



Voith Turbo H + L Hydraulic HBL System Training

HBL System Training

Punching system HBL general

Tutor:

Wang Aimin

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- **Punch press hydraulics - general overview**
- **HBL - functional principle and part search guide**
- **Service guide & trouble shooting**

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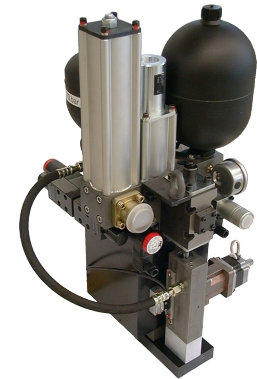
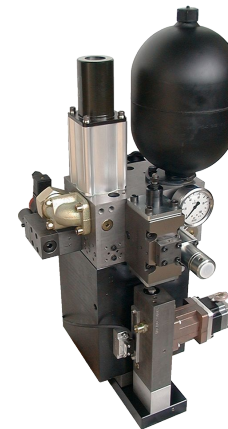
Voith - Standard systems

HBL

HRL

HRE

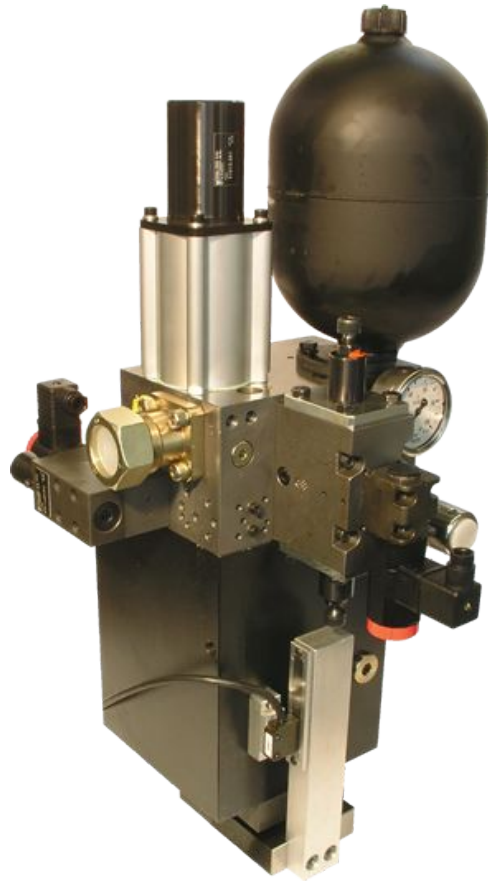
ECO^{plus}



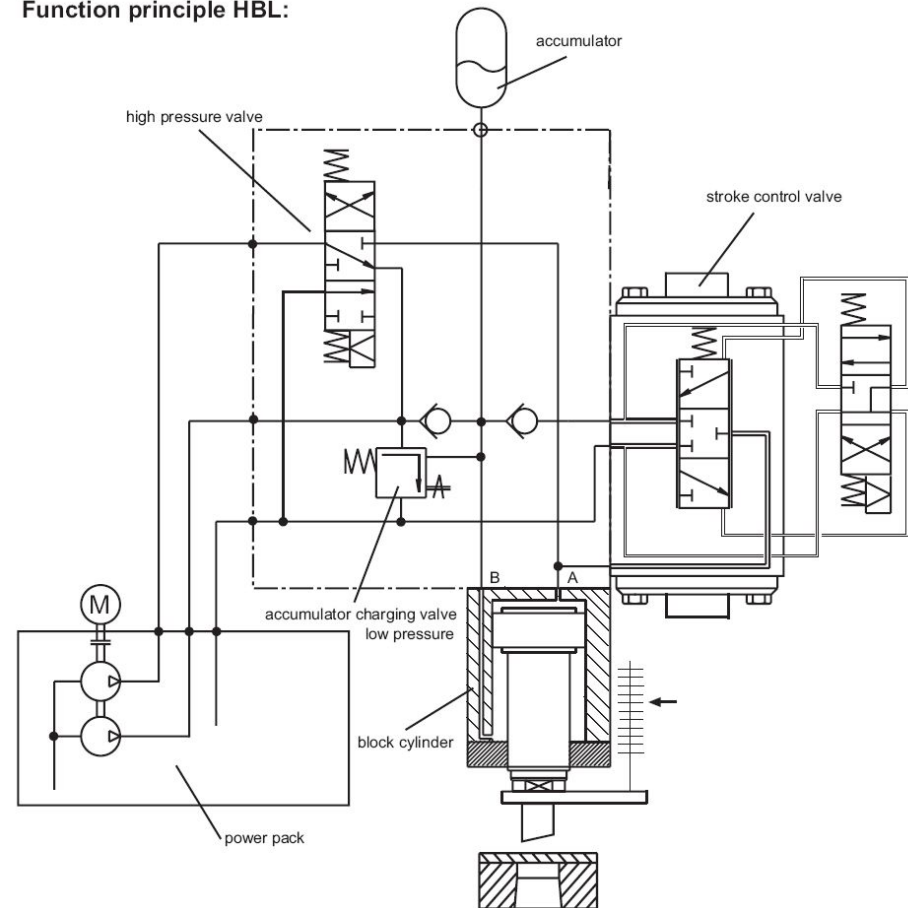
performance



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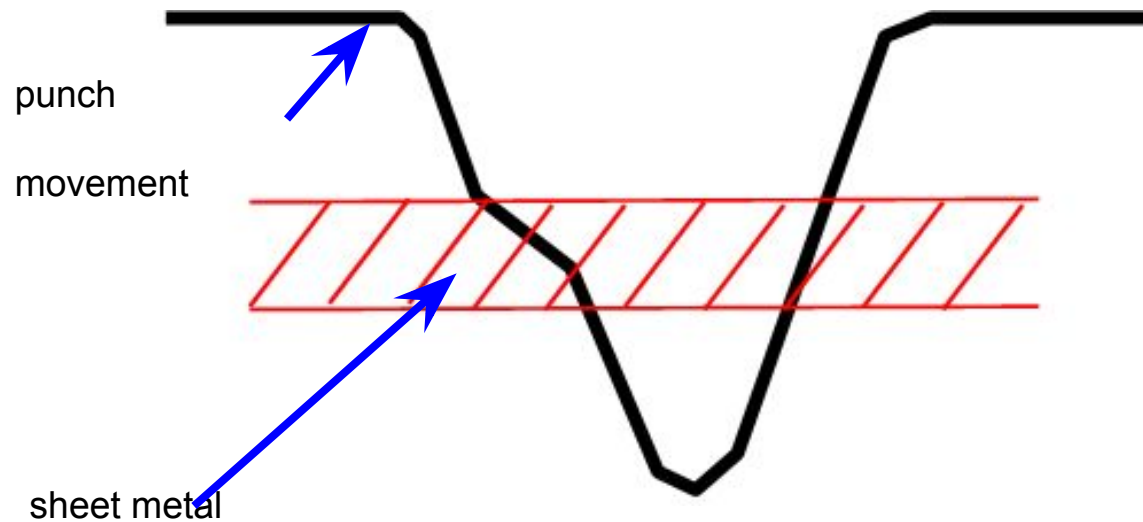


Function principle HBL:



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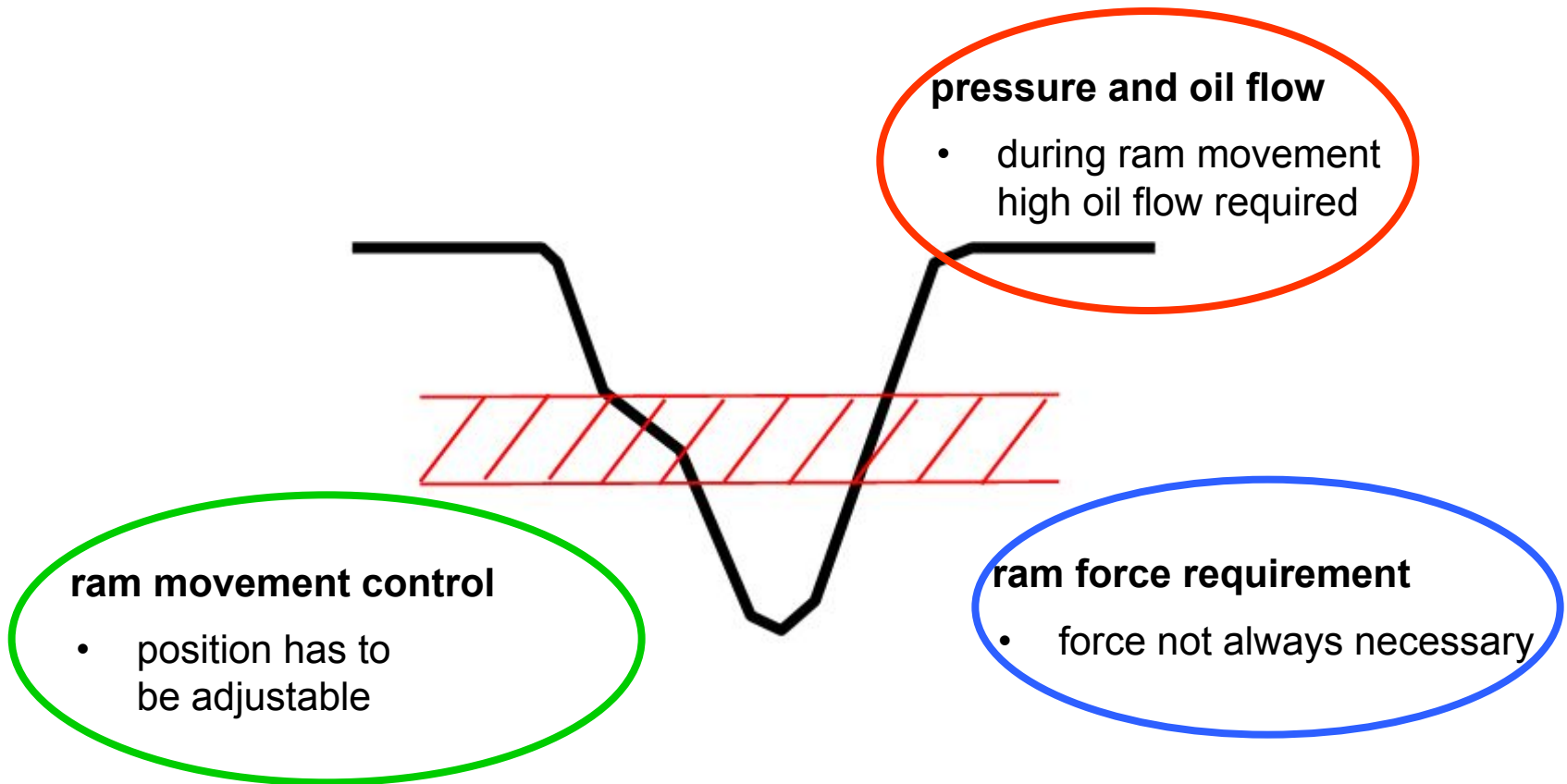
Punch operation - general reflection



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Punch operation - general reflection

Präsentation



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Basis functions

pressure and flow conditioning

- accumulator charging control
- consumption optimized hydraulic

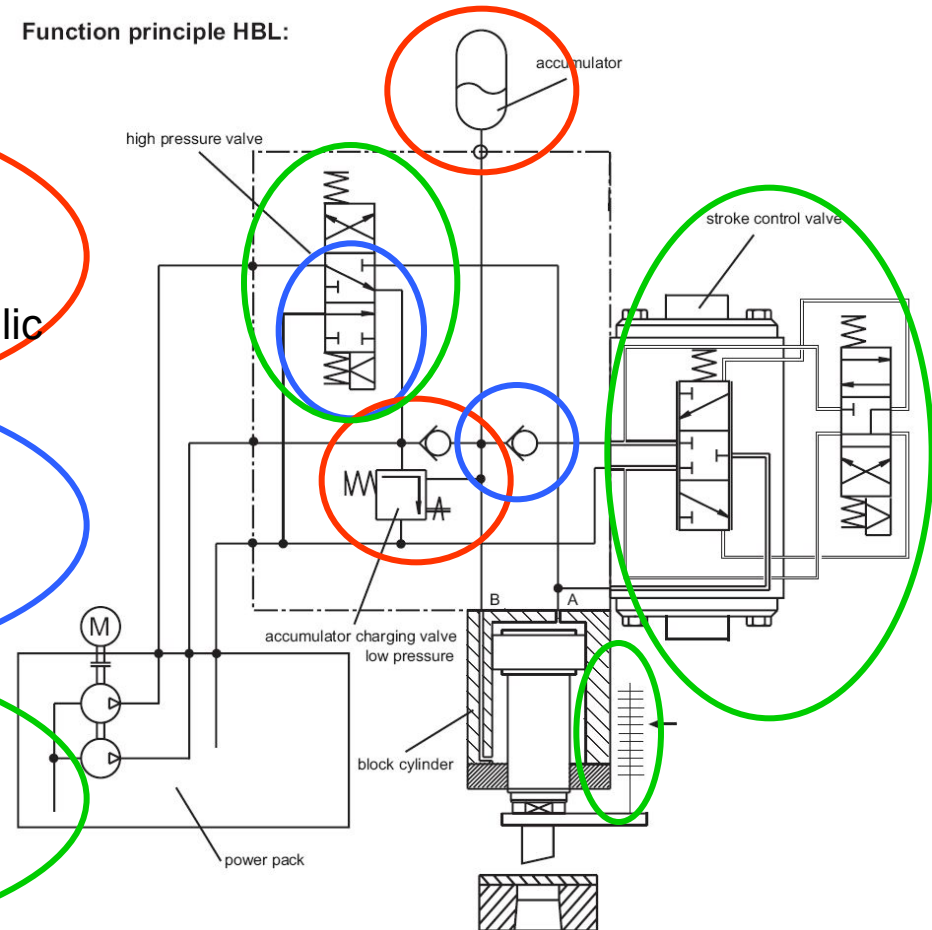
ram force supply

- load sensing control
- high pressure on demand

ram movement control

- position control
- short cycle times

Function principle HBL:



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Basis functions

pressure and flow conditioning

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- consumption optimized hydraulic

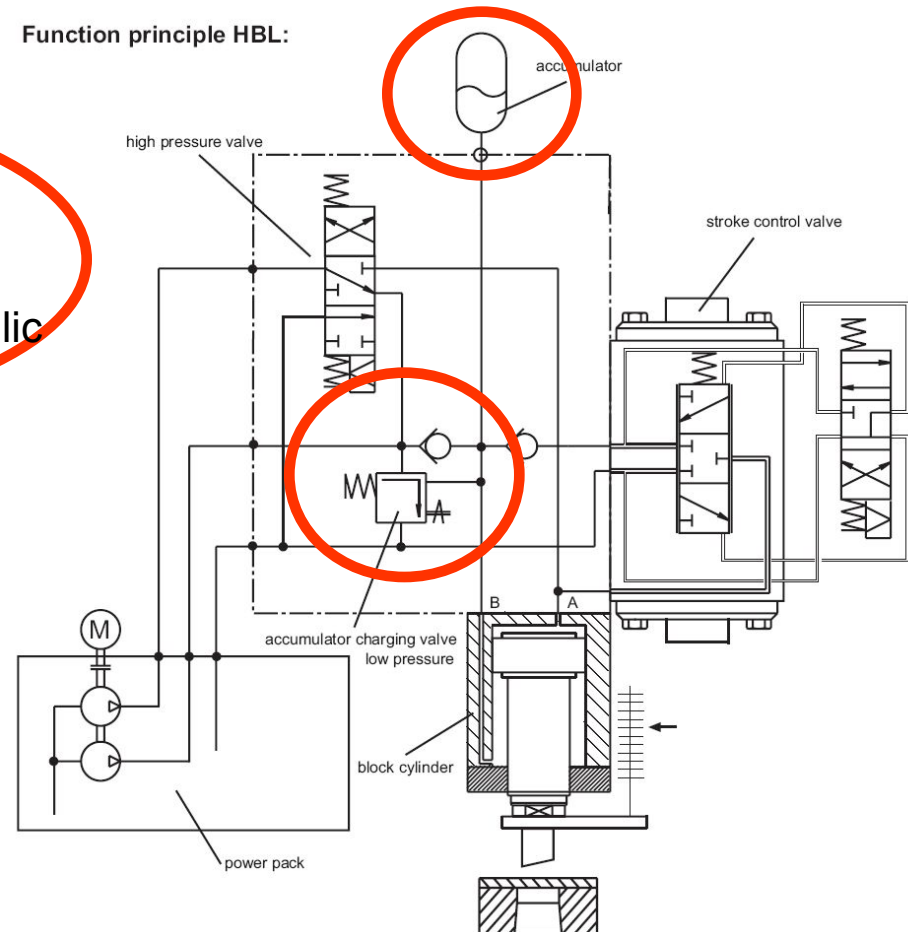
ram force supply

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ram movement control

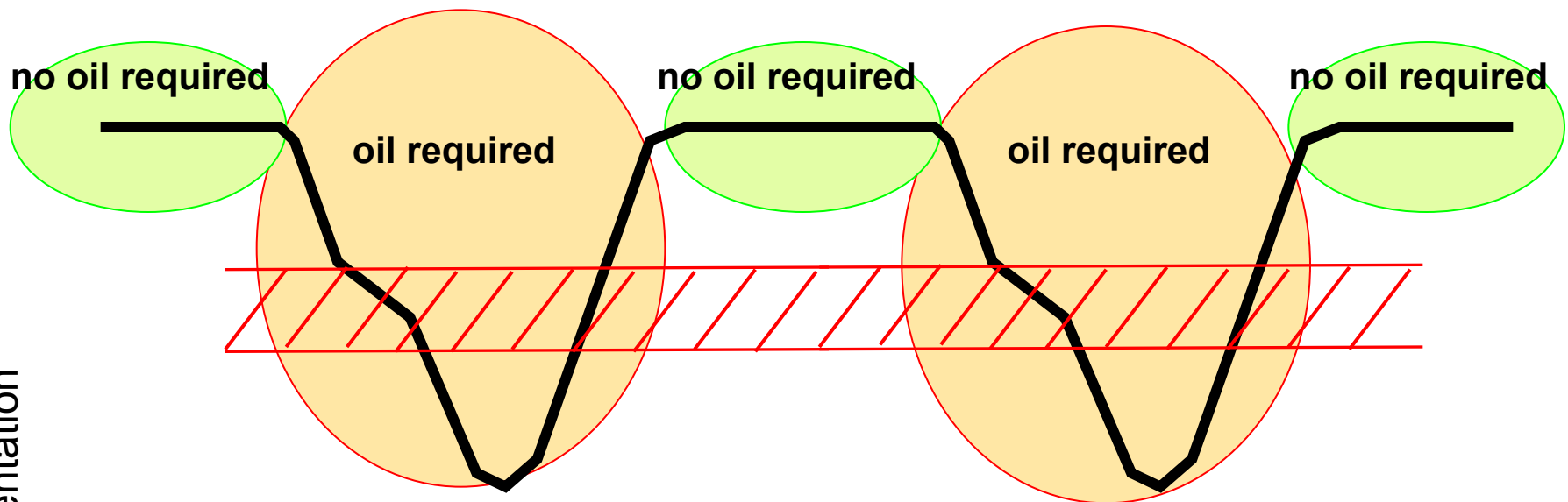
- position control
- short cycle times

Function principle HBL:



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General reflection – oil requirement

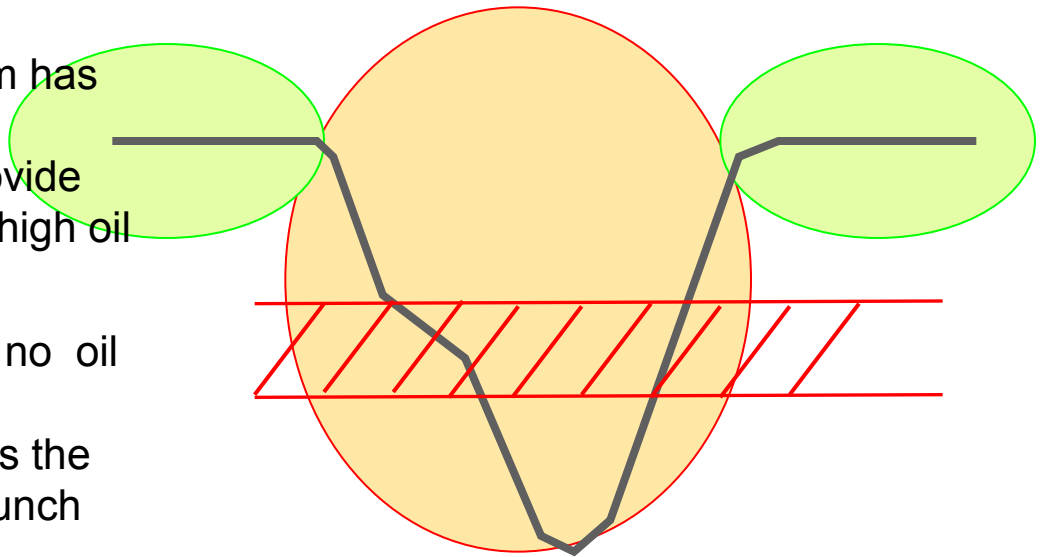


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General reflection – oil requirement

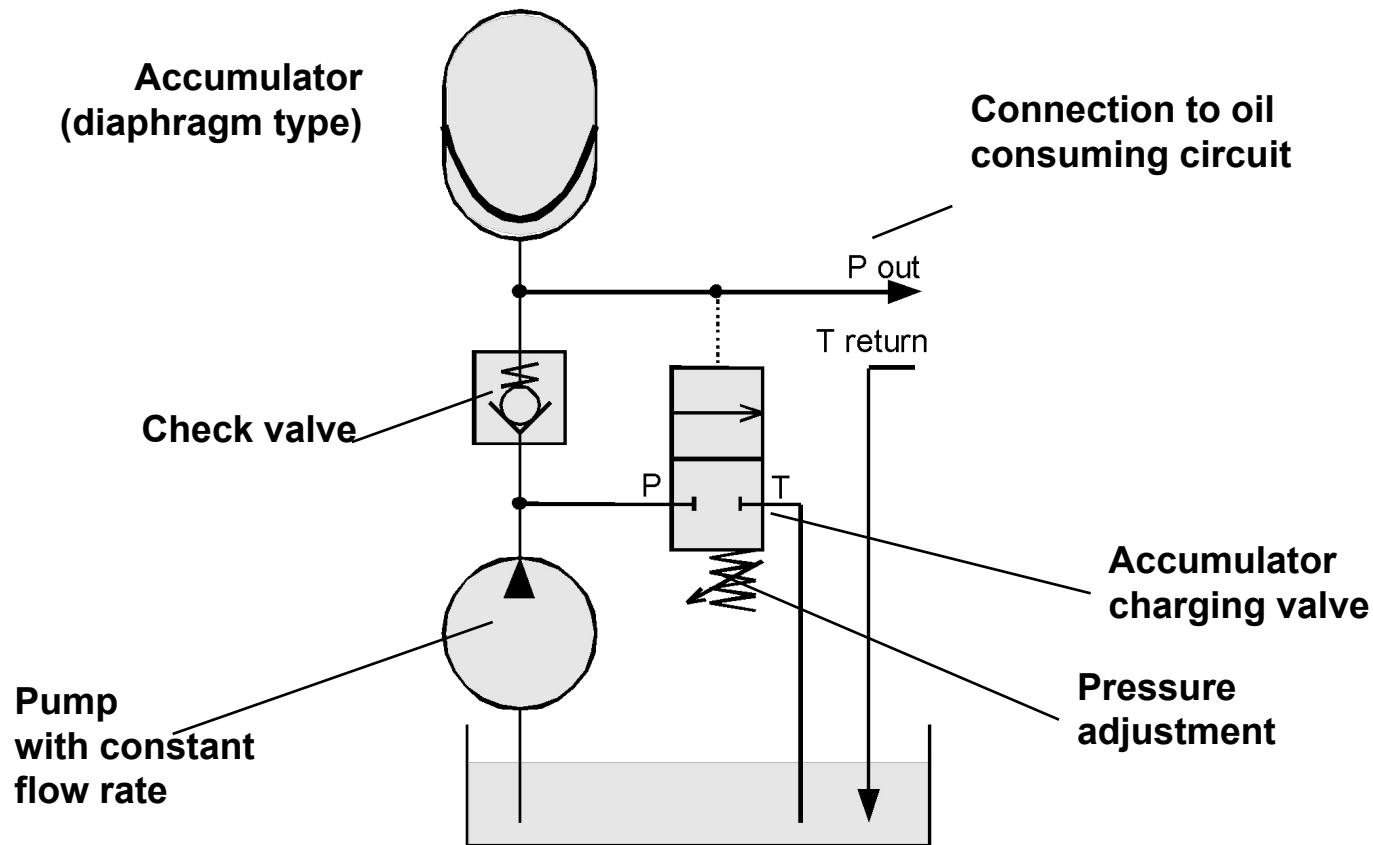
accumulator operation idea

- during punch operation ram has high oil consumption. accumulator and pump provide together the required very high oil flow.
- during X/Y axis movement no oil consumption of the ram. during that time pump refills the accumulator for the next punch cycle.



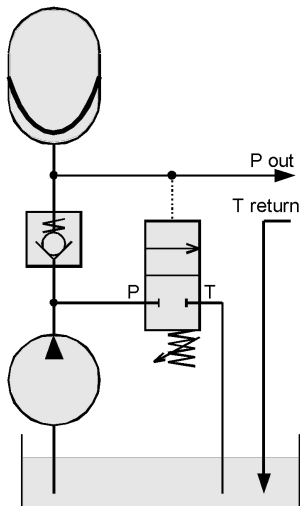
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Oil requirement – accumulator charging

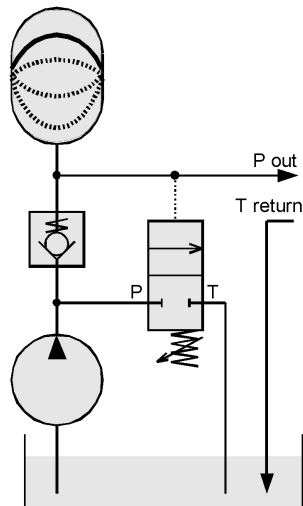


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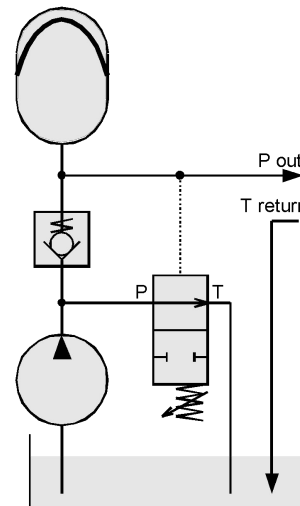
Oil requirement – accumulator charging sequence



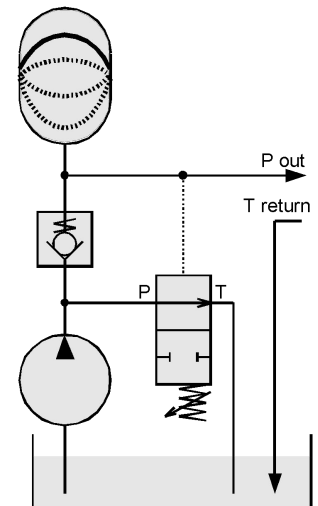
Empty:
Accu empty,
valve charging



Filling:
Accu filling,
valve charging



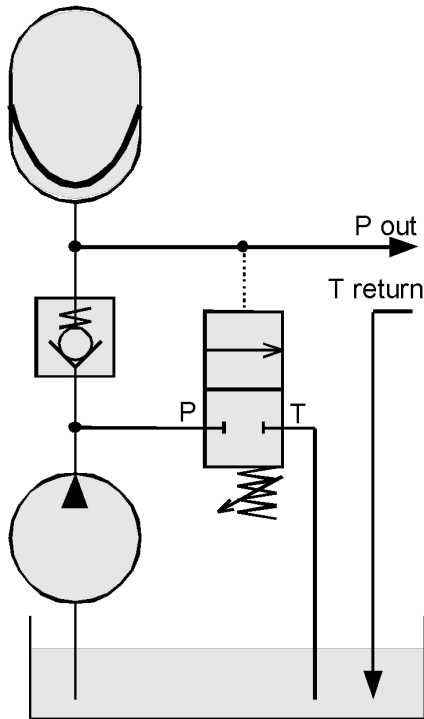
Full:
Accu full,
valve = bypass



Delivering:
Accu dropping,
valve = bypass

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Accumulator charging



Key Features:

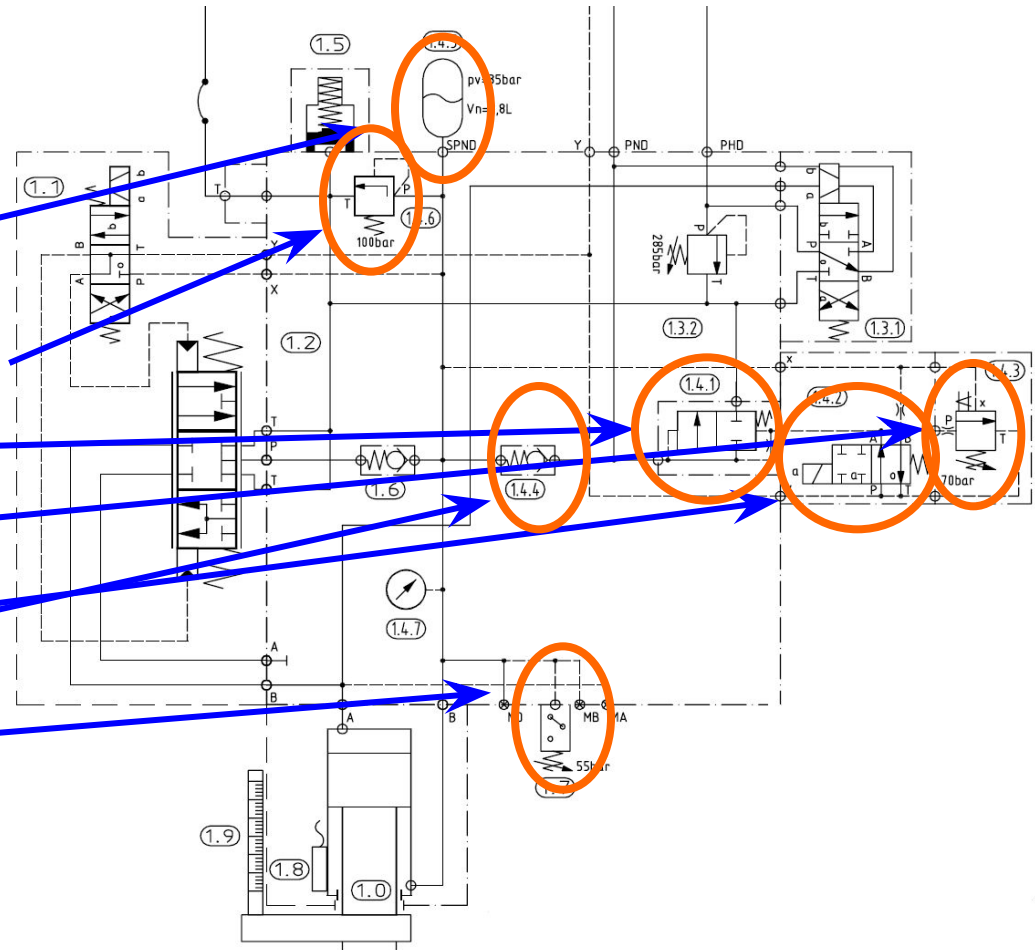
- **Efficient:** low bypass pressure saves energy
- **Reliable:** pure mechanical steering
constant flow rate pump
- **Setup:** no complex adjustments
- **Dynamics:** good response to load changes
- **Low noise:** soft switching valve

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Accumulator charging

devices

- accumulator
- safety valve (pressure relief)
- charging valve main stage
- charging valve pilot stage
- electr. discharging valve
- check valve
- pressure switch



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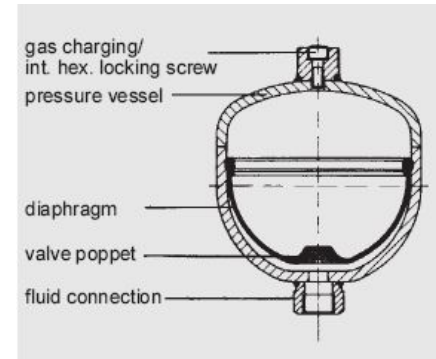
Accumulator charging - device guide

accumulator

- type of construction - diaphragm
- precharge pressure (nitrogen) according to hydraulic circuit

quick check for precharge pressure:

- start up hydraulic, let it pressurize
- stop pump, deenergize electr. discharge valve.
- monitor pressure gauge
- pressure must drop slowly until precharge level is reached, then will drop abruptly to zero.



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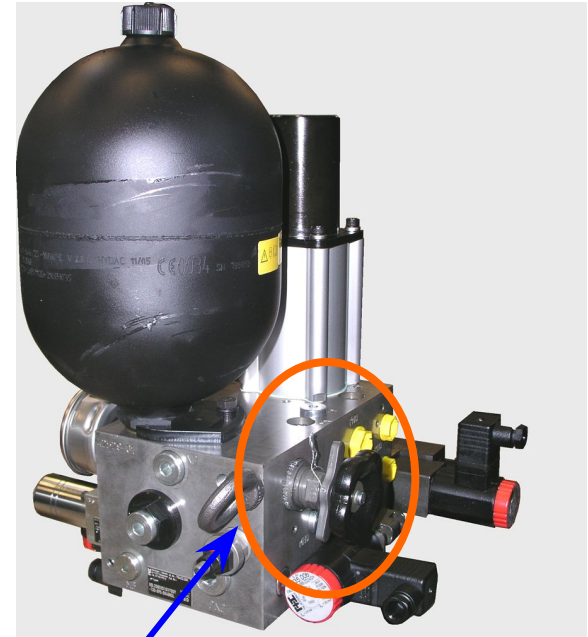
Accumulator charging - device guide

safety valve (pressure relief)

- type of construction – poppet seat valve

remark:

- for security issues only
- do not brake seals
- do not make any adjustments
- do not lose certificates



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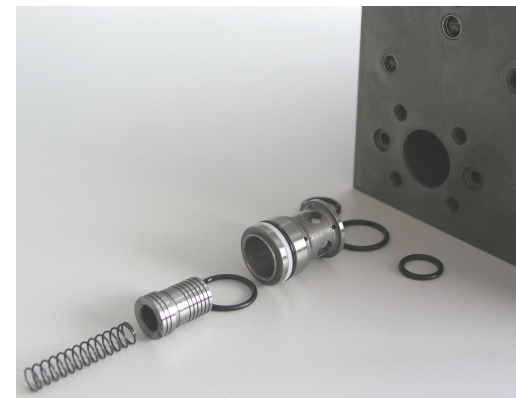
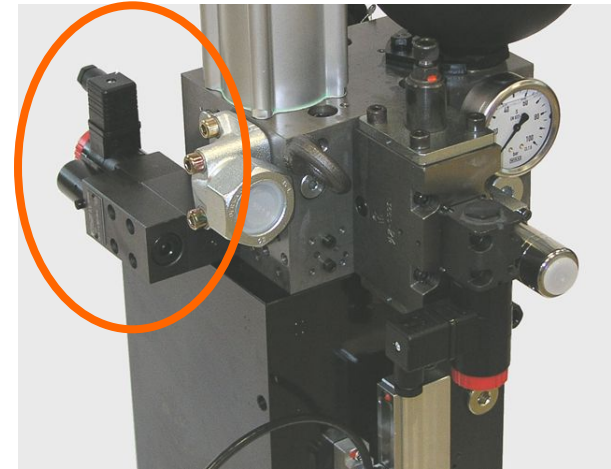
Accumulator charging - device guide

accumulator charging valve consisting of:

- main stage → cartridge valve (in manifold)
- pilot stage → for pressure adjustment
- electrical discharging → 4/2 solenoid valve

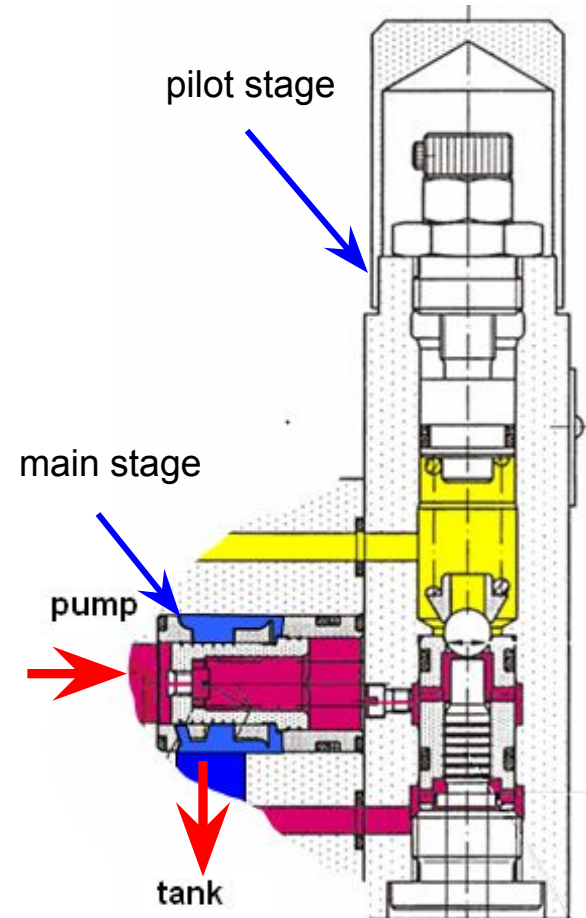
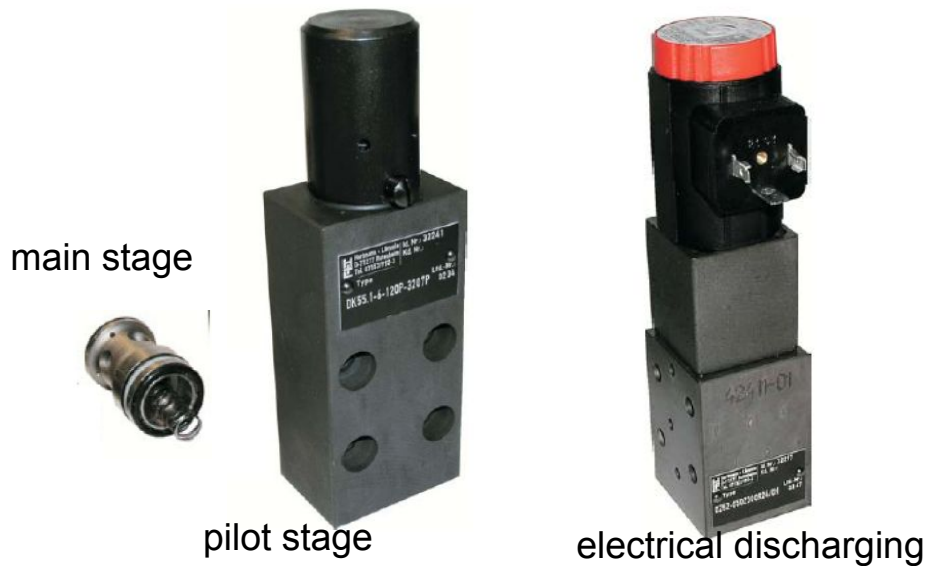
remark:

- restrictor in cartridge valve has to be clean!
- if restrictor is blocked → no pressure



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Accumulator charging - device guide

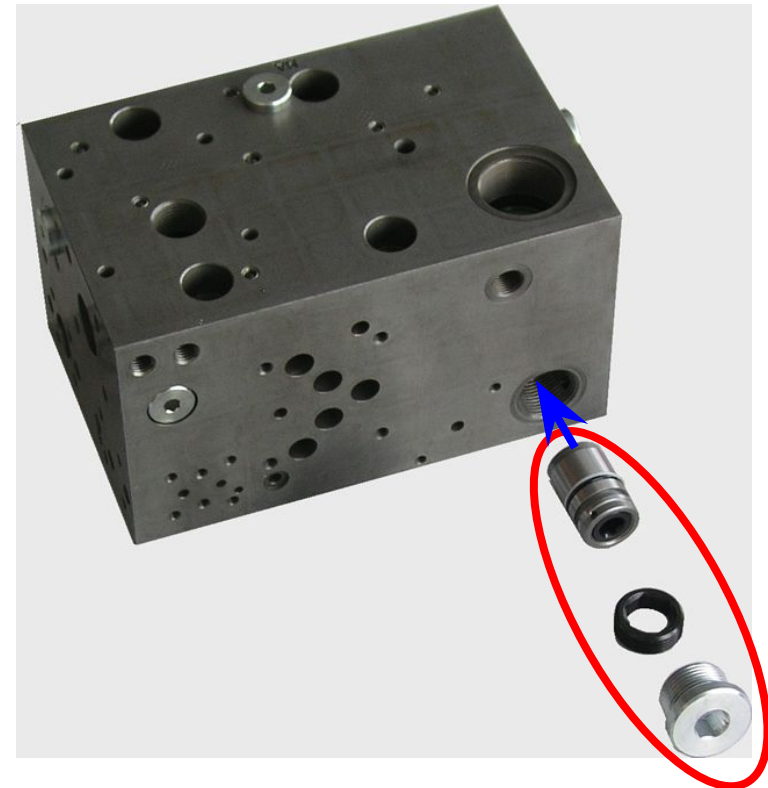
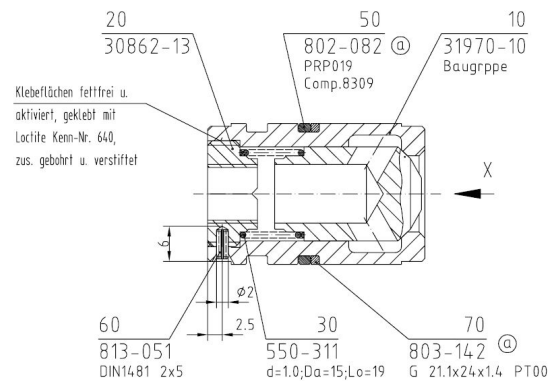


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Accumulator charging - device guide

check
valve:

- type of construction:
cartridge valve
- mounted in manifold



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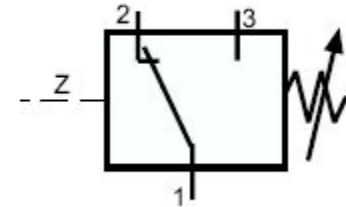
Accumulator charging - device guide

pressure switch

- type of construction – piston valve

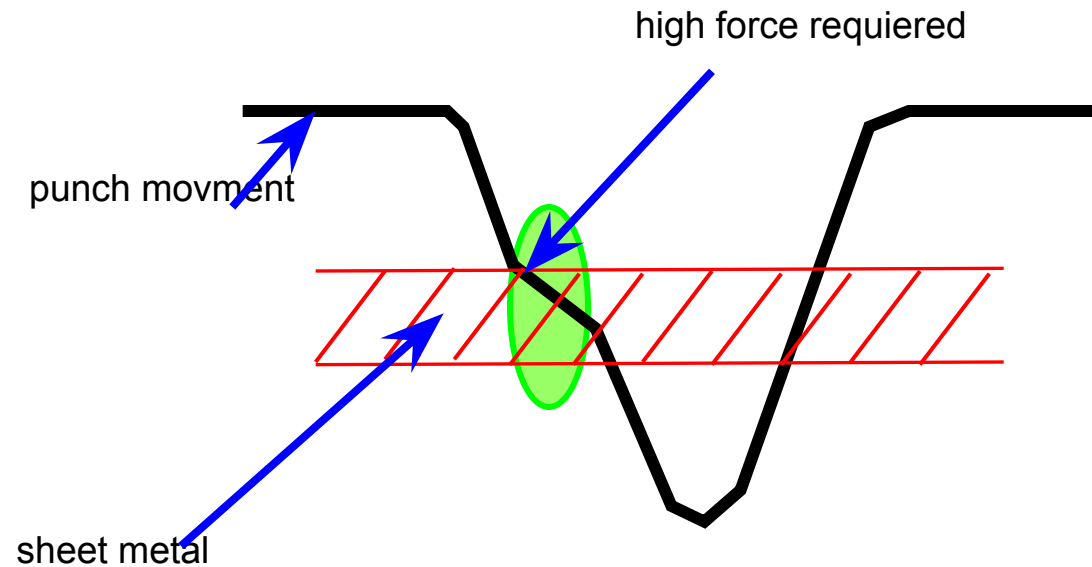
remark:

- for monitoring pressure only
- no other functions
- has to be controlled by machine control
- adjustment pressure according to hydraulic circuit



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Ram force supply

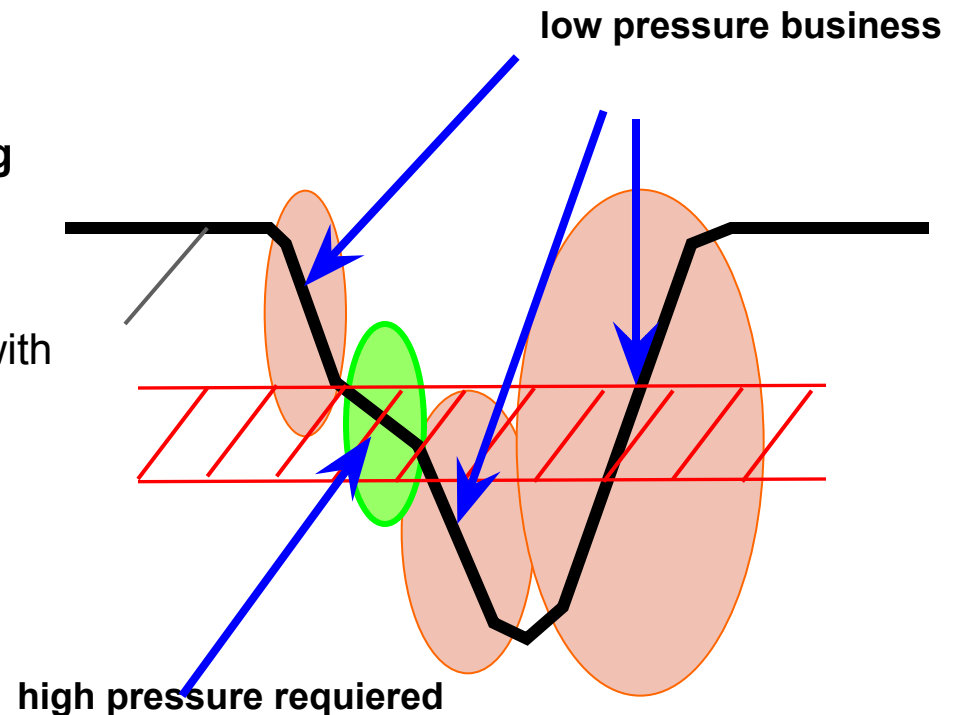


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Ram force supply - low/high pressure operation

consumption optimised punching

- two pressure solution with high and low pressure
- nibbling and punch processes with low force demand under low pressure
- only on high force demand high pressure generation

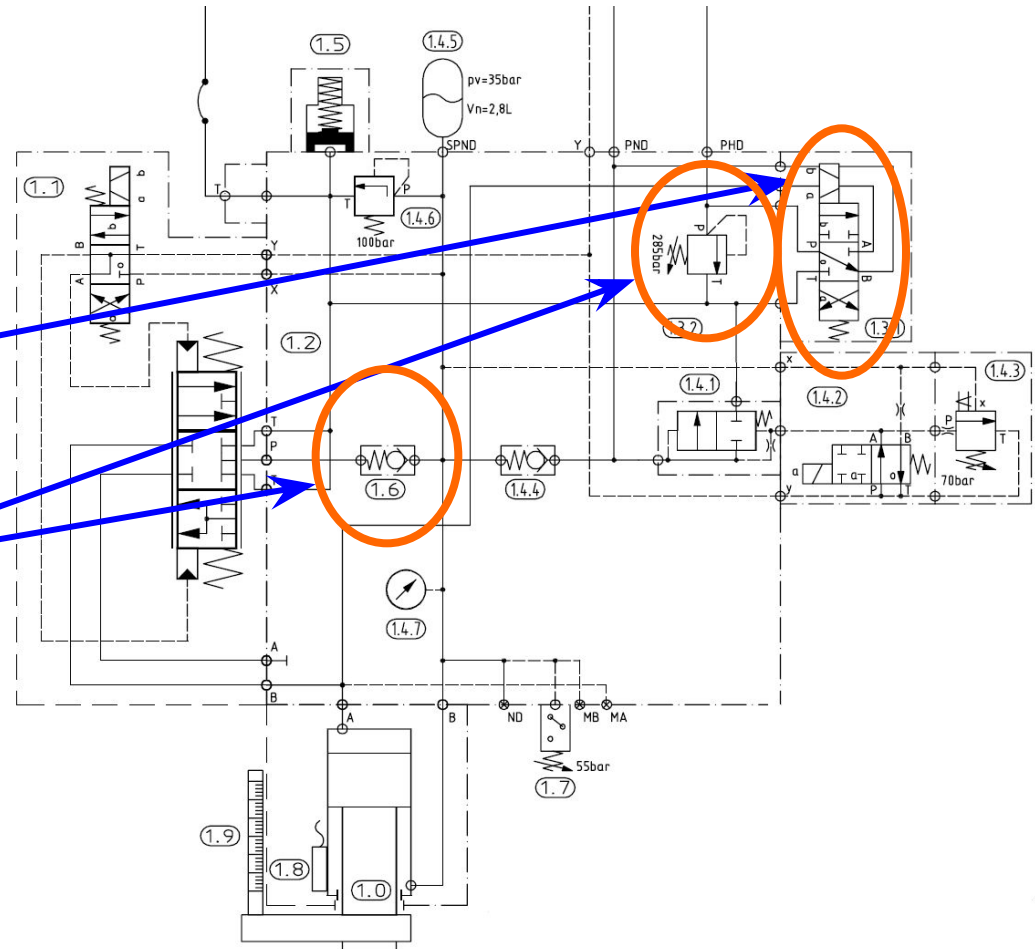


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Ram force supply

device guide

- slow move valve (high pressure switch on)
- high pressure relief valve
- check valve

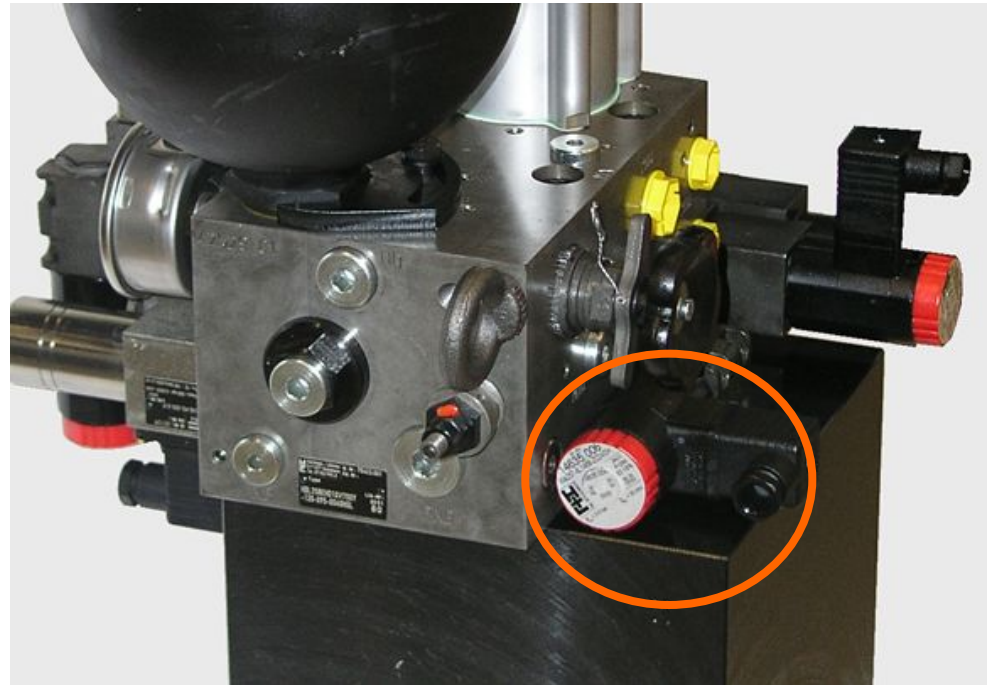
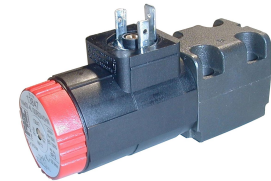


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Ram force supply - device guide

slow move valve

- high pressure switch on!
- directly controlled
- fast switching
- solenoid valve



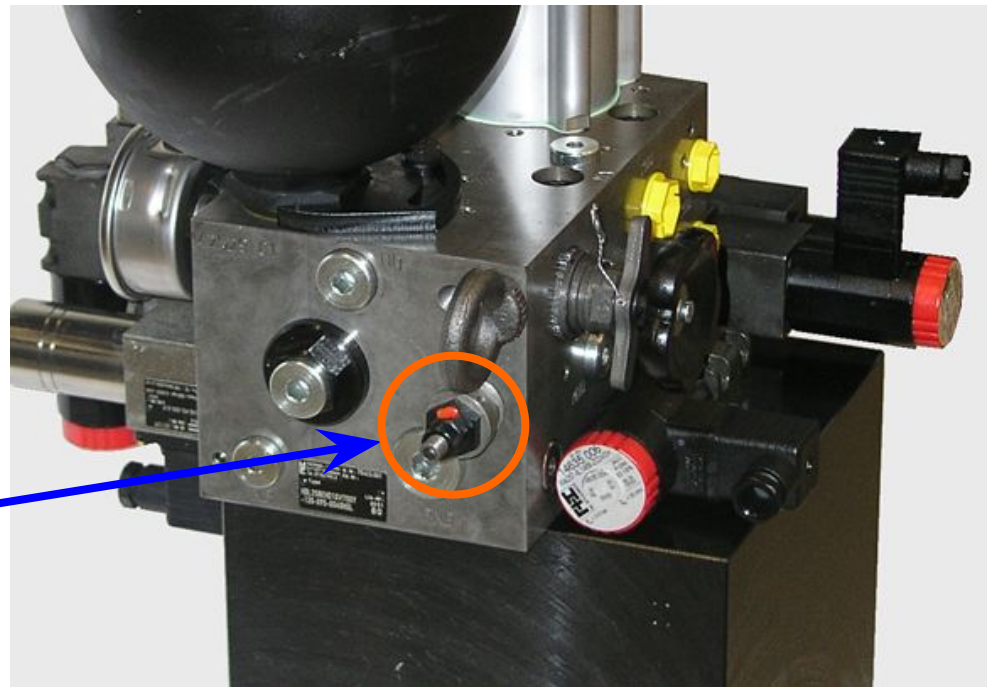
example 4/3 solenoid valve

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Ram force supply - device guide

high pressure relief valve

- directly controlled pressure relief valve

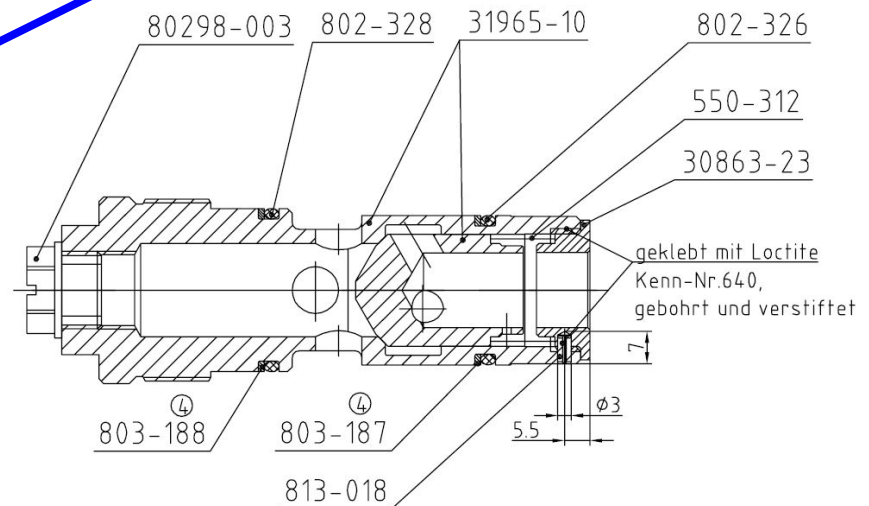
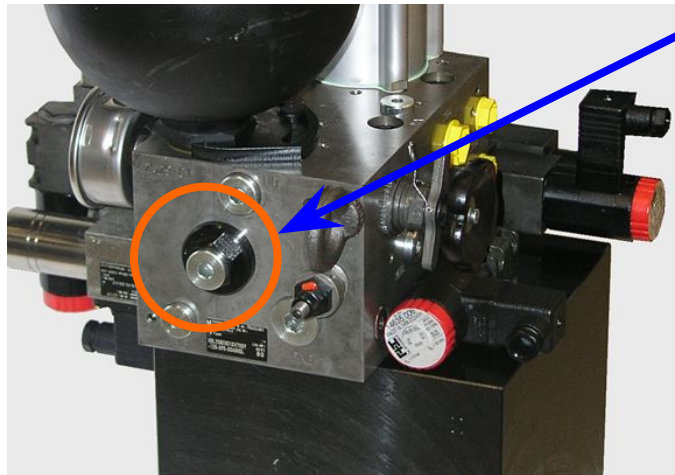


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Ram force supply - device guide

check valve

- poppet seat valve



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Basis functions

pressure and flow conditioning

- accumulator charging control
- consumption optimized hydraulic

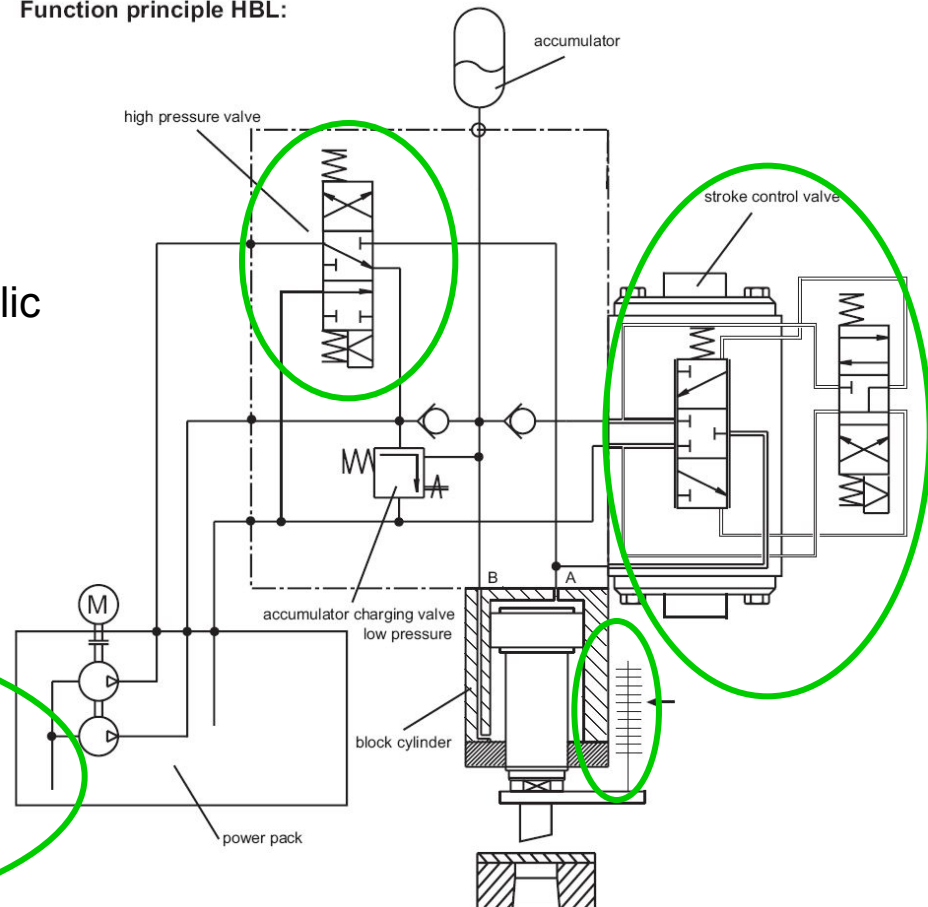
ram force supply

- load sensing control
- high pressure on demand

ram movement control

- position control
- short cycle times

Function principle HBL:

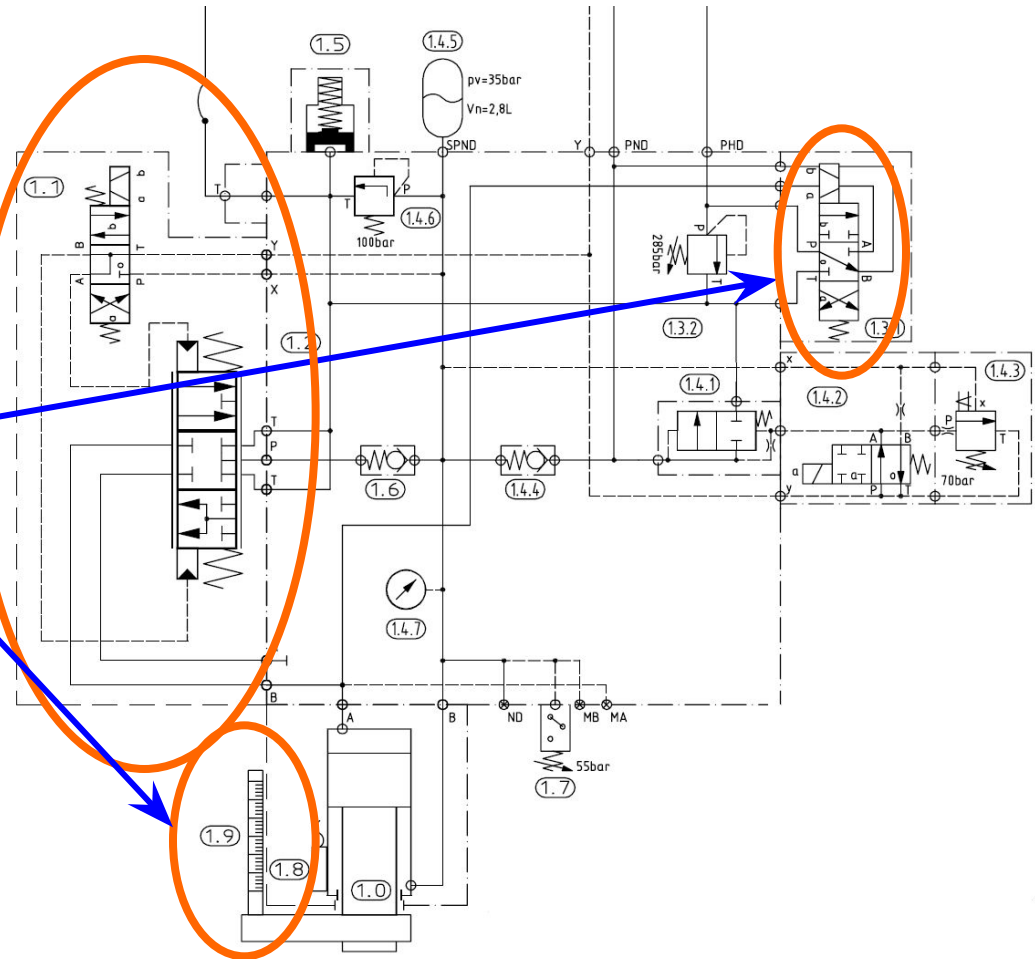


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Ram movement control

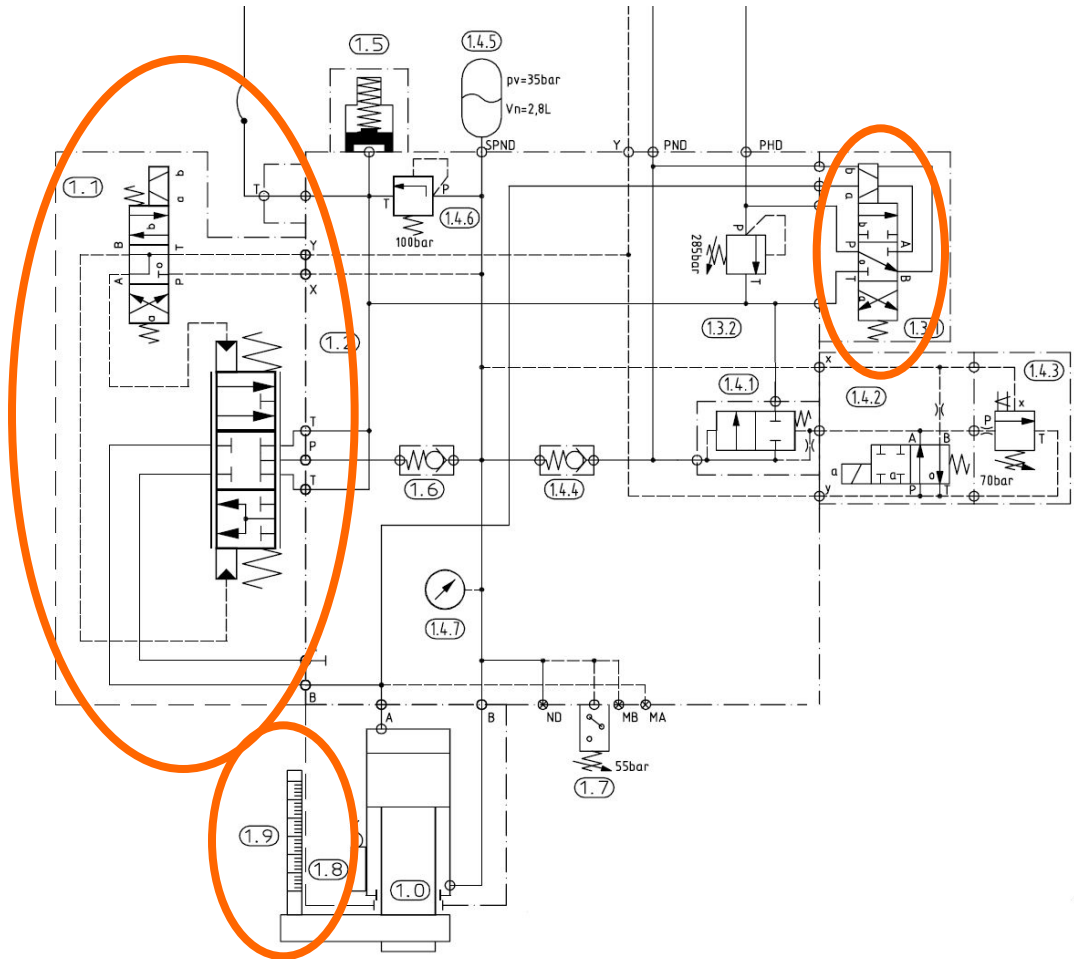
device guide

- main valve
- slow move valve
- linear measuring device



Ram movement control

- main & slow move valve
-> working in parallel
- both valves together
-> fast movement
-> full force
- only slow move valve
-> slow movement
-> high precision
- only main valve
-> reduced punch force
(only about 15%)

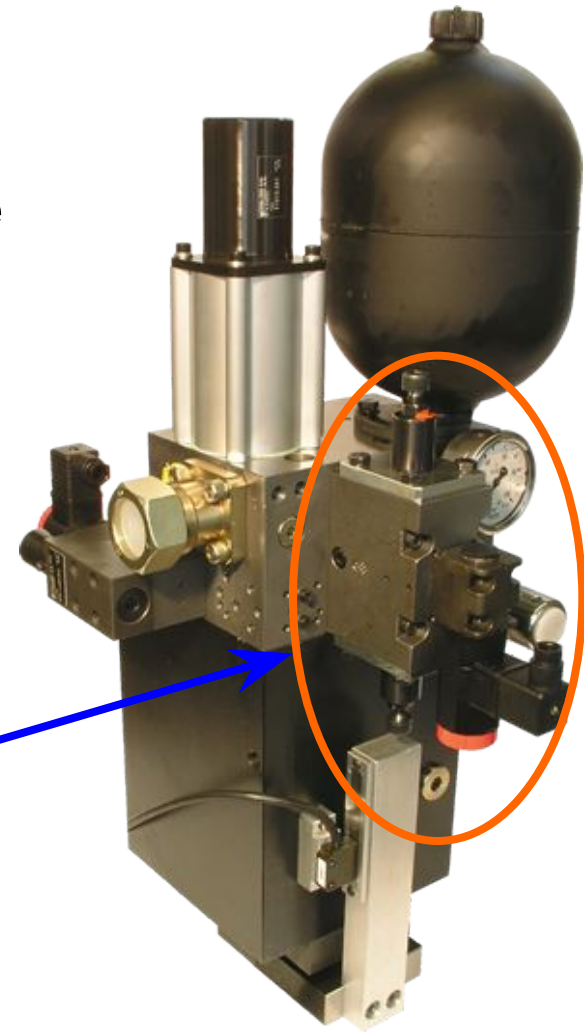
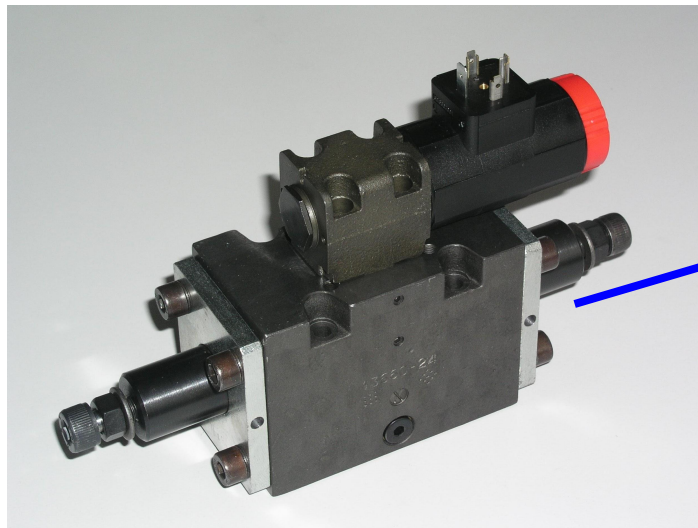


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Ram movement control - device guide

main valve

- type of construction
pilot operated spool valve

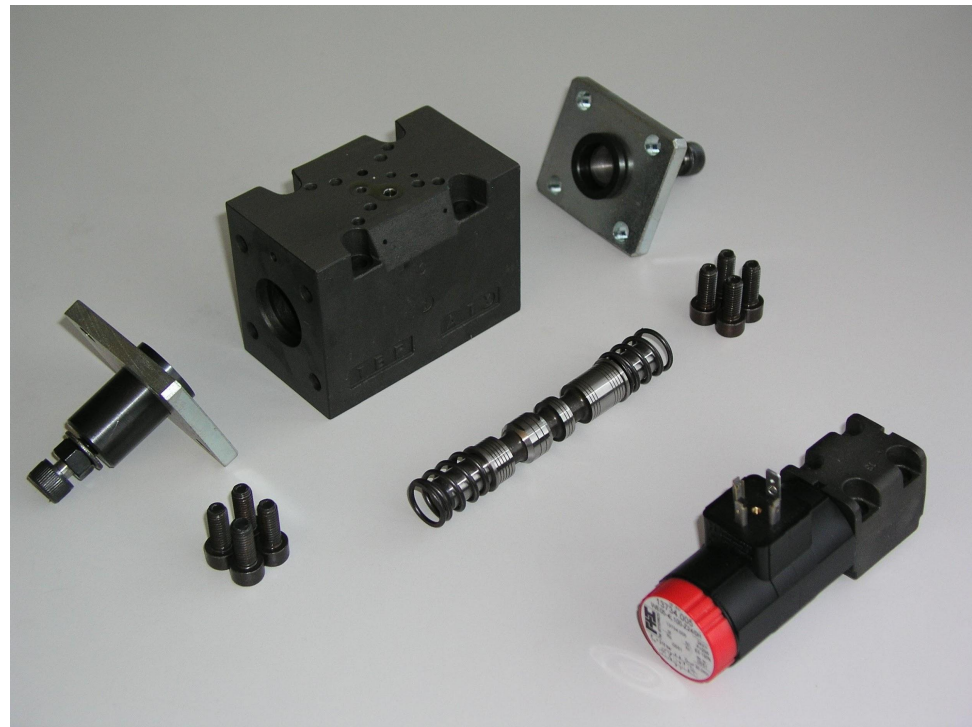
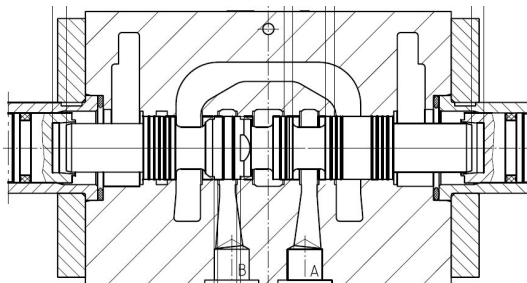


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Ram movement control - device guide

main valve

- pilot operated
- fast switching
- rugged design
- easy to handle

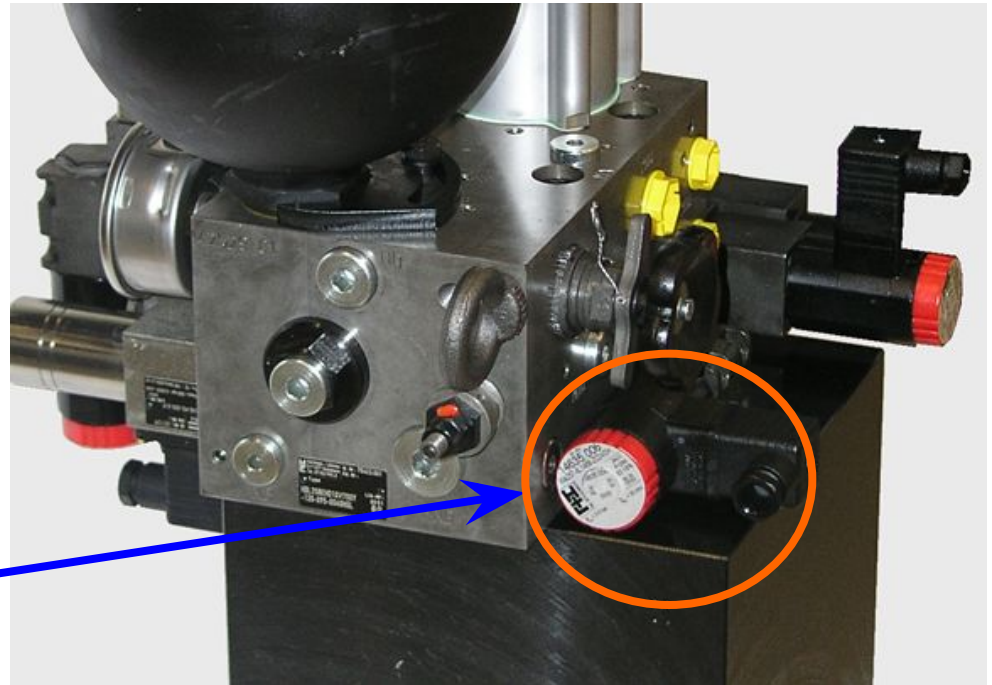
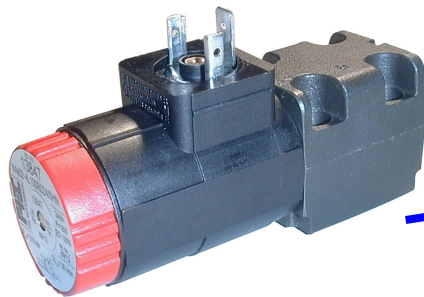


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Ram movement control - device guide

slow move valve

- directly controlled
- fast switching
- solenoid valve
- high pressure switch on!

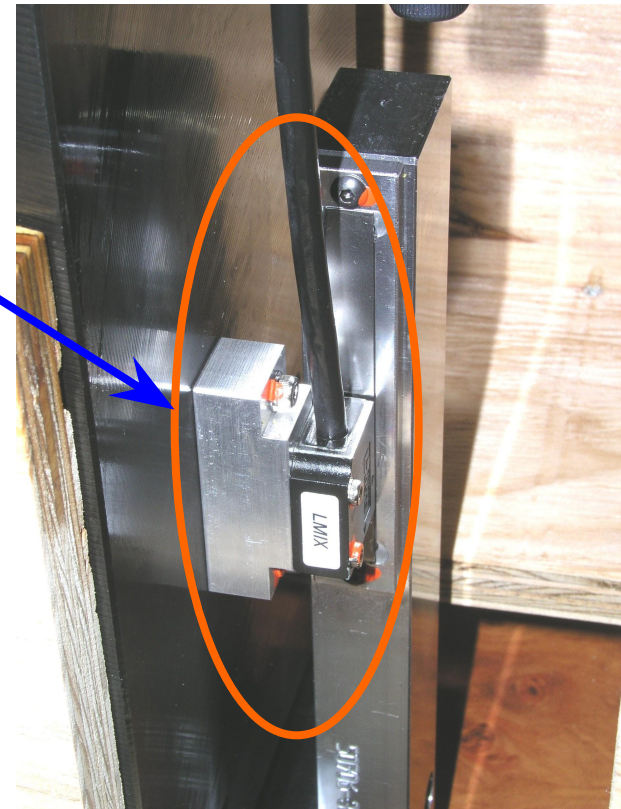


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Ram movement control - device guide

Linear measuring system (LMS)

- feedback sensor for ram position
- incremental signals, magnetic system
- gap adjustment 0.8 mm!

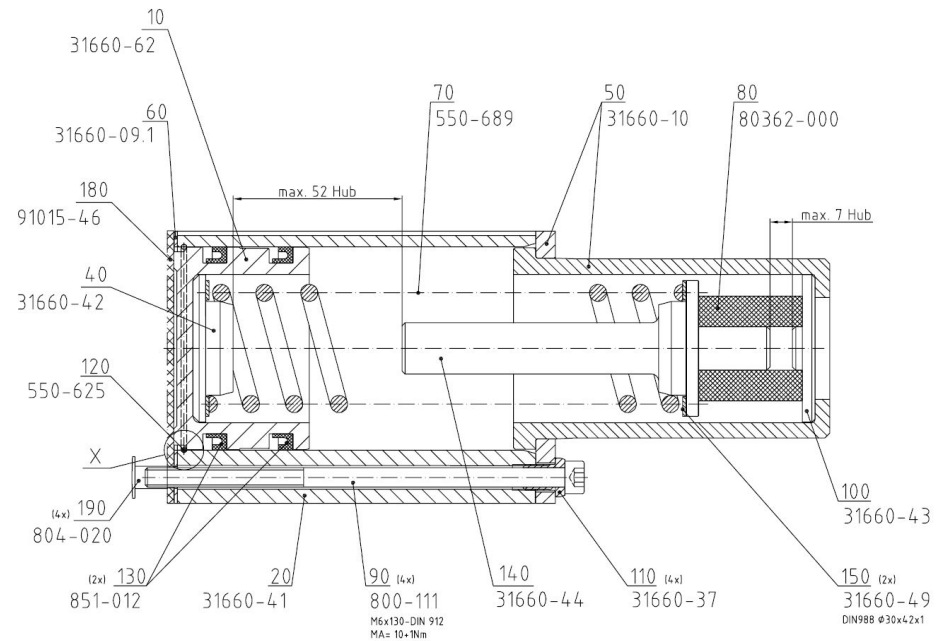
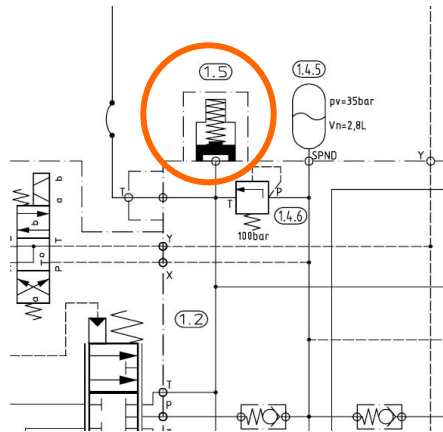


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Other ram devices

Tank line shock absorber

- piston accumulator
- damping pressure peaks in tank line

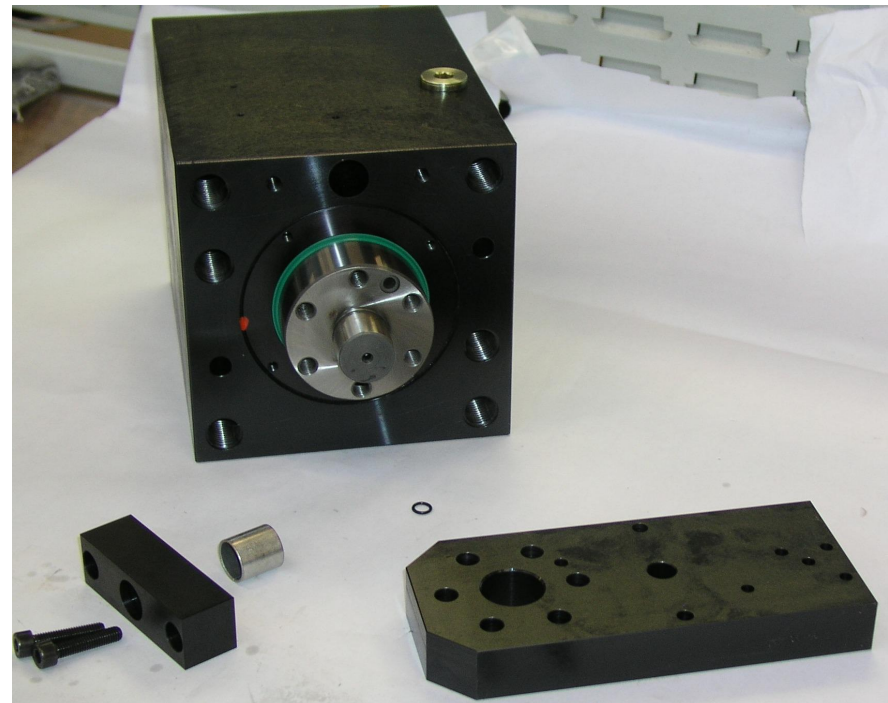


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Other ram devices

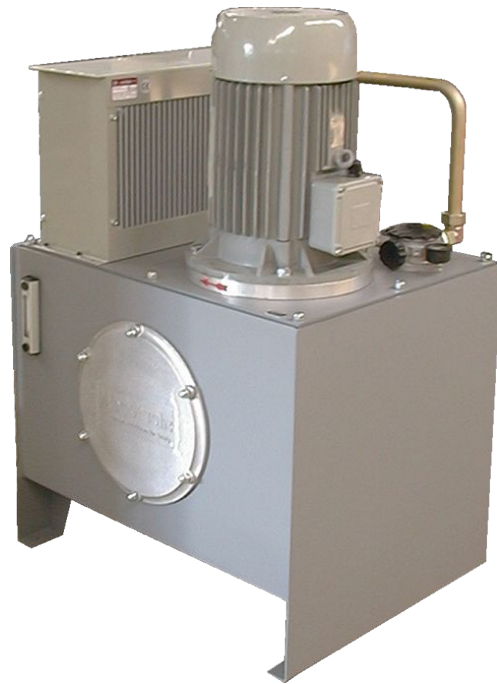
mechanical feedback parts

- guiding bar
- mechanics

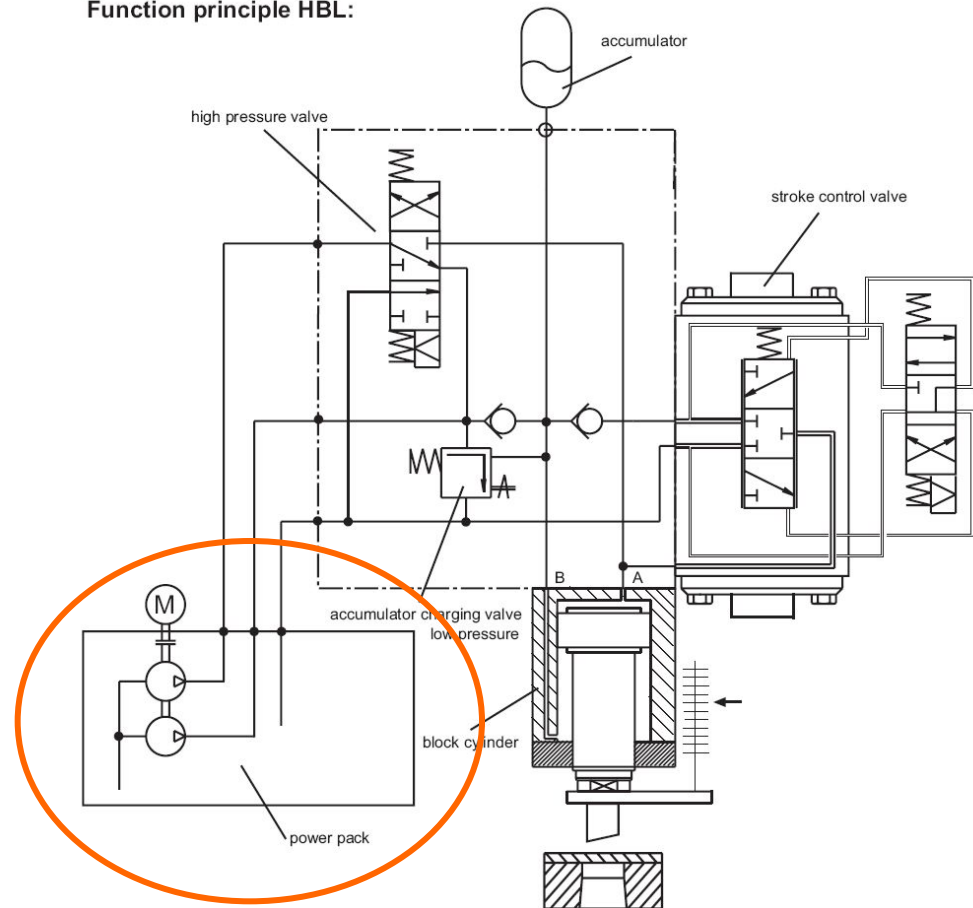


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Hydraulic power unit



Function principle HBL:

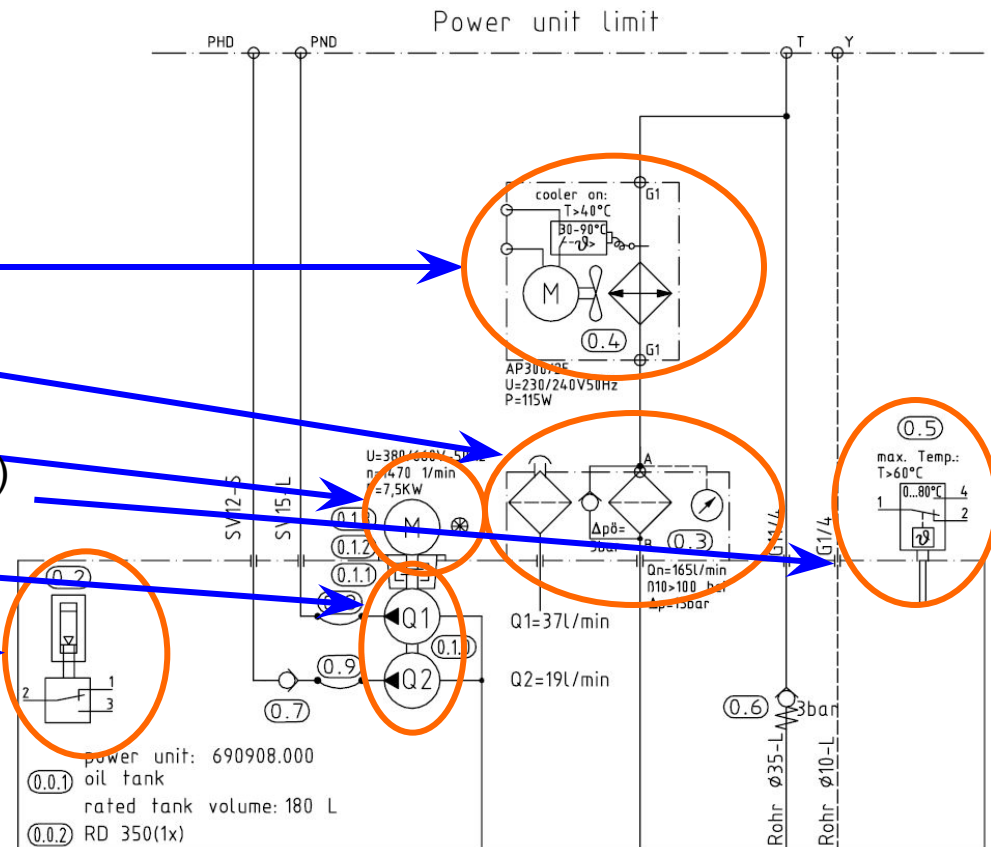


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Hydraulic power unit

device guide

- air cooler
- return line filter
- motor
- temperature control (option)
- gear pump combination
- oil level control (option)

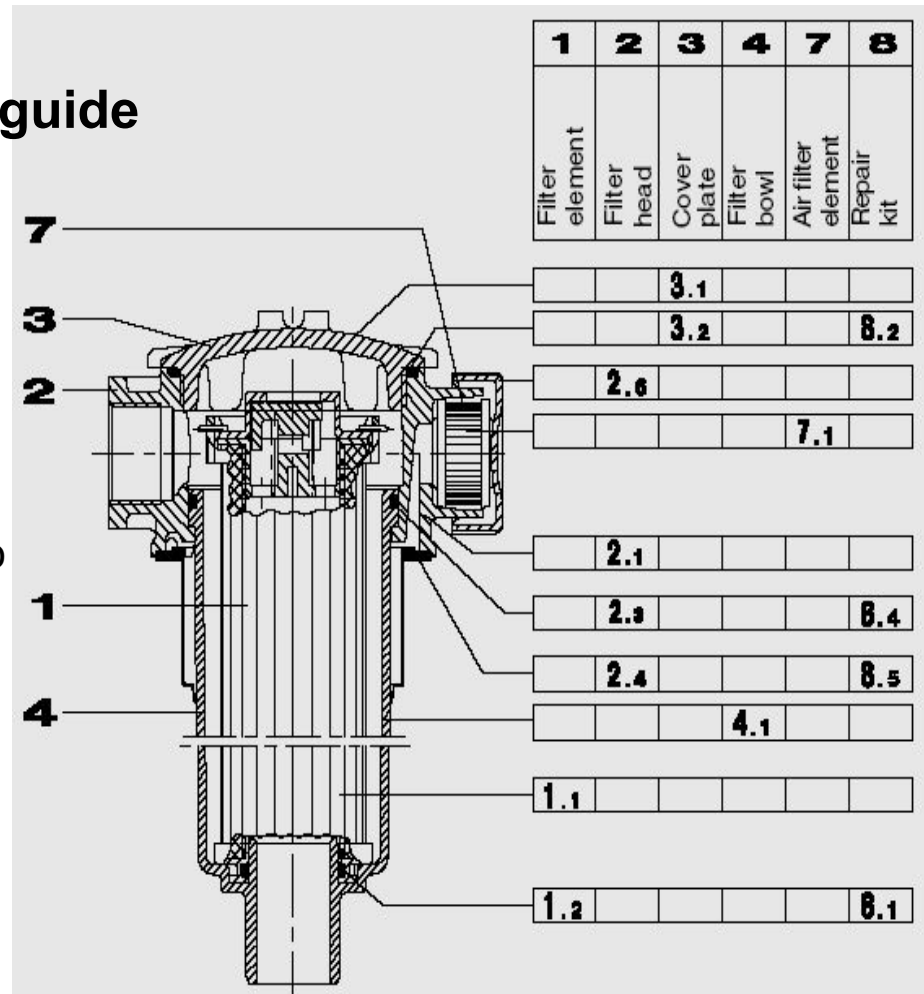


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Hydraulic power unit - device guide

return line filter

- contamination indicator has to be checked regularly
- filter elements are not reusable
do not try to clean used elements
- contaminated filterelements have to be replaced by original HYDAC spare parts
- do never run the hydraulics without filter elements

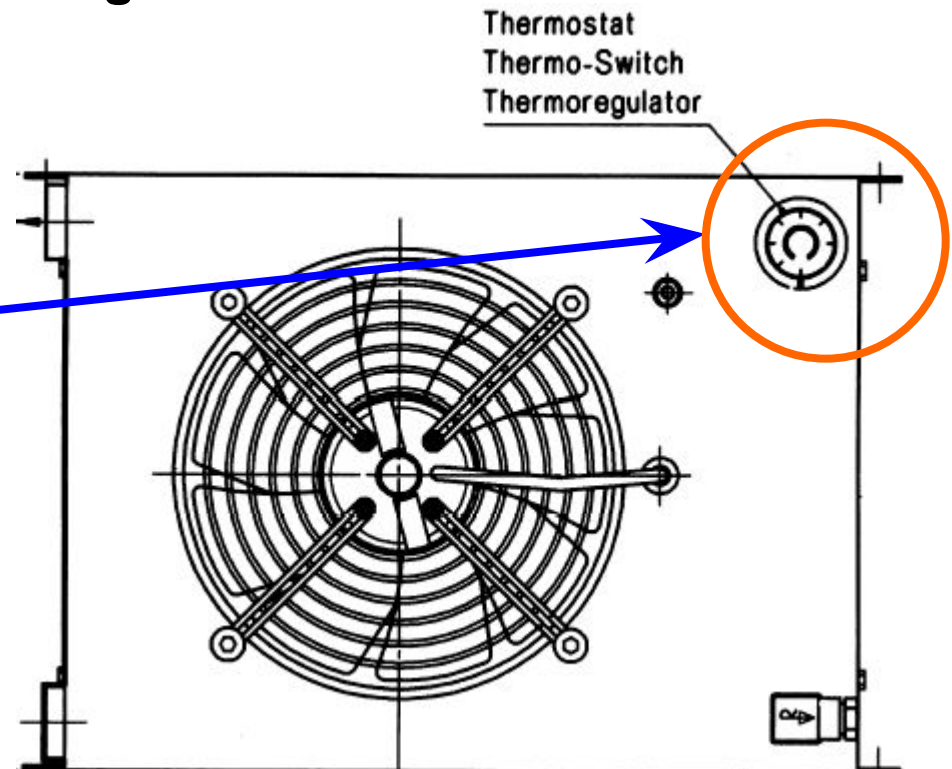
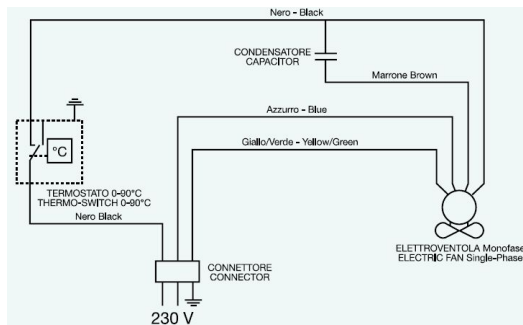


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Hydraulic power unit - device guide

heat exchanger

- type of construction
oil air cooler
- integrated thermo switch
- switch on temperature 40 °C



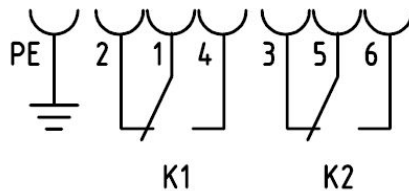
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Hydraulic power unit - device guide

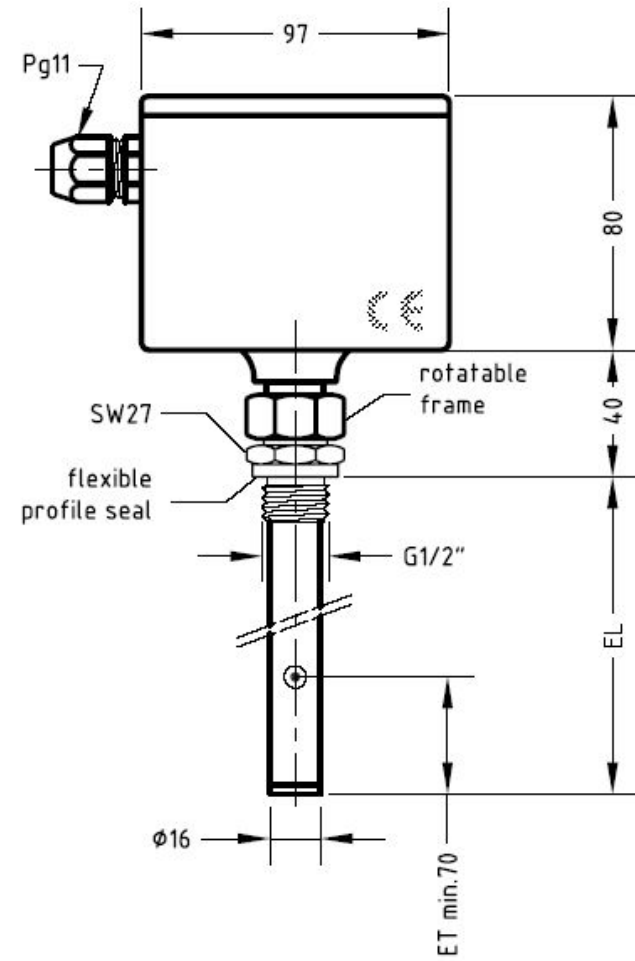
temperature control

- monitoring oil temperature

Terminal diagram



Function under switching
temperature





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Service guide - first meeting with the machine

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Service guide - first meeting with the machine

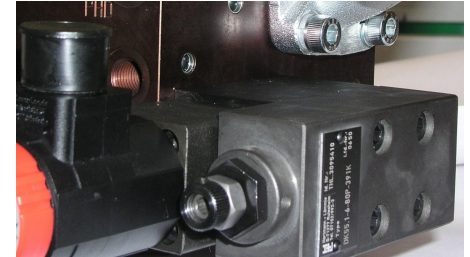
- pressure adjustments (low pressure)
- accumulator charging frequency
- accumulator precharge pressure
- high pressure switch on
- pressure adjustments (high pressure, pressure switch)
- other controls:
 - general punching behavior
 - noise (machine, pump, pipes and hoses)
 - LMS adjustment
 - external leakage

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Service guide- first meeting with the machine

Pressure adjustments (low pressure)

- hydraulic pressurized, machine not running – look at gauges
- low pressure 70bar (see hydraulic circuit), hysteresis 10% (7 bar).
pressure drops down very slowly to about 63 bar. Fast reloading back to 70 bar.
- pressure adjustment only at accumulator charging valve (pilot stage).
- upper switching point is defined as working pressure. For correct working pressure see hydraulic circuit.
- monitor pressure during punching. low pressure should be in a range between 70 to 50 bar and not drop below 40 bar.



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Service guide- first meeting with the machine

Accumulator charging frequency – low pressure

- hydraulic pressureized, machine not running, ram has to stay somewhere in mid-oil position - look at gauges
- low pressure charging frequency in a brandnew machine about 1-3 times a minute.
- high low pressure charging frequency can be caused by
 - to low accumulator precharge pressure
 - internal leakage caused by wear or cavitation in main valve
 - internal leakage through check valve (1.4.7)

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Service guide- first meeting with the machine

Accumulator precharge pressure - fast check

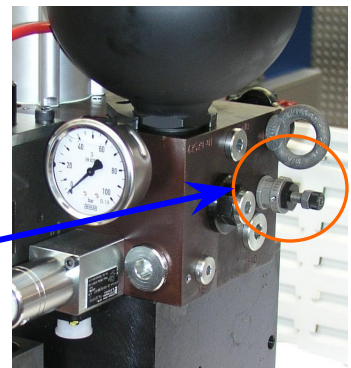
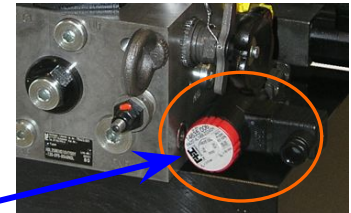
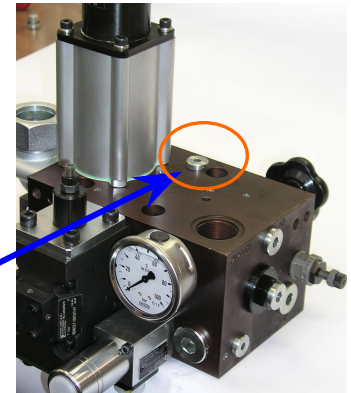
- stop pump, deenergize electrical discharge valve, monitor pressure gauges
- pressure must drop slowly until precharge level is reached, then will drop abruptly to zero.
- required precharge pressure see hydraulic circuit (about 35 bar)
- precharge pressure has to be measured under working temperature (45°C)
- Remark:
this procedure only useable for fast check, for detailed measuring appropriate measuring equipment required.

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Service guide- first meeting with the machine

Pressure adjustment (high pressure)

- put a pressure gauge in measuring port „MA“
- hydraulic pressurized, machine not running – look at gauges (you see about half the low pressure value at „MA“)
- move the ram down to the cylinder lower hard stop by switching “on” the “slow move valve” (Pos. 1.3.1) „manually“ with external 24 volt.
- look at gauges, you see high pressure value (285 bar) at „MA“
- high pressure adjustment only at high pressure relief valve

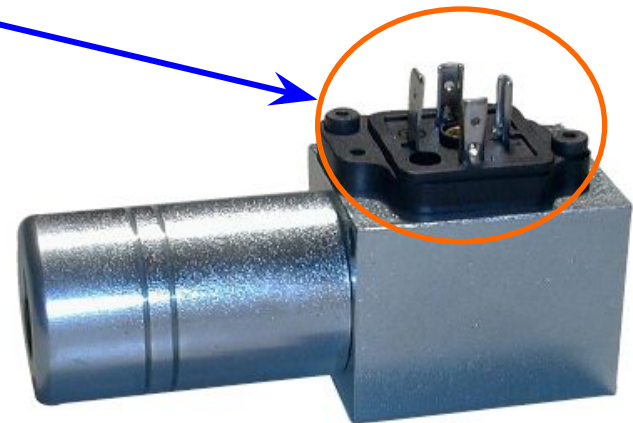
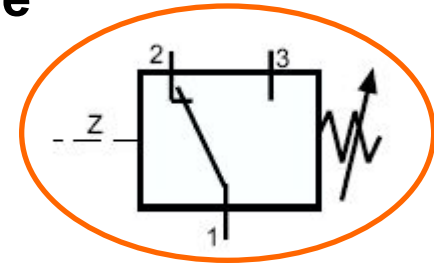


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Service guide- first meeting with the machine

Pressure adjustment (pressure switch)

- measure electrical resistance at pressure switch pin1 -> pin 3
- at working pressure pin1 -> pin3 connected
- deenergize electrical discharge valve, pressure drops slowly
- monitor pressure gauge, connection 1-3 opens at adjusted pressure value
- required switching point see hydraulic circuit



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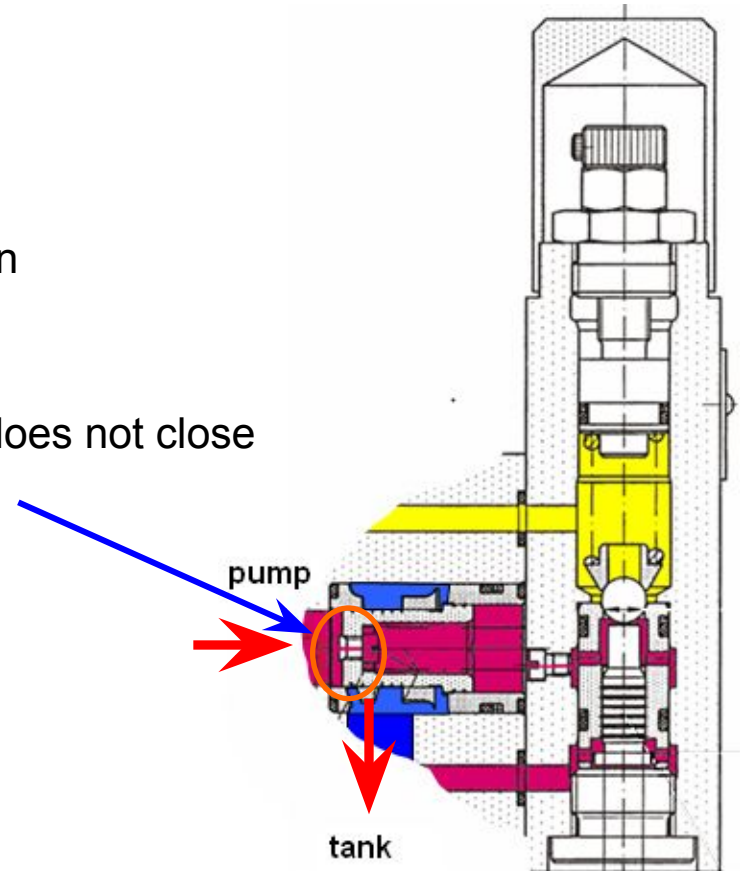
Service guide – trouble shooting

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Service guide - trouble shooting

No system pressure on pressure gauge

- electrical discharging valve not switched on
 - > lose connector plug
 - > jammed solenoid valve
- accumulator charging valve (main stage) does not close
 - > blocked restrictor in main stage piston
- extrem external leakage
 - > broken hose inside the powerpack



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Service guide - trouble shooting

System pressure problems (machine stand by)

- system pressure does not reach required level
 - > wrong pressure adjustment (accumulator charging valve)
 - > external leakage in powerpack - hose or flange connection
 - > broken pump (internal leakage)
 - > very high internal leakage in ram (search for source of heating!)
- to high accumulator charging frequency
 - > to low accumulator precharge pressure
 - > internal leakage ram (search for source of heating!)

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Service guide - trouble shooting

System pressure problems (machine punching)

- system pressure not high enough, machine stops very often during punching
 - > external leakage in powerpack - hose or flange connection
 - > wear in pump, does not deliver enough oil (internal leakage)
 - > internal leakage ram (losing oil)
- system pressure drops down too far during each punch stroke
 - > to low accumulator precharge pressure
 - > to long punch strokes
- system pressure seems to be fine, machine stops very often during punching
 - > check pressure switch adjustment
- Make punch master files!

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Service guide - trouble shooting

No home cycle possible

- low pressure not available -> see „no system pressure“
- “slow move valve“ (Pos. 1.3.1) does not switch correctly
-> check electrical connectors, valve piston blocked due to dirt?
- Make Punch master files!

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Service guide - trouble shooting

Tool change position (Pos1) not reached in time

- “slow move valve“ (Pos. 1.3.1) does not switch correctly
-> check electrical connectors, valve piston blocked due to dirt?
- Make Punch master files!

HBL System Training

Service guide - trouble shooting

Punching under high force not possible (more than 15% max. punchforce)

- high pressure valve (Pos 1.3.1) not switching
-> check electrical connectors, valve piston blocked due to dirt?
- check valve (1.6) does not close
-> does piston of check valve move smooth?
- punching force to high
-> punching force and striker force together higher than possible punching force
- wrong punching parameters
- pos 5 to high or to deep
- Make punch master files!



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Service guide - trouble shooting

Forming mode – machine stops because of overtime

- “slow move valve“ (Pos. 1.3.1) does not switch correctly
-> check electrical connectors, valve piston blocked due to dirt?
- Make punch master files!

HBL System Training

Service guide - trouble shooting

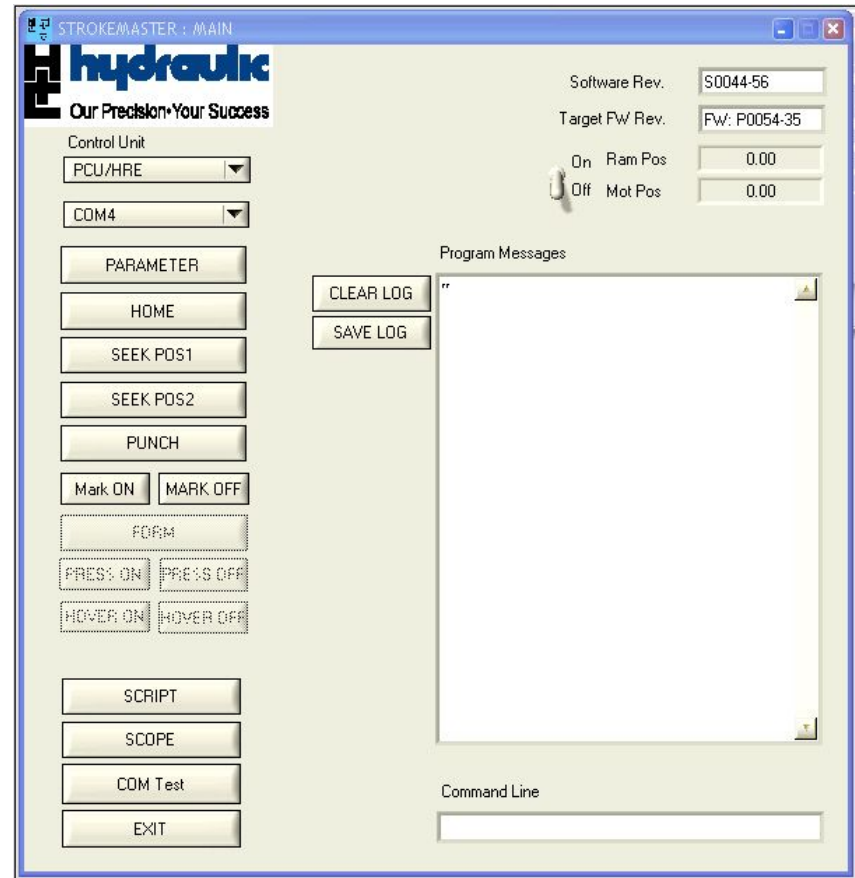
Ram moves down after hydraulic/electronic off

- slow creeping movement is normal (mass higher than friction of cylinder seals)

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Service guide – software tool strokemaster

- displays soft- and FW-revision
- modify / display parameter
- control RAM
- analyse last RAM movement

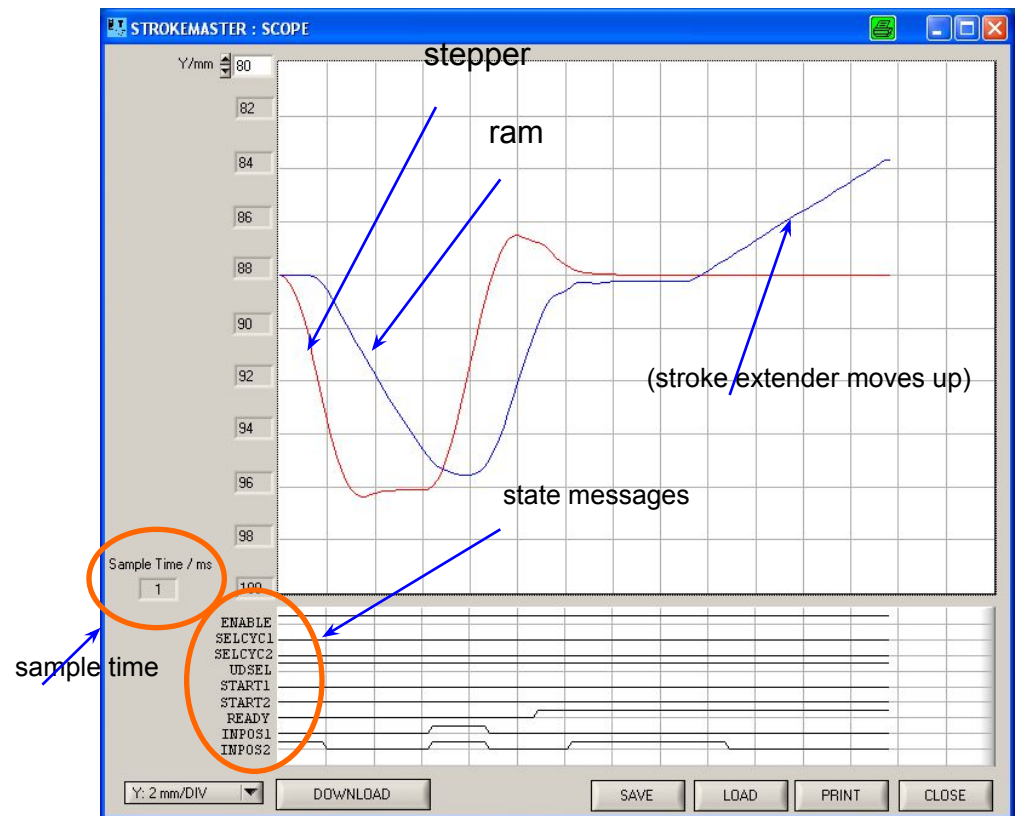


HBL System Training

Service guide - stroke master file

Tool to see what happens

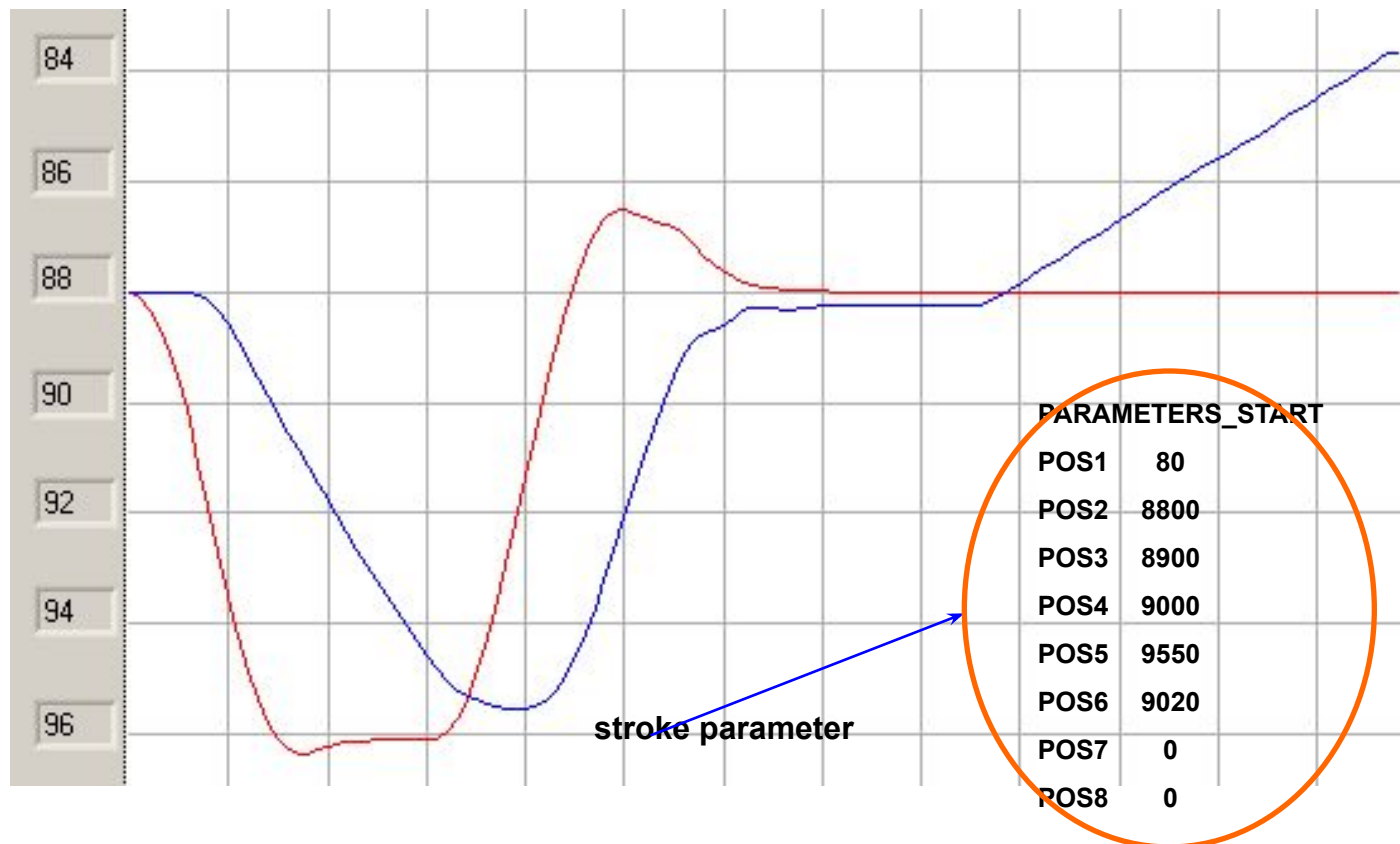
- ram movement real
- short punch cycles
-> sample time 2 ms
- long form cycles
-> sample time 3-5 ms
- make „master-files“ to be able to compare



HBL System Training

Service guide - stroke master file

Präsentation



HBL System Training

Service guide - questions

If you contact H+L for any questions please provide the following information:

- end user company
- ram type (example:HBL20to)
- firmware version
- date of machine installation
- description of failure / machine behavior
- stroke master files
- any remarks:

VOITH

Engineered reliability.

