HYDRAULIC POWER PACKS
(De)mounting instruction
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1.0 Introduction

Thank you for choosing a hydraulic generator (hereafter also referred to as: power pack or product) manufactured by Kramp Groep B.V.. This manual provides a description of the power pack types MPP, PP and UNTH. This manual contains important information for a good and safe operation of the products.

An employer is obliged to train and certify his employees for operating machines (Working Conditions Decree Chapter 7).

Carefully read this manual before installing and/or putting into operation the hydraulic power pack. Keep this manual for future reference to the instructions and safety conditions at all times.

A hydraulic diagram should also be delivered with the hydraulic power pack.

In case of questions or remarks, please contact your supplier.

1.1 Intentional use of the hydraulic power pack

The hydraulic power pack shall be used for generating hydraulic energy (pressure and flow). This hydraulic energy is transported to one or more actuators (motors, cylinders, etc.) by means of hoses and/or pipes to be connected to the power pack. The actuators can be operated by one or more control valves.

1.2 Installation and/or operation requirements

The hydraulic power pack shall only be used by trained persons familiar with the information in this manual and with sufficient knowledge to work on hydraulic and electric switches and systems.

1.3 Emission data

When purchasing the hydraulic power pack, it may contain residual hydraulic oil in the tank and/or components. This is residual oil of the functional final test.

1.4 Supplier data

Kramp Groep B.V.
Breukelaarweg 33
7050 DW Varsseveld
Tel.: 0031 (0)315 254 370
Fax: 0031 (0)315 257 399
Website: www.kramp.com

1.5 Guarantee and delivery conditions

Excerpt from the general delivery and assembly conditions applying to all offers, receipts and all agreements of Kramp Groep B.V.. These have been filed with the court registry of the district court in Arnhem on 07 February 2007 with number 2007/8

Guarantee and liability

Article XI, Guarantee

1. With respect to products we deliver, our guarantee shall not exceed the guarantee given to us by our supplier of those products.

2. We shall repair defects that were already present at the time of delivery, but that show within a period of three months afterwards, by means of replacement or in any other way at our discretion.

3. The obligation mentioned in section 2 only applies to those defects that were in all reasonableness not observable at delivery and that show under normal operation conditions and with correct use of the product delivered. It does neither cover defects resulting from or related to poor maintenance or from repairs carried out by or on behalf of the client nor defects resulting from usual wear.

4. The opposing party can only refer to the rights in this article if he:
   - it immediately reports to us the observed defects in writing,
   - it makes a reasonable cause for the defects being attributed to the weaker condition of the delivered products or, if and to the extent that we are responsible for the design of the product, resulting directly from a culpable fault on our side,
   - it cooperates with us in order to enable us to remedy the defects within a reasonable term.

5. Except when due to the nature of the defect repair is to be carried out at the installation location, the other party shall send us every part of the product showing any defect as mentioned here for repair or replacement. In this case we shall be considered to have met our guarantee obligation as soon as we have made available the repaired part or a replacement part.

6. The defective parts that we have replaced under these guarantee conditions are our property.

7. The alleged non-conformity with our guarantee obligation shall not exempt the other party from the obligation pursuant to this or any other agreement entered into with us.
Article XII, Liability

1. Except with respect to conformity with our guarantee obligation in accordance with the stipulations of the previous article and subject to stipulations of imperative law, any liability on our side (including liability pursuant to wrongful act) is excluded, apart from intention or gross fault on our side and subject to the liability explicitly accepted by us. In all cases, irrespective of whether direct damage, bodily injury or delay damage or damage with whatever designation is involved, our damage shall not exceed the compensation of the amount the other party is due to us pursuant to the agreement with the other party concerned.

2. We shall not accept any liability for intention and/or gross fault of non-executive subordinates.

3. We shall never accept any liability with respect to verbally provided advice, information, recommendations, etc.

4. All our subordinates can on equal terms with us appeal to the stipulations of this article towards the client and, if necessary, towards third parties.

5. The other party shall be responsible for providing the legally prescribed safety devices and for the consequences of any absent safeties, as well as for complying with all applicable legal regulations with respect to the products.

Note:
A copy of our complete General Delivery and Assembly Conditions will be provided upon request and free of charge.
Damage or costs related to the product as a result of non-compliance with the regulations stated in this manual (including but not limited to: safety measures and operating instructions) are not covered by the warranty.

In case components are replaced by spare parts which were not supplied by Kramp Groep B.V., or which did not obtain our explicit consent, then any liability of Kramp Groep B.V. for the supplied product expires. With the manual supplied with the product, no claim in any form can be made under warranty in case of malfunctioning of the hydraulic system or any (consequential) damage whatsoever.

For optimal use with a minimum number of operational stops, it is important that the hydraulic system is designed and produced according to the requirements of the installation and/or end user, and that it is used according to its design and that periodical maintenance is performed by competent personnel.

2.0 Description of the device

2.1 Application
The hydraulic power pack shall be used for generating hydraulic energy (pressure and flow). This hydraulic energy is transported to one or more actuators (motors, cylinders, etc.) by means of hoses and/or pipes to be connected to the power pack. The actuators can be operated by one or more control valves. The installed power may vary dependent on the delivered hydraulic power pack.

2.2 Improper use
- Non-observance of the instructions, warnings and/or safety measures as mentioned in this user manual may result in injury!
- The power pack should be used according to its intended use.
- Modifications of the hydraulic power packs or application of the hydraulic power packs for purposes other than mentioned above is strictly forbidden. This prohibition applies to all modifications of or with respect to components other than originally delivered by Kramp Groep B.V.
- Do not overload the power pack in any way, provide overload protection.
- Do not operate the power pack when parts have been damaged or are missing.
- Immediately stop the power pack in case of broken hoses or pipes.
- Immediately stop the power pack in case of defective cylinders.
- Do not carry out any repair or maintenance activities on a running power pack. Shut off the power or fuel supply.
- Do not insert any objects in rotating parts such as fans of coolers and/or electromotors.

2.3 Accessories
Drip trays and/or transport wheels are NOT a part of the default scope of delivery.

2.4 Safety function
In order to prevent the hydraulic power pack from exceeding the maximum pressure, the hydraulic power pack has been provided with a hydraulic safety device. This has been set to the required operation pressure in the factory and may NEVER be adjusted. The safety device has been sealed for this. If the seal is broken, the guarantee concerning the power pack will become null and void.
3. Safety regulations

Carefully read the safety regulations given below before installing and/or putting the hydraulic power pack into operation. Meticulously observe the regulations during use. KEEP THESE SAFETY REGULATIONS for future reference.

3.1 General safety regulations

• The power pack you purchased is exclusively meant for delivering hydraulic energy specifically to the application for which the hydraulic power pack is designed and built. Using the power pack for other than the intended purposes is explicitly not permitted!
• If any use is made of lifting or hoisting devices during the installation of the hydraulic power pack, the operators must also be familiar with the operation and functioning of the used lifting/hoisting device (see the instructions of the lifting/hoisting device).
• Commissioning of the hydraulic power pack shall exclusively be done by trained persons and in conformity with the described regulations (see chapters 4 and 5).
• Operation of the hydraulic power pack shall exclusively be done by trained persons within the functional limits.
• Operators of the hydraulic power pack must be familiar with the operation at all times.
• Maintenance and repair of the hydraulic power pack is to be performed exclusively by Kramp Groep B.V. or companies designated for that purpose by Kramp Groep B.V.!
• Incompetent repairs may lead to serious danger for the user!
• An power pack is a power source. Parts may become hot by intensive use, incorrect connections or overload. Always avoid touching any hot parts.
• Always wear eye protection while working with or on the power pack.
• If the power pack produces more than 85 dB (indicated on the power pack), wearing ear protection is mandatory.
• Read the manual for use of the power pack at all times.

3.2 Safety regulations for transport

• Lifting the power pack is exclusively allowed using the lifting eyes provided.
• LIFTING OF THE POWER PACK IS EXCLUSIVELY ALLOWED WITH EMPTY TANK! Remove the lifting eyes before filling the tank and replace them by the 4 bolts supplied along.
• Transport of the power pack is exclusively allowed on the pallet including tie rods and draw bolts delivered by Kramp Groep B.V.
• Make sure that no persons can be on, beside or below the power pack while transporting and/or hoisting the power pack in view of possible tilting or falling of the power pack.
• Take the given weight of the power pack into consideration in connection with the maximum weight to be lifted manually of 25 kg.

3.3 Safety regulations for commissioning

• Make sure that the power pack is placed on a safe, level, stable and solid surface.
• Make yourself familiar with the hydraulic and/or electrical circuit diagram. Always avoid incorrect connections of pipes and wires. This may result in situations dangerous to life!
• Adequately protect the entire electrical circuit against moist: 230 VAC can be fatal!
• Provide an adequately protected switch box the power supply of which is automatically shut off when opening the box.
• Apply the correct instructions and labels to the switch box.
• Only qualified and skilful employees shall work with electricity!!
• Provide a good and, if required, an inspected earth connection.
• Any voltage circuits used shall have been correctly designed and all safety aspects must have been observed.
• The low voltage must be stable, deviations shall be maximum +/-10% with on-off magnets and maximum +/-5% with proportional magnets (measured at the coils).
• In case of a large low-voltage circuit, make sure that sufficient power can be delivered. Here take the already installed peripheral equipment, such as coolers, parameter monitoring/security, lighting, etc., into consideration.
• Always avoid unexpected/improper starting of the power pack.
• Always avoid leakage or spilling of oil in view of a risk of slipping.
• In case of release of oil for whatever reason, always avoid penetration through the skin or taking in through the mouth.
• Always avoid contact with fluids under high pressure. Fluids under high pressure will easily penetrate clothes or skin, causing serious injuries.
3.4 Safety regulations for operation
- Always avoid unexpected/improper starting of the power pack.
- Always avoid contact with fluids under high pressure. Fluids under high pressure will easily penetrate clothes or skin, causing serious injuries.
- Always avoid contact with live parts.
- The power pack may be an electrical device. In order to prevent the risk of shock, injury and fire, ALWAYS comply with the safety regulations.
- NEVER use the power pack in a moist or wet workplace.
- NEVER use the power pack in the rain.
- Always avoid leakage or spilling of oil in view of a risk of slipping.

3.5 Safety regulations for maintenance and repair
- Always avoid unexpected/improper starting of the power pack.
- Always avoid contact with fluids under high pressure. Fluids under high pressure will easily penetrate clothes or skin, causing serious injuries.
- Always avoid contact with live parts.
- Make sure that the pressure has been released from accumulators during repair. Install pressure relief valves.
- Accumulators are pressure vessels. Take the risk of explosion into account. See section 5.2.10
- Always avoid leakage or spilling of oil in view of a risk of slipping.
- Cylinders can remain under pressure because of balancing valves or controlled non-return valves. Make sure that the cylinder is mechanically free.
- Provide a clean working environment, free from oil or obstacles.
- Ensure adequate protection around moving or rotating parts. Pay attention to the risk of crushing.
- Replace rubber and plastic hoses by equivalent hoses after six years. Hoses in stock may be used in non-mounted condition up to four years after the production date and in mounted condition only two years.
- Exclusively use original or equivalent parts (also see section 5.2.10).
- Always use solid and proper tooling.
- Observe the safety measures as drawn up by the labour inspectorate or other authorities.
- Non-compliance with the above-mentioned regulations and measures will be regarded as gross negligence. Kramp Groep B.V. shall not be held liable for any damage if you do not comply with the above-mentioned safety regulations and measures.

3.6 Safety icons
Make sure that the safety icons on the power pack are always complete and legible. Replace damaged and illegible safety symbols.

Icons
Location: applied at various places on the power pack

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>General symbol of danger. Caution!</td>
</tr>
<tr>
<td>⚠</td>
<td>Hazardous substances</td>
</tr>
<tr>
<td>⚡</td>
<td>Risk of electric shock</td>
</tr>
<tr>
<td>⚡⚡</td>
<td>Danger of rotating and moving parts</td>
</tr>
<tr>
<td>⚠️</td>
<td>Risk of slipping</td>
</tr>
<tr>
<td>⚠️℃</td>
<td>Danger of high temperatures</td>
</tr>
<tr>
<td>♂♀</td>
<td>Risk of crushing the body from one side</td>
</tr>
<tr>
<td>🧑‍🦰</td>
<td>Wear hearing protection</td>
</tr>
<tr>
<td>🧑‍🦰</td>
<td>Wear eye protection</td>
</tr>
<tr>
<td>🏙️</td>
<td>Falling loads</td>
</tr>
<tr>
<td>🏙️</td>
<td>Wear eye protection</td>
</tr>
<tr>
<td>📚</td>
<td>Accumulator: risk of explosion</td>
</tr>
<tr>
<td>📚</td>
<td>Read the manual</td>
</tr>
</tbody>
</table>
3.7 Protective equipment
Wearing the following personal protective equipment is mandatory:
• Face mask or safety goggles,
• Hearing protection: sound level > 85 dB(A),
• Safety shoes.

4.0 Preparation and installation

4.1 Development and research
You may ask yourself in advance, before the power pack including components and peripheral equipment are installed:
Where and how should the components be installed?
This depends on the following factors:
• Installation of the power pack and the components requiring intensive maintenance should be done in such a location that subsequent inspection and maintenance can reasonably be performed. After all, no system is free of maintenance or inspection.
• External temperature influences. Obviously, high ambient temperatures significantly reduce heat emission to the environment. However, low temperatures also require extra attention. The ideal temperature is between 38 and 50°C, with 60 to 68°C as a maximum. At higher temperatures, the life span of the oil and the components decreases sharply.
• Sound transmission/noise pollution. The following aspects require attention: units, motors and possibly cylinders should be fitted with damping rubbers. In addition, tubes and pipes should be fitted with the appropriate pipe brackets and, if necessary, accumulators should be installed to absorb pressure waves.
Good consultation in advance and knowledge of the expectations of the end user or machine operator concerning a new machine, saves a lot of trouble, distress and money afterwards.

4.2 Installation and assembly
Always follow the instructions of the manufacturer or supplier when assembling the components, couplings, tubes and pipes. During installation and assembly, keep the following three rules regarding cleanliness in mind:
1. Tubes, couplings and pipes are never clean on the inside once they have been treated and should always be cleaned before installation by rinsing, blowing through using lint-free paper or cotton that is soaked in oil or paraffin or using special equipment. The cleaning process should be repeated until all elements are completely free of impurities. To remove slag and loose material, hot-bent or welded pipes must be treated with hydrochloric acid, rinsed with copious amounts of water at high speed, followed by hot water to dry out the pipes and finally with oil or paraffin to protect against corrosion. Prefabricated tubes, couplings and pipes that are awaiting assembly must be plugged and protected against corrosion, moisture and dust. The same applies to the bright elements and components of the unit.
2. Keep the workplace clean during installation and assembly; otherwise, the system to be started up will be contaminated. Moreover, a clean workplace is safer and more pleasant to work in. Use the proper tools and ensure that they are clean.
3. Oil used for the assembly of components must be clean. Oil straight from a drum is not clean enough and may even contain water as a result of condensation during storage!
As is the case with every hydraulic system, rigorous attention to cleanliness and proper oil filtration is the key to successful functioning and a long life span. Failure to follow the above-mentioned rules will result in pump, valve and component malfunctioning and may cause serious damage and eventually lead to system failure.

4.3 Dimensioning of tubes and pipes
Selecting tubes and pipes with the correct diameter minimises system pressure drops. The greater the resistance, the greater the operational loss. It is essential to avoid factors that cause pressure drop, e.g. square screw couplings. The use of ‘smooth bends’ where necessary is recommended. If the pipes are very long or the oil speed is high, it is sensible to select pipes with a larger diameter. Please note: pipe diameter indications refer to the external diameter!
Use a flow chart when determining the correct dimensions. Solid-drawn precision steel pipes in accordance with DIN 2445/2-1974 must be used for pipework. Depending on the operating pressure, tubes with double steel braid reinforcement in accordance with DIN 20022/EN853, tubes with quadruple steel braid reinforcement in accordance with DIN 20023/EN856 or plastic tubes in accordance with SAE standards can be used. Always ensure that both tubes and pipes are assembled in a tension-free manner and avoid mechanical damage as a result of crossing pipes and tubes or incorrectly mounted fixing brackets. Do not spray dye or paint on tubes and keep them away from external chemical influences and heat sources.

4.4 Installation and assembly personnel
Installation and assembly must be carried out by expert personnel with professional training. They should be aware that they bear great responsibility, particularly with respect to safety. Incorrectly mounted cutting rings, tubes, etc., may result in life threatening situations.
The machine engineer should be aware of the fact that a CE statement must be supplied with the machine in which he declares himself fully liable for it and indicates how it should be used.
4.5 Filling the hydraulic system
A successful start-up phase and trial run is essential for a reliable and problem-free hydraulic system. Components, and particularly pumps, all too often fail prematurely, sometimes after a few days or even after a few minutes, because the most basic requirements are not met. Insufficient attention to cleanliness during installation, assembly and start-up is a common cause of malfunctions. Even the utmost care cannot preclude contamination in a new system. Moreover, the moving parts of the machine will release particles during the start-up phase. For this reason, it is essential to allow the system to filter out all the particles before running to the full.

4.5.1 Reservoir
Check the reservoir for impurities before filling it. Fill the reservoir to the maximum level with clean oil of the right kind, using a good filling device. The filling device must be fitted with a filter of at least 10 micron absolute. The suction pipe of the filling device may not reach down to the bottom of the drum, so that any water or large impurities present remain behind in the drum. If it is impossible to use a good filling device, use clean pitchers or funnels to fill the tank through the return filter.

4.5.2 Suction filters
If spin-on filters are mounted, these should be completely filled. Remove all air before replacing the element. Subsequently de-aerate the filter housing. Check for any leakage and determine whether the filter has been assembled correctly.

4.5.3 Gear pumps
Gear pumps generally do not require additional inspection. However, de-aerate the suction pipe if the pump is located outside the tank or fill it with oil if the pump is located above the oil level. Always check each connection for leakage and restrictions (closing devices).

4.5.4 Plunger pumps and vane-cell pumps
De-aerate the suction pipe of the pump at the highest point. Check the suction pipe for leakage and restrictions (closing devices and closed suction filters). Fill the pump housing with clean, filtered oil at the highest connection for leak-off oil.

4.5.5 Cylinders
Cylinders, particularly large cylinders, can be filled with oil in advance. The main advantage are that the oil level in the tank does not drop too much when the system is put into operation and the amount of air entering the system is minimised.

4.5.6 Gearboxes
Gearboxes, planetary boxes, wheel axles, etc., are always supplied without oil and should be filled with the oil type specified by the manufacturer and in accordance with instructions. Also pay attention to temperature stress in connection with the possible use of cooling systems.

4.6 Deploying the open-circuit system
4.6.1 Electrical
A number of conditions must be met for both stationary and mobile applications:
• When using electrical circuits, these must be designed correctly and meet all applicable safety requirements.
• Low voltage current must be stable; any deviations may not exceed +/-10% for on off magnets and +/-5% for proportional magnets.
• Ensure that sufficient power can be supplied if the low-voltage circuit is large in size. Take into account any peripheral equipment that has already been installed, such as cooling devices, parameter monitoring or security devices, lighting, etc.
• Ensure that the electrical circuit as a whole is sufficiently protected against moisture: 230 volts of alternating current can be lethal!
• Ensure that the ground connection used is of good quality and certified if necessary.
• Ensure that the switch cupboard is properly protected and power is switched off automatically when the cupboard is opened.
• Ensure that the appropriate instructions and stickers are present on the cupboard.
• Ensure that only qualified and expert personnel work with electricity!

4.6.2 Hydraulic
Check whether the pipework, flanged connections and screw couplings have been assembled properly before putting the system into operation. Pipes that come loose can cause substantial damage to the system as well as physical injury. Ensure that the circuit is depressurised when deploying the system. This can be done for gear pumps and adjustable pumps by making a free connection from P to T in the valve block or for constant pressure pumps by using a by-pass valve between P and T. For closed pump-motor combinations with adjustable stroke plates, the yield must be completely neutral.

4.6.3 Direction of rotation of the pump
First check whether the direction of rotation of the pump is correct. The direction of rotation is indicated on the pump and the electromotor:
The direction of rotation of the pump is determined from the side of the axle. This can be checked as follows:

- For a combustion motor, turn on the motor for a short period of time, during which it is prevented from starting.
- For an electromotor, turn on and immediately turn off the motor.

4.6.4 First start-up phase

During the first start-up phase, the pump must run completely depressurized in order to pump out all the air remaining in the suction pipe, filters and control circuits, if present. For mobile systems driven by a combustion motor, this should be done at as low a rotational speed as possible. During the start-up phase, check whether the pump is actually producing oil as an air lock may form in the suction filter or suction pipe.

In addition, check for dead air in the pump as a result of couplings that have not been sufficiently tightened or leakage via the suction filter. In general, dead air can be recognised by a 'sputtering' sound and excessive foaming in the tank. Monitor the level of oil in the reservoir during the start-up phase. Allow the system to circulate the oil without pressure for at least 15 minutes, enabling it to reach the required temperature. Check the system for leakage. Once the system has reached the required temperature, the underpressure (as measured directly at the pump) may not be lower than 0.3 bar for gear pumps or lower than the difference between housing pressure and suction pressure for adjustable pumps. For higher pressures, use a larger suction pipe or decrease the pre-pressure on the tank. The pressure may not exceed the indicated maximum housing pressure of the pump or any components. Excessive housing pressure will damage the pump or result in malfunctioning.

4.6.5 Adjusting the safety valve

The safety valve has been adjusted at the maximum operating pressure required ex-works. The safety valve has been sealed. When breaking the seal, the guarantee on the power pack will expire.

4.6.6 Adjusting the feedback pressure of the adjustable pump

If the pump is fitted with a pressure regulator, this determines the maximum system pressure. A separate shock safety valve has been installed for optimum safety. The shock safety valve must be set at a value that is approx. 25 bar higher than that of the pressure regulator. If the feedback pressure has not been set, proceed as follows:

- Drive in the adjusting screw of the pressure regulator until the maximum value has been reached.
- Then loosen the adjusting screw of the shock safety valve completely (lowest possible value) and set one of the control valves, for instance the pre-selector valve for a closed gate or a cylinder function, to such a position that the system pressure can reach the required level.
- Then gently drive in the adjusting screw of the shock safety valve until the required value has been reached, which is approx. 25 bar higher than the required system pressure. Once this value has been set, the pressure compensator must be turned back until the required system pressure has been reached. Check whether power consumption remains below installed power. Seal the adjusting devices once the correct feedback pressure has been set.

4.6.7 First trial run

Once the pump is functioning properly and the system has been regulated, the various functions can be started up one by one. Try to start up the functions with as little load as possible. Repeat this process several times in order to de-aerate the system as much as possible. Continually check the level in the reservoir during this trial run and replenish if necessary. Let the system reach the required pressure for the various functions and check the flanged connections and screw couplings for any leakage. Let the cylinders complete a full cycle and check whether the cylinder is properly encased in the housing. Also check for jamming, alignment errors and parts that become stuck. Adjust the cylinders on the basis of buckling load diagrams that are available. Install gate safety devices if the buckling limit is exceeded at the normal system pressure. Let the motors run at full power and check if the rotational speed is correct and the motor has sufficient additional capacity for high mass moments of inertia. If necessary, install cross-over valves with feed-through flaps for braking distance and to compensate for any leak-age loss.

4.6.8 Adjusting the balancing valves

Balancing valves can be installed if cylinders or motors start to gain on the pump yield as a result of external load. Balancing valves can only be regulated in a practical situation under pressure. There are two options for regulating:

1. Maximum holding pressure approx. 25 bar lower than system pressure (pressure measured between the cylinder and the balancing valve).
2. Balancing valve pressure approx. 25 bar higher than maximum induced pressure (pressure measured between the cylinder and the balancing valve).

4.6.9 Setting the parameters

When the system is completely regulated, such devices as pressure and limit switches and temperature and level monitoring devices, if any, can be set. For regulating pressure switches, a manometer must be placed parallel to the switch. In this way, the exact setting of the pressure switch can be determined.
For limit switches, the speed of response of the valve and the stopping speed of the mechanism in question has to be taken into account because of mass inertia. The temperature monitoring device must be set to the correct maximum temperature. If the device controls a cooler, take into account the fact that after the first signal and before the temperature of the cooler has stabilised, the temperature will rise before it drops (time delay). For this reason, the monitoring device must be set at a temperature below the maximum permitted temperature.

The level control device must be adjusted in such a manner that during normal operation the oil level can fluctuate above the critical level without the device being activated.

4.7 Deploying the closed-circuit system

4.7.1 Preparatory work

Air will be forced out of the system during the start-up phase. This may result in the machine becoming temporarily uncontrollable. In that situation, an external influence such as a small load may cause it to roll away. In order to guarantee safety, hydrostatically driven vehicles must be placed on blocks, i.e. with their wheels off the ground. In the case of winches and the like, the drive mechanism must be able to run freely without causing an action such as raising of steel cables. Keep safety in mind when deploying the system and be prepared for unexpected movements. Never let a closed pump-motor combination run without oil; this will result in irreparable damage.

4.7.2 Filling and de-aerating components

The system must be filled with clean, filtered oil before it is put into operation (see chapter 5, Hydraulic oil). When assembling spin-on filters, the filter element must be completely filled to avoid the formation of any air locks during the start-up phase. The suction pipe connected to the charging pump must be de-aerated or filled as close to the pump as possible. The pump housing and the motor housing must be filled with clean, filtered oil. The highest point must be used for this. This point is generally the connection point for a leakage pipe.

4.7.3 Filling a high-pressure system with a special filling device

The best method of filling a closed pump-motor combination is by using a filling device, which fills the entire high-pressure system internally under pressure. The filling device consists of a gear pump with a yield of 5 to 6 litres per minute, a pressure limiting valve (set at 20 bar) and a 10 micron absolute fine filter. The filling device is connected to the manometer connection of the feed pump. Connect the de aeration pipes to the manometer connections of the high-pressure gate and connect the latter to the tank. Switch on the filling device and let it run until the oil flowing out of both the manometer connections of the high-pressure gates is clear and free of air bubbles. Remove the filling device and the de-aeration pipes and mount measurement nipples or manometers to these gates. Check the oil level in the reservoir and replenish with clean and filtered oil if necessary.

4.7.4 First start-up phase of a closed pump-motor combination

During the first start-up phase, a closed pump-motor combination must run at as low a load as possible in order to pump out the air in the filters, pipes, pump housing and motor housing.

If no filling device has been used, proceed as follows:

Phase 1:
The adjustable plunger pump must be in the neutral position. Switch on the drive mechanism at the lowest possible rotational speed for 10 to 15 seconds. Switch off the drive mechanism for 2 to 3 minutes in order to stabilise the oil flow, enabling any residual air to escape. Repeat this procedure at least 5 times. Continually check the oil level in the reservoir and also pay attention to any leakage. During this procedure, the feeding pressure must reach the set value, generally approx. 20 to 30 bar. If the feeding pressure does not reach this value, the start-up process must be stopped immediately. Check again to ensure that the suction connection has been properly de aerated, there are no air locks and the suction pipe is sufficiently free. Once these matters have been checked, the above-mentioned procedure should be repeated until the feeding pressure reaches the required level.

Phase 2:
Increase the rotational speed of the drive mechanism somewhat and very slowly adjust the pump to one-fourth of the total stroke volume and leave the pump in this position for at least 30 seconds. Adjust the pump back to the neutral position and then very slowly adjust it in the other direction to one-fourth of the total stroke volume. Leave the pump in this position for at least 30 seconds and then adjust it back to the neutral position. The manometer reading for the feeding pressure must remain at the set value during this procedure. The manometer readings of the high-pressure gates should also indicate a stable value, depending on the load. The manometer reading for the return pipe of the motor should be virtually the same as the manometer reading for the feeding pressure. Repeat this procedure until the leak-off oil or rinse oil is clear and free of air bubbles.

If a special filling device has been used, phase 1 can be carried out over a shorter period of time. However, a 1-minute rest period should be observed. Phase 2 must be carried out in the same manner.
4.7.5 Removal of residual air and trial run

Once the first start-up phase has been properly completed, the system can be brought to the required temperature in order to remove residual air. This can be done by gradually increasing the rotational speed and the load. Check before the trial run whether multiple disc brakes or holding brakes, which are controlled by the feeding pressure supply, are functioning properly, so that action can be taken in the event of an emergency. Gradually increase the load, continually checking the pressure readings on the manometers. Always keep safety in mind! Finally, check whether the maximum operating pressure complies with the required or indicated values as the components have been pre-selected for a particular pressure level. Levels in excess of this pre-selected pressure level may result in serious damage.

4.7.6 System check

Before a new system – particularly a prototype – becomes operational, it is advisable to perform a complete circuit test during a trial run under circumstances that are comparable to the actual operating circumstances, including the most extreme situations. This circuit test is necessary in order to be able to claim a guarantee in the event of system damage and should be carried out by specialised, expert technicians using electronic measuring equipment. The measured values should be compared to the component data issued by the manufacturer, particularly the nominal operating pressure, maximum operating pressure, peak pressure, feeding pressure, oil flow and speed of response of the pump and motor. The system can only be approved and is only eligible for a guarantee once these data have been measured and printed by a recorder connected to the electronic measuring equipment. If this procedure is not followed, liability for the system rests entirely with the end user. Guarantee applications are subject to the binding decision of Kramp Groep B.V., against which no complaints are possible.

5.0 Maintenance

Every machine with a hydraulic system, whether mobile or stationary, is supplied with a user’s manual and a CE statement. Maintenance instructions are important. In order for maintenance to be performed correctly, the end user must know how to act. The transfer of this knowledge is the task of the machine engineer.

5.1 Preventive maintenance

Regular inspections of the hydraulic system are important economically. Downtime resulting from overdue maintenance will almost always turn out to be more expensive. Consequently, scheduled inspections must take place at pre-determined times, after a certain number of running hours, during which key components are checked preventively to avoid costly repair and downtime. Following the direction of the oil flow (starting with the reservoir) is an effective method to ensure that all components are inspected.

5.2 Periodic maintenance

The first overhaul should be performed 100 running hours after the system has been put into operation. At the very least, this overhaul should include replacing the filters and checking the oil. In addition, the entire installation must be inspected thoroughly. Keep the following points in mind during the inspection:

- After the first overhaul, a major maintenance inspection must be performed after 300 running hours and subsequently after every 500 running hours, or earlier, depending on the load and the operating conditions. A major maintenance inspection should be performed at least annually. In the end, the frequency of maintenance inspections is determined by external influences and the load to which the installation is subjected.
- The filters and oil must always be replaced during a major overhaul. If necessary, oil replacement can be postponed on the basis of an analysis by a specialist firm. See also section 5.2.1

Moreover, it is essential to follow the points below in order to optimise the maintenance inspection.

5.2.1 Reservoir

The oil level must be correct and the oil must be of the prescribed quality and viscosity. For larger installations, it may be advisable to have an oil sample analysed. There are specialised independent firms that can offer advice as to whether the oil should be replaced or whether it can still be used until the next planned periodic overhaul. These firms examine such properties as acidity, viscosity and degree of contamination. If you wish to avoid commissioning an expensive analysis, visual inspection is also possible, albeit highly unreliable. Rough conclusions can be drawn about the condition of the oil based on smell (sour or burnt), colour (yellow or milky) and degree of contamination.

Always use the same brand and quality of oil for replenishing and changing. Different brands and qualities should never be mixed without written permission from the oil supplier.

5.2.2 Suction pipe

The suction pipe should be inspected for damage and any protruding parts of the steel braid reinforcement of the tube. Screw couplings must be checked for leakage and tightened if necessary. Particular attention should be paid to plastic and rubber tubes without steel braid reinforcement as these are subject to deformation resulting from high oil temperatures and the suction force of the pump, which can restrict the passage to the pump.

5.2.3 Pumps
The pump must be checked for leakage along the pump shaft and external leakage near regulators, covers and mounted pipes. Pay particular attention to nearby oil traces, such as oil splashes on the floor or chassis components. Check the drive clutch for damage to the plastic stars, play on the detachable bearings or universal joint shafts, correct vee belt tension, etc.

The various circuits on the pressurised side should be checked separately, following the direction of the oil flow. Also pay attention to leakage near screw couplings and changes in noise levels (possibly caused by bearings).

5.2.4 Tubes and pipes
Inspect the pipework for leakage and damage. Check if pipe brackets are attached properly or show any fractures. Also look for any wear of the pipes near brackets and ensure that the location of the pipes is such that they are not obstructed. Check the tubes thoroughly for deformation, damage and corrosion. After six years, rubber and plastic tubes should be replaced by similar tubes (recommendation no. 1/74 of the Association of Industrial Accident Insurers; in accordance with DIN-20066). Unassembled tubes in stock may be used for four years after the date of manufacture, assembled tubes for only two years. Use of the wrong tubes or tubes that are too old may result in life-threatening situations and substantial environmental and mechanical damage.

5.2.5 Filters
If indicators have been installed, filters can be checked for impurities quite simply. If no indicators have been installed, the filters can be inspected visually. The condition of certain components can then be ascertained, if necessary after obtaining expert advice. Filters should always be replaced when the oil is replaced. Keep filter fineness in mind when doing so. Also perform regular checks of the ventilation filters on the reservoir in connection with underpressure or overpressure in the tank.

5.2.6 Cooler
Perform regular checks of the cooler radiator for impurities in connection with decreasing cooling capacity. A cooler containing compressed air must be cleaned against the direction of air flow. Never use steam cleaners as they will damage the system. In principle, heat exchangers are maintenance free if the cooling medium is cooling fluid. Replace the cooling fluid in accordance with the supplier’s instructions. Never mix cooling fluids of different brands or compositions without permission from the supplier. If tap water or groundwater is used as a cooling medium, the cooler must be checked regularly for calcium or manganese deposits, etc. Internal contamination causes sharp decreases in cooling capacity.

5.2.7 Intermediate and built-on valves
Intermediate and built-on valves, such as balancing valves, cross-over valves, controlled non-return valves, etc., should be visually checked for leakage and damage. When in doubt, disassemble, check and, if necessary, replace these valves. There should be no load on built-on valves (oil pressure or external load). Look out for unmanageable situations!

5.2.8 Cylinders
Cylinders must be inspected for leakage along the gasket(s) near the shaft. If necessary, gaskets should be replaced preventively. Also look for damage to the shaft (scratches and wear). When in doubt, consult with an expert about the appropriate course of action. Also inspect the attachment of the cylinder, particularly at damaged hinge loops and ball heads. Check the connection between the tubes and the cylinder, paying particular attention to wear and to whether the connections are without tension. There should be no load on built cylinders. Pay attention to controlled non-return valves and balancing valves and lock the mechanical part to avoid unmanageable situations.

5.2.9 Gearboxes
Perform regular checks of the oil level using a gauge glass or sounding rod. Oil in gear boxes should be replaced with the same frequency as hydraulic oil. Let the oil flow out when it is warm, keeping multiple drainage points, if any, in mind. Also check whether the de-aeration filter, which is mounted standard to the gearbox, is open. Clean it with cleaning fluid if necessary. Always use the same brand and quality of oil when filling or replacing oil. Never mix different brands or compositions without permission from the oil supplier.

5.2.10 Accumulators
When in doubt, the nitrogen pressure can be checked using special equipment. A number of safety rules must be observed before starting work on an accumulator. The accumulator must be completely depressurised on the oil side. Open the short-circuit tap so that pressure can flow off to the tank. A short-circuit tap is compulsory! Never refill an accumulator with oxygen or compressed air as this creates a risk of explosion! Instead, accumulators should only be refilled with nitrogen. Never fill accumulators in excess of the maximum permitted filling pressure, which should be stamped on the accumulator, together with the maximum permitted operating pressure. Exceeding either of these two values creates a risk of explosion.

5.3. Planning
Plan preventive maintenance inspections well in advance, in consultation with suppliers if necessary. Ensure that the inspection is performed by expert personnel or commission temporary personnel when in doubt. Try to take account of seasonal variations, peak pressure, weekends and holidays. Also keep in mind that crucial components must be in stock.
6.0 Hydraulic oil
6.1 Choice of oil

Energy transfer is the main function of the oil used in the system. In addition, it also lubricates the components and should be able to carry impurities, wear particles and heat out of the system.

Required oil properties:
- good lubricating properties
- good dirt-absorbing properties
- appropriate viscosity for its purpose
- good antifoam additive
- good air-separating properties
- good water-separating properties

In the end, the conditions of use determine the oil to be selected. There are three basic types of oil to choose from:
- mineral oil [most common type of oil]
- synthetic oil
- organic oil

With synthetic oil, particular attention should be paid to whether it is phosphate-ester based, in which case special gaskets are required. Organic oil should only be used under certain conditions as it can be highly hygroscopic (= water absorbent) and may have a short life-span, depending on the conditions.

In selecting a type of oil, consult with the oil supplier and the supplier of the hydraulic system. Once a decision has been taken, the type and brand of oil should be clearly indicated on the hydraulic system. The end user should also be informed about replenishing oil. Under normal operating conditions (38 to 50°C), the viscosity for gear pumps and plunger pumps should be 32 cSt. Before using oil under extreme conditions, it is sensible to consult your oil supplier about the right choice.

6.2 Properties that determine which hydraulic oil should be used

When selecting the right type of hydraulic oil, the following important properties should be taken into account:
- viscosity
- viscosity index VI and/or viscosity class VG (viscosity at 40°C)
- pour point

The properties of the hydraulic oil should be appropriate for each specific usage and environment.

6.2.1 Viscosity

Hydraulic oil has a low viscosity when thin (liquid) and a high viscosity when viscous. Viscosity is proportional to temperature: when the temperature rises, viscosity decreases and when the temperature drops, viscosity increases. Hydraulic installations, especially mobile vehicles, operate under extreme temperature fluctuations. Consequently, the viscosity range is essential. The hydraulic oil must be liquid enough to flow through filters, suction pipes, return pipes and the various components without a great deal of resistance. However, the hydraulic oil should not be too thin. If this is the case, the (lubricating) oil film will break, which will cause internal mechanical damage.

6.2.2 Viscosity index – viscosity class

The viscosity index (VI) is used to express the relationship between the temperature and viscosity of hydraulic oil. Viscosity-temperature diagrams show the operational temperature range of hydraulic oil at various viscosity indices. The temperature range is limited by a given maximum and minimum viscosity index. Most types of hydraulic oil have a VI between 90 and 110. Hydraulic oil with a VI between 130 and 200 is not very sensitive to temperature changes and is characterised by good start-up properties and minimal loss of power at low temperatures. For high temperatures, hydraulic oil with a high viscosity index can be used to ensure effective sealing and less wear. The high load-bearing capacity of hydraulic oil with a high viscosity index prevents damage and machine downtime, lowers operating costs and increases the life span of the installation.

6.2.3 Pour point

Hydraulic oil remains liquid when the pour point is reached at a low temperature. The lowest operating temperature permitted during start-up of the installation should be well above the pour point temperature. In other words, the minimum start-up viscosity should be compliant with the instructions of the pump manufacturer. The minimum start-up temperature of the installation can be deduced from this.

6.3 Conditions for the use of hydraulic oil

Hydraulic oil must be free from impurities as these negatively affect the operation, life span and reliability of the system.
6.3.1 Contamination
Sources and effects of contamination:

<table>
<thead>
<tr>
<th>Contamination source</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>Cavitation / Diesel effect / Combustion / Hydraulic oil becomes compressible / More noise produced</td>
</tr>
<tr>
<td>Water</td>
<td>Oil ages more quickly / Oil produces foam more quickly / Negative effect on lubricating properties</td>
</tr>
<tr>
<td>Temperature too low</td>
<td>Increase in viscosity / Danger of cavitation / Increased resistance in pipes and valves / Delay in control valves / Decrease in yield / Substantial pressure loss in filters, resulting in opening of by-pass valves or tearing of filter elements</td>
</tr>
<tr>
<td>Temperature too high</td>
<td>Decrease in viscosity / Oil ages more quickly / Thickness of lubricating film may decrease / Increase in internal leakage / Decrease in yield / Negative effect on properties and functions of gaskets</td>
</tr>
<tr>
<td>Dirt particles</td>
<td>Extreme wear of components / Clogging of choking elements / Energy loss as a result of internal leakage / Valves become increasingly difficult or impossible to control</td>
</tr>
</tbody>
</table>

6.3.2 Filtration value
Filter performance is expressed in the beta ratio. The higher this ratio, the better the filtration. The beta ratio can be converted into a measure of efficiency, expressed as a percentage. This method is generally accepted in the sector. In practice, a beta ratio equivalent of 75 is used.

6.3.3 Filter fineness
In the end, the fineness and material of the filter determine whether the system meets the requirements of the cleanliness class in question in combination with a beta ratio equivalent of 75. Filter elements are usually made from paper or fibreglass. Fibreglass filters meet virtually all the relevant requirements.

<table>
<thead>
<tr>
<th>Application</th>
<th>ISO 4406</th>
<th>NAS 1638</th>
<th>Beta ratio equivalent of 75</th>
<th>Filter fineness</th>
<th>Filter element</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servo systems / High-pressure systems</td>
<td>15/11</td>
<td>4 - 6</td>
<td>6</td>
<td>10</td>
<td>A10</td>
</tr>
<tr>
<td>Die-casting machines</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportional valves / Industrial hydraulics</td>
<td>16/13</td>
<td>7 - 8</td>
<td>10</td>
<td></td>
<td>A10</td>
</tr>
<tr>
<td>Mobile hydraulics / General mechanical engineering / Medium-pressure systems</td>
<td>18/14</td>
<td>8 - 9</td>
<td>16</td>
<td></td>
<td>A10</td>
</tr>
<tr>
<td>Low-pressure systems / Heavy industry</td>
<td>19/15</td>
<td>9 - 11</td>
<td>25</td>
<td></td>
<td>A25</td>
</tr>
<tr>
<td>Water hydraulics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.3.4 Safety and health measures regarding the use of hydraulic oil
Anyone working on installations where hydraulic oil, lubricating oil, grease or preservatives are used must observe the following rules:

- Do not let the skin come into prolonged contact with the fluid. Clean the skin carefully after contact. Wear dry clothing.
- Do not eat or drink during the work.
- Avoid contact with the eyes. Should this occur, flush with copious amounts of water and contact a physician.
- Fluids must be stored in accordance with official regulations. Fire-extinguishers and emergency exits must be present.
- In the event of a fire hazard, it is sensible to use a highly incombustible fluid.
- Any fluid spilled should be cleaned up immediately to prevent slipping.
- Fluids may not end up in the ground or in surface water.
- Concrete floors must be impervious to fluid.
- Waste fluid must be removed and recycled by a specialist firm.
- Never attempt to plug leaks in the system by hand.

6.3.5 Storage
Hydraulic fluid must be stored in spaces that meet applicable legal standards. The temperature must be kept as constant as possible to avoid condensation. Ensure sufficient circulation of stock. Opened drums must be closed to avoid contamination and condensation.
7.0 Supply of parts
As is the case for any mechanical installation, hydraulic installations are subject to wear and tear. Although Kramp Groep B.V. has a well-stocked warehouse with respect to standard components, there may be situations when we cannot help you immediately. In order to avoid costly downtime, we recommend that you build up a stock of a limited number of crucial components, particularly if the installation contains components that are unique or difficult to replace, such as cylinders, adjustable pumps and motors, proportional valves, electronic control devices, etc.

Spare parts should be ordered on the basis of the parts list and the hydraulic schematic, if present. When placing your order, always indicate the correct brand, model number and any identification number.

We can draw up a quotation on request for the spare parts that Kramp Groep B.V. advises you to keep in stock. When in doubt, our technical sales department will be glad to provide advice.

8 Malfunctions
Despite all the care that we have devoted to your installation, malfunctions may occur, even if you have followed the maintenance instructions. Malfunctions should be traced by qualified and professional personnel. If necessary, our technical sales department or our maintenance department can provide technical support. Before attempting to trace the malfunction, we recommend that you think matters through and become acquainted with the hydraulic system.

Malfunctions must be traced in a logical and systematic manner. In general, the reservoir should be the starting point.

1. Is the oil level correct?
2. Are the filters in good condition?
3. Are the pressure, oil flow and direction of flow as indicated?
4. Is the oil temperature correct (viscosity)?
5. Are there any vibrations or noises (caused by cavitation)?
6. Is the electrical circuit in working order?
7. Is the emergency control gear in working order?
8. Did the malfunction occur suddenly or arise gradually?
9. Have any modifications been implemented recently?

Once the location of a malfunctioning component has been established, the surrounding area should be thoroughly cleaned before the component is repaired or replaced. The cause of the malfunction should also be traced. Any parts that have broken off should be located in connection with possible future instances of malfunction. Hydraulic components should never be disassembled in the open air. Instead, perform disassemblies in specially equipped workshops. Contact Kramp Groep B.V. for expert advice if the damage is serious, for instance, if hydraulic pumps, motors and cylinders have been completely destroyed. Often, the entire system will have to be rinsed and cleaned in such cases.

A list of possible problems and their remedies is given below.

8.1 Installation produces excessive noise (pump cavitates, suction problems)

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>SOLUTION(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suction pipe or filter is obstructed.</td>
<td>Remove the obstruction; clean or replace the element in question.</td>
</tr>
<tr>
<td>Suction pipe is too narrow.</td>
<td>Replace with a suction pipe with a larger diameter.</td>
</tr>
<tr>
<td>Too many bends in the suction pipe.</td>
<td>Reduce the number of bends or use a larger passage.</td>
</tr>
<tr>
<td>Medium is too cold.</td>
<td>Heat the medium using a heating element.</td>
</tr>
<tr>
<td>Malfunctioning feed pump.</td>
<td>Repair or replace the feed pump.</td>
</tr>
<tr>
<td>Tank cannot 'breathe'.</td>
<td>Install an aerating filter.</td>
</tr>
<tr>
<td>Viscosity of the medium is too high.</td>
<td>Replace the oil with an oil type with a lower viscosity.</td>
</tr>
</tbody>
</table>

8.2 Air in oil

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>SOLUTION(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil level in tank is too low.</td>
<td>Fill tank to the correct level.</td>
</tr>
<tr>
<td>Return pipe ends above oil level in tank.</td>
<td>Extend return pipe until it is below oil level.</td>
</tr>
<tr>
<td>PROBLEM</td>
<td>SOLUTION(S)</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>End of return pipe is located too close to end of suction pipe.</td>
<td>Install return pipe and suction pipe as far away from each other as possible.</td>
</tr>
<tr>
<td>Shaft seals are air-permeable.</td>
<td>Replace shaft seals.</td>
</tr>
<tr>
<td>Pipe connections in suction pipe are air-permeable.</td>
<td>Draw pipeline tighter or replace pipe connections.</td>
</tr>
<tr>
<td>Suction hose is porous.</td>
<td>Replace suction hose.</td>
</tr>
</tbody>
</table>

### 8.3 Mechanical vibrations

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>SOLUTION(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipes are in contact and vibrate.</td>
<td>Improve the pipework.</td>
</tr>
<tr>
<td>Shaft couplings are not aligned or locked.</td>
<td>Align and lock the shaft couplings.</td>
</tr>
<tr>
<td>Safety valve vibrates as a result of:</td>
<td>Replace valve.</td>
</tr>
<tr>
<td>- Wear and tear</td>
<td>Check adjustment.</td>
</tr>
<tr>
<td>- Incorrect adjustment</td>
<td>Decrease the load or find out whether the pressure can be increased.</td>
</tr>
<tr>
<td>- The machine is under too much load, resulting in oil overflow.</td>
<td></td>
</tr>
<tr>
<td>Pump is worn out or damaged.</td>
<td>Repair or replace the pump.</td>
</tr>
<tr>
<td>Hydromotor is worn out or damaged.</td>
<td>Repair or replace the hydromotor.</td>
</tr>
</tbody>
</table>

### 8.4 Pump supplies insufficient oil and/or does not reach required pressure level

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>SOLUTION(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direction of rotation of the driving motor is incorrect.</td>
<td>Change direction of rotation.</td>
</tr>
<tr>
<td>Air in the system.</td>
<td>See chapter 3.</td>
</tr>
</tbody>
</table>

### 8.5 System temperature is too high, causing leakage

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>SOLUTION(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil viscosity is too low.</td>
<td>Replace with right type of oil (see chapter 5).</td>
</tr>
<tr>
<td>Cooling system not functioning properly as a result of insufficient size, incorrect adjustment or contamination of the cooler.</td>
<td>Check if sufficient cooling medium is being transported, clean the cooler, readjust the cooling system or install a larger cooler.</td>
</tr>
<tr>
<td>Safety valve setting is too low.</td>
<td>Reset the safety valve [in accordance with instructions].</td>
</tr>
<tr>
<td>Oil circulation is not depressurised in neutral position.</td>
<td>Check the neutral position of the valve; there may be a power failure.</td>
</tr>
<tr>
<td>Too much leakage as a result of worn-out pumps, control valves, hydromotors or cylinders</td>
<td>Check, repair or replace the worn-out components in order to determine the location of the leak.</td>
</tr>
</tbody>
</table>

### 8.6 Rotational speed of the pump is incorrect

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>SOLUTION(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The drive clutch is slipping.</td>
<td>Lock or repair the clutch.</td>
</tr>
<tr>
<td>The driving motor has broken down or is too small.</td>
<td>Repair the driving motor or install a larger one.</td>
</tr>
</tbody>
</table>
8.7 Leakage from the high-pressure side to the low-pressure side of the system

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>SOLUTION(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The system is contaminated to the extent that safety valves, relief valves or other components remain open.</td>
<td>Disassemble, clean and assemble the valve in question; determine whether it is necessary to fill the system with new oil or even to flush it.</td>
</tr>
</tbody>
</table>

8.8 Malfunctioning feed pump in a closed system

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>SOLUTION(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damaged pump, malfunctioning drive mechanism, damaged or contaminated valves, incorrect viscosity, contaminated feed filter.</td>
<td>Repair or replace the damaged pump, drive mechanism or valves; replace the oil with a type that is appropriate for the conditions and compliant with regulations; clean or replace the filter element. See chapter 4 for additional information.</td>
</tr>
</tbody>
</table>

9.0 Technical data

In the plastic file included you will find:

1. Acquisition report for the hydraulic power pack
2. Drawing

10 Data on type plate

Location of type plate: on the side of the tank

Never remove the type plate.

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11.0 EC declaration of conformity

EC declaration of conformity for machines
(directive 98/37/EC, Annex IIA)

Herewith certifies

Kramp Groep B.V.
Breukelaarweg 33
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that the hereafter-mentioned machine conforms to the requirements of the Machinery Directive and to the requirements of the Guidelines and Standards mentioned hereafter.

Machine:
Hydraulic Power Pack
Models: MPP, PP and UNTH

Intended use
The hydraulic power pack should be used for generating hydraulic energy (pressure and flow). Hydraulic energy is transported to one or more actuators (engines, cylinders, etc.) by means of tubes and/or pipes to be attached to the power pack. Operating the actuators can take place by means of one or more control valves.

EC directives used:
Machine directives (98/37/EC and 2005/42/EC);
Low voltage directive (2000/59/EC)
EMC directive (2004/108/EC)

Standards applied:
EN 982: 1996
EN 12100-1:2003 Safety requirements for fluid power systems and their components - Hydraulics
EN 13849-1:2007 Safety of machinery - Safety-related parts of control systems
EN 13857:2008 Safety of machinery - Safety distances to prevent danger zones being reached by upper and lower limbs
EN 60204-1:2006 Safety of machinery - Electrical equipment of machines - Part 1: General requirements

Varseveld, March 5, 2013

H.J. Scholten
Chief Financial Officer (CFO)