



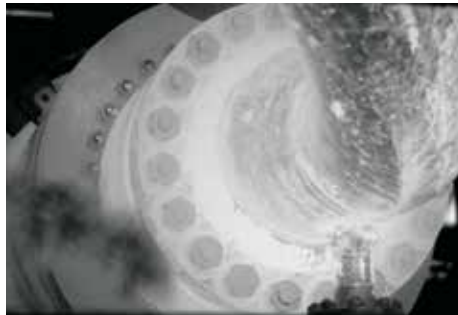
TECHNOLOGY NOTE

10 Tips for Getting the Most Out of an Optical Gas Imaging (OGI) Camera

INTRODUCTION

Optical Gas Imaging (OGI) cameras use spectral wavelength filtering and Stirling cooler cold-filtering technology to visualize the infrared absorption of gases such as methane (CH₄), sulfur hexafluoride (SF₆), carbon dioxide (CO₂), and refrigerants. FLIR produces several camera models, each with a filter that matches the spectral absorption of the gas its meant to visualize.

Through OGI technology, the oil and gas industry can incorporate a safer, more efficient 'Smart LDAR' (Leak Detection and Repair) program. Inspectors can detect fugitive emissions and leaks faster and pinpoint the source immediately, leading to prompt repairs, reduced industrial emissions, and greater conformity to regulations. In addition, OGI saves money, not only through efficiency but more importantly by improving the safety of company personnel and assets.



The GFx320/GF320 cameras can detect natural gas emissions, such as this compressor valve leak



Thermal imaging with the GF306 can detect SF₆ leaks from plumbing or circuit breakers



The FLIR GFx320 OGI camera visualizes most hydrocarbons used in the oil and gas industry, and carries an Intrinsic Safety designation

The following tips will help you get the most out of OGI equipment:

1. UNDERSTAND THE APPLICATION AND THE NEED.

Different applications require different cameras. In other words: one camera may not see all the gases, so you need to understand which type of gas you are dealing with. For example, a VOC/hydrocarbon OGI camera will not see



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SF₆, and a CO camera will not see refrigerants.

2. TAKE THE ENVIRONMENT INTO ACCOUNT.

The success of OGI depends on environmental conditions. The greater the background energy differential, the easier the camera will be able to visualize the gas leak and pinpoint its source. Active optical gas imaging (i.e. using a laser based backscattering technique) relies on a reflective surface in the background. This presents a significant challenge when you are looking at components high up and pointing the camera at the sky. Also, rain and strong winds need to be considered. Rain can make detection very difficult, but wind can help visualize the gas because it makes the gas move.

3. REMEMBER: OGI IS QUALITATIVE, NOT QUANTITATIVE.*

Due to the environmental variants and the background energy differential and variations, an OGI camera alone cannot determine the specific type or amount of gas escaping through a leak.

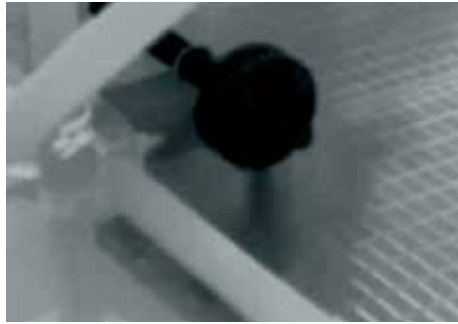
The exception to this general rule comes from pairing the OGI camera with a companion technology such as the QL320 by Providence Photonics. This product works with the FLIR GF320 and FLIR GFx320 to measure mass leak rates (lb/h or g/h) or volumetric leak rates (cc/min or L/min) for most hydrocarbons.

4. USE ALL THE FEATURES OF YOUR OGI CAMERA.

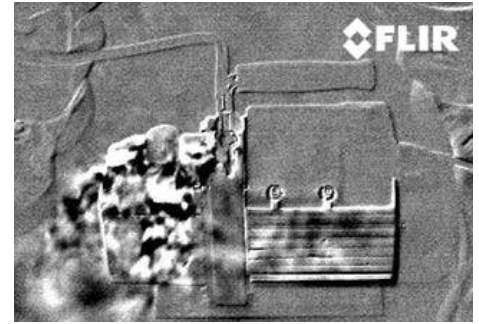
Learn how each feature of the OGI camera works - such as automatic GPS tagging or image enhancements - and use them to your advantage. Small concentrations of gases can be difficult to see sometimes, even with an OGI camera. High Sensitivity Mode (HSM) enhances the image so even small concentrations of gas are visible. Notation features, such as GPS tagging, can be critical to ensuring crews make the repairs on the correct asset.

5. MEASURE TEMPERATURE CORRECTLY.

Many OGI cameras are temperature-calibrated, making them dual-use systems. They are suitable for industrial maintenance inspections because they can measure and record temperatures across the scene and save the data to a JPEG or video. You can use these



A pressure gauge leaks gas byproducts of chemical manufacturing



Refrigerant leaks from car air conditioning in High Sensitivity Mode (HSM)

cameras to detect hot spots or electrical problems in high- and low-voltage electrical installations or mechanical installations, or to look for insulation failures in pipework, ovens and much more.

The thermographic function on your OGI camera can also help you improve the visual contrast between a gas cloud and the background scene. Unlike with other thermographic applications, your object of detection (gas) has no visual representation. You can only see the cloud by creating a radiant contrast between the cloud and the background. The cloud itself reflects almost no radiation. The key to making the cloud visible is enhancing the temperature difference (ΔT) between the cloud and the background.

6. USE THE CAMERA'S ADVANTAGES TO KEEP SAFE.

Gas imaging cameras are a quick, non-contact method for detecting leaks in hazardous or hard-to-reach areas. They are sensitive enough to detect small leaks from several meters away and large leaks from hundreds of meters away. Many offer visual enhancements such as HSM, which can improve detection of

leaks that are small or low in concentration.


Because OGI allows you to detect gas emissions from a safe distance, you should use it to your advantage. Beginning outside of the main work area, take an initial scan of the area to determine if there are any large gas leaks visible. Then, you can move in closer for more specific scans. Be sure to wear appropriate safety gear and store and transport your OGI camera in its provided case. Also, keeping up with camera maintenance will insure it doesn't become its own safety hazard.

7. WORK WITH PERMITS.

OGI cameras in general are not Zone 1 ATEX certified. Therefore, you will need to apply for a 'Hot Work Permit' or use it under a 'Permit to work scheme' for Zone 1 work.

Permits are also needed when using OGI cameras in Zone 2, with one possible exception: the FLIR GFx320, an Intrinsically Safe, certified Zone 2-compliant OGI camera for detecting hydrocarbons. Some company guidelines allow this camera to be used in Zone 2 without a hot work permit.

Remember, any top-notch OGI camera

	<p>ABOUT THE FLIR GF-SERIES The portable FLIR GF-Series cameras improve operator safety, by visualizing gases at a safe distance, and help to protect the environment by tracing leaks of environmentally harmful gases.</p>
<p>GF304</p>	<p>Refrigerants</p>
<p>GF306</p>	<p>Sulfur hexafluoride (SF₆) and ammonia (NH₃)</p>
<p>GFx320/GF320</p>	<p>Methane (CH₄), other hydrocarbons and VOCs</p>
<p>GF343</p>	<p>Carbon dioxide (CO₂)</p>
<p>GF346</p>	<p>Carbon monoxide (CO)</p>



will allow you to see significant and dangerous leaks from a safe zone, even outside of the facility perimeter.

8. KEEP TRACK OF YOUR RETURN-ON-INVESTMENT.

In many cases, an OGI camera can pay for itself on the very first day. Surveys performed with an OGI camera are generally nine-times faster than with traditional leak detecting technology, and they can help you detect leaks you might miss with a sniffer.

OGI is also a non-contact method that can be performed during normal operations – so companies don't lose revenue to shutdowns. Plus, by catching leaks early and making repairs quickly, companies can both avoid fines and retain gases they could sell for profit.

9. CONSIDER FUTURE INDUSTRIAL EMISSIONS REGULATIONS.

Fugitive gas emissions contribute to global warming and can potentially pose deadly risks to both workers and

people living close to these facilities. Because FLIR OGI cameras detect dozens of volatile organic compounds, such as benzene, they help contribute to a healthier environment while allowing companies to comply with existing industrial emissions regulations. These regulations are not static: there is always the chance government regulators such as the US Environmental Protection Agency or the EU Industrial Emissions Directive could adopt more strict rules on fugitive emissions. Having the right tools to meet these regulations puts your company ahead.

10. GET THE RIGHT TRAINING.

Learn from experienced and qualified OGI users to get the most out of your camera. You might follow a training course by quality organizations such as the Infrared Training Center (<http://www.infraredtraining.com>).

ITC's three-day Optical Gas Imaging certification class covers the set up and operation of FLIR GF-Series cameras, which gases these cameras can see, and how environmental conditions affect gas leak detection. Training includes classroom instruction and lab time, and results in earning 2.0 IACET Continuing Education Units (CEUs).

Further information on thermal imaging cameras and this application can be obtained from:

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