General Information

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The "General Information / Installation Guide" contains general information for installing, commissioning, servicing and maintenance of your hydraulic system.

Precisely follow the instructions, in order to avoid malfunction, failures and accidents.

Hydraulic power units, control blocks, valves and hydraulic cylinders are considered as machine elements and therefore are not to be CE labeled.

Content

General Information

Transport

The unit shall only be transported with suitable lifting equipment connected to the designated lifting points. Never attach the lifting equipment to motor or pump. Never lift units at pipes or hoses. It must be ensured that the lifting equipment does not deform the piping system.

Storing

If the system is out of operation for an extended period of time, all parts of the system must be protected from corrosion. Especially in countries with high humidity rust formation might occur inside of the hydraulic components without taking any special measures. Special care shall be taken before starting up a system which has been out of use for an extended period of time. Without the aforementioned special measures oil remains stay in the components after the test run, which resinifies and thus might damage adhesive seals (e.g. shaft seals of pumps) during the first - even minor - movements; as well as it might inhibit movements (e.g. in valve pistons) in general. Also, the pumps might run dry. They must be filled up prior to the initial operation as they have to be filled prior to the first start-up of the system.

Placement

During the configuration of the system, the consulting engineer has been questioning you in detail about the specific operating conditions and the installation site. Based on this information the system was designed to meet those requirements. In the subsequent operation of the system often new or additional requirements arise that lead to more extensive measures. To ensure the undisturbed operation of the system the following instructions should be followed in any case.

1. Place the unit on an even surface and align it horizontally. Chose a set up that makes the system easily accessible for maintenance (filter changes, fluid filling, pump replacement, etc.).

2. Please take care of a sufficient cooling air supply for the motor.
3. Your consulting engineer will give you technical support for the following additionally necessary measures:

   - installation of a cooling system
   - covering the unit with a sound insulating cabinet
   - Retrofitting of finer ventilation and pressure liquid filters

4. Provide a streamlined installation of all outgoing and incoming lines and their adequate fixing (see below).

5. Securely mount the unit to the standing surface with suitable means - unsecured units may start to move around when in operation.
6. **Please be aware of any applicable regulations of the local authorities.**

Connecting Pipes and Hoses

The pipes and hoses of the unit have to be connected to the machine by well-trained hydraulic technicians. The pipes and fittings shall comply with the pressure level for which the unit is designed. All piping must be secured by exactly fitting clamps which do not put any unnecessary pressure on the piping. The piping must be short and as straight as possible. The use of unnecessary elbows and bends shall be avoided - if possible, bends or tubes curved on suitable mashines shall be used. The number of fittings must be kept as low as possible - any union bears the risk of leakage and provides an unnecessary flow resistance. The piping diameter must match the specifications stated on the circuit diagram. The use of pipes with an inner diameter that is too small or pipes that are longer than necessary results in an increased flow resistance and pressure losses, which affect the performance of the entire system.

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Cleanliness

All pipes used for the oil hydraulic system must be absolutely clean and completely free of rust and dirt. After the installation, they must not be welded or soldered.All pipes must be assembled carefully, accurately and free of tension according to the installation specifications of the manufacturer. All sharp edges and burrs at the pipe ends must be removed. If threaded fittings are sealed with liquid sealant, it hast to be ensured that the end of the thread remains free of sealant to prevent particles of the cured sealant from entering the system. The attached plugs at the connections of the unit must only be removed immediately before connecting the respective pipes. This helps to maintain the cleanliness of the unit.

Initial Setting up of the System

The control unit has to be switched off while these operations are carried out!

Electrical Connection

It has to be checked whether the electric motor and other electro-hydraulic components for voltage and current match with the electric power supply. After connecting the electric motor the direction of rotation must be checked. For this purpose, the pump must be primed with oil. Then the direction of rotation is determined by briefly switching on and monitoring of the motor fan. The right direction of rotation is indicated by a direction arrow at the electric motor (fan housing or flange) or the bellhousing.

Rotating in the wrong direction for more than a few seconds leads to running dry of the pump, which causes severe damage to the pump. After the system has been out of operation for an extended period of time the instructions of the "Storage" section have to be followed before switching on the hydraulic power unit. The relevant provisions competent authorities must be strictly observed.

Pressure Accumulator

Prior to the initial operation of the system gas-filled accumulators have to be set to the correct gas pressure - if not already carried out. Unless otherwise stated, nitrogen is used as gas medium. The position of the vent valves and shut-off valves must be checked according to the circuit diagram.

When filling, assembling and maintaining the accumulators, it is essential to proceed according to the guidelines of the manufacturer. If a hydraulic assembly has to be carried out on a hydraulic system with accumulators, it must be ensured that all accumulators are completely drained.

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Filling of the Installation

Cleanliness

The hydraulic fluid is the "lifeblood" of the system - therefore you should treat it as carefully as possible. Be paricularly sure that you use the correct fluid and do not be fooled by the outer appearance of the fluid! Invisible particles of dirt can cause fatal unit-breakdowns. Even very fine-grained dust, which is not visible to the naked eye, is quite capable to cause a premature wear of the pump and the control components and thus to interfere with their function.

Regarding cleanliness, rather do too much than too little.

It is important to consider that fresh oil is never clean and free of water even if it originates from newly delivered container. Make sure that the filler neck and the equipment used for the decanting are scrupulously clean. Wherever possible you shall use a pump unit with fine filter for transferring. At least you should fill the unit through the built-in tank return filter. Under the air breather you usually find a coarse sieve, the mesh size of which can only retain the roughest particles of dirt. Especially for sensitive valves this is definetely not sufficient for filtering!

Rinsing the System

Before the system is put into operation with full operation pressure and full operating speed, all parts must be thoroughly rinsed. Whenever possible, the same kind of fluid shall be used which is later used for normal operation.

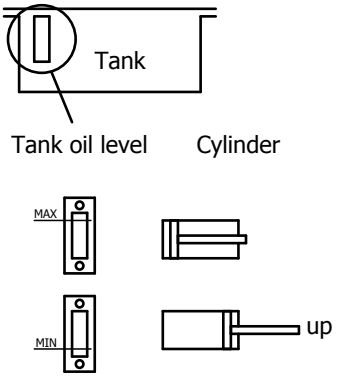
This is especially important for pressure fluids with water fractions.

In every brand new construction, as carefully as it may be built, most dirt particles are found in the piping system. For the rinsing process the load ports are bypassed with hose connections and sensitive valves are replaced by rinsing plates. Optionally, the rinsing process can be accelerated by installing filters into the hose bypasses. If it is necessarry to use the pump of the hydraulic system for the rinsing process, it has to be ensured that the pump only sucks in clean liquid and that the operating pressure is as low as possible. If a rinsing fluid is used, this must be compatible with the pressure fluid later used in the system. If the usual pressure fluid is already used as rinsing fluid, it should remain in the cleaned system because another changing of the fluid could insert new contamination into the tank and the system. While rinsing, be sure that the filters are not situated in the bypass flow.

It is essential to insert new filters after rinsing!

Fluid Level

During the initial operation of the system the fluid level will decrease as the fluid fills the whole piping system of the unit. Therefore, pressure fluid must be refilled as soon as possible. Because the system takes up more oil with extended piston rods than in the retracted position, fluid only shall be refilled while all piston rods are in a retracted position. Watch the fluid level very carefully when initiating the operation and refill hydraulic fluid in time. The pump running dry will cause serious damage very quickly! In addition, the fluid level should be checked at regular intervals during the subsequent operation of the system. The fluid level may not fall below the lower mark of the oil level inspection glass.



General Information

Pressure Fluids

Hydraulic Oil

The pressure fluid in a hydraulic system must possess a number of properties to provide a reliable operation of the system for a long time. It is recommended to only use the pressure fluid which the manufacturer of the unit has provided. Information about the intended pressure medium is to be found in the technical documentation or on an oil label on the unit. The degree of viscosity which the oil used in the system should have depends on the condition of the unit itself, on the starting temperature and finally on the resulting operating temperature. In general, the kinematic viscosity of the fluid at operating temperature shall be between 13 to 55 mm2 / s (cSt). Store the oil in enclosed rooms and clean environment, preferably at normal indoor temperature to prevent condensation. Oil barrels should not be stored upright, because dirt can easily accumulate on the barrel lid and could enter the barrel when the bunghole is opened.

Flame Retardant Hydraulic Fluids

If your unit is designed for the use of mineral oil, a conversion to a flame-retardant fluid is impossible without major changes (to be considered in particular: the limitation of the maximum operating pressure). Conversely, systems which are designed for the use of flame-retardant fluids cannot operate with a fluid based on mineral oil.

To avoid foaming of the pressure medium and the resulting severe damage to the hydraulic components, especially the pumps, different hydraulic fluids may not be mixed without a previous consultation of the supplier of the unit.

According to their composition the fire-retardant fluids can be divided into the following groups:

1. Oil-in-water emulsions, HFA (HS-A)
2. water-in-oil emulsions, HFB (HS-B)
3. solutions of polymers in water, HFC (HS-C)
4. anhydrous synthetic fluids, HFD (HS-D)

If water-containing liquids are used, the water content must be inspected regularly.
If you intend to use a flame-retardant fluid, seek advice from your consulting engineer regarding the selection of the fluid that shall be used. It is advisable to place a table with instructions concerning the filling (e.g. oils, filtering instructions etc) close to the oil filling site and close to the unit itself.

Starting up the system

Preparations

1. Check the oil level in the tank
2. If there are any shut-off valves in the suction pipes, they have to be opened completely
3. Remove all transport locks from the tank vent
4. Prefill the pump housing with clean hydraulic fluid
5. **Make sure that the system can be started up reliably and that no operator stays in dangerous areas. This should best be conducted with the control unit switched off.**

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Start

1. During this work constantly watch the oil level in the tank and refill if necessary.

2. Briefly switch on the electric motor then switch it off again. In doing so, check the direction of rotation (see above).
3. If no automatic vent is installed, the fittings at the pressure side of the pump should be loosened or vent valves should be opened so that the pump can start easily and the air can escape from the pump housing.

4. Let the movable parts of the system move at a low pressure and with almost closed throttle valves by operating the directional valve with the manual override to avoid any damages to the machine through possible mechanical collisions.

5. Each movement has to be operated manually and separately for as long as all air has escaped to the tank. If the system does not vent itself (no steady and smooth movements occur), the cylinders and hydraulic motors must be vented directly by hand.

6. This is carried out either via the venting plugs or by gently loosening the supply line until the fluid at the venting point escapes entirely bubble-free.

7. Let the system run at low pressure for a while.

8. Switch on the control unit and skip to automatic mode.

When all tests are successfully completed and the hydraulic fluid has reached its operating temperature, the system can be set to the specified operating parameters:

1. Turn on any existing cooling system and check their proper functioning.

2. **Set the pressure valves to the lowest value, at which the system operates satisfactorily. If the system is somewhere fitted with a variable displacement pump or control pump and pressure relief valves, the pressure value at the relief valves must be at least set 15% higher than the pump pressure. Otherwise it would result in an excessive, dangerous heating of the hydraulic fluid.**

3. Recheck the oil level in the tank and refill if necessary.

4. Once the operating temperature has reached its normal value (usually %0- %1 ° C), all fittings and brackets have to be tested and tighten if necessary. (Mind the guidelines of the connection manufacturer.) During transportation and installation, parts might have come loose.

5. Bypass filters and full-flow filters have to be cleaned or replaced more frequently during the first months of operation. Thereafter, at intervals that result from experience.

6. For sensitive hydraulic systems with proportional or servo valves fine filters with a large dirt-holding capacity are recommended for the initial period.

7. Write down times, temperatures and other parameters of the normal operation worth knowing for the future maintenance of the system.

8. After the pressure values ??have been read, any existing shut-off valves of the manometer should be closed. This extends the lifespan of the manometer.

Fault Causes and Troubleshooting

Noises, Cavitation

If all the above information and provisions have been followed during the initial setting up of the system, the hydraulic system should now work according to your specifications. On the following pages you will find information on malfunctions and incidents are listed, which can occur at some point during the operation of the system.

In most cases excessively loud noises in a brand new system are due to:

1. Air pockets in the hydraulic components, especially the pump.
   - After a short period of time the trapped air reaches the tank via the system, where it can outgas and the noises will be minimized or eliminated.
2. As a result of poor ventilation air bubbles stay in the pump housing or the regulators.

   - Venting the system again.
3. Leaking suction pipes. This is especially critical if a suction filter exists.

   - first check the pipe connections. For a preliminary examination viscous grease can be applied to suspicious areas. This causes a temporary sealing.
4. The fluid level in the tank is too low. Therefore, air is sucked in.
   - Refill.

Cavitation (explosively expanding air bubbles) in the pump also causes noises. Most common reasons are:

1. The viscosity of the pressure fluid is too high. For example, this is also the case if the unit has to start at a very low oil temperature.
   - perhaps provide heating
2. The viscosity of oil-in-water emulsions might be adversely affected if ratio between oil and water is not suitable.
   - check and adjust
3. Local constrictions of the suction line, such as partially closed valve, too strong springs in the non-return valve, damaged pipe or defective hose
   - check, fully open the valve, replace.
4. Clogged suction filter
   - clean or replace
5. Failure of pressure fluid supply (for non self-priming pumps)
   - repaire
6. Ventilation filter of the tank is dirty or transport plugs are not removed
   - clean or replace, change, remove
7. Suction line is too long, wrongly dimensioned or mounted with too many bends

   - correct

Warped pipes or pipes mounted under tension can also cause noises. Loose brackets sometimes produce a rattling which is difficult to localize. To decouple the vibrations generated by the pump the pressure, tank and drain hoses should lead from the unit into the piping system. Incorrectly adjusted pressure relief valves are other possible sources of noise. Heavy blows in the piping system when stopping a movement are usually caused by pilot-operated non-return valves. These can either be replaced by holding valves or a shock absorber can be integrated into the system.

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Foaming of the Pressure Fluid

1. Liquid level in the tank is too low, causing suction of air
   - Refill.
2. Return pipe ends above the fluid level
   - refill or extend the return pipe
3. Wrong pressure fluid or mixture of different fluids
   - fill in correct fluid and rinse system thoroughly
4. Air intake via shaft seal (particularly with gear pumps)
   - renew

Mechanical Vibration

1. Misaligned motor and pump shaft
   - correct
2. Pipes not sufficiently fixed
   - tighten or retrofit

Pressure Faults

1. Check the pump's direction of rotation
2. Check wether the procedure of starting the pump has been correctly executed and whether the settting of the system pressure relief valve is al least 15% higher than the pump pressure.
   - do the correct setup
3. Pumps can only produce pressure if a resistance is opposed to the pressure side of the oil flow. Check whether valves with open center position are used, through which the oil flows back to the tank with almost no pressure.,
   - make sure that no oil can flow directly back into the tank and then check pressure
4. Check the valve for unpressurized flow
   - must be closed
5. One or more valves are not working properly. Often caused by in the pressure or directional poppet valves
   - Extensive troubleshooting by experts. Request the assistance of your local dealer.
6. Defective hydraulic cylinders, oil flow passes the piston seal to the pressureless side
   - check, replace the piston seal
7. Make sure that you read the pressure at the right place of the system

Flow Faults

1. Wrong direction of rotation of the pump
   - check electrical connections
2. Broken clutch
   - replace
3. adjustment mechanism of control pumps is stuck
   - repairing pump
4. Controller does not work properly or is not properly set
   - correct, request the assistance of your local dealer
5. Hydraulic fluid flows directly to the tank because of incorrectly set pressure valves
   - check and adjust

General Information

Temperature Faults

1. If a water-oil heat exchanger is installed, the water flow has to be checked. The water outlet pipe should feel warmer than the water inlet pipe. The oil outlet pipe on the other hand must be colder than the oil inlet pipe.

2. If the system is equipped with an air-oil heat exchanger, check that the direction of rotation of the fan is correct and the air ducts are not blocked.

3. The oil pressure can be unnecessarily high
   - check that the settings of all pressure valves correspond with the specifications of the hydraulic circuit diagram

4. Any existing accumulator unload valves do not work properly or are not set correctly.

   - check and correct

5. If the system operates with a control pump and additional pressure relief valves, the value set to the pressure relief valves must be at least 15% higher than the pump pressure.

6. Overheating due to increased leakage oil in a worn pump

   - repair the pump

7. Verify that the viscosity of the oil meets the specifications

8. Liquid level in the tank is too low, causing suction of air

   - Refill.

9. file of the pressure lines is too small
   - correct

General Information

When changes occur in the calculated operating parameters such as:

- increase of the machine cycle
- increase of the system pressure
- increase of the flow volume
- upgrades to larger pumps, motors, accumulators, cooling or filter units

it is absolutely essential to check whether the other system components meet the increased requirements. If necessary, request the support of your local dealer.

The decrease of the fluid level in the tank may also be caused in leaking fittings.

Therefore, continously check the system during the initial start up period - later in regular intervals - to early detect oil leakage in inaccessible areas.

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Routine Maintenance

The use of a log book and a fixed maintenance in specified intervals are highly recommended. For this purpose, diagnostic systems recording flow, pressure and temperature and either print measuring strips directly or transfer the measurement values ??to a computer for storage are very useful tools. Ask your local dealer.

The following list contains suggestions for regular checks to be carried out:

1. Cycle time of the machine
2. Operating temperature of the hydraulic fluid
3. Readings of the different manometers
4. Unusual noises
5. Regular measurements of the leakage oil of the pump under same pressure and temperature conditions for the determination of reference values. Changes in the amount of leakage oil provides information about the status of the pump.

Significant deviations from the normal values ??related to these five points can be grounds for further investigation of the causes of malfunction and for the initiation of maintenance or repair measures.

Overhauling the System

If the routine maintenance inspections reveal after several years of operation that the performance of the system no longer meets the specified normal values, a thorough overhaul should to be considered.

This also gives the opportunity for a truly thorough cleaning of all equipment, especially the inside of the tank. The use of a flat plastic scraper is recommended for cleaning flat surfaces.

If cloth was used, cloth fibres could remain on the cleaned equipment, which could lead to considerable malfunctions later.

It is advisable to get in touch with the nearest office of the manufacturer prior to the overhaul, to get advice from him during the maintenance and for the replacement of probably defective or worn devices. In this context, new seal kits shall be used. After several years of use seals cannot ensure flawless functioning due to hardening. It should be also watched out for worn or cracked tubing in the piping system and other rubber parts and they should be replaced if necessary. When reassembling the system and the hydraulic equipment, the relevant regulations have to be observed. In any case, it has to be ensured that the hydraulic components are completely clean on the inside. Before the next use of the system it has to be treated just as before the first setting into operation (from page 2).

General Information

Precautions

Always act with caution when starting or maintaining the system. The following points should be brought to mind once again:

- Accumulators must be completely pressureless before the pipe system is opened or control components are removed.

- Loads that can fall down or move uncontrolled when control or piping components are removed, must be supported or wedged.

- If it is impossible to discharge the residual pressure in parts of the piping system (e.g. between the cylinder and a pilot-operated non-return valves or load holding valves or pilot-operated directional control valves), the pressure has to be released by a slight loosening of the corresponding pipe or hose. It should be regarded that especially the modern conical fittings can stick in the opposite port. By tapping against the tube or the hose fitting the connection can be loosend. Under no circumstances may the fitting be opened until the pressurized oil itself pushes the connection apart!

- Before starting any work on the system it must be ensured that the electrical current is turned off and the controllers are blocked.

- As long as the system is being worked on, appropriate signs need to call attention to the ongoing repair work clearly so that no one will unknowingly set the system into operation.

General Information

Spare parts and their storage

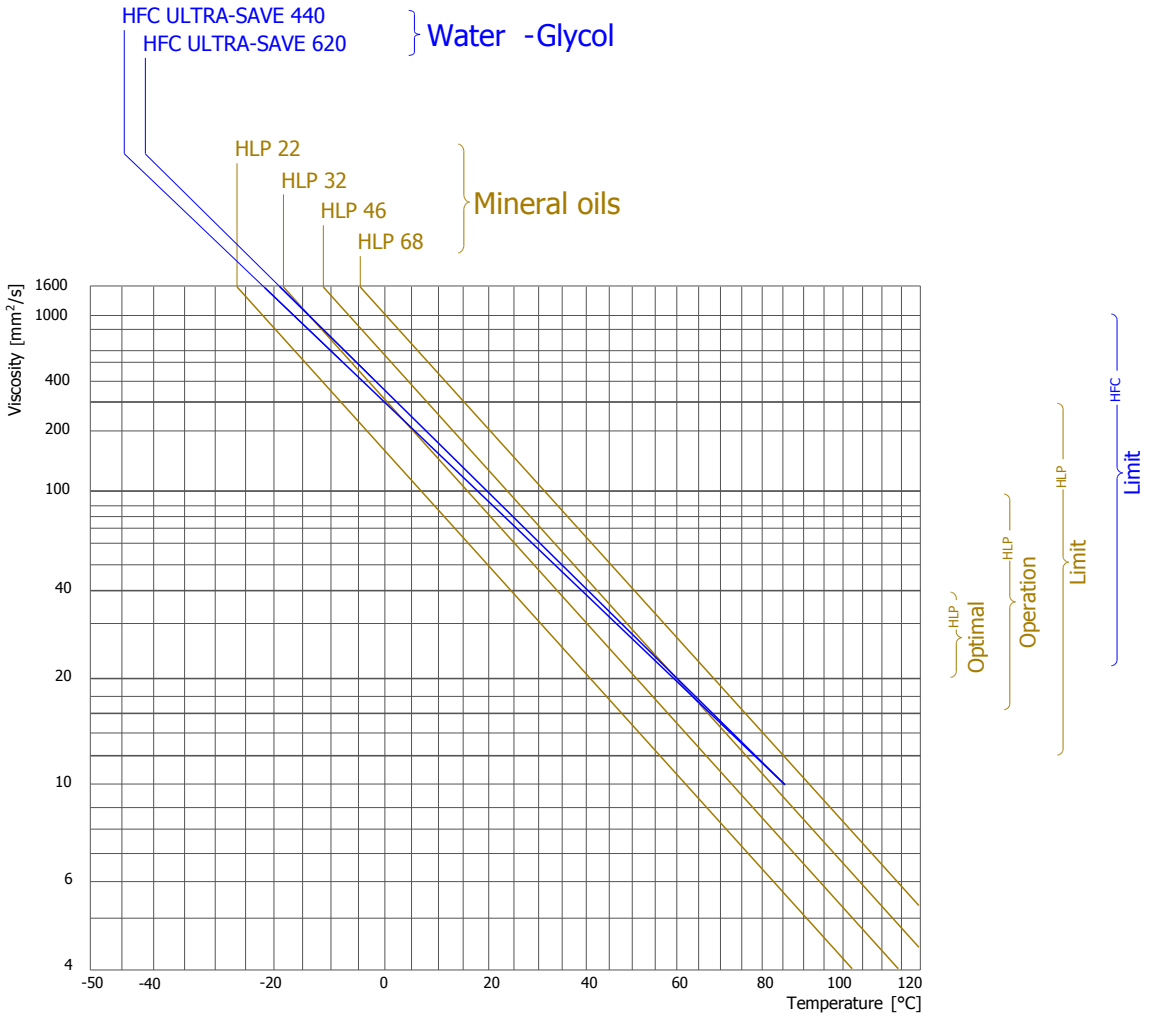
The hydraulic components are dimensioned in such a way that a complete filling with the medium, i.e. mostly in the installed condition, is required to achieve the longest possible service life.

Control system that guarantee a timely reaction for the spare parts acquisition are normally the standard in state of the art hydraulic systems.

The standard storage of hydraulic components for a longer duration is not recommended. If absolutely required, then only under certain storage conditions that are not standard. We would need time, environment and ambient information for these cases.

The 2 times storage of ventilation, return flow and pressure filter elements is recommended for the first commissioning. These are mainly contaminated during the connection of the actuators and the equipment due to the installation of the pipelines and they will be cleaned for the first time during the commissioning. This first flushing of the system usually results in an immediate contamination of the filters. The automatic filter monitoring results now in a standstill of the system. The contamination intensity is not known and therefore we can only make the recommendation that a 2 times storage is adequate if most cases.

General Information -Hydraulics



Overall

The hydraulic fluid is an important component of a functioning hydraulic system. It fulfils the following essential tasks:

- Force transmission
- Wear protection or wear reduction
- heat dissipation

The importance of the fluid can be seen from the following statement: Statistical data indicates that about 80% of all hydraulic component malfunctions are attributable to a lack of hydraulic fluid. The selection and maintenance / monitoring of hydraulic fluid for a hydraulic system plays a significant role. The most important criteria for this selection are listed here below.

General Information -Hydraulics

Power transmission

The most important measure of the force transmission behaviour of a fluid is the bulk modulus EÖl, specified in bars. It describes how much the volume of a liquid filling decreases with the application of pressure. A "hard" hydraulic fluid (higher bulk modulus) transmits pressures very quickly and makes a stiff hydraulic system. This is particularly desirable in controlled drives. "Stiff" systems can be achieved by small pressurised volume, hard walls (pipes instead of hoses) and high viscosity fluids. In addition, the bulk modulus increases greatly with the pressure. A soft hydraulic system is more prone to oscillations, but it is usually quieter, because high-frequency pressure fluctuations are better absorbed. The proportion of air in the fluid also has here a significant influence. Mineral oil contains 9% dissolved air at atmospheric pressure. If a portion of this air exits as air bubbles from negative pressure in the hydraulic circuit (suction side of pump from flow resistance or turbulence in the container caused by high back flow speed), the stiffness of a system significantly reduces and can be the cause of many problems.

The viscosity of the fluid has a large influence on the dynamic force transmission.

A high viscosity meaning thicker oil impairs the flowability and results in:

- higher pressure losses in pipes and flow-through components
- deterioration of the hydraulic-mechanical efficiency
- deterioration of absorbency, spillage, air leakage from the liquid

- inadequate filling of sealing and sliding gaps causing increased wear.

Viscosity which is too low has the following effects:
- Increased leakage over the gap seals in pumps and valves
- Thinner lubrication film leads to a higher tendency to wear at the slide and rolling bearing locations.

For these reasons, greater attention should be paid to the choice of viscosity and viscosity-temperature behaviour.

Selection criteria are:
- Design of hydraulic pumps and motors
- Operating pressure, operating temperature (and range)
- Ambient temperature (and range)
- Length of pipelines

The following limits apply:
- optimum operating range with regards to economy, efficiency and operational reliability v opt = 20 - 40 mm 2/s
- Operating range for full functionality v operation = 16 - 100 mm 2/s

- Operating limit range for limited load (speed, pressure, switch-on time) v limit = 12-300 mm 2/s

- Lower intrinsic viscosity, onset of harmful mixed friction, short-term at a max. 50% rated pressure v min = 8 mm 2/s
- maximum starting viscosity limit of suction for pumps, short-term at optimal suction line duct v start = 800 mm 2/s

- The recommended temperature range (fluid temperature) for the operation of a hydraulic system is between 30 °C and 70 °C. The lower limit of -30 °C and the upper limit of +90 °C must not be exceeded.

General Information - Electrical

Preface

The electronics must only be connected by qualified and trained personnel. Adherence to the relevant VDE regulations and other responsible institutions is mandatory.

Initial Setting up of the System

Before connecting the electronics it must be ensured that the supply voltage and the control voltage are in accordance with the voltage specified in the documentation. All systems must be disconnected from electricity and afterward secured against switch on before the wiring work is started. After a longer standstill of the system, it is mandatory to adhere to the additional notifications for storage in the respective product manual. The system must not be switched on or off in intervals that are too short if frequency converters, soft starters or similar components are installed. Details can be found in the manual of the respective product.

Operation

The intended and smooth operation is guaranteed if all items listed in this documentation are observed. Should operational failures occur nonetheless, then please adhere to the item "Possible operational failures".

Possible operational failures

Fault pattern	**Possible causes of faults**
System does not start up, components do not receive current.	Power supply not connected. Safety elements not switched on.
System does not start up, components receive current.	Release for controllers is not available. Controller not correctly programmed/configured. Failure of the bus communication. Supply voltage too low.
System starts up, motion NOK.	Control system not correctly set up. Supply voltage too low. Mechanics NOK

Servicing- and maintenance notifications for electric motors

"Electric motors are not without servicing and maintenance; the usual servicing and maintenance routines are to be carried out by the customer; general notifications on the servicing and maintenance of electric motors can be found on the manufacturers nameplate-/ rating plate on the equipment or on the websites of the manufacturers of relative electric motors"

General Information - Electrical

Storing

When storing the system, ensure that the environment is dry and free of dust. In most cases, the temperature should be between -10°C and +60°C without the possibility of bedewing. Detailed information can be found in the respective product manuals of the manufacturers.

Re-commissioning

After the re-commissioning after storage times or shutdown times of ≥1 year, it is mandatory to consult the manuals of the electrical operating resources. Especially the power electronics. Otherwise, the system may be damaged.

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