Ultravalve

Water Treatment Systems

"Pulsar"

Water conditioners and Descalers

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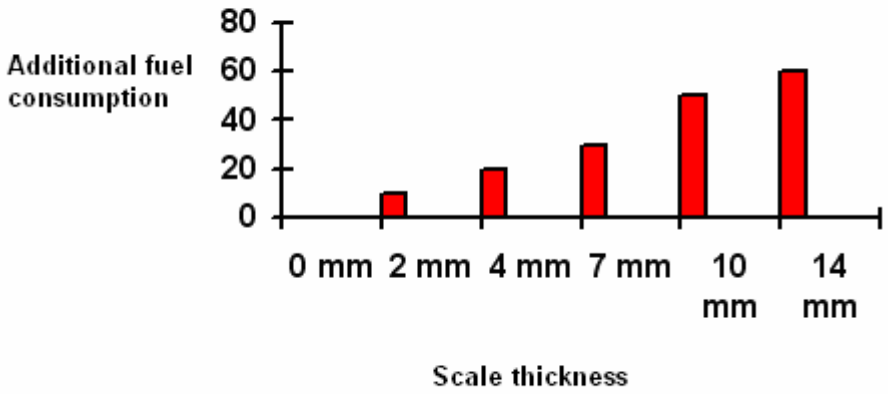
Contents

1. Introduction

Every year, huge amounts of money is wasted trying to prevent limescale build-ups that cause damage to plants and loss of energy, time and productivity. In some areas, water is “hard” as it contains dissolved ions of calcium and magnesium (hard salts) in a variable quantities. The hardness of water is measured in ppm (parts per million) or in hardness degrees (either French or German). When hard water is heated, hard salts precipitate in the form of crystals which bond together and attach to the surface of metalware, pipes, electric resistances, etc. causing deposits of limescale.
To explain the severity of the scale build-up problem, let’s consider that calcium salts are excellent insulators and they drastically reduce the thermal efficiency of machines, a very common situation that is better depicted by the following diagram:



A final solution to this problem has been searched for years and several devices have been developed which work on the following principles:

a) ion exchange with resins
b) reverse osmosis
c) evaporation
d) magnetic phenomena
e) chemical phenomena

While each one of the above systems has been able to either solve or alleviate the problems of limescale, all of them have generated side effects such as:

- high equipment costs
- high working costs
- poor results
- need for chemical products

2. The potentials and characteristics of Pulsar

As we are going to see, the potentials and characteristics of the Pulsar system provide more than a purely descaling action. If special installation methods are applied and suitable elements are added, they can solve problems other than scale deposits. Nevertheless, the main function of our system is that of a **WATER CONDITIONER AND DESCALER** for industrial and domestic use, whose main characteristics are:

a) It prevents the formation of scale even at a temperature of about 55 to 60°C

b) It keeps the properties of the water unaltered;

c) it preserves descaling properties over the time (approx. 25 days, according to laboratory tests);

d) it preserves its effects even at a distance (hundreds/thousands of metres) from the treating unit;

e) it eliminates the need for resins, chemical additives and other systems;

f) it gradually removes scale deposits from the pipe;

g) it allows the saving of energy proportional to the amount of scale that is prevented or removed from any hot-water fed systems;

h) it allows the reduction in the consumption of surface-active and softener products by around 20% in hard water up to 25° F and by more than 40% in harder water;

i) it helps to preserve the purity of water and avoid the proliferation of bacteria due to resins and limescale deposits, and

j) it minimises maintenance and working costs due to scale build-up and pipe corrosion;

3. The working method and operating principle

The Pulsar descaler is a low-voltage electrophysical descaler that alleviates the problems of calcium-carbonate salts in the water.

The scientific mechanism that prevents the formation of solid calcium-carbonate salts is quite complex and is based on electro-magnetic phenomena.

The descaler is composed of a feeder, that is basically made up of an obligate sequential-rephasing transformer supervising the whole system and an actual descaler composed of an AISI 316 L steel pipe where the water to be treated is made to flow. A number of coils connected in pairs and acting in couter-phase are wound around the pipe so that the signal generated by the transformer is amplified and received correctly.

The electromagnetic fields generated by the coils with a frequency of 0.5 to 5 MHz produce radio waves whose electric fields change at the same frequency of the magnetic fields.

The descaling effect of our systems basically depends on electric fields. The water contains calcium-carbonate colloids that grow rapidly at the same time as bicarbonate ions decompose and attach to the inner walls of the pipe in the form of crystallisation germs of rhombohedral calcite. These are compact and extremely adhesive and over the time they assume all the characteristics of limescale build-ups.

If however, the water is subject to the electromagnetic fields produced by the coils, the colloidal particles of calcium carbonate remain in suspension although they continue to grow, and they turn into crystalline germs of rhombic aragonite that is amorphous and poorly adhesive. While calcium carbonate is still present in the water (i.e. the chemical composition of water does not change), its crystalline structure is different from calcite and also its adhesive properties are different.

In summary, if the paracolloidal particles of calcium carbonate, which are charged by ionic adsorbance, are subject to the electric action of radio waves, they stop growing with the rhombohedral structure of calcite, but bond together in the typical rhombic structure of aragonite and remain in suspension.

The flowing of water easily removes the crystallisation germs as soon as they arise, starting from the primitive suspended particles. If the water remain motionless and temperature is sufficiently high, they can generate a thin layer of aragonite, which however is brittle and easy to remove.

The secondary effect of our system is to slowly remove old scale. As we have already mentioned, no limescale deposit arises in the water treated with the Pulsar descaler, because rhombohedral calcite is turned into rhombic aragonite. However, if there is old scale build-up on the inner wall of the pipe, it may crack over the time especially when water temperature changes.

If no W.T.S. treatment of water is provided, limescale cracks may refill quickly with new calcite deposits whose crystallographic structure is compatible and add to the old scale deposits. If conversely the water is treated by a Pulsar descaler, not only does calcium carbonate remain in suspension, but also the rhombic crystalline structure of suspended aragonite crystals is fully different from the rhombohedral structure of calcite. In other words, even if some scale deposits arise, they cannot refill the old limescale cracks because their crystallographic structures are incompatible.

Under these circumstances, the old limescale cracks continue to enlarge until the scale layer disaggregates progressively.

4. The advantages of Pulsar

For all the above reasons, the Pulsar descaler provides significant continuity and efficiency, even if the flow-rate of water changes. What follows is a comparison of similar commercial equipment:

- Permanent magnet equipment works in strict dependance of Lenz's law, so it can hardly adapt to flow-rate changes. Moreover, its operation is strongly affected by the iron contents of the water.
- The softeners that work on ion exchange with resins have a flow rate that depends on the range of the ionic exchanger and the regeneration rate of resins. The water treated this way changes its chemical composition and there is serious risk of bacteriological proliferation. Also, working and maintenance costs are very high.
- Polyphosphate equipment has a capacity that depends on the quantity of water to be treated and the polyphosphates available. Italian law no. 443/90 imposes strict regulation on the use of polyphosphates for drinking waters.
- Electrostatic equipment may be affected negatively by the pH-value and heat conditions of the water.
- Reverse osmosis equipment turns treated water into demineralised water with a very low efficiency and very high operating costs.

5. Applications

As mentioned above, the characteristics of Pulsar make its use extremely versatile. In particular, when applied to any type of plant, it allows remarkable saving of money and energy owing to the following factors:

a) when used for aqueducts, **it prevents the formation of scale deposits on pipes**, preserves the good working condition of the pipe and progressively removes old scale deposits;

b) It inhibits scale formation on electric resistances, therefore the energy consumption of household appliances and in general of all water-fed electrical apparatus remains at their rated value and **their efficiency is unchanged over the time**;

c) **it reduces the fuel consumption** of heat power stations: heat exchange is optimised due to the absence of any insulating layer composed of scale on the surfaces of pipes and heat-exchangers;

c) **it prevents the formation of scale deposits** on taps, cutlery and dishes, therefore it avoids the use of softening and descaling products;

e) it allows the **removal of resin circuits** from the equipment where they may be installed;

f) **it decreases the need for maintenance** of thermal plants, including unscheduled stoppages and break-downs caused by limescale deposits.

What follows is a list of possible applications for Pulsar:

- Aqueducts
- Agriculture
- Hotels
- Houses
- Wastewater disposal
- Food industry
- Tan industry
- Electronic industry
- Pharmaceutical industry
- Steelmaking industry
- Plastic moulding industry
- Textile industry
- Fish culture
- Mechanical industry
- Hospitals and clinics
- Heat exchangers
- Evaporating towers
- Fractionating towers

Basically, wherever a scale deposit problem arises, the Pulsar descaler can be installed and it produces results that are still unachievable with traditional systems.

In particular, any cost/benefit analysis should start from an assessment of the many problems that can be solved. In almost all cases, the investment can be amortised with the resulting savings in a generally very short period.

6. Product ranges

The Pulsar descaler by W.T.S. can be produced with the following configurations:

"PULSAR" DESCALER FOR INDUSTRY

The following product ranges can be applied to industrial uses, because engineering makes them suitable to critical conditions (for example, heat ranges from 0 to 90 °C). In addition, they incorporate a self-diagnostic mechanism that checks the correct function of the descaler from the profile of the generated resonance.

Model	**Cross section** (inch)	**Length** (mm)	**Weight** (Kg)	**Max flow rate** (lt/min.)	**Power** (Watt/h)
0112FI	1" 1/2	500	9,8	200	175
0200FI	2"	700	15,7	350	205
0212FL	2" 1/2	900	20,2	550	210
0300FL	3"	1000	25,6	800	227
0400 FL	4"	1000	29,6	1400	248

The above range of products can be extended on demand.

"PULSAR" DESCALER FOR THE HOME

The second range of products is designed for the home. Although they have the same characteristics of reliability and duration as the industrial products, these products are designed for small flow-rate plants in less aggressive environmental conditions (e.g. a thermal range of 0 to 50 °C).

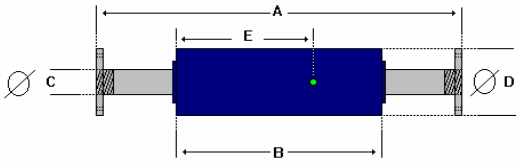
This range of product includes:

Model	**Cross section** (inch)	**Length** (mm)	**Weight** (Kg)	**Max flow rate** (lt/min.)	**Power** (Watt/h)
0018L	1/2"	250	1,35	22	22
0021FI	1/2"	250	1,35	22	35
0034 FI	3/4"	300	1,5	50	44
0100 FI	1"	500	7,5	90	61
0104 FI	1"1/4	500	7,5	130	63

7. Construction properties and dimensions

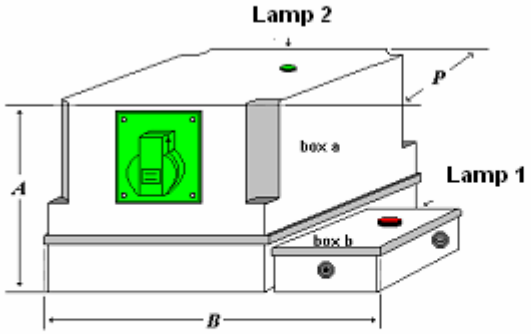
A typical Pulsar descaler is composed of two parts:

a) a pipe in AISI 316 L steel tested under 30 atm or in PVC beyond the 4" for food use PN10/16 that is wound by coils of a suitable dimension, connected to a diode of a given power. The pipe is completed with either threaded or flanged connections according its size and type. The models for industrial use are also equipped with a self-diagnostic mechanism that checks the correct function of the equipment from the profile of the resonance generated;



Mod.		∅	A	B	D	Notes
0018 L	1/2"	18	250	150	63	Smooth pipe
0021 FI	1/2"	21	250	150	63	Threaded for gas ½ "
0034 FI	3/4"	27	300	220	80	Threaded for gas ¾ "
0100 FI	1"	34	500	280	100	Threaded for gas 1"
0104 FI	1"1/4	42	500	280	100	Threaded for gas 1"¼
0112 FI	1"1/2	49	600	320	125	" " 1"½
0200 FI	2"	60	700	420	125	" " 2"
0212 FL	2"1/2	78	900	420	160	PN 16 flange - 4 holes
0300 FL	3"	89	1000	420	160	PN 16 flange - 8 holes
0400 FL	4"	114	1000	420	200	PN 16 flange - 8 holes
N.B. all measures in mm.						

b) a power feeder that is contained in a switchboard and made according to CEI C.43 with IP56 protection. It is connected to the coils by a Fror 450/750 cable according to CEI 20/22 of an appropriate length and cross section.



Mod.		A	B	P
0018 L	1/2"	80	100	80
0021 FI	1/2"	150	210	160
0034 FI	3/4"	150	290	160
0100 Fi	1"	150	210	160
0104 FI	1”1/4	150	210	160
0112 FI	1”1/2	150	290	160
0200 FI	2"	150	290	160
0212 FL	2"1/2	150	290	160
0300 FL	3"	170	350	200
0400 FL	4"	170	350	200
NB: all measures in mm.				

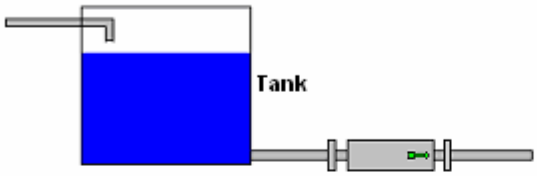
8. Installation

The following installation criteria must be applied to obtain a correct operation of the equipment:

1. Make sure that the water flows continually with no interruptions such as storage tanks, boilers or valves.
2. Select the right model of Pulsar according to the size of the plant where it will be installed, by taking into consideration the pressure and quantity of the water to be treated.
3. Install the Pulsar descaler upstream the crystal precipitation that occurs for heat shock.
4. The water must flow to the same direction of the arrow on the Pulsar. In any case, the equipment can be installed with any inclination with respect to the ground.
5. Connect the Pulsar to a power supply working at the same voltage and frequency as the switchboard. Make sure that is far from any heat source.
6. The Pulsar is designed for a temperature range of 0 to 70 °C for industrial applications and 5 to 50 °C for domestic applications.
7. Leave the length of the connection cable between the feeder and coils as it is. If you need a longer cable, please contact the manufacturer. A distance of at least 50 cm will be required between the feeder and the hydraulic system.
8. If recirculation (closed-circuit) systems are installed in the plant, place the descaler on both the integration circuit and the closed circuit before the water undergoes a new heat shock (for example, before the heat exchanger).
9. All Pulsar descalers are compliant with CEI C.431 (IP56 or IP54 for fanned equipment).

General rules for the correct positioning of the descaler

es.1)

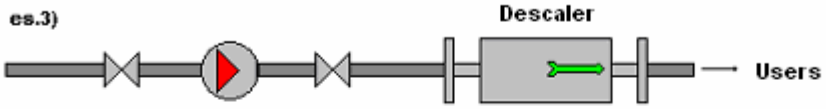


If tanks are installed, the descaler will be placed downstream

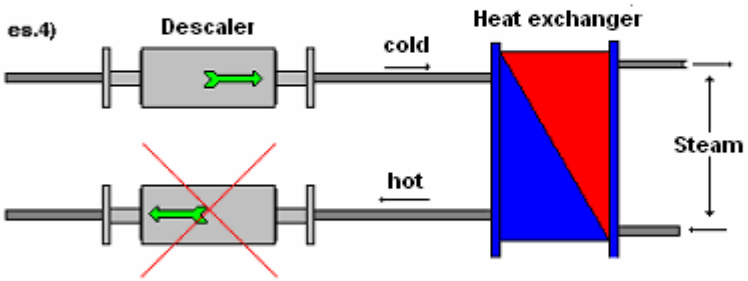
es.2)

The descaler has the same diameter as the pipe

es.3)



es.4)



9. Customer service

Besides covering products with a standard guarantee, W.T.S. has recently developed an efficient pre- and post-sales service for both customers and installers. Our engineers are always ready to check the conditions for correct operation either prior to or after the installation of the equipment. Contact our customer service by phone, e-mail or fax and specify whether you need our engineers to carry out a site inspection.

10. Guarantees

W.T.S. covers its products with a 36-month guarantee from the date of purchase for faulty material and manufacturing errors. However, we wish to remind you that the Pulsar descaler is a static system and in principle its working life is unlimited, unless its functioning is compromised by special reasons (such as mechanical accidents).
If engineering requirements are fulfilled and the equipment is installed correctly, defectivity rate is much lower and working life is much longer than in any standard industrial equipment.

11. References

Water network providers:

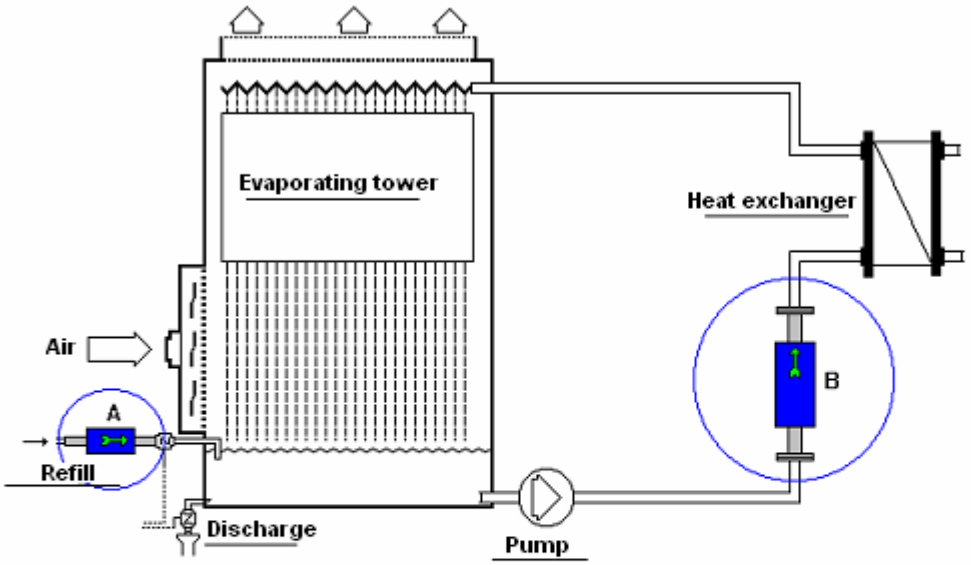
Pubbliacqua (Florence)
Umbra acque (Perugia)
Multiservizi S.p.A. (Ancona)
V.U.S. (Spoleto / Foligno)
Media Sabina (Rieti)
ENIA S.p.A. (Reggio Emilia)
ARIN S.p.A. – fountains - (Napoli)

Our references include several other descalers applied in Umbria, Latium and Tuscany, for example in sports centres (Sheraton Golf Hotel – Rome), hospitals (Ospedale Civile at Sora – Latina), fountains (Tivoli's Villa D' Este – Rome where a 27" equipment was installed) and other industries.

12. Application examples

Scheme no. 1

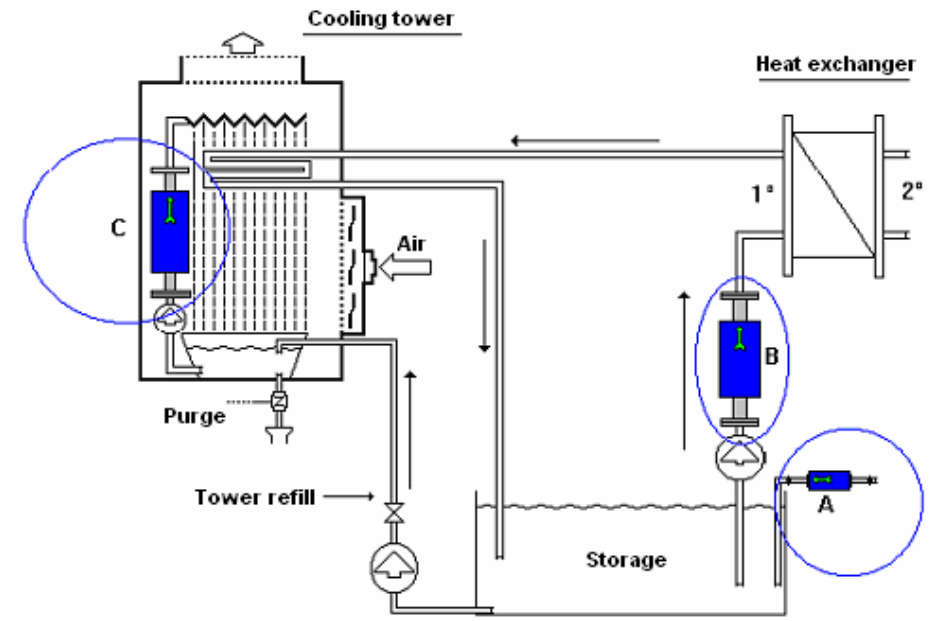
Treatment of one-circuit evaporation tower composed of:
no. 1 Pulsar descaler on refill (A);
no. 1 Pulsar descaler before heat exchanger (B).



Scheme no. 2

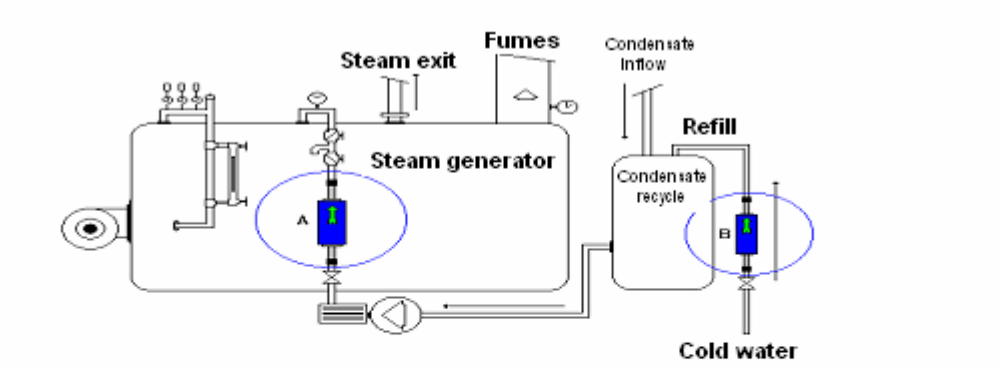
Treatment of sub-circuit evaporation tower composed of:

- no. 1 Pulsar descaler on refill (A);
- no. 1 Pulsar descaler before heat exchanger (B);
- no. 1 Pulsar descaler on tower water circuit (C).



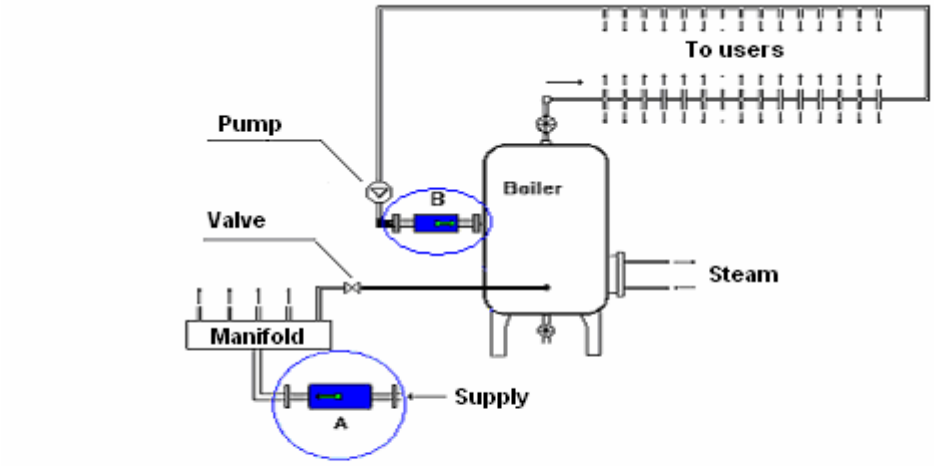
Scheme no. 3

Treatment of steam generation boiler composed of:
- no. 1 Pulsar descaler on refill (B);
- no. 1 Pulsar descaler after high-pressure pump (A).



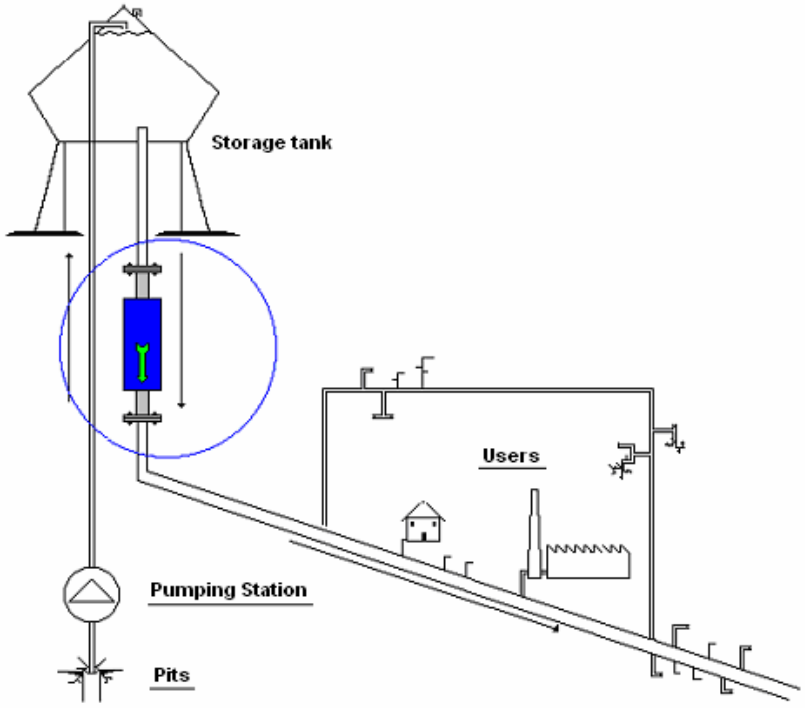
Scheme no. 4

Treatment of hot-water production boiler composed of:
- no. 1 Pulsar descaler on water supply (A);
- no. 1 Pulsar descaler on recirculation (B).



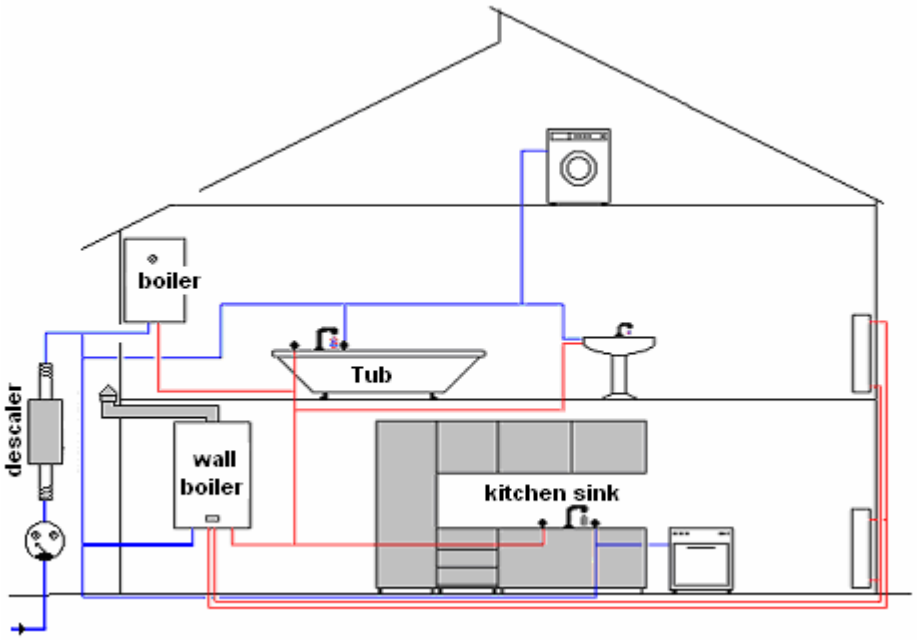
Scheme no. 5.

Distribution plant with gravity tower using no. 1 Pulsar descaler after storage tank.



Scheme no. 6.

Complete plant for the home.



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