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SUBJECT : **Banner Towing**

CERTIFICATION SPECIFICATION : CS-23 (including older codes)

PRIMARY GROUP / PANEL : 01 (Flight)

SECONDARY GROUPE / PANEL : All

NATURE : SCE

SPECIAL CONDITION

Banner Towing

A: GENERAL

A1: Applicability

CS-23

It is considered that only banner with known limitations and performance data's may be applicable for safe operations (drag, tow speeds,...).

It is further on considered that only Day VFR, non acrobatic Operations applicable for banner towing.

B: FLIGHT

B1: Proof of Compliance

In addition to basic certification requirement 23.21 a minimum of 3 tows with representative banner types must be shown.


The representative fleet of all kind of requested banners in all critical combinations of max., min. weight, aerodynamically characteristics including drag variations, max. ,min. speeds, ground handling of equipment and environmental conditions (rain) must be shown.

The performance data of the critical banner must be confirmed by flight tests (drag measurements).

B2: Take Off / Pick up

The take-off distance or required safe distance for the established pick-up procedure must be shown in the conditions of 23.45.

The required minimum safe speed for in flight pick up with the most critical banner must be demonstrated.

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If the snatch in flight pick up method is used, the safe minimum pick up distance shall be at least 1,25 times the distance from the pick up point to the point where the banner clears a height of 15m.

B3: Climb

The climb performance requirement from 23.65 must be shown for the banner tow formation in the conditions of 23.45 and 23.63.

The climb rate must not be less than 1,5 m/s at 450m MSL at ISA +20°C.

B4: Tow Speeds

The minimum and maximum tow speed must be determined by flight tests under condition of B1.

Minimum tow speed must not be less than $1,2 \cdot V_{s1}$.

Maximum tow speed must not be higher than v_a , or the limitations by the banner.

B5: Controllability and Manoeuvrability

The General Controllability, Manoeuvrability and Control forces required in the basic requirement must be shown for the complete tow formation except for the following conditions:

Sideslip,

Speeds more than the established maximum towing speed

Other tow cable length as determined under F2(c)

More than 30° left and right lateral banner position

More than 20° up and 40° down position of the banner, or the maximum deflection determined in flight.

Aerobatic manoeuvres

Power Off Conditions


Elevator Control force in manoeuvres

B6: Stall Warning

An adequate Stall Warning compared to the basic requirement must be shown for the banner tow condition.

B7: Tow Cable release

The banner release within the speeds of B3 may not cause a unsafe condition for the tow plane.

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B8: Landing

A procedure for drop-off the banner must be determined by tests.

C: STRUCTURE

C1: Proof of structure

Compliance with the Strength and Deformation, Structural Analysis and Load Test requirement from the base requirement must be shown for the banner tow condition and installation.

C2: Towing loads

(a) The tow must be initially assumed to be in stabilized level flight, with a minimum tow rope load of 50daN or the actual stationary tow rope load at maximum tow speed whichever is higher, acting at the towing hook in following direction:

- (1) horizontally rearward
- (2) in plane of symmetry rearward and downward at an angle of 40° to the horizon or the angle of the most critical banner, whichever is higher.
- (3) in plane of symmetry rearward and upward at an angle of 20° with the horizon
- (4) horizontally rearward and sideward at an angle of 30° with the plane of symmetry

Lower tow rope loads may be only acceptable if shown by detailed analysis

(b) The highest rated ultimate strength of the weak link (Q_{nom}) for the towed banner must be established.

Q_{nom} must not be lower than 300 daN.


(c) With the tow initially assumed to be subjected to the same conditions as specified in C2(a) the tow rope load due to surging and pick up suddenly increases to $1,0 \cdot Q_{nom}$, assuming a textile rope is used.

Snatch Loads from an in flight pick up of $1,2 Q_{nom}$ must be considered if applicable, lower loads may only be acceptable if detailed flight analysis available.

The resulting tow rope load increment must be balanced by linear and rotational inertia forces and superimposed to loads from C2(a).

C3: Strength of launching hook attachment

The launching hook attachment must be designed to carry a limit load of $1,5 Q_{nom}$ as defined in C2(b) acting in directions of C2(a).

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D: DESIGN and CONSTRUCTION

D1: Cable Systems

Each additional cable system installed with the tow installation must comply with the basic requirement of the towing plane.

D2: Release mechanisms

There must be a release mechanisms installed to give the tow pilot the ability to quick disconnect the banner.

- (a) The release mechanisms must be approved.
- (b) It must be extremely improbable for bolts or other projections on the release mechanism itself or the structure surrounding the mechanism, including the landing gear, to foul the towing rope.
- (c) It must be shown that the release force will not exceed the force limit of the JAR23, when a cable Q_{nom} (see C2(b)) is applied in any direction described in C2(a) and that the release mechanism functions properly under any operating condition.
- (d) The range of travel of the release lever in the cockpit, including free travel, must not exceed 120 mm.
- (e) The release lever in the cockpit must be arranged and designed so that the pilot force as defined in D2(c) can be easily applied
- (f) A visual inspection of the release mechanism must be easily possible.


IEM D2(f)

The possibility to open the release mechanism on the tow hook assembly for ground handling is recommended.

- (g) The release mechanism must be so installed that there is no interference between the tow rope and any control surface when the towed banner is in any position of C2(a) and the controls are operated through their full angular movement.
- (h) The towing hook must be suitable protected against inadvertent release.
- (i) The release control system must be designed to actuate the release mechanism of each launching hook at the same time, where more than one launching hook is fitted or a clear method must be established to prevent confused operation of the individual emergency releases.

D3: Colour marking and arrangement of cockpit controls

Towing cable release must be of yellow/red colour and installed for an operation with the same pilots hand as the power lever.

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D4: Rope deny

The tail section must be designed in a way to avoid inadvertent hang up during the in flight pick-up procedure.

E: POWERPLANT

E1: Engines

No Change to CS-23

E2: Fuel System

No Change to CS-23

E3: Cooling test procedure for reciprocating engine

Cooling test procedure as required by the base requirement for the tow plane must be carried out with the critical speeds and power settings for the banner tow formation established in Section B.

The most critical engine temperature must be determined.

F: EQUIPMENT

F1: Powerplant Instruments

A cylinder head temperature indicator or a indicator of the most critical temperature determined in E3 must be installed.

F2: Miscellaneous equipment

For towing flights the following additional equipment must be installed:


- (a) A adjustable mirror so that the pilot, when strapped in his seat, has full and unrestricted view of the towed banner in the positions according C2.
- (b) An indication to the pilot for the attached position of the tow rope according D2(f) or a second mirror to the tow hook if not covered by F2(a)
- (c) A tow rope of approved type including at least one weak link and connecting ring, this includes also a pick up hook if required.

The tow rope strength, length and flexibility must be established, assuming a textile material.

The type of pick-up hook is a part of the tow rope and must be established.

- (d) Placards determined by certification including a Limitation which kind of towing is approved (glider, banner)

Information about the additional required ground equipment must be furnished.

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G: OPERATING LIMITATIONS and INFORMATION

G1: Maintenance Manual

The Maintenance Manual must be amended for the additional installations.

G2: Operating Limitations


The following additional Information must be furnished in the AFM:

- (a) Maximum weight and drag for the banner.
- (b) A clear reference to the limitations of the banner to be used.
- (c) Maximum and minimum permissible towing speed.
- (d) Minimum and maximum tow cable length.
- (e) Strength and Definition of tow rope and weak link as necessary
- (f) Additional C of G and maximum takeoff weight Limitations if required.
- (g) All other limitations as a result of Section B
- (h) Maximum Number of Occupants in Tow
- (i) Limitation to Day VFR Operations only, non Icing Conditions, no acrobatic.

G3: Operating data and procedures

Information concerning normal and emergency procedures for the banner tow other pertinent information necessary for safe operation must be furnished, including:

- (a) approved pickup or takeoff method
- (b) C of G determination for the banner if required
- (c) different type of banners
- (d) minimum and maximum in flight pick-up speed
- (e) drop-off procedure
- (f) procedure for stowage and safe release of the pick-up hook if necessary.
- (g) inadvertent pick up with the landing gear
- (h) the pick-up procedure
- (i) additional preflight procedures
- (j) emergency Landing with banner attached

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G4: Performance Information


The following information must be in addition furnished:

- (a) demonstrated crosswind velocity for pick-up and drop-off
- (b) cruise performance
- (c) take off distances or minimum pick-up distance
- (d) climb performance

ANNEX

Appendix 1

Acceptable Means of Compliance to SC-O23.div-0x-01

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Appendix 1
ACCEPTABLE MEANS OF COMPLIANCE
Banner Towing

AMC D2(a)

Lufttüchtigkeitsforderungen für Schleppkupplungen (LFK) issued 11.8.1976 or later by LBA is an acceptable means as an approved specification.