

BRITISH COMPRESSED GASES ASSOCIATION



Registered office:
4a Mallard Way, Pride Park, Derby, UK. DE24 8GX
Company Number: 71798, England
www.bcga.co.uk



SAFETY ALERT

SAFETY ALERT 2

HYDROGEN AND OXYGEN FLAMES GENERATED FROM ELECTROLYSIS OF WATER – SAFETY DEVICES

Background

Over recent years technical improvements to the process of producing hydrogen and oxygen through the electrolysis of water has improved to the point where such equipment is now commercially available and is able to supply a sufficient quantity of the gases to produce a viable flame capable of use in some welding, cutting and other allied operations.

There are two basic designs for these electrolyzers. Broadly they may be characterized as:

Type 1. Mixed gas designs (known as HHO) that generate and deliver a stoichiometric mixture of hydrogen and oxygen straight from the unit. Hydrogen and oxygen are not separated and it is not possible to change the ratio of hydrogen and oxygen. This hydrogen and oxygen then flows via one hose to a torch or nozzle to deliver a mixed gas ready to ignite.

Type 2. A generator that delivers completely separate streams of hydrogen and oxygen via separate hoses. The gases are then mixed back together at the torch or nozzle either to deliver a pre-mixture or after the torch or nozzle to deliver a post mixture, ready for ignition.

Concerns

Hydrogen and oxygen, whether generated from electrolysis of water or from other more traditional means, such as gas cylinders, can form a flammable mixture. As such, any system designed to mix these gases together in order to create a flame requires appropriate certified safety devices to be fitted to protect the gas source and ensure the safety of the operator. In particular, protection is required from flashback and, to achieve this, flame arrestors should always be installed.

Flashbacks are caused either by a reverse flow of oxygen into the fuel gas hose or from fuel into the oxygen hose, therefore producing a flammable mixture within the hose. A flame can then burn back through the torch or nozzle into the hose and has the potential to reach the regulator and the gas source. Flashbacks can result in damage or destruction of equipment, with the potential to harm the operator.

Safety

All welding, cutting and allied activities require that a system of equipment is designed and then connected together to produce a flame in a safe and usable way.

BCGA provide guidance on safe oxy-fuel systems in Code of Practice 7, *The safe use of oxy-fuel gas equipment (individual portable or mobile cylinder supply)*.

Safety devices shall conform to a suitable recognised standard, such as BS EN ISO 5175, *Gas welding equipment. Safety devices*, and be suitable for the required conditions of service (type of gas used, maximum operating pressure, minimum operating flow, etc.).

A flame arrestor is a safety device which extinguishes a flame front (for example, caused by a flashback) at the point of installation (and is often referred to as a flashback arrestor). A composite safety device may incorporate several individual safety devices such as a flame arresting element, a non-return valve and a fast acting shut-off device, for example, a temperature sensitive shut off valve and / or a pressure sensitive shut-off valve.

Flame arrestors (or a composite safety device) should be marked with the direction of (normal) gas flow, a manufacture or an inspection / replacement date and the manufacturing standard.

All safety devices should be routinely checked for their presence, suitability and condition, including in the event of a (suspected) flashback. They should be replaced if damaged, regardless of the theoretical life. BCGA CP 7 provides guidance.

Choosing the correct flame arrestor

On Type 2 systems flame arrestors shall comply with a suitable recognised standard, such as BS EN ISO 5175. However, BS EN ISO 5175 does not cover Type 1 flame arrestors as it “... *does not apply to the use of safety devices incorporating flame arrestors for applications with premixed oxy/fuel or air/fuel gas supply systems, e.g. downstream of gas mixers or a generator to produce hydrogen/oxygen mixture by electrolytic decomposition of water.*” Therefore, when choosing a flame arrestor for use in Type 1 systems the Manufacturer of the device shall be consulted to ensure the device has a clear technical justification for use with HHO or mixed gas designs.

The flame arrestor shall be specifically tested for use with HHO or mixed gas designs by a 3rd party, be clearly marked for its compatibility and use with hydrogen / oxygen and be suitable for the specific electrolyser with which it is to be used.

The flame arrestor shall be mounted in the direction of normal gas flow.

For Type 1 systems a flame arrestor shall be fitted at the hose end connecting to the torch or nozzle. An additional flame arrestor may be installed on the outlet of the generator.

For Type 2 systems, as a minimum, a flame arrestor shall be fitted at the outlet of the generator. It is recommended that a flame arrestor is also fitted at the hose end connecting to the torch or nozzle.

In both cases hose lengths should be the minimum necessary.

The flame arrestor shall only be used within its life period. Note that a date is stamped on the body to identify its life, generally they have a five year life. BCGA TIS 18, *Date marking of gas accessories*, provides further information on date marking.

BCGA CP 7 provides further information on the selection, location and use of safety devices.

References

- 1) BS EN ISO 5175, *Gas welding equipment. Safety devices*.
- 2) BCGA Code of Practice 7, *The safe use of oxy-fuel gas equipment (individual portable or mobile cylinder supply)*.
- 3) BCGA Technical Information Sheet 18, *Date marking of gas accessories*.

For more information

British Standards Institute (BSI)

www.bsigroup.co.uk

British Compressed Gases Association (BCGA)

www.bcga.co.uk