JFY

Voith Turbo H + L Hydraulic
HBL System Training

HBL System Training

Punching system HBL general

Tutor:

Wang Aimin

HBL System Training

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

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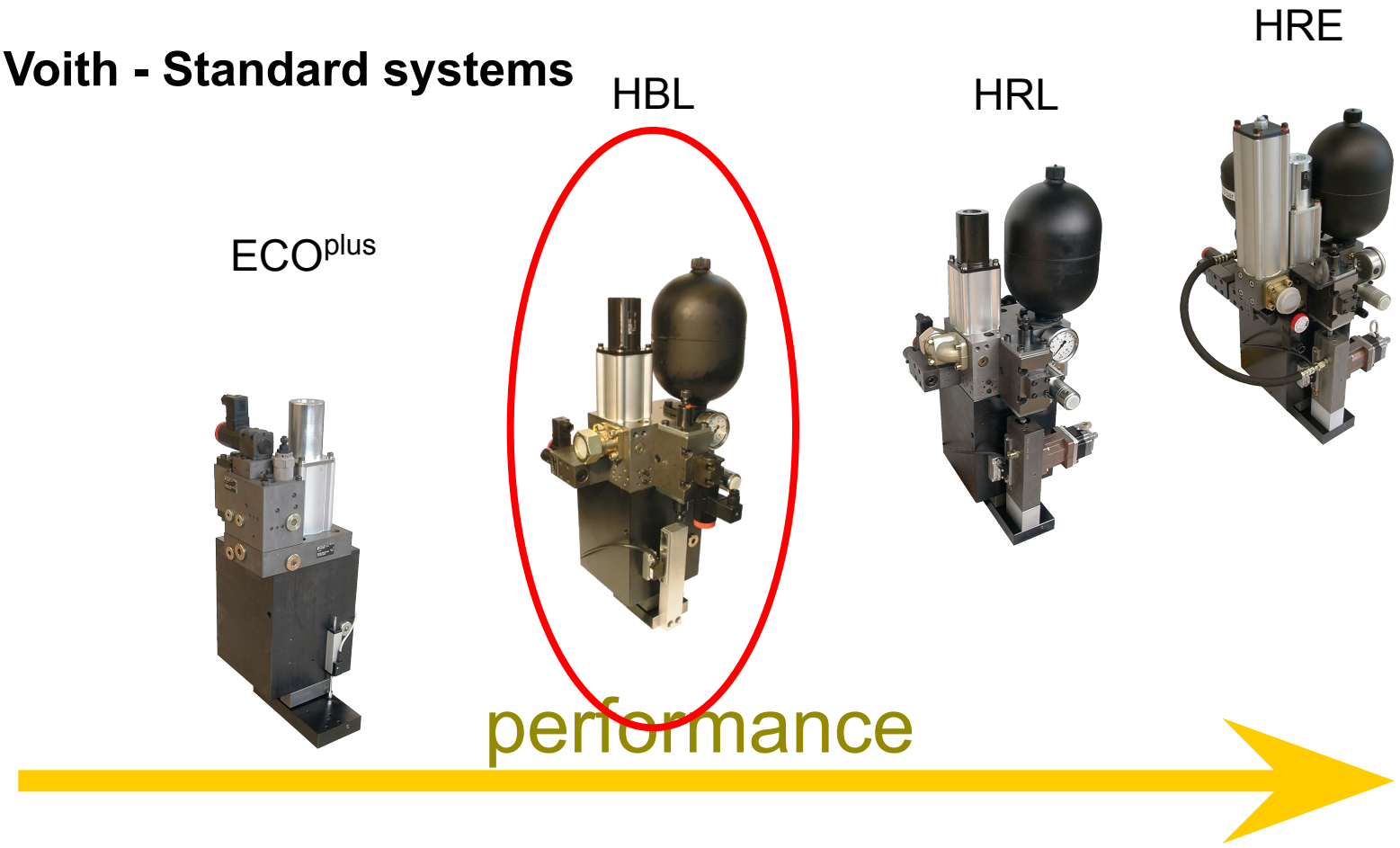
Voith - Standard systems



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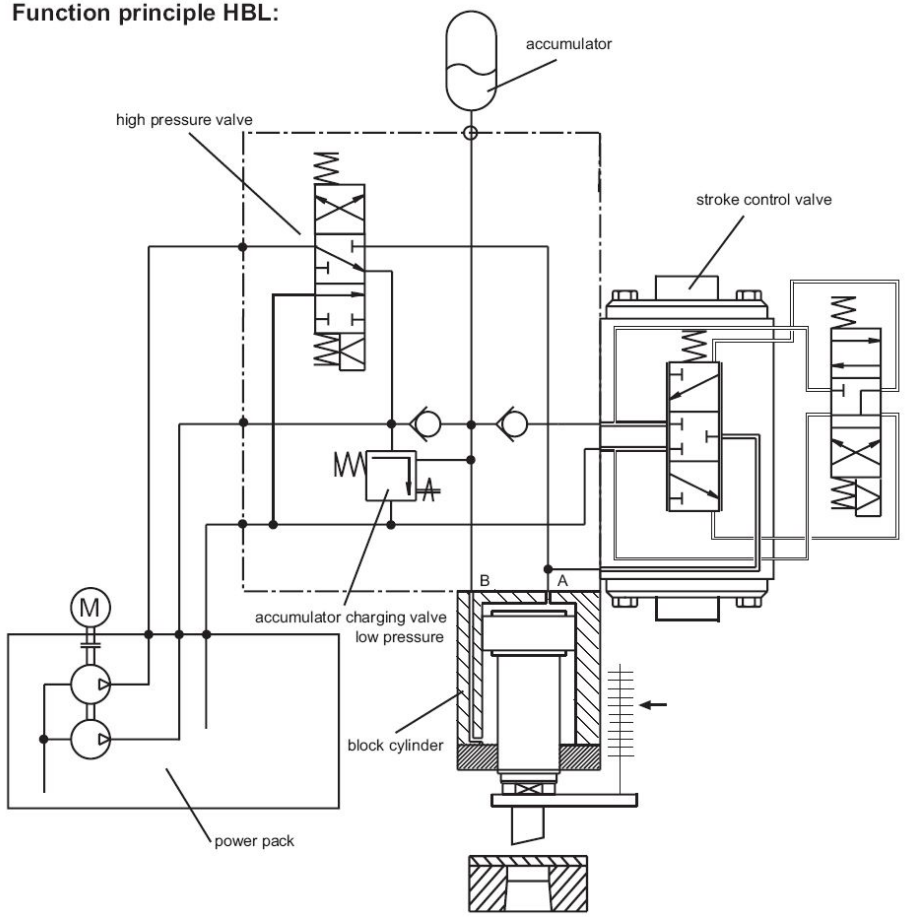
Function principle HBL:



Präsentation

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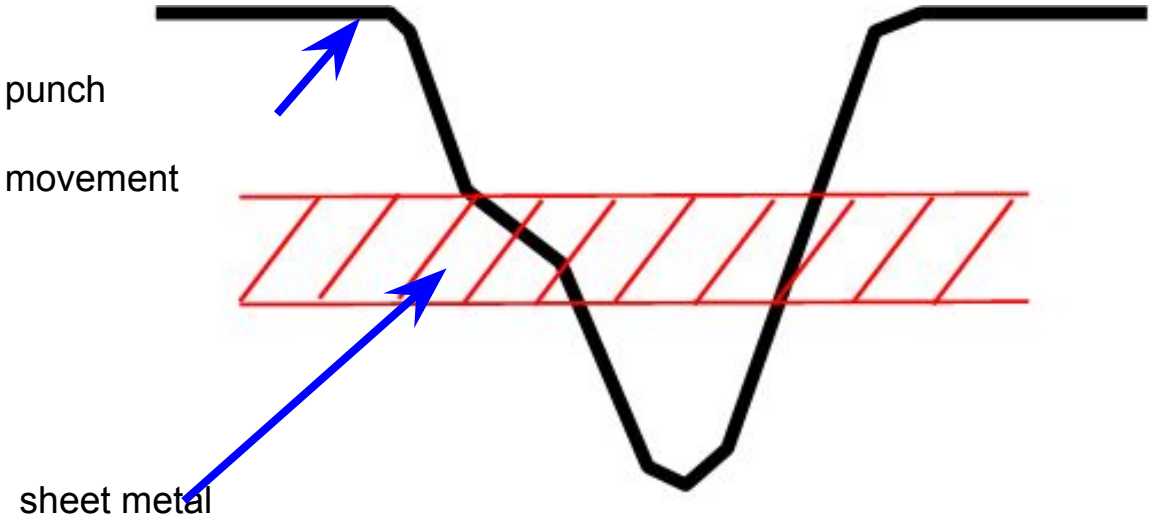
Punch operation - general reflection



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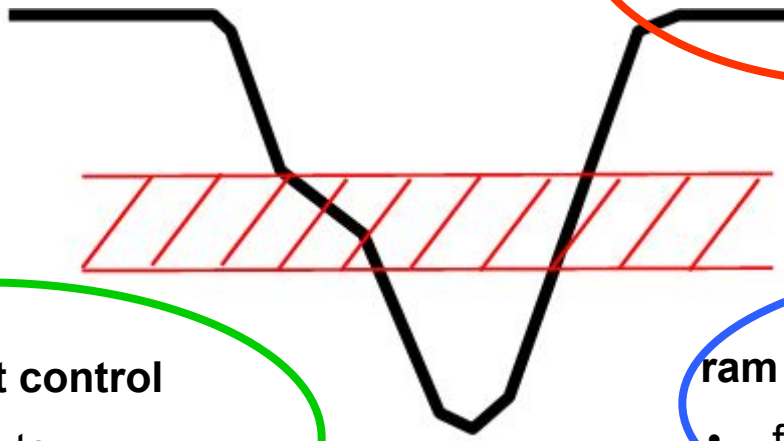
Punch operation - general reflection



pressure and oil flow

- during ram movement high oil flow required

ram movement control

- position has to be adjustable

ram force requirement

- force not always necessary

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Basis functions

pressure and flow conditioning

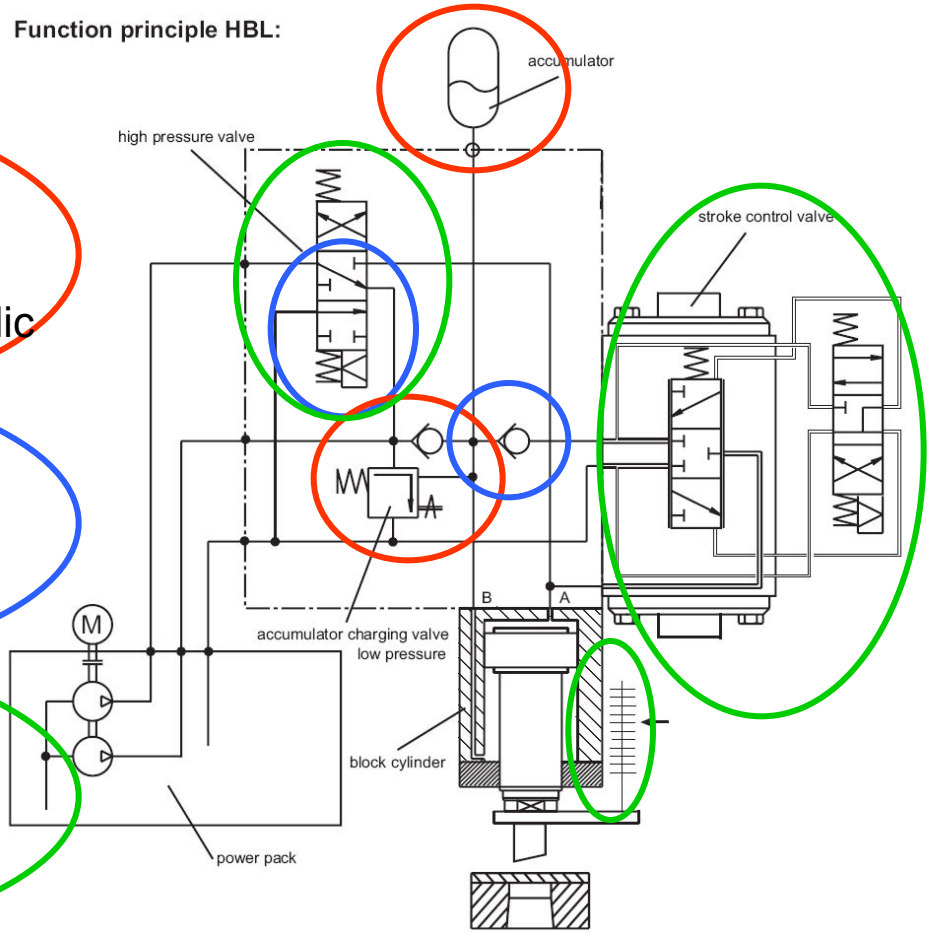
- accumulator charging control
- consumption optimized hydraulic

ram force supply

- load sensing control
- high pressure on demand

ram movement control

- position control
- short cycle times



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Basis functions

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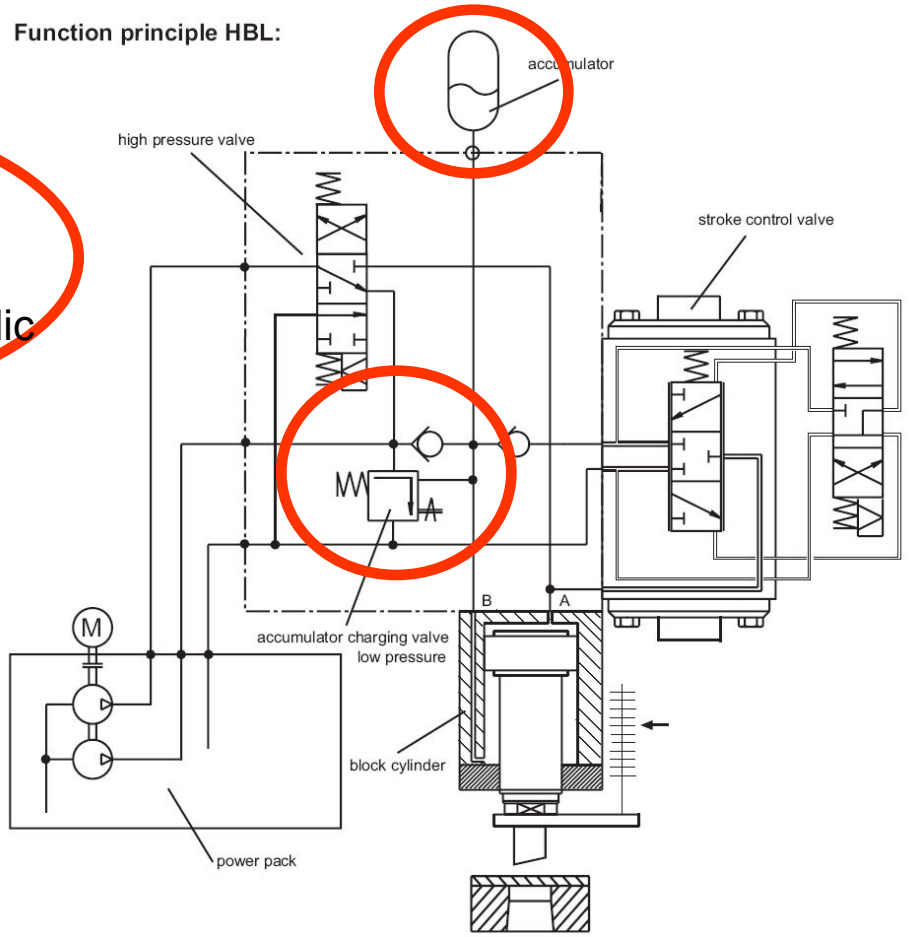

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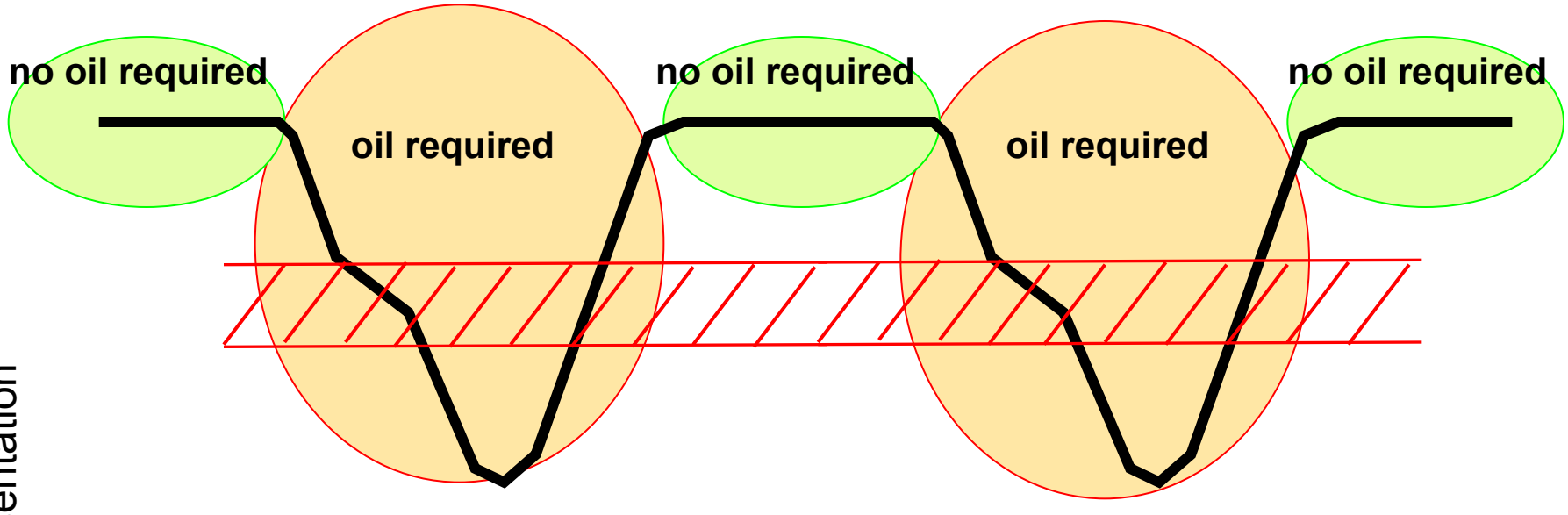
General reflection – oil requirement



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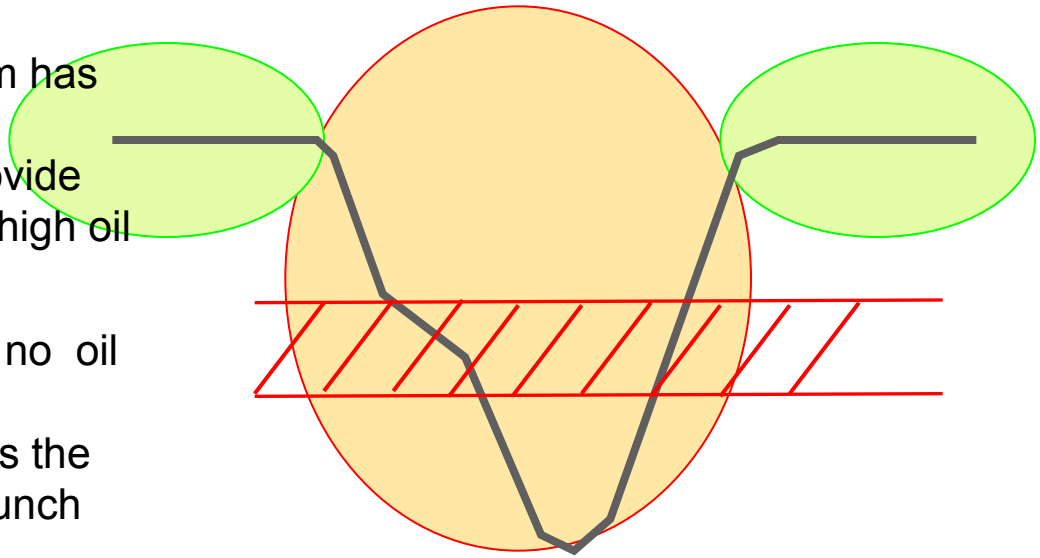
General reflection – oil requirement

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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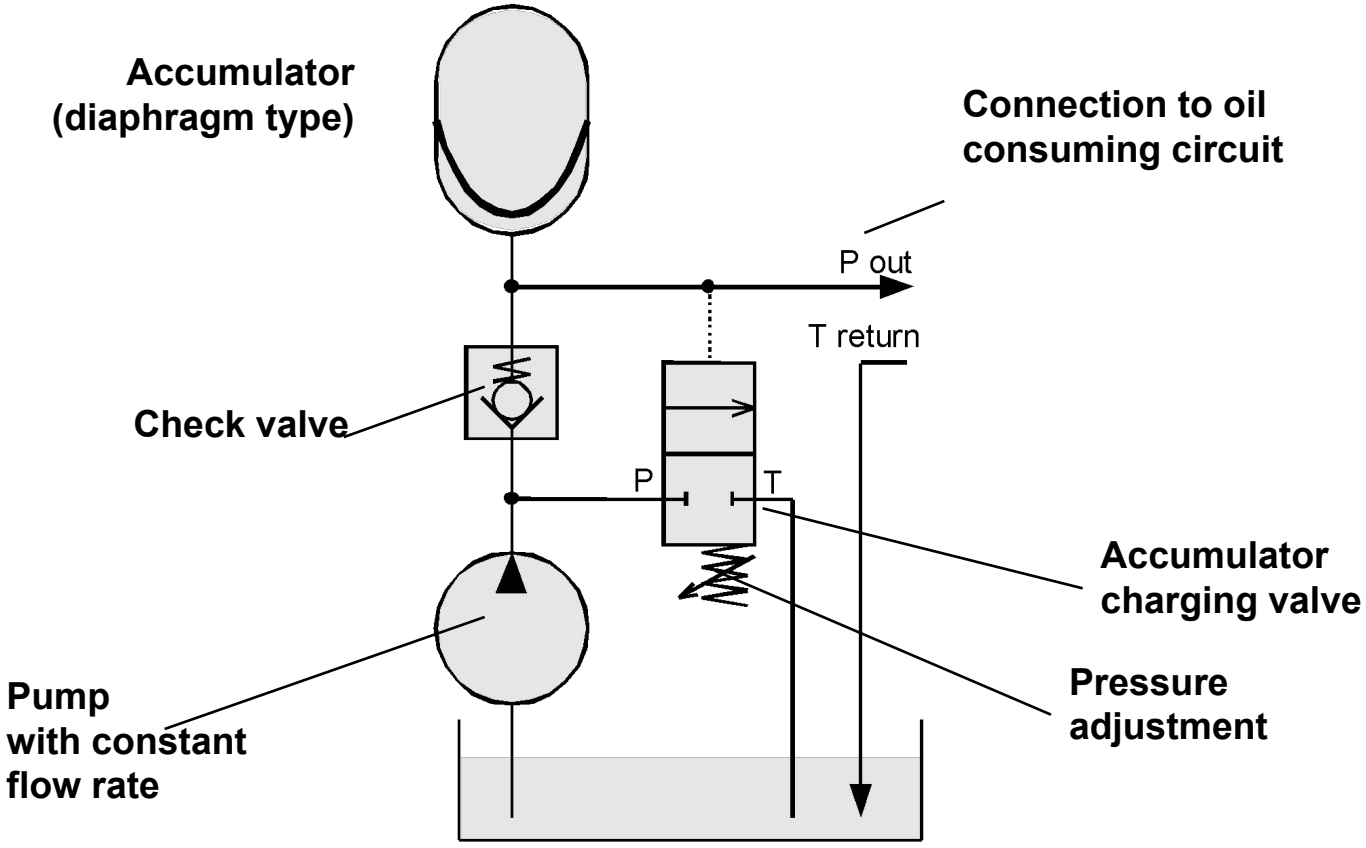
Oil requirement – accumulator charging



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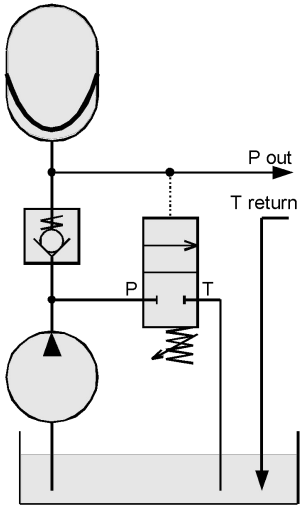
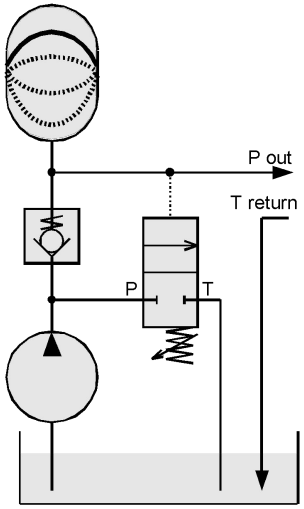
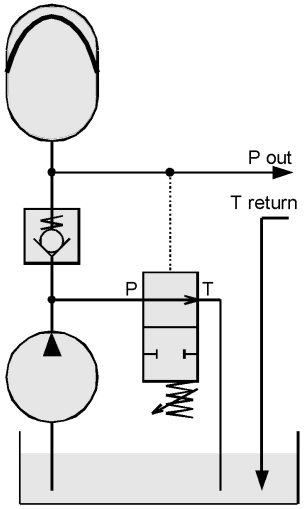
Oil requirement – accumulator charging sequence



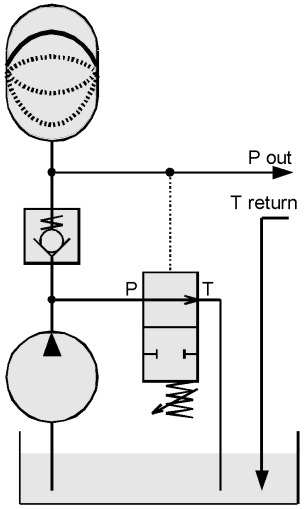
Empty:
Accu empty,
valve charging



Filling:
Accu filling,
valve charging



Full:
Accu full,
valve = bypass



Delivering:
Accu dropping,
valve = bypass

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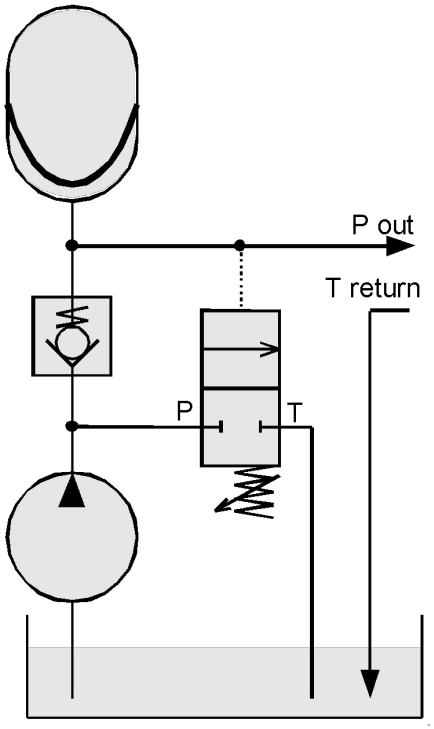
Accumulator charging



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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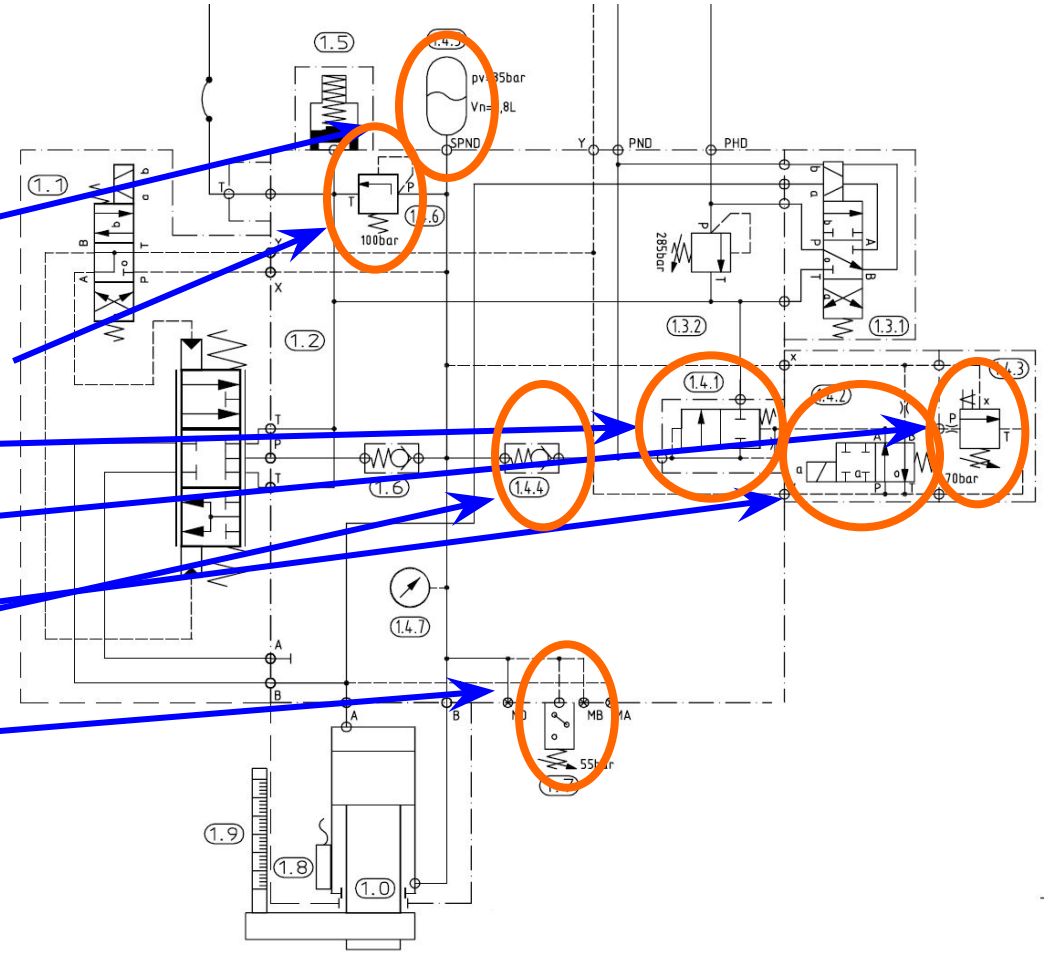
Accumulator charging

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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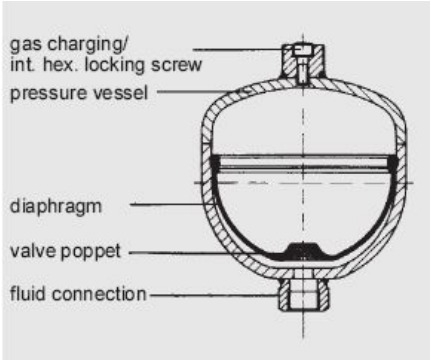
Accumulator charging - device guide

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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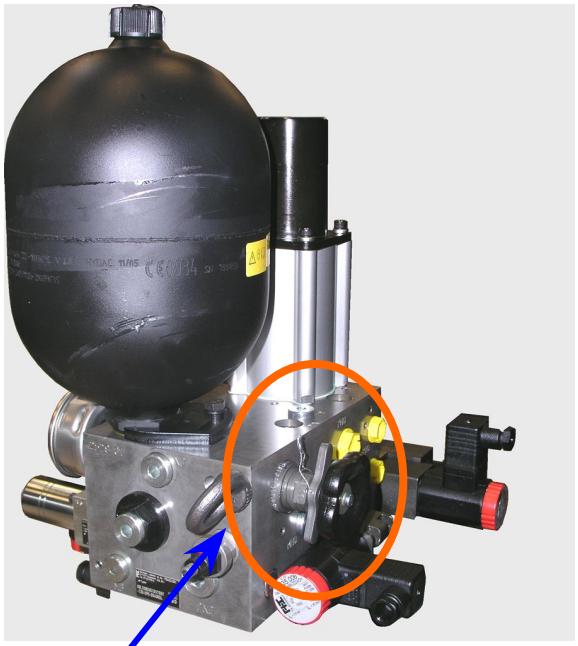
Accumulator charging - device guide

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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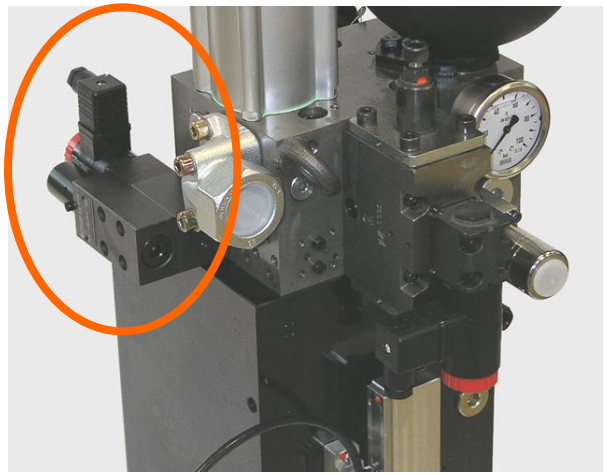
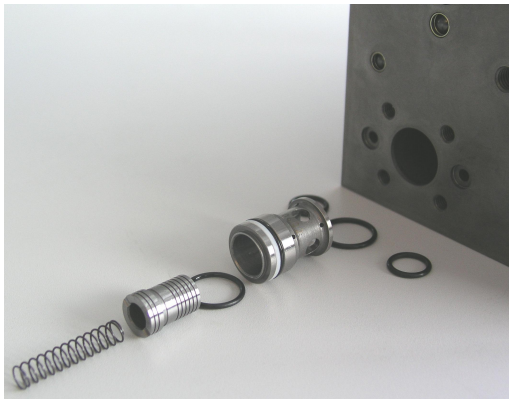
Accumulator charging - device guide



accumulator charging valve consisting of:

- main stage –> chartridge 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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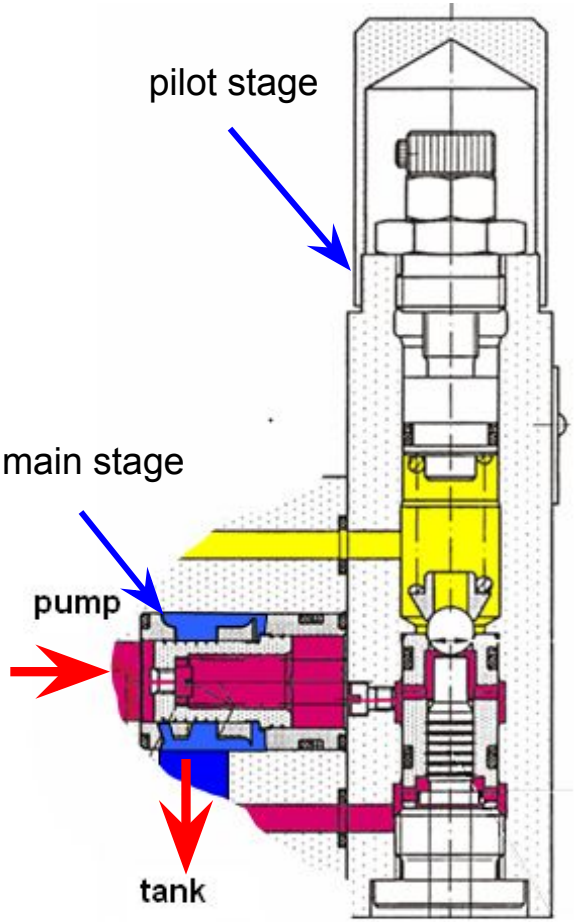
Accumulator charging - device guide

main stage

pilot stage

electrical discharging



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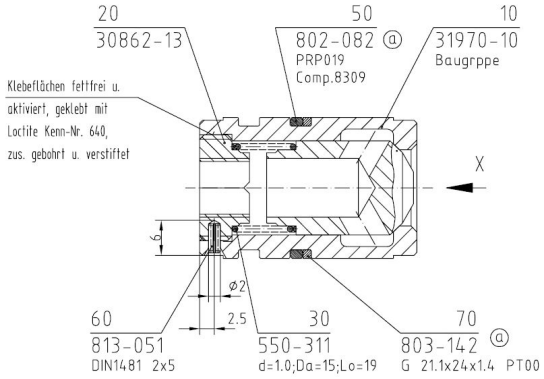
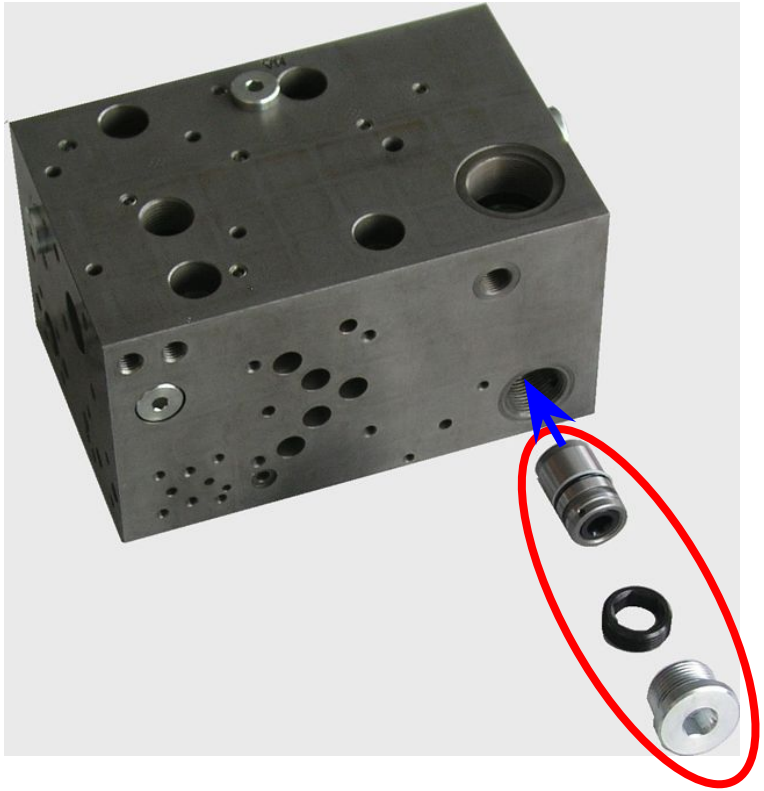
Accumulator charging - device guide

check valve:

- type of construction: cartridge valve
- mounted in manifold





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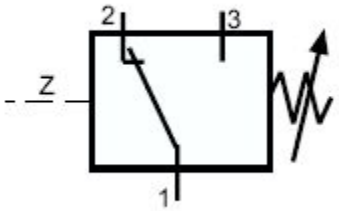
Accumulator charging - device guide



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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Basis functions

pressure and flow conditioning

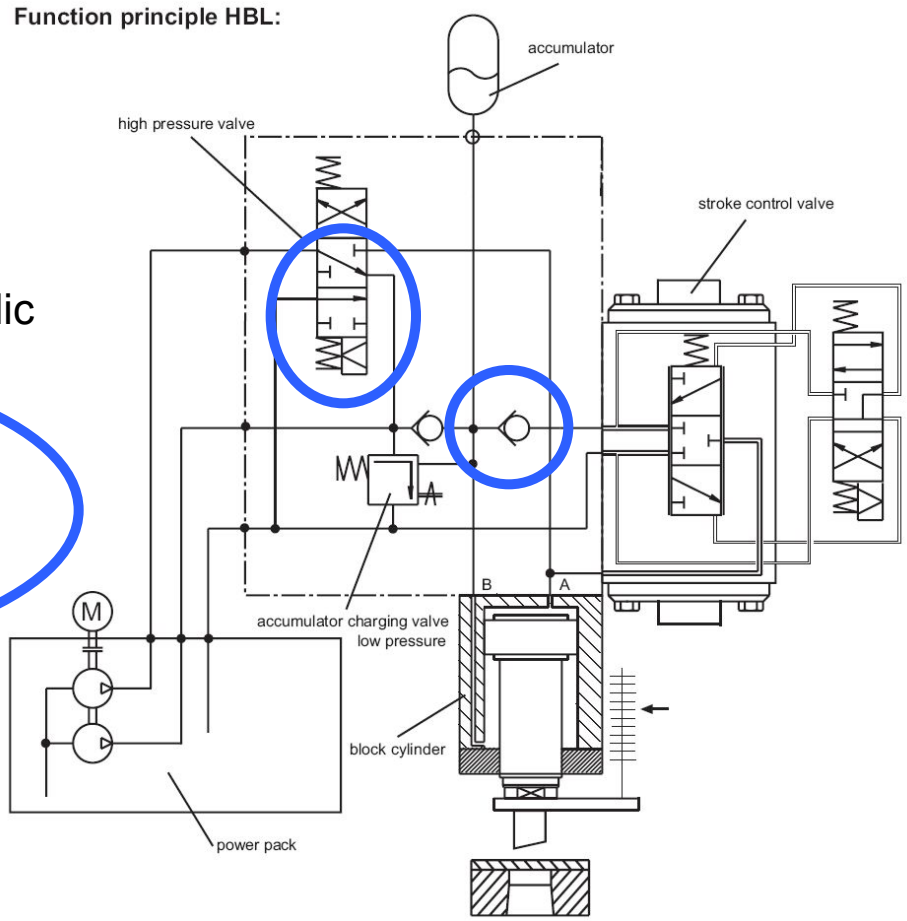
- accumulator charging control
- consumption optimized hydraulic

ram force supply

- load sensing control
- high pressure on demand

ram movement control

- position control
- short cycle times



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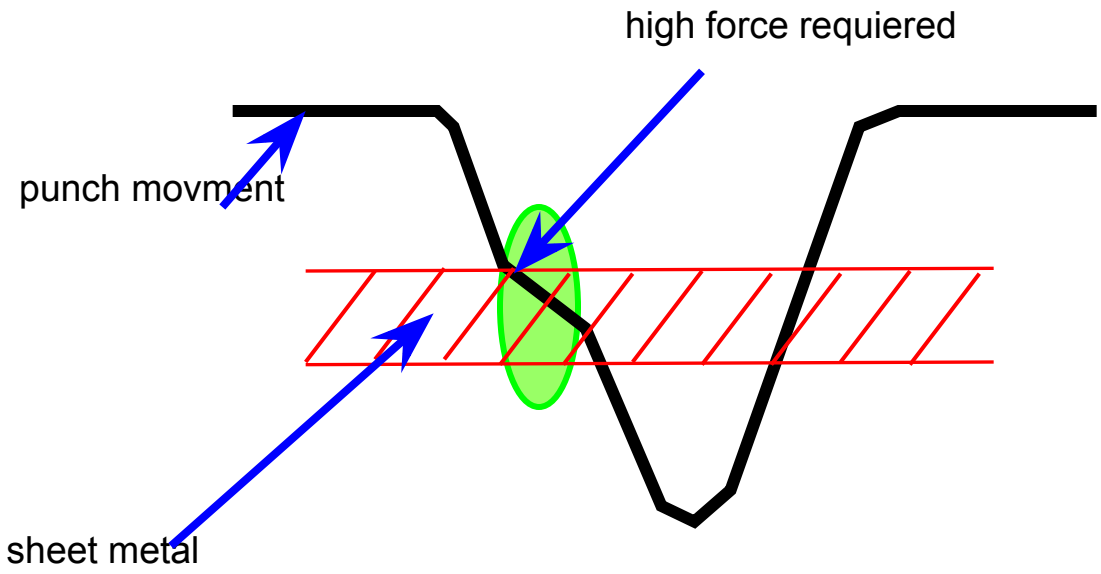
Ram force supply



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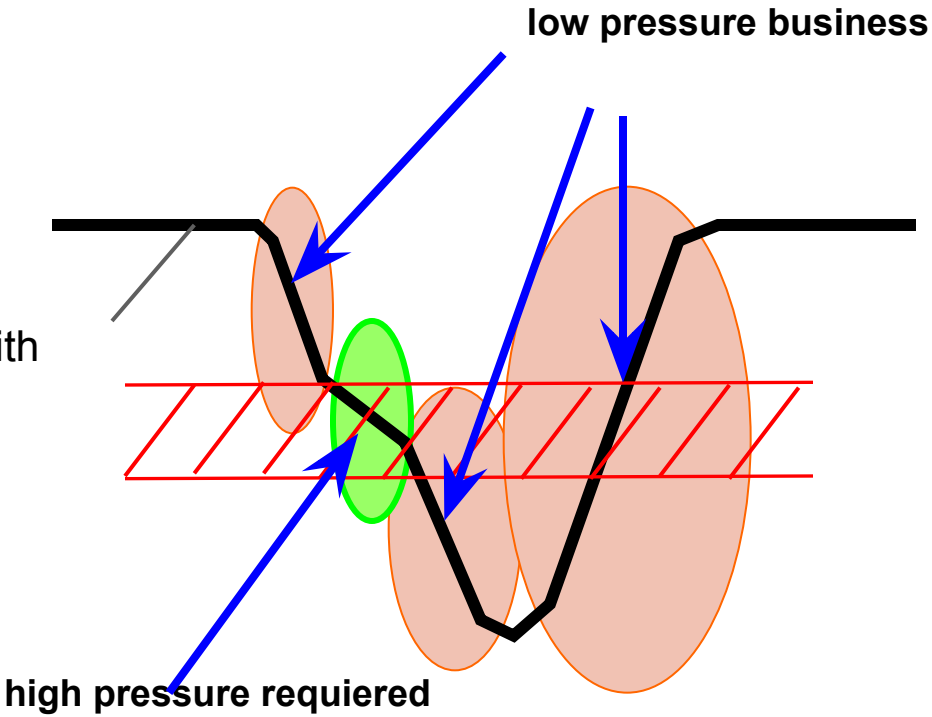
Ram force supply - low/high pressure operation

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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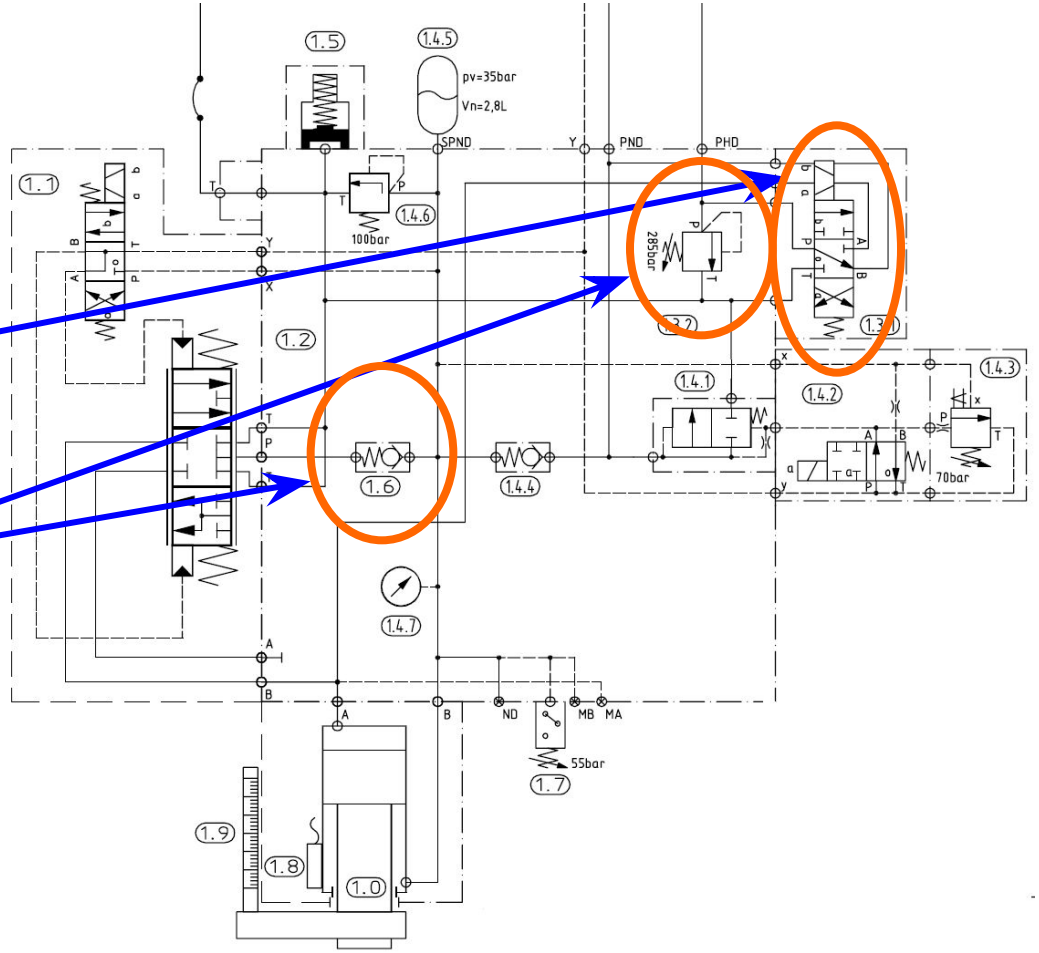
Ram force supply

device guide

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



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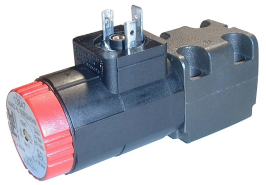
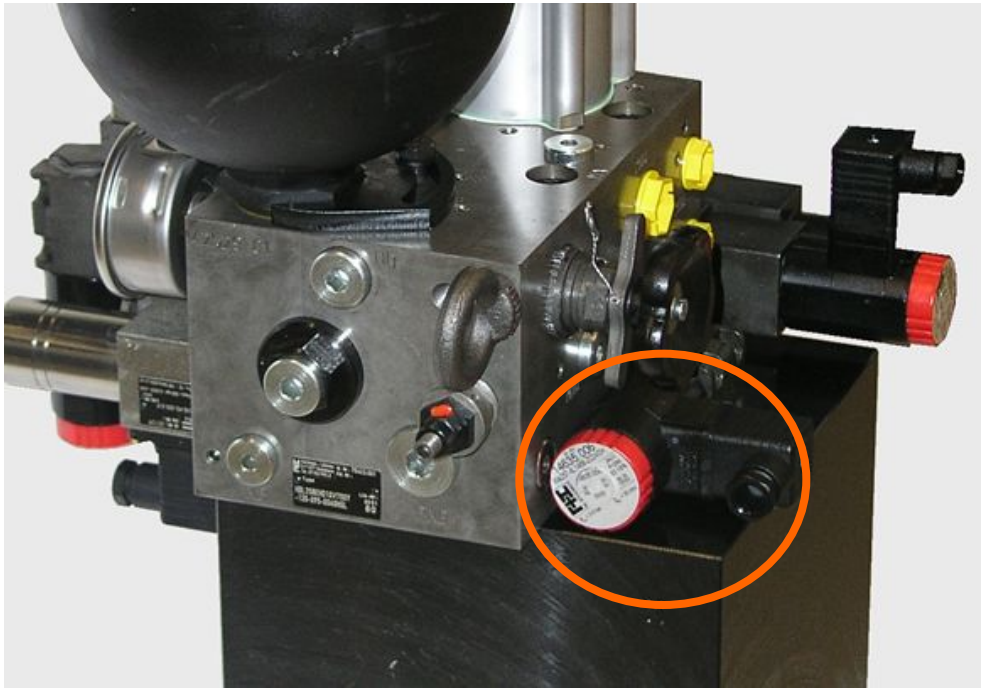
Ram force supply - device guide



slow move valve

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

example 4/3 solenoid valve



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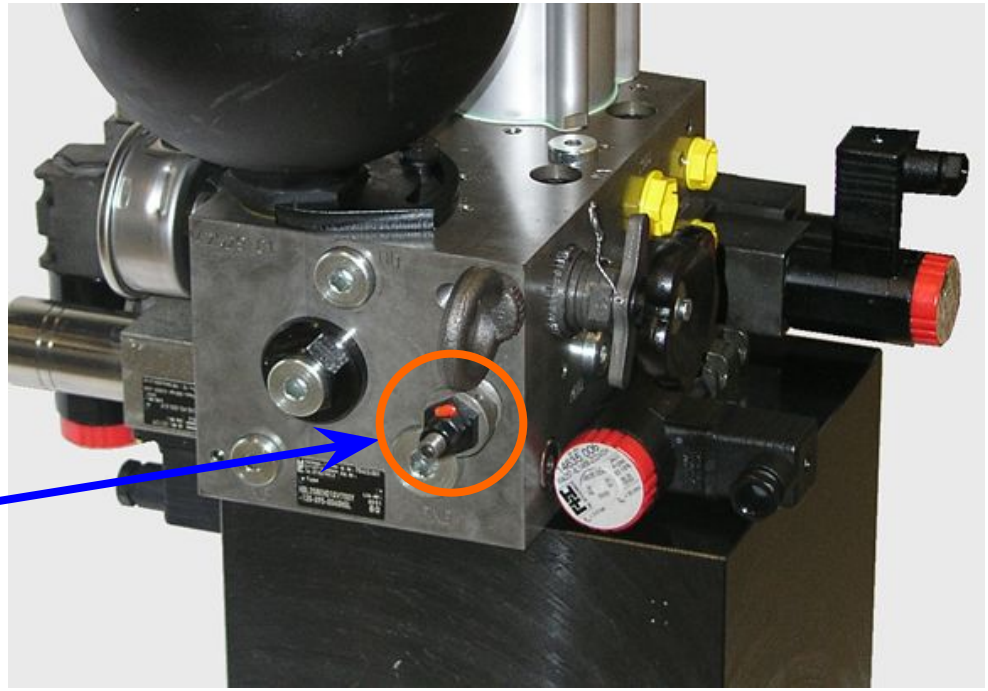
Ram force supply - device guide

high pressure relief valve

- directly controlled pressure relief valve



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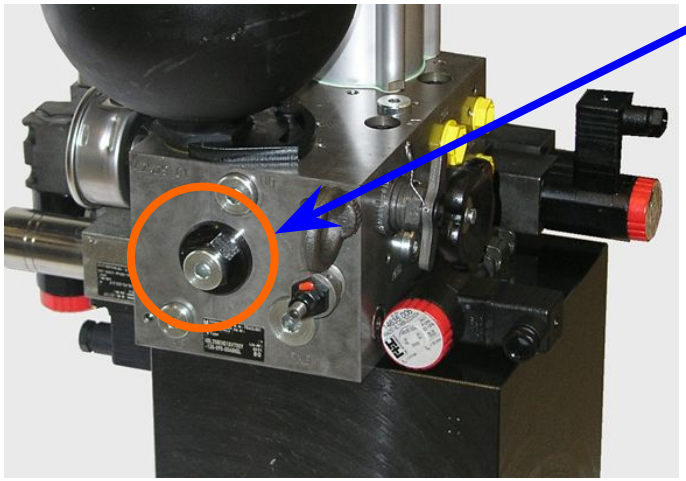
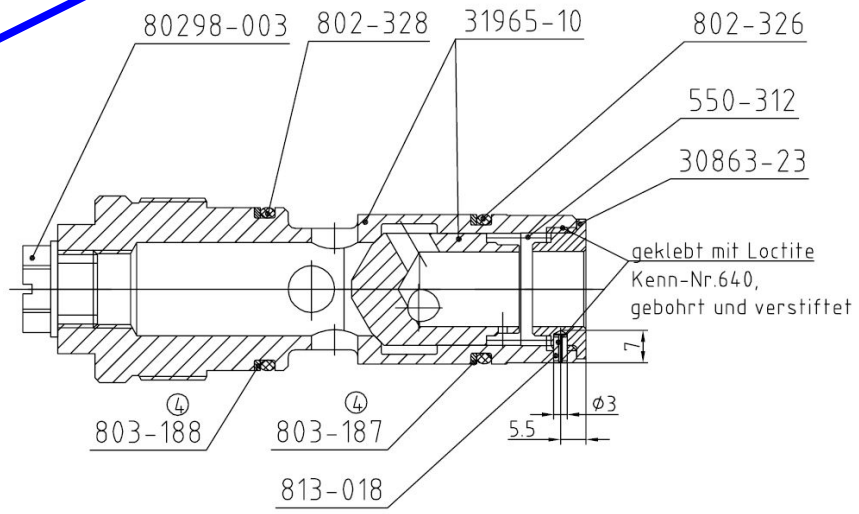
Ram force supply - device guide

check valve

- poppet seat valve





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Basis functions

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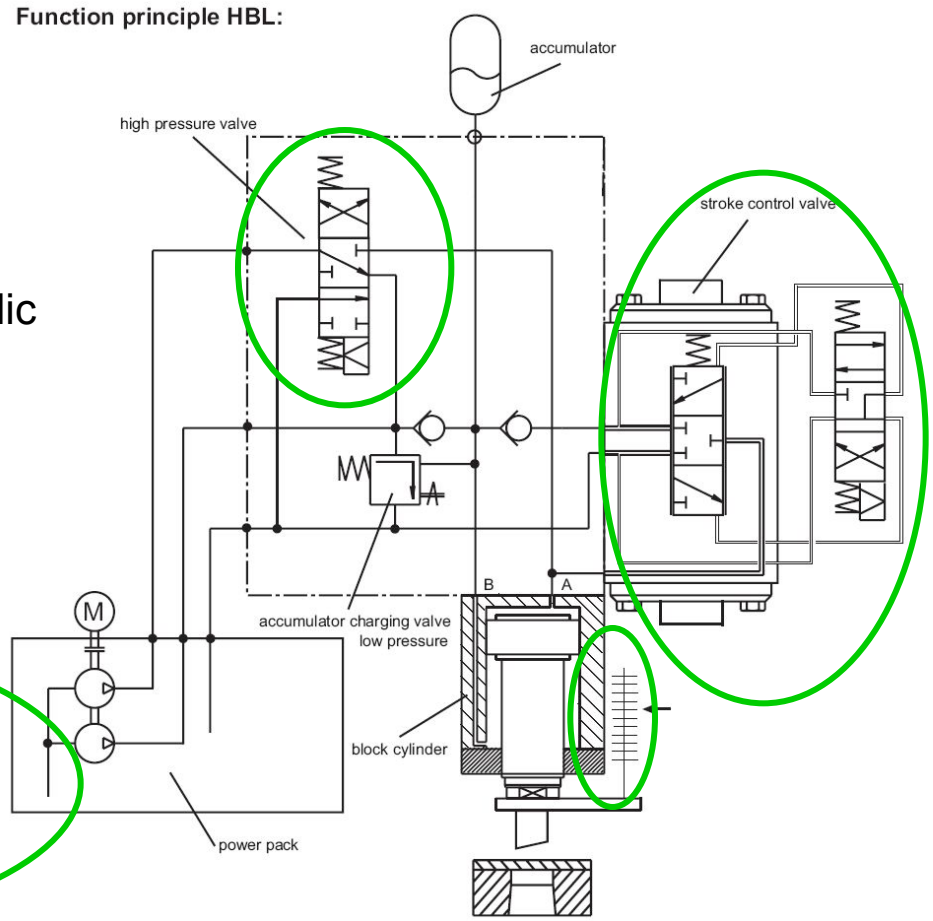
- accumulator charging control
- consumption optimized hydraulic

ram force supply

- load sensing control
- high pressure on demand

ram movement control

- position control
- short cycle times



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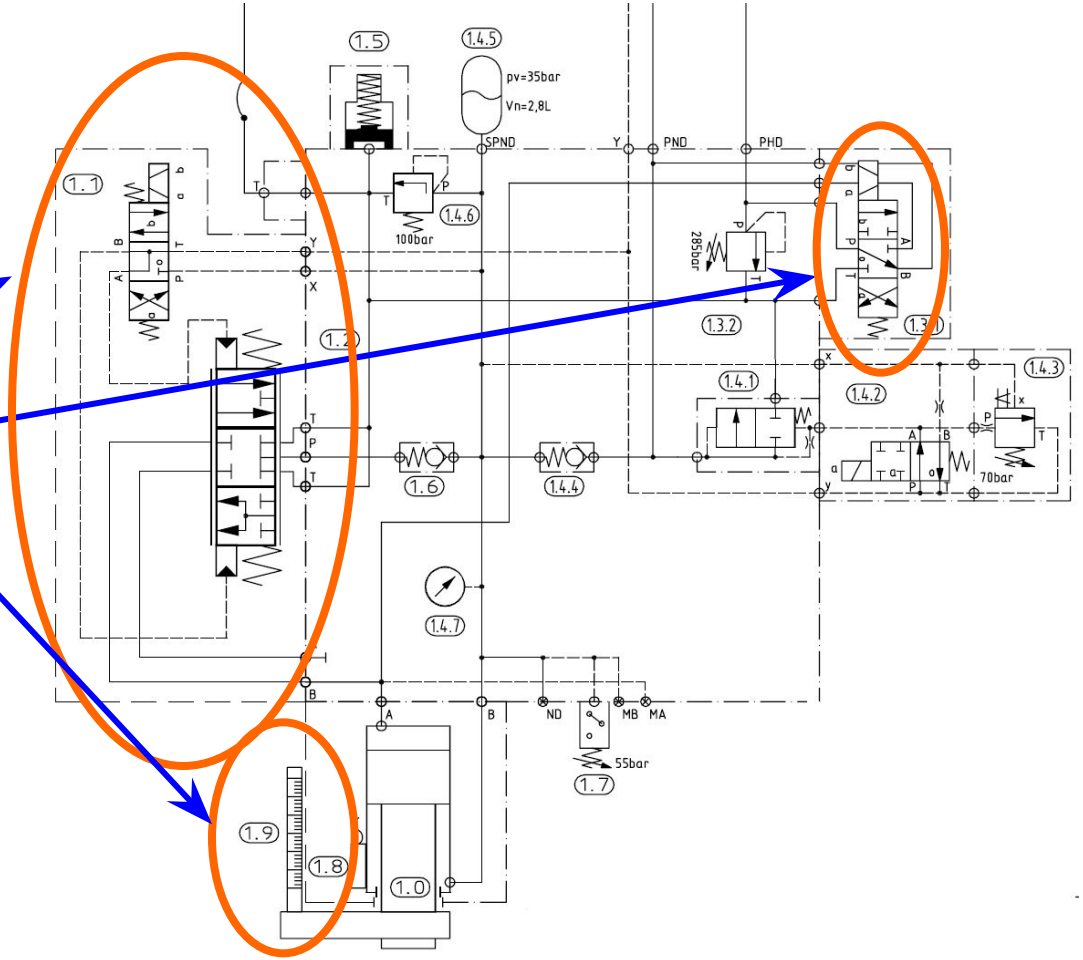
Ram movement control

device guide

- main valve
- slow move valve
- linear measuring device



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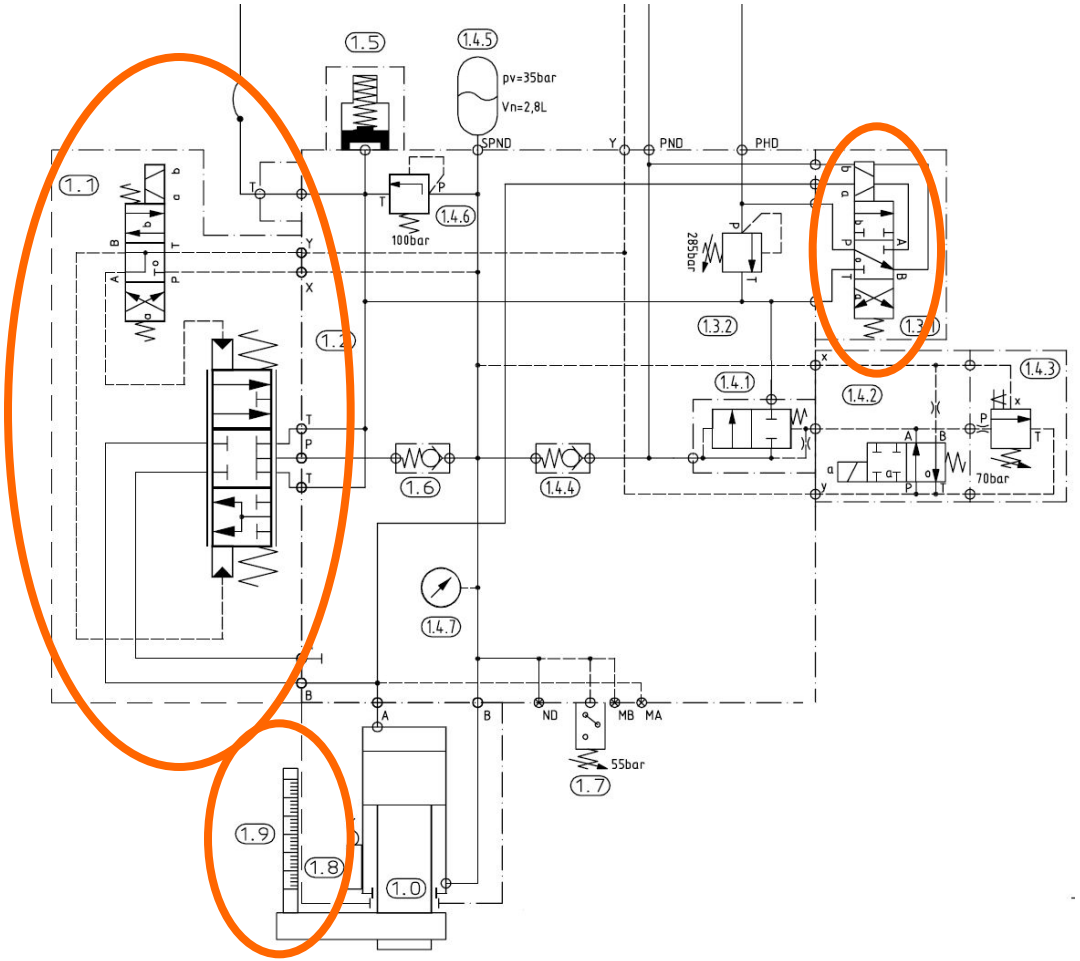
Ram movement control

description of function

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



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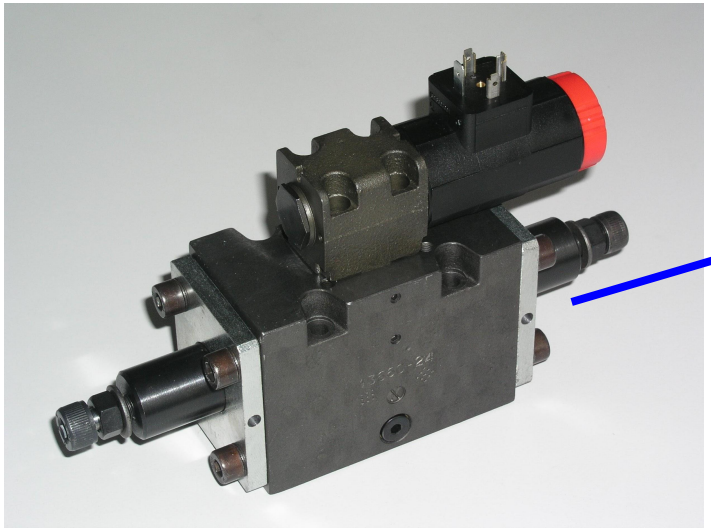
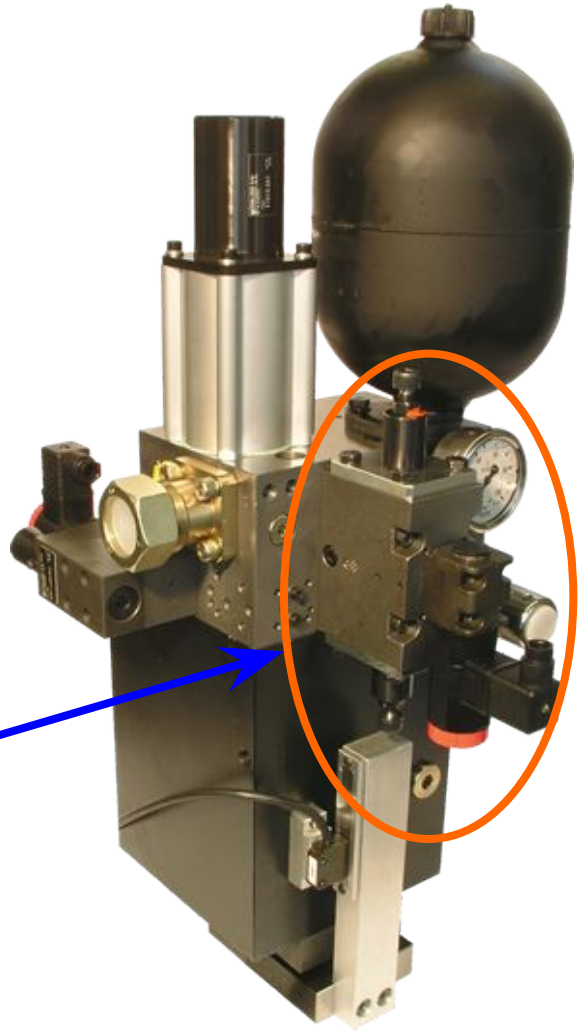
Ram movement control - device guide

main valve

- type of construction
  pilot operatet spool valve





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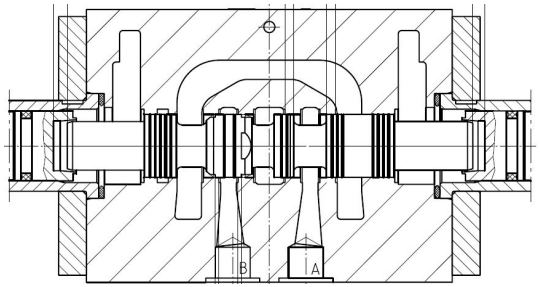
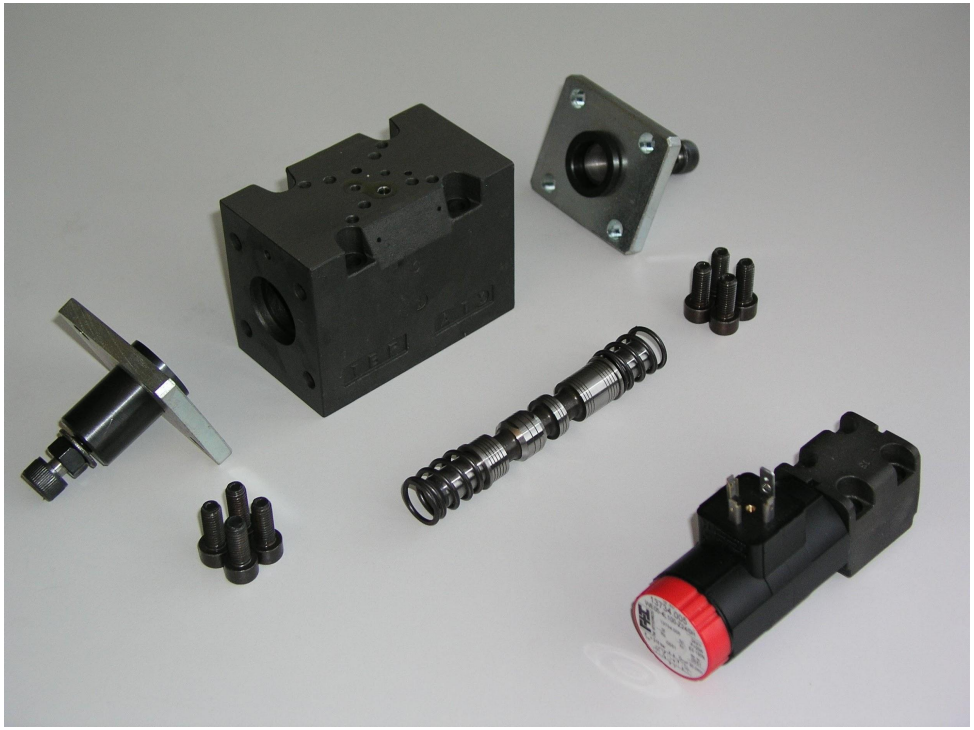
Ram movement control - device guide

main valve

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





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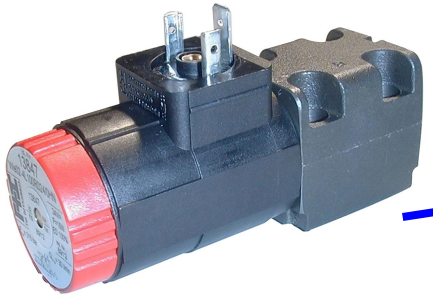
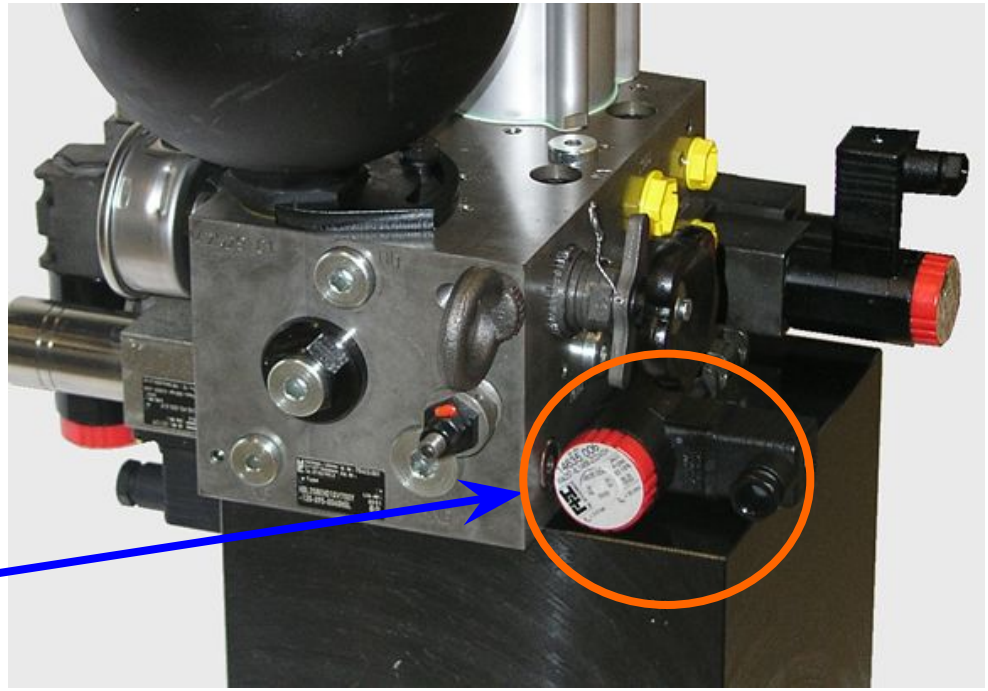
Ram movement control - device guide

slow move valve

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





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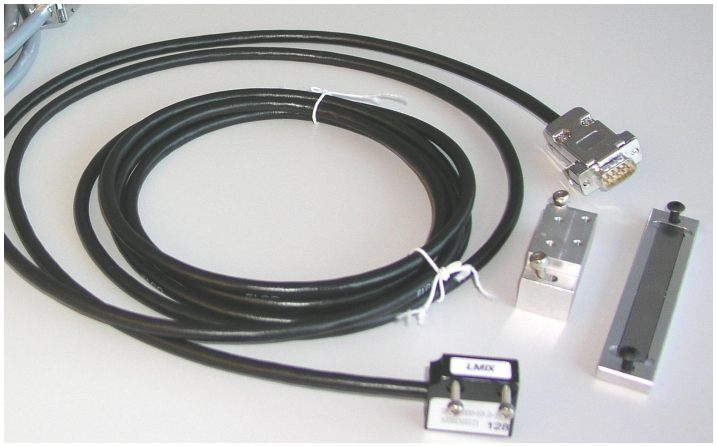
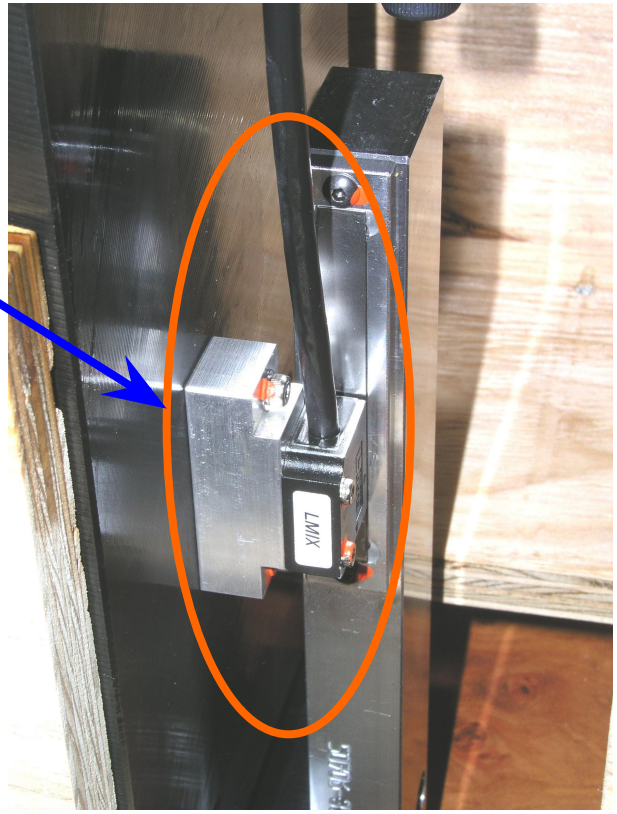
Ram movement control - device guide

Linear measuring system (LMS)

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





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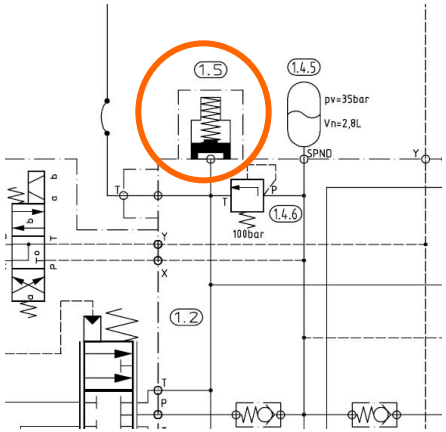
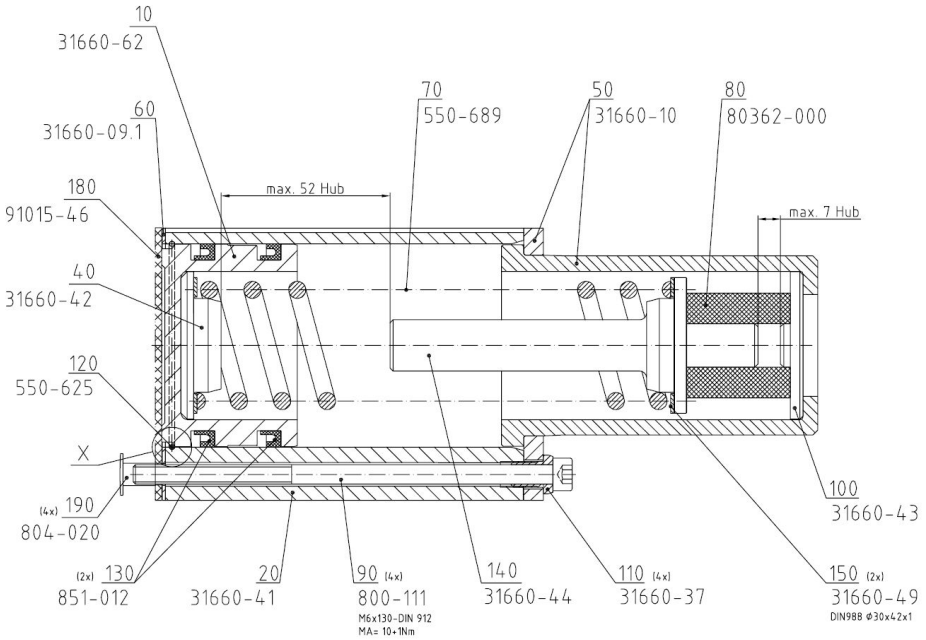
Other ram devices

Tank line shock absorber

- piston accumulator
- damping pressure peaks in tank line





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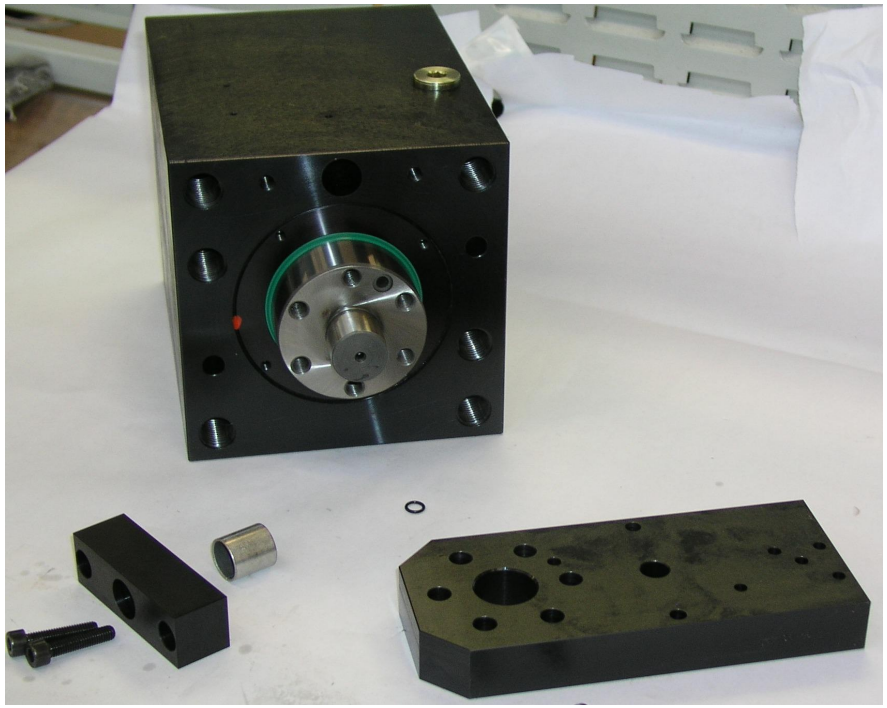
Other ram devices

mechanical feedback parts

- guiding bar
- mechanics



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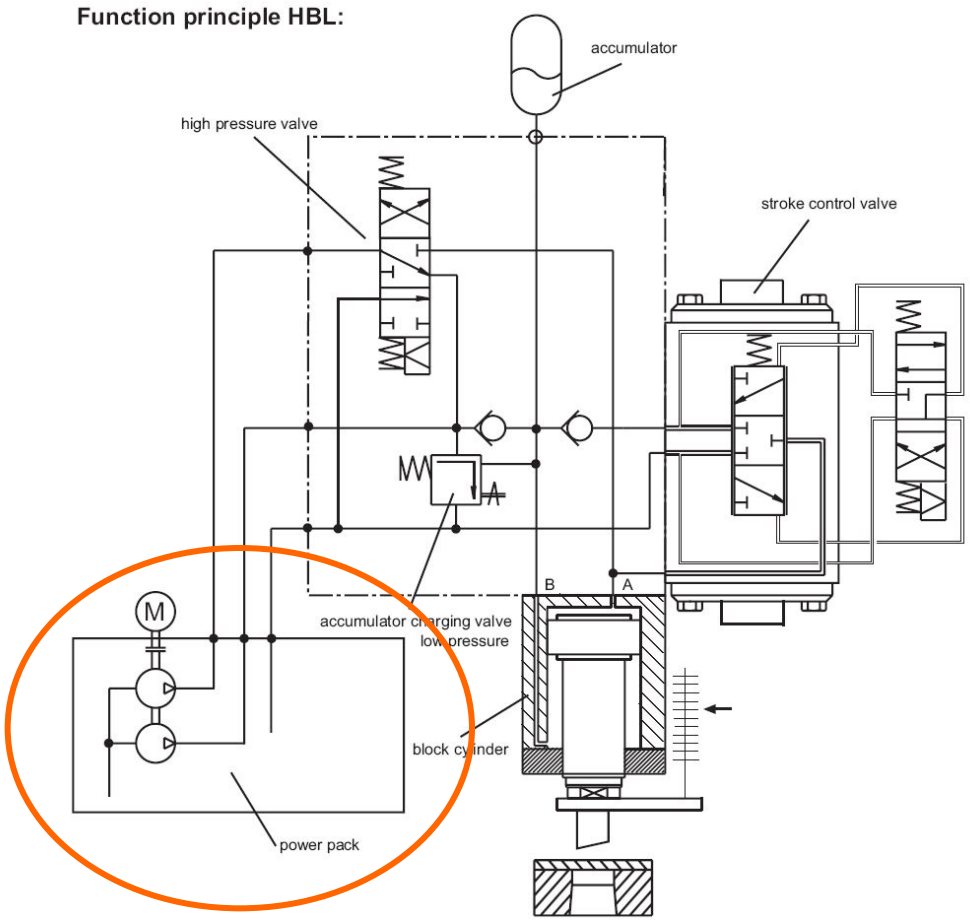
Hydraulic power unit



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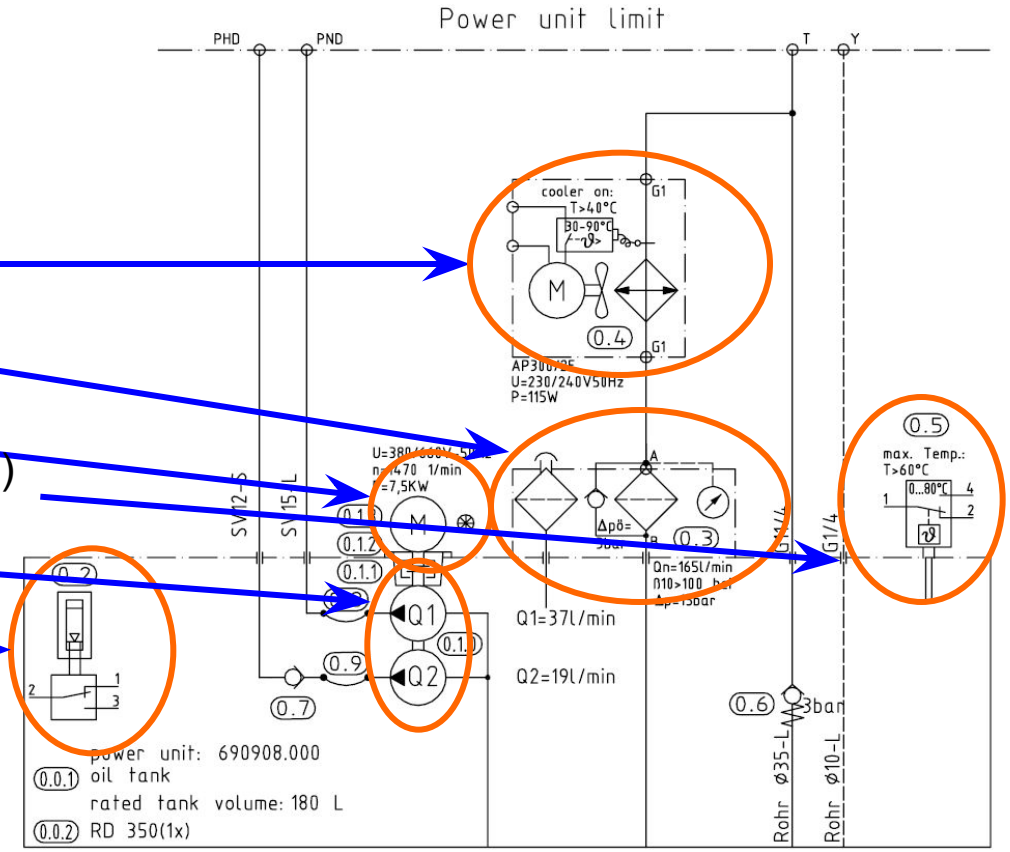
Hydraulic power unit

device guide

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



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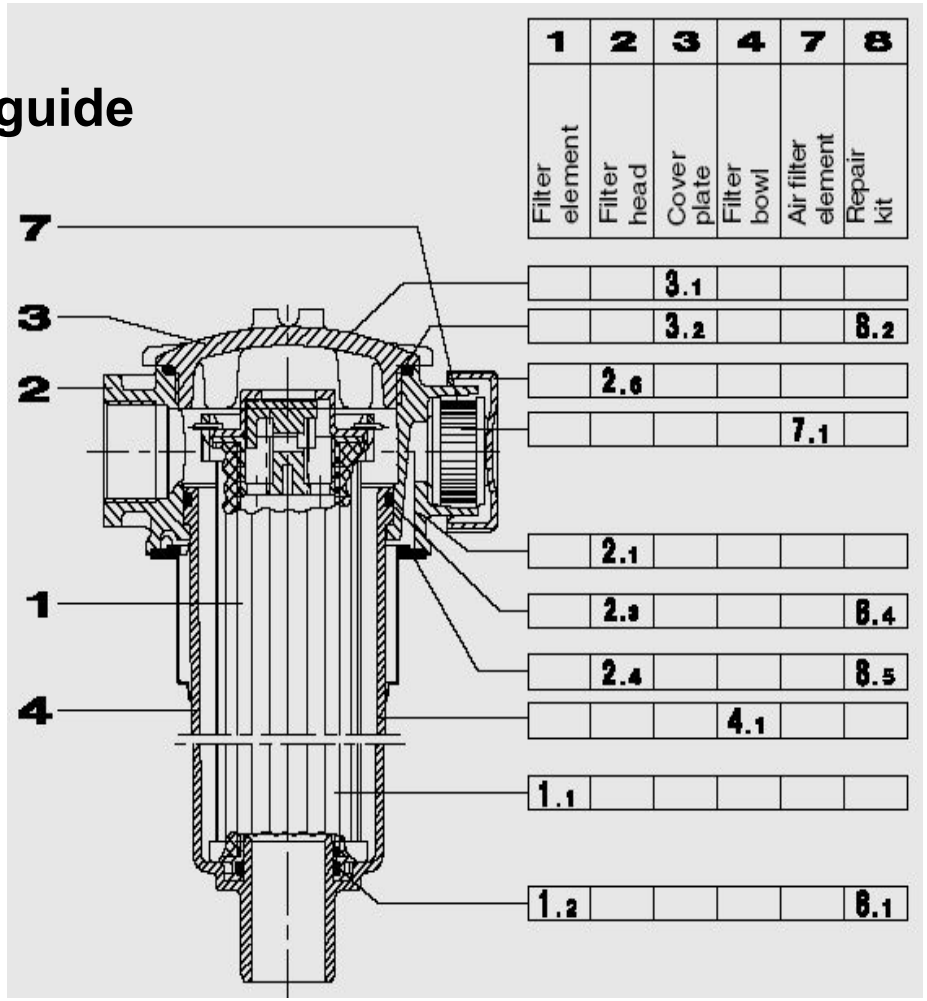
Hydraulic power unit - device guide

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 orgninal HYDAC spare sparts
- do never run the hydraulics without filter elements

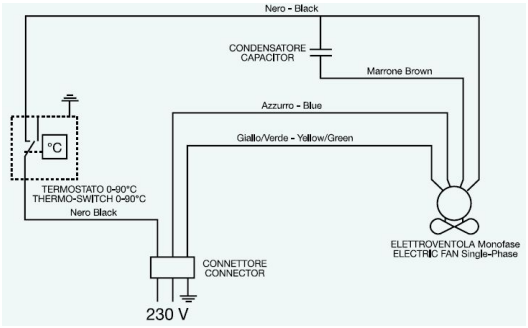


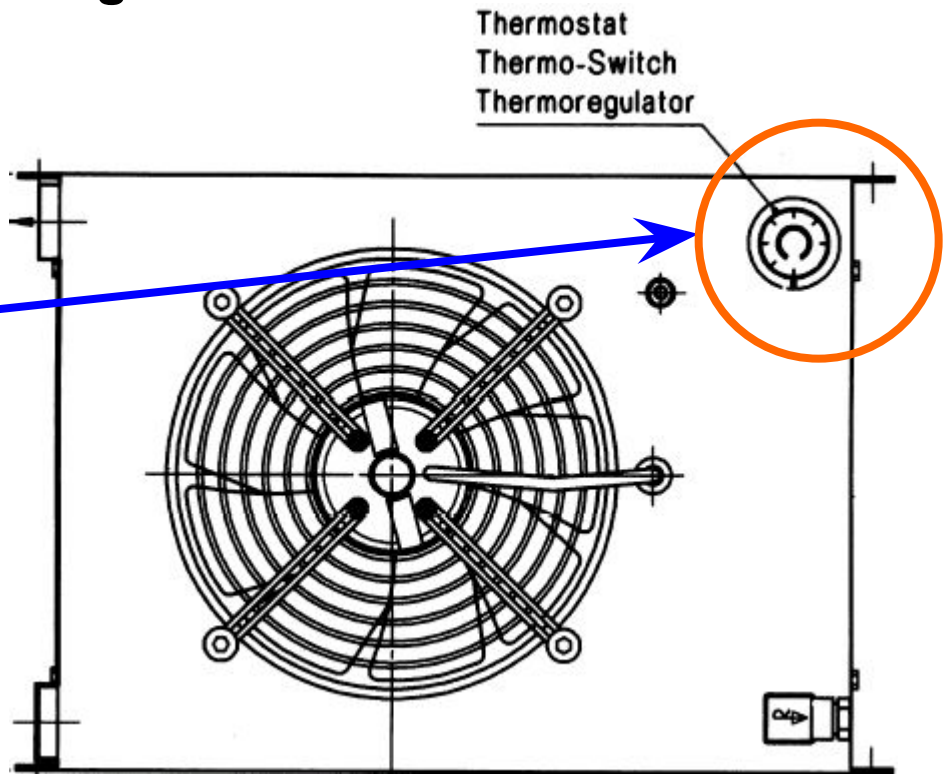
HBL System Training

Hydraulic power unit - device guide

heat exchanger

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





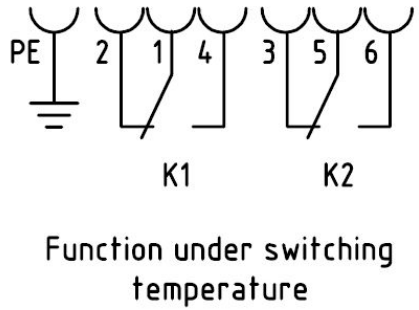
HBL System Training

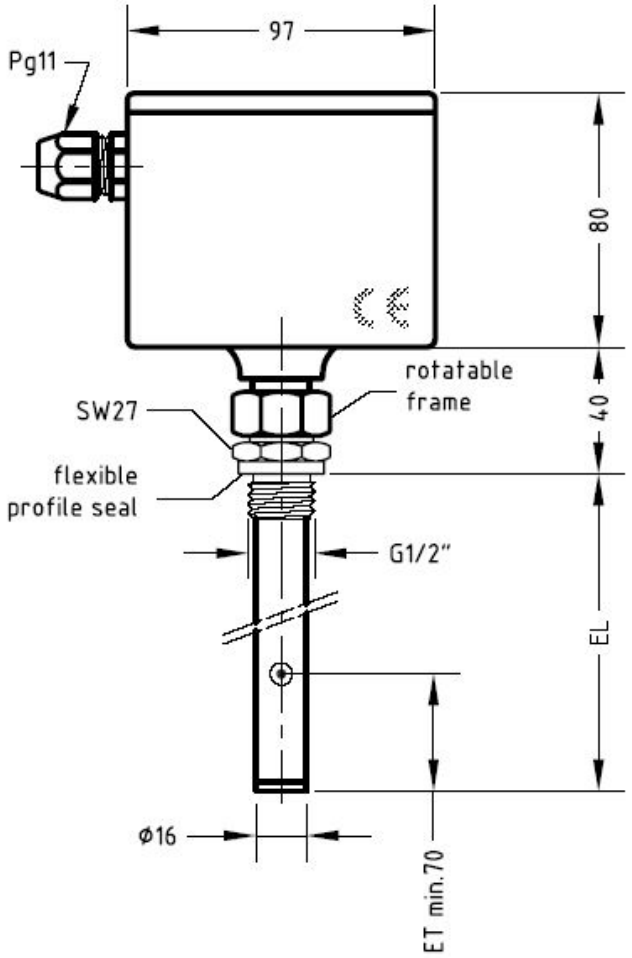
Hydraulic power unit - device guide

temperature control

- monitoring oil temperature

Terminal diagram



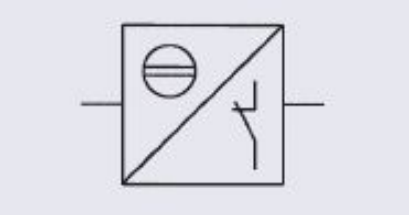


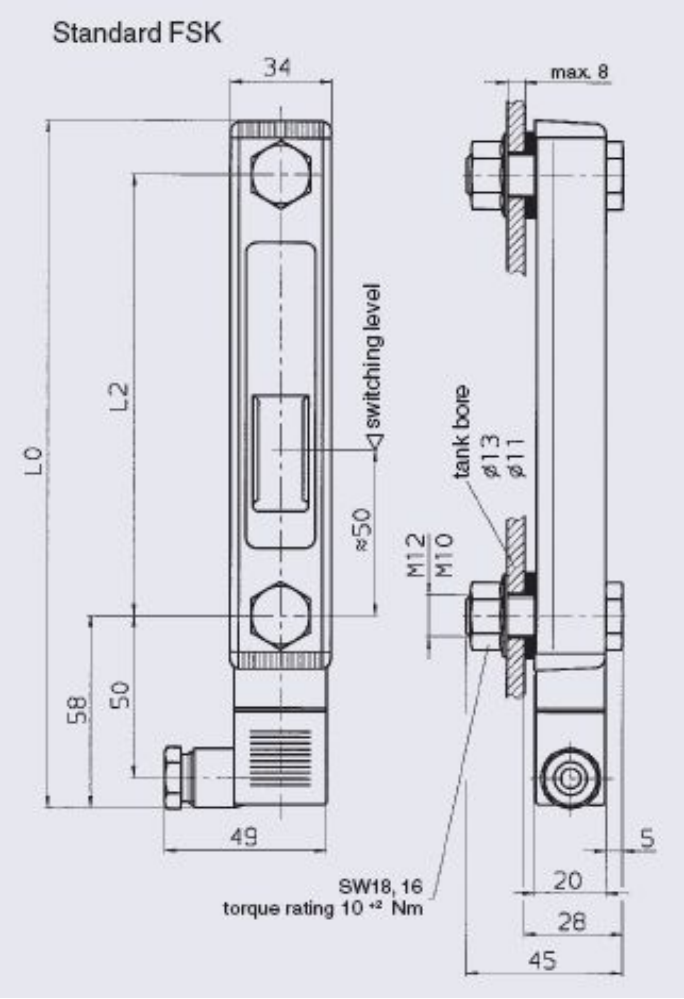
HBL System Training

Hydraulic power unit - device guide

oil level control

- monitoring oil level





HBL System Training

Service guide - first meeting with the machine

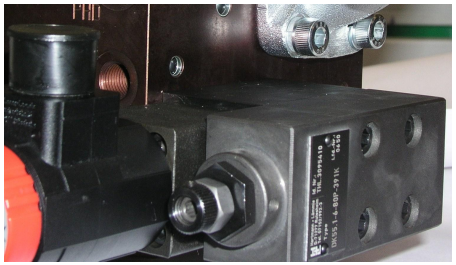
HBL System Training

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

HBL System Training

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.

HBL System Training

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)

HBL System Training

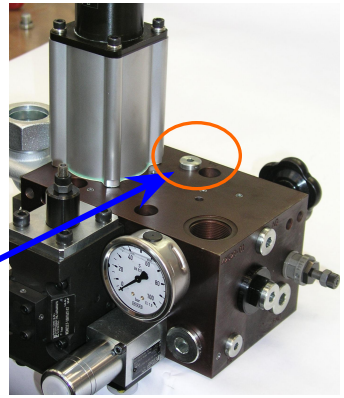
Service guide- first meeting with the machine

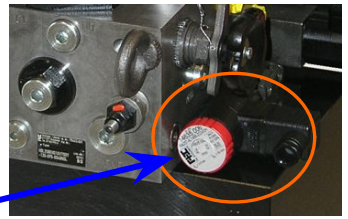
Accumulator precharge pressure - fast check

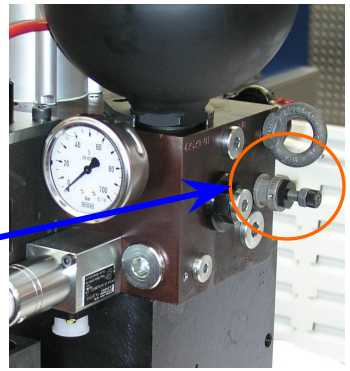
- stop pump, deenergize electrical discharge valve, monitor pressure gauges
- pressure must drop slowly until precharge level is reached, then will drop abruptly to zero.
- required precharge pressure see hydraulic circuit (about 35 bar)
- precharge pressure has to be measured under working temperature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

HBL System Training

Service guide- first meeting with the machine







Pressure adjustment (high pressure)

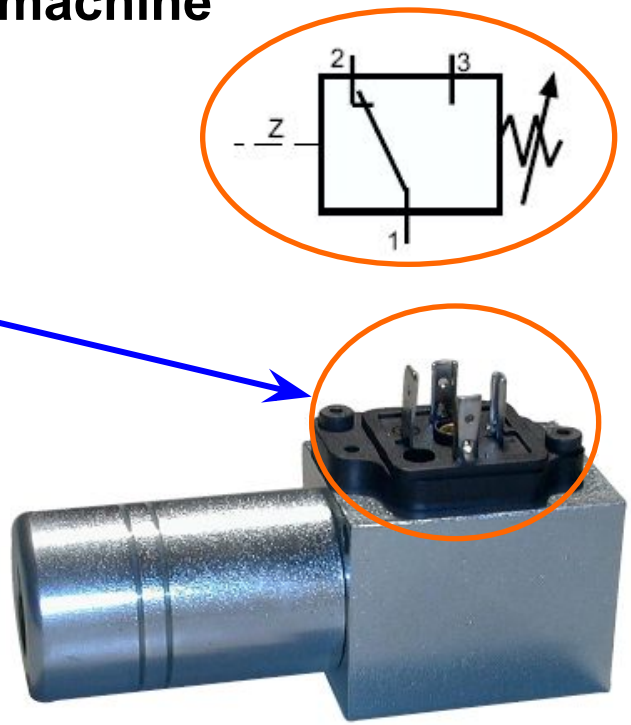
- put a pressure gauge in measuring port „MA“
- hydraulic pressurized, machine not running – look at gauges (you see about half the low pressure value at „MA“)
- move the ram down to the cylinder lower hard stop by switching “on“ the “slow move valve“ (Pos. 1.3.1) „manually“ with external 24 volt.
-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

HBL System Training

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



HBL System Training

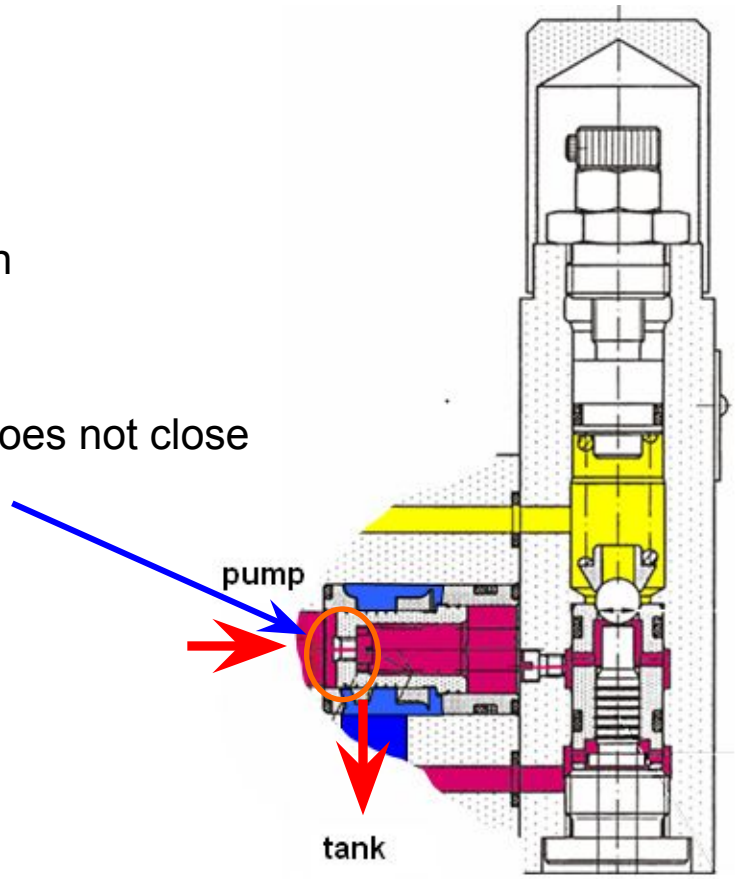
Service guide – trouble shooting

HBL System Training

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



HBL System Training

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!)

HBL System Training

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!

HBL System Training

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!

HBL System Training

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!

HBL System Training

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!

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Service guide - trouble shooting

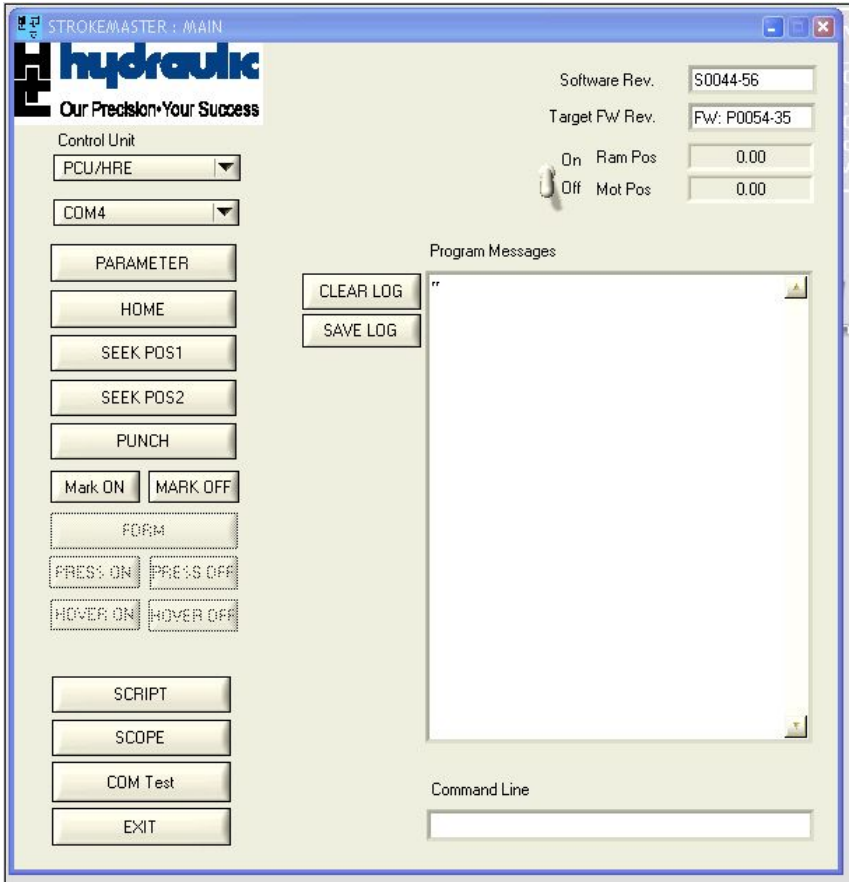
Ram moves down after hydraulic/electronic off

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

HBL System Training

Service guide –

software tool strokemaster



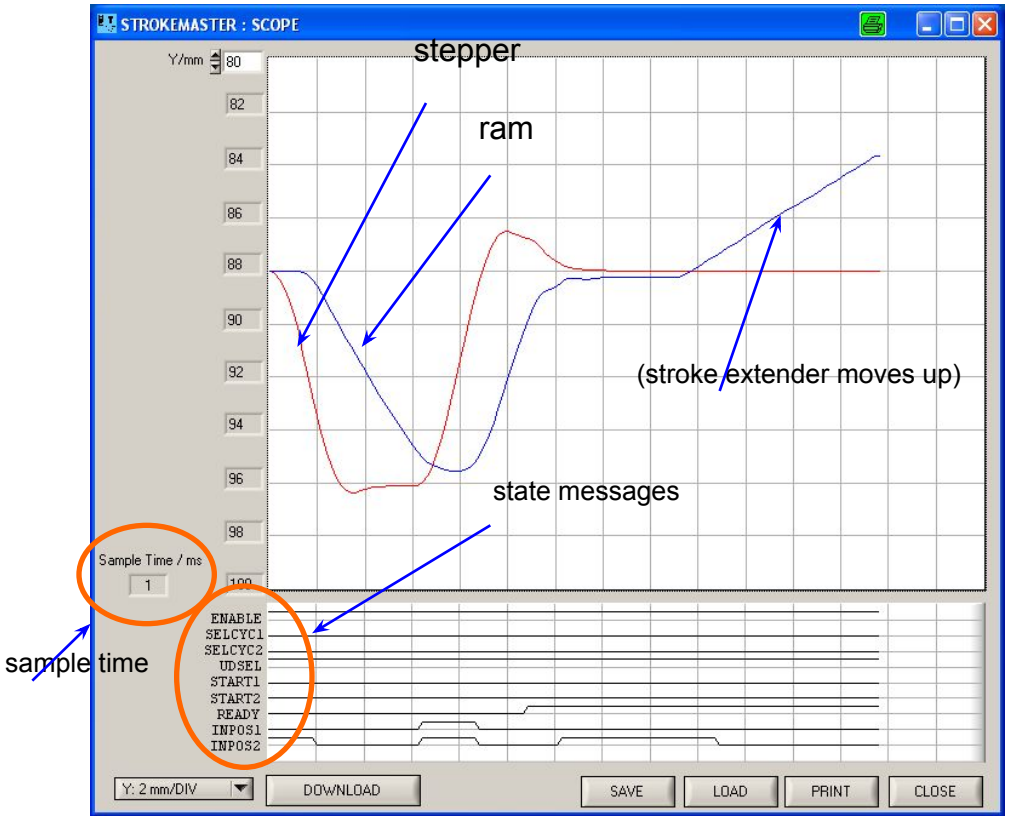
- displays soft- and FW-revision
- modify / display parameter
- control RAM
- analyse last RAM movement

HBL System Training

Service guide - stroke master file

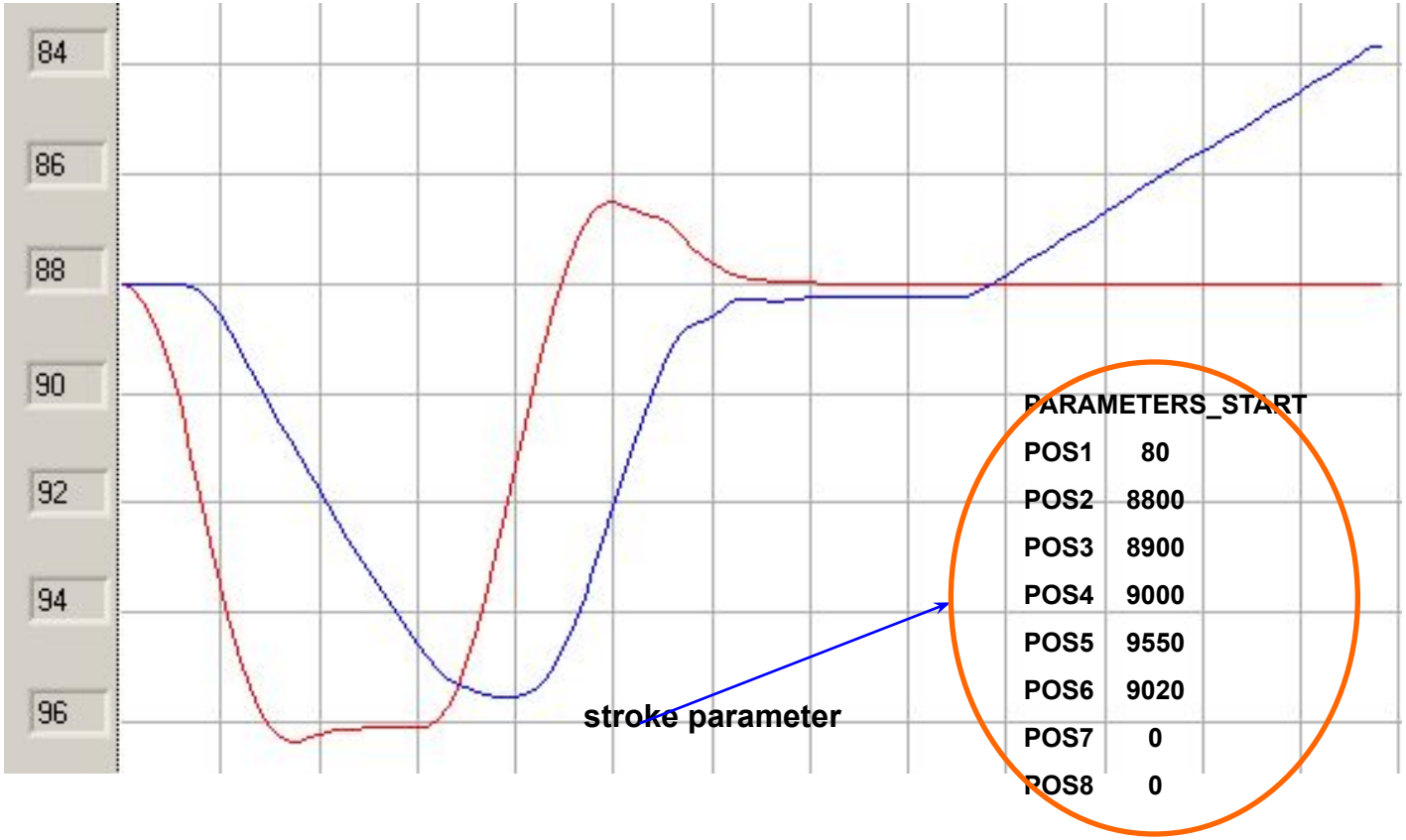
Tool to see what happens

- 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



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.