Written by Ray Thibault, CLS, OMA I and II, Contributing Editor and Mark Graham, CLS, CLGS, O'Rourke Petroleum
Thursday, 01 May 2008 00:00

It's a nagging, industry-wide question, and one that keeps many a supplier and end user up at night.

Oil Cleanliness Basics

One hallmark of a world-class company is its respect for oil cleanliness and the importance of such cleanliness on equipment reliability. *Lubrication Management & Technology* recently concluded a three-part series entitled "Oil Cleanliness: The Key to Equipment Reliability" *(see issues September/October 2007, November/December 2007 and January/February 2008)*. Please refer to these articles for a more complete discussion of oil cleanliness.

In the multi-step process of moving lubricants from THEIR tanks to YOUR equipment, where does contamination start? At what point do dirt and/or moisture enter the supply chain? Is it a problem with storage, handling, dispensing or a combination? This three-part series aims to answer these questions once and for all. Based on studies of actual field data of the cleanliness of new oil put into equipment, it will provide recommendations on how to more effectively guarantee cleanliness in the future. A continuing theme in this series will be the fact that it takes a strong, cooperative effort among lubricant supplier, distributor/marketer and end user for any oil cleanliness program to be successful (see Fig. 1).

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Most lubricants purchased today come from a distributor and are delivered in the following ways:

- Bulk shipments from the lube blending plant delivered directly to the customer
- Bulk shipments from stored lubricants at the distributor
- Drums and pails filled at the blend plant and delivered by distributor
- Drums and pails filled at distributor from oil in tankage

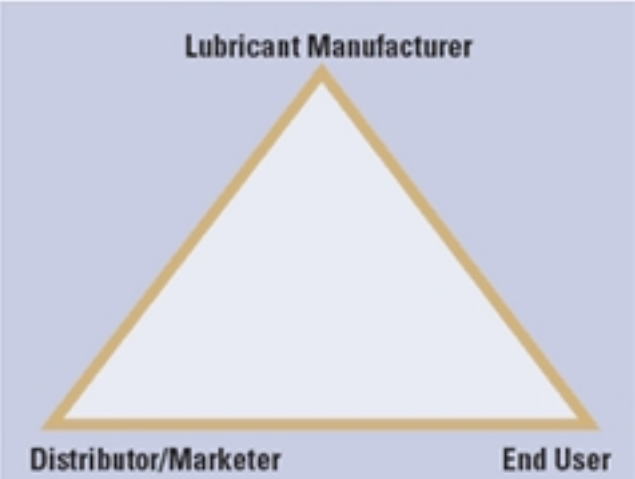

Fig. 1. A cooperative effort among all parties is vital in ensuring a company's oil cleanliness program.

How the lubricant is delivered by the distributor will have a major impact on oil cleanliness.

The lubricant blender also plays a key role in oil cleanliness. Typically, turbine and hydraulic oils are sent out of the blend plant at a cleanliness of 19/17/14. Once it is put in trucks or drums, the delivered oil will not be as clean. (One major manufacturer that is filtering hydraulic oil and putting it in new sealed steel drums, however, is achieving a cleanliness rating of 14/11/9. There is a cost for this procedure, but customers know they will receive very clean hydraulic oil as a result of it.)

Some companies may require special handling of their oils. A case in point is General Electric, which has a minimum cleanliness rating for turbine oils of 16/13. This is achieved by delivering filtered turbine oil to GE in a dedicated bulk truck. Lubricant suppliers are providing this service either directly from the blend plant or through filtration at the distributor.

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The end user also has a responsibility to maintain oil cleanliness. Oil can become dirty very quickly if it is not handled or dispensed properly. The customer needs to cooperate closely with the lube blender and distributor to develop a program achieving targeted oil cleanliness levels economically. Scope of this study In our study, new lubricants are being evaluated for two major contaminants: particles and water. All laboratory test work is being conducted by MRT Laboratories, an ISO 17025-2005 certified laboratory in Houston, TX. The following tests are being performed:

- Viscosity @ 40 C
- Karl Fischer Water Determination
- ISO 4406 Particle Count
- Emission Spectroscopy

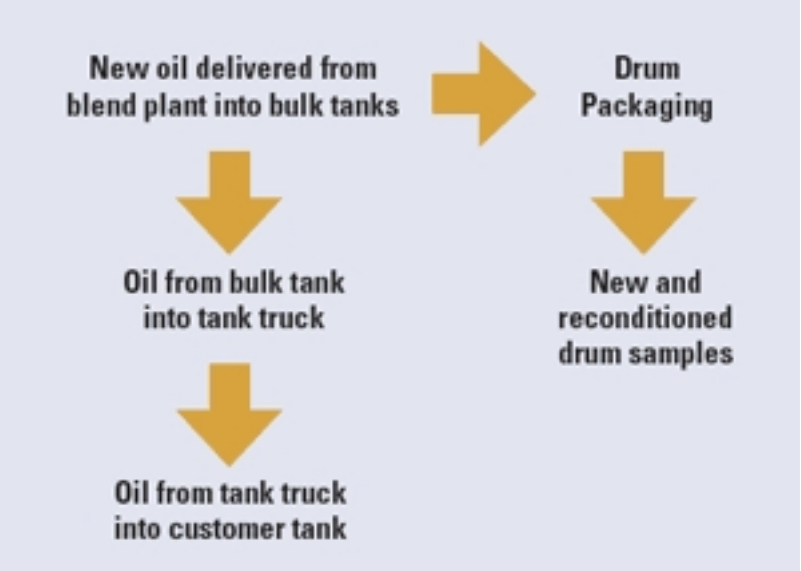

Fig. 2. Fluid flow through a distributor operation

The following samples were purchased from four major lubricant manufacturers for evaluation:

- ISO 32 turbine oil
- ISO 46 AW hydraulic oil
- ISO 220 EP gear oil
- ISO 100 R&O oil

As shown in Fig. 2, the lubricant flow through a distributor operation is being examined for both water and particle contamination. The major focus will be on turbine and hydraulic oils. Fluid

cleanliness will be examined at each stage to determine the effect of storage and handling on contamination.

The final phase of the study will be focusing on end user handling of lubricants. Very clean fluid can be delivered to the plant, but without proper handling all efforts for clean oil are wasted.

Lubricants at several end-use facilities will be examined to determine the introduction of contaminants at the various stages of lubricant dispensing (as indicated by Fig. 3). The use of filters and filter carts in the achieving of fluid cleanliness targets also will be examined.

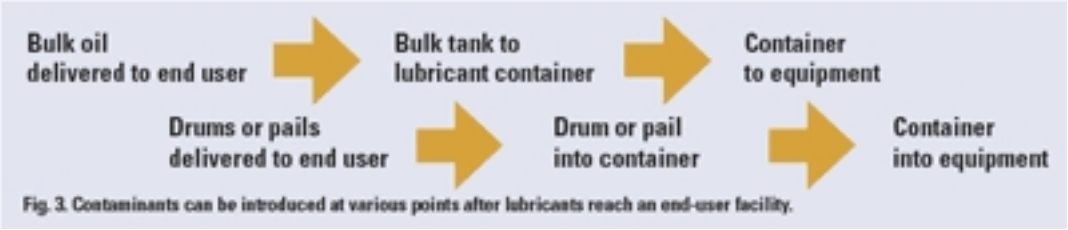

Fig. 3. Contaminants can be introduced at various points after lubricants reach an end-user facility.

After all study data is collected, recommendations will be made on the optimum way to achieve fluid cleanliness in the most economical way. Subsequent installments in this series will address best practices for lubricant blenders, distributors and end users.

ISO 4406: 1999 Cleanliness Code

Cleanliness will be measured by the use of an optical laser counter that measures the number and size of various particles. Although this procedure was discussed thoroughly in a previous article on oil cleanliness (see pgs. 34-35, Lubrication Management & Technology, September/October 2007), it will be reviewed here.

The data in Table I are used to assign a cleanliness code number for a fluid:

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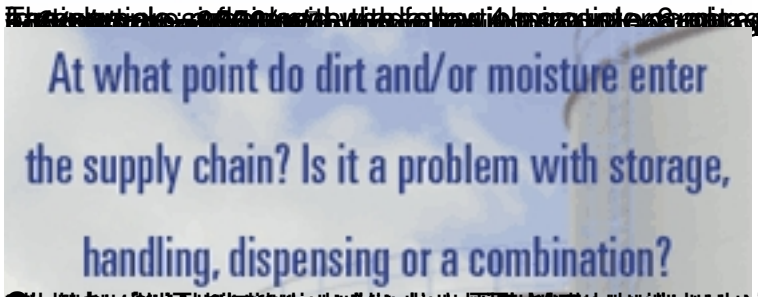
Table I. ISO 4406: 1999 Chart

Range Number	Number of particles per ml	
	More than	up to & including
24	80000	160000
23	40000	80000
22	20000	40000
21	10000	20000
20	5000	10000
19	2500	5000
18	1300	2500
17	640	1300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2.5	5
8	1.3	2.5
7	0.64	1.3
6	0.32	0.64



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