Safety Information

Prepared by the Safety Advisory Council and WG-2 Safety Info 16/21

Fires in Cylinder Regulators in Industrial Oxygen in Service

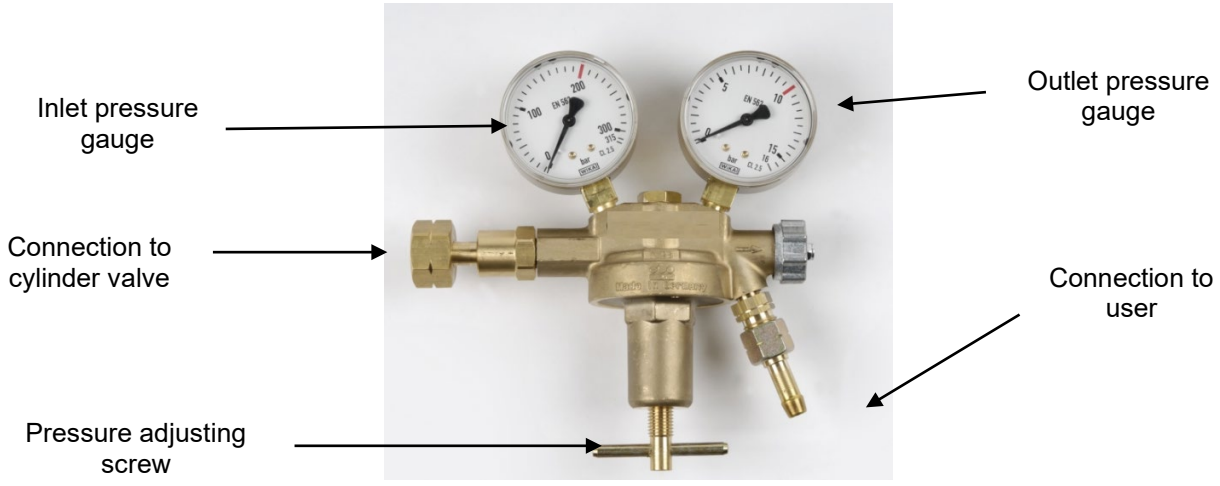
The Safety Advisory Council of EIGA (SAC) receives reports of incidents involving fires in oxygen gas cylinder regulators.

Incidents involving oxygen gas cylinder regulators may result in both injury and property damage, yet a number of simple precautions will ensure that these regulators operate without incident. Investigation of incidents involving oxygen gas cylinder regulators has shown that there are a number of common areas of concern.

The function of a gas cylinder regulator is to reduce the pressure in a gas cylinder to a pressure suitable for the process connected to the regulator. Most gas cylinder regulators are connected to the gas cylinder by the user, though there are some cylinder valves that incorporate a cylinder regulator built into the valve, commonly referred to as a "Valve with an Integrated Regulator", VIPR. This Safety Information does not apply to these types of regulators, which are covered by EN ISO 22435.

The gas cylinder regulator is a relatively simple item of equipment. The inlet to the regulator is connected to the gas cylinder with a connection compatible for the oxygen gas cylinder. The pressure regulating function is contained within the body of the regulator. There is a pressure adjusting screw, (referred to as a handle or knob) for pressure adjustment and usually pressure gauges to indicate the pressure in the gas cylinder and the usage pressure. Within the regulator body there is the regulating mechanism. This regulating mechanism carries out the pressure reduction process and in some regulators this is carried out in two stages and in others in only one stage. The advantage of the "two stage" regulator is that it will produce a more stable pressure reduction which is required for some processes.

Regulators are constructed from a variety of metallic and non-metallic components.



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National and international standards define the design and test requirements for gas cylinder regulators and oxygen regulators, for example EN ISO 2503. Oxygen regulators manufactured to these standards will perform safely if used and maintained in accordance with the manufacturers' instructions.

What can go wrong?

Almost every material will burn in pure oxygen, though some materials are less likely to burn in oxygen, and considerable work has been carried out to investigate the degree to which materials will burn in oxygen. A fire will occur if three components are present; oxygen, fuel and an ignition source. Obviously in an oxygen regulator oxygen is always present so the objective is to minimise the fuel and ignition sources.

Fuel

Some materials are less likely to burn in oxygen, and in particular metals compared to elastomers and other non-metals. A regulator should be designed and constructed using the minimum amount of non-metallic materials. As brass is one of the metals least likely to burn in oxygen, metallic components of oxygen regulators should be made from brass, though in some very limited applications other metals than brass are used. In order to provide gas sealing and pressure regulation, there is a need for non-metallic components. In this case there needs to be careful selection of the materials and the design of the regulator as well to minimise the amount non-metallic materials.

It is essential for the user and anyone who maintains a regulator to only use replacement components that are of an equivalent standard to the original design standard

Ignition source

An ignition source could be as minor as a particle that, at high velocity, strikes a component of the regulator which can generate sufficient heat to start a fire in regulator. A regulator should be manufactured and maintained in facilities where there is no risk of particles entering the regulator. This should avoid particle generation. Particles may enter the regulator during use and a common source of particles is foreign material from the outlet of the cylinder valve. For this reason, before connecting a cylinder regulator to a gas cylinder valve, the valve outlet should be wiped with a clean cloth to remove any particles. Regulators usually have a filter in the connection pipe to the regulator from the cylinder, but good practice avoids any particles.

Use

Where an oxygen regulator is connected to a process such as cutting or welding and where a fuel gas, (such as acetylene) is being used there is a risk of a flashback to the regulator. To avoid the risk of a flashback, a "flashback" arrestor should be installed to protect the regulator and cylinder.

Personnel shall be trained on the use of oxygen regulators and the importance of "backing the regulator off" before connecting and gas cylinder valves should be opened slowly to reduce the risk of excessive heat due to adiabatic compression.

When not connected to a gas cylinder, regulators should be stored in a clean, dry and oil free environment with inlet and outlet connections capped.

In all cases the manufacturer's instructions should be followed.

Maintenance

An oxygen regulator may be used in an environment where it could be damaged. When any component is damaged, for example the pressure gauges, these should be repaired in accordance with the manufacturer's instructions at a facility authorised to carry out the work using components of an equivalent specification to the original equipment. It is recommended that regulators be maintained in accordance with the manufacturers' instructions at authorised facilities and at intervals recommended by the manufacturer.

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Purchase

Only purchase oxygen cylinder regulators built in accordance with a recognised standard, for example EN ISO 2503. Purchase either directly from the supplier or their authorised agent.

Summary

- EIGA recommends to users to only purchase regulators manufactured to a recognised standard, e.g. EN ISO 2503, either directly from the manufacturer or their authorised agent.
- Use a regulator in accordance with the manufacturer's instructions.
- Ensure that the outlet of the cylinder valve is clean and free from contamination.
- Ensure the inlet of the regulator is clean and free from contamination and that it has not been modified.
- Repair and maintain the regulator in accordance with the manufacturers' instructions at authorised repair facilities.

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