

Specification for railway rails

ICS 45.080

Committees responsible for this British Standard

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- British Precast Concrete Federation Ltd
- Confederation of British Metalforming
- Health and Safety Executive
- London Underground Ltd
- Prestressed Concrete Association
- Railtrack
- Society of Chemical Industry
- Timber Trade Federation
- UK Steel Association

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Foreword

This revision of this British Standard has been prepared under the direction of the Iron and Steel Standards Committee and supersedes BS 11:1978, which is withdrawn.

Where practicable, action has been taken to align this standard with the requirements of ISO 5003-1980, “*Flat bottom railway rails and special rail sections for switches and crossings of non-treated steel*”, published by the International Organization for Standardization (ISO).

For all new installations of flat bottom rail sections of 46 kg/m and above, BS EN 13674-1:2003, *Railway applications — Track — Rail — Part 1: Vignole railway rails 46 kg/m and above* applies.

Requirements for other rail sections in this standard will be superseded on publication of the other parts of BS EN 13674. When all the parts of BS EN 13674 have been published, this British Standard will be declared obsolescent.

NOTE 1 In this British Standard rail sections are identified by a number which is the approximate mass per a unit length of rails in lb/yd. An approximate conversion to kg/m can be made by multiplying the value in lb/yd by 0.49.

NOTE 2 The term “Vignole rail” is in common use elsewhere in Europe. It is derived from the name of Charles Blacker Vignoles, an early railway engineer who promoted the use of flat bottom rail.

Improvements in rail steel quality have been achieved by a reduction in maximum sulfur and phosphorous limits in all rail steel grades and by small increases in maximum carbon levels in wear-resistant rail steel grades. Length tolerances are now applicable to rail lengths up to and including 36.576 m (120 ft).

Although preference has been given to metric sizes and tolerances, it has been recognized that a high proportion of rail requirements are for replacement purposes rather than for new track. The imperial dimensions have been retained since all the rail profiles are based on imperial design. However, in order not to preclude the development of metric designed rail profiles, tolerances based solely on metric units are also specified.

Referee gauge designs for the checking of bolt hole positions have been added to the standard.

This revision also incorporates the requirements of BS 103, “Falling weight testing machines for rails”, which has been withdrawn.

Appendix E outlines the independent chemical analyses and tensile test procedure.

BSI Committee ISM/74, whose constitution is shown at the end of this British Standard, takes collective responsibility for its preparation under the authority of the Board of the Institution. The Committee wishes to acknowledge the personal contribution of Messrs A J S Blanchfield and A B Henderson.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 45 and a back cover.

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1 Scope

This British Standard specifies the requirements for the quality of steel, dimensions, tolerances and other technical conditions of delivery for railway rails of 24.8 kg/m (50 lb/yd) and greater linear mass.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Information to be supplied by the purchaser

2.1 The purchaser shall state in his enquiry and order:

- a) the number of this British Standard, i.e. BS 11;
- b) the grade of steel (see Table 1);
- c) details of the rail section required (see Clause 4);
- d) rail length required (see Clause 19);
- e) use of rail to determine the tolerance on length (see Table 4).

2.2 Additionally certain alternatives or options shall be permitted by this standard as specified below:

- a) request details of the steelmaking and casting processes (see Clause 5);
- b) optional branding requirements (see 8.1.2);
- c) cold stamping of one end of a finished rail (see 8.2.7);
- d) application of delegated inspection or quality assurance (see Clause 10);
- e) request details of hydrogen flake avoidance procedure (see Clause 12);
- f) application of the rail end straightness tolerance applied to drilled rails (see 13.5);
- g) application of a continuous non-destructive testing (see 14.2);
- h) supply of a restricted percentage of short rail (see Clause 19).

Any of the required alternatives specified in the clause referred to above shall be stated by the purchaser at the time of the enquiry and order, and, shall be implemented by the manufacturer.

3 Definitions

For the purposes of this British Standard the following definitions apply.

3.1

sequence continuous casting

a process whereby a sequence of casts of the same grade of steel is poured through a continuous casting machine without interruption in flow of liquid steel into the moulds and strands. The pouring of the next cast begins before the flow of steel from the previous cast has finished, leading to an intermixing of some liquid steel from the two successive casts

3.2

main cast

blooms from each strand that are known to be entirely composed of steel from a single cast

3.3

changeover overlap or intermediate material

blooms that may contain steel from more than one cast, i.e. material arising during the changeover from one cast to the next in the sequence and therefore intermediate in position between two successive main casts

4 Dimensions and properties of rail sections

Where a rail section is ordered by BS rail section number [see 2.1c)], its dimensional properties and mass per unit length shall comply with the appropriate values given in Table 9 to Table 12 and Figure 5 to Figure 23.

NOTE 1 The provisions of this standard are not restricted to rails of British Standard section and may be applied to any section of 24.8 kg/m (50 lb/yd) or greater linear mass.

NOTE 2 The mass per unit length of rails quoted in this standard has been determined by multiplying the sectional area in mm² by 0.00785 to give the mass in kg/m or by multiplying the sectional area in ² by 10.209 to give the mass in lb/yd.

NOTE 3 The rail sections in this standard were designed before the change to SI units was planned. The original imperial dimensions used have been converted to SI dimensions with an accuracy necessary for the retention of the previous imperial profiles and properties of the rails.

Table 1 — Chemical composition

Steel grade	Carbon % by mass	Silicon % by mass	Manganese % by mass	Phosphorus % by mass	Sulfur % by mass
Normal	0.45/0.60	0.05/0.35	0.95/1.25	0.040 max.	0.040 max.
Wear-resisting A	0.65/0.80	0.10/0.50	0.80/1.30	0.040 max.	0.040 max.
B	0.55/0.75	0.10/0.50	1.30/1.70	0.040 max.	0.040 max.
NOTE Minor modifications in chemical composition may be agreed between the manufacturer and the purchaser (at the time of enquiry and order), to achieve the specified mechanical properties for the rail section ordered.					

5 Manufacture of steel

The source of the steel and the steelmaking processes employed shall be the responsibility of the manufacturer. The purchaser can request the supply of a broad outline description of the steelmaking and casting processes [see 2.2a)] and the manufacturer shall not alter these without informing the purchaser.

6 Chemical composition

When tested in accordance with Clause 16 the chemical composition of the appropriate grade of steel shall comply with the limits given in Table 1.

7 Mechanical properties

7.1 Falling weight test

When tested in accordance with Clause 17, the test pieces shall not fracture or crack between the supports.

7.2 Tensile properties

When tested in accordance with the tensile test given in Clause 18, the tensile properties of the steel shall comply with the values given in Table 2.

Table 2 — Tensile properties

Steel grade	Minimum tensile strength N/mm ^{2a}	Minimum elongation %
Normal	710	9
Wear-resisting A	880	8
B	880	8
NOTE These minimum elongation values are applicable to the results of tensile tests carried out on untreated specimens within 24 h of the machining of the test piece.		
^a 1 N/mm ² = 1 MPa.		

8 Marking

8.1 Branding

8.1.1 Brand marks shall be rolled in relief on one side of the web of each rail. The brand marks on the rails shall be clearly legible and shall be at least 20 mm high and 0.5 mm thick, and they shall read from the end nearer the top of the ingot or the top of the continuously cast strand.

The brand marks shall include:

- a) the number of the BS rail section or other rail section;
- b) the grade of the steel, i.e.:
 - 1) normal grade: no symbol
 - 2) wear-resisting grade A: "A"
 - 3) wear-resisting grade B: "B";
- c) the manufacturer's name, initials or other recognized mark, sufficient to identify the rolling mill;
- d) the last two figures of the year of manufacture.

8.1.2 Additionally the purchaser has the option of requesting further brand marks including any of the following [see 2.2b)]:

- a) the number of the month of manufacture (in roman numerals);
- b) the steelmaking process:
 - 1) O : Oxygen
 - 2) OB : Open hearth, basic
 - 3) E : Electric;
- c) letters identifying the purchasing administration:

Examples

BS 113-A-B-X and Co-85-V-O-ZR (i.e. wear-resisting grade B)

BS 90R- -X and Co-85-V-O-ZR (i.e. normal grade)

NOTE It is important to maintain a clear demarcation between the components of the brand marks. This is achieved by the use of hyphens.

8.2 Rail identification

8.2.1 General. In addition to the branding requirements of 8.1, each rail shall be identified by a numerical and/or alphabetical code system, hot stamped, on the non-branded side of the rail web, either manually (see 8.2.2) or by machine (see 8.2.3).

The figures and letters used shall be at least 15 mm high.

The identification system employed shall be such as to enable the hot stamped marking to be collated with:

- a) the number of the cast from which the rail has been rolled;
- b) the number of the ingot or the continuously cast strand and bloom;
- c) the position of the rail relative to the top of the ingot or bloom.

NOTE 1 As an alternative to manual hot stamping, repetitive application by a machine on the side of the rail web can be used for all or part of the identification system, e.g. the cast number.

NOTE 2 The hot stamping procedure for lighter section rails, e.g. 24.8 kg/m (50 lb/yd) and 29.9 kg/m (60 lb/yd) or for rails ordered in short prime lengths should be based on an agreement between the manufacturer and purchaser.

NOTE 3 For the purpose of identification, a rail may be considered to be that which exists as a single length after hot sawing. Where such rails are subsequently cold sawn or machined to produce two or more shorter lengths, these may each bear the identification of the original hot sawn rail.

8.2.2 Manual hot stamping. When manual hot stamping is used the specified rail identification shall be stamped on the side of the rail web in a position approximately 500 mm from the rail end.

8.2.3 Machine hot stamping. When repetitive machine hot stamping is used, the specified rail identification shall appear at least once every 5 m along the length of the rail.

8.2.4 Casting process identification. The manufacturer shall ensure that rails rolled from continuously cast blooms can be separately identified from rail produced from ingots.

8.2.5 Sequence casting identification. In the case of sequence continuous casting, a cast shall be considered as including all blooms up to, but excluding, the first bloom that is known to be entirely of the next cast. The change-over blooms at the end of the cast, plus the rails produced therefrom, shall be clearly identified.

8.2.6 Minority tonnage identification

NOTE When a rolling includes steel of different grades or of the same grade made by different processes, the branding of the majority tonnage can be used throughout the rolling.

For the minority tonnages the process or grade identity mark of the majority tonnage shall be cancelled. The minority tonnage grade and/or process identity mark shall then be included elsewhere in the branding, or alternatively in the hot stamp marking.

8.2.7 Cold stamping. Additional to the hot stamping requirements, the purchaser can request similar identification applied by cold stamping to one end of the finished rail [see 2.2c)].

9 Templates

The manufacturer shall supply two sets of master templates, internal and external, for each section of rail ordered, and shall submit them for the approval of the purchaser and obtain his approval before rolling of the rails is commenced. One set of master templates shall remain in the possession of the purchaser during the period of acceptance.

In addition to the master templates, the manufacturer shall supply one set of plus and minus limit acceptance gauges to the purchaser.

NOTE Where master templates have already been approved by another railway purchasing administration, or by an external referee, these should be used by other purchasers whenever possible.

10 Facilities for inspection

The manufacturer shall examine all rails and those found to be defective shall be clearly marked and removed from the batch for purchaser inspection (see Clause 14).

The purchaser shall have reasonable access to observe the manufacturing process and inspect the finished product.

The purchaser shall be advised by the manufacturer of the date of rolling, sample selection and mechanical testing of the test pieces to enable him to witness these procedures, and of the availability of the finished product for inspection.

Alternatively the purchaser may request the manufacturer to take responsibility for inspection based on “delegated inspection” or a “quality assurance system” [see 2.2d)].

All rails accepted by the agreed inspection procedure shall be marked.

NOTE The inspection or quality assurance system to be applied should be approved at the time of the enquiry or order (refer to BSI Handbook No. 22).

11 Manufacturer's tests and certificate

The manufacturer shall supply the purchaser with certificates of the steelmaking and casting processes, chemical analysis, results of mechanical tests and the position from which test samples have been selected (see Clause 15).

The manufacturer shall prepare and supply all test pieces and samples of steel, sample rails and drillings.

12 Manufacture of rails

Rails shall be manufactured from either:

- a) cast blooms; or
- b) blooms made from ingots.

The minimum rolling reduction of cross-sectional area for rails up to 60 kg/m section (120 lb/yd) rolled from continuously cast blooms of square or rectangular cross section, shall be 8:1.

Manufacturing precautions shall be taken so as to avoid the occurrence of hydrogen flakes in susceptible steel grades. The purchaser can request the manufacturer to inform him of the procedure used in the avoidance of the presence of hydrogen flakes [see 2.2e)].

13 Tolerances

13.1 Rail section profile

The tolerances for rails up to and including 60 kg/m (120 lb/yd) section mass with the principal dimensions given in a) to c) shall comply with the values given in Table 3.

- a) Rail height up to and including 165 mm (6½ in).
- b) Foot width up to and including 140 mm (5½ in).
- c) Head width up to and including 70 mm (2¾ in).

NOTE The tolerances for rails heavier than 60 kg/m (120 lb/yd) or with larger principal dimensions than above may be agreed between the purchaser and the manufacturer.

Table 3 — Tolerances on rail section profiles

Characteristic	1 Flat bottom sections designed in imperial units		2 Flat bottom sections designed in metric units	3 Bull head sections designed in imperial units	
	mm	in	mm	mm	in
Overall height of rail measured at the rail end	+0.80 −0.40	+ ¹ / ₃₂ − ¹ / ₆₄	±0.50	+0.80 −0.40	+ ¹ / ₃₂ − ¹ / ₆₄
Width of head	±0.40	± ¹ / ₆₄	±0.50	±0.40	± ¹ / ₆₄
Width of foot	±0.80	± ¹ / ₃₂	±1.00	±0.40	± ¹ / ₆₄
Thickness of web	±0.40	± ¹ / ₆₄	+1.00 −0.50	±0.40	± ¹ / ₆₄
Verticality: maximum deviation at rail head	0.40	¹ / ₆₄	0.50	0.40	¹ / ₆₄
Foot base : flat to maximum concavity : deviation from nominal profile	0.40	¹ / ₆₄	0.50	±0.50	±0.020
Fishing surfaces: Maximum stand off of fishing template					
From web	1.20	³ / ₆₄	1.20	1.20	³ / ₆₄
Maximum clearance from fishing surface	0.13	0.005	0.15	0.13	0.005
Asymmetry of rail section	0.40	¹ / ₆₄	0.50	0.40	¹ / ₆₄
Asymmetry of rail section as checked by means of combined verticality and asymmetry gauge: flat bottom rails only (see Appendix A)	1.20	³ / ₆₄	1.25	(see note)	(see note)
NOTE The gauge shown in Appendix A is not applicable to bull head rails. Other gauges are used for checking the verticality and asymmetry of bull head sections.					

The profile of each rail section shall be checked for conformity to the tolerances given in Table 3 by means of approved plus or minus limit gauges.

For flat bottom rails the tolerances given in columns 1 and 2 of Table 3 shall apply to rail sections designed in imperial and metric units respectively. The tolerances given in column 3 of Table 3 shall apply to bull head sections designed in imperial units.

13.2 Tolerance on rail length

The tolerances on length shall be as given in Table 4 and shall apply to rails up to and including 36.576 m (120 ft). The lengths shall be based on a rail at a temperature of 20 °C (68 °F). The tolerance on rail length shall be stated in the enquiry and order [see 2.1d)].

Table 4 — Tolerance on rail length

Rail used	Tolerances	
	Metric length mm	Imperial length in
Rails for butt welding	±25.0	±1
Rails for jointed track or other purposes	±5.0	± ³ / ₁₆

13.3 End squareness

The deviation from square in both horizontal and vertical directions shall not exceed 0.50 mm for rails designed in imperial and metric units.

These tolerances shall apply to rails within the range 25 kg/m up to and including 60 kg/m (50 lb/yd up to and including 120 lb/yd) and within the principal dimensions given in 13.1.

NOTE Pro rata increases in tolerances are recommended for heavier or larger section rails.

13.4 Fishbolt hole position

Fishbolt holes shall be drilled at right angles to the web; they shall be smooth and burrs shall be removed. The position of the centre of the holes relative to the end of the rail and the base of the flange shall be checked with suitably designed gauges. In case of dispute the fishbolt holes in the rail shall be checked with templates and gauges of the type shown in Appendix B and Appendix C.

The sizes and positions of the fishbolt holes for British Standard rail sections shall be as given in Figure 24 and Table 5 with tolerances as given in Table 6.

Table 5 — Position of fishbolt holes

BS rail section no.	Dimensions							
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
	Height of centreline of hole from foot of rail mm	Distance of centreline of 1st hole from end of rail mm	Pitch of hole centres mm	Diameter ^a of holes mm	Height of centreline of hole from foot of rail in	Distance of centreline of 1st hole from end of rail in	Pitch of hole centres in	Diameter ^a of holes in
50 "O"	41.47	47.62 ^b	101.60	23.81	1 ⁸¹ / ₁₂₈	1 ⁷ / ₈ ^b	4	1 ⁵ / ₁₆
60 A	47.62	47.62	101.60	25.40	1 ⁷ / ₈	1 ⁷ / ₈	4	1
60 R	47.62	47.62	101.60	25.40	1 ⁷ / ₈	1 ⁷ / ₈	4	1
70 A	50.80	47.62	101.60	26.99	2	1 ⁷ / ₈	4	1 ¹ / ₁₆
75 A	52.39	47.62	101.60	28.58	2 ¹ / ₁₆	1 ⁷ / ₈	4	1 ¹ / ₈
75 R	53.98	47.62	101.60	28.58	2 ¹ / ₈	1 ⁷ / ₈	4	1 ¹ / ₈
80 A	53.98	47.62	101.60	28.58	2 ¹ / ₈	1 ⁷ / ₈	4	1 ¹ / ₈
80 R	55.96	47.62	101.60	28.58	2 ¹³ / ₆₄	1 ⁷ / ₈	4	1 ¹ / ₈
80 "O"	53.98	60.32	127.00	28.58	2 ¹ / ₈	2 ³ / ₈	5	1 ¹ / ₈
90 A	57.15	53.98	114.30	30.16	2 ¹ / ₄	2 ¹ / ₈	4 ¹ / ₂	1 ³ / ₁₆
90 R	59.93	53.98	114.30	30.16	2 ²³ / ₆₄	2 ¹ / ₈	4 ¹ / ₂	1 ³ / ₁₆
95 A	58.74	53.98	114.30	31.75	2 ⁵ / ₁₆	2 ¹ / ₈	4 ¹ / ₂	1 ¹ / ₄
95 R	61.91	53.98	114.30	31.75	2 ⁷ / ₁₆	2 ¹ / ₈	4 ¹ / ₂	1 ¹ / ₄
95 RBH	64.70	60.32	114.30	28.58	2 ³⁵ / ₆₄	2 ³ / ₈	4 ¹ / ₂	1 ¹ / ₈
95 N	64.29	53.98	114.30	31.75	2 ¹⁷ / ₃₂	2 ¹ / ₈	4 ¹ / ₂	1 ¹ / ₄
100 A	60.32	53.98	114.30	31.75	2 ³ / ₈	2 ¹ / ₈	4 ¹ / ₂	1 ¹ / ₄
100 R	63.50	53.98	114.30	31.75	2 ¹ / ₂	2 ¹ / ₈	4 ¹ / ₂	1 ¹ / ₄
110 A	65.09	60.32	127.00	31.75	2 ⁹ / ₁₆	2 ³ / ₈	5	1 ¹ / ₄
113 A	65.09	60.32	127.00	31.75	2 ⁹ / ₁₆	2 ³ / ₈	5	1 ¹ / ₄

^a Where circumstances call for different size holes, these may be ordered.
^b This dimension was designated as 50.80 (2 in) in previous editions of this standard.

Table 6 — Tolerances on fishbolt hole dimensions and positions

Fishbolt holes	Tolerances	
	Diameter ≤ 30 mm	Diameter > 30 mm
Diameter of fishbolt holes	±0.5 mm	±0.7 mm
Centre and position of fishbolt holes vertically and horizontally	±0.5 mm	±0.7 mm

13.5 Straightness

A finished rail, after cold straightening, shall, when standing on its base or lying on its side, be capable of being pulled by hand into a straight line and of retaining that position.

The straightness of the rail, shall be judged by eye but, in case of doubt or dispute, the affected portion shall be checked using a 1 500 mm (5 ft) straightedge. The maximum permissible deviation shall be 0.8 mm (¹/₃₂ in) measured as the maximum ordinate on a chord of 1 500 mm (5 ft).

Rails to be used in welded track shall have the straightness of the ends checked by means of a 1 500 mm (5 ft) straightedge. The deviation from straight, both in the vertical and horizontal direction, shall not exceed 0.8 mm ($\frac{1}{32}$ in) measured as the maximum ordinate on a chord of 1 500 mm. This tolerance shall be allowed only for vertical deformation if the deviation raises the end. No tolerance shall be allowed if the deviation lowers the end. The purchaser can request this tolerance for rail end straightness in the case of drilled rails supplied for jointed track [see 2.2f)].

Any rails not complying with these requirements shall be rectified and reinspected.

14 Freedom from defects

14.1 Surface defects

The method used to check the depth of minor surface imperfections and to remove them, shall be approved by the purchaser.

14.2 Internal defects

The manufacturer shall ensure the absence of harmful internal defects by control during manufacture. The purchaser can request that the manufacturer applies continuous non-destructive testing (e.g. ultrasonic testing) appropriate to the manufacturing process and grade of steel [see 2.2g)].

15 Test sample selection

For rails produced from ingots, the accepted inherent characteristics of the product influence the test sample positions and these shall be as specified in Clause 16, Clause 17 and Clause 18.

In the production of rails from continuously cast blooms, the position of the rail in the bloom or strand in main cast material is of no significance, and test samples shall be selected by the manufacturer on a random basis, subject to all other provisions in this standard.

In the case of sequential continuously cast material, the initial test samples shall be selected only from known main cast blooms or rails. The changeover material, intermediate between two main casts and forming the last (or uppermost) blooms in each cast, shall only be sampled:

- a) as part of the retest procedure in the event of rejection of a cast, or casts, from within a succession of sequentially poured casts; or
- b) if a rolling batch terminates within intermediate material containing steel from a main cast which has not been sampled and tested. In this case the sampling and testing procedure shall commence with the last (or uppermost) rails, and retesting shall move progressively lower down the blooms and strand.

NOTE Predefined test sample positions for rails made from continuously cast steel may be agreed between the purchaser and the manufacturer at the time of enquiry and order.

16 Chemical analysis

16.1 Initial tests

NOTE The chemical composition of the steel shall be determined by ladle analysis and shall comply with the appropriate requirements of Clause 6. Determinations may be made chemically, spectrographically or by other modern instrumental methods.

After rolling the rails, the manufacturer shall supply the purchaser with the chemical composition of a product sample of each cast or part cast being supplied against the contract.

If the rails do not comply with the requirements of Clause 6 all rails from that cast or part cast shall be deemed not to comply with this standard, subject to the provisions of 16.2.

16.2 Retests

Should the chemical composition fail to comply with the requirements of Clause 6, the manufacturer shall make two further tests on samples cut from the rolled rail.

Drillings taken from a rolled rail sample to be used for these retest chemical analyses shall be taken from a hole drilled in a position as shown in Figure 1. The diameter of the drill shall be 25 mm (1 in) for larger sections [over 40 kg/m (80 lb/yd)] or 19 mm ($\frac{3}{4}$ in) for lighter sections, depending on rail head dimensions. Where spectrographic or other instrumental methods are used, the test position shall be in the sample area shown in Figure 1.

If the results of these retests are satisfactory, the cast or part cast shall be accepted. If one or both of the test pieces fail, the cast or part cast shall be rejected.

In the event of dispute, analyses shall be carried out by the appropriate methods described in BSI Handbook No. 19.

17 Falling weight¹⁾ test

17.1 Method of test

The test shall be carried out on a short length of unnotched rail by means of a guided falling weight. The requirements of the test shall be as follows.

- a) Mass of falling weight: normally 1 000 kg. This mass shall conform to the requirements of equation 1.
- b) Height of fall: measured from the top level of rail head and varying in relation to the rail section (see equation 1).
- c) Rail test piece: 1 300 mm minimum length with its base supported on two bearers.
- d) Distance between bearers: 1 000 mm from centreline to centreline.

The guides shall be rigid, straight and vertical and so constructed as to ensure that friction during the fall of the weight is reduced to a minimum. The falling weight shall strike midway between the bearers.

The falling weight shall be symmetrical in mass and shape in relation to the plane of the guides; its centre of gravity shall be as low as possible in this plane and it shall be exactly central between the two guides.

The release gear shall not cause any sideways movement of the falling weight when it is set in motion.

The striking face of the weight shall be rounded as part of a cylinder (see Figure 2) with its axis horizontal and in the plane of the guides.

The mass of the metal anvil block shall be not less than 10 000 kg and its supporting base shall be rigid. The bearers designed to receive the test piece shall be firmly fixed to the anvil block and shall be shaped as shown in Figure 3.

The striking face of the falling weight and the upper part of the bearers shall be trued-up or replaced when they become severely distorted.

For the test, the test piece shall normally be at ambient temperature. When ambient temperature is lower than 10 °C, the manufacturer may, at his discretion, increase the test piece temperature to between 10 °C and 25 °C. A single blow shall be applied. The height of fall (in m) varies with the mass per unit length of the rail and the mass of the falling weight according to the following equation:

$$H = \frac{150M_r}{M_m} \quad (1)$$

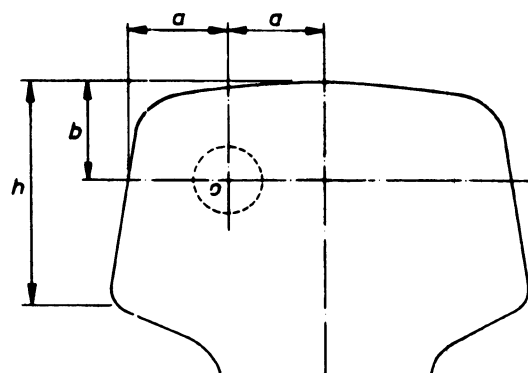
where

- H is the height of fall (in m);
 M_r is the mass per unit length of rail (in kg/m);
 M_m is the mass of the falling weight (in kg).

NOTE 1 For rails produced in wear-resistant grades, the values used in the formula may be adjusted, subject to agreement between the purchaser and the manufacturer.

NOTE 2 When a manufacturer does not possess the necessary equipment for carrying out a falling weight test under conditions specified in this standard, the test may be replaced by another falling weight test which has been adapted for his own installation and where the conditions have been agreed between the purchaser and the manufacturer.

¹⁾ Although the term “weight” in the context of this test has been superseded by the term “mass”, it has been decided to retain the term “weight” in preference to “mass” for both practical and historical reasons.



$$a = \frac{1}{4} \text{ of width at depth } b$$
$$b = \frac{2}{5} \text{ of } h$$

Figure 1 — Location of sample for chemical analysis and tensile test piece

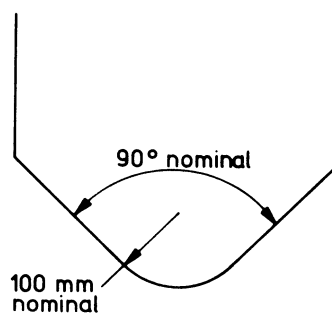


Figure 2 — Falling weight striking face

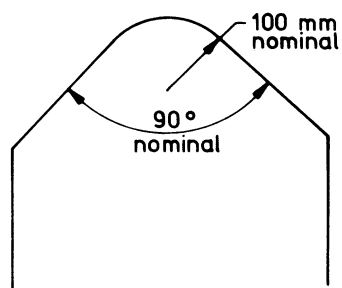


Figure 3 — Shape of falling weight test bearers