DUROPAN ALLIANCE

Technical description:

Thermal Transmitter TT1 / TT2

The Thermal Transmitter (TT) is an innovative technical solution for the utilization and direct conversion of waste heat from technical processes into electrical energy with the exclusion of mechanical components.
On the basis of the Seebeck effect, findings from space travel are transferred to terrestrial requirements. The essential prerequisites are the realization of a continuously high heat flux through the thermal generator (TEG), a good thermal coupling of the thermogenerator to the heat-conducting media, as well as the most complete utilization of the thermal energy levels available in many technical processes.

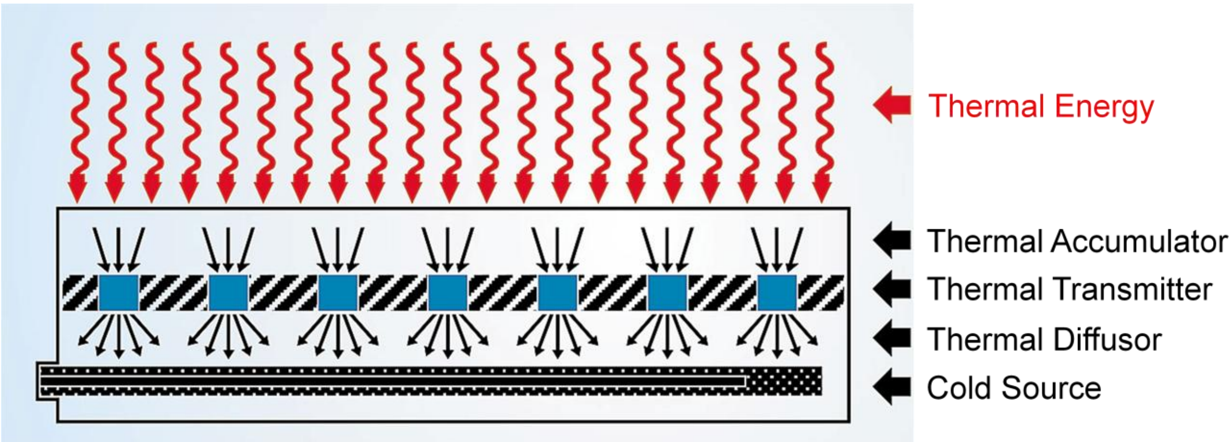

Figure 1: Principle of the thermal transmitter, example TT2

A fluid-carrying printed circuit board (547.5 x 582.5 mm) is used as the carrier element for the constructive construction of the transmitter. This circuit board of approximately 2.7 mm thickness has 5 inlets and outlets, through which a capillary network laid in the plate is passed. The capillary network is designed in such a way that the thermogenerators can be heated or cooled uniformly. 100 thermogenerators can be placed on a circuit board.

DUROPAN GmbH has made the following designations due to the large number of combinations of the thermally conductive media:

TT1 Thermal transmitter 1, carrier circuit board **hot**- flowed
TT2 Thermal Transmitter 2, carrier circuit board **cold**-flowed

The fluid used can be water or else another correspondingly thin liquid heat transfer fluid. The viscosity must not exceed 500 mPa · s. The fluid takes over the heating or cooling function.

The printed circuit board consists of a glass fabric bonded with epoxy resin. The technical data correspond to the circuit board material FR4. The ducts are made of copper and protected by a nickel or gold layer. The volume of the fluid in the circuit board is approx. 120 ml. The max. Permissible connection pressure for the fluid is 8 bar. The connections for the fluid are made of stainless steel, so that possible electrochemical reactions are prevented. Due to the fine capillary network, the use of flushable particle filters is sensible and mandatory. As an maintenance measure, an annual flushing with a short-term higher pressure is provided.

For stabilization and synchronization, a corresponding control electronics is used for 50 TEGs each. These are positioned outside the thermally active field. The power is extracted by means of two sturdy and additional moisture-proofed threaded connections with cable boot and M4 screw.

The entire system is sealed with an infrared-absorbing topcoat.

The media are fed via a stable outer copper tube system of 8mm diameter. The other connection can be made by means of a flexible hose with a 3/8 "thread. Depending on the number of plates, an increase in the cross-section in the feed is necessary. The temperature difference between feed and feed is max. 4 degrees.

Operational parameters for the operation of the thermal transmitter:

Thermal application: -30 ... + 120 °C.

In this case, a point thermal (over) loading of the plastic layer is inadmissible. This can lead to the combustion and the destruction of the layer. During operation a continuous heat flow must be ensured; avoid heat build-up.

The flow quantities in the circuit board and the possible flow quantities on the other side of the generator are available as control variables. Since the effective mode of operation is determined by the temperature difference between the hot side and the cold side, a balanced relationship between the two heat quantities (Qzu = Qab) has to be ensured by engineering engineering. This control circuit is to be determined and adjusted according to the application.

The voltage is output via the already mentioned connection terminals.
The voltage to be achieved depends on the temperature difference that can be displayed and is between 0 ... 18V. The corresponding power is linearly dependent on the temperature difference.

With a Delta T of 80 K, adjacent to the generator, a power of up to 200 W per panel is to be expected.

By means of an LED-based lighting system adapted to the thermal transmitter, illuminations can be operated in the low-voltage range without major energy conversions, without the need for expensive protective measures.

A further application is the use of charging arrays or the classical feeding into the grid via appropriate inverter technology.

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