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TOTAL FLUID MANAGEMENT FOR HYDRAULIC LIQUIDS

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Abstract: *Increases of lifetime and reliability of hydraulic systems by regular attendance of hydraulic liquids. VacuClean – Filtration and separating of water, gases and oxidants by vacuuming of operational liquid.*

Keywords: ***Hydraulic liquids, contamination, filtration, VacuClean, lifetime, vacuum chamber.***

1. Introduction

Our company Bosch Rexroth cooperate invariably and intensively with their customers on enhancement of life time and reliability of hydraulic systems. Reliability of lifetime of hydraulic systems depends mainly on quality and purity of hydraulic liquids. There are some main issues regarding hydraulic liquids (Schaefer, 2010). These are defined as follows:

1.1. Mechanical contamination

It causes to abrasion or collapse of hydraulic components. It effects shorter lifetime, breakdown of hydraulic systems and failure of production.

Prevention: effective filtration hydraulic liquid.

1.2. Contamination mainly by free and fixed water

It causes corrosion, abrasion; lowering of viscosity and worse lubrication ability(see Fig. 5); chemical reaction with working fluid; aging of working fluid; (diesel effect, oxidation of oil); lower ability to filtrate; shorter lifetime and in the end failure of production

Prevention: use of air filter AS (aquasorb); oil filter AS (separates only free water) and Vacuum Chamber.

1.3. Air and gases

It causes corrosion, abrasion; inaccurate function of valves; lower power efficiency; shorter life of pumps (cavitation); foam in hydraulic liquid; chemical reaction with operating fluid – lifetime of hydraulic liquid; oxidation – aging; diesel effect.

Prevention: air venting of hydraulic liquid… reseal of pumps and using of Vacuum Chamber.

2. Effects of water with the presence of metallic particles

Water creates serious harm to hydraulic systems (Trahan, 2009) especially when high amounts of metallic particles are present. In addition, water changes properties of hydraulic liquids by chemical reactions such as hydrolysis and cracking. As a consequence, quality and lifetime of hydraulic fluid can be significantly reduced. Lifetime of hydraulic components can be reduced by water presence in hydraulic liquid. Increase of water content in hydraulic liquid from 100 ppm to 500 ppm reduces the lifetime of the hydraulic components by 50%. On the other hand, lowering of water content below 100 ppm in hydraulic liquid usually doubles the lifetime of hydraulic components (see Fig. 1).

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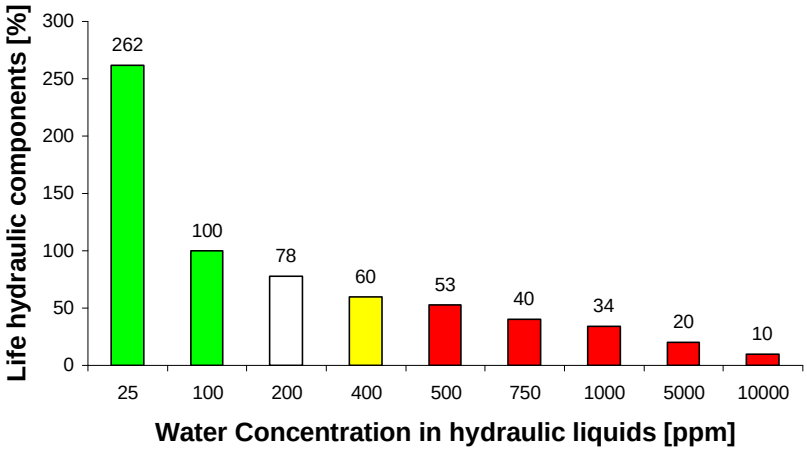
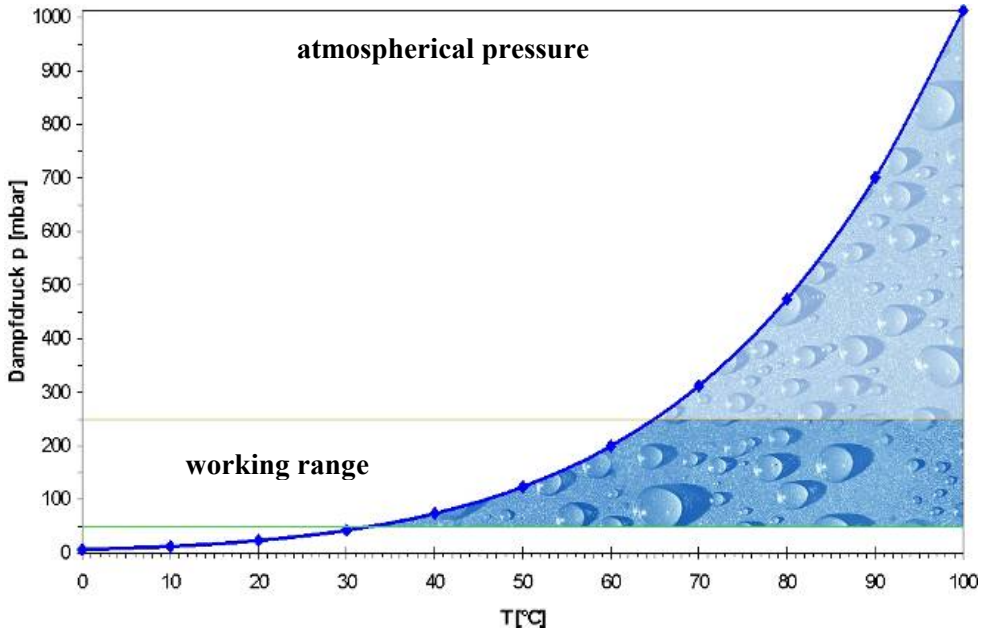


Fig. 1: Lifetime of the hydraulic components (Trahan, 2009).

3. Separation of water, air and oil oxidation products using VacuClean®

Due to high vacuum in the VacuClean® (vacuum chamber) (Trahan, 2009) it is possible to separate not only water, but also oxidants with low boiling point from the hydraulic liquid. Because of design of the vacuum chamber, building of foam of hydraulic liquid is reduced. Dissolved air and other gases are nearly completely separated. As a consequence, hydraulic liquid oxidation is reduced dramatically and usage of the hydraulic liquid is enhanced.



(1)

(2)

Fig. 2: Performance data VacuClean (Trahan, 2009).

The process of decontamination with help of VacuClean (see Fig. 3) is also very careful to working fluid, due to working temperature. The advantage of VacuClean is that there is no high temperature exposure to working fluid because of working temperature range from 32 to 65 degrees Celsius (see Fig. 2).

Fig. 3: VacuClean VCM 20 (Boecher, 2010).

4. Basics about water in oil

To specify water content in hydraulic liquid, ppm units (parts per million) are used:

1 ppm of water …. 1mililiter of water per 1000 liter of oil

Hydraulic liquid (oil) contains blocked and free water (after reaching of a saturation point) (Schaefer, 2010). Free water causes emulsion. Saturation point (indicated in ppm of water content) depends on temperature and chemical condition of hydraulic liquid. Saturation point is indicated with aw coefficient (for example aw = 0.4 means 40 % of contamination and 60% to saturation point). Saturated oil has aw = 1 (100% water).

Hydraulic liquid's ability to block water depends on its temperature and chemical condition. Due to the change of temperature in our example from 70 to 30 °C, saturation point falls to 3000 ppm. Ability to block water falls down to 1000 ppm (see "Difference" in Fig. 4).

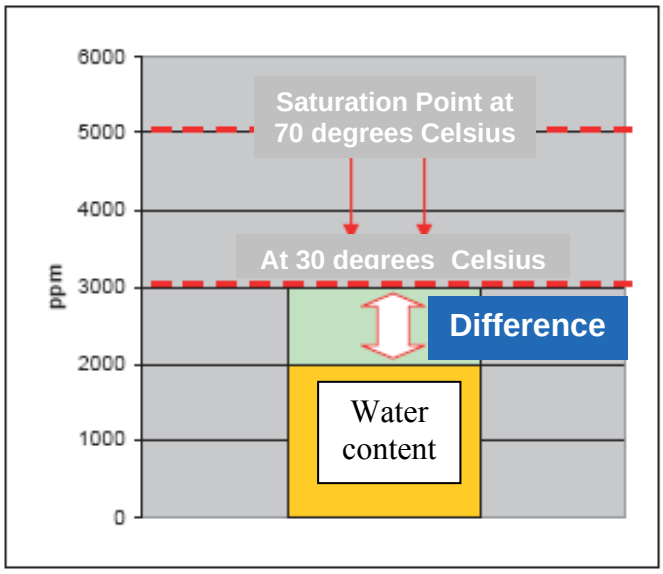


Fig. 4: Saturation point - dependence on temperature (Bosch Rexroth, 2002-10).

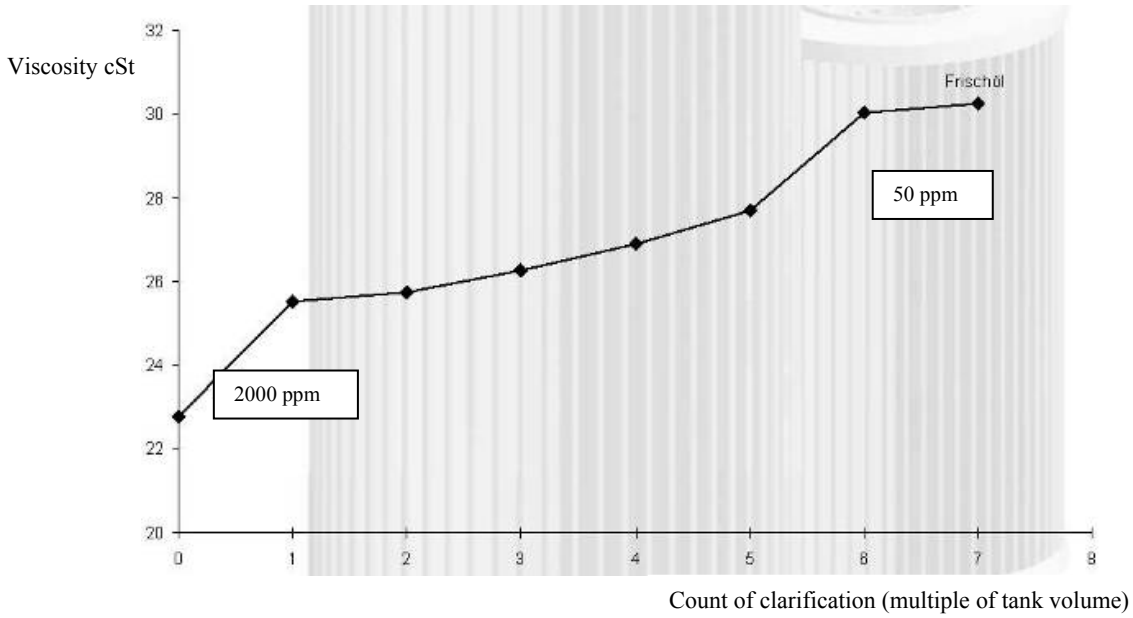


Fig. 5: Step by step regeneration of viscosity during VacuClean using (Schaefer, 2010). (Oil VG 46 at temperature 50 °C, Tank content 2000 l, VacuClean VCM 50).

5. Conclusion

By continuous operation of VacuClean equipment on hydraulic system, it is likely to extend lifetime of the hydraulic liquid by 3 – 7 times (practical experiences of Bosch Rexroth). In addition, lifetime of the hydraulic systems is extended and production issues minimized. As a result, customers benefit from lowering production costs which are clearly visible within 2 – 5 years after the start of machine operation.

References

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