PRESSURE SOLUTIONS

# C106: Determining Calibration Needs

Virtually nobody outside SANAS laboratories seem to be able to specify their calibration needs, probably because they are too lazy to do so. It's not rocket science!

A list such as the one below needs to be drawn up, and this must be an essential list, not a desirable list.

| Discipline | Application | Minimum Range | Maximum Range | UUT Uncertainty |
|---|---|---|---|---|
| **Pressure** | **Bag Filters** | **1 kPa** | **5 kPa** | **0,5% span** |
| **Pressure** | **Flow Transmitters** | **10 kPa** | **50 kPa** | **0,1% span** |
| **Pressure** | **Transmitters** | **60 kPa** | **2 500 kPa** | **0,25% span** |
| **Pressure** | **Switches** | **300 kPa** | **4 000 kPa** | **2% range** |
| **Pressure** | **Hydraulic Gauges** | **10 MPa** | **60 MPa** | **1% range** |
| **Temperature** | **Bearing RTDs** | **60ºC** | **120ºC** | **1ºC** |
| **Current** | **Loop Transmitters** | **0** | **24 mA** | **5 µA** |

If the company does not have a calibration policy in its quality management system, then take this up with the quality manager. All ISO listed companies should have this information on file somewhere.

Once the essential list is drawn up, any vendor proposal must be evaluated against this list. Proposals not meeting these requirements must be rejected, and those that do meet the list can then be short listed for a decision.

From the above, we can determine the minimum errors that can be tolerated in the various instruments.

We then need to know the required TUR (Test Uncertainty Ratio). This is more difficult to determine, since it is influenced by many factors, including the metrological proficiency of those doing the work. This could go as low as 2 in non-critical cases where the operators are qualified metrologists, although 3 is general considered the minimum under ISO guidelines.

**Examples on Proposals:**
Based on the above, we would suggest the following instruments. First, we will consider which applications will dictate expensive equipment, then consider whether other scope can be best met by extending this instrument, or buying separately.

Flow transmitters have a minimum permitted error of 0,1% of 10 kPa or 10 Pa. We need a calibrator with an uncertainty of 3 Pa to calibrate it. That's quite hard to do. The Fig. 551 deadweight tester has a range from 1,5 to 100 kPa. At 10 kPa we have an uncertainty of 0,02% of pressure which is 2 Pa. This is OK, but how about the

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bag filter transmitters. There we need to calibrate to 0,5% of 1 kPa, which means a permissible error of 5 Pa, and thus we need a calibrator with an uncertainty of less than 2 kPa at this pressure. This is below the minimum of the 551 deadweight tester.

The high and wide range of pressures for general purpose use might suggest a hydraulic deadweight tester. The 580DX will cover a range from 100 kPa up to 70 MPa. Now the deadweight tester always has a minimum pressure dictated by the pressure of the piston and weight carrier, so if we look at a minimum of 4 points in the calibration, we are looking at a minimum instrument range of 400 kPa. We now have two problems. 1. The deadweight tester is not a good way to calibrate switches, since it does not read continuous pressure. 2. What do we do for the transmitters over 100 kPa and under 400 kPa.

We can use small increment weights to be able to define a switching band that is well within the 6 kPa uncertainty of switch point on the switches. If we look at the Jofra APC, the ranges don't fit well. We can get a 200 kPa, which will handle the 60 – 200 kPa range, but the next range up is 1 500 kPa. Perhaps we should look at the APC for all the higher pressure work, and use its external sensor capacity to see how low we can go.

Lets take the 70 MPa indicator. We can use this for the pressure gauges down to 2 500 kPa. We can then look at a series of APM modules to give us the remaining required coverage.

For temperature, the range falls within any of the cooling dry-blocks. We need a total uncertainty of about 0,3ºC, so this excludes the ETC and the CTC, leaving the ITC as the minimum offering. Now the errors of any reading device which converts the signal to temperature must be taken into account. The ATC 156B will do the whole job. If we use the CSC200 this is going to contribute 0,2ºC to the system uncertainty. This makes the ITC/CSC combination marginal. The ASC300 is no better. If there's a need elsewhere, we could use the AMC900, but probably the ATC156B is the best bet.

For current, if we use the APC, we can get 5,6µA. Now if the 5 µA was **essential**, then this is not good enough.

This example illustrates just how complex a task we as suppliers face, and you can understand why so many suppliers don't ask too many questions, we just push want we think can sell.

It also implies that users should not ask for more accuracy than they need, because it will make compliance that much more difficult.

That is why a sensible definition of requirements is truly essential prior to purchasing calibration equipment that will stand up to audit.