MossHydro AS

MossHydro Brief history and background

- Established by Aage Bjørn Andersen and Stein Foss following development work originating from filter experiences with early Ballast Water Management (BWM) system installations

- In 2003 Andersen and Foss founded OceanSaver, early adopter to BWM
- Challenges with filter performance as well as the supply chain of OceanSaver encouraged the development of MossHydro and it's technology platform
- MossHydro is based in Drammen in a maritime engineering cluster
- Strategic production and co-operation agreement with OSO Hotwater enables MossHydro to pursue ramp-up with limited organizational impact
- OSO Hotwater strategic owner since fall of 2014

Source: MossHydro

MossHydro key personnel

Board

Leif Rune Rinnan, Chairman of the Board

Leif Rune Rinnan has thirty years' experience in international industry management, business development, finance and venture capital. He founded both Telenor Venture the venture capital arm of Telenor through Televenture and Norsk Innovasjonskapital a leading VC in early stage development. Rune has experience as board member and chairman in companies in different business sectors e.g Eltek, Tandberg, Opplysningen 1881 and ABB Oil&Gas companies.

Roy André Magnussen, Board member

Operations Director & QA-HSE Manager – OSO Hotwater Group AS.

Roy A. Magnussen has fifteen years experience in production technology development, process assurance and improvement. As an Operations Director – QA Manager and Lean Six Sigma Master Black Belt he is currently operating OSO Hotwater Groups production sites of total 25 000 m2 in Norway and Sweden. He is covering all operations from the development and deployment of strategies and goal alignment, to the development of advanced production technology and massproduction of high quality pressure vessels and steel products. Roy also serves as a boardmember in OSO Hotwater Group AS and OSO Manufacturing AB.

Neil Kristian Samuelsen, Board member

Neil Kristian Samuelsen is an Investment Analyst for Lani Development AS, a privately-held investment company owned by Lars Nilsen. Neil has a Master of Science degree in Financial Economics from BI Norwegian Business School and a Bachelor of Science in Business Administration from American University in Washington, DC, USA. Prior to joining Lani, Neil has worked as a Financial Analyst in DnB Markets, one of Norway's leading investment banks, as well as Finance Director in Honeywell Life Safety AS, responsible for finance and accounting for the Honeywell's Nordic Life Safety operations.

Management

Kristian Holmen, CEO

Kristian Holmen comes from a career within electromechanical industry and automation where he has worked with product- and business development. He holds a M.Sc. in Process Engineering (1990) and a MBA in Technology Management (2005).

Advisory Board

Stein Foss, Co-founder and Advisor

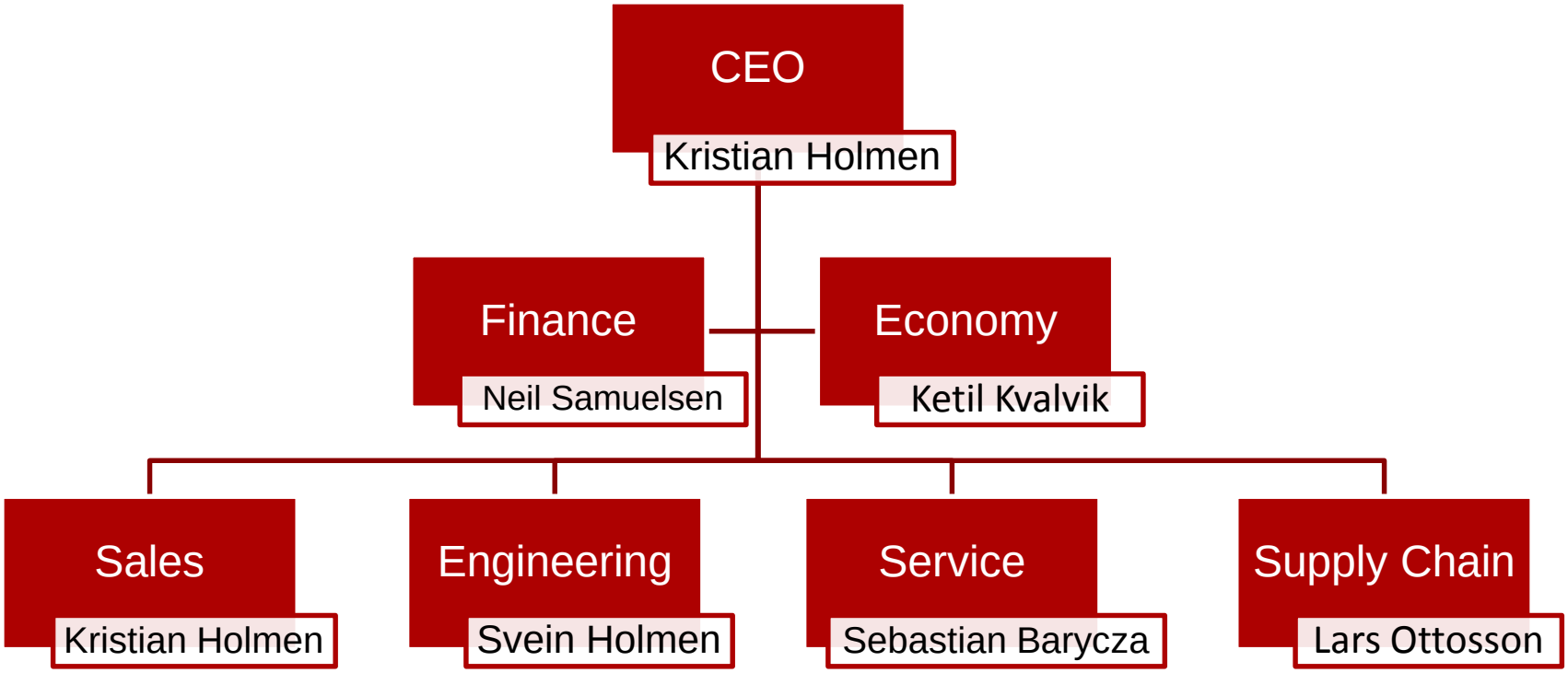
Stein Foss has a lifelong career in the maritime industry serving in various leading roles. He established the company Thermo-Services specializing in shipboard thermal insulation offering design and installation services worldwide. He later became a pioneer in the Ballast Water Management (BWM) industry and founded OceanSaver AS in 2003, one of the most successful companies in this industry.

Aage Bjørn Andersen, Co-founder and Advisor

Aage Bjørn Andersen has some 25 years of experience in R&D – primarily in the area of environmental solutions for maritime industries. He co-founded the BWM company OceanSaver in 2003 and later established Mentum AS – a company providing conceptual engineering and development services. He has background from Norwegian Clean Seas (NOFO) and DNV (Det Norske Veritas) among others. Mr. Andersen holds a Master of Science in Naval Architecture.

Source: MossHydro

Organisation



Market for water filtration

√ Ballast water

Since 2012
- First IMO TA 2013
- USCG pilots 2014
- Deliveries Nov 2014

√ Aquaculture

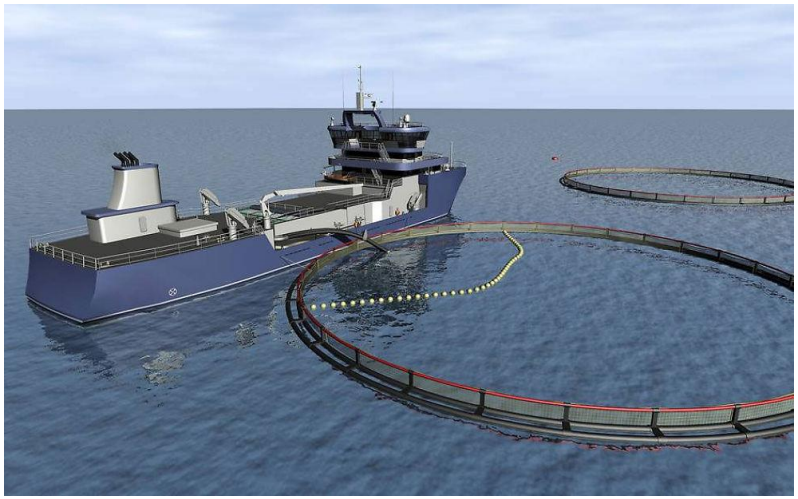
Since 2014
- Government funded
- Cooperation NIVA
- Start up May 2015

(√) Oil and Gas

May 2015

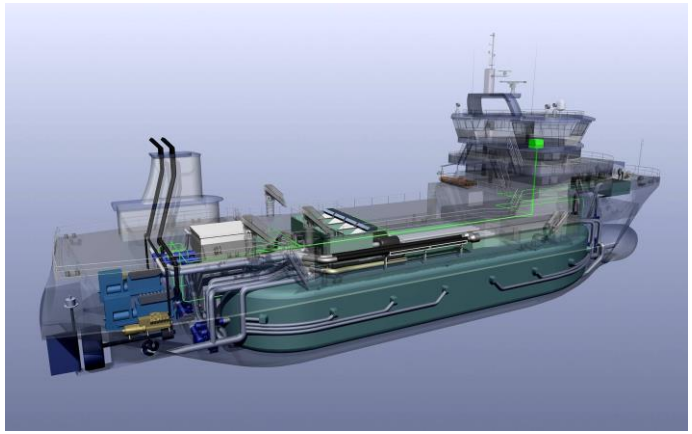
Water production

Aquaculture



Increased focus on water quality in the various process steps:

- Farming
- Transport – legislation expected in 2017
- Medication
- Processing
- Extreme flow capacity/ space challenges

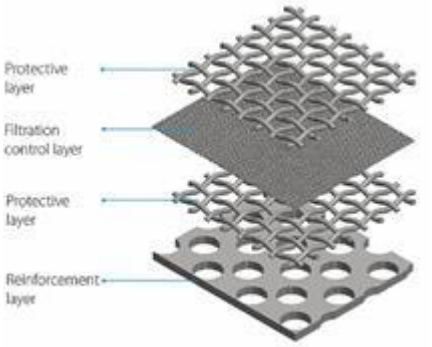


Technology

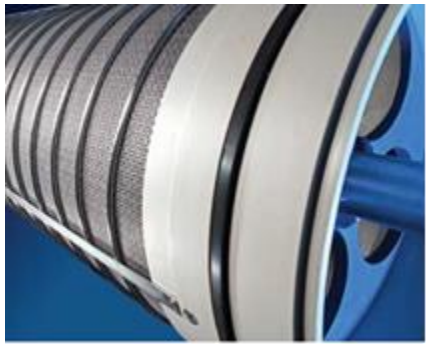
- Specifically designed for Ballast Water Treatment
- Proximity nozzle design family – cleans the full screen surface
- Patented
  - High Flow design
  - Self Cleaning design
- Square Weave Cartridged (SWC) Filter Screen design is MossHydro IP
- Screens 30µm, 40µm and 50µm filtration rates available
  - 316L (Standard)
  - 904L PREN 30-33 (Optional)
  - Incoloy 825 / Alloy 20 PREN 27-28 (Optional)
  - MossHydro PREN+ PREN 27-28 (Optional)
- Duplex Steel Pressure Vessel – DNV Type Approval
  - Cost competitive to Carbon Steel designs
    - Less material due to the high tensile strength of Duplex steel
  - Light weight and easy installation
  - Long Life and Low Operating cost
  - No pitting of main gasket seating and no issues with leaks of ballast water from filters

Filter screen

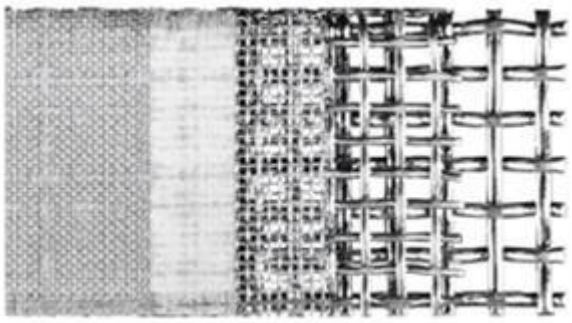
MossHydro filter screen design is a fully sintered self supporting structure whereas competition use a separate reinforcement layer by a perforated steel plate and a number of steel hoops. The competition perforated plate reinforcement restricts flow per m^2 relative to MossHydro.



Competition screen layers



Competiton reinforcement hoops



MossHydro sintered screen layers – no extra reinforcement needed.

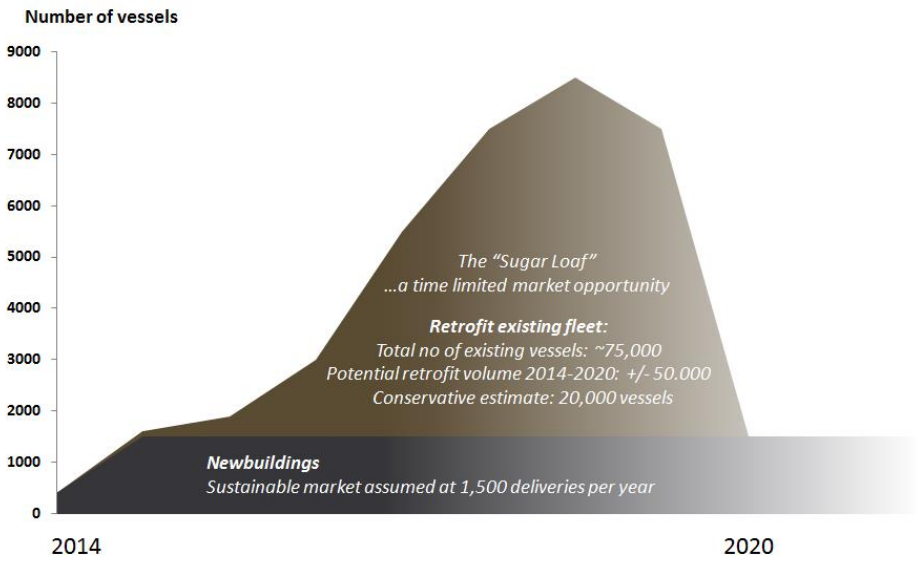
MossHydro nozzles

Features

- Use of Duplex Steel materials and welding results in a flexible assembly to withstand severe 'Water hammer' during start-up of ballasting system.
- Custom connections available
  - DIN PN10
  - JIS 10K
  - ANSI 150
- Horizontal and Vertical configurations available
- Non-Hazardous (Safe) Area and EX Area available
  - Electric motors Zone 1-2
  - Hydraulic motors Zone 0
- Operator Panel on the filter
  - Inlet/Outlet pressure sensors
- Control cabinet in Non-Hazardous (Safe) Area
  - 400-440V +/- 10%, 3Ph - 60 Hz
  - PLC
  - Backflush valve control
  - Backflush pump starter control
  - Analog pressure signal & digital status indicators for communication with parent system

BWM Volume plan

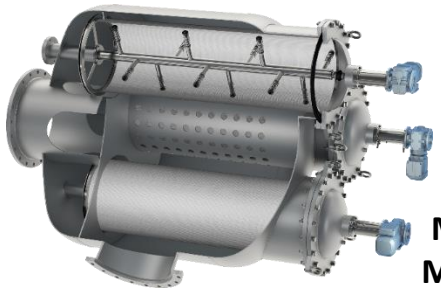
- 2015 Booking of 250 filters – average lead time 8 months
  - . Bookings June is 120 filters, Customer FC is 300-1000 filters/y
- 2016 500-1000 filters
- 2017 1-2000 filters
- 2018 2-3000 filters
- 2019 2-3000 filters
- 2020 1-2000 filters



June 2015

- Portefolio of 38 models finalized May 2014
- First order June 2014
- UV based USCG Type Approval started December 2014
- Hydrochlorination based USCG Type Approval started April 2015
- Hydrochlorination based USCG Type Approval starting July 2015
- Hydrochlorination based USCG Type Approval starting August 2015
- Local representation in Korea, Sales and Engineering Services
- USD 1 million government funded research project starting May 2015

MossHydro Single-screen



MossHydro Multi-screen

Source: MossHydro

Recent manufacturing

MH1.4 - 330m^3/h, May '15

MH3.5 - 830m^3/h, March '15

Product range 50 – 3500m³/h

Source: MossHydro

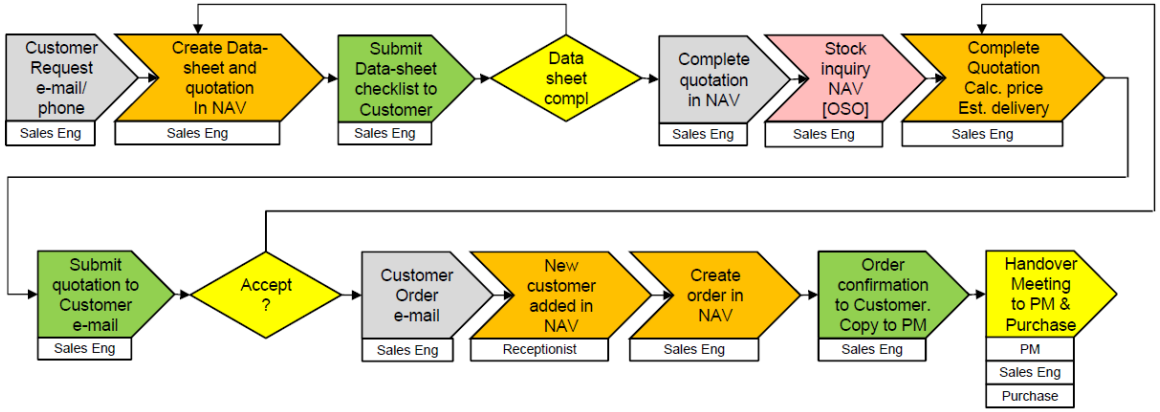
Filter range

MossHydro filter portefolio - technical specifications summary

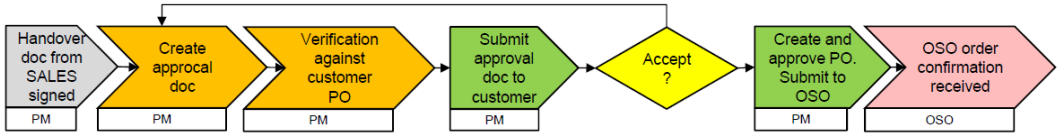
Pressure vessel Type Approval 6.0barg EN 13445 - DNV, other standards (also 6.9barg) available on request.
Filter housing and internals in Duplex 2205, Filter screen is 316L. Super Duplex or 904L available on request.
Flow numbers for 2.5bar inlet pressure, TSS 50mg/ltr. Minimum inlet pressure 2.0bar (1.6bar w. sludge pump).

			DIN 2576, PN10 (Opt. JIS, 10K)													
Model	Capacity m3/h 40um	Capacity m3/h 30um	Flanges main	Flanges backwash	Dry weight kg	Op. Weight kg	Instant backwash	Cycle backwash	Nozzles/screen	Screens	Main gasket diameter	Screen gasket diameter	Power consumption	Air release valve	Drain	Pressure transmitters
MH 14.0	3500	3080	700	100x4	2600	8250	280	4667	14	4	600x4	540x8	2,0kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 12.0	3000	2640	600	100x4	2310	7230	240	4000	12	4	600x4	540x8	2,0kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 10.0	2500	2200	600	100x4	2020	6250	200	3333	10	4	600x4	540x8	2,0kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 9.0	2250	1980	500	100x3	1620	5200	180	3000	12	3	600x3	540x6	1,5kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 7.5	1850	1628	500	100x3	1405	4495	150	2500	10	3	600x3	540x6	1,5kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 6.0	1500	1320	400	100x2	1260	4340	120	2000	12	2	600x2	540x2	1,0kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 5.0	1250	1100	400	100x2	1100	3690	100	1667	10	2	600x2	540x2	1,0kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 6.0	1500	1320	400	125					19	1	1000	720	0,5kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 5.4	1350	1188	400	125	605	2670	80	1333	17	1	1000	720	0,5kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 4.0	1000	880	350	100	480	2030	60	1000	12	1	1000	720	0,5kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 3.5	830	730	350	80	450	1710	50	833	10	1	1000	720	0,5kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 3.0	660	581	300	80	430	1430	40	667	8	1	1000	720	0,5kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 2.0	500	440	250	80	270	720	60	1000	12	1	500	360	0,5kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 1.7	425	374	250	80	260	660	50	833	10	1	500	360	0,5kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 1.4	330	290	200	80	250	550	40	667	8	1	500	360	0,5kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 1.0	250	220	200	80	240	485	30	500	6	1	500	360	0,5kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 0.6	150	150	150	80	200	310	30	500	6	1	350	256	0,5kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 0.4	100	100	100	80	190	280	20	333	4	1	350	256	0,5kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female
MH 0.2	50	50	80	80	180	240	10	167	2	1	350	256	0,5kW	1 1/2" BSP Female	3/4" BSP Female	1/2"x2 vBSP Female

MossHydro TQM

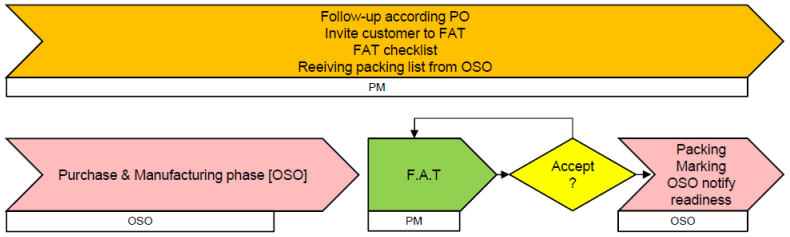


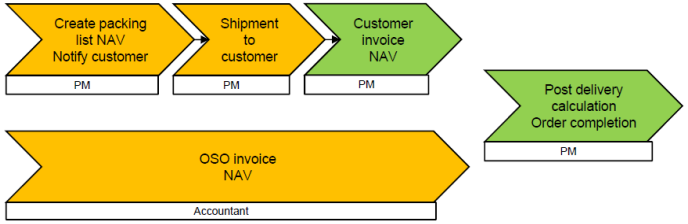
Sales



Engineering

Purchase, Manufacturing, FAT





Delivery

Fresh water testing 40um, November 2014

	Inlet				MossHydro 40µm	
	FR1	FR2	FR3	FR4	FR1	FR1
m^{-3}	**222 500**	**193 000**	**208 833**	**151 125**	**4 601**	**2 864**
Crustacea, Nauplii	14 833	-	14 917	3 875	-	-
Other Crustacea	22 250	24 125	22 375	15 500	-	-
Annelida	-	-	-	-	-	-
Arthropoda	-	-	-	-	-	-
Cilliophora	22 250	24 125	22 375	7 750	-	-
Dinophyceae	-	-	-	-	-	-
Ectoprocta	-	-	-	-	-	-
Nematoda	-	-	-	-	-	-
Platyhelminthes	-	-	-	-	-	-
Rotifera	163 167	144 750	149 167	124 000	4 601	2 864
Tardigrada	-	-	-	-	-	-
Sp.	-	-	-	-	-	-

Fresh water testing 30um, June 2015

MossHydro Land-based testing

Zooplankton distribution

	2015.06.03				
	Inlet			After filtration	
	FR1	FR2	FR3	FR1	FR2
m^{-3}	**1,173,000**	**953,833**	**900,667**	**121**	**78**
Crustacea, Nauplii	45,333	29,500	46,667	-	-
Other Crustacea	1,054,000	860,417	770,000	76	63
Annelida	-	-	-	-	-
Arthropoda	-	-	-	-	-
Cilliophora	5,667	4,917	4,667	45	-
Dinophyceae	-	-	-	-	-
Ectoprocta	-	-	-	-	-
Nematoda	-	-	-	-	-
Platyhelminthes	-	-	-	-	-
Rotifera	68,000	59,000	79,333	-	16
Tardigrada	-	-	-	-	-
Sp.	-	-	-	-	-

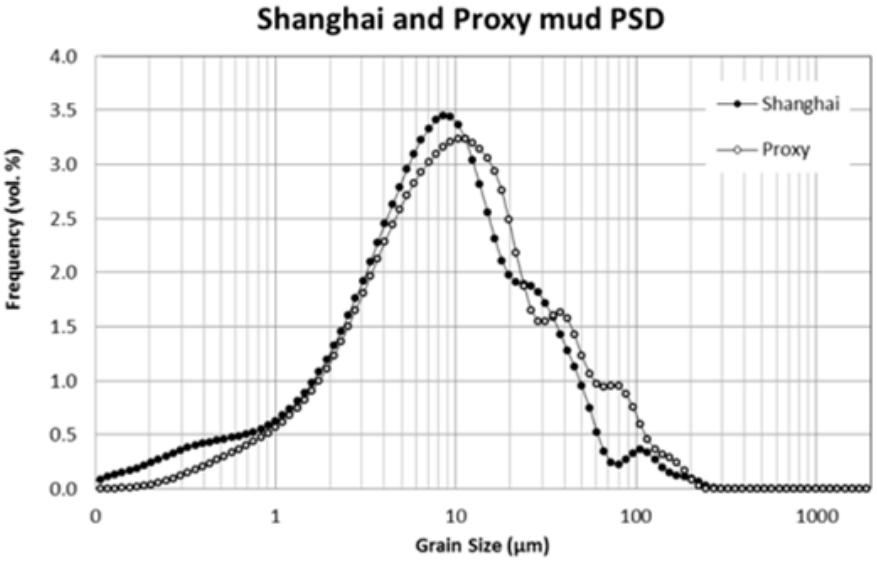
Dirty water simulation – December 2014

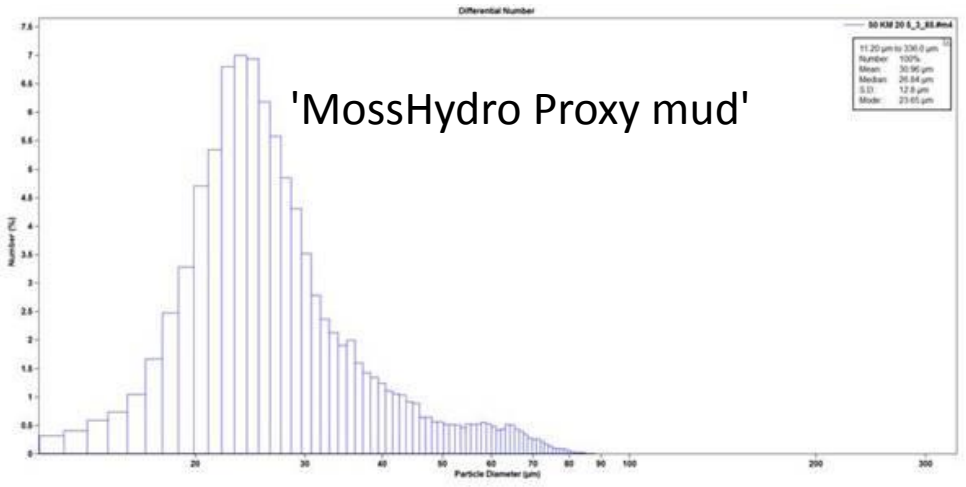
- Excess load of larger particles will clog a filter screen

  ... how efficient is the backflushing mechanism when working in excess load of large particles. Will the flow drop significantly under continous backflush?

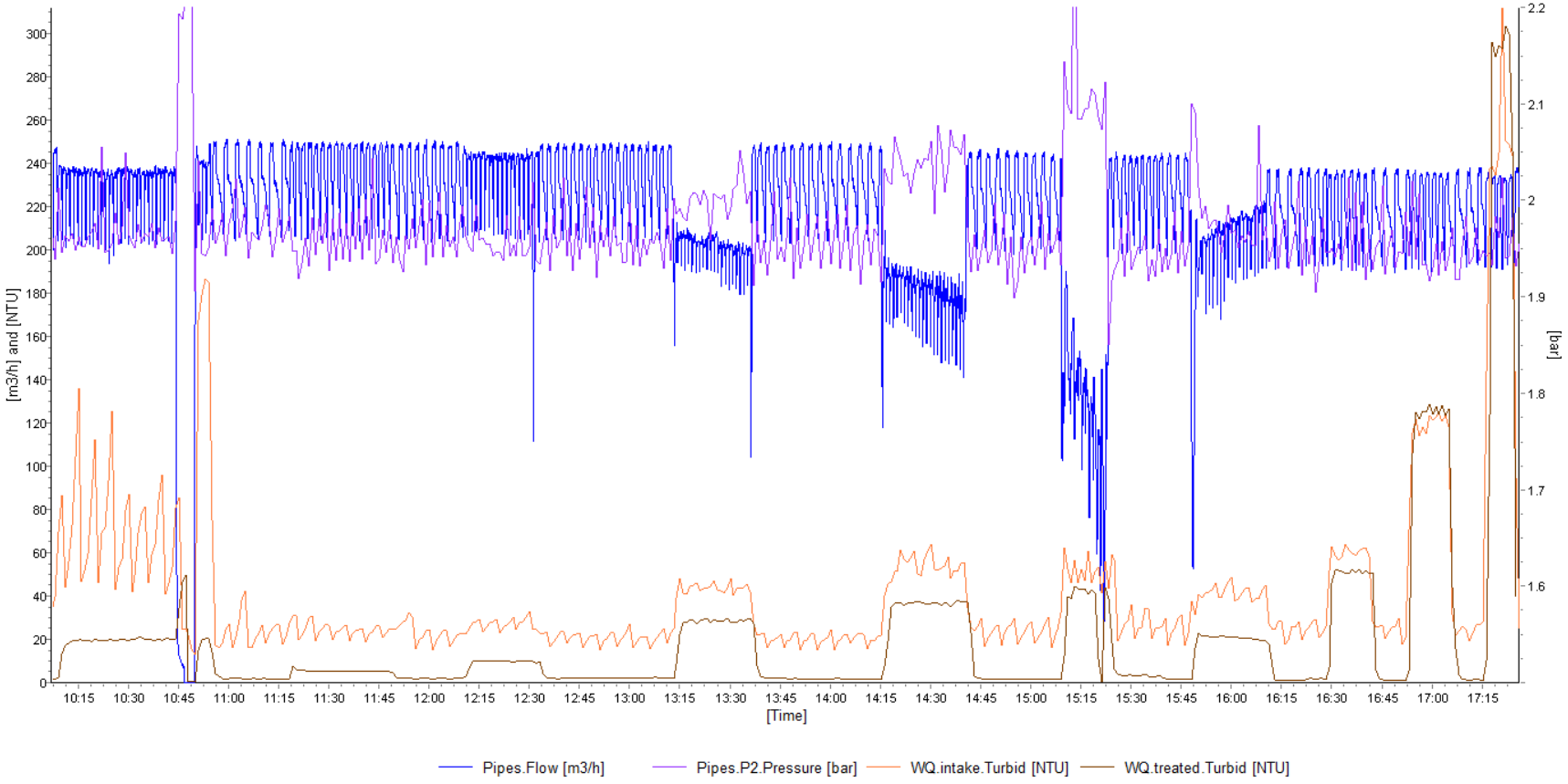
  ... will the filter screen be permanently damaged if the back pressure is removed and the pressure drop over the screen is left at a high level?

  ... will the filter performance be restored with return of back pressure or will manual cleaning/power hosing of the filter screen be needed?





Destructive testing – recovery demonstration

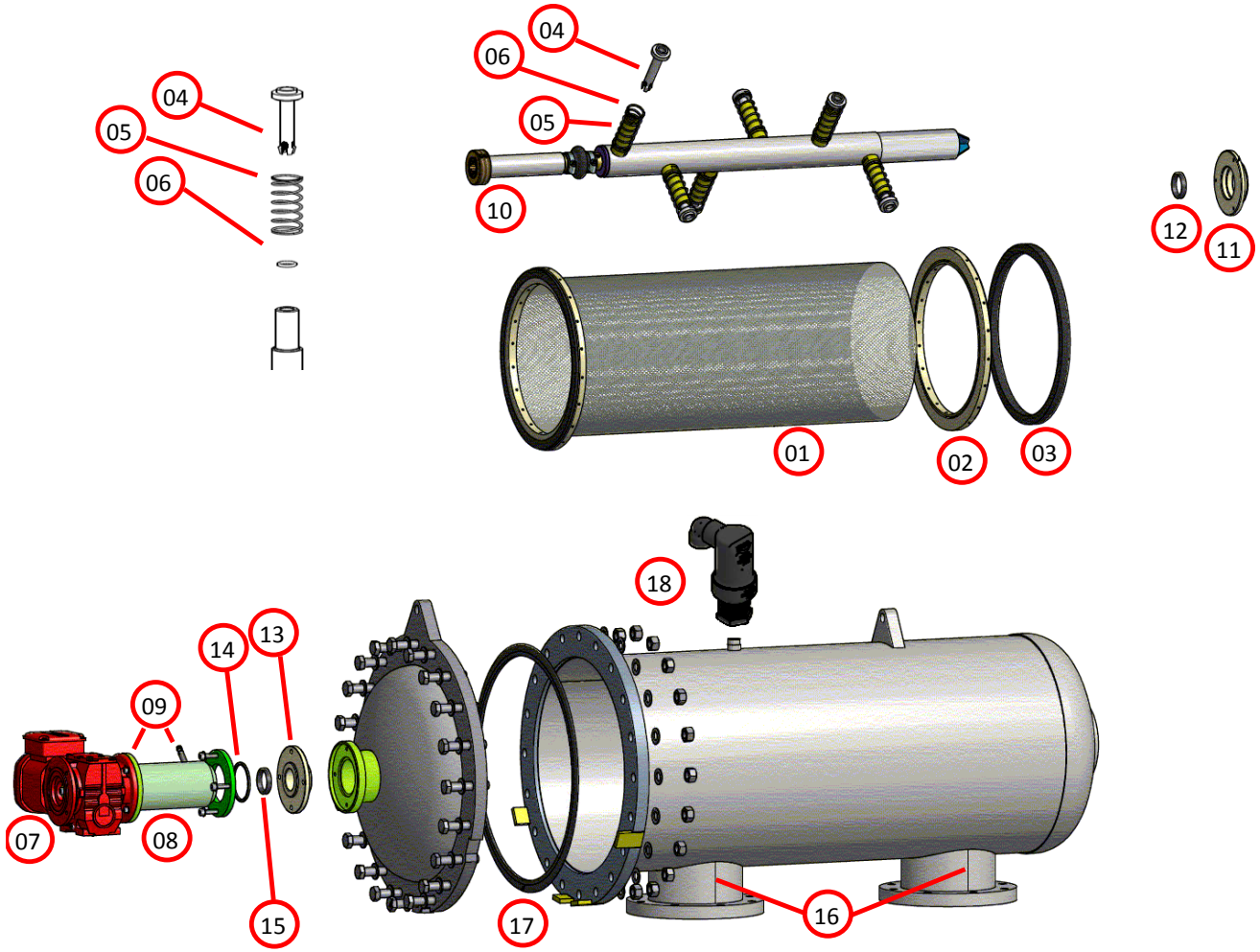


Source: DHI

Destructive testing – aftermath

- The MossHydro filter will not clog permanantly – Flow is always restored when proper back-pressure is introduced
- Flow is always maintained when proper back-pressure is present
- A full day of heavy sediment load (up to 150kg/hm^2) added to base water with a high level of starch will filter without any type of manual intervention
- Shanghai port is less challenging than the MossHydro test water:
  - Shanghai: 25-30% above 15µm (6% above 40µm + 22% 15-40um)
  - MossHydro test: 96% above 15µm (20% above 40µm + 76% 15-40um)
- MossHydro Screen will be clean and without any permanent embedding of sediments after backflushing
- MossHydro filters will not need manual cleaning of any kind

Filter parts notation

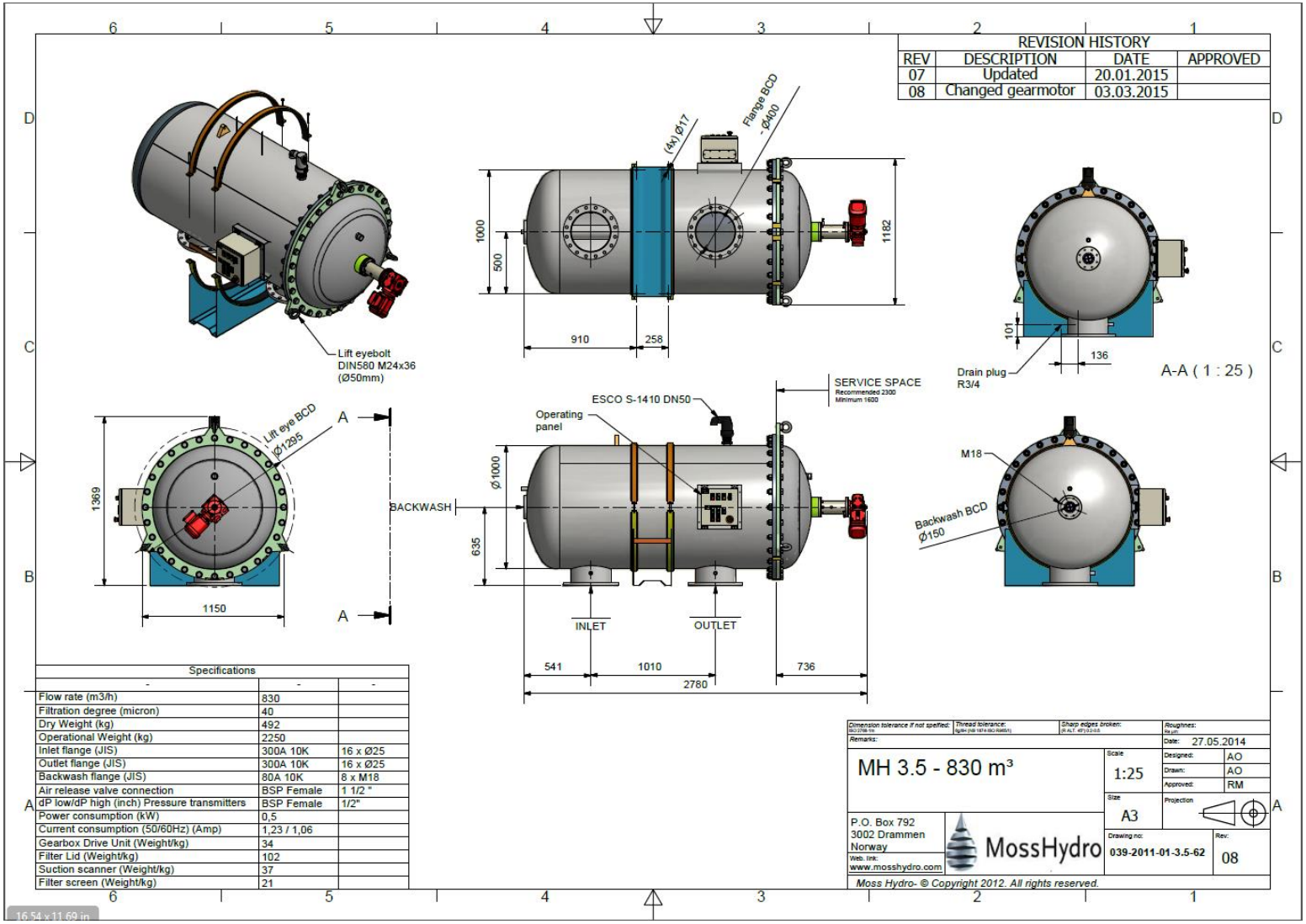


#	Part
	Filter screen kit
1	Filter screen
2	End rings
3	Screen gasket
	Nozzle kit
4	Nozzle
5	Spring
6	O-ring
	Drive unit complete
7	Gear motor
7a	Gear motor EX (optional)
8	Drive tube
9	Proximity sensors
9a	Proximity sensors EX (opt)
10	Drive pipe complete
11	Scanner support - lower
12	Simmerring scanner - lower
13	Scanner support - upper
14	O-ring scanner upper
15	Simmerring scanner - upper
16	Pressure transmitter
16a	Pressure transmitter EX (opt)
17	Main gasket
18	Air release valve

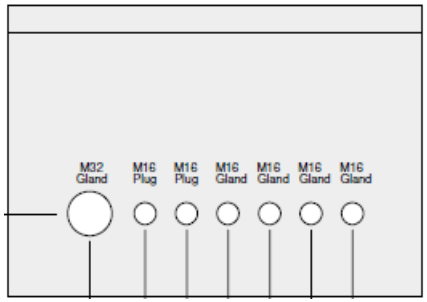
Filter parts overview

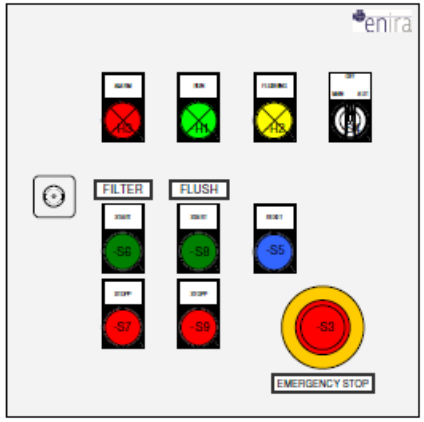
	Screen gasket diameter	255	255	255	360	360	360	360	720	720	720	720	540	540	540	540	540	540	540
	Main gasket diameter	350	350	350	500	500	500	500	1m	1m	1m	1m	600	600	600	600	600	600	600
	Filter model	0.2	0.4	0.6	1.0	1.4	1.7	2.0	3.0	3.5	4.0	5.4	5.0	6.0	7.5	9.0	10.0	12.0	14.0
#	Part																		
	Filter screen kit																		
1	Filter screen	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3	4	4	4
2	End rings	2	2	2	2	2	2	2	2	2	2	2	4	4	6	6	8	8	8
3	Screen gasket	2	2	2	2	2	2	2	2	2	2	2	4	4	6	6	8	8	8
	Nozzle kit																		
4	Nozzle	2	4	6	6	8	10	13	8	10	12	16	20	24	30	36	40	48	56
5	Spring	2	4	6	6	8	10	13	8	10	12	16	20	24	30	36	40	48	56
6	O-ring	2	4	6	6	8	10	13	8	10	12	16	20	24	30	36	40	48	56
	Drive unit complete																		
7	Gear motor	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3	4	4	4
7a	Gear motor EX (optional)																		
8	Drive tube	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3	4	4	4
9	Proximity sensors	2	2	2	2	2	2	2	2	2	2	2	4	4	6	6	8	8	8
9a	Proximity sensors EX (opt)																		
10	Drive pipe complete	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3	4	4	4
11	Scanner support - lower	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3	4	4	4
12	Simmerring scanner - lower	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3	4	4	4
13	Scanner support - upper	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3	4	4	4
14	O-ring scanner upper	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3	4	4	4
15	Simmerring scanner - upper	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3	4	4	4
16	Pressure transmitter	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
16a	Pressure transmitter EX (opt)																		
17	Main gasket	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3	4	4	4
18	Air release valve	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

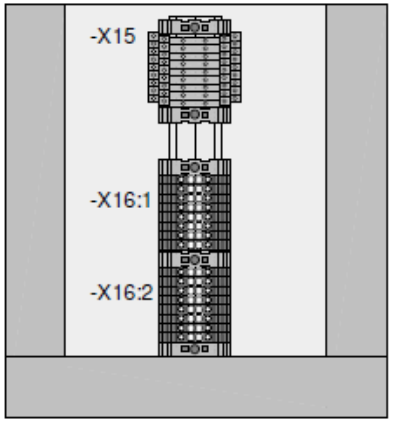
Typical Filter Outline



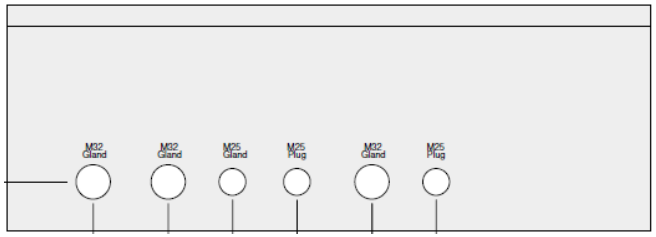
Operator Panel

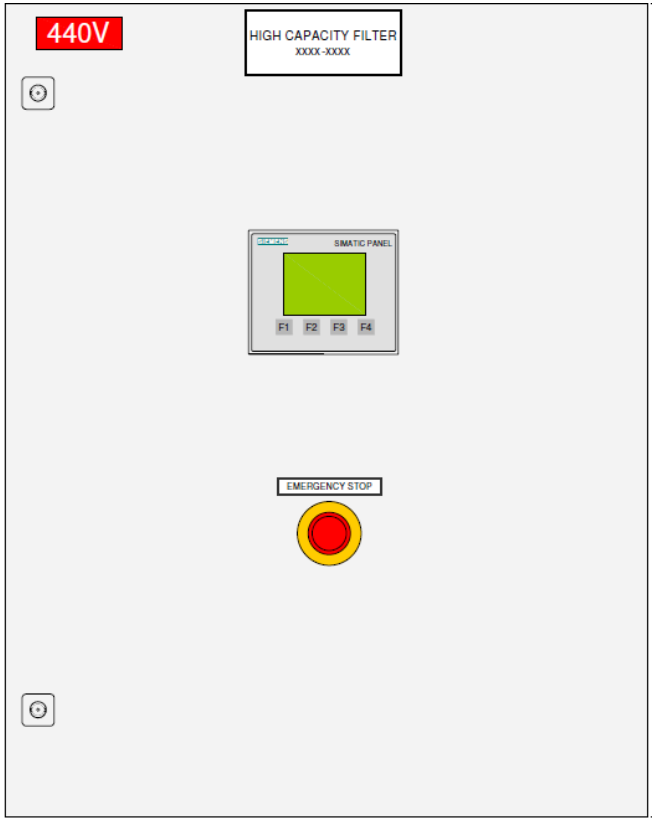


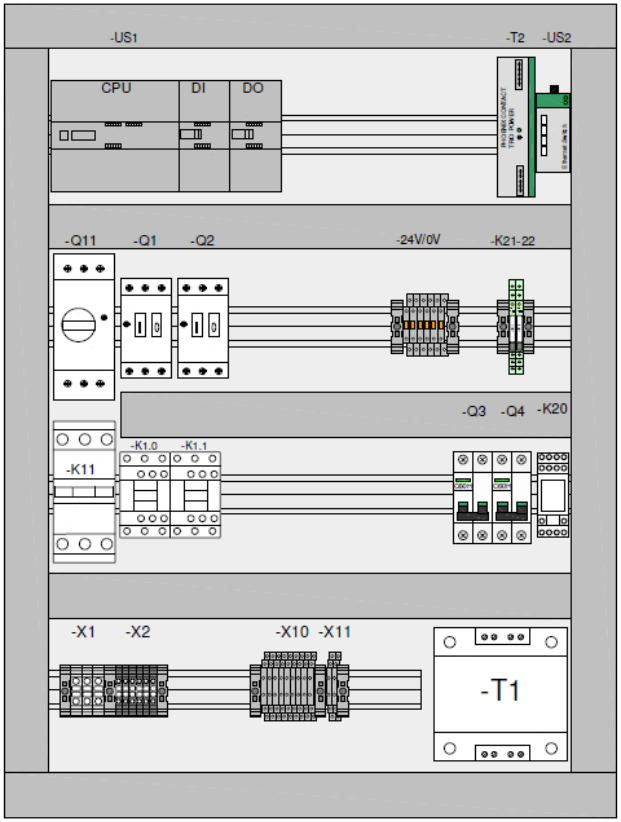




Control Cabinet







Status overview

- Company founded in 2012
- First Type Approval in 2013
- Portefolio launched May 2014
- First order booked in June 2014
- 5 USCG Type Approval processes initiated during fall 2014
- Budget for sales and opex met in 2014
- Order back log 120 filters, 72 for projects and 48 options
  - 28 bookings from 2014
  - 92 bookings from 2015
- Fixed cost is low, Opex is highly scalable
- OSO Hotwater is strategic partner and part owner

Strategic partnership with OSO Hotwater

OSO Hotwater administration and in Hokksund, Norway

- Lean Manufacturing philosophy
- Lean Six Sigma (L6S) quality philosophy
- Management all L6S Black Belt certified

- 80 years welding experience
- Welding of Stainless – 40 years experience
- ISO 9001 and 14001 certified
- OHSAS 18001 certified
- 3834 Welding standard certified

Established in 1932
- Family owned for 3 generations
- 20,000 m^2 production facility
- 200 employees

Managing Director:	Sigurd Braathen
Factory manager:	Roy Magnussen
Financial manager:	Rune Bogen
Product manager:	Bjørn Staff

"Would take 24 months and USD ~50m for competitor to develop similar automatic, robotized manufacturing line" (OSO statement)

Source: OSO Hotwater, MossHydro