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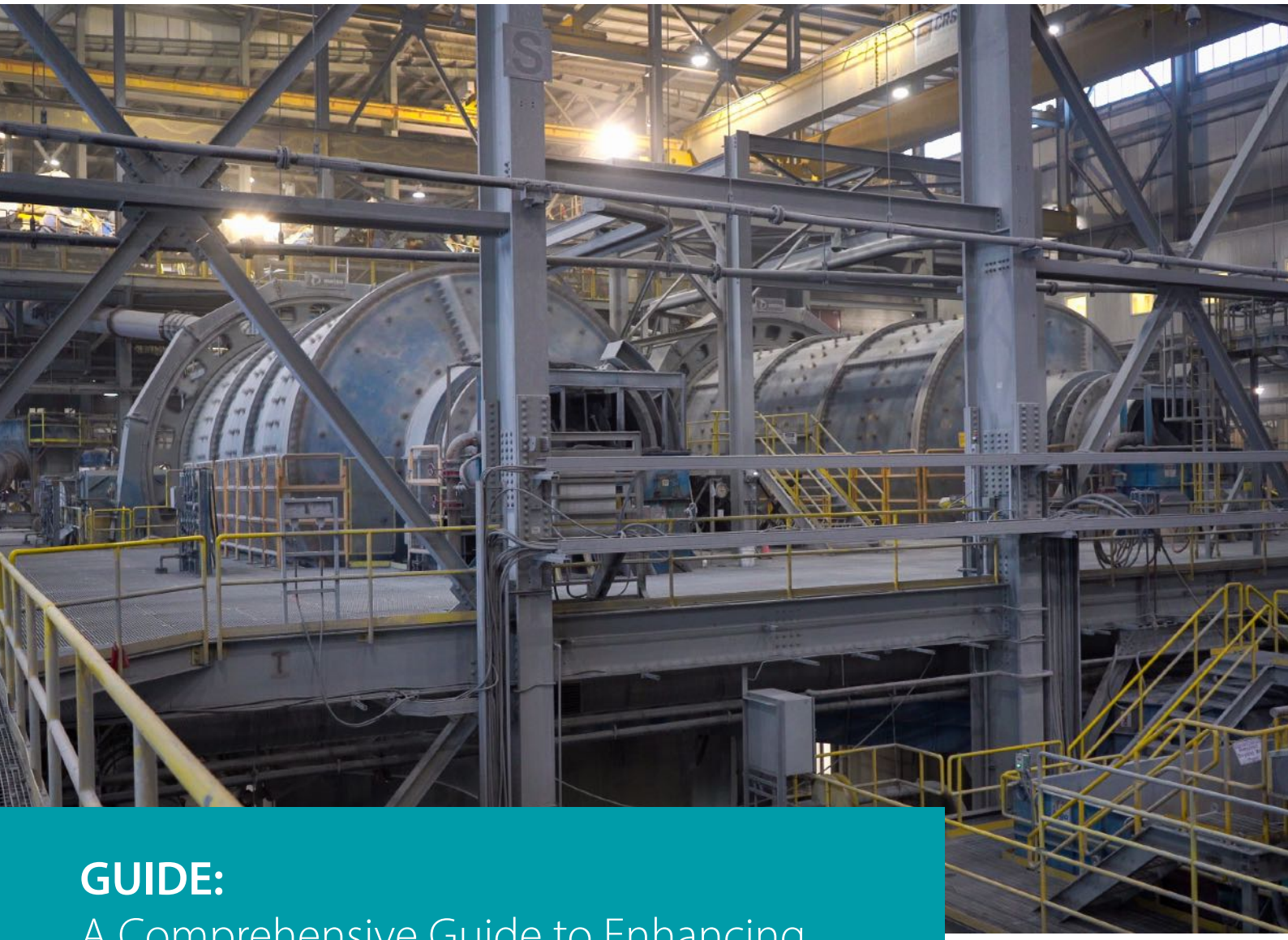
Oil Filtration in Mining – Goodbye Oil Contamination, Hello Savings!



GUIDE:
A Comprehensive Guide to Enhancing Your Operation's Productivity and Sustainability

Oil Filtration in Mining – Goodbye Oil Contamination, Hello Savings!

Mining is a tough environment, presenting operational difficulties unseen in any other industry. The complexity of equipment used, such as crushers, mills, and conveyors, and the hostile conditions mean that contamination of lubricants such as gear oil and hydraulic oil is a constant challenge, and oil can exceed OEM-recommended levels of cleanliness in only a few hours, which has devastating consequences for the equipment it serves, resulting in increased downtime and higher operational costs.

While every mining business has processes in place to keep these costs down, few are aware of innovations that are making a game-changing difference to their equipment's total cost of ownership (TCO). The good news is that oil can be cleaned. While most mines change the oil when it is contaminated, we help you clean and maintain clean oil – while in operation.

Oil Filtration can dramatically extend oil and component lifetimes, increasing asset availability and mean time between failure (MTBF), saving significant amounts per year and helping to meet sustainability targets.

"Oil Filtration can dramatically extend oil and component lifetimes"

Contaminated Oil Hurts

Contaminated oil is essentially sandpaper for components. Rather than lubricating and protecting, abrasive particles in the oil simply accelerate a variety of problems that shorten oil and component lifetimes, and ultimately result in system failure and downtime.

The typical issues from contaminated oil include:

- **Poor lubrication –** leading to increased component wear and potential failure.
- **Clogged in-line filters –** reducing the flow of oil to the system and causing it to work less efficiently and with lower performance.
- **Increased corrosion –** some contaminants, such as water and acidic substances, can cause corrosion of metal parts in the system, leading to reduced lifespan and potential failure.
- **Foaming –** reducing the oil's ability to lubricate components and trapping air in the system, which lowers performance.

These issues are very expensive to fix. The costs often break down into the following categories:

- **Repair costs –** contaminated oil causes increased wear on components, leading to more frequent repairs and maintenance. These costs can add up quickly, particularly if the equipment is out of service for extended periods of time.
- **Replacement costs –** when components fail or become damaged beyond repair, they need to be replaced. These are costly to buy and time consuming to replace.
- **Downtime costs –** when equipment is out of service due to contaminated oil, it leads to lost productivity and revenue. These costs can be significant, particularly in the competitive world of mining where price-per-tonne mined is vital for success**.**
- **Environmental costs –** contaminated oil can have severe consequences for sustainability, due to increased oil usage, handling, and waste, and poor fuel efficiency.

The risks of contaminated oil are significant, both in terms of lost productivity and maintenance. However, even in face of this, many businesses continue as they always have by endlessly replacing components and filters, regularly replacing dirty oil (at considerable financial and environmental cost) or filtering it.

And in mining – as in many other industries – time is money. When equipment does not work, it does not produce revenue, making availability a top priority.

Contaminants removed from dirty oil with a CJC® filter.

Learn How to Achieve Significant Savings by Optimising Your Oil Filtration Solution

You can eliminate 3 out of 4 oil change shutdowns, extend component lifetime, and reduce oil consumption by up to 75%

Inspiration from outside
Some mines have found inspiration from other industries, such as the wind-turbine industry. This industry has always faced permanently low commodity prices, and unforeseen breakdowns and downtime can be disastrous to profit margins. Today, more than 60% of global wind turbine gearboxes have offline oil filters installed and they have reduced service shutdowns by 75%.
The results were inspiring to many other industries, one of them being mining, where breakdowns and shutdowns are also costly. With highly contaminated oil, the dirt holding capacity of 4 kgs per filter insert led to significantly cleaner oil and benefits for mines around the world.

Leading mining equipment manufacturers
Leading manufacturers of mining equipment are also adopting this practice as standard. They deliver new machinery with the offline oil filter installed from factory, letting their customers benefit from all the advantages and savings achieved by running equipment continuously with clean oil.

In-line filtration alone is not enough
In-line filtration protects your oil system against larger particles, often through 15-50 µm filters. However, the critical mining components require even cleaner oil for optimum performance. Introducing offline oil filtration with down to 3 µm particle removal in combination with the in-line filter, will give an optimum protection and even the harmful small particles are removed. Since offline oil filters have far higher dirt holding capacities, the result is significantly lower cost per kilo of particles removed and reduced time spent on service. Furthermore, the lifetime of the in-line filters will be increased.

Proven results
Offline oil filtration systems are used to remove particles, water, and oil degradation products from hydraulic fluids, lubrication oils, and diesel fuels. The systems are appropriate for crushers, mills, dump trucks and excavators, drilling equipment, transformers, conveyor belts, and storage tanks.

Some of the world's most successful mines have achieved these results with offline oil filtration installed on their critical mining equipment:

- EUR 35,000 savings in bronze bushings per crusher/ year *(Kumba Iron Ore, Sishen Mine, South Africa)*
- 87% less downtime and annual savings up to USD 445,200 *(BHP Billiton, Minera Escondida, Chile)*
- USD 681,800/year total potential savings *(Kinross, Chirano Goldmine, Ghana)*

Benefits of CJC® offline oil filtration

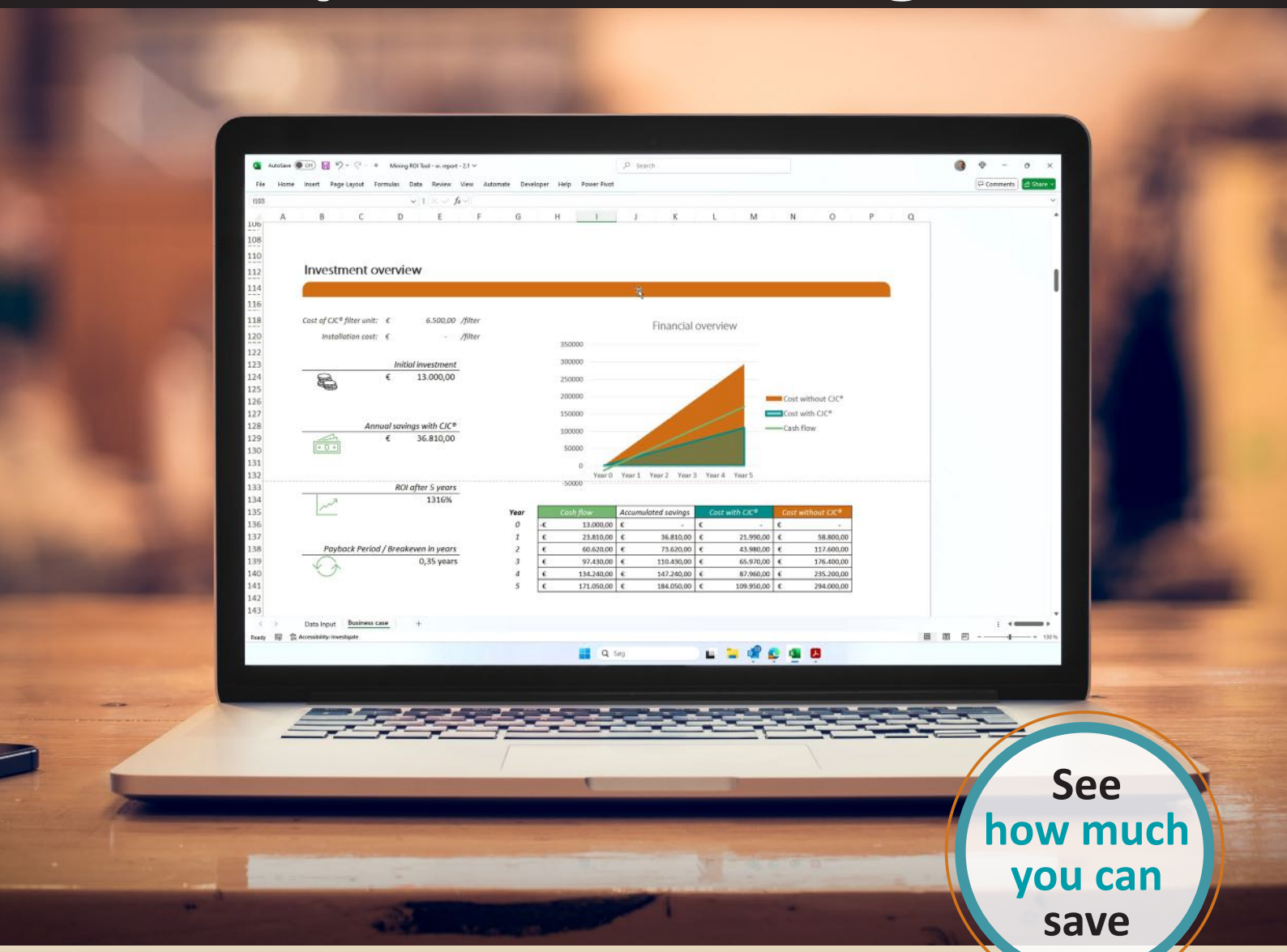
Mining operations experience many common benefits when using CJC® offline oil filtration:

- Less wear on pumps, cylinders, bearings, etc.
- Longer oil and component lifetime
- Cleaning of oil, gearboxes, and systems while they are in operation for increased uptime
- Fewer unplanned shutdowns
- The industry's lowest cost per kilo dirt removed
- Short payback time (ROI)
- Lower maintenance costs
- Greater process stability and efficiency

CJC® HDU 2x27/108

Typically used for lube oil on mills

Calculate your potential savings



See how much you can save

C.C.JENSEN has a ROI calculator that allows you to estimate your potential savings based on your current equipment, oil system, etc.

Please send us an email here, and we would be happy to make a calculation for you.

Understanding the Correlation between Cleanliness and Equipment Lifetime

Oil cleanliness level is often measured and categorised in ISO codes, where dirt is counted as particles.

ISO 4406 is a method for classifying the level of contamination by solid particles in a fluid. It specifies the number of particles per 100 ml of fluid according to their size ranges. Particles are counted based on sizes of 4 µm, 6 µm, and 14 µm.

Hence classifying oil according to ISO codes tells you how many particles of a given size are present in the oil.

Example:
ISO code 19/17/14 means the oil contains per 100ml fluid:

- 250,000 – 500,000 particles size 4 micron or bigger
- 64,000 – 130,000 particles size 6 micron and bigger
- 8,000 – 16,000 particles size 14 micron or bigger

ISO Classification Table

A typical sample from new bulk oil contains approximately in every 100 ml of oil:

450,000 particles ≥ 4 micron
120,000 particles ≥ 6 micron
13,000 particles ≥ 14 micron

In the ISO classification table (on the right), this oil sample has a contamination class of 19/17/14.

Some laboratories give the particle counting per millilitre instead of per 100 millilitres (mostly USA).

Note: The ISO class is a logarithmic scale; that is, a double in particle counts leads the ISO class to increase by one.

Number of particles per 100 ml fluid after their size ranges		
More than	**Till**	**ISO Class**
8,000,000	16,000,000	24
4,000,000	8,000,000	23
2,000,000	4,000,000	22
1,000,000	2,000,000	21
500,000	1,000,000	20
250,000	**500,000**	**19**
130,000	250,000	18
64,000	**130,000**	**17**
32,000	64,000	16
16,000	32,000	15
8,000	**16,000**	**14**
4,000	8,000	13
2,000	4,000	12
1,000	2,000	11
500	1,000	10
250	500	9
130	250	8
64	130	7
32	64	6

Contamination classes according to the ISO 4406 standard

Life Extension Table

Evaluation of particle count compared to machine lifetime.
The table describes the expected increase in lifetime when oil cleanliness is improved.

Each quadrant represents a machine type:

- Top left quadrant is for hydraulic components and diesel engines.
- Bottom right quadrant is for gearboxes

Example:
If the current oil cleanliness level in a hydraulic system is found to be ISO 24/22/19 and the oil is cleaned to a level of 16/14/11 the lifetime of hydraulic components is prolonged by a factor of 8 and the lifetime of gearboxes by a factor of 3.5!

Life Extension Table - Cleanliness Level, ISO Codes

	21/19/16		20/18/15		19/17/14		18/16/13		17/15/12		16/14/11		15/13/10		14/12/9		13/11/8		12/10/7	
24/22/19	2	1.6	3	2	4	2.5	6	3	7	3.5	8	4	>10	5	>10	6	>10	7	>10	>10
	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
23/21/18	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
	1.5	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
22/20/17	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
21/19/16			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
20/18/15					1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	5	3	7	4.6	>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
19/17/14							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
18/16/13									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
17/15/12											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
16/14/11													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
15/13/10															1.4	1.2	1.8	1.5	2.5	1.8
															1.2	1.1	1.6	1.3	2	1.6

Hydraulics and Diesel Engines | Rolling Element Bearings
Journal Bearings and Turbo Machinery | Gearboxes and others

Source: www.noria.com

Recommended ISO Cleanliness Level

ISO Code	Description	Suitable for	Dirt/year
ISO 14/12/10	Very clean oil	All oil systems	8.5 kg *
ISO 16/14/11	Clean oil	Servo & high pressure hydraulics	17 kg *
ISO 17/15/12	Light contaminated oil	Standard hydraulic & lube oil systems	34 kg *
ISO 19/17/14	New oil	Medium to low pressure systems	140 kg *
ISO 22/20/17	Very contaminated oil	Not suitable for oil systems	> 589 kg *

**) The amount of dirt passing the pump per year, if the oil passes with a capacity of 200 l/min, 8 hours a day, 230 working days per year.*

Recommendation

This figure shows the recommended ISO cleanliness levels in hydraulic, lube oil and gear systems.
New oil is typically contaminated with particles to ISO 19/17/14.

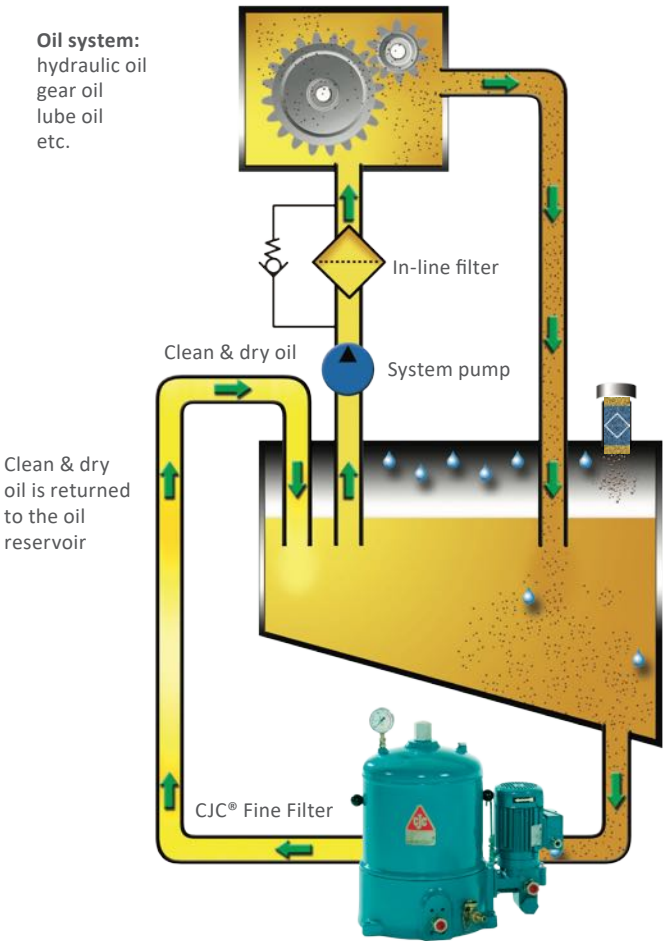
According to studies by Noria Corporation there is a direct correlation between *particle and water level* in lubrication systems and the *lifetime of critical components* such as bushings, bearings, gears and pumps.
Source: www.noria.com

Big Machines also Need Fine Filtration

It is a fact that small particles are the most harmful to any lubricating system. It is a common perception that big machines likes crushers are a rugged piece of equipment designed for a tough industry. But the truth is that a crusher contains many delicate moving elements. **The oil film thickness between the critical moving parts in a crusher are typically between 5 - 0.5 micron.**

This means that you need fine filtration to protect the equipment. Bigger particles - e.g. 15 micron and above - do not have the same harmful effect on your equipment because they cannot enter the narrow openings.

The most harmful are clearance size particles of similar size or slightly bigger than the dynamic tolerance between the moving parts in the oil system.

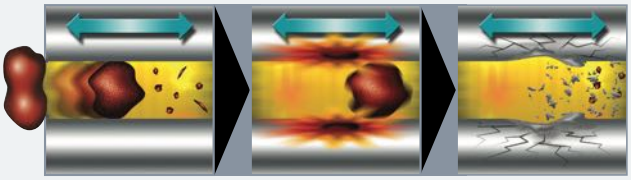


Oil contamination causes approximately 80% of all oil related failures and breakdowns in mining operations!

Particles/dirt and water cause the main problems in lubrication oil and hydraulic systems. Both will have a direct negative impact on the system and components.

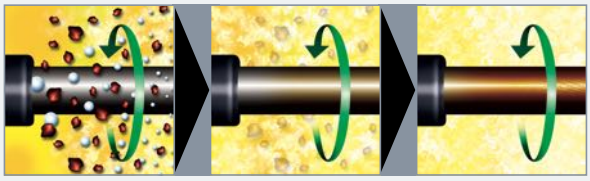
Abrasive Wear

Hard, clearance-sized particles wedged between movable metal parts destroy the metal surface and result in additional wear.



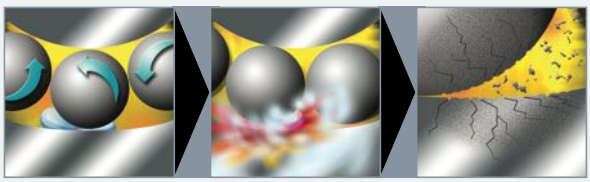
Oil Degradation

Wear metals, water, and high temperatures lead to oil degradation resulting in sticky varnish deposits on metal surfaces.



Cavitation & Pitting

In areas where water is present and oil is compressed, the water implodes, causing metal surfaces to crack and release even more particles.



About CJC®

Established in 1953, C.C.JENSEN is a family-owned international company with headquarters in Denmark.
We offer our customers a unique combination of tradition, innovation, and technical expertise. Our CJC® product range of oil filters covers tailor-made solutions for all system volumes.

CJC® Oil Filters solutions

- High dirt holding capacity
- Low maintenance requirements
- Customisable design, modular build up
- Highly qualified technical support
- Lowest total cost of ownership for a filter
- Even highly contaminated oil becomes clean

CJC® HDU Series: Achieve high-efficiency oil purification

These CJC® Offline Oil Filtration systems with integrated circulating pumps are perfect for many applications in the mining industry.

CJC® HDU 27/27

CJC® HDU 27/108

CJC® HDU 27/54

CJC® HDU 427/108

CJC® PTU Series: Remove large volumes of water from your oil

The CJC® Filter Separators combine depth filtration with water separation and are used for hydraulic and lubricating oils contaminated with water.

CJC® PTU3 2x27/108

CJC® PTU3 27/54

CJC® Filter Inserts: Capture the contaminants that damage your machines

With an absolute filtration ratio of 3 µm, CJC® Filter Inserts attract contaminants to the polar fibres. Particles down to 0.8 µm are retained in the unique CJC® Filter Insert cellulose mass. Water is removed either by absorption or separation according to oil system requirements.

The CJC® Filter Inserts are produced of 99,9% natural cellulose fibres from sustainable resources - no metal, no plastic

Customer Cases

SAG Mill, Copper Mine, Chile

SAG mill at large copper mine in Chile

Customer statement:

"The equipment was installed just to clean the oil periodically. However, due to the out-standing results, it has been installed to operate continuously."

Problem

The main lubricating system of 6,000 litres of oil was highly contaminated with pulp (ore-silica-water). The contamination caused numerous production stoppages.

Results

After 5 days, the oil and oil system was clean, avoiding any production stoppages, costing in the region of USD 90,000 per stop. CMD's investment costs including spares were USD 10,000

Industrial Gear Box, Conveyor Belts, Coal Terminal

BMA. Coal Loading Terminal, Hay Point, Queensland Australia

The System

- David Brown gearbox
- 180 L BP GRXP 320 (ISO VG 320)
- Gearbox that drives conveyor belt transporting coal

Problem

Contamination in this gearbox was greater than ISO 22/22/17, which indicates a much too high ingress and generation of particles in the oil system. Oxidation deposits were also found in the oil.
The customer had serious concerns about the long term reliability of this gearbox that is crucial for long-term production needs.

Results

The contamination in the oil was greatly reduced over a 42-day period. The ISO particle count on day 42 was 15/13/12.

Sandvik Secondary Cone Crusher

A large US copper mining company

The System

- SANDVIK Cone Crusher system
- Operates using gear oil with viscosity grade ISO VG 150 cSt
- Oil reservoir capacity: 1,000 litres

Problem

Excessive in-line filter consumption, bi-weekly oil changes, and frequent system pump breakdowns led to costly monthly shutdowns.

Results

CJC® Oil Filters extended oil change intervals from two weeks to 6-8 months and reduced pump replacements by 98%. Annual savings of 1,002,960 USD enabled payback within a month, prompting a planned site-wide expansion.

Primary Crusher, Gear, Fuller-Traylor Gyratory Crusher

BHP Billiton, Minera Escondida, Chile

The System

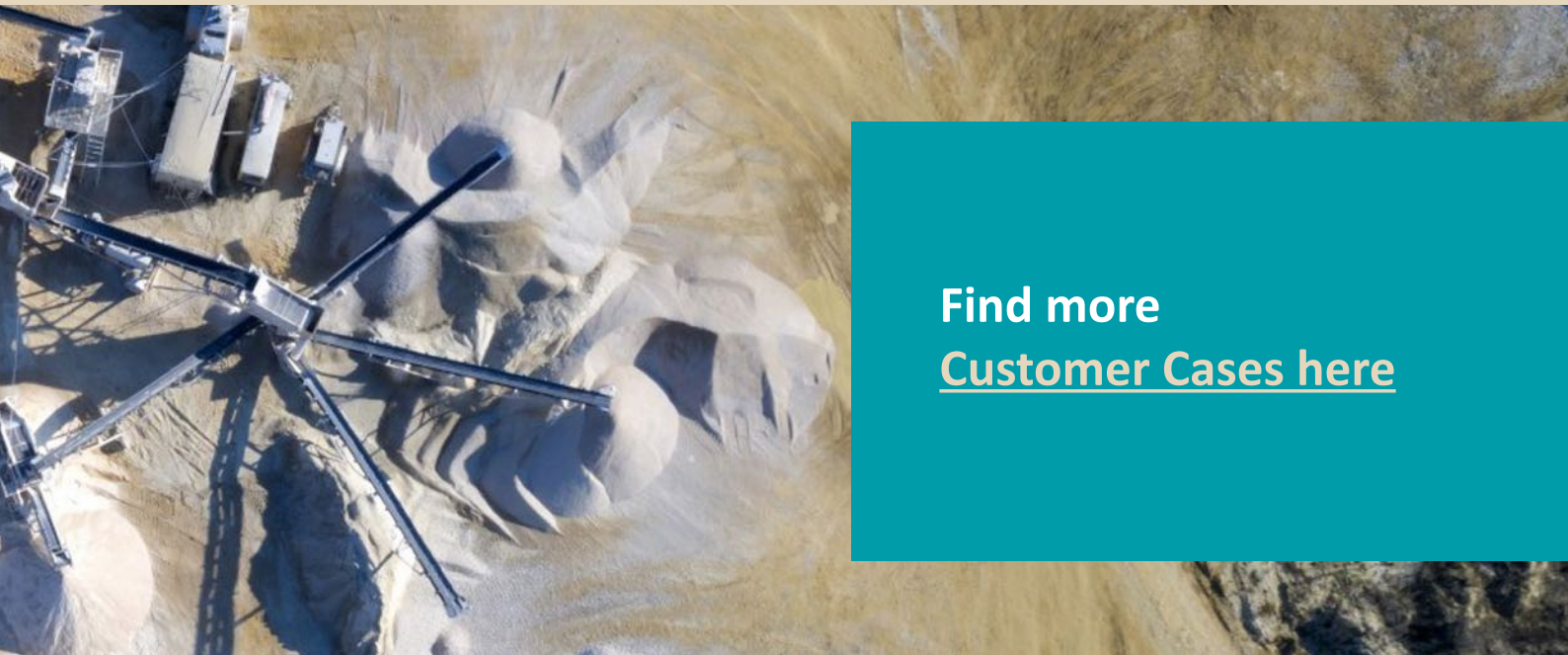
- Fuller-Traylor gyratory crusher (FLSmidth) system
- Primary crusher with a crushing capacity of 6,000 tonnes per hour
- Operates using ISO VG 320 oil
- Total oil volume: 4,000 litres

Problem

Severe dirt ingress caused frequent breakdowns and shutdowns every 60 days for oil changes, despite daily in-line filter replacements. Each shutdown of 8 hours led to high operational costs and downtime.

Results

Installing a CJC® Fine Filter HDU 427/108 reduced contamination, extending oil life and reducing component wear. Inline filter use was nearly eliminated, and three out of four oil changes were avoided. This led to 87% less downtime and annual savings of 445,200 USD, significantly boosting productivity.



Find more
Customer Cases here

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- contact us today!

Manufacturing & Headquarters

C.C.JENSEN A/S
Løvholmen 13 | DK - 5700 Svendborg | Denmark
Tel. +45 6321 2014 | Fax: +45 6222 4615
sales@cjc.dk | www.cjc.dk

C.C.JENSEN worldwide

Benelux
C.C.JENSEN Benelux B.V.
Tel.: +31 182 37 90 29
info.nl@cjc.dk
www.ccjensen.nl

Chile
C.C.JENSEN S.L. Limitada
Tel.: +56 2 739 2910
ccjensen.cl@cjc.dk
www.ccjensen.cl

China
C.C.JENSEN Filtration
Equipment (Tianjin) Co. Ltd.
Tel: +86 10 6436 4838
ccjensen.cn@cjc.dk
www.ccjensen.cn

Denmark
C.C.JENSEN Danmark
Tel: +45 7228 2222
ccjensen.dk@cjc.dk
www.cjc.dk

France
C.C.JENSEN France
Tel: +33 366 753 170
contact.fr@cjc.dk
www.ccjensen.fr

Germany
KARBERG & HENNEMANN
GmbH & Co. KG
Tel: +49 (0)40 855 04 79 0
kontakt@cjc.de
www.cjc.de

India
C.C.JENSEN India
Tel.: +91 4426241364
ccjensen.in@cjc.dk
www.ccjensen.in

Italy
KARBERG & HENNEMANN srl
Tel: +39 059 29 29 498
info@cjc.it
www.cjc.it

Poland
C.C.JENSEN Polska Sp. z o.o.
Tel.: +48 22 648 83 43
ccjensen@ccjensen.com.pl
www.ccjensen.pl

Spain
C.C.JENSEN Ibérica, S. L.
Tel.: +34 93 590 63 31
ccjensen.es@cjc.dk
www.cjc.dk

Sweden
C.C.JENSEN AB
Tel.: +46 8 755 4411
sales@ccjensen.se
www.ccjensen.se

United Arab Emirates
C.C.JENSEN Middle East
Tel.: +971 4 447 2886
ccjensen.uae@cjc.dk
www.cjc.ae

United Kingdom
C.C.JENSEN Ltd.
Tel.: +44 1 388 420 721
filtration@cjcuk.co.uk
www.ccjensen.co.uk

USA
C.C.JENSEN Inc.
Tel.: +1 770 692 6001
ccjensen@ccjensen.com
www.ccjensen.com

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