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Hydrogen technologies — Basic considerations for the safety of hydrogen systems

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Contents

Page

Foreword	vi
Introduction	vii
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Overview of hydrogen applications	13
4.1 Basic hydrogen infrastructure	13
4.1.1 Categories of infrastructure	13
4.1.2 Production	13
4.1.3 Storage and transport	13
4.1.4 Hydrogen end use applications	14
4.2 Typical hydrogen system components	15
4.2.1 General	15
4.2.2 Storage vessels	15
4.2.3 Fluid delivery lines, piping, joints, and seals	15
4.2.4 Flow controls	15
4.2.5 Pressure-relief systems	16
4.2.6 Detection methods	16
4.2.7 Other components	16
4.2.8 Considerations for conditions external to the system	16
4.3 Hydrogen fuel	17
4.4 Environmental effects	17
5 Basic properties of hydrogen	17
5.1 General properties	17
5.1.1 Atomic and molecular properties	17
5.1.2 Appearance and general characteristics	18
5.2 Selected thermophysical properties	18
5.2.1 General	18
5.2.2 Selected thermophysical properties of gaseous hydrogen	18
5.2.3 Selected thermophysical properties of cryogenic liquid hydrogen	19
5.3 Basic combustion properties	19
5.3.1 General remark on safety characteristics	19
5.3.2 Selected combustion properties of hydrogen	20
5.3.3 Deflagration	20
5.3.4 Detonation	21
5.3.5 Explosions	21
5.3.6 Flammability limits	22
5.3.7 Ignition energy and minimum ignition energy as applied to deflagration	22
6 Safety considerations for the use of gaseous and liquid hydrogen	23
6.1 General	23
6.2 Hazards involved as a consequence of the properties of hydrogen	24
6.2.1 General	24
6.2.2 Gaseous hydrogen	24
6.2.3 Liquid hydrogen	24
6.3 Factors involved in combustion hazards	25
6.3.1 Aspects of combustion	25
6.3.2 Non-premixed combustion processes	25
6.3.3 Explosions	26
6.4 Factors involved in pressure hazards	27
6.4.1 General	27
6.4.2 Gaseous storage	27
6.4.3 Liquid hydrogen	27
6.5 Factors involved in low temperature hazards	27

6.6	Factors involved in hydrogen embrittlement hazards.....	28
6.6.1	Hydrogen embrittlement.....	28
6.6.2	Hydrogen attack.....	28
6.7	Health hazards.....	28
6.7.1	Cold burns.....	28
6.7.2	High temperature burns.....	28
6.7.3	Asphyxiation.....	28
6.7.4	Combustion by-products.....	29
7	Mitigation and control of hazards and risks.....	29
7.1	General mitigation and control of hazards and risk.....	29
7.1.1	General.....	29
7.1.2	Lessons learned from past experience.....	29
7.1.3	Addressing hazards.....	30
7.1.4	Minimizing the severity of the consequences of hazards.....	30
7.2	Mitigation of design hazards and risks.....	31
7.2.1	Inherently safer design.....	31
7.2.2	Considerations in the selection of suitable construction material.....	31
7.2.3	Considerations for vessels and components.....	33
7.2.4	Prevention of overpressure.....	33
7.2.5	Considerations for piping, joints, and connections.....	33
7.2.6	Cleaning considerations.....	34
7.2.7	Component considerations.....	35
7.3	Prevention and mitigation of fire and explosion hazards and risks.....	36
7.3.1	General.....	36
7.3.2	Prevention of unwanted hydrogen/oxidizer mixtures.....	36
7.3.3	Identification of hazardous areas.....	36
7.3.4	Ignition.....	37
7.3.5	Deflagration and detonation.....	38
7.3.6	Oxygen enrichment.....	38
7.4	Detection considerations.....	39
7.4.1	Hydrogen release detection.....	39
7.4.2	Fire detection.....	40
7.5	Considerations for facilities.....	40
7.5.1	General.....	40
7.5.2	Locations.....	40
7.5.3	Exclusion areas.....	41
7.5.4	Protecting barricades.....	41
7.5.5	Safety control equipment.....	41
7.5.6	Disposal of hydrogen.....	42
7.5.7	Ground material.....	43
7.5.8	Buildings.....	43
7.5.9	Ventilation.....	44
7.5.10	Electrical components.....	44
7.5.11	Alarms and warning devices.....	45
7.5.12	Fire protection and fire fighting.....	45
7.6	Considerations for operations.....	46
7.6.1	General.....	46
7.6.2	Operating procedures.....	46
7.6.3	Personal protective equipment.....	46
7.6.4	Cool-down.....	47
7.6.5	Transportation.....	47
7.6.6	Storage and transfer operations.....	47
7.6.7	Safety procedures.....	48
7.7	Recommended practices for organizations.....	49
7.7.1	General.....	49
7.7.2	Control through organizational policies and procedures.....	50
7.7.3	Use of approved procedures and checklists.....	50
7.7.4	Conduct appropriate reviews.....	50

ISO/DTS 15916:2025(en)

7.7.5	Approved maintenance and quality control programmes.....	50
7.7.6	Personnel education/training.....	50
7.7.7	Hazard and operability assessment.....	51
Annex A (informative) Hydrogen properties		52
Annex B (informative) Hydrogen combustion data.....		56
Annex C (informative) Material data.....		59
Annex D (informative) Other storage options.....		64
Bibliography.....		65

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 197, *Hydrogen technologies*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/CLC/JTC 6, *Hydrogen in energy systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition of ISO/TS 15916 cancels and replaces ISO/TR 15916:2015, which has been technically revised.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The focus of this document is on relatively new hydrogen energy applications. The intent is to provide, those unfamiliar with the technology, a basis upon which to understand the safety issues. This document concerns itself with applications that derive their utility from the chemical reactions of hydrogen and does not apply to applications based on nuclear processes.

Traditionally, hydrogen has been used extensively in the petrochemical and chemical industries and in smaller quantities in the electronics, steel-producing, glass-making, and food hydrogenation industries. Given the promise that hydrogen brings as an efficient energy carrier and a fuel with minimal environmental impact, systems are being developed that produce hydrogen using variety of energy sources and feedstocks such as sunlight, wind, biomass, hydro power and fossil fuels, for use in energy applications for home and office heating, generation of electricity and transportation.

The safe use of hydrogen as a fuel is a primary goal to facilitate the rapid emergence of these hydrogen technologies. A key element in the safe use of hydrogen is to understand its unique safety-related properties and related phenomena, and that there are acceptable engineering approaches to controlling the hazards and risks associated with the use of hydrogen. This document describes the hazards associated with the use and presence of hydrogen, discusses the properties of hydrogen relevant to safety, and provides a general discussion of approaches taken to mitigate hydrogen hazards. The aim of this document is to promote the acceptance of hydrogen technologies by providing key information to regulators and by educating people involved with hydrogen safety issues.

The development of International Standards to eliminate barriers to international trade and to simplify the arduous regulatory process by providing hydrogen-specific standards to allow implementation for rapidly emerging technologies was among the needs identified by the ISO/TC 197. This document is one of many that have been developed, or are in the process of being developed. Detailed safety requirements associated with specific hydrogen applications are treated in separate International Standards. This document provides an informative reference for those separate standards as a common, consistent source of safety-related hydrogen information. This is expected to result in a reduction in duplication and possible inconsistencies in these separate standards.

The considerations presented in this document are broad, general, and attempt to address most aspects of hydrogen safety. The degree to which these guidelines are applied will vary according to the specifics of the application (such as the conditions and quantity of hydrogen involved, and the way in which the hydrogen is used). Industrial users may find large portions of the guidelines, presented herein, applicable for their operations. It is not expected that the general public will be required to apply this degree of knowledge to safely operate a hydrogen appliance. It is anticipated that good appliance design, coupled with appropriate care in installation, will reduce the degree of safety considerations to levels that are deemed acceptable by the public for common appliances. The manufacturers of hydrogen appliances will need to consider these guidelines to tailor sufficient specific information for the operation of their appliances, in the environment in which they are to be used, and for the audience that will use them. Readers are encouraged to keep these points in mind as they consider the information presented in this document. Hydrogen has been safely used in many different applications over many years. Adherence to the principles presented in this document can lead to a continuation of the safe and sustainable use of hydrogen.