

# APPLICATION STORY



## DETECTING THE MOST SUBTLE TEMPERATURE VARIATIONS - THERMOGRAPHY AS A RESEARCH PROJECT

*The Frankfurt based housing and real estate group ABG aims to provide the highest quality of living. A FLIR T1030sc thermal imaging camera helps improve the insulation of over 50,000 apartments and implement a European research project.*

The ABG housing company's program is called "WOHNEN FÜR ALLE" (HOUSING FOR EVERYONE), because with its 51,000 apartments, the real estate group in Frankfurt am Main provides living space for almost a quarter of the city's population. The company has several subsidiaries including Frankfurter Aufbau AG (FAAG), the limited liability companies WOHNHEIM, MIBAU, Hellerhof and SAALBAU Betriebsgesellschaft, as well as several joint ventures. With its slogan "we make passive houses", ABG is all about innovation.

The engineer Herbert Kratzel works at ABG toward achieving these objectives. But not only there, because this is just one of at least three jobs. He is the head of TGA

(Building Services Engineering) at ABG and FAAG. And as if this weren't enough, he is one of the three managing directors of ABGnova GmbH, a joint venture between ABG and Frankfurt energy supplier Mainova.

And Herbert Kratzel's working day is just as complex as his business card. He is one of four colleagues who are responsible for building monitoring and diagnostics at ABG. The analytical tools that Herbert Kratzel and his team use for this include the entire range of structural measurement technology: Blower-door test, probes, endoscopes and of course thermography. And he does not just use any thermal imaging camera for this. "ABG adheres to the highest quality standards." the



*With the FLIR T1030sc, ABG is using a top-notch thermal imaging camera for its research and development.*



*Herbert Kratzel with his FLIR T1030sc (blurred in the background: the tower of the Frankfurt trade fair)*



Calibration section in the insulation with open, partly filled and fully filled joint (from left)



The "RetroKit" European research project: Renovation of the facade with integration of the supply and exhaust pipes in the exterior insulation (photo: Ralf H. Pelkmann).

certified thermographer (Level 3) says, "and this also applies to thermal diagnostics for the buildings". In accordance with ABG's high quality standard, it has to be a FLIR - and with the T1030sc, even the top hand-held thermography system model.

### Examining External Thermal Insulation Composite Systems (ETICS)

Herbert Kratzel's work is characterized by the following three primary tasks: analyzing the quality of (newly installed) External Thermal Insulation Composite Systems (ETICS); examining minimum insulation requirements (sometimes also for external appraisals); and checking for leaks (air and water). When ABG decided to purchase a thermal imaging camera in 2007, emphasis was placed on examining newly installed ETICS, and this remains Herbert Kratzel's most important task today. "Unfortunately it is true: those whose work is checked work better and more accurately. Therefore we didn't just want to blindly trust the effectiveness of heat insulation; we actually wanted to see it. And of course we also wanted to see when and where it's not effective." To Herbert Kratzel's amazement, there was no reference material at the time to thermographically define the threshold values of ETICS errors.

### Achieving objectivity using comparative values

ABG therefore had no other choice but to develop its own procedures to achieve repeatable results. To

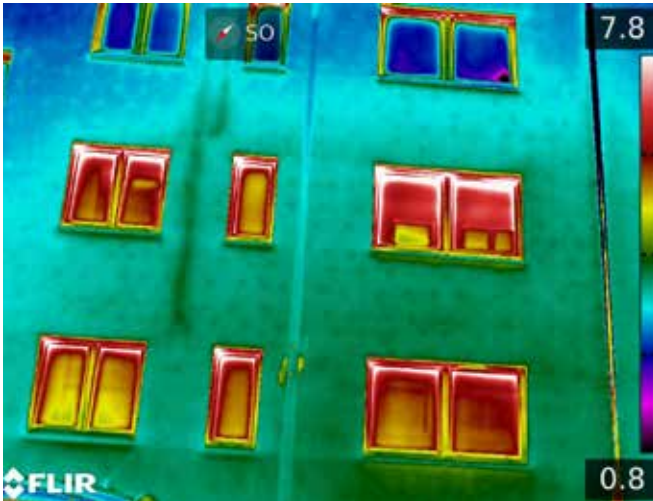
do this, Herbert Kratzel came up with an intriguing idea: "We simply included errors in the thermal insulation such as an entirely unfilled 5 mm wide joint or a partially closed joint. And then we had a look at this construction error or, as some like to say, "deviation from the standard", using the thermal imaging camera. Using this calibration test section (at known inside temperatures, which were recorded for several months), we then had comparative values and could thus make the following statements when encountering similar results: something is not right here and we think we know exactly what it could be." Using a meticulous system and thermographic scans, which were repeated under various conditions, the team not only gained a wealth of experience, but also acquired plenty of comparison measurements that are of great value to this day in the assessment of various abnormalities and heat patterns.

This concept proved so successful, that Herbert Kratzel now integrates this type of calibration section in almost every insulation. "I might not do this in every city, but in Frankfurt we hardly have any problems with algae or cracking

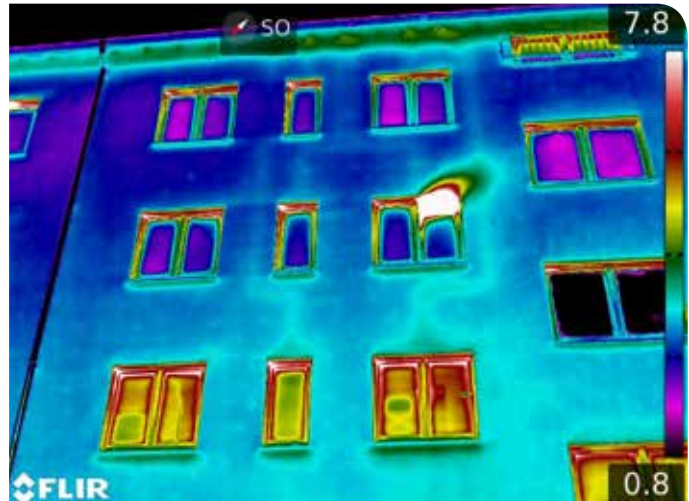


The simplicity of use and the high processing speed of the FLIR T1030sc facilitate Herbert Kratzel's work, as do the comments that he makes for each recording via Bluetooth headset.





The resolution of the FLIR T1030sc is not only detailed enough to detect the supply and exhaust pipes in the insulation (here the exhaust air pipe is on the left half of the screen below the wind rose), because even the thermally insulated plugs in the insulation construction are visible as dark points.



The supply and exhaust pipes in the insulation are clearly visible as brighter lines against the dark blue of the facade.

due to the climatic conditions," says the engineer. "And it seems to inspire our partners in the field of insulation, because we now have such an increasing number of really good facades that there is very little to complain about. We gladly communicate this to the commissioned company, so that if necessary we can say: you have proven in the past that you can do it better!" ABG's thermography team now inspects about 40 buildings with new ETICS per year. Of course other abnormalities, such as windows or dormer connections, as well as roof and wall joints, also show up. From the outset, ABG relied on FLIR thermal imaging cameras. "Our first FLIR B20 HSV is still in operation today," explains Herbert Kratzel, who particularly appreciates the camera's highly-sensitive low-noise detector.

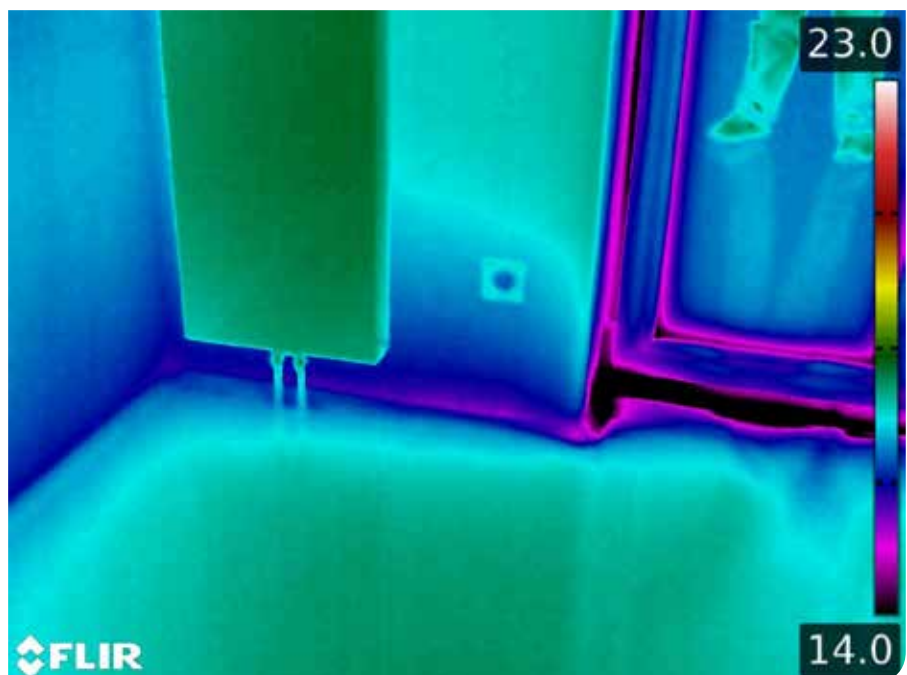
## The "RetroKit" European research project:

The team now also uses a FLIR T1030sc, which is actually intended for uses in research and development. "And that is exactly what we are doing with it," says Herbert Kratzel, citing two apartment buildings in Frankfurt-Bockenheim as an example. "Together with scientific

partners such as the Fraunhofer Institute, we have implemented the European research project "RetroKit", which includes refurbishment with ventilation ducts (supply and exhaust air) or only exhaust air on the outside of the building integrated in the insulation." The windows of the house were also replaced so that the tenants were hardly troubled during the renovation: Only once the new windows had been

installed from the outside, were the old windows removed from the inside.

The whole project was accompanied by continuous measurements of temperatures, humidity and CO2 levels. "Thanks to its exceptional thermal resolution of 1,024 x 768 pixels, the FLIR T1030sc detects the exhaust pipes following renovation and insulation although they



Air leak detection: isotherms clearly visible at a resolution of 0.1 K

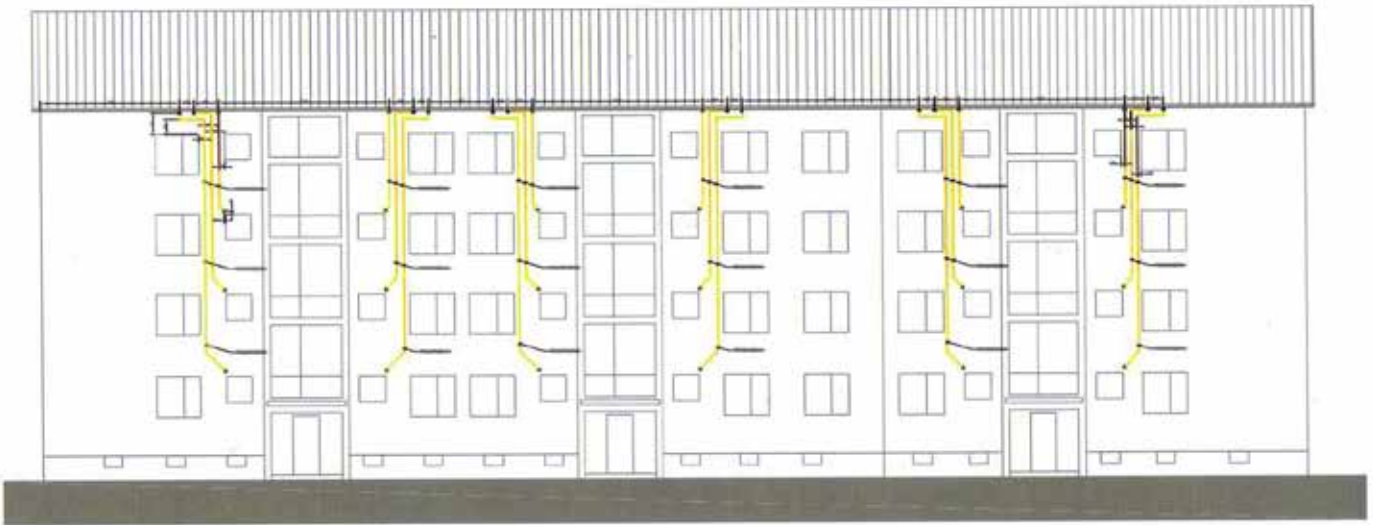


Diagram of the supply and exhaust pipes in the insulation

only heat the insulation by a few tenths of a degree," Herbert Kratzel explains and is visibly impressed with the performance and thermal sensitivity (NETD: < 20 mK) of his measuring tool. He especially likes the outstanding handling (Herbert Kratzel: "In this regard, the T1030sc is definitely the best FLIR camera thus far"), the exceptional resolution (which easily shows isotherms with a distance of 0,1 K) and the speed of the processor. In order to eliminate outside influences to the greatest extent possible, he usually works with the camera in the evening after sunset and at colder temperatures. "And anyone who has made 150 or more thermographic photos of a building at night in the winter knows what a difference it makes to either save a pair of images (IR and DC) in ten or just two seconds.

Surprisingly, the popular image enhancement functions UltraMax and MSX played a lesser role for Herbert Kratzel when deciding on the camera. "Perhaps it is our specific area of work, but for me the IR resolution of the camera alone is so convincing that I just use UltraMax and MSX as additional features. For me the pure infrared image always serves as the basis for analysis. Additional display options can then be used to provide additional knowledge," explains Herbert Kratzel.

## Only a systematic approach provides useful results

Based on his structural knowledge and his experience, Herbert Kratzel advocates a systematic and meticulous approach to thermographic analysis. "Only when I am aware of the outside influences that could affect the measurements, my thermographic images are more than just colorful pictures," says Kratzel. "In structural thermography, these adverse influences include moisture and wind as well as sunlight. If the sun shines directly on a building for just five minutes, I don't even need to measure the effects of the transmission any more. In this case, I would primarily be measuring the warming of the facade by the sun."

## In high demand in the company

Herbert Kratzel never questioned the usefulness of thermography. "Not everyone saw it that way in the beginning. Some colleagues from the construction division whispered to us back then: you are finding error that we were not even looking for. At the time we were considered to be know-it-alls," says Herbert Kratzel, and proudly adds: "In the meantime, perception has changed entirely and we are contacted as welcome support for various issues."

And thanks to the solid training and certification of Herbert Kratzel's team, the ABG engineering unit is well prepared - not only with ISO certification for its blower-door test. This of course includes thorough knowledge of thermography. Like his three colleagues, he initially attended an introductory course and became certified as a thermographer at levels 1 and 2. For Herbert Kratzel and a colleague, this was even followed by the highest (third) level of certification, which has also resulted in a regular lectureship in thermography at the college in the winter semester for the past 3 years. With the FLIR T1030sc, ABG has the right tools to best use this concentrated know-how.

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For more information about thermal imaging cameras or about this application, please visit:

[www.flir.com/research](http://www.flir.com/research)

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