Erratum

Comparison of pressure standards in the range 10 kPa to 140 kPa

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Owing to an unfortunate error in the printing of Section 7 of this article, the term ppm was inadvertently included when quoting pressure differences. With apologies to the authors, the corrected version is reproduced here.

7. Discussion

From the absolute mode figures it may be seen that the maximum difference between any two laboratories was approximately 1.6×10^{-5} at the lowest pressure of 11 kPa. At the highest pressure where measurements were taken by all laboratories, 101 kPa, the maximum difference was approximately 4.5×10^{-5}. When the results from those laboratories subsequently reporting errors with their standards and other problems (CSMU, CSIRO, BIPM2 and NPL4) are disregarded, the maximum difference falls to approximately 8.3×10^{-5} at 11 kPa and 3.0×10^{-5} at 101 kPa. The differences are clearly greater than would be expected from the claimed uncertainties of the participants.

Disagreements were also found in measurements made in the gauge mode with a difference between laboratories of 7.0×10^{-5} at 21 kPa and 3.5×10^{-5} at 101 kPa.

Possible causes of error in the comparison include both the measurement of temperature and, in the absolute mode, residual pressure. The temperature coefficient of the piston-cylinder was taken to be the traditional value of 2.16×10^{-5} K^{-1}. NIST1 reported [21] some additional data which suggested that the value was 2.09×10^{-5} K^{-1}, that is, different by 0.7×10^{-6} K^{-1}. The NIST also reported a shift in the thermometer's calibration corrections of approximately 0.1 K, corresponding to about 2×10^{-6} in effective area.

Errors ascribed to the performance of the Pirani gauge could have been marginally larger but the magnitude of these errors is not sufficient to explain fully the differences between the participants.

The results also show that there was no consistent variation of effective area with applied pressure, although there is evidence of a difference between the results obtained in the absolute mode and those obtained in the gauge mode. Such differences have been seen in other data [19, 20], although in some cases they may be a result of aerodynamic effects upon the spinning weights [20]. Indeed, one of the participants, NIST1, investigated the aerodynamic effect using the transfer standard and reported [21] their gauge mode results corrected to a zero rotational speed. This was not done by other participants. Analysis of the gauge-mode results is further complicated by the fact that participants carried out their measurements at different line pressures and the information reported did not always allow an accurate calculation of buoyancy effects: in some cases it was necessary to assume a gas density of 1.2 kg m^{-3} in the bell-jar. Also, some participants who did take measurements in the gauge mode did so only at certain nominal pressures, which were not the same for each participant.