

“Short” BEST PRACTICE GUIDE

**USE OF INFRARED FOREHEAD THERMOMETERS TO PERFORM
TRACEABLE NON-CONTACT MEASUREMENTS OF HUMAN BODY
TEMPERATURE**

*Based on the CCT-TG-BTM best practice guide: “Use of infrared
forehead thermometers to perform traceable non-contact
measurements of human body temperature”*

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1. Purpose

To aid the clinician to obtain the best performance from a forehead thermometer for determining human body temperature, including an estimate of the likely overall uncertainty¹.

2. Forehead thermometer indicated temperature versus human core body temperature

The temperature of the forehead (skin) can significantly depart from core body temperature depending on, for example skin perfusion and environmental conditions. As such, forehead (skin) thermometers are not suitable for fever screening in public places or use outside. With appropriate use in a suitably controlled environment with a well-designed/constructed thermometer, temperature trends may be determined.

3. Influence factors

Measurement distance: Forehead thermometers should be used as close to the skin as manufacturers recommend. Their output is sensitive to the distance to the skin and the temperature reading increasingly deviates from the true target temperature with increasing distance (in temperate climates, this means that the thermometer will generally read low). Errors of up to several degrees Celsius are easily obtained.

Measurement target: The region of the forehead (skin) being measured *must be clear* of all obstructions – e.g., hair, head covering, masks, eyeglasses and sweat free. The forehead or other skin is severely affected by ambient conditions (e.g., heater or solar radiation, wind, or air conditioning, etc.). The person *must* be allowed to acclimatise (typically 10 – 15 min) to the ambient conditions of the measurement location before their temperature is taken. Without following these precautions, large errors of several degrees Celsius could be obtained.

Ambient conditions: The forehead (skin) thermometer operates within specified ambient conditions given by the manufacturer. Use outside of those conditions could result in significant errors.

Influence of thermometer warming: It is important not to allow the thermometer to warm up above the ambient conditions – for example, through continual handling. This can adversely affect performance. The thermometer should only be held during measurement.

Drift: The thermometer accuracy will degrade over time. To correct for this, the device requires periodic and traceable calibration. The calibration status and when the next calibration is due should be clearly indicated on the device. The calibration should be performed with the thermometer indication in direct mode, when the output of an infrared thermometer displays the measured temperature with no attempted correction made to body temperature site (no correction for skin emissivity).

Device stress: If the device has been dropped, for example, or taken outside of its operating conditions (e.g., overheated), it may no longer reliably measure temperature and its performance *must* be confirmed before continuing use.

4. Expected accuracy in use

The maximum permissible error (MPE) stated in ASTM E1965 – 98 for infrared clinical (e.g., forehead) thermometers is 0.3 °C.

¹ This document is a summary of the key findings of: “CCT-TG-BTM best practice guide: Use of forehead thermometers to perform traceable non-contact measurements of human body temperature”. This can be downloaded for free from: bjgm.org

In use, following the manufacturer's instructions and taking the precautions outlined above, **the best achievable expanded uncertainty in the temperature measurement would be 0.9 °C ($k = 2$).**