



## Boiler and pressure vessel grades

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### ORDERING OF XLERPLATE® STEEL BOILER AND PRESSURE VESSEL GRADES

Special care is required in defining all requirements for pressure vessel steel grades. The information which follows is intended to assist customers in the preparation of enquiries and orders.

You should always refer to the original specification and use BlueScope Steel's Order Checklist on page 64 to assist with this process.

Pressure vessel grades, apart from those in the XLERPLATE® steel Standard Range are by enquiry to ensure grade, size and supplementary specifications are available.

The following tables show the chemical compositions and mechanical test requirements for AS 1548 grades.

### THROUGH THICKNESS TESTED XLERPLATE® STEEL

This special soundness 'Z' quality XLERPLATE® steel is a lamellar tear-resistant grade, with guaranteed through-thickness tensile properties, often specified for critical applications including some pressure vessels.

Lamellar tearing is a form of cracking in a plane parallel to the plate surface in the vicinity of highly restrained welded joints. Such joints are likely to be found where plate is used in the fabrication of structures such as offshore platforms, high-rise buildings, bridges, large draglines and open-cut dredging machines.

Three factors contribute to the occurrence of lamellar tearing – structural restraint, joint design and through-thickness ductility of the plate.

BlueScope Steel supplies lamellar tear-resistant steels to through-thickness tensile requirements subject to availability. Steels which are to be supplied to through-thickness tensile requirements are made to a high standard of internal cleanliness and have a low sulphur level, generally 0.01% or less, and may be treated with calcium for inclusion shape control.

Supply to a minimum through-thickness reduction of area can be negotiated for any structural or pressure vessel product in the XLERPLATE® steel range. XLERPLATE® steel is supplied ultrasonically tested to AS 1710 Level 2 Standard as a mandatory requirement.



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### PRODUCT ANALYSIS

Product analysis is available on enquiry (at additional cost) and is carried out on a sample obtained from the rolled XLERPLATE® steel. Where product analysis is specified by the customer for AS 1548 grades, it is normal practice to report all elements listed in the relevant specification. For other specifications, or where variation from this practice is required, this should be noted when ordering.

### PRODUCT SPECIFICATIONS

The supply of NATA endorsed test certificates for XLERPLATE® steel products is standard practice. Supply of standard test certificates are available at no extra cost. The identity of the XLERPLATE® steel should be verified against order and test documents as soon as practicable after delivery.

### Normalising

Normalising is a heat treatment process where the steel is heated to 880°C – 920°C (austenitised) for approximately 60 minutes per 25mm of thickness and air-cooled. The process refines the grain size to improve uniformity in microstructure and to remove stresses produced in the steel during rolling.

For pressure vessel grades (AS 1548) where it is intended to normalise XLERPLATE® steel as part of the fabrication procedure, XLERPLATE® steel may be ordered in the normalised rolled condition with tests to be carried out on normalised test pieces ('A' Condition). Normalising temperature depends on the steel grade and users should refer to test certificates for the actual temperature used in normalising of XLERPLATE® steel or test pieces.

Where customers order 'A' grade XLERPLATE® steel they must ensure that the appropriate heat treatment is carried out. It is recommended that additional samples be taken for quality assurances after normalising.

Dimensions of normalised XLERPLATE® steel are limited by the capacity of our normalising contractor and by other production factors such as lifting capability. Please refer to the XLERPLATE® steel Size Schedule appropriate to the steel grade concerned.



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### **Controlled rolling**

The amount of deformation and the temperature at which it occurs are controlled during this rolling process, which is designed to produce a fine-grained microstructure with the desired mechanical properties.

The mechanical properties obtained by controlled rolling are generally lost if the steel is reheated above 620 degrees Celsius. Customers should consult XLERPLATE® steel Technical Service on 1800 800 789 prior to hot forming these grades.

### **Normalised rolling**

In this process, the final deformation is carried out in a specific temperature range which leads to a material condition equivalent to that obtained after normalising, so that the specified values of the mechanical properties are retained even after normalising.



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### AS 1548 CHEMICAL COMPOSITION – XLERPLATE® STEEL PRESSURE VESSEL GRADES

GRADE	ANALYSIS TYPE	ANALYSIS, PERCENT (NOTES 1, 2, 5 AND 6)										CARBON IIW EQUIVALENT MAX. PERCENT (NOTE 3)
		C	Mn		Si	P	S	Nb		Al	Ti	
		Max	Min	Max	Max	Min	Max	Min	Max	Max	Max	
PT460 NR, N, T	Cast/ Product	0.20	0.90	1.70	0.60	0.040	0.030	*	0.010 (Note 4)	0.100	0.040	0.43
PT490 NR, N, T	Cast/ Product	0.20	0.90	1.70	0.60	0.040	0.030	0.010	0.050	0.100	0.040	0.46

#### Notes:

- The following elements may be present to the limits stated: Copper 0.40%, Nickel 0.50%, Chromium 0.25%, Molybdenum 0.10%, Vanadium 0.030%
- The use of sulphide shape control elements for these grades is permitted.
- Carbon equivalent (CE) is calculated from the equation:  

$$CE = \frac{C + Mn}{6} + \frac{Ni + Cu}{15} + \frac{Cr + Mo + V}{5}$$
- Niobium (up to 0.025%) may be added for L20, L40 and L50 designations.
- If per cent by mass of copper exceeds 0.3%, the per cent mass of Nickel must be at least half the per cent by mass of Copper.
- Copper + Chromium + Molybdenum = 0.45% max.



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### AS 1548 TENSILE REQUIREMENTS FOR XLERPLATE® STEEL PRESSURE VESSEL GRADES

TYPE AND GRADE	MINIMUM UPPER YIELD STRESS VALUE, MPa					TENSILE STRENGTH MPa	MINIMUM ELONGATION 'A' AS A PERCENTAGE PROPORTION OF GAUGE LENGTH OF $5.65 \sqrt{S_0}$ %
	Thickness, mm						
	≤ 16	> 16 ≤ 40	> 40 ≤ 80	> 80 ≤ 100			
PT460 NR, N, T	305	295	275	265		460 to 580	21
PT490 NR, N, T	360	340	330	320		490 to 610	20



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### AS 1548 CHARPY V-NOTCH IMPACT TEST REQUIREMENTS FOR XLERPLATE® STEEL PRESSURE VESSEL GRADES#

TYPE AND GRADE	IMPACT DESIGNATION	TEST TEMPERATURE °C	MINIMUM ABSORBED ENERGY, J					
			Size of test piece					
			10mm x 10mm		10mm x 7.5mm		10mm x 5mm	
			Individual test	Average of 3 tests	Individual test	Average of 3 tests	Individual test	Average of 3 tests
PT460NR	L0	0	38	51	29	40	27	34
PT460 NR, R, T	L20	-20	35	47	28	38	25	33
	L40	-40	33	45	27	36	23	32
	L50	-50	31	42	25	34	22	30
PT490 NR, N, T	L20	-20	43	55	35	44	30	39
	L40	-40	33	45	27	36	23	32
	L50	-50	31	42	25	34	22	30

**Note:**

For thickness less than 7mm, full thickness impact tests may be negotiated.

# Test Direction Longitudinal

Where no impact designation is specified, the base grades for PT430 and PT460 shall meet a minimum individual test requirement of 23 Joules and a minimum average of three test requirements of 31 Joules when tested at 0°C. The base grades for PT490 shall meet a minimum individual test requirement of 43 Joules and a minimum average of three test requirements of 55 Joules when tested at -20°C.

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### AS 1548 ELEVATED TEMPERATURE TENSILE TEST VALUES XLERPLATE® STEEL FOR PRESSURE VESSEL GRADES

TYPE AND GRADE	THICKNESS MM		LOWER YIELD STRESS OR 0.2% PROOF STRESS MINIMUM, MPa								
			Temperature °C								
			50*	100	150	200	250	300	350	400	450
PT460 NRH, NH, TH	≥ 8	≤ 16	295	277	257	236	216	199	184	173	163
	> 16	≤ 40	285	268	249	228	209	192	178	167	157
	> 40	≤ 80	266	250	232	213	195	179	166	156	145
	> 80	≤ 100	256	241	223	206	188	173	160	150	141
PT490 NRH, NH, TH	≥ 8	≤ 16	348	327	303	278	255	236	217	204	192
	> 16	≤ 40	329	310	287	263	242	222	205	193	182
	> 40	≤ 80	319	300	278	255	234	216	199	187	176
	> 80	≤ 100	310	291	269	248	227	210	193	182	172

\* Values at 50°C are included for design purposes only and are not subject to test.



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**[www.xlerplate.com.au](http://www.xlerplate.com.au)**



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