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## **Beneath the tough exterior** Lies sensitivity, intelligence and understanding

A brief guide to condition monitoring of  
equipment installed in hazardous areas  
with the ABB Ability™ Smart Sensor







## How is your industry adapting to digitalization?

A new generation of wireless smart sensors for rotating equipment operating in explosive atmospheres, brings cost-effective remote condition monitoring in applications like pumps, fans and compressors used in a wide range of industries such as:

- Chemical, oil and gas
- Mining of coal
- Food industry with grain and dust

These are areas where the presence of flammable vapor, gases or dust requires special precautions to prevent the risk of explosion. A single failure or plant trip can result in substantial production losses. Therefore, any solution that has the potential to improve productivity and safety could make an important contribution to the financial performance of a plant.







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# Five things you need to know about the ABB Ability™ Smart Sensor for hazardous areas

We've made the case...



Nothing gets in



What lies beneath



Raising the standard



Still unsure?







## We've made the case...

Denka, the Japanese chemicals giant, has eliminated failures of critical electrical motors at three of its plants in Singapore. This has been made possible by a service agreement based on ABB Ability™ Smart Sensors, including a new generation developed specifically for hazardous areas.





## Nothing gets in but you get everything out

ABB Ability™ Smart Sensor for hazardous areas incorporates:

**1** A battery life of up to three times longer than most competing designs



**2** Greater sensitivity to small changes in the condition of the equipment



**3** Longer communication range and higher data transfer speed





Nothing gets in  
but you get

ABB Ability™ Smart

1 A battery life

2 Greater sensi

3 Longer comm

## 1 A BATTERY LIFE OF UP TO THREE TIMES LONGER THAN MOST COMPETING DESIGNS



Designing an embedded system with a design life of up to 15 years and providing a reliable indication of remaining battery life is achieved by:

- To limit battery internal leakage current, the temperature experienced by the battery must be moderate. Enclosing the battery and its soldered pads in a battery holder that is separated from the primary heat sources by an air gap - this protects it from heat coming from the monitored asset
- Evaluating the temperature-dependent leakage current of the battery by measuring battery temperature during operation and estimating corresponding leakage current based on a proven battery model.
- Most of the time, the sensor is in a deep sleep and consumes very little power, but when the sensor wakes up, its power consumption ramps up.
- Sensor records how much time each battery-consuming operation takes. From the durations and power curves of the operations, the consumed charge is calculated and subtracted from initial battery capacity.
- Using Bluetooth® 5: all processes happen significantly faster and over a longer distance. The high speed also results in low energy consumption, which improves the battery life.



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Smart Sensor

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## WHY REPLACEABLE OR RECHARGEABLE BATTERIES ARE UNDESIRABLE

The Smart Sensor's main battery cannot be replaced or recharged. Replaceable or rechargeable batteries are undesirable because:

- Replaceable batteries can increase the cost of the sensor to the point where it makes more sense to simply change the entire sensor – and get new electronic components with higher performance into the bargain.
- There is a risk that the user would compromise the hazardous area protection status by inserting the new batteries incorrectly.
- Ingress protection against dust and water could be compromised if the batteries are not replaced correctly.



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## 2 GREATER SENSITIVITY TO SMALL CHANGES IN THE CONDITION OF THE EQUIPMENT

### Pinpoint detection accuracy

- Features the latest sensor technology including accelerometers, magnetometer and ultrasonic microphone.
- The sensor's mechanical design allows the transducers to pick up the true machine vibrations independent of resonances.
- Even slight anomalies in the equipment's condition can be detected at a very early stage.
- Thanks to the sensor's long battery life and Bluetooth® 5, the user has easy access to raw data for further analysis.



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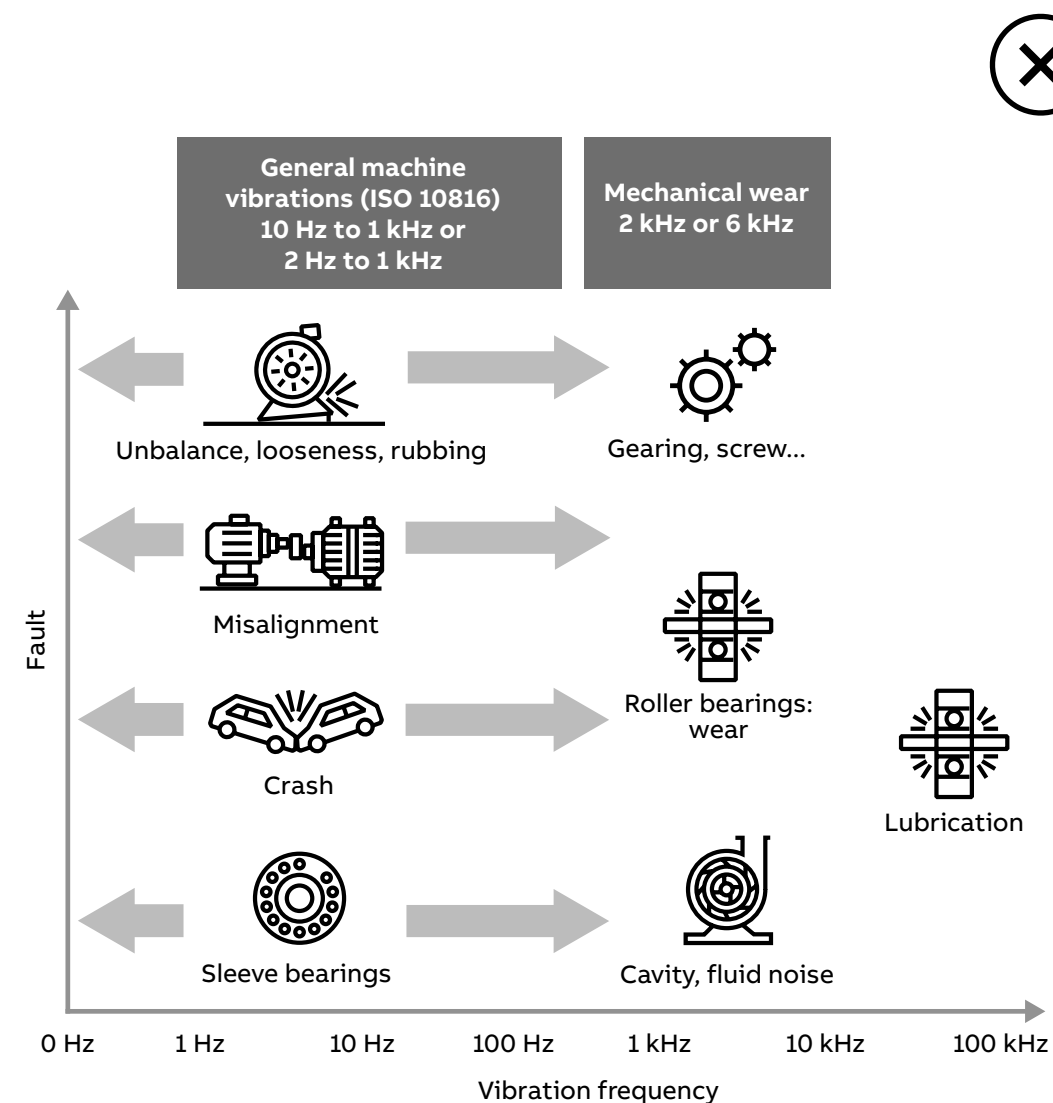
## MEASURING VIBRATION

The new high-performance sensor has two accelerometers: one for low frequencies (x, y, z direction) which goes from 0.1 Hz to 1,500 Hz and one for high frequencies (z direction) which goes up to 20,000 Hz.

Most faults in motors, such as unbalance, looseness and misalignment, can be identified in a frequency range between 10 Hz and 1000 Hz.

But to be able to pick up faults related to gear meshes, bearings and cavitation, the sensor needs to be able to capture much higher frequencies. To detect lubrication issues, for example, a frequency bandwidth of about 15,000 Hz is required.

As the new generation of Smart Sensors has two accelerometers covering a much wider frequency bandwidth, it is much more sensitive to picking up faults other sensors might not detect at an early stage.



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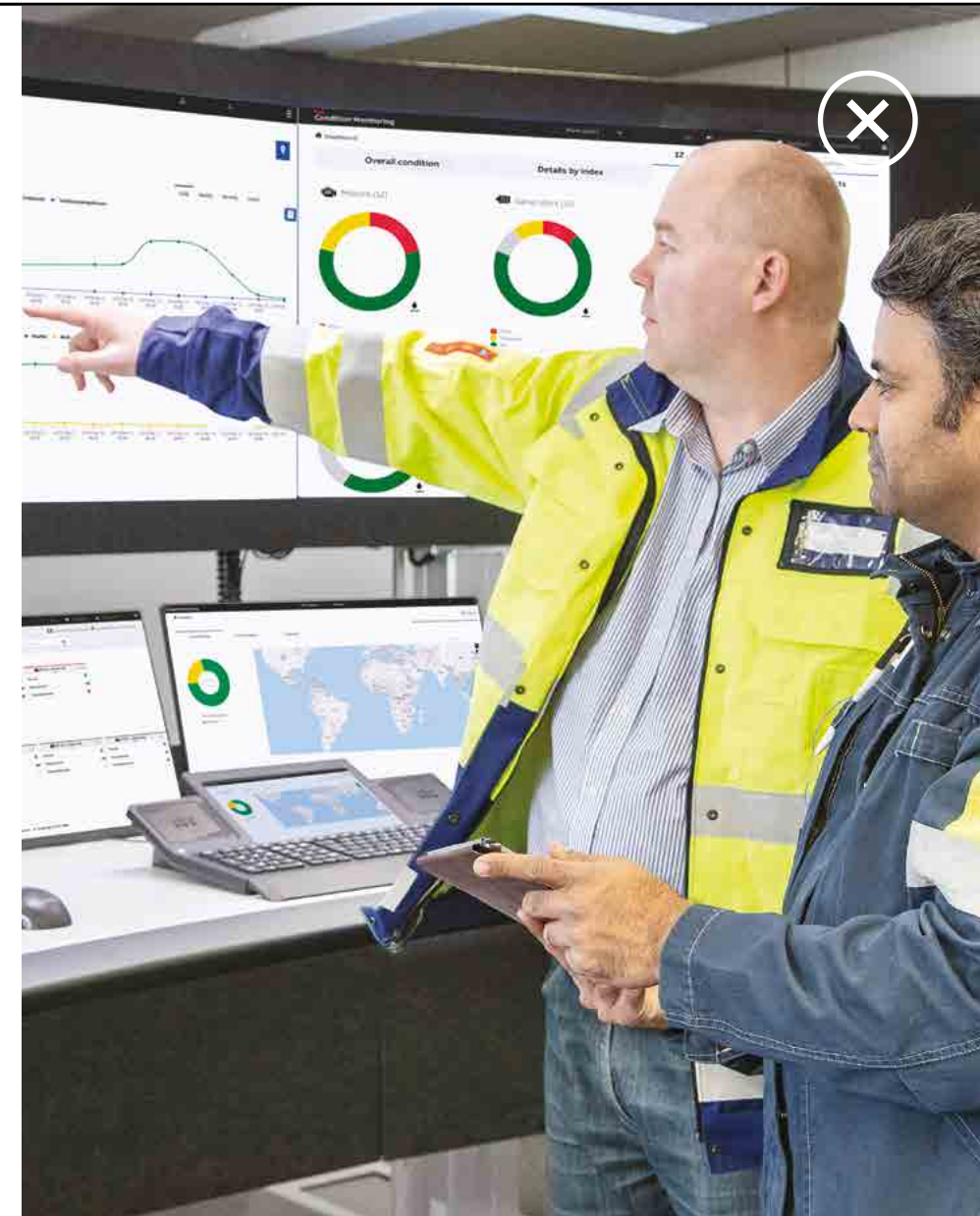
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### 3 LONGER COMMUNICATION RANGE AND HIGHER DATA TRANSFER SPEED

The new sensor offers an extended communication range and higher data throughput speed while consuming less energy. The longer communication range provides much more flexibility with regards to the location of the gateway. This can also reduce the costs of an installation as less gateways might be required.

This is enabled by:

- The sensor's advanced antenna which ensures reliable communication over distances of up to several hundred meters in line-of-sight.
- Bluetooth® 5 Low Energy, which offers the following benefits compared to previous versions:
  - Higher speed: Bluetooth® 5 has a higher data throughput. This means that all processes happen significantly faster which also decreases battery consumption.
  - Extended communication range
  - Lower energy consumption



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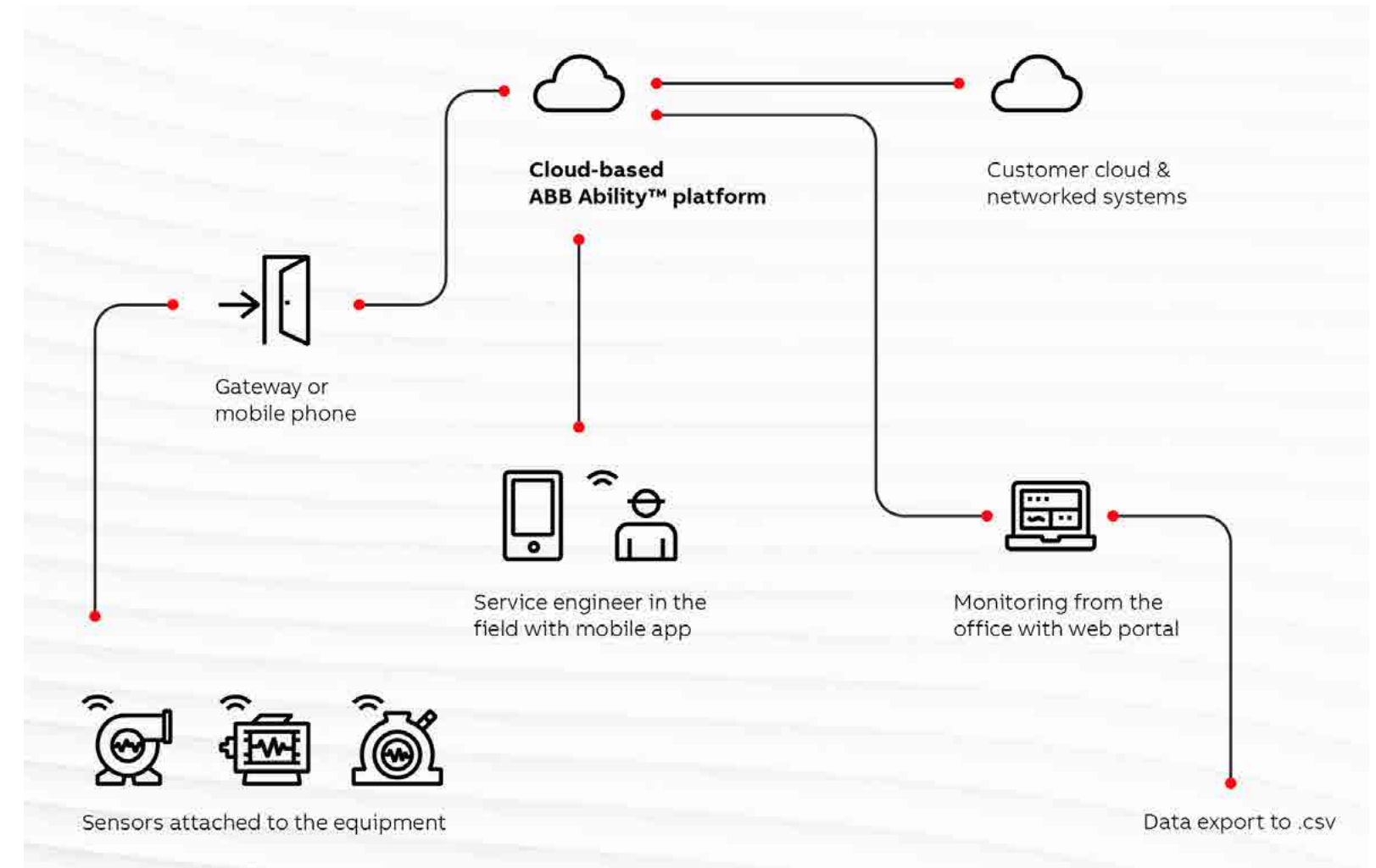
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Smart Sensor





## Beneath the tough exterior is a fully functional sensor protecting your assets

- Sensor can be used with ABB and third-party machines.
- It is simply attached directly to the equipment's housing or frame with a simple mounting bracket.
- No wiring or machining is required.
- Quick installation and activation allows monitoring and data collection to begin immediately.
- Same sensor can be optimized for different rotating machines, such as motors and pumps. Reconfiguration is done within minutes, saving time and reducing stock holding.



### ABB Ability™ Digital Powertrain monitoring solution:

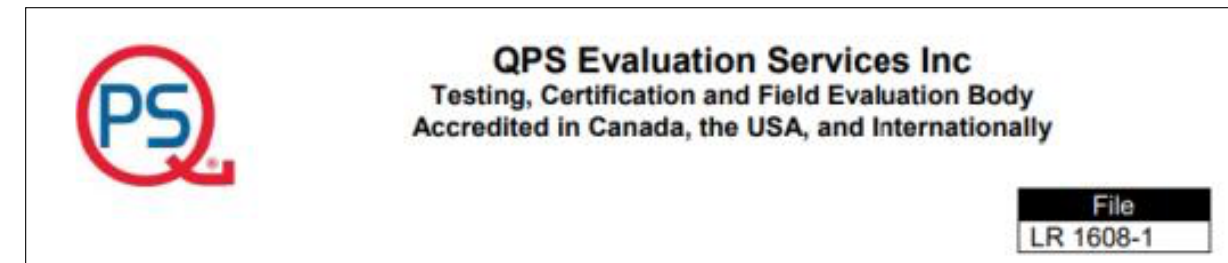
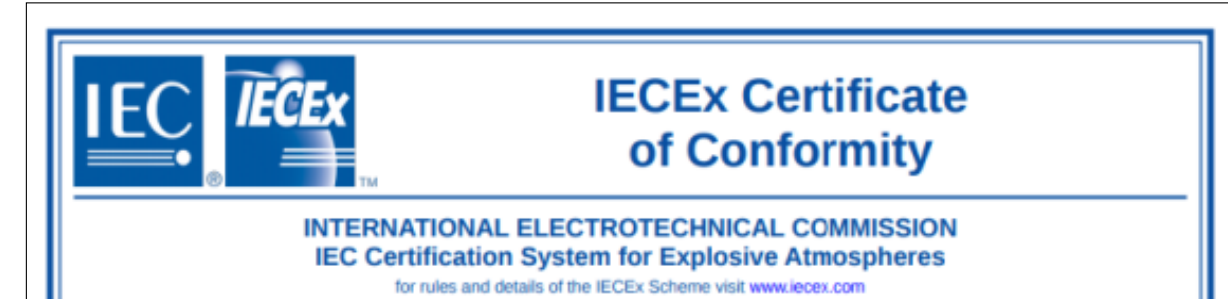
The Smart Sensor transmits the data via a smartphone or gateway to a secure cloud service. Advanced algorithms analyze the data and convert it into meaningful information, which is sent to the user's smartphone and customer portal. The solution can be integrated into the customer's own systems.



## Raising the standard

### Certified for hazardous areas

- ATEX, IECEx and NEC500 certified, hazardous-area certification (Zone 0, Zone 20, Class I Division I and Class 2 Division I) compliant with strictest requirements for equipment operating in explosive atmospheres. Local certifications are also available.
- The enclosure withstands high vibration levels and protects the sensor from total dust ingress (IP66/67).
- ABB has developed comprehensive cybersecurity features to satisfy customer requirements for data protection, including secure key exchange for Bluetooth® communication with out-of-band pairing, Bluetooth encryption, user authentication, role-based access control, and secure firmware update.





## Raising the Certified for

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- Based on increa developed comp customer requir Bluetooth® com encryption, use secure firmware

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### TO QUALIFY FOR OPERATION IN HAZARDOUS AREAS, SENSORS MUST:

- **Ensure that an internal short circuit in the battery will not cause heating that could ignite gas.**
  - When battery-powered sensors are short circuited during testing they must reach a temperature no higher than 135°C, the T4 temperature class standard.
- **Ensure that the sensor enclosure does not have any components that generate heat or sparks.**
  - Sensors must be filled with conductive material to prevent sparks or the spread of heat if the enclosure is compromised.
- **Be able to sustain stresses that arise from its environment.**
  - When the sensor was developed, the target operating range was -40°C to +85°C, which is typical for most industrial electronic components.
  - Highly Accelerated Life Tests (HALTs) proved that the Smart Sensor far exceeded these targets. HALTs use cycles of high and low temperature and a combination of high vibrations and extreme temperatures to test the resilience of the sensor.





## Still unsure about conditioning monitoring in hazardous areas?

- 1 Equipment installed in hazardous or remote locations may be difficult to inspect regularly and, therefore, operated until failure.
- 2 Increased personnel safety by enabling remote maintenance inspections.
- 3 Extended equipment lifetime.
- 4 Condition-based maintenance for lower servicing costs – maintenance can be planned according to actual needs rather than generic schedules.
- 5 Energy savings and process optimization for lower operating costs.
- 6 ATEX, IECEx and NEC 500 certified – compliant with strictest requirements for equipment operating in potentially explosive atmospheres.
- 7 Quick installation and activation for instant monitoring.
- 8 Easily retrofitted to ABB or third-party equipment





