# FEATURES OF DEVELOPMENT AND APPLICATION OF THE THERMAL NON-DESTRUCTIVE TESTING TECHNOLOGIES IN REPUBLIC KAZAKHSTAN

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Now both for economy of Republic Kazakhstan and for the countries CIS are characteristic presence of set of objects practically in all fields of activity with significant deterioration of the basic means, deterioration of a technical condition and reliability characteristics of buildings and constructions and, as consequence, are presence of power wastefulness and a high probability technological risks.

In modern conditions for the decision of an actual problem of diagnostics emergency and preemergency situations, reliable and effective operation of industrial objects, building constructions and objects of housing and communal services are widely used technologies of non-destructive testing.

The analysis of a modern condition of works and practice of monitoring of an operational condition and heat-power characteristics of various objects shows, that today it is represented expedient to carry out the control and diagnostics of such objects under the analysis of their temperature fields by a method of thermal non-destructive testing (TNDT). This method has proved to be, as one of the most perspective, technological, informative and objective methods of non-destructive testing, proved the efficiency and having certain scientific reserve.

The estimation of practical results and opportunities of application of thermo vision diagnostics technologies for different classes of objects and our long-term cooperation with the Russian scientists and experts in this area will allow making use today the received of experience and results for set of the Kazakhstan objects in various fields of activity. Today development and expansion of practice of application of the above mentioned technologies on various objects of Republic solve actual claimed problems of power saving and increases of reliability of functioning of industrial and social objects.

Claimed direction of application of methods of the thermal non-destructive testing is building objects and objects of housing and communal services. On these objects according to the Russian scientists, the potential power saving across the Russian Federation makes from 20 % up to 40 %. Taking into account similarity of building both industrial infrastructures and a uniform initial economic basis of Russia and Kazakhstan it is possible to use with the big reliability these estimations for Kazakhstan too.

Implementation and development of the thermal non-destructive testing technologies and thermo vision diagnostic complexes for monitoring the Kazakhstan building objects and objects of housing and communal services will enable to receive an operative estimation of their actual operational condition and their real heat-power characteristics that will allow to lower a level of their breakdown susceptibility, above permitted standard thermal losses, to increase power efficiency, reliability and safety of functioning of the above mentioned objects.

The thermal non-destructive testing technologies for industrial targets in strategic branches of economy of Kazakhstan are claimed today. Diagnostics of objects for the enterprises of mining - metallurgical branch and oil-and-gas sector of which presence of "dangerous" objects which operational condition substantially influences occurrence of preemergency, emergency and extreme situations is actual. Such objects are: the oven equipment (Vanjukov furnaces, furnaces of a boiling layer, roasting machines, drying drums, etc.), oil and gas mains, flues, boilers, power equipments, etc. Practice of work with such technological complexes shows, that deterioration of their operational properties, in most cases, is connected to infringement of their temperature modes, destruction isolation and thermo isolation coverings, infringement of tightness, occurrence of outflow, destruction of lining and etc.

Are actual now in Kazakhstan the works on application of methods of the thermal non-destructive testing for monitoring of ecological objects and objects of the Ministry of Emergency

Situations. Under this category get also potentially dangerous objects in various industries and subjects of works on monitoring safety of operation of railways (an estimation of increase of humidity of a railway embankment), monitoring and the control of increasing of deformation of the road basis owing to landslide processes, to detection of washouts and infringements of the road basis in places of passage of engineering communications (drainages, channels, water mains, etc.).

Carried out today *"SYSTEMOTEKHNIKA" Ltd* firm the project on development and expansion of sphere of application of thermo vision diagnostics technologies on various objects in Kazakhstan is focused on interaction with our colleagues in the Russian Federation and development hardware-software components, methodological and normative-legal rules in the given direction.

Below we shall present in more detail the results of performance of the first stages of the above mentioned project in 2009.

Some words about the project. The project «The Automated complexes of diagnostics of an operational condition of building, housing-and-municipal and power-intensive industrial objects » is initiated by *"SYSTEMOTEKHNIKA" Ltd* firm, maintained by joint-stock company «Fund of a science» and supervised today by an innovative consortium «Energy Innovation Group».

Works of the project are planned in view of the following factors.

- The theory and practice of thermal non-destructive testing (TNDT) technologies in the Russian Federation considerably outstrips a condition of the given direction in Kazakhstan.

- Implementation and development of thermo vision diagnostics technologies on objects in Kazakhstan is expedient for beginning not with «a pure sheet», and with effective methods and toolkit the express - diagnostics, received good practice on objects of the Russian Federation.

- The best stimulation of development of TNDT technologies in Republic is demonstration of the decision of tasks of an estimation of actual heat-power and operational characteristics on one of important objects in Kazakhstan with representation of opportunities and efficiency of thermo vision diagnostics methods.

- Today the process of training and certification of experts to TNDT methods is possible and expedient in the educational centers of the Russian Federation.

As it was marked above, a priority sphere of the application of TNDT technologies from positions of energy saving in Kazakhstan, as well as in Russia, building objects and housing and communal services are.

Today's pitiable condition of branch of housing and communal services in our republic - the known fact [1,2]. A fixed capital is worn out on the average on 40 %, and in some regions - on 60 %. All this leads to various emergencies. The level of reliability of engineering communications in Kazakhstan, as well as in Russia in 2,5 - 3 times is lower than in the European countries. The deterioration of a fixed capital of housing and communal services demands introduction of new methods of an operative estimation and the analysis of its infrastructure.

The operative estimation of a condition of objects, opportunity of fast decision-making on the basis of the documentary and illustrated reports on the carried out inspection allow not only to liquidate failure in the shortest terms, but also to warn it, and is exact in a place of probable malfunction. And it, in turn, enables to avoid expensive in every respect (both time and monetary) liquidation of consequences of failure or scale works on reconstruction of constructions.

In a basis of a choice of technology of the express diagnostics of heat-power and operational characteristics of building objects and objects of housing and communal services for implementation and distributions in Kazakhstan laid the following criteria:

- presence of the certificated techniques, technologies, hardware - software complexes of thermo vision diagnostics of objects;

- presence of experience of effective application of technologies and complexes TNDT on objects of the Russian Federation;

- scientific and technical support of operation and development of TNDT technologies and toolkit;

- personnel support and support of works on TNDT.

The estimation of practice of application of TNDT methods and technologies in the Russian Federation according to the above-stated criteria, experience of join work and publications [3,4] have allowed to make the proved choice for the benefit of technologies and toolkit of the Institute of technology of power inspections, diagnostics and non-destructive testing "WEMO", which scientific, technical and educational support is solved together with National research technological university " MISiS ". Thus, for base of thermo vision diagnostics technology of building objects and objects of housing and communal services in Kazakhstan the technology of laboratory of non-destructive testing of Technology Institute "WEMO" certificated in Russia and more 7 years effectively maintained has been chosen. The basis of the given laboratory was made the diagnostic software-technological complex including methodical, software and technical maintenance. The complex is mobile, modular hardware-software system with the unified system of gathering and processing of the multichannel information in the uniform information - analytical concentrator on multitask technology. Methodical maintenance of thermo vision diagnostic complex was based on the techniques certificated in the Russian Federation on the basis of which in last years it is carried out thermo vision inspection of set of objects in the Russian Federation. Under the order of *"SYSTEMOTEKHNIKA" Ltd* firm the thermo vision diagnostic complex has been modified by firm " WEMO ", in view of development of a technical platform and conditions of operation of objects in Kazakhstan.

For performance of practical sections of research and innovative works on implementation and development of thermo vision diagnostics technologies on the Kazakhstan objects, it was necessary for employees of *"SYSTEMOTEKHNIKA" Ltd* firm to training, to be certified and certificated on conformity of their qualification to a level of the stages planned in the project. Training on a speciality «The thermal non-destructive testing (diagnostics of quality, an estimation of a residual resource and energy efficiency of constructions)» was carried out in one of the central high schools of the Russian Federation - National research technological university «The Moscow institute of steel and alloys (MISiS)». For accreditation of the Kazakhstan experts examination center of " MISiS " has organized interaction with the scientific - educational centers accredited in the field of the thermal non-destructive testing, with independent body of certification of experts in the field of non-destructive testing and with special state body Rostechnadzor.

The estimation of efficiency of technologies mastered and developed within the framework of the carried out project of thermo vision diagnostics of building objects was carried out by results of research of the Kazakhstan objects in the city of Astana, carried out by our experts together with the Russian colleagues ( "Technology Institute" WEMO», MISiS, "IRTIS" company).

One of objects of research was a building of Management of office buildings of Administrations of the President and Government of the Republic Kazakhstan to the address: Astana, Beibitshilik str.2. It thermo vision inspection was carried out in conformity by the preliminary arrangement of a consortium «Energy Innovations Group» with Management.

The technology of carrying out of measurements at thermo vision inspection of buildings / constructions assumes registration of various parameters of surveyed object and environment surrounding it in bench-mark zones. These are temperatures and humidity of an environment, temperature of external protecting designs from the external and internal parties, density of thermal streams. Except for that the temperature map of object was removed with the thermo vision shootings of external protecting designs.

The list of variables measured at given thermo vision inspection, the order of carrying out of measurements and a hardware-software platform are defined by the specialized technique [5].

The set of devices and kinds of measurements spent on a protecting design, and also the computerized means for the further processing of measurements is illustrated by figures 1. and 2. The example of distribution of devices on bench-mark zones is shown on fig. 3.

Lead thermo vision inspection of the above mentioned object and the analysis of its results have allowed to make an estimation of its qualitative and quantitative characteristics, to allocate the basic zones of raised losses of heat, and also to recommend actions on improvement of heat-power

characteristics of a building. **The received results have confirmed efficiency and expediency of application and development of TNDT technologies on Kazakhstan objects in conditions of realization of energy saving strategy .**

It is necessary to note, that wide application and development of TUC technologies in Kazakhstan will depend substantially on development of legal support of application of the above mentioned technologies of express diagnostics of building objects and objects of housing and communal services. Today in Kazakhstan at acceptance new and the control of maintained objects it is failed estimations of their actual heat-power and operational characteristics. The selective control which is not reflecting an actual condition of all object as a whole is made. It is obvious, that this problem is eliminated by legal support of necessity of an estimation of actual operational characteristics of these objects.

Granting at disposal of the bodies, accepting objects in operation, technologies and the diagnostic complexes, allowing to receive an adequate qualitative and quantitative estimation of conformity building and housing and communal services of objects to normative requirements will allow to exclude practically «the human factor» and to raise objectivity of an estimation of heat-power and operational characteristics of objects. For this purpose branch supervising documents of a technique and the order of carrying out of the thermal control over building objects and objects of housing and communal services and display in power passports of objects their thermo vision diagnostics results should be developed and accepted.

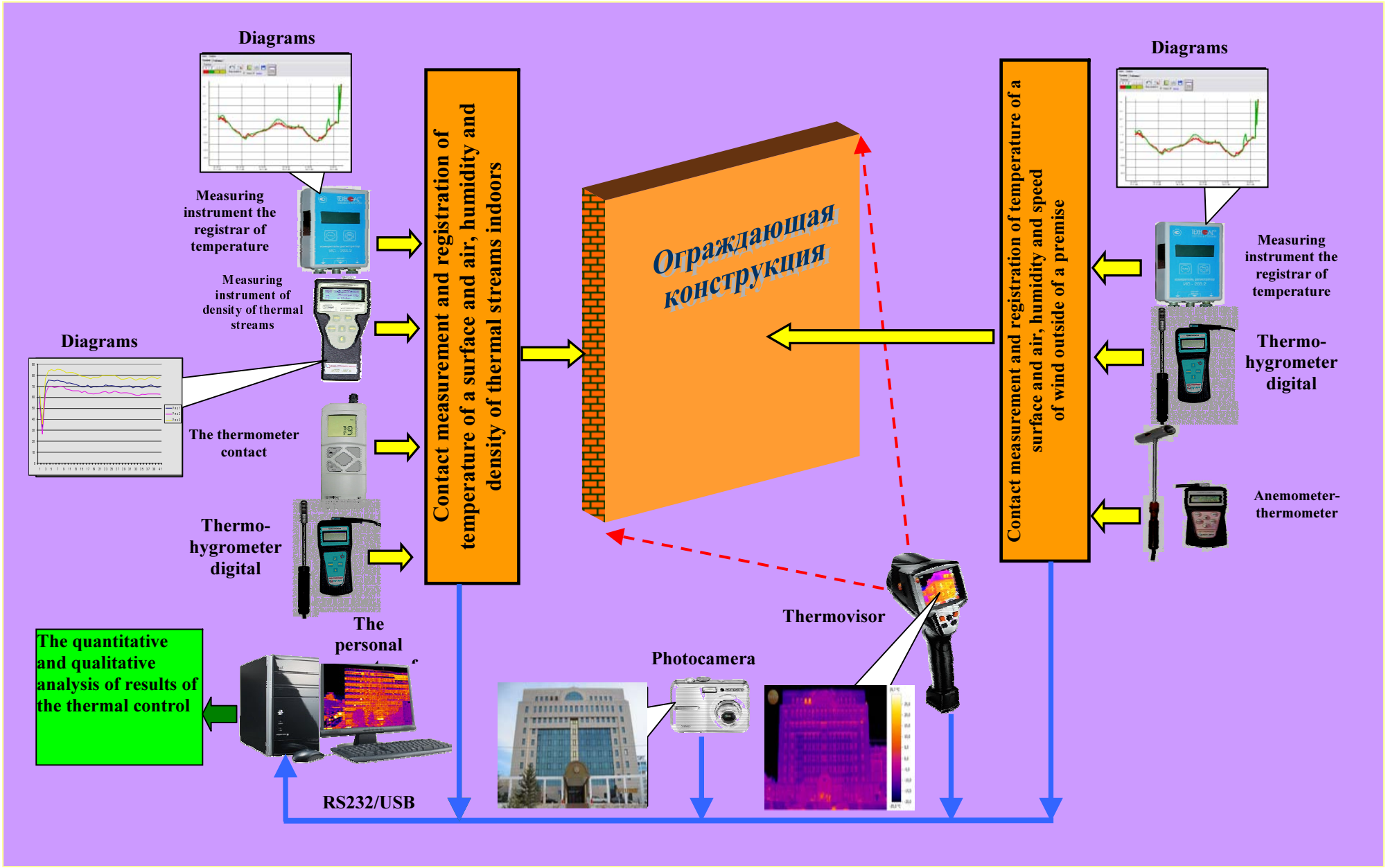


Fig. 1. Technical structure of a complex of carrying out thermo vision inspections of building object

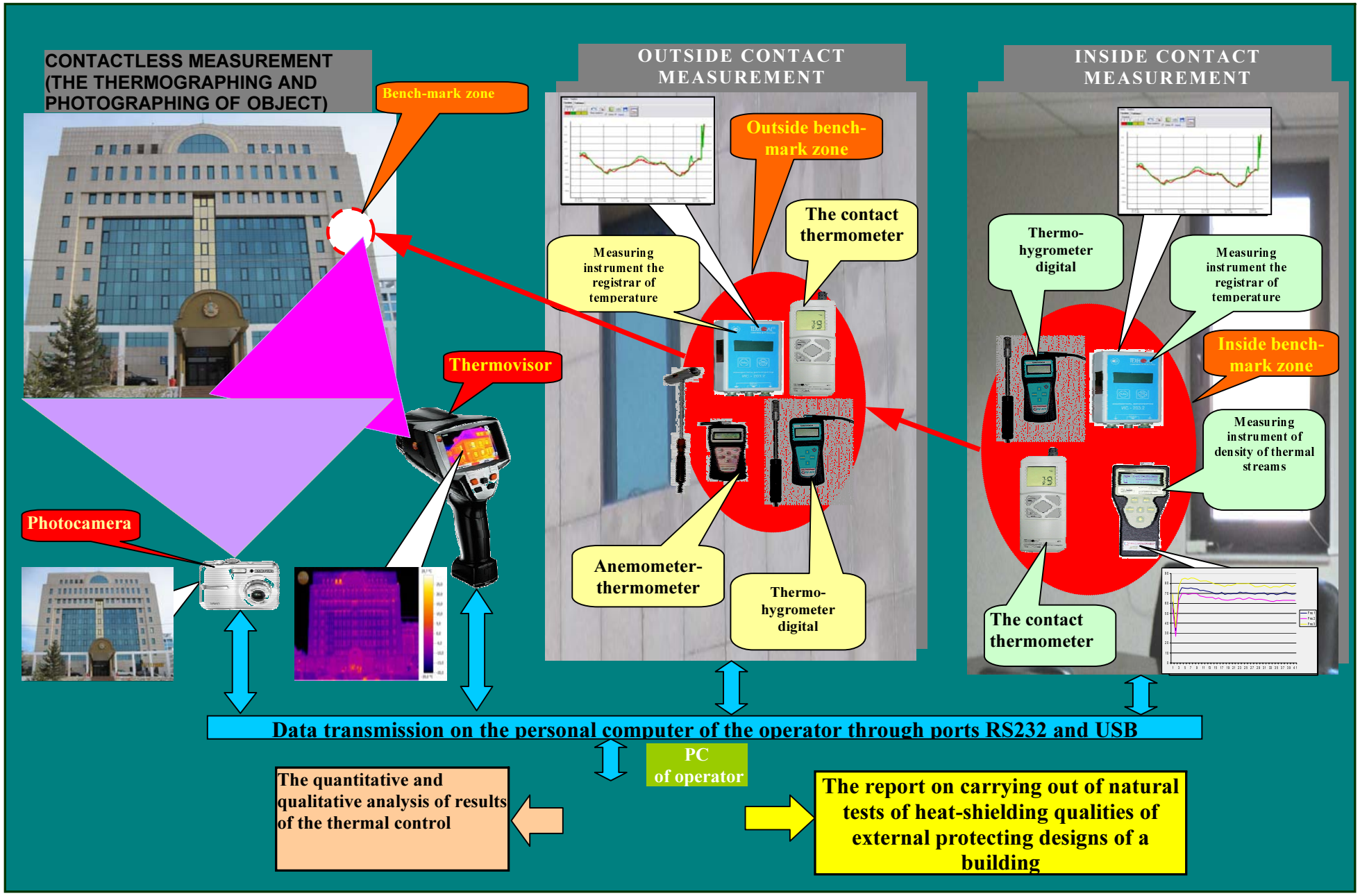


Fig. 2. Technology of carrying out thermo vision inspections of building objects

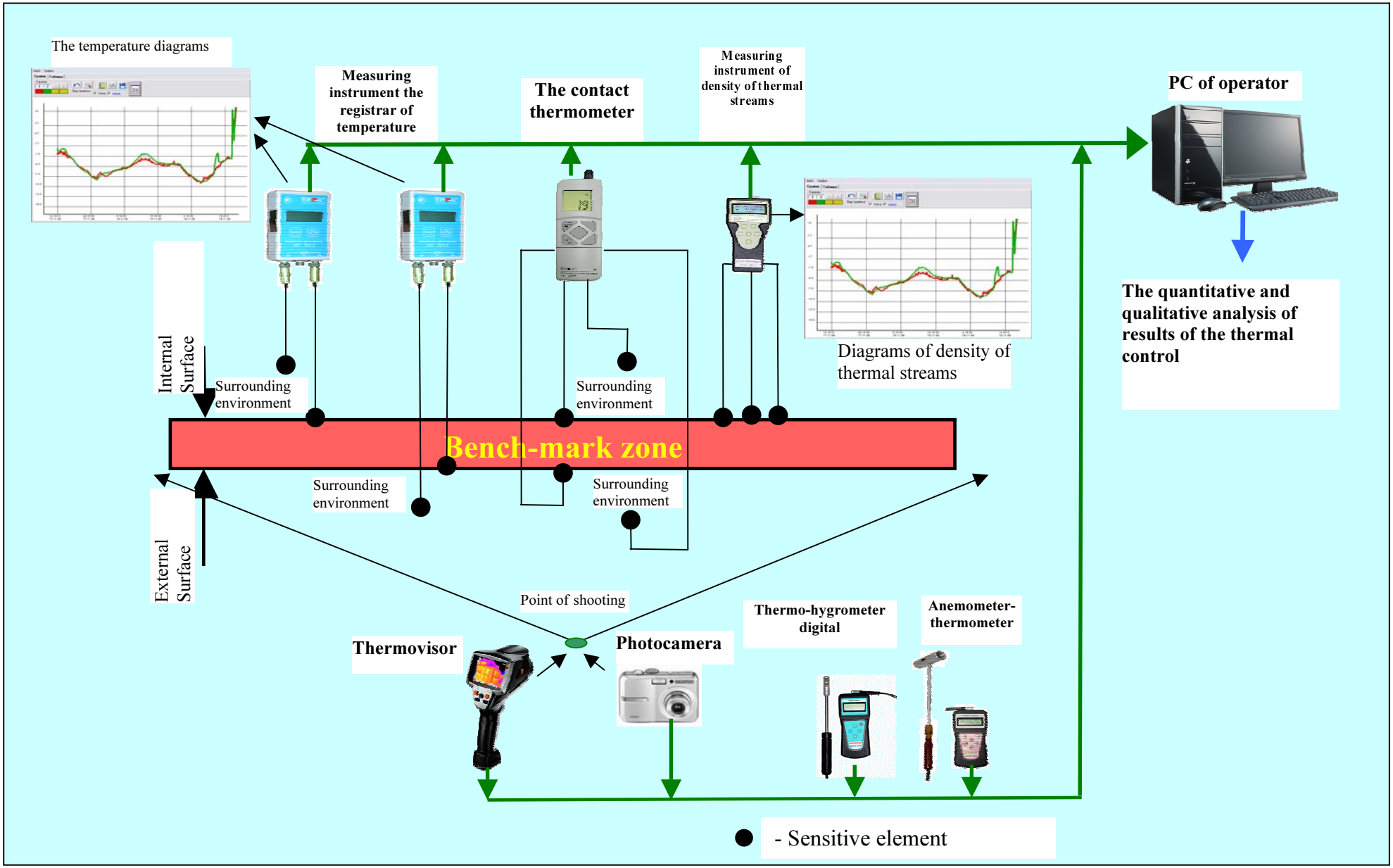


Fig. 3. An example of distribution of devices on bench-mark zones

**The list of the used sources**


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