

## From Experience of Development of Thermoelectric Conditioners For Driver's Cabins of Rail Transport

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### Abstract

During several years designers and management of RPE «Kvant» proved in various instances the advantages of use of thermoelectric conditioners for establishing of comfortable conditions in driver's cabins of diesel and electric locomotives. And only in 2000 technical requirements on development of conditioners for cabins of metro wagons «Yauza» of Moscow underground and cabins of diesel locomotives of the Kolomna Plant have been coordinated.

Some variants of such conditioners including conditioners with ribbon radiators were tested.

Presently dozens of train formations «Yauza» and «Rusich» of Moscow underground have thermoelectric conditioners in driver's cabins.

Power of the base block of the thermoelectric conditioners for 5 years has been increased in one and a half time at significant reduction of their weight.

Now more than 150 conditioners are located in modern diesel locomotives of series ТЭП70 of the Kolomna Plant.

The system «climate-control» for these conditioners is tested. Developments of the base block of the conditioner with improved weight – dimension characteristics are conducted.

### Thermoelectric Conditioners

Thermoelectric conditioners (TC) in comparison with compression conditioners have indisputable operational advantages:

- Environmentally friendly;
- High reliability;
- Large resource;
- Operational reversibility (cooling-heating);
- Maintenance free during operation;

However their wide use is restrained by a row of factors basic of which are: heavy weight, high consumption and, for the present, a high price.

RPE "Kvant" in 1999-2001 has developed and produced a series of thermal conditioners systems air-air for driver's cabins of the Moscow underground "Yuza" and "Rusich", as well as for diesel locomotive ТЭ70 with cooling capacity 1.0; 1.5 и 3.0 kW accordingly with the specific price 6 €/W. Cooling coefficient ( $K_x$ ) made ~0.6-0.65 and cooling capacity ~10-12 W/kg. These TC are operating at the present time. Several design modifications of radiator assemblies and technological improvements, use of collector free ventilators of DC allowed in 2005 to develop mass production TC for driver's cabin of the modern locomotives of «Kolomna Plant» 2ТЭ70, ТЭП70БС with cooling

capacity 3,6 kW with specific price 3,9 €/W and specific cooling capacity 16 W/kg.  $K_{cool}$  of this TC is ~0.85-0.9. Since 2006 more than 160 TC are installed in diesel locomotives. Block of TC is shown in Photo 1, 2.



Photo 1.



Photo 2.

In 2007 system "climate-control" was developed and stand tested (2) for this TC and presently serial output of this system is being prepared.

In cooperation with «Crystal» company RPE «Kvant» developed a new variant of TC (1) in which a thermo-cell, size 6x43 mm is located directly between U-shaped radiator plates of the conditioner (Photos 3 and 4).

These activities as well as use of ventilators with operating voltage corresponding to the operating voltage of diesel locomotive will greatly increase reliability and weight – size properties of TC.



Photo 3.



Photo 4.

### Conclusions

Summirizing the above-stated in the nearest future we hope to reduce TC price to 3.3-3.5 €/W and increase the cooling capacity to 20-22 W/kg that, taking into consideration the operational advantages, will increase the attraction of their application.

### References

1. Scientific –technical report on testing of the experimental model of thermalelectrical conditioner with light radiators, Moscow, RPE «Kvant», March, 2007
2. Scientific-technical report on testing of the system «climate-control» of conditioner БТК-3,0, Moscow, NPP «Kvant», April, 2007