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Setting Up Installment Plans for Mobile Home Furnace Upgrades

Overview of HVAC needs specific to mobile homes

In the realm of home improvement, particularly in the context of mobile homes, upgrading essential systems like furnaces can often prove to be a significant financial undertaking. Modern HVAC systems offer quieter operation for mobile home settings **mobile home hvac near me** water purification. The importance of setting up installment plans for furnace upgrades cannot be overstated, as they offer a manageable and practical approach to financing what could otherwise be an overwhelming expense.

Firstly, setting up installment plans democratizes access to efficient and modern heating solutions. Mobile homeowners are often working within tight budgets where large, lump-sum expenditures are not feasible. By breaking down the cost into smaller, more affordable payments over time, families can enhance their living conditions without jeopardizing their financial stability. This incremental payment structure allows for immediate access to improved heating systems that provide better energy efficiency and reliability, which can result in lower utility costs over time.

Moreover, installment plans help mitigate the urgency and stress associated with furnace breakdowns during critical times of the year. Winter months demand effective heating solutions, and when an old furnace falters or fails entirely, waiting until enough savings accumulate is not always an option. Installment plans enable homeowners to act promptly and ensure their household remains warm and safe during cold spells.

Financial institutions and retailers offering these plans also tend to provide flexible terms tailored to varying income levels and credit standings. This flexibility ensures that a wider demographic has access to necessary upgrades without facing prohibitive interest rates or rigid payment schedules. It's an inclusive approach that underlines the importance of equitable opportunities for all homeowners.

Additionally, investing in a modern furnace through an installment plan can increase property value—a crucial consideration for those who might wish to sell their mobile home in the future. Prospective buyers often prioritize homes with upgraded amenities because they promise reduced maintenance costs going forward.

From an environmental perspective, newer furnaces typically boast higher energy efficiency ratings compared to older models. By facilitating these upgrades through installment plans, homeowners are contributing positively toward reducing carbon footprints while enjoying lower operational costs due to decreased energy consumption.

In conclusion, setting up installment plans for mobile home furnace upgrades is a strategic move that addresses both immediate financial constraints and long-term benefits. It empowers homeowners by providing access to vital improvements without compromising their economic well-being. As such programs become more widespread and finely tuned to consumer needs, they hold immense potential in promoting sustainable living conditions across diverse communities while ensuring comfort and security throughout harsh weather conditions.

Upgrading the furnace in a mobile home can be a significant decision, one that involves careful consideration of both costs and benefits. As temperatures drop and energy efficiency becomes increasingly important, many mobile homeowners are contemplating whether an upgrade is worth the investment. Evaluating this decision involves not just assessing the immediate financial outlay but also understanding the long-term advantages, including setting up installment plans to manage costs effectively.

First and foremost, it's essential to consider the cost aspect of upgrading a furnace in a mobile home. Unlike traditional homes, mobile homes have specific requirements for heating systems due to their unique structure and size. This often means that homeowners might face higher upfront costs for specialized equipment and installation. However, modern furnaces tend to be more energy-efficient than older models, potentially leading to lower utility bills over time. The initial expense can be daunting, but with proper planning and budgeting, it can be managed without straining finances.

On the other hand, the benefits of upgrading cannot be understated. A new furnace system can significantly enhance comfort by providing consistent heat throughout the living space. Moreover, newer systems often come with advanced features such as programmable thermostats or smart controls that allow for better temperature management and energy conservation. Upgrading also means fewer repairs since older furnaces are prone to

breakdowns as they age, leading to additional costs and inconvenience.

To make furnace upgrades more accessible financially, many companies offer installment plans tailored specifically for mobile home owners. These plans allow homeowners to spread the cost over several months or years rather than paying a lump sum upfront. By breaking down payments into manageable monthly installments, these plans make it feasible for individuals on tight budgets to afford necessary upgrades without compromising their financial stability.

When considering an installment plan, it's crucial for homeowners to thoroughly evaluate terms such as interest rates and payment schedules. Selecting a plan with favorable terms ensures that while investing in comfort today does not become a burden tomorrow. Additionally, some manufacturers or contractors may offer promotions or zero-interest periods which can further alleviate financial pressure.

In conclusion, while upgrading the furnace in a mobile home involves both costs and benefits that must be carefully weighed against each other; setting up an installment plan offers a pragmatic solution for managing expenses efficiently. By opting for energy-efficient systems enhanced by convenient financing options like installment plans-homeowners not only improve their living conditions but also contribute positively towards sustainable energy use practices-a win-win situation indeed!

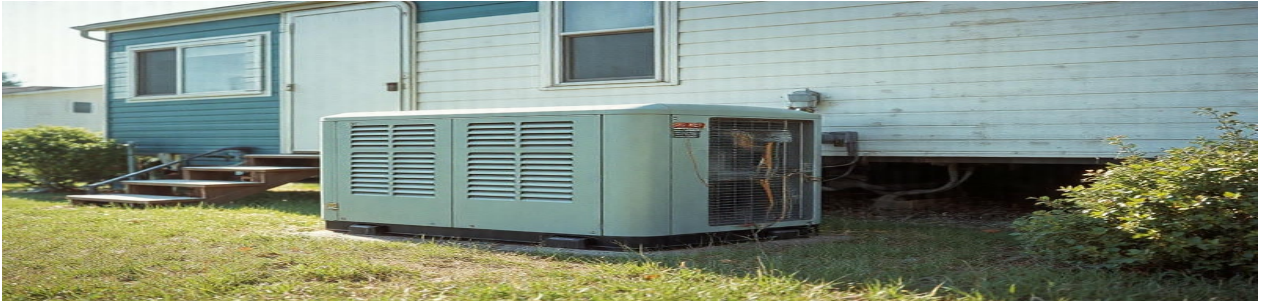
Affordable Payment Plans for Upgrading Mobile Home AC Systems



Choosing the right payment plan for upgrading your mobile home AC system is a crucial decision that can significantly impact your financial stability and comfort at home.. With numerous options available, it's essential to consider several factors to ensure you select a plan that aligns with your needs and budget. Firstly, assess your financial situation.

Posted by on 2024-12-30

Aligning Equipment Compatibility with Financing Options in Mobile Homes



In the dynamic world of mobile homes, aligning equipment compatibility with financing options is a crucial element that can significantly impact the success of any project.. The process involves ensuring that the equipment used in mobile home construction or renovation is not only technically suitable but also financially feasible.

Posted by on 2024-12-30

Benefits of Payment Plans Tailored for Mobile Home HVAC Upgrades



When contemplating upgrades to your mobile home's HVAC system, choosing the right payment plan is as crucial as selecting the equipment itself.. As energy efficiency and comfort become increasingly important, many homeowners are considering tailored payment plans that make these enhancements more accessible.

Posted by on 2024-12-30

Understanding Financing Options for Mobile Home HVAC

When considering the essential components of comfortable living in a mobile home, a reliable and efficient furnace stands out as a crucial element. However, upgrading or installing a new furnace can be a significant investment, one that might not be immediately affordable for many homeowners. Understanding financing options for mobile home furnace installments is vital to ensuring that comfort is attainable without undue financial strain.

Firstly, it is important to recognize the variety of financing options available. Many manufacturers and retailers offer their own installment plans which allow homeowners to spread the cost over several months or even years. These plans often come with varying interest rates and terms, so it's crucial for buyers to read the fine print and understand what they are committing to. Such in-house financing can be convenient because it simplifies the process by keeping both purchase and financing under one roof.

Another popular option is obtaining a personal loan from a bank or credit union. This route often provides more competitive interest rates compared to retailer financing, especially if the borrower has good credit. Personal loans also offer flexibility in terms of repayment periods and amounts borrowed, allowing homeowners to tailor their plan according to their financial situation.

Additionally, some government programs provide assistance for energy-efficient upgrades, including furnaces. These programs may offer low-interest loans or grants aimed at reducing overall energy consumption and improving efficiency in homes. It's worth exploring whether any such initiatives apply specifically to mobile homes in your area.

For those who may have less-than-perfect credit scores, there are still opportunities available, though they might come at higher costs. Subprime lenders specialize in offering loans to individuals with lower credit ratings; however, these typically carry higher interest rates as compensation for increased risk.

It's also beneficial for potential borrowers to consider partnerships with utility companies that occasionally provide rebates or special financing deals on energy-efficient equipment installations. These collaborations can significantly reduce upfront costs and make monthly payments more manageable.

Before committing to any financing agreement, it's wise for homeowners to assess their budget carefully. This includes not only evaluating current income but also anticipating future expenses that could impact their ability to meet installment obligations comfortably. Setting realistic expectations about what one can afford will prevent stressful situations down the line.

In conclusion, setting up installment plans for mobile home furnace upgrades requires careful consideration of various financing options available on the market today. By comparing different plans-whether through retailers, banks, government programs, or alternative lenders-and aligning them with personal financial circumstances and long-term goals, homeowners can make informed decisions that ensure warmth and comfort without compromising financial well-being.



Explanation of common financing packages available

Upgrading the furnace in a mobile home is often a necessary investment to ensure energy efficiency, comfort, and safety. However, the financial burden of such upgrades can be daunting for many homeowners. Establishing an installment plan becomes a practical solution, allowing homeowners to spread the cost over time while enjoying the immediate benefits of a

new heating system. Here are some crucial steps to setting up an effective installment plan for furnace upgrade projects.

The first step in establishing an installment plan is assessing your financial situation. This involves understanding your budgetary constraints and determining how much you can afford as a down payment and monthly installments. Begin by reviewing your income, expenses, and any existing debts to gauge your financial flexibility. Consider consulting with a financial advisor if you need assistance in balancing these elements effectively.

Next, research potential lenders or financing partners who specialize in home improvement loans or offer specific programs for HVAC upgrades. Many manufacturers and contractors provide financing options tailored to their products, which may offer competitive interest rates and terms compared to traditional banks or credit unions. It's essential to compare different offers carefully, considering factors such as interest rates, loan terms, penalties for early repayment, and any hidden fees.

Once you've identified suitable financing options, prepare the necessary documentation required by lenders. Typically, this includes proof of income (like pay stubs or tax returns), identification documents, credit history reports, and sometimes appraisals of your property's value. Being organized with these documents can expedite the approval process significantly.

After securing funding approval from your chosen lender, work closely with your contractor to finalize the details of the furnace upgrade project. Obtain a detailed quote that outlines all costs associated with purchasing and installing the new furnace system. Ensure that this quote aligns with your approved loan amount to prevent unexpected out-of-pocket expenses during installation.

The next step involves negotiating repayment terms that fit comfortably within your budgetary limits. It is crucial to discuss flexible payment plans with your lender that consider fluctuations in income or unforeseen expenses you may encounter throughout the repayment period. Some lenders might offer seasonal deferment options or lower initial payments followed by gradual increases over time-features worth exploring if they suit your circumstances.

Before signing any agreements, thoroughly review all contract details related to both the financing agreement and contractor services rendered during installation processes; clarity here prevents misunderstandings later on regarding obligations under either party's

jurisdiction-especially concerning warranty coverage on newly-installed equipment components post-completion stages involved therein too!

Finally comes commitment: diligently make timely payments according agreed-upon schedule thus avoiding potential late fees negatively impacting credit score overall health financially speaking long-term perspective-wise! Alongside regular payment adherence routine maintenance checks recommended prolong lifespan maximize efficiency newly-installed unit keeping future costs minimal possible thereby truly capitalizing entire endeavor undertaken initially outset start!

In conclusion setting up installment plan mobile home furnace upgrades requires careful planning informed decision-making process throughout each stage involved-from initial assessment through finalization contractual aspects alike! By taking proactive approach considering all variables affecting success ultimately achieved end result stands testament wise choices made along journey toward improved living conditions enhanced quality life enjoyed thereafter ensuing period following completion project undertaken herein discussed today now hopefully proving beneficial informative resource readers seeking similar guidance moving forward future endeavors likewise anticipated ahead horizon yet come too soon enough already present moment awaits us eagerly embrace wholeheartedly together united cause common good shared vision better tomorrow collectively envisioned aspired towards achieving collaboratively jointly hand-in-hand working alongside each other mutual benefit attained satisfactory outcome realized fruition reached culmination efforts expended hitherto embarked upon anew once more again ever onward upward always striving higher greater heights previously un

Key factors to consider when choosing a financing option

Managing payments and maintaining financial health can be challenging, particularly when it comes to significant investments like upgrading a mobile home furnace. One effective strategy to ease this financial burden is setting up installment plans. This approach not only makes the expense more manageable but also helps in sustaining overall financial stability.

Firstly, understanding the need for a furnace upgrade is crucial. A well-functioning furnace is essential for ensuring comfort and safety during colder months. However, upgrading or replacing an old unit can be expensive, making it a daunting task for many homeowners. This is where installment plans come into play, offering a practical solution by breaking down the total cost into smaller, more affordable monthly payments.

Setting up an installment plan begins with choosing the right financing option. Many manufacturers or retailers offer in-house financing with competitive interest rates and flexible terms tailored to various budgets. Alternatively, third-party lenders may provide personal loans specifically designed for home improvements. Comparing these options based on interest rates, repayment terms, and any additional fees will help in selecting the most suitable plan.

Once a financing option is selected, it's important to create a budget that accommodates these new monthly payments without disrupting other financial obligations. Start by assessing your current income and expenses to determine how much you can comfortably allocate towards the furnace upgrade each month. Remember to account for potential increases in utility bills due to enhanced heating capabilities.

Additionally, consider negotiating terms if possible. Some lenders might be open to customizing payment schedules or lowering interest rates based on creditworthiness or upfront deposits. Making larger initial payments can also reduce the overall loan amount and interest paid over time.

It's equally important to stay disciplined with your payment plan once it's established. Setting up automatic payments can ensure timely transactions and prevent late fees or penalties that could impact your credit score negatively.

While paying off an installment plan is important, maintaining overall financial health requires attention beyond just this one expense. Building an emergency fund should remain a priority so unexpected costs don't derail your budget. Regularly reviewing your finances will help identify areas where adjustments may be needed to sustain both short-term obligations and long-term goals.

In conclusion, setting up an installment plan for mobile home furnace upgrades offers a viable path toward achieving necessary home improvements while preserving financial stability. By carefully selecting financing options, creating realistic budgets, negotiating favorable terms, and maintaining disciplined payment habits, homeowners can manage their payments

effectively and keep their broader financial health intact.



Personal Loans for HVAC Systems

When it comes to upgrading a mobile home furnace, one of the most pressing concerns for homeowners is often the upfront cost. A reliable and efficient furnace is crucial, especially during colder months, but the financial burden can be daunting. This is where setting up installment plans becomes a valuable option. Choosing the right service providers for flexible payment plans is essential to ensure that the upgrade process is smooth and financially manageable.

First and foremost, it's important to identify service providers who offer transparent and flexible payment options. Transparency in billing and payment terms helps build trust between the homeowner and provider. Look for companies that clearly outline their financing options, including any interest rates or fees associated with the installment plan. It's equally important to understand if there are penalties for early repayment or any hidden charges that could surprise you down the line.

Another critical factor in choosing a service provider is their reputation and experience in offering financial solutions for home upgrades. Providers with a strong track record demonstrate reliability and expertise in handling such projects. Researching customer reviews and testimonials can provide insights into how other customers have fared with their services. Additionally, seeking recommendations from friends or family who have undertaken similar projects can guide you toward reputable providers.

Flexibility in payment plans is also significant because it allows homeowners to select a schedule that aligns with their budgetary constraints. Service providers offering various options-such as bi-weekly, monthly, or quarterly payments-can accommodate diverse financial situations better than those with rigid plans. This flexibility ensures that homeowners are not overburdened by payments while still enjoying an upgraded heating system.

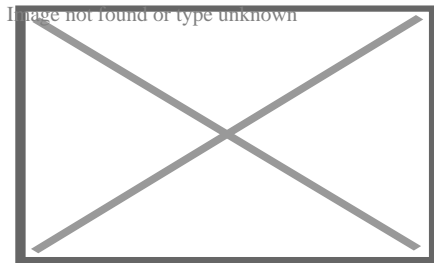
Customer support is another aspect that should not be overlooked when selecting a provider for flexible payment plans. Responsive customer service can make a significant difference when questions or issues arise throughout the repayment period. A provider with excellent customer support will address concerns promptly, ensuring peace of mind throughout your engagement with them.

Finally, consider whether the service provider offers additional perks like maintenance packages or extended warranties bundled into their installment plans. These added benefits can enhance value by protecting your investment over time while simplifying ongoing maintenance needs.

In conclusion, selecting the right service providers for flexible payment plans when setting up installment arrangements for mobile home furnace upgrades involves careful consideration of transparency, reputation, flexibility, customer support, and added benefits. By diligently evaluating these factors, homeowners can make informed decisions that ease financial strain while ensuring warmth and comfort within their homes during chilly seasons ahead.

About Thermal comfort

This article is about comfort zones in building construction. For other uses, see [Comfort zone \(disambiguation\)](#).



A thermal image of human

Thermal comfort is the condition of mind that expresses subjective satisfaction with the thermal environment.^[1] The human body can be viewed as a heat engine where food is the input energy. The human body will release excess heat into the environment, so the body can continue to operate. The heat transfer is proportional to temperature difference. In cold environments, the body loses more heat to the environment and in hot environments the body does not release enough heat. Both the hot and cold scenarios lead to discomfort.^[2] Maintaining this standard of thermal comfort for occupants of buildings or other enclosures is one of the important goals of HVAC (heating, ventilation, and air conditioning) design engineers.

Thermal neutrality is maintained when the heat generated by human metabolism is allowed to dissipate, thus maintaining thermal equilibrium with the surroundings. The main factors that influence thermal neutrality are those that determine heat gain and loss, namely metabolic rate, clothing insulation, air temperature, mean radiant temperature, air speed and relative humidity. Psychological parameters, such as individual expectations, and physiological parameters also affect thermal neutrality.^[3] Neutral temperature is the temperature that can lead to thermal neutrality and it may vary greatly between individuals and depending on factors such as activity level, clothing, and humidity. People are highly sensitive to even small differences in environmental temperature. At 24 °C, a difference of 0.38 °C can be detected between the temperature of two rooms.^[4]

The Predicted Mean Vote (PMV) model stands among the most recognized thermal comfort models. It was developed using principles of heat balance and experimental data collected in a controlled climate chamber under steady state conditions.^[5] The adaptive model, on the other hand, was developed based on hundreds of field studies with the idea that occupants dynamically interact with their environment. Occupants control their thermal environment by means of clothing, operable windows, fans, personal heaters, and sun shades.^{[3][6]} The PMV model can be applied to air-conditioned buildings, while the adaptive model can be applied only to buildings where no mechanical systems have been installed.^[1] There is no consensus about which comfort model should be applied for buildings that are partially air-conditioned spatially or temporally.

Thermal comfort calculations in accordance with the ANSI/ASHRAE Standard 55,^[1] the ISO 7730 Standard^[7] and the EN 16798-1 Standard^[8] can be freely performed with either the CBE Thermal Comfort Tool for ASHRAE 55,^[9] with the Python package `pythermalcomfort`^[10] or with the R package `comf`.

Significance

[edit]

Satisfaction with the thermal environment is important because thermal conditions are potentially life-threatening for humans if the core body temperature reaches conditions of hyperthermia, above 37.5–38.3 °C (99.5–100.9 °F),^{[11][12]} or hypothermia, below 35.0 °C (95.0 °F).^[13] Buildings modify the conditions of the external environment and reduce the effort that the human body needs to do in order to stay stable at a normal human body temperature, important for the correct functioning of human physiological processes.

The Roman writer Vitruvius actually linked this purpose to the birth of architecture.^[14] David Linden also suggests that the reason why we associate tropical beaches with paradise is because in those environments is where human bodies need to do less metabolic effort to maintain their core temperature.^[15] Temperature not only supports human life; coolness and warmth have also become in different cultures a symbol of protection, community and even the sacred.^[16]

In building science studies, thermal comfort has been related to productivity and health. Office workers who are satisfied with their thermal environment are more productive.^{[17][18]} The combination of high temperature and high relative humidity reduces thermal comfort and indoor air quality.^[19]

Although a single static temperature can be comfortable, people are attracted by thermal changes, such as campfires and cool pools. Thermal pleasure is caused by

varying thermal sensations from a state of unpleasantness to a state of pleasantness, and the scientific term for it is positive thermal alliesthesia.^[20] From a state of thermal neutrality or comfort any change will be perceived as unpleasant.^[21] This challenges the assumption that mechanically controlled buildings should deliver uniform temperatures and comfort, if it is at the cost of excluding thermal pleasure.^[22]

Influencing factors

[edit]

Since there are large variations from person to person in terms of physiological and psychological satisfaction, it is hard to find an optimal temperature for everyone in a given space. Laboratory and field data have been collected to define conditions that will be found comfortable for a specified percentage of occupants.^[1]

There are numerous factors that directly affect thermal comfort that can be grouped in two categories:

1. **Personal factors** – characteristics of the occupants such as metabolic rate and clothing level
2. **Environmental factors** – which are conditions of the thermal environment, specifically air temperature, mean radiant temperature, air speed and humidity

Even if all these factors may vary with time, standards usually refer to a steady state to study thermal comfort, just allowing limited temperature variations.

Personal factors

[edit]

Metabolic rate

[edit]

Main article: Metabolic rate

People have different metabolic rates that can fluctuate due to activity level and environmental conditions.^{[23][24][25]} ASHRAE 55-2017 defines metabolic rate as the rate of transformation of chemical energy into heat and mechanical work by metabolic activities of an individual, per unit of skin surface area.^[1]

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Metabolic rate is expressed in units of met, equal to 58.2 W/m² (18.4 Btu/h·ft²). One met is equal to the energy produced per unit surface area of an average person seated at rest.

ASHRAE 55 provides a table of metabolic rates for a variety of activities. Some common values are 0.7 met for sleeping, 1.0 met for a seated and quiet position, 1.2–1.4 met for light activities standing, 2.0 met or more for activities that involve movement, walking, lifting heavy loads or operating machinery. For intermittent activity, the standard states that it is permissible to use a time-weighted average metabolic rate if individuals are performing activities that vary over a period of one hour or less. For longer periods, different metabolic rates must be considered.^[1]

According to ASHRAE Handbook of Fundamentals, estimating metabolic rates is complex, and for levels above 2 or 3 met – especially if there are various ways of performing such activities – the accuracy is low. Therefore, the standard is not applicable for activities with an average level higher than 2 met. Met values can also be determined more accurately than the tabulated ones, using an empirical equation that takes into account the rate of respiratory oxygen consumption and carbon dioxide production. Another physiological yet less accurate method is related to the heart rate, since there is a relationship between the latter and oxygen consumption.^[26]

The Compendium of Physical Activities is used by physicians to record physical activities. It has a different definition of met that is the ratio of the metabolic rate of the activity in question to a resting metabolic rate.^[27] As the formulation of the concept is different from the one that ASHRAE uses, these met values cannot be used directly in PMV calculations, but it opens up a new way of quantifying physical activities.

Food and drink habits may have an influence on metabolic rates, which indirectly influences thermal preferences. These effects may change depending on food and drink intake.^[28]

Body shape is another factor that affects metabolic rate and hence thermal comfort. Heat dissipation depends on body surface area. The surface area of an average person is 1.8 m² (19 ft²).^[1] A tall and skinny person has a larger surface-to-volume ratio, can dissipate heat more easily, and can tolerate higher temperatures more than a person with a rounded body shape.^[28]

Clothing insulation

[edit]

Main article: Clothing insulation

The amount of thermal insulation worn by a person has a substantial impact on thermal comfort, because it influences the heat loss and consequently the thermal balance. Layers of insulating clothing prevent heat loss and can either help keep a person warm or lead to overheating. Generally, the thicker the garment is, the greater insulating ability it has. Depending on the type of material the clothing is made out of, air movement and relative humidity can decrease the insulating ability of the material.^{[29][30]}

1 clo is equal to $0.155 \text{ m}^2 \cdot \text{K/W}$ ($0.88 \text{ }^\circ\text{F} \cdot \text{ft}^2 \cdot \text{h/Btu}$). This corresponds to trousers, a long sleeved shirt, and a jacket. Clothing insulation values for other common ensembles or single garments can be found in ASHRAE 55.^[1]

Skin wetness

[edit]

Skin wetness is defined as "the proportion of the total skin surface area of the body covered with sweat".^[31] The wetness of skin in different areas also affects perceived thermal comfort. Humidity can increase wetness in different areas of the body, leading to a perception of discomfort. This is usually localized in different parts of the body, and local thermal comfort limits for skin wetness differ by locations of the body.^[32] The extremities are much more sensitive to thermal discomfort from wetness than the trunk of the body. Although local thermal discomfort can be caused by wetness, the thermal comfort of the whole body will not be affected by the wetness of certain parts.

Environmental factors

[edit]

Air temperature

[edit]

Main article: Dry-bulb temperature

The air temperature is the average temperature of the air surrounding the occupant, with respect to location and time. According to ASHRAE 55 standard, the spatial average takes into account the ankle, waist and head levels, which vary for seated or standing occupants. The temporal average is based on three-minutes intervals with at

least 18 equally spaced points in time. Air temperature is measured with a dry-bulb thermometer and for this reason it is also known as dry-bulb temperature.

Mean radiant temperature

[edit]

Main article: Mean radiant temperature

The radiant temperature is related to the amount of radiant heat transferred from a surface, and it depends on the material's ability to absorb or emit heat, or its emissivity. The mean radiant temperature depends on the temperatures and emissivities of the surrounding surfaces as well as the view factor, or the amount of the surface that is “seen” by the object. So the mean radiant temperature experienced by a person in a room with the sunlight streaming in varies based on how much of their body is in the sun.

Air speed

[edit]

Air speed is defined as the rate of air movement at a point, without regard to direction. According to ANSI/ASHRAE Standard 55, it is the average speed of the air surrounding a representative occupant, with respect to location and time. The spatial average is for three heights as defined for average air temperature. For an occupant moving in a space the sensors shall follow the movements of the occupant. The air speed is averaged over an interval not less than one and not greater than three minutes. Variations that occur over a period greater than three minutes shall be treated as multiple different air speeds.^[33]

Relative humidity

[edit]

Main article: Relative humidity

Relative humidity (RH) is the ratio of the amount of water vapor in the air to the amount of water vapor that the air could hold at the specific temperature and pressure. While the human body has thermoreceptors in the skin that enable perception of temperature, relative humidity is detected indirectly. Sweating is an effective heat loss mechanism that relies on evaporation from the skin. However at high RH, the air has close to the maximum water vapor that it can hold, so evaporation, and therefore heat

loss, is decreased. On the other hand, very dry environments (RH < 20–30%) are also uncomfortable because of their effect on the mucous membranes. The recommended level of indoor humidity is in the range of 30–60% in air conditioned buildings,^{[34][35]} but new standards such as the adaptive model allow lower and higher humidity, depending on the other factors involved in thermal comfort.

Recently, the effects of low relative humidity and high air velocity were tested on humans after bathing. Researchers found that low relative humidity engendered thermal discomfort as well as the sensation of dryness and itching. It is recommended to keep relative humidity levels higher in a bathroom than other rooms in the house for optimal conditions.^[36]

Various types of apparent temperature have been developed to combine air temperature and air humidity. For higher temperatures, there are quantitative scales, such as the heat index. For lower temperatures, a related interplay was identified only qualitatively:

- High humidity and low temperatures cause the air to feel chilly.^[37]
- Cold air with high relative humidity "feels" colder than dry air of the same temperature because high humidity in cold weather increases the conduction of heat from the body.^[38]

There has been controversy over why damp cold air feels colder than dry cold air. Some believe it is because when the humidity is high, our skin and clothing become moist and are better conductors of heat, so there is more cooling by conduction.^[39]

The influence of humidity can be exacerbated with the combined use of fans (forced convection cooling).^[40]

Natural ventilation

[edit]

Main article: Natural ventilation

Many buildings use an HVAC unit to control their thermal environment. Other buildings are naturally ventilated (or would have cross ventilation) and do not rely on mechanical systems to provide thermal comfort. Depending on the climate, this can drastically reduce energy consumption. It is sometimes seen as a risk, though, since indoor temperatures can be too extreme if the building is poorly designed. Properly designed, naturally ventilated buildings keep indoor conditions within the range where opening windows and using fans in the summer, and wearing extra clothing in the winter, can keep people thermally comfortable.^[41]

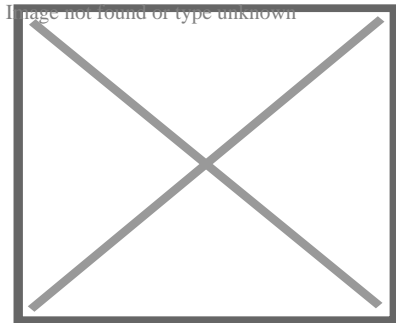
Models and indices

[edit]

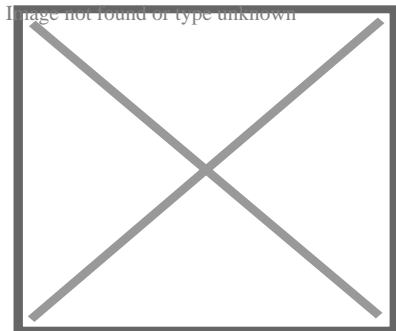
There are several different models or indices that can be used to assess thermal comfort conditions indoors as described below.

PMV/PPD method

[edit]



Psychrometric Chart



Temperature-relative humidity chart
Two alternative representations of thermal comfort for the PMV/PPD method

The PMV/PPD model was developed by P.O. Fanger using heat-balance equations and empirical studies about skin temperature to define comfort. Standard thermal comfort surveys ask subjects about their thermal sensation on a seven-point scale from cold (-3) to hot (+3). Fanger's equations are used to calculate the predicted mean vote (PMV) of a group of subjects for a particular combination of air temperature, mean radiant temperature, relative humidity, air speed, metabolic rate,

and clothing insulation.^[5] PMV equal to zero is representing thermal neutrality, and the comfort zone is defined by the combinations of the six parameters for which the PMV is within the recommended limits ($-0.5 < PMV < +0.5$).^[1] Although predicting the thermal sensation of a population is an important step in determining what conditions are comfortable, it is more useful to consider whether or not people will be satisfied. Fanger developed another equation to relate the PMV to the Predicted Percentage of Dissatisfied (PPD). This relation was based on studies that surveyed subjects in a chamber where the indoor conditions could be precisely controlled.^[5]

The PMV/PPD model is applied globally but does not directly take into account the adaptation mechanisms and outdoor thermal conditions.^{[3][42][43]}

ASHRAE Standard 55-2017 uses the PMV model to set the requirements for indoor thermal conditions. It requires that at least 80% of the occupants be satisfied.^[1]

The CBE Thermal Comfort Tool for ASHRAE 55^[9] allows users to input the six comfort parameters to determine whether a certain combination complies with ASHRAE 55. The results are displayed on a psychrometric or a temperature-relative humidity chart and indicate the ranges of temperature and relative humidity that will be comfortable with the given the values input for the remaining four parameters.^[44]

The PMV/PPD model has a low prediction accuracy.^[45] Using the world largest thermal comfort field survey database,^[46] the accuracy of PMV in predicting occupant's thermal sensation was only 34%, meaning that the thermal sensation is correctly predicted one out of three times. The PPD was overestimating subject's thermal unacceptability outside the thermal neutrality ranges ($-1 < PMV < 1$). The PMV/PPD accuracy varies strongly between ventilation strategies, building types and climates.^[45]

Elevated air speed method

[edit]

ASHRAE 55 2013 accounts for air speeds above 0.2 metres per second (0.66 ft/s) separately than the baseline model. Because air movement can provide direct cooling to people, particularly if they are not wearing much clothing, higher temperatures can be more comfortable than the PMV model predicts. Air speeds up to 0.8 m/s (2.6 ft/s) are allowed without local control, and 1.2 m/s is possible with local control. This elevated air movement increases the maximum temperature for an office space in the summer to 30 °C from 27.5 °C (86.0–81.5 °F).^[1]

Virtual Energy for Thermal Comfort

[edit]

"Virtual Energy for Thermal Comfort" is the amount of energy that will be required to make a non-air-conditioned building relatively as comfortable as one with air-conditioning. This is based on the assumption that the home will eventually install air-conditioning or heating.^[47] Passive design improves thermal comfort in a building, thus reducing demand for heating or cooling. In many developing countries, however, most occupants do not currently heat or cool, due to economic constraints, as well as climate conditions which border lines comfort conditions such as cold winter nights in Johannesburg (South Africa) or warm summer days in San Jose, Costa Rica. At the same time, as incomes rise, there is a strong tendency to introduce cooling and heating systems. If we recognize and reward passive design features that improve thermal comfort today, we diminish the risk of having to install HVAC systems in the future, or we at least ensure that such systems will be smaller and less frequently used. Or in case the heating or cooling system is not installed due to high cost, at least people should not suffer from discomfort indoors. To provide an example, in San Jose, Costa Rica, if a house were being designed with high level of glazing and small opening sizes, the internal temperature would easily rise above 30 °C (86 °F) and natural ventilation would not be enough to remove the internal heat gains and solar gains. This is why Virtual Energy for Comfort is important.

World Bank's assessment tool the EDGE software (Excellence in Design for Greater Efficiencies) illustrates the potential issues with discomfort in buildings and has created the concept of Virtual Energy for Comfort which provides for a way to present potential thermal discomfort. This approach is used to award for design solutions which improves thermal comfort even in a fully free running building. Despite the inclusion of requirements for overheating in CIBSE, overcooling has not been assessed. However, overcooling can be an issue, mainly in the developing world, for example in cities such as Lima (Peru), Bogota, and Delhi, where cooler indoor temperatures can occur frequently. This may be a new area for research and design guidance for reduction of discomfort.

Cooling Effect

[edit]

ASHRAE 55-2017 defines the Cooling Effect (CE) at elevated air speed (above 0.2 metres per second (0.66 ft/s)) as the value that, when subtracted from both the air

temperature and the mean radiant temperature, yields the same SET value under still air (0.1 m/s) as in the first SET calculation under elevated air speed.^[1]

$$\text{SET}(t_a, t_r, v, \text{met}, \text{clo}, \text{RH}) = \text{SET}(t_a - \text{CE}, t_r - \text{CE}, v = 0.1, \text{met}, \text{clo}, \text{RH})$$

The CE can be used to determine the PMV adjusted for an environment with elevated air speed using the adjusted temperature, the adjusted radiant temperature and still air (0.2 metres per second (0.66 ft/s)). Where the adjusted temperatures are equal to the original air and mean radiant temperatures minus the CE.

Local thermal discomfort

[edit]

Avoiding local thermal discomfort, whether caused by a vertical air temperature difference between the feet and the head, by an asymmetric radiant field, by local convective cooling (draft), or by contact with a hot or cold floor, is essential to providing acceptable thermal comfort. People are generally more sensitive to local discomfort when their thermal sensation is cooler than neutral, while they are less sensitive to it when their body is warmer than neutral.^[33]

Radiant temperature asymmetry

[edit]

Large differences in the thermal radiation of the surfaces surrounding a person may cause local discomfort or reduce acceptance of the thermal conditions. ASHRAE Standard 55 sets limits on the allowable temperature differences between various surfaces. Because people are more sensitive to some asymmetries than others, for example that of a warm ceiling versus that of hot and cold vertical surfaces, the limits depend on which surfaces are involved. The ceiling is not allowed to be more than +5 °C (9.0 °F) warmer, whereas a wall may be up to +23 °C (41 °F) warmer than the other surfaces.^[1]

Draft

[edit]

While air movement can be pleasant and provide comfort in some circumstances, it is sometimes unwanted and causes discomfort. This unwanted air movement is called "draft" and is most prevalent when the thermal sensation of the whole body is cool. People are most likely to feel a draft on uncovered body parts such as their head, neck, shoulders, ankles, feet, and legs, but the sensation also depends on the air speed, air temperature, activity, and clothing.^[1]

Floor surface temperature

[edit]

Floors that are too warm or too cool may cause discomfort, depending on footwear. ASHRAE 55 recommends that floor temperatures stay in the range of 19–29 °C (66–84 °F) in spaces where occupants will be wearing lightweight shoes.^[1]

Standard effective temperature

[edit]

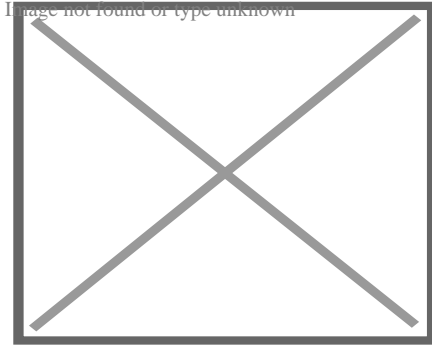
Standard effective temperature (SET) is a model of human response to the thermal environment. Developed by A.P. Gagge and accepted by ASHRAE in 1986,^[48] it is also referred to as the Pierce Two-Node model.^[49] Its calculation is similar to PMV because it is a comprehensive comfort index based on heat-balance equations that incorporates the personal factors of clothing and metabolic rate. Its fundamental difference is it takes a two-node method to represent human physiology in measuring skin temperature and skin wettedness.^[48]

The SET index is defined as the equivalent dry bulb temperature of an isothermal environment at 50% relative humidity in which a subject, while wearing clothing standardized for activity concerned, would have the same heat stress (skin temperature) and thermoregulatory strain (skin wettedness) as in the actual test environment.^[48]

Research has tested the model against experimental data and found it tends to overestimate skin temperature and underestimate skin wettedness.^{[49][50]} Fountain and Huizenga (1997) developed a thermal sensation prediction tool that computes SET.^[51] The SET index can also be calculated using either the CBE Thermal Comfort Tool for ASHRAE 55,^[9] the Python package pythermalcomfort,^[10] or the R package `comf`.

Adaptive comfort model

[edit]



Adaptive chart according to ASHRAE Standard 55-2010

The adaptive model is based on the idea that outdoor climate might be used as a proxy of indoor comfort because of a statistically significant correlation between them. The adaptive hypothesis predicts that contextual factors, such as having access to environmental controls, and past thermal history can influence building occupants' thermal expectations and preferences.^[3] Numerous researchers have conducted field studies worldwide in which they survey building occupants about their thermal comfort while taking simultaneous environmental measurements. Analyzing a database of results from 160 of these buildings revealed that occupants of naturally ventilated buildings accept and even prefer a wider range of temperatures than their counterparts in sealed, air-conditioned buildings because their preferred temperature depends on outdoor conditions.^[3] These results were incorporated in the ASHRAE 55-2004 standard as the adaptive comfort model. The adaptive chart relates indoor comfort temperature to prevailing outdoor temperature and defines zones of 80% and 90% satisfaction.^[1]

The ASHRAE-55 2010 Standard introduced the prevailing mean outdoor temperature as the input variable for the adaptive model. It is based on the arithmetic average of the mean daily outdoor temperatures over no fewer than 7 and no more than 30 sequential days prior to the day in question.^[1] It can also be calculated by weighting the temperatures with different coefficients, assigning increasing importance to the most recent temperatures. In case this weighting is used, there is no need to respect the upper limit for the subsequent days. In order to apply the adaptive model, there should be no mechanical cooling system for the space, occupants should be engaged in sedentary activities with metabolic rates of 1–1.3 met, and a prevailing mean temperature of 10–33.5 °C (50.0–92.3 °F).^[1]

This model applies especially to occupant-controlled, natural-conditioned spaces, where the outdoor climate can actually affect the indoor conditions and so the comfort zone. In fact, studies by de Dear and Brager showed that occupants in naturally ventilated buildings were tolerant of a wider range of temperatures.^[3] This is due to both behavioral and physiological adjustments, since there are different types of adaptive processes.^[52] ASHRAE Standard 55-2010 states that differences in recent thermal experiences, changes in clothing, availability of control options, and shifts in occupant expectations can change people's thermal responses.^[1]

Adaptive models of thermal comfort are implemented in other standards, such as European EN 15251 and ISO 7730 standard. While the exact derivation methods and results are slightly different from the ASHRAE 55 adaptive standard, they are substantially the same. A larger difference is in applicability. The ASHRAE adaptive standard only applies to buildings without mechanical cooling installed, while EN15251 can be applied to mixed-mode buildings, provided the system is not running.^[53]

There are basically three categories of thermal adaptation, namely: behavioral, physiological, and psychological.

Psychological adaptation

[edit]

An individual's comfort level in a given environment may change and adapt over time due to psychological factors. Subjective perception of thermal comfort may be influenced by the memory of previous experiences. Habituation takes place when repeated exposure moderates future expectations, and responses to sensory input. This is an important factor in explaining the difference between field observations and PMV predictions (based on the static model) in naturally ventilated buildings. In these buildings, the relationship with the outdoor temperatures has been twice as strong as predicted.^[3]

Psychological adaptation is subtly different in the static and adaptive models. Laboratory tests of the static model can identify and quantify non-heat transfer (psychological) factors that affect reported comfort. The adaptive model is limited to reporting differences (called psychological) between modeled and reported comfort.^{[citation n}

Thermal comfort as a "condition of mind" is *defined* in psychological terms. Among the factors that affect the condition of mind (in the laboratory) are a sense of control over the temperature, knowledge of the temperature and the appearance of the (test) environment. A thermal test chamber that appeared residential "felt" warmer than one which looked like the inside of a refrigerator.^[54]

Physiological adaptation

[edit]

Further information: Thermoregulation

The body has several thermal adjustment mechanisms to survive in drastic temperature environments. In a cold environment the body utilizes vasoconstriction; which reduces blood flow to the skin, skin temperature and heat dissipation. In a warm environment, vasodilation will increase blood flow to the skin, heat transport, and skin temperature and heat dissipation.^[55] If there is an imbalance despite the vasomotor adjustments listed above, in a warm environment sweat production will start and provide evaporative cooling. If this is insufficient, hyperthermia will set in, body temperature may reach 40 °C (104 °F), and heat stroke may occur. In a cold environment, shivering will start, involuntarily forcing the muscles to work and increasing the heat production by up to a factor of 10. If equilibrium is not restored, hypothermia can set in, which can be fatal.^[55] Long-term adjustments to extreme temperatures, of a few days to six months, may result in cardiovascular and endocrine adjustments. A hot climate may create increased blood volume, improving the effectiveness of vasodilation, enhanced performance of the sweat mechanism, and the readjustment of thermal preferences. In cold or underheated conditions, vasoconstriction can become permanent, resulting in decreased blood volume and increased body metabolic rate.^[55]

Behavioral adaptation

[edit]

In naturally ventilated buildings, occupants take numerous actions to keep themselves comfortable when the indoor conditions drift towards discomfort. Operating windows and fans, adjusting blinds/shades, changing clothing, and consuming food and drinks are some of the common adaptive strategies. Among these, adjusting windows is the most common.^[56] Those occupants who take these sorts of actions tend to feel cooler at warmer temperatures than those who do not.^[57]

The behavioral actions significantly influence energy simulation inputs, and researchers are developing behavior models to improve the accuracy of simulation results. For example, there are many window-opening models that have been developed to date, but there is no consensus over the factors that trigger window opening.^[56]

People might adapt to seasonal heat by becoming more nocturnal, doing physical activity and even conducting business at night.

Specificity and sensitivity

[edit]

Individual differences

[edit]

Further information: Cold sensitivity

The thermal sensitivity of an individual is quantified by the descriptor *FS*, which takes on higher values for individuals with lower tolerance to non-ideal thermal conditions.[⁵⁸] This group includes pregnant women, the disabled, as well as individuals whose age is below fourteen or above sixty, which is considered the adult range. Existing literature provides consistent evidence that sensitivity to hot and cold surfaces usually declines with age. There is also some evidence of a gradual reduction in the effectiveness of the body in thermo-regulation after the age of sixty.[⁵⁸] This is mainly due to a more sluggish response of the counteraction mechanisms in lower parts of the body that are used to maintain the core temperature of the body at ideal values.[⁵⁸] Seniors prefer warmer temperatures than young adults (76 vs 72 degrees F or 24.4 vs 22.2 Celsius).[⁵⁴]

Situational factors include the health, psychological, sociological, and vocational activities of the persons.

Biological sex differences

[edit]

While thermal comfort preferences between sexes seem to be small, there are some average differences. Studies have found males on average report discomfort due to rises in temperature much earlier than females. Males on average also estimate higher levels of their sensation of discomfort than females. One recent study tested males and females in the same cotton clothing, performing mental jobs while using a dial vote to report their thermal comfort to the changing temperature.[⁵⁹] Many times, females preferred higher temperatures than males. But while females tend to be more

sensitive to temperatures, males tend to be more sensitive to relative-humidity levels. [60][61]

An extensive field study was carried out in naturally ventilated residential buildings in Kota Kinabalu, Sabah, Malaysia. This investigation explored the sexes thermal sensitivity to the indoor environment in non-air-conditioned residential buildings. Multiple hierarchical regression for categorical moderator was selected for data analysis; the result showed that as a group females were slightly more sensitive than males to the indoor air temperatures, whereas, under thermal neutrality, it was found that males and females have similar thermal sensation. [62]

Regional differences

[edit]

In different areas of the world, thermal comfort needs may vary based on climate. In China^[where?] the climate has hot humid summers and cold winters, causing a need for efficient thermal comfort. Energy conservation in relation to thermal comfort has become a large issue in China in the last several decades due to rapid economic and population growth. [63] Researchers are now looking into ways to heat and cool buildings in China for lower costs and also with less harm to the environment.

In tropical areas of Brazil, urbanization is creating urban heat islands (UHI). These are urban areas that have risen over the thermal comfort limits due to a large influx of people and only drop within the comfortable range during the rainy season. [64] Urban heat islands can occur over any urban city or built-up area with the correct conditions. [65][66]

In the hot, humid region of Saudi Arabia, the issue of thermal comfort has been important in mosques, because they are very large open buildings that are used only intermittently (very busy for the noon prayer on Fridays) it is hard to ventilate them properly. The large size requires a large amount of ventilation, which requires a lot of energy since the buildings are used only for short periods of time. Temperature regulation in mosques is a challenge due to the intermittent demand, leading to many mosques being either too hot or too cold. The stack effect also comes into play due to their large size and creates a large layer of hot air above the people in the mosque. New designs have placed the ventilation systems lower in the buildings to provide more temperature control at ground level. [67] New monitoring steps are also being taken to improve efficiency. [68]

Thermal stress

[edit]

Not to be confused with thermal stress on objects, which describes the change materials experience when subject to extreme temperatures.

The concept of thermal comfort is closely related to thermal stress. This attempts to predict the impact of solar radiation, air movement, and humidity for military personnel undergoing training exercises or athletes during competitive events. Several thermal stress indices have been proposed, such as the Predicted Heat Strain (PHS) or the humidex.^[69] Generally, humans do not perform well under thermal stress. People's performances under thermal stress is about 11% lower than their performance at normal thermal wet conditions. Also, human performance in relation to thermal stress varies greatly by the type of task which the individual is completing. Some of the physiological effects of thermal heat stress include increased blood flow to the skin, sweating, and increased ventilation.^{[70][71]}

Predicted Heat Strain (PHS)

[edit]

The PHS model, developed by the International Organization for Standardization (ISO) committee, allows the analytical evaluation of the thermal stress experienced by a working subject in a hot environment.^[72] It describes a method for predicting the sweat rate and the internal core temperature that the human body will develop in response to the working conditions. The PHS is calculated as a function of several physical parameters, consequently it makes it possible to determine which parameter or group of parameters should be modified, and to what extent, in order to reduce the risk of physiological strains. The PHS model does not predict the physiological response of an individual subject, but only considers standard subjects in good health and fit for the work they perform. The PHS can be determined using either the Python package `pythermalcomfort`^[10] or the R package `comf`.

American Conference on Governmental Industrial Hygienists (ACGIH) Action Limits

and Threshold Limit Values

[edit]

ACGIH has established Action Limits and Threshold Limit Values for heat stress based upon the estimated metabolic rate of a worker and the environmental conditions the worker is subjected to.

This methodology has been adopted by the Occupational Safety and Health Administration (OSHA) as an effective method of assessing heat stress within workplaces.^[73]

Research

[edit]

The factors affecting thermal comfort were explored experimentally in the 1970s. Many of these studies led to the development and refinement of ASHRAE Standard 55 and were performed at Kansas State University by Ole Fanger and others. Perceived comfort was found to be a complex interaction of these variables. It was found that the majority of individuals would be satisfied by an ideal set of values. As the range of values deviated progressively from the ideal, fewer and fewer people were satisfied. This observation could be expressed statistically as the percent of individuals who expressed satisfaction by *comfort conditions* and the *predicted mean vote* (PMV). This approach was challenged by the adaptive comfort model, developed from the ASHRAE 884 project, which revealed that occupants were comfortable in a broader range of temperatures.^[3]

This research is applied to create Building Energy Simulation (BES) programs for residential buildings. Residential buildings in particular can vary much more in thermal comfort than public and commercial buildings. This is due to their smaller size, the variations in clothing worn, and different uses of each room. The main rooms of concern are bathrooms and bedrooms. Bathrooms need to be at a temperature comfortable for a human with or without clothing. Bedrooms are of importance because they need to accommodate different levels of clothing and also different metabolic rates of people asleep or awake.^[74] Discomfort hours is a common metric used to evaluate the thermal performance of a space.

Thermal comfort research in clothing is currently being done by the military. New air-ventilated garments are being researched to improve evaporative cooling in military settings. Some models are being created and tested based on the amount of cooling they provide.^[75]

In the last twenty years, researchers have also developed advanced thermal comfort models that divide the human body into many segments, and predict local thermal discomfort by considering heat balance.^{[76][77][78]} This has opened up a new arena of thermal comfort modeling that aims at heating/cooling selected body parts.

Another area of study is the hue-heat hypothesis that states that an environment with warm colors (red, orange yellow hues) will feel warmer in terms of temperature and comfort, while an environment with cold colors (blue, green hues) will feel cooler.^{[79][80][81]} The hue-heat hypothesis has both been investigated scientifically^[82] and ingrained in popular culture in the terms warm and cold colors ^[83]

Medical environments

[edit]



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Whenever the studies referenced tried to discuss the thermal conditions for different groups of occupants in one room, the studies ended up simply presenting comparisons of thermal comfort satisfaction based on the subjective studies. No study tried to reconcile the different thermal comfort requirements of different types of occupants who compulsorily must stay in one room. Therefore, it looks to be necessary to investigate the different thermal conditions required by different groups of occupants in hospitals to reconcile their different requirements in this concept. To reconcile the differences in the required thermal comfort conditions it is recommended to test the possibility of using different ranges of local radiant temperature in one room via a suitable mechanical system.

Although different researches are undertaken on thermal comfort for patients in hospitals, it is also necessary to study the effects of thermal comfort conditions on the quality and the quantity of healing for patients in hospitals. There are also original researches that show the link between thermal comfort for staff and their levels of productivity, but no studies have been produced individually in hospitals in this field. Therefore, research for coverage and methods individually for this subject is recommended. Also research in terms of cooling and heating delivery systems for patients with low levels of immune-system protection (such as HIV patients, burned patients, etc.) are recommended. There are important areas, which still need to be

focused on including thermal comfort for staff and its relation with their productivity, using different heating systems to prevent hypothermia in the patient and to improve the thermal comfort for hospital staff simultaneously.

Finally, the interaction between people, systems and architectural design in hospitals is a field in which require further work needed to improve the knowledge of how to design buildings and systems to reconcile many conflicting factors for the people occupying these buildings.^[84]

Personal comfort systems

[edit]

Personal comfort systems (PCS) refer to devices or systems which heat or cool a building occupant personally.^[85] This concept is best appreciated in contrast to central HVAC systems which have uniform temperature settings for extensive areas. Personal comfort systems include fans and air diffusers of various kinds (e.g. desk fans, nozzles and slot diffusers, overhead fans, high-volume low-speed fans etc.) and personalized sources of radiant or conductive heat (footwarmers, legwarmers, hot water bottles etc.). PCS has the potential to satisfy individual comfort requirements much better than current HVAC systems, as interpersonal differences in thermal sensation due to age, sex, body mass, metabolic rate, clothing and thermal adaptation can amount to an equivalent temperature variation of 2–5 °C (3,6–9 °F), which is impossible for a central, uniform HVAC system to cater to.^[85] Besides, research has shown that the perceived ability to control one's thermal environment tends to widen one's range of tolerable temperatures.^[3] Traditionally, PCS devices have been used in isolation from one another. However, it has been proposed by Andersen et al. (2016) that a network of PCS devices which generate well-connected microzones of thermal comfort, and report real-time occupant information and respond to programmatic actuation requests (e.g. a party, a conference, a concert etc.) can combine with occupant-aware building applications to enable new methods of comfort maximization.^[86]

See also

[edit]

- ASHRAE
- ANSI/ASHRAE Standard 55
- Air conditioning
- Building insulation
- Cold and heat adaptations in humans

- Heat stress
- Mean radiant temperature
- Mahoney tables
- Povl Ole Fanger
- Psychrometrics
- Ralph G. Nevins
- Room air distribution
- Room temperature
- Ventilative cooling

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Heating, ventilation, and air conditioning

Fundamental concepts

- Air changes per hour
- Bake-out
- Building envelope
- Convection
- Dilution
- Domestic energy consumption
- Enthalpy
- Fluid dynamics
- Gas compressor
- Heat pump and refrigeration cycle
- Heat transfer
- Humidity
- Infiltration
- Latent heat
- Noise control
- Outgassing
- Particulates
- Psychrometrics
- Sensible heat
- Stack effect
- Thermal comfort
- Thermal destratification
- Thermal mass
- Thermodynamics
- Vapour pressure of water

- Absorption-compression heat pump
- Absorption refrigerator
- Air barrier
- Air conditioning
- Antifreeze
- Automobile air conditioning
- Autonomous building
- Building insulation materials
- Central heating
- Central solar heating
- Chilled beam
- Chilled water
- Constant air volume (CAV)
- Coolant
- Cross ventilation
- Dedicated outdoor air system (DOAS)
- Deep water source cooling
- Demand controlled ventilation (DCV)
- Displacement ventilation
- District cooling
- District heating
- Electric heating
- Energy recovery ventilation (ERV)
- Firestop
- Forced-air
- Forced-air gas
- Free cooling
- Heat recovery ventilation (HRV)
- Hybrid heat
- Hydronics
- Ice storage air conditioning
- Kitchen ventilation
- Mixed-mode ventilation
- Microgeneration
- Passive cooling
- Passive daytime radiative cooling
- Passive house
- Passive ventilation
- Radiant heating and cooling
- Radiant cooling
- Radiant heating
- Radon mitigation
- Refrigeration
- Renewable heat
- Room air distribution
- Solar air heat
- Solar combisystem

Technology

- Air conditioner inverter
- Air door
- Air filter
- Air handler
- Air ionizer
- Air-mixing plenum
- Air purifier
- Air source heat pump
- Attic fan
- Automatic balancing valve
- Back boiler
- Barrier pipe
- Blast damper
- Boiler
- Centrifugal fan
- Ceramic heater
- Chiller
- Condensate pump
- Condenser
- Condensing boiler
- Convection heater
- Compressor
- Cooling tower
- Damper
- Dehumidifier
- Duct
- Economizer
- Electrostatic precipitator
- Evaporative cooler
- Evaporator
- Exhaust hood
- Expansion tank
- Fan
- Fan coil unit
- Fan filter unit
- Fan heater
- Fire damper
- Fireplace
- Fireplace insert
- Freeze stat
- Flue
- Freon
- Fume hood
- Furnace
- Gas compressor
- Gas heater
- Gasoline heater

**Measurement
and control**

- Air flow meter
- Aquastat
- BACnet
- Blower door
- Building automation
- Carbon dioxide sensor
- Clean air delivery rate (CADR)
- Control valve
- Gas detector
- Home energy monitor
- Humidistat
- HVAC control system
- Infrared thermometer
- Intelligent buildings
- LonWorks
- Minimum efficiency reporting value (MERV)
- Normal temperature and pressure (NTP)
- OpenTherm
- Programmable communicating thermostat
- Programmable thermostat
- Psychrometrics
- Room temperature
- Smart thermostat
- Standard temperature and pressure (STP)
- Thermographic camera
- Thermostat
- Thermostatic radiator valve
- Architectural acoustics
- Architectural engineering
- Architectural technologist
- Building services engineering
- Building information modeling (BIM)
- Deep energy retrofit
- Duct cleaning
- Duct leakage testing
- Environmental engineering
- Hydronic balancing
- Kitchen exhaust cleaning
- Mechanical engineering
- Mechanical, electrical, and plumbing
- Mold growth, assessment, and remediation
- Refrigerant reclamation
- Testing, adjusting, balancing

**Professions,
trades,
and services**

Industry organizations

- AHRI
- AMCA
- ASHRAE
- ASTM International
- BRE
- BSRIA
- CIBSE
- Institute of Refrigeration
- IIR
- LEED
- SMACNA
- UMC
- Indoor air quality (IAQ)
- Passive smoking
- Sick building syndrome (SBS)
- Volatile organic compound (VOC)
- ASHRAE Handbook
- Building science
- Fireproofing
- Glossary of HVAC terms
- Warm Spaces
- World Refrigeration Day
- Template:Home automation
- Template:Solar energy

Health and safety

See also

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Things To Do in Tulsa County

Photo

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Streetwalker Tours

0 (0)

Photo

Image not found or type unknown

Bob Dylan Center

4.9 (245)

Photo

Golden Driller Statue

4.6 (1935)

Photo

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The Outsiders House Museum

4.7 (885)

Photo

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Gathering Place

4.8 (12116)

Photo

Tours of Tulsa

4.9 (291)

Driving Directions in Tulsa County

Driving Directions From Harmon Security Group LLC. to Durham Supply Inc

Driving Directions From Reception Jehovah's Witnesses to Durham Supply Inc

Driving Directions From ALDI to Durham Supply Inc

Driving Directions From Tulsa to Durham Supply Inc

[Furnace repair service](#)

[Furnace store](#)

[Heating contractor](#)

[HVAC contractor](#)

[Mobile Home Furnace Installation](#)

[Mobile Home Air Conditioning Installation Services](#)

Driving Directions From Tours of Tulsa to Durham Supply Inc

Driving Directions From The Blue Dome to Durham Supply Inc

Driving Directions From Woodward Park and Gardens to Durham Supply Inc

Driving Directions From The Tulsa Arts District to Durham Supply Inc

Driving Directions From Tulsa Botanic Garden to Durham Supply Inc

Driving Directions From Philbrook Museum of Art to Durham Supply Inc

Mobile home supply store

Air conditioning repair service

Air conditioning store

Reviews for Durham Supply Inc

Durham Supply Inc

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Ethel Schiller

(5)

This place is really neat, if they don't have it they can order it from another of their stores and have it there overnight in most cases. Even hard to find items for a trailer! I definitely recommend this place to everyone! O and the prices is awesome too!

Durham Supply Inc

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Gerald Clifford Brewster

(5)

We will see, the storm door I bought says on the tag it's 36x80, but it's 34x80. If they return it.....they had no problems returning it. And it was no fault of there's, you measure a mobile home door different than a standard door!

Durham Supply Inc

Image not found or type unknown

B Mann

(5)

I was in need of some items for a double wide that I am remodeling and this place is the only place in town that had what I needed (I didn't even try the other rude place)while I was there I learned the other place that was in Tulsa that also sold mobile home supplies went out of business (no wonder the last time I was in there they were VERY RUDE and high priced) I like the way Dunham does business they answered all my questions and got me the supplies I needed, very friendly, I will be back to purchase the rest of my items when the time comes.

Durham Supply Inc

Image not found or type unknown

Dennis Champion

(5)

Durham supply and Royal supply seems to find the most helpful and friendly people to work in their stores, we are based out of Kansas City out here for a few remodels and these guys treated us like we've gone there for years.

Setting Up Installment Plans for Mobile Home Furnace Upgrades [View GBP](#)

Check our other pages :

- [Assessing Future Upgrade Paths for Mobile Home AC Brand Choices](#)
- [Evaluating Different Financing Packages for Mobile Home HVAC](#)
- [Scheduling Payments for Large Scale Mobile Home HVAC Replacements](#)
- [Setting Up Installment Plans for Mobile Home Furnace Upgrades](#)
- [Evaluating Carrier Options for Mobile Home Air Conditioning](#)

Frequently Asked Questions

What are the benefits of setting up an installment plan for a mobile home furnace upgrade?

Setting up an installment plan allows homeowners to spread the cost over time, making it more affordable. It also enables immediate access to improved energy efficiency and comfort without needing full upfront payment.

How do I determine if I'm eligible for an installment plan for a furnace upgrade?

Eligibility typically depends on credit history, income verification, and sometimes the value or condition of your mobile home. It's important to consult with the financing provider or HVAC company offering the plan for specific requirements.

What should I consider when choosing an installment plan for my mobile home's furnace upgrade?

Consider interest rates, repayment terms, any additional fees, and overall cost compared to paying upfront. Ensure that monthly payments fit within your budget without causing financial strain.

Are there specific companies or programs that offer installment plans for mobile home furnace upgrades?

Many HVAC companies provide in-house financing options or partner with third-party lenders. Additionally, some utility companies offer energy efficiency programs that include financing solutions. Research locally available options and compare their terms before deciding.

Royal Supply Inc

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