

A234 Grade WPB

ASTM/ASME A/SA 234 WPB · Unalloyed carbon steel for buttweld fittings

Material group: Unalloyed carbon steel for pressure-bearing buttweld fittings

ASTM / ASME standard: ASTM A234 / ASME SA-234

Grade: WPB (Wrought Pipe – Grade B)

EN equivalent: ≈ P235GH (1.0345) / P265GH (1.0425)

Matching pipe grades: ASTM A106 Gr. B · API 5L Gr. B

Service temperature: –29 °C to +427 °C (standard application per ASME B31.3)

Standards (fittings): ASTM A234 / ASME SA-234 · ASME B16.9 / B16.28

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

1 Material Equivalents & Comparable Grades

National equivalents

Standard / region	Designation	Material no. / Grade	Remark
ASTM/ASME	A234 / SA-234 WPB	–	Current designation – Wrought Pipe Grade B
EN	P265GH (≈)	1.0425	Closest European equivalent
EN	P235GH (≈)	1.0345	Also commonly substituted
MSS	SP-75 WPHY	–	For higher-strength pipeline applications
JIS (Japan)	STPG 410 / STPG 370	–	Japanese equivalent
Matching grades	A106 Gr. B (pipes) · A105 (flanges)	–	Consistent project material selection

Alternative materials

Material	Material no.	Reference / use	Note
A234 WPA	–	Lower strength, lower requirements	General applications
A234 WPC	–	Higher strength	More demanding applications
A234 WP11	–	1.25 Cr-0.5 Mo, creep resistant	High-temperature up to 593 °C
A420 WPL6	–	Low-temperature toughness to –46 °C	Low-temperature applications

2 Chemical Composition

Composition in mass percent (%). Standard: ASTM A234 / SA-234. A234 WPB is the standard material for ASME-designed C-steel fittings – the American counterpart to P265GH and by far the most commonly specified carbon-steel fitting grade worldwide.

Element	Symbol	Min. (heat)	Max. (heat)	Max. (product)	Function / remark
Carbon	C	–	0.30	0.30	Strength, weldability
Manganese	Mn	0.29	1.06	1.06	Strength, toughness
Phosphorus	P	–	0.050	0.050	Impurity – limit
Sulfur	S	–	0.058	0.058	Impurity – limit
Silicon	Si	0.10	–	–	Deoxidation, min. 0.10 %
Chromium	Cr	–	0.40	0.40	Residual
Copper	Cu	–	0.40	0.40	Residual
Molybdenum	Mo	–	0.15	0.15	Residual
Nickel	Ni	–	0.40	0.40	Residual
Vanadium	V	–	0.08	0.08	Residual

3 Mechanical Properties

Room temperature – minimum requirements (ASTM A234)

Property	Symbol	Unit	Minimum value	Remark
Tensile strength	Rm	MPa	415 – 585	–
Yield strength	Rp0.2	MPa	≥ 240	Minimum value
Elongation (long.)	A	%	≥ 22	Longitudinal specimens
Elongation (trans.)	A	%	≥ 14	Transverse specimens
Impact energy (0 °C)	KV	J	≥ 27	If required (supplemental req.)
Hardness	HB	–	≤ 197	Reference value

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

Temperature	100 °F	200 °F	400 °F	600 °F	750 °F	800 °F
Allow. Stress (ksi)	20.0	20.0	20.0	19.6	16.5	14.4

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	52	49	44	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
High-pressure steam (treated)	Standard application up to 427 °C	++
Hot water (treated, pH-neutral)	Boiler water, feed water	++
Dry hydrocarbons	Non-corrosive process streams	++
Dry technical gases	Compressed air, N ₂ , CO ₂	+
Natural gas (dry, treated)	Pipeline application	+
Atmosphere / humid air	Surface rust possible – coating recommended	o
Condensate / moisture	Corrosion protection recommended	o
Acids of any kind	No resistance	-
H ₂ S / sour service	For NACE MR0175: hardness limitation required	-
Chloride-bearing media / seawater	Corrosion risk, not recommended	-

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

A234 WPB is an unalloyed carbon steel without corrosion-resistant alloying – for corrosive media, higher-alloyed grades (stainless, nickel-base) are required.

6 Typical Applications

Industry / plant	Typical application	Operating condition
Power plants / energy	Steam and feedwater piping, HP piping	Up to 427 °C / ASME B31.1
Petrochemical / refining	Process piping, heat-exchanger connections	ASME B31.3 Process Piping
Pressure vessel construction	Nozzles, connection piping	ASME VIII / AD 2000
Pipelines (on/offshore)	Cross-country piping, station piping	API 5L / ASME B31.4 / B31.8

Industry / plant	Typical application	Operating condition
General industrial plants	General pressure piping	Standard application
Shipbuilding	Auxiliary piping, engine-room piping	Classification societies

7 Forms Available at Nirotec

Component	Standard (EN)	Standard (ASME/ASTM)	Remark
Elbows	≈ EN 10253-2 (P265GH)	ASME B16.9 · A234 WPB	LR/SR, 90°/45°, custom angles
Tees	≈ EN 10253-2	ASME B16.9 · A234 WPB	Equal and reducing branch
Reducers	≈ EN 10253-2	ASME B16.9 · A234 WPB	Concentric and eccentric
Caps	≈ EN 10253-2	ASME B16.9 · A234 WPB	Hemispherical caps
High-pressure forged fittings	–	ASME B16.11 · A234 WPB	SW / NPT up to Class 9000
Custom parts	Per drawing	Per drawing	Special-form components on request

8 Standards, Approvals & Codes

Standard / code	Title / application
ASTM A234 / ASME SA-234	Wrought fittings of C-steel and low-alloy steel
ASME B16.9	Factory-Made Wrought Buttwelding Fittings
ASME B16.11	Forged Fittings, Socket-Welding and Threaded
ASME B16.28	Wrought Steel Buttwelding Short Radius Elbows and Returns
MSS SP-75	High-Strength Wrought Butt-Welding Fittings
ASME B31.1	Power Piping
ASME B31.3	Process Piping
ASME B31.4 / B31.8	Liquid Transportation / Gas Transmission and Distribution Piping
PED 2014/68/EU	Pressure Equipment Directive (CE marking for EU supply)

9 Processing Notes

Weldability

Parameter	Specification / recommendation	Remark
Preheat	Not required (< 25 mm wall thickness)	For larger wall thicknesses preheat to 100–150 °C
Post-weld heat treatment	Stress relief 595–650 °C	Mandatory for wall thickness > 19 mm or PWHT specification
Filler metal	AWS A5.18 ER70S-2 / S-6 (GMAW)	Low-hydrogen electrodes preferred
Welding processes	GTAW, GMAW, SMAW, SAW	All standard processes suitable
Interpass temperature	< 315 °C	Standard practice for C-steel

- Delivery condition: hot-formed + normalised or cold-formed + normalised
- For A234 WPB hot-formed > 19 mm wall: heat treatment mandatory
- Identification per ASTM A234: manufacturer, A234, WPB, standard, heat, heat-treatment status
- Supplemental requirements (S1–S70) may apply per project (e.g. S1 Charpy, S5 NACE)
- For NACE MR0175 applications: hardness verification ≤ 248 HV / 22 HRC required

10 Inquiry & Contact

For a project-specific inquiry we ideally require:

- Standard and type (e.g. ASME B16.9 LR 90° in A234 WPB)
- Dimensions: NPS, wall thickness / schedule
- Quantity and required delivery date
- Required documentation (EN 10204 type 3.1 / 3.2, NDT, external inspection)
- Supplemental requirements (Charpy, NACE, PWHT specifications etc.)
- Applicable code (ASME B31.1 / B31.3 / B31.8 etc.)

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