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The railway isothermal rolling equipment classification considering the main body enclosure thermotechnical properties criteria

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Abstract
The article gives a classification of isothermal rolling equipment depending on the heat transfer coefficient, which evaluates the total heat-mass transfer through car body enclosure. This allows forming of the modern isothermal cars fleet in current transfer conditions of perishable grocery, artificial packaged and palletized freights, which require a protection from atmosphere precipitation and temperature differential.
Key words: ISOTHERMAL ROLLING EQUIPMENT, HEAT TRANSFER COEFFICIENT, FREIGHTS REQUIRING A PROTECTION FROM ATMOSPHERE PRECIPITATION AND TEMPERATURE DIFFERENTIAL

Introduction

The freight carriage by railway is performed in different rolling equipment types. The isothermal rolling equipment (IRE) performs the carriage of freights requiring a protection from atmosphere precipitation and temperature differential. Under current conditions, the perishable goods carriage directions and volumes are being changed; the severe requirements to isothermal transport vehicles are being imposed; the other transportation modes competition is being increased. At present time, the volumes of non-perishable grocery, artificial packaged and palletized freights, which require a protection from atmosphere precipitation and temperature differential, are being increased. This freights transfer conditions require the forming of covered railroad cars fleet with insulation against heat and cold. The body thermotechnical properties quality, which is characterized by the main factor - heat transfer coefficient, is considered as one of the main requirements to IRE.

Main body

Isothermal car (IC) is classified according to the IC freights type. They are divided into universal and specialized. The universal IC are

intend for the carriage of all perishable goods (PG) types that can be frozen, refrigerated and non-refrigerated. Specialized IC are intended for transportation of certain goods (fruits, wine, milk, etc).

According to cooling method, IC are divided into:

- with the machine cooling (refrigerated cars);
- with cooling water ice, a mixture of ice and salt or dry ice (ice-cooled cars);
- - without cooling and heating (thermos cars).

In addition to providing of the necessary conditions for the quality preserving of the freights, IC must have a minimum heat transfer coefficient of freight stowage space with the smallest possible thickness of body enclosure elements. According to "Agreement for the International Carriage of Perishable Foodstuffs and on the Special Equipment to be used for such Carriage" (ATP), IC can be classified by body (B) heat transfer coefficient values.

IC classification by body heat transfer coefficient values according to APT statements is given in Fig. 1.1.

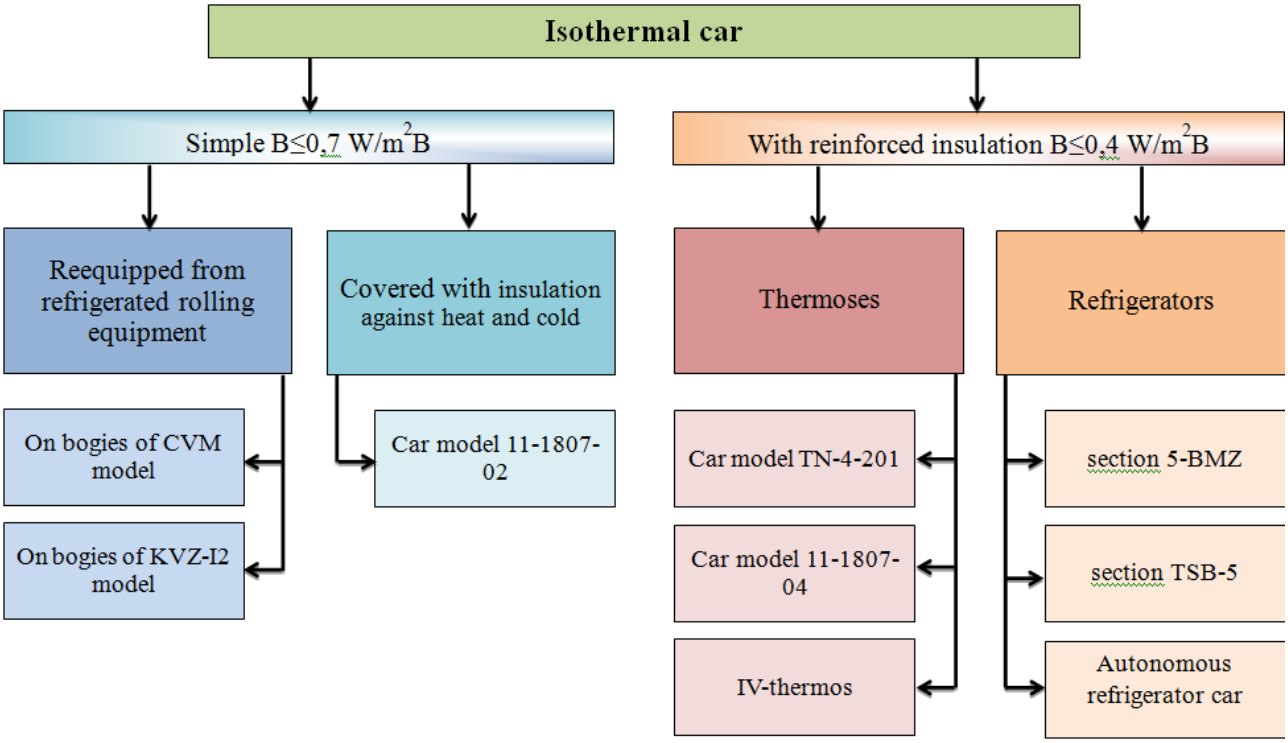

Figure 1. Classification of modern isothermal cars fleet in accordance ATP

Covered cars of type "918" with heat-insulated body reequipped from microwave relay station/radio-relay station/RRS on the bogies of CVM and KVZ-I2 model are used for carriage of non-refrigerated goods and confined list of refrigerated goods, which do not require the temperature specifications maintenance depending on carriage distance, season, according to "The Operating Procedure of Cars Reequipped from Refrigerated Cars and Grocery, some Types of Perishable Goods and other Freight Types to be Carried in such Carriage Conditions in International Traffic between the Members of the Commonwealth, the Republic of Latvia, the Republic of Lithuania, the Republic of Estonia" approved at the 38 Council meeting on rail transport of members of the Commonwealth. The heat transfer coefficient of enclosure covered cars with heat-insulated body is B=0.45 W/m^{2}B.

The cars on bogies of KVZ-I2 model have the capacity of 53t and stowage rate of 136m^3 while the cars on bogies of CVM model have the capacity of 50t and stowage rate of 127m^3. [2]

Covered cars with heat-insulation of 11-1807-02 model are intended for the carriage of non-perishable grocery artificial packaged and palletized freights requiring a protection from atmosphere precipitation and temperature differential. The heat transfer coefficient of covered car body with heat-insulation is B=0.56

W/m^{2}B, the capacity is 60t and stowage rate is 156 m^3.

The thermos cars of TN-4-201, 11-1807-04, «IV-thermos» models are used for carriage of refrigerated goods, which are thermally prepared for car loading. In cars thermoses, it is prohibited to transport the thermally unprepared perishable goods, which produce the biological heat (fresh vegetables and potatoes), and also the goods with fixed shelf life (after completion production process) less than 10 days. The heat transfer coefficient of thermos car body of TN-4-201 model is B=0.27 W/m^{2}B, the capacity is 60t and stowage rate is 126 m^3; the heat transfer coefficient of thermos car of 11-1807-04 model is B=0.248 W/m^{2}B, the capacity is 58t and stowage rate is 145 m^3; the heat transfer coefficient of IV-thermos is B=0.35 W/m^{2}B, the capacity is 50t and stowage rate is 127 m^3.

Refrigerated cars of 5-car sections and autonomous refrigerated cars are used for ensuring of PG carriages (fish, meat, etc.) over long distances. The PG carriage in refrigerated cars is carried out with cooling, air ventilation, heating and in “thermos” mode. The heat transfer coefficient of freight car body of 5-car refrigerated sections of 5BMZ type is B=0.32 W/m^{2}B, the capacity is 47t and stowage rate is 110 m^3. The heat transfer coefficient of freight car body of 5-car refrigerated sections of TSB5 type is B=0.35 W/m^{2}B, the capacity is 49t and stowage rate is 100 m^3. The heat transfer coefficient of autonomous refrigerated cars body with maintenance crew is B=0.35 W/m^{2}B, the capacity is 24t and stowage rate is 56 m^3. [3, 4]

The modern development of grocery artificial, packaged and palletized freights production technique allows the preliminary preparation of goods in their production or storage places; it does not require creation and preserving of thermal conditions by electric power installation when transporting. There is a need for rolling equipment, which proved only passive protection of freight from environmental exposure. There was a demand for modern transport vehicles and PG expedited delivery technique by mostly small shipments up to 25-30t, just in time and door-to-door. The refrigerated containers can provide that.

Conclusions

As can be seen from the above, the modern freight nomenclature, their transportation conditions, IRE freight railway carriage volumes analysis over recent years give grounds for further forming of covered cars fleet with heat-insulation, thermos cars and potentially isothermal containers.

Refernces

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