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Standard Specifications

for

Jarrah and Karri

together with

Notes on Allowable Working Stresses.

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FOREWORD.

Inspection of timber has been a function of the Forests Department since its inception in 1896. Over the past ten years the quantity of timber inspected, not including piles and poles, has averaged just over five million cubic feet per annum. The number of officers now holding inspection hammers is forty-six. These figures will give some idea of the work involved and necessary organisation to meet requests for inspection when called for.

At the present time the greater proportion of timber inspected is for the export market, this resulting in peak periods in demands for inspection immediately prior to loading of boats, usually in comparatively small parcels at mills widely distributed throughout forests of the South-West of the State. A far greater number of inspectors is required, therefore, than could cope with a steady demand for the same volume of inspection work, and for this reason the establishment of an entirely independent inspection bureau is a practical impossibility. Field officers of the Forests Department are recruited from men with a long experience in the timber industry and selected officers are given a thorough training in inspection methods and standards before being issued with a branding hammer.

For many years past the inspection of sleepers for supply to the Western Australian Government Railways and to other railway systems throughout the world has been to a standard specification published by the Forests Department, and with the system of inspection adopted whereby visiting senior officers maintain a uniform standard in interpretation of specifications by individual inspectors, comparatively few complaints have been received, considering the volume of inspection carried out.

For reasons outside the control of the Department the position with regard to specifications for timber other than sleepers has not been on an equally satisfactory basis. With few exceptions contract specifications in the past have called either for perfect timber or have been based on specifications prepared originally for other timbers of different character to Jarrah and Karri. The result has been that while fairly definite customs in supply with regard to quality, etc., have been built up, these may vary considerably from the nominal specifications quoted in contracts. Experience has shown that this basis is far from satisfactory, even in supply to established markets or old customers.

Accumulation of data aiming at preparation of suitable grading rules based on the custom of the trade has for the last six years been a major project of the Utilisation Branch working in co-operation with senior officers of the Department.

An important step forward was made in 1932, when an extensive grading study was undertaken in co-operation with the Division of Forest Products of the Council for Scientific and Industrial Research. Detailed field work over a period of five months by Messrs. F. Gregson, B.E., and R. F. Turnbull, B.E., resulted in preparation of tentative specifications for the major products supplied in Jarrah and Karri. A report covering investigations and recommended specifications was published in 1933 by the C.S.I.R. as Pamphlet 41, "The Grading of Western Australian Timber."

These investigations have been continued by Mr. Gregson (Utilisation Officer, Forests Department) and this work, together with experience in use of the specifications in actual inspection work, has enabled revision of a number of rules published in the Grading Bulletin of 1933.

The revised specifications have now been collected together and are published herein. Each specification is complete in itself. The classes of product covered represent approximately 80 per cent. of timber now produced but there are several important items still to be covered. It is intended to extend the series from time to time as the need arises.

The Forests Department carries out inspections at the request of either buyer or seller. The applicant must state, however, when applying for inspection, the Standard Specification published by the Department under which inspection is to be made or provide a reasonably complete specification setting out clearly requirements with regard to size, general quality and condition.

Other than in the case of railway sleepers the Department does not insist on the use of its own Standard Specifications, but these are strongly recommended on the grounds that they are the result of considerable study over a period of years and give a fair standard of supply both from the point of view of consumers' requirements and the producers' ability to supply. Information concerning inspection fees will be supplied on application. The Forests Department is at all times willing to assist in preparation of suitable specifications to cover material for special purposes.

Whether inspection by officers of the Department is required or not, buyers of Jarrah and Karri timber are recommended in their own interest (1) to state fully when ordering the purpose for which the timber is to be used; (2) to order the actual sizes (plus any necessary allowance for seasoning and machining) in which the timber is to be used. Practically all Jarrah and Karri is cut to special orders and the ordering of large cross sections or unnecessarily long lengths for re-sawing at destination is a practice unsatisfactory to the sawmiller and uneconomical from the point of view of the purchaser.

The terms used in these specifications are those standardised for Australia and published by the Forests Products Division of the Commonwealth Council for Scientific and Industrial Research in Trade Circular No. 15.

The notes on allowable working stresses for Jarrah and Karri are included as supplementary to Standard Specifications for Structural Timber.

S. L. KESSELL,
Conservator of Forests.

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STANDARD SPECIFICATION No. 10—JARRAH SLEEPERS.

Sleepers shall be of good sound strong timber, free from heart and rot.

Sleepers may be hewn or sawn and shall be cut square and straight. They shall measure at time of cutting $\frac{1}{4}$ inch in width and $\frac{1}{8}$ inch in thickness over nominal size, but slight variation in cutting will be allowed. The nominal length may be subject to a variation of 1 inch either way. They shall not be cut on the quarter.

Provided that the strength, durability and spike-holding capacity at the rail seat of the sleepers are not unduly impaired, the following or equivalent defects may be allowed:

Tight gum veins and small gum pockets: end splits or shakes not exceeding 1 inch per foot of length: occasional pinholes: camber or twist not to exceed $\frac{1}{2}$ inch: if clear of the rail seat sound knots up to 2 inches diameter, or clean knotholes up to $1\frac{1}{4}$ inches.

On sleepers showing sap, wane or want, the volume of true wood shall not be materially reduced, and either wane or want at the rail seat shall not exceed 1 inch measured on the bevel on two edges, or $1\frac{1}{2}$ inches if occurring on one edge only. Sap, if extending across the face of the sleeper, shall not exceed $\frac{1}{8}$ inch in depth at the centre.

This specification is written to cover green material. If sleepers are inspected any considerable time after cutting, or re-inspected after a seasoning period, reasonable allowance shall be made for shrinkage, checking and other normal changes in the seasoning process.

As issued, 1st November, 1934.

STANDARD SPECIFICATION No. 11—JARRAH CROSSING TIMBERS.

Crossing timbers shall be of good strong timber, free from heart and rot. Crossings shall be sawn square and straight and shall measure at time of cutting $\frac{1}{4}$ inch in width and $\frac{1}{8}$ inch in thickness over the nominal size, but slight variation in cutting will be allowed. The nominal length shall be subject to a variation of one and a half inches either way. They shall not be cut on the quarter.

Provided that the strength, durability, and spike-holding capacity of the crossing timber are not unduly impaired, the following or equivalent defects may be allowed:—

Tight gum veins and small gum pockets: occasional pinholes: knots and knotholes if small and clean: longitudinal shakes at the discretion of the inspector, but if running to an end the length shall not exceed the greatest cross-sectional dimension of the piece, nor shall any splits other than minor seasoning cracks run from one face to another at the end section: on crossing timbers showing either wane or want neither the wane nor the want shall exceed 1 inch measured across the bevel on each edge or $1\frac{1}{2}$ inches if only one edge is affected, but these figures may be doubled on the extreme ends of the crossing. Where sap extends across the face the depth shall not exceed $\frac{1}{8}$ inch at the centre.

This specification is written to cover green material. If crossing timbers are inspected any considerable time after cutting, or re-inspected after a seasoning period, reasonable allowance shall be made for shrinkage, checking and other normal changes in the seasoning process.

As issued, 1st November, 1934.

STRUCTURAL TIMBERS (JARRAH AND KARRI).

Specification No.

- 14—Select Quality Small Section Structural Timber—Jarrah.
- 15—Select Quality Large Section Structural Timber—Jarrah.
- 16—Standard Quality Structural Timber—Jarrah.
- 17—Select Quality Small Section Structural Timber—Karri.
- 18—Select Quality Large Section Structural Timber—Karri.
- 19—Standard Quality Structural Timber—Karri.

GENERAL PROVISIONS—STANDARD SPECIFICATIONS NOS. 14 TO 19.

(1) Material as described in these rules must be graded taking into consideration its suitability for constructional purposes in the shape and size in which it is ordered and shipped. It is not intended to cover material suitable for resawing into smaller sizes.

(2) Enumerated defects in any grade are intended to cover the lowest quality pieces such grade may contain, but not more than 20 per cent. of the pieces in any parcel shall be on the grade limit.

(3) The specification is written to cover green material. If timber is inspected any considerable time after cutting, reasonable allowance shall be made for shrinkage, checking and other normal changes in the seasoning process.

(4) The moisture content of timber described as seasoned and sold as of these grades shall not exceed 20 per cent. in sections up to 25 square inches or 25 per cent. in sections over 25 square inches.

(5) In sections 100 square inches and over, the limitation of defects shall be used as a guide only with due consideration given to the general quality of the piece and the location of defects.

(6) Unless otherwise specified the following will apply with regard to size. The minimum size at time of cutting shall be the nominal size. The following variations in sawing will be allowed in lengths up to 20 feet.

Dimension.	Maximum allowance above nominal size.
Up to 4in.	$\frac{1}{4}$ in.
5in. and 6in.	$\frac{5}{16}$ in.
7in. and 8in.	$\frac{3}{8}$ in.
9in., 10in., 11in.	$\frac{7}{16}$ in.
12in. and over	$\frac{1}{2}$ in.

If longer lengths, an increase of 25 per cent. in total variation will be allowed.

These rules supersede those for the same class of timber published in 1933 in C.S.I.R. Pamphlet No. 41, "The Grading of W.A. Timbers." Variations made are the result of practical application of earlier grading rules and further consideration as to trade requirements in this class of timber. The scope of each is covered in individual specifications.

STANDARD SPECIFICATION No. 14—SELECT QUALITY
SMALL SECTION STRUCTURAL TIMBER (JARRAH).

(Sections up to 25 square inches.)

SCOPE.

This grade is the highest structural quality recommended for Jarrah in smaller sections and should only be specified for special building and construction where maximum strength is the important limiting factor. For general construction purposes, see Specification No. 16. For recommended working stresses, see notes entitled "Allowable Working Stresses for Jarrah and Karri."

DESCRIPTION.

General Provisions 1 to 6 apply.

Timber to be selected for strength and to be free from heart, included sap, rot, shakes, knot holes and wane. Pieces shall be generally straight-grained and the general slope of the grain in the centre third shall not exceed 1 in 20. Sap will be allowed and any two of the following defects to the extent indicated:—

1. *Gums veins.*—Total length of tight gum veins on any face not to exceed one-fourth the length of the piece, individual lengths not to exceed 3 feet, provided that no complete gum ring runs from one face to another on the end section.

2. *Knots.*—one sound tight knot up to 1 inch diameter in any five lineal feet if clear of the centre third of the piece.

3. *Pinholes.*—Clean-edged pinholes, well scattered, not to exceed 10 in any half square foot.

4. Equivalent defect.

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STANDARD SPECIFICATION No. 15—SELECT QUALITY LARGE SECTION STRUCTURAL TIMBER.

(Sections over 25 square inches and up to 140 square inches.)

SCOPE.

This grade is the highest structural quality recommended for Jarrah in larger sections and should only be specified for special building and construction where maximum strength is the important limiting factor. For general construction purposes, see Specification No. 16. For recommended working stresses, see notes entitled "Allowable Working Stresses for Jarrah and Karri."

DESCRIPTION.

General provisions 1 to 6 apply.

Timber to be suitable for structural purposes, free from heart and rot. The general slope of the grain in the centre third shall not exceed 1 in 15. Sap will be allowed and any one of the following defects to the extent indicated:—

1. *Wane*.—Length measurement not to exceed one-sixth the length of the piece. Cross section dimensions not to exceed one-eighth the dimension of either face on which it occurs.

2. *Gum Pockets*.—One gum pocket on any face in any 5 lineal feet varying in size according to location and cross section from 5in. x $\frac{3}{8}$ in. at 50 sq. inches cross section to 7in. x $\frac{1}{2}$ in. in cross sections 120 sq. inches and over. Pockets to be measured radially for width.

3. *Gum Veins*—(a) *Sections up to 50 sq. inches*.—Total length of tight gum veins on any face not to exceed one-half the length of the piece and individual lengths not to exceed five feet.

(b) *Sections over 50 sq. inches*.—Total length of tight gum veins not to exceed three-fourths the length of the piece and individual lengths not to exceed six feet.

In totalling the length, tight gum veins less than 10in. shall be ignored.

4. *Knots*—(a) *Sections up to 50 sq. inches*.—One sound tight knot up to 1 inch diameter within the centre third or one sound tight knot up to 1½ inches diameter, or other knot up to $\frac{3}{4}$ inch diameter if not through, in any five lineal feet clear of the centre third.

(b) *Sections over 50 sq. inches*.—Tight knots not to exceed 2in. diameter within the centre third, other knots according to position but not to exceed 1½in. diameter.

5. *Pinholes*.—Clean-edged pinholes not to exceed 15 in any half square foot.

6. *Shakes*.—In sections over 50 square inches longitudinal shakes will be allowed provided the length does not exceed the greatest cross sectional dimension of the piece. No shake other than small seasoning cracks shall run from one face to another.

STANDARD SPECIFICATION No. 16—STANDARD QUALITY STRUCTURAL TIMBER (JARRAH).

(All Sizes.)

SCOPE.

This grade is recommended for all forms of ordinary building construction where stiffness rather than ultimate strength is the main consideration, ranging from house framing in the smaller dimensions to the heaviest classes of bridge and harbour construction. The grades for Select Quality Structural and Standard Quality Structural overlap and normal parcels of timber over 25 sq. inches cross section under Specification No. 16 will contain upwards of 70 per cent. material within the Select Structural grade. For recommended working stresses, see notes entitled "Allowable Working Stresses for Jarrah and Karri."

DESCRIPTION.

General provisions 1 to 6 apply.

Timber to be suitable for structural purposes, free from heart and rot, except that sections 12 inches x 12 inches and over, unless otherwise specified, may be supplied heart-in, provided heart is sound and well boxed in. The general slope of the grain in the centre third shall not exceed 1 in 12. Sap will be allowed and any one of the following defects to the extent indicated:—

1. *Wane:*

Length Measurement.—Not to exceed one-fourth the length of the piece.

Cross Section Dimensions.—

- (a) Under 6 inches not to exceed one-fourth the dimension of either face on which it occurs, with a maximum of 1 inch.
- (b) 6 inches and over not to exceed one-sixth the dimension.

2. *Gum Pockets.*—One gum pocket on any face in any 5 lineal feet varying in size according to location and cross section from 4 inches x $\frac{3}{8}$ inch in sections under 12 square inches to 6 inches x $\frac{3}{8}$ inch at 50 square inches cross section and 9 inches x $\frac{3}{8}$ inch in cross sections 120 square inches and over or equivalent. Gum pockets to be measured radially for width.

3. *Gum Veins:*

(a) *Sections up to 50 square inches.*—Total length of tight gum veins on any face not to exceed three-fourths the length of the piece.

(b) *Sections over 50 square inches.*—Total length of tight gum veins on any face not to exceed the length of the piece.

In totalling the length, tight gum veins less than 10 inches shall be ignored.

4. *Knots:*

(a) *Sections up to 50 square inches.*—One sound tight knot up to $1\frac{1}{4}$ inches diameter within the centre third, or one sound tight knot up to 2 inches diameter, or other knot up to 1 inch diameter if not through, in any five lineal feet clear of the centre third.

(b) *Sections over 50 square inches.*—Tight knots, other knots according to position, but not to exceed 2 inches diameter.

5. *Pinholes.*—Clean-edged pinholes not to exceed 20 in any half square foot.

6. *Shakes.*—In sections over 50 square inches, longitudinal shakes will be allowed provided the length does not exceed the greatest cross sectional dimension of the piece. No shake other than small seasoning cracks shall run from one face to another.

In addition, a combination of smaller defects equivalent to one of the above will be allowed provided the combination of defects on all faces at any section will not materially impair the strength of the piece.

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STANDARD SPECIFICATION No. 17—SELECT QUALITY SMALL SECTION STRUCTURAL TIMBER (KARRI).

(Sections up to 25 square inches.)

SCOPE.

This grade is the highest structural quality recommended for Karri in smaller sections and should only be specified where exceptional strength is essential. The Standard Structural Grade for Karri covered by Specification No. 19 is suitable for building and construction purposes even where maximum strength is the important limiting factor. Where used in damp locations or in contact with the ground, treatment with an approved preservative process is recommended. For recommended working stresses, see notes entitled "Allowable Working Stresses, Jarrah and Karri."

DESCRIPTION.

General Provisions 1 to 6 apply.

Timber to be selected for strength and to be free of heart, rot, shakes and wane. Pieces shall be generally straight grained and the general slope of the grain in the centre third shall not exceed 1 in 20. If treated by an approved preservative process, sap will be allowed without limit, but if untreated, this grade shall be practically free from sap. Any two of the following defects will be allowed to the extent indicated:—

1. *Gum Veins*.—Total length of tight gum veins on any face not to exceed one-sixth the length of the piece. Individual lengths not to exceed 2 feet.
2. *Knots*.—One sound tight knot up to 1 inch diameter if clear of the centre third of the piece.
3. *Grubholes*.—Not to exceed one $\frac{3}{8}$ inch hole in any two lineal feet.
4. Equivalent defect.

STANDARD SPECIFICATION No.18—SELECT QUALITY LARGE SECTION STRUCTURAL TIMBER (KARRI).

(Sections over 25 square inches.)

SCOPE.

This grade is the highest structural quality recommended for Karri in larger sections and should only be specified where exceptional strength is essential. The Standard Structural Grade for Karri covered by Specification No. 19 is suitable for building and construction purposes even where maximum strength is the important limiting factor. Where used in damp locations or in contact with the ground, treatment with an approved preservative process is recommended. For recommended working stresses see notes entitled "Allowable Working Stresses, Jarrah and Karri."

DESCRIPTION.

General Provisions 1 to 6 apply.

Timber to be suitable for structural purposes, free from heart and rot. The general slope of the grain in the centre third shall not exceed 1 in 15. Sap will be allowed and any one of the following defects to the extent indicated:—

1. *Wane*.—(a) If timber is treated with an approved preservative process, length measurement not to exceed one-sixth the length of the piece, cross section dimensions not to exceed one-eighth the dimension of either face on which it occurs.

(b) If untreated, cross section dimensions not to exceed one-twelfth the dimension.

2. *Gum Pockets*.—One gum pocket on any face in any 5 lineal feet varying in size according to location and cross section from 5 inches by $\frac{3}{8}$ of an inch at 50 square inches cross section to 7 inches by $\frac{1}{2}$ an inch in cross sections 120 square inches and over. Pockets to be measured radially for width.

3. *Gum Veins*. (a) *Sections up to 50 square inches*.—Total length of tight gum veins on any face not to exceed one-fourth the length of the piece and individual lengths not to exceed 3 feet.

(b) *Sections over 50 square inches*.—Total length of tight gum veins on any face not to exceed one-third the length of the piece. In totalling the length, tight gum veins less than 10 inches shall be ignored.

4. *Knots*.—(a) *Sections up to 50 sq. inches*.—One sound tight knot up to 1 inch diameter within the centre third or one sound tight knot up to $1\frac{1}{2}$ inches diameter, or other knot up to $\frac{3}{4}$ inch diameter if not through, in any five lineal feet clear of the centre third.

(b) *Sections over 50 square inches*.—Tight knots not to exceed 2 inch diameter within the centre third, other knots according to position but not to exceed $1\frac{1}{2}$ inches diameter.

5. *Grub holes*. (a) *Sections up to 50 square inches*.—One $\frac{1}{2}$ inch grub hole in any lineal foot.

(b) *Sections over 50 square inches*.—Grub holes to $\frac{3}{8}$ inch diameter if well distributed.

6. *Shakes*.—In sections over 50 square inches longitudinal shakes will be allowed provided the length does not exceed the greatest cross sectional dimension of the piece. No shake other than small seasoning cracks shall run from one face to another.

In addition a combination of smaller defects equivalent to one of the above will be allowed, provided the combination of defects on all faces at any section will not materially impair the strength of the piece.

STANDARD SPECIFICATION No. 19—STANDARD QUALITY STRUCTURAL TIMBER (KARRI).

(All Sizes.)

SCOPE.

This grade is recommended for all forms of ordinary building construction. Karri is essentially a structural timber and in this standard quality can be recommended for most purposes where ultimate strength is a limiting factor. The grades for Select Quality Structural and Standard Quality Structural overlap and normal parcels under Specification No. 19 will contain upwards of 70 per cent. material within the Select Structural Grade. Where used in damp locations or in contact with the ground, treatment with an approved preservative process is recommended. For recommended working stresses see notes entitled "Allowable Working Stresses for Jarrah and Karri."

DESCRIPTION.

General Provisions 1 to 6 apply.

Timber to be suitable for structural purposes, free from heart and rot. The general slope of the grain in the centre third shall not exceed 1 in 15. Sap will be allowed and any one of the following defects to the extent indicated.

1. *Wane.* (a) If treated with an approved preservative process.

Length measurement not to exceed one-fourth the length of the piece.

Cross Section Dimensions under 6 inches not to exceed one-fourth the dimension of either face on which it occurs, with a maximum of 1 inch.

6 inches and over not to exceed one-sixth the dimension.

(b) If untreated, cross section dimensions not to exceed one-tenth the dimension.

2. *Gum Pockets.*—One gum pocket on any face in any 5 lineal feet varying in size according to location and cross section from 4 inches x $\frac{3}{8}$ inch in sections under 12 square inches to 6 inches x $\frac{3}{8}$ inch at 50 square inches cross section and 9 inches x $\frac{3}{8}$ inch in cross sections 120 square inches and over. Gum pockets to be measured radially for width.

3. *Gum Veins.*—*Sections up to 50 square inches.*—Total length of tight gum veins on any face not to exceed one-third the length of the piece and individual lengths not to exceed 4 feet.

Sections over 50 square inches.—Total length of tight gum veins on any face not to exceed one-half the length of the piece and individual lengths not to exceed 6 feet.

In totalling the length, tight gum veins less than 10 inches shall be ignored.

4. *Knots:*

(a) *Sections up to 50 square inches.*—One sound tight intergrown knot up to 1½ inch diameter, within the centre third, or one sound tight intergrown knot up to 2 inches diameter or other knot up to 1 inch diameter, if not through, in any 5 lineal feet clear of the centre third.

(b) *Sections over 50 square inches.*—Tight intergrown knots; other knots according to position but not to exceed 2 inches diameter.

5. *Grub Holes.*—Provided these are well distributed.

6. *Shakes.*—In sections over 50 square inches, longitudinal shakes will be allowed provided the length does not exceed the greatest cross sectional dimension of the piece. No shake other than small seasoning cracks shall run from one face to another.

In addition a combination of smaller defects equivalent to one of the above will be allowed provided the combination of defects on all faces at any section will not materially impair the strength of the piece.

STANDARD SPECIFICATION No. 20—JARRAH CROSS-ARMS.

1. SCOPE.—This specification is prepared to cover the inspection of sawn Jarrah timber intended for use as telegraph cross-arms and docked to length before inspection.

2. SIZE.—As specified by the buyer with the following tolerances:—

Cross section—Minimum—Order size.

Maximum— $3/16$ in. above the order size in breadth and depth.

Length—From order size to $1/2$ in. over.

3. CUTTING.—Cross-arms shall be well sawn with adjacent sides at right angles and ends docked square.

4. QUALITY.—To be from sound strong timber free from heart, rot, and shakes, but allowing the following blemishes to the extent indicated:—

(1) *Sap*.—On the intersection of two adjacent sides provided the combined width of sap measured on the two faces does not exceed $1\frac{1}{2}$ inches.

(2) *Gum Veins*.—Tight gum veins not to exceed 12in. x $1/8$ in. or equivalent. Provided that (a) No gum vein exceeds 18 inches in length.

(b) Combined lengths on any face do not exceed 36 inches.

(c) Gum veins do not emerge through the edges or ends of arm.

(3) *Pinholes*.—Clean-edged pinholes provided not more than five occur on any face in any foot length.

(4) *Cross Grain*.—The cross-arms shall be generally straight grained with the grain approximately in the same direction as the length of the arm. Slight localised cross grain will be allowed away from the centre third of the arm provided the grain does not run from any face to within a third of the distance of the opposite face.

(5) Equivalent blemish.

5. CONDITION.—This specification is written to cover green material. If arms are inspected any considerable time after cutting, reasonable allowance shall be made for shrinkage, checking and other normal changes in the seasoning process.

NOTE.—Where material is supplied in random lengths, the following modifications will apply:—

(1) Docking will follow general practice with ordinary scantling.

(2) The allowance for combined gum will be applied to each 6ft. length.

(3) Limitations with regard to position of blemishes will not apply.

As issued 22nd February, 1935.

STANDARD SPECIFICATION No. 21—KARRI CROSS-ARMS.

1. SCOPE.—This specification is prepared to cover the inspection of sawn Karri timber intended for use as telegraph cross-arms and docked to length before inspection.

2. SIZE.—As specified by the buyer with the following tolerances:—
Cross section—Minimum—Order size.

Maximum— $3/16$ in. above the order size in breadth and depth.

Length—From order size to $1/2$ in. over.

3. CUTTING.—Cross-arms shall be well sawn with adjacent sides at right angles and ends docked square.

4. QUALITY.—To be from sound strong timber free from heart, rot, and shakes, but allowing the following blemishes to the extent indicated:—

(1) *Sap*.—On the intersection of two adjacent sides provided the combined width of sap measured on the two faces does not exceed 1 inch.

(2) *Gum Veins*.—Tight gum veins not to exceed 6in. x $1/8$ in. on any face and not to show on the end of the arm, combined lengths not to exceed 18in. on any face.

(3) *Pinholes*.—Clean-edged pinholes provided not more than five occur on any face in any foot length.

(4) *Cross Grain*.—The cross-arms shall be generally straight grained with the grain approximately in the same direction as the length of the arm. Slight localised cross grain will be allowed away from the centre third of the arm provided the grain does not run from any face to within a third of the distance of the opposite face.

(5) *Grub holes* not to exceed two $1/4$ in. diameter on any face, provided none occur within the centre foot of the arm.

(6) Equivalent blemish.

5. CONDITION.—This specification is written to cover green material. If arms are inspected any considerable time after cutting, reasonable allowance shall be made for shrinkage, checking and other normal changes in the seasoning process.

NOTE.—Where material is supplied in random lengths, the following modifications will apply:—

(1) Docking will follow general practice with ordinary scantling.

(2) The allowance for combined gum and grub holes will be applied to each 6ft. length.

(3) Limitations with regard to position of blemishes will not apply.

As issued 22nd February, 1935.

Experimental work will shortly be undertaken on development of a suitable mechanical impact test to test the green cross-arms at the mill. With such a test and visual inspection on the above specification, all arms likely to prove unsatisfactory should be eliminated and the rejection would take place at the mills before high freight charges are involved.

STANDARD SPECIFICATION No. 22—JARRAH MINE GUIDES.

SCOPE.

This specification covers the supply of Jarrah for use as mine or lift guides. For Karri mine guides see Standard Specification No. 23.

SIZE.

Unless otherwise specified the minimum size at time of sawing shall not be less than the nominal size, but variations in sawing will be allowed provided the maximum size does not exceed the nominal size by more than $\frac{3}{8}$ inch in width or $\frac{1}{4}$ inch in thickness.

DESCRIPTION.

To be from sound timber free from heart, rot, unsound knots, and shakes. The general slope of the grain shall not exceed 1 in 15 and spring shall not exceed 1 inch in 25 feet or equivalent. Pieces to have one good face and two good edges with defects limited as below. The junction of the better face and edges shall be free from wane but sap will be allowed. In guides where the thickness approaches the width, larger faults will be allowed on the edges towards the worse face.

Defects allowed on the better face or either edge.

1. *Gum Pockets.*—Not to exceed one 5 inch by $\frac{3}{8}$ inch in any five lineal feet.
2. *Gum Veins.*—Tight gum veins, total length, neglecting small tight gum veins under 10 inches, not to exceed one-fourth the length of the piece.
3. *Knots.*—One tight knot, not to exceed $1\frac{1}{2}$ inches diameter in any 5 lineal feet.
4. Equivalent defect.

On the other face, defects in excess of the above will be allowed, wane at the junction of face and edge limited to one-sixth the dimensions of either face on which it occurs.

All provided that the combination of defects at any section does not seriously impair the utility of the piece for a mine guide.

CONDITION.

The specification is written to cover supply of material green from the saw.

STANDARD SPECIFICATION No. 23—KARRI MINE GUIDES.

SCOPE.

This specification covers the supply of Karri for use as mine or lift guides. For Jarrah mine guides see Standard Specification No. 22.

SIZE.

Unless otherwise specified, the minimum size at time of sawing shall not be less than the nominal size, but variations in sawing will be allowed provided the maximum size does not exceed the nominal size by more than $\frac{3}{8}$ inch in width or $\frac{1}{4}$ inch in thickness.

DESCRIPTION.

To be from sound timber free from heart, rot, unsound knots, shakes and wane. The general slope of the grain shall not exceed 1 in 15 and spring shall not exceed 1 inch in 25 feet or equivalent. Pieces to have one good face and two good edges with defects limited as below. In guides where the thickness approaches the width larger faults will be allowed on the edges towards the worse face.

Defects allowed on the better face or either edge.

1. *Gum Pockets.*—Not to exceed one 5 inch by $\frac{3}{8}$ inch in any 5 lineal feet.
2. *Gum Veins.*—Tight gum veins, total length, neglecting gum veins under 10 inches long, not to exceed one-sixth the length of the piece.
3. *Knots.*—One tight knot not to exceed $1\frac{1}{2}$ inch in any 5 lineal feet.
4. *Grub holes.*—Occasional grub holes up to $\frac{3}{8}$ inch diameter, if well scattered. Individual surface grub tracks limited to 16 inches by $\frac{3}{8}$ inch and $\frac{1}{4}$ inch deep or equivalent.

5. Equivalent defect.

On the other face defects in excess of the above will be allowed.

All provided that the combination of defects at any section will not seriously impair the utility of the piece for a mine guide.

CONDITION.

The specification is written to cover supply of material green from the saw.

JARRAH FLOORING BOARDS.

Recognised Standard Specifications for milled Jarrah strip flooring are those adopted by the Standards Association, Australia, and published as Technical Standard No. 03—1934. Provision is made for three grades—Specially Select, Select, and Merchantable. The Specially Select grade is intended for show floors only and is supplied at a price considerably in advance of that for the Select grade. It is not considered suitable as a single standard grade for export owing to the extremely high quality. It aims at a perfect face and provision of an even colour throughout the boards. The Select grade gives a face free from sap and practically free from other defects, but with natural variations in colour no defect. The grade is suitable for all first class floors such as hospitals, dance floors, public buildings, exposed floors in residences, etc. It should be suitable as the principal standard grade for export to all markets. The merchantable grade provides a class of floor suitable for all ordinary home construction where the greater part of the floor is usually covered with linoleum or other floor covering and for factory floors.

Two grades are provided for sawn Jarrah boards to produce milled flooring of the quality required in the two Standards Association grades—Select and Merchantable. A grade corresponding to the Specially Select cannot be written as selection for this grade is only possible after machining.

From parcels of green boards graded as Select under Specification No. 24, with care in seasoning and machining, it should be possible to obtain upwards of 85 per cent. Select milled boards and 10 per cent. Merchantable quality with losses due to necessary docking less than 5 per cent. From parcels of dry boards ready for milling graded under the same specification it should be possible to obtain upwards of 90 per cent. Select milled boards with losses through docking less than 5 per cent.

The losses in conversion of the Merchantable grade should not exceed 10 per cent. in the case of green boards and 5 per cent. in the case of dry boards supplied under Specification No. 25. It is not possible, however, to incorporate these figures in the specifications as the supplier has no control over subsequent treatment through the seasoning and machining processes.

For wood block flooring, Specifications 29 and 30 have been written, the former to cover supply of green, part dry or dry boards for the production of wood block flooring and the latter to cover supply of the finished block.

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SAWN JARRAH BOARDS FOR STRIP FLOORING.

GENERAL PROVISIONS. STANDARD SPECIFICATIONS NOS. 24 AND 25.

1. Enumerated defects are intended to cover the lowest quality boards the grade may contain but not more than 20 per cent. shall contain defects on the grade limit.

2. *Size.*—Unless otherwise specified the following will apply:—

Sizes for Sawn Boards for Strip Flooring.

Nominal.	Cutting Size.	Minimum size of boards described as dry for milling.
6 x 1	$6\frac{3}{16}$ x $1\frac{1}{16}$	$5\frac{3}{8}$ x $1\frac{5}{16}$
5 x $1\frac{1}{4}$	$5\frac{3}{16}$ x $1\frac{5}{16}$	$4\frac{3}{8}$ x $1\frac{3}{16}$
5 x 1	$5\frac{3}{16}$ x $1\frac{1}{16}$	$4\frac{3}{8}$ x $1\frac{5}{16}$
4 x $1\frac{1}{4}$	$4\frac{3}{16}$ x $1\frac{5}{16}$	$3\frac{3}{4}$ x $1\frac{3}{16}$
4 x 1	$4\frac{3}{16}$ x $1\frac{1}{16}$	$3\frac{3}{4}$ x $1\frac{5}{16}$

Occasional variations in sawing will be allowed from the cutting size in the table as below:—

In width $\frac{1}{8}$ inch below and $\frac{3}{16}$ inch above cutting size.

In thickness $\frac{1}{16}$ inch below and $\frac{1}{8}$ inch above cutting size.

Boards will be supplied in random lengths 8 feet and up in the Select grade and 6 feet and up in the Merchantable grade.

3. *Condition.*—Sawn boards for flooring may be sold as—

- Green;
- Air Dry;
- Dry for milling.

The moisture content of boards described as air dry shall not exceed 25 per cent. at time of inspection.

Unless otherwise specified, the moisture content of boards described as dry for milling shall not exceed 16 per cent. at time of inspection.

STANDARD SPECIFICATION No. 24—SELECT SAWN JARRAH BOARDS FOR PRODUCTION OF STRIP FLOORING.

SCOPE.

This specification covers the supply of sawn Jarrah boards aiming at production of milled strip flooring equivalent in quality to that of Select (Standard Specification No. 27). This latter grade gives a face free from sap and practically free from other defects but with natural variations in colour no defect—a grade suitable for all first class floors such as hospitals, dance floors, public buildings, exposed floors in residences, etc. The grade under Specification 24 is the highest recommended for sawn boards, but the buyer should realise that any parcel of Select Sawn Boards will not give 100 per cent. Select Milled Boards owing to unavoidable losses in seasoning and milling.

DESCRIPTION.

General Provisions 1 to 3 apply.

Boards shall be well sawn from sound timber. Grading shall be on the better face. This face and adjacent half edges shall be free from sap and all defects which will not mill out other than the following to the extent indicated:—

1. *Gum.*—Tight gum veins not more than 1/16 inch wide, individual lengths not to exceed 9 inches with a combined length not exceeding 3 inches for each square foot or equivalent gum.
2. *Holes.*—Two holes not greater than 1/16 inch diameter for each three square feet, not more than three being grouped in any six square inches; or one large hole not to exceed 1/8 inch diameter for each five square feet.
3. *End splits.*—Green boards to be free from end splits but part dry or dry boards will allow a straight end split not to exceed 4 inches on one end or its equivalent on both ends.
4. Equivalent defect.

The lower half of the edges and back may contain sap and defects which will not prevent machining of a firm tongue and groove or affect the laying or strength of the floor.

STANDARD SPECIFICATION No. 25—MERCHANTABLE SAWN JARRAH BOARDS FOR PRODUCTION OF STRIP FLOORING.

SCOPE.

This specification covers the supply of sawn Jarrah boards aiming at production of milled strip flooring equivalent in quality to that of Merchantable (Standard Specification No. 28). This latter grade provides a class of floor suitable for all ordinary home construction where the greater part of the floor is usually covered with linoleum or other floor covering and for factory floors. This is not a mixed grade and parcels need contain no board which would be accepted as of Select Grade.

DESCRIPTION.

General Provisions 1 to 3 apply.

Boards to be well sawn from sound timber. Grading shall be on the better face. This face and adjacent half edges will allow any defect which will mill out and in addition any one of the following or combination of small defects equivalent to one defect:—

1. *Sap*.—Not to exceed one-fifth the width of the board.
2. *Gum*.—Tight gum veins not wider than $\frac{1}{8}$ inch, individual lengths not to exceed 3 feet, and combined length 1 foot for each square foot or equivalent gum.
3. *Knots*.—One tight knot flecked with bark or gum up to a diameter not exceeding one-eighth the width of the board, or one smooth clean tight knot up to one-fourth the width of the board in any 5 square feet.
4. *Holes*.—Four holes not greater than $\frac{1}{16}$ inch diameter for each square foot, provided not more than six are grouped in any four square inches. One hole not greater than $\frac{1}{4}$ inch diameter for each three square feet.
5. *End Splits*.—Green boards to be free from end splits but part dry or dry boards will allow a straight end split not to exceed 6 inches on one end or its equivalent on both ends.

The lower half of the edges and back may contain defects which will not prevent machining of a firm tongue and groove or effect the laying or strength of the floor.

MILLED JARRAH STRIP FLOORING.

(See Footnote.)

GENERAL PROVISIONS—STANDARD SPECIFICATIONS NOS. 26, 27, 28.

1. The enumerated defects in any grade cover the lowest quality boards the grade may contain, but not more than 20 per cent. shall contain defects on the grade limit.

2. *Size and Profile.*—Unless otherwise specified, boards shall be accurately milled in the properly seasoned state to the standard profile of the supplying firm and to the following sizes:—

Nominal Size.	Milled Cover Size.
6in. x 1in.	5 $\frac{1}{4}$ in. x $\frac{13}{16}$ in.
5in. x 1 $\frac{1}{4}$ in.	4 $\frac{1}{4}$ in. x $1\frac{1}{16}$ in.
5in. x 1in.	4 $\frac{1}{4}$ in. x $\frac{13}{16}$ in.
4in. x 1 $\frac{1}{4}$ in.	3 $\frac{3}{8}$ in. x $1\frac{1}{16}$ in.
4in. x 1in.	3 $\frac{3}{8}$ in. x $\frac{13}{16}$ in.

3. *Moisture Content.*—Unless otherwise specified the moisture content shall not exceed 16 per cent. at time of inspection.

4. For the purpose of computation of the extent of defects, the face area of the board in square feet shall mean the length in feet multiplied by the nominal width in feet.

STANDARD SPECIFICATION No. 26—SPECIALLY SELECT QUALITY MILLED JARRAH FLOORING.

SCOPE.

This grade represents the best it is possible to produce and is recommended for show floors only where costs are a secondary consideration.

DESCRIPTION.

General Provisions 2 and 3 apply.

For this quality, boards shall be taken from Select Grade, selection being based on the provision of a perfect face and a fair average even colour in the boards.

These grades are essentially those published by the Australian Standards Association as Technical Standard No. 0.3—1934, altered in form to comply with that of the remainder of specifications herein.

STANDARD SPECIFICATION No. 27—SELECT QUALITY MILLED JARRAH FLOORING.

SCOPE.

This grade gives a face free from sap and practically free from other defects but with natural variations in colour no defect. It is recommended for all first class floors such as hospitals, dance floors, public buildings, exposed floors in residences, etc.

DESCRIPTION.

General Provisions 1 to 4 apply.

Select quality milled flooring shall be well machined from sound timber, free on the face and the edges above the tongue and groove from sap and defects other than any two of the following:—

1. Tight gum veins not more than $1/16$ th inch wide, individual lengths not exceeding 9 inches with a combined length not exceeding 3 inches per square foot of face area or equivalent gum.
2. Two holes not greater than $1/16$ th inch diameter per 3 square feet of face area, not more than three being grouped in any 6 square inches.
3. One hole not greater than $1/8$ inch diameter per 5 square feet of face area.
4. A straight end split not exceeding 4 inches length on one end or its equivalent on both ends.
5. Equivalent defect.

On the rest of the edges and the back, sap and defects which will not affect the laying or strength of the floor shall be permitted. Skip in the middle of the back shall be allowed, but at the edges it shall not reduce the bearing area by more than one-fifth at any section.

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STANDARD SPECIFICATION No. 28—MERCHANTABLE QUALITY MILLED JARRAH FLOORING.

SCOPE.

This grade is recommended as the standard quality for all ordinary home construction and for use in factories.

DESCRIPTION.

Merchantable quality milled flooring shall be well machined from sound timber, free on the face and the edges above the tongue and groove from defects other than one of those below or a combination of smaller defects equivalent to one defect.

1. Two square inches of sap for each nominal square foot but not wider than one-fifth the width of the board.
2. Tight gum veins not more than $\frac{1}{8}$ inch wide, individual lengths not exceeding 3 feet with a combined length not exceeding 1 foot per square foot of face area or tight gum equivalent in effect in any other form.
3. One tight knot flecked with bark or gum, not greater than one-eighth the nominal width of the board or one smooth, clean, tight knot up to one-fourth the nominal width in any five lineal feet.
4. Four holes not greater than $\frac{1}{16}$ inch diameter per square foot of face area, not more than six being grouped in any four square inches.
5. One small hole not greater than $\frac{1}{4}$ inch diameter per 3 square feet of face area.
6. A straight end-split not exceeding 6 inches in length on one end or its equivalent on both ends.
7. Equivalent defect.

On the rest of the edges and the back, sap and defects which will not affect the laying or strength of the floor shall be permitted. Skip in the middle of the back shall be allowed, but on the edge it shall not reduce the bearing area by more than one-quarter at any section.

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STANDARD SPECIFICATION No. 29—SAWN WOOD BLOCK FLOORING (JARRAH).

SCOPE.

This specification covers supply of sawn Jarrah boards for production of wood block flooring.

SIZE.

(See footnote.)

Unless otherwise specified the following will apply:—

Minimum size at time of cutting—Order size.

Maximum size at time of cutting—Width $\frac{3}{16}$ inch above order size; thickness $\frac{1}{8}$ inch above order size.

The minimum size of boards described as dry for milling shall be $\frac{1}{4}$ inch and $\frac{1}{16}$ inch below the order size in width and thickness respectively.

DESCRIPTION.

The better face and adjacent half edges shall be free from sap and all defects which will not machine out. On the back and lower half edges, sap and one of the following will be allowed:—

1. One fine tight gum vein at any section.
2. One grub hole up to $\frac{1}{4}$ inch diameter in any lineal foot.
3. One tight knot up to $\frac{1}{2}$ inch diameter in any lineal foot.
4. Scattered pinholes but not more than four in any lineal foot.

CONDITION.

Boards may be sold as—

- (a) Green;
- (b) Air dry;
- (c) Dry for milling.

The moisture content of boards described as air dry shall not exceed 25 per cent. at time of inspection. Unless otherwise specified the moisture content of boards described as dry for milling shall not exceed 16 per cent. at time of inspection.

In supply of wood block flooring to the United Kingdom it is usual to cut full compared with the order size but there appears to be no standard practice in this connection. Where inspection is called for, the buyer must state clearly the minimum green cutting size or the minimum size of dry board he will take. In the latter case, an increase on the minimum green sizes will be made to cover shrinkage if necessary.

STANDARD SPECIFICATION No. 30—MILLED WOOD BLOCK FLOORING (JARRAH).

SCOPE.

This specification covers the supply of seasoned and milled Jarrah flooring blocks. The grade is suitable for all classes of floor, a perfect face being aimed at, but with natural variations in colour no defect.

SIZE AND DESIGN.

According to buyers' requirements.

DESCRIPTION.

Not less than 70 per cent. to be free from sap and all defects.

In the remaining 30 per cent., the better face and edges above the tongue and groove shall be free from sap and all defects, except that surface checks of total length less than 2 inches and of no appreciable width and slight torn grain which will be removed in sanding will each be allowed to the extent of 5 per cent. of the total number of blocks.

In addition, the rest of the edges and back will allow sap and slight skip up to one-quarter the area, and any one of the following defects:—

1. One fine tight gum vein at any section.
2. One grub hole up to $\frac{1}{4}$ inch diameter.
3. One sound tight knot up to $\frac{1}{2}$ inch diameter.
4. Four pin holes in any block.
5. Equivalent defect.

CONDITION.

Unless otherwise specified the moisture content at time of inspection shall not exceed 16 per cent.

BUNDLING.

Bundles to be securely tied in an approved fashion, so that with reasonable care in handling negligible damage to blocks should take place in transit.

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STANDARD SPECIFICATION No. 31—WAGON SCANTLING (JARRAH AND KARRI).

SCOPE.

This specification covers the supply of Jarrah and Karri for use as wagon scantling.

SIZE.

Unless otherwise specified the following will apply. Timber shall be cut full, the minimum and maximum allowances above nominal size being as follows:—

Size.	Minimum allowance.	Maximum allowance.
Up to 8 in.	$\frac{1}{8}$ in.	$\frac{7}{16}$ in.
9, 10, 11 in.	$\frac{3}{16}$ in.	$\frac{5}{8}$ in.
12 in. and over	$\frac{1}{2}$ in.	$\frac{7}{8}$ in.

DESCRIPTION.

Material must be inspected taking into consideration its suitability for ordinary railway wagon construction in the shape and sizes in which it is ordered and shipped.

Material to be free from heart, included sap, rot, shakes, wane and cross-grain exceeding 1 in 15, but will allow any two of the following defects to the extent indicated.

(1) *Sap*: Sections up to 25 square inches to be free from sap.

Sections over 25 square square inches.—Will allow sap on the intersection of two adjacent sides provided the combined width of sap does not exceed 3 inches in Jarrah and 1½ inches in Karri.

(2) *Gum Veins.*—Tight gum veins up to one-fourth the length of the piece provided no complete gum ring runs from one face to another on the end section.

(3) *Knots.*—Will allow one sound tight knot up to 1¼ inches diameter in any five lineal feet.

(4) *Pinholes.*—Clean-edged pinholes not to exceed 10 in any half square foot.

(5) Equivalent defect.

The enumerated defects are intended to cover the lowest quality pieces allowed, but not more than 20 per cent. of the pieces in any parcel shall be on the grade limit.

NOTES ON ALLOWABLE WORKING STRESSES FOR JARRAH AND KARRI.

The recommended working stresses given in attached tables and figures have been arrived at after detailed consideration of all available data on strength properties of the two timbers. Extensive tests by the Division of Forest Products of the Council for Scientific and Industrial Research, Melbourne, over the past two years, have resulted in complete information on the mechanical properties of small clear specimens of green karri. A summary of results will be published in the August issue of the Council Journal. Tests on dry karri have not been carried out as material is not yet sufficiently dry for testing. Information contained in Progress Reports by I. Langlands of the Division covering the tests has been freely used, particularly Progress Report No. 5, "Working Stresses for Karri."

Working stresses for Jarrah have been derived mainly by a comparison of strength properties of Jarrah and Karri as shown in results of tests by G. A. Julius in 1906 and application of results of comparison to allowable working stresses for Karri.

In a brief covering note it is impossible to discuss completely the derivation of each allowable working stress or reasons for variations from stresses recommended elsewhere. A complete consideration of the factors involved is given in the Progress Report No. 5 already referred to, and this information will no doubt be available generally on publication of full results of tests on green and dry material.

Working stresses are given for three conditions of service.

Condition A assumes use in interior locations or protected construction, not subject to excessive dampness or high humidity. Following methods of establishing working stresses used by the American Forest Products Laboratory at Madison and generally adopted in U.S.A., high working stresses given can be justified on the better conditions of service alone but are only recommended for use with seasoned timber. Use of seasoned timber with consequent reduction in movement after erection, allows use of higher stresses apart from the increase in actual strength in smaller sections. It is not usual to allow any increase in working stresses with seasoning in larger sizes as developments of defects in seasoning partially balances increase in strength through lower moisture content. Very large sizes will not ordinarily be used under such conditions, but in any case results published by Julius indicate that there is a definite increase in strength with seasoning even with the large sizes, so that it is considered unnecessary to place a maximum limit on sections for which the higher stresses can be used.

Condition B.—Occasionally wet—assumes use in exterior structures such as bridges, trestles, grandstands and exposed framework in open sheds, etc.—conditions embracing use of the greater proportion of heavy structural timber.

Condition C.—Usually wet—would apply to material such as wharf construction exposed to wave action or tidal waters, or timber in contact with the ground, or used in buildings in portions that would be more or less continuously wet.

Fibre Stress in Bending.—The allowable working stresses in bending are based on the average green Modulus of Rupture with cumulative reductions to allow for (1) variability in strength of clear wood; (2) the effect of long time loading; (3) the effect of allowable defects in the grade; (4) a small factor of safety to allow for accidental overloads; and (5) variations in conditions of service.

Horizontal Shear.—Allowable horizontal shear is derived by applying a straight-out factor of 6 to the figure of shear strength for karri and then making some allowance for effect of injurious defects. Figures from Julius indicate that shear strengths of Jarri and Karri are close to one another.

Allowable values for horizontal shear are maximum values. The maximum unit horizontal shear in a beam in three halves, the average unit shear obtained by dividing the total shear at the point by the area of the cross section.

It has been realised for some time that the generally accepted theory of shear stresses in beams is in error, the discrepancy being serious with concentrated loads near the ends.

A simple method of design that tends to the conservative side is as follows:— In calculating the shear at one end of a beam, concentrated loads between the end and the nearer quarter point, or between that end and a point distant three times the depth of the beam from it, whichever would be the lesser distance from the support, may be considered as acting at that point.

Modulus of Elasticity.—The average value is used to compute average deflection under short time loads. Long time loading will cause a certain amount of permanent set. This set is usually about equal in amount to the computed deflection of a fully loaded beam. In order to reduce the sag to a minimum, it is recognised practice to use only half the average modulus of elasticity in cases where deflection is important and where the load is applied for a long period.

Bearing Perpendicular to the Grain.—Allowable working stresses are based on a factor of safety of $1\frac{1}{2}$ at the limit of proportionality on the value for green timber. At one-tenth inch deformation the factor of safety is between 3 and 4. The factor of safety rises rapidly above the apparently low figure of $1\frac{1}{2}$ at the limit of proportionality with hardening of the surface due to partial seasoning. Greater unit stresses can be allowed with narrower plates but with wider plates the allowable stresses should be reduced slightly.

Bearing Parallel to the Grain and Strength of Columns.

Derivation of stress follows standard practice.

The allowable stresses in short columns are based on compression strength parallel to the grain, intermediate columns on compression strength and stiffness combined and long columns on stiffness using the Euler formula.

Rounding off of figures to the nearest 100 lbs. per square inch introduces apparent discrepancies between the various grades but these are unimportant.

ALLOWABLE WORKING STRESSES—JARRAH AND KARRI.

(All stresses in pounds per sq. inch.)

	Standard Structural Jarrah (Spec. No. 10.)		Select Structural Jarrah (Spec. No. 14 and 15.)		Standard Structural Karri (Spec. No. 19.)		Select Structural Karri (Spec. No. 17 and 18.)		All Grades (Spec. 14-19.)
	Condition A.	Condition B.	Condition A.	Condition B.	Condition A.	Condition B.	Condition A.	Condition B.	
Fibre Stress in bending	2,100	1,800	2,400	2,100	2,400	2,100	2,800	2,400	1,600
Shear—(a) in beams	180	160	200	180	180	160	200	180	160
(b) in joint details	270	240	300	270	270	240	300	270	240
Modulus of Elasticity—									
(a) Average	2,400,000	2,000,000	2,400,000	2,000,000	2,800,000	2,300,000	2,800,000	2,300,000	Karri { (a) 2,300,000 (b) 1,150,000
(b) Beam design	1,200,000	1,000,000	1,200,000	1,000,000	1,400,000	1,150,000	1,400,000	1,150,000	Jarrah { (a) 2,000,000 (b) 1,000,000
Bearing perpendicular to grain—									
Width of Plate 1/4 in.	600	500	600	500	700	600	700	600	400
Bearing parallel to grain	2,000	1,800	2,000	1,800	2,300	2,100	2,300	2,100	1,600
Short Columns 1/4 in. up to 10	1,500	1,350	1,700	1,500	1,700	1,500	1,900	1,700	1,200

See Figure 1 for Jarrah and Figure 2 for Karri.

$$n = \frac{P \parallel}{p \sin^2 \theta + q \cos^2 \theta} \text{ where } \begin{cases} n = \text{allowable bearing stress at angle } \theta \text{ to grain.} \\ p = \text{parallel to grain.} \\ q = \text{perpendicular to grain.} \end{cases}$$

Conditions of Service—A. Locations continuously dry using seasoned timber.
 B. Locations occasionally wet.
 C. Locations usually wet.

Note.—The values given above may be used without allowance for impact up to 100 per cent. of the live and dead loads. For stresses due to wind loads or by combination of wind loads and dead and live loads, the stresses given may be increased by 50 per cent., provided the resultant size of members is not less than required for live and dead loads alone.

WORKING STRESS POUNDS/SQ INCH

500 1000 1500 2000 2500

Note.—The values given above may be used without allowance for impact up to 100 per cent of the live and dead loads.
 For stresses due to wind loads or by combination of wind loads and dead and live loads, the stresses given may be increased by 50 per cent., provided the resultant size of members is not less than required for live and dead loads alone.

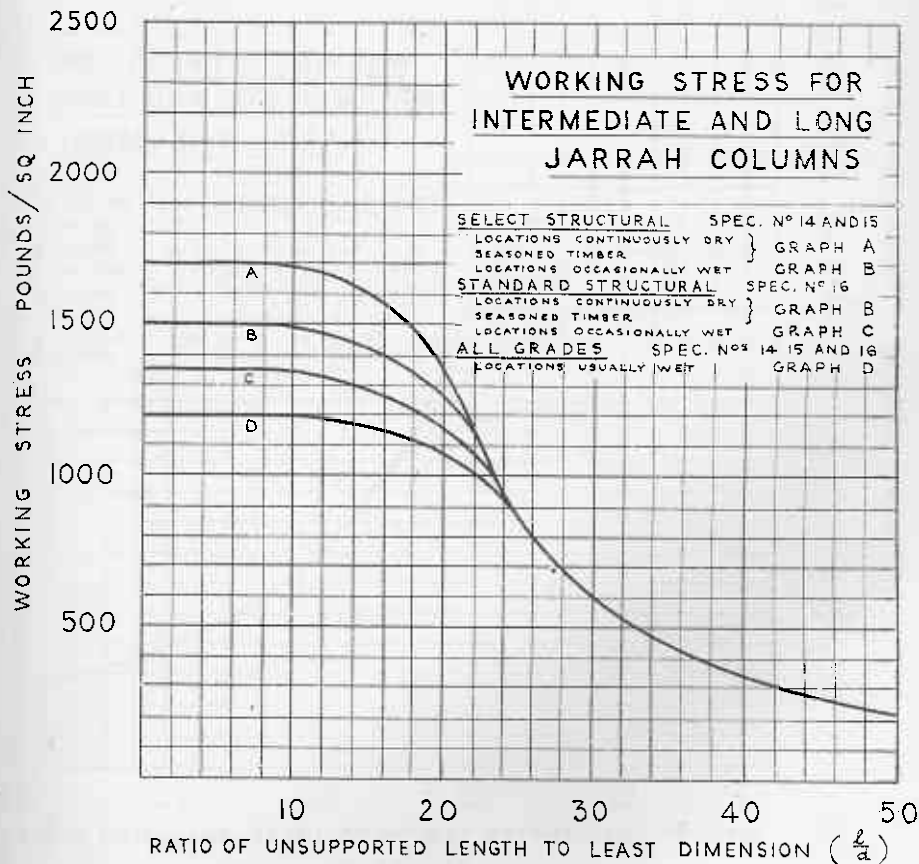


FIGURE 1

