

CS 31HB.45 Fuel cells

ED Decision 2009/005/R

1. It must be demonstrated by test or analysis or both that fuel cell's have sufficient strength margins to withstand all conditions of internal and external pressures, temperatures and loads likely to be encountered in operation, including during ground handling and ground transport. (See AMC 31HB.45(a))
2. The compatibility of the cells material with the fuel must be justified. Fatigue, ageing, fire resistance and corrosion capability of the cells must be assessed and any necessary limitation, protection or maintenance action must be determined.
3. Fuel cells, their attachments and related supporting structure must be shown by tests to be capable of withstanding, without detrimental distortion or failure, any inertia loads to which the installation may be subjected in operation. (See AMC 31HB.45(c))
4. A pressurised fuel cell must be equipped with:
 1. A shut-off valve. This valve must be equipped with a self-sealing coupling, or other means to avoid the release of hazardous quantities of fuel should the control be inadvertently operated without a fuel line connected. (See AMC 31HB.45(d)(1))
 2. A pressure relief valve, which must protect the fuel cell against over pressurisation.
 3. A means to control the maximum filling.
 4. A means to assess the fuel quantity. (See also [CS 31HB.47\(c\)\(2\)](#))
 5. A data plate containing information necessary for safe operation. (See AMC 31HB.45(d)(5))
5. Guards must be fitted to all fuel cells to protect the valves and other fittings from fuel leakage in case of:
 1. Inadvertent operation and
 2. Damage, during normal operation, ground handling or transport.
6. Rigid extensions must not be fitted directly to fuel cell valves or fittings due to the likelihood of overload or fracture occurring in the case of a hard or fast landing. (See also [CS 31HB.46](#))

AMC 31HB.45(a) Fuel cells

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The fuel cell design and manufacture should be verified by a test programme agreed by the Agency. This test programme should consider burst testing, fatigue testing, impact testing, drop testing, fire testing, macro examination of the material of the cell cylinder and welded joints (if applicable) and material variability.

Note: Road, ship or aircraft transport of fuel cells and their storage is an inherent characteristic of Hot Air Balloon operation. In order to comply with Transport and Storage legislation it is recommended to consider in parallel to airworthiness issues the compliance with such legislation applicable to pressurised gas containers (e.g. Accord européen relatif au transport international des marchandises Dangereuses par Route (ADR)).

AMC 31HB.45(c) Fuel cells

ED Decision 2011/013/R

The restraint of a full fuel cell (e.g. straps) should not detach under typical high g-loads experienced during a hard or fast landing.

In case of fuel cells supported at the lower end by the basket floor or other structure, the straps and buckle restraining a fuel cell shall be designed as applicable to a horizontal limit load of 6.0g and upward limit load of 2.0g. The factor of safety of 1.50 is applicable to these fuel cell straps.

The strap and buckle design should be shown to maintain sufficient pre-tensioned after a flight to withstand the upward limit load of 2.0g. The handling of the strap and buckle shall allow proper pre-tension, reliable locking, but also easy release e.g. for emergency fuel cell removal. Industry standards like EN 12195-2, ASTM D3950 or equivalent using the appropriate strap type and grade are considered appropriate standards.

Consideration of applied loads on fuel cells should include handling and transport cases.

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AMC 31HB.45(d)(1) Fuel cells

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The shut-off valve should be free from restrictors (excess flow limiters or overfill protection devices) that could fail in the closed position.

AMC 31HB.45(d)(5) Fuel cells

ED Decision 2009/005/R

The fuel cell data plate should include the following information:

1. the manufacturers name or mark;
2. the type design approval number (if applicable);
3. the manufacturers serial number;
4. the UN number and the proper name of the gas or mixture of gases (e.g. UN1978 Propane); and
5. the maximum filling of the receptacle with the fittings and accessories as fitted at the time of filling.

Note: The data plate should include, where applicable, information to allow safe filling by commercial facilities (e.g. filling by weight). Where a fuel cell has been designed to a standard which is not compatible with comparable industrial standards, the data plate should include the statement "For use in Hot Air Balloons only".

→ [CS 31HB.46](#)

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