



Australian Government
Civil Aviation Safety Authority

I, WILLIAM BRUCE BYRON, Director of Aviation Safety, on behalf of CASA, make this instrument under regulation 21A of the *Civil Aviation Regulations 1988*.

[Signed Bruce Byron]

Bruce Byron
Director of Aviation Safety and
Chief Executive Officer

19 December 2007

Civil Aviation Order 108.28 Instrument 2007

1 Name of instrument

This instrument is the *Civil Aviation Order 108.28 Instrument 2007*.

2 Commencement

This instrument commences on the day after it is registered.

3 New Civil Aviation Order 108.28

Civil Aviation Order 108.28 is repealed and a new Civil Aviation Order 108.28 substituted as set out in Schedule 1.

Schedule 1 Civil Aviation Order 108.28

Specification — manufacture of fixed pitch wooden propellers

1 Application

This Civil Aviation Order specifies standards and practices for the manufacture of fixed pitch wooden propellers and applies in such circumstances as may be directed by the Director or an authorised person under the *Civil Aviation Regulations 1988*.

2 Approved timbers

- 2.1 Wooden propellers must be manufactured only from types of timber approved and selected in accordance with Civil Aviation Order 108.29.
- 2.2 Timber for use in wooden propellers must be quarter sawn, unless otherwise approved.

3 Laminae

- 3.1 Each lamina must be cut from the planks so that the direction of its grain is as nearly as possible parallel to its length. The inclination of the grain on the edges of the short laminae used at the front and back faces of a propeller must not exceed 1 in 12 on the edges relative to the glued faces, and on the faces relative to the longitudinal axis of each lamina.
- 3.2 After being cut to shape and reduced to the required thickness, the laminae must be kept in the gluing room or under similar atmospheric conditions for a period of at least 24 hours before being glued. Any laminae found to be warped at the expiration of this period must be rejected.
- 3.3 Side by side jointing of laminae may be used if the joint, or joints, in adjacent laminae in the assembled block are discontinuous by at least 20 mm at the centre of the propeller. Plain joints only are permitted.
- 3.4 The laminae must be selected and arranged to ensure balance in the complete assembly.
- 3.5 The thickness and number of laminae to be used in a propeller must be specified on the approved drawing.

4 Gluing

- 4.1 Adhesive used for the gluing of laminae and side joints must be approved for this purpose by the Director. Adhesives must be used strictly in accordance with the appropriate manufacturer's instruction.

Note 1 Resorcinol formaldehyde or epoxy adhesives prepared specifically for timber are acceptable.

Note 2 Acid catalysed phenolics and/or urea formaldehyde type adhesives are not acceptable for this purpose.

- 4.2 The base on which the laminae are to be glued together must be flat and rigid and must provide continuous support for the entire length of the board.
- 4.3 Clamping of the laminae must be started at the centre of the block, after which other clamps must be fixed alternately on either side until the ends of the block are reached. The distance between adjacent clamps must not exceed 300 mm.
- 4.4 After the clamps have been removed, the block must be left for at least 48 hours before further operations are commenced. If removed from the gluing stool, the block must be stored in a horizontal position lying on 1 of the boss faces.

5 Boring and drilling

- 5.1 The bore and bolt holes must be straight, circular, smooth and parallel to the axis of rotation. The bolt holes must be jig drilled.
- 5.2 The boss faces must be flat, smooth and perpendicular to the axis of the bore.
- 5.3 To prevent exposure of the end grain, a suitable protective covering must be applied immediately upon completion of the drilling operations.

- 5.4 Unless otherwise stated on the approved drawing, the manufacturing limits and clearances must be as specified below:

Dimension	Tolerance
Bore	- 0.0 to + 0.5 mm
Diameter of bolt holes	+ 2.0 to + 2.5 mm on nominal bolt diameter
Position of bolt holes	within 0.5 mm of specified dimensions
Distances between the boss faces	± 2.0 mm
Diameter of counter boring (if any)	- 0.0 to + 2.0 mm
Diameter of boss	- 3.0 to + 4.0 mm

6 Shaping

- 6.1 After being roughly shaped, the propeller must be stored for at least 10 days under atmospheric conditions similar to the conditions existing in the final shaping shop, i.e. at a temperature of not less than 15°C and free from draughts.
- 6.2 To prevent exposure of the end grain, a suitable protective covering must be immediately applied to the end grain exposed by shaping operation in the area where the blade roots blend into the boss.
- 6.3 The propeller must be carefully examined during the shaping process for faults or defects.

7 Inspection

- 7.1 On completion of the final shaping, the propeller must be inspected for accuracy of angles, dimensions, track and balance, and for general finish.
- 7.2 Unless otherwise stated on the approved drawing, the allowable tolerances on angles, chords, maximum thickness, diameter and track must be as follows:

Angles	± 1° throughout the inner third of the blade length. ± ½° throughout the outer two-thirds of the blade length.
Chords	± 1 mm for chords up to 50 mm increasing by ± 0.5 mm for each 50 mm of chord, or part thereof, in excess of 50 mm.
Maximum	± 0.5 mm for thickness up to 10 mm increasing by ± 0.2 mm for each 10 mm, or part thereof, in excess of 10 mm.
Diameter	± 5 mm.
Track	± 1 mm for propellers of up to 1.5 m diameter, increasing by ± 0.5 mm for each 1 m, or part thereof, in excess of 1.5 m diameter.
Plan form	For propellers of up to 1.5 m in diameter, a tolerance of 2 mm is allowed on the distances (as given in the approved drawing) between the trailing edge of all sections (except that nearest the tip) and a datum plane containing the axis of the bore and the centre line of the section nearest the tip. This tolerance may be increased by ± 1 mm for each 1 m, or part thereof, by which the diameter exceeds 1.5 m.

8 Protective treatment

- 8.1 The propeller must be finished in accordance with the instructions specified on the approved drawing.
- 8.2 The bore and bolt holes must be protected with paint or suitable varnish.
- 8.3 Where lacquering is to be used:
 - (1) The surfaces of the propeller prior to lacquering must be smooth, even, dry and clean. Any small depressions remaining after the propeller has been rubbed down with fine sand paper may be filled up with plastic wood.
 - (2) To prevent “blushing”, the lacquering must be done in a dry shop free from cold draughts, at a temperature of from 20°C to 30°C.
 - (3) On completion of the lacquering, the propeller surfaces must be smooth and entirely free from bubbles and pin holes and the film of lacquer must be between 0.10 mm and 0.15 mm thick.
- 8.4 Where fabric covering is to be used:
 - (1) Fabric intended for covering propeller blades must comply with a specification approved by the Director. The covering for each blade must be in 1 piece and must extend to a position as stated on the approved drawing.
 - (2) The covering process must be carried out at a room temperature of not less than 20°C and the room must be free from draughts.
 - (3) After being allowed to dry for at least 12 hours, the fabric covering must be given 1 coat of undercoating varnish complying with a specification approved by the Director.

9 Metal sheathing

- 9.1 The metal sheathing, if specified, must be fitted in accordance with the instructions on the approved drawing.
- 9.2 Localised reduction of the thickness of sheath segments, e.g. by filing, is prohibited and the segments must, therefore, be worked in such a way as to make this unnecessary.
- 9.3 Sheaths must be attached by approved countersunk wood screws (suitably plated or dipped), except where the blade is less than 10 mm thick, in which region 14 SWG tinned copper rivets must be used. The position and spacing of screws and rivets must be as indicated on the approved drawing.
- 9.4 To prevent any movement of sheath segments relative to the blades, the edges of the screw and rivet holes in the segments must be punched or spun into the timber to form a countersink for the screw or rivet head which, when in place, must be slightly below the surface of the sheath. Care must be taken to prevent bulging or buckling of the sheath and/or damage to the covering and timber when the punching or spinning is done.
- 9.5 Slots in screw heads must be thoroughly cleaned before the screws are inserted. After insertion, screw and rivet heads must be flooded over with soft solder.
- 9.6 The application of solder to the whole or to any segment of a sheath for the purpose of securing balance is prohibited.

- 9.7 Drainage of the propeller blades must be provided for by filing slots in the tip segments after they have been lapped over and secured.
- 9.8 Care must be taken to avoid damage to the blade surface or protective covering when forming the edges of the sheaths.

10 Balance

- 10.1 The propeller must be tested for balance at the following stages:
 - (a) after final shaping has been completed;
 - (b) after sheaths have been fitted;
 - (c) when it is in the finished state (except for any small alteration necessary to secure balance);
 - (d) after any alterations shown to be necessary by the preceding tests.
- 10.2 The balance tests must be made on an approved type of balancing stand.
- 10.3 During the tests specified in paragraph 10.1 of this subsection, and making allowance for the known error for the balancing apparatus as ascertained by testing it with the propeller in position, any lack of balance detected in the propeller must not exceed the following limit whatever the position of the propeller in the plane of rotation:

1 500 mm-gms for propellers of up to 2 m diameter, increasing by 750 mm-gms for each 1 m, or part thereof, for propellers in excess of 2 m diameter.
- 10.4 If the propeller does not satisfy the requirements stated in paragraph 10.3 of this subsection, the error must be corrected in the following manner:
 - (a) after the first test (subparagraph 10.1 (a)). By removal of timber from the propeller to the extent permitted by the tolerances stated in paragraphs 5.4 and 7.2 of this Order;
 - (b) after the third test (subparagraph 10.1 (c)). By the application of cellulose, lacquer or varnish, whichever is appropriate. Any other method of securing balance is prohibited.

11 Identification markings

- 11.1 Each propeller must be marked with the particulars indicated below:
 - (a) the propeller drawing number; and
 - (b) the diameter and pitch in metres, preceded by the letters D and P, respectively; and
 - (c) the type of engine or engines (i.e. name, series, etc.) for which the propeller has been designed; and
 - (d) the manufacturer's serial number.
- 11.2 The foregoing particulars must be stamped between the boss and the root section of the blades in a position where they will not be obscured by the flange of the propeller mounting hub.

11.3 Care must be taken to ensure that all stamp impressions are legible.
