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☞ JIS E 1102 : 2001

Fish plates for rails

ICS 45.080

Descriptors : fish plates, railway rails

Reference number : JIS E 1102 : 2001 (E)

Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently **JIS E 1102 : 1992** is replaced with **JIS E 1102 : 2001**.

This revision, in striving after conformity to the corresponding International Standard, adopts **ISO 6305-1** *Railway components—Technical delivery requirements—Part 1 : Rolled steel fishplates* as the basis.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

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In the event of any doubts arising as to the contents,
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Fish plates for rails

Introduction This Standard has been prepared based on the first edition of **ISO 6305-1** *Railway components—Technical delivery requirements—Part 1 : Rolled steel fishplates* published in 1981 without modifying the technical contents of the corresponding International Standard, except supplement of the following clauses and technical contents not specified in the corresponding International Standard and deletion of some requirements of that Standard.

While **ISO 6305-1** has no specification for classification of fishplates, this Standard, as relative to flat bottom railway rails of **JIS E 1101**, specifies the classification as usual and further supplements some contents of the former **JIS**.

The parts sidelined or underlined with dots in this Standard show the matters not specified in the corresponding International Standard.

1 Scope This Japanese Industrial Standard specifies the quality requirements of the product and the conditions of acceptance testing for fishplates intended for use with railway rails⁽¹⁾ of calculated mass equal to or greater than 30 kg/m (hereafter referred to as “fishplates”).

Note ⁽¹⁾ The **JIS** standards for these rails are listed as follows.

JIS E 1101 *Flat bottom railway rails and special rails for switches and crossings of non-treated steel*

JIS E 1120 *Head hardened rails*

JIS E 1122 *Compromise rails*

JIS E 1123 *End hardened rails*

Remarks 1 The purchaser's attention is drawn to the fact that an invitation to tender should normally be accompanied by such relevant documents as definitions of the conditions of use and manufacture, and in particular those concerning the application of this Standard.

2 The International Standard corresponding to this Standard is as follows.

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

ISO 6305-1 *Railway components—Technical delivery requirements—Part 1 : Rolled steel fishplates* (MOD)

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 7514 *Steel straightedges*

JIS G 0303 *General rules for inspection of steel*

JIS G 1211 *Iron and steel—Methods for determination of carbon content*

- JIS G 1212 *Iron and steel—Methods for determination of silicon content*
- JIS G 1213 *Methods for determination of manganese in iron and steel*
- JIS G 1214 *Iron and steel—Methods for determination of phosphorus content*
- JIS G 1215 *Iron and steel—Methods for determination of sulfur content*
- JIS G 1253 *Iron and steel—Method for spark discharge atomic emission spectrometric analysis*
- JIS G 1256 *Iron and steel—Method for X-ray fluorescence spectrometric analysis*
- JIS G 1257 *Iron and steel—Methods for atomic absorption spectrometric analysis*
- JIS G 1258 *Iron and steel—Methods for inductively coupled plasma atomic emission spectrometry*
- JIS Z 2201 *Test pieces for tensile test for metallic materials*
- JIS Z 2241 *Method of tensile test for metallic materials*
- JIS Z 2243 *Brinell hardness test—Test method*
- JIS Z 9015-2 *Sampling procedures for inspection by attributes—Part 2 : Sampling plans indexed by limiting quality (LQ) for isolated lot inspection*

3 Classification and symbols Fishplates shall be classified, with the division by with/without heat treatment, to be symbolized as given in Table 1.

Table 1 Classification and symbol of fishplates

Type	Symbol	Type	Symbol
Class 1		Class 2	
For 30 kg rails	30	For 30 kg rails	30H
For 37 kg rails	37	For 37 kg rails	37H
For 40 kgN rails	40N	For 40 kgN rails	40NH
For 50 kg rails	50	For 50 kg rails	50H
For 50 kgN rails	50N	For 50 kgN rails	50NH
For 60 kg rails	60	For 60 kg rails	60H

Remarks : Those in class 1 are without heat treatment and in class 2 are with heat treatment (quenching and tempering).

4 Mechanical properties and chemical composition Table 2 gives the mechanical properties and chemical composition of fishplates. The purchaser shall designate the grade of strength, with the type, in his order. In case of no particular designation, to apply I-3 for class 1 and II-2 for class 2.

Table 2 Mechanical properties and chemical composition of fishplates

Type and symbol		Strength	Mechanical property			Chemical composition %				
		Grade	Tensile strength (N/m ²)	Elongation (%)	Hardness of finished surface, HB	C	Si	Mn	P	S
Class 1	30, 37, 40N, 50, 50N, 60	I-1	470 to 570	20 min.	—	—	—	—	—	—
	30, 37, 40N, 50, 50N, 60	I-2	550 to 650	18 min.	—	—	—	—	—	—
	30, 37, 40N, 50, 50N, 60	I-3	569 min.	15 min.	—	0.35 to 0.53	0.15 to 0.35	0.60 to 0.90	0.030 max.	0.035 max.
Class 2	30H, 37H, 40NH, 50H, 50NH, 60H	II-1	690 min. (yield point 480 min.)	12 min.	—	—	—	—	—	—
	30H, 37H, 40NH, 50H, 50NH, 60H	II-2	686 min.	12 min.	262 to 331	0.35 to 0.53	0.15 to 0.35	0.60 to 0.90	0.030 max.	0.035 max.

5 Shape and dimensions of fishplates

5.1 The shape and dimensions of fishplates shall be as shown in Table 3.

Table 3 Shape and dimensions of fishplates

Symbol		No. of Attached Fig.
Class 1	Class 2	
30	30H	Attached Fig. 1
37	37H	Attached Fig. 2
40N	40NH	Attached Fig. 3
50	50H	Attached Fig. 4
50N	50NH	Attached Fig. 5
60	60H	Attached Fig. 6

5.2 Dimensional and straightness tolerances The dimensional and straightness tolerances shall be as follows:

- Table 4 gives the dimensional and straightness tolerances, checking methods, etc.
- If, for normal operations and by agreement between the manufacturer and the purchaser, check gauges different from but equivalent to those given in 7.4 are used, only the latter shall be used in case of dispute.

Table 4 Dimensions, straightness, tolerances and checking methods

Characteristic		Dimension mm	Tolerance mm	Checking method, etc.
Length of fishplate, L		—	± 3	Checked with referee gauge, see Annex 1.
Thickness of fishplate, t		—	± 0.5	Checked with referee gauge.
Height of fishplate, h		$H < 165$ $165 \leq H < 180$ (H : height of rail)	± 0.5 ± 0.7	Checked with referee gauge. See Annex 1. May be omitted by application of the space to rail, S .
Space to rail, S		—	$+2.0$ -1.0	For 30 kg, 37 kg and 50 kg rails. Checked with referee gauge. May be omitted by application of the height of fishplate, h .
			$+1.5$ -0.5	For 40 kgN, 50 kgN, 60 kg rails. Checked with referee gauge. May be omitted by application of the height of fishplate, h .
Diameter of holes, d		$\phi \leq 32$	$+1.0$ -0.5	Checked with referee gauge. For punched holes, increase this tolerance by 0.05 times the thickness of fishplate for the diameter on the side where the punch emerges.
Position of holes (height from the rail base), h_1		—	± 1.0	Checked with referee gauge.
Intervals between holes, l_1, l_2 and l_3		—	± 1.0	Checked with referee gauge.
Size of notch, W_1 and W_2		—	± 1.0	Only for those for 30 kg, 37 kg and 50 kg rails. Checked with referee gauge.
Position of notch, l_4 and l_5		—	± 1.5	Only for those for 30 kg, 37 kg and 50 kg rails. Checked with referee gauge.
Intervals between hole and notch, l_6		—	± 1.5	Only for those for 30 kg, 37 kg and 50 kg rails. Checked with referee gauge.
Straightness deviation between ends	Upward	—	5, (2.0)	The values in () are for that for 60 kg rails. Checked by 1 m straightedge (JIS B 7514) and feeler gauges.
	Downward		5, (0.7)	
	Outward to rail		5, (2.0)	
	Inward to rail		5, (2.0)	
Inclination of fishing surfaces		—	± 3.6 (%)	Checked with referee gauge and feeler gauges. see Annex 1.
End squareness		—	± 2	Checked with referee gauge or by straight-edge.

Table 4 (concluded)

Characteristic	Dimension mm	Tolerance mm	Checking method, etc.
Radius of upper curved surface (19R) of fishplate, r	—	± 0.3	Only for that for 60 kg rails. Checked with referee gauge. See Annex 1.
Other sectional dimensions	—	± 0.5	

6 Appearance Fishplates shall be free from such defects detrimental to use for all over the length as flaws, twists and cracks.

7 Conditions of manufacture

7.1 Steelmaking process The steelmaking process shall be as follows:

- a) The steelmaking process shall be at the manufacturer's option. If requested by the purchaser, the manufacturer shall state in his tender the type and the principal characteristics of the steelmaking process; he may not alter them without advising the purchaser.

Remarks : The steelmaking process mentioned here means that by means of pure oxygen converter, electric furnace or basic Siemens-Martin process.

- b) In the steel ingot, steel cast blooms produced from continuous casting are also included.

7.2 Manufacture The manufacture of fishplates shall be as follows:

- a) Throughout the production process, the manufacturer shall use the best techniques so that the fishplates satisfy the requirements of this Standard.
- b) The ends of the steel ingot shall be cropped for a length sufficient to prevent any detrimental defect from remaining inside the fishplate.
- c) Fishplate shall be manufactured by a process of rolling, forging or hot extrusion, and shall be as follows:
- 1) To remove the burrs and fins remaining on the periphery of the fishplate.
 - 2) In the processing, to prevent detrimental decarburized layer from remaining.
- d) Any operation carried out either in the cold or hot state with the object of concealing a defect is not permitted.

7.3 Heat treatment For heat treated fishplates the manufacturer shall advise the purchaser, if required, of the conditions of heat treatment.

7.4 Working gauges The working gauges, where required by the purchaser, shall be as follows:

- a) The manufacturer shall make up, before starting production, two sets of working gauges incorporating the specified dimensional tolerances.
- b) The working gauges shall be stamped after approval by the purchaser.
- c) Only these working gauges shall be valid for checking purposes.
- d) One set of working gauges shall be made available to the receiving inspector for the period of acceptance testing (hereafter referred to as "referee gauges").
- e) The working gauges shall be provided at the manufacturer's expense.
- f) New working gauges need not be provided for items ordered in quantities of less than 5 000 at any one time.
- g) When the working gauges have been approved by a purchaser, or by an outside testing agency, these may be used for other purchasers.

7.5 Finishing

7.5.1 Straightening The straightening shall be carried out with gradual pressure and without impact.

7.5.2 Cut and fishing surface Cutting and finishing of fishplates shall be as follows:

- a) The rolled bars used shall be cut to length by any suitable method which does not impair the section and the quality of the metal.
- b) Each cut shall be free from burrs, fins, piping harmful to use and the like.
- c) Any projections shall be removed from the surfaces bearing on the rail.

7.5.3 Drilling and slotting The drilling and slotting shall be as follows:

- a) By agreement with the purchaser, the holes shall be drilled or punched.
- b) All necessary precautions shall be taken to ensure that the fishing surfaces are not deformed or the metal impaired.
- c) Burrs resulting from drilling and slotting shall be carefully removed.
- d) The dimensions of the holes and the intervals between them shall remain, on both surfaces, within the permissible tolerances limits.

8 Conditions of acceptance testing

8.1 General For the tests, the generic conditions shall be as follows:

- a) The tests shall be carried out in the manufacturer's works; the preparation of the test pieces and the costs shall be at the manufacturer's expense.
- b) Cutting and finishing of mechanical test pieces shall be made entirely in the cold state by means of machine tools and without any hammering, cold deformation, hardening or annealing.

8.2 Type and extent of tests Tests shall be carried out for the mechanical properties, chemical composition and shape and dimensions according to the following.

8.2.1 Mechanical test The mechanical test shall be as follows:

- a) For class 1 fishplates, to carry out a tensile test.
- b) For class 2 fishplates, to carry out a tensile test and a hardness test.
- c) For the tensile test JIS Z 2241 applies. The tensile test piece shall be in accordance with c) of 8.3.1.
- d) For the hardness test JIS Z 2243 applies.

8.2.2 Chemical analysis test The chemical analysis test shall be as follows:

- a) The chemical analysis test shall be carried out on fishplates of the strength grade I-3 and II-2.
- b) The chemical analysis test shall be carried out in the steelmaking mill. Where the manufacturer and the steelmakers are separate units, the steelmaker's quality certification (mill sheet) shall be deemed to contain the chemical analysis test values.
- c) The chemical analysis test shall be carried out by the methods of JIS G 1211, JIS G 1212, JIS G 1213, JIS G 1214 and JIS G 1215, or any of JIS G 1253, JIS G 1256, JIS G 1257 and JIS G 1258.

8.2.3 Shape and dimensions The test for shape and dimensions shall be as follows.

- a) The shape and dimensions shall be tested by using the working gauges specified in 7.4.
- b) The characteristics to be tested are given in 5.2, 6 and 7.5.

8.3 Selection of test pieces

8.3.1 Tensile test pieces Tensile test pieces shall be selected as follows.

- a) For the tensile test for class 1 fishplates, with those ingots in the same cast regarded as a batch, each one test piece shall be taken, in the following position in the head of fishplate produced from an optional ingot or steel material, by every batch.
 - 1) The area adjacent to one of the fishing surfaces, for those using a material corresponding to strength grades I-1 and I-2 of class 1.
 - 2) Head mid-part, for those using a material corresponding to strength grade I-3 of class 1.
- b) For class 2 fishplates, those in the same cast and the same heat treating conditions are regarded as a batch, and each one tensile test piece shall be taken, in the following portion in the head of an optional fishplate, by every batch.

- 1) The area adjacent to one of the fishing surfaces, for those using a material corresponding to strength grade II-1 of class 2.
 - 2) Head mid-part, for those using a material corresponding to strength grade II-2 of class 2.
- c) The tensile test piece shall be No. 14A of **JIS Z 2201** for those with strength grades I-1, I-2 and II-1, and No. 4 of **JIS Z 2201** for grades I-3 and II-2.

8.3.2 Hardness test samples A class 2 fishplate to be subject to hardness test shall be selected by the same methods as for the tensile test sample.

8.3.3 Chemical analysis test samples The chemical analysis test sample shall be selected in accordance with **JIS G 0303**.

8.3.4 Shape and dimensions The test sample for shape and dimensions shall be selected as follows:

- a) The parts selected for sampling shall be grouped in batches of the same kind.
- b) The samples shall be selected at random in such a way that they are representative of the batches submitted.

The size of a batch shall not be more than 5 000 parts.

- c) The purchaser or the inspector entrusted by the purchaser (hereafter referred to as inspector) has the right to break down or form batches for inspection purposes.
- d) The parts selected for sampling shall be marked by the receiving inspector, and these marks shall be kept intact until the end of the acceptance testing operations.

8.4 Checks

8.4.1 Mechanical checks The mechanical checks shall be as follows:

- a) The mechanical properties, when tested according to **8.2.1**, shall meet the values given in Table 2.
- b) If, from the batch corresponding to a cast or part cast, the single part selected for the test does not satisfy the conditions laid down, two re-tests shall be carried out as directed by the receiving inspector. If one of these re-tests is not satisfactory the corresponding batch shall be rejected.

8.4.2 Chemical analysis The chemical analysis, when carried out according to **8.2.2**, shall result to meet the values given in Table 2.

8.4.3 Shape and dimensional checks The shape and dimensional checks shall be as follows.

- a) Any fishplate which, after testing the following check items, is found to have at least one measurement exceeding the tolerance given in Table 4, or which does not satisfy the requirements of **7.5**, shall be deemed not to conform.

- 1) Length
 - 2) Height or space to the rail
 - 3) Diameter of holes
 - 4) Position of holes
 - 5) Straightness
 - 6) Inclination of the fishing surfaces
 - 7) Radius of upper curved surface (19R)
- b) The other dimensions for which tolerances are specified in Table 4 may at any time be checked by the receiving inspector, but are not subject to the decision of acceptance or rejection.
- c) The statistical sampling programme to be used shall be agreed between the purchaser and the manufacturer. The agreement shall define the acceptable levels of quality and risks and the size of the batch and of the sample.

In the absence of such an agreement, the statistical sampling plan shall be carried out according to **JIS Z 9015-2** or the Wald diagram.

The two control plans are more or less equally efficient, but the progressive plan is much more economical.

- d) The Wald diagram (see Annexes 2 and 3) involves the following risks.
- 1) a 5 % maximum probability of the rejection of a batch containing no more than 5 % of faulty parts;
 - 2) a 5 % maximum probability of the acceptance of a batch containing not less than 15 % of faulty parts.

The test shall be terminated as soon as the point representing the progress of the check enters the acceptance or rejection area.

In the case of a rejection, the manufacturer shall be entitled to sort the parts of the faulty batch, at his own expense, and to resubmit the batch for acceptance.

For the purpose of this second submission, the inspection shall be carried out in accordance with Annex 3. This provides a smaller risk for the purchaser.

8.4.4 Alternative to dimensional inspection by selection from batches—Quality control card system

- a) When the manufacturer makes a regular practice of using a system of quality control agreed by the purchaser for these products, the purchaser may arrange at his option the frequency of the dimensional inspection by sampling from batches.
- b) The results recorded on the quality control cards shall then be considered as constituting an acceptance inspection.
- c) The quality control cards shall be retained at the receiving inspector's disposal, who shall be free, at any time, to inspect the correct application of the procedure, by any method.

- d) The quality control cards shall contain any information necessary for the purpose of clearly identifying the product.
- e) They shall be retained by the manufacturer at least until 31 December of the year following the year shown on the parts.

9 Designations Fishplates shall be designated by the Standard number and type name, the Standard number and the type symbol, or the type name.

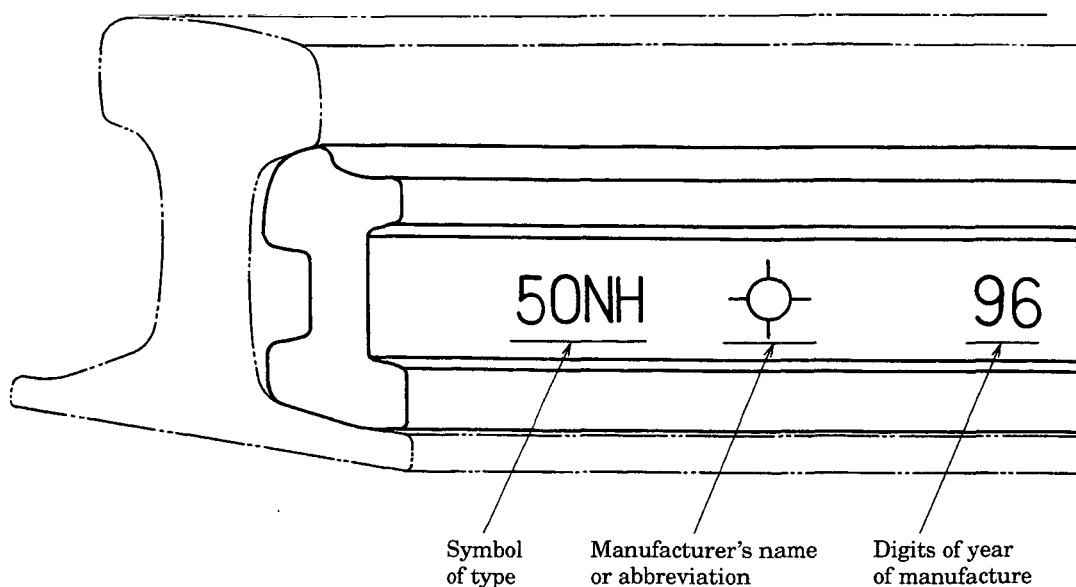
Example 1: JIS E 1102 class 2 for 50 kgN rails

Example 2: JIS E 1102 50 NH

Example 3: Class 2 for 50 kgN rails

10 Marking Fishplates shall be marked with the following information clearly in relief or stamping on the web outside surface as given in Fig. 1.

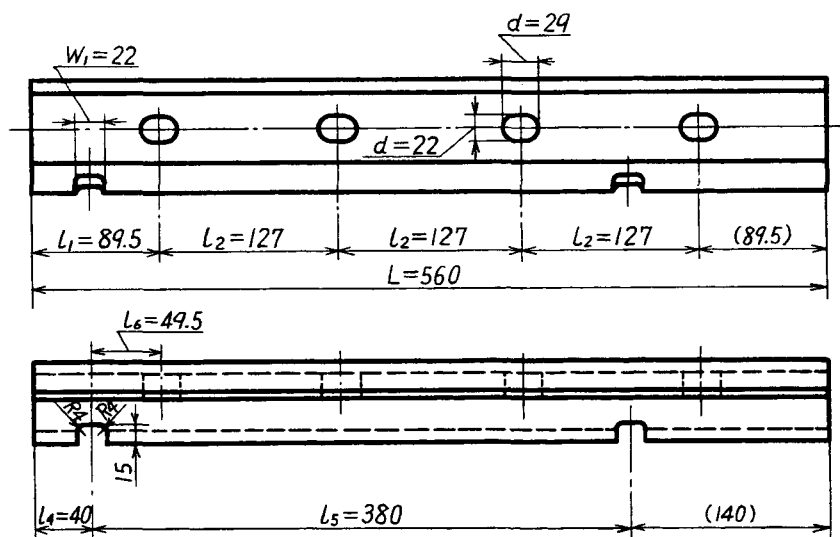
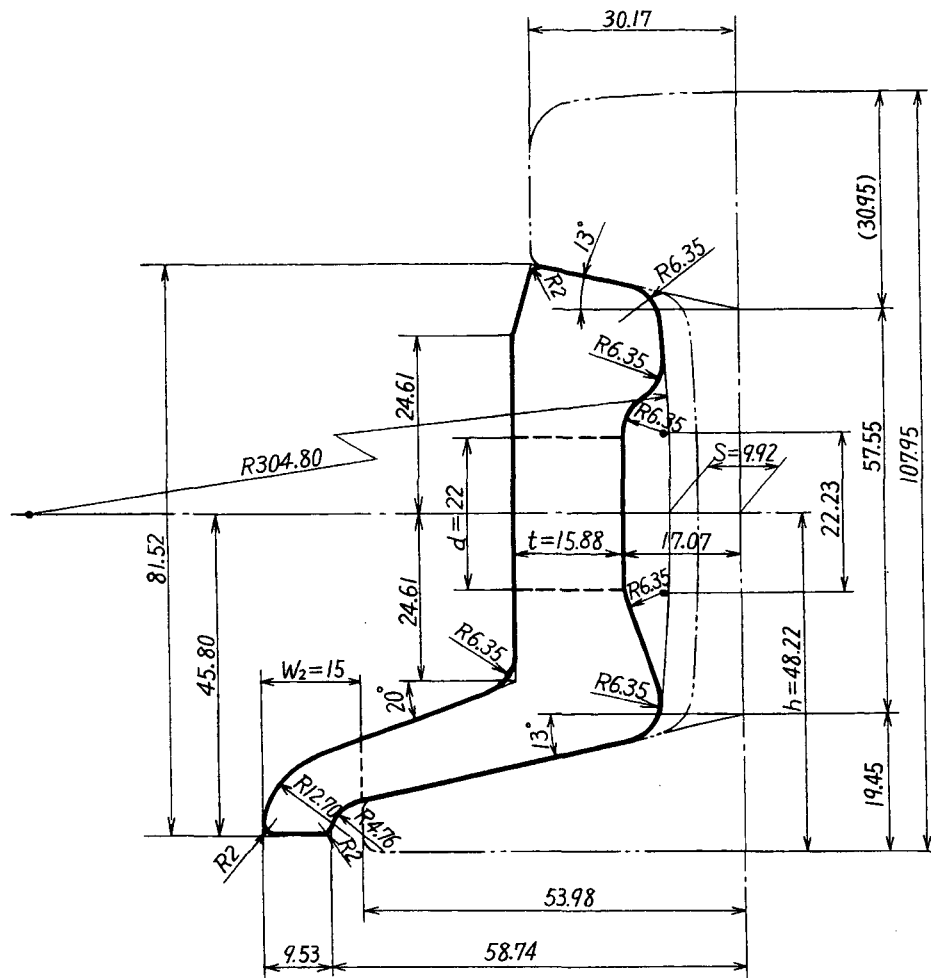
- a) Symbol of the type
- b) Manufacturer's name or abbreviation
- c) Last two digits of the year of manufacture
- d) The grade of strength (if requested by the purchaser)



Remarks : In this drawing, not to limit the position of marking "H" in symbols of the type.

Fig. 1 Example of marking

Unit : mm



- Remarks 1 Numerical values in () in the drawings are shown for information only.
2 6.7 kg in calculated mass, for informative reference.

Attached Fig. 1 Fishplate for 30 kg rails