

Periodic Filtering

("Kidney Looping", "Dialysis")

***What they haven't told you.....
And what you need to consider!***



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People are only made to suffer dialysis when they have sick kidneys. Kidney Transplants (ie: filter upgrades) are conducted where possible to avoid this procedure.

Yet, when it comes to our machines we burden ourselves with periodic filtration (ie: dialysis), instead of embarking upon the more appropriate option of upgrading or installing an effective filtration system (ie: kidney transplant).

Periodic Filtering - *The Pros*

1. Where it is impractical or impossible to install on-board full time filtration.

Sometimes, due to equipment design and function periodic filtration is the only strategy available (other than draining and replacing the lubricant).

2. Where the equipment is not critical or of high value.

The criticality or repair and replacement cost of the equipment does not warrant the investment in on-board full time filtration.

3. Where the need to filter the lubricant to maintain the ISO code within the target level is infrequent.

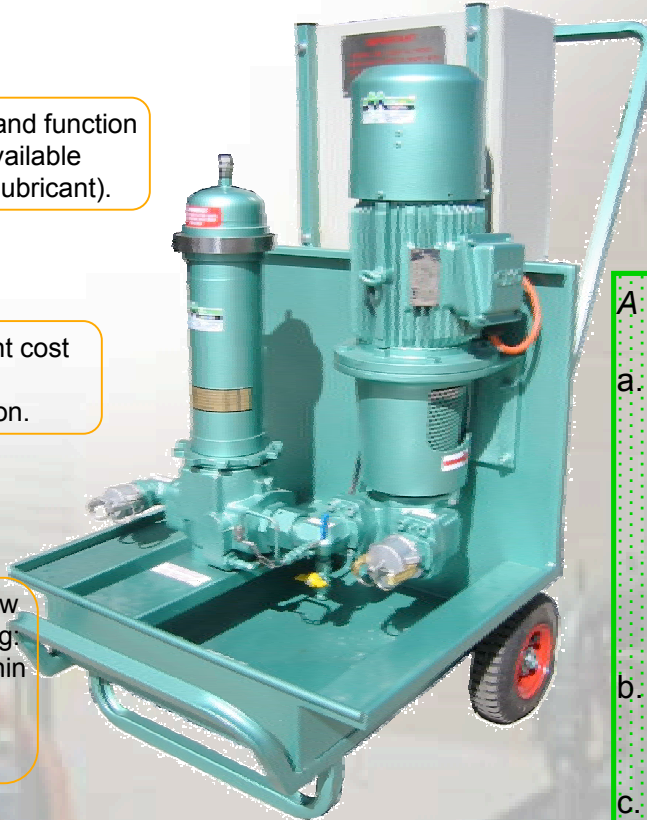
The external ingress and wear rates are low necessitating periodic filtration infrequently (eg: 3 or 6 monthly) to maintain the ISO code within the target level. (These applications are extremely rare but have been evidenced from time to time)

4. Where condition monitoring (SOS) trends are not critical.

The rise and fall in ISO code, elemental analysis (SOS) due to cycle of filtering, allowing the system to degrade and filtering again makes it difficult to trend or identify abnormalities.

5. As an interim measure to obtain some benefit to the business until a more ideal strategy can be implemented.

It has been demonstrated this strategy can deliver a benefit (whilst not optimal) to the business. Until the customer has the courage to initiate improvements or the OEM recognises the necessity for improved on-board filtration, then periodic filtration offers an interim band-aid solution.



A "Filter Cart" is an important tool used for:

- a. Cleaning a hydraulic or lubricated system prior to start-up following overhaul, repair or catastrophic failure. (ie: Establishing the Target ISO code prior to operation and during startup to minimise the likelihood of infant mortality.)
- b. Filtering oil when replenishing or topping up compartments.
- c. Quickly restore the compartment ISO code to the target level following an inadvertent contaminant ingress.

Periodic Filtering - *The Cons*

1. It does not control the “wear chain reaction” - it only interrupts it.

Particle numbers begin to immediately increase once the rig is disconnected and machine returns to work. Wear begins to accelerate immediately. Wear is not controlled at a constant level.

2. It is another task that needs to be planned, allocated resources and controlled.

This activity introduces hazards and risk that the business need not be exposed to. This risk can be eliminated rather than formulating SWPs to control it.

3. Good units are expensive to purchase, maintain and operate.

The units also require periodic maintenance. They also consume a greater number of filter elements than a system installed permanently on the machine.

4. Increased filter element cost.

The wear chain reaction has been allowed to generate an overall greater particulate level that now needs to be removed. There are far less particles to remove if they are removed when they are first ingressed or generated before they generate even more particles.

10. Most “filter rigs” sites are using are poorly designed, too inefficient for the purpose and are unable to achieve good ISO codes.

To maintain the operating ISO code to better than the target level you must filter the compartment to a number of codes below this level to provide some service life. Rigs (as illustrated below) are not capable of achieving the levels necessary for this (eg: <ISO -/14/12)



5. Extra analysis of lube is required prior to filtering to ensure it is economical and feasible to do so.

If the oil is too dirty or degraded it may consume more filter elements than the cost of replacing the lube.

9. The service period between the compartment requiring filtering to maintain it within the target level is unknown.

It may be hours or weeks depending on the ingress and wear rates. Experience with Haul Truck final drives indicates the level rises from a filtered level of ISO -/13/10 to “too dirty to evaluate” in less than 48 hours.

8. It does not address the root cause.

Many sites employ periodic filtering to overcome the deficiencies of inadequate poor performing permanent on-board filtration. Fix the root cause (upgrade the on-board filter) and periodic filtering is not required.

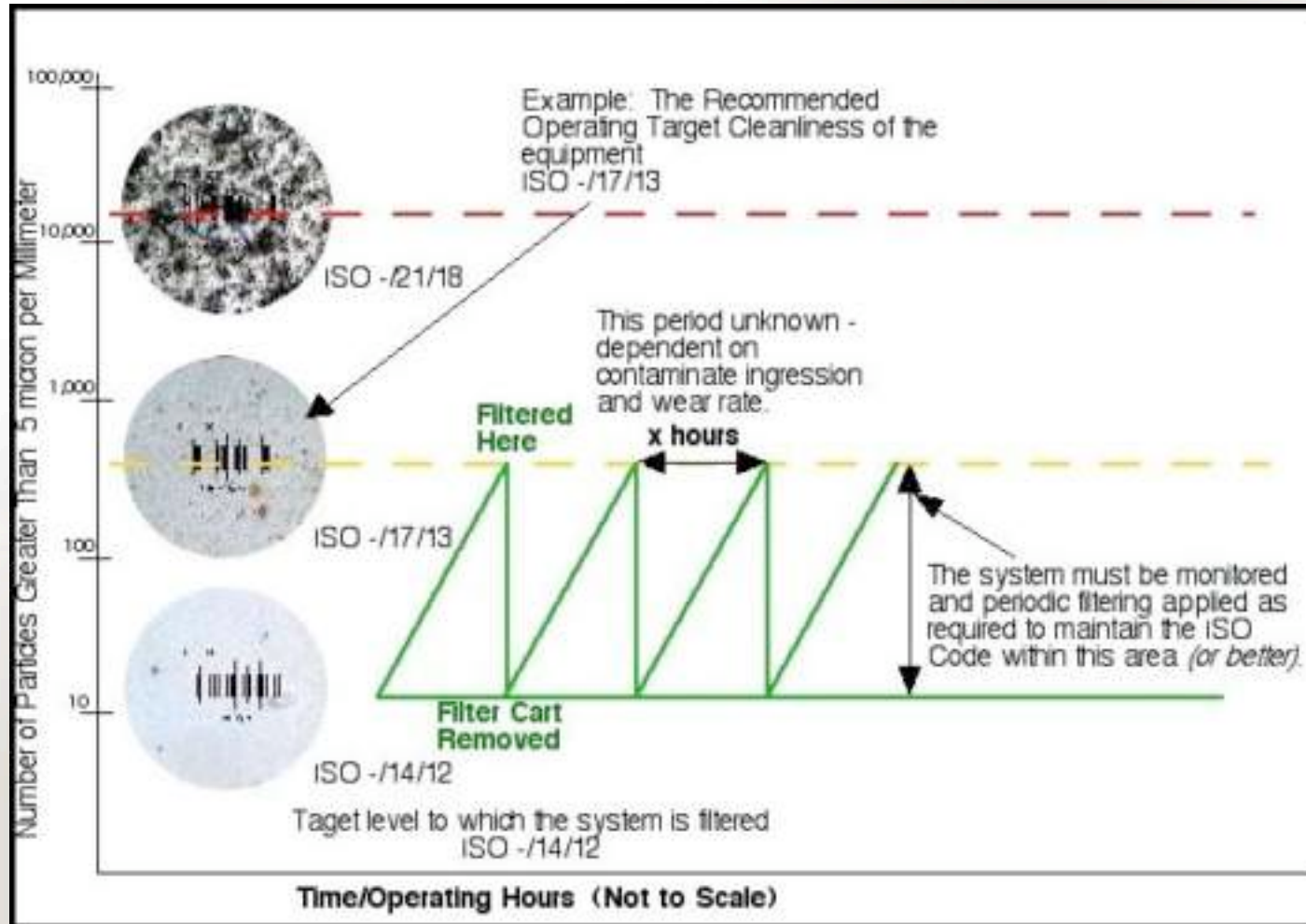
7. It does not enhance condition monitoring techniques. ISO codes and wear levels are not maintained at constant levels.

Abnormal results are more readily recognised when the ISO code & wear levels are maintained at a constant level.

6. Analysis of the lube must be conducted during the process to ensure the targeted ISO code has been achieved.

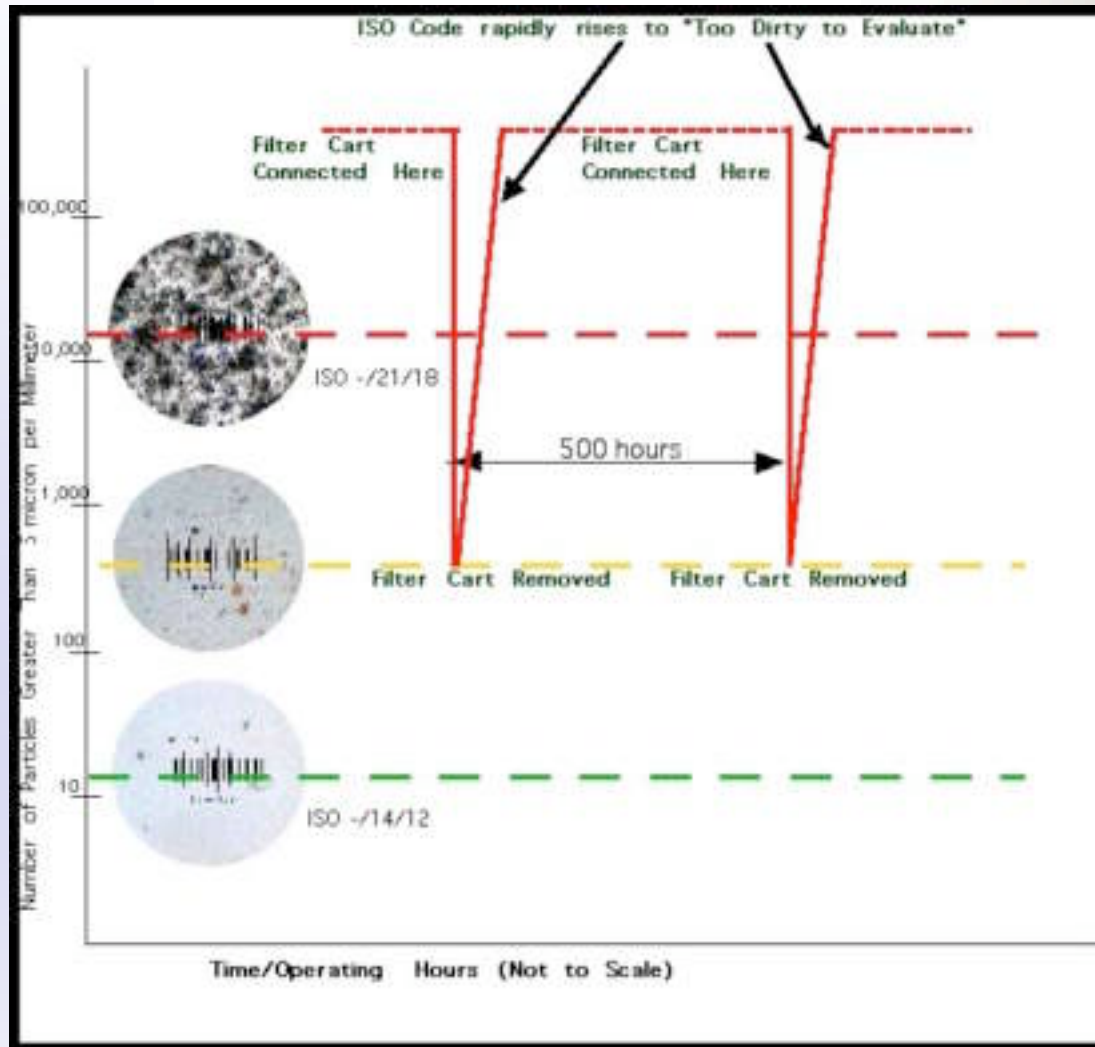
Filtering the oil for “x” hours does not guarantee the process has been successful - **THE RESULT MUST BE MEASURED.**

Periodic Filtering - **CORRECT**



Correct “Periodic Filtration” is difficult, requiring a regimented and dedicated approach to both condition monitoring and deployment of the filter rig. Where a large number of compartments are involved and the period between filtering to maintain the ISO Code within the target level is short, *this strategy quickly becomes unmanageable and ineffective.*

Periodic Filtering - **INCORRECT**

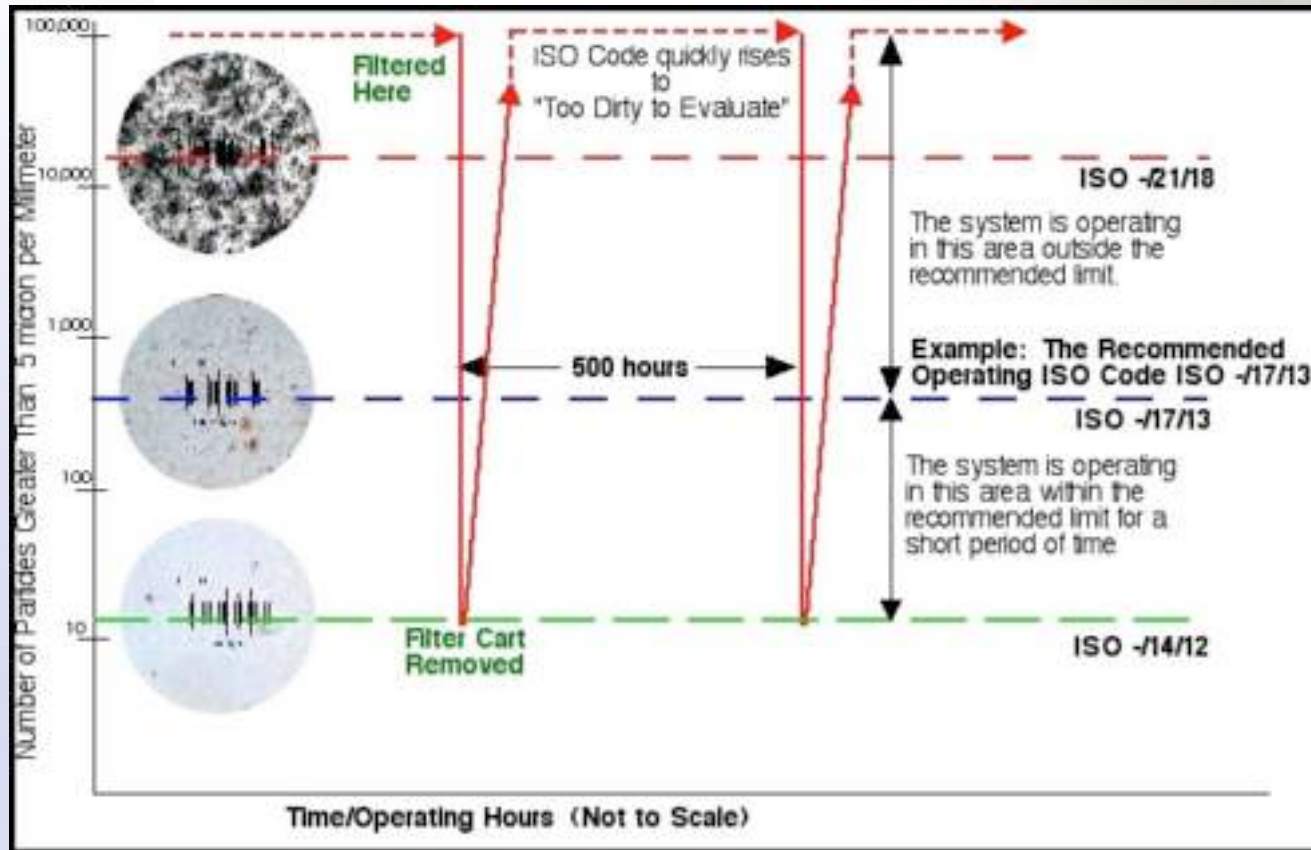


Unfortunately this chart illustrates the scenario commonly found where sites have implemented a periodic filtering strategy.

1. The period between flushing is fixed at 500 hours regardless of the ISO code of the lubricant.
2. The lubricant is filtered for a set period of time (eg: 2 hours), and is very rarely verified that the desired ISO code has been achieved.
3. Even where the result is verified the outcome targeted is only to that of the "recommended operating system ISO code" and not at least 3 or 4 codes better as it should be, to allow the compartment a period of time to operate within the recommended limit.
4. It can be clearly seen that under this implementation of periodic filtering, the system is never operating within its recommended ISO code.

Even this rudimentary implementation of the strategy provides an improvement in the reliability and service life of the components.....raising the question of what is possible if it is applied in an optimal manner!

Periodic Filtering - Questionable



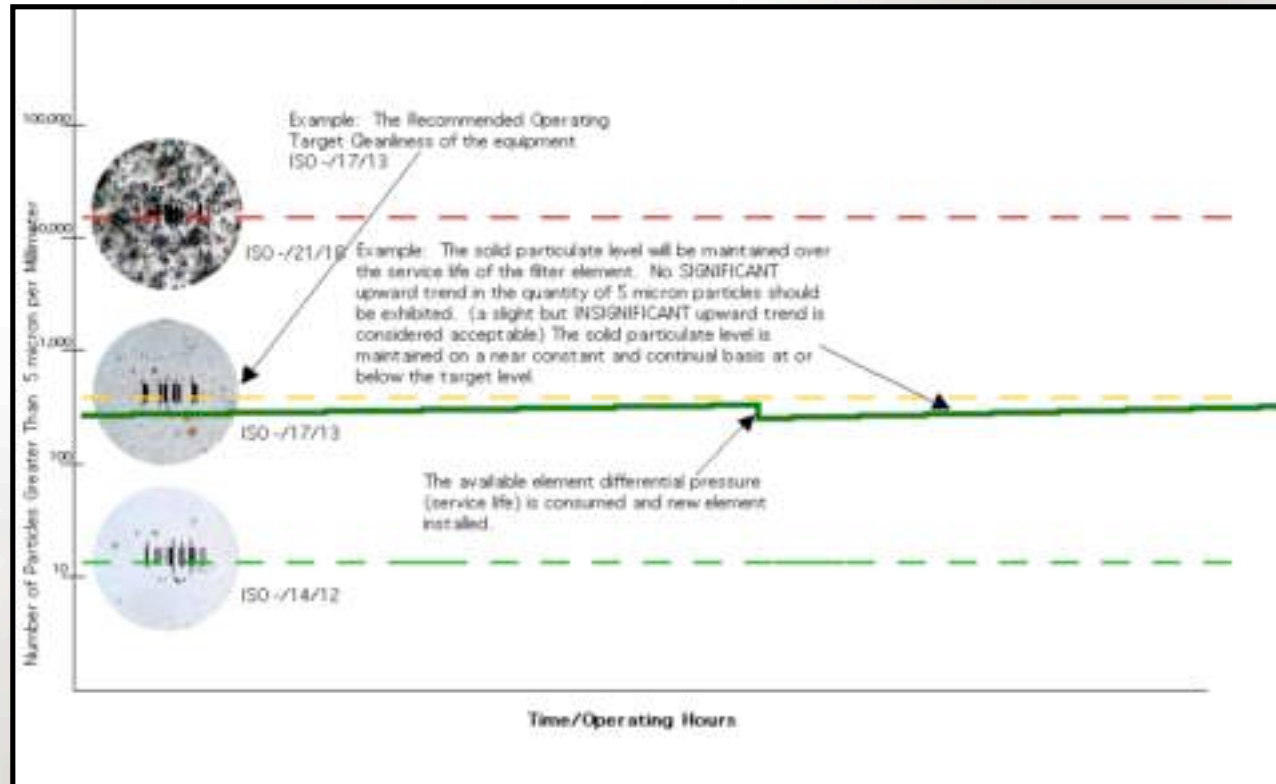
1. Even if the system is periodically filtered to a good ISO code, but a strategy of fixed period scheduled filtering is maintained, it is evident that the period the compartment operates within the recommended ISO code is still minimal. (It is acknowledged the odd exception does exist!)

2. Trials carried out at one site on a Haul Truck final drive found the ISO code returned to "too dirty to evaluate" within 48 hours following being filtered to ISO -13/10.

The compartment was still operating outside its recommended ISO code for the majority of its service life! (eg: 450 hours of 500 hours service interval)

Whilst not ideal, this scenario is probably the best outcome sites can be expected to practically achieve!

Full Time Filtration - The Difference

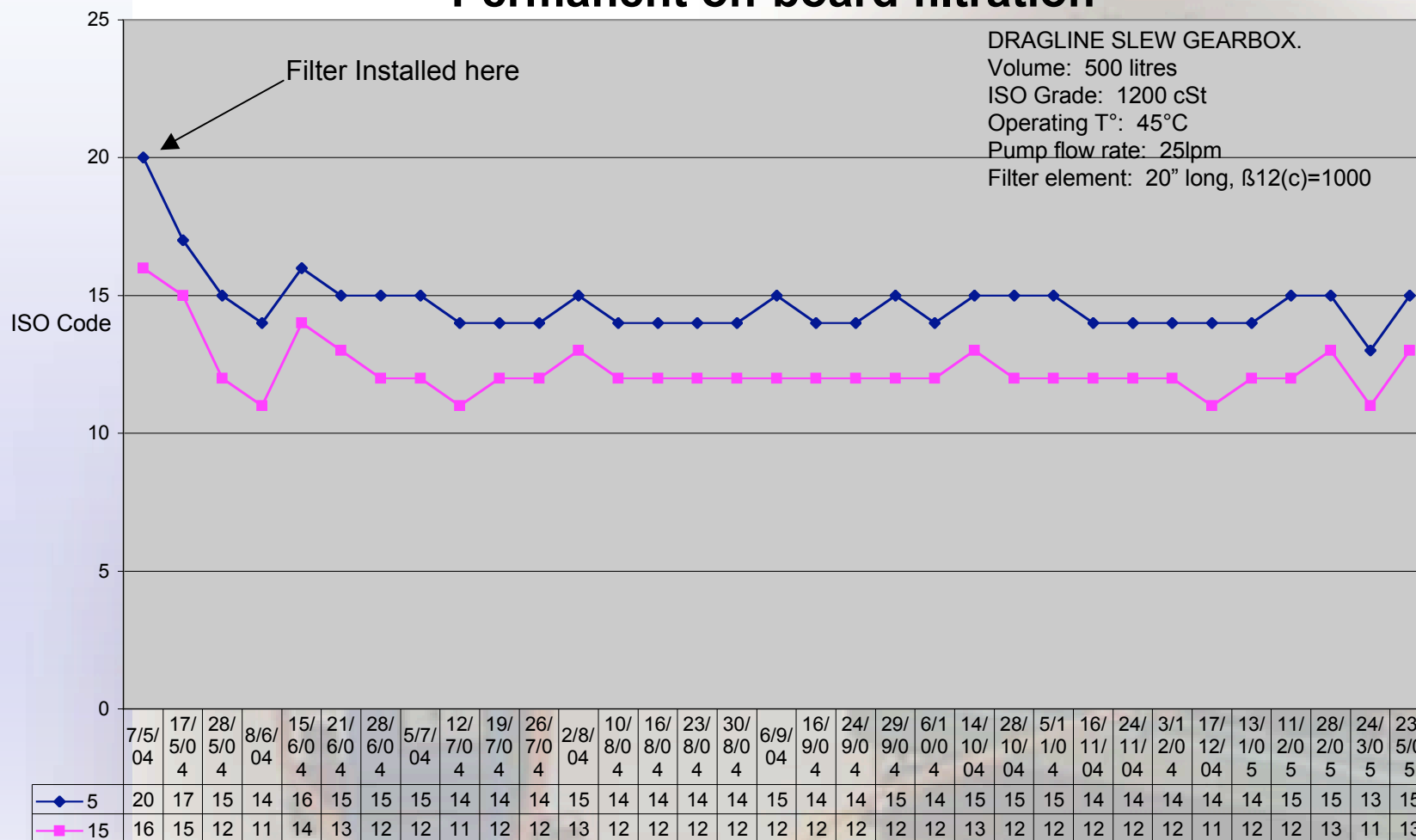


The effect is clearly evident - The ISO code (and thus wear levels) are maintained at a near constant rate at all times. Any major change in the condition of the components will firstly be identified by a dramatic rise in the ISO code (primary indicator) followed by a rise in the spectrometry elemental analysis (trailing indicator). The overall amount of particulate generated is much less, thus filter element consumption is much lower than would be employing periodic filtration.

NOTE: If your experience finds an upward trend in the ISO code and spectrometry elemental analysis as the service life of the filter element is consumed, then you are using inferior poor quality filter elements. (eg: They exhibit an unstable beta ratio and are constructed of non-uniform pore media: eg: Commodity priced elements) **Correct the root cause rather than burden yourself with periodic filtration!**

REAL LIFE EXAMPLE (ISO Code)

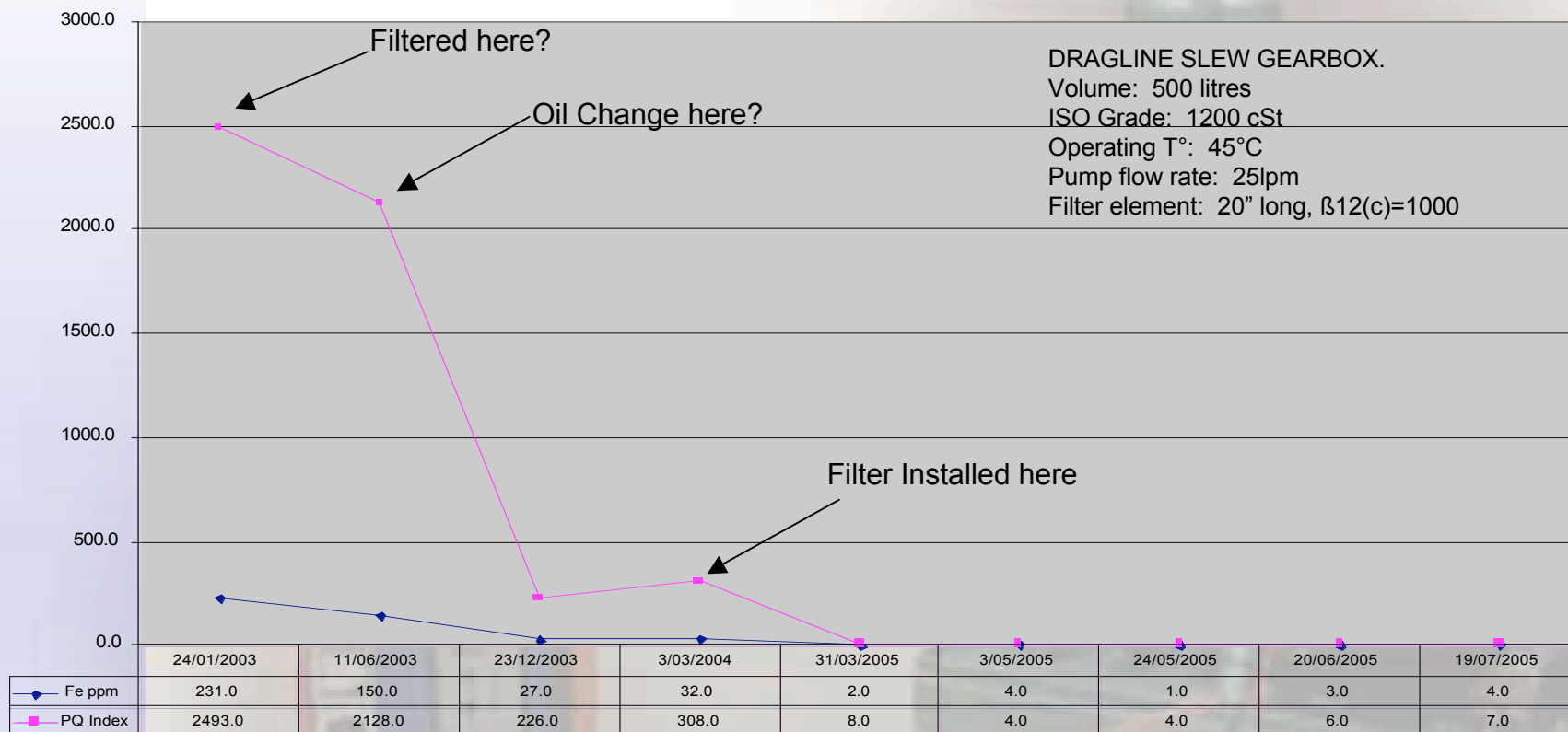
Permanent on-board filtration



Permanent on board filtration maintains the wear levels at a near constant rate.

REAL LIFE EXAMPLE (ICP)

Permanent on-board filtration



The graph clearly shows the large amount of wear debris present (from spectrometry iron levels and the PQ index) and the large variations in analysis prior to installation of the permanent on-filtration system. The strategy prior to installation of the permanent on-board filtration system was that of periodic filtration and/or scheduled oil changes.

Cost Benefit Analysis Example

Scenario: A fleet of 20 trucks, Hydraulic system ISO code is not being maintained.

COST to implement a periodic filtration strategy

Cost to upgrade existing filtration system

Capital Investment.

Filter Trolleys (x 2). \$40,000

New Filter Housings (x 10). \$20,000

Operating Cost.

Capital Investment write down - 20%
per annum over 4 years. \$8,000 per annum

\$4,000 per annum

Repairs and Maintenance

Pump, hoses, couplings etc. \$1,000 per annum

No additional above that which the
upgraded unit replaced. \$0 per annum

On-going labour to carry out task.

Connect, disconnect unit, obtain
additional samples to measure outcome
every 500 hours. 1 hour (\$50) x 12
times per year x 10 trucks \$6,000 per annum

Filters now replaced on "differential pressure
indication" only, so filters are replaced only
twice per annum. Therefore we have a
saving: 0.5 hour (\$25) x 10 times per year x
10 trucks Less \$2,500 per annum

On-going filter element costs.

Replace existing filter every 500
hours. \$75 ea x 12 times/year x
10 trucks + 2 x filter rig elements,
\$500 ea x 12 change outs/rig \$21,000 per annum

2 change-outs per annum at \$500 ea x 10
trucks \$10,000 per annum

Periodic Filtration Strategy Cost \$36,000 per annum

Upgrade on-board filtration Cost \$11,500 per annum

+ introduction of additional hazard/risk
(filter trolley operation, spills etc) PLUS \$???? per annum

What value are these
items worth?

- elimination of hazard/risk
(filter trolley operation, spills etc) LESS \$???? per annum

- limited improved reliability, optimised
oil and component service life. LESS \$???? per annum

- improved reliability, optimised oil and
component service life. LESS \$???? per annum

NOTE: This is a very simplistic example at best and you are challenged to carry out a more in-depth analysis to confirm the cost advantages of permanent on-board filtration over implementing a periodic filtration strategy. These figures are based on equipment that can demonstrate a reasonable measurable outcome continuously or within a minimal time frame. (eg: ISO codes better than ISO -/15/12)

The real life example (dragline swing-box) provided in this presentation is proof (just one of the many available) of how effective filtration is expected to perform. Unfortunately, this concept is foreign to the overwhelming majority of commodity filtration manufacturers, suppliers, and lubricant analysis technicians. As such a wealth of misinformation abounds within the industry involving wear control. Much is based on what people have generally experienced (eg: it is considered "normal") and the truth of the matter (ie: they have not experienced it) is disregarded.

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Conclusion

- 1. Periodic “Kidney Looping” is only a band-aid solution. It is far more cost effective to install and maintain good quality and effective permanent on-board filtration in most instances.**
- 2. It is a maintenance task that can be eliminated (or at least minimised) rather than purposely implementing it and placing a further burden on the site’s resources. It should be the last option pursued.**
- 3. “Kidney Looping”, even as it is currently being practiced, does provide a benefit rather than doing nothing at all.**
- 4. Until the OEM recognises the need for improved wear control, or we the end user is prepared to upgrade the installed filtration system, kidney looping is an interim measure that can provide some benefits to the business.**
- 5. By better understanding the process and employing equipment more appropriate for the task, the business benefit obtained from the time and effort expended on periodic filtering can be optimised.**