Development and improvement of high-technology items of space and aviation technology are necessarily led to increase of specific energy parameters. Moreover reliability and durability requirements increase. Hence requirements for accuracy of conducted calculation also increase at elaboration, designing and creation of new engineering specimens. Present work concerns the question of rising thermal load to construction parts, followed the augmentation of specific energy parameters. The increase of pressure and temperature at flow paths of engine combustion chambers and propulsion systems bring to rise of specific heat flows, including heat flows of radiant nature. Calculation of radiation heat flows, taking into consideration variety of physic phenomenon for real configuration, represents some computing and physico-mathematical difficulties. Present work contains the comparison of results of radiation heat flows calculation in model duct with uniform cross-section. These results were obtained with use of engineering calculation methods and contemporary computational approaches, which were realized in commercial software. The duct with uniform cross-section was considered as an object. The flow of multicomponent reactive gas medium of combustion products of air-hydrocarbon fuel mixture was examined in that duct at high pressure conditions. It was considered the turbulent flow of multicomponent gas mixture in axisymmetric channel. The combustion process was considered as equilibrium. The wall was considered as temperature with coefficient of radiation, representative all modern structural materials. At calculation with using of engineering methods, given in special literature, which recommended to use in process of creation of aerospace technique specimens, the essential difference in the level of radiation heat flows was determined. This difference can be explained by use of various empirical data, which underlied in engineering methods. As a physical model, used in commercial software, the model of thin radiant layer and discrete ordinate method. The comparison of calculation results has shown the satisfactory correspondence and close magnitudes to one of engineering method. Since the calculation magnitudes of radiation heat flows level may be cause of significant changes of construction, it is necessary to produce enough accurate method of calculation. Such method can be create with use of contemporary physical models and reliable experimental data.