

Initial Start Up and Maintenance

1. GENERAL

Trouble-free operation of any machine or installation depends upon the manufacturer's Operating and Servicing Instructions being complied with. Hydraulic installations can be of the most varied design and construction and, as integral components of machines, are covered by a whole range of different Operating instructions. It is true that general Operating and Maintenance instructions for hydraulic installations can give valuable pointers and advice; these, though, must be extended by special instructions in individual cases.

2. TASKS

The tasks included in the initial start up and repair of hydraulic installations are given in the overview Table 1.

Table 1

Initial Start Up	Maintenance		
	Inspection	Servicing	Repair
<p>Defined: Initial operation of a new installation, or resuming operation of a closed-down installation</p> <p>Actions: Installation, oil fill, bleeding, venting, basic setting, run-in</p>	<p>Defined: Checking the conditions and correct functioning</p> <p>Actions: Observation, measurements, test run</p>	<p>Defined: Maintaining the correct functioning, reduction of wear, replacement of fast-moving parts</p> <p>Actions: Cleaning and replacement of components (oil change, filter elements, seals, and gaskets)</p>	<p>Defined: Troubleshooting and repair of defects and damage</p> <p>Actions: Successful troubleshooting necessitates the ability to combine and to analyze logically</p> <p>Repair by replacing defective components</p> <p>Repairs of defective components by the manufacturer</p>

3. POINTERS ON WORK CARRIED OUT DURING INITIAL START UP AND MAINTENANCE

For reasons of safety, line connections screw fittings and units **MUST NOT** be loosened or disconnected while the system is under pressure. Before such steps are taken, the load is to be lowered, the pumps switched off, and the pressure accumulator relieved. Do not work with oily or greasy hands.

Maintain a clean working environment when performing any work on any hydraulic system. Dirt is the worst enemy of every hydraulic installation. Before loosening and disconnecting screwed fittings, the installation in the vicinity is to be cleaned, and all openings closed by caps to ensure that dirt cannot enter the system. The use of cotton waste is to be avoided when cleaning oil reservoirs. When filling the system, the oil must be poured through a filter.

Damaged pipes, tubes, and hoses are to be replaced immediately. In such cases, attention must be paid to the correct pressure stage (wall thickness, material). Only seamless, precision steel tube or pipe is to be used. When fittings are replaced, the correct pressure stage must also be observed.

When replacing units and devices, care must be taken that the type-designation is correct. When fitting or assembling, the correct tightening torques must be used. Seals rings must always be replaced and never used twice. Adjustable valves and pump controls are to be reset.

When nitro-based paints are applied by spray or brush, all elastic seals, as well as the bearings and mountings of moving parts, are to be masked to protect them from the paint.

4. INITIAL START UP

With mobile installations, the mounting and the pipework connection of the hydraulic components is carried out by the manufacturer, as is the initial start up.

It is often the case with stationary installations that pre-assembled units or sub-assemblies are delivered. Sometimes, the initial start up is then carried out by the machine manufacturer, and often, it can only take place at the final set up location.

Taken individually, the following points are to be observed upon initial start up:

- **Visual inspection** for transport damage and contamination
- **Setting up and fitting** of aggregates and sub-assemblies. Connection of the hydraulic installation to the machine. With piping and hose installations, the longer lines are to be flushed through.
- **Electrical installation** for the drive and for the controls is only to be carried out after the connection specifications have been checked (wattage, etc.). If necessary, connect the coolant supply. Check the correct direction of rotation of the pumps before switching on.
- **Filling the reservoir** with the specified (or equivalent) hydraulic fluid. In order to guarantee the trouble-free operation of the installation, it is absolutely imperative that the appropriate hydraulic fluid is used, and above all, that its viscosity is correct.

Keep the area close to the hydraulic installation clean! Before opening, always clean the filler opening plug or screw cap on the storage vessel or transportation vessel from which the hydraulic fluid is to be taken. Check the oil reservoir for dirt and, if necessary, also clean before opening and filling.

Check that the hydraulic fluid has not been contaminated with water. When filling or topping off, never remove either the filter strainer from the filler opening spout or the filter element. Wherever possible, always use a filling device which incorporates a special filter. Observe the marking for maximum fluid level.

- **Filling the pump housing** (in the case of piston-type pumps)
- **Opening the valves on the suction lines**
- **Setting the valves**
With variable capacity pumps, adjust the pressure control valves, flow control valves, and pressure compensators to as low a setting as possible. Set the directional control valves to their at-rest position.
- **Charge the accumulators** to their specified pre-charge pressures.
- **Check the correct direction of pump rotation** by briefly pressing the electric motor start button so that the motor only turns a few revolutions.
- **Bleed the system** at the load lines, as far as possible at the highest points. Operate the directional control valves and allow the loads to move in and out a number of times. Only increase the load

slowly. Increase the setting of the pressure control valves and/or pressure compensators. Bleeding has been completed correctly when no more foam appears in the reservoir, when all load movements are smooth and free from jerks, and when no abnormal noises are present.

- **Check hydraulic fluid level**
If necessary, top it off after bleeding has been completed.
- **Final valve setting and placing the machine in operation**
This is to take place in accordance to the manufacturer's instructions. No generally valid statement can be made in this respect. Adjustments are made at the pressure control valves, pressure switches, flow control valves, pump controllers, switch settings, etc.
- **Monitoring the operating temperature**
Observe the operating temperature of the machine. After it has been running at full load for a number of hours, the final operating temperature should not have risen above 70 degrees C. If it has, ascertain the cause, check the cooling equipment.
- **Repairing leaks**
It is usually sufficient to tighten suspect fittings after the installation has been running for a number of hours.
- **Clean the filters** (or replacing filter elements)
Experience has shown that the largest amount of contaminant is trapped within the first few hours of operation.

5. MAINTENANCE

5.1 Inspection and Service

Whereas the inspection of an installation is restricted to checks and tests using measurements and observation, the servicing of an installation also includes the cleaning work which is necessary, as well as the replacement of certain elements (oil change, filter element change, etc.).

Generally, the manufacturer of the machine specifies the scope and the intervals between inspections and servicing. These are laid out in an appropriate table or chart. The most important points for a hydraulic installation in this respect are combined in Table 2 (the intervals given depend, of course, upon the mode of operation, i.e.: multi-shift operation).

Table 2

Components:	Continuously or Daily	For the First Time After Operating Hours	Weekly	Monthly	Every 6 Months	Annually
The hydraulic components not listed here, for instance, pumps, valves, etc., are not usually subject to inspection and servicing regulations (the manufacturer's instructions are binding here).						
Accumulator Check the gas charge pressure		10-50			x... ..x	
Reservoir Check the hydraulic fluid level Monitor the fluid temperature Check for leaks Take a fluid test sample Change the fluid	x x x	50			x... ..x x... ..x	
Filter Monitor the level of contamination indicators Clean or replace the filter element Clean or replace the air breather element	x	10-50		x... ..x x... ..x		
Drive Check the couplings between the drive motor and the pump (running noises)					x... ..x	
Valves Check the settings of the pressure and flow control valves		10-50		x... ..x		
Signal Elements Check the settings of the pressure switches and the positions of the limit switches		10-50		x... ..x		
Cylinder(s) Visually check the piston rod and the scraper rings Clean and grease the suspension points				x... ..x		

Given below, are a number of useful and practical pointers regarding the inspection and servicing work.

Hydraulic Fluid Sample

The water content can be checked by pouring the hydraulic fluid sample into a test tube. After a certain period of time, the water collects at the bottom of the tube. If the fluid is cloudy, this also indicates that water is present. The hydraulic fluid turns a dark color due to contamination through foreign particles or from oxidation. Discoloration can be judged by comparison with the original oil. It is also possible to reach a judgment upon contamination and oxidation by placing a drop of oil on blotting paper. If it is necessary that a more precise examination of the hydraulic fluid must be made, oil samples can be sent to the manufacturer (laboratory tests).

Hydraulic Fluid Sample

The ideal temperature for the hydraulic fluid is about 122 degrees F (50 degrees C). It is quite common in practice, though, for the temperatures to lie in the 140 to 176 degrees F (60 to 80 degrees C) range. It must be taken into account that the higher the operating temperature, the more quickly the hydraulic fluid ages. If overheating occurs, it is imperative that the cause is found and eliminated.

Filter

When filter elements are cleaned or exchanged, the filter bowl is also to be thoroughly cleaned.

Measuring Equipment

The most important pieces of test equipment and their accessories (measuring connections and fittings, etc.) must also be maintained in a clean state.

5.2 Repair

Repair comprises

- a) trouble shooting, in other words, first of all ascertaining that there is a fault present, and then locating the cause of the discrepancy, and
- b) repair, that is, the replacement or repair of the faulty component(s) and the repair of the original cause of fault.

5.2.1 Trouble Shooting

Trouble shooting within a hydraulic system will only be successful if the trouble shooter is exactly acquainted with the design and the method of operation of the individual components and sub-assemblies, as well as of the installation as a whole. Furthermore, trouble shooting is made more easy if the person concerned is able to read and understand circuit and operational sequence diagrams, and is able to think logically and to apply this capability. Of course, practical experience is of particular importance. Circuit and operational sequence diagrams and other relevant documentation regarding the installation must also be made available. Trouble shooting is eased considerably if the installation is equipped with sufficient measuring points and if the appropriate test and measuring equipment is on hand. Electro-hydraulic controls are common, particularly in stationary installations and this combination of the two medias, electricity and hydraulics, naturally complicates trouble shooting. This can only be successful if cooperation between the electrician and the hydraulics technician is guaranteed. Due the high variety of installations on the market today, it is impossible to provide a trouble shooting method which can be regarded as universally valid. Refer to the "Trouble Shooting" tab in this manual for a number of practical pointers which are always applicable.

5.2.1 Repair

Repair takes place on site by replacing the defective components or sub-assemblies. These items are usually repaired by their manufacturers, or by the manufacturers' official workshops. If sufficient equipment and knowledge are available (possibly even a test stand), repairs can also be conducted by the end user, or by the OEM. Spare parts lists, as well as repair instructions, are available for the individual components and sub-assemblies.

Leaks are one of the most common forms of damage in hydraulic installations. Where these occur at tube and pipe fittings, they can often be dealt with simply by tightening. If the leaks are present at, or in, the components themselves, the seals and gaskets can be replaced (refer to the spare parts lists).

After the damage itself has been repaired, it is imperative that the primary cause of the trouble is located and addressed. For instance, when equipment has broken down due to dirt, an oil change must be carried out and the filtering network checked.