SLOVENSKI STANDARD
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Cevne spojke, vezne centiļ ne spojke in bazne ploģļ e za delovne in nosilne odre iz jeklenih cevi - Zahteve in postopki preskuģanja

Couplers, loose spigots and base-plates for use in working scaffolds and falsework made of steel tubes - Requirements and test procedures

Kupplungen, Zentrierbolzen und Fußplatten für Stahlrohr-Arbeitsgerüste und -Tragegerüste - Anforderungen, Prüfungen

Raccords, goujons d'assemblage et semelles pour échafaudages de service et d'étaiement en tubes d'acier - Spécifications et méthodes d'essai

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English version

Cooplers, loose spigots and base-plates for use in working scaffolds and falsework made of steel tubes; Requirements and test procedures

Raccords, goujons d'assemblage et semelles pour échafaudages de service et d'étaiement en tubes d'acier; Spécifications et méthodes d'essai

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Central Secretariat or to any CEN member.

This European Standard exists in the official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to CEN Central Secretariat has the same status as the official versions.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
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BRIEF HISTORY

Since July 1970 CEN/TC 53 "Components of tubular steel scaffoldings" has dealt with European standardization within the field of scaffolding in order to abolish trade barriers due to differing safety requirements on building sites. After preliminary vote on the European Standard EN 39 "Steel tubes for working scaffolds; requirements, tests" the European Standard pr EN 74 "Couplers and accessories for working scaffolds made of steel tubes; requirements and test procedures" was prepared and in autumn 1975 CEN submitted the first draft of this standard to its CEN Members for preliminary vote. At the same time this standard was also adopted as ISO 4054 by ISO/TC 5 "Metal pipes and fittings" and in November 1977 it was submitted to the ISO Members for vote. As the ISO Standard was adopted the first edition of ISO 4054 "Couplers, loose spigots and base-plates for use in working scaffolds made of steel tubes; requirements and test procedure" was published in April 1980.

During its 19th meeting in Copenhagen in spring 1984 CEN/TC 53 (meanwhile renamed "Scaffolds, falsework and mobile access towers") discussed once again the question concerning couplers for working scaffolds as well as for falsework and charged CEN/TC 53/WG 3 with the revision of the first draft prEN 74. In this connection the higher requirements which are necessary for falsework should also be taken into consideration.

During its 21st plenary meeting in autumn 1986 in Zurich CEN/TC 53 accepted EN 74 as amended by its working group WG 3 and requested the DIN secretariat to send EN 74 out as a European standard by CEN for final voting.

According to the Common CEN/CENELEC Rules, the following countries are bound to implement this European Standard:

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Norway, Portugal, Spain, Switzerland, United Kingdom.

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Dimensions in mm

1 Object and field of application

This European Standard specifies the requirements for materials and design, and test procedures and methods, for couplers, loose spigots and base-plates used for connecting steel tubes of 48,3 mm outside diameter and of at least 3,2 mm nominal wall thickness at a minimum in the construction of working scaffolds and falsework required for the construction, maintenance, repair and demolition of buildings and structures.

The requirements and test procedures specified are for the assessment of prototypes[1]) of these

[1]) For the purpose of this European Standard a spigot or base-plate of a new or old design submitted for the first time to specific tests specified in this standard.

couplers, loose spigots and base-plates.[2])

When no alteration has been made to the design, material or surface treatment of a type of coupler which has been approved as a prototype according to this European Standard, the assessment of subsequent production is made by comparison with the requirements given in this European Standard.

2 References

pr HD 1039-1987	Steel tubes for falsework and working scaffolds; requirements, tests
ISO 752-1982	Zinc ingots
ISO 2859-1974	(and its addendum 1), Sampling procedures and tables for inspection by attributes[3])
ISO 3207-1975	Statistical interpretation of data - Determination of a statistical tolerance interval
ISO 3951-1981	Sampling procedures and charts for inspection by variables for percent defective

3 Definitions

For the purpose of this European Standard, the following definitions apply:

3.1 Coupler: A component used for connecting two tubes.

3.2 Right angle coupler (RA): A coupler used for connecting two tubes crossing at a right angle.

Class A and class B right angle couplers have the same requirements, except that class B couplers have a higher load capacity, and a minimum requirement for torsional rigidity.

3.3 Swivel coupler (SW): A coupler used for connecting two tubes crossing at any angle.

3.4 Parallel coupler (PA): A coupler used for connecting two parallel tubes.

3.5 Sleeve coupler (SF or SS): A coupler used for joining two tubes located co-axially and whose purpose is to transmit tensile and compressive and bending forces.

Class A and class B sleeve couplers have the same requirements except that class B couplers have a minimum requirement for strength in bending and a higher tensile strength requirement.

There are two basic types of sleeve couplers:

3.5.1 Sleeve couplers functioning by friction (SF).

3.5.2 Sleeve couplers working with shear pins (SS).

3.6 Loose spigot (LS): An internal component used for aligning tubes co-axially and able to transmit compressive forces.

3.7 Base-plate (BP): A rigid plate used for spreading a load over a greater area.
If it has a means of vertical adjustment, it is called an "adjustable base-plate". This type of base-plate is not covered by this European Standard.

4 Symbols

4.1 Measured values

f	displacement in millimetres in figure 4
Δ	displacement in millimetres in figure 6
P	load in kN
L	specified lower limit for a load-bearing capacity or ultimate load in kN
ϕ	angle of rotation in degrees
Δ_1	displacement of the transverse tube under load relative to the basic tube in figure 3a) and figure 3b), or the relative displacement of two tubes in figure 8
Δ_2	displacement of the rear of the coupler fixed to the basic tube relative to the basic tube in figures 3a), 3b) and 8
Δ_3	displacement of the transverse tube relative to the basic tube resulting from the play of the swivel joint pin in figure 3b)
Δ_4	displacement of the tubes connected by a sleeve coupler relative to the two end reaction points in figure 7
$P_{max}(\Delta_1)$	maximum load-bearing capacity of the coupler in the displacement range Δ_1 = 0 to 7,0 mm for right angle and swivel couplers or 0 to 2,0 mm in the case of parallel couplers
$P_{max}(\Delta_2)$	maximum load-bearing capacity of the coupler (slipping load) in the displacement range Δ_2 = 0 to 0,5 mm
$L(\Delta_1)$, $L(\Delta_2)$, $L(\Delta)$	specified lower limit for $P_{max}(\Delta_1)$ or $P_{max}(\Delta_2)$ or $P_{max}(\Delta)$ in table 1, columns 5 and 6
$P = f(\Delta_1)$ $P = f(\Delta_2)$	relationship of load P to displacement Δ_1 or Δ_2 (load-displacement curve)
Subscript j	the running subscript j, found in Δ_j, $P(\Delta_j)$, $L(\Delta_j)$ stands for the figures j = 1,2,...; thus Δ_j means Δ_1 and Δ_2, etc.

4.2 Statistical values

N	batch size
n_a	size of random sample taken from a batch for inspection by attributes
n_v	size of random sample taken from a batch for inspection by variables

[2]) Allowable working loads shall be obtained from other appropriate documents.
[3]) At present in revision.

$\overline{x}$ mean load in kN estimated from a series of i measurements (measurements of forces) for $P_{max,i}(\Delta_j)$

$$\overline{x} = \frac{1}{n_v} \sum_{i=1}^{n_v} P_{max,i}(\Delta_j)$$

$\overline{x}(\Delta_1)$, $\overline{x}(\Delta_2)$ mean value of a series of measurements for $P_{max}(\Delta_1)$ or $P_{max}(\Delta_2)$

s standard deviation of force values in kN estimated from a series of i measurements (measurements of forces)

$$s = \sqrt{\frac{\sum_{i=1}^{n_v} (P_{max,i}(\Delta_j) - \overline{x})^2}{n_v - 1}}$$

$s(\Delta_1)$, $s(\Delta_2)$ estimate of the standard deviation from a set of measurements of $P_{max}(\Delta_1)$, or $P_{max}(\Delta_2)$

k_s the coefficient for the one-sided statistical tolerance (unknown standard deviation σ) based on sample size n_v. The interval confidence level $(1 - \alpha)$ is the probability that the statistical tolerance interval will contain at least a proportion q of the population (see ISO 3207). The interval is also a function of the estimate s of the standard deviation

$k_s = k_2(n_v, q, 1 - \alpha)$ (k_2 see ISO 3207)

z test value of a series of measurements for comparison with a specified lower limit:

$z = \overline{x} - k_s \cdot s$ in kN

$z(\Delta_1)$, $z(\Delta_2)$ test value of a series of measurements of $P_{max}(\Delta_1)$ or $P_{max}(\Delta_2)$

A_c acceptance number of a sampling plan for inspection by attributes, the choice of plan depending on the operating characteristic curve (see ISO 2859)

p the average percent defective of product in batches submitted by the supplier for inspection (see ISO 2859)

d number of defectives found in a sample

P_a probability of acceptance of a batch (of size N) in percent. For a given sampling plan, P_a is a function of the percent defective p in the batch being submitted (see 8.2.3).

5 Materials and design

5.1 Materials

All components shall be made of appropriate, if possible standardized, material such as forged steel, rolled steel, malleable cast iron, or cast steel. The material shall be free from any impurities and defects which might affect its satisfactory use, and the components shall either be made of corrosion-resistant material or be protected against oxidation and corrosion.

5.2 Design

5.2.1 Couplers

5.2.1.1 Couplers shall be designed and manufactured so that they will firmly fix tubes together even after repeated use.

5.2.1.2 Where a coupler is fixed to a tube with a diameter which is at the lower tolerance limit, the clamping device shall have at least 2,0 mm of travel remaining after tightening. For a wedge coupler, there shall be equivalent unused travel.

5.2.1.3 In normal use, the tube shall not be damaged by the couplers. However, slight local indentations and/or deformations are permitted.

5.2.1.4 The various parts of the coupler shall be firmly attached to each other unless the design precludes this and it is impossible for the coupler under load to remain in position on the tubes without all its parts.

5.2.1.5 Neither the wedge nor the end of the bolt should directly touch the tube in order to tighten the fitting unless the contact of wedge or bolt along the tube is greater than 18 mm in all cases. If necessary a permanently attached spacer shall be incorporated to protect the tube.

5.2.1.6 A coupler which is secured by means of a screw shall be so constructed that it will perform satisfactorily when tightened as follows:

Tightening torque shall be indicated by the manufacturer and preferably shall be between 40 and 80 Nm. For types of couplers where hexagonal nuts are used with ISO threads, the following tightening torques are preferred:

a) width across flats 22 mm: 50 Nm[4])
b) width across flats 24 mm: 80 Nm.

When tightened with these torques, the maximum stress in screwed components shall not be greater than 70 % of the yield stress of the material.

Couplers secured with a wedge shall be tightened by striking the wedge with a 500 g hammer, until there is a jarring blow.

5.2.1.7 In addition, sleeve couplers shall be such that the tubes are co-axial and shall have a tube centering device which ensures that both ends of the sleeve coupler will grip at least 46 mm of tube either end of the centering device.

[4]) The 22 mm size is not in accordance with ISO 272

5.2.2 Loose spigots

Loose spigots shall extend to a depth of at least 75 mm into the tubes on both sides of the flange. The outside diameter of flanges shall be not greater than 47,8 mm and not less than 47,0 mm. The circumscribing circle of the body shall have a diameter of not greater than 37,5 mm and not less than 35,0 mm, with the exception of cross-shaped bodies, which may have a maximum diameter of 38,7 mm. The flange and spigot axis shall be concentric, and the tolerance on concentricity shall be 1,0 mm.

5.2.3 Rigid base-plates

Each base-plate shall have a circular or square base with an area not less than 150 cm^2. The thickness of the plate shall be at least 5 mm for base areas up to 175 cm^2; if the base area is larger than this, the thickness shall be increased in proportion to the largest dimension of the base area. If the plate is shaped, the rigidity shall be equivalent to that of a flat base-plate.

5.2.3.1 The base-plate shall have a centering device which is so designed that it cannot move a distance greater than 11,0 mm within a bore of 43,0 mm internal diameter (see figure 1). The centering device shall be at least 50 mm long.

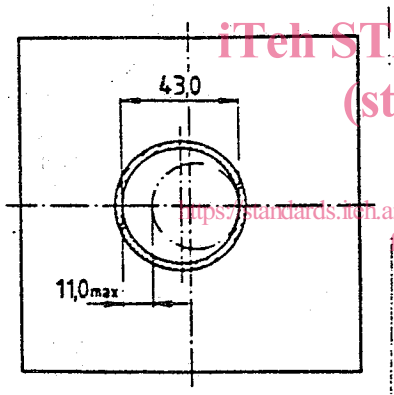


Figure 1. Maximum clearance between centering device and tube

5.2.3.2 The base-plate including the centering device shall be made from material having a tensile strength of not less than 300 N/mm^2 and a yield stress of not less than 200 N/mm^2.

5.3 Data required from the manufacturer for assessment purposes

The manufacturer shall record on drawings the following data for couplers, loose spigots and base-plates:

a) shape;

b) essential dimensions with tolerances;

c) mass with tolerance;

d) material characteristics;

e) surface protection;

f) the required tightening torque in the case of screw couplers;

g) the maximum permissible play of the swivel joints in the case of swivel couplers.

6 Requirements

6.1 Design requirements

6.1.1 All couplers, loose spigots and base-plates shall comply with the relevant items in clause 5.

6.1.2 The dimensions, mass and material characteristics shall lie within the tolerances specified in the manufacturer's drawings referred to in 5.3. The surface protection shall be as specified in the manufacturer's drawings.

6.2 Required characteristics for couplers under load (see clause 9)

The requirements for prototype testing of couplers are listed in table 1.

6.2.1 Assessment without statistical analysis

Where a coupler (as specified in column 1 of table 1) is tested using one of the procedures in column 2 and 3, the following limits shall apply in the case of non-statistical assessment:

a) in any test the load-bearing capacity or breaking load in column 4 shall not be less than the lower limit L or $L(\Delta_j)$ in column 5 for class A couplers or column 6 for class B couplers.

b) the appropriate permissible displacement range Δ_j in column 7 shall not be exceeded in any test at the lower limit $L(\Delta_j)$ of the load-bearing capacity specified in column 5 for class A couplers or column 6 for class B couplers.

Column 8 of table 1 gives the minimum number of tests required.

6.2.2 Assessment with statistical analysis

Prototype couplers are in accordance with this European Standard for their load-bearing capacity $P(\Delta_j)$ if it can be stated with a confidence level of 95 % that at least 90 % of the items in the batch from which the random sample was taken exhibit the same or better load-bearing capacity $P_{max}(\Delta_j)$ than the specified lower limit $L(\Delta_j)$. Examples of assessment procedures which test acceptance to these requirements are indicated in 8.2.4 and 8.2.5.

Further assessment procedures which may also be applied are to be found in ISO 2859 (and its addendum 1), ISO 3207 and ISO 3951.

6.3 Requirements in the case of design alteration

Where alterations which are likely to degrade performance are made to the design, material or surface treatment of couplers which have already been submitted to a prototype test, a new test shall be made.

7 Sampling for prototype tests

7.1 Sampling shall be carried out by an agreed representative of a competent authority or by an independent organization approved by the competent authority.

7.2 The test pieces required for prototype testing shall be taken at random (see ISO 2859, addendum 1) from a batch of at least 500 couplers obtained from the manufacturer's current production run or from stock.

7.3 The number of test pieces is specified in the description of the appropriate test procedure (see 9.2 to 9.10). In addition, the number is shown in column 9, table 1.

7.4 In statistical assessment, it may become necessary, depending on the operating characteristic and assessment procedure chosen, to test more couplers per batch than the minimum number indicated in column 9, table 1 (see also 8.2).

8 Assessment methods

8.1 Assessment without statistical analysis

8.1.1 Evaluation procedure

All tests which are marked "non statistical" in column 10 of table 1 are assessed without statistical analysis.

8.1.2 Criteria

a) All the loads measured in a given test series (for example ultimate load as specified in column 4 of table 1) are compared with their specified lower limits (column 5 for class A couplers or column 6 for class B couplers, table 1). No measurement shall be less than its lower limit, in any test.

b) When the displacement value is limited, then this displacement is measured under the load equal to the specified lower limit (column 6, table 1). No displacement value shall lie outside the permissible displacement range in any test (column 7, table 1).

8.2 Assessment with statistical analysis

8.2.1 Evaluation procedure

All tests so marked in column 10 of table 1 shall be statistically assessed.

8.2.2 Alternative methods

The method of inspection by attributes or the method of inspection by variables may be used for statistical acceptance.

In inspection by attributes it is only necessary to check whether or not the displacement Δ_j of the coupler exceeds a specified limiting value when subjected to a load $P = L(\Delta_j)$.

For inspection by variables, the value of the load-bearing capacity $P(\Delta_j)$ of every coupler in the sample is measured and a test quantity $z(\Delta_j)$ is calculated from the set of measurements: this must be greater than the lower limit specified for the load $L(\Delta_j)$ (see table 4). Inspection by variables is only permitted when the distribution of the test results does not differ significantly from normal, or the actual distribution can be transformed to a normal one.

The testing applicant, for example a manufacturer, is free to choose the method of analysis provided that both methods are applicable.

8.2.3 Operating characteristic curve

Note: A curve showing, for a given sampling plan, the probability of acceptance of a batch as a function of its actual quality.

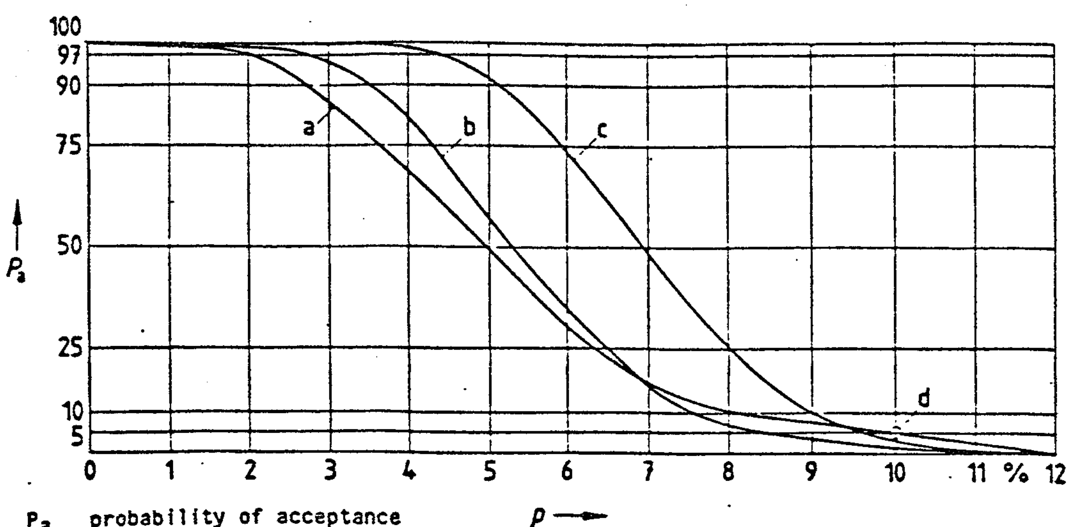
8.2.3.1 Both test methods shall be based on the comparable operating characteristics (see ISO 2859, addendum 1).

8.2.3.2 For use in prototype testing, an operating characteristic which runs through both the following points is recommended (see figure 2):

$p = 2\ \%;\ P_a = 97\ \%$

$p = 10\ \%;\ P_a = 5\ \%$

There are similar operating characteristic curves in the ISO publications previously referred to.



P_a probability of acceptance
p percent defective

a curve as recommended in 8.2.3.2
b operating characteristic curve associated with sampling plan L, AQL 2,5 in ISO 2859
c operating characteristic curve associated with sampling plan M, AQL 4,0 taken from ISO 2859
d limiting point ($p = 10\ \%$; $P_a = 5\ \%$) as specified in 6.2.2 and 8.2.3.3.

Figure 2. Operating characteristics