

High performance seamless circular unalloyed steel tubes

Technical delivery conditions

DIN
1630

Nahtlose kreisförmige Rohre aus unlegierten Stählen für
besonders hohe Anforderungen; technische Lieferbedingungen

Supersedes DIN 1629 Part 4,
January 1961 edition,
and parts of DIN 1629 Part 1,
January 1961 edition

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

The subclauses marked with a single dot • give specifications which are to be agreed upon at the time of ordering.

The subclauses marked with two dots •• give specifications which are optional and may be agreed upon at the time of ordering.

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1 Field of application

1.1 This standard applies to seamless circular tubes and pipes (hereinafter briefly referred to as "tubes") made of unalloyed steels as listed in table 1. These tubes are predominantly used in the construction of chemical plant, vessels, pipework and for general mechanical engineering purposes. They are designed to meet high performance requirements. Normally, there are no limiting values for the maximum permissible working pressure of these tubes. The permissible working temperature shall not exceed 300 °C. (The upper yield stress values for tubes at temperatures up to 300 °C are specified in Appendix A.)

The limits of application and other specifications given in this standard shall apply except in cases where other specifications are contained in codes of practice for specific fields of application, e.g. the *Technische Regeln für Dampfkessel (TRD)* (Technical rules on steam boilers) or the *Technische Regeln für Druckbehälter (TRB)*

(Technical rules on pressure vessels), *AD-Merkblätter* (AD Instruction sheets).

1.2 This standard does not apply to

- seamless circular unalloyed steel tubes subject to special requirements (DIN 1629);
- seamless circular steel tubes for structural steelwork (see DIN 17 121);
- seamless creep-resisting steel tubes (see DIN 17 175);
- seamless precision steel tubes (see DIN 2391 Part 2);
- medium-weight threaded steel tubes (see DIN 2440);
- heavyweight threaded steel tubes (see DIN 2441).

2 Classification into grades

This standard covers tubes made from the steel grades shown in table 1.

- The selection of the steel grade is at the purchaser's discretion.

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3 Designation and ordering

3.1 The standard designation for tubes complying with this standard shall give in the following order:

- the term "tube";
- DIN number of dimensional standard (DIN 2448);
- characteristic dimensions of tube (outside diameter X wall thickness);
- number of DIN Standard giving the technical delivery conditions (DIN 1630);
- symbol or material number for the steel grade (see tables 1 and 3);
- where applicable, the code letter N where the tubes are to be supplied in the normalized condition (see subclause 4.2.2).

Examples:

- a) A seamless tube conforming to this standard, with an outside diameter of 168,3 mm and a wall thickness of 4,5 mm as specified in DIN 2448, made from St 52.4 steel (material number 1.0581) shall be designated as follows:

Tube DIN 2448 – 168,3 X 4,5
DIN 1630 – St 52.4

or Tube DIN 2448 – 168,3 X 4,5
DIN 1630 – 1.0581

- b) A seamless tube conforming to this standard, with an outside diameter of 139,7 mm and a wall thickness of 4 mm as specified in DIN 2448, made from St 37.4 steel (material number 1.0255) in the normalized condition (N) shall be designated as follows:

Tube DIN 2448 – 139,7 X 4
DIN 1630 – St 37.4 N

or Tube DIN 2448 – 139,7 X 4
DIN 1630 – 1.0255 N

3.2 ● In addition to the standard designation as given in subclause 3.1, the purchaser shall always state in his order the required quantity (e.g. total length to be supplied), the type of length (see table 4), the length of the individual tube in the case of specified lengths and exact lengths, the type of document on materials testing as specified in DIN 50049 and, where applicable, any additional code of practice that may apply.

Example of an order:

1000 m tube DIN 2448 – 168,3 X 4,5
DIN 1630 – St 52.4

in specified lengths of 8 m, accompanied by
document DIN 50049 – 3.1 B.

3.3 ●● In addition to this, further details may be agreed at the time of ordering as described in those subclauses marked with two dots.

4 Requirements

4.1 Manufacturing process

4.1.1 The process employed for making the steels used to manufacture the tubes conforming to this standard is at the manufacturer's discretion. The type of deoxidation of the steels shall be as specified in table 1.

●● If so agreed, the purchaser shall be informed of the steelmaking process used.

4.1.2 ●● Unless otherwise agreed at the time of ordering, the process used to manufacture the tubes is at the manufacturer's discretion.

Tubes complying with this standard shall be manufactured by hot or cold rolling, hot pressing or hot and cold drawing.

4.2 As delivered condition

4.2.1 Tubes manufactured by hot forming shall be supplied in the hot formed condition. In order to comply with the requirements regarding mechanical and technological properties specified in table 3 and subclause 4.5 the tubes shall, if necessary, be normalized.

4.2.2 ●● If normalizing of the tubes is desired, this shall be agreed at the time of ordering. In this case, code letter N shall be used in the designation (see subclause 3.1). If the final forming stage in the production of the tube is a temperature-controlled hot forming operation, the requirement for normalizing shall be deemed to have been met if the forming process produces a condition equivalent to that produced by normalizing.

4.2.3 Cold rolled or cold drawn tubes shall be normalized after forming and supplied in this condition.

4.2.4 ●● If the surfaces of the tubes are to be provided with an anti-corrosive agent with a limited life, this shall be agreed at the time of ordering.

4.2.5 ●● If special requirements are made on the tubes (e.g. with regard to galvanizing, chromium plating or enamelling), this shall be agreed at the time of ordering.

4.3 Chemical composition

4.3.1 Cast analysis

The chemical composition of the steels determined in the cast analysis¹⁾ shall be as specified in table 1. Slight deviations from these values are permitted if the mechanical and technological properties of the tubes conform to this standard and weldability is not impaired.

4.3.2 Product analysis

In the test on the finished tube, the deviations shown in table 2 are permitted in comparison with the values specified in table 1.

4.4 Mechanical properties

The yield stress, tensile strength, elongation after fracture and impact strength of the tubes shall conform to the values specified in table 3. These shall apply for tubes in the as delivered condition and for the test conditions described in clause 5 of this standard.

4.5 Technological properties

The tubes shall meet the requirements specified in subclauses 5.5.3 to 5.5.5. In the tests described in the same subclauses, no unacceptable defects (e.g. cracks, scabs, laps or laminations) shall occur.

¹⁾ When sequential castings are supplied, as is possible with continuously cast tubes, the term "cast" should be read as "casting unit".

Table 1. Chemical composition (cast analysis) of steels for high-performance seamless circular tubes

Steel grade		Type of deoxidation (RR, fully killed)	Chemical composition, % by mass					Addition of nitrogen fixing elements (e.g. not less than 0,020% Al _{total})
Symbol	Material number		C	Si	Mn	P	S	
St 37.4	1.0255	RR	0,17 max.	0,35	≥ 0,35	0,040 max.	0,040	Yes
St 44.4	1.0257	RR	0,20	0,35	≥ 0,40	0,040	0,040	Yes
St 52.4	1.0581	RR	0,22	0,55	≤ 1,60	0,040	0,035	Yes

Table 2. Amounts by which the chemical composition in the product analysis may deviate from the limiting values applicable to the cast analysis (see table 1)

Element	Amount by which the product analysis may deviate from the limiting values applicable to the cast analysis % by mass
C	+ 0,02
Si	+ 0,03
Mn	+ 0,06 or - 0,06
P	+ 0,010
S	+ 0,010

Table 3. Mechanical properties of tubes in the as delivered condition at room temperature

• For wall thicknesses exceeding 65 mm, the values shall be agreed at the time of ordering.

Steel grade		Upper yield stress R_{eH} for wall thicknesses, in mm,			Tensile strength R_m N/mm ²	Elongation after fracture A_5		Impact energy 1) (ISO V-notch test pieces at +20°C)	
Symbol	Material number	up to 16	over 16 up to 40	over 40 up to 65		longi- tudinal	trans- verse	longi- tudinal	trans- verse
St 37.4	1.0255	235	225	215	350 ³⁾ to 480	25	23	43	27
St 44.4	1.0257	275 ²⁾	265 ²⁾	255 ²⁾	420 ³⁾ to 550	21	19	43	27
St 52.4	1.0581	355	345	335	500 ³⁾ to 650	21	19	43	27

1) Average value from three tests; only one individual value may fall short of the specified minimum value by not more than 30 %.

2) For cold finished tubes in the NBK condition (annealed above the upper transformation point under shielding gas or in a vacuum), minimum values of yield stress lower than these values by 20 N/mm² are permitted.

3) For cold finished tubes in the NBK condition, minimum values of tensile strength lower than these values by 10 N/mm² are permitted.

4.6 Weldability

Tubes made from the steel grades specified in this standard are suitable for gas fusion welding, arc welding, flash butt welding, electric pressure welding, and gas pressure welding.

According to DIN 8528 Part 1 however, weldability is dependent not only on the steel grade but also on the

conditions during welding, on the design and the operating conditions of the structural component.

4.7 Appearance of surface

4.7.1 The tubes shall have a smooth outside and inside surface consistent with the manufacturing process used.

4.7.2 Slight irregularities in the surface resulting from the manufacturing process, such as raised or depressed

areas or shallow grooves are permitted as long as the remaining wall thickness fulfils the requirements specified in subclause 4.10.2.2 and the function of the tubes is not impaired (see also subclause 7.1).

4.7.3 Proper removal of shallow surface defects using appropriate means is permitted as long as the remaining wall thickness fulfils the requirements of subclause 4.10.2.2. Stopping of surface defects is not permitted.

4.8 Leak tightness

The tubes shall remain leaktight when tested as specified in subclause 5.5.7.

4.9 Non-destructive testing

The requirements given in *Stahl-Eisen-Prüfblatt* (Iron and steel test sheet) 1916 are to be met in the non-destructive tests carried out on the tube ends (see subclause 5.3.1).

•• By agreement at the time of ordering, the tubes may be subjected to non-destructive testing in full (see subclause 5.5.9). The requirements given in *Stahl-Eisen-Prüfblatt* 1915 are to be met in this test.

4.10 Dimensions, masses per unit length and permissible deviations

4.10.1 Dimensions

DIN 2448 shall apply for the outside diameter and wall thickness of tubes.

Table 4 shall apply for the types of tube length.

4.10.2 Permissible dimensional deviations

4.10.2.1 The information given in table 5 (see subclause 5.5.11) shall apply for the permissible deviations in outside diameter d_a .

•• For the tube ends, the lower permissible deviations in diameter given in table 5 may also be agreed.

4.10.2.2 The permissible deviations in wall thickness are given in table 6.

4.10.2.3 •• In special cases, by agreement at the time of ordering, tubes may be supplied in accordance with these technical delivery conditions with the permissible deviations in outside diameter and wall thickness as specified in DIN 2391 Part 1.

4.10.2.4 The permissible deviations in length are given in table 4.

4.10.3 Permissible deviations of form

4.10.3.1 Circularity

The tubes shall be as circular as possible. The out-of-roundness shall be within the permissible deviations for the outside diameter.

Table 4. Types of length and permissible deviations in length

Type of length	Permissible deviations in length, in mm	
Manufacturing length ¹⁾	¹⁾	
Specified length	± 500	
Exact length	up to 6 m	+ 10 0
	over 6 m up to 12 m	+ 15 0
	over 12 m	By agreement

¹⁾ The products are supplied in the manufacturing lengths occurring in production. • The lengths differ according to the diameter, wall thickness and manufacturer's works and shall be agreed at the time of ordering.

Table 5. Permissible deviations in diameter

Outside diameter d_a mm	Permissible deviation in diameter	
	Tube barrel and tube ends	•• At tube ends, subject to particular agreement ¹⁾
≤ 100	± 1% d_a (values up to ± 0,5 mm are permitted)	± 0,4 mm
100 < d_a ≤ 200	± 1% d_a	± 0,5% d_a
> 200	± 1% d_a	± 0,6% d_a ²⁾

¹⁾ Over a length of about 100 mm from the tube ends.
²⁾ •• Subject to agreement at the time of ordering, the permissible deviation may also be referred to the inside diameter, in which case the permissible deviation in the wall thickness is to be taken into account.

Table 6. Permissible deviations in wall thickness

Permissible deviation in wall thickness for outside diameters d_a								
d_a ≤ 130 mm			130 mm < d_a ≤ 320 mm and wall thicknesses s			320 mm < d_a ≤ 660 mm		
≤ 2 · s_n	2 · s_n < s ≤ 4 · s_n	> 4 · s_n	≤ 0,05 d_a	0,05 d_a < s ≤ 0,11 d_a	> 0,11 d_a	≤ 0,05 d_a	0,05 d_a < s ≤ 0,09 d_a	> 0,09 d_a
+ 15% - 10%	+ 12,5% - 10%	± 9%	+ 17,5% - 12,5%	± 12,5%	± 10%	+ 20% - 15%	+ 15% - 12,5%	+ 12,5% - 10%

Note. s_n is the standard wall thickness as specified in DIN 2448.

4.10.3.2 Straightness

The tubes shall be straight to the eye.

- Particular requirements regarding straightness may be agreed.

4.10.4 Finish of tube ends

The tube ends shall be cut perpendicular to the tube axis and shall be free from burr.

- Subject to agreement, tubes with s not smaller than 3,2 mm may be supplied with end faces prepared for butt welding and exhibiting the following finish:

- the bevel of groove flank shall be $30^\circ \begin{smallmatrix} +5^\circ \\ 0 \end{smallmatrix}$;
- the thickness of the root face shall be $(1,6 \pm 0,8)$ mm.

Other types of edge preparation are subject to particular agreement.

4.10.5 Masses per unit length and permissible deviations

The values of masses per unit length of tubes are specified in DIN 2448. The following deviations from these values are permitted:

- + 12 % for a single tube,
- 8 %

- + 10 % for a batch of tubes not less than 10 t by mass.
- 5 %

5 Testing and documents on materials testing

5.1 General

Tubes complying with this standard shall be supplied with one of the following documents on materials testing as specified in DIN 50 049:

- document DIN 50 049 – 3.1 A (inspection certificate A);
- document DIN 50 049 – 3.1 B (inspection certificate B);
- document DIN 50 049 – 3.1 C (inspection certificate C).

- The type of document required and the test house concerned where acceptance inspection is to be carried out by a third party shall be specified in the order.

5.2 Test site

The tubes shall be tested at the manufacturer's works. Production at the manufacturer's works shall not be unduly disturbed when acceptance inspection is carried out by experts who are not employees of the manufacturer.

5.3 Scope of test programme

5.3.1 The tubes shall be inspected by batches.

Table 7 gives a synopsis of the scope of the test programme in each case.

For the purposes of testing, the tubes shall be divided up by steel grade and, if possible, also by dimensions, as a function of the outside diameter d_a , into batches each comprising the following numbers of tubes:

for $d_a \leq 500$ mm, 100 tubes;

for $d_a > 500$ mm, 50 tubes.

Remainders of up to 50 % of the batches may be distributed uniformly across the batches. Numbers of tubes and remainders amounting to more than 50 % and supplies of less than 50 % of a batch count as one complete batch.

One tube (sample tube) shall be taken at the inspector's discretion from each batch for the tests to be carried out. The following tests shall be carried out on this sample tube:

- tensile test;
- impact test in the case of wall thicknesses not smaller than 10 mm;
- •• product analysis, if this has been agreed at the time of ordering.

In addition, the following tests shall be carried out:

- flattening test, ring expanding test or ring tensile test, as a function of the outside diameter and wall thickness of the tubes, at one end of each rolled section of tube or at one end of each subsection as specified in table 8 (see subclause 5.4.3);
- non-destructive testing of the tube ends over a length of 25 mm as described in *Stahl-Eisen-Prüfblatt* 1916, in the case of wall thicknesses exceeding 40 mm.

5.3.2 Furthermore,

5.3.2.1 all tubes shall be tested by the manufacturer's works for leak tightness, normally by means of a hydraulic test (see subclause 5.5.7).

If, under the test conditions specified in subclause 5.5.7 (test pressure, 80 bar) a load limit of $0,7 \times R_{eH}$ (equivalent to a safety factor of about 1,5 against the yield stress) is not exceeded, then, at the manufacturer's discretion, instead of the hydraulic test a suitable non-destructive test method may be used for testing the leak tightness (for example an eddy current test as specified in *Stahl-Eisen-Prüfblatt* 1925).

5.3.2.2 all tubes shall be inspected inside and outside of their surface appearance;

5.3.2.3 the tubes shall be inspected for their accuracy to size and permissible deviations as specified in subclause 4.10.

5.4 Sampling and sample preparation

The information given in figure 1 shall apply for the sampling points and the test piece location.

5.4.1 Tensile test

5.4.1.1 For the tensile test, one strip test piece (see DIN 50 140) shall be taken from the sample tube, longitudinal to the tube axis. The test piece shall not be heat treated and not straightened within the gauge length. At the manufacturer's discretion, tubes may also be subjected to the tensile test in full (see DIN 50 140).

In the case of wall thicknesses greater than 30 mm, at the manufacturer's discretion, circular test pieces (see DIN 50 125) may be taken longitudinal to the tube axis, at a distance of one quarter of the wall thickness from the outside surface or as close as possible to this point.

5.4.1.2 In the case of tubes with outside diameters not smaller than 200 mm, round or flat test pieces worked on all sides, may be taken transverse to the tube axis (see DIN 50 125), provided that the tube dimensions permit this procedure for an unstraightened tube.

5.4.1.3 Normally, short proportional test pieces shall be taken for the tensile test. If the test pieces are not worked on all sides it is permitted to remove local irregularities but the rolling skin shall be retained at the thinnest area.

Table 7. Summary of the scope of test programme and documents on materials testing

See figure 1 for sampling points and location of test pieces; see subclause 5.3.1 for batch size.

No.	Testing		Scope of test programme	Responsibility for carrying out the tests	Type of document on materials testing
	Type of test	Sub-clause			
1	Tensile test	5.4.1 5.5.1	1 sample tube per batch, 1 test piece	By agreement	DIN 50 049 – 3.1 A or DIN 50 049 – 3.1 B or DIN 50 049 – 3.1 C
2	Impact test	5.4.2 5.5.2	At one end of sample tube specified above (No. 1) (for wall thickness ≥ 10 mm): 1 set of 3 individual test pieces)	By agreement	DIN 50 049 – 3.1 A or DIN 50 049 – 3.1 B or DIN 50 049 – 3.1 C
3	Test on annular test pieces ¹⁾	5.4.3 5.5.3 5.5.4 5.5.5	At one end of each rolled section or at one end of each subsection, for wall thicknesses not exceeding 40 mm: 1 test piece	By agreement	DIN 50 049 – 3.1 A or DIN 50 049 – 3.1 B or DIN 50 049 – 3.1 C
4	Non-destructive testing of tube ends	5.3.1 5.5.9	For wall thicknesses exceeding 40 mm, at the tube ends over a length of 25 mm	Manufacturer	DIN 50 049 – 2.1 ²⁾
5	Leak tightness test	5.3.2.1 5.5.7	All tubes	Manufacturer	DIN 50 049 – 2.1 ²⁾
6	Inspection of surface	5.5.8	All tubes	By agreement	DIN 50 049 – 3.1 A or DIN 50 049 – 3.1 B or DIN 50 049 – 3.1 C
7	Check on dimensions	5.5.10 5.5.11	All tubes	By agreement	DIN 50 049 – 3.1 A or DIN 50 049 – 3.1 B or DIN 50 049 – 3.1 C
8	Product analysis ³⁾	5.4.4 5.5.6	By agreement	Manufacturer	DIN 50 049 – 3.1 B
9	Non-destructive testing of tubes	4.9 5.5.9	By agreement	Manufacturer	DIN 50 049 – 3.1 B

1) See table 8 for information on the dimensional ranges for the application of these tests.
2) This certificate may also be included in the next higher stage of document.
3) The product analysis shall only be carried out if so agreed between the manufacturer and purchaser.

Table 8. Tests to be carried out on annular test pieces, as a function of diameter and wall thickness of the tubes

Diameter d , in mm		Wall thickness s , in mm		
outside	inside	< 2	$2 \leq s \leq 16$	$16 < s \leq 40$
$\leq 21,3$	≤ 15	Flattening test	Flattening test	–
$21,3 < d \leq 146$	> 15	Flattening test	Ring expanding test	Flattening test
> 146 ¹⁾	–	–	Ring tensile test	Ring tensile test ²⁾

1) This limit shall also apply for tubes ordered by inside diameter, if the outside diameter exceeds 146 mm.
2) For tubes with inside diameters not exceeding 100 mm, the flattening test shall be carried out instead of the ring tensile test.

5.4.2 Impact test

For the purposes of the impact test a set of three ISO V-notch test pieces shall be taken from the tube transverse to the tube axis provided that the tube dimensions permit this without straightening of the test pieces.

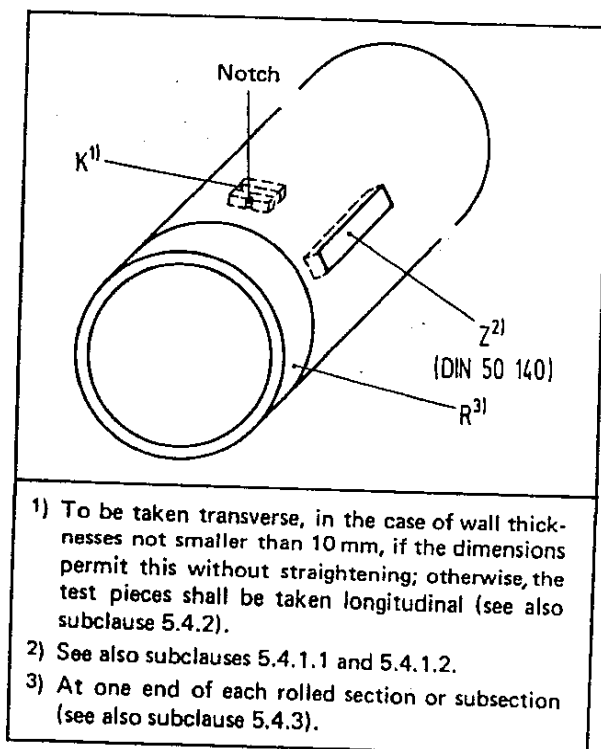
Otherwise, the test pieces shall be taken longitudinal to the tube axis. In the case of tubes the wall thicknesses of which exceeds 30 mm, the centre line of the test pieces shall have a distance from the external surface equal to one quarter of the wall thickness or shall be positioned as close as possible to this location.

The test pieces shall be taken and prepared in such a way that the axis of the notch is perpendicular to the tube surface.

5.4.3 Technological tests

The test pieces for the flattening test as specified in DIN 50 136 or for the ring expanding test as in DIN 50 137 or for the ring tensile test as in DIN 50 138 shall be taken from one end of each rolled section of tube or from each subsection (see table 8).

If the rolled sections are subsequently cut into subsections, no test pieces need be taken from these subsections provided it is clearly indicated from which already tested rolled section of tube the subsections have been taken. If such identification is not given, the rolled sections of tube shall not be tested; the subsections shall be tested instead.



In the illustration above

K = set of 3 ISO V-notch test pieces each, as specified in DIN 50 115;

Z = tensile test piece (see subclause 5.4.1);

R = test piece for flattening test, ring expanding test or ring tensile test (see subclause 5.3.1 and table 8);

Figure 1. Sampling points and location of test pieces

5.4.4 Chemical composition

For checking the chemical composition by a product analysis on the finished tube, the sample chips shall be taken at points uniformly distributed over the entire thickness of the product; a similar procedure shall be used for spectral analyses. In general, *Stahl-Eisen-Prüfblatt* 1805 shall apply for sampling.

5.5 Test procedure

5.5.1 The tensile test shall be carried out as specified in DIN 50 145 or DIN 50 140.

5.5.2 The impact test shall be carried out as described in DIN 50 115.

5.5.3 The flattening test shall be carried out as specified in DIN 50 136. The test pieces or tube ends shall be flattened until a specified distance between platens H is reached.

The following equation shall apply for the distance between platens:

$$H = \frac{(1 + c) \cdot s}{c + s/d_a}$$

where

s is the wall thickness, in mm;

d_a is the outside diameter, in mm, and

c is a constant having the following value:

0,09 for steel grade St 37.4;

0,07 for steel grades St 44.4 and St 52.4.

If the ratio s/d_a exceeds a value of 0,15, c shall be reduced by 0,01 for the steel grades concerned.

5.5.4 The ring expanding test shall be carried out as specified in DIN 50 137; for this test, the change in diameter of the test piece when drifted until fracture shall also be measured. In addition, the ductility of the ring expanding test pieces shall be assessed on the basis of the appearance of the fracture and the fracture surfaces.

5.5.5 The ring tensile test shall be carried out as specified in DIN 50 138.

5.5.6 The chemical composition shall be determined in accordance with the methods specified by the Chemists' Committee of the *Verein Deutscher Eisenhüttenleute* (Society of German Ferrous Metallurgy Engineers) (see the "Standards and other documents referred to" clause).

5.5.7 For the hydraulic leak tightness test (see also subclause 5.3.2.1) as specified in DIN 50 104, the test pressure shall be 80 bar.

5.5.7.1 ●● A higher test pressure may be agreed.

5.5.7.2 In no case however shall the safety margin with respect to the yield stress go below 1,1 (DIN 2413, June 1972 edition, subclause 4.6, $Y' = 0,9$ shall be complied with). Where appropriate, this shall also apply in the case of thin walled tubes with large outside diameters, even at 80 bar.

The test pressure shall be maintained for at least five seconds.

5.5.8 The appearance of the tubes shall be examined visually under appropriate lighting conditions by an inspector having normal vision.

Note. A demonstrably suitable non-destructive method of test may also be used instead of the visual examination.

5.5.9 The test conditions for non-destructive testing of the tube ends (see subclause 5.3.1) shall be in accordance with those specified in *Stahl-Eisen-Prüfblatt* 1916.

If non-destructive testing of the tubes in full has been agreed as specified in subclause 4.9, the test conditions given in *Stahl-Eisen-Prüfblatt* 1915 shall apply.

Non-destructive testing shall be carried out by the manufacturer.

•• Subject to prior agreement, the purchaser or a qualified inspector acting on his behalf may be present at the inspection.

5.5.10 The wall thicknesses shall be measured at the ends of the tube using suitable measuring instruments.

5.5.11 The diameter shall be measured using suitable measuring instruments as a two-point measurement.

5.6 Retests

5.6.1 Tubes not satisfying the requirements when tested as specified in subclauses 5.5.3 to 5.5.5 and 5.5.7 to 5.5.11 (tests on annular test pieces, leak tightness test, visual examination, non-destructive testing, check on dimensions) shall be rejected.

The manufacturer's works shall have the right to take suitable measures to correct defects or deviations found in these tests and to present these tubes for renewed acceptance inspection.

5.6.2 If one of the sample tubes fails the acceptance inspection including tensile test and impact test specified in subclauses 5.5.1 and 5.5.2 the manufacturer is justified in repeating the test giving unsatisfactory results on the same tube with twice the number of test pieces. All test pieces shall satisfy the requirements. If the requirements are still not satisfied in the new tests, the tube shall be rejected.

Two further tubes shall be taken from the batch concerned in place of the rejected sample tube and shall be submitted to the tests specified in subclauses 5.5.1 and 5.5.2. If one of the requirements is still not fulfilled, the entire batch shall be considered not to comply with the standard. However, individual testing may be agreed between the parties concerned.

If the unsatisfactory result of testing can be improved by means of heat treatment or other suitable measures, the supplier shall be given the opportunity to present a batch which was rejected for renewed acceptance inspection. If the test pieces continue to fail to satisfy the require-

ments, the entire batch shall be considered not to comply with the standard.

5.6.3 Test results attributable to improperly carried out sampling, sample preparation or test procedure or to an accidental and local defect in a test piece shall be deemed invalid.

5.7 Documents on materials testing

5.7.1 Depending on the agreement made at the time of ordering (see subclause 5.1), either document DIN 50 049-3.1 A (inspection certificate A), DIN 50 049-3.1 B (inspection certificate B) or DIN 50 049-3.1 C (inspection certificate C) shall be issued for tubes complying with this standard. The type and scope of the tests, the responsibility for carrying out the tests and the type of documentation covering the tests are shown in table 7. In each case, the technical rule agreed at the time of ordering shall be specified.

5.7.2 The documents shall state the marking of the tubes as specified in clause 6.

6 Marking

6.1 Every tube supplied in accordance with this standard shall be clearly and durably marked at one end, as follows:

- manufacturer's mark;
- symbol identifying the steel grade (where applicable supplemented by code letter N where normalizing of the tubes to be supplied has been agreed);
- an appended symbol *S* indicating that the tube is of the seamless type;
- symbol indicating that non-destructive testing of the tube has been carried out (if agreed, see subclause 4.9);
- inspector's mark.

6.2 Marking shall generally be applied by stamping. A different marking method (e.g. labelling the bundle of tubes) is also permitted for tubes with small outside diameters and/or small wall thicknesses.

7 Complaints

7.1 Under current law, a complaint may only be raised against defective tubes if the defects noticeably impair their processing and use. This shall apply unless otherwise agreed at the time of ordering.

7.2 It is normal and practical for the purchaser to give the supplier the opportunity to judge whether the complaints are justified, if possible by submitting the tube objected to or samples of the tubes supplied.

Appendix A

Elevated temperature upper yield stress values for tubes 1)

Table A.1.

Steel grade	Upper yield stress values for a design temperature of												
	50 °C ²⁾			200 °C ²⁾			250 °C			300 °C			
Symbol	Material number	and a wall thickness											
		≤ 16 mm	> 16 ≤ 40 mm	> 40 ≤ 65 mm	≤ 16 mm	> 16 ≤ 40 mm	> 40 ≤ 65 mm	≤ 16 mm	> 16 ≤ 40 mm	> 40 ≤ 65 mm	≤ 16 mm	> 16 ≤ 40 mm	> 40 ≤ 65 mm
N/mm ²													
St 37.4	1.0255	235	225	215	185	175	170	165	155	150	140	135	130
St 44.4	1.0257	275	265	255	215	205	200	195	185	180	165	160	155
St 52.4	1.0581	355	345	335	245	235	230	225	215	210	195	190	185

1) The values specified are approximate values for the 0,2% proof stress and it is not required to verify them. This should be taken into account in design by using a higher safety coefficient (e.g. as in DIN 2413, June 1972 edition, subclause 4.1.2, the value shall be increased by 20% for category II).

2) For the ranges between 20 °C and 50 °C and between 50 °C and 200 °C linear interpolation should be made. It is not permitted to round the values.

Other standards and documents referred to

- DIN 1629 Seamless circular unalloyed steel tubes subject to special requirements; technical delivery conditions
- DIN 2391 Part 1 Seamless precision steel tubes; dimensions
- DIN 2391 Part 2 Seamless precision steel tubes; technical delivery conditions
- DIN 2413 Steel pipes; calculation of wall thickness with regard to internal pressure
- DIN 2440 Medium-weight threaded steel tubes
- DIN 2441 Heavyweight threaded steel tubes
- DIN 2448 Seamless steel tubes; dimensions, masses per unit length
- DIN 8528 Part 1 Weldability; metallic materials, concepts
- DIN 17 121 Seamless circular steel tubes for structural steelwork; technical delivery conditions
- DIN 17 175 Seamless creep-resisting steel tubes; technical delivery conditions
- DIN 50 049 Documents on materials testing
- DIN 50 104 Internal pressure test on hollow products; leak tightness test up to a defined internal pressure; general specifications
- DIN 50 115 Testing of metallic materials; impact test
- DIN 50 125 Testing of metallic materials; tensile test pieces, guidelines for their preparation
- DIN 50 136 Testing of metallic materials; flattening test on tubes
- DIN 50 137 Testing of steel; ring expanding test on tubes
- DIN 50 138 Testing of metallic materials; ring tensile test on tubes
- DIN 50 140 Testing of metallic materials; tensile test on tubes and strips from tubes
- DIN 50 145 Testing of metallic materials; tensile test
- Stahl-Eisen-Prüfblatt 1805 2)
Probenahme und Probenvorbereitung für die Stückanalyse bei Stählen
 (Sampling and sample preparation for the product analysis of steels)
- Stahl-Eisen-Prüfblatt 1915 2)
Ultraschallprüfung auf Längsfehler von Rohren aus warmfesten Stählen
 (Ultrasonic testing of creep-resisting steel tubes for longitudinal defects)

2) See page 10.

Stahl-Eisen-Prüfblatt 1916 2)

Zerstörungsfreie Prüfung schmelzgeschweisster Fernleitungsrohre für brennbare Flüssigkeiten und Gase

(Non-destructive testing of fusion welded pipes for pipelines conveying combustible liquids and gases)

Stahl-Eisen-Prüfblatt 1925 2)

Elektromagnetische Prüfung von Rohren zum Nachweis der Dichtigkeit

(Electromagnetic testing of tubes for leak tightness)

Handbuch für das Eisenhüttenlaboratorium 2) (Handbook for the ferrous metallurgy laboratory)

Volume 2: *Die Untersuchung der metallischen Werkstoffe*

(Investigation of metallic materials); Düsseldorf 1966.

Volume 5 (supplement):

A 4.4 – *Aufstellung empfohlener Schiedsverfahren* (List of recommended arbitration procedures);

B – *Probenahmeverfahren* (Sampling methods);

C – *Analysenverfahren* (Methods of analysis);

(latest edition in each case).

Previous editions

DIN 1629: 08.29, 09.32; DIN 1629 Part 1: 01.61; DIN 1629 Part 4: 01.61

Amendments

The following amendments have been made in comparison with DIN 1629 Part 1, January 1961 edition, and DIN 1629 Part 4, January 1961 edition (see also Explanatory notes):

- The symbols for the steel grades have been changed (see table in the Explanatory notes).
- The maximum values for phosphorus and sulfur contents have been reduced (see tables 1 and 2).
- The values for the mechanical properties have been converted and in some cases changed (see table 3).
- The whole text has been revised, taking into account the specifications of DIN 1629 Part 1, January 1961 edition.

Explanatory notes

Recent technical developments in the manufacture and use of welded and seamless unalloyed steel tubes and the desire to harmonize requirements, meant that a revision of the technical delivery conditions for such products as specified in DIN 1626 Part 1 to Part 4, January 1965 editions and in DIN 1629 Part 1 to Part 4, January 1961 editions, had become necessary. A revision of the standards was carried out in a joint committee of the *Normenausschuss Eisen und Stahl (FES)* (Iron and Steel Standards Committee) and the *Normenausschuss Rohre, Rohrverbindungen und Rohrleitungen (FR)* (Pipes, Pipe Joint Assemblies and Pipelines Standards Committee) with the participation of the *Normenausschuss Gastechnik (NAGas)* (Gas Technology Standards Committee) and the *Normenausschuss Erdöl- und Erdgasgewinnung (NÖG)* (Petroleum and Natural Gas Production Standards Committee).

The essential changes compared with DIN 1629 Part 1 to Part 4, January 1961 editions, made in these revised editions of the technical delivery conditions for seamless tubes are as follows:

Restructuring standards

In order to improve clarity and to facilitate the application of the standards to the particular use of the products, it appeared expedient to change the existing numbering system and to revise the contents of the

various standards. On this basis, for the field of seamless tubes the following breakdown was introduced:

- DIN 1629 (tubes subject to special requirements), superseding DIN 1629 Part 3 (tubes subject to quality specifications),
- DIN 1630 (high performance tubes), superseding DIN 1629 Part 4 (specially tested tubes subject to quality specifications).

Since seamless tubes of commercial quality (ST 00 steel) are no longer of any importance, DIN 1629 Part 2, January 1961 edition, has been withdrawn without replacement. The content of DIN 1629 Part 1, January 1961 edition, has been incorporated into DIN 1629 and DIN 1630, as appropriate.

Classification and designation of steel grades

The classification and designation of the steels for seamless tubes (except for the USt 37.0 steel grade which has not been specified for seamless tubes) comply with the corresponding specifications for welded tubes assigned to the same requirement class (see DIN 1626 and DIN 1628).

The following table compares the former steel grades for seamless tubes with those specified in DIN 1629 and DIN 1630. The comparison is based on the specified minimum values for the yield stress at room temperature.

2) Published by: *Verein Deutscher Eisenhüttenleute*, obtainable from: *Verlag Stahl Eisen mbH*, Postfach 82 29, D-4000 Düsseldorf 1.

However, in some cases it is necessary to take account of differences, particularly in the type of deoxidation used for the steels.

Steel grade		Comparable steel grade	
Symbol	Specified in DIN 1629 ¹⁾	Symbol	Specified in DIN
St 00	Part 2	—	—
St 35	Part 3	St 37.0	1629
St 45	Part 3	—	—
—	—	St 44.0	1629
St 55	Part 3	—	—
St 52	Part 3	St 52.0	1629
St 35.4	Part 4	St 37.4	1630
St 45.4	Part 4	—	—
—	—	St 44.4	1630
St 55.4	Part 4	—	—
St 52.4	Part 4	St 52.4	1630

1) January 1961 edition, in each case.

Properties of products

The specifications relating to the chemical composition and the mechanical properties applying for the tensile

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test are the same as those specified in DIN 1626 and DIN 1628 for welded tubes. Particular attention is drawn to the fact that the permissible maximum phosphorus and sulfur contents have been substantially reduced, in comparison with the previous values. In addition, the requirements relating to the impact energy to be met by longitudinal and transverse test pieces in the case of high-performance tubes have been included (see DIN 1630, October 1984 edition, table 3).

Depending on the tube dimensions, the flattening test, ring expanding test or ring tensile test has been specified. The drift expanding test has been deleted in DIN 1630.

Non-destructive testing shall be carried out on the ends of high-performance tubes with wall thicknesses exceeding 40 mm, over a length of 25 mm. Subject to agreement at the time of ordering, the tubes assigned to this requirement class may be subjected to non-destructive testing in full.

Other contents

Some other amendments to the text of the standards resulted necessarily from the new specifications with regard to the factual content. For all these standards, the objective has been to ensure identical layout with identical wording (where this is appropriate to the particular case).