DOWNLOAD PDF SOURCE BOOK OF HEATING, VENTILATING AND AIR CONDITIONING DETAILS

Chapter 1 : ZCL | Xerxes - Heating, Ventilating, and Air Conditioning (HVAC) - CAD Drawings - blog.quinto

Free, high quality CAD drawings, blocks and details of Heating, Ventilating, and Air Conditioning (HVAC) for AGF Manufacturing.

A simple stylized diagram of the refrigeration cycle: In the refrigeration cycle, heat is transported from a colder location to a hotter area. As heat would naturally flow in the opposite direction, work is required to achieve this. A refrigerator is an example of such a system, as it transports the heat out of the interior and into its environment. The refrigerant is used as the medium which absorbs and removes heat from the space to be cooled and subsequently ejects that heat elsewhere. Circulating refrigerant vapor enters the compressor , where its pressure and temperature are increased. The hot, compressed refrigerant vapor is now at a temperature and pressure at which it can be condensed and is routed through a condenser. Here it is cooled by air flowing across the condenser coils and condensed into a liquid. Thus, the circulating refrigerant removes heat from the system and the heat is carried away by the air. The removal of this heat can be greatly augmented by pouring water over the condenser coils, making it much cooler when it hits the expansion valve. That pressure reduction results in flash evaporation of a part of the liquid refrigerant, greatly lowering its temperature. The cold refrigerant is then routed through the evaporator. A fan blows the interior warm air which is to be cooled across the evaporator, causing the liquid part of the cold refrigerant mixture to evaporate as well, further lowering the temperature. To complete the refrigeration cycle, the refrigerant vapor is routed back into the compressor. Modern air conditioning systems are not designed to draw air into the room from the outside, they only recirculate the increasingly cool air on the inside. Because this inside air always has some amount of moisture suspended in it, the cooling portion of the process always causes ambient warm water vapor to condense on the cooling coils and to drip from them down onto a catch tray at the bottom of the unit from which it must then be routed outside, usually through a drain hole. As this moisture has no dissolved minerals in it, it will not cause mineral buildup on the coils. This will happen even if the ambient humidity level is low. If ice begins to form on the evaporative fins, it will reduce circulation efficiency and cause the development of more ice, etc. A failing thermistor may also cause this problem. Refrigerators without a defrost cycle may have this same issue. Dust can also cause the fins to begin blocking air flow with the same undesirable result: The engineering of physical and thermodynamic properties of gasâ€”vapor mixtures is called psychrometrics. Heat pump unit[edit] Main article: Heat pump An example of an externally fitted AC unit which uses a heat pump system A heat pump is an air conditioner in which the refrigeration cycle can be reversed, producing heating instead of cooling in the indoor environment. They are also commonly referred to as a "reverse cycle air conditioner". The heat pump is significantly more energy efficient than electric resistance heating. Some homeowners elect to have a heat pump system installed as a feature of a central air conditioner. When the heat pump is in heating mode, the indoor evaporator coil switches roles and becomes the condenser coil, producing heat. The outdoor condenser unit also switches roles to serve as the evaporator, and discharges cold air colder than the ambient outdoor air. To compensate for this, the heat pump system must temporarily switch back into the regular air conditioning mode to switch the outdoor evaporator coil back to being the condenser coil, so that it can heat up and defrost. A heat pump system will therefore have a form of electric resistance heating in the indoor air path that is activated only in this mode in order to compensate for the temporary indoor air cooling, which would otherwise be uncomfortable in the winter. The icing problem becomes much more severe with lower outdoor temperatures, so heat pumps are commonly installed in tandem with a more conventional form of heating, such as a natural gas or oil furnace , which is used instead of the heat pump during harsher winter temperatures. In this case, the heat pump is used efficiently during the milder temperatures, and the system is switched to the conventional heat source when the outdoor temperature is lower. Absorption heat pumps are a kind of air-source heat pump, but they do not depend on electricity to power them. Instead, gas, solar power, or heated water is used as a main power source.

An absorption pump dissolves ammonia gas in water, which gives off heat. Next, the water and ammonia mixture is depressurized to induce boiling, and the ammonia is boiled off, which absorbs heat from the outdoor air. However, a window unit may only have an electric resistance heater. Evaporative cooler An evaporative cooler In very dry climates, evaporative coolers, sometimes referred to as swamp coolers or desert coolers, are popular for improving coolness during hot weather. An evaporative cooler is a device that draws outside air through a wet pad, such as a large sponge soaked with water. The sensible heat of the incoming air, as measured by a dry bulb thermometer , is reduced. The temperature of the incoming air is reduced, but it is also more humid, so the total heat sensible heat plus latent heat is unchanged. Some of the sensible heat of the entering air is converted to latent heat by the evaporation of water in the wet cooler pads. If the entering air is dry enough, the results can be quite substantial. Evaporative coolers tend to feel as if they are not working during times of high humidity, when there is not much dry air with which the coolers can work to make the air as cool as possible for dwelling occupants. Unlike other types of air conditioners, evaporative coolers rely on the outside air to be channeled through cooler pads that cool the air before it reaches the inside of a house through its air duct system; this cooled outside air must be allowed to push the warmer air within the house out through an exhaust opening such as an open door or window. Free cooling Air conditioning can also be provided by a process called free cooling which uses pumps to circulate a coolant typically water or a glycol mix from a cold source, which in turn acts as a heat sink for the energy that is removed from the cooled space. Common storage media are deep aquifers or a natural underground rock mass accessed via a cluster of small-diameter boreholes, equipped with heat exchanger. Some systems with small storage capacity are hybrid systems, using free cooling early in the cooling season, and later employing a heat pump to chill the circulation coming from the storage. The heat pump is added because the temperature of the storage gradually increases during the cooling season, thereby declining its effectiveness. Free cooling systems can have very high efficiencies, and are sometimes combined with seasonal thermal energy storage STES so the cold of winter can be used for summer air conditioning. Free cooling and hybrid systems are mature technology. Please help improve this section by adding citations to reliable sources. Unsourced material may be challenged and removed. December Learn how and when to remove this template message Since humans perspire to provide natural cooling by the evaporation of perspiration from the skin, drier air up to a point improves the comfort provided. The relatively cold below the dewpoint evaporator coil condenses water vapor from the processed air, much like an ice-cold drink will condense water on the outside of a glass. Therefore, water vapor is removed from the cooled air and the relative humidity in the room is lowered. The water is usually sent to a drain or may simply drip onto the ground outdoors. The heat is rejected by the condenser which is located outside of room to be cooled. Dehumidification program[edit] Most modern air-conditioning systems feature a dehumidification cycle during which the compressor runs while the fan is slowed as much as possible[citation needed] to reduce the evaporator temperature and therefore condense more water. When the temperature falls below a threshold, both the fan and compressor are shut off to mitigate further temperature drops;[clarification needed] this prevents moisture on the evaporator from being blown back into the room. Occasionally, to thaw any ice produced, the fan runs with the compressor shut down; this function is less effective when ambient temperatures are low. When the evaporator is too cold,[clarification needed] the compressor is slowed or stopped with the indoor fan running. Dehumidifier Typical portable dehumidifier A specialized air conditioner that is used only for dehumidifying is called a dehumidifier. It also uses a refrigeration cycle , but differs from a standard air conditioner in that both the evaporator and the condenser are placed in the same air path. A standard air conditioner transfers heat energy out of the room because its condenser coil releases heat outside. However, since all components of the dehumidifier are in the same room, no heat energy is removed. Instead, the electric power consumed by the dehumidifier remains in the room as heat, so the room is actually heated, just as by an electric heater that draws the same amount of power. In addition, if water is condensed in the room, the amount of heat previously needed to evaporate that water also is re-released in the room the latent heat of vaporization. The dehumidification process is the inverse of adding

water to the room with an evaporative cooler , and instead releases heat. Therefore, an in-room dehumidifier always will warm the room and reduce the relative humidity indirectly, as well as reducing the humidity directly by condensing and removing water. Inside the unit, the air passes over the evaporator coil first, and is cooled and dehumidified. The now dehumidified, cold air then passes over the condenser coil where it is warmed up again. Then the air is released back into the room. The unit produces warm, dehumidified air and can usually be placed freely in the environment room that is to be conditioned. Dehumidifiers are commonly used in cold, damp climates to prevent mold growth indoors, especially in basements. They are also used to protect sensitive equipment from the adverse effects of excessive humidity in tropical countries. Energy transfer[edit] In a thermodynamically closed system , any power dissipated into the system that is being maintained at a set temperature which is a standard mode of operation for modern air conditioners requires that the rate of energy removal by the air conditioner increase. This increase has the effect that, for each unit of energy input into the system say to power a light bulb in the closed system , the air conditioner removes that energy. Air conditioner equipment power in the U. The value is defined as 12, BTU per hour, or watts. Seasonal energy efficiency ratio[edit] Main article: Seasonal energy efficiency ratio For residential homes, some countries set minimum requirements for energy efficiency. In the United States, the efficiency of air conditioners is often but not always rated by the seasonal energy efficiency ratio SEER. The higher the SEER rating, the more energy efficient is the air conditioner. The electrical energy consumed per year can be calculated as the average power multiplied by the annual operating time: Another method that yields the same result, is to calculate the total annual cooling output: The EER is the efficiency rating for the equipment at a particular pair of external and internal temperatures, while SEER is calculated over a whole range of external temperatures i. The COP is a ratio with the same metric units of energy joules in both the numerator and denominator. They cancel out, leaving a dimensionless quantity. The United States now requires that residential systems manufactured in have a minimum SEER rating of 13 although window-box systems are exempt from this law, so their SEER is still around Window unit and packaged terminal[edit] How a window air conditioner works Air conditioning window unit Parts of a window unit Window unit air conditioners are installed in an open window. The interior air is cooled as a fan blows it over the evaporator. On the exterior the heat drawn from the interior is dissipated into the environment as a second fan blows outside air over the condenser. A large house or building may have several such units, allowing each room to be cooled separately. In , General Electric introduced a popular portable in-window air conditioner designed for convenience and portability. PTACs, which are frequently used in hotels, have two separate units terminal packages , the evaporative unit on the interior and the condensing unit on the exterior, with an opening passing through the wall and connecting them. This minimizes the interior system footprint and allows each room to be adjusted independently.

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Chapter 2 : Heating, Ventilation, and Air Conditioning Systems

Free, high quality CAD drawings, blocks and details of Heating, Ventilating, and Air Conditioning (HVAC) for ZCL | Xerxes.

James Baker NOAA Administrator, â€" Introduction The quotes below provide a profound lesson in the need for housing to provide protection from both the heat and cold. The bitter cold that gripped the Northeast through the weekend and iced over roads was blamed for at least three deaths, including that of a Philadelphia man found inside a home without heat. Heating and cooling are not merely a matter of comfort, but of survival. Both very cold and very hot temperatures can threaten health. Excessive exposure to heat is referred to as heat stress and excessive exposure to cold is referred to as cold stress. In a very hot environment, the most serious health risk is heat stroke. Heat stroke requires immediate medical attention and can be fatal or leave permanent damage. Heat stroke fatalities occur every summer. Heat exhaustion and fainting are less serious types of illnesses. At very cold temperatures, the most serious concern is the risk for hypothermia or dangerous overcooling of the body. Another serious effect of cold exposure is frostbite or freezing of exposed extremities, such as fingers, toes, nose, and ear lobes. Hypothermia can be fatal if immediate medical attention is not received. Heat and cold are dangerous because the victims of heat stroke and hypothermia often do not notice the symptoms. This means that family, neighbors, and friends are essential for early recognition of the onset of the conditions. Family, neighbors, and friends must be particularly diligent during heat or cold waves to check on individuals who live alone. Although symptoms vary from person to person, the warning signs of heat exhaustion include confusion and profuse and prolonged sweating. The person should be removed from the heat, cooled, and heavily hydrated. Heat stroke signs and symptoms include sudden and severe fatigue, nausea, dizziness, rapid pulse, lightheadedness, confusion, unconsciousness, extremely high temperature, and hot and dry skin surface. An individual who appears disorientated or confused, seems euphoric or unaccountably irritable, or suffers from malaise or flulike symptoms should be moved to a cool location and medical advice should be sought immediately. Warning signs of hypothermia include nausea, fatigue, dizziness, irritability, or euphoria. Individuals also experience pain in their extremities e. People who exhibit these symptoms, particularly the elderly and young, should be moved to a heated shelter and medical advice should be sought when appropriate. The function of a heating, ventilation, and air conditioning HVAC system is to provide for more than human health and comfort. The HVAC system produces heat, cool air, and ventilation, and helps control dust and moisture, which can lead to adverse health effects. The variables to be controlled are temperature, air quality, air motion, and relative humidity. The adequacy of the HVAC system and the air-tightness of the structure or room determine the degree of personal safety and comfort within the dwelling. Gas, electricity, oil, coal, wood, and solar energy are the main energy sources for home heating and cooling. Heating systems commonly used are steam, hot water and hot air. A housing inspector should have knowledge of the various heating fuels and systems to be able to determine their adequacy and safety in operation. To cover fully all aspects of the heating and cooling system, the entire area and physical components of the system must be considered. Click here for definition of terms related to HVAC systems. Any home using combustion as a source of heating, cooling, or cooking or that has an attached garage should have appropriately located and maintained carbon monoxide CO gas detectors. According to the U. The standard fuels for heating are discussed below. Gas fuels are colorless gases. Some have a characteristic pungent odor; others are odorless and cannot be detected by smell. Although gas fuels are easily handled in heating equipment, their presence in air in appreciable quantities becomes a serious health hazard. Gases diffuse readily in the air, making explosive mixtures possible. A proportion of combustible gas and air that is ignited burns with such a high velocity that an explosive force is created. Because of these characteristics of gas fuels, precautions must be taken to prevent leaks, and care must be exercised when gas-fired equipment is lit. Gas is broadly classified as natural or manufactured. Natural gasâ€"This gas is a mixture of several

combustible and inert gases. It is one of the richest gases and is obtained from wells ordinarily located in petroleum-producing areas. The heat content may vary from to 1, British thermal units BTUs per cubic foot, with a generally accepted average figure of 1, BTUs per cubic foot. Natural gases are distributed through pipelines to the point of use and are often mixed with manufactured gas to maintain a guaranteed BTU content. Manufactured gasâ€"This gas, as distributed, is usually a combination of certain proportions of gases produced from coke, coal, and petroleum. Liquefied petroleum gasâ€"Principal products of liquefied petroleum gas are butane and propane. Butane and propane are derived from natural gas or petroleum refinery gas and are chemically classified as hydrocarbon gases. Specifically, butane and propane are on the borderline between a liquid and a gaseous state. These gases are mixed to produce commercial gas suitable for various climatic conditions. Butane and propane are heavier than air. Gas burners should be equipped with an automatic shutoff in case the flame fails. Shutoff valves should be located within 1 foot of the burner connection and on the output side of the meter. Liquefied petroleum gas is heavier than air; therefore, the gas will accumulate at the bottom of confined areas. If a leak develops, care should be taken to ventilate the appliance before lighting it. With an electric system, the housing inspector should rely mainly on the electrical inspector to determine proper installation. There are a few items, however, to be concerned with to ensure safe use of the equipment. Most convector-type units must be installed at least 2 inches above the floor level, not only to ensure that proper convection currents are established through the unit, but also to allow sufficient air insulation from any combustible flooring material. The housing inspector should check for curtains that extend too close to the unit or loose, long-pile rugs that are too close. A distance of 6 inches on the floor and 12 inches on the walls should separate rugs or curtains from the appliance. Heat pumps are air conditioners that contain a valve that allows switching between air conditioner and heater. When the valve is switched one way, the heat pump acts like an air conditioner; when it is switched the other way, it reverses the flow of refrigerants and acts like a heater. Cold is the absence of energy or calories of heat. To cool something, the heat must be removed; to warm something, energy or calories of heat must be provided. Heat pumps do both. A heat pump has a few additions beyond the typical air conditioner: The reversing valve allows the unit to provide both cooling and heating. The unit operates as follows: The compressor compacts the refrigerant vapor and pumps it to the reversing valve. The reversing valve directs the compressed vapor to flow to the outside heat exchanger condenser , where the refrigerant is cooled and condensed to a liquid. The air blowing through the condenser coil removes heat from the refrigerant. The liquid refrigerant bypasses the first thermal expansion valve and flows to the second thermal expansion valve at the inside heat exchanger evaporator where it expands into the evaporator and becomes vapor. The refrigerant picks up heat energy from the air blowing across the evaporator coil and cool air comes out at the other side of the coil. The cool air is ducted to the occupied space as air-conditioned air. The refrigerant vapor then goes back to the reversing valve to be directed to the compressor to start the refrigeration cycle all over again. Heat pumps [3] are quite efficient in their use of energy. However, heat pumps often freeze up; that is, the coils in the outside air collect ice. The heat pump has to melt this ice periodically, so it switches itself back to air conditioner mode to heat up the coils. To avoid pumping cold air into the house in air conditioner mode, the heat pump also uses electric strip heaters to heat the cold air that the air conditioner is pumping out. Once the ice is melted, the heat pump switches back to heating mode and turns off the burners. Radiant heat warms objects directly with longwave electromagnetic energy. When properly installed, radiant heat warms a room sooner and at lower temperature settings than do other kinds of heat. Extreme care must be taken to protect against fire hazards from objects in close proximity to the infrared radiation reflectors. Inspectors dealing with this heat source should have specialized training. Radiant heating is plastered into the ceiling or wall in some homes or in the brick or ceramic floors of bathrooms. If wires are bare in the plaster, they should be treated as open and exposed wiring. The inspector should be knowledgeable about these systems, which are technical and relatively new. Fuel Oil Fuel oils are derived from petroleum, which consists primarily of compounds of hydrogen and carbon hydrocarbons and smaller amounts of nitrogen and sulfur. Domestic fuel oils are controlled by rigid

specifications. Six grades of fuel oilâ€”numbered 1 through 6â€”are generally used in heating systems; the lighter two grades are used primarily for domestic heating: Grade Number 1â€”a volatile, distillate oil for use in burners that prepare fuel for burning solely by vaporization oil-fired space heaters. Grade Number 2â€”a moderate weight, volatile, distillate oil used for burners that prepare oil for burning by a combination of vaporization and atomization. This grade of oil is commonly used in domestic heating furnaces. Heating values of oil vary from approximately , BTU per gallon for number 6 oil to , BTU per gallon for number 1 oil. Oil is more widely used today than coal and provides a more automatic source of heat and comfort. It also requires more complicated systems and controls. If the oil supply is in the basement or cellar area, certain code regulations must be followed Figure No more than two gallon tanks may be installed above ground in the lowest story of any one building. The IRC recommends a maximum fuel oil storage of gallons.

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Chapter 3 : HVAC - Wikipedia

Design Manual for Heating, Ventilation and Air Conditioning with Coordinated Standard Details Lee Kendrick Technical StandardsAssociation, - Air conditioning - pages.

Acoustics The fundamentals of equipment sound power levels, transmission paths, and resulting sound pressure readings go beyond the application and understanding of basic thermodynamics. The MER should have sufficient understanding of acoustics to be able to benchmark the sound quality of the equipment applied as the design solution and attenuate sound paths accordingly to the acoustical criteria for the occupied spaces. A standard of care document is now in print that details sound quality features for school environments. Successful compliance with this new standard will require a concentrated coordination effort between mechanical and general construction interest. All sound transmission paths discharge, radiated, breakout, etc. Equipment locations, equipment operating points, transmission path construction, end room reflectance, and resulting sound pressure are all variables that the MER needs to understand and manipulate. High Density Data Servers Facilities are becoming "smarter" and fully networked. This high-tech trend has created a new challenge for the MER. Communication and data storage servers are adding significant sensible cooling loads to the indoor environment. As server technology improves to provide better speed and capacity, the sensible heat rejection load component keeps rising. Recent studies show the heat rejection densities for server equipment doubling, maybe even tripling, in just the next five year window. See Information Technologies Engineering. Ozone Depletion Refrigerants are the fundamental substances used to transfer heat during the mechanical cooling process. Chloroflurocarbon CFC compounds such as R and R have been used for decades in refrigeration cycles. Evidence has linked the reduction of stratospheric ozone concentrations to the release of halogenated refrigerant vapor into the atmosphere. Once liberated, the chlorine atoms react with very cold polar stratospheric clouds containing water vapor and nitric acid to destroy the ozone concentration. Fortunately, the science of this destructive phenomenon has been identified and steps have been implemented globally to correct the negative impact to the atmosphere. Guidelines established in the Montreal Protocol adopted in and subsequent amendments, have set timetables for replacement and conversion to alternative refrigerants for developed and developing countries. Natural refrigerants, such as ammonia and carbon dioxide, which are not ozone depleting substances, are seeing use in certain applications. The MER must understand the current phase-out timetables, the dynamics of pending amendments, the science of the available alternatives, the impacts to system design, and the impact on performance and energy efficiency. ASHRAE Standard includes criteria for reducing the release of halogenated refrigerants from refrigerating and air-conditioning equipment and systems. HCFC refrigerants are an interim solution and have projected phase-out dates for new equipment application. Will the refrigerant be available for the life of the equipment? Replacements may or may not be as efficient. These dynamics need to be addressed when considering the overall life of the facility and the total ownership cost impact. How will alternative refrigerants impact facility design and operation? Toxicity and flammability issues now become critical, as do equipment room locations and safety design. The thermodynamic characteristics of alternatives may result in less efficient cooling processes. What is the correct balance of ozone depletion potential of the refrigerant being used versus the global warming potential of energy inefficiency and release of carbon dioxide into the atmosphere? Climate Change The increased accumulation of greenhouse gases GHG in the atmosphere and the increase in average global temperatures is creating a worldwide concern. The adoption of the Kyoto Protocol in initiated a commitment to reduce emission of global warming gases. The problem occurs when increased concentrations of GHG increase the energy trapping capabilities of the lower region of the atmosphere. Such a scenario causes the surface temperatures to increase. The continued burning of fossil fuels will continue to negatively impact the concentrations of GHG in the atmosphere. The design of buildings directly and indirectly impacts the release of GHG. The MER must address the following issues: The release of mechanical system

refrigerants must be avoided. Buildings must be evaluated to find the lowest, viable energy consumption solution. End user behaviors need to be altered to think globally. Occupant discomfort and building related illness are frequent complaints that owners must respond to. Discomfort factors can include: The MER should be cognizant of the following issues: Volatile Organic Compounds VOC pose a source challenge based on the variety of source opportunities and possible chemical introductions to the building. Consideration should be given to elimination, substitution, or containment of VOC generation sources. Effective temperature and humidity control are achievable with the application of appropriate systems, effective air distribution, and proper control sequences. Humidity levels can negatively impact mucous membranes too low and upper respiratory tracts too high. The MER should also consider that high humidity levels support the growth of mold and bacteria. The design of air systems must factor in the possible spread of airborne infectious agents, such as viruses and bacteria, generated by the occupants inside the building. As part of an appropriate risk management analysis, infrastructure solutions such as extent of filtration, UV light treatment, ventilation effectiveness, air changes, and building pressure control need to be investigated. The building or systems within it may be sources of infectious agents such as fungus or bacteria. These sources can contribute to significant invasive diseases such as aspergillosis, legionellosis, and histoplasmososis. Minimizing the introduction of moisture into the building or ventilation system is critical to the mitigation of these deadly diseases. The growth and support of non-infectious biological agents fungus, bacteria, dander, and allergens needs to be minimized. Locations of outside air ducts need to be optimized with site dynamics. Sources of moisture generation and intrusion need to be eliminated. Maintaining filtration and proper operation of equipment become critical factors. Non-biological particles must be considered. Construction activities can be a significant source of fine and large particles. Early occupancy of new construction can present a liability to the owner. Protection of buildings under renovation becomes a critical exercise. Inorganic gases such as carbon monoxide, nitrogen oxides, ozone, and radon can all have significant impact on occupants. These gases can be generated internally from smoking or combustion processes, operation of copiers and printers, operation of air cleaners, and poorly vented combustion equipment. Gases can also be introduced from the exterior via poor outdoor ventilation air, or in the case of radon, drawn up through the soil beneath and around the building. Individual susceptibility, the "human factor", can vary from person to person. Factors such as allergic sensitivity, prior exposure, stress, and gender all play a role in how individuals react to and are impacted by IAQ issues. It is rather a voluntary method by which building owners may demonstrate their commitment to energy efficient and environmentally friendly building design, construction, operations, and maintenance practices that are better than minimum code requirements. Additionally, many state and local government agencies have regionally customized rating systems that outline high-performance building roadmaps. A question often asked by clients is: What is the cost associated with designing and building high-performance green buildings? Although the first cost of designing and building is often more, the payback for owning and operating a high-performance building is typically 5 years or less. Since employee salary costs are typically ten times the cost of energy and operating costs of a building, paybacks may be much less when the increased productivity and lower absenteeism often associated with working in a high-performance building are considered. The old Division specification system has been completely replaced by a system that has 2 main Groups, 5 Subgroups, and 50 total Divisions. The MER is significantly impacted by this change as the familiar Division 15 - Mechanical does not exist anymore. The same can be said for the old Division 16 - Electrical. Plumbing, mechanical, and electrical systems for facilities have been organized into a new Group titled Specifications and a new Subgroup titled Facility Services. An excerpt from MasterFormat Edition showing the facility oriented content is organized as follows:

Chapter 4 : Water Source Unitary Heat Pumps Products | Construction Materials - Sweets

CAD Details for Building Products: 23 - Heating, Ventilating, and Air-Conditioning (HVAC) Below you will find a count of manufacturers for products and services related to MasterFormat 23 - Heating, Ventilating, and Air-Conditioning (HVAC).

A simple stylized diagram of the refrigeration cycle: The system refrigerant starts its cycle in a gaseous state. The compressor pumps the refrigerant gas up to a high pressure and temperature. From there it enters a heat exchanger sometimes called a condensing coil or condenser where it loses energy heat to the outside, cools, and condenses into its liquid phase. An expansion valve also called metering device regulates the refrigerant liquid to flow at the proper rate. The liquid refrigerant is returned to another heat exchanger where it is allowed to evaporate, hence the heat exchanger is often called an evaporating coil or evaporator. As the liquid refrigerant evaporates it absorbs energy heat from the inside air, returns to the compressor, and repeats the cycle. In the process, heat is absorbed from indoors and transferred outdoors, resulting in cooling of the building. In variable climates, the system may include a reversing valve that switches from heating in winter to cooling in summer. By reversing the flow of refrigerant, the heat pump refrigeration cycle is changed from cooling to heating or vice versa. This allows a facility to be heated and cooled by a single piece of equipment by the same means, and with the same hardware. Free cooling Free cooling systems can have very high efficiencies, and are sometimes combined with seasonal thermal energy storage so that the cold of winter can be used for summer air conditioning. Common storage mediums are deep aquifers or a natural underground rock mass accessed via a cluster of small-diameter, heat-exchanger-equipped boreholes. Some systems with small storages are hybrids, using free cooling early in the cooling season, and later employing a heat pump to chill the circulation coming from the storage. The heat pump is added-in because the storage acts as a heat sink when the system is in cooling as opposed to charging mode, causing the temperature to gradually increase during the cooling season. Some systems include an "economizer mode", which is sometimes called a "free-cooling mode". When economizing, the control system will open fully or partially the outside air damper and close fully or partially the return air damper. This will cause fresh, outside air to be supplied to the system. When the outside air is cooler than the demanded cool air, this will allow the demand to be met without using the mechanical supply of cooling typically chilled water or a direct expansion "DX" unit , thus saving energy. The control system can compare the temperature of the outside air vs. In both cases, the outside air must be less energetic than the return air for the system to enter the economizer mode. Minisplit ductless systems are used in these situations. Outside of North America, packaged systems are only used in limited applications involving large indoor space such as stadiums, theatres or exhibition halls. An alternative to packaged systems is the use of separate indoor and outdoor coils in split systems. Split systems are preferred and widely used worldwide except in the North America. In the North America, split systems are most often seen in residential applications, but they are gaining popularity in small commercial buildings. With the split system, the evaporator coil is connected to a remote condenser unit using refrigerant piping between an indoor and outdoor unit instead of ducting air directly from the outdoor unit. Indoor units with directional vents mount onto walls, suspended from ceilings, or fit into the ceiling. Other indoor units mount inside the ceiling cavity, so that short lengths of duct handle air from the indoor unit to vents or diffusers around the rooms. Split systems are more efficient and the footprint is typically smaller than the package systems. On the other hand, package systems tend to have slightly lower indoor noise level compared to split system since the fan motor is located outside. Dehumidification[edit] Dehumidification air drying in an air conditioning system is provided by the evaporator. Since the evaporator operates at a temperature below the dew point , moisture in the air condenses on the evaporator coil tubes. This moisture is collected at the bottom of the evaporator in a pan and removed by piping to a central drain or onto the ground outside. A dehumidifier is an air-conditioner-like device that controls the humidity of a room or building. It is often employed in basements which have a higher

relative humidity because of their lower temperature and propensity for damp floors and walls. In food retailing establishments, large open chiller cabinets are highly effective at dehumidifying the internal air. Conversely, a humidifier increases the humidity of a building. Maintenance[edit] All modern air conditioning systems, even small window package units, are equipped with internal air filters. These are generally of a lightweight gauzy material, and must be replaced or washed as conditions warrant. For example, a building in a high dust environment, or a home with furry pets, will need to have the filters changed more often than buildings without these dirt loads. Failure to replace these filters as needed will contribute to a lower heat exchange rate, resulting in wasted energy, shortened equipment life, and higher energy bills; low air flow can result in iced-over evaporator coils, which can completely stop air flow. Additionally, very dirty or plugged filters can cause overheating during a heating cycle, and can result in damage to the system or even fire. Because an air conditioner moves heat between the indoor coil and the outdoor coil, both must be kept clean. This means that, in addition to replacing the air filter at the evaporator coil, it is also necessary to regularly clean the condenser coil. Failure to keep the condenser clean will eventually result in harm to the compressor, because the condenser coil is responsible for discharging both the indoor heat as picked up by the evaporator and the heat generated by the electric motor driving the compressor. Energy efficiency[edit] Since the s, manufacturers of HVAC equipment have been making an effort to make the systems they manufacture more efficient. This was originally driven by rising energy costs, and has more recently been driven by increased awareness of environmental issues. Additionally, improvements to the HVAC system efficiency can also help increase occupant health and productivity. There are several methods for making HVAC systems more efficient. Heating energy[edit] In the past, water heating was more efficient for heating buildings and was the standard in the United States. Today, forced air systems can double for air conditioning and are more popular. Some benefits of forced air systems, which are now widely used in churches, schools and high-end residences, are Better air conditioning effects Even conditioning[citation needed] A drawback is the installation cost, which can be slightly higher than traditional HVAC systems. Energy efficiency can be improved even more in central heating systems by introducing zoned heating. This allows a more granular application of heat, similar to non-central heating systems. Zones are controlled by multiple thermostats. In water heating systems the thermostats control zone valves , and in forced air systems they control zone dampers inside the vents which selectively block the flow of air. In this case, the control system is very critical to maintaining a proper temperature. Forecasting is another method of controlling building heating by calculating demand for heating energy that should be supplied to the building in each time unit. Ground source heat pump[edit] Main article: Geothermal heat pump Ground source, or geothermal, heat pumps are similar to ordinary heat pumps, but instead of transferring heat to or from outside air, they rely on the stable, even temperature of the earth to provide heating and air conditioning. Many regions experience seasonal temperature extremes, which would require large-capacity heating and cooling equipment to heat or cool buildings. Although ground temperatures vary according to latitude, at 6 feet 1. An example of a geothermal heat pump that uses a body of water as the heat sink, is the system used by the Trump International Hotel and Tower in Chicago, Illinois. This building is situated on the Chicago River , and uses cold river water by pumping it into a recirculating cooling system, where heat exchangers transfer heat from the building into the water, and then the now-warmed water is pumped back into the Chicago River. This is done by transfer of energy to the incoming outside fresh air. Air conditioning energy[edit] The performance of vapor compression refrigeration cycles [23] is limited by thermodynamics. These air conditioning and heat pump devices move heat rather than convert it from one form to another, so thermal efficiencies do not appropriately describe the performance of these devices. The Coefficient-of-Performance COP measures performance, but this dimensionless measure has not been adopted. For example, the fan blades used to move the air are usually stamped from sheet metal, an economical method of manufacture, but as a result they are not aerodynamically efficient. A well-designed blade could reduce electrical power required to move the air by a third. Air filter Air handling unit , used for heating, cooling, and filtering the air Air cleaning and filtration removes particles, contaminants, vapors and

gases from the air. The filtered and cleaned air then is used in heating, ventilation and air conditioning. Air cleaning and filtration should be taken in account when protecting our building environments. When determining CADR, the amount of airflow in a space is taken into account. Along with CADR, filtration performance is very important when it comes to the air in our indoor environment. Filter performance depends on the size of the particle or fiber, the filter packing density and depth and also the air flow rate. The starting point in carrying out an estimate both for cooling and heating depends on the exterior climate and interior specified conditions. However, before taking up the heat load calculation, it is necessary to find fresh air requirements for each area in detail, as pressurization is an important consideration. International[edit] ISO It takes into account the need to provide a healthy indoor environment for the occupants as well as the need to protect the environment for future generations and promote collaboration among the various parties involved in building environmental design for sustainability. ISO is applicable to new construction and the retrofit of existing buildings.

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Chapter 5 : Air conditioning - Wikipedia

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Updating and Using Relevant Knowledge â€" Keeping up-to-date technically and applying new knowledge to your job. Making Decisions and Solving Problems â€" Analyzing information and evaluating results to choose the best solution and solve problems. Getting Information â€" Observing, receiving, and otherwise obtaining information from all relevant sources. Handling and Moving Objects â€" Using hands and arms in handling, installing, positioning, and moving materials, and manipulating things. Inspecting Equipment, Structures, or Material â€" Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects. Performing General Physical Activities â€" Performing physical activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping, and handling of materials. Controlling Machines and Processes â€" Using either control mechanisms or direct physical activity to operate machines or processes not including computers or vehicles. Repairing and Maintaining Electronic Equipment â€" Servicing, repairing, calibrating, regulating, fine-tuning, or testing machines, devices, and equipment that operate primarily on the basis of electrical or electronic not mechanical principles. Analyzing Data or Information â€" Identifying the underlying principles, reasons, or facts of information by breaking down information or data into separate parts. Establishing and Maintaining Interpersonal Relationships â€" Developing constructive and cooperative working relationships with others, and maintaining them over time. Operating Vehicles, Mechanized Devices, or Equipment â€" Running, maneuvering, navigating, or driving vehicles or mechanized equipment, such as forklifts, passenger vehicles, aircraft, or water craft. Communicating with Supervisors, Peers, or Subordinates â€" Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person. Organizing, Planning, and Prioritizing Work â€" Developing specific goals and plans to prioritize, organize, and accomplish your work. Scheduling Work and Activities â€" Scheduling events, programs, and activities, as well as the work of others. Training and Teaching Others â€" Identifying the educational needs of others, developing formal educational or training programs or classes, and teaching or instructing others. Evaluating Information to Determine Compliance with Standards â€" Using relevant information and individual judgment to determine whether events or processes comply with laws, regulations, or standards. Monitor Processes, Materials, or Surroundings â€" Monitoring and reviewing information from materials, events, or the environment, to detect or assess problems. Processing Information â€" Compiling, coding, categorizing, calculating, tabulating, auditing, or verifying information or data. Thinking Creatively â€" Developing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions. Identifying Objects, Actions, and Events â€" Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events. Interpreting the Meaning of Information for Others â€" Translating or explaining what information means and how it can be used. Coordinating the Work and Activities of Others â€" Getting members of a group to work together to accomplish tasks. Communicating with Persons Outside Organization â€" Communicating with people outside the organization, representing the organization to customers, the public, government, and other external sources. This information can be exchanged in person, in writing, or by telephone or e-mail. Performing for or Working Directly with the Public â€" Performing for people or dealing directly with the public. This includes serving customers in restaurants and stores, and receiving clients or guests. Developing Objectives and Strategies â€" Establishing long-range objectives and specifying the strategies and actions to achieve them. Judging the Qualities of Things, Services, or People â€" Assessing the value, importance, or quality of things or people. Guiding, Directing, and Motivating Subordinates â€" Providing guidance and direction to subordinates, including setting performance standards and monitoring performance. Coaching and

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Developing Others â€” Identifying the developmental needs of others and coaching, mentoring, or otherwise helping others to improve their knowledge or skills. Drafting, Laying Out, and Specifying Technical Devices, Parts, and Equipment â€” Providing documentation, detailed instructions, drawings, or specifications to tell others about how devices, parts, equipment, or structures are to be fabricated, constructed, assembled, modified, maintained, or used. Developing and Building Teams â€” Encouraging and building mutual trust, respect, and cooperation among team members. Provide Consultation and Advice to Others â€” Providing guidance and expert advice to management or other groups on technical, systems-, or process-related topics. Resolving Conflicts and Negotiating with Others â€” Handling complaints, settling disputes, and resolving grievances and conflicts, or otherwise negotiating with others. Estimating the Quantifiable Characteristics of Products, Events, or Information â€” Estimating sizes, distances, and quantities; or determining time, costs, resources, or materials needed to perform a work activity. Assisting and Caring for Others â€” Providing personal assistance, medical attention, emotional support, or other personal care to others such as coworkers, customers, or patients. Performing Administrative Activities â€” Performing day-to-day administrative tasks such as maintaining information files and processing paperwork. Interacting With Computers â€” Using computers and computer systems including hardware and software to program, write software, set up functions, enter data, or process information.

Chapter 6 : HVAC Manufacturer Listings - Sweets

Heating, ventilation, and air conditioning (HVAC) is the technology of indoor and vehicular environmental comfort. Its goal is to provide thermal comfort and acceptable indoor air quality. HVAC system design is a subdiscipline of mechanical engineering, based on the principles of thermodynamics, fluid mechanics and heat transfer.

Chapter 7 : - Heating and Air Conditioning Mechanics and Installers

This is an introduction to air conditioning systems (frequently referred to as HVAC systems - heating, ventilating and air conditioning systems). It is intended for.

Chapter 8 : HVAC Energy Efficiency | Resources & Guides | Carbon Trust

Connect heating or air conditioning equipment to fuel, water, or refrigerant source to form complete circuit. Study blueprints, design specifications, or manufacturers' recommendations to ascertain the configuration of heating or cooling equipment components and to ensure the proper installation of components.