

ask the experts - Hydrogen



Why is Hydrogen leak detection important?

Hydrogen is one of the three most dangerous combustible gases; the other two are Acetylene and Carbon Disulphide. These gases are particularly dangerous as they need very small ignition energy to ignite them (the minimum ignition energy of Hydrogen is just 40uJ) and for this reason have a separate gas group IIC as per the European standard.

Many times users feel that they do not need gas detection systems for Hydrogen in open areas, but a Hydrogen fire occurring in the daytime cannot be seen by the naked eye as the flame is white in colour and not visible in bright light. Another potential threat can arise from the mixture of Hydrogen and air, so it is always advisable to use a gas detection system with solenoid valve to automatically trip the gas supply in instances where leakage levels rise to 50% LEL / 2% Vol. (100% LEL of Hydrogen as per EN Standards is 4% Vol.)

Properties of Hydrogen :

Hydrogen is a colourless gas with no smell. It is not toxic in nature and the immediate health hazard is that it may cause thermal burns. Hydrogen is the most flammable gas on the planet and it can form mixtures with air that are highly flammable or explosive. Hydrogen may react violently if combined with oxidisers, such as air, Oxygen, and Halogens and it can cause suffocation and may displace Oxygen in a workplace atmosphere.

Flash Point: Not applicable, this material is a gas
Flammability LEL & UEL Limits in Air: 4.0% to 5.0%
Auto-ignition Temperature: 500°C
Appearance: Colourless
Odour: No Odour
Vapour Density: 0.082 g/L (much lighter than air)
Boiling Point: -252.9°C
Molecular Weight: 2.02
Chemical Stability: Hydrogen is stable
Conditions to Avoid: Sources of ignition, exposure to air
Extinguishing Media: None

Monitoring and detecting Hydrogen

Hydrogen is comparatively lighter than air and any sensors used to monitor for its presence should be typically mounted above the leakage source or in the path of the return air duct, if the room is air conditioned. Hydrogen sensors can monitor either % LEL or ppm, but the latter provides an earlier warning of any leakage occurring.

Due to the low ignition energy required, calibration and configuration of devices monitoring for Hydrogen should not be done in live or hot conditions unless the device has a non-intrusive way of doing calibration (i.e. without opening the covers the calibration can be either done by Intrinsic Safe IR remote control or Magnets).

Honeywell Analytics provides a number of solutions for the detection of Hydrogen gas in either a % LEL or ppm format:

Midas:



Midas is a gas monitoring system that provides fast and reliable response to the presence of a wide range of gases including Hydrogen (0-100% LEL / 0-1000ppm). With low cost of ownership through a combination of extended sensor calibration periods, flexible communications architecture and patented diagnostics that monitor sensor performance and flow control, Midas provides a robust solution for a wide array of applications.

Apex:



Apex is a flexible transmitter that can meet the tough demands of a wide array of industries and applications. With high performance, enhanced functionality, installation flexibility, a wide range of accessories and a choice of communication outputs, Apex offers unrivalled versatility. Sensors can be mounted up to 100m from the transmitter and for extra ease of use, Apex works with pre-calibrated smart sensors that are simple to change and can even be changed over when the device is powered.

References

- Book of SEMI Standards, Facilities Standards and Safety Guidelines. Mountain View, CA: Semiconductor Equipment and Materials International, 1993.
- Borak, Jonathan, M.D., Michael Callan and William Abbott, Hazardous Materials Exposure: Emergency Response and Patient Care. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1991.
- Braker, William and Allen L. Mossman, Matheson Gas Data Book (Sixth Edition). Lyndhurst, NJ: Matheson, 1980.
- Documentation of TLV's and BEI's. Cincinnati, Ohio: American Conference of Government Industrial Hygienists, 1992.
- Fire Protection Guide on Hazardous Materials. Quincy, MA: National Fire Protection Association, 1993.
- Material Safety Data Sheet: Hydrogen. Irvington, NJ: Spectra Gases, Inc., 1992.
- Safe Handling of Compressed Gases in Containers (Pamphlet P-1). Arlington, VA: Compressed Gas Association, Inc., 1991.
- Voltaix, Inc.: Post Office Box 5357, North Branch, New Jersey 08876-5357 USA Voice: 908-231-9060 or 800-VOLTAX, Facsimile: 908-231-9063
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Honeywell cannot guarantee that these are the only hazards that exist. Users are solely responsible for the proper operation and maintenance of gas detection equipment, safe storage, handling, use and disposal of Hydrogen cylinders, and for compliance with the applicable laws, regulations, authority having jurisdiction and accepted safe practices.