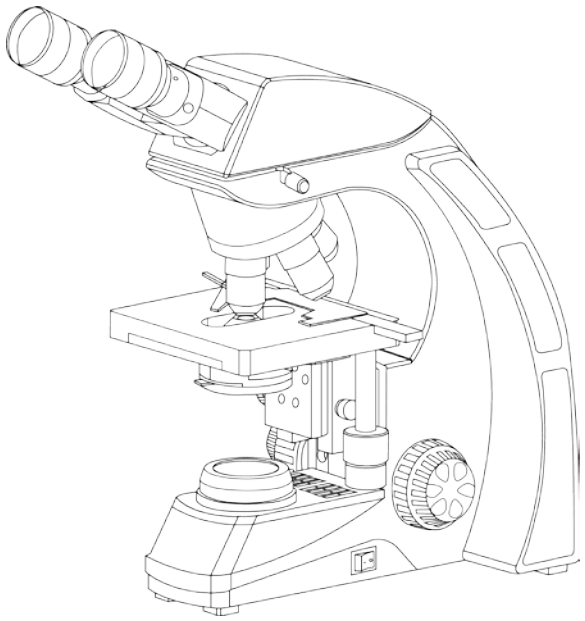
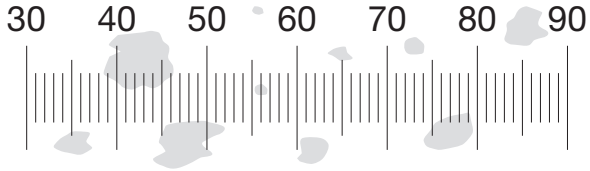
Related Fluid Power

DC Power Units

Contamination & Oil Cleanliness





Related Fluid Power Ltd. T: 0044 (0)1334 655600 F: 0044 (0)1334 650006 E: sales@relatedfluidpower.com www.relatedfluidpower.com

Table of Contents

Introduction	1
Contamination	1
Types of Contamination	1
Damage Caused by Contamination	1
Choosing the Correct Oil	2
Hydraulic Oil Specicications	2
Filling the System	2
Maintenance	3

Related Fluid Power Ltd. T: 0044 (0)1334 655600 F: 0044 (0)1334 650006 E: sales@relatedfluidpower.com www.relatedfluidpower.com

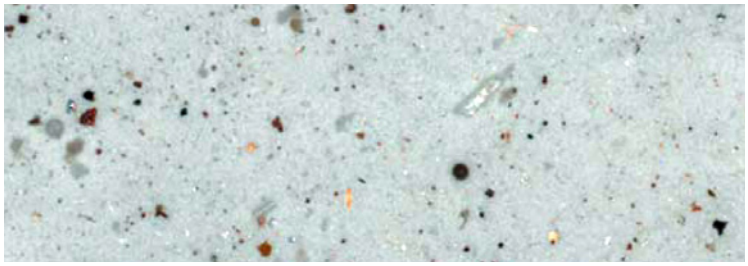
Introduction

The power in a hydraulic fluid power system is both controlled and transmitted by pressurised hydraulic oil within an enclosed circuit. The oil acts as both lubricant and power-transmitting medium and is considered the central component of any hydraulic system.

Contamination

Oil cleanliness is one of the most important factors when it comes to system maintenance with around 80% of system failures a result of contamination. Contamination in the oil can cause wear to components and reduce the ability of the hydraulic fluid to lubricate, having a direct bearing on system reliability and performance. The cost due to contamination can result from:

- Replacement of components
- Frequent fluid replacement
- Disposal costs
- Increased maintenance costs
- Loss of production (downtime)



Types of Contamination

Contamination can be defined as the presence of foreign matter in hydraulic fluid. Shredded seals or rust may be visible to the naked eye, although instrumentation may be required to see smaller particles. If left unchecked, regardless of the level of contamination, it will have a negative impact on a hydraulic system.

Contamination can be broken down into the following categories:

- Solid Particles (abrasion and dirt)
- Liquid Contamination (water, free and in solution)
- Gaseous Contamination (air)

Sources of Contamination

It is vital to have a good understanding of the most common sources of hydraulic contamination to be able to control it. The main sources of contamination are:

Built-in Contamination
- Foundry sand and dust
- Manufacturing residue (from welding, swarf, blasting, paint and preservation materials)
- Cleaning agent residue (textile fibers)

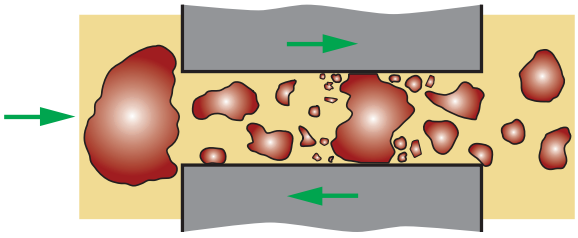
External Contamination
- Dirt from the ambient air
- Contamination caused by the handling and/or transfer of hydraulic fluid

Self-Generated Contamination
- Metallic wear caused by abrasion and erosion
- Seal abrasion
- Chemical corrosion
- Oil ageing products
- Oxidation residue
- Oil-insoluble substances caused by mixing oil

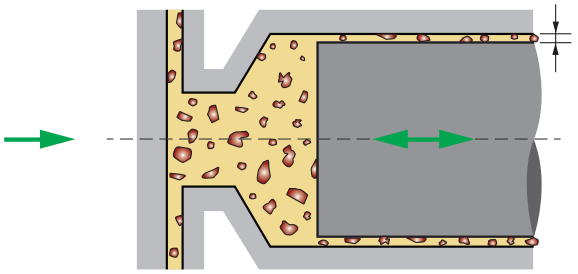
Damage Caused By Contamination

Contaminants from manufacturing and assembly can be left in the system if it is not propery flushed. These contaminants can include dust, welding slag, rubber particles from hoses and seals, sand from castings, and metal debris from machined components. Contamination can also be introduced when fluid is initially added to the system.

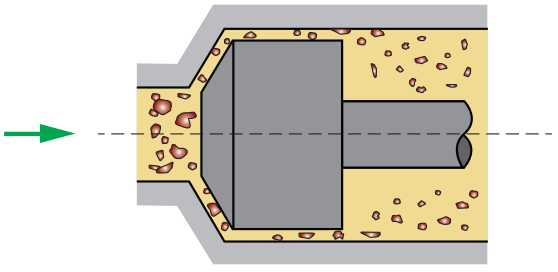
Breather caps, worn seals, and other system openings all allow contamination to enter during operation. Internal contamination is also generated during operation when component wear debris and chemical by-products react with component surfaces



Sliding or rotating faces / shaft



Cylinder



Check or Solenoid Valve Poppet

Related Fluid Power Ltd. T: 0044 (0)1334 655600 F: 0044 (0)1334 650006 E: sales@relatedfluidpower.com www.relatedfluidpower.com

Contamination Type and Damage Caused.

Solid Particles (abrasion and dirt)
- Consequences:
- Changes in control characteristics
- Component wear
- Component failure
- Machine downtime

Liquid Contamination (water, free and in solution)
Consequences:
- Corrosion and wear
- Viscosity impairment
- Chemical reaction with the fluid
- Impact on lubricating properties
- Ageing (oxidation) of oil
- Poor filterability
- Machine downtime

Gaseous Contamination (air)
Consequences:
- Foam formation in the oil
- Inaccurate valve response
- Loss of energy
- Pump damage
- Chemical reaction with the fluid
- Oxidation
- Machine downtime

Choosing the Correct Oil

To prolong product life and reduce running costs, make sure the correct hydraulic oil is used. When selecting hydraulic oil the following factors should be considered:

Duty
Duty covers factors such as running time, environment, likelihood of contamination ingress, maintenance arrangements etc.

Examples of Low, Medium and Heavy Duty

Duty			
Factors	**Light**	**Medium**	**Heavy**
Run time	<2 hours	>2 hours	>24 hours
Humidity	<70%	>70%	>90%
Dirt	Clean Room	Industrial	Agricultural
Maintenance	Regular	Irregular	Never

Temperature & Pressure
Temperatures below -10°C and above +60°C with pressures above 250 bar require an oil with appropriate additives. In most common applications, a mineral based oil (HM/HLP) which has anti-wear additives, oxidisation inhibitors and viscosity improvers will be sufficient. For long term stability of viscocity and lubrication, fully synthetic oil is recommended.

Viscosity Grade (VG)
Viscocity requirements are determened by the maximum and minimum operating temperatures and the load on the system. Hydraulic fluid has a low viscosity when it is thin and a high viscosity grade when it is thick. As temperatures rise, the viscocity is reduced and visa-versa. The fluid must be thin enough to pass through the system, but not too thin to avoid leakage and loss of wear protection.
Viscosity grade (VG) is expressed at 40°C and measured in cSt (Centistoke). For example, an oil with a grade of ISO 35 would have a viscocity of 35 cSt when measured at 40°C. A viscosity range between 12-80 cSt is recommended for general commercial hydraulic equipment.

Hydraulic Oil Specifications

Examples of suitable hydraulic oils used in power packs:

Hydraulic Oil (ISO11158-HM)
Mineral based – hydraulic oil grades widely used in light duty applications where temperature and pressures are moderate.

Hydraulic Oil (DIN51524-2-HLP)
Mineral based with additives for oxidation, corrosion and wear protection. Used for general applications where temperature and viscosity conditions are observed.

Hydraulic Oil (51524-3-HVLP)
Premium grade mineral based as per HLP but with improved viscosity temperature behaviour (VI>140).

Filling the System

Contamination control is of vital importance when it comes to maintaining a hydraulic system and involves more than just detecting contamination in the system. Brand new products may be contaminated and most new hydraulic fluid comes out of the drum with a degree of contamination. For this reason, all hydraulic fluid should be filtered before use.

- Check the reservoir is clean and free from all debris. If necessary clean before using.
- Always fill the resrvoir with a separate pump unit incorporating a micronic rated (10µ) filter.
- Make sure that the reservoir is filled to the correct level. The fluid level will fall when the system is first run as the fluid fills the pipework and actuators.

Related Fluid Power Ltd. T: 0044 (0)1334 655600 F: 0044 (0)1334 650006 E: sales@relatedfluidpower.com www.relatedfluidpower.com

- Always check that the correct fluid is being used. Do not mix fluid types or grades.

Maintenance

System maintenance should be caried out on a regular basis. Routine maintenance can save in repair cost and equipment downtime.

- Check tank oil level on a regular basis.
- Following the first few hours of operation, inspect the return line filter to verify the rate of pollution, and generally check the level of contaminants in the oil.
- Check / replace any serviceable pressure or return line filters in the system. The inclusion of clogging indicators in filters is ideal for this purpose. Otherwise, replace filters on a time basis commensurate with the environmental conditions.
- Clean the tank inside periodically and replace the oil after every 600-800 hours operation.
- In heavy duty conditions or hostile environments increase inspection and oil change frequency.
- Periodically check the power connections to the electric motor, the solenoid valves and any other electrical accessories (e.g. microswitches, etc.).
- In the event that o-rings need to be replaced, use the replacement parts specified for each of the valves.

Related Fluid Power Ltd. T: 0044 (0)1334 655600 F: 0044 (0)1334 650006 E: sales@relatedfluidpower.com www.relatedfluidpower.com