

Technical Guidance for Safety and Environment of Fuel Cell Vehicles Which are to Run on Public Road under the Approval of the Minister of Land, Infrastructure and Transport

Transmitted by Japan

1. Scope

Among those test motor vehicles as defined in paragraph 4 of article 56 of safety regulations for road vehicles, this technical guidance applies to fuel cell vehicles which are mounted with hydrogen gas in a compressed state and which use the hydrogen gas as their fuel (hereinafter referred to as the “fuel cell vehicle”),

2. Definitions of Terms

The terms in this Technical Guidance shall be defined as follows.

- (1) The term “hydrogen gas” means a gas whose main component is hydrogen.
- (2) The term “pressure” means a gauge pressure.
- (3) The term “normal pressure” means the highest pressure among pressures normally used.
- (4) The term “gas container” means a container which is intended for being filled with the hydrogen gas.
- (5) The term “container source valve” means a valve directly installed to the gas container that is able to cut off the flow of hydrogen gas in the gas container.
- (6) The term “container safety valve” means a valve which is actuated one time only and discharges hydrogen gas when the pressure or temperature of hydrogen gas in the gas container becomes abnormal.
- (7) The term “container accessories” means a container source valve and a container safety valve that are incorporated in the gas container.

- (8) The term “overflow prevention valve” means a valve that cuts off hydrogen gas automatically or that adjusts the hydrogen gas flow rate automatically when the hydrogen gas flow rate from the gas container exceeds a design allowance.
- (9) The term “main shut-off valve” means a valve which is installed in the vicinity of the container source valve and which electromagnetically cuts off the supply of hydrogen gas to downstream piping, etc.
- (10) The term “pressure regulator” means a valve, which regulates the hydrogen gas pressure to a specified pressure.
- (11) The term “pressure relief valve” means a valve which operates to protect the component parts in secondary side of the pressure regulator when the pressure on the secondary side of the pressure regulator rises abnormally.
- (12) The term “piping, etc.” means portions exclusively used for the flow of the hydrogen gas, except the fuel cell stack, the gas container and container accessories.
- (13) The term “gas filling port” means a connection port installed in the fuel cell vehicle for the purpose of filling the hydrogen gas into the gas container.
- (14) The term “gas filling valve” means a valve which cuts off the flow route between the gas container and hydrogen gas filling port except when the hydrogen gas is charged.
- (15) The term “check valve” means a valve which prevents the reverse flow of hydrogen gas from the gas container to the gas filling port.
- (16) The term “hydrogen system“ means portion of components where hydrogen gas flows, including the part from the gas filling port to the inlet of the fuel cell stack, and hydrogen circulation line which is from the outlet of the fuel cell stack to the inlet of the fuel cell stack, and the part from the outlet of the fuel cell stack to hydrogen purge outlet to the atmosphere, as well as means a device which controls those relevant components.
- (17) The term “fuel cell stack“ means a device that generates electricity by supplying air and hydrogen gas as a fuel.
- (18) The term “fuel cell system“ means a power generation system that consists of the hydrogen system, the air supplying system, the fuel cell stack and the device that controls those systems and the stack, including a humidifier for hydrogen gas and air and a thermostat for the fuel cell stack.

- (19) The term “purge“ means that a part of the hydrogen gas in the fuel cell system is exhausted to the outside by the control of the fuel cell stack.
- (20) The term “ignition source “ means heat energy source such as high temperature needed for hydrogen gas to be ignited, and/or electric energy source such as electric spark.
- (21)The term “basic insulation“ means insulation of live parts necessary to prevent electric shock by direct contact in a no fault condition.
- (22) The term “live part“ means a conductor or conductive part intended to be electrically energized in normal use.
- (23) The term “propulsion power source“ means power sources for driving fuel cell vehicles such as fuel cell stack and onboard electric energy storage equipment.

3. Safety

Fuel cell vehicles shall be vehicles which meet the criteria enumerated below and whose safety under the surroundings and operating condition specified by the vehicle manufacturer is confirmed by intensive in-house evaluation beforehand by those manufactures.

There should be no danger of harm to passengers and/or surroundings resulting from components of the fuel cell system in collision, etc..

This, however, shall not apply for fuel cell vehicles whose safety and other requirements are satisfied by other measures than those set in this technical guidance.

3.1 Safety of Pressurized Hydrogen

3.1.1 Hydrogen System

(1) Preventing Concentration of Hydrogen Gas

Fuel cell vehicles shall have the mechanism to prevent hydrogen concentration when hydrogen gas is leaked or permeated from the fuel cell system.

(2) Purge

1) Purged hydrogen gas shall not enter the driver or passenger compartment etc. but be safely exhausted to the atmosphere.

2) Any openings from which hydrogen gas may be purged shall be positioned away from any ignition source.

(3) Hydrogen Discharge

Hydrogen gas discharged by the actuated container safety valve or pressure relief valve

should not enter the driver or passenger compartment etc. and shall be safely discharged to the atmosphere.

Any openings from which hydrogen gas may be discharged shall be positioned away from any ignition source and be positioned in a location where it is not susceptible to any blockage.

3.1.2 Components of Hydrogen System

Any component of the hydrogen system shall be so designed that hydrogen embrittlement is taken into account.

(1) Gas Container

- 1) The gas container shall be a container which has passed the container inspection provided for in the Article 44 (inspection of anti-pressure, strength and air-tightness) of the High Pressure Gas Control Act and has received the stamping provided for in Article 45, a container which has passed the container inspection provided for in the Article 44 of the High Pressure Gas Control Act and has received the stamping provided for in the Article 49-25 (including cases where the provision of the Article 49-33 is applicable), or a container which has passed the container re-inspection of the Article 49.
- 2) The gas container shall be so located that the gas container is hard to susceptible to any shock and heat.
- 3) In the case when the gas container is mounted in compartment, the container accessories and piping, etc. shall be covered with air-tight housing and leaked gas shall be guided and exhausted to the outside of the vehicle.

(2) Container Source Valve, Container Safety Valve (Container Accessories)

The gas container shall be provided with the container source valve and container safety valve that comply with the followings given below.

- 1) The container source valve and container safety valve shall be accessories which have passed the accessory inspection provided for in the Article 49-2 (inspection of anti-pressure, strength and air-tightness) of the High Pressure Gas Control Act and have received the stamping provided for in the Article 49-3, accessories which have passed the accessory inspection provided for in the Article 49-2 of the High Pressure Gas Control Act and have received the stamping provided for in the Article 49-25 (including cases where the provision of the Article 49-33 is applicable), or accessories which have passed the accessory re-inspection of the Article 49-4.
- 2) The container source valve and container safety valve shall be installed directly in each gas container.
- 3) The container source valve and container safety valve shall have the pressure resistance corresponding to the maximum filling pressure of the gas container.

(3) Main Shut-off Valve

The main shut-off valve, which complies with the following items given below, shall be installed. The container source valve can be considered as the main shut-off valve if the container source valve is actuated electromagnetically.

- 1) The main shut-off valve shall be operated from the driver's seat.
- 2) The main shut-off valve shall close automatically when no power is supplied.
- 3) The main shut-off valve shall be able to withstand the pressure of one and a half time or more of the normal pressure, and shall have air-tightness against the outside under the normal pressure.

(4) Safety Mechanism (Overflow Prevention Valve and Main Shut-off Valve, etc.)

The safety mechanism such as overflow prevention valve or main shut-off valve etc. which has the equivalent function as the overflow prevention valve shall be installed and appropriately located.

(5) Pressure Regulator

The pressure regulator shall be able to withstand the pressure of one and a half time of the normal pressure, and shall have air-tightness against the outside under the normal pressure.

(6) Safety Device

In order to protect the components in the secondary side of the pressure regulator, either a main valve, etc. which is able to cut off the supply of the hydrogen gas or a pressure relief valve which is actuated when the pressure on the secondary side of the pressure regulator exceeds the normal pressure shall be installed.

(7) Piping, etc.

The piping, etc. shall employ a coupling system at which fuel leakage hardly occurs, shall be able to withstand the pressure of one and a half times or more of the normal pressure, and shall be fastened.

(8) Gas Filling Port

The gas filling port shall comply with the followings given below.

- 1) The gas filling port shall be so located that the gas fuel is easily filled.
- 2) The gas filling port shall be located where the safe distance away from any exposed electric terminal and electric switch gear is secured.
- 3) The gas filling port should not be opened to the internal compartment with seats or standing space.

(9) Gas Filling Valve

The gas filling valve which complies with the followings given below shall be provided in the vicinity of the gas filling port. This, however, shall not apply when a check valve, with the overflow prevention function which shall comply with the followings given below, is incorporated in the gas filling port or installed directly in the gas filling port.

- 1) The anti pressure performance of one and a half times or more of the normal pressure shall be secured.
- 2) The air-tightness under the normal pressure shall be secured.

(10) Check Valve

The piping, etc. used mainly for filling hydrogen gas or the container source valve which is attached to those piping, etc. shall be equipped with the check valve which complies with the followings given below.

- 1) The anti pressure performance of one and a half times or more of the normal pressure shall be secured.
- 2) The air-tightness under the normal pressure shall be secured.
- 3) The function which prevents the reverse flow under a pressure ranging from the normal pressure to extremely low pressure shall be secured.

3.1.3 Safety Measures against Emergency

(1) Fuel cell vehicles shall comply with the followings given below.

- 1) Fuel cell vehicles shall have safety devices at the downstream from the main –shut-off valve which detect leaked hydrogen, and shall have an alarm which informs the driver of the hydrogen leakage and a device to cut off the supply of the hydrogen gas in response to the amount of hydrogen leaked once leakage is detected,
- 2) Fuel cell vehicles shall have the mechanism which at the start-up confirms that the device to detect failure and the device to cut off hydrogen gas supply have neither breaking wire nor short-circuit.

(2) Safety measures against collision

A fuel cell vehicle shall have the mechanism, which automatically cut off the supply of the hydrogen gas from the gas container in the case of collision when downstream hydrogen system from the main shut-off valve might be damaged.

3.2 Safety of High Voltage

(1) The fuel cell stack and the other electric devices

The fuel cell stack and the other electric devices shall conform to the following requirements.

- 1) For the prevention of direct contact hazard, the live part shall have sufficient insulation resistance to the vehicle body, or shall be enclosed by a strong cover, or other means to secure safety shall be employed. And the live part shall have the structure to secure safety under fault condition.
- 2) Safety of high voltage shall be secured when the electrical insulation resistance is remarkably decreased in case of collision and a condition under water, etc..
- 3) Current from the fuel cell stack terminal shall be cut off when fuel cell stack might be damaged in collision.

(2) Propulsion power source

Current in all propulsion power sources shall be cut off by a circuit breaker, a voltage shut-off device or a fuse etc. in case of excess current or short-circuit which might be harmful to passenger and/or surroundings.

3.3 Other Safety Issues

The fuel cell system should not harm passenger or surroundings resulting from high temperature or high pressure etc. and an alarm to inform the driver of an emergency when abnormal condition (abnormal temperature or pressure, etc.) in the fuel stack is detected shall be employed.

4. Environment Issue

The emissions from fuel cell vehicles shall contain as little harmful substance as possible.

5. Others

(1) Measures against Emergency

Measures against emergency for owners of fuel cell vehicles to take appropriate measures in case of emergency such as collision shall be elaborated for the owners.

(2) Owner's Manual, etc.

An owner's manual, etc. which elaborates on handling procedure of hydrogen gas fuels shall be provided to users of fuel cell vehicles.