ISO/TS 19880-1:2016-07 (E)

Gaseous hydrogen - Fuelling stations - Part 1: General requirements

Contents

Page

Foreword vii

1 Scope 1

2 Normative references 2

3 Termsanddefinitions 3

4 Abbreviated terms 10

5 General safety recommendations 11
5.1 Hydrogen fuelling station safety recommendations 11
5.2 Risk assessment 12
5.2.1 Methodology for semi-quantitative and quantitative risk assessment for assessing hydrogen installation safety 13
5.3 Mitigation measures to improve system safety 20
5.4 Mitigations which reduce the potential for the formation of a flammable or explosive mixture 20
5.4.1 General 20
5.4.2 Hydrogen detection systems 21
5.4.3 Safety and emergency shut-off systems 22
5.4.4 Mitigation for the formation of a flammable or explosive mixture in enclosures 22 5.4.5 General requirement hydrogen venting for mitigation for the formation of a flammable or explosive mixture 23
5.5 Mitigations which reduce the potential for ignition 23
5.5.1 General 23
5.5.2 Areas subject to restriction of activity 23
5.6 Mitigation of the escalation and/or impact of a fire or explosion originating from the fuelling installation 24
5.6.1 General 24
5.6.2 Flame detection systems 25
5.6.3 Enclosures containing hydrogen systems 25
5.6.4 Emergency release of gas from hydrogen storage tanks under fire conditions 25
5.7 Mitigation of the effect of an external fire/events on the fuelling station installation 26
5.7.1 General 26
5.7.2 Layout 26
5.7.3 Fire barrier recommendations 26
5.7.4 Mitigating against vehicular impact 27
5.7.5 Firefighting systems 27
5.7.6 Emergency principles and operations 27
5.8 Safety distances 28
5.8.1 General 28
5.8.2 Types of safety distances 29
5.8.3 Examples of safety distances 30
5.8.4 Safety distances relating to hydrogen vent stack outlets 31
5.9 Protection measures for non-hydrogen hazards 32
5.9.1 General 32
5.9.2 Protection measures for asphyxiation hazard in an enclosure 32
5.9.3 Protection measures for emergency egress from enclosed spaces 32
5.9.4 Protection measures from environmental conditions 33
5.9.5 Protection measures for hose whip 33
5.9.6 Protection measures for noise 33

6 Process control and safety systems 33
6.1 General 33
6.2 Emergency shutdown functionality 34
6.3 Manually actuated emergency stop devices 35
6.4 Remote system control 35

7 Hydrogen supply safety and operation 36

7.1 On site generation 36
7.1.1 Hydrogen generators using water electrolysis process 36
7.1.2 Hydrogen generators using fuel processing technologies 36
7.2 Hydrogen delivery 36
7.2.1 Gaseous hydrogen supply by tube trailers and multiple element gas containers (MEGC) 36
7.2.2 Liquid hydrogen supply 37
7.3 Pipeline 39

8 Hydrogen dispensing 39
8.1 Dispensing description 39
8.1.1 Dispenser components 40
8.1.2 Dispenser sensors location 40
8.1.3 Ambient temperature range of fuelling 40
8.2 Hydrogen FCEV fuelling 41
8.2.1 Reference fuelling limits of FCEV vehicles 41
8.2.2 Fuelling process control 41
8.2.3 Manual control of dispensing 44
8.2.4 Pressure integrity check (leak check) 44
8.2.5 Metering 44
8.2.6 Maximum flow rate and pressure drop 44
8.2.7 Flow control and isolation 44
8.3 Dispenser safety devices 44
8.3.1 General considerations 44
8.3.2 Dispensing emergency shutdown 45
8.3.3 Over-pressure protection 45
8.3.4 Dispenser temperature control faults 46
8.3.5 Limitation of hydrogen released in case of fuelling line break 46
8.3.6 Process control failure 46
8.3.7 Shutdown in case of breakaway activation 46
8.3.8 Physical disturbance of the dispenser 46
8.3.9 Hazardous area around the dispenser 47
8.4 Hydrogen quality 47
8.5 Hydrogen quality control 47
8.5.1 General 47
8.5.2 Dispenser fuel filters 48

9 Equipment and components 48
9.1 General 48
9.1.1 General equipment recommendations 48
9.1.2 Material hydrogen compatibility 48
9.1.3 Hydrogen and material compatibility at cryogenic temperatures 49
9.1.4 Other material recommendations 49
9.2 Piping carrying gaseous hydrogen 49
9.2.1 General 49
9.2.2 Piping, fittings, valves, regulator for cryogenic service 49
9.3 Hydrogen storage recommendations 50
9.3.1 Gaseous hydrogen storage vessels 50
9.3.2 Hydrogen storage siting recommendations 50
9.4 Hydrogen compressors 52
9.4.1 General 52
9.4.2 Vibration and movement 52
9.4.3 Control and monitoring 52
9.5 Cryogenic pumps 53

9.5.1 General 53
9.5.2 High pressure vaporizer 54
9.6 Pressure relief devices for gaseous hydrogen systems 54
9.7 Valves for gaseous hydrogen 55
9.8 Instruments for gaseous hydrogen 55
9.9 Filters for gaseous hydrogen 55
9.10 Dispensers 56
9.10.1 Location and protection of dispensers 56
9.10.2 Fuelling pad 56
9.10.3 Dispenser system design 56
9.10.4 Dispenser fuelling assembly 58
9.11 Hose assembly 60
9.11.1 Rated operating conditions 60
9.11.2 Hose assembly design 60
9.11.3 Hose assembly type testing and production testing 60
9.11.4 Venting hose assembly 60
9.12 Fuelling connector (nozzle) general design and assembly 61
9.12.1 General design and assembly 61
9.12.2 Depressurization of nozzles 61
9.13 Hose breakaway device general design and assembly 61
9.13.1 Rated operating conditions 61
9.13.2 Breakaway durability 61
9.14 Gaseous hydrogen vent systems 61
9.14.1 General 61
9.14.2 Piping design 61
9.14.3 Flame arrestors 62
9.14.4 Vent outlet 62
9.14.5 Maximum flow rate calculation 62
9.14.6 Piping diameter and exit velocity 63
9.14.7 Maximum pressure drop 63
9.15 Pneumatics 63
9.16 Hydrogen purifier 63

10 Electrical safety 64
10.1 General 64
10.1.1 Overview of electrical hazards 64
10.1.2 Components 65
10.1.3 Site interconnections to and/or between equipment assemblies 65
10.1.4 Electrical grounding 65
10.1.5 Lightning protection 65
10.2 Hazardous areas (potentially explosive atmospheres) 66
10.2.1 General 66
10.2.2 Protection requirements for electrical equipment within hazardous (classified) areas 66
10.2.3 Other equipment in hazardous (classified) areas 67
10.2.4 Areas adjacent to hazardous areas 67
10.2.5 Protection from ignition due to accumulation of static charge 67
10.3 Electromagnetic compatibility and interference (EMC) 68
10.3.1 General 68
10.3.2 Industrial (EMC) environments 68
10.3.3 Residential, commercial, and light-industrial (EMC) environments 68

11 Markings 69
11.1 General 69
11.2 Warning signs 69
11.3 Functional identification 70
11.4 Marking of equipment (data plate) 70
11.5 Reference designations 71
11.6 Emergency contact information 71

12 Technical documentation 72
12.1 General 72
12.2 Information to be provided 72

12.3 Recommendations applicable to all documentation ... 73
12.4 Installation documents ... 73
12.4.1 General ... 73
12.4.2 Installation documentation for hazardous (classified) areas ... 74
12.4.3 Venting ... 74
12.4.4 Seismic documentation ... 74
12.4.5 Handling and lifting documentation ... 75
12.5 Overview diagrams and function diagrams ... 75
12.6 Circuit diagrams ... 75
12.7 Flow (P&ID) diagrams ... 75
12.8 Fuelling station operating manual ... 76
12.9 Hydrogen fuelling station dispenser operation instructions ... 76
12.10 Maintenance manual ... 76
12.11 Service manual ... 76
12.12 Parts list ... 76
12.13 Technical file ... 77

13 Station inspection and tests ... 77
13.1 General ... 77
13.2 Minimum hydrogen fuelling station acceptance inspection ... 78
13.2.1 General ... 78
13.2.2 Minimum hydrogen fuelling station acceptance testing ... 78
13.2.3 Pressure test ... 79
13.2.4 Leak test ... 79
13.2.5 Electrical testing ... 80
13.2.6 Communications test ... 81
13.2.7 Safety and performance functional testing of the hydrogen fueling station ... 81
13.3 Minimum periodic hydrogen fuelling station inspection and test ... 82

Annex A (informative)Safetydistancesdefinitionandbasicprinciples ... 87

Annex B (informative)ProposalforhydrogenfuellingverificationoftheSAEJ2601 fuelling protocol ... 93

Annex C (informative) Example matrices for guidance for hydrogen quality control ... 104

Annex D (informative)Pressureleveldefinitionsforthecompressedhydrogenstorage system and fuelling station dispensers ... 112

Annex E (informative) Examples of vehicular impact protection measures ... 113

Bibliography ... 115