

WB36 / 15NiCuMoNb5-6-4

Material no. 1.6368 · High-strength precipitation-hardened pressure-vessel steel

Material group: High-strength weldable pressure-vessel steel, Ni-Cu-Mo-Nb precipitation hardened

Material no. (EN): 1.6368

EN designation: 15NiCuMoNb5-6-4

Former DIN designation: WB36

ASTM / ASME equivalent: No direct equivalent – similar in application to A672/A691, comparable to ASME Code Case 2179

Service temperature: –10 °C to +400 °C (continuous)

Standards (pipes): EN 10216-2 · VdTÜV 354/4

Standards (fittings): EN 10253-2 (analog.) · per VdTÜV 354/4

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

1 Material Equivalents & Comparable Grades

National equivalents

Standard / region	Designation	Material no. / Grade	Remark
EN	15NiCuMoNb5-6-4	1.6368	Current European designation
DIN (old)	WB36	1.6368	Predecessor designation (widely used)
VdTÜV	15 NiCuMoNb 5	–	VdTÜV data sheet 354/4
ASME Code Case	2179	–	Approximation in ASME code

Alternative materials

Material	Material no.	Reference / use	Note
P355GH	1.0473	Lower alloyed, lower cost	For lower strength requirements
13CrMo4-5	1.7335	Creep resistant up to 530 °C	For higher temperatures
P460NL2	1.8915	High strength + low-temperature toughness	High strength + cold service
P355NL2	1.1116	Low-temperature toughness to –50 °C	Classic low-temperature

2 Chemical Composition

Composition in mass percent (%). Standard: VdTÜV 354/4 / EN 10216-2. WB36 is a precipitation-hardened pressure-vessel steel with Cu precipitates. Used primarily for high-pressure feedwater heaters (HPFWH) and feedwater piping in conventional power plants – an economic alternative to full CrMo steels at moderate temperatures.

Element	Symbol	Min. (heat)	Max. (heat)	Max. (product)	Function / remark
Carbon	C	0.10	0.17	0.18	Strength, weldability
Silicon	Si	0.25	0.50	0.55	Deoxidation
Manganese	Mn	0.80	1.20	1.30	Strength
Phosphorus	P	–	0.020	0.025	Impurity limit
Sulfur	S	–	0.010	0.012	Impurity limit
Aluminium	Al	–	0.050	0.060	Grain refining
Nickel	Ni	1.00	1.30	1.30	Toughness, strength
Copper	Cu	1.00	1.30	1.30	Precipitation strengthening
Molybdenum	Mo	0.25	0.50	0.50	Creep strength
Niobium	Nb	0.015	0.045	0.050	Grain refining, precipitation
Nitrogen	N	–	0.020	0.022	Limit
Chromium	Cr	–	0.30	0.30	Residual

3 Mechanical Properties

Normalised + tempered – minimum requirements (VdTÜV 354/4)

WB36 is normalised (920–960 °C) and tempered (550–680 °C). Strength is based on a fine-grained matrix with finely dispersed Cu precipitates.

Property	Symbol	Unit	Minimum value	Remark
Yield strength 0.2 %	Rp0.2	MPa	≥ 355	t ≤ 70 mm
Tensile strength	Rm	MPa	510 – 660	–
Elongation at fracture	A	%	≥ 21	Longitudinal specimens
Impact energy (0 °C)	KV	J	≥ 27	Mean value
Impact energy (–10 °C)	KV	J	≥ 27	If required
Hardness	HB	–	≤ 220	Reference value

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

Temperature	100 °C	200 °C	250 °C	300 °C	350 °C	400 °C
Rp0.2 (MPa)	320	295	280	265	245	215

4 Physical Properties

Property	Symbol	20 °C	200 °C	400 °C	Unit
Density	ρ	7.85	7.79	7.71	g/cm ³
Modulus of elasticity	E	212	200	184	GPa
Thermal conductivity	λ	39	41	40	W/(m·K)
Coeff. thermal expansion	α	12.0	12.7	13.3	10 ⁻⁶ /K
Specific heat capacity	cp	470	510	560	J/(kg·K)

5 Corrosion Resistance

Medium / environment	Remark	Resistance
High-pressure steam (treated)	Standard application up to 400 °C	++
Hot treated feedwater	Standard in feedwater-heater service	++
Dry hydrocarbons	Resistant	+
Dry gases	Compressed air, N ₂	+
Atmosphere / humid air	Surface rust possible – coating recommended	o
Condensate	Corrosion protection recommended	o
Acids of any kind	No resistance	-
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

WB36 is a high-strength pressure-vessel steel without corrosion protection – its strength lies in high strength at moderate temperatures, not in corrosion resistance.

6 Typical Applications

Industry / plant	Typical application	Operating condition
Conventional power plants	High-pressure feedwater heaters (HPFWH), feedwater piping	Up to 380 °C, high pressure
Steam power plants	Drum and header components	High pressures, moderate temp.
Pressure vessel construction	Shells for HP vessels, nozzles	Pressure vessels per AD 2000

Industry / plant	Typical application	Operating condition
Chemical plants	High-pressure reactors, connecting piping	Up to 400 °C
Existing plant maintenance	Spare parts for power-plant feedwater heaters	Maintenance, repair
Petrochemical	High-pressure piping, headers	Standard application

7 Forms Available at Nirotec

Component	Standard (EN)	Standard (ASME/ASTM)	Remark
Elbows	EN 10253-2 (analog.)	ASME (Code Case 2179)	LR/SR, 90°/45°, custom angles
Tees	EN 10253-2 (analog.)	ASME (Code Case 2179)	Equal and reducing branch
Reducers	EN 10253-2 (analog.)	ASME (Code Case 2179)	Concentric and eccentric
Caps	EN 10253-2 (analog.)	ASME (Code Case 2179)	Hemispherical caps
Weld neck flanges	EN 1092-1 Type 11	ASME B16.5 (Code Case)	PN 25 – PN 400
Custom parts	Per drawing	Per drawing	Special components on request

8 Standards, Approvals & Codes

Standard / code	Title / application
EN 10216-2	Seamless tubes for pressure purposes – alloy steels
EN 10222-2	Forgings for pressure equipment – alloy steels
EN 10028-2	Flat products of pressure-vessel steels – creep resistant
VdTÜV 354/4	15 NiCuMoNb 5 (1.6368) – material data sheet
AD 2000-W1 / W13	Steels for pressure vessels
PED 2014/68/EU	Pressure Equipment Directive
ASME Code Case 2179	Equivalent to WB36 in ASME code

9 Processing Notes

Weldability

Parameter	Specification / recommendation	Remark
Preheat	100–150 °C, mandatory for t > 25 mm	Prevents cold cracking
Post-weld heat treatment	Stress relief 580–620 °C	Mandatory for pressure-bearing parts
Filler metal	AWS A5.5 E8018-G / matching filler	Nb / Cu-bearing

Parameter	Specification / recommendation	Remark
Welding processes	GTAW, GMAW/MAG, SMAW, SAW	All standard processes
Interpass temperature	≤ 250 °C	Standard practice

- Delivery condition: normalised + tempered (N + T) – essential for precipitation hardening
- Critical for repairs: heat-treatment regime must be observed, otherwise strength loss
- Identification per EN 10216-2: heat no., 1.6368 / WB36, standard, dimensions
- For heat treatment > 620 °C: caution – overaging possible, strength decreases
- Not for sour service (H₂S) without separate NACE qualification

10 Inquiry & Contact

For a project-specific inquiry we ideally require:

- Standard and type (e.g. EN 10253-2 in 1.6368 / WB36)
- Confirm: new build or spare part for existing plant (HPFWH replacement?)
- Dimensions: DN / NPS, wall thickness or schedule
- Quantity and required delivery date
- Required documentation (EN 10204 type 3.1 / 3.2, NDT, hardness verification)
- Project-specific specification (plant operator, ASME Code Case 2179)

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