

DIN 2393-81 Part 2 WELDED PRECISION STEEL TUBES

1. Field of application

This Standard defines the technical conditions of delivery for welded precision steel tubes in accordance with DIN 2393 Part 1 which are made from the steel grades listed in section 5.

Tubes in accordance with this Standard are mainly used where accuracy to dimension and in some cases also small wall thicknesses and good surface condition are required.

Grade	Mfg. Process	Chemical composition (%)									
		C	Si	Mn	P	S	Ni	Cr	Mo	Others	
St28 USt28 RSt28	W	0.13Max	-	-	0.50Max	0.50Max	-	-	-	-	① ② ③ ④
St34.2 US34.2 RSt34.2	W	0.15Max	-	-	0.50Max	0.50Max	-	-	-	-	① ② ③ ④
St37.2 USt37.2 RSt37.2	W	0.17Max	-	-	0.50Max	0.50Max	-	-	-	-	① ② ③ ④
St44.2	W	0.21Max	-	-	0.50Max	0.50Max	-	-	-	-	① ② ③ ④
St52.3	W	0.22Max	0.55Max	1.60Min	0.040Max	0.040Max	-	-	-	-	① ② ③ ④

①Cold-finished/hard ②Cold-finished/soft ③Annealed ④Normalized

Grade	Material number	Tensile Test MPa or N/mm ²		Remarks (Similar to JIS)
		Min Yield point	Tensile Strength	
St28	-	-	400Min	(STKM11) (STAM80G)
USt28	1.0357	-	325Min	
RSt28	1.0326	-	265Min	
		175	275 – 380	
St34-2	-	-	410Min	
US34-2	1.0028	-	350Min	
RSt34-2	1.0034	-	305Min	
		205	315 – 410	
St37-2	1.0037	-	440Min	(STKM12)
USt37-2	1.0036	-	370Min	
RSt37-2	1.0038	-	315Min	
		235	340 – 470	
St44-2	1.0044	-	570Min	(STKM13) (STAM40G)
		-	450Min	
		-	390Min	
		255	410 – 540	
St52-3	1.0570	-	590Min	(STKM19)
		-	540Min	
		-	490Min	
		350	490 – 630	

Table 1. Steel grades

Quality grade	Steel grade	
	Code number	Material number
A and B	St 28	-
	USt 28	1.0357

	RSt 28	1.0326
	St 34-2	-
	USt 34-2	1.0028
	RSt 34-2	1.0034
	St 37-2	1.0037
	USt 37-2	1.0036
	RSt 37-2	1.0038
	St 44-3	1.0044
	St 52-3	1.0570
C	All steel grades IN accordance with quality grade A and B or other weldable steels, example to	
	DIN 1614	DIN 1651
	DIN 1623	DIN 17200
	DIN 1624	DIN 17 210

6. Chemical composition

6.1. Information on the chemical composition of the steels is given in table 2. Small departures from these data which apply to the ladle analysis are permissible provided the properties of the steel in use are not thereby impaired.

6.2. When subsequent testing is carried out on the finished tube, additions to the figures given for the ladle analysis in table 2 must be allowed for the maximum permissible contents in terms of carbon, phosphorus and sulfur :

- ifor deviations due to sampling and method of analysis + 5 %
- ifor deviations due to segregation
 - in the case of rimming steels + 20%
 - in the case of killed steels + 5 %

of the particular maximum content.

Table 2. Steel grades and chemical composition of the steels (ladle analysis) 1)

Steel grade		Chemical composition %		
Symbol	Material number	C	P	S
		max	max	max
St 28	-			

USt 28	1.0357			
RSt 28	1.0326			
St 34-2	-			
USt 34-2	1.0028	0.15	0.050	0.050
RSt 34-2	1.0034			
St 37-2	1.0037			
USt 37-2	1.0036	0.17	0.050	0.050
RSt 37-2	1.0038			
St 44-2	1.0044	0.21	0.050	0.050
St 52-3 2)	1.0570	0.22	0.040	0.040
1) See Explanations				
2) Si content 0.55% max. Mn content 1.60% max.				

7. Condition on delivery

The tubes are supplied in one of the conditions listed in table 3. Other conditions on delivery see table 9 (quality grade C).

Table 3. Conditions on delivery

Term	Symbol	Explanation
Cold-finished/hard (cold-finished as-drawn)	BK	No heat treatment after the last cold-forming process. for this reason, the tubes therefore have only low deformability.
Cold-finished/soft (lightly cold-worked)	BKW	After the last heat treatment there is a light finishing pass (cold drawing). if subsequent working is carried out properly, the tube can be cold-formed (e.g. bent, expanded) within certain limits.
Annealed	GBK	After the final cold-forming process, the tubes are annealed in a controlled atmosphere or under vacuum.
Normalized	NBK	The tubes are annealed above the upper transformation point in a controlled atmosphere or under vacuum.

8. Mechanical and technological properties

Steel grade	Condition on delivery			
	Cold-finished/soft (BK 3)	Cold-finished/soft (BKM 3)	Annealed (GBK 3)	Normalized (NBK)

Code number	Material number	Tensile strength	Elongation at reapture	Tensile strength	Elongation at reapture	Tensile strength	Elongation at reapture	Tensile strength	Upper yield point	Elongation at reapture
		Rm N/mm ² min	A5 % min	Rm N/mm ² min	A5 % min	Rm N/mm ² min	A5 % min	Rm N/mm ² min	A5 % min	ReH N/mm ² min
St 28	-									
USt 28	1.0357	400	8	320	12	260	32	270 to 380	180	32
RSt 28	1.0326									
St 34-2	-									
USt 34-2	1.0028	410	6	350	12	300	28	310 to 410	205	28
RSt 34-2	1.0034									
St37-2	1.0037									
USt37-2	1.0036	440	6	370	10	315	25	340 to 470	235	25
RSt 37-2	1.0038									
St 44-2	1.0044	520	5	450	8	390	21	410 to 540	255	21
St 52-3	1.0570	590	4	540	6	490	22	490 to 630	355	22

3) The yield point for the annealed GBK condition on delivery is at least 50% of the tensile strength.

According to the degree of deformation, the drawing process, the yield point of tubes delivered in the cold finished/hare (BK) and cold-finished/soft (BKW) condition may be increased to a level close to the tensile strength. The following value are recommended for calculating the yield pint : condition on delivery cold-finished/hard : $\geq 80\%$ of the tensile strength, cold-finished/soft: $\geq 70\%$ of the tensile strength.

4) In the case of tubes of outside diameter ≤ 30 mm, the wall thickness of which is ≤ 3 mm, the minimum value for the yield point is 10 N /mm² lower.