



SAFETY TRAINING LEAFLET 07 HYDROGEN

AIGA 009.07/26

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1 Introduction

1.1 Safety leaflets

Safety training leaflets summarise the basic operational safety knowledge which needs to be known by employees working in the gas industry.

Refer to AIGA 009 *Safety Training of Employees* for the various combinations of leaflets which define the scope of safety training for a variety of specific jobs.

Each leaflet addresses a specific topic as identified in the title.

1.2 Comprehension tests

There is a comprehension test for each leaflet, included in **Appendix 1**.

Each test comprises several questions. To pass the test it is suggested that the employee should score 75% at the first attempt. Incorrect answers should be discussed to confirm understanding.

Appendix 2 includes the list of correct answers.

2 Hydrogen

2.1 Properties of hydrogen

Hydrogen is referred to as H₂. It is a colourless, odourless and tasteless gas. It is non-toxic but does not support life and acts as an asphyxiant. It is the lightest element (and gas) known.

Hydrogen is highly flammable, and most mixtures of hydrogen and air will burn or even explode. It ignites more easily than any other common gas and a high-pressure leak can even ignite spontaneously. It burns with a hot and almost invisible flame. Hydrogen fires are difficult to extinguish. If you do extinguish a hydrogen flame and do not stop the flow of hydrogen, the escaping gas can be re-ignited, sometimes explosively.

3 Precautions with hydrogen

- When approaching a hydrogen leak, hold some readily combustible material such as a rolled-up newspaper or a straw broom in front of you.
- To extinguish a hydrogen fire, shut off the source of supply, provided that this can be done safely. If the hydrogen supply cannot be shut off keep nearby equipment cool by drenching with water until the flame has extinguished itself.
- Never release or vent hydrogen into buildings or confined spaces.
- Ensure that buildings in which hydrogen is stored or handled have adequate ventilation at high and low levels to prevent the build-up of an explosive atmosphere, especially in the ceiling. Keep all ventilation openings clear and do not block them for any reason.
- Do not smoke or bring matches and lighters into an area where hydrogen is manufactured, stored or used.
- Do not bring to any hydrogen installation any unauthorised electrical equipment such as torches, radios or power tools. Use only approved lighting apparatus.
- Do not carry out any hot work such as cutting, grinding, welding or soldering on a hydrogen installation. When hot work is necessary obtain a work permit - see Leaflet 23.
- Do not tamper with or damage grounding (earthing) systems; they are provided to prevent the accumulation of static electric charges which could act as a source of ignition.

- Before opening plant and equipment on a hydrogen installation for maintenance or any other purpose obtain a work permit. This permit will require all pipes and vessels to be purged with nitrogen before work commences.
- Before admitting hydrogen into a system, purge it with nitrogen to ensure that a flammable mixture cannot be developed. For liquid hydrogen system, a helium purge is required after or before the nitrogen purge.
- Never vent hydrogen from a high-pressure source, such as a cylinder, in order to remove contaminants. Always use an external source of nitrogen or air for this purpose.
- It is recommended to either permanently or periodically monitor hydrogen systems (pressure vessels and piping) using explosive atmosphere detectors in order to identify leaks as early as possible and take necessary corrective actions.

4 Hydrogen cylinders and tube trailers filling hazards and prevention measures

- You must know how to stop the cylinder-filling process in case of an emergency.
- When not connected to the filling rack, cylinders must be capped and secured against falling.
- Do not mix hydrogen with oxidising gases, because a violent explosion might occur.

5 Liquid hydrogen storage specific hazards and prevention measures.

- Liquid hydrogen storage tanks are registered pressure vessels, you must know what the marks on the identification plate mean. Tank pressure monitoring and control is critical, operating instructions must be known and followed, uncontrolled deviations shall be reported immediately.
- Pressure relief devices protect storage tanks against overpressure hazards, you must know their set points.
- Operation of liquid hydrogen storage tanks requires specific instructions and training. Storage tank and its surroundings must be kept in a tidy condition and not used for storage.
- Immediately report any abnormal condition.

Appendix 1 – HYDROGEN – Test Questions

Tick the correct answer (s) or write in the blank spaces as requested.

1. Tick the characteristics of Hydrogen:
A. Flammable
B. Odourless, colourless and tasteless
C. Much heavier than air
D. Smell sweet
E. Much lighter than air
2. Hydrogen burns with a hot and almost invisible flame during daylight
A. True
B. False
3. Tick the appropriate: "To extinguish a hydrogen fire
A. Shut off the source of supply, provided this can be done safely
B. Try to extinguish the flame at the appropriate distance
C. Only using foam
4. Why is so important to ground (earth) installations which handle hydrogen?
A. To prevent electrocution
B. To extinguish hydrogen fires
C. To prevent accumulation of static electric charges
D. To prevent pipe corrosion
5. Before opening plant and equipment on a hydrogen installation for maintenance or other purpose obtain a Hazardous Work Permit
A. True
B. False
6. Mixtures of Hydrogen are incompatible with :
A. Inert gases
B. Helium
D. Oxidising gases
E. Air
7. Hydrogen due to its characteristics can be used to remove contaminants like dust from clothing or debris in cylinder valves, provided it is done from a high pressure source such a cylinder:
A. True
B. False
8. Before admitting hydrogen into a system, purge it with nitrogen to ensure that a flammable mixture cannot be developed.
A. True
B. False

Appendix 2 – HYDROGEN – Test Answers

1. A, B and E
2. A
3. A
4. C
5. A
6. D and E
7. B
8. A