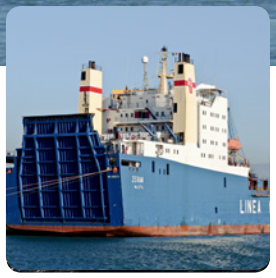
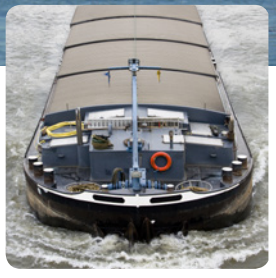
The Synonym for Oil Care

The tool for predictive maintenance

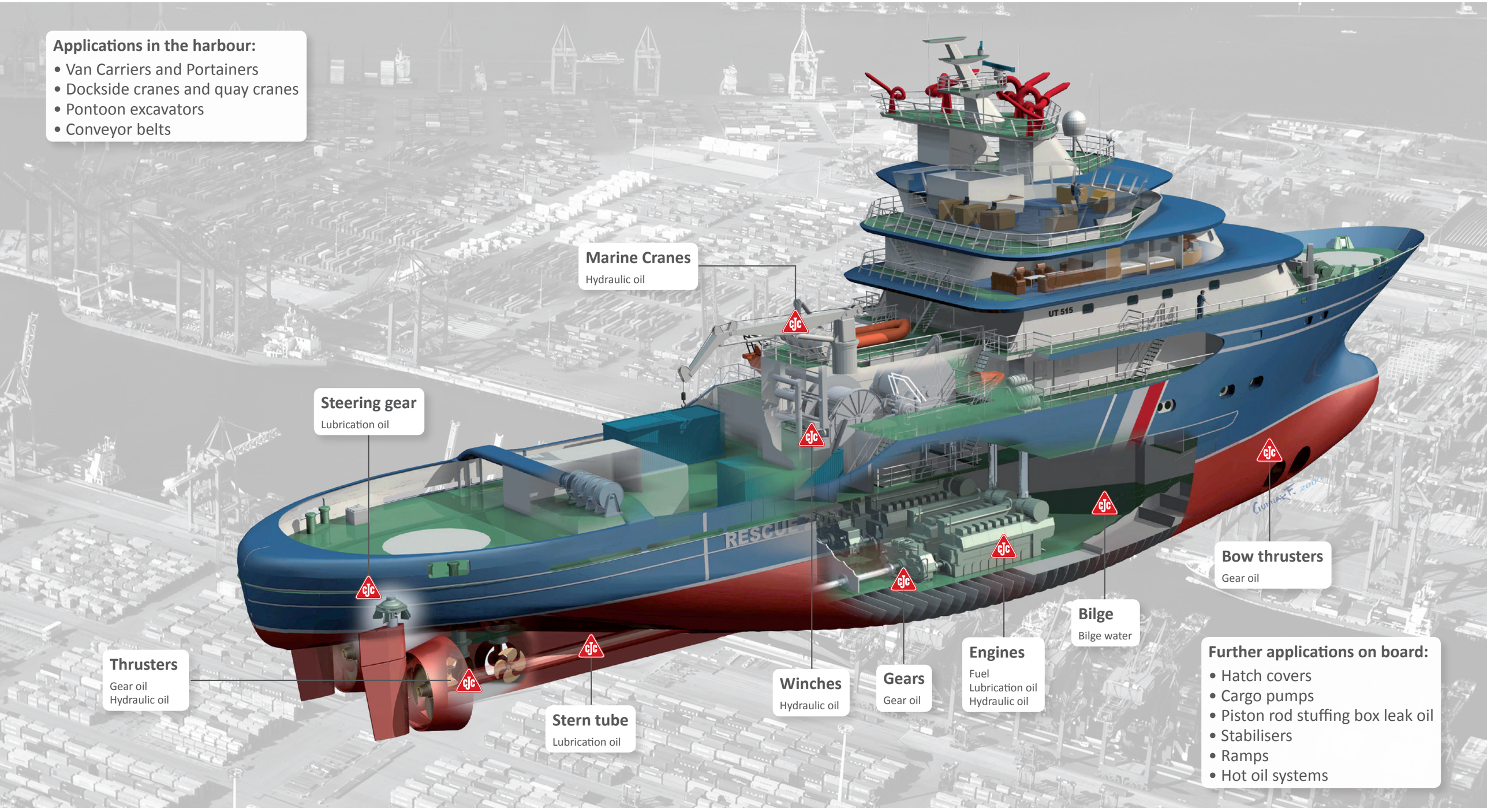




Fine Filter Systems for applications on board and in the harbour

www.cjc.de

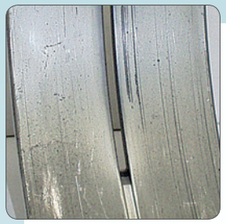
CJC™ Fine Filter Systems - One Solution for Many Applications



Karberg & Hennemann, Your Partner for Oil and Fuel Maintenance
- for more than 65 years!

Particles, Water and Oil Ageing

80 % of all breakdowns in hydraulic and lubrication systems are the result of contaminated system fluids



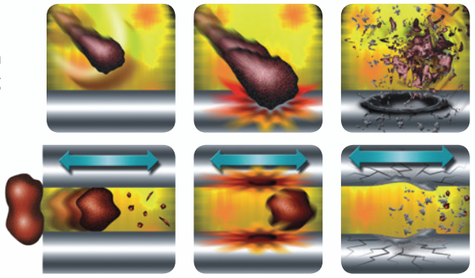
Grooving through abrasion (bearing ring)

Particles

Particle contamination of the oil can only be reduced, not avoided. The contaminants enter the system from the environment (e.g. through venting, oil refilling or repairs), but they are also generated inside the system (abrasion). Every particle in the system can generate more contamination (sand blasting effect).

Erosion
Small particles in a high velocity oil flow come in contact with metal surfaces and edges, breaking off more particles (sand blasting effect).

Abrasion
Hard particles jammed between moving parts destroy the surfaces (abrasive wear).



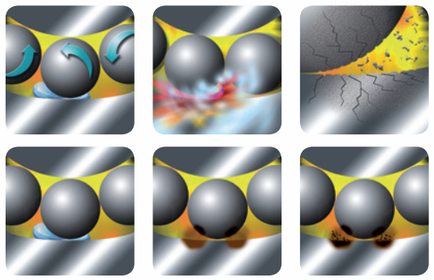
Corrosion (shaft)

Water

It is very difficult to avoid water contamination in the oil. Humid air enters the system via air vents and is absorbed by the oil. Varying temperatures enhance this process. Cooling water leakages and similar water ingress are also common sources of oil contamination.

Cavitation
Water droplets in the oil evaporate under high pressure, implode and rip particles off the metal surfaces.

Corrosion
Water or chemical contaminants in the oil cause rust or chemical reactions, which deteriorate the component surfaces.



Varnish (valve)

Oil ageing (formation of resins, varnish, sludge and acids)

Degradation products resulting from oil ageing occur in both lubrication and hydraulic systems. This is mainly influenced by oxidation (oxygen), hydrolysis (water) and pyrolysis (thermal decay at high temperatures). In most cases, all of these three factors combined are at play. The degradation products lead to formation of sludge and / or resin-like deposits. Additionally, an acidification of the fluid occurs during oil ageing process.

Oil degradation products
The resin-like degradation products are deposited on the metal surfaces and form a sticky layer to which particles adhere. The created sand paper effect accelerates wear and tear.

CJC™ Depth Filter made of Cellulose

Cellulose as filter material + offline depth filtration = highest possible oil cleanliness

Particles

Solid particles are permanently retained between the cellulose fibres. 75 % of the insert volume forms a structure of cavities. Each insert has a filtration degree of 3 µm absolute and 1 µm nominal. Especially developed CJC™ Fine Filter inserts offer a filtration degree in the submicron range.

Capacity: several kilogrammes

Water

Cellulose fibres absorb water by capillary attraction. Even if only a few ppm of water are in the oil, the fibres dry the oil.

Capacity: several litres

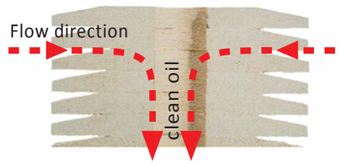
Oil ageing / Oxidation

Oxidation products, resins, varnish and sludge residues deposit permanently, with a combination of adsorption and absorption, on the polar sites of the cellulose fibres. Cellulose fibres have an inner surface of 120 to 150 m² per 1 gram.

Capacity: several kilogrammes

Depth filtration - extremely high dirt holding capacity and long filter lifetime

CJC™ Fine Filter inserts are depth filters, i.e. compared to surface filters contaminants are retained in the depth of the filter material. This implies an enormously high dirt holding capacity and extremely long filter lifetime. Due to the slow pace of the oil flow – only possible in an own circuit (offline filtration) – and the extremely long filter paths of a depth filter, CJC™ Fine Filter inserts are particularly effective. **The longer the fluid has contact with the filter material, the more effective is the fine filtration**. The filter efficiency is basically a function of the fluid's contact with the filter material.



Cross-section of a CJC™ Depth Filter insert - The oil flows through the CJC™ Depth Filter insert radially from the outside to the inside

Cross-section of a used CJC™ Depth Filter insert

For each application a suitable solution

With more than 20 various types of filter inserts we offer the optimal solution for each application.

- Mineral oils and synthetic pressure fluids and lubricants up to ISO VG 460 / 40 °C, also biodegradable oils
- Aqueous oils and fluids
- Oils and fluids with extremely high dirt ingress

See product sheets for further information. Download: www.cjc.de/produkte

Only clean oil is able to loosen already deposited particles and degradation products in the oil system and to hold them in suspension,

until these are also filtered out.

Offline Oil Maintenance

Independent of the machine‘s operation for highest possible oil cleanliness

Inline filtration in comparison with offline filtration

Bypass filter (inline)

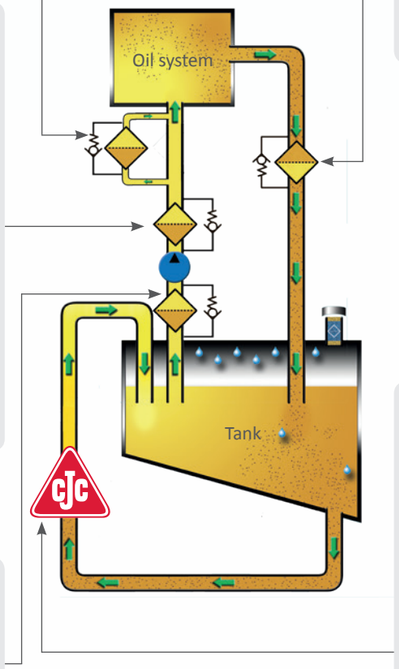
- Only a part of the inline fluid flow is filtered
- Dependent on the operation of the machine

Pressure filter (inline)

- Housings and filter elements are expensive, because they have to be designed for max. system pressure
- High energy costs (the higher the filtration degree, the higher the costs)
- High operation pressures and high flow rates lead to an extreme load (material fatigue, damage of the pore structure)
- Release of already filtered particles due to highly fluctuating pressure surges
- Short contact time between fluid and filter material due to the high flow rate
- Low dirt holding capacity
- Frequent filter replacements
- Dependent on the operation of the machine
- Only solid particles are filtered out, no protection against cavitation, corrosion and oil ageing

Suction filter (inline)

- Only protection against large solid particles
- No protection against caviation, corrosion, oil ageing and wear caused by fine particles
- Oil is drawn from the surface; contaminants in the oil sump are not captured
- Big filter sizes necessary
- Dependent on the operation of the machine



Return filter (inline)

- Big filter sizes in some cases necessary, because the return flow rate is often bigger than pump flow rate
- Short contact time between fluid and filter material due to the high flow rate
- Dependent on the operation of the machine
- Only solid particles are filtered out; no protection against cavitation, corrosion and oil ageing

Offline filter

- Particles, water and oil ageing products are simultaneously reduced to a minimum
- Fine filtration to a range of < 1 µm (submicron range)
- Continuous fine filtration (24/7), independent of the operation of the machine
- Oil is drawn from the lowest point of the system tank, meaning the highly-contaminated oil in the bottom of the tank (sediments) is filtered too - the clean oil is returned to the tank close to the suction point of the main system pump
- Its own pump enables an application-specific adjustment of the pump flow
- Efficient fine and depth filtration due to the long contact time between filter material and fluid
- For filter replacement it is not necessary to stop the machine
- No high pressures, flow rates or pressure surges and the related problems
- Extremely high dirt holding capacity and long lifetime of the filter elements

Highest possible oil cleanliness can only be ensured by continuous offline fine filtration - in conjunction with the inline filter.

Easy installation:

The oil is drawn and returned at the system tank.

Your Advantages

Reduce costs, increase machine reliability and avoid oil changes

Small investment, large effect

Good for you - good for our environment!

The constant high oil cleanliness level permanently achieved by offline fine filtration prolongs the lifetime of system components and oil by a factor of 2 up to >10!

Less maintenance, increased productivity

- Approx. 60 % lower maintenance costs
- Less wear and tear and therefore less unscheduled downtimes and lay days
- Improvement of the process stability
- Longer lifetime for system components and oil
- Longer lifetime for filter elements of inline filters

Lower energy consumption

- Less frictional loss
- Less pressure build-up by system pump necessary
  - ▸ as for pressure filters, a lower filtration degree can be selected
  - ▸ as due to the longer lifetime, the filter elements of pressure filters are saturated much slower

Short amortisation time

- > 75 % of the installed CJC™ Fine Filter systems have a payback time of less than one year of operation

Protect the environment

- As a result of the longer lifetime of oil and components the energy and resources consumption necessary for production and disposal of spare parts and operating material (new oil etc.) decrease
- Improvement of the carbon footprint by oil conditioning
  - ▸ Thermal disposal of waste oil causes approx. 2.6 kg of the harmful greenhouse gas CO_2 per 1 litre
- Filter material consists to 100 % of renewable raw material
- No additional impact on the environment during disposal of the filter material
  - ▸ CJC™ Fine Filter inserts can be disposed of according to the (German) Waste Product Key 150202 and thus, they also comply with the aims of DIN EN ISO 14001:2015 "environmental management system" and the life-cycle resource management

Profit from the advantages of the CJC™ Fine Filter systems!

Classification according to ISO 4406 (International Organization for Standardization)

The ISO 4406/1999 method for coding the level of contamination of solid particles is a classification system that converts the numbers of counted particles into an ISO class (oil cleanliness level). According to ISO 4407, counts at 5 and 15 µm from the manual particle counting are equivalent to the counts at 6 and 14 µm when using an automatic particle counter calibrated in accordance with ISO 11171.

Amount of particles > specified size		
more than	up to	ISO Code
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

(Extract from the currently valid ISO 4406 standard.)

Automatic particle count
From a 100 ml sample of the fluid to be examined, the quantity of particles > 4 µm, > 6 µm and > 14 µm is determined. The quantities of particles are then categorised in class codes, indicating the oil cleanliness level.

Example - ISO Code 19/17/14
(typical for new oil):

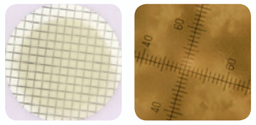
250,000 up to 500,000 particles ≥ 4 µm,
64,000 up to 130,000 particles ≥ 6 µm and
8,000 up to 16,000 particles ≥ 14 µm
are contained in 100 ml of the tested oil.

Microscopic analysis
Only the quantity of particles ≥ 5 µm and ≥ 15 µm is determined.

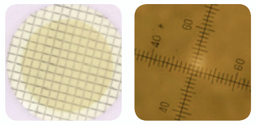
Example - ISO Code 17/14
(typical for new oil):

64,000 up to 130,000 particles ≥ 5 µm and
8,000 up to 16,000 particles ≥ 15 µm
are contained in 100 ml of the tested oil.

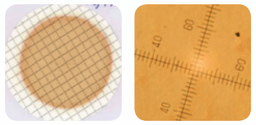
ISO 11/10/6



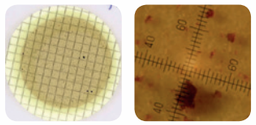
ISO 13/12/7



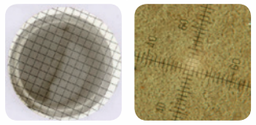
ISO 15/13/8



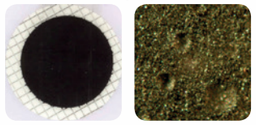
ISO 18/17/15



ISO 20/18/13



ISO 24/23/20



Photos of test membranes of various contamination degrees

Categorising cleanliness levels

Depending on the application, specified oil cleanliness levels for oil systems (ISO 4406) are recommended. The adjacent table shows these minimum requirements in an overview.
(Source: Noria Corporation)

The service life of hydraulic and lubrication system components varies distinctly according to the cleanliness level (ISO 4406).

22 / 20 / 17	19 / 17 / 14	17 / 15 / 12	16 / 14 / 11	14 / 12 / 10
heavily contaminated	medium contaminated e.g. new oil*	lightly contaminated	clean	very clean
not useable in oil systems	low and medium pressure systems	hydraulic and lubrication systems	servo and high pressure systems	all oil systems
50 % of service life	75 % of service life	100 % of service life	150 % of service life	200 % of service life

) Up to **0.05 % of insolubles are permissible in new oil. (DIN 51 524, Part 2)*

Karl-Fischer-Titration

With the Karl-Fischer-Titration it is possible to determine the water content in oils. Basis for water determination is the reaction of iodine with water in a dissolution. Two different methods exist:

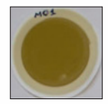
Volumetry:
This method is used for detection of larger amounts of water in oil. The measuring ranges from 0.01 % up to 100 % water in oil.

Coulometry:
This method is used for exact detection of smallest amounts of water in oils. The measuring ranges from 0.001 % up to 5 % water in oil.

Hydraulic oil samples with various water content.
From left: 0.01 % - 0.03 % - 0.06 % - 0.1 % - 0.2 % - 2 % water in oil

MPC-Test (Membrane Patch Colorimetry)

50 ml of the oil to be tested and 50 ml filtered heptane are mixed and vacuum-filtered through the test membrane. The colorimetric analysis is conducted after the subsequent drying of the membrane. The residuals on the membrane are analysed by the spectral sensor. The deposits absorb or reflect the light completely or partially. The differences between sent and reflected light as well as the colour intensity in the respective spectral range allow an MPC value to be calculated. The higher the MPC Index, the heavier the colour change on the membrane and the greater the potential of the oil to generate deposits.

0 - 10	11 - 25	26 - 30	31 - 45	46 - 50	51 - 55	56 - 60
Normal	**Monitor**	**Attention**	**Critical**	**Problematical**	**Oil change**	**System purification**
Normal oil ageing	Critical value for formation of deposits is achieved soon	Many soft contaminants, start of deposits on sleeve bearings and cooler spots in the lubrication system	Extremely high amount of soft contaminants, formation of deposits in bearings, valves or tanks	Additive degradation, oxidation, high oil temperatures and long use of the oil can generate further particles, which deposit	Additive degradation and oxidation well advanced, deposits in bearings, valves and tanks	Oil no longer useable, deposits in the whole system
						
MPC index 2	*MPC index 19*	*MPC index 35*	*MPC index 41*	*MPC index 49*	*MPC index 53*	*MPC index 60*

Further important analysis options:

- Viscosity determination
- Acid content: Detection of neutralisation number or base number
- Element analysis
- Particle Quantifier index

Read more about the topics of classification systems, oil analysis and correct oil sampling in our brochure "Ratgeber ÖL". Download: www.cjc.de

Ensuring a longer lifetime for machine, system components and oil is a must
to sustainably reduce the content of particles, water and oil degradation products to a minimum!

CJC™ Fine Filter Units

For lubrication, gear and hydraulic oils

Principle: Fine and depth filtration

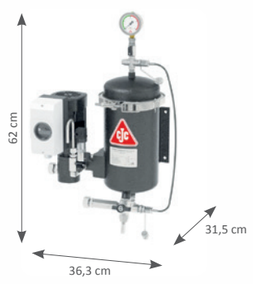
Applied for following contaminants:
- Particles
- Water
- Oil ageing products *(resins, varnish, sludge)*
- Acid compounds

See product sheets for further technical data.
Download: www.cjc.de/produkte

Standard design

[Subject to technical changes.]

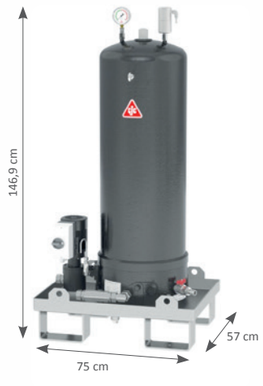
Design size 15/25



Design size 27/-

Design size	Filter Capacity	
	Dirt	Water
15/25	approx. 1,1 kg	approx. 0,5 l
27/27	approx. 2 kg	approx. 1,2 l
27/54	approx. 4 kg	approx. 2,4 l
27/81	approx. 6 kg	approx. 3,6 l
27/108	approx. 8 kg	approx. 4,8 l
38/100	approx. 15 kg	approx. 7,2 l
427/108	approx. 32 kg	approx. 19,2 l
727/108	approx. 56 kg	approx. 33,6 l

Design size 38/100



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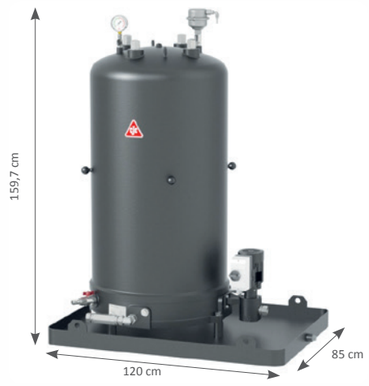


Design size 727/108-

Advantages over Centrifuges

More effective, cost-efficient and environmentally friendly

Easy installation and start-up

- The modular construction enables a flexible design - exactly the footprint as a centrifuge
- No steam heating incl. pipes necessary
- No sludge tank incl. pipes necessary
- No control air (valves) necessary
- No water connection necessary
- No periodic inspections necessary

Easy operation

- Simple operation without manpower requirement
- No cleaning processes necessary and because of that no water consumption
- Low-maintenance, solely the filter inserts have to be replaced
  - ▸ due to the enormously high dirt holding capacity the lifetime of a filter insert amounts approx. 1 year
- Extremely low energy consumption

Efficient oil maintenance and short amortisation time

- Efficient oil maintenance - not only particles and free water, but also dissolved water as well as oil ageing products are removed
- No ingress of water in oil (flush water for cleaning centrifuges)
- Oil cleanliness classes recommended by original equipment manufacturers are achieved without any problems and even exceeded
- No oil or fuel losses and therefore lower consumption of new oil

CJC™ Fine Filter units (above) and CJC™ Filter Separators (below) require the same or even a smaller footprint than a centrifuge. An exchange of a centrifuge with a CJC™ Fine Filter system ex post is quick and easy.

Application example

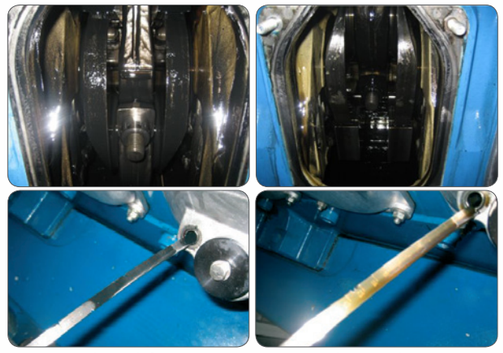
Supply vessel | Engine lube oil | Oil volume: 600 Litres

Result of the filtration

- After 18 days of fine filtration and 70 operating hours of the main engine, soot content was reduced to 0.1 wt.-%.
- During inspection of the inside of the main engine it was clearly visible that the black deposits had started to disappear *(Compare photos on the right side).*
- Significant time and cost savings as a result of dismounting the centrifuges
  - ▸ No disposal of oil sludge (approx. 280 m³/year)
    - ▸ *Reduced spare part costs for the incinerator- and the bilge water system*
    - ▸ *No diesel required for the combustion process*
  - ▸ No loss of lube oil, lower consumption of new oil
- All 4 engines of the vessel as well as of the sister vessels are equipped with CJC™ Fine Filter units.

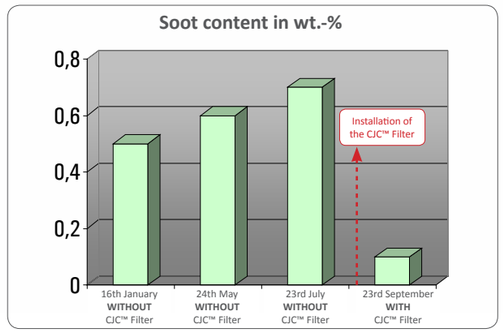
"I recommend that our lube oil centrifuges are left ashore and that CJC Filters are purchased also for the other main engines. ..."

Chief engineer of the shipping company, Switzerland,



Photos left: WITHOUT CJC™ Fine Filter

Photos right: WITH CJC™ Fine Filter



Fluid volume, viscosity, type and amount of dirt ingress, operating temperature and other parameters influence the dimensioning.

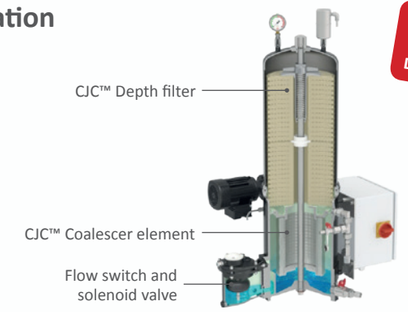
For optimal dimensioning customised for your fluid system, please contact us!

CJC™ Filter Separators

Especially for oils, fluids and fuels with a high content of free water

Principle: Fine and depth filtration in combination with coalescing

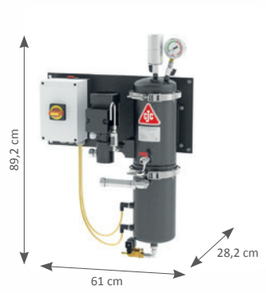
Applied for following contaminants:
- Particles
- Water
- Oil ageing products *(resins, varnish, sludge)*
- Acid compounds



See product sheets for further technical data. Download: www.cjc.de/produkte

Standard design:
[Technische Änderungen vorbehalten]

Design size 15/25

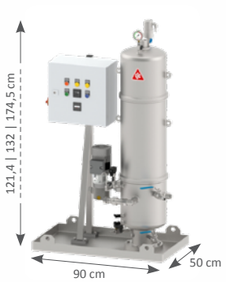


Design size 27/-

Design size	Dirt holding	Water separation
15/25	approx. 1,1 kg	
27/27	approx. 2 kg	
27/54	approx. 4 kg	
27/81	approx. 6 kg	
27/108	approx. 8 kg	
327/54	approx. 12 kg	
327/81	approx. 18kg	
327/108	approx. 24 kg	automatic
427/54	approx. 16 kg	
427/81	approx. 24 kg	
427/108	approx. 32 kg	
727/54	approx. 28 kg	
727/81	approx. 42 kg	
727/108	approx. 56 kg	
727/162	approx. 84 kg	

Filter housings made of stainless steel
[Subject to technical changes.]

Design size 27/-



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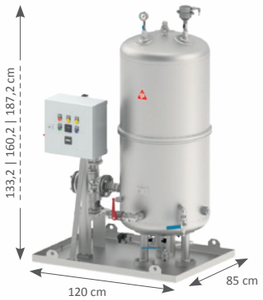

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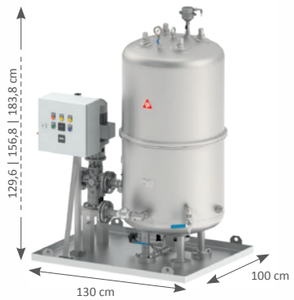

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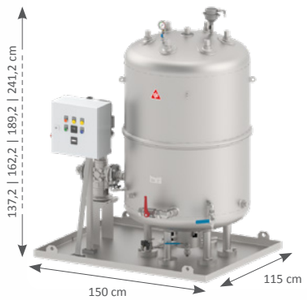


Fuel Conditioning

Improve engine performance, minimise emission, avoid soot debris

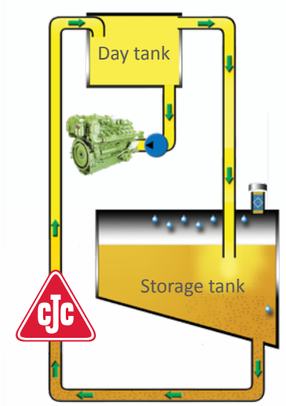
Water and particles in the fuel

Water especially in diesel oil boosts the spread of microorganisms (bacteria, fungi, yeast). The resulting bio sludge clogs system filters and fuel pipes and can cause malfunctions. With an increasing number of microorganisms the risk of corrosion damage in the tank and fuel system increases too. Especially on vessels and diesel-driven emergency power generators with long downtimes the risk is particularly high. Particles lead to wear and tear on injection nozzles and fuel pumps.

Examples of possible sources of contamination:
New oil (i.e. storage), environment (temperature fluctuation, air humidity), aeration, refilling procedures, maintenance and repair, cleaning processes, operation (wear and tear, reaction products i.e. during combustion processes)

Installation principle

For fuel fine filtration on vessels the CJC™ Filter Separator is installed between the storage and the day tank. This way the engine is always fed with clean and water free diesel fuel.



Application example

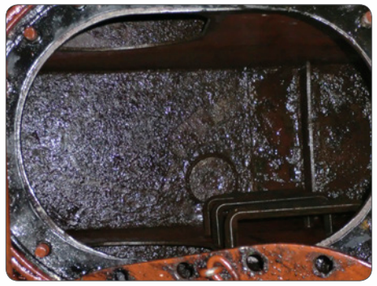
Tug boat | Diesel oil

Before filtration

- The Superintendent was **not satisfied with the performance of the centrifuges**:
  - ▸ Existing microorganisms were not removed
  - ▸ Water and particle content were not reduced satisfactorily
- Wear and tear on injection nozzles led to negative consequences during combustion:
  - ▸ Reduced engine performance
  - ▸ More output of nitrogen oxides (emissions)
  - ▸ More soot debris in the exhaust valves
  - ▸ More combustion residues in the lube oil
- **> 200,000 EUR costs due to wear and tear**

Result of the filtration

- Since installation of the CJC™ Filter Separator already **> 50,000 EUR was saved**
  - ▸ Less wear and tear on plungers, barrels and injection nozzles
  - ▸ Longer oil change intervals
- No oil-related engine failures and therefore fewer unscheduled breakdowns and lay days
- No sludge residues and microorganisms in the tanks; extensive tank cleaning is no longer required



Diesel tank contaminated due to dirt, sludge and water

The bottom of a diesel tank, heavy microbial growth

Certification on request

Bureau Veritas | American Bureauof Shipping | Det Norske Veritas

CJC™ Thruster Unit & Desorber

Especially for oils with a continuous water ingress

CJC™ Thruster Unit

The CJC™ Thruster Unit is a CJC™ Filter Separator designed especially for thruster applications. Water ingress in the oil system of thrusters can function-related not be avoided. The high-viscosity oil is preheated in two steps before entering the filter. The warm, thin oil is more filterable. The CJC™ Thruster Unit is used not only for thrusters but also for stern tubes and on many off shore rigs (drilling and production rigs etc.)

CJC™ Desorber-Filter-Combi-Unit

Fine and depth filtration in combination with desorption for quick reduction of the water content (free and dissolved water) in oils. Even oils with a poor demulsification time (water separation property), which rapidly form stable emulsions e.g. biodegradable oils (environmentally acceptable lubricants), are completely regenerative.

Applied for following contaminants
- Free and dissolved water
- Particles, also salt particles *(sea water)*
- Oil ageing products *(resins, varnish, sludge)*

Water separation with desorption
The desorption process is based on the principle that heated air can effectively hold large quantities of water. In the desorber, the warm oil is met by a counter flow of cold, dry air. The air, heated very quickly by the warm oil, absorbs any water present until saturation is reached. During the subsequent air cooling process the water condenses and the dry air is used again for drying of the following oil flow.

Challenge: water in oil

When using in applications where the risk of continuous water ingress is high, appropriate measures must be taken to reduce the water content. Water in oil leads to cavitation, corrosion, reduced lubricity, bacterial growth, oil ageing and additive decomposition. The contamination of biodegradable oils (environmentally acceptable lubricants) in particular with water leads to enormous problems. These oils have a poor hydrolytic stability and rapidly degrade when they come into contact with water.
Furthermore, some of these oils have poor demulsification properties and rapidly form stable emulsions. Biodegradable oils (environmentally acceptable lubricants) are for example ester, PAG (poly alfa glycols), PAO (poly alfa olefine) and vegetable oils as well as mixtures of these oils. These special oils are 3, 5 or even 8 times more expensive than mineral oils.

The classification society DNV-GL in their technical e-news-letter of June 2013 has stated that, for their CLEAN DESIGN Notification:
„If a biodegradable oil is used, an arrangment shall be in place to keep the water content of the oil under control."

Bio oil - Application Example

Prolong oil lifetime and protect components against corrosion, cavitation and wear

Stern tube | Cargo ship

Oil type: Castrol Biostat 100 | Oil volume: 800 litres

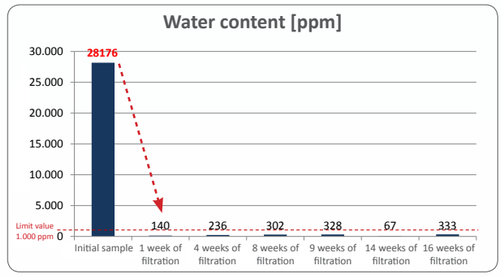
Before filtration
- Water content: 28,176 ppm (2.81 %)
- Oil cleanliness class: 19/18/10
- Sodium concentration (salt): 49,6 ppm

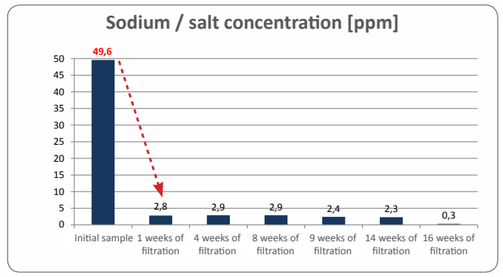
The demulsification property (water separation property) of Castrol Biostat 68, 100, 150 and 220 is very poor; this means that these oils rapidly form emulsions when they come into contact with water.

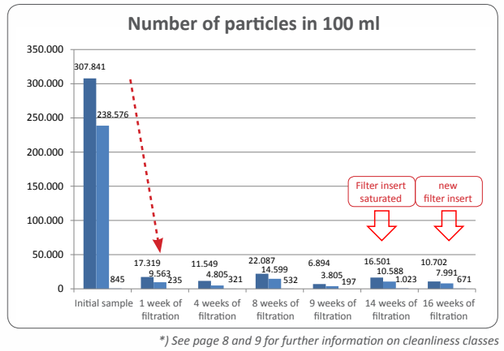
Result of the filtration
- Water content: 333 ppm (0.03 %)
- Oil cleanliness class: 14/13/10
- Sodium concentration (salt): 0.3 ppm

Within the first three days, the CJC™ Desorber-Filter-Combi-Unit separated 45 litres of water in total (15 L/day). Despite the constant water ingress, the water content was kept at a low level!
Salt (sodium) and particles were retained in the CJC™ Fine Filter insert.

Conclusion
- The oil can still be used without any issue; an oil change is no longer necessary.
- The risk of corrosion, wear and tear as well as unscheduled breakdowns and lay days is reduced to a minimum.
- Due to the reduction of the oil humidity from 28.176 to Ø 235 ppm the lifetime of the system components is extended by a factor of 10. *(Source: Noria Corporation)*
- As a result of the improved oil cleanliness class from 19/18/10 to 14/13/10 respectively 13/12/8, the lifetime of journal bearings is expected to be prolonged by a factor of 3 to 4.







*) See page 8 and 9 for further information on cleanliness classes

Ensuring a longer lifetime for machine, system components and oil is a must
to sustainably reduce the content of particles, water and oil degradation products to a minimium!

CJC™ Oil Absorb

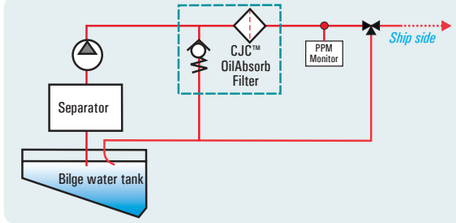
Environmental compliant discharge of bilge water

CJC™ OilAbsorb

With the CJC™ OilAbsorb the residual oil content in the pre-treated bilge water can be reduced to values below 5 ppm. This ensures the compliance with environmental regulations or internal ISO 14001 objectives and targets. After polishing the water is clean enough to be discharged into the sea.

Based on a unique absorption principle with the specially developed CJC™ OilAbsorb insert, the CJC™ OilAbsorb systems absorb oil from even emulsified bilge water, process and waste water and ensure environmentally friendly operations according to the legal requirements.

The CJC™ OilAbsorb insert removes very fine oil impurities from the bilge water. Each filter element has an oil holding capacity of 6 kg. The bilge water is polishing to a degree of 1 - 5 ppm.



Application samples

Research vessel | Bilge water

Before filtration

- The installed bilge water separator could not reduce the oil content in the bilge water below 15 ppm, the ppm monitor is constantly alert
- High disposal costs for the oily bilge water
  ▸ 11,000 to 13,000 EUR / months for 30-35 m³

Chief engineer on board:
"The system works very well – the ppm monitor shows less than 5 ppm most of the time. Personally, I am very pleased. Applying this filter means that we have no bilge water problems. Prior to installing this filter we delivered an average of approx. 30-35 m³ per month. As long as we have filter inserts on board we no longer need to deliver bilge water ashore. We haven't bought particularly many inserts either. We also have an incinerator with a sludge burner that can burn waste oil, which is separated from the bilge water."

Further Application Examples

Optimise wear protection and prolong lifetime of engine and components

Hydraulic oil | Hydraulic control, engine

Container vessel | Oil volume: 16.000 litres

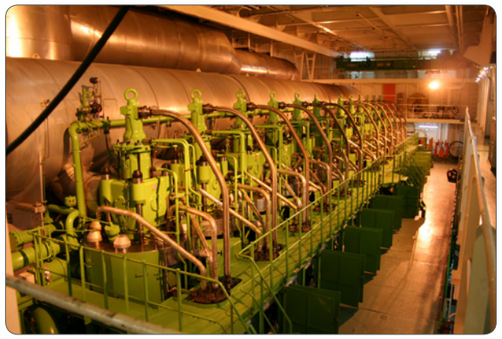
Before filtration

- Problems occured in the hydraulic control. An analysis of the hydraulic oil showed that the oil was heavily contaminated with water and particles.

Result of the filtration

- No downtimes since installation of the CJC Fine Filter system
- The impressive results of the filtration (see table) prompted the customer to install identical filters on the other 13 vessels of this class.

Technical inspector of the shipping company:
"Nothing but the installation of the CJC Fine Filters enabled us to meet the requirements of the ME-hydraulic system."



Engine MAN 12 K 98 ME - C6

Date	May	August	Sept.	Oct.
Particles > 2 µm	3,031,840	25,398	43,610	8,465
Particles > 5 µm	384,800	11,544	16,936	1,539
Particles > 15 µm	35,650	633	725	66
ISO Code	22/19/16	15/14/10	16/15/10	14/11/7
Water, ppm	1,300	1,100	1,065	851

*) See page 8 and 9 for further information on oil cleanliness classes.

Lubrication oil | Engine

Tug boat

Before filtration

- The oil was highly contaminated with blow-by-debris, soot and metal particles as well as combustion residues resulting in oil changes every 1,000 running hours.

Result of the filtration

- The soot contamination dropped immediately from 1.4 Wt.-% to 0.4 Wt.-% after start-up of the CJC™ Fine Filter unit.
- After 2,795 running hours the soot contamination was still lower than at the starboard engine after 410 running hours.
- Three times longer lifetime of the oil, this means that the oil only has to be changed after 3,000 instead of after 1,000 running hours.

Port engine WITH CJC™ Fine Filter unit				
Date	**Engine Hours**	**Oil Hours**	**Soot (%)**	**TBN mg KOH/g**
8th November	12,245	1,037	0.4	12.5
22nd June	13,666	2,458	1.0	10.8
9th August	14,003	2,795	1.1	9.9

Starboard engine WITHOUT CJC™ Fine Filter unit				
Date	**Engine Hours**	**Oil Hours**	**Soot (%)**	**TBN mg KOH/g**
8th November	12,221	1,033	1.6	12.8
Oil change				
22nd June	13,632	77	0.7	13.4
9th August	13,967	410	1.2	12.7

Equal which oil system and which type of vessel

CJC™ offers for each problem the optimal oil maintenance system!

Further Application Examples

Decrease repair and maintenance costs and reduce lay days to a minimum

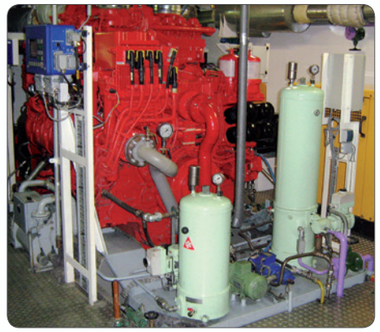
Lubrication oil and diesel | Engine

Tanker

Result of the filtration

- Since commissioning of the vessel in 2011 the engine has been running without any problem. The engine is always supplied with clean and water-free oil and diesel ensuring an optimum engine performance.
- 706,000 litres of fuel in total were dried and cleaned with only one set of filter inserts. At the time of the filter insert replacement the filter insert was not completely saturated.
- The lifetime of the lubrication oil could be prolonged by 50 % from 1,000 to 1,500 running hours (the manufacturer recommends an oil change after 1,000 running hours). The lifetime of the CJC™ Fine Filter insert is nine months.

Ship owner:
"I had a filter for diesel oil filtration on my old vessel and I was always satisfied. I absolutely had to have a CJC Filter again this time. For even better engine maintenance and performance I decided to clean the lubrication oil with a CJC Fine Filter too!"



CJC™ Fine Filter unit (left) for lube oil filtration and CJC ™ Filter Separator (right) for diesel oil filtration installed at the MTU engine

Gear oil | Bow thruster

Supply vessel | Oil volume: 800 litres

Before filtration

- Shortened oil lifetime due to the heavy contamination of the oil with water, particles and oil ageing products
- Frequent lay days in dry dock

Result of the filtration

- Within 48 hours the oil cleanliness was improved such that the urgently recommended oil change was no longer necessary.
- The water content decreased from 25,490 to 1,720 ppm.
- The particle content was reduced by 75 %; with an oil cleanliness class of 18/17/16 the oil is now cleaner than new oil.
- Because of the significantly improved oil cleanliness the lifetime of the system components can be expected to be prolonged by factor of 4 to 5. *(Source: Noria Corporation)*

	Before filtration	After 48 hours
Water content, ppm	25,490	1,720
Particle content, 2 µm	> 1,000,000	< 250,000
ISO Code *)	21/19/16	18/17/13

**) See page 8 and 9 for further information on oil cleanliness classes.*

Further Application Examples

Not only on board but also in the harbour an efficient oil maintenance is recommendable

Hydraulic oil | hydraulic system

Pontoon excavator | Oil volume: 6,400 litres

Before filtration

- The hydraulic system was heavily loaded as a result of the regular contamination with dirt and water.
- After 7,500 running hours the oil reached an oil cleanliness class of 21/20/18 (ISO Code) and a water content of 515 ppm.
- Frequent breakdowns of expensive hydraulic components

Result of the filtration

- After 2 months (1,000 running hours) oil cleanliness class 19/16/12 and after further 2 - 3 months (1,500 running hours) 15/13/10 (ISO Code)
- Water content decreased from 515 to 107 ppm.
- Due to the improvement of wear protection the system will be protected against unscheduled breakdowns.
- Oil lifetime significantly extended.

Liebherr pontoon excavator P 995 Litronic on spud carriage pontoon MP40 - in use for construction of the deep-water container terminal Jade-Weser-Port in Wilhelmshaven.

Running hours	ISO Code *)	Water [ppm]
7,000	21/19/15	311
7,500 (Installation of the CJC™ Fine Filter unit)	21/20/18	515
8,000	21/19/17	531
8,500	19/16/12	404
9,000	18/16/12	380
9,500	16/15/11	368
10,000	15/13/10	107

**) See page 8 and 9 for further information on oil cleanliness classes.*

Hydraulic oil | Straddle carrier

Oil volume: 300 - 400 litres

Before filtration

- The hydraulic oil (for moving the straddle carrier and lifting the containers) was heavily contaminated with particles and condensed water.

Result of the filtration

- Due to the improvement of the oil cleanliness class from 17/16/13 to 11/10/6 the lifetime of oil and system components can be expected to be extended by factor of 4. *(Source: Noria Corporation)*
- The risk of wear and tear, corrosion and cavitation is reduced to a minimum

Straddle Carriers

	AFTER 1st filter pass	AFTER 203 hours	AFTER 763 hours	AFTER 1,973 hours
Particles > 2 µm	73,184	4,420	2,605	1,922
Particles > 5 µm	59,127	1,853	824	869
Particles > 15 µm	4,682	148	69	36
ISO Code *)	17/16/13	13/11/8	12/10/7	11/10/6
Water, ppm	200.2	108.3	103.2	70.1

**) See page 8 and 9 for further information on oil cleanliness classes.*

In total more than 100 application studies from different industries verify the success of CJC™ -
Please feel free to contact us or visit our website for more information!

- worldwide

Karberg & Hennemann GmbH & Co. KG

Marlowring 5 | D - 22525 Hamburg | Germany
Phone: +49 (0)40 855 04 79 - 0 | Fax: +49 (0)40 855 04 79 - 20
filtration@cjc.de | www.cjc.de

History

Founded in 1928 and located in Hamburg, we develop and manufacture CJC™ Fine Filter technology since 1951. With substantial know-how and in-house analysis and test facilities we are experts when it comes to the maintenance of oils and fuels.

Quality

Competent advice and individual solutions, even for the most difficult filtration problems of our customers - that is our daily claim. The certification of our company according to DIN EN ISO 9001:2015 provides us with assurance and motivation.

CJC™ worldwide

CJC™ Fine Filter systems are available worldwide through subsidiaries and distributors.
Find your nearest distributor on our website www.cjc.de - or give us a call!