APPLICATION NOTE

Bearing Severity Overall: A Simple Way to Measure and Trend Bearing Condition

The Bearing Severity Overall, or BSO, is a patent-pending measurement from Fluke Reliability for trend monitoring bearings according to ISO 13373-3. The BSO simplifies data analysis by providing one overall number that can be understood at a glance and trended over time.

In 2017, the Prüftechnik service team was using an ISO norm that was relatively new at the time: ISO 13373-3. This norm establishes guidelines for procedures related to performing vibration diagnostics on rotating machines. It also includes a structured approach to fault diagnosis and provides examples of common machine faults.

One thing the norm does not cover is trending results over time. But the service team, part of the Fluke Reliability family, wanted to find a way to accomplish that. In looking for new methodologies for bearing diagnostics, they conceived a way to simplify and trend values quantifying bearing condition. The Bearing Severity Overall, or BSO, is a patent-pending measurement for trend monitoring bearings according to ISO 13373-3.

How the Bearing Severity Overall (BSO) simplifies data analysis

In ISO 13373-3, the status of the machine must be determined from a two-dimensional graph. The Bearing Severity Overall reduces the two dimensions to one single overall value, which can be easily trended. The new method combines the scalar overall value determined from the measurement of a broadband acceleration RMS value from 10 Hz to 10 kHz and the zero-peak-value of the same frequency band.

The high-frequency, high-resolution piezoelectric sensor in the Fluke 3563 Analysis Vibration Sensor makes these in-depth readings possible. Piezoelectricity refers to the phenomenon of certain types of quartz or crystal producing electrical charges when compressed. The charges, which are converted into measurable signals, are proportional to the applied mechanical stress.

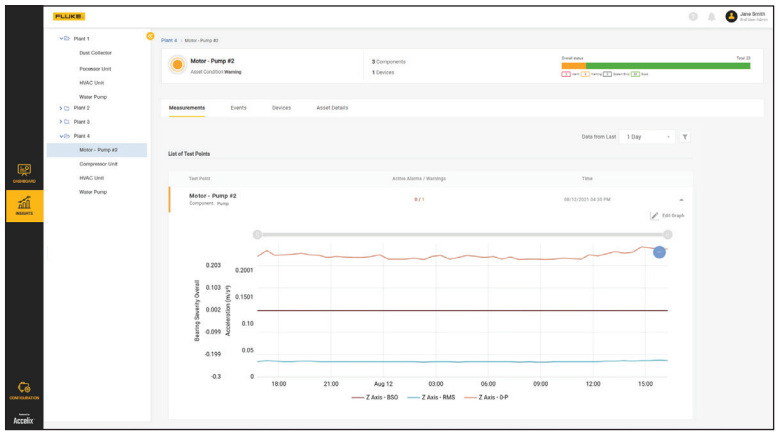
The Fluke 3563 is the equivalent of a panoramic camera — its frequency range means it can capture much more information than a typical wireless sensor. The BSO measurement doesn't work without a sensor that goes up to the 10 kHz level — the 3563 provides that.

How the BSO works in practice

In a bearing, there are four main components that maintenance teams are concerned about: the outer race, the inner race, the rolling elements, and the cage. Different types of faults in different components can happen at varying rates. The zones of the Bearing Severity Overall chart give users a starting point to determine when they will need to take action.

Instead of treating all bearings as the same, trending the condition of the same bearings over time offers greater accuracy and better insights. For example, bearings in large water pumps and bearings in rock crushers have different vibration, sounds, and other traits. When users know what is normal for a particular bearing, it is easier to identify potential faults.

Not every team has the depth of experience required to interpret all bearing-related data. The BSO measurement gives teams what they need to know about bearing condition without requiring them to understand all of the other underlying context.



What makes the BSO unique?

The BSO takes a complex measurement, runs a calculation, and provides one overall number that can be easily trended. Users get what they need to know about bearing condition without needing to understand every piece of data that goes into establishing the bearing severity value.

The concept is comparable to a quarterback passer rating in American football, where multiple statistics are combined to create one value that quickly conveys a given quarterback's effectiveness. That value can be used to compare one player with another, or to trend one player's performance over time.

The formula used to calculate the passer rating takes into account the quarterback's passing attempts, completions, yards, touchdowns, and interceptions — but a fan does not need to know each of those underlying statistics in order to find the passer rating useful and informative.

Similarly, the BSO takes multiple pieces of data and uses them to calculate one overall value users can easily understand and trend. With the BSO, bearing data analysis is simpler and more straightforward. The bearing severity value is trended within the LIVE-Asset Portal™ software, where the trend graph makes it simple to understand bearing condition at a glance.

How does the BSO help assess the severity of potential faults?

Annex D of ISO 13373-3 introduces a Rolling Element Bearing Severity chart. This chart can be used to assess the severity of a potential fault. The BSO reference chart is based on that of the ISO norm, while the physical measurement of the bearing severity is unique to Prüftechnik and Fluke Reliability.

The status evaluation (normal, alert, alarm) is configured so that when the BSO is in alarm, the corresponding ISO value indicates the same state.

The BSO measurement has four different zones:

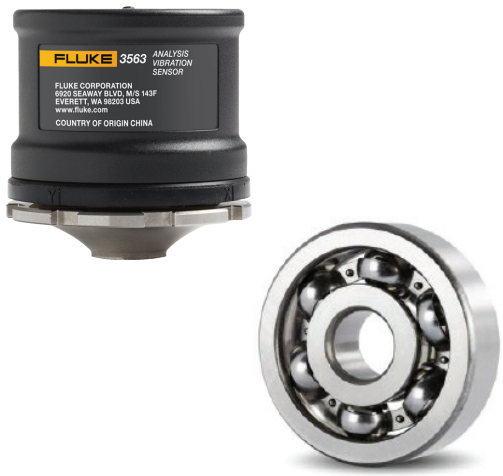
- Unrealistically low (indicating that the measurement should be repeated)
- Normal
- Alert
- Alarm

Within the LIVE-Asset Portal™ software, users can set alerts based on the zones of the ISO reference chart. The alert thresholds can be customized as needed. For example, if a machine with a value of V_{bs} = 6 is normal, a new alert threshold could be set at 11, to keep the zones consistent.

Advantages of the BSO over other methodologies

The BSO offers several advantages compared to older, existing methodologies, such as shock pulse measurement.

Shock pulse is highly sensitive to a sensor's resonance behavior. Therefore, it must be adjusted for every single sensor. It is also sensitive to changes in temperature and even the sensor mounting. In analog signal processing, it was used to cope with small signal-to-noise ratios and limited dynamic range. However, modern devices have high-quality electronics to accommodate for those deficits. In contrast to the shock pulse measurement, the BSO is more stable and sensor independent because it is used in the sensor's well-defined linear frequency range.



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