

WATER TREATMENT SYSTEM

SCAM/SWT-2, SCAM/SWT2-PLUS AND SCAM/ SA

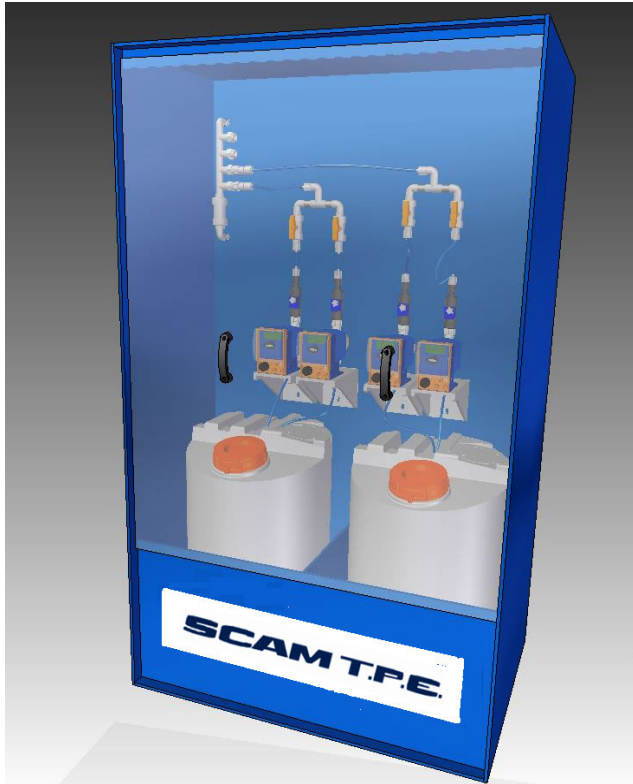


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1. SCOPE OF SUPPLY

Sometimes the water consumption into an operating cooling tower has a significant impact and it is determined by: evaporated water + dragged water (through the drift eliminators, but normally lower than 0.002% of the circulating tower water) + purge water (based on the concentration cycles). The consumed water is periodically re-integrated. The water level in the collecting basin is controlled by an automatic make-up floating valve (SCAM/VL), which can be supplied upon request. As explained water consumption increases water salinity. This entails the opening of a purge valve at regular intervals to restore the correct salts concentration of the solution. At the same time, the following measures are carried out:

- an anti-scaling product (paragraph 3.2) in proportion to the volume of re-integrated water in the circuit in order to prevent the precipitation of dissolved salts;
- a biocide product (paragraph 3.3) through a timed method in proportion to the volume of water in the circuit by regular shocks dosages to prevent the proliferation of micro-organisms within the system.

Water treatment system SCAM/ SWT2 consists of a skid which incorporates a device that measures the water conductivity SCAM WATER CONTROL 2 (SCAM/ WCNT2) and automatic purge control, pH measurement system and dosing pumps, which are redundant to keep system operative in case of pump failure. The system has the following components:

- No. 1 HDPE support skid (approx. size 1000x1250xh2000mm and weight 280 kg) to be installed on the ground, complete with No. 2 PVC transparent protection panels that can be opened (front and back sides). The skid houses pumps, instrumentation, valves & fittings and plastic tubes. The components are installed on both sides of the skid to optimize space usage;
- No. 1 anti-scaling dosage system with two electromagnetic pumps (one on stand-by) complete with a tank aspiration set and water meter (to be installed on the tower water make-up) and minimum level switch to block the pumps in absence of chemical product (low level). A local mechanical switch is installed to select stand-by and operating pumps for the dosage of the specific chemical product;
- No. 1 biocide dosage system with two electromagnetic pumps (one on stand-by) complete with a tank aspiration set and a minimum level switch to block the pumps in absence of chemical product (low level). A local mechanical switch is installed to select stand-by and operating pumps for the dosage of the specific chemical product;

- No. 2 storage tanks (biocide and anti-scaling) made of HDPE having a volume capacity of 140 lt each, housed in support skid and with predisposition for products inlet;
- No. 1 hydraulic set (PVC piping, manual interception valves, Y filter, sample taking point, manometer, no-return valve) and connections for analysis sensors;
- No. 1 measuring system SCAM/ WCNT2 having a pH and conductivity analysis sensor to control an automatic motorised valve for purge in relation to the tower water conductivity. SCAM/WCNT2 has the predisposition to provide the corrosive detectors for specific metals and RedOX reactions (included in SCAM/SWT2-PLUS system);
- No. 1 power supply panel endowed with thermo magnetic protection;
- No. 1 spherical 2-way electrical valve (purge);
- No. 1 dosage control system for each couple of pumps through a Flow-control device and back-pressure valves with predisposition for connections for the corrosion measuring sensors on copper and zinc (materials that are usually used for tower circuit piping and heat exchangers (users));

The water treatment system can be managed onsite (for example, dosing pumps control and selector for each pair of pumps). Instead some signals can be visualized and monitored remotely through SCAM/ TRACKSTER software that was purposely studied in order to create graphic telecontrol functions for SCAM/ WCNT2 device.

SCAM T.P.E. S.r.l. offers the possibility to implement additional (RedOX and corrosion) sensors on the above water treatment system that becomes SCAM/SWT2-PLUS, should it be necessary to control the pH of the water in the system in order to monitor the water corrosive action in the tower circuit. SCAM/ SWT2 system already includes wells for housing these (additional) sensors whose signals are managed by SCAM/ WCNT2. In addition, SCAM/ SWT2-PLUS system can also include, upon request:

- No. 1 measuring sensor for RedOX reactions;
- No. 2 corrosion sensors for Copper and Zinc respectively;

In the end, SCAM T.P.E. S.r.l. can supply an additional SCAM/ SA skid composed by:

- No. 1 "stand-alone" SCAM/ SA hanging unit equipped with a transparent door with two parallel dosing pumps (one pump is on stand-by) to be

installed on the wall for the dosage of sulphuric acid with a 98% p/p concentration controlled by pH reading of tower water solution.

The said skid in HDPE includes dosage and interception lines in PVDF for the air / water purification; and even spherical sectioning valves inlet and outlet to the electromagnetic dosage pumps. The feeding pumps contain counter pressure security valves together with an overflow sensor to be connected to the SCAM/ WCNT2 device. The electrical wiring on the SCAM/ SA skid is available, with predisposition for external connections.

2. SYSTEM FUNCTIONALITY

As shown in the figure below, in the SWT2 system water coming from tower circuit spillage (pos. 1) flows through a manual interception valve. It immediately meets a Y-filter that stops any eventual impurities and then enters the hydraulic section, where various detection sensors of SWT2 are installed, such as conductometer, pH probe, optionally RedOX and corrosion sensors for SCAM/ SWT2-PLUS system (pos. 2).

The conductivity sensor, including a compensation temperature sensor, measures the conductivity value of the circulating water and matches it with the set value determined by the user (set-point). If the measurement overcomes the set-point, the panel controls the solenoid opening in order to drain the saturated water (pos. 3). As an option, the readings of the values by pH, corrosion and RedOX sensors can be collected and eventually managed. pH signal can be elaborated by SCAM/ WCNT2 device that transmits it to SCAM/ SA skid (if requested), which doses the required quantity of acid to correct tower water pH in accordance with the set-point determined by the user.

In SCAM/ SWT2 system, water coming from "measuring sensors" section flows through a sample taking zone and a no-return valve before meeting the chemical products injection section (pos. 4). Then it is introduced once again in the recirculation circuit of the evaporating tower (pos. 5).

The two available dosage pumps (one of which is on stand-by. Redundancy ensures dosage continuity in case the other pump doesn't work) are positioned on the system support panel to carry out:

- 1) the anti-scaling dosage (inhibitor);
- 2) the biocide dosage;

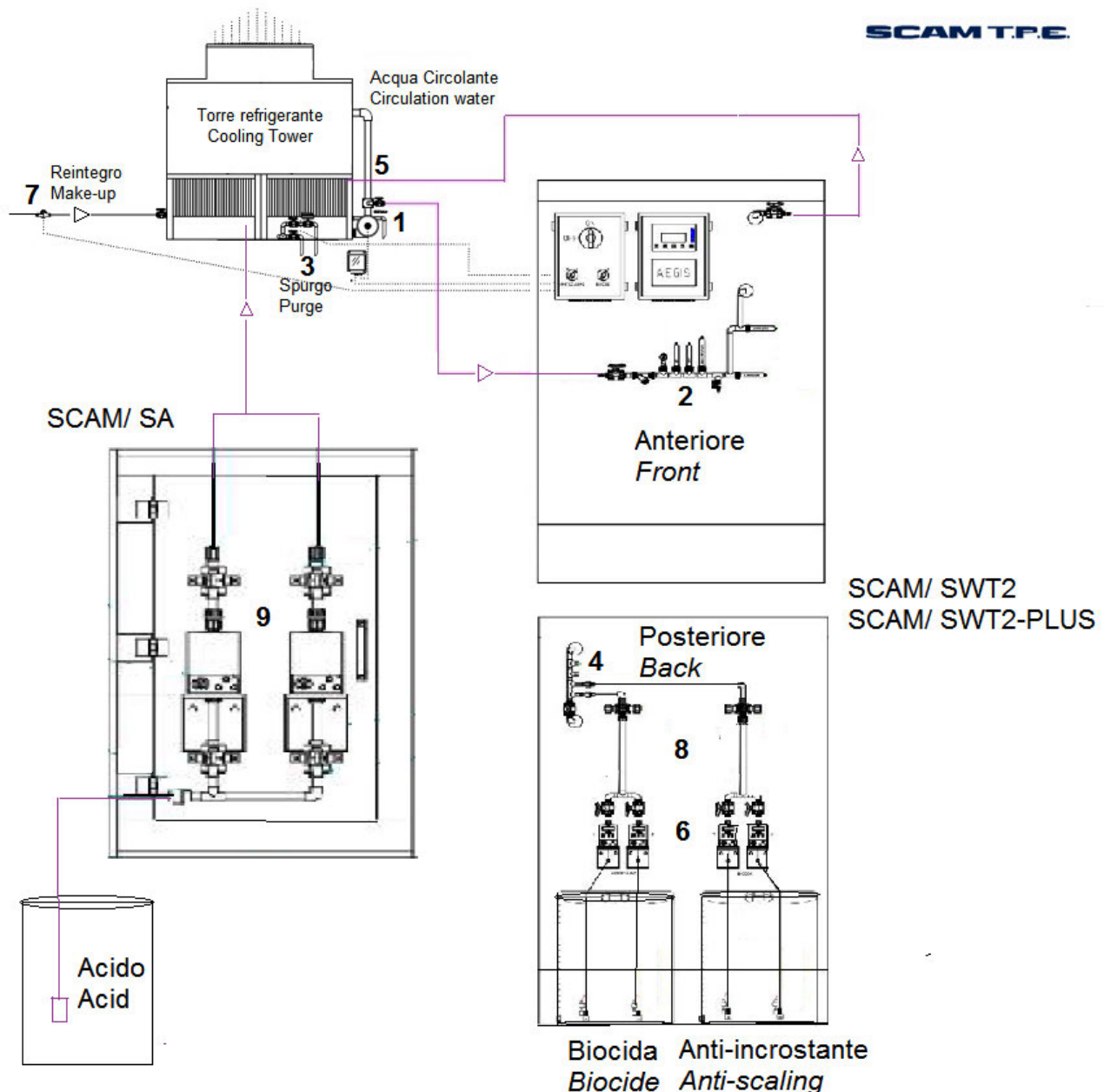


Figure 1 – Schematic drawing of water treatment

The membrane electromagnetic SCAM/PVT200-B pump, injects the biocide (pos. 6) periodically, and can be locally programmed through its own internal timer to enable the product to flow into the circuit in accordance to the desired quantities.

The membrane electromagnetic SCAM/PVT200-B pump injects (pos. 6) the anti-scaling / corrosion inhibiting product in proportion to the replenished water volume in accordance to the impulses received from the water meter (pos. 7) to be installed on the tower water replenishing line.

Dosing pumps are programmable onsite. The pumps are built in plastic material, suitable for contact with the chemical products to be injected in the tower water circuit.

At the bottom of each pump is placed a flow control device (pos. 8), which checks the single pump strokes, in order to send a warning signal when the dosed flow is approximately 20% lower than the set-point.

The optional SCAM/ SA skid for the sulphuric acid dosage is positioned on an independent panel and it can be supplied electrically and mechanically installed by the client, who has to wire it through SCAM/ SWT2 skid in order to receive pH signal. According to this, pump (pos. 9) will dose concentrated sulphuric acid to correct alkalinity of the circulating water.

The offer does not include neither storage tank nor the chemical product for SCAM/SA skid, but inlet and outlet connections are pre-installed.

3. SYSTEM COMPONENTS

The monoblock skid for purge control and chemical products dosage SCAM/ SWT-2 PLUS is composed by the components indicated in figure 2 (also valid for the SCAM/ SWT 2 skid excluding unexpected components).

SCAM/ SWT2-PLUS skid has approx. size of 1100 x 1250 x 2000h mm and it does not need to be anchored on wall, but it can be positioned on the ground (anchoring has to be done by the client). Flanged flow meter ISO for make-up line and a purge solenoid are included and these have to be hydraulically mounted on the installation and electrically wired to SCAM/ SWT-2 switchboard by the client. Purge valve does not include electrical connection cables, but conductivity sensor and dosing pumps are already pre-cabled on the skid, that the client will have to electrically supply. The water meter is endowed with a 3 mt signal cable that can be extended, if required, by customer.

Pos.	Description
1	Power supply / isolation switchboard with magnetermic switch
2	Control instrument SCAM/ WCNT2
3	Biocide dosing pumps
4	Anti-scaling dosing pumps
5	Water inlet DN 20
6	PVC spherical valve
7	Y-Filter
8	Manometer
9	Conductivity sensor mod. LMT1
10	pH measuring sensor
11	RedOX measuring sensor
12	Corrosion sensor for Zinc LPR
13	Corrosion sensor for Copper LPR
14	Sample socket / No-back valve
15	Anti-scaling dosage valve, flow meter and back-pressure valve
16	Biocide dosage valve, flow meter and back-pressure valve
17	Water outlet DN 20
18	Suction set for the inhibitor tank
19	Suction set for the biocide tank
20	Anti-scaling tank 140 Lt
21	Biocide tank 140 Lt
22	Skid in HDPE (RAL 5012) with a protective screen (PVC) on A + B sides
23	Make-up water meter
24	Motorised purge valve

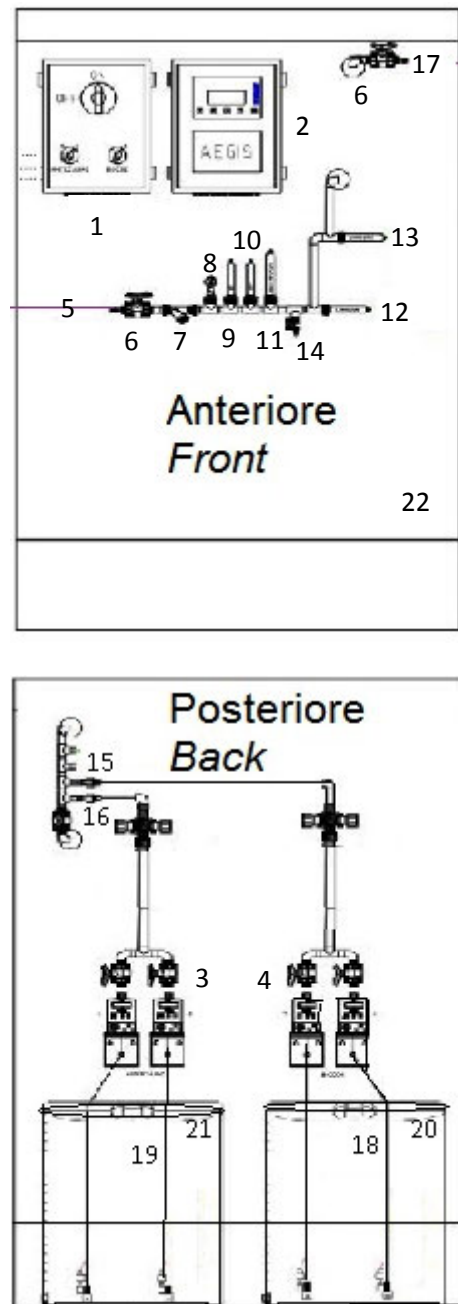


Figure 2 – Components for the SCAM/ SWT2-PLUS system

Monoblock skid SCAM/SA for the tower water pH control through acid sulphuric dosage at 98% is composed by the components in figure 3. The preliminary dimensions of the skid are 1000 x 600 x 1500 h mm.

Pos.	Description
25	Power supply panel
26	Isolation spherical valves
27	Product loss sensor (to be connected to SCAM/ WCNT2 control device)
28	Air/water interception line for piping cleaning-up
29	Safety back-pressure valves
30	Skid in HDPE for wall installation with a protective plastic door

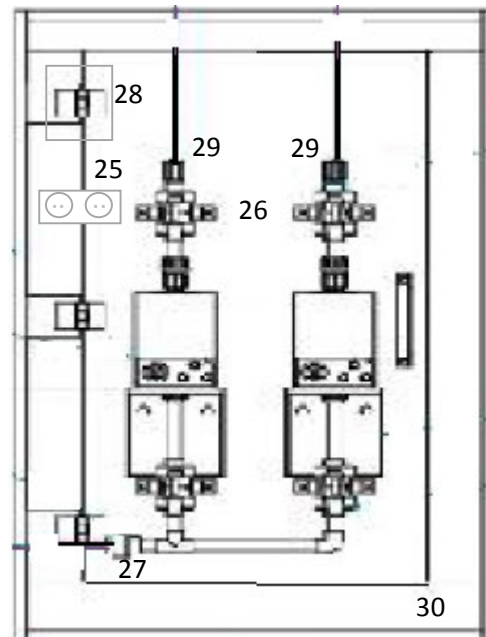


Figure 3 – Components for SCAM / SA system.

3.1. MEASURING INSTRUMENTS

In SCAM/ SWT2 system, the electronic measuring and control instrument, SCAM WCNT2, is purposely dedicated to the tower water chemical treatment. It includes a NEMA 4x certified tough casing and a LCD display having 2 retro-illuminated lines and polycarbonate keyboard. The device entails the conductivity measurement by a conductive sensor through a 4÷20 mA signal that automatically activates a two-way purge solenoid (IP67, 230V-50/60Hz with threaded ends). In addition, SCAM/ WCNT2 can also be connected to the pH sensor and, in the case of SCAM/ SWT2-PLUS, this can also be connected to the RedOX sensors and to Copper and Zinc corrosion ones (clean contacts). A LCD indicator allows the visualisation of the process signal value and its various parameters. Supervision interface are Ethernet and Modbus ones, and the device has different management programmes and functionalities for the dosage.



SCAM/ WCNT2 MEASUREMENT AND CONTROL DEVICE	
Measuring range	0,0...500/2000/5000 μ S/cm 20 mS/cm
Cell constant	0,006...12 cm ⁻¹
Accuracy	0.5% of the measuring range
Resolution	0.0625% of the measuring range
External dimensions	190x287x140H mm
Protection class	IP65 (for high humidity environments)
Installation type	On wall
Display type	LCD retro-illumination
Supply	230VAC / 50/60Hz



THERMO COMPENSATING CONDUCTIBILITY SENSOR	
Measuring scale	100...8000 μ S
Temperature sensor	Pt100
Max. Temperature	70°C
Max. Pressure	16 bar (@ 50°C)
Body / electrodes materials	Steel 1.4571 / PVC



pH ELECTRODE	
Measuring scale	1...12 pH
Temperature	0...60°C
Max. Pressure	3 bar
Min. Conductivity	> 150 μ S
Diaphragm	1 ceramic set
Dimensions	12 x 120 mm
Std connection	PG 13.5



CORROSION SENSORS	
Measurement technique	LPR
Operating tension	10 mV
Electrodes metal	ZN-Cu

REDOX ELECTRODE	
Measuring scale	-1000...+1000 mV
Temperature	0...60°C
Max. Pressure	3 bar
Min. Conductivity	> 150 μ S
Diaphragm	1 ceramic set
Dimensions	12 x 120 mm
Std connection	PG 13.5

PURGE ELECTRICAL VALVE	
Connection	ISO 5211 brass
Max. Diff. Press.	25 bar
Operating timeframe:	35 sec / 90°

Figure 4 - SCAM/ WCNT2 device, measurement sensors and purge electrical valve

3.2. INHIBITOR DOSAGE (ANTI-SCALING) THROUGH A PROPORTIONAL METHOD COMBINED WITH A WATER METER AND BIOCIDES TIMED DOSAGE.

SCAM/ SWT2 and SCAM/ SWT2-PLUS systems include:

- a couple of SCAM/ PVT200UA electromagnetic membrane dosage **pumps** for anti-scaling dosage, including a cast iron turbine water meter for cold water equipped with impulsive reed-switch exit for the water volume measurement on a local panel mounted on a protective frame;
- a couple of SCAM/ PVT200 electromagnetic membrane dosage **pumps** for biocide dosage with an internal timer.

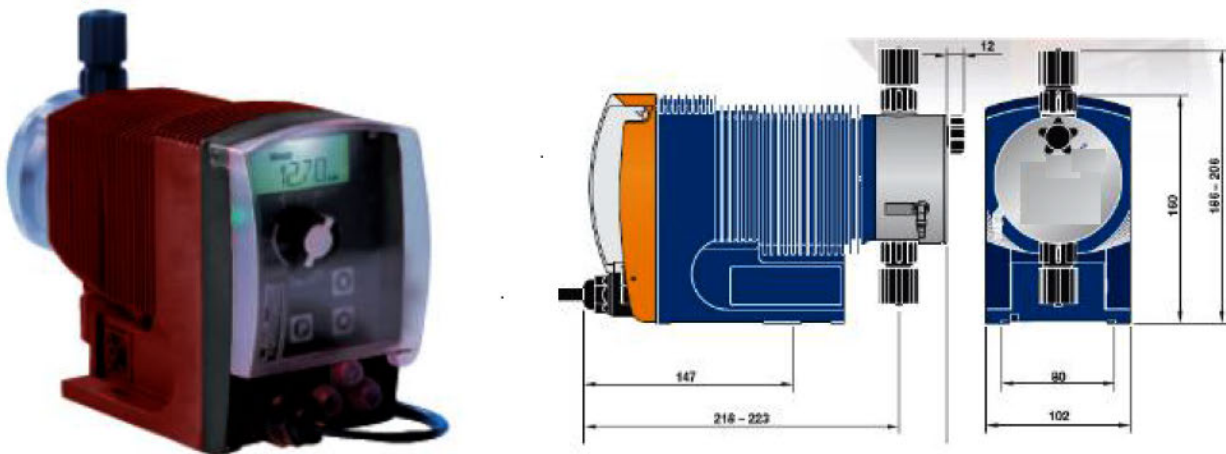


Figure 5 – Membrane dosage pumps for the dosage of chemical products.

Each membrane magnetic dosage pump is controlled by a microprocessor for liquid dosage. Flow rate can be manually modified during the process by means of a spinning knob from 100 to 0% as well as the frequency by means of a key switch, from 180 cycles/min in the range 1:180. Each pump has a large liquid crystal display, retro-illuminated, having a good readability even during unfavourable conditions.

The pump is manually controlled, by impulses (with the possibility to set-up multiplier/divider) or through an electronic signal 4...20 mA. With reference to the electronic command, the pump allows the operator to set up two points along the growing straight line within the range: an increase in mA signal corresponds to an increase in the pump frequency (and consequently flow rate). The electric connection has an universal tension ranging from 100 to 230 V, 50/60 Hz, with a tolerance of $\pm 10\%$. The dosage pumps have been tested

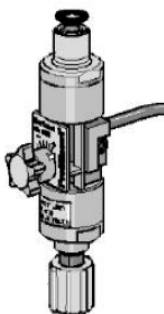
by TÜV-GS and admitted in accordance with the regulation DIN-VDE 0700 having a schematic B class in accordance with regulation DIN-VDE 0871.

Supply tension: 100... 230 V ac – Single phase - 50/60 Hz ±10% IP65				
Max. loading	2 - 20	l/h	Max. Pressure	16 bar g.
Max./Min. temperature	-10°C...+45°C		Connections:	Hose 6 x 4
Dosage frequency	0 -180 injections/minute		Dosage per impulse	0.33 mL at 100%
Process regulation:	Manual 30-100%		Intake height: 6 mt	
Note: power cable EU plug (2 metres), head manual breather.				
Materials in contact with the liquid				
Head body:	PVDF	Diaphragm:	PTFE	
Valves:	PVDF in ceramic	Content:	PTFE	
Dosed liquid	ANTISCALING AND BIOCIDES IN WATER SOLUTION			

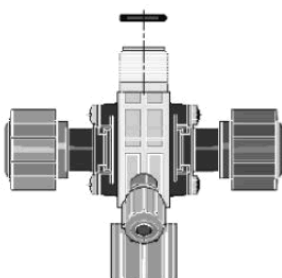


WATER METER FOR WATER REPLENISH	
Connection type	Flanged
Nominal capacity	78 mc/h with DP 40 mbar
Maximum capacity	78 mc/h
Minimum capacity	0.5 mc/h
Maximum pressure	16 bar g
Maximum temperature	50°C
Impulse interval	100 lit
Reed cable length	3 mt

Figure 6 – Technical data of the dosage pumps and water meter.



On inlet each pair of pumps has a “Flow Control” device to control the single strokes in accordance with the suspended body principle. The partial flow of dosed product passing in front of the suspended body is regulated in accordance to the flow volume determined on case-by-case basis. When the flow decreases of approximately 20% a malfunction warning appears. The flow measure device is made of PVDF, the suspension body is coated by PTFE meanwhile the gaskets can be made of Viton B or EPDM.



In conclusion, each pair of pumps houses a SCAM/ MFV multifunction valve to maintain a constant back-pressure

of 1.5 bar in the dosage conduit in order to guarantee the correct skid functionality.

Back-pressure can be temporarily reduced to zero through the relative knob. The valve also acts as a by-pass with opening at 6, 10 or 16 bar; and even the by-pass can be temporarily opened manually through the relative knob. The valve body is made of PVDF while its membrane has a PTFE coating and gaskets in Viton B or EPDM.

Safety opening pressure: 6 bar

Connection dimensions: 6 - 12 mm

By-pass connection: 12x9 mm

4. CHEMICAL PRODUCTS DOSAGE

Suggested chemical products for dosage into water tower circuit are respectively: a biocide and an anti-scaling, and eventually acid for the pH correction, whose dosage depends on the water quality (chemical and biological characteristics) and on specific processing parameters. To ensure the best performance of the cooling tower in accordance to the specific operational conditions of the system, it is necessary to refer to the company providing the chemical products who remains entirely responsible for the treatment programme.

5. LIMITATIONS

The supply limitations for SCAM/ SWT2, SCAM/ SWT2-PLUS and SCAM/ SA are the following ones:

- Flanges on inlet and outlet pipe of each skid
- Terminal glands on the cabinet of each skid
- The flanges of the water meter and of purge valve
- The electrical contacts of the water meter and of purge valve

EXCLUSIONS FROM SCOPE OF SUPPLY

- First supply of chemical products.
- Arrangement and installation of all components onsite.
- Wiring of the supply connections and of electrical signals.
- Electrical cables of the purge valve and of water meter.

6. DOCUMENTATION

The documentation, which will be provided to the client, includes user and maintenance manual regarding instruments and dosage pumps.

7. WARRANTY

The contractual warranty starts from materials availability and it lasts 24 months for all electrical parts and 12 months for hydraulic parts.

Damages due to force majeure are excluded from warranty as well as damages against third parties and/or suppliers. The warranty does not include transport costs and supervision / workforce onsite.