

Alloy fine grain steel tubes

Material Data Sheet

Steel designation:	Name	Material No.
	P355N	1.0562
	P355NH	1.0565
	P355NL1	1.0566
	P355NL2	1.1106

Scope

This data sheet applies for seamless and welded alloy fine grain steel tubes with circular diameter.

Application

These normalized fine grain steels suit for pressure equipment for apparatus engineering, pressure pipe lines as well as for hot worked construction parts.

This steels are specially suited for constructions, to which requirements regarding impact strength at low temperatures and/or requirements regarding aging resistance are made.

Chemical composition (heat analysis in %)

Steel grade	C	Si	Mn	P	S	Al	N	Cr*
P355N	≤0,20	≤0,50	0,90-1,70	≤0,025	≤0,020	≥ 0,020	≤0,020	≤0,30
P355NH								
P355NL1	≤0,18							
P355NL2								

Steel grade	Cu*	Mo*	Nb	Ni	Ti	V	Nb + Ti + V
P355N	≤0,30	≤0,08	≤0,05	≤0,50	≤0,03	≤0,10	0,12
P355NH							
P355NL1							
P355NL2							

* The allowed total mass content of the three elements chromium, copper und molybdenum is 0,45 %.

Mechanical properties at room temperature

Steel grade	Delivery condition	Upper yield strength R_{eH} or proof strength $R_{p0,2,min}$ N/mm ² for wall thickness T in mm		Tensile Strength R_m N/mm ² for wall thickness T in mm		Elongation A % min.	
						l ²⁾	t ³⁾
P355N P355NH P355NL1 P355NL2	N ¹⁾	≤ 12	355	490 bis 650	≤ 20	22	20
		> 12 ≤ 20					
		> 20 ≤ 40	345	490 bis 630	> 20 ≤ 40		
		> 40 ≤ 50	335		> 40 ≤ 65		
		> 50 ≤ 65	325				
		> 65 ≤ 80	315	450 bis 590	> 65 ≤ 100		
> 80 ≤ 100	305						

¹⁾ N = normalized; normalized rolled

²⁾ l = longitudinal

³⁾ t = transverse

Minimum values for impact test

Steel grade	Treatment condition	Product thickness mm	Minimum average absorbed energy KV in J							
			longitudinal				transverse			
			At a temperature of °C							
			- 40	- 20	0	+ 20	- 40	- 20	0	+ 20
P355N P355NH	normalized	≤ 40	-	40	47	55	-	27	35	39
		> 40 - 65	-	-	45	50	-	-	31	35
P355NL1		≤ 40	40	53	65	70	27	35	43	47
		> 40 - 65	-	47	60	65	-	31	39	43
P355NL2		≤ 40	50	70	90	100	33	47	60	70
		> 40 - 65	40	60	80	90	27	40	53	60

Minimum proof strength $R_{p0,2}$ at elevated temperatures

Steel grade	Material number	Wall thickness T mm	0,2 %-proof strength at a temperature of °C						
			100	150	200	250	300	350	400
			in N/mm ²						
P355NH	1.0565	≤ 20	304	284	255	235	216	196	167
		> 20 bis 50	294	275	255	235	216	196	167
		> 50 bis 65	284	265	245	226	206	186	157
		> 65 bis 80	275	255	235	216	196	177	147
		> 80 bis 100	265	245	226	206	186	167	137

Reference data for some physical properties

Density at 20 °C Kg/dm ³	Modulus of elasticity kN/mm ² at				Thermal conductivity at 20 °C W/m K	spec. thermal capacity at 20 °C J/kg K	spec. electrical resistivity at 20 °C Ω mm ² /m
	20 °C	200 °C	300 °C	400 °C			
7,82	212	199	192	184	48,0	461	0,22

Linear coefficient $10^{-6} K^{-1}$ of thermal expansion between 20 °C and

100 °C	200 °C	300 °C	400 °C
12,5	13,0	13,6	14,1

Hot forming / Heat treatment (for guidance only)

Hot forming		Heat treatment		
Temperature °C	Type of cooling	Normalizing ¹⁾	Stress relieving anneal ²⁾	Type of cooling
1100 - 950	Air	890 - 950 °C	570 - 620 °C	Air

¹⁾ Normalizing: Holding time 1 minute per mm plate thickness, minimum 30 minutes

²⁾ Stress relieving anneal: Holding time 1-2 minutes per mm plate thickness, minimum 30 minutes

Processing / Welding

Standard welding processes for these steel grades are:

TIG-welding

Arc welding (E)

MAG-welding solid wire

Submerged arc welding (SAW)

MAG-welding cored wire

For these steel grades as filler metal the following electrodes and welding wires are recommended.

Process	Filler metal
TIG	Union I 1,2 Ni
MAG solid wire	Union K5 Ni
MAG cored wire	Union RV Ni 1
Arc welding (E)	Phoenix SH V 1 (Phoenix 120K)
SAW	Union S 2 Ni 370 - UV 421 TT

These steels can be welded within all thickness ranges according to the afore mentioned welding processes considering the general rules of technology by hand and automatically welding.

The mentioned filler metals apply for highest demands. The details in brackets are for lower demands.

Hot and cold forming can be performed without and difficulties.

The material suits well for machining

For outside temperatures below +5 °C and for wall thicknesses larger than 30 mm a preheating up to 50 to 150 °C is recommended for flame cutting and welding.

The tube surface should be free from condensation water in any case.

Burning, preheating, welding and stress relieving annealing should occur under consideration of Stahl-Eisen-Material bulletin 310.

Specifications and standards concerning stress relieving anneal have to be observed.

Remark

The material is magnetizable.

References

ThyssenKrupp

DIN EN 10216-3:2004-07

DIN EN 10217-3:2005-05

Important Hint

Information given in this data sheet about property or applicability of materials respective products are no assurance of characteristics but serve for description.

Information, with which we like to advise you, relate to the experience of the producers and our own. Warranty for the results of the treatment and application of the products cannot be granted