

# Refrigeration Compressor Testing

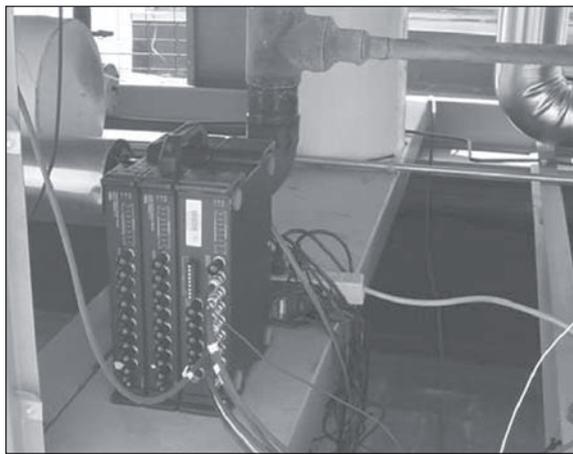
## using the ZonicBook

Industrial

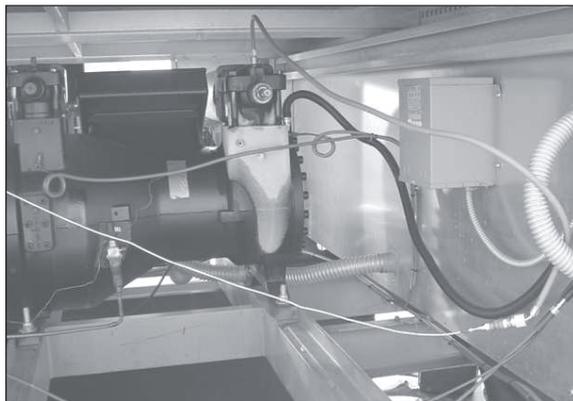
Application Note #108

### Application Summary

The medical supply industry typically stores a wide variety of drugs in special air-conditioned warehouses before they are shipped to distributors. The chill room temperatures in these warehouses must be controlled and flawlessly maintained to within 2° to 8°C to ensure that the products are well preserved. Although they are in storage for a relatively short time, millions of dollars worth of drugs depend on such extremely close temperature control.



*For several spring and summer months, a ZonicBook was located on a warehouse roof, chiefly exposed to the elements. Amazingly, in spite of various connector, cable, and sensor failures, the ZonicBook itself continued to provide critical data that the experts needed to troubleshoot refrigeration unit problems.*



*The refrigeration unit shown here is connected to several thermocouples and flow meters through cables that terminate in a ZonicBook located next to it. The laptop computer is about 150 feet away, located in a well-conditioned room to keep it protected from the outdoors.*

The refrigeration units are typically quite reliable and do not usually require much monitoring instrumentation. But sometimes a compressor failure occurs for obscure reasons and the situation calls for special data acquisition systems to log certain variables within the cooling system. Frequently, the instrumentation must be located on a rooftop next to the compressor while marginally protected against the hazards of the outdoor environment for days or weeks at a time.

### IOtech's Solution

Recently, a major pharmaceuticals company experienced several compressor problems, including a failure in a new installation for reasons that were quite vague. The building engineer responsible for the well being of the facility and the predictive maintenance technician quickly installed an IOtech ZonicBook™ next to the unit and connected several thermocouples to the compressor and refrigerant lines to measure temperature. They also monitored vibration, motor current, refrigerant, and pressure. The eZ-TOMAS™ program on the ZonicBook measured and logged these process variables.

During three weeks of monitoring, the data showed that the compressor tripped off several times, usually during the night. Moreover, the ZonicBook detected high discharge line temperature before these events. From these data, it was determined that the compressor's minimum design load limit was exceeded. This produced a low refrigerant flow in the compressor, which uses the refrigerant for both cooling and lubrication. In addition, a bypass recirculation line modification is being investigated to help correct the problem.

The ZonicBook detected another fault while monitoring the compressor's operating parameters; the motor current showed an abnormal voltage transient during the time the motor breaker was opening. Inspection revealed that the breaker relay had a burned contactor. The relay was replaced and the problem was solved.

Soon after the ZonicBook finished monitoring the first compressor, it was used on two similar units that experienced abnormal, frequent trips. After several weeks of testing, the first unit's sister was found to have developed the same problem. This compressor had already failed once before and was overhauled within its first few months of operation.

During the time these tests were run, the **ZonicBook** was located on the roof in a chiefly unprotected environment next to the compressor. It survived the spring and summer weather and severe thunderstorms, which are typical in the Midwest. One time, the **ZonicBook** was exposed to a storm generating 85-mph winds, 1.25 in. of rainfall, and 100% humidity.

Later in the summer, the roof surface temperature reached about 130°F while the air temperature hovered around 85° to 95°F. The **ZonicBook** survived these extreme conditions for weeks without a single problem, but several sensors, cables, connectors, and transducers failed during the same period. The laptop computer was connected to the **ZonicBook** via an Ethernet cable and was located about 150 feet away in a well-protected room. It was decided to continuously monitor the condition of the refrigerant compressors and protect the contents of the warehouse even if it meant sacrificing the **ZonicBook**. However, in the end, the **ZonicBook** withstood the extremely hazardous environment and provided the building engineer and preventative maintenance technician with the data they needed to convince the compressor system designer and supplier that a redesign was crucial.

## Conclusion

A reliability engineer at a medical supply warehouse used a **ZonicBook** to troubleshoot a failure of its chill-room air conditioning unit. The **ZonicBook** recorded excessively high compressor temperatures that resulted from low coolant and lubrication flow. From these data, the engineer and technician determined that the refrigerant system was improperly sized to handle low load conditions. The compressor system designer and supplier are currently making the modifications needed to remedy the problems detected by the **ZonicBook**.

## ZonicBook/618E

Vibration analysis and monitoring has never been easier than with the new **ZonicBook/618E™** and **eZ-Series™** analysis and monitoring software. The **ZonicBook** leverages 25+ years of experience providing vibration measurement solutions. This new Ethernet-based solution adds another dimension — the *lowest cost*, full-featured 8 to 56 channel analyzer available. The **ZonicBook** hardware is the signal conditioning and acquisition engine, while the **eZ-Series** software in the PC defines the specific analysis and monitoring features of the system.

### Features

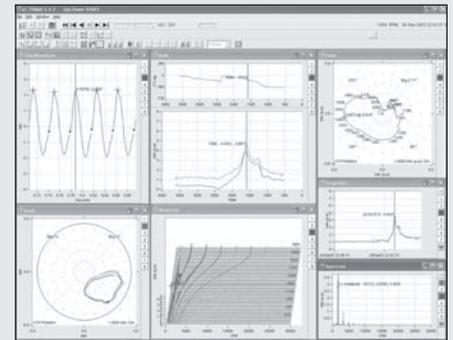
- 8 dynamic input channels, expandable up to 56 channels
- 4 tachometer channels for rotational measurements
- High-speed Ethernet connection to the PC for continuous recording
- Five **eZ-Series** software packages address a wide variety of vibration monitoring and analysis applications
- TEDS support



### Software Overview

Five software packages are available for the **ZonicBook**, each tailored to a particular vibration measurement and analysis application. Choose the package that suits your application now, and upgrade to additional packages as your requirements evolve.

- **eZ-Analyst™** provides real-time multi-channel vibration analysis, including overlay of previously acquired data while acquiring new data, strip charts of the throughput data files, cross channel analysis, and direct export to the most popular MODAL analysis packages, ME Scope and Star Modal.
- **eZ-TOMAS™** provides on-line vibration recordings, limit checking, storage, and analysis of rotating machinery. Order track, Waterfall, Orbit, Polar, Bode, Spectrum, and Trend displays show machine startup or shutdown events, as well as diagnose long term changes in machine health.
- **eZ-Balance™** is used to balance rotating machinery with up to seven planes. A balance toolkit, including Split Weight calculations, supports the balance process. The balance vectors are displayed on a polar plot so the user has a visual indication of the improvement. Time and spectrum plots show detailed vibration measurement during the balance process.
- **eZ-NDT™** package is exclusively used in production applications to determine the quality of composite-metal products at production rates of 1 part per second.



*eZ-TOMAS allows you to view Time-Domain, Spectrum, Waterfall, and Trend simultaneously on one screen*

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