

3. Hydraulics

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3.1 General points to be observed

- Before starting work on the hydraulic system, switch off the machine and wait until the pressure in the accumulators has dissipated (observe pressure gauge).
- Switch on pump only when the accumulators are filled with nitrogen.
- Maintain the accumulator pressure in accordance with pressure table in section 3. If the pressures are too high, there is not enough pressure oil available.
- Pipe lines are not to be tightened while under pressure.
- In order that the hydraulic system can function correctly, a list of conditions has to be complied with at regular intervals. Proceed as per maintenance plan in section 2.
- The safety valves 28 (and 31 for machines from 100 Mp) protect the accumulator from overload. These limit the top pressure. They have been tested and certified by the TÜV* and must not be reset.

* (German Safety Standard Organisation)

3.2.1 Equipment layout plan notation

The given numbers correspond with those in the hydraulic plan.

- Item No.1 Magnetic valve for opening and closing
- 2 " " for low pressure closing
 - 3 " " for the ejector
 - 4 " " for the core puller movable I
 - 6 " " for pressing, 2nd. phase
 - 7 " " for pressing, 1st, phase and return
 - 8 " " for pressure release
- 12 Valve for loading the multiplier memory
- 13 Magnetic valve for the positioning cylinder
- 14 " " for the positioning cylinder
 - 15 " " for closing the safety device
 - 16 " " for core puller I. fixed
 - 17 " " for core puller II. movable
 - 18 " " for core puller II. fixed
- 19 Non-return valve
- 20 Non-return valve
- 22 Non-return valve
- 24 Pressure reduction valve for core puller fixed (100 bar)
- 25 Pressure reduction valve for core puller movable(100 bar)
- 26 Hydraulic pump
- 27 Pressure switch valve (140 bar)
- 28 Pressure limiting valve (safety valve)(150 bar sealed)
- 29 Pressure reduction valve for pressing pressure
- 30 Pressure reduction valve for closing and opening
- 31 Pressure limiting valve (safety valve)(150 bar sealed)
- 33 Pressure valve for low pressure closing
- 34 Non-return valve
- 35 Hydraulic releaseable non-return valve
- 36 Choke non-return valve "Opening"
- 37 Choke non-return valve for closing
- 38 Choke for ejector
- 40 Choke non-return valve for 1st.phase pressing
- 41 Choke, 2nd. phase pressing
- 42 Non-return valve
- 43 Non-return valve

- 44 Non-return valve
45 Non-return valve
46 Non-return valve
47 Motor
48 Clutch
50 Intake filter
51 Pressure reservoir
52 Pressure reservoir for phase II pressing
53 Pressure reservoir for the multiplier
54 Highest pressure pipe
55 " " "
56 " " "
57 Gauge
58 Hydraulic container
59 Thermometer
60 Ventilator filter, filling hole
61 Oil level inspection glass
62 Heat exchanger
63 Highest pressure pipe
64 " " "
65 " " "
66 High pressure filter
67 Water valve
68 Drainage screw on the hydraulic tank
69 Air-bleeding valve
70 Control valve
71 Non-return valve
72 Choke non-return valve
73 Multiplier reservoir pressure limiting valve

Description of the hydraulic drive

The item numbers given correspond with those in the hydraulic plan.

The constant pressure hydraulic pump 26 sucks the hydraulic fluid in and, after being filtered by the high pressure filter 66, presses it into the system or into the accumulator 51/52 via the pressure switch valve 27. The nitrogen in the accumulators is thereby compressed to the required pressure. When the required pressure is reached, the valve 27 automatically feeds the pump supply into the tank. A non-return valve incorporated in valve 27 prevents the return of oil from the pressure accumulator to the oil tank. If the pressure in the system sinks by more than 15% due to the removal of oil, valve 27 returns the output of the pump to the accumulator or the system.

The control of the pump via the pressure accumulator facilitates dealing with varying oil demand during operation of the machine without enlarging the size of the pump. The oil flows to the closing side and via the return valve 43 to the casting side. Valve 29 regulates the casting pressure, whilst valve 31 is the safety valve for the injection accumulator, and valve 28 is the safety valve for the closing accumulator.

3.3.1 Pressure release and motor start

When the machine is switched off, the de-energised magnetic valve 8 is in the position indicated - the control lines to the safety valves are pressureless. Thus the accumulators are connected to the tank via the safety valve. When the machine is started, the motor is running in star configuration, the magnetic valve 8, however is not energised until the motor is switched on to delta configuration. When this happens the valve 8 is activated and blocks the control lines to the safety valves and allows the pressure to build up. In this way the motor is protected from overload during the starting phase.

The opposite applies when the machine is switched off, the solenoid valve 8, like all other solenoids, is de-energised and thus the accumulator is re-connected with the tank. The pressure on the oil is exhausted.

Before starting work on the hydraulic system it is advisable to switch the machine off and wait until the pressure on the gauge has dropped to zero.

3.3.2

Hydraulic Control Locking Cylinder

The locking cylinder is driven by the solenoid valves 1 and 15. The speed of opening and closing is infinitely adjustable by the reducing non-return valves 36 and 37. The valve 1 is a three way valve:
1 position for closing (s1b energised)
1 position for opening (s1a energised)
1 position for locating in any required position (s1a and s1b are de-energised = spring located mid-way position).

In this mid-way position, the cylinder can be manually operated and stopped in any required position. During automatic operation, for example, a power failure would cause a standstill in the current position, so that no damage is done to the machine tools.

The solenoid valve 15 blocks the supply line for closing and opens only when the safety conditions are complied with (door closed). The non-return valve 42 serves as an automatic monitor for these functions. If solenoid valve 15 should fail (spring broken, jammed), the return flow from the closing cylinder is blocked and the closing unit does not open. The operating pressure for closing and opening is adjustable at the pressure reducing valve 30.

During the closing movement adjustable low pressure can be used to safeguard against tool damage. By energising solenoid valve 2, the control pressure, adjusted on pressure valve 33, effects the pressure reducing valve 30. In order to lock the toggles at the stroke end the pressure for the movement is reduced.

3.3.3 Hydraulic control pressing cylinder

In the cold chamber machines, the forward drive of the pressing cylinder is in three phases:

- 1 st. phase: Forward drive, controlled by magnetic valve 7. The speed is continuously adjustable on the choke non-return valve 40.
- 2 nd. phase: Shot with die filling. By controlling magnetic valve 6, the rapid shot valve is quickly opened which enables the reservoir oil to flow un-restricted into the cylinders. The shot speed is adjustable on valve 41.
- 3 rd. phase : Multiplier effectivity and multiplier extra pressure. The multiplier becomes effective immediately following the shot and can be delayed by means of the choke non-return valve 72.
The degree of extra pressure applied by the multiplier is adjustable by means of pressure of the nitrogen in the reservoir (Item 53, refer to the table).

The distance of travel of the forward drive(1st.phase) can be set by means of moving the limit switch b 42.

The pressing pressure is adjustable by means of the pressure reduction valve 29, whereby, a nitrogen pressure of approx. 0.8 of the pressing pressure in the reservoir 52 is to be maintained.

3.3.4 Hydraulic control ejector, core puller

The ejector is controlled by the magnetic valve 3. In the event of power failure when the valve is in the central location, the piston is prevented from drifting away by means of an inhibited cylinder feeder line.

The core pullers are controlled by magnetic valves 4, 16, 17 and 18. Depending on selected program, they can be operated when the die is open or closed, which depends upon the application of either fixed or movable core puller.

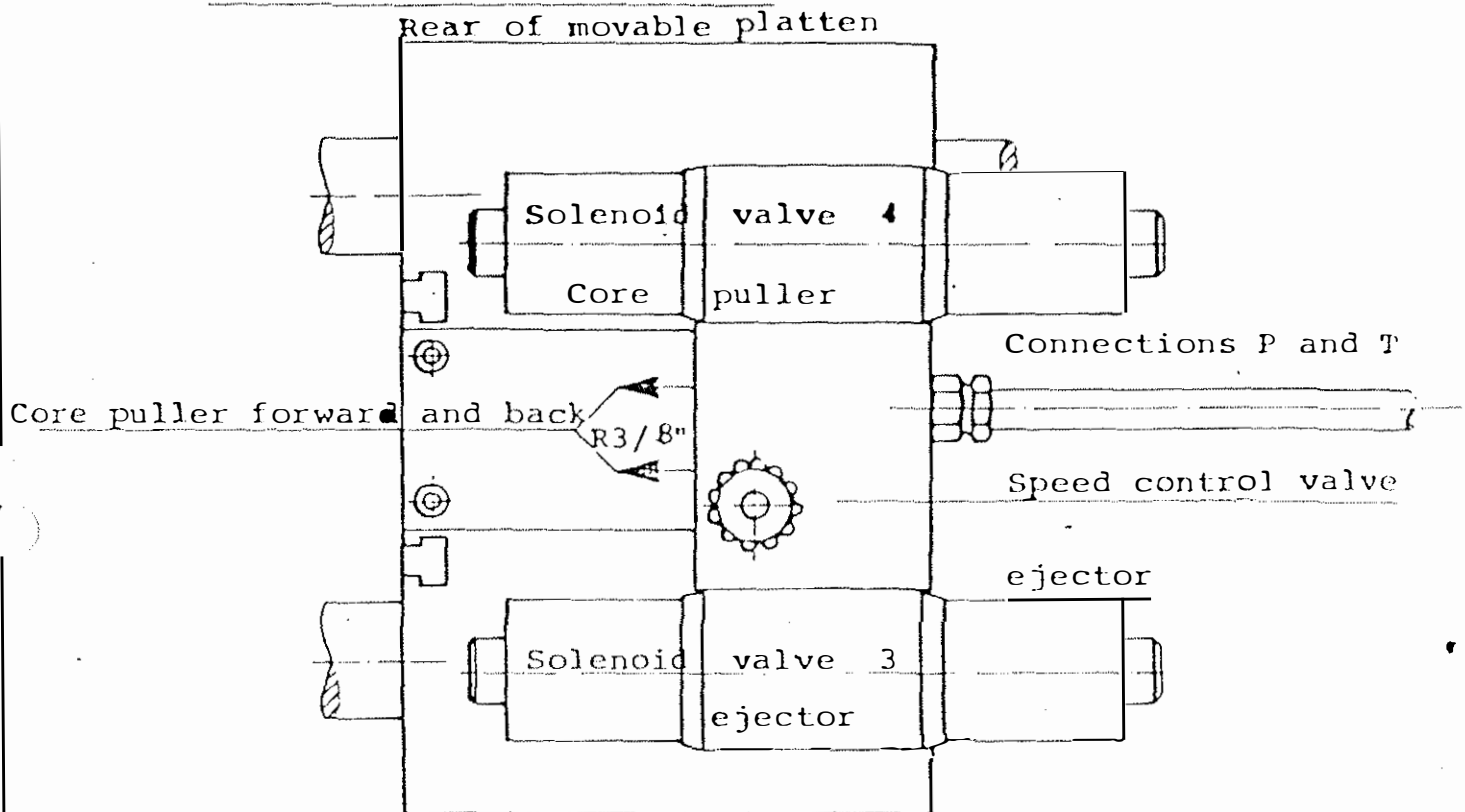
In the core puller II program (special device), the fixed die half core puller can be connected to a special block. This facilitates the operation of both fixed and movable core pullers at the same time.

In the core puller III program (Special device) an additional core puller can be applied to the movable and fixed die-half shoe. The sequence is determined on the plugs, i.e. the core puller from plug I is the first to move forward. Following end stop signal from the core puller, the 2 nd. core puller from plug 2 is activated. The return sequence is as follows, first is II and then I.

Note: If only one core puller is used (core puller program I and II), it is to be inserted into the appropriate recepticle (fixed or movable).

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Connections for core puller



Number of connections:

2 core pullers (standard)

4 core pullers (optional)

Caution: The machine has to be switched off before connecting the core pullers, and it is essential to wait until the pressure gauges show no longer any pressure.

Core puller programm I: Fixed or flexible core pullers can alternatively be connected to the above core puller connections.

Core puller programm II: Fixed core pullers have to be connected to a separate connection block. The above connections are only for flexible core pullers. For core puller programm II fixed and flexible core pullers can be connected at the same time.

ACCUMULATOR FILLING PRESSURES

Injection accumulator (large accumulator)

$P_{\text{nitrogen}} = 0.8 \times P_{\text{injection pressure}}$

Injection pressure

50 atm
60 atm
70 atm
80 atm
90 atm
100 atm

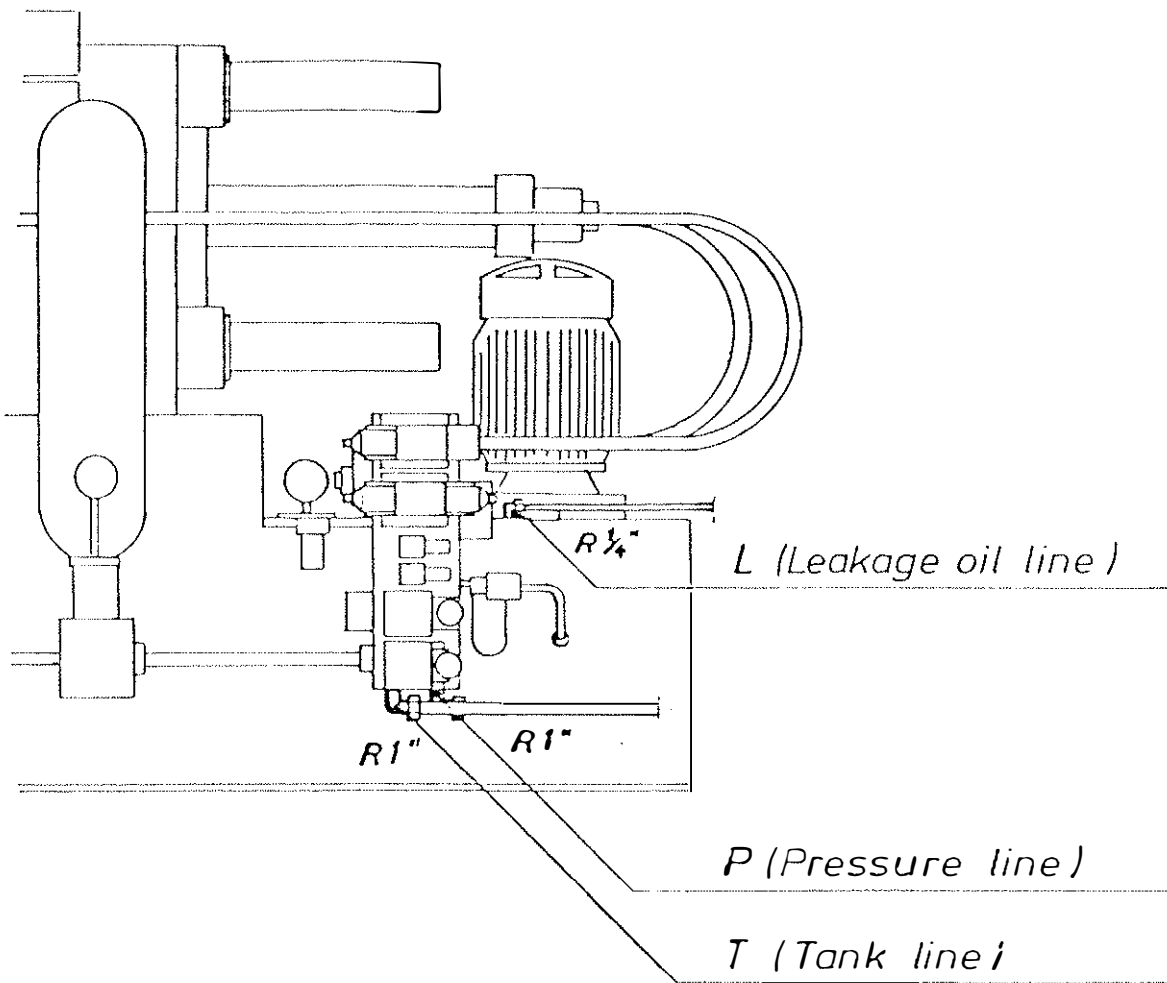
Nitrogen pressure

40 atm
48 atm
56 atm
64 atm
72 atm
80 atm

Intensifier accumulator (small accumulator): not in DAE/DAM machines

The nitrogen filling pressure corresponds to the pressure at which the intensifier is intended to activate.

Note: The following instructions from Bolenz & Schäfer inform you of the way to handle the hydraulic accumulators



DAW/M/K 40-63-100-166