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Translation

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Technical specification for the supply of screw couplings for tractive and trailing stock

*Spécification technique pour la fourniture des tendeurs d'attelage pour le matériel roulant moteur et
remorqué*

Technische Lieferbedingungen für Schraubenkupplungen für Triebfahrzeuge und Wagen



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- ISO R/79:1968, withdrawn on 1.9.1981 - suggested replacement document: ISO 6506-1:1999
- ISO R/82:1974, withdrawn on 1.7.1984 - suggested replacement document: ISO 6892:1998

Standards withdrawn and replaced by ISO:

- ISO R/85:1959, withdrawn on 1.7.1985 - replaced by ISO 7438:1985
- ISO R/286:1962, withdrawn on 1.9.1988 - replaced by ISO 286-1:1988
- ISO R/942:1969, withdrawn on 1.4.1981 - replaced by ISO 5922:1981
- ISO R/943:1969, withdrawn on 1.4.1981 - replaced by ISO 5922:1981

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

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Summary

This leaflet contains the technical specification for screw couplings for railway vehicles as well as the requirements for standard screw couplers.

1 - Purpose

1.1 - Type of stock

This specification governs the supply of screw couplings for rolling stock with reinforced coupling.

The specific provisions applicable to standard screw couplers are given in Appendix B - page 21.

All details relevant to the performance of the contract, especially those concerning the application of the following points of this specification:

2.1.1 - page 3, 2.1.2 - page 3, 2.2.2 - page 5, 2.2.3 - page 6, 2.2.4 - page 7,
3.2.2 - page 9, 3.2.4 - page 10,
4.2.1.1 - page 11, 4.2.2 - page 12, 4.2.2.1.1 - page 12, 4.2.4 - page 13
5.1 - page 18.

must be indicated in the order and its appended documents.

1.2 - Classification

There shall be one type of 850 kN coupling screw only, comprising all the main parts listed below:

- 1 shackle,
- 2 links,
- 1 screw,
- 1 trunnion nut (shackle fitting),
- 1 trunnion nut (link fitting),
- 1 pin,
- 1 operating lever or handle.

1.3 - List of reference documents

Reference is made in this technical specification to the following documents:

Leaflets from UIC Code: 520, 583, 840-2 (see Bibliography - page 30).

ISO Standards: ISO 6506-1, ISO 6892, ISO 83, ISO 7438, ISO 286-1, ISO 377, ISO 5922 (see Bibliography - page 30).

2 - Characteristics

2.1 - Constituent materials

2.1.1 - List of materials

The component parts shall be manufactured from the materials mentioned in the order and its appended documents.

The steels used shall be carbon steels or low alloy steels of the same grade and quality indicated in the order and its appended documents.

NB : Steels with alloy element content not exceeding the following values:

Nickel 0,30% - Chromium 0,30% - Molybdenum 0,05% - Vanadium 0,05% - Copper 0,30% -

$Cr + Mo + Ni + Cu \leq 0,60$

Failing any indication, the materials defined in point [2.1.2 - page 3](#) shall be used.

When it is necessary for the shackles and trunnions to be hardened and tempered after assembly, the steels of which they are made shall be of the same grade.

2.1.2 - Properties of the materials

The physical, geometric, chemical and mechanical properties of the materials used shall be as prescribed in the order and its appended documents.

Failing any indication on these documents, the materials used shall have the same properties as those shown in table below, which shall be regarded as minimum values.

Component parts	Metallurgical condition or process	On the product (in %)						Re (in N)	Rm (in N)	A % on 5 d	K U ^a in joules	Bending at 180°
		C	Mn	Si	Cr	S ≤	P ≤					
Screw	Normalised	≤ 0,60	≤ 1,00	≤ 0,50		0,050	0,050	430	750/860	12	15	3,5 e
	Hardened and tempered ^{bc}	0,52/0,60 0,38/0,45	0,60/0,90 0,50/0,80	0,15/0,40 0,15/0,40	0,90/1,20	0,045 0,035	0,0450, 035	430 550	710/860 800/950	15 14	25 25	
Schackle and schackle nut	Normalised	≤ 0,50	0,40/0,80	≤ 0,40		0,045	0,045	350	600/720	18	20	
	Hardened and tempered ^{bc}	0,57/0,65 0,38/0,45	0,60/0,90 0,50/0,80	0,15/0,40 0,15/0,40	0,90/1,20	0,045 0,035	0,045 0,035	460 550	750/900 900/1050	14 14	30 25	
Link	Normalised	≤ 0,50	0,40/0,80	≤ 0,40		0,045	0,045	350	600/720	18	20	
	Hardened and tempered ^c	0,57/0,65	0,60/0,90	0,15/0,40		0,045	0,045	460	750/900	14	30	
Link nut	Normalised	≤ 0,50	0,40/0,80	≤ 0,40		0,045	0,045	350	600/720	18	20	
	Hardened and tempered ^c	0,57/0,65	0,60/0,90	0,15/0,40		0,045	0,045	460	750/900	14	30	
Pin	Normalised	≤ 0,61	0,40/0,80	≤ 0,40		0,045	0,045	390	700/850	15	20	
	Hardened and tempered ^c	0,57/0,65	0,60/0,90	0,15/0,40		0,045	0,045	460	750/900	14	30	
Washer		≤ 0,17				0,060	0,050	220	370/450	24		1,5 e
Lever	Forged	≤ 0,19				0,050	0,050		370/450	26		
	Cast	Steel A 40 M 1 <i>Leaflet 840-2</i>										
Lever support	Cast	Steel A 40 M 1 <i>Leaflet 840-2</i>										
		White malleable cast iron grade A				Quality 36-10/ISO Standard 5922 (see Bibliography - page 30)						
		Black malleable cast iron grade A				Quality 35-12/ISO Standard 5922 (see Bibliography - page 30)						

- a. To be checked on a series of 2 test pieces neither of which must give a result less than the value prescribed - test carried out at 20 °C.
b. Steel with the following properties may also be used: C 0,35%, Mn 1,5%, Ni 1%.
c. Hardening temperature: 800 to 850°C - Tempering temperature: 550 to 600°C.

2.2 - Component parts

2.2.1 - Physical characteristics

2.2.1.1 - Appearance

Parts or components in the as-forged, as-stamped or as-cast condition must have smooth surfaces, carefully trimmed and be completely free of oxides and any foundry sand. In particular, the lever and ball must be free from burring, unevenness or other defects likely to make it dangerous to operate.

The surface condition of parts for which machining is laid down must conform to that prescribed in the order and its appended documents or to that of the specimens or standards previously approved by the Railway. No lack of material, sharp angles or accidental tool marks shall be accepted, particularly on parts or components subject to tensile or bending stresses.

Connecting radii, whether machined or not, must be correctly formed and free from scoring.

2.2.1.2 - Soundness

The component parts of the screw couplings must be sound throughout and show no defect such as laps, seams or cracks, irrespective of their size.

2.2.1.2.1 - Macroscopic examination

The macroscopic examination carried out after straightforward polishing of the cross-sections of the screws, pins, links and trunnions shall not show any cavity or discontinuity.

2.2.1.2.2 - Macrographic examination

After testing, the macrographic image obtained on the sections indicated in point 2.2.1.2.1 above must be of uniform colour and free from any marked segregation.

2.2.2 - Geometric characteristics

The shapes, dimensions and their tolerances must be those fixed, for each category of component parts, in the order and its appended documents. Failing any indication to this effect, the following tolerances must be complied with:

2.2.2.1 - Dimensions limited either by 2 unmachined or rough-machined surfaces or by one unmachined or rough-machined surface

1. Transverse dimensions:

Shackles and links:

- Dimensions determining the section of the parts subject to tensile stress:

Shackles: (burned portion between the 2 parallel arms):h 15

(other parts):js 15

Links:k 15

- Other dimensions:..... Js 16 or js 16

- Other parts:..... Js 16 or js 16

2. Longitudinal dimensions (all parts): Js 16 or js 16

NB : The tolerances js 15, js 16, Js 16, h 13, h 15, H 13, k 15, are those specified by *ISO Standard 286-1* (see Bibliography).

2.2.2.2 - Dimensions limited by two machined surfaces

1. Linear dimensions:

- Bores (internal diameters): H 13
- Shafts (external diameters):..... h 13

2. Angular dimensions:..... $\pm 2^\circ$

2.2.3 - Mechanical characteristics

Heat treatment

At the time of delivery, the screws, shackles, links, trunnion nuts and pins must be in the metallurgical condition, either normalised or hardened or tempered, required by the order and its appended documents which, for hardened parts, must also specify the area of hardening.

NB : Normalising treatment is taken to mean an operation consisting of:

- either, after having left the part to cool sufficiently slowly after forging or rolling down to ambient temperature sheltered from draughts, preferably in a covered trench or under a frame, then bringing it uniformly up to a temperature above the transformation zone and maintaining it at that temperature for a long enough period of time before placing it to cool in still air;
- or, after having left the part to cool after forging or rolling down to a temperature of between 540°C and 250°C, increasing it uniformly to a temperature above the transformation zone, maintaining it at that temperature for a long enough period of time and placing it to cool slowly sheltered from draughts, preferably in a covered trench or beneath a frame.

Subject to the agreement of the purchasing Railway, the slow cooling need not be carried out when the steel has been effectively de-gassed by other means, the object of the operation being to avoid the formation of hydrogen flakes.

No heat treatment of the levers, washers and rivets is required.

2.2.3.1 - Hardness

For each of the categories of component parts of the screw coupling, the hardness values recorded after execution of the heat treatment laid down shall conform to those prescribed in the order and its appended documents.

Failing any indication, these must be within the limits laid down in Table below:

Component parts	Metallurgical conditions		Brinell Hardness HB
Screw coupling	Normalised		210 to 250
	Hardened, tempered	carbon steel	210 to 260
		alloy steel	235 to 305
Shackle and trunnion nut	Normalised		170 to 220
	Hardened, tempered	carbon steel	225 to 275
		alloy steel	260 to 325
Trunnion nut (link fitting)	Normalised		170 to 220
	Hardened, tempered		225 to 275
Pin	Normalised		195 to 240
	Hardened, tempered		225 to 275

2.2.3.2 - Resilience

The energy absorbed to fracture in the impact tests on the screws, shackles, trunnions, links and pins having undergone the heat treatment prescribed must not be less than the value fixed, for each category of parts, in the order and its appended documents or, failing any relevant indication, than that shown in table [page 4](#).

2.2.4 - Manufacturers' marks

The component parts of the screw coupling shall be marked in the manner and position specified in the order and its appended documents.

Failing any relevant indication, each part shall bear the following marks:

- all parts: the manufacturer's mark,
- the screws, shackles, trunnion nuts, links and pins: the date of manufacture (last two figures of the year of manufacture),
- mark of ownership (on the lever).

In addition, the screw couplings shall bear the characteristic marks for interchangeability as defined in *UIC Leaflet 583* ([see Bibliography - page 30](#)).

In the case of forged parts, the marks shall be embossed when hot, during the stamping operation. In the case of the screws and exceptionally the trunnion nuts and pins, the marks may be applied when cold by means of rounded-edge stamps at the end of the screws, trunnions or pins.

2.3 - Screw couplings

2.3.1 - Physical characteristics

The screw/trunnion nut assembly must move freely without the need to apply excessive force on the end of the lever.

All pin joints must move freely.

The lever must fit firmly onto the screw to avoid any subsequent play.

2.3.2 - Geometric characteristics

The screw couplings must be interchangeable.

The functional dimensions of the assembled couplings must be within the limits laid down in *UIC Leaflet 520* (see [Bibliography - page 30](#)).

2.3.3 - Mechanical characteristics

Tensile test on a complete coupling:

2.3.3.1 - Test under a load of 350 kN

After the screw couplings have been subjected to a tensile stress of 350 kN, their component parts must not show any permanent deformation exceeding the following values:

- dimensions a, b, c, d, f and g defined in figure 3 of Appendix A - [page 20](#) to this specification: $\leq 0,2\%$ of the initial length in question,
- width "e" of the shackle defined in figure 3 of Appendix A: $\leq 0,5$ mm,
- deflection of pin ends of the trunnions and of the pin in the links: $\leq 0,5$ mm,

and in addition, there must be no signs of failure.

2.3.3.2 - Test under load of 850 kN

The assembled screw couplings must be able to withstand, without fracture and without cracking, a load of 850 kN maintained for 3 minutes.

3 - Manufacture

The manufacture of the screw couplings may be entrusted only to suppliers approved by the purchasing Railway.

3.1 - Preparation of the materials

The steel used for the manufacture of the screws, shackles, trunnions, links and pins shall be fully killed and made in the electric furnace, open-hearth furnace or by a top blown oxygen process.

For steel for other components, failing any indication to the contrary in the order and its appended documents, the manufacturing process shall be left to the supplier.

3.2 - Manufacture of the component parts

3.2.1 - Forging and stamping

Any forging operation involving deformation of the metal when cold and, in particular, any cold upsetting operation, is forbidden.

The shackles and links shall be obtained by partial or complete drop stamping. The form of the forging used and the number of forging blows required shall be such as to guarantee parts free from laps or folds.

The shackles shall be formed when hot to the minimum angle required for fitting the trunnion.

The forging of the trunnions must be carried out so that the axis of the pin ends coincides with the axis of the bar used.

The holes in the various forging may be formed by hot punching to a diameter permitting finishing by machining or by a process previously approved by the purchasing Railway.

3.2.2 - Machining

The manufacture of trunnions entirely by machining from solid bars may be allowed only after prior agreement with the purchasing Railway and in accordance with the process laid down by it.

Forming of the threads of the screws by thread rolling may be permitted only after agreement and approval of the process by the purchasing Railway.

When the threads are formed by screw cutting, this operation and the tapping of the nuts may be carried out after the prescribed heat treatment.

All machining burrs shall be carefully removed.

3.2.3 - Heat treatment

The screws, trunnions, shackles, links and pins must be heat-treated; i.e. normalising or hardening and tempering, as mentioned in the order or its appended documents.

The heat treatment operations must be carried out to ensure uniformity of the characteristics within each component and also among all components heat-treated together.

The parts shall be heated in furnaces having a non-oxidising atmosphere. This must always be carried out fairly slowly until all the parts have reached a temperature of at least 400°C.

The furnace temperatures shall be checked by means of recording pyrometers correctly adjusted, placed inside the furnace so that all areas can be checked and regulated.

The quenching tanks must have sufficient capacity and be equipped with a temperature regulation system.

3.2.4 - Assembly of the component parts

Failing any indication to the contrary in the order and its appended documents, the assembly of the shackles and their trunnions shall be carried out before heat treatment. This operation may be carried out when cold.

If, by special agreement, it is permitted that the trunnion be assembled in the shackle after the heat treatment, this operation may only be effected after re-heating of the shackle and under conditions defined by the purchasing Railway.

3.2.5 - Retouching

No retouching or repair may be carried out without the prior agreement of the purchasing Railway.

The elimination of superficial defects by removal of metal when cold (chiselling, filing, grinding or other approved process) may be authorised subject, however, to compliance with the dimensional tolerances and provided the effects of the heat treatment are not destroyed.

Any welding, building up and, generally speaking, any retouching to hide a defect are strictly forbidden and shall lead to rejection of the batch.

4 - Inspection

Failing any indication to the contrary in the order and its appended documents, the materials intended for the manufacture of the component parts of the screw coupling shall be subjected, before use, to inspection of their manufacture and their characteristics. However, by special agreement, these characteristics may be checked on the components.

4.1 - Inspection of the manufacture

The representative of the purchasing Railway must be able to ensure, by any checks which he considers necessary, that the manufacturing conditions prescribed in the order and its appended documents are fully complied with in respect of the materials, component parts and screw couplings themselves.

For this purpose, the manufacturing and inspection plans must be submitted to him and he must be kept advised of any modifications made thereto, and of any incidents occurring during manufacture.

In order to ensure that the heat treatment has been correctly carried out, he must be provided with the graphs of the recording pyrometers.

4.2 - Inspection of the materials, component parts and screw couplings

It must be possible for the component parts to be examined by the representative of the purchasing Railway. They may only be assembled with his agreement.

4.2.1 - Submission for acceptance

4.2.1.1 - Materials

Failing any provision to the contrary in the order and its appended documents, rolled products shall be presented in the delivery condition fixed by the manufacturer of the screw coupling in agreement with the purchasing Railway.

Castings shall be submitted in the un-machined condition after carrying out any heat treatment prescribed.

4.2.1.2 - Component parts

The component parts and the shackle-trunnion assemblies shall be submitted for acceptance after machining and heat treatment and before any application of the prescribed protection system.

4.2.1.3 - Screw couplings

The screw couplings shall be submitted fully assembled before receiving the protection treatment prescribed.

4.2.2 - Grouping into batches

4.2.2.1 - Materials

4.2.2.1.1 - Rolled products

The conditions for grouping into batches shall be those prescribed in the order and its appended documents, particularly those defined in the specifications (See ISO/R Standards, European standards EN) to which reference is made.

When no reference is made to any other document than this specification, each batch shall consist of a maximum of 20 tons of products of the same section from the same cast.

4.2.2.1.2 - Castings

The conditions for grouping into batches shall be those laid down in the following documents:

Steel castings:	<i>UIC Leaflet 840-2 (see Bibliography - page 30)</i>
White malleable cast iron:	<i>ISO Standard 5922 (see Bibliography - page 30)</i>
Black malleable cast iron:	<i>ISO Standard 5922 (see Bibliography - page 30)</i>

4.2.2.2 - Component parts

The component parts shall be grouped into uniform batches consisting of parts from the same manufacture and having undergone the same heat treatment, comprising a maximum of:

Screws, shackles, trunnions, pins, levers:	200 parts
Links:	400 parts

4.2.2.3 - Screw couplings

Each batch shall comprise a maximum of 200 assembled screw couplings consisting of elements from the same batches.

4.2.3 - Advice of submission for acceptance

Submission for acceptance shall take place in two stages, as follows:

- Submission of the component parts;
- Submission of the assembled screw couplings.

The date of the submission shall be advised to the representative of the purchasing Railway in writing signed by the Director of the factory or his authorised representative. The letter must indicate the number of parts or the number of screw couplings submitted, the composition of the batches and their marks, also the references of the order by which they are covered.

At the same time as the submission, the supplier shall provide the representative of the purchasing Railway with a certificate testifying that all the manufacturing conditions have been complied with, and that all the hardness tests and appearance, soundness and dimensional checks have been carried out, also that their results conform to the provisions.

A record of the results of the individual hardness tests carried out on component parts shall also be provided at the time of submission for acceptance.

4.2.4 - Nature and proportion of the tests

4.2.4.1 - Materials

Each batch of materials, made up in accordance with the provisions of point 4.2.2.1 - page 12, must satisfy the checks and tests prescribed in the order and its appended documents, and particularly the specifications (See ISO/R Standards, European standards EN, UIC leaflets) to which reference is made. If the only reference is to this specification, the characteristics indicated in point 2.1.2 - page 3 shall be checked for each type of material.

4.2.4.2 - Component parts and screw couplings

Each batch of component parts or screw couplings shall, on submission for acceptance, be subjected to the checks and tests, the nature and proportion of which are given in Table below:

Equipment or parts	Nature of the checks or tests	Proportion of the checks or tests
Materials	Characteristics prescribed in the order or its appended documents or those fixed in the table under point 2.1.2 - page 3	1 test series per batch
Materials Component parts Screw couplings	Appearance and dimensions	Depending on the representative of the purchasing Railway
Component parts (all categories)	Hardness test by the supplier ^a	Principal parts ^b 100%
Screws Trunnions Shackles Links Pins	Notched bar impact test with Charpy U-notch	1 per batch for each category of parts ^c
	Macroscopic test ^d Macrographic test	
	Chemical analysis ^e	1 per cast
Assembled screw couplings	Tensile test under 350 and 850 kN	1 per batch

a. The supplier must have checked the hardness of the parts and passed to the representative of the purchasing Railway the record of the results of these tests.

b. Screws, shackles, trunnions, links, pins.

c. The test is only carried out on categories of parts designated in the order or its appended documents.

d. Only if the order and its appended documents prescribe this test.

e. Depending on the representative of the purchasing Railway, the chemical analysis on parts need not be carried out if it has already been checked on the materials.

4.2.5 - Sampling and preparation of the samples and test pieces

4.2.5.1 - Sampling

4.2.5.1.1 - Samples for tests on components

The representative of the purchasing Railway shall designate, from each of the batches submitted, the parts on which he wishes to carry out the prescribed checks and tests. He shall mark them indelibly.

The macrographic examinations, the chemical analyses and impact test on screws may be carried out on parts of the assembled screw coupling which have undergone the tensile test.

4.2.5.1.2 - Samples for tests on screw couplings

After having agreed to the assembly of the component parts, the representative of the purchasing Railway shall designate from each of the batches the part(s) of each category needed to form a complete screw coupling. He shall mark these parts indelibly.

4.2.5.1.3 - Marking of the samples and test pieces

These samples and test pieces must retain the marks and stamps of the representative of the purchasing Railway. They may only be removed in his presence.

4.2.5.2 - Preparation of the samples and test pieces

Failing any indication to the contrary, the samples and test pieces shall be prepared in accordance with the provisions of *ISO Standard 377* (see [Bibliography - page 30](#)).

4.2.5.2.1 - Materials

The test pieces shall be cut and prepared under the conditions and from the positions defined in the order and its appended documents and in particular according to the specifications (See ISO/R Standards, European standards EN, UIC leaflets) to which reference is made.

If there is no reference to any other document than this specification, the tensile, notched bar impact and bend characteristics on test pieces shall be taken parallel to the direction of rolling and cut and treated in accordance with the following conditions:

1. Constructional steels:

Test pieces situated in the outer 1/3 of the radius or diagonal of the bar and tested in delivery conditions.

2. Forging steels for normalised parts:

If the section S of the product is $S \leq 4\,225\text{ mm}^2$ the test pieces are situated at 1/3 of the radius or the diagonal of the bar.

If the section S of the product is $4\,225\text{ mm}^2 \leq S \leq 14\,400\text{ mm}^2$, the test pieces are situated along the centre line of the bar and giving a welding coefficient of 3 in relation to it.

In both cases, the roughly formed blanks shall undergo normalising treatment.

3. Forging steels for hardened and tempered parts:

The test pieces are extracted by machining from a sample consisting of a section of the hardened and tempered bar in the conditions fixed in point [2.1.2 - page 3](#).

Irrespective of the section of the product, the longitudinal axis of the test pieces shall be situated 12,5 mm from the periphery of round bars and 12,5 mm from each of the adjacent sides of square or rectangular bars.

4.2.5.2.2 - Component parts

1. Hardness

Hardness tests shall be carried out on the components themselves, the area chosen by the representative of the Railway to receive the impressions being machined or ground to a depth of about 2 mm.

2. Notched bar impact test

Two standard Charpy U-notch test pieces shall be cut from the positions defined in Figure 1 of Appendix [A - page 20](#) to this specification, which also shows the orientation of the notch.

Machining of the test pieces shall be carried out in accordance with the indications of *ISO Standard 83* (see [Bibliography - page 30](#)).

3. Macroscopic and macrographic examinations

The sections to be examined, for each category of component, are those whose position is defined in Figure 1 of Appendix A to this specification. The surface of these sections shall be carefully machined, polished and degreased.

4. Chemical analysis

The sample for chemical analysis shall consist, in principle, of a small plate of full section, weighing at least 50 grammes, cut parallel to the section intended for the macrographic examination (see Figure 1 of Appendix A).

4.2.5.2.3 - Screw coupling

The screw couplings assembled as shown in point [4.2.5.1.2 - page 14](#) intended for the tensile test shall be set up so that the trunnion nuts are about 55 mm from the ends of the screw. They shall then be marked out in accordance with the indications in Figure 3 of Appendix [A - page 20](#) to this specification. If it is found easier to do so, the marks may be applied after placing of the screw coupling on the tensile machine.

4.2.6 - Carrying out of the checks and tests

4.2.6.1 - Materials

The checks and tests shall be carried out in accordance with the provisions in the order and its appended documents, and in particular those in the specifications (See ISO/R Standards, European standards EN, UIC leaflets) to which reference is made.

If no reference is made to any other document, the tests shall be carried out in accordance with the indications of the following documents:

Tensile test for the steel	<i>ISO Standard 6892</i> (see Bibliography - page 30)
Charpy resilience test	<i>ISO Standard 83</i> (see - Bibliography)
Bend test for the steel	<i>ISO Standard 7438</i> (see - Bibliography)

4.2.6.2 - Component parts

4.2.6.2.1 - Checking the dimensions

The dimensional check on the parts shall be carried out by any suitable means, particularly with the aid of gauges supplied by the manufacturer.

The accuracy of the threads on screws and in trunnions shall be checked by means of limit gauges approved by the purchasing Railway.

4.2.6.2.2 - Soundness of the parts

The surface conditions, particularly the regularity of the connecting radii of both as-forged and machined parts, shall be examined.

In case of doubt, the representative of the purchasing Railway may have recourse to additional methods of inspection, such as magnetic particle or dye penetrant crack testing.

4.2.6.2.3 - Hardness test

The hardness test shall be carried out in accordance with the provisions of *ISO Standard 6506-1* (see Bibliography - page 30): Brinell hardness test.

4.2.6.2.4 - Notched bar impact test

The impact test made on U-notch Charpy test pieces shall be carried out in accordance with *ISO Standard 83* (see Bibliography - page 30).

Neither of the 2 test pieces shall give a result lower than the prescribed value.

4.2.6.2.5 - Macroscopic examination

The surfaces of the sections prepared as indicated in paragraph 3 - page 15 of point 4.2.5.2.2 shall be examined with the naked eye.

4.2.6.2.6 - Macrographic examination

After satisfying the macroscopic examination, the surfaces to be examined shall be carefully degreased and their macrographic image recorded by application for at least 3 minutes of a sheet of gelatine silver bromide paper soaked in water containing 2% by volume of analytical sulphuric acid (specific gravity 1,83).

4.2.6.2.7 - Chemical analysis

The methods of analysis for the various elements shall be those defined by the ISO Standards in each case.

4.2.6.3 - Screw couplings

4.2.6.3.1 - Preparation of the test

The screw coupling prepared as indicated in point [4.2.5.2.3 - page 15](#) shall be secured in the tensile machine by means of loading attachments, the shape and dimensions of which are in accordance with those of Figure 2 of Appendix [A - page 20](#).

The screw coupling shall be subjected to an initial tension of 35 kN.

Dimensions a, b, c, d, e, f and g shall be measured and noted.

4.2.6.3.2 - Test under load of 350 kN

The tensile load shall be gradually increased up to a load equivalent to 350 kN or as little in excess of that figure as possible and this shall be maintained during one minute at least before the force is reduced to its initial value of 35 kN. The dimensions a, b, c, d, e, f and g then recorded must not reveal any permanent deformation greater than that indicated in point [2.3.3.1 - page 8](#).

4.2.6.3.3 - Test under load of 850 kN

The tensile load shall again be gradually increased up to a load equivalent to 850 kN or as little in excess of that figure as possible and this shall be maintained during 3 minutes and then released. The screw coupling shall then be examined.

4.3 - Completion of inspections

Any defect in appearance or any dimensional error unacceptable for satisfactory use observed on a screw coupling shall result in its rejection.

Any result not in accordance with one of the other tests shall result in rejection of the corresponding batch.

Retests may only be carried out at the request of the supplier, with or without improvement treatment, with the prior agreement of the purchasing Railway.

5 - Delivery

5.1 - Protection against oxidation

After inspection and stamping by the representative of the purchasing Railway and before storage or despatch, the screw couplings shall receive an anti-rust coating approved by the purchasing Railway, on the machined parts.

5.2 - Packing

The parts must be carefully protected by suitable packing with a view to avoiding any deterioration, especially of the machined parts, or deformation during handling or transit.

6 - Guarantee

The components shall be guaranteed for a period of 2 years against any defect due to the manufacture. This period shall run with effect from the end of the year marked on the parts.

If the screw couplings are intended for fitting to new stock, the date of delivery of the vehicles to which these screw couplings are fitted shall be regarded as the beginning of the guarantee.

Screw couplings which, during the guarantee period, are found to have defects rendering them unsuitable for service or likely to decrease their service life shall be rejected.

Before being finally rejected, the defective screw couplings may however be subjected to a joint inspection by the purchasing Railway and the supplier, if the latter so requests.

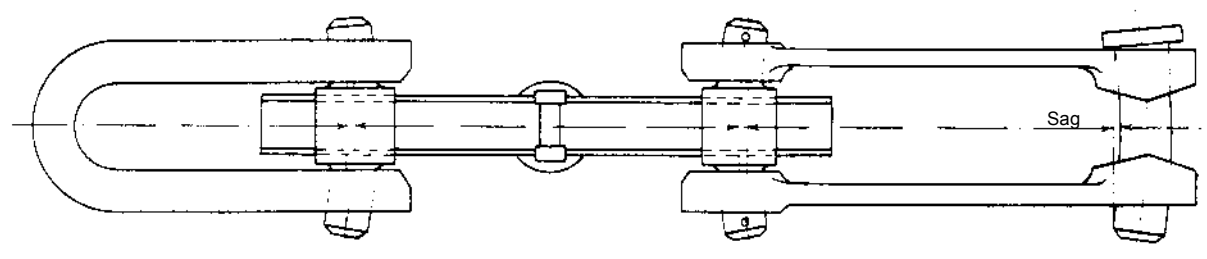
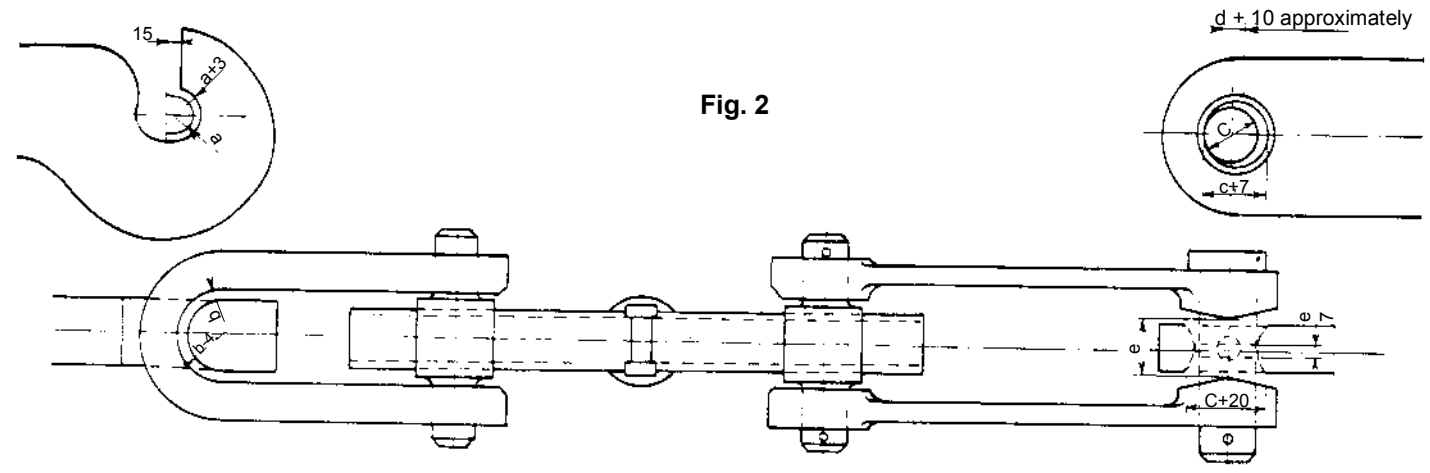
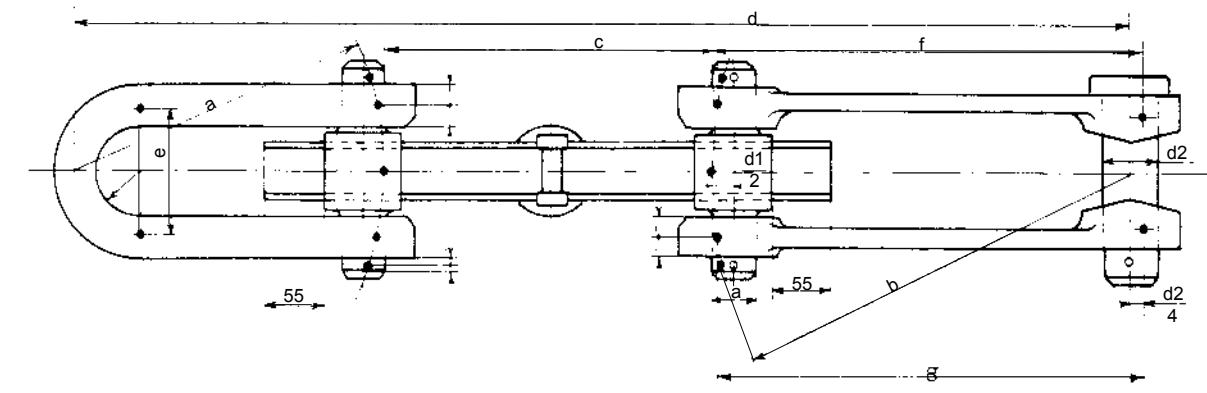
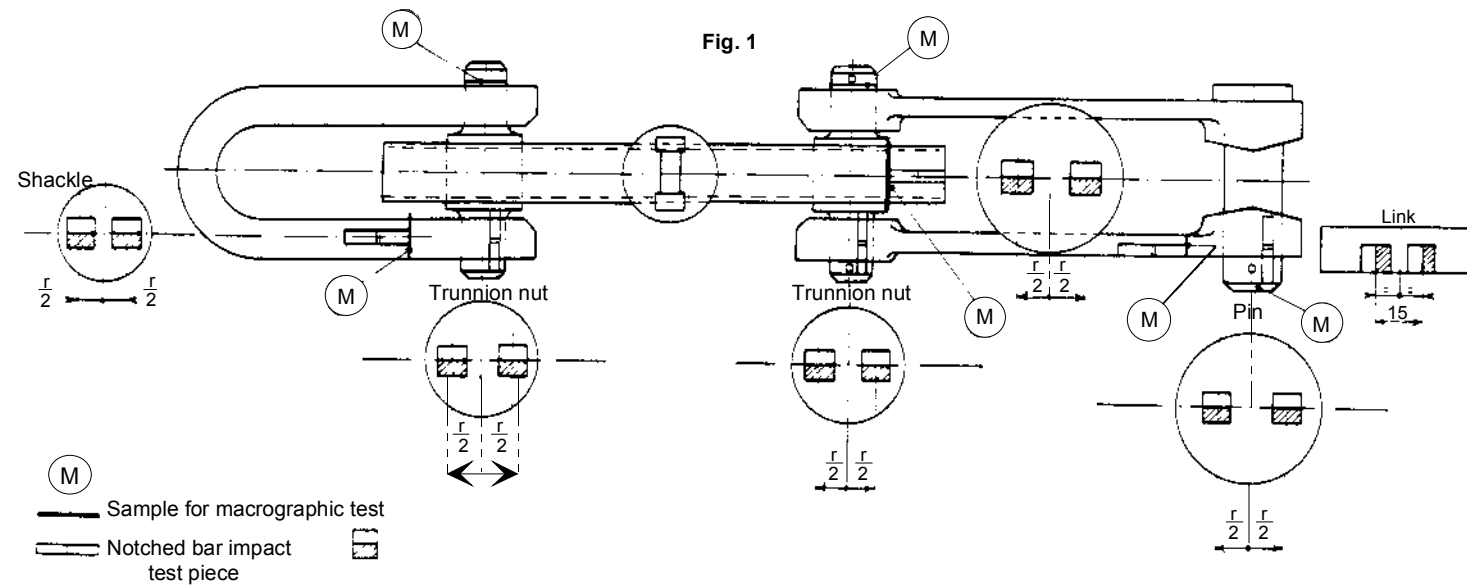
When the joint inspection confirms that the defects are definitely due either to the manufacture or to inadequate packing or protection against impacts, the defective screw couplings shall be finally rejected.

Should the results of the joint inspection not enable agreement to be reached between the Railway and the supplier, a jointly agreed expert may be appointed to arbitrate. The costs of arbitration shall be borne by the party held responsible for the defects.

When more than 5 % of the screw couplings from the same delivery show defects resulting in rejection, the purchasing Railway may reject the complete delivery.

Rejected screw couplings shall be made available to the supplier with a view to their replacement or reimbursement at their value, in new condition at the time of withdrawal.

Appendix A - Inspection and testing



Appendix B - Special requirements applicable to standard 850 kN screw couplers

NB : This Appendix has been drafted in the wake of UIC work on the standard 850 kN screw coupler, in order to enable the railways to place orders whilst pending publication of a CEN standard.

The requirements applicable to standard screw couplers (assembly drawings UIC/ERRI 100 M 3220 0001 and 100 M 3220 0002) are those contained in this specification, to which the special requirements of this Appendix are added.

The paragraphs which have been modified are given below:

1.2 - Classification (replaces the existing paragraph)

Standard screw couplings shall consist of the following parts:

- 1 shackle,
- 2 links, which shall act as the breaking point when the tractive effort exceeds 850 kN,
- 1 screw,
- 1 trunnion nut (shackle fitting),
- 1 trunnion nut/assembly or 1 trunnion nut (link fitting),
- 1 pin,
- 1 hinged handle,
- 2 spring washers,
- flat washers.

1.3 - List of documents cited (add to the paragraph)

<i>EN 287 - 1</i>	Qualification certificate for welders - Fusion welding - Steels.
<i>EN 288 - 8</i>	Description and qualification of a welding procedure for metallic materials - Qualification test based on execution of a special welded assembly prior to production.
<i>EN 10020</i>	Definition and classification of steel grades.
<i>EN 10021</i>	Steels and metallurgical products - General delivery conditions.
<i>EN 10025</i>	Hot rolled products in unalloyed construction steel.
<i>EN 10079</i>	Definition of steel products.
<i>EN 10083-1</i>	Hardening and tempering steels - Technical conditions for delivery of special steels.

<i>EN 10083-2</i>	Hardening and tempering steels - Technical conditions for delivery of quality unalloyed steels.
<i>EN 10204</i>	Metallic products - Types of inspection documents.
<i>EN 10228-3</i>	Ultrasonic inspection of forged parts (draft).
<i>EN 25817</i>	Arc-welded steel assemblies - Guide to defect acceptance levels.
<i>EN 29002</i>	Quality systems - Model for quality assurance in production and installation.

2.1.1 - List of materials (replaces the existing paragraph)

The materials shall be those indicated in the parts lists of the standard screw coupler drawings.

2.1.2 - Properties of the materials (replaces the existing paragraph)

The chemical and mechanical properties of the steels, as measured on the products, shall comply with those specified by the standards listed in Table 1 below.

Table 1 : Materials used

Component parts	Alloys	Metallurgical condition	Product standard
Screw	41 Cr 4 42 Cr Mo 4	TQ + T TQ + T	<i>EN 10083-1</i>
Link	41 Cr 4	TQ + T	<i>EN 10083-1</i>
Shackle	42 Cr Mo 4	TQ + T	<i>EN 10083-1</i>
Pin	2 C 60 3 C 60 41 Cr 4 42 Cr Mo 4	TQ + T TQ + T TQ + T TQ + T	<i>EN 10083-1</i> " " "
Trunnion nut (shackle fitting)	41 Cr 4 42 Cr Mo 4	TQ + T TQ + T	<i>EN 10083-1</i>
Trunnion nut (link fitting)	41 Cr 4 42 Cr Mo 4	TQ + T TQ + T	<i>EN 10083-1</i>
Spring washer	51 Cr V 4 ^a	TQ + T	<i>EN 10083-1</i>
Handle			
Head	1 Cr 35	TN	<i>EN 10083-2</i>
Body	1 C 35 230 - 400 M	TN TN	<i>EN 10083-2</i> <i>UIC Leaflet 840-2</i>
Flat washer	S 235 JR	Manufacturer to choose	<i>EN 10025</i>
Handle clip	S 235 JR 1 C 35	Manufacturer to choose TN	<i>EN 10025</i> <i>EN 10083-2</i>

a. Pending publication of a CEN standard on spring washers, steel grades specified in national standards can be accepted, provided the characteristics specified on the drawings are observed, for example: XC 75 of the AFNOR standard E 25-104 (See bibliography).

For unalloyed steels, the percentages of the principal alloying elements shall not exceed the limiting percentages specified in *standard EN 10020* (see point 1.3 - [page 21](#)) for each element taken separately or in combination.

The impact strength KV of the steel grades 2 C 60 or 3 C 60 must be greater than 25 J.

2.2.3.1 - Hardness (replaces the existing paragraph)

The HBS or HBW hardness values measured on parts shall fall within the ranges specified in Table 2 below.

Table 2 : Hardness levels

Component parts	Alloys and Metallurgical condition		Brinell hardness on the surface	Brinell hardness in the core
Link	41 Cr4	TQ + T	230 - 275	-
Screw	41 Cr4	TQ + T	275 - 325	-
	42 Cr Mo 4	TQ + T	305 - 355	-
Shackle	42 Cr Mo 4	TQ + T	305 - 355	-
Trunnion nuts	41 Cr 4	TQ + T	275 - 325	255 - 305
	42 Cr Mo 4	TQ + T	305 - 355	305 - 355
Pin	2 C 60	TQ + T	225 - 275	-
	3 C 60	TQ + T	225 - 275	-
	41 Cr 4	TQ + T	275 - 325	-
	42 Cr Mo 4	TQ + T	305 - 355	-

2.3.3.2 - (additional paragraph) - Fracture test on link (tensile test on finished part).

The links, in the delivery condition, shall fracture under a tensile load of between 425 kN and 475 kN.

3.1 - Preparation of the material (replaces the existing paragraph)

The steel used for the manufacture of the screws, shackles, trunnions, links and pins shall be fully killed and made in the electric furnace or by a pure oxygen process.

For steel for other components, failing any indication to the contrary in the order, the manufacturing process shall be left to the supplier.

The continuous casting procedure is permissible, provided the customer railway has previously approved the casting installation in the producing factory and approved the quality plan for the product as defined in *standard EN 29002* (see point 1.3 - [page 21](#)) including the execution of series tests on semi-finished products, including macrographic inspection and ultrasound quality checks.

If the above conditions are not met, in particular for the semi-finished products which were made:

- either by a manufacturing process not formally determined,
- or by a continuous casting method not approved by the customer railway,
- or in production factories not approved by the customer railway,

the products can nevertheless be accepted if they satisfactorily pass the checks specified in Appendix C - page 28.

3.2.2 - Machining (addition)

The thread of the screw of the standard screw coupling shall be produced by cold rolling using a process approved by the customer railway.

Central bore-holes at the ends of the coupling screw are acceptable provided this does not prevent marking of the screws.

Machining on the body of the trunnion nuts is permitted by agreement with the customer railway.

3.2.6 - Welding (additional paragraph)

3.2.6.1 - Qualification of the welders

The welders shall be qualified in accordance with *standard EN 287-1*.

3.2.6.2 - Qualification of the welding procedures

The choice of welding procedures shall be left to the supplier. For each procedure, the supplier shall prepare a qualification mock-up. It is recommended that this be done according to the requirements of the *standard EN 288-8* (see point 1.3 - page 21).

The weld obtained must meet acceptance level C of *standard EN 25817* (see point 1.3). In addition, the hardness HV 10 under the weld bead must not exceed the average value measured at five points in the parent metal by more than 80 points.

3.2.6.3 - Particular case of welding the washer on the coupler screw

The hardness should be measured on an axial cross-section of the mock-up.

By way of information, the following procedures have already been approved:

- arc welding with stainless steel electrode,
- MAG arc welding with active gas shield and a consumable stainless steel electrode.

4 - Inspection

The chemical and mechanical characteristics of the materials shall be checked on the component parts of standard screw couplers.

4.2.1.1 - Materials (replaces the existing paragraph)

The delivery of rolled products must be accompanied by an acceptance certificate (*document 3.1 B of standard EN 10204* (see point 1.3 - page 21)) or an acceptance report (*document 3.2 of standard EN 10204* (see point 1.3)) containing the following information:

- address of the factory that made them,
- manufacturing process,

- method of casting (ingot or continuous),
- delivery condition,
- for certain rolled or forged semi-finished products (as specified in *standard EN 10079* (see point 1.3 - [page 21](#))), the rate of rolling.

When a metallurgical product or semi-finished product is supplied by a manufacturer (rolling mills, finishers etc.) or an intermediary (stockist) as specified in the *standard EN 10021* (see point 1.3), he must provide the producer's document specified above, together with some appropriate means of identifying the product in order to ensure traceability between the product and the document.

If the manufacturer or the intermediary modifies the state or the dimensions of the metallurgical product or semi-finished product in any way he shall supply an additional conformity document (*standard EN 10204* (see point 1.3)) covering these new special conditions.

Cast steel parts shall be presented in the rough foundry condition and after normalisation.

4.2.4 - Nature and proportion of the tests (replaces the existing paragraph)

If the requirements of point 3.1 [page 23](#) cannot be observed, the supplier shall carry out the additional checks specified in Appendix [C - page 28](#) on semi-finished products.

Table 3 below lists the tests and checks to be carried out by the supplier on each batch, as well as the corresponding proportions.

Unless otherwise specified in the order, the tests may be carried out without the representative of the customer being present. In all cases, the customer shall be advised of the test results or the results shall be placed at his disposal.

Table 3 : Proportion of the tests - Finished products and component parts

Material or part	Nature of the checks	Proportion of the tests and checks
All component parts	Appearance and condition	100% of the parts
	Dimensions	10% of the parts
Coupler screw, shackles, links, pins	Chemical analysis	1 per casting ^a
	Macrographic examination	1 per batch
	Tensile test on specimen taken from the parts in the delivery condition (except links)	1 per batch
	Impact strength on V-notched specimens (test on 2 specimens taken on the parts) ^b	1 series per batch
	BRINELL hardness	100% of the parts
Trunnion nuts	Chemical analysis	1 per casting ^a
	Macrographic examination	1 per batch
	Impact strength on V-notched specimens (test on 2 specimens taken on the parts) ^b	1 series per batch
	BRINELL hardness on the surface	100% of the parts
	BRINELL hardness in the core	1 per batch
Screw couplings complete	Tensile test with 350 and 850 kN	1 per batch
Links	Tensile fracture test	1 per batch

a. The analysis on the parts may be dropped if already carried out on the material by the manufacturer of the parts.

b. If the specimens are taken from parts prior to the tensile test under nominal load, they shall undergo the reference treatment specified on delivery before the impact bend test.

4.2.5.2.1 - Materials (paragraph deleted)

4.2.5.2.2 - Component parts (addition)

Figure 4 [page 27](#) indicates the position of the tensile test and impact strength specimens and the macrographic slides as well as those intended for hardness measurements.

Figure 4 (see following page)

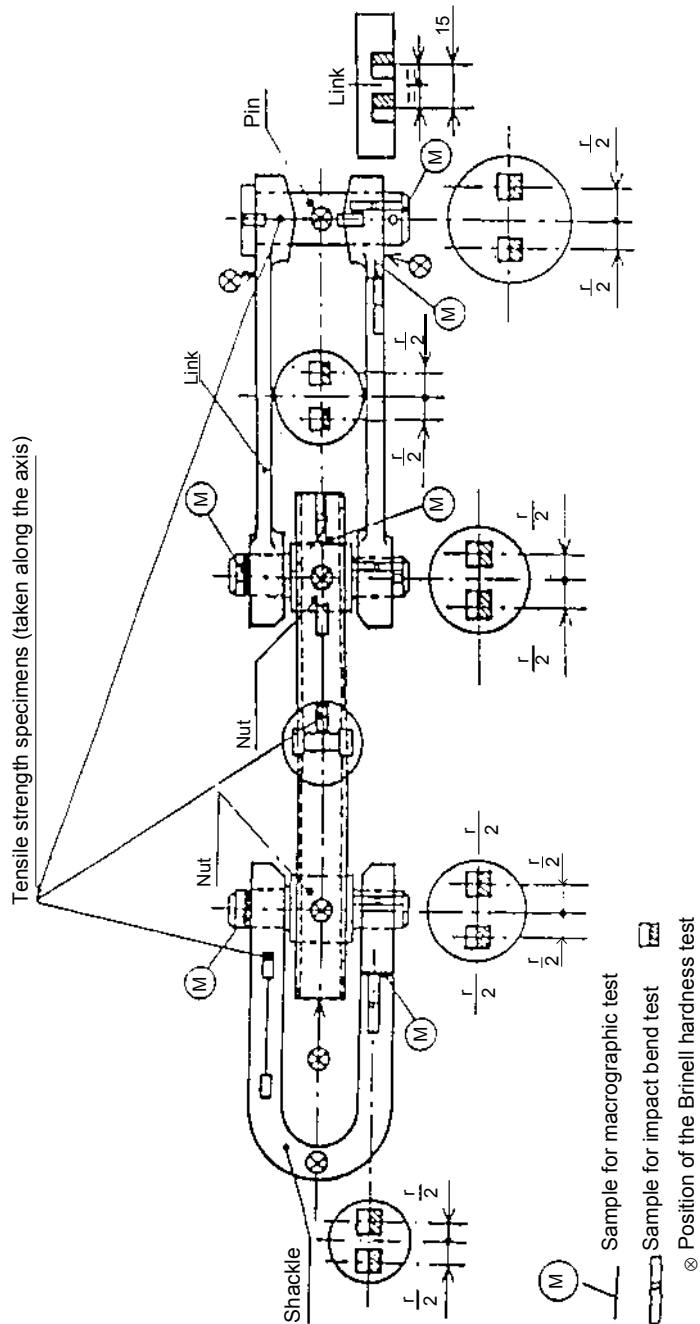
5. Tensile strength (additional paragraph to point 4.2.5.2.2)

The machining of the specimens shall be performed as indicated in *ISO Standard 83* ([see Bibliography - page 30](#)).

4.2.6.2.8 - Link fracture test (additional paragraph)

The tensile test shall be performed using appropriate apparatus to ensure that the link to be tested is subjected to the same tensile forces as in a standard screw coupling.

Figure 4



Appendix C - Additional tests on semi-finished products

C.1 - Scope and field of application

The macrographic and ultrasonic tests specified below are to be used when the semi-finished products delivered are from:

- an unspecified manufacturing procedure,
- a continuous casting process not approved by the customer railway,
- production factories not approved by the customer railway.

C.2 - Macrographic examination

This examination shall be carried out in accordance with the requirements of point [4.2.6.2.6 - page 17](#).

C.2.1 - Proposed test-pieces

The tests shall be performed on three straight sections of the ends of three semi-finished products that are representative of the casting.

C.2.2 - Test results

The BAUMANN prints (sulphur prints) obtained must be uniform, without shrink marks, cracks or clearly pronounced segregation.

C.3 - Ultrasonic inspection

This inspection shall be performed according to a procedure approved by the customer railway (equivalent diameter). It is recommended that the draft *standard EN 10228* (see point 1.3 - [page 22](#)), Part 3 be used.

The semi-finished products shall be scanned using a grid system.

- for semi-finished products of round cross-section:
 - along 2 lines at 90° to one another if the diameter is less than or equal to 200 mm,
 - along 3 lines at 60° to one another if the diameter is between 200 and 500 mm,
 - along 4 lines at 45° to one another if the diameter is greater than 500 mm.
- for semi-finished products of rectangular cross-section:
 - on 2 perpendicular faces following the lines of a quadrilateral with a square mesh and of side equal to the thickness of the test-piece without exceeding 200 mm.

Signal attenuation is taken into account above 6 dB. If a defect is detected, a fine scan is then carried out.

C.3.1 - Test proportion

The test is carried out on all the semi-finished products forming a batch from the same casting.

C.3.2 - Test results

Recurrent faults larger than 3 mm are not accepted. However, individually-occurring anomalies may be accepted (provided there is no other anomaly within 40 mm) if their equivalent diameter is less than 5 mm.

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