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Technical Code for Hydrogen Fuelling Station

加氢站技术规范

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2 Terms

2.0.1 Hydrogen fuelling station

It refers to a specific place wherein the hydrogen cylinders of the hydrogen fuel cell vehicle or hydrogen internal combustion engine automobile or hydrogen gas mixture fuel automobile are charged with hydrogen fuel.

2.0.2 The system of hydrogen produced on site

It refers to the hydrogen production system installed in the hydrogen fuelling station, which is usually a general name of hydrogen production, purification, compression and supporting facilities.

2.0.3 Deleted.

2.0.4 Deleted.

2.0.5 Station house

It refers to the building which is used for the management and operation of the hydrogen fuelling station.

2.0.6 Hydrogen fuelling island

It refers to the platform wherein the hydrogen fuelling machine OR the hydrogen & gas mixture dispenser is installed.

2.0.7 Deleted.

2.0.8 Hydrogen dispenser

It refers to the special purpose equipment which charges hydrogen to the hydrogen cylinder (tank) of the means of transportation, and is equipped with the functions of controlling, metering and pricing.

2.0.9 Deleted.

2.0.9A Stationary pressure vessels for storage of hydrogen

It refers to pressure vessels in fixed installation for the storage of hydrogen fuel, which include pressure vessels for gaseous hydrogen storage, liquid hydrogen storage and metal hydride storage. They are abbreviated as hydrogen storage vessels.

2.0.10 Pressure vessels for storage of gaseous hydrogen

It refers to pressure vessels for the storage of gaseous hydrogen, which include necessary safety accessories, pressure detection and display instruments, etc.

2.0.11 Cylinder assemblies for storage of gaseous hydrogen

It refers to a hydrogen storage facility which assembles several cylinder assemblies for storage of gaseous hydrogen into an integral, which includes the corresponding connecting pipes, valves and safety accessories and so on.

2.0.11A Pressure vessels for storage of liquid hydrogen

It refers to pressure vessels for the storage of liquid hydrogen, which includes adiabatic systems, necessary safety devices, pressure and liquid level display instruments, etc.

2.0.11B Pressure vessels for storage of metal hydride

It refers to hydrogen storage pressure vessels containing reversible metal hydride, which include heat exchange system, necessary safety accessories, pressure detection and display instruments, etc.

2.0.11C Liquid hydrogen booster pump

It refers to an equipment of raising the pressure of liquid hydrogen to satisfy the pressure required by the hydrogen dispenser.

2.0.12 Deleted.

2.0.13 Deleted.

2.0.14 Portable hydrogen compressor unit

It refers to the hydrogen compressor provided on one or more movable or transportable bases (discs) as well as its auxiliary equipment, electrical device, and connection pipelines, etc.

2.0.15 Vent unit

It refers to the special purpose vent device which is used to collect the hydrogen or hydrogen & gas mixture fuel as vented from the equipment and pipeline system of the hydrogen fuelling station.

2.0.16 Condensate drain unit

It refers to the special purpose device which is used to collect the condensate as drained from the equipment and pipeline system of the hydrogen fuelling station.

2.0.17 Break away coupling

It refers to the valve which can be separated into two sections under the effect of external force and which has the self-sealing function after separation.

2.0.18 Tube trailers for gaseous hydrogen

It refers to road transport vehicles consisting of a hydrogen storage cylinder permanently connected to a semi-trailer running mechanism or a shaped chassis through a supporting end plate or a frame.

2.0.18A Tube skid container for gaseous hydrogen

It refers to a mobile pressure vessel for shipping compressed hydrogen, which consists of a single hydrogen storage cylinder with a nominal water volume of 1,000 L ~ 4,200 L, which is permanently connected to the frame through the support end plate, and is composed of pipelines, safety accessories, instruments, loading and unloading accessories, etc.

2.0.19 Liquid hydrogen lorry truck

6 Hydrogen Fuelling Process and Equipment

6.1 Hydrogen Quality and Metering

6.1.1 The quality of the incoming hydrogen shall comply with the following stipulations:

1. The quality and inspection rules of hydrogen used for the hydrogen fuel cell vehicles shall comply with the stipulations of the current national standard "Fuel Specification for Proton Exchange Membrane Fuel Cell Vehicles - Hydrogen" GB/T 37244;

2. The quality and inspection rules of hydrogen used for hydrogen internal combustion engine vehicles or hydrogen and natural gas hybrid fuel vehicles shall comply with the relevant stipulations of the current national standard "Hydrogen - Part 1: Industrial Hydrogen" GB 3634.1 and "Hydrogen and Compressed Natural Gas (HCNG) Blended as Vehicle Fuel" GB/T 34537.

6.1.2 The quality of the outgoing hydrogen of the hydrogen fuelling station shall be determined in accordance with the user's requirements and shall be not lower than the following requirements:

1. The quality of the hydrogen which is used for the hydrogen fuel cell vehicles and so on shall comply with the stipulations of the current national standard "Fuel Specification for Proton Exchange Membrane Fuel Cell Vehicles - Hydrogen" GB/T 37244;

2. The quality of the hydrogen which is used for the hydrogen internal combustion vehicles or hydrogen and natural gas hybrid fuel vehicles shall comply with the relevant stipulations of the current national standard "Hydrogen - Part 1: Industrial Hydrogen" GB 3634.1 and "Hydrogen and Compressed Natural Gas (HCNG) Blended as Vehicle Fuel" GB/T 34537.

6.1.3 The metering of incoming hydrogen of the hydrogen fuelling station shall comply with the following requirements:

1. When the tube trailers for gaseous hydrogen and tube skid container for gaseous hydrogen are used to transport hydrogen, the calculation may be performed in accordance with the structure and volume of the hydrogen storage cylinder, as well as the starting and ending pressure, temperature and compression factor;

2. When the hydrogen pipeline is used to transport hydrogen, it is preferable to use the mass flow meter for metering purposes;

3. When liquid hydrogen is used, the liquid level of the liquid hydrogen storage pressure vessel shall be taken for metering; the liquid level measurement should adopt a capacitive liquid level gauge or a measurement method with the same accuracy;

4. The maximum allowable error of the metering device of incoming hydrogen of the hydrogen fuelling station shall be ± 1.5%.

6.1.4 The quality and metering requirements for the incoming natural gas in the mixed fuel shall comply with the relevant stipulations of the current national standard "Compressed natural Gas as Vehicle Fuel" GB 18047 and "Code for Design and Construction of Automobile Gasoline and Gas Filling Station" GB 50156. The fuel mixture proportion of the

hydrogen natural gas mixture vehicle shall be determined in accordance with the requirements of the mixture fuel vehicle engine.

6.1.5 As for the hydrogen used for the hydrogen fuel cell vehicles, if the quality of the incoming hydrogen cannot reach to the quality criteria of the hydrogen for fuel cell, it shall select the corresponding hydrogen purification device based on the purity or impurity content of the incoming hydrogen, and it is preferable for the hydrogen purification device to be in front of the hydrogen compressor.

6.1.6 Such procedures as purification, compression, metering, mixing, transportation, and storage, etc., in the hydrogenation process system shall be equipped with the pressure detection points, and it shall also be equipped with the over-pressure or low pressure alarm device in accordance with the safety operation requirements.

6.1.7 The hydrogen fuelling station shall set up a process control system. The operation status of the process equipment of the hydrogen fuelling station should be collaboratively optimized, managed, controlled and monitored in accordance with the actual demands.

6.2 Hydrogen Compressing Process and Equipment

6.2.1 The hydrogen compression process system of the hydrogen fuelling station shall be determined in accordance with the incoming hydrogen delivery method, and meanwhile comply with the following provisions:

1. When using the tube trailers for gaseous hydrogen and tube skid container for gaseous hydrogen to supply hydrogen, it shall provide the pressure boost hydrogen compressor in the hydrogen fuelling station, and shall select the hydrogen compressor and the hydrogen storage vessel based on the hydrogen storage or fuelling parameters;

2. When using the hydrogen pipeline to transport hydrogen, it shall select the hydrogen compressor and the hydrogen storage vessel based on the incoming hydrogen pressure, hydrogen storage or fuelling parameters;

3. When it is used for hydrogen fuel vehicles or hydrogen and natural gas hybrid fuel vehicles, it shall select the hydrogen compressor and the hydrogen storage vessel based on the parameters of the required hydrogen and the storage or fuelling parameters.

6.2.1A The setting of the liquid hydrogen booster pump of the hydrogen fuelling station shall comply with the following stipulations:

1. The type selection and number of the liquid hydrogen booster pumps shall be determined in accordance with the hydrogen supply pressure and flow rate; it should be in the form of a piston pump, and a backup liquid hydrogen booster pump should be set up;

2. The vaporization capacity of the vaporizer shall be determined by the liquid hydrogen flow and boost pressure, and the heat exchange form should be air temperature type;

3. A flexible connection shall be adopted between the liquid hydrogen storage pressure vessel and the liquid hydrogen booster pump. The inner diameter of the pipeline should not be smaller than the diameter of the liquid inlet of the pump. If necessary, a certain slope shall be set in accordance with the process requirements.

3. It is preferable for the control panel and instrument control panel for the hydrogen compressor to be located in a special-purpose control cabinet or an adjacent control room.

6.3 Hydrogen Storage System and Equipment

6.3.1 The working pressure of the hydrogen storage system in the hydrogen fuelling station shall be determined in accordance with the hydrogen charging pressure of the on-board hydrogen storage cylinder. When the hydrogen charging pressure is 35 MPa, the working pressure of the hydrogen storage system in the hydrogen fuelling station should not be greater than 45 MPa; when the hydrogen charging pressure is 70 MPa, the working pressure of the hydrogen storage system of the hydrogen fuelling station should not be greater than 90 MPa.

6.3.2 The mode of high-pressure hydrogen storage or liquid hydrogen storage should be adopted for hydrogen storage in the hydrogen fuelling station, and other hydrogen storage modes shall be adopted after technical and economic demonstration. The hydrogen storage facility in the hydrogen fuelling station should select a special-purpose fixed hydrogen storage pressure vessel.

6.3.2A The fixed hydrogen storage pressure vessel shall satisfy the requirements of pressure, temperature, hydrogen storage capacity, service life and environment of application, etc., and have sufficient safety margin to satisfy the requirements of safe application.

6.3.2B The stationary hydrogen storage pressure vessel shall be equipped with an operating parameter recording device, and shall conduct real-time monitoring and automatic recording of the number of pressure fluctuations, in which, the range of pressure, temperature and pressure fluctuation exceeds 20% of the design pressure. The recording device shall satisfy the requirement of keeping all the above-mentioned records intact in the long term.

6.3.2C The organizations using the stationary hydrogen storage pressure vessels shall use stationary hydrogen storage pressure vessels that have obtained production licenses and have passed the inspection. In addition, they shall also formulate operating procedures and establish corresponding safety production management systems.

6.3.2D The application management of the hydrogen storage pressure vessels shall comply with the relevant stipulations of the current national standard “Safety Technical Requirements for Hydrogen Storage Devices Used in Hydrogen Fuelling Station” GB/T 34583.

6.3.3 As for the hydrogen storage pressure vessels in the hydrogen fuelling station, it is preferable to set the pressure based on level 2 ~ level 3 respectively, and the volume of each level shall be determined based on such factors as the storage pressure of each level, hydrogen charging pressure, and charging hydrogen amount.

6.3.3A When hydrogen storage vessels with different design pressures are used to store hydrogen, pressure control measures shall be taken, and hydrogen storage vessels with a relatively low design pressure shall be prevented from overpressure.

6.3.4 Deleted.

6.3.5 The installation of the safety facilities for the hydrogen storage pressure vessels shall comply with the following requirements:

1. A safety valve shall be installed, and the set pressure must not exceed the design pressure of the vessel;

6.3.6 The cylinder assemblies for storage of gaseous hydrogen shall be fixed onto an independent stand and it is preferable to use the horizontal manner. It is not preferable for the net spacing between the same assembly of containers to be less than 0.03 m, and it is not preferable for the distance between the cylinder assemblies for storage of gaseous hydrogen to be less than 1.50 m.

6.3.6A The base or bracket of the hydrogen storage vessel shall be made of non-combustible materials and shall satisfy the strength requirements.

6.3.7 Deleted.

6.3.8 When the hydrogen storage vessel is adjacent to the vehicle passage in the station, it shall provide the safety guard rail or other anti-collision measures in between them.

6.3.8A The hydrogen storage vessel and hydrogen compressor shall be separated from public areas through guardrails. The height of the guardrails should not be less than 2 m. The guardrails should be made of metal materials. The requirements for the design, manufacture, installation and construction, engineering acceptance inspection and maintenance shall comply with the relevant stipulations of the current industrial standard "Technical Standard for Building Guardrail" JGJ/T 470.

6.3.9 Hydrogen storage capacity of hydrogen fuelling station shall comply with the requirements of hydrogen supply method, hydrogen supply pressure, hydrogen storage pressure, pressure level and hydrogen fuelling capacity, hydrogen charging pressure, and balanced continuous hydrogen supply.

6.3.10 When using a compressor to pressurize hydrogen and fuel it into a hydrogen storage pressure vessel, the discharge volume of the safety relief device of the hydrogen storage pressure vessel shall not be less than the maximum displacement of the compressor.

6.3.11 The tube trailers for gaseous hydrogen and the tube skid container for gaseous hydrogen shall comply with the relevant stipulations of the current industrial standard "Tube Trailer" NB/T 10354 and "Tube Skid Container" NB/T 10355.

6.4 Hydrogen Dispenser

6.4.1 Hydrogen dispenser shall not be located indoors.

6.4.2 The number of hydrogen dispensers shall be determined in accordance with the number of hydrogen energy vehicles to be hydrogenated, the amount of hydrogen required for each vehicle, the volume of the hydrogen storage vessel and the displacement of the hydrogen compressor. The performance of the hydrogen dispenser shall comply with the relevant stipulations of the current national standard "Compressed Hydrogen Dispenser for Vehicles" GB/T 31138. The hydrogen dispenser shall mark whether it is equipped with the function or mode of active flow adjustment.

6.4.2A When the hydrogen dispenser fuels hydrogen into the on-board hydrogen storage cylinder, it shall comply with the following stipulations:

1. The hydrogen compression system should not directly fuel hydrogen into the on-board hydrogen storage cylinder;

2. It shall be ensured that the on-board hydrogen storage cylinder is not over-temperature or over-pressure;

6.5.2A The hydrogen pipeline shall be equipped with a safety valve suitable for high-pressure hydrogen medium, and the set pressure of the safety valve shall not be greater than the design pressure of the hydrogen pipeline.

6.5.3 It is preferable for the hydrogen pipeline to be connected through welded or ferruled fittings qualified for hydrogen compatibility; the hydrogen pipeline and the equipment and valve may adopt flange connection or thread connection, etc. and at the thread connections, it shall use the PTFE film as filler.

6.5.3A The hydrogen pipeline system shall be flexible enough to reduce stress concentration and ensure the safety of the pipeline when the temperature changes cause thermal expansion and contraction.

6.5.3B The liquid hydrogen pipeline shall comply with the following stipulations:

1. The pipeline insulation shall adopt high-vacuum multilayer insulation or other forms of insulation that satisfy the requirements of thermal insulation performance;

2. The liquid hydrogen pipeline shall be provided with a temperature compensation structure that complies with the requirements of flexible pipeline design;

3. The liquid hydrogen pipeline should be connected by welding; the liquid hydrogen pipeline and the equipment or the pipeline at the dismantling part can be connected by a flat vacuum insulation flange or a vacuum insulation socket joint;

4. The pipeline accessories like liquid hydrogen valve shall comply with the performance requirements of liquid hydrogen insulation, sealing and medium compatibility.

6.5.3C The liquid hydrogen system shall be provided with an independent venting system and comply with the following stipulations:

1. It shall be vented to high altitude through a fixed vent pipe, and the height of the vent pipe shall be above 5 m higher than the platform or the top of a building within a range of 20 m;

2. The flow velocity of liquid hydrogen saturated steam shall not exceed 16 m/s; the flow velocity of single-phase flow hydrogen shall not exceed 150 m/s;

3. The vent pipe shall be equipped with devices to prevent air backflow, rain and snow intrusion, water vapor condensation, freezing and blockage by foreign matters; the vent nozzle should be equipped with a flame arrester or nitrogen purge and replacement;

4. When venting liquid hydrogen or low-temperature hydrogen, it shall be ensured that the outlet temperature is not lower than 90 K; the venting process shall maintain a positive pressure;

5. The high-pressure hydrogen vent pipe and the low-pressure hydrogen vent pipe shall not be connected to the same venting system.

6.5.3D The liquid hydrogen pipelines should be laid low overhead. When limited by conditions, they may be laid in open ditch, and shall comply with the stipulations of Clause 6.5.6 in this code.

6.5.4 The setting of the hydrogen vent unit shall ensure safe venting of hydrogen, and comply with the following provisions:

1. Deleted.

2. Vent pipes with different pressure levels shall not be directly connected, and shall be respectively led to the main vent pipe. The main vent pipe shall be set vertically upward, and the nozzle shall be higher above the highest point of the facility in the station by over 2 m, and its located ground by more than 5 m;

3. The single vent pipes and main vent pipe shall take measures to prevent rain and snow intrusion or debris clogging.

4. The inner diameter of the single vent pipes shall be greater than the diameter of the vent nozzle of the corresponding safety valve, and the cross-sectional area of the main vent pipe shall be greater than the sum of the cross-sectional areas of the vent nozzle of each safety valve;

5. The venting and exhausting device shall be equipped with an electrostatic grounding device, and shall be arranged within the effective protection range of lightning protection.

6.5.5 It is preferable for the outdoor hydrogen pipelines within the hydrogen fuelling station to be laid in open ditch or to be directly buried underground. If it is directly buried underground, it shall comply with the relevant requirements of the current national standard "Design code for hydrogen station" GB 50177.

6.5.6 When the hydrogen pipeline within the station is laid in open ditch, it shall comply with the following requirements:

1. It shall not be laid in the same ditch with other pipelines except nitrogen pipeline;

2. When the open ditch is equipped with a cover plate, the ditch shall be well-ventilated, and there shall be no space for hydrogen accumulation;

3. The pipe bracket and cover plate shall be made of non-combustible materials.

6.5.7 The laying and installation, etc., of the indoor hydrogen pipelines in the hydrogen production room and the hydrogen compressor room shall comply with the relevant requirements of the current national standard "Design code for hydrogen station" GB 50177.

6.6 Materials in Contact with Hydrogen

6.6.1 The materials in contact with hydrogen used by the hydrogen system in the hydrogen fuelling station shall be metal materials with mature experience of application or with test-proved good hydrogen compatibility.

6.6.2 The hydrogen compatibility test of metallic materials shall comply with the stipulations of the current national standard "Storage and Transportation Systems for Gaseous Hydrogen - Part 2: Test Methods for Evaluating Metallic Material Compatibility in Hydrogen Atmosphere" GB/T 34542.2 and "Storage and Transportation Systems for Gaseous Hydrogen - Part 3: Test Method for Determination of the Susceptibility of Metallic Materials to Hydrogen Gas Embrittlement (HGE)" GB/T 34542.3.

7 Fire Protection and Safety Facilities

7.1 Fire Protection Facilities

7.1.1 The hydrogen fuelling station shall be equipped with a fire hydrant fire water supply system. The fire hydrant fire water supply system shall comply with the relevant stipulations of the current national standard "Code for Fire Protection Design of Buildings" GB 50016 and "Code of Design on Fire Protection Water Supply and Hydrant Systems" GB 50974.

7.1.2 The setting of firefighting equipment shall comply with the relevant stipulations of "Code for Design of Extinguisher Distribution in Buildings" GB 50140, and the following stipulations:

1. **Every 2 sets of hydrogen dispenser shall be equipped with at least one 8 kg portable dry powder fire extinguisher or two 4 kg portable dry powder fire extinguishers; if the number of the hydrogen dispensers is less than 2 sets, it shall be calculated as 2 sets;**

2. **The hydrogen compressor room shall be equipped with one 8 kg portable dry powder fire extinguisher for every 50m^2 of the construction area, with the total number not less than 2; one portable hydrogen compressor unit shall be equipped with the portable dry powder fire extinguishers, the number of which shall be calculated based on 50m^2 of the construction area;**

3. **Deleted.**

4. **Deleted.**

7.2 Safety Facilities for Hydrogen Fuelling Process System

7.2.1 The hydrogen inlet manifold of the hydrogen fuelling station shall be equipped with emergency cut-off valve. The manual emergency cut-off valve shall be so positioned as being able to cut off the hydrogen source in time in case of accident.

7.2.2 Deleted.

7.2.3 When tube trailers for gaseous hydrogen and tube skid container for gaseous hydrogen are used as stationary pressure vessels for hydrogen storage in the hydrogen fuelling station, safety protection measures should be set in accordance with the stipulations of Clause 6.3.5 of this code.

7.2.4 Between the hydrogen storage vessel or the cylinder assemblies for storage of gaseous hydrogen and the hydrogen gun, it shall provide the cutoff valve, hydrogen trunk pipe cutoff valve, purge and vent device, emergency cutoff valve, air supply hose, and hydrogenation cutoff, etc.

7.2.5 The hydrogen storage vessel or the cylinder assemblies for storage of gaseous hydrogen shall be equipped with the test points, control valves, accessories and other devices, etc., for the hydrogenation process automatic control which matches the hydrogen dispenser.

7.2.6 Hydrogen systems and equipment shall be equipped with nitrogen purge device, and all nitrogen purge nozzle shall be equipped with the cutoff valve and check valve in front. In addition, the oxygen content in the purge nitrogen shall be not more than 0.5%.

7.2.7 The setting of the safety protection device of the liquid hydrogen storage pressure vessel shall comply with the following stipulations;

1. The inner container and vacuum interlayer of the liquid hydrogen storage pressure vessel shall be provided with safety pressure relief devices.

2. The design of the release capacity of the safety relief device in the liquid hydrogen storage pressure vessel shall take into account the danger of overpressure caused by the rapid phase transformation of liquid hydrogen into gaseous hydrogen.

7.2.8 The setting of the safety protection device of the liquid hydrogen booster pump shall comply with the following stipulations:

1. A safety valve shall be provided between the outlet of the liquid hydrogen booster pump and the first cutoff valve;

2. The liquid hydrogen booster pump shall be provided with an alarm for over-limit pressure at the inlet and outlet, and an over-limit shutdown device.

3. The liquid hydrogen booster pump system shall be equipped with an alarm device for over-frequency and under-frequency;

4. The liquid hydrogen booster pump shall be equipped with a temperature over-limit alarm and over-limit shutdown device;

5. The lubricating oil system shall be equipped with an alarm device for excessively high oil pressure, low oil pressure or high oil temperature.

7.3 Alarm Device

7.3.1 The hydrogen equipment shall take the following warning measures:

1. The hydrogen storage vessel shall be respectively equipped with overpressure alarm and low pressure alarm device based on the difference of pressure rating;

2. The discharge end of the tube trailers for gaseous hydrogen, the discharge end of the tube skid container for gaseous hydrogen, the portable hydrogen compressor unit, the proximity to the hydrogen storage vessel and the top of the hydrogen dispenser shall be equipped with the flame alarm detector.

3. The setting of the flame alarm detector shall comply with the relevant stipulations of the current national standard "Code for Design of Automatic Fire Alarm System" GB 50116.

7.3.2 The hydrogen compressor shall be equipped with an alarm device in accordance with the requirements of clause 6.2.5 of this code.

7.3.3 Hydrogen compressor room or portable hydrogen compressor unit, hydrogen storage vessel and hydrogen production room, where hydrogen is easily accumulated and leaked, shall be equipped with the alarm device to indicate the hydrogen concentration in the air exceeding limit, and such device shall alarm and record when the hydrogen content in the air reaches up to 0.4% (volume fraction) and initiate the corresponding accident exhaust fan.

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