



SAFE USE OF ALUMINIUM-STRUCTURED PACKING FOR OXYGEN DISTILLATION

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EUROPEAN INDUSTRIAL GASES ASSOCIATION AISBL



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As part of a programme of harmonisation of industry standards, the European Industrial Gases Association, (EIGA) has published EIGA Doc 144, *Safe Use of Aluminum-Structured Packing for Oxygen Distillation*, jointly produced by members of the International Harmonisation Council and originally published by the Compressed Gas Association as CGA G-4.8, *Safe Use of Aluminum-Structured Packing for Oxygen Distillation*.

This publication is intended as an international harmonised standard for the worldwide use and application of all members of the Asia Industrial Gases Association (AIGA), Compressed Gas Association (CGA), European Industrial Gases Association, and Japan Industrial and Medical Gases Association (JIMGA). Each association's technical content is identical, except for regional regulatory requirements and minor changes in formatting and spelling.

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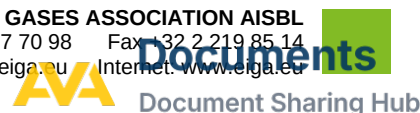
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Amendments to Doc 144/13

Section	Change
3	Added new definitions
10.3	Added new paragraph
12	General updates

NOTE Technical changes from the previous edition are underlined

1 Introduction

Many air separation plants use aluminum sieve trays in their distillation columns. Most plants built after 1990 have used structured packing in place of trays. The low pressure drop and good mass transfer effectiveness of packing make it attractive for some air separation applications, particularly for columns operating at near-atmospheric pressure.

2 Scope

This publication addresses the use of aluminum-structured packing in oxygen distillation. Other materials that can be used in this service such as brass, copper, or stainless steel are not addressed.

A summary of current knowledge and industrial practices used in the safe application of aluminum-structured packing in columns for the distillation of oxygen is included.

This publication is not intended to be a mandatory standard. It is based upon the combined experimental work, operating experience, and design practices of major producers and operators of air separation plants.

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.

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 Structured packing

Engineered structure consisting of numerous layers of thin, vertically oriented, corrugated metal sheets to facilitate intimate contact between liquid and vapor for mass transfer [1].¹

3.2.2 Violent energy release (VER)

Experimental result in which the following indications were observed during the combustion of aluminum in oxygen: a loud noise, white light, and physical destruction or substantial deformation of the specimen and/or the test vessel.

4 Summary

Aluminum components have been used extensively in oxygen service since the late 1950s. This has included piping, heat exchangers, vaporizers, pressure vessels, distillation trays, and packing. Overall, the safety record of aluminum in oxygen service has been very good.

Structured packing was introduced during the 1980s as an alternative to sieve trays for distillation. Three major investigations regarding the safety of aluminum-structured packing have been reported in the literature

[2, 3, 4]. The first of these references concludes that copper packing should be used in those sections of the distillation column where aluminum packing is flammable. The latter two, which included tests conducted under simulated operating conditions, conclude that aluminum can be used safely in all column sections. The information assembled for this publication provides the background to conclude that the use of aluminum-structured packing in all sections of the low pressure column of an air separation plant introduces no additional risk relative to that associated with aluminum sieve trays, provided that similar care is taken to clean equipment adequately and to lessen the presence of combustible contaminants.

Aluminum sieve trays have been used throughout the industry since the 1960s with no reported combustion incidents. Experimental work has shown that trays and packing require approximately equal energy levels for ignition (see 8.1), are flammable under some conditions that might be encountered in oxygen distillation columns (see 9.3), and combust with comparable intensities (see 9.3). Together these facts indicate that the safety of oxygen distillation columns fabricated from aluminum depends on the exclusion of ignition mechanisms and preventing accumulation of flammable contaminants in the flammable regions of the column. This is true for both trays and packing.

The procedures that have resulted in this record of safe operation with aluminum components have included following the practices described in EIGA Doc 147, *Safe Practices Guide for Cryogenic Air Separation Plants* and proper cleaning of aluminum equipment according to standards such as EIGA Doc 33, *Cleaning of Equipment for Oxygen Service* and ASTM G93, *Standard Guide for Cleanliness Levels and Cleaning for Materials and Equipment Used in Oxygen-Enriched Environments* [5, 6, 7]. EIGA DOC 65, *Safe Operation of Reboilers/Condensers in Air Separation Units* offers additional insights pertinent to aluminum components in air separation plants [8].

To ensure safe use for columns containing aluminum-structured packing, follow the procedures in EIGA Doc 147 and the cleaning specifications given in Section 10 of this publication [5]. The use of adsorption prepurification units, which prevent acetylene from entering the plant and initiating reactions, is also recommended.

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