



# Technical Presentation

# Summary:



## Lube Oil Filtration:

- Operating Principle
- Configurations
- Advantages
- Comparison
- References

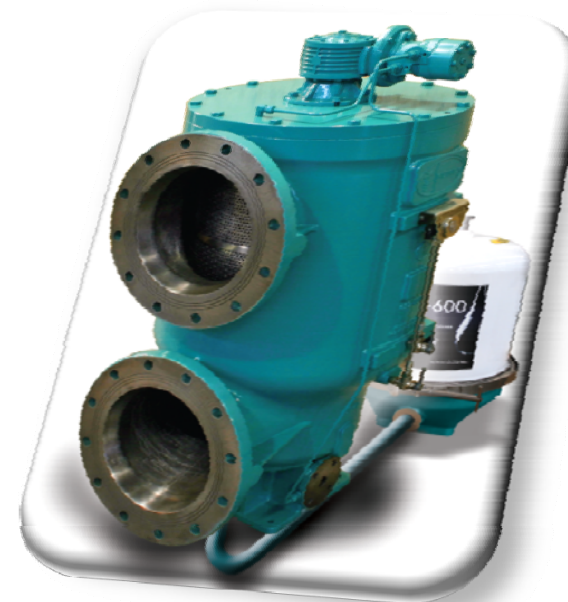


## Fuel Oil Filtration:

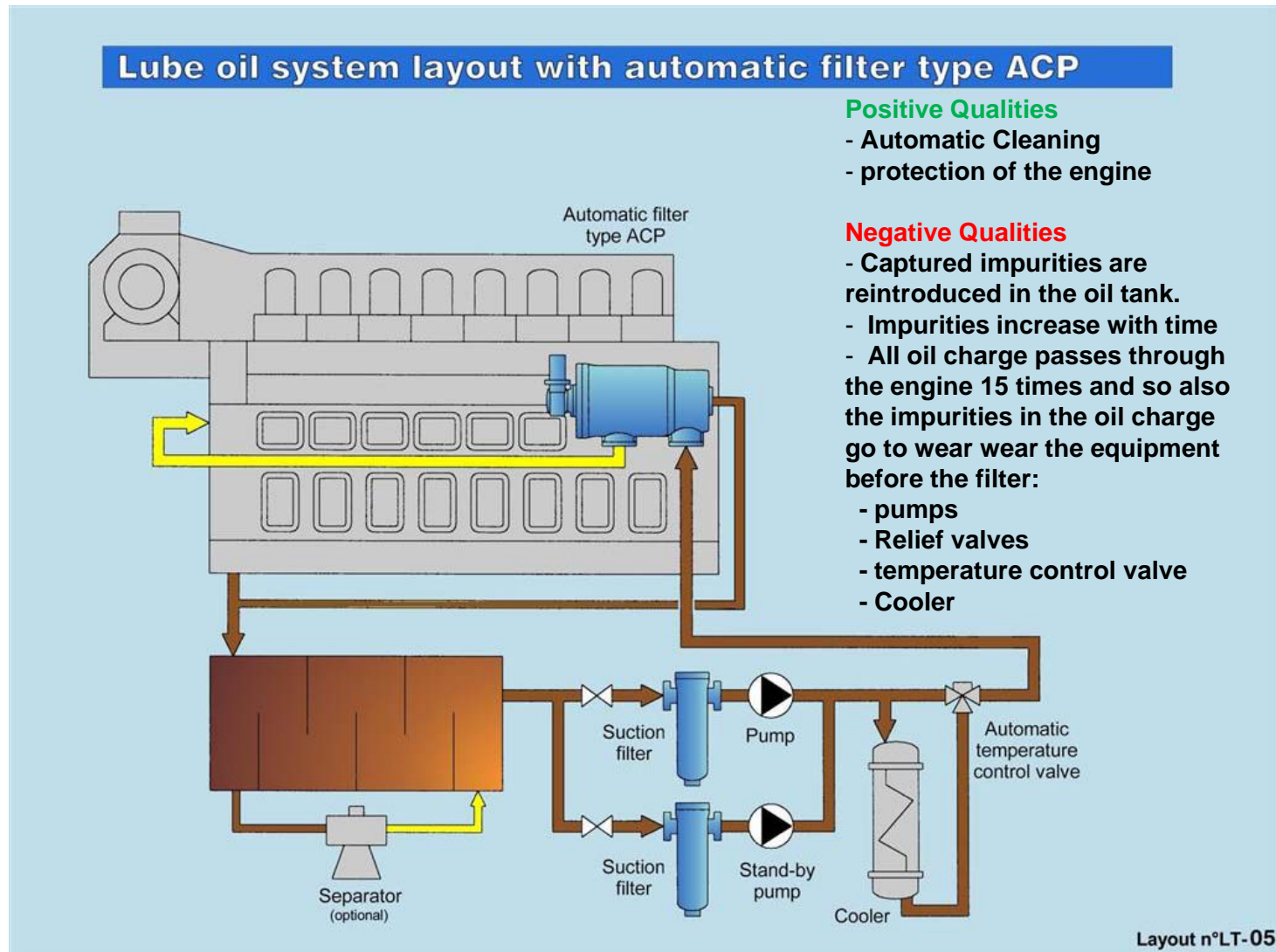
- Operating Principle
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- Advantages
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# Lube Oil Filtration



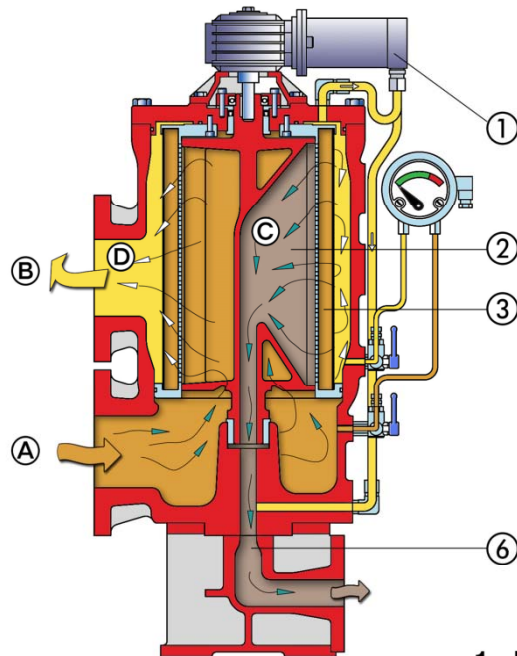
## Installation layout: ACP automatic filter



# Lube Oil:



## Operating Principle: ACP automatic filter



- A : Inlet
- B : Outlet
- C : Backwash Fluid
- D : Clean fluid
- 1 : Hydraulic motor
- 2 : Backwash nozzle
- 3 : Filtering element
- 6 : Backwash duct

### 1 - FILTRATION:

The fluid enters from (A), and flows through the sectors of the filtering element (3) (inside-outside filtration).

The filtered fluid is collected in chamber (D) and exits from (B).

When using an hydraulic motor (1), part of this fluid is spilled to drive it.

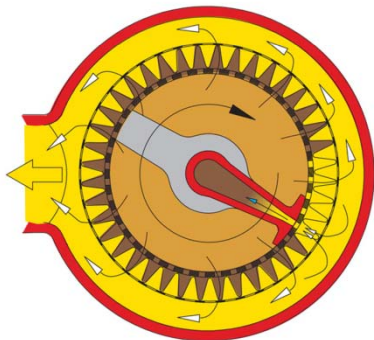
### 2 - CLEANING OF THE FILTERING ELEMENT DURING FILTRATION:

While the sectors of the filtering element (3) provide the filtration of the fluid, the motor (1) moves the nozzle (2) in front of a filtering sector cleaning it by the backwash flow spilled from the filtered fluid in chamber (D) (outside-inside filtration).

The impurities are carried away by the backwash fluid (C), through the duct (6), to the backwash line.

The nozzle (2) moves in front of each filtering sector continuously repeating the cleaning operation.

NOTE : The backwash flowrate is less then 3% of the max total flow.

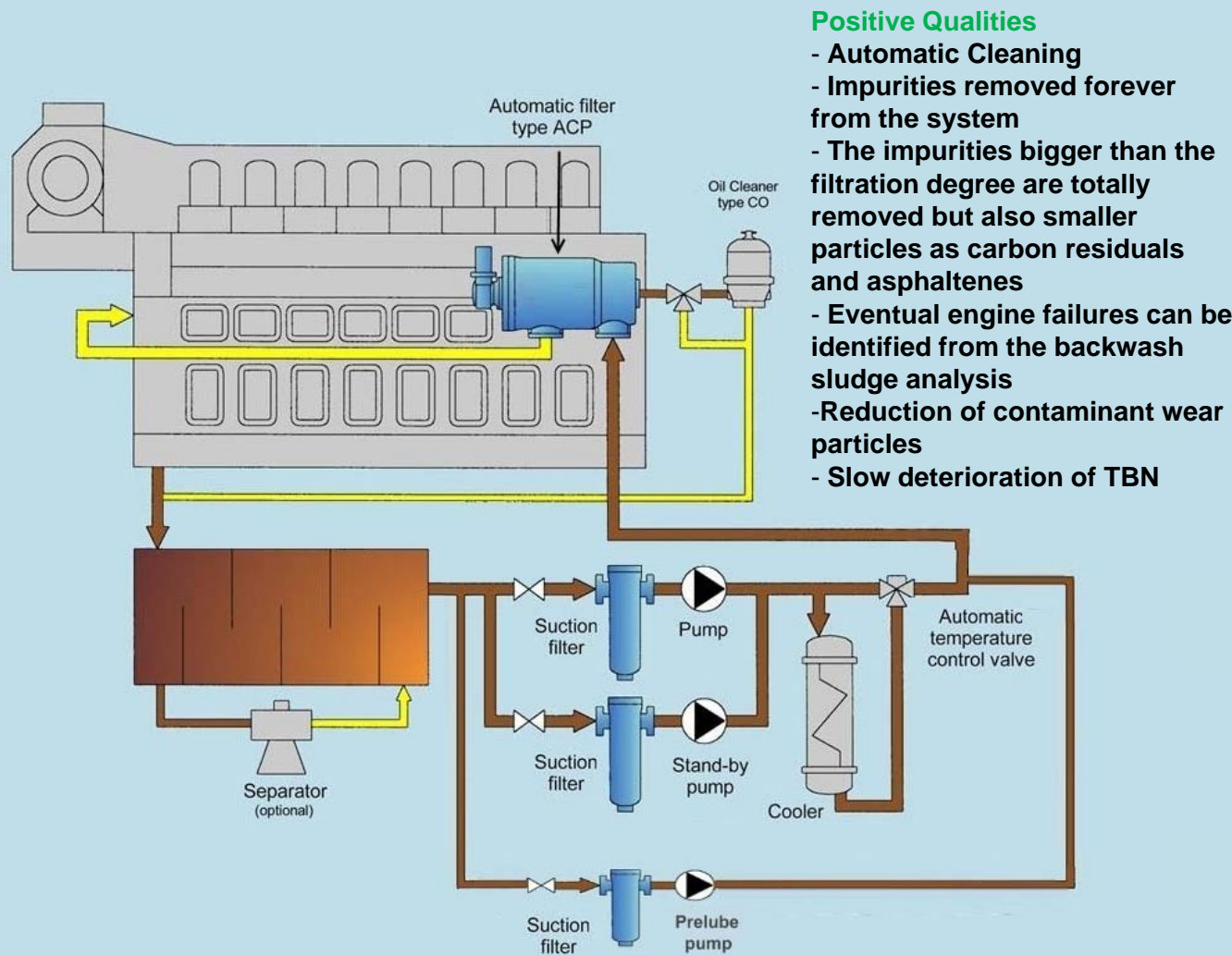


# Lube Oil:



## Optimization: ACP + CO

### Lube Oil System Layout with Automatic Filter type ACP<sub>H</sub>-CO

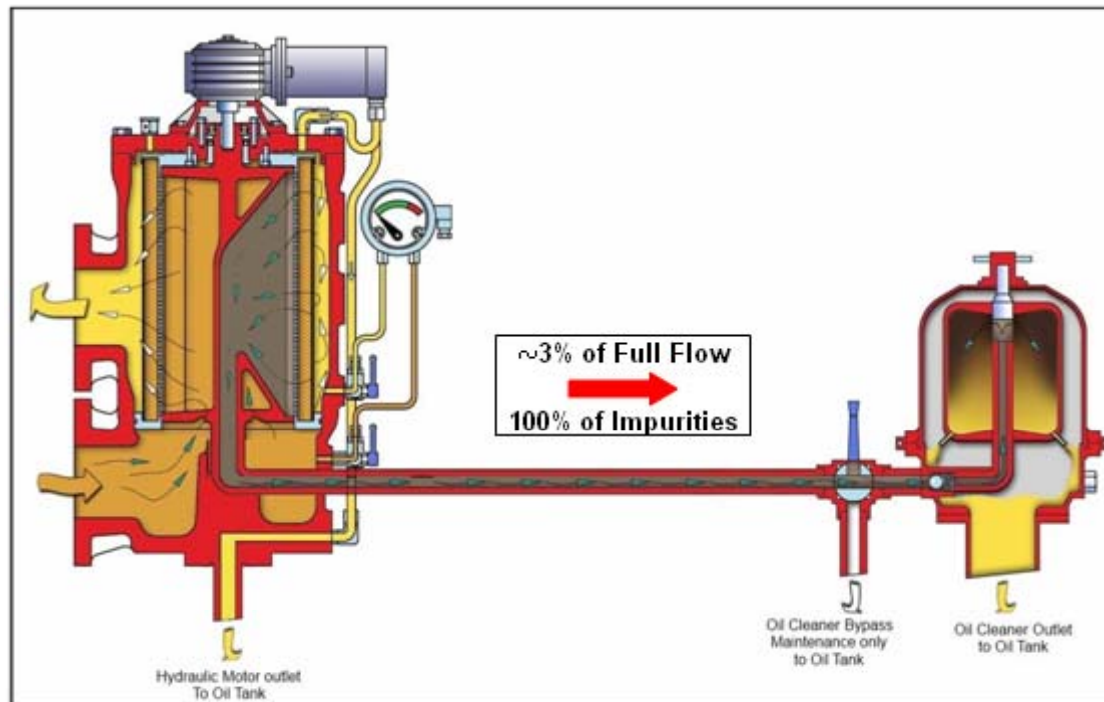




# Lube Oil:



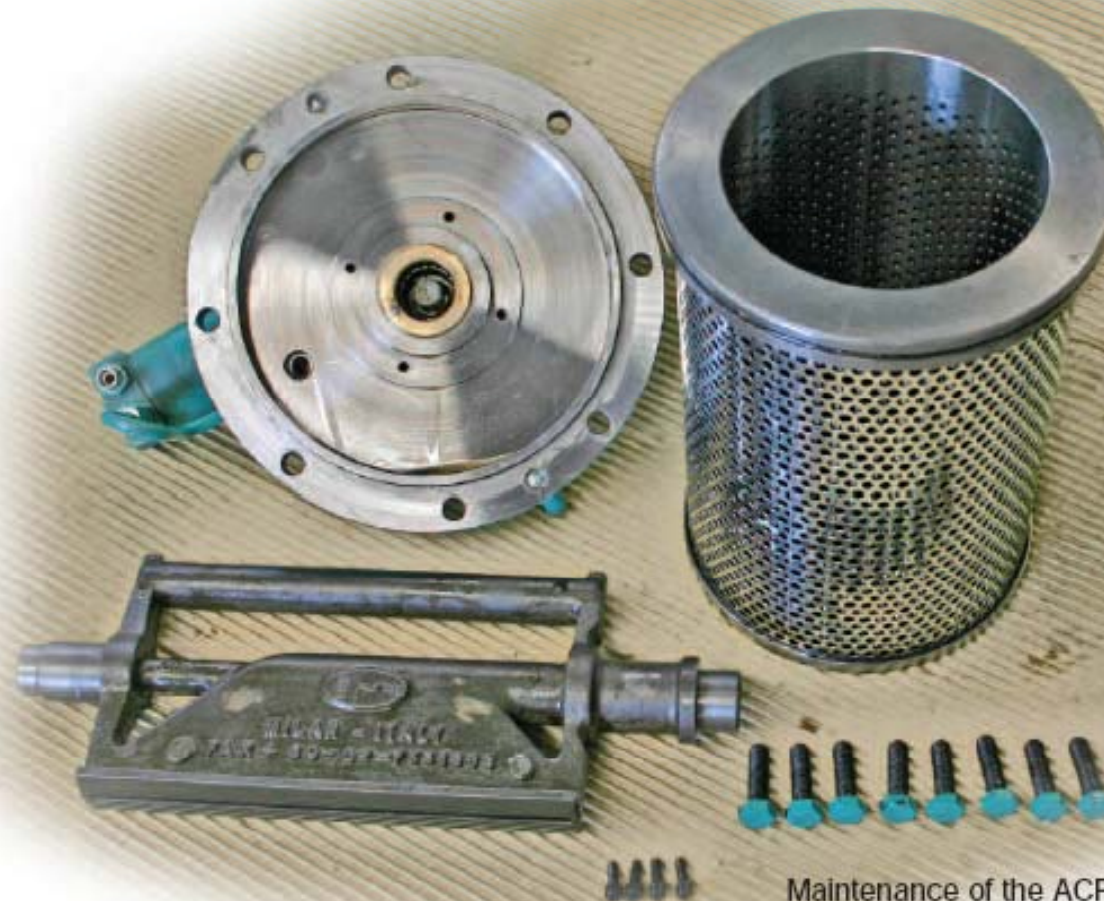
## Optimization: ACP + CO



The Backwash flowrate is less than the 3% of the filtered fluid but it contains the 100% of impurities; this fluid is fully treated by the centrifugal oil cleaner before returning to the tank.



## FILTREX **ACP** easy accessibility



Maintenance of the ACP filter is minimal. The above sequence illustrates how simple and easy the access to the internal parts is, should a dismantling be needed for any reason. The filter consists of few modular parts (cartridge, backwashing nozzle and motor) that can be inspected or serviced in a few minutes without any special tool or equipment.



# Lube Oil:



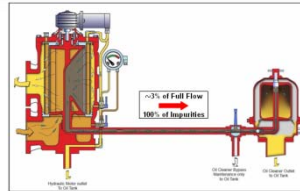
## Comparison:

		FILTREX	BOLL	MOATTI
FUNCTIONALITY	Fluid	Lube oil	Lube oil	Lube oil
	cleaning fluid	same filtered fluid	same filtered fluid	same filtered fluid
	cleaning	continuous	continuous	continuous
	Backflushing percentage % vs total flow	2-3%	6-10%	8-12%
	differential pressure	0,3 steady	0,3 increasing	0,3 increasing
BUILDING	body	nodular cast iron	grey cast iron	aluminium
	filtering element	inox cartidge	plastic candles or Inox (with by-pass)	aluminium disks & inox mesh
	n. filtering element	1	78	80
	drive	hydraulic external with radial pistons	internal turbine with gear on the dirty side	hydraulic internal
MAINTAINANCE	manual cleaning	none	periodical	periodical
	filter discharge	none	none	periodical
	maintenance	easy for just one filtering element	difficult for n° 78 candles	difficult for n°80 disks
CO Installation		Low backwash→High efficiency, CO sized properly.	High backwash→Low efficiency and high cost. Introduction of turbine that reduce the oil stationary time	High backwash→Low efficiency due to low rotation speed

# Lube Oil:



## Reference:

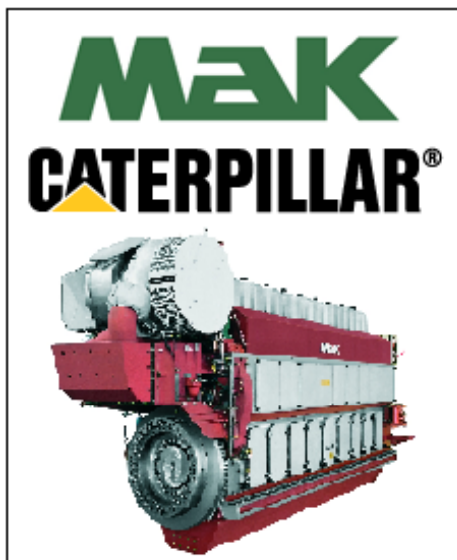


After several tests on board and on test bench, engine manufactures decided to improve their system with ACP-CO filters for old and new engines :



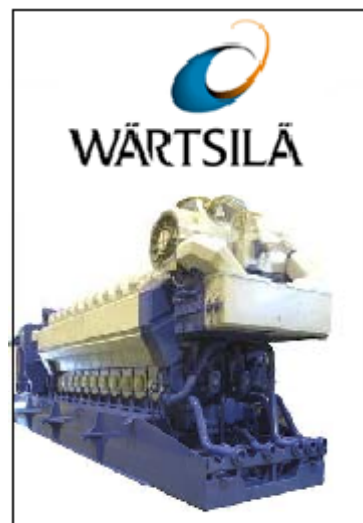
- Increased engine reliability
- Reduction of customers claims
- Slow deterioration of TBN

MaK Experience: After 2 hrs of operations (6M32C engine) it was found white metal and water in the CO





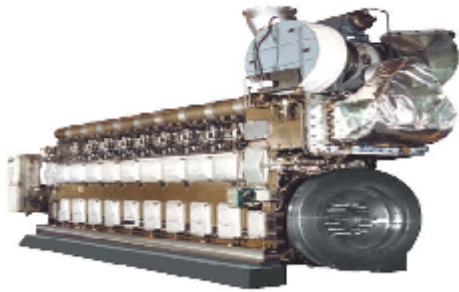
# Homologations & Installations





# Homologations & Installations

**FAIRBANKS  
MORSE  
ENGINE**



**S.E.M.T.  
PIELSTICK**



**YANMAR**





# Lube Oil:



## Reference:

In 1982 started the production of the first automatic filter for Navy application. French Navy, US Navy and Italian Navy etc, decided for a reliable and environmental friendly technology and costs reduction:

- Reduction of spare parts and maintenance costs
- Reduction of new oil cost



Italian Navy



French Navy



# ITALIAN NAVY TECHNICAL EVALUATION



MODULARIO  
D. MARINA 17

13 FEB. 2002  
Roma

Ministero della Difesa  
DIREZIONE GENERALE  
DEGLI ARMAMENTI NAVALI

REP. II DIV. 5 SEZ.

INDIRIZZO TELEGRAFICO: NAVARM

Prot. N° 50144 Allegato A

Spett.le  
FILTREX S.r.l.  
Via Anulare n°2  
20090 MILANO S.FELICE

ARGOMENTO: Self-cleaning filtering systems for lube oil of diesel engines, manufactured by Filtrex and installed on Italian Navy.

Refer to letter n° 5295/01/FM/ap dtd. 17/12/01 from Filtrex.

1. Installation of self-cleaning filtering systems manufactured by Filtrex has allowed optimisation of lube oil filtration in diesel engines for propulsion and for production of electric power installed on our Ships, increasing their reliability.  
Adoption of said systems, resulted from a comparison with systems manufactured by other companies and after an adequate comparative experimental period on board, has also prevented serious failures of engine components which are subject to major wear.  
Self-cleaning/self-regenerating system has demonstrated reliability without requiring replacement of cartridges of accessories for long periods (in some cases in excess of 6000 - 8000 hours presently foreseen for continuous and discontinuous self-cleaning systems respectively) bringing obvious benefits as far as both maintenance and oil consumption are concerned.
2. For a more detailed description of the situation is attached a brief table showing the characteristics and technical-operating results achieved by the subject systems.
3. What is mentioned above is in reply to your request, as well as a right and proper result of an effective and efficient co-operation with your Company for over twenty years.

IL DIRETTORE GENERALE  
Amm. Isp. Capo Emilio Plantini

MODULARIO  
Difesa - Marina - 17

Mod. 3F Sis C

Ministero della Difesa  
DIREZIONE GENERALE  
DEGLI ARMAMENTI NAVALI

TECHNICAL TABLE AND REVIEW OF THE STATUS OF FILTREX SELF-LUBRICATING SYSTEMS ON ITALIAN NAVY SHIPS

BEGINNING OF CO-OPERATION WITH NAVY	The Company FILTREX S.r.l. has been the supplier of Self-cleaning Filtering Systems for Italian Navy Ships since 1982.
CHOICE	The choice of Self-cleaning Filtering Systems was made after a comparative test with two different types of self-cleaning filters of major European manufacturers, after experimentation carried out on board Maestrale Class ships for about one year
TEST	Shock tests in compliance with N.A.T.O. standards at the highest level
N° INSTALLATIONS	Currently the Italian Navy has in service over 200 systems with Filtrex self-cleaning filters on GMT and WARTSILA engines
FILTERING DEGREE 25 µm	The tested filtering degree of 25 µm absolute (spherical mesh) was the determinant element in the solution of several serious problems to the most stressed engine parts
TOTAL HOURS OF OPERATION	In excess of 2.000.000 hours of operation has currently been achieved for all systems together
RELIABILITY	Tracking data from installations show that Filtrex systems are among the most reliable components of the Engine with a service failure lower than 1%
ENGINE STOP	By employing Self-cleaning Filtering Systems, the previously frequent need for Diesel Engine shut down for cartridge replacements and/or oil changes were avoided.
STOCK	Experience has allowed us to determine the actual stock requirements; which are very small compared to the number of installations
CARTRIDGE LIFE	On average cartridge replacement or maintenance interventions are required at intervals sometimes longer than those presently required i.e. every 6000 / 8000 running hours of the engine respectively for self-cleaning continuous and discontinuous systems
SPARES	Spare parts requirements are extremely reduced
ENVIRONMENTAL IMPACT	The impact on environment is practically null since the material (stainless steel) that the filter is made of, is non-polluting and the inconvenient oil drainages required for cartridge replacement, as it happened in the other types of filters, are eliminated
MAINTENANCE (EASY)	Simple design of every Filtrex Filtering System allows Italian Navy Personnel very easy and quick assembling and disassembling operations never requiring special tools
PERFORMANCE	Filtrex Filtration Systems are suitable for the service, fully meeting the strict reliability and quality requirements foreseen by N.A.T.O. standards. Specifically, as well as with shock tests, by using reinforced filtering elements, designed with mechanical resistance with collapse Δp higher than 10 bar, integrity of the cartridge structure in every load condition was proved, granting protection to all engine rotating parts.
QUALITY	The company has obtained AQAP 110 accreditation
ASSISTANCE	The company has always assured a direct, prompt and efficient assistance to the full satisfaction of the Italian Navy.

IL DIRETTORE GENERALE  
Amm. Isp. Capo Emilio Plantini



# US and French Navy TECHNICAL EVALUATION



MINISTÈRE DE LA DÉFENSE

**DGA**

FILTRI INDUSTRIALI  
VIA ANULARE, 2  
20090 MILANO SAN FELICE

Redacteur : IETA DANAN  
téléphone : 40.84.87.13

17054 DCNI/SDEE du 12.10.1993

**OBJET** : Filtre à huile à décolmatage automatique Filtrex modèle COSACFSU-720-80 en essai sur moteur FIELSTICK 16 PAM-200 VODS.

Messieurs,

Suite à l'essai réalisé, nous attestons ce qui suit :

- le filtre a été essayé sur moteur au banc de septembre 1992 à mars 1993 pour un total de 350 heures d'exercice ; pour toute la période d'essai, le filtre a fonctionné correctement sans aucun problème et avec des résultats satisfaisants.
- Les opérations de démontage et remontage se sont révélées être à la fois simples et rapides à effectuer.
- Après l'essai, ont été démontés 2 coussinets de tête de bielle dont l'état s'est vérifié être irréprochable (ni rayures ni aucun dommage).

FILTRI INDUSTRIALI  
M. VINCENT 40, rue de Chateaudun 75009 PARIS  
MAT "MAT/MAT" chrono - dossier : TEC.FIM.FHU, TEC.MTD.PAH  
FD/JDF

DCN  
INDRET

DCN INDRET - 44620 LA MONTAGNE - FRANCE  
TEL 40.84.85.00 - TÉLEX : DCN 700 695 F - TÉLÉCOPIE : 40.65.84.79

DCNI 82 XA 61

Suite de la note n° 17054 DCNI/SDEE du 12.10.1993 Page 2

**CONCLUSION**

Le filtre a, donc, rempli pleinement sa fonction pendant cet essai et dans la chambre de récupération de dépôts, ont été trouvées des particules de dimensions et nature diverses.

Veuillez agréer, Messieurs, l'assurance de notre considération distinguée.

Pour l'ingénieur en chef de l'Armement RANQUET  
sous-directeur "études-essais",  
et par ordre,  
L'ingénieur civil LEBEAU  
Chef du département "matériels".

DEPARTMENT OF THE NAVY  
PUGET SOUND NAVAL SHIPYARD  
1400 FARRAGUT AVENUE  
BREMERTON, WASHINGTON 98314-8001

950<sup>th</sup> REPLY REFERTO  
Ser 260LCM/024  
MAY 30 2001

Mr. A. C. Hill  
FDGM, Inc.  
800-C Principal Court  
Chesapeake, VA 23320

Dear Mr. Hill,

Your letter of May 3, 2001 requests approval of the Filtrex self-cleaning oil filter for use on U.S. Navy engines. You cite FDGM test report 150-127-00-003-2001 dated March 15, 2001 as justification for replacement of existing oil filter.

Having witnessed testing and having reviewed the FDGM test report, **we approve the Filtrex Model ACXC self-cleaning oil filter for ship evaluation** on U.S. Navy mine countermeasure and/or coastal mine hunter ships. Specific ship and engine application will be approved by NAVSEA PMS490. Please note the Filtrex assembly shall meet the magnetic silencing requirements for mine warfare ships.

When installed for ship evaluation, the Filtrex Model ACXC self-cleaning oil filter shall be configured as tested:

- 30 µM (absolute) primary filter element
- 35 µM (absolute) secondary filter element
- hydraulic motor-reduction gear assembly with emergency manual actuator.

Any changes to the tested configuration shall be requested and approved prior to installation. **Final Navy approval for the Filtrex self-cleaning oil filter is held in abeyance pending successful ship evaluation, shock and vibration testing.**

This correspondence does not change the terms of any understanding, solicitation or contract existing with the government. Any change inferred will not be effective or binding upon the government unless formalized by an appropriate contractual document executed by the cognizant administrative contracting officer.

Puget Sound Naval Shipyard is the Navy's Life Cycle Engineering Manager for valves and piping components. Technical point of contact is Mr. Mike Whitney, Code 260.5LCM, (360) 476-1469.

Sincerely,  
  
RICHARD M. SHIPLEY  
Acting Engineering and Planning Manager

Copy to:  
NAVSEA (SEA 05L3)

# Lube Oil:



## Carnival Experience:

### Comparative test Filtrex vs Boll

Vessel : Costa Luminosa  
 Engine : MaK 8M43C  
 Diesel generator : DG2  
 Filter Type : DACP-735-150  
 Centrifugal oil cleaner : CO400  
 Flowrate : 165 m<sup>3</sup>/h  
 Operating pressure : 5 bar  
 Operating temperature : 65°C  
 Filtration degree : 34µm  
 Total Oil tank recirculations: 15 times/hr



FILTREX

BOLL

#### Results:

- Confirmed the absolute filtration degree as required by Engine manufacturer
- 0.1 kg of impurities were removed by CO after 610 hrs
- If not removed by CO, 1.5 kg of impurities per hour would circulate in the circuit.
- Analysis of the sludge as per the table: the 62% in weight of the impurities are lower than the degree of filtration!

#### Comparison with existing filter:

- Reduction of sludge disposal cost
- Reduction of spare parts cost
- Increase oil life time
- Better protection of the engine

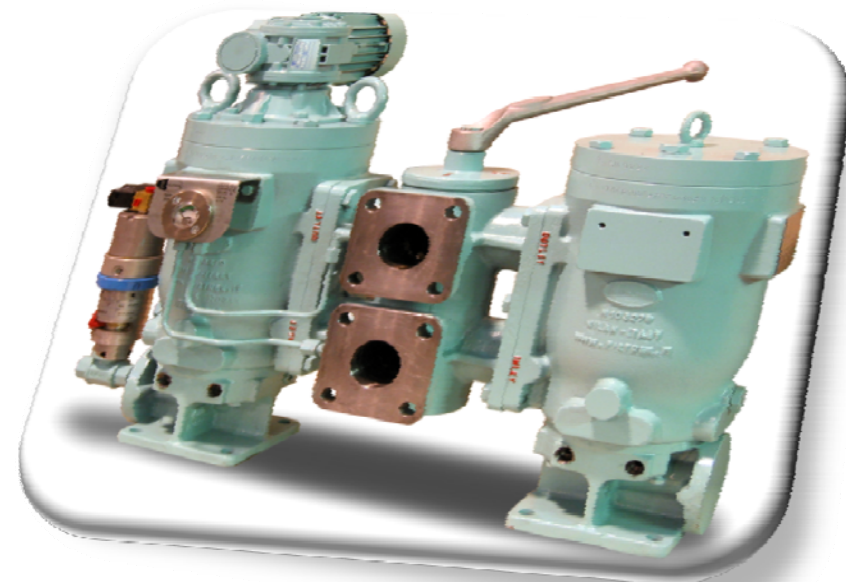
#### NETS:

Filtration Degree (µm)	Weight without imp. (gr)	Weight with imp. (gr)	Impurities weight (gr)	%	Circulating impurities if not removed			
					Kg/hr	Kg/day	Kg/month	Kg/year
125	17,864	32,940	15,076	15%	0,23	5,43	162,82	1.953,85
75	17,166	25,954	8,788	9%	0,13	3,16	94,91	1.138,92
60	19,133	22,286	3,153	3%	0,05	1,14	34,05	408,63
45	90,859	97,290	6,431	7%	0,10	2,32	69,45	833,46
34	86,052	90,610	4,558	5%	0,07	1,64	49,23	590,72
<b>25</b>	<b>63,830</b>	<b>90,878</b>	<b>27,048</b>	<b>28%</b>	<b>0,41</b>	<b>9,74</b>	<b>292,12</b>	<b>3.505,42</b>
17	56,716	65,852	9,136	9%	0,14	3,29	98,67	1.184,03
14	55,871	57,477	1,606	2%	0,02	0,58	17,34	208,14
10	19,936	34,953	15,017	15%	0,23	5,41	162,18	1.946,20
< 10	8,916	16,409	7,493	8%	0,11	2,70	80,92	971,09
<b>TOTAL</b>			<b>98,306</b>	<b>100%</b>	<b>1,47</b>	<b>35,39</b>	<b>1.061,70</b>	<b>12.740,46</b>

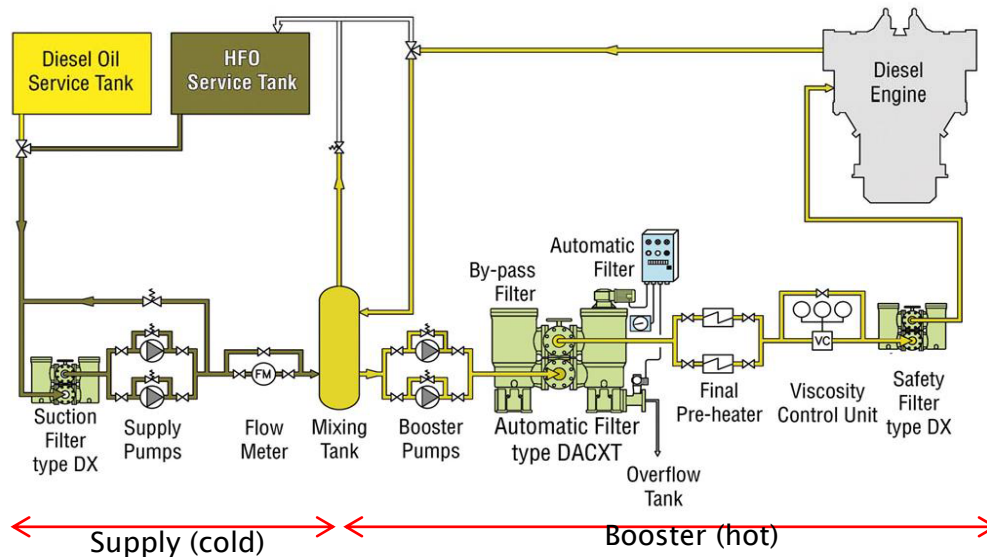
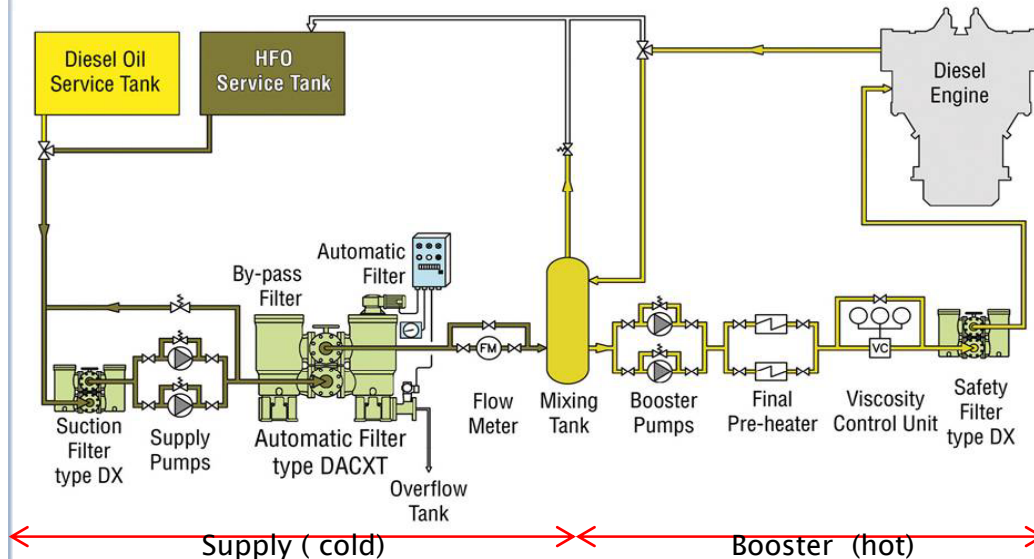




# Fuel Oil Filtration



# Fuel Oil:



## DACT Filter Positive Qualities

- No external fluid for cleaning: filter can be installed in both side, booster and supply.
- Low backwash consumption
- Backwash amount equal to the 10% of the filter volume .
- For any cleaning cycle, Filtrex saves 90% of HFO vs manual filters or filters cleaned by compressed air ( 100% filter volume for cleaning).
- In both side, cold and hot, the same filter size ( same filtering area): the impurities to be removed are the same in both side due to the new HFO ( = engine consumption). The already filtered fluid doesn't clog the filter
- High retention rate: elimination of cat fine

## Supply side installation:

- No protection of: booster pumps, final pre-heater and viscosity control unit and instrumentation
- Frequent manual cleaning of **safety filter** with risk of human error.
- **No protection** of the engine in case of equipments failure.

## Booster side installation

- Better **protection** of the engine from the **impurities** produced by the equipments.
- **Protection** of the engine from any **failure**.
- **cleaner FO** to DG and slight increase of fuel efficiency due to better **protection of injectors**
- Not usage of safety filter; avoid risk of human error.

## NOTE:

- Compressed air cannot be used in booster side due to humidity in the air
- Aluminium cannot be used in booster side

# Fuel Oil:

## Operating Principle: DACT automatic filter



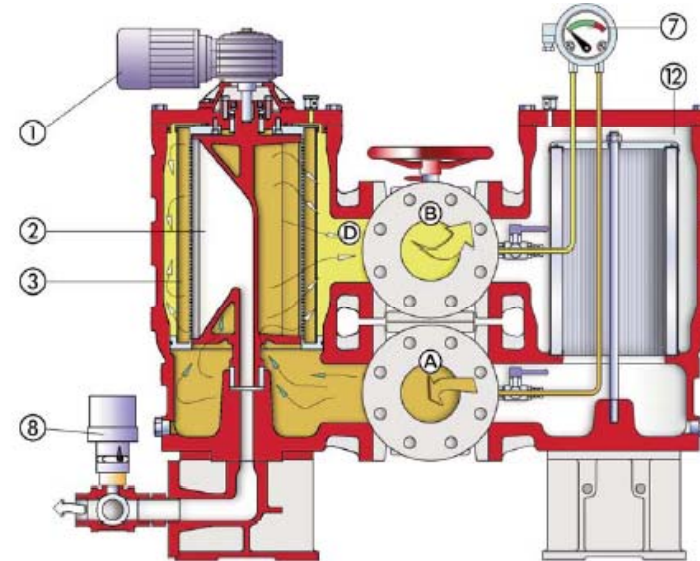
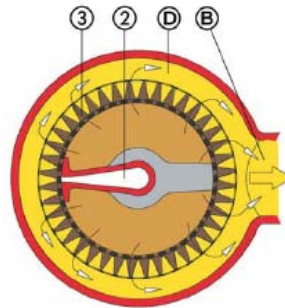
### Filtration Phase

$\Delta p < \Delta p$  Set Point Value

Motor is not running

Shaft is not turning

Backwash valve is closed



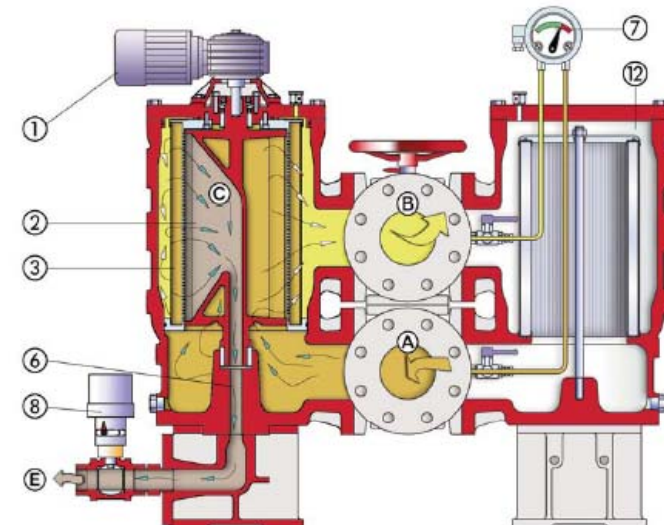
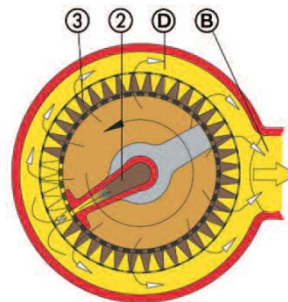
### Backwash Phase

$\Delta p > \Delta p$  Set Point Value

Motor is running

Shaft is turning

Backwash valve is open

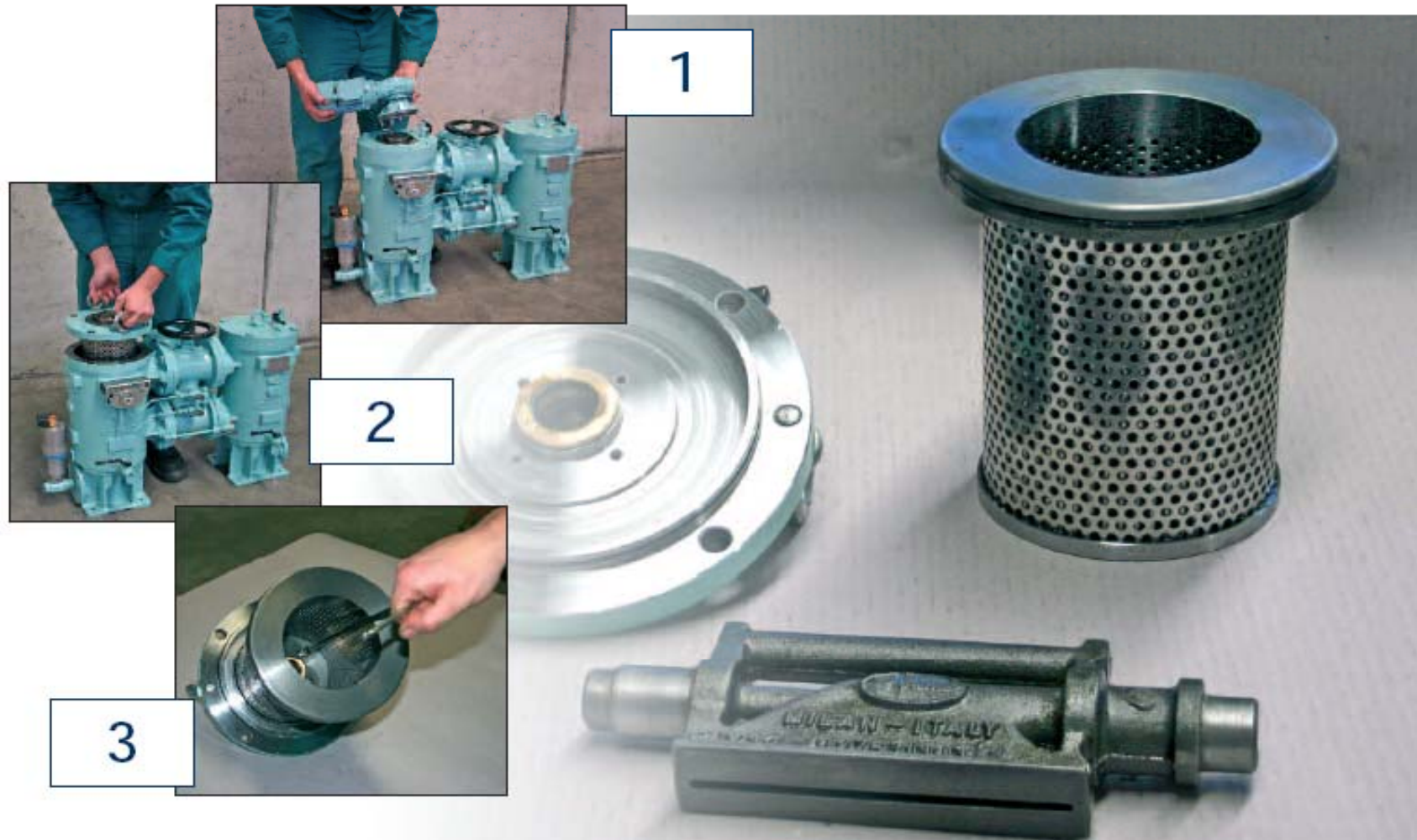




# Fuel Oil:



**FILTREX DACT - DACXT** easy accessibility



Maintenance of the DACT and DACXT filters is minimal. The above sequence illustrates how simple and easy the access to the internal parts is, should a dismantling be needed for any reason. The filter consists of few modular parts (cartridge, backwashing nozzle and motor) that can be inspected or serviced in a few minutes without any special tool or equipment.



# Fuel Oil:



## Comparison:

		FILTREX	BOLL	MOATTI
FUNCTIONALITY	Fluid	Fuel oil	Fuel oil	Fuel oil
	cleaning fluid	same filtered fluid	compressed air	same filtered fluid
	cleaning	on condition	on condition	continuous
	Flushing volume compare to vessel volume	10% volume vessel	100% volume vessel	15-20% flowrate
	differential pressure	0,3 steady	0,3 increasing	0,3 increasing
BUILDING	body	nodular cast iron	grey cast iron	nodular cast iron
	filtering element	inox cartidge	inox candles	aluminium disks & inox mesh
	n. filtering element	1	56	50
	drive	external electric	external electric	external electric
MAINTAINANCE	manual cleaning	none	periodical	periodical
	filter discharge	none	none	periodical
	maintenance	easy for just one filtering element	difficult for n° 56 candles	difficult for n° 50 disks
INSTALLATION		Supply and Booster possible	Supply Booster not possible (compressed air problem)	Supply Booster no possible (aluminium disc problem)



# Fuel Oil:

Thanks to the benefits of the DACT filters, Filtrex cooperate with the main module manufactures



# Fuel Oil:



## Retrofit:

In cooperation with the shipowners, Filtrex started a retrofit campaign of old filters technologies, mainly disc and candles filters , due to the high advantages compared to the low cost for new filter installation.

## Additional Filtrex experience with the same technology:

Thanks to the high regeneration capacity and to the ensured filtration degree, Filtrex is the only recommended supplier for slurry oil treatment by the major licensee as for example UOP.

The unfiltered slurry oil is used to produce HFO ( high percentage of cat fine) while if it is filtered the majority of the cat fines ( PSD: 3–15 $\mu$ m) are retained by the filter increasing the quality of the final product.



# Fuel Oil: Carnival Experience:

## Comparative test Filtrex vs Moatti

Vessel	: Costa Luminosa
Engine	: MaK 12M43C & 8M43C
Diesel generator	: DG4, DG6 and DG5
Filter Type	: DACT-705-65
Flowrate	: 13 m <sup>3</sup> /h
Operating pressure	: 4÷5 bar
Operating temperature	: 160°C
Filtration degree	: 45µm



Moatti

### Results:

- Confirmed the filtration degree required.
- 2.5 Lt/day for backwash

### Comparison with existing filter:

- 80% reduction of backwash amount  
(calculated more than 20.000 usd saved per year)
- Reduction of spare parts cost

