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Translation

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Technical specification for the supply of rails

Spécification technique pour la fourniture de rails
Technische Lieferbedingungen für Schienen



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1re edition, January 1954	This document, first published in 1954 as UIC Leaflet 722, was re-numbered 860 in 1955 and again 860-1 in 1961. When Leaflets 860-1 and 860-2 were merged on 1 January 1963, the resulting Leaflet was once again given the number 860.
6e edition, January 1970	and 1 Amendment
7e edition, January 1979	and 1 Amendment
8e edition, July 1986	and 1 Amendment
9e edition, January 2008	The Leaflet has now been overhauled to reflect recent developments in technology and the publication of European standard EN 13674-1.

The person responsible for this leaflet is named in the UIC Code

Contents

Summary	1
1 - Manufacturing conditions	3
1.1 - Production processes	3
1.2 - Gauges	3
1.3 - Marking	4
1.4 - Quality of execution	5
1.5 - Finishing	5
1.6 - Tolerances	6
2 - Acceptance conditions	10
2.1 - Supervision	10
2.2 - Presentation for acceptance	10
2.3 - Nature of tests	10
2.4 - Test samples	11
2.5 - Chemical analysis	11
2.6 - Falling weight test	13
2.7 - Tensile test	15
2.8 - Macroscopic examination	17
2.9 - Brinell hardness	18
3 - General conditions	19
3.1 - Guarantee	19
3.2 - Patent rights	19
Appendix A - Asymmetry check gauge	20
Appendix B - Marks	21
Appendix C - Typical sulphur prints of rails produced from continuously cast material	22
Bibliography	28

Summary

This Leaflet defines the provisions relating to the quality and the manufacture of the steel used, as well as the acceptance conditions in respect of flat-bottomed rails weighing more than 35 kg per metre made of continuously cast non heat-treated steel.

The chief modifications relating to technological aspects are as follows:

- Deletion of the ingot casting process,
- Checking of the body of the rail,
- Modification of the acceptance gauge approval procedure,
- Revision of point 1.4 on the execution quality,
- Deletion of the specific tests or requirements in respect of the ingot casting process.

When the invitation to tender is made this Leaflet shall be accompanied by the documents necessary for the execution of the order, particularly those relating to the application of the following clauses of this specification:

- 1.1 Manufacturing procedure
- 1.2 Gauges
- 1.3 Marking
- 1.4 Quality of execution
- 1.5 Finishing
- 1.6 Tolerances,
 - 1.6.6 Weight
- 2.3 Nature of tests
 - 2.5.1 Chemical analysis - Nature of tests
- 2.7 Tensile test
- 3.1 Guarantee

At the client's request certain provisions of this Leaflet may be supplemented or replaced by provisions from *EN 13674-1* or other specific technical requirements.

N.B.:

- Where the profile or profiles indicated in the invitation to tender are selected from *EN 13674-1*, some characteristics and particularly the weight per metre may differ from those of the corresponding profiles of UIC Leaflets or national specifications. This is on account of the precise geometrical definition of the profiles contained in *EN 13674-1*.
- Where a heat-treated grade of steel is called for in the invitation to tender, reference may be made to *EN 13674-1*.

1 - Manufacturing conditions

1.1 - Production processes

At the client's request the manufacturer shall specify in his tender the nature and the chief characteristics of his production processes; these may not then be modified without the client being previously informed.

Throughout the whole production process the manufacturer shall apply the rules of the art in order to ensure that the rails satisfy the conditions of this specification. The manufacturer shall take care to produce rails exhibiting the best possible properties, especially in respect of:

- residual stresses,
- content of non-metallic inclusions,
- fracture toughness.

The manufacturer shall, upon request, inform the client of the means adopted to achieve these objectives and of the actual values obtained.

The cross section of the bloom must be such that the forging head obtained is at least 8.

Measures shall be taken to avoid the presence of hydrogen flakes. The manufacturer shall, on request, inform the client of the procedures adopted to avoid the occurrence of such flakes in the rails.

By agreement between manufacturer and purchasing railway a maximum hydrogen content may be set for each particular grade of steel.

1.2 - Gauges

The master rail profile and all the gauges required for the specific checks shall be provided by the manufacturer at his own expense, and shall be submitted for the approval of the client.

Before manufacture, the supplier shall, at the request of the client, produce two sets of male and female gauges conforming to the theoretical outline of the rail section to be produced, together with two sets of plus and minus limit gauges in accordance with the stipulated dimensional tolerances. These gauges shall be stamped for approval by the delegated client. A set of all gauges shall remain in the possession of the client throughout the acceptance period.

Only gauges bearing the stamp of the client shall be valid for checking purposes.

When a master profile or a theoretical gauge has been approved by a client or by an outside inspection agency, it shall also be used for other customers wherever possible.

The asymmetry gauge is shown in Appendix [A - page 20](#).

1.3 - Marking

The marks applied to rails shall be as follows:

1.3.1 - Compulsory marking

1. *In relief*, and very legible, in characters 20 to 30 mm high as desired by the producer, and with a relief height of at least 0,8 mm, on one of the sides of the web
 - the identification mark of the production shop,
 - the last two figures of the year of manufacture,
 - the symbol denoting the grade of steel, in accordance with Appendix B - page 21,
 - the symbol of the rail section or the weight of the rail in kg/m.

Appendix B indicates the order in which these marks are to be shown.

2. *Hot stamped*, at a distance defined in agreement between manufacturer and client.

Of a height at the discretion of the manufacturer, but of at least 10 mm, on one side of the web, where they shall appear at least once, in a position to be agreed between manufacturer and client (or his representative) and using a numerical, alphabetical or alpha-numerical code providing the following indications:

- the number of the cast from which the rail has been rolled,
- the position of the rail in relation to the top of the bloom ,
- all other reference positions of the rail in the cast, as agreed between manufacturer and client.

NB : In the event of hot stamped identification marks disappearing as a result of cropping, they shall be re-identified in agreement with the client or his delegated representative.

1.3.2 - Optional marking

In the invitation to tender the client may specify one or more of the following marks:

In relief:

- the number of the month of manufacture in Roman numerals;
- the symbol denoting the manufacturing process, in accordance with Appendix B;
- a symbol designating rails made by continuous casting.

1.3.3 - Remarks

In a continuous casting sequence a cast shall be considered as including all blooms up to, but excluding, the first bloom emanating entirely from the following cast.

By agreement between manufacturer and client certain marks may be replaced by hot-stamped marks or may be omitted.

By agreement between manufacturer and client both the relief marks and the hot-stamped marks according to standard *EN 13674-1* (see Bibliography - page 28) may be replaced by those specified in this Leaflet.

The relief markings on rails manufactured in accordance with a UIC profile leaflet must include the symbol denoting the rail profile or the weight of the rail in kg/m as specified in each of the UIC Leaflets relating to standardised rail profiles. These are the UIC 60, the UIC 54 and the UIC 50 profiles (*UIC Leaflets 861-1, 861-2 and 861-3*, see Bibliography - page 28).

1.4 - Quality of execution

The rails must be free from all detrimental defects, i.e. faults which might have an unfavourable effect on their behaviour in service.

The manufacturer must draw up a frame of reference in respect of defects specifying the rejection criteria to be adopted for each defect. This frame of reference must be approved by the client prior to the commencement of manufacture.

The manufacturer shall be responsible for ultrasonically inspecting all the rails.

Before production is started the inspection procedure must be approved by the client.

In addition, the inspection may be used for a selective sampling of the rails, in agreement with the client.

Surface defects may be examined by the client, who will decide whether such defects are likely to have an adverse effect on the performance of the rail in service or whether they can be eliminated by appropriate treatment.

1.5 - Finishing

Cold-straightening shall be effected by gradual pressure and without impacts. Where straightening rollers are used the rails must only be passed through once in each straightening plane, unless specially agreed otherwise with the client, and the markings must be protected from the action of the rollers.

The rails shall be cut to length while cold, by milling or by sawing, and the burrs shall be removed without causing any perceptible bevelling of the section.

The holes shall be produced by drilling, and the walls must be perfectly cylindrical and smooth, without any burrs and with slightly chamfered edges.

The method of packing for despatch shall be defined by agreement between manufacturer and client.

1.6 - Tolerances

1.6.1 - Section and ends

	Dimensions in mm	Tolerances	Observations
1 - Height H of rail	H < 165 165 ≤ H < 180	+ 0,5 - 0,5 + 0,6 - 0,6	A displacement of - 0,5 mm of the tolerance range is acceptable in the working range of the straightening rollers
2 - Width L of rail foot	L < 150 150 ≤ L < 160	+ 1,0 - 1,0 + 1,0 - 1,1	- ditto (with + 0,5 mm)
3 - Nominal width C of the rail head ^a		± 0,5	- ditto (with + 0,1 mm)
4 - Asymmetry of section ^b	L < 150 150 ≤ L < 160	+ 1,2 - 1,2 + 1,5 - 1,5	^c
5 - Thickness of web ^d		+ 1,0 - 0,5	
6 - Inclination of fishing surfaces (on the basis of 14 mm parallel to the inclined theoretical fishing surface)		+ 0,5 - 0,5	
7- Height of fishplating		Same tolerance as H	
8 - Squareness of the ends		+ 0,6 - 0,6	
9 - Other dimensions	as for H	Same tolerance as H	

a. Measured 14 mm below the rail running surface, i.e. at the transition between the gauge corner and the sides of the rail head.

b. Checked using the UIC gauge.

c. Should a client specifically request it, this tolerance may be reduced to ± 1,2 mm for rails of normal grade steel.

d. Measured at the point of minimum thickness.

1.6.2 - Length of rails

(measured at a temperature of 15 °C; in the case of measurements taken at a different temperature allowance should be made for expansion of the rails).

Length	Rails with fish bolt holes at both ends	Other rails
L ≤ 24 m	± 3 mm	± 6 mm
24 m < L ≤ 36 m	± 4 mm	± 10 mm
36 m < L ≤ 60 m	-	± 20 mm

1.6.3 - Diameter of holes

- For holes ≤ 30 mm: $\pm 0,5$ mm
- For holes > 30 mm: $\pm 0,7$ mm.

1.6.4 - Vertical and horizontal positioning of the holes

The horizontal position of the holes shall be checked using a gauge with a stop designed to come into contact with the end of the rail and with pins designed to enter the holes.

The diameter of the pins shall be smaller than the diameter of the holes by:

- 1 mm for holes ≤ 30 mm
- 1,4 mm for holes > 30 mm

The distances between the centre-lines of the pins and the stop shall be equal to the nominal distances from the centre-line of the holes to the end of the rail.

It must be possible for all the gauge pins to enter the hole at the same time, while the stop is in contact with the end of the rail.

The vertical centring of the holes shall be verified on the basis of the reference plane shown in the drawing in *ISO 5003, Appendix H* (see *Bibliography - page 28*). The drilling side, right or left, is determined by proceeding from the side with the relief markings.

1.6.5 - Straightness

1.6.5.1 - Rail ends

The straightness of the ends shall be checked using a 1,5 m straight-edge (see Fig. 1 - page 8).

- In the vertical plane
This tolerance applies only if the curvature causes the rail end to lift; the maximum permissible deflection is then 0,70 mm.
- In the horizontal plane
The maximum permissible deflection is 0,70 mm.

In the horizontal and vertical planes the maximum deflection must be as far as possible away from the end, and certainly not within 500 mm of the end.

1.6.5.2 - In the body of the rail

- In the vertical plane
The body of the rail shall exhibit no straightness defects greater than 0,40 mm over a base length of 1 500 mm.
- In the horizontal plane
The body of the rail shall exhibit no straightness defects greater than 0,70 mm over a base length of 1 500 mm. The measuring method shall be subject to the approval of the client. In the event of dispute the straightness of the suspect rail(s) shall be checked using a 1 500 mm straight-edge.

1.6.5.3 - Rails designed for track with particular requirements

In the case of such rails any deflections from straightness and the measuring method shall be the subject of an agreement between the client and the manufacturer.

1.6.5.4 - Remark

Rails showing deflections greater than the tolerance indicated may be straightened by means of a pressing machine and then re-checked.

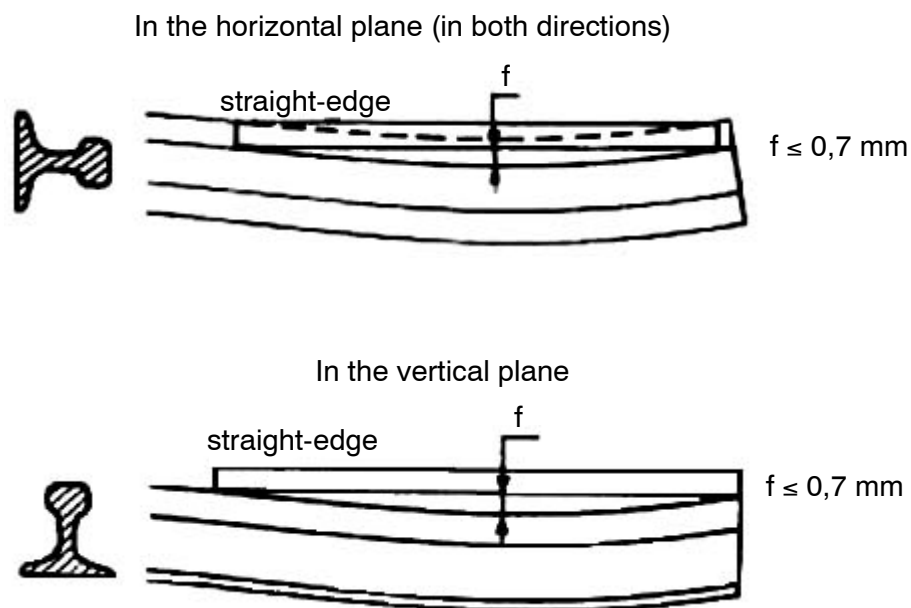


Fig. 1 - Schematic diagrams of the tolerances on the straightness of the rail ends

1.6.5.5 - Rail end twist

The rail end twist shall not exceed 0,4 mm in 1 metre. The measuring method is subject to the approval of the client.

1.6.6 - Weight

The nominal weight to be accepted per unit of length for each profile shall be calculated on the basis of a steel density of $7,85 \text{ g/cm}^3$.

For each production batch the mass of the rails delivered shall be determined by multiplying the length of these rails by the average weight per unit of length of 20 rails, half of them selected by the client and half by the manufacturer, or using any other method which might be agreed between client and manufacturer.

The weight determined in this way shall not be more than 2 % less than the nominal weight; below this limit the rails shall be rejected; above it, any excess weight greater than 1 % shall not be taken into account for costing purposes.

Where agreed between manufacturer and client, determination of the weight by weighing may be dispensed with. In this case the nominal weight calculated using the weight per metre shown on the rail drawing shall be used for invoicing purposes.

2 - Acceptance conditions

2.1 - Supervision

The client or his representative shall be entitled to monitor production, in full detail and for 24 hours a day, and to be present at all tests relating to the casting batches intended for his railway and to examine the results of these tests.

He shall be entitled to carry out all necessary checks to ensure that the manufacturing conditions specified are fulfilled to the letter.

Monitoring shall be conducted in such a way as not to interfere with the manufacturing operations without valid reason.

Before the date planned for commencement of the rolling schedule the manufacturer shall be required to advise the client. The deadline for this shall be specified in the contract.

By agreement between client and manufacturer the production and acceptance may be carried out using the manufacturer's quality assurance procedure. This quality assurance system shall be at least equivalent to the requirements set out in *ISO 9001* (see Bibliography - page 28).

In the event of any other acceptance procedure being adopted, the said procedure shall be defined by agreement between manufacturer and client.

2.2 - Presentation for acceptance

The acceptance procedure shall be carried out in such a way as not to interfere with the normal manufacturing process.

When a casting batch is rolled a number of times the tests carried out on that part of the batch rolled first may, after agreement between client and manufacturer, be considered as valid for the remaining part of the batch.

2.3 - Nature of tests

Irrespective of the above-mentioned checks on the rails, the quality of the rail material shall be defined by means of a chemical analysis and various tests including:

- falling weight tests for rolled products, but only at the request of the client;
- tensile tests on specimens; should the client so desire, the manufacturer may replace this tests with a calculation of the tensile characteristics or a Brinell hardness test:
 - the calculation of the tensile characteristics must be carried out as specified in point 2.7 - page 15;
 - the Brinell hardness test must be carried out as specified in point 2.9 - page 18;
- macroscopic examinations of crops.

The initial testpieces and also the samples intended for check tests must not be taken from rails coming from intermediate blooms. Tests shall be carried out with intermediate rails only in cases where all or part of the next casting batch has been rejected as not conforming to the specification, or for providing additional information if requested by the client.

The test methods and the conditions of execution of these tests, in so far as they are not defined in this specification, shall conform to ISO standards or to the standards applicable in the country of the manufacturer.

2.4 - Test samples

The testpieces shall be cold machined and must not be subjected to any hammering operation, any cold deformation, hardening or annealing.

The manufacturer shall be required to inform the client (or his representative) of the position from which the samples have been taken in the casting batch itself and in the casting strands. These testpieces must be representative of the production as a whole.

2.5 - Chemical analysis

2.5.1 - Nature of tests

The results of the analyses conducted by the mill laboratory with the ladle samples taken during each cast shall be communicated to the client to enable him to verify that the composition of the steel conforms to that shown in the table in point [2.5.3 - page 12](#).

The client shall, whenever he deems it necessary, witness the analysis operations in the mill laboratory.

Should the client consider it necessary to proceed with a check analysis the necessary samples shall be taken, under the supervision of the client or his representative, from those cast samples selected by the client, and after these samples have been suitably marked for identification purposes they shall be despatched immediately to a laboratory approved by both parties.

2.5.2 - Extent of tests

The manufacturer shall provide an abstract giving the chemical composition, with ladle samples, of every cast forming part of the production batch to be tested. These analyses shall include the contents of carbon, manganese, silicon, phosphorus and sulphur, as well as of any other additive elements such as chromium, molybdenum, vanadium and niobium, e.g. for grade 1100.

The number of samples to be analysed shall be one per cast.

The client shall reserve the right, wherever he feels this necessary, to check the chemical composition at the rate of one ladle sample per 20 casting batches ≤ 150 t and per 10 casting batches > 150 t.

2.5.3 - Results to be obtained

The chemical composition of the steel and the ranges within which the element contents shall fall are indicated in the table below.

The chemical analyses shall be taken on ladle samples.

The following table is valid both for tests on ladle samples and for tests on rolled products. In the case of rolled products, however, the phosphorus content may exceed by 0,01 the figures indicated in the table.

Quality	Chemical composition ^a						Tensile strength Rm N/mm ²	Elongation after fracture ^b A ₅ %
	C %	Mn %	Si %	Cr %	Pmax %	Smax %		
Grade 700	0,40-0,60	0,80-1,25	0,05-0,35	-	0,05	0,05	680-830	≥ 14
Grade 900 A	0,60-0,80	0,80-1,30	0,10-0,50	-	0,04	0,04	880-1030	≥ 10
Grade 900 B	0,55-0,75	1,30-1,70	0,10-0,50	-	0,04	0,04		
Grade 1100 ^c	0,60-0,82	0,80-1,30	0,30-0,90	0,80-1,30	0,03	0,03	≥ 1080	≥ 9

a. By agreement between manufacturer and client, the ranges of values for the chemical composition may be slightly altered in order to obtain the minimum mechanical characteristics required for the section of rail on order. This may also depend on the manufacturing process that is used.

b. The tensile test specimens for grades 900 and 1100 can be maintained at 100 °C for a period not exceeding 2 hours.

c. Other elements may only be added if agreed between user and manufacturer.

2.5.4 - Check tests

Where a check reveals that the result of a check analysis on a ladle sample deviates from the prescribed requirements, two further check analyses shall be carried out in an approved laboratory; these shall be made on two whole cross-sections cut from top-end crops of two different rolled rails originating from the cast or a part of the cast relating to the order and corresponding to the ladle sample.

If the results of these two further analyses conform to the specified requirements, the cast or part of the cast shall be accepted.

If the results do not show conformity to requirements the cast or the relevant part thereof shall be rejected. What is more, the client shall reserve the right to carry out further check tests on ladle samples coming from the same batch of 20 or 10 casts (see point 2.5.2 - page 11) as the rejected cast or part thereof. If the result of these analyses shows conformity to the specified requirements, the corresponding casts shall be accepted. If it does not, the procedure defined in points 2.5.1 and 2.5.2 shall be applied.

If a cast does not meet the conditions of the specification, rails produced from the intermediate metal belonging to the preceding casts shall be rejected or subjected to check tests. For these check tests the samples shall be taken from another strand.

2.6 - Falling weight test

2.6.1 - Nature of test

A single guided falling weight test shall be carried out, the height of the drop (in m) varying in relation to the mass per unit length of the profile M_r (in kg) and the mass of the falling weight selected M_m (in kg) according to the formula.

$$H = 150 \frac{M_r}{M_m}$$

This test shall be carried out using an unnotched testpiece at ambient temperature or which should, at all events, be above 10 °C. Features of the guided falling weight test shall be as follows:

- mass of falling weight:
1 000 kg in principle; but it may vary according to formula above;
- height of drop:
measured from the top of the rail head and variable according to formula above;
- rail:
1 300 mm minimum length, the foot resting on two bearers;
- spacing of bearers:
1 000 between centrelines.

The guides shall be absolutely rigid, straight and vertical, and arranged in such a way as to minimise friction during the fall of the weight.

The falling weight shall be symmetrical in mass and shape about 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 must not result in any sideways movement of the falling weight when it is set in motion.

The striking face of the weight shall be cylindrical at the end, the centreline of such cylinder being horizontal and in the plane of the guides. The shape shall be as indicated in Fig. 2 - page 14.

The mass of the anvil block must not be less than 10 000 kg and its supporting base must be sufficiently rigid. The bearers intended for supporting the rail to be tests shall be firmly fixed in the anvil block and shall be shaped as indicated in Fig. 3 - page 14.

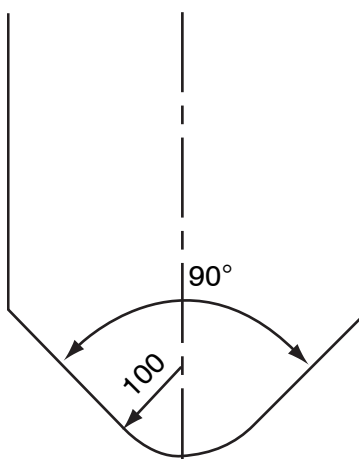


Fig. 2 -

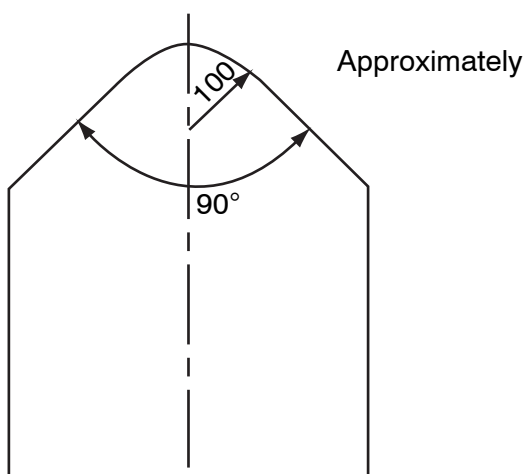


Fig. 3 -

The striking face of the falling weight and the upper part of the bearers must be trued up or replaced as soon as they become distorted.

2.6.2 - Extent of tests

One test per cast shall be carried out on a testpiece for the falling weight test. The position from which the sample is to be taken shall be as specified in point 2.4 - page 11.

By agreement between manufacturer and client the number of tests may be increased up to a maximum of one test per 100 tonnes, the samples being taken from different strands.

2.6.3 - Results to be obtained

The testpieces must be capable of withstanding the prescribed test without cracking or fracturing.

The deflection may be measured and recorded in the test report for information purposes.

No account shall be taken of tests in which the results obtained do not conform for reasons not relating to the material. Such tests shall then have to be repeated.

2.6.4 - Check tests

If a falling weight testpiece gives an unsatisfactory result two other tests must be carried out with the same casting strand the samples being taken from positions on either side of the one from which the unsatisfactory testpiece was taken, these positions being selected by agreement between manufacturer and client. At least one of these check tests must be carried out with rails from the same ingot and the material between these two checking points shall be rejected. If the two check tests give satisfactory results, all the remaining rails, produced from this strand, shall be accepted.

In the event of one of the two check tests not being satisfactory, the reasons may be investigated by the manufacturer. If the causes are established to the satisfaction of the client, further check tests may be carried out by agreement between client and manufacturer with a view to the acceptance of the remaining products.

2.7 - Tensile test

By agreement between the manufacturer and the client the tensile test may be dispensed with for continuously cast rails provided that a correlation between chemical analysis and mechanical characteristics has been established on the basis of at least 1 000 casts.

2.7.1 - Nature of tests

The tensile tests must be carried out in accordance with *EN 10002-1* (see Bibliography - page 28).

The tensile testpieces shall be cut cold and their centres shall be at point O located at $\frac{1}{4}$ of the width and $\frac{2}{5}$ of the height of the railhead, as shown in Fig. 4:

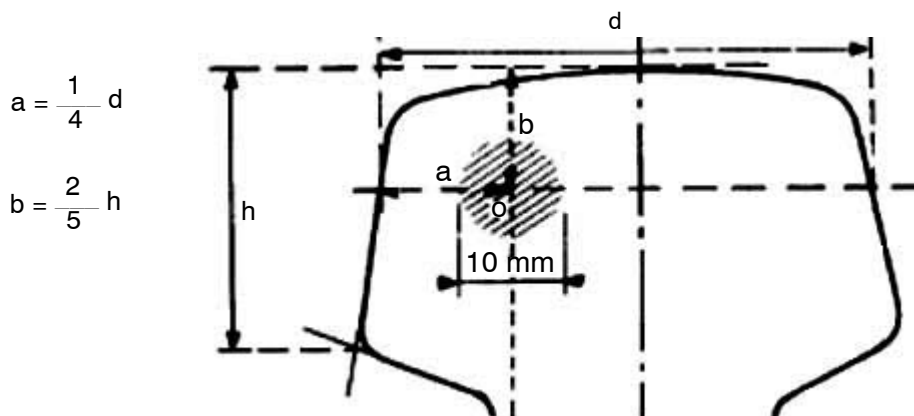


Fig. 4 -

They shall be cylindrical in shape and 10 mm in diameter, i.e. a cross-section of 78,5 mm². The length between datum marks shall be 50 mm, the calibrated part being between 60 and 70 mm.

The following shall be noted in respect of each testpiece:

- the tensile strength,
- The elongation after fracture.

2.7.2 - Extent of tests

- For casts ≤ 150 t: one test per cast.
- For casts > 150 t: two tests per cast, one taken from the first half of the cast and the other from the second.

This number may be reduced to one, by agreement between client and manufacturer.

2.7.3 - Results to be obtained

The tensile strength must conform to the table shown in point [2.5.3 - page 12](#).

No account shall be taken of tests in which the results do not conform to requirement for reasons not relating to the material. The test shall then be repeated.

The client may, at the request of the manufacturer, accept a tensile strength lower than the minimum limit indicated above but one which shall be at least 660 N/mm² for steel grade 700, 860 N/mm² for steel grade 900 and 1 060 N/mm² for grade 1100.

A shorter elongation at fracture may also be accepted, although it must not be less than 9 % for steel grade 900 and 8 % for grade 1100.

2.7.4 - Check tests

If an initial tensile test does not yield satisfactory results two further tests may be carried out. The first of these check tests shall be made with rails from the same cast strand while the second check test shall be made with rails produced from another strand of the same cast.

The check tests shall not be carried out with rails produced from the same intermediate ingot.

If the two check tests yield satisfactory results, the cast shall be accepted.

In the event of one of these two check tests or of both of them not giving satisfactory results, the causes may be investigated by the manufacturer. When these causes are established to the satisfaction of the client, further check tests may be carried out by agreement between client and manufacturer with a view to the acceptance of the remaining products.

NB : When two tensile tests have been carried out and one of them, or both, have not yielded satisfactory results, two check tests shall be carried out in the part or parts of the cast corresponding to the one for which the test results were not satisfactory.

2.8 - Macroscopic examination

2.8.1 - Nature of tests

The macroscopic examination shall be carried out with a Baumann print obtained by applying to the smooth clean surfaces of top-end and bottom-end crops a gelatino-bromide or silver citrate paper previously impregnated with a solution of sulphuric acid.

The sections intended for these tests shall be cold-sawn. They shall then be cleaned on one surface so as to completely eliminate all machining marks and to obtain a sharp macrographic impression.

In the case of rails from continuously cast material the choice of test sample position within the cast and the strand is left to the discretion of the manufacturer. The testpiece position may, however, be specified by the client in agreement with the manufacturer.

The initial testpieces and also those intended for the check tests shall not be taken from rails obtained from intermediate zones. Tests shall be carried out with such rails only where all or part of the adjacent cast has been rejected as not conforming to the specification.

2.8.2 - Extent of tests

A Baumann print shall be taken at the beginning and end of each sequence regardless of the number of casts. The Baumann print shall be taken from a different strand for each cast.

2.8.3 - Results to be obtained

The prints obtained must not reveal defects any more pronounced than those of the limit prints shown in Appendix C - page 22 (or similar to those shown).

Experience shows that in spite of the working method set out in point 2.8.1 - page 17 for obtaining Baumann sulphur prints, these prints differ in intensity of colour, and consequently this cannot be considered a decisive criterion.

The Appendix C contains a selection of typical Baumann prints which do not constitute limiting prints. The manufacturer and the client shall come to an agreement as to which prints should be considered as limiting prints.

2.8.4 - Check tests

Where an initial macroscopic examination carried out in accordance with point 2.8.3 - page 17 does not produce satisfactory results, two check tests may be carried out, the first with rails produced from the same strand and the second with rails from another strand of the same cast.

The check tests shall not be carried out with rails produced from intermediate ingots.

If the results of the two check tests are satisfactory, the cast shall be accepted.

Where the results of one or of both of these check tests are not satisfactory the causes may be investigated by the manufacturer. When these causes are established to the satisfaction of the client, further check tests may be carried out by agreement between client and manufacturer with a view to the acceptance of the remaining products.

2.9 - Brinell hardness

Should the client so desire, the tensile test may be replaced by the Brinell test described below. The Brinell hardness tests shall be conducted in accordance with the provisions of *ISO 6506-1* (see [Bibliography - page 28](#)).

2.9.1 - Nature of test

In the event of this test being carried out a print shall be made on the running surface of a piece of rail cut as indicated in point 2.4 - page 11.

The test conditions shall be as follows:

- ball diameter 10 mm
- load 29 420 N
- application time 15 seconds

2.9.2 - Extent of tests

One test per cast, where applicable on testpieces which have been used for macroscopic examinations.

3 - General conditions

3.1 - Guarantee

The rails shall be guaranteed by the manufacturer from the year of manufacturer N, which shall be shown in relief on the web of the rail, until 31 December of the year N + 5, against any defect attributable to manufacture but which might have gone undetected upon acceptance at the works.

If, during this period, any rails need to be withdrawn from service owing to a fracture or other defect, a check inspection in conjunction with the manufacturer shall be carried out, followed if necessary by a laboratory examination, or else just the laboratory examination shall be undertaken.

The client shall undertake to provide the manufacturer, on request, with sections of the defective rails for the purpose of the above-mentioned examination. Such sections shall be cut from points selected by the manufacturer to enable him to investigate the causes of the defect.

Where the manufacturing fault is detected during the inspection or examination, then, at the discretion of the manufacturer, the rail or rails shall be replaced free of charge or else a refund shall be given. In the latter case the supplier shall be required to refund their value as new at the time of withdrawal of the rail or rails in question plus any costs involved in their removal and any associated customs and transport costs, in accordance with the agreements between client and manufacturer.

If no agreement can be reached during the check inspection or examination referred to above, the matter shall be referred to specialist arbitrators approved by both parties to settle the dispute. The cost shall then be borne by the party found to be responsible.

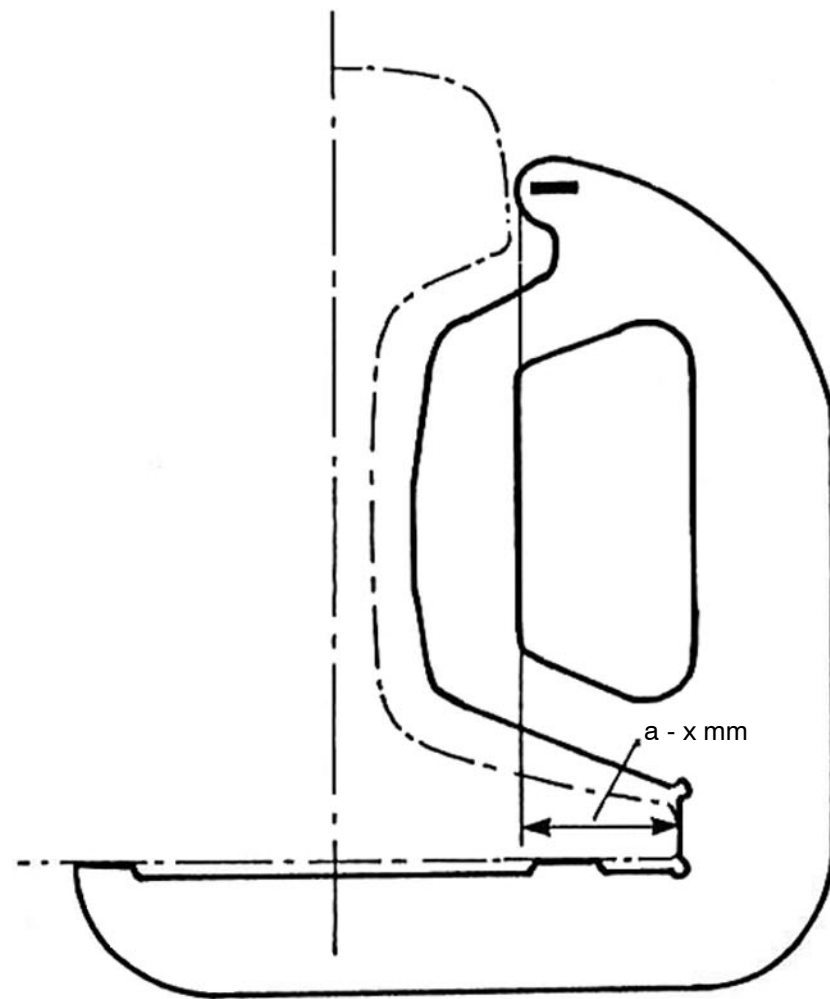
The defective rails shall remain the property of the client.

The manufacturer shall be advised, no later than 31 March of each year, of any withdrawal from service of rails covered by the guarantee and replaced during the course of the preceding year. The supplier shall have 60 calendar days in which to make his comments, from the time of his being advised or from the date of despatch of the defective rails, should he have requested these rails.

3.2 - Patent rights

Any patent rights shall be the responsibility of the manufacturer, who shall guarantee the client against any claims in this connection.

Appendix A - Asymmetry check gauge

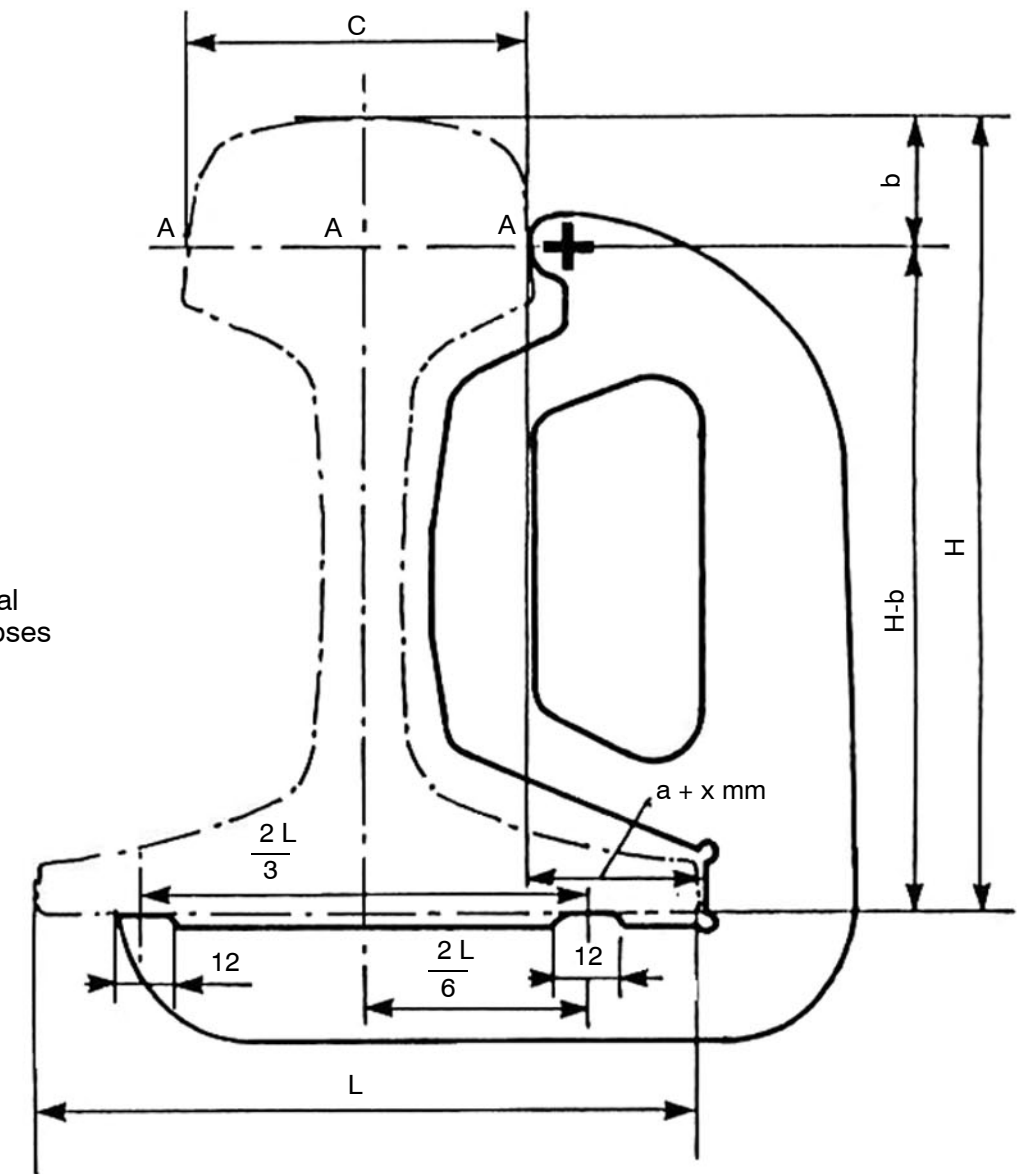


Gauge (-) is placed against the base of the rail foot and pushed sideways towards the rail

The stop (-) must not touch the rail head

- H = height of rail
- L = width of rail foot
- C = width of rail head at mid-point of side
- $a = \frac{L - C}{2}$
- x = depends on rail profile, see general table of tolerances
- b = distance from the top of the rail to the orthogonal projection of point A to the vertical centreline of the rail (for gauge design purposes H-b may be rounded off to the nearest mm).

the arrow $a \pm X$ goes right up to the gauge



Gauge (+) is placed against the base of the rail foot and pushed sideways towards the rail

The stop (+) must touch the rail head

Fig. 1 - Asymmetry check gauge

Appendix B - Marks

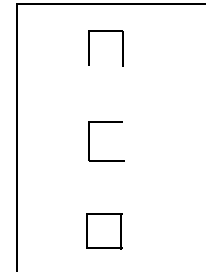
(see points 1.3.1 and 1.3.2 - page 4)

B.1 - Symbols of manufacturing processes

Siemens-Martin (basic) process.....

Electric process.....

Steel refined by oxygen blowing.....



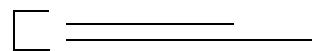
B.2 - Symbols for steel grades

Grade 700	:	no symbol
Grade 900 A	:	_____
Grade 900 B	:	_____
Grade 1100	:	_____

B.3 - Examples of rolling marks

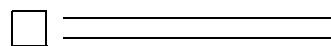
- Rail made from electric steel of grade 900 A

MANUFACTURER 85 XI UIC 54



- Rail made from grade 900 B steel refined by oxygen-blowing

MANUFACTURER 85 113



Appendix C - Typical sulphur prints of rails produced from continuously cast material



Fig. 2 - Dispersed segregation throughout the whole section (former catalogue: I)



II a

Fig. 3 - Central segregation (former catalogue: IIa)



II b

Fig. 4 - Central segregation (former catalogue: IIb)



III a

Fig. 5 - Inversed segregation (former catalogue: IIIa)



IIIb

Fig. 6 - Inversed segregation (former catalogue: IIIb)



IV

Fig. 7 - Skin blisters (former catalogue: IV)

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(Articles L 122-4 and L122-5 of the French Intellectual Property Code).

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