

Welded circular unalloyed steel tubes subject to special requirements

Technical delivery conditions

DIN
1626

Geschweisste kreisförmige Rohre aus unlegierten Stählen
für besondere Anforderungen; technische Lieferbedingungen

Supersedes DIN 1626 Part 3,
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*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 welded circular tubes and pipes (hereinafter briefly referred to as "tubes") with a longitudinal or spiral weld, made of unalloyed steels as listed in table 2. These tubes are predominantly used in the construction of chemical plant, vessels, pipework and for general mechanical engineering purposes. The maximum permissible working pressure and permissible working temperature are specified in table 1. (The upper yield stress values for tubes at temperatures up to 300 °C are specified in Appendix A.)

Table 1. Maximum permissible working pressure and permissible working temperature of tubes complying with DIN 1626

| Outside diameter d_a mm | Permissible working pressure bar max. | Permissible working temper- ature °C max. | To be supplied with document |
|---|---|--|--|
| Up to and including 219,1 | 64 | 300 ¹⁾ | DIN 50 049 – 2.2 |
| Over 219,1 up to and including 660 | 25 | | |
| Exceeding 660 | 16 | | |
| Any | 160 | 300 ¹⁾ | DIN 50 049 – 3.1 A or DIN 50 049 – 3.1 B or DIN 50 049 – 3.1 C |
| 1) See Appendix A for strength characteristics. | | | |

The limits of application and other specifications given in this standard shall apply except in cases where other specifications are given 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

- welded circular unalloyed steel tubes not subject to special requirements (see DIN 1615);
- high performance welded circular unalloyed steel tubes (see DIN 1628);
- welded circular steel tubes for structural steelwork (see DIN 17 120);
- steel tubes for pipelines conveying combustible liquids and gases (see DIN 17 172);
- electrically pressure welded creep-resisting steel tubes (see DIN 17 177);
- welded precision steel tubes (see DIN 2393 Part 2);
- welded and sized precision steel tubes (see DIN 2394 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 2.

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

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 2458);
- characteristic dimensions of tube (outside diameter X wall thickness);
- number of DIN Standard giving the technical delivery conditions (DIN 1626);
- symbol or material number for the steel grade (see tables 2 and 4);
- in addition, for pressure-welded tubes, where applicable, the code letters N or G where the tubes are to be supplied in the normalized condition or where there are special requirements with regard to cold workability (see subclauses 4.2.2 and 4.2.3).

Examples:

- a) A welded tube conforming to this standard, with an outside diameter of 168,3 mm and a wall thickness of 4 mm as specified in DIN 2458, made from St 52.0 steel (material number 1.0421) shall be designated as follows:

Tube DIN 2458 – 168,3 X 4
DIN 1626 – St 52.0

or Tube DIN 2458 – 168,3 X 4
DIN 1626 – 1.0421

- b) A welded tube conforming to this standard, with an outside diameter of 114,3 mm and a wall thickness of 3,2 mm as specified in DIN 2458, made from St 37.0 steel (material number 1.0254) in the normalized condition (N) shall be designated as follows:

Tube DIN 2458 – 114,3 X 3,2
DIN 1626 – St 37.0 N

or Tube DIN 2458 – 114,3 X 3,2
DIN 1626 – 1.0254 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. the total length to be supplied), the type of length (see table 5), 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 50 049 and, where applicable, any additional code of practice that may apply and also the extent to which it is intended to utilize the design stress (90 or 100 %, see subclause 4.1.3).

Example of an order:

1000 m tube DIN 2458 – 168,3 X 4
DIN 1626 – St 52.0

in specified lengths of 8 m, accompanied by document DIN 50 049 – 3.1 B,
design stress 90 %.

3.3 ●● In addition to this, further details may be agreed at the time of ordering, as described in the 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 2.

●● 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.

The tubes shall be fabricated in a fully mechanized process, generally by double-sided submerged-arc fusion welding carried out in such a way that a longitudinal weld or a spiral weld is produced, or by pressure welding in such a way that a longitudinal weld is produced joining appropriately bent sheet or strip. Pressure welded tubes made from St 44.0 or St 52.0 steel shall only be manufactured by electric pressure welding. If necessary, the tubes shall be finished to the final dimensions by additional hot reducing or cold drawing or by drifting or rolling to size.

Pressure welded tubes shall be supplied without welds used for joining lengths of strip.

4.1.3 The tubes shall be welded so as to ensure complete root penetration and so that the tubes conform to the requirements of this standard. The welding process shall be inspected to ensure that welds are properly carried out.

Unless otherwise agreed at the time of ordering, tubes subject to internal pressure stresses are to be used on the basis of a 90 % utilization of the design stress in the weld (see clause 6 for tubes identified by code letter A).

●● If agreed at the time of ordering, tubes subject to internal pressure stresses can be used on the basis of a 100 % utilization of the permissible design stress in the

weld (see clause 6 for tubes identified by code letter B). Such tubes shall be supplied with an inspection certificate.

4.1.4 In the case of fusion welded tubes, the welds shall be made from both sides.

Pressure welded tubes shall be supplied without external upset.

●● In the case of electrically pressure welded tubes supplied with a test report, internal deburring may be agreed at the time of ordering (see also subclause 4.10.4, item b).

In the case of electrically pressure welded tubes supplied with an inspection certificate and having an inside diameter not less than 20 mm, the internal upset specified in subclause 4.10.4, item b, shall not be exceeded.

Local repair of welds is permitted. Areas that are repaired shall then be subjected to non-destructive testing; in addition, the tube shall be tested for leak tightness.

4.1.5 The manufacturer's works shall have at its disposal the specialists and suitable equipment to enable welding work to be properly carried out and inspected. A certificate on the basis of a qualification test to be carried out by a recognized test house shall be provided. This certificate is valid only for those steel grades, dimensional ranges and welding processes specified in the certificate. If the above conditions change, a new qualification test shall be passed and the certificate amended accordingly.

4.2 As delivered condition

4.2.1 Tubes shall be supplied in the condition resulting from the manufacturing process. In order to comply with the requirements regarding mechanical and technological properties as listed in table 4 and subclause 4.5, in the case of pressure welded tubes, the tubes or the weld shall, if necessary, be normalized.

4.2.2 ●● In the case of pressure welded tubes, if normalizing of the tubes or the weld is desired, this shall be agreed at the time of ordering. In this case, code letter N (normalizing of complete tube) or G (normalizing of weld) is to be used in the designation (see subclause 3.1).

Table 2. Chemical composition (cast analysis) of steels for welded circular tubes subject to special requirements

| Steel grade | | Type of deoxidation U rimming R killed (including semi-killed) RR fully killed | Chemical composition % by mass | | | | Addition of nitrogen fixing elements (e.g. not less than 0,020 % Al _{total}) |
|-----------------------|-----------------|--|-----------------------------------|-------|-------|---------------------|---|
| | | | C | P | S | N ¹⁾ | |
| Symbol | Material number | | max. | | | | |
| USt 37.0 | 1.0253 | U | 0,20 | 0,040 | 0,040 | 0,007 | — |
| St 37.0 | 1.0254 | R | 0,17 | 0,040 | 0,040 | 0,009 ²⁾ | — |
| St 44.0 | 1.0256 | R | 0,21 | 0,040 | 0,040 | 0,009 ²⁾ | — |
| St 52.0 ³⁾ | 1.0421 | RR | 0,22 | 0,040 | 0,035 | — | yes |

¹⁾ It is permitted to exceed the specified maximum value if a phosphorus content less than the maximum specified by 0,005 % P per 0,001 % N is observed. However, the nitrogen content shall not exceed a value of 0,012 % N in the cast analysis and 0,014 % N in the product analysis.

²⁾ The specified maximum values do not apply if the steels are supplied with the RR (instead of R) type of deoxidation.

³⁾ The content shall not exceed 0,55 % Si and 1,60 % Mn in the cast analysis or 0,60 % Si and 1,70 % Mn in the product analysis.

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 ●● In cases where there are special requirements regarding cold workability, pressure welded tubes are to be ordered in conditions N or G as described in sub-clause 4.2.2.

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 2. 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 3 are permitted in comparison with the values specified in table 2.

4.4 Mechanical properties

The yield stress, tensile strength and elongation after fracture determined for the parent metal of the tubes shall conform to the values specified in table 4. These shall apply for tubes in the as delivered condition and for the test conditions described in clause 5 of this standard. The minimum values for the tensile strength and the yield stress given in table 4 shall also apply to the weld.

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

Table 3. Amounts by which the chemical composition in the product analysis may deviate from the limiting values applicable to the cast analysis (see table 2)

| Element | Amount by which the product analysis may deviate from the limiting values applicable to the cast analysis | |
|---------|---|--|
| | USt 37.0 | St 37.0, St 44.0, St 52.0 % by mass |
| C | + 0,05 | + 0,02 |
| P | + 0,015 | + 0,010 |
| S | + 0,015 | + 0,010 |
| N | + 0,002 ¹⁾ | + 0,001 ¹⁾ |

¹⁾ It is permitted to exceed the specified maximum value if a phosphorus content less than the maximum specified by 0,005 % P per 0,001 % N is observed. However, the nitrogen content shall not exceed a value of 0,012 % N in the cast analysis and 0,014 % N in the product analysis (this does not apply for the RR type of deoxidization.)

4.5 Technological properties

The tubes shall meet the requirements specified in sub-clauses 5.5.2 to 5.5.4. In the tests described in the same subclauses no unacceptable defects (e.g. cracks, scabs, laps or laminations) shall occur.

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 grade of steel but also on the conditions during welding, on the design and the operating conditions of the structural component.

4.7 Appearance of surface and weld

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

Table 4. Mechanical properties of tubes in the as delivered condition at room temperature
●● For wall thicknesses exceeding 40 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 | | Diameter of bending mandrel for the bend test on fusion welded tubes ¹⁾ |
|-------------|--------------------|---|---------------------|---|---------------------------------------|-----------------|--|
| Symbol | Material number | up to 16 | over 16 up to 40 | | longi- tudinal | trans- verse | |
| USt 37.0 | 1.0253 | 235 | - | 350 to 480 | 25 | 23 | 2 s |
| St 37.0 | 1.0254 | 235 | 225 | 350 ²⁾ to 480 | 25 | 23 | 2 s |
| St 44.0 | 1.0256 | 275 ²⁾ | 265 ²⁾ | 420 ²⁾ to 550 | 21 | 19 | 3 s |
| St 52.0 | 1.0421 | 355 | 345 | 500 ²⁾ to 650 | 21 | 19 | 4 s |

¹⁾ s is the wall thickness of tube (see subclause 5.5.4).
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.

Table 5. Types of length and permissible deviations in length

| Type of length | Permissible deviations in length, in mm, for outside diameters | | |
|---|--|--------------|--------------|
| | up to 500 | over 500 | |
| Manufacturing length 1) | 1) | 1) | |
| Specified length | ± 500 | ± 500 | |
| Exact length | up to 6 m | +10 0 | +25 0 |
| | over 6 up to 12 m | +15 0 | +50 0 |
| | over 12 m | By agreement | 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. | | | |

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 5.5.6.

4.9 Non-destructive testing

The requirements given in *Stahl-Eisen-Prüfblatt* (Iron and steel test sheet) 1916 or 1917 are to be met in the non-destructive tests specified in subclause 5.5.8.

4.10 Dimensions, masses per unit length and permissible deviations

4.10.1 Dimensions

DIN 2458 shall apply for the outside diameter and wall thickness of tubes.

Table 5 shall apply for the types of tube length.

4.10.2 Permissible dimensional deviations

4.10.2.1 The information given in table 6 (see subclause 5.5.10) shall apply for the permissible deviations in outside diameter d_a .

•• For the tube ends, the lower permissible deviations in diameter given in table 6 may also be agreed.

4.10.2.2 The permissible deviations in wall thickness s are:

for s up to 3 mm: $+0,30$
 $-0,25$ mm;

for s over 3 mm up to and including 10 mm: $+0,45$
 $-0,35$ mm²⁾;

for s over 10 mm: $-0,50$ mm, the upper limit being given by the permissible deviation in mass.

At isolated points, the minimum wall thickness resulting from the permissible undersize for the wall thickness may additionally fall short by 5 % of the wall thickness, but only for lengths not greater than twice the outside diameter of the tube, or 300 mm whichever is the lower. This means locally limited areas which, for example, can occur as a result of removal of defects by grinding (see subclause 4.10.4 for the permitted weld reinforcement).

2) The upper limit for tubes made from heavy plate is given by the permissible deviation in mass.

Table 6. Permissible deviations in outside diameter and from circularity

| Outside diameter d_a mm | Permissible deviation in diameter | | Permissible deviation of tube from circularity 2) |
|---------------------------------|---|---|--|
| | Tube barrel and tube ends | •• At tube ends, subject to particular agreement 1) | |
| < 200 | ± 1 % d_a ; (values up to ± 0,5 mm are permitted in all cases) | ± 0,5 % d_a ; (values up to ± 0,3 mm are permitted in all cases) | Within the permissible deviation in diameter |
| $200 \leq d_a < 1000$ | ± (0,5 % d_a + 1) mm ³⁾ | $200 \leq d_a < 325$: ± 1,0 mm $325 \leq d_a < 1000$: ± 1,6 mm ⁴⁾ | 2 %; (this value is not guaranteed for $\frac{d_a}{s}$ exceeding 100) |
| ≥ 1000 | ± 6 mm ³⁾ | By agreement 4) | |

1) Over a length of about 100 mm from the tube ends.

2) See subclause 4.10.3.1.

3) •• Subject to agreement at the time of ordering, in the case of tubes with outside diameters exceeding 500 mm, the permissible deviation may also be referred to the inside diameter, in which case the permissible deviation in wall thickness is to be taken into account.

4) •• 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 wall thickness is to be taken into account.

Misaligned edges in pressure welded tubes, where the reduction in cross section exceeds the permissible under-size of wall thickness, are not permitted.

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 2393 Part 1 or DIN 2394 Part 1.

4.10.2.4 The permissible deviations in length are given in table 5.

4.10.3 Permissible deviations of form

4.10.3.1 Circularity

The tubes shall be as circular as possible. The permissible deviations from circularity are specified in table 6. The out-of-roundness R (see subclause 5.5.11) shall be determined using the following formula:

$$R = 200 \cdot \frac{d_{a\max} - d_{a\min}}{d_{a\max} + d_{a\min}}, \text{ in } \%$$

where $d_{a\max}$ is the greatest measured outside diameter and $d_{a\min}$ is the smallest measured outside diameter.

4.10.3.2 Straightness

The tubes shall be straight to the eye.

●● Particular requirements regarding straightness may be agreed.

4.10.4 Permissible weld reinforcement

a) For fusion welded tubes, the weld reinforcement Δ_a shall not exceed the following values as a function of the wall thickness s :

for $s \leq 8$ mm, $\Delta_a \leq 2,5$ mm;

for s over 8 mm up to and including 14 mm,
 $\Delta_a \leq 3,0$ mm;

for s over 14 mm up to and including 40 mm,
 $\Delta_a \leq 4,0$ mm.

b) For electrically pressure welded tubes, in the case of inside diameters not smaller than 20 mm, after the upset has been removed, the weld reinforcement Δ_a on the inside shall not exceed 0,3 mm.

c) For hot pressure welded tubes, the weld reinforcement Δ_a on the inside shall not exceed 0,3 mm + 0,05 \times s .

4.10.5 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 $30^\circ \pm 5^\circ$;
- the thickness of the root face shall be $(1,6 \pm 0,8)$ mm.

Other types of edge preparation are subject to particular agreement.

4.10.6 Masses per unit length and permissible deviations

The values of mass per unit length of tubes are specified in DIN 2458. The following deviations from these values are permitted:

+ 12 % for a single tube;

– 8 % for a batch of tubes not less than 10 t by mass.

5 Testing and documents on materials testing

5.1 General

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

- document DIN 50 049 – 2.2 (test report);
- 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 Where the tubes supplied are to be accompanied by a test report, the values obtained for the yield stress, tensile strength and elongation after fracture listed in table 4 and compliance with the requirements specified in subclauses 5.5.2 (or 5.5.3 where applicable) and 5.5.4 shall be confirmed on the basis of continuous internal control.

5.3.2 Where the tubes supplied are accompanied by an inspection certificate, they 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.

The test of welds used for joining lengths of strip in the case of spirally welded tubes shall be carried out on batches comprising 50 tubes with strip joining welds.

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 on the parent metal;
- additional tensile test transverse to the weld in the case of tubes exceeding 500 mm outside diameter;
- flattening test on pressure welded tubes (if the weld is not recognizable, the drift expanding test shall be carried out instead);
- bend test on fusion welded tubes;
- ●● product analysis, if this has been agreed at the time of ordering.

Table 7. Summary of the scope of test programme and documents on materials testing required for tubes supplied with inspection certificate; see figure 1 for sampling points and location of test pieces, see subclause 5.3.2 for batch size

| No | Testing | | Scope of test programme | | Responsibility for carrying out the tests | Type of document on materials testing |
|----|---|----------------------------------|---|---|---|--|
| | Type of test | As in sub-clause | Fusion welded tubes | Pressure welded tubes | | |
| 1 | Tensile test | 5.4.1 5.5.1 | One sample tube per batch. One test piece from the parent metal for outside diameters ≤ 500 mm, plus one test piece transverse to the weld for outside diameters > 500 mm. | | By agreement | DIN 50 049 - 3.1 A or DIN 50 049 - 3.1 B or DIN 50 049 - 3.1 C |
| | | 5.4.1.5 | For strip joining welds of fusion welded tubes, one test piece from one sample tube per batch. | | | |
| 2 | Flattening test or drift expanding test | 5.4.2 5.4.3 5.5.2 5.5.3 | - | At one end of sample tube specified above (No. 1): 2 test pieces for flattening test or one test piece for drift expanding test. | By agreement | DIN 50 049 - 3.1 A or DIN 50 049 - 3.1 B or DIN 50 049 - 3.1 C |
| 3 | Bend test | 5.4.4 5.5.4 | At one end of sample tube specified above (No. 1): 2 test pieces. | - | By agreement | DIN 50 049 - 3.1 A or DIN 50 049 - 3.1 B or DIN 50 049 - 3.1 C |
| 4 | Leak tightness test | 5.3.4.1 5.5.8 | All tubes | | Manufacturer | DIN 50 049 - 2.1 ¹⁾ |
| 5 | Inspection of surface | 5.5.7 | All tubes | | By agreement | DIN 50 049 - 3.1 A or DIN 50 049 - 3.1 B or DIN 50 049 - 3.1 C |
| 6 | Non-destructive testing of welds | 5.5.8 | All tubes | | Manufacturer | DIN 50 049 - 3.1 B |
| 7 | Check on dimensions | 5.5.9 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 ²⁾ | 5.4.5 5.5.5 | By agreement | | Manufacturer | DIN 50 049 - 3.1 B |

¹⁾ This certificate can also be included in the next higher stage of document.
²⁾ The product analysis shall only be carried out if so agreed between the manufacturer and purchaser.

5.3.3 Where the tubes supplied are to be accompanied by an inspection certificate, the weld shall be subjected to non-destructive testing over its entire length during manufacture.

5.3.4 Irrespective of the type of document on materials testing

5.3.4.1 all tubes shall be tested by the manufacturer for leak tightness, normally by means of a hydraulic test (see subclause 5.5.6).

If, under the test conditions specified in subclause 5.5.6 (test pressure, 50 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).

5.3.4.2 all tubes shall be inspected inside and outside for their surface appearance;

5.3.4.3 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 In the case of tubes with outside diameters not greater than 500 mm, one strip test piece (see DIN 50 140) shall be taken from the parent metal of the sample tube, longitudinal to the tube axis and offset from the weld by about 90°. 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).

| Outside diameter mm | Fusion welded tubes | | Pressure welded tubes |
|------------------------|---------------------|-------------|-----------------------|
| | Longitudinal weld | Spiral weld | |
| ≤ 500 | | | |
| > 500 | | | |

¹⁾ See also subclause 5.4.1.1.
²⁾ See also subclauses 5.4.1.2 to 5.4.1.5.
³⁾ If the weld is not recognizable, one test piece for the drift expanding test shall be taken instead of the two test pieces used for the flattening test (see also subclause 5.4.3).

In the illustrations above

B = bend test piece as specified in DIN 50 121 Part 1,

RF = flattening test piece as specified in DIN 50 136;

Z = tensile test piece (see subclause 5.4.1).

Figure 1. Sampling points and location of test pieces

5.4.1.2 In the case of tubes with outside diameters equal to or greater than 200 mm, at the manufacturer's discretion, a flat test piece (see DIN 50 125) may also be taken from the parent metal transverse to the tube axis. The test piece shall be cold straightened and may be annealed at a temperature below 500 °C.

5.4.1.3 In the case of tubes with outside diameters greater than 500 mm, a flat test piece as illustrated in figure 1 of DIN 50 120 Part 1 (September 1975 edition) or in figure 2 of DIN 50 120 Part 2 (August 1978 edition) shall be taken transverse to the weld with the weld in the middle and one flat test piece (see DIN 50 125) transverse to the tube axis and offset from the weld by about 90°. The test pieces shall be cold straightened and may be annealed at a temperature below 500 °C.

5.4.1.4 Instead of sampling as described in subclause 5.4.1.2, at the discretion of the manufacturer it is also permitted to take an unstraightened test piece worked on all sides (see DIN 50 125) transverse to the tube axis for testing the parent metal.

5.4.1.5 Normally, short proportional test pieces shall be taken for the tensile test on the parent metal. 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.

For the strip joining welds in the case of spirally welded tubes, the same specifications shall apply as for the other welds.

5.4.2 Flattening test

For the flattening test in the case of pressure welded tubes, two test pieces shall be taken from one end of the sample tube. The relevant specifications in DIN 50 136 shall be observed for sampling.

5.4.3 Drift expanding test

For the drift expanding test in the case of pressure welded tubes, one test piece shall be taken from one end of the sample tube. The relevant specifications in DIN 50 135 shall be observed for sampling.

5.4.4 Bend test

For the bend test in the case of fusion welded tubes, two test pieces shall be taken from the sample tube transverse to the weld and with the weld in the centre. The relevant specifications in DIN 50 121 Part 1 shall be observed for sampling. Before the test, the test pieces may be aged for six hours at 250 °C to remove the hydrogen.

5.4.5 Chemical composition

For checking the chemical composition by a product analysis on the finished tube, or, at the manufacturer's discretion, on the starting product (sheet or strip), 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 on the parent metal shall be carried out as specified in DIN 50 140 or DIN 50 145.

The tensile test transverse to the weld shall be carried out on test pieces as shown in figure 1 of DIN 50 120 Part 1 (September 1975 edition) or figure 2 of DIN 50 120 Part 2 (August 1978 edition).

5.5.2 The flattening test on pressure welded tubes shall be carried out as specified in DIN 50 136, even in cases where the outside diameter exceeds 400 mm. One of the two test pieces shall be tested with the weld in the 12 o'clock position and the other with the weld in the 3 o'clock position. The test pieces or tube ends shall be flattened until a specified distance between platens H is reached.

5.5.2.1 The weld shall not open before the distance between platens H reaches two-thirds of the original outside diameter of the tube.

5.5.2.2 Cracks or breaks in the material shall not occur outside the weld before the distance between platens H has gone below a value

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

but not below two-thirds of the original tube outside diameter.

In the equation

s is the wall thickness, in mm;

d_a is the outside diameter, in mm;

c is a constant having the following value:

0,09 for steel grades USt 37.0 and St 37.0,

0,07 for steel grades St 44.0 and St 52.0.

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

5.5.2.3 In the case of pressure welded tubes subject to special requirements with regard to cold formability in accordance with subclause 4.2.3 (as delivered condition N or G), the distance between platens H referred to in subclause 5.5.2.2 shall be reached without the weld opening and without cracks or breaks occurring in the material outside the weld.

5.5.3 The drift expanding test on pressure welded tubes shall be carried out as specified in DIN 50 135, with the expansion reaching the values specified in table 8.

5.5.4 The bend test on fusion welded tubes shall be carried out as specified in DIN 50 121 Part 1, January 1978 edition, figures 7 and 9, using mandrels the diameters of which are specified in table 4. The bend angle shall not exceed 180°. One test piece shall be tested with the outside of the tube in the tension zone and the other with the inside of the tube in the tension zone, the weld being at the centre of the test piece. No objection shall

Table 8. Minimum expansion in the drift expanding test

| Steel grade | Expansion for a ratio of inside diameter (d_i) to outside diameter (d_a) | |
|-------------|--|---------|
| | $\leq 0,8$ | $> 0,8$ |
| | % | |
| USt 37.0 | 10 | 12 |
| St 37.0 | 10 | 12 |
| St 44.0 | 8 | 10 |
| St 52.0 | 6 | 8 |

be raised to small cracks at the edge of the test piece or to local defects in the weld, e.g. pores or small inclusions, provided they do not affect the behaviour of the test pieces under bending.

5.5.5 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).

5.5.6 For the hydraulic leak tightness test (see also subclause 5.3.4.1) as specified in DIN 50 104, the test pressure shall be 50 bar.

5.5.6.1 •• A higher test pressure up to a maximum of 200 bar may be agreed in the case of tubes subject to acceptance inspection.

5.5.6.2 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 50 bar.

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

5.5.6.3 • For tubes for the field of application covered by DIN 2470 Part 1, in all cases a hydraulic pressure test at a test pressure corresponding to 85% utilization of the minimum yield stress at 20°C (subject to a maximum of 200 bar) shall be carried out for a duration of ten seconds. In calculating the test pressure as specified in DIN 2413, June 1972 edition, subclause 4.6, however a 100% utilization of the design stress shall be assumed.

5.5.7 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.

5.5.8 Non-destructive testing of the welded joint in the case of pressure welded tubes intended for a 90% utilization of the design stress shall be carried out in accordance with test class A and in the case of tubes intended for a 100% utilization of the design stress, in accordance with test class B of *Stahl-Eisen-Prüfblatt* 1917.

In the case of fusion welded tubes intended for a 100% utilization of the design stress (test class B) non-destructive testing shall be carried out in accordance with *Stahl-Eisen-Prüfblatt* 1916.

- For fusion welded tubes intended for a 90 % utilization of the design stress (test class A), the conditions for non-destructive testing shall be agreed at the time of ordering on the basis of *Stahl-Eisen-Prüfblatt* 1916 (revised edition in preparation).

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.

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

5.5.10 The diameter shall be measured using suitable measuring instruments as a two-point measurement or measurement of circumference. In the case of tubes with outside diameters greater than 500 mm, the measurement of circumference shall be used.

5.5.11 For determining the circularity, a two-point measurement in one cross-sectional plane shall be made.

5.6 Retests

5.6.1 Tubes not satisfying the requirements when tested as specified in subclauses 5.5.6 to 5.5.11 (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, flattening test or drift expanding test and bend test as specified in subclauses 5.5.1 to 5.5.4, 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 to 5.5.4. 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 requirements, 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 A document DIN 50 049 – 2.2 (test report) shall be issued for tubes not subject to acceptance inspection.

5.7.2 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 subject to acceptance testing. 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.

5.7.3 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 letters N or G where a particular as delivered condition as described in subclause 4.2.2 or 4.2.3 has been agreed);
- an appended symbol W indicating that the tube is welded;
- inspector's mark (where acceptance inspection has been agreed);
- code letter A or B depending on the intended extent of utilization of the design stress (where acceptance inspection has been agreed, see subclause 4.1.3).

In addition, in the case of tubes falling within the scope of DIN 2470 Part 1, the manufacturer shall mark these tubes with "2470/1" by stamping.

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 tubes¹⁾

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 | ≤16 mm | >16≤40 mm | ≤16 mm | >16≤40 mm | ≤16 mm | >16≤40 mm |
| | | N/mm ² | | | | | | | |
| USt 37.0 | 1.0253 | 235 | | 185 | | 165 | | 140 | |
| St 37.0 | 1.0254 | 235 | 225 | 185 | 175 | 165 | 155 | 140 | 135 |
| St 44.0 | 1.0256 | 275 | 265 | 215 | 205 | 195 | 185 | 165 | 160 |
| St 52.0 | 1.0421 | 355 | 345 | 245 | 235 | 225 | 215 | 195 | 190 |

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 1615 Welded circular unalloyed steel tubes not subject to special requirements; technical delivery conditions
- DIN 1628 High-performance welded circular unalloyed steel tubes; technical delivery conditions
- DIN 2393 Part 1 Welded precision steel tubes; dimensions
- DIN 2393 Part 2 Welded precision steel tubes; technical delivery conditions
- DIN 2394 Part 1 Welded and sized precision steel tubes; dimensions
- DIN 2394 Part 2 Welded and sized 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 2458 Welded steel tubes; dimensions, masses per unit length
- DIN 2470 Part 1 Gas pipelines made of steel for working pressures up to 16 bar; requirements to be met by pipeline components
- DIN 8528 Part 1 Weldability; metallic materials, concepts
- DIN 17 120 Welded circular steel tubes for structural steelwork; technical delivery conditions
- DIN 17 172 Steel pipes for long-distance pipelines conveying combustible liquids and gases; technical delivery conditions
- DIN 17 177 Electrically pressure welded 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 50 120 Part 1 Testing of steel; tensile test on welded joints; fusion welded butt joints
- DIN 50 120 Part 2 Testing of steel; tensile test on welded joints; pressure welded butt joints
- DIN 50 121 Part 1 Testing of metallic materials; bend test on welded joints and welded claddings; fusion welded joints
- DIN 50 125 Testing of metallic materials; tensile test pieces, guidelines for their preparation
- DIN 50 135 Testing of metallic materials; drift expanding test on tubes
- DIN 50 136 Testing of metallic materials; flattening 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 1805³⁾

Probenahme und Probenvorbereitung für die Stückanalyse bei Stählen

(Sampling and sample preparation for the product analysis of steels)

³⁾ Published by: Verein Deutscher Eisenhüttenleute, obtainable from: Verlag Stahleisen mbH, Postfach 82 29, D-4000 Düsseldorf 1.

Stahl-Eisen-Prüfblatt 1916³⁾

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 1917³⁾

Zerstörungsfreie Prüfung elektrisch-pressuregeschweisster Rohre aus ferritischen Stählen
(Non-destructive testing of electrically pressure welded ferritic steel tubes)

Stahl-Eisen-Prüfblatt 1925³⁾

Elektromagnetische Prüfung von Rohren zum Nachweis der Dichtheit
(Electromagnetic testing of tubes for leak tightness)

Handbuch für das Eisenhüttenlaboratorium³⁾ (Handbook for the ferrous metallurgy laboratory)

Volume 2: *Die Untersuchung der metallischen Stoffe*

(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 1626: 12.52x; DIN 1626 Part 1: 01.65; DIN 1626 Part 3: 01.65

Amendments

The following amendments have been made in comparison with DIN 1626 Part 1, January 1965 edition and DIN 1626 Part 3, January 1965 edition (see also Explanatory notes):

- The symbols for the steel grades have been changed (see table in the Explanatory notes).
- The maximum values for carbon, phosphorus and sulfur contents have been reduced (see tables 2 and 3).
- The values for the mechanical properties have been converted and in some cases changed (see table 4).
- The specifications relating to non-destructive testing of the weld for pipes supplied with an inspection certificate have been extended (see subclause 5.5.3).
- The whole text has been revised, taking into account the specifications of DIN 1626 Part 1, January 1965 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 Gas-technik (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 1626 Part 1 to Part 4, January 1965 editions, made in these revised editions of the technical delivery conditions for welded 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 welded tubes the following breakdown was introduced:

DIN 1615 (tubes not subject to special requirements), superseding DIN 1626 Part 2 (tubes for general applications),

DIN 1626 (tubes not subject to special requirements), superseding DIN 1626 Part 3 (tubes subject to quality specifications) and

DIN 1628 (high-performance tubes), superseding DIN 1626 Part 4 (specially tested tubes subject to quality specifications).

The content of DIN 1626 Part 1 has been incorporated into DIN 1626 and DIN 1628, as appropriate.

Classification of steel grades

The classification of the steels has been based on DIN 17 100 as before. The revised edition of the standard for general structural steels (January 1980 edition) however necessitated a corresponding change in the classification of steel grades in the tube standards. In addition to this, the symbols for the steels for welded tubes subject to special requirements and high-performance welded tubes have been changed to bring them into line with the designation of steels for seamless tubes in the same requirement class.

³⁾ See page 11.

The following table compares the former steel grades for welded tubes with those specified in DIN 1615, DIN 1626 and DIN 1628. However, in some cases it is necessary to take account of differences, particularly in the type of deoxidization used for the steels.

| Steel grade | | Comparable steel grades | |
|-------------|-------------------------------------|-------------------------|------------------|
| Symbol | specified in DIN 1626 ¹⁾ | Symbol | specified in DIN |
| St 33 | Part 2 | St 33 | 1615 |
| St 37 | Part 2 | - | - |
| St 42 | Part 2 | - | - |
| St 34-2 | Part 3 | - | - |
| St 37-2 | Part 3 | USt 37.0 | 1626 |
| | | St 37.0 | 1626 |
| St 42-2 | Part 3 | - | - |
| - | | St 44.0 | 1626 |
| St 52-3 | Part 3 | St 52.0 | 1626 |
| St 34-2 | Part 4 | - | - |
| St 37-2 | Part 4 | St 37.4 | 1628 |
| St 42-2 | Part 4 | - | - |
| - | | St 44.4 | 1628 |
| St 52-3 | Part 4 | St 52.4 | 1628 |

¹⁾ January 1965 edition, in each case.

Properties of products

The specifications relating to the chemical composition and the yield stress, tensile strength and elongation after fracture values are the same as the values specified in DIN 1629 and DIN 1630 for seamless tubes.

The mechanical properties determined in the tensile test are largely the same as those specified in DIN 17 100. Compared with the technical delivery conditions for general structural steels, however, the maximum values for the phosphorus and sulfur contents have been substantially reduced. As a result of this, especially in view of more detailed impact energy values given in DIN 1628, October 1984 edition (see table 3), the requirements for welded unalloyed steel tubes are now more stringent than those applying to the starting products (plate, sheet and strip) specified in DIN 17 100.

The values that have to be achieved in the bend test on fusion welded tubes remain virtually unchanged compared

with the earlier requirements. This applies also to the flattening test in the case of pressure welded tubes, for which however more stringent conditions apply when ordering tubes subject to special requirements regarding cold workability. The ring drift expanding tests and ring tensile tests specified in DIN 1623 Part 3 and Part 4, January 1965 editions, according to the outside diameter, have been omitted.

By way of extension of previous specifications, welds on tubes complying with DIN 1626 shall if these tubes are certified, also be subjected to non-destructive testing over their entire length. It remains to be clarified whether the test conditions for test class A at present given in *Stahl-Eisen-Prüfblatt* 1917, October 1970 edition, for pressure welded tubes for which a 90% utilization of the design stress is intended provide sufficient sensitivity for detecting defects or whether they may need to be made more stringent. It is in any case intended to extend *Stahl-Eisen-Prüfblatt* 1916, which applies to fusion welded tubes, to include specifications for test class A.

Scope of test programme

The information on the scope of test programme provided in subclause 5.3 of DIN 1626, October 1984 edition, and DIN 1628, October 1984 edition, has been largely brought into line with the specifications in DIN 17 172, May 1978 edition, and DIN 17 177, May 1979 edition. Compared with the earlier specifications, this meant that there were changes in the method of test (for example in the position of the test pieces for the tensile test as a function of the outside diameter of the tubes) and in the number of tests per batch. The new specifications did not meet with the unanimous approval of all the representatives of consumers and the technical inspection boards but were accepted as reasonable by a majority of the participants taking into account the current state of production technology and also in comparison with the specifications in other national and international technical delivery conditions.

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 an identical layout with identical wording (where this is appropriate to the particular case).

International Patent Classification

B 21 C 37-08