

**BRITISH STANDARD 47 : 1959**

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**STEEL  
FISHPLATES  
FOR RAILWAY  
RAILS**

**BRITISH STANDARDS INSTITUTION**

BRITISH STANDARD SPECIFICATION

# STEEL FISHPLATES

FOR BULLHEAD  
AND FLAT BOTTOM  
RAILWAY RAILS

**B.S. 47 : 1959**

Incorporating amendment issued May, 1960 (PD 3771)

BRITISH STANDARDS INSTITUTION

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The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 9,000, fully indexed and with a note of the contents of each, will be found in the BSI Catalogue which may be purchased from BSI Sales Department. The Catalogue may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards :



- B.S. 9. Bullhead railway rails.
- B.S. 11. Flat bottom railway rails.
- B.S. 18. Tensile testing of metals. Part 2. Steel (general).
- B.S. 350. Conversion factors and tables.
- B.S. 1121. Methods for the analysis of iron and steel.

*British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.*

The following B.S.I. references relate to the work on this standard :  
Committee reference ISE/19      Draft for comment CY(ISE) 6642

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## CO-OPERATING ORGANIZATIONS

The Iron and Steel Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations :

Admiralty  
 Alloy Steels Association  
 British Bolt, Nut, Screw and Rivet Federation  
 British Cast Iron Research Association  
 British Constructional Steelwork Association  
 British Electrical and Allied Manufacturers' Association  
 British Engineers' Association  
 \*British Iron and Steel Federation  
 British Ironfounders Association  
 \*British Railways, The British Transport Commission  
 British Steel Castings Research Association  
 British Steel Founders' Association  
 Council of Ironfoundry Associations  
 Council of Iron Producers  
 \*Crown Agents for Oversea Governments and Administrations  
 Engineering Equipment Users Association  
 Federation of Civil Engineering Contractors  
 Institute of British Foundrymen  
 Institute of Iron and Steel Wire Manufacturers  
 Institute of Marine Engineers  
 \*Institution of Civil Engineers  
 Institution of Mechanical Engineers (Automobile Division)  
 Institution of Structural Engineers  
 Iron and Steel Board  
 Iron and Steel Institute  
 Joint Iron Council  
 Lloyd's Register of Shipping  
 Ministry of Labour and National Service (Factory Inspectorate)  
 Ministry of Supply  
 National Association of Drop Forgers and Stampers  
 National Ironfounding Employers' Federation  
 National Physical Laboratory (D.S.I.R.)  
 Oil Companies Materials Association  
 Royal Institute of British Architects  
 Shipbuilding Employers' Federation  
 Society of British Aircraft Constructors  
 Society of Motor Manufacturers and Traders Ltd.

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard :

London Transport Executive, The British Transport Commission  
 Ministry of Transport and Civil Aviation  
 Office of the High Commissioner for Australia  
 Office of the High Commissioner for the Union of South Africa  
 Individual firms

# BRITISH STANDARD SPECIFICATION FOR STEEL FISHPLATES FOR BULLHEAD AND FLAT BOTTOM RAILWAY RAILS

## FOREWORD

This revision of B.S. 47 has been authorized by the Iron and Steel Industry Standards Committee.

A complete revision of B.S. 11, 'Flat bottom railway rails', was published in 1958, and as a parallel with that revision it has been necessary to revise this standard accordingly. In the revision of B.S. 11 no changes have been made to the dimensional requirements for rails up to 55 lb/yd, but above that size and up to rails of 110 lb/yd, the sections have been completely redesigned. Rail sections of 115 lb/yd and 120 lb/yd have been deleted.

In consequence of these changes it has been necessary to amend the corresponding fishplates. At the same time, the Committee have taken the opportunity to review the general clauses of this standard and have, where practicable, brought them in line with more modern practice, and in line with the requirements of B.S. 9 and B.S. 11. It should be emphasized that no changes have been made to the dimensions of fishplates for use with bullhead railway rails, because the Committee do not propose to undertake any revision of this type of rail. The Committee also feel that it is only necessary to give the properties for fishplates for rail sections 60A to 110A.

NOTE. Where metric equivalents have been given, the figures in British units are to be regarded as the standard. The metric conversions are approximate. More accurate conversions should be based on the tables in B.S. 350 'Conversion factors and tables'.

## SPECIFICATION

### SECTION ONE : GENERAL REQUIREMENTS

#### SCOPE

1. This British Standard applies to steel fishplates for railway rails conforming to B.S. 9, 'Bullhead railway rails', and B.S. 11, 'Flat bottom railway rails'.

#### STEEL FISHPLATE SECTIONS

2. The steel fishplate sections for use with bullhead rails complying with B.S. 9 shall be in accordance with Section Two, and those for use with flat bottom rails complying with B.S. 11 shall be in accordance with Section Three.

3. The source of the steel and the steelmaking process employed shall be the responsibility of the manufacturer. The purchaser may require a broad outline of the steelmaking and steel supplies to be provided at the time of enquiry; the manufacturer shall not alter these without informing the purchaser. The steelmaking process used shall be noted on inspection and test certificates.

The chemical composition of the steel shall conform to the limits shown in Table 1 for the appropriate class.

TABLE 1. CHEMICAL COMPOSITION

| Element    | Class A |      | Class B |      |
|------------|---------|------|---------|------|
|            | %       |      | %       |      |
|            | Min.    | Max. | Min.    | Max. |
| Carbon     | 0.20    | 0.33 | 0.30    | 0.45 |
| Silicon    | —       | 0.35 | —       | 0.35 |
| Manganese  | —       | 0.90 | —       | 0.90 |
| Sulphur    | —       | 0.06 | —       | 0.06 |
| Phosphorus | —       | 0.06 | —       | 0.06 |

CHEMICAL ANALYSIS AFTER ROLLING

4. A chemical analysis for the specified elements shall be made from drillings taken from completed fishplates or from the tensile test piece or pieces selected by the engineer or the inspector (or the purchaser) and shall show that the chemical composition conforms to the requirements for the appropriate grade specified in Table 1.

When drillings are taken from a fishplate, a hole 1 in. (25.4 mm) in diameter shall be made through the thickness of the section.

NUMBER OF CHEMICAL ANALYSES AFTER ROLLING

5. The manufacturer shall make and provide the engineer or the inspector (or the purchaser) with one chemical analysis for the specified elements after rolling from each cast. If the analysis of any cast fails to conform to the provisions of Clause 3, the cast represented by the analysis which so failed may be rejected subject to the provisions of Clause 12.

TENSILE TESTS AND TEST PIECES

6. If the purchaser (or his representative) requires the tensile properties of the steel, they shall be determined in accordance with B.S. 18 : Part 2 using a round tensile test piece having an original gauge length,  $L_0 = 5.65 \sqrt{S_0}$  and a diameter of parallel length of test section of round test piece as shown in Table 2.

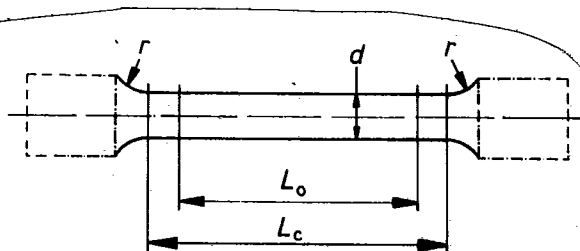


Fig. 1. Proportional round test piece

TABLE 2. RECOMMENDED DIMENSIONS FOR PROPORTIONAL ROUND TEST PIECES.

ORIGINAL GAUGE LENGTH  $L_o = 5.65 \sqrt{S_o}$ 

| Original cross-sectional area $S_o$ | Diameter of parallel length $d$ | Original gauge length $L_o$ | Parallel length $L_o$ min. | Transition radius $r$ min. | Tolerance on diameter $d$ |
|-------------------------------------|---------------------------------|-----------------------------|----------------------------|----------------------------|---------------------------|
| mm <sup>2</sup>                     | mm                              | mm                          | mm                         | mm                         | ± mm                      |
| 150                                 | 13.82                           | 69                          | 76                         | 13                         | 0.07                      |
| 78.5                                | 10.00                           | 50                          | 60                         | 10                         | 0.05                      |

Such tests shall be made on a standard test piece cut from a piece of steel selected by the purchaser (or his representative) from a fishplate, or a short length cut, at the hot saws during rolling, from a bar of which such fishplates formed a part.

The test shall show that the steel has the properties shown in Table 3.

TABLE 3. MECHANICAL PROPERTIES

| Class | Tensile strength    |                     | Minimum elongation |
|-------|---------------------|---------------------|--------------------|
|       | Min.                | Max.                |                    |
|       | N/mm <sup>2</sup> * | N/mm <sup>2</sup> * | %                  |
| A     | 430                 | 540                 | 19                 |
| B     | 550                 | 650                 | 17                 |

\*1 N/mm<sup>2</sup> = 1 MPa.

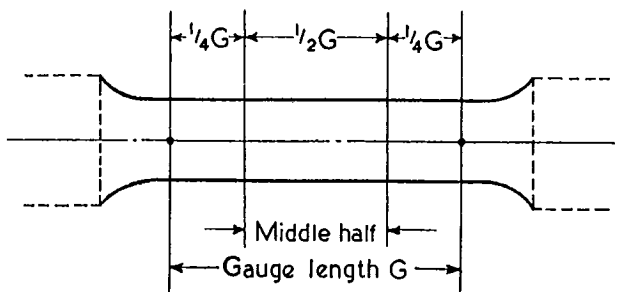


Fig. 2. Diagram explaining the term 'middle half' of the gauge length

Should a tensile test piece break outside the middle half of its gauge length (see Fig. 2) it may be discarded and such break should not be considered as a failure of the test. A further test, or tests, may be made by the manufacturer with a test piece, or test pieces, taken from a fishplate from the same cast from which the discarded test piece was taken.

#### NUMBER OF TENSILE TESTS

7. The manufacturer shall make one tensile test from each cast or part thereof if the cast consists of 20 tons (20·320 kg) of fishplates or under, and two tensile tests if the cast consists of more than 20 tons. If the test of any cast should fail all the fishplates made from the cast represented may be rejected, subject to the provisions of Clause 12.

#### BEND TESTS

8. The finished fishplates when cold, and, in the case of angle fishplates, with the flange sheared off at the angle, shall be bent between the bolt holes, without fracture on the outside, through 180° in the case of Class A and 120° in the case of Class B.

The internal radius of the bend shall not exceed twice the thickness of the fishplate at the centre. The pressure shall be applied gradually. The sheared surface of angle fishplates shall be machined or dressed to a smooth surface before bending.

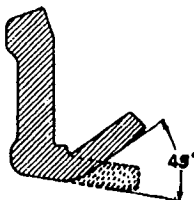


Fig. 3. Bend test on the flange of angle fishplates

The flange of an angle fishplate shall be bent upwards through an angle of 45° without fracture (see Fig. 3).

Such tests shall be made on any fishplate selected by the engineer or the inspector (or the purchaser).

#### NUMBER OF BEND TESTS

9. The manufacturer shall make one cold bend test from each cast or part thereof if the cast consists of 20 tons (20 320 kg) of fishplates or under, and two cold bend tests if the cast consists of more than 20 tons. If the test of any cast should fail all the fishplates made from the cast represented may be rejected, subject to the provisions of Clause 12.

#### CASTS TO BE KEPT SEPARATE

10. The fishplates from each cast shall be kept separate until the analysis and tests have been completed and the results have been approved by the engineer or the inspector (or the purchaser).

#### TESTS AT MANUFACTURERS' WORKS

11. The manufacturer shall carry out the mechanical tests at his works in the presence of the engineer or the inspector (or the purchaser) and shall supply the engineer or the inspector (or the purchaser) with certificates of the chemical analyses required by Clauses 4 and 5.

#### ADDITIONAL CHEMICAL ANALYSES AND MECHANICAL RETESTS

12. Should any of the chemical analyses or mechanical tests not comply with the requirements of this specification, and should the manufacturer notify the engineer or the inspector (or the purchaser) that he wishes to make additional chemical analyses and/or mechanical tests, he shall be at liberty to make additional chemical analyses and/or mechanical tests and shall, if he gives such notice, make such additional chemical analyses and/or mechanical tests as are mentioned below in this clause. The drillings, test pieces and/or pieces of fishplates for such additional chemical analyses and mechanical tests shall be taken or cut in the same manner as before and be selected by the engineer or the inspector (or the purchaser).

These additional chemical analyses and mechanical tests shall be carried out by the manufacturer in the same manner in all respects as the chemical analysis and mechanical tests first required.

*Chemical analyses.* Two additional complete chemical analyses may be made from drillings taken from two other fishplates from the same cast from which the drillings were taken for the chemical analysis which failed to conform to the requirements of Clause 3, and should either of these chemical analyses not conform to the provisions of that clause, the fishplates made from the cast represented do not comply with this British Standard.

*Tensile tests.* Two additional tensile tests in the case of casts of 20 tons (20 320 kg) or under, and three additional tensile tests in the case of casts of more than 20 tons, may be made from other fishplates taken from the same cast from which the tensile test which failed, and should any of these not comply with the requirements of Clause 6, all the fishplates made from the cast represented may be rejected.

*Bend tests.* Two additional bend tests in the case of casts of 20 tons (20 320 kg) or under, and three additional bend tests in the case of casts of more than 20 tons, may be made with other fishplates taken from the same cast from which the fishplate which failed was taken, and should any of these not comply with the provisions of Clause 8, the fishplates made from the cast represented do not comply with this British Standard.

#### INDEPENDENT CHEMICAL ANALYSES AND TENSILE TESTS

13. The engineer (or the purchaser) shall be at liberty to have independent chemical analyses and/or tensile tests made, and in the event of the chemical analyses and/or tensile tests not conforming to or complying with the provisions of Clauses 3 and 6 respectively, the cast or fishplates, as the case may be, shall be liable to rejection, provided always that, before such rejection, the additional chemical analyses and/or tensile tests mentioned in Clause 12 shall be made and the acceptance or rejection of the cast or fishplates shall depend upon the results of such chemical analyses and/or tensile tests in the same manner and to the same extent as if the manufacturer had made such chemical analyses and/or tensile tests himself. The drillings, test pieces and pieces of rails for such independent chemical analyses and tensile tests shall be selected, taken and cut in the same manner as before.

Such chemical analyses and/or tensile tests by an expert or experts to be mutually agreed upon, and the certificate or certificates of such expert or experts shall be accepted by the engineer (or the purchaser) and the manufacturer as conclusive of the results of such chemical analyses and tensile tests. The methods of chemical analyses shall be in accordance with the relevant parts of B.S. 1121 'Methods for the analysis of iron and steel'.

#### TEST FACILITIES

14. The manufacturer shall supply all templates and gauges, prepare and supply all test pieces and samples of steel, sample fishplates and drillings, and supply all labour and apparatus for testing which may be necessary or required by the engineer or the inspector (or the purchaser) for carrying out the tests and requirements of this specification, and render all reasonable assistance in making such tests. The manufacturer shall also supply all drillings, test pieces, and samples of steel for carrying out the independent chemical analyses and tensile tests provided for in Clause 13.

#### MANUFACTURE

15. All ingots used in the manufacture of the fishplates shall be clogged down into blooms and rolled into the finished fishplate bars, from each end of which sufficient crop shall be sheared to ensure that all unsound portions have been removed.

#### TEMPLATES

16. The manufacturer shall, if required by the engineer (or by the purchaser) prepare two sets of templates, internal and external, of approved metal for each British Standard section of fishplate ordered and shall submit them for the approval of the engineer or the inspector (or the purchaser) and obtain his approval before the rolling of the fishplates is commenced.

Each template shall be engraved with the name of the work for which the fishplates are required (or with the purchaser's name), the number of the British Standard rail section to which the fishplate belongs, the manufacturer's name and the date of the order or contract.

#### NOTICE OF ROLLING

17. The manufacturer shall give to the engineer or the inspector (or the purchaser) at least seven clear days notice in writing specifying the date of the proposed rolling of the first lot of fishplates and at least three clear days notice of the proposed rolling of any subsequent lot of fishplates, in order that arrangements may be made for the presence of the engineer or the inspector (or the purchaser) at the rolling. The section of the fishplate shall be approved by the engineer or the inspector (or the purchaser) at the commencement of the rolling.

#### FISHPLATES TO CONFORM TO TEMPLATES

18. Each section of fishplate shall be rolled to its respective template, and each fishplate shall take a true bearing in a metal stud gauge planed to the correct contour of the rail. The gauge shall be approved by the engineer or the inspector (or the purchaser).

The size and position of the holes shall be checked by means of suitable gauges.

#### CUTTING TO LENGTH

19. All fishplates shall be cut, either by sawing or by cold shearing, to within  $\frac{1}{16}$  in. (1.59 mm) above or below the specified length and the ends shall be square. Plates which have been cold sheared shall be re-heated to remove the effects of cold working. All burrs shall be removed.

#### STRAIGHTENING

20. Any necessary straightening of the fishplate shall be done hot after holing by gradual pressure, in a machine with proper dies of exact section, and any bulge caused by punching or otherwise shall be removed.

**FREEDOM FROM DEFECTS**

21. All fishplates shall be of uniform section throughout, and shall be sound, straight and free from defects of every kind.

**FACILITIES FOR INSPECTION OF MANUFACTURE**

22. The engineer and the inspector (and the purchaser) shall have access at all reasonable times to those parts of the manufacturer's premises where work on the subject of the contract or order is being performed and shall have liberty to inspect the same, and the manufacturer shall provide and afford all reasonable facilities for such access and inspection.

Before the fishplates are submitted to the engineer or the inspector (or the purchaser) for inspection, the manufacturer shall have them examined. He shall have all fishplates which are defective placed in a separate stack and the rest sorted into uniform lengths.

**BRANDING**

23. The number of the B.S. rail section to which the fishplate belongs, the process\* by which the steel has been manufactured, the manufacturer's name, initials or other recognized mark, and the month and year of manufacture shall be rolled in letters of such form and size and in such a position, clear of the bearing of the fishbolt head and nut, that the figures and letters can be seen when the fishplate is fixed in place, e.g. B.S. 95A—B.A.—X & Co., —2.59.

**PERMISSIBLE VARIATION IN WEIGHT**

24. A variation of 2 per cent above or below the weights given in Tables 4 and 5, or 6 and 7, as appropriate will be allowed and the calculated weight will be regarded as the actual weight.

**HOLES IN FISHPLATES**

25. The holes for the fishbolts shall at one stroke of the machine be punched at right angles through the section while the fishplates are hot, but by agreement, they shall be drilled through the fishplates in the cold state. They shall be clean, without burrs on either side, accurate in pitch, and exactly in the position and to the dimensions shown in the tables in Section 3.

**PERMISSIBLE VARIATION IN SIZE OF HOLES**

26. The dimensions of the holes may exceed the dimensions given in Sections 2 and 3 by not more than  $\frac{1}{32}$  in. (0.79 mm). Should any of the holes vary at all from the correct position or should the hole dimensions exceed the specified dimensions by more than  $\frac{1}{32}$  in. (0.79 mm), the fishplate, or fishplates, in which such variation occurs may be rejected.

\* The following abbreviations are recommended :

|      |                    |
|------|--------------------|
| O.A. | Open hearth acid.  |
| O.B. | Open hearth basic. |
| B.A. | Bessemer acid.     |
| E.   | Electric.          |

**NOTCHES FOR DOG SPIKES OR COACH SCREWS**

27. When required, the placing and size of the notches for the dog spikes or coach screws in the case of the fishplates for flat bottom rails shall be carried out in accordance with the requirements of the engineer (or of the purchaser).

**DIPPING IN BOILED OIL**

28. All fishplates shall be dipped into hot boiled linseed oil or other composition approved by the engineer or the inspector (or the purchaser) and shall, if required, be tied up into suitable bundles with steel wire not less than  $\frac{3}{16}$  in. (4.76 mm) in diameter.

**DELIVERY**

29. No fishplates shall be despatched from the manufacturer's works until the specified analyses, determinations, tests and requirements have been complied with and the fishplates have been approved as satisfactory by the engineer or the inspector (or the purchaser).