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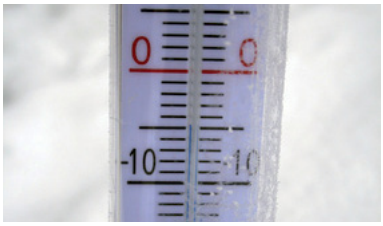
Temperature Meter and Temperature Probes

Temperature is an important parameter which defines not only the technological process, but also the condition of certain substances. The generally accepted scale is a scale with the temperature unit Kelvin (K), the starting point of that scale is absolute 0 (0 K). The majority of people are more familiar with the Celsius temperature scale (°C).

The name itself explains the function of the device, but as against to its „smaller brother"-ordinary thermometer, a temperature meter is a more complicated device meant for application in various fields, including industry. There are two general types of temperature meters: contact and non-contact (or pyrometer / infrared thermometer).

Among the most popular kinds of temperature meters the following can be pointed out:



Expansion thermometer – the volume of liquids and mass of the solids change when the temperature changes. The most popular one is a glass liquid thermometer which is filled with some liquid (mercury or ethyl alcohol) which expands with the raise of temperature and moves up the capillary.

Resistance temperature meters are based on the principle that the bodies change their electrical resistance when the temperature changes. In Metal thermometers the resistance grows almost lineally together with the temperature, but in semiconducting, on the contrary, goes down. These devices are primary transducers with the convenient signal for distant transmission - electric conductivity.

Thermocouple Meters – the main principle of operation is based on the ability of two dissimilar conductors to generate thermoelectric power when the place of their connection is heated. In industry various thermocouples are applied, mostly those which are made of pure metals (platinum) and alloys (copper and nickel (copel), chromium and nickel (chromel), aluminum and nickel (alumel), platinum and rhodium (platinum), tungsten and rhenium (volfrarenium)) the material of which the electrodes are made of set the limit value of the measured temperatures. For example, chromel-copel (600°C), chromel-alumel (1000°C).

A less accurate kind of meters available is a temperature measuring device having metal strips in it. They are connected to each other and the change in temperature causes the bending of one strip more than the other which will indicate the temperature information (due to the connection to the pointer).

Non-contact pyrometer is meant for measurement of the temperature without a direct contact through the emission of the warmed objects. Radiation pyrometer is one of the most widely-spread. Its principle is based on measurement of the whole emission energy of the heated object. The rays from the heated object are focused on the blackened plate with the help of the lens and it is warmed. The temperature of the plate turns out to be proportional to the emission energy, which, in its turn, depends on the measured temperature. A row of series-connected thermocouples are used to measure the temperature of the plate. The pyrometer consists as a rule of a telescope, measuring device and auxiliary equipment, meant to protect the telescope from the contaminants.

Infrared temperature meters appeared more than a century ago, but nowadays they have really turned into modern devices which are used in industrial processes. Infrared energy is not easy to detect for the human being, it is not much different from the regular light. The IR energy after it has been directed to a certain object or material, is partly absorbed and partly reflected. The same happens with the absorbed energy, part of it will be reflected inside, but part will be emitted again. Emissivity is not a stable magnitude, depending on the material and its structure and surface (polished, matt, shiny etc.), it may change a lot and be different at different temperatures. There are certain axioms which help to get a better understating of the interconnection between certain notions (temperature and emission), like Kirchoff's Law, Stephan Boltzmann Law, Wien's Displacement Law and Planck's Equation.

In general, non-contact temperature meters allow to conduct measurements which are impossible or very difficult to do with the regular devices. If the temperatures are very high, if the objects are in movement, if the contact may be dangerous because of the high voltage or possible negative influence of the harmful elements etc. the infrared non-contact meters should be used.

A very different but interesting kind of temperature measurement is application of non-electronic devices which may indicate the temperature (these will be exactly the samples of the tested surface.). This way will never depend on any kind of electrical influence in the surrounding environment and in such a way wrong measurement results are excluded. It goes about able to melt materials which after reaching certain temperatures start melting. Among the most popular indicators pallets, lacquers and crayons can be pointed out.

The word “cryogenic temperatures” sounds unfamiliar for the majority of people. In reality it goes about very low temperatures. The ITS has been changed for a few times in the last decades, but if to speak about modern times, cryogenic meters deal with everything what goes lower than 123 K (= -150°C). Among the regular temperature meters there is one particular kind – thermistors used for especially cold temperatures. The latest ranges have become so wide and reached such extremely low temperatures that it widens the possibilities for measurements and in addition the sensors do not depend on the possible influences of the magnetic and electromagnetic fields.