AUSTRALASIAN INSTITUTE OF ENGINEER SURVEYORS INC.

GAZETTE

MARCH 2018
Volume 28 Issue 1

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Photo courtesy of Sydney Heritage Fleet

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NOTICE OF AIES MEETINGS

Meetings are held at

The Ryde Eastwood Leagues Club

117 Ryedale Road, West Ryde, Sydney

5.30 pm Refreshments

6.00 pm General Meeting

2018 Meetings

Tuesday 6 March

Tuesday 5 June

Tuesday 4 September

December (to be Advised)

Closing Date for material for the next issue of the AIES Gazette is 27 August 2018

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The AIES Gazette is published two times per year by the AIES Editorial Committee.

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All contributions should be sent to the Editor at the contact details above for compilation and presentation to the Editorial Committee for consideration.

Articles should be submitted in Word document format, with separate (not embedded) high quality jpg files. Captions for all images should be provided and images should be free of copyright or other restrictions.

Submissions may include technical papers, case studies, success stories, letters to the Editor, news or any items which would be of interest to AIES members and readers. If recommending material from another publication or source, please include the name of the source, date of publication and contact details so that permission to republish can be sought.

AIES would also like to establish a library of copyrightfree images for use in the Gazette, so please send to the Editor any that you are happy to share, and hold the rights to, with a brief description of the subject.

CLOSING DATE FOR NEXT GAZETTE:

27 August 2018

COVER PICTURE:

The restored Steam Tug *Waratah* was host to the AIES Christmas Meeting on Sydney Harbour in November.

See page 4 for a full report.

(Photo courtesy Sydney Heritage Fleet)

Statement of Objectives of the

AUSTRALASIAN INSTITUTE OF ENGINEER SURVEYORS INCORPORATED

ABN 52 887 542 957

The objectives of the Australasian Institute of Engineer Surveyors Incorporated (AIES) are to:

1. Promote the development and practice of inspection of plant and equipment and coordinate its activities throughout Australia and New Zealand. Equipment shall include boilers and pressure vessels.
2. Advance the interests of all those engaged in the profession and safeguard their status and character.
3. Establish, promote, form, regulate and control any division of the Association in each State or Territory of Australia or New Zealand pursuant to the objectives of the Association.
4. Foster fraternal sympathy amongst members and stimulate discussion of all matters related to hazardous equipment.
5. Promote a uniform standard for inspectors throughout Australia and New Zealand.
6. Promote self regulation by the adoption of relevant Regulations and Standards and recognition of those accepted as members of the Association.
7. Encourage industry in the use of member's services for hazardous equipment inspection and all related activities to ensure safety in the workplace.
8. Promote public and environmental safety in the design, fabrication, testing, installation and inspection of hazardous equipment.

David Dowling
AIES President 2017-18

PRESIDENT'S REPORT

FEBRUARY 2018

The AIES has an active year ahead with many challenges that could promote our organisation and benefit Australian industry.

With participation from our Membership we can reinvigorate our website, produce more current articles for our Gazette, have more representation on Standards Committees and hopefully organise some speakers for a Technical Meeting.

At this stage it appears that Standards Australia will finance a much needed, long awaited upgrade of AS 2593 *Boilers – Safety management and supervision systems* – ideas and input to this will be welcomed.

The Committee would also like information on failures Members have experienced over the past Christmas shut-down period – that's pressure equipment failures!

Should you have topics you wish discussed at our next meeting please raise them with our Secretary now.

We are now planning the 2018 meetings and, just as the world is changing around us, our livelihoods will change as competing bodies, industry and Regulatory Bodies endeavour to keep up.

Participate Now.

David Dowling

Darren Sullivan
AIES Treasurer 2017-18

TREASURER'S REPORT

JANUARY 2018

1. Statements and reports from last financial years

(a) The outstanding balance sheets and financial reports from 2015-16 and 2016-17 have been completed since the annual general meeting in September 2017 and these records have been subsequently audited by Kevin Horne and Robert Crnkovic. These audited records were submitted with the annual return to NSW Fair Trading.

(b) Summary – On review of financial accounts I state that the association is in a sound financial position from the final 2016/17 financial year and as at the current date of this report. Financial summary reports are shown on page 17 and signed documents are available to AIES Members.

2. Annual return for NSW Fair Trading

(a) The outstanding annual returns for 2015/16 and 2016/17 have been processed with NSW Fair Trading to bring the association into compliance with the rules for the Associations Incorporation Act.

3. Bank Activity Statement

Current Closing Bank Balance at 18 January 2018 = $105,026.27

Cheque Account =$7,265.09

Investment Account = $97,761.18

4. Membership renewals including corporate renewals

(a) The current Aged Receivables indicate a number of members have subscriptions unpaid. Invoices will be resent to those as a reminder and it is important for all members to include their name or member number on the remittance so it can be allocated correctly to the member.

(b) It is also important that members update the association with any address changes so invoices can be sent correctly.

For any information or clarification on the financial records and accounts please contact the Treasurer on email treasurer@aies.org.au.

Darren Sullivan

Full Steam Ahead!
AIES *Christmas Meeting*

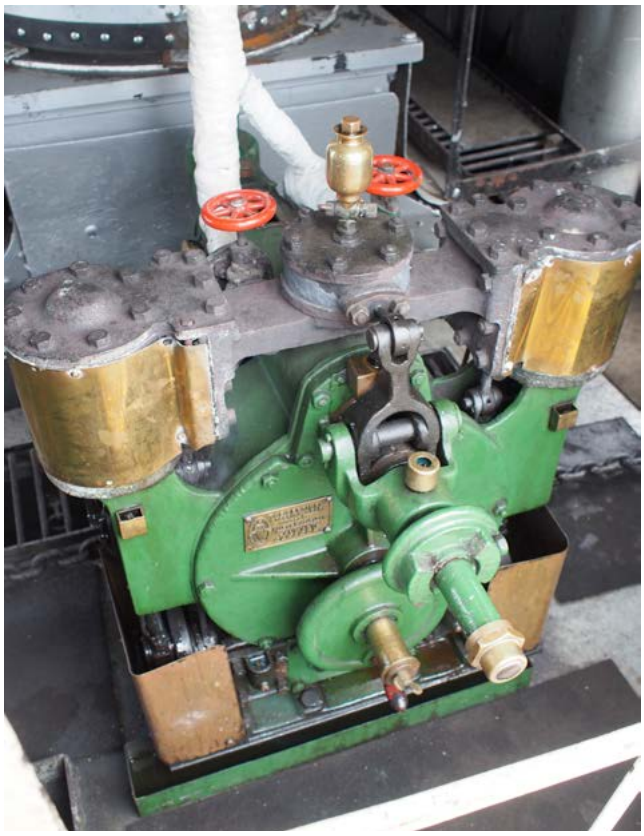
The AIES held its Christmas meeting on Saturday 18 November 2017 on board the Sydney Heritage Fleet's Steam Tug *Waratah* and a good day was had by all who attended.


Photo courtesy of Sydney Heritage Fleet

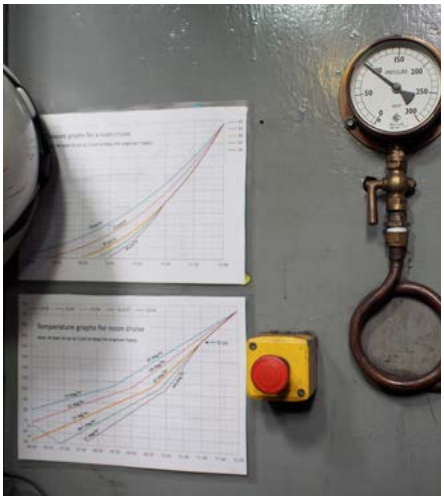
The *Waratah*, the oldest operational coal-fired steam tug in Australia, was launched at Cockatoo Island in May 1902. Originally named *Burunda*, she used to tow dredges and barges between various ports along the NSW coastline. She carried a crew of 14, including six officers who were accommodated in separate cabins aft.

Her sea-going days nearly ended in 1948 when, due to her age and condition, she was restricted to Newcastle Harbour. In 1968 it was announced that the old tug was beyond economical repair and was to be disposed of for scrap.

AIES Members and guests enjoying the Christmas meeting on Steam Tug Waratah



Coal-fired Scotch Marine Boilers produce steam at 827 kPa supplying the compound steam engine



The Sydney Heritage Fleet, realising her historical importance, acted to save her and proceeded to purchase the vessel from the Department of Public Works. After a subsequent five-year restoration programme by Sydney Heritage Fleet volunteers, she is now, once again, fully operational and regularly takes passengers on trips around Sydney Harbour.

The meeting was attended by over 20 AIES Members along with guests and partners. The Sydney Heritage Fleet volunteers were very obliging and helpful towards our group and, along with the Captain, they provided us with some interesting stories and facts relative to the history of ships that are within the Heritage Fleet.

At different stages during the day, a number of us visited the engine room on the *Waratah* and some interesting conversations were had with the engineering staff in regard to the workings of this beautiful old and well maintained steam powered vessel.

The two furnace coal-fired Scotch Marine Boilers produce steam at 827 kPa supplying the compound steam engine which delivers 205 KW of engine power at full output!

Graeme Vickery and Peter Murphy enjoying some refreshments

David Dowling and Rob Crnkovic sharing a laugh

Members gathered at the stern of the boat

Rob Haines outside the wheel house

While steaming along Sydney's great harbour with its pristine waters and rocky outcrops, together with picturesque sandy beaches scattered around the waterfront, there were many beautiful homes and properties to admire. There was plenty of chatter too and BYO food and drinks to enjoy.

After such an enjoyable afternoon on the harbour in ideal weather conditions we look forward to a similar outdoor type activity for our next Christmas meeting in 2018.

Finally, many thanks go to David Dowling and others who contributed their time and efforts in arranging such an interesting, relaxing and scenic afternoon.

The *Waratah's* authentic restoration has gained the Fleet world-wide recognition for historic ship preservation. To find out more about the work of the Sydney Heritage Fleet visit www.shf.org.au

Rob Haines

Corrosion Continues as Complex Concern

The degradation of private and public assets and infrastructure continues to have a major economic impact on industry and the wider community. It is estimated that governments and organisations spend approximately three percent of GDP – the equivalent of billions of dollars each year – mitigating and repairing corrosion damage.

In November, the Australasian Corrosion Association (ACA) hosted a major forum where the management and prevention of corrosion was the focus. The ACA's annual Corrosion and Prevention Conference and Trade Exhibition was held in the International Convention Centre Sydney (ICC) with nearly 500 delegates attending lectures, seminars and workshops.

ACA Executive Officer, Wes Fawaz, addressing delegates at C&P2017

The conference brings together corrosion practitioners and researchers, as well as asset owners and operators, from around the world in order to promote a better understanding of corrosion mitigation.

C&P2017 enabled all corrosion stakeholders to meet and discuss a wide range of topics. In particular, the conference brought together a panel of industry experts to discuss the challenges and the importance of maintaining vital infrastructure. The diverse technical streams showcased the latest developments in corrosion prevention, management and mitigation. The main themes of the technical seminars covered coatings, concrete and asset management, the oil and gas and offshore industry, and research. Topics ranged from fundamental corrosion science to hands-on application including: advances in sensing and monitoring; asset management; cathodic protection; concrete corrosion and repair; corrosion mechanisms, modelling and prediction; materials selection and design, and protective coatings.

The design, construction and operation of facilities and infrastructure represent major investments by companies, organisations and governments. Corrosion affects all structures at varying rates over time, depending on the material used, the types of corrosive agents in the environment and the physical processes and mechanisms involved. How to manage this degradation is a challenge for designers and engineers, as well as asset owners, managers and operators.

In the continuing efforts to minimise the impact of corrosion, new materials are being developed to build structures and procedures implemented that have been designed to protect both new and existing facilities.

The keynote address of the conference – the PF Thompson Memorial Lecture – has been delivered at every C&P Conference since 1951. The presenter for 2017 was Professor Maria Forsyth, Australian Laureate Fellow and Chair of Electromaterials and Corrosion Sciences at Deakin University. Professor Forsyth's lecture—Controlling Corrosion with Chemistry—related how using chemistry to control corrosion ranges from designing metallic coatings through to creating oxides on a metal substrate or protective polymeric coatings and using chemical additives in a given environment to produce inhibited surfaces.

A special guest at C&P2017 was David Thompson, son of Percival Thompson in whose honour the lecture is named. PF Thompson established the School of Metallurgy at the University of Melbourne and oversaw its development, growing from a handful of students to more than 200 before moving to RMIT to set up a similar school at that institution.

PF Thompson worked with the CSIRO but a lot of the projects were very secretive, especially during the Second World War. One investigation involved US warships at the time of the Battle of the Coral Sea; ships would have to head to port with heavily corroded condenser tubes that impacted the marine steam engines. It was discovered that the American navy had used brass alloy that had phosphorous added and that this additive enhanced the corrosion.

Another wartime investigation involved the catastrophic failure of aircraft engines. Many aircraft had glycol-cooled engines but some maintenance staff added a corrosion inhibitor to the mix, which my father and his team discovered deposited copper onto the aluminium cooling tubes causing the engines to overheat.

The annual Corrosion and Prevention Conference is just one aspect of how the ACA collaborates with industry and academia to research all aspects of corrosion mitigation in order to provide an extensive knowledge base that supports best practice in corrosion management, thereby ensuring all impacts of corrosion are responsibly managed, the environment is protected, public safety enhanced and economies improved.

The integral trade show, consisting of 72 exhibition booths, attracted more than 200 additional people to the event. The range of exhibitors included materials suppliers, equipment vendors, specialist contractors and consultants. Conference delegates were able to browse the stands throughout the conference and take the opportunity to discuss products and services with the exhibitors. Exhibitors benefited from broad exposure to corrosion industry practitioners from around Australia, New Zealand and the world.

The ACA's conference continues to be the premier corrosion event in the Asia Pacific region, with its extensive programme of keynote speakers and technical presentations. In 2018, South Australia's capital, Adelaide, will once again host the ACA conference.

For further information, please visit the Australian Corrosion Association website www.corrosion.com.au

For further information or to submit comments or suggestions regarding relevant standards, please contact Darren Sullivan, AIES committee representative for ME-001 Pressure Equipment or the AIES Secretary.

Standards Australia Pressure Equipment Committee – ME-001

The ME-001 Committee met on 8 and 9 November 2017 in Sydney. The meeting was chaired by the current chairman Rob West supported by the Project Manager from Standards Australia Ahshanur Rashid.

The purpose of the meeting included:

- ME-001 annual committee meeting including general business
- Review all standards (and publications) chartered to ME-001 committee
- Review of current projects
- Set directions for future projects under ME-001 committee
- Discuss pressure equipment industry concerns related to standards and scope of ME-001 including the Pressure Equipment Industry Plan.

Over the two days, approximately 15 representatives from various bodies participated in the meeting by attendance or by teleconference.

1. Review of specific standards

All standards under the ME-001 scope were reviewed at the meeting for both status and priority, however below is a shortened list of the key standards which are mainly of interest to AIES Members.

If you have any specific questions on other standards not listed please contact me. Standards Australia's next Project Prioritisation and Selection Process will open on Monday 5 February, with applications accepted until 5pm Wednesday 7 March 2018.

This topic took up a significant part of the meeting, recognising the need for review of a number of standards and the difficulties in obtaining project approvals. Prioritisation was a key objective of the meeting to ensure that a clear path for the project proposals and approvals could be achieved.

AS 1210 Pressure Vessels

It is likely that amendments will continue to be made to this standard, but these will not be significant changes. The standard will remain as it is currently and will be considered and reviewed in future as industry and manufacturing sectors change.

AS/NZS 3788 Pressure Equipment – In-service Inspection

The review of AS/NZS 3788 is continuing, with the industry-based working group that was formed previously well underway under the leadership of Roger Griffiths. Sub-working groups have been formed to develop work on sections of the standard. Currently it is not an official project under Standards Australia, however the work continues with a strong view to have Standards Australia adopt the changes and apply them to the standard in the future. It is possible a project proposal may be submitted for approval at some stage in 2018.

AIES is represented by Dean Raphael (Qld State Representative) and I encourage any member with a contribution for consideration in the work ongoing to make contact with Dean. At this stage there is no draft complete for distribution publicly.

The ME-001 Committee expressed their gratitude to Roger and the team and strongly supported the approval of this project to benefit Australian standards. It is expected that there will be a commentary produced for this standard as well.

AS 2593 Boilers – Safety Management and Supervision Systems

As Members are aware, this standard is in urgent need of an update. There was a meeting, held in December 2017, of sub-committee ME-001-11 members to progress a draft of changes needed to accompany the proposal for this standard. This should be presented to Standards Australia with a proposal, and with support of ME-001 we may see a project approval in the coming months.

The project will be led by Alan Sandilands and currently there are a number of AIES members on the sub-committee that met in December for the draft. If you have any comments for consideration please pass onto me or Dave Dowling and they will be forwarded to the sub-committee.

AS 1796 Certification of Welders and Welding Supervisors

It is possible a proposal will be submitted for approval in early 2018 by the Welding Technology Institute of Australia (WTIA).

AS 4041 Pressure Piping

The need for technical revision is recognised, however it is currently difficult to gain interest from members to participate in a large and complex project and document. No decision on this standard for project proposal has been made at this stage.

AS 4458 Pressure Equipment – Manufacture

The need for technical revisions has been recognised and a suggested scope of revisions will be prepared for further discussion.

AS 4037 Pressure Equipment – Examination and Testing

Possible review in 2019 is planned.

AS/NZS 3992 Pressure Equipment – Welding and Brazing Qualification

The project to further amend and revise this standard has been approved.

2. Other business

2.1 Australian Pressure Equipment (PE) Industry (Strategic) Plan

Several industry initiatives were undertaken in 2014-2016 including:

- PE Forum at Standards Australia office in Sydney in November 2014
- Industry meeting with Ministry of Industry, Canberra.

A general discussion as a follow up took place, with updates on any progression aligned with the key objectives listed below. The items below are the ME-001 Committee notifications only that were submitted to support the plan and actions by industry in the future, and any further support will be considered when submitted on a case-by-case basis. The general consensus was that the plan or the objectives from the plan have had limited progression.

Australian PE Industry Mission and Objectives

(a) Mission

Ensure Australia has an optimum PE industry providing and using safe, efficient, economic pressure equipment for the overall benefit of Australia.

(b) Broad Objectives

- Improve competitive position of Australian/New Zealand (NZ) PE manufacturers through technology/knowledge
- Sustain currently installed PE in a safe and viable condition
- Harmonised and uniform requirements across all jurisdictions
- Trained and knowledgeable people involved through whole PE life cycle
- Ongoing/sustainable Australian/NZ PE technology forum (ongoing leadership/governance)
- Industry/PE users-supported funding for support staff and Regulator engagement
- Knowledge resources available for all Australians and New Zealanders

(c) Pressure Industry Plan Aspects

- Recognition of need for action on the Australian pressure industry
- Australian Pressure Industry Plan
- Work Health and Safety (WHS) Law unification
- Uniform and appropriate implementation of WHS Laws
- National conformity assessment of pressure equipment
- Unified registration of pressure equipment
- Australian pressure equipment knowledge system
- Optimum standards and codes of practice for the Australian PE industry
- Total education improvement
- Increased cooperation between associations and institutes

(d) Australian Pressure Industry Plan – Problem Statement

The safe and economical use of PE is essential in underpinning performance across all industry sectors including the sectors in the Federal Government's Industry Growth Centre Initiative. Australia's PE industry is fragmented without a cohesive vision and strategies to sustain capability and to support critical industry. Consequently, there is an unsatisfactory decline in Australia's technologies, capabilities, resources, and personnel to provide and maintain safe economic performance of over 100 million items of high-hazard essential pressure plant.

2.2 Australian Pressure Equipment Knowledge (APEK)

Stan Ambrose informed the committee about APEK (http://www.apek.net.au/) objectives and use:

- Assist and improve the Australian PE industry
- Responding to many requests from industry for help and information
- Do this by those means within our grasp i.e. optimum documented national knowledge relating to PE = LAWS + STANDARDS + APEK i.e. Australian PE knowledge

The prime objective is to make Australian PE knowledge publically available via the APEK website which is under continual development.

ME-001 believes this type of website should help the industry including young professionals and should be maintained and administered by suitable industry organisations or associations. In 2018 there is planning for a meeting of associations to assist APEK develop.

2.3 Item registration by different regulators in Australia

ME-001 noted different Regulators have different requirements, and no requirements for pressure equipment items registration. Work Health and Safety (WHS) laws do not refer to any Australian Standard for item registration.

The PE industry has a real concern as Regulators are not referencing standards as guidance or putting requirements for items registration. Only AS 4343 *Pressure equipment – Hazard levels* is referenced/used by some states.

For the most part members of the ME-001 Committee do not support the removal of the requirement for plant registrations.

3. Contributions and comments

If any AIES Member wishes to contribute comments or information to Standards Australia, the ME-001 Committee or its sub-committees, please contact me directly by phone or email.

This is of particular importance when any standard is being revised such as AS 2593 and AS/NZS 3992 currently. I will continue to use AIES Constant Contact to keep members updated and the next ME-001 meeting is planned for October/November 2018.

Darren Sullivan, AIES Representative – Standards Australia Committee ME-001

Analysis of the Catastrophic Rupture of a Pressure Vessel

Article prepared by Tom Siewert in 2001 and republished with permission of the US National Institute of Standards and Technology (NIST)

On July 23, 1984, an explosion followed by a fire occurred at a petroleum refinery in Chicago, USA killing 17 people and causing extensive property damage[1]. The US National Bureau of Standards (NBS) was requested by the Occupational Safety and Health Administration (OSHA) to conduct an investigation into the failure of the pressure vessel that eye-witnesses identified as the initial source of the explosion and fire. This vessel was an amine absorber tower used to strip hydrogen sulphide from a process stream of propane and butane. The vessel was 18.8 m tall, 2.6 m in diameter, and constructed from 25 mm thick plates of type ASTM A516 Grade 70 steel.

The investigation was complicated by the damage caused by the explosion and fire. The explosive force had been sufficient to propel the upper 14 m of the vessel a distance of one kilometre from its original location, while the base remained at the centre of the subsequent fire.

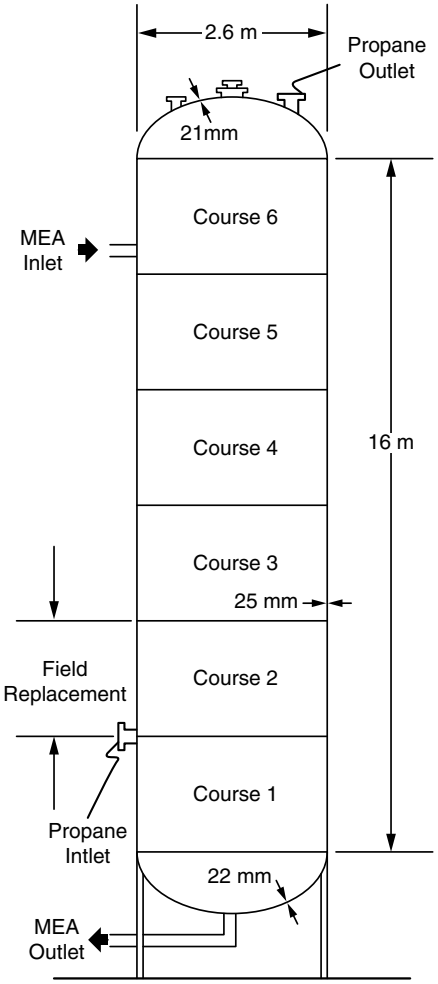


Figure 1 Schematic of the original pressure vessel consisting of a series of sections known as Courses

Sections of the vessel were shipped to NBS in August 1985, where a multi-disciplinary team sought the cause of the failure. The team was led by Harry McHenry, who was the Deputy Chief of the Fracture and Deformation Division and a leading expert in fracture mechanics. The study eventually involved 23 staff members from three different divisions from both the Boulder and Gaithersburg laboratories.

The investigation that followed was a diagnostic masterpiece pursued with textbook elegance and deliberation. After documenting the history of the vessel prior to its rupture, testing of the vessel segments began with non-destructive evaluation techniques. Magnetic particle inspection was applied to reveal hundreds of cracks confined mainly to the inner surfaces along the welds between Courses 1 and 2 of the vessel and between Courses 2 and 3. Ultrasonic measurements subsequently detected clear indications of delamination damage confined to Course 1. However, thickness measurements, made with a micrometre, showed that Courses 1 and 2 had wall thicknesses well within the prevailing allowances for pressure vessels.

More aggressive measurements were then undertaken to examine the mechanical and chemical characteristics of the initial and replacement components. Test after test showed that all initial and replacement components satisfied the industry standard specifications. The cause of failure did not become clear until metallography results were combined with stress corrosion cracking and hydrogen embrittlement tests, followed by a fracture mechanics analysis. It appeared that a pre-existing crack had extended through more than 90% of the wall thickness and was about 800 mm in length. Further, it was determined that hydrogen embrittlement had reduced the fracture resistance of the steel by more than half. After approximately six months of investigation, the findings were published as NBSIR 86-3049[1].

The vessel had been put into service in 1970 and had undergone several repairs and modifications before the July 1984 incident. The failure investigation determined that the vessel fractured along a path that was weakened by extensive cracking adjacent to a repair weld joining a replacement section to the original vessel. These pre-existing cracks initiated in areas of hard microstructure known to be susceptible to hydrogen stress cracking. This hard microstructure formed during the repair welding of the replacement section. The cracks grew through the vessel wall as a result of hydrogen pressure cracking. When the depth of the

largest of these pre-existing cracks exceeded 90% to 95% of the wall thickness, the remaining thin ligament of steel in the cracked section ruptured and leakage occurred. This crack triggered a complete fracture of the vessel circumference at the operating stress level of only 35 MPa (roughly 10% of the rated strength of the steel) because the toughness of the vessel steel had been reduced by hydrogen embrittlement.

The NBS publication pointed out previously unrecognised interactions between pressure vessel steel, the thermal cycles that occur during repair welds, and hydrogen-containing environments. Rapid dissemination of this information was important because many other vessels in the petrochemical and chemical processing industries might have had histories with a similar combination

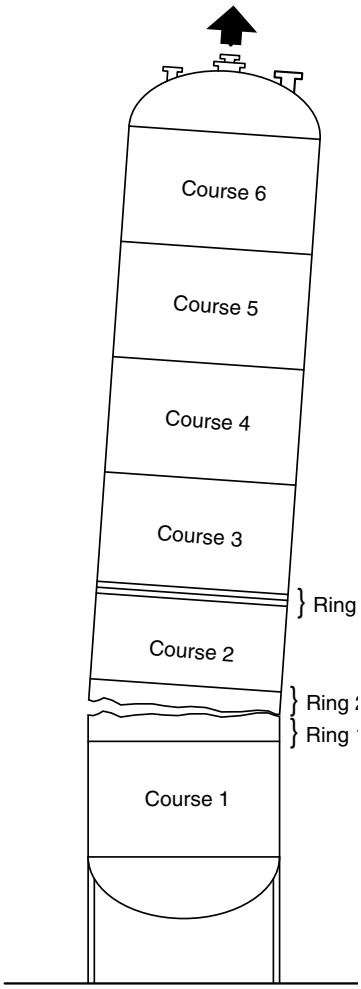


Figure 2 The pressure vessel ruptured adjacent to the repair weld joining Courses 1 and 2

of these factors, and so might also be at risk of a similar catastrophic failure. In late 1986, the findings of the report were summarised in articles published in *Corrosion Science*[2] and *Materials Performance*[3], journals which were widely read by industrial process engineers and safety officials in these industries.

OSHA recognised the technical complexities involved in assessing the mechanical integrity of the various items of equipment used in process industries such as petroleum refineries and petrochemical manufacturing. To provide the OSHA inspectors and regulators with necessary technical information regarding the design and construction and related factors affecting the integrity of process equipment, OSHA engaged the US National Institute of Standards and Technology (NIST) to perform two additional tasks:

1. Prepare an information document titled: 'Guidelines for Pressure Vessel Safety Assessment' for distribution within OSHA, and
2. Organise and conduct a training course (Course 340, Hazard Analysis in the Chemical Processing Industries) for OSHA inspectors, with informative lectures concerning pressurised equipment. The first course was taught at NBS (Boulder, Colorado) in 1988.

The publication of the findings in *Corrosion Science* and *Materials Performance* allowed industrial process engineers and inspection personnel to update the inspection plans for plants under their control. Now that they were aware of the conditions found in this study, the inspection personnel could search for similar problems (such as hydrogen blisters and cracks) during the next annual or biennial shutdowns of processing plants under their control, and inspection intervals could be adjusted accordingly.

Several years following the failure incident and the NBS/NIST report, OSHA issued a final rule titled 'Process Safety Management of Highly Hazardous Chemicals, Explosives and Blasting Agents'. This rule was published as 29CFR Part 1910 in the Federal Register on 24 February 1991, and became effective on 26 May 1992. The rules have had a major impact on the process industry, particularly those parts that indicated, for example, that inspection and testing procedures to assess the mechanical integrity of process equipment shall follow recognised and generally good engineering practices. These rules have prompted cooperatively funded activities in the process and allied industry sectors which focus on the preparation of technical documents that describe and define methodology, procedures and techniques that constitute 'recognised and good engineering practices'. The first document developed in this activity was expected to be completed and available in early 2000.

Meanwhile, the OSHA training centre has continued to offer the NBS-developed training course on hazard analysis to its inspectors. So far, the course has been held 11 times, and about 230 inspectors have attended it.

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4. Tom Siewert, Analysis of the Catastrophic Rupture of a Pressure Vessel. In David R. Lide (Ed.), A Century of Excellence in Measurements, Standards, and Technology: A Chronicle of Selected NBS/NIST Publications, 1901-2000 (350-352). Gaithersburg, Maryland: National Institute of Standards and Technology.

Acceptance of Non-Conforming Weld Root Wrap Overlap, Reinforcement and Spatter in Carbon Steel Pressure Equipment

1. Scope

This guidance note shows and assesses four significant signs or indications detected during in-service inspection of PE. It gives the basis for acceptance of these flaws and non-conforming weld root overlap.

Figure 1 Internal view showing the location of the indications

2. Purpose

The note provides feedback for all in the PE industry, including trainees, and shows that some 'does not conform' (DNC) situations can be acceptable. The note supports AS/NZS 3788 *Pressure equipment – In-service inspection*.

3. PE Involved

New vertical air-oil separator: Carbon steel, Class 3 pressure vessel, 9 mm thick, 700 mm OD. The imported vessel was designed to ASME VIII-1, η = 70% therefore no radiographic testing (RT) or ultrasonic testing (UT) had been required. Operating pressure = 2 MPa, Hydro-tested at 1.3 P, T = 60°C, Hazard Level = C.

4. Signs (indications)

- root reinforcement: 2.5 mm – continuous
- root overlap: 2 mm – continuous on both sides
- minor spatter from circumferential weld
- weld oxide scale.

5. Sign Location

Inside the vessel on the vertical longitudinal weld (see Figure 1).

6. Detection

The weld root overlap was detected by an In-service Inspector during visual testing as part of commissioning undertaken in Australia in 2014.

7. Assessment (by inspector, advisor, and owner-user)

- The inspector sought competent advice on flaw identification etc. and on which standard applied to the vessel.

This article was first published as Guidance Note GN 234 on the Australian Pressure Equipment Knowledge (APEK) website www.apek.net.au

The APEK website is a voluntary, free, open source of knowledge relating to pressure equipment which is designed to benefit all persons and organisations interested in the industry. Its primary goals are the development, consolidation, diffusion and updating of knowledge and the future provision of a forum for mutual discussion, assistance and advice on current pressure equipment (PE) issues.

Further guidance notes, case studies and advice are available free-of-charge on the website.

By sharing knowledge and experience it is hoped that we can ensure good practice, minimise costs and effectively manage risk in the PE industry.

Feedback on this guidance note and any other pressure equipment-related matters is available via the website. AIES Members are encouraged to utilise and contribute to the knowledge base.

- A check with 100% UT showed no other flaws. Various standards were reviewed.
- The weld root overlap did not conform (DNC) with AS 4037 *Pressure equipment – Examination and testing,* but was acceptable in ASME VIII-1 UW35a). Overlap is equivalent to a joint joggled or with backing strip – both standards allow these for circumferential joints. Overlap (and spatter and oxide scale) might not be acceptable for severe corrosion service or where hygiene is critical as with food or medical PE.
- For the service conditions of this vessel, as corrosion is negligible with oil, there was deemed a very low risk of corrosion failure. In addition, there was low stress (effective safety factor = 3.5/ (η = 70%) = 5.0); low stress range; medium number of cycles; and 'crack' parallel to stress. Hence a very low risk of fatigue failure. Spatter and thin oxide scale were acceptable.

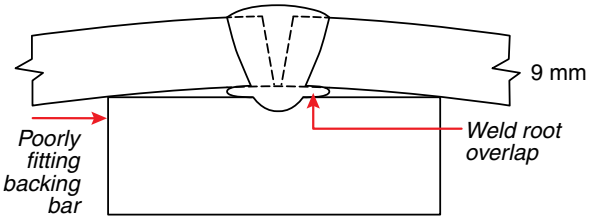


Figure 2 Schematic of the joint showing weld root wrap overlap

(Continued on page 14)

Meet the Committee . . .

The AIES committee team is made up of many dedicated volunteers, all of whom are keen to advance the Institute and ensure it delivers its objectives for both AIES Members and the industry as a whole. We invited them to tell us a little about themselves, their goals on the committee and what they see as the biggest challenge for the Australian pressure equipment industry.

Des Barnes

Secretary & Membership Officer

Pressure equipment In-service Inspector at Applied Boiler Inspection Services

AIES Member for 12 years

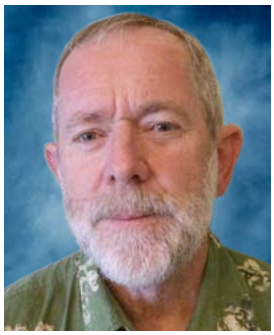
Previously Secretary, AICIP Representative & Committee Member

Goal this year: new younger membership to AIES.

Industry's biggest challenge: imported pressure equipment.

Tel: 0418 250 236 *Email:* secretary@aies.org.au

Bob Edgar



Editorial Committee

Self-employed as gasfitter/ inspector at MPE Calibrating

AIES Member for 8 years

Previously Gazette Proofreader

Goal this year: to encourage more members to attend meetings.

Industry's biggest challenge: fragmentation into sub-groups.

Tel: 0408 161 107 *Email:* mpelpg@bigpond.com

Mike Jack

New Zealand Contact

Engineer Surveyor, SGS New Zealand Ltd

AIES Member for more than 20 years

Goal this year: Mike is happy to maintain a NZ presence on the Committee but fully appreciates that NZ legislative areas differ from most Australian States.

Industry's biggest challenge: in NZ the challenge is to get the right people employed as Surveyors, and a lot of time is spent in training and maintaining continued professional development records.

Tel: +64 275 996 822 *Email:* mikejack@xtra.co.nz

Paul McNamara

AICIP Representative & Board Member

Engineer Surveyor, Trainer and Assessor, Adept Inspection and Training Pty Ltd

AIES Member for 10 years

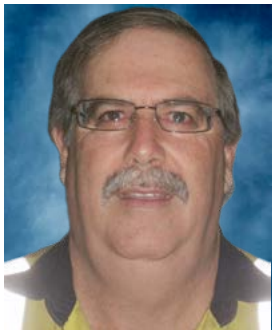
Previously Treasurer

Goal this year: to improve AICIP's standards and make systemic changes at AICIP with the AIES committee's involvement.

Industry's biggest challenge: improve the standard of pressure vessel inspections.

Tel: 0417 338 462
Email: paul.mcnamara@adeptengineering.com.au

Peter Murphy



General Committee Member

Senior Boiler Inspector, BlueScope Steel

AIES Member for 31 years

Goal this year: to encourage new membership and increase attendance at meetings.

Industry's biggest challenge: to ensure we get compliant pressure equipment imported into Australia.

Tel: 0418 671 166
Email: peter.murphy@bluescopesteel.com or petervmurphy6@bigpond.com

Dean Raphael

Queensland Representative & Editorial Committee

In-service inspector and Welding Management Consultant at Raphael's Inspection Services Pty Ltd

AIES Member for 10 years

Previously Committee Member

Goal this year: to provide assistance to AIES Members and Committee wherever possible. Dean welcomes any member to make contact with him and invites all members to propose a Gazette article about their work or work experiences.

Industry's biggest challenge: the perceived watering down of AICIP qualifications through the proposed modularisation scheme.

Tel: 0409 782 074
Email: dean@raphaelsinspection.com.au

Darren Sullivan

Treasurer & Standards Representative

Semi-Retired – Self Employed PE and Welding Consultant

AIES Member for 10 years

Previously Vice President, Treasurer, Committee Member

Goal this year: to assist where I can to promote new ideas for the future of AIES and develop a viable plan.

Industry's biggest challenge: Experience and competency of personnel to promote integrity and safety of plant in a challenging and competitive operating environment where there is less pressure from regulators for compliance.

Tel: 0419 414 881 *Email:* darrensullivan118@gmail.com

Rob Svensk

Vice President

Director, Senior AICIP Inspector, Technical Manager and RTO Trainer with Adept Inspection and Training Pty Ltd

AIES Member for 33 years

Previously President, Secretary and Committee Member

Goal this year: to encourage new membership.

Industry's biggest challenge: proposed modularisation of competencies of inspectors. Inspectors should be skilled in all areas of AS/NZS 3788 and equipment covered by the standard, not restricted to just specific equipment such as air receivers or refrigeration vessels.

Tel: 0408 682 274
Email: rob.svensk@adeptengineering.com.au

Graeme Vickery

General Committee Member

In-Service Pressure Equipment Inspector, Hatch Associates

AIES Member for 15 years

Previously President

Goal this year: Publicise issues from the 'coal face of industry'.

Industry's biggest challenge: Competing with inferior imports as a number appear to be permeating through industry due to a lack of robust regulatory intervention.

Tel: 0419 580 617
Email: Graeme.Vickery@bluescopesteel.com

Acceptance of Non-Conforming Weld Root Wrap Overlap, Reinforcement and Spatter in Carbon Steel Pressure Equipment

(Continued from page 12)

- Weld root reinforcement of 2.5 mm complies with AS 4037 and is within 0.1 mm of ASME VIII-1. It might not be acceptable for flow-accelerated corrosion or complete drainage.

8. Occurrence

The weld root overlap occurred during overseas manufacture of the vessel in 2013. Root overlap is rare – some inspectors would not recognise it.

9. Failure Modes (damage mechanism)

Corrosion and fatigue are possible – however very low probability.

10. Probable Cause(s)

Poorly fitting backing bar (e.g. copper) for small diameter vessel.

11. Outcome

The vessel can be put into service without removal or repair of the weld root overlap because:

a Conformance with ASME;

b For this application – corrosion and fatigue failure are very unlikely; and,

c Owner-user was happy as PE was urgently needed at minimum cost.

12. Fix

No correction was required.

13. Prevention

In manufacture: better shaped backing bar, edge bending or clamping; better QA or inspection.

In service: after 10 to 15 years, spot UT of the vertical weld lower half might be desirable.

14. Lessons

a If a flaw is judged DNC, consider if the PE might still be fit-for-service and if further assessment is worthwhile.

b Different laws, standards or service may have different acceptance criteria as seen in above.

c Acceptance of DNCs requires proper assessment, justification, documentation and sign-off by the inspector, advisor or owner-user.

15. References

AS/NZS 3788 *Pressure equipment – In-service inspection*

AS 4037 *Pressure equipment – Examination and testing*

ASME BPV Code Section VIII *Pressure Vessels* Division 1

APEK GN 234 *Acceptance of Non-Conforming Weld Root Overlap, Reinforcement, Spatter in CS PE* Rev 1 Issued: 25/10/2017

The Importance of Preparation for NDT and Inspection

Have you ever wondered, as a client, whether inspection or test results that have been acquired after an intensive inspection regime are true and correct? Does it seem odd that, on occasion, a failure occurs at a location where inspection or test results have given a clean bill of health? Some of these incidents cost a few million dollars in downtime production loss, not to mention repair costs and reduced safety – definitely worth avoiding where possible.

There are many factors which may contribute to such situations, but there is one factor that can be eliminated – poor preparation by the client or contractor prior to inspection. Preparation can have a profound impact on test results, life extension assessments and maintenance planning.

Inspections do not come cheaply, but they achieve much by giving engineers and plant owner/operators vital information about their plant to assist in maximising plant production at sensible maintenance costs. Sometimes, however, reluctance to accept the cost of preparation, or indeed the lack of thought of preparation, has compromised test results and, sadly, caused such plant failures.

Correct preparation of test and inspection areas is fundamental to achieving the desired results which ensure appropriate assessments and integrity of your plant and equipment.

As an inspector and NDT technician of large plant and all manner of equipment for the last 40 years, I can attest that lack of preparation of inspection areas has had a considerable impact on test results. Here are a couple of instances where poor preparation could have led to major incidents if not identified by the inspector.

Case 1

This involved a superheater header stub inspection, with magnetic particle inspection of the stub-to-header welds required at the end five rows of stubs, during a planned major outage. I would have expected at least all deleterious material be removed from the test area by the client or testing contractor, including removal of any scale which may have been present, prior to any testing being carried out.

In this instance, I received test results which indicated no recordable defects at the areas tested, a most welcome finding. The testing contractor, however, did not divulge that most of the inspection areas had up to 10 mm of corrosion product, insulation material and other forms of deleterious material covering the welds.

On inspecting the test areas I found white background lacquer had been sprayed over the lot.

After some considerable wire buffing and brushing and subsequent re-testing, cracks up to 12 mm were revealed at several leader and stub weld toes. Appropriate repairs were carried out, and preparation procedures were established for future inspections.

The item of plant? A 38 MW boiler/generator providing a significant amount of the power and steam for a major mineral production plant and nearby township. Impact of a possible failure if the cracks were not found? Substantial loss of plant production and possible blackouts in the township, particularly if another unit was off-line at the time.

Case 2

In this case, superheater pendants inside a 600 MW boiler were involved. Dye penetrant inspection was required at tube tie welds within the plates, to determine the existence of any stress cracking at the tube material surrounding

(Continued on page 16)

Tubular air heater shown prior to cleaning the air-side of the tube bottom ends. Perforations were found at the tubes after cleaning

Header tube stubs prior to preparation for inspection and NDT

Tube attachment welds which are encrusted with debris. Neither visual inspection nor NDT are possible in this condition

FOR YOUR DIARY

National Manufacturing Week **May 9-11 2018, Sydney Olympic Park, NSW** https://www.nationalmanufacturingweek.com.au/	**Technological Innovations in Metals Engineering (TIME 2018)** **May 30-31 2018, Haifa, Israel** http://www.tms.org/TIME2018
XIV International Conference on Nanostructured Materials (NANO 2018) **June 24-29 2018, Hong Kong** http://www.nano2018.org/	**Materials Innovations in Surface Engineering (MISE 2018)** **Date TBA, Sydney, NSW** http://www.materialsaustralia.com.au/events
IIW Annual Assembly & International Conference – Advanced Welding and Smart Fabrication Technologies for Efficient Manufacturing Processes **July 15-20 2018, Bali, Indonesia** http://www.iiw2018.com/	**Pipeline Repair, Hot Tapping and In-Service Welding – William A. Bruce** **October 23-24 2018, Sydney NSW** https://wtia.com.au/events-2/
15th International Conference and Exhibition on Materials Science and Engineering **November 7-8 2018, Atlanta, Georgia, USA** https://materialsscience.conferenceseries.com/	**Advancing Materials and Manufacturing (CAMS 2018)** **November 27-19 2018, Wollongong, NSW** https://materialsscience.conferenceseries.com/

the tie welds. Cracking had previously been found at these locations at similar power installations elsewhere. At this installation, inspection had been carried out at the superheater pendants by a particular contractor, with the resultant reports always showing there was no evidence of any cracking found during the previous two or three years of inspections.

Naturally, when the company I was with was awarded the next round of testing and inspection at the platens, the first thing I did was prepare the test areas by mechanical buffing using stainless steel-compatible abrasive discs and carborundum polishing pads, taking the normal care and precautions to ensure minimal or no loss of parent material. For me, it was merely the appropriate action to take prior to carrying out the inspection, due to the presence of thin, tight, uniform scale covering the inspection areas.

Approximately 10% of the hundreds of locations tested showed the same stress cracking as I had found elsewhere on other similar plant! I can only assume that the previous inspector/s had assumed that buffing would be sufficient preparation prior to testing, oblivious to the presence of the scale covering the test areas and confident that their test results were correct.

When I alerted the plant engineer of my findings, he promptly (and not too pleasantly) dismissed them claiming that all previous inspection/test results were 'true and correct' in their findings of 'no recordable defects'. I (even more promptly and probably not too pleasantly either!) ushered him into the high-climber to ascend the 40 metres or so to access the test locations so he could see for himself!

I re-tested a few locations where I had identified the cracking earlier. The engineer was dead silent. Assessment of the situation ultimately resulted in the implementation of an inspection and maintenance plan to be conducted during all major outages for all the boilers at the power installation.

The impact of possible continuous and multiple failures at the plant could have been economically disastrous. All because of a little scale!

(Continued on page 17)

FINANCIAL SUMMARY REPORTS

Income and Expense Summary 2015/2016

1 July 2015 – 30 June 2016	
Income/Contributions (membership)	$17,193.00
Investment/Bank Accounts Interest	$1,251.75
Total Income	$18,444.75
Expenses	$17,197.80
Income over Expense Balance	$1,246.95

Asset Report 2015/2016

Bank Statements	
Westpac Trading Account 19-6317	$4,679.65
Westpac Investment Account 19-6325	$96,818.79
Less Un-presented cheques	Nil
Accounts Receivable	$3,455.00
Total Assets	$104,953.44
Liabilities	Nil
Equity	$104,953.44

Signed 16 November 2017:
AIES Treasurer – Darren Sullivan

Auditor's Report

We have inspected the financial records of the Australasian Institute of Engineer Surveyors and are satisfied the balance sheets, accounts and asset report represent a true and correct financial position of the organisation for the 2015/2016 financial year as at the 29th day of August 2017. The records have been presented to us by Darren Sullivan as the current AIES Treasurer.

Signed 29 August 2017:
Kevin Horne and Robert Crnkovic

Income and Expense Summary 2016/2017

1 July 2016 – 30 June 2017	
Income/Contributions (membership)	$18,075.00
Investment/Bank Accounts Interest	$680.82
Unallocated Funds	$180.00
Total Income	$18,935.82
Expenses	$16,602.56
Income over Expense Balance	$3,333.26

Asset Report 2016/2017

Bank Statements	
Westpac Trading Account 19-6317	$3,899.99
Westpac Investment Account 19-6325	$97,491.71
Less Un-presented cheques	Nil
Accounts Receivable	$6,895.00
Total Assets	$108,286.70
Liabilities	Nil
Equity	$108,286.70

Signed 21 November 2017:
AIES Treasurer – Darren Sullivan

Auditor's Report

We have inspected the financial records of the Australasian Institute of Engineer Surveyors and are satisfied the balance sheets, accounts and asset report represent a true and correct financial position of the organisation for the 2016/2017 financial year as at the 21st day of November 2017. The records have been presented to us by Darren Sullivan as the current AIES Treasurer.

Signed 21 November 2017:
Kevin Horne and Robert Crnkovic

A Treasurer's Report is found on page 3 of this Gazette. Darren Sullivan reports that the association was in a sound financial position at the conclusion of the 2016/17 financial year and as at the current date of his report. Signed financial summary reports are available to AIES Members. For any information or clarification on the financial records and accounts please contact the Treasurer on email treasurer@aies.org.au

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There have been countless other incidents of poor preparation before inspection and testing, mostly minor but some not so minor, all of which would have affected final inspection results if some intervention had not occurred.

The message: do not under-estimate the importance of preparation works when you have your inspection carried out – or indeed if you are the inspector on the job. The correct preparation is fundamental to achieving accurate results, and ensuring appropriate maintenance is carried out when truly required. Liaise with testing and inspection personnel to ensure appropriate preparation has been carried out before they undertake their work. They should know what is required to achieve optimum test results and can offer good advice.

Make allowances in maintenance and inspection budgets for preparation works. Believe me, it is money well spent!

Bill Werdmuller, AICIP In-service Inspector 153
Billinspect Pty Ltd. Bill_werdmuller@hotmail.com

AUSTRALASIAN INSTITUTE OF ENGINEER SURVEYORS INCORPORATED

AIES MEMBERSHIP AND FEES

PERSONAL MEMBERSHIP

BENEFITS

- Participation in the AIES Identifying Numbering Scheme (Members Grade S, M only) for the purpose of identifying in-service equipment, fabrications inspected or designs verified within their area of competence
- Free electronic copy of the AIES Gazette publication
- Access to AIES member website and LinkedIn group
- News on developments in Standards, technical matters, failures and legislation
- Opportunities to attend general meetings, special site visits and forums
- Possibility of publishing technical articles
- Opportunities for liaison with equipment inspectors throughout Australia and New Zealand

CRITERIA

Membership is available to people with an interest in the safety of hazardous equipment as defined in the Institute's Objectives. This includes boilers and pressure vessels and other pressure equipment.

The three main grades of personal membership are:

- Senior Member (Grade S)
- Member (Grade M) and
- Associate (Grade B)

Equipment Inspectors e.g. AICIP Senior In-Service Inspectors or Design Verifiers currently certificated at the senior level usually satisfy AIES criteria for Senior Membership Grade S. Documentation of qualifications, certifications and five (5) years suitable experience in inspection or verification is required.

Applicants for Member Grade M must hold a suitable certificate of competency or equivalent e.g. AICIP In-Service Inspectors. At the time of application they must hold employment in this area and supply documentary evidence.

People who may be entering the industry or who do not possess all the above credentials but who have some technical competence in the area of hazardous equipment are usually eligible for admission as Associate Member Grade B.

AFFILIATE/CORPORATE MEMBERSHIP

BENEFITS

- Free electronic and agreed number of hard copies of the AIES Gazette publication
- Annual certificate of membership for display and recognition
- News on developments in Standards, technical matters, failures and legislation
- Automatic bold listing in the AIES Gazette
- Opportunity every year to contribute one page of advertorial information together with a small listing in the AIES Gazette
- Opportunity to have educational material from your company disseminated by email newsletters
- Access to AIES member website and LinkedIn group
- Link to your website on the AIES site
- Possibility of publishing technical articles
- Opportunities for your staff to attend general meetings and agreed special site visits
- Possibility of addressing meetings, with notice
- Opportunities to host visits to your premises
- Trade nights-promotional opportunities
- Opportunities for liaison with equipment inspectors
- Networking with companies of various backgrounds within the industry
- You will be supporting AIES's work for the safety of high-risk plant

CRITERIA

Grade C Affiliate/Corporate membership is available to organisations with an interest in the safety of hazardous equipment as defined in the Institute's Objectives. This includes boilers and pressure vessels and other pressure equipment.

AUSTRALASIAN INSTITUTE OF ENGINEER SURVEYORS INCORPORATED

ANNUAL SUBSCRIPTIONS

ANNUAL SUBSCRIPTION FEES (Australian dollars)

- Grade S — Senior Member .....$ 190.00
- Grade M — Member .....$ 180.00
- Grade B — Associate .....$ 170.00
- Grade R — Retired .....$ 35.00
  (must have previously been Grade M or S prior to retirement)
- Grade C — Affiliate/Corporate .....$ 700.00

APPLICATION FOR MEMBERSHIP OF ASSOCIATION

PERSONAL MEMBERSHIP (GRADES S, M & B)

AUSTRALASIAN INSTITUTE OF ENGINEER SURVEYORS INCORPORATED

Y11384 – 41 (Incorporated under the Associations Incorporation Act 2009) ABN 52 887 542 957

PLEASE COMPLETE THE APPLICATION IN FULL AND FORWARD TO secretary@aies.org.au

I, _____(full name of applicant)

of _____(home address)

& _____ (postal address)

(occupation) _____hereby apply to become a member of the above named incorporated association. In the event of my admission as a member. I agree to be bound by the rules of the association for the time being in force.

Signature of Applicant _____ Date _____

I, _____ (full name) a member of the association, number -_____ nominate the applicant, who is personally known to me, for membership of the association.

Signature of Proposer _____ Date _____

I, _____ (full name) a member of the association, number -_____ nominate the applicant, who is personally known to me, for membership of the association.

Signature of Seconder _____ Date _____

APPLICANT DETAILS:

TELEPHONE

Home +_____ (0) _____ Business +_____ (0) _____

Facsimile +_____ (0) _____ Mobile +_____ (0) _____

Email _____ Date of Birth_____

Employer _____ Position_____

Please Note – if accepted for membership your email address will be used for contact including fees and issue of Gazette. Any changes of details should be notified by email to the Secretary as soon as possible.

EDUCATION:

Years Attended	School/College/University Name & Location	Course or Subject	Certificate, Diploma or Degree Awarded

FURTHER EDUCATION, TECHNICAL OR PROFESSIONAL QUALIFICATIONS:

_____

_____

_____

_____

_____

APPLICATION FOR MEMBERSHIP OF ASSOCIATION

PERSONAL MEMBERSHIP (GRADES S, M & B)

AUSTRALASIAN INSTITUTE OF ENGINEER SURVEYORS INCORPORATED

Y11384 – 41 (Incorporated under the Associations Incorporation Act 2009) ABN 52 887 542 957

(CONTINUED) Name of Applicant _____

OTHER MEMBERSHIPS:

_____

_____

_____

EMPLOYER, POSITIONS HELD & DATES:

_____

_____

_____

_____

_____

QUALIFICATION FOR MEMBERSHIP GRADES S, M (Please submit copies of certificates)

Personnel Certification Body, Regulatory Authority etc.	Type of Inspection, Design Verification	Reg. No.	Approvals, Levels, Category	Expiry Date

ANY OTHER RELEVANT INFORMATION:

_____

_____

MEMBERSHIP GRADE APPLIED FOR _____ (See *Information for Personal Members*)

For Grade S: Evidence of 5 years suitable experience? For Grade M: Letter from employer enclosed?

Privacy: I agree that you may collect my contact data and publish them. I agree that you may collect my qualifications: block numbers issued (for Grades M & S) annually and retain these together with my other details in your files. I acknowledge that I have the right to check these for accuracy if I so wish.

APPLICANTS SIGNATURE _____ **DATE** _____

Note: You will be invoiced the appropriate fee after application approval by committee

OFFICE USE ONLY:

MEMB. GRADE AWARDED _____ NUMBER (if applicable)_____

APPROVAL MEETING DATE _____ SIGNED _____

FEES RECEIVED ☐ LETTER OF WELCOME ☐ CONSTITUTION ☐

NUMBERING SCHEME (Grade S, M) ☐ DATABASE ☐ GAZETTE ☐

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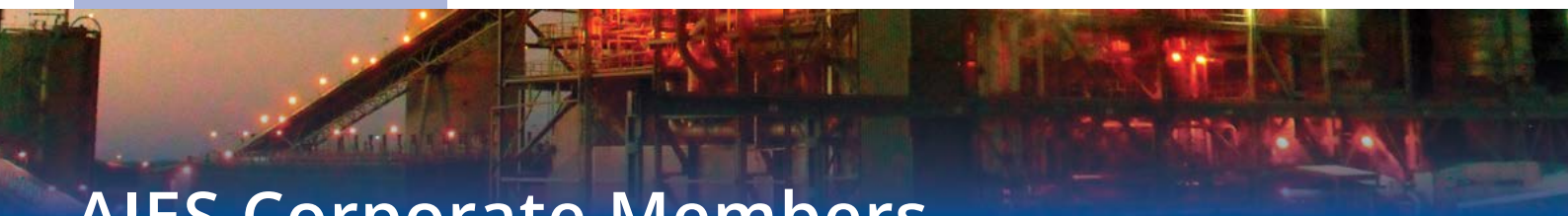

AIES Corporate Members

AAI — ALL AREAS INSPECTIONS

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Inspection Manager
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BAULKHAM HILLS BC NSW 2153
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Facsimile: +61 (0)2 8884 0799
Email: DWallis@aainspections.com.au
Website: www.aainspections.com.au

ADEPT INSPECTIONS & TRAINING PTY LTD

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Director
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Website: www.adeptengineering.com.au

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Facsimile: +61 (0)2 4922 2472
Email: DavidA.Ross@alsglobal.com
Website: www.alsglobal.com

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Email: admin@awsglobal.com.au
Website: www.awsglobal.com.au

JPS VALVES AND SERVICE PTY LTD

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Director
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WETHERILL PARK NSW 2164
Telephone: +61 (0)2 9729 0599
Email: sonyavc@jpsvalves.com.au
Website: www.jpsvalves.com.au

SPIRAX SARCO PTY LTD

Contact:
Trevor Peeling
Technical Manager
14 Forge Street
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Telephone: +61 (0)2 9621 4100
Facsimile: +61 (0)2 9831 8519
Email: TrevorPeeling@au.SpiraxSarco.com
Website: www.SpiraxSarco.com/au

Is your company interested in becoming a Corporate Member of th e AIES?

For further information please contact the AIES Secretary, whose details can be found on Page 1

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AUSTRALASIAN INSTITUTE OF ENGINEER SURVEYORS INC.
ABN 52 542 957
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