

Atex Approved Sensor

A practical guide to atex approved sensor, covering the reader intent, the relationship to atex approved sensor, key evaluation criteria, common risks, and the information the intended project audience should confirm before taking the next step.



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In industrial environments where flammable gases, mists, vapors, or combustible dusts are present, the selection of instrumentation is governed by strict safety standards. An ATEX approved sensor is a device certified to operate safely in these explosive atmospheres, ensuring that the instrument itself does not become a source of ignition. For engineers and project managers in sectors such as oil and gas, chemical processing, and wastewater treatment, understanding the nuances of ATEX certification is critical for both regulatory compliance and personnel safety.

This guide examines the technical principles of level measurement within hazardous zones, evaluates the different protection methods used in ATEX-certified equipment, and provides a framework for selecting the appropriate sensor for specific industrial applications.

| Principles of Level Measurement in Hazardous Areas

Before selecting an ATEX approved sensor, it is essential to understand the underlying measurement physics. Different technologies interact with the process medium and the surrounding atmosphere in unique ways, which influences their suitability for specific hazardous zones.

| Radar Level Measurement (Non-Contact)

Radar sensors, particularly Frequency Modulated Continuous Wave (FMCW) radar, emit high-frequency microwave signals toward the material surface. The time-of-flight or frequency shift is measured to determine the distance. Because radar signals do not require a physical medium for propagation, they are highly effective in vacuum or high-pressure environments. In hazardous areas, radar is often preferred because the electronic components are housed in robust, often flameproof (Ex d) or intrinsically safe (Ex ia) enclosures, separated from the process by a flange or antenna.

| Ultrasonic Level Measurement

Ultrasonic sensors function by emitting acoustic pulses. The time taken for the echo to return from the liquid or solid surface is converted into a level reading. While cost-effective, ultrasonic waves are mechanical longitudinal waves and can be affected by the composition of the gas in the tank. In an ATEX context, if the atmosphere contains heavy vapors or significant temperature gradients, the speed of sound changes, which can lead to inaccuracies unless compensated for. These sensors are commonly used in open-air sumps or water treatment tanks categorized as Zone 1 or Zone 2.

| Hydrostatic Pressure Measurement

Hydrostatic sensors measure the pressure exerted by a liquid column at a fixed point. This pressure is directly proportional to the height of the liquid and its density ($P = \rho \cdot g \cdot h$). For hazardous areas, submersible pressure transmitters must be designed with intrinsic safety in mind, as the sensor is in direct contact with the medium. High-quality ATEX approved sensors of this type utilize specialized vented cables to equalize atmospheric pressure while maintaining an explosion-proof seal.

| Understanding ATEX Zones and Protection Types

The ATEX directive (2014/34/EU) categorizes environments based on the frequency and duration of the occurrence of an explosive atmosphere. This categorization dictates the required safety level of the sensor.

Zone 0 / Zone 20: Areas where an explosive atmosphere is present continuously or for long periods. This typically includes the interior of storage tanks. Sensors here must meet the highest safety standards (Category 1).

Zone 1 / Zone 21: Areas where an explosive atmosphere is likely to occur in normal operation occasionally. (Category 2).

Zone 2 / Zone 22: Areas where an explosive atmosphere is not likely to occur in normal operation but, if it does, will persist for a short period only. (Category 3).

Common Protection Methods

When reviewing a Main Page for product specifications, you will encounter several protection codes:

1. Intrinsic Safety (Ex i): This method limits the electrical and thermal energy within the circuit to levels below those that could cause ignition of a specific hazardous mixture. It is the preferred method for Zone 0 applications.
2. Flameproof Enclosure (Ex d): The enclosure is designed to withstand an internal explosion of a flammable mixture and prevent the transmission of that explosion to the surrounding atmosphere.
3. Increased Safety (Ex e): This involves taking measures to prevent, with an increased degree of security, the possibility of excessive temperatures and the occurrence of arcs or sparks.

Selection Criteria for ATEX Approved Sensors

Choosing the right sensor involves more than just matching the ATEX zone. Engineers must also consider the chemical compatibility, temperature ranges, and physical properties of the medium.

Sensor Type	Ideal Application	ATEX Suitability	Key Limitation
Radar (80GHz)	Chemical reactors, volatile liquids	Zones 0, 1, 2	Higher initial cost
Ultrasonic	Water tanks, wastewater sumps	Zones 1, 2	Affected by foam and heavy vapor
Hydrostatic	Deep wells, fuel storage tanks	Zones 0, 1 (with barrier)	Sensitive to density changes
Magnetic Gauge	High-pressure boilers, oil tanks	Zones 0, 1	Mechanical moving parts

| Temperature and Pressure Considerations

Hazardous areas often coincide with extreme process conditions. An ATEX approved sensor must not only be safe but also durable. For instance, a sensor rated for 40 bar (approx. 580 psi) and 150°C (302°F) must maintain its explosion-proof integrity across that entire range. It is vital to check the "T" rating (Temperature Class) of the sensor, which indicates the maximum surface temperature the device can reach (e.g., T4 is $\leq 135^{\circ}\text{C}$).

| Installation and Wiring Considerations

The safety of an ATEX approved sensor is only as good as its installation. Even a certified sensor can become a hazard if wired incorrectly.

Zener Barriers and Galvanic Isolators: For intrinsically safe (Ex i) systems, these devices must be installed in the safe area. They limit the energy sent to the sensor in the hazardous area.

Cable Glands: Only ATEX-certified cable glands should be used. They must match the protection type of the sensor (e.g., Ex d glands for Ex d enclosures) to maintain the seal integrity.

Grounding and Bonding: Proper earthing is essential to prevent the buildup of static electricity, which is a common ignition source in dust-heavy environments (Zones 20-22).

Conduit Seals: In flameproof installations, conduit seals prevent the passage of gases, vapors, or flames from one portion of the electrical installation to another.

| Limitations and Potential Risks

While ATEX certification provides a high level of safety, there are inherent limitations to consider:

1. **Maintenance Requirements:** Flameproof enclosures must be inspected regularly for scratches or gaps in the "flame path" (the precisely machined joint between the cover and the body). Any damage can render the protection useless.

2. Chemical Attack: The materials used for the sensor probe or diaphragm (e.g., 316L Stainless Steel, PTFE, or Hastelloy) must be compatible with the process medium. Corrosion can lead to leaks, which in turn can bypass the safety seals of the instrument.

3. Dust Accumulation: In Zone 20/21 environments, dust buildup on the sensor head can cause overheating. Sensors must be selected with a temperature class that accounts for the "smolder temperature" of the specific dust present.

| Frequently Asked Questions (FAQ)

Q: Can I use a Zone 1 rated sensor in a Zone 0 environment?

A: No. You can always use a higher-rated sensor in a lower-risk zone (e.g., a Zone 0 sensor in Zone 1), but you cannot use a lower-rated sensor in a higher-risk zone. Doing so violates safety regulations and poses a significant explosion risk.

Q: What is the difference between ATEX and IECEx?

A: ATEX is a mandatory legal requirement for equipment used in hazardous areas within the European Union. IECEx is an international certification scheme. Many modern sensors carry both certifications to facilitate global distribution and engineering standardization.

Q: Does an ATEX approved sensor require special calibration?

A: The calibration process for level measurement remains the same as standard sensors. However, the calibration must be performed using equipment that is also safe for the environment, or the area must be declared safe (hot work permit) before opening any enclosures.

Q: How do I identify an ATEX approved sensor in the field?

A: Look for the "Ex" mark inside a hexagon on the product label. The label will also detail the specific zone, gas/dust group, and temperature class the sensor is certified for.

| Conclusion

Selecting an ATEX approved sensor is a foundational task in process safety engineering. By understanding the measurement principles—whether radar, ultrasonic, or hydrostatic—and matching them to the specific requirements of the hazardous zone, facilities can ensure accurate data collection without compromising safety. Always consult the manufacturer's technical documentation and ensure that the entire installation loop, including barriers and cabling, adheres to the relevant local and international standards for explosive atmospheres.