HEAT PUMP MODELLING

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For optimization of regimes and structure of a heat supply heliosystem with the ground accumulator of heat and heat pump (HP) it is necessary to have a method of a power consumed estimation by a HP.

Results of optimization essentially depend on a way of processes modeling in a power supply system within the limits of the chosen method of calculation. Usually are applied two methods: so-called thermodynamic Karno based on a return cycle, and experimental, with use of the results of real installations tests. The first way is not the full proved, besides it has qualitative character. The second, having high reliability, has a number of lacks, as its parametrical limitation of represented data and a way of their representation – usually graphic that is complicated for their application in analytical researches and optimization. Therefore is a necessity to develop the mathematical model well adapted for a wide spectrum of analytical applications

It is considered HP which a structure consists of following elements: evaporator, compressor, condenser and a throttle. For investigation of functional tie between defining parameters of HP the mathematical model of the processes in the considered device has be developed. The model is based on definition the areas of zones of boiling and an overheat in the evaporator, and also zones of cooling and condensation in the condenser with use of dimensionless specific thermal loadings of heat exchangers. The system of the equations of considered model includes enthalpy balances of HP cycle and the equations of heat transfer in the evaporator and the condenser. The stable work of heat exchange elements HP within the limits of model is provided with the compressor which productivity and difference of pressure should correspond to an outlet steam of the working agent formed as a result of boiling. As the working agent has been chosen cool agent R–12.

Results of investigations can be given as a formula for coefficient of performance

$$COP = 0,01 \cdot \exp\left(7,3501\frac{T_e}{T_c}\right) + \left(0,5219\frac{T_e}{T_c} - 0,3919\right)\frac{\tau_1}{\tau_1^n}.$$

Where T_e– boiling temperature in the evaporator, T_c – condensation temperature in the condenser, τ_1^n – temperature of a heat source for nominal conditions,

τ_1 - current temperature of a heat source.

This formula is the base for seeking the rational operating modes and schemes of heat supply systems which include a HP.