LUBRICATION RELATED MAINTENANCE CONSIDERATIONS

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Lubrication related maintenance considerations fall into one or more of these categories:

LUBRICANT TYPE

LUBRICATION SYSTEMS

HOUSING CONFIGURATION

OPERATING CONDITIONS

BUDGET PRIORITIES

MAINTENANCE SCHEDULES

EXPECTED EQUIPMENT LIFE AND SERVICE

PERFORMANCE

Clarifier drive maintenance actions and the frequency of each action are directed by several factors. Among the primary factors are expected equipment performance, service life, and replacement cost. Maintenance budget priorities, equipment configuration, and operating conditions are also important factors. Factors also considered include maintenance manpower resources, maintenance schedules, reactive or proactive maintenance, preferred types of lubrication, and the potential for combining required lubricant stocks to reduce inventory requirements.

The primary factors tend to have a great deal of influence in determining long-range maintenance decisions and goals while the other factors tend to shape short-term actions.

The equipment performance is obviously very high on the list of primary maintenance factors. If the equipment performance falls below a desired level it may not produce product of a quality justifying operation of the equipment. In some cases lack of maintenance can render the equipment ineffective. In some cases, the use of equipment in poor condition actually degrades the end product to a greater extent than operating the plant with that piece of equipment shut down or bypassed.

A typical clarifier drive is expected to have a minimum 20-year service life when operated at or below the design load and properly maintained. Proper maintenance includes routine inspection and servicing of the drive, replacement of worn parts and lubricants. These items such as oil, grease, seals, roller chain, v-belts and similar items are considered consumables.

The amount of maintenance an item can command is directly proportional to the expense to replace the item and the cost incurred during unscheduled outages. The incurred expenses could be the cost to remove the drive or parts of the drive and reinstall the replacements. Fines levied due to process problems resulting from the equipment outage are also expenses and should be considered.

The amount of maintenance a clarifier drive receives is also proportional to the amount of overall equipment maintenance scheduled and the amount of maintenance required by other essential equipment.

The choice of the drive lubricant should be determined by primary factors mentioned above. Lubrication of the drive reduces friction to a minimum by providing a film of lubricant between surfaces to reduce or eliminate contact of surface asperities. The lubricant additives should prevent adhesion of the surface asperities if they come into contact. The lubricant should also remove any wear debris and external contaminants from the critical surfaces. The lubricant chosen must be compatible with the drive design so that contaminants and depleted lubricant are removed from the bearing and gear teeth surfaces.

Oil has been and remains the best lubricant for rolling element bearings and gearing. Grease is used when oil cannot be retained in contact with the bearing surfaces or gear mesh, due to orientation or other unusual conditions such as sealing problems. An example of a bearing, which should be grease lubricated is an overhead shaft journal bearing. An oil reservoir or sump would be difficult to incorporate in this bearing design. Grease must have sufficient thickness or resistance to slump to remain in contact with the bearing surfaces during operation. The thickness or resistance to flow is given by the NLGI grade as measured by a standard penetration test. While thickness or resistance to penetration has no relationship to the lubricating properties of the grease, it does determine if the grease will stay in contact with the bearing or slip away.

A bearing that is designed for grease lubrication must have some provision for removal of depleted grease and replacement by fresh grease. If the grease has sufficient resistant to flow to be useful, it must be expelled from the bearing cavity by force when depleted. The new grease must not be able to short circuit and emerge from the bearing cavity before the majority of the old grease has been purged. If the new grease can short circuit, the depleted grease cannot be purged and will remain in contact with the bearing. This leads to lubricant starvation in spite of the quantities of new grease pumped into the drive.

If the housing surrounding the bearing or gear has clearance space, the depleted grease will fill this volume rather than being expelled from the housing. This precludes the maintenance crew from determining when the bearing has been properly re-greased. It also prevents any sampling of the expelled grease for local or laboratory examination for contaminants and wear particles.

Clarifier drive housings generally have this open volume, as the housing encloses the gear and pinion. This open volume is much greater than that found in grease lubricated bearing enclosures. Also, if the grease has an NLGI grade of 1 or higher, it is not likely to flow into the mesh of vertically orientated gear teeth, which are universally used as the final stage of pier supported clarifier drives.

Grease, which is not purged from the drive housing, will hold grit and moisture in contact with the bearing and gear surfaces resulting in abrasion and corrosion of these surfaces. Additionally, in some installations, bearings are grease lubricated in close proximity to gearing which is oil lubricated. This mixed regime lubrication is not recommended by lubricant manufacturers.

While it may appear at first thought that grease lubrication of the drive is more time efficient than oil bath lubrication, this is not true. Grease lubrication requires application of grease on a predetermined schedule. Since the amount and quality of the purged grease cannot be monitored, the possibility of catching a problem early or before extensive damage has occurred is reduced or precluded.

Operating speeds, ambient and operating temperatures, and contaminant load establish the frequency of grease replacement. Incomplete replacement of depleted grease is a very serious problem. Mixing new grease with depleted or contaminated grease degrades new grease.

Too much grease retained in the bearing pocket or enclosure can also damage bearings. This is due to the increased heat generated by the bearing forcing its way through the grease. This, however, is not usually a problem with clarifier drives.

It should be noted that most clarifier drive primary reduction units are lubricated with oil. The exceptions are almost exclusively lubricated by fluid greases, NLGI grade 0 through 000. These greases have a greater tendency to flow in this application, as the primary reducer will generate more heat than the intermediate or final reduction stages of the drive.

The only advantage a fluid grease has over lubricating oil is the ability to resist leakage through seals and joints, depending on the size of the unsealed passage. If the gaps are too large the fluid grease will leak through in spite of the thickener base.

Oil bath lubrication provides the ability to monitor oil levels either on a schedule or randomly. A sample may be easily drawn at any time. Positive information concerning the condition and quantity of lubricant available within the drive is thus readily provided.

Oil bath lubrication allows for complete removal of expended lubricant and settled and entrained contaminants by simple draining, or flush and draining procedures at schedule intervals or as required. In contrast the grease lubricated drive must be full disassembled to remove and repack bearings and gears with new grease.

Clarifier drives operate in extreme environments of high humidity, wide temperature variations, and aggressive contaminants. While grease is expected to assist in sealing out wind blown contaminants and humidity, all clarifier drives breath or circulate air from outside and inside the housing. If the housing is air tight, the differential pressure within the housing generated by ambient heating and cooling will force lubricant through the seal or joints. The loss of lubricant and the increased cleanup must then be addressed.

Preventive maintanaence actions scheduled in a rational manner prevents problems. Predictive maintenace builds on the preventive maintenace plan and adds inspection, monitoring, and sampling to diagnose and predict problems before they happen or schedule service before a problem becomes an outage. Oil lubrication of a clarifier drive lends itself to this type of program while grease lubrication of a clarifier drive hinders the program.

An in depth look at grease lubrication should convince most maintenance supervisors that while grease has its place as a lubricant, its place is not within a clarifier drive.