

# DIN CEN/TR 17797:2022-09 (E)

Gas infrastructure - Consequences of hydrogen in the gas infrastructure and identification of related standardisation need in the scope of CEN/TC 234; English version CEN/TR 17797:2022

---

Contents	Page
European foreword .....	5
Introduction .....	6
1 Scope.....	7
2 Normative references.....	7
3 Terms, definitions and abbreviations .....	7
3.1 Terms and definitions.....	7
3.2 Symbols and abbreviations .....	10
4 Executive summary.....	10
5 General considerations for the entire gas infrastructure .....	12
5.1 Explosion protection and prevention.....	12
5.1.1 General principles .....	12
5.1.2 Safety characteristics of natural gas-hydrogen mixtures and their impact on explosion prevention.....	13
5.1.3 Consequences of H <sub>2</sub> and H <sub>2</sub> NG in NG infrastructure for explosion protection related to identified H <sub>2</sub> concentrations.....	14
5.2 N <sub>2</sub> NG mixtures in contact with materials — Pressure integrity, gas tightness and functionality.....	15
5.2.1 General.....	15
5.2.2 Steel.....	18
5.2.3 PE and PA-U.....	26
5.2.4 Alloys .....	26
5.2.5 Information on deterioration and chemical aggression of elastomers.....	26
5.2.6 Others.....	26
5.3 Volume in relation to energy content — consequences for the capacity and function of the gas transportation, underground gas storage and distribution system.....	26
6 Technical considerations per topic applicable for the different parts of the gas infrastructure (along chain) .....	27
6.1 General.....	27
6.2 Gas quality .....	27
6.2.1 Scope of considerations — Gas quality — EN 16726.....	27
6.2.2 Technical considerations — Identified H <sub>2</sub> NG .....	28
6.3 Gas compression .....	33
6.3.1 Scope of consideration — Gas compression.....	33
6.3.2 Technical considerations — Identified H <sub>2</sub> NG aspects — Gas compression .....	34
6.4 Gas pipelines with MOP over 16 bar — Gas transmission .....	34
6.4.1 Scope of consideration — Gas transmission — EN 1594 .....	34
6.4.2 Hydrogen piping and pipelines — ASME B31.12 .....	34
6.4.3 Technical considerations — Identified H <sub>2</sub> NG aspect — Gas transmission.....	35
6.5 Gas pressure control.....	38
6.5.1 Scope of consideration — Gas pressure control — EN 12186 and EN 12279 .....	38
6.6 Gas metering.....	39
6.6.1 Scope of consideration — Gas metering — EN 1776.....	39
6.6.2 Technical considerations — Identified H <sub>2</sub> NG aspects — Gas metering.....	39
6.7 Gas supply systems up to and including 16 bar and pressure testing.....	40

6.7.1	Statement for gas pipelines with MOP up to and including 16 bar for all concentrations.....	40
6.7.2	Requalifying existing pipelines for hydrogen service.....	41
6.7.3	Technical consideration — Scoping considerations — EN 2007-1 to -4, CEN/TS 12007-6, EN 12327 and EN 12732.....	41
6.8	Service lines.....	45
6.8.1	Scoping considerations — Service lines — EN 12007-5.....	45
6.8.2	Technical considerations — Identified H <sub>2</sub> NG aspects integrity and safety, reliability and operation.....	46
6.9	Industrial piping.....	47
6.9.1	Scope of consideration - Industrial piping - EN 15001-1 and EN 15001-2.....	47
6.9.2	Technical considerations — Industrial piping.....	48
6.10	Gas pipework for buildings.....	49
6.10.1	Scope of consideration — Gas pipework for buildings - EN 1775.....	49
6.10.2	Technical considerations — Gas pipework for buildings.....	49
6.11	Underground gas storage.....	49
6.11.1	Scope of consideration for underground gas storage — Generals EN 1918-1 to -5....	49
6.11.2	Technical considerations — Underground gas storage.....	50
6.11.3	Identified H <sub>2</sub> NG impacts — Underground gas storage.....	51
6.12	Safety management and integrity management.....	52
6.12.1	Scope of considerations.....	52
6.12.2	Safety management system — Management of change.....	52
6.12.3	Pipeline integrity management system.....	53
7	Conclusions — H <sub>2</sub> suitability of components, materials and procedures used in the gas infrastructure related to identified H <sub>2</sub> concentrations.....	54
7.1	General.....	54
7.2	H <sub>2</sub> suitability — Gas quality.....	55
7.2.1	H-gas quality - Admixture of H <sub>2</sub> .....	55
7.2.2	Hydrogen quality in converted natural gas grids.....	56
7.3	H <sub>2</sub> suitability — Gas compressor stations.....	57
7.3.1	General.....	57
7.3.2	Less than 1 % hydrogen in natural gas.....	58
7.3.3	Over 1 Vol.-% up to 5 Vol.-% H <sub>2</sub> in natural gas.....	58
7.4	H <sub>2</sub> suitability — Gas transmission pipelines with MOP over 16 bar.....	61
7.5	H <sub>2</sub> suitability — Gas pressure control.....	62
7.5.1	Introduction.....	62
7.5.2	General.....	63
7.5.3	Up to 10 Vol.-% H <sub>2</sub> in natural gas.....	63
7.5.4	Over 10 Vol.-% up to 100 % H <sub>2</sub> in natural gas.....	64
7.6	H <sub>2</sub> suitability — Gas metering.....	65
7.7	H <sub>2</sub> suitability — Gas pipelines with MOP up to and including 16 bar.....	65
7.7.1	A Summary of findings for gas pipeline systems up to and including 16 bar and pressure testing (CEN/TC 234 WG 2).....	65
7.8	H <sub>2</sub> suitability — Service lines.....	66
7.9	H <sub>2</sub> suitability — Industrial piping.....	66
7.10	H <sub>2</sub> suitability — Gas pipework for buildings.....	67
7.11	H <sub>2</sub> suitability — Underground gas storage.....	67
7.11.1	Between 0 % and 1 % hydrogen in natural gas.....	67
7.11.2	Between 1 % and 20 % hydrogen in natural gas.....	68
7.11.3	Above 20 % hydrogen up to full replacement of natural gas by hydrogen (100 % hydrogen).....	68

<b>8</b>	<b>Revision needs of existing CEN/TC 234 standards and additional deliverables for the H<sub>2</sub>-readiness of the gas infrastructure .....</b>	<b>68</b>
<b>8.1</b>	<b>Action need.....</b>	<b>68</b>
<b>8.2</b>	<b>Gas quality — Expected revision of EN 16726:2015+A1:2018.....</b>	<b>69</b>
<b>8.3</b>	<b>Gas compression — Expected revision of EN 12583:2014.....</b>	<b>69</b>
<b>8.4</b>	<b>Pipelines for maximum operating pressure over 16 bar — Expected revisions of EN 1594:2013 .....</b>	<b>70</b>
<b>8.5</b>	<b>Gas pressure control — Expected revisions of EN 12186:2014 and EN 12279:2000 .....</b>	<b>71</b>
<b>8.6</b>	<b>Gas measuring systems — Expected revision of EN 1776:2015 .....</b>	<b>73</b>
<b>8.7</b>	<b>Pipelines for maximum operating pressure up to and including 16 bar — Expected revision of EN 12007 Parts 1 to 4 and EN 12327:2012 .....</b>	<b>74</b>
<b>8.8</b>	<b>Pressure testing, commissioning and decommissioning procedures — Expected revision of EN 12327:2012 .....</b>	<b>77</b>
<b>8.9</b>	<b>Welding of steel — Expected revision of EN 12732:2013 .....</b>	<b>78</b>
<b>8.10</b>	<b>Service lines — Expected revision of EN 12007-5:2014 .....</b>	<b>78</b>
<b>8.11</b>	<b>Gas installation pipework- Expected revision of FprEN 15001-1:2019 and EN 15001-2:2019 .....</b>	<b>81</b>
<b>8.12</b>	<b>Gas pipework for buildings — Expected revision of EN 1775 .....</b>	<b>85</b>
<b>8.13</b>	<b>Underground gas storage- Expected revision of EN 1918-1:2016 to -5:2016.....</b>	<b>86</b>
<b>8.14</b>	<b>Safety and Integrity Management System — Expected revision of EN 16348 and EN 15399 by prEN 17649 (merged standard) .....</b>	<b>91</b>
<b>Annex A (informative)</b>	<b>Any issue coming up during the discussion and outside of the TC 234 scope.....</b>	<b>92</b>
<b>Annex B (informative)</b>	<b>Safety characteristics of natural gas-hydrogen mixtures.....</b>	<b>93</b>
<b>Annex C (informative)</b>	<b>Operating principles for gas warning devices [2].....</b>	<b>94</b>
<b>Annex D (informative)</b>	<b>Hydrogen pressure versus hydrogen percentage .....</b>	<b>96</b>
<b>Annex E (informative)</b>	<b>Hydrogen pressure versus hydrogen fugacity .....</b>	<b>97</b>
<b>Annex F (informative)</b>	<b>An example of the use of an existing gas pipeline for hydrogen gas .....</b>	<b>99</b>
<b>Annex G (informative)</b>	<b>Use of polyamide (PA-U) in gas piping systems in relation to hydrogen, methane or their mixtures.....</b>	<b>101</b>
<b>Annex H (informative)</b>	<b>Netbeheer Nederland Study for biomethane and 100 % hydrogen .....</b>	<b>112</b>
<b>Annex I (informative)</b>	<b>Responsibility of CEN/TC 234 'Gas infrastructure' Working groups for the parts of the gas infrastructure along the chain .....</b>	<b>114</b>
<b>Annex J (informative)</b>	<b>Symbols and abbreviations.....</b>	<b>115</b>
<b>Bibliography</b>	<b>.....</b>	<b>118</b>