Crusher Maintenance

Introducing new standards for crusher uptime with offline oil filtration

Documented & proven track record on reducing oil consumption, wear and downtime

Clean Oil Increases Uptime

C.C.JENSEN

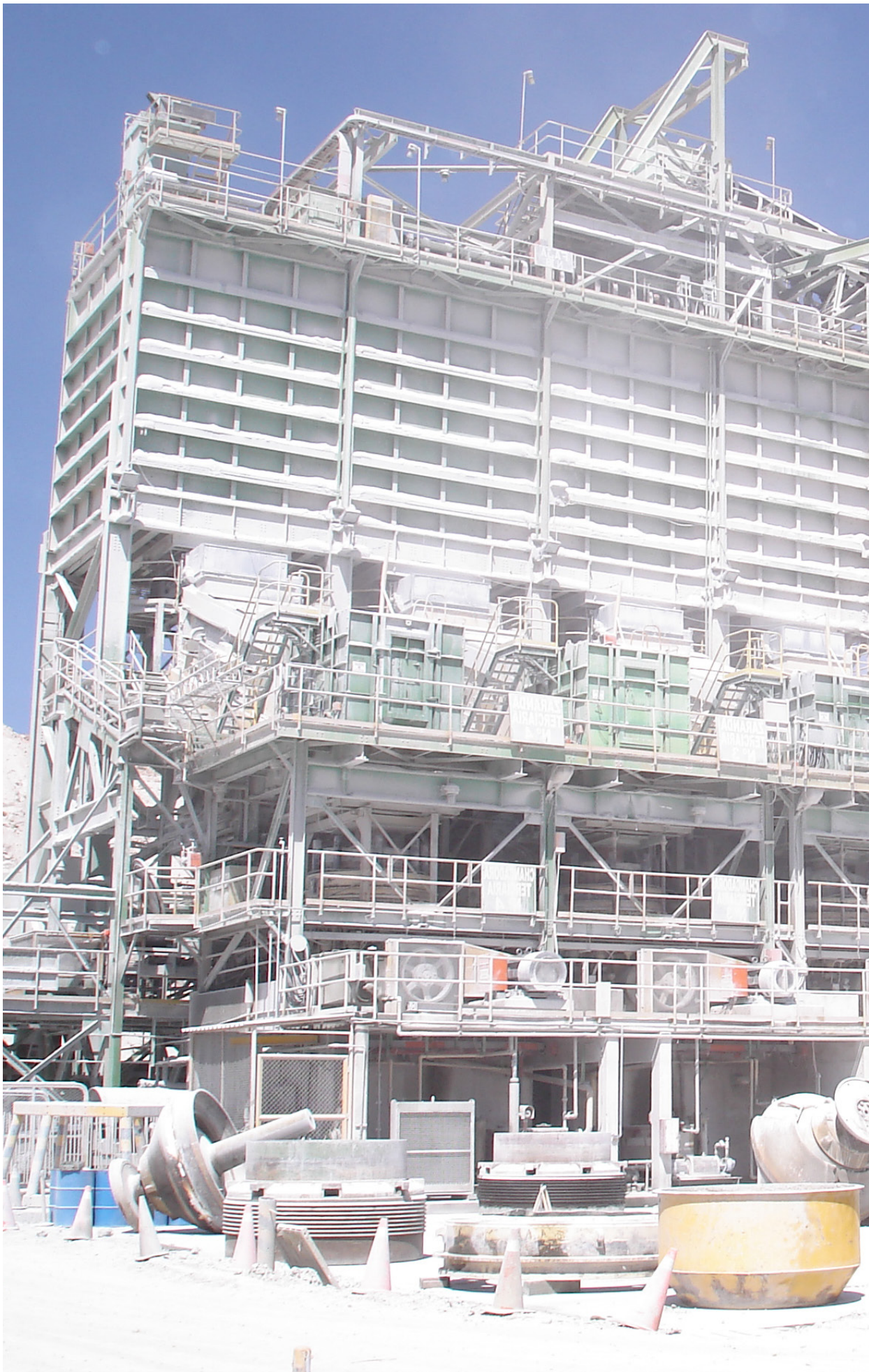
Cleaning oil for more than 60 years.

Oil can be cleaned

Most people change oil not because the properties of the oil are lost, but because the oil is dirty!
Oil can be cleaned and kept clean - while in operation!

What do we do differently

- Offline oil filtration technology - is not system critical
- Cleaning oil, tanks, gearboxes and systems while they are in operation
- The highest dirt holding capacity in the industry (4 kg dirt per Filter Insert)
- Removal of particles, water and oil degradation products with one and same solution
- The CJC™ Oil Filter can be serviced (change of Filter Inserts), while the crusher is in operation



and Lifetime of Your Machinery!

New Standards for Crusher Uptime

- Eliminate 3 out of 4 shutdowns due to oil and wear part changes
- Reduce wear parts consumption by up to 60%, e.g.:
  - Bushings
  - Gears
  - Bearings
  - Socket liners
- Extend oil lifetime by up to 80%

You don't have to stop the production!

In some cases it has become industry standard to plan production stoppages every second month or more often to change oil, to clean the system and/or replace wear parts and in-line filters!

But the truth is

that scheduled as well as unscheduled production stops can be reduced considerably with **preventative oil maintenance**!

Why Crushers need Oil Filtration

FACT

80% of all oil related failures are caused by oil contamination

Source: www.noria.com

Crushers operate under extreme environmental conditions, where high ingress of dirt is seen on a regular basis and in some cases water. This leads to highly contaminated systems and dirty oil with critically high dirt and water content, which can have a crucial impact on the system components and reliability.

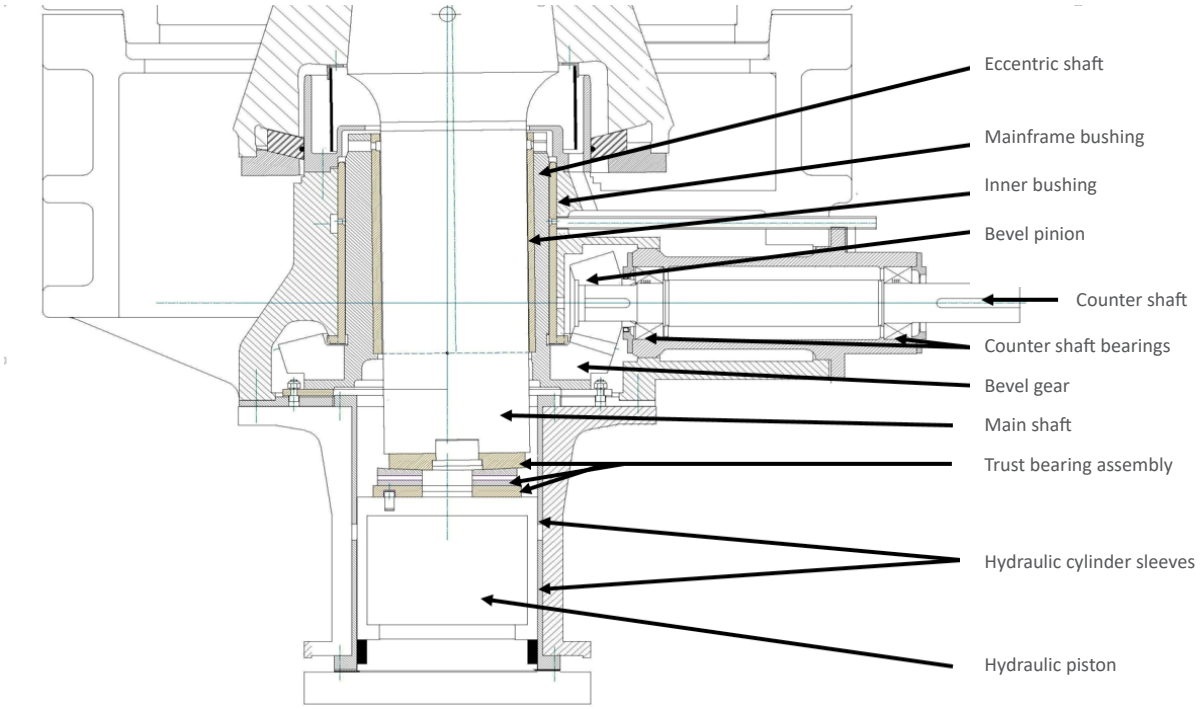
A circulating lubrication system keeps the bearings, bushings and gear within the crushers lubricated and cooled. When lubrication system and oil preventative maintenance is neglected, dirt will ingress the lubrication system and contaminate the oil. As the dirty oil flows past the seals, bushings and gear within the crusher, dirt/sand creates abrasive wear between the moving system components, resulting in severely worn components and system failure. This is particularly related to the critical components as seen in the illustration below.

Critical components being damaged:

- Bushings
- Socket liners
- Gears (pinion and crown)
- Hydraulic power pack
- Clamping cylinders
- Hydraulic adjusting motor
- Tramp release cylinders
- Valves pumps

Damage to these components will lead to expensive downtime and lost production. Frequent component and oil changes due to contamination is very expensive, because it often takes several hours of downtime! With offline filtration oil can be cleaned and kept clean during operation, significantly reducing wear on parts and oil consumption.

Critical Components in a Crusher



Cut open model of a Gyratory Crusher illustrating all moving parts. Failure to ensure clean oil will result in excessive wear and frequent oil changes. It is possible to reduce costs for spare parts and oil consumption, and eliminate many production stops with proper oil filtration for all oil lubricated crushers.

Clean Oil will Affect Your Operation

Most Common Benefits

Applying CJC™ Offline Oil Filtration system to your crusher, will be beneficial in several ways.

CJC™ Offline Oil Filters are the key to clean oil, hence the key to the most optimum and reliable production with 24/7 operation.

- Extended oil lifetime by 3-4 times, and no premature oil degradation/aging i.e. 80% reduction in oil consumption
- Up to 60% reduction in use of bushings on crushers
- Up to 80% reduced downtime – less planned as well as unscheduled showdowns
- Complete elimination of shutdown to clean out dirt from tanks
- Extended lifetime for crusher and lubrication components
- Significant reduction in use of in-line filters

Actual picture from a crusher lubrication tank with CJC™ Oil Filter.
"Is your oil this clean?"

Overall significantly
reduced lost production!

Value of Lost Production:

The cost of downtime for ONE crusher Commodity: Gold	
Cone Crusher GP220 capacity	200 tonnes per hour
Production hours per day	10 hours per day
Finish product per day	2,000 tonnes per day
Average sales price per gram	39 $
Grade (grams of a tonne)	5 gram
Value per tonne	195 $
One hour of lost production value	**39,000 $**

200 tonnes per hour x 10 production hours per day = 2,000 tonnes of finished product every day. With an average sales price of USD 195 per tonne, that's **USD 390,000** of lost production value per day.

Meaning - every oil change with 6 hour of downtime, cost, in this example, USD 234,000.
But it doesn't stop there: What about downtime due to worn out bushings, bevel gears, etc....
Change of main bushing requires 10 hours of downtime, could easily exceed USD 390,000.

Do Your own Calculation:

What is the value of one hour of downtime on your crusher?	
Crusher capacity	xxx tonnes per hour
Production hours per day	xx hours per day
Finish product per day	x,xxx tonnes per day
Average sales price per gram	xx $
Grade (grams of a tonne)	x gram
Value per tonne	xxx $
One hour of lost production value	**xx,xxx $**

Imagine if you can avoid
3 out of 4 shutdowns...

...what impact would that
have on your profitability?

Satisfied Customers

Problem solving & preventive maintenance are keywords in your crusher

Codelco Mine, Chile

A CJC™ Fine Filter installed on Crusher 4 at Codelco Mine site in Chile

Site: Codelco Mine site Chile where a parallel test was setup. Crusher 4 **with** CJC™ Offline Oil Filter and Crusher 3 **without** CJC™ Offline Oil Filter.

System: Symons 7' Cone Crusher (for medium and fine crushing of minerals)

Oil volume: 1,000 L

Oil type: ISO VG 68

Problem: Very dusty environment/ high contamination
Unexpected system shutdowns
High consumption of in-line filters and crusher components

After CJC™ Installation:
No unforeseen system shutdown
Purified oil system – 4,992 L of oil saved per year on just one crusher.
Reduced consumption of in-line filter and wear parts!

Savings: EUR 199,162 saved per year after CJC™ Offline Oil Filter was installed!

Payback time is
less than 2 months!

Yearly costs	Oil	In-line filter	Wear parts	Total costs, annually
Crusher 3, **without** CJC™ Oil Filter	2,754 EUR 5,824 L	2,019 EUR 14 pcs	31,411 EUR 8 pcs	EUR 36,184
Crusher 4, **with** CJC™ Oil Filter	393 EUR 832 L	288 EUR 2 pcs	11,779 EUR 3 pcs	EUR 12,460
			Yearly savings:	**EUR 23,724**

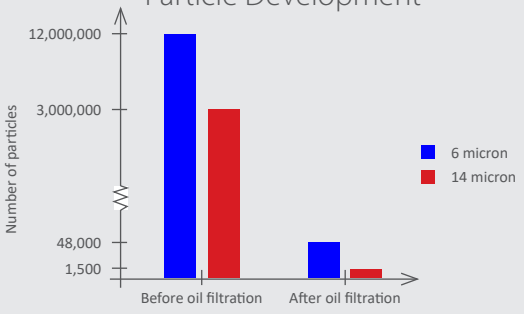
Anglo American, South Africa

Customer Statement

Senior Tribologist at Anglo American, Mr. Dave J. Gamble:
"The CJC™ Oil Filters will release benefits as reduced downtime for maintenance, greatly reduced wear and consequent failures, increased availability, utilisation and production combined with extended oil lifetime. All this combined, results in significant financial savings.

The CJC™ Oil Filter can easily clean the oil according to my recommendations, which is 16/14 on this type of application!"

Particle Development



	Before oil filtration	**After** oil filtration
ISO code	24/22	16/11

BHP Minera Escondida, Chile

Site: BHP Minera Escondida, Chile

System: Fuller, Model 60” x 89”
Capacity: 6,000 tonnes / h
Oil volume: 4,000 L
Oil type: ISO VG 320

Problem: Breakdown in dust seal
Heavy contamination ISO 25/23/22
Oil change every 30-60 days

Costs: Costs of 4,000 L oil
Breakdown wear components
Shutdown time 8-12 hours
Loss of productivity

BHP Minera Escondida site in Chile

Financial savings

Type of Costs	BEFORE CJC™ installation	AFTER CJC™ installation	TOTAL
Oil consumption	24,000 litres	4,000 litres	83% reduction
Waste oil handling	19,200 USD	4,800 USD	**Savings:** 14,400 USD
Shutdowns: 10,600 USD / hour - Stand still - Oil replacement - Cleaning - Service	6 shutdowns of 8 hours each = total 48 hours	1 shutdown of 6 hours	87% less downtime **Savings:** 445,200 USD
Spare parts	3 cylinders and plates	1 cylinder and plate	
	3 main bushings	1 main buching	

BHP Billiton, Minera Escondida, Primary Crusher

CJC™ Fine Filter HDU 427/108 installed

Dirty and saturated CJC™ Filter Insert

A used inline filter

Contamination of the Oil

Oil Contamination Causes approx. 80% of Oil Related Failures!

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

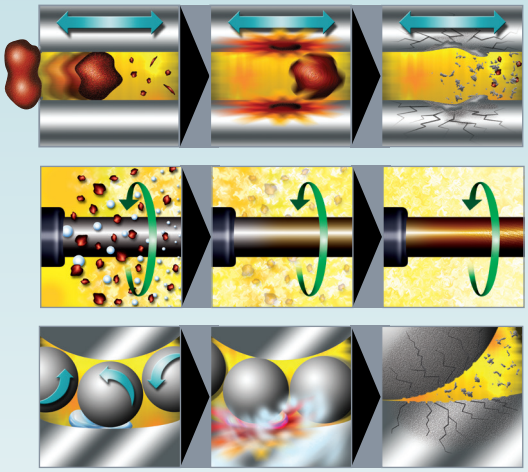
When clearance sized hard particles are wedged between movable metal parts, they destroy the metal surface further and can result in additional wear.

Oil Degradation

Wear metals, water and high temperatures lead to oil degradation, which is the precursor of varnish/resin. This results in sticky varnish that deposits on metal surfaces.

Cavitation & Pitting

Occurs in areas where water is present and oil is compressed; the water implodes, causing the metal surfaces to crackle and release more particles.

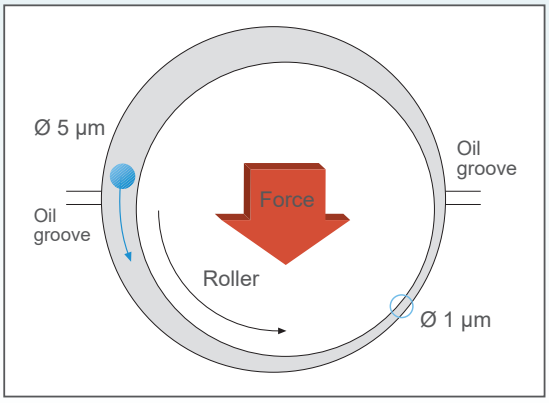


Do Crushers Need Fine Filtration?

It is in fact the small particles which are most harmful to any lubricating system. It is a common perception that a crusher is 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 in the Crusher:

More than *90%* of all particles are under *10 µm* and more than *75%* of all particles are smaller than *5 µm*

CJC™ Offline Oil Filtration

What do we do Differently

Compared to a standard in-line filter, CJC™ Offline Oil Filters have proven their many benefits.

The main benefits are:

- Huge dirt holding capacity
- 24/7 offline oil filtration
- Non-system critical (e.g. machinery shutdown is not necessary when changing filter insert in an offline oil filter system)
- Fine filtration capabilities with the removal of particles, water and oil degradation products with one and the same operation.

The industry's highest dirt holding capacity per filter insert

Dirt Holding Capacity of 1 x CJC™ 27/27 Filter Insert

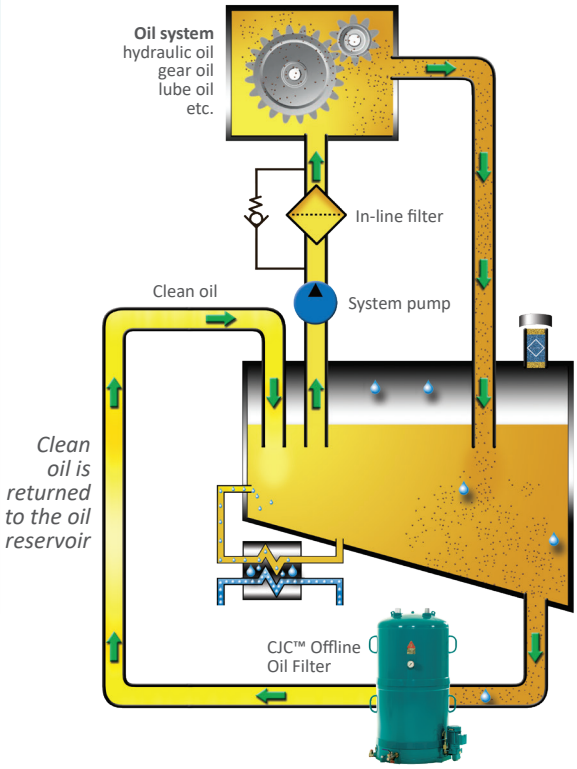
- Particles / dirt: 4 kg (lb 8.8)
- Water: 2 L (0.5 gal)
- Oil degradation products: 4 kg (lb 8.8)

Filtration Degree

- 98.7% of particles 3 µm and larger are removed from the oil in one single pass
- 50% of particles 0.8 µm to 3 µm in size are removed in one single pass

Dirty and clean CJC™ Filter Inserts.
The dirty insert is 12.17 kg heavier!
(after being drained)

Offline Oil Filtration



Offline Oil Filtration ensures optimal *cleanliness levels!*

Your Solutions

CJC™ Oil Filters, user-friendly design with low maintenance
- and we offer highly qualified technical back-up

Key CJC™ Oil Filter Figures

The CJC™ Oil Filters are offline depth filters for hydraulic and lubrication oils.

CJC™ Offline Oil Filters have a very high dirt holding capacity, and remove particles, water and oil degradation products, all in one and the same operation.

Our product range covers tailor made solutions for all system volumes.

The cleanliness level achieved and maintained by offline oil filtration means that the predicted lifetime of machine components and oil is expected to be extended 2-10 times! For specifics, see page 11.

Using CJC™ Offline Oil Filters will have a positive effect on your maintenance budget as well as increase your productivity and reduce your energy consumption.

CJC™ HDU Series

CJC™ Fine Filters are offline oil filtration systems with integrated circulating pumps for offline installation. The oil filters are recognised around the world as highly efficient purification systems for mining applications.

CJC™ Fine Filters have a 3 µm absolute filtration ratio and remove particles, water and oil degradation products from oils.

CJC™ HDU 27/54

CJC™ HDU 27/108

CJC™ HDU 2x27/108

CJC™ HDU 427/108

CJC™ PTU Series

The CJC™ Filter Separators combine depth filtration with water separation and are used for water contaminated hydraulic and lubricating oils. The CJC™ PTU Series continuously remove large volumes of water from oil.

CJC™ PTU3 27/81

CJC™ PTU3 2x27/108

CJC™ Filter Inserts

All CJC™ Filter Inserts have a 3 µm absolute filtration ratio and will remove particles, water and oil degradation products.

- **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.
- **Oil degradation products** are removed by the attraction to the polar fibres.

Modular Build-up

The modular build-up of the CJC™ Filter Inserts means that a CJC™ Oil Filter can be designed to fit any applications and requirements.

Understanding the Correlation between Cleanliness and Equipment Lifetime

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

The ISO 4406/1999 is a method for classifying the level of contamination by solid particles. Number of particles per 100 ml fluid after their size ranges - Particles are counted in size 4/6/14 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:

- 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 per 100 ml fluid!

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

LET - 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 *!*

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

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- contact us today!

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