



49TH TURBOMACHINERY & 36TH PUMP SYMPOSIA

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TEXAS A&M
UNIVERSITY



TURBOMACHINERY LABORATORY
TEXAS A&M ENGINEERING EXPERIMENT STATION

DEVELOPMENT OF ROTOR CONTACT DETECTING SYSTEM FOR DRY SCREW COMPRESSOR

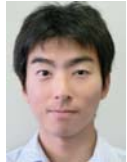
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KOBELCO
KOBELCO
KOBELCO STEEL GROUP

Presenter/Author Bios



Shugo Takaki is a Mechanical Engineering Manager of Screw Compressor Section in the Rotating Machinery Engineering Department for Compressor Division of Kobe Steel, Ltd. (KOBELCO), in Takasago, Japan. He has been involved in engineering and product development works for screw compressors for over 10 years. His current duties are mainly focused on detailed engineering and development of screw compressors. Mr. Takaki has a BS degree in Mechanical Engineering from Nagoya University.



Kaname Araki is a Senior Researcher of the Instrumentation Technology Research Section for the Production Systems Research Laboratory of the Technical Development Group of Kobe Steel, Ltd. (KOBELCO), in Kobe, Japan. He is a specialist of instrumentation technology, signal processing and mechatronics. He has 8 years of experience with research for screw compressors and other industrial machinery. Mr. Araki has a BS and MS degree in Mechanical Engineering from Osaka University.



Masato Hayashi is a Mechanical Design Engineer of Screw Compressor Section in the Rotating Machinery Engineering Department for Compressor Division of Kobe Steel, Ltd. (KOBELCO), in Takasago, Japan. He has been involved in engineering and product development works for screw compressors since 2014. His current duties are mainly focused on detailed engineering and development of screw compressors. Mr. Hayashi has a BS and MS degree in Mechanical Engineering from Kyoto University.

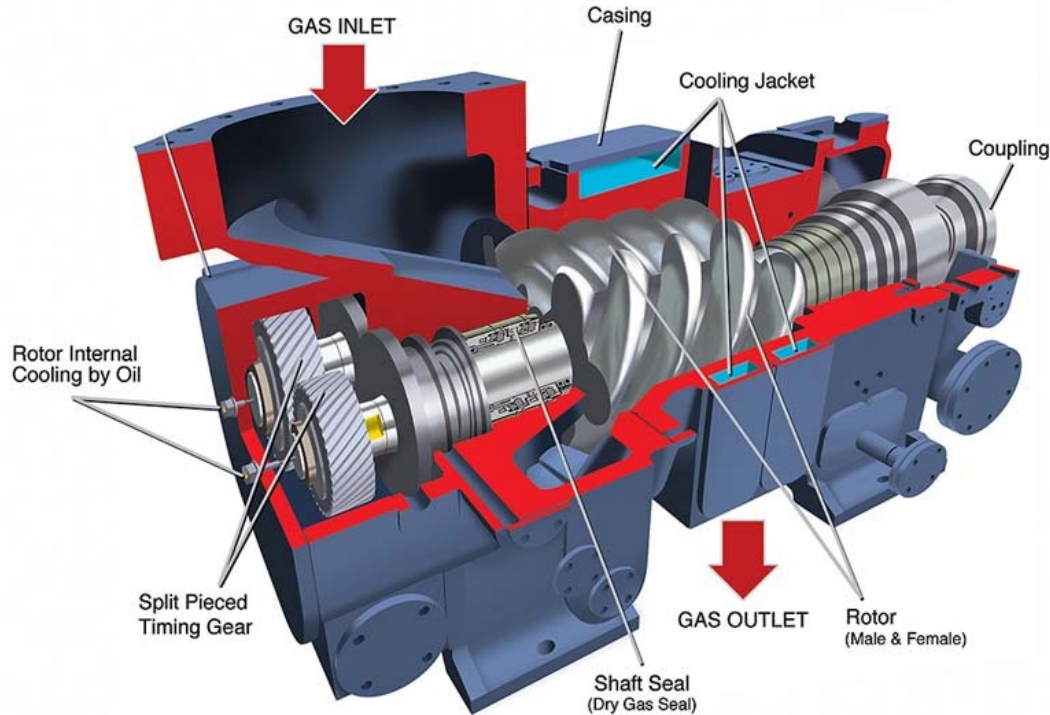
ABSTRACT

DRY screw compressors have the characteristics of a positive displacement type rotary compressor, are used in a wide range of applications.

DRY screw compressors are often treated as one of the important equipment in plants. Therefore, various monitoring devices for detecting abnormality are installed to the compressor. On the other hand, rotor contact is one of the typical failure modes for DRY screw compressors, the technology for detecting it rapidly and accurately is limited to the auscultation rod diagnosis by a skilled operator.

This paper focuses on this rotor contact of DRY screw compressors, introduces its mechanism and newly developed early detection technology with the experimental results at the OEM factory.

Background - What's DRY Screw Compressor?



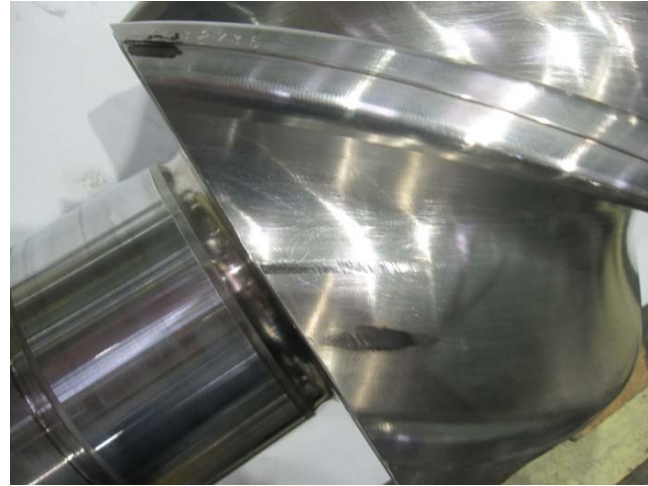
Screw Rotors

Structure of DRY Screw Compressor

Background - Rotor Contact Phenomena



case-1 Serious damage



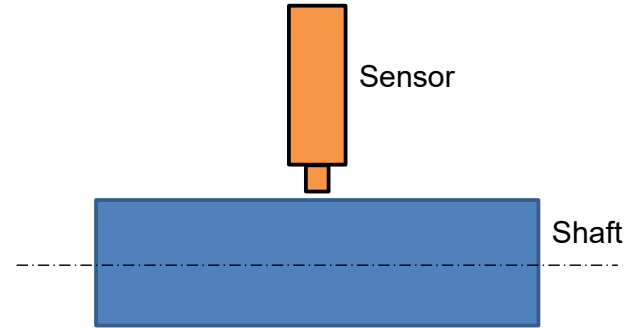
case-2 Slight damage

Early detecting is important!

Background - Rotor Contact Detecting Method (Conventional)

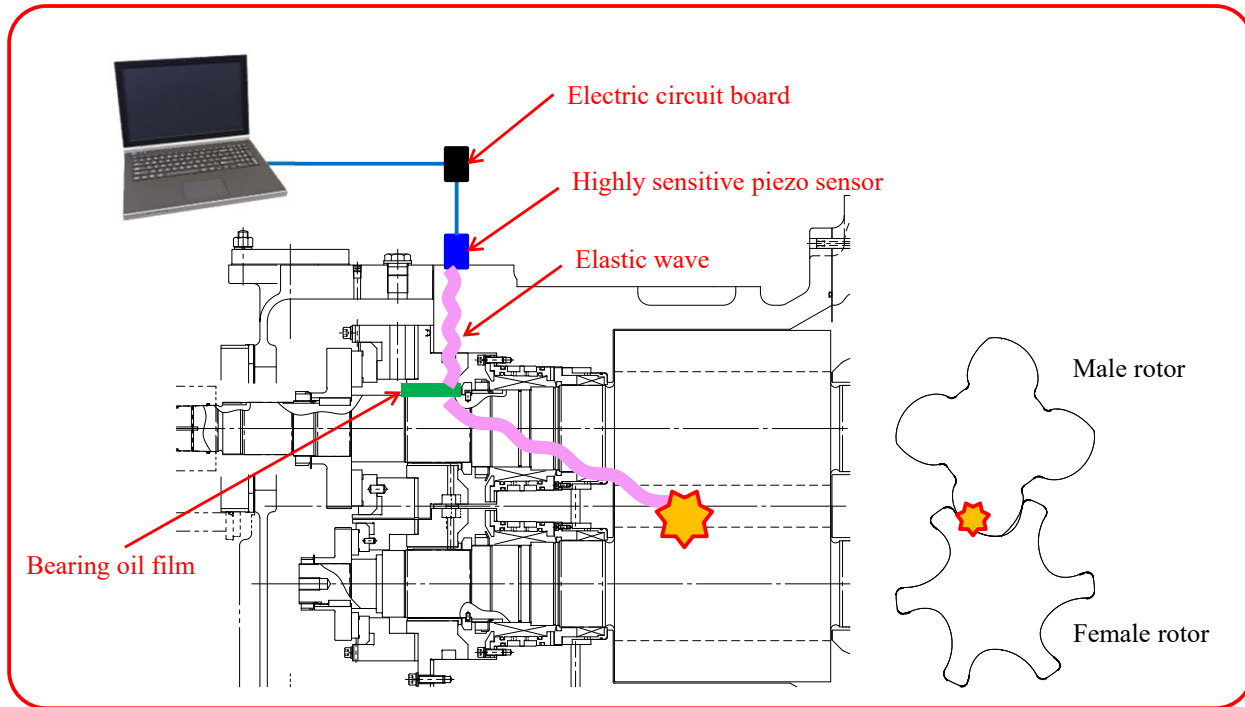


Auscultation Rod Diagnosis for Machine

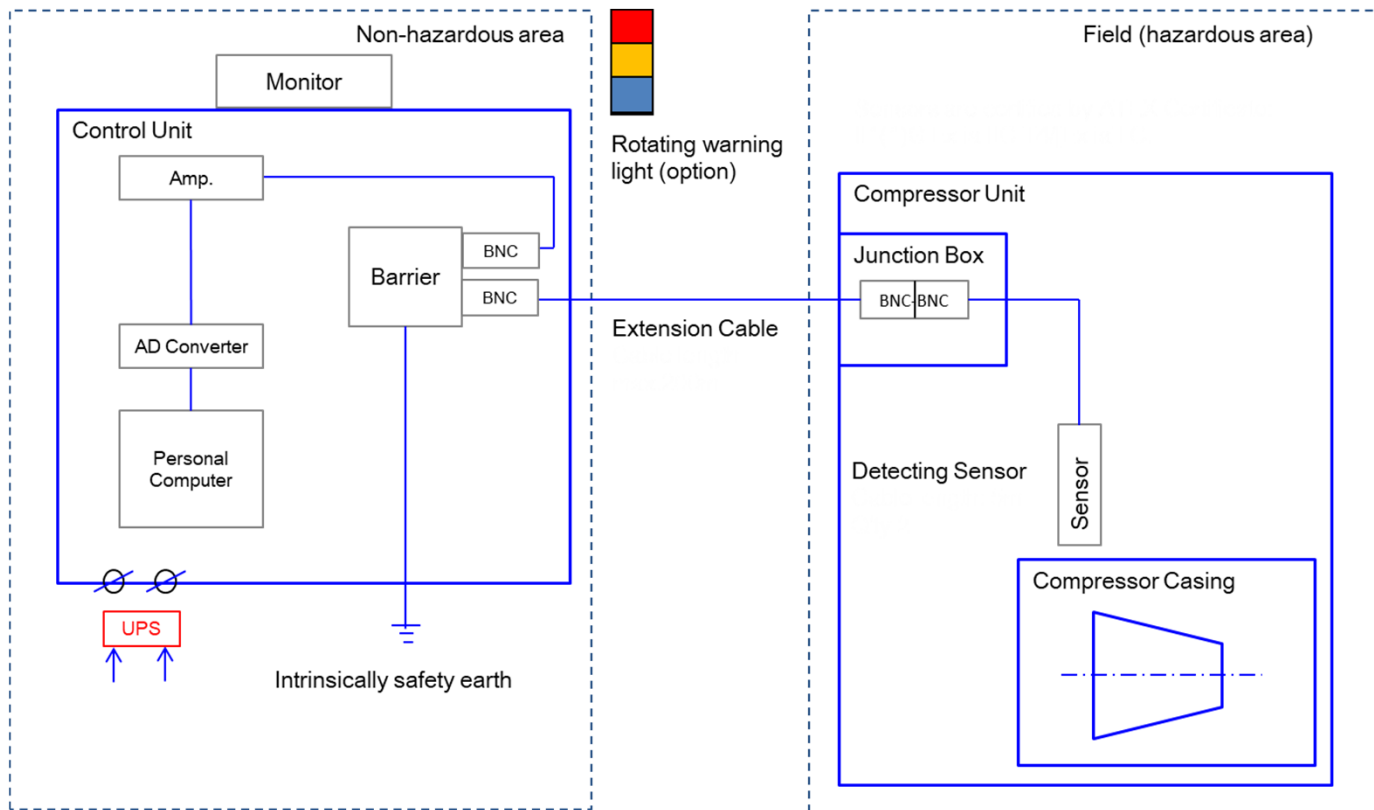


Shaft Vibration Monitoring

New Developed Technology - Outline

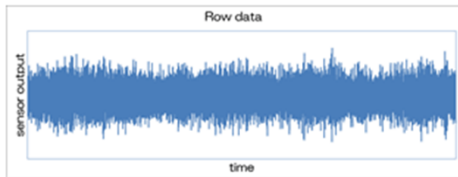


System Configuration

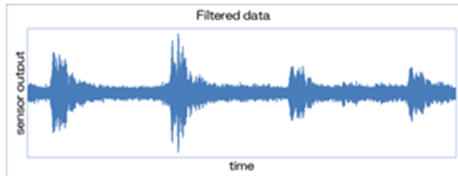


Advanced Contact Detecting Method

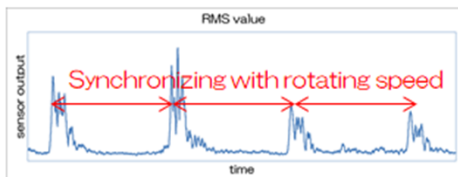
Raw data



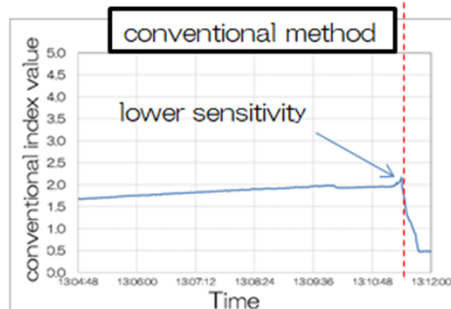
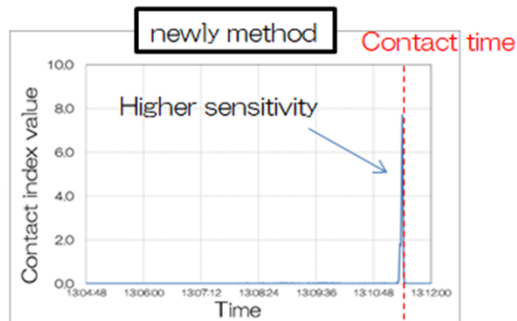
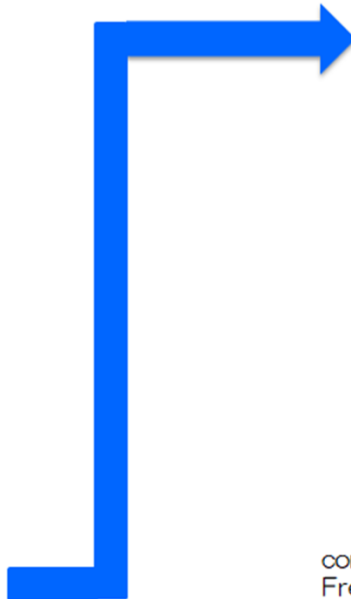
HPF
Remove the low
frequency noise



Root mean square



FFT and
Calculating the
contact index value



contact index value is calculated by not only Frequency component synchronizing with Rotating speed, but also not synchronizing component, and time derivative or so on.

Evaluation - Laboratory Test

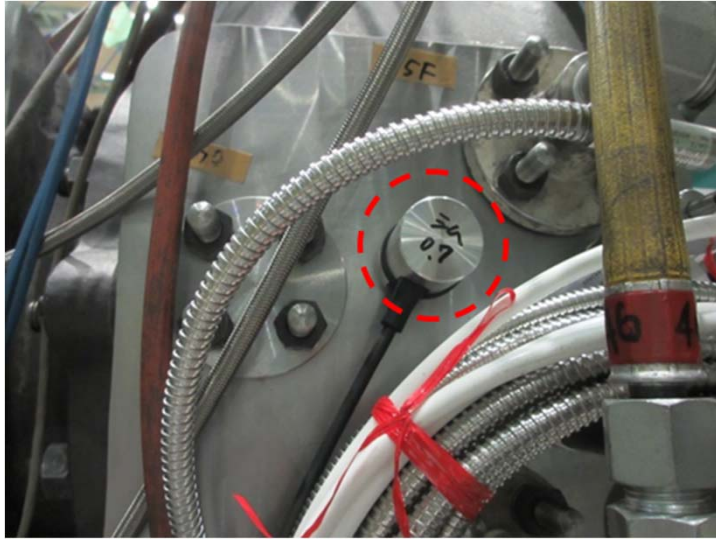


Appearance of Test Apparatus



Inside of Test Apparatus

Evaluation - Actual Machine Test



Sensor on the Compressor Casing



Measurement System

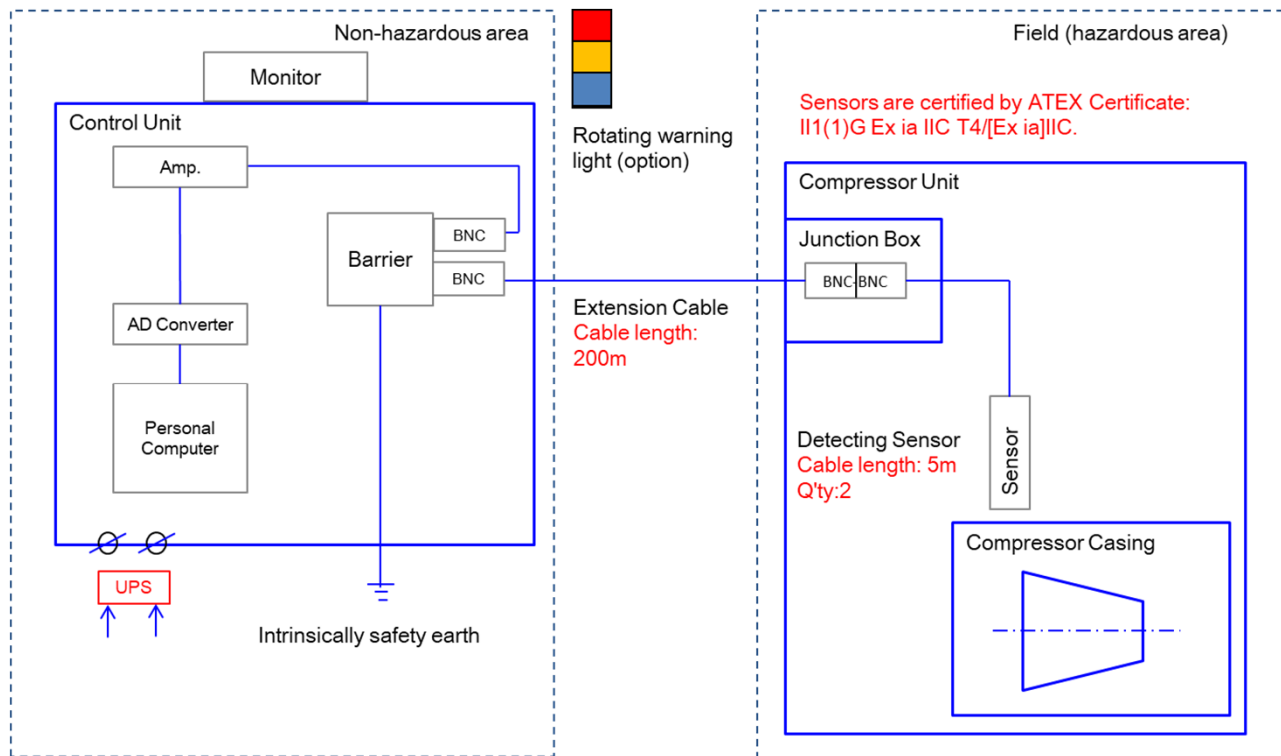
Evaluation - Result of Actual Machine Test

	Detected	Not detected
Rotor contact	100%	0%
Other abnormal conditions	86%	14%

	Not detected	Overdetection
Normal condition	71%	29%

Total Amount of Measurement Data:117 compressors

Evaluation - Field Test

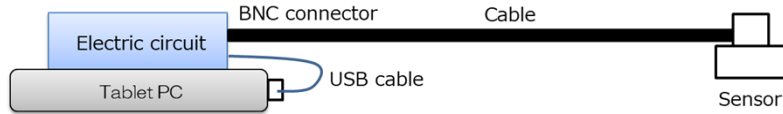


Test Period:
Jan.2015 ~ Dec.2015
Comp. Model:
KS50



Control Panel

Portable system



Easy to Use

This tool is used in shop test runs to assist operators at the OEM factory



Conclusion

- Authors developed the early detecting system for the rotor contact.
- The new system has been evaluated by laboratory test and actual machine test.
- The new system has been carried out the field test at the actual plant.
- The new system is used in shop test runs to assist operators at the OEM factory.
- The portable system using tablet PC has been developed to make it easier to use.

Thank you for your attention!!