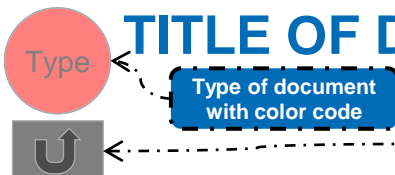


- **Sample Summary Sheet**
- Review of Codes, Standards, and Regulations
- Appendices For Detailed One-Pagers



LEGEND	
○	Generic mention. May include references
◐	Detailed requirements with some engineering parameters
●	In-depth design and engineering requirements

TITLE OF DOCUMENT



Name			Code													Date of Issue
Authorising / issuing agency			Fuel Applicability													Next Issue
Sector Applicability	Geographical coverage		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
<div style="border: 2px dashed black; padding: 5px; background-color: #0070C0; color: white; text-align: center;"> Brief description of document with key provisions/ recommendations outlined </div>			Fueling													
			Onboard Storage													
			Transfer													
			Gasification													
			Consumption													
			Sub System Element	Incl	Comment		Hazards Identified									
			Fuelling Facilities & Operations	✓												
<div style="border: 2px dashed black; padding: 5px; background-color: #0070C0; color: white; text-align: center;"> Key documents referenced with document type </div>			Fuel Systems & Tanks													
			Maintenance equip & procedures													
			Safe Practices													
			Emergency equip & procedures													
			Environmental issues	✓												
			Key take-outs / best practice													

Applicability of document to specific elements of the fuel system with degree of relevance

Applicability of document to specific sub-systems with key comments and hazards identified in the document

- Sample Summary Sheet
- **Review of Codes, Standards, and Regulations**
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US LNG/CNG Standards



Number	Title	Fueling					On-board storage					Transfer			Gasification		Consumption								
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
SAE J1616	Recommended Practice for Compressed Natural Gas Vehicle Fuel	General Requirements for CNG Fuel																							
SAE J2343	Recommended Practice for LNG Medium and Heavy Duty Powered Vehicles	●				●		●	○	●			●	●	●	○	○	●			●	●	●	●	●
SAE J2406	Recommended Practices for CNG Powered Medium and Heavy Duty Trucks	General CNG System Architecture																							
SAE J2645	Liquefied Natural Gas (LNG) Vehicle Metering and Dispensing Systems				●		○										○								
ANSI NGV1	Compressed Natural Gas Vehicle Fueling Connection Devices		●			●																			
ANSI NGV2	Compressed Natural Gas Vehicle Fuel Containers							●				○													
ANSI NGV3.1	Fuel System Components for Compressed Natural Gas Powered Vehicles	●	●			●			●	●			●	●	●		●		●	●	●	●	●	●	
ANSI NGV4.2	Hoses for Natural Gas Vehicles and Dispensing Systems	●				●				●	●			●	●							●	●		
ANSI NGV4.6	Manually Operated Valves for Natural Gas Dispensing Systems		●			●				●			●		●				●		●	●			
ANSI NGV4.8	Natural Gas Fueling Station Reciprocating Compressor Guidelines	●		●	●	●																			
ANSI PRD1	Pressure Relief Devices for Natural Gas Vehicle Fuel Containers		●									●						●		●					
ANSI B108-99	Natural Gas Fuelling Stations Installation Code	●	●	●		●	●																		
ANSI B109-01	Natural Gas for Vehicles Installation Code					●		●	●	●		●	●	●		●		●	●	●	●	●	●		
CGA C-6.4	Methods for External Visual Inspection of (NGV) Fuel Containers	○	○			○		●		○		○	○												

US LNG/CNG Codes and Regulations (non-Rail)



Number	Title	Fueling						On-board storage					Transfer			Gasification			Consumption						
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
NFPA 30A	Code for Motor Fuel Vehicle Dispensing Facilities and Repair Garages	●	◐	●	◐	◐	◐																		
NFPA 52	Vehicular Gaseous Fuel System Code	●	●		◐		◐	●	◐	●			●	●		◐	◐		●	◐	●		●		◐
NFPA 54	National Fuel Gas Code	●	●		●	●	◐																		
NFPA 57	Liquefied Natural Gas (LNG) Vehicular Fuel Systems Code	◐	◐	◐	◐	◐		●	◐	◐	◐		●	◐				◐	◐		◐		◐		◐
NFPA 59A	Standard for the Production, Storage, and Handling of Liquefied Natural Gas	●	●	◐	◐	◐	○																		
NFPA 70	National Electrical Code			●	◐																				
40 CFR 80.33	Controls applicable to natural gas retailers and wholesale purchaser- consumers	◐				◐																			
40 CFR 86.098-8	Emission standards for 1998 and later model year light-duty vehicles					○																			
49 CFR 174	Pipeline and Hazardous Materials Safety Administration, - carriage by rail							◐	○	○	○	○	○												
49 CFR 178.57&338	4L Welded Cylinders & Insulated Cargo Tank Motor Vehicle							●		◐	◐		◐												
49 CFR 193	Liquefied Natural Gas Facilities: Federal Safety Standards	○						○						○											
49 CFR 393.68	Fuel systems and CNG fuel Containers							○		○			○												
49 CFR 571.301&303	Fuel Systems Integrity & Fuel System / Container Integrity of CNG Vehicles							○		○															
UN ST/SG/AC Rev 18	Model Regulations on the Transport of Dangerous Goods							●	○	○	◐		◐												

Relevant US Rail Regulations (1 of 2)



Number	Title	Fueling					On-board storage					Transfer			Gasification		Consumption								
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
49 CFR 229.43	Engine exhaust	General Safety Requirement																							
49 CFR 229.93	Safety Cut-off Device Safety Requirements		○										○					○		○					
49 CFR 229.95	Venting Safety Requirements								○				○										○		
49 CFR 229.97	Grounding fuel tanks Safety Requirements						○		○				○										○		
49 CFR 229.101	Engines Safety Requirements																				○	○	○	○	○
49 CFR 229.135	Event Recorders in Cabs Safety Requirements																							○	○
49 CFR 229.209	Alternative locomotive crashworthiness designs	General Safety Guidelines																							
49 CFR 229.217	External fuel tanks						○																		
49 CFR 229 Sections 301-319	Railroad Locomotive Safety – Locomotive Electronics Safety	General Safety Requirements for Electronics																							
49 CFR 230.66	General design, construction and maintenance of tender	General Rollingstock Design Architecture																							
49 CFR 230.67	Safe and suitable for service	General Safety Requirement																							
49 CFR 230.86	Required Illumination	General Lighting Requirement																							
49 CFR 230.90	Draft systems, lost motion between locomotive and tender	General Interconnection Requirement																							
49 CFR 230.92	Draft systems safe & suitable	General Safety Requirement																							

Relevant US Rail Regulations (2 of 2)



Number	Title	Fueling						On-board storage					Transfer			Gasification		Consumption								
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors	
49 CFR 230.107	Tender frame and body	General Rollingstock Design Architecture																								
49 CFR 230.109	Tender Trucks	General Rollingstock Design Architecture																								
49 CFR 232.103	Brake Safety Standards –Requirements for Non-Passenger Train Brake Systems	General Brake Safety Requirements																								
49 CFR 232.105	Brake Safety Standards Requirements for Non-Passenger Locomotives	General Brake Safety Requirements																								
49 CFR 238.103	Passenger Equipment Safety Standards – Fire Safety	General Fire Safety For Passenger Trains																								
49 CFR 238.105	Passenger Equipment Safety Standards – Train electronic hardware and software	General Hardware and Software for Passenger Trains																								
49 CFR 238.117	Passenger Equipment Safety Standards – Protection against personal injury	General Touch Guards and Interlocks for Passenger Trains																								
49 CFR 238.223	Passenger Equipment Safety Standards – Requirements for Locomotive fuel tanks																									●
49 CFR 238.423	Passenger Equipment Safety Standards – Requirements for Locomotive fuel tanks																									○

Other Relevant Documents



Number	Title	Fueling						On-board storage					Transfer			Gasification			Consumption						
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
DOT-FTA-MA-26-7021-96-1	Design Guidelines for Bus Transit Systems Using Compressed Natural Gas (CNG) as an Alternative Fuel	General Requirements for CNG Fuel																							
DOT-FTA-MA-26-7021-97-1	Design Guidelines for Bus Transit Systems Using Liquefied Natural Gas (LNG) as an Alternative Fuel	General Requirements for LNG Fuel																							
DOT-FTA-MA-90-7007-95-3	Liquefied Natural Gas Safety in Transit Operations	General Safety Requirements for LNG Fuel																							
SAND2004-6258	Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water	General Safety Requirements for LNG Fuel																							

US OHS Regulations Pertinent to Natural Gas



Number	Title	Fueling					On-board storage					Transfer			Gasification		Consumption								
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
29 CFR Part 1910 Sec 101	OHS Standard – Compressed Gases – General Requirements							○	○																
29 CFR Part 1910 Sec 106	OHS Standards for Flammable Liquids	●	◐			◐		●		●	◐		◐												
29 CFR Part 1910 Sec 110	OHS Standard – Storage and handling of Liquefied Petroleum Gases	●	●	◐	●	●		●	◐	●	●		●	●	●			●	●		●	●	●		
29 CFR Part 1910.119 and 1926.64	OHS Standard – Process Safety Management of Highly Hazardous Chemicals	General Safety and Hazard Analysis Guidelines only																							
29 CFR Part 1910 Sec 1000	OHS Standard – Toxic and Hazardous Air Contaminants	General Safety Guidelines for Hazardous air contaminants																							
29 CFR Part 1915 Sec 171-173	OHS Standards for Shipyard Employment – Portable Unfired Pressure Vessels							◐					○												
29 CFR Part 1917 Sec 156	Marine Terminals – Fuel Handling and Storage	Safety for all Storage & Ops of fuels in marine terminals																							
29 CFR Part 1926 Sec 152	Construction Safety & Health – Flammable Liq Fire Protec & Prevention	◐	◐	◐	◐	◐	◐																		

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Number	Title	Fueling					On-board storage					Transfer			Gasification		Consumption								
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
ISO 8789	Rubber Hoses and Hose Assemblies for LPG in Motor Vehicles – Specification								●	○			●	○							○	●			
ISO 10976	Refrigerated Light HC Fluids – Measrmt of Cargoes on Board LNG Carriers						○		Other Sensors															●	●
ISO 11439	HP Cylinders for On-Board Storage of Natural Gas as fuel for Auto Vehicles						●																		
ISO/DIS 12614-1 (Draft)	Liquefied natural gas (LNG) fuel system components: General Requirements						○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
ISO/DIS 12614-2 (Draft)	Liquefied natural gas (LNG) fuel system components: Performance & Gen Tests						○	●	●	●	○	●	●	●	●	●	○	●	●	●	●	●	●	●	●
ISO/DIS 12614-3 (Draft)	Liquefied natural gas (LNG) fuel system components: Check Valve											●						●			●				
ISO/DIS 12614-4 (Draft)	Liquefied natural gas (LNG) fuel system components: Manual Valve											●						●			●				
ISO/DIS 12614-5 (Draft)	Liquefied natural gas (LNG) fuel system components: Tank Pressure Gauge							Onboard Sensors																	
ISO/DIS 12614-6 (Draft)	Liquefied natural gas (LNG) fuel system components: Overpressure Regulator							○								○			○	○					
ISO/DIS 12614-7 (Draft)	Liquefied natural gas (LNG) fuel system components: Pressure Relief Valve											●						●			●				
ISO/DIS 12614-8 (Draft)	Liquefied natural gas (LNG) fuel system components: Excess Flow Valve											●						●			●				
ISO/DIS 12614-9 (Draft)	Liquefied natural gas (LNG) fuel system components: Housing & Ventilation Hose								●				●										●		
ISO/DIS 12614-10 (Draft)	Liquefied natural gas (LNG) fuel system components: Rigid Fuel Line (SS)								●				●										●		
ISO/DIS 12614-11 (Draft)	Liquefied natural gas (LNG) fuel system components: Fittings									○				○								○			



Number	Title	Fueling					On-board storage					Transfer			Gasification		Consumption								
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
ISO/DIS 12614-12 (Draft)	Liquefied natural gas (LNG) fuel system components: Rigid Fuel Line (non-SS)								●				●										●		
ISO/DIS 12614-13 (Draft)	Liquefied natural gas (LNG) fuel system components: Pressure Control Regulator							●								●			●	●					
ISO/DIS 12614-14 (Draft)	Liquefied natural gas (LNG) fuel system components: Diff Pressure Fuel Gauge						Onboard Sensors																		
ISO/DIS 12614-15 (Draft)	Liquefied natural gas (LNG) fuel system components: Capacitance Fuel Gauge						Onboard Sensors																		
ISO/DIS 12614-16 (Draft)	Liquefied natural gas (LNG) fuel system components: Heat Exchanger/ Vaporizer																●								
ISO/DIS 12614-17 (Draft)	Liquefied natural gas (LNG) fuel system components: Natural Gas Detector						Other Sensors																	●	
ISO/DIS 12614-18 (Draft)	Liquefied natural gas (LNG) fuel system components: Gas Temp Sensor												Gasification Sensors												
ISO/DIS 12617 (Draft)	Liquefied natural gas vehicles – connector for refueling vehicles				●																				
ISO 12991	LNG – Tanks for On-Board Storage as a Fuel for Automotive Vehicles						●					●													
ISO 14469-1	Road Vehicles CNG Refueling Connector – Part 1 – 200 Bar Connector		●		●																				
ISO 14469-2	Road Vehicles CNG Refueling Connector – Part 2 – 200 Bar Connector, Size 2		●		●																				
ISO 14469-3	Road Vehicles CNG Refueling Connector – Part 3 – 250 Bar Connector		●		●																				
ISO 15403-1	Natural gas as Compressed Fuel for Veh. – Part 1 – Designation of Quality	○ ○ ○ ○ General Requirements for Natural Gas Fuels ○ ○ ○ ○																							
ISO 15403-2	Natural gas as Compressed Fuel for Veh. – Part 2 – Specification of Quality	○ ○ ○ ○ General Requirements for Natural Gas Fuels ○ ○ ○ ○																							

Number	Title	Fueling					On-board storage					Transfer			Gasification		Consumption								
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
ISO 15500-1	Road Vehicles – CNG System Comp. – Part 1 – General Req and Definitions						○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
ISO 15500-2	Road Vehicles – CNG System Comp. – Part 2 – Performance and Test Methods	General Test Procedures For All Fuel Components																				○	○	○	
ISO 15500-3	Road Vehicles – CNG Fuel System Components – Part 3 – Check Valve										●							●		●					
ISO 15500-4	Road Vehicles – CNG Fuel System Components – Part 4 – Manual Valve										●							●		●					
ISO 15500-5	Road Vehicles – CNG Fuel System Components – Part 5 – Manual Cyl Valve										●							●		●					
ISO 15500-6	Road Vehicles – CNG Fuel System Components – Part 6 – Automatic Valve										●							●		●					
ISO 15500-7	Road Vehicles – CNG Fuel System Components – Part 7 – Gas Injector																				●				
ISO 15500-8	Road Vehicles – CNG Fuel System Components – Part 8 – Pressre Indicator																							●	
ISO 15500-9	Road Vehicles – CNG Fuel System Components – Part 9 – Pr. Regulator								●								●		●	●					
ISO 15500-10	Road Vehicles – CNG Fuel System Components – Part 10 – Gas Flow Adjstr								●								●		●	●					
ISO 15500-11	Road Vehicles – CNG Fuel System Components – Part 11 – Gas/ Air Mixer																				●				
ISO 15500-12	Road Vehicles – CNG Fuel System Components – Part 12 – Pr. Relief Valve											●						●		●					
ISO 15500-13	Road Vehicles – CNG Fuel System Components – Part 13 – Pr. Relf Device																							●	
ISO 15500-14	Road Vehicles – CNG Fuel System Comp. – Part 14 – Excess Flow Valve											●													

ISO Standards (Page 4 of 6)



Number	Title	Fueling					On-board storage					Transfer			Gasification			Consumption							
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
ISO 15500-15	Road Vehicles – CNG Fuel Sys. Comp. – Part 15 – Housing & Ventilation hose								●				●										●		
ISO 15500-16	Road Vehicles – CNG Fuel Sys. Comp. – Part 16 – Rigid Fuel Lines in SS								●				●										●		
ISO 15500-17	Road Vehicles – CNG Fuel Sys. Comp. – Part 16 – Flexible Fuel Lines								●				●										●		
ISO 15500-18	Road Vehicles – CNG Fuel Sys. Comp. – Part 18 – Filters									○				○								○			
ISO 15500-19	Road Vehicles – CNG Fuel Sys. Comp. – Part 19 – Fittings									●				●								●			
ISO 15500-20	Road Vehicles – CNG Fuel Sys. Comp. – Part 20 – Rigid Fuel Lines (Non SS)								●				●										●		
ISO 15501-1	Road Vehicles – CNG Fuel Systems – Part 1 – Safety Requirements							●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
ISO 15501-2	Road Vehicles – CNG Fuel Systems – Part 2 – Test Methods							●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
ISO 18132-1	General Reqs for Automatic Tank Gauges – Part 1 – For LNG on Marine Carriers				●																				
ISO 18132-2	Gen Req for Auto Level Gauges – Part 2 – Gauges in Refrigerated Shore Tanks				●																				
ISO 18132-3	Gen Req for Auto Tank Gauges – Part 3 – For LPG on Board Marine Carrier				●																				
ISO 19078	Gas Cyl – Inspection of Installation and Requalification of HP Cyl for On-Board							●	○	○	○		○												
ISO 20421-1	Cryo Vessels – Large Transp Vac-Ins – Part 1 – Design, Fab, Inspec & Tests							●	●	●	●		●												
ISO 20421-2	Cryo Vessels – Large Transportable Vacuum-Insulated – Part 2 – Op Reqs							●	○	○	○		○												

ISO Standards (Page 5 of 6)



Number	Title	Fueling					On-board storage					Transfer			Gasification		Consumption								
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
ISO 20826	Automotive LPG Components – Containers							●																	
ISO 21009-1	Cryo Vessels – Static Vac-Ins – Part 1 – Design, Fab, Inspection and Tests							●	◐	◐	◐		●												
ISO 21009-2	Cryo Vessels – Static Vacuum-Insulated – Part 2 – Operational Requirements							◐	○	○	○		○												
ISO 21012	Cryogenic Vessels – Hoses	●				●				●	●			●	●										
ISO 21013-1	Cryo Vessels – Pressure-Relief Accessories – Part 1 – Re-closable PRV		◐										◐												
ISO 21013-2	Cryo Vessels – Pressure-Relief Accessories – Part 2 – Non-rec PRDs								◐								◐								
ISO 21013-3	Cryo Vessels – Pressure-Relief Accessories – Part 3 – Sizing & Cap								◐								◐								
ISO 21013-4	Cryo Vessels – Pilot Operated PRD – Part 4 – Pressure-Relief Accessories		◐										◐												
ISO 21014	Cryogenic Vessels – Cryogenic Insulation Performance							◐																	
ISO 21028-1	Cryogenic Vessels – Toughness Req Materials – Part 1 – Temp Below -80 °C							●																	
ISO 21028-2	Cryogenic Vessels – Toughness Req Materials – Part 2 – Betwn -80 & -20 °C							●																	
ISO 21029-1	Cryo Transportable Vacuum Insulated Vessels – Design, Fab, Inspec & Tests							●	◐	◐	○		◐												
ISO 21029-2	Cryo Transportable Vacuum Insulated Vessels – Operational Requirements							◐																	
ISO 23208	Cryogenic Vessels – Cleanliness for Cryogenic Service							◐																	



Number	Title	Fueling					On-board storage					Transfer			Gasification		Consumption								
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
ISO 24490	Cryogenic Vessels – Pumps for Cryogenic service										●						●								

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		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
GPS 1.1	Product Safety Act – Law on provision of products on the market	General Requirements For GS/ CE Marking																							
GPS 2.11.1	Equipment and protective systems intended for use in explosive atmosphere	General Requirements Only																							
GPS 2.1.15	Improving health and safety of workers from explosive atmospheres	General Requirements Only																							
BGR 104	Explosion protection rules	Compilation of General Technical Rules																							
BGR 132	Avoiding ignition due to electrostatic charges	<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	<input type="radio"/>			<input type="radio"/>														
TRGS 200	Technical Rule for Hazardous Substances - classification and labeling of substances, preparations and products	Recommendations on Classification & Labeling Only																							
TRGS 201	Technical Rule for Hazardous Substances - classification and labeling of hazardous substances	Recommendations on Classification & Labeling Only																							
TRGS 400	Technical Rule for Hazardous Substances - Risk assessment for activities involving hazardous substances	Recommendations on Classification & Labeling Only																							
TRGS 510	Technical Rule for Hazardous Substances - storage of hazardous substances in portable tanks	Focus on Storage of Hazardous Substances																							
TRGS 720	Technical Rule for Hazardous Substances - Dangerous explosive atmospheres - General	General Requirements Only																							
TRGS 721	Technical Rule for Hazardous Substances - Assessment of the risk of explosion	General Requirements Only																							

Number	Title	Fueling					On-board storage					Transfer			Gasification		Consumption								
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
TRGS 722	Technical Rule for Hazardous Substances - prevention or restriction of hazardous explosive atmospheres	General Requirements Only																							
TRGS 751/ TRBS 3151	Technical Rule for Hazardous Substances - prevention of fire, Explosions and pressure hazards at gas stations and filling equipment for filling of land vehicles	○							○			○													
TRGS 800	Technical Rule for Hazardous Substances - Fire Protection Measures	General Requirements Only																							
Directive 97/23/EC	Pressure Equipment Directive (PED)	General Requirements Only																							
TRBS 2141	Technical rules for operational safety - hazards from steam and pressure	○				○		○		○	○		○												
TRBS 2152	Technical rules for operational safety - Dangerous explosive atmospheres	General Requirements Only																							
TRBS 2153	Technical rules for operational safety - Prevention of ignition hazards due to electrostatic charges	◐	○		○			○		○		○													
BGR 500	Accident Prevention Regulations – operating systems for handling gases	○				○	○	○	○		○			○	○	○	○					○		○	
BGI 590	Accident Prevention Information - Safe transport of LPG cylinders and aerosols with vehicles on the road	General Regs & Laws For Road Transport Of Gas Cylinders																							
B 2207	Guidelines implementing dangerous goods Regulation by Road, rail and Inland Waterways	General Regs & Guidelines on Transport Of Dangerous Goods																							

Number	Title	Fueling					On-board storage					Transfer			Gasification		Consumption								
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
RID 2013	Regulations concerning the International Carriage of Dangerous Goods	◐	◐			○		●	◐	◐	○		◐	◐											
UNECE Reg 49	CNG - Approval of compression-ignition	General Emissions Related Regulations Only																							
UNECE Reg 67	CNG – Approval of propulsion by liquefied gases						●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
UNECE Reg 110	CNG – Drive systems in motor vehicles						●	●	●	●		●	●	●	●	●		●	●	●	●	●	●	●	●
UNECE Reg 115	CNG – Special LPG retrofit systems on motor vehicles						○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
BGV D34	Accident prevention Information: Handling of liquefied gas	○	○			○	○		○	○		○	○	○	○		○					○	○		
TRB 851	Filling equipment for filling of compressed gases from compressed gas containers in pressure vessel	○	○																						

- Sample Summary Sheet
- **Review of Codes, Standards, and Regulations**
 - United States
 - International Organization of Standardization (ISO)
 - Germany
 - **Australia**
 - Japan
- Appendices For Detailed One-Pagers

Australian Codes Standard and Regulations



Number	Title	Fueling					On-board storage					Transfer			Gasification			Consumption							
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
AS 1210	Pressure vessels	●	●		●	●		●	●	●		●													
AS/ NZS 1425	LPG fuel systems for vehicle engines						●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
AS/ NZS 1869	Hose and hose assemblies for LPG	●				●			●	●			●	●								●	●		
AS 2359.2	Powered industrial trucks	General Safety Requirements for Operation of Trucks																							
AS/ NZS 2739	Natural gas fuel systems for vehicle engines						●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●
AS 2746	Working areas for gas-fueled vehicles	General Safety Requirements for Maintenance Facilities																							
AS 2809.1	Road tank vehicles for dangerous goods						●	○	○	○		○													
AS 2809.2	Road tank vehicles for flammable liquids						●		●	●		●													
AS 2809.6	Tankers for cryogenic liquids						●	●	●	●	●														
AS/ NZS 3788	Inspection of pressure equipment	General Requirements Safety Inspection all Pressure Eqp																							
AS 3961	Storage and handling of LNG	●	●	●	●	○	●	○	●	●	●	●	●	●	○	○	●	●	○						
AS 4041	Pressure piping	●	●		●	●			●	●		●	●	●			●			●	●	●		●	●
AS 4564	Specification for general purpose natural gas	General Requirements for Fuel Quality of NG																							
AS 4838	High pressure gas cylinders	Identical to ISO 11439																							

Australian Codes Standard and Regulations



Number	Title	Fueling					On-board storage					Transfer			Gasification		Consumption								
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
AS 4983	Gas fuel systems for forklifts and industrial vehicles						●	○	●	●		●	●	●	●	○		●	○	●	●	●	○	○	
AS 5092	CNG refueling stations	●	●	●	●	●																			
AS/ NZS 60079.10.1	Explosive atmospheres	Classification and Safety in Explosive Gas Atmospheres																							
ADR 44	Vehicle design rule 44: specialty vehicles	Basic Safety Guidelines only																							
	Rail Safety National Law of 2012	Basic Safety & Regulatory Guidelines only																							
	Dangerous goods act (2008)	Basic Safety & Regulatory Guidelines only																							
NCOP 9	Light vehicle construction fuel system modifications						○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	

- Sample Summary Sheet
- **Review of Codes, Standards, and Regulations**
 - United States
 - International Organization of Standardization (ISO)
 - Germany
 - Australia
 - **Japan**
- Appendices For Detailed One-Pagers

Japanese Codes, Standard and Regulations



Number	Title	Fueling					On-board storage					Transfer			Gasification			Consumption							
		Hoses	Valves	Compressor	Metering & Snr	Fittings	Break Away	Tanks	Regulators	Hoses	Fittings	Refrigeration	Valves	Hoses	Fittings	Break Away	Regulators	Vaporizer	Valve	Regulator	Valves & Rgtrs	Fittings	Pipes / Hoses	Metering	Sensors
KHKS 0124	High pressure container valve design		● ○																						
KHKS 0150	High pressure tank truck															●									
KHKS 0501	LPG supply standard				●	●	●	○				○								○					
KHKS 0739	LPG technology benchmark				●																				
KHKS 0744	LPG fueling safety	●																							
KHKS 0850	Inspection standards for LNG	○	○		○	General Safety Inspection Requirements only																			
JASO E203	CNG refueling connectors											●	●												
JASO E204	CNG vehicles: pressure relief devices											●	●												
JASO E205	CNG vehicle valve requirements											●					●			●					
JASO E207	CNG vehicle tubes and fittings											●	●		●	●						●	●		
Act 186 of 1948	Fire service act	General Requirements. No Specifications																							
Act 204 of 1957	High pressure gas safety act	General Requirements. No Specifications																							

- Sample Summary Sheet
- Review of Codes, Standards, and Regulations
- **Appendices For Detailed Summaries**
 - **United States**
 - International Organization of Standardization (ISO)
 - Germany
 - Australia
 - Japan

SAE J1616 Recommended Practice for Compressed Natural Gas Vehicle Fuel

Name	Recommended Practice for Compressed Natural Gas Vehicle Fuel			Code	J1616										Date of Issue	Feb 1994				
Authorising / issuing agency	SAE International			Fuel Applicability	CNG										Next Issue					
Sector Applicability	All NG powered vehicles		Geographical coverage	US	System/Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> The properties of natural gas are influenced by: <ul style="list-style-type: none"> The processing of the natural gas by production and transmission companies The regional gas supply, storage and demand balancing Natural gas is comprised chiefly of methane (88-96 mole %), with balance being decreasing proportions ethane, propane, butane etc. Mecaptan odorants are added by local distribution companies for safety reasons 			Fueling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Onboard Storage				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Transfer				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gasification				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Consumption				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sub System Element				Incl	Comment	Hazards Identified		Pertains to fuel and hence applicable to all components in contact with fuel												
Fuelling Facilities & Operations	<input checked="" type="checkbox"/>	Impacts dew point and fuel storage																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	<input checked="" type="checkbox"/>	May impact operational only																
<ul style="list-style-type: none"> SAE Papers 902069, 920593 ANSI/AGI Publications, NGV2 ASTM 1142-90, 1945-91, 3588-91, 4084-88 NFPA 52 Vehicle systems code and NFPA 70 – National Electrical Code GRI91/1011/0123 and 92/0150 	Paper Std.	Maintenance equip & procedures																		
	Std.	Safe Practices																		
	Code	Emergency equip & procedures																		
	Paper	Environmental issues																		
	Key take-outs / best practice				<ul style="list-style-type: none"> Wobbe index - - natural gas can be characterised by the wobbe index – measure of fuel energy flow rate through a fixed orifice under given inlet conditions Impact on knock rating of fuel – operational issue Pressure water dew point – critical on drivability 															

SAE J2343 Recommended Practice for LNG Medium and Heavy Duty Powered Vehicles

Name	Recommended Practice for LNG Medium and Heavy Duty Powered Vehicles			Code	J2343								Date of Issue	Jul 2008			
Authorising / issuing agency	SAE International			Fuel Applicability	LNG								Next Issue				
Sector Applicability	On-highway MD and HD Vehicles	Geographical coverage	All	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description	<ul style="list-style-type: none"> Recommended practice for construction, operation and maintenance on commercial LNG powered medium and heavy duty vehicles The vehicle are defined as having Gross vehicle weights (GVW) of greater than 6350kg (14,0001 US pounds) used in public transport and commercial applications 			Fueling													
				Onboard Storage	●	●		●		●			●				
				Transfer	●			●			○						
				Gasification	●			●									
				Consumption	●	●		●									
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)				Type	Sub System Element	Incl	Comment	Hazards Identified									
					Fuelling Facilities & Operations												
					Fuel Systems & Tanks	✓	Good design direction for fuel systems / drop tests procedures	Primary pressure relief valves blockage									
<ul style="list-style-type: none"> API 620 Design and Construction of large, welded low pressure storage tanks ASME, Boiler and Pressure Vessel Code, Section VIII, Division 1 CGA S-1.2 Pressure Relief Device Standards Parts 2 & 3 49CFR 393.65 All fuel systems 49CFR 393.67 Liquid fuel tanks 49 CFR 178.57 Specification 4L welded Insulated Cylinders NFPA 52 2006 Vehicle systems code (includes old NFPA 57, 52 and NFPA 70 – National Electrical Code) Texas administrative Code Title 16, Part 1, Chapter 13; Regulations for CNG and Liquefied Natural Gas 				Code	Maintenance equip & procedures	✓	Some insight , mostly around fuel systems										
				Code Std.	Safe Practices	✓	Limited – mostly around fuel systems										
				Reg. Reg.	Emergency equip & procedures	✓	Limited insight										
				Reg. Code	Environmental issues												
				Code	Key take-outs / best practice												
					<ul style="list-style-type: none"> Fuel systems design 												



SAE J2406 Recommended Practice for CNG Medium and Heavy Duty Powered Vehicles



Name	Recommended Practice for CNG Medium and Heavy Duty Powered Vehicles		Code	J2406				Date of Issue	Mar 2002										
Authorising / issuing agency	SAE International		Fuel Applicability	CNG				Next Issue											
Sector Applicability	On-highway MD and HD Vehicles	Geographical coverage	All	System/Component	Hoses/Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Recommended practice for construction, operation and maintenance on commercial CNG powered medium and heavy duty vehicles The vehicle are defined as having Gross vehicle weights (GVW) of greater than 6350kg (14,000 US pounds) used in public transport and commercial applications 			Fueling															
				Onboard Storage															
				Transfer															
				Gasification															
				Consumption															
				Sub System Element	Incl	Comment	Hazards Identified												
				Fuelling Facilities & Operations															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks			✓	Design direction for CNG fuel systems with schematic	Primary pressure relief valves blockage												
<ul style="list-style-type: none"> SAE Publication: J1703, J1616, J2343 ANSI/AGI Publications NGV1, NGV2, PRD 1, FCI 70-2 CGA S-1.2, 6.1, 6.4 Pressure Relief Device Standards 49CFR 571.301 Fuel system Integrity 49CFR 571.303 Fuel system integrity of CNG 49 CFR 571.304 CNG Fuel Container integrity NFPA 52 Vehicle systems code and NFPA 70 – National Electrical Code California Code of Regulation: Title 08 CNG & LNG vehicle regulations 	Std.	Maintenance equip & procedures		✓	Limited comments														
	Std.	Safe Practices		✓	Limited – mostly around fuel systems														
	Reg.	Emergency equip & procedures		✓	Limited insight														
	Reg.	Environmental issues																	
	Code	Key take-outs / best practice																	
Code	<ul style="list-style-type: none"> Fuel systems design schematic CNG only 																		

SAE J2645 Liquefied Natural Gas (LNG) Vehicle Metering and Dispensing systems

Name	Liquefied Natural Gas (LNG) Vehicle Metering and Dispensing systems			Code	J2645							Date of Issue	Mar 2003							
Authorising / issuing agency	SAE International			Fuel Applicability	LNG							Next Issue								
Sector Applicability	All vehicle LNG engines		Geographical coverage	All	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Provide information on issues that are important to consider regarding LNG metering and dispensing systems 			Fueling								○	●							
Onboard Storage																				
Transfer														○						
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations				✓	Useful for understanding definitions															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type																			
– NIST Handbook 44 – Specifications for weighing and measuring devices	Pub.	Maintenance equip & procedures																		
– NFPA 52 – Compressed Natural Gas Vehicle Fuel Systems Code	Code	Safe Practices																		
– NFPA 57 - Standard for Liquefied Natural Gas (LNG) Vehicular Fuel Systems	Code	Emergency equip & procedures																		
– NFPA 59A - Standard for the Production, Storage and Handling of LNG	Code	Environmental issues																		
– NFPA 70 -The National Electric Code (1996)	Code	Key take-outs / best practice																		
– NFPA 497A - Recommended Practice for Classification of Class I Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas	Code	<ul style="list-style-type: none"> Useful for understanding definitions and methods of measuring LNG volume and flow 																		

ANSI NGV1-2006 Compressed Natural Gas Vehicle (NGV) Fueling Connection Devices

Name	Compressed Natural Gas Vehicle (NGV) Fueling Connection Devices			Code	ANSI NGV1-2006 CSA NGV1-2006							Date of Issue	Mar 2006							
Authorising / issuing agency	American National Standard / CSA Standard			Fuel Applicability	CNG							Next Issue	-							
Sector Applicability	All vehicles		Geographical coverage	US / Canada	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Examination, testing and certification of compressed Natural Gas Vehicle (NGV) fuelling nozzles and receptacles only Does not refer to the entire system, but only above 2 components Standardized nozzles and receptacles specific to operating pressure of vehicle to improve availability and avoid misfueling 			Fueling		●		●	●											
Onboard Storage																				
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Nozzle and receptacle design requirements	Leakage, corrosion, abnormal loads															
<ul style="list-style-type: none"> ANSI/ ASQC Q91/92/93 – Quality Systems ANSI/ SAE J516, J1453 and J1926 – Fittings and O-ring seals ASTM B117-90, B154-92, D471-79 and D572-88 – Standard test methods ANSI/ NFPA 52 CNG Vehicular fuel systems CAN/ CGA B149.1-M86/ B149.4-M91 – Natural gas installation codes CGA Lab 006/ 007 – CGA certification lab requirements CR89-002 – Certification requirement NGV refuelling probes CAN3-Z299.1-85 – Z299.4-85 – Quality Assurance Program ISO 228-1, 1179 and 6149 – Pipe threads and connections 	Std.	Maintenance equip & procedures	✓	Serviceability, durability and maintainability	Life in cycles of operation															
	Std.	Safe Practices	✓	Multiple tests identified to confirm design requirement																
	Code	Emergency equip & procedures																		
	Code	Environmental issues																		
	Std.	Key take-outs / best practice																		
Std.	<ul style="list-style-type: none"> Scope limited to nozzles and receptacles for fuelling vehicles Attempt to standardize fittings to improve interchangeability across multiple manufacturers and operating pressures 																			

ANSI NGV 2-2007 Compressed Natural Gas Vehicle Fuel Containers

Name	Compressed Natural Gas Vehicle Fuel Containers			Code	ANSI NGV 2-2007							Date of Issue	Jun 2007								
Authorising / issuing agency	American National Standard / CSA Standard			Fuel Applicability	CNG							Next Issue	-								
Sector Applicability	All vehicles		Geographical coverage	US		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Safe operation, substantial and durable construction and performance testing of containers for the on-board storage of compressed natural gas for vehicle operation Requirements for material, design, manufacture and testing of NGV containers intended only for the storage of CNG for vehicle operation 			Fueling																	
Onboard Storage					○											●					
Transfer																					
Gasification																					
Consumption																					
Sub System Element				Incl	Comment	Hazards Identified															
Fuelling Facilities & Operations																					
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	CNG fuel container design only			Leaks, manufacturing defects														
<ul style="list-style-type: none"> ASD1 Aluminium standards and data BPVC Boilers and pressure vessels Multiple ASTM standards for testing and material properties ANSI/ ISO/ ASQC Q9000 Series 2000 Quality management and quality assurance standards QS9000 Quality systems requirements Multiple BS (British) and CSA (Canadian) standards ANSI/ IAS PRD 1 Basic requirement for pressure relief devices for NGV fuel containers CGA C-1 and C-6.4 Methods of testing for compressed gas cylinders FMVSS 303 and 304 DOT/ NHTSA standards Multiple ISO standards testing and materials NACE TM0177 Lab tests of metals NFPA 52 Vehicular fuel systems code SAE J1616 and J2578 Recommended practices for CNG vehicle fuel 	Std. Code Std.	Maintenance equip & procedures	✓	Serviceability, durability and maintainability			Overpressurization, filling cycles, temperature														
	Std. Std.	Safe Practices	✓	Multiple tests identified to confirm design requirement			Safe disposal of rejected containers														
	Std. Std. Std.	Emergency equip & procedures																			
	Std. Std.	Environmental issues																			
	Std. Reg. Std. Std. Code Std.	Key take-outs / best practice																			
					<ul style="list-style-type: none"> Detailed design, testing, serviceability and maintenance of CNG fuel containers Entire lifecycle of CNG containers accompanied by hazards which need to be regularly tested to confirm if container is fit for service 																

Source: Ricardo assessment

ANSI NGV 3.1 Fuel System Components for Compressed Natural Gas Powered Vehicles

Name	Fuel System Components for Compressed Natural Gas Powered Vehicles			Code	ANSI NGV 3.1-2012 CSA 12.3-2012							Date of Issue	Feb 2012							
Authorising / issuing agency	American National Standard / CSA Standard			Fuel Applicability	CNG							Next Issue	-							
Sector Applicability	All vehicles		Geographical coverage	US / Canada	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> A standard for the safe operation, substantial and durable construction and performance testing of natural gas vehicle fuel systems The standard does not apply to the original manufacture of motor vehicles which comply with the Federal Motor Vehicle Safety standards (FMVSS) or Canadian Motor Vehicle Safety standards (CMVSS) 			Fueling																
Onboard Storage				●	●	○	○	○	○											
Transfer				●	●	○	○	○												
Gasification				●	●	○	○			○										
Consumption				●	●	○	○	○	○											
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks		✓	Valves, injector, indicators, regulators and fuel lines							Leakage, excessive loads, corrosion, continuous operation								
<ul style="list-style-type: none"> ASTM B117 – Standard practice for operating salt spray testing ASTM D471 – Standard Test method for rubber properties ASTM D572 – Standard test for the deterioration or rubber by heat and oxygen ASTM A 269 & A632 – Standard specification for seamless and welded Stainless Steel tubing CSA NGV 4.2 – Hoses for natural gas vehicles and dispensing systems CSA PRD 1 – Basic requirements for pressure relief devices for NGV fuel containers CGSB 3.513 – Natural base for vehicles SAE J1742, J1616 and J1673 	Std.	Maintenance equip & procedures																		
	Std.	Safe Practices		✓	General test methods and specific component test methods															
	Std.	Emergency equip & procedures																		
	Std.	Environmental issues																		
	Std.	Key take-outs / best practice																		
	Std.	Std.	<ul style="list-style-type: none"> Lists all fuel system components (table 1) Identifies general test procedures for the entire system and also for each component 																	

ANSI/ IAS NGV 4.2 Hoses for Natural Gas Vehicles and Dispensing Systems

Name	Hoses for Natural Gas Vehicles and Dispensing Systems (Reaffirmed 2009)			Code	ANSI/ IAS NGV 4.2-1999 CSA 12.52-M99							Date of Issue	2009							
Authorising / issuing agency	American National Standard / CSA Standard			Fuel Applicability	CNG							Next Issue	-							
Sector Applicability	All vehicles		Geographical coverage	US / Canada		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> A standard for the safe operation, substantial and durable construction and performance testing of components for hoses for natural gas vehicles and dispensing systems The standard does not apply to the original manufacture of motor vehicles which comply with the Federal Motor Vehicle Safety standards (FMVSS) or Canadian Motor Vehicle Safety standards (CMVSS) 			Fueling	●			○												
Onboard Storage				●			○													
Transfer				●			○													
Gasification				●			○													
Consumption				●			○													
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations	✓	Hose assemblies only																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Hose assemblies only	Leakage, abrasion, cracks, electrical conduction															
– ASTM B117 – Standard practice for operating salt spray testing	Std.	Maintenance equip't & procedures																		
– ASTM D573 – Standard test method for rubber deterioration in an air oven	Std.	Safe Practices	✓	Instructions and markings on hoses and test methods	Materials, corrosion, strength															
– ASTM D638 – Standard test method for tensile properties of plastics	Std.	Emergency equip't & procedures																		
– ASTM D1149 Standard test method for rubber deterioration – surface ozone cracking in a chamber	Std.	Environmental issues																		
– ASTM G53 – Standard practice for operating light and water exposure apparatus for exposure of non-metallic materials	Code Std.	Key take-outs / best practice																		
– CAN/ CGA-B108 – NGV refuelling stations installation code		<ul style="list-style-type: none"> Covers all hose assemblies including fittings used to connect the fuel dispenser to the fuelling nozzle and also all assemblies used within the vehicle's fuel system Special considerations for Canada are also specified Design and test requirements for safety, sustainability and durability are considered 																		
– ISO 6945 – Rubber hoses – determination of abrasion resistance of the outer cover																				

Source: Ricardo assessment

ANSI/ IAS NGV 4.6 Manually Operated Valves for Natural Gas Dispensing Systems

Name	Manually Operated Valves for Natural Gas Dispensing Systems (Reaffirmed 2009)			Code	ANSI/IAS NGV 4.6-1999 CSA 12.56-M99							Date of Issue	2009							
Authorising / issuing agency	American National Standard / CSA Standard			Fuel Applicability	CNG							Next Issue	-							
Sector Applicability	All vehicles		Geographical coverage	US / Canada	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> A standard for the safe operation, substantial and durable construction and performance testing of components for manually operated valves for natural gas dispensing systems The standard does not apply to the original manufacture of motor vehicles which comply with the Federal Motor Vehicle Safety standards (FMVSS) or Canadian Motor Vehicle Safety standards (CMVSS) 			Fueling		●		○												
Onboard Storage					●		○													
Transfer					●		○													
Gasification					●		○													
Consumption					●		○													
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks		✓	Manually operated valves only			Leakage, strength, corrosion, continued operation												
<ul style="list-style-type: none"> ANSI/ASME B1.1-1989 – Screw Threads ANSI/ASME B1.20.1-1983 – Pipe threads ANSI/ASME B16.3-1993 – Iron threaded fittings ASTM B117 – Standard practice for operating salt spray CSA C22.2 No. 139 – Electrically operated valves ISO 68:1973, 261:1973, 1179:1982, 6149-1:1993 CAN/ CGA-B108-M95 NGV Refuelling stations Installation Code NFPA 52-1996 CNG for Vehicular Fuel systems SAE J516, J1453, J1926, J525 UL 429, UL 1002 	Std. Std. Std. Std. Std. Std. Code Code Std. Std.	Maintenance equip & procedures																		
		Safe Practices		✓	Instructions, markings and test procedures			For installation, operation and servicing												
		Emergency equip & procedures																		
		Environmental issues																		
Key take-outs / best practice																				
<ul style="list-style-type: none"> Covers all manually operated valves including fasteners used in natural gas dispensing systems Special considerations for Canada are also specified Design and test requirements for installation, operation and servicing are considered 																				

ANSI NGV 4.8 Standard for NGV fuelling station reciprocating compressor guidelines

Name	Standard for NGV fuelling station reciprocating compressor guidelines			Code	ANSI NGV 4.8-2012 CSA 12.8-2012							Date of Issue	March 2012					
Authorising / issuing agency	American National Standard / CSA Standard			Fuel Applicability	CNG/ LNG							Next Issue	-					
Sector Applicability	All vehicles	Geographical coverage	US / Canada	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Performance standard for North America regarding fuelling station reciprocating compressors applicable to dispensing natural gas to vehicles A standard for the safe operation, substantial and durable construction and performance testing of compressor packages containing reciprocating compressors for natural gas dispensing systems 			Fueling	●			●		●				●				
Onboard Storage																		
Transfer																		
Gasification																		
Consumption																		
Sub System Element				Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations				✓	Reciprocating compressors and associated utilities	Sound pressure, electrical hazard												
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																
<ul style="list-style-type: none"> ARI-270 – Sound rating of outdoor unitary equipment ANSI/ API 11P – Specification for packaged reciprocating compressors for oil and gas production services API 520-1 – Sizing, selection and installation of pressure relieving devices ASME BPV, ASME SEC II, ASME SEC VIII, ASME SEC IX, ASME B1.20.1, ASME B1.20.3, ASME B16.1, ASME B16.5, ASME B16.42, ASME B16.3 ASTM A395 – Standard specs for ferritic ductile iron pressure retaining castings for use at elevated temperatures BS 21 – Pipe threads for tubes and ANSI/ AGA NGV3.1 – Fuel system components for NGVs CSA B51, CSA B108, CSA B109, CSA B149, CSA C22.1 NFPA 52 – CNG Vehicular fuel systems NFPA 70 – National electric code SAE J1616 – Recommended practice for CNG vehicle fuel 	Std.	Maintenance equip & procedures																
	Std.	Safe Practices	✓	Inspection, testing and alarms														
	Code	Emergency equip & procedures	✓	Emergency shutdown procedures														
	Std.	Environmental issues																
	Std.	Key take-outs / best practice																
	Code	<ul style="list-style-type: none"> Covers all manually operated valves including fasteners used in natural gas dispensing systems Special considerations for Canada are also specified Design and test requirements for installation, operation and servicing are considered 																

Source: Ricardo assessment

ANSI PRD 1-2013 Pressure Relief Devices for Natural Gas Dispensing Systems



Name	Pressure Relief Devices for Natural Gas Vehicle (NGV) Fuel containers			Code	ANSI PRD 1-2013								Date of Issue	Mar 2013						
Authorising / issuing agency	American National Standard / CSA Standard			Fuel Applicability	CNG								Next Issue	-						
Sector Applicability	All vehicles		Geographical coverage	US / Canada	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> A standard for the safe operation, substantial and durable construction and performance of pressure relief devices (PRD) for natural gas vehicle (NGV) containers, for the on-board storage of compressed natural gas for vehicle operation 			Fueling																
Onboard Storage					●															
Transfer					●															
Gasification					●															
Consumption					●															
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations	✓																			
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Design requirements		Routing														
– ASTM D572-04, D1149-99, D1193-06, D4814-11b, G154-06	Std.	Maintenance equip't & procedures	✓	Design service life																
– ISO 68:1973, 261:1973, 1179:1982, 6149-1:1993	Std.	Safe Practices	✓	Covers PRD testing																
– CGA S1,1-2011 Pressure Relief Device Standards– cylinders for compressed gasses	Std.	Emergency equip't & procedures																		
– 49CFR 571.303 Fuel system integrity of CNG	Reg.	Environmental issues																		
– 49 CFR 571.304 CNG Fuel Container integrity	Reg.	Key take-outs / best practice																		
– NFPA 52 2010 Vehicular Gaseous system code	Code	<ul style="list-style-type: none"> Focus on Pressure Relief Devices (PRD's) Comments of Vehicle level implications e.g. Routing 																		
– SAE J1616-1994 – Natural Gas Vehicles	Std.																			
– Transport Canada Motor Vehicle Regulations 301.202012 CNG fuel system integrity	Std.																			



ANSI B108-99 Natural gas fuelling stations installation code



Name	ANSI Natural gas fuelling stations installation code			Code	ANSI B108-99							Date of Issue	2012							
Authorising / issuing agency	American National Standard / CSA Standard			Fuel Applicability	CNG							Next Issue	-							
Sector Applicability	All vehicles		Geographical coverage	US / Canada	System/Component	Hoses/Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description				Fueling	●	●				●		●			●					
<ul style="list-style-type: none"> A standard for the installation of fuelling station facilities within a building that has primary functions other than fuelling. It covers indoor fuelling stations for vehicles that use natural gas as a motive fuel 				Onboard Storage																
				Transfer																
				Gasification																
				Consumption																
								Sub System Element	Incl	Comment						Hazards Identified				
				Fuelling Facilities & Operations	✓							Ventilation, electrical								
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)				Type																
<ul style="list-style-type: none"> – CSA B51-97 Boiler, pressure vessel and piping code – CGA 12.6-M94 Vehicle Refuelling appliances – CASN/CGA-B1 49.1-M94 – Natural Gas installation Code – CGA NGV-1-M94 – CNG NGV fuel Connection Devices – CGA 12.52 / ANSA NGV 4.2-1998 Hoses for Natural Gas and Dispensing Systems 				Std.	Maintenance equip't & procedures															
				Std.	Safe Practices	✓														
				Std.	Emergency equip't & procedures	✓	Use of Emergency shutdown (ESD) switch						Alarm conditions and emergency shutdown							
				Std.	Environmental issues															
								Key take-outs / best practice												
								<ul style="list-style-type: none"> Covers high and low flow fuelling Covers requirements for Canada 												

ANSI B109-01 Natural gas for vehicles installation code



Name	ANSI Natural gas for vehicles installation code			Code	ANSI B109-01							Date of Issue	2012							
Authorising / issuing agency	American National Standard / CSA Standard			Fuel Applicability	CNG							Next Issue	-							
Sector Applicability	All vehicles		Geographical coverage	US / Canada		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> A standard applies to the installation, servicing and repair of natural gas fuel systems on self propelled vehicles for the provision of motive power 			Fueling						●										
Onboard Storage				●	●	●	●									●				
Transfer				●	●	●	●													
Gasification				●	●	●	●													
Consumption				●	●	●	●													
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations	✓																			
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks		✓	System requirements and assemblies		Fuel supply line recommendations													
<ul style="list-style-type: none"> CSA B51-97 Boiler, pressure vessel and piping code CGA 12.6-M94 Vehicle Refuelling appliances CGA NGV-1-M94 – CNG NGV fuel Connection Devices CGA 12.52 / ANSA NGV 4.2-1998 Hoses for Natural Gas and Dispensing Systems ANSI/ASME B1.1-1989 – Screw Threads CGA S1,1-2011 Pressure Relief Device Standards– cylinders for compressed gasses ISO 1179:1981, 6149:1993 SAE: J514-1999, J516-1999, J1292-981, J1483-1998 	Std.	Maintenance equip & procedures		✓	Appendix A : Service & repair of cylinders Appendix B: Depressurisation of fuel cylinders															
	Std.																			
	Std.	Safe Practices		✓	Useful NGV vehicle checklist															
	Std.	Emergency equip & procedures																		
	Std.	Environmental issues																		
	Std.	Key take-outs / best practice <ul style="list-style-type: none"> Covers multi-fuel vehicles and converted vehicles Useful checklist 																		



CGA C-6.4 Methods for External Visual Inspection of Natural Gas Vehicle (NGV) and Hydrogen Gas Vehicle (HGV) Fuel Containers and their Installations

Name	Methods for External Visual Inspection of Natural Gas Vehicle (NGV) and Hydrogen Gas Vehicle (HGV) Fuel Containers and their Installations			Code	CGA C-6.4						Date of Issue	2012									
Authorising / issuing agency	Compressed Gas Association			Fuel Applicability	CNG and Hydrogen gas						Next Issue	-									
Sector Applicability	NGV & HGV		Geographical coverage	US / Canada	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description	<ul style="list-style-type: none"> Provides information and procedures for periodic visual examination and inspection of natural gas and hydrogen fuel containers and the condition of the installation Installed in vehicles qualified by the OEM or aftermarket manufacturer to meet ANSI NGV2, US DOT NHTSA FMVSS standard 304, CMVSR standard 301.2 or CSA B51 Can be extended to other FGV (Fuel Gas Vehicles) containers that qualify to meet specs and standards 				Fueling	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>											
					Onboard Storage	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>							<input type="checkbox"/>				
					Transfer																
					Gasification																
					Consumption																
					Sub System Element	Incl	Comment	Hazards Identified													
	Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks		<input checked="" type="checkbox"/>	Fuel containers only with sample inspection form (appendix)						Leakage, collision damage, weathering, corrosion										
<ul style="list-style-type: none"> ANSI NGV2 – American national standard for NGV containers CFR 49 Part 571 Standard 304 – CNG fuel container integrity CMVSR Standard 301.2 – CNG fuel system integrity CSA B51 – BPV and pressure piping code ISO 11439 – Gas cylinders for the on-board storage of natural gas in vehicles NFPA 52 – Vehicular gaseous fuel systems code CSA B109 – Natural gas for vehicles installation code ANSI/ AGA NGV3.1 – Fuel system components for NGVs CFR 49 Parts 100-180 CFS 49 Part 571 Standard 303 – Fuel system integrity of CNG Vehicle Transportation of dangerous goods regulations (Canada) CGA C-18, CGA C-20, CGA C-6/ 6.1/ 6.2, CGA P-22 ASTM E213, ASTM E797, ASTM E215, ASTM E94 	Std. Reg. Std. Code Std. Code Code Std. Reg. Reg. Std. Std.	Maintenance equip & procedures																			
		Safe Practices		<input checked="" type="checkbox"/>	Labelling, damage conditions, inspection methods						Unfit for service, safe disposition										
		Emergency equip & procedures																			
		Environmental issues																			
		Key take-outs / best practice																			
		<ul style="list-style-type: none"> Covers all damage types for fuel containers with relevant damage pictures for clarity Discusses visual inspection methods and non-destructive tests for deeper inspection 																			

NFPA 30A – Motor Fuel Dispensing Facilities and Repair Garages

Name	NFPA Motor Fuel Dispensing Facilities and Repair Garages		Code	NFPA 30A							Date of Issue	2012						
Authorising / issuing agency	National Fire Protection Association		Fuel Applicability	All Fuels							Next Issue	-						
Sector Applicability	All fuel dispensing facilities, ground and marine	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Applies to all motor fuel dispensing facilities including marine and indoor, however facilities that dispense only LPG/ LNG/ CNG are excluded from this code Discusses storage and piping for liquid fuels and their fuel dispensing systems Discusses building construction, electrical and operation requirements for these facilities and dispensing systems Special provisions for marine fuelling and CNG/ LNG stations 		Fueling	●	●	●	●	●	●	●	●	●	●	●	●	●		
Onboard Storage																		
Transfer																		
Gasification																		
Consumption																		
Sub System Element			Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations	✓	Design requirements for tanks, piping and pumps	Ignition, leakage, overfilling, corrosion															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																
<ul style="list-style-type: none"> Multiple NFPA Publications API 607 – Fire Test for valves ANSI 842 – Standard for valves ANSI 2085 – Standard for protected above ground tanks Multiple UL Standards NFPA 30 – Flammable and combustible liquids code 49 CFR Parts 171 and 173 29 CFR Part 1910.106 Other PEI and STI publications 	Code Std.	Maintenance equip & procedures	✓	Maintenance testing and operations														
	Code Std.	Safe Practices	✓	General safety requirements	Asphyxiation, ignition													
	Code Std.	Emergency equip & procedures	✓	Emergency shutdown procedures	Fire, spill													
	Code Reg. Reg. Std.	Environmental issues																
	Key take-outs / best practice																	
<ul style="list-style-type: none"> Good guide for general requirements for all motor fuel dispensing facilities with specific considerations for CNG/ LNG 																		

NFPA 52 (2010) – Vehicular Gaseous Fuel Systems Code

Name	NFPA Vehicular Gaseous Fuel Systems Code			Code	NFPA 52 (2010)							Date of Issue	2010						
Authorising / issuing agency	National Fire Protection Association			Fuel Applicability	CNG/ LNG							Next Issue	2013						
Sector Applicability	All vehicles with gaseous fuel systems	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Applies to the design, installation, operation and maintenance of compressed natural gas (CNG) and liquefied natural gas (LNG) engine fuel systems on vehicles of all types and for fueling vehicle (dispensing) systems and associated storage, including the following: <ul style="list-style-type: none"> Original equipment manufacturers (OEMs) Final-stage vehicle integrator/manufacture (FSVIM) Vehicle fueling (dispensing) systems Includes marine, highway, rail, off-road and industrial vehicles 			Fueling	●	●	◐				◐	◐							
Onboard Storage				●	●	◐						◐			●				
Transfer				●	●									◐					
Gasification				●	●								◐						
Consumption				●	●								◐						
Sub System Element				Incl	Comment	Hazards Identified	Fuelling Facilities & Operations	✓											
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	System requirements and assemblies													Fuel supply line recommendations		
<ul style="list-style-type: none"> Multiple standards published by NFPA, ANSI, ASTM, CGA (Compressed Gas Association), DOT and SAE Foreign standards including, but not limited to, CSA (Canadian Standards Association), ICC (International Code Council), CTA (Canadian Transport Agency) Title 29, Code of Federal Regulations, Part 1910 Title 49, Code of Federal Regulations, Parts 100–185 Title 49, Code of Federal Regulations, Part 571.304 	Std.	Maintenance equip & procedures	✓	More focus on procedures													Preventive maintenance procedures		
	Std.	Safe Practices	✓	General safety requirements														Personnel training	
	Reg.	Emergency equip & procedures	✓	Emergency shutdown equipment															
	Reg.	Environmental issues																	
	Reg.	Key take-outs / best practice	<ul style="list-style-type: none"> Comprehensive and important document for the design of CNG and LNG fuelling facilities and vehicular fuel systems 																

NFPA 54 (2006) – National Fuel Gas Code (ANSI Z223.1-2006)

Name	NFPA National Fuel Gas Code			Code	NFPA 54 (2006) ANSI Z223.1-2006							Date of Issue	2006					
Authorising / issuing agency	National Fire Protection Association			Fuel Applicability	CNG							Next Issue	2012					
Sector Applicability	Piping system from point of delivery to appliance	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Applies to the installation of fuel gas piping systems, appliances, equipment, and related accessories from the point of delivery to the appliance connections Piping systems include design, materials, components, fabrication, assembly, installation, testing, inspection, operation, and maintenance Appliances, equipment and related accessories include installation, combustion, and ventilation air & venting 			Fueling	●	●	●	●	◐	◐	◐	●						
Onboard Storage																		
Transfer																		
Gasification																		
Consumption																		
Sub System Element				Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations	✓	Design of system, materials and components	Ignition risks															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Includes all systems related to piping only	Pressure regulators and shut-off valves													
– Multiple standards published by NFPA, ANSI, ASTM	Std.	Maintenance equip't & procedures	✓	Guidelines only and not a formal code														
– MSS SP-6, Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings, 2001	Std.	Safe Practices	✓	Suggested checklists and methods														
– ANSI/MSS SP-58, Pipe Hangers and Supports – Materials, Design and Manufacture, 1993	Std.	Emergency equip't & procedures	✓	Suggested procedure														
– UL 651, Schedule 40 and Schedule 80 Rigid PVC Conduit, 2003	Std.	Environmental issues																
– ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Reaffirmed 2001).	Std.	Key take-outs / best practice																
– ANSI/ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800, 1998	Std.	<ul style="list-style-type: none"> More focused on piping design requirements rather than the fuelling system Restricted to CNG fuel, but can be extended to LNG also in conjunction with respective application codes 																
– ANSI/ ASME B16.20, Metal Gaskets for Pipe Flanges, Ring Joint Spiral Wound and Jacketed, 2000	Std.																	
– ANSI/ASME B36.10, Welded and Seamless Wrought-Steel Pipe, 2001	Std. Reg.																	
– Title 49, Code of Federal Regulations, Part 192																		

NFPA 57 (2002) – Liquefied Natural Gas (LNG) Vehicular Fuel Systems Code

Name	NFPA Liquefied Natural Gas (LNG) Vehicular Fuel Systems Code		Code	NFPA 57 (2002)		Date of Issue	2002									
Authorising / issuing agency	National Fire Protection Association		Fuel Applicability	LNG		Next Issue	-									
Sector Applicability	All vehicles with LNG fuel systems	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Applies to the design, installation, operation, and maintenance of liquefied natural gas (LNG) engine fuel systems on vehicles of all types, to their associated fueling (dispensing) facilities and to their storage facilities Includes marine, highway, rail, off-road and industrial vehicles 		Fueling	●	●	●	●	●	●	●				●		
			Onboard Storage	●	●	●	●			●			●			
			Transfer	●	●											
			Gasification	●	●											●
			Consumption	●	●					●						
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Sub System Element	Incl	Comment	Hazards Identified									
<ul style="list-style-type: none"> Multiple standards published by NFPA, CGA and SSPC ANSI Z87-1, Occupational and Educational Eye and Face Protection, 1991 ANSI Z89-1, Personal Protection — Protective Headwear for Industrial Workers, 1997 API 620, Design and Construction of Large, Welded, Low-Pressure Storage Tanks, 1996 ASME B31.3, Process Piping, 1996 IEEE/ASTM SI 10, Standard for Use of the International System of Units (SI): The Modern System, 1987 ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C, 1996 NACE RP 0169, Control of External Corrosion of Underground or Submerged Metallic Piping Systems, 1996 			Std. Std. Std.	Fuel Systems & Tanks	✓	Complete vehicular fuel system	Pressure regulators and shut-off valves									
			Std.	Maintenance equip & procedures	✓	General guidelines for fuel systems and facilities										
			Std.	Safe Practices	✓	Fire protection, training and safety guidelines	Hazard analysis procedure outlined									
			Std. Std.	Emergency equip & procedures	✓	No formal procedure, but equipment specified										
			Std.	Environmental issues												
			Std.	Key take-outs / best practice												
			Std.	<ul style="list-style-type: none"> Detailed system design requirements for all LNG fuelling related facilities and equipment Storage tank requirements are specified 												

Code

NFPA 59A – Standard for the Production Storage and Handling of Liquefied Natural Gas (LNG)

Name	NFPA Standard for the Production, Storage and Handling of Liquefied Natural Gas (LNG)			Code	NFPA 59A							Date of Issue	2013						
Authorising / issuing agency	National Fire Protection Association			Fuel Applicability	LNG							Next Issue	-						
Sector Applicability	General LNG handling	Geographical coverage	US/ Canada	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Applies to the following – <ol style="list-style-type: none"> Facilities that liquefy natural gas Facilities that store, vaporize, transfer and handle LNG Training of all personnel involved with LNG Design, location, construction, maintenance and operation of all LNG facilities Specific exclusions – <ol style="list-style-type: none"> Frozen ground containers Portable storage containers stored/ used in buildings All LNG vehicular applications, including fuelling 			Fueling	●	●		◐	◐	◐	○	◐							
Onboard Storage																			
Transfer																			
Gasification																			
Consumption																			
Sub System Element				Incl	Comment	Hazards Identified	Fuelling Facilities & Operations	✓	Focus on storage and handling (incl cryogenic)	Corrosion, ignition, pressure explosion									
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																	
– NFPA 52 – Vehicular gaseous fuel systems code	Code	Maintenance equip & procedures	✓	Maintenance procedures including manual															
– NFPA 54 – National fuel gas code	Code	Safe Practices	✓	Safe operating and test procedures		Natural hazards, spill, leakage, fire													
– NFPA 101 – Life safety code	Code	Emergency equip & procedures	✓	Emergency shutdown procedures and systems		Fire, leakage, security													
– ANSI/ UL 723 – Standard for test of surface burning characteristics of building materials	Std.	Environmental issues																	
– NACE SP 0169 – Control of external corrosion of metallic piping system	Std.	Key take-outs / best practice																	
– CSA B51 – Boiler, pressure vessel and pressure piping code	Code	<ul style="list-style-type: none"> More focused on LNG storage and handling facilities. Not very applicable to vehicular fuelling and fuel systems Has some special considerations for handling cryogenic pumps and piping 																	
– CSA C22.1 – Canadian Electric code	Code																		
– CGA 341 – Insulated cargo tank specs for cryogenic liquids	Std.																		
– CGA S-1.3 – Pressure relief device standard	Std.																		
– ASTM E84, E136 and E2652 – Standard Test methods	Std.																		
– Other NFPA, ASME, ASCE, API and ACI publications	Std.																		

NFPA 70 – National Electric Code

Name	NFPA National Electric Code			Code	NFPA 70							Date of Issue	2014							
Authorising / issuing agency	National Fire Protection Association			Fuel Applicability	All fuels							Next Issue	-							
Sector Applicability	All stationary electrical equipment		Geographical coverage	US		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Covers installation of electrical conductors, equipment and raceways, signalling and communication conductors, equipment and raceways, and optical fiber cables and raceways for stationary applications Some important exclusions – <ol style="list-style-type: none"> Installations in ships and other floating buildings Installation of railways for generation, transformation, transmission or distribution of power 			Fueling								●		●						
Onboard Storage																				
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations				✓	Only for electrical equipment															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																		
– NFPA 52 – Vehicular gaseous fuel systems code	Code Code Code Std.	Maintenance equip & procedures	✓	Maintenance procedures including manual																
– NFPA 54 – National fuel gas code		Safe Practices	✓	Electrical equipment safety	Explosion, ignition,															
– NFPA 101 – Life safety code	Std. Code Code Std.	Emergency equip & procedures	✓	Emergency shutdown procedures and systems																
– ANSI/ UL 723 – Standard for test of surface burning characteristics of building materials		Environmental issues																		
– NACE SP 0169 – Control of external corrosion of metallic piping system		Key take-outs / best practice																		
– CSA B51 – Boiler, pressure vessel and pressure piping code	Std. Std. Std. Std.	<ul style="list-style-type: none"> Only for electrical equipment for stationary applications Not very relevant for fuel system design – important for fuelling facilities 																		
– CSA C22.1 – Canadian Electric code																				
– CGA 341 – Insulated cargo tank specs for cryogenic liquids																				
– CGA S-1.3 – Pressure relief device standard																				
– ASTM E84, E136 and E2652 – Standard Test methods																				
– Other NFPA, ASME, ASCE, API and ACI publications																				

40 CFR Part 80 Sec 33 Controls applicable to natural gas retailers and wholesale purchaser- consumers



Name	40 CFR Part 80 Sec 33 Controls applicable to natural gas retailers and wholesale purchaser- consumers			Code	40 CFR Part 80 Sec 33							Date of Issue	1994					
Authorising / issuing agency	CFR – Code of Federal Regulations			Fuel Applicability	Natural Gas							Next Issue						
Sector Applicability	All NG powered vehicles	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> After January 1, 1998 every retailer and wholesale purchaser-consumer handling over 1,215,000 standard cubic feet of natural gas per month shall equip each pump from which natural gas is introduced into natural gas motor vehicles with a nozzle and hose configuration which vents no more than 1.2 grams of natural gas to the atmosphere per refuelling of a vehicle 			Fueling	●			●										
Onboard Storage																		
Transfer																		
Gasification																		
Consumption																		
Sub System Element				Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations	✓	HD dedicated facilities exempt																
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type																	
None cited	Fuel Systems & Tanks																	
	Maintenance equip & procedures																	
	Safe Practices																	
	Emergency equip & procedures																	
	Environmental issues	✓													NG release when refuelling			
Key take-outs / best practice	<ul style="list-style-type: none"> Limited usage for this study - any dispensing pump shown to be dedicated to heavy-duty vehicles is exempt from this requirement 																	

40 CFR Part 86 Sec 098-8 Emission standards for 1998 and later model year light-duty vehicles

Name	40 CFR Part 86 Sec 098-8 Emission standards for 1998 and later model year light-duty vehicles		Code	40 CFR Part 86 Sec 098-8		Date of Issue	1994									
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All fuels		Next Issue										
Sector Applicability	All light vehicles	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> (iv) Refuelling receptacle (for natural gas-fuelled vehicles). Refuelling receptacles on natural gas-fuelled vehicles shall comply with the receptacle provisions of the ANSI/AGA NGV1 standard- 1994 (as incorporated by reference in § 86.1) 		Fueling					○								
			Onboard Storage													
			Transfer													
			Gasification													
			Consumption													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Sub System Element	Incl	Comment	Hazards Identified									
– ANSI/AGA NGV1 standard- 1994			Std.	Fuel Systems & Tanks												
				Maintenance equip & procedures												
				Safe Practices												
				Emergency equip & procedures												
				Environmental issues												
Key take-outs / best practice																
							<ul style="list-style-type: none"> Not relevant 									



49 CFR Part 174 - Carriage by rail of Hazardous Materials



Name	Carriage by rail of Hazardous Materials			Code	49 CFR Part 174							Date of Issue	Current 2013						
Authorising / issuing agency	CFR – Code of Federal Regulations			Fuel Applicability	All fuels							Next Issue							
Sector Applicability	Rail	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description				Fueling															
<ul style="list-style-type: none"> Requirements to be observed with respect to the transportation of hazardous materials in or on rail cars Includes detailed requirements for Class 2 (gases) materials and flammable materials Detailed requirements for special handling, material strengths, safety markings, inspections and emergency situations 				Onboard Storage	○	○	○	○	○	○			◐		○				
				Transfer															
				Gasification															
				Consumption															
				Sub System Element	Incl	Comment		Hazards Identified											
Fuelling Facilities & Operations																			
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks		✓	Specification DOT-4L (§ 178.57)														
<ul style="list-style-type: none"> Subpart F—Detailed Requirements for Class 2 (Gases) Materials 174.200 Special handling requirements. 174.201 Class 2 (gases) material cylinders. 174.204 Tank car delivery of gases, including cryogenic liquids Subpart G—Detailed Requirements for Class 3 (Flammable Liquid) Materials 174.300 Special handling requirements. 174.304 Class 3 (flammable liquid) materials in tank cars. 	Std.	Maintenance equip & procedures																	
	Std.	Safe Practices		✓	Inspection and safety requirements		Leakage, explosive device, excessive loading												
	Std.	Emergency equip & procedures		✓	Interior pipes for liquid and gas discharge valves equipped with check valves														
	Std.	Environmental issues																	
	Std.	Key take-outs / best practice																	
<ul style="list-style-type: none"> Fuelling / loading on private tracks and is required to be piped directly to large storage facility 																			

49 CFR Part 178.57 & 338 – Specifications for Packaging – 4L Welded Insulated Cylinders and Insulated Cargo Tanks

Name	Specifications for Packaging – 4L Welded Insulated Cylinders and Insulated Cargo Tanks		Code	49 CFR Part 178.57 & 338		Date of Issue	Current 2013									
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All fuels		Next Issue										
Sector Applicability	Rail	Geographical coverage	US	System/Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Prescribes the manufacturing and testing specifications for packaging and containers used for the transportation of hazardous materials in commerce Type, size, service pressure, and design service temperature for welded insulated containers – details about material, welding and testing of containers specified Specifications for insulated cargo tanks, welding, fittings and piping 		Fueling													
			Onboard Storage	●	●		●	●					●			
			Transfer													
			Gasification													
			Consumption													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Sub System Element	Incl	Comment	Hazards Identified									
<ul style="list-style-type: none"> CGA C-3 – Standards for Welding on Thin-Walled Steel Cylinders ASTM E 8 - Standard Test Methods for Tension Testing of Metallic Materials ASTM E 23 - Standard Test Methods for Notched Bar Impact Testing of Metallic Materials ASTM A 240/A 240M - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels ASME BPV Code 49 CFR Part 173.318 - Cryogenic liquids in cargo tanks 49 CFR Part 177.840 – Loading of Class 2 materials CGA G-4.1 - Cleaning Equipment for Oxygen Service ASTM B 580 - Standard Specification for Anodic Oxide Coatings on Aluminum 49 CFR Part 173.315 - Compressed gases in cargo tanks and portable tanks 			Std.	Fuel Systems & Tanks	✓	Detailed specifications for insulated tanks and connections	Leakage, corrosion, defects, fire hazard,									
			Std.	Maintenance equip & procedures												
			Std.	Safe Practices	✓	Inspection and testing of material and welds	Leakage, manufacturing defects, accident									
			Std.	Emergency equip & procedures												
			Code	Environmental issues												
			Reg.	Key take-outs / best practice												
			Reg.				<ul style="list-style-type: none"> Detailed specs for manufacture and testing of insulated cargo tanks and associated welding, fittings and piping 									



49 CFR Part 193 Liquefied Natural Gas Facilities: Federal Safety Standards



Name	Liquefied Natural Gas Facilities: Federal Safety Standards			Code	49 CFR Part 193							Date of Issue	2007							
Authorising / issuing agency	CFR – Code of Federal Regulations			Fuel Applicability	LNG							Next Issue								
Sector Applicability	All light vehicles		Geographical coverage	US		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Prescribes safety standards for LNG facilities used in the transportation of gas by pipeline that is subject to the pipeline safety laws (49 U.S.C. 60101 et seq.) and Part 192 of CFR. This part does not apply to; <ul style="list-style-type: none"> LNG facilities used by ultimate consumers of LNG In the case of marine cargo transfer system; from the last manifold or valve to the marine vessel 193.2155 Design & construct to prevent impairment by <i>railroad, collision by or explosion of a train, tank car, or tank</i> 			Fueling	<input type="checkbox"/>															
Onboard Storage				<input type="checkbox"/>													<input type="checkbox"/>			
Transfer				<input type="checkbox"/>																
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations	<input checked="" type="checkbox"/>	Design of equipment and transfer procedures																		
Fuel Systems & Tanks	<input checked="" type="checkbox"/>	Design must comply with NFPA 59A Covers tank sitting & impoundment	Thermal radiation Flammable vapour-gas dispersion																	
Maintenance equip & procedures	<input checked="" type="checkbox"/>	Requirement for clear maintenance procedures	Corrosion review of all sub-systems																	
Safe Practices	<input checked="" type="checkbox"/>	Remote Control centre with continuous monitoring																		
Emergency equip & procedures	<input checked="" type="checkbox"/>	Operating & Emergency procedures & training req.																		
Environmental issues																				
Key take-outs / best practice																				
			<ul style="list-style-type: none"> Non-destructive testing of welds Excellent, clear guidelines on transfer of LNG Covers training and emergency procedures 																	
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type																			
<ul style="list-style-type: none"> AGA "Purging Principles and Practices" (2001) API Standard 620 "Design and Construction of Large, Welded, Low-Pressure Storage Tanks" (2008) ASME Boiler & Pressure Vessel Code, Section VIII, Division 1, "Rules for Construction of Pressure Vessels" (2007) ASME Boiler & Pressure Vessel Code, Section VIII, Division 2, "Alternative Rules, Rules for Construction of Pressure Vessels" (2007) GTI-04/0032 LNGFIRE3: "A Thermal Radiation Model for LNG Fires" (2004) GTI-04/0049 (April 2004) "LNG Vapor Dispersion Prediction with the DEGADIS 2.1: Dense Gas Dispersion Model For LNG Vapor Dispersion"(2004) GRI-96/0396.5 "Evaluation of Mitigation Methods for Accidental LNG Releases, Volume 5: Using FEM3A for LNG Accident Consequence Analyses" (1997) NFPA 59A, "Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)" (2006) 	<ul style="list-style-type: none"> Std. Std. Code Code Std. Std. Std. Std. 																			

Source: Ricardo assessment

49 CFR Part 393.65 & 68 Compressed Natural Gas fuel containers and Fuel Systems

Name	49 CFR Part 393.65 & 68 Fuel systems and CNG fuel Containers		Code	49 CFR Part 393.65 & 68		Date of Issue	2007									
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All fuel systems / CNG Containers		Next Issue										
Sector Applicability	All commercial vehicles	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> The rules in this section apply to compressed natural gas (CNG) fuel containers used for supplying fuel for the operation of commercial motor vehicles or for the operation of auxiliary equipment installed on, or used in connection with commercial motor vehicles 393.65(5) A fuel line does not extend between a towed vehicle and the vehicle that is towing it while the combination of vehicles is in motion; 		Fueling													
			Onboard Storage	○	○								○			
			Transfer		○						○					
			Gasification													
			Consumption													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified											
		Fuelling Facilities & Operations														
		Fuel Systems & Tanks	✓		Damage to piping											
		Maintenance equip & procedures														
		Safe Practices	✓	Excess flow valves												
		Emergency equip & procedures														
		Environmental issues														
Key take-outs / best practice																
		<ul style="list-style-type: none"> Excess flow valve. When pressure devices are used to force fuel from a fuel tank, a device which prevents the flow of fuel from the fuel tank if the fuel feed line is broken must be installed in the fuel system. Section 68 Applies to CNG only – no paragraphs within this sections relating to LNG 														

49 CFR Part 571.301 Fuel systems integrity & 571.303 Standard No. 304; Fuel system integrity of CNG vehicles

Name	49 CFR Part 571.301 Fuel systems integrity & 571.303 Standard No. 304; Fuel system / container integrity of compressed natural gas vehicles		Code	49 CFR Part 571.301, 303 & 304		Date of Issue	2007									
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All fuels / CNG		Next Issue										
Sector Applicability	All motor vehicles	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> 571.301 standard applies to all vehicles which use fuel with a boiling point above 0 °C. 571.303 standard specifies requirements for the integrity of motor vehicle fuel systems using compressed natural gas (CNG), including the CNG fuel systems of bi-fuel, dedicated, and dual fuel CNG vehicles The purpose of this standard is to reduce deaths and injuries occurring from fires that result from fuel leakage during and after motor vehicle crashes 		Fueling													
			Onboard Storage	○									○			
			Transfer							○						
			Gasification													
			Consumption													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Sub System Element	Incl	Comment	Hazards Identified									
None cited				Fuelling Facilities & Operations												
				Fuel Systems & Tanks	✓	Fuel system, and tank integrity and testing	Crash test procedures									
				Maintenance equip & procedures												
				Safe Practices	✓	Details shielding, thermocouples, placement										
				Emergency equip & procedures												
				Environmental issues												
Key take-outs / best practice			<ul style="list-style-type: none"> Key insight into CNG tank safe practices No specific comment on LNG 													

Name	Transport of Dangerous Goods			Code	ST/SG/AC/Rev 18. Vol1							Date of Issue	2013							
Authorising / issuing agency	United Nations			Fuel Applicability	All fuels							Next Issue								
Sector Applicability	All transport		Geographical coverage	US		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Discuss principles of classification, definition of classes, listing of dangerous goods, packing requirements, testing procedures, marking, labelling/ placarding and transport documents Regulated to prevent accidents to persons or to the environment. Aim is to make movement of dangerous goods feasible by eliminating or reducing risk Transport of dangerous good but excludes sea-going or in-land navigation bulk carriers or tank vessels LNG is classified under 2.1 , Flammable cases which are ignitable with a 13% mixture with air 			Fueling																
Onboard Storage				○	◐	○	◐	○	○							●				
Transfer															○					
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Focus on packing materials and safety devices			Leakage, corrosion, ignition, accidental damage													
<ul style="list-style-type: none"> UN number 1972 UN number 3373 UN Publication – ECE/TRANS/225 – International carriage of dangerous goods by road INFCIRC/274 – Convention on physical protection of nuclear material Basel Convention – Control of transboundary movements of hazardous wastes and their disposal Various ISO and ASTM standards 	Std.	Maintenance equip & procedures																		
	Std.	Safe Practices	✓	Covers training and security			Radioactive exposure, asphyxiation, fire													
	Std.	Emergency equip & procedures	✓	Emergency response training																
	Paper	Environmental issues																		
	Std.	Key take-outs / best practice					<ul style="list-style-type: none"> Detailed process for classifying dangerous goods Focuses mainly on safety provisions like labelling, marking, tests and emergency provisions 													



49 CFR Part 229.43 Railroad Locomotive Safety Standards - Exhaust and Battery gases Safety Requirements



Name	Railroad Locomotive Safety Standards - Exhaust and Battery gases Safety Requirements		Code	49 CFR Part 229.43				Date of Issue	Current 2013									
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels				Next Issue										
Sector Applicability	All locomotives	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> • Products of combustion shall be released entirely outside the cab and other compartments. Exhaust stacks shall be of sufficient height or other means provided to prevent entry of products of combustion into the cab or other compartments under usual operating conditions • Battery containers shall be vented and batteries kept from gassing excessively 			Fueling														
				Onboard Storage														
				Transfer														
				Gasification														
				Consumption														
				Sub System Element	Incl	Comment	Hazards Identified											
				Fuelling Facilities & Operations														
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																
None Cited		Maintenance equip & procedures																
		Safe Practices			✓	All combustion gases and battery fumes												
		Emergency equip & procedures																
		Environmental issues																
		Key take-outs / best practice			<ul style="list-style-type: none"> • Applies to all fuels including gaseous fuels 													



49 CFR Part 229.93 Railroad Locomotive Safety Standards – Safety Cut-off Device Safety Requirements



Name	Railroad Locomotive Safety Standards – Safety Cut-off Device Safety Requirements		Code	49 CFR Part 229.93				Date of Issue	Current 2013									
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels				Next Issue										
Sector Applicability	All locomotives	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description			Fueling															
<ul style="list-style-type: none"> The fuel line shall have a safety cut-off device that— <ul style="list-style-type: none"> a) Is located adjacent to the fuel supply tank or in another safe location; b) Closes automatically when tripped and can be reset without hazard; and c) Can be hand operated from clearly marked locations, one inside the cab and one on each exterior side of the locomotive. 			Onboard Storage		○													
			Transfer		○													
			Gasification		○													
			Consumption		○													
			Sub System Element	Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Location and performance of cut-off device														
None Cited	Maintenance equip & procedures																	
	Safe Practices	✓	Auto cut-off device															
	Emergency equip & procedures																	
	Environmental issues																	
	Key take-outs / best practice																	
<ul style="list-style-type: none"> Applies to all fuels including gaseous fuels 																		



49 CFR Part 229.95 Railroad Locomotive Safety Standards – Venting Safety Requirements



Name	Railroad Locomotive Safety Standards – Venting Safety Requirements		Code	49 CFR Part 229.95		Date of Issue	Current 2013											
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels		Next Issue												
Sector Applicability	All locomotives	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description			Fueling															
<ul style="list-style-type: none"> Fuel tank vent pipes may not discharge on the roof nor on or between the rails 			Onboard Storage	○														
			Transfer	○														
			Gasification	○														
			Consumption	○														
			Sub System Element	Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Tank vent pipes only														
None Cited	Maintenance equip & procedures																	
	Safe Practices																	
	Emergency equip & procedures																	
	Environmental issues																	
	Key take-outs / best practice																	
		<ul style="list-style-type: none"> Applies to all fuels including gaseous fuels 																



49 CFR Part 229.97 Railroad Locomotive Safety Standards – Grounding fuel tanks Safety Requirements



Name	Railroad Locomotive Safety Standards – Grounding fuel tanks Safety Requirements		Code	49 CFR Part 229.97							Date of Issue	Current 2013						
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels							Next Issue							
Sector Applicability	All locomotives	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description			Fueling															
<ul style="list-style-type: none"> Fuel tanks and related piping shall be electrically grounded 			Onboard Storage	○									○					
			Transfer	○														
			Gasification	○														
			Consumption	○														
			Sub System Element	Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)		Type	Fuel Systems & Tanks		✓	Tank and piping												
None Cited		Maintenance equip & procedures																
		Safe Practices																
		Emergency equip & procedures																
		Environmental issues																
		Key take-outs / best practice			<ul style="list-style-type: none"> Applies to all fuels including gaseous fuels 													

49 CFR Part 229.101 Railroad Locomotive Safety Standards – Engines Safety Requirements

Name	Railroad Locomotive Safety Standards – Engines Safety Requirements			Code	49 CFR Part 229.101							Date of Issue	Current 2013							
Authorising / issuing agency	CFR – Code of Federal Regulations			Fuel Applicability	All Fuels							Next Issue								
Sector Applicability	All locomotives		Geographical coverage	US		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> The temperature and pressure alarms, controls and related switches of internal combustion engines shall function properly Whenever an engine has been shut down due to mechanical or other problems, a distinctive warning notice giving reason for the shut-down shall be conspicuously attached near the engine starting control until repairs have been made Wheel slip/slide protection shall be provided on a locomotive with an engine displaying a warning notice whenever required by Sec 229.115(b) 			Fueling																
Onboard Storage																				
Transfer																				
Gasification																				
Consumption				○	○	○	○	○	○							○				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Fuel Systems & Tanks	✓	Engine and all related components																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Maintenance equip & procedures																		
– 49 CFR Part 229.115 – Slip/ slide alarms	Reg.	Safe Practices	✓	Warning signals specified																
		Emergency equip & procedures																		
		Environmental issues																		
		Key take-outs / best practice																		
		<ul style="list-style-type: none"> Applies to all internal combustion engines 																		



49 CFR Part 229.135 Railroad Locomotive Safety Standards – Event Recorders in Cabs Safety Requirements



Name	Railroad Locomotive Safety Standards – Event Recorders in Cabs Safety Requirements			Code	49 CFR Part 229.135							Date of Issue	Current 2013								
Authorising / issuing agency	CFR – Code of Federal Regulations			Fuel Applicability	All Fuels							Next Issue									
Sector Applicability	All locomotives		Geographical coverage	US		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description				Fueling																	
<ul style="list-style-type: none"> Event recorders shall monitor and record data elements with at least the accuracy required of the indicators displaying any of the required elements to the engineer The event recorder shall record the most recent 48 hours of operation of the electrical system of the locomotive on which it is installed Following elements are required - Train speed, Selected direction of motion, Time, Distance, Throttle position, Applications and operations of the train automatic air brake, Applications and operations of all brakes, Cab signal aspect(s), if so equipped and in use, End-of-train communications, Activation of all lights and horns, Cruise control activation and Safety critical train control data 				Onboard Storage																	
				Transfer																	
				Gasification																	
				Consumption																	
				Sub System Element	Incl	Comment		Hazards Identified													
Fuelling Facilities & Operations																					
Fuel Systems & Tanks	✓	Only related to event recorders																			
Maintenance equip & procedures																					
Safe Practices	✓	Testing and compliance of event recorders																			
Emergency equip & procedures																					
Environmental issues																					
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)				Type																	
<ul style="list-style-type: none"> – 49 CFR Part 229.7 and 229.9 - Safety non-compliance – 49 CFR Part 229.25 and 229.27 – Safety Tests 				Reg.																	
				Reg.																	
				Key take-outs / best practice																	
				<ul style="list-style-type: none"> A locomotive with an inoperative event recorder is not deemed to be in improper condition, unsafe to operate, or a non-complying locomotive only till the next calendar day 																	



49 CFR Part 229.209 Railroad Locomotive Safety Standards – Alternative Locomotive Crashworthiness



Name	Railroad Locomotive Safety Standards – Alternative Locomotive Crashworthiness			Code	49 CFR Part 229.209							Date of Issue	Current 2013							
Authorising / issuing agency	CFR – Code of Federal Regulations			Fuel Applicability	All Fuels							Next Issue								
Sector Applicability	All locomotives	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description				Fueling																
<ul style="list-style-type: none"> Govern consideration and action upon requests for FRA approval of locomotive crashworthiness designs which are not consistent with any FRA-approved locomotive crashworthiness design standard 				Onboard Storage																
				Transfer																
				Gasification																
				Consumption																
								Sub System Element	Incl	Comment					Hazards Identified					
				Fuelling Facilities & Operations																
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks																
– 49 CFR Part 229.205 - General locomotive crashworthiness			Reg.	Maintenance equip't & procedures																
				Safe Practices		✓	For non-standard designs													
				Emergency equip't & procedures																
				Environmental issues																
				Key take-outs / best practice				<ul style="list-style-type: none"> Any new design shall meet 49 CFR Part 229.205 general requirements and must be petitioned for approval 												



49 CFR Part 229.217 Railroad Locomotive Safety Standards – Fuel Tanks Crashworthiness



Name	Railroad Locomotive Safety Standards – Fuel Tanks Crashworthiness		Code	49 CFR Part 229.217		Date of Issue	Current 2013									
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels		Next Issue										
Sector Applicability	All locomotives	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> External fuel tanks – Locomotives equipped with external fuel tanks shall, at a minimum, comply with the requirements of AAR S-5506, except for section 4.4 This does not apply to locomotives subject to the fuel tank safety requirements of Sec. 238.223 or Sec. 238.423 The Director of the Federal Register approves incorporation by reference of the AAR S-5506 in accordance with 5 U.S.C. 552(a) and 1 CFR part 51 Internal fuel tanks – Locomotives equipped with internal fuel tanks shall, at a minimum, comply with the requirements of Sec. 238.223(b) 			Fueling												
				Onboard Storage									○			
				Transfer												
				Gasification												
				Consumption												
				Sub System Element	Incl	Comment	Hazards Identified									
				Fuelling Facilities & Operations												
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Requirements for fuel tanks												
<ul style="list-style-type: none"> AAR S-5506 - "Performance Requirements for Diesel Electric Locomotive Fuel Tanks" (October 1, 2001) 49 CFR Part 238.223 49 CFR Part 238.423 5 USC Part 552 1 CFR Part 51 	Std.	Maintenance equip & procedures														
	Reg. Reg. Code Reg.	Safe Practices	✓	Safety requirements specified in referred documents												
		Emergency equip & procedures														
		Environmental issues														
	Key take-outs / best practice															
<ul style="list-style-type: none"> Applies to all fuel tanks. Specific safety requirements indicated in referred documents 																



49 CFR Part 229.301-319 Railroad Locomotive Safety Standards – Locomotive Electronics Safety Requirements



Name	Railroad Locomotive Safety Standards – Locomotive Electronics Safety Requirements		Code	49 CFR Part 229.301-319		Date of Issue	Current 2013												
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels		Next Issue													
Sector Applicability	All locomotives	Geographical coverage	US	System/ Component	<table border="1"> <tr> <td>Hoses/ Pipes</td> <td>Valves</td> <td>Regulators</td> <td>Fittings</td> <td>Connectors</td> <td>Sensors</td> <td>Break Away</td> <td>Metering</td> <td>Tanks</td> <td>Compressor</td> <td>Refrigeration</td> <td>Vaporizers</td> </tr> </table>	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers								
Description			Fueling																
<ul style="list-style-type: none"> Promote the safe design, operation, and maintenance of safety-critical electronic locomotive control systems, subsystems, and components Railroads shall develop a Safety Analysis (SA) for each product prior to the initial use of such product on their railroad Railroads shall establish and implement training and qualification program for products prior to the product being placed in use 			Onboard Storage																
			Transfer																
			Gasification																
			Consumption																
			Sub System Element	Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																			
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																	
– 49 CFR Part 236 (H & I)	Reg.	Maintenance equip & procedures																	
		Safe Practices	✓	Requirements for safety critical products and relevant training															
		Emergency equip & procedures																	
		Environmental issues																	
		Key take-outs / best practice																	
<ul style="list-style-type: none"> All safety critical changes made to a product shall be notified to the FRA and the relevant SA should be updated Relevant personnel should be trained adequately before use 																			

General Safety Requirement for all electronic systems and sub-systems



49 CFR Part 230.66 Steam Locomotives and Tenders – Design, Construction and Maintenance



Name	Steam Locomotives and Tenders – Design, Construction and Maintenance		Code	49 CFR Part 230.66		Date of Issue	Current 2013										
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels		Next Issue											
Sector Applicability	All steam powered locomotives	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description			Fueling														
<ul style="list-style-type: none"> The steam locomotive owner and operator are responsible for the general design, construction and maintenance of the steam locomotives and tenders under their control 			Onboard Storage														
			Transfer														
			Gasification														
			Consumption														
			Sub System Element	Incl	Comment		Hazards Identified										
		Fuelling Facilities & Operations															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks													
None cited				Maintenance equip & procedures													
				Safe Practices													
				Emergency equip & procedures													
				Environmental issues													
			Key take-outs / best practice														
					<ul style="list-style-type: none"> Not very useful since general requirement only 												



49 CFR Part 230.67 Steam Locomotives and Tenders – Responsibility for Inspection and Repairs



Name	Steam Locomotives and Tenders – Responsibility for Inspection and Repairs		Code	49 CFR Part 230.67		Date of Issue	Current 2013			
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels		Next Issue				
Sector Applicability	All steam powered locomotives	Geographical coverage	US	System/ Component	Hoses/ Pipes Valves Regulators Fittings Connectors Sensors Break Away Metering Tanks Compressor Refrigeration Vaporizers					
Description			Fueling							
<ul style="list-style-type: none"> The steam locomotive owner and/or operator shall inspect and repair all steam locomotives and tenders under their control All defects disclosed by any inspection shall be repaired in accordance with accepted industry standards, which may include established railroad practices, before the steam locomotive or tender is returned to service The steam locomotive owner and/or operator shall not return the steam locomotive or tender to service unless they are in good condition and safe and suitable for service 			Onboard Storage							
			Transfer							
			Gasification							
			Consumption							
			Sub System Element	Incl	Comment	Hazards Identified				
Fuelling Facilities & Operations										
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks								
None cited	Maintenance equip & procedures									
	Safe Practices		✓	General safety requirements						
	Emergency equip & procedures									
	Environmental issues									
	Key take-outs / best practice									
<ul style="list-style-type: none"> Not very useful since general requirement only 										



49 CFR Part 230.86 Steam Locomotives and Tenders Inspection and Maintenance – Illumination Requirements



Name	Steam Locomotives and Tenders Inspection and Maintenance – Illumination Requirements		Code	49 CFR Part 230.86		Date of Issue	Current 2013																																																																																																	
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels		Next Issue																																																																																																		
Sector Applicability	All steam powered locomotives	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers																																																																																								
Description	<ul style="list-style-type: none"> Each steam locomotive used between sunset and sunrise shall be equipped with an operable headlight that provides illumination If a steam locomotive is regularly required to run backward for any portion of its trip other than to pick up a detached portion of its train or to make terminal movements, it shall also be equipped on its rear end with an operable headlight Such headlights shall be provided with a device whereby the light from same may be diminished in yards and at stations or when meeting trains 			Fueling																																																																																																				
				Onboard Storage																																																																																																				
				Transfer			General Requirements for Illumination only																																																																																																	
				Gasification																																																																																																				
				Consumption																																																																																																				
							Sub System Element	Incl	Comment	Hazards Identified																																																																																														
				Fuelling Facilities & Operations																																																																																																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	<table border="1"> <tr> <td>Fuel Systems & Tanks</td> <td></td> <td></td> <td colspan="13"></td> </tr> <tr> <td>Maintenance equip & procedures</td> <td></td> <td></td> <td colspan="13"></td> </tr> <tr> <td>Safe Practices</td> <td></td> <td>✓</td> <td colspan="13">General illumination requirements</td> </tr> <tr> <td>Emergency equip & procedures</td> <td></td> <td></td> <td colspan="13"></td> </tr> <tr> <td>Environmental issues</td> <td></td> <td></td> <td colspan="13"></td> </tr> <tr> <td colspan="4">Key take-outs / best practice</td> </tr> <tr> <td colspan="4"> <ul style="list-style-type: none"> Not very useful since general requirements for illumination only </td> </tr> </table>															Fuel Systems & Tanks																Maintenance equip & procedures																Safe Practices		✓	General illumination requirements													Emergency equip & procedures																Environmental issues																Key take-outs / best practice				<ul style="list-style-type: none"> Not very useful since general requirements for illumination only 			
Fuel Systems & Tanks																																																																																																								
Maintenance equip & procedures																																																																																																								
Safe Practices		✓	General illumination requirements																																																																																																					
Emergency equip & procedures																																																																																																								
Environmental issues																																																																																																								
Key take-outs / best practice																																																																																																								
<ul style="list-style-type: none"> Not very useful since general requirements for illumination only 																																																																																																								
None cited																																																																																																								



49 CFR Part 230.90 Inspection and Maintenance – Draw gear between steam locomotive and tender



Name	Inspection and Maintenance – Draw gear between steam locomotive and tender		Code	49 CFR Part 230.90		Date of Issue	Current 2013												
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels		Next Issue													
Sector Applicability	All steam powered locomotives	Geographical coverage	US	System/ Component	<table border="1"> <tr> <td>Hoses/ Pipes</td> <td>Valves</td> <td>Regulators</td> <td>Fittings</td> <td>Connectors</td> <td>Sensors</td> <td>Break Away</td> <td>Metering</td> <td>Tanks</td> <td>Compressor</td> <td>Refrigeration</td> <td>Vaporizers</td> </tr> </table>	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers								
Description			Fueling																
<ul style="list-style-type: none"> The draw gear between the steam locomotive and tender, together with the pins and fastenings, shall be maintained in safe and suitable condition for service One or more safety bar(s) or two or more safety chains shall be provided between the steam locomotive and tender Additional provisions for Maintenance, Testing, Strength, Length, Lost Motion and Spring Buffers are outlined 			Onboard Storage																
			Transfer																
			Gasification																
			Consumption																
			Sub System Element	Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																			
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																	
None cited		Maintenance equip't & procedures																	
		Safe Practices	✓	Connection between Locomotive and Tender															
		Emergency equip't & procedures																	
		Environmental issues																	
	Key take-outs / best practice		<ul style="list-style-type: none"> Not very useful since general requirements for connection between Locomotive and Tender only 																

General Requirements for connection between Locomotive and Tender



49 CFR Part 230.92 Steam Locomotive Inspection and Maintenance – Draw gear and Draft Systems



Name	Steam Locomotive Inspection and Maintenance – Draw gear and Draft Systems		Code	49 CFR Part 230.92				Date of Issue	Current 2013										
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels				Next Issue											
Sector Applicability	All steam powered locomotives	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Couplers, draft gear and attachments on steam locomotives and tenders shall be securely fastened, and maintained in safe and suitable condition for service 			Fueling															
				Onboard Storage															
				Transfer															
				Gasification															
				Consumption															
							Sub System Element	Incl	Comment	Hazards Identified									
				Fuelling Facilities & Operations															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type																		
None cited	Maintenance equip & procedures																		
	Safe Practices					✓	Connection between Locomotive and Tender												
	Emergency equip & procedures																		
	Environmental issues																		
	Key take-outs / best practice																		
<ul style="list-style-type: none"> Not very useful since general requirements only 																			



49 CFR Part 230.107 Steam Locomotive Inspection and Maintenance – Tender Frame and Body



Name	Steam Locomotive Inspection and Maintenance – Tender Frame and Body		Code	49 CFR Part 230.107				Date of Issue	Current 2013										
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels				Next Issue											
Sector Applicability	All steam powered locomotives	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Tender frames shall be maintained in a safe and suitable condition for service Requirements for height, gangways and frame defects outlined 			Fueling															
				Onboard Storage															
				Transfer			General Requirements for Tender cars only												
				Gasification															
				Consumption															
							Sub System Element	Incl	Comment	Hazards Identified									
				Fuelling Facilities & Operations															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type			Fuel Systems & Tanks		✓	Limited requirements for tender cars												
None cited				Maintenance equip & procedures															
				Safe Practices															
				Emergency equip & procedures															
				Environmental issues															
					Key take-outs / best practice														
								<ul style="list-style-type: none"> This part is restricted to steam powered locomotives only and is out of scope. But tender car provisions can be extended for all fuels 											



49 CFR Part 230.109 Steam Locomotive Inspection and Maintenance – Tender Trucks



Name	Steam Locomotive Inspection and Maintenance – Tender Trucks		Code	49 CFR Part 230.109				Date of Issue	Current 2013									
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels				Next Issue										
Sector Applicability	All steam powered locomotives	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Requirements for tender truck frames, bolsters, spring defects, securing arrangement, centring devices and side bearings outlined 		Fueling															
			Onboard Storage															
			Transfer															
			Gasification															
			Consumption															
			Sub System Element	Incl	Comment	Hazards Identified												
	Fuelling Facilities & Operations																	
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Limited requirements for tender trucks and associated fitments														
None cited	Maintenance equip & procedures																	
	Safe Practices																	
	Emergency equip & procedures																	
	Environmental issues																	
	Key take-outs / best practice																	
<ul style="list-style-type: none"> This part is restricted to steam powered locomotives only and is out of scope. But tender truck provisions can be extended for all fuels 																		



49 CFR Part 232.103 Brake System Safety Standards – Requirements for Non-Passenger Train Brake Systems



Name	Brake System Safety Standards –Requirements for Non-Passenger Train Brake Systems		Code	49 CFR Part 232.103		Date of Issue	Current 2013									
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels		Next Issue										
Sector Applicability	All non-passenger trains	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> The primary brake system of a train shall be capable of stopping the train with a service application from its maximum operating speed within the signal spacing existing on the track over which the train is operating A train shall not move if less than 85 percent of the cars in that train have operative and effective brakes Except as otherwise provided in this part, all equipment used in freight or other non-passenger trains shall, at a minimum, meet the AAR Standard S-469-47 contained in the AAR Section E 		Fueling													
			Onboard Storage													
			Transfer													
			Gasification													
			Consumption													
			Sub System Element	Incl	Comment		Hazards Identified									
			Fuelling Facilities & Operations													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks												
<ul style="list-style-type: none"> 49 CFR Part 232.205 – Brake test inspection 49 CFR Part 232.15 & 609 – Defective equipment AAR S-469-47 - “Performance Specification for Freight Brakes” (April 1, 1999) 			Reg.	Maintenance equip & procedures												
			Reg.	Safe Practices		✓	Safety requirement for all braking systems	Defective equipment								
			Std.	Emergency equip & procedures												
			Std.	Environmental issues												
			Key take-outs / best practice													
					<ul style="list-style-type: none"> Not very relevant to the scope of study since only general requirements of braking systems 											

General Requirements for all braking systems for non-passenger trains



49 CFR Part 232.105 Brake System Safety Standards – General Requirements for Non-Passenger Locomotives



Name	Brake System Safety Standards –General Requirements for Non-Passenger Locomotives		Code	49 CFR Part 232.105		Date of Issue	Current 2013												
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels		Next Issue													
Sector Applicability	All non-passenger trains	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> All applicable locomotives shall be equipped with a hand or parking brake that is: <ol style="list-style-type: none"> Capable of application or activation by hand Capable of release by hand and Capable of holding the unit on a 3% grade Use of the feed or regulating valve to control braking is prohibited When taking charge of a locomotive or locomotive consist, an engineer must know that the brakes are in operative condition 			Fueling															
				Onboard Storage															
				Transfer															
				Gasification															
				Consumption															
				Sub System Element	Incl	Comment	Hazards Identified												
				Fuelling Facilities & Operations															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																	
None Cited		Maintenance equip & procedures																	
		Safe Practices		✓	Safety requirement for locomotive braking systems	Leakage and defective equipment													
		Emergency equip & procedures																	
		Environmental issues																	
		Key take-outs / best practice		<ul style="list-style-type: none"> Not very relevant to the scope of study since only general requirements of locomotive braking systems 															



49 CFR Part 238.103 Passenger Equipment Safety Standards – Fire Safety



Name	Passenger Equipment Safety Standards – Fire Safety		Code	49 CFR Part 238.103				Date of Issue	Current 2013										
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels				Next Issue											
Sector Applicability	All passenger trains	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Materials used in constructing a passenger car or a cab of a locomotive shall meet the test performance criteria for flammability and smoke emission characteristics Railroads shall ensure that fire safety considerations and features in the design of this equipment reduce the risk of personal injury caused by fire to an acceptable level in its operating environment using a formal safety methodology Railroads shall develop and adopt written procedures for the inspection, testing, and maintenance of all fire safety systems and fire safety equipment on the passenger equipment it operates 			Fueling															
				Onboard Storage															
				Transfer															
				Gasification															
				Consumption															
				Sub System Element	Incl	Comment	Hazards Identified												
				Fuelling Facilities & Operations															
				Fuel Systems & Tanks															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)		Type		Maintenance equip & procedures															
– MIL-STD-882		Std.		Safe Practices		✓	General Fire Safety requirements for all equipments	Hazard analysis required											
				Emergency equip & procedures															
				Environmental issues															
				Key take-outs / best practice															
				<ul style="list-style-type: none"> Only specifies general fire safety requirements for all passenger trains. Does not discuss at component or system level Hazard analysis required based on MIL specifications 															



49 CFR Part 238.105 Passenger Equipment Safety Standards – Train electronic hardware and software safety



Name	Passenger Equipment Safety Standards – Train electronic hardware and software safety		Code	49 CFR Part 238.105				Date of Issue	Current 2013										
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels				Next Issue											
Sector Applicability	All passenger trains	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Apply to electronic hardware and software used to control or monitor safety functions in passenger equipment The railroad shall develop and maintain a written hardware and software safety program to guide the design, development, testing, integration, and verification of software and hardware that controls or monitors equipment safety functions The hardware and software safety program shall be based on a formal safety methodology that includes a Failure Modes, Effects, Criticality Analysis (FMECA) 			Fueling															
				Onboard Storage															
				Transfer															
				Gasification															
				Consumption															
							Sub System Element	Incl	Comment	Hazards Identified									
				Fuelling Facilities & Operations															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																	
None Cited		Maintenance equip & procedures																	
		Safe Practices				✓	General hardware & software safety provisions	Hazard analysis required											
		Emergency equip & procedures																	
		Environmental issues																	
		Key take-outs / best practice																	
	<ul style="list-style-type: none"> Only specifies general hardware & software safety requirements for all passenger trains Does not discuss at component or system level 																		



49 CFR Part 238.117 Passenger Equipment Safety Standards – Protection against personal injury



Name	Passenger Equipment Safety Standards – Protection against personal injury		Code	49 CFR Part 238.117		Date of Issue	Current 2013									
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels		Next Issue										
Sector Applicability	All passenger trains	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> All moving parts, high voltage equipment, electrical conductors and switches, and pipes carrying hot fluids or gases on all passenger equipment shall be appropriately equipped with interlocks or guards to minimize the risk of personal injury This section does not apply to the interior of a private car 		Fueling													
			Onboard Storage													
			Transfer													
			Gasification													
			Consumption													
			Sub System Element	Incl	Comment		Hazards Identified									
			Fuelling Facilities & Operations													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type		Fuel Systems & Tanks													
None Cited			Maintenance equip & procedures													
			Safe Practices		✓	General safety provisions										
			Emergency equip & procedures													
			Environmental issues													
			Key take-outs / best practice													
		<ul style="list-style-type: none"> Only specifies general safety requirements for all passenger trains Does not discuss at component or system level 														

49 CFR Part 238.223 Passenger Equipment Safety Standards – Requirements for Tier I Locomotive fuel tanks

Name	Passenger Equipment Safety Standards – Requirements for Tier I Locomotive fuel tanks			Code	49 CFR Part 238.223							Date of Issue	Current 2013							
Authorising / issuing agency	CFR – Code of Federal Regulations			Fuel Applicability	All Fuels							Next Issue								
Sector Applicability	All passenger trains		Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Only applicable for railroad passenger equipment operating at speeds not exceeding 125 miles per hour Internal locomotive fuel tanks shall be positioned in a manner to reduce the likelihood of accidental penetration from roadway debris or collision Internal fuel tank vent systems shall be designed so they do not become a path of fuel loss in any tank orientation due to a locomotive overturning Additional provisions for strength of materials 			Fueling																
Onboard Storage																●				
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Provision for construction and strength of materials				Collisions, leakage due to overturning												
None Cited		Maintenance equip & procedures																		
		Safe Practices	✓	General safety provisions for tanks																
		Emergency equip & procedures																		
		Environmental issues																		
	Key take-outs / best practice								<ul style="list-style-type: none"> General safety requirements for fuel tanks on passenger trains 											



49 CFR Part 238.423 Passenger Equipment Safety Standards – Requirements for Tier II Locomotive fuel tanks



Name	Passenger Equipment Safety Standards – Requirements for Tier II Locomotive fuel tanks		Code	49 CFR Part 238.423				Date of Issue	Current 2013									
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels				Next Issue										
Sector Applicability	All passenger trains	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description			Fueling															
<ul style="list-style-type: none"> Only applicable for railroad passenger equipment operating at speeds exceeding 125 mph but not exceeding 150 mph Must at least comply with requirements of 49 CFR Part 238.223 			Onboard Storage										○					
			Transfer															
			Gasification															
			Consumption															
			Sub System Element	Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks			✓	Provision for construction and strength of materials		Collisions, leakage due to overturning								
– 49 CFR Part 238.223			Reg.	Maintenance equip & procedures														
				Safe Practices			✓	General safety provisions for tanks										
				Emergency equip & procedures														
				Environmental issues														
				Key take-outs / best practice														
<ul style="list-style-type: none"> Not very useful since reference to Tier I provisions 																		



Design Guidelines for Bus Transit Systems Using Compressed Natural Gas as an Alternative Fuel



Name	Design Guidelines for Bus Transit Systems Using Compressed Natural Gas (CNG) as an Alternative Fuel		Code	DOT-FTA-MA-26-7021-96-1 DOT-VNTSC-FTA-96-3		Date of Issue	June 1996	
Authorising / issuing agency	U.S. Department of Transportation, Federal Transit Administration (FTA)		Fuel Applicability	CNG only		Next Issue	August 1997	
Sector Applicability	On-highway Commercial Vehicles	Geographical coverage	US	System/Component	Hoses/ Pipes Valves Regulators Fittings Connectors Sensors Break Away Metering Tanks Compressor Refrigeration Vaporizers			
Description			Fueling					
<ul style="list-style-type: none"> This guidelines document presents various facility and bus design issues that need to be considered to ensure safe operations when using CNG as the alternative fuel. The report covers; Fuel properties, potential hazards, fuel requirements for specified level of service, codes & standards, ventilation, and electrical classification Critical fuel related safety issues in the design of the related systems A system safety assessment and hazard resolution process 			Onboard Storage			General system requirements only and no specific component level requirements specified		
			Transfer					
			Gasification					
			Consumption					
			Sub System Element	Incl	Comment	Hazards Identified		
Fuelling Facilities & Operations	✓	Process description & Fuel Transfer hazards	Indoor/ Outdoor fuelling Vehicle collision damage					
Fuel Systems & Tanks	✓	Including defueling strategy	Leak events					
Maintenance equip & procedures	✓	Process description & Maintenance hazards	Ignition sources of electrical equipment					
Safe Practices	✓	Emergency planning detailed	Inadequate personnel training					
Emergency equip & procedures	✓	Hazard analysis details	(Based on MEL-STD-882C)					
Environmental issues								
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Key take-outs / best practice				
<ul style="list-style-type: none"> Energy Policy Act of 1992 (EPACT) Public Law 102-486 Alternative Motor Fuels Act of 1988 (AMFA), Public Law 100-494. CFR 40, "Protection of Environment." Part 86 Control of Air Pollution from New and In-Use Motor Vehicles and New and In-Use Motor Vehicle Engines CFR 49, Part 171: Hazardous materials regulation CFR 29. Part 1910 - Occupational Safety and Health Standards. (OSHA) Superfund Amendments and Reauthorization Act (1986) SARA Title III NFPA 30A - Automotive and Marine Service Station Code NFPA 52 - Standard for Compressed Natural Gas (CNG) vehicular fuel sys NFPA 54 - National Fuel Gas Code NFPA 70 -The National Electric Code (1996) NFPA 88A - Standard for Parking Structures ANSI/ AGA NGV2-1992 - Basic requirements for CNG vehicle (NGV) fuel containers 			Statue	<ul style="list-style-type: none"> Train operating staff regularly, control ignition sources Alarms / warning systems and gas detection equipment should be maintained properly, good Facility ventilation 				
			Statue					
			Reg.					
			Reg.					
			Reg.					
			Code					
Code								
Code								
Std.								
Std.								
Std.								

Source: Ricardo assessment



Design Guidelines for Bus Transit Systems Using Liquefied Natural Gas (LNG) as an Alternative Fuel



Name	Design Guidelines for Bus Transit Systems Using Liquefied Natural Gas (LNG) as an Alternative Fuel		Code	DOT-FTA-MA-26-7021-97-1 DOT-VNTSC-FTA-97-3		Date of Issue	March 1997		
Authorising / issuing agency	U.S. Department of Transportation, Federal Transit Administration (FTA)		Fuel Applicability	LNG only		Next Issue	-		
Sector Applicability	On-highway Commercial Vehicles	Geographical coverage	US	System/Component	Hoses/ Pipes Valves Regulators Fittings Connectors Sensors Break Away Metering Tanks Compressor Refrigeration Vaporizers				
Description			Fueling						
<ul style="list-style-type: none"> This guidelines document presents various facility and bus design issues that need to be considered to ensure safe operations when using LNG as the alternative fuel. The report covers; Fuel properties, potential hazards, fuel requirements for specified level of service, codes & standards, ventilation, and electrical classification Critical fuel related safety issues in the design of the related systems A system safety assessment and hazard resolution process 			Onboard Storage			General system requirements only and no specific component level requirements specified			
			Transfer						
			Gasification						
			Consumption						
						Sub System Element	Incl	Comment	Hazards Identified
			Fuelling Facilities & Operations	✓	Process description & Fuel Transfer hazards	Indoor fuelling Vehicle collision damage			
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks	✓				
<ul style="list-style-type: none"> Energy Policy Act of 1992 (EPACT) Public Law 102-486 Alternative Motor Fuels Act of 1988 (AMFA), Public Law 100-494. CFR 40, "Protection of Environment." Part 86 Control of Air Pollution from New and In-Use Motor Vehicles and New and In-Use Motor Vehicle Engines CFR 49, Part 193: Liquefied Natural Gas Facilities; Federal Safety Standards CFR 29. Part 1910 - Occupational Safety and Health Standards. (OSHA) NFPA 30A - Automotive and Marine Service Station Code NFPA 54 - National Fuel Gas Code NFPA 57 - Standard for Liquefied Natural Gas (LNG) Vehicular Fuel Systems NFPA 59A - Standard for the Production, Storage and Handling of LNG NFPA 70 -The National Electric Code (1996) NFPA 497A - Recommended Practice for Classification of Class I Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas NFPA 88A - Standard for Parking Structures 			Statue	Maintenance equip & procedures	✓	Process description & Maintenance hazards			
			Statue	Safe Practices	✓	Emergency planning detailed			
			Reg. Reg. Code	Emergency equip & procedures	✓				
			Code	Environmental issues					
			Std. Code Std.	Key take-outs / best practice					
Std.	<ul style="list-style-type: none"> Train operating staff, control ignition sources Alarms / warning systems, good Facility ventilation 								

Source: Ricardo assessment



Liquefied Natural Gas Safety in Transit Operations



Name	Liquefied Natural Gas Safety in Transit Operations		Code	DOT-FTA-MA-90-7007-95-3 DOT-VNTSC-FTA-95-10		Date of Issue	March 1996	
Authorising / issuing agency	U.S. Department of Transportation, Federal Transit Administration (FTA)		Fuel Applicability	LNG only		Next Issue	-	
Sector Applicability	On-highway Commercial Vehicles	Geographical coverage	US	System/Component	Hoses/ Pipes Valves Regulators Fittings Connectors Sensors Break Away Metering Tanks Compressor Refrigeration Vaporizers			
Description	<ul style="list-style-type: none"> This report examines the safety issues relating to the use of Liquefied Natural Gas (LNG) in transit service based on the review of 4 on-site surveys of transit bus operations The surveys also included an examination of the occupational hygiene aspects of LNG use. Survey results showed that differences exist between transit agencies in their mitigation of LNG hazards. 		Fueling					
			Onboard Storage					
			Transfer					
			Gasification					
			Consumption					
			Sub System Element	Incl	Comment	Hazards Identified		
			Fuelling Facilities & Operations	✓	Planning			
			Fuel Systems & Tanks	✓	Conversions			
			Maintenance equip & procedures	✓				
			Safe Practices	✓				
			Emergency equip & procedures	✓				
			Environmental issues					
			Key take-outs / best practice					
			<ul style="list-style-type: none"> Safe operations require a clear understanding by employees of LNG hazards, knowing and following safe practices, and understanding and remembering the proper emergency response procedure The fuel transfer technology is the least developed in LNG bus operations 					



Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water



Name	Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water		Code	SAND2004-6258				Date of Issue	Dec 2004										
Authorising / issuing agency	Sandia National Laboratories for U.S. Department of Energy (DOE)		Fuel Applicability	LNG only				Next Issue	-										
Sector Applicability	Marine	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> This report provides guidance on a risk-based analysis approach to assess and quantify potential threats to an LNG ship, the potential hazards and consequences of a large spill from an LNG ship, and review prevention and mitigation strategies that could be implemented to reduce both the potential for and the risks of an LNG spill over water Risks from intentional events, such as terrorist acts, can be significantly reduced with appropriate security, planning, prevention, and mitigation 			Fueling															
				Onboard Storage															
				Transfer															
				Gasification															
				Consumption															
							Sub System Element	Incl	Comment	Hazards Identified									
				Fuelling Facilities & Operations	✓	Covers all aspects of unintentional & intentional spill	All key hazards identified												
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																	
<ul style="list-style-type: none"> ANSI 1992] American National Standard for Respiratory Protection, ANSI Z88.2-1992. American National Standards Institute, New York, 1992. [NFPA 2001] National Fire Protection Association – Standard 59A, “Standard for the Protection, Storage, and Handling of Liquefied Natural Gas”, 2001 Edition, Quincy, MA. 	Std.	Maintenance equip & procedures																	
	Code	Safe Practices		✓	Good safety practices recommended														
		Emergency equip & procedures		✓	Limited discussion														
		Environmental issues																	
		Key take-outs / best practice																	

29 CFR Part 1910 Sec 101 – OHS Standard – Compressed Gases – General Requirements

Name	OHS Standard – Compressed Gases – General Requirements			Code	29 CFR Part 1910 Sec 101							Date of Issue	Current 2013							
Authorising / issuing agency	CFR – Code of Federal Regulations			Fuel Applicability	All Compressed Gases							Next Issue								
Sector Applicability	All Uses		Geographical coverage	US		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Each employer shall determine that compressed gas cylinders under his control are in a safe condition to the extent that this can be determined by visual inspection The in-plant handling, storage, and utilization of all compressed gases in cylinders, portable tanks, rail tankcars, or motor vehicle cargo tanks shall be in accordance with CGA P-1 Compressed gas cylinders, portable tanks, and cargo tanks shall have pressure relief devices installed and maintained in accordance to CGA S-1.1 and S-1.2 			Fueling			○													
Onboard Storage						○										○				
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations	✓	All cylinders and PR devices																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓																	
– 49 CFR Parts 171-179, Transportation – Hazardous materials regulations	Reg.	Maintenance equip & procedures	✓																	
– 14 CFR Part 103, Air traffic and general operating rules of Ultralight vehicles	Reg.	Safe Practices	✓	Proper inspection and installation																
– CGA C-6, Standards for Visual Inspection of Steel Compressed Gas Cylinders	Std.	Emergency equip & procedures																		
– CGA C-8, Standard for requalification of seamless steel cylinder	Std.	Environmental issues																		
– CGA P-1, Safe handling of compressed gases in containers	Std.	Key take-outs / best practice																		
– CGA S-1.1, PRD standards – Cylinders for compressed gases	Std.	<ul style="list-style-type: none"> Refers to the proper regulations and standards for the design, installation, maintenance and inspection of all compressed gas cylinders and pressure relief devices 																		
– CGA S-1.2, PRD standards – Cargo and portable tanks for compressed gases	Std.																			



29 CFR Part 1910 Sec 106 – OHS Standards for Flammable Liquids



Name	OHS Standards for Flammable Liquids			Code	29 CFR Part 1910 Sec 106						Date of Issue	Current 2013									
Authorising / issuing agency	CFR – Code of Federal Regulations			Fuel Applicability	All Flammable Liquids						Next Issue										
Sector Applicability	All Uses		Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description				Fueling	●	◐		◐	◐												
<ul style="list-style-type: none"> Regulations describing safety standards for storage, fabrication, installation and spacing of tanks containing flammable liquids Various classes of flammable liquids defined Special consideration to proper venting and design of vent pipes Both underground and above-ground tanks considered Testing procedures for safe operation of tanks and related accessories defined 				Onboard Storage	●	◐		◐	◐					●							
				Transfer																	
				Gasification																	
				Consumption																	
								Sub System Element	Incl	Comment						Hazards Identified					
				Fuelling Facilities & Operations	✓	For tanks and all related accessories						Ignition, fire, asphyxiation, corrosion									
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)				Type	Fuel Systems & Tanks	✓															
<ul style="list-style-type: none"> – ASTM D-86-62, Standard test method for distillation of petroleum products – ASTM D-56-70, Standard Method of Test for Flashpoint by Tag Closed Tester – ASME Boiler and Pressure Vessel Code – NFPA 32 				Std.	Maintenance equip & procedures																
				Std.	Safe Practices	✓	General safety / security guidelines						Spill, leakage, fire								
				Code	Emergency equip & procedures																
					Environmental issues																
								Key take-outs / best practice													
				<ul style="list-style-type: none"> Safety regulations for tanks and all related piping, valves and fittings Guidelines for fire protection and security also specified 																	

29 CFR Part 1910 Sec 110 – OHS Standard – Storage and handling of Liquefied Petroleum Gases

Name	OHS Standard – Storage and handling of Liquefied Petroleum Gases			Code	29 CFR Part 1910 Sec 110							Date of Issue	Current 2013							
Authorising / issuing agency	CFR – Code of Federal Regulations			Fuel Applicability	All Liquefied Petroleum Gases							Next Issue								
Sector Applicability	All Uses		Geographical coverage	US		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Describes regulations for Occupational Health and Safety Standards related to Hazardous Materials Liquefied petroleum gases”— Any material which is composed predominantly of any of the following hydrocarbons, or mixtures of them; propane, propylene, butanes (normal butane or iso-butane), and butylenes Discusses all regulations, guidelines and specifications for all uses of LPG for its proper storage and handling 			Fueling	●	●	○	●	●	●	●	○	○	○	○	○	○	○		
Onboard Storage				●	●	○	●	●	○	○	○	○	○	○	○	○	○	○	○	○
Transfer				●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Gasification				●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Consumption				●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations				✓	Guidelines for tanks and all related accessories															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Detailed specifications of all related tubing	Ignition, fire, corrosion, electrical hazard															
– 49 CFR Parts 178, Transportation – Hazardous materials regulations	Reg.	Maintenance equip & procedures																		
– ASME Boiler and Pressure Vessel Code	Code	Safe Practices	✓	Procedures for markings and instructions																
– NFPA 58, Storage and Handling of Liquefied Petroleum Gases	Std.	Emergency equip & procedures																		
– ANSI H38.7, Specifications for aluminium alloy pipes	Std.	Environmental issues																		
– NFPA 54, Standard for installation of gas appliances	Std.	Key take-outs / best practice																		
– NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines		<ul style="list-style-type: none"> Very detailed specifications and regulations regarding all equipment and accessories pertaining to storage and handling of LPG Not very relevant for natural gas applications 																		
– NFPA 96, Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment	Std.																			



29 CFR Part 1910.119 and 1926.64 – OHS Std. – Process Safety Management of Highly Hazardous Chemicals



Name	OHS Standard – Process Safety Management of Highly Hazardous Chemicals		Code	29 CFR Part 1910.119 and 1926.64		Date of Issue	Current 2013												
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels		Next Issue													
Sector Applicability	All Uses	Geographical coverage	US	System/ Component	<table border="1"> <tr> <td>Hoses/ Pipes</td> <td>Valves</td> <td>Regulators</td> <td>Fittings</td> <td>Connectors</td> <td>Sensors</td> <td>Break Away</td> <td>Metering</td> <td>Tanks</td> <td>Compressor</td> <td>Refrigeration</td> <td>Vaporizers</td> </tr> </table>	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers								
Description			Fueling																
<ul style="list-style-type: none"> Contains requirements for minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals May result in toxic, fire or explosion hazards Applies to – <ul style="list-style-type: none"> Process which involves a chemical at or above the specified threshold quantities Process which involves a Category 1 flammable gas on site in one location, in a quantity of 10,000 pounds Does not apply to retail facilities, unoccupied remote facilities and oil or gas well drilling or servicing operations 			Onboard Storage																
			Transfer																
			Gasification																
			Consumption																
			Sub System Element		Incl	Comment		Hazards Identified											
Fuelling Facilities & Operations																			
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks															
<ul style="list-style-type: none"> American Institute of Chemical Engineers, Guidelines for Hazard Evaluation Procedures Center for Chemical Process Safety, Guidelines for Technical Management of Chemical Process Safety Chemical Manufacturers Association, Guidelines for Technical Management of Chemical Process Safety Chemical Manufacturers Association, Safe Warehousing of Chemicals API 750, Management of process hazards API 2220, Improving Owner and Contractor Safety Performance 			Paper	Maintenance equip & procedures															
			Paper	Safe Practices	✓	Procedures for process safety	Chemicals, technology, equipment												
			Paper	Emergency equip & procedures	✓	Emergency planning and response													
			Paper	Environmental issues															
			Key take-outs / best practice		<ul style="list-style-type: none"> Describes process safety related to hazardous chemicals, technology or process and equipment in the process Method for performing hazard analysis on processes 														



29 CFR Part 1910 Sec 1000 – OHS Standard – Toxic and Hazardous Air Contaminants



Name	OHS Standard – Toxic and Hazardous Air Contaminants		Code	29 CFR Part 1910 Sec 1000		Date of Issue	Current 2013	
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Gaseous Fuels		Next Issue		
Sector Applicability	All Uses	Geographical coverage	US	System/ Component	Hoses/ Pipes Valves Regulators Fittings Connectors Sensors Break Away Metering Tanks Compressor Refrigeration Vaporizers			
Description	<ul style="list-style-type: none"> An employee’s exposure to any toxic and hazardous air contaminant as defined by this regulation shall be limited in accordance with the requirements specified Lists detailed limits on exposure concentration for each type of air contaminant 		Fueling					
			Onboard Storage					
			Transfer					
			Gasification					
			Consumption					
			Sub System Element	Incl	Comment	Hazards Identified		
			Fuelling Facilities & Operations					
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type		Fuel Systems & Tanks					
None Cited			Maintenance equip & procedures					
			Safe Practices		✓ Exposure to hazardous air contaminant	Asphyxiation		
			Emergency equip & procedures					
			Environmental issues					
			Key take-outs / best practice					
			<ul style="list-style-type: none"> Detailed limits on exposure to air contaminants No direct reference to natural gas 					

General Safety Guidelines only for exposure to Hazardous air contaminants



29 CFR Part 1915 Sec 171-173 – OHS Standards for Shipyard Employment – Portable Unfired Pressure Vessels



Name	OHS Standards for Shipyard Employment – Portable Unfired Pressure Vessels		Code	29 CFR Part 1915 Sec 171-173		Date of Issue	Current 2013												
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels		Next Issue													
Sector Applicability	Marine/ Ships	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Applies to ship repairing and shipbuilding and not to shipbreaking Portable unfired pressure vessels shall be subjected to a hydrostatic pressure test of one and one-half times the working pressure of the vessels The relief valves on the vessels shall be set to the safe working pressure of the vessels, or set to the lowest safe working pressure of the systems, whichever is lower Pressure vessels, drums and containers containing toxic or flammable liquids or gases shall not be stored or used where they are subject to open flame, hot metal, or other sources of artificial heat 			Fueling															
				Onboard Storage		○							○		●				
				Transfer															
				Gasification															
				Consumption															
				Sub System Element	Incl	Comment	Hazards Identified												
	Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																	
– ASME Boiler and Pressure vessel code	Code	Maintenance equip & procedures																	
		Safe Practices			✓	General safety guidelines		Ignition, fire, over pressurization											
		Emergency equip & procedures																	
		Environmental issues																	
		Key take-outs / best practice																	



29 CFR Part 1917 Sec 156 – Marine Terminals – Fuel Handling and Storage



Name	Marine Terminals – Fuel Handling and Storage		Code	29 CFR Part 1917 Sec 156		Date of Issue	Current 2013									
Authorising / issuing agency	CFR – Code of Federal Regulations		Fuel Applicability	All Fuels		Next Issue										
Sector Applicability	Marine/ Ships	Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Safety requirements for the storage and handling of liquid fuels, liquefied gas fuels and fuel containers General safety requirements for overall fuelling operations in marine terminals General safety requirements for overall storage for fuels in marine terminals, including storage of fuelled vehicles 			Fueling												
				Onboard Storage												
				Transfer												
				Gasification												
				Consumption												
				Sub System Element	Incl	Comment		Hazards Identified								
				Fuelling Facilities & Operations												
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks												
None Cited				Maintenance equip & procedures												
				Safe Practices	✓	General safety guidelines		Spill, ignition, fire,								
				Emergency equip & procedures												
				Environmental issues												
				Key take-outs / best practice												
				<ul style="list-style-type: none"> General safety requirements for storage and operations of fuels in marine terminals 												

29 CFR Part 1926 Sec 152 – Construction Safety and Health – Flammable Liquids Fire Protection and Prevention

Name	Construction Safety and Health – Flammable Liquids Fire Protection and Prevention			Code	29 CFR Part 1926 Sec 152							Date of Issue	Current 2013								
Authorising / issuing agency	CFR – Code of Federal Regulations			Fuel Applicability	All Fuels							Next Issue									
Sector Applicability	All Uses		Geographical coverage	US	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description	<ul style="list-style-type: none"> Only approved containers and portable tanks shall be used for storage and handling of flammable liquids Detailed requirements for ventilation including design of vent lines Safety requirements for fire protection and prevention Covers all aspects of the facility including tanks (all types), piping, safety devices and valves and all electrical and relevant mechanical equipment 			Fueling	●	●	●	●	●	●	●	●	●	●	●	●	●	●			
Onboard Storage																					
Transfer																					
Gasification																					
Consumption																					
Sub System Element				Incl	Comment	Hazards Identified															
Fuelling Facilities & Operations				✓	Basic requirements for all facilities																
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type																				
<ul style="list-style-type: none"> NFPA 251, Standard Methods of Fire Test of Building Construction and Material NFPA 30, The Flammable and Combustible Liquids Code 	Std.	Maintenance equip & procedures	✓	Covers best practices for repairs and maintenance																	
	Code	Safe Practices	✓	General safety guidelines	Spill, ignition, fire, collision damage																
		Emergency equip & procedures																			
		Environmental issues																			
	Key take-outs / best practice																				
<ul style="list-style-type: none"> General Safety Reqs for Construction related to Flammable Liquids Focuses on best practices for construction of facilities dealing with flammable liquids 																					

- Sample Summary Sheet
- Review of Codes, Standards, and Regulations
- **Appendices For Detailed Summaries**
 - United States
 - **International Organization of Standardization (ISO)**
 - Germany
 - Australia
 - Japan

ISO 8789 – Rubber Hoses and Hose Assemblies for LPG in Motor Vehicles - Specification



Name	Rubber Hoses and Hose Assemblies for LPG in Motor Vehicles – Specification		Code	ISO 8789		Date of Issue	12-15-2009									
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LPG		Next Issue										
Sector Applicability	All Motor Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Specifies requirements for rubber hoses and hose assemblies up to a maximum hose size of 19 Only for motor vehicles with LPG installations Designed for use up to a maximum working pressure of 30 bar and at working temperatures from -40 °C to +80 °C 		Fueling													
			Onboard Storage	●			○									
			Transfer	●			○									
			Gasification	●			○									
			Consumption	●			○									
			Sub System Element	Incl	Comment		Hazards Identified									
			Fuelling Facilities & Operations													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Specifies material, dimension, performance requirements		Leakage, bursting										
– ISO 37, 188 - Rubber, vulcanized or thermoplastic	Std.	Maintenance equip & procedures														
– ISO 68, General purpose screw threads – Basic Profile	Std.	Safe Practices	✓	Type and routine of testing hoses		Corrosion, leakage, bursting, strength										
– ISO 1402, 4080, 4671, 8330 - Rubber and plastics hoses and hose assemblies	Std.	Emergency equip & procedures														
– ISO 1817, Rubber, vulcanized – Effect of liquids	Std.	Environmental issues														
– ISO 4672, 7326, 8033 – Rubber and plastic hoses	Std.	Key take-outs / best practice														
– ISO 23529, Rubber – Preparing test pieces for physical test methods	Std.	<ul style="list-style-type: none"> Not very relevant for natural gas (CNG/ LNG) systems as suitable only for LPG systems 														
– ASME B1.1, Unified inch screw threads	Std.															

ISO 10976 – Refrigerated Light Hydrocarbon Fluids – Measurement of Cargoes on Board LNG Carriers

Name	Refrigerated Light Hydrocarbon Fluids – Measurement of Cargoes on Board LNG Carriers		Code	ISO 10976		Date of Issue	07-01-2012		
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG		Next Issue			
Sector Applicability	All off-shore and on-shore vessels	Geographical coverage	Global	System/ Component	Hoses/ Pipes Valves Regulators Fittings Connectors Sensors Break Away Metering Tanks Compressor Refrigeration Vaporizers				
Description	<ul style="list-style-type: none"> Provides methods for measuring quantities on LNG carriers Recommended methods for measuring, reporting and documenting quantities Includes measurement of liquid volume, vapour volume, temperature and pressure 		Fueling						
			Onboard Storage				●	●	
			Transfer						
			Gasification				●		
			Consumption				●	●	
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Sub System Element	Incl	Comment	Hazards Identified		
				Fuelling Facilities & Operations					
				Fuel Systems & Tanks	✓	Specifies location and types of measuring devices and procedures	Gas up and cool down precautions, cleanliness, excessive moisture		
<ul style="list-style-type: none"> ISO 8310, Refrigerated light hydrocarbon fluids – measurement of temperature in tanks containing liquefied gases ISO 8943, Refrigerated light hydrocarbon fluids – sampling LNG ISO 18132-1, Refrigerated hydrocarbon and non-petroleum based liquefied gaseous fluids – general requirements for automatic tank gauges IEC 60533, Electrical and electronic installations in ships EN 1160, Installations and equipment for LNG API 2217A, Guidelines for work in inert confined spaces IACS E10 ICS Tanker safety guide – Liquefied gas ICS/ OCIMF/ IAPH ISGOTT IMO IGC Code SIGTTO Liquefied gas handling principles on ships and in terminals SIGTTO Liquefied gas fire hazard management 			Std.	Maintenance equip & procedures	✓	Calibration and maintenance discussed	Measurement errors due to improper calibration		
			Std. Std.	Safe Practices	✓	Sets out marking requirements	Fire, explosion, cryogenic burns, reactions		
			Std. Std. Std.	Emergency equip & procedures					
			Std. Std.	Environmental issues					
			Key take-outs / best practice						
			Code Std. Std.	<ul style="list-style-type: none"> Useful Annex A; LNG Carrier design and operations Detailed requirements for equipment and procedures needed for proper measurement of LNG on board vessels 					

ISO 11439 – High Pressure Cylinders for the On-Board Storage of Natural Gas as a fuel for Automotive Vehicles

Name	High Pressure Cylinders for the On-Board Storage of Natural Gas as a fuel for Automotive Vehicles		Code	ISO 11439		Date of Issue	06-01-2013									
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	CNG		Next Issue										
Sector Applicability	All automotive vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Specifies minimum requirements for light-weight refillable gas cylinders intended only for the on-board storage of high pressure CNG as a fuel for automotive vehicles Service conditions do not cover external loadings that can arise from vehicle collisions Covers all types of cylinders except stainless steel Reference working pressure of 200 bar considered 		Fueling													
			Onboard Storage										●			
			Transfer													
			Gasification													
			Consumption													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Sub System Element	Incl	Comment	Hazards Identified									
				Fuelling Facilities & Operations												
				Fuel Systems & Tanks	✓	Detailed specifications for on board cylinders	Mechanical or chemical attack									
<ul style="list-style-type: none"> ISO 148, 6506, 6892 – For metallic minerals ISO 306, 527 – For plastics ISO 2808, Paints and varnishes – determination of film thickness ISO 7866, 9809 – Gas cylinders – design, construction and testing ISO 9227, Corrosion tests in artificial atmospheres ISO 9712, Non-destructive testing ISO 14130, Fiber-reinforced plastic composites ISO 15403, Natural gas for use as a compressed fuel for vehicles ISO 15500, Road vehicles – CNG fuel system components ASTM D522, D1308, D2794, D3170, D3359 and D3418 – Standard test methods ASTM G154, Standard practice for operating fluorescent light apparatus NACE/ TM 0177, Lab testing of metals for resistance to sulfide stress cracking 			Std.	Maintenance equip & procedures												
			Std. Std.	Safe Practices	✓	Inspection and testing requirements	Fire, manufacturing defect, fracture, impact damage									
			Std. Std.	Emergency equip & procedures												
			Std. Std.	Environmental issues												
			Key take-outs / best practice													
			Code Std. Std.	<ul style="list-style-type: none"> Specs for all types of on-board cylinders except stainless steel Focus on materials and testing – not much on quantitative design requirements and stresses 												

ISO/DIS 12614 – Liquefied natural gas (LNG) fuel system components Part 1: General requirements & definitions

Name	Road Vehicles – LNG fuel system components Part 1: General requirements and definitions			Code	ISO/DIS 12614-1 (Draft)							Date of Issue	04-16-13									
Authorising / issuing agency	International Organisation of Standardisation			Fuel Applicability	LNG							Next Issue										
Sector Applicability	All vehicles		Geographical coverage	Global		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description	<ul style="list-style-type: none"> This part of ISO 12614 specifies general requirements and definitions for liquefied natural gas fuel system; intend for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 			Fueling																		
Onboard Storage																						
Transfer																						
Gasification																						
Consumption																						
Sub System Element				Incl	Comment	Hazards Identified																
Fuelling Facilities & Operations																						
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																				
<ul style="list-style-type: none"> ISO 3833:1977, Road vehicles - types ISO 6722-1: to 4 1996 Road Vehicles – unscreened low tension cables ;test methods, requirements, conductor sizes and dimensions for insulated cables 	Std. Std.	Maintenance equip & procedures																				
		Safe Practices																				
		Emergency equip & procedures																				
		Environmental issues																				
Key take-outs / best practice																						
				<ul style="list-style-type: none"> Useful Annex A; Construction & Assembly of LNG Fuelling system Marking of components 																		

ISO/DIS 12614 – Liquefied natural gas (LNG) fuel system components Part 2: Performance & general test methods

Name	Road Vehicles – LNG fuel system components Part 2: Performance & general test methods		Code	ISO/DIS 12614-2 (Draft)						Date of Issue	04-16-13							
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG						Next Issue								
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> This part of ISO 12614 specifies general requirements and definitions for liquefied natural gas fuel system; intend for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 		Fueling															
Onboard Storage			●	●	●	●	●	●	●	●	●	●	○	○	○	○	○	
Transfer			●	●	●	●	●	●	●	●	●	●	●	○	○	○	○	○
Gasification			●	●	●	●	●	●	●	●	●	●	●	○	○	○	○	○
Consumption			●	●	●	●	●	●	●	●	●	●	●	○	○	○	○	○
Sub System Element			Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Sets out tests for components within a LNG fuel system				Hazards associated with 11 tests listed below										
<ul style="list-style-type: none"> ISO 3833:1977, Road vehicles - types ISO 188:1998 Rubber, vulcanized or thermoplastic – accelerated ageing and heat resistant tests ISO 9227:1990 Corrosion tests in artificial atmosphere – salt spray tests 	Std.	Maintenance equip & procedures																
	Std.	Safe Practices	✓	Sets out marking requirements														
	Std.	Emergency equip & procedures																
	Std.	Environmental issues																
	Key take-outs / best practice			<ul style="list-style-type: none"> Details general component tests for - Hydrostatic strength, Leakage, Torque resistance, Bending moment, Continued operation, Corrosion resistance, Oxygen ageing, Electrical over-voltages, Non-metallic material immersion, Vibration resistance, Brass compatibility 														

ISO/DIS 12614 – Liquefied natural gas (LNG) fuel system components Part 3: Check Valve



Name	Road Vehicles – LNG fuel system components: Part 3: Check Valve		Code	ISO/DIS 12614-3 (Draft)						Date of Issue	04-16-13						
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG						Next Issue							
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description			Fueling														
<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for the check valve, an LNG system component intended for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 			Onboard Storage		●												
			Transfer		●												
			Gasification		●												
			Consumption		●												
			Sub System Element	Incl	Comment			Hazards Identified									
		Fuelling Facilities & Operations															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)		Type	Fuel Systems & Tanks		✓	Sets out applicable & specific check valve tests			Pressure, Leakage, Fatigue								
<ul style="list-style-type: none"> ISO 3833:1977, Road vehicles - types ISO 12614-1, Road vehicles general requirements ISO 12614-2, Performance and general test methods 		Std.	Maintenance equip & procedures														
		Std.	Safe Practices		✓	Sets out marking requirements											
		Std.	Emergency equip & procedures														
				Environmental issues													
				Key take-outs / best practice		<ul style="list-style-type: none"> Specific test requirements for Hydrostatic strength, Leakage and Continued operation General tests for - Torque resistance, Bending moment, Corrosion resistance, Oxygen ageing, Non-metallic material immersion, Vibration resistance, Brass compatibility 											

ISO/DIS 12614 – Liquefied natural gas (LNG) fuel system components Part 4: Manual Valve

Name	Road Vehicles – LNG fuel system components: Part 4: Manual Valve		Code	ISO/DIS 12614-4 (Draft)						Date of Issue	04-16-13							
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG						Next Issue								
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for the manual valve, an LNG system component intended for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 		Fueling															
Onboard Storage				●														
Transfer				●														
Gasification				●														
Consumption				●														
Sub System Element			Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Sets out applicable & specific manual valve tests				Pressure, Leakage, Fatigue										
<ul style="list-style-type: none"> ISO 3833:1977, Road vehicles - types ISO 12614-1, Road vehicles general requirements ISO 12614-2, Performance and general test methods 	Std.	Maintenance equip & procedures																
	Std.	Safe Practices	✓	Sets out marking requirements														
	Std.	Emergency equip & procedures																
		Environmental issues																
	Key take-outs / best practice																	
<ul style="list-style-type: none"> Specific test requirements for Hydrostatic strength, Leakage and Continued operation General tests for - Torque resistance, Bending moment, Corrosion resistance, Oxygen ageing, Non-metallic material immersion, Vibration resistance, Brass compatibility 																		

ISO/DIS 12614 – Liquefied natural gas (LNG) fuel system components Part 5: Tank Pressure Gauge

Name	Road Vehicles – LNG fuel system components: Part 5: Tank Pressure Gauge		Code	ISO/DIS 12614-5 (Draft)										Date of Issue	04-16-13				
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG										Next Issue					
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description			Fueling																
<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for the tank pressure gauge, an LNG system component intend for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 			Onboard Storage							●									
			Transfer																
			Gasification																
			Consumption																
			Sub System Element	Incl	Comment								Hazards Identified						
		Fuelling Facilities & Operations																	
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks			✓	Sets out applicable & specific tank pressure gauge tests								Pressure, Leakage, Fatigue			
<ul style="list-style-type: none"> – ISO 3833:1977, Road vehicles - types – ISO 12614-1, Road vehicles general requirements – ISO 12614-2, Performance and general test methods 			Std. Std. Std.	Maintenance equip & procedures															
				Safe Practices			✓	Sets out marking requirements											
				Emergency equip & procedures															
				Environmental issues															
				Key take-outs / best practice															
<ul style="list-style-type: none"> The tank pressure gauge must be capable of displaying at least 120% of working pressure It should be equipped with a shatter proof lens and possess a means of pressure relief located at the rear of its body 																			

ISO/DIS 12614 – Liquefied natural gas (LNG) fuel system components Part 6: Overpressure Regulator

Name	Road Vehicles – LNG fuel system components: Part 6: Overpressure regulator		Code	ISO/DIS 12614-6 (Draft)										Date of Issue	04-16-13					
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG										Next Issue						
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description			Fueling																	
<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for the overpressure regulator, an LNG system component intend for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 			Onboard Storage			○														
			Transfer			○														
			Gasification			○														
			Consumption			○														
			Sub System Element	Incl	Comment								Hazards Identified							
		Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)		Type	Fuel Systems & Tanks			✓	Sets out applicable & specific overpressure regulator tests								Pressure, Leakage, Fatigue					
<ul style="list-style-type: none"> – ISO 3833:1977, Road vehicles - types – ISO 12614-1, Road vehicles general requirements – ISO 12614-2, Performance and general test methods 		Std.	Maintenance equip & procedures																	
		Std.	Safe Practices			✓	Sets out marking requirements													
		Std.	Emergency equip & procedures																	
				Environmental issues																
				Key take-outs / best practice																
		<ul style="list-style-type: none"> The over pressure regulator must have a factory set maximum outlet pressure with the maximum outlet and inlet pressure marked on the regulator 																		

ISO/DIS 12614 – Liquefied natural gas (LNG) fuel system components Part 7: Pressure Relief Valve (PRV)

Name	Road Vehicles – LNG fuel system components: Part 7: Pressure Relief Valve		Code	ISO/DIS 12614-7 (Draft)					Date of Issue	04-16-13								
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG					Next Issue									
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for the pressure relief valve, an LNG system component intend for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 		Fueling															
Onboard Storage				●														
Transfer				●														
Gasification				●														
Consumption				●														
Sub System Element			Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Sets out applicable & specific PRV tests				Pressure, Leakage, Fatigue, Operational limits										
<ul style="list-style-type: none"> – ISO 3833:1977, Road vehicles - types – ISO 12614-1, Road vehicles general requirements – ISO 12614-2, Performance and general test methods 	Std.	Maintenance equip & procedures																
	Std.	Safe Practices	✓	Sets out marking requirements														
	Std.	Emergency equip & procedures																
		Environmental issues																
	Key take-outs / best practice																	
<ul style="list-style-type: none"> - Specific test requirements for Hydrostatic strength, Leakage, Continued operation and operational - General tests for - Torque resistance, Bending moment, Corrosion resistance, Oxygen ageing, Non-metallic material immersion, Vibration resistance, Brass compatibility 																		

ISO/DIS 12614 – Liquefied natural gas (LNG) fuel system components Part 8: Excess Flow Valve

Name	Road Vehicles – LNG fuel system components: Part 8: Excess Flow Valve		Code	ISO/DIS 12614-8 (Draft)						Date of Issue	04-16-13							
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG						Next Issue								
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for the excess flow valve, an LNG system component intend for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 		Fueling															
Onboard Storage				●														
Transfer				●														
Gasification				●														
Consumption				●														
Sub System Element			Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Sets out applicable & specific excess flow valve types & tests				Pressure, Leakage, Torque/ Bending, Fatigue, Operational limits										
<ul style="list-style-type: none"> – ISO 3833:1977, Road vehicles - types – ISO 12614-1, Road vehicles general requirements – ISO 12614-2, Performance and general test methods 	Std.	Maintenance equip & procedures																
	Std.	Safe Practices	✓	Sets out marking requirements														
	Std.	Emergency equip & procedures																
		Environmental issues																
	Key take-outs / best practice																	
<ul style="list-style-type: none"> - Specific test requirements for Hydrostatic strength, Leakage, Continued operation, Operational, Torque resistance and Bending moment - General tests for - Corrosion resistance, Oxygen ageing, Non-metallic material immersion, Vibration resistance, Brass compatibility 																		

ISO/DIS 12614 – Liquefied natural gas (LNG) fuel system components Part 9: Gas-tight housing & ventilation hose

Name	Road Vehicles – LNG fuel system components: Part 9: Gas-tight housing & ventilation hose		Code	ISO/DIS 12614-9 (Draft)		Date of Issue	04-16-13	
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG		Next Issue		
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes Valves Regulators Fittings Connectors Sensors Break Away Metering Tanks Compressor Refrigeration Vaporizers			
Description	<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for the Gas-tight housing & ventilation hose, LNG system components intend for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 		Fueling					
			Onboard Storage	●				
			Transfer	●				
			Gasification	●				
			Consumption	●				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Sets out applicable & specific Gas-tight housing & ventilation hose tests	Leakage, and pull-off			
<ul style="list-style-type: none"> – ISO 3833:1977, Road vehicles - types – ISO 12614-1, Road vehicles general requirements – ISO 12614-2, Performance and general test methods 	Std.	Maintenance equip & procedures						
	Std.	Safe Practices	✓	Sets out marking requirements				
	Std.	Emergency equip & procedures						
		Environmental issues						
Key take-outs / best practice								
<ul style="list-style-type: none"> The gas-tight housing must be assembled in such a way that the function of the pressure relief device or devices (PRD's) will not be affected 								

ISO/DIS 12614 – Liquefied natural gas (LNG) fuel system components Part 10: Rigid fuel line in stainless steel

Name	Road Vehicles – LNG fuel system components: Part 10: Rigid fuel line in stainless steel		Code	ISO/DIS 12614-10 (Draft)		Date of Issue	04-16-13	
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG		Next Issue		
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/Pipes Valves Regulators Fittings Connectors Sensors Break Away Metering Tanks Compressor Refrigeration Vaporizers			
Description	<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for rigid fuel lines in stainless steel, LNG system components intend for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 		Fueling					
			Onboard Storage	●				
			Transfer	●				
			Gasification	●				
			Consumption	●				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Sets out applicable & specific Rigid fuel lines in stainless steel tests	Excess Pressure , Leakage, fatigue and damage			
<ul style="list-style-type: none"> – ISO 3833:1977, Road vehicles - types – ISO 1127, Stainless steel tubes – dimensions, tolerances and conventional masses per unit length – ISO 12614-1, Road vehicles general requirements – ISO 12614-2, Performance and general test methods 	Std. Std.	Maintenance equip & procedures						
	Std. Std.	Safe Practices	✓	Sets out construction & marking requirements				
	Std. Std.	Emergency equip & procedures						
	Std. Std.	Environmental issues						
	Key take-outs / best practice		<ul style="list-style-type: none"> The stainless steel rigid fuel line must be seamless cold worked austenitic stainless steel tubing complying with ISO 1127 					

ISO/DIS 12614 – Liquefied natural gas (LNG) fuel system components Part 11: Fittings

Name	Road Vehicles – LNG fuel system components: Part 11: Fittings		Code	ISO/DIS 12614-11 (Draft)				Date of Issue	04-16-13									
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG				Next Issue										
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for fittings, LNG system components intend for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 		Fueling															
Onboard Storage						●												
Transfer						●												
Gasification						●												
Consumption						●												
Sub System Element			Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Sets out applicable & specific fittings tests				Excess Pressure, Leakage, vibration, corrosion and pull-off										
<ul style="list-style-type: none"> ISO 3833:1977, Road vehicles – types ISO 12614-1, Road vehicles general requirements ISO 12614-2, Performance and general test methods 	Std.	Maintenance equip & procedures																
	Std.	Safe Practices	✓	Sets out construction & marking requirements														
	Std.	Emergency equip & procedures																
		Environmental issues																
	Key take-outs / best practice			<ul style="list-style-type: none"> The fittings must be compatible with a rigid fuel lines 														

ISO/DIS 12614 – LNG fuel system components

Part 12: Rigid fuel line in material other than stainless steel

Name	Road Vehicles – LNG fuel system components: Part 12: Rigid fuel line in material other than stainless steel		Code	ISO/DIS 12614-12 (Draft)								Date of Issue	04-16-13				
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG								Next Issue					
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description			Fueling														
<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for rigid fuel lines in material other than stainless steel, LNG system components intend for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 			Onboard Storage	●													
			Transfer	●													
			Gasification	●													
			Consumption	●													
			Sub System Element	Incl	Comment			Hazards Identified									
		Fuelling Facilities & Operations															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks		✓	Sets out applicable & specific Rigid fuel lines in material not in SS tests					Excess Pressure , Leakage, fatigue and damage					
<ul style="list-style-type: none"> – ISO 3833:1977, Road vehicles - types – EN 12735-1, Copper and Copper alloys: Seamless tubes from Copper for cold and air conditioning – ISO 12614-1, Road vehicles general requirements – ISO 12614-2, Performance and general test methods 			Std. Std.	Maintenance equip & procedures													
			Std. Std.	Safe Practices		✓	Sets out construction & marking requirements										
				Emergency equip & procedures													
				Environmental issues													
						Key take-outs / best practice											
							<ul style="list-style-type: none"> The copper rigid fuel lines must be seamless tube complying with EN 12735 										

ISO/DIS 12614 – Liquefied natural gas (LNG) fuel system components Part 13: Pressure Control Regulator

Name	Road Vehicles – LNG fuel system components: Part 13: Pressure Control Regulator			Code	ISO/DIS 12614-13 (Draft)							Date of Issue	04-16-13							
Authorising / issuing agency	International Organisation of Standardisation			Fuel Applicability	LNG							Next Issue								
Sector Applicability	All vehicles		Geographical coverage	Global		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for the Pressure Control Regulator, an LNG system component intended for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 			Fueling																
Onboard Storage						●														
Transfer						●														
Gasification						●														
Consumption						●														
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks		✓	Sets out applicable & specific pressure control regulator tests							Excess Pressure, Leakage, vibration, corrosion and fatigue								
<ul style="list-style-type: none"> – ISO 3833:1977, Road vehicles – types – ISO 12614-1, Road vehicles general requirements – ISO 12614-2, Performance and general test methods 	Std.	Maintenance equip & procedures																		
	Std.	Safe Practices		✓	Sets out construction & marking requirements															
	Std.	Emergency equip & procedures																		
	Environmental issues																			
	Key take-outs / best practice				<ul style="list-style-type: none"> The pressure control regulator must have a factory set maximum outlet pressure with the maximum outlet and inlet pressure marked on the regulator 															

ISO/DIS 12614 – LNG fuel system components

Part 14: Differential pressure fuel content gauge

Name	Road Vehicles – LNG fuel system components: Part 14: Differential pressure fuel content gauge		Code	ISO/DIS 12614-14 (Draft)		Date of Issue	04-16-13	
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG		Next Issue		
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes Valves Regulators Fittings Connectors Sensors Break Away Metering Tanks Compressor Refrigeration Vaporizers			
Description	<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for the differential pressure fuel content gauge, an LNG system component intend for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 		Fueling					
			Onboard Storage			●		
			Transfer					
			Gasification					
			Consumption					
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified			
		Fuelling Facilities & Operations						
		Fuel Systems & Tanks	✓	Sets out applicable & specific differential pressure gauge tests	Excess Pressure, Leakage, vibration, corrosion and fatigue			
<ul style="list-style-type: none"> – ISO 3833:1977, Road vehicles – types – ISO 12614-1, Road vehicles general requirements – ISO 12614-2, Performance and general test methods 	Std.	Maintenance equip & procedures						
	Std.	Safe Practices	✓	Sets out construction & marking requirements				
	Std.	Emergency equip & procedures						
		Environmental issues						
	Key take-outs / best practice							
<ul style="list-style-type: none"> The differential pressure fuel content gauge should be equipped with a shatter proof lens and possess a means of pressure relief located at the rear of its body 								

ISO/DIS 12614 – LNG fuel system components

Part 15: Capacitance fuel content gauge

Name	Road Vehicles – LNG fuel system components: Part 15: Capacitance fuel content gauge		Code	ISO/DIS 12614-15 (Draft)		Date of Issue	04-16-13									
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG		Next Issue										
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for the capacitance fuel content gauge, an LNG system component intend for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 		Fueling													
			Onboard Storage							●						
			Transfer													
			Gasification													
			Consumption													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Sub System Element	Incl	Comment	Hazards Identified									
<ul style="list-style-type: none"> ISO 3833:1977, Road vehicles – types ISO 12614-1, Road vehicles general requirements ISO 12614-2, Performance and general test methods 			Std. Std. Std.	Fuel Systems & Tanks	✓	Sets out applicable & specific capacitance fuel contents gauge tests	Corrosion, vibration, excess torque and high voltages									
				Maintenance equip & procedures												
				Safe Practices	✓	Sets out construction & marking requirements										
				Emergency equip & procedures												
				Environmental issues												
			Key take-outs / best practice													
					<ul style="list-style-type: none"> The Capacitance fuel contents gauge consists of – Capacitance transmitter (placed next to fuel tank), Fuel content indicator (placed on dashboard), Capacity transmission cables, Signal transmission cable 											

ISO/DIS 12614 – LNG fuel system components

Part 16: Heat Exchanger - vaporiser



Name	Road Vehicles – LNG fuel system components: Part 16: Heat Exchanger – vaporiser		Code	ISO/DIS 12614-16 (Draft)							Date of Issue	04-16-13					
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG							Next Issue						
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description			Fueling														
<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for the Heat Exchanger - vaporiser, an LNG system component intended for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 			Onboard Storage														
			Transfer														
			Gasification														
			Consumption														
			Sub System Element	Incl	Comment			Hazards Identified									
		Fuelling Facilities & Operations															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks			✓	Sets out applicable & specific heat exchanger - vaporiser tests			Corrosion, excess pressure, excess torque and freezing water jacket						
<ul style="list-style-type: none"> – ISO 3833:1977, Road vehicles – types – ISO 12614-1, Road vehicles general requirements – ISO 12614-2, Performance and general test methods 			Std.	Maintenance equip & procedures													
			Std.	Safe Practices			✓	Sets out construction & marking requirements									
				Emergency equip & procedures													
				Environmental issues													
			Key take-outs / best practice														
<ul style="list-style-type: none"> The heat exchanger must be compatible with a rigid fuel lines 																	

ISO/DIS 12614 – LNG fuel system components

Part 17: Natural Gas Detector



Name	Road Vehicles – LNG fuel system components: Part 17: Natural Gas Detector		Code	ISO/DIS 12614-17 (Draft)						Date of Issue	04-16-13								
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG						Next Issue									
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description			Fueling																
<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for the natural gas detector, an LNG system component intend for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 			Onboard Storage							●									
			Transfer																
			Gasification								●								
			Consumption								●								
			Sub System Element	Incl	Comment						Hazards Identified								
		Fuelling Facilities & Operations																	
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks			✓	Sets out applicable & specific natural gas detector tests						Corrosion, vibration, excess torque and high voltages					
<ul style="list-style-type: none"> – ISO 3833:1977, Road vehicles – types – ISO 12614-1, Road vehicles general requirements – ISO 12614-2, Performance and general test methods 			Std. Std. Std.	Maintenance equip & procedures															
				Safe Practices			✓	Sets out construction & marking requirements											
				Emergency equip & procedures															
				Environmental issues															
				Key take-outs / best practice															
<ul style="list-style-type: none"> The output of the natural gas detector should be shown in the dashboard The sensor should provide a signal at 10% of the Lower Explosion Limit (LEL) When the signal is 20% of LEL. The automatic valve should stop delivery after one minute without any influence of the driver In case of measuring 50% of LEL, the valve would close immediately 																			

ISO/DIS 12614 – LNG fuel system components

Part 18: Gas Temperature Sensor

Name	Road Vehicles – LNG fuel system components: Part 18: Gas Temperature Sensor		Code	ISO/DIS 12614-18 (Draft)		Date of Issue	04-16-13									
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG		Next Issue										
Sector Applicability	All vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> This part of ISO 12614 specifies tests and requirements for the gas temperature sensor, an LNG system component intend for use on all types of motor vehicle as defined in ISO 3833 This standard will also cover other modes of transport; for example locomotives or ships until a specific norm is worked out It provides general design principles and specific requirements for instructions and markings It does not cover stationary engines, fuel containers or fuel receptacles 		Fueling													
			Onboard Storage													
			Transfer													
			Gasification													
			Consumption													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Sub System Element	Incl	Comment	Hazards Identified									
<ul style="list-style-type: none"> ISO 3833:1977, Road vehicles – types ISO 12614-1, Road vehicles general requirements ISO 12614-2, Performance and general test methods 			Std.	Fuelling Facilities & Operations												
			Std.	Fuel Systems & Tanks	✓	Sets out applicable & specific gas temp sensor tests	Corrosion, vibration, excess torque, insulation and high voltages									
			Std.	Maintenance equip & procedures												
				Safe Practices	✓	Sets out construction & marking requirements										
				Emergency equip & procedures												
				Environmental issues												
Key take-outs / best practice																
<ul style="list-style-type: none"> The gas temperature sensor should be mounted on the outlet pipeline of the vaporizer on LNG before the automatic shut-off valve The temperature signal should be sent to the operator dashboard The temperature set point is the responsibility of the vehicle manufacturer bit should not be set lower than -40 degrees Celsius 																

ISO 12617 – Liquefied natural gas vehicles – connector for refuelling vehicles

Name	Liquefied natural gas vehicles – connector for refuelling vehicles		Code	ISO/DIS 12617 (Draft)										Date of Issue	03-31-13			
Authorising / issuing agency	International Organisation of Standardisation		Fuel Applicability	LNG										Next Issue				
Sector Applicability	Road vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description			Fueling					●	●									
<ul style="list-style-type: none"> This ISO was developed to examine, test and certify newly produced LNG gas refuelling nozzles and receptacles used in LNG refuelling systems and not the system itself 3 main parameters used in design and construction <ul style="list-style-type: none"> All nozzles / receptacle have a working pressure of 3.4MPa Design Life <ul style="list-style-type: none"> Nozzle A – High frequency 100,000 cycles over 3 years Nozzle B – Medium frequency, 20,000 cycles over 5 years Training 			Onboard Storage															
			Transfer															
			Gasification															
			Consumption															
			Sub System Element	Incl	Comment		Hazards Identified											
		Fuelling Facilities & Operations	✓	Focus on nozzle and receptacle for vehicles														
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks														
<ul style="list-style-type: none"> ISO 12614 – LNG fuel systems part 1 IEC 60534 industrial process control valves ISO 14469 Part 1, 20 MPa connector for non-igniting evaluation 			Std.	Maintenance equip & procedures														
			Std.	Safe Practices	✓	Sets out clarity of marking requirements												
			Std.	Emergency equip & procedures														
						Environmental issues												
						Key take-outs / best practice												
			<ul style="list-style-type: none"> Receptacle drawing / standard dimensions with Protective cap to prevent dirt and moisture ingress Positive locking – interlocking device for fuelling with Nozzle impact resistance Cycle definition and durability requirements 															

ISO 12991 – LNG – Tanks for On-Board Storage as a Fuel for Automotive Vehicles

Name	LNG – Tanks for On-Board Storage as a Fuel for Automotive Vehicles		Code	ISO 12991		Date of Issue	11-15-2012									
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	LNG		Next Issue										
Sector Applicability	All Automotive Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Specifies construction requirements for refillable fuel tanks for LNG used in vehicles Testing methods required to ensure reasonable level of protection from fire and explosion For fuel tanks permanently attached to land vehicles but can be used for other mode of transports too 		Fueling													
			Onboard Storage		●								●			
			Transfer													
			Gasification													
			Consumption													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Sub System Element	Incl	Comment	Hazards Identified									
				Fuelling Facilities & Operations												
				Fuel Systems & Tanks	✓	Detailed specifications for design of fuel tanks and accessories	Corrosion, temperature, overfilling									
<ul style="list-style-type: none"> ISO 1176, Road vehicles – Masses – vocabulary and codes ISO 1431, Rubber, vulcanized or thermoplastic – Resistance to ozone cracking ISO 2768, General tolerances ISO 6957, Copper alloys – Ammonia test ISO 9227, Corrosion tests in artificial atmospheres – Salt spray ISO 21013, Cryogenic vessels – Pressure relief accessories ISO 21014 – Cryogenic vessels – Cryogenic insulation perfor. ISO 21028 – Cryogenic vessels – Toughness requirements ISO 21029 – Cryogenic vessels – Transportable vacuum insulated vessels ISO 23208 – Cryogenic vessels - Cleanliness 			Std.	Maintenance equip & procedures												
			Std.	Safe Practices	✓	Discusses test types and routines	Bursting, corrosion, overfilling, leakage									
			Std.	Emergency equip & procedures												
			Std.	Environmental issues												
			Std.	Key take-outs / best practice												
			Std.	<ul style="list-style-type: none"> Design and testing of LNG fuel tanks and associated accessories (especially valves) Applicable tests specified with testing requirements 												

ISO 14469 – Road Vehicles CNG Refuelling Connector – Part 1 – 200 Bar Connector



Name	Road Vehicles CNG Refueling Connector – Part 1 – 200 Bar Connector		Code	ISO 14469-1		Date of Issue	11-01-2004									
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG		Next Issue										
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Specifies CNG refuelling nozzles and receptacles constructed entirely of new and unused parts and materials for CNG powered road vehicles Examination, testing and certification of new CNG vehicle fuelling nozzles and receptacles Refuelling connector consists of the receptacle, its protective cap (mounted on the vehicle) and the nozzle Only applicable to devices with a service pressure of 200 bar with standardized mating components Connector must prevent fuelling with higher service pressures, but may allow fuelling with service pressures <= 200 bar 		Fueling		●		●	●								
			Onboard Storage													
			Transfer													
			Gasification													
			Consumption													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified											
		Fuelling Facilities & Operations	✓	Detailed engineering specs for refuelling nozzles and receptacles												
		Fuel Systems & Tanks														
	Std.	Maintenance equip't & procedures														
	Std.	Safe Practices	✓	Detailed inspection and testing requirements	Leakage, strength, impact, corrosion, abuse											
	Std.	Emergency equip't & procedures														
	Std.	Environmental issues														
Key take-outs / best practice		<ul style="list-style-type: none"> Detailed specifications including engineering drawings and parameters for standardized refueling nozzles and receptacles for CNG vehicles Discusses testing requirements for both nozzle and receptacle for multiple operating conditions and hazards 														

ISO 14469 – Road Vehicles CNG Refuelling Connector – Part 2 – 200 Bar Connector, Size 2



Name	Road Vehicles CNG Refueling Connector – Part 2 – 200 Bar Connector, Size 2		Code	ISO 14469-2		Date of Issue	12-15-2007										
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG		Next Issue											
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description	<ul style="list-style-type: none"> Specifies CNG refuelling nozzles and receptacles constructed entirely of new and unused parts and materials for CNG powered road vehicles Examination, testing and certification of new CNG vehicle fuelling nozzles and receptacles of size 2 Refuelling connector consists of the receptacle, its protective cap (mounted on the vehicle) and the nozzle Only applicable to devices with a service pressure of 200 bar with standardized mating components of size 2 Connector must prevent fuelling with higher service pressures, but may allow fuelling with service pressures <= 200 bar 		Fueling		●		●	●									
			Onboard Storage														
			Transfer														
			Gasification														
			Consumption														
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified												
		Fuelling Facilities & Operations	✓	Detailed engineering specs for refuelling nozzles and receptacles													
		Fuel Systems & Tanks															
	Std.	Maintenance equip & procedures															
	Std.	Safe Practices	✓	Detailed inspection and testing requirements	Leakage, strength, impact, corrosion, abuse												
	Std.	Emergency equip & procedures															
	Std.	Environmental issues															
		Key take-outs / best practice															
				<ul style="list-style-type: none"> Detailed specifications including engineering drawings and parameters for standardized refueling nozzles and receptacles of size 2 for CNG vehicles Discusses testing requirements for both nozzle and receptacle for multiple operating conditions and hazards 													

ISO 14469 – Road Vehicles CNG Refuelling Connector – Part 3 – 250 Bar Connector



Name	Road Vehicles CNG Refueling Connector – Part 3 – 250 Bar Connector		Code	ISO 14469-3		Date of Issue	07-15-2006										
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG		Next Issue											
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description	<ul style="list-style-type: none"> Specifies CNG refuelling nozzles and receptacles constructed entirely of new and unused parts and materials for CNG powered road vehicles Examination, testing and certification of new CNG vehicle fuelling nozzles and receptacles Refuelling connector consists of the receptacle, its protective cap (mounted on the vehicle) and the nozzle Only applicable to devices with a service pressure of 250 bar with standardized mating components Connector must prevent fuelling with higher service pressures, but may allow fuelling with service pressures <= 250 bar 		Fueling		●		●	●									
			Onboard Storage														
			Transfer														
			Gasification														
			Consumption														
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified												
		Fuelling Facilities & Operations	✓	Detailed engineering specs for refuelling nozzles and receptacles													
		Fuel Systems & Tanks															
	Std.	Maintenance equip't & procedures															
	Std.	Safe Practices	✓	Detailed inspection and testing requirements	Leakage, strength, impact, corrosion, abuse												
	Std.	Emergency equip't & procedures															
	Std.	Environmental issues															
		Key take-outs / best practice															
				<ul style="list-style-type: none"> Detailed specifications including engineering drawings and parameters for standardized refueling nozzles and receptacles for CNG vehicles Discusses testing requirements for both nozzle and receptacle for multiple operating conditions and hazards 													

ISO 15403 – Natural gas for use as a Compressed Fuel for Vehicles – Part 1 – Designation of the Quality

Name	Natural gas for use as a Compressed Fuel for Vehicles – Part 1 – Designation of the Quality		Code	ISO 15403-1										Date of Issue	10-15-2006		
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG										Next Issue			
Sector Applicability	All Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description	<ul style="list-style-type: none"> For NGVs that utilize CNG stored “on-board” Pressure of gas stored in containers must be ≤ 25 MPa This part stipulates international requirements placed on natural gas used as a motor fuel <ul style="list-style-type: none"> Provide safe operation of vehicle and associated equipment Protect system from corrosion, poisoning and deposition Provide satisfactory vehicle performance under any and all conditions of climate and driving demands 		Fueling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Onboard Storage			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transfer			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gasification			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Consumption			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sub System Element			Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations																	
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks															
– ISO 6976, Natural gas – calculations of calorific values, density, relative density and Wobbe index from composition	Std.	Maintenance equip & procedures															
		Safe Practices	<input checked="" type="checkbox"/>	Discusses detailed fuel quality requirements	Corrosion, cracks, poisoning, deposition, clogging, freezing												
		Emergency equip & procedures															
		Environmental issues															
	Key take-outs / best practice			<ul style="list-style-type: none"> Detailed guide about natural gas fuel quality including important hazards and tests Important for overall fuel system design 													

ISO 15403 – Natural gas for use as a Compressed Fuel for Vehicles – Part 2 – Specification of the Quality

Name	Natural gas for use as a Compressed Fuel for Vehicles – Part 2 – Specification of the Quality		Code	ISO 15403-2		Date of Issue	08-15-2006									
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG		Next Issue										
Sector Applicability	All Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Extends previous part and focuses more on quantitative specifications Critical items to gas composition - <ul style="list-style-type: none"> Water content Sulphur compounds, particulate matter Higher hydrocarbons, CO₂ Free Oxygen, Glycol/ Methanol Oil Content, Corrosive Compounds Not applicable to gas entering refuelling stations, only concerned with gas entering the vehicle 		Fueling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
			Onboard Storage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
			Transfer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
			Gasification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
			Consumption	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
			Sub System Element	Incl	Comment	Hazards Identified										
			Fuelling Facilities & Operations													
			Fuel Systems & Tanks													
			Maintenance equip & procedures													
			Safe Practices		✓	Discusses quantitative fuel quality requirements	Corrosion, cracks, poisoning, deposition, clogging, freezing									
			Emergency equip & procedures													
			Environmental issues													
			Key take-outs / best practice													
			<ul style="list-style-type: none"> Extension of part 1 and focuses on quantitative specifications Important for overall fuel system design 													

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 1 – General Requirements, Definitions

Name	Road Vehicles – CNG Fuel System Components – Part 1 – General Requirements and Definitions			Code	ISO 15500-1							Date of Issue	03-01-2000							
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	CNG							Next Issue								
Sector Applicability	All Road Vehicles		Geographical coverage	Global		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> General requirements and definitions of CNG fuel system components Also discusses general design principles and requirements for instructions and markings Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 			Fueling																
Onboard Storage																				
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)				Type	Fuel Systems & Tanks			✓	General requirements for all CNG fuel components			Leakage, corrosion								
<ul style="list-style-type: none"> ISO 3833, Road vehicles – Types ISO 6722, Road vehicles – Unscreened low-tension cables ISO 15403, Natural gas – Designation of quality ISO 15501, Road vehicles – CNG Fuelling systems DIN 477, Gas cylinder valves up to 300 bar ANSI/ ASME B1.1, Unified inch screw threads 				Std.	Maintenance equip & procedures															
				Std.	Safe Practices			✓	Requirements for instructions and marking											
				Std.	Emergency equip & procedures															
				Std.	Environmental issues															
				Key take-outs / best practice					<ul style="list-style-type: none"> General requirements and design principles for all components on board the vehicle 											

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 2 – Performance and Test Methods



Name	Road Vehicles – CNG Fuel System Components – Part 2 – Performance and Test Methods			Code	ISO 15500-2										Date of Issue	04-15-2012																																
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	CNG										Next Issue																																	
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers																																
Description	<ul style="list-style-type: none"> Performance and general test methods for CNG fuel system components on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 			Fueling																																												
Onboard Storage				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																													
Transfer				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																													
Gasification				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																													
Consumption				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																													
Sub System Element				Incl	Comment	Hazards Identified	<p style="text-align: center;">General Test Procedures for all fuel components on board vehicle</p>																																									
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	<table border="1"> <tr> <td>Fuelling Facilities & Operations</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Fuel Systems & Tanks</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Maintenance equip & procedures</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Safe Practices</td> <td></td> <td>✓</td> <td>Test procedures specified</td> </tr> <tr> <td>Emergency equip & procedures</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Environmental issues</td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="4">Key take-outs / best practice</td> </tr> <tr> <td colspan="4"> <ul style="list-style-type: none"> Specifies general test procedure and performance </td> </tr> </table>															Fuelling Facilities & Operations				Fuel Systems & Tanks				Maintenance equip & procedures				Safe Practices		✓	Test procedures specified	Emergency equip & procedures				Environmental issues				Key take-outs / best practice				<ul style="list-style-type: none"> Specifies general test procedure and performance 			
Fuelling Facilities & Operations																																																
Fuel Systems & Tanks																																																
Maintenance equip & procedures																																																
Safe Practices		✓	Test procedures specified																																													
Emergency equip & procedures																																																
Environmental issues																																																
Key take-outs / best practice																																																
<ul style="list-style-type: none"> Specifies general test procedure and performance 																																																
<ul style="list-style-type: none"> ISO 188, Rubber, vulcanized or thermoplastic – Accelerated ageing and heat resistance tests ISO 1817, Rubber, vulcanized or thermoplastic – Determination of the effect of liquids ISO 9227, Corrosion tests in artificial atmospheres – Salt spray 	Std.	Maintenance equip & procedures																																														
	Std.	Safe Practices	✓	Test procedures specified	Strength, leakage, breakage, corrosion,																																											
	Std.	Emergency equip & procedures																																														
		Environmental issues																																														

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 3 – Check Valve

Name	Road Vehicles – CNG Fuel System Components – Part 3 – Check Valve		Code	ISO 15500-3										Date of Issue	04-15-2012		
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG										Next Issue			
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description	<ul style="list-style-type: none"> Specifies tests and requirements for the check valve for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 		Fueling														
Onboard Storage				●													
Transfer				●													
Gasification				●													
Consumption				●													
Sub System Element			Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations																	
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks															
– ISO 3833, Road vehicles – Types	Std. Std.	Maintenance equip & procedures															
– ISO 15403, Natural gas – For use as a compressed fuel for vehicles		Safe Practices	✓	Requirements for marking and tests	Strength and leakage												
		Emergency equip & procedures															
		Environmental issues															
Key take-outs / best practice																	
<ul style="list-style-type: none"> Specific tests for check valves defined – hydrostatic test, leakage test and continued operation tests 																	

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 4 – Manual Valve



Name	Road Vehicles – CNG Fuel System Components – Part 4 – Manual Valve		Code	ISO 15500-4							Date of Issue	04-15-2012						
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG							Next Issue							
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Specifies tests and requirements for the manual valve for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 		Fueling															
Onboard Storage				●														
Transfer				●														
Gasification				●														
Consumption				●														
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Sub System Element	Incl	Comment	Hazards Identified											
<ul style="list-style-type: none"> ISO 3833, Road vehicles – Types ISO 15403, Natural gas – For use as a compressed fuel for vehicles 			Std. Std.	Fuel Systems & Tanks	✓	Construction and assembly requirements												
				Maintenance equip & procedures														
				Safe Practices	✓	Requirements for marking and tests	Strength and leakage											
				Emergency equip & procedures														
				Environmental issues														
			Key take-outs / best practice															
			<ul style="list-style-type: none"> Specific tests for manual valves defined – hydrostatic test, leakage test and continued operation tests 															

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 5 – Manual Cylinder Valve

Name	Road Vehicles – CNG Fuel System Components – Part 5 – Manual Cylinder Valve		Code	ISO 15500-5										Date of Issue	04-15-2012			
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG										Next Issue				
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Specifies tests and requirements for the manual cylinder valve for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 		Fueling															
Onboard Storage				●														
Transfer				●														
Gasification				●														
Consumption				●														
Sub System Element			Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																
– ISO 3833, Road vehicles – Types	Std. Std.	Maintenance equip & procedures																
– ISO 15403, Natural gas – For use as a compressed fuel for vehicles		Safe Practices	✓	Requirements for marking and tests		Strength and leakage												
		Emergency equip & procedures																
		Environmental issues																
Key take-outs / best practice			<ul style="list-style-type: none"> Specific tests for manual cylinder valves defined – hydrostatic test, leakage test and continued operation tests 															

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 6 – Automatic Valve



Name	Road Vehicles – CNG Fuel System Components – Part 6 – Automatic Valve		Code	ISO 15500-6							Date of Issue	04-15-2012					
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG							Next Issue						
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description			Fueling														
<ul style="list-style-type: none"> Specifies tests and requirements for the automatic valve for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 			Onboard Storage		●												
			Transfer		●												
			Gasification		●												
			Consumption		●												
			Sub System Element	Incl	Comment		Hazards Identified										
		Fuelling Facilities & Operations															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Construction and assembly requirements													
<ul style="list-style-type: none"> ISO 3833, Road vehicles – Types ISO 15403, Natural gas – For use as a compressed fuel for vehicles IEC 60079-10-1, Explosive atmospheres – Part 10-1: Classification of areas 	Std.	Maintenance equip & procedures															
	Std.	Safe Practices	✓	Requirements for marking and tests		Strength, leakage, electrical											
	Std.	Emergency equip & procedures															
	Std.	Environmental issues															
			Key take-outs / best practice														
		<ul style="list-style-type: none"> Specific tests for automatic valves defined – hydrostatic, leakage, continued operation, insulation resistance, minimum opening voltage and pressure impulse tests 															

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 7 – Gas Injector



Name	Road Vehicles – CNG Fuel System Components – Part 7 – Gas Injector		Code	ISO 15500-7						Date of Issue	09-01-2002							
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG						Next Issue								
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Specifies tests and requirements for the gas injector for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 		Fueling															
Onboard Storage																		
Transfer																		
Gasification																		
Consumption								☉										
Sub System Element			Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Construction and assembly requirements														
<ul style="list-style-type: none"> ISO 3833, Road vehicles – Types ISO 15403, Natural gas – For use as a compressed fuel for vehicles 	Std. Std.	Maintenance equip & procedures																
		Safe Practices	✓	Requirements for marking and tests				Strength, electrical										
		Emergency equip & procedures																
		Environmental issues																
		Key take-outs / best practice																
<ul style="list-style-type: none"> Specific tests for gas injector defined – pneumatic strength, continued operation, insulation resistance and minimum opening voltage tests 																		

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 8 – Pressure Indicator

Name	Road Vehicles – CNG Fuel System Components – Part 8 – Pressure Indicator		Code	ISO 15500-8										Date of Issue	01-15-2001			
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG										Next Issue				
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Specifies tests and requirements for the pressure indicator for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 		Fueling															
Onboard Storage											●							
Transfer																		
Gasification												●						
Consumption												●						
Sub System Element			Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Construction and assembly requirements														
<ul style="list-style-type: none"> ISO 3833, Road vehicles – Types ISO 15403, Natural gas – For use as a compressed fuel for vehicles 	Std. Std.	Maintenance equip & procedures																
		Safe Practices	✓	Requirements for marking and tests				Strength, leakage, electrical										
		Emergency equip & procedures																
		Environmental issues																
		Key take-outs / best practice	<ul style="list-style-type: none"> Specific tests for pressure indicators defined – hydrostatic strength, leakage, continued operation, insulation resistance and minimum opening voltage tests 															

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 9 – Pressure Regulator



Name	Road Vehicles – CNG Fuel System Components – Part 9 – Pressure Regulator		Code	ISO 15500-9										Date of Issue	04-15-2012				
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG										Next Issue					
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description			Fueling																
<ul style="list-style-type: none"> Specifies tests and requirements for the pressure regulator for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 			Onboard Storage			●													
			Transfer			●													
			Gasification			●													
			Consumption			●													
			Sub System Element	Incl	Comment		Hazards Identified												
		Fuelling Facilities & Operations																	
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks			✓	Construction and assembly requirements													
<ul style="list-style-type: none"> ISO 3833, Road vehicles – Types ISO 15403, Natural gas – For use as a compressed fuel for vehicles 	Std. Std.	Maintenance equip & procedures																	
		Safe Practices			✓	Requirements for marking and tests		Strength, leakage, electrical											
		Emergency equip & procedures																	
		Environmental issues																	
		Key take-outs / best practice		<ul style="list-style-type: none"> Specific tests for pressure regulator defined – hydrostatic strength, leakage, continued operation, insulation resistance, minimum opening voltage, pressure impulse and water jacket freezing tests 															

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 10 – Gas Flow Adjustor



Name	Road Vehicles – CNG Fuel System Components – Part 10 – Gas Flow Adjustor		Code	ISO 15500-10		Date of Issue	01-15-2001											
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG		Next Issue												
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Specifies tests and requirements for the gas flow adjustor for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 		Fueling															
			Onboard Storage			●												
			Transfer			●												
			Gasification			●												
			Consumption			●												
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified													
		Fuelling Facilities & Operations																
		Fuel Systems & Tanks																
	Std.	Maintenance equip & procedures																
	Std.	Safe Practices	✓	Requirements for marking and tests	Strength, leakage, electrical													
		Emergency equip & procedures																
		Environmental issues																
		Key take-outs / best practice																
					<ul style="list-style-type: none"> Specific tests for gas flow adjustors defined – hydrostatic strength, leakage, continued operation, insulation resistance and minimum opening voltage tests 													

Std.

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 11 – Gas/ Air Mixer



Name	Road Vehicles – CNG Fuel System Components – Part 11 – Gas/ Air Mixer		Code	ISO 15500-11										Date of Issue	01-15-2001		
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG										Next Issue			
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description	<ul style="list-style-type: none"> Specifies tests and requirements for the gas/ air mixer for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 		Fueling														
Onboard Storage																	
Transfer																	
Gasification																	
Consumption								☉									
Sub System Element			Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations																	
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks															
– ISO 3833, Road vehicles – Types	Std. Std.	Maintenance equip & procedures															
– ISO 15403, Natural gas – For use as a compressed fuel for vehicles		Safe Practices	✓	Requirements for marking and tests	Strength, leakage, corrosion												
		Emergency equip & procedures															
		Environmental issues															
Key take-outs / best practice																	
			<ul style="list-style-type: none"> Specific tests for gas/ air mixers defined – hydrostatic strength, leakage, continued operation and corrosion tests 														

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 12 – Pressure Relief Valve

Name	Road Vehicles – CNG Fuel System Components – Part 12 – Pressure Relief Valve		Code	ISO 15500-12										Date of Issue	01-15-2001			
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG										Next Issue				
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Specifies tests and requirements for the pressure relief valve for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 		Fueling															
Onboard Storage				●														
Transfer				●														
Gasification				●														
Consumption				●														
Sub System Element			Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																
– ISO 3833, Road vehicles – Types	Std. Std.	Maintenance equip & procedures																
– ISO 15403, Natural gas – For use as a compressed fuel for vehicles		Safe Practices	✓	Requirements for marking and tests	Strength, leakage													
		Emergency equip & procedures																
		Environmental issues																
Key take-outs / best practice			<ul style="list-style-type: none"> Specific tests for pressure relief valves defined – hydrostatic strength, leakage, continued operation and operational tests 															

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 13 – Pressure Relief Device

Name	Road Vehicles – CNG Fuel System Components – Part 13 – Pressure Relief Device			Code	ISO 15500-13							Date of Issue	04-15-2012						
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	CNG							Next Issue							
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Specifies tests and requirements for the pressure relief device (PRD) for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 			Fueling															
Onboard Storage												●							
Transfer																			
Gasification													●						
Consumption													●						
Sub System Element				Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																			
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																	
– ISO 3833, Road vehicles – Types	Std.	Maintenance equip & procedures																	
– ISO 11439, Gas cylinders – High pressure cylinders for on-board storage of natural gas as a fuel for automotive vehicles	Std.	Safe Practices	✓	Requirements for marking and tests	Strength, leakage, corrosion														
– ISO 15403, Natural gas – For use as a compressed fuel for vehicles	Std.	Emergency equip & procedures																	
		Environmental issues																	
Key take-outs / best practice																			
<ul style="list-style-type: none"> Specific tests for pressure relief devices defined – hydrostatic strength, leakage, bending moment, continued operation, accelerated life, benchtop activation, thermal cycling, condensate corrosion resistance and flow capacity tests 																			

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 14 – Excess Flow Valve

Name	Road Vehicles – CNG Fuel System Components – Part 14 – Excess Flow Valve		Code	ISO 15500-14		Date of Issue	04-15-2012									
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG		Next Issue										
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Specifies tests and requirements for the excess flow valve for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 		Fueling													
			Onboard Storage		●											
			Transfer													
			Gasification													
			Consumption													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Sub System Element	Incl	Comment	Hazards Identified									
				Fuelling Facilities & Operations												
				Fuel Systems & Tanks												
			Std.	Maintenance equip & procedures												
			Std.	Safe Practices		✓	Requirements for marking and tests	Strength, leakage								
				Emergency equip & procedures												
				Environmental issues												
			Key take-outs / best practice													
			<ul style="list-style-type: none"> Specific tests for excess flow valve defined – hydrostatic strength, leakage, excess torque resistance, bending moment, continued operation, operation and pressure impulse tests 													

ISO 15500 – Road Vehicles – CNG Fuel System Comp. – Part 15 – Gas-Tight Housing and Ventilation Hose

Name	Road Vehicles – CNG Fuel System Components – Part 15 – Gas-Tight Housing and Ventilation Hose		Code	ISO 15500-15											Date of Issue	01-15-2001		
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG											Next Issue			
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description			Fueling															
<ul style="list-style-type: none"> Specifies tests and requirements for the gas-tight housing and ventilation hose for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 			Onboard Storage	●					●									
			Transfer	●					●									
			Gasification	●														
			Consumption	●						●								
			Sub System Element	Incl	Comment								Hazards Identified					
				Fuelling Facilities & Operations														
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks														
<ul style="list-style-type: none"> ISO 3833, Road vehicles – Types ISO 15403, Natural gas – For use as a compressed fuel for vehicles 			Std. Std.	Maintenance equip & procedures														
				Safe Practices			✓	Requirements for marking and tests								Leakage, pull-off		
				Emergency equip & procedures														
				Environmental issues														
				Key take-outs / best practice														
		<ul style="list-style-type: none"> Specific tests for gas-tight housing and ventilation hose defined – leakage and pull-off tests 																

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 16 – Rigid Fuel Line in Stainless Steel

Name	Road Vehicles – CNG Fuel System Components – Part 16 – Rigid Fuel Line in Stainless Steel			Code	ISO 15500-16										Date of Issue	04-15-2012				
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	CNG										Next Issue					
Sector Applicability	All Road Vehicles		Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Specifies tests and requirements for the rigid fuel line in stainless steel for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 			Fueling																
Onboard Storage				●																
Transfer				●																
Gasification				●																
Consumption				●																
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																		
<ul style="list-style-type: none"> ISO 1127, Stainless steel tubes – Dimensions, tolerances and conventional masses per unit length ISO 3833, Road vehicles – Types ISO 15403, Natural gas – For use as a compressed fuel for vehicles 	Std.	Maintenance equip & procedures																		
	Std.	Safe Practices																		
	Std.		✓	Requirements for marking and tests										Strength						
		Emergency equip & procedures																		
		Environmental issues																		
Key take-outs / best practice																				
<ul style="list-style-type: none"> Specific tests for rigid fuel line in stainless steel defined – hydrostatic strength, continued operation and bending tests 																				

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 17 – Flexible Fuel Line

Name	Road Vehicles – CNG Fuel System Components – Part 17 – Flexible Fuel Line		Code	ISO 15500-17										Date of Issue	04-15-2012			
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG										Next Issue				
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Specifies tests and requirements for the flexible fuel line for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 		Fueling															
Onboard Storage			●															
Transfer			●															
Gasification			●															
Consumption			●															
Sub System Element			Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																
– ISO 1746, Rubber or plastic hose or tubing – bending tests	Std.	Maintenance equip & procedures																
– ISO 3833, Road vehicles – Types	Std.	Safe Practices	✓	Requirements for marking and tests	Strength, pull-off, electrical													
– ISO 15403, Natural gas – For use as a compressed fuel for vehicles	Std.	Emergency equip & procedures																
– SAE J517, Hydraulic hose	Std.	Environmental issues																
– JIS B 8362, Textile reinforced thermoplastic hose assemblies for hydraulic use	Std.	Key take-outs / best practice																
		<ul style="list-style-type: none"> Specific tests for flexible fuel line defined – hydrostatic strength, continued operation, bending, pull-off, electrical conductivity and permeability tests 																

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 18 – Filter



Name	Road Vehicles – CNG Fuel System Components – Part 18 – Filter		Code	ISO 15500-18										Date of Issue	04-15-2012			
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG										Next Issue				
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Specifies tests and requirements for the filter for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 		Fueling															
Onboard Storage									○									
Transfer										○								
Gasification										○								
Consumption										○								
Sub System Element			Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																
<ul style="list-style-type: none"> ISO 3833, Road vehicles – Types ISO 15403, Natural gas – For use as a compressed fuel for vehicles 	Std. Std.	Maintenance equip & procedures																
		Safe Practices	✓	Requirements for marking and tests	Strength, vibration													
		Emergency equip & procedures																
		Environmental issues																
		Key take-outs / best practice																
<ul style="list-style-type: none"> Specific tests for filter defined – hydrostatic strength, continued operation and vibration resistance tests 																		

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 19 – Fittings

Name	Road Vehicles – CNG Fuel System Components – Part 19 – Fittings		Code	ISO 15500-19										Date of Issue	04-15-2012		
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG										Next Issue			
Sector Applicability	All Road Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description			Fueling														
<ul style="list-style-type: none"> Specifies tests and requirements for the fittings for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 			Onboard Storage				●										
			Transfer				●										
			Gasification				●										
			Consumption				●										
			Sub System Element	Incl	Comment			Hazards Identified									
		Fuelling Facilities & Operations															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks															
<ul style="list-style-type: none"> ISO 3833, Road vehicles – Types ISO 15403, Natural gas – For use as a compressed fuel for vehicles 	Std. Std.	Maintenance equip & procedures															
		Safe Practices			✓	Requirements for marking and tests			Strength, vibration, pull-off								
		Emergency equip & procedures															
		Environmental issues															
		Key take-outs / best practice															
					<ul style="list-style-type: none"> Specific tests for fittings defined – hydrostatic strength, continued operation, vibration resistance and pull-off tests 												

ISO 15500 – Road Vehicles – CNG Fuel System Components – Part 20 – Rigid Fuel Line (Non SS)

Name	Road Vehicles – CNG Fuel System Components – Part 20 – Rigid Fuel Line in material other than SS			Code	ISO 15500-20										Date of Issue	03-15-2007				
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	CNG										Next Issue					
Sector Applicability	All Road Vehicles		Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Specifies tests and requirements for the rigid fuel lines in carbon steel for use on motor vehicles Not applicable to the following – <ul style="list-style-type: none"> LNG fuel system components and stationary engines Fuel containers and container mounting hardware Electronic fuel management and refuelling receptacles For service pressure of 200 bar at 15 °C. 			Fueling																
Onboard Storage				●																
Transfer				●																
Gasification				●																
Consumption				●																
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																		
<ul style="list-style-type: none"> ISO 3833, Road vehicles – Types ISO 15403, Natural gas – For use as a compressed fuel for vehicles EN 10305-1, Steel tubes for precision applications – Technical delivery conditions 	Std.	Maintenance equip & procedures																		
	Std.	Safe Practices		✓	Requirements for marking and tests										Strength					
	Std.	Emergency equip & procedures																		
	Environmental issues																			
	Key take-outs / best practice																			
<ul style="list-style-type: none"> Specific tests for rigid fuel lines in carbon steel defined – hydrostatic strength, continued operation and bending tests 																				

ISO 15501 – Road Vehicles – CNG Fuel Systems – Part 1 – Safety Requirements

Name	Road Vehicles – CNG Fuel Systems – Part 1 – Safety Requirements		Code	ISO 15501-1		Date of Issue	04-01-2012									
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	CNG		Next Issue										
Sector Applicability	All Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Specifies minimum safety requirements applicable to CNG on-board fuel systems on motor vehicles For service pressure of 200 bar at 15 °C. 		Fueling													
			Onboard Storage	●	●	●	●	●	●	●			●		●	
			Transfer	●	●	●	●	●	●		●					
			Gasification	●	●	●	●			●						●
			Consumption	●	●	●	●	●	●			●				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Sub System Element	Incl	Comment	Hazards Identified									
				Fuelling Facilities & Operations												
				Fuel Systems & Tanks	✓	Design requirements for all components and tanks	Ignition, fire, corrosion, asphyxiation									
			Std.	Maintenance equip & procedures												
			Std.	Safe Practices	✓	Requirements for marking and safety										
			Std.	Emergency equip & procedures												
			Std.	Environmental issues												
			Std.	Key take-outs / best practice												
			Std.	<ul style="list-style-type: none"> Design requirements related to safe operating and functioning Annex A: Technical solutions to functional requirements Annex B: Examples of CNG on-board fuel systems 												

ISO 15501 – Road Vehicles – CNG Fuel Systems – Part 2 – Test Methods



Name	Road Vehicles – CNG Fuel Systems – Part 2 – Test Methods			Code	ISO 15501-2							Date of Issue	10-01-2002							
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	CNG							Next Issue								
Sector Applicability	All Vehicles		Geographical coverage	Global		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Specifies test methods for checking the minimum safety requirements Applicable to functionality of the fuel systems designed to operate on CNG of motor vehicles 			Fueling																
Onboard Storage																				
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)				Type	Fuel Systems & Tanks			✓	Annex A for mounting of steel cylinders				Strength, corrosion							
<ul style="list-style-type: none"> – ISO 898-1, Mechanical properties of fasteners made of carbon steel and alloy steel – Bolts, screws and studs – ISO 3833, Road vehicles – Types – ISO 6487, Road vehicles – Measurement in impact tests – ISO 11439, Gas cylinders – High pressure cylinders for on-board storage of natural gas as a fuel for automotive – ISO 15500, Road vehicles – CNG fuel system components 				Std.	Maintenance equip & procedures															
				Std.	Safe Practices			✓	Tests methods for entire fuel system				Strength, leakage							
				Std.	Emergency equip & procedures															
				Std.	Environmental issues															
				Std.	Key take-outs / best practice <ul style="list-style-type: none"> Test requirements for entire fuel system as a whole Special Annex for mounting of steel cylinders – single and multiple 															

ISO 18132 – General Requirements for Automatic Tank Gauges – Part 1 – For LNG on Marine Carriers

Name	General Requirements for Automatic Tank Gauges – Part 1 – For LNG on Marine Carriers			Code	ISO 18132-1							Date of Issue	08-01-2011							
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	LNG							Next Issue								
Sector Applicability	Marine only		Geographical coverage	Global		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Establishes general principles for the accuracy, installation, calibration and verification of automatic tank gauges used for custody transfer measurement of LNG on board an LNG carrier or floating storage The LNG should be refrigerated and at or near atmospheric pressure Also specifies technical requirements for data collection, transmission and reception LNG automatic tank measurement by a custody transfer measurement system involves determination of liquid level, average temperature of liquid and vapour and vapour pressure 			Fueling								●		●						
Onboard Storage																				
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations	✓	Installation and use of ATGs with measurement																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																		
– ISO 6578, Refrigerated hydrocarbon liquids – Static measurement	Std.	Maintenance equip & procedures	✓	Calibration and verification during use																
– ISO 13398, Refrigerated light hydrocarbon fluids – Custody transfer on ship	Std.	Safe Practices	✓	General safety and test methods																
– ISO/IEC Guide 98-3, Expression of uncertainty in measurement	Std.	Emergency equip & procedures																		
– IEC 60079-0, Explosive atmospheres – Equipments	Std.	Environmental issues																		
– IACS Unified Requirements E10	Std.	Key take-outs / best practice																		
– API, Manual of petroleum measurement standards	Std.	<ul style="list-style-type: none"> Important guide about the construction, installation and use of ATGs for floating carriers Discusses in detail about data measurements and calibration and verification of gauges during normal use 																		
– API RP 500, Locations for electrical installations at petroleum facilities	Std.																			
– API RP 2003, Protection against ignitions from currents	Std.																			
– Energy institute, Hydrocarbon measurement 61	Std.																			
– ICS/ OCIMF/ IAPH, International safety guide for oil tankers and terminals	Std.																			
– IGC, International code for the construction of ships carrying liquefied gases	Code																			
– International group of LNG importers, LNG custody transfer handbook	Std.																			
– SIGTTO, Liquefied gas fire hazard management	Std.																			
– SIGTTO, Liquefied gas handling practices on ships and in terminals	Std.																			
– US Coast Guard – 33 CFR Part 153, 46 CFR Part 39.20, Marine safety center	Reg.																			
– NVIC 2-89 – Basis guidelines for electrical installations on merchant vessels																				

Source: Ricardo assessment

ISO 18132 – General Requirements for Automatic Level Gauges – Part 2 – Gauges in Refrigerated Shore Tanks

Name	General Requirements for Automatic Level Gauges – Part 2 – Gauges in Refrigerated Shore Tanks			Code	ISO 18132-2							Date of Issue	03-15-2008							
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	LNG & LPG							Next Issue								
Sector Applicability	All uses		Geographical coverage	Global		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> General requirements for the specification, installation and calibration/ verification testing of automatic level gauges used for refrigerated light hydrocarbon fluids (LNG/ LPG) stored in bulk storage tanks on shore at pressures close to atmosphere Not applicable to pressurized shore tanks If the static measurement method is used to determine quantity, the liquid level in the tank significantly influences determination Annex A discusses various error factors that influence quantification 			Fueling								●		●						
Onboard Storage																				
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations	✓	Installation and use of ATGs with measurement																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																		
– ISO 8310, Refrigerated light hydrocarbon fluids – Resistance thermometers and thermocouples	Std.	Maintenance equip & procedures	✓	Calibration and verification during use																
– OIML R 85, Automatic level gauges for measuring level of liquid in fixed storage tanks	Std.	Safe Practices	✓	General safety and test methods																
– OIML D 11, General requirements for electronic measuring	Std.	Emergency equip & procedures																		
– ISO 4266-3, Petroleum and liquid petroleum products – Measurement of level in pressurized storage tanks	Std.	Environmental issues																		
– IEC 60079-10, Electrical apparatus for explosive gas atmospheres – Classification of hazardous areas	Std.	Key take-outs / best practice																		
<ul style="list-style-type: none"> Important guide about the installation and use of ATGs for on shore storage tanks Discusses in detail about verification and calibration of gauges during normal use 																				

ISO 18132 – General Requirements for Automatic Tank Gauges – Part 3 – Gauges for LPG on Board Marine Carrier

Name	General Requirements for Automatic Tank Gauges – Part 3 – Gauges for LPG on Board Marine Carrier			Code	ISO 18132-3							Date of Issue	08-01-2011							
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	LPG							Next Issue								
Sector Applicability	Marine only		Geographical coverage	Global		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Establishes general principles for the accuracy, installation, calibration and verification of automatic tank gauges used for custody transfer measurement of liquefied petroleum and chemical gases on board a gas carrier or floating storage Also specifies technical requirements for data collection, transmission and reception LNG automatic tank measurement by a custody transfer measurement system involves determination of liquid level, average temperature of liquid and vapour and vapour pressure 			Fueling								●		●						
Onboard Storage																				
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations	✓	Installation and use of ATGs with measurement																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																		
– ISO 6578, Refrigerated hydrocarbon liquids – Static measurement	Std.	Maintenance equip & procedures	✓	Calibration and verification during use																
– ISO 11223, Petroleum and liquid petroleum products – Measurement	Std.	Safe Practices	✓	General safety and test methods	Corrosion, leakage, accuracy of level															
– ISO 15169, Petroleum and liquid petroleum products – Volume, density and mass of HC content of vertical cylindrical tanks	Std.																			
– ISO/IEC Guide 98-3, Expression of uncertainty in measurement	Std.	Emergency equip & procedures																		
– IEC 60079-0, Explosive atmospheres – Equipments	Std.	Environmental issues																		
– IACS Unified Requirements E10	Std.	Key take-outs / best practice																		
– API, Manual of petroleum measurement standards	Std.	<ul style="list-style-type: none"> Important guide about the construction, installation and use of ATGs for floating carriers specific to LPG Discusses in detail about data measurements and calibration and verification of gauges during normal use 																		
– API RP 500 and RP 2003	Std.																			
– ICS/ OCIMF/ IAPH, International safety guide for oil tankers and terminals	Std.																			
– ICS, Tanker safety guide	Std.																			
– IGC, International code for the construction of ships carrying liquefied gases	Code																			
– SIGTTO, Liquefied gas fire hazard management	Std.																			
– SIGTTO, Liquefied gas handling practices on ships and in terminals	Std.																			
– US Coast Guard – 33 CFR Part 153, 46 CFR Part 39.20, Marine safety center NVIC 2-89 – Basis guidelines for electrical installations on merchant vessels	Reg.																			

Source: Ricardo assessment

ISO 19078 – Gas Cylinders – Inspection of Installation and Requalification of High Pressure Cylinders for On-Board

Name	Gas Cylinders – Inspection of Installation and Requalification of High Pressure Cylinders for On-Board			Code	ISO 19078							Date of Issue	01-15-2013								
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	CNG							Next Issue									
Sector Applicability	All Vehicles		Geographical coverage	Global		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Specifies requirements for inspection, installation and requalification of high pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles Provides criteria for the acceptance or rejection of a cylinder and its installation 			Fueling																	
Onboard Storage				○	○	○	○	○	○						◐						
Transfer																					
Gasification																					
Consumption																					
Sub System Element				Incl	Comment	Hazards Identified															
Fuelling Facilities & Operations																					
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																			
– ISO 11439, Gas cylinders – High pressure cylinders for on-board storage of natural gas as a fuel for automotive	Std.	Maintenance equip & procedures																			
– ISO 15500-13 and 15 , Road vehicles – CNG fuel system components	Std.	Safe Practices			✓	Marking and inspection procedures			Fire, collision, impact, leakage, defect												
– ISO 15501. Road vehicles – CNG fuel systems	Std.	Emergency equip & procedures																			
– ISO 25760, Gas cylinders, Operational procedures for the safe removal of valves from gas cylinders	Std.	Environmental issues																			
				Key take-outs / best practice																	
				<ul style="list-style-type: none"> All inspection procedures and tests required to confirm condition of cylinders and its accessories Inspection checklist provided in annexure 																	



ISO 20421 – Cryogenic Vessels – Large Transportable Vacuum-Insulated – Part 1 – Design, Fab, Inspec and Tests



Name	Cryogenic Vessels – Large Transportable Vacuum-Insulated – Part 1 – Design, Fab, Inspec and Tests		Code	ISO 20421-1		Date of Issue	04-15-2006																	
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	All cryogenic fuels		Next Issue																		
Sector Applicability	All Vehicles	Geographical coverage	Global	System/ Component	<table border="1"> <tr> <td>Hoses/ Pipes</td> <td>Valves</td> <td>Regulators</td> <td>Fittings</td> <td>Connectors</td> <td>Sensors</td> <td>Break Away</td> <td>Metering</td> <td>Tanks</td> <td>Compressor</td> <td>Refrigeration</td> <td>Vaporizers</td> </tr> </table>	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers							
Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers													
Description			Fueling																					
<ul style="list-style-type: none"> Specifies requirements for the design, fabrication, inspection and testing of large transportable vacuum-insulated cryogenic vessels of > 450 L volume that are fixed or portable attached to a means of transport Does not apply to vessels designed for toxic fluids Does not include general vehicle requirements Does not cover specific requirements for refillable liquid-hydrogen tanks that are primarily dedicated as fuel tanks in vehicles 			Onboard Storage	●	●	●	●	●	●	●	●													
			Transfer																					
			Gasification																					
			Consumption																					
			Sub System Element	Incl	Comment	Hazards Identified																		
Fuelling Facilities & Operations																								
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks	✓	Detailed design and construction of tanks and accessories	Corrosion, fatigue, over-pressurization																	
<ul style="list-style-type: none"> – ISO 4126-2, Safety devices against excessive pressure – Bursting disc – ISO 4136, 5173, 9016 – Destructive tests on welds in metals – ISO 9606, Testing of welders – ISO 9712, 17636 – Non-destructive testing – ISO 10474, Steel and steel products – Inspection documents – ISO 14732, Welding personnel – Approval testing of operators – ISO 15607, 15613, 15614 – Specification and qualification of welding procedures for metallic materials – ISO 20421, 21010, 21011, 21013, 21028, 23208 – Cryo vessels – ASME VIII-2 – EN 1708-1, Welding – Pressurized components, basic weld joint in steel – EN 10028, Flat products made of steels for pressure purposes – EN 12300, Cryogenic vessels – Cleanliness for cryogenic service – EN 13068-3, Non-destructive testing – Radioscopic test of metals by X rays – EN 13445, Unfired pressure vessels – Design and fabrication – UN recommendations on the transport of dangerous goods – Model regulations 			Std.	Maintenance equip & procedures																				
			Std.	Safe Practices	✓	Marking and inspection procedures	Defects, leakage																	
			Std.	Emergency equip & procedures																				
			Std.	Environmental issues																				
			Std.	Key take-outs / best practice																				
			Code	<ul style="list-style-type: none"> Detailed specifications and requirements for the design and fabrication of cryogenic tanks with related accessories Requirements for marking, labeling, periodic inspection and acceptance criteria 																				

ISO 20421 – Cryogenic Vessels – Large Transportable Vacuum-Insulated – Part 2 – Operational Requirements

Name	Cryogenic Vessels – Large Transportable Vacuum-Insulated – Part 2 – Operational Requirements		Code	ISO 20421-2		Date of Issue	06-15-2005									
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	All cryogenic fuels		Next Issue										
Sector Applicability	All Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Specifies operational requirements for large transportable vacuum-insulated cryogenic vessels of > 1000 L volume Includes putting into service, filling, withdrawal, transport, storage, maintenance, periodic inspection and emergency procedures Additional requirements for flammable fluids are specified 		Fueling													
			Onboard Storage	○	○	○	○	○	○	○		◐				
			Transfer													
			Gasification													
			Consumption													
			Sub System Element	Incl	Comment	Hazards Identified										
			Fuelling Facilities & Operations													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks	✓	Basic requirements for safe operation and disposal of vessels										
			Std.	Maintenance equip & procedures	✓	Maintenance, repair and periodic inspection										
			Std.	Safe Practices	✓	General safety and operating requirements	Leakage, spillage, ignition, fire, corrosion, contamination									
				Emergency equip & procedures	✓	Brief guidelines about basic requirements										
				Environmental issues												
			Key take-outs / best practice		<ul style="list-style-type: none"> Basic requirements and guidelines about safe operation of cryogenic vessels including personnel training, repair, maintenance, periodic inspection and emergency procedures 											



ISO 20826 – Automotive LPG Components - Containers



Name	Automotive LPG Components – Containers		Code	ISO 20826		Date of Issue	08-15-2006									
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	LPG		Next Issue										
Sector Applicability	All Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Specifies technical requirements for the design and testing of automotive LPG containers to be permanently attached to a motor vehicle Covers design criteria, requirements on construction and workmanship, marking and re-qualification procedures Also covers all tests, including their frequencies, to be carried out during production and performance verification 		Fueling													
			Onboard Storage										●			
			Transfer													
			Gasification													
			Consumption													
			Sub System Element	Incl	Comment	Hazards Identified										
			Fuelling Facilities & Operations													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type		Fuel Systems & Tanks	✓	General provisions and material requirements											
– ISO 175, 306 - Plastics – Tests & Thermoplastic materials	Std.		Maintenance equip & procedures													
– ISO 2504, Radiography of welds & viewing conditions for films	Std.															
– ISO 4136, 5173 - Destructive tests on welds in metallic material	Std.		Safe Practices	✓	Marking, inspection and testing procedures											
– ISO 6507-1, 6892, 7438, 7799 – Metallic materials – Vickers test, Tensile test, Bend Test and Reverse bend test	Std.															
– ISO 6721, Plastics – Dynamic mechanical properties	Std.		Emergency equip & procedures													
– ISO 9328-7, Steel flat products for pressure purposes – Stainless steels	Std.															
– ISO 9606, Approval testing of welders	Std.		Environmental issues													
– ISO 12097-2, Road vehicles – Testing of airbag modules	Std.															
– ISO15614-1, Arc and gas welding of steels	Std.															
– ISO 17636, Non-destructive testing of welds	Std.															
– ASTM 3039, Fiber resin composite	Std.															
– ASTM D2343, D2344 – Standard test methods	Std.															
– ASTM D4018.81, Carbon	Std.															
– EN 589, Automotive fuels – LPG – Requirements and test methods	Std.															
– EN 10120, Steel sheet and strip for welded gas cylinders	Std.															
			Key take-outs / best practice	<ul style="list-style-type: none"> General material and design requirements for LPG cylinders – detailed calculations in annexure Detailed test and inspection requirements including inspection schedules Restricted to LPG fuel only 												

Source: Ricardo assessment



ISO 21009 – Cryogenic Vessels – Static Vacuum-Insulated – Part 1 – Design, Fabrication, Inspection and Tests



Name	Cryogenic Vessels – Static Vacuum-Insulated – Part 1 – Design, Fabrication, Inspection and Tests		Code	ISO 21009-1		Date of Issue	09-01-2008												
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	All cryogenic fuels		Next Issue													
Sector Applicability	All uses	Geographical coverage	Global	System/ Component	<table border="1"> <tr> <td>Hoses/ Pipes</td> <td>Valves</td> <td>Regulators</td> <td>Fittings</td> <td>Connectors</td> <td>Sensors</td> <td>Break Away</td> <td>Metering</td> <td>Tanks</td> <td>Compressor</td> <td>Refrigeration</td> <td>Vaporizers</td> </tr> </table>	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers								
Description			Fueling																
<ul style="list-style-type: none"> Specifies requirements for the design, fabrication, inspection and testing of static vacuum-insulated cryogenic vessels designed for a maximum allowable pressure of more than 0.5 bar Does not apply to vessels designed for toxic fluids 			Onboard Storage	●	●	●	●	●	●	●	●	●							
			Transfer																
			Gasification																
			Consumption																
			Sub System Element	Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																			
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks	✓	Detailed design and construction of tanks and accessories	Corrosion, fatigue, over-pressurization												
<ul style="list-style-type: none"> – ISO 4126-2, Safety devices against excessive pressure – Bursting disc – ISO 4136, 5173, 9016 - Destructive tests on welds in metals – ISO 6520-1, Welding and allied processes – Fusion welding – ISO 9606, Testing of welders – ISO 9712, 17635, 17636, EN 13068 – Non-destructive testing – ISO 10474, Steel and steel products – Inspection documents – ISO 14732, Welding personnel – Approval testing of operators – ISO 15607, 15609, 15613, 15614 – Specification and qualification of welding procedures for metallic materials – ISO 21010, 21011, 21013, 21028, 23208 – Cryogenic vessels – ASME Boiler and Pressure Vessel Code – EN 1708-1, Welding – Pressurized components, basic weld joint in steel – EN 10028, Flat products made of steels for pressure purposes – EN 13133, 13134 – Brazing – Brazer and Procedure approval – EN 13445-3, Unfired pressure vessels – Design 			Std.	Maintenance equip & procedures															
			Std.	Safe Practices	✓	Marking and inspection procedures	Defects, leakage												
			Std.	Emergency equip & procedures															
			Std.	Environmental issues															
			Std.	Key take-outs / best practice															
			Code	<ul style="list-style-type: none"> General material and design requirements for LPG cylinders – detailed calculations in annexure Detailed test and inspection requirements including inspection schedules 															



ISO 21009 – Cryogenic Vessels – Static Vacuum-Insulated – Part 2 – Operational Requirements



Name	Cryogenic Vessels – Static Vacuum-Insulated – Part 2 – Operational Requirements		Code	ISO 21009-2		Date of Issue	10-01-2006									
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	All cryogenic fuels		Next Issue										
Sector Applicability	All Uses	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Specifies operational requirements for static vacuum-insulated cryogenic vessels designed for maximum allowable pressure of > 0.5 bar Discusses additional requirements for flammable gases 		Fueling													
			Onboard Storage	○	○	○	○	○	○	○		◐				
			Transfer													
			Gasification													
			Consumption													
			Sub System Element	Incl	Comment		Hazards Identified									
			Fuelling Facilities & Operations													
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks	✓	Basic requirements for safe operation and disposal of vessels										
– ISO 23208, Cryogenic vessels – Cleanliness for cryogenic service			Std.	Maintenance equip & procedures	✓	Maintenance, repair and periodic inspection										
– EN 13458, Cryogenic vessels – Static vacuum insulated vessels			Std.	Safe Practices	✓	General safety and operating requirements		Leakage, spillage, ignition, fire, corrosion, contamination								
				Emergency equip & procedures	✓	Brief guidelines about basic requirements										
				Environmental issues												
			Key take-outs / best practice													
			<ul style="list-style-type: none"> Basic requirements and guidelines about safe operation of cryogenic vessels including personnel training, repair, maintenance, periodic inspection and emergency procedures 													

ISO 21012 – Cryogenic Vessels – Hoses



Name	Cryogenic Vessels – Hoses			Code	ISO 21012							Date of Issue	11-15-2006					
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	All cryogenic fuels							Next Issue						
Sector Applicability	All Uses	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Specifies design, construction, type and production testing, and marking requirements for non-insulated cryogenic flexible hoses used for the transfer of cryogenic fluids Operating conditions – Temperature from -270 C to -65 C and Nominal size from 10 to 100 DN End fittings for mounting of any couplings are within the scope of this standards, but the couplings are subject to other standards 			Fueling	●			●										
				Onboard Storage	●			●										
				Transfer	●					●								
				Gasification														
				Consumption														
				Sub System Element	Incl	Comment	Hazards Identified											
	Fuelling Facilities & Operations	✓	Requirements for design and construction	Strength, leakage														
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks			✓													
<ul style="list-style-type: none"> – ISO 6708, Pipework components – Definition & selection of DN – ISO 7369, Pipework – Metal hoses and hose assemblies – ISO 10380, Pipework – Corrugated metal hoses and hose assemblies – ISO 10806, Pipework – Fittings for corrugated metal hoses – ISO 21010, Cryogenic vessels – Gas/ materials compatibility – ISO 21028-1, Cryogenic vessels – Toughness requirements for materials at cryogenic temperature below -80 C – ISO 23208, Cryogenic vessels – Cleanliness for cryogenic service 	Std.	Maintenance equip & procedures																
	Std.	Safe Practices	✓	Detailed testing, marking & labelling requirements	Leakage, ignition, fire, corrosion,													
	Std.	Emergency equip & procedures																
	Std.	Environmental issues																
	Std.	Key take-outs / best practice			<ul style="list-style-type: none"> Specifies all requirements for design, construction, material and size selection of hoses and fittings Detailed requirements for testing, inspection and production testing 													



ISO 21013 – Cryogenic Vessels – Pressure-Relief Accessories – Part 1 – Re-closable Pressure-Relief Valves



Name	Cryogenic Vessels – Pressure-Relief Accessories – Part 1 – Re-closable Pressure-Relief Valves		Code	ISO 21013-1		Date of Issue	06-15-2008												
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	All cryogenic fuels		Next Issue													
Sector Applicability	All Uses	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description			Fueling		●														
<ul style="list-style-type: none"> Specifies requirements for the design, manufacture and testing of pressure-relief valves for cryogenic service Restricted to valves not exceeding a size of DN 150 designed to relieve single-phase vapours or gases Does not provide methods for determining the capacity of relief valves for a particular cryogenic vessels 			Onboard Storage		●														
			Transfer		●														
			Gasification																
			Consumption																
			Sub System Element				Incl	Comment		Hazards Identified									
Fuelling Facilities & Operations				✓	Requirements for design and construction		Strength, leakage, corrosion												
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks		✓													
<ul style="list-style-type: none"> ISO 4126-1, Safety devices against excessive pressure – Safety valves ISO 6708, Pipework components – Definition and selection of DN ISO 11114, Transportable gas cylinders ISO 15761, Steel gate, globe and check valves sizes DN 100 and smaller ISO 20421-1, Cryogenic vessels – Design, fabrication, inspection and tests of large transportable vacuum-insulated vessels ISO 21009-1, Cryogenic vessels – Design, fabrication, inspection and tests of static vacuum-insulated vessels ISO 21010, Cryogenic vessels – Gas/ materials compatibility ISO 21028, Cryogenic vessels – Toughness requirements for materials at cryogenic temperature ISO 21029-1, Cryogenic vessels - Design, fabrication, inspection and tests of transportable vacuum insulated vessels of <= 1000 L volume ISO 23208, Cryogenic vessels – Cleanliness for cryogenic service ASME B16.34, Valves – Flanged, threaded and welding end 			Std.	Maintenance equip & procedures															
			Std.	Safe Practices	✓	Detailed testing, marking & labelling requirements		Leakage, corrosion											
			Std.	Emergency equip & procedures															
			Std.	Environmental issues															
			Std.	Key take-outs / best practice															
			Std.	<ul style="list-style-type: none"> Specifies all requirements for design, construction and material of all pressure relief valves Detailed requirements for testing, inspection and production testing 															

ISO 21013 – Cryogenic Vessels – Pressure-Relief Accessories – Part 2 – Non-reclosable PRDs



Name	Cryogenic Vessels – Pressure-Relief Accessories – Part 2 – Non-reclosable PRDs		Code	ISO 21013-2		Date of Issue	06-15-2007	
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	All cryogenic fuels		Next Issue		
Sector Applicability	All Uses	Geographical coverage	Global	System/ Component	Hoses/ Pipes Valves Regulators Fittings Connectors Sensors Break Away Metering Tanks Compressor Refrigeration Vaporizers			
Description	<ul style="list-style-type: none"> Specifies requirements for the design, manufacture and testing of non-reclosable pressure-relief devices for cryogenic service Restricted to bursting-disc and bulking-pin devices not exceeding a size of DN 200 designed to relieve single-phase vapours or gases Does not provide methods for determining the capacity of bursting-disc or bulking-pin devices for a particular cryogenic vessel 		Fueling			●		
			Onboard Storage			●		
			Transfer			●		
			Gasification					
			Consumption					
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Sub System Element	Incl	Comment	Hazards Identified	
				Fuelling Facilities & Operations	✓	Requirements for design and construction	Strength, leakage, corrosion	
				Fuel Systems & Tanks	✓			
<ul style="list-style-type: none"> ISO 4126-2, Safety devices against excessive pressure – Bursting-disc ISO 6708, Pipework components – Definition and selection of DN ISO 11114, Transportable gas cylinders ISO 20421-1, 21009-1, 21010, 21028, 21029-1, 23208 – Cryogenic vessels – Design, fabrication, inspection and tests of large transportable vacuum-insulated vessels ASME B16.34, Valves – Flanged, threaded and welding end ASME Boiler and Pressure Vessel Code CGA S-1.2, Pressure relief device standards – Cargo and portable tanks for compressed gases CGA S-1.3, Pressure relief device standards – Stationary storage containers for compressed gases 			Std.	Maintenance equip & procedures				
			Std.	Safe Practices	✓	Detailed testing, marking & labelling requirements	Leakage, corrosion	
			Std.	Emergency equip & procedures				
			Std.	Environmental issues				
			Code Std.	Key take-outs / best practice				
			Std.	<ul style="list-style-type: none"> Specifies all requirements for design, construction and material of bursting-disc and bulking-pin valves only Detailed requirements for testing, inspection and production testing 				

ISO 21013 – Cryogenic Vessels – Pressure-Relief Accessories – Part 3 – Sizing and Capacity Determination

Name	Cryogenic Vessels – Pressure-Relief Accessories – Part 3 – Sizing and Capacity Determination			Code	ISO 21013-3							Date of Issue	01-01-2006								
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	All cryogenic fuels							Next Issue									
Sector Applicability	All Uses		Geographical coverage	Global		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Provides separate calculation methods for determining the required mass flow to be relieved for each specified conditions Many conditions with varying temperatures, pressures and pressure regulator functionality are used as test cases 			Fueling			●														
Onboard Storage						●															
Transfer						●															
Gasification																					
Consumption																					
Sub System Element				Incl	Comment	Hazards Identified															
Fuelling Facilities & Operations				✓	Requirements for sizing and installation	Over pressurization, leakage, corrosion															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																			
– ISO 4126-1, Safety devices for protection against excessive pressure – Safety valve	Std.	Maintenance equip't & procedures																			
– ISO 4126-6, Safety devices for protection against excessive pressure – Application, selection and installation bursting disc	Std.	Safe Practices																			
– CGA S-1.2 – Pressure relief device standards – Cargo and portable tanks for compressed gases	Std.	Emergency equip't & procedures																			
– CGA S-1.3 - Pressure relief device standards – Stationary storage containers for compressed gases	Std.	Environmental issues																			
– Wolfgang Lehmann, Sicherheitstechnische Aspekte bei Auslegung und Betrieb von LHe-badgedehaltenen Supraleiter-Magnetkryostaten	Paper	Key take-outs / best practice <ul style="list-style-type: none"> Specifies all requirements for sizing and installation of pressure-relief devices for cryogenic vessels More focused on calculations of heat transfer between the vessel and outer jacket and also mass flow calculations 																			

ISO 21013 – Cryogenic Vessels – Pilot Operated Pressure-Relief Devices – Part 4 – Pressure-Relief Accessories



Name	Cryogenic Vessels – Pilot Operated Pressure-Relief Devices – Part 4 – Pressure-Relief Accessories			Code	ISO 21013-4							Date of Issue	06-01-2012								
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	All cryogenic fuels							Next Issue									
Sector Applicability	All Uses		Geographical coverage	Global		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Specifies the requirements for the design, manufacture and testing of pilot operated pressure-relief valves for cryogenic service Restricted to valves not exceeding a size of DN 300 designed to relieve single phase vapours, gases or mixtures Does not provide methods for determining the capacity of relief valves for a particular cryogenic vessel 			Fueling		●															
Onboard Storage					●																
Transfer					●																
Gasification																					
Consumption																					
Sub System Element				Incl	Comment	Hazards Identified															
Fuelling Facilities & Operations				✓	Requirements for design and construction	Over pressurization, leakage, corrosion															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type																				
– ISO 4126-4, Safety devices for protection against excessive pressure – Pilot operated safety valves	Std.	Maintenance equip't & procedures																			
– ISO 6708, Pipework components – Definition & selection of DN	Std.	Safe Practices	✓	Requirements for marking and testing	Contamination, leakage,																
– ISO 11114, Gas cylinders – Compatibility of cylinder and valve	Std.	Emergency equip't & procedures																			
– ISO 15761, Steel gate, globe and check valves <= DN 100	Std.	Environmental issues																			
– ISO 20421-1 , 21009-1 , 21010, 21013 , 21028 , 21029-1 , 23208 – Cryogenic vessels	Std.	Key take-outs / best practice																			
– ASME B16.34, Valves flanged, threaded and welding end	Std.	<ul style="list-style-type: none"> Specifies all requirements for design and construction of pilot operated pressure-relief devices for cryogenic vessels Also specifies testing and qualification criteria with marking requirement 																			
– EN 12516, Industrial valves – Shell design strength	Std.																				

ISO 21014 – Cryogenic Vessels – Cryogenic Insulation Performance



Name	Cryogenic Vessels – Cryogenic Insulation Performance			Code	ISO 21014								Date of Issue	08-01-2006							
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	All cryogenic fuels								Next Issue								
Sector Applicability	All Uses		Geographical coverage	Global		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Main purpose if to harmonize various methods of defining the insulation performance of cryogenic vessels Define practical methods for determining the heat-leak performance of cryogenic vessels Includes measurement on both open and closed systems Standard neither specifies the requirement levels for insulation performance nor when the defined methods should be applied 			Fueling																	
Onboard Storage																					
Transfer																					
Gasification																					
Consumption																					
Sub System Element				Incl	Comment	Hazards Identified															
Fuelling Facilities & Operations																					
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type																				
<ul style="list-style-type: none"> Gas Encyclopedia, Air Liquide, Elsevier Thermophysical properties of gases, Technical notes/ Computer programs, National institute of standards and technology GASPAK, Thermophysical properties of gases, Computer program, CRYODATA Inc. 	Std. Paper	Maintenance equip & procedures																			
	Paper	Safe Practices		✓	Requirements for measuring heat losses																
		Emergency equip & procedures																			
		Environmental issues																			
	Key take-outs / best practice		<ul style="list-style-type: none"> Important guide to measure performance of insulation of cryogenic vessel. Discusses various methods and calculations including error corrections and conversion from volume to mass 																		

ISO 21028 – Cryogenic Vessels – Toughness Requirement for Materials – Part 1 – Temperatures Below -80 °C

Name	Cryogenic Vessels – Toughness Requirement for Materials – Part 1 – Temperatures Below -80 °C			Code	ISO 21028-1								Date of Issue	07-01-2004						
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	All cryogenic fuels								Next Issue							
Sector Applicability	All Vehicles		Geographical coverage	Global		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Based on EN 1252-1 European Standard Material toughness is the most important property to be considered at low temperatures Specifies toughness requirements of metallic materials to ensure their suitability for cryogenic vessels Not applicable to unalloyed steels and cast materials 			Fueling																
Onboard Storage																				
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks		✓	General provisions and material requirements			Leakage, impact resistance												
<ul style="list-style-type: none"> – ISO 148, Metallic materials – Charpy pendulum impact test – EN 10028-4, Flat products made of steels for pressure purposes – Nickel alloy steels – ISO 20421-1, Cryogenic vessels – Design, fabrication, inspection and tests – EN 485-3, Aluminum and Aluminum alloys – Tolerances on dimensions and form for hot-rolled products – EN16527, 1653, 1981, 12163 – Copper and copper alloys – EN 10028, Flat products made of steels for pressure purposes 	Std.	Maintenance equip & procedures																		
	Std.	Safe Practices		✓	Inspection and testing procedures															
	Std.	Emergency equip & procedures																		
	Std.	Environmental issues																		
	Std.	Key take-outs / best practice		<ul style="list-style-type: none"> General material and design requirements for cryogenic cylinders Detailed test and inspection requirements including acceptance criteria 																

ISO 21028 – Cryogenic Vessels – Toughness Requirement for Materials – Part 2 – Temp. Between -80 °C and -20°C

Name	Cryogenic Vessels – Toughness Requirement for Materials – Part 2 – Temp. Between -80° C and -20°C			Code	ISO 21028-2							Date of Issue	04-15-2004							
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	All cryogenic fuels							Next Issue								
Sector Applicability	All Vehicles		Geographical coverage	Global		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Based on EN 1252-2 European Standard Material toughness is the most important property to be considered at low temperatures Specifies toughness requirements of metallic materials to ensure their suitability for cryogenic vessels Applicable to fine-grain and low-alloyed steels, aluminium and aluminium alloys, copper and copper alloys and austenitic stainless steels 			Fueling																
Onboard Storage																	●			
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks		✓	General provisions and material requirements															
<ul style="list-style-type: none"> ISO 148, Metallic materials – Charpy pendulum impact test ISO 15614-1, Specification and qualification of welding procedures for metallic materials – Arc and gas welding Sanz, G. Metal CIT Sandstrom, R. Scandinavian J of Metallurgy Garwood, S.J. & Dervhan, J.B. The fracture toughness requirements of BS 5500 	Std.	Maintenance equip & procedures																		
	Std.	Safe Practices		✓	Testing procedures															
	Paper	Emergency equip & procedures																		
	Paper	Environmental issues																		
	Paper	Key take-outs / best practice																		
			<ul style="list-style-type: none"> General material and design requirements for cryogenic vessels Detailed test and welding requirements 																	



ISO 21029 – Cryogenic Vessels – Transportable Vacuum Insulated Vessels – Part 1 – Design, Fab, Inspec and Tests



Name	Cryogenic Vessels – Transportable Vacuum Insulated Vessels – Part 1 – Design, Fab, Inspec and Tests		Code	ISO 21029-1		Date of Issue	12-01-2004							
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	All cryogenic fuels		Next Issue								
Sector Applicability	All Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes Valves Regulators Fittings Connectors Sensors Break Away Metering Tanks Compressor Refrigeration Vaporizers									
Description			Fueling											
<ul style="list-style-type: none"> Requirements for design, fabrication, inspection and testing of transportable vacuum-insulated cryogenic vessels <= 1000 L volume designed to operate at a maximum pressure greater than atmospheric Does not apply for such vessels designed for toxic fluids Does not cover requirements for refillable liquid hydrogen tanks that are dedicated as fuel tanks for vehicles 			Onboard Storage	◐	◐	◐	○	○	◐	●				
			Transfer											
			Gasification											
			Consumption											
			Sub System Element	Incl	Comment	Hazards Identified								
Fuelling Facilities & Operations														
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Design and material parameters for safe operation and transport	Corrosion, overfilling, over pressurization, low temperatures									
<ul style="list-style-type: none"> ISO 148, Metallic materials – Charpy pendulum impact test ISO 2244, Packaging – Complete, filled transport packages and unit loads – Horizontal impact tests ISO 4126-2, Safety devices for excessive pressure ISO 4136, 5173 - Destructive tests on welds in metallic material ISO 6520-1, Welding and allied processes – Fusion welding ISO 9606, Test of welders ISO 9712, EN 13068-3 - Non-destructive testing ISO 10474, Steel and steel products ISO 11117, Gas cylinders – valve protection ISO 14732, Welding personnel ISO 15613, 15614, EN 288-1 - Welding procedures for metallic materials ISO 17636, 17637 – Non-destructive testing of welds ISO 21010, 21011, 21013, 21014, 21028, 21029, EN 12300 – Cryogenic vessels 	Std. Std.	Maintenance equip & procedures												
	Std. Std. Std. Std.	Safe Practices	✓	Quality testing and inspection procedures										
	Std. Std.	Emergency equip & procedures												
	Std. Std.	Environmental issues												
	Key take-outs / best practice		<ul style="list-style-type: none"> Detailed specifications and parameters for design and fabrication of all cryogenic vessels Quality testing and inspection procedures including acceptance criteria Special requirements for flammable fluids 											

ISO 21029 – Cryogenic Vessels – Transportable Vacuum Insulated Vessels – Part 2 – Operational Requirements

Name	Cryogenic Vessels – Transportable Vacuum Insulated Vessels – Part 2 – Operational Requirements		Code	ISO 21029-2										Date of Issue	05-15-2004			
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	All cryogenic fuels										Next Issue				
Sector Applicability	All Vehicles	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Operational requirements for transportable vacuum insulated cryogenic vessels of <= 1000 L volume operating above atmospheric pressure Not applicable for cryogenic vessels designed for personal medical use Includes putting into service, filling, withdrawal, transport, storage, maintenance, inspection and emergency procedures 		Fueling															
Onboard Storage													●					
Transfer																		
Gasification																		
Consumption																		
Sub System Element			Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																
<ul style="list-style-type: none"> ISO 2632, Roughness comparison specimens ISO 21010, Cryogenic vessels – Gas/ material compatibility ISO 23208, Cryogenic vessels – Cleanliness for cryogenic service 	Std.	Maintenance equip & procedures		✓	Procedures for maintenance, repair and periodic inspection	Leakage, damage, electrical hazard												
	Std.	Safe Practices		✓	Marking, labelling and inspection practices	Untrained personnel, corrosion, ignition, asphyxiation, burns												
	Std.	Emergency equip & procedures		✓	Guidelines to prepare emergency procedures	Fire, spills												
			Environmental issues															
Key take-outs / best practice																		
					<ul style="list-style-type: none"> Safety guidelines for all operating conditions including commissioning, service life and end of life Maintenance and emergency procedures also discussed 													

ISO 23208 – Cryogenic Vessels – Cleanliness for Cryogenic Service

Name	Cryogenic Vessels – Cleanliness for Cryogenic Service			Code	ISO 23208										Date of Issue	02-15-2005		
Authorising / issuing agency	International Organisation for Standardisation			Fuel Applicability	All cryogenic fuels										Next Issue			
Sector Applicability	All uses	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Specifies minimum requirements for cleanliness of all surfaces of cryogenic vessels and associated accessories that are in contact with cryogenic fluid at any operating condition Defines acceptable level of surface and particle contamination to minimize risk of malfunction of equipment and ensure safety against ignition when in contact with oxygen or oxidizing fluids 			Fueling														
Onboard Storage														●				
Transfer																		
Gasification																		
Consumption																		
Sub System Element				Incl	Comment	Hazards Identified	Fuelling Facilities & Operations											
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																
– ISO 10156-2, Gas cylinders – Gases and gas mixtures – Determination of oxidizing ability of toxic and corrosive gases	Std.	Maintenance equip & procedures																
– ISO 21010, Cryogenic vessels – Gas/ material compatibility	Std.	Safe Practices																
– ISO 21009-1, Cryogenic vessels – Static vacuum insulated vessels – Design, fabrication, inspection and tests	Std.																	✓
– ISO 21029-1, Cryogenic vessels – Transportable vacuum insulated vessels – Design, fabrication, inspection and tests	Std.	Emergency equip & procedures																
– ISO 20421-1, Cryogenic vessels – Large transportable vacuum-insulated – Design, fabrication, inspection and tests	Std.	Environmental issues																
Key take-outs / best practice																		
<ul style="list-style-type: none"> General guidelines for cleanliness of cryogenic vessels to avoid corrosion, ignition and contamination Annexure – Inspection methods for cleanliness tests 																		



ISO 24490 – Cryogenic Vessels – Pumps for Cryogenic service



Name	Cryogenic Vessels – Pumps for Cryogenic service		Code	ISO 24490		Date of Issue	04-15-2005											
Authorising / issuing agency	International Organisation for Standardisation		Fuel Applicability	All cryogenic fuels		Next Issue												
Sector Applicability	All uses	Geographical coverage	Global	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description			Fueling															
<ul style="list-style-type: none"> Specifies minimum requirements for the design, manufacture and testing of pumps for cryogenic service Applicable to centrifugal pumps, but principles may be applied to other types of pumps also Gives guidance on the design of installations Does not specify requirements for operation or maintenance 			Onboard Storage															
			Transfer															
			Gasification															
			Consumption															
			Sub System Element	Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks	✓	General requirements for all cryogenic pumps with relevant tests	Corrosion, brittle transition, leakage, over-pressurization											
<ul style="list-style-type: none"> – ISO 5198, Centrifugal, mixed flow and axial pumps – Code for hydraulic performance tests – Precision grade – ISO 5199, 9908 – Technical specification for centrifugal pumps – ISO 6708, Pipework components – Definition & selection of DN – ISO 20421-1, Cryogenic vessels – Large transportable vacuum-insulated vessels – Design, fabrication, inspection and tests – ISO 21009-1, Cryogenic vessels – Static vacuum insulated vessels – Design, fabrication, inspection and tests – ISO 21010, Cryogenic vessels – Gas/ material compatibility – ISO 21028, Cryogenic vessels – Toughness requirements for materials at cryogenic temperature – ISO 21029-1, Cryogenic vessels – Transportable vacuum insulated vessels < 1000 L – Design, fabrication, inspection and tests – ISO 23208 – Cryogenic vessels – Cleanliness for cryogenic 			Std.	Maintenance equip & procedures														
			Std.	Safe Practices	✓	Cleanliness and marking requirements	Contamination, ignition, corrosion											
			Std.	Emergency equip & procedures														
			Std.	Environmental issues														
			Key take-outs / best practice															
			Std.	Std.	Std.	Std.					<ul style="list-style-type: none"> General guidelines for all centrifugal pumps used for cryogenic service Tests for design, production and cryogenic service specified Annex A: Guidance in installation design Annex B: Acceptable materials for construction of centrifugal pumps 							

Source: Ricardo assessment

- Sample Summary Sheet
- Review of Codes, Standards, and Regulations
- **Appendices For Detailed Summaries**
 - United States
 - International Organization of Standardization (ISO)
 - **Germany**
 - Australia
 - Japan

GPS 1.1 – Product Safety Act: Law on provision of products on the market

Name	Gesetz über die Bereitstellung von Produkten auf dem Markt (Produktsicherungsgesetz – ProdSG)			Code	GPS 1.1								Date of Issue	11-2011			
Authorising / issuing agency	Federal law gazette			Fuel Applicability	All Fuels								Next Issue				
Sector Applicability	All uses	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description	<ul style="list-style-type: none"> This Act applies, if provided in the course of a commercial products on the market, issued or used for the first time Construction and operation of installations requiring supervision, serve the commercial or economic purposes or endanger employees A use finished product may be marked with the GS mark, if the character has been awarded by a GS body on the manufacturer or his authorized representative request CE marking, declared by the manufacturer that the product meets the applicable requirements are set out in Community harmonization legislation of the European Union, which prescribe their attachment 			Fueling													
Onboard Storage				General requirements for GS/ CE marking only													
Transfer																	
Gasification																	
Consumption																	
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified												
<ul style="list-style-type: none"> Directive 2001/95/EG Art. 30, regulation no. 765/2008 of European Parliament 	Reg. Reg.	Fuelling Facilities & Operations															
		Fuel Systems & Tanks															
		Maintenance equip & procedures															
		Safe Practices															
		Emergency equip & procedures															
Environmental issues																	
Key take-outs / best practice																	
<ul style="list-style-type: none"> Not very useful since general requirement only 																	

GPS 2.11.1 – Equipment and protective systems intended for use in explosive atmosphere

Name	Richtlinie für Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen		Code	Directive 94/9/EG GPS 2.11.1		Date of Issue	03-994	
Authorising / issuing agency	European Parliament, Council on the approximation of the laws of the Member States		Fuel Applicability	All Fuels		Next Issue		
Sector Applicability	All uses	Geographical coverage	EU	System/ Component	Hoses/ Pipes Valves Regulators Fittings Connectors Sensors Break Away Metering Tanks Compressor Refrigeration Vaporizers			
Description	<ul style="list-style-type: none"> Applies to equipment and protective systems intended for use in potentially explosive atmospheres The ATEX Directive 94/9/EC (also unofficially known as "ATEX 95") of the European Parliament and of the Council on the approximation of the laws of the member states concerning equipment and protective systems intended for use in potentially explosive atmospheres sets the rules for the marketing of products that are used in hazardous areas Requirements for CE conformity marking 		Fueling					
			Onboard Storage			General requirements only		
			Transfer					
			Gasification					
			Consumption					
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified			
None cited		Fuelling Facilities & Operations						
		Fuel Systems & Tanks						
		Maintenance equip & procedures						
		Safe Practices						
		Emergency equip & procedures						
		Environmental issues						
		Key take-outs / best practice						
		<ul style="list-style-type: none"> Not very useful since general requirement only 						

GPS 2.1.15 – Improving health and safety of workers from explosive atmospheres

Name	Richtlinie 1999/92/EG über Mindestvorschriften zur Verbesserung des Gesundheitsschutzes und der Sicherheit der Arbeitnehmer, die durch explosionsfähige Atmosphären gefährdet werden können			Code	Directive 1999/92/EG GPS 2.1.15/ ArbSch 2.1.15							Date of Issue	12-1999							
Authorising / issuing agency	European Parliament, Counsel of the European Union			Fuel Applicability	All Fuels							Next Issue								
Sector Applicability	All uses		Geographical coverage	EU		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> This Directive is the Fifteenth individual Directive within the meaning of Article 16, paragraph 1 of Directive 89/391/EEC It lays down minimum requirements in relation to safety and health of workers determined, which can be at risk from explosive atmospheres For the purposes of this directive, “explosive atmosphere” is a mixture of air and flammable gases, vapors, mists or dusts under atmospheric conditions in which the combustion process is after ignition, to transmit the entire unburned mixture Requirements for EX conformity marking 			Fueling																
Onboard Storage						General requirements only														
Transfer																				
Gasification																				
Consumption																				
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)				Type	Sub System Element	Incl	Comment	Hazards Identified												
		Fuelling Facilities & Operations																		
		Fuel Systems & Tanks																		
– Directive 89/391/EEC: Article 6, paragraph 3 and Article 9, paragraph 1: Assessment of the specific risks arising from explosive atmospheres caused by the employer	Std.	Maintenance equip & procedures																		
		Safe Practices																		
		Emergency equip & procedures																		
		Environmental issues																		
Key take-outs / best practice																				
<ul style="list-style-type: none"> Not very useful since general requirement only 																				

BGR 104 – Explosion protection rules collection of technical rules for avoiding the hazards of explosive atmosphere with sample collection

Name	Explosionsschutz-Regeln für das Vermeiden der Gefahren durch explosionsfähige Atmosphäre mit Beispielsammlung			Code	BGR 104							Date of Issue	12-2002						
Authorising / issuing agency	Professional association rules for safety and health at work (BG rules)			Fuel Applicability	All Fuels							Next Issue							
Sector Applicability	All uses	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Collection of technical rules for avoiding the hazards of explosive atmosphere with sample collection, including Structure and application the technical rules for operational safety (TRBS 1001) Risk assessment and safety assessment (TRBS 1111) Inspections of work equipment and requiring monitoring facilities (TRBS 1201) Hazardous explosive atmosphere (TRBS 2152, TRGS 720) Related to stationary systems; neither train/ tank cars nor LPG/ CNG applications in detail 			Fueling															
Onboard Storage						Compilation of general technical rules													
Transfer																			
Gasification																			
Consumption																			
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)				Type	Sub System Element	Incl	Comment	Hazards Identified											
– Compilation of technical rules mentioned above	Reg.	Fuel Systems & Tanks																	
		Maintenance equip & procedures																	
		Safe Practices																	
		Emergency equip & procedures																	
		Environmental issues																	
Key take-outs / best practice																			
<ul style="list-style-type: none"> Not very useful since general requirement only 																			

BGR 132 – Avoiding ignition due to electrostatic charges

Name	Vermeidung von Zündgefahren infolge elektrostatischer Aufladungen		Code	BGR 132										Date of Issue	03-2003			
Authorising / issuing agency	BG (Berufsgenossenschaft, Professional association) Rules for safety and health at work		Fuel Applicability	All Fuels										Next Issue				
Sector Applicability	All uses	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> The BG rule helps in risk assessment according to the operating safety regulations to avoid fire and explosion hazards to take account of static electricity as an ignition source and effective measures to avoid them Discharge of static electricity can be an explosive atmosphere consisting of mixtures of flammable gases, vapors, mists or dusts with air in hazardous quantities under atmospheric conditions by many operational processes unintentionally ignition source 		Fueling	<input type="radio"/>	<input type="radio"/>													
Onboard Storage			<input type="radio"/>	<input type="radio"/>									<input type="radio"/>					
Transfer																		
Gasification																		
Consumption																		
Sub System Element			Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations			<input checked="" type="checkbox"/>	Safety requirements														
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Fuel Systems & Tanks	<input checked="" type="checkbox"/>	Safety requirements for infrastructure environment														
<ul style="list-style-type: none"> The technical committee of the chemical trade association has created regulations according "Prevention of ignition hazards due to electrostatic charges" in BGR 132 The ABS has included this in the application of the cooperation model (BArbBI 5/2001 p 61) as TRBS 2153 in his technical rules 	Reg.	Maintenance equip & procedures																
	Reg.	Safe Practices																
		Emergency equip & procedures																
		Environmental issues																
Key take-outs / best practice																		
<ul style="list-style-type: none"> Table for maximum permissible flow velocities for the filling of railway tank cars 																		

Code

TRGS 200 – Technical rule for hazardous substances: classification and labeling of substances, preparations and products



Name	Einstufung und Kennzeichnung von Stoffen, Zubereitungen und Erzeugnissen		Code	TRGS 200				Date of Issue	10-2011										
Authorising / issuing agency	Federal Institute for Occupational Safety and Health (BAuA), Committee on Hazardous Substances (AGS)		Fuel Applicability	All Fuels				Next Issue											
Sector Applicability	All uses	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Technical rules are recommendations and proposals that recommend a way to comply with a law, a regulation, a technical sequence, etc.. They are not legal norms and have therefore not necessarily the character of law The Technical Rules for Hazardous Substances (Technischen Regeln für Gefahrstoffe (TRGS)) reflect the state of the art, occupational medicine and industrial hygiene and other sound knowledge for work with hazardous substances, including their classification and labeling They are appointed by Committee on Hazardous Substances (Ausschuss für Gefahrstoffe (AGS)) determined or adjusted and announced by the Federal Ministry of Labour and Social Affairs in the Joint Ministerial 			Fueling															
				Onboard Storage															
				Transfer															
				Gasification															
				Consumption															
				Sub System Element	Incl	Comment	Hazards Identified												
				Fuelling Facilities & Operations															
				Fuel Systems & Tanks															
				Maintenance equip & procedures															
				Safe Practices															
				Emergency equip & procedures															
				Environmental issues															
				Key take-outs / best practice															
				<ul style="list-style-type: none"> Comprehensive and generic overview of classification of substances 															

Source: Ricardo assessment

Code

TRGS 201 – Technical rule for hazardous substances: classification and labeling of hazardous substances



Name	Einstufung und Kennzeichnung bei Tätigkeiten mit Gefahrstoffen	Code	TRGS 201	Date of Issue	10-2011												
Authorising / issuing agency	Federal Institute for Occupational Safety and Health (BAuA), Committee on Hazardous Substances AGS)	Fuel Applicability	All Fuels	Next Issue													
Sector Applicability	All uses	Geographical coverage	GER	System/ Component	<table border="1"> <tr> <td>Hoses/ Pipes</td> <td>Valves</td> <td>Regulators</td> <td>Fittings</td> <td>Connectors</td> <td>Sensors</td> <td>Break Away</td> <td>Metering</td> <td>Tanks</td> <td>Compressor</td> <td>Refrigeration</td> <td>Vaporizers</td> </tr> </table>	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers						
Description	<ul style="list-style-type: none"> Technical rules are recommendations and proposals that recommend a way to comply with a law, a regulation, a technical sequence, etc.. They are not legal norms and have therefore not necessarily the character of law The technical rules for hazardous substances describe the procedures for classification and labeling of hazardous substances in activities pursuant to § 2 para 4 Hazardous Substances (Gefahrstoffverordnung (GefStoffV) especially according to § 6 para 3 and § 8 para 2 GefStoffV 	Fueling		Onboard Storage		Transfer		Gasification		Consumption							
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified												
– § 8 Abs. 2 GefStoffV (hazardous substances regulation)	Reg.	Fuelling Facilities & Operations															
		Fuel Systems & Tanks															
		Maintenance equip & procedures															
		Safe Practices															
		Emergency equip & procedures															
		Environmental issues															
		Key take-outs / best practice															
		<ul style="list-style-type: none"> Labeling substances and mixtures in transport containers 															

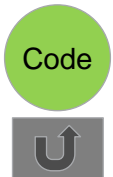
Source: Ricardo assessment



TRGS 400 – Technical rule for hazardous substances: risk assessment for work with hazardous substances



Name	Gefährdungsbeurteilung für Tätigkeiten mit Gefahrstoffen		Code	TRGS 400										Date of Issue	12-2010			
Authorising / issuing agency	Federal Institute for Occupational Safety and Health (BAuA), Committee on Hazardous Substances (AGS)		Fuel Applicability	All Fuels										Next Issue				
Sector Applicability	All uses	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description			Fueling															
<ul style="list-style-type: none"> Technical rules are recommendations and proposals that recommend a way to comply with a law, a regulation, a technical sequence, etc.. They are not legal norms and have therefore not necessarily the character of law Technical Rule 400 describes procedures for information gathering and risk assessment in accordance with § 6 of the Hazardous Substances Ordinance. It binds the requirements of the Hazardous Substances Ordinance in by the Labour Protection Act (§ § 5 and 6 ArbSchG) a given frame 			Onboard Storage	Recommendation on classification and labeling only														
			Transfer															
			Gasification															
			Consumption															
						Sub System Element	Incl	Comment			Hazards Identified							
			Fuelling Facilities & Operations															
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)			Type	Fuel Systems & Tanks														
<ul style="list-style-type: none"> Ordinance on Hazardous Substances (GefStoffV) TRGS 720: dangerous explosive atmospheres TRGS 721: assessment of the risk of explosion TRGS 722: prevention or restriction of hazardous explosive atmospheres TRGS 510: storage of hazardous substances in portable tanks 			Reg. Code	Maintenance equip & procedures														
			Code	Safe Practices														
			Code	Emergency equip & procedures														
			Code	Environmental issues														
			Key take-outs / best practice			<ul style="list-style-type: none"> Risk assessment procedure for activities involving hazardous substances 												



TRGS 510 – Technical rule for hazardous substances: storage of hazardous substances in portable tanks



Name	Lagerung von Gefahrstoffen in ortsbeweglichen Behältern	Code	TRGS 510	Date of Issue	01-2013												
Authorising / issuing agency	Federal Institute for Occupational Safety and Health (BAuA), Committee on Hazardous Substances (AGS)	Fuel Applicability	All Fuels	Next Issue													
Sector Applicability	All uses	Geographical coverage	GER	System/ Component	<table border="1"> <tr> <td>Hoses/ Pipes</td> <td>Valves</td> <td>Regulators</td> <td>Fittings</td> <td>Connectors</td> <td>Sensors</td> <td>Break Away</td> <td>Metering</td> <td>Tanks</td> <td>Compressor</td> <td>Refrigeration</td> <td>Vaporizers</td> </tr> </table>	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers						
Description	<p>Fueling</p> <p>Onboard Storage</p> <p>Transfer</p> <p>Gasification</p> <p>Consumption</p> <p>Sub System Element</p> <p>Incl</p> <p>Comment</p> <p>Hazards Identified</p> <p>Fuelling Facilities & Operations</p>																
<ul style="list-style-type: none"> Technical rules are recommendations and proposals that recommend a way to comply with a law, a regulation, a technical sequence, etc.. They are not legal norms and have therefore not necessarily the character of law TRGS 510 applies to the storage of hazardous materials in portable tanks, including the following activities: Storage and retrieval, Transportation equipment inside the warehouse, Eliminate released hazardous substances 	Focus on storage of hazardous substances																
	Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Fuel Systems & Tanks														
	<ul style="list-style-type: none"> 1272/2008 (CLP Regulation): classification 67/548/EWG : material policy 1999/45/EG: preparation directive 	Reg.	Maintenance equip & procedures														
		Reg.	Safe Practices														
		Reg.	Emergency equip & procedures														
Reg.		Environmental issues															
Key take-outs / best practice																	
<ul style="list-style-type: none"> Focus on stationary storage, ch. 10: storage of gases under pressure Common storage facility table as a function of storage class Storage quantities for flammable liquids in kg 																	

Code

TRGS 720 – Technical rule for hazardous substances: dangerous explosive atmospheres (general introduction)



Name	Technische Regeln für Gefahrstoffe, gefährliche explosionsfähige Atmosphäre (allgemein)	Code	TRGS 720	Date of Issue	06-2006																																																																																						
Authorising / issuing agency	Federal Institute for Occupational Safety and Health (BAuA), Committee on Hazardous Substances (AGS)	Fuel Applicability	All Fuels	Next Issue																																																																																							
Sector Applicability	All uses	Geographical coverage	GER	System/ Component	<table border="1"> <tr> <td>Hoses/ Pipes</td> <td>Valves</td> <td>Regulators</td> <td>Fittings</td> <td>Connectors</td> <td>Sensors</td> <td>Break Away</td> <td>Metering</td> <td>Tanks</td> <td>Compressor</td> <td>Refrigeration</td> <td>Vaporizers</td> </tr> </table>	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers																																																																										
Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers																																																																																
Description	<ul style="list-style-type: none"> Technical rules are recommendations and proposals that recommend a way to comply with a law, a regulation, a technical sequence, etc.. They are not legal norms and have therefore not necessarily the character of law The Technical Rule for operational safety (TRGS 720) gives the state of the technology, occupational medicine and hygiene related rules and other established knowledge according to the provision and use of work equipment and the operation again requiring monitoring TRGS 720 is similar to TRBS 2152 (technical rule for operational safety – dangerous explosive atmospheres) 	<table border="1"> <tr> <td>Fueling</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Onboard Storage</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Transfer</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Gasification</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Consumption</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Fueling												Onboard Storage												Transfer												Gasification												Consumption												<table border="1"> <thead> <tr> <th>Sub System Element</th> <th>Incl</th> <th>Comment</th> <th>Hazards Identified</th> </tr> </thead> <tbody> <tr> <td>Fuelling Facilities & Operations</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Fuel Systems & Tanks</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Maintenance equip & procedures</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Safe Practices</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Emergency equip & procedures</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Environmental issues</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Sub System Element	Incl	Comment	Hazards Identified	Fuelling Facilities & Operations				Fuel Systems & Tanks				Maintenance equip & procedures				Safe Practices				Emergency equip & procedures				Environmental issues			
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Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	<ul style="list-style-type: none"> ArbSchG: occupational health and safety act TRBS 2152 part 1/TRGS 721: assessment of the risk of explosion TRBS 2152 Teil 2/TRGS 722:prevention or restriction of hazardous explosive atmospheres 	Type	<table border="1"> <tr> <td>Reg. Code</td> <td>Maintenance equip & procedures</td> <td></td> <td></td> </tr> <tr> <td>Code</td> <td>Safe Practices</td> <td></td> <td></td> </tr> <tr> <td>Code</td> <td>Emergency equip & procedures</td> <td></td> <td></td> </tr> <tr> <td>Code</td> <td>Environmental issues</td> <td></td> <td></td> </tr> </table>	Reg. Code	Maintenance equip & procedures			Code	Safe Practices			Code	Emergency equip & procedures			Code	Environmental issues			<table border="1"> <thead> <tr> <th>Key take-outs / best practice</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> Polling scheme to recognize and to avoid risk of explosion </td> </tr> </tbody> </table>	Key take-outs / best practice	<ul style="list-style-type: none"> Polling scheme to recognize and to avoid risk of explosion 																																																																					
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TRGS 721 – Technical rule for hazardous substances: assessment of the risk of explosion

Name	Technische Regeln für Gefahrstoffe: Gefährliche explosionsfähige Atmosphäre – Beurteilung der Explosionsgefährdung	Code	TRGS 721	Date of Issue	06-2006																																																																																																																																																											
Authorising / issuing agency	Federal Institute for Occupational Safety and Health (BAuA), Committee on Hazardous Substances (AGS)	Fuel Applicability	All Fuels	Next Issue																																																																																																																																																												
Sector Applicability	All uses	Geographical coverage	GER	System/Component	<table border="1"> <tr> <td>Hoses/ Pipes</td> <td>Valves</td> <td>Regulators</td> <td>Fittings</td> <td>Connectors</td> <td>Sensors</td> <td>Break Away</td> <td>Metering</td> <td>Tanks</td> <td>Compressor</td> <td>Refrigeration</td> <td>Vaporizers</td> </tr> </table>	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers																																																																																																																																															
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Description	<ul style="list-style-type: none"> Technical rules are recommendations and proposals that recommend a way to comply with a law, a regulation, a technical sequence, etc.. They are not legal norms and have therefore not necessarily the character of law The Technical rule specifies the Ordinance on Hazardous Substances (GefStoffV) with respect to the identification and assessment of hazards and the derivation of appropriate measures. TRGS 721 is similar to TRBS 2152 part 1 (technical rule for operational safety – dangerous explosive atmospheres) 	<table border="1"> <tr> <th>Fueling</th> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>Onboard Storage</th> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>Transfer</th> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>Gasification</th> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>Consumption</th> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>Sub System Element</th> <th>Incl</th> <th>Comment</th> <th colspan="9">Hazards Identified</th> </tr> <tr> <td>Fuelling Facilities & Operations</td> <td></td> <td></td> <td colspan="9"></td> </tr> <tr> <th>Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)</th> <th>Type</th> <td>Fuel Systems & Tanks</td> <td></td> <td></td> <td colspan="8"></td> </tr> <tr> <td rowspan="5">– TRBS 2152 – Technical rules for operational safety: dangerous explosive atmospheres</td> <td>Code</td> <td>Maintenance equip & procedures</td> <td></td> <td></td> <td colspan="8"></td> </tr> <tr> <td></td> <td>Safe Practices</td> <td></td> <td></td> <td colspan="8"></td> </tr> <tr> <td></td> <td>Emergency equip & procedures</td> <td></td> <td></td> <td colspan="8"></td> </tr> <tr> <td></td> <td>Environmental issues</td> <td></td> <td></td> <td colspan="8"></td> </tr> <tr> <th colspan="3">Key take-outs / best practice</th> <td colspan="9"> <ul style="list-style-type: none"> Not very useful since general requirement only </td> </tr> </table>	Fueling												Onboard Storage												Transfer												Gasification												Consumption												Sub System Element	Incl	Comment	Hazards Identified									Fuelling Facilities & Operations												Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Fuel Systems & Tanks											– TRBS 2152 – Technical rules for operational safety: dangerous explosive atmospheres	Code	Maintenance equip & procedures												Safe Practices												Emergency equip & procedures												Environmental issues											Key take-outs / best practice			<ul style="list-style-type: none"> Not very useful since general requirement only 								
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TRGS 722 – Technical rule for hazardous substances: prevention or restriction of hazardous explosive atmospheres

Name	Technische Regeln für Gefahrstoffe: Vermeidung oder Einschränkung gefährlicher explosionsfähiger Atmosphäre		Code	TRGS 722										Date of Issue	03-2012		
Authorising / issuing agency	Federal Institute for Occupational Safety and Health (BAuA), Committee on Hazardous Substances (AGS)		Fuel Applicability	All Fuels										Next Issue			
Sector Applicability	All uses	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description	<ul style="list-style-type: none"> Technical rules are recommendations and proposals that recommend a way to comply with a law, a regulation, a technical sequence, etc.. They are not legal norms and have therefore not necessarily the character of law This Technical Rule 722 specifies the requirements for avoiding or restriction of hazardous explosive atmospheres It applies both to equipment, systems requiring monitoring and for activities; although in this technical rule always taken with respect to plants and plant parts is, its application extends to equipment and requiring monitoring Systems and to activities. TRGS 722 is similar to TRBS 2152 part 2 		Fueling														
			Onboard Storage			General requirements only											
			Transfer														
			Gasification														
			Consumption														
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified												
		Fuelling Facilities & Operations															
		Fuel Systems & Tanks															
	Reg. Code	Maintenance equip & procedures															
		Safe Practices															
		Emergency equip & procedures															
		Environmental issues															
Key take-outs / best practice																	
<ul style="list-style-type: none"> Not very useful since general requirement only 																	

Code

TRGS 751 & TRBS 3151 – prevention of fire explosions and pressure hazards at gas stations and filling equipment for filling of land vehicles



Name	Vermeidung von Brand-, Explosions- und Druckgefährdungen an Tankstellen und Füllanlagen zur Befüllung von Landfahrzeugen		Code	TRGS 751/ TRBS 3151		Date of Issue	08-2012									
Authorising / issuing agency	Committee on Industrial Safety (ABS), Committee on Hazardous Substances (AGS)		Fuel Applicability	LNG, CNG		Next Issue										
Sector Applicability	All Land Vehicles	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> This Technical Rule contains requirements for assembly, installation and operation of service stations and filling stations of the purposes for land vehicles It serves to protect workers and others from printing, fire and explosion hazards Includes requirements on facilities for storing and bagging other flammable liquids such as waste oil and heating oil, including their storage containers when they are in close spatial or operational connection with gas stations or filling stations Requirements for floor areas, storage containers, blow-off pipes 		Fueling	<input type="radio"/>					<input type="radio"/>							
			Onboard Storage	<input type="radio"/>	<input type="radio"/>				<input type="radio"/>							
			Transfer													
			Gasification													
			Consumption													
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)			Type	Sub System Element	Incl	Comment	Hazards Identified									
<ul style="list-style-type: none"> BetrSichV: ordinance on industrial safety TRBS 2152: dangerous explosives atmospheres TRBS 2153: prevention of ignition hazards due to electrostatic hazards 			Reg. Code Code	Fuel Systems & Tanks	<input checked="" type="checkbox"/>	General fuel system requirements for stationary systems										
				Maintenance equip & procedures												
				Safe Practices	<input checked="" type="checkbox"/>	Stationary system related										
				Emergency equip & procedures												
				Environmental issues												
Key take-outs / best practice			<ul style="list-style-type: none"> Filling system for liquid gas, natural gas (chapter 4.2.2, 4.2.3) 													

TRGS 800 – Technical rule for hazardous substances – fire protection measures

Name	Brandschutzmaßnahmen		Code	TRGS 800										Date of Issue	12-2010		
Authorising / issuing agency	Committee on Industrial Safety (ABS), Committee on Hazardous Substances (AGS)		Fuel Applicability	All Fuels										Next Issue			
Sector Applicability	All uses	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description			Fueling														
<ul style="list-style-type: none"> This Technical Rule contains requirements for assembly, installation and operation of service stations and filling stations of the purposes for land vehicles The rule shall apply to activities with flammable or oxidizing hazardous substances where fire hazards may arise It takes into account the identification and assessment of whether the substances, preparations or articles on activities, may result to a fire hazard The assessment of fire risk is within the risk assessment required by § 5 and § 6 of Employment Protection Act Hazardous Substances Act (see also Technical Rule 400) to perform 			Onboard Storage	General requirements only													
			Transfer														
			Gasification														
			Consumption														
	Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified											
		Fuel Systems & Tanks															
<ul style="list-style-type: none"> TRGS 400: risk assessment for activities involving hazardous substances TRBS 2152/ 2153: dangerous explosive atmospheres/ prevention of ignition hazards due to electrostatic charges 	Code	Maintenance equip & procedures															
	Code	Safe Practices															
		Emergency equip & procedures															
		Environmental issues															
	Key take-outs / best practice																
<ul style="list-style-type: none"> The appendix contains a catalog for assessing fire hazard 																	

Directive 97/23/EC – Pressure equipment directive (PED)



Name	Rechtsvorschriften der Mitgliedstaaten über Druckgeräte		Code	Directive 97/23/EC GPS 2.14.1		Date of Issue	05-1997	
Authorising / issuing agency	European Parliament and Council on the approximation of the laws of the Member States		Fuel Applicability	All Fuels		Next Issue		
Sector Applicability	All uses	Geographical coverage	EU	System/ Component	Hoses/ Pipes Valves Regulators Fittings Connectors Sensors Break Away Metering Tanks Compressor Refrigeration Vaporizers			
Description	<ul style="list-style-type: none"> This Directive applies to the design, manufacture and conformity assessment of pressure equipment and assemblies with a maximum allowable pressure of more than 0.5 bar Categorization of pressure equipment according to increasing risk potential General calculation methods for compressive strength, resilience and stability of pressure equipment Specific requirements for certain pressure equipment including allowable loads Conformity assessment charts in the appendix 		Fueling					
			Onboard Storage			General requirements only		
			Transfer					
			Gasification					
			Consumption					
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type		Sub System Element	Incl	Comment	Hazards Identified		
			Fuelling Facilities & Operations					
			Fuel Systems & Tanks					
			Maintenance equip & procedures					
			Safe Practices					
			Emergency equip & procedures					
			Environmental issues					
			Key take-outs / best practice					
								<ul style="list-style-type: none"> The appendix contains a catalog of necessary knowledge for assessing the fire hazard GPS 1.1 is based on this directive

TRBS 2141 – Technical rules for operational safety: hazards from steam and pressure

Name	Gefährdungen durch Dampf und Druck			Code	TRBS 2141							Date of Issue	03-2007					
Authorising / issuing agency	Committee on Industrial Safety (Ausschuss für Betriebssicherheit)			Fuel Applicability	All Fuels							Next Issue						
Sector Applicability	All uses	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> This technical rule applies to the identification and assessment risks from steam or pressure that may arise in the provision and use of work equipment and describes exemplary measures The rule consists of three parts: <ul style="list-style-type: none"> Part 1: Deviations of the operating parameters of permissible limits, which can lead to failure of the pressure bearing wall Part 2: Time-dependent damage (eg corrosion, creep stress, alternating stress) which may arise from the operation or from deviations from the operating parameters Part 3: Identification and assessment of hazards in the area of steam and pressure may develop (eg leaks, deflagration, opening of safety valves, etc.) 			Fueling	<input type="radio"/>			<input type="radio"/>										
Onboard Storage				<input type="radio"/>	<input type="radio"/>		<input type="radio"/>								<input type="radio"/>			
Transfer																		
Gasification																		
Consumption																		
Sub System Element				Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations																		
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Fuel Systems & Tanks		<input checked="" type="checkbox"/>	Measures for prevention of risk													
<ul style="list-style-type: none"> Note on policies to substantive requirements (97/23/EC and 87/404/EC) for the assembly of components for the manufacture of pressure equipment or a simple pressure vessel 	Reg.	Maintenance equip & procedures																
		Safe Practices		<input checked="" type="checkbox"/>	Determination and assessment of risk													
		Emergency equip & procedures																
		Environmental issues																
		Key take-outs / best practice																
<ul style="list-style-type: none"> Assessment scheme for deriving of danger in appendix 																		

Code

TRBS 2152 – Technical rules for operational safety: dangerous explosive atmospheres



Name	Technische Regeln für Betriebssicherheit und Gefahrenstoffe			Code	TRBS 2152										Date of Issue	06-2006	
Authorising / issuing agency	Committee on Industrial Safety (Ausschuss für Betriebssicherheit)			Fuel Applicability	All Fuels										Next Issue		
Sector Applicability	All uses	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description	<ul style="list-style-type: none"> Technical rule for the assessment of explosion risks due to substances which may form an explosive atmosphere Subdivided into four parts: <ul style="list-style-type: none"> - Part 1: specification of the requirements for the assessment of explosion risks from explosive atmospheres - Part 2: specification of the requirements for the prevention or restriction of hazardous explosive atmospheres - Part 3: specification of the requirements of the Occupational Safety Regulation to avoid the inflammation of hazardous explosive atmospheres over from the effective ignition sources - Part 4: explosion protection measures which limit the effects of an explosion to an acceptable level 			Fueling													
Onboard Storage						General requirements only											
Transfer																	
Gasification																	
Consumption																	
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified												
<ul style="list-style-type: none"> - TRGS 720, 721, 722 	Code	Fuel Systems & Tanks															
		Maintenance equip & procedures															
		Safe Practices															
		Emergency equip & procedures															
		Environmental issues															
Key take-outs / best practice																	
<ul style="list-style-type: none"> TRBS 2152 corresponds in general part and parts 1 and 2 to the Technical Rules 720/721/722 																	

TRBS 2153 – Technical rules for operational safety: prevention of ignition hazards due to electrostatic charges

Name	Vermeidung von Zündgefahren infolge elektrostatischer Aufladungen			Code	TRBS 2153								Date of Issue	04-2009				
Authorising / issuing agency	Committee on Industrial Safety (ABS)			Fuel Applicability	All Fuels								Next Issue					
Sector Applicability	All Uses	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Assessment and prevention of ignition hazards due to electrostatic charges in hazardous areas Selection and implementation of protective measures to avoid these dangers Requirements for RTCs in addition to general requirements for medium-sized containers <ul style="list-style-type: none"> - Resistance between rail and tank cars - Filling procedure and maximum flow velocity including Requirements on metering pumps and nozzles 			Fueling	●	○						○						
Onboard Storage				○	○									○				
Transfer																		
Gasification																		
Consumption																		
Sub System Element				Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations	✓	Flow velocity																
Fuel Systems & Tanks	✓	Metering pumps and nozzles																
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Maintenance equip & procedures	Reg.															
	Reg.	Safe Practices																
	Reg.	Emergency equip & procedures																
		Environmental issues																
Key take-outs / best practice																		
<ul style="list-style-type: none"> Table for maximum permissible flow velocities for the filling of railway tank cars chapters 4.4.2, 4.4.3 																		

BGR 500 Chapter 2.33 – Accident prevention regulation: Operating systems of handling gases

Name	Accident prevention regulation – Operating systems of handling gases (BG-Regel)			Code	BGR 500							Date of Issue	04-2008							
Authorising / issuing agency	Mandatory casualty insurance (Unfallversicherung)/ Government safety insurance (Berufsgenossenschaft)			Fuel Applicability	CNG/ LNG							Next Issue								
Sector Applicability	All Uses		Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Measures to avoid accidents and worker injuries during operating systems to handle gas, e.g. sealing, filling levels, setup of alarm systems, transport of liquefied gas, fire safety, heat insulation, etc. Summary of testing procedures for tubes, pipes, warning system, sealing, etc. Regulation of minimum actions to define counter-actions for fires, explosions, leakages, etc. General summary of statues, regulations and standards for handling dangerous materials, specifically gas Does not cover gas storage used for heating, welding, furnaces, etc. 			Fueling	<input type="radio"/>			<input type="radio"/>	<input type="radio"/>			<input type="radio"/>								
Onboard Storage						<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							<input type="radio"/>					
Transfer				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>						<input type="radio"/>						
Gasification																				<input type="checkbox"/>
Consumption				<input type="radio"/>	<input type="radio"/>							<input type="radio"/>								
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified															
		Fuelling Facilities & Operations	<input checked="" type="checkbox"/>	Operators have to be familiar with hazards																
		Fuel Systems & Tanks	<input checked="" type="checkbox"/>	Proper inspection and installation																
	Reg. Reg. Reg.	Maintenance equip & procedures	<input checked="" type="checkbox"/>	Proper inspection and installation																
	Reg. Reg. Reg.	Safe Practices	<input checked="" type="checkbox"/>	Have to be Identified and installed																
	Reg. Reg. Std. Std. Reg.	Emergency equip & procedures	<input checked="" type="checkbox"/>	Proper preparation for emergencies																
	Reg. Reg. Std. Std. Reg.	Environmental issues	<input checked="" type="checkbox"/>	Key task for gas tank owners																
		Key take-outs / best practice																		
		<ul style="list-style-type: none"> Systems to handle gases can have to operated by well trained staff Key risks have to addressed and solutions have to be defined Companies handling gases are responsible for safety of staff & goods 																		

BGI-590 – Accident prevention Information: Safe transport of LPG cylinders and aerosols with vehicles on the road

Name	Accident prevention Information – Safe transp. of LPG cylinders and aerosols with vehicles on the road			Code	BGI/ GUV-I 590					Date of Issue	08-2012						
Authorising / issuing agency	Mandatory casualty insurance (Unfallversicherung)/ Government safety insurance (Berufsgenossenschaft)			Fuel Applicability	CNG/ LNG					Next Issue							
Sector Applicability	Road transport	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers	
Description	<ul style="list-style-type: none"> Binding minimum regulations for road transport of gas cylinders for all members of the mandatory insurance (basically all German companies) Mainly summary of European and federal regulation on the transport of gas, gas cylinders, dangerous goods, etc. – strong focus on exceptions to the general rule Regulation on safety measures, e.g. minimum distance to smoke, installation of fire extinguisher, identification marks, etc. Very practical examples to explain regulations to operators 			Fueling													
	<ul style="list-style-type: none"> Binding minimum regulations for road transport of gas cylinders for all members of the mandatory insurance (basically all German companies) Mainly summary of European and federal regulation on the transport of gas, gas cylinders, dangerous goods, etc. – strong focus on exceptions to the general rule Regulation on safety measures, e.g. minimum distance to smoke, installation of fire extinguisher, identification marks, etc. Very practical examples to explain regulations to operators 			Onboard Storage	General regulations & laws for road transport of gas cylinders												
Transfer																	
Gasification																	
Consumption																	
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified												
		Fuelling Facilities & Operations	✓	Safety regulations on loading & unloading													
		Fuel Systems & Tanks															
	Reg. Reg.	Maintenance equip & procedures	✓	Maintenance of vehicle & cylinders req.													
		Safe Practices	✓	Sealing, fire prevention, operator's training													
	Reg. Reg. Std.	Emergency equip & procedures	✓	Equipment in place, procedures defined													
		Environmental issues															
		Key take-outs / best practice															
	Reg.	<ul style="list-style-type: none"> Not all vehicles transporting gas cylinders fall under the same regulation (e.g. small craftsmen, private transports) Clear identification marks of goods transport required 															



B 2207 – Guidelines implementing dangerous goods regulation by road, rail and inland waterways



Name	Guidelines implementing dangerous goods regulation by road, rail and inland waterways			Code	B 2207							Date of Issue	05-2013						
Authorising / issuing agency	Federal Ministry of Transport, Building and Urban Development (BMVBS)			Fuel Applicability	CNG/ LNG							Next Issue							
Sector Applicability	Transport (road, rail, inland waterways)	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Regulations on transport of dangerous goods on various modes on transportation – except for intra-company transport Responsibilities of government bodies (federal, state, communal-level) concerning dangerous goods (definitions, exceptions, permissions, control, etc.) Responsibilities and rights of the transporting bodies, companies, operators Definition of sanctions and fines for breaches of the law (GGVSEB) Basic guidelines for the training of operators of vehicles transporting dangerous goods 			Fueling															
				Onboard Storage			General regulation & guidelines on road, rail & waterway transport of dangerous goods												
				Transfer															
				Gasification															
				Consumption															
				Sub System Element	Incl	Comment	Hazards Identified												
				Fuelling Facilities & Operations															
				Fuel Systems & Tanks															
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type																		
<ul style="list-style-type: none"> GGVSEB: Ordinance on the Domestic and International Transport of Dangerous Goods by Road, Rail and Inland Waterways GbV: Dangerous goods agent regulation ADR: Regulation of international transport for dangerous goods on the road AND: Regulation on dangerous good transportation via waterways RID: Regulations concerning the International Carriage of Dangerous Goods by Rail 	Reg.	Maintenance equip & procedures																	
			Safe Practices																
	Reg.	Emergency equip & procedures																	
	Reg.	Environmental issues																	
	Reg.	Key take-outs / best practice																	
		<ul style="list-style-type: none"> Refers to the proper regulations and standards for the transport of dangerous goods 																	



RID 2013 – Regulations concerning the international carriage of dangerous goods



Name	Regulations concerning the international carriage of dangerous goods			Code	RID 2013							Date of Issue	01-2011							
Authorising / issuing agency	OTIF (Organisation for International Carriage by Rail)			Fuel Applicability	CNG/ LNG							Next Issue								
Sector Applicability	Rail transport	Geographical coverage	RID-states	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description	<ul style="list-style-type: none"> General regulations for rail transport of dangerous goods, incl. gases Requirements for training of personnel involved in the transport , loading, packing, etc. of dangerous goods Government responsibilities and supervisory requirements for transported goods and transport carriages Definition of test methods, identification marks, packaging densities and requirements and emergency processes Requirements for the construction and testing of pressure devices, cylinders, tanks, etc. containing liquefied gas Provisions on handling dangerous goods and transport carriages 			Fueling	●	●	○	○	○											
Onboard Storage				●	●	●	○	○	○					●						
Transfer				●	●															
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations				✓	Sealing, fire prevention, operator's training															
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Fuel Systems & Tanks		✓	Sealing, fire prevention, operator's training															
<ul style="list-style-type: none"> UN numbers from the United Nations Committee of Experts on the Transport of Dangerous Goods ISO 9809, 7866, 4706, etc.: Refillable gas cylinders ISO 11117-20: Other Gas cylinders, cylinder closures, etc. ISO 6406 & 10460: Testing & inspection of gas cylinders 84/525 to 527/EEC Annex I: EU directive on gas cylinders EN1440:2008, etc.: EU directive on transportable gas cylinders ECE Regulation No. 110: Motor vehicles with CNG propulsion ECE Regulation No. 115: Motor vehicles with CNG propulsion 	Std.	Maintenance equip't & procedures	✓	Sealing, fire prevention, operator's training																
	Std.	Safe Practices																		
	Std.	Emergency equip't & procedures																		
	Std.	Environmental issues																		
	Reg.	Key take-outs / best practice																		
	Reg.	<ul style="list-style-type: none"> Very specific regulation on design, identification marking, usage, operation, testing and licensing of new and existing carriages and tanks 																		

UNECE Reg 49: Measures against emission of gaseous and particulate pollutants from engines for use in vehicles

Name	Measures against emission of gaseous and particulate pollutants from engines for use in vehicles		Code	UNECE Reg 49		Date of Issue	03-04-2013									
Authorising / issuing agency	United Nations Economic Commission for Europe		Fuel Applicability	All fuels		Next Issue										
Sector Applicability	All vehicles	Geographical coverage	GER	System/Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Applies to motor vehicles of categories M1, M2, N1 and N2 with a reference mass exceeding 2,610 kg and to all motor vehicles of categories M3 and N3 Does not apply to engines mounted in vehicles of up to 2,840 kg reference mass to which an approval to Regulation No. 83 has been granted as an extension 			Fueling												
				Onboard Storage												
				Transfer												
				Gasification												
				Consumption												
				Sub System Element	Incl	Comment		Hazards Identified								
				Fuelling Facilities & Operations												
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)			Type	Fuel Systems & Tanks	✓	System level regulations to control emissions										
None Cited				Maintenance equip't & procedures												
				Safe Practices	✓	Testing and inspection to control emissions										
				Emergency equip't & procedures												
				Environmental issues												
				Key take-outs / best practice												
				<ul style="list-style-type: none"> Main focus on emission control – getting approval for vehicle engines and testing of components to maintain requirements No component level information for fuel systems 												

UNECE Reg 67: Approval of equipment of vehicles of category M & N using LPG propulsion systems

Name	Approval of equipment of vehicles of category M & N using LPG propulsion systems			Code	UNECE Reg 67							Date of Issue	10-10-2012					
Authorising / issuing agency	United Nations Economic Commission for Europe			Fuel Applicability	LPG							Next Issue						
Sector Applicability	Vehicles in Category M & N	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Applies to approval of specific equipment of vehicles of category M and N using liquefied petroleum gases in their propulsion system Applies to Approval of vehicles of category M and N fitted with specific equipment for the use of LPG in their propulsion system with regard to the installation of such equipment 			Fueling														
Onboard Storage				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Transfer				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Gasification				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Consumption				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Sub System Element				Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Detailed component level design requirement														
<ul style="list-style-type: none"> ISO 37, 188, 1431.1, 1817 - Rubber, vulcanized or thermoplastic ISO 1402, 4080 - Rubber and plastics hoses and hose assemblies ISO 1436, Rubber hoses and hose assemblies -- Wire-braid-reinforced hydraulic types for oil-based or water-based fluids – Specification ISO 1307, Rubber and plastics hoses -- Hose sizes, minimum and maximum inside diameters, and tolerances on cut-to-length hoses ISO 7438, 7799 - Metallic materials EN 288, Specification and approval of welding procedures for metallic materials EN 876, 895 - Destructive tests on welds in metallic materials EN 910, Destructive tests on welds in metallic materials. Bend tests EN 10002-1, Tensile testing of metallic materials - Method of test at ambient temperature EN 10120, Steel sheet and strip for welded gas cylinders EN 22768-1, Tolerances for linear and angular dimensions without individual tolerance indications 	Std.	Maintenance equip & procedures																
	Std.	Safe Practices	✓	Detailed testing and marking requirements			Cracking, strength, leakage, temperature, over pressure											
	Std.	Emergency equip & procedures																
	Std.	Environmental issues																
	Std.	Key take-outs / best practice																
	Std.	<ul style="list-style-type: none"> Detailed requirements for each component of the fuel system including hose assemblies, valves, safety devices, regulators and all types of pumps and vaporizers Contains detailed testing and marking requirements also 																

UNECE Reg 110: Approval of specific components of motor vehicles using CNG in their propulsion system

Name	Approval of specific components of motor vehicles using CNG in their propulsion system			Code	UNECE Reg 110							Date of Issue	08-19-2013					
Authorising / issuing agency	United Nations Economic Commission for Europe			Fuel Applicability	CNG							Next Issue						
Sector Applicability	Vehicles in Category M & N	Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Applies to specific components for vehicles of categories M and N using compressed natural gas (CNG) in their propulsion system Applies to vehicles of categories M and N with regard to the installation of specific components, for the use of compressed natural gas (CNG) for propulsion, of an approved type 			Fueling														
Onboard Storage				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Transfer				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Gasification				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Consumption				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Sub System Element				Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks		✓	Detailed component level design requirement													
Almost 100 standards referenced throughout the document, including ASTM, BSI, ISO and NACE (National Association of Corrosion Engineers) standards	Std.	Maintenance equip & procedures																
		Safe Practices		✓	Detailed testing and marking requirements							Cracking, strength, leakage, temperature, over pressure						
		Emergency equip & procedures																
		Environmental issues																
		Key take-outs / best practice				<ul style="list-style-type: none"> Detailed requirements for each component of the fuel system including hose assemblies, valves, safety devices and regulators Pumps and vaporizers are not included Contains detailed testing and marking requirements also 												

UNECE Reg 115: Approval of specific LPG/ CNG retrofit systems in vehicles for use in their propulsion system



Name	Approval of specific LPG/ CNG retrofit systems in vehicles for use in their propulsion system			Code	UNECE Reg 115							Date of Issue	08-21-2013								
Authorising / issuing agency	United Nations Economic Commission for Europe			Fuel Applicability	LPG							Next Issue									
Sector Applicability	Certain Vehicles in Category M & N		Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description	<ul style="list-style-type: none"> Applies Specific LPG/ CNG retrofit systems to be installed in motor vehicles for the use of LPG/ CNG in the propulsion system Applies when the retrofit systems manufacturer keep the initial characteristics of the whole system, for the specific vehicle family for which the approval has been granted Does not apply to the procedures, checks and inspections aimed at verifying the correct installation of the retrofit systems on vehicles, since this matter relies on the competence of the Contracting Party where the vehicle is registered 			Fueling																	
Onboard Storage																					
Transfer																					
Gasification																					
Consumption																					
Sub System Element				Incl	Comment	Hazards Identified															
Fuelling Facilities & Operations																					
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Referred to previous regulations																	
<ul style="list-style-type: none"> – UNECE Regulation 67, Approval of equipment of vehicles of category M & N using LPG propulsion systems – UNECE Regulation 110, Approval of specific components of motor vehicles using CNG in their propulsion system 	Reg.	Maintenance equip & procedures																			
	Reg.	Safe Practices	✓	Detailed marking requirements																	
		Emergency equip & procedures																			
		Environmental issues																			
Key take-outs / best practice																					
<ul style="list-style-type: none"> Applies to all components of CNG/ LPG retrofit systems, however referred to other UNECE regulations for more information Detailed discussion about overall vehicle approval requirements, especially emission regulations 																					

BGV D34 – Accident prevention Information: Handling of liquefied gas

Name	Accident prevention Information: handling of liquefied gas		Code	BGV D34		Date of Issue	03-2007								
Authorising / issuing agency	Mandatory casualty insurance (Unfallversicherung)/ Government safety insurance (Berufsgenossenschaft)		Fuel Applicability	LPG		Next Issue									
Sector Applicability	All sectors	Geographical coverage	GER	System/ Component	Hoses/ Pipes Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Requirements on handling personnel, containers, close environment, etc. of pressure tanks and liquefied gas General responsibilities of companies owning pressure tanks and liquefied gas operating equipment and profession of testing personnel Measures to minimize leakage, requirements of sealings Specific requirements on usage and handling of liquefied gas in e.g. transportation Requirements on vehicle's safety for operating with liquefied gas Basic description of emission requirements 		Fueling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
			Onboard Storage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
			Transfer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
			Gasification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
			Consumption	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified										
		Fuelling Facilities & Operations	<input checked="" type="checkbox"/>	General requirements for safe operation											
		Fuel Systems & Tanks	<input checked="" type="checkbox"/>	General requirements for safe operation											
	Reg.	Maintenance equip't & procedures	<input checked="" type="checkbox"/>	General requirements											
	Reg.	Safe Practices	<input checked="" type="checkbox"/>	General requirements and safety measures											
	Reg.	Emergency equip't & procedures	<input checked="" type="checkbox"/>	General requirements and measures											
	Reg. Std.	Environmental issues	<input checked="" type="checkbox"/>	General requirements											
	Std.	Key take-outs / best practice													
	Reg. Reg.	<ul style="list-style-type: none"> General requirements for safe handling of liquefied gas and pressure tanks 													



TRB 851 – Filling equipment for filling of compressed gases from compressed gas containers in pressure vessel



Name	Technical rules for pressure vessel regulations: filling equipment for filling of compressed gases from compressed gas containers in pressure vessel			Code	TRB 851							Date of Issue	02-1997							
Authorising / issuing agency	Federal government			Fuel Applicability	CNG/ LNG							Next Issue								
Sector Applicability	All sectors		Geographical coverage	GER	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description				Fueling	<input type="radio"/>	<input type="radio"/>														
<ul style="list-style-type: none"> Filling of pressurized gases from compressed gas containers in pressure vessel Handling and storage of compressed gases Separation distance between filling plants Requirements for labeling and marking Description of movable connecting cables 				Onboard Storage																
				Transfer																
				Gasification																
				Consumption																
				Sub System Element		Incl	Comment		Hazards Identified											
Fuelling Facilities & Operations																				
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)				Type	Fuel Systems & Tanks		<input checked="" type="checkbox"/>	General requirements for filling connection												
<ul style="list-style-type: none"> DruckbehV: Regulation on pressure tanks TRB 600, TRB 801: Technical regulation of pressure tanks ArbStättV: Work site ordinance ASR: Work-site policy DIN 4102: Fire protection class; non-combustible building materials DIN 4815, part 1: Rubber and plastics hoses for liquefied UVV: safety mark in the workplace BGV: Safety and health signs at workplace BGR 104: professional association rules 				Reg.	Maintenance equip & procedures															
				Reg.	Safe Practices															
				Reg.	Emergency equip & procedures															
				Std.	Environmental issues															
				Reg.	Key take-outs / best practice															
Std.	<ul style="list-style-type: none"> General requirements for filling equipment with indication of relevant regulations and standards 																			

Source: Ricardo assessment

- Sample Summary Sheet
- Review of Codes, Standards, and Regulations
- **Appendices For Detailed Summaries**
 - United States
 - International Organization of Standardization (ISO)
 - Germany
 - **Australia**
 - Japan

AS 1210 – Pressure Vessels



Name	Pressure Vessels			Code	AS 1210							Date of Issue	10-19-2010							
Authorising / issuing agency	Council of Standards Australia			Fuel Applicability	All Fuels							Next Issue								
Sector Applicability	All uses		Geographical coverage	AUS	System/Component	Hoses/Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Minimum requirements for the materials, design, manufacture, testing, inspection, certification, documentation and dispatch of fired and unfired pressure vessels constructed in ferrous or non-ferrous metals by welding, brazing, casting, forging or cladding and lining and includes the application of non-integral fittings required for safe and proper functioning of pressure vessels Also specifies requirements for non-metallic vessels and metallic vessels with non-metallic linings 			Fueling	●	●		●	●	●		●								
Onboard Storage				●	●		●	●	●						●					
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	All pressure vessels and associated components																
Over 200 referenced documents and other related documents specified in Appendix R	Maintenance equip & procedures																			
	Safe Practices	✓	Marking and performance tests																	
	Emergency equip & procedures																			
	Environmental issues																			
	Key take-outs / best practice																			
<ul style="list-style-type: none"> Detailed design, manufacture and material specs for all pressure vessels, including transportable vessels Has some related requirements for associated components like PRDs, PRVs and piping 																				

AS/ NZS 1425 – LPG Fuel Systems For Vehicle Engines

Name	LPG Fuel Systems For Vehicle Engines			Code	AS/ NZS 1425								Date of Issue	10-04-2013																																																																																																					
Authorising / issuing agency	Council of Standards Australia/ Council of Standards New Zealand			Fuel Applicability	LPG								Next Issue																																																																																																						
Sector Applicability	All Vehicles		Geographical coverage	AUS/ NZ	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers																																																																																																		
Description	<ul style="list-style-type: none"> Specifies requirements for LPG fuel systems for engines mounted on motor vehicles, either for the propulsion of the vehicles or for driving some auxiliary function like a mixer or a pump Provides requirements for the design and construction of component parts and for their installation in vehicles, and for tests, commissioning and periodic inspection Does not apply to LPG usage for appliances in caravans, mobile homes, forklifts, floor sweepers, polishers, tow tractors, elevating work platforms and industrial engines or for the propulsion of marine craft 			Fueling																																																																																																															
Onboard Storage				●	●	○	○	○	●						○			○																																																																																																	
Transfer				○	●	○	○	○						●																																																																																																					
Gasification				○	●	○	○						●							○																																																																																															
Consumption				○	●	○	○	○	○	○			●		○																																																																																																				
Sub System Element				Incl	Comment	Hazards Identified																																																																																																													
Fuelling Facilities & Operations																																																																																																																			
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)				Type	<table border="1"> <tr> <td colspan="5">Fuel Systems & Tanks</td> <td>✓</td> <td colspan="8">All fuel system components for LPG</td> <td colspan="2"></td> </tr> <tr> <td colspan="5">Maintenance equip & procedures</td> <td></td> <td colspan="8"></td> <td colspan="2"></td> </tr> <tr> <td colspan="5">Safe Practices</td> <td>✓</td> <td colspan="8">Inspection tests and marking</td> <td colspan="2">Leakage, spill, ignition, corrosion</td> </tr> <tr> <td colspan="5">Emergency equip & procedures</td> <td></td> <td colspan="8"></td> <td colspan="2"></td> </tr> <tr> <td colspan="5">Environmental issues</td> <td></td> <td colspan="8"></td> <td colspan="2"></td> </tr> <tr> <th colspan="5">Key take-outs / best practice</th> <td colspan="13"> <ul style="list-style-type: none"> Detailed design requirements for LPG fuel system components – special focus on valves and safety devices Also discusses inspection, testing and commissioning requirements </td> </tr> </table>													Fuel Systems & Tanks					✓	All fuel system components for LPG										Maintenance equip & procedures																Safe Practices					✓	Inspection tests and marking								Leakage, spill, ignition, corrosion		Emergency equip & procedures																Environmental issues																Key take-outs / best practice					<ul style="list-style-type: none"> Detailed design requirements for LPG fuel system components – special focus on valves and safety devices Also discusses inspection, testing and commissioning requirements 												
Fuel Systems & Tanks					✓	All fuel system components for LPG																																																																																																													
Maintenance equip & procedures																																																																																																																			
Safe Practices					✓	Inspection tests and marking								Leakage, spill, ignition, corrosion																																																																																																					
Emergency equip & procedures																																																																																																																			
Environmental issues																																																																																																																			
Key take-outs / best practice					<ul style="list-style-type: none"> Detailed design requirements for LPG fuel system components – special focus on valves and safety devices Also discusses inspection, testing and commissioning requirements 																																																																																																														
<ul style="list-style-type: none"> AS 1210, Pressure vessels AS 1572, Copper and copper alloys – Seamless tubes for engineering AS 2030, 2337, 2473, 2613 – Gas cylinders AS 2746, Working areas for gas fuelled vehicles AS 4732, LPG fuel systems for marine engines AS 4983, Gas fuel systems for forklifts and industrial engines AS/ NZS 1596, Storage and handling of LPG AS/ NZS 1869, Hose and hose assemblies for LPG, NG and town gas AS/ NZS 3509, LPG fuel vessels for automotive use AS/ NZS 60079, Explosive atmospheres ECE R67, ECE Regulation 67 NZ Vehicle Inspection Requirements Manual NZ Land Transport Rule: Vehicle Equipment SAE J30, Fuel and oil hoses SAE J527, Brazed double wall low carbon steel tubing 				Std. Std. Std. Std. Std. Std. Std. Std. Std. Std. Reg. Reg. Reg. Std. Std.																																																																																																															

AS/ NZS 1869 – Hose and Hose Assemblies for LPG Natural Gas and Town Gas

Name	Hose and Hose Assemblies for LPG, Natural Gas and Town Gas			Code	AS/ NZS 1869							Date of Issue	02-28-2012							
Authorising / issuing agency	Council of Standards Australia/ Council of Standards New Zealand			Fuel Applicability	LPG/ NG/ Town Gas							Next Issue								
Sector Applicability	All uses		Geographical coverage	AUS/ NZ	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Ensure performance, safety, durability and fitness for the purpose of hose and hose assemblies in the gas industry Specifies requirements for hose and hose assemblies for LPG, natural gas and town gas manufactured from oil products, tempered LPG and simulated NG in transport, automotive, industrial and domestic applications Provides for hose up to and including 100 mm inside dia. and 2.6 MPa maximum working pressure Does not specify requirements for LPG hose for welding 			Fueling	●			●												
Onboard Storage				●			●													
Transfer				●			●													
Gasification				●			●													
Consumption				●			●													
Sub System Element				Incl	Comment	Hazards Identified	Fuelling Facilities & Operations			✓	Classification, design and construction		Leakage, fire, corrosion, bursting, fracture							
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks			✓	All hose and hose assemblies														
<ul style="list-style-type: none"> AS 1179, Glossary of terms for rubber hose AS 1257, Bore sizes, test pressures and tolerances on lengths of elastomeric hose AS 1335, Hose and hose assemblies for welding, cutting AS 1683.20, Methods of test for rubber AS 1683.23, Rubber vulcanized – Resistance to liquids AS 2103, Dial gauges and test dial indicators ISO 37, 4661 - Rubber vulcanized or thermoplastic ISO 4671, Rubber and plastic hoses and hose assemblies ISO 23529, Rubber – Preparing and conditioning pieces for physical test methods ASTM D1149, Standard test methods for rubber deterioration cracking in an ozone controlled environment 	Std. Std.	Maintenance equip & procedures																		
	Std. Std.	Safe Practices			✓	Marking and performance tests		Corrosion, electrical shocks, crushing, ignition												
	Std. Std.	Emergency equip & procedures																		
	Std. Std.	Environmental issues																		
	Std. Std.	Key take-outs / best practice			<ul style="list-style-type: none"> Detailed design, construction and performance requirements for all hoses and hose assemblies using LPG, NG and town gas Appendix J – List of specifications for hose assemblies 															

AS 2359.2 – Powered Industrial Trucks - Operations

Name	Powered Industrial Trucks – Operations			Code	AS 2359.2										Date of Issue	02-13-2013																																																																																																																																																											
Authorising / issuing agency	Council of Standards Australia			Fuel Applicability	All Fuels										Next Issue																																																																																																																																																												
Sector Applicability	Self Propelled Trucks		Geographical coverage	AUS	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers																																																																																																																																																										
Description	<ul style="list-style-type: none"> Specifies requirements for the operation, maintenance, repair and modification of self-propelled industrial trucks and their attachments and gives guidance for the design of workplaces in which they are used Does not apply to tow tractors with capacity greater than 20 kN, manually propelled trucks, rough terrain reach stackers and rough terrain variable reach trucks 			Fueling																																																																																																																																																																							
Onboard Storage																																																																																																																																																																											
Transfer																																																																																																																																																																											
Gasification																																																																																																																																																																											
Consumption																																																																																																																																																																											
Sub System Element				Incl	Comment	Hazards Identified																																																																																																																																																																					
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)				Type	<table border="1"> <tr> <td colspan="4">Fuelling Facilities & Operations</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="4">Fuel Systems & Tanks</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>– AS 1055, Acoustics – Description and measurement of noise</td> <td>Std.</td> <td>Maintenance equip & procedures</td> <td></td> <td>✓</td> <td>Basic maintenance of trucks</td> <td colspan="2">Exhaust asphyxiation, fire, fuel spills</td> </tr> <tr> <td>– AS 1657, Fixed platforms, walkways, stairways and ladders</td> <td>Std.</td> <td rowspan="2">Safe Practices</td> <td></td> <td>✓</td> <td>General safety requirements for operation</td> <td colspan="2">Overload, collision, training</td> </tr> <tr> <td>– AS 1735, Lifts, escalators and moving walks</td> <td>Std.</td> <td></td> <td></td> <td></td> <td colspan="2"></td> </tr> <tr> <td>– AS 2402, Traction batteries – Lead Acid</td> <td>Std.</td> <td rowspan="2">Emergency equip & procedures</td> <td></td> <td></td> <td></td> <td colspan="2"></td> </tr> <tr> <td>– AS 2550, Cranes, hoists and winches</td> <td>Std.</td> <td></td> <td></td> <td></td> <td colspan="2"></td> </tr> <tr> <td>– AS 2746, Working areas for gas-fuelled vehicles</td> <td>Std.</td> <td rowspan="2">Environmental issues</td> <td></td> <td></td> <td></td> <td colspan="2"></td> </tr> <tr> <td>– AS 3713, Acoustics – Industrial trucks</td> <td>Std.</td> <td></td> <td></td> <td></td> <td colspan="2"></td> </tr> <tr> <td>– AS 4564, Specs for general purpose natural gas</td> <td>Std.</td> <td colspan="6">Key take-outs / best practice</td> </tr> <tr> <td>– AS 4983, Gas fuel systems for forklifts and industrial engines</td> <td>Std.</td> <td colspan="6"> <ul style="list-style-type: none"> General safety practices for operation and marking of trucks, training their operators and maintenance procedures Safety related to refueling discussed briefly </td> </tr> <tr> <td>– AS/ NZS 1269, Occupational noise management</td> <td>Std.</td> <td colspan="6"></td> </tr> <tr> <td>– AS/ NZS 1596, Storage and handling of LP gas</td> <td>Std.</td> <td colspan="6"></td> </tr> <tr> <td>– AS/ NZS 1680, Interior lighting</td> <td>Std.</td> <td colspan="6"></td> </tr> <tr> <td>– AS/ NZS 1891, Industrial fall-arrest systems and devices</td> <td>Std.</td> <td colspan="6"></td> </tr> <tr> <td>– AS/ NZS 60079, Explosive atmospheres</td> <td>Std.</td> <td colspan="6"></td> </tr> <tr> <td>– ISO 10525, Counterbalanced trucks handling freight containers >= 6m length</td> <td>Std.</td> <td colspan="6"></td> </tr> </table>													Fuelling Facilities & Operations																		Fuel Systems & Tanks																			– AS 1055, Acoustics – Description and measurement of noise	Std.	Maintenance equip & procedures		✓	Basic maintenance of trucks	Exhaust asphyxiation, fire, fuel spills		– AS 1657, Fixed platforms, walkways, stairways and ladders	Std.	Safe Practices		✓	General safety requirements for operation	Overload, collision, training		– AS 1735, Lifts, escalators and moving walks	Std.						– AS 2402, Traction batteries – Lead Acid	Std.	Emergency equip & procedures						– AS 2550, Cranes, hoists and winches	Std.						– AS 2746, Working areas for gas-fuelled vehicles	Std.	Environmental issues						– AS 3713, Acoustics – Industrial trucks	Std.						– AS 4564, Specs for general purpose natural gas	Std.	Key take-outs / best practice						– AS 4983, Gas fuel systems for forklifts and industrial engines	Std.	<ul style="list-style-type: none"> General safety practices for operation and marking of trucks, training their operators and maintenance procedures Safety related to refueling discussed briefly 						– AS/ NZS 1269, Occupational noise management	Std.							– AS/ NZS 1596, Storage and handling of LP gas	Std.							– AS/ NZS 1680, Interior lighting	Std.							– AS/ NZS 1891, Industrial fall-arrest systems and devices	Std.							– AS/ NZS 60079, Explosive atmospheres	Std.							– ISO 10525, Counterbalanced trucks handling freight containers >= 6m length	Std.						
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AS/ NZS 2739 – Natural Gas Fuel Systems for Vehicle Engines

Name	Natural Gas Fuel Systems for Vehicle Engines			Code	AS/ NZS 2739							Date of Issue	03-16-2009							
Authorising / issuing agency	Council of Standards Australia/ Council of Standards New Zealand			Fuel Applicability	CNG/ LNG							Next Issue								
Sector Applicability	On road vehicles	Geographical coverage	AUS/ NZ	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description	<ul style="list-style-type: none"> Specifies requirements for NG fuel systems for engines mounted on motor vehicles, either for propulsion or for auxiliary functions Requirements for design and construction of component parts and for their installation in vehicles, and for tests, commissioning and periodic inspection Applies to all vehicle types – rigid/ articulated chassis and semi trailers Does not cover areas where major structural modifications are to be carried out to the vehicle Does not apply to NG usage for the gas supply system for appliances in vehicles or mobile appliances or for the propulsion of marine craft 			Fueling																
Onboard Storage				●	◐	◐	●	◐	◐						●					
Transfer				●	◐	◐	●	○					●							
Gasification				●	◐	◐	●					◐							◐	
Consumption				●	◐	◐	●	○	◐					◐						
Sub System Element				Incl	Comment	Hazards Identified														
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)				Type	Fuelling Facilities & Operations															
<ul style="list-style-type: none"> AS 1210, Pressure Vessels AS 2337, Gas cylinder test stations AS 2473, 2613 – Components for compressed gas cylinders AS 4564, Specs for general purpose natural gas AS 4732, 4983 - Gas fuel systems AS 4838, ISO 11439 - Gas cylinders – On board storage of NG AS MP48, Certificated gas cylinder test stations AS/ NZS 1869, Hose and hose assemblies for LPG, NG and Town Gas ISO 527, Plastics – Determination of tensile properties ISO 14469, Road vehicles – CNG refueling connector ISO 15500, Road vehicles – CNG fuel system components ISO 19078, Gas cylinders – Inspection of cylinder installation ADR 30/01, 37/01, 70/00, 79/00-02, 80/00-01 – Aus Rules for emission control New Zealand Transport Agency, Vehicle Inspection Requirements AG 805, 807 – Approval requirements for NGV components 				Std.	Fuel Systems & Tanks			✓	Detailed design for container & components			Collision, leakage, strength, over-pressurization								
				Std.	Maintenance equip & procedures															
				Std.	Safe Practices			✓	Safety, inspection, marking and labelling			Leakage, damage, spillage, defects								
				Std.	Emergency equip & procedures															
				Std.	Environmental issues															
				Std.	Key take-outs / best practice															
Std.																				
Reg.																				
Reg.																				
Reg.																				

AS 2746 – Working Areas for Gas-Fuelled Vehicles

Name	Working Areas for Gas-Fuelled Vehicles			Code	AS 2746										Date of Issue	10-21-2008			
Authorising / issuing agency	Council of Standards Australia			Fuel Applicability	CNG/ LNG/ LPG										Next Issue				
Sector Applicability	All vehicles	Geographical coverage	AUS	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Requirements for the premises and procedures for the following types of work or activity associated with gas-fuelled vehicles <ul style="list-style-type: none"> Converting and equipping vehicles to use gas as an engine fuel Maintenance, servicing and repairs to the gas fuel system Routine motor vehicle maintenance not involving the gas fuel system Provide constructors, installers, servicing personnel and regulators with the requirements for working areas for gas-fuelled vehicles in order to ensure work on the vehicles is carried out in a safe manner 			Fueling															
Onboard Storage																			
Transfer				General Requirements for maintenance facilities including fire safety and protection															
Gasification																			
Consumption																			
Sub System Element				Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																			
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																	
– AS 1210, Pressure Vessels	Std.	Maintenance equip & procedures	✓	Maintenance facilities for NGVs	Leakage, fire, ignition, asphyxiation														
– AS 1668, Use of ventilation and air conditioning in buildings	Std.																		
– AS 2337, Gas cylinder test stations	Std.																		
– AS 4332, Storage and handling of gases in cylinders	Std.	Safe Practices	✓	Special focus on fire safety & safety methods															
– AS/ NZS 1425, LPG fuel systems for vehicle engines	Std.																		
– AS/ NZS 1596, Storage and handling of LPG	Std.	Emergency equip & procedures	✓	Emergency scenarios for gas vehicles	Sparks, leaks, fire, asphyxiation														
– AS/ NZS 1869, Hose and hose assemblies for LPG, NG and Town Gas	Std.																		
– AS/ NZS 2430, Classification of hazardous areas	Std.	Environmental issues																	
– AS/ NZS 2739, NG fuel systems for vehicle engines	Std.																		
– AS/ NZS 60079, Electrical apparatus for explosive gas atmospheres	Std.																		
– ISO 15500, Road vehicles – CNG fuel system components	Std.																		
– ISO 21012, Cryogenic vessels - Hoses	Std.																		
– AG 807 – Approval requirements for NG hose and hose assemblies	Reg.																		
– ASME Boiler Pressure Vessel code	Code																		
– UN ECE R110, Components of motor vehicles using CNG propulsion	Reg.																		
Key take-outs / best practice				<ul style="list-style-type: none"> Guide about design and construction of gas vehicle maintenance facilities with special consideration to safety equipment and safe practices including fire safety Appendix also discusses emergency response scenarios for CNG/ LNG/ LPG vehicles 															

Source: Ricardo assessment

AS 2809 – Road Tank Vehicles for Dangerous Goods – Part 1 – General Requirements

Name	Road Tank Vehicles for Dangerous Goods – General Requirements			Code	AS 2809.1							Date of Issue	09-05-1999							
Authorising / issuing agency	Council of Standards Australia			Fuel Applicability	All Fuels							Next Issue								
Sector Applicability	All road vehicles		Geographical coverage	AUS	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> General requirements for design, construction, testing, maintenance and inspection that are common to all road tank vehicles intended for road transportation of dangerous goods For vehicles that are designed and constructed specifically as road tank vehicles and for conventional vehicles that are provided with transportable tanks To provide designers, planners, operators and regulators with technical requirements for road tank vehicles transporting dangerous goods 			Fueling																
Onboard Storage				○	○	○	○	○	○						◐					
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Main focus on tank and related fittings																
<ul style="list-style-type: none"> AS 1678, Emergency procedure guide – Transport AS 1850, Portable fire extinguishers – Classification, rating and performance AS 2030, Verification, filling, inspection, testing and maintenance of cylinders AS 2174, Articulated vehicles – Mechanical coupling between prime movers AS 2809, Road tank vehicles for dangerous goods AS/ NZS 1841, Portable fire extinguishers HB 76, Dangerous goods – Initial emergency response guide Australian code for the transport of dangerous goods by road and rail Guide to heavy vehicle suspension systems and acceptable axle loads for road tank vehicles Australian design rules for motor vehicles and trailers Regulations on axle loads and load sharing NFPA 325M, Fire hazard properties of flammable liquids and gases 	Std.	Maintenance equip & procedures																		
	Std.	Safe Practices	✓	Safety practices and guidelines				Collision, overturning, spill, leakage, fire, ignition												
	Std.	Emergency equip & procedures																		
	Code Reg.	Environmental issues																		
	Reg. Code	Key take-outs / best practice																		
					<ul style="list-style-type: none"> Main focus on safety practices for road tanks and their related accessories No special mention of fuel components 															

AS 2809 – Road Tank Vehicles for Dangerous Goods – Part 2 – Road Tank Vehicles For Flammable Liquids

Name	Road Tank Vehicles for Dangerous Goods – Road Tank Vehicles For Flammable Liquids			Code	AS 2809.2							Date of Issue	05-05-2008							
Authorising / issuing agency	Council of Standards Australia			Fuel Applicability	All Fuels							Next Issue								
Sector Applicability	All road vehicles		Geographical coverage	AUS	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Specifies requirements for design, construction, inspection and testing of road tank vehicles for the transport of flammable liquids Provide designers, planners, operators and regulators with technical requirements for road tank vehicles transporting flammable liquids 			Fueling																
Onboard Storage				●	●		●	●	●						●					
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Main focus on tank and related fittings																
– AS 1210, Pressure vessels	Std.	Maintenance equip & procedures																		
– AS 1940, Storage and handling of flammable and combustible liquids	Std.	Safe Practices	✓	Safety practices and guidelines				Collision, overturning, spill, leakage, fire, ignition												
– AS 2809, Road tank vehicles for dangerous goods	Std.	Emergency equip & procedures																		
– AS 4100, Steel structures	Std.	Environmental issues																		
– AS/ NZS 60079, Electrical apparatus for explosive gas atmospheres	Std.																			
– API 2000, American petroleum institute – Venting atmospheric and low pressure storage tanks	Std.																			
– ADR – Australian Design Rules for motor vehicles and trailers	Reg. Code																			
– ADG Code – Australian code for the transport of dangerous goods	Code																			
Key take-outs / best practice																				
<ul style="list-style-type: none"> Main focus on safety practices for road tanks and their related accessories No special mention of fuel components 																				

AS 2809 – Road Tank Vehicles for Dangerous Goods – Part 6 – Tankers For Cryogenic Liquids

Name	Road Tank Vehicles for Dangerous Goods – Tankers For Cryogenic Liquids			Code	AS 2809.6							Date of Issue	06-24-2001							
Authorising / issuing agency	Council of Standards Australia			Fuel Applicability	All Cryogenic Fuels							Next Issue								
Sector Applicability	All road vehicles		Geographical coverage	AUS	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Specifies requirements for the design and construction of road tankers for the transport of certain listed cryogenic liquids Provides for vehicles which are specifically designed and constructed as road tankers or which are conventional trucks provided with transportable tanks for use as tankers 			Fueling																
Onboard Storage				●	●	●	●	●	●						●			●		
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Main focus on tank and related fittings																
– AS 1210, Pressure vessels	Std.	Maintenance equip & procedures																		
– AS 2430, Classification of hazardous areas	Std.	Safe Practices	✓	Safety practices and guidelines																
– AS 2809, Road tank vehicles for dangerous goods	Std.	Emergency equip & procedures																		
– AS 4041, Pressure piping	Std.	Environmental issues																		
– AS/ NZS 3788, Pressure equipment – In-service inspection	Std.	Key take-outs / best practice																		
– ADG Code – Australian code for the transport of dangerous goods	Code	<ul style="list-style-type: none"> Main focus on safety practices for road tanks for cryogenic liquids and their related accessories and components No special mention of fuel components 																		
– ANSI B31.3, Process piping	Std.																			
– ANSI B31.5, Refrigeration piping	Std.																			
– BS 6755, Testing of valves	Std.																			
– CGA V6, Standard cryogenic liquid transfer connections	Std.																			

AS/ NZS 3788 – Pressure Equipment – In-Service Inspection

Name	Pressure Equipment – In-Service Inspection			Code	AS/ NZS 3788								Date of Issue	07-27-2006					
Authorising / issuing agency	Council of Standards Australia/ Council of Standards New Zealand			Fuel Applicability	All Fuels								Next Issue						
Sector Applicability	All pressurized equipments	Geographical coverage	AUS/ NZ	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Specifies minimum requirements for the inspection, repair and alteration of in-service boilers, pressure vessels, piping, safety equipment and associated safety controls Specifies requirements for initial inspection after installation Information provided on mechanisms of deterioration, assessment of defects and the assessments of fitness for service of pressure equipment Applies to boilers and associated pressure parts, pressure vessels and associated pressure parts, pressure piping, pressurized storage tanks Does not deal with pressurized machines and pipelines 			Fueling															
Onboard Storage																			
Transfer																			
Gasification																			
Consumption																			
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified														
Over 100 referenced documents and other related documents specified in Appendix A		Fuelling Facilities & Operations																	
		Fuel Systems & Tanks																	
		Maintenance equip & procedures																	
		Safe Practices		✓	Inspection procedure and guidelines	Defects, corrosion, leakage, bulging, over pressurization													
		Emergency equip & procedures		✓	Emergency shutdown systems and procedure														
	Environmental issues																		
Key take-outs / best practice																			
<ul style="list-style-type: none"> Detailed safety inspection guidelines, procedures and frequency Special mention for pressure relief devices and piping Appendices mention specific tests and procedures 																			

AS 3961 – The Storage And Handling Of LNG



Name	The Storage And Handling Of LNG			Code	AS 3961							Date of Issue	04-13-2005								
Authorising / issuing agency	Council of Standards Australia			Fuel Applicability	LNG							Next Issue									
Sector Applicability	All uses		Geographical coverage	AUS/ NZ		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Specifies requirements for the design, construction and operation of installations for the storage and handling of LNG Applies to installations of atmospheric tanks for supplying marine tanker terminals and pipeline peaking Applies to pressure tanks, which are usually part of a distribution system for LNG by road tanker Does not apply to design of liquefaction equipment, frozen ground storage techniques or transport of LNG by ship 			Fueling	●	●	○	●	●	●	○	○	●			●					
Onboard Storage				●	●	○	●	●	●							●			●		
Transfer				●	●	○	●	●							○						
Gasification				●	●	○	●			●											●
Consumption																					
Sub System Element				Incl	Comment	Hazards Identified															
Fuelling Facilities & Operations	✓	Component details of storage facilities	Defects, corrosion, leakage, bulging, over pressurization																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type																				
Around 100 referenced documents and other related documents specified in Appendix A	Fuel Systems & Tanks	✓	Component details of storage and handling																		
	Maintenance equip & procedures	✓	Maintenance and inspection procedures																		
	Safe Practices	✓	Fire safety and other safety procedures																		
	Emergency equip & procedures	✓	Special section on fire emergencies	Fire, ignition																	
	Environmental issues																				
Key take-outs / best practice																					
				<ul style="list-style-type: none"> Details about all components for storage and handling of LNG systems Special requirements for valves, safety devices, hose assemblies and pumps and compressors 																	

AS 4041 – Pressure Piping



Name	Pressure Piping			Code	AS 4041							Date of Issue	09-20-2006					
Authorising / issuing agency	Council of Standards Australia			Fuel Applicability	All Fuels							Next Issue						
Sector Applicability	All pressurized equipments	Geographical coverage	AUS	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Minimum requirements for materials, design, fabrication, testing, inspection, reports and pre-commissioning of piping subject to internal pressure or external pressure or both Applies specifically to pressure piping, i.e., piping which may present a significant risk of injury to people, property or the environment Specific requirements for piping constructed of carbon, carbon-manganese, low alloy and high alloy steels, ductile and cast iron, copper, aluminium, nickel, titanium and alloys of these materials Figure 1 lists scope of piping covered by this standard 			Fueling	●	◐		●	●	◐								
Onboard Storage				●	◐		●	●	◐									
Transfer				●	◐		●	●										
Gasification				●	◐		●					◐						
Consumption				●	◐		●	●				◐						
Sub System Element				Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations	✓	All piping including fittings, valves and connectors for use in any pressure equipment	Defects, leakage, corrosion, impact															
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks			✓	connectors for use in any pressure equipment												
Over 300 referenced documents and other related documents specified in Appendix A	Maintenance equip & procedures																	
	Safe Practices				✓	Inspection and testing guidelines			Defects, corrosion, leakage, bulging, over pressurization									
	Emergency equip & procedures																	
	Environmental issues																	
	Key take-outs / best practice																	
<ul style="list-style-type: none"> Detailed design requirements for all pressure piping, valves, connectors and related accessories Discusses relevant inspection and testing methodologies also 																		

AS 4564 – Specification for General Purpose Natural Gas

Name	Specification for General Purpose Natural Gas			Code	AS 4564							Date of Issue	06-09-2011							
Authorising / issuing agency	Council of Standards Australia			Fuel Applicability	CNG/ LNG							Next Issue								
Sector Applicability	All uses		Geographical coverage	AUS	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Specifies requirements for the safe composition, transportation and supply of general purpose natural gas for use in natural gas appliances and equipment and for use as fuel in natural gas vehicles Applies to natural gas that is from petroleum, landfill, biogas, coal seam and other sources for direct or blended supply for commercial use or for use in natural gas appliances and equipment including NGVs, compressors and refuelling facilities 			Fueling																
Onboard Storage																				
Transfer				General Requirements for fuel quality of NG																
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	<ul style="list-style-type: none"> AS 2885, Pipelines – Gas and liquid petroleum AS/ ISO 13443, Natural gas – Standard reference conditions ISO 4259, Petroleum products – Determination and application of precision data in relation to methods of test ISO 5725, Accuracy of measurement methods and results ISO 6326, Natural gas – Sulfur compounds ISO 6327, Gas analysis – Water dew point ISO 6974, 6975, 6976, 10101, 13686 – Natural gas ASTM D1070, Relative density of gaseous fuels ASTM D1072, Total sulfur in fuel gases ASTM D1142, Water vapor content of gaseous fuels 																		
	Std.	Maintenance equip & procedures																		
	Std.	Safe Practices	✓	General fuel quality specs																
	Std.	Emergency equip & procedures																		
	Std.	Environmental issues																		
Key take-outs / best practice				<ul style="list-style-type: none"> Specifications for fuel quality of natural gas. Applicable to all CNG/ LNG applications 																

AS 4983 – Gas Fuel Systems for Forklifts and Industrial Engines

Name	Gas Fuel Systems for Forklifts and Industrial Engines			Code	AS 4983							Date of Issue	01-08-2010							
Authorising / issuing agency	Council of Standards Australia			Fuel Applicability	LPG/ CNG							Next Issue								
Sector Applicability	Industrial equipment	Geographical coverage	AUS	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description	<ul style="list-style-type: none"> Specifies requirements for LPG & CNG fuel systems for engines mounted on industrial equipment, either for propulsion or for driving an auxiliary function Provides requirements for design and construction of component parts and for their installation, tests, commissioning and periodic inspection Does not apply to LPG/ CNG usage in caravans, mobile homes or propulsion of marine craft or passenger or commercial vehicles Does not apply to LNG fuel supply systems Does not cover major structural modifications on the industrial equipment 			Fueling																
Onboard Storage				●	●	○	●	●	●						●					
Transfer				●	●	○	●	●					●							
Gasification				●	●	○	●					○								
Consumption				●	●	○	●	●				○			○					
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	<ul style="list-style-type: none"> Fuel Systems & Tanks ✓ Detailed requirements for all components Corrosion, defect, strength, asphyxiation Maintenance equip & procedures Safe Practices ✓ Requirements for inspection and tests Leakage, corrosion, defects, bulging, over pressurization Emergency equip & procedures Environmental issues 																		
Almost 100 referenced documents and other related documents specified in Appendix A		Key take-outs / best practice																		
		<ul style="list-style-type: none"> Component level requirements for LPG and CNG fuel systems for use on industrial equipment only Requirements for periodic inspection and testing 																		

AS 5092 – CNG Refuelling Stations



Name	CNG Refueling Stations			Code	AS 5092							Date of Issue	10-01-2009						
Authorising / issuing agency	Council of Standards Australia			Fuel Applicability	CNG							Next Issue							
Sector Applicability	All NG vehicles	Geographical coverage	AUS	System/Component	Hoses/Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Specifies requirements for design, construction, operation and maintenance of CNG refuelling stations Applies to fast fill, time fill and a combination of both Does not cover equipment sizing and refuelling performance Does not cover requirements for LNG stations or VRA installations Appendix D contains a checklist for guidance on putting a station into service and during annual safety inspections 			Fueling	●	●	●	●	●	●	●	●	●	●	●	●	●		
Onboard Storage																			
Transfer																			
Gasification																			
Consumption																			
Sub System Element				Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations	✓	Details of all components of refuelling	Over pressurization, ignition, electrical hazard																
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																	
– AS AG 807, Natural gas flexible hose & hose assys > 2.6MPa	Reg. Std.	Maintenance equip & procedures																	
– AS 1329, Bourdon tube pressure and vacuum gauges	Std.	Safe Practices						✓	Installation safety and periodic inspections	Fire, explosion, collision,									
– AS 1674, Safety in welding and allied processes	Std.	Emergency equip & procedures						✓	Based on emergency planning										
– AS 2030, Gas cylinders	Std.	Environmental issues																	
– AS 2473, Valves for compressed gas cylinders	Std.																		
– AS 4041, Pressure piping	Std.																		
– AS 4332, Storage and handling of gases in cylinders	Std.																		
– AS 4564, Specs for general purpose natural gas	Std.																		
– AS 5601, Gas installations	Std.																		
– AS/ NZS 3788, Pressure equipment – In-service inspection	Std.																		
– AS/ NZS 60079, Explosive atmospheres	Std.																		
– ISO 11439, Gas cylinders – HP cylinders on-board storage of NG	Std.																		
– ISO 14469, Road vehicles – CNG refueling connector	Std.																		
– ANSI/ IAS NGV 2, Basic requirements for compressed NGV fuel containers	Code																		
– CSA B51, Boiler, pressure vessel and pressure piping code	Code																		
Key take-outs / best practice		<ul style="list-style-type: none"> Guidelines for all components of CNG refueling stations Checklists for inspection and testing, as well as hot work permits 																	

AS/ NZS 60079 – Explosive Atmospheres – Part 10.1 – Classification of Areas – Explosive Gas Atmospheres

Name	Explosive Atmospheres – Part 10.1 – Classification of Areas – Explosive Gas Atmospheres			Code	AS/ NZS 60079.10.1							Date of Issue	09-18-2009				
Authorising / issuing agency	Council of Standards Australia/ Council of Standards New Zealand			Fuel Applicability	All flammable gases							Next Issue					
Sector Applicability	All uses		Geographical coverage	AUS/ NZ	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers
Description	<ul style="list-style-type: none"> Classification of areas where flammable gas or vapour or mist hazards may arise – used as a basis to support proper selection and installation of equipment for use in a hazardous area Can be applied where there may be an ignition hazard due to the presence of flammable gas or vapour, mixed with air under normal atmospheric conditions Does not apply to mines, manufacture of explosives, hazard due to ignitable dusts or fibres, catastrophic failures beyond the concept of abnormality and domestic premises 			Fueling Onboard Storage Transfer Gasification Consumption		<div style="border: 1px solid black; padding: 5px; text-align: center;"> General Guidelines for classification and safety of explosive gas atmospheres </div>											
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)				Type	Sub System Element	Incl	Comment	Hazards Identified									
<ul style="list-style-type: none"> AS 1940, Storage and handling of flammable and combustible liquids AS 2030, Gas cylinders AS/ NZS 1596, Storage and handling of LP gas AS/ NZS 1668, Ventilation and air-conditioning in buildings AS/ NZS 1677, Refrigerating systems AS/ NZS 2229, Fuel dispensing equipment for explosive atmospheres NZS 5223.1, HP gas and petroleum liquids pipelines – HP gas pipelines AS 5601, NZS 5261 – Gas installation NZS 5425.1, CNG compressors and refueling stations – Site storage & location AS 4645, NZS 5258 – Gas distribution networks AG 901, Code of practice fro NGV refueling stations UK IP 15, Model code of safe practice in the petroleum industry – Part 15 ADG, Aus code for transport of dangerous goods by road & rail New Zealand Hazardous Substances and New Organisms Act IEC 60050-426, International electro techn vocabulary – Eqp for explosive atm. 				Std.	Maintenance equipt & procedures												
				Std.	Safe Practices	✓	General safety and ventilation guide	Fire, explosion, ignition, leakage, asphyxiation									
				Std.	Emergency equipt & procedures												
				Code	Environmental issues												
				Std.	Key take-outs / best practice												
				Code	<ul style="list-style-type: none"> General guidelines only about classification of areas with potentially explosive gas atmospheres Precautions against release of explosive gases 												
				Code													
				Code													
				Reg.													
				Std.													



ADR 44/02 – Australian Design Rule – Specific Purpose Vehicle Requirements



Name	Australian Design Rule – Specific Purpose Vehicle Requirements			Code	ADR 44/02							Date of Issue	04-26-2006					
Authorising / issuing agency	Australian Ministry of Local Government, Territories and Roads			Fuel Applicability	LPG							Next Issue						
Sector Applicability	Special purpose vehicles	Geographical coverage	AUS	System/Component	Hoses/Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Specify requirements for the construction of taxis, tow trucks, pole-type trailers, LPG-fuelled vehicles, emergency vehicles, motorhomes/ caravans and omnibuses Additional design and construction requirements for vehicles as specific purpose vehicles 			Fueling														
Onboard Storage																		
Transfer																		
Gasification																		
Consumption																		
Sub System Element				Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations																		
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Reference to AS standards														
<ul style="list-style-type: none"> AS 1425, Automotive LPG code AS 3509, LPG fuel vessels for automotive use Australian LPG Association, Code Governing the Installation in Caravans of Liquefied Petroleum Gas Equipment and Appliances 	Std. Std. Code	Maintenance equip & procedures																
		Safe Practices	✓	General safety guidelines only														
		Emergency equip & procedures																
		Environmental issues																
Key take-outs / best practice																		
<ul style="list-style-type: none"> Specific mention for LPG fuel system design – referred to AS standards for more information Basic safety guidelines only for vehicles 																		



Rail Safety National Law of 2012



Name	Rail Safety National Law of 2012			Code												Date of Issue	01-20-2013			
Authorising / issuing agency	Parliament of South Australia			Fuel Applicability	All Fuels											Next Issue				
Sector Applicability	Railroads	Geographical coverage	AUS	System/Component	Hoses/Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description	<ul style="list-style-type: none"> To provide for safe railway operations in Australia To establish the Office of the National Rail Safety Regulator. To make provision for the appointment, functions and powers of the National Rail Safety Regulator To assist rail transport operators to achieve productivity by the provision of a national scheme for rail safety To operate the national scheme in a timely, transparent, accountable, efficient, effective, consistent and fair way 			Fueling																
Onboard Storage																				
Transfer				Basic Safety and Regulatory guidelines only																
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type																			
None Cited		Maintenance equip & procedures																		
		Safe Practices	✓	Safety guidelines and regulations																
		Emergency equip & procedures	✓	Discusses emergency procedures and hazard analysis																
		Environmental issues																		
Key take-outs / best practice																				
				<ul style="list-style-type: none"> No specific information about fuel systems and components Provides safety, emergency and regulatory framework for safe operations of all railways 																



Dangerous Goods Act



Name	Dangerous Goods Act			Code		Date of Issue	06-30-1985													
Authorising / issuing agency	Parliament of Victoria			Fuel Applicability	All Fuels				Next Issue											
Sector Applicability	All Uses	Geographical coverage	AUS	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description	<ul style="list-style-type: none"> To promote the safety of persons and property in relation to the manufacture, storage, transfer, transport, sale, purchase and use of dangerous goods and the import of explosives To ensure that adequate precautions are taken against certain fires, explosives, leakages and spillages of dangerous goods and that when they occur, they are reported to the emergency services and the inspectors without delay Does not apply to radioactive substances, pathogenic microbes, explosive substances covered in the Mines Act and dangerous goods under the control of harbour s, port authority, aircraft or pipelines 			Fueling																
				Onboard Storage																
				Transfer			Basic Safety and Regulatory guidelines only													
				Gasification																
				Consumption																
							Sub System Element	Incl	Comment	Hazards Identified										
				Fuelling Facilities & Operations																
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type																			
None Cited	Fuel Systems & Tanks																			
	Maintenance equip & procedures																			
	Safe Practices		✓	General safety guidelines only	Fire, theft, spillage, leakage															
	Emergency equip & procedures																			
	Environmental issues																			
	Key take-outs / best practice																			
	<ul style="list-style-type: none"> Discusses basic safety and regulatory guidelines only pertaining to the use and handling of dangerous goods. No information for fuel systems. 																			

NCOP 9 – Light Vehicle Construction and Modification (VSB 14)

Name	Light Vehicle Construction and Modification (VSB 14)			Code	NCOP 9							Date of Issue	01-01-2011								
Authorising / issuing agency	Vehicle Safety Standards			Fuel Applicability	All Fuels							Next Issue									
Sector Applicability	All Uses		Geographical coverage	AUS	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description	<ul style="list-style-type: none"> • Outlines the minimum design, installation and fabrication requirements for light vehicle modifications involving fuel systems • Following modifications are covered – Fitting an additional or replacement fuel tank and associated components, fitting a surge tank or installing LPG or NG fuel systems • Following modifications are excluded – fitting replacement fuel lines, additional fuel filters, alternative fuel pumps or manufacturer's optional fuel system 			Fueling																	
Onboard Storage																					
Transfer																					
Gasification																					
Consumption																					
Sub System Element				Incl	Comment	Hazards Identified															
Fuelling Facilities & Operations																					
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks		✓	Regulation to refer to appropriate standards																
None Cited	Maintenance equip & procedures																				
	Safe Practices	✓	Checklist for modifications																		
	Emergency equip & procedures																				
	Environmental issues																				
	Key take-outs / best practice				<ul style="list-style-type: none"> • Regulatory guidelines for modifying an OEM fuel system into NG or LPG systems • Contains checklist and references to applicable standards 																

- Sample Summary Sheet
- Review of Codes, Standards, and Regulations
- **Appendices For Detailed Summaries**
 - United States
 - International Organization of Standardization (ISO)
 - Germany
 - Australia
 - **Japan**

KHKS 0124: High Pressure Gas Cylinders Valve Design and Construction Standard

Name	High Pressure Gas Cylinders Valve Design and Construction Standard			Code	KHKS 0124							Date of Issue							
Authorising / issuing agency	High Pressure Gas Safety Institute			Fuel Applicability	All Compressed Gases							Next Issue							
Sector Applicability	All Uses	Geographical coverage	Japan	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Design – material must comply with ISO 11114-1 and 2. Non-metallic material must comply with ISO 15001 Connection of valves to gas cylinder must comply with ISO 10920, ISO 11116-1, ISO15245, JIS B8246, and the mouth with ISO407, ISO 5145, ISO 10692, JIS B8246 Testing procedures are described 			Fuelling		●													
Onboard Storage																			
Transfer																			
Gasification																			
Consumption																			
Sub System Element				Incl	Comment	Hazards Identified													
Fuelling Facilities & Operations																			
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Fuel Systems & Tanks		✓	Design and construction	Pressure, Oxygen													
<ul style="list-style-type: none"> High Pressure Gas Safety Act, Article 48, Section 1-3 JIS B 8241:1996 High Pressure Gas Steel Cylinder without Net JIS B 8246:2004 High Pressure Gas Cylinder Valve ISO 407:2004 - ISO 5145:2008 -ISO 10156:2010 ISO 10692-1(2001) - ISO 10920 (1997) -ISO 11114-1(2012) ISO 11114-2(2013) –ISO 11116-1 (1999) –ISO 11117 (2008) ISO 13341 (1997) - ISO 15001 (2010) - ISO 15245 (2001) 	Reg. Std.	Maintenance equip & procedures																	
	Std.	Safe Practices																	
	Std.	Emergency equip & procedures																	
	Std.	Environmental issues																	
	Std.	Key take-outs / best practice																	
																	<ul style="list-style-type: none"> Oxidizing lubricant must not be used and prevent adiabatic compression according to ISO 10156 Follow procedures of proto type testing No significant revision except for typographical clean up 		

KHKS 0150: High Pressure Gas Tank Lorry Re-testing Standard



Name	High Pressure Gas Tank Lorry Re-testing Standard			Code	KHKS 0150							Date of Issue	2007					
Authorising / issuing agency	High Pressure Gas Safety Institute			Fuel Applicability	LPG							Next Issue						
Sector Applicability	High Pressure Gas transporting vehicle Cylinder	Geographical coverage	Japan	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Re-testing of cylinders, accessories, voluntary routine, and preliminary testing of equipment and accessories must be performed in accordance with the description here by the testing facility that is permitted by the governor of the respective prefecture 			Fuelling														
Onboard Storage																		
Transfer						●			●									
Gasification																		
Consumption																		
Sub System Element				Incl	Comment	Hazards Identified												
Fuelling Facilities & Operations																		
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Fuel Systems & Tanks																
– JIS B 7518:1993 Depth Gauge	Std.	Maintenance equip & procedures																
– JIS B 7507:1993 Venire calipers	Std.	Safe Practices			✓	Re-testing												
– JIS B 7516: 1987 Metallic Rules	Std.	Emergency equip & procedures																
– JIS G 0565:1992 Magnetic Particle examination and classification	Std.	Environmental issues																
– JIS Z 2343-4 :2001 Non-destructive Testing 4	Std.	Key take-outs / best practice																
– JIS Z4606: 1995 Industrial X ray	Std.	<ul style="list-style-type: none"> Requirement for testing facility Required testing items and procedures in detail 																
– JIS B 7505: 1999 Bourdon Tube pressure measure	Std.																	
– JIS Z 2343-1: 2001 Non-destructive Testing 1	Std.																	
– JIS Z 3104: 1995 Steel Welding connection x ray test	Std.																	
– JIS D 1601: 1990 Vehicle parts vibration test	Std.																	
– JIS K 6347: 1995 LP Gas hose	Std.																	

Std.

KHKS 0501: LP Gas Bulk Supply Standard (Industrial)

Revision Proposal

Name	LP Gas Bulk Supply Standard (Industrial) Revision Proposal			Code	KHKS 0501							Date of Issue						
Authorising / issuing agency	METI			Fuel Applicability	LPG							Next Issue						
Sector Applicability	Industrial, Agricultural	Geographical coverage	Japan	System/Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Need to use evaporator that controls the pressure inside of gasification pipe to be 1MPa or larger. If the receiver's evaporator that controls the pressure to less than 1MPa, it needs to be certified by the High Pressure Gas Safety Institute Must not fuel LP gas directly from movable production equipment to the cylinder installed in vehicles Movable Production equipment needs to comply with Exhibit A and B LP Gas storage needs to comply with Exhibit C and G Person in charge of Safety needs to maintain storage and perform in accordance with Exhibit H and J Sellers and Transporters need to comply with Exhibit I 			Fueling						●	●	●						
Onboard Storage				○	○	●												
Transfer																		
Gasification				●		○												
Consumption																		
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Sub System Element	Incl	Comment	Hazards Identified													
		Fuelling Facilities & Operations	✓	Bulk Lorry, Pump, Compressor	Malfunction													
		Fuel Systems & Tanks																
	Std.	Maintenance equip & procedures	✓	Person in Charge														
	Std.	Safe Practices	✓	Location, inspection and tests	Natural disaster, Fire													
	Std.	Emergency equip & procedures	✓	Shut off equipment														
	Std.	Environmental issues																
		Key take-outs / best practice																
				<ul style="list-style-type: none"> Bulk Lorry to supply both industrial and consumers shall obtain movable production equipment and fuelling equipment permit 														

KHKS 0739: Technical Standard concerning Liquefied Petroleum Gas Law Enforcement Regulations

Name	Technical Standard concerning Liquefied Petroleum Gas Law Enforcement Regulations			Code	KHKS 0739							Date of Issue	March 2003							
Authorising / issuing agency	High Pressure Gas Safety Institute of Japan			Fuel Applicability	LPG							Next Issue								
Sector Applicability	All Uses		Geographical coverage	Japan		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> Underground pipes-corrosion-detecting instrument must comply with described specification Level gauge to display measurements using electronic parts must comply with the standard described in addition to the notification by MITI 			Fuelling									●							
Onboard Storage																				
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Fuel Systems & Tanks																		
– Notification No. 127 by Ministry of International Trade and Industry (March 17, 1997) Article 4.1-7	Reg.	Maintenance equip & procedures		✓	Measuring instrument															
		Safe Practices		✓	Level Gauge															
		Emergency equip & procedures																		
		Environmental issues																		
	Key take-outs / best practice																			
						<ul style="list-style-type: none"> Additional standard in accordance to MITI notification 														

KHKS 0744: LP Gas Bulk Fueling Procedure Standard (Draft)

Name	LP Gas Bulk Fueling Procedure Standard (Draft)			Code	KHKS 0744							Date of Issue	2007							
Authorising / issuing agency	High Pressure Gas Safety Institute of Japan			Fuel Applicability	LPG							Next Issue								
Sector Applicability	Fuelling Business Operator		Geographical coverage	Japan		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers		
Description	<ul style="list-style-type: none"> In order to secure safety during fuelling work, the operator must comply items described herein in accordance with LP Gas Act Fuelling operator must maintain the facility in compliance with the technical standard of LP Gas Act, Article 64 Fuelling operator must have all personnel who performs the fuelling work complete the training concerning knowledge and technique at a facility certified by High Pressure Gas Safety Institute or Minister of Economy and Industry 			Fuelling	●															
Onboard Storage																				
Transfer																				
Gasification																				
Consumption																				
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations				✓		Valve is turned on when the container is empty.														
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	Fuel Systems & Tanks																		
<ul style="list-style-type: none"> LP Gas Act, Article 64 LP Gas enforcement regulations , Article 19, Section 3 – RO LP Gas enforcement regulations, Article 34, Section 1- 18- HA LP Gas Act, Article 27, Section1-1 LP Gas enforcement regulations 36 LP Gas Act, Article 37-4 Section 2 	Reg.	Maintenance equip & procedures	✓	Repair and Cleaning																
	Reg.	Safe Practices	✓	Recording																
	Reg.	Emergency equip & procedures	✓	Leak procedure	Leak, fire, earthquake, car accident															
	Reg.	Environmental issues																		
	Reg.	Key take-outs / best practice																		
<ul style="list-style-type: none"> Safety procedures for bulk fuelling Case study concerning leak accident and future prevention 																				

KHKS 0850-1: Safety Inspection Standard for 7 standards revised by High Pressure Gas Safety Institute of Japan

Name	Safety Inspection Standard for 7 standards revised by High Pressure Gas Safety Institute of Japan			Code	KHKS 0850-1							Date of Issue	10-14-2011								
Authorising / issuing agency	Advisory Committee for Natural Resources and Energy, High Pressure Gas and Explosive Safety Committee, Safety Inspection Standard Examination Sub-committee			Fuel Applicability	LPG							Next Issue									
Sector Applicability	All Uses		Geographical coverage	Japan		System/Component	Hoses/Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> The new standard includes the inspection method according to the technical standard provision. It clarifies the technical standard and the inspection method according to the general high-pressure gas safety regulation, the LP gas safety regulation, and the complex safety regulation 			Fueling																	
Onboard Storage																					
Transfer																					
Gasification																					
Consumption																					
Sub System Element				Incl	Comment	Hazards Identified															
Fuelling Facilities & Operations																					
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	<ul style="list-style-type: none"> – KHKS0850-1(2011) Safety Inspection Standard (Related to General High Pressure Gas Safety Regulation (Except for Gas Station and Cold Evaporator) – KHKS0850-2(2011) Safety Inspection Standard (Related to LP Gas Safety Regulation Except for Gas Station) – KHKS0850-3(2011) Safety Inspection Standard (Related to Industrial Complex Safety Regulations (Except for Gas Station) – KHKS0850-4(2011) Safety Inspection Standard (Related to Refrigeration Safety Regulations) – KHKS0850-5(2011) Safety Inspection Standard (Related to Natural Gas Station) – KHKS0850-6(2011) Safety Inspection Standard (Related to LP Gas Station) – KHK/KLKS0850-7(2011) Safety Inspection Standard (Related to LNG Reception Base) 																			
	Std.	Maintenance equip & procedures																			
	Std.	Safe Practices		✓	Inspection requirements																
	Std.	Emergency equip & procedures																			
	Std.	Environmental issues																			
Key take-outs / best practice		<ul style="list-style-type: none"> The new safety inspection standard is recommended following the evaluation 																			

KHKS 0850-5: Safety Inspection Standard (Natural Gas Station) – LP Gas Bulk Supply

Name	LP Gas Bulk Supply Standard (Industrial) Revision Proposal			Code	KHKS 0850-5							Date of Issue	06-23-2011								
Authorising / issuing agency	High Pressure Gas Safety Institute of Japan			Fuel Applicability	Natural Gas							Next Issue									
Sector Applicability	All Uses		Geographical coverage	Japan		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Inspection must confirm the compliance in the record of the examination according to the description in Method II In case this method is not applicable and Article 99 of the General Safety Regulation or Article 54 of the Industrial Complex Safety Regulation established by the ministry of Economy, Trade and Industry applies, the METI rules shall supersede Pressure resistance test must not be performed in safety inspections. In addition, visual and non-destructive tests for the interior of the equipment must not be performed 			Fuelling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>				<input type="radio"/>										
Onboard Storage				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>															
Transfer																					
Gasification																					
Consumption																					
Subsystem Element				Incl	Comments	Hazards Identified															
Fuelling Facilities & Operations	<input checked="" type="checkbox"/>	Boundary, Signs, Layout, Proximity to fire	Fire																		
Fuel Systems & Tanks	<input checked="" type="checkbox"/>	Underground tank	Temperature, earthquake, leak, sinking																		
Maintenance equip & procedures																					
Safe Practices	<input checked="" type="checkbox"/>	Inspection and tests																			
Emergency equip & procedures	<input checked="" type="checkbox"/>	Shut off equipment																			
Environmental issues																					
Key Takeouts / Best Practices																					
				<ul style="list-style-type: none"> Pressure resistance test shall not be performed Visual inspection to detect corrosion, swelling or fracture is important 																	
Statues, Regulation & Standards referenced in the document (blue highlight refers to documents covered in this report)	Type	<ul style="list-style-type: none"> General High Pressure Gas Safety Regulations Article 7 Industrial Complex Safety Regulations Article 7 KHKS 0850-5 																			
	Reg. Std.																				

JASO E203: Compressed Natural Gas Vehicles – Refuelling Connectors



Name	Compressed Natural Gas Vehicles – Refuelling Connectors			Code	JASO E203								Date of Issue	2005							
Authorising / issuing agency	Japanese Automobile Standards			Fuel Applicability	CNG								Next Issue								
Sector Applicability	All Vehicles		Geographical coverage	JP	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description	<ul style="list-style-type: none"> Specifies receptacles for CNG vehicles with maximum filling pressure of 20 MPa and 24.8 MPa (gauge pressure) 			Fueling																	
Onboard Storage					●		●	●													
Transfer																					
Gasification																					
Consumption																					
Sub System Element				Incl	Comment	Hazards Identified															
Fuelling Facilities & Operations																					
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks		✓	All components for fuelling receptacle			Leakage, strength, corrosion, temperature, ignition, fire													
– JIS B 0100, Glossary of terms for valves	Std.	Maintenance equip & procedures																			
– JIS B 0116, Glossary of terms for packings and gaskets	Std.	Safe Practices		✓	Marking and performance tests																
– JIS B 0142, Glossary of terms for oil hydraulics and pneumatics	Std.	Emergency equip & procedures																			
– JIS K 2001, Industrial liquid lubricants – ISO viscosity classification	Std.	Environmental issues																			
– JIS K 6253, K 6257 – Rubber vulcanized or thermoplastic	Std.																				
– JIS K 8085, Ammonia solution (reagent)	Std.																				
– JIS R 6111, Artificial abrasives	Std.																				
– JIS Z 2329, Methods for bubble leak testing	Std.																				
– JIS Z 2371, Methods for salt spray testing	Std.																				
– ANSI/AGA CGA NGV 1, Compressed NGV fuelling connection	Std.																				
– ASTM B154, Standard test method for mercurous nitrate test	Std.																				
– SAE AS 568A, Aerospace size standard for o-rings	Std.																				
Key take-outs / best practice		<ul style="list-style-type: none"> Detailed design, material and performance requirements for all components of receptacles including valves and connectors Testing and marking requirements also specified 																			

JASO E204: Compressed Natural Gas Vehicles – Pressure Relief Devices for CNG Cylinders - Performance

Name	Compressed Natural Gas Vehicles – Pressure Relief Devices for CNG Cylinders – Performance			Code	JASO E204							Date of Issue	2002								
Authorising / issuing agency	Japanese Automobile Standards			Fuel Applicability	CNG							Next Issue									
Sector Applicability	All Vehicles		Geographical coverage	JP	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers				
Description	<ul style="list-style-type: none"> Applicable to pressure relief devices for CNG cylinders rated at the maximum charging pressure of 20 MPa designed for fuel apparatuses used in compressed NGVs When applied to even pressure devices the test pressure shall be multiplied by the value that is obtained by dividing the maximum charging pressure MPa by 20 			Fueling																	
Onboard Storage					●		●	●	●												
Transfer																					
Gasification																					
Consumption																					
Sub System Element				Incl	Comment	Hazards Identified															
Fuelling Facilities & Operations																					
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Explanatory notes on PRD components			Corrosion, ignition														
<ul style="list-style-type: none"> JIS K6257, Accelerated ageing test for vulcanized rubber JIS K6258, Test for effects of liquids on vulcanized rubber JIS Z 2371, Methods of neutral salt spray testing JIS D1601, Vibration testing for automobile parts 	Std.	Maintenance equip & procedures																			
	Std.	Safe Practices	✓	Key focus on performance reqs			Over pressurization, strength, corrosion, heat														
	Std.	Emergency equip & procedures																			
	Std.	Environmental issues																			
	Key take-outs / best practice				<ul style="list-style-type: none"> Key focus of standard is on performance requirements and testing Explanatory notes (appendix) explains PRD components in more detail 																

JASO E205: Compressed Natural Gas Vehicles – Opening and Shutting Valves – Performance Requirements



Name	Compressed Natural Gas Vehicles – Opening and Shutting Valves – Performance Requirements			Code	JASO E205								Date of Issue	2003						
Authorising / issuing agency	Japanese Automobile Standards			Fuel Applicability	CNG								Next Issue							
Sector Applicability	All Vehicles		Geographical coverage	JP	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Specifies a fill valve, check valve, fuel tank main valve, electric fuel tank main valve and main stop valve which are to be attached to a fuel system for a compressed NGV with a maximum filling pressure of 20 MPa Assumed that these valves are attached outside of an engine compartment and on the upstream side of a pressure reducing valve 			Fueling																
Onboard Storage					●															
Transfer					●															
Gasification					●															
Consumption					●															
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks	✓	Overview of basic requirements																
<ul style="list-style-type: none"> JIS D 1601, Vibration testing for automobile parts JIS K 6257, Accelerated ageing test for vulcanized rubber JIS Z 2371, Methods of neutral salt spray testing JASO D 001, General rules of environmental testing methods for automotive electronic equipment JASO D 005, General rules of test methods for solenoid of automobiles 	Std.	Maintenance equip & procedures																		
	Std.	Safe Practices	✓	Key focus on performance reqs				Over pressurization, strength, corrosion, heat												
	Std.	Emergency equip & procedures																		
	Std.	Environmental issues																		
	Key take-outs / best practice																			
<ul style="list-style-type: none"> Key focus of standard is on performance requirements and testing Brief overview of basic structural requirements 																				

JASO E207: Compressed Natural Gas Vehicles – Tube Fittings and Tubing – Performance Requirements

Name	Compressed Natural Gas Vehicles – Tube Fittings and Tubing – Performance Requirements			Code	JASO E207								Date of Issue	2006						
Authorising / issuing agency	Japanese Automobile Standards			Fuel Applicability	CNG								Next Issue							
Sector Applicability	All Vehicles		Geographical coverage	JP	System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> Specifies tube fittings and tubings that are used in fuel supply lines for compressed NGV with maximum filling pressures of 20 MPa and 24.8 MPa Carbon steel pipes used in high-pressure tubings are excluded 			Fueling																
Onboard Storage				●			●													
Transfer				●			●													
Gasification				●			●													
Consumption				●			●													
Sub System Element				Incl	Comment	Hazards Identified														
Fuelling Facilities & Operations																				
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	<ul style="list-style-type: none"> JASO Z202, Automotive parts – Pipe fittings – Glossary JIS D 1601, Vibration testing for automobile parts JIS K 6257, Accelerated ageing test for vulcanized rubber JIS Z 2329, Methods for bubble leak testing JIS Z 2371, Methods of neutral salt spray testing ASTM B117-95, Standard practice for operating salt spray fog ASTM F1387, Specs for performance of piping and tubing mechanically attached fittings 																		
	Std.	Maintenance equip & procedures																		
	Std.	Safe Practices	✓	Key focus on performance reqs	Over pressurization, strength, corrosion, heat															
	Std.	Emergency equip & procedures																		
	Std.	Environmental issues																		
Key take-outs / best practice																				
<ul style="list-style-type: none"> Key focus of standard is on performance requirements and testing Brief overview of basic requirements for all tubings and tube fittings in the fuel system are discussed in explanatory notes 																				



Act No. 186: Fire Service Act



Name	Fire Service Act			Code	Act No. 186				Date of Issue	2007											
Authorising / issuing agency	The Government of Japan			Fuel Applicability	All Fuels				Next Issue												
Sector Applicability	All Uses		Geographical coverage	US		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description				Fueling																	
<ul style="list-style-type: none"> To prevent and suppress fires and to reduce the damage arising from fires or disasters such as earthquakes Governs the Hazardous Materials Safety Techniques Association (KHK) to conduct the examination of an outdoor tank storage facility and to conduct tests, investigations and provide technical assistance concerning the safety of storage, handling or transportation of hazardous materials or designated flammable goods Governs the Japan Fire Equipment Inspection Institute to conduct a test and lot inspection of a machine or tool used for fire defense 				Onboard Storage																	
				Transfer																	
				Gasification																	
				Consumption																	
				Sub System Element	Incl	Comment		Hazards Identified													
Fuelling Facilities & Operations																					
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																			
None Cited		Maintenance equip & procedures																			
		Safe Practices		✓	General fire safety, marking and inspection																
		Emergency equip & procedures		✓	Brief emergency measures																
		Environmental issues																			
	Key take-outs / best practice																				
				<ul style="list-style-type: none"> Guidelines about prevention of fire accidents and all the organizations involved in ensuring fire safety regulations 																	

Act No. 204: High Pressure Gas Safety Act

Name	High Pressure Gas Safety Act			Code	Act No. 204				Date of Issue	2006											
Authorising / issuing agency	The Government of Japan			Fuel Applicability	All Compressed Gases				Next Issue												
Sector Applicability	All Uses		Geographical coverage	US		System/ Component	Hoses/ Pipes	Valves	Regulators	Fittings	Connectors	Sensors	Break Away	Metering	Tanks	Compressor	Refrigeration	Vaporizers			
Description	<ul style="list-style-type: none"> To regulate the production, storage, sale, transportation and other matters related to the handling of high pressure gases, their consumption as well as the manufacture and handling of their containers Articles 5 to 19 – Production and Storage Articles 23 to 25 – Transportation, Consumption and Disposal Articles 26 to 39 – Safety Articles 40 to 58 – Equipments including containers 			Fueling																	
Onboard Storage																					
Transfer																					
Gasification																					
Consumption																					
Sub System Element				Incl	Comment	Hazards Identified															
Fuelling Facilities & Operations	✓	Focus on facility construction and equipment																			
Statutes, Regulation & Standards referenced in the document (blue highlight for documents in this report)	Type	Fuel Systems & Tanks																			
– METI Ordinances	Reg.	Maintenance equip & procedures																			
		Safe Practices		✓	General safety, marking and inspection																
		Emergency equip & procedures		✓	Brief emergency measures																
		Environmental issues																			
		Key take-outs / best practice			<ul style="list-style-type: none"> General guidelines about production, storage and handling of all high pressure gases 																