Mobile Home Owners

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Planning a Timely Furnace Upgrade in Mobile Home Settings

Importance of Selecting the Right Units for Upgrades

In the realm of mobile home living, ensuring comfort and efficiency through each season is paramount. One of the key systems that contribute to this is the HVAC system, particularly the furnace. Proper insulation improves HVAC efficiency in mobile homes **Mobile Home Hvac Service** knowledge. Planning a timely furnace upgrade in mobile home settings requires an understanding of specific HVAC requirements unique to these types of residences.

Mobile homes, by their very nature, have distinct characteristics compared to traditional houses. Their construction materials and design often mean they are less insulated and more susceptible to temperature fluctuations. Therefore, the HVAC systems installed must be tailored to meet these challenges head-on. When considering an upgrade, one must first acknowledge the size constraints typical of mobile homes. Space within these structures is limited; thus, any new furnace must be compact yet powerful enough to heat efficiently.

Another critical factor in planning a furnace upgrade is energy efficiency. Mobile homes can benefit greatly from modern furnaces designed with high-efficiency ratings. These units not only provide consistent warmth but also help reduce energy bills-a significant consideration for many mobile homeowners looking to economize. Opting for models with Energy Star certifications can ensure that the upgrade aligns with sustainable practices while maximizing cost savings.

Moreover, compatibility with existing ductwork is essential when upgrading a furnace in a mobile home setting. Unlike conventional homes where ductwork can be extensive and complex, mobile homes have simplified systems that require specific fittings and sizes to function optimally without necessitating major overhauls or renovations.

Timing also plays a crucial role in executing a successful furnace upgrade. Proactive planning before the onset of colder months ensures that homeowners are not left scrambling during peak winter periods when HVAC service providers are busiest and potentially more expensive due to demand surges.

Furthermore, because space is at such a premium in mobile homes, maintenance access should be considered during an upgrade. Ensuring that technicians can easily reach components for future repairs or inspections prevents unnecessary complications down the line.

Lastly, it's beneficial for mobile homeowners to consult with professionals who specialize in HVAC systems tailored for manufactured housing environments. These experts can provide invaluable insights into selecting equipment that meets both practical needs and personal preferences regarding climate control.

In conclusion, understanding mobile home HVAC system requirements involves recognizing space limitations, prioritizing energy efficiency, ensuring compatibility with existing infrastructure, and timing upgrades appropriately-all while seeking expert advice tailored specifically for these unique dwellings. By addressing these considerations thoughtfully during planning stages, homeowners can enjoy enhanced comfort and peace of mind through every season following their furnace upgrade decision-making process.

Factors to Consider When Choosing HVAC Units for Mobile Homes —

Evaluating Your Current Furnace and Identifying Upgrade Needs is an essential step in planning a timely furnace upgrade in mobile home settings. Given the unique characteristics of mobile homes, such as their size and construction materials, ensuring that your heating system is both efficient and effective is crucial for maintaining comfort and safety.

The first step in evaluating your current furnace involves assessing its age and efficiency. Furnaces typically last between 15 to 20 years; if yours falls within or exceeds this range, it might be time to consider an upgrade. Older furnaces are often less efficient, leading to higher energy bills and greater environmental impact. Checking the Annual Fuel Utilization Efficiency (AFUE) rating can provide insight into how well your furnace converts fuel into heat. A lower AFUE indicates a less efficient system that could benefit from modernization.

Next, consider the performance of your existing furnace. Are there cold spots in your home? Does the system struggle to maintain consistent temperatures? Frequent breakdowns or repairs are also red flags indicating that your heating system may no longer meet your needs effectively. It's vital to ensure that the furnace's capacity matches the size of your mobile home; an undersized unit will work overtime without adequately heating the space, while an oversized unit may cycle on and off too frequently, wasting energy and wearing out faster.

Additionally, evaluate the type of fuel used by your current furnace. Some mobile homes still use older models designed for oil or propane when more cost-effective and environmentally friendly options like natural gas or electric furnaces are available today. Transitioning to a different fuel type can not only enhance efficiency but also reduce operating costs over time.

In identifying upgrade needs, consider advancements in technology that offer improved efficiency and enhanced features for modern furnaces. Newer models boast smart thermostats for better temperature control, variable-speed blowers for more consistent airflow, and sealed combustion chambers which improve safety by preventing carbon monoxide leakage.

Moreover, consult with HVAC professionals who specialize in mobile home systems to tailor recommendations based on specific requirements like insulation levels and climate conditions prevalent in your area. Their expertise will help you choose a unit that balances upfront costs with long-term savings through reduced utility bills.

Finally, timing plays a critical role when planning a furnace upgrade in mobile homes. Ideally, upgrades should occur during warmer months when demand for HVAC services is lower-this not only ensures better availability of technicians but can also result in potential discounts.

In conclusion, taking a comprehensive approach towards evaluating your current furnace involves examining its age, performance issues, fuel type compatibility along with exploring technological advances suited specifically for mobile home environments-all crucial factors that contribute towards making informed decisions about necessary upgrades aimed at enhancing comfort while optimizing energy usage efficiently over time.

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Energy Efficiency and Environmental Impact

Choosing a new furnace for a mobile home is an essential decision that impacts both comfort and energy efficiency. As with any significant investment, careful planning is crucial to ensure the right choice is made. Here are several factors to consider when planning a timely furnace upgrade in mobile home settings.

Firstly, understanding the specific heating needs of your mobile home is paramount. Mobile homes often have different insulation standards and space configurations compared to traditional homes, which can influence heat distribution and retention. Conducting a thorough assessment of your home's square footage and layout will help determine the appropriate furnace size, ensuring optimal performance without overconsumption of energy.

Energy efficiency is another critical factor. Modern furnaces come equipped with various energy-saving features that can significantly reduce electricity bills. Look for units with high Annual Fuel Utilization Efficiency (AFUE) ratings; the higher the rating, the more efficient the furnace. While these models might have a higher upfront cost, they usually pay off in terms of lower utility expenses over time.

Additionally, fuel type plays an essential role in choosing a new furnace. Options typically include electric, natural gas, propane, or oil furnaces. The choice largely depends on availability and cost-effectiveness in your area. For example, natural gas may be more affordable if you live in an area where it is readily available and less expensive than electricity or other fuels.

Space constraints also need consideration when selecting a new heating system for mobile homes. Due to limited interior space, compact designs are preferable as they fit well into small utility rooms or closets without compromising functionality. Ensure that there's adequate ventilation around the unit to prevent overheating and maintain safety standards.

Moreover, installation requirements should not be overlooked. Installing a furnace in a mobile home often requires adherence to specific building codes and regulations that differ from those applicable to conventional houses. It's advisable to consult with professional HVAC contractors who are experienced in handling mobile home systems to ensure compliance with all necessary guidelines.

Lastly, consider future maintenance needs when choosing your new furnace. Opting for models from reputable manufacturers known for their reliability can save headaches down the line. Furthermore, checking warranty terms can provide peace of mind by covering potential repairs during the initial years following installation.

In conclusion, selecting the right furnace for your mobile home involves balancing several key factors: understanding heating needs, emphasizing energy efficiency, considering fuel types and space limitations, adhering to installation requirements, and evaluating maintenance considerations. By carefully weighing these elements during your decision-making process-and consulting with professionals as needed-you can ensure that your upgrade results in improved comfort and cost savings well into the future.

Cost-Effectiveness and Budget Considerations

When planning a furnace upgrade in mobile home settings, budgeting and financing options are critical considerations that can significantly impact the success of the project. Mobile homes, due to their unique construction and energy needs, require careful planning to ensure that any heating system upgrades are both efficient and cost-effective. As such, understanding how to budget properly and exploring various financing options can help homeowners make informed decisions while enhancing the comfort and energy efficiency of their living spaces.

The first step in the budgeting process is assessing the current state of your existing furnace. This involves evaluating its age, efficiency, and performance to determine if an upgrade is necessary. Older furnaces tend to lose efficiency over time, leading to higher energy bills and potentially costly repairs. By identifying these issues early on, homeowners can avoid unexpected expenses and plan for a timely upgrade.

Once it has been established that an upgrade is needed, creating a detailed budget becomes essential. This budget should account for all potential costs associated with the purchase and installation of a new furnace. Key factors include the price of the unit itself, installation fees, permits (if required), and any modifications needed to accommodate the new system in your mobile home. Additionally, ongoing maintenance costs should be considered to ensure long-term savings.

Exploring financing options is crucial as it provides flexibility for those who may not have immediate access to sufficient funds. Homeowners have several avenues they can pursue when financing their furnace upgrades. Traditional loans from banks or credit unions offer one option; these typically come with competitive interest rates but require good credit scores for approval. Alternatively, many utility companies provide financing programs specifically designed for energy-efficient upgrades, often offering low-interest rates or rebates as incentives.

Another attractive option is taking advantage of government incentives or tax credits aimed at encouraging energy-efficient home improvements. These programs can significantly reduce out-of-pocket expenses by providing financial assistance or reimbursements upon completion of a qualifying upgrade.

For those seeking environmentally friendly solutions, leasing or renting a high-efficiency furnace might also be worth considering. Some companies offer leasing plans where homeowners pay monthly installments rather than purchasing outright-this allows individuals access modern technology without bearing significant upfront costs.

Ultimately though whichever route you choose will depend largely on personal circumstances including financial standing eligibility criteria preferences-you must weigh each option carefully against your own needs goals aspirations.

In conclusion: Planning ahead securing appropriate funding key successful execution any major home improvement project especially something integral as upgrading heating systems within mobile homes setting smart strategic approach ensures not only improved comfort lower utility bills but increased property value overall thus rewarding investment future stability peace mind!

Sizing and Compatibility with Mobile Home Structures

Upgrading a furnace in a mobile home setting is an endeavor that requires careful planning and strategic timing to ensure minimal disruption. As these homes are often compact and intricately designed, any significant change, such as replacing a furnace, can cause inconvenience if not executed thoughtfully. When planned correctly, however, this upgrade can enhance the comfort and efficiency of living spaces without causing unnecessary upheaval.

The first step in planning a furnace upgrade is understanding the existing system's lifecycle and performance. Typically, furnaces have a lifespan of 15 to 20 years. If you notice that your energy bills are rising or if your furnace requires frequent repairs, it might be time to consider an upgrade. Early identification of these signs allows for proactive planning rather than reactive measures when the system fails unexpectedly.

Timing is crucial for minimizing disruption during a furnace upgrade. Ideally, such projects should be scheduled during seasons when heating demand is low-often late spring or early fall. During these periods, the weather typically does not necessitate continuous heating, making it easier for residents to manage without central heat while installation occurs. This approach helps avoid any potential discomfort that could arise from being without heat during colder months.

Additionally, scheduling the upgrade outside peak contractor busy seasons can lead to better availability of skilled professionals and potentially more competitive pricing. Contractors are less busy during off-peak times and may offer discounts or have more flexibility in scheduling convenient dates for homeowners.

Another consideration in minimizing disruption is preparing the space adequately before work begins. Clearing pathways to and from the furnace area and removing any objects that could obstruct access will facilitate smoother operations by technicians and reduce installation timeframes. Informing neighbors about scheduled work can also help maintain community harmony as they might experience temporary noise disturbances.

Communication with your chosen HVAC contractor throughout the process ensures alignment on expectations and timelines. A reputable contractor will provide clear guidance on what homeowners should anticipate before, during, and after installation-helping all parties involved prepare accordingly.

Finally, post-installation checks are vital to verifying that everything functions correctly before heavy usage commences with colder temperatures. Ensuring all new components integrate seamlessly with existing systems prevents future disruptions caused by malfunctions or inefficiencies.

In conclusion, upgrading a furnace in mobile home settings demands meticulous planning both regarding timing and preparation strategies. By assessing current system performance early on, choosing optimal seasons for upgrades, preparing spaces effectively beforehand, communicating clearly with contractors throughout processes involved-all contribute toward achieving seamless transitions into improved living environments without significant inconvenience or stressors along the way.

Installation Challenges and Solutions

Upgrading a furnace in a mobile home setting is no small task. It requires meticulous planning, careful consideration of the unique requirements of mobile homes, and most importantly, hiring qualified professionals for installation and maintenance. When embarking on this crucial project, understanding the importance of professional expertise cannot be overstated.

Mobile homes present distinct challenges compared to traditional houses when it comes to furnace upgrades. They often have limited space for equipment, different ventilation needs, and specific structural considerations that must be taken into account. This is where the expertise of seasoned professionals becomes invaluable. Qualified technicians bring with them not only the technical know-how but also an understanding of local building codes and safety regulations that are essential for a successful installation.

The first step in planning a timely furnace upgrade is to consult with experts who can assess the current heating system's efficiency and compatibility with newer models. Professionals can provide insights into energy-efficient options that will not only enhance comfort but also reduce utility bills over time. Their guidance helps homeowners make informed decisions about which furnace models are best suited to their mobile home's unique layout and heating requirements.

Once a suitable model has been selected, scheduling the installation at an appropriate time is crucial. Professional installers typically recommend avoiding peak seasons such as mid-winter when demand for heating services skyrockets. Instead, planning an upgrade during milder months ensures availability and potentially more competitive pricing from service providers.

Installation by qualified professionals guarantees that all components are correctly fitted and safely connected. This reduces the risk of malfunction or hazards such as gas leaks or electrical issues, which could arise from improper installation. Furthermore, reputable contractors offer warranties on their work, providing peace of mind in case any problems occur post-installation.

Maintenance is another critical aspect where professional involvement makes a significant difference. Regular check-ups by trained technicians help maintain optimal performance and extend the lifespan of the new furnace. These inspections can identify minor issues before they escalate into costly repairs or replacements, ensuring continuous comfort throughout colder seasons.

In conclusion, while upgrading a furnace in a mobile home setting involves several logistical challenges, hiring qualified professionals for installation and maintenance simplifies this complex process significantly. Their expertise ensures adherence to safety standards, enhances efficiency through proper selection and setup of equipment, and secures long-term reliability through regular maintenance checks. By investing in skilled professionals, homeowners not only safeguard their property but also ensure a warm and comfortable living environment year-round-a worthwhile investment indeed.

Maintenance and Long-term Performance

Upgrading a furnace in a mobile home setting is a task that requires careful consideration of both energy efficiency and adherence to local regulations. In the face of rising energy costs and increasing environmental awareness, ensuring that home heating systems are both effective and compliant has never been more crucial. This essay explores the importance of planning a timely furnace upgrade, with an emphasis on energy efficiency and regulatory compliance.

Mobile homes present unique challenges when it comes to heating. Their smaller size and often less robust insulation compared to traditional houses mean that choosing an efficient furnace is vital to maintain comfort without incurring excessive energy costs. An outdated or inefficient furnace not only fails to provide adequate warmth but also results in higher utility bills and increased carbon emissions. Therefore, upgrading to a modern, efficient system can significantly benefit homeowners by reducing long-term expenses and minimizing their environmental footprint.

Energy efficiency should be at the forefront of any furnace upgrade decision. Modern furnaces offer advanced technologies designed to maximize heat output while using less fuel. For instance, high-efficiency models convert a greater percentage of fuel into usable heat compared to older units. Homeowners should look for furnaces with high Annual Fuel Utilization Efficiency (AFUE) ratings, which indicate how efficiently the unit converts energy from its fuel source into heat over the course of a year.

In addition to selecting an energy-efficient model, compliance with local regulations is essential when planning a furnace upgrade in mobile homes. Building codes and environmental regulations vary widely across regions, so it's important for homeowners to familiarize themselves with these requirements before proceeding with an installation. Local authorities may have specific codes regarding ventilation, safety standards, or emissions limits that must be adhered to during installation.

Failure to comply with these regulations can lead not only to fines but also potential safety hazards for residents. It's advisable for homeowners to consult with certified HVAC professionals who are knowledgeable about local codes and can ensure that installations meet all necessary requirements. These experts can also guide homeowners through obtaining any necessary permits or inspections required by local authorities.

Timing plays a critical role in planning a successful furnace upgrade project. Ideally, upgrades should be scheduled during warmer months when heating demands are lower, thus avoiding disruptions during colder seasons when reliable heating is most needed. Planning ahead allows ample time for researching options, consulting professionals, securing necessary approvals, and scheduling installation without haste.

In conclusion, upgrading a furnace in mobile home settings requires thoughtful planning centered around energy efficiency and regulatory compliance. By investing in modern technology and adhering strictly to local guidelines, homeowners can achieve significant savings on their utility bills while contributing positively towards environmental sustainability goals. Ultimately, this proactive approach ensures that mobile homes remain warm havens throughout colder months without compromising on cost-effectiveness or legal obligations.

About Refrigerant

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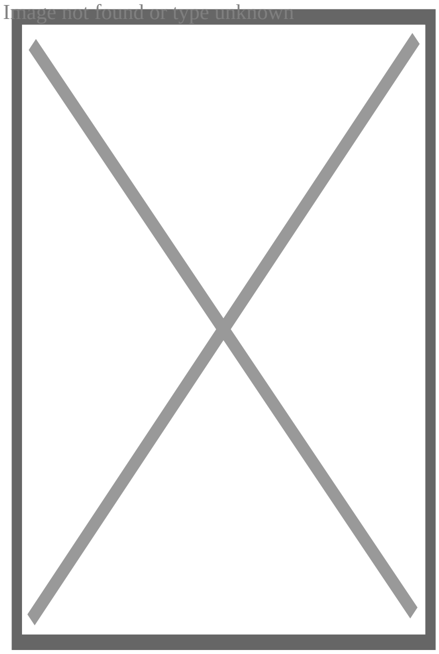
This article's lead section **may be too short to adequately summarize the key points.** Please consider expanding the lead to provide an accessible overview of all important aspects of the article. *(March 2021)*



A DuPont R-134a refrigerant

A **refrigerant** is a working fluid used in cooling, heating or reverse cooling and heating of air conditioning systems and heat pumps where they undergo a repeated phase transition from a liquid to a gas and back again. Refrigerants are heavily regulated because of their toxicity and flammability[1] and the contribution of CFC and HCFC refrigerants to ozone depletion[2] and that of HFC refrigerants to climate change.[3]

Refrigerants are used in a direct expansion (DX- Direct Expansion) system (circulating system)to transfer energy from one environment to another, typically from inside a building to outside (or vice versa) commonly known as an air conditioner cooling only or cooling & heating reverse DX system or heat pump a heating only DX cycle. Refrigerants can carry 10 times more energy per kg than water, and 50 times more than air.

Refrigerants are controlled substances and classified by International safety regulations ISO 817/5149, AHRAE 34/15 & BS EN 378 due to high pressures (700–1,000 kPa (100–150 psi)), extreme temperatures (?50 °C [?58 °F] to over 100 °C [212 °F]), flammability (A1 class non-flammable, A2/A2L class flammable and A3 class extremely flammable/explosive) and toxicity (B1-low, B2-medium & B3-high). The regulations relate to situations when these refrigerants are released into the atmosphere in the event of an accidental leak not while circulated.

Refrigerants (controlled substances) must only be handled by qualified/certified engineers for the relevant classes (in the UK, C&G 2079 for A1-class and C&G 6187-2 for A2/A2L & A3-class refrigerants).

Refrigerants (A1 class only) Due to their non-flammability, A1 class non-flammability, non-explosivity, and non-toxicity, non-explosivity they have been used in open systems (consumed when used) like fire extinguishers, inhalers, computer rooms fire extinguishing and insulation, etc.) since 1928.

History

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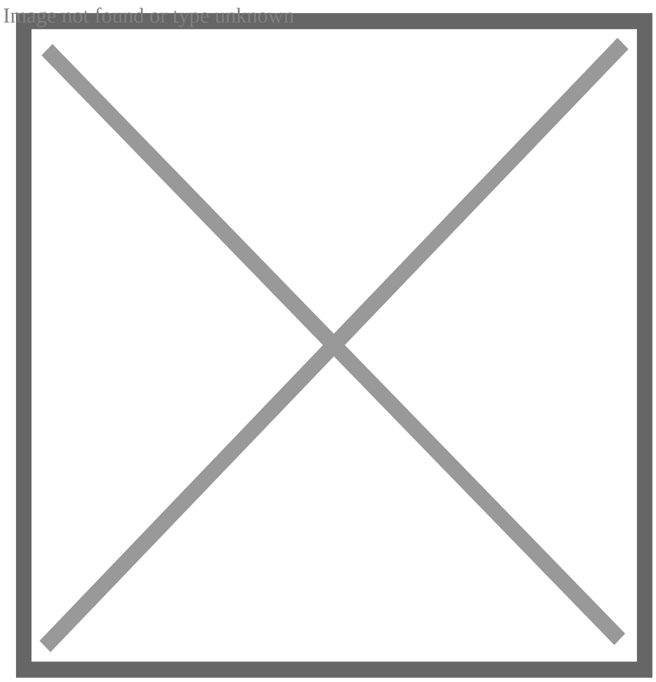

The observed stabilization of HCFC concentrations (left graphs) and the growth of HFCs (right graphs) in earth's atmosphere.

The first air conditioners and refrigerators employed toxic or flammable gases, such as ammonia, sulfur dioxide, methyl chloride, or propane, that could result in fatal accidents when they leaked.[4]

In 1928 Thomas Midgley Jr. created the first non-flammable, non-toxic chlorofluorocarbon gas, *Freon* (R-12). The name is a trademark name owned by DuPont (now Chemours) for any chlorofluorocarbon (CFC), hydrochlorofluorocarbon (HCFC), or hydrofluorocarbon (HFC) refrigerant. Following the discovery of better synthesis methods, CFCs such as R-11,[5] R-12,[6] R-123[5] and R-502[7] dominated the market.

Phasing out of CFCs

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See also: Montreal Protocol

In the mid-1970s, scientists discovered that CFCs were causing major damage to the ozone layer that protects the earth from ultraviolet radiation, and to the ozone holes over polar regions.[8][9] This led to the signing of the Montreal Protocol in 1987 which aimed to phase out CFCs and HCFC[10] but did not address the contributions that HFCs made to climate change. The adoption of HCFCs such as R-22,[11][12][13] and R-123[5] was accelerated and so were used in most U.S. homes in air conditioners and in chillers[14] from the 1980s as they have a dramatically lower Ozone Depletion Potential (ODP) than CFCs, but their ODP was still not zero which led to their eventual phase-out.

Hydrofluorocarbons (HFCs) such as R-134a,[15][16] R-407A,[17] R-407C,[18] R-404A,[7] R-410A[19] (a 50/50 blend of R-125/R-32) and R-507[20][21] were promoted as replacements for CFCs and HCFCs in the 1990s and 2000s. HFCs were not ozone-depleting but did have global warming potentials (GWPs) thousands of times greater than CO_2 with atmospheric lifetimes that can extend for decades. This in turn, starting from the 2010s, led to the adoption in new equipment of Hydrocarbon and HFO (hydrofluoroolefin) refrigerants R-32,[22] R-290,[23] R-600a,[23] R-454B,[24] R-1234yf,[25][26] R-514A,[27] R-744 (CO_2),[28] R-1234ze(E)[29] and R-1233zd(E),[30] which have both an ODP of zero and a lower GWP. Hydrocarbons and CO_2 are sometimes called natural refrigerants because they can be found in nature.

The environmental organization Greenpeace provided funding to a former East German refrigerator company to research alternative ozone- and climate-safe refrigerants in 1992. The company developed a hydrocarbon mixture of propane and isobutane, or pure isobutane,[31] called "Greenfreeze", but as a condition of the contract with Greenpeace could not patent the technology, which led to widespread adoption by other firms.[32][33][34] Policy and political influence by corporate executives resisted change however,[35][36] citing the flammability and explosive properties of the refrigerants,[37] and DuPont together with other companies blocked them in the U.S. with the U.S. EPA.[38][39]

Beginning on 14 November 1994, the U.S. Environmental Protection Agency restricted the sale, possession and use of refrigerants to only licensed technicians, per rules under sections 608 and 609 of the Clean Air Act.[40] In 1995, Germany made CFC refrigerators illegal.[41]

In 1996 Eurammon, a European non-profit initiative for natural refrigerants, was established and comprises European companies, institutions, and industry experts.[42][43][44]

In 1997, FCs and HFCs were included in the Kyoto Protocol to the Framework Convention on Climate Change.

In 2000 in the UK, the Ozone Regulations[45] came into force which banned the use of ozone-depleting HCFC refrigerants such as R22 in new systems. The Regulation banned the use of R22 as a "top-up" fluid for maintenance from 2010 for virgin fluid and from 2015 for recycled fluid.[*citation needed*]

Addressing greenhouse gases

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With growing interest in natural refrigerants as alternatives to synthetic refrigerants such as CFCs, HCFCs and HFCs, in 2004, Greenpeace worked with multinational corporations like Coca-Cola and Unilever, and later Pepsico and others, to create a corporate coalition called Refrigerants Naturally!.[41][46] Four years later, Ben & Jerry's of Unilever and General Electric began to take steps to support production and use in the U.S.[47] It is estimated that almost 75 percent of the refrigeration and air conditioning sector has the potential to be converted to natural refrigerants.[48]

In 2006, the EU adopted a Regulation on fluorinated greenhouse gases (FCs and HFCs) to encourage to transition to natural refrigerants (such as hydrocarbons). It was reported in 2010 that some refrigerants are being used as recreational drugs, leading to an extremely dangerous phenomenon known as inhalant abuse.[49]

From 2011 the European Union started to phase out refrigerants with a global warming potential (GWP) of more than 150 in automotive air conditioning (GWP = 100-year warming potential of one kilogram of a gas relative to one kilogram of CO_2) such as the refrigerant HFC-134a (known as R-134a in North America) which has a GWP of 1526.[50] In the same year the EPA decided in favour of the ozone- and climate-safe refrigerant for U.S. manufacture.[32][51][52]

A 2018 study by the nonprofit organization "Drawdown" put proper refrigerant management and disposal at the very top of the list of climate impact solutions, with an impact equivalent to eliminating over 17 years of US carbon dioxide emissions.[53]

In 2019 it was estimated that CFCs, HCFCs, and HFCs were responsible for about 10% of direct radiative forcing from all long-lived anthropogenic greenhouse gases.[54] and in the same year the UNEP published new voluntary guidelines,[55] however many countries have not yet ratified the Kigali Amendment.

From early 2020 HFCs (including R-404A, R-134a and R-410A) are being superseded: Residential air-conditioning systems and heat pumps are increasingly using R-32. This still has a GWP of more than 600. Progressive devices use refrigerants with almost no climate impact, namely R-290 (propane), R-600a (isobutane) or R-1234yf (less flammable, in cars). In commercial refrigeration also CO_2 (R-744) can be used.

Requirements and desirable properties

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A refrigerant needs to have: a boiling point that is somewhat below the target temperature (although boiling point can be adjusted by adjusting the pressure appropriately), a high heat of vaporization, a moderate density in liquid form, a relatively high density in gaseous form (which can also be adjusted by setting pressure appropriately), and a high critical temperature. Working pressures should ideally be containable by copper tubing, a commonly available material. Extremely high pressures should be avoided.[*citation needed*]

The ideal refrigerant would be: non-corrosive, non-toxic, non-flammable, with no ozone depletion and global warming potential. It should preferably be natural with well-studied and low environmental impact. Newer refrigerants address the issue of the damage that CFCs caused to the ozone layer and the contribution that HCFCs make to climate change, but some do raise issues relating to toxicity and/or flammability.[56]

Common refrigerants

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Refrigerants with very low climate impact

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With increasing regulations, refrigerants with a very low global warming potential are expected to play a dominant role in the 21st century,[57] in particular, R-290 and R-1234yf. Starting from almost no market share in 2018,[58] low GWPO devices are gaining market share in 2022.

Code	Chemical	Name	GWP 20yr[59]	GWP 100yr [59]	Status	Commentary
R-290	C_3H_8	Propane		3.3[60]	Increasing use	Low cost, widely available and efficient. They also have zero ozone depletion potential. Despite their flammability, they are increasingly used in domestic refrigerators and heat pumps. In 2010, about one-third of all household refrigerators and freezers manufactured globally used isobutane or an isobutane/propane blend, and this was expected to increase to 75% by 2020.[61]
R-600a	$HC(CH_3)_3$	Isobutane		3.3	Widely used	See R-290.

R-717	NH_3	Ammonia	0	0[62]	Widely used	Commonly used before the popularisation of CFCs, it is again being considered but does suffer from the disadvantage of toxicity, and it requires corrosion-resistant components, which restricts its domestic and small-scale use. Anhydrous ammonia is widely used in industrial refrigeration applications and hockey rinks because of its high energy efficiency and low cost.
R-1234yf HFO-1234yf	$C_3H_2F_4$	2,3,3,3-Tetrafluoropropene		<1		Less performance but also less flammable than R-290.[57] GM announced that it would start using "hydro-fluoro olefin", HFO-1234yf, in all of its brands by 2013.[63]

R-744	CO_2	Carbon dioxide	1	1	In use	Was used as a refrigerant prior to the discovery of CFCs (this was also the case for propane)[4] and now having a renaissance due to it being non-ozone depleting, non-toxic and non-flammable. It may become the working fluid of choice to replace current HFCs in cars, supermarkets, and heat pumps. Coca-Cola has fielded CO_2-based beverage coolers and the U.S. Army is considering CO_2 refrigeration.[64][65] Due to the need to operate at pressures of up to 130 bars (1,900 psi; 13,000 kPa), CO_2 systems require highly resistant components, however these have already been developed for mass production in many sectors.

Most used

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Code	Chemical	Name	Global warming potential 20yr[59]	GWP 100yr [59]	Status	Commentary

R-32 HFC-32	CH_2F_2	Difluoromethane	2430	677	Widely used	Promoted as climate-friendly substitute for R-134a and R-410A, but still with high climate impact. Has excellent heat transfer and pressure drop performance, both in condensation and vaporisation.[66] It has an atmospheric lifetime of nearly 5 years.[67] Currently used in residential and commercial air-conditioners and heat pumps.
R-134a HFC-134a	CH_2FCF_3	1,1,1,2-Tetrafluoroethane	3790	1550	Widely used	Most used in 2020 for hydronic heat pumps in Europe and the United States in spite of high GWP.[58] Commonly used in automotive air conditioners prior to phase out which began in 2012.
R-410A		50% R-32 / 50% R-125 (pentafluoroethane)	Between 2430 (R-32) and 6350 (R-125)	> 677	Widely Used	Most used in split heat pumps / AC by 2018. Almost 100% share in the USA.[58] Being phased out in the US starting in 2022.[68][69]

Banned / Phased out

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Code	Chemical	Name	Global warming potential 20yr[59]	GWP 100yr [59]	Status	Commentary
R-11 CFC-11	CCl_3F	Trichlorofluoromethane	6900	4660	Banned	Production was banned in developed countries by Montreal Protocol in 1996

R-12 CFC-12	CCl_2F_2	Dichlorodifluoromethane	10800	10200	Banned	Also known as Freon, a widely used chlorofluorocarbon halomethane (CFC). Production was banned in developed countries by Montreal Protocol in 1996, and in developing countries (article 5 countries) in 2010.[70]
R-22 HCFC-22	$CHClF_2$	Chlorodifluoromethane	5280	1760	Being phased out	A widely used hydrochlorofluorocarbon (HCFC) and powerful greenhouse gas with a GWP equal to 1810. Worldwide production of R-22 in 2008 was about 800 Gg per year, up from about 450 Gg per year in 1998. R-438A (MO-99) is a R-22 replacement.[71]
R-123 HCFC-123	$CHCl_2CF_3$	2,2-Dichloro-1,1,1-trifluoroethane	292	79	US phase-out	Used in large tonnage centrifugal chiller applications. All U.S. production and import of virgin HCFCs will be phased out by 2030, with limited exceptions.[72] R-123 refrigerant was used to retrofit some chiller that used R-11 refrigerant Trichlorofluoromethane. The production of R-11 was banned in developed countries by Montreal Protocol in 1996.[73]

Other

[edit]

Code	Chemical	Name	Global warming potential 20yr[59]	GWP 100yr[59]	Commentary
R-152a HFC-152a	CH_3CHF_2	1,1-Difluoroethane	506	138	As a compressed air duster
R-407C		Mixture of difluoromethane and pentafluoroethane and 1,1,1,2-tetrafluoroethane			A mixture of R-32, R-125, and R-134a
R-454B		Difluoromethane and 2,3,3,3-Tetrafluoropropene			HFOs blend of refrigerants Difluoromethane (R-32) and 2,3,3,3-Tetrafluoropropene (R-1234yf).[74][75][76][77]
R-513A		An HFO/HFC blend (56% R-1234yf/44%R-134a)			May replace R-134a as an interim alternative[78]
R-514A		HFO-1336mzz-Z/trans-1,2- dichloroethylene (t-DCE)			An hydrofluoroolefin (HFO)-based refrigerant to replace R-123 in low pressure centrifugal chillers for commercial and industrial applications.[79][80]

Refrigerant reclamation and disposal

[edit]
Main article: Refrigerant reclamation

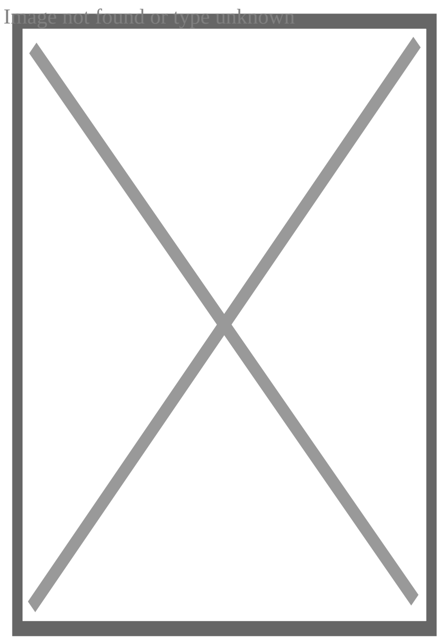
Coolant and refrigerants are found throughout the industrialized world, in homes, offices, and factories, in devices such as refrigerators, air conditioners, central air conditioning systems (HVAC), freezers, and dehumidifiers. When these units are serviced, there is a risk that refrigerant gas will be vented into the atmosphere either accidentally or intentionally, hence the creation of technician training and certification programs in order to ensure that the material is conserved and managed safely. Mistreatment of these gases has been shown to deplete the ozone layer and is suspected to contribute to global warming.[81]

With the exception of isobutane and propane (R600a, R441A and R290), ammonia and CO_2 under Section 608 of the United States' Clean Air Act it is illegal to knowingly release any refrigerants into the atmosphere.[82][83]

Refrigerant reclamation is the act of processing used refrigerant gas which has previously been used in some type of refrigeration loop such that it meets specifications for new refrigerant gas. In the United States, the Clean Air Act of 1990 requires that used refrigerant be processed by a certified reclaimer, which must be licensed by the United States Environmental Protection Agency (EPA), and the material must be recovered and delivered to the reclaimer by EPA-certified technicians.[84]

Classification of refrigerants

[edit]



R407C pressure-enthalpy diagram, isotherms between the two saturation lines

Main article: List of refrigerants

Refrigerants may be divided into three classes according to their manner of absorption or extraction of heat from the substances to be refrigerated:[*citation needed*]

- Class 1: This class includes refrigerants that cool by phase change (typically boiling), using the refrigerant's latent heat.
- Class 2: These refrigerants cool by temperature change or 'sensible heat', the quantity of heat being the specific heat capacity x the temperature change. They are air, calcium chloride brine, sodium chloride brine, alcohol, and similar nonfreezing solutions. The purpose of Class 2 refrigerants is to receive a reduction of temperature from Class 1 refrigerants and convey this lower temperature to the area to be cooled.
- Class 3: This group consists of solutions that contain absorbed vapors of liquefiable agents or refrigerating media. These solutions function by nature of their ability to carry liquefiable vapors, which produce a cooling effect by the absorption of their heat of solution. They can also be classified into many categories.

R numbering system

[edit]

The R- numbering system was developed by DuPont (which owned the Freon trademark), and systematically identifies the molecular structure of refrigerants made with a single halogenated hydrocarbon. ASHRAE has since set guidelines for the numbering system as follows:[85]

R-$X_1X_2X_3X_4$

- **X_1** = Number of unsaturated carbon-carbon bonds (omit if zero)
- **X_2** = Number of carbon atoms minus 1 (omit if zero)
- **X_3** = Number of hydrogen atoms plus 1
- **X_4** = Number of fluorine atoms

Series

[edit]

- **R-xx** Methane Series
- **R-1xx** Ethane Series
- **R-2xx** Propane Series
- **R-4xx** Zeotropic blend
- **R-5xx** Azeotropic blend
- **R-6xx** Saturated hydrocarbons (except for propane which is R-290)
- **R-7xx** Inorganic Compounds with a molar mass < 100
- **R-7xxx** Inorganic Compounds with a molar mass ? 100

Ethane Derived Chains

[edit]

- **Number Only** Most symmetrical isomer
- **Lower Case Suffix (a, b, c, etc.)** indicates increasingly unsymmetrical isomers

Propane Derived Chains

[edit]

- **Number Only** If only one isomer exists; otherwise:
- **First lower case suffix (a-f):**
  - **a Suffix** Cl_2 central carbon substitution
  - **b Suffix** Cl, F central carbon substitution
  - **c Suffix** F_2 central carbon substitution
  - **d Suffix** Cl, H central carbon substitution
  - **e Suffix** F, H central carbon substitution
  - **f Suffix** H_2 central carbon substitution

- **2nd Lower Case Suffix (a, b, c, etc.)** Indicates increasingly unsymmetrical isomers

Propene derivatives

[edit]

- **First lower case suffix (x, y, z)**:
  - **x Suffix** Cl substitution on central atom
  - **y Suffix** F substitution on central atom
  - **z Suffix** H substitution on central atom
- **Second lower case suffix (a-f)**:
  - **a Suffix** $=CCl_2$ methylene substitution
  - **b Suffix** =CClF methylene substitution
  - **c Suffix** $=CF_2$ methylene substitution
  - **d Suffix** =CHCl methylene substitution
  - **e Suffix** =CHF methylene substitution
  - **f Suffix** $=CH_2$ methylene substitution

Blends

[edit]

- **Upper Case Suffix (A, B, C, etc.)** Same blend with different compositions of refrigerants

Miscellaneous

[edit]

- **R-Cxxx** Cyclic compound
- **R-Exxx** Ether group is present
- **R-CExxx** Cyclic compound with an ether group
- **R-4xx/5xx + Upper Case Suffix (A, B, C, etc.)** Same blend with different composition of refrigerants
- **R-6xx + Lower Case Letter** Indicates increasingly unsymmetrical isomers
- **7xx/7xxx + Upper Case Letter** Same molar mass, different compound
- **R-xxxxB#** Bromine is present with the number after B indicating how many bromine atoms
- **R-xxxxI# I**odine is present with the number after I indicating how many iodine atoms
- **R-xxx(E)** Trans Molecule
- **R-xxx(Z)** Cis Molecule

For example, R-134a has 2 carbon atoms, 2 hydrogen atoms, and 4 fluorine atoms, an empirical formula of tetrafluoroethane. The "a" suffix indicates that the isomer is unbalanced by one atom, giving 1,1,1,2-Tetrafluoroethane. R-134 (without the "a" suffix) would have a molecular structure of 1,1,2,2-Tetrafluoroethane.

The same numbers are used with an R- prefix for generic refrigerants, with a "Propellant" prefix (e.g., "Propellant 12") for the same chemical used as a propellant for an aerosol spray, and with trade names for the compounds, such as "**Freon** 12". Recently, a practice of using abbreviations HFC- for hydrofluorocarbons, CFC- for chlorofluorocarbons, and HCFC- for hydrochlorofluorocarbons has arisen, because of the regulatory differences among these groups.[*citation needed*]

Refrigerant safety

[edit]

ASHRAE Standard 34, *Designation and Safety Classification of Refrigerants*, assigns safety classifications to refrigerants based upon toxicity and flammability.

Using safety information provided by producers, ASHRAE assigns a capital letter to indicate toxicity and a number to indicate flammability. The letter "A" is the least toxic and the number 1 is the least flammable.[86]

See also

[edit]

- Brine (Refrigerant)
- Section 608
- List of Refrigerants

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External links

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- US Environmental Protection Agency page on the GWPs of various substances
- Green Cooling Initiative on alternative natural refrigerants cooling technologies
- International Institute of Refrigeration Archived 2018-09-25 at the Wayback Machine

- v
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- e

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

Technology

- 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
- Solar cooling
- Solar heating
- Thermal insulation

- 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
- Grease duct

Components

- Grille
- Ground-coupled heat exchanger

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
Professions, trades, and services	◦ 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

Industry organizations

- AHRI
- AMCA
- ASHRAE
- ASTM International
- BRE
- BSRIA
- CIBSE
- Institute of Refrigeration
- IIR
- LEED
- SMACNA
- UMC

Health and safety

- Indoor air quality (IAQ)
- Passive smoking
- Sick building syndrome (SBS)
- Volatile organic compound (VOC)

See also

- ASHRAE Handbook
- Building science
- Fireproofing
- Glossary of HVAC terms
- Warm Spaces
- World Refrigeration Day
- Template:Home automation
- Template:Solar energy

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About Modular building

For the Lego series, see Lego Modular Buildings.

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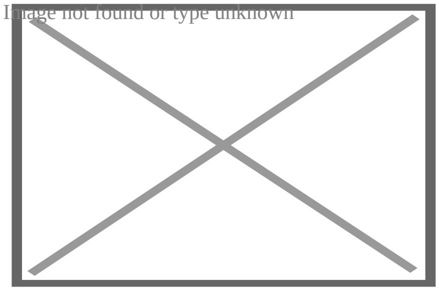
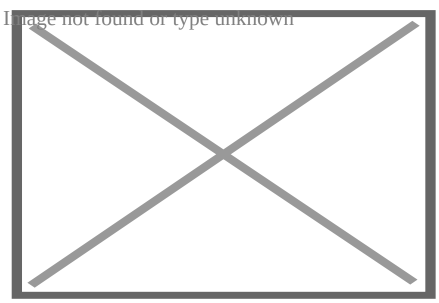


Prefabricated house in Valencia, Spain.

A **modular building** is a prefabricated building that consists of repeated sections called modules.[1] Modularity involves constructing sections away from the building site, then delivering them to the intended site. Installation of the prefabricated sections is completed on site. Prefabricated sections are sometimes placed using a crane. The modules can be placed side-by-side, end-to-end, or stacked, allowing for a variety of configurations and styles. After placement, the modules are joined together using inter-module connections, also known as inter-connections. The inter-connections tie the individual modules together to form the overall building structure.[2]

Uses

[edit]



Modular home prefab sections to be placed on the foundation

Modular buildings may be used for long-term, temporary or permanent facilities, such as construction camps, schools and classrooms, civilian and military housing, and industrial facilities. Modular buildings are used in remote and rural areas where conventional construction may not be reasonable or possible, for example, the Halley VI accommodation pods used for a BAS Antarctic expedition.[3] Other uses have included churches, health care facilities, sales and retail offices, fast food restaurants and cruise ship construction. They can also be used in areas that have weather concerns, such as hurricanes. Modular buildings are often used to provide temporary facilities, including toilets and ablutions at events. The portability of the buildings makes them popular with hire companies and clients alike. The use of modular buildings enables events to be held at locations where existing facilities are unavailable, or unable to support the number of event attendees.

Construction process

[edit]

Construction is offsite, using lean manufacturing techniques to prefabricate single or multi-story buildings in deliverable module sections. Often, modules are based around standard 20 foot containers, using the same dimensions, structures, building and stacking/placing techniques, but with smooth (instead of corrugated) walls, glossy white paint, and provisions for windows, power, potable water, sewage lines, telecommunications and air conditioning. Permanent Modular Construction (PMC) buildings are manufactured in a controlled setting and can be constructed of wood, steel, or concrete. Modular components are typically constructed indoors on assembly lines. Modules' construction may take as little as ten days but more often one to three months. PMC modules can be integrated into site built projects or stand alone and can be delivered with MEP, fixtures and interior finishes.

The buildings are 60% to 90% completed offsite in a factory-controlled environment, and transported and assembled at the final building site. This can comprise the entire building or be components or subassemblies of larger structures. In many cases, modular contractors work with traditional general contractors to exploit the resources and advantages of each type of construction. Completed modules are transported to the building site and assembled by a crane.[4] Placement of the modules may take from several hours to several days. Off-site construction running in parallel to site preparation providing a shorter time to project completion is one of the common selling points of modular construction. Modular construction timeline

Permanent modular buildings are built to meet or exceed the same building codes and standards as site-built structures and the same architect-specified materials used in conventionally constructed buildings are used in modular construction projects. PMC can have as many stories as building codes allow. Unlike relocatable buildings, PMC structures are intended to remain in one location for the duration of their useful life.

Manufacturing considerations

[edit]

The entire process of modular construction places significance on the design stage. This is where practices such as Design for Manufacture and Assembly (DfMA) are used to ensure that assembly tolerances are controlled throughout manufacture and assembly on site. It is vital that there is enough allowance in the design to allow the assembly to take up any "slack" or misalignment of components. The use of advanced CAD systems, 3D printing and manufacturing control systems are important for modular construction to be successful. This is quite unlike on-site construction where the tradesman can often make the part to suit any particular installation.

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Ready for delivery to
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Two-story modular dwelling

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Upfront production investment

[edit]

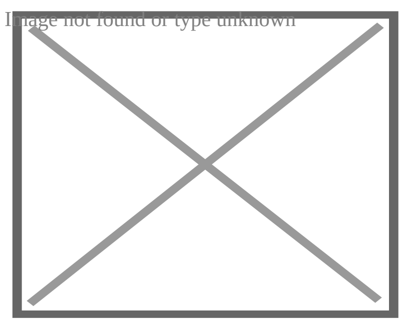
The development of factory facilities for modular homes requires significant upfront investment. To help address housing shortages in the 2010s, the United Kingdom Government (via Homes England) invested in modular housing initiatives. Several UK companies (for example, Ilke Homes, L&G Modular Homes, House by Urban Splash, Modulous, TopHat and Lighthouse) were established to develop modular homes as an alternative to traditionally-built residences, but failed as they could not book revenues quickly enough to cover the costs of establishing manufacturing facilities.

Ilke Homes opened a factory in Knaresborough, Yorkshire in 2018, and Homes England invested £30m in November 2019,[5] and a further £30m in September 2021.[6] Despite a further fund-raising round, raising £100m in December 2022,[7][8] Ilke Homes went into administration on 30 June 2023,[9][10] with most of the company's 1,150 staff made redundant,[11] and debts of £320m,[12] including £68m owed to Homes England.[13]

In 2015 Legal & General launched a modular homes operation, L&G Modular Homes, opening a 550,000 sq ft factory in Sherburn-in-Elmet, near Selby in Yorkshire.[14] The company incurred large losses as it invested in its factory before earning any revenues; by 2019, it had lost over £100m.[15] Sales revenues from a Selby project, plus schemes in Kent and West Sussex, started to flow in 2022, by which time the business's total losses had grown to £174m.[16] Production was halted in May 2023, with L&G blaming local planning delays and the COVID-19 pandemic for its failure to grow its sales pipeline.[17][18] The enterprise incurred total losses over seven years of £295m.[19]

Market acceptance

[edit]



Raines Court is a multi-story modular housing block in Stoke Newington, London, one of the first two residential buildings in Britain of this type. (December 2005)

Some home buyers and some lending institutions resist consideration of modular homes as equivalent in value to site-built homes.[*citation needed*] While the homes themselves may be of equivalent quality, entrenched zoning regulations and psychological marketplace factors may create hurdles for buyers or builders of modular homes and should be considered as part of the decision-making process when exploring this type of home as a living and/or investment option. In the UK and Australia, modular homes have become accepted in some regional areas; however, they are not commonly built in major cities. Modular homes are becoming increasingly common in Japanese urban areas, due to improvements in design and quality, speed and compactness of onsite assembly, as well as due to lowering costs and ease of repair after earthquakes. Recent innovations allow modular buildings to be indistinguishable from site-built structures.[20] Surveys have shown that individuals can rarely tell the difference between a modular home and a site-built home.[21]

Modular homes vs. mobile homes

[edit]

Differences include the building codes that govern the construction, types of material used and how they are appraised by banks for lending purposes. Modular homes are built to either local or state building codes as opposed to manufactured homes, which are also built in a factory but are governed by a federal building code.[22] The codes that govern the construction of modular homes are exactly the same codes that govern the construction of site-constructed homes.[*citation needed*] In the United States, all modular homes are constructed according to the International Building Code (IBC), IRC, BOCA or the code that has been adopted by the local jurisdiction.[*citation needed*] In some states, such as California, mobile homes must still be registered yearly, like vehicles or standard trailers, with the Department of Motor Vehicles or other state agency. This is true even if the owners remove the axles and place it on a permanent foundation.[23]

Recognizing a mobile or manufactured home

[edit]

A mobile home should have a small metal tag on the outside of each section. If a tag cannot be located, details about the home can be found in the electrical panel box. This tag should also reveal a manufacturing date.[*citation needed*] Modular homes do not have metal tags on the outside but will have a dataplate installed inside the home, usually under the kitchen sink or in a closet. The dataplate will provide information such as the manufacturer, third party inspection agency, appliance information, and manufacture date.

Materials

[edit]

The materials used in modular buildings are of the same quality and durability as those used in traditional construction, preserving characteristics such as acoustic insulation and energy efficiency, as well as allowing for attractive and innovative designs thanks to their versatility.[24] Most commonly used are steel, wood and concrete.[25]

- Steel: Because it is easily moldable, it allows for innovation in design and aesthetics.
- Wood: Wood is an essential part of most modular buildings. Thanks to its lightness, it facilitates the work of assembling and moving the prefabricated modules.
- Concrete: Concrete offers a solid structure that is ideal for the structural reinforcement of permanent modular buildings. It is increasingly being used as a base material in this type of building, thanks to its various characteristics such as fire resistance, energy savings, greater acoustic insulation, and durability.[26]

Wood-frame floors, walls and roof are often utilized. Some modular homes include brick or stone exteriors, granite counters and steeply pitched roofs. Modulars can be designed to sit on a perimeter foundation or basement. In contrast, mobile homes are constructed with a steel chassis that is integral to the integrity of the floor system. Modular buildings can be custom built to a client's specifications. Current designs include multi-story units, multi-family units and entire apartment complexes. The negative stereotype commonly associated with mobile homes has prompted some manufacturers to start using the term "off-site construction."

New modular offerings include other construction methods such as cross-laminated timber frames.[27]

Financing

[edit]

Mobile homes often require special lenders.[28]

Modular homes on the other hand are financed as site built homes with a construction loan

Standards and zoning considerations

[edit]

Typically, modular dwellings are built to local, state or council code, resulting in dwellings from a given manufacturing facility having differing construction standards depending on the final destination of the modules.[29] The most important zones that manufacturers have to take into consideration are local wind, heat, and snow load zones.[*citation needed*] For example, homes built for final assembly in a hurricane-prone, earthquake or flooding area may include additional bracing to meet local building codes. Steel and/or wood framing are common options for building a modular home.

Some US courts have ruled that zoning restrictions applicable to mobile homes do not apply to modular homes since modular homes are designed to have a permanent foundation.[*citation needed*] Additionally, in the US, valuation differences between modular homes and site-built homes are often negligible in real estate appraisal practice; modular homes can, in some market areas, (depending on local appraisal practices per Uniform Standards of Professional Appraisal Practice) be evaluated the same way as site-built dwellings of similar quality. In Australia, manufactured home parks are governed by additional legislation that does not apply to permanent modular homes. Possible developments in equivalence between modular and site-built housing types for the purposes of real estate appraisals, financing and zoning may increase the sales of modular homes over time.[30]

CLASP (Consortium of Local Authorities Special Programme)

[edit]

The Consortium of Local Authorities Special Programme (abbreviated and more commonly referred to as CLASP) was formed in England in 1957 to combine the resources of local authorities with the purpose of developing a prefabricated school building programme. Initially developed by Charles Herbert Aslin, the county architect for Hertfordshire, the system was used as a model for several other counties, most notably Nottinghamshire and Derbyshire. CLASP's popularity in these coal mining areas was in part because the system permitted fairly straightforward replacement of subsidence-damaged sections of building.

Building strength

[edit]

Modular Home being built in Vermont photo by Josh Vignona

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Modular home in Vermont

Modular homes are designed to be stronger than traditional homes by, for example, replacing nails with screws, adding glue to joints, and using 8–10% more lumber than conventional housing.[31] This is to help the modules maintain their structural integrity as they are transported on trucks to the construction site. However, there are few studies on the response of modular buildings to transport and handling stresses. It is therefore presently difficult to predict transport induced damage.[1]

When FEMA studied the destruction wrought by Hurricane Andrew in Dade County Florida, they concluded that modular and masonry homes fared best compared to other construction.[32]

CE marking

[edit]

The CE mark is a construction norm that guarantees the user of mechanical resistance and strength of the structure. It is a label given by European community empowered authorities for end-to-end process mastering and traceability.[*citation needed*]

All manufacturing operations are being monitored and recorded:

- Suppliers have to be known and certified,
- Raw materials and goods being sourced are to be recorded by batch used,
- Elementary products are recorded and their quality is monitored,
- Assembly quality is managed and assessed on a step by step basis,
- When a modular unit is finished, a whole set of tests are performed and if quality standards are met, a unique number and EC stamp is attached to and on the unit.

This ID and all the details are recorded in a database, At any time, the producer has to be able to answer and provide all the information from each step of the production of a single unit, The EC certification guaranties standards in terms of durability, resistance against wind and earthquakes.[*citation needed*]

Open modular building

[edit]
See also: Green building

The term Modularity can be perceived in different ways. It can even be extended to building P2P (peer-to-peer) applications; where a tailored use of the P2P technology is with the aid of a modular paradigm. Here, well-understood components with clean interfaces can be combined to implement arbitrarily complex functions in the hopes of further proliferating self-organising P2P technology. Open modular buildings are an excellent example of this. Modular building can also be open source and green. Bauwens, Kostakis and Pazaitis[33] elaborate on this kind of modularity. They link modularity to the construction of houses.

This commons-based activity is geared towards modularity. The construction of modular buildings enables a community to share designs and tools related to all the different parts of house construction. A socially-oriented endeavour that deals with the external architecture of buildings and the internal dynamics of open source commons. People are thus provided with the tools to reconfigure the public sphere in the area where they live, especially in urban environments. There is a robust socializing element that is reminiscent of pre-industrial vernacular architecture and community-based building.[34]

Some organisations already provide modular housing. Such organisations are relevant as they allow for the online sharing of construction plans and tools. These plans can be then assembled, through either digital fabrication like 3D printing or even sourcing low-cost materials from local communities. It has been noticed that given how easy it is to use these low-cost materials are (for example: plywood), it can help increase the permeation of these open buildings to areas or communities that lack the know-how or abilities of conventional architectural or construction firms. Ergo, it allows for a fundamentally more standardised way of constructing houses and buildings. The overarching idea behind it remains key - to allow for easy access to user-friendly layouts which anyone can use to build in a more sustainable and affordable way.

Modularity in this sense is building a house from different standardised parts, like solving a jigsaw puzzle.

3D printing can be used to build the house.

The main standard is OpenStructures and its derivative Autarkytecture.[35]

Research and development

[edit]

Modular construction is the subject of continued research and development worldwide as the technology is applied to taller and taller buildings. Research and development is carried out by modular building companies and also research institutes such as the Modular Building Institute[36] and the Steel Construction Institute.[37]

See also

[edit]

- Image not found or type unknown Housing portal
- Affordable housing
- Alternative housing
- Commercial modular construction
- Construction 3D printing
- Container home
- Kit house
- MAN steel house
- Manufactured housing
- Modern methods of construction
- Modular design
- Portable building
- Prefabrication
- Open-source architecture
- Open source hardware
- OpenStructures
- Prefabricated home
- Relocatable buildings
- Recreational vehicles
- Shipping container architecture
- Stick-built home
- Tiny house movement
- Toter

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About Durham Supply Inc

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Things To Do in Oklahoma County

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Stockyards City Main Street

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Route 66 Park

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Beavers Bend State Park and Nature Center

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Museum of Osteology

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Oklahoma Railway Museum

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Oklahoma City Museum of Art

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Driving Directions in Oklahoma County

Driving Directions From Orr Nissan Central to Durham Supply Inc

Driving Directions From Oklahoma City to Durham Supply Inc

Driving Directions From Central Oklahoma City to Durham Supply Inc

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Driving Directions From Science Museum Oklahoma to Durham Supply Inc

Driving Directions From Centennial Land Run Monument to Durham Supply Inc

Driving Directions From Oklahoma City National Memorial & Museum to Durham Supply Inc

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Reviews for Durham Supply Inc

Durham Supply Inc

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K Moore

(1)

No service after the sale. I purchased a sliding patio door and was given the wrong size sliding screen door. After speaking with the salesman and manager several times the issue is still not resolved and, I was charged full price for an incomplete door. They blamed the supplier for all the issues…and have offered me nothing to resolve this.

Durham Supply Inc

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Jennifer Williamson

(5)

First we would like to thank you for installing our air conditioning unit! I'd like to really brag about our technician, Mack, that came to our home to install our unit in our new home. Mack was here for most of the day and throughly explained everything we had a question about. By the late afternoon, we had cold air pumping through our vents and we couldn't have been more thankful. I can tell you, I would be very lucky to have a technician like Mack if this were my company. He was very very professional, kind, and courteous. Please give Mack a pat on the back and stay rest assured that Mack is doing a great job and upholding your company name! Mack, if you see this, great job!! Thanks for everything you did!! We now have a new HVAC company in the event we need one. We will also spread the word to others!!

Durham Supply Inc

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Noel Vandy

(5)

Thanks to the hard work of Randy our AC finally got the service it needed. These 100 degree days definitely feel long when your house isn't getting cool anymore. We were so glad when Randy came to work on the unit, he had all the tools and products he needed with him and it was all good and running well when he left. With a long drive to get here and only few opportunities to do so, we are glad he got it done in 1 visit. Now let us hope it will keep running well for a good while.

Durham Supply Inc

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Crystal Dawn

(1)

I would give 0 stars. This isnTHE WORST company for heating and air. I purchased a home less than one year ago and my ac has gone out twice and these people refuse to repair it although I AM UNDER WARRANTY!!!! They say it's an environmental issue and they can't fix it or even try to or replace my warrantied air conditioning system.

Durham Supply Inc

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Salest

(5)

Had to make a quick run for 2 sets of ?? door locks for front and back door.. In/ out in a quick minute! They helped me right away. ?? Made sure the 2 sets had the same ? keys. The ? bathroom was clean and had everything I needed. ? ?. Made a quick inquiry about a random item... they quickly looked it up and gave me pricing. Great ? job ?

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Royal Supply Inc

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Google Business Profile

Company Website : **https://royal-durhamsupply.com/locations/oklahoma-city-oklahoma/**