

X11CrMoWVNb9-1-1 (P92)

Mat. No. 1.4901 · Advanced 9Cr-Mo-W-V-Nb creep-resistant steel

Mat. No.: 1.4901

EN designation: X11CrMoWVNb9-1-1

ASTM/ASME equiv.: Pipes: A/SA 335 P92 · Fittings: A/SA 234 WP92 · Flanges: A/SA 182 F92

Advantage over P91: Higher allowable stress at 600–650 °C due to W addition – thinner walls possible

Temperature range: Up to +650 °C

Standard: EN 10216-2 · EN 10253-2

Delivery forms: Elbows · Tees · Reducers · Caps · Flanges · Pipes

1 Material Equivalents & Comparable Grades

International Equivalents

Standard / Region	Designation	Mat. No. / Grade	Note
EN	X11CrMoWVNb9-1-1	1.4901	9Cr-W steel, European designation
ASTM	A/SA 335 P92	–	Pipes
ASTM	A/SA 234 WP92	–	Fittings
ASTM	A/SA 182 F92	–	Flanges
Tradename	NF616 (Nippon Steel)	–	Original development designation

Alternative Materials

Material	Mat. No.	Relation to X11CrMoWVNb9-1-1 (P92)	When to use
P91	1.4903	No W addition	For up to 625 °C; more data available
P22	1.7380	Lower alloy	For temperatures up to 600 °C

2 Chemical Composition

Values in mass percent (%). Standard: EN 10216-2.

P92 adds W (~1.8 %) to P91 composition. Increases creep strength 20–30 % vs. P91 at 600–650 °C.

Element	Sym.	Min. (Heat)	Max. (Heat)	Max. (Prod.)	Function
Carbon	C	0.07	0.130	0.150	Precise control critical

Chromium	Cr	8.50	9.500	9.800	Creep + oxidation resistance
Molybdenum	Mo	0.30	0.500	0.600	Reduced vs. P91; W compensates
Tungsten	W	1.50	2.000	2.100	Key addition vs. P91 – solid solution strengthening
Vanadium	V	0.15	0.250	0.280	Carbonitride precipitation
Niobium	Nb	0.04	0.090	0.110	Grain refinement
Boron	B	0.001	0.006	0.008	Grain boundary strengthening

3 Mechanical Properties

Room Temperature – Minimum Requirements

N+T mandatory. All welding procedures must be qualified to P92-specific WPS.

Property	Sym.	Unit	Min. Value	Note
Yield strength	Rp0.2	MPa	≥ 440	N+T condition
Tensile strength	Rm	MPa	620–820	–
Elongation	A	%	≥ 20	–
Impact (+20 °C)	KV	J	≥ 40	–
Hardness	HB	–	185–265	–

Elevated Temperature Yield Strength Rp0.2 in MPa (indicative values)

Temp.	400 °C	500 °C	550 °C	600 °C	625 °C	650 °C
Rp0.2 (MPa)	385	348	318	272	238	198

4 Physical Properties

Property	Sym.	20 °C	200 °C	400 °C	Unit
Density	ρ	7.75	7.66	7.55	g/cm ³
Modulus of elasticity	E	218	202	184	GPa
Thermal conductivity	λ	28	26	25	W/(m·K)
Thermal expansion	α	10.7	11.4	12.1	10 ⁻⁶ /K

5 Corrosion Behaviour

Medium / Environment	Notes	Rating
Ultra-supercritical steam (up to 650 °C)	Designed for USC power plants	+
High-temp. oxidation	9Cr provides good scaling resistance	+

Chlorides / acids	Not suitable	-
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++ excellent
+ good
o limited
- not suitable

P92: next-generation upgrade from P91. 20–30 % higher allowable stress. Fewer qualified WPS available – allow lead time for procedure qualification.

6 Typical Applications

Industry / Plant	Typical Application	Operating Conditions
Ultra-supercritical power plants	Main steam, hot/cold reheat headers	Highest-temperature creep service >600 °C
Advanced combined-cycle plants	Steam headers and transition pieces	Where P91 allowable stress insufficient

7 Delivery Forms at Nirotec

Component	Standard (EN)	Standard (ASME/ASTM)	Note
Elbows	EN 10253-2	ASME B16.9 · A/SA 234 WP92	LR/SR, 90°/45°
Tees	EN 10253-2	ASME B16.9 · A/SA 234 WP92	Equal and reducing
Reducers	EN 10253-2	ASME B16.9 · A/SA 234 WP92	Concentric and eccentric
Caps	EN 10253-2	ASME B16.9 · A/SA 234 WP92	Ellipsoidal
Flanges	EN 1092-1 Type 11	ASME B16.5 · A/SA 182 F92	PN 16–400
Pipes	EN 10216-2	A/SA 335 P92	Seamless

8 Standards, Approvals & Codes

Standard / Code	Title / Application
EN 10216-2	Seamless steel tubes – elevated temperature
EN 10253-2	Butt-welding fittings
ASME B31.1	Power Piping
EPRI	P92 welding guidelines

9 Fabrication Notes

Weldability

Parameter	Requirement / Recommendation	Note
Preheat	200–300 °C mandatory	Even stricter than P91 due to W addition
PWHT	Mandatory: 760–790 °C, min. 2 h	Higher PWHT temperature than P91
Filler	P92-specific consumables	Do NOT use P91 consumables
Hardness control	185–265 HB after PWHT	Mandatory for all welds

- Delivery condition: N+T mandatory
- P92-specific filler metals required – do NOT use P91 consumables
- PWHT temperature higher than P91: 760–790 °C

10 Enquiry & Contact

For a project-specific quotation, please provide:

- Standard and execution (e.g. LR 90° elbow per EN 10253-4)
- Dimensions: DN / NPS and wall thickness or schedule
- Quantity and requested delivery date
- Documentation: EN 10204 Type 3.1 / 3.2, NDT, third-party inspection
- Any project-specific specifications or special requirements

Nirotec GmbH & Co. KG

Otto-Hahn-Str. 4 · 59423 Unna · Germany
Tel.: +49 (0) 02303 / 985-0 · info@nirotec.de · www.nirotec.de

All information is provided without warranty. Applicable standards and project specifications at time of order are authoritative.