EAC

No. 22-1

TABLE of CONTENTS

Requirements for some specific, non-conventional aircraft designs

AC 22. 1
Applicability (Interpretative Material)
See 22. 1

This Part is considered to be applicable to conventional airplanes. Some specific, non-conventional designs such as canards. tandem wings, winglets, may need additional requirements.

AC 22. 21(c)
Proof of compliance (Interpretative Material).
See 22. 21(c)

Whenever used, the sentence ‘may not require exceptional piloting skill’ should be interpreted to mean that it is not it is no more than the skill expected from an average pilot.

AC 22. 21(d)
Proof of compliance (Acceptable Means of Compliance)
See 22. 21(d)

1. Performance and flight characteristics related to stalling speed, take-off, and climb should be investigated with a wet profile.
2. Although the performance may exceed the limits specified in 22. 45, 22. 51, 22. 65, (dry conditions), the variations from those achieved in dry conditions should not exceed 5 kt for V_{S0}, 50 m for take-off distance, 0.5 m/s (100 ft per min.) for rate climb.
3. The test conditions should be such that the profile must remain wet throughout all of the test.

AC 22. 23
Load Distribution Limits (Interpretative material)
See 22. 23

1. The centre of gravity range within which the airplane may be operated safely without the use of removable ballast should not be less than that which corresponds to:
   a. An occupant weight of 55 kg to 86 kg for single-seat airplanes.
   b. An occupant weight of 55 kg to 172 kg for two-seat airplanes.

2. In each case the safe e.g. range should permit operation with a fuel load ranging from the lower limit of useable fuel up to fuel sufficient for one hour of operation at rated maximum continuous power.

AC 22. 45
Performance, General (Acceptable Means of compliance)
See 22. 45

1. The performance tests may be conducted in a non-standard atmosphere, not at sea level, and in non-still air. This requires testing procedures and data reduction methods that reduce the data to still air and standard sea level atmospheric conditions, where the performance must be met.
2. Data reduction should include corrections for engine power.

AC 22. 173 and AC 22. 175
Static longitudinal stability (Interpretative Material)
See 22. 173 and 175

Instrument stick force measurements should be made unless:

a. Changes in speed are clearly reflected by changes in stick forces; and
b. The maximum forces obtained under 22. 173 and 175 are not excessive.

AC 22. 201
Wings level stall (Interpretative Material)
See 22. 201

Yawing angles up to 5° should not appreciably change the stalling characteristics.

AC 22. 301
Loads (Interpretative Material)
See 22. 301(d)

A conventional configurations may be taken as an airplane with :

a. A forward wing with an aft cruciform tail unit substantially separated in the fore and aft sense from the wing; and
b. Whose lifting surfaces are either un-tapered or have essentially continuous taper with no more than 30° fore or aft sweep at the quarter chord line and equipped with trailing edge controls. Trailing edge flaps may be fitted.

Note: Configurations for which specific investigation is required include:

(i) Canard. tandem-wing, close-coupled or tailless arrangements of the lifting surfaces;
(ii) Cantilever bi-planes or multi-planes;
(iii) T-tail or V-tail arrangements;
(iv) Highly swept (more than 30° at quarter chord), delta or slatted lifting surfaces;
(v) Winglets or other tip devices, including outboard fins.

AC 22. 307(a)
Proof of structure (Interpretative Material)
See 22. 307(a)

1. Substantiating load tests made in accordance with 22. 307 (a) should normally be taken to ultimate design load.
2. The results obtained from strength tests should be so corrected for departures from the mechanical properties and dimensions assumed in the design calculations so as too establish the possibility of any structure having strength less than the design value, owing to material and dimensional variation is extremely remote.

AC 22. 405
Secondary Control System (Interpretative Material)
See 22. 405

Single hand or foot loads assumed for design should not be less than the following:

a. Hand loads or small hand-wheels, cranks, etc, applied by finger or wrist-force: P=15 daN.
b. Hand loads on levers and hand-wheels applied by the force of an unsupported arm without making use of the body weight: P=35 daN.
c. Hand loads on levers and hand-grips applied by the force of a supported arm or by making use of the body weight: P=60 daN.
d. Foot loads applied by the pilot when sitting with his back supported (e.g., toe-brake operating loads): P=75 daN.

AC 22. 441
Maneuvering loads ((Interpretative Material and Acceptable means of compliance)
See 22. 441

For airplanes where the horizontal tail is supported by the vertical tail, the tail surfaces and their supporting structure including the rear portion of the fuselage should be designed to withstand the prescribed load on the vertical tail and the roll-moments induced by the horizontal tail acting in the same direction.

2. For T-tail in the absence of a more rational analysis, the rolling-moment induced by deflection of the vertical rudder may be computed as follows:

$$Mr = 0.3\ St\ \frac{\rho o}{2}\ \beta\ V^2\ bH$$

where -

Mr = induced roll-moment at horizontal tail (Nm).

bH = span of horizontal tail (m)

$$\beta = \frac{dL}{d\eta}\ \eta\ f\eta$$

η = rudder deflection

$\frac{dL}{d\eta}$ = change of zero lift angle of $\eta f\eta = 1$

$f\eta$ = effectively factor in accordance with angle of rudder deflection

V = speed of flight (m/s)

St = area of horizontal tail (m^2)

ρo = air density sea level (kg/m^3)

AC 22. 443

Gust loads (Interpretative Material and Acceptable means of compliance)

See 22. 443

1. For airplane when the horizontal tail is supported by the vertical tail, the tail surfaces and their supporting structure including the rear portion of the fuselage should be designed the withstand the prescribed load on the vertical tail and the roll-moments induced by the horizontal tail acting in the same direction.
2. For t-tail in the absence of a more rational analysis, the rolling-moment induced by gust load may be computed as follows:

$$Mr = 0.3\ St\ \frac{\rho o}{2}\ VU\ bH\ K$$

where -

Mr = induced roll-moment at horizontal tail (NM).

K = gust factor = 1.2

bH = span of horizontal tail (m)

St = area of horizontal tail (m^2)

ρo = air density sea level (kg/m^3)

V = speed of flight (m/s)

U = gust speed (m/s)

AC 22. 479(b)

Level landing conditions (Acceptable means of compliance)

See 22. 479(b)

'properly combined' may be defined by a rational analysis or as follows:

a. Max spin-up condition-

Pz = 0.6 Pz max; Px = -0.5 pz max.

b. Max spring back condition -

Pz = 0.8 Pz max; Px = 0.5 Pz max.

c. Max vertical load condition -

Pz = Pz max; Px = $\pm$ 0.3 Pz max.

where -

Px = Horizontal component of ground reaction

Pz = Vertical component of ground reaction

AC 22. 572(a)
Parts of structure critical to safety (interpretative material)
See 22. 572(a)

At least the wing main spar, the horizontal tail and their attachments to the fuselage should be investigated to determine if the stress levels exceed the values given in table in AC 22. 572(b).

AC 22. 572(b)
Parts of structure critical to safety (Interpretative Material and Acceptable means of compliance)
See 22. 572(b)

1. The use of the following stress levels may be taken as sufficient evidence, in compliance with good design practices to eliminate stress concentrations, that structural items have adequate safe lives:

Material used	Allowable normal stress level of maximum limit load
- Glass rovings in epoxy resin	25 daN/ mm2
- Carbon fibre rovings in epoxy resin	40 daN/ mm2
- Wood	According to ANC -18*
- aluminum alloy	Half of rupture tensile strength
- Steel Alloy	Half of rupture tensile strength

2. Higher stress levels need further fatigue investigation using one or a combination of the following methods:
   a. By a fatigue test, based on a realistic operating spectrum.
   b. By a fatigue calculation using strength values which have been proved to be sufficient by fatigue tests of specimens or components.

   * ANC-18 is the ANC bulletin ‘Design of wood aircraft structures’; issued June 1944 by the Army-Navy-Civil Committee on Aircraft Design Criteria (USA).

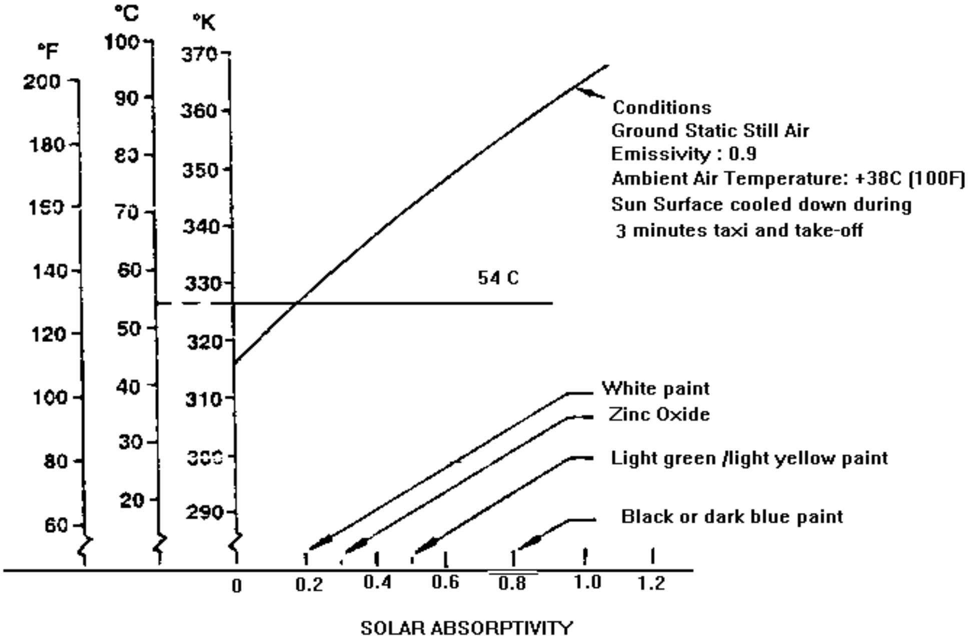
AC 22. 613(b)
Material strength properties and design values (Interpretative Material)
See 22. 613(b)

Material specifications should be those contained in documents accepted either specifically by the Authority or by having been prepared by an organization or person which the authority accepts has the necessary capabilities. In defining design properties these material specification values should be modified and/or extended as necessary by the constructor to take account of manufacturing practices (for example method of construction, forming, machining and subsequent heat treatment).

AC 22. 613(c)
Material strength properties and design values (Acceptable means of compliance)
See 22. 613(c)

Test temperature -

a. For white painted surface and vertical sunlight: 54C. if the test cannot be ----- temperature an addition factor of 1.25 should be used.
b. For other surfaces the curve below may be used to determine the test ---------



AC 22. 615
Design properties (Acceptable means of compliance)
See 22. 615

When the manufacturer is unable to provide satisfactory statistical justification for A and B values, especially in the case of manufacturing of composite materials, a safety super factor should be applied to ensure A and B values are met.

AC 22. 619
Special factors (Acceptable means of compliance)
See 22. 619

For the substantiation of composite structures, unless more rational means are agreed by the Authority, one of the following may be used:

a. An additional factor of 1.2 for moisture conditioned specimen tested at maximum service temperature, providing that a well established manufacturing and quality control procedure is used.

b. An additional factor of 1.5 for specimen tested with no specific allowance for moisture and temperature.

NOTES:

1. For cold cured structures it may be assumed that the completed structure is fully moisture conditioned.
2. The factor in a. above may be varied based on the coefficient of variation that the manufacturer is able to show for this product. (See table1).

TABLE 1

Coefficient of Variation %	Test factor
5	1.00
6	1.03
7	1.06
8	1.10
9	1.12
10	1.15
12	1.22
14	1.30
15	1.33
20	1.55

Definition : Coefficient of variation

For a population with mean M and standard deviation σ, the coefficient of variation, Cv, is defined by -

$Cv = \sigma/M$

the coefficient of variation is frequently expressed as a percentage, in which case

$Cv(\%) = 100\ \sigma/M$

Additional advisory material:

When the population coefficient of variation is estimated from tests of critical structural features, the results from tests of at least 6 specimens should be used.

The sample coefficient of variation should be adjusted to obtain a 95% confidence estimate of the population coefficient of variation which may be used in Table 1.

In the absence of a more rational method, this may be done by multiplying the sample coefficient of variation by a Factor F, defined by :

$$F = \frac{1 + Up\ \{ 1/2f\ (1 - c^2 Up^2/n) + c^2/n \}^{1/2}}{1 - c^2 Up^2/n}$$

Where -

Up is the standardized normal variant corresponding to the confidence level being used (for 95% confidence, Up = 1.6452)

n is the number of specimens in the Sample.

f is the number of statistical degree of freedom [= (n-1)] c is the population coefficient of variation. The value of the factor F is relatively insensitive to the value of c used in the absence of more rational data, a value of 0.2 should be used.

AC 22. 773
pilot compartment view (Acceptable means of compliance)
See 22. 773

Compliance with 22. 773 may be provided by the canopy having a suitable opening.

AC 22. 775(a)
Windshields and windows (Acceptable means of compliance)
See 22. 775(a)

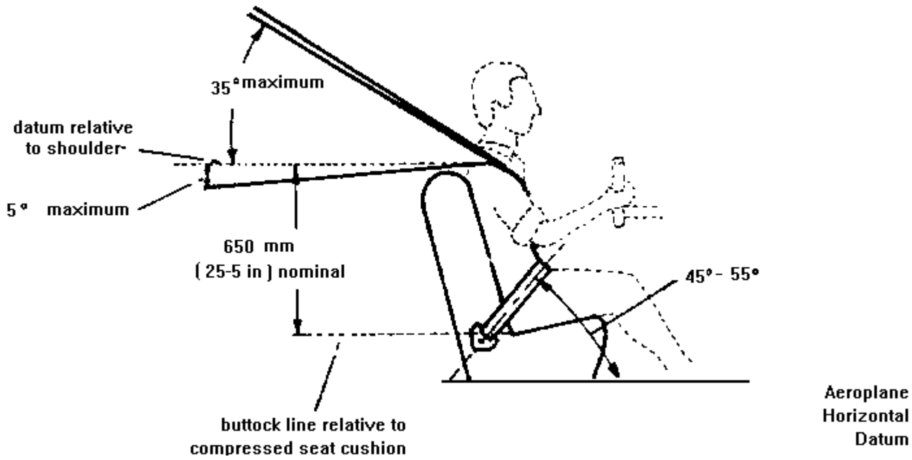
Windshields and windows made of synthetic resins are accepted as complying with this requirement.

AC 22. 777
cockpit Controls (interpretative material)
See 22. 777

The pilot should not need to change the hand operating the primary controls in order to operate a secondary control during critical stages of the flight (e.g., during take-off and landing).

AC 22. 785(e)
Seats, safety belts and Harnesses (Acceptable means of compliance)
See 22. 785(e)

Installation of shoulder harness. Figure 1(a), 1(b) and 1(c) show the recommended installation geometry of this type of restraint.



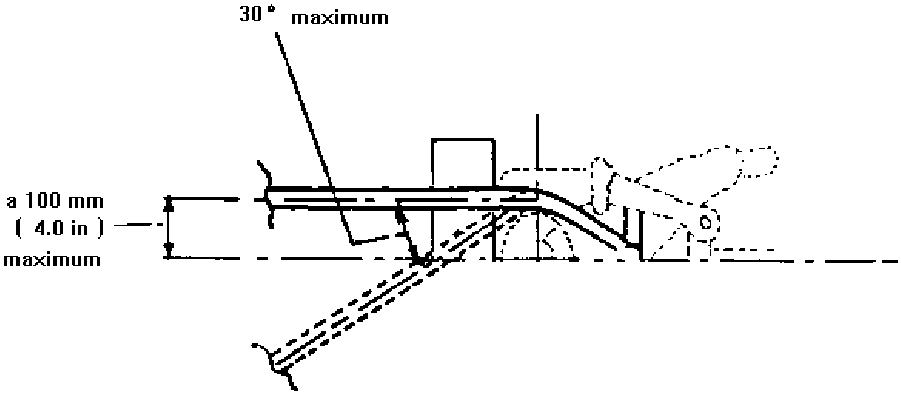


FIGURE 1 (b)
RANGE OF ANGLES OF SHOULDER STRAPS

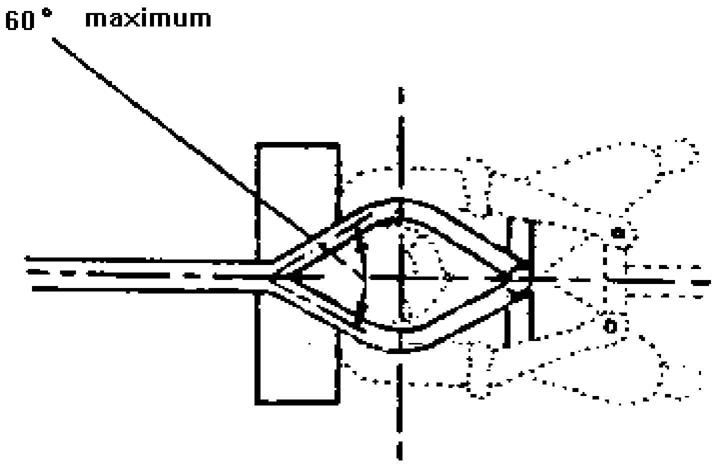


FIGURE 1 (c)

NOTES:

1. Where possible it is recommended that a negative G or crotch strap is fitted, otherwise during abrupt decelerations the shoulder straps tend to raise the belt portion (unless tightly adjusted) from around the hips onto the stomach, thus allowing the wearer to slide underneath the lap portion of the belt.
2. Where there is more than 152 mm (6 in) of webbing between the attachment point of the shoulder straps, and the top of the seat back, suitable means should be provided to limit sideways movement e.g. guide loops, in order to ensure compliance with 22. 785(e) and to ensure adequate separation of shoulder straps to minimize injury or chafing of the wearer’s neck.
3. Where the seat back is of adequate strength and such height that the harness geometry relative to the shoulder conforms with Figure 1(a) (i.e., 650 mm (25.5 in)), it is permissible to attach the shoulder straps to the seat back or via guide loops to the airplane floor.
4. Where the seat back is of adequate strength the use of means, e.g. guide loop of suitable strength, will limit sideways movement during the emergency alighting accelerations of 22. 561(b)(2).
   Safely belt with one diagonal shoulder strap (ODS Safety Belt). Figures 2(a) and 2(b) show the recommended installation geometry for this type of restraint.

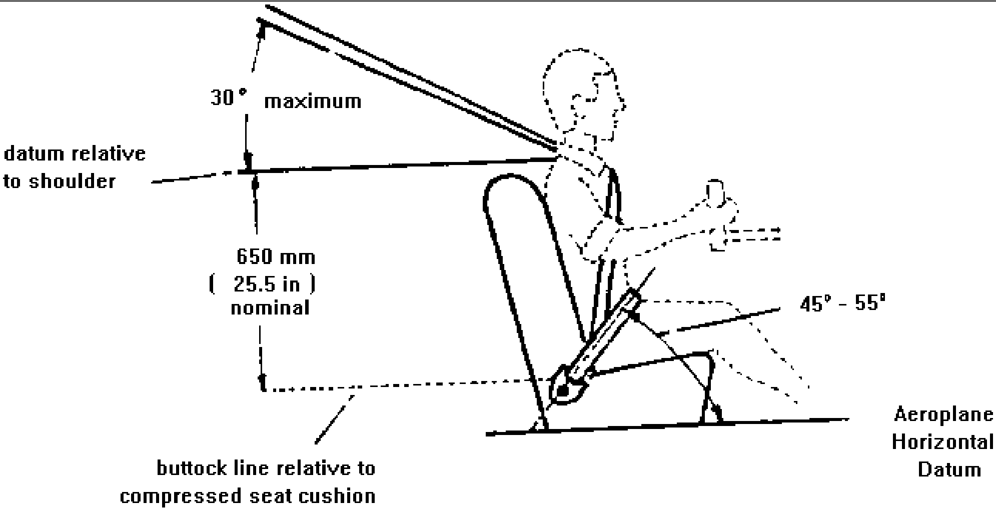


FIGURE 2(a)

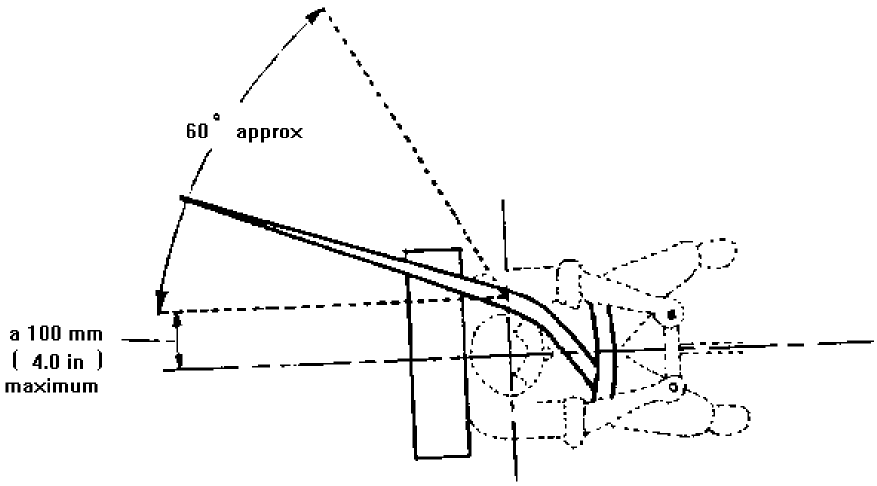


FIGURE 2 (b)

NOTES:

1. The total length of the diagonal shoulder strap should be kept as short as possible, in order to reduce the effect of webbing stretch under the emergency alighting loads.
2. Where the seat back is of adequate strength and such height that the harness geometry relative to the shoulder conforms with the Figure 2(a)(i.e., (i.e., 650 mm (25.5 in)), it is permissible to attach the shoulder straps to the seat back or via guide loops to the airplane floor.
3. The installation should be such as to minimize the risk of injury or chafing of the wearer's neck; a guide loop may assist in achieving this.

AC 22. 903(a)
Engine type certificate (Acceptable means of compliance)
See 22. 903(a)

The engine may be type certificated under JAR-E, JAR-22 Subpart H, or FAR Part 33.

AC 22. 905(a)
Propellers (Acceptable means of compliance)
See 22. 905(a)

The propeller may be type certificated or otherwise approved under JAR-P, JAR-22 Subpart J, or FAR Part 35.

AC 22. 943
Negative Acceleration (Acceptable means of compliance)
See 22. 943

Compliance with 22. 943 may be shown by submitting the aircraft to such period of negative acceleration that is within the capability of the airplane, but not less than-

a. One continuous period of 2 seconds at less than zero ‘g’, and separately,

b. At least two excursions to less than zero ‘g’ in rapid succession in which the total time at less than zero ‘g’ is at least two seconds.

AC 22. 1011(c)
Oil system, General (interpretative material)
See 22. 1011(c)

In assessing the reliance that can be placed upon the means for providing the appropriate fuel/oil mixture to the engine to prevent a hazardous condition, account should be taken of, for example -

a. The3 tolerance of the engine to fuel/oil mixture ratios other than the optimum;

b. The procedure established for refueling and introducing the appropriate amount of oil; and

c. The means by which the pilot may check that the fuel contains an adequate mixture of oil.

AC 22. 1105
Induction system screens (Acceptable means of compliance)
See 22. 1105

The de-icing of the screen may be provided by heated air.

AC 22. 1305(a)
Powerplant Instruments (interpretative material)
See 22. 1305(a)

A single indicator is acceptable for each group of interconnected tanks functioning as a single tank, such that individual tanks cannot be isolated.

AC 22. 1436
Hydraulic Manually-Powered Brake systems (interpretative material)
See 22. 1436

For hydraulic systems other than manually-powered brake systems the requirement of FAR 22.1435 should be applied.

AC 22. 1587(a) (4)
Performance Information (interpretative material)
See 22. 1587(a) (4)

The variation in aerodrome altitude to be covered need not exceed from sea level to the smaller of 2438 m (8000 ft.), and the altitude at which a steady rate of climb of 1.02 m/s (200 ft per min) may be achieved. The temperature variations to be covered at each altitude need not exceed 33°C below standard to 22°C above standard.