

P460NL2

Material no. 1.8915 · High-strength low-temperature tough fine-grain steel

Material group: High-strength weldable fine-grain structural steel, low-temperature toughness

Material no. (EN): 1.8915

EN designation: P460NL2

Former DIN designation: TStE 460 / EStE 460

ASTM / ASME equivalent: No direct equivalent – similar to A841 Gr. F or A737 Gr. C

Service temperature: –50 °C to +400 °C (continuous service)

Standards (pipes): EN 10216-4 · EN 10028-3

Standards (fittings): EN 10253-2 · ASME B16.9 (analog.)

Forms (Nirotec): Elbows · tees · reducers · caps · flanges · custom parts

1 Material Equivalents & Comparable Grades

National equivalents

Standard / region	Designation	Material no. / Grade	Remark
EN	P460NL2	1.8915	Current European designation
DIN (old)	TStE 460 / EStE 460	1.8915	Predecessor designation
EN 10222-4	P460NL2	1.8915	Forgings
EN 10028-3	P460NL2	1.8915	Plates
ASTM/ASME	A841 Gr. F	–	US approximation
ASTM/ASME	A737 Gr. C	–	US approximation

Alternative materials

Material	Material no.	Reference / use	Note
P355NL2	1.1116	Lower strength, same cold service	Lower wall loading
P460NH	1.8935	Higher strength, only to –20 °C	No low-temp requirement
WB36	1.6368	Precipitation hardened	Highest pressures
S690QL	1.8928	Quenched + tempered	Strength focus

2 Chemical Composition

Composition in mass percent (%). Standard: EN 10216-4 / EN 10028-3. P460NL2 combines high strength (460 MPa yield) with guaranteed Charpy impact at $-50\text{ }^{\circ}\text{C}$ – achieved via microalloying with V, Nb and Ti.

Element	Symbol	Min. (heat)	Max. (heat)	Max. (product)	Function / remark
Carbon	C	–	0.20	0.22	Strength, weldability
Silicon	Si	–	0.60	0.65	Deoxidation
Manganese	Mn	1.00	1.70	1.80	Strength, toughness
Phosphorus	P	–	0.020	0.025	Impurity – limit
Sulfur	S	–	0.005	0.007	Very low S for toughness
Aluminium (tot.)	Al	0.020	–	–	Grain refining, $\geq 0.020\text{ }%$
Chromium	Cr	–	0.30	0.35	Residual
Copper	Cu	–	0.70	0.75	Strength
Molybdenum	Mo	–	0.10	0.12	Residual
Nickel	Ni	–	0.85	0.90	Toughness
Nitrogen	N	–	0.025	0.027	Strength contribution
Vanadium	V	–	0.20	0.22	Strength contribution
Niobium	Nb	–	0.05	0.05	Grain refining
Titanium	Ti	–	0.05	0.05	Grain refining

3 Mechanical Properties

Normalised – minimum requirements (EN 10216-4)

Valid for wall thicknesses $t \leq 16\text{ mm}$. Higher strength than P355NL2 through microalloying.

Property	Symbol	Unit	Minimum value	Remark
Yield strength 0.2 %	Rp0.2	MPa	≥ 460	$t \leq 16\text{ mm}$
Yield strength 0.2 %	Rp0.2	MPa	≥ 450	$16 < t \leq 40\text{ mm}$
Tensile strength	Rm	MPa	570 – 720	–
Elongation at fracture	A	%	≥ 17	Longitudinal specimens
Impact energy ($-50\text{ }^{\circ}\text{C}$)	KV	J	≥ 27	Mean value (NL2)
Impact energy ($0\text{ }^{\circ}\text{C}$)	KV	J	≥ 60	Mean value
Hardness	HB	–	≤ 240	Reference value

Hot yield strength Rp0.2 in MPa (typical values per standard)

Temperature	100 °C	200 °C	300 °C	400 °C
Rp0.2 (MPa)	420	390	355	315

4 Physical Properties

Property	Symbol	20 °C	200 °C	400 °C	Unit
Density	ρ	7.85	7.76	7.65	g/cm ³
Modulus of elasticity	E	210	196	180	GPa
Thermal conductivity	λ	45	43	39	W/(m·K)
Coeff. thermal expansion	α	11.5	12.3	13.0	10 ⁻⁶ /K
Specific heat capacity	cp	470	504	530	J/(kg·K)

5 Corrosion Resistance

Medium / environment	Remark	Resistance
Low-temperature service (to -50 °C)	Standard application	++
LPG (liquid propane/butane)	Cold service	++
Dry hydrocarbons	Resistant	+
Treated water	Feed water, condensate	+
Atmosphere / humid air	Surface rust – coating recommended	o
Acids	Not resistant	-
Sour gas (H ₂ S)	Not NACE qualified without special review	-
Chloride-bearing media	Corrosion risk	-

++ excellent resistance
+ good resistance
o limited resistance
- not resistant

P460NL2 combines high strength (460 MPa) with low-temperature toughness – weight optimisation for pressure vessels in cold service.

6 Typical Applications

Industry / plant	Typical application	Operating condition
High-pressure vessels	High-strength shells, heavy-wall parts	Down to -50 °C
Cold-climate offshore	Load-bearing structures, nodes	NORSOK compatible
Petrochemical / tank build	Large vessels with weight optimisation	High strength + low temp.
LPG large-volume storage	Wall-thickness-optimised tanks	Weight savings vs. P355NL2

Industry / plant	Typical application	Operating condition
Mobile pressure vessels	Road tankers, rail tank cars	Strength + low-temp
Hydropower	Pressure piping, penstock components	High strength

7 Forms Available at Nirotec

Component	Standard (EN)	Standard (ASME/ASTM)	Remark
Elbows	EN 10253-2	ASME B16.9 (analog.)	LR/SR, 90°/45°
Tees	EN 10253-2	ASME B16.9 (analog.)	Equal and reducing branch
Reducers	EN 10253-2	ASME B16.9 (analog.)	Concentric and eccentric
Caps	EN 10253-2	ASME B16.9 (analog.)	Hemispherical caps
Weld neck flanges	EN 1092-1 Type 11	ASME B16.5 (analog.)	PN 25 – PN 400
Custom parts	Per drawing	Per drawing	Special components on request

8 Standards, Approvals & Codes

Standard / code	Title / application
EN 10216-4	Seamless tubes – low-temperature steels
EN 10028-3	Flat products – weldable fine-grain
EN 10222-4	Forgings – fine-grain steels
EN 10253-2	Butt-welding fittings – unalloyed and ferritic steels
EN 1092-1	Flanges and their joints
AD 2000-W10	Steels for low temperatures
PED 2014/68/EU	Pressure Equipment Directive

9 Processing Notes

Weldability

Parameter	Specification / recommendation	Remark
Preheat	100–150 °C mandatory for t > 20 mm	Prevents cold cracking
Post-weld heat treatment	Stress relief 530–580 °C	PWHT max. 580 °C (strength loss!)
Filler metal	AWS A5.5 E9018-G / EN ISO 18275	Higher strength, low hydrogen
Welding processes	GTAW, GMAW, SMAW, SAW	Strictly controlled heat input

Parameter	Specification / recommendation	Remark
Interpass temperature	≤ 200 °C	Strictly observe

- Delivery condition: normalised (N) – strength based on microalloy precipitation
- PWHT limit ≤ 580 °C – above that loss of strength and low-temperature toughness
- Identification per EN 10216-4: heat no., 1.8915 / P460NL2, standard, dimensions
- Charpy test at –50 °C is mandatory, confirm on every certificate
- For very heavy walls (> 60 mm): special agreement on property guarantee

10 Inquiry & Contact

For a project-specific inquiry we ideally require:

- Standard and type (e.g. EN 10253-2 in 1.8915 / P460NL2)
- Lowest operating temperature and highest wall loading
- Dimensions: DN / NPS, wall thickness or schedule
- Quantity and required delivery date
- Required documentation (EN 10204 type 3.1 / 3.2, Charpy –50 °C, NDT)
- PWHT specification (max. 580 °C strictly required)

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