BAM
Bundesanstalt für Materialforschung und -prüfung

Recognized technical code (Anerkanntes Technisches Regelwerk, ATR)

Transportable, fully wrapped carbon composite cylinders and tubes for hydrogen

(ATR D 1/21)

Based on Section 8 no 10 of the Ordinance on the Transport of Dangerous Goods by Road, Rail and Inland Waterways (GGVSEB) in the version promulgated on 11 March 2019 (Federal Law Gazette I, p. 258) as amended by Article 14 of the Act of 12 December 2019 (Federal Law Gazette I, p. 2510), the Federal Institute for Materials Research and Testing (BAM) in agreement with the Federal Ministry of Transport and Digital Infrastructure promulgates the technical code for the construction, equipment, test, approval, marking and use of fully wrapped carbon composite cylinders and tubes for hydrogen (ATR D 1/21) recognized in accordance with section 6.2.5 of ADR and RID[1] as set out below.

The Federal Institute for Materials Research and Testing promulgates this ATR also based on Section 6 paragraph 5 no. 1 of the Transport of Dangerous Goods by Sea Ordinance in the version promulgated on 21 October 2019 (Federal Law Gazette I, p. 1475) as last amended by Article 16 of the Act of 12 December 2019 (Federal Law Gazette I, p. 2510) in conjunction with sub-section 6.2.3.1 of the IMDG Code[2].

The present code may be applied from the date of its publication in the Federal Ministry of Transport Gazette. The Federal Ministry of Transport and Digital Infrastructure will submit this code to the competent OTIF[3] and ECE[4] Secretariats in accordance with section 6.2.5 of ADR/RID.

The present ATR may be applied until 30 June 2023.

The present ATR may be applied to the approval of transportable, fully wrapped carbon composite cylinders and tubes for hydrogen in rail, road, inland waterway, and maritime transport.

[1]RID Regulations governing the international carriage of dangerous goods by rail
ADR Agreement concerning the international carriage of dangerous goods by road

[2]IMDG Code International Maritime Dangerous Goods Code

[3]OTIF Intergovernmental Organisation for International Carriage by Rail (Bern)

[4]ECE United Nations Economic Commission for Europe (Geneva)

1 Introduction

1.1 The reason for the elaboration of the present recognized technical code is the need to use special composite pressure receptacles for the exclusive transport of hydrogen. For this purpose, standard EN 17339:2020 has been drawn up and published; this standard is expected to be referenced in ADR/RID as from version 2023.

With this standard, given that the use of the pressure receptacles is limited to hydrogen, the maximum developed internal pressure at 65°C is reduced to 118 % of the working pressure instead of the usual 150 % for general use (cf. EN 12245 or ISO 11119-2 or -3). This results in a reduction of loads, which results in weight and cost savings in comparison with comparable pressure receptacle for general use.

1.2 To be able to initially monitor designs intended for a reduced internal pressure at the same working and also test pressure with regard to safety aspects, the present ATR, in principle, provides for the application of EN 17339:2020 “Transportable gas cylinders - Fully wrapped carbon composite cylinders and tubes for hydrogen”. In the above-mentioned transitional period until EN 17339:2020 will be referenced in law, this will, however, be complemented by additional safety measures that are either currently being applied by the manufacturers to guarantee their own product safety or provide a basis for tracking subsequent ageing and for the determination of periods for periodic inspection in accordance with BAM-GGR 022[5].

1.3 The majority of the additional requirements were also proposed within the framework of the EN 17339 standardization project by representatives of the competent mirror committee of DIN but could not gain majority support at the time. These complements to the standard do not lead to deviations from the standard but only to complements so that a pressure receptacle in accordance with the present ATR fully complies with standard EN 17339:2020.

[5] BAM-GGR 022: https://tes.bam.de/TES/Content/DE/Downloads/ggr-022.pdf?__blob=publicationFile

2 Scope and duration

2.1 The present ATR may be applied to the approval and use of fully wrapped carbon composite cylinders and tubes for the transport of hydrogen by rail, road, inland waterways, and sea.

2.2 Cylinders and tubes for the transport of hydrogen pursuant to this ATR shall be constructed, equipped, tested, marked, approved, placed on the market and used for transport in accordance with the Ordinance on transportable pressure equipment (Ortsbewegliche-Druckgeräte-Verordnung) of 29 November 2011 (Federal Law Gazette I, p. 2349), as amended by Article 491 of the Ordinance of 31 August 2015 (Federal Law Gazette I, p. 1474), in conjunction with section 6.2.5 of ADR/RID and/or section 6.2.3 of the IMDG Code.

2.3 For conformity assessment, the procedure under 1.8.7 and 6.2.3.6.1 of ADR/RID, in the version that may be applied from 1 January 2021 and is mandatory from 1 July 2021, shall be applied.

2.4 The applicability of the present ATR for the conformity assessment of new design types shall end on 30 June 2023.

2.5 Pressure receptacles manufactured in conformity with a design type approved under the present ATR may continue to be used after 30 June 2023. Should EN 17339:2020 be withdrawn for reasons of safety and should the pressure receptacles constructed in accordance with this standard have to be recalled, this shall in general also apply to pressure receptacles in accordance with the present ATR.

2.6 Pressure receptacles that were tested within the context of other standards but meet the requirements of the present ATR in conjunction with EN 17339 may also fall under the present ATR if the requirements stipulated in the ATR for the respective pressure are considered to be fully complied with.

3 Specifications for materials, design and testing

3.1 Definitions

For the purposes of the application of the present code, the definitions and symbols of sections 3 and 4 of EN 17339:2020 shall apply.

3.2 General requirements

The cylinders and tubes shall comply with the requirements of 6.2.1, 6.2.3 and 6.2.5 of RID/ADR. The requirements of standard EN 17339:2020 "Transportable gas cylinders - Fully wrapped carbon composite cylinders and tubes for hydrogen" shall be complied with, unless derogations are described in the following. Where additional tests are required, these shall be performed in accordance with ISO 11119-3:2020.

3.3 Derogations with regard to the type of construction

By derogation from the scope as well as 5.2.1 of EN 17339:2020 and further details regarding requirements to be met by liners, no metal or load sharing liners shall be permitted.

3.4 Derogations with regard to the matrix material (resin system)

By derogation from 6.2.1.1 of EN 17339:2020, the glass transition temperature of the matrix system shall be at least 30°C above the maximum permissible service temperature and shall in no case be below 85°C.

3.5 Derogations within the scope of design type testing regarding the burst test

By derogation from 6.2.5 of EN 17339:2020, test 5 within the scope of design type testing shall be performed at a reduced rate of pressurization of not more than 20 % of the test pressure per hour[6]. By derogation from Table A.4 in Annex A, the burst test shall be performed on 5 samples.

Based on the 5 test results, the mean value and standard deviation shall be determined in accordance with BAM-GGR 021. Both values shall be filed by the technical service for use, if applicable, in the determination of periods for

[6] Slow Burst Test (in acc. with BAM-GGR 021)
https://tes.bam.de/TES/Content/DE/Downloads/ggr-021.pdf?__blob=publicationFile

periodic inspection in accordance with GGR 022[5] and shall be made available to every buyer (operator).

3.8 Additional requirement regarding the pneumatic cycle test

In addition to EN 17339:2020, the pneumatic cycle test in accordance with 8.5.16 of EN ISO 11119-3:2020 shall be performed within the scope of design type testing. Hydrogen shall be used for this test.

3.9 Derogations within the scope of the manufacturer batch test with regard to the burst test

By derogation from 6.2.5 and Annex A 4.5.1 b) of EN 17339:2020, test 5 within the scope of the manufacturer batch test shall be performed at a reduced rate of pressurization of not more than 20 % of the test pressure per hour[5].

All test results of the batch tests shall be collected and assessed in the form of the mean value and the scattering of the determined bursting values for the production as a whole and also for the annual production in accordance with BAM-GGR 022.

Complementary to the tests and inspections of the finished cylinders in accordance with A.4.5 of EN 17339:2020, the bursting results of the respective last five batches shall be assessed with regard to their mean value before any batch is released. If the mean value is below 90 % of the previous statistical mean of the production and/or the production of the previous year, the causes shall be investigated in detail.

The manufacturer shall be obliged to analyse and assess, together with the notified body monitoring the manufacturing, the production data determined in accordance with the above requirements. The assessments shall be documented and made available to the competent authority upon request.

The calculated mean values and standard deviations from the design type testing and the batch test shall be filed by the technical service for use, if applicable, in the determination of periods for periodic inspection in accordance with GGR 022[6] and shall be made available to every buyer (operator).

5 Marking

5.1 Marking shall be in accordance with the requirements of EN 17339:2020 in accordance with Chapter 6.2 of ADR/RID. “ATR D 1/21” shall be permanently marked in the location stipulated in the standard.

5.2 “EN 17339” may be marked in addition.

6 Periodic inspections

6.1 Pressure receptacles in accordance with the present ATR shall generally be subjected to the regular periodic inspections in accordance with packing provision P200 of ADR/RID/the IMDG Code every 5 years.

6.2 An extension of the period to 10 years shall be permissible in application of BAM-GGR 022[5] in accordance with the procedure set out for composite pressure receptacles in Germany in keeping with packing provision P200 in chapter 4.1 of ADR/RID/the IMDG Code.

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BAM FEDERAL INSTITUTE FOR MATERIALS RESEARCH AND TESTING

Department 3 Containment Systems for Dangerous Goods	Division 3.5 Safety of Gas Storage Systems
For the Federal Institute for Materials Research and Testing	For the Federal Institute for Materials Research and Testing
(sgd) Th. Goedecke	*(sgd)* Georg Mair
Dr.-Ing. Th. Goedecke	Dr.-Ing. Georg W. Mair

The present ATR consists of 6 pages.