Attachment 100

TECHNICAL STANDARD FOR FUEL SYSTEMS OF MOTOR VEHICLES FUELED BY COMPRESSED HYDROGEN GAS

1. Scope

This Technical Standard shall apply to fuel systems (referring to the hydrogen system, fuel cell system, and other parts related to fuel as well as power generation by the fuel in fuel cell vehicles. Hereinafter the same.) of fuel cell vehicles fueled by compressed hydrogen gas (except motorcycles with or without sidecar).

2. Definitions

In addition to the definitions described in Article 1 of the Safety Regulations and Article 2 of the Announcement That Prescribes Details of Safety Regulations for Road Vehicles, the terms appearing in this Technical Standard shall be defined in the following Items 2–1 to 2–19.

2–1 "Hydrogen system" in fuel cell vehicles means devices related to filling, storage and supply of hydrogen gas in the line from the gas filling port to the inlet of the fuel cell stack, the components in the hydrogen circulation line where hydrogen returns from the outlet of the fuel cell stack to its inlet, as well as their controlling devices. In other motor vehicles, it means devices related to filling, storage and supply of hydrogen gas in the line from the gas filling port to the engine.

2–2 "Fuel cell system" means a power generation system comprised of hydrogen system, air-supply system, and fuel cell stack, as well as their controlling devices, including humidifiers for hydrogen gas and air, and temperature regulating device for the fuel cell stack.

2–3 "Fuel cell stack" means a device which generates power directly by causing hydrogen to react with oxygen.

2–4 "General-use pressure" means the highest pressure in the pressure commonly used.

2–5 "Pressure" means gauge pressure.

2–6 "Container main valve" means a valve attached directly to a gas container and shuts off the flow of hydrogen gas from the gas container.

2–7 “Main stop valve” means, among the container main valves, a valve that electromagnetically shuts off hydrogen gas supplied to the downstream of that valve.

2–8 “Container check valve” means, among the container main valves, a valve that prevents hydrogen gas from flowing backward from the gas container to the gas filling port.

2–9 “Container safety valve” means a valve, attached directly to the gas container, that is deployed only once to discharge hydrogen gas when the hydrogen gas temperature within the gas container rises abnormally high to the extent that the gas container may be damaged.

2–10 “Container attachments” mean a main stop valve, a container check valve and a container safety valve.

2–11 “Overflow prevention valve” means a valve that automatically shuts off hydrogen gas or regulates its flow when the flow of hydrogen gas from the gas container increases abnormally.

2–12 “Pressure reducing valve” means a valve that regulates pressure of hydrogen gas at designated levels.

2–13 “Safety device” means a device capable of preventing significant rise in pressure at the secondary side of the pressure-reducing valve.

2–14 “Pressure relief valve” means a valve that reduces pressure when the secondary pressure of the pressure reducing valve rises abnormally.

2–15 “Piping, etc.” mean components of the passage of hydrogen gas, excluding the fuel cell stack, engine, gas containers and container attachments.

2–16 “Gas filling port” means a connective opening installed on a vehicle for filling the gas container with hydrogen gas.

2–17 “Gas filling valve” means a valve for shutting off the flow of gas between the gas container and the gas filling port when the gas is not being filled.

2–18 “To purge” means to discharge a portion of hydrogen gas within the fuel cell system outside (excluding discharges from the container safety valve and pressure relief valve) by the control of the fuel cell system.

2–19 “Purge gas discharging section” means a discharging port for purged gas, usually having a pipe shape.

3. Requirements

3–1 Container attachments

3–1–1 Container attachments shall be attached directly to each gas container.

3–1–2 The main stop valve shall comply with each of the following Items 3–1–2–1 and 3–1–2–2.

3–1–2–1 The main stop valve that supplies and shuts off hydrogen gas shall be operatable at the driver’s seat. The valve must operate without fail.

3–1–2–2 It shall be operated electromagnetically, and shall be closed automatically when the power source of its operation fails.

3–1–3 A container check valve shall be capable of preventing reverse flow at pressures ranging from the general-use pressure to the minimum pressure that is normally used.

3–1–4 Hydrogen gas discharged when the container safety valve is operated due to an abnormal rise in temperature of the gas container shall be emitted in the manners enumerated in each of the following Items 3–1–4–1 through 3–1–4–5.

3–1–4–1 Not emitting directly into the passenger compartment or luggage compartment;

3–1–4–2 Not emitting into the tyre housing;

3–1–4–3 Not emitting toward the exposed electrical terminals, electrical switches or other ignition sources;

3–1–4–4 Not emitting toward other gas containers; and

3–1–4–5 Not emitting toward the front of the motor vehicle.

3–2 Overflow prevention valve, etc.

3–2–1 Any of the devices that prevent one of the overflow enumerated in following Items 3–2–1–1 to 3–2–1–3 shall be provided.

3–2–1–1 An overflow prevention valve (installed on the main stop valve or in close proximity thereto);

3–2–1–2 A system consisting of a device that detects the pressure inside the gas container or piping, etc. and a main stop valve that shuts off the supply of hydrogen gas from the gas container when the aforementioned device detects an abnormal drop in pressure; and

3–2–1–3 A system consisting of a device that detects the flow rate of hydrogen gas inside the gas container or piping, etc. and a main stop valve that shuts off the supply of hydrogen gas from the gas container when the aforementioned device detects any abnormal rise in the flow rate.

3–3 Pressure-reducing valve

3–3–1 A pressure-reducing valve shall not be attached upstream of the main stop valve. However, this provision shall not apply to cases where the shut-off function is provided at the passage from the pressure-reducing valve to the atmosphere or where there is no passage leading to the atmosphere.

3–4 Safety device

3–4–1 A safety device capable of preventing significant rise in pressure at the secondary side of the pressure-reducing valve, that complies with the following Items 3–4–1–1 or 3–4–1–2, shall be provided. However, this provision shall not apply to cases where all components at the secondary side of the pressure-reducing valve (in cases where another pressure-reducing valve is provided at the secondary side, all components down to the pressure-reducing valve concerned) have pressure-resistant performance toward the pressure at the primary side of the pressure-reducing valve.

3–4–1–1 A pressure relief valve that operates at a pressure lower than the resistant pressure of the devices at the secondary side of the pressure-reducing valve when the pressure at the secondary side of the pressure-reducing valve exceeds the general-use pressure, and that has a discharge flow rate necessary for the protection of the devices at the secondary side.

3–4–1–2 A safety device consisting of a device that detects the pressure at the secondary side of the pressure-reducing valve, and a valve that shuts off the supply of hydrogen gas at the primary side of the pressure-reducing valve at a pressure lower than the resistant pressure of the devices at the secondary side of the pressure-reducing valve when the aforementioned device detects a pressure higher than the general-use pressure.

3–4–2 Hydrogen gas discharged from the pressure relief valve shall be emitted in the manners enumerated in each of the following Items 3–4–2–1 through 3–4–2–3.

3–4–2–1 Not emitting directly into the passenger compartment or luggage compartment;

3–4–2–2 Not emitting into the tyre housing; and

3–4–2–3 Not emitting toward the exposed electrical terminals, electrical switches or other ignition sources.

3–5 Gas containers, piping, etc.

3–5–1 Gas containers, piping, etc. shall not be such one that is removed for filling the hydrogen gas.

3–5–2 Gas containers, piping, etc. shall not be provided in the passenger compartment, luggage compartment or other places where ventilation is not sufficient. However, this provision shall not apply to cases where the gas containers, piping, etc. are housed in a housing that complies with each of the following Items 3–5–2–1 through 3–5–2–3. (In the case of metal gas containers and gas containers with metal lining, it shall be acceptable if only the container attachments and their joint sections are housed.)

3–5–2–1 No gas leakage shall be present when subjected to the airtightness test of the housing pursuant to Paragraph 1 of Attached Sheet 1 "Airtightness and Ventilation Test."

3–5–2–2 A ventilation opening shall be provided for discharging leaked hydrogen gas. Furthermore, hydrogen gas shall be emitted in the manners enumerated in Items 3–5–2–2–1 through 3–5–2–2–3.

3–5–2–2–1 Not emitting directly into the passenger compartment or luggage compartment;

3–5–2–2–2 Not emitting toward the tyre housing; and

3–5–2–2–3 Not emitting toward the exposed electrical terminals, electrical switches or other ignition sources.

3–5–2–3 When subjected to the ventilation test of the housing pursuant to

Paragraph 2 of Attached Sheet 1 "Airtightness and Ventilation Test," the time required for the gas concentration inside the housing to drop by 90% shall be within 180 seconds.

3–5–3 Gas containers and piping, etc. shall be securely installed so as to prevent shifting or damage while traveling, and sections thereof that is liable to damage shall be protected by covering. In the case where the natural frequency of the vertical, longitudinal and/or horizontal vibration of the gas container's mounting part is 20 Hz or below, the part shall satisfy either of the Items 3–5–3–1 or 3–5–3–2 below in relation to the aforementioned vertical, longitudinal and/or horizontal vibration.

3–5–3–1 It shall meet the requirements of the Attached Sheet 18, "Technical Standards for Mounting Devices for Automotive-Use Fuel Gas Containers" (excluding the portion relating to the range of application).

3–5–3–2 It shall have the proven resistance against vibration equal to, or above, the resistance indicated in Item 3–5–3–1, calculated using the rate of acceleration measured by actual driving, including travel on rough road.

3–5–4 A gas container and container attachments in motor vehicles other than those for which Paragraph 3, Article 17 of the Safety Standards are applicable, shall be installed in a position where the horizontal distance from their front to the vehicle's front end is not less than 420 mm on the line parallel to the vehicle's median longitudinal line, and the horizontal distance from their rear to the vehicle's rear end is not less than 300 mm on the line parallel to the vehicle's median longitudinal line. The part attaching the gas container, when the container is filled with compressed hydrogen gas at the general-use pressure, must not be torn by acceleration toward the moving direction, indicated in Paragraphs 3–5–4–1 through 3–5–4–3 below for each type of motor vehicles. Conformity with the requirements as related to acceleration may be proven by calculation.

3–5–4–1 Motor vehicles used for carriage of goods with a gross vehicle weight of less than 3.5 t: ± 196 m/s^2

3–5–4–2 Motor vehicles exclusively for carriage of passengers, having a passenger capacity of 11 persons or more, with a gross vehicle weight of less than 5 t, or vehicles for carriage of goods with a gross vehicle weight of 3.5 t or more and less than 12 t: ± 98 m/s^2

3–5–4–3 Motor vehicles exclusively for carriage of passengers, having a passenger capacity of 11 persons or more, with a gross vehicle weight of 5 t or more, or vehicles for carriage of goods with a gross vehicle weight of 12 t or more: ± 64.7 m/s^2

3–5–5 In cases where the test is conducted pursuant to Attachment 24 “Technical Standard for the Protection of the Occupants in the Event of a Lateral Collision” in order to judge the compliance with the said Technical Standard, based on the provisions of Paragraph 3 of Article 18 of the Safety Regulations, the said test shall be conducted according to Paragraphs 3–5–5–1 and 3–5–5–2, and motor vehicles whose seat is at a height of 700 mm or less above the ground (except motor vehicles used exclusively for carriage of passengers with a passenger capacity of 10 persons or more and motor vehicles similar in shape to motor vehicles used exclusively for carriage of passengers with a passenger capacity of 10 persons or more, motor vehicles used for the carriage of goods with a gross vehicle weight exceeding 3.5 t and motor vehicles similar in shape to motor vehicles used for the carriage of goods with a gross vehicle weight exceeding 3.5 t, three-wheeled motor vehicles, mini-sized motor vehicles with caterpillar tracks and sleds, large-sized special motor vehicles, small-sized special motor vehicles, and trailers) shall satisfy the requirements of Paragraph 3–5–5–3.

3–5–5–1 Conditions shall be in accordance with Paragraphs 3–5–5–1–1 through 3–5–5–1–4 given below:

3–5–5–1–1 The gas container shall be filled with helium to 90% or more of the specified general-use pressure.

3–5–5–1–2 The main stop valve and shut-off valves, etc. for hydrogen gas, located in the downstream gas piping, shall be kept open immediately prior to the collision.

3–5–5–1–3 Motor vehicles without a system to close the main stop valve and other valves automatically upon the collision to shut off the fuel supply shall open these valves immediately in the case when they were closed after the collision.

3–5–5–1–4 Motor vehicles having a system to close the main stop valve and other valves automatically upon the collision to shut off the fuel supply may be set in such a way that this system operates. In cases where the measurement of the pressure inside the gas container is interfered due to the fact that the valve is closed after the collision, it shall be opened when the pressure is measured or a pressure sensor or a temperature sensor for the measurement shall be attached, as required.

3–5–5–2 The pressure and temperature of the gas shall be measured inside the gas container or at the upstream of the first pressure-reducing valve located downstream of the gas container, immediately before the collision and 60 minutes after the collision.

3–5–5–3 The rate of hydrogen gas leakage measured by the following procedure of Items 3–5–5–3–1 through 3–5–5–3–5 shall not exceed 131 NL per minute.

3–5–5–3–1 The helium gas pressure at the upstream of the first pressure-reducing valve within the gas container or the one located downstream of the gas container, immediately before the collision and 60 minutes after the collision, shall be converted to the pressure at 0°C.

$$P_0' = P_0 \times \{273 / (273 + T_0)\}$$

where:

P_0' : Helium gas pressure converted to pressure at 0 °C before collision (MPa abs)

P_0 : Measured helium gas pressure before collision (MPa abs)

T_0 : Measured helium gas temperature before collision (°C)

$$P_{60}' = P_{60} \times \{273 / (273 + T_{60})\}$$

where:

P_{60}' : Helium gas pressure converted to pressure at 0 °C 60 minutes after collision (MPa abs)

P_{60} : Measured helium gas pressure 60 minutes after collision (MPa abs)

T_{60} : Measured helium gas temperature 60 minutes after collision (°C)

3–5–5–3–2 The gas density before the collision and 60 minutes after the collision shall be calculated, respectively, using the pressure at 0°C converted from the helium gas pressure at the upstream of the first pressure-reducing valve within the gas container or the one located downstream of the gas container, immediately before the collision and 60 minutes after the collision, which have been obtained in Item 3–5–5–3–1.

$\rho_0 = -0.00621 \times (P_0')^2 + 1.72 \times P_0' + 0.100$

where:

ρ_0 : Helium gas density before collision (kg/m^3)

$\rho_{60} = -0.00621 \times (P_{60}')^2 + 1.72 \times P_{60}' + 0.100$

where:

ρ_{60} : Helium gas density 60 minutes after collision (kg/m^3)

3–5–5–3–3 The helium gas volume before the collision and 60 minutes after collision shall be calculated, respectively, using the gas density obtained in Item 3–5–5–3–2 above. However, the internal volume shall be the internal volume of the gas container in cases where the helium gas pressure has been measured inside the gas container; and the internal volume of the container down to the upstream of the first pressure-reducing valve located downstream of the gas container in cases where the helium gas pressure has been measured at the upstream of the first pressure-reducing valve located downstream of the gas container.

$Q_0 = \rho_0 \times V \times (22.4 / 4.00) * 10^{-3}$

where:

Q_0 : Helium gas volume before collision (m^3)

V : Internal volume (L)

$Q_{60} = \rho_{60} \times V \times (22.4 / 4.00) * 10^{-3}$

where:

Q_{60} : Helium gas volume 60 minutes after collision (m^3)

V : Internal volume (L)

3–5–5–3–4 The rate of helium gas leakage shall be calculated.

$\Delta Q = (Q_0 - Q_{60}) \times 10^3$

$RHe = \Delta Q / 60$

where:

ΔQ : Volume of helium gas leakage 60 minutes after collision (NL)

RHe : Rate of helium gas leakage (NL/min)

3–5–5–3–5 The rate of helium gas leakage shall be converted to the rate of hydrogen gas leakage.

$RH = 1.33 \times RHe$

where:

RH : Rate of hydrogen gas leakage (NL/min)

3–5–6 Container attachments must be installed at a distance not less than 200 mm from the vehicle's external end in the proximity (excluding rear end). The part attaching the gas container, when the container is filled with compressed hydrogen gas and at the general-use pressure, must not be torn by acceleration toward the horizontal direction perpendicular to the moving direction, indicated in Paragraph 3–5–6–1 or 3–5–6–2 below for each type of motor vehicles. Conformity with the requirements as related to acceleration may be proven by calculation. Moreover, the requirement of Paragraph 3–5–6–1 shall not apply to motor vehicles to which Paragraph 3–5–5 is applicable. Furthermore, with regard to the side where the test is conducted, it shall be permissible even if the container attachments are not installed at a distance not less than 200 mm from the vehicle's external end in the proximity (excluding the rear end).

3–5–6–1 Motor vehicles exclusively for carriage of passengers, having a passenger capacity of 9 persons or less, or vehicles for carriage of goods with a gross vehicle weight of less than 3.5 t: $\pm$ 78.4 m/s^2

3–5–6–2 Motor vehicles exclusively for carriage of passengers, having a passenger capacity of 10 persons or more, or vehicles for carriage of goods with a gross vehicle weight of 3.5 t or more: $\pm$ 49 m/s^2

3–5–7 Metal parts of the supporting fixtures for the piping shall not be in direct contact with the piping. However, this provision shall not apply to cases where the piping is soldered or welded to the supporting fixtures.

3–5–8 Gas piping with both ends secured shall have an appropriate bend at its midpoint, and shall be supported at an interval of 1 m or less.

3–5–9 Gas containers, piping, etc. that may be affected significantly by the heat of the exhaust pipes, mufflers, etc., shall be protected by appropriate heat-insulating measures. Moreover, gas containers exposed to direct sunlight shall be provided with an adequate cover or other adequate sunshade.

3–6 Gas filling port

3–6–1 The gas filling port shall be provided with a gas filling valve having overflow prevention function.

3–6–2 A gas filling port shall comply with the requirements enumerated in each of the following Items 3–6–2–1 through 3–6–2–3.

3–6–2–1 The gas filling port shall be installed at a position where filling can be performed easily.

3–6–2–2 The gas filling port shall not be installed in the passenger compartment, luggage compartment and other places where ventilation is not sufficient.

3–6–2–3 The gas filling port shall be located at least 200 mm away from exposed electrical terminals, electrical switches, and other ignition sources.

3–7 Airtightness, etc. of piping, etc.

3–7–1 Piping, etc. shall be durable and sturdy, with airtightness from external atmosphere under general-use pressure, allowing no gas leakage when tested for airtightness of piping, etc. pursuant to Paragraph 3 of the Attached Sheet 1, “Airtightness and Ventilation Test”.

3–7–2 Piping, etc. from the gas filling port to the first pressure-reducing valve in the downstream of the gas container shall be durable and sturdy, having, in addition to the requirement prescribed in 3–7–1 above, the pressure resistance 1.5 times the general-use pressure, taking into account the embrittlement caused by hydrogen.

3–8 Purge

3–8–1 In fuel cell vehicles that discharge gas containing hydrogen purged from the fuel cell system into the atmosphere, the purged gas in excess of 4% of hydrogen concentration shall not be discharged or leak to the atmosphere.

3–8–2 In fuel cell vehicles that discharge gas containing hydrogen purged from the fuel cell system into the atmosphere, as for the hydrogen concentration of the purged gas at time of discharge into the atmosphere, the maximum hydrogen concentration obtained according to the method specified in Attached Sheet 2 “Measurement of Hydrogen Concentration of Purged Gas at Time of Discharge” shall not exceed 4%.

3–9 Detection of hydrogen gas leakage, etc.

3–9–1 At least one detector of hydrogen gas leakage (hereinafter “hydrogen gas leakage detector”) shall be installed at a position fitting for detection, such as the upper section of the area where the components (except one-piece piping) from the main stop valve to the fuel cell stack (the engine in a vehicle other than fuel cell vehicle) are installed. However, this provision shall not apply to the construction that comes under one of the following Items 3–9–1–1 or 3–9–1–2.

3–9–1–1 Construction in which the components (except one-piece piping) from the main stop valve to the fuel cell stack (the engine in a vehicle other than fuel cell vehicle) are installed in a space that is sufficiently open upward.

3–9–1–2 Construction in which hydrogen gas leaked from the components (except one-piece piping) from the main stop valve to the fuel cell stack (the engine in a vehicle other than fuel cell vehicle) will not stay, but will be led to the atmosphere by the method enumerated in the following items 3–9–1–2–1 through 3–9–1–2–3, and in which at least one hydrogen gas leakage detector is installed at an appropriate position of its passage.

3–9–1–2–1 It shall not be guided into the passenger compartment or luggage compartment;

3–9–1–2–2 It shall not be guided toward the tyre housing;

3–9–1–2–3 It shall not be guided toward exposed electrical terminals, electrical switches or other ignition sources.

3–9–2 A device shall be installed, that gives a warning to the driver that hydrogen gas is leaking when the hydrogen gas leakage detector detects hydrogen gas leakage.

3–9–3 A device shall be installed, that shuts off the supply of hydrogen gas when the hydrogen gas leakage detector detects hydrogen gas leakage.

3–9–4 The warning device shall be located at a position readily recognizable by the driver.

3–9–5 When subjected to the tests according to Attached Table 3 "Test for Hydrogen Gas Leakage Detector, etc.," the hydrogen gas leakage detector, device that gives a warning to the driver and device that shuts off the supply of hydrogen gas shall detect hydrogen gas, actuate the warning device, and shut off the supply of hydrogen gas. Moreover, if a motor vehicle is equipped with plural hydrogen systems, it shall be acceptable if the device shuts off the supply of hydrogen gas from the hydrogen system that is leaking hydrogen gas.

3–9–6 There shall be a device which gives a warning to the driver at the driver's seat when an open wire or a short circuit takes place in the hydrogen gas leakage detector.

3–10 Pressure gauge and residual amount meter

3–10–1 The driver's seat shall be provided with a pressure gauge indicating the pressure at the primary side of the first pressure-reducing valve, or a residual amount meter indicating the residual amount of hydrogen gas, calculated by adding the correction by the gas temperature to the pressure at the primary side of the first pressure-reducing valve.

Attached Sheet 1

AIRTIGHTNESS AND VENTILATION TEST

(Related to 3–5–2–1, 3–5–2–3 and 3–7–1 of this Technical Standard)

1. Airtightness test of housing

1–1 Test gas

The test gas shall be helium or carbon dioxide. (The same in Paragraph 2. below)

1–2 Test method

1–2–1 Insert a test gas induction hose, detector hose, and pressure gauge hose into the ventilation hole of the housing and completely seal the ventilation hole concerned.

1–2–2 Blow the test gas into the housing until the internal pressure of the container housing measures 10 kPa. Maintain this condition for 5 minutes.

1–2–3 Check gas leakage at each of the seal sections of the housing, using a gas detector.

2. Ventilation test of housing

2–1 Test method

After completion of the test of Paragraph 1.2, open all ventilation holes. Then, measure the change in test gas concentration in the housing at every 30 seconds. This measurement shall be continued for 20 minutes or until the gas concentration drops to 0%.

3. Airtightness test of piping, etc.

3–1 With the motor vehicle held stationary and the pressure applied to piping, etc., check to see if hydrogen gas leakage is present at confirmable sections of the piping, etc. from the high-pressure section to the fuel cell stack (the engine in vehicles other than fuel cell vehicles), using a gas detector or detector liquid, such as soap water.

Attached Sheet 2

MEASUREMENT OF HYDROGEN CONCENTRATION OF PURGED GAS AT TIME OF DISCHARGE

(Related to 3–8–2 of this Technical Standard)

1. Measuring device

Devices for measuring hydrogen concentration ("measuring devices" in this Attached Sheet) shall be a contact-combustion type hydrogen detector having the capacity posted in the following table or any other detector of the equivalent capacity.

Table Capacity of contact-combustion type hydrogen detector

Item	Capacity
Range of detection	Hydrogen concentration 0 ~ 4%
Reading of hydrogen concentration	Reading should be possible at least to approximately 0.1 % of hydrogen concentration.
Indication error	±0.2% or below of hydrogen concentration
Measurement interval	100 millisecond (msec) or less

2. Measurement site

The measurement shall be conducted where it is little affected by wind.

3. Measurement method

3–1 Preparation for measurement

3–1–1 The fuel cell system of the test vehicle shall be warmed up thoroughly.

3–1–2 The measuring device shall be warmed up thoroughly before use.

3–1–3 Place the measuring section of the measuring device on the center line of the purged gas flow at the closest possible position within 100 mm from the purged gas discharge outlet.

3–1–4 If the fuel cell system stops automatically during the measurement, measures shall be taken so that the fuel cell system will not stop.

3–2 Measurement

Perform purging, following the procedure of 3–2–1 and 3–2–2 below. At this time, measure hydrogen concentration.

3–2–1 With the test motor vehicle in a stationary state, turn the ignition key switch to start the fuel cell system. Then, after a lapse of one minute or more, turn off the ignition key switch, and measure the hydrogen concentration during this period.

3–2–2 Continue the measurement of hydrogen concentration, until the purging is finished after the ignition key switch has been stopped.

4. Maximum hydrogen concentration

The maximum hydrogen concentration shall be the sum of the maximum value of the measured hydrogen concentration and the indication error of the measuring device.

Attached Sheet 3

TEST FOR HYDROGEN GAS LEAKAGE DETECTOR, ETC.

(Related to 3–9–5 of this Technical Standard)

1. Test conditions

1–1 Test vehicle

The test vehicle shall be in the condition given in Paragraphs 1–1–1 and 1–1–2 below.

1–1–1 Unless necessary for the discharge of test gas, the hood, luggage compartment lid, and doors shall be closed.

1–1–2 Components that are unlikely to affect test results need not be genuine parts.

1–2 Test gas

Mixture of air and hydrogen gas with 3.9% ± 0.1% hydrogen concentration shall be used.

1–3 Test site

The test shall be conducted where it is little affected by wind.

2. Test method

2–1 Preparation for test

2–1–1 Start the fuel cell system of the test vehicle if the vehicle is a fuel cell vehicle, and warm it up thoroughly in a stationary state. If the vehicle is not a fuel cell vehicle, warm it up and keep it idling.

2–1–2 If necessary for blowing the test gas to the hydrogen gas leakage detector without fail, the following measures of Paragraphs 2–1–2–1 through 2–1–2–3 may be taken.

2–1–2–1 Attach a test gas induction hose to the hydrogen gas leakage detector.

2–1–2–2 Take measures to make the gas stay near the hydrogen gas leakage detector.

2–1–2–3 Remove the hydrogen gas leakage detector.

2–1–3 If the fuel cell system in a fuel cell vehicle stops automatically during the test, measures shall be taken so that the fuel cell system will not stop. If the test vehicle is not a fuel cell vehicle and is constructed to stop idling automatically, measures shall be taken so as to prevent the engine from stopping.

2–1–4 In cases where the operating conditions of the device to shut off hydrogen gas supply cannot be confirmed, confirmation may be performed by monitoring the operating signal or supply power of the shut-off valve.

2–2 Test

Blow test gas to the hydrogen gas leakage detector.

(Reference)

INSTALLATION OF HYDROGEN GAS LEAKAGE DETECTOR IN FUEL CELL VEHICLES

(Related to 3–9–1 of this Technical Standard)

Motor room

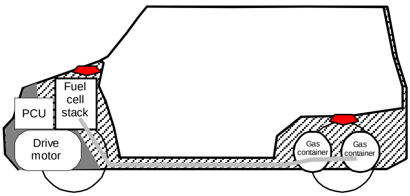
Body (passenger compartment and luggage compartment)

Section where hydrogen system components (from the main stop valve to the fuel cell stack; excluding one-piece gas piping) are provided

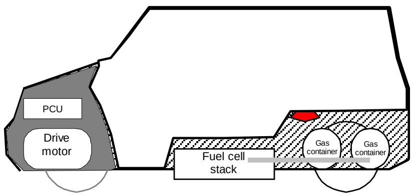
Hydrogen gas leakage detector

Gas piping, etc.

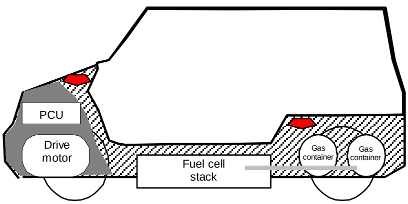
PCU Power control Unit



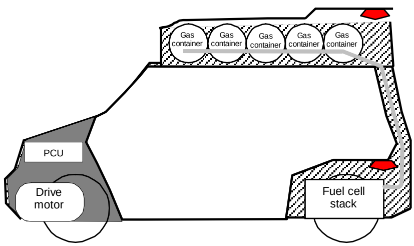
Example 1. Hydrogen system components installed in the motor room and under the floor of the body



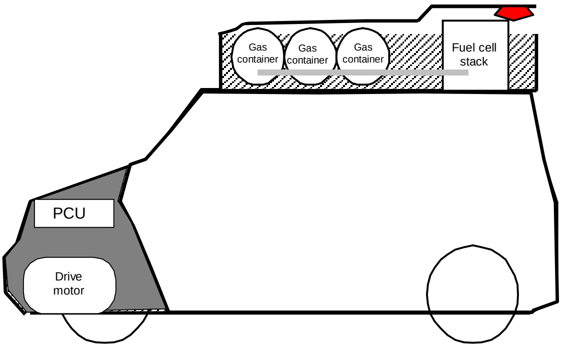
Example 2. Hydrogen system components installed under the floor of the body, separate from the motor room



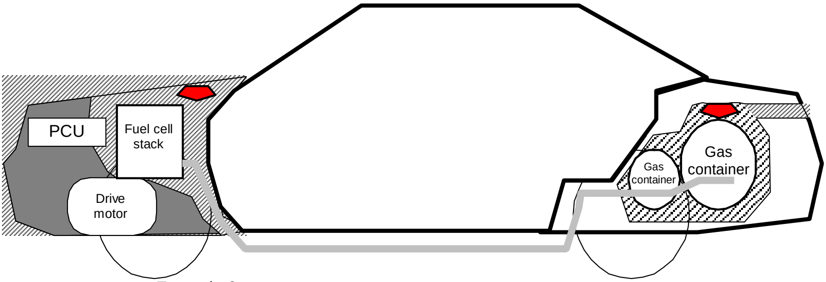
Example 3. Hydrogen system components installed under the floor of the body (two upward sections)



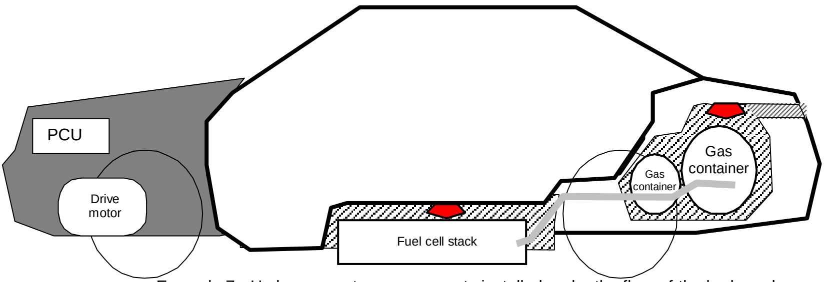
Example 4. Hydrogen system components installed at the roof and under the floor of the body



Example 5. Hydrogen system components installed at the roof



Example 6. Hydrogen system components installed in the motor room and in the housing in the luggage compartment



Example 7. Hydrogen system components installed under the floor of the body and in the housing in the luggage compartment