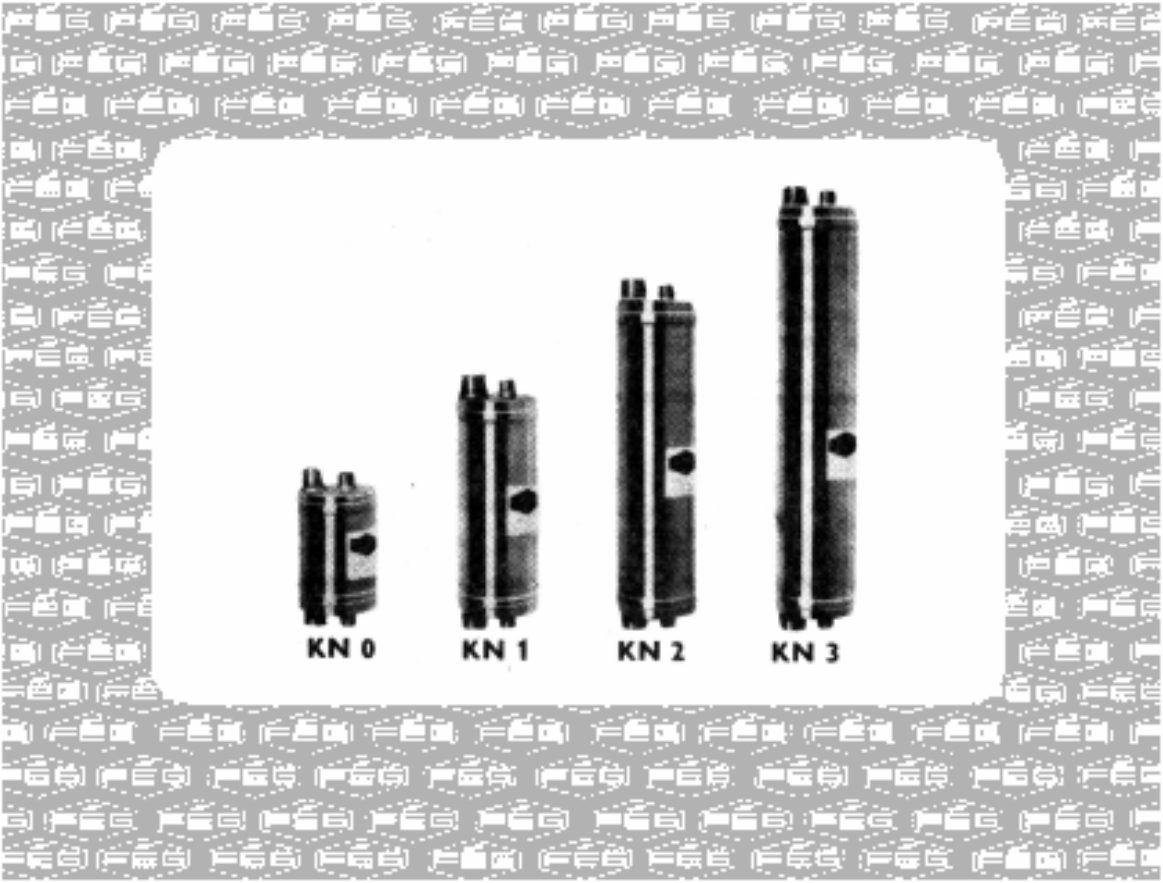
USER'S MANUAL FOR
FÉG-SPIREC
KN and KT type heat exchangers



Fűtéstechnikai Készülékgyártó Ltd.
Hungary, 6900 Makó, Aradi street 136.

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Important information

The FÉG-SPIREC KN and KT heat exchangers may be used for various heat exchanging media. Their main application is heat exchange between water and water, production of sanitary hot water and heating.

The dimensions of heat exchangers are extremely small. Their operational range for producing sanitary hot water is 3-75 l/min, for heating purposes up to 100 kW a stand-alone heat exchanger, above 100 kW a group of them is needed. A smaller heat exchanger built together with a storage tank facilitates the production of larger quantities of sanitary hot water.

The structural design of heat exchangers provides an overall heat transfer rate of 3-6 kW/m². Considering their heat-resistancy and pressure-tightness the heat exchangers can be applied for district heating. In case of production of sanitary hot water in order to prevent scaling do not produce hot water warmer than 50 °C. It is advisable to adjust so the temperature of heating water as to keep the temperature of heat exchanging surface below 65 °C. Above this temperature the hot water should be recirculated through the heat exchanger at a speed of 1m/s and in the case of extremely hard water an agent preventing scaling is to be applied.

The corrosion-proof steel sheets altogether with the built-in seals ensure a long lifetime and do not have harmful effects on health. The heat exchangers are manufactured of 0,8 mm thick, polished and bossed pairs of sheets, which are rolled onto each other. These form the heat transmitting surfaces that isolate the primary and secondary media from each other. Determination of primary and secondary side depends on the given circumstances of task.

The KN heat exchangers with threaded connections and the KT heat exchangers are produced with flanged connections.

Main applications of heat exchangers:

- production of sanitary hot water. The primary heat carrier may be water or steam with an overpressure of 0,4 bar.
- solar energy utilization
- heat exchanger of heat pump
- floor heating
- food industry
- chemical industry
- condensator or evaporator of refrigerators with chloroprene (neoprene) separating sealing tube
- heating and cooling of oil
- cooling of swimming pools, etc.

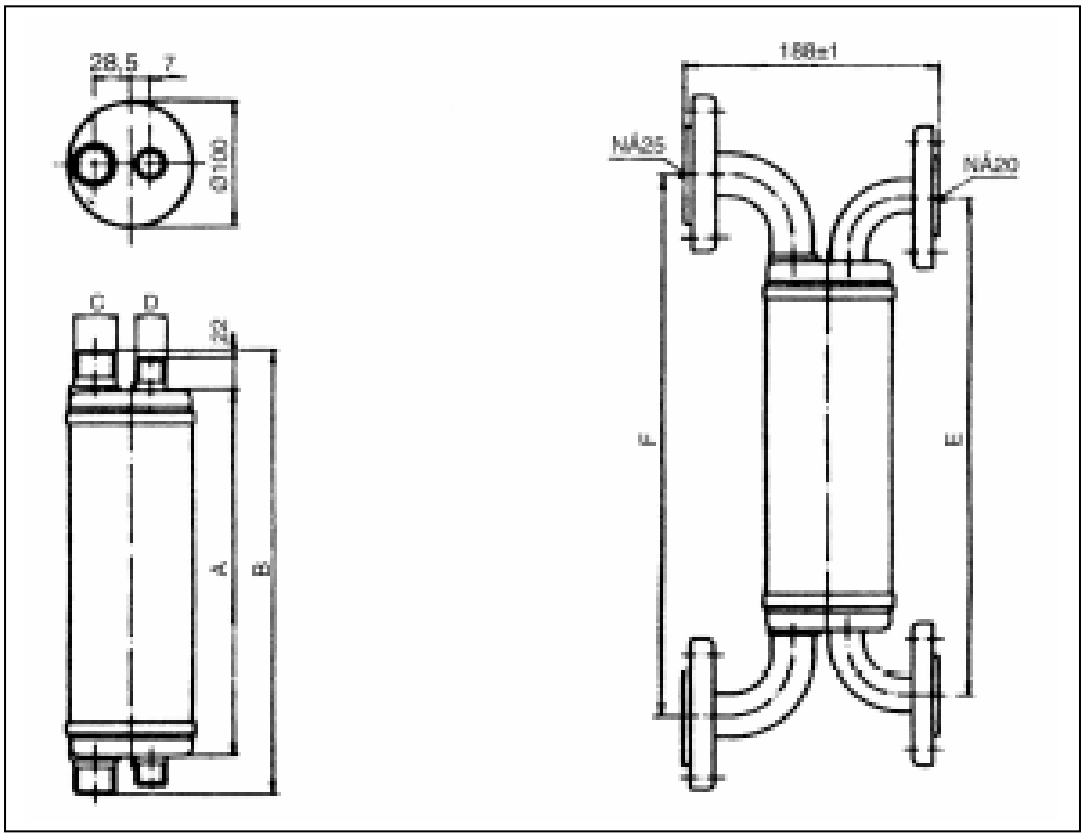
Structural characteristics

The main part of the heat exchangers is the rolled plate made of 0,8 mm thick corrosion proof steel sheet.
Material of parts:

- KO 41 MSZ 4360 or X2 CrNi 18 9 DIN 17440, Wnr 1.4306
- KO 38 MSZ 4360 or X2 CrNiMo 18 10 DIN 17440, Wnr 1.4404
- KO 38 MSZ 4360 or X10 CrNiTi 18 9 DIN 17440, Wnr 1.4541

- Silicone rubber tube (PEMÜSZIL)
- Chloroprene rubber tube

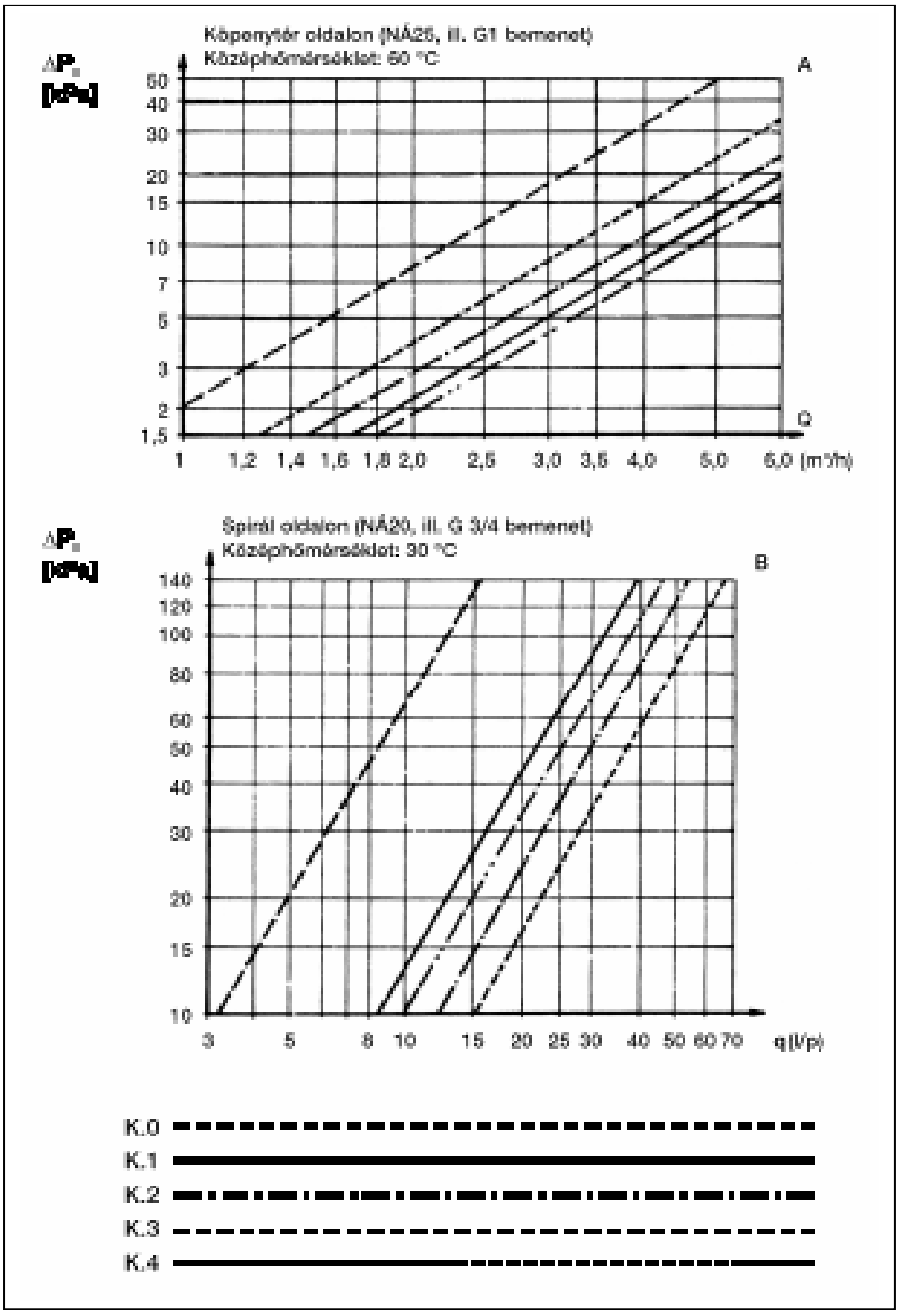
Dimensions



Type	A	B	C	D	Weight (Kp)	
					Empty	Full
KN 0	153	210	3/4	1/2	2,7	3,2
KN 1	273	330	1	3/4	4,7	5,5
KN 2	393	450	1	3/4	6,7	7,7
KN 3	513	570	1	3/4	8,7	10,0

Type	E	F	Weight (Kp)	
			Empty	Full
KT 3	610	640	10,7	12,0

Resistance of heat exchangers



Technical data
Max. operation pressure: 16 bar on both sides
Max. operation temperature: 150 °C on both sides

Type		K.0	K.1	K.2	K.3
Casing side	Cross section of flow $10^{-3}m^2$	1,46			1,57
	Volume at 1m/sec $V'_1 m^3/h$	5,25			5,66
Spiral side	Cross section of flow $10^{-3}m^2$	0,114	0,24	0,366	0,515
	Volume at 1m/sec $V'_1 m^3/h$	0,41	0,86	1,32	1,85
Heating surface A m²		0,167	0,351	0,536	0,73

Capacity of heat exchangers

Values of heat transfer: S x U (surface x heat transfer coefficient)

A (m³/h)	B(m³/h)	K.0	K.1	K.2	K.3
1	0,3 0,6	500 580	840 1000	1040 1280	1200 1500
2	0,3 0,6 1,5	680 790 -	1040 1300 1600	1240 1610 2060	1400 1900 2530
5	0,6 1,5 2,5	1050 - -	1610 2130 -	2000 2730 3100	2330 3320 3840
10	0,6 1,5 2,5	1220 - -	1850 2500 -	2230 3190 3720	2560 3820 4500

The values shown in the table are given at W/°C, at water-water operation and at 50°C Delivery Water Temperature (DWT).
A= mass flow of casing side(C´´ or DN25)
B= mass flow of spiral casing (C´´ or DN20)
Transferred quantity of heat in the heat exchanger: Q = S x U x TDm, where TDm is the logarithmic temperature difference.

Sample:
- 2 m³/h from 10 to 60°C heating the
- 5 m³/h 85-65 °C heating water can be applied from which TDm = 36,5 °C
- $Q = Q_v \times \Delta T$ = 5000 l/h x 20 °C = kcal/h°C = 116,3 kW/°C

$$SxU = \frac{Q}{TDm} = \frac{116,3}{36,5} = 3,18 kW/°C$$

Under the given conditions the value of K.3 type heat exchanger is 3,58kW/°C. Its resistance at the given mass flows is the next:

Casing side: Δpk = 25 kPa (0,25 bar)
Spiral side: Δpk = 40 kPa (0,45 bar)

Directives for design

The heat exchangers are to be mounted in accordance with the actual regulations (e.g.: piping fittings, etc.). The heat exchanger is to be mounted vertically or horizontally. Avoid production of sanitary hot water warmer than 50°C, especially when a recirculation tube is not built. In case of hard water prevent crustation by a chemical agent (e.g.: Hydrogel). The control of sanitary hot water producer is to be designed in accordance to the fundamental principles considering the following:

- Type of the controller should be P or PI.
- Maximum operation time of the valve driver can be 120 sec.
- When mounting the thermal sensor its whole length must contact with the secondary hot water or other media.
- Nominal dimension of a two-way valve is to be determined in accordance with the mass flow of the heating water. So choose the pressure drop on the open valve as it should be at least the half of the resistance of the pipe with variable mass flow. Besides this the total head of the pump must be four-fivefold of the resistance of this pipe. In addittion to this the resistance of bypass and pipe with variable mass flow must be almost the same.
- I t is advisable to install a limiter thermostat into the system that stops the primary pump at the determined temperature of heating water. Restart of the pump should be realized manually only.

Design of steam heating

In case of steam with an absolute pressure of 1,4 bar the max. speed of steam can be 70 m/sec. (The heat exchanger can be operated with steam pressures other than this.)
The values given in the table refer to steam entering the spiral side at a speed of 70 m/sec, the second values of K.2-K.3 heat exchangers refer to steam flowing in the connection stub at a speed of 70 m/sec.

Type	Steam (m^3/h)	Steam (kg/h)	Heat efficiency (103 kcal/h)	Water at 10-15 °C (l/min.)
K.0	104	83	41	15
K.1	208	166	82	30
K.2	312 208	249 166	123 82	45 30
K.3	396 208	316 166	156 82	57 30

*The data given are principal values!

Examples for installation

Installation of a single heat exchanger

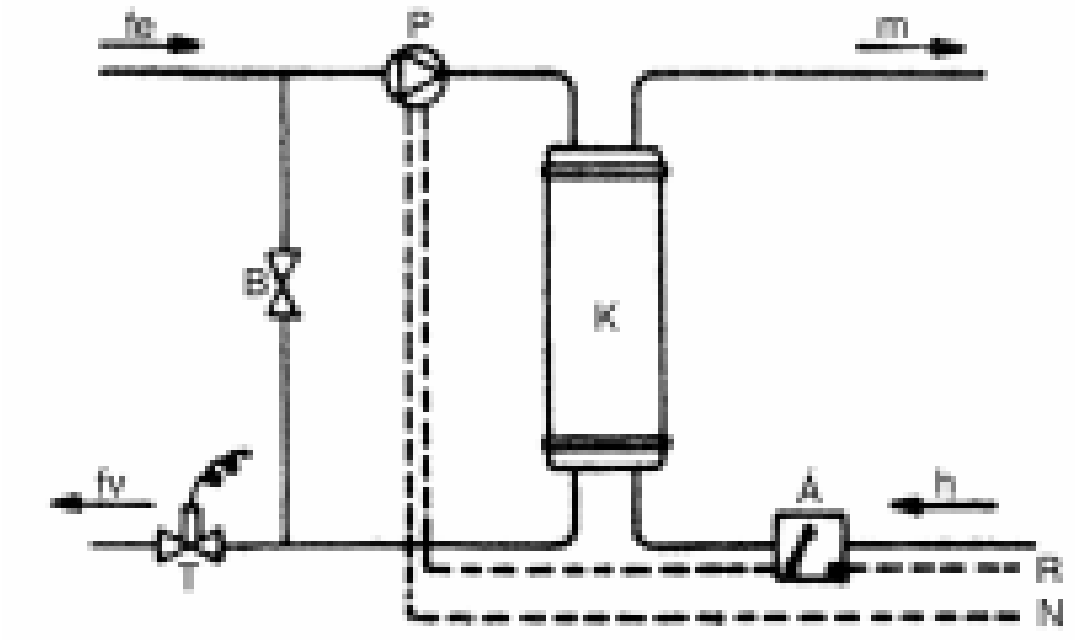


Fig. 3.

K= heat exchanger
P= pump
B= by-pass valve
Á= flow-switch
T= thermostatic valve

fe= return heating water
fv= delivery heating water
h= cold water
m= hot water

Vertical installation of the heat exchanger

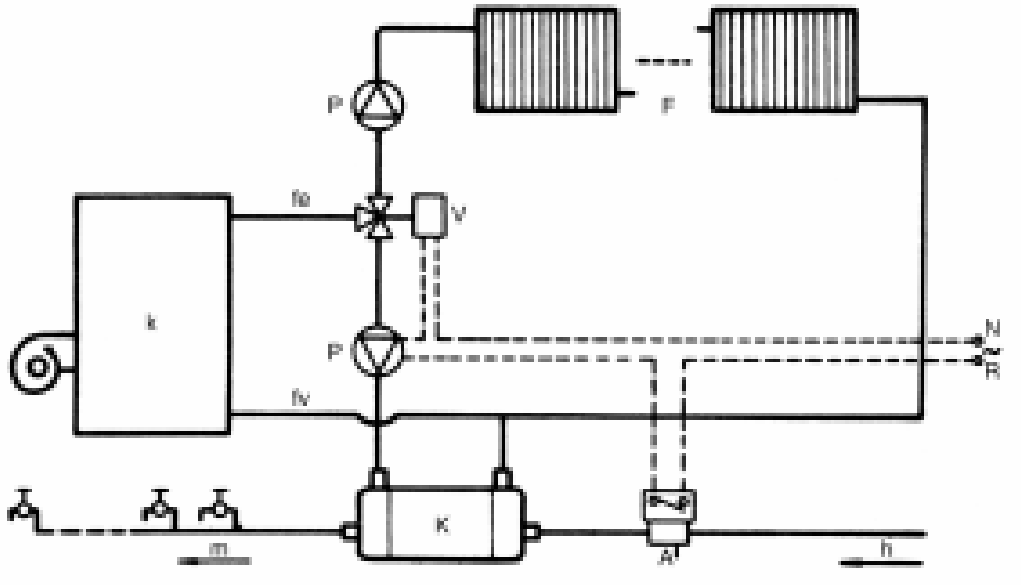


Fig. 4.

K= heat exchanger
Á= flow switch
V= cross valve
P= pump
F= heating system
R-N= electric input

k= boiler
fe= delivery heating water
fv= return heating water
h= cold water
m= hot water

Installation of heat exchanger with a storage tank

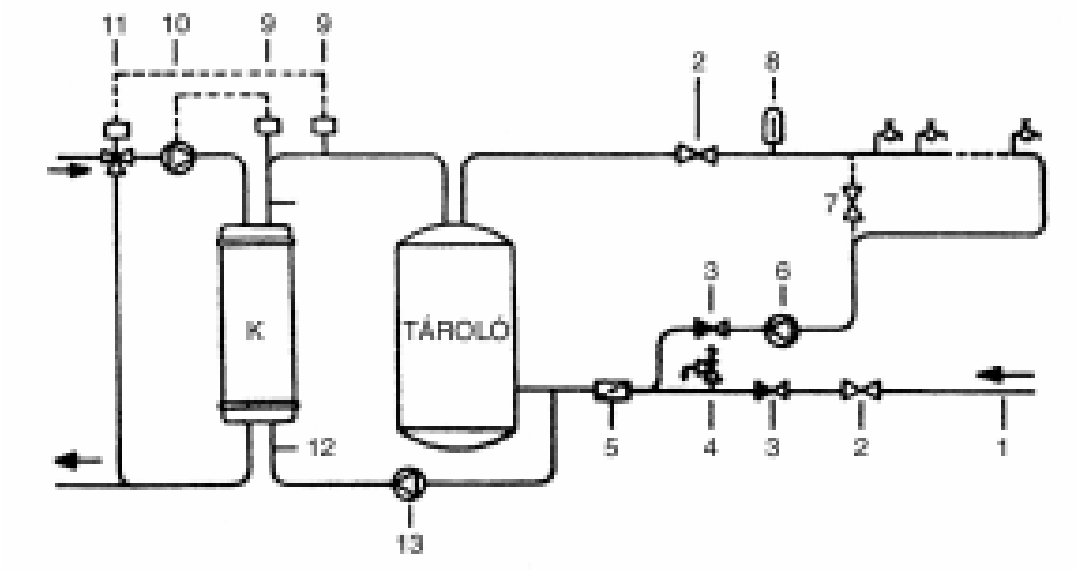


Fig. 5.

Paralel installation of heat exchangers

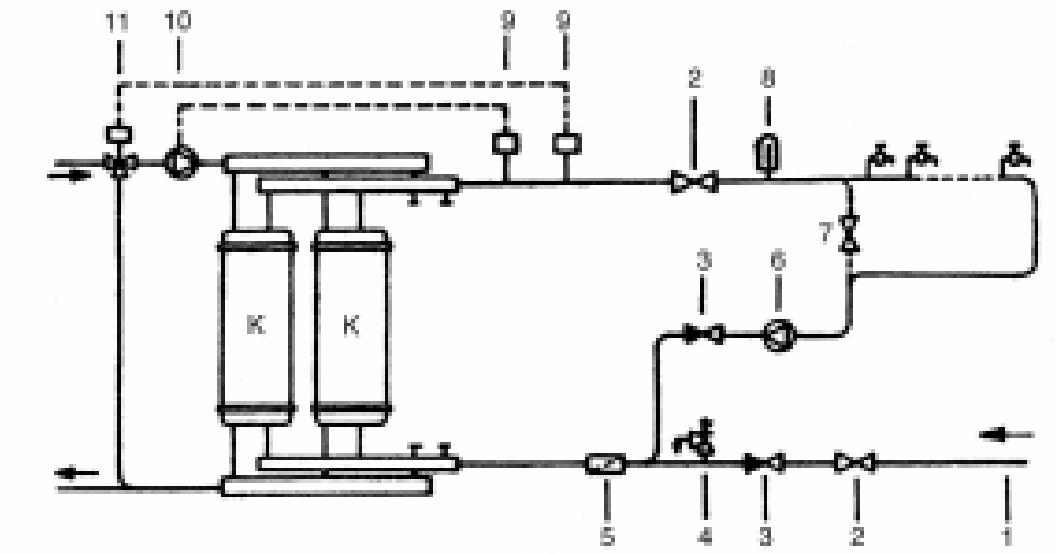


Fig. 6.

Legend of Fig. 5. and 6.:

1. inlet of cold water
2. shut-off valve
3. back-pressure valve
4. blow-off valve
5. filter
6. sanitary hot water accelerating pump
7. by-pass control valve (if required)
8. thermometer
9. temperature sensor
10. heating water accelerating pump
11. automatic control valve
12. cleaning stub
13. hot water accelerating pump

Rules of installation

The heat exchanger is to be installed vertically or horizontally.
A filter must be installed before the heat exchanger, after the junction of circulation pipe.
Do not exceed the max. temperature and pressure during operation.

Maintenance

In the case of a well designed and installed system the heat exchanger does not require regular maintenance.
Power decrease of the heat exchanger refers to obstruction or crustation. The deposit of scale can be removed as follows.
It is advisable to execute the dissolution of scale when the heat exchanger is dismounted because weighing it before and after flush out refers to the removed quantity of crust and the difference from the original weight.
The applied stainless steel and the silicone rubber withstands acidic dissolvents so the flush out may be executed several times.

Dissolution of deposit:

Always use an acidic solution for this procedure. Contact with this must be as short as possible (5 minutes in case of slight scaling and approx.imately 1 hour in case of an almost obstructed device). Dissolution may be carried out with water of 10-20 °C since the higher temperature mixture accelerates the process.

Solution to be used:

For dissolution of scale the 10% concentration amidosulphuric acid $H_2N\text{-}SO_2\text{-}OH$ (NH_2SO_3H) is the most appropriate.
The relatively high price of this chemical is balanced by its advantages:

- It dissolves scale well,
- spares stainless steel,
- use of inhibitor is not necessary,
- less dangerous than hydrocloric acid.

With greater care the hydrochloric acid may be used together with inhibitor e.g.: 24+1% hydrazine hydrate or 4% stannum-chloride (soluted in water).

Do not use:

- sulphuric acid
- nitric acid

The pump to be applied:

must withstand chemicals.
is to ensure a min. of 10 m total head at the capacity of 1-1,5 m^3/h.

ATTENTION!

Use of safety equipment (eye-guard, apron, safety gloves) during dissolution of scale is compulsory.

Flush:

After finishing dissolution of scale the appliance is to be flushed immediately with running water.

Passivation:

To prevent the further effects of the possible dissolvent residues in the appliance neutralize those with 4% hydrazin hydrate or 2% calcium-carbonate solution. Neutralization is to be executed for 10 minutes by a pump with the same capacity as the one used for dissolution of scale. Check the pH of the solution by an indicator and keep it above 9 pH. After finishing passivation flush the appliance with clean drinking water.