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The Third Link in the Chain

In the previous articles in this series (which began in the May/June 2008 issue of Lubrication Management & Technology), the focus was on the first two links in the cleanliness chain: the lubricant blender and the distributor. In this installment, the authors look at the final link—the end user.

No study of oil cleanliness really would be complete without a look at what happens once the oil reaches the end user. Is that where the real trouble starts? To try to find out, we chose to examine two large plants, an oil refinery and a petrochemical complex. Both facilities have large populations of rotating equipment, including significant numbers of centrifugal pumps, electric motors and compressors. A large number of oil samples were collected from both plants and evaluated separately for viscosity, ISO Cleanliness and water by MRT Laboratories. The findings from each plant—or end user company—are as follows:

Oil refinery data

The large Gulf Coast refinery selected for this study has instituted a program requiring the delivery of clean and dry oil. Its requirement of 15/13/11 along with

Table I. Cleanliness Levels at a Large Gulf Coast Refinery

Lubricant Source	Viscosity-cSt, @ 40 C	ISO Cleanliness	Water, Karl Fischer
Reciprocating Compressor	141	15/13/07	40
Reciprocating Compressor	192	Too Dirty For Evaluation	34
Centrifugal Compressor	31	19/17/08	25
Centrifugal Compressor	46	16/13/08	24
Turbine Gear Box	66	17/14/10	24
Lube Oil Reservoir-Centrifugal Compressor	31	17/15/11	28
Bulk Tank	31	21/18/15	32
Metal Container-Pumps	57	20/17/12	25
Oil Safe Container-Pumps	70	23/22/13	45

The results from the referenced refinery indicate that while there is a wide variation in oil cleanliness at the site— even for the same equipment types—overall, the cleanliness is not out of range. Several concerns, however, surfaced here.

Table II. Cleanliness Levels at a Large Petrochemical Complex

Lubricant Source	Viscosity-cSt, @ 40 C	ISO Cleanliness	Water, Karl Fischer
Centrifugal Compressor	32	18/15/11	21
Blower	32	18/14/10	22
ISO 68 Tank	63	19/16/11	28
ISO 68 Tank	66	17/14/10	70
ISO 220 Gear Oil in Pail	213	22/21/19	80
Sealed Plastic Container	59	20/18/15	79
Sealed Plastic Container	58	Too Dirty For Evaluation	31
Sealed Plastic Container	67	Too Dirty For Evaluation	33
ISO 32 Pail	32	19/18/16	95
Metal Container	65	Too Dirty For Evaluation	480

1. The cleanliness rating of the oil in the ISO 32 bulk tank (21/18/15) was high for a centrifugal compressor, indicating that the fluid was too dirty for that service.

2. The oil from one reciprocating compressor was too dirty for evaluation.

3. The containers used to add oil to the pumps also raised concerns. The recommended sealed plastic containers utilized for this task contained very dirty oil (23/22/13). No matter how clean oil is when it is delivered, it can become contaminated very quickly if not handled properly. One bright note, though, was the dryness of the oil. No sample exceeded 50 ppm.

Although the results of this refinery evaluation were obtained from a small number of samples, they still provide useful data on the cleanliness of the oil in this facility. All sampling was observed by one of the authors. Collection was consistent with best practices to minimize the introduction of outside contaminants.

Petrochemical complex data
The second end user facility evaluated for this study was a large petrochemical complex that has no cleanliness requirements for incoming oil. Table II reflects cleanliness data collected at this operation. Our major focus in this plant was on the evaluation of lubricants in storage tanks and small containers used to add oil to pumps and small equipment.

Although samples from the tankage were found to be reasonably clean, those from containers used to add oil to pumps and small equipment were found to be very dirty. This strongly suggests that improvements in keeping oil clean in containers should enhance pump reliability.

Conclusion
Yes, the oil in the large equipment at the two end-user facilities evaluated for this study was reasonably clean. However, given the fact that the oil in some tankage and containers at these plants was not as clean as it should have been, these areas seem to be where real improvement efforts should be focused.

While cleanliness levels in samples from some of the large equipment at the two facilities could be attributed to filtration, end users should be mindful of the fact that it is vitally important to start out with as clean an oil as possible. Unfortunately, as illustrated by this study, clean oil delivered by a supplier can become seriously contaminated as a result of poor storage and handling practices.

One of the most important findings from this study is that everyone in the oil cleanliness chain—including you, the end user—has to take ownership in ensuring that clean oil reaches your equipment.

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COMING UP

The concluding article in the series will summarize all the ? ndings from the blender, distributor and end user. Best practices to achieve oil cleanliness targets and enhanced equipment reliability, including utilization of mobile particle counters, will be discussed in detail.