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ISO 4406-1999 – Effects on the End User

Question:

Please explain the impact on me, as an end user, of the changes brought about by ISO 4406-1999? Is my database of previous results no longer valid? Can I continue just using the two range codes I have traditionally used?

Answer:

In practical terms, as an end user monitoring and trending just the stock standard two number ISO code (eg: ISO 14/12), you probably would have been none the wiser for the change had not such a fuss been made about it. You needed to know, but from your perspective the effect is minimal.

A good place to start is to obtain a copy of **ISO 4406-1999** *(Hydraulic Fluid Power - Fluids - Method for coding the level of contamination by solid particles)*.

The last two allocations of **the CODE itself** has not changed from **ISO 4406-1987** that this newer revision replaced.

What has changed is the test dust on which the instrument is calibrated. Also, the fact that automatic particle counters (APC, Laser Counter) use a different method to a microscope to size particles has been accounted for in this latest revision of the Standard.

In essence, the calibration of automatic particle counters using the new test dust has been adjusted to align the resultant ***code*** with those collected over the years and to correlate with the ***code*** obtained when using a microscope.

There are many technical papers available which detail the history and considerations taken during the development of standards based on an alternate test dust (eg; the impact on particle counting, filter efficiency determination etc).

Luckily, the committees involved in this change sought to minimize the impact on the end user. Unfortunately, confusion was created through focusing on an in-depth commentary of the *process*, rather than simply the *outcome* intended by the committees involved.

Therefore, this discussion supporting the opening statements above is limited to some key points from ISO 4406-1999. (eg: reporting of the solid particulate level)

NOTE: Where you see a "µm" followed by a "(c)", eg: "µm(c)" it signifies the range size where the automatic particle counter is calibrated in accordance with ISO 11171 with the NIST standard reference material SRM 2806. (eg: simply the new calibration standard and new test dust)

Discussion

Fact 1. (ISO 4406-1999, section 3.1)

ISO 4406-1999 clearly states that when conducting an optical microscopic count using a microscope in accordance with ISO 4407 (Hydraulic Fluid Power - Fluid Contamination - Determination of particulate contamination by the counting method using a microscope) that the particle is still sized in the same manner - that is, as being equal to its longest dimension.

When using a microscope the range sizes to determine the code are exactly as they were in ISO 4406-1987, that is ≥5 µm and ≥15 micron. (Although not required by the standard, at times and depending on the application, ≥2µm was and still is additionally included in an microscopic result)

Since there have been no changes to how the result is obtained or reported using a microscope, it could be argued that it is still the datum against which other techniques are aligned.

Fact 2. (ISO 4406-1999, section 3.1)

ISO 4406-1999 details how the use of a different calibration procedure (eg: Different test dust with a different particle distribution) brought about the need to adjust the measured range sizes so the CODE reported by the instrument was in alignment with the previous CODE. (eg: to obtain an equivalent CODE, the range sizes are now ≥6 µm(c) and ≥14 µm(c)as opposed to ≥5 and ≥15 micron.)

No only was it important to adjust the instrument to provide a CODE with previous CODES to maintain the integrity of the many databases built up over the years, but it was necessary to make these adjustments so CODES obtained from an automatic particle counter aligned themselves with those obtained using the traditional microscopic counting method.

Fact 3. (ISO 4406-1999, section 3.2, 3.3, 3.4, 3.5)

ISO 4406-1999 is comprised of a 3 part code.

You can continue to use just the two last codes as previously done**,** however you need to annotate it a little differently to comply with ISO 4406-1999 by using the 3 part format and not a 2 part format.
(ie: **ISO -/14/12** rather than **ISO 14/12**) The actual representation chosen will depend on the particle counting method used, as follows:

1. You can report the code from an automatic particle counter using the following size ranges:

≥4 µm(c)/ml	(the standard provides no equivalent, however it is generally recognized it replaces ≥2 µm that may have been optionally reported previously)
≥6 µm(c)/ml	(equal to ≥5 µm/ml under ISO 4406-1987)
≥14 µm(c)/ml	(equal to ≥15 µm/ml under ISO 4406-1987)

Therefore your result will be reported as such: **ISO 16/14/12**

2. To obtain the code using a microscope in accordance with ISO 4407 the following size ranges are used:

≥2 µm/ml (Optional)	*(not necessary to comply with the standard but you may find it included)*
≥5 µm/ml	(unchanged from ISO 4406-1987)
≥15 µm/ml	(unchanged from ISO 4406-1987)

Therefore your result will be reported as such: **ISO -/14/12**

3. If you wish to continue reporting just the traditional two scale code, you can do so by complying with the following provisions:

Where there are too many particles to count a notation of "*****" will be entered into the scale allocation. (eg **ISO */14/12**)

And where there is no requirement to count or where a microscopic count is conducted an annotation of "**-**" will be entered into the scale allocation. (eg **ISO -/14/12**)

Conclusion

The change has impacted on various sectors of the filtration and related industry in varying degrees. However, where the end user's exposure is limited to the final result (eg: ISO code reported on the analysis sheet), the change is of little consequence, provided he is aware of the requirement to report the result in the 3 part format in accordance with the provisions provided.

References:

ISO 4406-1999 *Hydraulic Fluid Power - Fluids - Method for coding the level of contamination by solid particles*

ISO 4406-1987 *Hydraulic Fluid Power - Fluids - Method for coding the level of contamination by solid particles*

ISO 4407 *Hydraulic Fluid Power - Fluid Contamination - Determination of particulate contamination by the counting method using a microscope*

How will new test dusts impact particle size, particle count and fluid cleanliness classes?
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