SERVERSCHECK

Difference between Body and Skin temperature

Coronavirus (COVID-19) has turned our lives upside down and continues to capture headlines as countries start to lift restrictions to reactivate their economies. The demand for thermal screening devices (IR spot and thermal cameras) used to detect elevated skin temperatures (EST) is surging, with businesses, schools and other public-facing organisations leveraging the technology to screen for this potential indicator of COVID-19 infection.

Most of us are aware that our body's core temperature range is typically between 36.5–37.5 °C, but did you know that skin temperature (what thermal and infrared sensors detect) is significantly lower than core body temperature? Another important factor that is not common knowledge is the way that ambient temperature can affect body temperature – core and surface. This article delves into these issues to help readers better understand what to look for in a potential thermal screening solution.

The images below illustrate a human's core temperature area the impact of ambient temperature on the thermal conditions throughout the human body.

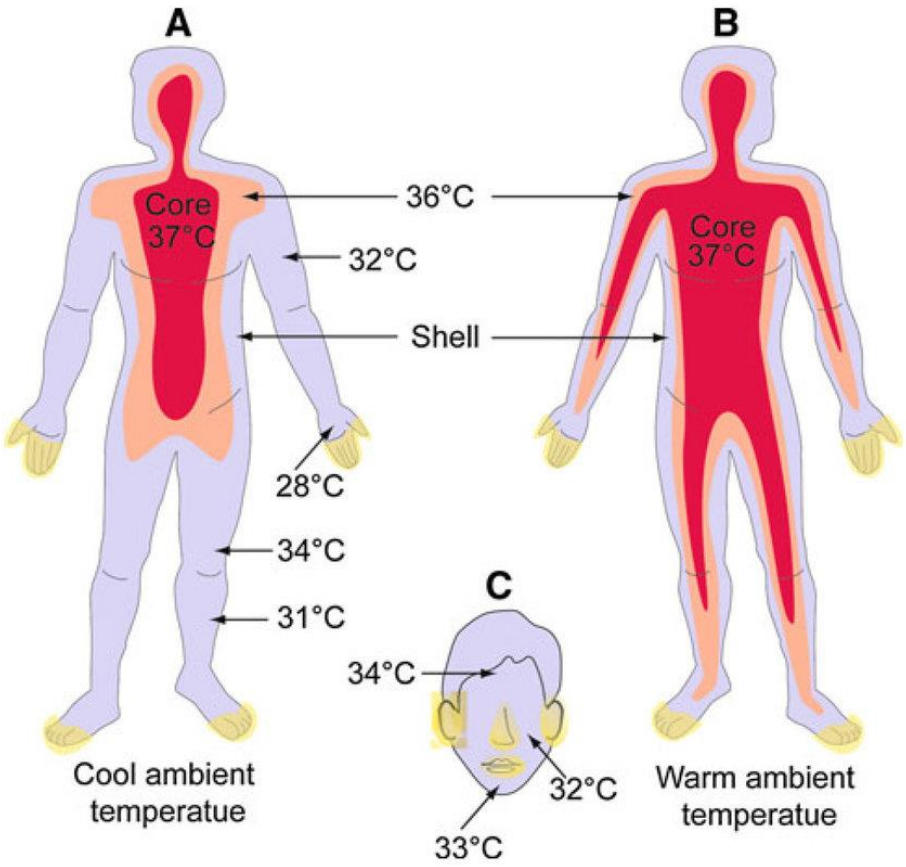
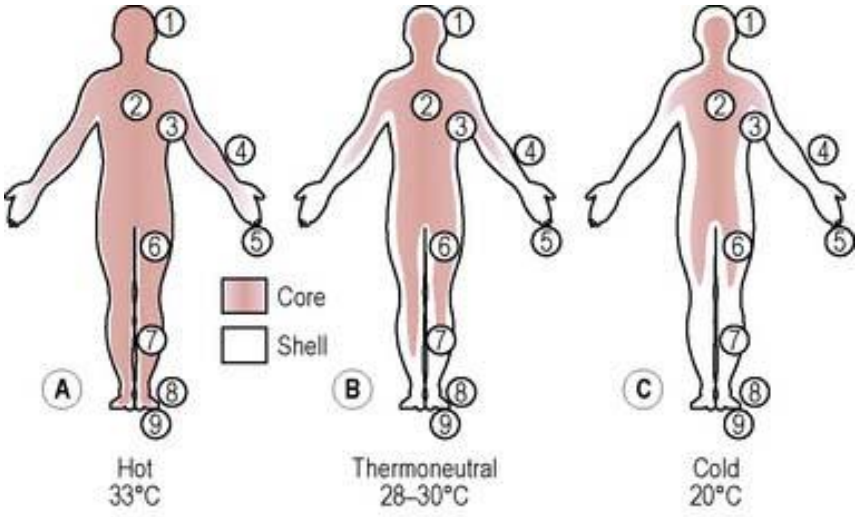


Figure 1: Euthermia: the anomaly of human body temperature



	Site	A (°C)	B (°C)	C (°C)
1	Scalp	36.0	34.8	32.8
2	Chest	35.8	34.5	31.3
3	Axilla	36.5	36.4	36.4
4	Arm	35.9	33.5	27.6
5	Finger	35.9	33.2	21.0
6	Thigh	35.2	33.4	27.8
7	Leg	35.3	30.1	25.2
8	Foot	35.5	29.7	22.7
9	Toe	36.2	29.1	21.4

Figure 2: Body core temperature and temperature of the skin surface at various sites in a hot, a thermoneutral and a cold environment

(Based on an original figure by Aschoff & Wever, cited in Stainer et al 1984, with additional data from Childs C.)

Many business leaders and the people tasked to source thermal screening devices are not aware that there is a significant difference between a human's skin temperature and core temperature as per the above illustration. Therefore, when considering a potential thermal screening device, one should ask questions like:

- What part of the body's surface is this device intended to scan?

- In the case of automated systems where the data is logged and/or configured to trigger notifications, is the software calibrated to factor in the expected discrepancy between core and surface temperature?

It's also important that the methodology around your EST regime takes into account the effect of ambient environmental temperature on human temperature readings. Consistency is key here; testing should be ideally be conducted in a temperature-controlled room so that the offset formula can remain constant. Any type of EST screening should never be performed outdoors; only indoors.

Most thermal screening for EST is done with people facing the thermal screening device. We refer to this as frontal screening.

Following SARS and other infectious disease outbreaks, multiple research papers have been published on the difference between skin and core temperatures and correlating elevated skin temperature with fever.

These research papers discuss the frontal and lateral screening methods and explore which methods have a closer correlation to average human core temperatures.

With frontal screening the following areas are screened;

- Complete facial area,
- Lacrimal caruncle area (inner corner of the eye), and
- Forehead.

With lateral screening the following areas are screened;

- Maximum lateral (temple, ear and neck), and
- Temple

The following areas that have the best correlation to our body core temperature are:

- The lacrimal caruncle area, and
- Temple area.

Research states that the mean temperature of the lacrimal caruncle and temple is approximately 35.4°C in a well-controlled climatic environment.

When deploying a thermal screening device, its alert parameters must be set to a lower temperature than our body core temperature to eliminate false "pass" temperature readings. Given the high stakes of a potential infectious person shutting down business operations, it is preferable to have a false "fail" screening that can be

confirmed with a secondary temperature test by a resident medical officer or by a doctor than allowing a possibly infectious person to ‘slip under the radar’ because of a poorly designed EST screening protocol.

Sources:

Detection of body temperature with infrared thermography: accuracy in detection of fever
(https://www.researchgate.net/publication/232712926_Detection_of_body_temperature_with_infrared_thermography_accuracy_in_detection_of_fever)

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Fever Screening and Detection of Febrile Arrivals at an International Airport in Korea: Association among Self-reported Fever, Infrared Thermal Camera Scanning, and Tympanic Temperature
(https://www.e-epih.org/journal/view.php?doi=10.4178/epih/e2014004)
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