AS 2764—1985

Australian Standard®

FIBRE REINFORCED PLASTICS (FRP) ALUMINIUM ALLOY GAS CYLINDERS—HOOP OVERWRAPPED

[Title allocated by Defence Cataloguing Authority:
CYLINDER, COMPRESSED GAS (FRP, Aluminium..NSC 8120)]

This Australian standard was prepared by Committee ME/2, Gas Cylinders. It was approved on behalf of the Council of the Standards Association of Australia on 25 October 1984 and published on 31 January 1985.

The following interests are represented on Committee ME/2:

Aluminium Development Council
Australasian Steamship Owners Federation
Australian Chamber of Commerce
Australian Liquefied Petroleum Gas Association Ltd.
Australian Underwater Federation
Board of Fire Commissioners, N.S.W.
Bureau of Steel Manufacturers of Australia
Confederation of Australian Industry
Department of Defence
Department of Employment and Industrial Affairs, Qld
Department of Industrial Affairs, W.A.
Department of Industrial Relations, N.S.W.
Department of Labour and Industry, Tas.
Department of Labour and Industry, Vic.
Department of Labour, S.A.
Department of Mines and Energy, N.T.
Department of Mines, Qld
Department of Territories and Local Government
Railways of Australia Committee

This standard was issued in draft form for comment as DR 82003.

Australian Standard®

FIBRE REINFORCED PLASTICS (FRP) ALUMINIUM ALLOY GAS CYLINDERS—HOOP OVERWRAPPED

First published 1985

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
1 THE CRESCENT, HOMEBUSH, NSW 2140

ISBN 0 7262 3615 2

PREFACE

This standard was prepared by the Association's Committee on Gas Cylinders. It is based on a submission from the Commonwealth Industrial Gases Limited and provides for very specialized processes.

FRP aluminium alloy gas cylinders offer higher stored capacity to mass ratios than available with conventionally manufactured cylinders, and are expected to have application in portable breathing apparatus and where mass is critical. The technology was developed for the United States space program.

The standard provides for hoop overwrapped construction only, and not for totally overwrapped construction.

This standard specifies a bonfire test to establish the performance of the complete cylinder system. Performance in this test depends on the valve and safety relief device (if fitted) as well as the cylinder and the cylinder lading. It is therefore necessary for the purchaser to specify any required departures from the method given in this standard.

This standard specifies a maximum stretch under the hydrostatic test stretch as a permanent volume increase related to total volume increase at test pressure. This is the departure from the usual Australian practice of relating permanent volume increase to original internal volume and will require measurement of total volume increase in accordance with AS 2337, Gas Cylinder Test Stations.

CONTENTS

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
for
FIBREGLASS REINFORCED PLASTICS (FRP) ALUMINIUM ALLOY GAS CYLINDERS—HOOP OVERWRAPPED

1 SCOPE. This standard specifies requirements for the materials, design, manufacture, inspection, pressure tests and markings of aluminium alloy gas cylinders reinforced by hoop overwrapping with fibre reinforced plastics (FRP), intended for storage and transport of compressed gases, and of water capacity exceeding 0.10 kg but not exceeding 130 kg.

NOTES:

1. Appendix A lists the suggested minimum information that should be supplied by the purchaser when ordering gas cylinders covered by this standard.
2. Appendix E provides a suggested format for a certificate for recording of data that is to be given to the purchaser.

2 REFERENCED DOCUMENTS. The following documents are referred to in this standard:

AS 1544	Methods for Impact Tests on Metals Part 3—Charpy U-notch and Key-hole Notch
AS 1777	Aluminium Cylinders for Compressed Gases—Seamless—0.1 kg to 130 kg
AS 2030.1	SAA Gas Cylinders Code Part 1—Cylinders for Compressed Gases Other than Acetylene
AS 2337	Gas Cylinder Test Stations
AS 2473	Valves for Compressed Gas Cylinders (Threaded Outlet)
ANSI B1.20.3	Dryseal Pipe Threads (Inch)
ANSI B1.20.4	Dryseal Pipe Threads (Metric)
ANSI B1.20.5	Gauging for Dryseal Pipe Threads (Inch)
ANSI B57.1 CGA V-1 CSA B96	Compressed Gas Cylinder Valve Outlet and Inlet Connections
ASTM D 2343	Test Method for Tensile Properties of Glass Fiber Strands, Yarns and Rovings used in Reinforced Plastics
ASTM D 2344	Test Method for Apparent Interlaminer Shear Strength of Parallel Fiber Composits by Short-beam Method
DIN 477	Gas Cylinder Valves
MIL-R-60346B 4 April 1975	Military Specifications, Roving, Glass, Fibrous (For Filament Winding Applications).

3 DEFINITIONS. For the purpose of this standard, the definitions given in AS 2030.1 and the following apply:

3.1 Inspector—a person, acceptable to the Inspecting Authority, who ensures and certifies that all the inspections specified herein have been carried out and that the cylinders comply with all the requirements of the standard.

3.2 Autofrettage pressure—the pressure within the overwrapped cylinder at which the required distribution of stresses between the liner and the overwrap is established.

3.3 Liner—the seamless aluminium alloy gas cylinder to which the overwrap is applied.

3.4 Overwrap—the reinforcement of filament and resin system applied over the liner.

3.5 Hoop wrap—winding of filament in a substantially circumferential pattern over the cylindrical portion of the liner so that the filament does not transmit any significant stresses in a direction parallel to the cylinder longitudinal axis.

4 OVERWRAP MATERIALS.

4.1 Filament. The filament shall be glass fibre filament commercially known as Type S2 or Type E Fibreglass, or any other fibre, as approved by the relevant Inspecting Authority.

NOTE: Typical properties for Type S2 and Type E fibreglass are given in Appendix B.

When determined in accordance with ASTM D 2343, the filament tensile strength shall be not less than—

(a) for Type S2 Fibreglass . . . . . 2760 MPa; or

(b) for Type E Fibreglass . . . . . 1380 MPa.

4.2 Resin. The resin shall be epoxy with amide or anhydride curing agent, or any material otherwise approved by the relevant Inspecting Authority. The resin shall be translucent to facilitate inspection.

4.3 Fibre reinforced plastics specimen. When determined in accordance with ASTM D 2344, the shear strength of a test specimen constructed of the filament and resin specified in Clauses 4.1 and 4.2 shall be not less than 35 MPa.

5 DESIGN OF LINER. The design of the liner shall be in accordance with AS 1777, with the following additional requirements:

(a) The design test pressure of the liner shall be not less than 50 percent of the design test pressure of the overwrapped cylinder.

(b) The liner design burst pressure shall be not less than 80 percent of the design test pressure of the overwrapped cylinder.

(c) The design of the liner shall ensure that the overwrapped cylinder complies with Clause 9.4.2.

(d) The design of the liner shall ensure that the liner, after autofrettage, will not buckle owing to compressive forces induced by the overwrap when the internal and external pressures are equalized at atmospheric pressure.

(e) The design of the liner ends shall ensure that the stress intensity (Von Mises) in the liner ends is less than the stress intensity in the liner cylindrical portion, at the design test pressure.