Inserts for temperature dry-well calibrators

Temperature dry-well calibrators are a popular type of instrument for checking temperature measuring instruments. The construction and operation of a temperature dry-well calibrator is as follows:

- In a solid body (the insert), there is a customer-specific number of bores.
- In these bores are located the temperature probes/ measuring instruments to be tested (test items).
- The solid body is tempered to the test temperature using a dry-well calibrator and its temperature controller, in order to calibrate the test items.
- The temperature in the bores of this block (insert) depends upon the correct selection of the framework conditions.

Framework conditions for the use of the correct inserts

The two decisive framework conditions in the selection of the insert are two properties:

Material

The dimensions and the material of the inserts are matched to the block construction. The exterior design with chamfers, offset edges or a vent hole ensures that the best stability can be ensured within the insert. Over the complete temperature range of a dry-well calibrator, only one material is used:

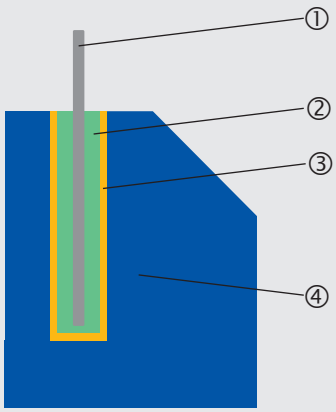
- Aluminium (up to 450 °C [842 °F])
- Brass (up to 650 °C [1,202 °F])
- Ceramic (up to 1,200 °C [2,192 °F])

The material, in turn, ensures that the temperature is transferred sufficiently quickly to the immersed thermometers. The better this material is matched to the block construction, the quicker is the transfer time of the temperature to the test items.

Dimensions

The bores in the insert are matched to the probes which should be immersed and tempered. The bores in diameters of 0.3 ... 0.5 mm [0.01 ... 0.02 in] should be bigger than the diameter of the thermometers which should be immersed in the bore. This is the optimal dimension which prevents a mechanical jamming of the sensor through thermal expansion and, in addition, ensures the lowest air gap.

Correct insert, bore size and material



① Temperature probe
② Insert
- Dimensions ✓
- Material ✓
- Bore size ✓

③ Bore for insert
④ Temperature calibrator

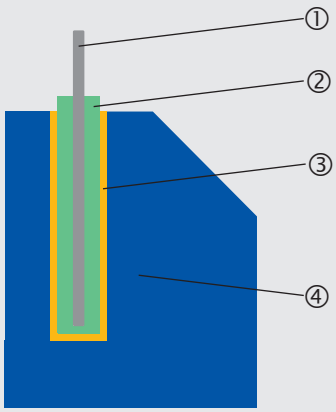
Data sheets showing similar products and accessories:
To improve the total uncertainty of the calibration with a temperature dry-well calibrator; see data sheet IN 00.32

Some scenarios that can lead to measuring errors

Insert from another calibrator

An exchange of inserts from one calibrator to another is not readily possible. Material and dimensions do not match. In addition, it is possible that the diameter of the insert does fit, but not the length and this protrudes at the top of the calibrator. This dramatically affects the heat transfer. Thus the specifications from the data sheet can no longer be maintained.

Insert from another calibrator



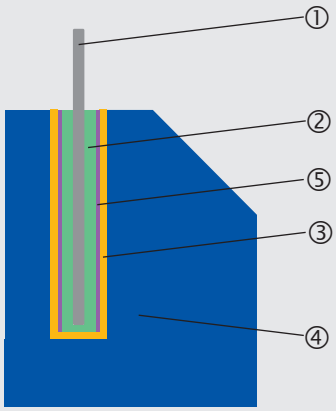
① Temperature probe
② Insert
- Dimensions ×
- Material ×
- Bore size ×

③ Bore for insert
④ Temperature calibrator

Dimensions of the insert too small

If the external dimensions of the insert are not matched to the block, then there can be air gaps which act as an insulator. These prevent that the specifications from the data sheet can no longer be met, a stable temperature cannot be controlled and also the set point cannot be achieved.

Dimensions of the insert too small



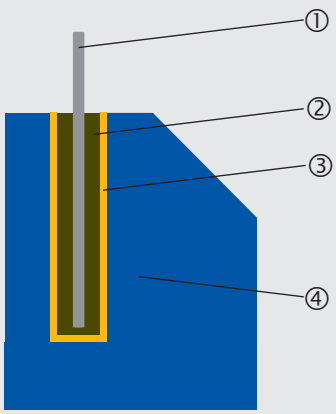
① Temperature probe
② Insert
- Dimensions too small ×
- Material ✓
- Bore size ✓

③ Bore for insert
④ Temperature calibrator
⑤ Air gap too large

Wrong material of the insert

Should the material not match the block, the heat transfer can no longer be guaranteed to be optimal. This possibly prevents the specifications from the data sheet being able to be maintained. In the worst case, the insert material would not endure the maximum service temperature and would melt. Thus, the calibrator could no longer be used.

Wrong material of the insert



① Temperature probe
② Insert
- Outer diameter ✓
- Wrong material ×
- Bore size ✓

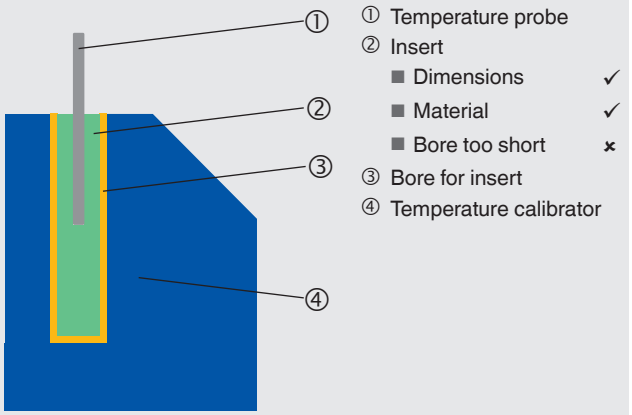
③ Bore for insert
④ Temperature calibrator

Bore too short

If the bore in the insert is drilled too short, the temperature in the block will not match that on the display. This has an axial gradient, meaning that there is a temperature difference from bottom to top. Calibrators are always measured at the bottom of an insert. Should such a short bore be required due to the probe, then one uses an additional, external reference which is immersed to the same depth. Thus, the traceably calibrated display of the calibrator is no longer trusted, rather only the external reference.

Working with an external reference is currently very widespread and has significant benefits.

Bore too short



Advantages with measurements with an external reference

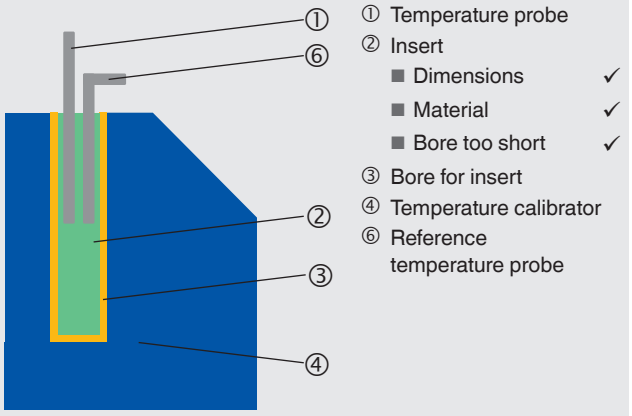
Flexible application of the equipment

- A dry-well calibrator and an external reference can also be used independently of one another.
- By acquiring multiple external references, different levels of accuracy can be achieved with a calibrator.
- Almost all probe lengths can be calibrated with good results; so long as the thermometers are inserted to the same depth in the calibrator (“success guarantee”).

Simple return and accurate calibration possible for the external reference

If one no longer trusts the display of the calibrator - to be able to do this, then the display must definitely be calibrated - one must read the reference value on an external instrument. The external reference must be traceably calibrated. This is easier to send than a calibrator, due to the dimensions and weight. In addition, for an external reference it is not just a comparative calibration which is feasible, but possibly also a calibration at fixed points.
A comparative calibration and a fixed-point calibration of the reference promise higher accuracies.

Measurements with external reference



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