



**SAFETY TRAINING LEAFLET 08
ACETYLENE, CALCIUM CARBIDE,
LIME SLUDGE
AND PURIFYING MATERIALS**

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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 Acetylene

Acetylene is a gas, often referred to as C₂H₂; when in cylinders it is known as Dissolved Acetylene (DA). Acetylene is colourless, invisible, slightly lighter than air, non-toxic and can cause asphyxiation. Industrial acetylene, because it is slightly impure, smells like garlic.

Acetylene burns in air with an intensely hot, luminous and smoky flame. Acetylene/air mixtures are flammable over a very wide range (2.3 to 82%). Mixtures of acetylene and air ignite or explode easily; this reaction can be started by ignition sources such as sparks, small flames or hot spots.

- To extinguish an acetylene fire, shut off the source of supply, provided that this can be done safely. If the acetylene supply cannot be shut off, keep nearby equipment cool by drenching with water until the flame has extinguished itself.
- Never release or vent acetylene into buildings or confined spaces.
- Ensure that buildings in which acetylene is manufactured, stored or used have adequate ventilation. Keep all ventilation openings clear and do not block them for any reason.
- Do not smoke or bring matches or lighters into an area where acetylene is manufactured, stored or used.
- Do not bring to any acetylene installation any unauthorised electrical equipment such as electric torch, radios or power tools. Use only certified flameproof tools and lighting devices.
- Do not carry out any work which could produce hot spots or sparks such as grinding, cutting, welding or soldering in an acetylene plant. When it is necessary, obtain a Work Permit - see Leaflet 22.
- Do not tamper with or damage grounding systems; they are provided to prevent the accumulation of static electric charges which could act as a source of ignition.
- Before opening plant equipment in an acetylene plant for either maintenance or cleaning, obtain a Work Permit. This Permit will require all pipes and vessels to be isolated and purged with nitrogen before work commences when safe atmosphere is restored.
- Before admitting acetylene into a system, purge with nitrogen to ensure that a flammable mixture cannot be developed.

When heated or compressed above normal operating limits acetylene may decompose and explode.

- Never heat a pipe or vessel containing acetylene.
- Open and close valves in acetylene systems slowly.
- Avoid rapid increases in pressure in acetylene systems, for instance on cylinder charging racks.

Only certain materials are suitable for use with acetylene; in particular, acetylene forms explosive compounds with copper, silver and mercury.

- Never use copper, silver or mercury in acetylene plants.
- Report to your supervisor if you see any copper, silver or mercury in an acetylene plant and check with him that any materials which you use are approved.

3 Calcium Carbide

Calcium carbide is a solid, manufactured from coke and lime. It is delivered either in steel drums or containers. The size of carbide particles can vary from supplier to supplier.

- Become familiar with the size ranges normally used and report any change to your supervisor.

Calcium carbide reacts spontaneously with water and forms acetylene, lime sludge, some impurities and produces heat. In the normal process for production of acetylene, water must be in excess to carry off the heat which is formed, and temperature must be closely monitored.

- Always maintain adequate water flow to generators.

Calcium carbide also absorbs moisture from the air; this reaction also produces acetylene and heat. As there is no excess water, hot spots can form on the surface of the carbide and ignite the surrounding acetylene.

- Avoid accidental contact between carbide and water or moist air.
- Regularly remove carbide dust and dispose of it according to instructions.

If carbide drums or containers are not perfectly airtight, air and moisture can enter and react with the carbide to produce acetylene. If this happens, there is a possibility of explosion, particularly when the drums are opened:

- Do not handle drums roughly; in particular, do not drop them.
- Do not open hot or swollen drums.
- Keep drums closed when not in use.
- Open drums according to company procedures.
- Empty drums completely.
- Report damaged containers to your supervisor.

4 Lime Sludge

Lime sludge contains acetylene which has been dissolved in the water of the generator. It may also contain particles of calcium carbide which have not finished reacting with the water completely; these particles can produce acetylene.

- Ensure that areas where lime sludge is handled are well ventilated and that the rules for smoking, unauthorised electrical equipment and hot work are the same as those for acetylene.

Lime sludge contains chemical impurities like ammonia, hydrogen sulphide and phosphine, which can be irritating or toxic.

- When handling lime sludge, in pits or drains for instance, use protective equipment and clothing as instructed e.g. boots, goggles, gloves and masks.

5 Purifying Materials

Most acetylene production processes use chemicals for drying and purifying the gas.

- Follow the general rules given in Leaflet 20 and always wear the appropriate protective clothing and equipment when handling these materials.

Appendix 1 – ACETYLENE, CALCIUM CARBIDE, LIME SLUDGE AND PURIFYING MATERIALS – Test Questions

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

1. Tick at least two characteristics of Acetylene:
A. Flammable
B. Odourless
C. Inert
D. Colourless
E. Can decompose
F. Toxic
2. Acetylene is much heavier than air
A. True
B. False
3. Tick the appropriate: "To extinguish an acetylene 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. Acetylene forms flammable mixtures with air from:
A. 24%
B. 4%
C. 2.3%
D. 20%
5. Which are the characteristics of calcium carbide?
A. It is flammable and explosive
B. It reacts with water, producing a great amount of heat and acetylene gas
C. It gives off toxic vapours in contact with acetone
6. Tick which of the following materials are incompatible with acetylene:
A. Carbon steel
B. P.V.C.
C. Copper
D. Silver
E. Stainless steel
7. When handling lime sludge, a series of safety measures must be followed. Out of the following, tick the compulsory ones:
A. Do not use grease in materials that are in contact with acetylene
B. No smoking
C. Use cotton gloves
D. Ensure that areas are well ventilated
8. Tick the suitable extinguishing agent for calcium carbide fires.
A. Water
B. Foam
C. Dry sand.
D. Damp sand

Appendix 2 – ACETYLENE, CALCIUM CARBIDE, LIME SLUDGE & PURIFYING MATERIALS – Test Answers

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