Calibration with portable instruments in hazardous areas

With intrinsic safety it's never risky

Explosive atmospheres can never be completely avoided. Action must therefore be taken to prevent their ignition, depending on the zone classification. Ignition sources should always be eliminated in hazardous areas. The hazard potential created by a calibrator for controlling measurement and control technology in an industrial plant can be prevented by using suitable materials and design measures.

The requirements placed on the reference instrument used for checking in a potentially explosive area are high

Most industrial plants constitute a hazardous zone. Many materials essential for process operation, and often also the finished prod-ucts, are flammable or explosive. The more of these materials that are needed or generated for the manufacturing process – for example in the chemical, petrochemical or food industries – the higher the risk and the farther reaching the safety measures. Even the slightest spark or overheating can lead to an explosion with fatal consequences. High-quality measurement and control technology in industrial plants is a must. Its routine calibration increasingly takes place in the plant, for instance using portable pressure calibrators. The requirements placed on the reference instrument used for checking in an Ex (potentially explosive) area are high. Ignition sources should always be eliminated in hazardous areas. They include calibrators without the ap-

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propriate approval. Such sources could trigger an explosion as a result of friction or impact sparks or possibly an electrostatic discharge. This hazard potential in a calibrator can be prevented by using suitable materials and design measures. EMC-protected ABS plastic is used, amongst other things, to prevent static discharge from the calibrator enclosure during handling.

The intrinsically safe CPH65I0 pressure calibrator with an accuracy of 0.025 % of span

Atex conformity

The "Ex-suitability" of an instrument is guaranteed by the Atex certificate, which is based on the European Community's 94/9/EC Directive for avoiding unwanted explosions in industry. This directive lays down all relevant requirements for calibrators, equipment and components. Calibrators developed, designed and built in accordance with the directive can be subjected to a standardised EC type examination. If the instrument passes this examination, it is granted an Atex certificate and can be used to calibrate process parameters in hazardous areas.

Generally speaking, however, explosion-proof test items should only be tested using intrinsically safe calibrators. Their comprehensive protection principle is based primarily on specific electronic components, which ensure that the calibrator can produce neither sparks nor ignition temperatures. All circuits in instruments such as the Wika CPH65I0 model are current and voltage-limited so that even if a fault occurs, there is no danger of ignition. Intrinsically safe calibrators are divided into three different levels of protection – "ia", "ib" and "ic" – according to requirements. An instrument with the "ia" classification has two redundant components (i.e. if two safety critical components fail, their function is provided by a third). With the "ib" protection level there is only one redundant component while with "ic" there are none.

High measurement accuracy

However, reliability is not the sole motive for using intrinsically safe calibrators: only they combine the highest possible accuracy with secure protection. If, for example, an Atex-approved process transmitter was to be tested with a non-intrinsically safe calibrator, it would not be possible to exclude damage from unlimited current and voltage outputs. A safety barrier (such as a zone separator) would have to be inserted to guard against this risk. These protective devices affect the measuring accuracy, however, so that errors would have to be taken into account in the calibration. Intrinsic safety renders such considerations superfluous. The demand for portable calibrators in hazardous areas is rising – not only for safety reasons but also because explosion-proof test items can remain in the plant. Mobile devices are also an economical solution for many industrial applications – even when expensive intrinsically safe products are purchased. Since on-site calibration only interrupts the process for a relatively short period, operators can save time – and hence money.

Calibrator for hazardous areas

The intrinsically safe CPH65I0 pressure calibrator with an accuracy of 0.025 % of span and various additional functions is suited to a wide range of applications, including hazardous areas, due to its Atex approval. This handheld instrument is available with either one or two built-in reference pressure sensors, covering 24 different measuring ranges up to 700 bar. In addition, the CPH65I0 accepts transmitter output signals (0...24 mA) while the ambient and medium temperatures (-40 to +150 °C) are measured by a resistance thermometer. A pressure switch test function completes the functionality. All pressure measuring instrument types can thus be calibrated using the new device. Although multi-functional, the robust CPH65I0 is simple to operate with just three keys. Three measurement parameters can be displayed simultaneously on the five-digit backlit display.

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FACTS & FIGURES

Principles of explosion protection

The three basic requirements for an explosion are a combustible gas, oxygen (ambient atmosphere) and an effective ignition source. However, an explosive atmosphere only occurs with a defined mixture ratio of gas and oxygen, which must not be too rich or too weak. This means that if the concentration of combustible gas is too high or too low, there can be no explosion. If the ratio is somewhere inbetween these values, then it is explosive. The mixture can be ignited in different ways, for example by heated surfaces, mechanically or electrically produced sparks or static electricity.

Depending on the explosion hazard, the relevant industrial areas are divided into three zones. In the IEC 60079-10-1 standard these are defined as follows:

- Zone 0: Area in which an explosive gas-air mixture is continuously present or present for long periods.
- Zone 1: Area in which an explosive gas-air mixture is likely to occur for short periods in normal operation.
- Zone 2: Area in which an explosive gas-air mixture is not likely to occur, and if it occurs it will only exist for a very short time due to an abnormal condition.

Thus, instruments for Zone 0 are naturally subject to higher requirements than those for Zone 1 or Zone 2. One key consideration for the use of test instruments is the ignition temperature of the respective gas-air mixture. The surface temperature of the calibrator components, such as the circuit board, must be below this value. To enable the devices to be categorised, six temperature classes are defined:

- T1: Ignition temperature > 450 °C, maximum permissible surface temperature at the calibrator 450 °C
- T2: Ignition temperature > 300 to 450 °C, maximum permissible surface temperature at the calibrator 300 °C
- T3: Ignition temperature > 200 to +300 °C, maximum permissible surface temperature at the calibrator 200 °C
- T4: Ignition temperature > 135 to 200 °C, maximum permissible surface temperature at the calibrator 135 °C
- T5: Ignition temperature > 100 to 135 °C, maximum permissible surface temperature at the calibrator 100 °C
- T6: Ignition temperature > 85 to 100 °C, maximum permissible surface temperature at the calibrator 85 °C