SLOVENSKI STANDARD
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Ubežne in razpršene emisije skupnega pomena za industrijske sektorje - Detekcija ubežnih emisij par, ki nastajajo zaradi netesnosti naprav in puščanja cevovodov z optično detekcijo plinov (OGI)

Fugitive and diffuse emissions of common concern to industry sectors - Detection of fugitive emission of vapours generating from equipment and piping leaks using Optical Gas Imaging (OGI)

Fugitive und diffuse Emissionen von allgemeinem Interesse für Industriebereiche - Erkennung fugitiver Emissionen von Dämpfen aus Lecks von Betriebseinrichtungen und Rohrleitungen mit optischer Gasdetektion (OGI)

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English Version

Fugitive and diffuse emissions of common concern to industry sectors - Detection of fugitive emission of vapours generating from equipment and piping leaks using Optical Gas Imaging (OGI)

Fugitive und diffuse Emissionen von allgemeinem Interesse für Industriebereiche - Erkennung fugitiver Emissionen von Dämpfen aus Lecks von Betriebseinrichtungen und Rohrleitungen mit optischer Gasdetektion (OGI)

This draft Technical Specification is submitted to CEN members for Vote. It has been drawn up by the Technical Committee CEN/TC 264.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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European foreword

This document (FprCEN/TS 18393:2026) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

This document is currently submitted to the Vote on TS.

Introduction

This document has been developed to provide detailed guidance on the use of optical gas imaging (OGI) cameras for visualizing leaks of vapours and gases that can be detected using their spectral properties in the infrared (IR) region of the electro-magnetic spectrum.

European legislation for a set of industrial activities states the operators of affected installations can put in place a leak detection and repair (LDAR) programme to risk-assess, identify and either eliminate or reduce fugitive and other diffuse emissions of certain vapours and gases that are harmful to human health and the environment.

Under legislation, certain categories of industrial installations within the sectors for energy, waste management, oil and gas refining, and the chemical sectors can have a LDAR programme. LDAR required by legislation specifies the use of OGI cameras to detect leaks.

Although legislation does not currently prescribe OGI within LDAR programmes for other types of industrial activity, the technique is still a powerful tool for visualizing leaks of gases and vapours with have an IR absorption profile that OGI cameras can detect. These activities include but are not limited to: small anaerobic digestion plants; landfill-gas infrastructure, and; natural-gas distribution systems.

OGI cameras have proven to be an effective detection technique, where an IR sensor is used to visualize emissions of volatile organic compounds (VOCs), methane and other compounds (e.g. SF_6, NH_3), which cannot normally be seen by the human eye.

This document focuses on the use of OGI cameras dedicated to leak detection of VOCs, and methane. OGI cameras can also be utilized for detecting other types of emissions, e.g. venting or non-fugitive diffuse emissions. OGI cameras enable the user to visualize emissions – and make it possible to make a comparative assessment between small, medium and large emissions. In addition to detection, some OGI camera systems provide the means to quantify emission rates by implementing quantitative optical gas imaging (QOGI). This document does not focus on QOGI but introduces the technique in an informative annex.

The strength of an OGI camera is that it allows many components to be inspected in a relatively short time, making this camera a powerful instrument for making fugitive emissions visible and then controlling them. Although OGI cameras are highly portable and readily deployed and seem to be easy to use, these devices require users to be trained and sufficiently experience to be proficient.

A typical deployment would use the OGI cameras to detect the larger leaks or as a complement of a conventional LDAR programme by enabling screening of components inaccessible to point sampling technique according to EN 15446, commonly known as “sniffing”, and applied to the framework described in EN 17628.

This document does not describe techniques for quantifying releases of VOCs. This subject is covered by EN 15446 for sniffing techniques, whilst forthcoming standards from CEN will describe other techniques for quantifying VOCs emissions, such as bagging and QOGI.

1 Scope

This document specifies the performance requirements, test procedures, operator proficiency, and operational requirements for a technique known as optical gas imaging (OGI).

This document applies to the use of OGI cameras as part of an LDAR programme. It specifies the scope of application, performance requirements for OGI equipment and QA/QC procedures.

This document focuses on LDAR programmes, applied to VOCs (including methane), but a similar approach could be applied to other compounds that have IR spectral properties that enable visualization, by adapting the selection of OGI cameras having a detector with a different bandwidth.

Different types of technologies for OGI camera exist on the market, such as detectors which are either cooled or uncooled, as well as active and passive OGI cameras. However, this document focuses on the utilization of the most commonly utilized technology, the passive OGI cameras. Despite this, a similar approach could be applied to the use of active OGI cameras.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 17628:2022, *Fugitive and diffuse emissions of common concern to industry sectors — Standard method to determine diffuse emissions of volatile organic compounds into the atmosphere*

EN 15446:2008, *Fugitive and diffuse emissions of common concern to industry sectors — Measurement of fugitive emission of vapours generating from equipment and piping leaks*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
active thermography
technique of applying an external energy source to an object or process, to induce a variation in temperature for analysis with an IR camera

Note 1 to entry: Active thermography can be a viable non-destructive test method for objects or scenes with no naturally occurring thermal variation. In other words, no naturally occurring temperature differences exist in the object or scene.

Note 2 to entry: An active OGI camera uses a source of electromagnetic radiation to irradiate the background and relies on a reflective surface in the background. The effect is to increase the sensitivity.

3.2
component
assembly or mechanical part of an equipment

Note 1 to entry: Examples are fitting, flange, pump seal, valve seal, open-ended line.

3.3
detection
recognition of the presence of an emission source in a certain area

3.4
detection limit
minimum quantity of a substance which produces an observable response. When using an OGI camera, this limit is affected by environmental conditions. A theoretical detection limit can be observed and tested under controlled conditions

3.5
diffuse emission
emission to the atmosphere from an identified site or facility, not specifically directed to identified stack emission points

Note 1 to entry: This term comprises the sum of various unaccounted channelled emissions, fugitive emissions and area emissions.

3.6
equipment
assembly composed by one or more components

Note 1 to entry: Examples are pump, manual valve, control valve, safety valve.

3.7
emission
discharge of substances into the atmosphere

Note 1 to entry: This term comprises four types of emission sources:

— Accounted channelled emissions (from monitored stacks)

— Unaccounted channelled emissions (from, e.g. vents, flares)

— Fugitive emissions (leaks from, e.g. valves seals)

— Other diffuse emissions (from, e.g. water treatment basins, coke storage)

3.8
fugitive emission
emission to the atmosphere caused by loss of tightness of an item which is designed to be tight

[SOURCE: EN 15446:2008 [9]]

3.9
localisation
determination with a certain degree of precision of the position of an emission

3.10
main equipment
identifiable asset with primary process function composed by one or more pieces of equipment, frequently used as a top-level node in LDAR databases

Note 1 to entry: Examples are: compressors, distillation towers, individual basins, individual storage tanks, and water separators.

3.11
maximal permitted distance of detection
greatest distance that can be practicably achieved on a day-to-day basis between a screened component and the OGI system executing the survey (d_{max})

Note 1 to entry: The maximum distance of detection is the greatest distance at which an emission source can be detected under test conditions (see Annex A).

Note 2 to entry: The value of d_{max} is determined using the procedure described in Annex B. The value of d_{max} can be larger than the operating envelope determined in Annex A, depending on specific circumstances described in Annex B.

3.12
noise equivalent concentration length
NECL
lowest detectable concentration of gas over a specified path length

Note 1 to entry: The unit is ppm·m. A lower NECL in an OGI camera means a greater sensitivity for detecting gas leaks

3.13
noise equivalent temperature difference
NETD
lowest temperature difference that an optical gas imaging camera can distinguish from the camera's internal noise

Note 1 to entry: The unit is millikelvins (mK) and the lower the NETD, then the higher the sensitivity of the camera, and hence a better image quality

3.14
operating envelope
range of conditions (i.e. wind speed, ΔT, viewing distance, OGI camera setup) within which a survey can be conducted to achieve the quality objective

Note 1 to entry: Each OGI camera model has a unique operating envelope that depends on its intrinsic performance, the lens fitted, the sensitivity mode, whether a tripod is used, and other parameters.

[SOURCE: Directive 2010/75/EC [3]]

3.15
passive thermography
relies upon the naturally occurring thermal radiation emitted from an object or process for condition evaluations

Note 1 to entry: With passive thermography, thermal contrast is only observed with an IR camera if the target's temperature differs from the ambient temperature or surrounding objects. The resulting thermal image will show little variation in colour or greyscale if there is no thermal contrast

Note 2 to entry: Passive OGI rely on favourable environmental conditions to detect a gas notably the value of ΔT (the difference in temperature between the target gas and background).

3.16
quantification
determination of an emission rate

3.17
site
area within a defined perimeter where emissions might take place

3.18
volatile organic compound
VOC
organic compound, including methane, having a vapour pressure of 0,01 kPa or more at 293,15 K or having the corresponding volatility under the conditions of use

[SOURCE: Directive 2010/75/EC [3], modified]

Note 1 to entry: Care is necessary in the use of the term VOC, as there are many different definitions in common use. In some contexts, VOC excludes methane or methane and ethane. It is recommended to clearly state which range of compounds is reported as VOC.

4 Symbols and abbreviations

4.1 General

For the purposes of this document, the following symbols and abbreviations apply.

4.2 Symbols

ΔT	Difference in temperature between the target gas and the background
d_{max}	Maximal permitted distance of detection
d_{ini}	initial distance
σ	Standard deviation of the temporal noise
R	Responsivity
V	Average signal
T	Temperature

4.3 Abbreviations

ATEX	ATmosphères EXplosibles
CL	Concentration Length
DL	Detection limit
EPA	Environmental Protection Agency
EUMR	European Methane Regulation
GIS	Geographic Information System
HSM	High Sensitivity Mode
IR	Infrared
LDAR	Leak Detection and Repair
LEL	Lower Explosive Limit
NECL	Noise Equivalent Concentration Length

NETD	Noise Equivalent Temperature Difference
OGI	Optical Gas Imaging
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control
QOGI	Quantitative Optical Gas Imaging
TVA	Toxic Vapour Analyser
VOC	Volatile Organic Compound

5 Principle of OGI

5.1 Detection principle

There are two types of OGI cameras, which are passive and active. A passive camera relies on imaging infrared radiation absorption differences between the background and the targeted gas. An active OGI camera uses a source to emit IR radiation on a given wavelength, to image its absorption by the targeted gas. This technical specification focuses on passive OGI cameras.

NOTE This technical specification can be applied to active OGI cameras, with some adjustments to the procedures and specifications.

Typically, OGI cameras operate in the IR region of the electromagnetic spectrum. An OGI camera system consists of:

— a lens

— an optical filtering stage

— a detector

— software that processes the detector signal and

— an internal or external display to make the signals visible to the operator

The filter ensures that a narrow IR band passes through to the detector. This filter is selected such that the IR wavelength of the target range of VOCs is detected by the camera. When the background radiation is absorbed by the target gases, the gases are visible to the user of the camera.

Visibility of gases depends on four conditions:

— the target gas absorbs energy at the wavelength range that the filter allows to pass through to the detector;

— the gases themselves are moving;

NOTE When the gas is moving, this creates a contrast between frames in the image, enabling the user to readily see the gas.

— there is a difference between the temperature of the target gases and the background. This difference is known as ΔT;