Condition Monitoring of Hydraulic Oils

Technical Bulletin

Factors To Consider

Hydraulic oils contain all the requisite additives to protect the equipment from wear, corrosion and excess friction. The additives in the oil are multi-functional, therefore, it is important they do not deplete (and is one of the reasons oil types should not be mixed). This is particularly important in long term usage.

The change in oil condition is characterized in the following ways:-

1. Visual darkening of oil
2. A 'burnt smell' to the oil
3. An increase in viscosity
4. Visual haziness
5. Foaming

The condition of the hydraulic oil and the need to change can be assessed by a number of tests. A sample of oil should be drawn off the system into a clean clear glass container. Care should be taken to ensure that the oil is drawn from a point in the circuit continually flushed with system oil.

1. Visual Darkening

The oil should have a bright appearance. There may be a darkening of the oil which is not necessarily significant but any cloudiness is a warning sign of contamination. This effect is quite slow and requires a regular comparison between fresh oil and system oil. Sudden changes in colour can either be a change of grade, a contaminant (blown filter – water ingress) or gross over-heating of the fluid. This latter effect gives the oil a burnt smell, a condition known as being oxidised.

2. Burnt Smell

If the oil has this smell do not be alarmed. Many systems work for years having both a darker colour and possess a burnt smell.

The question remains, how far should the smell and colour go before the oil is rejected?

Oxidation of most oils is measured by its change in acidity level. Increasing or sudden changes in the acidity of the oil can indicate contamination or oxidation, for example ageing, or overheating, of the oil especially when linked to changes in viscosity. The source of this type of oil degradation should be investigated and controlled. The level of acidity of a fluid is expressed as the Total Acid Number (TAN). Depending on the fluid specification the total acid number can vary greatly. It must be remembered that the value is a relative one and must be compared to the oil specification to be of true relevance. From the graph it can be seen that a typical new hydraulic oil has a TAN of 0.6. Through time and usage this value initially changes downwards and then proceeds to increase. Values exceeding 1mg KoH/g (1mg potassium/gram) should be considered for oil change. Guidance for the determination

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of TAN may be obtained from ASTM D663 and 664.

3. Change in Viscosity

Viscosity is the measure of resistance to flow of an oil. If the oil is clearly thinner than normal, it has most likely had a thinner charge of lubricant added or is contaminated with a solvent. Most hydraulic oils thicken with usage. This thickening can be measured in a laboratory using a viscometer at a specific temperature and is measured normally at 40°C and given in units of centistokes (cSt). Any oil which increases in viscosity by greater than 15% should be discarded.

4. Visual Haziness

If an oil has an opaque or hazy appearance, it usually signifies the presence of water. The limits of water contamination is usually 0.1%, anything greater will reduce significantly the fluids ability to lubricate and prevent corrosion. Excess water will also reduce the effectiveness of the additives. Water content is best established by analysis.

5. Foaming

Foaming is usually due to mechanical problems caused by churning or air taken into the system by return oil lines or leaks on the inlet side of the pump. Premium hydraulic fluids contain anti-foaming agents, the effectiveness of which is reduced as the oil degrades, so excess foaming can be used as an indicator of degraded oil quality.

6. Measurement of Oil Condition

Measurements of viscosity, acidity and water content can be made quite simply. Systems Services offer a complete oil analysis service including sampling, laboratory analysis of condition and wear element analysis and particle count for cleanliness levels. It is important that oil condition monitoring is completed on a regular basis to ensure that the oil quality is stable. Regular monitoring soon builds a history of the fluid condition allowing informed decisions to be taken.

Continued operation with degraded oil will lead to accelerated wear of moving parts and filtration problems resulting in an accumulation of sludge in the tank and pipework.

Systems Services do not recommend the mixing of hydraulic fluids—even of the same viscosities (unless of the original manufacturer). Systems Services only recommend the use of premium fluids from well known manufacturers—please enquire for further information.

For more information please call:

01205 724242 or email us at support@systems-services.co.uk

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