



# PUMP INDUSTRY AUSTRALIA

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## PRESIDENTS MESSAGE...

The Association has been very busy over the last 3 months and we have been pleased to see several new members join our ranks in recent weeks. Welcome aboard. We have produced a new Flyer to outline the features of PIA membership and this can be downloaded from our website, if you wish to pass this on to potential new members. It is one of our principal objectives for 2018 to increase the size and variety of members to get the broadest possible input to initiatives that will benefit all members.

We were proud to present another seminar in May at Bruce County Conference Centre on the theme of Pump energy efficiency and reliability in operation. Our thanks to Albert Dessi (DOE) for making a presentation on the Industrial Equipment Upgrade program under development by the Government. This continues the work PIA has been doing with several Government Authorities in the past 12 months. Further seminars are planned for later this year in Brisbane & Sydney and we invite you to participate.

Alan Rowan organised another Installation & Commissioning course in Brisbane, which was well attended and there is a more detailed report later in the newsletter. These courses are based on best Industry practice and we encourage all members to send their Installation supervisors and complete this program. The next course will be in Melbourne on 14 August. Look out for the Flyer for more information.

As members will know, PIA recently concluded a reciprocal agreement with Irrigation Australia. This allows both organisations to cooperate in issues of common interest and we hope to develop this relationship further over time. The recent Irrigation Expo in Sydney attracted a number of Pump Companies and proved to be a valuable platform for introducing new products to this important market segment. In my day job as MD of KSB, I was very interested to attend, since irrigation is a competitive market in Australia. Many players are well established, and we were keen to get our new products in front of the experts in the irrigation. Irrigation Australia did a great job and we thank them for their support.

Finally, let me say a big "Thank you" to Ron Astall, who recently advised us that he would have to resign as Councillor, since the pressure of work and more overseas travel makes it difficult to meet his own very high expectations of the contribution he wants to make to PIA. We hope Ron will still find time to attend PIA functions and add some humour to meetings and events that are organised in future.

Yours in Pumping,

**DAVE ALEXANDER**  
**PIA PRESIDENT**



## Executive Officer Report

**KEITH SANDERS -  
MARKETING & STATISTICS**

Work continues promoting events which are designed to inform and support members at a time of rapid change in technology, standards and legislation affecting the Pump Industry. There was a lot of effort put into the recent Energy Efficiency seminar in Melbourne and further negotiations are in train to organise half day events in Brisbane & Sydney in September on the same theme. We continue discussions with ABCB and Dept of Environment (DOE) to attract Guest speakers to these events and we are optimistic this can be confirmed. Look out for flyers on the other meetings which include Technical meetings in Brisbane and Adelaide, as well as the I&C course in Melbourne.

We will be sharing more information from the IbisWorld market report later in the newsletter, but we hope that the informal networking opportunities provided at meetings will also help members gain important perceptions about the state of the Industry. We hope to outline growth potential in particular products and market segments to assist forward planning.

## ENERGY EFFICIENCY IN PUMPING SYSTEMS SEMINAR

**15TH MAY 2018, MELBOURNE**

**MORE THAN THIRTY PUMP INDUSTRY PROFESSIONALS RECENTLY GATHERED IN MELBOURNE ON TUESDAY 15TH MAY FOR A ONE DAY SEMINAR HELD BY PUMP INDUSTRY AUSTRALIA ON DEVELOPMENTS IN NEW TECHNOLOGY & ENERGY EFFICIENCY.**

The morning kicked off with an address from PIA Executive Officer Keith Sanders, followed by Keynote speaker Albert Dessi, Assistant Director of the Department of Environment & Energy, who delivered a presentation outlining the federal government's Emissions Reduction Fund scheme, which is a regulated means by which to act on the energy efficiency savings presented by upgrades and retrofits to industrial equipment, including pump systems. Albert outlined the eligibility criteria for and how the method calculates emissions reductions, and also introduced the new requirements for energy audits and management systems. Keith Sanders expanded upon this topic later on in the day with his presentation about Energy Auditing and Certification, which outlined the approaches being used in both the US and Europe to calculate energy efficiency gains that can be made by assessing and improving already operating pump systems; and also touched upon the work the PIA is currently working on around the certification and accreditation of pump auditors.

Rounding out the mornings' presentations were Warwick Stannus, Group Manager at AG Coombs with his presentation on safety and reliability in pumps for building services. Warwick discussed the efficiencies that can be made through assessing pump systems and making better product selections. Continuing on with the energy efficiency theme and focus on legislation, Naren Gangaiah of KSB delivered a presentation outlining how energy efficiency legislation is already operating in Europe from a manufacturers perspective and explained the European Extended Product Approach.

Attendees also gained an insight in how advancements in digital technology are being utilised overseas to monitor and improve efficiencies in networks and pumping systems with an informative presentation from James Chalmers, Global Water Manager of ABB, who presented specific case studies of how water utilities in the UK have used business intelligence and big data to address issues of leakage and optimise the performance of their network and pumping assets. Andrew Rathjen of Davey also presented how digital is being used in the Australian space to save power and improve operation of irrigation equipment using Remote Data Capture.



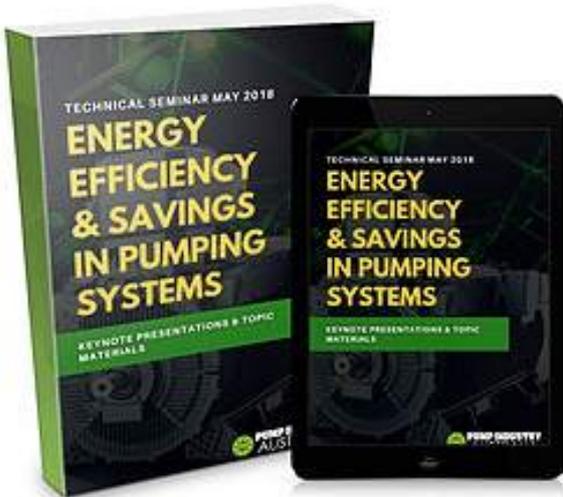


Technical papers also made up the seminar program, with Malcolm Robertson of Robertson Technology discussing pump testing and improvement using the thermodynamic method, and Ken Kugler, PIA Executive Officer for Standards, who presented the newly released pump performance test standard AS ISO 9906:2018 and explained the differences and key points in the new standard compares to the AS 2417 pump companies and their clients must understand when it comes to guarantees of pump performance.

The final afternoon session focused on the fire protection industry with presentations from Brett Dundules, Senior Technical Manager at the FPAA, who informed attendees about the proposed changes in the 2019 National Construction Code for sprinkler systems in buildings less than 25m, and how the NCC addresses primary and secondary referenced documents and how these relate to pumpsets. Brett also highlighted the way building codes are currently interpreted and enforced now with regard to minimum standards developers and builders must comply with, and recalled some recent tragic and confronting examples which really hit home to the audience it's a matter that has life and death implications but seems to attract little interest from regulators or the building authority.

Following on from Brett the final presentation of the day was from Bala Thuraisingham of Kotta38 and Ken Kugler of PIA focusing on fire pump installations and the conformance to AS 2941, which presents a major enforcement shortfall in the fire protection sector, and showed numerous examples of fire pump installations which clearly do not meet the code in a number of areas, and yet enforcement is negligible in most cases, with self-certification being the effective norm. Ken also informed attendees of what PIA has done to help improve the quality of fire pump installations with the AS 2941 Fire Pump Installation Checklist that is available to all members on the pumps.asn.au website.

Each segment was followed by some stimulating question and answer sessions, and were useful in providing background into the regulatory framework, issues and product solutions that are being developed to meet the specific needs of Australian pump users. Keith Sanders delivered a closing address to attendees to wrap up the seminar, emphasising the importance the association places on pumping and system efficiency and PIA's proactivity in working with government departments, regulators and other organisations on energy efficiency initiatives, programs and legislative models introduced that will best suit the Australian Pump user and market will continue to be a focus.



## FOR THOSE WHO MISSED IT...

The PIA is pleased to advise that we have published a downloadable Ebook of the seminar presentations and reference material which is now available from our website. Go to [pumps.asn.au](http://pumps.asn.au) and visit the Publications page and select the Seminar Ebook from the publications available.

PIA members are entitled to a \$25 discount off the retail price (\$50.00 for PIA members, \$75 for non-members) just enter the promo code **PIASem** at checkout.

The Ebook will be emailed to you and made available for download following receipt of payment.



## BRISBANE TECHNICAL MEETING - 17TH JULY 2018



**MAKE A DATE IN YOUR DIARY TO ATTEND ANOTHER PIA TECHNICAL MEETING COMMENCING AT 5.15 PM ON 17TH JULY AT THE POPULAR VENUE OF RIVERSIDE RECEPTIONS IN NEW FARM.**

Dave Alexander and John Inkster will be coordinating this event and will update Queensland members on the Association activities planned for the rest of 2018. This is a great opportunity to network with Industry colleagues.

They don't call Queensland the "Sunshine State" for nothing, so Solar Energy is potentially an important source of power particularly in remote areas. We are pleased to have Franklin Electric provide members with an update on how the Sun's energy can be utilized moving forward.

Ian Mercer – National Business Development Manager will talk to us on several important issues surrounding the emerging technology

- What is Solar Pumping?
- How does a Solar Pump work?
- Types of Solar Pumps and applications
- Types of Motors used with Solar Pumps
- Solar Pumping Systems

Presentations will be followed by a networking session at which finger food and refreshments will be served. An attendance fee of \$50 applies to both members and guests. Grab your place at this meeting by registering on the PIA website or emailing Kevin Wilson accordingly.

# STAY TUNED...

## Upcoming Courses & Events

**VISIT PUMPS.ASN.AU FOR MORE INFORMATION & TO RESERVE YOUR PLACE.**

**BOOKINGS ARE LIMITED SO REGISTER EARLY TO AVOID DISAPPOINTMENT!**

**14  
AUG**

### INSTALLATION & COMMISSIONING COURSE MELBOURNE @ LINK PUMPS

14th August commencing at 8.30 am. Venue will be Link Pumps in Williamstown. Alan Rowan will be running the course with assistance Link staff for the practical sessions.

**21  
AUG**

### PIA TECHNICAL MEETING ADELAIDE

A Technical Meeting is planned for the 21 August to be held in Adelaide commencing 4.30 pm at a Venue TBA followed by a networking session with drinks and refreshments. Look out for the Flyer due out soon

**18  
SEP**

### HALF-DAY ENERGY EFFICIENCY & SAVINGS IN PUMPING SEMINARS - BRISBANE & SYDNEY

BRISBANE  
18 September commencing 1.30 pm  
Pacific Golf Club, Carindale, QLD.

**19  
SEP**

SYDNEY  
19 September commencing 1.30 pm  
Bankstown Golf Club, Milperra, NSW.

Flyers for these events will be issued shortly.  
Attendance for Members \$150 and Non-members \$180

## Executive Officer Report

ALAN ROWAN -  
PUBLICATIONS & TRAINING

A review of the Pump Technical Handbook has begun, which will continue throughout this year and well into 2019 for a new edition to be released. Recent standards and updated technology needs to be reflected in the new edition and we invite contributions from members on what they would like to see addressed within this framework.

The Pipe Friction Handbook review has been completed. It is anticipated only minor changes and corrections will be needed. It has been suggested that we reinstate the tables for ABS pipe to the Australian Standard and we would like to hear from any members who think this would be of benefit to the book. Prior to reviewing the Pipe Friction Handbook, the annual review of the applicable standards was conducted with no immediate changes flagged, although it was noted that the standard for brass tube is being updated with publication due late 2018.

Work has been completed on the commissioning check list based on the Installation and Commissioning Course and it is currently being prepared for uploading on the PIA website.

Following the successful Installation & Commissioning Course at KSB in Bundamba in April, our next Installation and Commissioning Course will be held at Link Pumps in North Williamstown, Melbourne on the 14th August 2018. It has been some time since we last ran this course in Melbourne and we look forward to your support to make this course a success. Preparations for this course are about to begin and we are looking forward to having a very successful course.

## INSTALLATION & COMMISSIONING COURSE

18TH APRIL 2018, BRISBANE

### THE SEVENTH INSTALLATION AND COMMISSIONING TRAINING COURSE WAS HELD AT KSB IN BUNDAMBA ON THE 18TH APRIL 2018.

Eight participants were in the course this time, an ideal size for this particular hands-on course. Alan Rowan, as lead trainer, was assisted by Nathan Dale of KSB with the practical segment of the course. The morning session, covering the theory of installation and commissioning, went relatively smoothly and was completed by 12.30 am which included a review and marking of the theory test papers. During the morning session the participants provide good feedback, with lots of questions and comments. It was pleasing to see such an engaged group on this occasion.

After lunch, we began with Nathan running the levelling and alignment segment under Alan's supervision. KSB provided a pump set which required alignment. After levelling, Nathan conducted a demonstration of preliminary alignment with basic adjustment tools, then final alignment to the highest accuracy with laser equipment. During the whole process we were able to ensure that everyone participated to the maximum extent.

A second pump set had been set up for a commissioning run. During this practical demonstration, the group followed the process outlined in the course theory, with all participants actively taking part in the operation. Subsequently, a full set of results from the commissioning process has been sent to all participants for their records. We were able to demonstrate that the pump was running satisfactorily with most of the readings within acceptable tolerances.

After evaluation all participants were presented with PIA Accreditation certificates to confirm their capabilities.



## ONLINE TECHNICAL TRAINING AVAILABLE TO MEMBERS FROM INTERNATIONAL PARTNERS BPMA & HYDRAULIC INSTITUTE

As one of our major technical partners BPMA still offers a wide range of Pump Training courses. Members may download a brochure on their complete program from the BPMA website. This contains a number of E-Learning courses which may be appropriate for members who do not find it easy to attend formal training programs run by PIA. Pump Systems Matter is a subsidiary of the Hydraulic Institute that provides tools and education to the pump user community, with an emphasis on energy efficiency, improved reliability, increased productivity, and profitability. PSM offers a wide variety of training options, that are customizable to fit specific market niches while also focusing on specific technologies that fit your market space. This includes webinars that may be of interest to Australian users.

## Executive Officer Report

**KEN KUGLER -  
STANDARDS**

### A NEW PUMP PERFORMANCE TEST STANDARD ADOPTED FOR AUSTRALIA

Following the adoption of AS ISO9906 – 2018 Rotodynamic pumps – Hydraulic performance acceptance tests – Grades 1, 2 and 3, PIA has organised for a PowerPoint to be prepared, which Ken Kugler presented at the recent Energy Efficiency Seminar in Melbourne. Further presentations are being planned for Sydney and Brisbane later in the year.

More recently, PIA Council have resolved to submit a proposal to Standards Australia to adopt ISO/ASME 14414:2015 Pump system energy assessment for use here. For some years, this standard has been accepted as a European (EN) and British (BS) standard. It provides a standardized approach to the energy assessment of a pumping system. Should the proposal be accepted by Standards Australia it would still be some months before its adoption in this country.

### TANK STANDARD

A new draft of AS2304 Water storage tanks for fire protection systems has been prepared and PIA will be voting for the acceptance of this shortly. The committee reviewing this will report accordingly and the ballot will be completed by June 19. A major input in this standard was to ensure good design for suction piping between the tank and the pump suction.

### FIRE PUMP CHECKLIST

PIA has been in discussion with FPPA and reached agreement on an acceptable format for a Firepump Checklist. This has now been posted on the PIA website and we encourage all members to use the appropriate sections in their own QA program when designing, manufacturing & commissioning pumpsets for sprinkler systems and other fixed fire installations.

## FORTHCOMING EVENTS FOR 2018...



### AMCA Expo

AMCA will be running their annual Construction Innovation 2018 Forum on 23 – 24 August at the Melbourne Convention and Exhibition Centre. For more information on the schedule for the event please refer to their website.

[www.bimmepaus.com.au](http://www.bimmepaus.com.au)



### IAL training courses

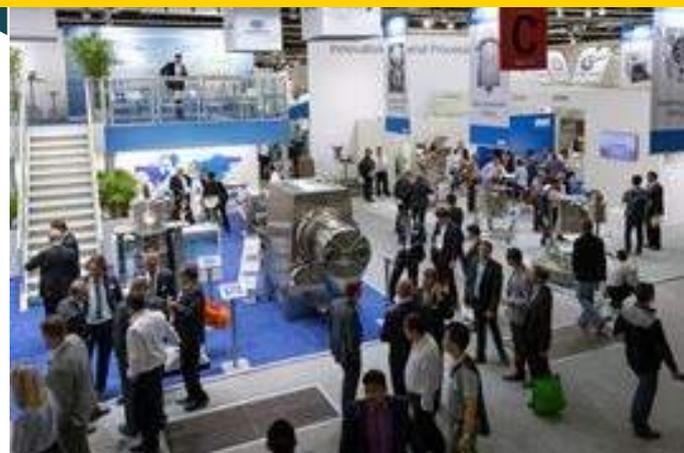
IAL has organised a series of training programs covering Meter validation and Installation, Irrigation Efficiency and Drip Irrigation workshops throughout Australia. Anyone interested can check out dates and locations on the IAL website.

[www.irrigationaustralia.com.au](http://www.irrigationaustralia.com.au)

## ACHEMA EXPO 2018

The ACHEMA trade fair and congress has been bringing engineers and chemists together for almost 100 years. The first ACHEMA took place in 1920, with just 75 exhibitors and 876 visitors. This year, organisers will welcome 3,800 exhibitors and 170,000 visitors. ACHEMA takes place every three years at Messe, Frankfurt. This year it was from 11 – 15 June, showcasing the latest technology from the chemical, pharmaceutical and food processing industries, including pumps and compressors. Many new products were on display underlining the continued investment in R&D.

## GLOBAL NEWS

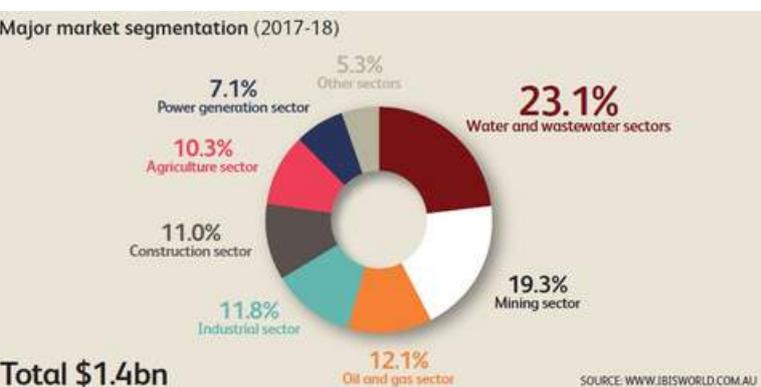




In the last newsletter, we shared with members some broad information about the state of the Industry as a whole. While this does not predict much growth potential overall, there are key sectors where pumps are more in demand than others and the push for improved energy efficiency is likely to result in investments in more modern pumping solutions.

Many of the larger pumps installed in the 1960's and 1970's will be coming to the end of their useful life, so more efficient solutions may be sought by users, in part to take advantage of Government incentives, like the Industrial Equipment Upgrade program.

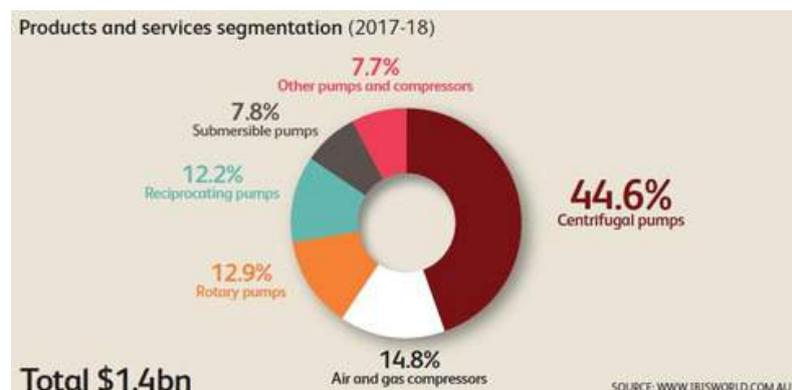
## MARKET SEGMENTATION



Market segments that are geared to population growth or routine upgrades of equipment over time, are likely to drive consistent demand for pumping equipment. Water & Wastewater along with the Construction sector are likely to be growth markets, while the Oil & Gas sector is likely to decline in Australia as refinery capacity moves offshore. As coal-fired power plants are closed, demand in this sector is expected to decline also. Resources Exploration is likely to continue. Irrigation is also expected to be a growth market in the years ahead as production targets increase to meet overseas demand in the Asia Pacific region.

## PRODUCT SEGMENTATION

Not surprisingly, the centrifugal pump market is very strong in Australia and has formed the base load for Australian manufacturers for a long period of time (approx. 45%). The compressor market is significantly smaller (approx. 15%) while the combined demand for positive displacement pumps is estimated to be approx. 25%. Submersible pumps and other types make up the rest of the market (approx. 15.5%). Anecdotal evidence suggests that more pumps are being supplied with variable speed drives these days and new products often include these as standard.



Our understanding is that the total figure put forward by IbisWorld (1.4 bn) probably understates the overall size of the market. However, we believe the split of pumps across the various market segments and product types is still representative of the Industry situation but based on a larger figure of \$2.4 bn.

*Welcome...*

## PIA WELCOMES THE FOLLOWING NEW MEMBERS TO THE ASSOCIATION



### ATLAS COPCO POWER TECHNIQUE

Atlas Copco has introduced a range of dewatering solutions including diesel driven self-priming pump skids, portable trash pumps and electro submersible dewatering pumps. The company is backed by Atlas Copco's ever increasing product range. For more information please visit their website. <http://www.atlascopco.com.au>

### TECHTOP AUSTRALIA



Techtop Australia is a nationally based electric motor company with an extensive range that covers single and three phase TEFC electric motors in both Aluminium and Cast Iron. Techtop has the exclusive distribution for all Varvel gearboxes. The range also includes single stage helical gearboxes, variable speed drives, stainless steel motors and gearboxes. Their nominated representative for PIA is Anthony Southwick, who members may remember from his time with CMG in Melbourne. For more information please go to [www.techtop.com.au](http://www.techtop.com.au)

### NEW MEMBER BROCHURE AVAILABLE

The PIA has prepared a leaflet for distribution to potential new members outlining PIA services available. We encourage members to promote the Association to friends, business associates etc., to help swell our ranks and increase our profile with Government and Industry.



### IS THERE LIFE AFTER BEING PRESIDENT?

Ask Bill Clinton or Barack Obama, life after being President of any organisation has its difficulties. While there is no fixed term for the President's office in PIA, it is nevertheless a pretty demanding role and takes its toll on personal time. With increasing demands on Senior Management to achieve key business objectives, it is no small sacrifice to serve as President of an Industry Association where so much is expected. Two recent past Presidents have contributed a lot to the Association and now take on other challenges in their professional and personal life...



## Ron Astall steps down as Councillor

As Dave Alexander mentioned in his opening message, Ron Astall has informed Council that he is obliged to step down as Councillor after more than 35 years of involvement with the Association. Ron has contributed greatly in roles on the Technical Committee, Councillor, Vice President and President.

My own relationship with Ron began in 1984, at an APMA conference in Canberra. He was there with Dave McLeish, who was himself APMA President at the time. Since then Ron has made a tremendous contribution to the Association activities.

I have greatly admired his commitment to the technical aspects of our Industry, particularly for the Oil & Gas sector, where API 610 dominates and product reliability at high pressures & temperatures is a key success factor. Ron has been willing to share his knowledge (and Collingwood jokes) with colleagues whenever called upon to do so.

His career with United has been significant and apart for brief spells with Acromet, Mono and Sulzer as well as running his own business, Ron is best known for his expertise in API applications engineering, such that he always analyses the actual pump operating environment and recommends the "right pump for the job".

In his own words, Ron advised "I want to make it clear that I am not winding down – in fact, I am busier than ever with United expanding and marketing more outside Australia. That is the main reason for reluctantly cutting back on my PIA involvement; which I have enjoyed enormously. I have really valued the personal friendships that I have made through PIA and previously the APMA. My view on PIA membership is that it is very important vehicle for maintaining a better industry overview and understanding of the pressures facing our industry. I have also benefited greatly from my involvement at the seminars and conferences where there is always something to learn or a different perspective to be had. Involvement really has its own reward and I've never understood the attitude of some that never come to functions, never get involved and then complain that membership has no benefits for them."

We still look forward to seeing Ron at PIA functions and presenting the occasional paper at future seminars as circumstances allow. All the best mate.

## HARRY HITS THE ROAD

Another Past President who has accepted a different challenge is Harry Katunar. Harry was President in 2012/13, (immediately before Ron) after which he left Australia to run the KSB Valve Company located in Shanghai. Some of you might remember Harry shared part of this experience with members with his talk at the PIA - AGM held at Windy Hill 2 years ago.

He recently took time out to pursue a personal goal from his "bucket list" and is currently cycling along the Danube to travel from end to end of this famous river in Europe. He embarked on this 3000 km ride from Zurich to Constanta (in Romania on the Black Sea), from the source of the Danube to its mouth. "I am fulfilling a lifelong dream and

realise how lucky I am to have the health & freedom to travel. We will be following Bikeway Eurovelo 6, through Switzerland, Germany, Austria and Hungary through the Balkans to Romania".

Harry will be returning Australia shortly to take up a new position in the Pump Industry, so watch this space for more information. The pump bug is like Malaria, it keeps coming back.....



# PUMP COMPANIES SUPPORT THE IRRIGATION AUSTRALIA EXPO IN SYDNEY



Members of the irrigation industry from across Australia and beyond sampled the latest in technology, equipment and policy at **Irrigation Australia International Conference and Exhibition** held at the International Convention Centre in Sydney from 13 to 15 June. The exhibition showcased a huge range of irrigation equipment and services ranging from pumps, motors and irrigation application equipment such as emitters through to scheduling tools and services using the latest in data collation and analysis software. IAL CEO Bryan Ward said that feedback from the 160+ exhibitors was extremely upbeat with many commenting that the visitors and sales leads generated were of high quality.

There was certainly a buzz around the exhibition floor on each of the three days of the exhibition, which supports the positive comments we have received from both exhibitors and participants,” said Mr Ward. Several PIA members had stands to showcase new products being introduced into the market. This was the first time that major pump company **KSB** had exhibited at the event.

Presenting their Movitec Delta booster unit, submersible bore pumps and functioning Etanorm centrifugal pump unit, KSB Australia said “there was a good level of interest in products and customers gave positive feedback on the state of the industry.”

KSB Australia managing director Dave Alexander said “Irrigation is a competitive market in Australia, with many players well established. We were keen to get our offering in front of the experts in the irrigation game and show we can be leaders in pump efficiency and reliability.”



Australian Distributors and Dealers celebrated Lowara’s five decades as a leading manufacturer in pressed SS pump technology with a Harbour cruise at the recent Irrigation Australia Exhibition.

Lowara products are distributed by **Brown Brothers Engineers** in New Zealand and QLD, NSW, VIC and TAS in Australia. They are represented by WBS Pumps in SA & NT and by Advanced Pump Technologies in WA.

Lowara’s success in Australia and New Zealand is built upon the dedication of their distributor and dealer network to promote the quality of their products and service the market.

Lowara has been offering solutions in building services, residential and public utilities, agriculture, aquaculture, mining and general industry since it was founded in 1968 in Montecchio, Vincenza in Italy.



**Pentair** also took the opportunity to introduce new products developed for the Australian market.

Their new Intellimaster series of pumps are fitted with a variable speed drive which adjusts the pump speed in relation to water demand. This ensures constant pressure while consuming significantly less power when compared to a conventional fixed speed pump. Intellimaster Kits include chosen pump model, LCD display with adjustable pressure set point, variable frequency drive, five-way tee, pressure transducer and 8L pressure tank. This offers the complete package for easy installation, with no additional fittings required!



The PVMI unit is now supplied with new drives up to 2.2kW single phase, and up to 18.5kW 3 phase. With models suitable for single pump or multi-pump operation it also features a smart control system for the control of up to 4 pump units, each fitted with a variable frequency drive.

Benefits include an easy to use touch screen control, giving the complete system status at a glance. The PVMI can also be configured for protection against over-current, over/under voltage, low/high pressure, high pressure, overheating & overload.

## NEW SKF EXPLORER SINGLE-ROW ANGULAR CONTACT BALL BEARINGS FOR HIGH-SPEED APPLICATIONS

Single-row angular contact ball bearings are typically used in applications such as screw, scroll or centrifugal compressors and pumps. A clear trend in these applications is to raise the power density by increasing the rotational speed.

To fulfil this requirement, **SKF** has developed a new range of single-row angular contact ball bearings. The goals have been threefold:

- to increase the limiting speed by 40%,
- to reduce the noise levels
- to increase the robustness of the bearing in unfavourable operating conditions. (shock loads, shaft misalignment, etc.)

For more information, please refer to the SKF Bulletin *New SKF Explorer single-row angular contact ball bearings for high-speed applications\_2018\_E2\_EN.pdf*

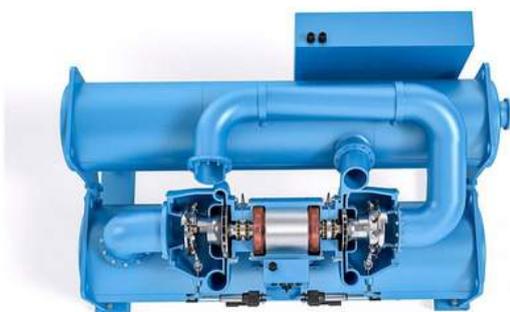


Fig. 1. Centrifugal compressor

