CALCULATION OF HYDRAULIC PROCESSES IN SOLAR WATER HEATER COLLECTOR HEAT PIPES

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Annotation: The article cited data on hydraulic and Maxal resistances, factors affecting the movement of water inside the solar water heat collector. These factors, in turn, affect the pressure of the water, leading to excessive energy consumption. Considering these resistances in all respects, the calculation of the scheme that consumes the least energy and gives greater thermal energy, but since the pressure loss is the smallest, was determined in the accounting work and Δh plotted Q graph, which depends on the consumption of pressure loss. At the end of the calculation, a garafig of the difference in pressure from one of the sum of the resulting graphs from the hydraulic calculations of all schemes was described and its table in percentages was calculated.

Keywords: Hydraulics, solar collector, pipe, temperature, collector, hydraulic resistance, local resistance, consumable.

Types of hydraulic loss and its formation.

Calculating the geometric dimensions (diameter, length)of pipes according to a certain consumption, or calculating the costs of pipes whose dimensions are given at a given pressure, is called hydraulic calculation of pipes.

It consists in the development of a method for hydraulic calculation of the heat exchange panel of a solar tube collector of a pipe type with a non-uniform distribution of fluid flow under natural circulation conditions. Standard rational designs and determination of the thermal efficiency of solar water heating collectors are based on the uniform distribution of current along the lifting pipes of the heating system with one or more collectors. In a non-uniform flow distribution, some parts of the collector that contain pipes with lower flow rates may have temperatures, which are sections of a fluid much higher than that with higher flow rates. For this reason, maintaining the same heat-carrying fluid flow across the lifting tubes is an important problem that needs to be addressed when designing a solar collector system. Hydraulic loss is usually classified into two types:

The loss in length (which is spent on the force of friction) occurs at the expense of movement along the length of the current and will depend on its length. [1]

Hydraulic resistance occurs at the expense of uneven movement in certain sections of the flow. The sections that generate uneven movement are the areas of the groove or groove where the cross-sectional shapes have changed (elbows, obstacles, sharp expansion, sharp narrows, cranes) and the hydraulic loss here does not depend on length.

The total hydraulic loss is equal to the sum of these two losses:

$$\Delta H_u = H_l + H_m + H_{ishq} \quad (1)$$

here H_l- longitudinal loss; H_m- maxillary resistance.[2]

In the *volumetric method* the liquid falls from the stream being examined into a specially graded container (menzurka), the filling time of the container is measured using a stopwatch. If the volume of the container is *V*, the measured Time Is *t*, the volumetric consumption is equal to:

$$Q = \frac{V}{t}; \ \left[\frac{m^3}{sek}\right] \quad (2)$$

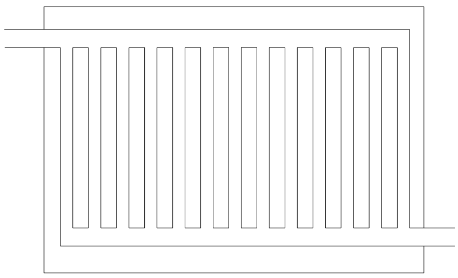
When the motion section of the current is known, its velocity is determined by the formula:

$$\vartheta = \frac{4Q}{\pi d^2}; \ \left[\frac{m}{sek}\right] \quad (3)$$

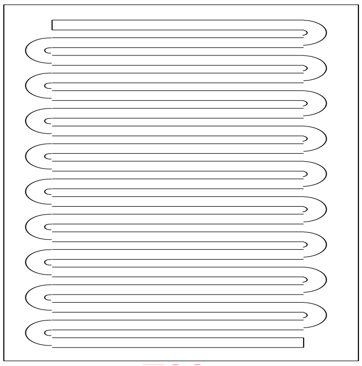
In the *weight method* fluid is drained from a stream into a container. By weighing it on the scales, the weight of the liquid in the container is found G. If the dish has a full time of t, the weight consumption is equal to*:*

$$Q_G = \frac{G}{t} \quad (4)$$

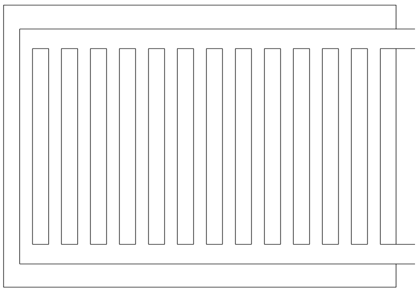
In this hydraulic account, the collector is the pressure loss due to its circulation process and Mahal resistances by changing the internal pipe circuits. A graph is drawn that depends on pressure loss and consumption. In this case, with the shapes being different, the total surface of the collector was calculated in size $S=1m^2$ and the length of the pipes inside did not differ from one to very large numbers. The length of the tubes contained within the Collector circuits became approximately *L=18m* in length when placed countably. The Collector surface was measured in height *h=1,4m* while width *a=0,7m* gave the Surface $S=1m^2$. The diameter of the Collector pipe in the circuits is selected the smallest diameter *d=18mm*. Since the material of the Collector inner tubes was miss metal, the hydraulic account also performed the bookwork as miss from the tube. This scheme was placed in The Shape of the pipes with a length of *L=18m*, marked on the surface of the Collector. The structure received a constant water consumption due to its uniformity of dimensions. The water inside the pipe is in regular circulatory motion with the help of a pump. As a result of sunlight falling on the Collector surface, the moving water in the Collector bladder converts solar energy into thermal energy. At the end of the calculation, however, a graph of pressure loss due to the calculation of hydraulic resistance was calculated.[3]



a) collector scheme in the form of a Harp.

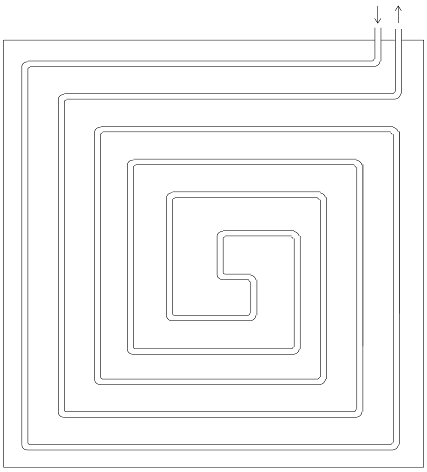


b) collector scheme in the form of a Mender.



s) collector scheme in the form of a Harp.

Collector circuit with low hydraulic resistance: This scheme was placed in The Shape of the pipes of a length of 18m, which are marked on the surface of the Collector. The water inside the pipe is in regular circulatory motion with the help of a pump. As a result of solar radiation falling on the Collector surface, the moving water in the Collector bladder converts solar energy into thermal energy.[4]



Collector circuit with low hydraulic resistance

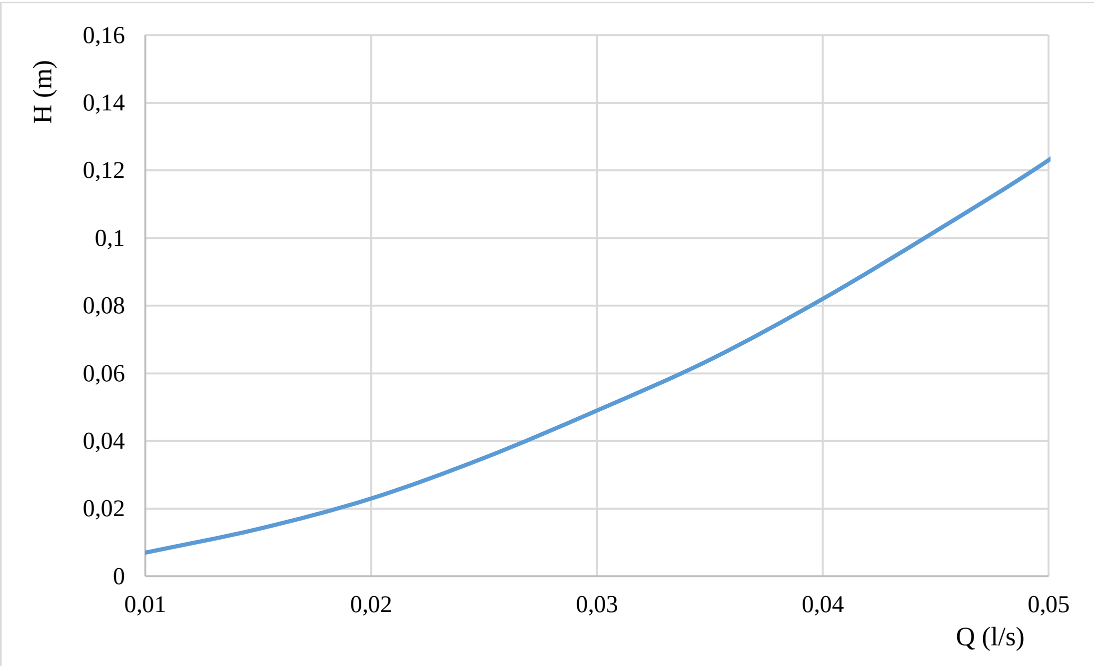
Table

N_o	d_{mm}	L_m	T_{sek}	$Q_{l/sek}$	$\vartheta_{m/sek}$	Δh_m	$\sum\Delta h_m$
1	18	16,5	50	0,01	0,047	0,007	12
2	18	16,5	50	0,015	0,071	0,014	12
3	18	16,,5	50	0,02	0,095	0,023	12
4	18	16,5	50	0,025	0,118	0,035	12
5	18	16,5	50	0,03	0,142	0,049	12
6	18	16,5	50	0,035	0,166	0,064	12

7	18	16,5	50	0,04	0,189	0,082	12
8	18	16,5	50	0,045	0,213	0,102	12
9	18	16,5	50	0,05	0,237	0,123	12
10	18	16,5	50	0,055	0,26	0,147	12

Hydraulic calculation of the Collector circuit with low hydraulic resistance

In the table above, the hydraulic account of the collector in the form of a hot floor is calculated. With the increase in water consumption, the pressure loss is increasing, while we can also support the change in speed due to consumption. It was calculated that the total pressure loss$\sum \Delta h = 12m$ is higher, as seen from the hydraulic calculation in the Collector circuit in the form of a hot pole, the pressure loss is the smallest than in the other 4 circuits.[5]



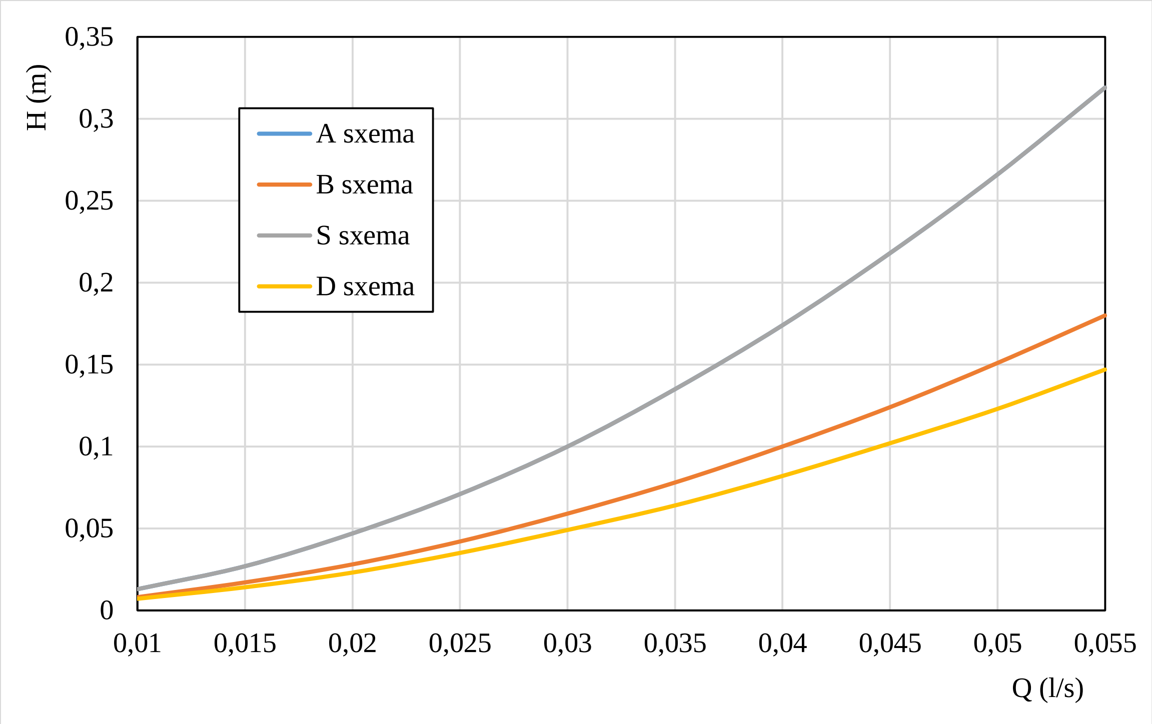
Collector with low hydraulic resistance graph of dependence on consumption and pressure loss

The graph above describes the increase in pressure loss as consumption increases. On the *Y* axis, the pressure loss is placed, while on the *X* axis, the water consumption inside the pipe is. The pressure loss seen from the graph is the smallest of the remaining circuits pressure loss.

Q	Δh_a	Δh_b	Δh_s	Δh_d	□Δh_a	□Δh_b	□Δh_s
0,01	0,013	0,008	0,013	0,07	46,15385	12,5	46,15385
0,015	0,027	0,017	0,027	0,014	48,14815	17,64706	48,14815
0,02	0,047	0,028	0,047	0,023	51,06383	17,85714	51,06383
0,025	0,071	0,042	0,071	0,035	50,70423	16,66667	50,70423

0,03	0,1	0,059	0,1	0,049	51	16,94915	51
0,035	0,135	0,078	0,135	0,064	52,59259	17,94872	52,59259
0,04	0,174	0,1	0,174	0,082	52,87356	18	52,87356
0,045	0,218	0,24	0,218	0,102	53,21101	17,74194	53,21101
					51,34251	17,21871	51,34251

The difference in hydraulic accounting and interest of the Collector scheme of all types



Graph of the sum of pressure losses in all schemes.

The graph above is a graph of pressure loss and water consumption dependence, and the graphs generated from the hydraulic calculus in all schemes were put together in a single graph. From this it is possible to compare the pressure losses from one to another.[6]

Conclusion: The following article proposes an energy-efficient scheme of a solar water heater with low hydraulic resistance. In this case, the total hydraulic loss was calculated in volumetric methods and weight methods. The article considers the pressure losses due to its circulation process and mahaly resistances by changing the scheme of the internal pipes of the proposed collector, and through this a graph of the dependence on pressure loss and consumption has been shown.

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