



Advanced Test Equipment Corp.

www.atecorp.com 800-404-ATEC (2832)

GT6000 Mobilis



Portable emission monitoring system, GT6000 Mobilis and PSS

Is it possible to perform emission monitoring tasks on a similar level as with fixed systems, but portably? It sure is, with our GT6000 Mobilis paired with Portable Sampling System. Whether your work happens in a laboratory or directly on-site at the stack, this solution will keep up with your pace.



What is this yellow box?

The GT6000 Mobilis is a portable FTIR analyzer for monitoring gas concentrations in hot, wet, and corrosive gas streams. Together with Portable Sampling System (PSS Plus or PSS Base), it transforms into complete portable FTIR emissions monitoring system. FTIR technology ensures that results will be available immediately on-site, and further analysis provides hard data for your specific needs.

Designed specifically for you

We designed the GT6000 Mobilis to provide the best possible user experience. It is quick to set up, disassemble, and comfortable to carry. The set-up requires just attaching heated lines and power cables where only a wrench is needed. This allows fast mobilization and less time wasted in waiting to conduct the analysis. The device is robust as it is shock and vibration resistant (IP42) and it even withstands splashes and light rain.

Uncompromised performance

GT6000 Mobilis enables you to measure all key compounds at once, including oxygen with PSS Plus. Results are immediate, with a high level of precision. Even the smallest concentrations are measured with high accuracy, and you can follow the measurement readings in real-time on-site or remotely. The system is operated by the powerful, yet easy to use, Calcmet software on a PC or tablet. For a smoother user experience, the software guides you step-by-step during measurement. It also enables you to re-analyze the data and identify possible unknown compounds.

The system is typically set up to measure H₂O, CO₂, CO, NO, NO₂, N₂O, SO₂, NH₃, CH₄, HCl, HF and different VOCs and can measure up to 50 gases simultaneously.

What is it used for?

As GT6000 Mobilis uses powerful FTIR technology, the system can be used in a wide variety of applications, ranging from research applications to process measurements and emissions monitoring. Typical uses include:

- / Stack testing: QAL2 tests for HCl, NH₃, SO₂, NO_x and other gases
- / Scrubber and catalyst efficiency research
- / Combustion research
- / Carbon capture and storage
- / Formaldehyde emissions from biogas

Truly portable emission monitoring system

GT6000 Mobilis is designed to be used with the portable sampling system, PSS Plus or PSS Base. PSS utilizes the hot-and-wet measurement principle (no drying or dilution). This ensures that the analysis is done properly with a representative sample.

Why choose GT6000 Mobilis?

- > Intuitive user interface and ergonomic design
- > Easy to disassemble, carry, and set-up again
- > Multigas measurements in a portable package
- > Realtime results reliably and remotely
- > Exceptional robustness: shock and vibration resistivity by design
- > Smart software with self-diagnostics for easy and fast service
- > Suitable for on-site or laboratory use

? Did we convince you already?

You can contact our GT6000 Mobilis experts here: contact@gasmet.fi



GAS-APP-003 : Extended CEM application

4.1.2023

#	Compound name	Formula	CAS number	Minimum range	Typical range	Maximum range	Unit
1	Water	H ₂ O	7732-18-5	0 - 25	0 - 30	0 - 40	vol-%
2	Carbon dioxide	CO ₂	124-38-9	0 - 10	0 - 20	0 - 30	vol-%
3	Carbon monoxide	CO	630-08-0	0 - 60	0 - 500	0 - 2000	ppm
4	Nitrous oxide	N ₂ O	10024-97-2	0 - 50	0 - 100	0 - 500	ppm
5	Nitrogen monoxide (Nitric oxide)	NO	10102-43-9	0 - 100	0 - 200	0 - 2000	ppm
6	Nitrogen dioxide	NO ₂	10102-44-0	0 - 100	0 - 200	0 - 500	ppm
7	Sulfur dioxide	SO ₂	7446-09-5	0 - 30	0 - 100	0 - 2000	ppm
8	Ammonia	NH ₃	7664-41-7	0 - 20	0 - 50	0 - 500	ppm
9	Hydrogen chloride	HCl	7647-01-0	0 - 10	0 - 50	0 - 500	ppm
10	Hydrogen fluoride	HF	7664-39-3	0 - 3	0 - 10	0 - 100	ppm
11	Methane	CH ₄	74-82-8	0 - 20	0 - 100	0 - 1000	ppm
12	Ethane	C ₂ H ₆	74-84-0	*		0 - 200	ppm
13	Ethylene (Ethene)	C ₂ H ₄	74-85-1	*		0 - 200	ppm
14	Propane	C ₃ H ₈	74-98-6	*		0 - 200	ppm
15	Hexane	C ₆ H ₁₄	110-54-3	*		0 - 100	ppm
16	Formaldehyde	HCOH	50-00-0	0 - 15		0 - 70	ppm

* The CEM hydrocarbon ranges depend on the application.

Higher ranges and additional compounds are available upon request from Gasmeter Technologies Oy.

Note: Standard GAS-APP-003 application package includes one range per compound.

Power of FTIR

ADVANTAGES OF FTIR

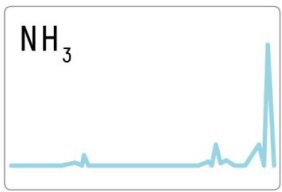
- > **True multicomponent measurements**
- > **On-line results**
- > **Adding new components is easy and affordable**



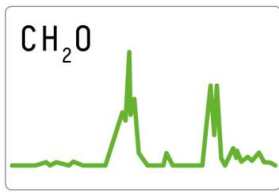
FTIR



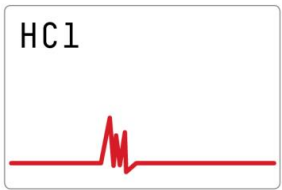
1 Characteristic Absorption Spectra



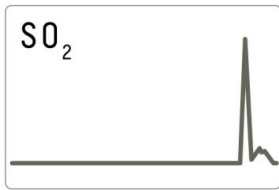
AMMONIA



FORMALDEHYDE

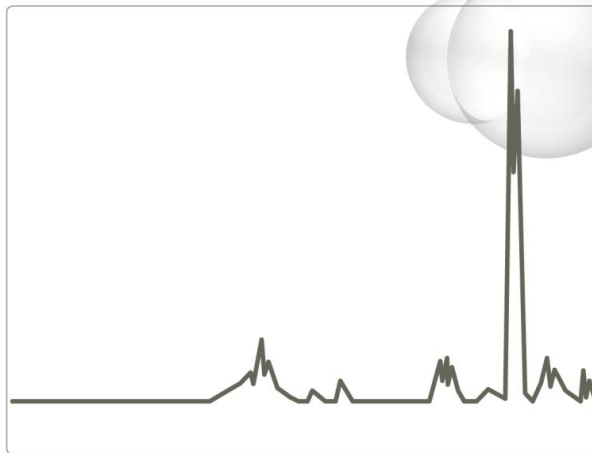


HYDROGEN CHLORIDE

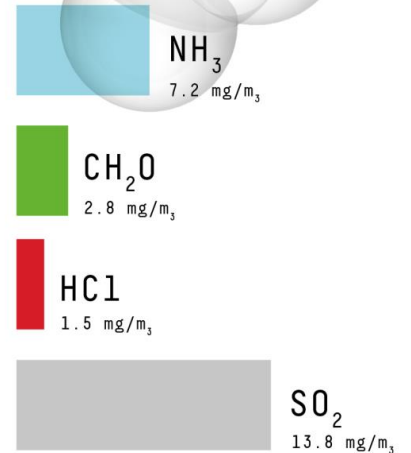


SULFUR DIOXIDE

2 Measurement Spectrum



3 Analysis results





gaset
GT8000 MOBILIS

CAUTION HOT!
SAMPLE IN

CAUTION HOT!
SAMPLE OUT

Supply 230V/115V ~ 300W
50/60 Hz
UK CE
Gaset Technologies Oy
Made in Finland
www.gaset.com

CLASS 1 LASER PRODUCT
LUOKAN 1 LASERLAITE
KLASS 1 LASER APPARAT
EN 60825-1:2007

Gaset GT6000 Mobilis

Gaset GT6000 Mobilis is a portable, mains powered high performance multicomponent gas analyzer for demanding applications. GT6000 Mobilis incorporates temperature stabilized sample cell at 50 °C or 180 °C, which allows measuring from hot and wet gas streams. GT6000 Mobilis is recommended to be used with a Gaset portable sampling system PSS Base or PSS Plus.

System specifications

Measuring principle	Fourier transform infrared, FTIR
Multigas capability	Simultaneous analysis of up to 50 gas compounds
Response Time	Typically < 120 s
Power supply	115 / 230 VAC 50 / 60Hz
Power consumption	Max. 300 W
Analysis Software	Calcmnet (Required operating system Windows 10)
Data Connection	USB (HID), Ethernet, Bluetooth, WiFi Access Point and WiFi Station
Sample pump	Recommended: Gasmet PSS Base or PSS Plus.
Sample gas filtration	Minimum 2 µm particulate filtration. Recommended: Gasmet PSS Base or PSS Plus with standard filter.
Gas fittings	Sample in: 6 mm Swagelok Sample out: 8 mm Swagelok Interferometer purge: 6 mm quick connect
Enclosure	Dimensions: 474 x 315 x 183 mm Material: ABS PC IP class: IP42
Weight	11.2 kg
CE label	According to EMI guideline 2014/30/EU and low-voltage directive 2014/35/EU
Spectrometer	Resolution: 4/8 cm ⁻¹ Detector: Thermoelectrically cooled MCT Beamsplitter: Antireflection coated ZnSe Wave number range: 900 - 4 400 cm ⁻¹
Sample cell	Structure: Multi-pass, fixed path length 5.0 m Material: 100 % purity gold coated aluminum Mirrors: 100% purity gold coated metal mirrors with protection layers Volume: 0.5 liters Temperature: 50 °C or 180 °C

Operating and storage conditions

Sample gas pressure	Ambient
Sample gas flow rate	Recommended: Gasmet PSS Base or PSS Plus with nominal flow of 4 l/min. If another sampling system is used, flow rate should be 2 – 8 l/min
Storage temperature	-20°C to 60°C, Non-condensing
Operating temperature	Long term -5 to 40 °C, short term -10 to 50 °C

Performance specifications

Zero-point drift	< 2 % of measuring range per zero-point calibration interval
Sensitivity drift	None
Linearity deviation	< 2 % of measuring range
Temperature drift	< 2 % of measuring range across long term operating temperature range
Pressure influence	1 % change of measuring value for 1 % sample pressure change. Ambient pressure changes measured and compensated



V1.8

Background measurement interval

24 hours, with nitrogen (5.0 or higher N₂ recommended)

Zero gas

Nitrogen (5.0 or higher purity)

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PSS Base & PSS Plus

Gaset PSS is an automated portable sampling system for continuous extractive sampling from hot and wet gas streams. It is designed for periodic, continuous measurements on site. PSS Base and PSS Plus are controlled with Calcmet software and GT6000 Mobilis gas analyzer.

The PSS Base is affordable option with all the basic features for automated, continuous sampling. PSS Plus has additional features for advanced measurements: oxygen measurement, sample flow status signal and integrated rotameters for instrument air and zero gas flow control. There is also a possibility to connect instrument air for safety and purging, saving N₂.

System specifications

Heated sampling train	Set temperature: 50 °C or 180 °C Main components: filter, pump, sample lines Materials: Teflon and stainless steel
Sample	Flow: nominal 4 l/min, at ambient pressure 2 l/min at -200 mbar (relative) 2 l/min at +400 mbar (relative) Filtering before PSS (optional probe): Filtration of particulates (2 µm)
Power supply	Separate models for 100-115 and 230 V / 50 -60 Hz Power connection: CEE7 standard European Schuko plug or fixed cable Power consumption: 400 W maximum PSS only, 2400W maximum for heated lines. Maximum for single heated line 2300 W for 230 V version and 1150 W for 115 V version.
Sample inlet/outlet fittings	6 mm Swagelok, stainless steel
Auxiliary gas inlets (zero gas, instrument air (only in PSS Plus))	Recommended pressure: 2 bar Recommended flow: 4 l/min, PSS Plus: adjustable 0-7 l/min
Enclosure	Dimensions: 420x245x290 mm Material: Steel, Powder Coated Grey IP class: IP42
Weight	16 kg (PSS Plus), 15 kg (PSS Base)
CE label	According to EMI guideline 2014/30/EU and low-voltage directive 2014/35/EU
Internal heated filter	Default: PTFE 2 µm Option: Sintered stainless steel 0.1µ
Oxygen sensor (only in PSS Plus)	Principle: ZrO ₂ cell Measuring range: 0.1 – 25 % Calibration: Automated single point calibration with air
Optional heated line	Tube size: 4 mm inner diameter, 6 mm outer diameter Core material: Teflon Fittings: 6 mm Swagelok Power supply: Supplied from PSS Power density: 120 watts/meter Maximum total sample line length: 20 m for 230V model, 13 m for the 115V model

Operating and storage conditions

Operating temperature	Long term -5 to 40 °C, short term -10 to 50 °C
Storage temperature	-20 to 60 °C, non-condensing

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FTIR GAS ANALYSIS

INTRODUCTION

FTIR (Fourier Transform InfraRed) spectroscopy is the most popular analytical technology for industrial applications requiring the continuous measurement of multiple parameters simultaneously. Typically, FTIR analyzers are employed for process control and emissions monitoring, however, due to the robustness and flexibility of this technique, it can also be applied in a wide variety of different applications, which will be discussed in greater detail below.

FTIR gas analyzers identify and measure gaseous compounds by their absorbance of infrared radiation. This is possible because every molecular structure has a unique combination of atoms, and therefore produces a unique spectrum when exposed to infrared light. Instrumental analysis of the spectrum (2 to 12 micrometer wavelength) enables the qualitative identification and quantitative analysis of the gaseous compounds in the sample gas. Importantly, FTIR analyzers are able to simultaneously measure multiple analytes in complex gas matrices, detecting virtually all gas-phase species (both organic and inorganic, except diatomic elements N₂, O₂ etc. and noble gases He, Ne, etc.). For example, the Gaset™ FTIR gas analyzer collects a complete infrared spectrum (a measurement of the infrared light absorbed by molecules inside the sample gas cell) 10 times per second. Multiple spectra are co-added together according to a selected measurement time (improving accuracy by raising the signal-to-noise ratio). The actual concentrations of gases are calculated from the resulting sample spectrum using a patented modified Classical Least Squares analysis algorithm.

TYPICAL APPLICATIONS

The ability of FTIR to monitor multiple gases simultaneously, even in hot, wet aggressive gas streams means that it is ideal for emissions monitoring in the power sector, energy from waste, incineration plants and in industries such as cement and aluminium. These processes have to demonstrate compliance with emissions limit values specified in regulatory permits using instrumentation with appropriate certification (a list of Gaset's comprehensive certification is given below).

A number of typical configurations exist for monitoring emissions including parameters such as CO, NO, H₂O, SO₂, HCl, NH₃, NO₂, N₂O, CO₂, HF, CH₄ and CHOH. However, with the ability to monitor thousands of compounds, the opportunities for industrial process monitoring with FTIR are endless.

The emissions from all types of engines are monitored for compliance purposes and also to improve engine efficiency.

Again multigas capability is required and FTIR is therefore commonly applied. With increasing concern over the impact of vehicle emissions on ambient air quality, FTIR is a popular monitoring technique with engine developers; providing an opportunity to refine engine performance whilst measuring the effects on the individual components of emitted gases.

In addition to emissions monitoring, Gaset FTIR analyzers are also employed in other environmental applications, particularly where multigas monitoring is required or where it is necessary to be able to identify unknown gases. Portable and ambient versions of the same FTIR technology are therefore available and are employed in applications such as greenhouse gas monitoring in soils, contaminated land, chemical leak/spill, fire investigation etc.

Gaset FTIR analyzers are also used in occupational safety applications such as anaesthetic gases, shipping container investigation, fumigation and testing of compressed breathing air for impurities.

FTIR GAS ANALYZER VERSIONS

Gasmet FTIR analyzers are available in a variety of different formats to meet the requirements of different applications. The core FTIR technology is exactly the same in every model, so all users, working in any application, can rely on the same high levels of accuracy and reliability. The main models are as follows:

1. Fixed Continuous Emissions Monitoring System - the CEMS II *e* has enhanced certification for the monitoring of multiple gases. The FTIR analyzer, a heated sampling unit, an industrial PC and a Zirconia oxygen analyzer are installed in an air-conditioned cabinet for the analysis of up to 50 compounds simultaneously in extracted gases.
2. Portable heated FTIR - the DX4000 analyzer employs the same technology as the CEMS II *e* for the analysis of extracted gases in a portable housing weighing less than 20 kg (40 lbs).
3. Portable ambient gas FTIR analyzer – the DX4040 is a battery powered analyzer capable of measuring up to 25 parameters simultaneously, with remote PDA control via Bluetooth.
4. Fixed multipoint ambient FTIR gas analyzer – the Gasmet FCX incorporates an FTIR analyzer with a built-in industrial computer and a TFT display in a compact IP65 rated stainless steel wall mounted enclosure.
5. Stack/duct mounted FTIR gas analyzer – the Gasmet In-Situ analyzer consists of a sample cell inserted into the stack or duct, a heated steel mounting flange and the rugged GICCOR™ interferometer unit in an IP65 enclosure that is directly attached to the flange. With no sample extraction, response time is faster. However, extractive FTIR should be employed: with wet stacks where the gas temperature is down to the dew point; in very hot stacks with gas temperature above 250°C, and in ducts with diameter less than probe length (c.700 mm).

FTIR – COMMON QUESTIONS

1. WHAT IS AN FTIR SPECTROMETER? AND HOW DOES IT WORK?

A FTIR spectrometer consists of the following key components:

- A broadband IR source emitting all recorded wavelengths simultaneously
- Beamsplitter which separates the IR beam into two equal parts
- A moving/stationary mirror assembly where the two beams travel a distance which can be varied by moving one or more mirrors continuously back and forth
- A reference laser source, which is used to track the position of the moving mirror
- Focusing optics used to transfer the beam into the sample cell and from the sample cell into the detector
- Sample cell filled with sample gas or test gas
- IR detector which responds to the entire wavelength range of the spectrometer
- Laser detector which responds to the wavelength of reference laser used

The beamsplitter and moving/stationary mirror assembly are collectively known as the **interferometer** and this is the heart of a FTIR spectrometer. Due to the motion of mirrors, the two beams produced by beamsplitter have a phase difference and when they recombine at the beamsplitter the produced IR intensity varies with mirror position. The interferometer can be considered an optical modulator and the modulation of the beam is the key to calculating intensity at each frequency from the signal recorded by IR detector.

The IR detector records a signal as a function of time (or mirror position, as the moving mirror has a constant speed) known as the interferogram. This signal is linked with the IR spectrum by a Fourier transformation, a mathematical tool for converting time domain signal $I(t)$ to a frequency domain signal $I(f)$. By placing a sample cell between the interferometer and the detector, the spectrometer can be used to measure an absorption spectrum of the sample gas, and the identity and concentration of gases in the sample can be calculated from the absorption spectrum.

2. WHAT IS AN INFRARED SPECTRUM?

The infrared spectrum is a plot of infrared radiation related quantities as a function of wavelength or wavenumber. There are three commonly used quantities for an infrared spectrum:

Intensity (I), is a measure of IR light falling on the detector, and this can have a unit of power per surface area but more commonly this is represented on a unitless scale of detector counts.

Transmittance (T), is the ratio of Intensity measured with sample gas in the sample cell (sample spectrum) and Intensity measured with zero gas in the sample cell (background spectrum). Transmittance is a unitless number and is typically expressed as percentage (0 - 100%). The reason why Intensity is commonly represented by detector counts instead of SI units of power/area is that the same units are used for both I and I₀ when calculating transmittance and they cancel each other.

Absorbance (A), is a logarithm of Transmittance with reversed sign. Absorbance is particularly useful for gas analysis because it is directly proportional to gas concentration unlike Transmittance or Intensity. The x-axis of an IR spectrum can be either wavelength in micrometers (microns) or more commonly wavenumber in reciprocal centimeter units. Wavenumbers are in common use as the spacing of spectral lines in IR spectrum is more constant in wavenumber than wavelength scale. The table below shows some common wavelengths and wavenumbers.

TABLE 1 COMMON WAVELENGTHS AND WAVENUMBERS

	Wavelength	Wavenumber
Boundary of IR and Microwave scale	500 μm	20 cm ⁻¹
Low end of Mid-IR scale	20 μm	500 cm ⁻¹
High end of Mid-IR scale	2.5 μm	4000 cm ⁻¹
Visible red	0.77 μm (770 nm)	13000 cm ⁻¹
Typical Gasmet spectral range	12 μm to 2.5 μm	900 cm ⁻¹ to 4200 cm ⁻¹

A typical infrared spectrum of HCl gas is shown below. The HCl molecules vibrate with a frequency that corresponds to the gap in the middle of the spectrum, and the individual lines are due to combinations of vibration and rotation of the molecules. This pattern is unique to HCl and each gas has a

corresponding ‘fingerprint’ which is different to the spectra of other gases, forming the basis of identification. The peak heights in absorbance scale are also proportional to gas concentration, which is the basis of quantification of gases from the spectrum.

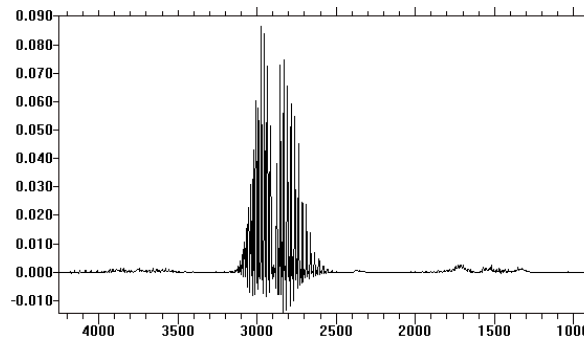


FIGURE 2 INFRARED SPECTRUM FOR HCL

3. HOW IS THE IR SPECTRUM USED FOR THE QUANTIFICATION OF GASES?

The amount of light passing through an absorbing medium decreases exponentially as the thickness of the absorber is increased (Figure 2). In the case of gas analysis the absorber is the sample cell filled with IR absorbing gas. Absorbance at a given wavelength (λ) is a logarithm of transmittance, $A = \log_{10}(I/I_0)$, and is directly proportional to gas concentration (c), the distance travelled by the IR beam in the sample gas (b), and a gas specific constant (ε) known as molar absorptivity. The relation can be expressed as the Lambert-Beer law: $A(\lambda) = \epsilon(\lambda) \times b \times c$

In this equation, the concentration c is the quantity to be determined, A is taken from the measured spectrum, ε from the reference spectrum (see below) and pathlength b is a known quantity of the FTIR gas analyzer. The actual quantification is achieved by building a model spectrum from the reference spectra and matching them against the sample spectrum over a wide range of wavelengths to determine concentrations of multiple gases simultaneously. The illustration below shows how light intensity drops when the beam passes through a thickness of IR absorbing sample gas.

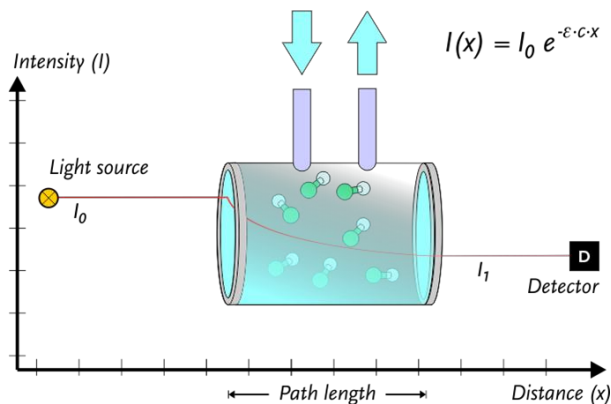


FIGURE 3: LAMBERT-BEER LAW AND ABSORBANCE

4. WHAT IS A REFERENCE SPECTRUM?

A reference spectrum is a spectrum of known concentration of one IR absorbing gas diluted in nitrogen. Reference spectra are used to analyze measured sample spectra. The absorption peaks in a sample gas are compared with those of reference spectra to determine simultaneously the concentrations of multiple gas components of the sample. For instance, if the absorption due to Methane in the sample is 1.2 times that of a 10 ppm Methane reference spectrum, the concentration of Methane is 12 ppm.

The reference spectrum is recorded using a long measurement time to eliminate noise from the spectrum and the instrument is carefully purged to eliminate traces of moisture and carbon dioxide (the two main atmospheric IR absorbing gases) from the spectrum. In order to model moisture and carbon dioxide in the sample, reference spectra of these gases are used.

5. WHICH GASES CAN BE MEASURED BY THE GASMET™ FTIR GAS ANALYZERS?

IR absorption spectroscopy such as FTIR detects those gases that absorb infrared radiation in internal motion (vibration) of the molecule. The absorption strength of a gas depends on the change of dipole moment (separation of electric charge) caused by the vibration. A molecule with strongly varying dipole moment absorbs radiation strongly whereas a molecule with no net change of dipole moment is transparent to IR radiation. Most molecules absorb IR light and are therefore measurable. However some molecules (N_2 , O_2 , H_2 , Cl_2 , ...) and all single-atom gases (He, Ne, Ar, Hg, ...) do not change dipole moment and therefore they do not have an IR absorption spectrum. These gases, especially Nitrogen, can be used as a zero gas for recording a background spectrum (I_0). The gases measured by FTIR include:

- Inorganic gases: Water, CO_2 , CO , NO , NO_2 , N_2O , NH_3 , SO_2 , HCl , HF , ...
- Volatile organic compounds: hydrocarbons, alcohols, aldehydes, ketones, freons, ...
- The main exceptions are:
- noble gases (He, Ar, ...)
- metals (Hg)
- molecules with just two atoms of the same element (N_2 , O_2 , H_2 , Cl_2)
- molecules with very small dipole moment change (H_2S)
- low volatility organics (high boiling point or room temperature solid)
- particulate matter or aerosols (not a gas)

6. WHAT IS THE TYPICAL PERFORMANCE OF GASMET™ FTIR GAS ANALYZERS IN EMISSIONS MONITORING APPLICATIONS?

Gasmet FTIR analyzers meet the performance requirements laid down in EN 15267-3 (Europe) and PS 15 (U.S). Linearity deviations are less than 2% of full scale and cross-interference effects due to stack emissions gas (H_2O up to 40 vol-%) are less than 4% of full scale for certified gases. Measurement accuracy is typically expressed in terms of expanded measurement uncertainty (U_c), a combination of uncertainty sources such as:

- nonlinearity (lack of fit)
- cross-interference
- zero and span drift
- temperature
- flow rate
- pressure
- mains voltage

Measurement uncertainty for specific gases (CO , NO , NO_2 , SO_2 , HCl , HF , ...) has a limit value proportional to emission limit value in the EU Industrial Emissions Directive, and the Gasmet system typically has measurement uncertainties smaller than one half the maximum uncertainty allowed for a certified (EN 15267-3, TÜV, MCERTS) emissions monitoring system. This ensures that Gasmet gas analyzers are capable of monitoring not only today's emission limits but also lower limit values that may be introduced in the future.

7. HOW ARE NEW GASES ADDED TO THE LIBRARY?

New gases can be either measured with the instrument in question or imported from a generic library. The best method depends on the application; if traceability is required, instrument specific calibration is the best option, otherwise generic spectra may be used. Instrument specific calibration can be performed by the user or by the Gaset calibration laboratory.

8. WHEN SHOULD GASMET™ FTIR GAS ANALYZERS BE RECALIBRATED?

FTIR gas analyzers do not require periodic recalibration. A daily background spectrum measurement with zero gas is enough to preserve measurement accuracy. Instead of periodic span calibrations, reference spectra for analysed gases are measured at the factory when the instrument is made and these do not drift.

Calibration of an FTIR instrument relies on:

- reference spectra recorded on a computer
- daily background spectrum measurement with zero gas (N₂) which compensates for any variation in the IR source, sample cell, etc.
- continuous internal reference of wavelength scale with a reference laser

For the above reasons the response of an FTIR instrument does not drift and separate zero and span adjustments of each measured gas are not required. FTIR measures low ppm concentrations of pollutants in hot/wet gases up to 40 vol-% (400 000 ppm) water, so the reference spectra of H₂O are measured again after a service operation (involving the optical components) to preserve highest accuracy.

9. WHY IS THE QUALITY OF THE INTERFEROMETER CRUCIAL?

The Gaset GICCOR (Genzel Interferometer with Cube Corner Retroreflectors) interferometer is specially designed for maximum optical throughput and maximum signal-to-noise ratio at a resolution of 7.72 cm⁻¹ providing unparalleled stability with respect to vibration and temperature changes. It can be used in a temperature range of 0 to 40 °C (short term) and also in a person-portable analyzer while the user is moving with the instrument. The use of cube corner mirrors, a highly symmetric mirror layout and a patented moving

mechanism removes temperature and vibration influence and the use of non-hygroscopic optical material removes the need for dry air or nitrogen purging of the interferometer

10. WHY IS THE QUALITY OF THE SAMPLE CELL IMPORTANT?

The Gaset sample cells have mirror surfaces machined directly to the cell end plates, eliminating a source of drift and uncertainty associated with adjustable mirror gas cells. The cell surfaces are coated with a proprietary combination of materials including Rhodium and Gold selected for their corrosion resistance against reactive gases and high IR reflectance (in the case of Gold). Sample cells are available in a very wide range of path lengths from 1cm to 980cm, and long path lengths are achieved in a small cell volume (450ml in the case of 980cm path). The cells are heated optionally up to 180 °C to allow hot/wet sampling of gases with high concentrations of H₂O, SO₂, etc.

11. DO ACIDIC GASES SUCH AS HCL AND HF DAMAGE THE SAMPLE CELL?

The multiple layer coatings on the sample cell and elevated cell temperatures make the cell remarkably resistant to the corrosive effects of acid gases even when the water content of the gas is high. However, if the sample is allowed to cool down and condense inside the cell or the acid gas dew point exceeds cell temperature, damage to the cell is possible. For this reason the Gaset sampling system design prevents the sample pump from pulling wet gas into a cell under the temperature set-point. If the temperature of any heated part falls below the set-point, or the system loses power, the cell is flushed with dry air or nitrogen before condensation can take place. As long as condensation is avoided the cell is not damaged by moderately high levels HCl or HF.

The corrosion resistance of the sample cell depends on the prevention of condensation inside the cell. The cell temperature should exceed the dew point of the sample gas by a safety margin. For this reason Gaset analyzers have different temperature set points as shown in the table below:



#	Compound name	Formula	CAS number	Maximum range		Unit	Notes
				GAS-REF-001*	GAS-REF-002**		
Typical components							
1	Water	H ₂ O	7732-18-5	40	60	vol-%	
2	Carbon dioxide	CO ₂	124-38-9	30	100	vol-%	
3	Carbon monoxide	CO	630-08-0	1	30	vol-%	
4	Nitrous oxide	N ₂ O	10024-97-2	200	5000	ppm	
5	Methane	CH ₄	74-82-8	1	50	vol-%	
Open-chain hydrocarbons							
6	1,3-Butadiene	C ₄ H ₆	106-99-0	200	1000	ppm	
7	1-Butene	C ₄ H ₈	106-98-9	200	1000	ppm	
8	1-Heptene	C ₇ H ₁₄	592-76-7	200	1000	ppm	
9	1-Hexyne	C ₆ H ₁₀	693-02-7	NB	NB	ppm	
10	1-Nonene	C ₉ H ₁₈	124-11-8	NB	1000	ppm	
11	1-Octene	C ₈ H ₁₆	111-66-0	100	1000	ppm	
12	1-Pentene	C ₅ H ₁₀	109-67-1	200	1000	ppm	
13	2,2-Dimethylbutane	C ₆ H ₁₄	75-83-2	NB	NB	ppm	
14	2,3,4-Trimethylpentane	C ₈ H ₁₈	565-75-3	NB	NB	ppm	
15	2,3-Dimethylbutane	C ₆ H ₁₄	79-29-8	NB	NB	ppm	
16	2,3-Dimethylpentane	C ₇ H ₁₆	565-59-3	NB	NB	ppm	
17	2,4,4-Trimethyl-1-pentene	C ₈ H ₁₆	107-39-1	NB	NB	ppm	
18	2,4,4-Trimethyl-2-pentene	C ₈ H ₁₆	107-40-4	NB	NB	ppm	
19	2,4-Dimethylhexane	C ₈ H ₁₈	589-43-5	NB	NB	ppm	
20	2,4-Dimethylpentane	C ₇ H ₁₆	108-08-7	NB	NB	ppm	
21	2,5-Dimethylhexane	C ₈ H ₁₈	592-13-2	NB	NB	ppm	
22	2-Methyl-1-butene	C ₅ H ₁₀	563-46-2	NB	NB	ppm	
23	3-Methyl-1-butene	C ₅ H ₁₀	563-45-1	NB	NB	ppm	
24	3-Methylhexane	C ₇ H ₁₆	589-34-4	NB	NB	ppm	
25	3-Methylpentane	C ₆ H ₁₄	96-14-0	NB	NB	ppm	
26	Acetylene (Ethyne)	C ₂ H ₂	74-86-2	500	2000	ppm	
27	Butane	C ₄ H ₁₀	106-97-8	200	1000	ppm	
28	Cetane (n-Hexadecane)	C ₁₆ H ₃₄	544-76-3	NB	NB	ppm	Calibration only for heated analyzer.
29	cis-2-Butene	C ₄ H ₈	590-18-1	NB	NB	ppm	
30	cis-2-Pentene	C ₅ H ₁₀	627-20-3	NB	NB	ppm	
31	Decane	C ₁₀ H ₂₂	124-18-5	100	500	ppm	
32	Dodecane	C ₁₂ H ₂₆	112-40-3	100	500	ppm	
33	Ethane	C ₂ H ₆	74-84-0	200	2000	ppm	
34	Ethylene (Ethene)	C ₂ H ₄	74-85-1	200	2000	ppm	
35	Heptane	C ₇ H ₁₆	142-82-5	200	1000	ppm	
36	Hexane	C ₆ H ₁₄	110-54-3	200	1000	ppm	
37	Hexene	C ₆ H ₁₂	592-41-6	200	1000	ppm	
38	Isobutane (2-Methyl propane)	C ₄ H ₁₀	75-28-5	200	1000	ppm	
39	Isobutene (2-Methyl-1-propene)	C ₄ H ₈	115-11-7	NB	NB	ppm	
40	Isoheptane	C ₇ H ₁₆	591-76-4	NB	NB	ppm	
41	Isohexane (2-Methyl pentane)	C ₆ H ₁₄	107-83-5	200	1000	ppm	
42	Iso-octane (2,2,4-Trimethyl pentane)	C ₈ H ₁₈	540-84-1	100	500	ppm	
43	Isopentane (2-Methyl butane)	C ₅ H ₁₂	78-78-4	200	1000	ppm	
44	Isopentene (2-Methyl-2-butene)	C ₅ H ₁₀	513-35-9	200	1000	ppm	
45	Isoprene	C ₅ H ₈	78-79-5	200	1000	ppm	
46	Nonane	C ₉ H ₂₀	111-84-2	100	500	ppm	
47	Octane	C ₈ H ₁₈	111-65-9	100	500	ppm	
48	Pentane	C ₅ H ₁₂	109-66-0	200	1000	ppm	
49	Propane	C ₃ H ₈	74-98-6	200	1000	ppm	
50	Propene	C ₃ H ₆	115-07-1	200	1000	ppm	
51	Propyne	C ₃ H ₄	74-99-7	NB	NB	ppm	
52	Tetradecane	C ₁₄ H ₃₀	629-59-4	100	500	ppm	
53	trans-2-Butene	C ₄ H ₈	624-64-6	NB	NB	ppm	
54	trans-2-Pentene	C ₅ H ₁₀	646-04-8	NB	NB	ppm	
55	Tridecane	C ₁₃ H ₂₈	629-50-5	100	500	ppm	
56	Undecane	C ₁₁ H ₂₄	1120-21-4	100	500	ppm	
57	Vinylacetylene (1-Buten-3-yne)	C ₄ H ₄	689-97-4	NB	NB	ppm	
Aromatic or cyclic hydrocarbons							
58	(-)-trans-Caryophyllene	C ₁₅ H ₂₄	87-44-5	NB	NB	ppm	
59	1,2,3-Trimethylbenzene	C ₉ H ₁₂	526-73-8	200	1000	ppm	
60	1,2,4-Trimethylbenzene	C ₉ H ₁₂	95-63-6	200	1000	ppm	
61	1,2,4-Trivinylcyclohexane	C ₁₂ H ₁₈	2855-27-8	NB	NB	ppm	
62	1,3,5-Triisopropylbenzene	C ₁₅ H ₂₄	717-74-8	NB	NB	ppm	
63	1,3,5-Trimethylbenzene (Mesitylene)	C ₉ H ₁₂	108-67-8	200	1000	ppm	
64	1-Ethyl-naphthalene	C ₁₂ H ₁₂	1127-76-0	NB	NB	ppm	Only non-instrument specific references. Solid material.
65	1-Methyl-naphthalene	C ₁₁ H ₁₀	90-12-0	NB	NB	ppm	Only non-instrument specific references. Solid material.
66	2-Ethyltoluene	C ₉ H ₁₂	611-14-3	200	1000	ppm	

67	2-Methylnaphthalene	C ₁₁ H ₁₀	91-57-6	NB	NB	ppm	Only non-instrument specific references. Solid material.
68	2-Vinytoluene (2-methylstyrene, o-methylstyrene)	C ₉ H ₁₀	611-15-4	NB	NB	ppm	
69	3-Ethyltoluene	C ₉ H ₁₂	620-14-4	200	1000	ppm	
70	3-Vinytoluene (3-methylstyrene, m-methylstyrene)	C ₉ H ₁₀	100-80-1	NB	NB	ppm	
71	4-Ethyltoluene	C ₉ H ₁₂	622-96-8	200	1000	ppm	
72	4-tert-Butylstyrene	C ₁₂ H ₁₆	1746-23-2	NB	NB	ppm	
73	4-Vinyl-1-cyclohexene	C ₈ H ₁₂	100-40-3	NB	NB	ppm	
74	4-Vinytoluene (4-methylstyrene, p-methylstyrene)	C ₉ H ₁₀	622-97-9	NB	NB	ppm	
75	5-Ethylidene-2-norbornene (ENB)	C ₉ H ₁₂	16219-75-3	NB	NB	ppm	
76	5-Vinyl-2-norbornene (VNB)	C ₉ H ₁₂	3048-64-4	NB	NB	ppm	
77	Acenaphthene	C ₁₂ H ₁₀	83-32-9	NB	NB	ppm	Only non-instrument specific references. Solid material.
78	Benzene	C ₆ H ₆	71-43-2	200	1000	ppm	
79	Biphenyl	C ₁₂ H ₁₀	92-52-4	NB	NB	ppm	
80	cis-1,4-Dimethylcyclohexane	C ₈ H ₁₆	624-29-3	NB	NB	ppm	
81	Cumene	C ₉ H ₁₂	98-82-8	200	1000	ppm	
82	Cyclohexane	C ₆ H ₁₂	110-82-7	100	500	ppm	
83	Cyclopentane	C ₅ H ₁₀	287-92-3	100	500	ppm	
84	Cyclopentene	C ₅ H ₈	142-29-0	200	1000	ppm	
85	Cyclopropane (Trimethylene)	C ₃ H ₆	75-19-4	NB	NB	ppm	
86	Delta-3-Carene	C ₁₀ H ₁₆	13466-78-9	200	1000	ppm	
87	Dicyclopentadiene (DCPD)	C ₁₀ H ₁₂	77-73-6	NB	NB	ppm	
88	Ethyl benzene	C ₈ H ₁₀	100-41-4	500	2000	ppm	
89	Ethylcyclohexane	C ₈ H ₁₆	1678-91-7	100	500	ppm	
90	Indene	C ₉ H ₈	95-13-6	NB	NB	ppm	
91	Isopropylcyclohexane (Methylethylcyclohexane)	C ₉ H ₁₈	696-29-7	NB	NB	ppm	
92	Limonene	C ₁₀ H ₁₆	138-86-3	200	1000	ppm	
93	m-Diethylbenzene (1,3-diethylbenzene)	C ₁₀ H ₁₄	141-93-5	100	500	ppm	
94	Methylcyclohexane	C ₇ H ₁₄	108-87-2	100	500	ppm	
95	Methylcyclopentane	C ₆ H ₁₂	96-37-7	100	500	ppm	
96	m-Xylene	C ₈ H ₁₀	108-38-3	500	2000	ppm	
97	Naphthalene	C ₁₀ H ₈	91-20-3	NB	NB	ppm	Only non-instrument specific references. Solid material.
98	o-Diethylbenzene (1,2-diethylbenzene)	C ₁₀ H ₁₄	135-01-3	100	500	ppm	
99	o-Xylene	C ₈ H ₁₀	95-47-6	500	2000	ppm	
100	p-Diethylbenzene (1,4-diethylbenzene)	C ₁₀ H ₁₄	105-05-5	100	500	ppm	
101	Phenyl acetylene (1-Phenylethyne)	C ₈ H ₆	536-74-3	200	1000	ppm	
102	Propylbenzene	C ₉ H ₁₂	103-65-1	NB	NB	ppm	
103	p-Xylene	C ₈ H ₁₀	106-42-3	500	2000	ppm	
104	Styrene	C ₈ H ₈	100-42-5	500	2000	ppm	
105	Tetraline (1,2,3,4-Tetrahydronaphthalene; Bacticin; benzocyclohexane)	C ₁₀ H ₁₂	119-64-2	NB	NB	ppm	
106	Toluene	C ₇ H ₈	108-88-3	200	2000	ppm	
107	trans-1,4-Dimethylcyclohexane	C ₈ H ₁₆	2207-04-7	NB	NB	ppm	
108	α-Methylstyrene	C ₈ H ₁₀	98-83-9	200	2000	ppm	
109	α-Pinene	C ₁₀ H ₁₆	80-56-8	200	500	ppm	
110	β-Pinene	C ₁₀ H ₁₆	127-91-3	200	500	ppm	

Acids and derivatives

111	1,4-Butanediol dimethacrylate (BDDMA)	C ₁₂ H ₁₈ O ₄	2082-81-7	NB	NB	ppm	
112	1-Ethoxy-2-propyl acetate (2-Acetoxy-1-ethoxypropane)	C ₇ H ₁₄ O ₃	54839-24-6	NB	NB	ppm	
113	1-Methoxy-2-propyl acetate	C ₆ H ₁₂ O ₃	108-65-6	100	500	ppm	
114	2-(2-Butoxyethoxy)ethyl acetate	C ₁₀ H ₂₀ O ₄	124-17-4	100	500	ppm	
115	2-Butoxyethyl acetate	C ₈ H ₁₆ O ₃	112-07-2	100	500	ppm	
116	2-Ethoxyethyl acetate (Cellosolve acetate)	C ₆ H ₁₂ O ₃	111-15-9	100	500	ppm	
117	2-Ethylhexyl acrylate	C ₁₁ H ₂₀ O ₂	103-11-7	NB	NB	ppm	
118	2-Hydroxybutyl acetate	C ₆ H ₁₂ O ₃	24469-20-3	NB	NB	ppm	
119	2-Methoxy-1-propyl acetate	C ₆ H ₁₂ O ₃	70657-70-4	NB	NB	ppm	
120	2-Methoxyethyl acetate (Methyl cellosolve acetate)	C ₅ H ₁₀ O ₃	110-49-6	100	500	ppm	
121	3-Methoxybutyl acetate	C ₇ H ₁₄ O ₃	4435-53-4	NB	NB	ppm	
122	Acetic acid	C ₂ H ₄ O ₂	64-19-7	200	500	ppm	
123	Acetic acid anhydride	C ₄ H ₆ O ₃	108-24-7	100	200	ppm	
124	Acetoacetic ester (Ethyl acetoacetate)	C ₆ H ₁₀ O ₃	141-97-9	NB	NB	ppm	
125	Acrylic acid	C ₃ H ₄ O ₂	79-10-7	100	500	ppm	
126	Butyl acetate	C ₈ H ₁₆ O ₂	123-86-4	100	500	ppm	
127	Butyl acrylate (2-propenoic acid butyl ester)	C ₇ H ₁₂ O ₂	141-32-2	NB	NB	ppm	
128	Butyl butyrate (Butanoic acid butyl ester, Butyric acid butyl ester, Butyl butanoate)	C ₈ H ₁₆ O ₂	109-21-7	NB	NB	ppm	
129	Butyl glycolate (Glycolic acid butyl ester)	C ₆ H ₁₂ O ₃	7397-62-8	NB	NB	ppm	
130	Butyl lactate (Butyl 2-hydroxypropanoate)	C ₇ H ₁₄ O ₃	138-22-7	NB	NB	ppm	
131	Butyric acid (butanoic acid)	C ₄ H ₈ O ₂	107-92-6	NB	NB	ppm	
132	Citraconic acid (Methylmaleic acid)	C ₆ H ₆ O ₄	498-23-7	NB	NB	ppm	
133	Di(ethylene glycol) dimethacrylate (DEGDMA)	C ₁₂ H ₁₈ O ₅	2358-84-1	NB	NB	ppm	
134	Diethyl carbonate (Carbonic acid diethyl ester)	C ₆ H ₁₂ O ₃	105-58-8	50	200	ppm	
135	Dimethyl adipate	C ₈ H ₁₄ O ₄	627-93-0	NB	NB	ppm	
136	Dimethyl carbonate (DCM; Methyl carbonate)	C ₃ H ₆ O ₃	616-38-6	50	200	ppm	
137	Dimethyl glutarate (Pentanedioic acid dimethyl ester)	C ₇ H ₁₂ O ₄	1119-40-0	NB	NB	ppm	
138	Dimethyl succinate (Succinic acid dimethyl ester)	C ₆ H ₁₀ O ₄	106-65-0	NB	NB	ppm	
139	Di-tert-butyl dicarbonate	C ₁₀ H ₁₈ O ₅	24424-99-5	NB	NB	ppm	
140	Ethyl acetate	C ₄ H ₈ O ₂	141-78-6	100	500	ppm	
141	Ethyl acrylate	C ₆ H ₁₀ O ₂	140-88-5	NB	NB	ppm	

142	Ethyl formate	C ₃ H ₆ O ₂	109-94-4	NB	NB	ppm	
143	Ethyl lactate (Ethyl α-hydroxypropionate)	C ₆ H ₁₀ O ₃	97-64-3	100	500	ppm	
144	Ethyl methacrylate (Ethyl 2-methylpropenoate)	C ₈ H ₁₀ O ₂	97-63-2	NB	NB	ppm	
145	Ethyl methyl carbonate (Methyl ethyl carbonate)	C ₄ H ₈ O ₃	623-53-0	50	200	ppm	
146	Ethyl-3-ethoxypropionate	C ₇ H ₁₄ O ₃	763-69-9	100	500	ppm	
147	Ethylene carbonate (1,3-Dioxolan-2-one)	C ₃ H ₄ O ₃	96-49-1	NB	NB	ppm	Calibration only for heated analyzer.
148	Formic acid	CH ₂ O ₂	64-18-6	200	500	ppm	
149	Furfuryl acetate	C ₇ H ₈ O ₃	623-17-6	NB	NB	ppm	
150	Heptanoic acid	C ₇ H ₁₄ O ₂	111-14-8	NB	NB	ppm	
151	Hexanoic acid (caproic acid)	C ₆ H ₁₂ O ₂	142-62-1	NB	NB	ppm	
152	Hexyl acetate	C ₈ H ₁₆ O ₂	142-92-7	NB	NB	ppm	
153	Isobutyl acetate	C ₆ H ₁₂ O ₂	110-19-0	NB	NB	ppm	
154	Isobutyl formate (2-Methylpropyl formate)	C ₅ H ₁₀ O ₂	542-55-2	NB	NB	ppm	
155	Isobutyl methacrylate	C ₈ H ₁₄ O ₂	97-86-9	NB	NB	ppm	
156	Isooctyl acrylate	C ₁₁ H ₂₀ O ₂	29590-42-9	NB	NB	ppm	
157	Isopentyl acetate	C ₇ H ₁₄ O ₂	123-92-2	100	500	ppm	
158	Isopropyl acetate	C ₆ H ₁₀ O ₂	108-21-4	100	500	ppm	
159	Isopropyl lactate	C ₆ H ₁₂ O ₃	63697-00-7	NB	NB	ppm	
160	Isovaleric acid (3-Methylbutyric acid, Isopentanoic acid, Delphinic acid)	C ₆ H ₁₀ O ₂	503-74-2	NB	NB	ppm	
161	Lactic acid	C ₃ H ₆ O ₃	50-21-5	NB	NB	ppm	
162	Methacrylic acid	C ₄ H ₆ O ₂	79-41-4	NB	NB	ppm	
163	Methyl-3-methoxypropionate (3-Methoxypropanoic acid methyl ester)	C ₅ H ₁₀ O ₃	3852-09-3	NB	NB	ppm	
164	Methyl acetate	C ₃ H ₆ O ₂	79-20-9	100	500	ppm	
165	Methyl acrylate	C ₄ H ₆ O ₂	96-33-3	100	500	ppm	
166	Methyl formate	C ₂ H ₄ O ₂	107-31-3	100	500	ppm	
167	Methyl methacrylate	C ₅ H ₈ O ₂	80-62-6	100	500	ppm	
168	Methyl valerate (Pentanoic acid methyl ester)	C ₆ H ₁₂ O ₂	624-24-8	NB	NB	ppm	
169	Pentyl acetate (Banana oil)	C ₇ H ₁₄ O ₂	628-63-7	100	500	ppm	
170	Propionic acid	C ₃ H ₆ O ₂	79-09-4	100	500	ppm	
171	Propyl acetate	C ₅ H ₁₀ O ₂	109-60-4	100	500	ppm	
172	Propylene carbonate (4-Methyl-1,3-dioxolan-2-one)	C ₄ H ₆ O ₃	108-32-7	NB	NB	ppm	
173	tert-Butyl acetate	C ₆ H ₁₂ O ₂	540-88-5	NB	NB	ppm	
174	trans-2-Hexenyl acetate	C ₈ H ₁₄ O ₂	2497-18-9	NB	NB	ppm	
175	Valeric acid (Pentanoic acid)	C ₅ H ₁₀ O ₂	109-52-4	NB	NB	ppm	
176	Vinyl acetate	C ₄ H ₆ O ₂	108-05-4	100	500	ppm	
177	Vinylene carbonate (1,3-Dioxol-2-one)	C ₃ H ₂ O ₃	872-36-6	NB	NB	ppm	Calibration only for heated analyzer.
Aldehydes							
178	2-Ethyl-2-hexenal	C ₈ H ₁₄ O	645-62-5	NB	NB	ppm	
179	2-Ethylacrolein (2-Ethylacrylaldehyde)	C ₅ H ₈ O	922-63-4	NB	NB	ppm	
180	2-Ethylhexylaldehyde (2-Ethylhexanal)	C ₈ H ₁₆ O	123-05-7	200	1000	ppm	
181	2-Methylbutylaldehyde	C ₅ H ₁₀ O	96-17-3	NB	NB	ppm	
182	5-Hydroxymethyl-2-furfural (5-Hydroxymethyl-2-furaldehyde)	C ₆ H ₈ O ₃	67-47-0	NB	NB	ppm	
183	5-Methylfurfural (5-Methyl-2-furaldehyde)	C ₆ H ₈ O ₂	620-02-0	100	500	ppm	
184	Acetaldehyde	C ₂ H ₄ O	75-07-0	200	1000	ppm	
185	Acrolein (Acrylic aldehyde)	C ₃ H ₄ O	107-02-8	NB	NB	ppm	Only non-instrument specific references. Chemical not available.
186	Benzaldehyde	C ₇ H ₆ O	100-52-7	NB	NB	ppm	
187	Butylaldehyde (Butanal)	C ₄ H ₈ O	123-72-8	200	1000	ppm	
188	Citronellal	C ₁₀ H ₁₆ O	106-23-0	NB	NB	ppm	
189	Crotonaldehyde	C ₄ H ₆ O	4170-30-3	NB	NB	ppm	
190	Formaldehyde	CH ₂ O	50-00-0	NB	NB	ppm	Maximum calibration 500ppm.
191	Furfural (2-Furaldehyde)	C ₅ H ₄ O ₂	98-01-1	200	1000	ppm	
192	Glutaraldehyde	C ₅ H ₈ O ₂	111-30-8	NB	NB	ppm	
193	Hexanal (Hexanaldehyde)	C ₆ H ₁₂ O	66-25-1	100	500	ppm	
194	Isobutyraldehyde (2-Methylpropanal)	C ₄ H ₈ O	78-84-2	200	1000	ppm	
195	Isovaleraldehyde	C ₅ H ₁₀ O	590-86-3	NB	NB	ppm	
196	Methacrylaldehyde (2-Methyl-2-propenal)	C ₄ H ₆ O	78-85-3	200	1000	ppm	
197	Nonanal	C ₉ H ₁₈ O	124-19-6	NB	NB	ppm	
198	Octanal (Caprylic aldehyde)	C ₈ H ₁₆ O	124-13-0	100	500	ppm	
199	o-Phthalaldehyde (OPA)	C ₈ H ₆ O ₂	643-79-8	NB	NB	ppm	Only non-instrument specific references.
200	o-Tolualdehyde	C ₈ H ₈ O	529-20-4	200	1000	ppm	
201	Pentanal (Pentanaldehyde; Valeraldehyde; Valeric aldehyde)	C ₅ H ₁₀ O	110-62-3	NB	NB	ppm	
202	Propionaldehyde (Propanal)	C ₃ H ₆ O	123-38-6	200	1000	ppm	
203	trans-2-Nonenal	C ₉ H ₁₆ O	18829-56-6	NB	NB	ppm	
Ketones							
204	2,3-Butanedione (Diethyl)	C ₄ H ₆ O ₂	431-03-8	NB	NB	ppm	
205	2,3-Heptanedione	C ₇ H ₁₂ O ₂	96-04-8	NB	NB	ppm	
206	2,3-Hexanedione	C ₆ H ₁₀ O ₂	3848-24-6	NB	NB	ppm	
207	2,3-Pentanedione	C ₅ H ₈ O ₂	600-14-6	NB	NB	ppm	
208	2,6-Dimethyl-4-heptanone	C ₉ H ₁₈ O	108-83-8	NB	NB	ppm	
209	2-Acetyl furane (2-Furyl methyl ketone)	C ₆ H ₈ O ₂	1192-62-7	NB	NB	ppm	
210	2-Methylcyclohexanone	C ₇ H ₁₂ O	583-60-8	NB	NB	ppm	
211	2-Nonanone (Heptyl methyl ketone)	C ₉ H ₁₈ O	821-55-6	NB	NB	ppm	
212	4-Heptanone (Dipropyl ketone, Butyrone, DPK, Propyl ketone)	C ₇ H ₁₄ O	123-19-3	NB	NB	ppm	
213	4-Hydroxy-4-methyl-2-pentanone (Diacetone alcohol)	C ₆ H ₁₂ O ₂	123-42-2	NB	NB	ppm	
214	4-Methyl-3-penten-2-one (Mesityl oxide)	C ₆ H ₁₀ O	141-79-7	NB	NB	ppm	
215	5-methyl-2-hexanone (MIAK; methyl isoamyl ketone)	C ₇ H ₁₄ O	110-12-3	NB	NB	ppm	

216	Acetoin (3-hydroxybutanone)	C ₄ H ₈ O ₂	513-86-0	NB	NB	ppm
217	Acetone	C ₃ H ₆ O	67-64-1	200	1000	ppm
218	Acetophenone (Phenyl methyl ketone)	C ₈ H ₈ O	98-86-2	100	500	ppm
219	Benzyl Methyl Ketone	C ₉ H ₁₀ O	103-79-7	NB	NB	ppm
220	Carvone	C ₁₀ H ₁₄ O	2244-16-8	NB	NB	ppm
221	Cyclohexanone (Cyclohexyl ketone)	C ₆ H ₁₀ O	108-94-1	100	500	ppm
222	Cyclopentanone	C ₅ H ₈ O	120-92-3	NB	NB	ppm
223	Diethyl ketone (DEK; 3-Pentanone)	C ₅ H ₁₀ O	96-22-0	200	1000	ppm
224	Diketene (4-methylideneoxetan-2-one, γ-methylenebutyrolactone)	C ₄ H ₄ O ₂	674-82-8	NB	NB	ppm
225	Isophorone (3,5,5-Trimethyl-2-cyclohexene-1-one, Isoforone, Isoacetone)	C ₉ H ₁₄ O	78-59-1	NB	NB	ppm
226	Menthone	C ₁₀ H ₁₈ O	3391-87-5	NB	NB	ppm
227	Methyl butyl ketone (MBK; 2-Hexanone)	C ₆ H ₁₂ O	591-78-6	200	1000	ppm
228	Methyl ethyl ketone (MEK, 2-butanone)	C ₄ H ₈ O	78-93-3	200	1000	ppm
229	Methyl isobutyl ketone (MIBK; 4-Methyl-2-pentanone)	C ₆ H ₁₂ O	108-10-1	200	1000	ppm
230	Methyl pentyl ketone (2-Heptanone)	C ₇ H ₁₄ O	110-43-0	200	1000	ppm
231	Methyl propyl ketone (2-Pentanone)	C ₅ H ₁₀ O	107-87-9	200	1000	ppm
232	Methyl vinyl ketone (3-Buten-2-one)	C ₄ H ₆ O	78-94-4	NB	NB	ppm
Alcohols						
233	1-(2-Butoxypropoxy)propan-2-ol	C ₁₀ H ₂₂ O ₃	24083-03-2	NB	NB	ppm
234	1,2-Propanediol (propylene glycol)	C ₃ H ₈ O ₂	57-55-6	200	1000	ppm
235	1,3-Butanediol	C ₄ H ₁₀ O ₂	107-88-0	200	1000	ppm
236	1,4-Butanediol (1,4-Dihydroxybutane)	C ₄ H ₁₀ O ₂	110-63-4	NB	NB	ppm
237	1-Butanol	C ₄ H ₁₀ O	71-36-3	200	1000	ppm
238	1-Butoxy-2-propanol (1,2-Propylene glycol 1-monobutyl ether)	C ₇ H ₁₆ O ₂	5131-66-8	200	1000	ppm
239	1-Ethoxy-2-propanol	C ₃ H ₈ O ₂	1569-02-4	NB	NB	ppm
240	1-Heptanol	C ₇ H ₁₆ O	111-70-6	NB	NB	ppm
241	1-Hexanol	C ₆ H ₁₄ O	111-27-3	NB	NB	ppm
242	1-Pentanol (Amyl alcohol)	C ₅ H ₁₂ O	71-41-0	200	1000	ppm
243	1-Propanol	C ₃ H ₈ O	71-23-8	200	1000	ppm
244	1-Propoxy-2-propanol (Propylene glycol n-propyl ether)	C ₆ H ₁₄ O ₂	1569-01-3	100	500	ppm
245	2-Butanol (sec-Butyl alcohol)	C ₄ H ₁₀ O	78-92-2	200	1000	ppm
246	2-Ethoxyethanol (Cellosolve)	C ₄ H ₁₀ O ₂	110-80-5	100	500	ppm
247	2-Ethylhexanol (2-EH; 2-Ethylhexan-1-ol)	C ₈ H ₁₈ O	104-76-7	NB	NB	ppm
248	2-Methoxyethanol (methyl cellosolve)	C ₃ H ₈ O ₂	109-86-4	100	500	ppm
249	2-Methoxy-1-propanol (2-methoxypropanol)	C ₄ H ₁₀ O ₂	1589-47-5	NB	NB	ppm
250	2-Methyl-1-butanol	C ₅ H ₁₂ O	137-32-6	NB	NB	ppm
251	2-Methyl-2-butanol	C ₅ H ₁₂ O	75-85-4	NB	NB	ppm
252	4-Methoxy-1-butanol (Butylene glycol methyl ether)	C ₅ H ₁₂ O ₂	111-32-0	NB	NB	ppm
253	4-Methyl-2-pentanol	C ₆ H ₁₄ O	108-11-2	NB	NB	ppm
254	Allyl alcohol	C ₃ H ₆ O	107-18-6	NB	NB	ppm
255	Benzyl alcohol	C ₇ H ₈ O	100-51-6	200	1000	ppm
256	cis-3-Hexen-1-ol (leaf alcohol)	C ₆ H ₁₂ O	928-96-1	NB	NB	ppm
257	Cyclohexanol	C ₆ H ₁₂ O	108-93-0	NB	NB	ppm
258	Diethylene glycol (DEG)	C ₄ H ₁₀ O ₃	111-46-6	NB	NB	ppm
259	Diethylene glycol monoethyl ether acetate	C ₈ H ₁₆ O ₄	112-15-2	100	500	ppm
260	Diethylene glycol monomethyl ether (MDGE, 2-(2-Methoxyethoxy)ethanol)	C ₅ H ₁₂ O ₃	111-77-3	NB	NB	ppm
261	Ethanol	C ₂ H ₆ O	64-17-5	500	2000	ppm
262	Ethylene glycol (1,2-Ethanediol)	C ₂ H ₆ O ₂	107-21-1	200	1000	ppm
263	Furfuryl alcohol (2-Furan methanol)	C ₅ H ₆ O ₂	98-00-0	200	1000	ppm
264	Glycerol (1,2,3-Propanetriol)	C ₃ H ₈ O ₃	56-81-5	NB	NB	ppm
265	Isobutanol (2-Methyl-1-propanol)	C ₄ H ₁₀ O	78-83-1	200	1000	ppm
266	Isoeugenol (2-Methoxy-4-propenylphenol)	C ₁₀ H ₁₂ O ₂	97-54-1	NB	NB	ppm
267	Isopentyl alcohol (Isoamyl alcohol; Isopentanol; 3-Methyl-1-butanol)	C ₅ H ₁₂ O	123-51-3	200	1000	ppm
268	Isopropanol (2-Propanol; Isopropyl alcohol)	C ₃ H ₈ O	67-63-0	200	1000	ppm
269	Linalool (3,7-Dimethyl-1,6-octadien-3-ol)	C ₁₀ H ₁₈ O	78-70-6	NB	NB	ppm
270	m-Cresol (3-Methyl phenol)	C ₇ H ₈ O	108-39-4	200	1000	ppm
271	Menthol (2-Isopropyl-5-methylcyclohexanol, Hexahydrothymol)	C ₁₀ H ₂₀ O	1490-04-6	NB	NB	ppm
272	Methanol	CH ₄ O	67-56-1	500	2000	ppm
273	o-Cresol (2-Methyl phenol)	C ₇ H ₈ O	95-48-7	200	1000	ppm
274	p-Cresol (4-Methyl phenol)	C ₇ H ₈ O	106-44-5	200	1000	ppm
275	Phenol	C ₆ H ₆ O	108-95-2	200	1000	ppm
276	Pinacolyl alcohol (3,3-Dimethyl-2-butanol)	C ₆ H ₁₄ O	464-07-3	200	1000	ppm
277	Propargyl alcohol	C ₃ H ₄ O	107-19-7	NB	NB	ppm
278	t-Butanol (1,1-Dimethyl ethanol)	C ₄ H ₁₀ O	75-65-0	200	1000	ppm
279	Terpinen-4-ol [4-Methyl-1-(1-methylethyl)-3-cyclohexen-1-ol]	C ₁₀ H ₁₈ O	562-74-3	200	1000	ppm
280	Terpineol	C ₁₀ H ₁₈ O	8000-41-7	200	1000	ppm
281	Triethylene glycol (TEG)	C ₆ H ₁₄ O ₄	112-27-6	NB	NB	ppm
Ethers						
282	1,2-Dimethoxyethane (Ethylene glycol dimethyl ether)	C ₄ H ₁₀ O ₂	110-71-4	100	500	ppm
283	1,3-Dimethoxy-2-hydroxybenzene (Syringol)	C ₈ H ₁₀ O ₃	91-10-1	NB	NB	ppm
284	1,3-Dioxane (trimethylene glycol methylene ether)	C ₄ H ₈ O ₂	505-22-6	NB	NB	ppm
285	1,3-Dioxolane (1,3-Dioxacyclopentane)	C ₃ H ₆ O ₂	646-06-0	NB	NB	ppm
286	1,4-Butanediol vinyl ether	C ₆ H ₁₂ O ₂	17832-28-9	NB	NB	ppm
287	2,2-Dimethoxypropane	C ₅ H ₁₂ O ₂	77-76-9	100	500	ppm
288	2-Methoxyphenol (Guaiacol)	C ₇ H ₈ O ₂	90-05-1	NB	NB	ppm
289	Anisole (Methoxybenzene)	C ₇ H ₈ O	100-66-3	100	500	ppm

Calibration for heated analyzer only.

Calibration for heated analyzer only.

290	Butyl methyl ether	C ₈ H ₁₂ O	628-28-4	NB	NB	ppm
291	Di(ethylene glycol) ethyl ether (2-(2-Ethoxyethoxy)ethanol)	C ₈ H ₁₆ O ₃	111-90-0	NB	NB	ppm
292	Dibutyl ether	C ₈ H ₁₈ O	142-96-1	NB	NB	ppm
293	Diethyl ether (Ethoxy ethane)	C ₄ H ₁₀ O	60-29-7	100	500	ppm
294	Diethylene glycol butyl ether [2-(2-Butoxyethoxy)ethanol]	C ₈ H ₁₈ O ₃	112-34-5	100	500	ppm
295	Diethylene glycol dimethyl ether (Diglyme)	C ₆ H ₁₄ O ₃	111-96-6	NB	NB	ppm
296	Diisopropyl ether	C ₆ H ₁₄ O	108-20-3	100	500	ppm
297	Dimethoxymethane (Methylene dimethyl ether; Methylal)	C ₃ H ₈ O ₂	109-87-5	100	500	ppm
298	Diphenyl ether	C ₁₂ H ₁₀ O	101-84-8	NB	NB	ppm
299	Dipropylene glycol dimethyl ether	C ₈ H ₁₈ O ₃	89399-28-0	NB	NB	ppm
300	Dipropylene glycol monomethyl ether	C ₇ H ₁₆ O ₃	34590-94-8	NB	NB	ppm
301	Ethyl tert-butyl ether (ETBE; 2-Ethoxy-2-methylpropane)	C ₆ H ₁₄ O	637-92-3	NB	NB	ppm
302	Ethyl vinyl ether	C ₄ H ₈ O	109-92-2	100	500	ppm
303	Ethylene glycol monobutyl ether (2-Butoxyethanol)	C ₆ H ₁₄ O ₂	111-76-2	100	500	ppm
304	Ethylene glycol monoisopropyl ether (2-Isopropoxyethanol)	C ₆ H ₁₂ O ₂	109-59-1	NB	NB	ppm
305	Eucalyptol (1,8-Cineole; 1,8-Epoxy-p-menthane; 1,3,3-Trimethyl-2-oxat	C ₁₀ H ₁₈ O	470-82-6	NB	NB	ppm
306	Isosafrole	C ₁₀ H ₁₀ O ₂	120-58-1	NB	NB	ppm
307	Methyl ether (Dimethyl ether)	C ₂ H ₆ O	115-10-6	NB	NB	ppm
308	Methyl salicylate (2-Hydroxybenzoic acid methyl ester)	C ₈ H ₈ O ₃	119-36-8	100	500	ppm
309	Methyl tert-butyl ether (MTBE; 2-Methoxy-2-methylpropane)	C ₅ H ₁₂ O	1634-04-4	100	500	ppm
310	p-Dioxane (Glycol ethylene ether; 1,4-Dioxane)	C ₄ H ₈ O ₂	123-91-1	100	500	ppm
311	Tert-amyl methyl ether (TAME; 2-methoxy-2-methylbutane)	C ₆ H ₁₄ O	994-05-8	NB	NB	ppm
312	α-Propylene glycol monomethyl ether (1-Methoxy-2-propanol)	C ₄ H ₁₀ O ₂	107-98-2	100	500	ppm
Epoxy compounds						
313	2,5-Dimethylfuran	C ₆ H ₈ O	625-86-5	NB	NB	ppm
314	2-Methylfuran	C ₅ H ₈ O	534-22-5	NB	NB	ppm
315	Ethylene oxide (Oxirane; Epoxyethane)	C ₂ H ₄ O	75-21-8	NB	NB	ppm
316	Furan (Furfuran)	C ₄ H ₄ O	110-00-9	200	1000	ppm
317	Maleic anhydride	C ₄ H ₂ O ₃	108-31-6	NB	NB	ppm
318	Propylene oxide (Methyl oxirane; Epoxypropane)	C ₃ H ₆ O	75-56-9	200	1000	ppm
319	Tetrahydrofuran (THF; 1,4-Epoxybutane)	C ₄ H ₈ O	109-99-9	200	1000	ppm
Sulfur compounds						
320	1,2-Ethanedithiol (1,2-Dimercaptoethane Dithioglycol Ethylene merca	C ₂ H ₆ S ₂	540-63-6	NB	NB	ppm
321	1-Butanethiol (Butyl mercaptan)	C ₄ H ₁₀ S	109-79-5	NB	NB	ppm
322	2-Methylthiophene	C ₅ H ₆ S	554-14-3	NB	NB	ppm
323	3-(Methylthio)propionaldehyde (3-Methylsulfanyl-propionaldehyde)	C ₄ H ₈ OS	3268-49-3	NB	NB	ppm
324	3-Mercaptopropionic acid	C ₃ H ₆ O ₂ S	107-96-0	NB	NB	ppm
325	Benzenethiol (Phenylthiol; Thiophenol)	C ₆ H ₆ S	108-98-5	NB	NB	ppm
326	Carbon disulfide	CS ₂	75-15-0	50	200	ppm
327	Carbonyl sulfide	COS	463-58-1	NB	NB	ppm
328	Diethyl sulfate (Sulfuric acid diethyl ester)	C ₄ H ₁₀ O ₄ S	64-67-5	NB	NB	ppm
329	Dimethyl disulfide (DMDS)	C ₂ H ₆ S ₂	624-92-0	200	1000	ppm
330	Dimethyl sulfate (DMSO4; Sulfuric acid dimethyl ester)	C ₂ H ₆ O ₄ S	77-78-1	NB	NB	ppm
331	Dimethyl sulfide (DMS)	C ₂ H ₆ S	75-18-3	200	1000	ppm
332	Dimethyl sulfoxide	C ₂ H ₆ OS	67-68-5	100	500	ppm
333	Ethylmercaptan (Ethanethiol)	C ₂ H ₆ S	75-08-1	100	500	ppm
334	Mercaptoacetic acid (Thioglycolic acid)	C ₂ H ₄ O ₂ S	68-11-1	NB	NB	ppm
335	Methylmercaptan (Methanethiol)	CH ₄ S	74-93-1	NB	NB	ppm
336	Tetrahydrothiophene (Tetramethylene sulfide)	C ₄ H ₈ S	110-01-0	NB	NB	ppm
337	Thiophene (Thiacyclopentadiene)	C ₄ H ₄ S	110-02-1	NB	NB	ppm
Nitrogen compounds						
338	(-)-Nicotine	C ₁₀ H ₁₄ N ₂	54-11-5	NB	NB	ppm
339	1,1-Dimethylhydrazine (Dimazine)	C ₂ H ₈ N ₂	57-14-7	NB	NB	ppm
340	1-(2-Aminoethyl)piperazine	C ₆ H ₁₂ N ₃	140-31-8	NB	NB	ppm
341	1,3-Dimethyl-2-imidazolidinone (N,N'-Dimethylethyleneurea)	C ₅ H ₁₀ N ₂ O	80-73-9	NB	NB	ppm
342	1,4-Diaminobutane (Tetramethylenediamine, 1,4-Butanediamine)	C ₄ H ₁₂ N ₂	110-60-1	NB	NB	ppm
343	1,6-Hexamethylene diisocyanate	C ₈ H ₁₆ N ₂ O ₂	822-06-0	NB	NB	ppm
344	1-Formylpiperazine (1-Piperazinecarboxaldehyde)	C ₅ H ₁₀ N ₂ O	7755-92-2	NB	NB	ppm
345	1-Methyl-2-pyrrolidinone	C ₅ H ₉ NO	872-50-4	NB	NB	ppm
346	1-Methylimidazol	C ₄ H ₈ N ₂	616-47-7	NB	NB	ppm
347	1-Vinyl-2-pyrrolidinone (N-vinyl-2-pyrrolidinone)	C ₆ H ₉ NO	88-12-0	NB	NB	ppm
348	2-(2-Aminoethoxy)ethanol (Diethylene glycol amine)	C ₄ H ₁₁ NO ₂	929-06-6	NB	NB	ppm
349	2-(Ethylamino)ethanol (EMEA; N-Ethylethanolamine)	C ₄ H ₁₁ NO	110-73-6	NB	NB	ppm
350	2,3-Dimethylpyrazine	C ₆ H ₈ N ₂	5910-89-4	NB	NB	ppm
351	2,4,6-Trimethylpyridine	C ₈ H ₁₁ N	108-75-8	NB	NB	ppm
352	2,4-Toluene diisocyanate	C ₉ H ₈ N ₂ O ₂	584-84-9	NB	NB	ppm
353	2,5-Dimethylpyrazine	C ₆ H ₈ N ₂	123-32-0	NB	NB	ppm
354	2,6-Diethylaniline	C ₁₀ H ₁₅ N	579-66-8	NB	NB	ppm
355	2,6-Dimethylpyrazine	C ₆ H ₈ N ₂	108-50-9	NB	NB	ppm
356	2-Amino-1-butanol	C ₄ H ₁₁ NO	96-20-8	200	1000	ppm
357	2-Amino-2-methylpropanol (β-Aminoisobutyl alcohol, AMP)	C ₄ H ₁₁ NO	124-68-5	NB	NB	ppm
358	2-Dimethylaminoethanol (N,N-Dimethyl-2-hydroxyethylamine, N,N-Din	C ₄ H ₁₁ NO	108-01-0	NB	NB	ppm
359	2-Ethyl-6-methylaniline	C ₉ H ₁₃ N	24549-06-2	NB	NB	ppm
360	2-Methylaminoethanol (N-Methylethanolamine)	C ₃ H ₉ NO	109-83-1	NB	NB	ppm
361	2-Methylpyrazine	C ₅ H ₈ N ₂	109-08-0	NB	NB	ppm
362	2-Methylpyridine (α-Picoline)	C ₆ H ₇ N	109-06-8	NB	NB	ppm

363	3-Amino-1-propanol	C ₃ H ₉ NO	156-87-6	NB	NB	ppm	
364	3-Methylpyridine	C ₆ H ₇ N	108-99-6	NB	NB	ppm	
365	3-Picolylamine (3-(Aminomethyl)pyridine)	C ₆ H ₈ N ₂	3731-52-0	NB	NB	ppm	
366	3-Pyridinecarboxaldehyde (Nicotinaldehyde)	C ₆ H ₅ NO	500-22-1	NB	NB	ppm	
367	4,N,N-Trimethylaniline	C ₉ H ₁₃ N	99-97-8	NB	NB	ppm	
368	Acetone cyanohydrin	C ₄ H ₇ NO	75-86-5	NB	NB	ppm	
369	Acetonitrile	C ₂ H ₃ N	75-05-8	NB	NB	ppm	
370	Acrylonitrile	C ₃ H ₃ N	107-13-1	200	1000	ppm	
371	Allyl cyanide (3-Butenenitrile)	C ₄ H ₅ N	109-75-1	NB	NB	ppm	
372	Aniline (Benzenamine)	C ₆ H ₇ N	62-53-3	200	1000	ppm	
373	Benzonitrile (Phenyl cyanide)	C ₇ H ₅ N	100-47-0	NB	NB	ppm	
374	Benzylamine (α-Aminotoluene)	C ₇ H ₉ N	100-46-9	NB	NB	ppm	
375	Butyl isocyanate (1-Isocyanatobutane)	C ₆ H ₁₃ NO	111-36-4	NB	NB	ppm	
376	Butylamine (1-Butanamine)	C ₄ H ₁₁ N	109-73-9	200	1000	ppm	
377	Cyanogen (Dicyan)	C ₂ N ₂	460-19-5	NB	NB	ppm	
378	Cyclohexylamine	C ₆ H ₁₃ N	108-91-8	NB	NB	ppm	
379	Dibutylamine	C ₈ H ₁₇ N	111-92-2	NB	NB	ppm	
380	Diethanolamine (DEA; 2,2'-Iminodiethanol, Bis(2-hydroxyethyl)amine)	C ₄ H ₁₁ NO ₂	111-42-2	NB	NB	ppm	
381	Diethylamine	C ₄ H ₁₁ N	109-89-7	200	1000	ppm	
382	Diethylaminoethanol [2-(Diethylamino)-ethanol]	C ₆ H ₁₅ NO	100-37-8	200	1000	ppm	
383	Diethylenetriamine	C ₄ H ₁₃ N ₃	111-40-0	100	500	ppm	
384	Dihexylamine	C ₁₂ H ₂₇ N	143-16-8	NB	NB	ppm	
385	Dimethylacetamide	C ₄ H ₉ NO	127-19-5	200	1000	ppm	
386	Dimethylamine	C ₂ H ₇ N	124-40-3	NB	NB	ppm	
387	Dimethylformamide (DMF)	C ₃ H ₇ NO	68-12-2	200	1000	ppm	
388	Ethanolamine (2-Aminoethanol; MEA)	C ₂ H ₇ NO	141-43-5	200	1000	ppm	
389	Ethylamine (1-Ethanamine)	C ₂ H ₇ N	75-04-7	NB	NB	ppm	
390	Ethylenediamine (Ethane-1,2-diamine)	C ₂ H ₈ N ₂	107-15-3	100	500	ppm	
391	Ethylmorpholine	C ₆ H ₁₃ NO	100-74-3	NB	NB	ppm	
392	Hexylamine	C ₆ H ₁₅ N	111-26-2	NB	NB	ppm	
393	Hydrogen cyanide	HCN	74-90-8	100	500	ppm	
394	Isocyanic acid (Hydrogen isocyanate)	HNCO	75-13-8	NB	NB	ppm	Only non-instrument specific references.
395	Isopropyl isocyanate (1-Methylethyl isocyanate, 2-Isocyanatopropane)	C ₄ H ₇ NO	1795-48-8	200	1000	ppm	
396	Isopropylamine (2-Propanamine)	C ₃ H ₉ N	75-31-0	200	1000	ppm	
397	Methacrylonitrile	C ₄ H ₅ N	126-98-7	NB	NB	ppm	
398	Methyl diethanolamine (MDEA)	C ₅ H ₁₃ NO ₂	105-59-9	100	500	ppm	
399	Methyl isocyanate (Isocyanatomethane)	C ₂ H ₃ NO	624-83-9	NB	NB	ppm	
400	Methylamine	CH ₅ N	74-89-5	NB	NB	ppm	
401	Morpholine	C ₄ H ₉ NO	110-91-8	200	1000	ppm	
402	N,N-Diethylmethylamine (N-Methyldiethylamine)	C ₆ H ₁₃ N	616-39-7	NB	NB	ppm	
403	N,N-Dimethylaniline	C ₈ H ₁₁ N	121-69-7	100	500	ppm	
404	N,N-Dimethylethylamine (N-Ethyldimethylamine, DMEA)	C ₄ H ₁₁ N	598-56-1	NB	NB	ppm	
405	N,N-Dimethylisopropylamine (N,N-Dimethyl-2-propanamine)	C ₅ H ₁₃ N	996-35-0	NB	NB	ppm	
406	Nitrobenzene	C ₆ H ₅ NO ₂	98-95-3	200	1000	ppm	
407	Nitroethane	C ₂ H ₅ NO ₂	79-24-3	200	1000	ppm	
408	Nitromethane	CH ₃ NO ₂	75-52-5	200	1000	ppm	
409	N-Methyl-1,3-diaminopropane (MAPA; 3-(Methylamino)propylamine; 1)	C ₄ H ₁₂ N ₂	6291-84-5	NB	NB	ppm	
410	n-Methylmorpholine (4-Methylmorpholine)	C ₅ H ₁₁ NO	109-02-4	200	1000	ppm	
411	o-Nitrotoluene	C ₇ H ₇ NO ₂	88-72-2	NB	NB	ppm	
412	o-Toluidine (2-Aminotoluene; 2-Methylbenzenamine)	C ₇ H ₉ N	95-53-4	NB	NB	ppm	
413	Phenyl isocyanate (Carbanil; Phenylcarbimide)	C ₇ H ₅ NO	103-71-9	NB	NB	ppm	
414	Phenyl isothiocyanate (Isothiocyanatobenzene)	C ₇ H ₅ NS	103-72-0	NB	NB	ppm	
415	Piperazine (Diethylenediamine; Hexahydropyrazine)	C ₄ H ₁₀ N ₂	110-85-0	NB	NB	ppm	
416	Piperidine	C ₅ H ₁₁ N	110-89-4	200	1000	ppm	
417	Propanenitrile	C ₃ H ₅ N	107-12-0	NB	NB	ppm	
418	Propylamine (1-Aminopropane)	C ₃ H ₇ N	107-10-8	200	1000	ppm	
419	Pyridine	C ₅ H ₅ N	110-86-1	100	500	ppm	
420	Pyrrolidine (Azacyclopentane)	C ₄ H ₉ N	123-75-1	200	1000	ppm	
421	tert-Butylamine (2-Methyl-2-propanamine)	C ₄ H ₁₁ N	75-64-9	NB	NB	ppm	
422	Tetraethylurea (1,1,3,3-Tetraethylurea)	C ₉ H ₂₀ N ₂ O	1187-03-7	NB	NB	ppm	
423	Tetramethylurea (1,1,3,3-Tetramethylurea)	C ₆ H ₁₂ N ₂ O	632-22-4	NB	NB	ppm	
424	Triethanolamine	C ₆ H ₁₅ NO ₃	102-71-6	NB	NB	ppm	
425	Triethylamine	C ₆ H ₁₅ N	121-44-8	NB	NB	ppm	
426	Trimethylamine	C ₃ H ₉ N	75-50-3	NB	NB	ppm	
Chloro compounds (see also freons)							
427	1,1,1-Trichloroethane	C ₂ H ₃ Cl ₃	71-55-6	NB	NB	ppm	Only non-instrument specific references. Chemical not available.
428	1,1,2,2-Tetrachloroethane	C ₂ H ₂ Cl ₄	79-34-5	200	1000	ppm	
429	1,1,2-Trichloroethane	C ₂ H ₃ Cl ₃	79-00-5	200	1000	ppm	
430	1,1-Dichloroethane	C ₂ H ₄ Cl ₂	75-34-3	200	1000	ppm	
431	1,2,3-Trichloropropane	C ₃ H ₃ Cl ₃	96-18-4	200	1000	ppm	
432	1,2,4-Trichlorobenzene	C ₆ H ₃ Cl ₃	120-82-1	NB	NB	ppm	
433	1,2-Dichlorobenzene (o-Dichlorobenzene)	C ₆ H ₄ Cl ₂	95-50-1	200	1000	ppm	
434	1,2-Dichloroethane (Freon 150)	C ₂ H ₄ Cl ₂	107-06-2	200	1000	ppm	
435	1,2-Dichloropropane (Propylene dichloride)	C ₃ H ₄ Cl ₂	78-87-5	200	1000	ppm	
436	1,3-Dichloro-2-propanol	C ₃ H ₆ Cl ₂ O	96-23-1	NB	NB	ppm	
437	1,3-Dichlorobenzene	C ₆ H ₄ Cl ₂	541-73-1	NB	NB	ppm	
438	1,3-Dichloropropane	C ₃ H ₆ Cl ₂	142-28-9	NB	NB	ppm	

439	1,4-Dichlorobenzene (μ -Dichlorobenzene)	C ₆ H ₄ Cl ₂	106-46-7	NB	NB	ppm
440	2,3-Dichloro-1-propanol	C ₃ H ₆ Cl ₂ O	616-23-9	NB	NB	ppm
441	2,5-Dichlorophenol	C ₆ H ₄ Cl ₂ O	583-78-8	NB	NB	ppm
442	2-Chloroethanol	C ₂ H ₅ ClO	107-07-3	NB	NB	ppm
443	3-Chloro-2-methyl-1-propene (Methallyl chloride)	C ₄ H ₇ Cl	563-47-3	NB	NB	ppm
444	3-Chloropropionyl chloride (3-Chloropropionic acid chloride; 3-Chloro	C ₃ H ₄ Cl ₂ O	625-36-5	NB	NB	ppm
445	3-Chlorotoluene (1-Chloro-3-methylbenzene)	C ₇ H ₇ Cl	108-41-8	200	1000	ppm
446	Acetyl chloride (Acetic chloride)	C ₂ H ₃ ClO	75-36-5	200	1000	ppm
447	Allyl chloride (3-chloro-1-propene)	C ₃ H ₅ Cl	107-05-1	200	1000	ppm
448	Benzyl chloride (α -Chlorotoluene)	C ₇ H ₇ Cl	100-44-7	200	1000	ppm
449	Bis(trichloromethyl) carbonate (Triphosgene)	C ₃ Cl ₆ O ₃	32315-10-9	NB	NB	ppm
450	Butyl chloroformate (Butyl chlorocarbonate)	C ₅ H ₉ ClO ₂	592-34-7	NB	NB	ppm
451	Carbon tetrachloride (Freon 10)	CCl ₄	56-23-5	NB	NB	ppm
452	Chloroacetyl chloride	C ₂ H ₂ Cl ₂ O	79-04-9	NB	NB	ppm
453	Chlorobenzene (Phenyl chloride)	C ₆ H ₅ Cl	108-90-7	200	1000	ppm
454	Chloroform (Trichloromethane; Freon 20)	CHCl ₃	67-66-3	200	1000	ppm
455	Chloromethyl chloroformate	C ₂ H ₃ Cl ₂ O ₂	22128-62-7	NB	NB	ppm
456	cis-1,2-Dichloroethene	C ₂ H ₂ Cl ₂	156-59-2	200	1000	ppm
457	Dichloroacetyl chloride	C ₂ HCl ₂ O	79-36-7	NB	NB	ppm
458	Dichloromethane (Methylene chloride; Freon 30)	CH ₂ Cl ₂	75-09-2	200	1000	ppm
459	Dimethylcarbonyl chloride (Dimethyl carbamic chloride)	C ₂ H ₄ ClNO	79-44-7	NB	NB	ppm
460	Diphosgene	C ₂ Cl ₄ O ₂	503-38-8	NB	NB	ppm
461	Epichlorohydrin (Chloromethyloxirane)	C ₃ H ₅ ClO	106-89-8	NB	NB	ppm
462	Ethyl chloride	C ₂ H ₅ Cl	75-00-3	NB	NB	ppm
463	Ethyl chloroformate (Carbonochloridic acid ethyl ester; Cathyl chloric	C ₃ H ₅ ClO ₂	541-41-3	NB	NB	ppm
464	Hexachloro-1,3-butadiene	C ₄ Cl ₆	87-68-3	200	1000	ppm
465	Methyl chloride (Freon 40)	CH ₃ Cl	74-87-3	NB	NB	ppm
466	Methyl chloroacetate	C ₃ H ₅ ClO ₂	96-34-4	NB	NB	ppm
467	Methyl chloroformate (Methyl chlorocarbonate)	C ₂ H ₃ ClO ₂	79-22-1	NB	NB	ppm
468	Pentachloroethane	C ₂ HCl ₅	76-01-7	NB	NB	ppm
469	Pentachlorophenol	C ₆ HCl ₅ O	87-86-5	NB	NB	ppm
470	Phosgene	COCl ₂	75-44-5	NB	NB	ppm
471	Propyl chloroformate (n-Propyl chloroformate)	C ₄ H ₇ ClO ₂	109-61-5	NB	NB	ppm
472	Tetrachloroethylene	C ₂ Cl ₄	127-18-4	200	1000	ppm
473	trans-1,2-Dichloroethene	C ₂ H ₂ Cl ₂	156-60-5	200	1000	ppm
474	Trichloroacetyl chloride	C ₂ Cl ₃ O	76-02-8	NB	NB	ppm
475	Trichloroethylene (Trichlorethene)	C ₂ HCl ₃	79-01-6	200	1000	ppm
476	Vinyl chloride (Chloroethene)	C ₂ H ₃ Cl	75-01-4	NB	NB	ppm
477	Vinylidene chloride (1,1-Dichloroethene)	C ₂ H ₂ Cl ₂	75-35-4	200	1000	ppm
Fluoro compounds (see also freons)						
478	(1E)-1,3,3,3-Tetrafluoro-1-propene (HFO-1234ze)	C ₃ H ₂ F ₄	29118-24-9	NB	NB	ppm
479	1,1,1,2,2,3,5,5,5-Nonafluoropentane	C ₅ H ₂ F ₉	141993-31-9	NB	NB	ppm
480	1,1,1,2,3,4,4,5,5,5-Decafluoropentane	C ₅ H ₂ F ₁₀	138495-42-8	NB	NB	ppm
481	2,3,3,3-Tetrafluoropropene (HFO-1234yf)	C ₃ H ₂ F ₄	754-12-1	NB	NB	ppm
482	2-Fluorotoluene (1-Fluoro-2-methylbenzene)	C ₇ H ₇ F	95-52-3	NB	NB	ppm
483	4-Ethoxy-1,1,1-trifluoro-3-buten-2-one	C ₆ H ₇ F ₃ O ₂	17129-06-5	NB	NB	ppm
484	Carbonyl difluoride	COF ₂	353-50-4	NB	NB	ppm
485	Desflurane (1,2,2,2-tetrafluoroethyl difluoromethyl ether)	C ₃ H ₂ F ₆ O	57041-67-5	NB	NB	ppm
486	Ethyl fluoride (Fluoroethane, HFC-161)	C ₂ H ₅ F	353-36-6	NB	NB	ppm
487	Ethyl trifluoroacetate	C ₄ H ₅ F ₃ O ₂	383-63-1	NB	NB	ppm
488	Fluorobenzene	C ₆ H ₅ F	462-06-6	NB	NB	ppm
489	Hexafluoropropylene (Perfluoropropene)	C ₃ F ₆	116-15-4	NB	NB	ppm
490	Methyl fluoride (Fluoromethane, Freon 41)	CH ₃ F	593-53-3	NB	NB	ppm
491	Octafluorocyclopentene (Perfluorocyclopentene)	C ₅ F ₈	559-40-0	NB	NB	ppm
492	Perfluoro-1,2-dimethylcyclohexane	C ₈ F ₁₆	306-98-9	NB	NB	ppm
493	Perfluoro-1,3-dimethylcyclohexane	C ₈ F ₁₆	335-27-3	NB	NB	ppm
494	Perfluoro-2-methylpentane	C ₆ F ₁₄	355-04-4	NB	NB	ppm
495	Perfluoroheptane	C ₇ F ₁₆	335-57-9	NB	NB	ppm
496	Perfluorohexane	C ₆ F ₁₄	355-42-0	NB	NB	ppm
497	Sevoflurane [2,2,2-trifluoro-1-(trifluoromethyl) ethyl ether]	C ₄ H ₈ F ₇ O	28523-86-6	NB	NB	ppm
498	Tetrafluoroethylene (Perfluoroethylene)	C ₂ F ₄	116-14-3	NB	NB	ppm
499	trans-4-(Trifluoromethyl)perfluoro-2-pentene	C ₆ F ₁₂	3709-71-5	NB	NB	ppm
500	Trifluoroacetic acid	C ₂ HF ₃ O ₂	76-05-1	NB	NB	ppm
501	Trifluoroethene (Ethylene trifluoride)	C ₂ HF ₃	359-11-5	NB	NB	ppm
Freons						
502	Dichlorodifluoromethane (Freon 21)	CHCl ₂ F	75-43-4	NB	NB	ppm
503	Freon 11 (Trichloromonofluoromethane)	CCl ₃ F	75-69-4	NB	NB	ppm
504	Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	C ₂ Cl ₃ F ₃	76-13-1	NB	NB	ppm
505	Freon 113a (1,1,1-Trichloro-2,2,2-trifluoroethane)	C ₂ Cl ₃ F ₃	354-58-5	NB	NB	ppm
506	Freon 114 (1,2-Dichloro-1,1,2,2-tetrafluoroethane)	C ₂ Cl ₂ F ₄	76-14-2	NB	NB	ppm
507	Freon 114 B2 (1,2-dibromo-1,1,2,2-tetrafluoroethane)	C ₂ Br ₂ F ₄	124-73-2	NB	NB	ppm
508	Freon 115 (Chloropentafluoroethane)	C ₂ ClF ₅	76-15-3	NB	NB	ppm
509	Freon 116 (Hexafluoroethane)	C ₂ F ₆	76-16-4	NB	NB	ppm
510	Freon 12 (Dichlorodifluoromethane)	CCl ₂ F ₂	75-71-8	NB	NB	ppm
511	Freon 122 (1,2,2-Trichloro-1,1-difluoroethane)	C ₂ HCl ₃ F ₂	354-21-2	NB	NB	ppm
512	Freon 123 (1,1-Dichloro-2,2,2-trifluoroethane)	C ₂ HCl ₂ F ₃	306-83-2	NB	NB	ppm

12/2019: Availability uncertain. Non-instrument specific references enclosed

Only non-instrument specific references. Chemical not available.

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513	Freon 124 (1-Chloro-1,2,2,2-tetrafluoroethane)	C ₂ HClF ₄	2837-89-0	NB	NB	ppm
514	Freon 125 (Pentafluoroethane)	C ₂ HF ₅	354-33-6	NB	NB	ppm
515	Freon 12B1 (Bromochlorodifluoromethane, Halon 1211)	CBrClF ₂	353-59-3	NB	NB	ppm
516	Freon 133a (1-Chloro-2,2,2-trifluoroethane)	C ₂ H ₂ ClF ₃	75-88-7	NB	NB	ppm
517	Freon 134a (1,1,1,2-Tetrafluoroethane)	C ₂ H ₂ F ₄	811-97-2	NB	NB	ppm
518	Freon 13B1 (Bromotrifluoromethane; Halon 1301)	CBrF ₃	75-63-8	NB	NB	ppm
519	Freon 14 (Carbon tetrafluoride)	CF ₄	75-73-0	NB	NB	ppm
520	Freon 141b (1,1-Dichloro-1-fluoroethane)	C ₂ H ₃ Cl ₂ F	1717-00-6	NB	NB	ppm
521	Freon 142b (1-Chloro-1,1-difluoroethane)	C ₂ H ₃ ClF ₂	75-68-3	NB	NB	ppm
522	Freon 143a (1,1,1-Trifluoroethane)	C ₂ H ₃ F ₃	420-46-2	NB	NB	ppm
523	Freon 152a (Difluoroethane; Ethylidene Difluoride)	C ₂ H ₄ F ₂	75-37-6	NB	NB	ppm
524	Freon 218 (Perfluoropropane)	C ₃ F ₈	76-19-7	NB	NB	ppm
525	Freon 22 (Chlorodifluoromethane)	CHClF ₂	75-45-6	NB	NB	ppm
526	Freon 23 (Trifluoromethane)	CHF ₃	75-46-7	NB	NB	ppm
527	Freon 236fa (1,1,1,3,3,3-Hexafluoropropane; HFC-236fa)	C ₃ H ₂ F ₆	690-39-1	NB	NB	ppm
528	Freon 32 (Difluoromethane)	CH ₂ F ₂	75-10-5	NB	NB	ppm
529	Freon C318 (Octafluorocyclobutane)	C ₄ F ₈	115-25-3	NB	NB	ppm
Other organic compounds						
530	1,1,3,3-Tetramethyldisiloxane	C ₄ H ₁₄ OSi ₂	3277-26-7	NB	NB	ppm
531	1,3,5-Trioxane	C ₃ H ₆ O ₃	110-88-3	NB	NB	ppm
532	1-Bromopropane (Propyl bromide)	C ₃ H ₇ Br	106-94-5	NB	NB	ppm
533	2-Bromopropane (Isopropyl bromide)	C ₃ H ₇ Br	75-26-3	NB	NB	ppm
534	Bromoethane (Ethyl bromide)	C ₂ H ₅ Br	74-96-4	NB	NB	ppm
535	Bromoform (Tribromomethane)	CHBr ₃	75-25-2	NB	NB	ppm
536	Chloropicrin (Trichloronitromethane, Nitrochloroform)	CCl ₃ NO ₂	76-06-2	NB	NB	ppm
537	Chlorpyrifos	C ₉ H ₁₁ Cl ₃ NO ₃ PS	2921-88-2	NB	NB	ppm
538	Cyanogen chloride	CNCl	506-77-4	NB	NB	ppm
539	Decamethylcyclopentasiloxane (D5)	C ₁₀ H ₃₀ O ₅ Si ₅	541-02-6	NB	NB	ppm
540	Decamethyltetrasiloxane (L4)	C ₁₀ H ₃₀ O ₄ Si ₄	141-62-8	NB	NB	ppm
541	Diazinon	C ₁₂ H ₂₁ N ₂ O ₃ PS	333-41-5	NB	NB	ppm
542	Dibromomethane (Methylene dibromide)	CH ₂ Br ₂	74-95-3	NB	NB	ppm
543	Diisopropyl methanephosphonate (DIMP)	C ₇ H ₁₇ O ₃ P	1445-75-6	NB	NB	ppm
544	Dimethoate	C ₃ H ₁₂ NO ₃ PS ₂	60-51-5	NB	NB	ppm
545	Dimethyldichlorosilane	C ₂ H ₆ Cl ₂ Si	75-78-5	NB	NB	ppm
546	Dimethyldiethoxysilane	C ₆ H ₁₆ O ₂ Si	78-62-6	NB	NB	ppm
547	Dimethyldimethoxysilane	C ₄ H ₁₂ O ₂ Si	1112-39-6	NB	NB	ppm
548	Dimethylvinylchlorosilane	C ₄ H ₈ ClSi	1719-58-0	NB	NB	ppm
549	Divinyltetramethyldisiloxane	C ₆ H ₁₈ O ₂ Si ₂	2627-95-4	NB	NB	ppm
550	Dodecamethylcyclohexasiloxane (D6)	C ₁₂ H ₃₆ O ₆ Si ₆	540-97-6	NB	NB	ppm
551	Dodecamethylpentasiloxane (L5)	C ₁₂ H ₃₆ O ₅ Si ₅	141-63-9	NB	NB	ppm
552	Enflurane [2-Chloro-1-(difluoromethoxy)-1,1,2-trifluoroethane]	C ₃ H ₂ ClF ₅ O	13838-16-9	NB	NB	ppm
553	Ethylene dibromide (1,2-Dibromoethane)	C ₂ H ₄ Br ₂	106-93-4	NB	NB	ppm
554	Ethylmethyldichlorosilane	C ₃ H ₆ Cl ₂ Si	4525-44-4	NB	NB	ppm
555	Halothane (Freon 123B1, 2-Bromo-2-chloro-1,1,1-trifluoroethane)	C ₂ HBrClF ₃	151-67-7	NB	NB	ppm
556	Heptamethyltrisiloxane	C ₇ H ₂₂ O ₃ Si ₃	1873-88-7	NB	NB	ppm
557	Hexamethylcyclotrisiloxane (D3)	C ₆ H ₁₈ O ₃ Si ₃	541-05-9	NB	NB	ppm
558	Hexamethyldisilazane [1,1,1-Trimethyl-N-(trimethylsilyl)-silanamine]	C ₆ H ₁₈ NSi ₂	999-97-3	NB	NB	ppm
559	Hexamethyldisiloxane (L2)	C ₆ H ₁₈ O ₂ Si ₂	107-46-0	NB	NB	ppm
560	Isoflurane (1-Chloro-2,2,2-trifluoroethyl difluoromethyl ether)	C ₃ H ₂ ClF ₅ O	26675-46-7	NB	NB	ppm
561	Malathion	C ₁₀ H ₁₉ O ₆ PS ₂	121-75-5	NB	NB	ppm
562	Methyl bromide (Bromomethane)	CH ₃ Br	74-83-9	NB	NB	ppm
563	Methyl iodide	CH ₃ I	74-88-4	NB	NB	ppm
564	Methyldichlorosilane	CH ₃ Cl ₂ Si	75-54-7	NB	NB	ppm
565	Methyltrichlorosilane	CH ₃ Cl ₃ Si	75-79-6	NB	NB	ppm
566	Methylvinylchlorosilane	C ₃ H ₆ Cl ₂ Si	124-70-9	NB	NB	ppm
567	Octamethylcyclotetrasiloxane (D4)	C ₈ H ₂₄ O ₄ Si ₄	556-67-2	NB	NB	ppm
568	Octamethyltrisiloxane (L3)	C ₈ H ₂₄ O ₃ Si ₃	107-51-7	NB	NB	ppm
569	Pentamethyldisiloxane	C ₅ H ₁₆ O ₂ Si ₂	1438-82-0	NB	NB	ppm
570	Perfluoro-2-n-butyltetrahydrofuran	C ₈ F ₁₆ O	335-36-4	NB	NB	ppm
571	Perfluoro-N-methylmorpholine	C ₅ F ₁₁ NO	382-28-5	NB	NB	ppm
572	Perfluorotributylamine (Heptacosafuorotributylamine, Fluorinert FC-C ₁₂ F ₂₇ N)	C ₁₂ F ₂₇ N	311-89-7	NB	NB	ppm
573	Perfluorotripentylamine (Fluorinert FC-70)	C ₁₅ F ₃₃ N	338-84-1	NB	NB	ppm
574	Perfluorotripropylamine (Tri(perfluoropropyl)amine)	C ₉ F ₂₁ N	338-83-0	NB	NB	ppm
575	Phenylmethyldichlorosilane	C ₇ H ₈ Cl ₂ Si	149-74-6	NB	NB	ppm
576	Phenylphosphonous dichloride (Dichlorophenylphosphine)	C ₆ H ₅ Cl ₂ P	644-97-3	NB	NB	ppm
577	Phenyltrichlorosilane	C ₆ H ₅ Cl ₃ Si	98-13-5	NB	NB	ppm
578	p-Nitrofluorobenzene (4-fluoronitrobenzene)	C ₆ H ₄ FNO ₂	350-46-9	NB	NB	ppm
579	Propyltrichlorosilane	C ₃ H ₇ Cl ₃ Si	141-57-1	NB	NB	ppm
580	tert-Butyl hydroperoxide	C ₄ H ₁₀ O ₂	75-91-2	NB	NB	ppm
581	Tertiary Butyl Dimethyl Silyl alcohol (tert-Butyldimethylsilanol)	C ₆ H ₁₆ OSi	18173-64-3	NB	NB	ppm
582	Tetraethyl orthosilicate	C ₈ H ₂₀ O ₄ Si	78-10-4	NB	NB	ppm
583	Tetramethyl orthosilicate (Tetramethoxysilane)	C ₄ H ₁₂ O ₄ Si	681-84-5	NB	NB	ppm
584	Tetramethylsilane	C ₄ H ₁₂ Si	75-76-3	NB	NB	ppm
585	Thiophosgene	CCl ₂ S	463-71-8	NB	NB	ppm
586	Tributyl phosphate	C ₁₂ H ₂₇ O ₄ P	126-73-8	NB	NB	ppm
587	Trichloromethanesulfonyl chloride	CCl ₃ S	594-42-3	NB	NB	ppm

Only non-instrument specific references. Chemical not available.

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588	Triethyl borate	C ₆ H ₁₅ BO ₃	150-46-9	NB	NB	ppm	
589	Triethyl phosphate	C ₆ H ₁₅ O ₄ P	78-40-0	NB	NB	ppm	
590	Triethylsilane	C ₆ H ₁₆ Si	617-86-7	NB	NB	ppm	
591	Trifluoroacetyl chloride	C ₂ ClF ₃ O	354-32-5	NB	NB	ppm	
592	Trimethoxysilane	C ₃ H ₁₀ O ₃ Si	2487-90-3	NB	NB	ppm	
593	Trimethyl borate (Trimethoxyborane)	C ₃ H ₉ BO ₃	121-43-7	NB	NB	ppm	
594	Trimethylchlorosilane	C ₃ H ₉ ClSi	75-77-4	NB	NB	ppm	
595	Trimethylsilanol (Hydroxytrimethylsilane)	C ₃ H ₁₀ OSi	1066-40-6	NB	NB	ppm	
596	Vinyl bromide (1-Bromoethene, Bromoethylene, R1140 B1)	C ₂ H ₃ Br	593-60-2	NB	NB	ppm	
597	Vinyltrichlorosilane	C ₂ H ₃ Cl ₃ Si	75-94-5	NB	NB	ppm	
Inorganic compounds							
598	Ammonia	NH ₃	7664-41-7	500	5000	ppm	
599	Arsine	AsH ₃	7784-42-1	NB	NB	ppm	
600	Boron trichloride	BCl ₃	10294-34-5	NB	NB	ppm	
601	Boron trifluoride	BF ₃	7637-07-2	NB	NB	ppm	
602	Carbon(12) dioxide	CO ₂	124-38-9	NB	NB	ppm	
603	Carbon(13) dioxide	CO ₂	1111-72-4	NB	NB	ppm	
604	Chlorine dioxide	ClO ₂	10049-04-4	NB	NB	ppm	Only non-instrument specific qualitative references.
605	Deuterium oxide (Heavy water; Dideuterium oxide)	D ₂ O	7789-20-0	NB	NB	ppm	
606	Diborane	B ₂ H ₆	19287-45-7	NB	NB	ppm	
607	Dichlorosilane	SiH ₂ Cl ₂	4109-96-0	NB	NB	ppm	
608	Disilane	Si ₂ H ₆	1590-87-0	NB	NB	ppm	
609	Germane	GeH ₄	7782-65-2	NB	NB	ppm	
610	Germanium tetrachloride	GeCl ₄	10038-98-9	NB	NB	ppm	
611	Hydrogen bromide	HBr	10035-10-6	NB	NB	ppm	Only non-instrument specific references.
612	Hydrogen chloride	HCl	7647-01-0	500	5000	ppm	
613	Hydrogen fluoride	HF	7664-39-3	NB	NB	ppm	Only non-instrument specific references.
614	Hydrogen peroxide	H ₂ O ₂	7722-84-1	NB	NB	ppm	Only non-instrument specific references.
615	Nitric acid	HNO ₃	7697-37-2	NB	NB	ppm	Only non-instrument specific references.
616	Nitrogen dioxide	NO ₂	10102-44-0	500	5000	ppm	Maximum calibration 5%.
617	Nitrogen monoxide (Nitric oxide)	NO	10102-43-9	2000	10000	ppm	
618	Nitrogen trifluoride	NF ₃	7783-54-2	NB	NB	ppm	
619	Oxygen difluoride	OF ₂	7783-41-7	NB	NB	ppm	Only non-instrument specific references. Chemical not available.
620	Ozone	O ₃	10028-15-6	NB	NB	ppm	Only non-instrument specific qualitative references.
621	Phosphine	PH ₃	7803-51-2	NB	NB	ppm	
622	Phosphorus oxychloride	POCl ₃	10025-87-3	NB	NB	ppm	
623	Phosphorus tribromide	PBr ₃	7789-60-8	NB	NB	ppm	
624	Phosphorus trichloride	PCl ₃	7719-12-2	NB	NB	ppm	
625	Silane (Silicon tetrahydride)	SiH ₄	7803-62-5	NB	NB	ppm	
626	Silicon tetrachloride	SiCl ₄	10026-04-7	NB	NB	ppm	
627	Silicon tetrafluoride	SiF ₄	7783-61-1	NB	NB	ppm	
628	Sulfur dioxide	SO ₂	7446-09-5	2000	10000	ppm	
629	Sulfur hexafluoride	SF ₆	2551-62-4	NB	NB	ppm	
630	Sulfur trioxide	SO ₃	7446-11-9	NB	NB	ppm	
631	Sulfuryl chloride (Sulfuryl dichloride)	SO ₂ Cl ₂	7791-25-5	NB	NB	ppm	
632	Sulfuryl fluoride	SO ₂ F ₂	2699-79-8	NB	NB	ppm	Only non-instrument specific references.
633	Thionyl chloride	Cl ₂ OS	7719-09-7	NB	NB	ppm	
634	Trichlorosilane	SiHCl ₃	10025-78-2	NB	NB	ppm	
635	Tungsten hexafluoride	WF ₆	7783-82-6	NB	NB	ppm	Only non-instrument specific references.
Chemical warfare agents and derivatives ***							
636	Mustard gas [Bis(2-chloroethyl)sulphide]	C ₄ H ₈ Cl ₂ S	505-60-2	NB	NB	ppm	Only non-instrument specific references.
637	Sarin (o-Isopropyl methylphosphonofluoridate)	C ₆ H ₁₆ FO ₂ P	107-44-8	NB	NB	ppm	Only non-instrument specific references.
638	Soman (o-Pinacoly methylphosphonofluoridate)	C ₇ H ₁₈ FO ₂ P	96-64-0	NB	NB	ppm	Only non-instrument specific references.
639	Chlorosoman (1,2,2-Trimethyl propyl methyl phosphonochloridate)	C ₇ H ₁₆ ClO ₂ P	7040-57-5	NB	NB	ppm	Only non-instrument specific references.
640	Tabun (o-Ethyl N,N-dimethyl phosphoramidocyanidate)	C ₈ H ₁₇ N ₂ O ₂ P	77-81-6	NB	NB	ppm	Only non-instrument specific references.
641	Lewisite (2-Chlorovinyl)dichloroarsine	C ₂ H ₂ AsCl ₃	541-25-3	NB	NB	ppm	Only non-instrument specific references.
642	VX (Methylphosphonothioic acid)	C ₁₁ H ₂₆ NO ₂ PS	50782-69-9	NB	NB	ppm	Only non-instrument specific references.
643	Diethyl methanephosphonate (DEMP)	C ₆ H ₁₃ O ₃ P	683-08-9	NB	NB	ppm	Only non-instrument specific references.
644	Dimethyl methylphosphonate (DMMP)	C ₅ H ₉ O ₃ P	756-79-6	NB	NB	ppm	Only non-instrument specific references.
645	Dimethyl phosphite (Dimethyl hydrogen phosphite)	C ₂ H ₇ O ₃ P	868-85-9	NB	NB	ppm	Only non-instrument specific references.
646	Diisopropyl methylphosphonate (DIMP)	C ₇ H ₁₇ O ₃ P	1445-75-6	NB	NB	ppm	Only non-instrument specific references.

Other components

Not all the components are included in the list above. Please contact Gasmet Technologies Oy for availability and ranges for the components not mentioned.

* GAS-REF-001 price applies only to components with maximum range indicated above.

** GAS-REF-002 price applies only to components with maximum range indicated above.

*** Very limited availability, subject to export limitations.

NB GAS-REF-003 components. Please ask for a price quotation for each component separately.

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