

## SAFETY CIRCULAR ON THE USE OF OXYGEN-FUEL GAS EQUIPMENT



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### INTRODUCTION

Oxygen-fuel (oxy-fuel) gas equipment are portable, easy to operate and widely used for heating and cutting operation. The commonly used fuel gases include acetylene and Liquefied Petroleum Gas (LPG). The oxy-fuel equipment could be highly hazardous and cause serious accidents when not used properly.

It is important that safety guidelines are followed when using oxy-fuel gas equipment.

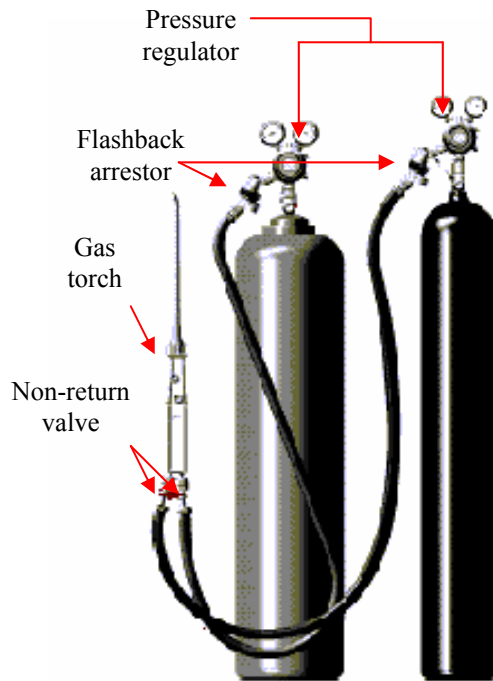
### COMPONENTS OF OXY-FUEL GAS EQUIPMENT

Oxy-fuel gas equipment consists of the following:

- ❖ cylinders of oxygen and fuel gas (e.g. acetylene)
- ❖ a pressure regulator fitted to the outlet of each gas cylinder
- ❖ a suitable flashback arrestor fitted to each pressure regulator
- ❖ a gas torch
- ❖ a suitable non-return valve (check valve) fitted between each gas torch inlet and gas hose

The gases are drawn from cylinders through flexible hoses and mixed in the gas torch to produce the flame

for heating or cutting operation. The pressure regulators serve to reduce and control the gas pressure.



**Figure 1** Components of oxy-fuel gas equipment

### HAZARDS IN USING OXY-FUEL GAS EQUIPMENT

The use of oxy-fuel gas equipment could lead to accidents if safe work practices are not followed. Workers could suffer minor burns as well as serious bodily injury or fatality.

The main hazards associated with oxy-fuel gas equipment are fire and explosion. They are mainly caused by:

- ❖ the presence of flammable substances at the work area

- ❖ the unsafe use of lighted gas torch
- ❖ gas leaks from hoses, valves and other equipment
- ❖ flashbacks
- ❖ the unsafe handling of oxygen



**Figure 2** Burns on hand of worker as a result of flashbacks

## SAFE WORK ENVIRONMENT

It is a good practice to implement a **permit-to-work** system for hot work. A hazard assessment of the work area should be first carried out to ensure that the surroundings are free from flammable and explosive substances.

All workers must be trained in the safe use of equipment and instructed on the necessary precautions to be taken. Appropriate personal protective equipment must also be provided with fire-fighting equipment readily available at the work area.

## SAFE USE OF GAS TORCH

Always ensure that only suitable types of gas torches are used. When the gas torch tip openings are

clogged, they should be cleaned with the appropriate appliances. The operating valves of a gas torch should also be constructed or protected such that they cannot be opened accidentally.

When carrying out hot work, always ensure that:

- ❖ work surroundings are free from flammable substances
- ❖ hoses are free from contact with flames, sparks or other heat sources
- ❖ the gas torch is shut off immediately after use
- ❖ gas cylinders are kept at a safe distance from heat sources

## HOSES AND CONNECTIONS

Only hoses meant for gas cutting operation should be used for the supply of oxygen and fuel gas. The following colour coding is used to identify the hose for the different gases:

Gas	Colour of cover
Acetylene	Red
Oxygen	Blue
LPG	Orange

Source: Singapore Standard CP 50

**Table 1** Colour Coding of hoses

Hose connections must be clamped or securely fastened in a manner that it can withstand at least twice the pressure to which they are normally subjected in service, but in no case

less than a pressure of 2.1 MN/m<sup>2</sup> (300 psi). **No jubilee clip shall be used as a hose clamping device.**



**Figure 3** Jubilee clip shall not be used for hose connections

The use of jubilee clips could cause gas leaks due to under-tightened (loosened connections) or over-tightened (cut into hose) conditions.

Always regularly inspect and test the gas hoses for leaks, external burns and other defects. A defective hose must be repaired or replaced immediately.

## FLASHBACKS

A flashback could occur when there is a reverse flow of oxygen into the fuel gas hose (or fuel into the oxygen hose), producing an explosive mixture in the hose. The flame could then burn back through the gas torch, into the hose and may even reach the cylinders. A flashback may also result in an explosion of the cylinder.

In protecting gas equipment and users, a suitable **flashback arrestor must be fitted at the pressure regulator outlet** of every gas

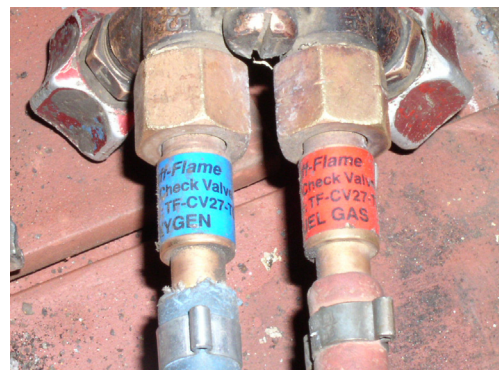
cylinder. Additional flashback arrestors may be also fitted at the gas torch inlets as an added protection.

A list of approved flashback arrestors can be found on our website: [http://www.mom.gov.sg/MOM/OSD/SafetyCirculars/1366 ApprovedFlashbackArrestors.pdf](http://www.mom.gov.sg/MOM/OSD/SafetyCirculars/1366%20ApprovedFlashbackArrestors.pdf)



**Figure 4** Flashback arrestor fitted at the outlet of a pressure regulator

To prevent backflow of gases, a suitable **non-return valve (check valve) must be fitted between each gas torch inlet and gas hose** from the oxy-fuel equipment.



**Figure 5** Non-return valves fitted at inlets of a gas torch

## SAFE HANDLING OF OXYGEN

Oxygen contamination increases the risk of fire. While oxygen will not burn, it supports and accelerates combustion. It could cause explosions if use with incompatible materials.

In particular, oxygen reacts explosively with oil and grease. It must always be followed that oxygen cylinders are not handled with oily hands or gloves. Care must be taken to ensure that oil or grease does not come into contact with oxygen valves or cylinder fittings.

### ***Accident Case: 13 January 2004***

An explosion of oxygen cylinder followed by a fire occurred in a factory arising from the use of oxy-acetylene gas equipment. Four persons were killed and another two workers were injured in the accident.



**Figure 6** Aftermath of the accident

## SAFE OPERATING PROCEDURES

Follow these safe operating procedures when using oxy-fuel gas equipment:

- ❖ visually examine all equipment and fittings before use
- ❖ check hoses for cuts, cracks and other defects
- ❖ wear the necessary personal protective equipment
- ❖ check that there is no flammable substances nearby
- ❖ purge the hoses individually before lighting the gas torch
- ❖ use only flint guns or spark lighters to light the gas torch
- ❖ lay out hoses properly to prevent coming into contact with heat sources
- ❖ secure all gas cylinders to prevent them from being knocked down and keep them at a safe distance from heat sources
- ❖ ensure fire-fighting equipment are readily available for immediate use
- ❖ shut off gas valves at cylinders and disconnect hoses from supply valves when operation ceases

For more safety requirements on the use of oxy-fuel gas equipment, please refer to **Singapore Standard CP 50** Code of Practice for Safety in Welding and Cutting (and Other Operations Involving the Use of Heat).

Under the **Factories (Singapore Standards and Codes of Practice) Order 2001**, it is a mandatory requirement for factory occupiers to comply with Singapore Standard CP 50.