The official journal of the Vibrations Association of New Zealand

Spectrum

Spring 2024 | Issue 113

Using your eyes and ears

- when examining a machine

Getting the most from your protection system

+

Keep these dates free!

May 20th - 22nd, 2025

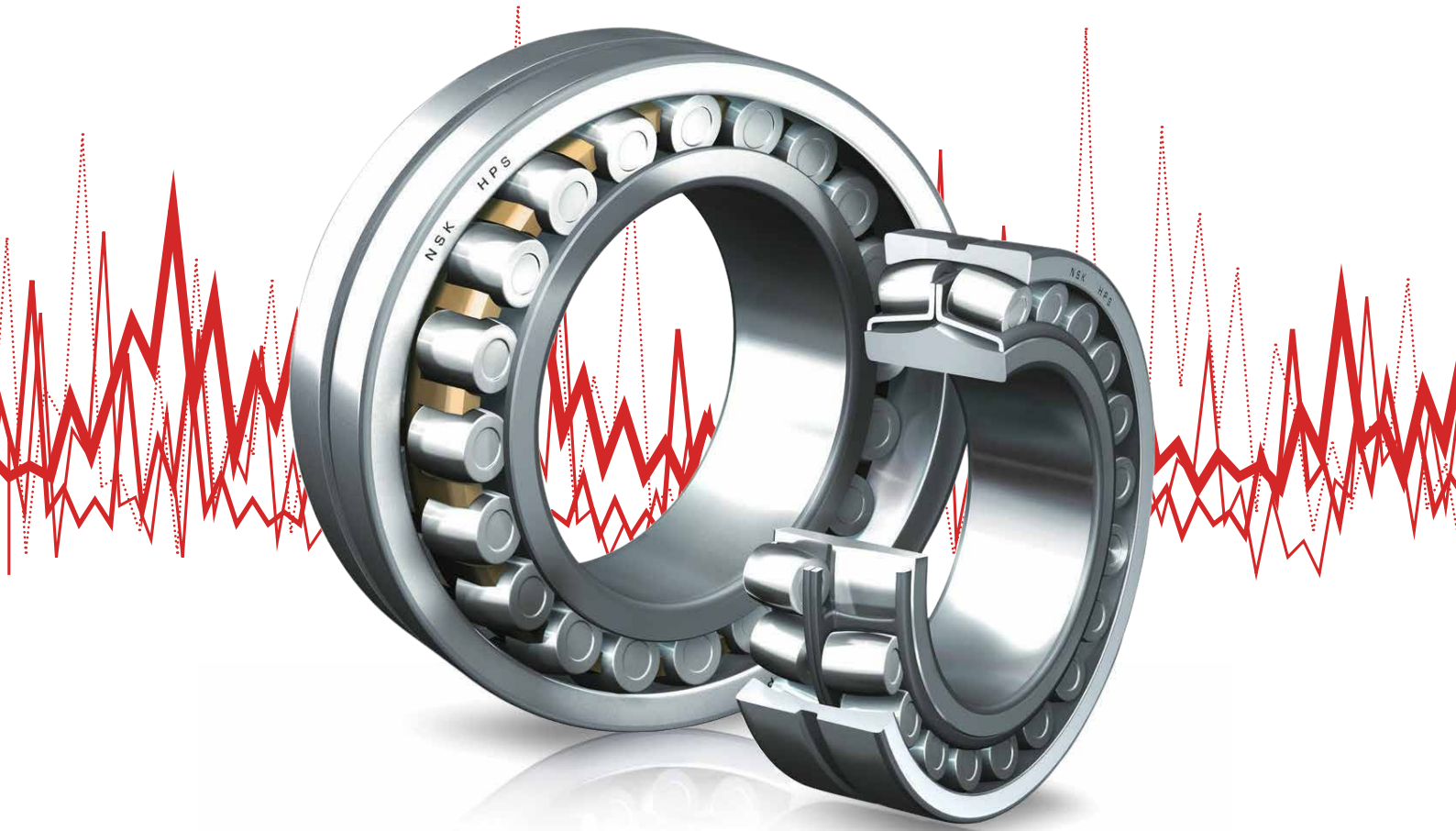
Conference 25

New Plymouth, NZ

VANZ
VIBRATIONS ASSOCIATION of NEW ZEALAND

ABD GROUP

Proudly 100% NZ Owned



ABD Group is proud to be platinum sponsor
for the VANZ 2025 Conference in New Plymouth

www.ABDGROUP.co.nz sales@abdgroup.co.nz 0800 ABDGROUP

BEARINGS » POWER TRANSMISSION » SEALS » GASKETS

ALBANY » WIRI » AVONDALE » HAMILTON » TAURANGA » NEW PLYMOUTH » WANGANUI » CHRISTCHURCH

CONTENTS

Issue 113 | Spring 2024

Features

Regulars

Spectrum

ISSN 1173-793X

Spectrum is published by the Vibrations Association of New Zealand (VANZ). The magazine is produced in a quarterly cycle annually in both digital and printed mediums.

The magazine is designed to cover all aspects of the Vibration, Condition Monitoring, Reliability and the wider Predictive Asset Management field and distributed to all VANZ members, including corporate members.

Missed an issue?

Simply scan the QR code here to link your device directly to the VANZ website. There you will find Spectrum issues available to view or download*. You can also access previous issues by visiting our website online at: **www.vanz.org.nz**

**QR code reading app need on your device first.*

CONTACT US...

VANZ
VIBRATIONS ASSOCIATION *of* NEW ZEALAND

> Website: **www.vanz.org.nz**

Conference paper submissions
> papers@vanz.org.nz

Contributions to Spectrum are welcome.
Email material to:
> spectrumeditor@vanz.org.nz

Address all VANZ correspondence to:
PO Box 308093
Manly, Auckland 0952,
New Zealand

Editor: Angie Delfino
> spectrumeditor@vanz.org.nz

President: Tim Murdoch
> Timothy.Murdoch@ballance.co.nz

Treasurer: Graeme Finch
> g.finchnz@gmail.com

Design: Eddie van den Broek
Flashpoint Design and Marketing
> info@flashpoint.design

PRESIDENTS' REPORT

By Tim Murdoch | VANZ President

The end of year is closing in fast, along with Christmas and the new year. As we welcome the warmth and renewal of spring, I am delighted to share updates on our association's activities and plans. The team at the Plymouth International Hotel are again ready and waiting to host us in 2025 for our VANZ Conference, which of course will be held in New Plymouth. It's going to be an industrial hub of technical knowledge for all to share. Have you locked it in yet?

Our dedicated committee has been working tirelessly to organise the upcoming conference, which will be on 20th – 22nd May 2025. Their commitment and hard work will ensure that this event will be both informative and engaging. We are currently in the process of developing the program and we are eager to include a diverse range of presentations.

> **Our dedicated committee has been working tirelessly to organise the upcoming conference, which will be on 20th – 22nd May 2025.**

We invite all members to contribute to the success of our conference by presenting papers. This is a fantastic opportunity to share your knowledge, research, and experiences with your peers. Whether you have conducted groundbreaking research or have practical insights from your work, we encourage you to get in touch at papers@vanz.org.nz and if you need assistance we are here to help. In addition to research papers, we are particularly interested in hearing about the challenges you have faced at your work sites, case studies are always appreciated! What obstacles have you encountered, and how have you overcome them? Sharing these experiences can provide valuable lessons for all members. Your participation and contributions are what make our association strong, informative and vibrant.

Exhibitors, if you are interested in showcasing your innovations, connecting with industry and expanding your network please reach out to secretary@vanz.org.nz to book a booth.

Many thanks go to ABD – our official platinum sponsor for Conference '25. We look forward to working with them in the coming months and fostering a mutually beneficial relationship for the good of all our members and attendees. We'll be updating more details for sponsorship/trade stands/exhibitor opportunities shortly on our website www.vanz.org.nz so be sure to stay tuned. As well as following along with our social media accounts using LinkedIn and Facebook, we'll be posting details to put in your calendars. Keep an eye out for that.

Stay safe this summer and enjoy your time with your families. ■

Below: The wonderful staff at the Plymouth International look forward to once again hosting the VANZ Conference in 2025.

VANZ
VIBRATIONS ASSOCIATION of NEW ZEALAND

Conference 25

New Plymouth, NZ

20-22 May 2025

Join us for the VANZ 2025 Conference event!

We're back in beautiful New Plymouth at the Plymouth International Hotel.

If you have an interest in the area of mechanical and electrical machine condition monitoring, to facilitate predictive asset management – this conference is for you. Calling all in-house technicians, consulting engineers, engineering students, and suppliers and/or distributors of specialised equipment – **this conference is for you!**

Proudly brought to you by:

ABD GROUP

For more info, please contact us at:

secretary@vanz.org.nz

Exhibitor Packages for Conference'25

Secure your booking early. Packages will sell quickly! See our 2025 exhibitor options below.

Conference 25
New Plymouth, NZ

Package	Gold	Silver	Bronze
Price	$3,355	$2,420	$1,760
Naming rights of conference			
Primary sponsorship on key online & offline promotional material before and during conference*			
Official role at the opening of the conference and five minute speaking opportunity			
Trade stand that offers sponsors the opportunity to showcase products, services and ideas	Premium	Standard	Table
Signage opportunities at conference & dinner			
Pre conference Spectrum advertising opportunities (early registrations only)	✓		
Acknowledgement as sponsor & vendor	✓	✓	
Company literature in delegates goodie bags	✓	✓	
Brand on conference programme (early registrations 1 month before event)	✓	✓	✓
Sponsorship on key online & offline promotional material before and during conference**	✓	✓	✓
Logo on VANZ conference publications & website***	✓	✓	✓
Post conference Spectrum advertising opportunities	✓	✓	
Conference entry for staff	x2	x1	x1

Booth size (Platinum and Gold)	1.8 x 3.0 metres
Booth size (Silver)	1.2 x 2.4 metres
Table top size (Bronze)	1.8 x 0.6 metres

*Website** Animated landscape panels @ 460px wide x 200px high
*Website*** Animated landscape panels @ 460px wide x 200px high - x1
*Logo file**** To be supplied as either a vector eps or hi res tif/png/jpeg

Files to be supplied to specifications.

Further Sponsorship Options

Informal Welcome Event (Tues night)	$2,000	Lanyard sponsor	$500 + lanyards
Networking Session Sponsor NEW	$1,000	Bag sponsor	$500 + bags
Dinner Sponsor	POA		

All conference pricing excludes GST.

Note. All exhibitors have the annual dinner included for the number of delegates associated with the respective category.
Example: Gold 2 delegates, Silver 1 delegate, Bronze 1 delegate. There will also be provision for extra annual dinner attendee purchases at $125 per person.

Proudly brought to you by:

VANZ Vibrations Association of New Zealand

ABD Group

For more info, please contact us at:
secretary@vanz.org.nz

Brüel & Kjær Vibro

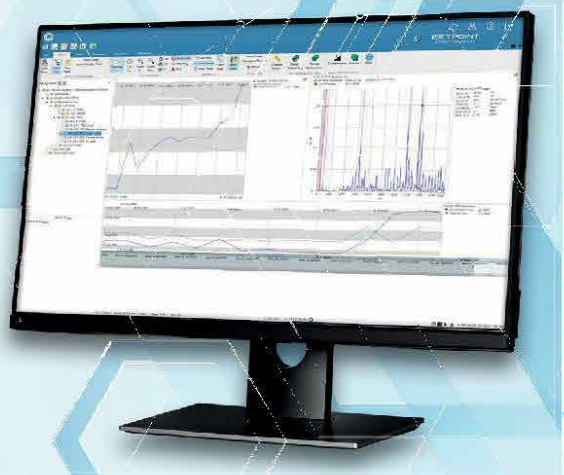
A member of the NSK Group

CSE

W.ARTHUR FISHER

Unleash the benefits of SETPOINT®

CONDITION MONITORING WITH SEAMLESS CONNECTIVITY



SETPOINT® software effortlessly integrates with your AVEVA™ PI System™ for powerful plant-wide machine analysis. Monitor asset health and fix faults before they cause damage or downtime.

Use a wired connection

SETPOINT® links directly to our VC-8000 machinery protection system and VCM-3 condition monitoring unit for data acquisition, without the need for additional hardware.

Or connect wirelessly

Now SETPOINT® can securely connect to our wireless BKV Collect sensors and BKV Connect gateways, eliminating unnecessary infrastructure and freeing up resources.

▶ Learn more: **www.setpoint.bkvibro.com**

Enquire Now: sales@cse-waf.nz

VANZ MAILBAG

A warm invitation

Dear all,
I am pleased to invite you to the inaugural Colloquium of the Acoustics and Vibration Research Centre at the University of Auckland. The aims of this colloquium include:

- To provide an overview of research within our Research Centre - particularly to industry and community stakeholders interested in acoustics and vibration;
- Network with people from industry to seek opportunities for joint work and employment opportunities for our student members (who are entirely postgraduate students).

The colloquium will be held on Friday the 29th of November between 12:00 noon and 3:00 pm in building 401 (20 Symonds St) at the University of Auckland. The colloquium will include two keynote talks on select topics in acoustics and vibration and will conclude with lunch and a poster session where student members of the Centre will be available to discuss their research with attendees. The full programme is on the adjacent page.

Note that the session between 12:00 noon and 1 pm will be streamed via Zoom here:
https://auckland.zoom.us/j/94341596784

If you plan to attend in-person or online, please register by the 31st of October using the form at the following link:
https://forms.gle/sNcfJxUakQA2qh1y5

I'll look forward to seeing you in November!

A. Prof Yusuke Hioka
Director of the Acoustics and Vibration Research Centre
The University of Auckland

EDITORS' CORNER

By Angie Delfino | Spectrum Editor

Greetings dear readers, this being the last issue of the year we here at VANZ hope you've all had a productive 2024 and the next few months before the Christmas holidays eases you into the new year.

As another year passes we look back and reflect on the last 12 months within the industry, the changes that have been made, the new technologies discovered and the trials and tribulations that we've faced.

Check out the latest quiz from Carl and our President's latest musings in his end of year report, as well as having a read through the interesting articles that have been contributed for this issue from Ian Van Der Sar and Chris Engdahl.

As we start planning for the new year we have a busy team organising everything for the 2025 conference, the info we currently have available can also be found on our website **www.vanz.org.nz** so keep checking back for more details!

VANZ would like to wish you all a very Merry Christmas, Happy Holidays, Season's Greetings and a happy and safe New Year. Make the most of the holiday season by spending time with family and friends and take a well deserved break.

Many thanks go to the companies that advertise with us, we greatly appreciate your support for another year and hope to continue with you all next year. Happy reading!

VANZ would like to take the opportunity to wish all our readers and members

Seasons Greetings and a safe & happy New Year!

Colloquium of the Acoustics and Vibration Research Centre

Building 401, University of Auckland
20 Symonds St, Auckland City

Friday, 29th November
(between 12:00 noon and 3:00 pm)

Program of Events

Time	Session	Room	Speaker/ Presenter
12:00 noon	Welcome & Introduction	401-439	Director
12:10 – 12:35 pm	Keynote 1 (Vibration)	401-439	A. Prof Lihua Tang
12:35 – 1:00 pm	Keynote 2 (Acoustics)	401-439	Dr Andrew Hall
1:00 – 3:00 pm	Poster session & Lunch	401-418	Students

About the Acoustics and Vibration Research Centre

We are New Zealand's premier acoustics and vibration research group, committed to undertaking high-quality research and seeking opportunities to create meaningful impact across the nation. The Acoustics and Vibration Research Centre brings together a diverse range of staff and students and aims to foster collaboration and collegiality amongst its members. Our members conduct research which has impact and which is of benefit to New Zealand.

Acoustics & Vibration Research Centre

Enerpac Safety Tips

Hydraulic technology is useful in maintenance for all sorts of applications where pushing, pulling, or lifting is required. However, the use of this equipment should not be taken lightly. To use it safely, there are a few things that you need to know.

Choosing pumps and cylinders

- Single acting pumps and cylinders are used for applying force in one direction only. (See fig.1)
- Double acting pumps and cylinders can be used for applying force in both directions. (See fig.2)
- Enerpac cylinders have a code to indicate their approximate capacity. The following table gives a few examples to show how the coding works. Refer to the manufacturers catalogue for full details.

Series	*Example*	*Capacity (ton)*
50	*RC-53*	*5*
100	*RC-108*	*10*
150	*RC-152*	*15*
250	*RC-252*	*25*
500	*RC-504*	*50*
750	*RC-756*	*75*
1000	*RC-1006*	*95*

Care of equipment

- Clean coupling connections before using and use dust caps when not connected. This prevents contamination and ensures correct operation of the equipment. (See fig.2)
- Do not carry the equipment by the hose. This damages the hose and can lead to VERY serious injuries.
- If the hose assembly is ever repaired or replaced, it is essential that the hose and fittings are rated for 10,000PSI.

Use of equipment

- Check that all components are in good condition before using them. Enerpac recommend 6 monthly inspections and pressure tests for their equipment. Enerpac will come on site and do an “audit” for you at no charge. You just pay for any parts required. Create a schedule in your maintenance management system to remind you that the audits are due.
- Always fit a pressure gauge. It lets you see what is going on. It makes it is possible to ensure that a system

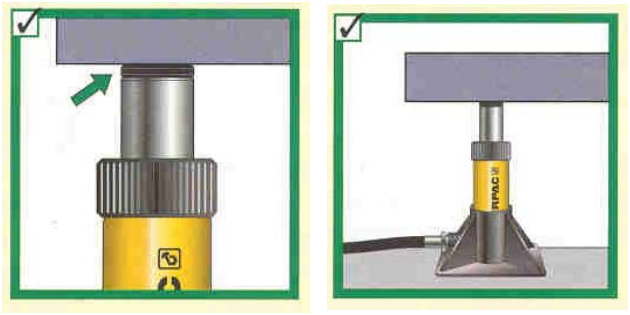
Fig. 1

Fig. 2

Article prepared by Rod Bennett.

is not over pressurised, and that the pump is working correctly.

- Do not place your hands or any part of your body against or near the hose when it is under pressure. If the hose leaks under pressure, the oil is atomised, is not visible, and travels at the velocity of a bullet. Oil can be injected under the skin, which may lead to amputation or worse!
- Operate the equipment slowly and check often.
- Do not stand in the line of force.
- Do not use a ram that has a damaged base, as it will be unstable.
- Always use a “saddle” on the end of the ram. This will prevent distortion of the ram and will ensure that the load is evenly distributed.
- Do not apply a side load. The stroke must be parallel to the direction of movement of the load.
- Do not exceed 80% of the rated stroke or pressure. This gives you some margin for error.
- Cylinder base attachments are available to provide more stability.
- Do not use cylinders as packers. The cylinder may become overloaded and can fail catastrophically. This has caused injury at Western Port.
- Do not extend the length of the pump handle. If the pump is being used correctly, this is not necessary.
- Strongbacks are the biggest cause of incidents with this type of equipment. Ensure that the strongback is in good condition and that it is rated for the load that you are going to apply.
- Do not place any part of your body under a load supported on a cylinder. ■



FEATURE

Getting the most from your protection system

When an Export Gas Compressor on an offshore platform failed, the Operations and Maintenance Staff were anxious to understand why the incident was not detected, and how to improve their monitoring regime for the future. Machinery diagnostic engineers were consulted on the incident and were able to demonstrate how the existing machinery monitoring system could be optimized to enable a higher level of Asset Management capability. This article discusses the background of the incident and explores a "best practice" monitoring strategy for the compressor in order to provide timely identification of a change in machine integrity in advance of major impact on plant operations.

BACKGROUND

The compressor was monitored by an API standard protection rack, configured for only basic alarming and tripping on direct amplitude, transmitting amplitudes and events to the control system by Modbus for data-logging.

As shown in the trend plot (fig.1) from the plant control system, the vibration trip level of 3.0 mils pk-pk was not reached during steady state operation – even during the suspected failure event. Subsequently, plant operators and engineers had no advanced warning of the change in machine behaviour at this time.

The machine was taken out of service a week later due to an unrelated problem with the lubrication system but, on startup, was unable to reach normal operating speed of around 7000rpm without tripping on high vibration alarm. Inspection, and root cause failure analysis by maintenance engineers, pointed to condensate carry-over into the compressor suction as the initiator of the failure. This had led to both a build up of carbon deposits on the impellor (inside the impellor suction eye) and cracking of the 1st stage impellor disk, with significant loss of metal at several vanes.

Continued over page >

Article prepared by Chris Engdahl. Field Applications Engineer with Baker Hughes / Bently Nevada.

Conference 25

NEW PLYMOUTH, NZ

CALL FOR PAPERS

The VANZ conference is a place for learning and sharing

- **Have you ever had an experience that you think others would benefit from?**
- **Something that went right or wrong?**

We can all learn from our own experience, but we can avoid a lot of problems if we learn from other people too! That is what VANZ is all about.

If you could talk for just 15 minutes (or longer if you like), we would love to hear from you.

For more info,
please contact us at:
papers@vanz.org.nz

VANZ
VIBRATIONS ASSOCIATION *of* NEW ZEALAND

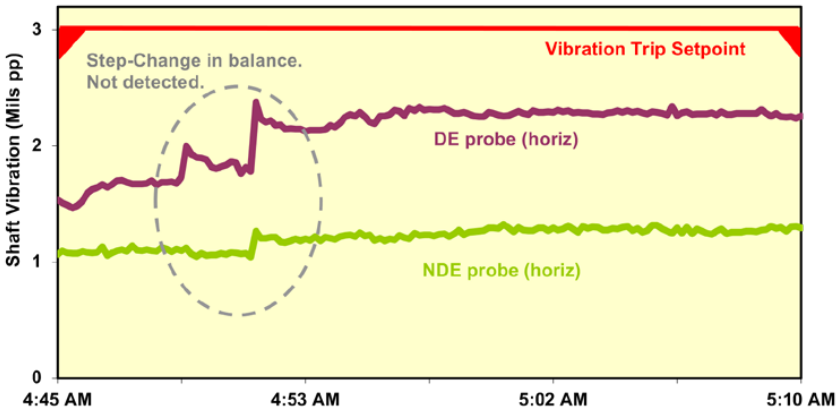


Fig. 1

Fig. 2

It is believed most of the significant damage was incurred while the compressor was operating, but it was only during a later start-up that the magnitude of the problem became clear.

Early warning of the failure, in this instance, would have provided up to a week for better maintenance planning, reducing total downtime by at least several days. As it was, spare parts had to be sourced overseas and flown in urgently, delaying repairs, however plant engineers believe that even a two day reduction in the forced shutdown would represent up to $500,000 in production benefits for the facility.

> **“It is believed most of the significant damage was incurred while the compressor was operating.”**

WHAT HAPPENED?

The characteristic vibration response of a centrifugal compressor is governed by machine design, assembly, and process conditions. If we consider just the direct vibration amplitude (which is what was monitored by the plant control system in this case study) then, at any given speed we will see a vibration response which is proportional to the excitation force (ie: unbalance), but as speed varies through startup and shutdown, we will see resonance amplification as the shaft speed passes through the “critical speed” frequencies.

When the rotor unbalance increases (due to loss of metal or build-up of carbon), the most significant increase will be seen at the critical speed range of the rotor. In the example shown, the unbalance increase is about 200%, not enough to trip the machine in service (or even raise an alarm) but causes the trip vibration amplitude to be exceeded during startup.

Unbalance vibration is typically sinusoidal motion, which we can represent by an amplitude and phase measurement as shown. (This base measurement is a combination of residual unbalance, rotor bow & measurement track error) In reality, the vibration signal is a more complex interaction of many different frequency waveforms, however it is common practice to separate the synchronous vibration component for unbalance analysis (this is typically the principal component)

We can also represent the unbalance vibration behaviour in graphical format in a “Polar Plot”, as shown in fig. 3.

Any change in the balance state of the rotor will cause a vector change which is additive to the initial vibration vector. The net vibration amplitude may increase, decrease or stay the same depending on the relative phase angle between the two vibration vectors.

HOW DO WE IDENTIFY UNBALANCE OR FOULING OF THE COMPRESSOR ?

Unbalance of the rotor, such as due to loss of metal, should result in a step-change in the vibration vector, while progressive fouling may lead to a more steadily changing vibration vector. In either case, a corresponding change in dynamic vibration behaviour and compressor performance will be observed.

The typical industry practice for machinery monitoring and protection is to set alert and trip levels based upon Direct (or overall) vibration amplitude. This is valid for machinery protection purposes because it relates directly to the physical clearances within the machine seals and bearings, but is too simplistic for accurate machinery condition monitoring.

For the purpose of monitoring machine condition and identifying changes in the balance state of the rotor, it is necessary to monitor the change in vibration, not only the

overall level. To do this, the recommended technique is known as “acceptance region” alarming. This can be implemented either within the machinery protection rack, or with on-line machinery monitoring software.

ACCEPTANCE REGION MONITORING

Acceptance region monitoring involves setting tight alarm levels around the baseline vibration vector to identify subtle changes in the machine’s behaviour.
The technique can be applied to closely monitor specific root-cause failure modes on critical equipment, including:

- Shaft Cracks in turbomachinery (1X and 2X vector monitoring)
- Alignment changes in pumps and hydro turbines (vane-passing frequency vector monitoring)
- Material build-up on process compressors (1X vector monitoring)
- Structural integrity changes (1X and 2X vector monitoring)

The best solution is to set a circular acceptance region (CAR) around the steady-state vibration vector. This will alert us if the amplitude of the change exceeds the radius of the acceptance region. CAR is the most advanced form of acceptance region monitoring and is available with many leading vibration monitors.

The basic acceptance region is an alternative to CAR, where we set alarms both on amplitude and phase angle. This method can be applied to both vibration monitors and condition monitoring software.

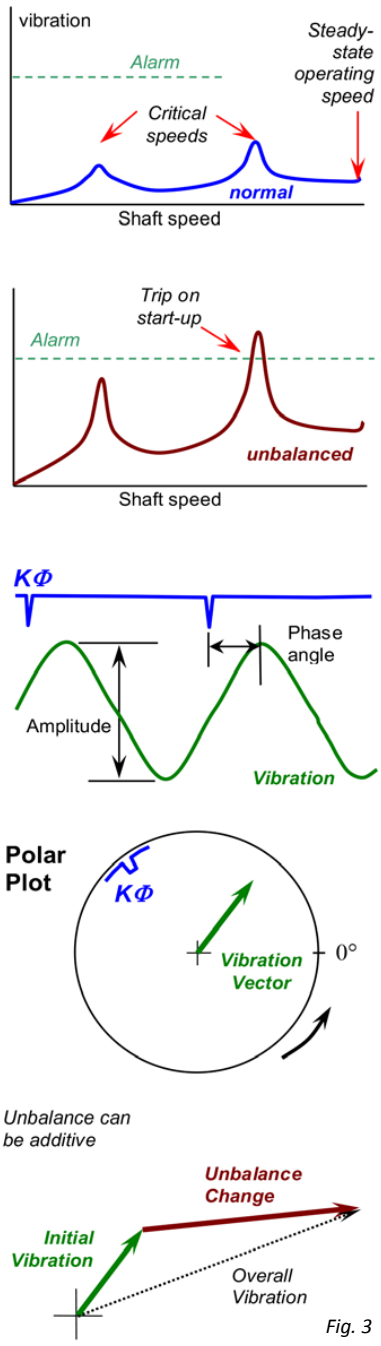


Fig. 3

The process of setting the acceptance region alarm involves firstly establishing the normal operating vibration behaviour (baseline) for the measurement point and setting the alarm boundaries to avoid “nuisance alarms”, but still be sensitive enough to identify changes in machine condition. These alarms would normally be suppressed when the machine is not at steady operating speed conditions.

Initial Acceptance region alarm settings should be based upon the available baseline data (4 to 6 weeks is best) and allow for 30% below minimum amplitude and 30% above maximum amplitude, and +/- 30 degrees of phase angle. After several months of operation, the alarm settings can be reviewed and optimized.

RECOMMENDATIONS

In this instance, the protection system was a Bently Nevada 3500 series monitor, with a primary role of machinery protection, but also with onboard monitoring and analysis functionality which was not being leveraged by the end-user. It was apparent there was good potential to exploit the inherent functionality of the existing system as a simple and cost effective approach to machinery management.

Machinery diagnostic engineers recommended that the 3500 machinery protection system be configured for acceptance region alarming. This would not interfere with the protection functionality prescribed by the equipment OEM but will enable “early warning” of a change in rotor dynamics due to gradual change in balance through mass build-up, or step-change due to loss of metal. It was also suggested to configure the tachometer monitor to warn of surge related speed changes, possibly a root-cause factor with the condensate carry-over problem.
The implementation is simplified as all monitored parameters are transmitted via Modbus to the plant control system for monitoring, trending and alarming. The Modbus register is completely customizable, so incorporating the new monitoring parameters requires only a small engineering input.

The following steps where recommended for optimisation of the monitoring system:

1. Identification of baseline steady-state behaviour. This could be based upon test data using the customer’s portable test & measurement instrumentation. Alternatively, the 1X amplitude and phase values can be sent to the control system via Modbus for trending and evaluation.
2. Setting Acceptance Region monitoring parameters. The following page illustrates the configuration fields that would be modified.
3. Additional Modbus Registers to be mapped to the plant control system to raise alert notification of Acceptance Region violation and for monitoring of the basic acceptance region parameters (1X amplitude and phase at drive-end and non-drive-end bearings, both X and Y probes)

Continued over page >

4. Writing Operating Procedures / Updating Maintenance Management Plan. The implementation of the acceptance region is not a once-off task as the set-points should be regularly reviewed and adjusted to maintain an effective monitoring program. The operating procedure should specify:
   (i) The agreed method for selecting initial alarm setpoints,
   (ii) The agreed timeframe for review and continued optimization,
   (iii) The current actual acceptance region alarm setpoints,
   (iv) Operator response to alarm indication.

LONG-TERM MACHINERY MANAGEMENT SOLUTION

The optimisation of the existing machinery protection system, as described above was recommended as the best-practice first line of defence against future production impact from impellor failure. Engineers also recommended a longer term, comprehensive machinery management solution using the Bently Nevada System 1 platform, which communicates directly with the protection rack.

The key advantage of System 1 in this case is the correlation of compressor performance measurement (efficiency) with mechanical integrity measurement (vibration change).

System1 Decision Support would look for a corresponding change in performance when vibration changes are seen, thus identifying the true compressor condition with confidence. This would enable better maintenance planning, less surprises when the casing is opened, and therefore days or weeks of production savings when a problem does occur. An additional benefit of introducing advanced condition monitoring with real-time compressor performance analysis is in tracking the compressor stability and operation relative to surge point. This may be a valuable tool in managing the process to minimize the opportunity of condensate carry-over.

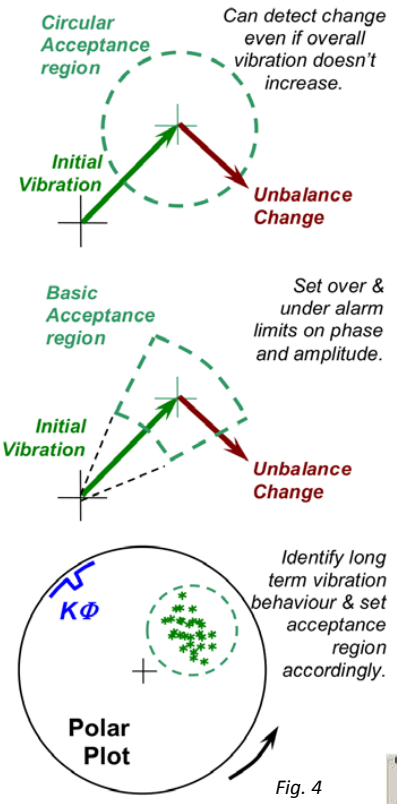


Fig. 4

SUMMARY

Modern machinery protection systems have tremendous in-built diagnostic and machinery management functionality which is often not fully utilized. This example has shown how those features may be effectively employed for a cost-effective, yet technically advanced, machinery management solution. ■

Below: Extracts from Config SW, showing how easy it is to configure acceptance regions in the 3500 system.

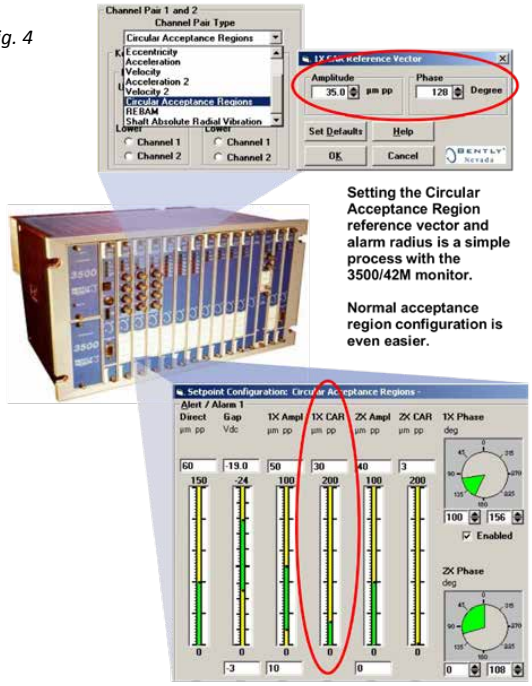


Fig. 5

BAL-200® Bearing Assembly Lubricant Protects Parts During Assembly and Maintenance Cycles

Balance, align and lift your fans, bearings, generators and turbine motors with BAL-200® bearing assembly lubricant. BAL-200 provides lift for the parts and works for any rotor or bearing that requires maintenance, which ensures smooth and effortless rotation during assembly or maintenance. Apply as needed to coat the shaft and surface. It is translucent in use, making it easy to visually inspect parts during maintenance. BAL-200 is fully compatible with most industrial oils and turbine oils; there is no cross-contamination risk, and it will not change the performance characteristics of the oils.

Beneficial Qualities

Perfect for Maintenance Cycles

- Works with any bearing, fan, generator or turbine rotor that requires maintenance
- Creates lift and cushions metal from shock loading
- Reduces metal-to-metal contact during assembly or maintenance

Tacky & Compatible

- Is extremely tacky and clings tenaciously to metal surfaces
- Compatible with most industrial and turbine oils* Safe & Easy
- Appears translucent in use, allowing visual inspection of the parts being maintained
- Should be applied generously as needed to coat shaft surfaces

LUBRICATION ENGINEERS
New Zealand - 09 415 9411 - info@lubengnz.co.nz
"Cutting costs for industry through performance and service - Guaranteed"
www.lubricationengineers.co.nz

FEATURE

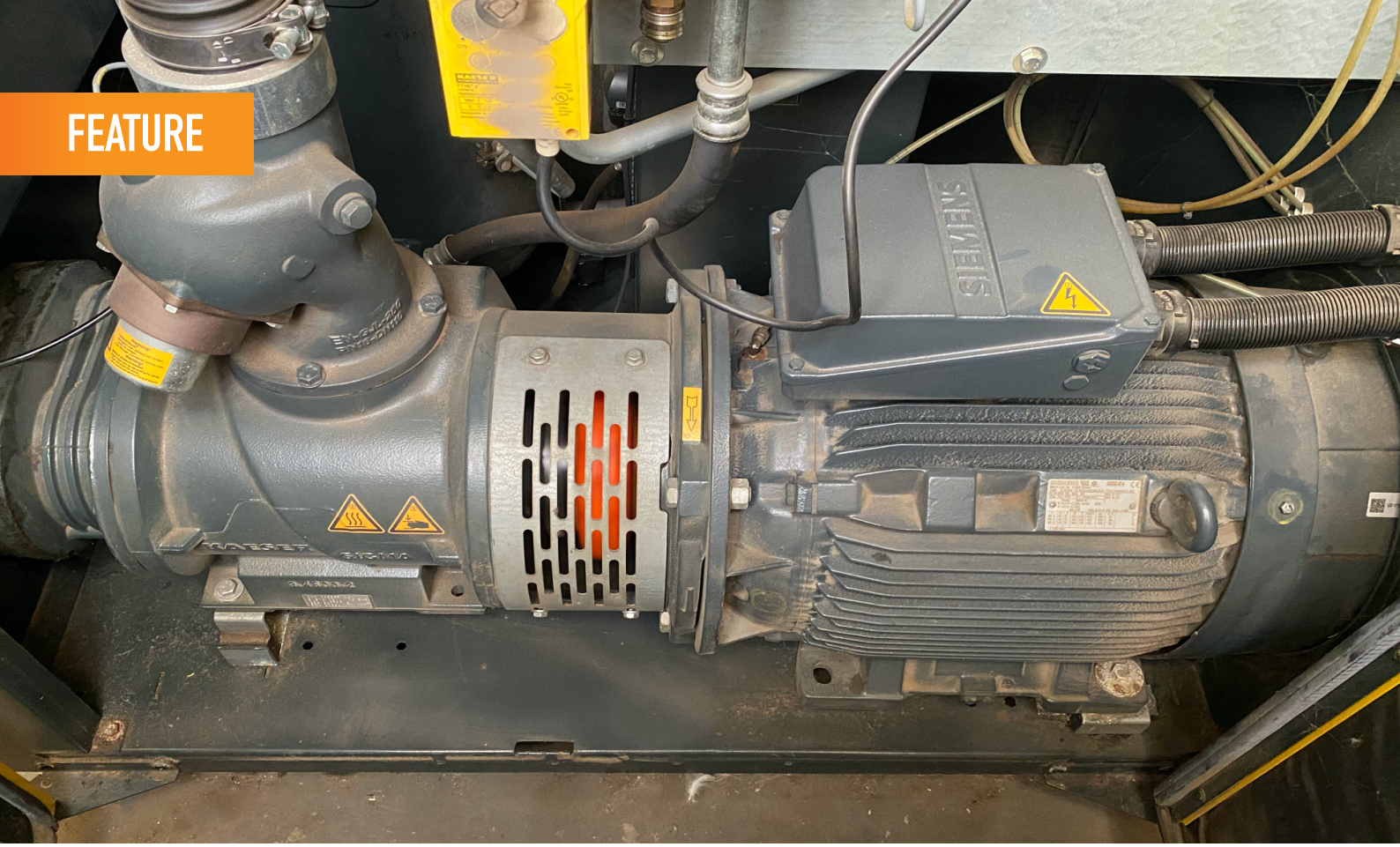


Fig.1 The patient.

Using your eyes and ears when examining a machine

This short case study is an example of the importance of using all the senses when examining a machine. One of the advantages we have in our line of work is that machines don't lie.

Above (fig.1) is the patient in question, a simple Kaeser BSD83 Air Compressor – 45 kW 2 pole drive motor DOL (fixed speed). There is no gearbox here. This unit, along with its identical neighbour, is are included in a regular monthly monitoring program. Each test is carried out at load, for data consistency. Some of you may recognise the familiar orange coupling in this photo – watch this space!!

So, the routine test procedure involves accessing the compressor unit via the enclosure door. The package designers were kind and clever enough to ensure that opening the door doesn't trip the machine (no sneaky micro-switches) or interfere with the cooling/ventilation system. Other package designers (and I've run into a few...) ensure that a round of doughnuts is required to make up for the unintended shutdown....a lesson learned after the first time.

Now, I've never been a fan of the these couplings for in this type of application, and this experience has not altered this, as you will see. This coupling is fine for certain applications, particularly where a "break-away" function can be useful to prevent consequential damages in the event of a sudden stop of rotation of one component (I'm sure you can all think of situations). But this style of coupling, I believe, is less suitable for high-speed or precision requirements, and also, the torque across the coupling at load tends to introduce an axial load that the machine components may not cope with (I've had a very scary event years ago, from this). I'll leave it there...

Moving to the situation at hand. On one occasion earlier this year (1/2/24), when I opened the enclosure,

Continued over page >

Article prepared by Ian van der Sar.

APPLIED
Industrial Technologies

RELIABILITY SOLUTIONS

OFFLINE AND ONLINE MONITORING

New modern and advanced SKF hardware and software for offline and online machine monitoring

1 ONLINE
SOLUTIONS FOR MONITORING

- o Permanent sensor installation
- o 24h machine monitoring
- o Remote analysis and report
- o Designed for machine learning
- o Integration to industry 4.0
- o Automatic notifications
- o Wired and wireless solution

SKF IMx-1 WIRELESS

SKF IMx-8/16 WIRED

ABB SMART SENSOR WIRELESS

DODGE OPTFY WIRELESS

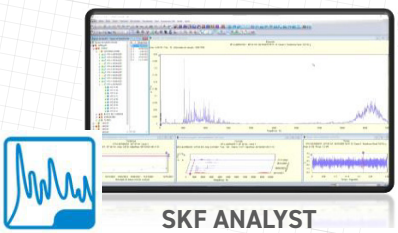
SKF OBSERVER

2 OFFLINE
SOLUTIONS FOR MONITORING

- o Portable instruments
- o Travel time
- o Site visit
- o Data collecting
- o Analysis and report
- o Monthly surveys in most cases

SKF QUICK COLLECT SENSOR

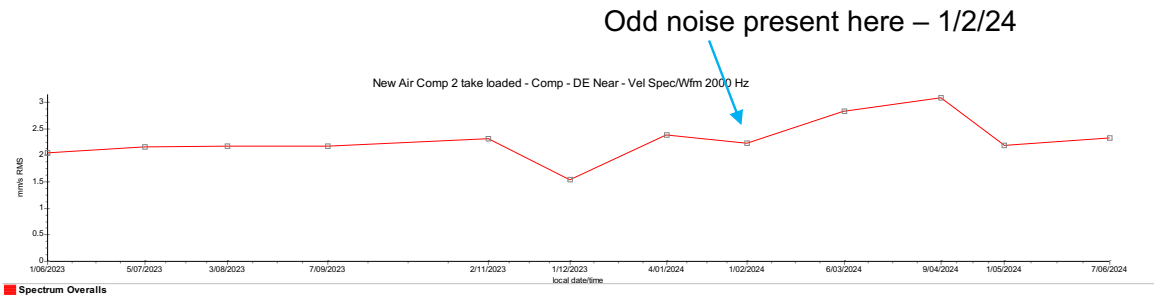
SKF MICROLOG



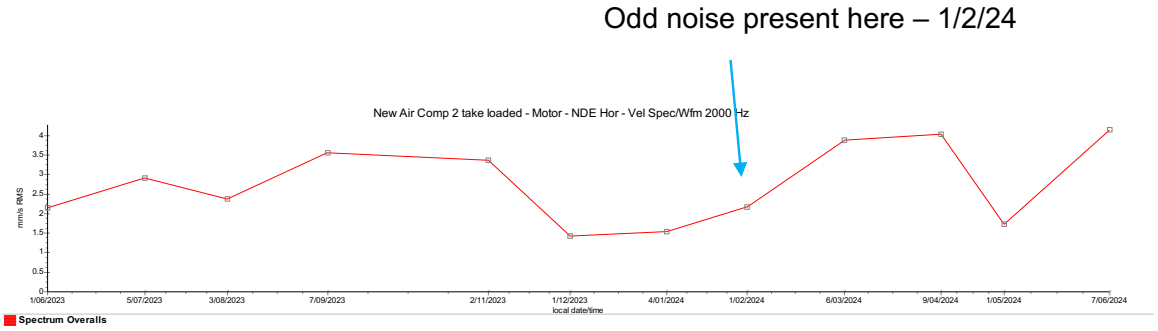
SKF ANALYST

SCAN THE QR CODE & CONNECT WITH US!

VISIT **APPLIEDNZ.CO.NZ**



Compressor DE – velocity trend *Fig.2*



Motor NDE – velocity trend *Fig.3*

I heard an unusual noise. Many of you will know what this is like – a moment of excitement when there's something extra to look for!

So, moving through all the routine data collection on the machine, looking for that "jump" in high or low frequency measurements, but nothing! In the overall measurements, all seemed normal, but the noise remained. And it stayed, regardless of on or off load. For those interested, here are the data collection specs for the routine measurements:

Motor – radial NDE and DE

- Velocity Spectrum/Time Waveform to 2 kHz – 3200 lines.
- Enveloped Acceleration - Spectrum/Time Waveform to 1 kHz – 1600 lines – 2kHz – 10 kHz bandpass.
- Enveloped Acceleration - Spectrum/Time Waveform to 250 Hz – 1600 lines – 500Hz – 2.5 kHz bandpass. (legacy measurement from a previous machine/model)
- Raw Acceleration - Spectrum/Time Waveform to 5 kHz – 6400 lines.

Motor – axial DE

- Velocity Spectrum only to 500 Hz – 800 lines.

Compressor – 4 locations

- Velocity Spectrum/Time Waveform to 2 kHz – 3200 lines.
- Velocity Spectrum/Time Waveform to 200 Hz – 800 lines.
- Enveloped Acceleration - Spectrum/Time Waveform to 1 kHz – 1600 lines – 2kHz – 10 kHz bandpass.
- Enveloped Acceleration - Spectrum/Time Waveform to 250 Hz – 1600 lines – 500Hz – 2.5 kHz bandpass. (legacy measurement from a previous machine/model)
- Raw Acceleration - Spectrum/Time Waveform to 5 kHz – 6400 lines.

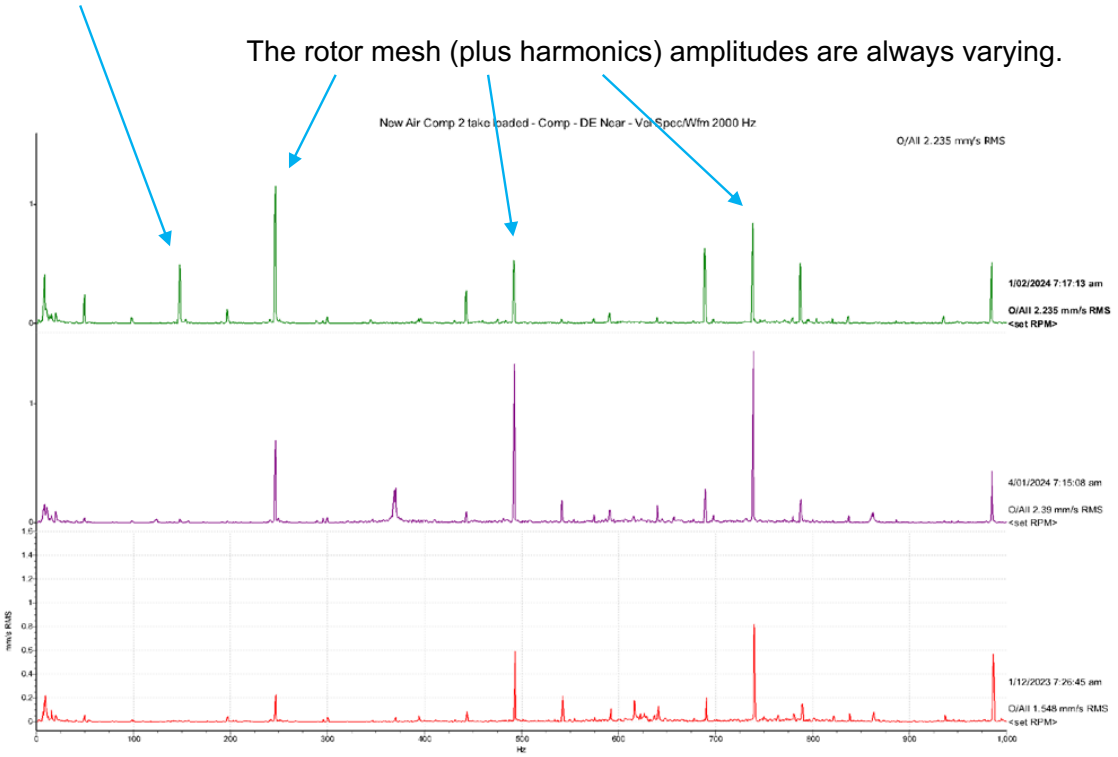
The above specs seem to provide me with the necessary data that I can then quickly flick through without wasting time zooming in on the lower areas of spectra in the waterfall plot.

Having made a note in my notebook (yes, its an old but reliable way….notebooks never need "updates" and they never get a flat battery…) I then moved on with the rest of the day, making no mention to the client of the odd noise. Come analysis time, we have the measurements above, beginning with the velocity trend leading up to the measurement date in question. Note the lack of any significant change here, even though there was actually a developing problem here.

So, instead of relying on the trends to give an early warning, this is a reminder to take the advice of Clyde Volpe, who I remember said many years ago, "if a client pays you to take data, at least have a good look at it…" Having shown no change in the velocity trends then, lets "have a good look at it" then….

Opposite (fig.4) is the compressor drive end spectral stack for the three measurements leading up to "the noise" – the upper most trace is for the date in question. The only variation – the 3x motor speed component – increased from 0.03 mm/s to 0.5 mm/s – hardly riveting stuff.

Similar results were seen at all machine locations on the date in question. Having seen these changes, the temptation is to launch full noise into looking into what could possibly cause a 3x increase, even at such low amplitudes.



Compressor Input – velocity spectral stack

Fig.4

When reporting to the client, I've always preferred to mention the noise and very subtle changes in vibration, while suggesting no further action and "see how this looks again next time", along with the usual "have an occasional look/listen till the next test", something that is usually ignored….

I didn't spend a great deal of time trying to figure out the 3x, thinking it'll show me something more next time.
The next time, a month later (6/3/24), came around and I was looking forward to seeing the developments. The pre-test briefing with the client confirmed no investigative action and no inspection had occurred since the previous test.

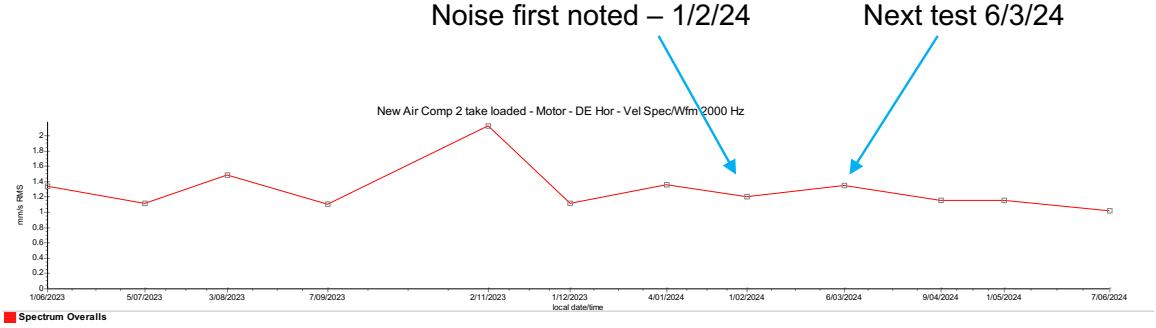
Still the same noise, which seemed to be worse, and still no change in the velocity overalls anywhere. Below (fig. 5) is the typical velocity trend, with the dates noted.

At this point, I thought we should take a closer look and grabbed the very handy strobe light, to check out the coupling. It was the only exposed machine item (through the mesh guard) we could check, so I thought, "what the heck – have a look" even though I couldn't even hypothesise how a failing coupling of this style could produce a 3x. Well, looky here! And what did we have? Check out the photo (fig. 6) taken out of a video I made of the strobe light inspection.

So, even with a large chunk of the coupling about to part company with the mother-ship, there was virtually no change in the machine 1x, in fact, in some locations the 1x actually increased following coupling replacement – see spectral stack on next page (fig.7) - the centre trace being that of the actual measurement while a sizeable section of the coupling element was about to become momentarily airborne.

1x increased from 0.14 mm/s to 0.4 mm/s after coupling element replacement.

Continued over page >



Motor DE – velocity trend

Fig.5

The bottom trend (fig. 8) similarly shows no change in velocity with the new coupling element. With the evidence here, the only hypothesis I have is that the failing coupling was somehow producing the “giveaway” noise but was not able to produce a 1x vibration change to otherwise announce its presence.

A bit more context and history here. These air compressors (2 off) were initially delivered new a few years ago with the black-coloured coupling element, and the client asked me for my opinion of the compressor packages. I said “great, apart from the couplings”…, and explained why. And within three years from new, the black coupling element failed – a whole chunk came off – even after I suggested an inspection which was not carried out. So this later failure, detailed here, is the second failure, with the second element lasting less than a year.

So, the relevant message here is three-fold:

- Have a good look at all the data taken – the client (hopefully) pays you for this.
- Don’t rely only on overall alarms to take the place of analysis work. And pay attention to what your senses are telling you – they’re usually right! ■

Fig.6

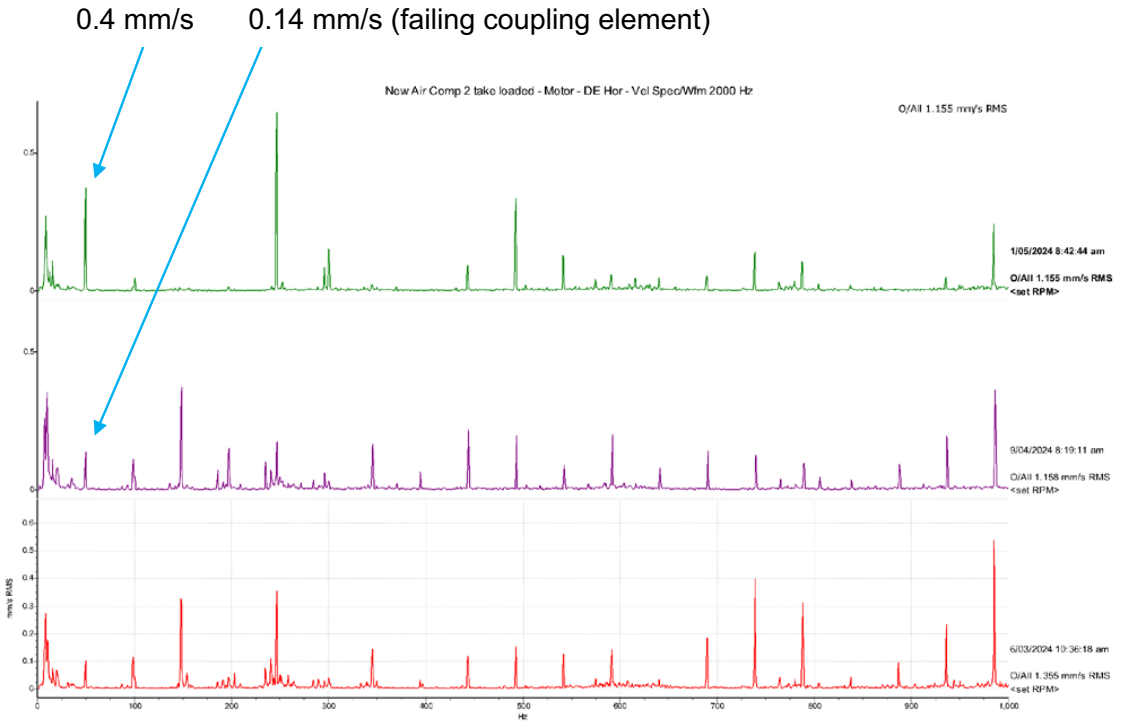
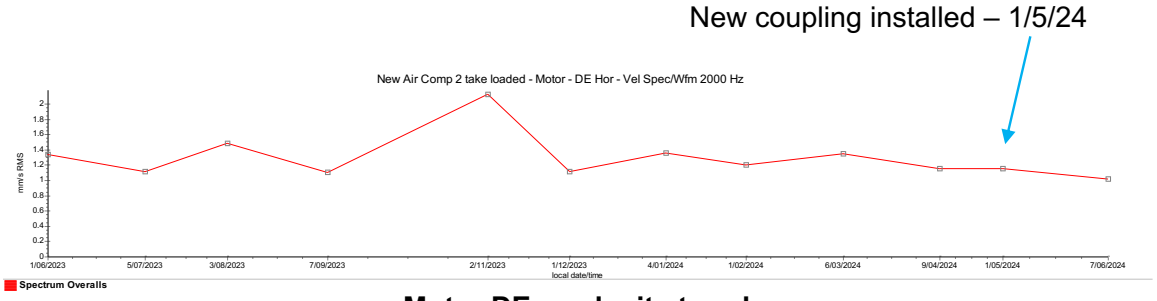


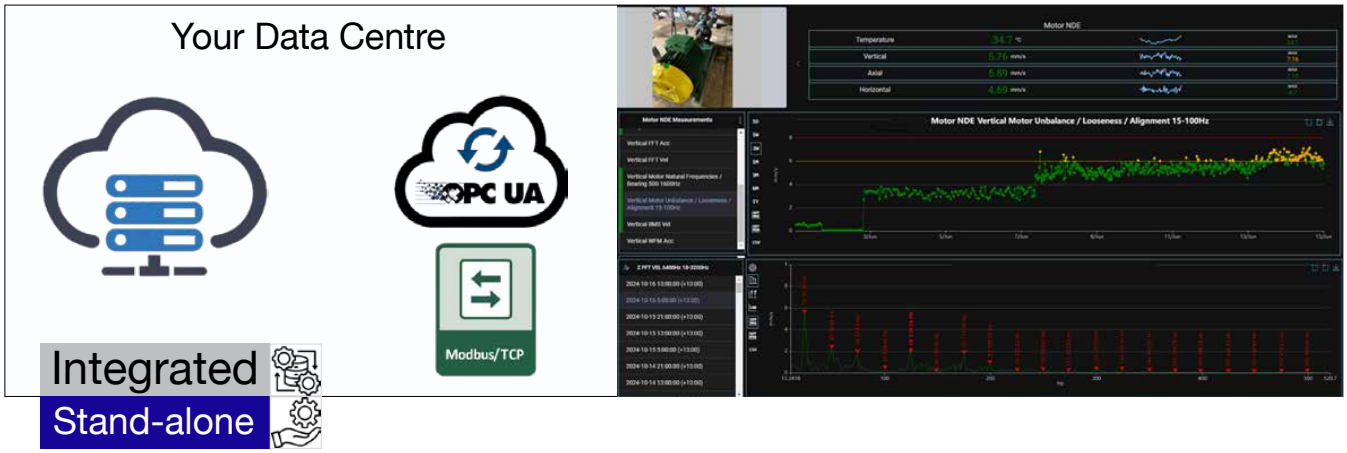
Fig.7



Motor DE – velocity trend

Fig.8

The Complete Wireless Solution for Machine Predictive Maintenance



Agen System

- ✓ Install in minutes
- ✓ Operate on standard Wi-Fi
- ✓ Up to 5 years battery life | Direct power option
- ✓ Web HTML browser interface | No software install
- ✓ Email alarms
- ✓ Assists predictive maintenance
- ✓ SaaS | Lease | CapEx/OpEx models
- ✓ Cost effective | Compelling ROI
- ✓ Stand alone, or fully integrated
- ✓ Intrinsically Safe — ATEX Ex certified
- ✓ NZ designed, manufactured and supported

Your sensors (ICP® or 4-20mA Vibration Sensors or Proximity Probes)

Your assets

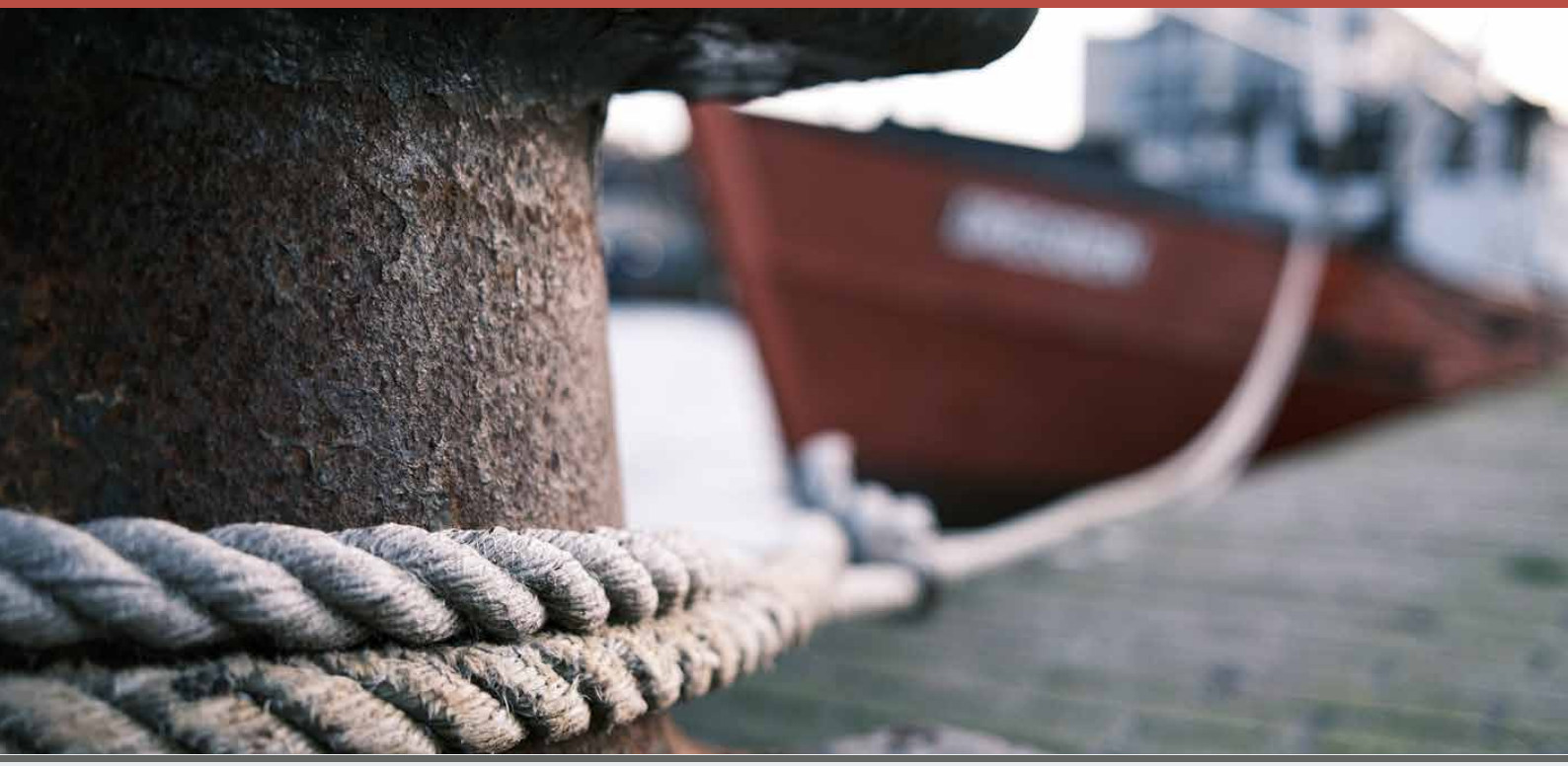
Agen Limited
8/2 Barry Hogan Place, Riccarton,
Christchurch 8041 New Zealand

www.agen.co.nz
contact@agen.co.nz
Ph: 03 930 0840

CarltonTechnology
• vibration • noise • reliability / engineering support

Carlton Technology Ltd
PO Box 18046, Merrilands, New Plymouth 4360
Ph: 64 6 759 1134 • Fax: 64 6 759 1184
Email: ctownsend@xtra.co.nz

TEST YOUR KNOWLEDGE - PART 77 OF A SERIES



1 The maximum bollard pull of a harbour tug can depend on the power and efficiency of its propulsion system. To check it, a wire rope (tow line) of uniform mass was anchored from a bollard on the wharf at one end, and the winch aboard the tug at the other end. By "plucking" the cable and measuring the frequency response, the vibration analyst was able to calculate the tension in the cable (i.e. the bollard pull). What factors would he/she need in order to calculate the tension?

A. The mass of the cable
B. The length of the cable between the anchoring points
C. The diameter of the cable
D. Both A and B

2 A bias voltage checker is used to test the condition of an ICP accelerometer and its cabling. If the result is zero volts, what might this indicate?

A. A short circuit in the cabling
B. An open circuit in the cabling
C. A short circuit in the transducer
D. Could be A and/or C

3 You notice that harmonics of gearmeshing frequency are starting to emerge over time. What might this indicate?

A. General wear in the gear teeth
B. A chipped gear tooth
C. Either the driver or the driven gear shaft has become bent
D. None of the above

4 An air compressor is tripping on high motor current, but it does this randomly and the cause is a mystery. You set up your spectrum analyser to capture the high-current events using a clip-on ammeter on one of the phases. You have selected a time-waveform set-up with level triggering so you see the last few seconds of current behaviour before the level trip. Which of the following pre-trigger percentages would be most suitable for this application?

A. 10 %
B. 50 %
C. 90 %
D. The choice of pre-trigger percentage is irrelevant

5 A residual balance check is conducted on a rigid rotor by attaching a known balance weight (one at a time) into each of 12 evenly spaced holes on a PCD, and measuring the vibration amplitude on your shop balancing machine for each position. The chosen weight is approximately 5 x the expected residual unbalance. This process is conducted on both ends of the rotor. When the results of vibration (y axis) v/s hole position (x axis) are plotted, what shape would you expect to see for each end of the rotor? Assume there is some residual unbalance in the rotor.

A. A sinusoidal pattern with one full cycle
B. A sinusoidal pattern with 2 full cycles
C. A saw-tooth pattern
D. A flat line

6 A fan that runs at a fixed speed (i.e. no VSD fitted) is vibrating strongly and the vibration is at 1 x the speed of the fan shaft. This might be due to the impeller being unbalanced, but it could be due to the fan running in resonance. What might make you suspect that resonance could be a factor?

A. The ratio of vibration between horizontal and vertical (or vice-versa) is high (e.g. greater than 4 to 1)
B. The comparison of the phases between horizontal and vertical is nowhere near 90 degrees
C. The vibration levels drop almost instantly when the power is turned off and the fan runs down smoothly through the speed range
D. Any or all of the above could indicate that resonance could be a factor

7 You are setting up a measurement point in your analyser. You have chosen the units to be g's of acceleration. If you are using an accelerometer with a sensitivity of 10 mV/ g, and your analyser asks you to enter the sensitivity in V/EU (EU = engineering unit), which of the following should you enter?

A. 0.001
B. 0.01
C. 0.1
D. 10

8 The accelerometer cable that comes with your instrument has a polyurethane jacket. What is the likely maximum temperature that you can expose this cable to?

A. 20 degrees C
B. 120 degrees C
C. 220 degrees C
D. 320 degrees C

9 In theory, if a centre-hung rotor has a couple unbalance, what will the radial phase relationship be between the supporting bearings?

A. 0 degrees
B. 90 degrees
C. 180 degrees
D. 270 degrees

10 The 2025 VANZ conference will be held in which city?

A. New Plymouth
B. Auckland
C. Christchurch
D. Invercargill

Check your answers on page 28 >

TEST YOUR KNOWLEDGE

Further enquiries can be directed to: Carl Townsend at Carlton Technology Ltd.
Phone: 64-6-759 1134 | Email: ctownsend@xtra.co.nz | Address: P.O. Box 18046 Merrilands, New Plymouth 4360, NZ

PUZZLE CORNER

Solutions on page 28

WORD BUILDER

How many words of **three or more** letters can you make using the six letters below? You can only use each letter once. Plurals are allowed, but no foreign words or words beginning with a capital.

Word scores expected...

50 - Good | 60 - Very Good | 70+ - Excellent

I	R	P	T	E	A

There is two 6 letter words in this puzzle.

There's 76 possible three or more letter words to find.

WORD LADDER

A Word Ladder has two words in the ladder, one at the top and one at the bottom. You must form a sequence of words going down. On every step of the ladder (1-6), you must unscramble and create a new word that only differs by one letter from the word above it until you reach the destination word on line 6.

Dry to Wet...

1. PLANT
2.
3.
4.
5.
6. SPADE

SUDOKU

To solve, each number from 1 to 9 must appear once in:

- **Each of the nine vertical columns**
- **Each of the nine horizontal rows**
- **Each of the nine 3 x 3 boxes**

No number can be repeated twice in a box, row or column. **We've started it off for you...**

55.3% of puzzlers can solve this. Can you?

Puzzle difficulty: **Hard**

		7	1		5		6	
5			2			1	3	
							9	
7			3			2	5	
								6
	8			4				
			6					7
1								9
		4		3		6	1	

Improve your motor condition monitoring regime with Adash Motor Vibration Analyzers

Proudly bought to you by
AVO New Zealand

- Full range – for all technical levels, applications and budgets
- Plan predicative maintenance rather than suffering costly shutdowns
- Vibration Analysis made easy with built in FASIT mode (fault source identification)
- 5 Year Warranty!
- Models ex-stock now at AVO New Zealand

Adash

AVO®

0800 485 990

avo.co.nz

Spectrum

The official journal of the Vibrations Association of New Zealand (VANZ)

Our quarterly magazine includes:

- Papers from conference reprinted
- Conference information
- Articles and reports from industry leaders
- Presidents report
- Notices
- Committee reports
- Interactive activities *and much more..*

SAVE UP TO $200 ON ADVERTISING BOOK TODAY!

VANZ
VIBRATIONS ASSOCIATION *of* NEW ZEALAND

Advertising Rates

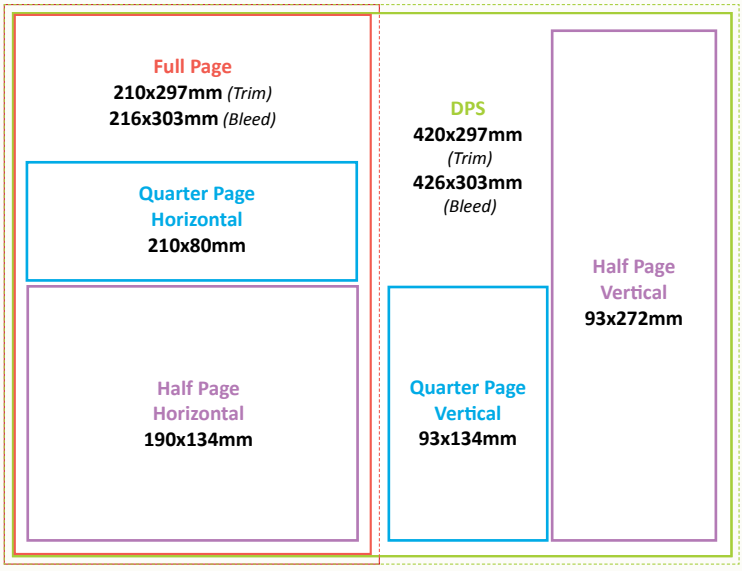
DPS	Full Page	Half Page	Quarter Page	Advertorial
Size *(width x height):* 420x297mm *(Trim)* 426x303mm *(Bleed)*	Size *(width x height):* 210x297mm *(Trim)* 216x303mm *(Bleed)*	Size *(width x height):* 190x134mm *(Horz)* 93x272mm *(Vert)*	Size *(width x height):* 190x80mm *(Horz)* 93x134mm *(Vert)*	$100 per page or 50% discount if bought in conjunction with a full page colour advert.
Single issue rate: **$615+GST**	Single issue rate: **$395+GST**	Single issue rate: **$330+GST**	Single issue rate: **$275+GST**	
4-issue (1 year) rate: **$550+GST**	4-issue (1 year) rate: **$355+GST**	4-issue (1 year) rate: **$295+GST**	4-issue (1 year) rate: **$250+GST**	

The small print...

How to supply an advert:
All advertising copy to be supplied in high-res PDF format at the correct size required. Files to be supplied press ready at 300dpi with 3mm bleed for full page and DPS advertisements. The special 4-issue rates are for advertising in 4 consecutive issues. i.e. Issue 111, 112, 113 and 114.
Save up to $200 on your advertising in Spectrum!
Email Angie at **spectrumeditor@vanz.org.nz** to confirm your advert(s) and method of payment as soon as possible.

Publishing:
Each SPECTRUM will be distributed as an epub document and available for download and printing by VANZ members. Previous issues will become available on the public domain.

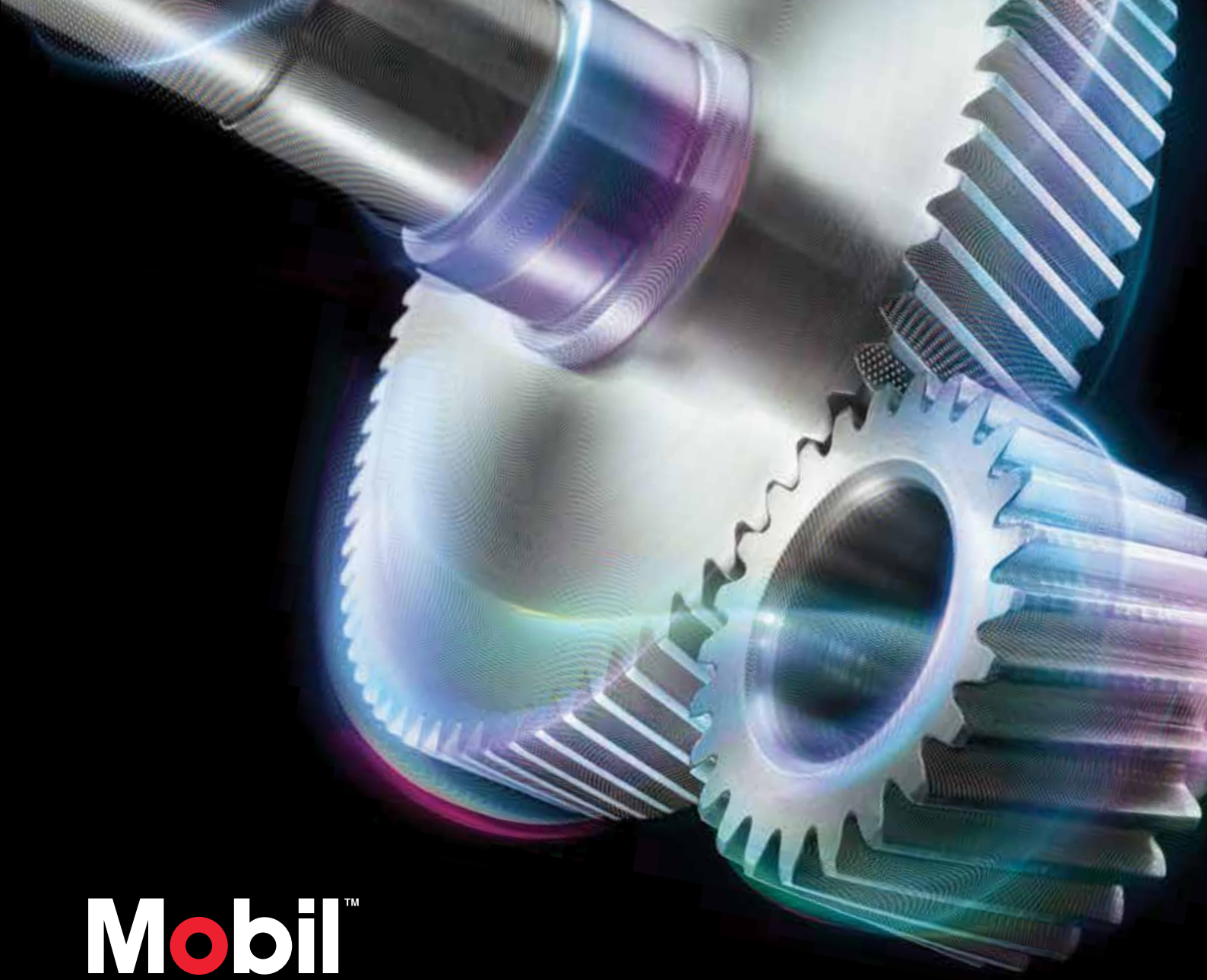
Article submissions:
Articles for upcoming issues of Spectrum are welcomed by the editor. Copy to be supplied preferably in Microsoft Word, but PDF file format is also acceptable.
Please email **spectrumeditor@vanz.org.nz** with your submission or should you require further information.



Carlton Technology Quiz 77: 1D, 2D, 3A, 4C, 5A, 6D, 7B, 8B, 9C, 10A

Word Builder: pirate, pratie

Word Ladder: 1. plant 2. plane 3. plate 4. slate 5. spate 6. spade



Mobil™

Maintain peak performance of your gearboxes.

Your gearboxes face demanding environments. That's why we've developed the **Mobil SHC™ 600** Series to provide:

- Superior equipment protection across varying temperatures.
- Extended oil life to minimise maintenance and replacement expenses.
- Lower power consumption to help cut operational costs.

Allied Petroleum

New Zealand's Authorised Distributor of Mobil Lubricants

sales@alliedpetroleum.co.nz | alliedpetroleum.co.nz | 0800 383 566

Phantom Wireless Vibration & Temperature Sensors

NVMS

NVMS are Leaders in Wireless Machine Surveillance with low power consumption, low latency and powerful data processing at the source.

Mount Anywhere

Designed to be compatible with any rotating machine. Its compact dimensions ensure easy installation in the most unique environments.

Environmental Protection

With IP69 protection, the Phantom G3 Wireless Triaxial Accelerometer allows your sensor to be exposed in the most demanding environments.

Replacable Battery

Long lasting and replaceable battery for long-term use, the third-generation Phantom is designed in accordance with the highest quality standards.

ben.heywood@nvms.co.nz

Powered By ERBESSD INSTRUMENTS