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Prosaris Compressed Air Leak Detection Initial Field Tests

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MEMO

TO: Eric Olson, NEEA
FROM: Justin Ramsay and Jordan Pratt, Energy 350
SUBJECT: Prosaris Compressed Air Leak Detection Initial Field Tests
DATE: December 16, 2022

1. Background

Compressed air leak reduction remains a significant source of savings for efficiency programs in the Pacific Northwest. As such, NEEA's emerging technology and product team has been in communication with Prosaris regarding their new leak detection product, the OL1, and its potential application in support of energy efficiency programs. NEEA identified the potential use for the OL1 as an easy to use leak detection tool that can potentially increase participation in leak detection efforts. NEEA reached out to Energy 350 for assistance in preliminary scoping/field testing of the equipment due to our experience in industrial leak detection and ongoing relationships with industrial customers.

As an initial test of the product, Energy 350 used the Prosaris OL1 on multiple compressed air leak audits and are reporting on the functionality, ease of use, potential impact of the device, and recommendations for next steps. For this effort, we used the OL1 to perform leak audits at two industrial facilities. Testing using the OL1 leak detector was performed side by side with other personnel performing a leak audit using industry standard ultrasonic technologies. This allowed a clear point of reference between new and existing technologies, as well as reducing the effort for the customer. The following sections of this memo discuss the results of the initial field testing as well as recommendations for further testing of this product.

2. Overview of Equipment

2.1 Typical Leak Detection Equipment

The most readily available leak detection equipment in use today are audio-only ultrasonic detectors, consisting of a microphone, an amplifier to convert the sound to the sonic ranges, and a headset for the user to hear the sound collected. Currently Energy 350 uses the UE Systems Ultraprobe 3000 for leak detection efforts. This detector has no visual components, but will display the sound intensity of the leak, which is used to estimate leak flow using a manufacturer provided relationship. Since there is no visual interface, the user listens to the intensity of the sound while using the direction of the handheld microphone to determine the source of the leak.

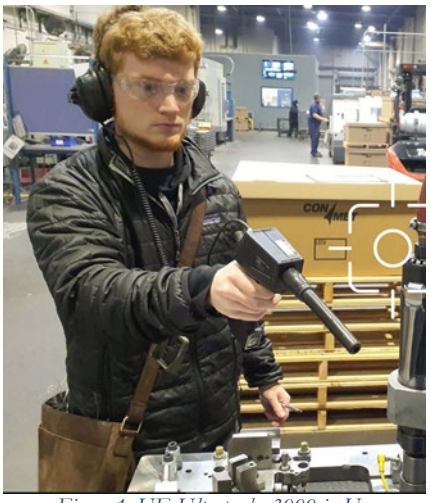

Figure 1: UE Ultraprobe 3000 in Use

2.2 Prosaris Leak Detection Equipment

For the field test, Prosaris supplied the following equipment:

- (1) Prosaris OL1, including accessories such as interface cables and a carrying case
- (1) Samsung Active 3 Tablet, with Prosaris software installed

The Prosaris OL1 utilizes three arrays of directional, steerable microphones (24 total microphones) to determine the direction and intensity of sound emitted from compressed air leaks. The OL1 attaches to and interfaces with the tablet to provide a visual indication of the leaks. The Prosaris software utilizes two user-defined inputs - distance from the leak and compressed air system pressure, and one directly measured value of leak sound intensity, to estimate the flow rate of each leak. The software then allows the user to record the leak location (both with the tablet's GPS function and with notes), sound intensity, estimated leak flow rate, and a photo and description of the leak for reporting and repair.

Figure 2: OL1 In Use

Note that while additional reporting functionality is provided on the OL1, to protect the confidentiality of the customers where the leak audits were performed, some capabilities of the device were disabled, including location services and cloud-based reporting/documentation, so we did not test these functions of the device as part of this effort.

Figure 1 shows the OL1 attached to the tablet, as shown on Prosaris's website.

Figure 3: OL1 and Tablet Package

While traditional leak detection equipment relies on audio-only detection, the benefit of the OL1 is the visual component. This creates a more intuitive leak detection effort, allowing the user to directly see the location of the compressed air leak.

3. Discussion of Field Test Strategy

Energy 350 regularly performs leak audits at industrial sites as a contractor for Energy Trust of Oregon's Production Efficiency program. The field testing for the OL1 was performed in tandem on two of these leak audits, with the intent to minimize effort for the customer.

3.1 Field Test 1

The first field test was performed at a metals manufacturer in the Portland metro area on November 16, 2022. For this effort, Energy 350 personnel met with a member of the facilities team to perform a facility wide leak audit. As part of this effort, one engineer from Energy 350 used the Ultraprobe 3000 to perform the leak audit for Energy Trust, while a second engineer worked beside them with the OL1. In total, 28 compressed air leaks were identified within a few hours on site.

3.2 Field Test 2

The second field test was performed at a food products facility in the Portland metro area on December 6, 2022. For this effort, Energy 350 personnel met with a member of the maintenance team to perform a facility wide leak audit. As part of this effort, one engineer from Energy 350 used the Ultraprobe 3000 to perform the leak audit for Energy Trust, while a second engineer worked beside them with the OL1. In total, 32 compressed air leaks were identified within a four hour period on site.

4. Findings

4.1 Leak Identification/Detection

During the field tests, using the OL1 proved to be easy to use and capable of identification of compressed air leaks in an industrial facility. Throughout the test audits, both engineers identified the same leaks with the two different technologies, with both units performing comparably in the ability to detect and identify compressed air leaks. In cases with high ambient noise levels, especially with other air or steam leaks around, it could be more difficult to identify the source of a leak with the OL1, but this seemed to be an infrequent situation in the field tests.

4.2 Leak Flow Accuracy

Once leaks were identified, both pieces of equipment recorded similar decibel and leak flow readings relative to one another. There was no attempt to determine the accuracy of the leak flow estimates for either device as part of this effort, but the values estimated by the OL1 seemed within the expected ranges based on Energy 350's engineering experience with these efforts and were similar to the values expected from the ultrasonic leak detector.

4.3 Leak Reporting/Tracking

The reporting process for the OL1 was much quicker and simpler than the typical process. Since all reporting and recording for the OL1 was done on the tablet, the engineer using the OL1 was often finished much more quickly than the engineer using the Ultraprobe, who needs to write pertinent details by hand and attach a compressed air leak tag at the point of the leak. After the audit is complete, these details were then compiled by the engineer in a spreadsheet based report. This final step could be eliminated with the use of the OL1, as the photo of the leak, user input comments, and estimated flow is all compiled into a report using the cloud-based software. The reporting function of the OL1 will likely pair well with SEM or other continuous improvement efforts in industrial facilities.

4.4 Price Point and Value Proposition

For this effort the Prosaris equipment was provided for use on a trial basis, so we did not directly request pricing for the equipment tested. Using costs available via online ordering, we can compare costs across the various technologies.

The UE Systems Ultraprobe 3000 is listed for $4,200[1] and provides no visual display of the compressed air leaks. The Ultraprobe 3000 does allow the user to calculate leak flow via sound intensity readings, but the calculation is performed by the user.

The OL1 package, as tested, is listed for approximately $4,000[2], plus a $500 annual subscription for the reporting software. Costs for the OL1 are similar to the Ultraprobe 3000, but the visual display and integrated reporting and documentation are a significant upgrade.

Energy 350 has very little experience with other leak detectors that utilize the visual display, but the pricing for comparable equipment can be found online. The Fluke i900 has a similar visual display as the OL1 and is listed at $22,000[3].

Based on the available costs, the OL1 appears to be a great value for the type of technology it provides. So much so that the package price point is in some cases lower than some audio-only leak detectors.

5. Recommendations

[1] https://www.tequipment.net/UE/UP3000KT/Ultrasonic-Leak-Detectors/?Source=googleshopping, retrieved January 10, 2023

[2] https://prosaris.ca/product/prosaris-ol1/, retrieved January 10, 2023

[3] https://www.tequipment.net/Fluke/II900/Acoustic-Imagers/, retrieved January 10, 2023

As a result of this experience in using the Prosaris OL1, Energy 350 recommends the use of this product for the purposes of compressed air leak detection. The use of the equipment is very intuitive, requiring minimal instruction before use. This ease of use and reduction in time spent on site is promising to attract more industrial customers directly and proactively involved in compressed air leak repair. It's important to note that due to confidentiality concerns, Energy 350 did not fully utilize the reporting software, but the functionality of the Prosaris to accurately pinpoint the location of the leak and provide detailed documentation available on the cloud looks to be a good fit for energy efficiency programs seeking to reduce implementation costs while maintaining accuracy.

Potential next steps for study of this technology could include:

- **Testing of the accuracy of assigned leak flows.** The OL1 outputs a value for the flow lost through an identified leak based on the measured sound intensity of the leak. Future efforts could test the accuracy of these values at the system level, using pre and post leak repair monitoring to determine the achieved flow reduction of repaired leaks.

- **Potential program design.** This effort was intended to determine the usefulness of the OL1 equipment for energy efficiency program purposes. Further efforts could focus on the best applications of this tool for energy conservation programs.

- **Testing of the functionality for other compressed gases.** For this effort, the leak audits were focused on compressed air, but the OL1 would also be a useful tool in finding leaks of other compressed gases.

Overall, Energy 350's field test results indicate that this product has the potential to streamline leak detection efforts and provide value to efficiency programs without sacrificing accuracy. When compared to existing products used for leak detection, the Prosaris OL1 provided similar quantitative results using an easier to use data gathering and reporting platform. Based on the ease of use, we expect this product will allow users with little or no leak detection experience to quickly perform audits, resulting in an increase in leak reduction efforts.