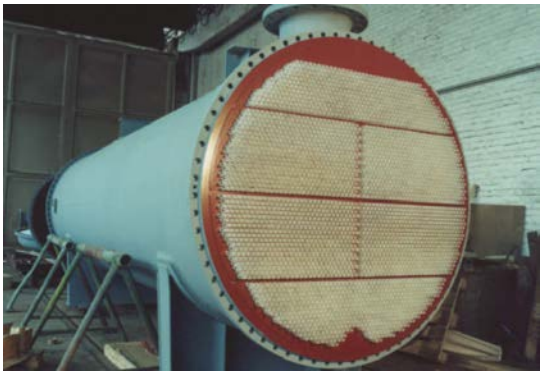
EQOBRUSH

POWERED BY WACON-KALVO

AUTOMATIC BRUSHING SYSTEMS FOR CHILLER CONDENSERS & HEAT EXCHANGERS

Contents:



Introduction

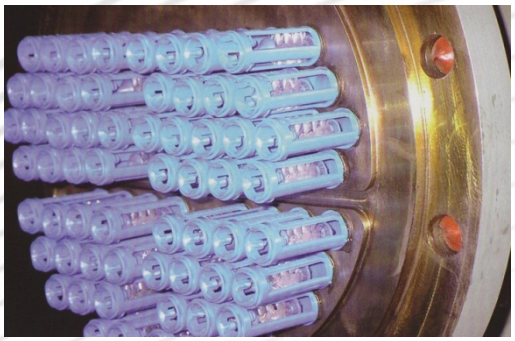
Fouling build-up in heat exchangers and condensers are an ongoing problem with high impact. Excessive consumption of electricity, high budgets for maintenance and repair, shortened life spans of equipment and standard over-design of heat exchanging units are just a few examples of the issues related to fouling.

In the era of environmental consciousness governments and corporations are adapting more responsible attitudes towards the consequences of fouling.

Automatic on-line cleaning systems are the answer to the problems as only these systems can guarantee optimal performance of the heat exchanger units at all times.

In the GB50736-2012 (section 8.6.4.3) the Chinese government related design institutions are actively promoting the application of on-line cleaning in HVAC systems in order to minimize energy consumption.

Eqobrush is a brushing system of European design now available in China with most advanced technology to clean your chiller condenser and heat exchangers.



WATCO Group – KALVO

Watco are determined to contribute to a better and greener world via the development and marketing of sustainable solutions for industrial sized water cooling systems.

- Head-offices incorporated in Singapore
- Dutch management, engineering and quality approach
- Long experience in the field of industrial water cooling

Kalvo is a household name for brush cleaning in Europe, featured by VOGLER GmbH in Germany. As the market leader for in the European industry it has been active for over 30 years in manufacturing and installation of brush cleaning systems.

Watco and Kalvo decide to join forces in bringing the best possible technology in this field to Asian markets.

Our products are all manufactured in Asia (Singapore, China) allowing us to combine the best of both worlds in terms of quality and pricing. Where requested we can also offer the European products for the Asian applications.


MANNESMANN
DEMAG


PHILIP MORRIS


SIEMENS


BASF
The Chemical Company


steag


ALSTOM

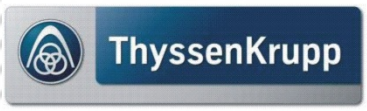

degussa.


BAYER
Bayer


RWE


Linde


Hoechst


ThyssenKrupp


DUPONT


GHH
BORSIG

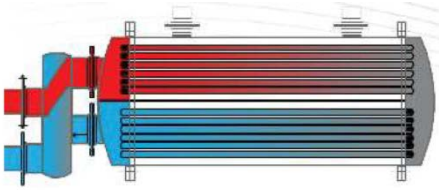

bp


SULZER
ESCHER
WYSS


Landis
Gyr

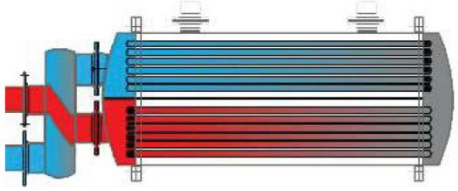
System Description

The brush cleaning system consists of two catch baskets and one brush for each heat exchanger tube. Both baskets are permanently fitted to the pipe ends and serve to accept the brushes.



Operation

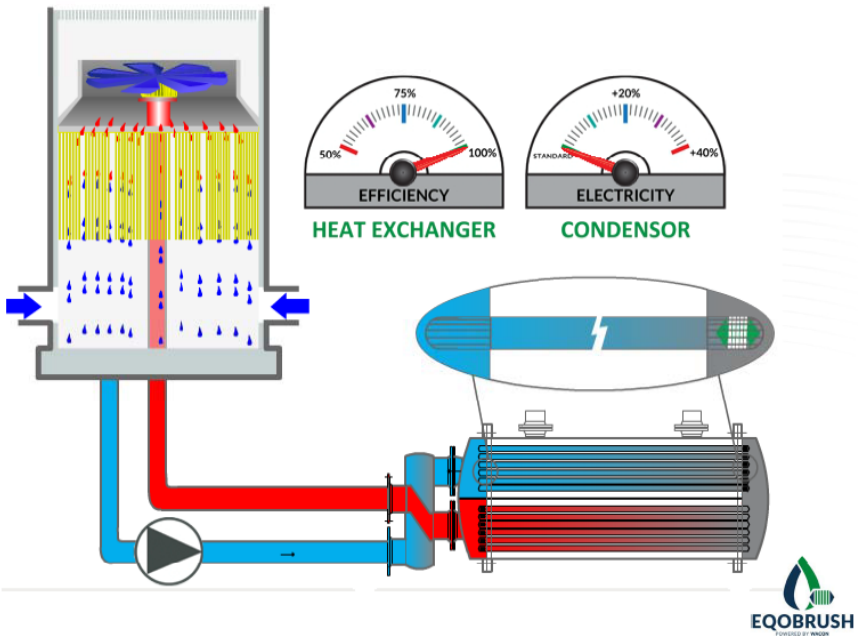
By reversing the direction of the cooling water flow, the brush is pressed through the tube and at the other end it is accepted by the basket. When the cooling water stream is diverted again in the normal direction, also the brush will return into the catch basket located at the delivery end, the inner walls of the tubes thus being cleaned now.



Cleaning

The reversal of the water flow direction occurs by means of a reversing armature which can be set to any desired cycle via an electric actuator and control box. This cleaning interval is fixed by our engineers according to the operating conditions and degree of contamination of the cooling medium, but dependent on seasons or other influences it may also be changed by the operating personnel.

The cleaning action of the brush makes it possible to remove loose, gelatinous deposits from the internal surface of the tube without any restriction and hard deposits, tending to adhere more strongly, cannot even get the opportunity to form. Moreover, sludge accumulations or other contamination are precluded.



Fouling Issues and consequences

The formation of deposits and other contamination is a serious problem for branches of industry in which heat exchangers play an important part. First a loose, gelatinous amorphous deposit will form, which tends to harden on the surfaces being heated. This will often result in pitting provoked by local deposits forming galvanic cells.

To remedy this situation, various means and processes are employed. In their essential features they can be classified as intermittent and continuous. Acid treatment and mechanical cleaning, e.g., are intermittent processes. True, very effective but, in principle, they require the functioning of the heat exchanger to be interrupted. Moreover, between the relevant cleaning operations a period of reduced heat transfer efficiency has to be considered.

The continuous process include the processing of cooling water by the constant addition of chemicals, in order that the formation or adherence of abrasive materials as well as the application of sponge balls are among the methods gaining more and more ground in the last few years. The automatic WACON-KALVO brush cleaning system offers the following effective advantages as compared with the other well-known processes:

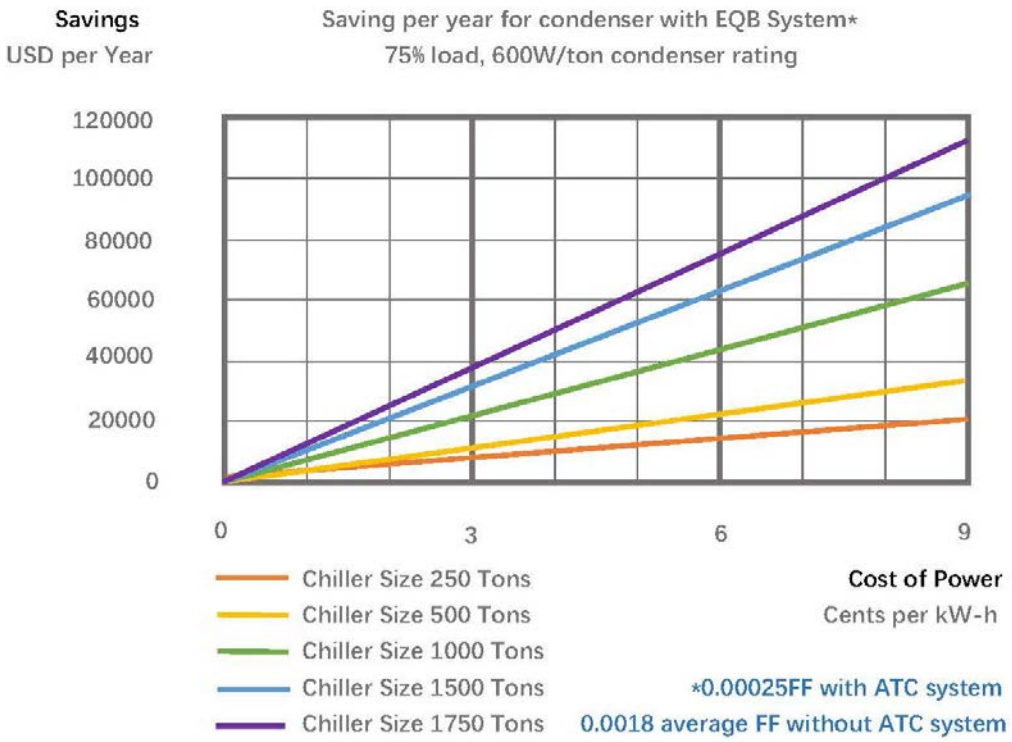
- The cleaning effect is the result of a physical flow phenomenon, without the necessity of laying the exchanger out of service.
- Constrained cleaning of each individual tube is guaranteed at any desired moment.
- Any accident whatever is ruled out. So it cannot possibly occur that pipes or individual parts thereof are only cleaned seldom, or not at all, which has also proved to be extremely advantageous in view of corrosion due to deposits of dirt or other substances contained in the water.

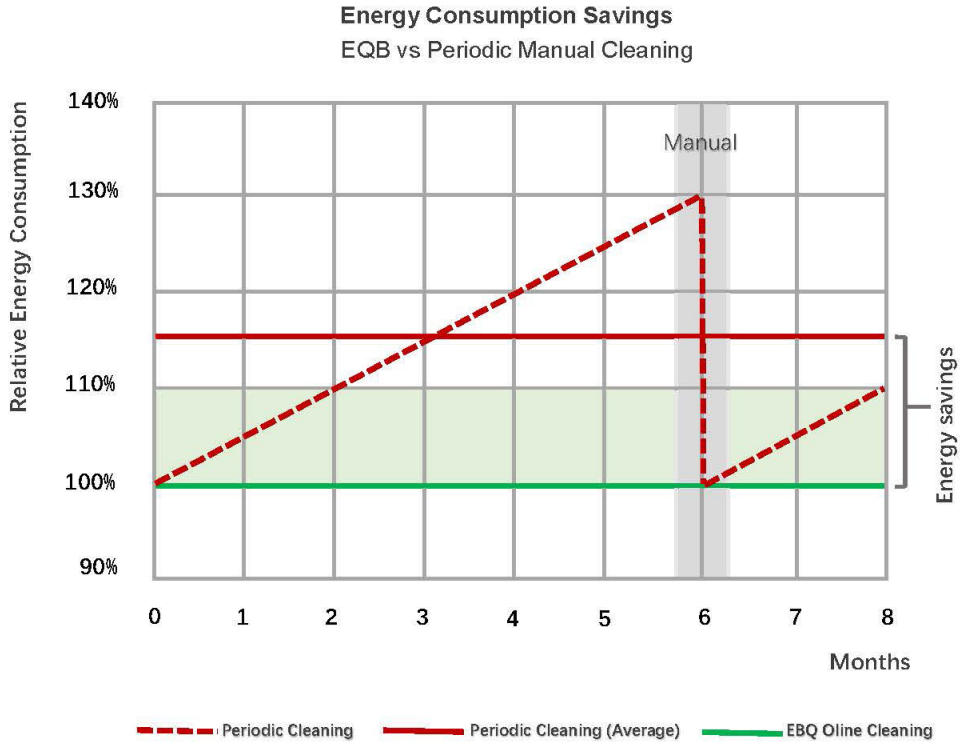
Types of fouling:

- Slime
- Algae
- Bacterial
- Corrosion
- Silt
- Sludge
- Mud
- Reaction products

Chiller fouling caused by cooling tower water issues is to a large extend linear, which means it will continue to build up until the only solution is to open and manually clean the condenser.

Energy Savings





Product advantages

The benefits of the EQOBRUSH system have been most widely demonstrated by the huge number of worldwide applications. The EQOBRUSH system is accepted in HVAC and industrial applications.

Reduction in Energy Consumption

Electrical energy consumption is reduced by up to 30% with the EQOBRUSH System. The heat exchanger tubes are always optimally clean.

The amount of debris build-up, or fouling on a tube is measured by the thermal resistance across the wall of a tube. This thermal resistance is expressed as the Fouling Factor. Examples of the amount of scale build-up, and the increase in power consumption for various fouling factors is illustrated in the Fouling Factor table below. EQOBRUSH Systems have consistently delivered fouling factors of 0.0001 to 0.0002 and have never exceeded 0.0005.

Fouling Impact on Energy Use

The relation between scale build-up and the increase in power consumption is illustrated in the Fouling Factor Table.	Fouling Factor FF	Scale thickness in mm	Power increase required
	**0.000**	0.000	0.00%
	0.0001	0.03	1.1%
	0.0005	0.15	5.5%
	0.0010	0.30	11.0%
	0.0020	0.61	22.0%
	0.0030	0.91	33.0%
	0.0040	1.22	44.0%

1 mm fouling → 30% power consumption increase

EQOBRUSH Systems have consistently delivered fouling factors of.0001 to .0002 and have never exceeded .0005 after being applied to heat exchanger fouling problems defined by design fouling factors of .0010 and higher

Reduction in Maintenance Costs:
Semi-annual maintenance of chillers is eliminated by the EQOBRUSH. Besides the costs of labour, chemicals, and cleaning equipment, human exposure to corrosive chemicals is eliminated.

Increase of Production Capacity:
If the heat exchanger performance is controlling the production output of your process, you benefit 24 hours a day, 365 days a year of your maximum production capacity.

Reduction in Chemicals:
The amount of chemicals added to prevent scaling can often be reduced because the EQOBRUSH System keeps precipitates from forming on tube walls. Cleaning chemicals such as acids are not required anymore.

Saving Water:
The EQOBRUSH System normally allows a higher cycle of concentration of the cooling water. This reduces the blow down volume and implies savings in water and sewer costs

Reduction of Equipment Downtime:
Conventional techniques for cleaning makes it necessary to take equipment out of service and manually clean the tubes with dangerous chemicals, or to manually brush each tube. Both techniques are labor intensive, costly, and result in expensive down time of equipment.
In addition, cleaning offers only a temporary solution, and must be repeated periodically. The heat transfer across that tubes starts deteriorating almost immediately after start-up.
Now, the EQOBRUSH system allows you to clean condenser and heat exchanger tubes while operating under load, and without shutdown!
The system virtually eliminates tube fouling by removing energy sapping debris from tube surfaces as often as necessary.

System Components

Cleaning brushes

The assortment of cleaning brushes is designed for a diameter range from 10mm to 24mm in case of circular tubes, for elliptic tubes there is a special design available.

The cleaning function within circular tubes requires a water flow velocity in minimum of 0.6 m/s at a pressure drop of 0.06 bar. For elliptic tubes the velocity in minimum must be 1.0 m/s.

The friction resistance between bristles and the internal wall of the tube reduces the brush velocity to half of the water velocity. This velocity difference between cooling water flow and brush affects the splash-out of the soluble fouling particles. Any grinding on the natural protection layer of the heat transfer surfaces or protective layers provided are negligible. The materials of brush caps, bristles and internal wire are resistant against any kind of cooling water (for example: city, ground, surface and sea water) up to water temperatures of 100°C. Special materials for hire temperature are also available.

The life-time of cleaning brushes and accessories in standard design conditions and for regular cleaning periods (from 4 to 6 hours) amounts 5 years.

Catch Baskets

The range of catch baskets includes many sizes to meet all tube diameters according to the metric and British dimensioning systems. In general, the connection will be executed by laminating with a special adhesive resulting in a save adhesion at the tube end for many years. But an absolute clean and grease free contact surface in the range of the sockets mouthpiece will be essential.

Another possibility of the connection is the shrinking method, If the tubes have an excess length in minimum of 10 mm.

The required free space for the different tube diameters and their spacing essential, please find out from our data sheets (download section).

The releasable connection between mouthpiece and basket enables very simple to exchange the brushes and/or their inspection, if required.

The catch baskets are not subject to wear and tear.

Reversing Armature

The most important component of the automatic brush cleaning system is the special reversing valve, designed as 4way-valve in the nominal size from 80 mm to 600 mm, respective for nominal flow rate from 50m³/h to 3000 m³/h. In case of larger nominal sizes or flow rates, the flow direction will be reserved by butterfly valves. This method is approved in the power industry for many years.

Beside the functional security of long term operation the pressure drop and the leakage rate of the reversing armature are very important parameters. In our type KV they perform extreme low values.

The standard unit is designed for an operation pressure of 10 bar and a cooling water temperature in maximum of 50°C. In accordance with the actual operation conditions and water quality the units will be manufactured of construction steel inclusive coating (standard design) or of stainless steel.

Standard Materials are:

- Body & Swing pipe: SS400
- Shaft & Key: S45C
- Slider rings (2x): Teflon
- Bearing: Bronze (CuZn)
- O-Rings & Seal: NBR
- General sealant: Liquid gasket

The flow direction and the position of installation are variable, they will be arranged according to the local conditions.

Switch board

The switch board carries the components required for the automatic operation. Any time wanted between 15 minutes (min.) and 24 h (max.) can be switched on for the cleaning cycle by a special timer. For the remaining time in reverse position only 3 min. will be provided. All switching positions are affixed according to the actual operation conditions during installation on-site.

Between the cleaning periods, furthermore before start of operation or plan stop there are additional switches/cleanings possible by use a pressure switch. For function control each cycle will be registered by a counting device.
If the torque switch of the actuator starts the alarm, the drive system returns to the original position and remains until manually reset.

The controls are built in an IP 54 control box with door lock.
It includes:

- Programmable timer.
- Position indication.
- Alarm indication if actuator runs slow or does not arrive at the end-positions.
- Cycle counter.
- Cable connectors.
- Power feed 220V/50Hz/6A

The EQOBRUSH switch boards can simply be connected to the BMS (Building Management System)

Electric actuator

The combination of rotating drive system and the worm gear unit was a success of our special reversing valve. It offers the selection of moving periods and moving forces for all armature sizes and operation conditions in optimum.

The electric motor drives via worm gear the shaft of the valve. Just in time, after arrival of the switched end position the rotating will be stopped by the limit switch. After the end of the remaining time defined in the reverse position it follows the way back to the normal flow automatically.

The actuator is a heavy duty industrial design with micro switches to mark the end positions of the runway.
The actuator has a life span of over 30.000 cycles (>10 years standard EQOBRUSH-operation).

Pneumatic actuators and safety override actuators (with spring returns) are available on request.

Warranty Conditions

EQOBRUSH Brushing Systems are carefully engineered to your requirement and manufactured only from the best materials. Provided that the service and maintenance instructions and procedures, as laid down in the operational manuals, are followed strictly they can have a extended operational lifetime during which the accumulated savings will be a multitude of the investment made.
Our warranty conditions are the following:

- 12 months on all components.
- Warranty protects against material defects or deficiency in performance.
- Faulty maintenance, as well unskilled treatment of the installation, not in accordance with operational recommendations and instructions excludes any warranty claims.
- The warranty period is counted from date of start up or from shipment date (+ 6 months); whichever comes first.

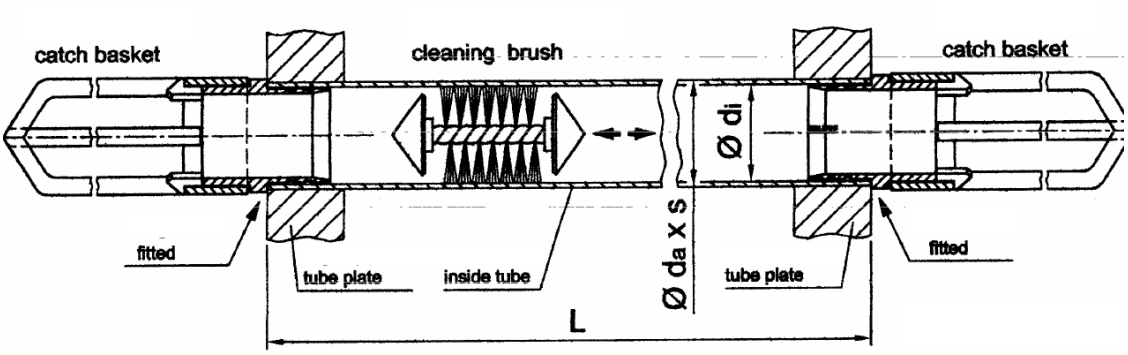
This is for indication purposes only. We adhere to Orgalime 2012 General Conditions for the Supply of Mechanical, Electrical and Electronic products. Kindly refer to our website for further details.

Technical info:

Brushes and catch baskets

Function

Tube heat exchanger:
Type:
Fabr. No.:



Dimensions: ***L*** = _____ mm ***d_a × s*** = _____ mm ***d_i*** = _____ mm

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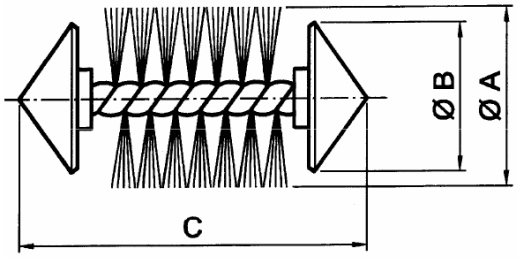
Cleaning brush

Dimensions:

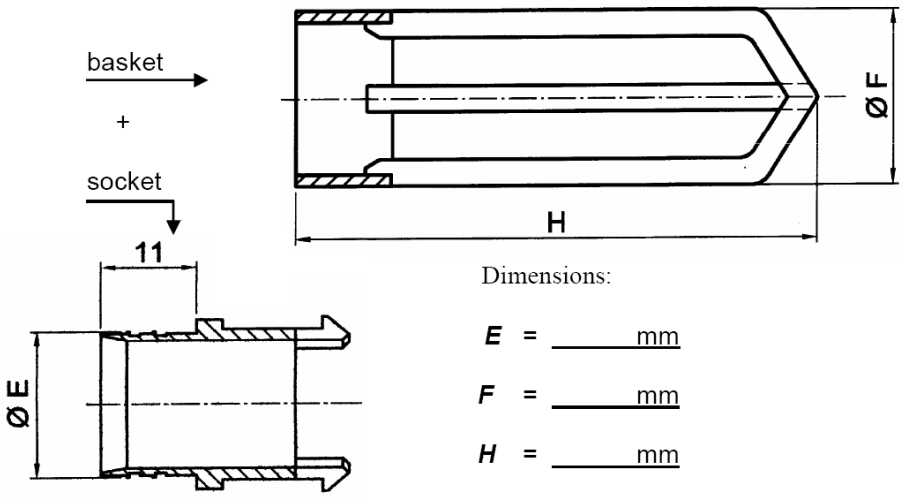


A = _____ mm

B = _____ mm

C = _____ mm

Catch basket



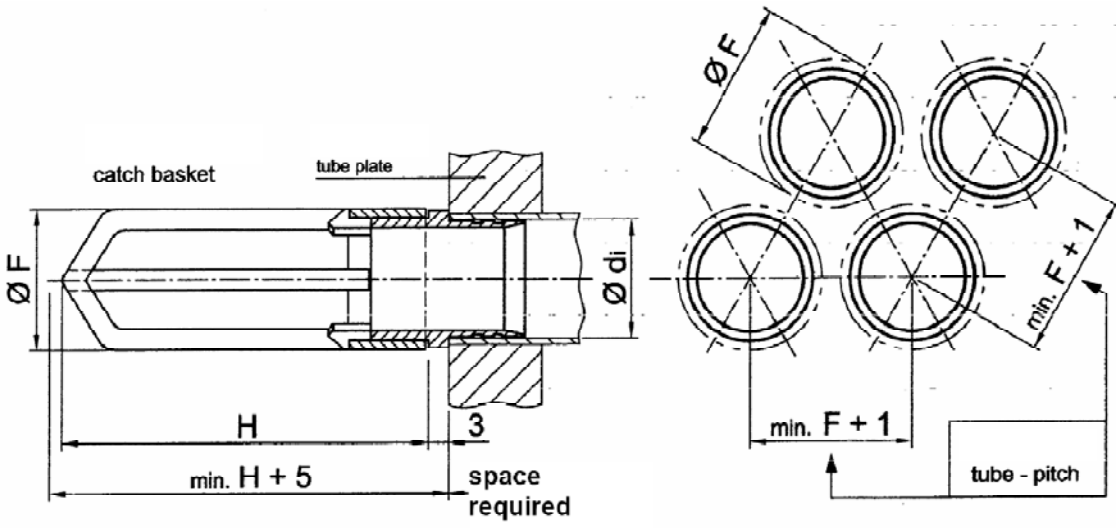
Dimensions:

E = _____ mm

F = _____ mm

H = _____ mm

Catch baskets: **Dimensions**



Dimensions:

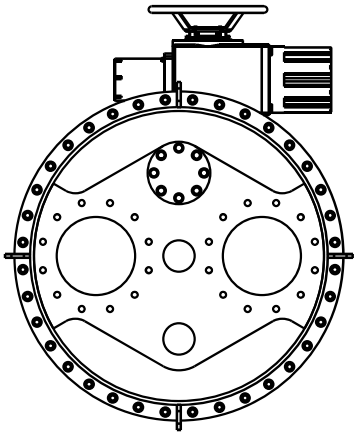
inside tube	catch basket		
d_i mm	F mm	H mm	$(H + 5)$ mm
≥ 10,0 … 14,5	18,0	65	70
> 14,5 … 16,7	20,0	65	70
> 16,7 … 19,1	22,0	70	75
> 19,1 … 22,2	25,5	70	75
> 22,2 … 24,0	28,0	75	80

Remark:

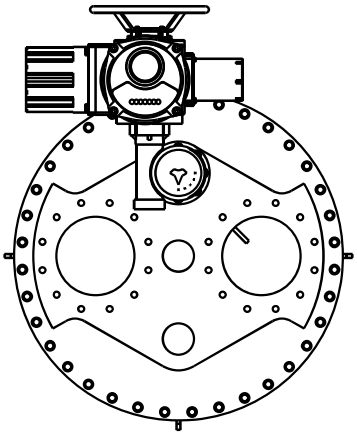
Dimensions for special types and oval-tubes by inquiry.

Reversal valve - Model A

Functional design	Flange Standards	Materials	Pressure levels
Zero Cross over	DIN	Carbon Steel 405	PN10/150 lbs.
Minimal pressure loss	ANSI	SST304	PN16/300 lbs.
Minimal actuator runtime	JIS	SST	PN25/450 lbs.
Available for pipe connections in the range from DN200-DN600			



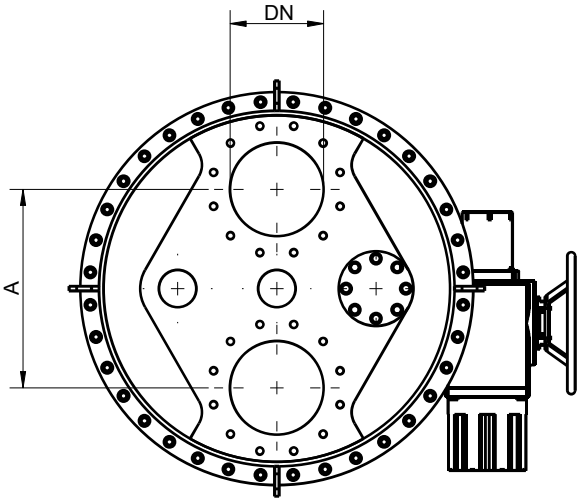
BOTTOM VIEW



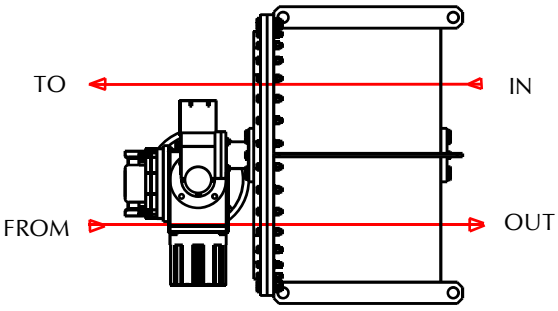
TOP VIEW

DN	A	B	C	D	E	F
200	440	890	800	570	920	960
250	530	1050	950	700	1050	770
300	585	1160	1060	800	1200	800
350	780	1480	1300	980	1350	1190
400	880	1680	1500	1080	1550	1230
450	880	1780	1600	1110	1580	1230
500	1060	2080	1900	1280	1650	1350
600	1060	2100	1920	1325	2010	1350

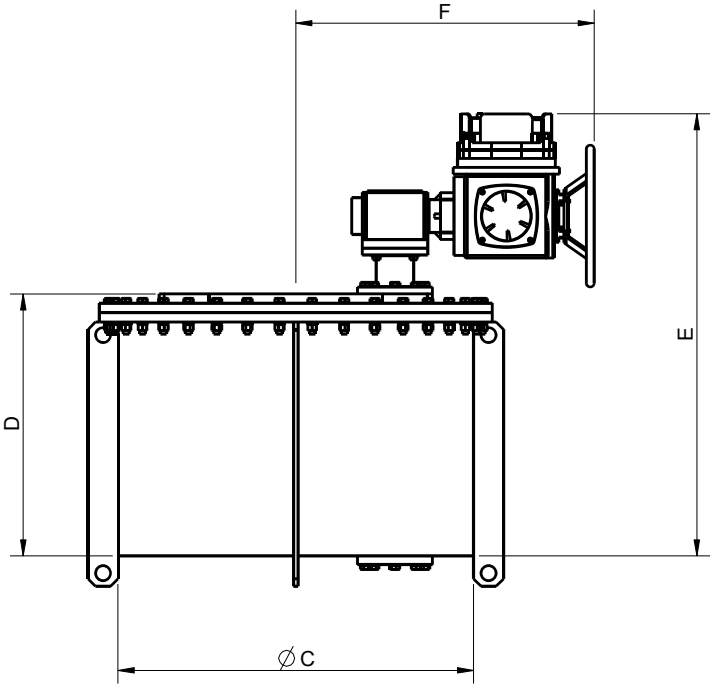
all dimensions in mm



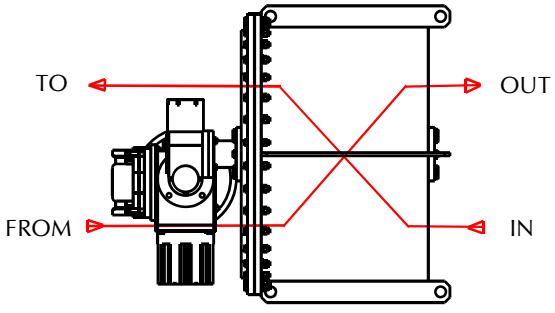
BOTTOM VIEW



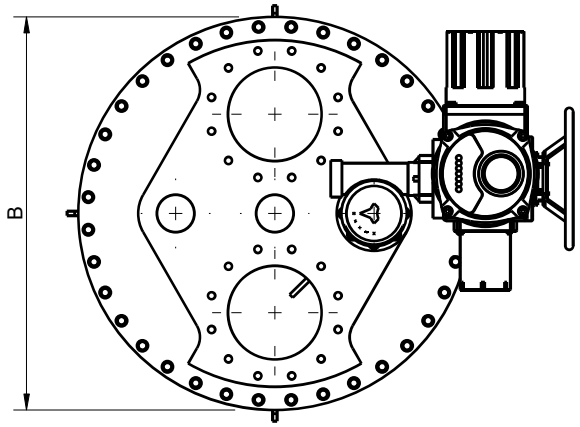
OPERATION POSITION



SIDE VIEW



CLEANING CYCLE POSITION

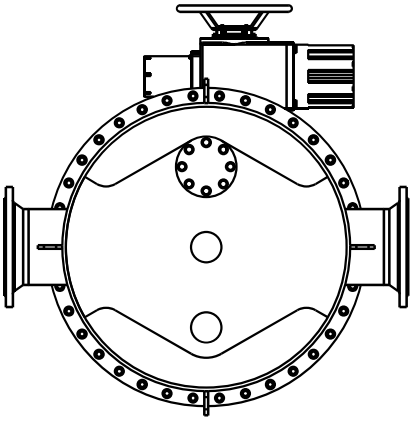


TOP VIEW

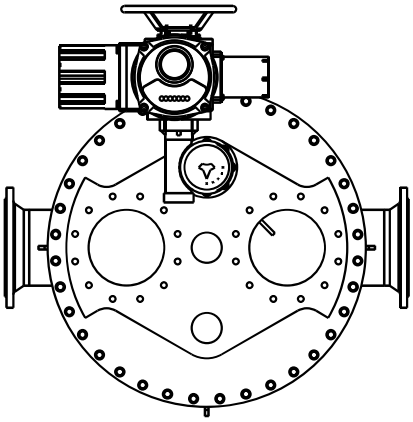
Model A: Overall dimensions

Reversal valve - Model B

Functional design	Flange Standards	Materials	Pressure levels
Zero Cross over	DIN	Carbon Steel 405	PN10/150 lbs.
Minimal pressure loss	ANSI	SST304	PN16/300 lbs.
Minimal actuator runtime	JIS	SST	PN25/450 lbs.
Available for pipe connections in the range from DN200-DN600			



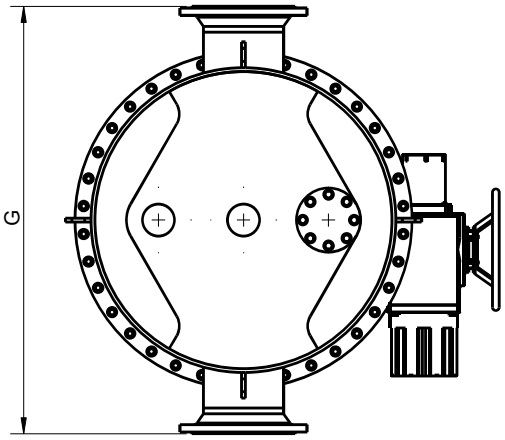
BOTTOM VIEW



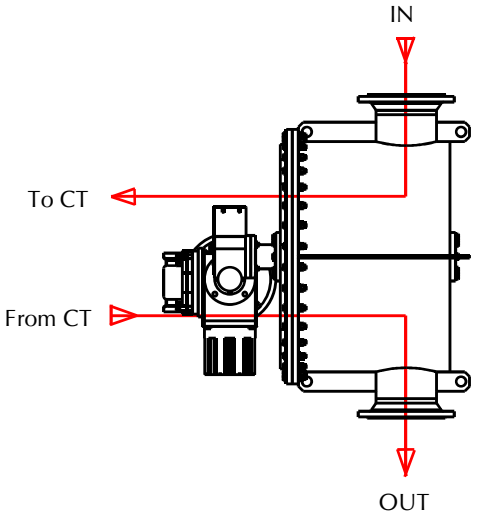
TOP VIEW

DN	A	B	C	D	E	F	G
200	440	890	800	570	920	960	1176
250	530	1050	950	700	1050	770	1330
300	585	1160	1060	800	1200	800	1440
350	780	1480	1300	980	1350	1190	1688
400	880	1680	1500	1080	1550	1230	1892
450	880	1780	1600	1110	1580	1230	1998
500	1060	2080	1900	1280	1650	1350	2304
600	1060	2100	1920	1325	2010	1350	2332

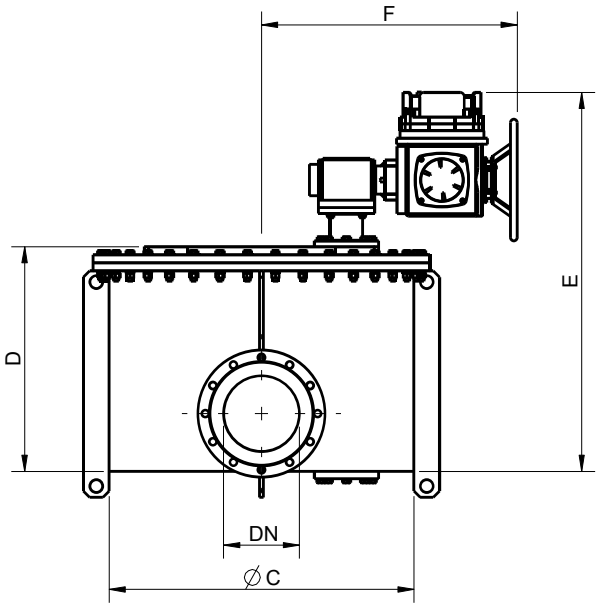
all dimensions in mm



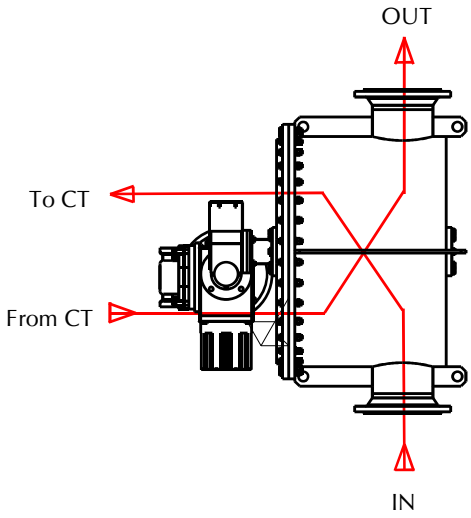
TOP VIEW



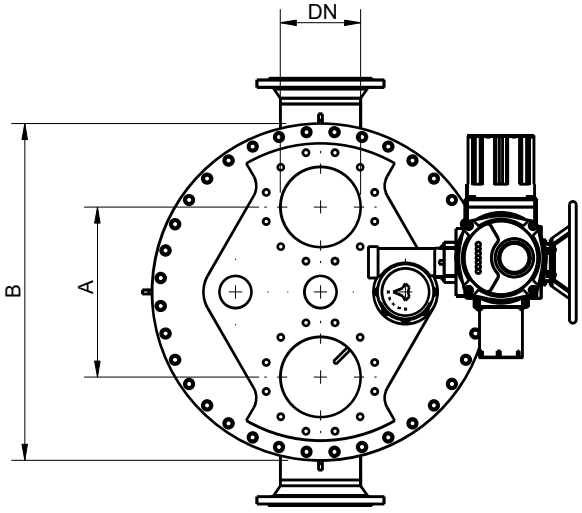
OPERATION POSITION



SIDE VIEW



CLEANING CYCLE POSITION

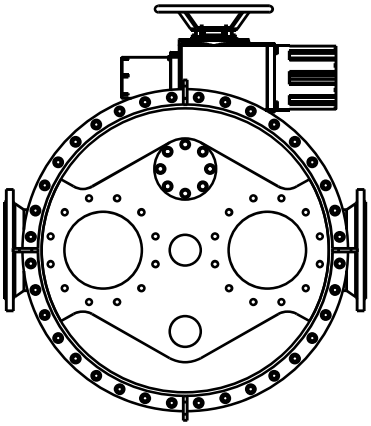


BOTTOM VIEW

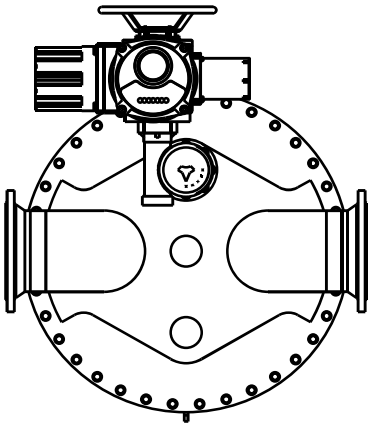
Model B: Overall dimensions

Reversal valve - Model C

Functional design	Flange Standards	Materials	Pressure levels
Zero Cross over	DIN	Carbon Steel 405	PN10/150 lbs.
Minimal pressure loss	ANSI	SST304	PN16/300 lbs.
Minimal actuator runtime	JIS	SST	PN25/450 lbs.
Available for pipe connections in the range from DN200-DN600			



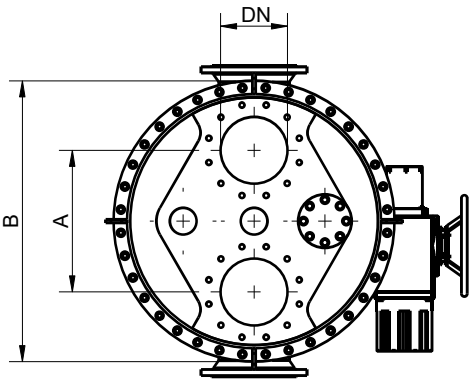
BOTTOM VIEW



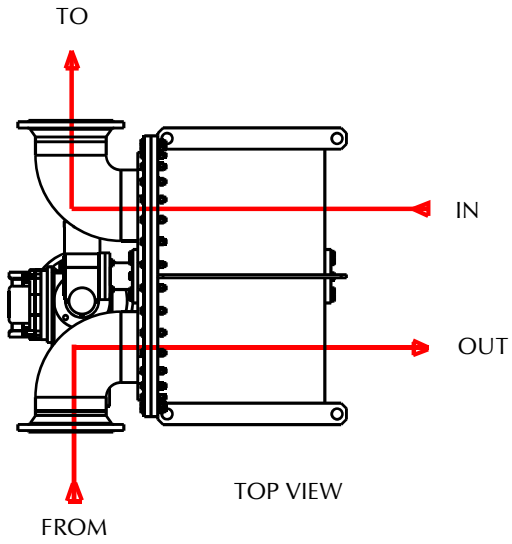
TOP VIEW

DN	A	B	C	D	E	F	G	H
200	440	890	800	570	920	960	967	900
250	530	1050	950	700	1050	770	1148	1156
300	585	1160	1060	800	1200	800	1250	1347
350	780	1480	1300	980	1350	1190	1560	1447
400	880	1680	1500	1080	1550	1230	1840	1748
450	880	1780	1600	1110	1580	1230	1910	1850
500	1060	2080	1900	1280	1650	1350	2250	2173
600	1060	2100	1920	1325	2010	1350	2498	2313

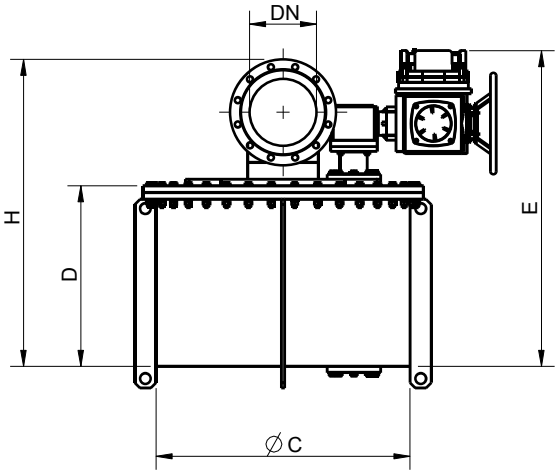
all dimensions in mm



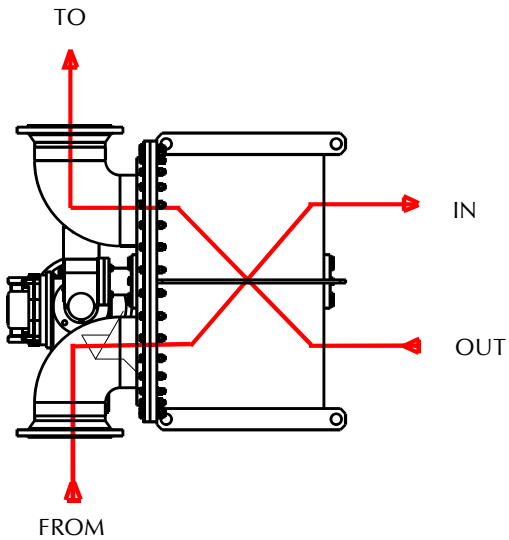
TOP VIEW

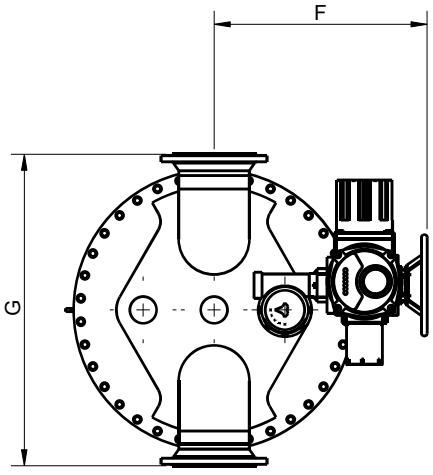


TOP VIEW



SIDE VIEW



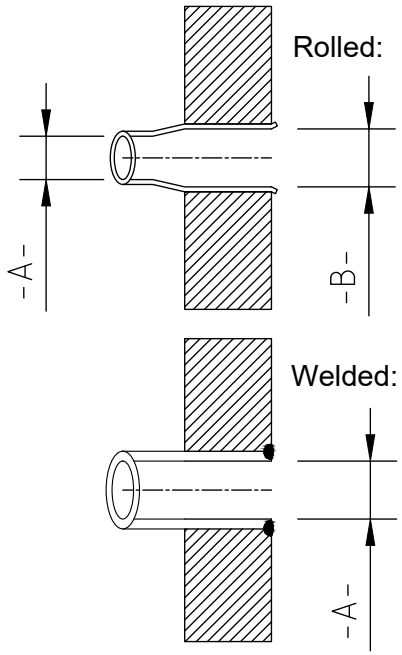


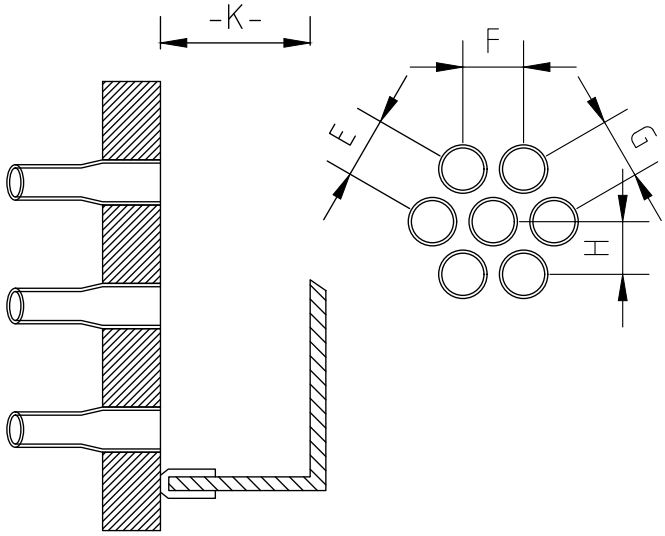
BOTTOM VIEW

Model C: Overall dimensions

ON LINE BRUSH CLEANING SYSTEM FOR SHELL & TUBE HEAT EXCHANGERS DATA-SHEET

1	Type of Equipment:	Chiller:	
2		Condenser:	
3		Proces Heatexchanger:	
4	Flow:	m3/h/gpm:	
5	Pipe Connections IN / OUT:	mm/inch:	
6	Type of Pipe Connection:	Flanged/Victaulic:	
7	System Design Pressure:	bar / mPa / lbs:	
8	Flange Standard:	DIN / ANSI / JIS:	
9	Number of pipes (total):		
10	Number of Passes:		
11	Inside Pipe Diameter > size -A-:	mm: (+/- 0.1 mm)	
12	Inside Pipe Diameter at Pipe End > size -B-:	mm: (+/- 0.1 mm)	
13	Rolled / Welded:		
14	Min. distance to Cover Head > size -K-:	mm:	
15	Pipe Pitch > size -E- -F- -G- -H-:	mm: (+/- 0.1 mm)	
16	Lenght of Pipes:	m:	
17	Power Supply Info:	V: Hz:	
18	Heat Exchanger System Pressure.	bar/psi:	
19	Water:	Sea Water:	
20		Brackish Water:	
21		Industrial Water:	
22	Comments:	Treatment:	
			Provide water anaysis if available. Provide heat exchanger drawing if available.





EQOBRUSH
POWERED BY WACON

PROJECT / MODEL

CLIENT:

TITLE

DATE:

AUTHOR: