C.2 AUTO-IGNITION TEMPERATURE

The minimum temperature at which an optimised flammable vapour and air mixture will spontaneously ignite when heated to a uniform temperature in a normal atmosphere without an external source of ignition, such as a flame or spark.

C.3 AUXILIARY TANKS

Fuel tanks installed that make additional fuel available for increasing the flight range of the aeroplane. The term 'auxiliary' means that the tank is secondary to the aeroplane's main fuel tanks; i.e., the functions of the main tanks are immediately available and operate without immediate supervision by the flight crew in the event of a failure or the inadvertent depletion of fuel in an auxiliary tank. Auxiliary tanks are usually intended to be emptied of usable fuel during flight and have been installed in various locations including centre wing structures, horizontal stabilisers, wings, and cargo compartments.

C.4 BARRIER

A physical partition attached to the aeroplane structure that separates one wire or group of wires from another wire or group of wires in order to prevent arcing, fire, and other physical damage between wires or groups of wires.

C.5 CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS (CDCCLS)

Airworthiness Limitations that define those critical design features of the design that must be maintained to ensure that ignition sources will not develop within the fuel tank system.

C.6 ELECTRICAL SPARK

A spark that is initiated by a potential difference, which causes an electrical breakdown of a dielectric such as a fuel/air mixture, produced between electrodes that are initially separated, with the circuit initially carrying no current. The term 'voltage sparks' is sometimes used interchangeably with the term electrical sparks.

C.7 ELECTRICAL ARCS

Electrical arcs occur between electrodes that are in contact with each other and carry excessive current, which results in melting at the contact points. This may result in electric arc plasma and/or the ejection of molten or burning material. The term thermal sparks is used interchangeably with the term electrical arcs.

C.8 EXPLOSION PROOF

Components designed and constructed so they will not ignite any flammable vapour or liquid surrounding the component under any normal operating condition or any failure condition. Further information on the possible failure conditions that should be considered is specified in CS 25.981(a)(3).

C.9 FAIL-SAFE

Applicants should assume the presence of foreseeable latent (undetected) failure conditions when demonstrating that subsequent single failures will not jeopardise the safe operation of the aeroplane.

C.10 FILAMENT HEATING

The heating of a small diameter piece of conductive material when exposed to electrical current.

C.11 FLAMMABLE

Flammable, with respect to a fluid or gas, means susceptible to igniting readily or to exploding.

C.12 FLASHPOINT

The flashpoint of a flammable fluid is defined as the lowest temperature at which the application of a flame to a heated sample causes the vapour to ignite momentarily, or 'flash.' The test standard for jet fuel is defined in the fuel specification.

C.13 FRICTION SPARK

A heat source in the form of a spark that is created by mechanical contact, such as debris contacting a rotating fuel pump impeller.

C.14 FUEL SYSTEM AIRWORTHINESS LIMITATION

Any mandatory replacement time, inspection interval, related inspection procedure, and all the critical design CDCCLs approved under CS 25.981 for the fuel tank system identified in the Airworthiness Limitations Section of the ICA (as required by CS 25.981(d) and Section H25.4 of Appendix H to CS-25).

C.15 GROUND FAULT INTERRUPTER (GFI)

A device that provides thermal circuit breaker protection, detects an electrical power short circuit-to-ground condition, and interrupts electrical power to the ground fault.

C.16 HOT SHORT

Electrical energy introduced into equipment or systems as a result of unintended contact with a power source, such as bent pins in a connector or damaged insulation on adjacent wires.

C.17 IGNITION SOURCE

A source of sufficient energy to initiate combustion of a fuel/air mixture. Hot surfaces that can exceed the auto-ignition temperature of the flammable vapour under consideration are considered to be ignition sources. Electrical arcs, electrical sparks, and friction sparks are also considered ignition sources if sufficient energy is released to initiate combustion.

C.18 INSTALLATION APPRAISAL

A qualitative appraisal of the integrity and safety of the installation.

C.19 INTRINSICALLY SAFE

Any instrument, equipment, or wiring that is incapable of releasing sufficient electrical or thermal energy to cause an ignition source within the fuel tank under normal operating conditions, or the anticipated failure conditions (see CS 25.981(a)(3)) and environmental conditions.

C.20 LATENT FAILURE

Please refer to the definition provided in AMC 25.1309.

C.21 LINE REPLACEMENT UNIT (LRU)

Any components that can be replaced while the aeroplane remains in operational service. Examples of fuel system LRUs include components such as flight deck and refuelling panel fuel quantity indicators, fuel quantity system processors, and fuel system management control units.

C.22 MAXIMUM ALLOWABLE SURFACE TEMPERATURE

As defined in CS 25.981(a)(1) and (2), the surface temperature within the fuel tank (the tank walls, baffles, or any components) that provides a safe margin under all normal or failure conditions, which is at least 27.8 °C (50 °F) below the lowest expected auto-ignition temperature of the approved fuels. The auto-ignition temperatures of fuels will vary because of a variety of factors (ambient pressure, dwell time, fuel type, etc.). The value accepted by EASA without further substantiation for kerosene fuels, such as Jet A, under static sea level conditions, is 232.2 °C (450 °F). This results in a maximum allowable surface temperature of 204.4 °C (400 °F) for an affected component surface.

C.23 QUALITATIVE

Those analytical processes that assess system and aeroplane safety in an objective, non-numerical manner.

C.24 QUANTITATIVE

Those analytical processes that apply mathematical methods to assess system and aeroplane safety.

C.25 TRANSIENT SUPPRESSION DEVICE (TSD)

A device that limits transient voltages or currents on wiring to systems such as the fuel tank quantity, fuel temperature sensors, and fuel level switches, etc., to a predetermined level.

[Amdt 25/1]
[Amdt 25/9]
[Amdt 25/26]

AMC 25.981(b)(1) Fuel tank flammability design precautions

ED Decision 2009/010/R

The intention of this requirement is to introduce design precautions, to avoid unnecessary increases in fuel tank flammability. These precautions should ensure:

(i) no large net heat sources going into the tank,

(ii) no unnecessary spraying, sloshing or creation of fuel mist,

(iii) minimization of any other energy transfer such as HIRF;

Applicants should limit the heat inputs to the maximum extent. Heat sources can be other systems, but also include environmental conditions such as solar radiation. The following design features have been found acceptable:

— heat insulation between a fuel tank and an adjacent heat source (typically ECS packs),

— forced ventilation around a fuel tank,

— fuel transfer logic leaving sufficient fuel in transfer tanks exposed to solar radiations on the ground in order to limit their effects

— heat rejecting paintings or solar energy reflecting paints to limit the heat input by solar radiation.

A critical parameter is the maximum temperature rise in any part of the tank under warm day conditions during a 4 hours ground operation. Any physical phenomenon, including environmental conditions such as solar radiation, should be taken into account. A temperature increase in the order of 20°C limit has been found acceptable for tanks not fitted with an active Flammability Reduction Means and therefore unable to meet the exposure criteria as defined in M25.1(b)(1).

Note 1: for tanks fitted with Flammability Reduction Means, applicants should limit heat and energy transfers to the maximum extent. No maximum temperature increase limit is defined; however the 20 °C limit is applicable in case of dispatch with the active Flammability Reduction Means inoperative.

Note 2: the maximum temperature increase under the conditions described above should be quantified whether or not the affected tank is fitted with a Flammability Reduction Means.

[Amdt 25/6]

AMC 25.981(b)(2) Fuel tank flammability definitions

ED Decision 2009/010/R

Equivalent Conventional Unheated Aluminium Wing is an integral tank in an unheated semi-monocoque aluminium wing of a subsonic aeroplane that is equivalent in aerodynamic performance, structural capability, fuel tank capacity and tank configuration to the designed wing.

Fleet Average Flammability Exposure is defined in Appendix N and means the percentage of time the fuel tank ullage is flammable for a fleet of an aeroplane type operating over the range of flight lengths.

[Amdt 25/6]

FUEL SYSTEM COMPONENTS

CS 25.991 Fuel pumps

ED Decision 2008/006/R

(a) *Main pumps*. Each fuel pump required for proper engine operation, or required to meet the fuel system requirements of this Subpart (other than those in sub-paragraph (b) of this paragraph), is a main pump. For each main pump, provision must be made to allow the bypass of each positive displacement fuel pump other than a fuel injection pump approved as part of the engine.

(b) *Emergency pumps*. There must be emergency pumps or another main pump to feed each engine immediately after failure of any main pump.

[Amdt 25/5]

CS 25.993 Fuel system lines and fittings

ED Decision 2003/2/RM

(a) Each fuel line must be installed and supported to prevent excessive vibration and to withstand loads due to fuel pressure and accelerated flight conditions.

(b) Each fuel line connected to components of the aeroplane between which relative motion could exist must have provisions for flexibility.

(c) Each flexible connection in fuel lines that may be under pressure and subject to axial loading must use flexible hose assemblies.

(d) Flexible hose must be approved or must be shown to be suitable for the particular application.

(e) No flexible hose that might be adversely affected by exposure to high temperatures may be used where excessive temperatures will exist during operation or after engine shut-down.

(f) Each fuel line within the fuselage must be designed and installed to allow a reasonable degree of deformation and stretching without leakage.

CS 25.994 Fuel system components

ED Decision 2007/010/R

(See AMC 25.994)

Fuel system components in an engine nacelle 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. 25/3]

AMC 25.994 Fuel system components

ED Decision 2003/2/RM

FAA Advisory Circular 25.994-1 Design Considerations To Protect Fuel Systems During A Wheels-Up Landing, dated 24/07/86, is accepted by the Agency as providing acceptable means of compliance with CS 25.994.

CS 25.995 Fuel valves

ED Decision 2003/2/RM

In addition to the requirements of CS 25.1189 for shut-off means, each fuel valve must –

(a) *Reserved*.

(b) Be supported so that no loads resulting from their operation or from accelerated flight conditions are transmitted to the lines attached to the valve.

CS 25.997 Fuel strainer or filter

ED Decision 2003/2/RM

There must be a fuel strainer or filter between the fuel tank outlet and the inlet of either the fuel metering device or an engine 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 engine) to ensure that engine 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 engine in CS-E.

CS 25.999 Fuel systems drains

ED Decision 2003/2/RM

(a) Drainage of the fuel system must be accomplished by the use of fuel strainer and fuel tank sump drains.

(b) Each drain required by sub-paragraph (a) of this paragraph must –

  (1) Discharge clear of all parts of the aeroplane;

  (2) Have manual or automatic means for positive locking in the closed position; and

  (3) Have a drain valve –

    (i) That is readily accessible and which can be easily opened and closed; and

    (ii) That is either located or protected to prevent fuel spillage in the event of a landing with landing gear retracted.

CS 25.1001 Fuel jettisoning system

ED Decision 2003/2/RM

(a) A fuel jettisoning system must be installed on each aeroplane unless it is shown that the aeroplane meets the climb requirements of CS 25.119 and 25.121(d) at maximum take-off weight, less the actual or computed weight of fuel necessary for a 15-minute flight comprised of a take-off, go-around, and landing at the airport of departure with the aeroplane configuration, speed, power, and thrust the same as that used in meeting the applicable take-off, approach, and landing climb performance requirements of this CS-25.

(b) If a fuel jettisoning system is required it must be capable of jettisoning enough fuel within 15 minutes, starting with the weight given in sub-paragraph (a) of this paragraph, to enable the aeroplane to meet the climb requirements of CS 25.119 and 25.121(d), assuming that the fuel is jettisoned under the conditions, except weight, found least favourable during the flight tests prescribed in sub-paragraph (c) of this paragraph.

(c) Fuel jettisoning must be demonstrated beginning at maximum take-off weight with wingflaps and landing gear up and in –

(1) A power-off glide at 1·3 V_{SR1};

(2) A climb at the one-engine inoperative best rate-of-climb speed, with the critical engine inoperative and the remaining engines at maximum continuous power; and

(3) Level flight at 1·3 V_{SR1}, if the results of the tests in the condition specified in sub-paragraphs (c)(1) and (2) of this paragraph show that this condition could be critical.

(d) During the flight tests prescribed in subparagraph (c) of this paragraph, it must be shown that –

(1) The fuel jettisoning system and its operation are free from fire hazard;

(2) The fuel discharges clear of any part of the aeroplane;

(3) Fuel or fumes do not enter any parts of the aeroplane;

(4) The jettisoning operation does not adversely affect the controllability of the aeroplane.

(e) *Reserved.*

(f) Means must be provided to prevent jettisoning the fuel in the tanks used for take-off and landing below the level allowing climb from sea level to 3048 m (10 000 ft) and thereafter allowing 45 minutes cruise at a speed for maximum range. However, if there is an auxiliary control independent of the main jettisoning control, the system may be designed to jettison the remaining fuel by means of the auxiliary jettisoning control.

(g) The fuel jettisoning valve must be designed to allow flight personnel to close the valve during any part of the jettisoning operation.

(h) Unless it is shown that using any means (including flaps, slots and slats) for changing the airflow across or around the wings does not adversely affect fuel jettisoning, there must be a placard, adjacent to the jettisoning control, to warn flight-crew members against jettisoning fuel while the means that change the airflow are being used.

(i) The fuel jettisoning system must be designed so that any reasonably probable single malfunction in the system will not result in a hazardous condition due to unsymmetrical jettisoning of, or inability to jettison, fuel.

OIL SYSTEM

CS 25.1011 General

ED Decision 2003/2/RM

(a) Each engine 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 under critical operating conditions and the approved maximum allowable oil consumption of the engine under the same conditions, plus a suitable margin to ensure system circulation.

CS 25.1013 Oil tanks

ED Decision 2003/2/RM

(a) *Installation*. Each oil tank installation must meet the requirements of CS 25.967.

(b) *Expansion space*. Oil tank expansion space must be provided as follows:

(1) Each oil tank must have an expansion space of not less than 10% of the tank capacity.

(2) Each reserve oil tank not directly connected to any engine may have an expansion space of not less than 2% of the tank capacity.

(3) It must be impossible to fill the expansion space inadvertently with the aeroplane in the normal ground attitude.

(c) *Filler connection*. Each recessed oil tank filler connection that can retain any appreciable quantity of oil must have a drain that discharges clear of each part of the aeroplane. In addition each oil tank filler cap must provide an oil-tight seal.

(d) *Vent*. Oil tanks must be vented as follows:

(1) Each oil tank must be vented from the top part of the expansion space so that venting is effective under any normal flight condition.

(2) Oil tank vents must be arranged so that condensed water vapour that might freeze and obstruct the line cannot accumulate at any point.

(e) *Outlet*. There must be means to prevent entrance into the tank itself, or into the tank outlet, of any object that might obstruct the flow of oil through the system. No oil tank outlet may be enclosed by any screen or guard that would reduce the flow of oil below a safe value at any operating temperature. There must be a shut-off valve at the outlet of each oil tank, unless the external portion of the oil system (including the oil tank supports) is fireproof.

(f) *Flexible oil tank liners*. Each flexible oil tank liner must be approved or must be shown to be suitable for the particular application.

CS 25.1015 Oil tank tests

ED Decision 2003/2/RM

Each oil tank must be designed and installed so that –

(a) It can withstand, without failure, each vibration, inertia, and fluid load that it may be subjected to in operation; and

(b) It meets the provisions of CS 25.965, except –

(1) The test pressure –

(i) For pressurised tanks used with a turbine engine, may not be less than 34 kPa (5 psi) plus the maximum operating pressure of the tank instead of the pressure specified in CS 25.965(a); and

(ii) For all other tanks, may not be less than 34 kPa (5 psi) instead of the pressure specified in CS 25.965(a); and

(2) The test fluid must be oil at 121°C (250°F) instead of the fluid specified in CS 25.965(c).

CS 25.1017 Oil lines and fittings

ED Decision 2003/2/RM

(a) Each oil line must meet the requirements of CS 25.993 and each oil line and fitting in any designated fire zone must meet the requirements of CS 25.1183.

(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 if foaming occurs or causes emitted oil to strike the pilot's windshield; and

(3) The breather does not discharge into the engine air induction system.

CS 25.1019 Oil strainer or filter

ED Decision 2003/2/RM

(a) Each turbine engine installation must incorporate an oil strainer or filter through which all of the engine oil flows and which meets the following requirements:

(1) Each oil strainer or filter that has a bypass, must be constructed and installed so that oil will flow at the normal rate through the rest of the system with the strainer or filter completely blocked.

(2) The oil strainer or filter must have the capacity (with respect to operating limitations established for the engine) to ensure that engine oil system functioning is not impaired when the oil is contaminated to a degree (with respect to particle size and density) that is greater than that established for the engine under CS-E.

(3) The oil strainer or filter, unless it is installed at an oil tank outlet, must incorporate an indicator that will indicate contamination before it reaches the capacity established in accordance with sub-paragraph (a)(2) of this paragraph.

(4) The bypass of a strainer or filter must be constructed and installed so that the release of collected contaminants is minimised by appropriate location of the bypass to ensure that collected contaminants are not in the bypass flow path.

(5) An oil strainer or filter that has no bypass, except one that is installed at an oil tank outlet, must have a means to connect it to the warning system required in CS 25.1305(c)(7).

CS 25.1021 Oil system drains

ED Decision 2003/2/RM

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.

CS 25.1023 Oil radiators

ED Decision 2003/2/RM

(a) 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.

(b) Each oil radiator air duct must be located so that, in case of fire, flames coming from normal openings of the engine nacelle cannot impinge directly upon the radiator.

CS 25.1025 Oil valves

ED Decision 2003/2/RM

(a) Each oil shut-off must meet the requirements of CS 25.1189.

(b) The closing of oil shut-off means may not prevent propeller feathering.

(c) 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.

CS 25.1027 Propeller feathering system

ED Decision 2003/2/RM

(See AMC 25.1027.)

(a) If the propeller feathering system depends on engine oil, there must be means to trap an amount of oil in the tank if the supply becomes depleted due to failure of any part of the lubricating system other than the tank itself.

(b) The amount of trapped oil must be enough to accomplish the feathering operation and must be available only to the feathering pump. (See AMC 25.1027(b).)

(c) The ability of the system to accomplish feathering with the trapped oil must be shown. This may be done on the ground using an auxiliary source of oil for lubricating the engine during operation.

(d) Provision must be made to prevent sludge or other foreign matter from affecting the safe operation of the propeller feathering system.

AMC 25.1027 Inadvertent Propeller Feathering

ED Decision 2003/002/RM

The design of the propeller feathering system should be such that it is possible to complete the feathering and the unfeathering operation under all normal operating conditions.