

AUSTRALIAN STAINLESS

SPECIALISING IN STAINLESS STEEL AND ITS APPLICATIONS

#48
AUTUMN
2011

- › Stainless vision
- › Pipes run half marathon
- › Grade 431
- › Whole of life costing
- › Outstanding design & specification



Image courtesy of Marcus Canning.

PROUDLY SPONSORED BY



EDITED AND PUBLISHED BY THE AUSTRALIAN STAINLESS STEEL DEVELOPMENT ASSOCIATION
PRINT POST APPROVED PP451207/00205



STAINLESS VISION

INSPIRATION FROM MEDIEVAL TALE

The lance used by St George to slay the dragon in Medieval mythology - *Ascalon* - has inspired a stunning addition to Perth's St George's Cathedral forecourt.

Ascalon, designed by Perth artist Marcus Canning and New York based Christian de Vietri, was chosen as the winning piece from an international competition attracting 99 entries.

The sculpture features an 18m grade 316 stainless steel telescopic pole with a mirror finish, surrounded by



a billowing white fibre reinforced plastic (FRP) 'cape', which represents St George on his steed.

ASSDA Accredited Fabricator Diverse Welding Services was commissioned by engineers and project managers Capital House Australasia to create the pole, which weighs about 2 tonnes.

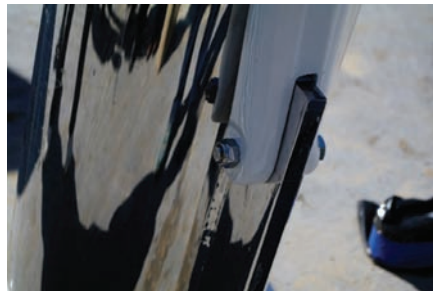
Capital House managing director John Knuckey said the artists had a vision for the sculpture and his team's role was to make it happen.

He said the strength of the central pole was a concern for the artists, while the structural engineers were strongly focussed on minimising vibrations and maximising stiffness.

Capital House's research indicated that 316 would be the most appropriate grade and their interest in selecting from standard sections determined the dimensions.

"The pole also had to be dead straight because people would pick it by eye if it wasn't," Mr Knuckey said.

"We had no desire to compromise on quality but we were concerned that polishing would be too expensive, so originally only the bottom third was going to be mirror polished. In the end Diverse Welding Services said they could achieve a mirror finish on the entire pole and they did an excellent job.



"At first we weren't sure who to trust with the job, but once we had visited Diverse Welding's factory, we knew they were the right people."

Diverse Welding Services director Karl Schmidt said their main challenge was determining the weld design to ensure the work conformed to AS1554 Part 6.

They welded together stainless steel pipe in differing dimensions to create the telescopic shape of the pole and produced joining spigots from plate (supplied by ASSDA Member Stirlings Australia), enabling the pole to be bolted to the FRP 'cape'.

The sections were rotated on horizontal positioners and welded using stainless steel flux cored wire and TIG welding processes. The pole was given a full mirror finish and passivated using a citric based product.

Artist Marcus Canning said Diverse Welding and Capital House were fantastic to work with on the project.

"It was a late decision to shift to a telescopic design, which increased the complexity of the job under a pressured timeline, but they rolled with it and did what they had to do to get the job done, and done right," Mr Canning said.

"The pole is such an important element to the work now it's in situ and responding to the elements - the mirror finish makes its quality shift dramatically throughout the day and night as lighting conditions change."

The sculpture was created following a \$500,000 donation from Australian prospecting geologist Marc Creasy to the Cathedral Arts Foundation, and the only guideline was the theme of St George and the dragon.



Images courtesy of Marcus Canning.



FABRICATIONS
Australia Pty Ltd
ALL ASPECTS OF METAL FABRICATION
DESIGN AND INSTALLATION

P +617 3807 6159
E info@fabaus.com
W www.fabaus.com

PIPES RUN HALF MARATHON THAT DESERVES A DRINK!



A joint venture between two ASSDA Accredited Fabricators has seen 21km of stainless steel pipe work installed as part of the greenfields Bluetongue Brewery recently completed at Warnervale on the Central Coast of NSW.

The \$120 million Pacific Beverages brewery, which officially opened in November 2010, contains more than 2000 tonnes of stainless steel, including more than 120 tonnes of tube sourced in Australia through ASSDA Sponsor Atlas Steels.

The brewery construction was overseen by German brewery manufacturer Ziemann, who contracted ASSDA Accredited Fabricators TFG Pty Ltd and TripleNine Stainless Pty Ltd as the sole installation partners for the stainless steel components.

TFG/TripleNine assembled and installed the pumps, heat exchangers, valves, brewing vessels and fermentation tanks, as well as fabricating and installing all the pipework.

TFG Manager Tom Moultrie said they used grade 304 and 316 tube ranging from 25mm to 100mm in diameter.

To ensure accuracy, speed, efficiency and quality, specialist sanitary welders orbital welded the tube on site.

The construction phase lasted 8 months and, at the height of the project, TFG/TripleNine had 60 fabricators on site.

Mr Moultrie said the scope and size of the project were the motivating factors behind the first-time joint venture.

"The joint venture made sense because both companies could continue to service our other clients during the construction phase, as well as meeting the tight deadline," he said.

Ziemann project manager Sven Mauchnik said TFG/TripleNine

were chosen due to their brewery experience and their ability to match the tight time schedule.

"We were able to build the complete brewery within 8 months and make the first brew on the original planned date," Mr Mauchnik said.

"The quality TFG/TripleNine delivered was beyond our expectation, which is obvious for everybody who visits the brewery."

TFG/TripleNine installed 48 silos, including fermentation and storage vessels around 18m high. Two cranes were used to install four vessels a day.

The fermentation tanks and brewing vessels were manufactured abroad by Ziemann to assist in meeting the tight time frames.

The Bluetongue Brewery is unique in its design because it has twin-stream brew houses under one roof, which allow for brewing flexibility.



See the benefits of 445M2™ ten years on

445M2™ has atmospheric corrosion resistance that is better than 316, so your jobs look better, longer. The Portal Building, pictured on the Brisbane River is nearly 10 years old and a shining example of how corrosion resistant 445M2™ really is.

445M2™ is a new ferritic stainless steel that fabricates like carbon steel, so it's easier to work with than 316 and it's a lot easier on your tools. And because 445M2™ contains no nickel, it is a cost effective solution that offers genuine stability in price.



BRANCHES

www.australwright.com.au

Sydney

02 9827 0790

Melbourne

03 9409 8500

Adelaide

08 8300 1800

Brisbane

07 3722 0800

Perth

08 9258 2600

Austral Wright Metals

ADVERTISEMENT



GRADE 431

A VERSATILE, HIGH STRENGTH MARTENSITIC STAINLESS STEEL

MARTENSITIC STAINLESS STEELS ARE A LESS WELL-KNOWN BRANCH OF THE STAINLESS FAMILY. THEIR SPECIAL FEATURES – HIGH STRENGTH AND HARDNESS – POINT TO THEIR MAIN APPLICATION AREA AS SHAFTS AND FASTENERS FOR MOTORS, PUMPS AND VALVES IN THE FOOD AND PROCESS INDUSTRIES.

The name “martensitic” means that these steels can be thermally hardened. They have a ferritic microstructure if cooled very slowly, but a quenching heat treatment converts the structure to very hard martensite, the same as it would for a low alloy steel such as 4140. Neither the familiar austenitic grades (304, 316 etc) nor the duplex grades (2205 etc) can be hardened in this way.

Grade 431 (UNS 43100) is the most common and versatile of these martensitic stainless steels. It combines good strength and toughness with very useful corrosion resistance and in its usual supply condition can be readily machined.

CHEMICAL COMPOSITION

The composition of 431 specified in ASTM A276 is given in **Table 1** below.

C	Mn	Si	P	S	Cr	Ni
0.20% max	1.00% max	1.00% max	0.040% max	0.030% max	15.0- 17.0%	1.25- 2.50%

Table 1: Composition of 431 (as specified in ASTM A276)

The inclusion of a small amount of nickel in grade 431 is different from most other martensitic grades. This small but important addition makes the steel microstructure austenitic at heat treatment temperatures, even with such a high (for a martensitic grade) chromium content. This high temperature austenite enables formation of hard martensite by quenching.

CORROSION RESISTANCE

The relatively high chromium content gives grade 431 pitting, crevice and general corrosion resistance approaching that of grade 304, which is very useful in a wide range of environments including fresh water and many foods.

Grade 431 has the highest corrosion resistance of any of the martensitic grades. Corrosion resistance is best with a smooth surface finish in the hardened and tempered condition.

Grade 431 is sometimes used for boat shafting and works well in fresh water but is usually not adequate for sea water.

HEAT RESISTANCE

Grade 431 has good scaling resistance to about 700°C but, as martensitic steels are hardened by thermal treatment, any exposure at a temperature above their tempering temperature will permanently soften them. 600°C is a common limit.

MECHANICAL PROPERTIES

The application of grade 431 is all about strength and hardness. **Table 2** below lists mechanical properties of the grade annealed and in hardened and tempered “Condition T”.

Condition	Tensile Strength (MPa)	Yield Strength 0.2% Proof (MPa)	Elongation (% in 50mm)	Hardness Brinell (HB)
Annealed*	860 typical	650 typical	20 typical	285 max
H&T Condition T**	850-1000	635 min	11 min	248-302

*Annealed tensile properties are typical. Annealed hardness listed is the specified maximum for Condition A of ASTM A276
**Grade 431 is frequently stocked and supplied in hardened and tempered “Condition T”.

Table 2: Mechanical properties of 431 annealed and in H&T ‘Condition T’

HEAT TREATMENT

A feature of grade 431 is that it can, like other martensitic steels, be hardened and then tempered at various temperatures to generate properties within a wide spectrum, depending on whether the requirement is for highest possible hardness, or best ductility, or some balance between these. Hardening is by air or oil quenching, usually from 950-1000°C.

The tempering diagram in **Figure 1** shows properties typically achieved when the hardened steel is tempered at the indicated temperature. A tempering temperature within the range 580 – 680°C is usual. Tempering between 370 and 570°C should be avoided because of resulting low impact toughness. Tempering should follow quenching as quickly as possible to avoid cracking.

Softening is usually by sub-critical annealing, by heating to 620 – 660°C and then air cooling.

PHYSICAL PROPERTIES

Density	7700kg/m ³
Elastic Modulus	200GPa
Thermal Expansion (0-100°C)	10.2µm/m/°C

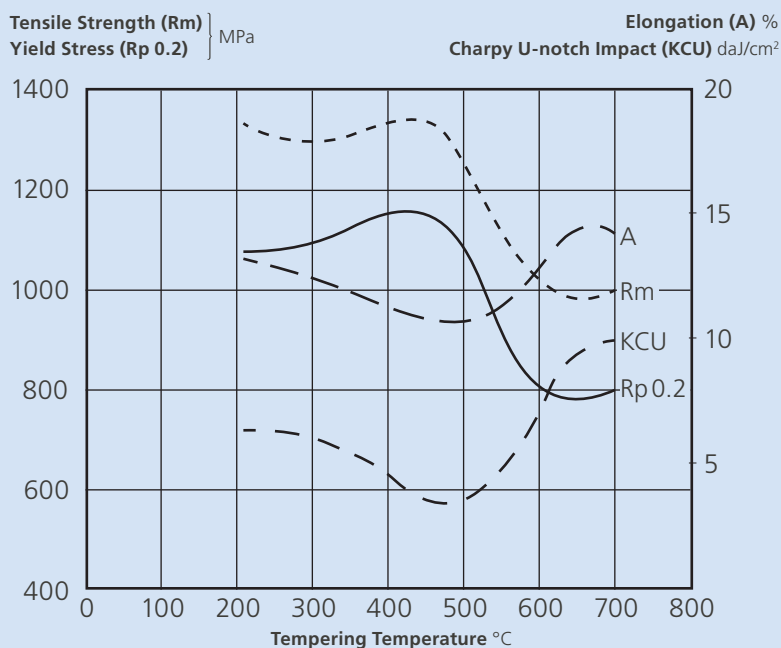


Figure 1 Typical mechanical properties shown after oil quenching at 1000°C and tempering for 2 hours.

Source: Ugitech.

FABRICATION

Machining is readily carried out in the annealed condition, and also in the common Condition T. Modern machining equipment enables high speed machining at this hardness of about 30HRC.

Welding of 431 is rarely carried out — its high hardenability means that cracking is likely unless very careful pre-heat and post-weld heat treatments are carried out. If welding must be done this can be with 410 fillers to achieve high strength but austenitic 308L, 309L or 310 fillers give softer and more ductile welds.

Cold bending and forming of hardened 431 is very difficult because of the high strength and relatively low ductility.

FORMS AVAILABLE

Grade 431 is available in a wide range of bar sizes — virtually exclusively round but some hexagonal. Most other martensitic grades are only available in round bar, although the higher carbon 12% chromium “420” series of grades may also be available as hollow bar and as blocks and plates intended for tooling applications.

ALTERNATIVES

Another approach to high strength stainless steel bar is a precipitation hardening grade, such as 17-4PH. These grades have similar corrosion resistance and offer some advantages in producing long, straight, higher strength shafts.

Shafts to be used in more corrosive environments are likely to be a duplex or super duplex or nitrogen-strengthened austenitic grade. These, however, have lower achievable strengths than martensitic or precipitation hardening grades.

SPECIFICATIONS

Grade 431 is usually specified by ASTM A276, with composition as in **Table 1**. In the Australian market, however, there are usually two deviations from A276:

1. It is most common to find this grade supplied in the hardened and tempered “Condition T” to AS 1444 or BS 970, with specified tensile strength of 850-1000MPa. Yield and elongation are typically in conformance with the limits listed above. ASTM A276 only lists a Condition A version of grade 431 — this is the annealed condition that would normally require hardening heat treatment after machining.
2. The second deviation is that it is usual for cold finished stainless steel bars stocked in Australia to be with the all-minus ISO h9 or h10 diameter tolerances. Hot finished “black” bars with all-plus ISO k tolerances may also be available.

This article was prepared by ASSDA Technical Committee member Peter Moore from Atlas Steels. Further technical advice can be obtained via ASSDA's technical inquiry line on +617 3220 0722.

WHOLE OF LIFE COSTING

19 YEARS PLUS POINTS TO STAINLESS



A fresh focus on whole of life costing at Gold Coast City Council has led to the specification of stainless steel for long-term structures in the foreshore zone.

The philosophy, which was adopted following the publication of a study by Griffith University and GCCC, is likely to have flow on effects to other councils and government bodies.

GCCC's co-ordinator of technical governance Paul Conolly said the seed was planted in 1998 when Council's Technical Services Branch specified stainless steel for a modular toilet structure in a foreshore zone park. The material was deemed at the time to be cost prohibitive on a capital expenditure basis but the process sparked an interest in life cycle costing.

Mr Conolly said Council's growing interest in life cycle costing, combined with an expectation among locals and tourists that public facilities showcase a 'resort style' finish, had brought the focus back to stainless steel in recent years.

"There has been a clear trend towards lighter, more open structures for public facilities and these lend themselves to steel work," he said.

"A lot of our public facilities are in the foreshore zone and some materials weren't performing as well as we wanted, so we started to look at corrosion issues and how to best manage this. We started using stainless steel for critical elements, such as joint interfaces for concrete works; bolts, brackets and cleats for boardwalks; and for high use facilities such as rubbish bins.

"Our observations led us to believe that stainless was the way to go in the foreshore zone, but we had

no tangible justification which the designers could use to validate the decision for our asset custodians. We needed clear evidence to prove the initial cost of stainless steel was justified over the life of the structures."

Griffith University scholarship student Jordan Cocks was called on to research the topic in conjunction with industry affiliate GCCC as partial fulfilment of his Bachelor of Civil Engineering.

Mr Cocks investigated multiple structural scenarios from the perspective of what would represent the most cost-effective solution: hot dipped galvanized (HDG) steel, paint systems, duplex systems using both HDG and paint, or stainless steel.

The result was a report containing a design guide, a life cycle cost analysis and a life cycle costing spreadsheet for structures in the foreshore zone. The report indicates stainless steel is a viable option based on cost alone for structures with a design life greater than 19 years. Conversely, the study indicates a HDG coating would theoretically have a life span of 14 years, leaving the exposed steel subject to rapid corrosion unless protected by an increasingly costly maintenance regime.

Mr Conolly said the report had delivered a workable tool enabling designers to input various parameters, such as current prices and design life, producing a guide for selection of the appropriate material or finishes based around optimising whole of life costs.

Similar principles were used to shift the specification of a park arbour in Broadbeach towards stainless steel. The material was essential due to the warm, humid environment of the foreshore, regular spraying with water and fertiliser, and the fact that the arbour would have plants growing over it that would take many years to fully establish.

The report has now been used to guide material selection for a number of projects, including toilet blocks in Jacobs Well, Miami (pictured) and Burleigh Heads.

"With these projects, we have gone to the asset custodians and our first question was – what is the design life?" Mr Conolly said.

"The report has helped reinforce the need for a 'cradle to grave' approach to responsible and sustainable asset management encompassing all stakeholders. This includes not just the designer and asset custodian but all the operational and maintenance personnel involved with a structure.

"For stainless steel structures, the asset custodians now recognise that to retain an asset over the long-term and to satisfy the whole of life cost advantage there must be regular wash downs as part of the maintenance program. The higher initial construction costs are offset by the lower cost regular wash downs which form the major component in the new maintenance regimes. The buildings are also being designed to be hosed from ceiling to floor. The overall process has really helped improve the relationship between the asset custodians, designers and maintenance staff."

Mr Conolly said the report had also been used to promote the use of stainless steel in playground equipment and shade sail structures.

"It is just a matter of making that little leap towards recognising the whole of life cost and ensuring delivery of a durable product – it's not rocket science, just common sense when you think about it."

GCCC is also now favouring ASSDA Accredited Fabricators and looking to ASSDA to provide third party technical expertise or adjudication should conflicts arise relating to material performance.

The ASSDA Accreditation Scheme requires fabricators to conform to stringent standards of competence, training and education and encourages a consistently high standard through industry self-regulation.

ASSDA Executive Director Richard Matheson said GCCC's decision to favour ASSDA Accredited Fabricators and specify stainless steel in the foreshore zone was a welcome one.

"I believe we will see this initiative mirrored by other councils and government bodies in the near future," Mr Matheson said.

"There is no doubt that informed specification and quality fabrication by people who know and understand the material will offer long-term cost





savings and extend the life of the product. This is why ASSDA places so much emphasis on education and technical expertise – Councils and other government bodies need to get it right the first time and ensure value for money for their constituents.”

Mr Conolly said for long-term structures, stainless steel was becoming the default specification in the foreshore zone and the trend was even moving inland.

“We’re asking the question: what will look and perform best from cradle to grave? It’s making people think differently,” he said.

OUTSTANDING DESIGN & SPECIFICATION SUNSHINE COAST STAINLESS SHINES 18 MONTHS LATER



Image courtesy of Chelmstone. Photography by Greg Gardner Photography.

An impressive span of stainless steel balustrade at Bulcock Beach, Caloundra on Queensland’s Sunshine Coast is demonstrating that good design and specification achieves stunning results that last the distance.

The \$8.5 million Sunshine Coast Council Bulcock Beach redevelopment, which was opened in late 2009, incorporates over 300m of grade 316 stainless steel balustrade.

PLACE Design Group’s project landscape architect and lead consultant Ben Stevens said the balustrade was a collaborative design effort between PLACE Design Group and ASSDA Accredited Fabricator Bell Stainless.

“We wanted a clean, simple design that didn’t detract from the magnificent sweeping views of Pumicestone Passage, and one that stood up to the front-line marine location,” Mr Stevens said.

“We worked closely with Bell Stainless to refine the design. They had some great ideas to maximise long term performance of the stainless steel, while reining in expenditure.”

The final design included 100mm x 50mm rectangular hollow sections

(RHS) for the main balustrade stanchions. Because RHS and circular hollow sections (CHS) were available pre-polished from ASSDA Sponsor Fagersta Steels, it meant that significant cost savings could be achieved in the fabrication and finishing stages. The use of standard RHS sections instead of plate and flatbar significantly minimised the inclusion of crevices in the detailing.

“Because we managed to achieve the required balustrade budget allowance and satisfy Council about the long-term durability of a stainless steel balustrade system we think an outstanding outcome has been achieved,” Mr Stevens said.

Bell Stainless managing director David Vine said this was a landmark project for the company in many ways.

“We saw an opportunity to raise the bar for coastal commercial installations,” he said.

“After exploring the project’s specified finish, we developed a hand-polishing technique that worked extremely well. We’re really pleased with how it’s performing.”

JMA ENGINEERING
Australian distributors for **VELO GROUP**

**Storage - Fermentation
Stainless and Mild
Steel Fabrication**

David 0408 001 020
Mark 0408 822 434
E jma@eng.com.au
www.jmaeng.com.au

ADVERTISEMENT

A1 ENGINEERING
88 Broadway Street, Cobram VICTORIA 3644

ASSDA ACCREDITED
“Our focus is excellence”

CNC Plasma Cutting - DOL Welding - Orbital Welding
Factory Installation & Maintenance
Stainless Steel & Aluminium Custom Engineering
General Engineering
Machining - Guillotine - Press Brake - Rolling
Special Steel Sales - CAD Designs

PH: 03 5871 2138 MOBILE: 0418 570 128
FAX: 03 5871 2168

anthony@a1eng.com.au www.a1eng.com.au

ADVERTISEMENT

PacRim Stainless 2011

Smart, Strong, Sustainable

October 20-21, 2011

Novotel Twin Waters Resort, Sunshine Coast, Queensland

PacRim Stainless is the Australian stainless steel industry's premier networking and knowledge sharing event, attracting both national and international delegates.

It's no secret that Australia's industrial landscape has shifted significantly in recent years. This year's conference theme of *Smart, Strong, Sustainable* will focus on how the domestic stainless steel industry must adapt to the changing environment and use its strengths to secure a sustainable future.

The world is at our doorstep and, more than ever, the industry needs to think outside the square to secure work amidst increasing global competition. **Find out how at PacRim Stainless 2011.**

BE SEEN SUPPORTING OUR INDUSTRY

SPONSOR

PacRim Stainless 2011

Sponsorship packages available from \$2,750

Email siri_g@assda.asn.au for more information

PROGRAM OVERVIEW

- › 2 half day conference sessions
- › Friday afternoon option of industry tour or PacRim Golf Ambrose
- › Sessions focussing on:
 - › a big picture look at our industry - market overview, industry analysis, where will the work be in the future?
 - › case studies from asset owners, Councils and specifiers
 - › new technologies and strategies for survivability and securing a foothold in the global supply chain
 - › sustainability and how it can be achieved

SPEAKER HIGHLIGHTS SO FAR

- › Australian Steel Institute
- › Bureau of Resources & Energy Economics
- › Gold Coast City Council
- › Tersinox Australia



CONTACT DETAILS FOR ASSDA MEMBERS APPEARING IN THIS EDITION

- › **Atlas Steels**
John Pearson
07 3246 9999
John.Pearson@atlassteels.com.au
www.atlassteels.com.au
- › **Bell Stainless Pty Ltd**
David Vine
07 5476 8877
dvine@bellstainless.com.au
www.bellstainless.com.au
- › **Diverse Welding Services Pty Ltd**
Karl Schmidt
08 9276 6000
karl@diversewelding.com.au
www.diversewelding.com.au
- › **Fagersta Steels Pty Ltd**
Garry Nielsen
07 3115 4700
garryn@fagersta.com.au
www.fagersta.com.au
- › **Stirlings Australia**
Matt Smith
(08) 9366 6700
matts@stirlingsaus.com.au
www.stirlingsaustralia.com.au
- › **TFG Pty Ltd**
Tom Moultrie
08 9451 7300
tom@tfggroup.com.au
www.tfggroup.com.au
- › **TripleNine Stainless Pty Ltd**
Justin Brooks
02 9748 7200
justin@triplenestainless.com.au
www.triplenestainless.com.au

MORE INFORMATION

Enquiries for further information on any material presented in this publication should be directed to:

Australian Stainless Steel Development Association
Level 15, 215 Adelaide Street
Brisbane Queensland 4000 Australia
Phone: 07 3220 0722
Fax: 07 3220 0733
Email: assda@assda.asn.au OR www.assda.asn.au

EDITORIAL AND ADVERTISING

EDITORIAL — Contributions of story ideas specialising in stainless steel and its applications are welcome from members and non-members of ASSDA.

ADVERTISING — Advertise in the only publication that targets more than 8,000 readers in the stainless steel industry. Rates available at www.assda.asn.au

CONTACT — Publications & Conference Co-ordinator
Siri Grabski siri_g@assda.asn.au

DISCLAIMER

ASSDA sources articles and advertisements from a variety of contributors and accordingly does not accept responsibility for the accuracy of the contents of this publication nor the suitability of specific applications referred to herein for any particular use. Competent advice should be sought before acting on any matter contained in this publication.

ASSDA SPONSORS 1

 **Austral Wright Metals**

 **Nickel INSTITUTE**
knowledge for a brighter future

 **OUTOKUMPU**

 **Atlas Steels**

 **FAGERSTA**
"all we do is stainless"

 **SANDVIK**

ASSDA SPONSORS 2

Acerinox Australasia Pty Ltd
BHP Billiton Stainless Steel Materials
Midway Metals Pty Ltd
OneSteel Stainless
Outokumpu Stainless
Sanwa Pty Ltd
Stainless Tube Mills
Stoddart Manufacturing
Valbruna Australia Pty Ltd

ASSDA SPONSORS 3

ArcelorMittal Stainless International
Australian Stainless Distributors Pty Ltd
Dalsteel Metals Pty Ltd
Morgan Metal Corp Pty Ltd
Nisshin Steel Co Ltd
Prochem Pipeline Products Pty Ltd
Stemcor Australia Pty Ltd