Influence of aluminium heating appliances working conditions on its thermal power

Z. G. Mar'ina,
A. Yu.Vereshchagin,
A. V. Novozhilova,
M. A. Komarevtsev
K. O. Isaeva

Northern Arctic federal university named after M. V. Lomonosov,
17, Northern Dvina Emb., Arkhangel'sk
komarevcev.m@edu.narfu.ru, a.novozhilova@narfu.ru

ROYAL Termo Evolution

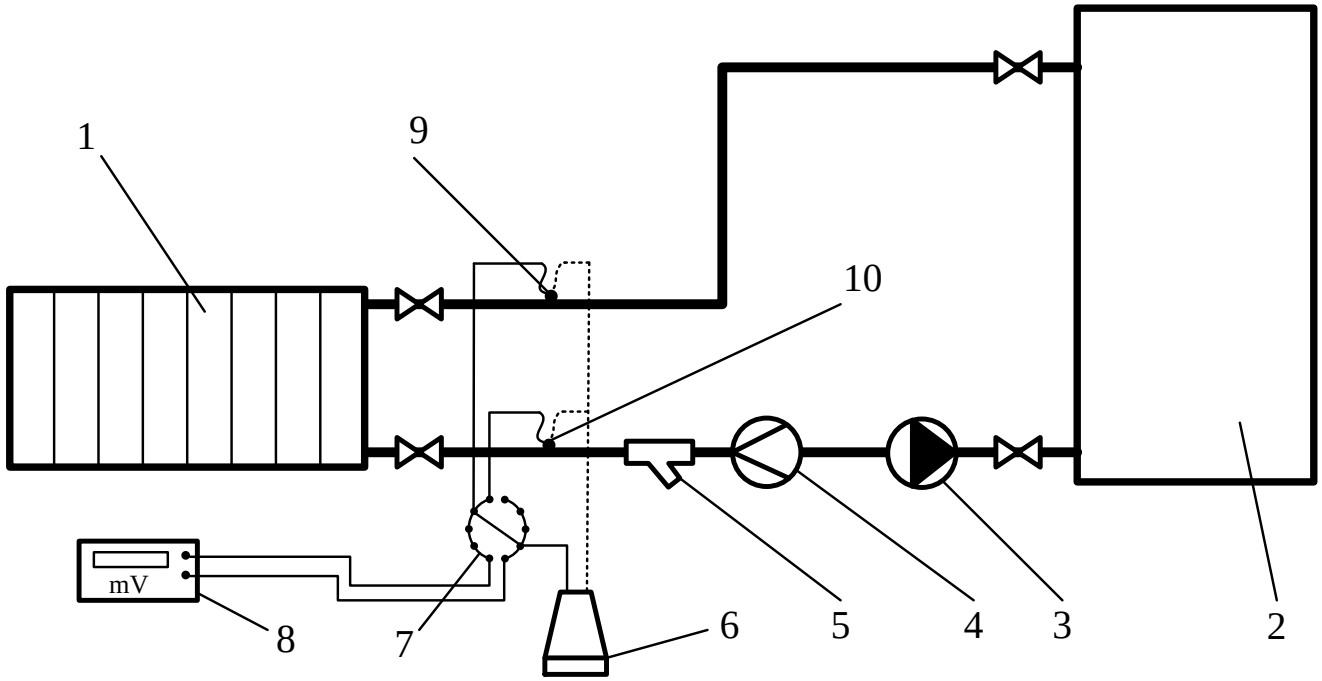
Radiator characteristics

Pressure, MPa	Heat transfer of one section, W	Maximum temperature of the coolant, °C	Volume of one section, l	Centre-to-centre dimensions, mm
1,6	203	110	0,35	500

PURPOSES OF RESEARCH :

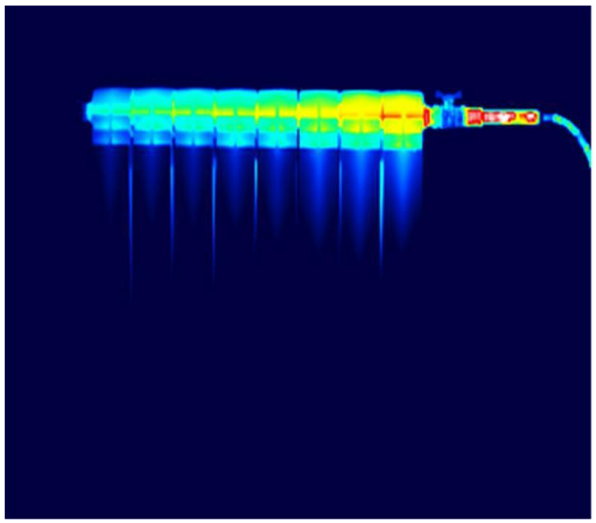
- Study of the actual heat output of the radiator.
- Influence of the method of connecting the radiator on its efficiency.
- Temperature distribution over the radiator sections with different connection methods.
- Determination of the direction of movement of the coolant in the radiator and its effect on heat transfer.

The scheme of the experimental installation

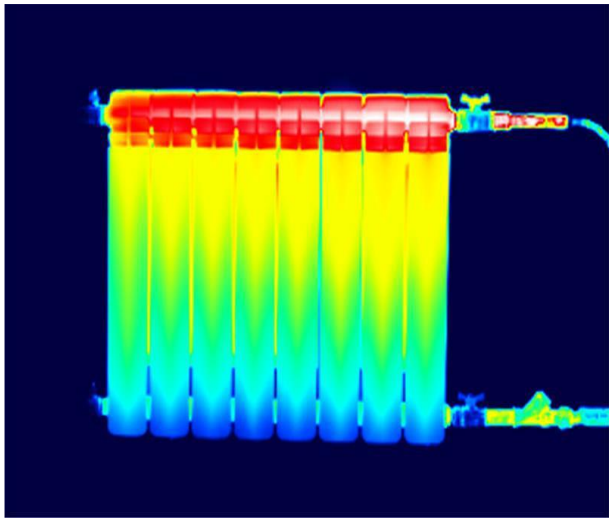


1 – radiator
2 – water heater
3 – pump
4 – flow meter
5 – screen filter
6 – Dewar vessel
7 – multi-position switch
8 – millivoltmeter
9, 10 – Chromel-Copel thermocouples

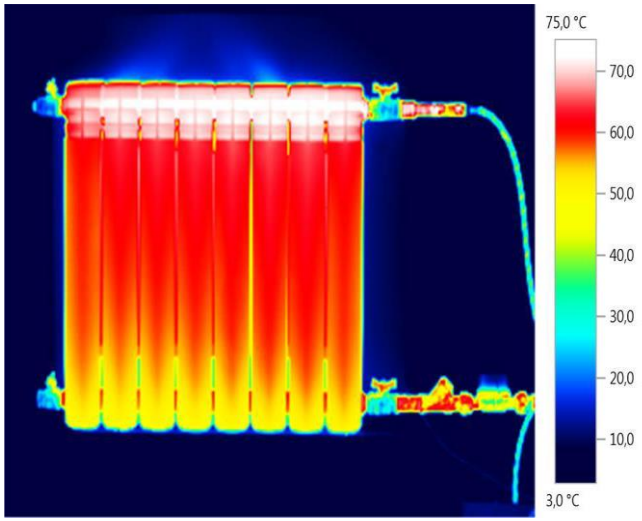
THE STUDY A ONE-SIDED «TOP-BOTTOM» METHOD CONNECTION



40 seconds



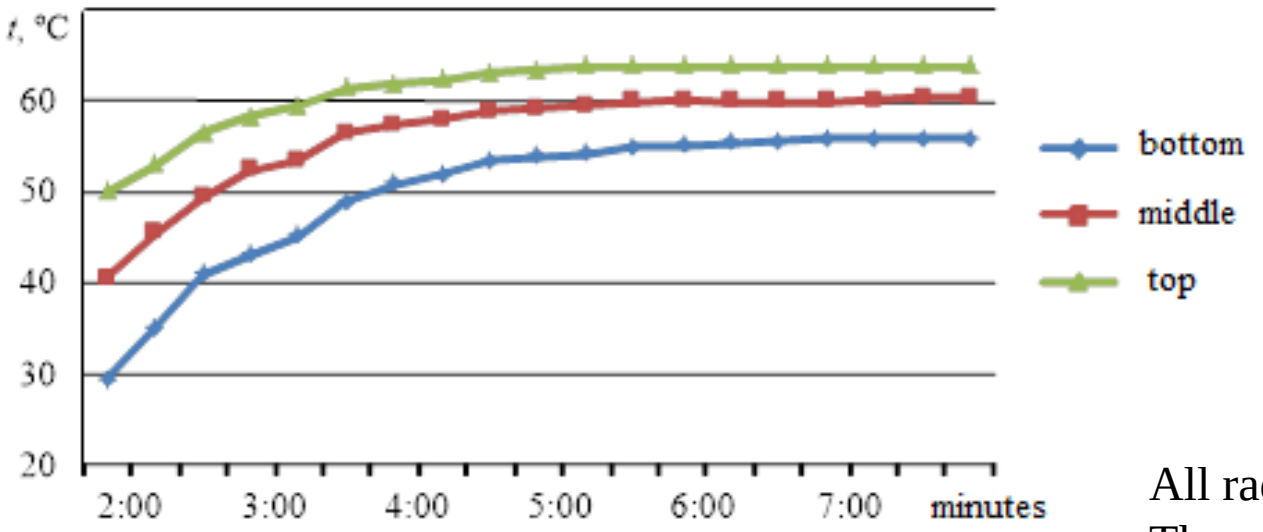
1 minute 40 seconds



3 minutes 20 seconds

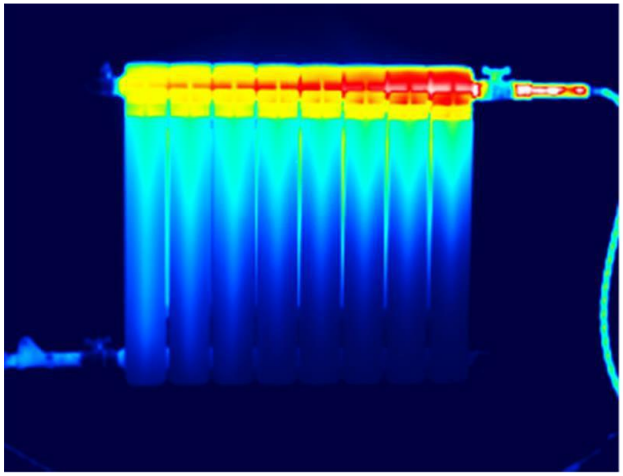
THE STUDY A ONE-SIDED «TOP-BOTTOM» METHOD CONNECTION

Fins surface temperature of the sections during the heating

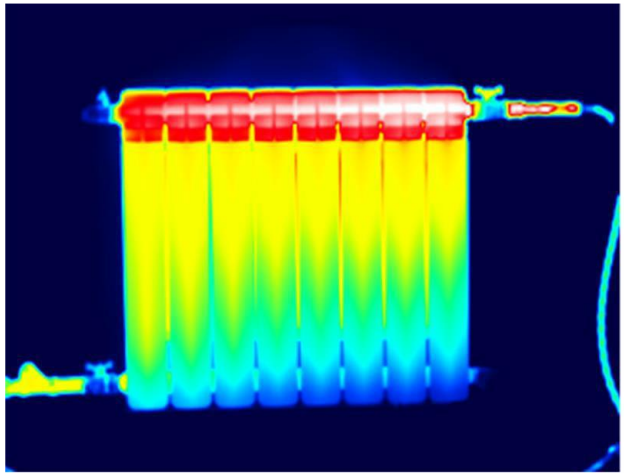


All radiator sections heat evenly. The surface temperature differed only in height for the extreme and central sections: at the initial moment — by 20 ºC and by 8 ºC after heating.

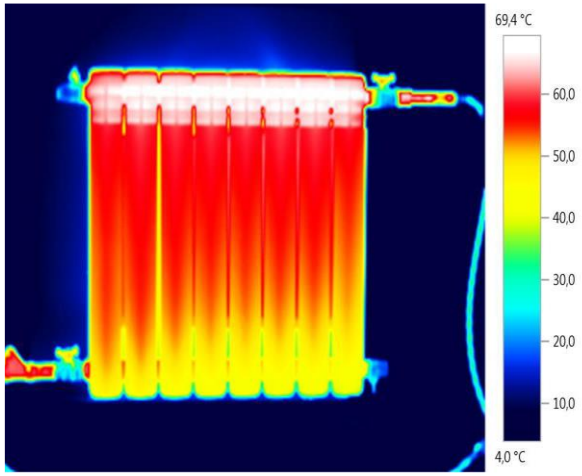
THE STUDY A DIAGONAL «TOP-BOTTOM» METHOD CONNECTION



60 seconds



2 minutes



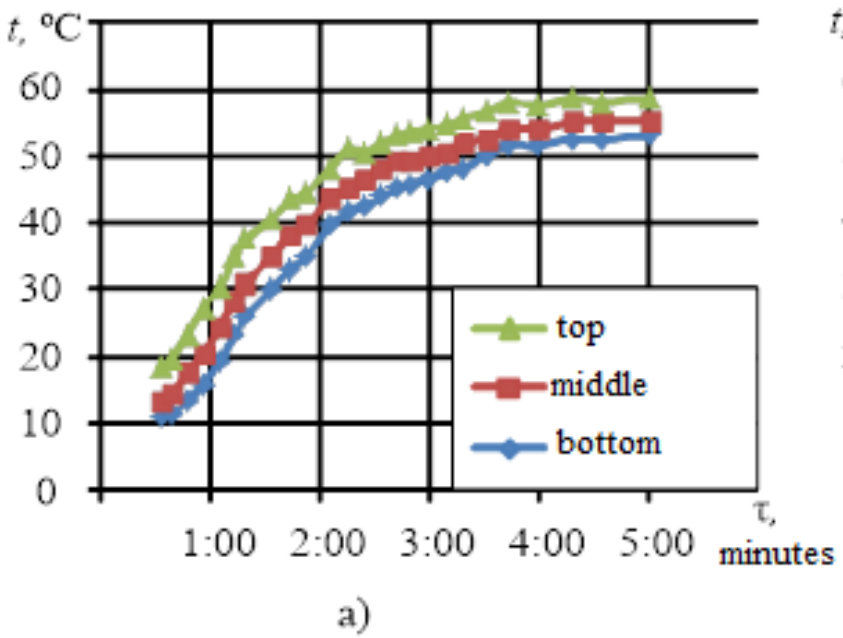
5 minutes

The heating of the eighth section proceeds more evenly, as the coolant circulation begins to flow through it.

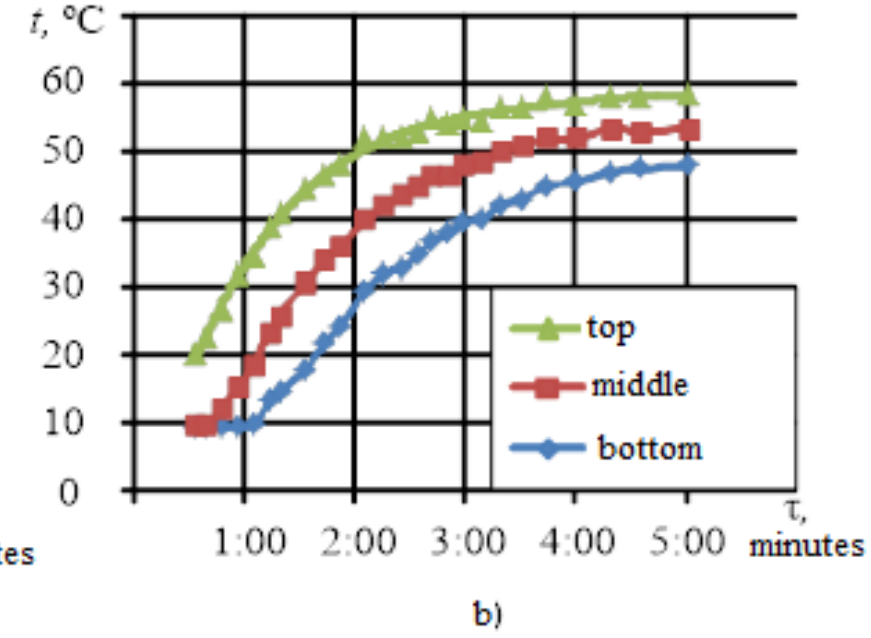
The first section starts to heat with a delay

THE STUDY A DIAGONAL «TOP-BOTTOM» METHOD CONNECTION

The temperature of the fins' surface of the aluminum radiator sections: eighth section (a) and first (b)

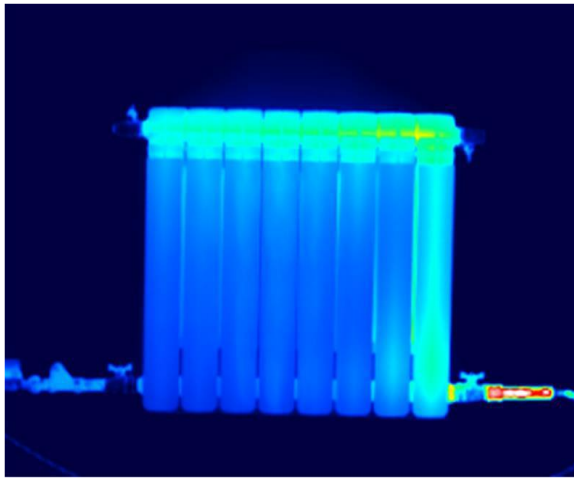


a)

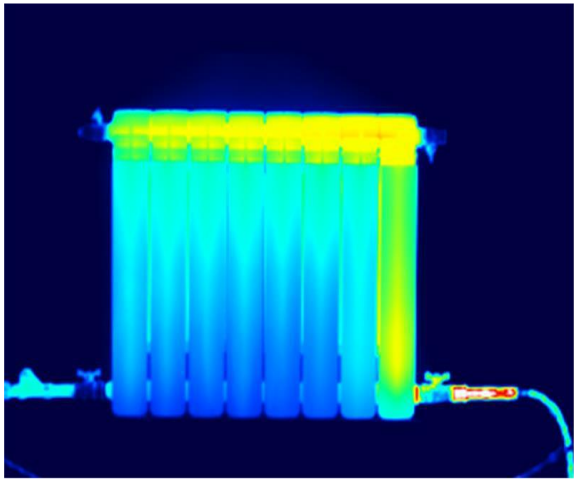


b)

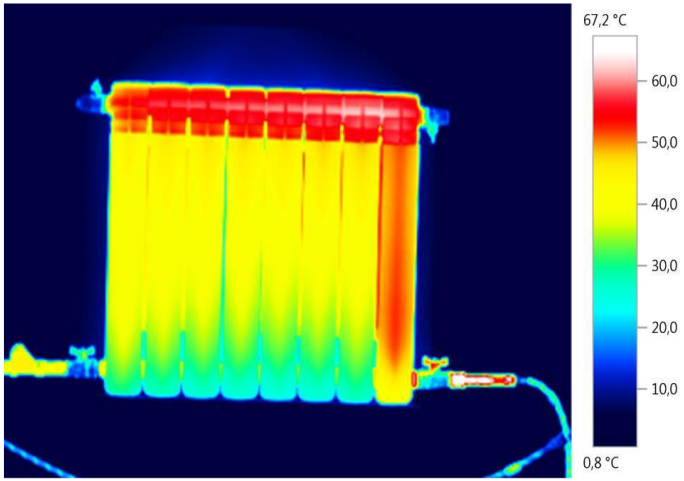
THE STUDY A «BOTTOM-BOTTOM» METHOD CONNECTION



60 seconds

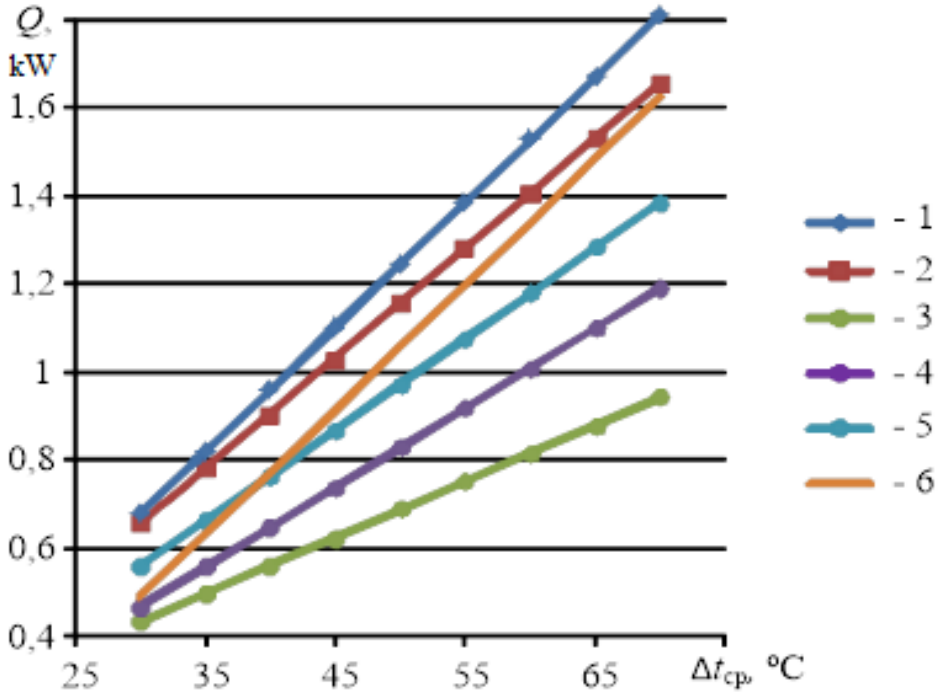


2 minutes



5 minutes

ACTUAL HEAT OUTPUT OF THE RADIATOR



1 - one-sided «top-bottom» connection; 2 - diagonal «top-bottom» connection; 3, 4 5 - «bottom-bottom» connection with coolant flow rates of 0.062 kg/s, 0.054 kg/s and 0.037 kg/s, respectively; 6 - declared by the manufacturer

CONCLUSIONS :

- The thermal power of the section declared by the manufacturer is 203 W, it corresponds only to the diagonal «top-bottom» connection.
- The thermal power of the eight-section radiator in the design conditions with one-sided «top-bottom» connection is 12% higher than with a diagonal one.
- The actual thermal power of the section varies in the range of 135 ... 225 W at 70 ºC, depending on the coolant flow rate and connection method of the radiator.
- Studies show, when designing heating systems, it is necessary to take into account the connection method and the number of device sections

Thank you
for your attention

Mikhail Komarevtsev
komarevcev.m@edu.narfu.ru