

# Welded Cold Drawn Steel Tube to EN10305-2

Table 1 - Delivery conditions

Designation	Symbol	Description
Cold drawn / hard	+C	No heat treatment after the final cold drawing process.
Cold drawn / soft	+LC	After the final heat treatment there is a suitable drawing pass.
Cold drawn and stress relieved	+SR	After the final cold drawing process there is a stress relief heat treatment in a controlled atmosphere.
Annealed	+A	After the final cold drawing process the tubes are annealed in a controlled atmosphere.
Normalised	+N	After the final cold drawing operation the tubes are normalised in a controlled atmosphere.

Table 2 - Chemical composition (cast analysis)<sup>a</sup>

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
E195	1.0034	0,15	0,35	0,70	0,025	0,025
E235	1.0308	0,17	0,35	1,20	0,025	0,025
E275	1.0225	0,21	0,35	1,40	0,025	0,025
E355 <sup>b</sup>	1.0580	0,22	0,55	1,60	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 permitted at the discretion of the manufacturer. The content of these elements shall be reported.

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Table 3 - Permissible deviations of the product analysis from the specified limits given in Table 2

Element	Limiting value for cast analysis in accordance with Table 2 in % by mass	Permissible deviation of the product analysis in % by mass
C	≤0,22	+ 0,02
Si	≤0,55	+ 0,05
Mn	≤1,60	+ 0,10
P	≤0,025	+ 0,005
S	≤0,025	+ 0,005

Table 4 - Mechanical properties at room temperature

Steel grade		Minimum values for the delivery condition <sup>ab</sup>											
Steel name	Steel number	+C <sup>c</sup>		+LC <sup>c</sup>		+SR			+A <sup>d</sup>		+N		
		R <sub>m</sub> <sup>m</sup> MPa	A %	R <sub>m</sub> <sup>m</sup> MPa	A %	R <sub>m</sub> <sup>m</sup> MPa	R <sub>eH</sub> <sup>e</sup> MPa	A %	R <sub>m</sub> <sup>m</sup> MPa	A %	R <sub>m</sub> <sup>m</sup> MPa	R <sub>eH</sub> <sup>e</sup> MPa	A %
E155	1.0033	400	6	350	10	350	245	18	260	28	270 to 410	155	28
E195	1.0034	420	6	370	10	370	260	18	290	28	300 to 440	195	28
E235	1.0308	490	6	440	10	440	325	14	315	25	340 to 480	235	25
E275	1.0225	560	5	510	8	510	375	12	390	21	410 to 550	275	21
E355	1.0580	640	4	590	6	590	435	10	450	22	490 to 630	355	22

a) R<sub>m</sub>: tensile strength; R<sub>eH</sub>: upper yield strength (see EN10002-1); A: elongation after fracture. For symbols for the delivery conditions see Table 1.

b) 1MPa = 1 N/mm<sup>2</sup>

c) Depending on the degree of cold work in the finishing pass the yield strength may nearly be as high as the tensile strength. For calculation purposes the following relationships are recommended:

- for delivery condition +C : R<sub>eH</sub> ≥ 0.8 R<sub>m</sub>

- for delivery condition +LC : R<sub>eH</sub> ≥ 0.7R<sub>m</sub>

d) For calculation purposes the following relationship is recommended: R<sub>eH</sub> ≥ 0,5 R<sub>m</sub>

e) For tubes with outside diameter ≤ 30 mm and wall thickness ≤ 3 mm the R<sub>eH</sub> minimum values are 10MPa lower than the values given in this table.