CIRCULAR COLLECTOR HYDRAULIC DRIVES

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Hydraulic drives have been employed over many years and in many applications to provide smooth starting under load, variable speed, and accurate overload relief. The hydraulic drive is a convenient method of transmitting power over long distance.

With the advent of variable frequency controllers for AC motors and AC power monitors for overload protection hydraulic drives lost much of their advantage over electro-mechanical systems.

The higher initial, repair, and replacement costs of hydraulic drive components over conventional motor reducer combinations has become a disadvantage for hydraulic drives in collector applications. The potential fire hazard of leaking hydraulic systems has been well documented and is universally considered as a disadvantage to this type of drive. Additionally, high pressure leaks pose a safety hazard and may require intensive clean up. In water plants system leaks may contaminate the treated product and in both water and wastewater plants, leakage may become a costly maintenance burden in both replacement hydraulic fluid and maintenance man hours. 'It is unfortunate, that many leaks identified in hydraulic systems are left to drip away profits of a company - profits lost with unnecessary energy consumption, reduced equipment performance, decreased reliability, increased fluid costs, increased house keeping cost, etc.'(1)

The level of training required to properly operate and maintain hydraulic systems effectively is often not available in many maintenance establishments. This leads to improper initial flushing of lines and components during installation and ineffective contaminate control during operation. Due to hydraulic system vulnerability to water and particulate contamination costly damage results from this lack of contamination control. 'Contaminants, the natural enemy of hydraulic systems, cause more than 70 % of all failures. If not controlled, particles too small to be seen can reduce hydraulic system efficiency. System efficiencies may be reduced as much as 20 % before it is recognized that something is wrong. Contamination affects hydraulic systems in many ways.'(2)

'If you have worked with hydraulic equipment for any length of time it's likely that you've come across a hydraulic system with cloudy oil. Oil becomes cloudy when it is contaminated with water above its saturation level. The saturation level is the amount of water that can dissolve in the oil's molecular chemistry and is typically 200 - 300 ppm at 68 ^{o}F (20 ^{o}C) for mineral oil. Note that if hydraulic oil is cloudy it indicates that a

minimum of 200 – 300 ppm of water is present. I recently audited a hydraulic system with cloudy oil that was found to contain greater than 1 % (10,000 ppm) water. '[3]

While these quotations may seem harsh, the US Department of Defense has an even more harsh position; 'At least 75 % of all hydraulic systems degrade and fail due to contaminated or aging hydraulic fluid. Contamination causes aging/degradation of fluids and ultimate failure of hydraulic systems for a number of different reasons. In addition to increasing internal leakage (which lowers efficiency of pumps, motors, and cylinders,) it also decreases the ability of valves to control flow and pressure accurately, thus wasting horsepower and generating excess heat. Furthermore, it causes parts to stick due to sludge or silting, or they seize when large amounts of contaminants accumulate in the clearances. Sources of contamination can include: (1) the manufacturing process, (2) hydraulic fluids, (3) environmental exposure, (4) system wear, (5) and servicing.'[4]

Electromechanical drives provide smooth starting under load, variable speed, and accurate overload relief without the disadvantages of higher initial and maintenance costs. Electromechanical drives can be maintained by almost all maintenance departments found in water and wastewater facilities. Electromechanical drives are much less susceptible to environmental exposure and contaminants.

Hydraulic drives should be reserved for those applications that indeed require the benefits of this type of drive that would out weigh the inherent disadvantages of hydraulic systems.

(1) Detecting and Managing Hydraulic System Leakage, Machinery Lubrication Magazine, July 2001, Kevan Slater, Schematic Approach Inc.,

(2) Hydraulic Filtration and Contamination, Technical Service Bulletin 96-3R, Filter Manufacturers Council

(3) Dealing with water in hydraulic fluid, Insider Secrets to Hydraulics, www.insidersecretstohydraulics.com/water-hydraulic-fluid.html

(4) Understanding and reducing the effects of contamination on hydraulic fluids and systems, United States Department of Defense, The AMPTIAC Quarterly, Volume 7, Number 1