

<i>Rise of Floor (degrees)</i>	<i>Percentage Increase</i>
30	0
25	10
20	20
15 or less	30

Intermediate values are to be determined by interpolation.

M.42.7.3 Adequate reinforcement shall be provided in way of the attachments of shaft brackets.

M.43 Hull Stiffening

M.43.1 Section Modulus

M.43.1.1 Section modulus in relation to a frame or stiffener is provided by the member and the panel of plywood to which it is glued and fastened having an effective width of one frame spacing.

M.43.1.2 Section modulus in relation to a web frame, beam or girder supporting stiffeners is provided by the member and an effective width of plywood equal to either half the sum of the spacing on either side of the member or 33 per cent of the unsupported span of the member, whichever is the less. For a member alongside an opening, the effective width of the plywood is equal to either one half the spacing or 16.5 per cent of the unsupported span whichever is less.

M.43.1.3 Section modulus in relation to a member not glued and fastened to the plywood is provided by that member only.

M.43.2 Stem, Keel and Hog

M.43.2.1 Scantlings for the stem, keel and hog are given in Tables M.2 and M.17 and associated notes, except that in Note (b) (i) of Table M.17, 3 times the plywood thickness should be provided on either side of the keel and in Note (b) (ii) of Table M.17 the moulding should be sufficient to provide 3 times the plywood thickness.

M.43.2.2 The stem, keel or hog may be either of laminated or solid timber construction.

M.43.2.3 A solid keel or hog in vessels 10 metres or less in length shall be of one length and in vessels over 10 metres in length where the keel or hog is not in one length it shall be efficiently scarphed.

M.43.2.4 Where the keel or hog is to be of laminated construction, full details of the glue to be used and the method of laminating must be submitted to the Authority for approval.

M.43.2.5 The keel or hog may be scarphed at one third their respective lengths with at least 10 times the keel moulding given in Table M.17 between the adjacent scarph in the keel and the scarph in the hog.

M.43.2.6 Keel or hog scarphs should be avoided in that portion of the keel and hog extending one engine length forward and aft of the main engine.

M.43.2.7 Keel and hog scarphs shall not be less in length than 6 times the tabular keel moulding or hog moulding respectively. The scarphs shall have nibs of the following depth.

- (a) 0.25 times the depth of the scarph for a moulding not greater than 200mm.
- (b) 0.125 times the depth of the scarph plus 25mm for a moulding greater than 200mm.

M.43.2.8 Stopwaters shall be fitted at all centre line construction joints where they intercept the rabbet line.

M.43.2.9 The scarph of the stem to the keel shall be not less in length than 2.5 times the tabular moulding.

M.44 Sheer Clamp

M.44.1 A suitable sheer clamp shall be fitted and the minimum section as shown in Table M.22 is to be maintained.

M.44.2 The siding and moulding of the sheer clamp shall be sufficient to maintain faying surfaces equal to twice the planking thickness for deck and hull respectively.

M.45 Chines

M.45.1 The cross sectional area of the chine batten in millimetres²: over 0.6L amidships shall not be less than

$$\text{area} = 12.5 t_b^2$$

where t_b = thickness of bottom plywood.

M.45.2 The ratio of siding to moulding is generally not to be greater than 1 to 2. In any case the siding shall be sufficient to provide a faying surface equal to 2.5 times the thickness of the bottom plywood.

M.45.3 Where practicable, chines should be in one length. If not in one length, chines shall be scarphed.

M.45.4 Where chines are scarphed the length of the scarph shall not be less than 6 times the moulding.

M.45.5 Feather edge scarphs may only be used in vessels less than 15 metres in length. The length of the scarph is to be not less than 6 times the moulding. The scarph is to be glued and fastened.

M.46 Beam Shelf

M.46.1 Where a beam shelf is fitted, the section modulus (Z) about the horizontal axis is to be not less than

$$Z = 0.045 S^2 B_1$$

where B_1 = span of beam supported.

M.47 Stringers

M.47.1 The section modulus of each bottom stringer in association with the plywood to which it is attached, is not to be less than

$$Z = 0.022 \text{ P.S.} \left(\frac{e}{100} \right)^2$$

M.47.2 The section modulus of each side stringer in association with the plywood to which it is attached is not to be less than:

$$Z = 1.1S \left(\frac{h}{1000} + 0.25 \right) \left(\frac{e}{100} \right)^2$$

M.47.3 Where practicable stringers should be in one length. If not in one length, the stringers shall be scarphed or joined by a butt strap.

M.47.4 Where stringers are scarphed the length of scarph shall not be less than 6 times the siding.

M.47.5 Where a butt strap is used, it shall extend the full distance between adjacent web frames and the thickness shall be not less than that of the bottom or side plywood, as is appropriate.

M.47.6 Feather edge scarphs may only be used in vessels less than 15 metres in length. The length of the scarph is to be not less than 6 times the siding. The scarph is to be glued and fastened.

M.48 Fitting of Longitudinal Members

M.48.1 Beyond 0.6L amidships the scantlings of the chine and sheer clamp may be reduced by a uniform taper of both moulding and siding up to 20 per cent of the cross sectional area.

M.48.2 Adjacent joints in stringers, chines, sheer clamps and beam shelves, shall not be made closer than the web frame spacing. The distance between the joints is to be measured between the end of one scarph and the commencement of the next.

M.48.3 Joints in longitudinal members are not permitted in way of bulkheads, web frames or in line with keel scarphs.

M.48.4 The scarph in a sheer clamp shall not be closer to a butt in the side plywood than one web frame spacing.

M.49 Web Frames

M.49.1 Web frames are to be efficiently connected to floors and are to be aligned with strong full deck beams. The section modulus (Z) of each web frame in association with the plywood to which it is attached is not to be less than:

(a) in the case of a bottom web:

$$Z = 0.026 P.S. \left(\frac{e}{100} \right)^2$$

(b) in the case of a side web:

$$Z = 1.1S \left(\frac{h}{1000} + 0.25 \right) \left(\frac{e}{100} \right)^2$$

In no case shall the siding and moulding of the side web frame be less than 60 per cent of the siding and moulding of the bottom web frame.

M.50 Floors

M.50.1 Floors shall be provided at each web frame and between web frames at not more than 450 mm centres.

The depth of floor at centreline shall be 62.5Bmm and the modulus of section at centreline shall be 35 S.D.B.²;

M.50.2 Intermediate floors between web frames shall extend and be fastened to a stringer.

M.51 Transom Stiffeners

M.51.1 Horizontal stiffeners where fitted, are to be aligned and efficiently connected to side shell stringers. Where the length of a horizontal stiffener exceeds 2 metres, vertical transom stiffeners are to be fitted. Vertical stiffeners are to align with and be efficiently connected to the hog, engine beds, or bottom stringers or efficiently bracketted to the bottom plywood and carried through to the first web frame.

M.51.2 Horizontal stiffeners are to have a section modulus (Z) in association with the plywood to which they are attached, of not less than:

$$Z = 1.1S \left(\frac{h}{1000} + 0.25 \right) \left(\frac{e}{100} \right)^2$$

M.51.3 Vertical stiffeners in association with the plywood to which they are attached are to have a section modulus (Z) of not less than:

$$Z = 1.1S \left(\frac{h}{1000} + 0.25 \right) \left(\frac{e}{100} \right)^2$$

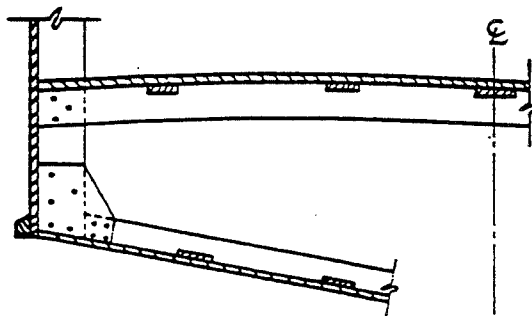
M.52 Transverse and Longitudinal Deck Beams

M.52.1 Where the deck is supported as illustrated below, the modulus of section (Z) of each deck longitudinal in association with the plywood to which it is attached, is not to be less than:

$$Z = 25 S \left(\frac{e}{1000} + 1 \right)^2$$

and the modulus of section (Z) of the transverse deck beam is not to be less than:

$$Z = 25 S \left(\frac{e}{1000} + 1 \right)^2$$



M.52.2 Where the plywood deck is fastened directly to the transverse deck beams without longitudinals, the modulus of section (Z) of the beam in association with the deck plywood is not to be less than:

$$Z = 25 S \left(\frac{e}{1000} + 1 \right)^2$$

M.52.3 Heavier beams or supporting pillars shall be fitted under areas of concentrated loads such as masts, winches, fish tanks, windlasses.

M.52.4 The ends of transverse beams are to be aligned with and efficiently connected to side web frames. Where intermediate beams are fitted they are to be supported by a beam shelf and/or sheer clamp and efficiently connected to the side web frames.

M.53 Pillars

M.53.1 Pillars are to be fitted below masts, winches, windlasses, bollards and other heavy and vibrating deck loads, where no alternate means of support are provided.

M.53.2 The load on a pillar is to be obtained from the following equation:

$$w = 0.715 bhs \text{ tonnes}$$

where:

w = load in tonnes

b = mean breadth in metres of area supported

s = spacing of pillars in metres

h = height in metres above the deck supported as defined below:

- h for a pillar below an exposed deck on which cargo is carried is the distance from the deck supported to a point 3.65 metres above the exposed deck. Where it is intended to carry deck cargoes in excess of 2640 kg/m²; this head is to be increased in proportion to the added loads which will be imposed on the structure.
- Where tweendeck cargo is carried and its mass is greater or less than 2640 kg/m²; h is also to be suitably adjusted.
- h for a pillar below the freeboard deck is to be measured to a point not less than $0.02L + 0.75$ metres above the freeboard deck.
- h for a pillar below the superstructure deck is to be measured to a point not less than $0.02L + 0.50$ metres above the superstructure deck.

M.53.3 The permissible load a pillar can carry is to be equal to or greater than the pillar load w as determined above. The permissible load may be obtained from the equation:

$$w_a = \frac{A}{1000} \left(1 - 17 \left(\frac{1}{a} \right) \right)$$

Where:

w_a = Permissible load on the pillar in tonnes

l = Unsupported length of the pillar in metres

a = Diameter of a circular pillar or shorter side of a rectangular pillar in millimetres.

A = Area of cross section in square millimetres

Table M.14 gives pillar loadings for a representative selection of round and rectangular pillars.

M.53.4 The scantlings of pillars and stanchions or material other than timber shall be determined from the appropriate Sub-sections of the Construction Section.

M.53.5 Pillars or stanchions may be placed directly under beams, deck opening corners or deck longitudinals. The spacing of pillars fitted under longitudinals between bulkheads shall not exceed 5 times the beam spacing plus 500 mm in the fore and aft direction, nor shall they be placed more than 25 per cent of the beam from the vessel's centreline.

M.53.6 Supports under pillars or stanchions are to be of sufficient strength to distribute the loads effectively.

M.54 Engine Seatings

M.54.1 The engine seatings are to be of dimensions commensurate with the power of the machinery fitted thereto. They should

- (i) be of a length not less than twice the distance between the extreme engine holding down bolts;
- (ii) distribute the load over as many transverses as possible;
- (iii) terminate on a substantial transverse member; and
- (iv) be checked over and securely fastened through all transverse floors and the hull planking.

M.54.2 Where the maximum height of a timber engine seating above the top of the floors exceeds three times the siding of the seating, then the seating shall be stiffened and supported with side brackets on every second floor. Support shall also be provided between the seatings in way of the side brackets.

M.55 Plywood Bulkheads

M.55.1 The thickness of the bulkhead is not to be less than:

$$t = 0.0042 \left(\frac{h}{1000} + \frac{7L}{15} \right) S$$

Where:

h = height of bulkhead at the centreline.

M.55.2 The thickness of the collision bulkhead is not to be less than 25 per cent greater than the thickness given in sub-clause M.55.1.

M.55.3 The bulkhead is to be efficiently fastened to a transverse web frame.

M.55.4 Bulkhead stiffeners on watertight bulkheads in association with the plywood to which they are attached are to have a modulus of section (Z), of not less than:

$$Z = 1.06 \left(\frac{e}{100} \right)^2 \frac{Sh}{1000}$$

Where:

h = height from midpoint of span to top of bulkhead measured at the centreline.

M.55.5 Stiffeners on collision bulkheads are to have a modulus of section (Z) not less than 1.25 times that given in sub-clause M.55.4.

M.56 Deckhouses

M.56.1 The thickness of plywood used for the construction of a deckhouse or casing is not to be less than:

- (a) in the case of a deckhouse front:

$$t = 0.0028 S (B + K)$$

- (b) in the case of a deckhouse side or after bulkhead or deckhead:

$$t = 0.0022 S (B + K),$$

where K is derived from:

L	K
Less than 5 metres	3
5 metres and less than 7.5 metres	4
7.5 metres and less than 10.0 metres	5
10 metres and less than 15.0 metres	6
15 metres and over	7

M.56.2 Where the front of the deckhouse is located less than 0.25L from the forward perpendicular, the stiffener spacing is to be reduced by 20 per cent or the thickness of the plywood is to be increased by 25 per cent.