Thermal comfort in the workplace

Guidance for employers

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This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.

Contents

Introduction

1 Each year, especially when the weather is very hot or cold, the Health and Safety Executive (HSE) gets calls from employers, employees and the public about what HSE considers a comfortable temperature for people to work in, and whether maximum or minimum temperatures are laid down in health and safety legislation.

2 This publication looks at what is meant by thermal comfort in the workplace and what the law says. It gives guidance to you, the employer, on the steps you can take to ensure comfortable working temperatures for your employees during hot or cold weather, suggests some standards you can use, and tells you where to get further information and help. It also sets out what the Workplace (Health, Safety and Welfare) Regulations and the accompanying Approved Code of Practice (ACOP) require you to do (see paragraphs 27, 29-33).

3 The publication deals with thermal comfort in most indoor workplaces such as shops, offices, factories and laboratories. It does not deal with working in **extreme** conditions such as:

- **work outdoors in hot or cold weather;**
- **work with hot processes or in hot environments (eg foundries, glassworks and potteries);**
- **work in humid conditions (eg paper mills and laundries);**
- **work in cold environments (eg chilled workrooms or cold stores); or**
- **work requiring special personal protective clothing to be worn**.

Other guidance for these workplaces is available from HSE Books and other sources. However, some of the principles contained in this publication could be used to ensure thermal comfort in most workplaces.

What is thermal comfort?

4 Thermal comfort is very difficult to define. This is because you need to take into account a range of environmental and personal factors when deciding on the temperatures and ventilation that will make your employees feel comfortable. The best that you can realistically hope to achieve is a thermal environment which satisfies the majority of people in the workplace, or put more simply, ‘reasonable comfort’.

5 You, as an employer, are responsible for assessing risks to the health, safety and welfare of your employees. These include the effects of heat, cold and humidity. You will need to consider the way in which (a) environmental factors (eg air-conditioning or the weather outside) and (b) factors affecting individual people (eg age, sex and state of health) contribute to how they feel. You will need to ensure that a reasonable balance is achieved between all these factors.

6 As an employer, you need to consider:

(a) The environment

- **air temperature;**
- **radiant temperature, ie from a source of heat;**
- **relative air humidity;**
- **ventilation;**
- **air movement;**
- **climatic and seasonal variations, ie outdoor temperatures and conditions; and**
- **how the building has been designed, eg type of insulation, glass windows with film to reduce glare etc.**

(b) The individual

- **the way different people's bodies balance the different demands made on them (eg some people sweat more than others, or feel the cold more);**
- **the amount and type of special clothing or personal protective equipment that is worn;**
- **the type of work being done;**
- **the age, sex, state of health and degree of fitness of the individual;**
- **how long the individual is exposed to the hot/cold environment; and**
- **specific groups of people such as young people and pregnant workers.**

In general, you should try to ensure that the temperature at the workplace is pleasant, rather than too hot or too cold. You should also try to ensure that the atmosphere is dry rather than damp or humid (but not too dry as dry air can irritate eyes, cause coughs and make people feel uncomfortable).

7 There may, of course, need to be different temperatures in different parts of the workplace, for example changing rooms and shower facilities need to be warmer than offices or the factory floor.

8 You should make sure above all that there is a reasonable degree of air movement. Air movement is especially important to thermal comfort because it

distributes fresh air or warmth throughout a workplace, or has a cooling effect. It has been shown that workplaces which have a constant temperature, constant humidity and insufficient air movement can make people feel uncomfortable because of the static conditions.

How to assess thermal comfort

9 You cannot simply 'measure' thermal comfort with a thermometer. For example, a normal or 'dry-bulb' thermometer in a workplace may read 21°C (70°F) but if humidity is high, people are likely to feel uncomfortable unless some form of air-cooling or ventilation is provided.

10 An acceptable zone of thermal comfort for most people in the UK lies roughly between 13°C (56°F) and 30°C (86°F), with acceptable temperatures for more strenuous work activities concentrated towards the bottom end of the range, and more sedentary activities towards the higher end.

11 One method for assessing thermal comfort, which takes account of different environmental and individual factors, uses an **effective temperature** scale. This seeks to combine the effects of air temperature, humidity and air movement into a single measurement. This gives a better approximation of the temperatures which people in the workplace are likely to feel. In general, effective temperatures will be 1°C (2°F) to 3°C (6°F) lower than the air temperature. This, like other methods, seeks to define a **thermal comfort zone** where a majority of people will feel reasonably comfortable. The thermal comfort zone will vary from workplace to workplace, depending on the environmental and individual factors.

What can you do to ensure thermal comfort?

12 You should first take into account people's thermal comfort as part of your health and safety risk assessment. If the temperature in the workplace is shown to be a significant hazard or the existing precautions are insufficient, then action should be taken to remove the hazard or control the risks.

13 As part of the risk assessment ask your employees or safety representatives if they have experienced any problems, for example light-headedness, difficulty in concentrating, or in gripping/handling equipment or loads. Find out about possible ill-health effects of hot or cold weather on any workers who may already have health problems. If you feel it is necessary you may wish to seek

advice on thermal comfort and thermal environments from qualified ergonomists or occupational health and hygiene consultants. In addition, you may find it useful to refer to the additional guidance material listed in the 'Further reading' section on page 10.

14 There are six main methods of control which you can use:

(a) Control the source:

- **reduce/increase the temperature; and/or**
- **insulate or clad the source of heat or cold**.

(b) Control the environment:

- **replace hot air with cold, or increase air movement by ventilation or air-conditioning; or**
- **replace cold air with heated air**.

(c) Separate the source of heat or cold from the worker:

- **erect barriers, shield the work area or restrict access**.

(d) Control the task:

- **restrict the time that workers are exposed to heat or cold; and/or**
- **control the amount of work that workers are expected to do**.

(c) Protect the worker:

- **provide suitable special clothing and/or equipment (eg desk fans)**.

(f) Monitor the worker:

- **provide appropriate supervision**.

15 However, these methods may not be sufficient to ensure thermal comfort. You may need to consider other factors such as those given below.

Building design and layout

16 The most effective way of ensuring thermal comfort is to design the workplace appropriately. For example, enclosing loading and unloading areas will increase comfort in winter conditions, particularly if combined with increased thermal insulation.

Heating

17 Many types of heating are available:

- **hot air, heated by gas or oil burners;**
- **central heating by steam heat, where the steam, or hot fluid, is circulated through radiators;**
- **combined heating and ventilating systems, where the air-conditioning system is used to heat air, which is then circulated;**

- **miscellaneous electric heating, eg where heating is by electric (radiant) heaters;**
- **floor heating, where the floor is heated by heating coils which can be either electric elements or pipes through which a heated fluid is circulated;**
- **overhead radiant heating, either gas or electric**.

18 Most of these systems have useful applications. However, ceiling heating and overhead radiant heaters may warm the head but leave feet cold. Floor heating is a good method but installation costs are high and people may find it uncomfortable on the feet. Using radiators can cause problems, as workers nearby will benefit but people further away may not. Whatever form of heating is used, it must be safe and properly maintained. If portable or temporary heaters are used, such as electric fires or gas or paraffin heaters, care should be taken to avoid the particular risks that these bring.

Air movement

19 There are many methods for increasing air movement. Small 'personal' fans can provide a refreshing movement of air on the face. Larger oscillating fans can provide a swirling air movement, though some people may find this draughty. There may also be noise problems. Large-diameter fans suspended from the ceiling can provide a swirling air movement that is effective over a wide area. Exhaust fans, mounted in the roofs and walls, are useful for removing heated air; however, while improving general air movement, they may have little effect on thermal comfort.

Air-conditioning

20 This can range from small units, that lower the air temperature but do not control humidity levels or air movement, to large units that can cope with extreme conditions, and also control humidity and air movement.

Evaporative cooling

21 Evaporative coolers produce a moderate reduction in air temperature and increase humidity. They operate by passing hot air over water-saturated pads and the water evaporation effect reduces the dry-bulb temperature.

Thermal insulation

22 There are many different types of thermal insulation materials such as loose fills, foams, rock wool and boards. The material acts as a barrier, which retards heat flow in the summer and heat loss in the winter, but it is only effective where there is a temperature difference between the inside and the outside of the building or between two areas inside a building.

Some simple ways you can ensure thermal comfort in hot weather

23 You can help ensure thermal comfort in hot weather by:

(a) putting insulating material around hot plant or pipes;

(b) providing air-cooling or air-conditioning plant;

(c) providing fans, eg either desk, pedestal or ceiling-mounted fans;

(d) ensuring that windows can be opened;

(e) shading windows with blinds or using reflective film to reduce the heating effect of the sun;

(f) siting workstations away from direct sunlight and places or plant which radiate heat;

(g) providing additional facilities, eg cold water dispensers (water is preferable to caffeine or carbonated drinks);

(h) introducing work systems to limit exposure, such as flexible working patterns, eg early start/finish times;

(i) allowing sufficient breaks to enable employees to get cold drinks or to cool down;

(j) introducing flexible working practices such as flexible hours or earlier starts to the working day to avoid the worst effects of working in exceptionally high temperatures;

(k) relaxing formal dress codes, but you must ensure that personal protective equipment is provided and used if required.

Some simple ways you can ensure thermal comfort in cold weather

24 You can help ensure thermal comfort in cold weather by:

(a) providing adequate heating in the workplace or local heating such as temporary heaters;

(b) reducing exposure to the cold by separating cold products or cold areas from areas where people are working;

(c) reducing draughts;

(d) providing insulated duckboards or other floor coverings or special footwear where workers have to stand for long periods on cold floors;

(e) providing the appropriate type of protective clothing;

(f) introducing work systems to limit exposure to a cold environment, for example by introducing later start times to allow the daytime temperature to rise; and

(g) allowing sufficient breaks to enable employees to get hot drinks or to warm up in heated areas.

What the Law requires you, as an employer, to do

25 All workplaces are covered by the **Health and Safety at Work etc. Act 1974 (HSW Act).** This sets out the general duties that you have towards your employees and members of the public, and those duties which employees have to themselves and to each other. Although it does not mention temperature specifically, you should ensure, so far as is reasonably practicable, the health, safety and welfare at work of your employees. This includes providing a working environment that is both safe and without risk to health.

26 The amended **Management of Health and Safety at Work Regulations 1992 (MHSWR)** builds on the HSW Act. It places duties on you to assess risks and where necessary take action to ensure and safeguard health and safety, including health surveillance where appropriate. You are also required to consider possible risks to new and expectant mothers and not to employ young people if they are likely to be exposed to extreme cold or heat.

27 The main Regulations on the ventilation of indoor workplaces and on indoor workroom temperature are in the **Workplace (Health, Safety and Welfare) Regulations 1992** with accompanying Approved Code of Practice (ACOP) and guidance. These Regulations require that:

(a) workplaces must be adequately ventilated (regulation 6);

(b) the temperature during working hours must be reasonable (regulation 7);

(c) any method of heating or cooling used should not produce dangerous or offensive fumes, gas or vapour (regulation 7); and

(d) thermometers should be provided in the workplace to measure temperatures (regulation 7).

These Regulations do not apply to outdoor workplaces.

Ventilation

28 To effectively ventilate a workplace, fresh clean air should be drawn from a source outside and circulated through the workrooms. This air should be

uncontaminated by discharges from flues, chimneys or other process outlets. The ventilation system should remove and dilute warm, humid air and provide air movement, to create a sense of freshness without causing a draught. If the workplace contains process or heating equipment or sources of dust, fumes or vapours, more fresh air will be needed to provide adequate ventilation. Humidity and ventilation should be maintained at levels which prevent discomfort or problems of sore eyes, especially if display screen equipment is used.

Temperature

29 The Regulations do not specify a minimum or maximum indoor workplace temperature. The ACOP does, however, recommend the following:

(a) minimum temperatures for **workrooms** of at least 16°C (62°F), or 13°C (56°F) if much of the work involves severe physical effort. These minimum temperatures do not apply to rooms or parts of rooms where it would be impractical to maintain these temperatures, for example in rooms which have to be kept open to the outside or where food or other products have to be kept cold;

(b) where a reasonably comfortable temperature cannot be achieved throughout a workroom, local heating or cooling should be provided;

(c) if, despite local heating or cooling, your workers are still exposed to uncomfortable temperatures, you should take further action to resolve the problem.

30 The practical advice in an ACOP has a special legal status. If you are prosecuted for a breach of health and safety law, and it is proved that you have not followed relevant provisions, a court will find you at fault, unless you can show that you have complied with the ACOP in some other way.

Other legislation

31 Schedule 1 to the **Health and Safety (Display Screen Equipment) Regulations 1992** requires that equipment belonging to any workstation should not produce excessive heat which could cause discomfort to operators or users. There should also be an adequate level of humidity. The guidance to the Schedule adds that ventilation and humidity should be maintained at levels which prevent discomfort or problems of sore eyes.

32 Schedule 1 of the **Offshore Installations and Wells (Design and Construction etc) Regulations 1996** addresses, in brief, both thermal comfort and protection against bad weather for offshore installations.

33 **The Construction (Health, Safety and Welfare) Regulations 1996** require a reasonable working temperature to be maintained in any indoor place of work, and protection from adverse weather at any outdoor place of work.

Where to find guides or standards on thermal comfort

34 The following organisations produce guides and standards on thermal comfort:

- **The Chartered Institution of Building Services Engineers (CIBSE)** (Tel: 0181 675 5211) publishes guides on building design which give design data relevant to workplace temperature;

- **The British Occupational Hygiene Society** (Tel: 01332 298101) has produced *Technical Guide No 8: The thermal environment* which is a comprehensive general guide on thermal comfort;

- **The International Organisation for Standardisation (ISO)** in Geneva (Tel: 0041 22 7490111) has published a range of standards on the measurement, assessment and evaluation of the thermal environment. The effects of thermal comfort have been published or are under discussion. The standard most relevant to general thermal comfort is
  ISO 7730:1994 *Moderate Thermal environments - Determination of the Predicted Mean Vote (PMV) and Predicted Percentage Dissatisfied (PPD) indices and specification of the conditions for thermal comfort.*
  You can also use other ISO standards on extremes of thermal environment.

Further reading

Guidance for indoor work

Workplace health, safety and welfare - A short guide for managers INDG244 HSE Books (single copies free;
ISBN 0 7176 1328 3 for priced packs of ten copies)

Page 22 of *How to deal with sick building syndrome - Guidance for employers, building owners and building managers* HSG132 HSE Books ISBN 0 7176 0861 1

Pages 56-59 and Appendix 4 of *Health and safety in retail and wholesale warehouses* HSG76 HSE Books
ISBN 0 11 885731 2

Workroom temperatures in places where food is handled FIS3 (rev1) HSE Books (free)

Guidance for outdoor work

Keep your top on: Health risks from working in the sun INDG147(rev1) (single copies free: ISBN 0 7176 1578 2 for priced packs of 20 copies)

International Standards

ISO 7730:1994 *Moderate thermal environments - Determination of the Predicted Mean Vote (PMV) and Predicted Percentage Dissatisfied (PPD) indices and specification of the conditions for thermal comfort*

ISO 11399:1995 *Ergonomics of the thermal environment - Principles and application of relevant International Standards*

ISO/CD 13731 *Ergonomics of the thermal environment - vocabulary*

ISO 7726 *Thermal environments - Instruments and methods for measuring physical quantities*

ISO 10552 *Assessment of the influence of the thermal environment using subjective judgement scales*

The future availability and accuracy of the references listed in this publication cannot be guaranteed.

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