CS 25J994 Fuel system components

ED Decision 2007/010/R

Fuel system components in an APU compartment or in the fuselage must be protected from damage which could result in spillage of enough fuel to constitute a fire hazard as a result of a wheels-up landing on a paved runway under each of the conditions prescribed in CS 25.721(b).

[Amdt 25/1]
[Amdt 25/3]

CS 25J995 Fuel valves

ED Decision 2005/006/R

In addition to the requirements of CS 25J1189 for shut-off means, each fuel valve must be supported so that no loads resulting from their operation or from accelerated flight conditions are transmitted to the lines attached to the valve, unless adequate strength margins under all loading conditions are provided in the lines and connections.

[Amdt 25/1]

CS 25J997 Fuel strainer or filter

ED Decision 2005/006/R

For essential APUs:

There must be a fuel strainer or filter between the fuel tank outlet and the inlet of either the fuel metering device or an APU driven positive displacement pump, whichever is nearer the fuel tank outlet. This fuel strainer or filter must:

(a) Be accessible for draining and cleaning and must incorporate a screen or element which is easily removable;

(b) Have a sediment trap and drain except that it need not have a drain if the strainer or filter is easily removable for drain purposes;

(c) Be mounted so that its weight is not supported by the connecting lines or by the inlet or outlet connections of the strainer or filter itself, unless adequate strength margins under all loading conditions are provided in the lines and connections; and

(d) Have the capacity (with respect to operating limitations established for the APU) to ensure that APU fuel system functioning is not impaired, with the fuel contaminated to a degree (with respect to particle size and density) that is greater than that established for the APU in CS-APU 250.

[Amdt 25/1]

OIL SYSTEM

CS25J1011 Oil System General

ED Decision 2005/006/R

(a) Each APU must have an independent oil system that can supply it with an appropriate quantity of oil at a temperature not above that safe for continuous operation.

(b) The usable oil capacity may not be less than the product of the endurance of the aeroplane and the maximum allowable oil consumption of the APU plus a suitable margin to ensure system circulation.

[Amdt 25/1]

CS 25A1017 Oil lines and fittings

ED Decision 2005/006/R

(a) Each oil line must meet the requirements of CS 25J993 and each oil line and fitting in any designated fire zone must meet the requirements of CS 25J1183.

(b) Breather lines must be arranged so that:

(1) Condensed water vapour that might freeze and obstruct the line cannot accumulate at any point;

(2) The breather discharge does not constitute a fire hazard;

(3) The breather does not discharge into the APU air intake system.

[Amdt 25/1]

CS 25J1019 Oil Filter

ED Decision 2005/006/R

Where there is a filter in the APU lubrication system through which all the oil flows, it must be constructed and installed so that oil may flow at an acceptable rate through the rest of the system with the filter element completely blocked. An impending filter by-pass indication is required.

[Amdt 25/1]

CS 25J1021 Oil system drains

ED Decision 2005/006/R

A drain (or drains) must be provided to allow safe drainage of the oil system. Each drain must:

(a) Be accessible; and

(b) Have manual or automatic means for positive locking in the closed position.

[Amdt 25/1]

CS 25J1023 Oil radiators

ED Decision 2005/006/R

Each oil radiator must be able to withstand, without failure, any vibration, inertia, and oil pressure load to which it would be subjected in operation.

[Amdt 25/1]

CS 25J1025 Oil valves

ED Decision 2005/006/R

(a) Each oil shut-off must meet the requirements of CS 25J1189.

(b) Each oil valve must have positive stops or suitable index provisions in the "on'' and "off'' positions and must be supported so that no loads resulting from its operation or from accelerated flight conditions are transmitted to the lines attached to the valve, unless adequate strength margins under all loading conditions are provided in the lines and connections.

[Amdt 25/1]

COOLING

CS 25J1041 General

ED Decision 2005/006/R

(See AMC 25J1041.)

The APU cooling provisions must be able to maintain the temperatures of APU components and fluids within the temperature limits established for these components and fluids, under critical ground and flight operating conditions, and after normal APU shutdown.

[Amdt 25/1]

AMC 25J1041 General

ED Decision 2005/006/R

The need for additional tests, if any, in hot climatic conditions should take account of any tests made by the APU constructor to establish APU performance and functioning characteristics and of satisfactory operating experience of similar power units installed in other types of aeroplane.

The maximum climatic conditions for which compliance will be established should be declared and this should not be less severe than the ICAO Intercontinental Maximum Standard Climate (37·8°C (100°F) at sea-level). If the tests are conducted under conditions which deviate from the maximum declared ambient temperature, the maximum temperature deviation should not normally exceed 13·9°C (25°F).

[Amdt 25/1]

CS 25J1043 Cooling tests

ED Decision 2005/006/R

(a) General. Compliance with CS 25J1041 must be shown by tests, under critical conditions. For these tests, the following apply:

(1) If the tests are conducted under conditions deviating from the maximum ambient atmospheric temperature, the recorded APU temperatures must be corrected under sub-paragraph (c) of this paragraph.

(2) No corrected temperatures determined under sub-paragraph (a)(1) of this paragraph may exceed established limits.

(b) Maximum ambient atmospheric temperature. A maximum ambient atmospheric temperature corresponding to sea level conditions must be established. The temperature lapse rate is 2.0°C per 300 metres of altitude above sea level until a temperature of -56.5°C is reached, above which altitude, the temperature is considered constant at -56.5°C.

(c) Correction factor. Unless a more rational correction applies, temperatures of APU fluids and components for which temperature limits are established, must be corrected by adding to them the difference between the maximum ambient atmospheric temperature and the temperature of the ambient air at the time of the first occurrence of the maximum component or fluid temperature recorded during the cooling test.

[Amdt 25/1]

CS 25J1045 Cooling test procedures

ED Decision 2005/006/R

(a) Compliance with CS 25J1041 must be shown for the critical conditions that correspond to the applicable performance requirements. The cooling tests must be conducted with the aeroplane in the configuration, and operating under the conditions that are critical relative to cooling. For the cooling tests, a temperature is 'stabilised' when its rate of change is less than 1°C per minute.

(b) Temperatures must be stabilised prior to entry into each critical condition being investigated, unless the entry condition normally is not one during which component and APU fluid temperatures would stabilise (in which case, operation through the full entry condition must be conducted before entry into the critical condition being investigated in order to allow temperatures to reach their natural levels at the time of entry).

(c) Cooling tests for each critical condition must be continued until:

(1) The component and APU fluid temperatures stabilise;

(2) The stage of flight is completed; or

(3) An operating limitation is reached.

[Amdt 25/1]

AIR INTAKE AND BLEED AIR DUCT SYSTEMS

CS 25J1091 Air intake

ED Decision 2005/006/R

The air intake system for the APU:

(a) Must supply the air required by the APU under each operating condition for which certification is requested,

(b) May not draw air from within the APU compartment or other compartments unless the inlet is isolated from the APU accessories and power section by a firewall,

(c) Must have means to prevent hazardous quantities of fuel leakage or overflow from drains, vents, or other components of flammable fluid systems from entering,

(d) Must be designed to prevent water or slush on the runway, taxiway, or other airport operating surface from being directed into the air intake system in hazardous quantities,

(e) Must be located or protected so as to minimise the ingestion of foreign matter during takeoff, landing, and taxiing.

[Amdt 25/1]

CS 25J1093 Air intake system icing protection

ED Decision 2016/010/R

(See AMC 25J1093)

(a) Each non-essential APU air intake system, including any screen if used, which does not comply with CS 25J1093(b) will be restricted to use in non-icing conditions, unless it can be shown that the APU complete with air intake system, if subjected to the icing conditions, defined in Appendices C, O and P will not affect the safe operation of the aeroplane.

b) For essential APUs:

Each essential APU, with all icing protection systems operating, and screen if used, must:

(1) operate throughout its flight power range in the icing conditions defined in Appendices C, O and P, and in falling and blowing snow within the limitations established for the aeroplane for such operation, without the accumulation of ice on the APU, air intake system components or airframe components that would do any of the following:

(i) Adversely affect installed APU operation or cause a sustained loss of power; or an unacceptable increase in gas path operating temperature; or an airframe/APU incompatibility; or

(ii) Result in unacceptable temporary power loss or APU damage; or

(iii) Cause a stall, surge, or flameout or loss of APU controllability (for example, rollback).

(2) operate for a minimum of 30 minutes on the ground in the icing conditions shown in Table 1 of CS 25.1093(b)(2), unless replaced by similar test conditions that are more critical. These conditions must be demonstrated with the available icing protection (if applicable) at its critical condition, without adverse effect. The applicant must document the APU minimum ambient temperature demonstrated, if any, and establish the aeroplane operating limitations. (See AMC 25J1093(b))

[Amdt 25/1]
[Amdt 25/16]
[Amdt 25/18]

AMC 25J1093(b) Essential APU air intake system de-icing and anti-icing provisions

ED Decision 2015/008/R

1. General

In establishing compliance with the requirements of CS 25J1093(b), reference should be made to AMC 25.1093(b). All the reference made to "engine" may be transposed to "essential APU". Engine test (especially CS-E 780) may refer to essential APU icing test done for the APU certification, if any.

When the air intake is assessed separately, it should be shown that the effects of air intake icing would not invalidate the icing tests of CS-APU. Factors to be considered in such evaluation are:

a. Distortion of the airflow and partial blockage of the air intake.

b. The shedding into the APU of air intake ice of a size greater than the APU has been shown to ingest.

c. The icing of any APU sensing devices, other subsidiary air intakes or equipment contained within the air intake.

d. The time required to bring the protective system into full operation

2. Operating limitations

The conditions defined in CS 25J1093(b)(2), in terms of time and temperature, should be considered as limitations necessary for the safe operation in freezing fog, and made available to the crew in the Aeroplane Flight Manual (refer to CS 25.1581).

Nevertheless, the applicant may use an analysis to substantiate safe operation of the APU at temperatures below the demonstrated minimum temperature. No limitation would then be required in the Aeroplane Flight Manual.

Any additional substantiation provided by the applicant to demonstrate the capability of an extended exposure beyond the conditions defined in CS 25J1093(b)(2), based on further testing and/or analysis, will be considered by the Agency.

[Amdt 25/1]
[Amdt 25/16]

CS 25J1103 Air intake system ducts

ED Decision 2005/006/R

(a) Each air intake system duct must be:

(1) Drained to prevent accumulation of hazardous quantities of flammable fluid and moisture in the ground attitude. The drain(s) must not discharge in locations that might cause a fire hazard; and

(2) Constructed of materials that will not absorb or trap sufficient quantities of flammable fluids such as to create a fire hazard.

(b) Each duct must be:

(1) Designed to prevent air intake system failures resulting from reverse flow, APU surging, or inlet door closure; and

(2) Fireproof within the APU compartment and for a sufficient distance upstream of the APU compartment to prevent hot gases reverse flow from burning through the APU air intake system ducts and entering any other compartment or area of the aeroplane in which a hazard would be created resulting from the entry of hot gases.

The materials used to form the remainder of the air intake system duct and plenum chamber of the APU must be capable of resisting the maximum heat conditions likely to occur.

(c) Each duct connected to components between which relative motion could exist must have means for flexibility.

[Amdt 25/1]

CS 25J1106 Bleed air duct systems

ED Decision 2005/006/R

(a) For APU bleed air duct systems, no hazard may result if a duct failure occurs at any point between the air duct source and the aeroplane unit served by the bleed air.

(b) Each duct connected to components between which relative motion could exist must have a means for flexibility.

(c) Where the airflow delivery from the APU and main engine is delivered to a common manifold system, precautions must be taken to minimise the possibility of a hazardous condition due to reverse airflow through the APU resulting from malfunctions of any component in the system.

[Amdt 25/1]

EXHAUST SYSTEM

CS 25J1121 General

ED Decision 2005/006/R

(a) Each exhaust system must ensure safe disposal of exhaust gases without fire hazard or carbon monoxide contamination in any personnel compartment. For test purposes, any acceptable carbon monoxide detection method may be used to show the absence of carbon monoxide.

(b) Each exhaust system part with a surface hot enough to ignite flammable fluids or vapours must be located or shielded so that leakage from any system carrying flammable fluids or vapours will not result in a fire caused by impingement of the fluids or vapours on any part of the exhaust system including shields for the exhaust system.

(c) Each component that hot exhaust gases could strike, or that could be subjected to high temperatures from exhaust system parts, must be fireproof. All exhaust system components must be separated by fireproof shields from adjacent parts of the aeroplane that are outside the APU compartment.

(d) No exhaust gases may discharge so as to cause a fire hazard with respect to any flammable fluid vent or drain.

(e) Reserved

(f) Each exhaust system component must be ventilated to prevent points of excessively high temperature.

(g) Each exhaust shroud must be ventilated or insulated to avoid, during normal operation, a temperature high enough to ignite any flammable fluids or vapours external to the shroud.

[Amdt 25/1]

CS 25J1123 Exhaust piping

ED Decision 2005/006/R

(a) Exhaust piping must be heat and corrosion resistant, and must have provisions to prevent failure due to expansion by operating temperatures.

(b) Piping must be supported to withstand any vibration and inertia loads to which it would be subjected in operation; and

(c) Piping connected to components between which relative motion could exist must have means for flexibility.

[Amdt 25/1]

APU CONTROLS AND ACCESSORIES

CS 25J1141 APU controls

ED Decision 2005/006/R

(a) Means must be provided on the flight deck for starting, stopping, and emergency shutdown of each installed APU. Each control must:

(1) Be located, arranged, and designed under CS 25.777(a)(b)(c)(d) and marked under CS 25.1555(a); and

(2) Be located so that it cannot be inadvertently operated by persons entering, leaving, or moving normally on the flight deck; and

(3) Be able to maintain any set position without constant attention by flight crew members and without creep due to control loads or vibration; and

(4) Have sufficient strength and rigidity to withstand operating loads without failure and without excessive deflection; and

(5) For flexible controls, be approved or must be shown to be suitable for the particular application.

(b) APU valve controls located in the flight deck must have:

(1) For manual valves, positive stops or, in the case of fuel valves, suitable index provisions in the open and closed positions,

(2) In the case of valves controlled from the flight deck other than by mechanical means, where the correct functioning of the valve is essential for the safe operation of the aeroplane, a valve position indicator which senses directly that the valve has attained the position selected must be provided, unless other indications in the flight deck give the flight crew a clear indication that the valve has moved to the selected position. A continuous indicator need not be provided.

(c) For unattended operation, the APU installation must:

(1) Provide means to automatically shutdown the APU for the following conditions:

(i) Exceedence of any APU parameter limit or existence of a detectable hazardous APU operating condition; and

(ii) Bleed air duct failure between the APU and aeroplane unit served by the bleed air, unless it can be shown that no hazard exists to the aeroplane.

(2) Provide means to automatically shut off flammable fluids per CS 25J1189 in case of fire in the APU compartment.

(d) APU controls located elsewhere on the aeroplane, which are in addition to the flight deck controls, must meet the following requirements:

(1) Each control must be located so that it cannot be inadvertently operated by persons entering, leaving, or moving normally in the area of the control; and

(2) Each control must be able to maintain any set position without creep due to control loads, vibration, or other external forces resulting from the location.