Application Description AD/TEMP/004-EN

Temperature measurement Sensors

The best sensors in the world

Introduction

Industrial temperature measurement is the most common form of instrumentation found in every process plant. For many processes the quality of this measurement determines the quality and yield of the final product resulting in a direct impact on the profitability of the entire plant.

The measuring sensor or 'inset' represents a small portion of the cost of the measuring assembly but contributes significantly to the accuracy and reliability of the measurement. The inset's value to the customer is often understated.

The measuring assembly

The measuring assembly comprises the inset (the thermometer that reads the temperature), a transmitter that transmits the value to the process control equipment and all the components required to package the measuring assembly. The sensor head protects the inset and transmitter from the environment. The thermowell protects the inset from the process fluid while enabling the inset to be removed for repair or re-calibration. The extension tube lifts the transmitter away from a potentially hot process. All of these items are essential to provide a robust temperature measurement solution and all are dependent on the quality of the inset to provide accurate and reliable temperature measurement.

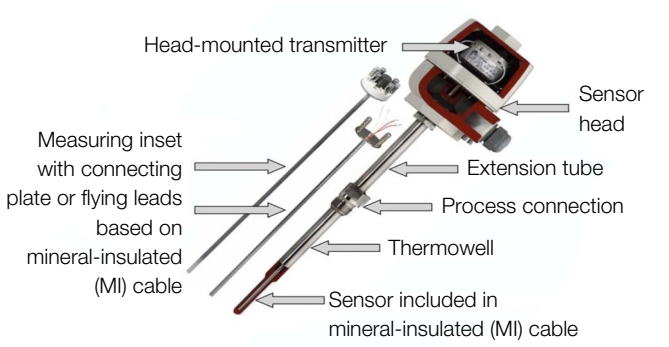

Fig. 1 The measuring assembly

Mineral-insulated (MI) cables and why they matter

All industrial insets are manufactured using MI cables. The cable has an outer sheath of a robust material like stainless steel that contains the internal cables of copper or the dissimilar metals required to make a thermocouple sensor. The internal cables are insulated from each other by a ceramic material that is most commonly magnesium oxide. In many cables this is in a powder form.

Fig. 2 ABB MI cables

ABB cables differ from the many alternatives on the market in significant ways. The mineral insulation retains its high density form that provides consistent insulation over the whole length of the cable. The internal cables have a consistent diameter and separation from each other giving predictable and stable results. The internal cables have a small grain size that reduces the internal resistance, improves the flexibility of the cable and improves the in-service life of the cables. The external diameter and finish of the cable is held to very high standard that allows for a number of advantages in the manufacture and final quality of the finished inset.

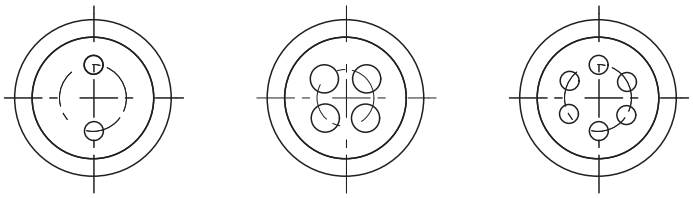

Fig. 3 ABB cables

ABB's unique production processes for MI cables result in unbeatable consistency in all these dimensions giving the customer absolute confidence in the accuracy and reliability of the measurement.

Pre-aging of the internal cables ensures significantly lower life-time drift of the cable resistance and thermocouple signal.

The results of all these significant differences are that ABB make insets that last longer and deliver a higher accuracy over their life-time. Longer lasting sensors are high value sensors.

Contaminant-free cable manufacture

The best insets on the market don't happen by accident. Careful thought and significant investment has been given to every stage of an inset's production to ensure that the highest possible value is given to the customer.

Using only the best quality cables is absolutely essential to achieving the best results possible from automated manufacturing processes. Automation provides a manufacturing environment where consistency and the removal of potential contamination result in an inset that lasts longer in service.

The process starts with straightening and cutting the cable to length.

Fig. 4 Cable cutting

The 'hot' end or measuring end of the inset has the outer stainless steel sheath removed and the compact mineral insulation removed, all fully automatically.

Fig. 5 Automatic sheath removal

The sensing element in the case of a Platinum Resistance Thermometer (PRT), or the thermocouple joint are welded by laser to ensure that no contamination of the joint occurs. A stainless steel cap is then welded in place to cover and protect the sensing element.

Fig. 6 Laser welding

A PRT element is extremely small: Fig. 7 shows a main cable with a diameter of just 6 mm.

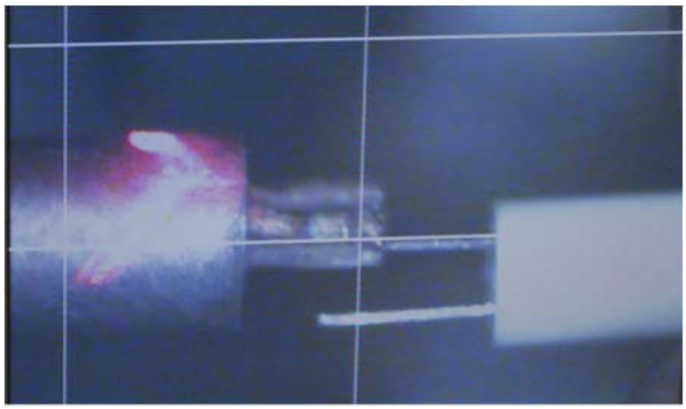

Fig. 7 PRT element

The best thermometer is the best value

ABB insets are the best on the market. They are technically far superior to the vast majority of competitors who, even if they use identical components, cannot match ABB's manufacturing processes. However, all of this technical and manufacturing excellence would mean nothing if it did not deliver very high value to the customer.

The majority of the cost of an industrial thermometer is to be found in the packaging that protects the measuring inset from the environment and the process. This cost can be let down by the use of inferior measuring insets. A cheap inset must be replaced more often. Only the customer knows how expensive this can be; the cost of replacement parts, the cost of the time spent replacing the inset and finally the cost associated with the loss of the measurement. This expense must be many multiples more than the price of a high quality ABB inset!

Markets served

ABB sensors are trusted by operators in the following demanding markets:

- Nuclear Power, reactor loops and power loops
- Oil & Gas, up and down streams
- Chemicals
- Petrochemicals
- Railways
- Aerospace
- Pharmaceuticals
- Power stations
- Shipping
- Buildings
- And many more

ABB measuring insets are the best value-for-money insets on the market.

Talk to your temperature PLS for more information on how ABB temperature adds value in a surprising number of ways to your customer's operations.

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