Risk control

Thermal Comfort at Work

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Thermal Comfort at Work

Introduction

The topic of thermal comfort comes up in the news regularly with concerns about rising energy costs; possibility of power cuts; and the added pressure on our energy supplies. This is exacerbated by more people following a hybrid working model and working from home more often.

However, with financial pressures being faced by everyone it is necessary for organisations to take the time to review what it is doing to actively manage the risks.

With pressure on resources every person has been encouraged to cut down on electricity and gas consumption. The easiest way to achieve this is seen as turn down the thermostat on the central heating system to save money and put on a jumper. However, this shows an extremely basic understanding of thermal comfort.

An organisation must therefore consider what factors affect thermal comfort; the legal requirements placed on an employer and explore what practical measures it can take to mitigate the risk.

Environmental Factors

The Health and Safety Executive is regularly approached about what is a sensible temperature to maintain a workplace at, to the point where it is on their frequently asked questions page on the website.

A response to that question depends on what the organisation does, the type of environment a person is working in, and personal factors to do with an employees' job, work wear and level of activity.

So, it is necessary to look at both the environmental and personal factors that can influence their comfort. The temperature of the work environment; the heat radiated towards an individual; the air movement around them, and the amount of moisture in the air all influence comfort.

Air Temperature

The air temperature is a significant factor. This is the temperature of the air surrounding the body and in the United Kingdom is usually given in degrees Celsius (°C).

Typically, in an indoor workplace we would expect a level no lower than 16 °C and, although an upper level is not specified, the World Health Organisation recommends 24ºC as a maximum for comfortable working.

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Radiant Heat

Thermal radiation is the heat that radiates from a warm object. Radiant heat may be present if there are heat sources in an environment such as:

— Central heating radiators

— Fan heaters

— Electric fires

— Ovens

— Cookers

— Dryers

— Hot surfaces on machinery.

Radiant temperature has a greater influence than air temperature on how we lose or gain heat to the environment.

Air Velocity

Air velocity describes the speed of air moving across the employee and may help cool them if the air is cooler than the environment.

It is a crucial factor in thermal comfort for example:

— Still or stagnant air in indoor environments that are artificially heated may cause people to feel stuffy. It may also lead to a build-up in odour

— Moving air in warm or humid conditions can increase heat loss through convection without any change in air temperature

— Physical activity also increases air movement, so air velocity may be corrected to account for a person's level of physical activity

— Small air movements in cool or cold environments may be perceived as a draught as people are particularly sensitive to these movements

Humidity

If water is heated and it evaporates to the surrounding environment, the resulting amount of water in the air will provide humidity. Relative humidity is the ratio between the actual amount of water vapour in the air and the maximum amount of water vapour that the air can hold at that air temperature.

Relative humidity between 40% and 70% does not have a major impact on thermal comfort. In workplaces which are not air conditioned, or where the weather conditions outdoors may influence the indoor thermal environment, relative humidity may be higher than 70%. Humidity in indoor environments can also vary greatly and may be

dependent on whether there are drying processes where steam is given off.

High humidity environments maintain significant vapour in the air, which prevents the evaporation of sweat from the skin. In hot environments greater than 80% humidity is important because less sweat evaporates. The evaporation of sweat is the main way our bodies reduce the core body temperature.

This may be significant depending on what a person is wearing when they are working. When non-breathable vapour-impermeable personal protective equipment (PPE) is worn, the humidity inside the garment increases as the wearer sweats because the sweat cannot evaporate. If an employee is wearing this type of PPE (e.g. asbestos or chemical protection suits etc.) the humidity within the PPE will be high.

Personal Factors

The employer must also educate the employee about the part they can play in ensuring thermal comfort. The clothing an individual wears and the work rate they sustain can both affect how comfortable they feel.

Clothing

Clothing is both a potential cause of thermal discomfort as well as a control for it. Comfort is very much dependent on the insulating effect of clothing on the wearer. Wearing too much clothing or PPE may be a primary cause of heat stress even if the environment is not considered warm or hot. If clothing does not provide enough insulation, the wearer may be at risk from significant discomfort or in extreme cases cold injuries such as frostbite or hypothermia.

We may add layers of clothing if we feel cold or remove layers of clothing if we feel warm. Many employers do not think about this when providing work wear such as a specific uniform or PPE.

It is important to identify how the clothing contributes to thermal comfort or discomfort. By periodically evaluating the level of protection provided by existing PPE and evaluating newer types of PPE we may be able to improve the level of thermal comfort experienced.

Metabolic Rate

The more physical work a person does, the more heat they produce. The more heat they produce, the more heat needs to be lost so that the individual does not overheat. The impact of metabolic rate on thermal comfort is therefore critical.

A person's physical characteristics should always be kept in mind when considering their thermal comfort, as factors such as their size and weight, age, fitness level, and gender can all have an impact on how they feel, even if other factors such as air temperature, humidity and air velocity are all constant.

Maintaining Heat Balance

The human body is always trying to balance the heat loss or gain from the environment to maintain a core body temperature between 36-38 °C. It uses a number of mechanisms to influence heat exchange with the surroundings.

Heat Loss

If a job relies on someone lying on a concrete floor, then their conductive heat loss is significant. If they work in a workshop environment with an open roller shutter door the windy conditions help create convective heat loss. If the person is hotter than their surroundings they radiate heat.

Heat Gain

If someone is working in an enclosed space with the sunlight coming in through the window, they will experience radiant heat gain. If there is hot equipment near with exhaust ventilation points it will cause the warm air to move causing convective heat gain. If standing on a heated floor this would cause conductive heat gain.

Sweating

The human body circulates warm blood to the surface of the skin causing the body to sweat. That moisture on the surface of the skin, which is then absorbed into the air as water vapour, causes a cooling effect on the blood. This process is called evaporative heat loss.

Getting the Balance Wrong

When the balance is not right, the individual will exhibit signs of Heat or Cold Stress. Recognising these symptoms is important when talking about thermal comfort in the workplace as these clues could indicate the workplace risk assessment has been inadequate.

Signs of Thermal Stress

A person showing the signs of heat stress may talk about finding it difficult to concentrate; experiencing muscle cramps, developing a heat rash, are visibly sweating, or have a severe thirst. In more significant cases fainting due to dehydration can occur or result in a heat stroke.

Whereas a person with signs of cold stress will often talk about feeling cold, experiencing pain and numbness, and be visibly shivering. In some cases, the person can have

uncharacteristic mood and behaviour changes, suffer confusion, or become very drowsy and become difficult to rouse.

Legislation

The Health and Safety at Work etc. Act 1974[1] is an enabling act setting out the broad framework of duties and is then supported by a large number of supporting regulations. At least 50 directly relevant to health and safety.

Section 2 - General Duty of Employers places an obligation on the employer "to ensure, *so far as is reasonably practicable*, the health safety and welfare at work of all employees."

A similar requirement is contained in Section 3 of the Act which extends to those persons not employed but affected by how an organisation conducts its undertaking.

To achieve this goal, the Management of Health and Safety at Work Regulations 1999[2] requires the employer to undertake an assessment of risks and have a system of management to implement control measures to ensure thermal comfort at work. To guide the employer on aspects to implement the Workplace Health, Safety and Welfare Regulations 1992[3] sets out the key features of a workplace that must be provided.

Key Considerations

The guidance to the regulations explains that the temperature inside the workplace should provide reasonable comfort without the need for special clothing. If reasonable comfort cannot be achieved because of hot or cold processes, all reasonable steps should be taken to achieve a temperature which is as close as possible to comfortable.

As previously mentioned, the temperature in a workplace should normally be at least 16 °C. If work involves rigorous physical effort, the temperature should be at least 13 °C. However, these temperatures may not necessarily provide reasonable comfort, depending on other factors such as air movement, relative humidity, and worker clothing. No upper temperature is specified, the World Health Organisation however recommends 24ºC as a maximum for comfortable working.

These temperature guidelines are not applicable where it would be impractical to maintain those temperatures, for example in rooms which must be open to the outside, or where food or other products must be kept cold.

Education Establishments

The Special Premises (England) Regulations 2012[4] does not contain a specific temperature although the National Education Union in England has recommended to its members the classroom should be a minimum of 18 °C.

The Education (School Premises) Regulations 1999[5] in Wales do explicitly state in Regulation 20 that, in areas where there is the normal level of physical activity associated with teaching, the appropriate minimum temperature is 18ºC. In areas where there is a lower-than-normal level of activity (e.g. first aid rooms) or higher than normal level of activity (e.g. gymnasia and washrooms), the appropriate minimum temperatures are 21ºC and 15ºC, respectively.

The School Premises (General Requirements and Standards) (Scotland) Regulations 1967[6] regulation 23 sets out guidance on the temperature for parts of a school should be.

- Medical spaces, changing and bathrooms should be around 18°C
- Teaching spaces, dining rooms, nursery, staff, and common rooms should be around 17°C
- Assembly Areas should be around 15°C
- First aid rooms should be around 14°C
- Cloakrooms, corridors, and gymnasiums should be 13°C each.
- Games halls should be around 10°C

Where a comfortable temperature cannot be achieved throughout a workroom, local heating or cooling could be provided. In extremely hot weather, fans and increased ventilation may be used instead of local cooling. For areas of the workplace other than workrooms, such as toilets and rest facilities, temperatures should be reasonable, and no specific temperature figure has been suggested. Where provided changing rooms and shower rooms should also not be cold.

Thermometers made available at suitable locations in every part of the workplace would allow people to measure temperatures, however it is not necessary for thermometers to be provided in every workroom. When a thermometer is provided it should not be located directly in front of windows or near radiant heat sources which would give a false reading of the air temperature.

Where local heating or cooling is unable to provide reasonable comfort protective clothing and rest facilities must be provided.

Another option is to include in the safe system of work task rotation among employees to ensure the amount of time individual workers are exposed to uncomfortable temperatures is limited.

Solutions

Temperature controls

Firstly, organisations need to review the different conditions the person may have to work in. In situations where it is too hot put insulation around unnecessary heat sources to reduce radiant heat. Or for offices using solar film to reduce solar heat gain from windows.

Humidity

As we said the humidity can be significant. Remember a low relative humidity where the air is “dry” allows water vapour can leave the surface of the skin easily. Where the relative humidity is high the air is “damp” water vapour cannot easily leave the surface of the skin. Adding real plants into an environment increases the humidity. Using a dehumidifier takes moisture out of the air in an office.

Warm Spaces

The Government has been encouraging Council’s to provide warm spaces in a variety of community spaces including community and church halls, libraries, leisure centres and even museums.

Not only can someone keep warm and reduce their household bills, but it also helps with mental health and wellbeing by encouraging getting out and meeting others.

Clothing

Look carefully at what the person is wearing. The unit CLO is a value that describes the degree of insulation provided by an article of clothing.

A CLO value of 1 is equal to the amount of clothing required by a resting human to maintain thermal comfort at a room temperature of 21 degrees Celsius.

Average indoor air temperatures in the UK range from 68.5 to 75 degrees Fahrenheit in the winter, and 75 to 80.5 degrees Fahrenheit in the summer.

Clo = 1 - corresponds to the insulating value of clothing needed to maintain a person in comfort sitting at rest in a room at 21 ℃ with air movement of 0.1 m/s and humidity less than 50% - typically a person wearing a business suit.

The higher the CLO value, the more insulating value is provided by the clothing in question.

Workwear

Where organisations provide personal protective equipment which is clothing review the different conditions the person may have to work in. Try to provide layers that can be combined when needed, for instance a high viz jacket with a detachable fleece as a liner.

Hot Environments

If the temperature in a workroom is uncomfortably high, for example because of hot processes or building design, take all reasonable steps to achieve a comfortable temperature, for example by:

- Insulating hot plants or pipes
- Providing air-cooling plant
- Shading windows
- Siting workstations away from places subject to radiant heat

If a person must work in a hot environment for a good proportion of their day, organisations should consider:

- Restricted work periods
- Drinks to replace lost salts/fluids
- Supervision to ensure regimes are followed and detect heat stress early

Cold Environments

Conversely, if a person must work in a cold environment for a good proportion of their day, organisations should consider the following factors.

In rooms where food or other products / processes must be kept at low temperatures and it is impractical to comply, the following measures should be applied as appropriate:

- Enclosing or insulating the product
- Pre-chilling the product
- Keeping chilled areas as small as possible
- Exposing the product to workroom temperatures as briefly as possible
- Providing insulated duckboards or other floor coverings where workers must stand for extended periods on cold floors, unless special footwear is provided which prevents discomfort
- Excluding draughts from workstations, e.g. by using baffles
- Installing self-closing doors where such measures are practical and would reduce discomfort

Management would need to ensure:

- Warm shelters for break
- Dry clothing if necessary
- Warm drinks to replace fluids

If they are required to work below -7 degrees C

- Close Supervision may be necessary
- Avoid sweating if possible
- Avoid sitting or standing for extended periods

Conclusions

It is important to get the basics right in health and safety.

Organisations need understand what is required to maintain thermal comfort before they can begin to control it. Not all of it is down to the individual, the employer has a responsibility to identify the risks and actively manage them.

Take the opportunity to review risk assessments and thermal comfort arrangements regularly, taking account of the seasons.

References

1. The Health and Safety at Work etc. Act 1974. Available here: https://www.legislation.gov.uk/ukpga/1974/37/contents
2. The Management of Health and Safety at Work Regulations 1999 (as amended). Available here: https://www.legislation.gov.uk/uksi/1999/3242/contents
3. The Workplace (Health, Safety and Welfare) Regulations 1992. Available here: https://www.legislation.gov.uk/en/uksi/1992/3004/contents
4. The School Premises (England) Regulations 2012 SI 2012 No.1943. Available here: The School Premises (England) Regulations 2012
5. The Education (School Premises) Regulations 1999. Available here: https://www.legislation.gov.uk/uksi/1999/2/contents/made
6. The School Premises (General Requirements and Standards) (Scotland) Regulations 1967. Available here: https://www.legislation.gov.uk/uksi/1967/1199/contents/made

Additional Sources

1. Heat and Health Factsheet. Available here: World Health Organisation
2. Guidance to help schools and local authorities understand their obligations in relation to the School Premises Regulations 2012. Available here: Guidance on standards for school Premises

Risk Management Partners and Gallagher Bassett would like to thank QBE European Operations for the material used to shape this toolkit segment.

Further information

For access to further RMP Resources you may find helpful in reducing your organisation's cost of risk, please access the RMP Resources or RMP Articles pages on our website. To join the debate follow us on our LinkedIn page.

Get in touch

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