ISO 19887-1:2024-10 (E)

Gaseous Hydrogen - Fuel system components for hydrogen-fuelled vehicles - Part 1: Land vehicles

Contents

Page

Foreword ..... **viii**

Introduction ..... **ix**

1 Scope **1**
1.1 Inclusions 1
1.2 Applicability 2
1.3 Exclusions 2

2 Normative references **2**

3 Terms and definitions **3**

4 General requirements **7**
4.1 General construction and assembly 7
4.1.1 Intended use 7
4.1.2 Material requirements 8
4.1.3 Threaded openings 9
4.1.4 Service temperatures 10
4.1.5 Design service life 10
4.2 Failure modes and effects analysis (FMEA) 10
4.3 Electrical equipment and wiring 10
4.3.1 Openings 10
4.3.2 Equipment 10
4.3.3 Materials 10
4.3.4 Connectors 10
4.4 Component literature 11
4.4.1 General 11
4.4.2 Instructions – General 11
4.4.3 Instructions – Additional considerations 11
4.4.4 Installation instructions 11
4.5 Marking 11
4.5.1 General marking information 11
4.5.2 Marking methods 12
4.5.3 Exclusion of markings 12

5 General test methods **12**
5.1 General test requirements 12
5.1.1 Testing samples 12
5.1.2 References to other standards 12
5.1.3 Pressure and temperature requirements 13
5.1.4 Test gases 13
5.1.5 Material acceptance 14
5.1.6 Multi-functional components 14
5.1.7 Pre-cooling effects 14
5.1.8 Electrically operated components 14
5.2 Hydrostatic strength 14
5.2.1 General 14
5.2.2 Test method 14
5.3 Leakage 15
5.3.1 General 15
5.3.2 External leakage 15
5.3.3 Internal leakage 15
5.3.4 Test conditions 15

5.4 Excess torque resistance 16
5.5 Bending moment 16
5.6 Continuous operation 17
5.6.1 General 17
5.6.2 Test method 17
5.7 Corrosion resistance 18
5.7.1 General 18
5.7.2 Salt spray exposure 19
5.7.3 Accelerated cyclic corrosion 19
5.8 Ultraviolet resistance of external surfaces 21
5.8.1 General 21
5.8.2 Ultraviolet resistance test 21
5.8.3 Pass criteria 22
5.9 Automotive fluid exposure 22
5.9.1 General 22
5.9.2 Test method 22
5.9.3 Fluids 22
5.9.4 Pass criteria 22
5.10 Atmospheric exposure 22
5.10.1 Oxygen aging 23
5.10.2 Ozone 23
5.11 Abnormal electrical voltages 23
5.11.1 Overvoltage testing 23
5.11.2 Minimum opening voltage 24
5.12 Non-metallic material hydrogen compatibility 24
5.12.1 General 24
5.12.2 Hydrogen gas exposure 24
5.13 Vibration resistance 24
5.13.1 Test method 24
5.13.2 Pass criteria 25
5.14 Stress corrosion cracking resistance 25
5.14.1 General 25
5.14.2 Test method 25
5.14.3 Pass criteria 25
5.15 Insulation resistance 25
5.16 Pre-cooled hydrogen exposure 26

6 Quality assurance 26

7 Production inspection and acceptance testing 26
7.1 Inspection and acceptance testing plan 26
7.2 Inspection of system critical components 26
7.3 External leak testing 26

8 Check valves 26
8.1 Marking 26
8.2 Construction and assembly 27
8.3 Tests 27
8.3.1 General 27
8.3.2 Continuous operation 28
8.3.3 Pass criteria 28

9 Manual valves 28
9.1 Marking 29
9.2 Construction and assembly 29
9.2.1 General 29
9.2.2 Handles 29
9.2.3 Emergency manual shut-off valves 29
9.2.4 Quarter-turn valves 29
9.2.5 Multi-turn valves 29
9.3 Tests 29
9.3.1 General 29
9.3.2 Continuous operation 30
9.3.3 Operating torque 31
9.3.4 Valve stem torque 32

10 Manual container valves 32
10.1 Marking 32
10.2 Construction and assembly 32
10.2.1 General 32
10.2.2 Handle 32
10.2.3 Quarter-turn valves 33
10.2.4 Multi-turn valves 33
10.2.5 Internal excess flow valve 33
10.3 Tests 33
10.3.1 General 33
10.3.2 Continuous operation 33
10.3.3 Operating torque 34
10.3.4 Valve stem torque 34

11 Automatic valves and automatic container valves 35
11.1 Marking 35
11.2 Construction and assembly 35
11.2.1 General 35
11.2.2 De-energized position 35
11.2.3 Shut-off valve failure position 35
11.2.4 Internal excess flow valve 35
11.3 Tests 35
11.3.1 General 35
11.3.2 Continuous operation 36
11.3.3 Automatic valve manual override torque 37

12 Hydrogen injectors 37
12.1 Marking 37
12.2 Construction and assembly 38
12.2.1 General 38
12.2.2 De-energized position 38
12.3 Tests 38
12.3.1 General 38
12.3.2 Continuous operation 38
12.3.3 Insulation resistance 39
12.3.4 Pneumatic strength 39
12.3.5 Extreme temperature cycling 39

13 Pressure sensors, temperature sensors, and pressure gauges 40
13.1 Marking 40
13.2 Construction and assembly 41
13.2.1 General 41
13.2.2 Pressure gauge lens 41
13.3 Tests 41
13.3.1 General 41
13.3.2 Continuous operation 41
13.3.3 Abnormal electrical voltages 42
13.3.4 Insulation resistance 43

14 Pressure regulators 43
14.1 Marking 43
14.2 Construction and assembly 43
14.2.1 General 43
14.2.2 Nominal outlet pressure 43
14.2.3 Pressure regulator PRV 43
14.3 Tests 43
14.3.1 General 43
14.3.2 Hydrostatic strength 44
14.3.3 Leakage 45
14.3.4 Continuous operation 45
14.3.5 Pressure impulse 45

14.3.6 Pressure chamber – PRV operation 46

15 Pressure relief valves 46
15.1 Marking 46
15.2 Construction and assembly 46
15.2.1 General 46
15.2.2 Venting 46
15.2.3 Inspection and acceptance testing 46
15.3 Tests 46
15.3.1 General 46
15.3.2 Hydrostatic strength 47
15.3.3 Leakage 47
15.3.4 Continuous operation 47
15.3.5 Opening and reseating characteristics 48

16 Pressure relief devices 48

17 Excess flow valves 48
17.1 Marking 48
17.2 Construction and assembly 49
17.3 Tests 49
17.3.1 General 49
17.3.2 Continuous operation 49
17.3.3 Bypass flow 49

18 Gastight housing and leakage capture passages 50
18.1 Marking 50
18.2 Construction and assembly 50
18.2.1 General 50
18.2.2 Inspection and acceptance testing 50
18.3 Tests 50
18.3.1 General 50
18.3.2 Leakage 51
18.3.3 Venting ability and pressure retention 51
18.3.4 Pull-off 52

19 Rigid fuel lines 52
19.1 Marking 52
19.2 Construction and assembly 52
19.3 Tests 52
19.3.1 General 52
19.3.2 Continuous operation 53
19.3.3 Bending 53

20 Flexible fuel lines, hoses, and hose assemblies 53
20.1 Markings 54
20.1.1 General 54
20.1.2 Bulk hoses 54
20.1.3 Hose assemblies 54
20.1.4 Marking surfaces 55
20.1.5 Date code 55
20.2 Construction, assembly, and installation instructions 55
20.2.1 General 55
20.2.2 Linings 55
20.2.3 Hose cover 55
20.2.4 Protection from permeation or leakage 55
20.2.5 Static electricity dissipation 56
20.2.6 End connections 56
20.2.7 Component literature 56
20.3 Tests 56
20.3.1 General 56
20.3.2 Hydrostatic strength 57

20.3.3 Leakage 58
20.3.4 Corrosion resistance 58
20.3.5 Automotive fluid exposure 59
20.3.6 Vibration resistance 60
20.3.7 Pressure cycle 61
20.3.8 Electrical conductivity 63
20.3.9 Hose permeation 64
20.3.10 Ultraviolet light and water exposure 65
20.3.11 Hydrogen impulse 65
20.3.12 Ozone exposure resistance 67
20.4 Manufacturing plan 67
20.4.1 Documentation 67
20.4.2 Production processes 67
20.4.3 Leakage test conducted as production test 67

21 Filter assemblies 68
21.1 Marking 68
21.2 Construction and assembly 69
21.2.1 General 69
21.2.2 Electrical conductivity 69
21.3 Tests 69
21.3.1 General 69
21.3.2 Continuous operation 69

22 Fittings 70
22.1 Marking 70
22.2 Construction and assembly 70
22.3 Tests 70
22.3.1 General 70
22.3.2 Continuous operation 71
22.3.3 Repeated assembly 71

23 Non-metallic low-pressure rigid fuel lines 71
23.1 General 71
23.2 Marking 71
23.3 Construction and assembly 72
23.4 Tests 72
23.4.1 General 72
23.4.2 Hydrostatic strength 72
23.4.3 Continuous operation 72
23.4.4 Chloride resistance 73

24 Discharge line closures 73
24.1 Markings 73
24.2 Construction and assembly 74
24.2.1 General 74
24.2.2 Inspection and acceptance testing 74
24.3 Tests 74
24.3.1 General 74
24.3.2 Continuous operation 75
24.3.3 Water jet protection 75
24.3.4 Leakage venting 75

Annex A (Informative) **Extreme thermal cycling test 76**

Bibliography 78