

STANDARDS ASSOCIATION OF AUSTRALIA.

Headquarters :

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AUSTRALIAN STANDARD SPECIFICATION FOR AIRCRAFT MATERIAL
(Emergency Series).

BOLLYWOOD

This standard forms one of a series prepared by the Standards Association of Australia at the request of Departments of the Commonwealth Government for particular application in time of national emergency. In appropriate cases these specifications will be reviewed for inclusion in the normal series of Australian standards.

First Issued	-	-	-	June,	1942.
Revised	-	-	-	February,	1944.

The terms and trade and botanical names used in this specification shall be interpreted in accordance with A.S. No. O.1, Terms and Definitions used in Timber Grading Rules, and A.S. No. O.2, Nomenclature of Australian Timbers.

1. Scope. This specification applies to the selection of timber for aircraft construction.

The specification is divided into three parts.

(a) Part I describes the requirements for the purchase of raw material intended for subsequent preparation as aircraft material.

- (i) Section 1 applies to clear timber which, after subsequent preparation and grading under Part II, may be released for the manufacture of aircraft parts.
- (ii) Section 2 provides for the classification of timber into recutting grades, permitting the inclusion of defects which are prohibited under Section 1, but which will be eliminated prior to or during the manufacture of the aircraft parts.

(b) Part II applies to the preparation and testing of the timber and provides for its classification according to its mechanical properties.

- (i) Section 3 applies to the preliminary preparation and inspection of rough timber supplied under Part I.
- (ii) Section 4 applies to the test requirements for material for parts the strength and stiffness of which do not affect the safety of the aircraft.
- (iii) Section 5 applies to the test requirements for material for those portions of the aircraft structure the loads of which are laid down in the airworthiness requirements or failure of which would endanger the safety of the aircraft.

(c) Part III applies to the final inspection of timber included in the finished parts.

PART I.

Section 1. Rough Timber.

2. Condition. The timber may be rough or dressed, green or dry.

3. Dimensions. The timber shall be in the form of selected planks 2 in. or less in thickness.

4. Quality.

(a) The timber shall be free from obvious and incipient decay, knots, shakes, splits, seasoning checks, internal checks, brittle heart, compression failures, figured grain, gum veins, pith streaks, callus tissue, insect attack, wane or want, blemishes due to handling and other injuries, but the following imperfections will be permitted :

- (i) pin-knots : not exceeding $\frac{1}{8}$ in. dia. and not closer than 2 in. nor more than six in any 1 sq. ft. of face area ;
- (ii) pin-holes : not exceeding $\frac{1}{16}$ in. dia. and not closer than 2 in. nor more than six in any 1 sq. ft. of face area ;
- (iii) sloping grain as determined by the splitting test : not exceeding 1 in 15 ;
- (iv) spring : not exceeding 1 in 576 ($\frac{1}{4}$ in. in 12 ft.) ;
- (v) bow : not exceeding 1 in 288 ($\frac{1}{2}$ in. in 12 ft.) ;
- (vi) twist : not exceeding $\frac{1}{4}$ in. in 10 sq. ft. of face area.

(b) The timber shall be immune from attack by the powder post borer (*Lyctus brunneus*) because of:

- (i) the complete absence of starch, or
- (ii) satisfactory treatment under approved supervision with boric acid (H_3BO_3) in accordance with the procedure described in Appendix B.

Every plank shall be clearly marked showing whether it is:

- (i) starch-free, or
- (ii) treated with boric acid, giving the treatment batch number.

All planks stated as being starch-free shall be tested for the presence of starch, and any plank in which starch is present shall be rejected.

The boric acid content of treated timber shall be not less than 0.2%, the individual determinations in no instance being less than 0.18%. Should any sample plank fail to comply with these requirements, all of the planks in the treatment batch represented by that sample shall be rejected.

5. **Density.** Although no tests are required on material accepted under this section, it is desirable that the timber shall weigh less than 35 lb. per cu. ft. when dried to a moisture content of 15%.

6. **Marking.** Timber supplied under this section shall be marked in the manner directed by the purchaser.

Section 2. Recutting Classes.

7. **Recutting Classes.** A plank which fails to comply with the requirements of Section 1 because of the occurrence of defects prohibited under Clause 4, may be released as recutting quality timber, provided that the maximum number of faults to be eliminated from the plank does not exceed one per 4 sq. ft. of face area of the plank. A fault shall be any prohibited defect or group of prohibited defects occurring in an area not exceeding 36 sq. in. per 4 sq. ft. of face area.

A plank may be rejected if in the opinion of the inspector the faults will affect the use of the plank.

Planks shall be classified according to the percentage of recoverable timber they contain, as follows:

- (a) Class 1 timber shall yield in one piece 100% of timber complying with Section 1.
- (b) Class 2 timber shall yield not less than 80% of timber complying with Section 1 in cuttings 6 ft. or longer and 3 in. or wider.
- (c) Class 3 timber shall yield not less than 60% of timber complying with Section 1 in cuttings 6 ft. or longer and 3 in. or wider.

8. **Marking.** Timber supplied under this section shall, if of Class 2 or Class 3, be marked with the percentage recovery applicable to the class to which the plank conforms.

PART II.

9. Timber supplied under Part I of this specification shall comply with the appropriate provisions of this part before being released for the manufacture of aircraft parts.

10. **Tests—General.** Unless otherwise specified herein, test specimens shall be selected and prepared and the tests carried out in the manner described in A.S. No. (E)CD.800—1944, Standard Methods of Testing Timber for Aircraft Construction.

Unseasoned timber may be submitted for testing. Under these circumstances the visual inspection required under Clause 14 below shall be made after seasoning.

11. **Re-tests.** A plank which does not comply with the test requirements applicable to a particular grade of timber may be sawn down the wide face. If on re-test one part then complies with these requirements that part may be released as that grade.

12. **Marking.** Each plank accepted under this part shall be stamped with the following particulars:

- (a) the supplier's name or distinguishing mark,
- (b) the number of this specification (A.S. No. (E)2D.807—1944),
- (c) the grade of timber (Grade A Mech. or Grade B Mech. as appropriate),
- (d) the inspector's stamp.

Section 3. Preparation of Rough Timber.

13. **Seasoning.** The timber shall be either air-dried or kiln-dried to the moisture content specified; if kiln-dried, the operation shall be carried out under approved supervision in accordance with the appropriate schedule in Appendix A.¹

14. **Visual Inspection.** After seasoning, every plank shall be inspected to ensure that it complies with the requirements of Part I.

Section 4. Grade B Mech. Timber.

15. Timber which complies with Part I shall, after preparation in accordance with the provisions of Section 3, comply with the further provisions of this section before being released as Grade B Mech. timber.

¹If, however, in the opinion of the inspector, the quality of the timber would be improved by the use of a milder schedule, lower temperatures and/or smaller wet bulb depressions may be used until the moisture content of the wettest sample plank reaches 30%.

16. Moisture Content. The moisture content of every plank shall be determined by means of an approved electrical moisture meter. Tests shall be made at points approximately 18 in. from each end and at the mid-length. The three readings shall be between 15% and 10% and the individual readings shall not vary by more than 2% moisture content in any one plank.

NOTES.— (i) Notwithstanding the above provisions, the moisture content of the timber in an air-seasoning stack or kiln charge which has been seasoned under approved conditions may be determined from representative samples selected from the air stack or kiln charge at the discretion of the inspector, and the moisture content so determined shall be accepted as the moisture content of the stack or charge as a whole.

However, if when this procedure is adopted any sample plank should fail to comply with the requirements of Clause 16, all of the planks in the stack or kiln charge represented by that sample shall be tested.

(ii) In the event of a dispute, the moisture content as determined by the electrical moisture meter may be checked by the oven-drying method and the value so obtained shall be adopted.

17. Density. The density of every plank shall be determined and shall be between 26 and 34 lb. per cu. ft.

18. Brittleness Test. A determination of brittleness shall be carried out on specimens from each plank. No specimen shall have an Izod value less than 4 ft. lb.

Section 5. Grade A Mech. Timber.

19. Timber which complies with the requirements of Section 4 shall comply with the further requirements of this section before being released as Grade A Mech. timber.

20. Brittleness Test. The Izod value of the timber, determined by the brittleness test described in Clause 18, shall be not less than 5 ft. lb.

21. Compression Strength Parallel to Grain. The compression strength parallel to the grain shall be determined for every plank and shall be not less than the value specified in Table I for the appropriate moisture content.

TABLE I.

Moisture Content ²	Compression Strength Parallel to Grain
%	lb. per sq. in.
10	6,100
11	5,800
12	5,600
13	5,400
14	5,200
15	5,000
16	4,800
17	4,600
18	4,400
19	4,300
20	4,100

PART III.

Section 6. Aircraft Quality Timber.

22. Timber which complies with Section 4 or Section 5 shall comply with the further provisions of this section before being released as Grade B or Grade A aircraft quality timber.

The inspection required under Clause 23 shall be made during and/or at the completion of the manufacture of the aircraft parts to ensure that any faults in the timber permitted under Section 2 are completely eliminated from the final products.

23. Quality. The timber in the finished parts shall be free from obvious and incipient decay, knots, shakes, splits, seasoning checks, internal checks, brittle heart, compression failures, figured grain, gum veins, callus tissue, insect attack, wane or want, blemishes due to handling and other injuries. The presence of the following imperfections will be at the discretion of the inspector :

- (a) pin-knots : not exceeding $\frac{1}{8}$ in. dia. and not closer than 2 in. nor more than six in any 1 sq. ft. of face area ;
- (b) pin holes : not exceeding $\frac{1}{16}$ in. dia. and not closer than 2 in. nor more than six in any 1 sq. ft. of face area ;
- (c) where applicable, sloping grain as determined by the splitting test : not exceeding 1 in 15.

24. Marking. The finished part shall be marked in the manner directed by the inspector.

²Moisture content as determined by the oven-drying method.

APPENDIX A.

Kiln-Drying Schedules for Bollywood.

(a) Up to 1 in.—Mixed Sawn.

Moisture Content Change-points (moisture content of wettest sample plank)	Dry Bulb Temperature	Wet Bulb Depression	Remarks
	°F.	°F.	
Green	130	7	
50%	130	10	
40%	140	15	
30%	140	20	
20%	140	30	
15%	160	30	
12%	160	9	For 48 hours.
	180	3	To relieve stress.
	160	9	For 24 hours.

(b) Over 1 in. up to 2 in.—Mixed Sawn.

Schedules for thicknesses over 1 in. are not yet available, but if the timber is kiln-dried the temperature shall not exceed 140° F., save for short periods, totalling not more than 6 days, when a temperature of 160° F. may be used.

- NOTES.— (i) Seven sample planks, which shall be representative of the stock in the kiln charge, and no two of which are prepared from the same length of timber, shall be included in each kiln charge and shall be well distributed throughout the charge.
- (ii) The moisture content change-points shall be determined by the moisture content of the wettest of the sample planks.
- (iii) For stock which has been partly air-dried, the initial kiln-drying conditions used shall be those shown as applicable to the appropriate moisture content change-point. Should the moisture content of the stock lie between two of the change-points shown, the kiln-drying conditions used shall be those applicable to the wetter of the two change-points.

APPENDIX B.

Method of Application of Boric Acid Treatment.

(a) Condition of Timber.

Timber to be submitted to boric acid treatment shall be so treated green from the saw. In the interval between sawing and treatment it shall be block stacked, and the surfaces of the stack shall be kept wet by the application of water as required.

Under no circumstances shall partially dry timber or timber with dry surfaces be included in a treatment batch.

(b) Treatment Procedure.

Planks of the same thickness shall be stacked in a suitable bath, the planks being separated on faces and edges by at least $\frac{1}{4}$ in. The timber shall be completely covered with boric acid solution which shall be heated to and maintained at a temperature of not less than 200° F. for the appropriate period specified below. To ensure satisfactory treatment, the volume of solution in the bath shall be not less than eight times the volume of the timber.

Throughout the treatment the level of the solution shall be maintained to cover the timber completely and the concentration of the solution shall not fall below 8%.

Thickness of planks.	Minimum concentration of boric acid solution.	Min. temperature of solution during treatment.	Period of immersion of timber in hot solution
	%	°F.	hours
Up to 1 in.	8	200	10
Over 1 in. up to 1½ in.	8	200	14
Over 1½ in. up to 2 in.	8	200	18
Over 2 in. up to 2½ in.	8	200	22
Over 2½ in. up to 3 in.	8	200	26

NOTE.—Full information regarding the boric acid treatment of timber may be obtained from the Council of Scientific & Industrial Research, Division of Forest Products, or the Forestry Commission of N.S.W., Division of Wood Technology.

For the purposes of this specification the term "Inspector" shall be interpreted in the manner directed by the Australian Airworthiness Authority concerned.

This specification, prepared by the Special Committee on Aircraft Materials and Components, was approved on behalf of the Council of the Association on 24th January, 1944.

NOTE.

In order to keep abreast of progress in the industries concerned, Australian standards are subject to periodical review. Suggestions for improvement, addressed to the Headquarters of the Association, will be welcomed.