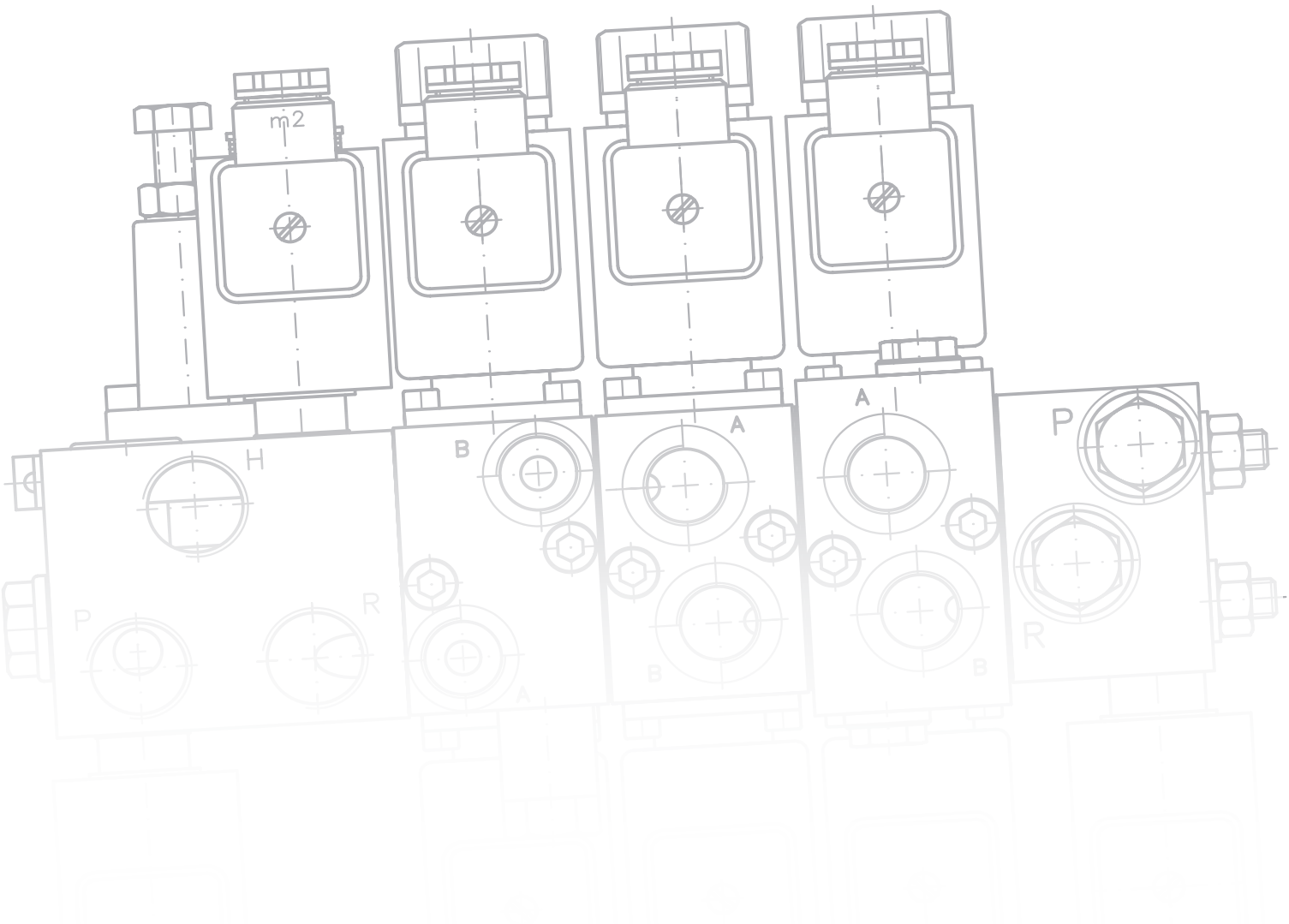
General operating manual for the assembly,initial operation and maintenance of oil-hydraulic components and system



Operating manual

B 5488

03-2013-1.2

HAWE Hydraulik SE - Streitfeldstr. 25 • 81673 München

Contents

1 General operating manual for the assembly, initial operation and maintenance of hydraulic components and systems

1.1 General

The diversity of hydraulic components and systems requires different operation instructions. A general operating manual may offer valuable notes, but usually has to be completed with instructions corresponding to the very product/application. Proper handling and maintenance will prolong the service life of hydraulic components and systems and contribute to the functional safety of the equipment.

The following guidelines are supplementary valid:

- VDI 3027 „Initial operation and maintenance of hydraulic systems“
- DIN 24 346 „Hydraulic systems“
- ISO 4413 „Fluid engineering - design guidelines hydraulics”

2 Assembly

2.1 Assembly preparation

- Check stored parts for completeness and possible shipping damages.

Caution
All work should be completed in a clean environment.

- All external surfaces of the power pack (tank, pipes, motor, etc.), components and the surrounding should be held clean or cleaned before.
- No dirt or moisture should mix into the pressure fluid.
- All connections should be plugged with protecting caps always, even when opened only for short periods.

2.2 Execution of the assembly and preparation to initial operation

- Use the standard raising eyes and transport devices.
- Mounting surfaces for valves must be flat. Manifold mounted valves do not only require clean but also scratch-free surfaces machined within the specifications. The mounting screws have to be tightened evenly with the specified torque to avoid unwanted distortions and subsequent malfunctions.
- The correct pressure rating has to be selected for all tubes, hoses, and fittings/flanges (strength, material). Only seamless precision tubes are suited.
- The mounting notes of the fitting manufacturer have to be taken into account to avoid external leakages at the junction points.
- Hemp or Teflon (PTFE) tape must not be used! State of the art, widely available assembly material makes hemp or Teflon (PTFE) tape definitely superfluous!
- Pay attention to correct routing of tubes and hoses! Any mechanical stress, rubbing of hoses at other components must be prevented.
- Filling the tank with pressure fluid.

Caution
Compatibility of the fluid with the system and its components (e.g. seals etc.) has to be checked. The hydraulic fluid has to be filled in via the system filter or via a mobile filtration system. The absolute filter rating for the initial filtration must be minimum as high as the rating of the system filter. Top-up fluid until the max. marking of fluid level gauge is reached.

- Charging hydraulic accumulators

Caution
Hydraulic accumulators must comply with local regulations and laws. Only nitrogen is suited for the gas filling!

- Make sure that the hydraulic side of the system is completely de-pressurized. Add nitrogen until the gas pre-load pressure p0 is reached as specified in the respective documentation.
- Possible installation positions of accumulators: Diaphragm type accumulators no specified installation position; Bladder type accumulators preferably vertical with hydraulic port down-wards: Piston type accumulators vertical only.

- Connect the drive motor to mains.
- Connect all valve solenoids and sensors to the power supply.

3 Initial operation

3.1 Test run

- The test run should be carried out by technically qualified staff of the manufacturer or by own service staff.
- All pressure valves (pressure reducing- and pressure limiting valves) and also pressure controller of variable displacement pumps should be relieved and set to minimum. This doesn't apply to lead-sealed safety valves, the setting must not be changed.
- Open shut-off valves and throttles as wide as possible.
- Briefly start the drive motor to verify that the rotation direction is conforming the specification of the pump.
- Verify that all valves are in their desired position (acc. to the hydraulic circuit plan).
- Pump housings should be primed with pressure fluid to ensure that all parts are sufficiently lubed (see resp. manuals).
- Briefly start the power pack and observe that no unusual noise can be detected.
- Bleeding the hydraulic system
  Carefully loosen top screw fittings or dedicated bleed screws but do not remove them. When the hydraulic fluid flows out without bubbles, the bleeding process is complete. At this point, fittings/screws should then be re-tightened. The pump motor should also be switched on and off again several times.
- Flushing the system.
  The hydraulic application should be operated in unloaded state for several complete cycles until all movements are performed without any hesitation and at correct speed.
- As soon as the operation temperature (but min. 40°C) is achieved, one can slowly rise the system pressure (permanently monitored by a pressure gauge) until the specified pressure level is achieved.
- Check the surface temperature of pumps and motors (max. 80°C).
- Check the fluid level and refill when necessary.
- Check proper setting/function of all safety and pressure limiting valves either by external load or abrupt deceleration of the application.
- Check for external leaks.
- Cut-off the drive.
- Check and retighten all mounting screws, fittings etc. with the specified torque, even if no leaks are visible.

Caution
Completely relieve the system pressure before retightening!

- Did you detect any unsuited pipe mounting during alternating load conditions?
- Did you detect any rubbing of hoses at other components during alternating load conditions?
- Functional tests of the complete system.
  Compare the measured figures to the specified values and max. ratings.
  Check that speeds are within the specified tolerances.
  Reset the control device when necessary.
- When the fluid foams inside the tank, hesitations and/or too slow speeds are detected this might be an indicator that there is still air trapped in the system.
  Perform the bleeding procedure once again.
- Check the persistent operation temperature.

3.2 Initial operation of complex systems or systems with several simultaneous consumer movements

This usually applies to machine tools, crane controls, machines with electro-hydraulic controls, etc. Initial operation of such complex systems is much more demanding, as usually several measurements (e.g. differing pressure levels, electrical signals, distances, speed rates, flows, etc.) have to be taken in parallel to detect undesired mutual influences or desired ensemble acting of several consumers. These measurements, as well as the optimization of the system, can't be performed with the usual test equipment (pressure gauge, temperature gauge, multimeter etc.). It is therefore recommended to contact the manufacturer of the machine.

3.3 Most frequent mistakes during initial operation

- Insufficient cleanliness during assembly.
- Valves are mounted with distortion or with wrong torque.
- The pressure fluid at filling is inadequately filtered.
- The hydraulic system was not checked / possible fluid loss because of retro-fitted components.
- The system is not sufficiently bled.
- Safety valves are set too near to the setting of the working pressure (hysteresis for closing is not taken into account).
- The flow direction specified for some valve types is not followed.
- Striking mechanical noises especially from the pump are not taken into account (cavitation, leaking suction line, misalignment pump/motor, etc.).
- The design related switching hysteresis of mechanical pressure switches is not taken into account while setting them.
- Hydraulic pump and motor housings are not properly primed with pressure fluid prior to initial operation.
- The set values are not documented or specifications are missing.
- Means of adjustment are not properly secured, locked, or lead sealed.
- Unqualified staff performing the initial operation.

4 Maintenance

HAWE power packs and components have been designed to enable fault-free operation over a long service life. However, maintenance measures will nonetheless need to be planned and carried out, taking into account the length of time for which the power packs and components are switched on, their switching frequency, the potential consequences in the event of a failure and the availability or guarantee time requested. In special cases, instructions in addition to the general operating manual must be observed, see Chapter 5, "Con-current documents".

The industrial standard DIN 31 051 defines the following tasks as maintenance:

- **Inspection**
  Measurements to detect and evaluate the current state of the system, i.e. research whether and why wear appears.
- **Maintenance**
  All measurements which preserve the designed state of the machine or minimize wear of it.
- **Repair**
  All measurements which recondition the designed state of the machine i.e. repair and elimination of any signs of wear. Even though above industrial standard distinguished these three forms they are usually tightly linked in practice.

4.1 Inspection

Usually there is some kind of maintenance schedule which covers and describes all works in detail enabling a staff with differing qualification to perform these tasks.

Major inspection tasks:

- Check pressure fluid level in the tank.
- Check cleanliness/condition of the pressure fluid.

Caution
The sensoric check of the fluid can be regarded only as a rough indicator for the fluid condition (milky/black appearance, gumming, sludge at the tank bottom, smell of burned oil etc.).

- Check filter clogging indicators/difference pressure switches (when apparent) while system is in operation.
- Check persistent fluid temperature while system is in operation (usually <60°C, max. 80°C).
- Check operation pressure levels and operation speeds.
- Check for external leaks.
- Check piping and tubes for proper mounting and indications of rubbing.

Caution
Damaged pipes and hoses should be replaced immediately!

- Check visually the hydraulic accumulators.
- Check visually all electrical connections of motor, solenoids, sensors, pressure switches, etc.

4.2 Maintenance

An overview of inspection and maintenance intervals can be taken from table 1 in Chapter 5, "Con-current documents".

Important maintenance works:

- Pressure fluid
  The service life of hydraulic fluids is highly dependent on the operation temperature and the conditions (tank size, number of throttle sections ...). The max. operation temperature usually is 80°C (lower for fluids employing water), an increase of 10°C will reduce the service life by 50%.
  Different kind of pressure fluids should not be mixed as this might cause sludge, gumming, etc. It is recommended to flush the system prior to any change of the fluid type and to contact the fluid manufacturer.

- The fluid should be drained while the system is warm. Used oil should be disposed professionally.
- Heavily aged or contaminated fluid can't be improved by simply adding fresh fluid.
- The hydraulic fluid has to be filled-in via the system filter or via a mobile filtration system. The absolute filter rating for this initial filtration must be at least as high as the rating of the system filter.
- Fluid samples have to taken and tested for contamination kind, size, and level with the results being documented.

Caution
The complete hydraulic system has to be depressurized prior to any works at accumulators.
No soldering, welding, or machining is allowed at hydraulic accumulators! Incompetent handling may cause severe accidents!

- Check the setting of system and control pressure.
- Any pressure re-adjustments should be documented , as this may be a sign of wear.
- When repeated readjustment of the pressure valve becomes necessary to achieve the specified setting, it indicates wear of the pressure valve.
- Check the pipe works for external leaks.

Caution
It is most important that the system is completely depressurized prior to removal of fittings, hoses or other components.
Leaks at joints sealed via soft-iron rings, O-rings or other contoured seals can't be solved by simply retightening of the joint (observe the perm. torque) as the seal material has hardened or is otherwise damaged. Seals should be replaced always.

- Check the function of control and monitoring devices (pressure gauges, pressure switches etc.).

4.3 Repair

Diagnosis and localization of the cause for malfunctions.

- Trouble shooting
  A successful trouble shooting of hydraulic systems requires a detailed knowledge about the hydraulic system and understanding of the layout, operation, and ensemble acting of the individual components. All documentation required should be at hand. Understanding usually requires the ability to read hydraulic and electrical circuit plans.
  Suited test devices (temperature gauge, pressure gauge, multimeter, stethoscope for industrial use, stop watch, rev. counter, etc.) are a must.
- Repair
  Cleanliness is mandatory when working on hydraulic systems! All surfaces where joints are to be separated should be cleaned prior to disassembly.
  Defective devices should not be repaired on site as the tools and cleanliness required for professional repairs are not apparent. It is better to replace only the complete unit or at least sub-assemblies, which can be tested individually, on site. This way standstill periods and fluid losses are minimized as well as repairs are eased.
  It is important to take into account whether the malfunction of the repaired component may have caused malfunction of other components e.g. by migrating debris or even fragments.
  After repair of the component one should look for and solve the basic cause for this malfunction (e.g. unsuitable filtration level, service periods etc.).

4.4 Repair and overhaul of hydraulic devices

Minor repairs can be undertaken by the user via spare part lists and exploded views. Basic repairs and overhauls should be undertaken at the premises of the manufacturer, as this usually most efficient and more safe (expert staff, specific tools/test equipment, renewed warranty, etc.).

5 Con-current documents

- Pressure fluids - notes for selection: D 5488/1
- Specific product documentations e.g. product related service notes, hydraulic circuit plans, technical drawings, test protocols, technical supplements etc.

Table 1

Inspection- and maintenance intervals	During start		During standard operation always after			
	daily or permanent	1 week or 40 h	3 months or 500 h	6 months or 1000 h	1 year or 2000 h	2 year or 4000 h
Pressure fluid						
Filling level	●		●			
Service temperature	●		●			
Condition (fluid sample)		●		●		
Change				●	●[1)]	●[1)]
Filter						
Replacement/inspection of filters without clogging indicator	●		●	●[1)]		
Monitoring of the clogging indicator	●				●	
Cleaning of the breather filter			●	●[1)]		
Replacement of the drying filters (silica gel)				●	●[1)]	
Accumulator						
Check gas pre-load pressure p0, check mounting	●		●	●[1)]		
Set values						
Pressure-, flow valves, pump controllers, monitoring devices	●		●	●[1)]		
Cooler						
Clean fluid/air-cooler			●	●[1)]		
Clean fluid/water-cooler					●	●[1)]
Other controls						
External leaks	●	●		●	●[1)]	
Contamination				●		
Damages	●			●	●[1)]	
Noise	●	●		●	●[1)]	
Test equipment					●	●[1)]

[1)] Inspection or maintenance intervals for operation < 500 h / year