TECH-TRADE A·S

Selection Guidelines for Strainer Equipment

by Morris Gallimore

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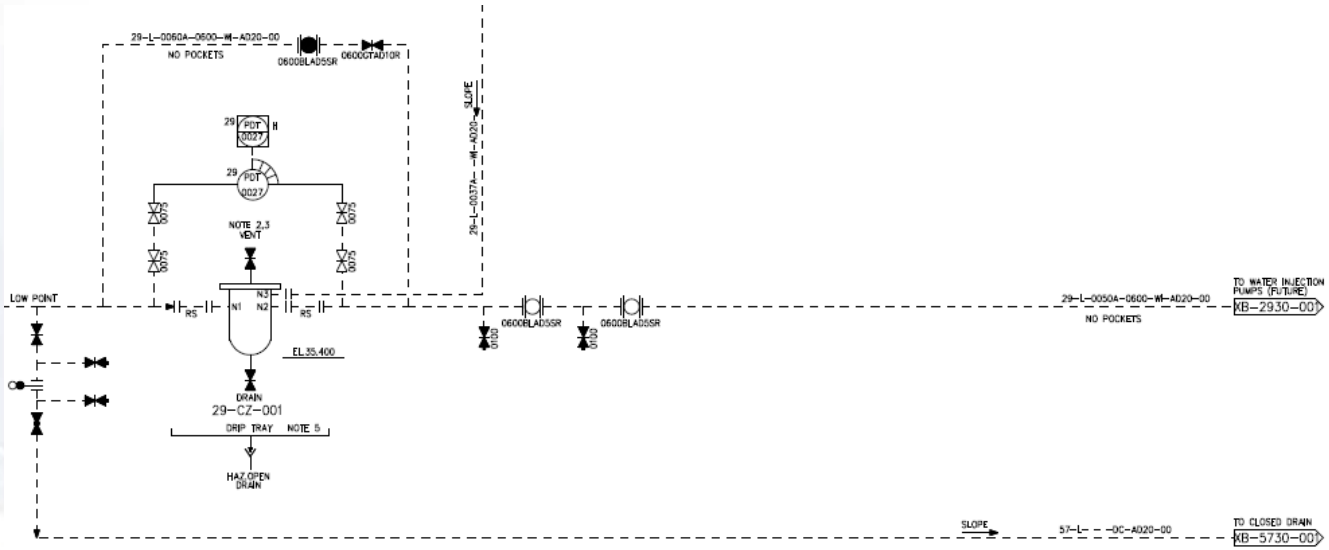
Purpose of Strainers

- Strainers remove continuous unwanted solids produced in a process stream.
- Strainers protect equipment that could be damaged by solid contaminants (pumps, heat exchangers, compressors etc).
- Strainers can be used temporarily to remove debris during testing and commissioning.



Filtration Sizing

- Commonly specified in mesh, mm or microns.
- Filtration value for strainers is nominal not absolute.
- Determined from the maximum size particle that is allowed to pass through.
- Normally specified by suppliers of downstream equipment (eg: for protection of pumps, compressors, heat exchangers).

Mesh Versus Size

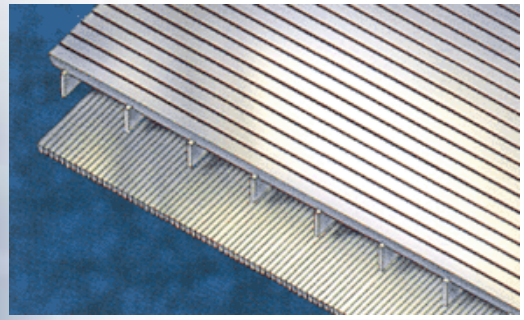
STRAINER MESH COMPARISON GUIDE

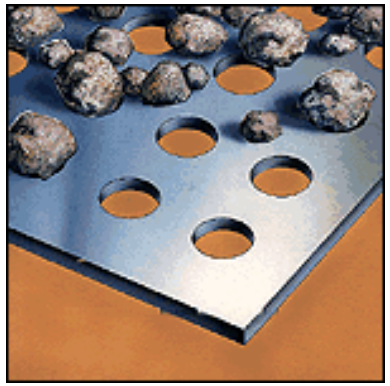
Mesh Size	Micron Rating	Gap Size mm	Gap Size inch
20 Mesh	740 microns	0.74 mm	0.030 in
30 Mesh	500 microns	0.50 mm	0.020 in
40 Mesh	400 microns	0.40 mm	0.015 in
60 Mesh	250 microns	0.25 mm	0.010 in
80 Mesh	200 microns	0.20 mm	0.008 in
100 Mesh	150 microns	0.15 mm	0.006 in
120 Mesh	125 microns	0.125 mm	0.005 in
150 Mesh	100 microns	0.10 mm	0.0039 in
200 Mesh	76 microns	0.076 mm	0.0030 in.
300 Mesh	50 microns	0.05 mm	0.0020 in.

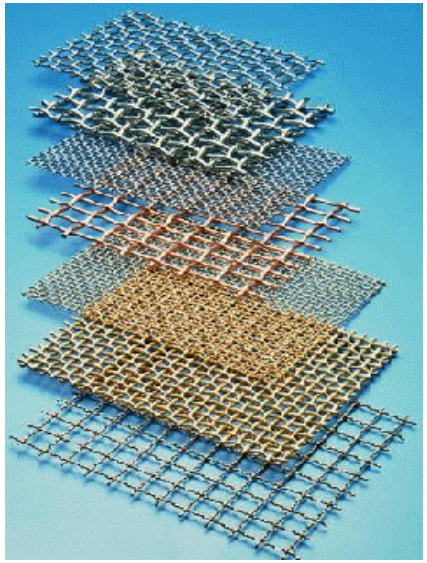
Note: Gap size is subject to mesh wire thickness.

Types of Strainer Element

- Perforated plate.
- Wire mesh.
- Wedge wire.







Strainer Sizing

- Not always equal to the pipeline size.
- Normally needs to make consideration to pressure drop limitations.
- Must take into consideration dirt loading
  (ie: volume of solids expected between allowable cleaning periods).

Why is strainer sizing important?

Undersized strainers can lead to the following problems:

- Strainer Element/Basket Collapse.
- Pump Cavitation/Pump Shutdown.
- Heat Exchanger Blockage.
- Deluge Blockage.

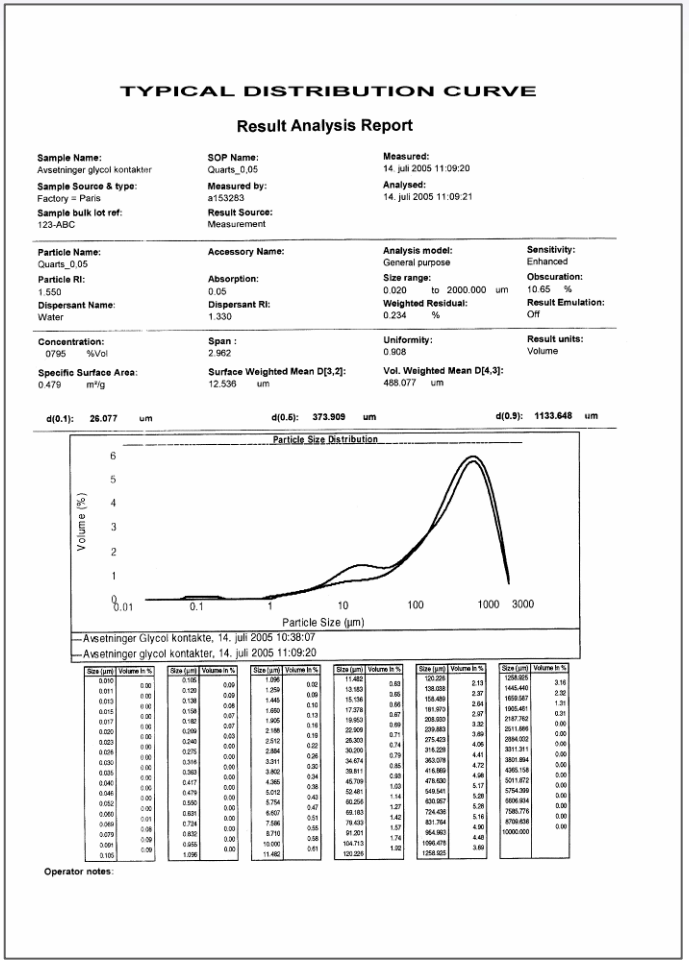
Dirt loading - solids content

- Sometimes difficult to determine.
- Define the type of process stream (eg: firewater, seawater, oil, gas).
- Define the type of solids (eg: sand, degradation products, wax, algae, mussels). Not all contaminants are strainer friendly.
- Define the frequency and approximately volume of solids (eg: particle count of ppm solids in stream by size).

Dirt Loading
Typical Particle Analysis

Provides valuable information:

- Volume flow of solids.
- Size distribution of solids.
- Concentration of particle size(s)
- Identifies types of solids.



TYPICAL DISTRIBUTION CURVE

Result Analysis Report

Sample Name: Avsetninger glycol kontakter	**SOP Name:** Quarts_0.05	**Measured:** 14. juli 2005 11:09:20	
Sample Source & type: Factory = Paris	**Measured by:** a153283	**Analysed:** 14. juli 2005 11:09:21	
Sample bulk lot ref: 123-ABC	**Result Source:** Measurement		
Particle Name: Quarts_0.05	**Accessory Name:**	**Analysis model:** General purpose	**Sensitivity:** Enhanced
Particle RI: 1.550	**Absorption:** 0.05	**Size range:** 0.020 to 2000.000 um	**Obscuration:** 10.65 %
Dispersant Name: Water	**Dispersant RI:** 1.330	**Weighted Residual:** 0.234 %	**Result Emulation:** Off
Concentration: 0795 %Vol	**Span :** 2.962	**Uniformity:** 0.908	**Result units:** Volume
Specific Surface Area: 0.479 m²/g	**Surface Weighted Mean D[3,2]:** 12.536 um	**Vol. Weighted Mean D[4,3]:** 488.077 um	

d(0.1): 26.077 um **d(0.5):** 373.909 um **d(0.9):** 1133.648 um

Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.010	0.00	0.118	0.09	1.096	0.02	11.482	0.83	120.226	2.13	1258.925	3.16
0.011	0.00	0.120	0.09	1.259	0.09	13.183	0.95	138.038	2.37	1445.440	2.32
0.013	0.00	0.138	0.08	1.445	0.16	15.136	0.86	158.489	2.94	1659.587	1.31
0.015	0.00	0.158	0.08	1.659	0.13	17.378	0.87	181.970	2.97	1905.461	0.31
0.017	0.00	0.182	0.07	1.905	0.16	19.953	0.89	208.930	3.32	2187.762	0.00
0.020	0.00	0.209	0.07	2.188	0.18	22.909	0.71	239.883	3.69	2511.886	0.00
0.023	0.00	0.240	0.00	2.512	0.22	26.303	0.74	275.423	4.06	2884.032	0.00
0.026	0.00	0.275	0.00	2.884	0.26	30.200	0.79	316.228	4.41	3311.311	0.00
0.030	0.00	0.316	0.00	3.311	0.30	34.674	0.85	363.078	4.72	3801.894	0.00
0.035	0.00	0.363	0.00	3.802	0.34	39.811	0.93	416.869	4.96	4365.158	0.00
0.040	0.00	0.417	0.00	4.365	0.38	45.709	1.03	478.630	5.17	5011.872	0.00
0.046	0.00	0.479	0.00	5.012	0.43	52.481	1.14	549.541	5.28	5754.399	0.00
0.052	0.00	0.550	0.00	5.754	0.47	60.256	1.27	630.957	5.28	6606.934	0.00
0.060	0.01	0.631	0.00	6.607	0.51	69.183	1.42	724.436	5.16	7585.776	0.00
0.069	0.06	0.724	0.00	7.586	0.55	79.433	1.57	831.764	4.90	8709.636	0.00
0.079	0.08	0.832	0.00	8.710	0.58	91.201	1.74	954.993	4.48	10000.000	
0.091	0.09	0.955	0.00	10.000	0.61	104.713	1.92	1096.478	3.89		
0.105	0.09	1.096	0.00	11.482		120.226		1258.925			

Operator notes:

Pressure drop

- Important for downstream equipment (eg: NPSHa required for pump equipment).
- Pressure Drop $\propto$ (Velocity)^2.
- Pressure Drop $\propto$ (1/Diameter)^4.
- Maximum “clean” pressure drop should not exceed 0.1 bar.
- Maximum “dirty” pressure drop across screen should not be more than 0.5 bar for a standard strainer basket.
- Can be calculated or read from a pressure drop chart with considerations made for fluid, viscosity, velocity etc.
- Pressure drop information is approximate.

conaco
a division of Inoxfucine S.p.A.

Conaco™ Strainers Pressure Drop Calculation
"Y" Strainers

Conaco™ Strainer Data

Tag No.	
Strainer	707 8"#150
Screen Area sq.mm	212421
Screen Perf. mm	5,0
Screen Open Area	0.62
Wire Mesh	500
Wire Mesh Open Area	0.25
Total Free Area sq.mm	53105
Open Area/Inlet Area	164 %
Fluid	Liquid
Viscosity	1.4 cps
Density	1010 Kg/cumt
Specific Volume	N/A
Pressure	N/A
Temperature	N/A
Compressibility Factor	N/A
Flowrate	91.3 cumt/h

Pressure Drop

Clean	0.009 bar
10% Dirty	0.009 bar
20% Dirty	0.010 bar
30% Dirty	0.011 bar
40% Dirty	0.013 bar
50% Dirty	0.016 bar
60% Dirty	0.021 bar
70% Dirty	0.032 bar
80% Dirty	0.063 bar

Pressure Drops are calculated using Conaco™ propietary software "**StrainDrop**", result of more than 20 years of experience in filtration. The software is based on variations of the D'Arcy and Reynolds formulas, taking into account shape coefficients, variable passages and multiple layer screens.

$$h_L = 512\frac{Kq^2}{d^4} = 2.59 \times 10^{-4}\frac{KQ^2}{d^4}$$

$$\Delta P = 1.078 \times 10^{-4} K_{PP'} = 3.62\frac{K_{PQ}^2}{d^4}$$

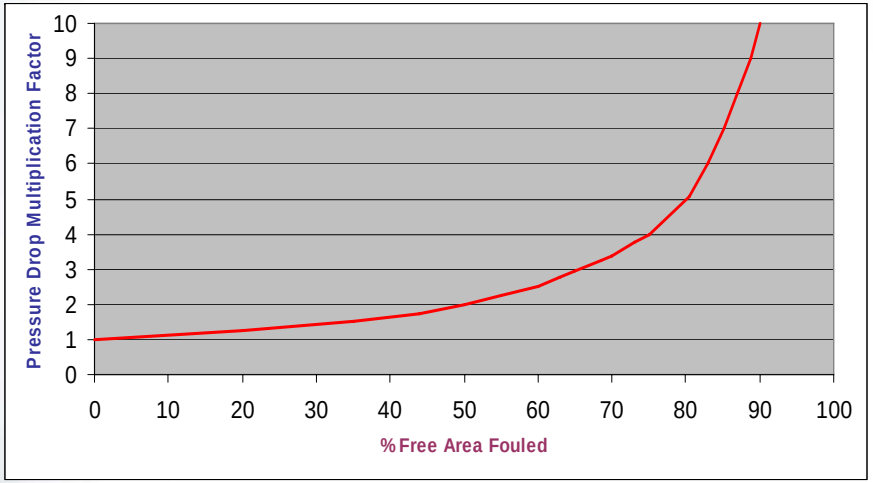
$$\Delta P = 18 \times 10^{-6}\frac{K_P Q^2}{d^4}$$

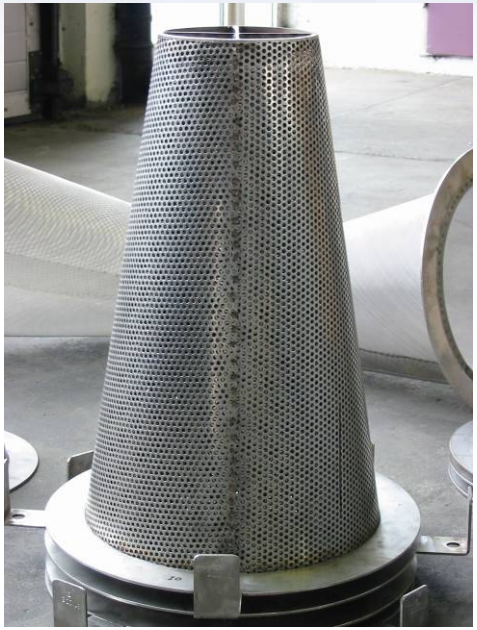
$$\Delta P = 28 \times 10^{-6}\frac{KW^2V}{d^4}$$

$$\Delta P = 6.05 \times 10^{-10}\frac{K(q'_s)^2 T S_2}{d^4 P'}$$

$$\Delta P = 16.33 \times 10^{-10}\frac{K(q'_s)^2 S_2^2}{d^4 \rho}$$

Free Open Area

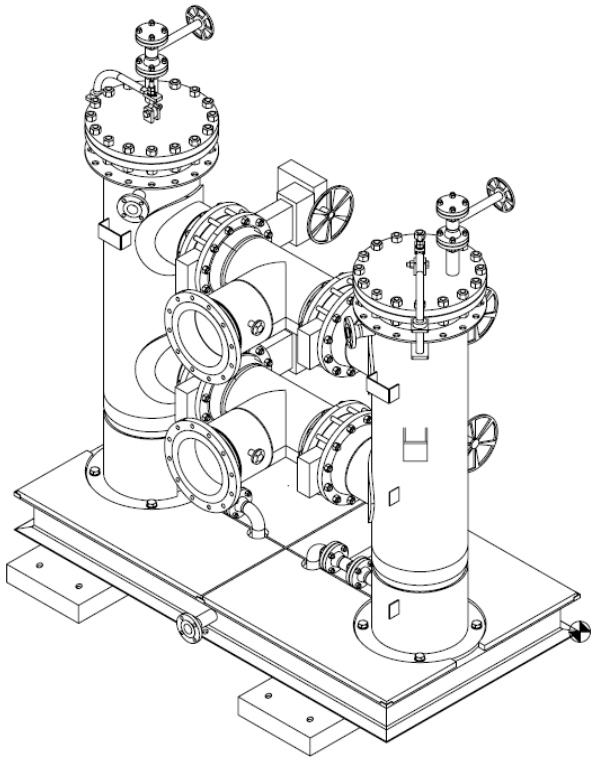




- This is the area available in the filter screen for the fluid the pass through.
- It is sometimes quoted as a ratio of the screen free area over the inlet pipe area.
- A 4:1 ratio is a good rule of thumb for sensible strainer sizing.
- As solids collect in the strainer the free open area is reduced increasing pressure drop.
- Low “Free Open Area” can result in rapid pressure drop build up as the strainer collects solids.

Other design parameters

- Design temperature range.
- Design pressure range.
- Materials of construction.



Codes, standards, directives

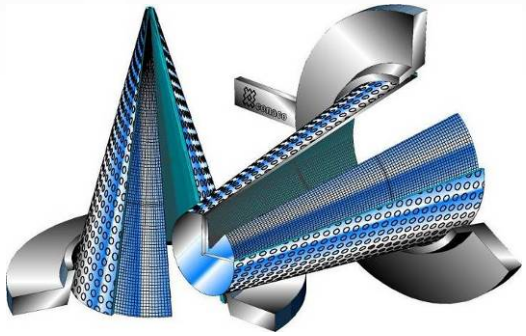
- Vessel codes: EN 13445, PD 5500, ASME VIII etc.
- Piping/valve codes: ASME B31.3, API 598 etc.
- NORSOK standards: M-601, M-630, M-650, R-001 etc.
- 97/23/EC: Pressure Equipment Directive.
- 94/9/EC: ATEX (Atmosphere Explosive) Directive
- 98/37/EC: Machinery Directive

Strainer Selection Considerations

- Temporary or permanent service.
- Pressure drop limitations.
- Type of solids.
- Expected solid volume rates.
- Standby/duty requirements.
- Cleaning requirements (manual vs automatic).

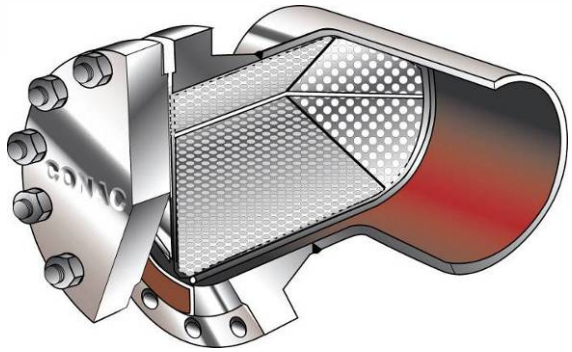
Conical Strainers

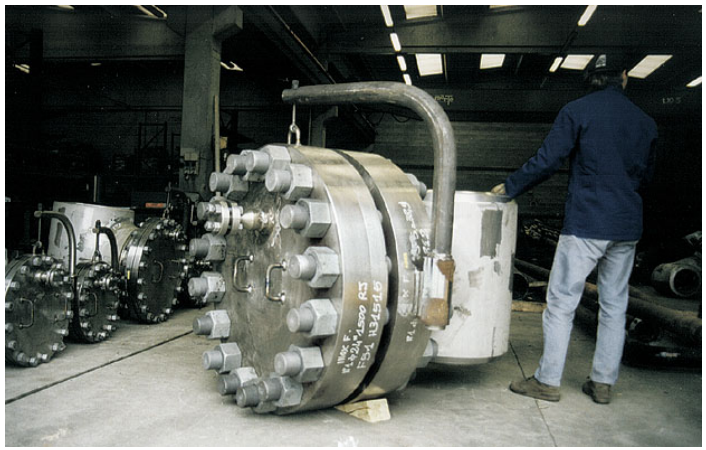
- Temporary solution.
- Very low cost.
- Low weight/compact.
- Poor filtration area.
- Debris collects in flow path.
- Pipeline spool broken for cleaning.
- Sometimes left in line leading to process problems.



Bathtub Strainers

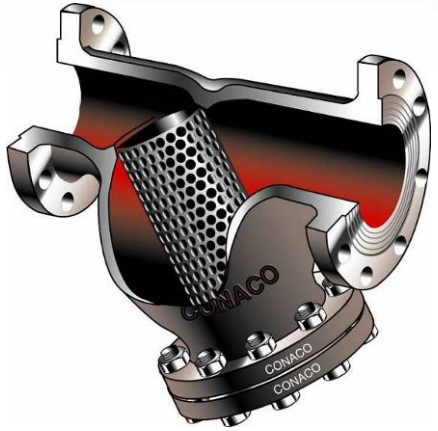
- Temporary solution.
- Guard strainer solution.
- Low cost.
- Low weight/compact.
- Poor filtration area.
- Debris collects in flow path.
- 2-Dimensional filtration.





Y-type Strainers

- Used typically for pump protection.
- Good filtration area.
- Low cost.
- Compact design.
- Low weight.
- 3-dimensional filtration.
- Debris is collected away from the flow.

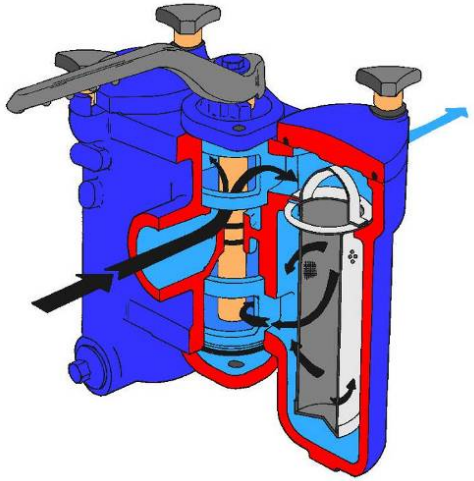


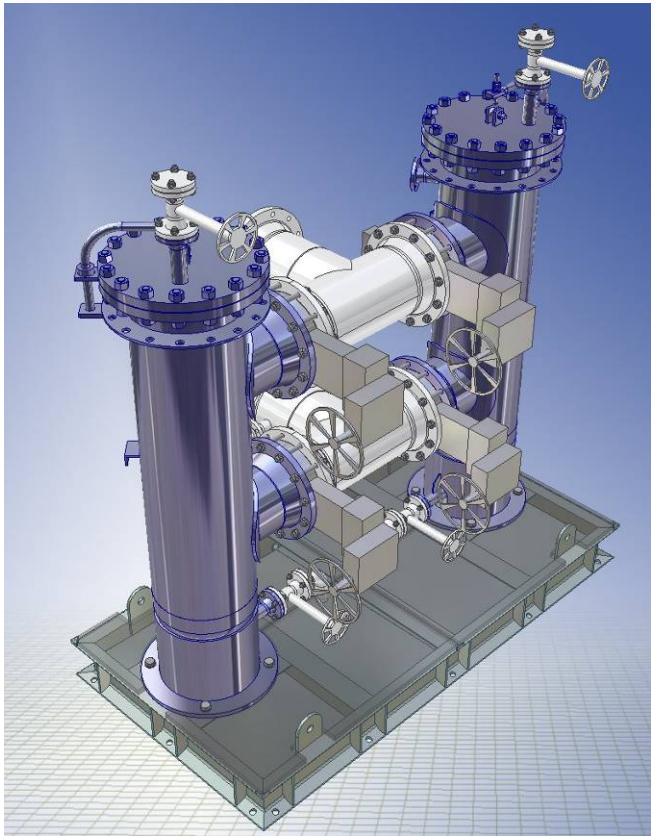
Basket/Simplex Strainers

- Used typically in higher dirtload streams providing continuous filtration (eg. heating medium applications).
- Offers better solids holding capacity.
- Custom design possible to increase solids holding capacity.

Duplex Strainers

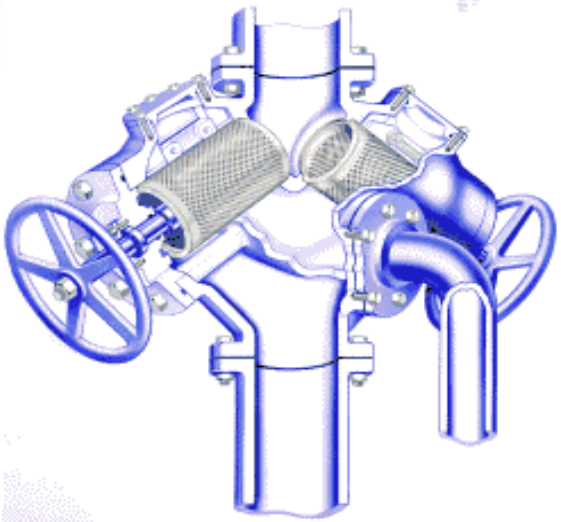
- Used where continuous process flow is essential.
- Provides all advantages of a basket strainer.
- Allows baskets to be changed out without isolating the process stream.





Hellan Strainer

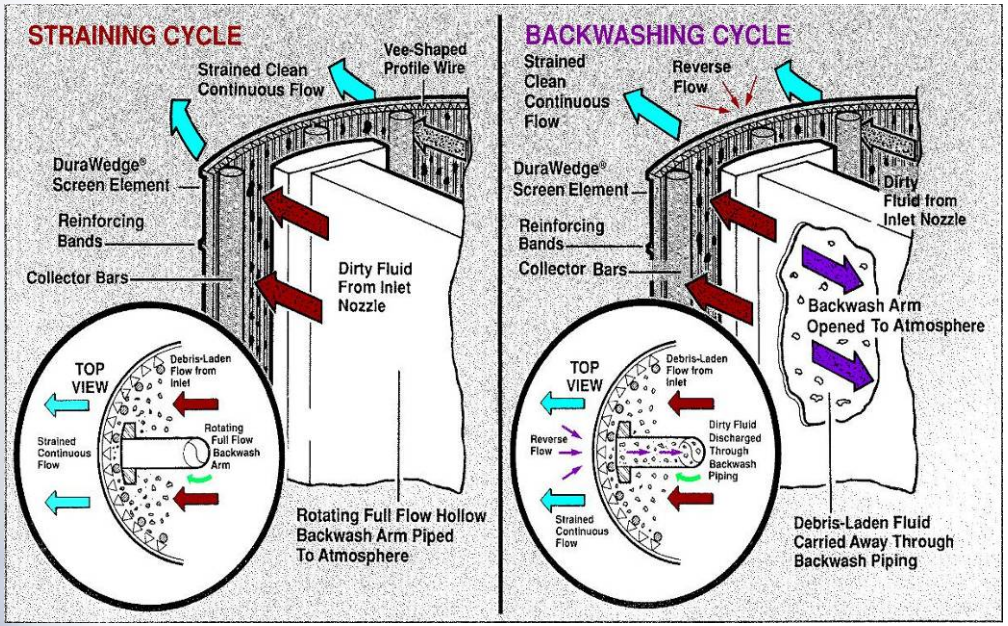
- HMS friendly - Does not require any entry into the filter for basket removal during cleaning.
- Operator friendly - Online cleaning effective in seconds. No contact with process media. Can be automated with motors.
- Space/Weight friendly - Compact inline solution.
- Cost Friendly – Competitive alternative to dual and backwash strainers.
- Maintenance Friendly – Many strainers operating maintenance free for over 10-years in service.
- Proven Solution – Over 30-years on Ekofisk and over 20-years on Valhall platforms.
- Offshore Solution - Available in various standard and exotic hi-alloy materials to NORSOK and PED requirements.

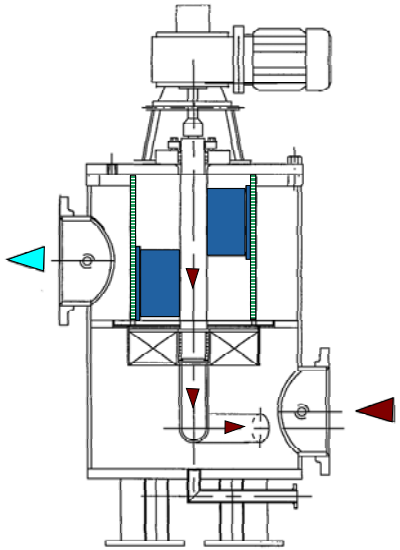


Automatic Backwash Strainer

- Used for very high dirt load applications (eg. Seawater filtration).
- Several different designs available.
- Units are automated with a control unit.
- Backwash activated by either timer, high DP or manual.
- Screens are cleaned using a backwash supply.
- Solids are drained away in a separate backwash stream.

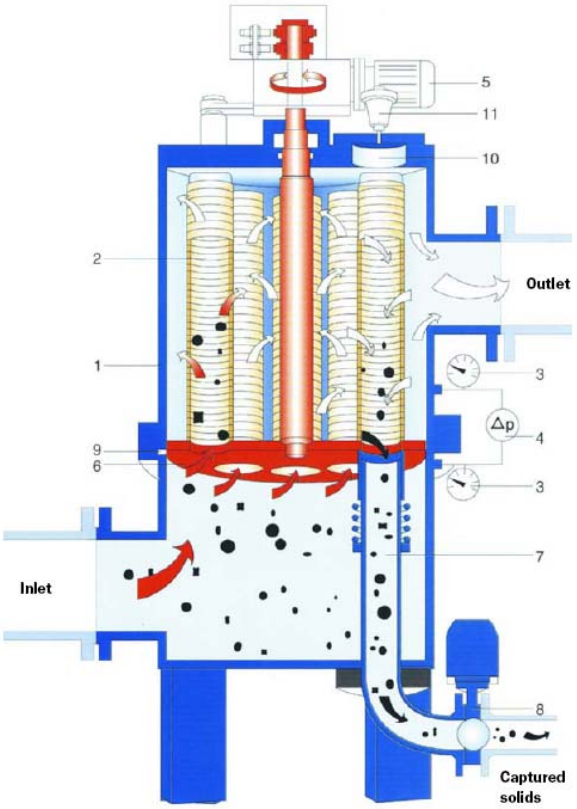
Automatic Backwash Strainer





TYPICAL OPERATION/BACKWASH SEQUENCE

Automatic Backwash Strainer



Automatic Backwash Strainer