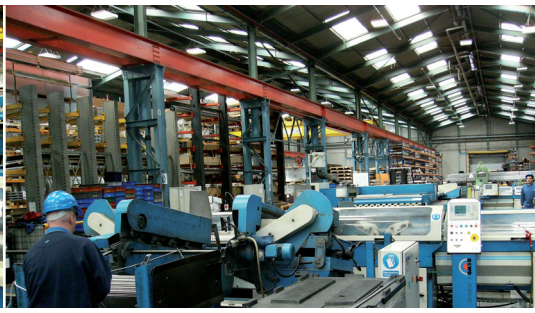
Bespoke solutions for Automotive tube requirements





ThyssenKrupp Materials (UK)
Tube Service Centre

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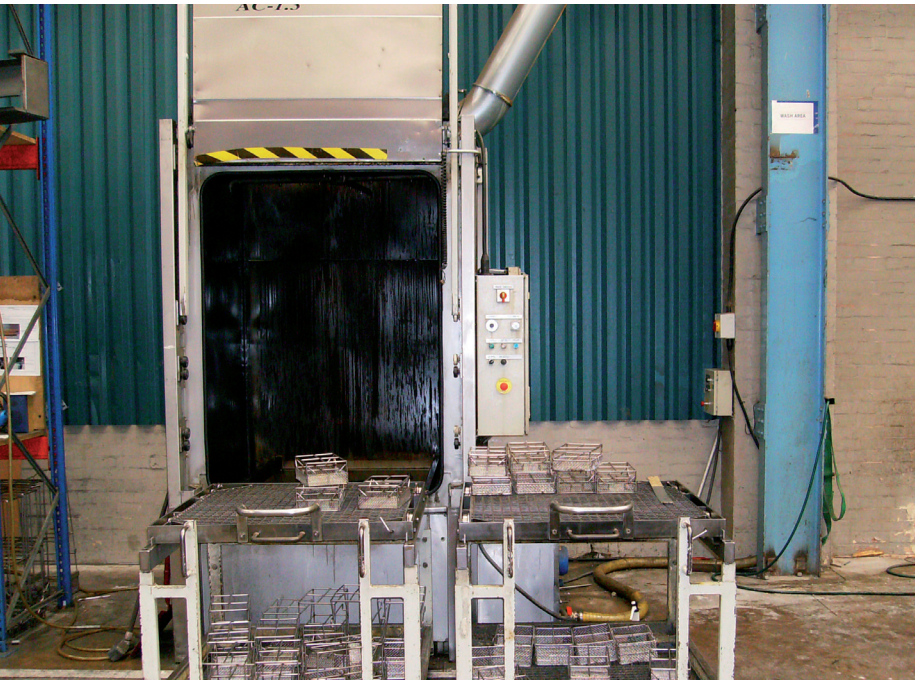
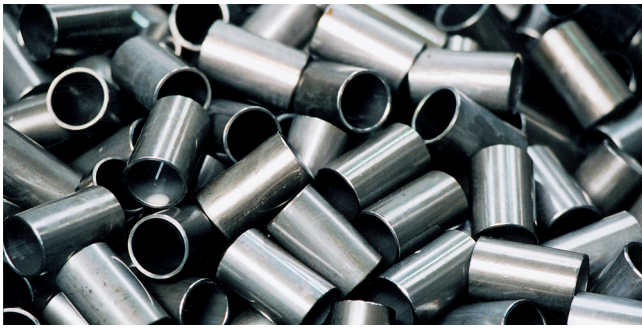
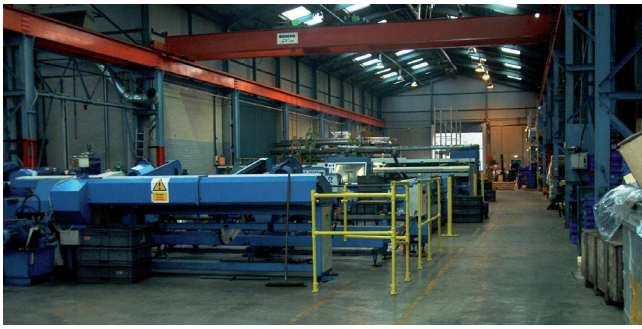
Added-value partnership







Tube Service Centre is a division of ThyssenKrupp Materials (UK), providing a variety of processing options for tube products.

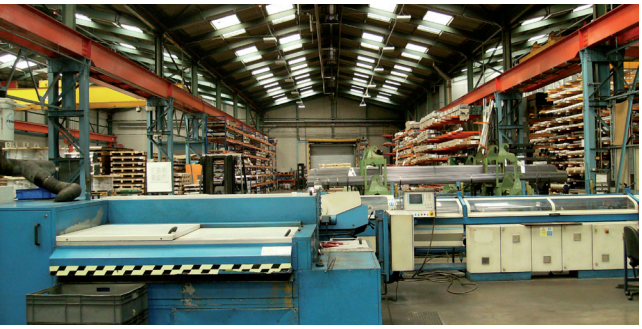
Philosophy
Our philosophy is clear: we will deliver what our customers require, when and where required.

Demand more
We believe that the demands of our industry sector require much more than just offering a service. For that reason we build and establish a partnership between customer and supplier that facilitates the highest possible levels of customer service and satisfaction.

As in all good partnerships, communication is key. We talk to our customers on a regular basis, ensuring that any changes that need to be made are communicated before they happen.

We provide a complete service package that extends far beyond just the product, with ongoing technical support as standard.

Our product range and materials



Product Range

Carbon Steel
- Seamless
- Cold drawn welded
- Welded
- Galfan
- Zinc Coated

Approvals

Quality
ISO 9001:2008
TS16949

Environmental
ISO 14001:2004

Health & Safety
OHAS 18001:2007

Sectors & End Uses

- Fluid carrying pipes
- Safety applications
- Boot hinges
- Fuel fillller tubes

Second and third tier supply chain to Audi, JLR and Volvo.

The value chain

Engineering

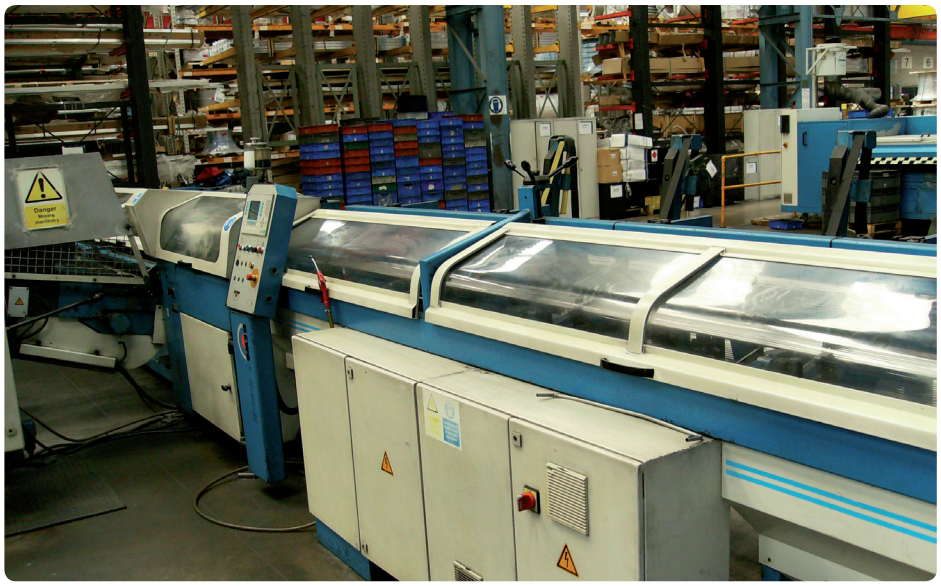
- Material advice
- Technical input
- Bespoke solutions

Procurement

- Source from approved suppliers
- Quality approval

Production

- Quality controlled process
- Sawing
- Brush de-burring
- Vibratory grinding
- Washing
- Packing to customer requirements
- PPAP's IMDS, 8D FMEI All available



A broad range of processing services

Sawing	
OD min.	6mm
OD max.	90mm
Wall thickness min.	0.71mm
Wall thickness max.	5mm
Cut length min.	20mm
Cut length max.	3000mm

Vibratory Grinding	
OD min.	6mm
OD max.	50mm
Wall thickness min.	0.71mm
Wall thickness max.	5mm
Cut length min.	20mm
Cut length max.	150mm

Brush Deburring	
OD min.	6mm
OD max.	90mm
Wall thickness min.	0.71mm
Wall thickness max.	5mm
Cut length min.	80mm
Cut length max.	3000mm

Washing	
OD min.	6mm
OD max.	50mm
Cut length min.	20mm
Cut length max.	2000mm

Cutting Tolerances
Available on request, from +/- 0.25mm.

TGL UK Locations

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Cox's Lane
Cradley Heath
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B64 5QU

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Tel: 01384 563 133
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Birmingham Sales Office
Cox's Lane
Cradley Heath
West Midlands
B64 5QU
Tel: 01384 563 900
Fax: 01384 563 191

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Watchmoor Road
Camberley
Surrey
GU15 3AD
Tel: 01276 673 173
Fax: 01276 673 189

Northern Sales Office
Phoenix Close Industrial Estate
Phoenix Close
Heywood
Lancs
OL10 2JG
Tel: 01706 361 000
Fax: 01706 693 933

Northern Ireland Sales Office
Units 1-5
City Business Park
Derriaghy
Dunmurry
Belfast
Co. Antrim
BT17 9GX
Tel: 0844 326 7300
Fax: 0844 326 7320

Tube Tolerances

Tube type	Din	OD		Wall	
Seamless precision steel tubes	DIN 2391 Part 1	from 4mm - 30mm	+/- 0,08mm	+/- 10%	
		from 32mm - 40mm	+/- 0,15mm	+/- 10%	
		from 42mm - 50mm	+/- 0,20mm	+/- 10%	
		from 55mm - 60mm	+/- 0,25mm	+/- 10%	
		from 65mm - 70mm	+/- 0,30mm	+/- 10%	
	New: EN 10305-1	from 4mm - 30mm	+/- 0,08mm	+/- 10% or +/- 0,1mm*	
		from 32mm - 40mm	+/- 0,15mm	+/- 10% or +/- 0,1mm*	
		from 42mm - 50mm	+/- 0,20mm	+/- 10% or +/- 0,1mm*	
		from 55mm - 60mm	+/- 0,25mm	+/- 10% or +/- 0,1mm*	
		from 65mm - 70mm	+/- 0,30mm	+/- 10% or +/- 0,1mm*	
					* the higer value applies
Cold drawn welded precision steel tubes	DIN 2393 Part 1	from 4mm - 30mm	+/- 0,08mm	+/- 7,5%	+/- 0,35mm maximium
		from 32mm - 40mm	+/- 0,15mm	+/- 7,5%	+/- 0,35mm maximium
		from 42mm - 50mm	+/- 0,20mm	+/- 7,5%	+/- 0,35mm maximium
		from 55mm - 60mm	+/- 0,25mm	+/- 7,5%	+/- 0,35mm maximium
		from 65mm - 70mm	+/- 0,30mm	+/- 7,5%	+/- 0,35mm maximium
	New: EN 10305-2	from 4mm - 30mm	+/- 0,08mm	+/- 7,5%	+/- 0,35mm maximium
		from 32mm - 40mm	+/- 0,15mm	+/- 7,5%	+/- 0,35mm maximium
		from 42mm - 50mm	+/- 0,20mm	+/- 7,5%	+/- 0,35mm maximium
		from 55mm - 60mm	+/- 0,25mm	+/- 7,5%	+/- 0,35mm maximium
		from 65mm - 70mm	+/- 0,30mm	+/- 7,5%	+/- 0,35mm maximium
Welded precision steel tubes	DIN 2394 Part 1	from 4mm - 18mm	+/- 0,12mm	+/- 10%	+/- 0,35mm maximium
		from 20mm - 30mm	+/- 0,15mm	+/- 10%	+/- 0,35mm maximium
		from 32mm - 40mm	+/- 0,20mm	+/- 10%	+/- 0,35mm maximium
		from 45mm - 55mm	+/- 0,30mm	+/- 10%	+/- 0,35mm maximium
		from 60mm - 80mm	+/- 0,40mm	+/- 10%	+/- 0,35mm maximium
	New: EN 10305-3	from 6mm - 19mm	+/- 0,12mm	wall < 1,5mm: +/- 0,15mm or wall > 1,5mm: +/- 10% x wall or +/- 0,35mm*	
		from 20mm - 30mm	+/- 0,15mm	wall < 1,5mm: +/- 0,15mm or wall > 1,5mm: +/- 10% x wall or +/- 0,35mm*	
		from 32mm - 42,4mm	+/- 0,20mm	wall < 1,5mm: +/- 0,15mm or wall > 1,5mm: +/- 10% x wall or +/- 0,35mm*	
		from 44mm - 51mm	+/- 0,25mm	wall < 1,5mm: +/- 0,15mm or wall > 1,5mm: +/- 10% x wall or +/- 0,35mm*	
		from 55mm - 63,5mm	+/- 0,30mm	wall < 1,5mm: +/- 0,15mm or wall > 1,5mm: +/- 10% x wall or +/- 0,35mm*	
		from 70mm - 76mm	+/- 0,35mm	wall < 1,5mm: +/- 0,15mm or wall > 1,5mm: +/- 10% x wall or +/- 0,35mm*	
					* the lower value applies
Seamless stainless steel tubes	DIN 2462 Part 1 Cold Drawn	OD ≤ 219,1 D2: +/- 1,0% min. +/- 0,5mm		T3: +/- 10% min. +/- 0,2mm	
		D3: +/- 0,75% min. +/- 0,3mm		T4: +/- 7,5% min. +/- 0,15mm	
		D4: +/- 0,5% min. +/- 0,1mm			
	DIN 2462 Teil 1 Warm Manuf.	44,5 ≤ OD ≤ 219,1 D1: +/- 1,5% min. +/- 0,75mm		T1: +/- 15% min. +/- 0,6mm	
		D2: +/- 1.0% min. +/- 0,5mm		T2: +/- 12,5% min. +/- 0,4mm	
	New: EN ISO 1127	D1: +/- 1,5% min. +/- 0,1mm		T1: +/- 15% min. +/- 0,6mm	
		D2: +/- 1% min. +/- 0,5mm		T2: +/- 12,5% min. +/- 0,4mm	
		D3: +/- 0,75% min. +/- 0,3mm		T3: +/- 10% min. +/- 0,2mm	
		D4: +/- 0,5% min. +/-0,1mm		T4: +/- 7,5% min. +/- 0,15mm	
				T5: +/- 5% min. +/- 0,1mm	

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Tube Service Centre

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Seamless Steel Tube to EN10305-1

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 atmospohere.
Normalised	+N	After the final cold drawing operation the tubes are normalised in a controlled atmosphere.

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.	Al max.
E215	1.0212	0,10	0,05	0,70	0,025	0,025	0,025
E235	1.0308	0,17	0,35	1,20	0,025	0,025	-
E355[b]	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.

Seamless Steel Tube to EN10305-1

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	≤0,040	+/- 0,005
Al	≥0,025	- 0,005

Table 4 - Mechanical properties at room temperature

Steel grade		Minimum values for the delivery condition[a b]											
		+C[c]		+LC[c]		+SR			+A[d]		+N		
Steel name	Steel number	R_m MPa	A %	R_m MPa	A %	R_m MPa	R_eH MPa	A %	R_m MPa	A %	R_m MPa	R_eH[e] MPa	A %
E215	1.0212	430	8	380	12	380	280	16	280	30	290 to 430	215	30
E235	1.0308	480	6	420	10	420	350	16	315	25	340 to 480	235	25
E355	1.0580	640	4	580	7	580[f]	450[f]	10	450	22	490 to 630	355	22

a) R_m: tensile strength; R_eH: upper yield strength (see EN10002-1); A: elongation after fracture. For symbols for the delivery condition see Table 1.
b) 1 MPa = 1 N/mm^2
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 : $R_eH \geq 0.8\ R_m$
- for delivery condition +LC : $R_eH \geq 0.7\ R$

d) For calculation purposes the following relationship is recommended: $R_eH \geq 0,5\ R_m$.
e) 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.
f) For tubes with outside diameter > 160 mm: $R_eH \geq 420$ MPa

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)[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
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[b]	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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Tube Service Centre

Welded Cold Drawn Steel Tube to EN10305-2

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 [ab]											
		+C[c]		+LC[c]		+SR			+A[d]		+N		
Steel name	Steel number	R_m MPa	A %	R_m MPa	A %	R_m MPa	R_eH MPa	A %	R_m MPa	A %	R_m MPa	R_eH[e] 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) Rm: tensile strength; R_eH: upper yield strength (see EN10002-1); A: elongation after fracture. For symbols for the delivery conditions see Table 1.
b) 1MPa = 1 N/mm^2
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 : $R_eH \geq 0.8\ R_m$
- for delivery condition +LC : $R_eH \geq 0.7 R_m$

d) For calculation purposes the following relationship is recommended: $R_eH \geq 0,5\ R_m$
e) 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.

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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.

Welded Steel Tube to EN10305-3

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)

ThyssenKrupp Materials (UK)
Tube Service Centre

Seamless Steel Tube to EN10305-4 For Hydraulic Applications

Table 1 - Chemical composition (cast analysis)[a]

Steel grade		% by mass					
Steel name	Steel number	C max.	Si max.	Mn max.	P max.	S max.	Al tot min.
E215	1.0212	0,10	0,05	0,70	0,025	0,015	0,025
E235	1.0308	0,17	0,35	1,20	0,025	0,015	-
E355[b]	1.0580	0,22	0,55	1,60	0,025,	0,015	-

a) Elements not inlcuded 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.

Table 2 - Permissible deviations of the product analysis from the specified limits given in Table 1

Element	Specified limit of the cast analysis % by mass	Permissible deviation of the product analysis % by mass
C	≤0,22	+ 0,02
Si	≤0,55	+ 0,05
Mn	≤1,60	+ 0,10
P	≤0,025	+ 0,005
S	≤0,015	+ 0,003
Al	≤0,025	- 0,005

Table 3 - Mechanical properties at room temperature

Steel grade		Tensile strength	Yield strength[a]	Elongation
Steel name	Steel number	R_m min. MPa	R_eH min. MPa	A min. %
E215	1.0212	290 to 430	215	30
E235	1.0308	340 to 480	235	25
E355	1.0580	490 to 630	355	22

a) For tubes with outside diameter ≤ 30mm and wall thickness ≤ 3mm, the R_eH minimum values are 10MPa lower than the values given in this table.
NOTE The steel grades defined in this part of EN10305 have an intrinsic minimum transverse impact energy of 27 J at 0°C.

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