Precise Lubrication with InCTRL:

Controlling the Lack and Excess of Lubrication with Airborne Ultrasound

Figure 1: An ultrasound technician uses the CTRL UL101 and InCTRL to assess the lubrication status of a motor bearing.

Did you know that 40-70% of bearing failures in industries are due to bad lubrication procedures? Does your company have a good method to control lubrication for your bearings? The UL101 instrument together with the InCTRL platform offers you a solution.

The Lubrication Dilemma

Every year great investments of money and effort are made to determine what lubricants give the best performance to the different appliances we have in the industry. Storage rooms are built for lubricants and procedures are implemented worldwide to make sure that during the buying, reception, storage, and loading procedures the risks of the lubrication being contaminated is minimized, but when lubrication frequencies are being established, when and how much lubrication to apply, there is a void of information that may severely affect our bearings.

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Like in many other everyday aspects in the industrial world, we understand there are many different lubrication methods exist. From greasing to pumping grease from one side to the other, or mathematically calculating the lubrication frequencies based on the size of the bearings and operative conditions, there is always a better option. The precision lubrication is based on asking, with an ultrasound detector, the bearing if it needs to be lubricated and how much lubricant it needs to be a reliable asset.

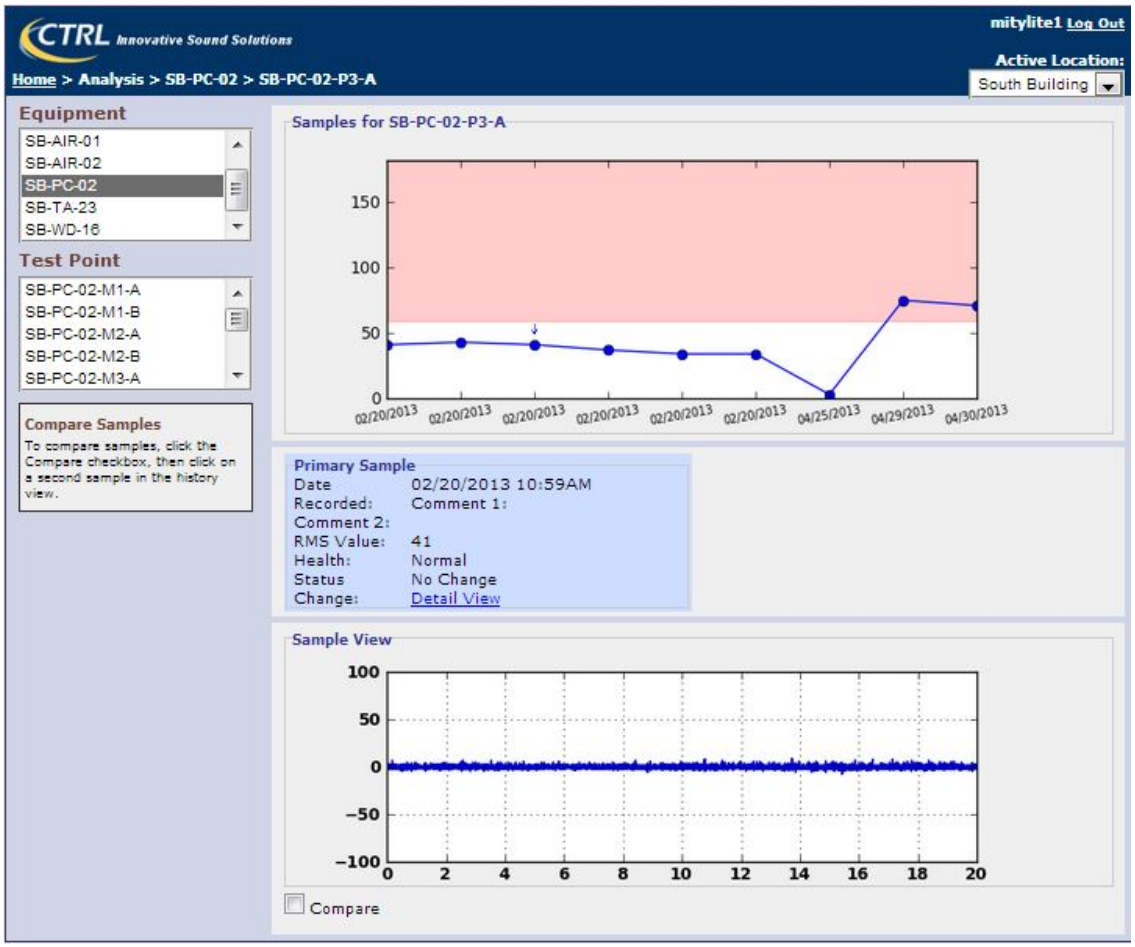

Figure 2: The InCTRL platform allus the user to analyze the friction index of each bearing in addition to allowing him to see the waveforms that provide the necessary information for maintenance personnel to make decisions.

Airborne Ultrasound

Airborne & Structure-borne Ultrasound (AB&S) is a technology that allows the user to detect frequencies over the human audition threshold. The friction caused by the bearings, not mattering the type, size, speed, or weight, generate detectable high frequency acoustic energy. This acoustic energy can be represented with a mathematical value known as Root Mean Square (RMS). RMS is a measure of the magnitude of a varying quantity of delivered power in the acoustic emission generated by friction. In other words, it is possible to represent the friction index of each bearing in a precise and trustworthy manner by using a tendency based on a RMS linear scale, differentiating from a decibel tendency (dB uses the logarithmic scale), the RMS linear scale achieves to be a better representative of both the base line and the friction deviation index of the bearing.

The UL101 Ultrasound Detector and the InCTRL Platform

The ultrasound detector UL101, because of its sturdiness, weight, and ease of use, is the ideal option to compliment the InCTRL platform. Through a simple interconnection arrangement, this device will be able to transmit the bearing ultrasound signal in a very clear manner guaranteeing that the collected information is trustworthy and can be considered in making decisions.

The InCTRL platform is composed of two parts. The first one is based on a program that is in a set of servers that you can access through the internet (cloud), in the program we create inspection routes, mediation points, we store the information that is collected in the field and we analyze spectrally each collected fact.

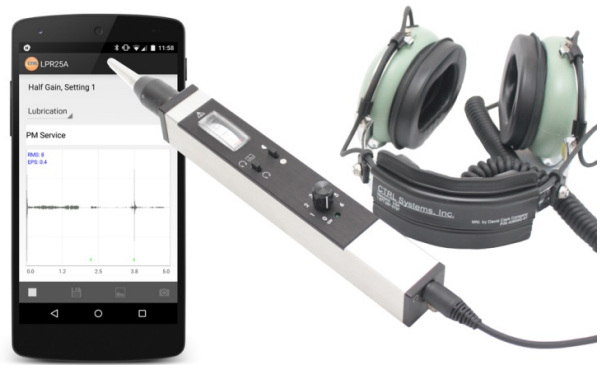

Figure 3: The InCTRL Mobile app and the UL101.

The second part is an app for mobile phones with an Android operative system that allows you to connect the UL101 to record sounds, take notes, take pictures, and see linear references. This information is transmitted in real time by Wi-Fi or 4G network to InCTRL.

Establishing the Treshold

For many years the key to success of lubrication programs based on airborne ultrasound has been the ability to establish correctly the base line and the alarm levels. The ISO 29821-1 rule establishes that the alarm level should be based on historic facts that show the increase of value in the acoustic energy detected in the bearing. Based on this criteria we can establish a change in the tendency that allows us to take the necessary actions to prolongue the life of the bearing, in other words, this change in the tendency is the one that determines the moment in which the bearing should be lubricated.

To establish the base line, the InCTRL platform of CTRL Systems Inc. requires that the user collects at least 5 readings of each bearing. The system analyzes not only the RMS values but also the wave form of each reading because it is possible to identify in the wave forms the impacts that generate problems that are related to lubrication, indicating that this particular bearing is suspected of an impending failure.

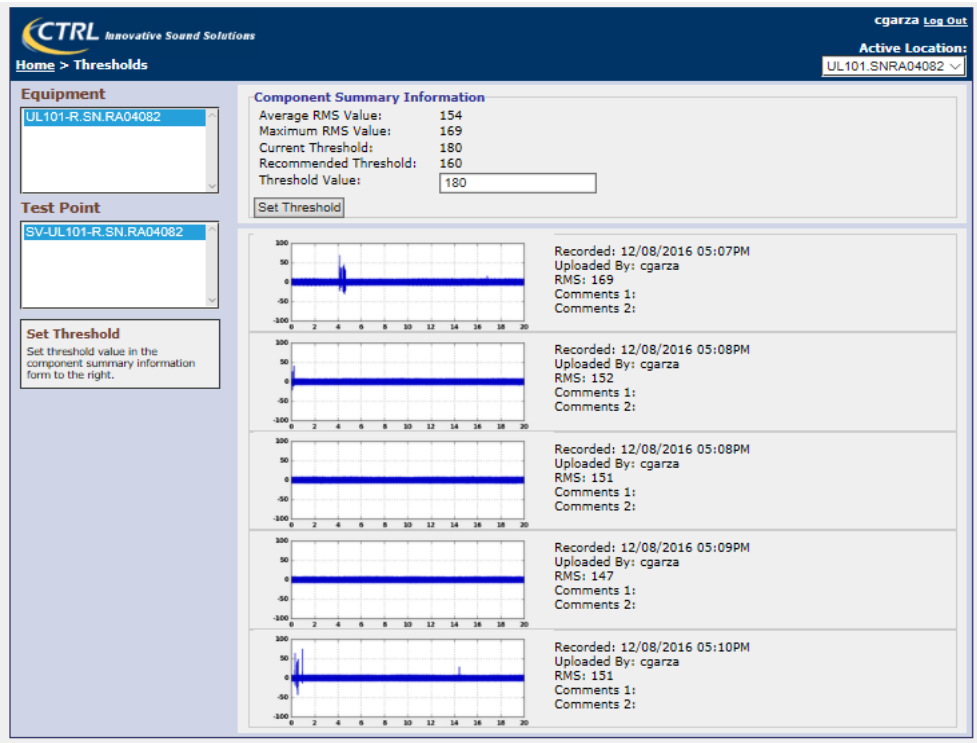

Figure 4: Five readings of the same motor bearing; InCTRL analyzes the RMS values and the waveforms of each reading to suggest a recommended threshold.

The user has the option of deciding to take the recommendation or to modify the alarm level to continue with the monitoring process, generating a tendency of behavior that represents the friction index of each bearing. If this is maintained constant or below the established alarm level it is not necessary to proceed to lubrication.

Avoiding Under-lubrication

"When and how much lubricant should I apply?" To answer the question, you should establish a routine inspection using the airborne ultrasound of the bearing elements where you wish to implement the lubrication of precision based on condition. After establishing the base line, the InCTRL platform differentiates through a pink color zone, the limit of established alarm, giving us the opportunity to see graphically the precise moment in which the bearing indicates us that it requires lubrication.

Afterward, we should decide how much lubricant to apply. It should be lubricated enough so that the friction index is as close as possible to the base line. When applying the lubricant you should do it slowly to give time so that the grease distributes in a uniform manner and the instrument can be able to register the new friction index. Once the adequate level is reached you should continue to monitor according to the established routines.

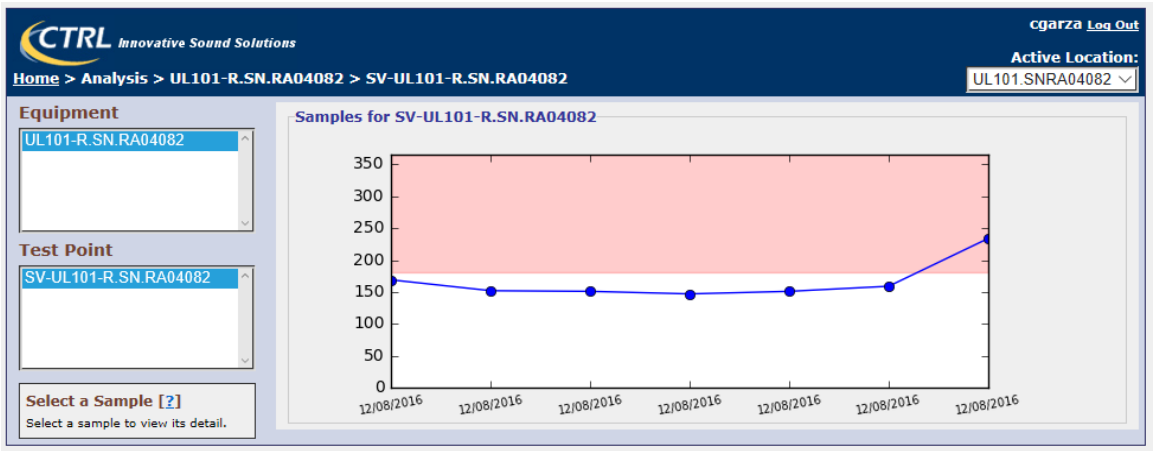

Figure 5: This chart shows that the bearing in question has maintained its friction index until the most recent sample when the RMS rose above the recommended threshold. The health assessment indicates that this bearing requires lubrication in order to return to its acceptable friction index.

Avoiding Over-lubrication

To avoid excess lubrication (that causes more problems than the lack of lubrication), the InCTRL platform registers the base line value information that will be transmitted to the mobile that is being used to collect the facts, and therefore the user will have the possibility of comparing that permanent fact.

The technician should only lubricate with the necessary quantity so that the bearing's RMS value gets as close as possible to the established base line.

Figure 6: The waveform shows a constant friction index that is below the established RMS threshold. The technician does not need to lubricate.

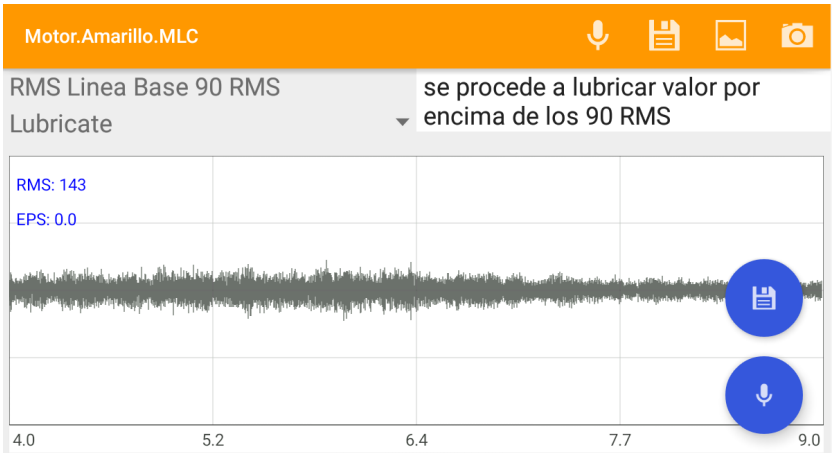

Figure 7: The waveform shows a constant friction wave that is over the established RMS level. The technician should proceed with lubrication.

Conclusion

The ISO 29281-1 rule establishes that when an airborne ultrasound tool detects deviations related to the base line, these variations should be documented and the modulated audio signal should be analyzed to determine the severity and subsequent corrective actions. The use of the InCTRL platform will help the user not only determine the severity of an abnormality, but also at the same time will provide a practical way to report findings of the bearings that are being inspected routinely.

By controlling the lubrication frequencies you will considerably lower the index of bearing failures. This type of programs will be able to maintain the assets of the plant in optimal operative conditions at the same time that it will reduce the operation and maintenance costs, incrementing the availability time of the process, diminishing the risks to the personnel and plant assets.

CTRL Systems Inc. has more than 25 years providing the civil and military industry the light weight, sensitive, sturdy, and friendly detection airborne ultrasound tools. If you wish to receive more information or know more about it, please contact us.

Ing. Carlos E. Garza

A&SB US inspector under ISO 18436:8

CTRL Systems Inc.