

Fever Screening Best Practice Recommendations

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Statement of Need:

In order to help protect the public, the American Academy of Thermology (AAT) has created a video to demonstrate the proper technique for implementing non-contact, infrared (IR) skin temperature measurement as used for fever screening. For an introductory video on this topic click this link: [Why IR Fever Screening is Needed](#)

IR Fever Screening Attestation:

The AAT is implementing a training program for individuals, businesses, and agencies that are performing IR skin temperature measurements in an effort to protect their employees and customers.

The AAT is offering this training program at no charge, and it is all on-line. The training takes only about two hours and concludes with a Certificate of Participation for individuals. The AAT is also offering a Fever Screening Compliance Attestation program for businesses and agencies. The AAT Compliance Certificate requires businesses and agencies to attest that they are:

1. Performing thermal equilibration of employees/patrons.
2. Obtaining tear duct temperature measurements, or in the alternative, if forehead* temperature measurement is done, then there is a prescreening of at least 10 people to determine average forehead temperature for a baseline temperature comparator. * Other locations such as sublingual or the ear canal may also be considered, but they are less commonly utilized in this setting.
3. Establishing a meaningful fever threshold (Tear duct temperature of 99°F, or forehead average temperature plus 1.4 °F).
4. Implementing a secondary measurement protocol (such as oral temperature measurement) for all who fall outside screening limits.
5. In compliance with the bullet points itemized within this document.

Individuals may obtain a Certificate of Participation by completing the on-line training module (Level I) and achieving an 80% passing score on a post-test.

Businesses or agencies can receive an IR Fever Screening Compliance Attestation Certificate by also completing Level II training and achieving an 80% passing score on its post-test.

Prior to the issuance of the Certificate individuals, businesses, and agencies will be asked to confirm that their practices are consistent with AAT IR Temperature measurement fever screening recommendations.

Background:

After months of arguing about the effectiveness of cloth masks, wearing them is now rapidly becoming mandatory as we try to reduce the spread of COVID-19. Likely soon to follow is the use of infrared (IR) thermometers and infrared cameras for fever screening. Today's fever screening using non-contact IR cameras is not for dummies. You can NOT simply look at the number on the IR camera or thermometer to determine if a person has a fever.

Many employers and hospitals have already implemented ways to take temperatures of associates as they report to work. Retailers are likely to follow suit. Most are using IR cameras to measure forehead temperatures. While the use of IR for inferring temperature differences in a controlled environment is a reliable measurement, and guidelines have been written by organizations such as the International Electrotechnical Commission (IEC) and the American Academy of Thermology (AAT) to help delineate how to do measurements correctly, our observation is that they are often not done correctly out in the field. As a result, there is likely a significant percentage of mis-interpretations that lead to false positive and false negative outcomes.

Consider the following example. During a visit to a business yesterday, upon entering, the security personnel pointed an IR thermometer at my forehead, announced my temperature as 96°F and allowed me to enter. When asked what is the limit for a fever, I was told 101°F. That scared me. I said to myself, "No way. Everyone knows that forehead skin temperature is not the same as internal body temperature". In fact, the average internal body temperature is about 98.6°F and that most doctors don't consider anything below 100.4°F to be a fever. So why are people then measuring forehead temperature, which typically is 3-5°F degrees below the internal body temperature while using the same decision thresholds as used for the internal temperature measurements? The answer is because they are doing it incorrectly.

Another factor to consider is outside weather conditions. Depending upon the weather outside, skin temperature changes. If your body has not been given a chance to equilibrate with room temperature then what is being measured has even less of a correlation with internal temperature. Would you check a child's forehead to see if he or she has a fever if they just walked in from playing in the snow or after a soccer game? Probably not.

The purpose of IR skin temperature measurements for fever screening is to identify probable candidates for further testing; those, for example, that may need to have an oral temperature taken following a positive IR test. This means that today, every non-contact IR *screening* process must include a secondary step to validate a suspected fever case.

Recommendations:

Let's consider the correct way to employ IR skin temperature measurement for fever screening through the use of infrared thermometers and cameras. First, consider where to do the IR measurement. Based on previous studies, the AAT guidelines say you should be measuring the temperature of the tear duct (medically referred to as the medial canthus) area of the eye, not the forehead. This site has shown to have the best correlation to the internal body temperature. Tear duct measurement is possible with IR camera systems but not IR thermometers. Many non-medical grade IR thermometers include laser pointers that should not be used in the vicinity of the eye.

Second, consider the threshold. A fever is defined after internal temperature crosses 100.4°F. So, it is reasonable to suspect that if someone's external temperature measured by IR camera at the tear duct is 100°F or higher, then there is need to confirm the suspicion of fever by performing a second test with an oral thermometer.

If you are going to measure forehead temperature (not recommended) and make a decision based on it, then you will have to do another validation step prior to implementing the screening procedure. You have to scan the foreheads of many healthy people and establish the average "healthy" forehead temperature. The threshold for "healthy" set should have standard deviation of 0.5°F. Once you know the average and standard deviation, you can define a positive fever screen as anyone with a forehead temperature of at least 1.4°F higher than the average.

If the upper limit is met or exceeded, then the person should be taken aside to perform an oral temperature test to validate the screening temperature result. Normally, since climate conditions change throughout the day, the "average forehead temperature" sample taken early on has to be revalidated periodically throughout the day. You can see why this method is cumbersome at best and leads to inaccurate measurements.

There are other critical parameters that must be taken into consideration for IR measurement of temperature as well. Subjects should have rested in an indoor screening area for at least 5 minutes for each 0 – 10°F difference between the screening room temperature and the outside ambient temperature. This is necessary to allow the body to equilibrate.

Fever Screening requires the intelligent application and use of fever screening devices. It is essential to use the instruments correctly. For those who are serious, we refer you to ISO Standard 13154, The American Academy of Thermology Oral-Systemic Guidelines, video tutorials on IR Fever screening, Member Certification Courses, and the FDA publication: Best practices for standardized performance testing of infrared thermographs intended for fever screening. These resources were published following the SARS outbreak and provide excellent information.

The FDA has mandatory requirements when it comes to IR skin temperature measurement systems that might be used for fever screening or any other medical application. As such, these thermographic systems are intended for use by licensed health care professionals for medical purposes. IR systems that are marketed to the general public for general, non-medical purposes, such as use in construction and other industrial applications, should never be used for medical conditions.

Taken together, recommendations for medical grade thermographic equipment and procedures for fever screening should include the following elements (consistent with the standards according to IEC 80601-2-59:2017 and ISO/TR 13154 – 2017):

- Temperature accuracy that is less than or equal to $\pm 0.5^{\circ}\text{C}$ ($\pm 0.9^{\circ}\text{F}$) over the temperature range of at least $34\text{-}39^{\circ}\text{C}$ ($93.2\text{-}102.2^{\circ}\text{F}$)
- The system utilizes an accurate blackbody* temperature reference source for accurate calibration. *This is an FDA requirement, however some manufacturers proopt to circumvent the need for a black body through software or firmware enhancements
- Temperature measurements are made from the immediate area that is adjacent to the medial canthus of the eye.
- Software aids in obtaining these temperature measurements allows any necessary adjustment of the threshold levels.
- The labeling for the system includes a prominent notice that the measurement should not be solely or primarily relied upon to diagnose or exclude a diagnosis of COVID-19 or any other disease.
- Any elevated body temperature measurements above the threshold levels should be confirmed with secondary evaluation methods.
- The system should be used to measure only one subject's temperature at a time and the visible thermal patterns are only intended for locating the points from which to extract the thermal measurement.
- The stability and drift are less than 0.2°C (0.36°F) within a timeframe specified by the manufacturer.
- A description of how different environmental and system setup factors can affect the measurement, including the body site chosen for measurement, the condition of the screening site (e.g., screening background, ambient temperature and humidity) and acceptable subject equilibration times.
- The important factors to consider in the design of the facility protocol (e.g., installation, viewing angle, blackbody temperature reference source, traffic flow)
- The installation procedures and qualification testing of the operators that should be performed during installation or when imaging equipment is being relocated.
- The appropriate imaging distance based on the spatial resolution and camera performance.

The AAT can play a key role in providing hands-on guidance and support to individuals, businesses, and agencies in several critical areas. These include:

- Issuance of IR Fever Screening Certificates of Participation for individuals and Fever Screening Compliance Attestation Certificates for businesses and agencies*
- Provide minimum standards for equipment requirements
- Equipment calibration and Quality Control/Quality Assessment
- In depth training for screening operators and decision makers: image acquisition Standard Operating Procedures - locations, protocols, storage requirements, HIPAA compliance; image interpretation, beyond a simple go-no-go decision when ambiguity exists
- Identification of proper IR system suppliers: IR cameras, software, enhancing access when demand outpaces supply
- Strategic planning and screening program roll-out: coordinate with first responders and health care providers; better prepare for the future; efficiently implement a screening program.

*Visit <http://courses.aathermology.org>