



RECIPROCATING CRYOGENIC PUMPS AND PUMP INSTALLATIONS FOR OXYGEN, ARGON, AND NITROGEN

Doc 159/21

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EUROPEAN INDUSTRIAL GASES ASSOCIATION AISBL



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RECIPROCATING CRYOGENIC PUMPS AND PUMP INSTALLATIONS FOR OXYGEN, ARGON, AND NITROGEN

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As part of a programme of harmonisation of industry standards, the European Industrial Gases Association (EIGA) has published EIGA Doc 159, *Reciprocating Cryogenic Pump and Pump Installations for Oxygen, Argon and Nitrogen*. This publication was jointly produced by members of the International Harmonisation Council.

This publication is intended as an international harmonised publication for the worldwide use and application by all members of the International Harmonisation Council whose members include the Asia Industrial Gases Association (AIGA), Compressed Gas Association (CGA), European Industrial Gases Association (EIGA), and Japan Industrial and Medical Gases Association (JIMGA). Regional editions have the same technical content as the EIGA edition, however, there are editorial changes primarily in formatting, units used and spelling. Regional regulatory requirements are those that apply to Europe.

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Amendments to 159/14

Section	Change
	Editorial to align with IHC associations
2	Clarification of scope
3.2.6	Clarification purge gas
5	Minor updates to provide guidance of best operating practice
5.3	Addition of information regarding EIGA Doc 133
5.5	Recommendation of using plastic tubing for valve actuation
6	Additional information on selection of materials reference to EIGA Doc 200 and EIGA Doc 73

7	Clarification of mandatory requirements for oxygen and optional requirements for inerts
8, 9, 10	Minor updates for best practice
11	New sub-sections on maintenance programmes

NOTE Technical changes from the previous edition are underlined

1 Introduction

Reciprocating cryogenic pumps have become key components within the industrial gas industry handling primarily, liquid oxygen, argon, and nitrogen. To ensure that pumps operate both safely and reliably, it is important that pumps are correctly designed, installed, operated, and maintained for the required duty.

Pumping cryogenic fluids is accompanied by some degree of hazard. The hazards include liquid under pressure, cryogenic temperatures, volume and pressure increases due to vaporisation, and the ability of oxygen to accelerate combustion.

This publication gives guidance to manage these hazards.

2 Scope

This publication is intended to cover cryogenic reciprocating pumps and installations for liquid oxygen, argon, and nitrogen.

The publication contains a summary of industrial practices and is based on the combined knowledge, experience, and practices of industrial gas and equipment suppliers.

Carbon dioxide pumps are not covered in this publication. For information regarding carbon dioxide pumps, see CGA G-6.3, Carbon Dioxide Cylinder Filling and Handling Procedures or EIGA Doc 83, Recommendations for Safe Filling of CO2 Cylinders and Bundles [1, 2].¹

Centrifugal liquid oxygen pumps are not covered in this publication. See EIGA Doc 148, Stationary Electric-Motor-Driven Centrifugal Liquid Oxygen Pumps [3].

The design and installation requirements and recommendations included in this publication apply only to installations begun after the publication date and not to existing installations. However, the information contained in this publication may benefit existing installations or those in the project phase. Furthermore, to the extent that they exist, national laws supersede the suggested practices listed in this publication. It should not be assumed that every local standard, test, safety procedure, or method is contained in these recommendations or that abnormal or unusual circumstances may not warrant additional requirements or procedures.

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

Indicates that the procedure is optional.

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

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 Cavitation

This phenomenon occurs when the pressure of a liquid drops to less than the vapour pressure of the liquid at a certain temperature. At this point, liquid vaporises, thereby creating vapour bubble. These bubbles can cause a pump to lose prime or suffer heavy vibration and damage.

3.2.2 Cold end

Pump assembly through which the cryogenic liquid passes and is elevated in pressure.

3.2.3 Cryogenic reciprocating pump

Consists of a motor (single, twin, or variable drive) belt drive, gear drive or direct couple assembly, warm end (crank drive), and the cold end.

3.2.4 Loss of prime

Loss of liquid flow to and/or through the pump.

3.2.5 Net positive suction head (NPSH)

Margin of difference (measured in height) between the actual pressure of a liquid flowing into a pump and the vapour pressure of the liquid.

3.2.6 Purge gas

Ambient temperature, dry (dew point of -40°C [-40°F] or less), oil-free, particle-free, and carbon dioxide-free (less than 3 ppm) air, nitrogen, or argon used to sweep away or prevent concentrated oxygen or moisture laden air.

3.2.7 Subcooled liquid

Liquid at a temperature less than its boiling point.

NOTE Subcooling can be achieved by increasing the liquid pressure greater than its equilibrium pressure or bubble point.

3.2.8 Thermosiphon tank

Tanks with dedicated pump pipework with both feed and return pipework connected to the tank liquid phase. This arrangement improves pump priming by allowing circulation of liquid from tank, through the pump and back to the tank, even when the pump is not running.

3.2.9 Warm end

Crank case box that drives the cold end.