



Data Sheet

Gas tube specifications

Why gas detection?

Exposure of employees to substances hazardous to health, should be prevented or adequately controlled. This is a fundamental requirement of the Control of Substances Hazardous to Health (COSHH) regulations 1994.

If there is any doubt of which gases may be present in a workplace and how they should be monitored, then a COSHH assessment should be carried out by an appropriate body.

Exposure can occur by inhalation, ingestion or absorption through the skin but inhalation is usually the main route of entry into the body. The EH40 document, by the Health and Safety Executive (RS stock no. 159-1311), Lists the Occupational Exposure Limits which should be used in determining the exposure by inhalation.

These OELs (Occupational Exposure Limits) relate to personal exposure to substances hazardous to health in the air of the workplace. Concentrations of gases and vapours in air are usually expressed in parts per million (ppm) which is a measure of concentration by volume. However they can also be expressed as milligrams per cubic metre of air (mg m⁻³) which is a measure of concentration by mass.

The EH40 is the main reference document to which all company personnel, responsible for Health and Safety in the workplace will refer to, and use for guidance. It is therefore essential that anyone using gas detection products should have a copy of EH40 or easy access to it.

It is the responsibility of the customer to seek advice from the HSE or other suitable consultancy when unsure of which gases to monitor

The main application for the Gastec detector tube system is to help company personnel responsible for health and safety in the workplace, to ensure that the OELs are adhered to.

Why detector tubes for gas detection?

There are several different forms of gas detection all of which have their own suitability depending on the application and environment.

Common forms of gas detection are;

1. Fixed monitors with electrochemical/pellistor sensors.
2. Portable monitors with electrochemical/pellistor sensors.
3. Sampling pumps with sorbent collection media (further analysis of medium is required by laboratory methods).
4. Paper tape colorimetric badges.
5. Gas detector tubes.

Gas detector tubes are one of the simplest forms of gas detection.

The detector tube method permits a simple, quick, and economical analysis at the working site thereby providing a lot of advantages over other laboratory based methods. These laboratory methods require complicated equipment, specialist help and usually take a long time to determine the result.

Gas detector tubes are very cost effective. The relative low cost and ease of use of the detector tube system, enable the operator to carry out regular sampling without unnecessary drain on their time, or budget.

The benefit of more regular monitoring means that a better understanding of the workplace is achieved and that unnecessary exposure of toxic gases to personnel, is reduced.

Gas detector tube technology

The first detector tube was invented in the USA in 1919, to measure concentrations of carbon monoxide (CO) in the workplace. It utilised a chemical reaction of CO with a reagent filled thin glass tube. If air, containing CO, passed through the tube, the reagent would change colour in reaction to the CO. Colour intensity is proportional to the concentration of CO. Therefore operators could measure the concentration by comparing the colour intensity with a previously prepared colour chart.

1970 saw the development of the first direct reading detector tubes that indicated concentrations directly on calibration scales printed on the tubes.

A colorimetric detector tube is a glass tube filled with an absorbent material, usually silica gel impregnated with a chemical reagent. Air is drawn through the tube by the Gastec piston pump and if the gas of interest is present, it reacts with the chemicals in the tube to cause a colour change. The length of the stain is a measure of the concentration of the gas. By using the calibration scales printed on the tube, the concentration may be read immediately.

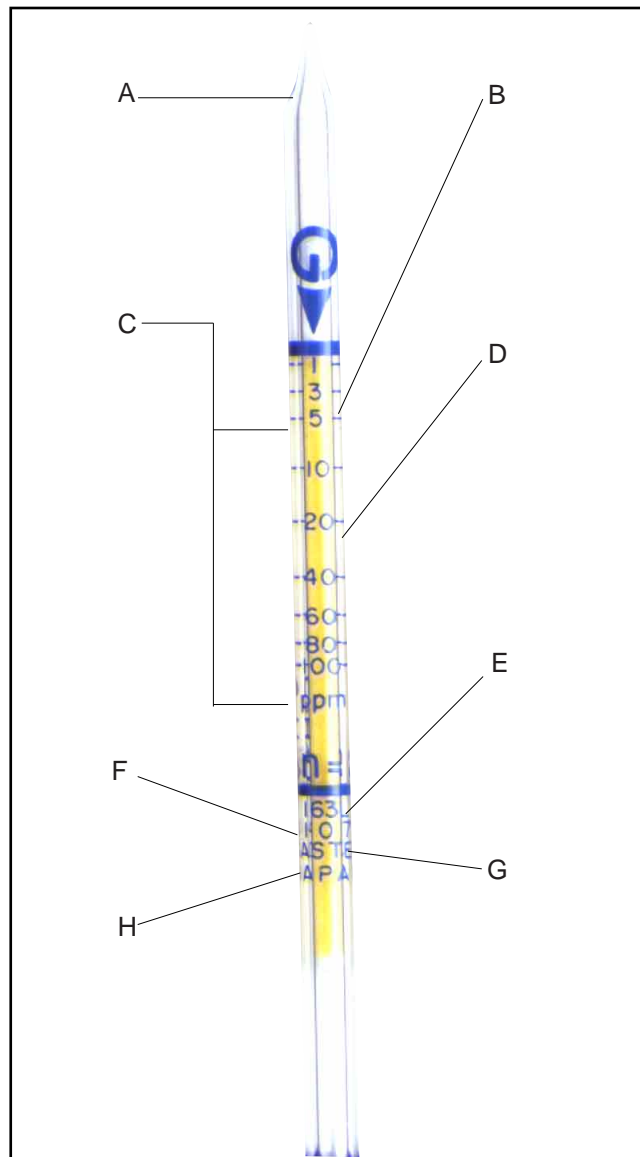
The specificity of detector tubes depends upon the gas being measured and the chemical reagent. Some reagents are specific to only one gas but others respond to a group of similar or related gases. This is not always a bad thing as it enables the tube to be used for detecting gases other than those for which it is designed. Gastec always advise this specificity on the individual instruction sheet which accompanies each packet of tubes.

There are now almost 500 kinds of Gastec detector tubes on the market. RS offer 33 different types, for the more general gases, within the catalogue. The remainder can be accessed via purchase support and are ordered by telephoning (01536) 444066.

Detector tubes are often more accurate than many people imagine. Accuracy depends upon the volume of air sampled and hence on the precision of the pump used. Some evaluation tests have shown accuracies of better than +/-5%. This is well within the British standard specification for gas detector tubes (BS5343).

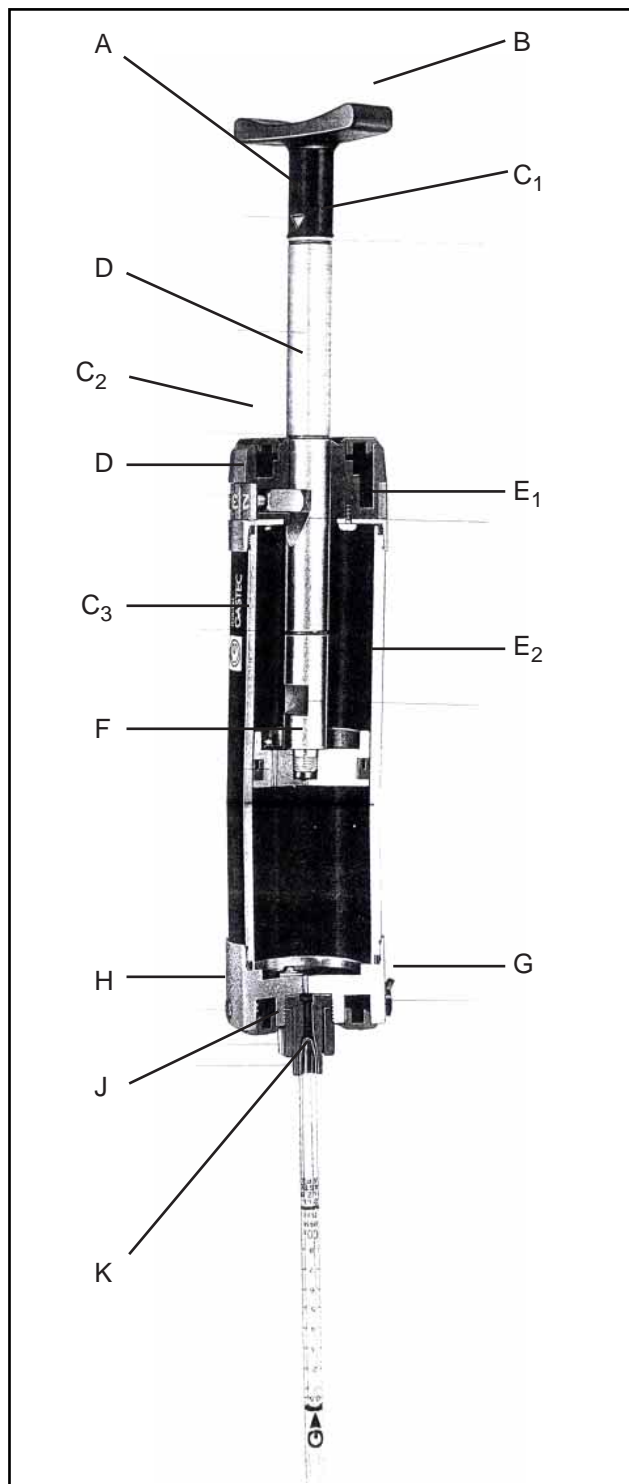
Dositube is the latest type of detector tube which samples diffusion and therefore does not require the use of a pump. This system is used for monitoring personal exposure rather than the standard system which gives on-the-spot measurements. The Dositube can be used to monitor exposures for between 1-10 hours. The absence of a pump means that the tube can function as an extremely lightweight personal dosimeter, thus providing an immediate read out of Time Weighted Average.

Gastec standard detector tube system



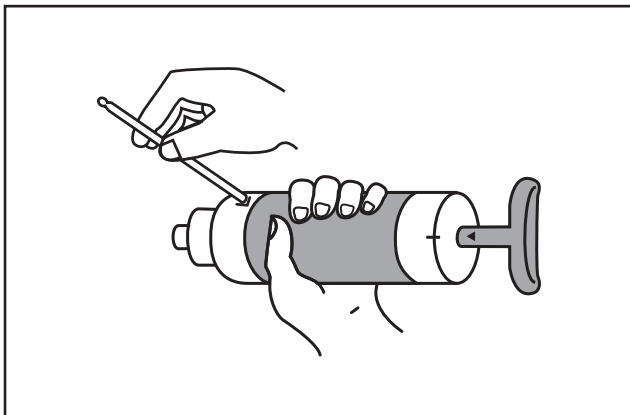
- A. High quality glass
- B. Distinct layer of colour change
- C. Calibration scale (in ppm, mg/l or % depending on the substance and concentration to be measured)
- D. Reliable detecting reagents that comply with Gastec's stringent quality standards (regulating the length of colour change layer, the clarity of demarcation and the tone and brightness of colour change.)
- E. Chemical formula of the substance to be measured. An abbreviation is used for long formulae.
- F. Standard number of pump stroke (n). The number of pump strokes required to collect the standard volume of sample air for this tube
- G. Detector tube number. The numeral represents the kind of substance the tube can measure and the letter(s) specify the level concentrations the tube can determine. For example, H, M and L respectively indicate high medium and low level concentrations

Gastec sampling pump

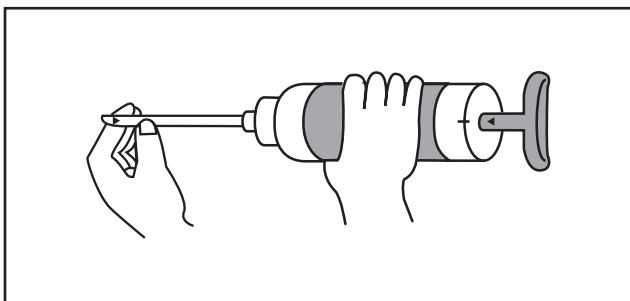


- A. Handle
- B. Guide marks. A red triangle mark (10) is aligned with the red guide line on the pump to place the handle at the initial position.
- C₁₋₃. Stroke guide rings. Red rings on the pump shaft to indicate a full stroke position for sampling 100ml (C3), a half stroke position for sampling 50ml (C2) and the initial position (C1).
- D. Pump shaft
- E₁₋₂. Counter ring. Used to keep count of pump strokes for multiple pump stroke applications. To advance the count, turn the ring counterclockwise, or turn is clockwise to reset the count.
- F. Pump piston. Gasket sealing is airtight and assures excellent durability.
- G. Tube tip breaker cap. A rubber tip that can be opened to remove the tips collected in the tube tip breaker.
- H. Tube tip breaker. Used to break and store the ends (tips) of detector tubes. It can accommodate tips from approximately 60 tubes. An optional Gastec tube tip breaker that can accommodate tips from about 130 tubes is also available.
- J. Inlet clamping nut. Holds the rubber inlet in place.
- K. Rubber inlet. A rubber flange into which the detector tube is inserted.

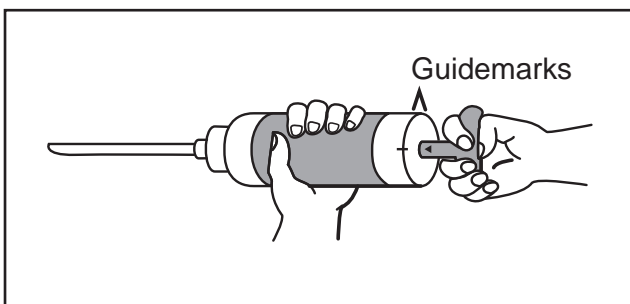
Operation of the Gastec standard detector tube system



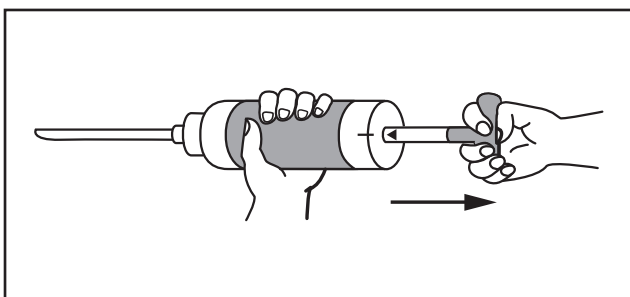
1. Select a detector tube to be used.
2. Break off both ends of the detector tube by using the built-in tip breaker.
3. Confirm the pump handle is fully pushed in. Insert the detector tube into the rubber inlet of the Model **RS** stock no. 376-9875 sampling pump with arrow (▲) on the tube pointing toward the pump.



4. Align the guide marks on the pump shaft and handle.



5. Pull out the handle fully until it is locked.

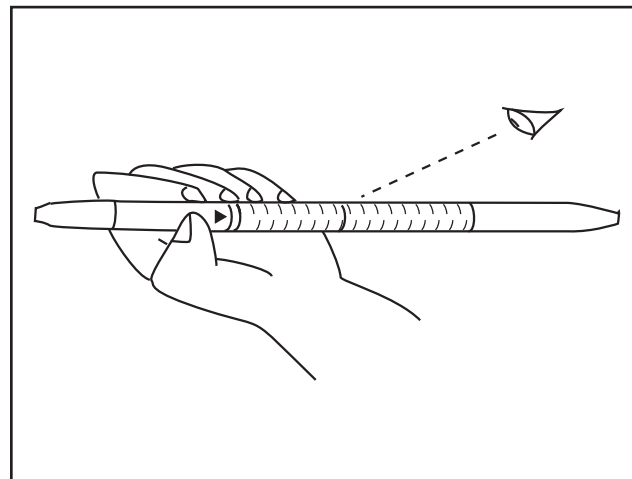


6. Wait until the sampling time has elapsed, which is indicated by the end of stroke indicator returning to its home position, (if multiple pump strokes are required, repeat the previous three steps).

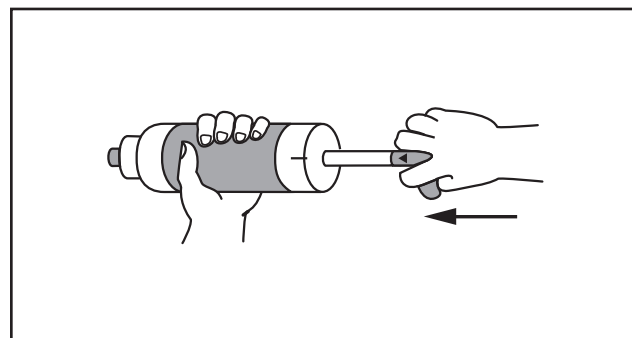
Number of pump strokes and sampling time

Most Gastec detector tubes can determine concentrations of the target substance with 1 pump stroke (100ml) in accordance with the Health and Safety Executive OEL's. Some tubes however require 1/2 stroke (50ml) or multiple strokes (100ml x n) depending on the substance and the concentration to be measured. The required number of strokes are detailed in the instruction sheet included with the detector tube.

7. When sampling starts, the colour of the reagent in the detector will start to change. The colour change will continue at a slower rate, when the sampling time has elapsed. It is therefore important to take the reading as soon as the sampling time has elapsed.



8. Remove the tube from the pump and read the indication at the end of the colour change layer.
9. Unlock the handle by turning it more than 1/4 turn to restore it to initial position.



Features and benefits of Gastec standard detector tubes

- The Gastec precision gas sampling pump provides stable and accurate detection by giving a precise and controlled sample volume.
- Most tubes require a one pump stroke operation which means analysis is quicker and easier to carry out.
- The pump although very robust weighs a mere 270g and can be easily carried.
- The pump has a built in glass tip breaker which captures broken glass tips. This allows the safe disposal of glass shrapnel.
- The Gastec tubes have very fine granules which means that the end point can be more easily read due to sharper demarcation.
- There are more than 484 different types of Gastec tubes which means that Gastec offer a very comprehensive choice.

- 70% of Gastec tubes have a 3 year shelf life which means that a user has less wastage.
- All tubes are direct reading and do not require comparison of the colour change with a prepared colour chart.
- All standard Gastec detector tubes for use with the pump have one price, therefore making purchasing easier.

Operation of the Gastec passive dositube system for long term gas & vapour analysis

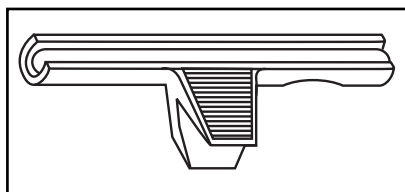
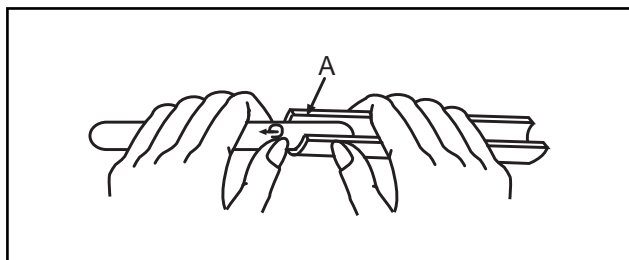
The TWA Measurement System consists of Gastec Dositubes and the Tube Holder (RS stock no. 229-9303). Dositubes are special detector tubes for measuring time-weighted average gas concentrations (TWA values). They can be attached, by the Tube Holder, in the breathing zone on an individual, or affixed in the workplace for a prolonged time (1 to 10 hours) to measure personal exposure values. With this system day-to-day gas concentration fluctuation or distribution in the workplace can easily be monitored. Values measured can be used to assess the working environment by comparing them with the threshold limit values (TLV-TWA) recommended by Health and Safety Executive.

Features

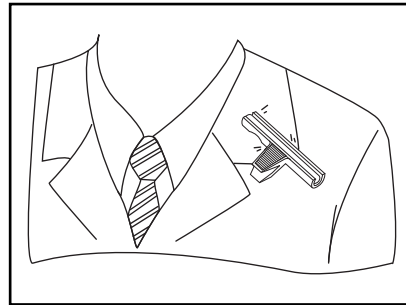
- Small and lightweight
- Simple direct measurements without special analysis equipment or complicated operation procedures.

Measurement procedure

1. Write down the starting time of measurement on an adhesive label included inside each box of Dositubes and place the label onto the tube.
2. Insert the G marked end of the Dositube into the Tube Holder and break the tube end at the breaking line (A). Remove the broken end from the tube holder, (due to the pre-scoring of the tube, this break is clean and leaves no sharp edges).



3. Insert the Dositube fully into the tube holder.



4. Attach the tube holder with the Dositube to the shirt collar for personal sampling, or place at an appropriate measurement point in the workplace.

5. When the measuring is finished, write down the finishing time on the label and determine the actual sampling time:

$$= (\text{finishing time}) - (\text{starting time})$$

6. Obtain the average concentration (TWA value) by the following formula. TWA value (ppm)

$$= \frac{\text{Dositube reading (ppm/hr)}}{\text{Actual sampling time (hr)}}$$

Features and benefits of Gastec passive dositube system for long term gas and vapour analysis

- Allows the measurement of personal exposure values in the workplace from 1-10 hours.
- The tubes and tube holder are small and lightweight and therefore can be easily worn by the operator.
- Results can be read directly at the end of the measurement period in order to calculate the 8 hour TWA.
- As the tubes are direct-reading, the operator will be alerted immediately to over exposure.
- The Dositube system is an extremely low cost screening product and all standard Gastec Dositubes have one price, therefore making purchase easier.

Gastec detector tubes, safe storage and disposal

As detector tubes contain sensitive reagents that are ready to react, some reagents might be corrosive, care should be taken for their storage and disposal.

Storage of detector tubes

To keep the high quality of Gastec detector tubes, it is necessary to store them in a cool (0 to 10°C) (32 to 50°F), dark place (never expose them to the direct sunlight). Never store tubes above normal room temperature. Keep them in a safe place and out of reach of children.

Disposal of detector tubes

Used or date-expired detector tubes should be disposed of properly in accordance with your local regulations i.e. glassware and sharps disposal system.

Gastec standard detector tube system (tubes supplied in packs of 10)

Tube	RS stock no.	Range (ppm) from 1 pump stroke (100mls)	Min/Max. range (ppm) with differing pump strokes	Typical Applications	
Pump	376-9875				
Ammonia	229-8956	1-30	0.5-60	Agriculture	Fertiliser production
Ammonia	229-8962	50-500	50-1000	Chemical	
Benzene	229-8978	10-60	0.125-60	Petroleum refineries,	Chemical building block
				chemical	for chemical synthesis
Carbon dioxide	229-8984	0.25-3%	0.13-6%	Environmental	Product of combustion
Carbon monoxide	229-8990	25-500	8-1000	Environmental	Product of incomplete combustion
Chlorine	229-9000	0.5-8	0.05-16	Chemical	Disinfectant
Ethyl Mercaptans	229-9016	0.5-30	0.2-75	Oil & gas	Odourant in gas
Formaldehyde	229-9022	5-32.5	0.1-1.5	Chemical	Widely used sterilent
Hydrogen chloride	229-9038	1-20	0.2-40	Chemical	Common lab chemical
Hydrogen sulphide	229-9044	100-2000	10-4000	Petrochemical	Present in refinery process
Hydrogen sulphide	229-9050	2.5-60	0.25-120	Environmental	Waste water odour
Mercaptans	229-9066	5-120	0.5-120	Oil & gas	Odourant in gas
Nitrogen dioxide	229-9072	30-125	0.5-125	Environmental	Traffic pollutant
Ozone	229-9094	0.6-3	0.025-3	Environmental	Factor in sick building syndrome
Styrene	229-9101	20-500	10-1500	Chemical	Polymer production
Sulphur dioxide	229-9117	5-100	1.25-200	Environmental	Air pollutant
Toluene	229-9123	10-300	5-600	Chemical	Solvent in adhesives
Trichloroethylene	229-9139	5-100	2-250	Chemical	Degreasing agent
Xylene	229-9151	10-250	5-625	Chemical	Surface coatings



Tube	RS stock no.	Range (ppm/hr)		Typical Applications
Tube holders	229-9303			
Acetone	229-9167	5-1500	Chemical	Solvent/fibre production
Ammonia	229-9173	2.5-1000	Agriculture food/drink	Fertiliser production, used as a refrigerant
1,3 Butadiene	229-9189	3-200	Paper & paints	Production of coatings
Carbon monoxide	229-9195	1.04-2000	Environmental	Product of incomplete combustion
Formaldehyde	229-9218	0.1-20	Chemical	Widely used sterilent
Hydrogen chloride	229-9224	1-100	Chemical	Common lab chemical
Hydrogen fluoride	229-9246	1-100	Chemical	Catalyst and etching agent
Hydrogen sulphide	229-9252	0.2-200	Petrochemical Environmental	Refinery hazard, Waste water odour
Nitrogen dioxide	229-9268	0.1-30	Environmental	Traffic pollutant
Perchloroethylene	229-9274	1.5-150	Dry cleaning	Solvent
Sulphur dioxide	229-9319	0.2-100	Environmental	Air pollutant
Toluene	229-9375	10-2000	Chemical	Solvent in adhesives

Gastec tube datasheet**Acetone**

RS stock no.:

Dositube _____ 229-9167
 Chemical formula _____ CH_3COCH_3
 Molecular weight _____ 58.1
 Specific gravity _____ 0.79
 Vapour density _____ 2.0
 Vapour pressure _____ 180 mmHg (at 20°C or 68°F)
 Boiling point _____ 56.3°C (133.3°F)
 Flash point _____ -20°C (-4°F)
 Explosive range _____ 2.1 to 13.0%
 TLVs :
 TWA _____ 750 ppm
 STEL _____ 1500 ppm

Features

Clear, colourless liquid; aromatic odour; soluble in water.

Hazardous properties

1. Inhaling the vapour will cause headache, vertigo and vomiting.
2. Higher concentrations vapour will cause unconsciousness by its narcotic action.
3. Repeated contacts with the eyes and the mucous membranes of the nasal passages and throat will cause inflammation.

Ammonia

RS stock no.:

Detector tubes _____ 229-8962, 229-8956
 Dositube _____ 229-9173
 Chemical formula _____ NH_3
 Molecular weight _____ 17.0
 Specific gravity _____ 0.6 (gas)
 Vapour density _____ na
 Vapour pressure _____ na
 Boiling point _____ -33.4°C (-28.1°F)
 Flash point _____ na
 Explosive range _____ 16.0 to 25.0%
 TLVs :
 TWA _____ 25 ppm
 STEL _____ 35 ppm

Features

Colourless gas; suffocating, pungent odour, soluble in water.

Hazardous properties

1. Will acutely irritate and corrode the skin and mucus membranes and be liable to affect subsurface of tissues.
2. Inhaling high concentrations of ammonia will cause pulmonary oedema and respiratory arrest. Also may cause visual impairment if it gets in the eyes.

Benzene

RS stock no.:

Detector tube _____ 229-8978
 Chemical formula _____ C_6H_6
 Molecular weight _____ 78.1
 Specific gravity _____ 0.88
 Vapour density _____ 2.8
 Vapour pressure _____ 75 mmHg (at 20°C or 68°F)
 Boiling point _____ 80.1°C (176.2°F)
 Flash point _____ -11°C (12°F)
 Explosive range _____ 1.3 to 7.1%
 TLVs :
 TWA _____ 5 ppm

Features

Colourless liquid; characteristic aromatic odour; insoluble in water; soluble in ethanol and ether.

Hazardous properties

1. The vapour of its 100 ppm or higher concentrations. will cause the loss of appetite, lassitude, headache or vertigo.
2. Chronic poisoning will cause abnormal haematogenesis, a plastic anaemia or leukemia.

1,3-Butadiene

RS stock no.:

Dositube _____ 229-9189
 Chemical formula _____ $\text{CH}_2\text{CHCHCH}_2$
 Molecular weight _____ 54.1
 Specific gravity _____ 0.62
 Vapour density _____ na
 Vapour pressure _____ na
 Boiling point _____ -4.4°C (24.1°F)
 Flash point _____ na
 Explosive range _____ 2.0 to 12.0%
 TLVs :
 TWA _____ 10 ppm

Features

Colourless gas; aromatic odour; hardly soluble in water; soluble in ethanol and ether.

Hazardous properties

1. High concentrations will be narcotic.
2. Will irritate and inflame the skin, eyes, and the mucous membranes of the nasal passages.

Carbon Dioxide

RS stock no.:

Detector tube _____ 229-8984
 Chemical formula _____ CO₂
 Molecular weight _____ 44.0
 Specific gravity _____ 1.53(gas)
 Vapour density _____ na
 Vapour pressure _____ na
 Boiling point _____ -78.5°C (-109°F)
 Flash point _____ Incombustible
 Explosive range _____ na
 TLVs :
 TWA _____ 5,000 ppm
 STEL _____ 15,000 ppm

Features

Colourless liquid; characteristic odour; slightly soluble in water; soluble in organic solvents.

Hazardous properties

1. No effect for 6-hour exposure to 0.55% concentrations.
2. 1 to 2% concentrations. will cause unpleasantness
3. 3 to 4% concentrations. will cause tachypnoea, palpitation, rushing up of blood pressure, headache or vertigo.
4. 6% concentrations. will cause dyspnoea.
5. 7 to 10% concentrations will cause unconsciousness, cyanosis and death in a few minutes

Carbon Monoxide

RS stock no.:

Detector tube _____ 229-8990
 Dositube _____ 229-9195
 Chemical formula _____ CO
 Molecular weight _____ 28.0
 Specific gravity _____ 0.97 (gas)
 Vapour density _____ na
 Vapour pressure _____ na
 Boiling point _____ 191.5°C
 Flash point _____ na
 Explosive range _____ 12.5 to 74.0%
 TLVs :
 TWA _____ 50 ppm
 STEL _____ 300 ppm

Features

Colourless and odourless gas; hardly soluble in water; soluble in alkaline water solution and ethanol.

Hazardous properties

1. Will combine with the haemoglobin of the blood which will impede its oxygen carrying capability, causing toxic symptoms.
2. Symptoms include headache, nausea, vertigo, dizziness, ringing in the ears, perspiration, pain in limbs, lassitude or forgetfulness.

Chlorine

RS stock no.:

Detector tube _____ 229-9000
 Chemical formula _____ Cl₂
 Molecular weight _____ 70.9
 Specific gravity _____ 2.5 (gas)
 Vapour density _____ na
 Vapour pressure _____ na
 Boiling point _____ 34°C (-29.2°F)
 Flash point _____ na
 Explosive range _____ na
 TLVs :
 TWA _____ 0.5 ppm
 STEL _____ 1 ppm

Features

Yellow green gas; strong pungent odour; hardly soluble in water; liquifies under 5 atm.

Hazardous properties

1. Skin contact will cause inflammation.
2. Inhaling will cause coughing, dysnea, or death may result.
3. Chronic symptoms include bronchitis, inflammation of the nasal mucous membranes.

Ethyl Mercaptan

RS stock no.:

Detector tube _____ 229-9016
 Chemical formula _____ C₂H₅SH
 Molecular weight _____ 62.1
 Specific gravity _____ na
 Vapour density _____ 1.0
 Vapour pressure _____ na
 Boiling point _____ 34.7°C (94.5°F)
 Flash point _____ 27°C (81°F)
 Explosive range _____ 2.8 to 18.2%
 TLVs :
 TWA _____ 0.5 ppm

Features

Colourless liquid; garlicky odour; slightly soluble in water; soluble in ethanol and ether.

Hazardous properties

1. Will cause hypnosis, or high concentrations will paralyse the central nervous system.
2. Strong pungent odour will cause headache or vomiting, or in high concentrations cause cyanosis, cool limbs, rapid pulsation, irritation of respiratory tissues, unconsciousness, or in serious case may cause pulmonary oedema.

Formaldehyde

RS stock no.:

Detector tube _____ 229-9022
 Dositive _____ 229-9218
 Chemical formula _____ HCHO
 Molecular weight _____ 30.0
 Specific gravity _____ na
 Vapour density _____ 1.0
 Vapour pressure _____ na
 Boiling point _____ -19.2°C
 Flash point _____ 85°C (185°F)
 Explosive range _____ 7.0 to 73.0%
 TLVs :
 TWA _____ 2 ppm
 STEL _____ 2 ppm

Features

Colourless liquid (water solution); strong pungent odour;
 soluble in water; ethanol and ether.

Hazardous properties

1. Will irritate the skin by contact, causing chapped skin or ulcers.
2. Its vapour will be lacrimatory.
3. Inhaling the vapour will irritate the mucous membranes causing coughing.
4. Chronic symptoms include renal or hepatic damage.

Hydrogen Chloride

RS stock no.:

Detector tube _____ 229-9038
 Dositive _____ 229-9224
 Chemical formula _____ HCl
 Molecular weight _____ 36.5
 Specific gravity _____ 1.3 (gas)
 Vapour density _____ na
 Vapour pressure _____ na
 Boiling point _____ -85°C (-121°F)
 Flash point _____ na
 Explosive range _____ na
 TLVs :
 STEL _____ 5 ppm

Features

Colourless gas; strong pungent odour; fuming; soluble in water.

Hazardous properties

1. Contact with the skin or eyes will cause inflammation.
2. Inhaling will irritate the mucous membranes of the nasal passages and throat causing coughing.
3. Inhaling a large quantity will cause pulmonary oedema and death will result.

Hydrogen Flouride

RS stock no.:

Dositube _____ 229-9246
 Chemical formula _____ HF
 Molecular weight _____ 20.0
 Specific gravity _____ 1.00
 Vapour density _____ 0.7
 Vapour pressure _____ na
 Boiling point _____ 19.5°C (67.1°F)
 Flash point _____ na
 Explosive range _____ na
 TLVs :
 STEL _____ 3 ppm

Features

Colourless liquid; pungent odour; fuming; highly soluble in water.

Hazardous properties

1. Will acutely irritate the eye, the mucous-membranes of the nasal passages and throat. Inhaling its vapour will cause pulmonary oedema or bronchitis.
2. Chronic poisoning will inflame the respiratory tract or cause erosion of bones and dental enamel.

Hydrogen Sulphide

RS stock no.:

Detector tubes _____ 299-9044, 229-9050
 Dositube _____ 229.9252
 Chemical formula _____ H₂S
 Molecular weight _____ 34.1
 Specific gravity _____ 1.2 (gas)
 Vapour density _____ na
 Vapour pressure _____ na
 Boiling point _____ -60.4°C (-76.7°F)
 Flash point _____ na
 Explosive range _____ 4.0 to 44%
 TLVs :
 TWA _____ 10 ppm
 STWL _____ 15 ppm

Features

Colourless gas; odour of rotten eggs; highly soluble in water; soluble in methanol and carbon disulfide.

Hazardous properties

1. 0.05 ppm concentrations will give first perceptible odour.
2. 5 ppm concentrations will give offensive odour.
3. 50 to 100 ppm concentrations will irritate the respiratory tract or cause conjunctivitis.
4. 200 to 300 ppm concentrations will cause subacute intoxication in an hour.
5. 600 ppm or higher concentrations will cause fatal toxication in an hour.
6. 1000 ppm or higher concentrations will be fatal immediately.

Methyl Mercaptan

RS stock no.:

Detector tube _____ 229-9066
 Chemical formula _____ CH₃SH
 Molecular weight _____ 48.1
 Specific gravity _____ 0.90
 Vapour density _____ na
 Vapour pressure _____ na
 Boiling point _____ 6.0°C (42.8°F)
 Flash point _____ Lower than 0°C (32°F)
 Explosive range _____ 3.9 to 21.8%
 TLVs :
 TWA _____ 0.5 ppm

Features

Colourless gas; strong offensive odour; slightly soluble in water; soluble in ethanol and petroleum naphtha.

Hazardous properties

1. Will be absorbed through the skin. Prolonged continuous contact will develop skin cancer.
2. Will be narcotic and paralyse the central nervous system.
3. High concentrations will cause conjunctivitis or cornea opacity.

Nitrogen Dioxide

RS stock no.:

Detector tube _____ 229-9072
 Dositube _____ 229-9268
 Chemical formula _____ NO₂
 Molecular weight _____ 46.0
 Specific gravity _____ 1.59 (gas)
 Vapour density _____ na
 Vapour pressure _____ 400 mmHg (80°C or 176°F)
 Boiling point _____ 21.3°C (70.3°F)
 Flash point _____ na
 Explosive range _____ na
 TLVs :
 TWA _____ 3 ppm
 STEL _____ 5 ppm

Features

Dark reddish-brown gas, pungent odour; soluble in water and organic solvents.

Hazardous properties

1. High concentrations will acutely irritate the eyes and the mucous membranes or the nasal passages and throat causing coughing, vertigo, headache or nausea.
2. Inhaling a large quantity will cause cyanosis or pulmonary oedema.
3. Chronic symptoms include bronchitis, gastrointestinal disturbance or erosion of dental enamel.

Ozone

RS stock no.:

Detector tube _____ 229-9094
 Chemical formula _____ O₃
 Molecular weight _____ 48.0
 Specific gravity _____ 1.65 (gas)
 Vapour density _____ na
 Vapour pressure _____ na
 Boiling point _____ -111.9°C (-169.4°F)
 Flash point _____ na
 Explosive range _____ na
 TLVs :
 STEL _____ 0.2 ppm

Features

Gaseous at ordinary temperatures; liquid is blue; characteristic pungent odour; soluble in water and oils.

Hazardous properties

1. Skin contact with 10 to 30% concentrations of liquid will inflame the skin like 90% concentrations. hydrogen peroxide.
2. Inhaling 0.1 ppm concentrations of gas for 2 hours or more will decrease the lung capacity by 20%.
3. Inhaling 1 ppm concentrations of gas for 6 hours or more will cause headache or bronchitis.

Styrene

RS stock no. :

Detector tube _____ 229-9101
 Chemical formula _____ C₆H₅CH:CH₂
 Molecular weight _____ 104.2
 Specific gravity _____ 0.91
 Vapour density _____ 3.6
 Vapour pressure _____ 5 mmHg (at 20°C or 68°F)
 Boiling point _____ 145.2°C (293.4°F)
 Flash point _____ 32°C (90°F)
 Explosive range _____ 1.1 to 1.6%
 TLVs :
 TWA _____ 100 ppm
 STEL _____ 250 ppm

Features

Colourless liquid; slightly soluble in water; highly soluble in ethanol and ether.

Hazardous properties

1. Repeated skin contact with the liquid will inflame the skin.
2. Its vapour will irritate the eyes and the mucous membranes, causing lacrimation.
3. The high concentrations. vapour will be narcotic and cause polyneuritis.

Sulphur Dioxide

RS stock no.:

Detector tube _____ 229-9117
 Dositube _____ 229-9319
 Chemical formula _____ SO₂
 Molecular weight _____ 64.1
 Specific gravity _____ 2.3 (gas)
 Vapour density _____ na
 Vapour pressure _____ na
 Boiling point _____ -10°C (14°F)
 Flash point _____ na
 Explosive range _____ na
 TLVs :
 TWA _____ 2 ppm
 STEL _____ 5 ppm

Features

Colourless gas; offensive, pungent odour; soluble in water.

Hazardous properties

1. 0.1 to 1ppm will give first perceptible odour.
2. 2 ppm or higher concentrations will produce pungent odour and unpleasantness.
3. 5 ppm or higher concentrations will irritate the mucous membranes of the nasal passages and throat, causing coughing.
4. 30 ppm or higher concentrations will cause dyspnoea.
5. 400 ppm or higher concentrations will be fatal in a short time.

Toluene

RS stock no.:

Detector tube _____ 229-9123
 Dositube _____ 229-9375
 Chemical formula _____ C₆H₅CH₃
 Molecular weight _____ 92.1
 Specific gravity _____ 0.87
 Vapour density _____ 3.1
 Vapour pressure _____ 36.7 mmHg (at 30°C or 86°F)
 Boiling point _____ 110.6°C (231.1°F)
 Flash point _____ 4°C (39.2°F)
 Explosive range _____ 1.4 to 6.7%
 TLVs :
 TWA _____ 50 ppm
 STEL _____ 150 ppm

Features

Colourless liquid; aromatic odour; insoluble in water; highly soluble in organic solvents.

Hazardous properties

1. The liquid and its vapour will irritate the skin, eyes and mucous membranes of the throat.
2. Contact with the skin will remove natural oils from the skin.
3. Will cause headache, vertigo, fatigue and loss of balance.
4. High concentrations. will cause narcotic action, or death may result.

Trichloroethylene

RS stock no.:

Detector tube _____ 229-9139
 Chemical formula _____ $\text{CCl}_2 = \text{CHCl}$
 Molecular weight _____ 131.4
 Specific gravity _____ 1.46
 Vapour density _____ 4.5
 Vapour pressure _____ 100 mmHg (at 32°C or 90°F)
 Boiling point _____ 86.6°C (188°F)
 Flash point _____ na
 Explosive range _____ na
 TLVs :
 TWA _____ 100 ppm
 STEL _____ 150 ppm

Features

Colourless liquid; slightly soluble in water; highly soluble in ethanol and ether.

Hazardous properties

1. The liquid and its vapour will irritate the eyes and mucous membranes of the nasal passages and throat.
2. Repeated skin contact will cause dermatitis.
3. Inhaling the vapour will cause headache, vertigo, nausea, anaemia or hepatic damage.

Xylene

RS stock no.:

Detector tube _____ 229-9151
 Dositive _____ 229-9375
 Chemical formula _____ $\text{C}_6\text{H}_4(\text{CH}_3)_2$
 Molecular weight _____ 106.2
 Specific gravity _____ 0.88
 Vapour density _____ 3.7
 Vapour pressure _____ 10 mmHg (at 32°C or 90°F)
 Boiling point _____ 138 to 142°C (280 to 287.6°F)
 Flash point _____ 27 to 32°C (81 to 90°F)
 Explosive range _____ 1 to 7%
 TLVs :
 TWA _____ 100 ppm
 STEL _____ 150 ppm

Features

Colourless liquid; pungent odour; insoluble in water, highly soluble in ethanol and ether.

Hazardous properties

1. The liquid and its vapour will irritate the eyes, the mucous membranes of the nasal passages and throat.
2. Repeated skin contact will cause dermatitis.
3. Inhaling the high concentrations vapour will cause excitement, narcotic action and death.
4. Chronic symptoms include marrow depression.

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