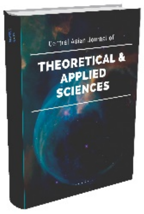

CENTRAL ASIAN JOURNAL OF THEORETICAL AND APPLIED SCIENCES

Volume: 03 Issue: 06 | Jun 2022 ISSN: 2660-5317

Optimization of Working Parameters of Colorifiers used in Heat Supply Systems

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Received 25th March 2022, Accepted 29th May 2022, Online 18th June 2022

Annotation: *This article solves the task of calculating the heat of air heaters used in heating systems of buildings, their types and principles of operation, as well as to justify the technical parameters of heating.*

Keywords: *Heater, heater, heat, density, Reynolds number, pressure loss.*

Main body: To date, in the Republic of Uzbekistan, traditional water and air systems for heating industrial and public buildings are utilized. For this purpose, heating systems for engineering communications facilities are used. In particular, boilers, air and water heating system, pipes, various pumps and other engineering equipment with the help of hot water and hot air with the necessary parameters are used in the organization, which in turn, creating favorable conditions for the social sphere of the population in terms of heat and hot water supply continuous and quality service is one of the most important factors [1]. Today, due to the extremely outdated boiler equipment and networks, it is not possible to optimally use heat sources in the existing Heat Supply System, which adversely affects the operation of heat supply enterprises, the quality of heat Service and hot water supply of consumers.

In general, the amount of heat released from the thermal equipment should be controlled depending on such indicators as the amount of temperature of the outside air is high or low.

Simply put, the amount of heat supplied to the room from the heating system and appliances should be controlled, which means that, depending on the difference in the temperature of the external and internal environment of the building, it is necessary to transfer the necessary amount of heat spent through the external barrier into the room through the heat sink. But in any case, we require deep knowledge from engineers of a wide potential, the reason is that in the new residential buildings and public buildings, which are being restored in our country today, it is necessary to design options that are high and economically advantageous in terms of useful working coefficients that remain exactly to the level that meets the modern requirements of heating [2].

In the Heat Supply Systems of industrial or public buildings are mainly used in traditional heating equipment, including calorifiers. There are several types of calorifiers, they are divided into the following.

- Water calorifiers
- Steam generators
- Air heaters

The spiral die-casted biometall types of calorifiers are widely used. Their brands are KSk3, KSk4, KP3-SK and Kp4-KS. In ksk3 and KSk4 calorifiers, heated water is used as a heat carrier, and its working pressure is 1.2 MPa while its temperature is up to 180°C. The heat carrier of the kp3-KS and KP4-KS calorifiers is Steam, the working pressure of which is up to 1.2 MPa.[3]

1-table. Technical characteristics of calorifiers

Named after	F_n, m^2	f_v, m^2	f_{tr}, m^2	A	Calorie size Width,x height, m
KSk 3-5	10,20	0,21	0,0008	11,20	0,42x0,5
KSk 3-6	13,26	0,27	0,000846	12,12	0,53x0,5
KSk 3-7	16,34	0,33	0,000846	12,97	0,65x0,5
KSk 3-8	19,42	0,39	0,000846	13,83	0,78x0,5
KSk 3-9	22,50	0,46	0,000846	14,68	0,9x,05
KSk 3-10	28,66	0,58	0,000846	16,39	1,15x0,5
KSk 3-11	83,12	1,66	0,00258	34,25	1,7x1,0
KSk 3-12	125,27	2,49	0,0030	64,29	1,7x1,5

The installation of calorifiers can be parallel or sequential, depending on the air passing through them. When installing the calorifiers in a row, the air velocity increases, and this increases the heat transfer of the calorifiers, but the resistance of the calorimeter device increases.[4]

As a result of the calculation of the calorifiers, its type, number, quantity, type of connection by air and heat carrier, aerodynamic and gravity resistance are determined.

Figure 1. KSK-80 water air heater

Air-to-air heating systems are a real joint heating system, called a water-to-air or steam-to-air heating system. For heating the air, heating devices and other types of heat sources are used. For example, initially air was heated in heating devices, fireplaces. Hot air is returned to the furnace to cool down and heat up again, after raising the temperature of the room air much higher and distributing the amount of excess heat to the rooms. This process is carried out in the following two ways:

1. Warm air is distributed to heated rooms, mixed with the air in the room, and its temperature decreases to the level of the temperature of the room air.
2. The air pipes around the rooms, without getting into the room where the heated air should be heated, are in motion and heat up their walls.[5]

Figure 2. KP-SK 3-4 Branded steam heater

These types of heaters are rapidly gaining popularity because they can heat a room of 200-250 square meters in a matter of minutes. Other advantages of the device include: ease of installation; low noise level; long-term performance; high level of security.[6]

The main operating parameters of the heaters can be calculated as follows:

3. Heat consumption for heating air, W, is determined by the following formula

$$Q = 0{,}28 \cdot L \cdot \rho_k \cdot c(t_k - t_n)$$

here

$L -$ heating air consumption (for the cold season)

m^3/hour

$\rho_k - t_k$ density of air at room temperature kg/m^3

$c -$ specific heat capacity of air - 1,005 kDj/(kg °C)

$t_n -$ air temperature before the heater °C, for the cold period of the year

t_n^B we can say that

$t_k -$ the temperature of the air leaving the heater °C

$$f_v' = \frac{L \cdot \rho_k}{3600 \cdot \upsilon \rho'} \qquad (2)$$

4. From the reference f_v' depending on the type, number and number of heaters installed in parallel and in series on the heat carrier in the air, the total surface are f_v' equal to the front section $\sum f_v$ is

selected. The data in the table are recorded: the heating surface of one heater F_n, m^2, the cutting surface for water flow f_{tr}, m^2.

5. The actual mass velocity is determined, kg/(m^2 0s)

$$\upsilon\rho = L \cdot \frac{\rho}{3600 \cdot \sum f_v} \quad (3)$$

6. Mass consumption is determined, $\frac{kg}{c}$

$$G_j = \frac{Q}{0{,}28 \cdot c_j (t_{is} - t_{qay})} \quad (4)$$

where $c_j -$ is the specific heat capacity of the water, 4,19 kDj/(kg*°C);

$t_{is} -$ temperature of hot (transmitted) water;

$t_{qay} -$ the temperature of the returning water;

7. The velocity of the water in the heater pipes is determined, m/s

$$\upsilon_{tr} = \frac{G_j}{f_{tr} \cdot 1000 \cdot 3600} \quad (5)$$

8. The heat transfer coefficient k is determined by the mass velocity and the velocity of the water, Vt/(m^2 °C)

9. The heating surface of the required heater is determined, m^2

$$F_{tr} = \frac{1{,}1\, Q}{k(t_{sr}^T - t_{sr}^V)} \quad (6)$$

where

Q-is the heat consumption for heating the air, Vt

$t_{sr}^T -$ the average temperature of the heat carrier, (for water

$t_{sr}^T = (t_{is} - t_{qay})/2$, 0,03 MPa for steam at a pressure greater than

$t_{sr}^T -$equal to the saturated steam temperature);

$t_{sr}^V = (t_k - t_n)/2$ the average temperature of the heated air

10. The total number of calipers to be installed is determined

$$n' = \frac{F_{tr}}{F_n} \quad (7)$$

By rounding the number of heaters, we determine the actual heating surface of the heater

$$F_d = F_n \cdot n \quad (8)$$

11. We determine the reserve of the heating surface of the heater, %

$$\varphi = \frac{(\mathrm{F_d} - \mathrm{F_{tr}})100}{\mathrm{F_{tr}}} \quad (9)$$

The reserve of the heating surface of the heater should not exceed 10%. If the excess heat capacity of the heater exceeds 10%, another model or number is selected and recalculated.

12. We determine the aerodynamic resistance of air by mass velocity. Depending on the scheme of installation of heaters, their total aerodynamic resistance ΔR_k, Pa (pressure loss in the installation of air

heaters in series is found by multiplying the pressure loss of a single row of heaters by the number of rows).

13. Hydrodynamic resistance of water from the heater ΔR_{tr}, kPa

$$\Delta R_{tr} = A \cdot v_{tr}^2 \quad (10)$$

A - coefficient taken from the table.

The hydraulic resistance of a device is determined by multiplying the resistance of one heater by the number of heaters.[7]

The graph of the pressure drop across the operating parameters of the heaters, including the Reynolds number, is as follows.

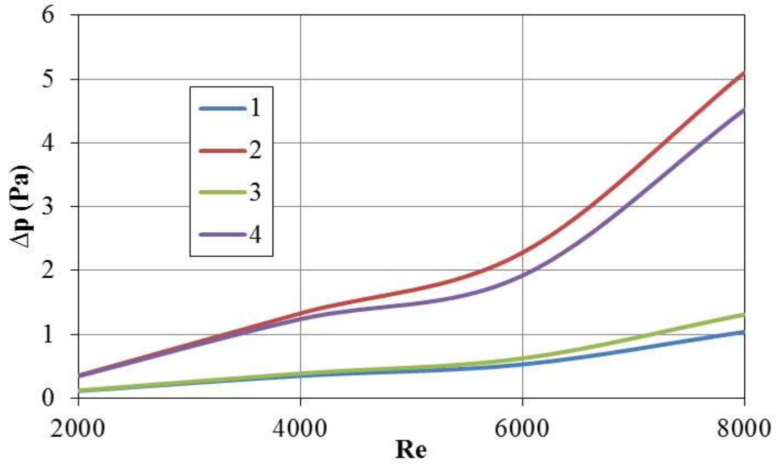

Figure 3. The pressure drop depends on the Reynolds number

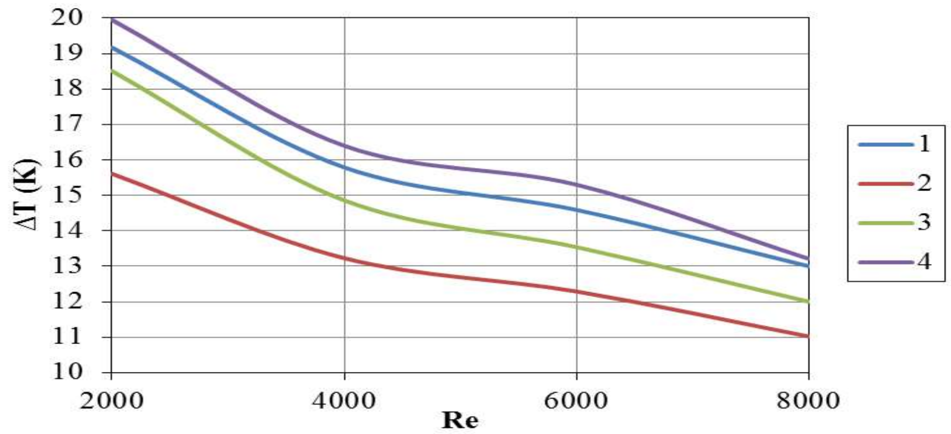

Figure 4. The change in temperature depends on the Reynolds number

Conclusion: Improving the heating system of buildings allows you to reduce waste energy by choosing the right heating equipment and using it in accordance with the technical parameters.

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