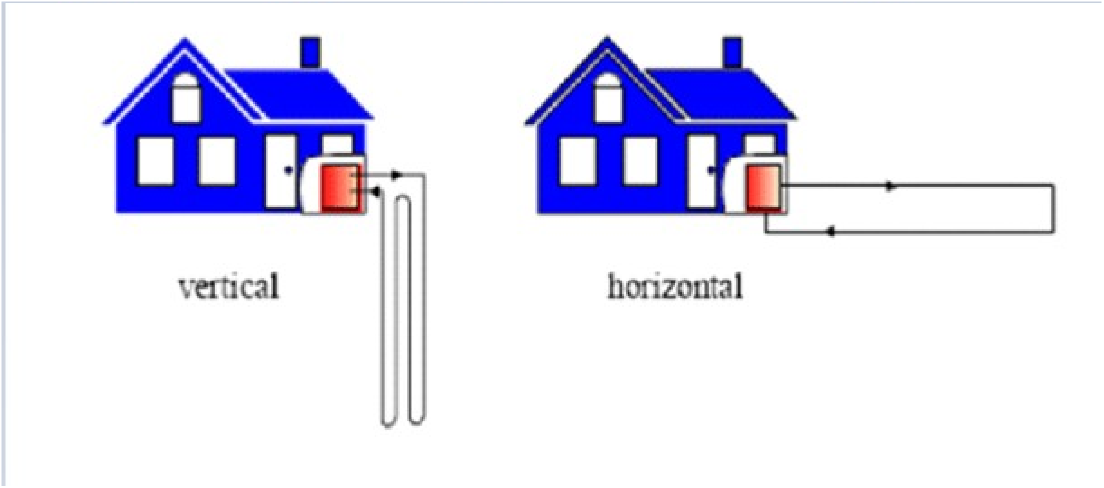
”GHEORGHE ASACHI” TECHNICAL UNIVERSITY OF IASI, ROMANIA
DEPARTMENT OF BUILDING SERVICES ENGINEERING

GEOTHERMAL HEAT EXCHANGER WITH SPECIAL GEOMETRY - DESCRIPTION AND CALCULATION MODEL

Andreea Irina BARAN[1], Theodor MATEESCU[2]

1Ph.D. Student, Department of Building Services Engineering, Technical University of Iasi Romania
2Professor, Department of Building Services Engineering, Technical University of Iasi Romania



Usual technical solutions - one or more:

-horizontal polyethylene pipes at depths of 1.2-1.8 m from the surface of the ground in the form of closed loops at lengths of up to 100 m;

-vertically mounted - in boreholes with diameters starting from 15 mm and up to 400 mm and depths between 15 and 280 m;

-constant diameter of 32-45 mm;

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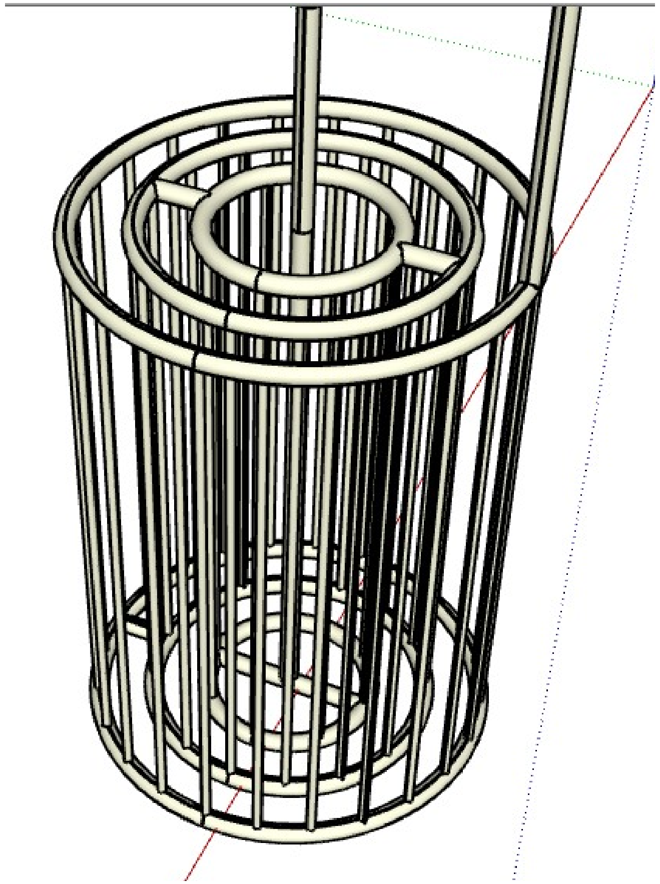
Heat exchangers with variable geometry:

-insulated modules

-transfer surfaces in an inverse ratio proportional to the average working agent temperature

- uniformization of the thermal fields
- ensures the balanced loading of the massive mass by homogenizing the thermal density and consequently reducing the surfaces of the land, respectively the length of drilling needed for the arrangement of the source.

Description of the modular cylindrical heat exchanger made up of variable height pipe bundles



The speeds of the registers successively traveled **are decreasing**, influencing the **coefficients of heat transfer** in correlation with the **variation of the temperature difference inside and outside**.

Uniformization of the thermal load in the mass of the storage tank.

Characteristics:

- the entrance, the exit and the upper and lower rings: De = 15 mm; Di = 13 mm;
-vertical pipes: De = 6 mm; Di = 5 mm.
-H = 50 cm;
-outer ring: Dsch = 36.5 cm.
-three registers with 8, 16 and 24 vertical pipes.

Calculation model

The calculation is performed successively, provided that the output temperature of the last module is achieved, at least equal to the required return temperature.

If the requirement is not met, the calculation is continued in one of the following alternatives:

- o Inserting with a second heat exchanger with similar structure, to which the temperature difference is distributed;
- o Amplification of the transfer surface by adding additional registers;
- o Increasing the number of exchangers (S), with which the storage device is to be equipped, in order to reduce the unit thermal load (Q_S).

Parameter	Equation
Load/module	$Q_M = \frac{Q_{inc}}{M}$
Flow/module	$G_M = \frac{1}{1000} * \frac{Q_M}{cp_1 * (T_{RI} - T_{TI})}$
Velocity inside the pipes	$v = \frac{1}{3600} * \frac{G_M}{0.785 * d_i^2 * N} = constant$
Flow regime	$Re = \frac{G_M}{3600 * 0.785 * d_i * N * v}$
Surface required for transfer/module	$S_M^{nec} = \frac{G_M * c_1 * (T_{RI} - T_{TI})}{K * (\Theta_M - T_M)}$
Height of the modules	$H_M^{nec} = \frac{S_{M(i)}^{nec}}{3.14 * d_e * N}$

Thank you for your attention!