Application Note

Idler Sound Monitor

The Idler Sound Monitor (ISM) is designed to detect problems in long distance conveyor belts associated with bearing wear in the idler rollers (A) or material build up on the roller surfaces (B).

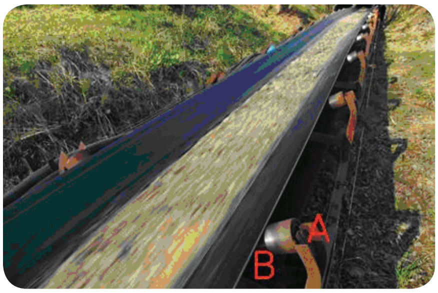

Figure 1. Location of bearing wear in the idler rollers (A) and roller surfaces (B).

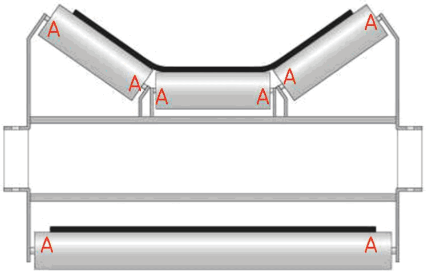

Figure 2. Location of bearing wear in the idler rollers (A).

Since vibration is not a practical measurement for this application, a solution is achieved by measuring the sound being emitted from the rollers in the frequency band of 5 to 40 kHz. This band encompasses “sound”, which is sound that can be heard by humans, and “ultrasound”, which is high frequency sound beyond the range of human hearing.

This choice of frequency range has distinct advantages and limitations that should be taken into consideration when using the ISM, especially if using it on applications other than long distance conveyors.

1 A basic principal of acoustics is that low frequency sound travels much further than high frequency sound. For example, fog horns, to protect shipping, emit a low note because their sound travels further across the sea than a high note.

This principle is used in the ISM to improve operator safety by allowing them to stand at an increased distance from the conveyor. The disadvantage of measuring lower frequencies is that they are susceptible to background noise interference.

Nominally, the maximum range is 3 m (*10 ft.*); however, this value will increase or decrease significantly dependant on the loudness of the fault and the loudness of any background noise. The range will be severely reduced if the conveyor is covered.

Longer range is achieved by the use of a parabolic reflector around the microphone. The parabolic shape is carefully chosen to amplify the desired frequencies of interest and suppress frequencies from unwanted background noise.

Figure 3. Fog horn.

2 Whilst high frequency sounds are limited in the distance that they travel, they do have the advantage that they are associated with impacts due to tiny defects or friction, both of which allow for an earlier detection of the onset of a problem. Another advantage is that "ultrasound" is less susceptible to common types of background, noise so the reliability of the measurement increases.

Ultrasound can be used to detect the absence of lubrication in a bearing and friction created by the belt rubbing against a roller in the case where a roller has seized. However, it should be noted that industrial sources of ultrasound include water droplets, water jets and compressed air or steam flow. This can be accidental through a valve or pipe leak or deliberate through the operation of compressed air brakes on vehicles. This has the advantage that the ISM can potentially be used to detect leaks, although this is not its intended purpose. However, the disadvantage is that a temporary false diagnosis of a conveyor will occur if a vehicle operates its air brakes.

Figure 4. Valve leak.

3 The human ear and brain have huge analytical power and an immense capacity to disregard background noise interference. We can talk on a mobile phone on a busy high street or in a noisy area and subconsciously filter out the interference without any thought. This power should be harnessed when using the ISM and listening to the signal over the headphones. The ear defenders allow the operator's ears to focus on the sound being measured.

The electronics and algorithms in the ISM translate the high frequency sounds that humans cannot normally hear and convert them to sounds that we can. This is very powerful and gives the operator the ability to hear and analyze ultrasound coming from defects that they would not normally hear. **However, the operator may need to consciously disregard some background noise causing false alarms in the same way that we would subconsciously disregard a noisy motorcycle passing us on the high street.**

Figure 5. Filter out interference.

4 There is limit to the loudness of sounds that the ISM can accommodate. On the street, we would simply stop talking if the sound of the passing motorcycle was excessively loud and then continue our conversation when it had passed. This requires a degree of pragmatism. No measurement device using acoustics can be totally immune to the same problem and therefore its use requires the same pragmatism.

Rocks landing onto an impact conveyor would swamp (saturate) any traditional vibration measurement of the bearing health, and a sound measurement is no different. We would need to wait for an occasion when the excessively high levels had stopped, e.g., when the conveyor is running but rocks aren't falling.

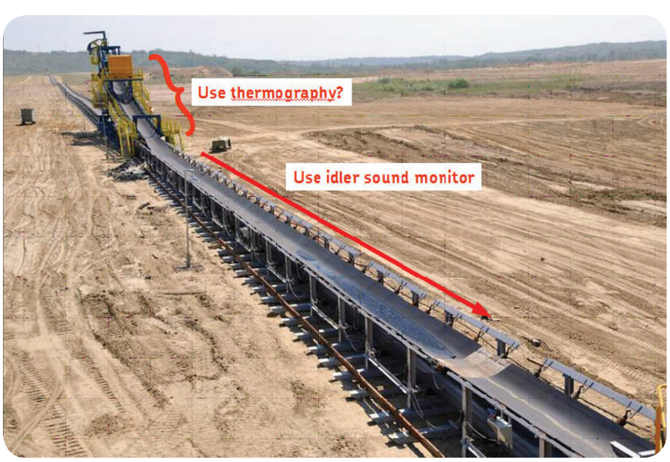

Figure 6. Wait to measure when excessively high levels have stopped.

5 Any microphone used for the measurement of sound is a delicate device. The microphone of a mobile phone will stop working if it is exposed to rain drops or clogged with dirt. The same applies to the precision microphone used in the idler sound monitor. The microphone should be stored in a dust-proof box when not in use and operated with an appropriate level of care and attention.

Annual calibration is also strongly recommended to confirm the continued integrity of the device.

Figure 7. Take care of the microphone.

6 High pressure air flow creates ultrasound due to air turbulence that can be measured to detect air leaks or steam leaks. In a similar way, low speed airflow due to the wind can create turbulence around the parabola and microphone that creates low frequency interference. This can be detected by an increase in false alarms and heard over the headphones, but easily rectified by installing the wind baffle.

Figure 8. Wind baffle.

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