Welded Steel Tube to EN10305-3

Table 1 - Delivery conditions

Designation	Symbol[a]	Description
Welded and cold sized	+CR1[a]	Normally not heat treated, but suited for final annealing.
Welded and cold sized	+CR2[b]	Not intended for heat treatment after the welding and sizing process.
Annealed	+A	After the welding and sizing process the tubes are annealed in a controlled atmosphere.
Normalised	+N	After the welding and sizing process the tubes are normalised in a controlled atmosphere. This delivery condition can be reached via direct processing.

a) After annealing or normalising, the mechanical properties given in Table 4 for the delivery condition +A or +N respectively are normally obtained.
b) If further heat treatment is applied, the resulting mechanical properties may be outside the specified requirements.

Table 2 - Chemical composition (cast analysis)[a]

Steel Grade		% by mass				
Steel name	Steel number	C max.	Si max.	Mn max.	P max.	S max.
E155	1.0033	0,11	0,35	0,70	0,025	0,025
E190	1.0031	0,10				
E195	1.0034	0,15	0,35	0,70	0,025	0,025
E220	1.0215	0,14				
E235	1.0308	0,17	0,35	1,20	0,025	0,025
E260	1.0220	0,16				
E275	1.0225	0,21	0,35	1,40	0,025	0,025
E320	1.0237	0,20				
E355[b]	1.0580	0,22	0,55	1,60	0,025	0,025
E370[b]	1.0261	0,21				
E420[b]	1.0575	0,16	0,50	1,70	0,025	0,025

a) Elements not included in this table (but see footnote b) shall not be intentionally added to the steel without the agreement of the purchaser, except for elements which may be added for finishing the cast. All appropriate measures shall be taken to prevent the addition of undesirable elements from scrap or other materials used in the steel making process.
b) Additions of Nb, Ti and V are all permitted at the discretion of the manufacturer. The content of these elements shall be reported.

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Table 3 - Mechanical properties at room temperature for the delivery conditions +CR1, +A and +N

Steel grade		Minimum values for the delivery condition						
		+CR1[a,b]		+A[c]		+N		
Steel name	Steel number	R_m MPa	A %	R_m MPa	A %	R_m MPa	R_eH[d] MPa	A %
E155	1.0033	290	15	260	28	270 to 410	155	28
E195	1.0034	330	8	290	28	300 to 440	195	28
E235	1.0308	390	7	315	25	340 to 480	235	25
E275	1.0225	440	6	390	21	410 to 550	275	21
E355	1.0580	540	5	450	22	490 to 630	355	22

a) R_m: tensile strength; R_eH: upper yeild strength (see EN10002-1); A: elongation after fracture. For symbols for the delivery condition see Table 1.
b) Depending on the degree of cold forming the strip material and sizing the 'as welded tube', the yield strength may nearly be as high as the tensile strength. For calculation purposes yeild strength values of $R_eH \geq 0.7\ R_m$ are recommended in the +CR1 condition.
c) NOTE The mechanical properties and technological properties of the weld zone may, in the case of the delivery conditions +CR1 and +A, differ from those of the base material.
d) For tubes with outside diameter ≤ 30 mm and wall thickness ≤ 3 mm the R_eH minimum values are 10MPa lower than the values given in this table.

Table 4 - Mechanical properties (minimum values) at room temperature for the delivery condition +CR2[a]

Steel grade		Tensile strength	Yield strength	Elongation after fracture
Steel name	Steel number	R_m MPa	R_eH MPa	A %
E190	1.0031	270	190	26
E220	1.0215	310	220	23
E260	1.0220	340	260	21
E320	1.0237	410	320	19
E370	1.0261	450	370	15
E420	1.0575	490	420	12

NOTE The mechanical and technological properties of the weld zone may differ from those of the base material.
a) For the symbol for the delivery condition see Table 1.

Table 5 - Tolerances

OD range	Tolerance limits
6-19	+/- 0.12
20-30	+/- 0.15
32-42.4	+/- 0.20
44-51	+/- 0.25
55-63.5	+/- 0.30
70-76	+/- 0.35

Outside diameter on heat treated tubes

T/D Ratio	Factor
≥ 0.5	1
0.05 ≥ T/D ≥ 0.025	1.5
< 0.025	2

Wall thickness

T ≤ 1.5mm ± 0.15mm
T > 1.5mm ± 0.1T or ± 0.35 (whichever is the smaller)

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