CONTAMINATION CONTROL

The Importance of ISO Cleanliness Codes

By Leonard Badal, Chevron Global Lubricants ;
John Whigham Petrolink USA Inc. ;
Trigg Minnick, Des-Case Corporation

The International Organization for Standardization (ISO) has developed a code system called ISO Cleanliness codes, a universal standard for measuring and reporting particulate contamination levels in fluids. ISO 4406:99 is the newest and most commonly used cleanliness code. It is assigned on the basis of the number of particles per unit volume greater than 4, 6 and 14 microns. The numbers are given in this specific order for consistency in comparison. Each code represents a range of solid particles present in a lubricant.

What are ISO Cleanliness Codes?

First, particle count analysis is conducted on a representative sample of the fluid in a system. The particle count test provides the quantity and micron size of the various solid contaminants in the fluid. The actual particle count and subsequent ISO Cleanliness Code are compared to the target code for the system. If the actual cleanliness level of a system is worse than the desired target, corrective action is recommended.

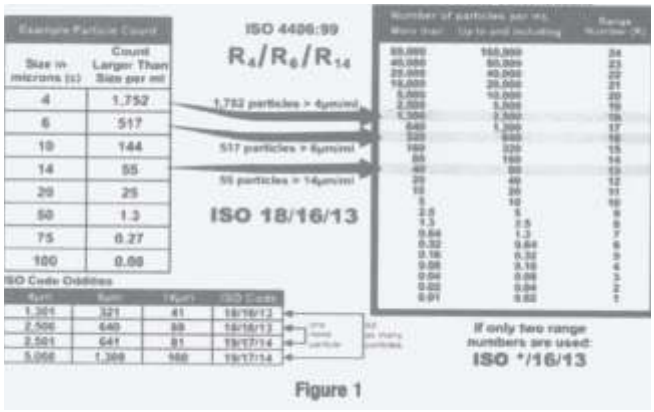

Figure 1

Different mechanical systems have distinct levels of cleanliness that are required for optimum life and minimum component wear. Contaminants in a system accelerate wear, reduce efficiency, increase operating costs and can cause significant downtime.

Typically, new fluids are not clean fluids. Bulk lubricants from blending plants can range from 19/17/15 to 17/14/13, while sealed drum lubricants can have cleanliness codes as high as 22/21/19. In contrast, highly filtered fluids may have a code of 16/14/11 or lower.

Importance of Code Compliance

High ISO Cleanliness codes indicate high levels of particulate contamination in the oil, which increase wear and shorten the lives of both machinery and lubricants. However, if a company maintains a sophisticated and effective contamination control program, the codes can be used to achieve increased efficiency and reduced downtime.

The codes are also used as a basis for comparison, to understand how equipment performs under specific cleanliness levels. Maintenance personnel typically use the codes to evaluate the need for various levels of contamination protection.

ISO Cleanliness codes themselves do not differ for various components. There are no set standards outside a handful of original equipment manufacturer recommendations, but Table 1 provides a fluid cleanliness guide for hydraulic systems.

Operating Pressure →	<1,500 psi	1,500-2,500 psi	>2,500 psi
Servo Valve	16/14/12	15/13/11	14/12/10
Proportional Valve	17/15/12	16/14/12	15/13/11
Variable Volume Pump	17/16/13	17/15/12	16/14/12
Cartridge Valve	18/16/14	17/16/13	17/15/12
Fixed Piston Pump	18/16/14	17/16/13	17/15/12
Vane Pump	19/17/14	18/16/14	17/16/13
Pressure/Flow Control Valve	19/17/14	18/16/14	17/16/13
Solenoid Valve	19/17/14	18/16/14	18/16/14
Gear Pump	19/17/14	18/16/14	18/16/14

Adjust to cleaner levels for duty cycle severity, machine criticality, fluid type (water base) and safety concerns.

Table 1. Typical Cleanliness Recommendations

Generally, the tighter the tolerance on the component's metal-to-metal surfaces, the tighter the cleanliness code. For instance, servo valves on hydraulic systems are more susceptible to contamination-related failures than low-speed gearboxes. Therefore, the hydraulic reservoir fluid will require a lower ISO code (cleaner fluid) than the gearbox. This knowledge allows maintenance departments to focus on preventing failures instead of treating them, and prompts them to employ enhanced tactics to keep contamination out of the hydraulic reservoir.

Contamination Prevention and Removal

There are numerous methods available to meet the appropriate cleanliness codes, which vary according to equipment and environment The main objective is to stop contamination from initial entry, because studies show that it is approximately ten times more cost -efficient to prevent contamination than it is to remove it once it is present in a system. Specific solutions include quality breathers, hydraulic sleeves and improved storage and handling of fluids.

Several technologies exist for the removal of solid contaminants from a lubrication system. The most widely used method is filtration, followed by centrifuge and electrostatic technologies.

It is also important to institute a contamination control program for the establishment and monitoring of appropriate target cleanliness codes for machinery, storage and dispensing of lubricants, periodic cleaning of reservoir tanks and storage vessels, and installation of breathers to reduce ingression of contaminants. Oil analysis can be used for tracking trends to determine the value of various preventive maintenance efforts.

Some of the major lubricant manufacturers offer programs to help control fluid contamination and maximize lubricant investment values. For instance, ChevronTexaco's IsoCleanTM Solutions offers fluid conditioning services to remove damaging particulates from system fluids and IsoCleanTM storage containers to provide fluid contaminant protection and improve facility and system cleanliness. Desiccant breatl1ers created by Des-Case® Corporation reduce airborne particulate and water contamination, whim are leading causes of lubricant-related equipment failure. Petrolink USA, Inc., offers on-site lubricant reconditioning and preventive maintenance services to manufacturing facilities in the Midwest, Northeast and Southeastern areas of the United States.

Industry Utilization of ISO Cleanliness Codes

Industry as a whole is beginning to implement solutions to achieve compliance with ISO Cleanliness codes. Manufacturers of machinery are establishing target cleanliness codes for systems and are also providing extended warranty considerations for end-users who maintain long-term system hygiene as part of their reliability programs.

In addition, end-use customers are becoming more educated about contamination control and as a result, are creating buy-in from provide tools for removing contaminants. They can also utilize life extension tables to illustrate potential benefits in reducing system contamination from high to low levels, along with capturing the economic value of these solutions.

Moving to Proactive Maintenance

It can be difficult to convince maintenance staff of the importance of complying with and relying on the value of ISO Cleanliness codes. Due to the recent economy, maintenance departments are usually squeezed for time and money. Also, because contaminants are microscopic and invisible to the eye, most planners are unaware of the harm these unseen contaminants can cause to system reliability. Therefore, new tactics can often be seen as burdensome and inconvenient.

However, with recent emphasis on education and training, more maintenance personnel are learning about the problems associated with contamination. Once appreciative of the benefits that improved cleanliness offers, most maintenance departments are eager to travel the road to less downtime and improved reliability and profitability. Nevertheless, the transition can sometimes be tough, because while the maintenance department must deal with typical issues such as rebuilds, outages and frequent oil changes, it must simultaneously execute new measures that require extra time. Plus, depending on the equipment and environment, it is possible that benefits may not be seen for an extended period of time. Consequently, this paradigm shift requires a great deal of discipline and commitment from the maintenance staff.

❑❑❑