

An Investigation Into the Effect of Varying Temperature On PTP Corrections in TG-51

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Presentations

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Purpose: To determine the effect on machine output calibration, following the TG-51 protocol, as the water temperature increasingly deviates from Standard temperature (22°C)

Methods: A water tank was set up according to TG-51 protocol. Two sets of measurements were taken and the pressure recorded. The measurements consisted of readings at different temperatures. In the first set, $P_{(ion)}$, $P_{(pol)}$, and $P_{(elec)}$ were assumed constant while they were accounted for in the second. The outputs were normalized to that at 22°C. The first readings were taken after the chamber had equilibrated to the water temperature. The water temperature was then raised at intervals of approximately 1-2°C and measurements taken after 5-10 minutes (as per TG-51).

Results: In both measurements, $P_{(TP)}$ was corrected for using equation 10 in TG-51. The normalized output is expected to be 1.0 with all corrections accounted for. However as the water temperature was gradually increased, the normalized output also varied. The largest discrepancy observed while not accounting for the factors, $P_{(ion)}$, $P_{(pol)}$, and $P_{(elec)}$ was 1.1%, and while accounting for these factors, the largest discrepancy was 1.0%.

Conclusion: Our results show discrepancies in output measured at different temperatures. Although a lack of equilibrium may explain these discrepancies, it is not as easy to ensure true equilibrium. It is also possible that these discrepancies are real and related to the inherent venting mechanism of the chamber. However, more work would need to be done to investigate this further and to determine if this effect is true across all Exradin and/or other manufacturer chambers. Most importantly, the physicist should perform TG-51 at room temperature and pressure to better ensure thermal equilibrium. If this is not currently being done, and not enough time is given, especially when the water temperature is "significantly" different from 22°C, the calibration will be less accurate.