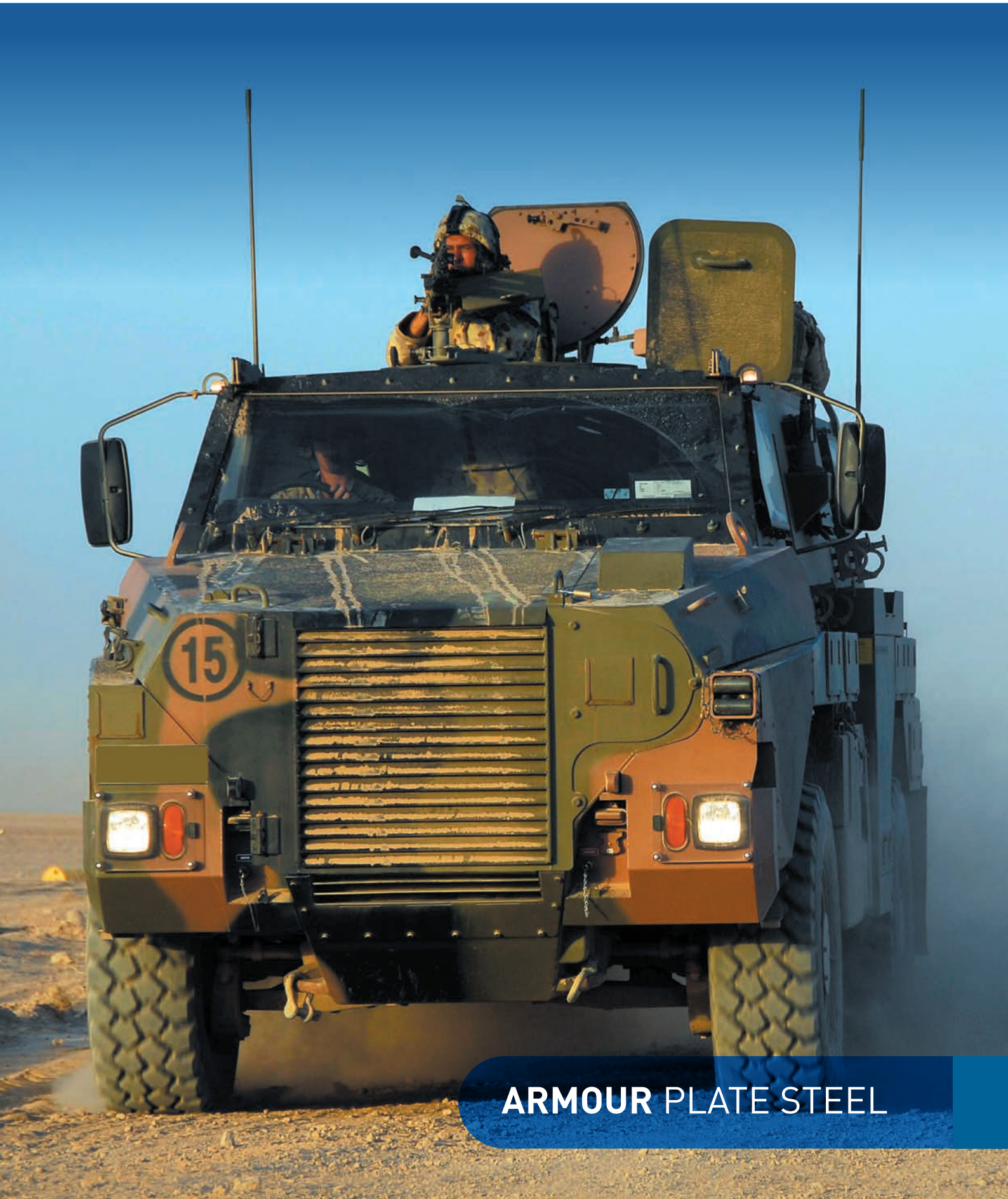
AUSTRALIAN MADE

Bisalloy
ARMOUR



ARMOUR PLATE STEEL

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

BISALLOY® - performance for life.

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 DST Group 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 40 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 here and abroad. 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 locally 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.

Case Studies

Armoured steel does the job for civilian security vehicles

PARTNER: PLASAN RE'EM

Armoured steel isn't only used in military applications. Increasingly, it can be found in a range of other civilian applications. It is used to make training facilities, security booths, splinter boxes, embassy 'safe rooms' and more.

Israeli manufacturer Plasan Re'em uses the steel to make high performance civilian armoured vehicles that offer maximum ballistic protection, as well as high performance, speed, manoeuvrability, comfort and control.

To make these vehicles, Plasan Re'em required a steel product that is strong, bendable, weldable, formable and light.

The company found all of this in BISALLOY® ARMOUR steel, a product ideally suited for light, fast and manoeuvrable vehicles that require the highest level of ballistic protection.

The unique chemistry of BISALLOY® steel means it is more weldable and bendable than any other 600 Brinell Hardness armour steel currently on the market, offering significant opportunities for companies like Plasan Re'em to develop innovative and highly effective solutions.

Aussie BISALLOY® steel to protect a new generation of Australian soldiers

PARTNER: RHEINMETALL

BISALLOY® ARMOUR steel will be used by Rheinmetall in the production of over 200 Boxer Combat Reconnaissance Vehicles (CRVs) for the Australian Government's $5.2 billion LAND 400 Phase 2 Armoured Vehicle program.

BISALLOY® Armour steel has become a leading product for defence applications in Australia and abroad and has been specified for hulls in Armoured Personnel Carriers (APC), Light Armoured Vehicles (LAV), Collins Class submarines and the Bushmaster Infantry Mobility Vehicles in Australia, along with many APCs and LAVs worldwide.

Rheinmetall was committed to choosing the best available partners to work with for LAND 400 bid program. Bisalloy showed throughout the tender process that not only do they manufacture a world-class armour steel product but also that they have the technical and manufacturing capability required for such a critical project.

PRODUCT **DATA SHEET**

Bisalloy ARMOUR

BISALLOY® ARMOUR 80A STEEL

Introduction

BISALLOY® ARMOUR 80A steel is a specialised armour grade of quenched and tempered steel armour plate suitable for use in military applications where the maximum resistance to high rates of shock loading is required.

Brinell hardness

Thickness (mm)	Specification	Typical
5 - 50[1]	-	255 HB

Tensile properties

Property	Specification
0.2% Proof Stress	690 MPa
Tensile Strength	790 MPa
Elongation in 50 mm GL	18%

Charpy impact values

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

Chemistry

The chemical analysis is as follows:

Chemical composition

Thickness (mm)	Weight %	C	P	Mn	Si	S	Cr	Mo	B	CE(IIW)**	CET**
5 - <30	Maximum	0.18	0.025	1.2	0.60	0.008	1.00	0.25	0.002	0.44	0.26
30 - 50	Maximum	0.18	0.025	1.3	0.60	0.008	1.00	0.25	0.002	0.54	0.32

** Typical average

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 direct or visit www.bisalloy.com.au

[1] Other thicknesses may be available on application

PRODUCT **DATA SHEET**

Bisalloy ARMOUR

BISALLOY® ARMOUR RHA300 STEEL

Introduction

BISALLOY® ARMOUR RHA300 steel (Rolled Homogeneous Armour) - 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	1000 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 - <8	10 x 5	-40°C	24J	24J
8 - <12	10 x 7.5	-40°C	37J	37J
≥12	10 x 10	-40°C	49J	49J

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

BISALLOY® ARMOUR RHA300 STEEL

Other

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

Fabrication

For advice on fabrication refer to relevant Bisalloy technical brochures.
Contact Bisalloy direct or visit www.bisalloy.com.au

* Typical for 12mm plate

[1] Other thicknesses may be available on application

 Published August 2020

PRODUCT **DATA SHEET**

Bisalloy ARMOUR

BISALLOY® ARMOUR RHA360 STEEL

Introduction

BISALLOY® ARMOUR RHA360 steel (Rolled Homogeneous Armour) - 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	15%

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 - <8	10 x 5	-40°C	12J[3]	12J[3]
8 - <12	10 x 7.5	-40°C	17J[3]	17J[3]
≥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

PRODUCT **DATA SHEET**

Bisalloy ARMOUR

BISALLOY® ARMOUR RHA360 STEEL

Other

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

Fabrication

For advice on fabrication refer to relevant Bisalloy technical brochures.
Contact Bisalloy direct or visit www.bisalloy.com.au

* 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

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. **Published August 2020**

PRODUCT **DATA SHEET**

Bisalloy ARMOUR

BISALLOY® ARMOUR HTA400 STEEL

Introduction

BISALLOY® ARMOUR HTA400 steel (High Toughness Armour) - 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	1080 MPa
Tensile Strength	1250 MPa
Elongation in 50 mm GL	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 - <8	10 x 5	-40°C	9J	9J
8 - <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

PRODUCT **DATA SHEET**

Bisalloy ARMOUR

BISALLOY® ARMOUR HTA400 STEEL

Other

Equivalent Specification	Surface Finish
NIL	Shotblasted

Fabrication

For advice on fabrication refer to relevant Bisalloy technical brochures.
Contact Bisalloy direct or visit www.bisalloy.com.au

* Typical for 12mm plate
[1] Other thicknesses may be available on application

 Published August 2020

PRODUCT **DATA SHEET**

Bisalloy ARMOUR

BISALLOY® ARMOUR UHT440 STEEL

Introduction

BISALLOY® ARMOUR UHT440 steel (Ultra High Toughness) - 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	1110 MPa
Tensile Strength	1450 MPa
Elongation in 50 mm GL	12%

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

PRODUCT **DATA SHEET**

Bisalloy ARMOUR

BISALLOY® ARMOUR UHT440 STEEL

Other

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

Fabrication

For advice on fabrication refer to relevant Bisalloy technical brochures.
Contact Bisalloy direct or visit www.bisalloy.com.au

* Typical for 12mm plate
[1] Other thicknesses may be available on application

 Published August 2020

PRODUCT **DATA SHEET**

Bisalloy ARMOUR

BISALLOY® ARMOUR HHA500 STEEL

Introduction

BISALLOY® ARMOUR HHA500 steel (High Hardness Armour) - 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	1300 MPa
Tensile Strength	1640 MPa
Elongation in 50 mm G.L.	10%

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 - <8	10 x 5	-40°C	8 J	10 J
8 - <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 (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

PRODUCT **DATA SHEET**

Bisalloy ARMOUR

BISALLOY® ARMOUR HHA500 STEEL

Other

Equivalent Specification	Surface Finish
MIL - DTL - 46100	Shotblasted

Fabrication

For advice on fabrication refer to relevant Bisalloy technical brochures.
Contact Bisalloy direct or visit www.bisalloy.com.au

* Typical for 12mm plate
[1] Other thicknesses may be available on application

 Published August 2020

PRODUCT **DATA SHEET**

Bisalloy ARMOUR

BISALLOY® ARMOUR VHH550 STEEL

Introduction

BISALLOY® ARMOUR VHH550 steel (Very High Hardness) - 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 - 50[1]	530-570 HB	550 HB

Tensile properties

Property	Typical
0.2% Proof Stress	1400 MPa
Tensile Strength	1850 MPa
Elongation in 50 mm G.L.	8%

Charpy impact values

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

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
5.5 - 50[1]	Maximum	0.38	0.020	0.50	0.35	0.005	1.00	1.20	0.30	0.002	0.68*	0.46*

Thickness tolerance

Thickness (mm)	Special Tolerance
5.5 - 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
Bisalloy proprietary specification	Shotblasted

Fabrication

For advice on fabrication refer to relevant Bisalloy technical brochures.
Contact Bisalloy direct or visit www.bisalloy.com.au

* 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.

 Published August 2020

PRODUCT **DATA SHEET**

Bisalloy ARMOUR

BISALLOY® ARMOUR UHH600 STEEL

Introduction

BISALLOY® ARMOUR UHH600 steel (Ultra High Hardness) - 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 - 25[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	7%

Charpy impact values

Thickness (mm)	Test Piece	Test Temp	Min. Energy (Transverse) [2]	Min. Energy (Longitudinal) [2]
≥12	10 x 10	-40ºC	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 - 25[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 - 25	-0.0 + 1.0

Test frequency

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

Other

Thickness (mm)	Equivalent Specification	Surface Finish
≤16	MIL - DTL - 32332 class 1	Shotblasted
>16 - 25[1]	Bisalloy proprietary specification	Shotblasted

Fabrication

For advice on fabrication refer to relevant Bisalloy technical brochures.
Contact Bisalloy direct or visit www.bisalloy.com.au

* 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.

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