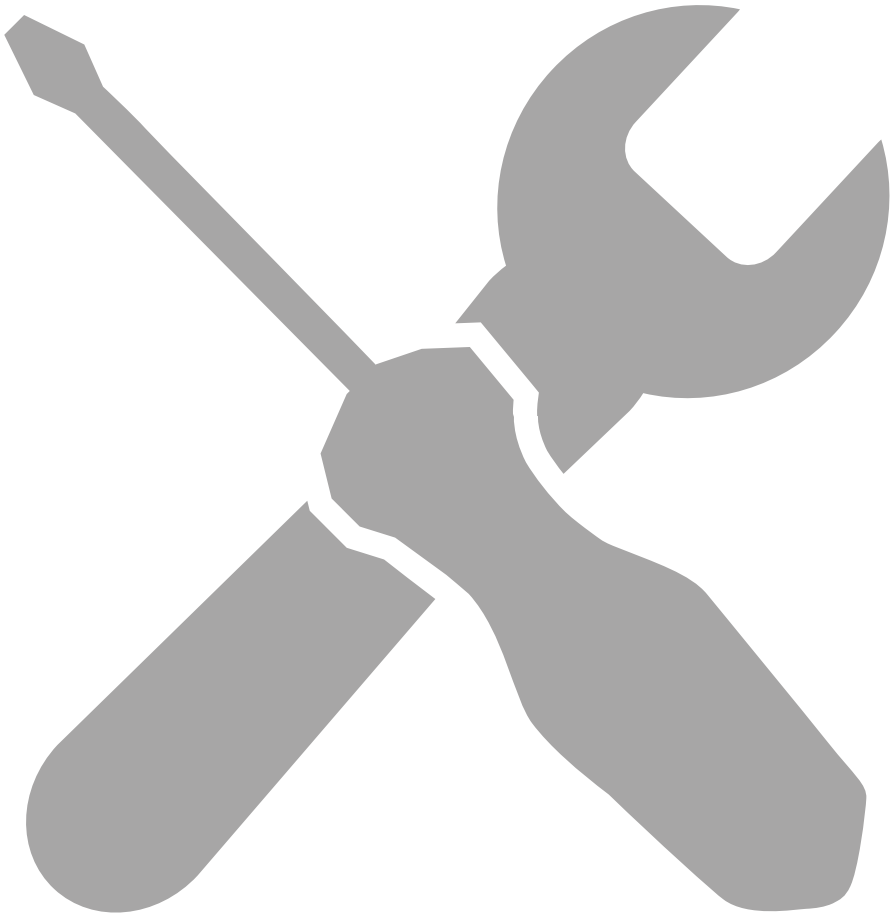
General operating and assembly instructions

Assembly, commissioning and maintenance



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HAWE HYDRAULIK

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1 About these instructions

These instructions provide general information about systems and components that HAWE Hydraulik SE assembles, operates and maintains. They serve as reference information for customers and are intended to prevent hazards relating to assembly, commissioning and maintenance.

Validity

These instructions are only valid in conjunction with the specific operating/assembly instructions for the HAWE products concerned. These instructions do not replace the operating instructions for the complete machine/system.

Liability

Provisions relating to liability are governed in the contract that was concluded. The liability may be invalidated if the components are converted or modified.

1.1 Target audience

The target audience of this manual is trained and qualified personnel who are familiar with the installation, operation and maintenance of machines.

The manual provides relevant information for the machine manufacturer and machine operator as well as for training courses.

1.2 Safety instructions and symbols

Safety indication

In these instructions, the following warning and safety notes are used:

Symbol	Meaning
DANGER	Draws your attention to a **hazardous** situation that can lead directly to **serious injury** or **death** if not avoided.
WARNING	Draws your attention to a **hazardous** situation that can indirectly lead to **serious injury** or **death** if not avoided.
CAUTION	Draws your attention to a hazardous situation that can indirectly lead to **light** to **moderate** injury if not avoided.
	**Notice** to prevent environmental and material damage.
	**Information** to ensure the correct use of the product.

Safety symbols

	**General safety symbol** Draws your attention to additional safety information.		
	Slipping hazard		Dragging hazard from moving parts
	Harmful substances		Tripping and falling hazard
	Fire accelerants		Falling loads

	Burn hazard		Crushing hazard
	Electrical voltage		Suspended loads
	No access to persons with pacemakers and defibrillators		

Mandatory signs

	Protective equipment
	**Safety boots** Wear appropriate safety boots to protect your feet against mechanical hazards
	**Work gloves** Wear suitable work gloves to protect your hands against chemical and mechanical hazards.
	**Safety goggles** Wear safety goggles to protect your eyes against chemical and mechanical hazards.
	**Protective clothing** ► Wear fitted clothing without protruding parts. ► Follow the safety data sheet of the hydraulic fluid.

1.3 Applicable documents

Standard	Designation
2006/42/EC	Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC
2014/30/EU	Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility
2014/68/EU	Pressure Equipment Directive
2009/104/EC	Use of Work Equipment Directive
DIN 51524	Pressure fluids - Hydraulic oils - Part 1: HL hydraulic oils, Minimum requirements
ISO 4406	Hydraulic fluid power. Fluids. Method for coding the level of contamination by solid particles
IEC 60529	Protection classes provided by housings (IP code) (IEC 60529:1989 + A1:1999 + A2:2013)
DIN EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
DIN EN ISO 14120	Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards
DIN EN ISO 14118	Safety of machinery - Prevention of unexpected start-up
DIN EN ISO 4413	Hydraulic fluid power - General rules and safety requirements for systems and their components
DIN EN ISO 13849-1	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design
DIN EN ISO 13849-2	Safety of machinery - Safety-related parts of control systems - Part 2: Validation

Standard	Designation
German Social Accident Insurance (DGUV) Rule 113-020	Hydraulic hose lines and hydraulic fluids – regulations for safe application
German Social Accident Insurance (DGUV) FBHM-046	Machinery, robotics and production automation – Hydro-pneumatic hydraulic accumulators

2 For your safety

The product is built according to the state of the art and recognized safety regulations.

Nevertheless, there is a risk of personal injury and damage to property if this chapter and the safety instructions in this manual are not observed.

2.1 Intended use

- The product is considered technical work equipment and is intended solely for commercial and industrial use.
- The product must only be operated in accordance with the specified technical data, operating conditions and performance limits.
- Use only genuine accessory parts and genuine spare parts approved by the manufacturer.

Partly completed machinery

The product is a partly completed machine according to the EC Machinery Directive 2006/42/EC and is intended exclusively for installation in a machine or system. The product is controlled via the manufacturer's machine / plant control.

► Comply with the manufacturer's operating instructions.

2.2 Misuse

- Use in other operating modes than specified in the intended use
- Using the product beyond the specified performance limits

- Using hydraulic fluids other than those specified
- Structural modifications

2.3 Residual risks

⚠ DANGER

Hazard from explosive combustion

Hydraulic fluid as well as the mist and vapor of hydraulic fluid are fire accelerants. Contact with ignition sources leads to explosive combustion. Serious injury or death.

► Avoid fire, open flames and smoking in the vicinity of the product.
► Immediately dispose of combustible materials wetted with hydraulic fluid as special waste.
► Do not use flammable or corrosive cleaning fluids.

⚠ DANGER

Danger to life from pressurized systems

When lines and components on pressurized systems are disconnected, hydraulic fluid escapes at high pressure and penetrates deep into the body via the skin and eyes. Severe injury or death.

- Depressurize the hydraulic system including the pressure tank.
- Secure the hydraulic system against unintentional restart.
- Check components for correct assembly before pressure is applied.
- Observe maximum pressure load for fittings and lines.

⚠ DANGER

Danger to life due to damaged hydraulic accumulator

Due to incorrect use or damaged pressure accumulators, hydraulic fluid or gas escapes under high pressure and penetrates far into the body through the skin and eye. Serious injury and death.

- Work on the pressure accumulator only by trained specialist personnel.
- Only fill the pressure accumulator with approved medium.
- Use suitable test and filling equipment.
- Never weld, solder or drill hydraulic accumulators.
- Protect hydraulic accumulators from mechanical damage, e.g. by padding.
- Do not use hydraulic accumulators and attachments as suspension devices.
- After unloading / complete draining, depressurize all liquid-side lines connected to the pressure accumulator and do not close them again.

⚠ WARNING

Electrical and magnetic fields

Electrical and magnetic fields impair the functionality of cardiac pacemakers and implanted defibrillators.

- People with pacemakers or implanted defibrillators must maintain a sufficient distance from magnets.
- Advise people with pacemakers or implanted defibrillators against approaching magnets.
- Cordon off the area around the drive system and affix suitable warning signs to the barriers.

⚠ WARNING

Risk of injury from crushing and shearing

Parts of the body may be crushed or severed between the machine frame and hydraulic system due to lack of caution during transport, assembly and disassembly.

- Never reach between the hydraulic system and the machine frame.
- Ensure that third parties cannot enter the hazardous area.
- Wear work gloves and work boots.

⚠ CAUTION

Burn hazard from hot surfaces and hydraulic fluid

A burn hazard results from directly or indirectly coming into contact with hot hydraulic fluid and hot components of the hydraulic system.

- Wear work gloves.
- Arrange the access to the hydraulic system in such a way that hot surfaces are not accessible to the user.
- Wait until the hydraulic system has cooled down before servicing or disassembling it.

⚠ CAUTION

Risk of falling from leaking hydraulic fluid

Spilled or leaked hydraulic fluid can form a slippery film on the floor.

- Use suitable aids when filling or bleeding.
- Check all connecting elements that convey oil for leaks before switching on the motor in the parent system.
- Wipe up leaked hydraulic fluid with suitable aids.

When handling hydraulic fluid, comply with the safety data sheet of the manufacturer of the hydraulic fluid.

2.4 Duties of the operator

Observe and comply with regulations:

- Do not put the product into operation until the complete machine or system complies with the country-specific regulations, safety regulations and standards of the application.
- Observe and apply regulations for accident prevention and environmental protection.

Operate product safely:

- Despite safety devices, the product still poses residual risks. Observe the safety instructions in this manual to reduce health hazards and avoid dangerous situations.
- The operator must ensure that the operating conditions (see general, hydraulic and electrical data) are within the operating limits of the product.
- Keep all instructions / signs on the product in legible condition and observe them.

Instruct personnel:

- Regularly train the personnel in all points of these instructions and ensure that they are observed.
- Ensure the terms of the industrial safety and operating instructions are observed.
- Only use qualified personnel. Due to their training and experience, the qualified personnel must be able to recognize risks and avoid possible hazards.

2.5 Qualification of the personnel

The activities described in these instructions require basic knowledge of mechanics, hydraulics and electrics.

For the transport and handling of heavy loads, additional knowledge in handling hoists and slings is required.

- The activities may only be carried out by an appropriate specialist or an instructed person under the supervision of a specialist.
- Activities other than those described in these instructions may only be performed by HAWE or authorized specialist companies.
- The personnel must have read and understood these instructions.

Trained personnel

Personnel instructed comprehensively, by skilled staff on behalf of the owner, in how to perform its appointed tasks and in how to use the product safely.

Specialist personnel

Due to their technical training, knowledge and experience, specialists are able to assess and carry out the assigned work and can independently recognize possible dangers.

Qualified electrician

A person with appropriate professional training, knowledge and experience, so that he/she can recognize and avoid dangers that can be caused by electricity.

Auditor

Persons of a technical inspection body who are authorized to perform testing and monitoring tasks for pressure equipment and electrical systems.

2.6 Personal protective equipment

Personal protective equipment is designed to prevent and reduce hazards.

In the instructions, safety instructions with mandatory symbols indicate the wearing of special protective equipment for special activities.

Instruction and supply is carried out by the operator.

3 Transport and storage

Observe the following safety instructions additionally to the safety instructions in chapter For your safety.

⚠ CAUTION

Personal injury from tipping and falling loads

The pallet or skeleton container may tip and/or fall during transport. Hands and feet can be crushed.

- Adhere to the symbols on the packaging.
- Carefully transport the pallets or skeleton containers as near as possible to the installation location using approved transport equipment.
- Select transport equipment that has the capacity to transport the maximum load safely.
- Wear protective clothing.

3.1 Transport

DAMAGE

Avoid transport damage

- Valves or other mounted components must not be subjected to a load.
- Do not bend hoses.

Only use tested and approved tools. Use existing eyelets or transport devices for transporting hydraulic components.

3.2 Checking the delivery

Unpacking

1. Remove product.
2. Check product for transport damage and completeness.
   - ► Note transport damage on the transport documents or on the carrier's delivery bill.
   - ► Document transport damage with photos and report to the manufacturer.
3. Properly dispose of the product packaging in accordance with local regulations.

DAMAGE

For any defect found, file a complaint immediately with:

HAWE Hydraulik SE
Einsteinring 17
85609 Aschheim near Munich, Germany
Tel.: +49 89 379100-1491
service@hawe.de

Claims for damages can only be addressed within the applicable complaint periods. HAWE does not accept any liability for subsequent complaints.

3.3 Storage

The following factors affect the storage life of hydraulic components:

- The seals used
- Moistening with hydraulic fluid during functional testing at the factory

DAMAGE

Property damage from incorrect storage

Incorrect storage can lead to damage. Refer to the technical data.

Store the product and its separate components as follows:

- Do not store outdoors.
- Store dry and free of dust.
- Protect the equipment against sunlight (UV radiation).
- optimum storage temperature: 15 - 20 °C
- Do not store close to ignition and heat sources, aggressive media (e.g. acids, fuel, lubricants), and ozone-emitting illuminants (e.g. fluorescent light sources, mercury vapor lamps).
- Protect the valves and valve controllers against gumming of the hydraulic fluid if stored more than 2 years. To do so, contact the manufacturer of the hydraulic fluid.
- Avoid mechanical jolts.

- Store components such that they are not subject to any tension or deformation.
- Relative humidity: ≈ 65 % (± 10 %)
- Components stored in plastic bags (without plasticizer, impermeable to UV light)
- Elastomers stored in accordance with the applicable standards
- Hydraulic fluids can be stored for an unlimited period if they are in containers that were sealed by the manufacturer.
- Carry out a functional test annually (manual override, dry switching).
- Safety components: half-yearly functional test, and inspection at the factory – including replacing the seals – every 2 years

4 Assembly and installation

DAMAGE

Material damage due to mechanical damage

Protect the product from mechanical damage during assembly and installation, e.g. by padding.

4.1 Mechanical connection

DAMAGE

Property damage from incorrectly installed hydraulic system

- Assembly by trained specialists only.
- Ensure all labels and markings of the hydraulic system are easily visible and legible after assembly.
- Check installation space/connection points for damage.

DAMAGE

Damage from connecting soiled components

Connecting soiled components may cause system failure and irreparable damage.

- Clean the workspace before connecting the hydraulic system.
- Clean hydraulic components before connecting the hydraulic system.
- Only use hydraulic fluid of sufficient grade.

☑ The outer surfaces of hydraulic power packs, components and lines are clean.

☑ The seals are undamaged. Contact HAWE Service in case of any damage.

1. Place the product in the higher-level machine.
2. Ensure that all fastening holes and hydraulic connections are perfectly aligned.
3. Tighten the fastening screws to the relevant torque.
4. Check the fastening screws at the latest after a week of operation.

4.2 Hydraulic connection

- Select the pipes/tubes, hoses, fittings and flanges in line with the relevant pressure stage, wall thickness and materials.
- Only use seamless precision steel tubes.
- Observe the installation information from the fitting manufacturer.
- Route pipes/tubes and hose lines in accordance with the applicable standards. Avoid mechanical tension on the pipes/tubes. Do not kink the hoses. Avoid chafing points.
- Fill the system with the specified hydraulic fluid.

⚠ DANGER

Danger to life due to damaged hydraulic accumulator

Due to incorrect use or damaged pressure accumulators, hydraulic fluid or gas escapes under high pressure and penetrates far into the body through the skin and eye. Serious injury and death.

- Work on the pressure accumulator only by trained specialist personnel.
- Only fill the pressure accumulator with approved medium.
- Use suitable test and filling equipment.
- Never weld, solder or drill hydraulic accumulators.
- Protect hydraulic accumulators from mechanical damage, e.g. by padding.
- Do not use hydraulic accumulators and attachments as suspension devices.
- After unloading / complete draining, depressurize all liquid-side lines connected to the pressure accumulator and do not close them again.

- Have specialist personnel fill the hydraulic accumulator until the specified gas pre-load pressure of p_0 is reached.
- The safety engineering of Category I – IV hydraulic accumulators must be assessed by the operator. The operator must derive inspection intervals from this assessment. Depending on which category applies, the necessary inspections are performed and logged either by a qualified person as per TRBS 1203 or by an approved inspection body (AIB).

Inspection group	Acceptance inspection	Recurring inspection		
		External	Internal	Pressure
I PS > 0.5 and 50 bar PS x V ≤ 200 bar L	qualified person	qualified person	qualified person	qualified person
II PS > 1 and 200 bar PS x V ≤ 1,000 bar L	AIB	qualified person	qualified person	qualified person
III PS > 1 and 1,000 bar PS x V ≤ 3,000 bar L	AIB	AIB 2 years	AIB 5 years	AIB 10 years
IV PS > 4 PS x V > 3,000 bar L	AIB	AIB 2 years	AIB 5 years	AIB 10 years

Installation types for accumulators

- Diaphragm accumulators can be installed as desired.
- Bladder accumulators are preferably installed vertically with an oil connection underneath.
- Piston type accumulators are almost always installed vertically.

4.3 Electrical connection

⚠ DANGER

Risk of fatal injury from electric shock

Touching live components directly or indirectly causes injury or death.

- Only trained specialist personnel are permitted to replace or connect electronic components.
- Obey all applicable electrical safety rules.
- Only connect electric lines to the hydraulic system while the system is de-energized.

⚠ WARNING

Electrical and magnetic fields

Electrical and magnetic fields impair the functionality of cardiac pacemakers and implanted defibrillators.

- People with pacemakers or implanted defibrillators must maintain a sufficient distance from magnets.
- Advise people with pacemakers or implanted defibrillators against approaching magnets.
- Cordon off the area around the drive system and affix suitable warning signs to the barriers.

DAMAGE

Hazard for electronic components – property damage

- To prevent electrostatic discharge, do not touch electronic components and contacts.
- After switching off the electrical power supply, wait at least 15 minutes for the energy stored in the capacitors to dissipate.
- Do not expose components to moisture and an aggressive environment.
- Always keep any ventilation outlets unobstructed to prevent overheating.

- Use only approved connecting lines with an adequate cross section.
- De-energize the product before carrying out any work.

5 Start-up

5.1 First test run

⚠ DANGER

Danger to life from pressurized systems

When lines and components on pressurized systems are disconnected, hydraulic fluid escapes at high pressure and penetrates deep into the body via the skin and eyes. Severe injury or death.

- Depressurize the hydraulic system including the pressure tank.
- Secure the hydraulic system against unintentional restart.
- Check components for correct assembly before pressure is applied.
- Observe maximum pressure load for fittings and lines.

1. Set any pressure-reducing and pressure-limiting valves to their minimum values. Sealed TÜV pressure-limiting valves are exempt.
2. Set any pressure controllers of variable pumps to their minimum setting.
3. Open any shut-off valves and throttle valves as wide as possible.
4. Fill the pump housing with hydraulic fluid.
5. Briefly switch on the drive motor and test whether the motor's rotation direction matches the pump's rotation direction (which may have been stipulated).
6. Check the position of any directional valves and, if necessary, move them into the desired position (check this using the hydraulic schematic).
7. Briefly start the hydraulic power pack and listen for any unusual noises.
8. Vent the system:
   a) Carefully undo the fittings/vent screws at the top but do not unscrew them entirely.
   b) Once the hydraulic fluid escapes without any bubbles, tighten the fittings again.
9. Switch the pump motor on and off several times.
10. Flush the system:
    a) Perform all the functions of the system several times without any load until they run smoothly and in the pre-defined time.
11. Once the operating temperature of the hydraulic fluid has been reached (min. 40 °C), test the system under load. Slowly increase the pressure to the target value (check this using a pressure gauge).
12. Monitor the housing temperature of the pumps and motors (max. 80 °C).
13. Monitor the hydraulic fluid; top off hydraulic fluid if necessary.
14. Check the setting of the pressure-limiting and safety valves by applying a load or suddenly braking the system.
15. Check for external leakages.
16. Switch off the drive.
17. Check the fittings of add-on valves and re-tighten to the specified tightening torque.

Check the following before carrying out subsequent steps:

- Are the pipelines still securely fastened?
- Are hoses chafing against other components?

5.2 Functional tests on the complete systems

☑ Pipelines have been securely fastened.

☑ Hoses cannot chafe against other components.

1. Compare the measured values obtained from the first test run against the permitted maximum values.
2. Compare the adjustment and rotation speeds achieved against the targets.
   ✓ Re-adjust the control units if required.
3. Repeat the venting process in the following cases:
   ► Jerky movements occur or adjustment speeds are not reached.
   ► Foam forms on the surface of the hydraulic fluid.
4. Check the operating temperature at regular intervals.

5.3 Commissioning complex systems

When commissioning complex systems, it is often necessary to take multiple measurements (e.g. multiple pressures, electrical signals, routes, speeds, flow rates etc.) at different measuring points simultaneously. This ensures the consumers interact with one another in a targeted way.

These measurements cannot be taken using conventional measurement devices (such as pressure gauges, thermometers, electrical multimeters etc.). In such cases, please contact the Service department of the system manufacturer.

6 Operation

6.1 Switching the hydraulic system on/off

The hydraulic system is switched on and off via the system controller. Initial start-up of the system must have been performed properly.

It will no longer be possible to operate the system safely if any of the following apply:

- The product exhibits visible damage.
- The product is not working, or is not working correctly.
- The product has been stored for a long time and/or in sub-optimal conditions.
- The product was subjected to heavy loads while being transported.

DAMAGE

If it is no longer possible to operate the system safely, decommission the product and secure it against being switched back on accidentally.

7 Maintenance

Maintenance measures consist of inspection, service and repair. Maintenance measures are described here.

- Maintenance work must only be carried out by qualified personnel.
- Tasks not described in this chapter may only be carried out by HAWE Service.
- If faults or damage occur, switch off the hydraulic system immediately.
- Observe the information in the supplier documentation.
- Document all activities in a maintenance log.

⚠ WARNING

Danger of accident and fatal injury due to lack of maintenance or careless maintenance

Omitted or negligently performed maintenance can cause the hydraulic system to malfunction. Improperly performed maintenance or improperly conducted troubleshooting can pose a danger to personnel.

- Read and abide by all instructions provided in this section.

Observe the following safety instructions additionally to the safety instructions in chapter For your safety.

⚠ DANGER

Danger to life from pressurized systems

When lines and components on pressurized systems are disconnected, hydraulic fluid escapes at high pressure and penetrates deep into the body via the skin and eyes. Severe injury or death.

- Depressurize the hydraulic system including the pressure tank.
- Secure the hydraulic system against unintentional restart.
- Check components for correct assembly before pressure is applied.
- Observe maximum pressure load for fittings and lines.

⚠ CAUTION

Burn hazard from hot surfaces and hydraulic fluid

A burn hazard results from directly or indirectly coming into contact with hot hydraulic fluid and hot components of the hydraulic system.

- Wear work gloves.
- Arrange the access to the hydraulic system in such a way that hot surfaces are not accessible to the user.
- Wait until the hydraulic system has cooled down before servicing or disassembling it.

⚠ CAUTION

Risk of falling from leaking hydraulic fluid

Spilled or leaked hydraulic fluid can form a slippery film on the floor.

- Use suitable aids when filling or bleeding.
- Check all connecting elements that convey oil for leaks before switching on the motor in the parent system.
- Wipe up leaked hydraulic fluid with suitable aids.

7.1 Maintenance plan

Failure of hydraulic systems

Failures of hydraulic systems can be caused by a wrong choice of hydraulic fluid or a high level of solids contamination in the hydraulic fluid due to poor service.

- Select hydraulic fluid according to specifications.
- Perform all activities described in this section carefully and according to schedule.

Unless specified otherwise, hydraulic components such as valves require no maintenance. Check hoses, pipes/tubes and hydraulic accumulators at least once a year.

	Inspection and maintenance intervals				
	In the start phase		During series operation		
	After 10 hours	After 100 hours	Every 500 hours	Every 1000 hours	Every 2000 hours
Fluid level of hydraulic fluid (if there is no sensor/switch)	√	√	√		
Operating temperature of hydraulic fluid (if there is no sensor/switch)	√	√	√		
Check/replace the hydraulic fluid. (It only makes sense to take an oil sample for relatively large oil volumes as from ≈ 50 l)		(√)		√ if < 20 l	√
Replace the filter without a contamination indicator.				√	
Check the visual filter contamination indicator.		√	√		
Clean/replace the breather filter.				√*	√
Check the silica gel filter (air drying filter).			√		
Check that the accumulator has a gas pre-load pressure of p0; check the attachment fixtures. (also see Chapter 4.2, "Hydraulic connection")	√			√ (min. 1x a year)	
Check for damage on the hose lines (observe the max. period of use).		√		√ (min. 1x a year)	
Check for any other damage.		√		√	
Check for external leakages.	√	√	√		
Check for contamination.				√	
Listen for any noises.	√	√	√		
Check the measurement devices.					√
Clean the oil/air cooler.				√*	√

* in the case of dusty environments

Hydraulic fluid

The intervals for the hydraulic fluid and filters depend on the system's operating time and operating temperature.

Overview of theoretical operating hours under specified product-specific operating conditions:

Operating temperature in °C		Theoretically achievable operating hours
Mineral oils	Synthetic oils	
50	60	40000
60	75	20000
70	90	10000
80	105	5000
90	120	2500
100	135	1250
110	150	625

A distinction must be made between mobile and stationary systems:

General recommended temperature			Theoretically achievable operating hours	
			Mineral oils	Synthetic oils
Stationary hydraulics	< 400 bar	40 - 60 °C	20000 - 40000	40000
	> 400 bar	50 - 70 °C	10000 - 40000	20000 - 40000
Mobile hydraulics	general	max. 90 °C	2500	10000
	HAWE	max. 80 °C	5000	10000 - 20000

7.2 Inspection

Visual check:

- ► Hydraulic fluid level
- ► Cleanliness/condition of the hydraulic fluid

Indicators that the hydraulic fluid is in poor condition:

- Milky cloudiness
- Darker appearance than when it was filled
- Sediment in the fluid reservoir
- A smell of burnt oil

- ► Contamination indicators of filters or differential pressure switches during operation
- ► Temperature of the hydraulic fluid during operation (usually < 60 °C, max. 80 °C)
- ► Pressures and adjustment speeds
- ► External leakages
- ► Loose attachment fixtures in the pipeline system
- ► Chafing points on hose lines
- ► Hydraulic accumulators
- ► Electrical supply lines of the motor, solenoid valves, sensors, pressure switches etc.

7.3 Service

Hydraulic fluid

- ► The operating time of the hydraulic fluid depends on the operating conditions, in particular the operating temperature (max. +80 °C).
- ► Do not mix hydraulic fluids. Doing so will result in the formation of sludge, resinification, etc.
- ► Replace the hydraulic fluid after consulting with the manufacturer and flush the system.

- Heavily aged or contaminated hydraulic fluid will not be improved by adding new hydraulic fluid.
- Fill the hydraulic fluid using the system filter or a filter that has the same deposition rate as the system filter
- Take samples of the hydraulic fluid regularly and have them tested to determine the particle type, size and quantity. Record the values.

Pressure valves

- Check the settings for the system pressure and pilot pressure.
- Record any pressure corrections.
- If the pressure valve needs to be re-adjusted again to achieve the planned pressure:
  - Note about wear on the pressure valve: check the pressure valve. Replace the pressure valve if necessary.
  - Check for any external leakages in the hydraulic system.

  If there are leakages at connection points that have been sealed with soft seals (e.g. O-rings), these leakages usually cannot be rectified by re-tightening the connection points. The sealing elements will have been destroyed or hardened and will need to be replaced with new sealing elements.
- Check that control and monitoring elements (pressure gauges, pressure switches, etc.) are working.

7.4 Repair

☑ Aids: measurement devices such as a thermometer, multimeter, industrial stethoscope, stopwatch, tachometer etc.

☑ The hydraulic system has been switched off and secured against being switched back on accidentally.

☑ The system has been de-pressurised.

☑ The working environment is clean.

- Only replace complete components or components that can be checked individually.
  - ✓ Minimises downtime
  - ✓ Simplifies troubleshooting
  - ✓ Only a small amount of hydraulic fluid is lost
- Clarify whether consequential damage could occur as a result of greater metal abrasion or fragments in the hydraulic circuit.
- Clarify whether the failure had a primary cause, e.g. poor filter fineness or unsuitable maintenance intervals. Remedy the primary cause.

8 Disassembly and disposal

Observe the following safety instructions additionally to the safety instructions in chapter For your safety.

⚠ DANGER

Danger to life due to damaged hydraulic accumulator

Due to incorrect use or damaged pressure accumulators, hydraulic fluid or gas escapes under high pressure and penetrates far into the body through the skin and eye. Serious injury and death.

- Work on the pressure accumulator only by trained specialist personnel.
- Only fill the pressure accumulator with approved medium.
- Use suitable test and filling equipment.
- Never weld, solder or drill hydraulic accumulators.
- Protect hydraulic accumulators from mechanical damage, e.g. by padding.
- Do not use hydraulic accumulators and attachments as suspension devices.
- After unloading / complete draining, depressurize all liquid-side lines connected to the pressure accumulator and do not close them again.

⚠ CAUTION

Burn hazard from hot surfaces and hydraulic fluid

A burn hazard results from directly or indirectly coming into contact with hot hydraulic fluid and hot components of the hydraulic system.

- Wear work gloves.
- Arrange the access to the hydraulic system in such a way that hot surfaces are not accessible to the user.
- Wait until the hydraulic system has cooled down before servicing or disassembling it.

DAMAGE

- Do not release hydraulic fluid into the environment.
- Collect cleaning, operating and lubrication fluids and consumable materials in suitable containers and dispose of them according to local regulations.

Disassembly

1. Shut down the hydraulic system in the machine controls.
2. Secure it against unintentional restarting.
   ✓ System shut down securely.
3. Drain hydraulic fluid.
   ✓ The hydraulic system has been depressurized and can be disassembled.
4. Disconnect electrical cables.
5. Disconnect hydraulic lines.
6. Disassemble electrical and hydraulic components.
7. Properly dispose of all disassembled parts.

Disposal

Dispose of hydraulic fluid and system components as follows:

- ► Dispose of hydraulic fluid, packaging/containers, soaked cleaning cloth, etc., as stipulated in the specifications for hydraulic fluid according to the regional waste disposal requirements.
- ► Dispose of the electronic components at approved collection points or with approved disposal companies according to local regulations.
- ► Dispose of metal with approved specialist disposal companies.

Recommendations

Disposal of hydraulic power packs by type of refuse:

- Mixed scrap: valve bank, valve control, manifold
- Electronic waste: switch box, pump housing with motor, heating element
- Scrap iron: metal frame, accumulator (unpressurised), gear pump

If the components cannot be disposed of by separate refuse type, dispose of the entire hydraulic power pack as mixed scrap. The hydraulic fluid must be drained beforehand and disposed of separately as used oil.

9 Troubleshooting

The following table lists possible faults and measures to eliminate these. Contact the manufacturer in case of faults that cannot be remedied by following the descriptions here.

9.1 Faults during commissioning

Possible fault causes:

- Insufficient level of cleanliness during assembly
- Valves are under tension or were fitted with the incorrect tightening torque
- The hydraulic fluid was not filtered. The cleanliness level was not complied with.
- The hydraulic system was not checked before commissioning.
- Hydraulic fluid leaked during subsequent conversion work.
- System parts were not vented or were insufficiently vented.
- Pressure-limiting and safety valves were set too closely above the operating pressure (closing hysteresis was not observed).
- The specified flow direction was not complied with.
- Unusual mechanical noises (e.g. from the pump) were ignored.

Fault	Possible cause	Check	Remedy
Mechanical noises occur	cavitation	Check the hydraulic fluid level.	Vent the system. Top off hydraulic fluid.
	leaking suction line	visual check	Replace the suction line.
	Pump and motor incorrectly aligned.	Check the alignment of the pump and motor.	Correctly align the pump and motor.
	The switching hysteresis of mechanical pressure switches that is dictated by the design was not considered when adjusting the settings.	Check the setting.	Set the correct setting.
	The pump housing and motor housing were not filled with hydraulic fluid.	visual check	Top off hydraulic fluid.
	Technical settings were not documented. The correct specified values are missing.	Check the settings.	Add the specified values and set the correct setting.
	Adjusting spindles were not secured/ locked or sealed.	visual check	Secure them.

References

Additional versions

- Oil recommendations: D 5488/1

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