

## ENERGY SAVING

## 7.4. Thermal imaging diagnostics of energy equipment

## 7.4.1. Currency of applying thermal imaging devices

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The infrared control and scanning play more and more important role in the maintenance of power and industrial equipment. The images, obtained in the thermal spectrum invisible for a human eye, allows without any contact with the object to receive complete information, concerning the temperature distribution on the object surface. It allows finding out the temperature anomalies that often precede to the failures of technical equipment and devices, which could result as well in the emergencies and catastrophes with the heavy environmental consequences.

Thermal methods of controlling the joints and details allow carrying out their diagnostics in the process of operation in real time without disconnection of equipment. Thermal control allows correct planning and carrying out only necessary fixed-schedule maintenance and repairs.

At the present time the up-to-date devices for infrared inspection of different objects appeared. They possess the wide possibilities for recording the heat flows. Among the devices of remote infrared inspection we can allocate pyrometers, infrared imagers and linear infrared scanners. The up-to-date infrared imagers and scanners allow fixing and remembering the thermal images of objects and their joints for their further analysis and processing.

The devices for measuring the infrared radiation have currently the following characteristics and special features:

- wide range of the measured temperatures;
- high resolution which is few times as high as for mechanical scanning systems;
- small sizes and mass: the infrared thermographs are currently so small, that they correspond the sizes of modern video camera;
- high accuracy of measurements;
- possibility of storing the data of measurements in the standard digital format;
- simplicity of usage;
- possibility of connecting the outside storage device compatible with PC;
- reliable operation;
- possibility of automatic color correction of signals, registered by elements of infrared sensor matrix;
- possibility and convenience of processing the data of measurements at PC.

The simplest in operation devices for registration of thermal radiations – pyrometers – allow carrying out temperature measurement of one seat (point) of object. For creation of the total picture of object's thermal state, it is necessary to determine a temperature of the large amount of control points. Taking into account that the pyrometer registers a temperature in the range of specified special angle, the accuracy of temperature measurement in the point reduces as we

are moving from the object. Therefore, determination of temperature distribution in object by means of pyrometer becomes the labor-intensive operation with not high accuracy. At the same time the pyrometers have high reliability; they are convenient in operation and have a low cost.

The infrared imagers give the full visual thermal picture of the object under study practically at once in real time with high spatial resolution and keeping the image for the consequent processing and analysis. Using the replaceable optical system, the infrared imagers allow to carry out inspection of objects being in distance equal to tens and hundreds meters (for pyrometers these distances are 10...15 m). Unfortunately, the infrared imagers have still a high price.

The linear infrared scanners combine a high efficiency of infrared imagers during the objects inspection and the simplicity of pyrometers operation. The working element of scanner is not a complex and expensive matrix as in infrared imagers, but only a bar of sensors. Scanning in vertical direction is carried out by an operator or by a scanning optical system. Scanning makes a little more difficult the process of inspection; however, it significantly decreases the cost of infrared radiation recorder.

Thermal imaging technique can be widely used in electric power industry and adjacent industries:

*in electric power engineering* — control of electric equipment of substations, power transformers, switches (breakers) and safety devices (fuses); inspection of HV transmission lines, switching and control equipment;

*in thermal power engineering* — control of the state of furnaces, boilers, refractory and thermal insulation, tanks for liquids storage, thermal insulation of pipelines and airways;

*at community facilities* — inspection of state or conditions of housings and structures with controlling the thermal loss through the protecting building structures, the search of condensing moisture aggregations in building structures; control of technical state and search of faults in the heating facilities of buildings and structures;

*in machine building* – the states of electric drive, pipelines, lifting mechanisms, pumps, compressors, shafts, couplings, sheaves, different gears and clutches;

*at transport* — control of the state of railway and underground vehicles being in operation and in depot, control of internal combustion engines and details of motor transport.

Thermal control allows the specialists quick finding the certain places of supernormative heat evolution and making the conclusions on these or other violations and failures of the operating equipment. Let us consider in details the application of infrared imagers in electric power industry, namely: at TPS's.