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Steel pipes for pipelines for combustible fluids

Material Data Sheet

Steel designation:	Name	Material No.
	X42	**API 5L PSL1**
	(L290GA)	**(1.0483)**
	X42N	**API 5L PSL2**
	(L290NB)	**(1.0484)**

Scope

This data sheet applies for hot rolled welded and seamless pipes.

Application

These steel pipes are used for the transportation of combustible fluids on land, preferably for gas supply systems.

Chemical composition[1)] (Heat analysis in %)[5)a]

Name	Product form	C [3)b]	Si	Mn [3)b]	P	S	V	Nb	Ti	others
X42	T_S	≤ 0,28	-	≤ 1,30	≤ 0,030	≤ 0,030	c	c	c	-
	T_w	≤ 0,26	-	≤ 1,30	≤ 0,030	≤ 0,030	c	c	c	-
L290GA	T_S/T_w	≤ 0,20	≤ 0,40	≤ 1,40	≤ 0,030	≤ 0,030	2)	2)	2)	-
X42N	T_S/T_w	≤ 0,24	≤ 0,40	≤ 1,20	≤ 0,025	≤ 0,015	≤ 0,06	≤ 0,05	≤ 0,04	-
L290NB	T_S/T_w	≤ 0,17	≤ 0,40	≤ 1,20	≤ 0,025	≤ 0,020	≤ 0,05	≤ 0,05	≤ 0,04	5)

T_S = seamless tubes - T_w = welded tubes

1)-5) = DIN EN 10208 part 1 and 2 - a-c = API 5L

1) The steels have to be fully killed with 0,015 % ≤ Al_{total} < 0,060 %.

2) V, Nb, Ti and their combinations can be added by choice of manufacturer. The sum of these elements shall not exceed 0,15 % .

3) For each reduction of 0,01 % below the maximum concentration for carbon, an increase of 0,05 % above the specified maximum concentration of manganese is permissible, were as the increasing is limited on 0,2 %.

4) It is not allowed to add elements, which are not mentioned in the table, without agreement of the purchaser. This is not applicable for elements, which are added for deoxidation and for finishing treatment of the Heat.

5) 0,015 % Al_{gesamt} < 0,060 %; N ≤ 0,012 %; Al/N ≥ 2/1; Cu ≤ 0,25 %; Ni ≤ 0,30 %; Cr ≤ 0,30 %; Mo ≤ 0,10 %

a Cu ≤ 0,50 %; Ni ≤ 0,50 %; Cr ≤ 0,50 %; Mo ≤ 0,15 %; for these steel grades Cu, Cr and Ni shall not be added intentionally.

b For each reduction of 0,01 % below the maximum concentration for carbon, an increase of 0,05 % above the specified maximum concentration for manganese is permissible, up to a maximum of 1,65 %.

c The sum of Nb-, V- and Ti concentrations shall be ≤ 0,15 %.

Name	Carbon equivalent in %, max. for nominal wall thickness ≤ 25 mm	
	CE_{IIW}	CE_{Pcm}
X42N[a]	0,43	0,25
L290NB	0,42[1)]	

1) $CEV = C + \frac{Mn}{6} + \frac{(Cr+Mo+V)}{5} + \frac{(Ni+Cu)}{15}$; CEV is only determined for the random analysis.

a CE_{IIW}-limits apply, if the carbon mass fracture is greater than 0,12 %; CE_{Pcm}-limits apply, if the carbon mass fracture is less than or equal 0,12 %.

$$CE_{IIW} = C + \frac{Mn}{6} + \frac{(Cr+Mo+V)}{5} + \frac{(Ni+Cu)}{15}$$

$$CE_{Pcm} = C + \frac{Si}{30} + \frac{Mn}{20} + \frac{Cu}{20} + \frac{Ni}{60} + \frac{Cr}{20} + \frac{Mo}{15} + \frac{V}{10} + 5B$$

(For seamless tubes with t > 20,0 mm the limits of the carbon equivalent should be agreed.)

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Mechanical properties at room temperature

Steel grade	Delivery condition	Yield/proof strength $R_{t0,5}$ N/mm²	Tensile strength R_m N/mm²	Elongation A %	Impact energy ISO-V- transverse test piece in J, min. at 0 °C
X42	a)	min. 290	min. 415	b)	-
L290GA	a)	min. 290	415 - 555	21	-
X42N	N	290 - 495	415 - 760	b)	-
L290NB	N	290 - 440	min. 415	21	40 transverse / 60 longitudinal

N = normalizing, normalizing forming

a) Manufacturers choice.

b) The specified minimum elongation A_f, expressed in % and rounded to the nearest percent, shall be as determined using the following equation:

$$A_f = C\frac{A_{xc}^{0,2}}{U^{0,9}}$$

see 9.3 of API 5L

Reference data for some physical properties

Density at 20 °C	Modulus of elasticity kN/mm² at				Thermal conductivity at 20 °C	spec. thermal capacity at 20 °C	spec. electrical resistivity at 20 °C
Kg/dm³	20 °C	300 °C	400 °C	450 °C	W/m K	J/kg K	Ω mm²/m
7,85	210	192	184	179	51	461	0,20

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

100 °C	200 °C	300 °C	400 °C	450 °C
12,5	13,0	13,6	14,1	14,3

Hot forming / Heat treatment

Hot forming		Heat treatment		
Temperature °C	Type of cooling	Normalizing[1)]	Stress revieling anneal [2)]	Type of cooling
1100 - 950	Air	890 - 950 °C	600 - 650 °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
MAG-welding massive wire
MAG- welding cored wire
Arc welding (E)
Submerged arc welding (SAW)

Depending on the welding position and the plate thickness, maybe other filler metals have to be applied, which can be inquired at the manufacturer in case of need.

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

Process	**Filler metal**	
TIG	Union I 52	
MAG massive wire	Union K 52 Union K 56	
MAG cored wire	Union MV 70 Union BA 70	
Arc welding (E)	Phoenix Cel 80	
SAW	Wire	Powder
	Union S2 (Union S2)	UV 400 (UV 306)

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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.

Burning, preheating, welding and stress relieving annealing should occur under consideration of Stahl-Eisen-Material bulletin 088.

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

Remark
The material is magnetizable.

References
ThyssenKrupp
DIN EN 10208-1:2009-07
DIN EN 10208-2:2009-07
API Specification 5L:2007-10

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.