

EN 10305-1						DIN 2391					UNI 7945:79										
Steel name	E355*					Steel name	St 52					Steel name	Fe 490								
	C	Si	Mn	P	S ^b		C	Si	Mn	P	S		C	Si	Mn	P	S				
Chemical composition*	≤ 0.22	≤ 0.55	≤ 1.60	≤ 0.025	≤ 0.025	Chemical composition*	≤ 0.22	≤ 0.55	≤ 1.60	≤ 0.025	≤ 0.025	Chemical composition	≤ 0.23	≤ 0.35	≤ 1.5	≤ 0.050	≤ 0.050				
	* Additions of Nb, Ti and V are permitted at the discretion of the manufacturer. The content of these elements shall be reported. *a controlled sulphur content of 0.015% e 0.040% is specified to support machinability.						* The following alloying elements may be added: Nb ≤ 0.03%, Ti ≤ 0.03%, V ≤ 0.05%, Nb+Ti+V ≤ 0.05%														
DELIVERY CONDITIONS						DELIVERY CONDITIONS						DELIVERY CONDITIONS									
+C	no heat treatment after the final cold drawing process					BK	Tubes do not undergo heat treatment following the final cold forming and, thus, have a rather high resistance to deformation.					GBK	the tubes are annealed in a controlled atmosphere								
+LC	after the final heat treatment there is a suitable drawing pass					BKW	The final heat treatment is followed by cold drawing involving limited deformation. Appropriate further processing allows a certain degree of cold forming (e.g. bending, expanding).					NBK	the tubes are normalized in a controlled atmosphere								
+SR	after the final cold drawing process there is a stress relief heat treatment in a controlled atmosphere					BKS	Heat treatment is applied following the last cold forming process. Subject to appropriate processing conditions, the increase in the residual stresses involved enables both forming and machining to a certain degree					BK	no heat treatment after the final cold drawing process								
+A	after the final cold drawing process the tubes are annealed in a controlled atmosphere					GBK	The last cold forming process is followed by annealing in a controlled atmosphere.					BKW	Heat treatment is applied following the last cold forming process. Subject to appropriate processing conditions, the increase in the residual stresses involved enables both forming and machining to a certain degree								
+N	after the final cold drawing operation the tubes are normalized in a controlled atmosphere					NBK	The last cold forming process is followed by annealing above the upper transformation point in a controlled atmosphere.														
MECHANICAL PROPERTIES						MECHANICAL PROPERTIES						MECHANICAL PROPERTIES									
Tensile strength (R _m) (Mpa) min	+C	+LC	+SR	+A	+N	Tensile strength (R _m) (Mpa) min	BK	BKS	BKW	GBK	NBK	Tensile strength (R _m) (Mpa) min	BK	BKW	GBK	NBK					
	640	580	580	450	490 a 630		640	580	580	490	490 - 630		600	550	480	490					
Yield strength (R _{eH}) (Mpa) min	+C	+LC	+SR	+A	+N	Yield strength (R _{eH}) (Mpa) min	BK	BKW	BKS	GBK	NBK	Yield strength (R _{eH}) (Mpa) min	BK	BKW	GBK	NBK					
	≥ 0.8 R _m	≥ 0.7 R _m	450*	450	355*		≥ 80% R _m	≥ 70% R _m	420	≥ 50% R _m	355		600	550	480	285					
*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						For tubes with D ≤ 30mm e Wt ≤ 3mm the minimum yield strength may be 10N/mm ² lower.						The tubes in the GBK or NBK are to be regarded as weldable. It should, however, be noted that the mechanical properties of cold drawn tubes are modified in the zone of the tube which has been subjected to heat									
Elongation %	+C	+LC	+SR	+A	+N	Elongation %	BK	BKW	BKS	GBK	NBK	Elongation %	BK	BKW	GBK	NBK					
	4	7	10	22	22		4	7	10	22	22		4	7	23	21					
TOLERANCES						TOLERANCES						TOLERANCES									
Outside diameter D(mm)	+C	+LC	see Table 6			Outside diameter D(mm)	BK - BKW	see Table 2				Outside diameter D(mm)	BK - BKW	see Table VII							
	Per +SR +A +N is function of Wt/D***						For GBK - NBK - BKS is function of Wt *						Per GBK - NBK is function of Wt/D								
	≥ 0.05		< 0.05 ≥ 0.025		< 0.025		≥ 0.05*D		< 0.05*D ≥ 0.025*D		< 0.025*D		≥ 1/20		< 1/20 ≥ 1/40		< 1/40 ≥ 1/60		< 1/60		
	1* value tab.6		1.5* value tab.6		2* value tab.6		1* value tab.2		1.5* value tab.2		2* value tab.2		1* value table VII		1.5* value table VII		2* value table VII		2.5* value table VII		
The tolerances of the outside diameter shall be in accordance with this table divided by 2, with a minimum of ± 0.05 mm ***The diameter tolerances shall be unilateral, with the corresponding range specified in this table						If one of the limit deviations is to be zero, this shall be stated in the order, e.g. instead of (55±0.25) mm, either (55 ^{+0.5}) mm or (55 _{as} ⁰) mm * The dimensions given also apply to the inside diameter															
Inside diameter d(mm) see Table 6						Inside diameter d(mm) see Table 2						Inside diameter d(mm) see Table VII									
Wall thickness Wt(mm) ± 10 % o 0.1 mm (whichever is the greater)						Wall thickness Wt(mm) ± 10 %						Wall thickness Wt(mm) ± 10 % with a minimum of 0.12 mm per 4 ≤ D ≤ 5 mm ± 20 % - per 6 ≤ D ≤ 8 mm ± 15 %									
Length L(mm)	random length	min. 3m e max.8m (max. range 2m per order item)				Length L(mm)	manufacturing lengths	random lengths between 4m and 7m The number of tubes in lengths from 2 m to below 4 m shall not exceed 15% of the quantity ordered and shall be supplied in separate bundles				Length L(mm)	Exact lengths								
	approximate length	± 500 mm					cut lengths	± 500 mm of the length ordered Short lengths of 2000 mm or more being supplied in separate bundles up to a maximum of 10% of the quantity ordered					≤ 0.5 m	> 0.5 m ≤ 2 m	> 2 m ≤ 5 m	> 5 m ≤ 7 m	> 7 m				
	exact length	≤ 500	>500 ≤2000	>2000 ≤5000	>5000 ≤8000		>8000	exact lengths	≤ 500	> 500 ≤ 2000	> 2000 ≤ 5000		> 5000 ≤ 7000	> 7000	+ 2 0	+ 3 0	+ 5 0	+ 10 0	to agree		
		*	+3 0	+5 0	+10 0		*		+ 2 0	+ 3 0	+ 5 0		+ 10 0	to agree	Manufacturing lengths from 2m to 7m						
*an agreed unilateral tolerance is specified																					
STRAIGHTNESS *						STRAIGHTNESS *						STRAIGHTNESS *									
D > 15 mm	R _{eH} ≤ 500		R _{eH} > 500			D > 15 mm	0.25% of the total length				D > 15 mm	3 mm/m									
0.0015*L		0.002*L			0.3 % of the total length for tubes with R _{eH} > 500 N/mm ²				shall be measured as distance between the tubes surface and the chord linking two random points 1 m apart												
D < 15 mm	Straightness and the inspection method may be agreed at the time of enquiry and order					D < 15 mm	shall be subject to agreement					More stringent requirements regarding straightness shall be subject to agreement									
* Short exact lengths below 1000mm may have a limit deviation from straightness of 0.003 L						* Localized deviations shall not exceed 3mm/m						* The tubes shall be straight									
INSPECTION DOCUMENTS (in accordance with EN 10204)						INSPECTION DOCUMENTS (in accordance with DIN 50049)						INSPECTION DOCUMENTS (in accordance with UNI 5447)									
Test report	2.2					Without inspection document (quality grade A)	Inspection document	2.2				Without inspection document	Certificate of compliance with order								
Inspection certificate	3.1.B							With inspection document (quality grade C)	Inspection certificate	The manufacturer shall submit tubes to: a dimensional check, a surface inspection, a tensile test, a flattening test, a drift expanding test				With inspection document	Test report						
	3.1.A - 3.1.C					3.1B This shall be agreed upon at the time of ordering. The order shall state the type of document requested and the name the testing agency if the inspection is carried out by a third party				Inspection certificate											
The purchaser shall supply to the manufacturer the name and address of the organization or person nominated to carry out the inspection and to issue and validate the inspection document												Inspection report									
FREQUENCY OF TESTS						FREQUENCY OF TESTS						FREQUENCY OF TESTS									
Tensile test			one sample per batch			Tensile test			one sample per batch			Tensile test			one sample per batch						
*A test unit shall comprise not more than 3000m o 500 tubes whichever is the greater mass of the same steel grade and dimensions continuously manufactured by the same process and in the same delivery condition, heat treated, where applicable, in the same batch and the same heat treatment facility. Residual quantities of less than 50 tubes may be added to test units evenly. Option **The test unit shall only contain tubes from one cast.						Tubes shall be divided according to steel grade, final supply condition and size, into batches each comprising 200 units. Remainders of up to 20 units may be distributed uniformly across the other batches, remainders ranging from 20 to 200 units and consignments of less than 200 units being considered a whole batch						Tubes shall be divided according to steel grade, final supply condition and size, into batches each comprising 200 units. Remainders of up to 20 units may be distributed uniformly across the other batches. R remainders ranging from 20 to 200 units and consignments of less than 200 units being considered a whole batch									
MARKING						MARKING *						MARKING *									
Manufacturer's name	Specified dimensions	The number of this EN (EN 10305 - 1)			Manufacturer's mark	Technical delivery condition and quality grade		Steel grade			Manufacturer's mark	The number of this norm - (UNI 7945)									
Steel name	The cast number, when option ** applies	The delivery condition including the surface condition (symbol)				Supply condition (BK, BKW,...)	dimensions	Inspector's mark for tubes with inspection certificate				Steel grade	Technical delivery condition								
In case of specific inspection, an identification number which permits the correlation of the product or delivery unit to the related document						* A durable tag shall be securely attached to each bundle						* A durable tag shall be securely attached to each bundle									