

IR Thermographic Survey to Control-points Determination

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Abstract – One approach of the control points for temperature sensors determination by infrared camera is examined. It is important to be fixed the places of control points in a storehouse with different temperature gradients in its regions. An effective method in such case is a snapshot making of the storehouse thermic mappings. Some results of control points fixing from a kitchen room, refrigeration camera located next to the examined premises, inside and outside wall for the storehouse with border gradients are presented. The measurements are done for empty and incomplete filled storehouse.

Keywords – Heat transfer, Thermal management, Infrared camera, Thermography, Nondestructive testing

I. INTRODUCTION

In many technical problems it is important to inspect the temperature in definite points. These points can spread in different locations and temperature ranges [1]. Used technical instruments can also be quite different depending on the type of object, temperature range or measurement method. The measurement method and accuracy as well as the optimal location is important to be available an authoritative temperature pictures in certain surroundings.

On the other hand ISO 9000 procedure accepting requires a traceable process included condition in safe-keeping. In such aspect the question of control point optimal location is actually for temperature measurement in storehouse rooms.

It is necessary the temperature of some points in a storehouse to be measured giving information for temperature distribution when the storehouse borders on others premises have got diverse temperatures.

The boundary conditions just like the border wall parameters have to be known during analytical detection the temperature of specific points. This requirement is no always executed, especially for premises reconstructed on old walls. Applying the experimental method is felicitous for such situations.

The measurement method requires utilizing the same measurement methods for the check-points and the applied control. That in many cases is expensive process especially for huge storehouses. A distance measurement of temperature field by infrared (IR) camera is the possible alternative solution.

Additionally to traditional temperature sensors, which

supply product information only for local points, an infrared imaging camera is applied to record a general view over local differences of surface temperatures in the storage good. The project objective is to investigate to which extent an improved climate control can be obtained by application of thermography.

II. PRINCIPLE OF DISTANCE THERMAL MEASUREMENT

A. Approach

There are three approaches for check-points mapping:

- analytical solution;
- expert decision;
- by measurement.

A combination of these methods may also be utilized.

Using some of commercial software for thermal analysis (for example ANSYS, FLOTHERM, COMSOL etc) we can find analytically the places of check-points [2].

B. Measurements

The plan of the investigated storehouse with surroundings is presented on Fig.1, from where it can be send the boundary conditions and premises. The areas with different temperatures for different regimes of air-conditioning are clear distinguished. Depending on convection in storehouse some temperature differences in the shelves with goods are observed (see Fig.2).

Measurements for the specific condition of ambient temperature and different levels of filled storehouse are performed by an IR camera of FLIR Systems, which has 640x480 pixels FPA.

Examined storehouse for minimal power of air-conditioning and empty premises can be seen on the Fig.3.

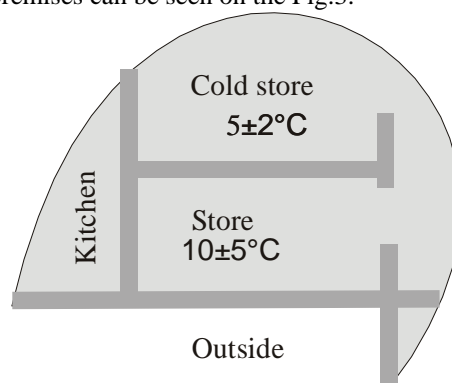


Fig.1. Storehouse with indoor temperature of 10°C

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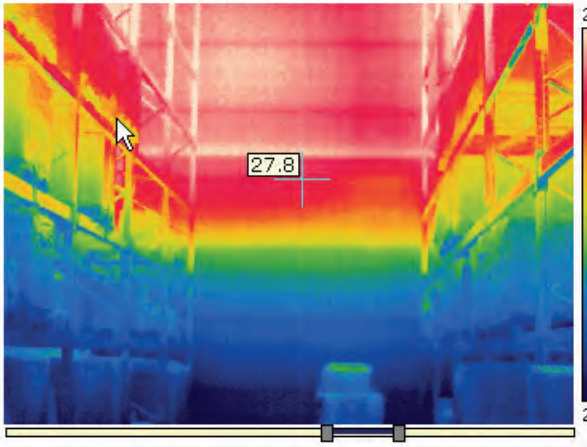


Fig.2. Temperature gradient indoor of the storehouse

Snapshots of the different walls conditions are made and the IR images are analyzed. The air-conditioning process was investigated, too. The air streams were successfully discovered by the thermovision camera as is shown in Fig.4.

After detecting the thermic mappings of the storehouse by IR camera some control measurements on discrete points were accomplished by calibrated thermometer with accuracy of $0,1^{\circ}\text{C}$.



Fig.3. Temperature field in the empty storehouse

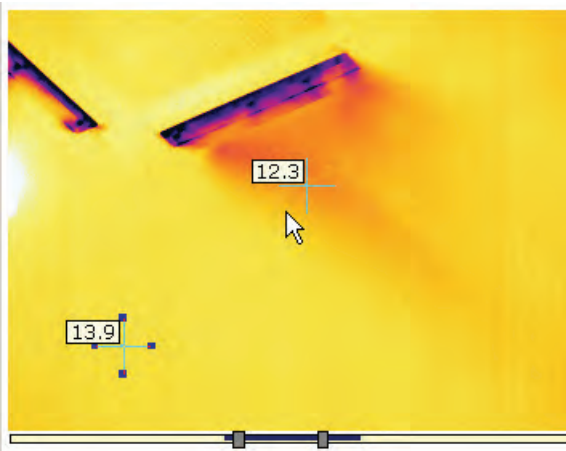


Fig. 4. A thermograph of air streams when air-conditioning is mounted on the ceiling

It must report that thermovision camera could not be effectively use in high dynamic of filled storehouse and deep shelves.

After thermovision inspection a control system is introduce into this storehouse. The scheme of the sensor control system is shown on Fig.5.

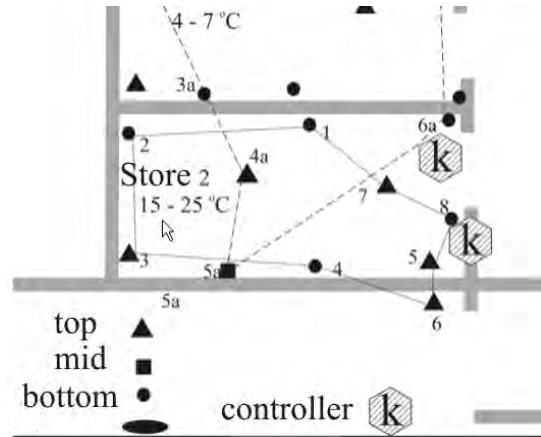


Fig. 5. Scheme of the sensor control syste

III. CONCLUSION

IR thermography cameras can be used for a wide array of energy audit which is ideal for missing insulation, mold detection, storehouse inspection etc. Visible thermic mappings of temperatures received and after that check-point for discrete measurements were very fast discovered. Critical points and thermal isolation effectiveness were determined. Collected results manifest that the next-door kitchen and freezing rooms exercise influence practically alike on storehouse temperature. The last is a good characteristic for the thermo isolation quality.

The mapping of air stream from the air-conditioner allow optimal disposition for check-point thereby temperature of air-conditioner as itself storehouse are available.

The effectiveness of applying IR thermography permits the inspection to be accomplished in the range of one hour, while the old inspection method was required time of 3 - 4 hours and by using of 4 - 5 sensors.

An infrared imaging camera acquires a view of wide area of the storehouse and shows such a way temperature patterns and local temperature differences at the stack surfaces. Using film sequences, thermal imaging offers the possibility to visualise processes like warming up, cooling and airflow development in the storehouse. The infrared camera fast determines the lowest local temperature differences.

Thermography opens new possibilities to visualise and evaluate climate control processes. Furthermore, application of thermography allows verifying model calculations more exactly. In this way, optimising of traditional climate control is possible

However, thermography is only one of several analytic methods. Additionally, the interpretation of infrared images requires special experiences. To make adjustment to the

temperature values, measured by thermal imaging, is essential for a correct quantitative temperature recording.

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