Understanding Oil Cleanliness

ISO Particle Count | 4406:99

What is it?

The International Organization for Standardization (ISO) has developed a cleanliness code that is the primary piece of data reviewed on most industrial oil analysis reports. The value of this code can help determine the overall cleanliness of the monitored system. Often times, an end user will establish a target value to achieve, thus offering a level of confidence so long as the used oil sample meets this established target. The trend in the oil analysis world is to give too much credit to the value of the ISO cleanliness code. Some laboratories have even begun to only report the ISO code. There is also a heavy reliance on this value by end-user analysts. The ISO code is a fantastic tool to use for setting target alarms and establishing a goal to achieve and maintain as it relates to system cleanliness. It is also the perfect value to use for key performance indicator (KPI) tracking, charting and posting. However, the ISO code should play only a secondary role when it comes to evaluating used oil sample data.

Why is it important?

Why is cleanliness so important? The answer is simple: competition. In such a globally competitive market where products can potentially be manufactured and shipped from overseas at a lower cost than can be manufactured from here at home, maintaining a precise level of reliability and uptime is necessary to keep costs at a manageable level. Contaminant-free lubricants and components will extend the lifetime of both, and in turn increase the overall reliability of the equipment.

While the general rule of thumb is that for every increase in the ISO cleanliness code, the number of particles has doubled, this certainly is not the case in every situation. Because the number of allowable particles actually doubles within each code number, it is possible for the number of particles to increase by a factor of 4 and only increase a single ISO code. This becomes a significant problem when you have a target cleanliness level of 19/17/14, your previous sample was 18/16/13, and your most current sample is 19/17/14. For all reporting purposes, you have achieved and maintained the target cleanliness level of 19/17/14. This suggests that your component should be in a "normal" status. Given the information presented previously, it is easy to see how you could have two to four times the amount of particle ingress and only increase by a single ISO code or have no increase at all.

More Than (P/mL)	Up to and Including (P/mL)	ISO Code 4406:99
80,000	160,000	24
40,000	80,000	23
20,000	40,000	22
10,000	20,000	21
5,000	10,000	20
2,500	5,000	19
1,300	2,500	18
640	1,300	17
320	640	16
160	320	15
80	160	14
40	80	13
20	40	12
10	20	11
5	10	10
3	5	9
1	3	8

How the ISO Code is Determined?

It's easy to look at the ISO table and notice a pattern. At each row, the upper limit for each code is approximately double that of the lower limit for the same code. Likewise, the upper and lower limits are double that of the upper and lower limits of the next lower code. This is known as a Renard's series table. The unit of measure for particle count data is "particles per milliliter of sample." The particle counters used in laboratories incorporate much more than a milliliter of sample. During the testing process, approximately 100 milliliters of sample are taken into the instrument. The numbers of particles are counted based on this value. The total number of particles is then compared to the number of times that 2 will go into that total count exponentially.

Example ISO Code: 20/17/13		
Range	Results (P/mL)	ISO Code
>4 Microns	9,721	20
>6 Microns	1,254	17
>10 Microns	326	
>14 Microns	73	13
>25 Microns	12	
>50 Microns	5	
>100 Microns	0	

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