Overview of EASA SCs and ESFs for GA

Presentation on the most significant Special Conditions and Equivalent Safety Findings for GA Products

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General Aviation Seminar 2015
20th October 2015

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TE.GEN.00409-001

Rotax 912 iSc Engine Installation

- Installation challenge since engine does not meet some VLA requirements.
  - 2 ESFs are being issued to address the issues:
    - Fuel Pumps
    - Ignition Switches
  - Other items covered by AMC CRIs (not detailed today: Generator Warnings, Fuel Systems Tests)

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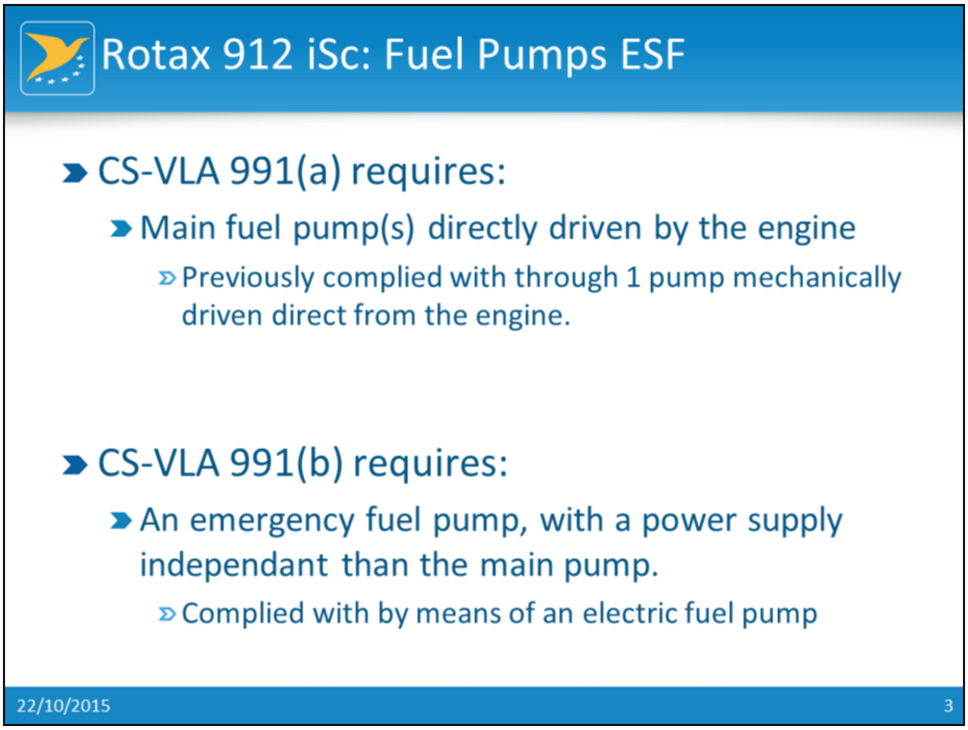
Also included in the list of other items are Engine Instrumentation and ECU Status lamps (both covered under the Certification Plan, no CRIs raised)



CS-VLA 991 Fuel pumps

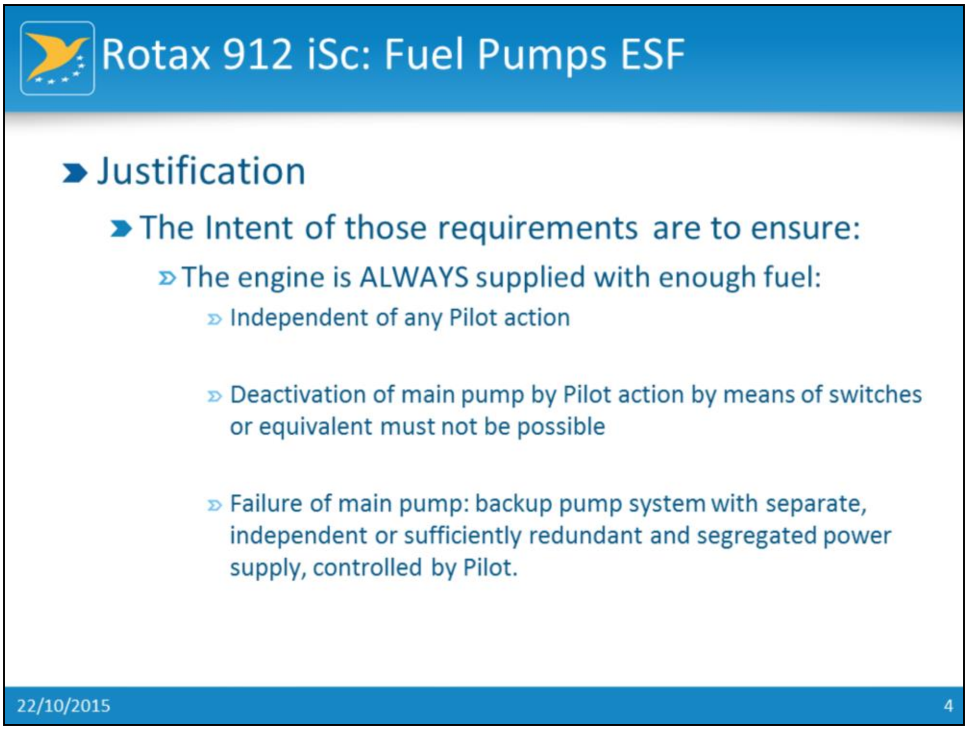
(a) *Main pump*. For the main pump, the following applies:

For an engine installation having fuel pumps to supply fuel to the engine, at least one pump must be directly driven by the engine and must meet CS-VLA 955. This pump is a main pump.

(b) Emergency pump. There must be an emergency pump immediately available to supply fuel to the engine if the main pump (other than a fuel injection pump approved as part of an engine) fails. The power supply for the emergency pump must be independent of the power supply for the main pump.

(c) Warning means. if both the main pump and emergency pump operate continuously, there must be a means to indicate to the pilot a malfunction of either pump.

(d) Operation of any fuel pump may not affect engine operation so as to create a hazard, regardless of the engine power or the functional status of any other fuel pump.

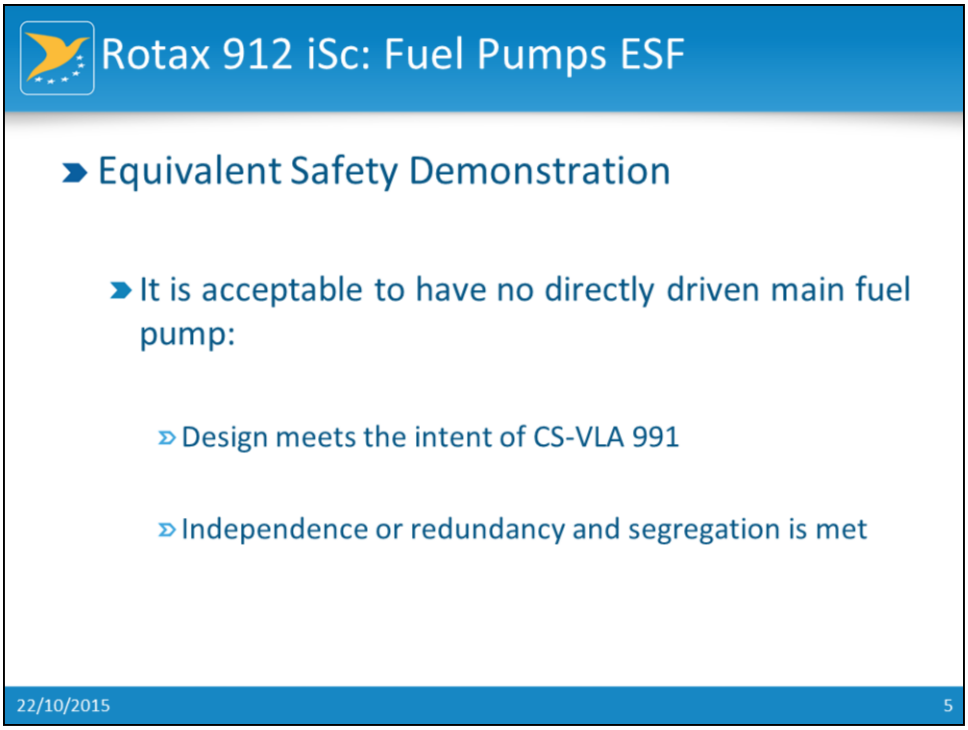


Justification:

The intent of those requirements mentioned above is:

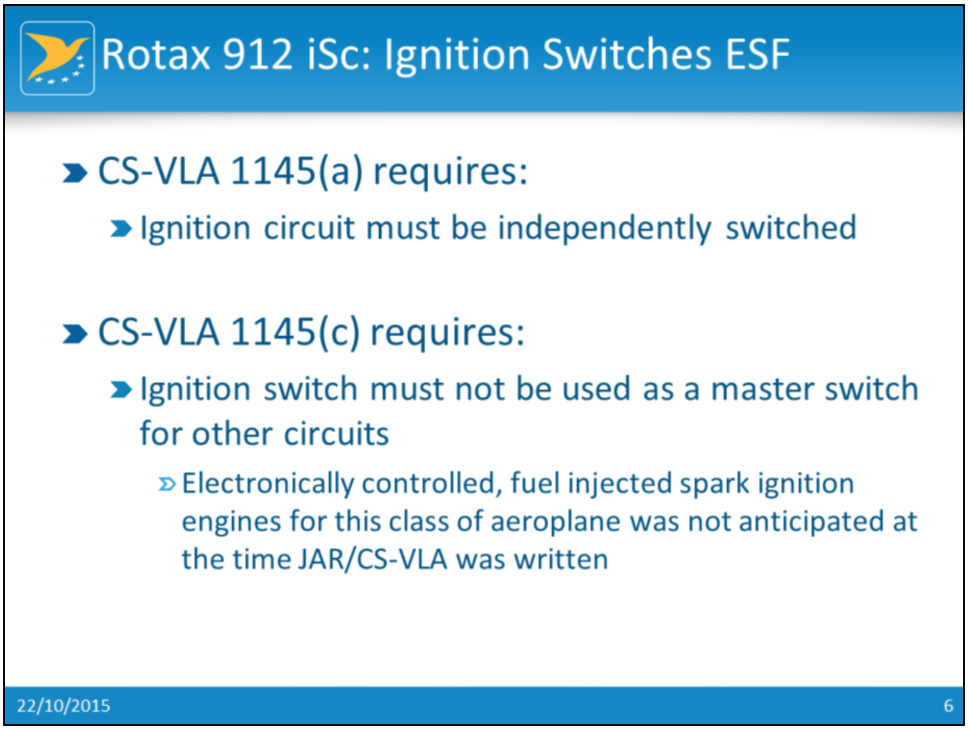
There is a main pump always supplying enough fuel to the engine, independent of any action of / control by the pilot. Deactivation of the main fuel pump by the pilot by means of switches or equivalent must not be possible, unless for check of the fuel pump.

For the case of failure of the main pump, there is a backup fuel pump system with a separate, independent or sufficiently redundant and segregated power supply, controlled by the pilot in case of need, and capable to provide enough fuel to the engine.



Safety Equivalency Demonstration:

It is acceptable to have no directly driven main fuel pump, if it can be demonstrated that the intent of CS-VLA 991 and the independence or redundancy and segregation as listed above is still met with the different design.

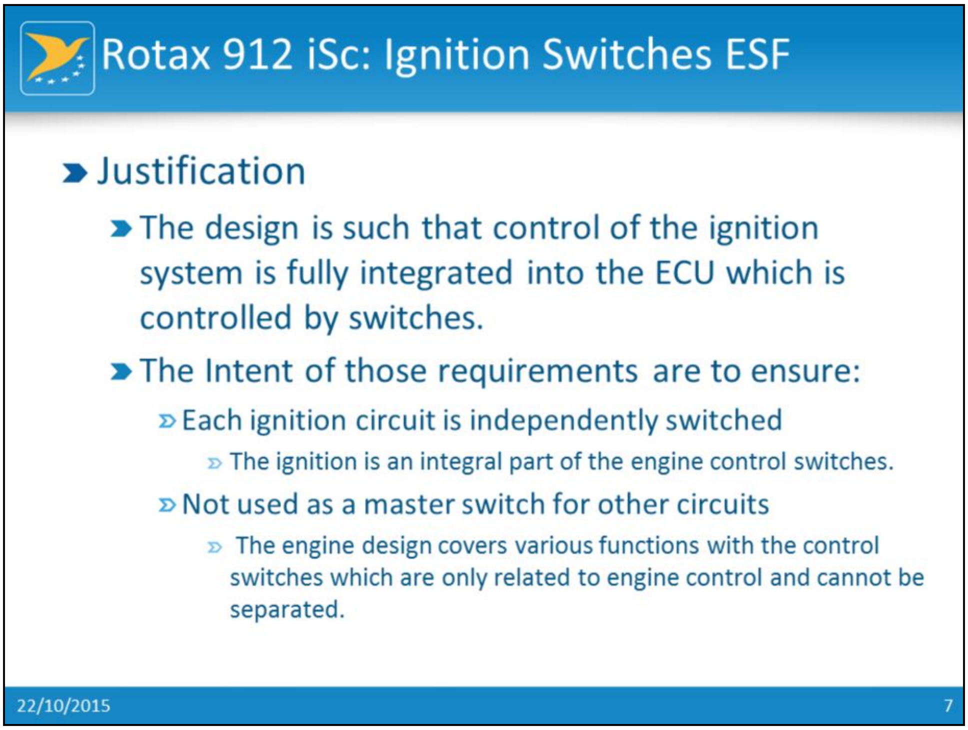


CS-VLA 1145 Ignition switches

(a) Each ignition circuit must be independently switched, and must not require the operation of any other switch for it to be made operative.

(b) Ignition switches must be arranged and designed to prevent inadvertent operation.

(c) The ignition switch must not be used as the master switch for other circuits.



The control of the ignition system is fully integrated into the ECU which are controlled by LANE A/B switches. Thus there are no separate ignition switches in accordance with CS-VLA 1145. Therefore CS-VLA 1145 cannot be complied with in the same way as traditional systems.

Justification:

CS.VLA 1145 require that

(a)

Each ignition circuit must be independently switched

Must not require the operation of any other switch for it to be made operative

The Ignition is an integral part of the engine control switches. Each LANE could be independently switched. The design proposal include an independent ENGINE MASTER which made the engine control, and the ignition as part of the electronically engine system operative.

(b)

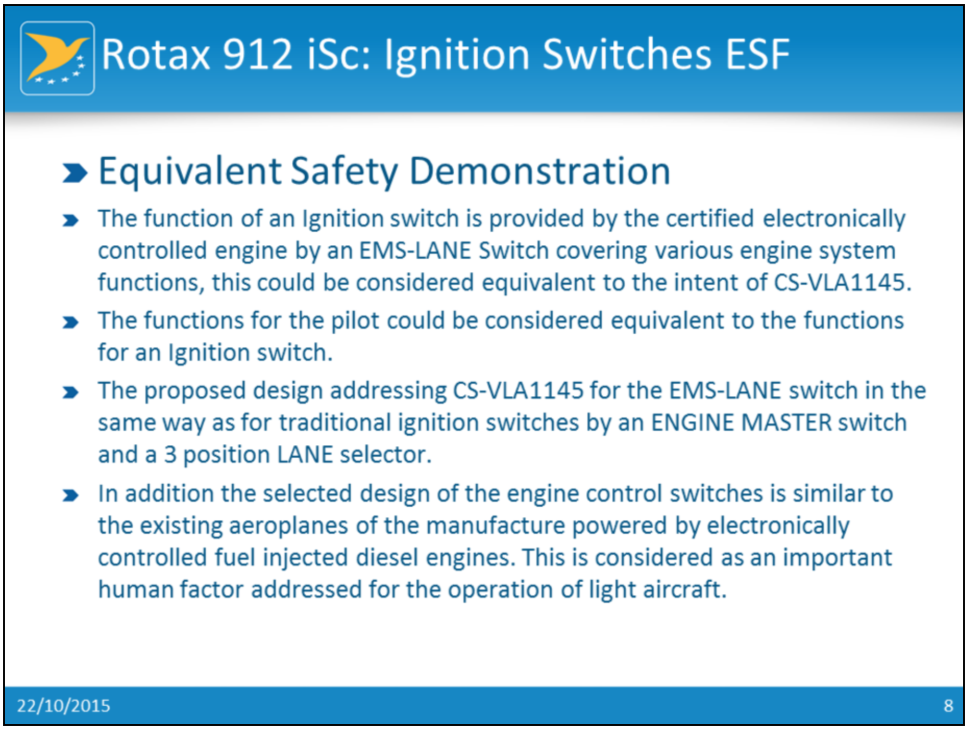
Ignition switches must be arranged and designed to prevent inadvertent operation

The Engine control switches ENGINE MASTER and LANE are both protected against inadvertent operation.

(c)

The ignition switch must not be used as a master switch for other circuits

The engine design itself covers various functions with the LANE control switches. This is part of the engine design and cannot be separated but it does not cover other functions of the electric system except functions which are related to the engine control as required by the installation manual of the engine.



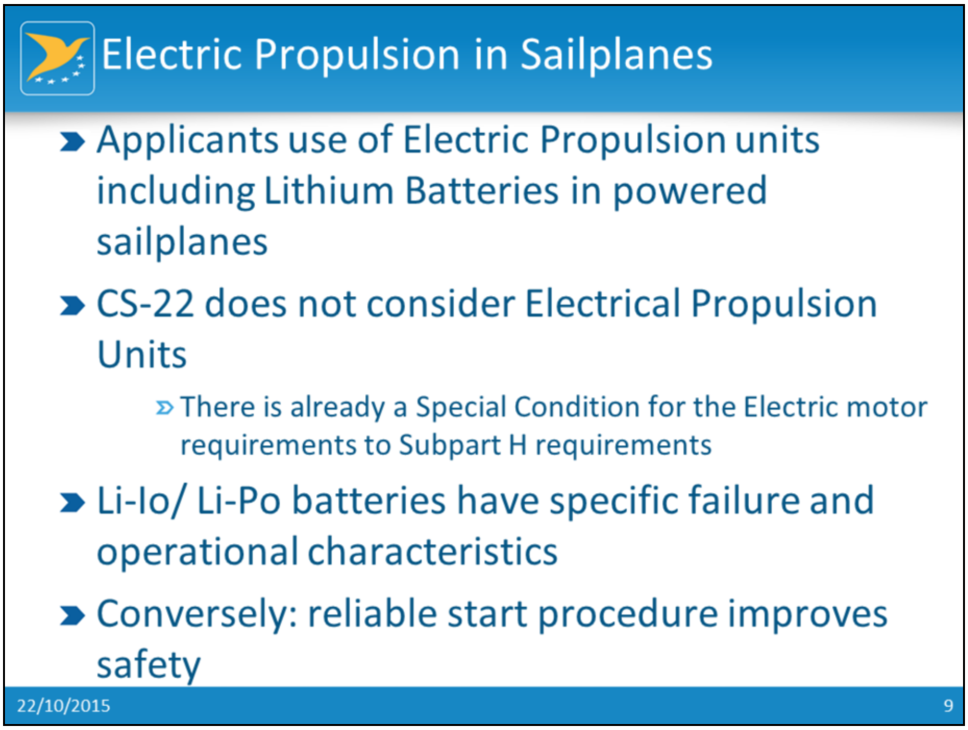
Safety Equivalency Demonstration:

The function of an Ignition switch is provided by the certified electronically controlled engine by an EMS-LANE Switch covering various engine system functions, this could be considered equivalent to the intent of CS-VLA1145.

The functions for the pilot could be considered equivalent to the functions for an Ignition switch.

The proposed design addressing CS-VLA1145 for the EMS-LANE switch in the same way as for traditional ignition switches by an ENGINE MASTER switch and a 3 position LANE selector.

In addition it has been noted, that the selected design of the engine control switches is similar to the existing design powered by electronically controlled fuel injected diesel engines. This is considered as an important human factor addressed for the operation of light aircraft.

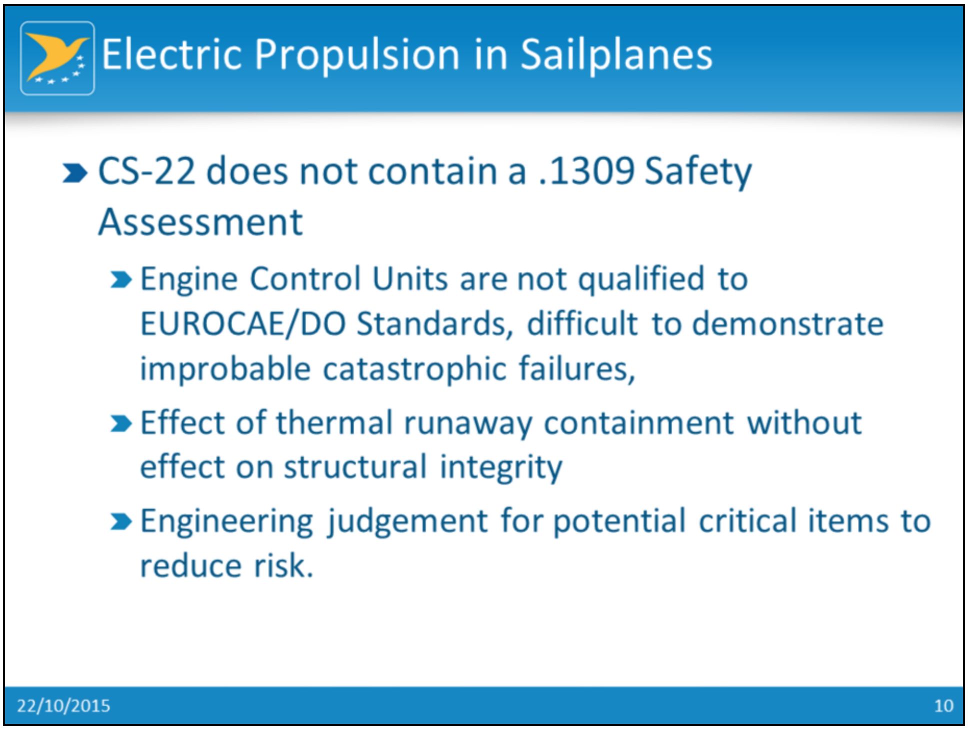


Applicants intend to use electric propulsion units including installation of Li-Po batteries in powered sailplanes. The airworthiness standard applicable to CS-22 aircrafts currently does not consider Electrical Propulsion Units. The proposed Special Condition amends CS-22 with regard to the consideration of specific design features of installation of electric propulsion in sailplanes. The Special Conditions is based on the special conditions “Airworthiness Standard for CS-22H Electrical Retractable engine to be operated in powered sailplanes” for the approval of the electrical engine and “Temporary guidance material for the installation of electric power in powered sailplanes, LBA 19.04.2013” that have been applied in several projects of self-launching electric powered sailplanes.

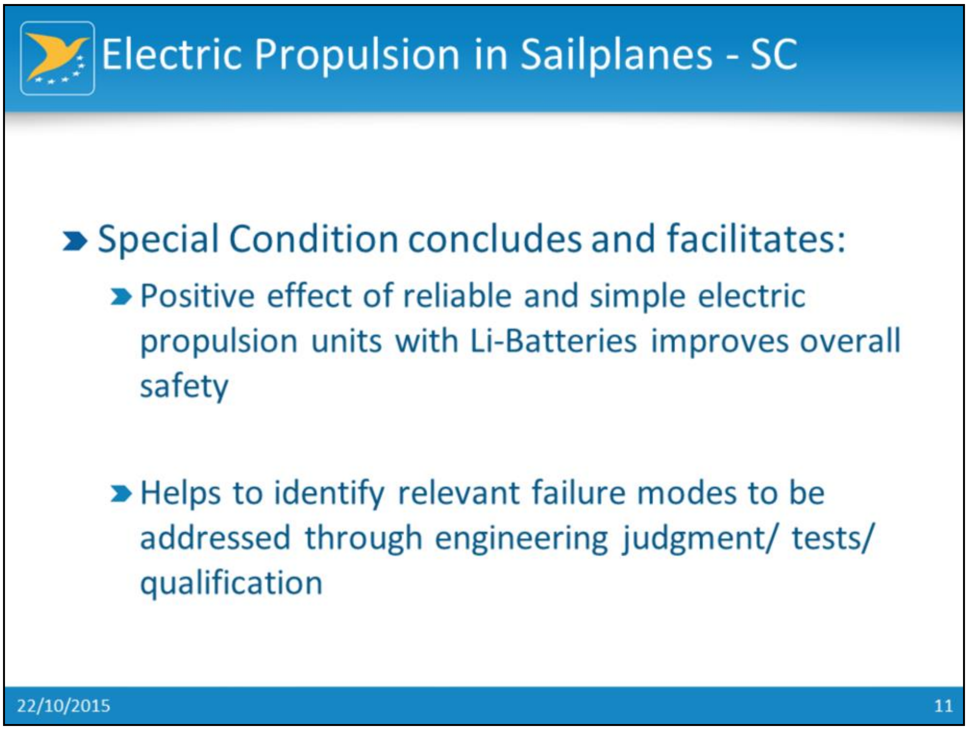
This special condition covers the installation of electric propulsion systems in powered sailplanes using rechargeable batteries as energy storage device. For different energy storage technologies (e.g. fuel cells, capacitors) or hybrid propulsion systems the applicability of this special condition needs to be assessed.

The certification of electric motors and propellers is not part of this special condition.

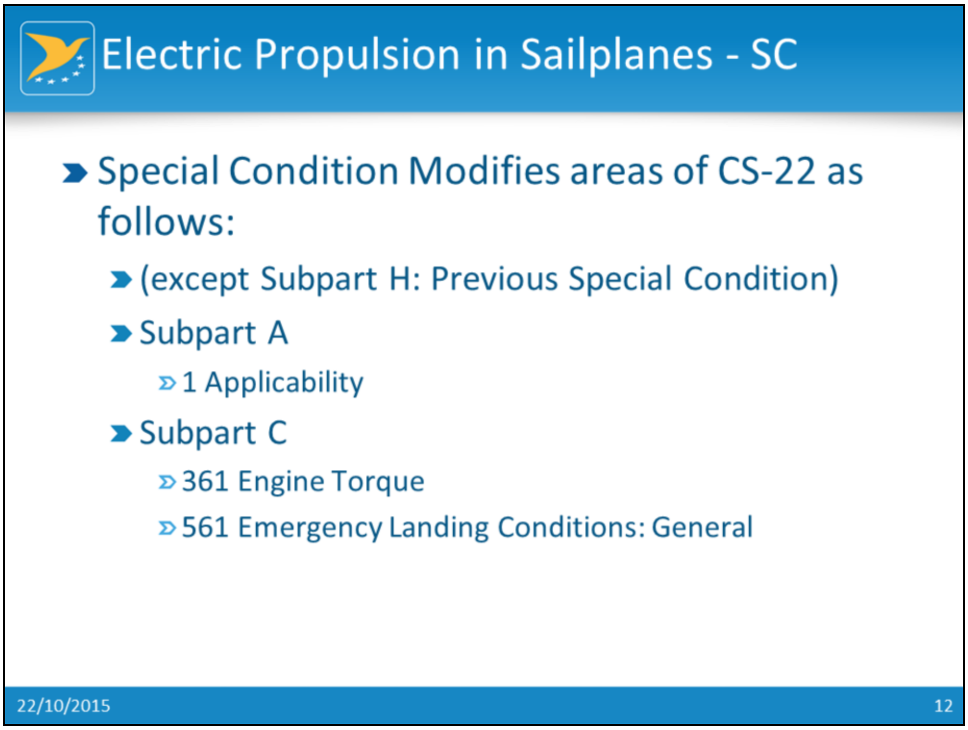
The special condition does not cover or replace applicable regulations for handling, storage, transport and disposal of batteries.



A safety assessment according (CS 2x.1309) is not required for Sailplanes and Powered Sailplanes. The engine control units for these kind of aircraft are normally not qualified according relevant EUROCAE/DO standards. Thus it is difficult to demonstrate that potentially hazardous or catastrophic failures are improbable. It also cannot be expected that the effect of a thermal runaway of Li batteries could be contained without any effect on the structural integrity of a powered sailplane, but with good engineering judgement all potentially critical items should be addressed to reduce the risk.



As the result of this review, EASA has determined that the amended special condition as attached does adequately address installations of electric propulsion units and Li-Batteries and due to the positive effect of reliable and simple electric propulsion units improves overall safety. Additional requirements and notes introduced in this SC should help to identify relevant failure modes and operational characteristics that have to be addressed with good engineering judgment and necessary tests and qualification.



CS 22.1 Applicability

to read

(2) powered sailplanes the design value W/b^2 (weight to span^2) of which is not greater than 3(W[kg], b[m]) and the maximum weight of which does not exceed 850 kg; and

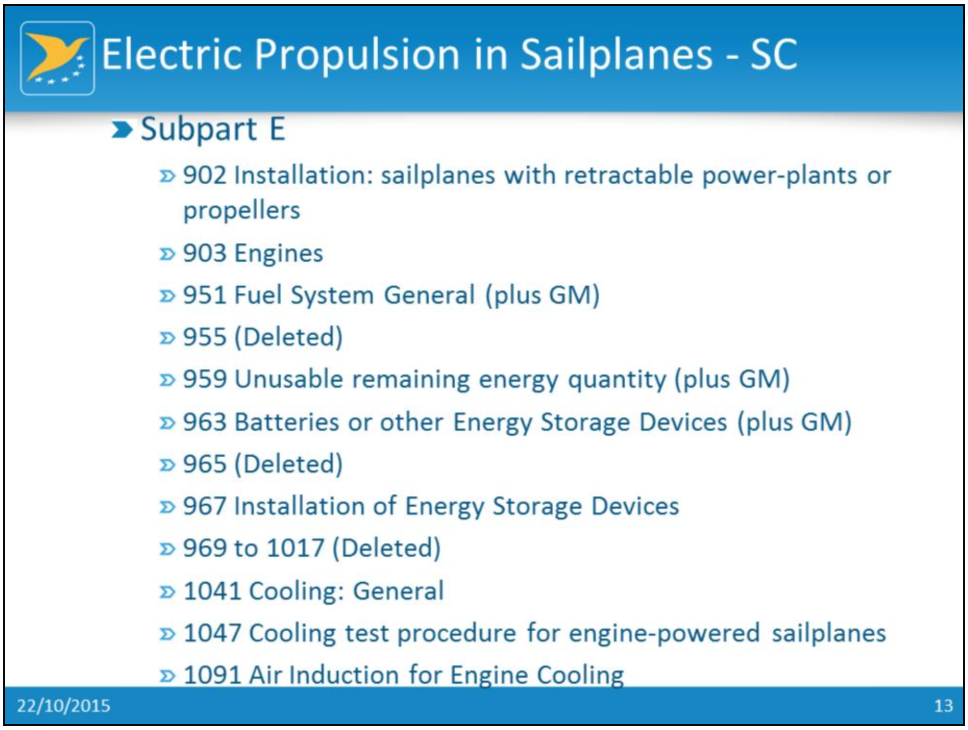
CS22.361 Engine torque

(c) For electric propulsion systems the system must be able to withstand the maximum torque provided by the engine.

CS 22.561 General

additionally

(f) If batteries or any other energy storage device are installed in such a way that the pilot(s) could be endangered in the emergency landing case, an ultimate inertia load corresponding to 15 g in the forward direction for the fastening of battery or any other energy storage device shall be assumed.



CS 22.902 Powered sailplanes with retractable power plants or propellers

additionally

(f) When the power plant is in the retracted position and during extension and retraction neither electric spark breaking nor radio disturbances may arise.

CS 22.903 Engines

to read

(a) The engine must meet the special condition for electrical engines established by the Agency.

CS 22.951 General

(a) Each energy system shall be constructed and arranged in such a way to ensure a flow of energy at a capacity required for the proper engine functioning under any normal operating conditions.

(b) In case of self-launching powered sailplane, the capacity of the energy storage devices must allow at least the Take-off with take-off performance of the engine and climb with maximum continuous power for 5 minutes plus sufficient energy for use of electrical systems during the following un-powered flight continuation.

(c) Each energy storage device shall be designed in such a way that an equal charge of battery cells is ensured. A manual switchover to other sources of energy is allowed.

(d) A protection against overcharge and critical discharge of the batteries or any other energy storage device shall be provided including deep or unbalanced discharge if necessary for the type of battery.

GM 22.951

Potentially critical battery type installations (e.g. Ni-Cd, LiPo) should have a system to control the status of battery cells and provide information and warnings about critical parameter and failures. Engine Control Units and Battery Management Systems should be designed and manufactured following good engineering practice with consideration of electric magnetic interference, environmental and software aspects.

(d) Electric effects of the system in a wind milling condition (e.g. prop brake not effective), when the Engine works as a generator shall be considered.

CS 22.955 Fuel flow

deleted

CS 22.959 Unusable remaining energy quantity

The unusable remaining energy quantity shall be established.

GM CS 22.959

Some designs might prevent using the full energy quantity in order to avoid damaging the energy source; the corresponding energy quantity shall be declared as unusable. Other designs might allow the crew to use the full energy quantity, with or without requiring a specific crew action. In such cases, the cockpit indication should be designed adequately, and proper instructions for continued airworthiness and servicing shall be provided to ensure the energy source capacity is subsequently restored after the flight.

CS 22.963 Batteries or other energy storage devices

(a) The suitability and reliability of batteries or other energy storage devices shall be proved due to experience or tests.

(b) Characteristics of the energy storage devices, including failure modes (e.g. thermal runaway, expansion, explosion, toxic emission) should be identified. Batteries cells and other subcomponents of the system should be assembled and installed minimizing the effects of failures.

GM CS 22.963 (a): Battery cells should be qualified according accepted standards (e.g. EUROCAE/DO 311, UN T 38.3).

CS 22.965 Fuel tank tests

deleted

CS 22.967 Installation of energy storage devices

(a) Each energy storage device shall be installed by observing 22.627. In addition design precautions shall be provided to prevent chafing between its components and with supports or surrounding structure, if such chafing may arise.

(b) If it has not been proved that neither vapours nor fluids may separate out from the energy storage device, its compartment must be ventilated and drained.

(c) If the energy storage device is installed in the personnel compartment, it shall be demonstrated that adequate ventilation and drainage are provided, that the presence of the energy storage device will in no way interfere with the operation of the powered sailplane or the normal movement of the occupants, and that no leaking fluids and vapours will have direct contact to any occupant.

(d) Each energy storage device shall be installed to minimize the effects of the failure mode identified under CS 22.963. Design precautions might include:

Providing the crew with the relevant information allowing to take proper actions (e.g. temperature or pressure monitoring),

Mitigating the effect of thermal runaway or fire, and ensuring the surrounding structure might be able to withstand the thermal loads,

Designing the compartment for the battery in order to cope with overpressure or expansion.

CS 22.969 to 22.1017 inclusive

deleted

CS 22.1041 Cooling - General

The cooling provisions shall be able to maintain the temperatures of all components, units and systems of the propulsion system within the established temperature limits during all likely operating conditions.

CS 22.1047 Cooling test procedure for engine-powered sailplanes

(a) To show compliance with the requirements in CS 22.1041, cooling tests shall be carried out according to the recommended take-off or climb procedure.

To be measured:

(1) Take-off with take-off performance of the engine, to be continued for one minute or 5 minutes climb with maximum power in case of self-sustaining sailplanes

(2) The climb shall be continued with the maximum continuous power until reaching the maximum temperature indication, and afterwards for 5 minutes or until reaching the minimum energy level according 22.959.

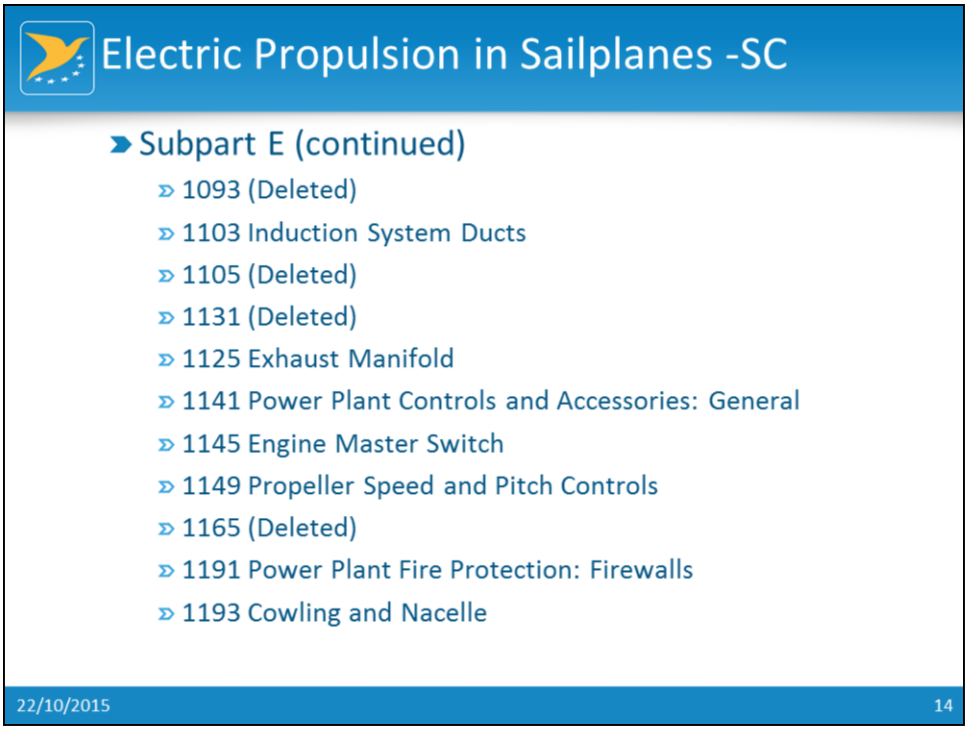
(b) The flight required under (a) shall be carried out at a speed not being higher than the best rate of climb speed with maximum continuous power.

(c) The maximum anticipated air temperature is to be fixed at 38°C at sea-level (hot-day conditions).

(d) The temperature of the engine, its units and systems shall be corrected in that way that the difference between the maximum anticipated air temperature and the ambient temperature at the time of the first occurrence of the maximum recorded temperature of the components shall be added to the latter.

CS 22.1091 Air induction for engine cooling

Air induction for engine cooling shall be ensured under all likely operating conditions.



CS 22.1093

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CS 22.1103 Induction system ducts

(a) If induction system ducts are installed, they shall have a drain to prevent the accumulation of moisture in the normal ground and flight attitudes of the powered sailplane.

(b) Induction system ducts connected to components between which relative motion could arise shall have flexible connections.

CS 22.1105 Induction system screens

deleted

CS 22.1121 General

deleted

CS 22.1125 Exhaust manifold

(a) If an exhaust manifold exists, it shall be attached in such a way to withstand any dynamic stress and inertia forces, to which it may be subjected during normal operation.

(b) Parts of the manifold connected to components between which relative motion may exist, shall have flexible connections.

CS 22.1141 General

The part of each power plant control in the engine compartment that is required to be operated in the event of fire shall at least be of a fire-resistant material.

CS 22.1145 Engine master switch

The system should be protected against an inadvertent engine run.

CS 22.1149 Propeller speed and pitch controls

(a) Propeller speed and pitch shall be limited to values that ensure safe operation under normal operating conditions.

(b) Propellers that may not be controlled in-flight, shall meet the following requirements:

(1) During take-off and initial climb at V_Y, the propeller must limit the engine speed at full constant speed drive or power regulator to a value not exceeding the maximum allowable take- off speed, and during a glide at V_{NE} or at a maximum allowable speed with power plant extended, with closed constant speed drive or power regulator or with power plant „off", the propeller must not permit the engine to achieve a rotational speed greater than 110 % of the maximum continuous speed.

(c) Propeller that may be controlled in-flight, but do not have constant speed controls must be designed in such a way that

(1) CS 22.1149 (b) (1) is met with the lowest possible pitch selected and

(2) CS 22.1149 (b) (2) is met with the highest possible pitch selected.

(d) Controllable pitch propellers with constant speed control must comply with the following conditions:

(1) With the control unit in operation, there must be a device to limit the maximum engine speed to the maximum allowable take-off speed, and

(2) with the control unit being inoperative, there must be a device to limit the maximum engine speed to 103 % of the maximum allowable continuous speed with the propeller blades at the lowest possible pitch and the powered sailplane being stationary with no wind.

CS 22.1165 Engine ignition systems

deleted

CS 22.1191 Firewalls

(a) The engine shall be separated from the other parts of the powered sailplane by firewalls, casings or any other equivalent devices when there is the risk of a sustaining fire.

(b) Firewalls and casings shall be designed in such a way that no dangerous quantity of liquids, gases or flames may pass from the engine compartment into other parts of the powered sailplane.

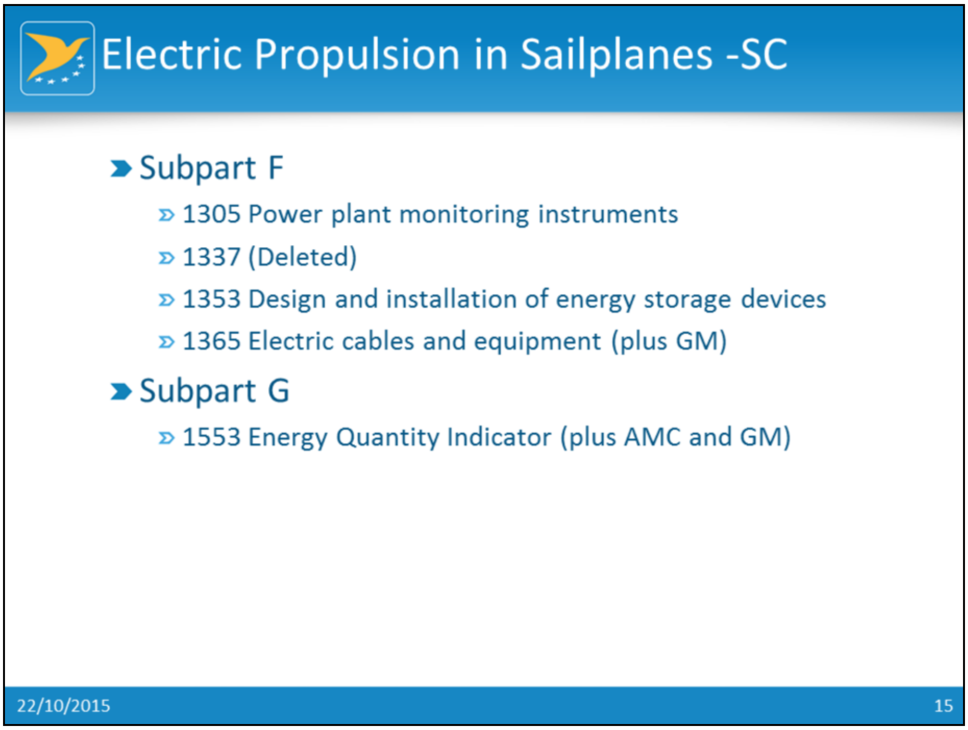
(c) Firewalls and casings must at least be fire-resistant and protected against corrosion.

CS 22.1193 Engine cowling and nacelle

(a) Engine cowlings shall be designed and attached in such a way that they may withstand any stresses due to vibrations, masses and aerial forces, to which they may be exposed under operation.

(b) If leakage substances may arise, devices shall be provided to ensure a rapid and complete drainage of leakage substances from all parts of the cowling in the normal ground and flight attitudes. The drainage of leakage substances may not happen where they may cause a fire hazard.

(c) Engine cowlings must be at least fire-resistant when there is the risk of a sustaining fire.



CS 22.1305 Power plant monitoring instruments

Powered sailplanes with electric propulsion units shall be equipped with the following monitoring instruments:

(a) a tachometer for RPM indication or an output meter

(b) an indicator for the remaining energy quantity in the energy storage device

(c) an engine temperature indicator (or internal cooling indicator) (d) if a liquid cooling is installed, a coolant temperature indicator (e) an elapsed time indicator

CS 22.1337 Power plant monitoring instruments

deleted

CS 22.1353 Design and installation of energy storage devices

additionally

(d) Batteries or any other energy storage devices shall be installed in such a way that the occupants may not be endangered in case of a forced landing.

(e) Warnings, placards and procedures reducing the risk to ground personnel (rescue teams) should be provided.

(f) Energy storage devices should be contained in rugged casings or separate compartments to resist air, ground, and emergency landing loads and minimize identified hazards depending on the battery cell chemistry.

(g) Energy storage devices and the high voltage system should be adequately protected from probable leaking of fuel or water ballast and moisture in ventilated compartments.

(g) Batteries should include a main fuse directly at the energy storage device to isolate the system in case of a short circuit. A mechanical shutoff and/or battery isolation relays to disconnect both poles of high voltage batteries should be considered. A mechanical shut-off should not rely on any processor or software actions to provide electrical isolation of the battery.

CS 22.1365 Electric cables and equipment

additionally

(d) Electric cables shall be installed in such a way that electromagnetic and reciprocal influencing do not endanger safe operation (e.g. due to induction).

(e) The design and construction of the electric cable installation including routing, attachments and connectors shall minimize the risk of electric shock in high voltage systems (HV). The design shall incorporate electrical isolation-insulation materials capable of shielding the occupants and ground personnel from electrical shock under all operating conditions, e.g. flight in rain. No pins of connectors in high voltage systems should be exposed while under battery voltage. High voltage cables should be separated from fuel lines, control systems and low voltage cables.

(f) A ground fault detection system that provides the pilot or ground personnel a warning if the airframe is no longer fully electrically isolated should be installed for any electrical system in which the voltage can exceed 50 Vrms (AC) or 120 V (DC) under normal conditions and under single-fault conditions. Available devices may have two threshold indications: warning and critical.

(g) High Voltage cables have to be clearly identifiable and colour coded in bright orange. Warning placards marking HV components should be considered.

GM CS 22.1365 (e)

Automatic safety systems to ensure safety of pilot, maintenance and handling personnel and rescue personnel should be provided for HV systems. A shut-down circuit (interlock) which runs through all safety relevant parts of the system should disable the HV circuit (i.e. disconnect the battery isolation relays). It should be possible to activate the HV system only when the shut-down circuit is closed. If the shut-down circuit is interrupted at any point, the HV batteries should be disconnected by opening the battery isolation relays. An Automatic Shutoff should not create an additional hazard regarding a safe flight.

These safety relevant parts are HV master switch, emergency shut-down button, isolation monitoring device and all connectors in the HV power lines.

After opening the battery isolation relays, the voltage in the HV circuit should automatically drop to a safe level in a reasonable time (5-10 sec). An indication may be considered to show (to pilot and maintenance personnel) when the voltage in the HV circuit is above the low voltage limit.

An acceleration sensor might also be an option to interrupt the shut-down circuit in case of an emergency, reacting to forward acceleration like in an ELT, to provide automatic shut-down of the HV circuit in case of a crash landing.

CS 22.1553 Energy quantity indicator

An energy quantity indicator should inform the pilot of the remaining energy in the energy storage device.

The information shall be intuitive to the pilot, preferably have a coloured arc, colour coded bars or similar warning system denoting minimum energy reserves in accordance with CS 22.959, and

have a corresponding numerical readout showing remaining energy as suitable unit equivalent to the energy level.

Additional information needed to determine the quantity and availability of energy has to be provided.

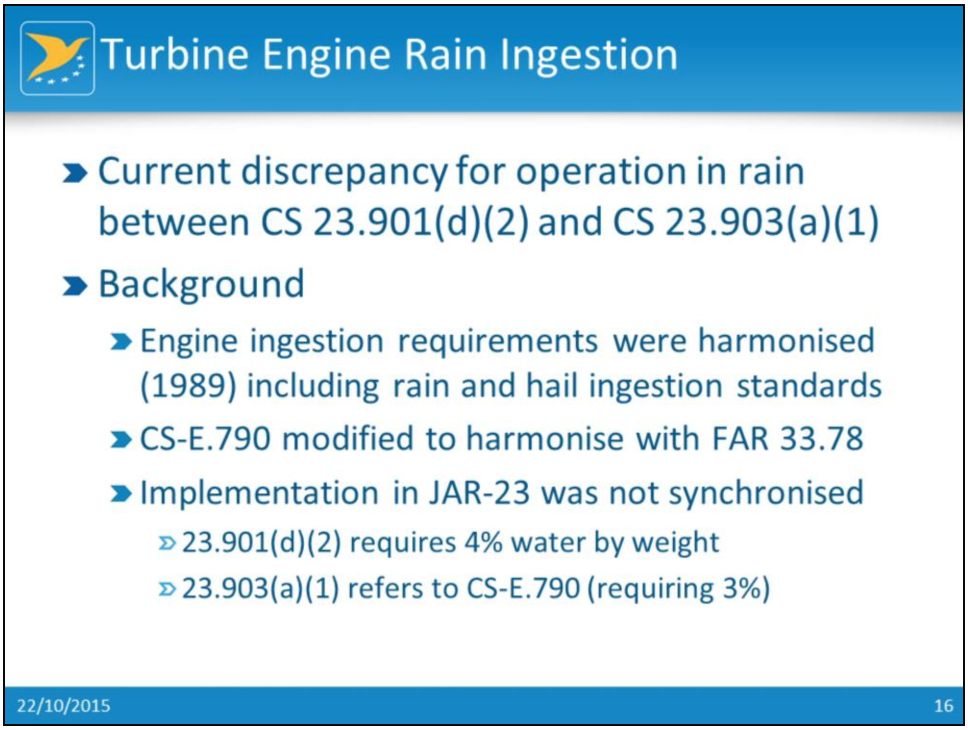
For self-launching sailplanes it must be clearly identifiable if sufficient energy is available to perform a self-launch and climb according CS.951(b).

AMC CS 22.1553 (b)

Suitable units might kWh, per cent of capacity, remaining engine time or any other suitable unit equivalent to the energy level.

GM CS 22.1553 (c)

If required by the battery technology additional information on energy storage device status, such as temperatures might be needed, e.g. a cold battery might need to be heated prior engine start or charging.



CS 23.901 Installation

(d) Each turbine engine installation must be constructed and arranged to –

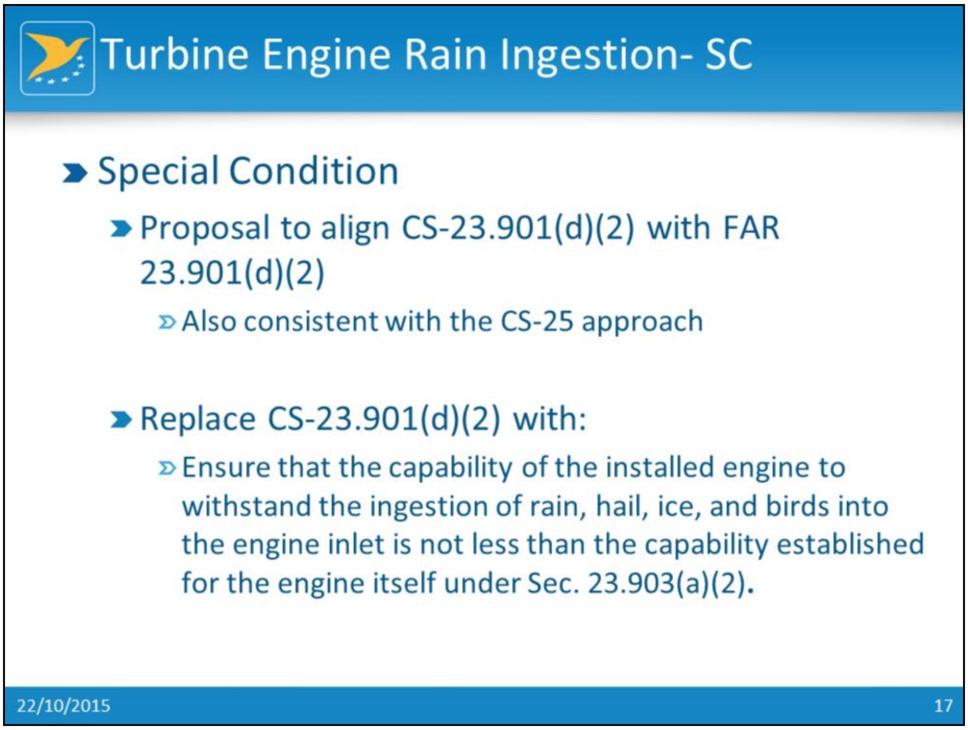
(2) Provide continued safe operation without a hazardous loss of power or thrust while being operated in rain for at least 3 minutes with the rate of water ingestion being not less than 4% by weight, of the engine induction airflow rate at the maximum installed power or thrust approved for take-off and at flight idle.

CS 23.903 Engines and auxiliary power units

(See AMC 23.903 (a) (1) and AMC 23.903 (f))

(a) Each turbine engine must either –

(1) Comply with CS E-790 and CS E-800



<u>STATEMENT OF ISSUE</u>

The Certification Basis for operation under rain for turbine engine aircraft on CS-23 aircraft present a discrepancy between the turbine engine installation requirement (CS 23.901(d)(2) and the requirement to be demonstrated during turbine engine certification that is called by CS 23.903(a)(1).

<u>BACKGROUND</u>

In 1989 engine ingestion requirements were harmonised (with JAA participation)including rain and hail ingestion standards (ref preamble of FAR 23 amendment 23-53, 23-95 and 33-19).

As result CS E.790 was modified to incorporate harmonised requirements with FAR 33.78.

However during implementation of the rain and Hail requirement for JAR-23 the installation paragraph 23.901(d)(2) has not been changed. As a consequence, its 4% water by weight contradicts 23.903(a)(1) which refers to CS E.790, which features a 3% requirements.

EASA Position

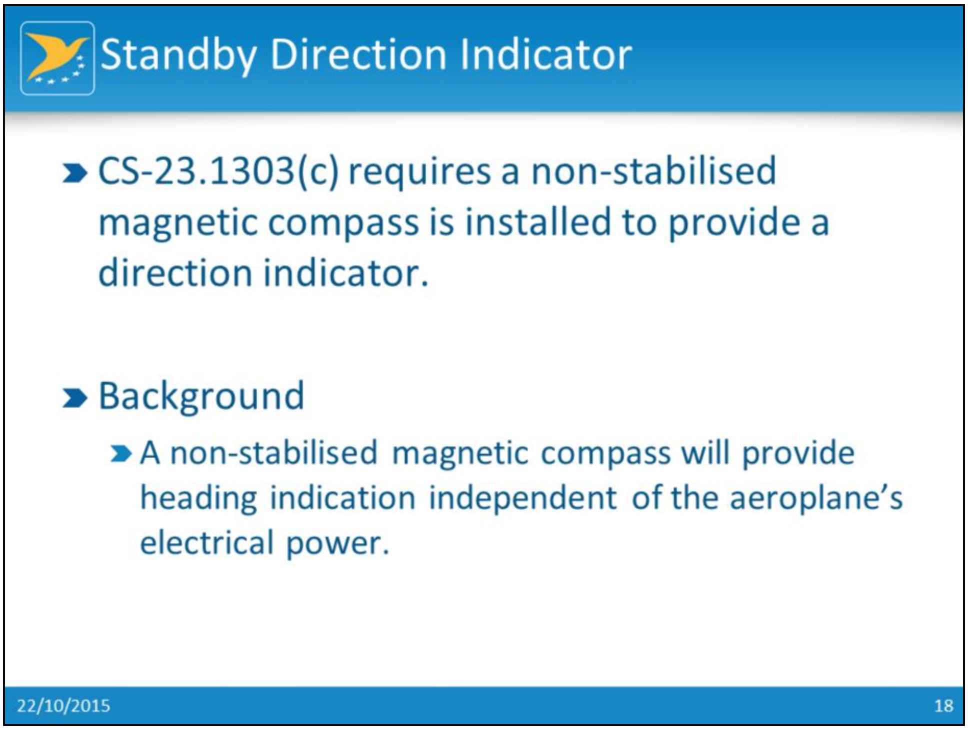
Despite thorough research, the reasons for not amending JAR 23.901(d)(2) while updating CS E.790 are unclear.

It is therefore proposed to align CS 23.901(d)(2) with FAR 23.901(d)(2). In addition, this is consistent with the CS-25 approach; there is no significant technical differences in the design or operational envelope of a CS-23 versus a CS-25 turbine installation.

It is proposed to issue a Special Condition, replacing 23.901(d)(2) as found in CS-23 amdt 2, with the following text:

23.901 Installation:

(d) (2) Ensure that the capability of the installed engine to withstand the ingestion of rain, hail, ice, and birds into the engine inlet is not less than the capability established for the engine itself under Sec. 23.903(a)(2).



CS 23.1303 Flight and navigation instruments

The following are the minimum required flight and navigational instruments:

(a) An airspeed indicator.

(b) An altimeter.

(c) A non-stabilised magnetic direction indicator .

Standby Direction Indicator -EFS

- With the move to Glass Cockpits more applicants are requesting the use of an electronic standby compass
- ESF
  - The use of a Electronic Standby Instrument System is acceptable provided:
  - the reference data is derived from an independent source.
  - The unit is powered from the Emergency Bus or independent battery

Smart Probes

- Current CS-23 requirements do not foresee the use of the latest design of Air Data Smart Probes.
  - There are prescriptive CS23 requirements for positive moisture drains, notably:
    - 23.1323 (c) Airspeed Indicating system
      - The design and installation of each airspeed indicating system must provide positive drainage of moisture from the pitot static plumbing.
    - 23.1325(b)(1)(i) Static Pressure System
      - Positive drainage of moisture is provided

Smart Probes - ESF

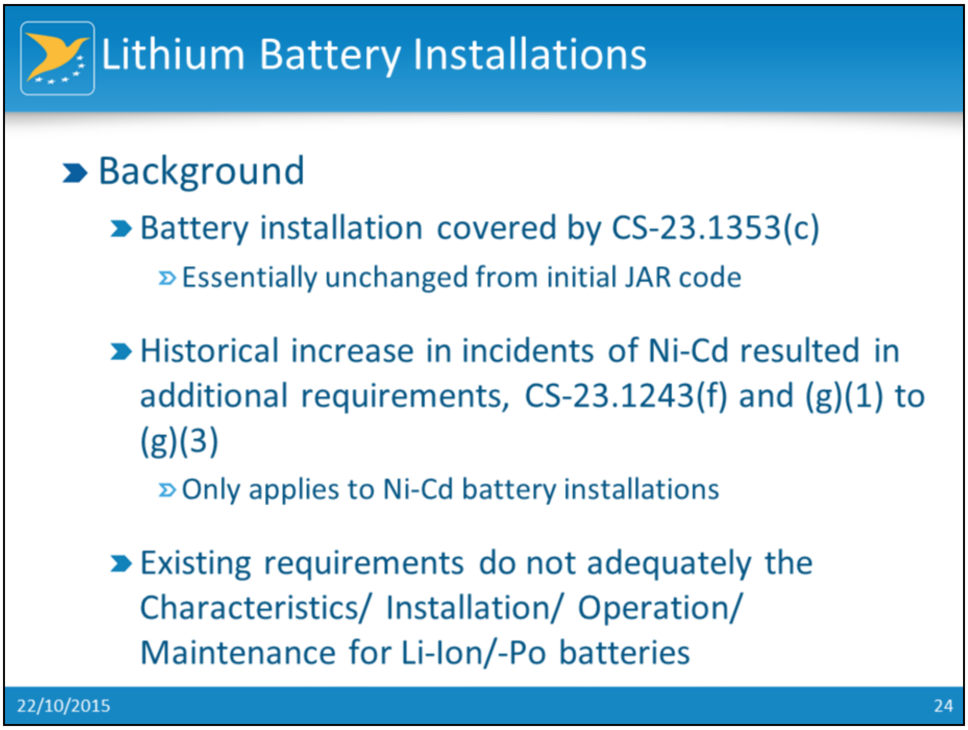
- Justification
  - The intent is to ensure the smart probes (and pitot-static system) can not be blocked by moisture to affect performance of the system
  - Smart Probe designs do not meet the positive drainage requirement as the drain ports are not the lowest point of the pressure line system which are terminated within the smart probe

Smart Probes - ESF

- ESF
  - The design of the smart probe includes an always on heating system while the aeroplane is powered, can be powered to varying levels depending on ground/flight status. This heating is designed to evaporate any moisture in the system and provides the positive means to remove any collected moisture.

Lithium Battery Installations

- Li-Ion and Li-Po have certain failure and operations characteristics that differ significantly from Ni-Cd/ lead acid
- SC requires all characteristics of Li-Ion/Po batteries/ installation and maintenance that could affect safe operation are addressed to ensure availability of electrical power when required



CS 23.1353 Storage battery design and installation

(a) Each storage battery must be designed and installed as prescribed in this paragraph.

(b) Safe cell temperatures and pressures must be maintained during any probable charging and discharging condition. No uncontrolled increase in cell temperature may result when the battery is recharged (after previous complete discharge) –

(1) At maximum regulated voltage or power;

(2) During a flight of maximum duration; and

(3) Under the most adverse cooling condition likely to occur in service.

(c) Compliance with sub-paragraph (b) must be shown by tests unless experience with similar batteries and installations has shown that maintaining safe cell temperatures and pressures presents no problem.

(f) Each nickel cadmium battery installation capable of being used to start an engine or auxiliary power unit must have provisions to prevent any hazardous effect on structure or essential systems that may be caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its

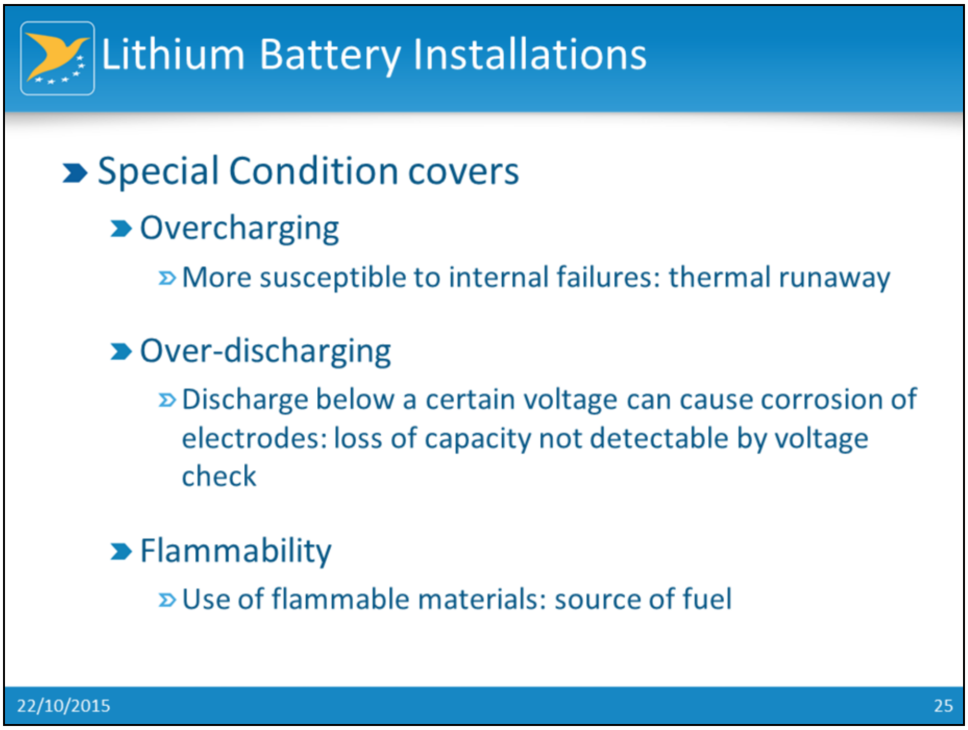
individual cells.

(g) Nickel cadmium battery installations capable of being used to start an engine or auxiliary power unit must have –

(1) A system to control the charging rate of the battery automatically so as to prevent battery overheating; or

(2) A battery temperature sensing and over temperature warning system with a means for disconnecting the battery from its charging source in the event of an over temperature condition; or

(3) A battery failure sensing and warning system with a means for disconnecting the battery from its charging source in the event of battery failure.



Overcharging

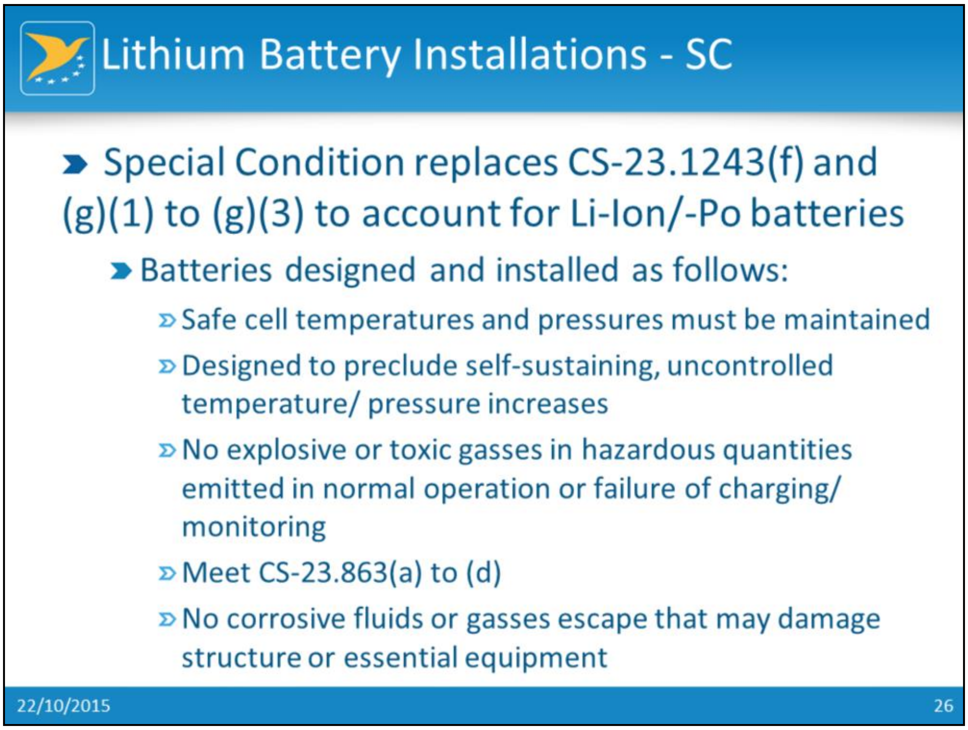
Li batteries in general are significantly more susceptible to internal failures that can result in self-sustaining increases in temperature and pressure (i.e. thermal runaway) than their Ni-Cd and lead-acid counterparts. This is especially true for overcharging which causes heating and destabilisation of the components of the cell which can cause the formation of highly unstable metallic lithium which can ignite resulting in a self-sustaining fire or explosion. Certain types of Li batteries pose a potential safety problem because of the instability and flammability of the organic electrolyte employed by the cells of those batteries. The severity of thermal runaway increases with increasing battery capacity, due to the higher amount of electrolyte in larger batteries.

Over-discharging

Discharge of some versions of the Li cell beyond a certain voltage can cause corrosion of the electrodes of the cell resulting in loss of battery capacity that cannot be reversed by recharging. This loss of capacity may not be detected by the simple voltage measurements commonly available to flight crews as a means of checking battery status, a problem shared with Ni-Cd batteries.

Flammability of Cell Components

Unlike Ni-Cd and lead-acid cells, some types of Li cells employ, in a liquid state, electrolytes that are known to be flammable. This material can serve as a source of fuel for an external fire in the event of a breach of the cell container.



EASA proposes that the following Special Condition be applied to the Li batteries and battery installations in lieu of the requirements of CS 23.1353(f), (g)(1) through (g)(3):

Lithium batteries and battery installations of the HA-420 must be designed and installed as follows:

(1) Safe cell temperatures and pressures must be maintained during any probable charging or discharging condition, or during any failure of the charging or battery monitoring system not shown to be extremely remote. The Li battery installation must be designed to preclude explosion in the event of those failures.

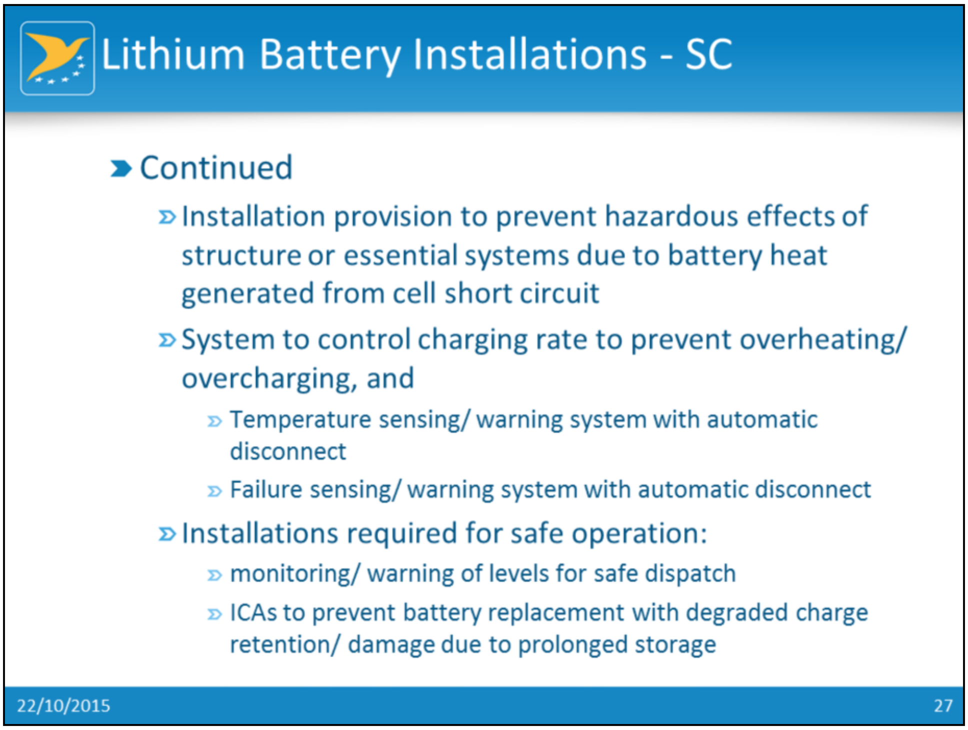
(2) Li batteries must be designed to preclude the occurrence of self-sustaining, uncontrolled increases in temperature or pressure.

(3) No explosive or toxic gasses emitted by any Li battery in normal operation or as the result of any failure of the battery charging or monitoring system, or battery installation not shown to be extremely remote, may accumulate in

hazardous quantities within the aeroplane.

(4) Li battery installations must meet the requirements of CS 23.863(a) through (d). CS 23.863 Flammable fluid fire protection

(5) No corrosive fluids or gasses that may escape from any Li battery may damage surrounding aeroplane structures or adjacent essential equipment.



(6) Each Li battery installation must have provisions to prevent any hazardous effect on structure or essential systems that may be caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells.

(7) Li battery installations must have a system to control the charging rate of the battery automatically so as to prevent battery overheating or overcharging, and,

(i) A battery temperature sensing and over-temperature warning system with a means for automatically disconnecting the battery from its charging source in the event of an over-temperature condition or,

(ii) A battery failure sensing and warning system with a means for automatically disconnecting the battery from its charging source in the event of battery failure.

(8) Any Li battery installation whose function is required for safe operation of the aeroplane, must incorporate a monitoring and warning feature that will provide an indication to the appropriate flight crewmembers, whenever the capacity and SOC of the batteries have fallen below levels considered acceptable for dispatch of the aeroplane.

(9) The Instructions for Continued Airworthiness must contain maintenance procedures for Lithium-ion batteries in spares storage to prevent the replacement of batteries whose function is required for safe operation of the aeroplane, with batteries that have experienced degraded charge retention ability or other damage due to prolonged storage at low SOC.

EASA
European Aviation Safety Agency

Many Thanks

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