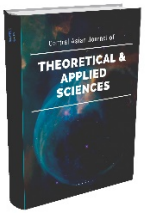

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# Simplified Calculation of the Number of Bimetallic Radiator Sections

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***Abstract:*** *This article discusses the issue of a simplified calculation of the number of sections for a heating system. The advantages and disadvantages of bimetallic radiators are considered. With the help of what methods you can count the number of sections. The method of calculating them by area, by volume, norms, which regulate the minimum power of batteries per 1 m2 of area. What parameters should be considered when calculating the number of sections.*

***KeyWords:*** *heating system, bimetallic radiators, steel core, water hammer, overheating, climatic zone.*

## INTRODUCTION:

As time shows, in our modern world, heating plays a very important role in human life during the harsh winter days. Thanks to the system, people living in cities with far from the warmest conditions and climate can provide themselves with a comfortable time spent in private houses and apartments.

The main and probably the only purpose of a heating system for a home is to provide an acceptable temperature for the room. The heating system heats all rooms in damp and cold weather, creating a comfortable temperature for living, controlling the humidity in the room. It must be reliable, efficient and energy efficient.

It is worth noting that there are several ways to provide warmth. For example, if water is used as a home heater, then it makes sense to use it as hot water supply.

For such heating, it is necessary to correctly calculate all the features of housing: the characteristics of the floors and walls, the height of the ceilings. It is necessary to take into account how all the heating components are located. Taking these rules into account, a heating project is made. The design begins with the type of boiler on which this system works and with the calculation of the power. After choosing a boiler, of course, radiators are an important piece of equipment in the heating system. The choice of radiator material plays an important role in heat transfer.

There are many types of radiators made of different materials. When choosing, you need to take into account all the pros and cons of radiators, methods of their installation, heat transfer coefficient, reliability, etc.

Installing bimetallic batteries - is a trend in recent years. Numerous tests and user experience show that the devices are suitable for different heating systems and demonstrate good space heating performance. The inside of the bimetallic radiator has a steel core and the outer structure is made of aluminum. The

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contact of the coolant only with the steel core made the batteries insensitive to the quality of water in the system, and the use of aluminum is also relatively easy.

It is worth noting other advantages of bimetallic radiators:

- Resistance to high pressure and water hammer;
- Stylish design;
- Possibility of application in autonomous and central systems;
- Reliability;
- Another important advantage of bimetallic radiators is high heat transfer - about 185 W per section;
- Resistant to corrosion;
- Fast response to commands of the thermostat.

**Cons of bimetallic radiators:**

- **Price.** Compared to conventional cast iron or aluminum radiators, bimetallic ones cost two to three times more. But the cost is justified by their functional properties and corrosion protection, which standard radiators do not have.
- **Overheating.** If bimetallic heating radiators are installed incorrectly, then the places where the contact is poor will overheat. So, it is important to install the radiators correctly so that they serve as long and efficiently as possible.
- **Not suitable for antifreeze.** If you have an autonomous heating system using antifreeze, then bimetallic radiators will not work for you.

Thus, the advantages of the devices are obvious. And for those people who are going to buy such radiators, it is advisable to think about one point: the competent calculation of the sections. How much will be optimal for a particular room? How to make the calculations correctly?

**SECTION CALCULATION METHODS**

You can use the methods to calculate the number of sections for purchase.

By area: There are standards that govern the minimum capacity of batteries per 1 $m^2$ of area. If we take the average climatic zone, the figure will be 100 W.[1,2].

**К = 3*5*100/185**

Where 185 is the thermal power of 1 section. It comes out 8.1. That is, you need to buy a device for 8 sections.

**Area calculation has many disadvantages:**

- the results will be reliable only when the ceiling height is up to 3 meters;
- the features of the premises are not taken into account, such as the number of rooms, the level of heat loss, etc .;

following from this, the calculations will in most cases be inaccurate.[3]

**By volume:**

Here again, the size of the room is taken, but taking into account 3 dimensions. That is, the volume. It is based on data on the capacity of the heating system per $1m^3$.

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Let's try to perform the operation with a similar bimetallic radiator of 185 W and taking into account the ceiling height of 2.8 m. In this case, instead of 100 W, we will take 41 W, since we are not talking about $m^2$, but about $m^3$.

- room volume = 3 * 5 * 2.8 = 42m3;
- battery power = 42 * 41 = 1722 W;
- number of sections = 1722/185 = 9.3.

As you can see, you will need not 8, but 9 sections of radiators. That is, more power is required than was calculated in the previous method.[4]

WHAT PARAMETERS SHOULD BE TAKEN INTO ACCOUNT

When choosing the optimal number of sections, it is important to take into account many points: like the condition of the windows, the number of external walls and their degree of insulation, the thermal regime of the room is higher, the climate in the region, etc. There are also certain correction factors (K + No.):

1) takes into account the design of the glazing. So, for paired wooden bindings, K will be 1.27. If there are 2 double-glazed windows on window structures, 1.0 is used. For a three-chamber - 0.85;
2) takes into account thermal insulation. With weak insulation, it is worth taking an amendment of 1.27. If the thermal insulation is good, take 0.85;
3) shows the ratio of area to window and floor. If the% of glazing is expressed in the numerator, the denominator will be the heat consumption coefficient: 50 / 0.8, 40 / 0.9 and the rest;
4) takes into account the average temperature of the coldest week. If it's minus 35, 1.5 is taken. At -25 - 1.3. If it is -20 - 1.1;
5) provides for a correction for the number of outer walls of two bricks. If she is alone, take 1.1. Each next wall increases the coefficient by 0.1;
6) takes into account the influence of the room temperature higher. For an unheated attic, you need to take 1, and for a heated one - 0.9. If the apartment is higher, it will be 0.8;
7) refers to the height of the room. For ceilings of 2.5 m, the coefficient will be 1.0. If it is 3 m - 1.05. This is followed by an increase of 0.05.

Let's try to calculate everything with correction factors. Imagine that you live in the middle lane, where the maximum temperature in winter is -20 degrees. You live on the penultimate floor, there are three-chamber packages on the windows, and the ratio of glazing to the floor is 40%. There are 2 outer walls, they are well insulated. The ceiling height is 2.5 m, and the area of the room is 20 $m^2$. [5,6,7]

We use the formula:

100W / per meter * 1.1 * 0.8 * 0.85 * 0.9 * 1.2 * 0.85 * 1 = 68.6.

It turns out 69 W / $m^2$.

Now we multiply the result by m2 of the room (20) and we get 1380 W.

We divide by the capacity of 1 section and it turned out 1380/185 = 7.45. That is 7 sections.

**CONCLUSIONS**

Calculating and understanding the calculations of bimetallic heating devices is very important. This is then necessary to select the exact number of sections. If there are few of them, radiators simply cannot

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fully warm up the premises. Consequently, the room will be cool. An overabundance of sections is fraught with the opposite effect. That is, it is fundamentally important to make calculations only correctly in order to ensure comfortable living conditions.

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