# THERMOGRAPHIC ANALYSIS

**Customer**: SEP srl

**Reference:** VERIFYING THE THERMAL EFFICIENCY OF THE SEPLUX 40 5PX PC-PANELS

**Place:** Würth Arena Egna (BZ)

**Date:** 18 January 2016

**Temperature:** external -5 °C
internal +11 °C

# INDEX

PRELIMINARY CONSIDERATIONS ........................................................................................ 3

TECHNICAL SPECIFICATIONS………….................................................................................................. 5

THERMOGRAMS ........................................................................................................................ 5

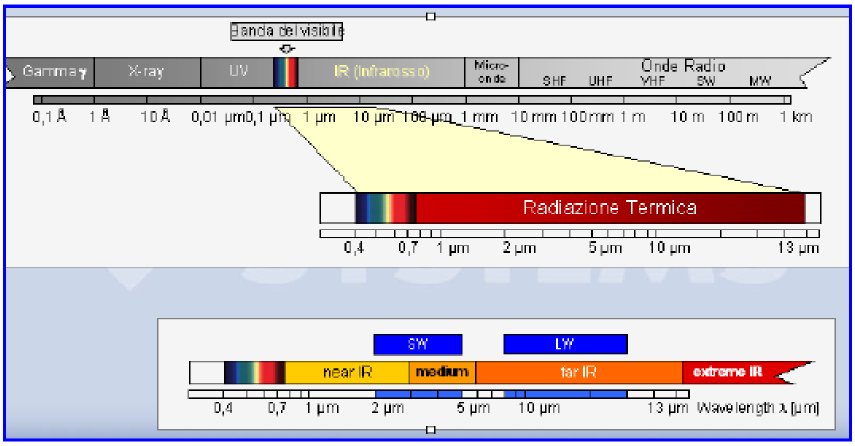
CONCLUSIONS ………............................................................................................................ 10

ATTACHMENTS: THERMOCAMERA TECHNICAL DATA SHEET……………………………………………….................................................................. 11

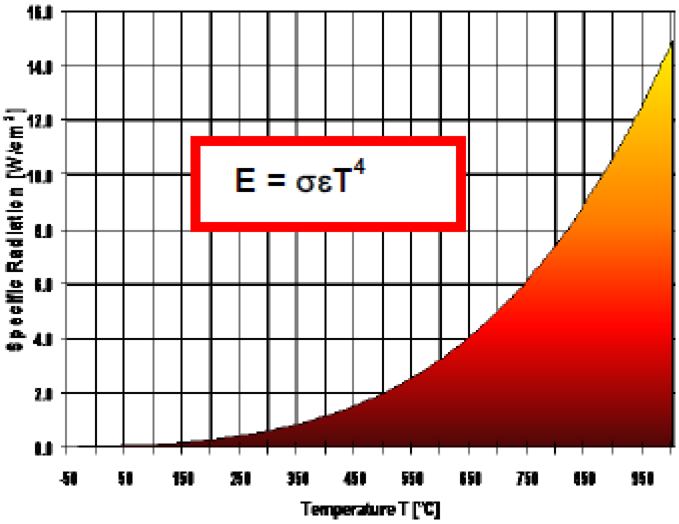
# PRELIMINARY CONSIDERATIONS

Any object having a temperature above absolute zero (-273.15 degrees Celsius or 0 Kelvin) does emit radiations in the infrared area (heat) that our eyes are unable to perceive. Infrared thermography can be defined as the art of representing a "heat" setting framed with the help of infrared cameras (thermocameras), by means of a colour image which allows to read the temperature values of all its pixels.

Below we present a diagram of the electromagnetic spectrum, where we highlight the relative frequencies to the thermal radiation.




The higher is the temperature of the object, the higher is the energy emitted in the form of heat and the better the thermocamera defines the object in question; such a statement does respond to the Stefan Boltzmann's law, of which below we see a graphical representation.




In reality, besides the temperature, the radiated energy depends linearly on the parameter emissivity, pure number included between 0 and 1 indicating substantially the efficiency of thermal radiation.

The following report, concerning the thermographic inspection, presents a series of images, both in the frequency range of the thermal infrared and in the visible range, which together with the analysis tools required, will show abnormal temperature differences on the surface of the various monitored subjects.

# TECHNICAL SPECIFICATIONS

**Survey target:**

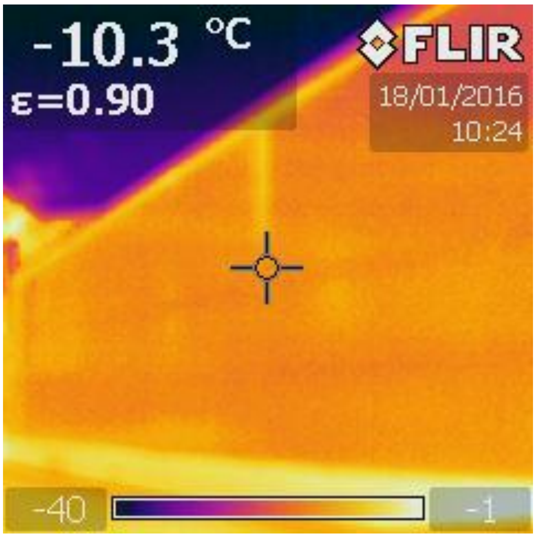
The target of this survey is to verify the thermal conditions of a glazing vertical surface made with polycarbonate panels series SEPLUX 40. To check the result and the quality of the application we must verify any discontinuity between the different areas of the surface, quantifying the performance differences also with regard to the various materials of the other structures.

The tool used was a FLIR b60 therrmocamera.

# THERMOGRAMS

The thermograms do show colder areas colored with colours verging on blue and warmer areas with colours verging on red / white; from the graph at the base you can determine the trend of the temperature and the distribution of heat.

SOUTH FACADE





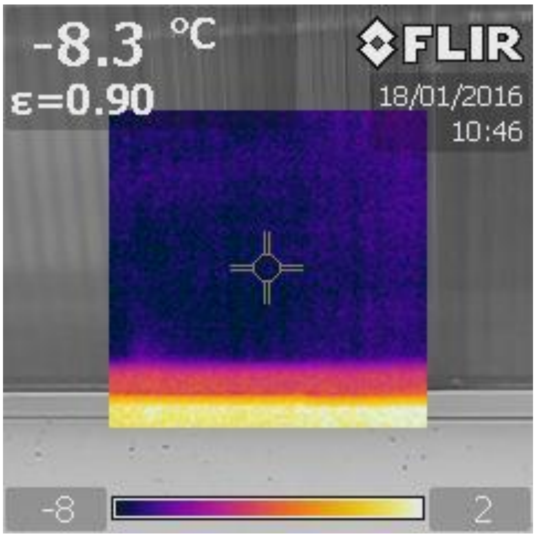

K.I.N company
Kyoto International Network
株式会社ケーアイエヌ

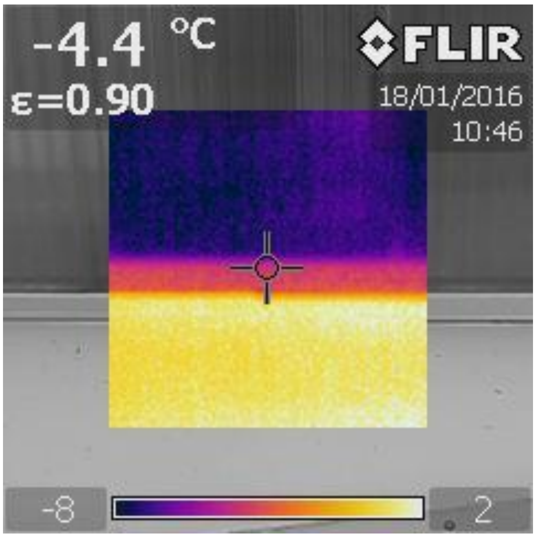
The south wall was built using the single polycarbonate panel, one single panel separates the outside from the inside of the building.

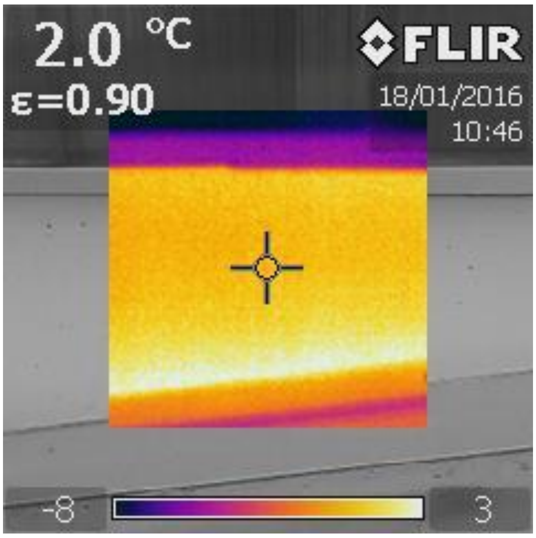
In the overview of the façade you notice that the wall made with polycarbonate panels does guarantee a uniform distribution of the heat and therefore of the thermal insulation, minimizing the presence of thermal bridges.

In the previous images the light and warmer band at the bottom is connected with the traditional masonry concrete and highlights the least isolation of the same; the temperature difference between the surfaces of polycarbonate and concrete is equal to about 10 ° C. It is also evident the dispersion/loss due to the metal profiles to the perimeter polycarbonate panels, which in this case are not  thermal break profiles.

We can analyze in detail the connection point polycarbonate / masonry:

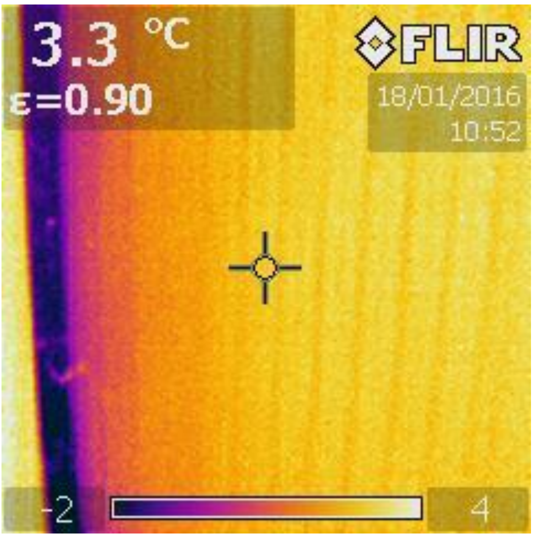


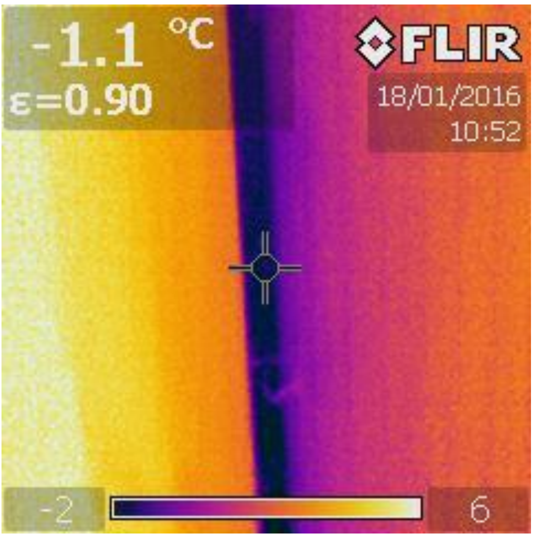



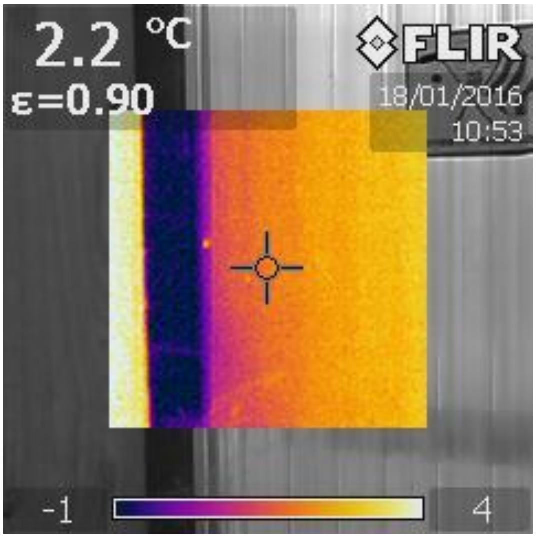




The outer side presents some significant temperature differences of the different materials: polycarbonate has a temperature of the external surface equal to -8.3 ° C, the aluminum profiles without thermal break -4.4 ° C, the  concrete masonry 2.0 ° C.

Analyzing the same wall on the inner side we obtain the following results:




You notice how the temperature distribution on the inner side reflects the external situation with a significant difference (about 5 ° C) between the polycarbonate and the aluminum profile.

The thermal behaviour of the polycarbonate near the aluminium profiles is considerably influenced by the same, it follows the importance of the use of thermal break profiles.

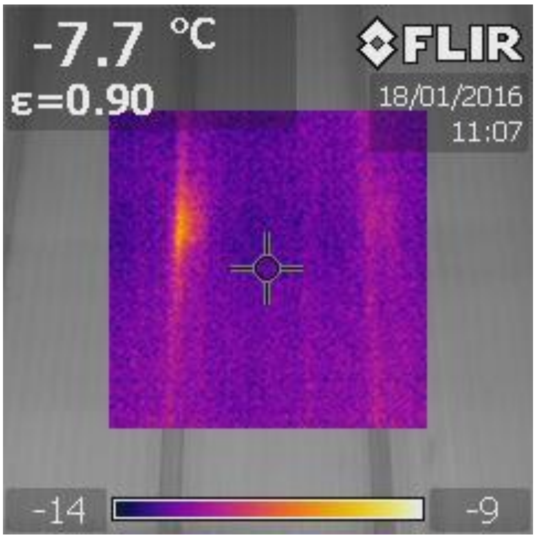
You can notice that the temperature difference between the inner and outer surfaces of the panels polycarbonate is between 12 and 14 C, while the difference of the environmental temperature at the time of the test was about 16 ° C, as evidence of the excellent thermal behaviour of the material.

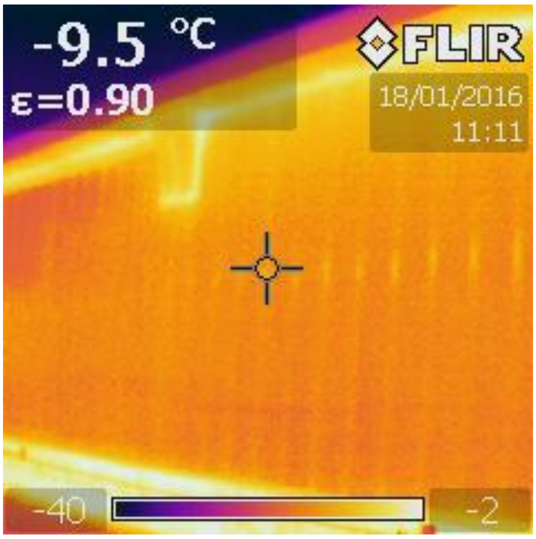
Analyzing the wall on a larger scale we can verify the behaviour of the surface in correspondence of the metal anchor hooks, you may notice a small temperature difference due to the higher thermal conductivity of the metal and to the change of the panel's geometry as a consequence of the hook coupling .

The found differences are limited in the direction of the joint connection of the panels to 20/30 cm, while in the transverse direction to the panel are negligible.

These small differences can be configured as minor thermal bridges, which significantly alter the thermal behaviour of the wall as a whole.

It is instead entirely negligible the heat flow at the joints between the various panels showing the good coupling achieved.

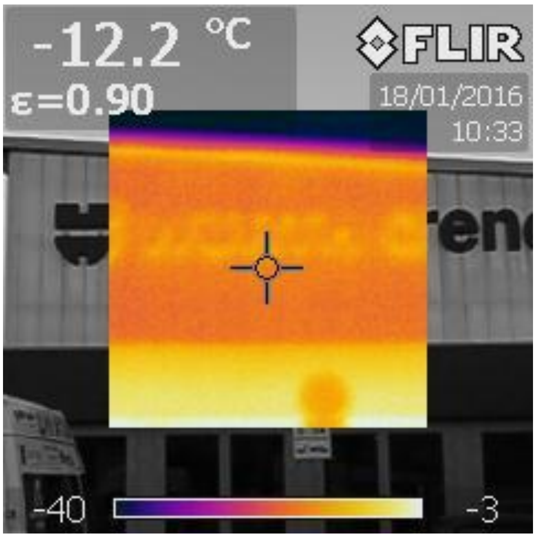


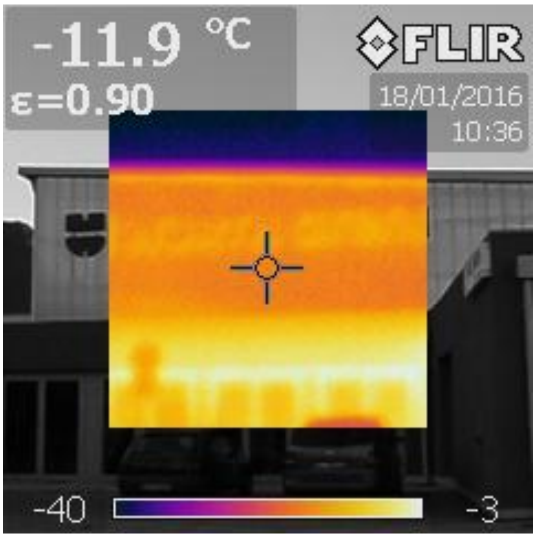



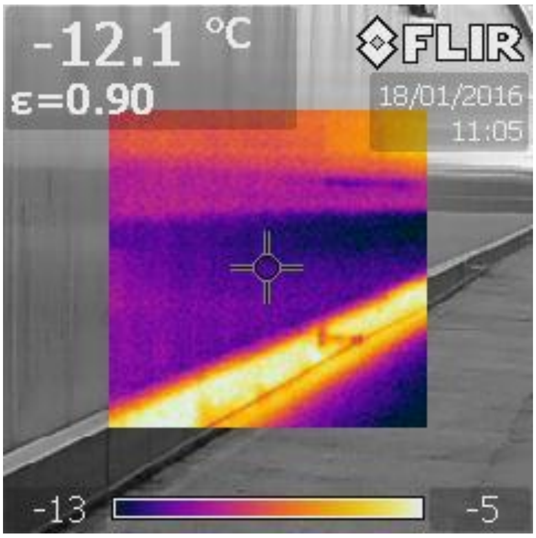

NORTH FACADE

The wall of the north facade has been realized with a "double skin" structure, a double polycarbonate panel with an air chamber in correspondence of the bearing structure.

In this case it is expected an improvement of the thermal characteristics of the wall, which is confirmed by the different temperature of the outer side, appearing to be an average of 4 ° C lower than the south wall.



# CONCLUSIONS

Based on the findings from the thermographic reliefs, it can be stated that the wall polycarbonate has a homogeneous behaviour and is practically free from thermal bridges on the surface.

A temperature gradient has been evidenced towards the metal profile installed, due to lack of a profile with a thermal break.

The "double skin" wall turns out as significantly improving the thermal point of view in comparison to the single panel, thus ensuring an excellent energy performance.

Volano, 19.01.2015