



CONVERSION OF CRYOGENIC TRANSPORT TANKS TO OXYGEN SERVICE

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EUROPEAN INDUSTRIAL GASES ASSOCIATION AISBL



AVENUE DES ARTS 3-5 • B – 1210 BRUSSELS
Tel: +32 2 217 70 98 • Fax: +32 2 219 85 14
E-mail: info@eiga.eu • Internet: www.eiga.eu





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Prepared by WG-6 Cryogenic Vessels

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EUROPEAN INDUSTRIAL GASES ASSOCIATION AISBL
Avenue des Arts 3-5 B 1210 Brussels Tel +32 2 217 70 98 Fax +32 2 219 85 14
E-mail: info@eiga.eu Internet: www.eiga.eu



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Amendments to 08/07

Section	Change
	Editorial to align style with IHC associations
1	Clarification and explanation of the risks of conversion to oxygen service
2	Change in scope for nitrogen, argon and nitrous oxide
3	Update to competent person definition
4	Complete re-write and re-draw of process flow diagram
6	Additional detail and re-draw of process flow diagram
Annex	Minor updates

NOTE Technical changes from the previous edition are underlined

1 Introduction

The transportation of oxygen as a refrigerated liquid has been practised for decades. The technology and working practices are well established and well known, being covered in international transport regulations, standards and industry publications.

When converting a cryogenic transport tank, which has previously been used for liquid nitrogen (LIN) or liquid argon (LAR), to liquid oxygen (LOX), contaminants, typically hydrocarbons, which have no safety implications in the inert gas can constitute a fire risk in oxygen. Contaminants and hydrocarbons can easily be ignited in liquid oxygen and can promote ignition of other materials not normally considered fuel in a fire, for example metals. Oxygen fires are intense and lead to violent reactions often with failure of pressure equipment and energy release. Ignition of an oxygen fire requires significantly less energy than conventional fires and may be started by mechanisms such as particle impact, mechanical impact and friction. See EIGA Doc 13 *Oxygen Pipeline and Piping Systems* and EIGA Doc 200 *Design, Manufacture, Installation, Operations and Maintenance of Valves Used in Liquid Oxygen and Cold Gaseous Oxygen Systems* for more information [1, 2].¹

Conversion of nitrogen and argon transport tanks into oxygen service should be avoided where possible to avoid risks posed by contamination and hydrocarbons in oxygen service. If a transport tank is to be converted to oxygen service care shall be taken to examine service records and operation, check materials for oxygen compatibility, check for contamination and complete purging into oxygen service following a prescribed procedure.

Transport tanks in carbon dioxide or flammable service shall not be converted to oxygen service due to reasons such as the incompatibility of contaminants with oxygen, materials, design etc.

2 Scope and purpose

2.1 Scope

This publication provides the principles for checking the suitability for oxygen service of a transport tank, the methods for checking for hydrocarbon contamination and procedure for converting to oxygen service from liquid nitrogen or liquid argon service.

This publication may be used as a guide for conversion of nitrous oxide transport tanks to oxygen service. It may also be used as a guide for conversion of transport tanks to nitrous oxide service (instead of oxygen service).

This publication covers the hazards associated with contamination and materials in the conversion of a transport tank to oxygen service. It does not cover the legislative requirements in conversion to oxygen service (for example ADR requirements and gross vehicle weights amongst others [3]).

The main safety features outlined in this publication are the use of non-return valves to prevent back contamination and the warming-up procedures for hydrocarbon removal.

2.2 Purpose

This publication is intended to provide guidance to companies, when preparing new procedures or reviewing existing practices, for converting a cryogenic transport tank into oxygen service. It is not intended that the typical procedures given here are taken directly as work instructions or given to operators. The principles described require review by individual companies for implementation in conjunction with both specific equipment and working practices. The hazards of converting a cryogenic transport tank contaminated by hydrocarbons into oxygen service are outlined in Appendix A.

¹ References are shown by bracketed numbers and are listed in order of appearance in the reference section.

3 Definitions

For the purpose of this publication, the following definitions apply.

3.1 Publication terminology

3.1.1 Shall

Indicates that the procedure is mandatory. It is used wherever the criterion for conformance to specific recommendations allows no deviation.

3.1.2 Should

Indicates that a procedure is recommended.

3.1.3 May

Indicate that the procedure is optional.

3.1.4 Will

Is used only to indicate the future, not a degree of requirement.

3.1.5 Can

Indicates a possibility or ability.

3.2 Technical definitions

3.2.1 Competent person

Person who has the knowledge, experience and training to authorise a change of service for a cryogenic transport tank and approve the required procedure.

3.2.2 Contamination

Any material that may react violently with oxygen.

NOTE For conversion of transport tanks to oxygen service contaminants are typically hydrocarbon compounds.

The following are sources of contamination:

- back contamination from a process;
- contamination from liquid taken from a customer tank; or
- any activity that is not considered as normal service for tanker (see 3.2.7.1).

3.2.3 Conversion to oxygen service

Procedure by which a tank is prepared to be used in oxygen service after it has been in service with another gas.

3.2.4 Cryogenic transport tank

A cryogenic transport tank means any of the following:

- a road tanker, i.e. a tank vehicle;
- a railcar, i.e. a tank wagon;
- a tank container; or
- a portable tank.

See ADR section 1.2.1 for full definitions [3].

3.2.5 Oxygen service

Service with liquid or gaseous oxygen.

3.2.6 Storage tank

A tank for storage of refrigerated liquid gases and liquefied gases.

3.2.7 Service conditions before conversion to oxygen service

3.2.7.1 Normal service

A transport tank is considered in normal service where it:

- delivers to a cryogenic storage tank where there is a non-return valve between the cryogenic transport tank and the storage tank;
- delivers to a customer process where there is a non-return valve between the cryogenic transport tank and the process; or
- is filled from with liquid taken from a cryogenic storage tank where there is a non-return valve between the tank and the process. The liquid shall be analysed for hydrocarbons before transfer and certified to be acceptable.

3.2.7.2 Other service

Other service is any other service, typically this would be;

- direct delivery to a cryogenic storage tank or process without the use of non-return valves; or
- collection of liquid from a cryogenic storage tank without hydrocarbon analysis (or when liquid is certified as unacceptable).

4 Principles of safe conversion of a cryogenic transport tank into oxygen service

Transport tanks in carbon dioxide or flammable service shall not be converted to oxygen service due to reasons such as the incompatibility of contaminants with oxygen, materials, design etc.

Prior to conversion of a transport tank to oxygen service, complete operating history of the transport tank shall be checked to confirm no previous record of contamination and that transport tank has been in normal service as per definition in 3.2.7.1.

Transport tank materials and materials of pipework, valves, pumps and vaporisers shall be reviewed for oxygen compatibility.

Note that type approval only is not sufficient, the accessories and all the equipment shall be specifically checked to confirm their suitability for the intended service. See EIGA Doc 200 [2] for further information.