



ARMOUR PLATE STEEL

BISALLOY® - performance for life.

KEY FACTS

BISALLOY® Armour steel has been the product of choice for:

- Construction of the Collins Class submarine hull/structure and naval surface ships
- Thales Australia's revolutionary Bushmaster Infantry Mobility Vehicle & Hawkei Vehicle
- Construction of the US Army MRAP & MATV

Since 1980, Bisalloy has proudly been Australia's only manufacturer of quenched and tempered steel plate used for armour, structural and wear-resistant steel applications and has established an outstanding international reputation for quality products and technical support.

Putting performance first, we work closely with manufacturers, specifiers, distributors and channel partners to deliver innovative products and service solutions and have become the trusted performance steel partner to customers across Australia and the world.



Technical data at your fingertips

Visit www.bisalloy.com.au to quickly access detailed:

- **Information on Bisalloy's products and solutions, services and distributors**
- **Reference materials including a range of Technical Guides with detailed information on fabrication, performance, specifications and product comparisons**
- **Case Studies on projects utilising Bisalloy's performance steel products and also the latest company news**



Your performance steel partner

As a specialist supplier of quenched and tempered steel plate, Bisalloy is highly responsive and agile in partnering with our customers to meet their demands, specialised needs and market challenges in Australia and across the globe.

- To fully meet the challenges of our customers, we focus on our performance first to ensure we consistently excel in our field of expertise and deliver the best in performance steel products
- We form strong partnerships with our customers and develop a deep understanding of their businesses and needs, enabling us to deliver value-added products and services that support their success
- We collaborate with leaders in science, technology and steel manufacture on intensive research programs involving critical testing and evaluation of materials to produce innovations at the forefront of steel technology worldwide



BISALLOY® Armour Steel

Having won international acclaim for the strength, weldability and toughness of the BISALLOY® Armour steel plate specifically developed for the Australian Bushmaster Infantry Mobility Vehicles, you can rest assured you will always receive the best from Bisalloy.

The strength and reliability of BISALLOY® Armour steel has long been chosen to support Australia's defence forces and is an achievement which brings great pride to Bisalloy.

Of particular significance was the production of 8,000 tonnes of performance steel for the Collins Class submarines - steel which had to undergo rigorous testing to conform to the RAN's stringent requirements for submarine hulls capable of operating under severe conditions without loss of structural performance or integrity.

Requiring vital characteristics including strength, toughness and shock loading resistance, the steel also needed to be readily cold formed, fabricated and welded.

Collaborating on intensive development and testing with the Defence Science & Technology Organisation and Australian steel manufacturer BlueScope, Bisalloy's special

submarine grade steel withstood the Charpy V-notch impact test, Schnadt tests, Dynamic Tear tests and the demanding Explosion Bulge test (the dry land equivalent of close-range depth charging).

The same approach and capabilities are deployed in Bisalloy's development and manufacture of armour plate steel for use in land-based military applications, in Australia and around the world, where lightweight steel plate with superior ballistic performance is required.

In addition to traditional support for manufacturers of armoured vehicles, Bisalloy is increasingly supplying BISALLOY® Armour steel to police, military forces, government and civilian applications worldwide for use in security vehicles, training facilities, security booths, splinter boxes, embassy 'safe rooms' and myriad other applications.





The benefits of choosing BISALLOY® Armour steel

Australian made

This represents the highest standards in quality and service, which customers in Australia and our global markets have relied upon for decades.

Known and trusted

You have the confidence of working with known and trusted, quality products from an Australian steel manufacturer with more than 30 years of expertise in producing market-leading armour grade steel and other performance steel products for Australia and the world.

Technical expertise

Our people are experts in specifying, developing, manufacturing and using our products. Bisalloy's range of armour plate grades are specifically designed, hot rolled and heat treated to provide the best solution in military and defence applications.

Product quality

Bisalloy's product quality is second to none, with our armour steel the first choice in defence applications. BISALLOY® Armour steel is specified for hulls in Armoured Personnel Carriers (APC), Light Armoured Vehicles (LAV) and the Bushmaster Infantry Mobility Vehicles in Australia, along with many APCs and LAVs worldwide.

Partnership Focused

With Bisalloy, you are partnering with a company that works closely with customers, and engages with leaders in science and technology, to deliver truly innovative and tailored product solutions and services.

Product range

We produce a wide range of quenched and tempered steel products to meet the varying requirements and needs of our many customers – and are committed to ongoing research and development to ensure Bisalloy's product range remains at the leading edge of available quenched and tempered steels.

BISALLOY® Armour RHA300 steel

Introduction

BISALLOY® Rolled Homogeneous Armour 300 (BISALLOY® Armour RHA300 steel) - quenched and tempered steel armour plate suitable for use in military applications where light weight and maximum resistance to high rates of shock loading is required.

Brinell hardness

Thickness (mm)	Specification	Typical
5 - 50 ¹	260-310 HB	280 HB

Tensile properties

Property	Typical
0.2% Proof Stress	900 MPa
Tensile Strength	1020 MPa
Elongation in 50 mm GL	16%

Charpy impact values

Thickness (mm)	Test Piece	Test Temp	Min. Energy (Transverse)	Min. Energy (Longitudinal)
5	10 x Thk	-40°C	By Agreement	By Agreement
6 - <9.5	10 x 5	-40°C	20J	20J
9.5 - <12	10 x 7.5	-40°C	30J	30J
≥12	10 x 10	-40°C	40J	40J

Chemistry

The chemical specification conforms to the requirements of MIL-DTL-12560, although it is tighter than the requirements of that specification so as to optimise the material's performance. Product chemical analyses are taken on a per-heat basis. Chemical analysis is as follows:

Chemical composition

Thickness (mm)	Weight %	C	P	Mn	Si	S	Ni	Cr	Mo	B	CE(IIW)	CET
5 - 50 ¹	Maximum	0.32	0.025	1.50	0.60	0.005	0.50	1.20	0.30	0.002	0.61*	0.40*

Thickness tolerance

Thickness (mm)	Special Tolerance
5 - 25	-0.0 + 1.0
>25 - 50	-0.0 + 1.2

Test frequency

Per Plate	Per Batch	By Agreement
Hardness	Charpy (L), Charpy (T)	Thickness, Tensile, Ballistic Properties, Product Analysis

Other

Equivalent Specification	Surface Finish
MIL - DTL - 12560 class 2	Shotblasted

Fabrication

For advice on fabrication refer to relevant Bisalloy technical brochures. Contact Bisalloy ZA direct or visit www.bisalloy.co.za

* Typical for 12mm plate

¹ Other thicknesses may be available on application

BISALLOY® Armour RHA360 steel

Introduction

BISALLOY® Armour Rolled Homogeneous Armour 360 (BISALLOY® Armour RHA360 steel) - a quenched and tempered steel armour plate, possessing very good weldability, suitable for use in both military and civil applications where high rates of shock loading and resistance to penetration by ballistic projectiles are required.

Brinell hardness

Thickness (mm)	Specification	Typical
5 - 50 ¹	310-410 HB ²	350 HB

Tensile properties

Property	Typical
0.2% Proof Stress	1040 MPa
Tensile Strength	1140 MPa
Elongation in 50 mm GL	16%

Charpy impact values

Thickness (mm)	Test Piece	Test Temp	Min. Energy (Transverse)	Min. Energy (Longitudinal)
5	10 x Thk	-40°C	By Agreement	By Agreement
6 - <9.5	10 x 5	-40°C	12J	12J
9.5 - <12	10 x 7.5	-40°C	17J	17J
≥12	10 x 10	-40°C	22J ³	22J ³

Chemistry

The chemical specification conforms to the requirements of MIL-DTL-12560, although it is tighter than the requirements of that specification so as to optimise the material's performance. Product chemical analyses are taken on a per-heat basis. Chemical analysis is as follows:

Chemical composition

Thickness (mm)	Weight %	C	P	Mn	Si	S	Ni	Cr	Mo	B	CE(IIW)	CET
5 - 50 ¹	Maximum	0.32	0.025	1.50	0.60	0.005	0.50	1.20	0.30	0.002	0.61*	0.40*

Thickness tolerance

Thickness (mm)	Special Tolerance
5 - 25	-0.0 + 1.0
>25 - 50	-0.0 + 1.2

Test frequency

Per Plate	Per Batch	By Agreement
Hardness	Charpy (L), Charpy (T)	Thickness, Tensile, Ballistic Properties, Product Analysis

Other

Equivalent Specification	Surface Finish
MIL - DTL - 12560 class 1	Shotblasted

Fabrication

For advice on fabrication refer to relevant Bisalloy technical brochures. Contact Bisalloy ZA direct or visit www.bisalloy.co.za

* Typical for 12mm plate

¹ Other thicknesses may be available on application

² Hardness range varies depending on thickness

³ Minimum average energy will vary depending on hardness

BISALLOY® Armour HTA400 steel

Introduction

BISALLOY® Armour High Toughness Armour 400 (BISALLOY® Armour HTA400 steel) - a quenched and tempered steel armour plate, possessing very good weldability, suitable for use in both military and civil applications where high rates of shock loading and resistance to penetration by ballistic projectiles are required.

Brinell hardness

Thickness (mm)	Specification	Typical
5 - 50 ¹	370-430 HB	400 HB

Tensile properties

Property	Typical
0.2% Proof Stress	1100 MPa
Tensile Strength	1250 MPa
Elongation in 50 mm GL	16%

Charpy impact values

Thickness (mm)	Test Piece	Test Temp	Min. Energy (Transverse)	Min. Energy (Longitudinal)
5	10 x Thk	-40°C	By Agreement	By Agreement
6 - <9.5	10 x 5	-40°C	9J	9J
9.5 - <12	10 x 7.5	-40°C	13J	13J
≥12	10 x 10	-40°C	17J	17J

Chemistry

Product chemical analyses are taken on a per-heat basis. Chemical analysis is as follows:

Chemical composition

Thickness (mm)	Weight %	C	P	Mn	Si	S	Ni	Cr	Mo	B	CE(IIW)	CET
5 - 50 ¹	Maximum	0.32	0.025	1.50	0.60	0.005	0.50	1.20	0.30	0.002	0.61*	0.40*

Thickness tolerance

Thickness (mm)	Special Tolerance
5 - 25	-0.0 + 1.0
>25 - 50	-0.0 + 1.2

Test frequency

Per Plate	Per Batch	By Agreement
Hardness	Charpy (L), Charpy (T)	Thickness, Tensile, Ballistic Properties, Product Analysis

Other

Equivalent Specification	Surface Finish
NIL	Shotblasted

Fabrication

For advice on fabrication refer to relevant Bisalloy technical brochures. Contact Bisalloy ZA direct or visit www.bisalloy.co.za

* Typical for 12mm plate

¹ Other thicknesses may be available on application

BISALLOY® Armour UHT440 steel

Introduction

BISALLOY® Armour Ultra High Toughness 440 (BISALLOY® Armour UHT440 steel) - a quenched and tempered steel armour plate suitable for use in both military and civil applications where light weight and a high combined resistance to both shock and penetration is required.

Brinell hardness

Thickness (mm)	Specification	Typical
6 - 50 ¹	420-470 HB	450 HB

Tensile properties

Property	Typical
0.2% Proof Stress	1150 MPa
Tensile Strength	1450 MPa
Elongation in 50 mm GL	14%

Charpy impact values

Thickness (mm)	Test Piece	Test Temp	Min. Energy (Transverse)	Min. Energy (Longitudinal)
6 - <8	10 x 5	-40°C	11J	11J
8 - <12	10 x 7.5	-40°C	17J	17J
≥12	10 x 10	-40°C	22J	22J

Chemistry

The chemical specification conforms to the requirements of MIL-DTL-12560, although it is tighter than the requirements of that specification so as to optimise the material's performance. Product chemical analyses are taken on a per-heat basis. Chemical analysis is as follows:

Chemical composition

Thickness (mm)	Weight %	C	P	Mn	Si	S	Ni	Cr	Mo	B	CE(IIW)	CET
6 - 50 ¹	Maximum	0.25	0.025	1.40	0.60	0.005	0.50	1.20	0.35	0.002	0.46*	0.30*

Thickness tolerance

Thickness (mm)	Special Tolerance
6 - 25	-0.0 + 1.0
>25 - 50	-0.0 + 1.2

Test frequency

Per Plate	Per Batch	By Agreement
Hardness	Charpy (L), Charpy (T)	Thickness, Tensile, Ballistic Properties, Product Analysis

Other

Equivalent Specification	Surface Finish
MIL - DTL - 12560 class 4	Shotblasted

Fabrication

For advice on fabrication refer to relevant Bisalloy technical brochures. Contact Bisalloy ZA direct or visit www.bisalloy.co.za

* Typical for 12mm plate

¹ Other thicknesses may be available on application

BISALLOY® Armour HHA500 steel

Introduction

BISALLOY® Armour High Hardness Armour 500 steel (BISALLOY® Armour HHA500 steel) - a quenched and tempered steel armour plate suitable for use in both military and civil applications where light weight and resistance to ballistic projectiles is required.

Brinell hardness

Thickness (mm)	Specification	Typical
5 - 50 ¹	477 - 534 HB	500 HB

Tensile properties

Property	Typical
0.2% Proof Stress	1350 MPa
Tensile Strength	1640 MPa
Elongation in 50 mm G.L.	14%

Charpy impact values

Thickness (mm)	Test Piece	Test Temp	Min. Energy (Transverse)	Min. Energy (Longitudinal)
5	10 x Thk	-40°C	By Agreement	By Agreement
6 - <9.5	10 x 5	-40°C	8 J	10 J
9.5 - <12	10 x 7.5	-40°C	12 J	15 J
≥12	10 x 10	-40°C	16 J	20 J

Chemistry

The chemical specification conforms to the requirements of MIL-DTL-46100, although it is tighter than the requirements of that specification so as to optimise the material's performance. Product chemical analyses are taken on a per-heat basis. Chemical analysis is as follows:

Chemical composition

Thickness (mm)	Weight %	C	P	Mn	Si	S	Ni	Cr	Mo	B	CE(IIW)	CET
5 - 50 ¹	Maximum	0.32	0.025	0.80	0.50	0.005	0.50	1.20	0.30	0.002	0.61*	0.40*

Thickness tolerance

Thickness	Special Tolerance
5 - 25mm	-0.0 + 1.0
>25 - 50mm	-0.0 + 1.2

Test frequency

Per Plate	Per Batch	By Agreement
Hardness	Charpy (L), Charpy (T)	Thickness, Tensile, Ballistic Properties, Product Analysis

Other

Equivalent Specification	Surface Finish
MIL - DTL - 46100	Shotblasted

Fabrication

For advice on fabrication refer to relevant Bisalloy technical brochures. Contact Bisalloy ZA direct or visit www.bisalloy.co.za

* Typical for 12mm plate

¹ Other thicknesses may be available on application

BISALLOY® Armour UHH600 steel

Introduction

BISALLOY® Armour Ultra High Hardness 600 (BISALLOY® Armour UHH600 steel) - a quenched and tempered steel armour plate suitable for use in both military and civil applications where light weight and resistance to ballistic projectiles is required.

Brinell hardness

Thickness (mm)	Specification	Typical
5.5 - 16 ¹	570-640 HB	600 HB

Tensile properties

Property	Typical
0.2% Proof Stress	1500 MPa
Tensile Strength	2050 MPa
Elongation in 50 mm GL	8%

Charpy impact values

Thickness (mm)	Test Piece	Test Temp	Min. Energy (Transverse) ²	Min. Energy (Longitudinal) ²
≥12	10 x 10	-40°C	8J	8J

Chemistry

The chemical specification conforms to the requirements of MIL-DTL-32332, although it is tighter than the requirements of that specification so as to optimise the material's performance. Product chemical analyses are taken on a per-heat basis. Chemical analysis is as follows:

Chemical composition

Thickness (mm)	Weight %	C	P	Mn	Si	S	Ni	Cr	Mo	B	CE(IIW)	CET
5.5 - 16 ¹	Maximum	0.45	0.020	0.50	0.35	0.005	1.00	1.20	0.30	0.002	0.75*	0.52*

Thickness tolerance

Thickness (mm)	Special Tolerance
5.5 - 16	-0.0 + 1.0

Test frequency

Per Plate	Per Batch	By Agreement
Hardness	Charpy (L), Charpy (T)	Thickness, Tensile, Ballistic Properties, Product Analysis

Other

Equivalent Specification	Surface Finish
MIL - DTL - 32332 class 1	Shotblasted

Fabrication

For advice on fabrication refer to relevant Bisalloy technical brochures. Contact Bisalloy ZA direct or visit www.bisalloy.co.za

* Typical for 12mm plate

¹ Other thicknesses may be available on application

² For plate thickness under 12mm subsize charpy V-specimens are used. The specified minimum value is then proportional to the specimen cross-section.

PLEASE NOTE: Every care has been taken to ensure the accuracy of information contained in this manual which supersedes earlier publications, however Bisalloy Steels shall not be liable for any loss or damage whatsoever caused from the application of such information. Typical values are provided for reference information only and no guarantee is given that a specific plate will provide these properties. Information is subject to change without notice. October 2016

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