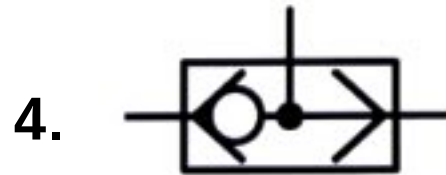
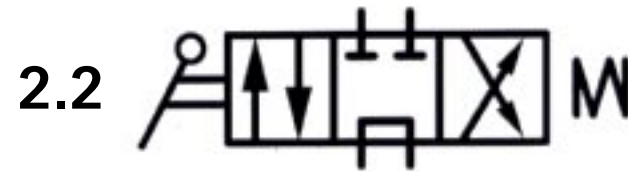
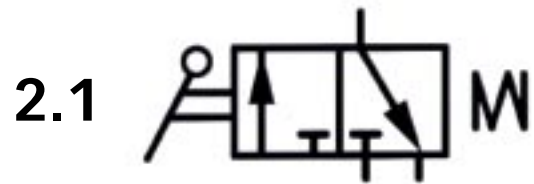
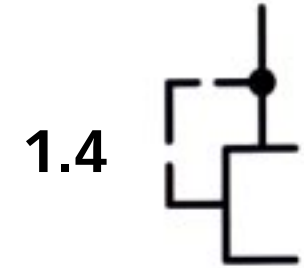
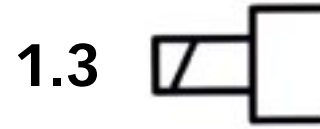
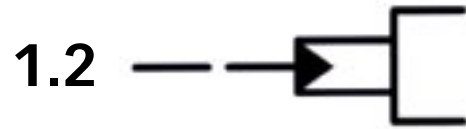


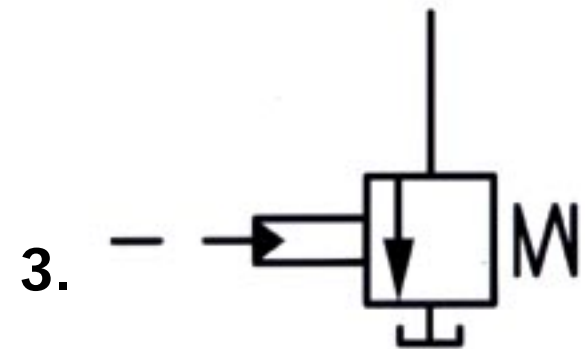
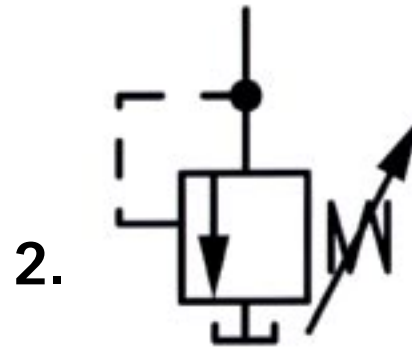
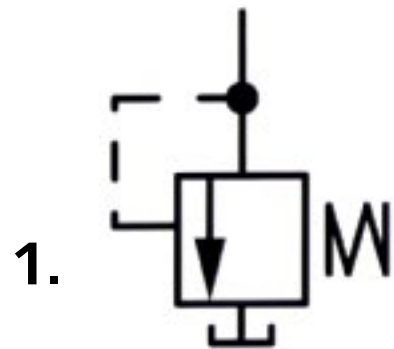
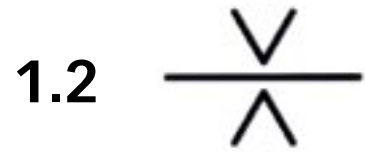
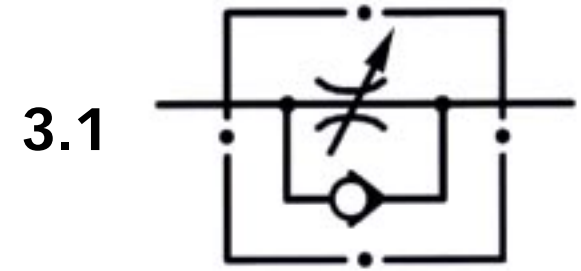
3.2

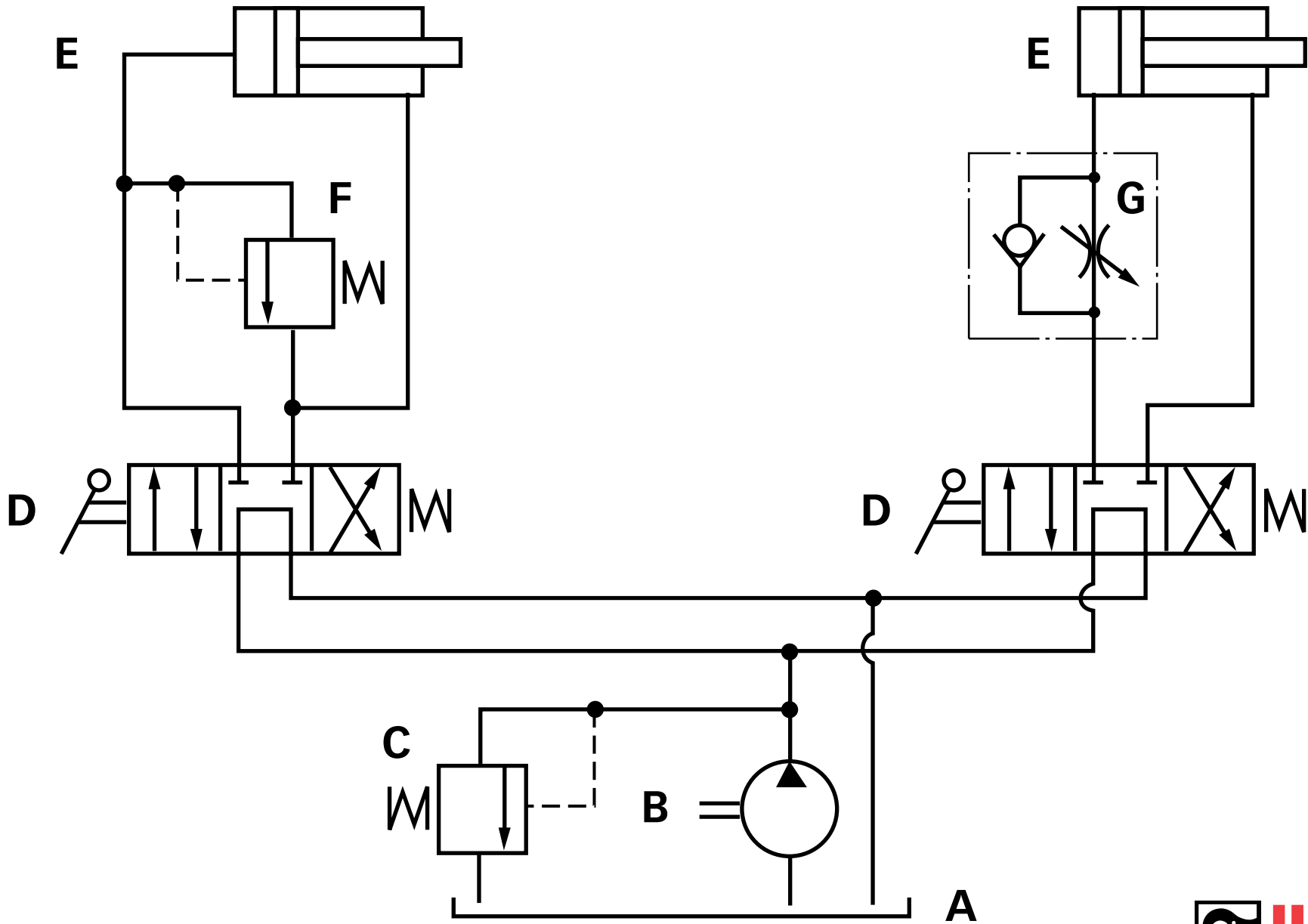


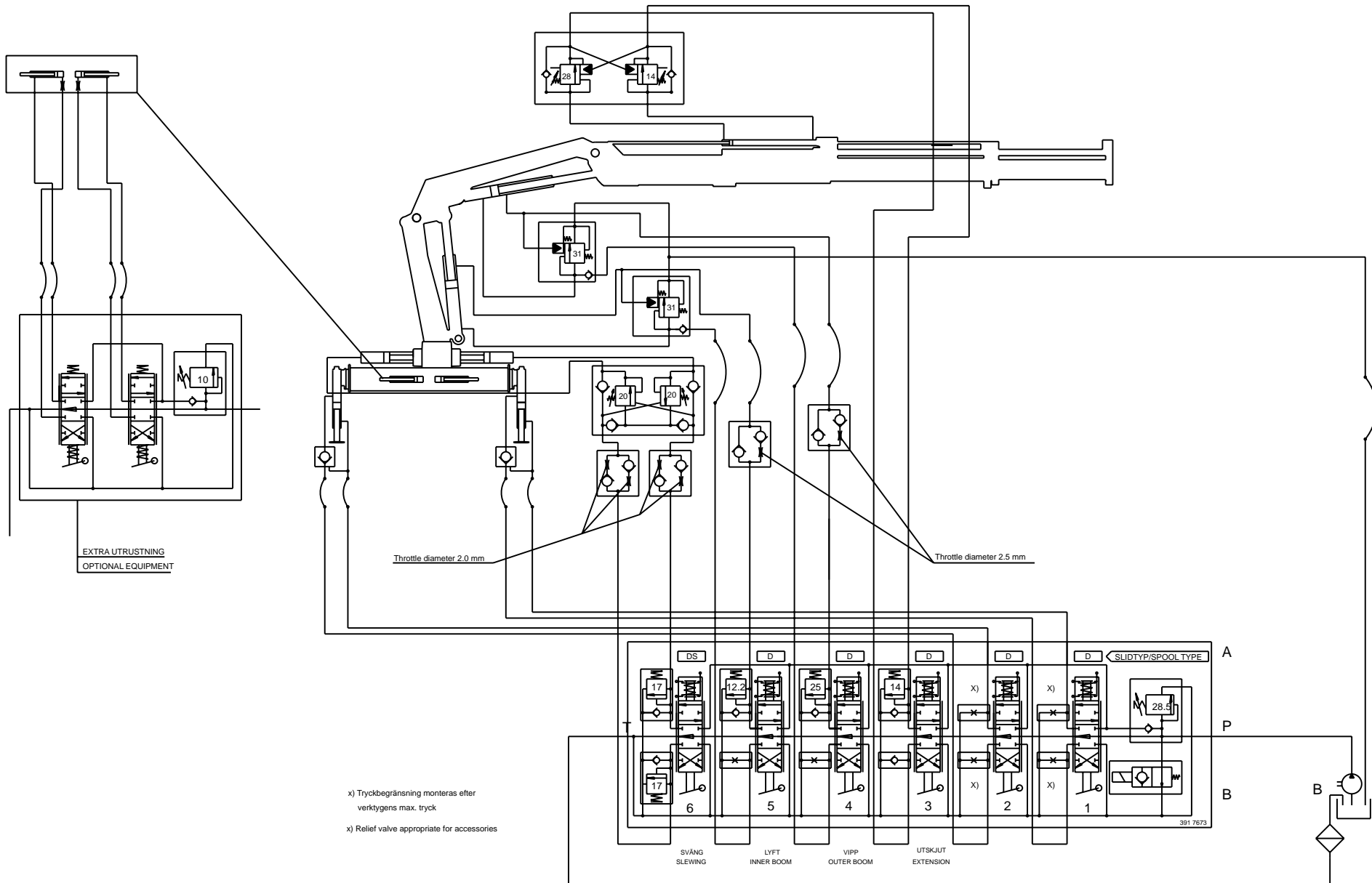
1.3











- x) Tryckbegränsning monteras efter verktygens max. tryck
- x) Relief valve appropriate for accessories