Air Quality

- **Mapping Duct Layouts for Cleaner Airflow in Mobile Homes**
  Mapping Duct Layouts for Cleaner Airflow in Mobile Homes Inspecting Vent Connections for Improved Air Quality Minimizing Drafts Through Sealed Mobile Home Duct Systems Scheduling Regular Cleanings for Mobile Home Ventilation Evaluating Filter Efficiency for Enhanced Mobile Home Air Quality Addressing Mold Risks in Mobile Home Ductwork Installing Air Purification Systems in Mobile Homes Checking Air Pressure to Reduce Allergens in Mobile Home Interiors Identifying Common Leaks in Flexible Mobile Home Ducts Balancing Humidity Levels for Healthier Mobile Home Air Considering UV Technology for Mobile Home Air Treatment Using Diagnostic Tools to Assess Air Quality in Mobile Homes
- **Preparing Mobile Home HVAC Units for Intense Summer Heat**
  Preparing Mobile Home HVAC Units for Intense Summer Heat Protecting Mobile Home Furnaces During Low Temperature Periods Coping with Storm Related Damage to Mobile Home Air Conditioners Adjusting Climate Control in Mobile Homes for Coastal Humidity Handling Power Outages in Mobile Home Heating Systems Planning Winterization Steps for Mobile Home HVAC Equipment Adapting Mobile Homes to Rapid Seasonal Swings in Temperature Evaluating Wind Exposure Factors for Mobile Home AC Placement Addressing Extended Rainy Periods in Mobile Home Ventilation Considering Local Building Codes for Mobile Home Climate Adaptations Balancing Heat Needs in Mobile Homes Across Different Regions Checking Insurance Coverage for Storm Damaged Mobile Home AC Units
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Identifying Common Leaks in Flexible Mobile Home Ducts

Importance of Efficient Duct Layouts for Airflow

In the context of mobile homes, ensuring a comfortable and energy-efficient living environment hinges significantly on the integrity of the ductwork system. Often constructed with flexible materials, these ducts are prone to leaks that can compromise both comfort and economy. Identifying and fixing these leaks is not just a matter of convenience but also an essential step toward optimizing energy use and ensuring a healthier indoor atmosphere.

Flexible ducts in mobile homes serve as vital conduits for air distribution from heating and cooling systems. However, their pliable nature makes them susceptible to damage over time. Common causes include physical wear and tear, improper installation, or even pest intrusion. When leaks occur, conditioned air escapes before reaching its intended destination, leading to inefficient system performance. This inefficiency manifests as uneven temperature distribution throughout the home-some areas may remain too hot while others are excessively cold.

Thermostat settings should be adjusted to match seasonal needs in mobile homes **mobile home hvac** allergen.

The importance of identifying these leaks cannot be overstated. First and foremost, unaddressed duct leaks lead to higher utility bills as heating or cooling systems work overtime to compensate for lost air. This not only strains the mechanical components but also accelerates their wear, potentially leading to costly repairs or replacements

down the line. By pinpointing and sealing these leaks early on, homeowners can achieve substantial savings in energy costs.

Moreover, leaky ducts can significantly impact indoor air quality–a concern particularly pertinent in the confined spaces of mobile homes. Leaks allow dust, mold spores, and other contaminants from crawl spaces or attics into the airflow system, which can then be distributed throughout the home. This poses health risks especially for individuals with allergies or respiratory issues.

Fixing duct leaks is thus a proactive measure towards maintaining both economic efficiency and health standards within a mobile home environment. Several approaches can be employed depending on the severity and location of the leakages–from simple DIY solutions like applying mastic sealant or foil tape to professional services using diagnostic tools such as duct blasters that pressurize ducts to detect breaches accurately.

In conclusion, addressing duct leaks in mobile homes is an integral part of preserving comfort while minimizing operational costs. It requires vigilance in identifying potential problem areas coupled with timely intervention to repair any discovered breaches effectively. By doing so, homeowners not only protect their investment but also contribute positively towards environmental conservation through reduced energy consumption–a win-win scenario that underscores the critical importance of this often-overlooked aspect of home maintenance.

Flexible ducts are an integral component of the heating, ventilation, and air conditioning (HVAC) systems in mobile homes. These ducts are responsible for distributing conditioned air throughout the home, ensuring comfort and efficiency. However, the very flexibility that makes these ducts so useful can also lead to common issues–particularly leaks–that compromise their effectiveness. Identifying these leaks is crucial for maintaining an efficient and cost-effective HVAC system.

One of the primary causes of leaks in flexible ducts is poor installation. During installation, if connections between duct sections or between the ducts and other HVAC components are not properly sealed, gaps can form. These gaps allow air to escape before it reaches its intended destination, reducing system efficiency and leading to increased energy costs. Moreover, if ducts are not adequately supported during installation, sagging can occur over time. This sagging can create stress points where leaks are more likely to develop.

Another common cause of leaks is physical damage to the duct material itself. Flexible ducts are typically made from a combination of plastic and wire coil; while this construction provides necessary flexibility, it can be susceptible to tears or punctures from sharp objects or accidental impacts during home maintenance or renovations. Additionally, exposure to extreme temperatures or environmental factors such as rodents can further exacerbate wear and tear on the duct material.

Over time, natural aging of materials can also contribute to leakage in flexible ducts. The plastic coating may become brittle with age, leading to cracks that allow air to escape. This aging process is often accelerated by continuous exposure to fluctuating temperatures within attics or crawl spaces where these ducts are commonly located.

Poor maintenance practices can also lead to duct leaks. Regular inspection and cleaning are essential for identifying early signs of wear or damage before they develop into significant problems. Failure to conduct routine maintenance not only increases the likelihood of existing leaks going unnoticed but also diminishes overall system performance due to accumulated dust and debris.

Lastly, improper handling during routine servicing or repairs may inadvertently cause new leaks in flexible ducts. For instance, stepping on a duct while navigating through tight spaces could crush it partially closed or create small fissures along its length.

In conclusion, while flexible ducts offer numerous advantages for mobile home HVAC systems due to their versatility and ease of installation, they require diligent attention both during initial setup and throughout their operational lifespan. By understanding common causes like poor installation practices, physical damage from environmental factors or mishandling during maintenance tasks-as well as recognizing signs indicative of aging materials-homeowners can take proactive steps towards identifying potential leak sources early on thus safeguarding both comfort levels within their residence alongside optimizing energy efficiency outcomes over time.

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Techniques for Mapping Duct Layouts

Identifying leaks in flexible mobile home ducts is crucial for maintaining a comfortable and energy-efficient living environment. These duct systems are integral to heating, ventilation, and air conditioning (HVAC) efficiency, yet they can often become compromised over time. Recognizing the signs and symptoms of leaky ducts can help homeowners address issues before they escalate into more significant problems.

One of the most common indicators of leaky ducts is an unexpected increase in utility bills. When ducts are compromised, the HVAC system must work harder to maintain the desired temperature, consuming more energy than usual. Homeowners might notice that their electricity or gas bills are suddenly higher despite no change in usage habits or external temperatures. This spike in costs often points to inefficiencies within the ductwork, making it an essential first clue for identifying leaks.

Another symptom is uneven heating or cooling throughout the mobile home. If certain rooms feel significantly warmer or cooler than others, it might indicate that conditioned air isn't reaching those areas efficiently due to leaks in the duct system. This inconsistency not only affects comfort but also suggests that air is escaping through cracks or gaps instead of circulating properly throughout the house.

Visible dust accumulation around vents can also be a telltale sign of duct leakage. When there are holes or gaps in the ducts, unfiltered air from attics, basements, or crawl spaces can enter the system and distribute dust throughout the home. If you find yourself needing to clean more frequently or notice dusty buildup near vents and registers, it may be time to inspect your ductwork for potential leaks.

Additionally, unusual noises coming from the HVAC system can signal problems with duct integrity. Whistling sounds or rattling noises when the system is running might indicate that air is escaping through loose connections or tears within flexible ducts. These audible clues should prompt immediate investigation as they could reflect underlying issues that need addressing.

Finally, conducting a simple visual inspection can reveal physical signs of wear and tear on flexible mobile home ducts. Look for visible tears, kinks, disconnected sections, or deteriorated tape at joints and connections. While this method won't uncover all hidden leaks–such as those located inside walls–it provides a straightforward starting point for identifying problem areas.

In conclusion, recognizing signs like increased utility bills, uneven temperature distribution across rooms, excessive dust accumulation near vents, unusual noises from HVAC systems, and visible damage during inspections are all critical steps toward identifying common leaks in flexible mobile home ducts. By staying vigilant and addressing these symptoms promptly with professional assistance if necessary–homeowners can ensure their living spaces remain comfortable while optimizing energy efficiency year–round.

Tools and Technologies for Accurate Duct Mapping

Locating leaks in flexible mobile home ducts is a crucial task for ensuring energy efficiency and maintaining indoor air quality. Mobile homes, characterized by their unique construction and spatial limitations, often rely on flexible ductwork to deliver heating and cooling throughout the living space. Over time, these ducts can develop leaks due to wear and tear, poor installation, or mechanical damage. Identifying common leaks in this type of ductwork not only enhances the performance of the HVAC system but also contributes to lower utility bills and improved comfort within the home.

The first step in locating leaks is a thorough visual inspection. This method involves examining the ductwork for any visible signs of damage such as tears, loose connections, or disconnected sections. Although this approach is straightforward, it requires careful attention as some leaks may be hidden behind obstructions or within walls. Tools like flashlights and mirrors can aid in inspecting hard-to-reach areas.

Another effective method is the "feel test," which involves turning on the HVAC system and feeling along the length of the ducts for escaping air. Leaks are often noticeable as drafts or changes in airflow when moving a hand close to potential problem areas. While this technique can be useful for detecting larger leaks, smaller ones might go unnoticed without more sensitive methods.

For a more precise assessment, homeowners can employ smoke pencils or incense sticks during operation of the HVAC system. By holding these near suspected leak points, any movement or disturbance in the smoke's path indicates escaping air. This visual cue helps pinpoint even minor leaks that might otherwise be missed.

Advanced detection methods include using specialized equipment such as duct blasters or thermal imaging cameras. A duct blaster pressurizes the ductwork with a fan while measuring leakage rates through pressure differentials. Thermal imaging cameras detect temperature variations on duct surfaces that result from leaking air, providing an accurate

map of leakage sites.

Lastly, acoustic testing employs sound waves to detect leaks by listening for changes in noise patterns around seams and joints where issues frequently occur. This method requires specific equipment but offers another layer of precision in identifying problematic areas.

Once detected, sealing these leaks typically involves using mastic sealant or metal-backed tape specifically designed for use with flexible ducts-common household tapes are not suitable as they degrade over time under HVAC conditions.

In conclusion, identifying common leaks in flexible mobile home ducts is essential for optimizing energy efficiency and enhancing living conditions within mobile homes. From simple visual inspections to sophisticated acoustic testing techniques, each method serves its purpose depending on available resources and expertise levels of those involved in maintenance tasks. Addressing these issues promptly ensures that residents enjoy consistent climate control while minimizing environmental impact through reduced energy consumption.

Best Practices for Cleaner Airflow

Identifying and repairing leaks in flexible mobile home ducts is a vital task that ensures the efficient operation of heating, ventilation, and air conditioning (HVAC) systems. Leaks in ductwork can lead to significant energy loss, increased utility bills, and an uncomfortable living environment. Thus, having the right tools and materials on hand is crucial for effective leak detection and repair.

Firstly, one of the most fundamental tools needed is a flashlight or headlamp. Mobile home ducts are often located in dimly lit areas such as crawl spaces or attics. A good light source will help illuminate these areas so that you can clearly see any cracks or separations in the ductwork.

A smoke pencil or smoke generator is another essential tool for detecting leaks. By releasing a small amount of smoke near the suspected leak area, you can observe where the smoke gets drawn into the duct system. This method helps pinpoint even minor leaks that might not be visible to the naked eye.

Next on the list are temperature sensors or infrared thermometers. These devices measure temperature differences along the ductwork, helping identify sections where conditioned air might be escaping due to leakage.

Once identified, repairing these leaks requires specific materials. Aluminum foil tape is commonly used for sealing small holes or gaps because it adheres well to ducts and withstands temperature fluctuations without deteriorating. For larger openings, mastic sealant is highly effective; this thick paste-like material can be applied over seams and joints to create an airtight seal once dry.

For more substantial repairs involving replacing damaged sections of ductwork, tin snips are necessary for cutting through metal ducts, while aviation shears work best on flexible

material. It's also wise to have spare duct sections or connectors available to replace any severely compromised parts.

Additionally, securing repaired sections may require zip ties or hose clamps which provide extra reinforcement around sealed areas ensuring they remain airtight over time.

Finally, having personal protective equipment (PPE) like gloves and dust masks is important when working with HVAC systems as it protects against sharp edges of metal ducts and potential exposure to dust or mold within old ductwork.

In conclusion, identifying common leaks in flexible mobile home ducts involves a combination of keen observation aided by technology like smoke pencils and infrared thermometers. Once detected, using appropriate repair materials such as aluminum foil tape and mastic sealant ensures long-lasting solutions. With these tools at your disposal alongside basic safety gear like PPEs-homeowners can effectively maintain their HVAC systems' efficiency while minimizing energy wastage-a win-win situation both economically and environmentally!

Case Studies of Improved Air Quality in Mobile Homes

Repairing leaks in flexible ducts, particularly within mobile homes, is a crucial task that ensures energy efficiency and comfort. Mobile home duct systems are often more susceptible to leaks due to their unique design and materials, which makes identifying and addressing these issues a priority for homeowners.

One of the first steps in repairing leaks in flexible ducts is identifying where they are occurring. Common areas for leaks include connections between sections of ductwork, around joints, and at points where the duct has been damaged or punctured. A visual inspection can often reveal obvious tears or disconnections. However, many leaks may not be as easily visible and require the use of diagnostic tools such as smoke pencils or infrared cameras to detect changes in air flow.

Once a leak is identified, it is essential to choose the appropriate repair method based on the type and severity of the damage. For small tears or holes, duct mastic a thick sealant can be applied over the affected area. Mastic should be spread generously over the leak and smoothed out with a brush or trowel to ensure complete coverage. While mastic requires time to cure, it provides a durable seal that withstands temperature fluctuations common in mobile home environments.

For larger tears or disconnected sections, foil-backed tape specifically designed for duct repair offers an effective solution. It is critical to clean both surfaces thoroughly before applying this tape to ensure proper adhesion. Unlike standard duct tape, which can degrade over time due to heat and moisture exposure, foil-backed tape maintains its integrity under various conditions.

In cases where sections of the flexible duct are significantly damaged or beyond simple repair methods, replacing those portions might be necessary. This involves cutting out the compromised section and inserting new ductwork using proper connectors and clamps to secure everything tightly together.

Beyond immediate repairs, implementing preventive measures can help maintain your mobile home's HVAC system's overall efficiency. Regularly inspecting ducts for signs of wear or potential issues allows homeowners to address problems before they escalate into more significant concerns. Additionally, ensuring that ducts are properly supported prevents sagging that may lead to stress points prone to leaking.

Finally, educating oneself about common causes of leaks such as poor installation practices or environmental factors like pests can guide homeowners towards proactive solutions like reinforcing vulnerable areas with additional insulation or barriers.

In conclusion, maintaining an efficient heating and cooling system through timely detection and repair of flexible duct leaks ensures not only comfort but also energy savings in a mobile home setting. By employing best practices such as using appropriate sealing materials and conducting regular inspections, homeowners can mitigate potential problems effectively while extending their HVAC system's lifespan considerably.

Preventive Measures to Avoid Future Duct Leaks

When it comes to maintaining a comfortable and energy-efficient mobile home, the integrity of your ductwork is paramount. Flexible ducts, commonly found in mobile homes, are susceptible to leaks that can compromise your heating and cooling systems' efficiency. Identifying and addressing these leaks not only preserves the comfort of your

living space but also helps in reducing energy bills. In this essay, we will explore preventive measures that can help avoid future duct leaks.

One of the primary causes of duct leaks is poor installation. Ensuring that ducts are installed correctly from the outset is crucial. Homeowners should engage qualified professionals who adhere to industry standards for duct installation. This includes securing connections properly and avoiding sharp bends or kinks that can stress the ducts over time. A well-installed system lays a solid foundation for leak prevention.

Regular maintenance is another key preventive measure. Over time, ducts can experience wear and tear due to temperature fluctuations and mechanical stress. Routine inspections by HVAC professionals can identify potential problem areas before they escalate into significant leaks. During these inspections, professionals should check for signs of damage such as tears, loose connections, or sagging sections in flexible ducts.

Sealing existing leaks promptly is essential in maintaining duct integrity. Using mastic sealant or metal-backed tape specifically designed for HVAC applications ensures a durable seal that withstands temperature variations better than standard duct tape. Homeowners should periodically inspect visible segments of their ductwork for any developing issues and address them immediately to prevent expansion into larger problems.

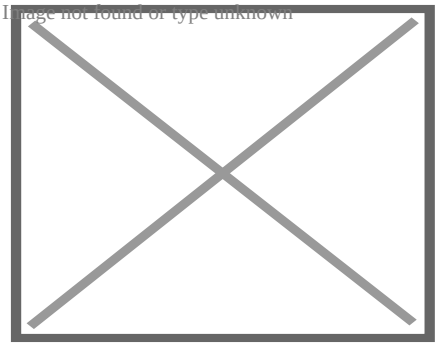
Insulating ducts properly serves as both a preventive measure against leaks and an enhancement of energy efficiency. Insulation reduces thermal loss through the duct walls, which minimizes condensation-a common precursor to material degradation in flexible ducts. Quality insulation also protects against external physical damage and reduces strain on the material during extreme temperatures.

Moreover, controlling humidity levels within mobile homes can significantly impact duct longevity. High humidity accelerates wear on flexible materials used in duct construction, leading to premature failure and leakage. Utilizing dehumidifiers where necessary helps maintain optimal indoor humidity levels that prolong the life of your HVAC system components.

Lastly, educating oneself about common practices leading to duct damage is invaluable for prevention efforts. Simple actions like avoiding storage items too close to exposed ducts or ensuring children do not climb over them can prevent unintentional harm that may lead to leaks.

In conclusion, while flexible mobile home ducts present unique challenges regarding leak prevention due to their material properties and installation constraints, several proactive steps can mitigate these risks effectively. Proper installation by professionals sets a strong baseline; regular maintenance coupled with prompt repairs ensures ongoing reliability; insulating effectively enhances both protection and performance; managing indoor humidity guards against environmental stresses; finally, awareness of routine behaviors contributing to wear equips homeowners with knowledge necessary for preserving their system's health long-term. By implementing these preventive measures diligently, homeowners can enjoy enhanced comfort while safeguarding their investment in their mobile home's heating and cooling infrastructure.

About Heat exchanger



Tubular heat exchanger

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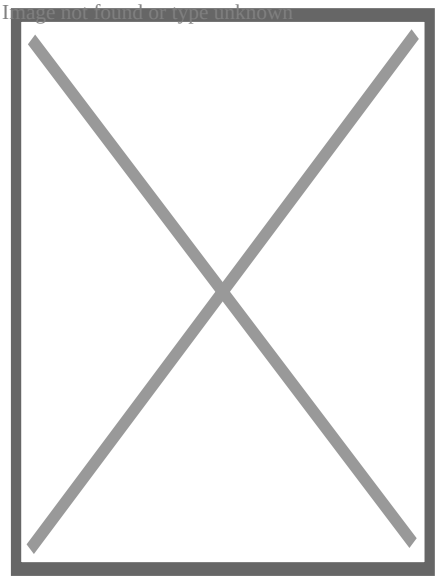

Partial view into inlet plenum of shell and tube heat exchanger of a refrigerant based chiller for providing air-conditioning to a building

A **heat exchanger** is a system used to transfer heat between a source and a working fluid. Heat exchangers are used in both cooling and heating processes.[1] The fluids may be separated by a solid wall to prevent mixing or they may be in direct contact.[2] They are widely used in space heating, refrigeration, air conditioning, power stations, chemical plants, petrochemical plants, petroleum refineries, natural-gas processing, and sewage treatment. The classic example of a heat exchanger is found in an internal combustion engine in which a circulating fluid known as engine coolant flows through radiator coils and air flows past the coils, which cools the coolant and heats the incoming air. Another example is the heat sink, which is a passive heat exchanger that transfers the heat generated by an electronic or a mechanical device to a fluid medium, often air or a liquid coolant.[3]

Flow arrangement

[edit]

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Countercurrent (A) and parallel (B) flows

There are three primary classifications of heat exchangers according to their flow arrangement. In *parallel-flow* heat exchangers, the two fluids enter the exchanger at the same end, and travel in parallel to one another to the other side. In *counter-flow* heat exchangers the fluids enter the exchanger from opposite ends. The counter current design is the most efficient, in that it can transfer the most heat from the heat (transfer) medium per unit mass due to the fact that the average temperature difference along any unit length is *higher*. See countercurrent exchange. In a *cross-flow* heat exchanger, the fluids travel roughly perpendicular to one another through the exchanger.

Fig. 1: Shell and tube heat e

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Fig. 1: Shell and tube heat exchanger, single pass (1–1 parallel flow)

Fig. 2: Shell and tube heat

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For efficiency, heat exchangers are designed to maximize the surface area of the wall between the two fluids, while minimizing resistance to fluid flow through the exchanger. The exchanger's performance can also be affected by the addition of fins or corrugations in one or both directions, which increase surface area and may channel fluid flow or induce turbulence.

The driving temperature across the heat transfer surface varies with position, but an appropriate mean temperature can be defined. In most simple systems this is the "log mean temperature difference" (LMTD). Sometimes direct knowledge of the LMTD is not available and the NTU method is used.

Fig. 2: Shell and tube heat exchanger, 2-pass tube side (1–2 crossflow)
Fig. 3: Shell and tube heat e

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Fig. 3: Shell and tube heat exchanger, 2-pass shell side, 2-pass tube side (2-2 countercurrent)

Types

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Double pipe heat exchangers are the simplest exchangers used in industries. On one hand, these heat exchangers are cheap for both design and maintenance, making them a good choice for small industries. On the other hand, their low efficiency coupled with the high space occupied in large scales, has led modern industries to use more efficient heat exchangers like shell and tube or plate. However, since double pipe heat exchangers are simple, they are used to teach heat exchanger design basics to students as the fundamental rules for all heat exchangers are the same.

1. Double-pipe heat exchanger

When one fluid flows through the smaller pipe, the other flows through the annular gap between the two pipes. These flows may be parallel or counter-flows in a double pipe heat exchanger.

(a) Parallel flow, where both hot and cold liquids enter the heat exchanger from the same side, flow in the same direction and exit at the same end. This configuration is preferable when the two fluids are intended to reach exactly the same temperature, as it reduces thermal stress and produces a more uniform rate of heat transfer.

(b) Counter-flow, where hot and cold fluids enter opposite sides of the heat exchanger, flow in opposite directions, and exit at opposite ends. This configuration is preferable when the objective is to maximize heat transfer between the fluids, as it creates a larger temperature differential when used under otherwise similar conditions.[*citation needed*]

The figure above illustrates the parallel and counter-flow flow directions of the fluid exchanger.

2. Shell-and-tube heat exchanger

In a shell-and-tube heat exchanger, two fluids at different temperatures flow through the heat exchanger. One of the fluids flows through the tube side and the other fluid flows outside the tubes, but inside the shell (shell side).

Baffles are used to support the tubes, direct the fluid flow to the tubes in an approximately natural manner, and maximize the turbulence of the shell fluid. There are many various kinds of baffles, and the choice of baffle form, spacing, and geometry depends on the allowable flow rate of the drop in shell-side force, the need for tube support, and the flow-induced vibrations. There are several variations of shell-and-tube exchangers available; the differences lie in the arrangement of flow configurations and details of construction.

In application to cool air with shell-and-tube technology (such as intercooler / charge air cooler for combustion engines), fins can be added on the tubes to increase heat transfer area on air side and create a tubes & fins configuration.

3. Plate Heat Exchanger

A plate heat exchanger contains an amount of thin shaped heat transfer plates bundled together. The gasket arrangement of each pair of plates provides two

separate channel system. Each pair of plates form a channel where the fluid can flow through. The pairs are attached by welding and bolting methods. The following shows the components in the heat exchanger.

In single channels the configuration of the gaskets enables flow through. Thus, this allows the main and secondary media in counter-current flow. A gasket plate heat exchanger has a heat region from corrugated plates. The gasket function as seal between plates and they are located between frame and pressure plates. Fluid flows in a counter current direction throughout the heat exchanger. An efficient thermal performance is produced. Plates are produced in different depths, sizes and corrugated shapes. There are different types of plates available including plate and frame, plate and shell and spiral plate heat exchangers. The distribution area guarantees the flow of fluid to the whole heat transfer surface. This helps to prevent stagnant area that can cause accumulation of unwanted material on solid surfaces. High flow turbulence between plates results in a greater transfer of heat and a decrease in pressure.

4. Condensers and Boilers Heat exchangers using a two-phase heat transfer system are condensers, boilers and evaporators. Condensers are instruments that take and cool hot gas or vapor to the point of condensation and transform the gas into a liquid form. The point at which liquid transforms to gas is called vaporization and vice versa is called condensation. Surface condenser is the most common type of condenser where it includes a water supply device. Figure 5 below displays a two-pass surface condenser.

The pressure of steam at the turbine outlet is low where the steam density is very low where the flow rate is very high. To prevent a decrease in pressure in the movement of steam from the turbine to condenser, the condenser unit is placed underneath and connected to the turbine. Inside the tubes the cooling water runs in a parallel way, while steam moves in a vertical downward position from the wide opening at the top and travel through the tube. Furthermore, boilers are categorized as initial application of heat exchangers. The word steam generator was regularly used to describe a boiler unit where a hot liquid stream is the source of heat rather than the combustion products. Depending on the dimensions and configurations the boilers

are manufactured. Several boilers are only able to produce hot fluid while on the other hand the others are manufactured for steam production.

Shell and tube

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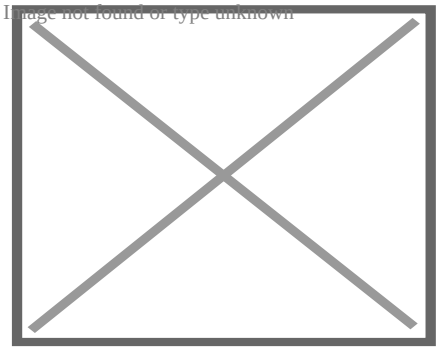
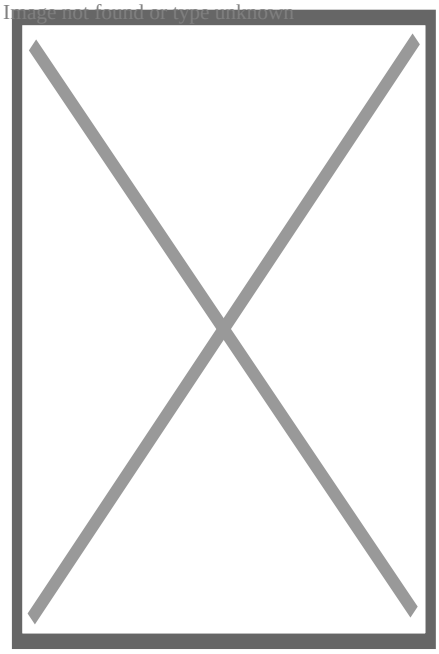
Main article: Shell and tube heat exchanger



A shell and tube heat exchanger



Shell and tube heat exchanger

Shell and tube heat exchangers consist of a series of tubes which contain fluid that must be either heated or cooled. A second fluid runs over the tubes that are being

heated or cooled so that it can either provide the heat or absorb the heat required. A set of tubes is called the tube bundle and can be made up of several types of tubes: plain, longitudinally finned, etc. Shell and tube heat exchangers are typically used for high-pressure applications (with pressures greater than 30 bar and temperatures greater than 260 °C).[4] This is because the shell and tube heat exchangers are robust due to their shape.
Several thermal design features must be considered when designing the tubes in the shell and tube heat exchangers: There can be many variations on the shell and tube design. Typically, the ends of each tube are connected to plenums (sometimes called water boxes) through holes in tubesheets. The tubes may be straight or bent in the shape of a U, called U-tubes.

- Tube diameter: Using a small tube diameter makes the heat exchanger both economical and compact. However, it is more likely for the heat exchanger to foul up faster and the small size makes mechanical cleaning of the fouling difficult. To prevail over the fouling and cleaning problems, larger tube diameters can be used. Thus to determine the tube diameter, the available space, cost and fouling nature of the fluids must be considered.
- Tube thickness: The thickness of the wall of the tubes is usually determined to ensure:
  - There is enough room for corrosion
  - That flow-induced vibration has resistance
  - Axial strength
  - Availability of spare parts
  - Hoop strength (to withstand internal tube pressure)
  - Buckling strength (to withstand overpressure in the shell)
- Tube length: heat exchangers are usually cheaper when they have a smaller shell diameter and a long tube length. Thus, typically there is an aim to make the heat exchanger as long as physically possible whilst not exceeding production capabilities. However, there are many limitations for this, including space available at the installation site and the need to ensure tubes are available in lengths that are twice the required length (so they can be withdrawn and replaced). Also, long, thin tubes are difficult to take out and replace.

- Tube pitch: when designing the tubes, it is practical to ensure that the tube pitch (i.e., the centre-centre distance of adjoining tubes) is not less than 1.25 times the tubes' outside diameter. A larger tube pitch leads to a larger overall shell diameter, which leads to a more expensive heat exchanger.
- Tube corrugation: this type of tubes, mainly used for the inner tubes, increases the turbulence of the fluids and the effect is very important in the heat transfer giving a better performance.
- Tube Layout: refers to how tubes are positioned within the shell. There are four main types of tube layout, which are, triangular (30°), rotated triangular (60°), square (90°) and rotated square (45°). The triangular patterns are employed to give greater heat transfer as they force the fluid to flow in a more turbulent fashion around the piping. Square patterns are employed where high fouling is experienced and cleaning is more regular.
- Baffle Design: baffles are used in shell and tube heat exchangers to direct fluid across the tube bundle. They run perpendicularly to the shell and hold the bundle, preventing the tubes from sagging over a long length. They can also prevent the tubes from vibrating. The most common type of baffle is the segmental baffle. The semicircular segmental baffles are oriented at 180 degrees to the adjacent baffles forcing the fluid to flow upward and downwards between the tube bundle. Baffle spacing is of large thermodynamic concern when designing shell and tube heat exchangers. Baffles must be spaced with consideration for the conversion of pressure drop and heat transfer. For thermo economic optimization it is suggested that the baffles be spaced no closer than 20% of the shell's inner diameter. Having baffles spaced too closely causes a greater pressure drop because of flow redirection. Consequently, having the baffles spaced too far apart means that there may be cooler spots in the corners between baffles. It is also important to ensure the baffles are spaced close enough that the tubes do not sag. The other main type of baffle is the disc and doughnut baffle, which consists of two concentric baffles. An outer, wider baffle looks like a doughnut, whilst the inner baffle is shaped like a disk. This type of baffle forces the fluid to pass around each side of the disk then through the doughnut baffle generating a different type of fluid flow.

- Tubes & fins Design: in application to cool air with shell-and-tube technology (such as intercooler / charge air cooler for combustion engines), the difference in heat transfer between air and cold fluid can be such that there is a need to increase heat transfer area on air side. For this function fins can be added on the tubes to increase heat transfer area on air side and create a tubes & fins configuration.

Fixed tube liquid-cooled heat exchangers especially suitable for marine and harsh applications can be assembled with brass shells, copper tubes, brass baffles, and forged brass integral end hubs.[*citation needed*] *(See: Copper in heat exchangers).*

Plate

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Main article: Plate heat exchanger

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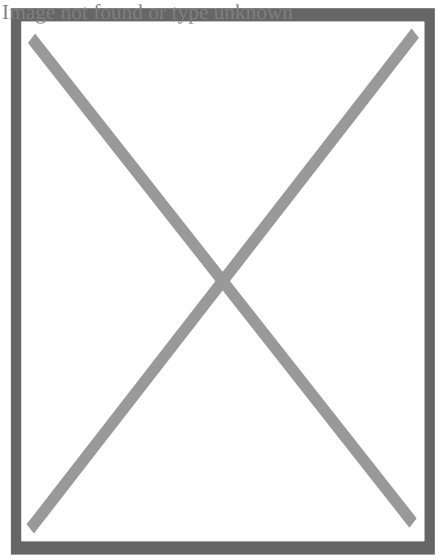
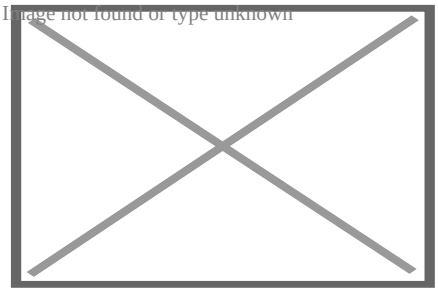
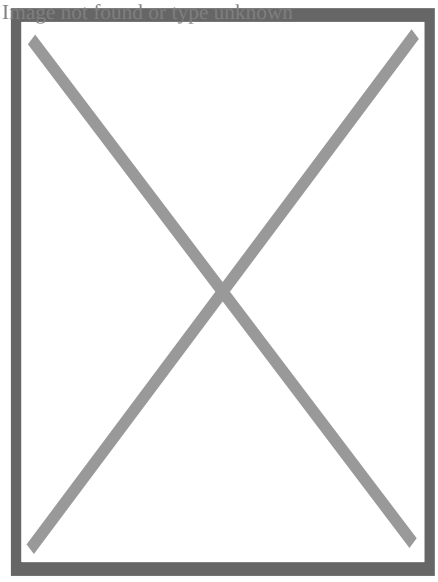


Conceptual diagram of a plate and frame heat exchanger



A single plate heat exchanger



An interchangeable plate heat exchanger directly applied to the system of a swimming pool

Another type of heat exchanger is the plate heat exchanger. These exchangers are composed of many thin, slightly separated plates that have very large surface areas and small fluid flow passages for heat transfer. Advances in gasket and brazing technology have made the plate-type heat exchanger increasingly practical. In HVAC applications, large heat exchangers of this type are called *plate-and-frame*; when used in open loops, these heat exchangers are normally of the gasket type to allow periodic disassembly, cleaning, and inspection. There are many types of permanently bonded plate heat exchangers, such as dip-brazed, vacuum-brazed, and welded plate varieties, and they are often specified for closed-loop applications such as refrigeration. Plate heat exchangers also differ in the types of plates that are used, and in the configurations of those plates. Some plates may be stamped with "chevron", dimpled, or other patterns, where others may have machined fins and/or

grooves.

When compared to shell and tube exchangers, the stacked-plate arrangement typically has lower volume and cost. Another difference between the two is that plate exchangers typically serve low to medium pressure fluids, compared to medium and high pressures of shell and tube. A third and important difference is that plate exchangers employ more countercurrent flow rather than cross current flow, which allows lower approach temperature differences, high temperature changes, and increased efficiencies.

Plate and shell

[edit]

A third type of heat exchanger is a plate and shell heat exchanger, which combines plate heat exchanger with shell and tube heat exchanger technologies. The heart of the heat exchanger contains a fully welded circular plate pack made by pressing and cutting round plates and welding them together. Nozzles carry flow in and out of the platepack (the 'Plate side' flowpath). The fully welded platepack is assembled into an outer shell that creates a second flowpath (the 'Shell side'). Plate and shell technology offers high heat transfer, high pressure, high operating temperature, compact size, low fouling and close approach temperature. In particular, it does completely without gaskets, which provides security against leakage at high pressures and temperatures.

Adiabatic wheel

[edit]

A fourth type of heat exchanger uses an intermediate fluid or solid store to hold heat, which is then moved to the other side of the heat exchanger to be released. Two examples of this are adiabatic wheels, which consist of a large wheel with fine threads rotating through the hot and cold fluids, and fluid heat exchangers.

Plate fin

[edit]
Main article: Plate fin heat exchanger

This type of heat exchanger uses "sandwiched" passages containing fins to increase the effectiveness of the unit. The designs include crossflow and counterflow coupled with various fin configurations such as straight fins, offset fins and wavy fins.

Plate and fin heat exchangers are usually made of aluminum alloys, which provide high heat transfer efficiency. The material enables the system to operate at a lower temperature difference and reduce the weight of the equipment. Plate and fin heat exchangers are mostly used for low temperature services such as natural gas, helium and oxygen liquefaction plants, air separation plants and transport industries such as motor and aircraft engines.

Advantages of plate and fin heat exchangers:

- High heat transfer efficiency especially in gas treatment
- Larger heat transfer area
- Approximately 5 times lighter in weight than that of shell and tube heat exchanger. [*citation needed*]
- Able to withstand high pressure

Disadvantages of plate and fin heat exchangers:

- Might cause clogging as the pathways are very narrow
- Difficult to clean the pathways
- Aluminium alloys are susceptible to Mercury Liquid Embrittlement Failure

Finned tube

[edit]

The usage of fins in a tube-based heat exchanger is common when one of the working fluids is a low-pressure gas, and is typical for heat exchangers that operate using ambient air, such as automotive radiators and HVAC air condensers. Fins dramatically increase the surface area with which heat can be exchanged, which improves the efficiency of conducting heat to a fluid with very low thermal conductivity, such as air. The fins are typically made from aluminium or copper since they must conduct heat from the tube along the length of the fins, which are usually very thin.

The main construction types of finned tube exchangers are:

- A stack of evenly-spaced metal plates act as the fins and the tubes are pressed through pre-cut holes in the fins, good thermal contact usually being achieved by deformation of the fins around the tube. This is typical construction for HVAC air coils and large refrigeration condensers.
- Fins are spiral-wound onto individual tubes as a continuous strip, the tubes can then be assembled in banks, bent in a serpentine pattern, or wound into large spirals.
- Zig-zag metal strips are sandwiched between flat rectangular tubes, often being soldered or brazed together for good thermal and mechanical strength. This is common in low-pressure heat exchangers such as water-cooling radiators. Regular flat tubes will expand and deform if exposed to high pressures but flat microchannel tubes allow this construction to be used for high pressures.[5]

Stacked-fin or spiral-wound construction can be used for the tubes inside shell-and-tube heat exchangers when high efficiency thermal transfer to a gas is required.

In electronics cooling, heat sinks, particularly those using heat pipes, can have a stacked-fin construction.

Pillow plate

[edit]

A pillow plate heat exchanger is commonly used in the dairy industry for cooling milk in large direct-expansion stainless steel bulk tanks. Nearly the entire surface area of a tank can be integrated with this heat exchanger, without gaps that would occur between pipes welded to the exterior of the tank. Pillow plates can also be constructed as flat plates that are stacked inside a tank. The relatively flat surface of the plates allows easy cleaning, especially in sterile applications.

The pillow plate can be constructed using either a thin sheet of metal welded to the thicker surface of a tank or vessel, or two thin sheets welded together. The surface of the plate is welded with a regular pattern of dots or a serpentine pattern of weld lines. After welding the enclosed space is pressurised with sufficient force to cause the thin metal to bulge out around the welds, providing a space for heat exchanger liquids to flow, and creating a characteristic appearance of a swelled pillow formed out of metal.

Waste heat recovery units

[edit]

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A waste heat recovery unit (WHRU) is a heat exchanger that recovers heat from a hot gas stream while transferring it to a working medium, typically water or oils. The hot gas stream can be the exhaust gas from a gas turbine or a diesel engine or a waste gas from industry or refinery.

Large systems with high volume and temperature gas streams, typical in industry, can benefit from steam Rankine cycle (SRC) in a waste heat recovery unit, but these cycles are too expensive for small systems. The recovery of heat from low temperature systems requires different working fluids than steam.

An organic Rankine cycle (ORC) waste heat recovery unit can be more efficient at low temperature range using refrigerants that boil at lower temperatures than water. Typical organic refrigerants are ammonia, pentafluoropropane (R-245fa and R-245ca), and toluene.

The refrigerant is boiled by the heat source in the evaporator to produce super-heated vapor. This fluid is expanded in the turbine to convert thermal energy to kinetic energy, that is converted to electricity in the electrical generator. This energy transfer process decreases the temperature of the refrigerant that, in turn, condenses. The cycle is closed and completed using a pump to send the fluid back to the evaporator.

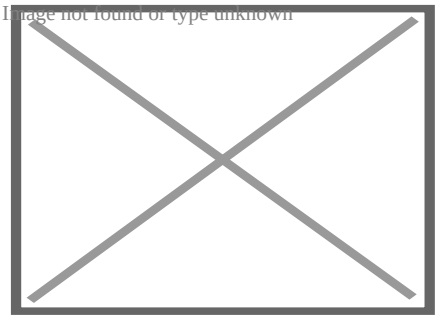
Dynamic scraped surface

[edit]

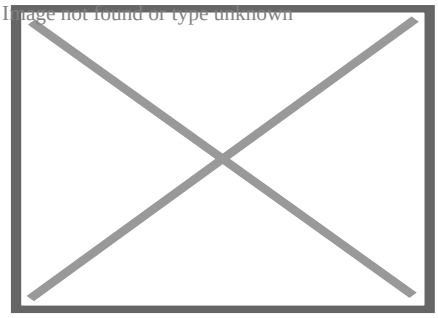
Another type of heat exchanger is called "(dynamic) scraped surface heat exchanger". This is mainly used for heating or cooling with high-viscosity products, crystallization processes, evaporation and high-fouling applications. Long running times are achieved due to the continuous scraping of the surface, thus avoiding fouling and achieving a sustainable heat transfer rate during the process.

Phase-change

[edit]



Typical kettle reboiler used for industrial distillation towers



Typical water-cooled surface condenser

In addition to heating up or cooling down fluids in just a single phase, heat exchangers can be used either to heat a liquid to evaporate (or boil) it or used as condensers to cool a vapor and condense it to a liquid. In chemical plants and refineries, reboilers used to heat incoming feed for distillation towers are often heat exchangers.[6][7]

Distillation set-ups typically use condensers to condense distillate vapors back into liquid.

Power plants that use steam-driven turbines commonly use heat exchangers to boil water into steam. Heat exchangers or similar units for producing steam from water are often called boilers or steam generators.

In the nuclear power plants called pressurized water reactors, special large heat exchangers pass heat from the primary (reactor plant) system to the secondary (steam plant) system, producing steam from water in the process. These are called steam generators. All fossil-fueled and nuclear power plants using steam-driven turbines have surface condensers to convert the exhaust steam from the turbines into condensate (water) for re-use.[8][9]

To conserve energy and cooling capacity in chemical and other plants, regenerative heat exchangers can transfer heat from a stream that must be cooled to another stream that must be heated, such as distillate cooling and reboiler feed pre-heating.

This term can also refer to heat exchangers that contain a material within their structure that has a change of phase. This is usually a solid to liquid phase due to the small volume difference between these states. This change of phase effectively acts as a buffer because it occurs at a constant temperature but still allows for the heat exchanger to accept additional heat. One example where this has been investigated is for use in high power aircraft electronics.

Heat exchangers functioning in multiphase flow regimes may be subject to the Ledinegg instability.

Direct contact

[edit]

Direct contact heat exchangers involve heat transfer between hot and cold streams of two phases in the absence of a separating wall.[10] Thus such heat exchangers can be classified as:

- Gas – liquid
- Immiscible liquid – liquid
- Solid-liquid or solid – gas

Most direct contact heat exchangers fall under the Gas – Liquid category, where heat is transferred between a gas and liquid in the form of drops, films or sprays.[4]

Such types of heat exchangers are used predominantly in air conditioning, humidification, industrial hot water heating, water cooling and condensing plants.[11]

Phases[12]	Continuous phase	Driving force	Change of phase	Examples
Gas – Liquid	Gas	Gravity	No	Spray columns, packed columns
			Yes	Cooling towers, falling droplet evaporators
		Forced	No	Spray coolers/quenchers
		Liquid flow	Yes	Spray condensers/evaporation, jet condensers
	Liquid	Gravity	No	Bubble columns, perforated tray columns
			Yes	Bubble column condensers
		Forced	No	Gas spargers
		Gas flow	Yes	Direct contact evaporators, submerged combustion

Microchannel

[edit]

Microchannel heat exchangers are multi-pass parallel flow heat exchangers consisting of three main elements: manifolds (inlet and outlet), multi-port tubes with the hydraulic diameters smaller than 1mm, and fins. All the elements usually brazed together using controllable atmosphere brazing process. Microchannel heat exchangers are characterized by high heat transfer ratio, low refrigerant charges,

compact size, and lower airside pressure drops compared to finned tube heat exchangers.[*citation needed*] Microchannel heat exchangers are widely used in automotive industry as the car radiators, and as condenser, evaporator, and cooling/heating coils in HVAC industry.

Main article: Micro heat exchanger

Micro heat exchangers, **Micro-scale heat exchangers**, or **microstructured heat exchangers** are heat exchangers in which (at least one) fluid flows in lateral confinements with typical dimensions below 1 mm. The most typical such confinement are microchannels, which are channels with a hydraulic diameter below 1 mm. Microchannel heat exchangers can be made from metal or ceramics.[13] Microchannel heat exchangers can be used for many applications including:

- high-performance aircraft gas turbine engines[14]
- heat pumps[15]
- Microprocessor and microchip cooling[16]
- air conditioning[17]

HVAC and refrigeration air coils

[edit]

One of the widest uses of heat exchangers is for refrigeration and air conditioning. This class of heat exchangers is commonly called *air coils*, or just *coils* due to their often-serpentine internal tubing, or condensers in the case of refrigeration, and are typically of the finned tube type. Liquid-to-air, or air-to-liquid HVAC coils are typically of modified crossflow arrangement. In vehicles, heat coils are often called heater cores.

On the liquid side of these heat exchangers, the common fluids are water, a water-glycol solution, steam, or a refrigerant. For *heating coils*, hot water and steam are the most common, and this heated fluid is supplied by boilers, for example. For *cooling coils*, chilled water and refrigerant are most common. Chilled water is supplied from a chiller that is potentially located very far away, but refrigerant must come from a

nearby condensing unit. When a refrigerant is used, the cooling coil is the evaporator, and the heating coil is the condenser in the vapor-compression refrigeration cycle. HVAC coils that use this direct-expansion of refrigerants are commonly called *DX coils*. Some *DX coils* are "microchannel" type.[5]

On the air side of HVAC coils a significant difference exists between those used for heating, and those for cooling. Due to psychrometrics, air that is cooled often has moisture condensing out of it, except with extremely dry air flows. Heating some air increases that airflow's capacity to hold water. So heating coils need not consider moisture condensation on their air-side, but cooling coils *must* be adequately designed and selected to handle their particular *latent* (moisture) as well as the *sensible* (cooling) loads. The water that is removed is called *condensate*.

For many climates, water or steam HVAC coils can be exposed to freezing conditions. Because water expands upon freezing, these somewhat expensive and difficult to replace thin-walled heat exchangers can easily be damaged or destroyed by just one freeze. As such, freeze protection of coils is a major concern of HVAC designers, installers, and operators.

The introduction of indentations placed within the heat exchange fins controlled condensation, allowing water molecules to remain in the cooled air.[18]

The heat exchangers in direct-combustion furnaces, typical in many residences, are not 'coils'. They are, instead, gas-to-air heat exchangers that are typically made of stamped steel sheet metal. The combustion products pass on one side of these heat exchangers, and air to heat on the other. A *cracked heat exchanger* is therefore a dangerous situation that requires immediate attention because combustion products may enter living space.

Helical-coil

[edit]

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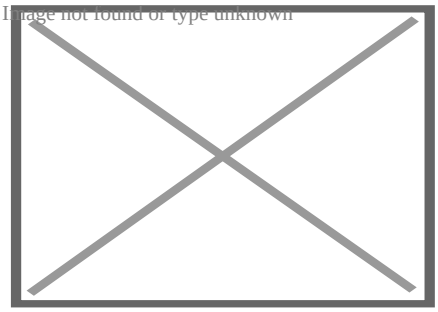


Helical-Coil Heat Exchanger sketch, which consists of a shell, core, and tubes (Scott S. Haraburda design)

Although double-pipe heat exchangers are the simplest to design, the better choice in the following cases would be the helical-coil heat exchanger (HCHE):

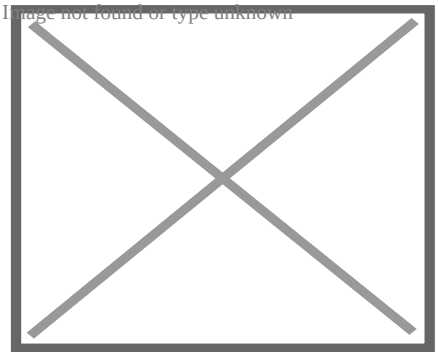
- The main advantage of the HCHE, like that for the Spiral heat exchanger (SHE), is its highly efficient use of space, especially when it's limited and not enough straight pipe can be laid.[19]
- Under conditions of low flowrates (or laminar flow), such that the typical shell-and-tube exchangers have low heat-transfer coefficients and becoming uneconomical.[19]
- When there is low pressure in one of the fluids, usually from accumulated pressure drops in other process equipment.[19]
- When one of the fluids has components in multiple phases (solids, liquids, and gases), which tends to create mechanical problems during operations, such as plugging of small-diameter tubes.[20] Cleaning of helical coils for these multiple-phase fluids can prove to be more difficult than its shell and tube counterpart; however the helical coil unit would require cleaning less often.

These have been used in the nuclear industry as a method for exchanging heat in a sodium system for large liquid metal fast breeder reactors since the early 1970s, using an HCHE device invented by Charles E. Boardman and John H. Germer.[21] There are several simple methods for designing HCHE for all types of manufacturing industries, such as using the Ramachandra K. Patil (et al.) method from India and the Scott S. Haraburda method from the United States.[19][20]

However, these are based upon assumptions of estimating inside heat transfer coefficient, predicting flow around the outside of the coil, and upon constant heat flux.[22]

Spiral

[edit]



Schematic drawing of a spiral heat exchanger

A modification to the perpendicular flow of the typical HCHE involves the replacement of shell with another coiled tube, allowing the two fluids to flow parallel to one another, and which requires the use of different design calculations.[23] These are the Spiral Heat Exchangers (SHE), which may refer to a helical (coiled) tube configuration, more generally, the term refers to a pair of flat surfaces that are coiled to form the two channels in a counter-flow arrangement. Each of the two channels has one long curved path. A pair of fluid ports are connected tangentially to the outer arms of the spiral, and axial ports are common, but optional.[24]

The main advantage of the SHE is its highly efficient use of space. This attribute is often leveraged and partially reallocated to gain other improvements in performance, according to well known tradeoffs in heat exchanger design. (A notable tradeoff is capital cost vs operating cost.) A compact SHE may be used to have a smaller footprint and thus lower all-around capital costs, or an oversized SHE may be used to have less pressure drop, less pumping energy, higher thermal efficiency, and lower energy costs.

Construction

[edit]

The distance between the sheets in the spiral channels is maintained by using spacer studs that were welded prior to rolling. Once the main spiral pack has been rolled, alternate top and bottom edges are welded and each end closed by a gasketed flat or conical cover bolted to the body. This ensures no mixing of the two fluids occurs. Any leakage is from the periphery cover to the atmosphere, or to a passage that contains the same fluid.[25]

Self cleaning

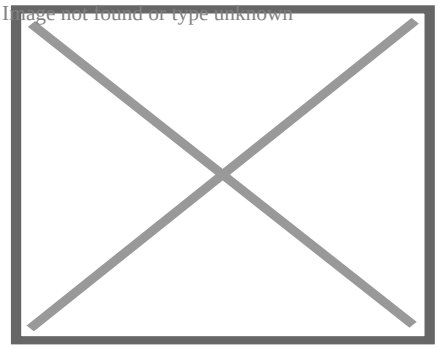
[edit]

Spiral heat exchangers are often used in the heating of fluids that contain solids and thus tend to foul the inside of the heat exchanger. The low pressure drop lets the SHE handle fouling more easily. The SHE uses a "self cleaning" mechanism, whereby fouled surfaces cause a localized increase in fluid velocity, thus increasing the drag (or fluid friction) on the fouled surface, thus helping to dislodge the blockage and keep the heat exchanger clean. "The internal walls that make up the heat transfer surface are often rather thick, which makes the SHE very robust, and able to last a long time in demanding environments."[*citation needed*] They are also easily cleaned, opening out like an oven where any buildup of foulant can be removed by pressure washing.

Self-cleaning water filters are used to keep the system clean and running without the need to shut down or replace cartridges and bags.

Flow arrangements

[edit]



A comparison between the operations and effects of a **cocurrent and a countercurrent flow exchange system** is depicted by the upper and lower diagrams respectively. In both it is assumed (and indicated) that red has a higher value (e.g. of temperature) than blue and that the property being transported in the channels therefore flows from red to blue. Channels are contiguous if effective exchange is to occur (i.e. there can be no gap between the channels).

There are three main types of flows in a spiral heat exchanger:

- **Counter-current Flow**: Fluids flow in opposite directions. These are used for liquid–liquid, condensing and gas cooling applications. Units are usually mounted vertically when condensing vapour and mounted horizontally when handling high concentrations of solids.
- **Spiral Flow/Cross Flow:** One fluid is in spiral flow and the other in a cross flow. Spiral flow passages are welded at each side for this type of spiral heat exchanger. This type of flow is suitable for handling low density gas, which passes through the cross flow, avoiding pressure loss. It can be used for liquid–liquid applications if one liquid has a considerably greater flow rate than the other.
- **Distributed Vapour/Spiral flow:** This design is that of a condenser, and is usually mounted vertically. It is designed to cater for the sub-cooling of both

condensate and non-condensables. The coolant moves in a spiral and leaves via the top. Hot gases that enter leave as condensate via the bottom outlet.

Applications

[edit]

The Spiral heat exchanger is good for applications such as pasteurization, digester heating, heat recovery, pre-heating (see: recuperator), and effluent cooling. For sludge treatment, SHEs are generally smaller than other types of heat exchangers.[*citation ne*] These are used to transfer the heat.

Selection

[edit]

Due to the many variables involved, selecting optimal heat exchangers is challenging. Hand calculations are possible, but many iterations are typically needed. As such, heat exchangers are most often selected via computer programs, either by system designers, who are typically engineers, or by equipment vendors.

To select an appropriate heat exchanger, the system designers (or equipment vendors) would firstly consider the design limitations for each heat exchanger type. Though cost is often the primary criterion, several other selection criteria are important:

- High/low pressure limits
- Thermal performance
- Temperature ranges
- Product mix (liquid/liquid, particulates or high-solids liquid)
- Pressure drops across the exchanger
- Fluid flow capacity
- Cleanability, maintenance and repair

- Materials required for construction
- Ability and ease of future expansion
- Material selection, such as copper, aluminium, carbon steel, stainless steel, nickel alloys, ceramic, polymer, and titanium.[26][27]

Small-diameter coil technologies are becoming more popular in modern air conditioning and refrigeration systems because they have better rates of heat transfer than conventional sized condenser and evaporator coils with round copper tubes and aluminum or copper fin that have been the standard in the HVAC industry. Small diameter coils can withstand the higher pressures required by the new generation of environmentally friendlier refrigerants. Two small diameter coil technologies are currently available for air conditioning and refrigeration products: copper microgroove[28] and brazed aluminum microchannel.[*citation needed*]

Choosing the right heat exchanger (HX) requires some knowledge of the different heat exchanger types, as well as the environment where the unit must operate. Typically in the manufacturing industry, several differing types of heat exchangers are used for just one process or system to derive the final product. For example, a kettle HX for pre-heating, a double pipe HX for the 'carrier' fluid and a plate and frame HX for final cooling. With sufficient knowledge of heat exchanger types and operating requirements, an appropriate selection can be made to optimise the process.[29]

Monitoring and maintenance

[edit]

Online monitoring of commercial heat exchangers is done by tracking the overall heat transfer coefficient. The overall heat transfer coefficient tends to decline over time due to fouling.

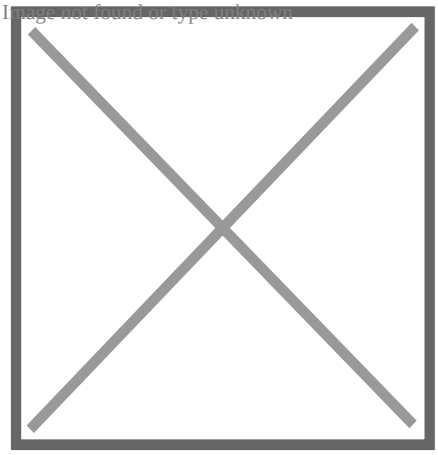
By periodically calculating the overall heat transfer coefficient from exchanger flow rates and temperatures, the owner of the heat exchanger can estimate when cleaning the heat exchanger is economically attractive.

Integrity inspection of plate and tubular heat exchanger can be tested in situ by the conductivity or helium gas methods. These methods confirm the integrity of the plates or tubes to prevent any cross contamination and the condition of the gaskets.

Mechanical integrity monitoring of heat exchanger tubes may be conducted through Nondestructive methods such as eddy current testing.

Fouling

[edit]
Main article: Fouling



A heat exchanger in a steam power station contaminated with macrofouling

Fouling occurs when impurities deposit on the heat exchange surface. Deposition of these impurities can decrease heat transfer effectiveness significantly over time and are caused by:

- Low wall shear stress
- Low fluid velocities
- High fluid velocities
- Reaction product solid precipitation
- Precipitation of dissolved impurities due to elevated wall temperatures

The rate of heat exchanger fouling is determined by the rate of particle deposition less re-entrainment/suppression. This model was originally proposed in 1959 by Kern and Seaton.

Crude Oil Exchanger Fouling. In commercial crude oil refining, crude oil is heated from 21 °C (70 °F) to 343 °C (649 °F) prior to entering the distillation column. A series of shell and tube heat exchangers typically exchange heat between crude oil and other oil streams to heat the crude to 260 °C (500 °F) prior to heating in a furnace. Fouling occurs on the crude side of these exchangers due to asphaltene insolubility. The nature of asphaltene solubility in crude oil was successfully modeled by Wiehe and Kennedy.[30] The precipitation of insoluble asphaltenes in crude preheat trains has been successfully modeled as a first order reaction by Ebert and Panchal[31] who expanded on the work of Kern and Seaton.

Cooling Water Fouling. Cooling water systems are susceptible to fouling. Cooling water typically has a high total dissolved solids content and suspended colloidal solids. Localized precipitation of dissolved solids occurs at the heat exchange surface due to wall temperatures higher than bulk fluid temperature. Low fluid velocities (less than 3 ft/s) allow suspended solids to settle on the heat exchange surface. Cooling water is typically on the tube side of a shell and tube exchanger because it's easy to clean. To prevent fouling, designers typically ensure that cooling water velocity is greater than 0.9 m/s and bulk fluid temperature is maintained less than 60 °C (140 °F). Other approaches to control fouling control combine the "blind" application of biocides and anti-scale chemicals with periodic lab testing.

Maintenance

[edit]

Plate and frame heat exchangers can be disassembled and cleaned periodically. Tubular heat exchangers can be cleaned by such methods as acid cleaning, sandblasting, high-pressure water jet, bullet cleaning, or drill rods.

In large-scale cooling water systems for heat exchangers, water treatment such as purification, addition of chemicals, and testing, is used to minimize fouling of the heat exchange equipment. Other water treatment is also used in steam systems for power plants, etc. to minimize fouling and corrosion of the heat exchange and other equipment.

A variety of companies have started using water borne oscillations technology to prevent biofouling. Without the use of chemicals, this type of technology has helped in providing a low-pressure drop in heat exchangers.

Design and manufacturing regulations

[edit]

The design and manufacturing of heat exchangers has numerous regulations, which vary according to the region in which they will be used.

Design and manufacturing codes include: ASME Boiler and Pressure Vessel Code (US); PD 5500 (UK); BS 1566 (UK);[32] EN 13445 (EU); CODAP (French); Pressure Equipment Safety Regulations 2016 (PER) (UK); Pressure Equipment Directive (EU); NORSOK (Norwegian); TEMA;[33] API 12; and API 560.[*citation needed*]

In nature

[edit]

Humans

[edit]

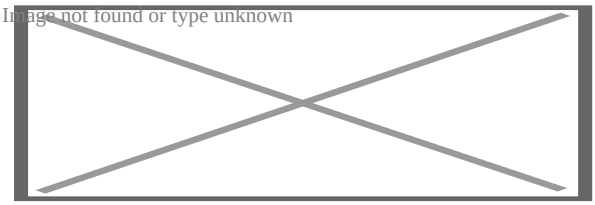
The human nasal passages serve as a heat exchanger, with cool air being inhaled and warm air being exhaled. Its effectiveness can be demonstrated by putting the hand in front of the face and exhaling, first through the nose and then through the mouth. Air exhaled through the nose is substantially cooler.[34][35] This effect can be

enhanced with clothing, by, for example, wearing a scarf over the face while breathing in cold weather.

In species that have external testes (such as human), the artery to the testis is surrounded by a mesh of veins called the pampiniform plexus. This cools the blood heading to the testes, while reheating the returning blood.

Birds, fish, marine mammals

[edit]



Counter-current exchange conservation circuit

Further information: Counter-current exchange in biological systems

"Countercurrent" heat exchangers occur naturally in the circulatory systems of fish, whales and other marine mammals. Arteries to the skin carrying warm blood are intertwined with veins from the skin carrying cold blood, causing the warm arterial blood to exchange heat with the cold venous blood. This reduces the overall heat loss in cold water. Heat exchangers are also present in the tongues of baleen whales as large volumes of water flow through their mouths.[36][37] Wading birds use a similar system to limit heat losses from their body through their legs into the water.

Carotid rete

[edit]

Carotid rete is a counter-current heat exchanging organ in some ungulates. The blood ascending the carotid arteries on its way to the brain, flows via a network of vessels where heat is discharged to the veins of cooler blood descending from the nasal passages. The carotid rete allows Thomson's gazelle to maintain its brain almost 3 °C (5.4 °F) cooler than the rest of the body, and therefore aids in tolerating bursts in metabolic heat production such as associated with outrunning cheetahs (during which the body temperature exceeds the maximum temperature at which the brain could function).[38] Humans with other primates lack a carotid rete.[39]

In industry

[edit]

Heat exchangers are widely used in industry both for cooling and heating large scale industrial processes. The type and size of heat exchanger used can be tailored to suit a process depending on the type of fluid, its phase, temperature, density, viscosity, pressures, chemical composition and various other thermodynamic properties.

In many industrial processes there is waste of energy or a heat stream that is being exhausted, heat exchangers can be used to recover this heat and put it to use by heating a different stream in the process. This practice saves a lot of money in industry, as the heat supplied to other streams from the heat exchangers would otherwise come from an external source that is more expensive and more harmful to the environment.

Heat exchangers are used in many industries, including:

- Waste water treatment
- Refrigeration
- Wine and beer making
- Petroleum refining
- Nuclear power

In waste water treatment, heat exchangers play a vital role in maintaining optimal temperatures within anaerobic digesters to promote the growth of microbes that

remove pollutants. Common types of heat exchangers used in this application are the double pipe heat exchanger as well as the plate and frame heat exchanger.

In aircraft

[edit]

In commercial aircraft heat exchangers are used to take heat from the engine's oil system to heat cold fuel.[40] This improves fuel efficiency, as well as reduces the possibility of water entrapped in the fuel freezing in components.[41]

Current market and forecast

[edit]

Estimated at US$17.5 billion in 2021, the global demand of heat exchangers is expected to experience robust growth of about 5% annually over the next years. The market value is expected to reach US$27 billion by 2030. With an expanding desire for environmentally friendly options and increased development of offices, retail sectors, and public buildings, market expansion is due to grow.[42]

A model of a simple heat exchanger

[edit]

A simple heat exchange [43][44] might be thought of as two straight pipes with fluid flow, which are thermally connected. Let the pipes be of equal length L, carrying fluids with heat capacity λ_i (energy per unit mass per unit change in temperature) and let the mass flow rate of the fluids through the pipes, both in the same direction, be μ_i (mass per unit time), where the subscript i applies to pipe 1 or pipe 2.

Temperature profiles for the pipes are $T_1(x)$ and $T_2(x)$, where x is the distance along the pipe. Assume a steady state, so that the temperature profiles are not functions of time. Assume also that the only transfer of heat from a small volume of fluid in one pipe is to the fluid element in the other pipe at the same position, i.e., there is no

transfer of heat along a pipe due to temperature differences in that pipe. By Newton's law of cooling the rate of change in energy of a small volume of fluid is proportional to the difference in temperatures between it and the corresponding element in the other pipe:

$$\displaystyle \frac du_1dt=\gamma (T_2-T_1)$$

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$$\displaystyle \frac du_2dt=\gamma (T_1-T_2)$$

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(this is for parallel flow in the same direction and opposite temperature gradients, but for counter-flow heat exchange countercurrent exchange the sign is opposite in the second equation in front of $\displaystyle \gamma$) where T_1 is the thermal energy per unit length and γ is the thermal connection constant per unit length between the two pipes. This change in internal energy results in a change in the temperature of the fluid element. The time rate of change for the fluid element being carried along by the flow is:

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$$\displaystyle \frac du_1dt=J_1\frac dT_1dx$$

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$$\displaystyle \frac du_2dt=J_2\frac dT_2dx$$

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where $\displaystyle J_1$ is the "thermal mass flow rate". The differential equations governing the heat exchanger may now be written as:

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$$\displaystyle J_1\frac \partial T_1\partial x=\gamma (T_2-T_1)$$

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$$\displaystyle J_2\frac \partial T_2\partial x=\gamma (T_1-T_2).$$

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Since the system is in a steady state, there are no partial derivatives of temperature with respect to time, and since there is no heat transfer along the pipe, there are no second derivatives in *x* as is found in the heat equation. These two coupled first-order differential equations may be solved to yield:

$$\displaystyle T_1=A-\frac Bk_1k\,e^-kx$$

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$$\displaystyle T_2=A+\frac Bk_2k\,e^-kx$$

Image not found or type unknown

where $\displaystyle k=k_1+k_2$ $\displaystyle J_1=\gamma /J_2$

(this is for parallel-flow, but for counter-flow the sign in front of $\displaystyle J_1$ is negative, so that if $\displaystyle k=0$ for the same "thermal mass flow rate" in both opposite directions, the gradient of temperature is constant and the temperatures linear in position x with a constant difference $\displaystyle T_2-T_1$ along the exchanger, explaining why the counter current design countercurrent exchange is the most efficient)

and A and B are two as yet undetermined constants of integration. Let $\displaystyle T_{10}$ and $\displaystyle T_{20}$ be the temperatures at x=0 and let $\displaystyle T_{1L}$ and $\displaystyle T_{2L}$ be the temperatures at the end of the pipe at x=L. Define the average temperatures in each pipe as:

$$\displaystyle \overline T_1=\frac 1L\int _0^LT_1(x)dx$$

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$$\displaystyle \overline T_2=\frac 1L\int _0^LT_2(x)dx.$$

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Using the solutions above, these temperatures are:

$$\displaystyle T_{10}=A-\frac Bk_1k$$

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$$\displaystyle T_{20}=A+\frac Bk_2k$$

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$$\displaystyle T_{1L}=A-\frac Bk_1ke^-kL$$

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$$\displaystyle T_{2L}=A+\frac Bk_2ke^-kL$$

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$$\displaystyle \overline T_1=A-\frac Bk_1k^2L(1-e^-kL)$$

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$$\displaystyle \overline T_2=A+\frac Bk_2k^2L(1-$$

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Choosing any two of the temperatures above eliminates the constants of integration, letting us find the other four temperatures. We find the total energy transferred by integrating the expressions for the time rate of change of internal energy per unit length:

$$\displaystyle \frac dU_1dt=\int _0^L\frac du_1dt\,dx=J_1(T_{1L}-T_{10})=\gamma L(\overl$$

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\displaystyle \frac dU_2dt=\int _0^L\frac du_2dt\,dx=J_2(T_2L-T_20)=\gamma L(\ov

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By the conservation of energy, the sum of the two energies is zero. The quantity \displaystyle \overline T_2-\overline T_1

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is known as the *Log mean temperature difference*, and is a measure of the effectiveness of the heat exchanger in transferring heat energy.

See also

[edit]

- Architectural engineering
- Chemical engineering
- Cooling tower
- Copper in heat exchangers
- Heat pipe
- Heat pump
- Heat recovery ventilation
- Jacketed vessel
- Log mean temperature difference (LMTD)
- Marine heat exchangers
- Mechanical engineering
- Micro heat exchanger
- Moving bed heat exchanger
- Packed bed and in particular Packed columns
- Pumpable ice technology
- Reboiler
- Recuperator, or cross plate heat exchanger
- Regenerator
- Run around coil
- Steam generator (nuclear power)
- Surface condenser
- Toroidal expansion joint
- Thermosiphon

- Thermal wheel, or rotary heat exchanger (including enthalpy wheel and desiccant wheel)
- Tube tool
- Waste heat

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External links

[edit]

Wikimedia Commons has media related to ***Heat exchangers***.

- Shell and Tube Heat Exchanger Design Software for Educational Applications (PDF)
- EU Pressure Equipment Guideline
- A Thermal Management Concept For More Electric Aircraft Power System Application (PDF)

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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

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

- 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

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

About Oklahoma City

For other uses, see Oklahoma City (disambiguation).

Oklahoma City is located in the United States

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Oklahoma City
Oklahoma City
Location within the United States

Oklahoma City

State capital city

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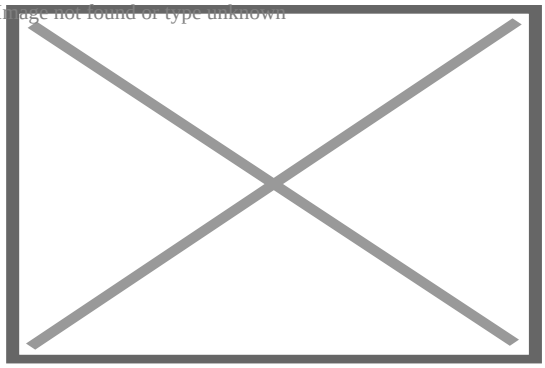

Downtown Oklahoma City

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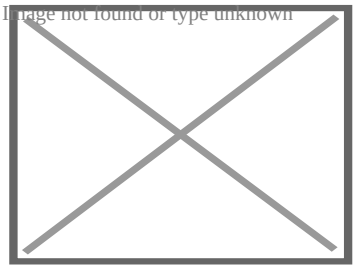

Oklahoma City Hall

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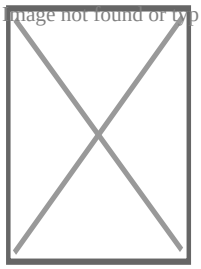

Skydance Bridge

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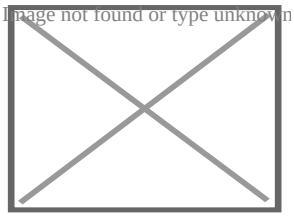

Oklahoma City National Memorial

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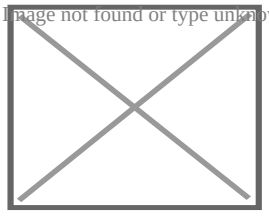

Oklahoma State Capitol

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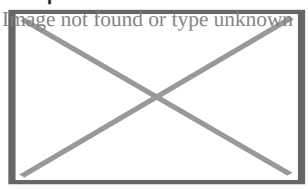

Paycom Center

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Flag of Oklahoma City

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Flag

Official seal of Oklahoma City

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Seal

Nickname(s):

"OKC", "The 405", "Oklas", "Boomtown", "The Big Friendly",[1] "The City",[2]

Map

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Interactive map of Oklahoma City

Oklahoma City is located in Oklahoma

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Oklahoma City

Oklahoma

City

Location within the state of

Oklahoma

Coordinates: 35°28'7"N 97°31'17"WÃÆ'Ã‚Â¯Ã‚Â»Ã‚Â¿ / ÃÆ'Ã‚Â¯Ã‚Â»Ã‚Â¿35.46861°N 97.52139°WCountryUnited StatesStateOklahomaCounties

- Oklahoma
- Canadian
- Cleveland
- Pottawatomie

FoundedApril 22, 1889[3]IncorporatedJuly 15, 1890[3]Government

· TypeCouncil–manager · BodyOklahoma City Council · MayorDavid Holt (R) · City managerCraig FreemanArea

[4]

· City

620.79 sq mi (1,607.83 km^2) · Land606.48 sq mi (1,570.77 km^2) · Water14.31 sq mi (37.06 km^2) · Urban

421.73 sq mi (1,092.3 km^2)Elevation

[5]

1,198 ft (365 m)Population

(2020)

· City

681,054 (Increase)

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· Rank62nd in North America

20th in the United States

1st in Oklahoma · Density1,122.96/sq mi (433.58/km^2) · Urban

982,276 (US: 46th) • Urban density2,329.2/sq mi (899.3/km^2) • Metro

[6]

1,441,695 (US: 42nd)

- Oklahoma Cityan
- Oklahoma Citian

Demonyms
GDP

[7]

• Metro$100.054 billion (2023)Time zoneUTC−6 (Central (CST)) • Summer (DST)UTC−5 (CDT)ZIP Codes

Zip codes[8]

Area code(s)405/572FIPS code40-55000GNIS feature ID1102140[5]Websitewww.okc.gov

Oklahoma City (/ÃƒÆ'Ã¢â‚¬Â¹Ãƒâ€¦Ã¢â‚¬Â¢ÃƒÆ'Ã…Â ÃƒÂ¢Ã‚Â k ÃƒÆ'Ã¢â‚¬Â°ÃƒÂ¢Ã¢â‚¬Å¾Ã‚Â¢ ÃƒÆ'Ã¢â‚¬Â¹Ãƒâ€¹Ã¢â‚¬Â ÃƒÆ'Ã…Â ÃƒÂ¢Ã‚Â m ÃƒÆ'Ã¢â‚¬Â°ÃƒÂ¢Ã¢â‚¬Å¾Ã‚Â¢/ ÃƒÆ'Ã‚Â¢ÃƒÂ¢Ã¢â‚¬Â¬Ã…â€œÃƒâ€¹Ã…â€œ), officially the **City of Oklahoma City**, and often shortened to **OKC**, is the capital and most populous city of the U.S. state of Oklahoma. The county seat of Oklahoma County,[9] its population ranks 20th among United States cities and 8th in the Southern United States. The population grew following the 2010 census and reached 681,054 in the 2020 census.[10] The Oklahoma City metropolitan area had a population of 1,396,445,[11] and the Oklahoma City–Shawnee Combined Statistical Area had a population of 1,469,124,[11] making it Oklahoma's largest municipality and metropolitan area by population.

Oklahoma City's city limits extend somewhat into Canadian, Cleveland, and Pottawatomie counties. However, much of those areas outside the core Oklahoma County area are suburban tracts or protected rural zones (watershed). The city is the eighth-largest in the United States by area including consolidated city-counties; it is the second-largest, after Houston, not including consolidated cities. The city is also the second-largest by area among state capital cities in the United States, after Juneau, Alaska.

Oklahoma City has one of the world's largest livestock markets.[12] Oil, natural gas, petroleum products, and related industries are its economy's largest sector. The city is in the middle of an active oil field, and oil derricks dot the capitol grounds. The federal government employs a large number of workers at Tinker Air Force Base and the United States Department of Transportation's Mike Monroney Aeronautical Center (which house offices of the Federal Aviation Administration and the Transportation Department's Enterprise Service Center, respectively).

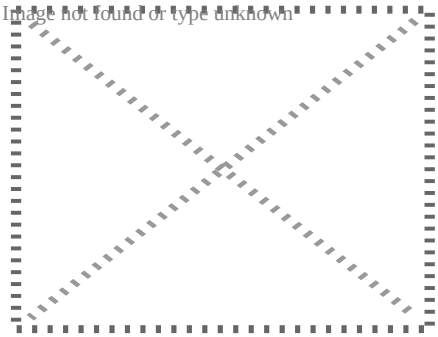
Oklahoma City is on the I-35 and I-40 corridors, one of the primary travel corridors south into neighboring Texas and New Mexico, north towards Wichita and Kansas City, west to Albuquerque, and east towards Little Rock and Memphis. Located in the state's Frontier Country region, the city's northeast section lies in an ecological region known as the Cross Timbers. The city was founded during the Land Run of 1889 and grew to a population of over 10,000 within hours of its founding. It was the site of the April 19, 1995, bombing of the Alfred P. Murrah Federal Building, in which 167 people died,[13] the deadliest terror attack in U.S. history until the attacks of September 11, 2001, and the deadliest act of domestic terrorism in U.S. history.

Since weather records have been kept beginning in 1890, Oklahoma City has been struck by 14 violent tornadoes, 11 of which were rated F4 or EF4 on the Fujita and Enhanced Fujita scales, and two rated F5 and EF5.[14]

History

[edit]
Main article: History of Oklahoma City

For a chronological guide, see Timeline of Oklahoma City.



Map of Indian Territory (Oklahoma) 1889, showing Oklahoma as a train stop on a railroad line. Britannica 9th ed.

Native American names for Oklahoma City

Choctaw: *TÃƒÆ'Ã…Â ÃƒÂ¢Ã¢â€šÂ¬Ã‚Â¹maha chito O*

Cherokee:
ÃƒÆ'Ã‚Â¡Ã‚Â¢Ã‚Â½Ã‚Â£ÃƒÆ'Ã‚Â¡Ã‚Â¢Ã‚Â½Ã‚Â¦ÃƒÆ'Ã‚Â¡Ã‚Â¢Ã‚Â½Ã‚Â
ÃƒÆ'Ã‚Â¡Ã‚Â¢Ã‚Â½Ã‚Â¦ÃƒÆ'Ã‚Â¡Ã‚Â¢Ã‚ÃƒÂ¢Ã‚Â¡Ã‚Â¡ÃƒÆ'Ã‚Â¡Ã‚Â

Romanized: ogalahoma gaduhvi

Cheyenne: *Ma'xepóno'e*

Comanche: *Pia SookaÃƒÆ'Ã…â€™Ãƒâ€šÃ‚Â h*

Delaware: *Oklahoma-utènaii*

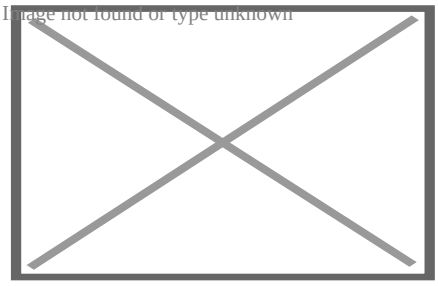
Iowa-Oto: *Chína Chége ItúÃƒÆ'Ã‚Â¢Ãƒâ€šÃ‚Â•Ãƒâ€š*

Navajo: *Halgai Hóteeldi Kin HaalÃƒÆ'Ã…Â ÃƒÂ¢Ã€šÃ‚*

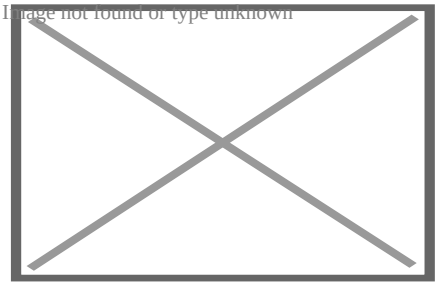
Meskwaki: *Okonohômîheki*[16]

Oklahoma City was settled on April 22, 1889,[17] when the area known as the "Unassigned Lands" was opened for settlement in an event known as "The Land Run".[18] On April 26 of that year, its first mayor was elected, William Couch. Some 10,000 homesteaders settled in the area that would become the capital of Oklahoma. The town grew quickly; the population doubled between 1890 and 1900.[19] Early leaders of the development of the city included Anton H. Classen, John Wilford Shartel,

Henry Overholser, Oscar Ameringer, Jack C. Walton, Angelo C. Scott, and James W. Maney.



Lithograph of Oklahoma City from 1890.



Looking north on Broadway from present-day Sheridan Ave, 1910.

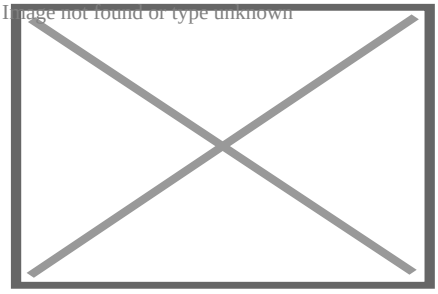
By the time Oklahoma was admitted to the Union in 1907, Oklahoma City had surpassed Guthrie, the territorial capital, as the new state's population center and commercial hub. Soon after, the capital was moved from Guthrie to Oklahoma City.[20] Oklahoma City was a significant stop on Route 66 during the early part of the 20th century; it was prominently mentioned in Bobby Troup's 1946 jazz song "(Get Your Kicks on) Route 66" made famous by artist Nat King Cole.

Before World War II, Oklahoma City developed significant stockyards, attracting jobs and revenue formerly in Chicago and Omaha, Nebraska. With the 1928 discovery of oil within the city limits (including under the State Capitol), Oklahoma City became a major center of oil production.[21] Post-war growth accompanied the construction of the Interstate Highway System, which made Oklahoma City a major interchange as the convergence of I-35, I-40, and I-44. It was also aided by the federal development of Tinker Air Force Base after successful lobbying efforts by the director of the Chamber of Commerce Stanley Draper.

In 1950, the Census Bureau reported the city's population as 8.6% black and 90.7% white.[22]

In 1959, the city government launched a "Great Annexation Drive" that expanded the city's area from 80 to 475.55 square miles (207.2 to 1,231.7 square kilometers) by the end of 1961, making it the largest U.S. city by land mass at the time.[23]

Patience Latting was elected Mayor of Oklahoma City in 1971, becoming the city's first female mayor.[24] Latting was also the first woman to serve as mayor of a U.S. city with over 350,000 residents.[24]



Oklahoma City National Memorial at Christmas.

Like many other American cities, the center city population declined in the 1970s and 1980s as families followed newly constructed highways to move to newer housing in nearby suburbs. Urban renewal projects in the 1970s, including the Pei Plan, removed older structures but failed to spark much new development, leaving the city dotted with vacant lots used for parking. A notable exception was the city's construction of the Myriad Gardens and Crystal Bridge, a botanical garden and modernistic conservatory in the heart of downtown. Architecturally significant historic buildings lost to clearances were the Criterion Theater,[25][26] the Baum Building,[27] the Hales Building,[28][29] and the Biltmore Hotel.[30]

In 1993, the city passed a massive redevelopment package known as the Metropolitan Area Projects (MAPS), intended to rebuild the city's core with civic projects to establish more activities and life in downtown. The city added a new baseball park; a central library; renovations to the civic center, convention center, and fairgrounds; and a water canal in the Bricktown entertainment district. Water taxis transport passengers within the district, adding color and activity along the canal. MAPS has

become one of the most successful public–private partnerships undertaken in the U.S., exceeding $3 billion in private investment as of 2010.[31] As a result of MAPS, the population in downtown housing has exponentially increased, with the demand for additional residential and retail amenities, such as groceries, services, and shops.

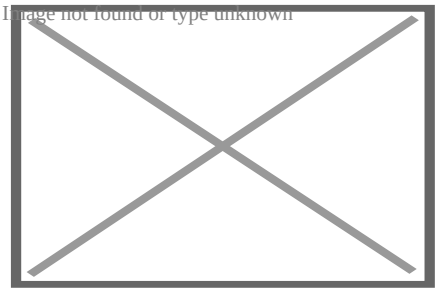
Since the completion of the MAPS projects, the downtown area has seen continued development. Several downtown buildings are undergoing renovation/restoration. Notable among these was the restoration of the Skirvin Hotel in 2007. The famed First National Center is also being renovated.

Residents of Oklahoma City suffered substantial losses on April 19, 1995, when Timothy McVeigh detonated a bomb in front of the Murrah building. The building was destroyed (the remnants of which had to be imploded in a controlled demolition later that year), more than 100 nearby buildings suffered severe damage, and 168 people were killed.[32] The site has been commemorated as the Oklahoma City National Memorial and Museum.[33] Since its opening in 2000, over three million people have visited. Every year on April 19, survivors, families, and friends return to the memorial to read the names of each person lost. McVeigh was executed by lethal injection on June 11, 2001.

The "Core-to-Shore" project was created to relocate I-40 one mile (1.6 km) south and replace it with a boulevard to create a landscaped entrance to the city.[34] This also allows the central portion of the city to expand south and connect with the shore of the Oklahoma River. Several elements of "Core to Shore" were included in the MAPS 3 proposal approved by voters in late 2009.

Geography

[edit]



Mid-May 2006 photograph of Oklahoma City taken from the International Space Station (ISS)

Oklahoma City lies along one of the primary corridors into Texas and Mexico and is a three-hour drive from the Dallas–Fort Worth metroplex. The city is in the Frontier Country region in the state's center, making it ideal for state government.

According to the United States Census Bureau, the city has a total area of 620.34 square miles (1,606.7 km^2),[35] of which 601.11 square miles (1,556.9 km^2) is land and 19.23 square miles (49.8 km^2) is water.

Oklahoma City lies in the Sandstone Hills region of Oklahoma, known for hills of 250 to 400 feet (80 to 120 m) and two species of oak: blackjack oak (*Quercus marilandica*) and post oak (*Q. stellata*).[36] The northeastern part of the city and its eastern suburbs fall into an ecological region known as the Cross Timbers.[37]

The city is roughly bisected by the North Canadian River (recently renamed the Oklahoma River inside city limits). The North Canadian once had sufficient flow to flood every year, wreaking destruction on surrounding areas, including the central business district and the original Oklahoma City Zoo.[38] In the 1940s, a dam was built on the river to manage the flood control and reduce its level.[39] In the 1990s, as part of the citywide revitalization project known as MAPS, the city built a series of low-water dams, returning water to the portion of the river flowing near downtown.[40] The city has three large lakes: Lake Hefner and Lake Overholser, in the northwestern quarter of the city; and the largest, Lake Stanley Draper, in the city's sparsely populated far southeast portion.

The population density typically reported for Oklahoma City using the area of its city limits can be misleading. Its urbanized zone covers roughly 244 square miles (630 km

^{2}) resulting in a 2013 estimated density of 2,500 per square mile (970/km^2), compared with larger rural watershed areas incorporated by the city, which cover the remaining 377 sq mi (980 km^2) of the city limits.[41]

Oklahoma City is one of the largest cities in the nation in compliance with the Clean Air Act.[42]

Tallest buildings

[edit]

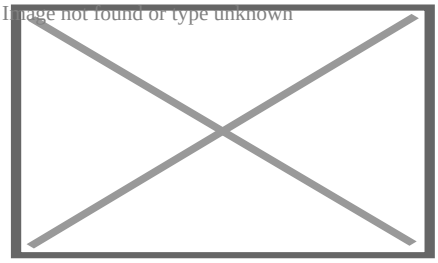
Main article: List of tallest buildings in Oklahoma City

Rank	Building	Height	Floors	Built	Ref.
1	Devon Energy Center	844 feet (257 m)	50	2012	[43]
2	BancFirst Tower	500 feet (152 m)	36	1971	[44]
3	First National Center	446 feet (136 m)	33	1931	[45]
4	BOK Park Plaza	433 feet (132 m)	27	2017	[46]
5	Oklahoma Tower	410 feet (125 m)	31	1982	[47]
6	Strata Tower	393 feet (120 m)	30	1973	[48]
7	City Place	391 feet (119 m)	33	1931	[49]
8	Valliance Bank Tower	321 feet (98 m)	22	1984	[50]
9	Leadership Square North	285 feet (87 m)	22	1984	[51]
10	Arvest Tower	281 feet (86 m)	16	1972	[52]

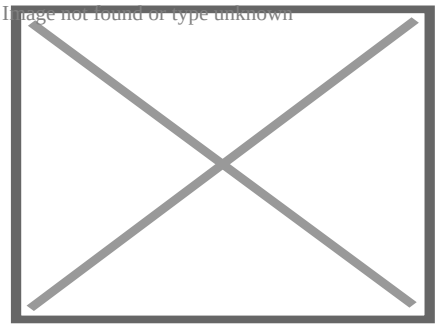
Neighborhoods

[edit]

Main article: Neighborhoods of Oklahoma City



Automobile Alley in Oklahoma City



Looking up in the heart of Oklahoma City's Central Business District

Oklahoma City neighborhoods are highly varied, with affluent historic neighborhoods located next to districts that have not wholly recovered from the economic and social decline of the 1970s and 1980s.[*citation needed*]

The city is bisected geographically and culturally by the North Canadian River, which divides North Oklahoma City and South Oklahoma City. The north side is characterized by diverse and fashionable urban neighborhoods near the city center and sprawling suburbs further north. South Oklahoma City is generally more blue-collar working class and significantly more industrial, having grown up around the Stockyards and meat packing plants at the turn of the century. It is also the center of the city's rapidly growing Latino community.

Downtown Oklahoma City, which has 7,600 residents, is seeing an influx of new private investment and large-scale public works projects, which have helped to revitalize a central business district left almost deserted by the Oil Bust of the early 1980s. The centerpiece of downtown is the newly renovated Crystal Bridge and Myriad Botanical Gardens, one of the few elements of the Pei Plan to be completed. In 2021, a massive new central park will link the gardens near the CBD and the new convention center to be built just south of it to the North Canadian River as part of a

massive works project known as "Core to Shore"; the new park is part of MAPS3, a collection of civic projects funded by a one-cent temporary (seven-year) sales tax increase.[53]

Climate

[edit]
Main article: Climate of Oklahoma City

Oklahoma City has a temperate humid subtropical climate (Köppen: *Cfa*, Trewartha: *Cfak*), along with significant continental influences. The city features hot, humid summers and cool winters. Prolonged and severe droughts (sometimes leading to wildfires in the vicinity) and hefty rainfall leading to flash flooding and flooding occur regularly. Consistent winds, usually from the south or south-southeast during the summer, help temper the hotter weather. Consistent northerly winds during the winter can intensify cold periods. Severe ice storms and snowstorms happen sporadically during the winter.

The average temperature is 61.4 °F (16.3 °C), with the monthly daily average ranging from 39.2 °F (4.0 °C) in January to 83.0 °F (28.3 °C) in July. Extremes range from −17 °F (−27 °C) on February 12, 1899 to 113 °F (45 °C) on August 11, 1936, and August 3, 2012;[54] The last sub-zero (Fahrenheit) reading was −14 °F (−26 °C) on February 16, 2021.[55][56] Temperatures reach 100 °F (38 °C) on 10.4 days of the year, 90 °F (32 °C) on nearly 70 days, and fail to rise above freezing on 8.3 days.[55] The city receives about 35.9 inches (91.2 cm) of precipitation annually, of which 8.6 inches (21.8 cm) is snow.

The report "Regional Climate Trends and Scenarios for the U.S. National Climate Assessment" (NCA) from 2013 by NOAA projects that parts of the Great Plains region can expect up to 30% (high emissions scenario based on CMIP3 and NARCCAP models) increase in extreme precipitation days by mid-century. This definition is based on days receiving more than one inch of rainfall.[57]

Extreme weather

[edit]

Oklahoma City has an active severe weather season from March through June, especially during April and May. Being in the center of what is colloquially referred to as Tornado Alley, it is prone to widespread and severe tornadoes, as well as severe hailstorms and occasional derechoes. Tornadoes occur every month of the year, and a secondary smaller peak also occurs during autumn, especially in October. The Oklahoma City metropolitan area is one of the most tornado-prone major cities in the world, with about 150 tornadoes striking within the city limits since 1890. Since the time weather records have been kept, Oklahoma City has been struck by 13 violent tornadoes, eleven rated F/EF4 and two rated F/EF5.[14]

On May 3, 1999, parts of Oklahoma City and surrounding communities were impacted by a tornado. It was the last U.S. tornado to be given a rating of F5 on the Fujita scale before the Enhanced Fujita scale replaced it in 2007. While the tornado was in the vicinity of Bridge Creek to the southwest, wind speeds of 318 mph (510 km/h) were estimated by a mobile Doppler radar, the highest wind speeds ever recorded on Earth.[58] A second top-of-the-scale tornado occurred on May 20, 2013; South Oklahoma City, along with Newcastle and Moore, was hit by an EF5 tornado. The tornado was 0.5 to 1.3 miles (0.80 to 2.09 km) wide and killed 23 people.[59] On May 31, less than two weeks after the May 20 event, another outbreak affected the Oklahoma City area. Within Oklahoma City, the system spawned an EF1 and an EF0 tornado, and in El Reno to the west, an EF3 tornado occurred. This lattermost tornado, which was heading in the direction of Oklahoma City before it dissipated, had a width of 2.6 miles (4.2 km), making it the widest tornado ever recorded. Additionally, winds over 295 mph (475 km/h) were measured, one of the two highest wind records for a tornado.[60]

With 19.48 inches (495 mm) of rainfall, May 2015 was Oklahoma City's record-wettest month since record-keeping began in 1890. Across Oklahoma and Texas generally, there was a record flooding in the latter part of the month.[61]

Climate data for Oklahoma City (Will Rogers World Airport), 1991–2020 normals,[a] extremes 1890–present[b]

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °F (°C)	83 (28)	92 (33)	97 (36)	100 (38)	104 (40)	107 (42)	110 (43)	113 (45)	108 (42)	97 (36)	87 (31)	86 (30)	113 (45)
Mean maximum °F (°C)	71.7 (22.1)	77.1 (25.1)	84.2 (29.0)	86.9 (30.5)	92.3 (33.5)	96.4 (35.8)	102.4 (39.1)	101.5 (38.6)	96.2 (35.7)	88.9 (31.6)	79.1 (26.2)	71.2 (21.8)	103.8 (39.9
Mean daily maximum °F (°C)	49.3 (9.6)	53.8 (12.1)	62.9 (17.2)	71.1 (21.7)	78.9 (26.1)	87.5 (30.8)	93.1 (33.9)	92.2 (33.4)	83.9 (28.8)	72.8 (22.7)	60.7 (15.9)	50.4 (10.2)	71.4 (21.9
Daily mean °F (°C)	38.2 (3.4)	42.3 (5.7)	51.2 (10.7)	59.3 (15.2)	68.2 (20.1)	76.9 (24.9)	81.7 (27.6)	80.7 (27.1)	72.7 (22.6)	61.1 (16.2)	49.2 (9.6)	40.0 (4.4)	60.1 (15.6
Mean daily minimum °F (°C)	27.0 (−2.8)	30.8 (−0.7)	39.5 (4.2)	47.5 (8.6)	57.6 (14.2)	66.2 (19.0)	70.3 (21.3)	69.1 (20.6)	61.5 (16.4)	49.4 (9.7)	37.7 (3.2)	29.5 (−1.4)	48.8 (9.3)
Mean minimum °F (°C)	11.7 (−11.3)	15.4 (−9.2)	21.5 (−5.8)	32.3 (0.2)	43.8 (6.6)	56.6 (13.7)	63.6 (17.6)	61.7 (16.5)	48.4 (9.1)	33.8 (1.0)	21.7 (−5.7)	14.3 (−9.8)	7.5 (−13.6
Record low °F (°C)	−11 (−24)	−17 (−27)	1 (−17)	20 (−7)	32 (0)	46 (8)	53 (12)	49 (9)	35 (2)	16 (−9)	9 (−13)	−8 (−22)	−17 (−27
Average precipitation inches (mm)	1.32 (34)	1.42 (36)	2.55 (65)	3.60 (91)	5.31 (135)	4.49 (114)	3.59 (91)	3.60 (91)	3.72 (94)	3.32 (84)	1.68 (43)	1.79 (45)	36.39 (924
Average snowfall inches (cm)	1.8 (4.6)	1.8 (4.6)	0.8 (2.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.5 (1.3)	1.8 (4.6)	6.7 (17)
Average precipitation days (≥ 0.01 in)	5.0	5.7	6.9	7.9	10.0	8.6	6.0	6.7	7.1	7.5	5.8	5.7	82.9

Average snowy days (≥ 0.1 in)	1.3	1.3	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.3	1.4	4.9
Average relative humidity (%)	66.6	65.7	61.3	61.1	67.5	67.2	60.9	61.6	67.1	64.4	67.1	67.8	64.9
Average dew point °F (°C)	23.7 (−4.6)	28.0 (−2.2)	35.2 (1.8)	45.1 (7.3)	55.8 (13.2)	63.7 (17.6)	65.3 (18.5)	64.4 (18.0)	59.5 (15.3)	47.7 (8.7)	37.0 (2.8)	27.5 (−2.5)	46.1 (7.8)
Mean monthly sunshine hours	200.8	189.7	244.2	271.3	295.2	326.1	356.6	329.3	263.7	245.1	186.5	180.9	3,089
Mean daily daylight hours	10.1	10.9	12.0	13.1	14.1	14.5	14.3	13.4	12.4	11.3	10.3	9.8	12.2
Percent possible sunshine	64	62	66	69	68	75	80	79	71	70	60	60	69
Average ultraviolet index	3	4	6	8	9	10	10	9	8	5	3	2	6.4

Source 1: NOAA (relative humidity and sun 1961–1990)[62][55][63]

Source 2: Weather Atlas(Daylight-UV) [64]

Demographics

[edit]

Population of Oklahoma City 1890–2022

Census	Pop.	Note	%±
1890	4,151		—
1900	10,037		141.8%

1910	64,205	539.7%
1920	91,295	42.2%
1930	185,389	103.1%
1940	204,424	10.3%
1950	243,504	19.1%
1960	324,253	33.2%
1970	368,164	13.5%
1980	404,014	9.7%
1990	444,719	10.1%
2000	506,132	13.8%
2010	579,999	14.6%
2020	681,054	17.4%
2024 (est.)	709,330 [65]	4.2%

U.S. Decennial Census[66]
1790–1960[67] 1900–1990[68]
1990–2000[69] 2010[70]

In the 2010 census, there were 579,999 people, 230,233 households, and 144,120 families in the city. The population density was 956.4 inhabitants per square mile (321.9/km^2). There were 256,930 housing units at an average density of 375.9 per square mile (145.1/km^2). By the 2020 census, its population grew to 681,054.[71]

Of Oklahoma City's 579,999 people in 2010, 44,541 resided in Canadian County, 63,723 lived in Cleveland County, 471,671 resided in Oklahoma County, and 64 resided in Pottawatomie County.[72]

In 2010, there were 230,233 households, 29.4% of which had children under 18 living with them, 43.4% were married couples living together, 13.9% had a female householder with no husband present, and 37.4% were non-families. One person households account for 30.5% of all households, and 8.7% of all households had someone living alone who was 65 years of age or older. The average household size

was 2.47 and the average family size was 3.11.[73]

According to the American Community Survey 1-year estimates in 2022, the median income for a household in the city was $63,713, and the median income for a family was $80,833. Married-couple families $99,839, and nonfamily households $40,521.[74] The per capita income for the city was $35,902.[75] 15.5% of the population and 11.2% of families were below the poverty line. Of the total population, 20.1% of those under 18 and 10.6% of those 65 and older lived below the poverty line.[76]

In the 2000 census, Oklahoma City's age composition was 25.5% under the age of 18, 10.7% from 18 to 24, 30.8% from 25 to 44, 21.5% from 45 to 64, and 11.5% who were 65 years of age or older. The median age was 34 years. For every 100 females, there were 95.6 males. For every 100 females age 18 and over, there were 92.7 males.

Oklahoma City has experienced significant population increases since the late 1990s. It is the first city in the state to record a population greater than 600,000 residents and the first city in the Great Plains region to record a population greater than 600,000 residents. It is the largest municipal population of the Great Plains region (Oklahoma, Kansas, Nebraska, South Dakota, North Dakota).[*ambiguous*]

In the 2020 census, there were 268,035 households in the city, out of which 81,374 households (30.4%) were individuals, 113,161 (42.2%) were opposite-sex married couples, 17,699 (6.6%) were unmarried opposite-sex partnerships, and 2,930 (1.1%) were same-sex married couples or partnerships.[77]

Race and ethnicity

[edit]

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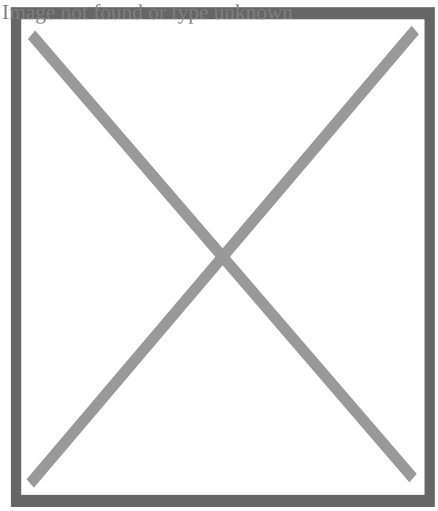


Map of racial distribution of the Oklahoma City area, 2020 U.S. census. Each dot is one person: ÃƒÆ'Ã‚Â¢Ã€šÃ‚Â¬Ã€šÃ‚Â¤ White

ÃƒÆ'Ã‚Â¢Ã€šÃ‚Â¬Ã€šÃ‚Â¤ Black

ÃƒÆ'Ã‚Â¢Ã€šÃ‚Â¬Ã€šÃ‚Â¤ Asian

ÃƒÆ'Ã‚Â¢Ã€šÃ‚Â¬Ã€šÃ‚Â¤ Hispanic

ÃƒÆ'Ã‚Â¢Ã€šÃ‚Â¬Ã€šÃ‚Â¤ Multiracial

ÃƒÆ'Ã‚Â¢Ã€šÃ‚Â¬Ã€šÃ‚Â¤ Native American/Other

Historical racial composition	**2020 [71]**	**2010[78]**	**1990[22]**	**1970[22]**	**1940[22]**
White (Non-Hispanic)	49.5%	56.7%	72.9%	82.2%	90.4%
Hispanic or Latino	21.3%	17.2%	5.0%	2.0%	n/a
Black or African American	13.8%	14.8%	16.0%	13.7%	9.5%
Mixed	7.6%	4.0%	0.4%	–	–
Asian	4.6%	4.0%	2.4%	0.2%	–
Native American	3.4%	3.1%	4.2%	2.0%	0.1%

According to the 2020 census, the racial composition of Oklahoma City was as follows:[79] White or European American 49.5%, Hispanic or Latino 21.3%, Black or African American 13.8%, Asian 4.6%, Native American 2.8%, Native Hawaiian and Other Pacific Islander 0.2%, other race 0.4%, and two or more races (non-Hispanic) 7.6%. Its population has diversified since the 1940s census, where 90.4% was non-Hispanic white.[22] An analysis in 2017 found Oklahoma City to be the 8th least racially segregated significant city in the United States.[80] Of the 20 largest US cities, Oklahoma City has the second-highest percentage of the population reporting two or more races on the Census, 7.6%, second to 8.9% in New York City.

2020

[edit]

Oklahoma City – Racial and ethnic composition

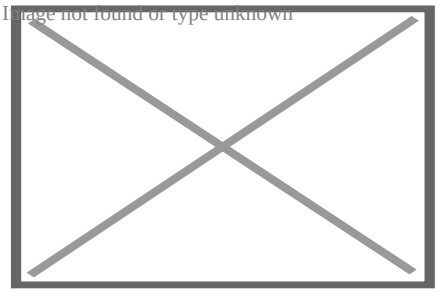
Note: the US Census treats Hispanic/Latino as an ethnic category. This table excludes Latinos from the racial categories and assigns them to a separate category. Hispanics/Latinos may be of any race.

Race / Ethnicity (*NH* = *Non-Hispanic*)	**Pop 2000 [81]**	**Pop 2010[82]**	**Pop 2020[83]**	**% 2000**	**% 2010**	**% 2020**
White alone (NH)	327,225	328,582	337,063	64.65%	56.65%	49.49%
Black or African American alone (NH)	76,994	85,744	93,767	15.21%	14.78%	13.77%
Native American or Alaska Native alone (NH)	16,406	18,208	18,757	3.24%	3.14%	2.75%
Asian alone (NH)	17,410	23,051	31,163	3.44%	3.97%	4.58%
Pacific Islander alone (NH)	278	464	971	0.05%	0.08%	0.14%
Some Other Race alone (NH)	452	700	2,700	0.09%	0.12%	0.40%
Mixed Race or Multi-Racial (NH)	15,999	23,212	51,872	3.16%	4.00%	7.62%

Hispanic or Latino (any race)	51,368	100,038	144,761	10.15%	17.25%	21.26%
Total	**506,132**	**579,999**	**681,054**	**100.00%**	**100.00%**	**100.00%**

Metropolitan statistical area

[edit]



Old Interstate 40 Crosstown, Oklahoma City

Oklahoma City is the principal city of the eight-county Oklahoma City metropolitan statistical Area in Central Oklahoma and is the state's largest urbanized area. As of 2015, the metro area was the 41st largest in the nation based on population.[84]

Religion

[edit]

The Association of Religion Data Archives in 2020 reported that the Southern Baptist Convention was the city and metropolitan area's most prominent Christian tradition with 213,008 members, Christianity being the area's predominant religion. Non/interdenominational Protestants were the second largest tradition with 195,158 members. The Roman Catholic Church claimed 142,491 adherents throughout the metropolitan region and Pentecostals within the Assemblies of God USA numbered 48,470.[85] The remainder of Christians in the area held to predominantly Evangelical

Christian beliefs in numerous evangelical Protestant denominations. Outside of Christendom, there were 4,230 practitioners of Hinduism and 2,078 Mahayana Buddhists. An estimated 8,904 residents practiced Islam during this study.[85]

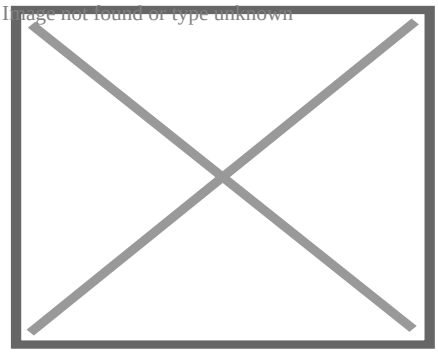
Crime

[edit]

Law enforcement claims Oklahoma City has traditionally been the territory of the notorious Juárez Cartel, but the Sinaloa Cartel has been reported as trying to establish a foothold in Oklahoma City. There are many rival gangs in Oklahoma City, one whose headquarters has been established in the city, the Southside Locos, traditionally known as Sureños.[86]

Oklahoma City also has its share of violent crimes, particularly in the 1970s. The worst occurred in 1978 when six employees of a Sirloin Stockade restaurant on the city's south side were murdered execution-style in the restaurant's freezer. An intensive investigation followed, and the three individuals involved, who also killed three others in Purcell, Oklahoma, were identified. One, Harold Stafford, died in a motorcycle accident in Tulsa not long after the restaurant murders. Another, Verna Stafford, was sentenced to life without parole after being granted a new trial after she had been sentenced to death. Roger Dale Stafford, considered the mastermind of the murder spree, was executed by lethal injection at the Oklahoma State Penitentiary in 1995.[87]

The Oklahoma City Police Department has a uniformed force of 1,169 officers and 300+ civilian employees. The department has a central police station and five substations covering 2,500 police reporting districts that average 1/4 square mile in size.

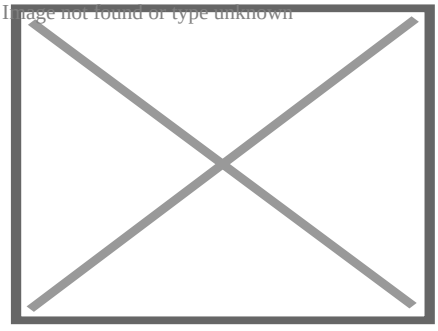


The Murrah Federal Building after the attack

On April 19, 1995, the Alfred P. Murrah Federal Building was destroyed by a fertilizer bomb manufactured and detonated by Timothy McVeigh. The blast and catastrophic collapse killed 168 people and injured over 680. The blast shock-wave destroyed or damaged 324 buildings within a 340-meter radius, destroyed or burned 86 cars, and shattered glass in 258 nearby buildings, causing at least an estimated $652 million. McVeigh was convicted and subsequently executed by lethal injection on June 11, 2001.

Economy

[edit]
See also: List of companies based in Oklahoma City



The Sonic Drive-In restaurant chain is headquartered in Oklahoma City.

The economy of Oklahoma City, once just a regional power center of government and energy exploration, has since diversified to include the sectors of information technology, services, health services, and administration. The city is headquarters to two Fortune 500 companies: Expand Energy and Devon Energy,[88] as well as being home to Love's Travel Stops & Country Stores, which is ranked thirteenth on Forbes'

list of private companies.[89]

As of March 2024, the top 20 employers in the city were:[90]

#	Employer	# of employees
1	State of Oklahoma (State Capital)	37,600
2	Tinker Air Force Base	26,000
3	Oklahoma State University–Stillwater	13,940
4	University of Oklahoma–Norman	11,530
5	Integris Health	11,000
6	Amazon	8,000
7	Hobby Lobby Stores (HQ)	6,500
8	Mercy Health Center (HQ)	6,500
9	SSM Health Care (Regional HQ)	5,600
10	FAA Mike Monroney Aeronautical Center	5,150
11	University of Oklahoma Health Sciences Center	5000
12	City of Oklahoma City	4,500
13	OU Medical Center	4,360
14	Paycom (HQ)	4,200
15	The Boeing Company	3,740
16	Midfirst Bank (HQ)	3,100
17	Norman Regional Hospital	2,740
18	AT&T	2,700
19	OGE Energy Corp (HQ)	2,240
20	Dell	2,100

Other major corporations with a significant presence (over 1,000 employees) in the city of Oklahoma City include the United Parcel Service, Farmers Insurance Group, Great Plains Coca-Cola Bottling Company, Deaconess Hospital, Johnson Controls, MidFirst Bank, Rose State College, and Continental Resources.[91][92]

While not in the city limits, other large employers within the Oklahoma City MSA include United States Air Force – Tinker AFB (27,000); University of Oklahoma (11,900); University of Central Oklahoma (2,900); and Norman Regional Hospital (2,800).[91]

According to the Oklahoma City Chamber of Commerce, the metropolitan area's economic output grew by 33% between 2001 and 2005 due chiefly to economic diversification. Its gross metropolitan product (GMP) was $43.1 billion in 2005[93] and grew to $61.1 billion in 2009.[94] By 2016 the GMP had grown to $73.8 billion.[95]

In 2008, *Forbes* magazine reported that the city had falling unemployment, one of the strongest housing markets in the country and solid growth in energy, agriculture, and manufacturing.[96] However, during the early 1980s, Oklahoma City had one of the worst job and housing markets due to the bankruptcy of Penn Square Bank in 1982 and then the post–1985 crash in oil prices (oil bust).[*citation needed*]

Tourism

[edit]

Approximately 23.2 million visitors contributed $4.3 billion to Oklahoma City's economy. These visitors directly spent $2.6 billion, sustained nearly 34,000 jobs, and generated $343 million in state and local taxes.[97]

Business districts

[edit]
See also: Neighborhoods of Oklahoma City

Business and entertainment districts (and, to a lesser extent, local neighborhoods) tend to maintain their boundaries and character by applying zoning regulations and

business improvement districts (districts where property owners agree to a property tax surcharge to support additional services for the community).[98] Through zoning regulations, historic districts, and other special zoning districts, including overlay districts, are well established.[99] Oklahoma City has three business improvement districts, including one encompassing the central business district.

Culture

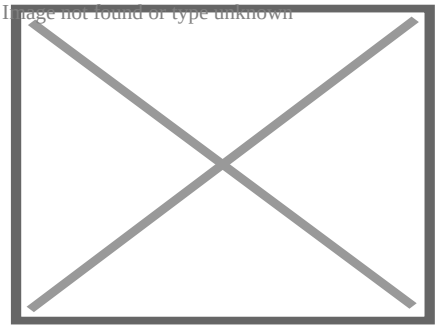
[edit]

Museums and theaters

[edit]

This article **needs additional citations for verification**. Please help improve this article by adding citations to reliable sources. Unsourced material may be challenged and removed.

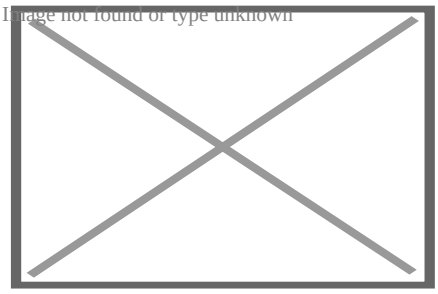
Find sources: "Oklahoma City" – news · newspapers · books · scholar · JSTOR *(April 2018) (Learn how and when to remove this message)*



Water taxis in Oklahoma City's downtown Bricktown neighborhood

The Donald W. Reynolds Visual Arts Center is the new downtown home for the Oklahoma City Museum of Art. The museum features visiting exhibits, original selections from its collection, a theater showing various foreign, independent, and classic films each week, and a restaurant. OKCMOA is also home to the most comprehensive collection of Chihuly glass in the world, including the 55-foot Eleanor Blake Kirkpatrick Memorial Tower in the Museum's atrium.[100] The art deco Civic

Center Music Hall, which was renovated in 2001, has performances from the Oklahoma City Ballet, the Oklahoma City Opera, the Oklahoma City Philharmonic, and also various concerts and traveling Broadway shows.



The Survivor Tree on the grounds of the Oklahoma City National Memorial

Other theaters include the Lyric Theatre, Jewel Box Theatre, Kirkpatrick Auditorium, the Poteet Theatre, the Oklahoma City Community College Bruce Owen Theater, and the 488-seat Petree Recital Hall at the Oklahoma City University campus. The university opened the Wanda L Bass School of Music and Auditorium in April 2006.

The Oklahoma Contemporary Arts Center (formerly City Arts Center) moved downtown in 2020, near Campbell Art Park at 11th and Broadway, after being at the Oklahoma State Fair fairgrounds since 1989. It features exhibitions, performances, classes, workshops, camps, and weekly programs.

The Science Museum Oklahoma (formerly Kirkpatrick Science and Air Space Museum at Omniplex) houses exhibits on science and aviation and an IMAX theater. The museum formerly housed the International Photography Hall of Fame (IPHF), which displays photographs and artifacts from an extensive collection of cameras and other artifacts preserving the history of photography. IPHF honors those who have contributed significantly to the art and/or science of photography and relocated to St. Louis, Missouri in 2013.

The Museum of Osteology displays over 450 real skeletons and houses over 7,000.[101] Focusing on the form and function of the skeletal system, this 7,000 sq ft (650 m^2) museum displays hundreds of skulls and skeletons from all corners of the world. Exhibits include adaptation, locomotion, classification, and diversity of the vertebrate kingdom. The Museum of Osteology is the only one of its kind in America.

The National Cowboy & Western Heritage Museum has galleries of western art[102] and is home to the Hall of Great Western Performers.[103]

In September 2021, the First Americans Museum opened to the public, focusing on the histories and cultures of the numerous tribal nations and many Indigenous peoples in the state of Oklahoma.[104]

The Oklahoma City National Memorial in the northern part of Oklahoma City's downtown was created as the inscription on its eastern gate of the Memorial reads, "to honor the victims, survivors, rescuers, and all who were changed forever on April 19, 1995"; the memorial was built on the land formerly occupied by the Alfred P. Murrah Federal Building complex before its 1995 bombing. The outdoor Symbolic Memorial can be visited 24 hours a day for free, and the adjacent Memorial Museum, in the former *Journal Record* building damaged by the bombing, can be entered for a small fee. The site is also home to the National Memorial Institute for the Prevention of Terrorism, a non-partisan, nonprofit think tank devoted to preventing terrorism.

The American Banjo Museum in the Bricktown Entertainment district is dedicated to preserving and promoting the music and heritage of the banjo.[105] Its collection is valued at $3.5 million[*citation needed*], and an interpretive exhibit tells the evolution of the banjo from its roots in American slavery, to bluegrass, to folk, and to world music.

The Oklahoma History Center is the state's history museum. Across the street from the governor's mansion at 800 Nazih Zuhdi Drive in northeast Oklahoma City, the museum opened in 2005 and is operated by the Oklahoma Historical Society. It preserves Oklahoma's history from the prehistoric to the present day.

The Oklahoma State Firefighters Museum contains early colonial firefighting tools, the first fire station in Oklahoma,[106] and modern fire trucks.[107]

Restaurants

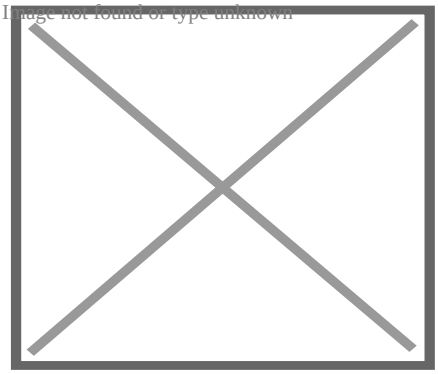
[edit]

Florence's Restaurant in 2022 was named one of America's Classics by the James Beard Foundation.[108][109] It was the first James Beard award for an Oklahoma entity.[108] *The Oklahoman* called Florence's "The Grand Dame of all local restaurants".[110] Andrew Black, chef/owner of Grey Sweater, won the 2023 James Beard Award for Best Chef Southwest.[111]

The Food Network show *Diners, Drive-Ins, and Dives* has been to several restaurants in the Oklahoma City metropolitan area. Some of these include Cattlemen's Steakhouse, Chick N Beer, Clanton's Cafe, The Diner, Eischen's Bar, Florence's Restaurant, and Guyutes, among several others.[112]

Sports

[edit]
Main article: Sports in Oklahoma City



Chickasaw Bricktown Ballpark, home of the Oklahoma City Comets

Oklahoma City is home to several professional sports teams, including the Oklahoma City Thunder of the National Basketball Association. The Thunder is the city's second "permanent" major professional sports franchise after the now-defunct AFL Oklahoma Wranglers. It is the third major-league team to call the city home when considering the temporary hosting of the New Orleans/Oklahoma City Hornets for the 2005–06 and 2006–07 NBA seasons. However, the Thunder was formerly the Sonics before the movement of the Sonics to OKC in 2008.

Other professional sports clubs in Oklahoma City include the Oklahoma City Comets, the Triple-A affiliate of the Los Angeles Dodgers, the Oklahoma City Energy FC of the United Soccer League, and the Crusaders of Oklahoma Rugby Football Club of USA Rugby. The Oklahoma City Blazers, a name used for decades of the city's hockey team in the Central Hockey League, has been used for a junior team in the Western States Hockey League since 2014.

The Paycom Center in downtown is the main multipurpose arena in the city, which hosts concerts, NHL exhibition games, and many of the city's pro sports teams. In 2008, the Oklahoma City Thunder became the primary tenant. Nearby in Bricktown, the Chickasaw Bricktown Ballpark is the home to the city's baseball team, the Comets. "The Brick", as it is locally known, is considered one of the finest minor league parks in the nation.[113]

Oklahoma City hosts the World Cup of Softball and the annual NCAA Women's College World Series. The city has held 2005 NCAA Men's Basketball First and Second round and hosted the Big 12 Men's and women's basketball tournaments in 2007 and 2009. The major universities in the area – University of Oklahoma, Oklahoma City University, and Oklahoma State University – often schedule major basketball games and other sporting events at Paycom Center and Chickasaw Bricktown Ballpark. However, most home games are played at their campus stadiums.

Other major sporting events include Thoroughbred and Quarter Horse racing circuits at Remington Park and numerous horse shows and equine events that take place at the state fairgrounds each year. There are multiple golf courses and country clubs spread around the city.

High school football

[edit]

The state of Oklahoma hosts a highly competitive high school football culture, with many teams in the Oklahoma City metropolitan area. The Oklahoma Secondary School Activities Association (OSSAA) organizes high school football into eight distinct classes based on school enrollment size. Beginning with the largest, the classes are 6A, 5A, 4A, 3A, 2A, A, B, and C. Class 6A is broken into two divisions. Oklahoma City schools in include: Westmoore, Putnam City North, Putnam City, Putnam City West, Southeast, Capitol Hill, U.S. Grant, and Northwest Classen.[114]

Oklahoma City Thunder

[edit]

The Oklahoma City Thunder of the National Basketball Association (NBA) has called Oklahoma City home since the 2008–09 season, when owner Clay Bennett relocated the franchise from Seattle, Washington. The Thunder plays home games in downtown Oklahoma City at the Paycom Center. The Thunder is known by several nicknames, including "OKC Thunder" and simply "OKC", and its mascot is Rumble the Bison.

After arriving in Oklahoma City for the 2008–09 season, the Oklahoma City Thunder secured a berth (8th) in the 2010 NBA Playoffs the following year after boasting its first 50-win season, winning two games in the first round against the Los Angeles Lakers. In 2012, Oklahoma City made it to the NBA Finals but lost to the Miami Heat in five games. In 2013, the Thunder reached the Western Conference semi-finals without All-Star guard Russell Westbrook, who was injured in their first-round series against the Houston Rockets, only to lose to the Memphis Grizzlies. In 2014, Oklahoma City reached the NBA's Western Conference Finals again but eventually lost to the San Antonio Spurs in six games.

Sports analysts have regarded the Oklahoma City Thunder as one of the elite franchises of the NBA's Western Conference and a media darling of the league's future. Oklahoma City earned Northwest Division titles every year from 2011 to 2014

and again in 2016 and has consistently improved its win record to 59 wins in 2014. The Thunder is led by third-year head coach Mark Daigneault and was anchored by All-Star point guard Russell Westbrook before a July 2019 trade that sent him to the Houston Rockets.

Hornets

[edit]
Main article: Effect of Hurricane Katrina on the New Orleans Hornets

In the aftermath of Hurricane Katrina, the NBA's New Orleans Hornets temporarily relocated to the Ford Center, playing the majority of its home games there during the 2005–06 and 2006–07 seasons. The team became the first NBA franchise to play regular-season games in Oklahoma.[*citation needed*] The team was known as the New Orleans/Oklahoma City Hornets while playing in Oklahoma City. The team returned to New Orleans full-time for the 2007–08 season. The Hornets played their final home game in Oklahoma City during the exhibition season on October 9, 2007, against the Houston Rockets.

Professional sports teams

[edit]
Main article: Sports in Oklahoma City

Current professional sports teams

Sports Franchise	League	Sport	Founded	Stadium (capacity)
Oklahoma City Thunder	NBA	Basketball	2008	Paycom Center (18,203)
Oklahoma City Comets	MiLB	Baseball	1998	Chickasaw Bricktown Ballpark (13,066)

Oklahoma City Blue	NBA G League	Basketball	2018	Paycom Center (18,203)
Oklahoma City Energy	USL Championship (Division 2)	Soccer	2018	Taft Stadium (7,500)
Oklahoma City Football Club	Women's Premier Soccer League	Soccer	2022	Brian Harvey Field (1,500)
Oklahoma City Spark	Women's Professional Fastpitch	Softball	2023	USA Softball Hall of Fame Stadium (13,500)

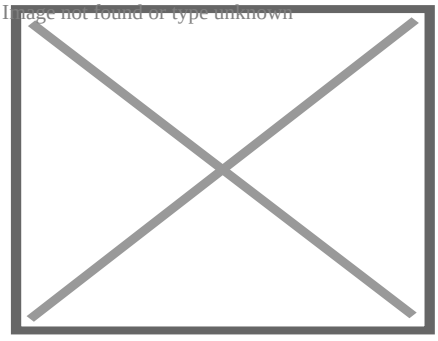
2028 Olympics

[edit]

Venues in Oklahoma City will host two events during the 2028 Summer Olympics, which will primarily be held in Los Angeles. The LA Olympic Organizing Committee opted to have canoe slalom and softball in Oklahoma City, given the lack of acceptable venues for those sports in Los Angeles. Riversport OKC will host the canoe slalom competition, while Devon Park will host the softball competition. Oklahoma City is located approximately 1,300 miles away from Los Angeles.[115]

Parks and recreation

[edit]



Myriad Botanical Gardens, the centerpiece of downtown OKC's central business district

One of the more prominent landmarks of downtown Oklahoma City is the Crystal Bridge tropical conservatory at the Myriad Botanical Gardens, a large downtown urban park. Designed by I. M. Pei, the park also includes the Water Stage amphitheater, a bandshell, and lawn, a sunken pond complete with koi, an interactive children's garden complete with a carousel and water sculpture, various trails and interactive exhibits that rotate throughout the year including the ice skating in the Christmas winter season. In 2007, following a renovation of the stage, *Oklahoma Shakespeare In The Park* relocated to the Myriad Gardens. Bicentennial Park, also downtown located near the Oklahoma City Civic Center campus, is home to the annual *Festival of the Arts* in April.

The Scissortail Park is just south of the Myriad Gardens, a large interactive park that opened in 2021. This park contains a large lake with paddleboats, a dog park, a concert stage with a great lawn, a promenade including the Skydance Bridge, a children's interactive splash park and playground, and numerous athletic facilities. Farmers Market is a common attraction at Scissortail Park during the season, and there are multiple film showings, food trucks, concerts, festivals, and civic gatherings.

Returning to the city's first parks masterplan, Oklahoma City has at least one major park in each quadrant outside downtown. Will Rogers Park, the Grand Boulevard loop once connected Lincoln Park, Trosper Park, and Woodson Park, some sections of which no longer exist. Martin Park Nature Center is a natural habitat in far northwest Oklahoma City. Will Rogers Park is home to the *Lycan Conservatory*, the Rose Garden, and the Butterfly Garden, all built in the WPA era. In April 2005, the *Oklahoma City Skate Park* at Wiley Post Park was renamed the *Mat Hoffman Action Sports Park* to recognize Mat Hoffman, an Oklahoma City area resident and businessman who was instrumental in the design of the skate park and is a 10-time BMX World Vert champion.[116]

Walking trails line the Bricktown Canal and the Oklahoma River in downtown. The city's bike trail system follows around Lake Hefner and Lake Overholser in the northwest and west quadrants of the city. The majority of the east shore area of Lake Hefner is taken up by parks and bike trails, including a new leashless dog park and the postwar-era *Stars and Stripes Park*, and eateries near the lighthouse. Lake

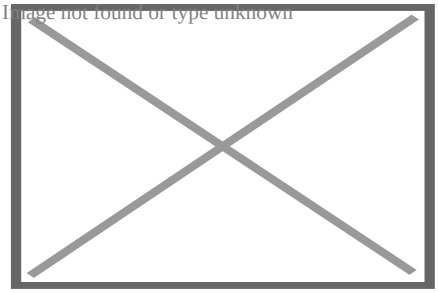
Stanley Draper, in southeast Oklahoma City, is the city's largest and most remote lake, offering a genuine rural yet still urban experience.

The Oklahoma City Zoo and Botanical Garden is home to numerous natural habitats, WPA era architecture and landscaping, and major touring concerts during the summer at its amphitheater. Nearby is a combination racetrack and casino, Remington Park, which hosts both Quarter Horse (March – June) and Thoroughbred (August—December) seasons.

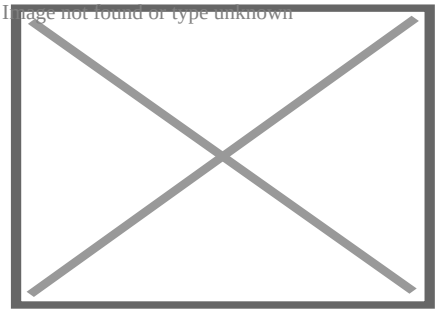
Oklahoma City is also home to the American Banjo Museum, which houses a large collection of highly decorated banjos from the early 20th century and exhibits the banjo's history and its place in American history. Concerts and lectures are also held there.

Government

[edit]
Main article: Government of Oklahoma City
See also: List of mayors of Oklahoma City



Oklahoma State Capitol, seen from the OK History Center



The Art Deco city hall building, a block from the Civic Center

The City of Oklahoma City has operated under a council–manager form of city government since 1927.[117] David Holt assumed the office of Mayor on April 10, 2018, after being elected two months earlier.[118] Eight councilpersons represent each of the eight wards of Oklahoma City. The City Council appointed current City Manager Craig Freeman on November 20, 2018. Freeman took office on January 2, 2018, succeeding James D. Couch, who had served in the role since 2000. Before becoming City Manager, Craig Freeman served as Finance Director for the city.[119]

Politics

[edit]

Similar to many American cities, Oklahoma City is politically conservative in its suburbs and liberal in the central city. In the United States House of Representatives, it is represented by Republicans Stephanie Bice and Tom Cole of the 5th and 4th districts, respectively. The city has called on residents to vote for sales tax–based projects to revitalize parts of the city. The Bricktown district is the best example of such an initiative. In the recent MAPS 3 vote, the city's fraternal police order criticized the project proposals for not doing enough to expand the police presence to keep up with the growing residential population and increased commercial activity. In September 2013, Oklahoma City area attorney David Slane announced he would pursue legal action regarding MAPS3 on claims the multiple projects that made up the plan violate a state constitutional law limiting voter ballot issues to a single subject.[120]

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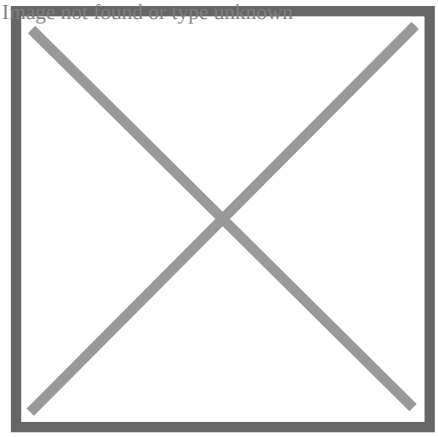

Oklahoma City region population dot map and 2016 presidential election results by precinct (click to enlarge).

Oklahoma County Voter Registration and Party Enrollment as of November 1, 2020[121]

Party	Number of Voters	Percentage
Democratic	164,628	37.26%
Republican	189,991	43.00%
Libertarian	3,385	0.77%
Unaffiliated	83,799	18.97%
Total	**441,803**	**100%**

International relations

Consulates

[edit]

Consulate	Date	Consular District
Guatemalan Consulate-General, Oklahoma City[122]	06.2017	Oklahoma, Kansas
Mexican Consulate, Oklahoma City[123]	05.2023	Oklahoma

Germany Honorary Consulate, Oklahoma City		

Twin towns – sister cities

[edit]

Oklahoma City's sister cities are:[124]

- Brazil – Rio de Janeiro, Brazil
- China – Haikou, China
- Mexico – Puebla, Mexico
- Peru – Piura, Peru
- Rwanda – Kigali, Rwanda
- Russia – Ulyanovsk, Russia (suspended August, 2022)
- Taiwan – Tainan, Taiwan
- Taiwan – Taipei, Taiwan
- Australia – Darwin, Australia

Education

[edit]

Higher education

[edit]

See also: List of colleges and universities in Oklahoma City

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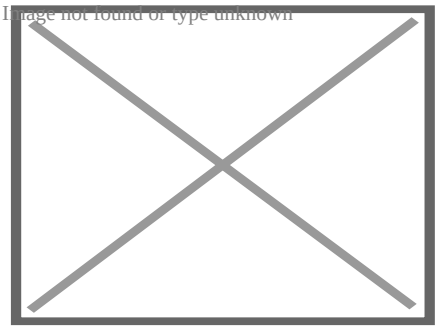


OU Health Sciences Center in Oklahoma City

The city is home to several colleges and universities. Oklahoma City University, formerly known as Epworth University, was founded by the United Methodist Church on September 1, 1904, and is known for its performing arts, science, mass communications, business, law, and athletic programs. OCU has its main campus in the north-central section of the city, near the city's Asia District area. OCU Law is in the old Central High School building in the Midtown district near downtown.

The University of Oklahoma has several institutions of higher learning in the city and metropolitan area, with OU Medicine and the University of Oklahoma Health Sciences Center campuses east of downtown in the Oklahoma Health Center district, and the main campus to the south in the suburb of Norman. OU Medical Center hosts the state's only Level-One trauma center. OU Health Sciences Center is one of the nation's largest independent medical centers, employing over 12,000 people.[125] OU is one of only four major universities in the nation to operate six medical schools.[*clarifica*

The third-largest university in the state, the University of Central Oklahoma, is just north of the city in the suburb of Edmond. Oklahoma Christian University, one of the state's private liberal arts institutions, is just south of the Edmond border, inside the Oklahoma City limits.[126]

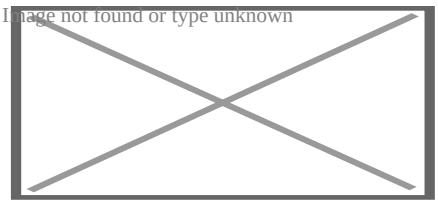
Oklahoma City Community College in south Oklahoma City is the second-largest community college in the state. Rose State College is east of Oklahoma City in suburban Midwest City. Oklahoma State University–Oklahoma City is in the "Furniture District" on the Westside. Northeast of the city is Langston University, the state's historically black college (HBCU). Langston also has an urban campus in the eastside section of the city. Southern Nazarene University, which was founded by the

Church of the Nazarene, is a university in suburban Bethany, which is surrounded by the Oklahoma City city limits.

Although technically not a university, the FAA's Mike Monroney Aeronautical Center has many aspects of an institution of higher learning. Its FAA Academy is accredited by the Higher Learning Commission. Its Civil Aerospace Medical Institute (CAMI) has a medical education division responsible for aeromedical education in general, as well as the education of aviation medical examiners in the U.S. and 93 other countries. In addition, The National Academy of Science offers Research Associateship Programs for fellowship and other grants for CAMI research.

Primary and secondary

[edit]
Main article: Education in Oklahoma City



Bishop McGuinness Catholic High School

Oklahoma City is home to (as of 2009) the state's largest school district, Oklahoma City Public Schools,[127] which covers the most significant portion of the city.[128] The district's Classen School of Advanced Studies and Harding Charter Preparatory High School rank high among public schools nationally according to a formula that looks at the number of Advanced Placement, International Baccalaureate and/or Cambridge tests taken by the school's students divided by the number of graduating seniors.[129] In addition, OKCPS's Belle Isle Enterprise Middle School was named the top middle school in the state according to the Academic Performance Index and recently received the Blue Ribbon School Award, in 2004 and again in 2011.[130]

Due to Oklahoma City's explosive growth, parts of several suburban districts spill into the city. All but one of the school districts in Oklahoma County includes portions of Oklahoma City. The other districts in that county covering OKC include: Choctaw/Nicoma Park, Crooked Oak, Crutcho, Deer Creek, Edmond, Harrah, Jones, Luther, McLoud, Mid-Del, Millwood, Moore, Mustang, Oakdale, Piedmont, Putnam City, and Western Heights.[128] School districts in Cleveland County covering portions of Oklahoma City include: Little Axe, McLoud, Mid-Del, Moore, and Robin Hill.[131] Within Canadian County, Banner, Mustang, Piedmont, Union City, and Yukon school districts include parts of OKC.[132]

There are also charter schools. KIPP Reach College Preparatory School in Oklahoma City received the 2012 National Blue Ribbon, and its school leader, Tracy McDaniel Sr., was awarded the Terrel H. Bell Award for Outstanding Leadership.

The city also boasts several private and parochial schools. Casady School and Heritage Hall School are both examples of a private college preparatory school with rigorous academics that range among the top in Oklahoma. Providence Hall is a Protestant school. Two prominent schools of the Archdiocese of Oklahoma City include Bishop McGuinness High School and Mount Saint Mary High School. Other private schools include the Advanced Science and Technology Education Center and Crossings Christian School.

The Oklahoma School of Science and Mathematics, a school for some of the state's most gifted math and science pupils, is also in Oklahoma City.

CareerTech

[edit]

Oklahoma City has several public career and technology education schools associated with the Oklahoma Department of Career and Technology Education, the largest of which are Metro Technology Center and Francis Tuttle Technology Center.

Private career and technology education schools in Oklahoma City include Oklahoma Technology Institute, Platt College, Vatterott College, and Heritage College. The Dale Rogers Training Center is a nonprofit vocational training center for individuals with disabilities.

Media

[edit]
See also: Media in Oklahoma City

Print

[edit]

The Oklahoman is Oklahoma City's major daily newspaper and is the most widely circulated in the state. NewsOK.com is the Oklahoman's online presence. *Oklahoma Gazette* is Oklahoma City's independent newsweekly, featuring such staples as local commentary, feature stories, restaurant reviews, movie listings, and music and entertainment. *The Journal Record* is the city's daily business newspaper, and *okcBIZ* is a monthly publication that covers business news affecting those who live and work in Central Oklahoma.

Numerous community and international newspapers cater to the city's ethnic mosaic, such as *The Black Chronicle*, headquartered in the Eastside, the OK VIETIMES and *Oklahoma Chinese Times*, in Asia District, and various Hispanic community publications. *The Campus* is the student newspaper at Oklahoma City University. Gay publications include *The Gayly Oklahoman*.

An upscale lifestyle publication called *405 Magazine* (formerly Slice Magazine) is circulated throughout the metropolitan area.[133] In addition, there is a magazine published by *Back40 Design Group* called *The Edmond Outlook*. It contains local commentary and human interest pieces directly mailed to over 50,000 Edmond residents.

Ready Player One is set in Oklahoma City in the year 2045.

Broadcast

[edit]

Oklahoma City was home to several pioneers in radio and television broadcasting. Oklahoma City's WKY Radio was the first radio station transmitting west of the Mississippi River and the third radio station in the United States.[134] WKY received its federal license in 1921 and has continually broadcast under the same call letters since 1922. In 1928, WKY was purchased by E.K. Gaylord's Oklahoma Publishing Company and affiliated with the NBC Red Network; in 1949, WKY-TV (channel 4) went on the air and later became the first independently owned television station in the U.S. to broadcast in color.[134] In mid-2002, WKY radio was purchased outright by Citadel Broadcasting, who was bought out by Cumulus Broadcasting in 2011. The Gaylord family earlier sold WKY-TV in 1976, which has gone through a succession of owners (what is now KFOR-TV is owned by Nexstar Media Group as of October 2019).

The major U.S. broadcast television networks have affiliates in the Oklahoma City market (ranked 41st for television by Nielsen and 48th for radio by Arbitron, covering a 34-county area serving the central, north-central and west-central sections of Oklahoma); including NBC affiliate KFOR-TV (channel 4), ABC affiliate KOCO-TV (channel 5), CBS affiliate KWTV-DT (channel 9, the flagship of locally based Griffin Media), PBS station KETA-TV (channel 13, the flagship of the state-run OETA member network), Fox affiliate KOKH-TV (channel 25), independent station KOCB (channel 34), CW owned-and-operated station KAUT-TV (channel 43), MyNetworkTV affiliate KSBI-TV (channel 52), and Ion Television affiliate KOPX-TV (channel 62). The market is also home to several religious stations, including TBN owned-and-operated station KTBO-TV (channel 14) and Norman-based Daystar owned-and-operated station KOCM (channel 46).

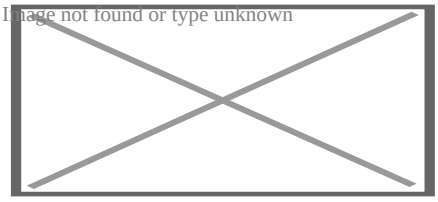
Despite the market's geographical size, none of the English-language commercial affiliates in the Oklahoma City designated market area operate full-power satellite stations covering the far northwestern part of the state (requiring cable or satellite to view them). However, KFOR-TV, KOCO-TV, KWTV-DT, and KOKH-TV each operate low-power translators in that portion of the market. Oklahoma City is one of the few markets between Chicago and Dallas to have affiliates of two or more of the significant Spanish-language broadcast networks: Telemundo affiliate KTUZ-TV (channel 30), Woodward-based Univision/UniMás affiliate KUOK 35 (whose translator KUOK-CD, channel 36, serves the immediate Oklahoma City area), and Estrella TV affiliate KOCY-LD (channel 48). (Locally based Tyler Media Group, which owns the three stations above, also owns eight radio stations in the market, including Regional Mexican-formatted KTUZ-FM (106.7) and news–talk outlet KOKC (1520 AM).)

Infrastructure

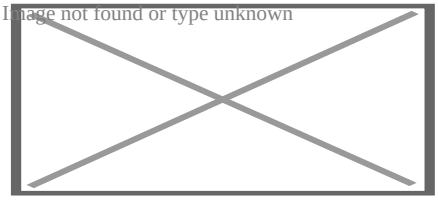
[edit]

Fire department

[edit]



OKCFD dive team at Lake Hefner



OKCFD ambulance

Oklahoma City is protected by the Oklahoma City Fire Department (OKCFD), which employs 1015 paid, professional firefighters. The current Chief of Department is Richard Kelley, and the department is commanded by three Deputy Chiefs, who – along with the department chief – oversee the Operational Services, Prevention Services, and Support Services bureaus. The OKCFD operates out of 37 fire stations throughout the city in six battalions. The OKCFD operates a fire apparatus fleet of 36 engine companies (including 30 paramedic engines), 13 ladder companies, 16 brush pumper units, six water tankers, two hazardous materials units, one Technical Rescue Unit, one Air Supply Unit, six Arson Investigation Units, and one Rehabilitation Unit along with several special units. Each engine Company is staffed with a driver, an officer, and one to two firefighters, while each ladder company is staffed with a driver, an officer, and one firefighter. The minimum staffing for each shift is 213 personnel. The Oklahoma City Fire Department responds to over 70,000 emergency calls annually.[135][136][137]

Transportation

[edit]
Main article: Transportation in Oklahoma City

Highway

[edit]

Oklahoma City is an integral point on the United States Interstate Network, with three major interstate highways – Interstate 35, Interstate 40, and Interstate 44 – bisecting the city. Interstate 240 connects Interstate 40 and Interstate 44 in south Oklahoma City. At the same time, Interstate 235 spurs from Interstate 44 in north-central Oklahoma City into downtown. Interstate 44, between NW 23rd St and NW 36th St, is the busiest roadway in the city and state, with an average daily traffic count of 167,200 vehicles per day in 2018.[138]

Major state expressways through the city include Lake Hefner Parkway (SH-74), the Kilpatrick Turnpike, Airport Road (SH-152), and Broadway Extension (US-77) which continues from I-235 connecting Central Oklahoma City to Edmond. Lake Hefner Parkway runs through northwest Oklahoma City, while Airport Road runs through southwest Oklahoma City and leads to Will Rogers World Airport. The Kilpatrick Turnpike loops around north and west Oklahoma City.

Oklahoma City also has several major national and state highways within its city limits. Shields Boulevard (US-77) continues from E.K. Gaylord Boulevard in downtown Oklahoma City and runs south, eventually connecting to I-35 near the suburb of Moore, Oklahoma. Northwest Expressway (Oklahoma State Highway 3) runs from North Classen Boulevard in north-central Oklahoma City to the northwestern suburbs.

The following significant expressways traverse Oklahoma City:

- Interstate 35
- Interstate 40 (Crosstown Expressway, Stanley Draper Expressway, Tinker Diagonal, Tom Stead Memorial Highway)
- Interstate 44 (Turner Turnpike, Belle Isle Freeway, Will Rogers Expressway, H.E. Bailey Turnpike)
- Interstate 235 (Centennial Expressway) / U.S. 77 (Broadway Extension)
- Interstate 240 (Southwest Expressway)
- Lake Hefner Parkway (State Highway 74)
- Airport Road (State Highway 152)
- Kilpatrick Turnpike

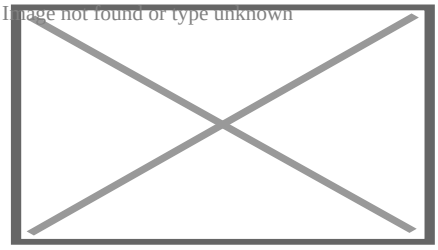
Air

[edit]

Oklahoma City is served by two primary airports, Will Rogers World Airport and the much smaller Wiley Post Airport (incidentally, the two honorees died in the same plane crash in Alaska)[139] Will Rogers World Airport is the state's busiest commercial

airport, with 4,341,159 passengers served in 2018, a historical record.[140]

Tinker Air Force Base, in southeast Oklahoma City, is the largest military air depot in the nation. It is a major maintenance and deployment facility for the Navy and the Air Force and the second largest military institution in the state (after Fort Sill in Lawton).



United Airlines Embraer 170 aircraft at the East Concourse of Will Rogers World Airport

Rail and intercity bus

[edit]

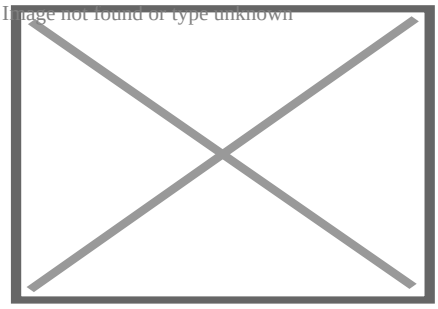
Amtrak has a station downtown at the Santa Fe Depot, with daily service to Fort Worth and the nation's rail network via the Heartland Flyer. Oklahoma City once was the crossroads of several interstate passenger railroads at the Santa Fe Depot, the Union Station, and the Missouri–Kansas–Texas Railroad station.[141] But service at that level has long since been discontinued. However, several proposals to extend the current train service have been made, including a plan to expand the Heartland Flyer to Newton, Kansas, which is currently being connected through Amtrak Thruway. Freight service is provided by BNSF Railway, Union Pacific Railroad, and Stillwater Central.

Greyhound and several other intercity bus companies serve Oklahoma City at the Union Bus Station in downtown.

Public transit

[edit]

Main articles: Embark (transit authority) and Oklahoma City Streetcar



Streetcar of the OKC Streetcar system passing the historic First United Methodist Church, in downtown

Embark (formerly Metro Transit) is the city's public transit company. The primary transfer terminal is downtown at NW 5th Street and Hudson Avenue. Embark maintains limited coverage of the city's primary street grid using a hub-and-spoke system from the main terminal, making many journeys impractical due to the relatively small number of bus routes offered and that most trips require a transfer downtown. The city has recognized transit as a significant issue for the rapidly growing and urbanizing city. It has initiated several recent studies to improve the existing bus system, starting with a plan known as the Fixed Guideway Study.[142] This study identified several potential commuter transit routes from the suburbs into downtown OKC as well as feeder-line bus and/or rail routes throughout the city.

Though Oklahoma City has no light rail or commuter rail service, city residents identified improved transit as one of their top priorities. From the fruits of the Fixed Guideway and other studies, city leaders strongly desire to incorporate urban rail transit into the region's future transportation plans. The greater Oklahoma City metropolitan transit plan identified from the Fixed Guideway Study includes a streetcar system in the downtown area, to be fed by enhanced city bus service and commuter rail from the suburbs including Edmond, Norman, and Midwest City. There is a significant push for a commuter rail line connecting downtown OKC with the eastern suburbs of Del City, Midwest City, and Tinker Air Force Base. In addition to commuter rail, a short heritage rail line that would run from Bricktown just a few blocks away from the Amtrak station to the Adventure District in northeast Oklahoma City is under reconstruction.

In December 2009, Oklahoma City voters passed MAPS 3, the $777 million (7-year, 1-cent tax) initiative. This initiative would generate funding (approx. $130 million) for the modern Oklahoma City Streetcar system in downtown Oklahoma City and the establishment of a transit hub.

On September 10, 2013, the federal government announced that Oklahoma City would receive a $13.8-million grant from the U.S. Department of Transportation's TIGER program. This was the first-ever grant for Oklahoma City for a rail-based initiative and is thought to be a turning point for city leaders who have applied for grants in the past, only to be denied continuously. It is believed the city will use the TIGER grant along with approximately $10 million from the MAPS 3 Transit budget to revitalize the city's Amtrak station, becoming an Intermodal Transportation Hub, taking over the role of the existing transit hub at NW 5th/Hudson Ave.[*citation needed*]

Construction of the Oklahoma City Streetcar system in Downtown OKC began in early 2017,[143] and the system opened for service in December 2018.[144][145] Also known as the Maps 3 Streetcar, it connects the areas of Bricktown, Midtown and Downtown. The 6.9 mi (11.1 km) system serves the greater Downtown area using modern low-floor streetcars. The initial system consists of two lines connecting Oklahoma City's Central Business District with the entertainment district, Bricktown, and the Midtown District. Expansion to other districts surrounding downtown and more routes in the CBD is already underway.[*citation needed*]

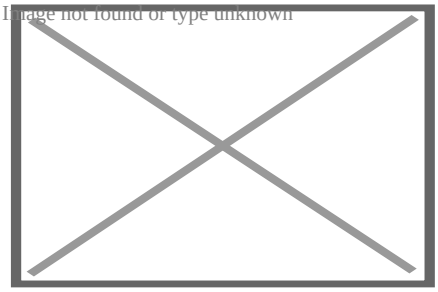
Walkability

[edit]

A 2013 study by Walk Score ranked Oklahoma City the 43rd most walkable out of the 50 largest U.S. cities. Oklahoma City has 18 neighborhoods with a Walk Score above 60, mainly close to the downtown core.[146]

Health

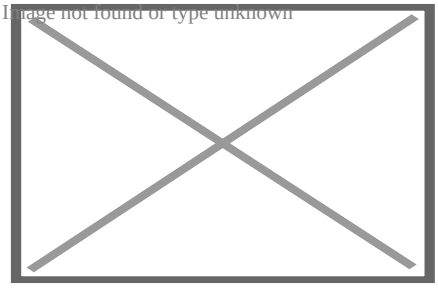
[edit]



OU Physicians Center

Oklahoma City and the surrounding metropolitan area have several healthcare facilities and specialty hospitals. In Oklahoma City's MidTown district near downtown resides the state's oldest and largest single-site hospital, St. Anthony Hospital and Physicians Medical Center.

OU Medicine, an academic medical institution on the campus of The University of Oklahoma Health Sciences Center, is home to OU Medical Center. OU Medicine operates Oklahoma's only level-one trauma center at the OU Medical Center and the state's only level-one trauma center for children at Children's Hospital at OU Medicine,[147] both of which are in the Oklahoma Health Center district. Other medical facilities operated by OU Medicine include OU Physicians and OU Children's Physicians, the OU College of Medicine, the Oklahoma Cancer Center, and OU Medical Center Edmond, the latter in the northern suburb of Edmond.



INTEGRIS Baptist Medical Center

INTEGRIS Health owns several hospitals, including INTEGRIS Baptist Medical Center, the INTEGRIS Cancer Institute of Oklahoma,[148] and the INTEGRIS Southwest Medical Center.[149] INTEGRIS Health operates hospitals, rehabilitation centers, physician clinics, mental health facilities, independent living centers, and home health agencies throughout much of Oklahoma. INTEGRIS Baptist Medical Center ranks high-performing in the following categories: Cardiology and Heart Surgery; Diabetes and Endocrinology; Ear, Nose and Throat; Gastroenterology; Geriatrics; Nephrology; Orthopedics; Pulmonology and Urology.

The Midwest Regional Medical Center is in the suburb of Midwest City; other significant hospitals include the Oklahoma Heart Hospital and the Mercy Health Center. There are 347 physicians for every 100,000 people in the city.

In the American College of Sports Medicine's annual ranking of the United States' 50 most populous metropolitan areas on the basis of community health, Oklahoma City took last place in 2010, falling five spots from its 2009 rank of 45.[150] The ACSM's report, published as part of its American Fitness Index program, cited, among other things, the poor diet of residents, low levels of physical fitness, higher incidences of obesity, diabetes, and cardiovascular disease than the national average, low access to recreational facilities like swimming pools and baseball diamonds, the paucity of parks and low investment by the city in their development, the high percentage of households below the poverty level, and the lack of state-mandated physical education curriculum as contributing factors.[151]

Notable people

[edit]
For a more comprehensive list, see List of people from Oklahoma City.

See also

[edit]

- Coyle v. Smith
- History of Oklahoma
- List of mayors of Oklahoma City

- USS *Oklahoma City*, 2 ships

Portals:

- Geography
- North America
- Oklahoma
- United States
- Cities

Notes

[edit]

1. ^ Mean monthly maxima and minima (i.e. the expected highest and lowest temperature readings at any point during the year or given month) calculated based on data at said location from 1991 to 2020.
2. ^ Official records for Oklahoma City were kept at the Weather Bureau Office from November 1890 to December 1953, and at Will Rogers World Airport since January 1954. For more information, see Threadex

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- Official city website
- Oklahoma City tourism information
- Convention & Visitors' Bureau

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- OKC.NET cultural commentary about Oklahoma City
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City of Oklahoma City

- Bombing
- Climate
- Education
- Government
- People
- History
- Timeline
- Mayors
- Media
- Transportation
    - Streetcar

Districts	○ Adventure District ○ Asia District ○ Capitol Hill ○ Downtown ○ Eastside ○ Midtown ○ Paseo ○ 39th Street ○ Uptown ○ Western Avenue
Professional sports teams	○ Oklahoma City Thunder ○ Oklahoma City Blue ○ Oklahoma City Comets ○ Oklahoma City Energy FC ○ Oklahoma City Spark

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- State of Oklahoma

Articles relating to Oklahoma City

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Municipalities of the Greater Oklahoma City metropolitan area

Population over 500,000	○ Oklahoma City
Population over 100,000	○ Norman

Population over 50,000	○ Edmond ○ Midwest City ○ Moore
Population over 20,000	○ Bethany ○ Del City ○ Mustang ○ Shawnee ○ Yukon
Population over 10,000	○ Chickasha ○ Choctaw ○ El Reno ○ Guthrie ○ Newcastle ○ Warr Acres
Population over 5,000	○ Blanchard ○ Harrah ○ Noble ○ Piedmont ○ Purcell ○ Tecumseh ○ Tuttle ○ The Village

Population over 2,000	○ Bethel Acres ○ Chandler ○ Goldsby ○ Jones ○ Lexington ○ McLoud ○ Nichols Hills ○ Nicoma Park ○ Pink ○ Prague ○ Slaughterville ○ Spencer ○ Stroud
Population over 1,000	○ Crescent ○ Forest Park ○ Langston ○ Luther ○ Maud ○ Meeker ○ Minco ○ Ninnekah ○ Okarche ○ Rush Springs ○ Union City

Population over 500	○ Carney ○ Cashion ○ Cole ○ Davenport ○ Dibble ○ Earlsboro ○ Valley Brook ○ Verden ○ Washington ○ Wayne ○ Wellston
Population over 200	○ Alex ○ Agra ○ Amber ○ Asher ○ Bridge Creek ○ Byars ○ Calumet ○ Cedar Valley ○ Coyle ○ Johnson ○ Marshall ○ Mulhall ○ Tribbey ○ Tryon ○ Wanette

Population under 200	○ Arcadia ○ Bradley ○ Brooksville ○ Cimarron City ○ Etowah ○ Fallis ○ Kendrick ○ Lake Aluma ○ Macomb ○ Meridian ○ Norge ○ Orlando ○ Pocasset ○ Rosedale ○ Smith Village ○ Sparks ○ St. Louis ○ Warwick ○ Woodlawn Park
Counties	○ Canadian ○ Cleveland ○ Grady ○ Logan ○ Lincoln ○ McClain ○ Oklahoma ○ Pottawatomie
Metropolitan planning organization	○ Association of Central Oklahoma Governments

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Skyscrapers in Oklahoma City

Current

- Devon Energy Center
- BancFirst Tower
- First National Center
- City Place
- Oklahoma Tower
- BOK Park Plaza
- Strata Tower
- Valliance Bank Tower
- Bank of Oklahoma Plaza
- Leadership Square
- Regency Tower
- Founders Tower
- Mid America Tower
- Union Plaza
- The Classen
- Dowell Center
- 101 Park Avenue Building
- 100 Park Avenue Building
- Colcord Hotel
- 50 Penn Place
- Skirvin Hilton Hotel
- Oklahoma County Courthouse

See also

- List of tallest buildings in Oklahoma City

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State of Oklahoma

Oklahoma City (capital)

Topics

- Index
- Climate change
- Earthquakes
- Geography
- Government
  - governor (list)
- History
  - Land Rush of 1889, 1891, 1892, 1893, and 1895
  - Unassigned Lands
- Mass media
  - newspapers
  - radio
  - TV
- People
- Sports
- Symbols
- Tourist attractions

Society

- Abortion
- Cannabis
- Culture
- Crime
- Demographics
- Economy
- Education
- Gun laws
- LGBT rights
- Politics

Regions	○ Arklatex ○ Central ○ Cherokee Outlet ○ Choctaw Country ○ Cross Timbers ○ Four State Area ○ Flint Hills ○ Green Country ○ Little Dixie ○ Northwestern ○ Oklahoma City Metro ○ Ouachita Mountains ○ The Ozarks ○ Panhandle ○ South Central ○ Southwestern ○ Texoma ○ Tulsa Metro ○ Western

Largest cities	○ Ardmore ○ Bartlesville ○ Bixby ○ Broken Arrow ○ Del City ○ Duncan ○ Edmond ○ Enid ○ Lawton ○ Midwest City ○ Muskogee ○ Moore ○ Norman ○ Oklahoma City ○ Owasso ○ Ponca City ○ Shawnee ○ Stillwater ○ Tulsa ○ Yukon

- Adair
- Alfalfa
- Atoka
- Beaver
- Beckham
- Blaine
- Bryan
- Caddo
- Canadian
- Carter
- Cherokee
- Choctaw
- Cimarron
- Cleveland
- Coal
- Comanche
- Cotton
- Craig
- Creek
- Custer
- Delaware
- Dewey
- Ellis
- Garfield
- Garvin
- Grady
- Grant
- Greer
- Harmon
- Harper
- Haskell
- Hughes
- Jackson
- Jefferson
- Johnston
- Kay
- Kingfisher

flag Oklahoma portal

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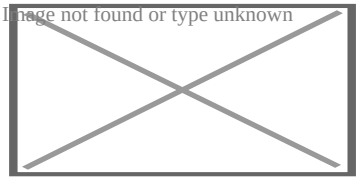
Municipalities and communities of Canadian County, Oklahoma, United States

County seat: **El Reno**

Cities	○ El Reno ○ Geary[] ○ Mustang ○ Oklahoma City[] ○ Piedmont[]
Towns	○ Yukon ○ Calumet ○ Okarche[] ○ Union City
CDP	○ Cedar Lake
Other communities	○ Concho ○ Scott[]
Footnotes	[]This populated place also has portions in an adjacent county or counties



Canadian County map

- Oklahoma portal
- United States portal

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Municipalities and communities of Cleveland County, Oklahoma, United States

County seat: **Norman**

Cities	○ Lexington ○ Moore ○ Noble ○ Norman ○ Oklahoma City[] ○ Purcell[]
Towns	○ Etowah ○ Slaughterville
Neighborhood	○ Hall Park
Footnotes	[]This populated place also has portions in an adjacent county or counties

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Cleveland County map

○ Oklahoma portal
○ United States portal

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Municipalities and communities of Oklahoma County, Oklahoma, United States

County seat: **Oklahoma City**

Cities	○ Bethany ○ Choctaw ○ Del City ○ Edmond ○ Harrah ○ Midwest City ○ Nichols Hills ○ Nicoma Park ○ Oklahoma City[1] ○ Spencer ○ The Village ○ Warr Acres
Towns	○ Arcadia ○ Forest Park ○ Jones ○ Lake Aluma ○ Luther ○ Smith Village ○ Valley Brook ○ Woodlawn Park
Unincorporated communities	○ Britton ○ Crutcho ○ Newalla ○ Wheatland
Footnotes	[1]This populated place also has portions in an adjacent county or counties

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Oklahoma County map

- Oklahoma portal
- United States portal

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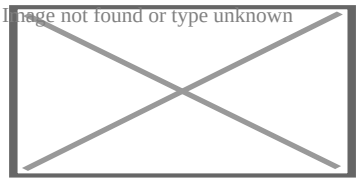
Municipalities and communities of Pottawatomie County, Oklahoma, United States

County seat: **Shawnee**

Cities	○ Maud ○ Oklahoma City ○ Shawnee ○ Tecumseh
Towns	○ Asher ○ Bethel Acres ○ Brooksville ○ Earlsboro ○ Johnson ○ Macomb ○ McLoud ○ Pink ○ St. Louis ○ Tribbey ○ Wanette
CDP	○ Dale ○ Aydelotte ○ Bellemont ○ Centerview
Other communities	○ Garden Grove ○ Harjo ○ Pearson ○ Romulus ○ Sacred Heart ○ Trousdale
Ghost towns	○ Avoca ○ Keokuk Falls



Pottawatomie County map

Footnotes

 This populated place also has portions in an adjacent county or counties

- Oklahoma portal
- United States portal

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Capitals of the United States by jurisdiction

Nation:

- **US** Washington, D.C.

States:

- **AL** Montgomery
- **AK** Juneau
- **AZ** Phoenix
- **AR** Little Rock
- **CA** Sacramento
- **CO** Denver
- **CT** Hartford
- **DE** Dover
- **FL** Tallahassee
- **GA** Atlanta
- **HI** Honolulu
- **ID** Boise
- **IL** Springfield
- **IN** Indianapolis
- **IA** Des Moines
- **KS** Topeka
- **KY** Frankfort
- **LA** Baton Rouge
- **ME** Augusta
- **MD** Annapolis
- **MA** Boston
- **MI** Lansing
- **MN** Saint Paul
- **MS** Jackson
- **MO** Jefferson City
- **MT** Helena
- **NE** Lincoln
- **NV** Carson City
- **NH** Concord
- **NJ** Trenton
- **NM** Santa Fe

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County seats in Oklahoma

- Ada
- Altus
- Alva
- Anadarko
- Antlers
- Arapaho
- Ardmore
- Arnett
- Atoka
- Bartlesville
- Beaver
- Boise City
- Buffalo
- Chandler
- Cherokee
- Cheyenne
- Chickasha
- Claremore
- Coalgate
- Duncan
- Durant
- El Reno
- Enid
- Eufaula
- Fairview
- Frederick
- Guthrie
- Guymon
- Hobart
- Holdenville
- Hollis
- Hugo
- Idabel
- Jay
- Kingfisher
- Lawton
- Madill

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The 100 most populous cities of the United States

1. New York, New York
2. Los Angeles, California
3. Chicago, Illinois
4. Houston, Texas
5. Phoenix, Arizona
6. Philadelphia, Pennsylvania
7. San Antonio, Texas
8. Dallas, Texas
9. San Diego, California
10. Austin, Texas
11. Jacksonville, Florida
12. San Jose, California
13. Fort Worth, Texas
14. Columbus, Ohio
15. Charlotte, North Carolina
16. Indianapolis, Indiana
17. San Francisco, California
18. Seattle, Washington
19. Denver, Colorado
26. Portland, Oregon
27. Louisville, Kentucky
28. Memphis, Tennessee
29. Detroit, Michigan
30. Baltimore, Maryland
31. Milwaukee, Wisconsin
32. Albuquerque, New Mexico
33. Tucson, Arizona
34. Fresno, California
35. Sacramento, California
36. Mesa, Arizona
37. Kansas City, Missouri
38. Atlanta, Georgia
39. Colorado Springs, Colorado
40. Omaha, Nebraska
41. Raleigh, North Carolina
42. Virginia Beach,
51. Arlington, Texas
52. Aurora, Colorado
53. New Orleans, Louisiana
54. Cleveland, Ohio
55. Anaheim, California
56. Honolulu, Hawaii
57. Henderson, Nevada
58. Stockton, California
59. Riverside, California
60. Lexington, Kentucky
61. Corpus Christi, Texas
62. Orlando, Florida
63. Irvine, California
64. Cincinnati, Ohio
65. Santa Ana, California
66. Newark, New Jersey
67. Saint Paul, Minnesota
76. Chandler, Arizona
77. North Las Vegas, Nevada
78. Chula Vista, California
79. Buffalo, New York
80. Gilbert, Arizona
81. Reno, Nevada
82. Madison, Wisconsin
83. Fort Wayne, Indiana
84. Toledo, Ohio
85. Lubbock, Texas
86. St. Petersburg, Florida
87. Laredo, Texas
88. Irving, Texas
89. Chesapeake, Virginia
90. Glendale, Arizona
91. Winston-Salem, North Carolina
92. Scottsdale, Arizona

Cities ranked by United States Census Bureau population estimates for July 1, 2022.

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Geographic	○ MusicBrainz area
Other	○ IdRef ○ NARA

About Durham Supply Inc

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Things To Do in Tulsa County

Photo

Oxley Nature Center

4.8 (563)

Photo

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Route 66 Historical Village

4.4 (718)

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Streetwalker Tours

0 (0)

Photo

OkieTundra

4.5 (84)

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Tulsa Air and Space Museum & Planetarium

4.3 (419)

Photo

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The Tulsa Arts District

4.7 (22)

Driving Directions in Tulsa County

Driving Directions From Tulsa VA Behavioral Medicine Clinic to Durham Supply Inc

Driving Directions From Waffle House to Durham Supply Inc

Driving Directions From Church on the Move Tulsa to Durham Supply Inc

Driving Directions From Dollar General to Durham Supply Inc

https://www.google.com/maps/dir/Tuff+Shed+Tulsa/Durham+Supply+Inc/@36.157262
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95.8371145!2d36.1572625!1m5!1m1!1sChIJDzPLSIrytocRY_EaORpHGro!2m2!1d-
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95.745817!2d36.188987!1m5!1m1!1sChIJDzPLSIrytocRY_EaORpHGro!2m2!1d-
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95.8384781!2d36.1563128!3e1

Driving Directions From Philbrook Museum of Art 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

Driving Directions From Gathering Place to Durham Supply Inc

Driving Directions From Golden Driller Statue to Durham Supply Inc

Driving Directions From Tours of Tulsa to Durham Supply Inc

**https://www.google.com/maps/dir/Philbrook+Museum+of+Art/Durham+Supply+Inc/@
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https://www.google.com/maps/dir/Oxley+Nature+Center/Durham+Supply+Inc/@36.22.95.9030304,14z/data=!3m1!4b1!4m14!4m13!1m5!1m1!1sunknown!2m2!1d-95.9030304!2d36.2234573!1m5!1m1!1sChIJDzPLSIrytocRY_EaORpHGro!2m2!1d-95.8384781!2d36.1563128!3e2

Reviews for Durham Supply Inc

Durham Supply Inc

Image not found or type unknown

Ty Spears

(5)

Bought a door/storm door combo. Turns out it was the wrong size. They swapped it out, quick and easy no problems. Very helpful in explaining the size differences from standard door sizes.

Durham Supply Inc

Image not found or type unknown

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

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.

Identifying Common Leaks in Flexible Mobile Home Ducts**View GBP**

Frequently Asked Questions

What are the most common signs of leaks in flexible mobile home ducts?

Common signs of leaks include uneven heating or cooling across different areas, increased energy bills, visible gaps or tears in ductwork, and a decrease in overall system efficiency. You might also notice excess dust around vents.

How can I locate leaks in my mobile homes flexible ductwork?

To locate leaks, visually inspect the ducts for any noticeable damage or disconnections. Turn on the HVAC system and feel for escaping air along the ducts. You can also use smoke pencils or incense sticks to identify airflow disruptions that indicate leaks.

What tools and materials do I need to repair common duct leaks in a mobile home?

Youll need mastic sealant or metal-backed (foil) tape specifically designed for ductwork repairs. Basic tools like scissors, a utility knife, and gloves will help with cutting and securing materials. Avoid using standard duct tape as it doesnt adhere well over time.

Can I prevent future leaks in my mobile homes HVAC ducts?

Yes, you can prevent future leaks by regularly inspecting your ductwork for wear and tear, ensuring proper installation without excessive bending or kinks, sealing all joints securely during initial installation or repairs, and scheduling periodic professional inspections to maintain overall system health.

Royal Supply Inc

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State : OK

Zip : 73149

Address : Unknown Address

Google Business Profile

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

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