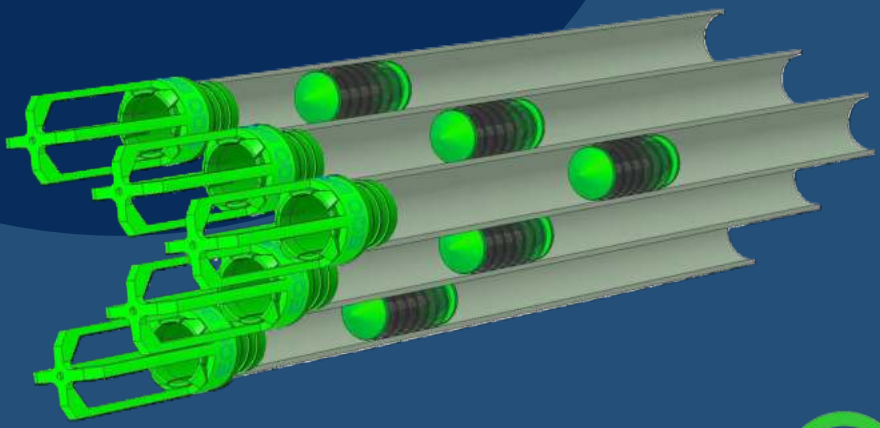
EQOBRUSH

AUTOMATIC TUBE BRUSHING FOR ENERGY SAVING IN CHILLER CONDENSERS



WATCO GROUP

www.watco-group.co
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Issue 2023

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Introduction

Automatic Tube Cleaning, using the power of water

Fouling build-up in chiller condensers is an ongoing problem with high impact. Excessive electricity consumption, high maintenance and repair budgets, shortened equipment life span and standard over-design of heat exchanging units are just a few 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.

The EQOBRUSH cleaning system for shell and tube heat exchangers and (chiller) condensers is an effective method to clean ALL the tubes DURING OPERATION and guarantee optimal heat dissipation from the condenser at all times.

15-20 %

Achieve ambitious

Energy Saving Targets

on

Chiller Electricity Usage

Fouling

The formation of deposits and other contamination is a severe problem for branches of industry in which heat exchangers play an essential part. First, a loose, gelatinous amorphous deposit will form, which tends to harden on the heated surfaces. The deposits can form galvanic cells and provoke pitting. Fouling buildup is an ongoing and inevitable process and will, if not addressed, eventually lead to system failure.

Types of fouling:

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

Various strategies can help to avoid fouling problems. In their essential features, they are either intermittent or continuous.

Acid treatment and mechanical cleaning, e.g., are **intermittent** processes. Although effective, they require interruption of the operation. Moreover, a period of fouling buildup and reduced heat transfer efficiency will occur between the cleaning operations.

The **continuous** processes include the processing of cooling water by the constant addition of chemicals, as well as online mechanical cleaning solutions.

The automatic EQOBRUSH cleaning system offers the following practical advantages:

- The ongoing cooling water flow is the driving force behind the mechanical cleaning process, and there is no need to interrupt the heat exchanger or condenser.
- The system brushes each tube within the unit during each cleaning cycle. (multiple cleaning cycles per day).

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THE TECHNICAL AND FINANCIAL CONSEQUENCES OF FOULING

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Macro Fouling

- Tube clogging
- Narrowing of tubes
- Hindrance to water flow
- Impediment to heat transfer, loss of efficiency
  - Output reduction
  - Additional water chemistry
  - Additional energy
    - Cost of chemicals and energy

Micro Fouling

- Tube scaling and fouling
- Tube inlet erosion +
- Overall tube erosion +
- Corrosion =
- Tube damage
  - Capacity reduction and need for service interruption
    - Maintenance and cleaning
    - Repairs of leaking tubes
    - Reduced system lifespan

Profit Loss

Increased operational expenses

Loss of availability

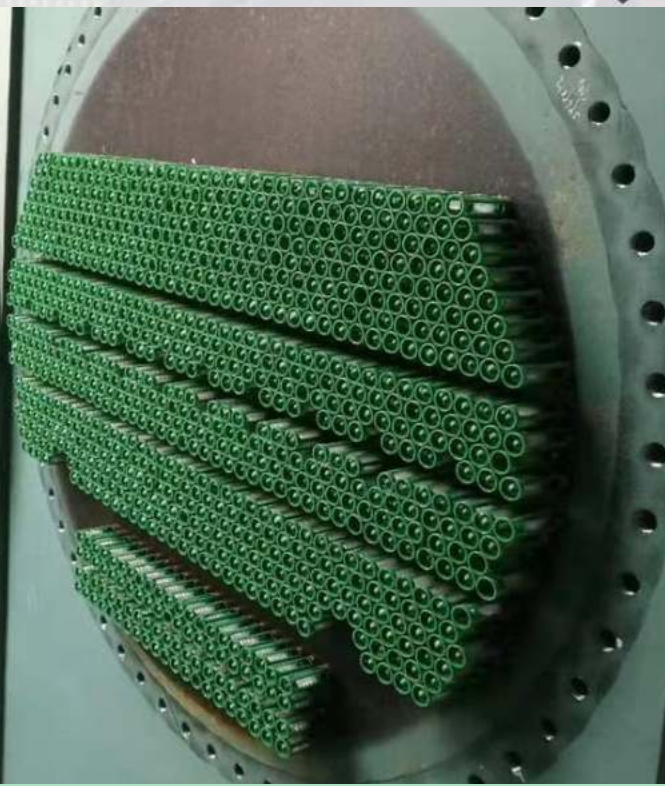
Increased maintenance cost

Faster depreciation

Profit loss by lost output

Increased overall cost

Cost
Output



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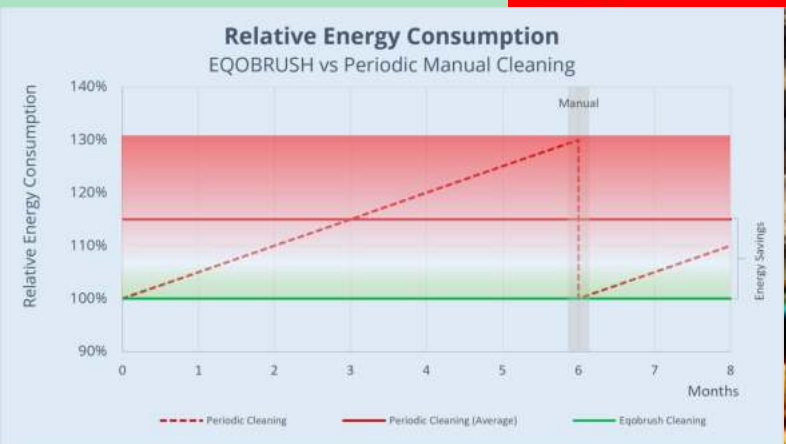
Studies on the economical impact of fouling have demonstrated a clear relation between the so-called Fouling Factor and the efficiency loss in chiller performance.

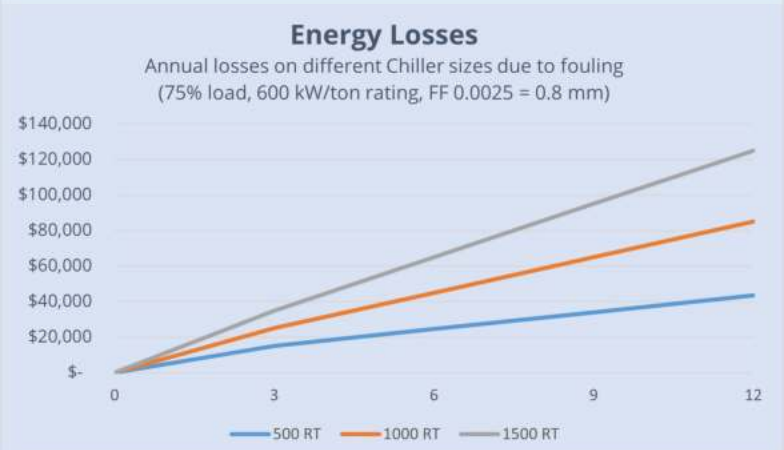
The Fouling Factor Table.

Demonstrates the relation between scale buildup and chiller compressor power consumption.

Fouling Factor [m2*K/kW]:	Scale thickness (mm)	Power increase required (%)
0.000	0.00	0%
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 LEADS TO 30% POWER INCREASE!





Above: Clean brushed surfaces in an extremely fouled heat exchanger

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System Description

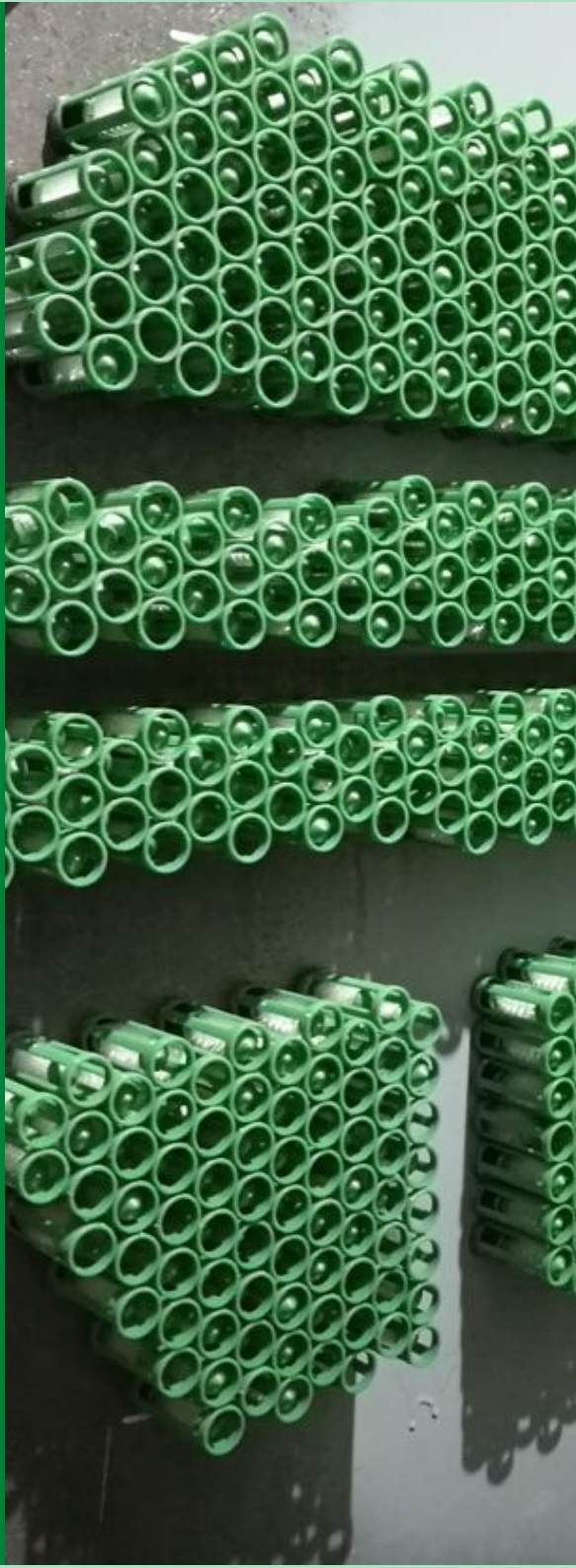
The special design flow reversal valve reverses the flow of the cooling water in the heat exchanger at regular intervals (about every 4 hours) for a short period (7-20 seconds).

Catch baskets with cleaning brushes are installed at all the pipe ends in the heat exchangers. While the heat exchanger is in normal operation, the brushes are in a parking position outside the pipes. During the water reversion cycle, the brushes travel up and down the pipes while removing any fouling or scaling.

The cleaning cycles are initiated from a control panel, which includes a programmable touch screen control panel to initiate and monitor the operations of EQOBRUSH.

The EQOBRUSH components are designed for the lowest possible cross-over flow in the reversing valve (<0.01%) and zero additional pressure drop over the heat exchanger.

EQOBRUSH helps to realize a reduction of the electric energy consumption in kW/RT of chillers of >10% compared to units that are manually cleaned at regular (2-6 month) intervals.



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ROI & RETROFIT

Investments in EQOBRUSH have a high ROI and short Payback period (within two years). Retrofit existing installations to realize economical Energy Saving Targets.
Ask for an **ROI assessment** with your quotation.

EQOBRUSH Benefits

REDUCE SYSTEM DOWNTIME
for (unscheduled) maintenance, repairs and cleaning interruptions.

INCREASE ENERGY EFFICIENCY
and save electricity in chiller operations.

REDUCE WATER CONSUMPTION
through a higher allowable CoC (cycle of concentration) in the cooling water.

REDUCE CHEMICALS
for water treatment and periodical cleaning (including disposal cost.

EXTEND EQUIPMENT LIFESPAN
Corroded and leaking tubes will no longer limit the lifespan of the equipment

INCREASE CAPACITY
through additional heat rejection (allows for non-fouling design of smaller units: reduce CAPEX)

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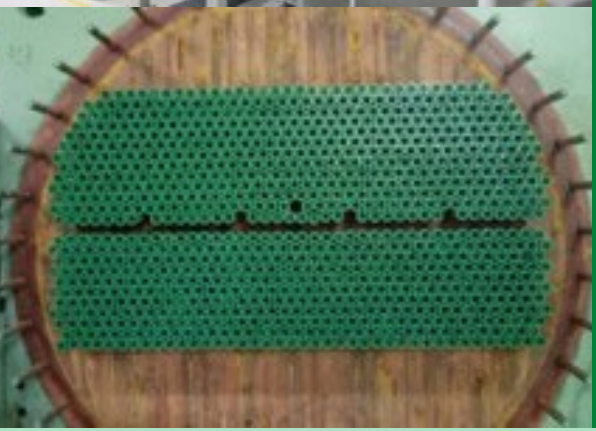
SYSTEM COMPONENTS



The system components are carefully designed and precision tooled to ensure optimal performance, reliability and durability.

The main components are:

1. Brush & Basket sets
2. Flow Reversal Valve
3. Intelligent Actuator
4. Touch Screen Control Panel
5. Remote Performance Monitoring (Optional)

Brush & Basket Sets

Each tube in the heat exchanger will be equipped with a set of one Brush and two Baskets, one at each pipe end. The basket studs are glued in the pipe end using specialized metal cement.

BRUSHES

The standard brushes are made of Rilsan (nylon) with SST316 twisted wire and a PA streamlined end-cap.

BASKETS

The baskets are made of PE and withstand up to 60 °C.
For condensers in HVAC applications, we normally use slim baskets with an end clip.
The brushes are easily replaceable if required.

For industrial heavy-duty applications, sea and brackish water operated heat exchangers, we select a socket type with a demountable basket.

The brushes and baskets are easily demountable for cleaning or brush replacement (life span 3-5 years).

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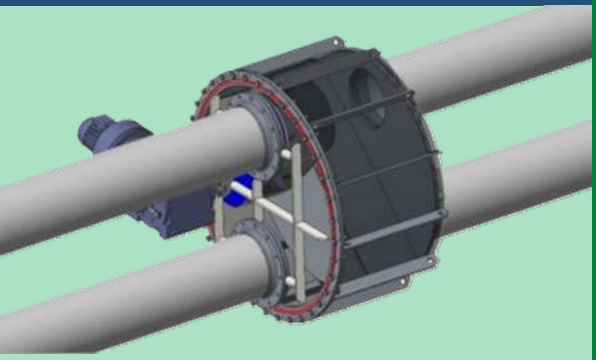
Flow Reversal Valve



The KV FLOW REVERSAL VALVE is available in different materials and variations to suit specific piping layouts.
To initiate a cleaning cycle, the internal pipe (swing box) makes a swing movement of 90 degrees. The valve has a cross-over leak range of < 0.01 %. At a water flow speed of 2.5 m/s through the valve, the pressure resistance in the valve is less than 0.04 bar.

Design Pressures:
PN 6 / PN 10/ PN 16/ PN 25

Flange Standard Options:
DIN / ANSI / JIS / GB
Victaulic or Dresser couplings

Materials:
Body:

- CS-Q245R with optional marine coating.
- CS-Q245R with SST cladding of wet parts.
- SST 304L or SST 316L

Slider rings & seals:
Teflon / POM
Bearing bushels:
Bronze (CuZn)

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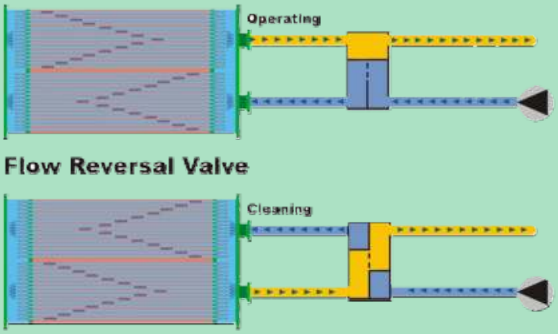
Flow Reversal Valve



Remarks:

Design Standard: according to DIN pressure vessel calculations.

Installation components: A set of compensators (if required) with gaskets, bolts, and nuts, is shipped with each flow reversal valve.

Optional: Engineered piping solutions to minimize piping arrangements or easy integration in existing piping systems.

Max. Allowable Flow:

DN	200	250	300	350	400	450	500	600	700
m3/h	317	495	712	969	1266	1602	1978	2849	3877
ANSI	8"	10"	12"	14"	16"	18"	20"	24"	28"
gpm	1394	2179	3137	4270	5577	7059	8715	12549	17080
Δp					< 0.03 bar - 0.5 psi				

Intelligent Electrical Actuator

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The actuator is a compact, heavy-duty industrial gear reducer with a combination of a worm-gear drive and a bevel piston drive to generate high torque with low power consumption.

Torque monitoring and end-position switches are integrated. Manual operation is possible.

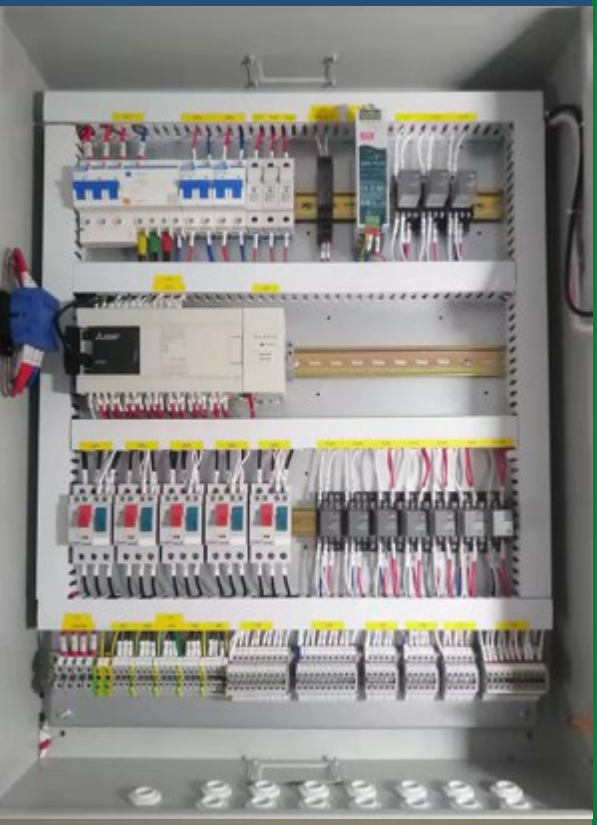
The motors are IP 56 class F motor 0.2 -7.5 kW.
The actuator has a life span of over 30.000 cycles (>10 years of standard EQOBRUSH-operation).

Motor Ratings Actuator:

DN	200	250	300	350	400	450	500	600	700
ANSI	8"	10"	12"	14"	16"	18"	20"	24"	28"
90⁰/turn -sec	8	8	9	9	9	12	12	15	15
Power-kW	0.7	0.7	1.4	2.2	3.7	4.5	4.5	7.5	7.5

The actuator can be manually operated. Also, the dial switch on the actuator can be used to set it to run from the local control on the actuator or via remote control from the control box.

Touch Screen Control Panel



The controls are installed in an IP 55 control panel with the door lock and include:

- Lockable main switch at panel side.
- Power section and display.
- PLC controlled run time control and cycle registration.
- Touch screen setting & monitoring.
- Relays for motor power and function, and power control.
- Option for connections to a process management system.
- Cable connectors.
- Power feed 380-415-440V @50/60Hz.
- Instruction manual for operating staff.

The control panel is highly flexible in its settings for time selection, cleaning intervals, and communication with Manufacturing or Process Management Systems.

Each panel can be equipped to manage 5 Eqobrush systems.

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Remote monitoring is offered as an additional option to EQOBRUSH users.

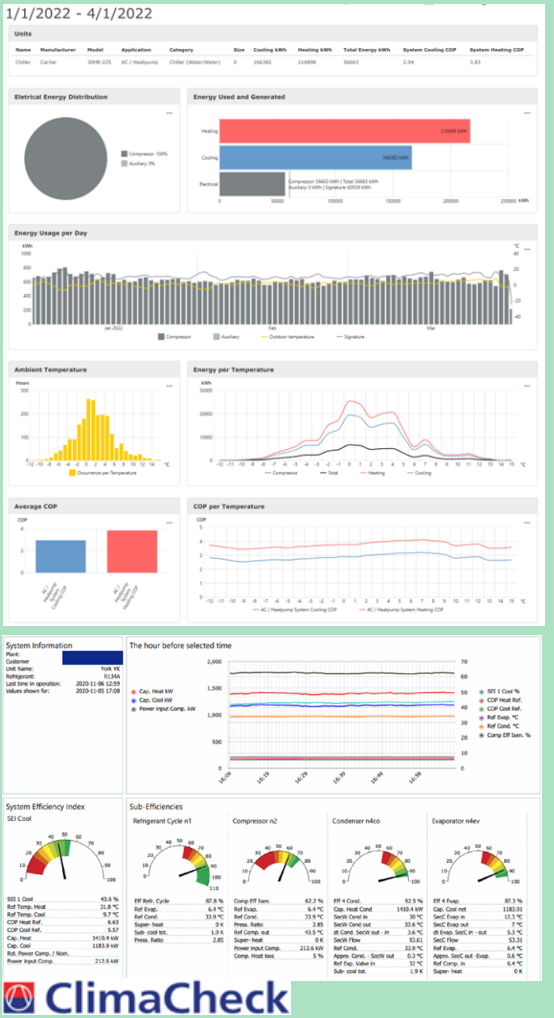
Remote Performance Monitoring

The Chillers are the main energy consumers in your building and Chiller-COP should have priority as a critical KPI for facility and building management.

Modern IoT technology allows relevant Chiller Data to come off the traditional log-sheets, straight into the board room.

Get insight in the efficiency of your chillers as main energy consuming equipment. Heat-load and Electricity use.

Read actionable data from clear screens. Compare different periods and installations.
Get notified on any issues with the equipment.



ClimaCheck

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INSTALLATION

EQOBRUSH accredited staff supervise the installation of the brushes and baskets with special materials and tools in the heat exchanger. This is to warrant the correct placement and long lifetime of the equipment.

Based on the existing or intended project lay-out we propose the best possible solution for valve placement in the system.

Also, we commission the solid operation of the flow reversal valve in wet operating conditions after start-up of the chillers/processes.

The installation of the flow reversal valve and connecting cables (from the panel to the service box on the valve) are not included and should be executed by a local, client appointed, M&E contractor.

The system installation only takes a few days. Our installation manual is available on request.

EQOFLUSH

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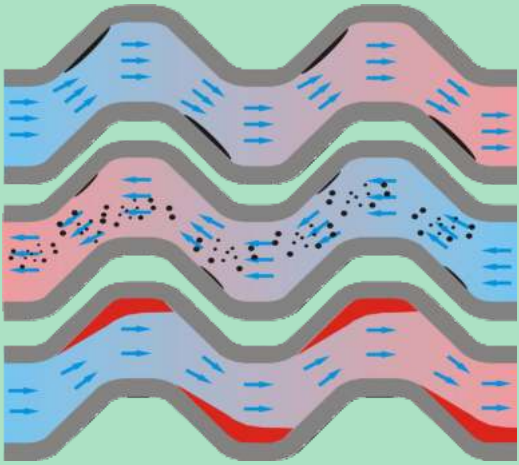
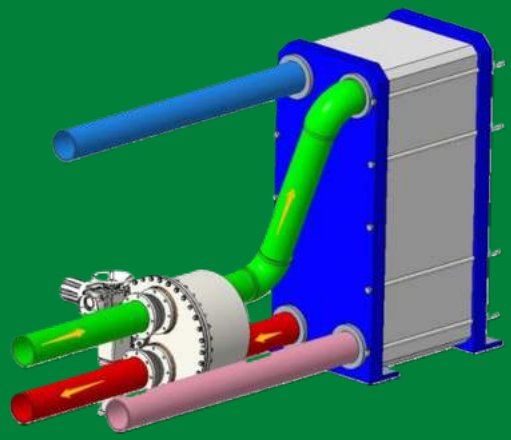
Cooling systems in seasonal areas often include Plate Heat Exchangers: the returning cooling tower water during the cool period is sufficiently cold to absorb the heat from the building water.

PLATE HEAT EXCHANGER APPLICATIONS

Fouling builds up in the direction of the flow and accumulates at the inlet side of the unit. A brief reversal of the cooling water flow flushes out dirt, debris and biological fouling. The cooling channels remain unblocked with maximum flow area.

The Eqoflush backflushing system reduces operating expenses: **extended intervals between cleaning and fewer gasket replacements.**





Fouling Dynamics:

Material accumulates in the low velocity areas

Low velocity is high velocity during backflush. Fouling is washed off.

Without backflush, the buildup will continue until cleaning interruption.

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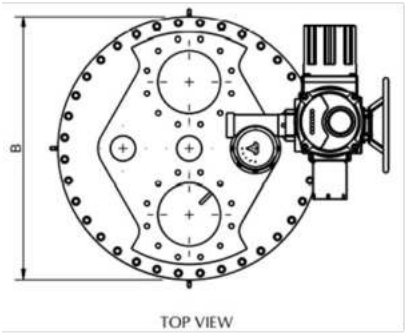
WARRANTY CONDITIONS

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, your system can have an extended operational lifetime during which the accumulated savings will multiply the investment made.
We adhere to ORGALIME S-2022 with the following warranty conditions:

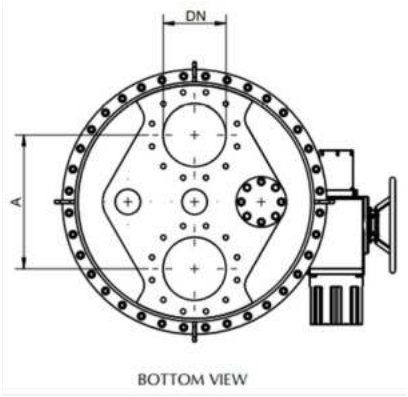
- 12 months on all components. The warranty period is counted from date of start-up or the reported Factory Acceptance Test completion date (+ 6 months); whichever comes first.
- Warranty protects against material defects or deficiency in performance.
- Max allowable flow override excludes warranty claims.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

KV-VALVE SELECTION OPTIONS

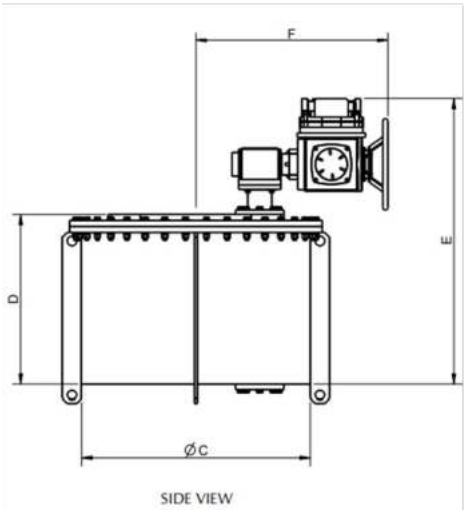
Nominal pressure	Model	DN	A	B	C	D	E	F
1.0MPa - 2.5MPa	KV 200	200	440	890	800	570	920	660
	KV 250	250	30	1050	900	700	1050	770
	KV 300	300	585	1160	1060	800	1200	800
	KV 350	350	780	1480	1300	980	1350	1190
	KV 400	400	880	1680	1500	1080	1550	1230
	KV 450	450	880	1780	1600	1110	1580	1230
	KV 500	500	1060	2080	1900	1280	1650	1350
	KV 600	600	1060	2100	1920	1325	2010	1350



TOP VIEW



BOTTOM VIEW



SIDE VIEW

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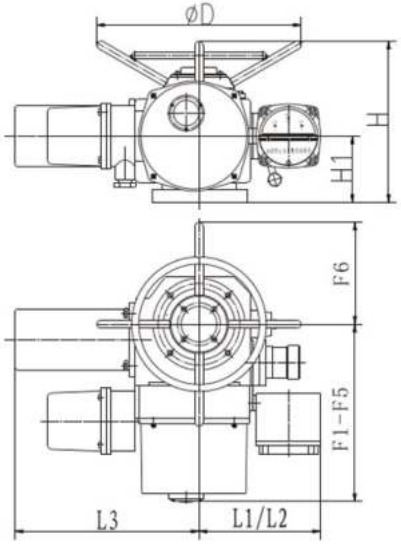
ACTUATOR SELECTION OPTIONS

Model	Applied to: DN	Output torque (Nm)	Nominal thrust force (kN)	Reference weight (kg)	Output Speed (r/min)	Motor power (kW)	Electricity (A)
Z10	80-150	100	40	45	18	0.25	1.3
Z20	200	200	100	63	18	0.37	1.6
Z30	250	300	100	65	18	0.55	2.4
Z45	300	450	150	110	24	1.10	3.4
Z60	350-450	600	150	120	36	2.20	6.5
Z90	500	900	200	139	36	3.00	9.0
Z120	600	1200	200	142	36	4.00	9.0

Protection grade: IP55 for outdoor type and explosion-proof type (IP67 for special orders).

Model	Applied to: DN	H	H1	L1	L2	L3	F1-5	F6	D
Z10	80-150	282	113	150	238	287-392	207	150	300
Z20	200	267	130	197	238	295-400	228	125	400
Z30	250	316	130	200	238	195-400	228	200	400
Z45	300	415	195	277	277	394-544	245	230	460
Z60	350-450	415	195	277	277	394-544	245	230	460
Z90	500	453	195	281	281	412-562	277	278	556
Z120	600	453	195	281	281	412-562	277	278	556



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SCOPE OF SUPPLY

Description	Engineering	Supply	Installation
Cleaning Brushes	EQOBRUSH	EQOBRUSH	⚙
Catch Baskets	EQOBRUSH	EQOBRUSH	⚙
Metal Putty	EQOBRUSH	EQOBRUSH	⚙
Installation Tools for B&B	EQOBRUSH	EQOBRUSH	⚙
Flow Reversal Valve	EQOBRUSH	EQOBRUSH	⚙
Valve support	EQOBRUSH	🧍	⚙
Compensators (if required)	EQOBRUSH	EQOBRUSH	⚙
Electrical Actuator	EQOBRUSH	EQOBRUSH	⚙
Control Panel	EQOBRUSH	EQOBRUSH	⚙
Connection cables Panel to Actuator	⚙	🧍	⚙
Power connections	⚙	⚙	⚙
Cable glands	⚙	🧍	⚙
Project Supervision during installation and commissioning	EQOBRUSH	EQOBRUSH	EQOBRUSH

EQOBRUSH **WATCO / EQOBRUSH**

🧍 **Local Purchase by Client**

⚙ **Local client appointed M&E contractor**

WATCO CREDENTIALS

We are active in the engineering and installation of Automatic Tube Brushing Systems since 1982. Netherlands owned WATCO is a Singapore-registered company with an engineering, procurement and sales basis in Guangzhou (China).

- SGBC-leader
- Member of Guangzhou Energy Saving Association
- Recognized energy saving product of Guangdong province (China)
- ISO 9001, 14001 certified
- Patented designs (Swingbox flow reversal valve)

SINGAPORE GREEN BUILDING PRODUCT SGBC LEADER

SGBP 2018-1701

CERTIFIED ISO 9001:2015 COMPANY

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