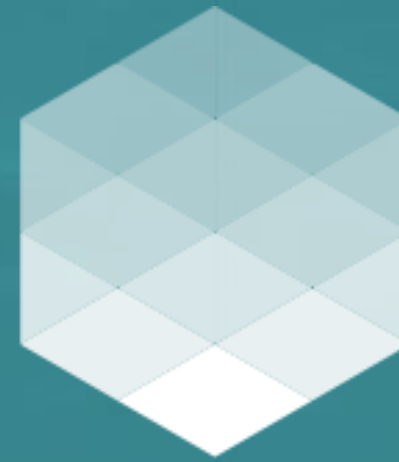




ATTEN2
Advanced Monitoring Technologies

Industrial lubrication 4.0: Contribution of Online lubricant monitoring to end users and added value lubrication services offers

WE DEVELOP CONDITION MONITORING SOLUTIONS FOR YOUR CRITICAL ASSETS

Why to enable digitalization of lubricated assets, industrial lubrication 4.0?

High-Quality standards and more demanding working conditions



Remote data management for lubrication assets



Better failure detection and Improvement of risk assessment



Combination of operational and real-time condition data increase reliability



Detect operational issues long before equipment fails, reducing downtime and costs

...using ON-LINE OIL MONITORING

INTRODUCTION

Industry 4.0



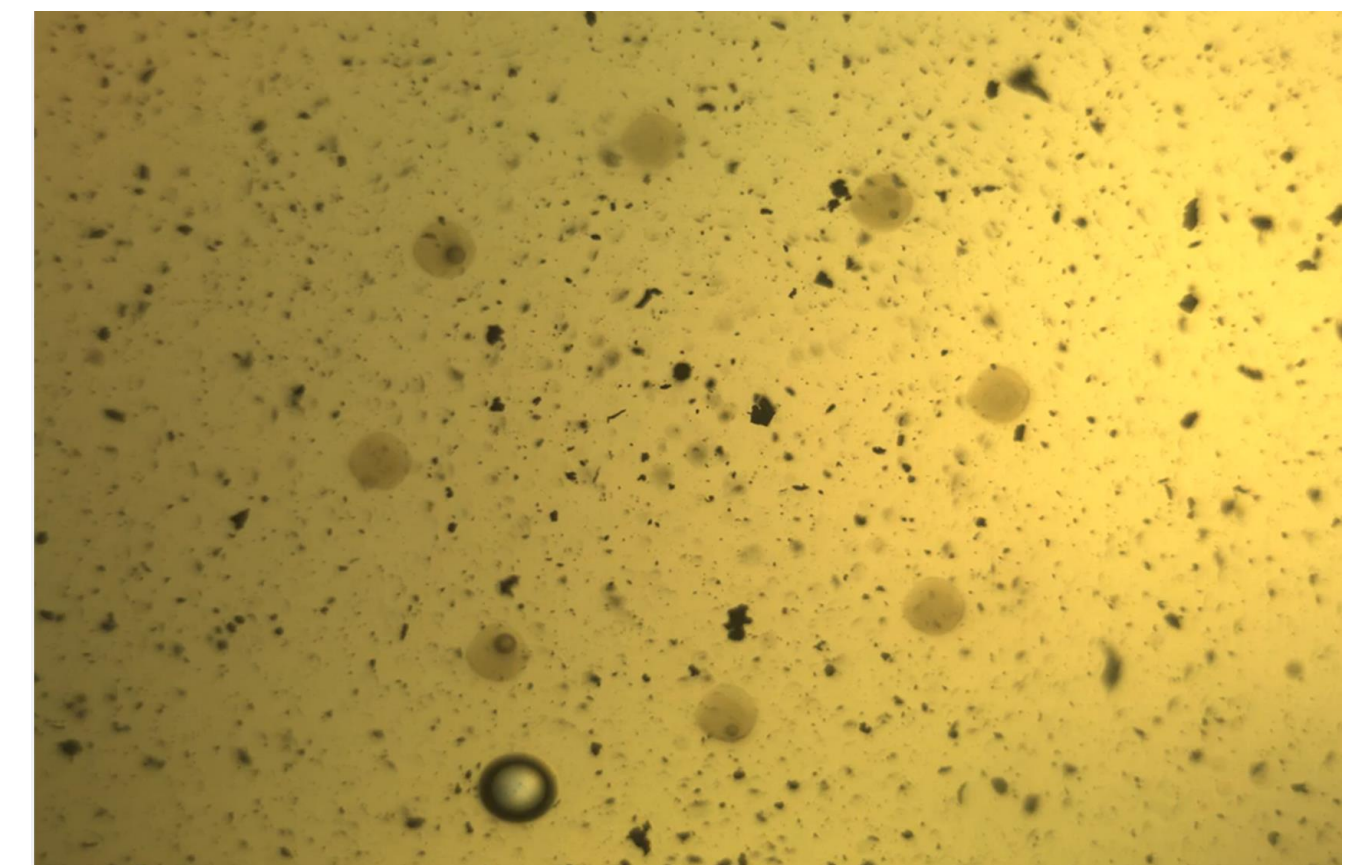
- Lubrication-related failures are a common source of rotating machinery failures.
- Industry 4.0: New types of data are opening up strategies to increase lubrication efficiency and benefits in industrial machinery.
- The integration of online equipment monitoring technologies generates a new perspective in the different lubricant maintenance activities.
- New business models due to time reduction and cost-efficient activities that can take advantage of the different solutions in the market.



ON-LINE OIL CONDITON MONITORING

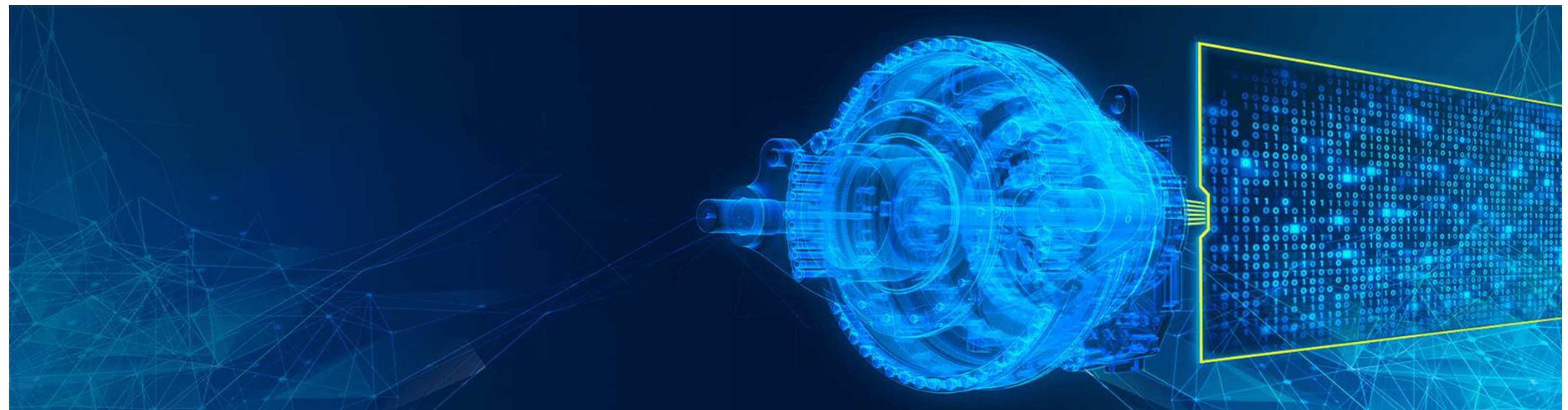
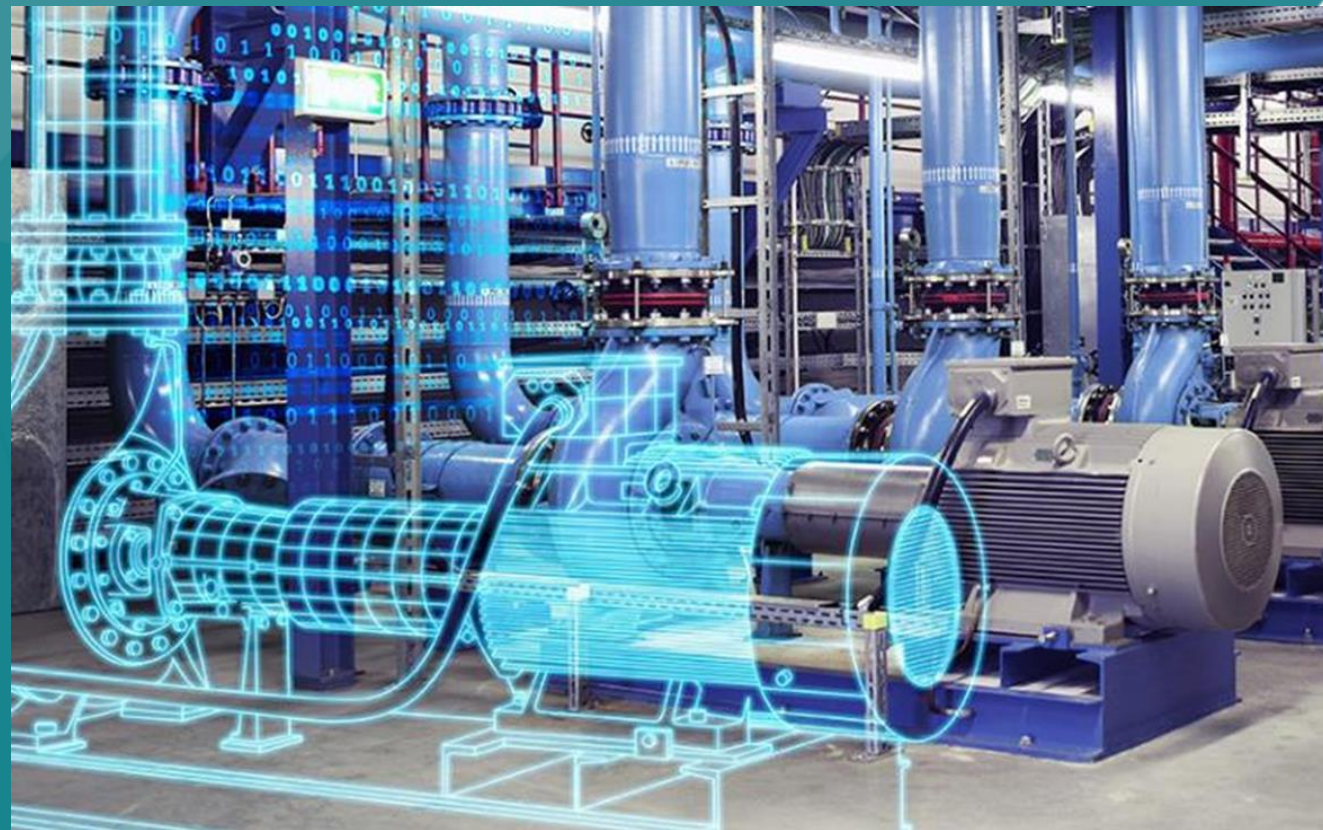
The development of online lubricant monitoring technology has been disruptive in the last decade

- Viscosity
- Lubricant degradation
- Fluid contamination
- Relative humidity



Who could apply this type of technology?

- **Lubricant manufacturers**
- **Critical lubricated asset operators**
 - Compressors
 - Gearboxes/Transmissions
 - Power generation units
 - Hydraulic systems
 - Presses
- **Maintenance or CM service providers**
 - Filtration/Flushing
 - Condition Monitoring



Added value in lubricant lifecycle



Lubricant reception

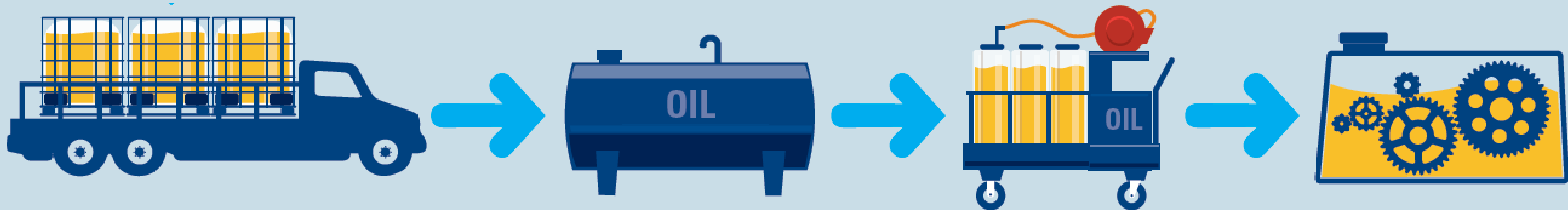
Lubricant storage

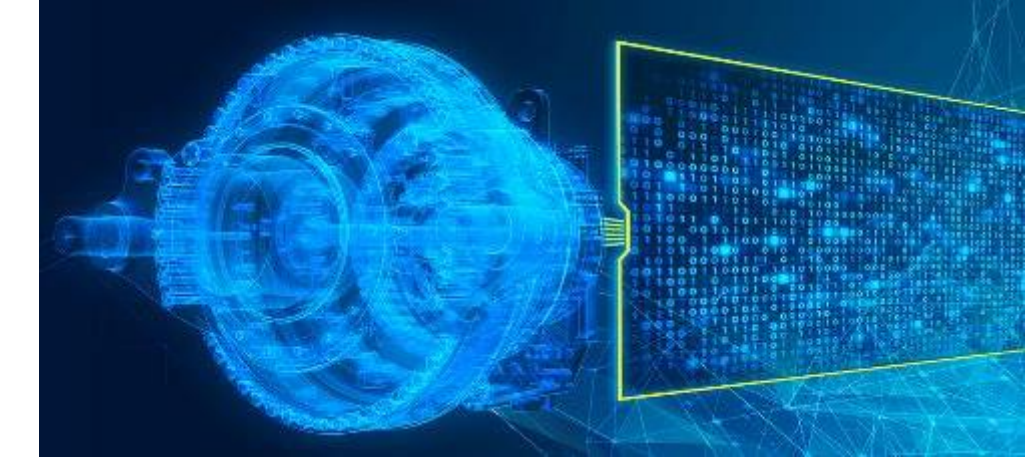
Lubricant dispensing

Lubricant actions

Flushing

Oil analysis

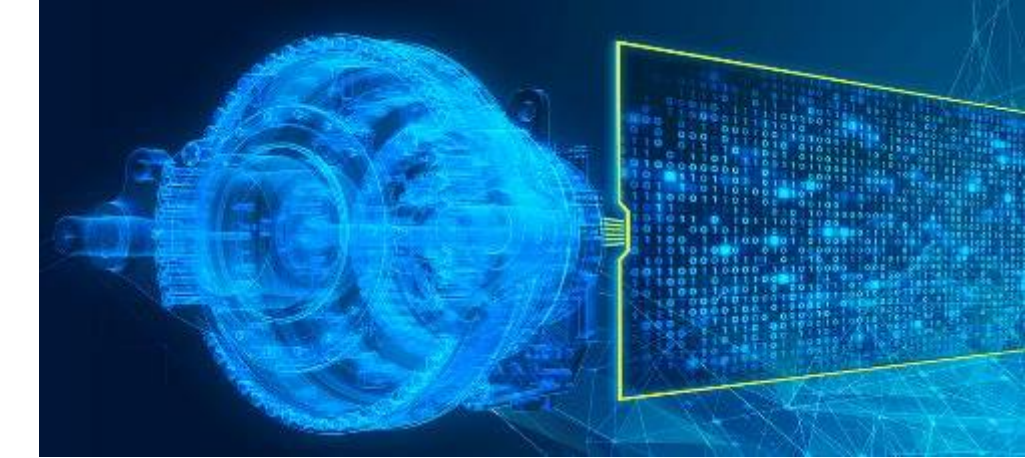




REMOTE DIAGNOSTIC FEATURES

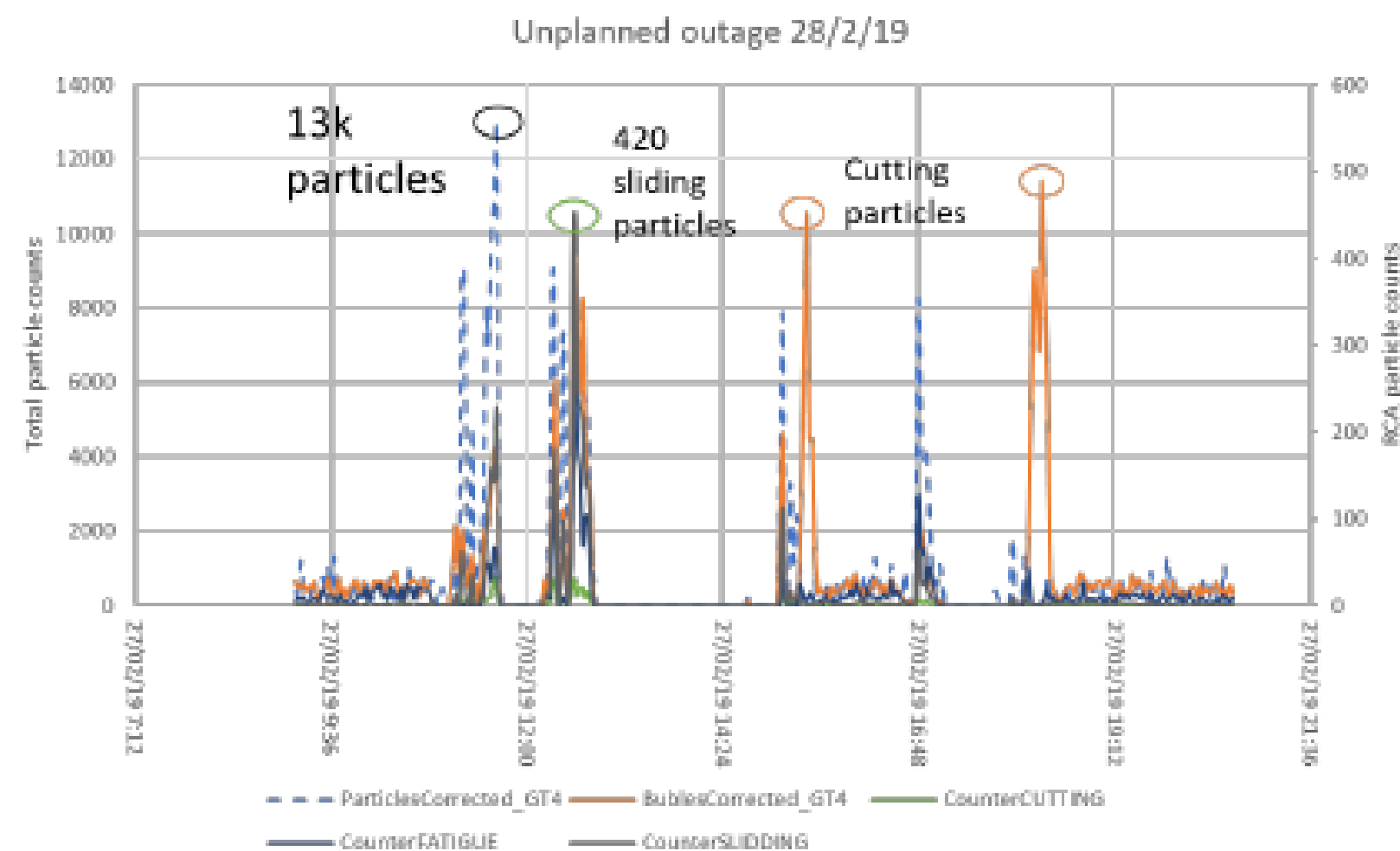
Remote assets such as wind turbine drivetrains or isolated power generation units suppose a cost increase in any maintenance service provided.

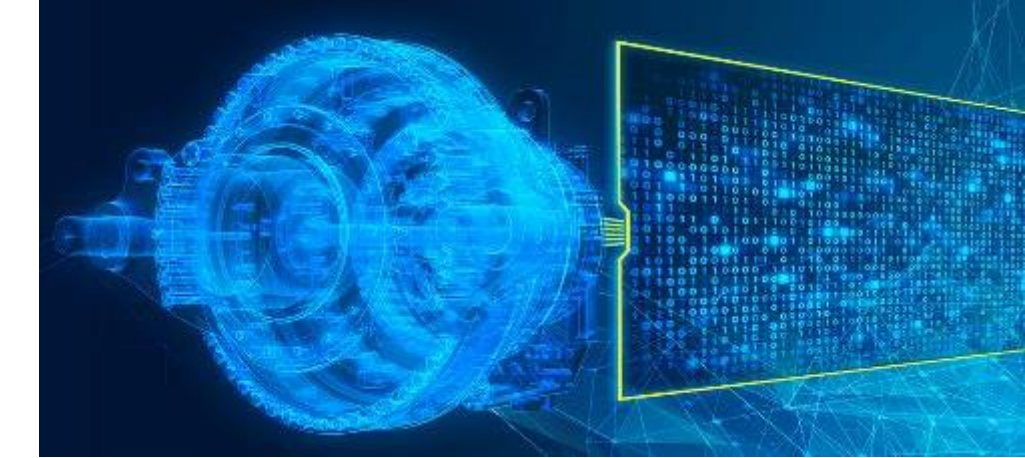




REMOTE DIAGNOSTIC FEATURES

Detection of wear onset in unplanned outages in gas turbine
Application of external filtration to ensure cleanliness levels



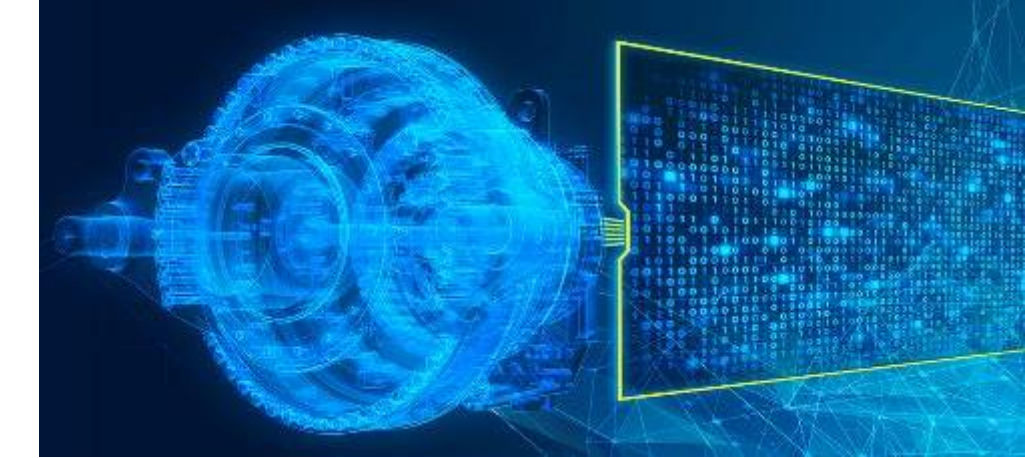


FRESH OIL CONTROL

There are claims of fresh oil being not as clean as some equipment requirements

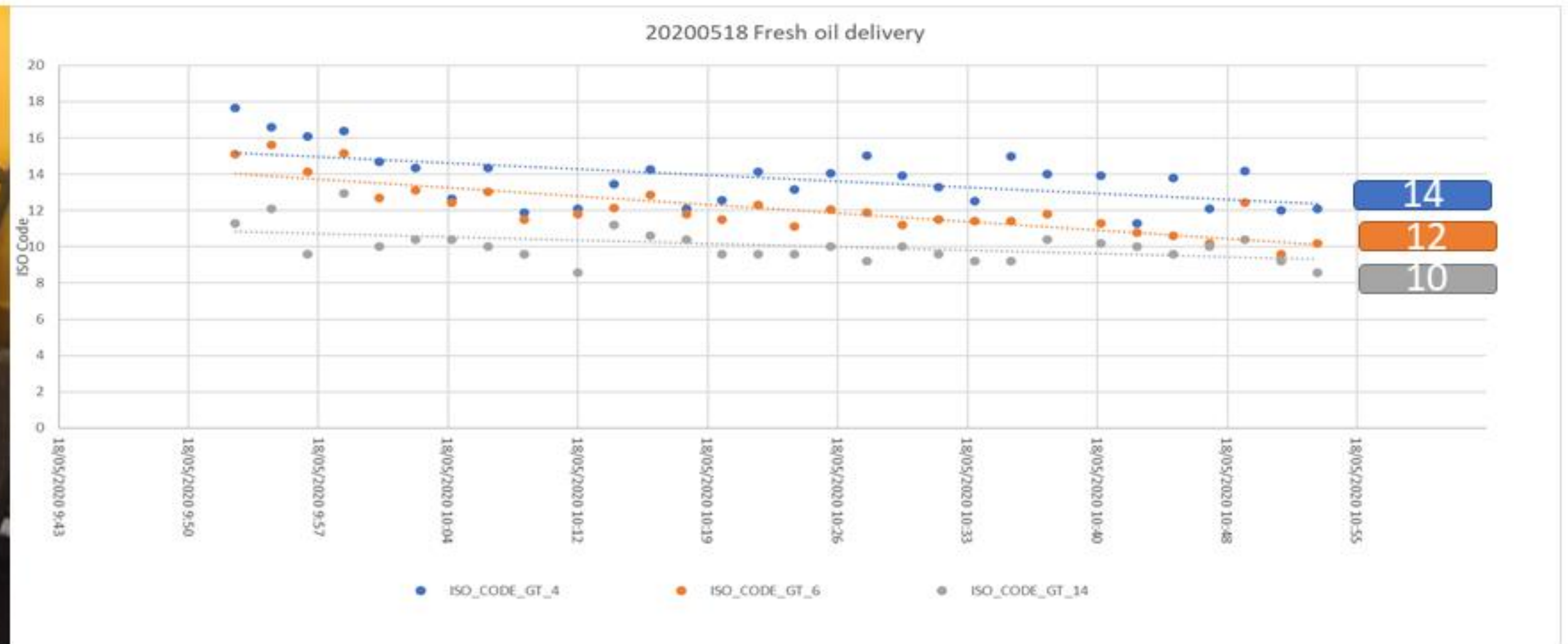
Online monitoring can ensure oil is always complying with OEM requirements for the specific machinery.

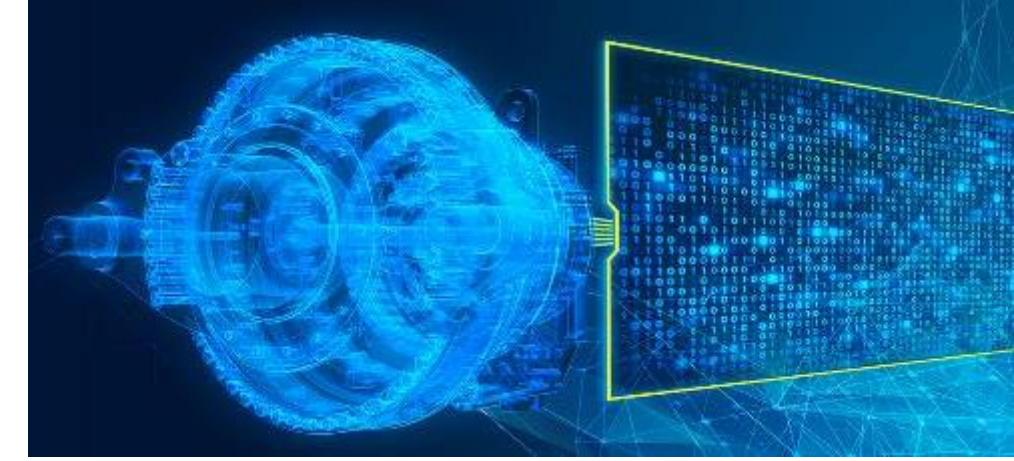




FRESH OIL CONTROL

Lubricant ISO code is monitored before being introduced in the gas turbine tank storage, to ensure OEM cleanliness requirements.





FILTRATION EQUIPMENT MONITORING

Filtration activities to critical machinery units is a common practice.

Specialized in filtering a specific type of contaminants: microscopic particles, degradation by-products, water ingress, etc.

Filtration Efficiency

Filtration Period

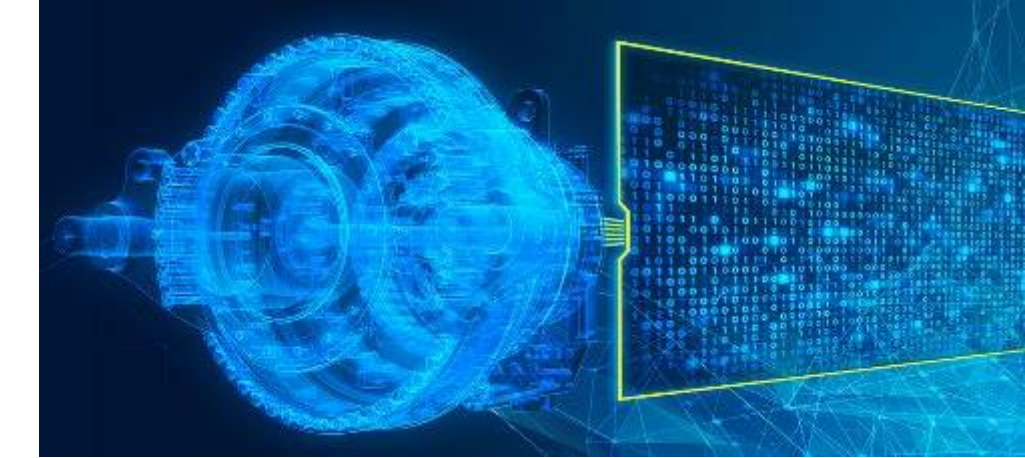
Contamination Control



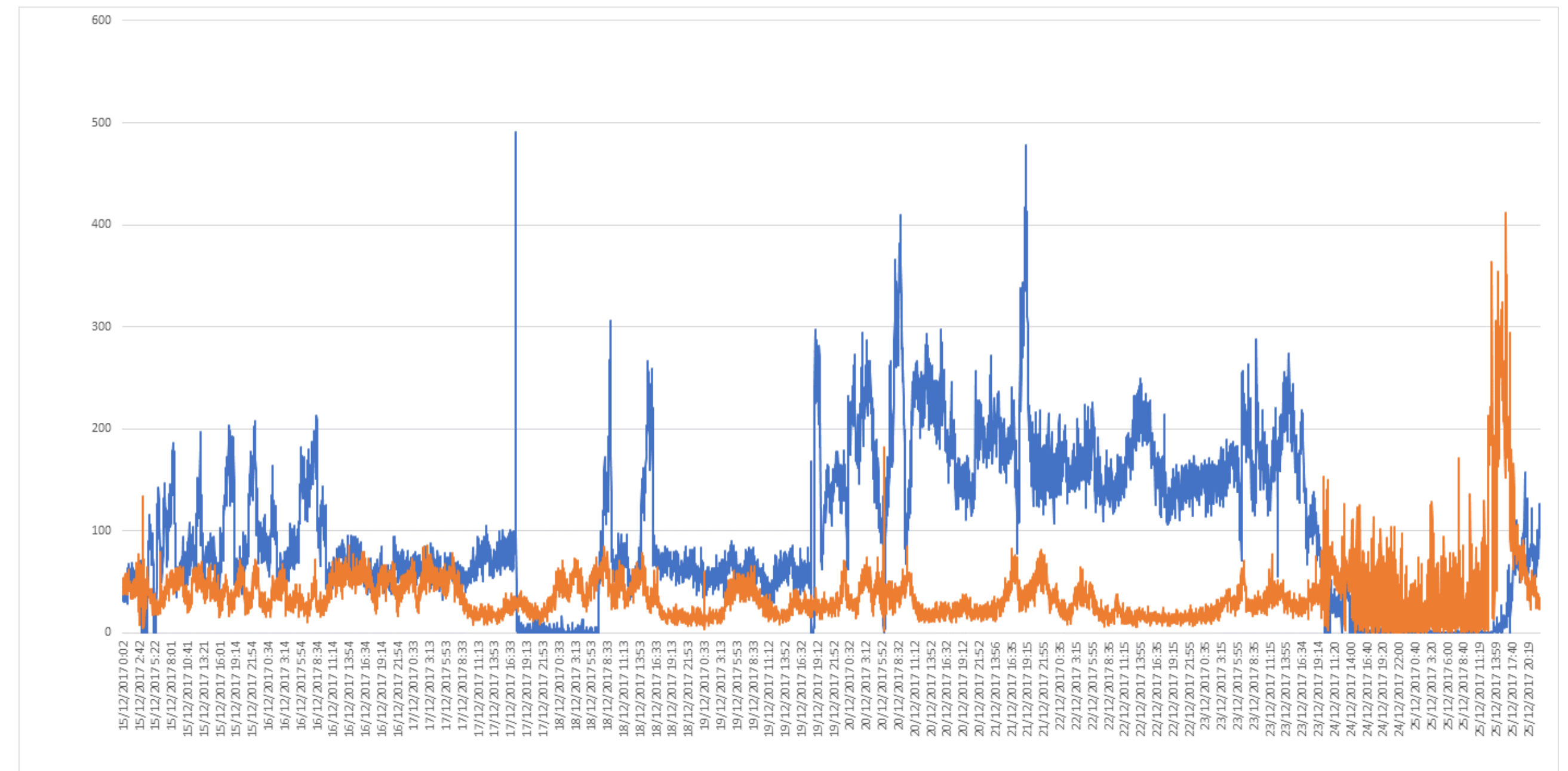
FILTRATION EQUIPMENT MONITORING

- Monitoring the external filtration application in a gearbox
- According to the particle counting analysis and wear process, a modification in the filter configuration was adopted
- Changes in cleanliness codes were detected

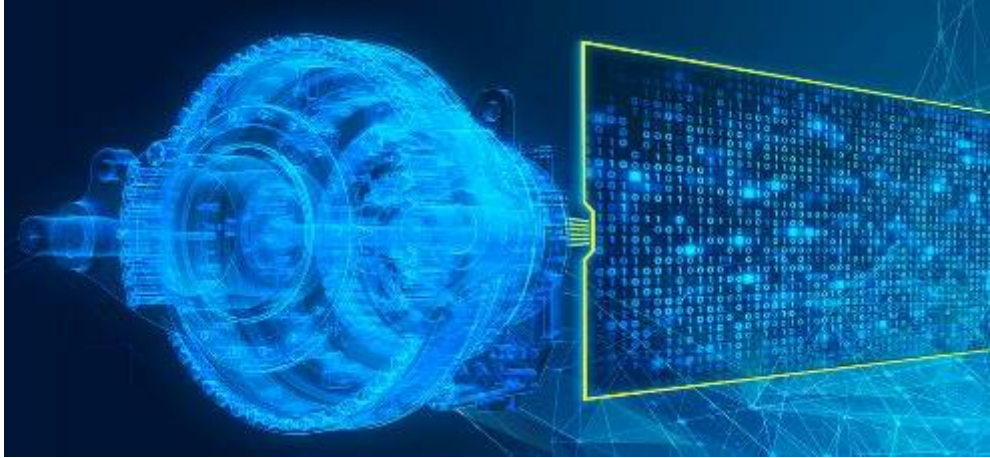




FILTRATION EQUIPMENT MONITORING



The gearbox with a more efficient filter configuration had **20% less wear**



FILTRATION EQUIPMENT MONITORING



According to the life extension table, the gearbox enhanced its useful life by 30% due to the reduction of oil cleanliness.

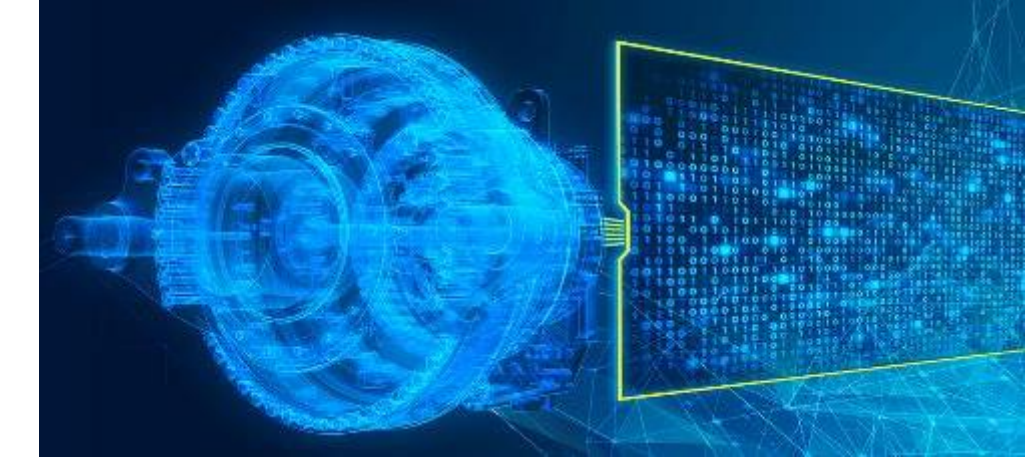
NIVEL DE LIMPIEZA NUEVO (CÓDIGO ISO)

NIVEL DE LIMPIEZA ACTUAL (CÓDIGO ISO)

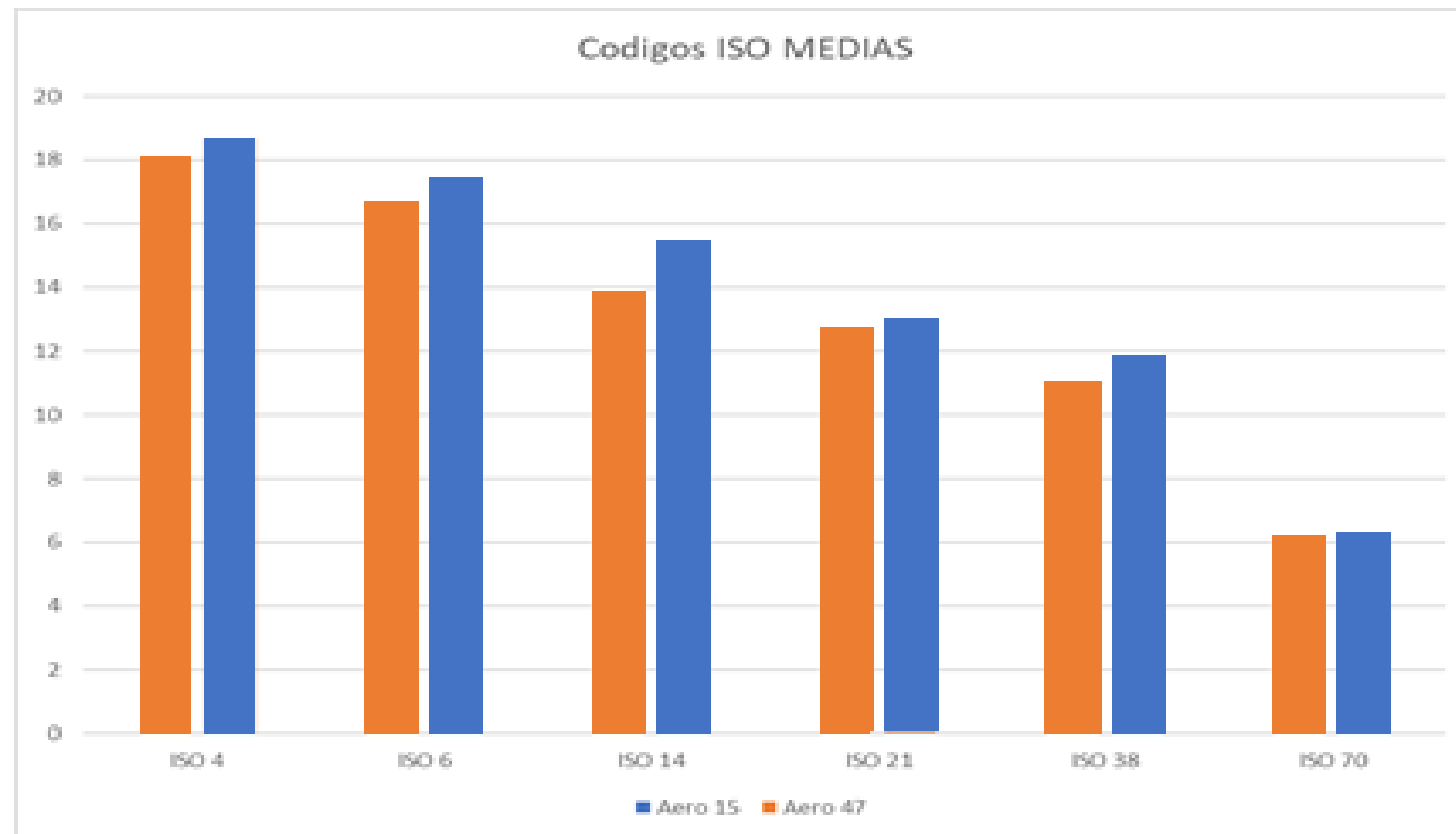
	*/20/17		*/19/16		*/18/15		*/17/14		*/16/13		*/15/12		*/14/11		*/13/10		*/12/9		*/11/8		*/10/7	
*/26/23	5	3	7	3.5	9	4	>10	5	>10	6	>10	7.5	>10	9	>10	>10	>10	>10	>10	>10	>10	>10
	4	2.5	4.5	3	6	3.5	6.5	4	7.5	5	8.5	6.5	10	7	>10	9	>10	10	>10	>10	>10	>10
*/25/22	4	2.5	5	3	7	3.5	9	4	>10	5	>10	6	>10	7	>10	9	>10	>10	>10	>10	>10	>10
	3	2	3.5	2.5	4.5	3	5	3.5	6.5	4	8	5	9	6	10	7.5	>10	9	>10	>10	>10	>10
*/24/21	3	2	4	2.5	6	3	7	4	9	5	>10	6	>10	7	>10	8	>10	10	>10	>10	>10	>10
	2.5	1.5	3	2	4	2.5	5	3	6.5	4	7.5	5	8.5	6	9.5	7	>10	8	>10	10	>10	>10
*/23/20	2	1.5	3	2	4	2.5	5	3	7	3.5	9	4	>10	5	>10	6	>10	8	>10	9	>10	>10
	1.7	1.3	2.3	1.5	3	2	3.7	2.5	5	3	6	3.5	7	4	8	5	10	6.5	>10	8.5	>10	10
*/22/19	1.6	1.3	2	1.6	3	2	4	2.5	5	3	7	3.5	8	4	>10	5	>10	6	>10	7	>10	>10
	1.4	1.1	1.8	1.3	2.3	1.7	3	2	3.5	2.5	4.5	3	5.5	3.5	7	4	8	5	10	5.5	>10	8.5
*/21/18	1.3	1.2	1.5	1.5	2	1.7	3	2	4	2.5	5	3	7	3.5	9	4	>10	5	>10	7	>10	10
	1.2	1.1	1.5	1.3	1.8	1.4	2.2	1.6	3	2	3.5	2.5	4.5	3	5	3.5	7	4	9	5.5	10	8
*/20/17			1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	5	3	7	4	9	5	>10	7	>10	9
			1.2	1.05	1.5	1.3	1.8	1.4	2.3	1.7	3	2	3.5	2.5	5	3	6	4	8	5.5	10	7
*/19/16					1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	5	3	7	4	9	6	>10	8
					1.2	1.1	1.5	1.3	1.8	1.5	2.2	1.7	3	2	3.5	2.5	5	3.5	7	4.5	9	6
*/18/15							1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	5	3	7	4.5	>10	6
							1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.7	3	2	3.5	2.5	5.5	3.7	8	5
*/17/14									1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	6	3	8	5
									1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.7	3	2	4	2.5	6	3.5
*/16/13											1.3	1.2	1.6	1.5	2	1.7	3	2	4	3.5	6	4
											1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.8	3.7	3	4.5	3.5
*/15/12													1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5
													1.2	1.1	1.5	1.4	1.8	1.5	2.3	1.8	3	2.2
*/14/11															1.3	1.3	1.6	1.6	2	1.8	3	2
															1.3	1.2	1.6	1.4	1.9	1.5	2.3	1.8
*/13/10																	1.4	1.2	1.8	1.5	2.5	1.8
																	1.2	1.1	1.6	1.3	2	1.6

Basado en ISO 4406:99 - Se ha omitido el rango de 4 micrones.

Basado en ISO 4406:99 - Se ha omitido el rango de 4 micrones.



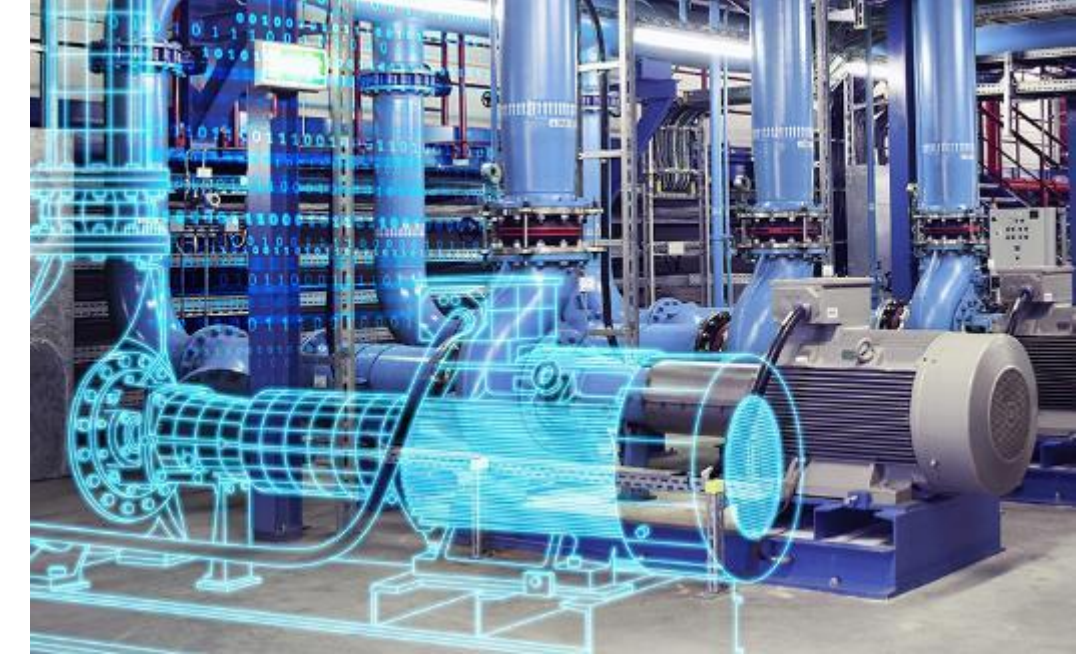
FILTRATION EQUIPMENT MONITORING



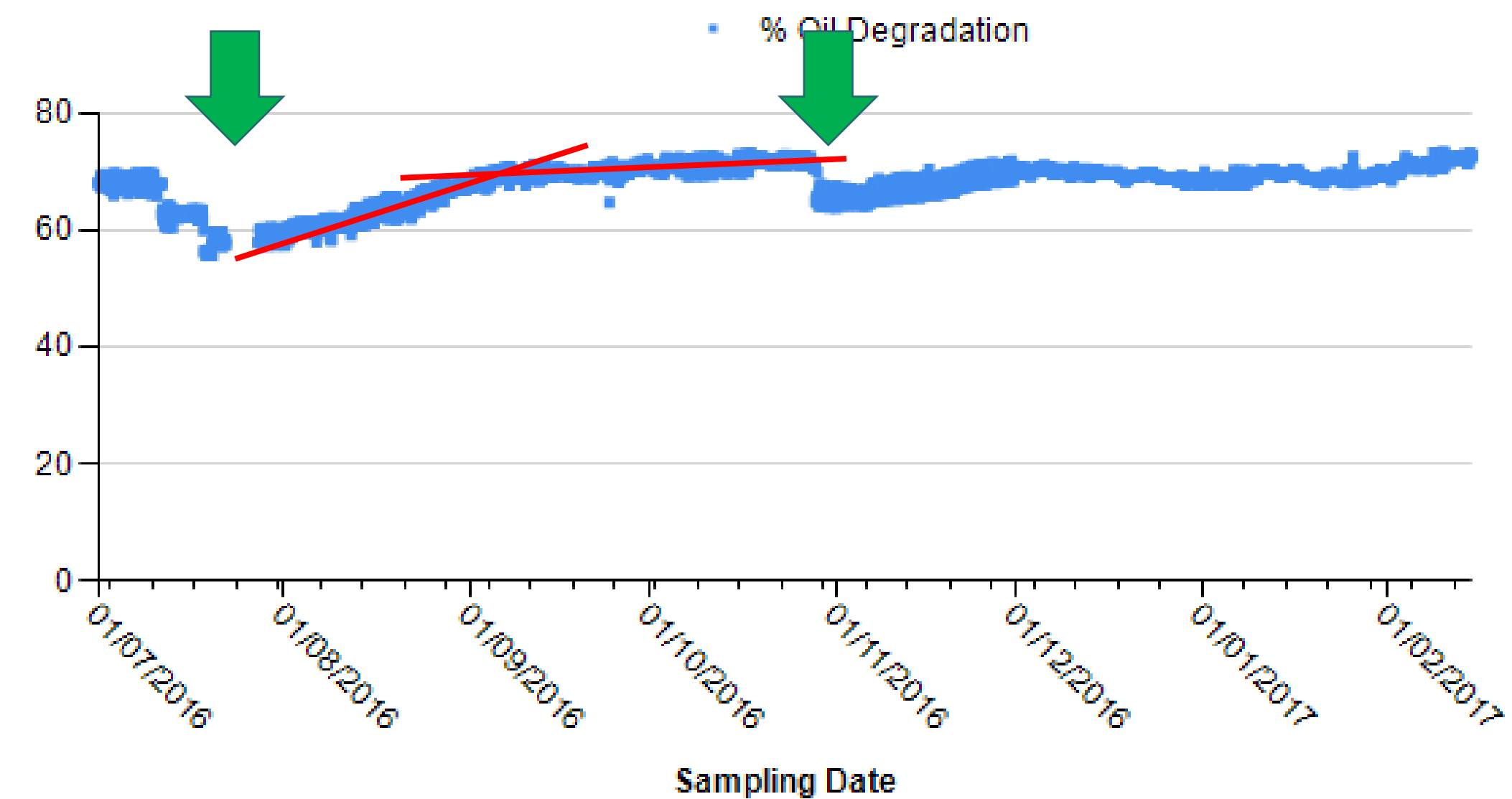
The effect of kidney filter is observed in medium and big particles (>6 and >14 microns)

Standard filtration systems are more efficient capturing huge particles (>21 microns), but not <20 microns particles

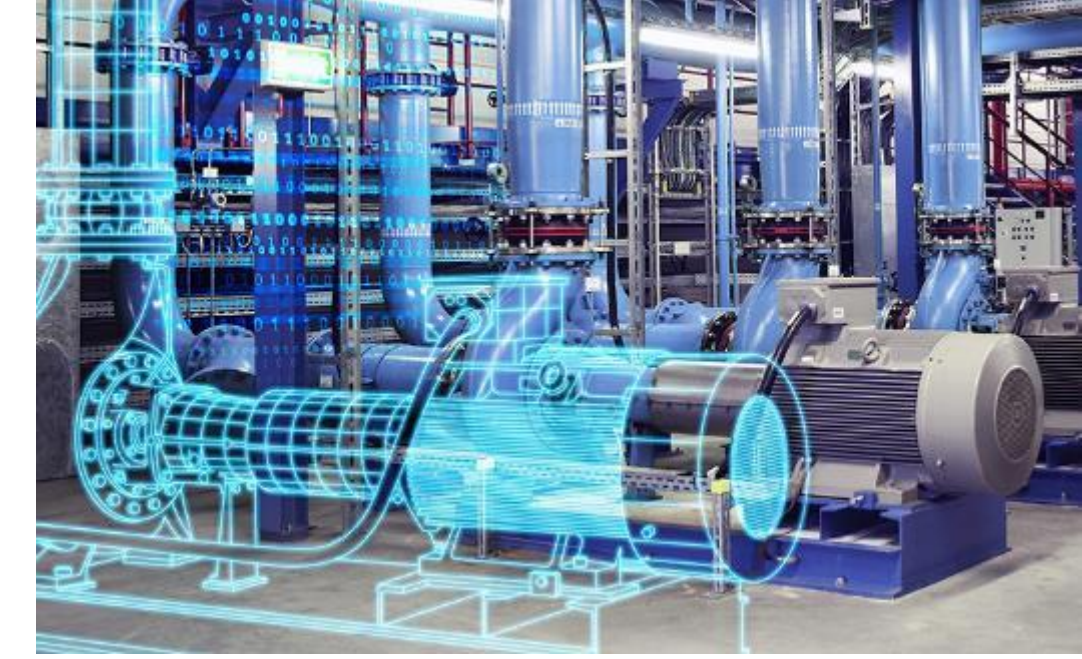
LUBRICANT DIGITALIZATION



- › Monitoring of lubricant degradation parameter in real time
- › Detection of:
 - › Top-up events
 - › Variation in degradation speed correlated with operating conditions
- › This solution allows end-user to improve the planification in fluid life.
- › The end-user can quantify the operation impact on fluid life



FLUSHING ANALYSIS



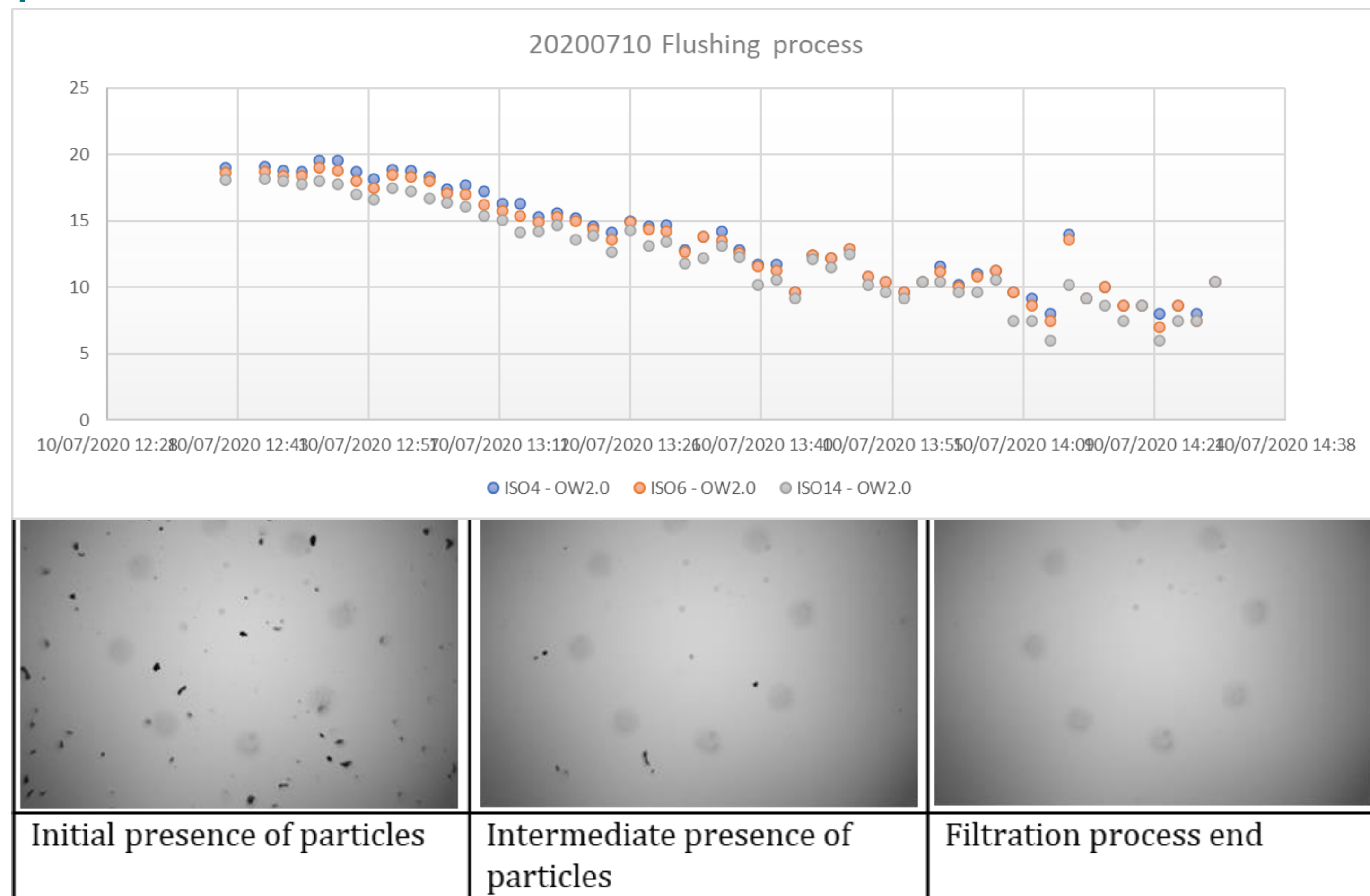
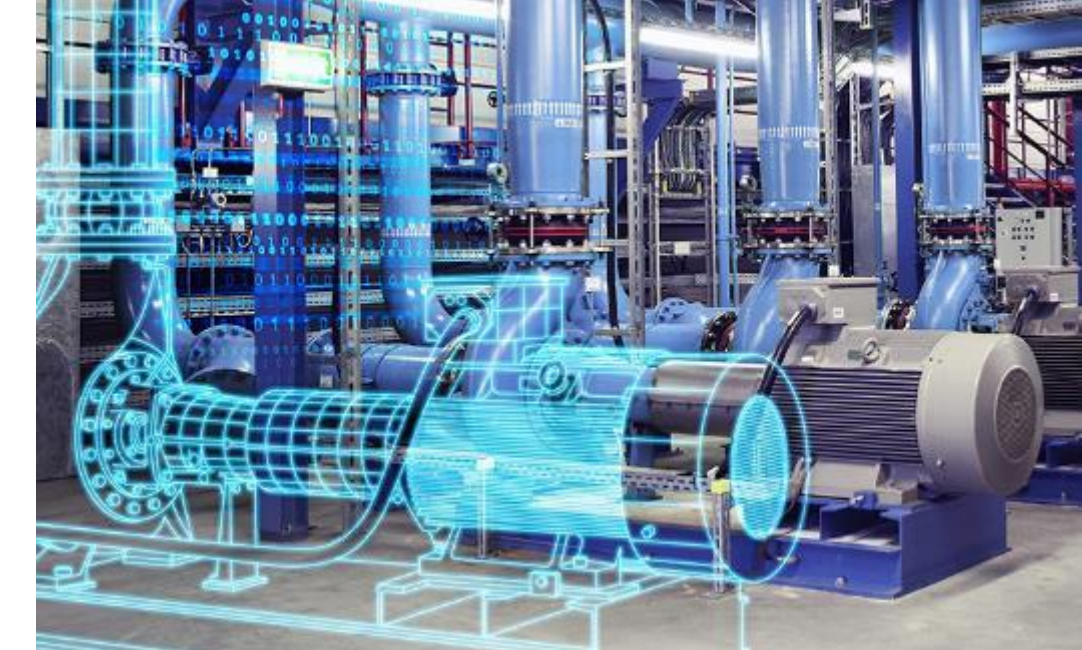
Flushing are typical fast processes to reduce drastically contamination content.

Current process monitoring is based on at-site or lab equipment being used periodically while flushing.



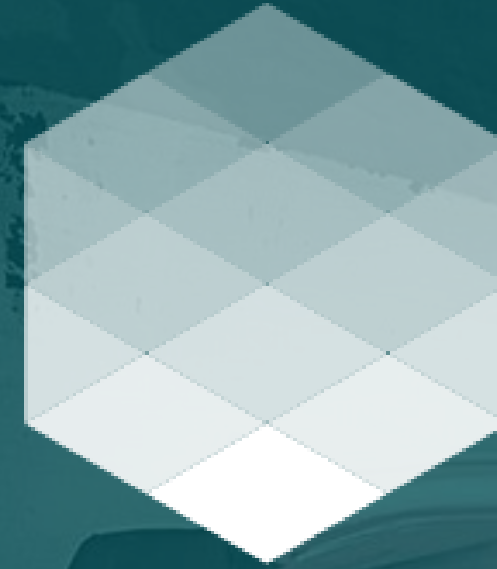
FLUSHING ANALYSIS

Online monitoring of the flushing process can lead to a time optimization and direct control of the process.



Conclusions

- The industry is pushing for efficiency and digitalization, and the combination of all these requirements creates the necessity to take advantage of new technology in lubrication services.
- Online lubricant monitoring offers added value in the whole lubricant supply and uses chain. From the oil factory to the end-of-life lubricant drain, lubricant monitoring sensors are offering added value to the agents involved.
- The complete oil lifecycle can be enhanced by the use of online technology, from fresh oil storage and delivery to the different maintenance actions used to enhance asset and lubricant performance.
- The application of innovative technology in lubrication services reduces operational risk and enables the possibility to create new and improved services, products and business models to deal with stringent industry demands and aligned with the industry 4.0 current trend.



ATTEN2

Advanced Monitoring Technologies

THANK YOU FOR YOUR ATTENTION

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