Advanced exergy analysis of a R744 booster refrigeration system with parallel compression

In this paper, the advanced exergy analysis was applied to a R744 booster refrigeration system with parallel compression taking into account the design external temperatures of 25 degrees C and 35 degrees C, as well as the operating conditions of a conventional European supermarket. The global efficiencies of all the chosen compressors were extrapolated from some manufactures’ data and appropriated optimization procedures of the performance of the investigated solution were implemented. According to the results associated with the conventional exergy evaluation, the gas cooler/condenser, the HS (high stage) compressor and the MT (medium temperature) display cabinet exhibited the highest enhancement potential. The further splitting of their corresponding exergy destruction rates into their different parts and the following assessment of the interactions among the components allowed figuring out the real achievable improvements. The avoidable irreversibilities of the HS compressor and that of the MT evaporator were mainly and completely endogenous, respectively. On the other hand, the gas cooler/condenser could be predominantly improved by decreasing the inefficiencies of the MT evaporator. As regards the auxiliary compressor, large enhancements were attainable through the drop in the irreversibilities occurring in the remaining components. (C) 2016 Elsevier Ltd. All rights reserved.