

Colorno, 14/01/2019

**SUBJECT: Hoses AT7, AT8, AT8S, MTHAT1, MTHAT2 series**  
**Guidelines for the use with high pressure oxygen**

The use of flexible hoses for the passage of high pressure oxygen presents some sources of danger that are good to know and avoid. This document gives some indications and recommendations to use ZEC hoses safely.

#### Application field

Typical examples of use of flexible hoses with high pressure oxygen are the pressure regulating stations, cylinders supply systems or the centralised welding equipment, in which the hose is connected on one side to the oxygen supply system and on the other side to the decompression station or to the first stage of pressure reduction. Even oxygen enriched mixtures, such as those used in diving, can present risks.

ZEC hoses belonging to series AT7, AT8, AT8S, MTHAT1, MTHAT2 must not be used for the direct connection to the welding torch, for the conveying of acetylene or for the direct connection with respiratory protective devices.

#### Problems

The main causes of failure of a flexible hose with high pressure oxygen are [1]:

- Contamination. In particular with greases and oils that have a low auto ignition temperature in oxygen. The presence of contaminants could cause a flame fuelled by oxygen that can burn the hose.
- Rapid pressurization and depressurization. Rapid changing of pressure, for example caused by the sudden opening or closing of a valve can create adiabatic compression inside the hose that could increase the temperature up to the autogenous ignition temperature of the materials. Failures caused by adiabatic compression are favoured by the presence of contaminants.
- Presence of particles. Free particles inside the hoses flow along the hose together with the gas. The impact of these particles can cause the increase of the temperature and then the ignition. The particles, above all if they are metallic, could generate static electricity and cause electrostatic discharge.

#### Recommendations

Each of the causes listed must be reduced as much as possible. For these reasons ZEC S.p.A. suggests to follow these guidelines when using the hoses in applications with high pressure oxygen.

##### Cleaning

For the crimping process shall not be used lubricants and, after the crimping, the hoses must be cleaned to remove any trace of oil, grease and metallic particles. The suggested cleaning procedure consists of a flushing with compatible solvents, then a drying and the sealing of the hose in clean container to avoid contaminations during the transport. Please contact ZEC technical department to have a confirmation about the compatibility of the solvents with the chosen hose. Consult [2] and [3] for further information about the cleaning for oxygen.

The utmost care in cleaning shall be maintained in the system. We advise to use filters at the exit of the cylinders and to clean carefully all the valves connected to the hose.

##### Avoid rapid pressurizations and depressurizations

Rapid pressurizations shall be avoided using appropriate valves. The systems shall be designed to avoid any dead-end or plug at the end of the hoses. The manual or automatic opening of the oxygen supply system must be performed as slowly as possible.

In case this should be difficult we recommend using a hose with PTFE inner core that has a higher auto ignition temperature. Please note that the only choice of PTFE inner core hose, without implementing all the other recommendations, is not sufficient to avoid the self-ignition phenomenon.

##### Restraining cables

For working pressure exceeding 40 bar is recommended the use of safety cables [4] to prevent hoses from flailing around in case of rupture of the hose. The cables must be firmly fixed on both ends and must be designed in accordance with the requirements specified in [5].

##### Distance pieces

The use of metallic distant pieces is recommended where valves, regulators or other passage closure devices are present at the end of a hose assembly. The aim of a metallic distance piece is to absorb and to dissipate the thermal energy generated from the rapid compressions and prevents that this energy could be discharged on the hose liner. The distance pieces can be made of copper, steel or brass. They can be straight or bent to be adapted to the system. The recommended length is more than 150 mm for each meter of hose. Please consult [4, appendix C] and [6] to have further information about the design of suitable distance pieces.

To have further information and to select the most appropriate hose, please contact the ZEC staff.

ZEC S.p.A.

- [1] EIGA Doc 42/16 – *Flexible Connections in high pressure gas systems.*
- [2] EIGA Doc 33 – *Cleaning of equipment for oxygen service.*
- [3] ASTM G93-96 – *Standard Practice for Cleaning Methods and Cleanliness Levels for Material and Equipment Used in Oxygen-Enriched Environments.*
- [4] EN ISO 14113:2013 – *Gas welding equipment. Rubber and plastic hose and hose assemblies for use with industrial gases up to 450 bar (45MPa).*
- [5] ASTM STP 1319
- [6] ISO 16964 – *Gas cylinder - Flexible hoses assemblies - Specification and testing.*