

# VALVES AND HYDRAULIC POWER UNITS



INSTALLATION, COMMISSIONING  
AND MAINTENANCE

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**POCLAIN HYDRAULICS**  
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General information

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Industrial valves

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Hydraulic power units



**Foreword:**

This document is intended for installers of Poclair Hydraulics' products. It describes the technical properties of Poclair Hydraulics products and specifies their conditions for installation and startup that will assure their optimal operation.

This document includes important remarks concerning safety. They are displayed in the following manner:



**Safety notice.**

This document also includes instructions essential for the operation of this product along with general information. They are displayed in the following manner:



**Essential instruction.**



**General information.**



**Recover used oil.**



# GENERAL INFORMATION ABOUT HYDRAULIC PRODUCTS

## Relating documents

1. directive 89/391/EC
2. directive 94/9/EC
3. directive 97/23/EC
4. directive 99/92/EC
5. EN ISO 13849-1
6. ISO 1219
7. ISO 2230
8. ISO 3448
9. ISO4406
10. ISO 17165
11. DIN 31051
12. DIN 51524
13. NAS 1638

## Important basic information

This product information applies to the following types of hydraulic products:

- hydraulic components
- hydraulic systems

This product information applies to hydraulic products that are operated with mineral oil based pressure fluids unless their operation instructions expressly permit the use of other pressure fluids.



This product information generally applies to Poclain Hydraulics valves and Hydraulic power units and some of the content may not necessarily apply to the hydraulic product that you purchased. Only by strictly observing this product information and the operating instructions can accidents be prevented and problem-free operation of Poclain Hydraulics hydraulic product guaranteed.



Observing the product information and operating instructions reduces downtime and maintenance costs and increases the service life of your hydraulic products.



The operating instructions must be directly accessible to one of the personnel that operates the hydraulic product. The operating instructions must be read and understood by the operative personnel. We recommend that a record is made in writing of the employee's familiarisation with the relevant parts. Directives, standards and regulations contained in this product information refer to the versions valid at the time of writing this product information, which can be read from the page bottom or back cover of this catalog.

In addition to this document, product information for hydraulic products normally includes Operating Instructions consisting of three parts:

- Part I, the general Operating Instructions for the relevant class of products
- Part II, the Technical Datasheet2.
- Part III, the Product- and Application-specific Operating Instructions.3.

If you do not have all three parts, please request the missing part. Only if all the information contained in all parts of the three-part Operating Instructions is observed safe operation of hydraulic products can be ensured.

The Operating Instructions contain detailed information about the product, including:

- Information about the scope of delivery,
- Safety instructions,
- Technical data and operating limits,
- Information about bringing into (first) use and maintenance,
- Information about the mode of operation,
- Layouts, drawings,
- Information about replacement parts and accessories.



## Scope of delivery and responsibilities

### Scope of delivery and responsibilities of Poclair Hydraulics

Poclair Hydraulics hydraulic products fulfil all safety requirements applicable to fluid power systems and their components.



For the scope of delivery and the responsibilities of Poclair Hydraulics with respect to the product, please refer to the product specific Operating Instructions.

### Responsibilities of the plant operator



**If hydraulic products are positioned in the vicinity of sources of ignition or strong radiators of heat, protection must be put in place that would prevent any escaping pressure fluid from igniting and the hose lines from aging prematurely.**



**Mineral-oil-based pressure fluid is hazardous to water and flammable. It may only be used if the relevant safety data sheet from the manufacturer is available and all the measures stipulated therein have been implemented.**



**If there is a risk of fluid leaking from the hydraulic product and contaminating water or the ground, the hydraulic product in question must be placed in a suitable collecting trough. In connection with this, the applicable statutory regulations must be observed.**

You must also observe the EU directives for the use of work equipment (Directive 89/391/EC) and the associated individual directives, especially Directive 1999/92/EC for the protection from the danger arising from potentially explosive atmospheres and their implementations in national legislation. The legislation contains minimum requirements with respect to the making available by the employer of work equipment and for the use of work equipment by employees at work, including the regulations for operating equipment requiring supervision and the obligation to produce explosion protection documentation. This involves, for example, dividing areas endangered by potentially explosive atmospheres into zones and specifying suitable work equipment and procedures for these areas.

### Noise protection

The weighted equivalent continuous sound power level of hydraulic products can be obtained from the relevant Operating Instructions. If no values are documented then it can be taken that the value is less than 70 dB.

Installation of hydraulic products in a machine or system may increase this value, and if so, the manufacturer of the machine/system must document this.

At or above 85 dB, the plant operator must ensure suitable hearing protection available to the personnel.

### Special points concerning the installation of certain products

A hydraulic product is intended above all for installation in machines, systems and power units as a part machine or a component for installation into another machine or system and is not a complete machine in the sense of the EU directive. In addition to the Machinery Directive, still further directives may apply.

A wide range of dangers can arise from the combined actions of the hydraulic product and the machine or system in which the hydraulic product is installed. Therefore you must always make sure that the hydraulic product is also suitable without restriction for the proposed application at the installation location. The interfaces with the overall machine and the operating conditions are also of the greatest importance. We recommend that the results of the hazard analysis of the overall machine are taken into account in the design of the hydraulic product.

The functioning of the hydraulic product is also influenced by the machine or system in which it is installed.

For this reason, you must also always observe the Operating Instructions of the overall system in which your hydraulic product is installed. It is most important for you to also consider the possible use of the hydraulic product in a potentially explosive atmosphere (see 94/9/EC).



At the time of their first introduction on to the market, hydraulic products comply with the requirements of all relevant EU directives. If the scope of delivery is intended to be installed in a machine or system, then the Machinery Directive applies as appropriate in that the scope of delivery does not necessarily comply with the requirements of the Machinery Directive because the scope of delivery is intended for installation in a machine or because the scope of delivery is intended for combination with other machines into a machine or a hydraulic system.

The bringing into use of the scope of delivery shall therefore not be permitted until the machine or system in which the scope of delivery is to be installed or of which it represents a component complies with the requirements of all relevant EU directives.



### Liability, guarantee, warranty

Poclain Hydraulics shall not be liable for damages that result from noncompliance with or disregard of these and other parts of the Operating Instructions.

Unauthorised tampering shall render the warranty null and void.

Poclain Hydraulics shall only be liable if the scope of delivery was shown to be defective. Poclain Hydraulics shall not be liable if a deficiency occurs that involves parts having been replaced by the customer with equivalent but not identical parts as specified by the manufacturer.

Please refer to our general terms of supply or your contract for details of the guarantee and manufacturer's warranty.

## Basic safety instructions

### What to do in an emergency

In the event of an emergency, fault or other abnormal occurrences:

1. Switch off the hydraulic system.
2. Secure the main switch against being unintentionally switched on again.
3. Secure the danger area so that no one can enter the danger area unknowingly or uncontrolled.
4. Notify the relevant specialist personnel immediately.
5. In the event of fire, observe the provisions of the safety data sheets issued by the manufacturer of the pressure fluid and the fire precautions specifically applicable to your place of work, which must be documented in the plant operator's operating manual.



**Fighting fires with materials other than those permitted can lead to explosions and/or more rapid spread of the fire!  
Danger to life from smoke inhalation!**

### Safety labelling on the hydraulic product



The meanings of the safety labelling on the hydraulic product are explained in the Operating Instructions.

### Proper use

Hydraulic products are designed and constructed for the provision, transmission, control or regulation of energy and signals using the flow of hydraulic fluid.

Hydraulic product satisfies at least safety category B in accordance with EN ISO 13849-1.

If the overall machine in which the hydraulic product is to be installed indicates that a safety category higher than category B in accordance with EN ISO 13849-1 is required for the hydraulic product, then a correspondingly higher rated hydraulic product can be supplied and installed only after special agreement.



The hydraulic product shall be operated exclusively with pressure fluids complying with DIN 51524. Where other pressure fluids are permitted is specially mentioned in the Operating Instructions.



## Proper use

- Hydraulic products may only be operated if they are in perfect technical condition.
  - In the event of disturbances in the power supply and/or damage to the electrical equipment, switch off immediately and secure the main switch against being switched on again without authorisation.
  - Report and rectify all faults and damage indicated by the system or discovered by other means.
- The connections, operating conditions and performance data specified in the Operating Instructions must be observed and never changed.
- Poclain Hydraulics hydraulic products shall not be converted or otherwise modified without prior consultation with Poclain Hydraulics.
- Program codes of programmable control systems must not be changed without prior consultation with Poclain Hydraulics.
- The safety devices fitted by the producer must be present, properly installed and in full working order except when this is impractical during setting up or maintenance work.
- Safety components such as limit switches, valves and other control components shall not be rendered inoperative.
- Tamperproof lead seals installed by the manufacturer shall not be removed.
- The specified maintenance tasks in the Operating Instructions shall be carried out at the intervals stated in the Operating Instructions.
- Uncontrolled access by persons unfamiliar with the system to the immediate operating zone of hydraulic products is prohibited (even if the product in question has been shut down).
- Hydraulic products must never be assembled, operated or maintained by persons under the influence of alcohol, drugs or other medication which affect one's ability to react.

## Requirements for personnel, duty of care

### Qualifications of specialist personnel

A specialist person is someone who, using his specialist training, knowledge and experience as well as familiarity with the relevant conditions, can::

- safely carry out the tasks allocated to him and correctly assess the scope and implications of his work,
- recognise possible dangers,
- undertake the necessary measures to eliminate possible accidents.

### Requirements for hydraulic maintenance personnel

In accordance with DIN 31051, maintenance comprises the individual activities of inspection, servicing and repair. All personnel involved in maintenance shall be familiar with and observe all parts of the Operating Instructions and this product information.

**Inspection personnel** shall fulfil the following requirements:

- They have been instructed in the relevant activity.
- Specialist knowledge of hydraulics is not required for purely inspection activities but the personnel must be aware of the particular dangers associated with hydraulic products.

**Servicing personnel** (who carry out filter and oil changes, for example) shall fulfil the following requirements:

- They have been instructed in the relevant activity.
- Specialist knowledge of hydraulics is not required to carry out servicing work.

**Repair personnel** shall fulfil the following requirements:

- The personnel must be hydraulics experts, who have been instructed and meet the definition given above.
- Repair personnel must be familiar with the function of the hydraulic system as a whole, from subsystems to their interaction with the function of the entire machine.
- Repair personnel must be able to read hydraulic circuit diagrams, interpret individual functions from their symbols and understand function diagrams.
- Repair personnel must possess knowledge of the function and construction of hydraulic elements.

### Requirements for electrical maintenance personnel

All work on electrical equipment shall only be carried out by an authorised, qualified electrician, or by instructed persons under the guidance and supervision of a qualified electrician, in accordance with the rules applicable to electrotechnical products.



## Minimum age

Persons under the age of 18 may not work on Poclain Hydraulics hydraulic products. This does not apply to young persons of 16 or over if:

- working on hydraulic products is necessary in order for them to accomplish a training objective,
- their protection is guaranteed by the supervision of an experienced, competent person,
- they are allowed to use only tools, work implements and protective gear that preclude the risk of injury.

## Training

The plant operator using hydraulic products shall train his personnel regularly in the following subjects:

- Observation and use of the Operating Instructions and legal requirements.
- Proper operation of the hydraulic product.
- Observation of the instructions of safety officers and the plant operator's operating manual.
- What to do in an emergency.



Poclain Hydraulics can provide you with support in these specialist areas.

## General ancillary dangers and protective measures when operating hydraulic products

In the interests of your safety, all safety instructions shall be carefully observed, especially those in the Operating Instructions.

In spite of the high intrinsic safety of hydraulic products, the risk of personal injury or damage to the environment cannot be excluded, even when the equipment is properly used.



New, additional dangers may arise if the hydraulic product is installed in another machine or installed with other machines in a system.

Information on these additional dangers can be found in the overall operating manual of the supplier of the overall system in which the hydraulic product is installed.

## Dangers from pressure fluid

Handling pressure fluid without protection is hazardous to health.



Please observe the manufacturer's safety instructions and the safety data sheets for the pressure fluid that you are using.

**Serious damage to health or death may result if pressure fluid enters the blood stream or is swallowed. If this occurs, contact a doctor immediately!**

## Malfunctions due to pressure fluid contamination

Contamination of the pressure fluid can be caused by:

- Wear during operation of the machine/system (metallic and non-metallic abrasion),
- Leaks of the hydraulic product,
- Contaminants introduced during servicing/repair,
- The use of dirty (unfiltered) pressure fluid when the pressure fluid is changed.

Contaminants lead to malfunctions, increased wear and shorter service life of the hydraulic product. This can have negative effects on the safety and reliability of the hydraulic product. Therefore the maintenance tasks specified in the Operating Instructions shall be carried out at regular intervals and the utmost cleanliness is required during work on the hydraulic product.



When changing the pressure fluid, always use factory-fresh pressure fluid and filter it before filling to remove any contaminants in the pressure fluid that often contains from the packaging container (drum). Flush out lines and hoses before installation.



The cleanliness class of a pressure fluid is specified in accordance with ISO 4406. Detailed information can be obtained from the relevant data sheet or the Operating Instructions.

In older data sheets, the cleanliness class is sometimes specified in accordance with NAS 1638. The following table can be used to convert this to an equivalent ISO 4406 cleanliness class:

Comparison table for cleanliness classes	
Earlier class to NAS 1638	Current class to ISO 4406
Class 7	Class 18/16/13
Class 9	Class 20/18/15

## Electrical dangers

When working on electrical systems:

- De-energise the hydraulic system before beginning any maintenance work.
- Cordon off the working area with red-white safety chain and warning signs.
- Lock the main switch, remove the key and keep it in a safe place until the work is completed.
- Attach a warning sign to the main switch.
- Check that there is no voltage using a two-pole voltage detector.
- Earth and short-circuit the point where you are working.
- Cover neighbouring live parts.
- Clear your workplace to prevent contact with live parts as a result of tripping or slipping.
- Always use electrically insulated tools.
- Disconnect plugs at sensors and valves – even those with low voltages – after the system has been de-energized.

**Even after disconnection of the electrical supply (main switch OFF) the following supply systems/danger areas can still give rise to life-threatening voltages:**



- Electrics, electronics, hydraulics (e.g. accumulators, rechargeable batteries),
- Main switch,
- Power supply cables,
- Points identified with an electric shock warning sign.

## Product-specific ancillary dangers

All product-specific ancillary dangers and precautions can be found in the relevant Operating Instructions.

## Disposal

- Take metal, cable and plastic ducts to a recycling materials collection centre.
- Dispose of electronic components as electronic waste.
- Dispose of batteries as special waste.
- Cleaning agents, operating fluids and other materials:



Please observe the disposal regulations specified in the appropriate safety data sheets.



## Technical data and ambient conditions



The product-specific technical data, operating limits and ambient conditions for the operation of your hydraulic product can be found in the Operating Instructions.

This includes following information:

- Minimum flow rate for adequate cooling,
- Permissible maximum temperature of the coolant,
- Performance data,
- Type of control and regulation functions,
- Permissible pressures, flow rates,
- Connections.

### Information about pressure fluids

Unless otherwise indicated in the Operating Instructions, the following specification applies to the pressure fluid to be used:

- Mineral-oil-based pressure fluid complying with the requirements of DIN 51524,
- Operating temperature range 0°C ~ 80°C [32°F ~ 176°F] (in tank < 72°C [162°F]).

Any deviations from this can be found in the Operating Instructions.



Poclain Hydraulics recommends a maximum operating temperature of 55°C [131°F], because the rate of ageing of the pressure fluid increases and the service life of the seals and hoses is reduced at higher temperatures.

- Viscosity ranges: see technical data shown in product catalogue.
- Max. permissible contamination class of the pressure fluid in accordance with ISO 4406: see technical data shown in product catalogue.

The maximum permissible cleanliness class can be found in the Operating Instructions. The following types of pressure fluids shall be used:



Poclain Hydraulics hydraulic products are tested with test oil ISO VG 46 at approx. 40°C [104°F], (Viscosity  $\eta$  = approx. 46 mm<sup>2</sup>/s).

### Ambient conditions

#### Use in potentially explosive atmospheres



Hydraulic products shall be used in potentially explosive atmospheres only if they are designed for this purpose and this is expressly stated in the Operating Instructions.



Directive 1999/92/EC of the European Parliament and Council concerning the minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres governs protection from danger from potentially explosive atmospheres. Observe the requirements contained in the regulations for operating equipment requiring supervision and the obligation to produce explosion protection documentation.

This involves, for example, dividing areas endangered by potentially explosive atmospheres into zones and specifying suitable work equipment and procedures for these areas.

Observe the requirements of Directive 94/9/EC on the approximation of laws of the member states concerning equipment and protective systems intended for use in potentially explosive atmospheres (ATEX Product Directive). The directive contains requirements for the use of equipment and protective systems in potentially explosive atmospheres.



## Climatic operating conditions

Unless otherwise indicated in the Operating Instructions, the permissible ambient temperatures are:

- for control units: 0°C ~ 50°C [32°F ~ 122°F]
- for drive units with electric motors without heat exchangers, surface-cooled by free air circulation: 0°C ~ 30°C [32°F ~ 86°F]
- for drive units with heat exchangers: < 40°C [104°F]

Unless otherwise specified, hydraulic products are designed for use in temperate climate zones and in covered areas (not in the open air) at relative air humidities of < 70% and at room temperatures of 22°C [72°F].



For systems with oil-air heat exchangers: Observe the information given in the circuit diagram in the Operating Instructions.

In relation to the electronic equipment, the permissible ambient conditions apply to installed and protected electrical connections of class IP55:

- ambient temperature: 5°C ~ 40°C [41°F ~ 104°F]  
(assuming that the average air temperature over a 24 hour period does not exceed 35° [95°F])
- Relative air humidity: 23 ~ 95%, non-condensing.
- Altitude: up to 1000 m [3280 ft] above national datum.



Hydraulic products shall not be used in aeronautical equipment, except where they have been specially approved and appropriately labelled to this effect.

## What you need to know about pressure fluids

### *How to handle pressure fluid safely*



Mineral-oil-based pressure fluid is hazardous to water and flammable. It may only be used if the relevant safety data sheet from the manufacturer is present and all the measures stipulated therein have been implemented.

### *Functions and effectiveness*

Pressure fluid selection, inspection and maintenance are of vital importance for:

- proper functioning,
- operating safety,
- service life,
- effectiveness of a hydraulic product.

The task of pressure fluid:

- to transmit hydraulic energy from the pump to the hydraulic cylinder/motor,
- to lubricate parts moving against one another,
- corrosion protection,
- to remove contaminants,
- to remove locally accumulated heat.



### Reduced function due to ageing

The effectiveness of pressure fluid diminishes as it ages (undergoes chemical changes). Acids and resinous residues form, which may cause valve spools to stick.

The following factors affect the ageing process::

- high temperatures,
- oxygen in the pressure fluid,
- air humidity,
- water,
- metallic catalysers,
- operating pressure,
- contaminants.



Observe the following rules of thumb:  
At pressure fluid temperatures > 70°C [158°F], the rate of ageing doubles for each 10°C [50°F].

### Viscosity

#### Viscosity grades

The most important characteristic of a pressure fluid is its viscosity that always plays a priority role in the selection of a pressure fluid.

Viscosity is measured in the SI unit [mm<sup>2</sup>/s]. Many manufacturers still provide their information in centi Stoke [cSt], the equivalent of [mm<sup>2</sup>/s].

The viscosity grades (VG = viscosity grade) in accordance with ISO 3448 relate to the viscosity at 40°C [104°F]. The viscosity grade can be appended also to the commercial name of the pressure fluid.

Example: A pressure fluid with a viscosity grade of ISO VG 46 has a viscosity of 46 mm<sup>2</sup>/s at 40°C [104°F].

The relationship between medium temperature and viscosity for hydraulic oil (example):

Temperature		Viscosity mm <sup>2</sup> /s
°C	°F	
3	37.4	800
8	46.4	500
25	77	100
60	140	20
77	170.6	12

Too high a viscosity leads to the formation of air and vapour bubbles as a result of low pressure (cavitation). Too low viscosity leads to increased leakage losses. Increased leakage losses cause the pressure fluid to heat up more, leading in turn to a further reduction in viscosity. The pressure fluid then loses its ability to lubricate.

For certain ambient and operating temperatures, not all the requirements can always be covered with the available ranges of the viscosity grades.

In order to comply with all the requirements, high viscosity pressure fluids with viscosity index improvers or a pressure fluid cooler/heater may be used.

### Leakage fluid

Clearances and play mean that some leakage fluid escapes from all hydraulic products. Leakage fluid can be lead away internally or externally, depending on the component. It can be fed back into the tank or must be disposed of.



**Make sure that the leakage fluid is fed back into the tank in a proper manner.  
Dispose of leakage fluid that is not fed back into the tank properly, in compliance with the applicable environmental protection regulations.**

### Topping up/refilling



**When topping up/refilling your hydraulic system, make sure that you use pressure fluid of the same sort and type and from the same manufacturer.**

If the fluid is heavily contaminated or prematurely aged, then the system, including the tank must be cleaned and flushed before refilling. New pressure fluid must always be filtered in accordance with the required cleanliness class, as it does not normally meet the required cleanliness class in the as-supplied state.



## Construction and mode of operation of a hydraulic system

### Definitions of terms

**Hydraulics (fluid technology):**

Transmission, control and distribution of energy and signals using a pressurised fluid medium.

**Hydraulic system:**

Arrangement of interconnected components for transferring and controlling hydraulic energy.

**Component:**

A single unit (e.g. valve, filter, cylinder, motor) that consists of one or more parts and which is a functional constituent of a hydraulic system.

**Drive:**

A component that converts the energy of the hydraulic fluid into mechanical energy (e.g. motor, cylinder).

### Schematic

In a system operated with hydraulic oil, first of all mechanical energy is converted into hydraulic energy, transported and controlled in this form, to finally be converted once more into mechanical work.

Hydraulic components are arranged in accordance with these functions. The following diagram shows a schematic representation of the elements of a complete hydraulic system.

To demonstrate their operating principle, standardised symbols (ISO 1219) are used instead of sectional diagrams of the various devices. Line connections are represented by simple lines.

### Safety concept

Hydraulic products contain sensors and actuators, the interaction of which is particularly important with regard to the fulfilment of technical safety functions.

Individual hydraulic products form part of an overall safety concept.

Applications required to perform safety functions are designed using special hydraulic components that satisfy the requirements of the relevant directives, such as the Pressure Equipment Directive and other standards.

The manufacturer of the overall machine or system defines and bears responsibility for the safety category to EN ISO 13849-1 to be fulfilled.



A more detailed description of the safety concept and the specific safety components installed can be found in the Operating Instructions and the Operating Instructions of the supplier of the overall system in which the hydraulic product is installed.

## Moving hydraulic systems and components

Hydraulic systems or components may be moved by a fork-lift truck or a hoist, depending on their size and the local conditions.



For details see the Operating Instructions.



**Always ensure hydraulic products are empty of pressure fluid for transportation.**

Hydraulic products are delivered empty of pressure fluid. However, products may contain oil residues left over from the final inspection at our factory.

## Storage and longer standstills

### Subsequent bringing of hydraulic systems into use after storage

Corrosion, especially oxidation, can cause metal surfaces to lose the standard of surface finish required for the hydraulic system to function properly.

Rust and other metallic and non-metallic particles lead to abrasive wear (erosion), which detrimentally affects the functioning of the hydraulic system.



**If a hydraulic system is to be brought into use again following a long standstill, it must first be flushed clean.**



## Factory-applied corrosion protection

Hydraulic products are tested in accordance with Class III using a hydraulic oil that has additional anticorrosive properties. The film of oil that remains in the product after the test provides sufficient internal corrosion protection.

This factory lubrication ensures that valves do not stick during subsequent use of the hydraulic product, and guarantees compatibility with seals and the pressure fluid to be used.



The factory-applied corrosion protection is adequate provided that:

- no condensation or leakage water can enter the system
- long standstills are avoided.

Contact Poclain Hydraulics if you are not clear about the consequences of long standstills on the state of the hydraulic product.

## Storage times in relation to the ambient conditions

Delays in bringing into use, long shipping and storage times or long periods of nonuse can lead to rust formation in hydraulic products. Additional corrosion protection measures must be implemented to prevent this



If all the openings on the hydraulic products are not sealed so as to be airtight, this will reduce the storage life of the hydraulic product by nine months. After the specified storage time has expired, in any event not longer than 24 months, the corrosion protection must be checked and further conservation measures applied if necessary

## Seals, hoses and hose lines



### Seals:

**Observe the requirements of ISO 2230 and the specific manufacturer's data on seals.**

### Hoses and hose lines:

**Observe the requirements of ISO 17165 and the specific manufacturer's data on hoses and hose lines.**

In addition, the following conditions shall be observed:

- Seals, hoses and hose lines are stored in cool, dry and dust-free conditions.

The hoses and hose lines can be enclosed in plastic foil to ensure low-dust storage conditions. Ideal storage conditions for hoses and hose lines are temperatures from 15°C to 25°C [59°F to 77°F] and a relative humidity below 65%.

- Do not store elastomers below  $-10^{\circ}\text{C}$  [14°F]. The ideal storage conditions for seals are temperatures from 10°C to 20°C [50°F to 68°F] and a relative humidity between 65% and 75%.
- Store hoses and hose lines in the original packaging if possible.
- Avoid direct sunlight and UV radiation and shield from nearby sources of heat.
- Darkened storage locations are preferred.
- Do not use ozone-forming light sources or equipment (e.g. fluorescent lamps, mercury-vapour lamps, copiers, laser printers) or electrical spark-forming devices in the vicinity of hoses and hose lines.
- Seals, hoses and hose lines must not come into contact in particular with materials or vapours that could damage them (e.g. acids, alkalis, solvents).
- Store seals, hoses and hose lines lying down and free from tension. If the hoses and hose lines are coiled, take care not to bend them to less than the smallest bending radius specified by the manufacturer.

Minimum storage times:

- NBR seals: 4 years
- FKM seals: 10 years
- Hoses : 4 years

For reasons of safety, seals, hoses/hose lines shall not be used once these permissible storage times are reached or exceeded. Permissible storage times could be considerably reduced if the permissible storage conditions are not maintained. If you are not clear about the storage times and/or storage conditions then you should not use the product.



## Assembly and bringing into first use



Only the permissible pressure fluids given in the Operating Instructions are to be used. Information on other pressure fluids can be found in the Operating Instructions or are available on request. Filling the pressure fluid tank must always take place through a suitable filter unit. Experience has shown that even new pressure fluid can often have more than the maximum permissible level of contamination.

All information specific to assembly and bringing into first use can be found in the Operating Instructions.

Pay attention to cleanliness:

- Do not use cleaning wool or cloths containing fibres for cleaning.  
Depending on the condition of the system or machine, cleaning with fibre-free cloths may be sufficient. Use suitable liquid cleaning agents to remove lubricants and other stronger contaminants. Make sure that cleaning agent does not get into the hydraulic system.
- Never use hemp and putty as sealants.  
The functional or failure behaviour of identical hydraulic products may vary due to conditions specific to the machine or system in which the hydraulic product is installed (mass, speed, electrical triggering at setpoint values, etc.), see also "Trouble-shooting", page 19.

### Safety advice for assembly and bringing into first use

**Hydraulic products are generally intended for installation in machines/systems or devices.**

**The function of the hydraulic product must therefore always be seen in relation to the function of this machine – i.e. seemingly identical hydraulic products may demonstrate different functional behaviours as a result of the function of the machine in which they are installed.**

**For this reason, a hydraulic drive must not be brought into use until it has been determined that the machine in which it is installed conforms to EU standards.**



**Do not bring hydraulic drives into use until you have familiarised yourself completely, firstly with the function of the hydraulic product and hydraulic equipment and secondly with the hydraulically powered machine functions, and have clarified and dealt with any possible dangers.**

**Bringing into (first) use shall only be done by an instructed, authorised hydraulics expert who has the required specialist knowledge.**

Specialist hydraulics knowledge means, among other things, that the person can read and fully understand hydraulics drawings. In particular, he must fully comprehend the range of functions of the integrated safety components as part of the overall safety concept.

### Before bringing into first use

1. Check the scope of delivery for transport damage.
2. Check that the Operating Instructions for the hydraulic product are present and complete.  
Contact us if the Operating Instructions are not there or are incomplete.
3. Assemble the hydraulic product.
  - Observe the Operating Instructions and this product information.
  - Assemble the hydraulic components, so that they are mounted strain-free on even surfaces.
4. Ensure that the interfaces of the system/machine and the installation conditions provide for safe operation of the hydraulic product. If any doubt, consult the people responsible for the overall system/functional machine.
5. Check the construction of the hydraulic product against the circuit diagrams, lists of equipment and assembly drawings. If there are any differences, draw this to the attention of the people responsible. If important documents are missing, they can be requested from Poclain Hydraulics. Only documents issued by the bodies authorised to do so shall be used.
6. Based on the Operating Instructions for the system or machine in which the hydraulic product is installed, check whether bringing the hydraulic system into use could lead to uncontrolled, dangerous movements. Where appropriate, take into account the hazard analysis/risk assessment for the system or machine.
7. Take the precautions appropriate to the anticipated dangers, e.g.
  - Ensure that the cylinder piston rod can move out without danger.
  - Use a hoist or other lifting device to additionally secure lifted loads.
8. As part of bringing into (first) use, check whether the electric motors and valve solenoids can be switched manually using the electrical controls of the system/machine. If they cannot be switched manually – or can but with difficulty – you must provide a remote control for the internal function test of the hydraulic system.



Starting up the hydraulics solely by means of emergency manual operation is not recommended, as several valves at once cannot be switched as required in the correct sequence.

9. Draw up a sequential program for bringing into (first) use and store it with the technical documentation as an appendix to the Operating Instructions.

Hydraulic drives basically consist of the following functional groups:

- Pump circuit (generation of pressurised oil flow); pump, electric motor, oil tank, filters, monitoring devices, etc.
  - Control system for at least one hydraulic consumer (cylinder, motor); directional control valves, pressure and flow control valves, check valves.
  -
10. Divide the functional circuit diagram into separate mini circuits that can each be started up in succession.
  11. Read the functional circuit diagram and seek clarification of any unclear text or diagrams. More information about the functioning of components, e.g. a pump regulator, is available in the Technical Datasheet.
  12. Establish into which position valves are to be switched, or how valves are to be set.
  13. Put up any necessary directional, prohibitive or informative signs and check whether the meaning of these signs are explained in the Operating Instructions.
  14. Follow this sequence for bringing into (first) use:
    - Pump circuit
    - Parts of control system: e.g. pressure cut-off and switchover, open centre, pressure reduction etc.
    - Cylinder and motor circuits: First move, fill and bleed, then finally optimise all settings.

### *Bringing into first use, subsequent bringing into use*



**Before bringing into (first) use, have all pressure accumulators and safety systems checked by an expert or specialist in accordance with national regulations.**

1. Clean the hydraulic unit and all other component groups, so that no dirt can get into the hydraulic system during bringing into (first) use.
2. Check the paint on the tank for integrity.
3. Flush the connection lines to remove dirt, scale, chips etc.
4. Pickle and flush welded pipes.



Remove all residues of water and cleaning agents before performing further work.

5. Clean the interior of the hydraulic components to get rid of contaminants:
  - Clean the filler plug of the pressure fluid tank.
  - Remove dust and chips using an industrial vacuum cleaner, by rinsing parts or similar cleaning method.
  - Completely remove any oil residues left over from the factory test.
  - Remove any gummed oil which may have formed due to incorrect storage.
6. Connect up all connection lines.



Observe the installation instructions from the manufacturer of the connection components.



Make sure that pipes and hoses are connected at all ports or that the ports are sealed with screw plugs.

7. Carry out a special check to make sure that the union nuts and flanges are correctly tightened at the pipe connections and flanges.



Mark all the checked connections, e.g. with paint. Označite vse preverjene povezave (npr. z barvo).

Make sure that all pipes and hoses and every combination of connection pieces, couplings or connection points with hoses or pipes are checked for their operational safety by someone who has the appropriate knowledge and experience.

8. Connect the hydraulic consumers. Dimension the connection lines in accordance with the performance data in the Circuit Diagram and the Operating Instructions.



9. Install the electrical system for the drive and control system:
  - Check the connected loads.
  - Connect coolant water if necessary.
  - Check the direction of rotation of the pumps (e.g. as indicated by attached arrow markings).
10. Check the pressure fluid to ensure that no water has entered it.
11. Before filling the pressure fluid tank, please observe the following requirements:
  - The pressure fluid must conform to the specification in the Operating Instructions.



**Never fill new hydraulic products with used pressure fluid.**

- The drums of pressure fluid must be sealed and clean on the outside.



If the pressure fluid has a high level of initial contamination (see page 11, “Technical data and ambient conditions”) use a filter unit to fill the pressure fluid tank. Ensure that the filter element is clean.



The fineness of the filter shall correspond to the cleanliness class required by the overall system and if possible be even finer. The filter unit used shall fulfil the requirements for functional safety and service life.

- If possible, fill the pressure fluid tank via a filling coupling, using a return filter if possible.



**Use oil filler units (filter units) suitable for pressure fluids.**

- Do not remove the filter strainers from filler necks or the filter element from filters before filling the pressure fluid tank.

12. Fill the pressure fluid tank up to the upper mark on the level gauge. Observe the maximum fluid level, taking into consideration the volume in the connection lines and hydraulic consumers.
13. Set the pressure and flow control valves, pump regulator, signalling elements such as pressure switches, limit switches and temperature regulators to the settings and values defined in the sequential program (see page 16, “Before bringing into first use”).



**Do not change the settings of valves with a safety function, valves with a position switch or valves with preset electronics.**

- Set operating-pressure valves and flow control valves to the lowest possible values.
- Set directional control valves to their basic setting.
- Reduce the setpoint values of proportional valves to minimum values.
- Do not remove the tamperproof lead seals. Damaged or removed tamperproof lead seals indicate improper use of the hydraulic product.

14. If applicable:  
Fill the pressure accumulator to the specified gas precharge pressure and then check the pressure, see Operating Instructions.
15. Fill the pump body:  
Use the leakage oil port to fill pump bodies that have this feature, see Operating Instructions.
16. If applicable:  
Open the cocks in the suction line.
17. Start the drive motors:
  - With electric motor in jogging mode, allow to start briefly.
  - Combustion engines in idle.
  - Pay attention to the direction of rotation.
18. Bleed the hydraulics (valve, pump, motor, line, cylinder).



Details on bleeding can be found in the Operating Instructions.

- Operate the hydraulic product at low pressure until it is fully bled.
- Bleed the hydraulics lines to consumers or measuring points at the highest point, if possible.
- Operate the directional valves in jogging mode.
- Next, advance and retract all hydraulic consumers several times.
- Increase the load slowly. Check the pressure fluid level in the pressure fluid tank. If necessary, top it up with pressure fluid.

Bleeding has been accomplished fully and correctly if the pressure fluid in the tank does not foam, if the hydraulic consumers do not make any jerky movements and if no abnormal noises can be heard.



19. Set the valves and sensors and start up the machine:

- Set the switching operations of valves in accordance with the dynamic conditions, see Operating Instructions.
- Finally adjust and optimise the setting of proportional valves.

Manufacturing tolerances mean that valves and amplifiers have to be adjusted in line with one another. Valves with electronics have the valve and amplifiers adjusted in line with one another at the factory.

Amplifiers for valves are supplied from the factory with a basic setting. Depending on the type of valve and amplifier, you may have to fine-tune the null point and sensitivity before bringing the valve into use.



Details on fine-tuning can be found in the Operating Instructions.

20. Check the operating temperature after the machine has been running continuously for several hours. Too high operating temperature indicates that there are faults that need to be analysed and rectified.

21. Rectify any leakages, e.g. by relieving couplings from pressure and then retightening.



Apart from moisture, which should not be sufficient to form one drop, no measurable, unintentional leakage shall be found.

22. After bringing the machine into first use, have a sample of the pressure fluid analysed to ensure that it achieves the required cleanliness class. Change the pressure fluid if the required cleanliness class is not achieved. If the pressure fluid is not tested in the laboratory after bringing the machine into first use change the pressure fluid.

23. Replace the pressure fluid filter.

24. Document and file all set values.

25. To ensure the safety of persons and the system, after bringing the machine into first use, perform the following tests using the defined maximum values:

- Function test
- Pressure test

Prepare a record of the bringing into (first) use or acceptance and have it signed by the plant operator. This record is an important document and requires to be filed.



Information on how to perform the function test and pressure test can be found in the Operating Instructions.

## Operation

Please refer to the Operating Instructions for all information on how to operate the Poclain Hydraulics hydraulic products.

## Trouble-shooting

### *What to do in the event of a fault*



In the event of abnormal occurrences or malfunctions, stop all work on the Poclain Hydraulics hydraulic product immediately and inform the responsible personnel.



A table for product-specific trouble-shooting can be found in the Operating Instructions.

If the responsible personnel are unable to rectify the problem immediately:

- Switch off the main switch. If applicable, turn off any combustion engines used as drive motors.
- Secure the main switch against being unintentionally switched on again.
- Inform the machine manufacturer.

### *The basic approach to trouble-shooting*

The information in this section is intended to help you create the ideal conditions for carrying out trouble-shooting as efficiently as possible.



## General conditions

- Is all the necessary technical documentation to hand?
- If no hydraulic circuit diagram is available:  
Can a hydraulic circuit diagram be drawn using the structure, signs and labelling of the equipment?
- Are there enough measuring points?
- Has the customer provided useful information about how the malfunction manifests itself and about the functional behaviour of the system/ component prior to the malfunction?
- Is there a machine record book that may document similar malfunctions in the past?

## Recommended way of working when trouble-shooting

Successful trouble-shooting for a hydraulic product requires precise knowledge about the structure and method of operation of the individual components.

Where hydraulics are combined with electrics/electronics, in particular, trouble-shooting is rendered more difficult and cooperation between electricians and hydraulic specialists is required.

- Even if you are under time pressure, proceed systematically and methodically. Indiscriminate, hasty dismantling and readjustments may, in the worst case, result in the original cause of failure being impossible to determine.
- Make sure that you gain an overview of the function of the hydraulics in respect of the overall system in which the hydraulics are installed.
- Try to find out whether the hydraulics performed the required function in the overall system prior to the occurrence of the fault.
- Try to determine any modifications to the overall system in which the hydraulics are installed:
  - Have the operating conditions or operating range of the hydraulics been changed?
  - Have modifications (e.g. retrofitted equipment) or repairs been carried out on the overall system (machine/system, electrics, control system) or on the hydraulics? If yes: What were they?
  - Have the set values of the hydraulics been changed?
  - Have the hydraulics recently undergone maintenance?
  - Has the hydraulic product/machine been operated improperly?
  - How does the malfunction manifest itself?
- Form a clear picture of the cause of the fault. Ask the machine operators directly, if necessary.
- Document any work undertaken, changed set values, etc.
- Document any amendments/additional information that should be included in the Operating Instructions.

## Systematic trouble-shooting procedure

- Is there an inspection and maintenance book which might provide information about the trend of test parameters (e.g. temperature of hydraulic fluid, replacement intervals of filter elements, noises)?
- Have there been any identical or similar failures in the past?
  - Make a note of causes of failures with a low probability. Only investigate the failure causes you have noted down if all failure causes with a high probability have been proven to be inapplicable.
  - Draw up a list of priorities of the most probable failure causes.
  - Verify these listed failure causes one after the other (by means of theoretical conclusions, disassembly, measurements or tests).
  - Document the causes of failure you have discovered, and note down how you discovered them.

## Trouble-shooting tables



The causes of failure in hydraulic systems can be extremely complex. Therefore, general rules for trouble-shooting can only be laid down to a limited degree.

Please refer to the relevant Operating Instructions for product specific information about trouble-shooting the Poclain Hydraulics hydraulic product.



## Maintenance

### Definitions of terms

The term Maintenance as defined in DIN 31051 encompasses all measures to maintain and restore the desired conditions and to determine and assess the actual condition of the technical devices of a system.

These measures are divided into the following categories:

- Inspection (determining the actual condition),
- Servicing (maintaining the desired condition),
- Repair (restoring the desired condition).

The above measures include:

- Adapting maintenance objectives to suit company objectives.
- Determining appropriate maintenance strategies.

### Safety during maintenance task



**In the interests of safety, please observe all the following safety instructions carefully and at all times.**

- Check safety devices regularly to see that they are working properly.
- Perform all maintenance work properly, completely and within the stipulated periods and make a record of the work.
- Inform all personnel before commencing maintenance work.
- Generously cordon off the maintenance zone before commencing work.
- Inform all persons of ongoing maintenance work by means of the appropriate signs.  
In particular, attach warning signs to the control cabinet, main switch, actuators and points of access.

If you have to switch off the hydraulic product, secure it against being unintentionally switched on again as follows:

- Switch off all drives, disconnect the hydraulics from the mains at the main switch.
- Depressurise the hydraulic product (relieve any pressure accumulators of pressure).
- Secure the main switch against being unintentionally switched on again.

Before undertaking any manual intervention in the Poclain Hydraulics hydraulic product:



**Please refer to the Operating Instructions for all the necessary information on depressurisation and on those parts of the Poclain Hydraulics hydraulic product that are not depressurised automatically.**

- **Advance all cylinders to their safe end position.**
- **Lower all loads.**
- **Switch off all pumps.**
- **Mechanically support vertical cylinders so that they cannot drop. Never perform any maintenance work on raised units without external support.**
- **Relieve any accumulators of pressure in the proper manner.**
- **Switch off the pressure supply and secure the hydraulic product against being inadvertently switched on again.**
- **Ensure that only authorised personnel remain in the work zone.**
- **Wear safety glasses, gloves and boots.**
- **Allow pressure lines and sections of the system which have to be opened to cool down before commencing maintenance work.**
- **Open with care any segments that have to remain under pressure.**

Since check valves are located in the pressure lines above the pumps, the hydraulic system may still be under pressure even after it has been disconnected from the actual pressure supply.

Certain segments, such as servo cylinders, also continue to remain under pressure because the proportional valves remain in the closed position (all valves are illustrated in their basic position in the hydraulics diagram).



Observe the following:

- Only new, interchangeable and tested components, replacement parts and lubricants in original-equipment quality are approved for use/replacement.
- For reasons of safety, the installation of used and/or untested components is strictly prohibited and leads to loss of EU Conformity.

Exercise extreme vigilance when operating the hydraulic product in maintenance mode, which may in certain circumstances necessitate the temporary removal of certain safety devices.

Make sure that all safety devices are properly installed and have undergone a function test before bringing the system (back) into use.

- Perform welding, burning or grinding work on the hydraulic unit or its attachments only with the approval of local safety authorities/fire brigade and with suitable protective covering to prevent ingress of contaminants.
- When performing assembly work above your height, use the steps and platforms provided by the plant operator. Do not climb on any parts of the system.
- Remove all tools and materials needed for maintenance from the hydraulic product.
- Always rectify any leakage from the hydraulic product immediately.
- Always inform personnel before (re)starting the hydraulic product.

## Inspection and servicing

The objective of inspection and servicing is:

- To maintain all system functions along with the initial parameters of the system.
- To ensure continual availability of the system.
- To detect weak points.
- To ensure that the system attains the required service life.



The following general specifications are based on use of the hydraulic product in central Europe and under the usual operating conditions of commercial and industrial plants.

We strongly recommend the use of an inspection and servicing book, in which all work specific to that site, and all inspection and servicing intervals should be defined and documented.

An inspection and servicing book is also helpful in that:

- It provides comparison values to aid with early detection of malfunctions.
- It allows warranty claims to be dealt with more easily.
  - Please observe the requirements for pressure fluids mentioned in 16, "Assembly and bringing into first use".
  - Clean the external environment of couplings/joints and devices before disassembly. Do not use cleaning wool or cloths containing fibres for cleaning.
  - Seal all openings using protective caps.
- Bleed the hydraulic product after each item of servicing work.
- Document and file details of any work undertaken, changed set values, etc.
- Document and file details of any amendments/additional information that should be included in the Operating Instructions.
- Modifications and additions could affect the validity of the EU Conformity Declaration/Manufacturer's Declaration. Always consult Poclain Hydraulics about any proposed modifications or additions.





### Inspection procedures and general test equipment

The following are some of the typical inspection and testing procedures that are regularly used in connection with hydraulic systems and components.



Keep the indicated typical test equipment ready for this type of work.

Type of test	Typical test equipment	Typical testing activities
Pressure measurement	Pressure gauge or sensor with suitable measuring range and connection pipe and connection coupling.	Checking of: - specified pressure, - opening pressure, - pressure difference before and after the object under test.
Visual inspections	-	Checks for: - all components securely seated, - damage, - wear, - leakage (formation of oil droplets), - presence of all warning and informative signs.
Touch inspection	-	Checks for: - unusual local vibrations.
Temperature inspection	Temperature measuring instrument	Checks for: - unusual local temperature zones.
Acoustic inspection	-	Checks for: - changes in running noise of the unit, - changes in flow noise, - changes in operating noise in the unit and valve control.

General information

### Location of testing and measuring points



Please refer to the Operating Instructions for the installation location of filling level indicators, filling points, drainage points, filters, testing points, strainers, solenoids, etc. that require regular inspection and servicing.

### Inspection and servicing plan, electrohydraulic systems

Electrohydraulic systems with proportional valves must be serviced in accordance with hydraulic requirements and strategies. However, technical control components must also be incorporated in these servicing cycles. On this basis, an overall strategy for system servicing must be developed and documented.



The appropriate component characteristics relevant to servicing can be found in the Operating Instructions.

### Inspection and servicing plan: electrics and control system



The product-specific inspection and servicing plan for electrics and control systems can be found in the Operating Instructions.

### Lubrication points, lubricants, intervals



The details of the specified lubricants, lubrication points and associated lubrication cycles can be found in the Operating Instructions.

Industrial valves

Hydraulic power units

### Set values of valves, regulators and signalling elements

Pressure and flow control valves, pump regulators and signalling elements such as pressure sensors, pressure switches, limit switches and temperature regulators are given their optimum setting when the system is brought into first use.

Check regularly whether all values are correctly set with the aid of the hydraulics diagram and the documented values.



The set values of valves with position switches shall only be calibrated or readjusted at the factory.  
The set values of safety valves shall not be altered by the user. Any readjustment shall be performed by authorised testing bodies only.

Too low a pressure difference between the operating pressure and the opening pressure can lead to frequent opening of safety valves. This leads to increased power losses and an unacceptable increase in temperature of the pressure fluid. In this event, select a lower operating pressure.

### Replacement of pressure fluid filters and ventilation filters



**Unfiltered pressure fluid filters lead to increased wear of all the system's hydraulic products and can cause functional failures with dangerous effects. Therefore, always replace contaminated oil filters immediately.**

**Clogged ventilation filters result in inadequate cooling and can therefore cause excessive heating up and malfunctions of the hydraulic system. Therefore, always replace contaminated ventilation filters immediately.**

- Clogged filters must always be replaced immediately. Do not clean clogged filters.
- Allow the contents of the replaced oil filter to drip and fully drain.
- Dispose of the filter in accordance with the applicable regulations.

Exact instructions on how to replace a filter can be found in the Filter manufacturer's instructions for use.

### Checking filters with a contamination indicator

Filters with contamination indicators continuously measure the degree of fouling. The dirt-retention capacity of the filter is utilized to the full.



Check the contamination indicator when the pressure fluid is warm (during or immediately after operation).

If the ambient temperature is low or the pressure fluid is cold, its high viscosity may cause clogging to be indicated, although the pressure fluid is in fact clean.

Procedure:

1. Wait until the hydraulic product has reached operating temperature.
2. Press the indicator button (check function): If the indicator button pops out again immediately, the filter must be replaced by the end of the shift at the latest.

Due to the progressive loss in pressure as the filter becomes increasingly contaminated, the indicator point has a certain reserve capacity, i.e. generally sufficient for a work shift of 8 h.

If the filter is not replaced after 8 h, dirt may penetrate the system, resulting in contamination of the hydraulic product.



**In certain circumstances the contamination indicator does not show a required filter replacement.**

If the check function never indicates filter replacement and the contamination indicator is functioning correctly, this may have the following causes:

- Faulty filter,
- A bypass valve may have been installed and is not closing correctly, e.g. due to the entry of dirt particles.

### Service and storage lives of hose lines



In terms of the service life of hydraulic hose lines in these Operating Instructions, replacement and storage lives are measured from the date of manufacture of the hose line.

Even when properly stored and subjected to permissible loads, seals, hoses and hose lines undergo a natural ageing process.

The replacement and storage lives of seals, hoses and hose lines are therefore limited (see page 15, "Seals, hoses and hose lines").



**Hose lines must be replaced in accordance with the provisions of the servicing plan, even if there are no detectable technical defects in the hose line.**

**Hoses that have already been used as part of a hose line shall not be reused in a hose line.**

**The first use may have changed the properties of the hose material to such an extent that reuse of the hose represents a very high risk.**



### Topping up the pressure fluid



Only pressure fluids specified in the Operating Instructions are to be used.

When changing or topping up the pressure fluid, fill the pressure fluid tank on the hydraulic product as follows:

1. Fill the pressure fluid tank using a special filling unit with an integral filter (min. 10 µm).
2. Drop the system pressure right down by resetting the pump. Set the pressure setting value on the pump pressure control to minimum or zero pressure.
3. Fill and bleed the line system of the hydraulic product from the unit to the cylinder. To do this actuate the cylinder in both directions, see Operating Instructions.
4. Top up the pressure fluid volume to the specified quantity.
5. Raise the pump pressure to the system pressure. The hydraulic product is ready for operation.
6. Carry out a test run.
7. Check the level of the fluid after the hydraulic product has warmed up to the operating temperature and adjust if necessary.



Check the contamination indicator when the pressure fluid is warm (during or immediately after operation). If the ambient temperature is low or the pressure fluid is cold, its high viscosity may cause clogging to be apparently indicated.

### Servicing pressure accumulators



**Pressure accumulators are subject to the national legislation on safety requirements for pressure vessels applicable in the place of installation.**

**Observe the Pressure Equipment Directive 97/23/EC.**



The gas precharge pressure is measured with a testing and filling device. Details of the procedure can be found in the Operating Instructions.

Inspection and servicing:

- Carry out the tests required by law.
- Test and monitor the gas precharge pressure regularly.

### Repair



Repair (corrective maintenance) is the restoring of the desired condition.

In addition, observe the special safety instructions on page 21, "Maintenance" and the safety instructions in the Operating Instructions.



**Ensure cleanliness during all work.**

- Clean the external environment of couplings/joints and devices before disassembly. Do not use cleaning wool or cloths containing fibres for cleaning.
- Seal all openings using protective caps.
- Bleed the hydraulic product after each item of repair work.
- If appropriate, follow the procedure for bringing into first use, see page 17, "Bringing into first use, subsequent bringing into use".
- Document any amendments/additional information that should be included in the Operating Instructions.



## General safety instructions for repair work



**Repair work shall only be done by an authorised hydraulics expert who has the required specialist hydraulics knowledge.**

Specialist hydraulics knowledge means, among other things, that the person can read and fully understand hydraulics drawings. In particular, he must fully comprehend the range of functions of the integrated safety components.

Components may only be dismantled for the purpose of repair to the extent described in the Operating Instructions.

Never repair a defective safety valve. It must be completely replaced.

Faulty parts may only be replaced by new, interchangeable, tested components in original-equipment quality. Any deviations from this can be found in the Operating Instructions. Before each subsequent bringing into use after repair work, the hydraulic product shall be accepted by a hydraulics expert.

The operator of the hydraulic product is required to check by means of a servicing record that the inspection and servicing plan as been complied with.

Pressure vessels have to be pressure tested every 10 years and the information recorded in accordance with the Pressure Equipment Directive 97/23/EC or its implementation in national legislation.

## General information about hydraulic pressure accumulators

### General

The regulations applicable at the place of installation concerning hydraulic pressure accumulators (hydrostatic accumulators) must be observed before bringing into use and during operation.

The plant operator bears sole responsibility for compliance with the existing regulations.

Hydrostatic accumulators are subject to the national implementation of the EU Pressure Equipment Directive 97/23/EC. Documents supplied with accumulators must be preserved with care; they will be required during recurring inspections by specialists.

The bringing into use of hydrostatic accumulators shall be carried out by trained expert personnel only.

**Do not perform any welding, soldering or mechanical work on accumulator vessels.**



**Welding and soldering carry a risk of explosion! Mechanical tampering may cause the vessel to burst and the operating permit will be withdrawn.**

**Do not charge hydrostatic accumulators with oxygen or air. Risk of explosion!**

**Depressurise the system before working on hydraulic installations.**

**Improper installation can lead to serious damage to persons and property.**

### Safety devices relating to hydraulic pressure accumulators

The equipping, installation and operation of hydrostatic accumulators is regulated by the national implementation of the EU Pressure Equipment Directive 97/23/EC and additionally in the Federal Republic of Germany by the Technical Regulations for Pressure Vessels (TRB). This legislation requires the following safety equipment:

- Device to protect against excessive pressure (prototype-tested),
- Pressure relief device,
- Pressure measuring device,
- Test gauge connection,
- Shut-off device,
- Optional: electromagnetically operated pressure relief device,
- Safety device to protect against overheating.



See the Operating Instructions.



## Hydraulic systems

Hydraulic systems are generally intended for installation in machines or systems. In addition to the basic information about the installed components, the information contained in the Operating Instructions made available for each hydraulic system by also applies to hydraulic systems.

By installing the hydraulic system in a machine or system, the interaction of the hydraulic system with the overall machine may give rise to changes in the potential dangers. In particular the effect of hydraulic and electrical control of hydraulic drives that create mechanical movement are to be considered.

This information shall be included in the hazard analysis/risk assessment of the overall machine carried out by its supplier and in the Operating Instructions of the overall machine. This also applies to the specification of the interfaces between the hydraulic system and the overall machine.

Hydraulic systems are subject to legislation including the Pressure Equipment Directive and other relevant EU directives that have been implemented in national legislation. Exact information can be found in the EU Conformity Declaration or Manufacturer's Declaration that is supplied with the hydraulic system or the hydraulic product.

**Before installing a hydraulic system in a machine or modifying an existing hydraulic system in a machine, satisfy yourself that:**



- The hydraulic system is suitable for its application in the machine.
- The ambient conditions in the machine are suitable and/or permissible for the use of the hydraulic system.
- Other installed items on or in the machine cannot disturb or endanger the functioning or the safe operation of the hydraulic system.

If the overall machine is to be used in a potentially explosive atmosphere, then it must be ensured that the hydraulic system has been designed and is suitable for this use.

### *Effects of leaks in the hydraulic system on the machine*

If pressure fluid escapes from the hydraulic system and comes into contact with hot surfaces on the machine, this can lead to the generation of life-threatening smoke, fire and/or other dangerous operating conditions.

These risks shall be determined by the machine manufacturer by means of a hazard analysis and if necessary provision made for the appropriate safety devices.





# INSTALLATION, COMMISSIONING AND MAINTENANCE OF INDUSTRIAL VALVES

## Relating documents

1. ISO 4406
2. ISO 4413
3. DIN 51524
4. VDMA 24568
5. NAS 1638

## General

Before put in to operating of industrial valves, observe the notes in the following data sheets:

- Related data sheet
- ISO standard ISO 4413

## System flushing

With external pilot oil supply, ensure that this connection is also flushed.

The hydraulic fluid volume contained in the system should be flushed through the filter at least 150 times.

A decisive factor for the flushing time is the degree of contamination of the hydraulic fluid according to "Filtration", page 30. To achieve the required minimum cleanliness the hydraulic system must be flushed sufficiently long. This can be ensured only through continuous monitoring using a particle counter.

If the hydraulic fluid is changed over to special fluids that are not compatible or miscible with the hydraulic fluids used before, considerably longer flushing times may be required.

During the flushing process, all filters must be checked at short intervals and the filter elements replaced as required.

## Installation

### *Rules for the installation*

Before installing the valve on the system, compare the type designation of the valve with the order data.

Make sure that the connection surfaces of the valve and the subplate are dry and free from oil.

- Cleanliness:
  - When installing the component, make sure that the industrial valve and the surroundings are clean.
  - The tank must be sealed against external contamination.
  - Pipes and tank must be freed from contamination, scale, sand, chips, etc. prior to the installation.
  - Warm-bent or welded pipes must be pickled, flushed and oiled.
  - For cleaning use only lint-free cloth or special paper.
- Sealing materials such as hemp, putty or sealing tape are not permitted.
- For pipework use seamless precision steel pipes to EN 10305-4.
- The mounting face must feature a surface quality of  $R_t \max \leq 4 \mu\text{m}$  [157  $\mu\text{in}$ ] and a flatness of  $\leq 0,01 \text{ mm}/100 \text{ mm}$  [0.0004 in / 3.94 in] length.
- Fixing screws must comply with the dimensions and the strength class specified in the data sheet and must be tightened at the specified tightening torque.
- As filler/breather filter we recommend a filter with the same mesh width as the filter in the hydraulic system!

### *Valve installation*

When installing the valve, make sure that the mounting face and the subplates are dry and free from oil. If the presence of oil on the connecting faces cannot be avoided, the fixing screws must be tightened manually, not with the aid of power tools. In the case of more than 4 fixing screws, care should be taken that the central screws are tightened first.

This measure ensures that the seal rings seal properly against the valve connection face.



### Installation position

Optional, preferably horizontal for directional valves! For valve versions such as, for example:

- without spring centring of the spool,
- or with solenoids hanging downwards,

other installation positions can lead to malfunction or restrictions with regard to the specified technical data.

In the case of pressure switches with drain port the installation position must be selected so that the max. permissible pressure of 2 bar [29 PSI] is not exceeded.

### Electrical connection

For circuit examples and pin assignments, see the relevant data sheet.

## Bringing into first use

### Hydraulic fluid

Observe the recommendations given in the data sheet! Observe pressure and temperature ranges!

In general, the following fluids can be used:

- Mineral oil (HL; HLP) to DIN 51 524
- Fast bio-degradable fluids to VDMA 24 568
  - HETG (rape seed oil)
  - HEPG (polyglycols)
  - HEES (synthetic esters)

The maximum temperatures recommended by the fluid supplier should not be exceeded. To ensure constant response characteristics it is recommended that the hydraulic fluid temperature be kept constant ( $\pm 5^{\circ}\text{C}$  [ $\pm 41^{\circ}\text{F}$ ]).

### Is the sealing material used suitable?

For hydraulic fluids (e.g. HEPG and HEES) and in the case of temperatures  $> 80^{\circ}\text{C}$  [ $176^{\circ}\text{F}$ ] FKM seals must be used.

### Filtration

- Reliable filtration prolongs the service life of valves.  
Please also observe the recommendations with regard to the max. permissible degree of contamination of the hydraulic fluid according to NAS 1638 in our data sheet.
- The max. permissible differential pressure across the filter element must not be exceeded.
- We recommend the use of filters with clogging indicator.
- Observe strict cleanliness when changing the filter.

Contamination on the outlet side of the filter is flushed into the system and causes malfunction.

Contamination on the inlet side reduces the useful life of the filter element.

### Bleeding

- Bleeding of the valves is not necessary!
- However, to ensure proper operation of the valves, draining of the tank line must be avoided (installation of a precharge valve).

## Maintenance

The valves are basically maintenance-free; since seals are subject to natural wear and aging, they must be replaced as required.

## Storage

Storage requirements:

- Dry, dust-free room, free of corrosive substances and vapours.

When storing for periods of more than 6 months:

- Fill the valve with preserving oils and seal it.



# INSTALLATION, COMMISSIONING AND MAINTENANCE OF HYDRAULIC POWER UNITS

## Relating documents

1. ISO 4413
2. DIN 51524
3. VDMA 24568

## General

Long service life and functional reliability of hydraulic systems and their components depend on correct handling both in stage of installation and commissioning, as well as while in use. These instructions are of a general nature and demand from users their special knowledge in the field of hydraulics and knowledge of the whole machine or appliance has hydraulic system installed.

Ensure trouble-free operation by observing the following points:

- specific installation and maintenance instructions for the relevant components,
- special instructions in individual cases,
- technical data in the data sheet and hydraulics system documentation,t
- ISO 4413 standard – General rules that apply to hydraulics systems.

## Installation

### *Preparatory work for the installation*

Check hydraulic system. Write down any damages that have occurred during transport. Ensure availability of all components of the system. Make sure that the hydraulic system is clean.

### **Clean surroundings**

Keep the hydraulics systems, its components and hydraulics fluid clean or clean them (e.g. pickling after processes have been carried out that involve heat, i.e. welding, hot bending). Take care of contamination and humidity – especially with the tank.

### **Cleanliness of the hydraulic fluids**

Internal protective coatings must be resistant to the hydraulic fluid used in the system.  
Provide new hydraulic fluid.

### **Cleanliness of stored and other components**

The storage of parts that were not filled or treated with anticorrosion fluid can lead to the formation of resin. Solve the resin using a corresponding solvent and renew the lubricating oil film.

### *Carrying out the installation*

In the process of installation use lifting accessories and transport facilities. Do not use force. Transverse forces and tension on pipes and components are not allowed.

The valve mounting surfaces must be undamaged, perfectly even and clean; the fixing screws must be tightened evenly at the specified torque.

### **The pipes**

Take care that pipes are adequately fixed. Use only seamless precision steel pipes. Make sure that you remove plastic shielding plug before use. Deburring and clean the pipes before installation, make sure that welded pipes and pipes that were subject to heat treatment are mechanically cleaned and subject to pickling.

When selecting pipes, hoses, fittings and flanges, observe the correct pressure stage. Do not use hemp or putty as sealing materials, because this may cause contamination of the fluid.

Observe the installation instructions of the pipe fittings' manufacturer. We recommend the use of fittings with elastic seals.

Make sure that hoses are properly laid. Rubbing and abutting of the lines must be prevented below the smallest radius allowed. Observe guidelines of the pipes' manufacturer.



### Hydraulic fluids

Before filling in the fluid, check the cleanliness of the tank and clean it, if necessary. The cleanliness of the new hydraulic fluid does not comply with the requirements for the use in the hydraulic system. Fill oil tanks only through filters, preferably system filters or portable filter stations with fine filters, which adequately clean the fluid.

Provide the prescribed hydraulic fluids:

- Mineral hydraulic oils HLP according to DIN 51524 are generally suitable for standard hydraulic systems.
- When using fast bio-degradable hydraulic fluids VDMA 24568 and very inflammable hydraulic fluids the whole system needs to be specially adapted. In this case please follow special instructions.

When using certain fluid, it is necessary to take under consideration the viscosity of the hydraulic fluid, operating temperature range and type of seals used on the components fitted. Note, that the hydraulic system reaches its full operating capacity with the viscosity of the fluid 16 ~ 100 mm<sup>2</sup>/s, while optimal value is 20 ~ 40 mm<sup>2</sup>/s. Recommended operating temperature range of the fluid is 30 ~ 60°C [86 ~ 140°F].

### Commissioning

When the installation has been carried out correctly, proceed with commissioning and functional testing.

#### Preparations for trial run

Before trial run check and make sure that:

- technical documentation of the hydraulic fluid is available,
- the tank is clean,
- lines are cleaned and properly installed,
- fittings and flanges are tightened correctly,
- lines and components are correctly connected in line with installation drawings and circuit diagram,
- accumulator is filled with nitrogen until the precharge pressure, as specified,



In the process of control and maintenance of the nitrogen pressure in the accumulator use corresponding instrument and follow the instructions for the use of accumulator and the instrument! You can check the filling pressure on the accumulator label and on the hydraulic circuit diagram. Accumulators must comply with safety regulations that apply in the place of installation.

- the drive motor and pump are properly installed and axis aligned,
- components (drive motor, electromagnets/solenoids, switches, measuring instruments...) are connected correctly and to the corresponding voltage,
- the system is properly earthed,
- filters are of the prescribed filter rating and are fitted in the correct direction of fluid flow,
- if the specified hydraulic fluid is filled up to the upper control marking.

#### Trial run

For safety reasons, only professional personnel may perform trial run. Before the run all safety measures must be taken to ensure safety of persons and protection of system components in the process. All safety measures should be followed.

- All pressure relief valves, including pressure controllers of pumps, must be loaded at the minimum pressure. Exemptions to this are pre-set valves, set according to the technical regulations.
- Open isolator valves completely.
- Check the position of the directional valves and, if necessary, move them to the required position.
- Set the control spool to by-pass.
- Suction valve of the pump should be completely open. If required, fill pump housing with hydraulic fluids to prevent damages because of running dry.
- Switch the system on briefly and then switch it off. Check whether the direction of rotation of the drive motor matches the prescribed direction.
- If a pilot oil pump is provided, commission it.
- Start up every pump for a short period of time and listen for any noises.
- Bleed the system. Carefully loosen fittings or bleed screws at high points in the system. When the escaping fluid is free from bubbles, then the filling process is completed. Re-tighten fittings.
- Flush the system. If possible, switch off actuators. Flush the system until the filters remain clean; check the filters! With servo-systems, the servo-valves must be removed and replaced by flushing plates or directional valves of the same size. During flushing, the hydraulic fluid in the complete hydraulic system should reach temperatures that are at least as high as later during operation. It is recommended that longer lines, installed during installation process, are flushed separately with corresponding appliance. During flushing fluid velocity should be high



enough to ensure turbulent stream. Change the filter elements if filter socks are full. Flushing continues until the required minimum cleanliness is reached. This can only be achieved by continuous monitoring using a particle counter.

- Check the system functions under no-load conditions, if possible, by hand. Test the electro hydraulic control at a room temperature.
- When the operating temperature has been reached, test the system under load; slowly increase the pressure.
- Monitor control and instrumentation equipment.
- Check the housing temperature of hydraulic pumps and hydraulic motors.
- Pay attention to abnormal noises.
- Check the hydraulic fluid level in the tank; if required, top up, however note, that the fluid level changes during the cycle.
- Check the setting of pressure relief valves by loading or breaking the system.
- Inspect the system for leaks of fluid.
- Switch off the drive.
- Retighten all fittings, even if there is no evidence of leakage.



Only tighten fittings when the system is depressurized!

- Check if the pipe fixing is adequate, even under changing pressure loads.
- Check if the fixing points are at the correct positions.
- Check if the hoses are laid so that they do not chamfer even under pressure load.
- Test the system for all functions and compare measured values with the permissible or specified data (pressure, velocity; adjust further control components).
- Jerky movements indicate the presence of air in the system. The system is completely bled when all functions are performed jerk-free and smoothly and the surface of the hydraulic fluid level is free from foam. Experience has shown that foaming should have ceased approximately one hour after start-up.
- Check the temperature of the fluid.
- Switch off the drive.
- Inspect filters for residues, clean or replace them. Paper or glass fibre elements cannot be cleaned.
- If further contamination is found in the fluid, additional flushing is required.
- All the adjustments made in the process of commissioning should be documented of a special form.

### *The most common faults occurring during commissioning*

Apart from servicing, correct commissioning is very decisive for the service life and functional reliability of a hydraulic system. The most common faults occurring during commissioning are:

- The fluid tank is not inspected.
- The hydraulic fluid is not filtered before being filled in.
- Lines were not inspected.
- System components are not bled.
- Pressure relief valves are set only considering the operating pressure and the hysteresis is not observed.
- Pressure controllers of hydraulic pumps are set higher or to the same pressure as the pressure relief valve.
- The flushing time of servo systems is not adhered to.
- Abnormal pump noise is ignored, although it shows some imperfections, such as cavitations, leaking suction lines, too much air in the system, etc.
- Transversal loads on cylinder piston rods are not observed (installation error).
- Hydraulic cylinders are not bled and this may cause damage to seals.
- Limit switches are set too low.
- The switching hysteresis of pressure switches is not taken into account when settings are made.
- Hydraulic pump and hydraulic motor housings are not filled with hydraulic fluid prior to commissioning.
- Settings of the system are not documented.
- Adjustment spindles are not sealed and secured from unprofessional personnel.
- Unprofessional personnel performed the commissioning of the system.

### *Restart after longer period of non-use of the system*

It is necessary to follow the same instructions and warnings as with the first run/commissioning.



## Maintenance

Maintenance includes inspection, maintenance in the sense of measures to preserve desired state, and repair. In practice these concepts are not as strictly divided as with definitions. Maintenance should be planned and performed according to the load of the system, consequences of malfunctioning and desired availability of the system.

### Inspection

The term "maintenance" includes measures to recognise and assess the actual situation or to recognise how and why the so-called wear reserve continues to decrease.

The individual points to be inspected for a certain hydraulic system should be summarised in so-called inspection lists.

Important points of inspection are:

- Checking the hydraulic fluid level in the tank.
- Checking the heat exchanger for effectiveness.
- Visual inspection of the system for external leakage.
- Checking the hydraulic fluid temperature during operation.
- Checking pressures in the system.
- Amount and control of leakage.
- Checking the cleanliness of the hydraulic fluid.



Visual inspections can only give an approximation (clouding of the hydraulic fluid, darker appearance than at the time of filling, sediments in the fluid tank) and are not sufficient for detection of the exact actual state of the fluid. The following three methods can be used for establishing the fluid cleanliness: particle counts using electronic counting and sorting equipment, microscopic examination and gravimetric establishment of solids.

- Analyse the chemical properties of the hydraulic fluid.
- Check the temperature at critical points.
- Check the generation of noise.
- Test performance and velocity.
- Inspect accumulator and accumulator stations.
- Inspect pipes and hoses.



Damaged pipes and hoses must be immediately replaced.

### Maintenance

Maintenance includes measures to preserve desired state of the system or to keep its wear during service life. Often it is done in conjunction with inspections. Following maintenance work is important to be performed at least once a week or more frequently, if necessary (e.g. in the process of commissioning, changes in operating conditions).



For safety reasons, do not loosen or remove pipes and hoses, fittings and components, while the system is subject to pressurization loads.

### Maintenance book

We recommend that a maintenance book is created to lay down the parts to be inspected periodically and to note all corrections in the set up of the system.

### Hydraulic fluid level

Continuously during commissioning and shortly after commissioning. Later, at a weekly intervals.

### Filters maintenance

During commissioning every two to three hours, then daily during the first week. Replace filters or filter socks, if required. After 50 hours (at the latest) after the commissioning the filters should be cleaned or replaced.

Suction and air filters require particularly thorough servicing.

After the running-in period, the filters must be inspected at least once a week and cleaned or replaced, if necessary. Filters that indicate they are filled to capacity must be replaced within eight hours of activity after the indication is shown.

### Maintenance of the system fluid

Maintenance intervals depend on the hydraulic fluid condition (e.g. water in oil, age of oil) and on the operating temperature and oil fill.



We recommend that the fluid is changed in dependence upon an oil analysis. With systems whose oil is not analysed at regular intervals the fluid should be replaced every 2000 to 4000 operating hours at the latest:

- Drain the system fluid at an operating temperature and change it with a new one.
- Only fill in oil via filters that have at least the same separation capacity as the filters installed in the system, or use a system filter.

Regularly take samples of the system fluid to have the type, size and amount of particles analysed in the lab. Record the results. If the cleanliness of the fluid doesn't correspond to the one required, it must be additionally filtrated or replaced with a new one. The fluid that was in use for too long and is heavily contaminated could not be improved by adding new fluid.

#### Checking the accumulator for its pre-charge pressure

For this, the accumulator must be depressurised on the fluid side.



In the process of control and maintenance of the nitrogen pressure in the accumulator use corresponding instrument and follow the instructions for the use of accumulator and the instrument! Repairs on hydraulic accumulator may only be carried out by Poclain Hydraulics service personnel.

#### Measuring operating temperature of the fluid

An increase in the operating temperature indicates increasing friction and leakage.

#### Leakage in the pipework

Leakage, especially with under floor piping, represents, apart from loss of fluid, a risk for making floor dirty. For safety reasons, sealing work on the pipes may only be carried out when the system is depressurised. Leakage at points that are sealed with soft seals (O-rings, form seal rings, etc.) cannot be eliminated by tightening as these sealing elements are either destroyed or hardened. Sealing can only be achieved by replacing the sealing elements.

#### Main and pilot pressure inspection

All pressure corrections should be documented in the maintenance book. Frequent pressure adjustments indicate wear of the pressure relief valve.

#### Repair

Repair includes measures to restore desired state and effective performance with normal wear of the system.

#### Fault localization

A precondition for system repairs is systematic fault search. This requires in any case detailed knowledge of the structure and the operating principle of the individual components as well as of the entire system. The required documentation should be available and easily accessible. The most important measuring instruments (manometer, ampere meter, thermometer, electrical millimetre, industrial stethoscope, chronometer, rpm counter, etc.) should also be available in the vicinity of the system, especially in the case of large systems.

#### Fault correction

When carrying out any work, observe strictest cleanliness. Before loosening fittings, clean the surrounding area.

Generally, defective components should not be repaired on site, since for the proper repair the required tooling and the required cleanliness are usually not given on site. On site, only complete components should be changed whenever possible, in order:

- to keep the time for which the opened system is exposed to ambient influences to a minimum,
- to keep the fluid loss as low as possible,
- to ensure the shortest possible downtime.s

Troubles with a certain component may cause harm to the other components of the system. After failed components are located, it is essential to check whether the entire system or parts of the system have been contaminated by broken parts or larger amounts of abraded metal or whether there are any other consequences of troubles.

#### Repair and major overhaul of hydraulic components

Generally, it can be said that only the component manufacturer can carry out major overhauls in the most efficiently and reliably (same quality standard, trained personnel, test facilities, warranty, etc.).

We recommend all interventions in the hydraulic system should only be carried out by Poclain Hydraulics service personnel.



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