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Département fédéral de l'environnement, des transports, de l'énergie et de la communication DETEC

Annexe 1 de l'ordonnance du DETEC sur la navigabilité des aéronefs (RS 748.215.1)

Exigences de navigabilité, conditions générales d'exploitation et prescriptions relatives au marquage

applicables aux aéronefs de la catégorie spéciale,

Sous-catégorie Ecolight

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1 Nature juridique

Les présentes exigences de navigabilité, conditions générales d'exploitation et prescriptions relatives au marquage (NEM) constituent l'annexe 1 de l'ordonnance du DETEC sur la navigabilité des aéronefs.

2 Critères de certification et exigences de navigabilité généraux

2.1 Les avions à gouvernes aérodynamiques doivent répondre aux normes de conception et de construction de l'autorité aéronautique allemande (*Luftfahrtbundesamt*, LBA) relatives aux avions ultra-légers à gouvernes aérodyamiques (LTF-UL) datées du 30 janvier 2003 (NfL II-17/03, cf. site internet du LBA) ou à la version antérieure de ces normes en vigueur au moment de la certification de type.

2.2 La masse au décollage des appareils monoplaces ne doit pas excéder 300 kg. Un poids forfaitaire jusqu'à concurrence de 15 kg peut être comptabilisé en sus pour le dispositif de secours, fixations et éléments nécessaires à son déclenchement compris.

2.3 La masse au décollage des appareils biplaces ne doit pas excéder 450 kg. Un poids forfaitaire jusqu'à concurrence de 22,5 kg peut être comptabilisé en sus pour le dispositif de secours, fixations et éléments nécessaires à son déclenchement compris.

2.4 Les équipements de communication, les transpondeurs et les ELT (*Emergency Location Transmitter*, radiobalise de détresse) emportés doivent être certifiés J/ETSO (*Joint/European Technical Standard Order*) ou certifiés par l'OFAC.

2.5 L'OFAC vérifie le bon respect des exigences de navigabilité dans le cadre d'une procédure de certification (validation du type).

2.6 Dans le cas d'un avion étranger déjà en circulation, une attestation du constructeur selon laquelle ledit avion remplit les exigences de navigabilité est exigée.

3 Exigences de navigabilité supplémentaires

3.1 Généralités

Item	Requirement	Remarks
	FLIGHT	
B1	Stall characteristics:	

	Compliance to LTF-UL 201 must be demonstrated with the airplane in uncoordinated flight, corresponding to one ball width displacement on a slip-skid indicator.	This requirement is added to ensure the stall characteristics are acceptable even with some level of sideslip as there is no requirement for spin recovery in LTF-UL.
POWERPLANT		
E1	Engine qualification: (a) If the engine is not certified and is not identical to a certified engine, that engine should be qualified against CS-22 subpart H. (b) By way of derogation to paragraph (a), documented qualification based on proven service experience and agreed by the Authority can be accepted.	The LTF requirement does not cover all aspects: 50FH without further qualification (vibration test, teardown inspection) is not considered as sufficient to ensure safe operation, No requirement on the design and construction.
E2	Induction system icing protection: (a) Except as permitted by (b), each engine having a conventional venturi carburetor must be provided with a pre-heater capable, in air free of visible moisture at temperature of -1°C, of increasing the intake air temperature by 50°C with the engine at 75% of maximum continuous power. (b) Where the intake air is continuously heated, and it is demonstrated that the temperature rise is adequate, a pre-heater need not be provided. (c) By way of derogation to paragraph (a) and (b), other system providing an equivalent level of protection against engine failure due to icing and agreed with the Authority can be accepted.	The requirement LTF-UL 901 requires that the engine operates satisfactorily and can be safely operated within the defined limits. State of the art in the general aviation as ground and flight conditions potentially leading to carburetor icing are not rare and can lead to engine failure.

3.2 Avions Ecolight destiné au remorquage de planeurs

Item	**Swiss additional requirement for ECOlight towing aircraft**	**Remarks References**
Engine		
1	Ensure at first that the engine and propeller are type certificated according to JAR/CS-E and –P or FAR-33 and 35.	Identical but not certified engines may be accepted (for example

		ROTAX engine models)r
2	Perform 50 flight hours after completion of flight testing	Glider towing operation
	STRUCTURE	
1	Fatigue evaluation Fatigue aspects are not considered for UL aircraft. For towing aircraft, it is anticipated that a higher number of cycles will be performed and therefore additional work is needed. Therefore, fatigue aspects have to be considered for the following elements: - Wing spar and attachments - HTP attachments - Flap and flap fittings. Design must be performed using, AMC VLA 572(b) design allowable. For fittings and attachments design with stress allowable below endurance level of S/N curves must be shown	Reference 23.571 23.572 23.573 AMC VLA 572(b)
	DESIGN AND CONSTRUCTION	
1	**Release mechanisms** There must be a release mechanisms installed to give the aerotow pilot the ability to quickly disconnect the aerotow formation. (a) The release mechanisms must be approved	
2	**Tow cable retraction mechanisms** If an aerotow cable retraction mechanisms is installed, it must be of an approved type. (a) The function of the rope cutting device must be demonstrated by ground testing	
	POWER- PLANT Installation	
1	Fuel system hot weather operation	§ 23.961
2	Cooling tests To be performed according to Flight Test Guide item 245/248 (see book 2 of CS-23).	§ 23.1041 /1043/1047
	OPERATING INFORMATION	
1	**Operating data and procedures** Information concerning normal and emergency procedures for the tow other pertinent information necessary for safe operation must be furnished, including: (1) Special attention for sailplanes with bottom tow hook installation (2) tow upsets (3) sailplanes types whose relevant characteristics are comparable to those types used in the flight tests (4) landing procedure	

3.3 Motoplaneurs Ecolight

Item	Additional requirement versus [LTF-UL and Swiss additional requirement for microlight]	Remarks
	FLIGHT	
B.1	**71 Rate of descent** For a powered sailplane the smallest rate of descent in power-off configuration at maximum weight and most unfavourable c.g. position must not exceed the following limits: (a) with a single-seater powered sailplane, 1·0 m/s; (b) with a two-seater powered sailplane, 1·2 m/s.	Glider operation
B.2	**73 Descent, high speed** It must be shown that the sailplane with the airbrakes extended, will not exceed VNE in a dive at an angle to the horizon of: (i) 30° (ii) less than 30° when a rate of descent of more than 30 m/s can be achieved.	Glider operation
B.3	**75 Descent, approach** It must be shown that the sailplane has a glide slope not flatter than one in seven at a speed of 1·3 VS0 with air brakes extended at maximum weight.	Glider operation
B.4	**AMC to LTF-UL 143 Controllability and manoeuvrability** Compliance with 143(2) should include the extension of airbrakes at speeds up to 1.05 VNE. The time to extend airbrakes should not exceed 2 seconds. **Additional requirement** (6) Any unusual flying characteristics observed during the flight tests required to determine compliance with the flight requirements and any significant variations in flight characteristics caused by rain must be determined. In the case of a powered sailplane this requirement must be met with the engine running at all allowable powers. AMC 143 (6) The characteristics to be noted should include stalling speeds and stalling behaviour.	Special features not foreseen in LTF-UL Glider operation
B.5	**145 Longitudinal control** It must be possible, without exceptional piloting skill, to maintain the sailplane in steady straight flight: (1) reserved (2) when retraction or extension of the airbrakes is made at speeds between 1·1 VS1 and 1·5 VS1, where VS1 is the stalling speed with airbrakes retracted or extended, whichever is the higher, for a given flap position.	Special features not foreseen in LTF-UL
B.6	**153 Approach and landing**	Special features not foreseen in LTF-UL

	The use of air brakes during the approach must not cause excessive variation of control force or control displacement nor affect the controllability of the sailplane, when it is brought into use at any allowable speed down to 1·2 VS1, where VS1 is appropriate to the configuration with air brakes retracted or extended, whichever gives the greater value.	
B.7	**161 Trim** For powered sailplanes, retraction and extension of the power-plant or propeller must not produce excessive trim changes.	Special features not foreseen in LTF-UL
B.8	**201 Wings level stall** LTF-UL 201 4. must be considered also with airbrakes retracted and extended	Special features not foreseen in LTF-UL
B.9	**203 Turning flight stalls** (a) When stalled during a co-ordinated 45° banked turn, it must be possible to regain normal level flight without encountering uncontrollable rolling or spinning tendencies. Compliance with this requirement must be shown under the conditions of LTF 201 4. that result in the most critical stall behaviour of the sailplane. In any case the landing configuration, with airbrakes retracted and extended, must be investigated.	Glider operation
	STRUCTURE	
C.1	**335 Design air speeds** *LTF-UL 335 3. and 4. are replaced by the following paragraph* *3. Design Maximum Speed VD.* The design maximum speed may be chosen by the applicant but must not be lower than: Vd= $18*(W/S)^{(1/3)}/Cd_{min}$ (km/h) For a powered sailplane, VD must also not be lower than 1·35 VH. W/S= wing loading (daN/m2) at design maximum weight Cd min= Lowest possible drag coefficient of the sailplane *4. Design Gust Speed VB.* VB must not be less than VA.	Glider operation
C.2	**337 Limit manoeuvring load factors** The limit manoeuvring load factors on the V-n diagram (see CS 22 Figure 1) must have at least the following values: n1 +5·3 n2 +4·0 n3 –1·5 n4 –2·65	Glider operation
C.3	**345 Loads with air brakes and wing-flaps extended** (a) *Loads with air brakes extended*	Glider operation

	(1) The sailplane structure including airbrake system, must be capable of withstanding the most unfavourable combination of the following parameters: Equivalent Air speed VD (EAS) : - Air brakes from the retracted to the fully extended position - Manoeuvring load factor from -1·5 to 3·5 (2) The horizontal tail load is assumed to correspond to the static condition of equilibrium. (3) In determining the spanwise load distribution, changes in this distribution due to the presence of the air brakes must be accounted for. (b) reserved (c) *Speed limiting flaps.* If wing-flaps are to be used as a drag-increasing device for the purpose of speed limitation (air-brake) conditions specified in 345(a) must be met for all wing-flap positions.	Special features not foreseen in LTF-UL
C.4	**397 Loads resulting from limit pilot forces** The airbrakes system and supporting points must be designed to withstand as far as to the stops (these included) limit loads arising from the pilot forces of 35 daN.	
C.5	**561 Emergency landing conditions - General** (4) An ultimate load of 6 times the weight of the sailplane acting rearwards and upwards at an angle of 45° to the longitudinal axis of the sailplane acts on the forward portion of the fuselage at the foremost point(s) suitable for the application of such a load. (5) Each sailplane with a retractable landing gear must be designed to protect each occupant in a landing with wheel(s) retracted under the following conditions: - a downward ultimate inertia force corresponding to an acceleration of 3 g; - a coefficient of friction of 0·5 at the ground. (6) For a powered sailplane with the engine located behind and above the pilot's seat, an ultimate inertia load of 15 g in the forward direction must be assumed.	Glider operation (field landing)
C.6	**593 Hand forces at the horizontal tail surfaces** A limit hand force of 3% of the design maximum weight of the sailplane but not less than 15 daN must be assumed to act on either tip of the horizontal tail surface: (a) in the vertical direction; (b) in the horizontal direction, parallel to the longitudinal axis.	Glider ground operation (rigging)
DESIGN AND CONSTRUCTION		
D.1	**785 Seats and safety harnesses** 5. Each seat in a sailplane must be designed so that an occupant is comfortably	Glider operation (filed landing)

	seated, whether he wears a parachute or not. The seat design must allow the accommodation of a parachute worn by an occupant. 6. Each seat and safety harness installation must be designed to give each occupant every reasonable chance of escaping serious injury under the conditions of CS 22.561(b)(1). (SeeAMC 22.785 (f))	
D.2	**788 Headrests** a) A headrest must be provided to protect each occupant from rebound injuries in the event of a crash landing. It must be equipped with energy absorbent padding protected against wear and weathering encountered in normal operation. If an adjustable headrest is provided it must be capable of being positioned such that the point of head contact is at eye level. (See AMC 22.788(a)) b) Each headrest must be so designed to minimize the possibility of clothing or the parachute becoming caught when bailing out. (See AMC 22.788 (b)) c) Each headrest in its most critical position must be designed for an ultimate load of at least 135 daN normal to a vertical plane which touches the contact point of the head. d) The width and design of the headrest must not unduly restrict vision from either seat.	Glider operation (filed landing)
D.3	**807 Emergency exit** (a) The cockpit must be so designed that unimpeded and rapid escape in emergency situations during flight and on the ground is possible with the occupant wearing a parachute. (b) The opening, and where appropriate jettisoning, of each canopy or emergency exit must not be prevented by the presence of the appropriate aerodynamic forces and/or the weight of the canopy at speeds up to VDF or by jamming of the canopy with other parts of the sailplane. The canopy or emergency exit attachment fittings must be designed to permit easy jettisoning, where jettisoning is a necessary feature of the design. (c) The opening system must be designed for simple and easy operation. It must function rapidly and be designed so that it can be operated by each occupant strapped in his seat and also from outside the cockpit. (d) A canopy or emergency exit jettison system must be actuated by not more than two controls, either or both of which must remain in the open position. The canopy jettisoning controls must be capable of being operated with a pilot effort of between 5 and 15 daN. If two controls are used they must both move in the same sense to jettison the canopy. If there are controls for each pilot, both controls or sets of	Glider operation (in-flight collision) Global parachute recovery system not thoroughly tested is not considered equivalent to a pilot wearing a parachute.

	controls must move in the same sense. If a single control is used for jettisoning, it must be designed to minimise the risk of inadvertent or unintentional operation towards the jettison position. (e) In order to enable the occupants to bail out under acceleration conditions, sufficiently strong cabin parts, or grab-handles, must be available and suitably located so that the occupants can lift themselves out of their seats and support themselves. These parts must be designed to an ultimate load of at least 200 daN in the anticipated direction of force application.	
D.4	**883 Ground clearance** (a) There must be at least 0.10 m of ground clearance for the tailplane with the wing-tip touching the ground. (b) With the wing-tip touching the ground, the associated aileron may not touch the ground when deflected fully down.	Central landing gear only.
	POWER- PLANT	
E.1	**902 Installation: sailplanes with retractable powerplants or propellers** Powered sailplanes with retractable powerplants or propellers must comply with the following: (a) Retraction and extension must be possible without risk of damage and without the use of exceptional skill or effort or excessive time. (b) It must be possible to secure the retraction (extension) mechanism in the extreme positions. There must be a means to inform the pilot that this mechanism is secured in the fully retracted or extended position. (c) Any doors associated with extension and retraction must not impair extension and retraction and they must be restrained against spontaneous opening. (d) The installation must be so designed as to prevent the heat of the engine from causing a fire or other hazardous condition. (e) Fuel or lubricant must not discharge in dangerous quantities from the engine, its components or accessories, when the powerplant is in the retracted position and during extension and retraction.	Special features not foreseen in LTF-UL
E.2	**1149 Propeller speed and pitch controls** Propellers that cannot be controlled in flight must meet the following requirements: (1) reserved (2) reserved (3) For powered sailplanes capable of extending and retracting the powerplant during a glide at VPE with the throttle closed, the propeller must not permit the engine to achieve a rotational speed of more than 110% of the max. continuous speed. VPE must not be	Special features not foreseen in LTF-UL

	less than 1·4 VS1 where VS1 is the stalling speed with the wing flaps neutral at maximum weight.	
EQUIPMENT		
F.1	**1441 Oxygen equipment and supply** (a) Oxygen equipment must be approved. (b) Oxygen equipment must be free from hazards in itself, in its method of operation, and its effect upon other components. (c) There must be a means to allow the crew to readily determine, during the flight, the quantity of oxygen available in each source of supply. (d) Oxygen bottles must be installed so as not to be hazardous in crash landings.	Glider operation
F.2	**1449 Means for determining use of oxygen** There must be a means to allow the crew to determine whether oxygen is being delivered to the dispensing equipment.	Glider operation
OPERATING LIMITATIONS AND INFORMATION		
G.1	**1513 Powerplant extension and retraction speed** The flight speed range for extension and retraction of the powerplant must be established, together with any limitations associated with it.	Special features not foreseen in LTF-UL
G.2	**1514 Powerplant extended maximum permitted speed** The powerplant extended maximum speed VPE must be established as required by E.2 for powered sailplanes capable of extending and retracting the powerplant.	Special features not foreseen in LTF-UL

4 Limitations opérationnelles

4.1 Les vols de virtuosité sont interdits.

4.2 Les vols selon les règles de vol à vue de nuit (NVFR) et les vols selon les règles de vol aux instruments (IFR) sont interdits.

5 Marquage

5.1 Une plaquette marquée de façon permanente sera placée dans l’habitacle de l’avion, à un endroit bien visible pour ses occupants; elle portera la mention suivante:

ECOLIGHT

Une autorisation de vol a été établie pour le présent aéronef, lequel appartient à la catégorie spéciale, sous-catégorie Ecolight. Cet aéronef ne correspond que partiellement aux normes internationales.

5.2 L’inscription suivante, composée de caractères ayant une taille de 30 mm au moins, sera apposée sur la partie extérieure de l’avion à un endroit bien visible en accédant à bord:

ECOLIGHT

Ittigen, le 24 juin 2015

Département fédéral de l’environnement, des transports,
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