

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

## Gaseous hydrogen - Fuelling stations - Part 1: General requirements

---

<b>Contents</b>		<b>Page</b>
Foreword .....		vii
<b>1</b>	<b>Scope .....</b>	<b>1</b>
<b>2</b>	<b>Normative references .....</b>	<b>2</b>
<b>3</b>	<b>Terms and definitions .....</b>	<b>3</b>
<b>4</b>	<b>Abbreviated terms .....</b>	<b>10</b>
<b>5</b>	<b>General safety recommendations .....</b>	<b>11</b>
<b>5.1</b>	<b>Hydrogen fuelling station safety recommendations .....</b>	<b>11</b>
<b>5.2</b>	<b>Risk assessment .....</b>	<b>12</b>
<b>5.2.1</b>	<b>Methodology for semi-quantitative and quantitative risk assessment for assessing hydrogen installation safety .....</b>	<b>13</b>
<b>5.3</b>	<b>Mitigation measures to improve system safety .....</b>	<b>20</b>
<b>5.4</b>	<b>Mitigations which reduce the potential for the formation of a flammable or explosive mixture .....</b>	<b>20</b>
<b>5.4.1</b>	<b>General .....</b>	<b>20</b>
<b>5.4.2</b>	<b>Hydrogen detection systems .....</b>	<b>21</b>
<b>5.4.3</b>	<b>Safety and emergency shut-off systems .....</b>	<b>22</b>
<b>5.4.4</b>	<b>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 .....</b>	<b>23</b>
<b>5.5</b>	<b>Mitigations which reduce the potential for ignition .....</b>	<b>23</b>
<b>5.5.1</b>	<b>General .....</b>	<b>23</b>
<b>5.5.2</b>	<b>Areas subject to restriction of activity .....</b>	<b>23</b>
<b>5.6</b>	<b>Mitigation of the escalation and/or impact of a fire or explosion originating from the fuelling installation .....</b>	<b>24</b>
<b>5.6.1</b>	<b>General .....</b>	<b>24</b>
<b>5.6.2</b>	<b>Flame detection systems .....</b>	<b>25</b>
<b>5.6.3</b>	<b>Enclosures containing hydrogen systems .....</b>	<b>25</b>
<b>5.6.4</b>	<b>Emergency release of gas from hydrogen storage tanks under fire conditions .....</b>	<b>25</b>
<b>5.7</b>	<b>Mitigation of the effect of an external fire/events on the fuelling station installation .....</b>	<b>26</b>
<b>5.7.1</b>	<b>General .....</b>	<b>26</b>
<b>5.7.2</b>	<b>Layout .....</b>	<b>26</b>
<b>5.7.3</b>	<b>Fire barrier recommendations .....</b>	<b>26</b>
<b>5.7.4</b>	<b>Mitigating against vehicular impact .....</b>	<b>27</b>
<b>5.7.5</b>	<b>Firefighting systems .....</b>	<b>27</b>
<b>5.7.6</b>	<b>Emergency principles and operations .....</b>	<b>27</b>
<b>5.8</b>	<b>Safety distances .....</b>	<b>28</b>
<b>5.8.1</b>	<b>General .....</b>	<b>28</b>
<b>5.8.2</b>	<b>Types of safety distances .....</b>	<b>29</b>
<b>5.8.3</b>	<b>Examples of safety distances .....</b>	<b>30</b>
<b>5.8.4</b>	<b>Safety distances relating to hydrogen vent stack outlets .....</b>	<b>31</b>
<b>5.9</b>	<b>Protection measures for non-hydrogen hazards .....</b>	<b>32</b>
<b>5.9.1</b>	<b>General .....</b>	<b>32</b>
<b>5.9.2</b>	<b>Protection measures for asphyxiation hazard in an enclosure .....</b>	<b>32</b>
<b>5.9.3</b>	<b>Protection measures for emergency egress from enclosed spaces .....</b>	<b>32</b>
<b>5.9.4</b>	<b>Protection measures from environmental conditions .....</b>	<b>33</b>
<b>5.9.5</b>	<b>Protection measures for hose whip .....</b>	<b>33</b>
<b>5.9.6</b>	<b>Protection measures for noise .....</b>	<b>33</b>

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) Safety distances definition and basic principles .....		87
Annex B (informative) Proposal for hydrogen fuelling verification of the SAE J2601 fuelling protocol .....		93
Annex C (informative) Example matrices for guidance for hydrogen quality control .....		104
Annex D (informative) Pressure level definitions for the compressed hydrogen storage system and fuelling station dispensers .....		112
Annex E (informative) Examples of vehicular impact protection measures .....		113
Bibliography .....		115