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METHOD FOR PARAMETRIVTEPLOUTYLIZATORA engineering calculations livestock buildings

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Based on the theoretical and experimental dependences of the technique of engineering calculation of parameters of heat utilizers for livestock buildings. The use of heat utilizers developed for pig-vidhodivelnyka 100 heads allows cost reduction

electricity when compared with the base vehicle - Fan AOB-M1 ЭVO 0.9 (10 kW).

Heat recovery units, methods, microclimate, livestock premises, temperature, heat transfer.

Formulation of the problem. Today there are so many designs Casing pipe heat recovery units and related studies of structural and technological parameters [1, 2, 3]. However, in these studies little attention is paid to methods of engineering calculation parameters heat utilizers for livestock buildings.

Analysis of recent research. As a result of our theoretical and experimental studies [6] developed a mathematical model of heat transfer in concentric trohtrubnomu heat recovery units (Fig. 1) with regard to the phenomenon of condensation in it, which allows to determine the temperature distribution of air flow for its length and its thermal capacity.

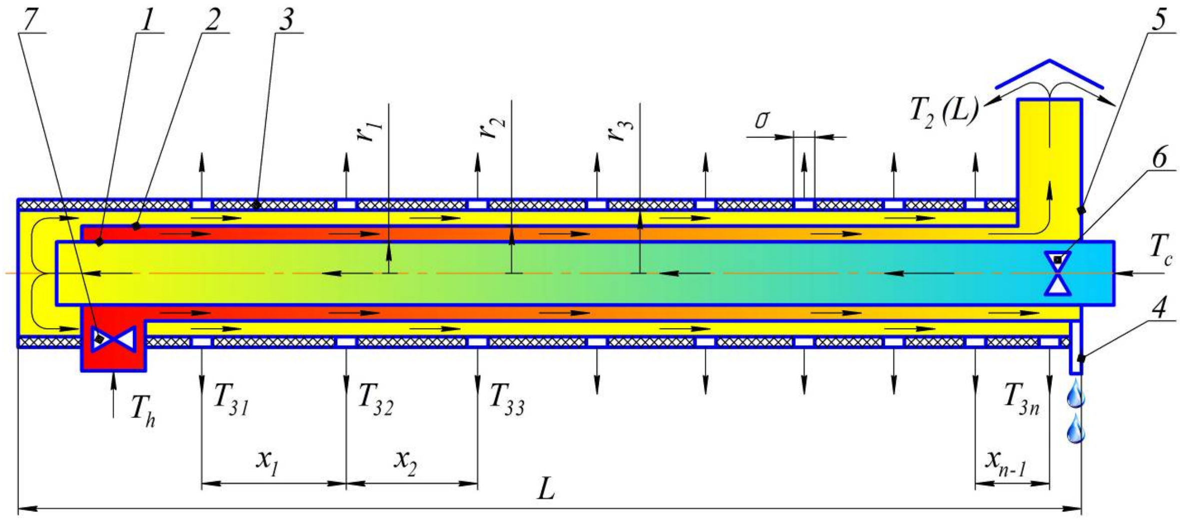

Fig. 1. flowsheet trohtrubnoho heat utilizers of the main parameters: 1, 2, 3 - pipe; 4 - tube to drain condensate; 5 - miscarriage mine; 6 - supply fan; 7 - miscarriage fan.

By flowsheet trohtrubnoho heat utilizers [7] of backflow are tubes 1, 2 and 3, installed coaxially, the tube to drain condensate 4 that passes through the pipe 3 and is located at the bottom of the pipe 2, miscarriages shaft 5 passing through the pipe 3 , supply 6 and 7 miscarriage fans (Figure 1). Heat recovery units makes the manufacturing process follows. The forced (cold) air fan 6 is fed to the inner tube 1. Fan 7 miscarriage (warm) air is blown out of the room into the space between the pipes 1 and 2, which has a circular cross-section. Flows moving in the opposite direction, miscarriage air goes into the environment of miscarriage shaft 5 and supply air turns around and continues to move in the opposite direction in the space between the pipes 2 and 3, which also has a circular cross-section. Thus the process of heat exchange between miscarriage and tidal air through the walls of the pipes 1 and 2, so that supply air is heated to a certain amount. Upon cooling air miscarriage on the outer surface of the pipe 1 and the inner surface of the pipe 2 condensation to drain tube which serves 4.

The purpose of research. A method for engineering calculation of parameters of heat utilizers for livestock buildings.

Research results. Methods of engineering calculation of parameters of heat utilizers for livestock buildings based on the requirements to microclimate and developed mathematical models. The first step is to calculate the air livestock premises held by the humidity of the test for carbon dioxide. Under the settlement accepted by most air on which design the ventilation system. In terms of volume ventilation dry climate can be determined by the amount of carbon dioxide emitted by animals. All ventilation volume is the volume of air that must be removed from the room by the hour to the percentage of carbon dioxide did not exceed the permissible limit (0.25%).

All ventilation volume of the accumulation of carbon dioxide are as follows:

$$O_{CO_2} = \frac{E}{\varepsilon_1 - \varepsilon_2}, \tag{1}$$

where: O_{CO_2} - Time ventilation volume, m3 / hr .; E - amount of carbon dioxide emitted by all animals per hour l / h. [6]; ε1 - allowable amount of carbon dioxide in 1 m3 of air space, l / m3; ε2 - the amount of carbon dioxide in the air 1 m3, l / m3.

The volume of ventilation, which is calculated on the content of carbon dioxide in most cases is not sufficient to remove the steam room. Therefore, estimates of ventilation in high humidity outside air to maintain better humidity. The hour volume of ventilation air humidity is determined by the formula:

$$O_W = \frac{\Xi}{\omega_1 - \omega_2} \tag{3}$$

where: OW - the amount of air that must be removed from the room an hour to support it relative humidity in the normal range (70-85%) m3 / h. [7]; Ξ - amount of water vapor that animals emit the light moisture that evaporates from the surface flooring, feeders, drinkers, walls and other barriers hour g / hr .; ω1 - absolute humidity in the premises at which the relative humidity is within the standard, g / m3; ω2 - average absolute humidity of outside air that enters the room during the transition period (November and March) in a given climate zone), g / m3.

For further calculation takes the most time volume ventilation (1)(1) or (2).

The second step is to study the plan livestock premises, establishing its geometric dimensions. Under which identifies possible locations of heat recovery units and their length L:

$$L = 14{,}776 \cdot \frac{O}{3600} + 3{,}7335. \tag{3}$$

This air flow volume equal $V = \frac{O}{3600}$. If teloutylizatora length exceeds the length of the room at first defined volumetric air flow V:

$$V = \frac{L - 3{,}7335}{14{,}776}. \tag{4}$$

And then calculated the amount of heat recovery units n the basis of the conditions:

$$[n] = \frac{O}{3600V}, \tag{5}$$

where: [...] - the operator of an integer.

The third step is to determine the radii of pipelines heat utilizers r1, r2, r3:

$$r_3 = 0{,}3619 \cdot V + 0{,}1523, \quad (6)$$

$$r_2 = 0{,}686 \cdot r_3, \quad (7)$$

$$r_1 = 0{,}343 \cdot r_3. \quad (8)$$

The fourth step is the calculation by the developed mathematical model of air temperature T3 (0) at the output of heat utilizers and its useful heat output ΔN. Due to the thermal power which is released animals and the resulting value temperature T3 (0) at the output of heat utilizers allows to set the power of a heater to be installed for additional heating temperature in the room.

The fifth step is to determine the location of the holes in geometry Air trohtrubnoho concentric heat utilizers using the developed mathematical model. The technique of engineering calculation of parameters of heat utilizers for premises apply to svynovidhodivelniy farm, pig-plan brick vidhodivelnyka (100 goals) which is shown in Figure 2. The total amount of pig heads 100 is 17.3 m × 8,2 m (141.86 m2), including easel room - 109.44 m2. Ceiling height - 3.5 m.

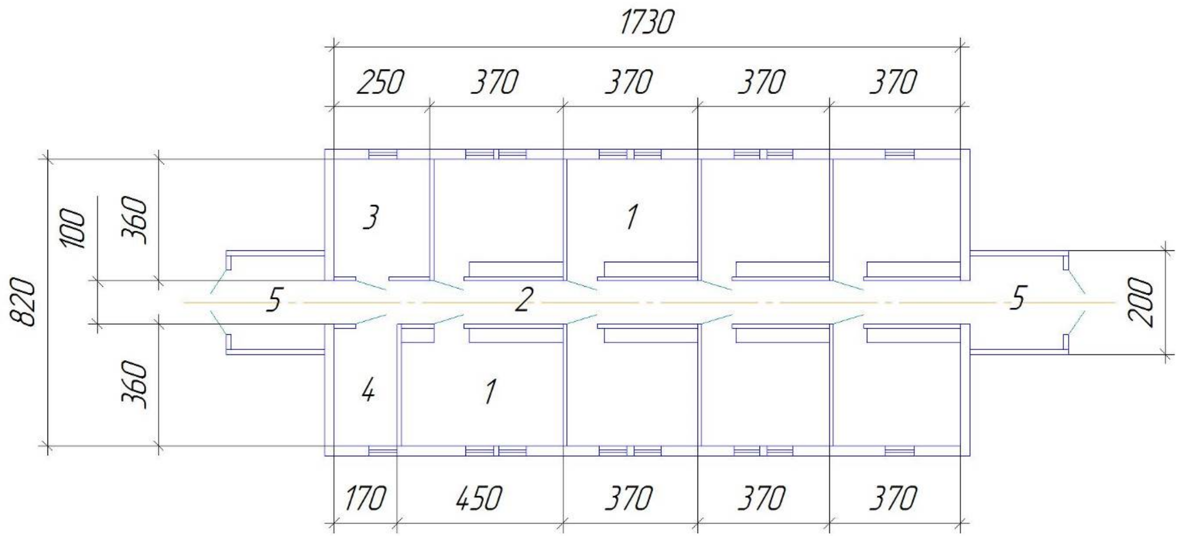

Fig. 2. Plan pig-vidhodivelnyka 100 head farm svynovidhodivelniy 1 - easel premises; 2 - pass; 3 - office; 4 - room for weights and equipment; 5 - platform.

According to [7] The amount of carbon dioxide released one adult pigs is 49.3 l / hr., Then to 100 head of this value is - 4930 l / h. For pig space allowable amount of carbon dioxide in 1 m3 of room air is 2.5 l / m3, and the amount of carbon dioxide in 1 m3 of air - 0.3 l / m3. Then the formula (1) have ventilation time amount of carbon dioxide accumulation is $O_{CO_2} = 2240\ м^3/год$.

According to [7] The amount of water vapor, which provides one adult pig fattening is 156.0 g / hr., Then to 100 head of this value is - 15600 g / hr. Absolute humidity indoors, where the relative humidity is within the norm of 10.15 g / m3, and the average absolute humidity of the outside air that enters the room in a transitional period - 2.99 g / m3. [7] Then the formula (2) the amount of time have ventilation of the accumulation of carbon dioxide is $O_W = 2178\ м^3/год$. For further calculation takes the most time ventilation volume O = 2240 m3 / h.

According to the obtained dependence (3) teloutylizatora length is L = 12,9 m length not exceeding pig-vidhodivelnyka. This air flow volume equal
V = 0,622 m3 / s.

Putting the data in (6) - (8) pipelines heat utilizers get radii r1 = 0,213 m, r2 = 0,259 m, r3 = 0,377 m.

According algorithm temperature T3 (0) at the output of heat utilizers at ambient temperature 0 ° C is 11,6 ° C, and its useful heat output ΔN = = 8206 watts. Due to the thermal power that is released from a pig fattening 73 W [7], get their number in Pig from animals released 7300 watts.

Using the calculator "Teplotehnycheskyy calculator" [8], which is based on [9, 10] calculated heat loss through the building envelope proposed pig-vidhodivelnyka - 3426 watts. Calculate the cost of power for heating the air in the Pig from 0 ° C to 18 ° C at a defined volumetric air flow. $d\dot{Q}_i(x) = \dot{m}_i C_p dT_i(x)$, Spending capacity is 13,515 watts. Given the heat loss through the building envelope overall cost capacity is 16,941 watts.

Since the amount of thermal power that stands out from all the animals and useful heat output teloutylizatora less than the total cost of power, then to maintain the temperature in the Pig at 18 ° C is necessary to install an additional heater [11, 12] with useful capacity of 16941 W - 7300 W - 8206 watts = 1435 watts.

To determine the location of the holes in geometry Air trohtrubnoho concentric heat utilizers use the algorithm, whereby we get 16 holes, which are separated by a distance x1 = 0,920 m; x2 = 0,925 m; x3 = = 0,925 m; x4 = 0,918 m; x5 = 0,908 m; x6 = 0,893 m; x7 = 0,873 m; x8 = = 0,850 m; x9 = 0,824 m; x10 = 0,796 m; x11 = 0,765 m; x12 = 0,732 m; x13 = = 0,698 m; x14 = 0,662 m; x15 = 0,626 m; x16 = 0,589 m.

Conclusions

Based on the theoretical and experimental dependences of the technique of engineering calculation of parameters of heat utilizers for livestock buildings.

The use of heat utilizers developed for pig-vidhodivelnyka 100 head allows reducing power consumption when compared to the base vehicle - Fan AOB-M1 ЭVO 0.9 (10 kW).

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Based poluchennыh Theoretically эksperymentalnыh dependence and engineering calculation method is designed teploutylyzatora parameters for zhyvotnovodcheskyh premises. Using razrabotannoho teploutylyzatora for pig-heads otkormochnyka 100 allows us umenshet rashod electricity when compared to bazovым funds - Fan AOB-M1 ЭVO 0.9 (10 kW).

Teploutylyzator, methods, microclimate, zhyvotnovodcheskye the premises, temperature, heat transfer.

On basis of theoretical and experimental dependences of technique of engineering calculation of parameters of heat exchanger for livestock buildings. Using heat exchanger designed to piggery fattening 100 goals allows umenshet power consumption when compared to the base vehicle - fan heater AOB 0.9 M1-EVO (10 kW).

Heat recovery, methods, microclimate, animal room, temperature, heat transfer.

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EVALUATION characteristics of errors in monitoring quality parameters of water impedance parameters

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We consider the electric model conductometric cell. The method of water quality control for their electrical parameters. Analysis of the characteristics of errors arising in the measurement of active and reactive component of conductivity.

Quality control, quality electrical impedance, error.

Formulation of the problem. Of particular interest to industry practices are electrochemical analysis methods to automate monitoring of water quality of centralized drinking water supply, control over the observance of technological regime in water treatment and environmental monitoring of human existence. [1] Noteworthy methods of monitoring water quality parameters for its electrical conductivity.

Analysis of recent research. Research methods for monitoring water quality and milk through conductometry presented in the literature [1-4]. In particular, [1] and [4] the control is with the active and reactive