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English Version of "Werksnorm 001"

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Rectangular and square TIG-welded precision stainless steel tubes

1. Field of application

This Standard applies to the dimensions of rectangular and square TIG-welded precision stainless steel tubes with reference to the german standard DIN 2395, Part 1, Part 2 and Part 3 made of the steel grades listed in section 5. Tubes in accordance with this Standard are manufactured by cold forming and TIG-welding.

2. Other relevant standards

DIN 50 049 Certificates on material testing

3. Quality grade

The tubes are supplied in the following quality grade:

A Precision stainless steel tubes made of trading quality grades without certificate on material testing

B Precision stainless steel tubes made of trading quality grades with or without works certificate on used rawmaterial

C precision stainless steel tubes with special requirements, supplied with or without acceptance test certificate (DIN 50 049 -2.2) Special requirements and relevant tests must be agreed in advance and have to be specified in the enquiry.

4. Designation

Orders for tubes must specify the following details:

a) quantity
b) quality grade
c) steel grade
d) condition on delivery
e) height, width and wall thickness
f) length to be delivered
g) certificate on material testing

If no quality grade is specified, tubes are supplied according to quality grade A. For quality grade A the choice of the condition at delivery will be the procucer´s decision. If no delivered length is specified, production lengths of 6.000 mm are supplied.

If for, e.g., 5000 m of welded precision stainless steel tubes in trade quality grade (quality grade A, steel grade 1.4301) with a height h = 60 mm, width b = 40 mm and wall thickness s = 2 mm, delivered length 1 = 6000mm production length (Hstl.) is ordered, designation to be used in ordering reads as follows:

5000 m A 4301 60 x 40 x 2

If for e.g. , 5000m of welded precision stainless steel tube of quality grade B, made of steel grade 1.4571, ground with grain 240, cerificate about realized tests, works certificate DIN 50 049 - 3.1B of the used raw material (certificate of raw material supplier) is ordered, the designation to be used on ordering then reads:

5000 m B-G-K240 4571 60 x 40 x 2 - 3.1B

5. Material

Precision stainless steel tubes in accordance with this Standard are manufactured from high alloyed steel grades of material specification 1.4301 and 1.4571. If no steel grade is specified in the order, the producer chooses the steel grade.

6. Condition on delivery

The tubes are supplied in blanc condition, of hot-rolled or cold rolled raw material. If not agreed separately, the choice of the raw material is up to the producer. For ground tubes the order must contain details about the grain dimensions (grains e.g. K240). Ground tubes have to be orderd with the letter "G".

7. Mechanical and technological properties

7.1 For precision stainless steel tues in quality grade A mechanical properties are not established.

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7.2 For precision stainless steel tues in quality grade B mechanical properties according to the applied steel grade can be established. The established figures are taken of the steel work´s certificates. The figures do not apply to edges and welded areas.

7.3 Tubes according to this Standard are regarded as weldable on the basis of their chemical composition.This does not apply to different welding-methods since the behaviour of steel during and after the welding does not only depend on the quality grade but on the circumstances of the production and the later employment of the construction element.

8. Surface condition

8.1 The tubes must have a smooth surface, appropriate to the method of manufacture. Minor surface defects, such as pits, pores and longitudinal scores are permissible.

For precision stainless steel tubes signed with "G" the grain-dimension must be agreed on ordering. If only a ground surface is ordered, the choice of the grain-dimensions is up to the producer. The surface of ground tubes must be at least grain-dimension K=180. Tube-edges are not ground, if not explecitly agreed (price-surcharge). Due to the grinding-process of tubes one-sided grinding is not possible. At least the two opposite sides of the tube have to be ground. In no other agreement was made, tubes are ground on all sides.

8.2 The outside weld seam is normally not visible, as a consequence of the surface grinding-process for all quality grades. Normally an inside weld flash is max. 0.3mm since the tubes are welded up to 90 - 95%. If the weld seams have to be welded up to 100% it has to be enquired and orderd explicitely. Normally, the inner weld seam is metallic (blanc). This does not apply to high dimensional tubes. The buyer is no no right to insist in the metallic (blanc) inner surfa

8.3 The welding seam is always in the center of one side. Regarding rectangular dimensions the welding seam is normally located on the smaller side. If the welding seam`s location is determined, it has to be agreed.

8.4 Residues resulting from the production process may occur on the surfaces.

9. Dimensions and permissible deviations

9.1 Side lengths and wall thicknesses

Permissible deviations from the nominal dimension of the height and the width of the tubes are shown in table 1.

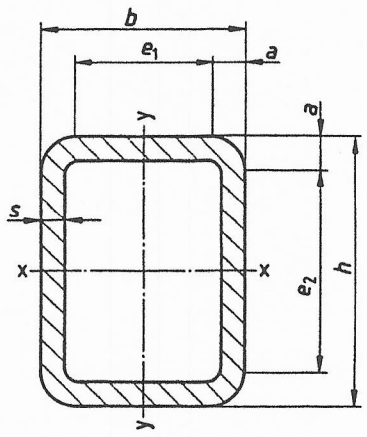
The permissible deviation from the nominal dimension of the wall thickness does not exceed +/- 10%. For intermediate dimensions, which can be supplied by agreement, the permissible deviations from the next larger nominal dimension apply. The permissible deviations given for the wall thicknesses do not, however, apply in the edge region or the weld region.

9.2 Edge region

The edge region a (Figure 1) is the width in the radial and axial directions of the flattening or rounding at the transition to the side faces.
The following values apply:

for wall thicknesses s ≤ 3 mm: 1,5 to 2,0 s
for wall thicknesses s > 3 mm: 1,5 to 2,5 s

On this basis, the inside edge region is approximately a - s, but should not be less than 0,5 mm.



Edge region
$a=\frac{b-e_1}{2}$ or $\frac{h-e_2}{2}$

Figure 1.

9.3 Position of the weld

Unless otherwise agreed, the weld lies in the centre of the narrow side (exeptions e.g. 300 x 100 or 250 x 150).

The permissible deviation of centres of the weld may be:

± 2 mm for side length b < 35 mm
± 4 mm for side length b > 35 mm

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9.4 Bowing
The side surfaces may exhibit concavity or convexity within the permissible deviations in height and width.

9.5 Squareness
The deviation of the cross sections from squareness may be +/- 1 °.

9.6 Twist
The permissible twist (twist of section) is 1 °/m for machine-finished tubes

9.7 Straightness
The permissible deviation from straightness (f) is 0,25 % of the measured length (l). This deviation is measured betweer the tube and a straight line (chord) connecting two arbitary points 1000 mm apart. The maximum deviation from straightness referred to the tube length must not, however, exceed 0,25 % of the overall length of the tube.

Figure 2.

9.8 Lengths
A distinction is made between:

a) Production lengths
Lengths between 3.000 and 7.000 mm with a permissible deviation of $_{0}^{+50}$ mm.
If no particular stipulations are made at the time of ordering, production lengths of 6000 mm +/- $_{0}^{50}$ mm are supplied (only production lengths are stocked up). Short lengths of < 2000 mm can represent 5% of the ordered quantity.

b) Fixed lengths (Exact lengths)
Unless otherwise agreed, the following deviations are permissible:

up to		500 mm length:	$\pm\ _{0}^{2}$ mm
over	500 to	2000 mm length:	$\pm\ _{0}^{3}$ mm
over	2000 to	5000 mm length:	$\pm\ _{0}^{5}$ mm
over	5000 to	7000 mm length:	$\pm\ _{0}^{10}$ mm
over		7000 mm length:	by agreement

9.9 Tube ends
The tubes must be parted as accurately as possible at right angles to the tube axis. The tubes may be delivered with the ends produced by the normal process used for parting them. This may result in demnesional variations at the end and even local reductions in wall thickness. This does not apply to fixed lengths. Any special finishing of the ends may be agreed.

9.10 Excess deliveries and shortfall deliveries
Excess deliveries or shortfall deliveries of up to 10 % of the ordered quantity are permissible in the case of production lengths. In the case of fixed lengths, shortfall deliveries are not permissible. Excess deliveries of up to 20 % of the ordered quantitiy are permissible.

10. Testing
10.1 Tubes without test certificate
Unless particular requirements are specified at the time of ordering, no works certificate about raw material tests for all quality grades is prepared.

10.2 Tubes with test certificate
By agreement at the time of ordering, the tubes of quality grade B and C can be supplied with an acceptance test certificate of the raw material (certificate of the steel mill) in accordance with DIN 50 049. Details about the required certificate must be agreed by ordering.

By agreement at the time of ordering, the tubes of quality grade C can be supplied with a work certificate of the tube-producer in accordance with DIN 50 049-2.2. Details about the required certificate must be agreed by ordering.

10.2.1 Extent of testing

For the establishment of the works certification in accordance with DIN 50 049-2.2 every 10. tube in production is tested in accordance with the nominal values and tolerances of the works certificate. In case of deviations, the previous 9 tube: are tested 100% and separated - if necessary.The machines´standard is corrected and every single tube is tested until the rolling-tolerances are guaranteed. Tubes which do not correspond to the required tolerances, are separated and can only be accepted by the work`s direction in agreement with the customer.

10.2.2 Test methods and results

All tests must be carried out at room temperature.

10.2.3.1 Dimensonal test

The dimensions of the tubes are controlled by random test (see 10.2.1) with special test-equipment. The control of the side-lengths (h and b) is to take with a distance of the edges of the tubes of at least 100mm.For the edge area applies topic 9.2, for the weld zone applies topic 9.3. All test-results are reported and signed by the test-personnel. The work certificate contains an analysis of the reported dates. Normally no test of the mechanical and metallographic standards i realized, therefore the dates of the raw material are copied.
These dates do not apply to edge and weld-zones. If further tests according to DIN 50 049 are required, the german "Technischer -Überwachungsverein" must be consultated.

10.2.3.2 Visual examination

Visual examination of the outside surface must be carried out on tubes selected at random. Visual examination of the tubes must be cariied out by the naked eye with suitable illumination. This visual examination is a 100% examination of rolling-scratches, grind-failures and weld-failures. Another visual examination on random is effected by packaging.

11. Marking

The tubes must be marked by labels or signs fixed firmly to the bundles or to the crate and bearing the following information:

- manufacturer's symbol
- technical conditions of delivery and quality grade
- steel grade
- dimensions
- technical conditions at delivery

Other marking by agreement.

12. Packaging

The tubes are normally supplied in bundles. The bundles are tied together in plastic strip or paper-wrapped steel strip. Ground tubes are wrapped one by one in plastic foil and supplied in bundles. Bundles are supplied with wooden piece under the plastic or steel strip. Otherwise the type of packaging must be agreed according to the quality requirements.

13. Complaints

Complaints may only be made about defects within the terms of the technical conditions of delivery in this Standard or other agreements. The customer must give the supplier the opportunity to judge whether a complaint is justified by submitting the tube objected to and samples of the other tubes delivered.

14. Trade material

The criteria given in this Standard are exclusively relevant for products made by Albrecht Zwick GmbH. Regarding trade material the normal tolerances customary in the trade apply. The reponsiblilty of these products is assumed by the producers of the trade material.

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Table 1: Dimensions, Heighth and widths tolerances

Side-lengths h Nominal-dimension [mm]	b Nominal-dimension [mm]	Per. dev. for h and b [mm]	Nominal-dimension [mm]	Nominal-dimension [mm]	Per. dev. for h and b [mm]	Nominal-dimension [mm]	Nominal-dimension [mm]	Per. dev. for h and b [mm]
10	10	± 0,10	45	25	± 0,20	80	80	± 0,40
15	15	± 0,15		35		90	90	± 0,45
16	16	± 0,15		45		100	20	± 0,30
22	22	± 0,15	50	15	± 0,25		30	
23	10	± 0,15		20			40	
20	10[1]	± 0,15		25			50	
	15			30			60	
	20			40			80	± 0,40
25	10[1]	± 0,15		50			100	
	15		55	25	± 0,15	120	40	± 0,50
	20			55	± 0,20		60	
	25		57	15	± 0,15		70	± 0,60
30	10[1]	± 0,15	59	15	± 0,15		80	
	15			20			100	
	20		60	15	± 0,20		120	
	25			20		140	60	± 0,80
	30			25			80	± 1,00
32	32	± 0,15		30			140	
33,7	23	± 0,15		40	± 0,30	150	50	± 0,80
34	34	± 0,15		45			70	
35	15	± 0,20		60			80	± 1,00
	20		70	20	± 0,25		100	
	35			30			150	
37	37	± 0,15		40	± 0,30	160	80	± 1,00
40	15	± 0,20		50		180	80	± 1,00
	20			70	± 0,35	200	50	± 1,30
	25		80	20	± 0,30		80	
	27			30			100	
	29			40			200	± 1,80
	30			50		250	100	± 1,80
	40			60	± 0,40		150[1]	± 2,00
						300	100[1]	± 3,00

[1] By this dimensions is the weld lies in the centre of the bride side.