Crusher Maintenance

Introducing new standards for crusher uptime with offline oil filtration

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

Clean Oil Increases Uptime and Lifetime of Your Machinery!
Clean Oil Increases Uptime 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 inline filters!

But the truth is that scheduled as well as unscheduled production stops can be reduced considerably with preventative oil maintenance!
Crushers operate under extreme environmental conditions, where high ingress of dirt is seen on 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 at below illustration.

**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 on 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.

**Why Crushers need Oil Filtration**

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

Source: www.noria.com

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 to spare parts and oil consumption, and eliminate many production stops with proper oil filtration for all oil lubricated crushers.
Most Common Benefits

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

CJC™ Offline Oil Filters is 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 bushing on crushers
- Up to 80% reduced downtime – less planned as well as unscheduled shutdowns.
- Complete elimination of shutdown to clean out dirt from tanks.
- Extended lifetime for crusher and lubrication components
- Significantly reduction in use of inline filters

Overall significantly reduced lost production!

Value of Lost Production:

<table>
<thead>
<tr>
<th>The cost of downtime for ONE crusher Commodity: Gold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cone Crusher GP220 capacity</td>
</tr>
<tr>
<td>Production hours per day</td>
</tr>
<tr>
<td>Finish product per day</td>
</tr>
<tr>
<td>Average sales price per gram</td>
</tr>
<tr>
<td>Grade (grams of a ton)</td>
</tr>
<tr>
<td>Value per ton</td>
</tr>
<tr>
<td>One hour of lost production value</td>
</tr>
</tbody>
</table>

200 ton per hour x 10 production hours per day = 2,000 ton of finished product every day. With an average sales price of 195 USD per ton, that’s **390,000 USD** 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 gear, etc... Change of main bushing is 10 hours of downtime: could easily excess of USD 390,000.

Do Your own Calculation:

<table>
<thead>
<tr>
<th>What is the value of one hour of downtime on your crusher?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crusher capacity</td>
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Imagine if you can remove 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

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: 1000 L
Oil type: ISO VG 68

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

After CJC™ Installation:
None unforeseen system shutdown
Purified oil system – 4992 L of oil saved per year on just one crusher.
Reduced consumption of inline filter and wear parts!

Savings: 23,483 EUR saved per year after CJC™ Offline Oil Filter was installed!

Payback time is less than 2 month!

Yearly costs

<table>
<thead>
<tr>
<th></th>
<th>Oil</th>
<th>In-line filter</th>
<th>Wear parts</th>
<th>Total costs, annually</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crusher 3, without CJC™ Filter</td>
<td>2,754 EUR, 5,824 L</td>
<td>2,019 EUR, 14 pcs</td>
<td>31,411 EUR, 8 pcs</td>
<td>36,936 EUR</td>
</tr>
<tr>
<td>Crusher 4, with CJC™ Filter</td>
<td>396 EUR, 832 L</td>
<td>537 EUR, 2 pcs</td>
<td>11,868 EUR, 3 pcs</td>
<td>13,453 EUR</td>
</tr>
</tbody>
</table>

Yearly savings: 23,483 EUR

Anglo American, South Africa

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

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

Customer Statement

Anglo American, South Africa Particle Development

Before filtration

<table>
<thead>
<tr>
<th>Particle Size (Micron)</th>
<th>Before filtration</th>
<th>After filtration</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>ISO code 24/22</td>
<td>16/11</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Number of particles

Before filtration

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<th>Particle Size (Micron)</th>
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After filtration

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<td>12,000,000</td>
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<tr>
<td>14</td>
<td>1,500</td>
</tr>
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</table>
BHP Minera Escondida, Chile

Site: BHP Minera Escondida, Australia
System: Fuller, Model 60” x 89”
Capacity: 6000 ton / h
Oil volume: 4000 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 4000 L oil
Breakdown wear components
Shutdown time 8-12 hours
Loss of productivity

CJC™ Fine Filter HDU 427/108 installed at BHP Minera Escondida!

CJC™ Filter Inserts remove up to 150 kg of solids every 2 month at BHP Minera Escondida!

Increase uptime with clean oil!

<table>
<thead>
<tr>
<th>Yearly costs</th>
<th>Before filtration</th>
<th>After filtration</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shutoffs</td>
<td>4 annual shutdowns of 12 hours each</td>
<td>1 annual shutdown of 6 hours for control</td>
<td>83% less downtime Saving 445,800 USD</td>
</tr>
<tr>
<td></td>
<td>total 48 hours</td>
<td>total 6 hours</td>
<td></td>
</tr>
<tr>
<td>Spareparts</td>
<td>3 main bushings</td>
<td>1 main bushing</td>
<td>Saving 20,000 USD</td>
</tr>
</tbody>
</table>

Costs of 4000 L oil
Breakdown wear components
Shutdown time 8-12 hours
Loss of productivity
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.
Offline Oil Filtration

What do we do Differently

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

The main advantages are expressed by:

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

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

The industry highest dirt holding capacity per insert

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

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 Figures of the CJC™ Oil Filters
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.

- all Advantages in Terms of Your Total Economy!

CJC™ HDU Series
CJC™ Fine Filters are offline oil filtration systems with integrated circulating pumps for offline installation. The filters are recognized 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™ 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™ 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 fibers.

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.
Oil cleanliness level is measured and categorized 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!

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### Life Extension Table - Cleanliness Level, ISO Codes

<table>
<thead>
<tr>
<th>Cleanliness Level</th>
<th>Suitable for</th>
<th>Dirt/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 14/12/10</td>
<td>Very clean oil</td>
<td>All oil systems</td>
</tr>
<tr>
<td>ISO 16/14/11</td>
<td>Clean oil</td>
<td>Servo &amp; high pressure hydraulics</td>
</tr>
<tr>
<td>ISO 17/15/12</td>
<td>Light contaminated oil</td>
<td>Standard hydraulic &amp; lube oil systems</td>
</tr>
<tr>
<td>ISO 19/17/14</td>
<td>New oil</td>
<td>Medium to low pressure systems</td>
</tr>
<tr>
<td>ISO 22/20/17</td>
<td>Very contaminated oil</td>
<td>Not suitable for oil systems</td>
</tr>
</tbody>
</table>

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

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### 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 are prolonged by a factor of **8** and the lifetime of gearboxes by a factor of **3** times!

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**Recommended ISO Cleanliness Level**

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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