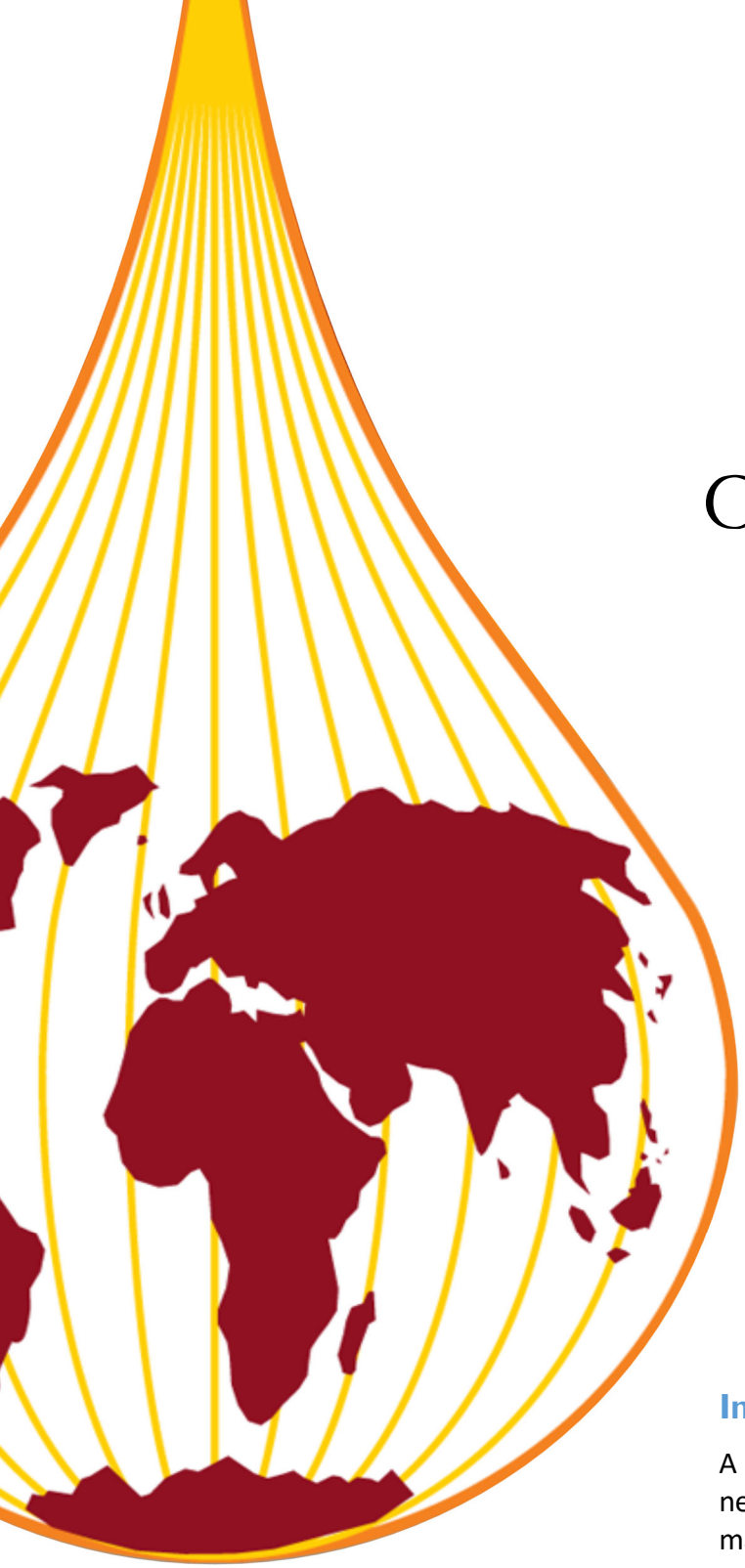

Oil Cooling & Filtration Unit Saves a Critical Asset in a Pharmaceutical Plant

A standby unit was not an option for Ijssel Predictive Maintenance.

Introduction

A leading pharmaceutical/antibiotics company desperately needed to improve her current lubrication practices at a manufacturing plant. A growing demand on products generally leads to an intensive use of machinery, pushing equipment to its limits while the ultimate consequence shall be clear to everyone: fatal machine failure. However, in this case, the single critical asset that most necessitated this effort for improvement was a separator module. A separator is a vertically arranged disc centrifuge that features high-speed rotational plates. These plates use centrifugal force to separate solid-liquid mixtures or liquid-liquid mixtures as necessary, thus isolating product components from water and other contaminants.

December 2021

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For an extended period of time, the plant's separator had been exhibiting a continuously high oil temperature. This temperature had been wearing down gears through pitting, and it had also affected the fit of the bearings, thus causing looseness and vibration issues on the driving axes.

In an effort to combat the observable symptoms, this separator had been fitted with new bearings and gears three times in the two years prior to IJssel's involvement. Downtime was always costly: a one-hour standstill would yield a loss of turnover of approximately seven thousand euros, while each oil change would require approximately one month to achieve ROI. However, no preventive actions had been taken to minimize the risk of machine failure, so a complete breakdown of this asset was just a matter of time. Besides a serious risk of injury, such an unplanned breakdown could have led to a substantial downtime and a complete plant stop, leaving the company with higher costs than anticipated. Fortunately, all this has been prevented.

The Challenge

During this time, the pharmaceutical customer had already considered—and rejected—the introduction of a standby separator that could take over in the event of the critical asset's failure. Though the presence of a standby unit is generally a smart precaution, the company had already concluded that such an installation of a brand-new standby separator (including execution, implementation, and commissioning before being put into operation) would have been a prohibitively expensive and time-consuming project.

When IJssel Predictive Maintenance was finally brought in to address the situation, the customer's management board did not request for us to install a

secondary unit during overhaul. Rather, we were tasked with thoroughly re-designing the current system, which would necessitate mechanical and electrical changes. Although the company's conclusion was to go forward, the time gap between the "go ahead" and the final realization of the project would have to be bridged to lower the risk of machine failure to the current asset. It was the managements' obligation and decision to take immediate action by conditioning the current asset a.s.a.p. on its critical parameters (temperature and oil cleanliness), hence limiting the risk of an unplanned downtime and/or production loss. So here IJssel Predictive Maintenance came in to play.

Simply stated, running the separator with a wet sump gearbox in a continual state of overdrive to meet production schedules is risky because excessive oil temperatures rapidly deteriorate the oil quality. The deteriorated oil then acts as a catalyst in combination with high temperature and high gear-speed to increase wear on moving parts.

The plant's historic machine data provided detailed insight into this recurring scenario. Temperature parameters were readily available due to vibration and thermal sensors located at the primary separator. Meanwhile, oil changes were being conducted twice weekly. IJssel was already familiar with this machine's oil cleanliness

Sample Date	Sample#	Fe	Cr	Ni	Al	Cu	Pb	Sn	Cd	Ag	V	Oil Change	Oil Add	Filter Change	Viscosity 40°C cSt	Oxidatie abs/cm	ISO Code 4406	Water ppm
INSTALLATION WITH OIL COOLING & FILTRATION UNIT																		
10/30/2020	16	1	0	0	0	0	0	1	0	0	0	NO	0	YES	472	3	17/15/13	16
8/20/2020	15	1	0	0	1	0	0	2	0	0	0	NO	0	NO	486	3	20/18/14	17
7/15/2020	14	1	0	0	0	0	0	4	0	0	0	NO	0	NO	480	4	19/18/14	5
5/14/2020	13	1	0	0	1	1	0	4	0	0	0	NO	0	NO	468	5	18/16/13	6
11/20/2019	12	1	0	0	0	0	0	1	0	0	0	NO	0	NO	461	3	19/17/15	12
INSTALLATION WITHOUT OIL COOLING & FILTRATION UNIT																		
10/24/2019	11	24	0	5	0	209	1	28	0	0	0	YES	8	NO	512	3	26/24/18	23
10/8/2019	10	107	1	5	0	228	1	31	0	0	0	YES	83	NO	525	4	DK/DK/DK	27
9/24/2019	9	2	0	0	0	34	0	3	0	0	0	YES	7	NO	487	5	27/25/19	6
9/12/2019	8	1	0	0	0	15	0	0	0	0	0	YES	7	NO	464	4	26/23/19	9
8/13/2019	7	4	0	0	0	42	0	5	0	0	0	YES	7	NO	488	3	25/22/17	188
6/20/2019	6	16	0	1	0	68	0	5	0	0	0	YES	7	NO	493	4	26/23/19	6
6/6/2019	5	68	0	7	0	289	0	39	0	0	0	UNK	0	NO	526	3	VD/VD/VD	41
5/23/2019	4	28	0	3	0	143	0	17	0	0	0	YES	7	NO	518	3	26/23/19	24
5/9/2019	3	22	0	5	0	173	0	25	0	0	0	YES	7	NO	523	3	26/25/18	30
4/9/2019	2	13	0	3	0	139	0	16	0	0	0	YES	7	NO	534	3	VD/VD/VD	15
3/28/2019	1	10	0	4	0	171	0	23	0	0	0	YES	7	NO	511	3	26/23/18	10

Figure 1: Particle (ISO 4406) trend data with and without oil cooling and filtration

because we had been handling this plant's oil samples on a regular basis for several years, having worked closely with an internationally accredited laboratory for all important tests and reports.

Oil analyses showed us case after case in details that oil was deteriorating at an increasingly high level, leaving oil cleanliness far behind and even showing a negative trend to levels up to 26/23/19 and hitting 27/25/19 (ISO 4406-15). Even the worst case happened: a "too dark to analyze" signal.

"The data made it clear that oil changes alone were just not enough to prevent the eventual failure of this asset."

The Solution

The data made it clear that oil changes alone, performed during regularly planned stops for maintenance overhauls, were just not enough to prevent the eventual failure of this particular asset. Something had to be done.

Our ICML-certified personnel are employed to perform best practices in machinery lubrication and oil sampling, but the responsibility for backup and spare equipment lies with the customer. In our case the wet sump lacked a bypass oil cooling and filtration system, so we decided to install such a unit that would continuously clean and cool the gear oil to accepted set-points. With this unit we anticipated the gear oil temperature could be simply controlled to acceptable levels while filtering the oil with a premium filter so to reach ISO cleanliness levels suitable for gearboxes.

Although space for installation was quite limited, our ICML-certified engineers managed to design a custom unit that could be placed in between the existing pipework without adversely affecting the space needed for maintenance and operation.

Installation was conducted during one of the customer's planned outages for maintenance overhaul. The stainless steel, rig-mounted Oil Cooling & Filtration Unit is

equipped with an On-Off temperature controller with a high alarm output, chosen for simplicity and economical cost. A clogging switch installed on the filter warns when the filter element should be changed or (not preferably) cleaned. A flow switch warns in case of low- or no-flow of oil in bypass of the asset. A special connection block with sight glass prevents the wet sump from running dry while the buffer tank holds overflow so the pump is fed at a constant level. The connection block easily connects the unit with quick couplings, while no concessions have been made to the number of sample points installed on the unit.

The Results

The results are promising. Cleanliness shows us current levels reaching 19/17/14 (ISO 4406-15) and below, while the gear oil

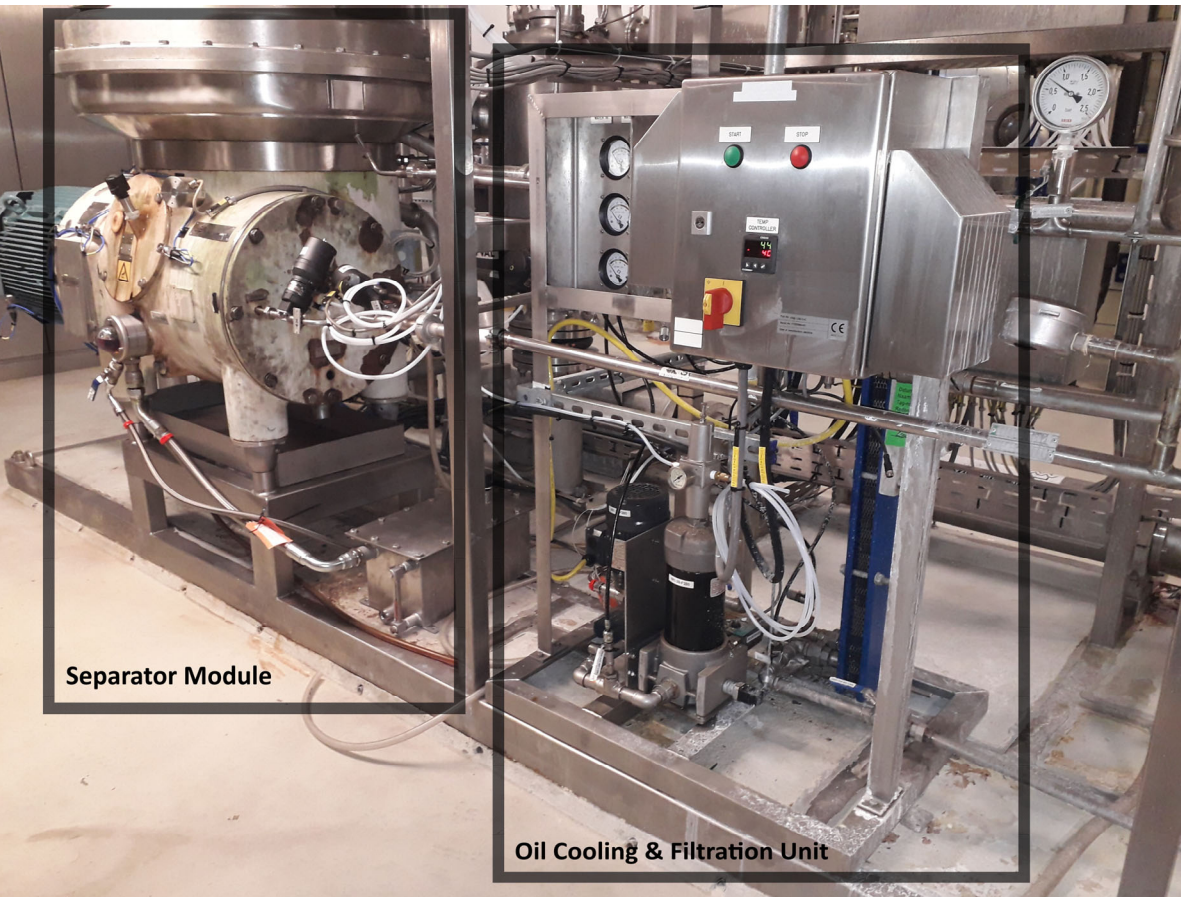

Figure 2: IJssel Predictive Maintenance installed an Oil Cooling & Filtration Unit alongside the customer's existing separator module.

temperature is controlled from approximately 90°C to a preferred setting of 40 to 60°C.

Downtime and overhaul costs have been reduced to a minimum. (Recall that, prior to our solution, the customer had fitted the separator with new bearings and gears at least three times during the previous two years, ever since becoming aware that high temperatures were negatively affecting the fit of the bearings.)

Additionally, reduced from its previous twice -weekly oil change schedule, the separator proceeded to run without any problems at least six months on the same oil, saving a considerable amount of loss on turnover. Today, the separator is also continuously monitored with vibration sensors by IJssel Predictive Maintenance with our own UpTimeWorks condition monitoring system. Vibration is significantly reduced with the cleaner and cooler oil while temperature remains monitored online, too.

Figure 3: Trend data for the Bottom Output Shaft Separator Module without IJssel's Oil Cooling & Filtration Unit. Clockwise from upper left: Vibration measurements (FFT PEAK; mm/s) shows multiple peaks above alarm values (3-3.5 mm/s); Temperature graph shows a continuous level above alarm values (80-85°C); No data; No data. [Source: UpTimeWorks.com]

Conclusion: This simple system saved a critical asset. The great change from a reactive to a predictive maintenance philosophy and actual performance has finally led to an increased return on investment with a significant potential cost saving. ICML

Figure 4: Trend data for the Bottom Output Shaft Separator Module with IJssel's Oil Cooling & Filtration Unit installed. Clockwise from upper left: Vibration measurements (FFT PEAK; mm/s) shows a flared level of peaking below alarm values (3-3.5 mm/s); Temperature graph shows a continuous level below alarm values (80-85°C); Oil Cooling & Filtration Unit outlet temperature graph shows a continuous level below alarm values (45-50°C); Oil Cooling & Filtration Unit inlet temperature. [Source: UpTimeWorks.com]

IJssel Predictive Maintenance is a Full Member of ICML. IJSSEL predictive maintenance