

Physical Agents

Thermal Comfort for Office Work

On this page

[What is meant by thermal comfort?](#)

[What factors influence thermal comfort?](#)

[What temperature should an office be?](#)

[What humidity level should an office be?](#)

[What impact does air velocity have?](#)

[What role do the other factors play?](#)

What is meant by thermal comfort?

To have “thermal comfort” means that a person wearing a normal amount of clothing feels neither too cold nor too warm. Thermal comfort is important both for one's well-being and for productivity.

Temperature preferences vary greatly among individuals, and no one temperature can satisfy everyone. Nevertheless, an office that is too warm makes its occupants feel tired; on the other hand, one that is too cold causes the occupants' attention to drift, making them restless and easily distracted.

It is important to maintain constant thermal conditions in the offices. Even minor deviations from comfort may be stressful and affect performance and safety. Workers already under stress are less tolerant of uncomfortable conditions.

What factors influence thermal comfort?

Thermal comfort is determined by a number of factors:

- Metabolic rate and/or activity level (of the persons in the room): varies with the number of occupants, and the amount of activity done by occupants (e.g., sitting in a restaurant versus serving the customers).
- Clothing: varies by individual's choices in clothing or by work requirements (e.g., garments worn in an office, chemical protective clothing, or rain gear).
- Air temperature.

- Radiant temperature: a complex term, but generally described as how the heat transfers between the body and other objects in the area (e.g., radiation is the process by which the body gains heat from surrounding hot objects, such as hot metal, furnaces or steam pipes, and loses heat to cold objects, such as chilled metallic surfaces, **without contact** with them).
- Solar loading.
- Air speed (velocity): the rate of air movement.
- Humidity: a general description of the moisture content of the air.

What temperature should an office be?

The American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Standard 55 Thermal Environmental Conditions for Human Occupancy offers a "comfort zone" example and the effect of clothing worn (based on operative temperature, relative humidity, humidity ratio and wet bulb temperature). Generally speaking:

Table 1: Comfort Zone and the effect of clothes

**Values in degrees Celsius with relative humidity at 50%

Clothing value*	Lower comfort zone**	Higher comfort zone**
Clothing value 0.65	21	25
Clothing value 1.0	18	23

*Clothing value 0.65 is approximately equivalent to wearing trousers and a long-sleeved shirt, or wearing a knee-length skirt (with a full slip) and a long-sleeved shirt. Clothing value 1.0 is approximately equivalent to wearing trousers, a long-sleeved shirt, a long-sleeved sweater, a t-shirt, or a knee-length skirt, a long-sleeved shirt, a half slip, and a suit jacket. In comparison, walking shorts and a short-sleeve shirt would have a clothing value of 0.36.

This range of temperatures is based on the assumption that people would dress to be slightly cool in the summer (that is, wear lighter-weight clothing), while people in the winter dress to be slightly warm (wear heavier-weight clothing). Some people may feel uncomfortable even if these values are met, and additional measures may be required.

In some situations, legislation may have specific requirements. A list of temperature requirements found in legislation is available in the OSH Answers document [Temperature Conditions - Legislation](#).

What humidity level should an office be?

The ASHRAE Standard 55 uses a graphic comfort zone method that takes into account the factors of relative humidity, humidity ratio, operative temperature, and wet bulb temperature with notes on clothing, metabolic rate, radiant temperature, and air speeds. ASHRAE states “there are no established lower humidity limits for thermal comfort; consequently, this standard does not specify a minimum humidity level.”

Relative humidity levels below 20% can cause discomfort through drying of the eyes, mucous membranes and skin. Low relative humidity levels may also cause static electricity build-up and negatively affect the operations of some office equipment, such as printers and computers. Relative humidity levels above 70% may lead to the development of condensation on surfaces and within the interior of equipment and building structures. Left alone, these areas may develop mould and fungi. Higher humidity also makes the area feel stuffy.

The Health and Safety Executive (UK) states that a relative humidity between 40% and 70% does not have a major impact on thermal comfort.

What impact does air velocity have?

Air velocity can be created by the air conditioning or ventilation system, and by cold surfaces (e.g., air flowing towards the floor). Thermal comfort is affected by this air movement. Drafts, especially on the head region (head, neck, and shoulders) and leg region (ankles, feet, legs), can cause discomfort.

Generally speaking, temperatures considered in the comfort zone will increase with increased airspeed.

What role do the other factors play?

Thermal comfort also depends on the metabolic rates (activities being done), the clothing a person wears, and the radiant temperatures of other surfaces.

The influence of metabolic rate (e.g., from performing activities) and clothing will vary from person to person, even if every person wears the same clothing and performs the same activity. Where possible, allow individuals to have some control over clothing options and the pace of work.

Radiant temperature sources include floors and windows. For example, poorly insulated windows can create a cold area in the winter, and sunshine can create a warm area in the summer. Humans are most sensitive to warm ceilings and to cold vertical surfaces such as windows. Floor surface temperatures that are too high or too low, and that are different from air temperatures, also contribute to thermal discomfort.

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