



*Greetings from the team at FLUID CLEAN and EXCEL HYDRAULICS*

## This Issue - OIL CLEANLINESS

Since we are in the business of oil purification and hydraulic maintenance and repair, we would like to share some insights, gathered from years of practical experience, which in the long term will dramatically reduce your maintenance costs and machinery downtime.

By having a better understanding of how oil cleanliness levels affect your business, we hope to help save you time, money and unnecessary hassles which can be easily avoided by following some basic principles.

### CONTAMINATED OIL KILLS MACHINES

Hydraulic experts estimate that 70% of component failure is due to surface degradation caused by excessive dirt and water contamination in hydraulic systems.

Clean oil is one of the most important factors affecting the service life of lubricated components of all machinery.

In hydraulic systems, clean fluid is absolutely essential for long term operation. Many sources cite dramatic improvements in expected machine life resulting from even modest improvements in lubricant cleanliness.

#### What does clean mean?

For the purpose of this article, and in keeping with industry practice, the terms "clean" and "cleanliness" refers to the amount and size of particulate contamination in a lubricating or hydraulic fluid.

#### How clean is "new" oil?

Studies of "new" oils indicate varying degrees of cleanliness, from a low of \*14/11 to as high as \*23/20. Hydraulic oil straight from the drum, has a **typical cleanliness level of ISO 4406 \*\*18/15.**

Poor handling practices are another source of new oil contamination. Do you know what type of vessels are used in your plant for transporting and adding makeup oil? Are they as clean as you want your oil to be? Many companies find that proper filtering of new oil before filling contributes greatly to extending machinery life.

### HOW LONG WILL YOUR MACHINERY LAST?

The British Hydromechanics Research Association (BHRA) has conducted a three year case study to determine the correlation between fluid cleanliness and breakdown frequency. This involved a controlled 'field' study of 117 hydraulic machines including: injection moulding; machine tools; materials handling; mobile equipment, (for example, earth moving;) and marine hydraulics.

The test results were:

Average ISO Code	Average hours between breakdowns	Relative life factor
24/21	200	0.19
23/20	250	0.24
22/19	325	0.31
21/18	430	0.41
20/17	600	0.57
19/16	800	0.76
<b>**18/15</b>	<b>1050</b>	<b>1 (arbitrary base)</b>
17/14	1400	1.33
16/13	1900	1.81
15/12	2600	2.48
14/11	3800	3.62
<b>13/10</b>	<b>5000</b> Achievable by Fluid Clean	<b>4.76</b>
12/9	6500	6.19
11/8	9000	8.57
10/7	20,000	19.05

\*The first number in the code represents the number of particles 5 microns and greater. The second number represents the number of particles 15 microns and greater in a 1ml sample.

A code of 18/15 means that the particle count  $\geq 5$  microns is between 1,300 and 2,500, and the count for particles  $\geq 15$  microns is between 160 and 320 for a 1 millilitre sample.

In practical terms this means that increasing the cleanliness from 18/15 to 17/14 is a 50% reduction in particulate contaminants, or doubling the cleanliness levels!



## Contaminants

### Particulate.

These can be introduced or self generated. They can also be in the system from new. Many are introduced during filling and topping up, unless extreme care is taken. Most of these can be abrasive. Ingression can also be caused by oil film on seals. Worn seals will increase this possibility.

Reservoir openings not fitted with appropriate breathers are common sources of contaminants.

### Gases.

Entrained air is a cause of cavitation and can damage pumps. When compressed to 2000 PSI or more it could become locally very hot and cause the fluid surrounding the bubble to burn. The products of combustion are both fluid and solid contaminants, which will further reduce the life of the equipment.

### Moisture and chemicals.

The detrimental effects of these can be even greater than a dirty system. When combined with solid contaminants the damage is accelerated.

It causes:

- Accelerated corrosion
- Reduced bearing life
- Thinner load-bearing oil film
- Material fatigue
- Accelerated oil oxidation
- Change in viscosity
- Deterioration of oil additives
- Bacterial problems

There are two distinct phases of water that can be present in oil - free and dissolved water. Free water can also be present in the form of an emulsion - microscopic droplets of water distributed throughout the fluid.

Water, in excess of the oil's saturation point damages a system through accelerated abrasive wear, corrosion and fluid breakdown.

The saturation point of water at 65 Deg C is about 200 ppm, (0.02%.) Higher levels than this will result in the formation of free water in the system, which can react with products of lubricant oxidation and additives, to form organic acid compounds and sludge that will compromise hydraulic performance.

## Contamination removal

Contaminants can be removed by various means.

These include:

- Filtration
- Separation
- Centrifugation
- Pasteurisation
- Vacuum dehydration
- Ion exchange filtration
- Coalescing filtration
- Water absorbing element filtration

Most systems have filtration units installed which can easily remove solid contaminants, but few have the capability of removing water, chemicals and gases. Two of the most efficient methods of doing this are:

### Centrifugation.

A centrifuge removes the bulk of free water and solid particles, but not dissolved or emulsified water. It does not remove or separate the oil additives.

### Vacuum dehydration.

Free and dissolved water and gasses are removed by exposing the contaminated fluid to a low relative humidity atmosphere in a vacuum chamber. The air expands about five times its former volume resulting in five time reduction in relative humidity. Water and gas molecules are attracted to the lower vapour pressure produced and are exhausted with the air flow. This can achieve levels of less than 100 parts per million.

**FLUID CLEAN** can carry out *on-site purification* on a variety of oils. Our mobile rig utilises a **centrifuge, vacuum dehydrator and filtration down to 1 micron.**

**This means:**

- **No machinery down time**
- **Bonus system flush (pipe work, valves and system components)**
- **Little disruption to operation**
- **No costly disposal of used oil**
- **It can produce a cleaner system than when the machinery was newly installed.**

**We frequently purify to ISO 4406 13/10**

**TO CLEAN YOUR SYSTEM  
THEN KEEP IT CLEAN, CALL**

**1300 PURIFY**

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