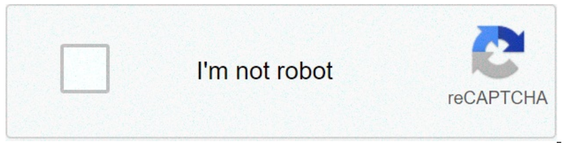

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How does adsorption chiller work

Refrigeration method Adsorption refrigeration was invented by Michael Faraday in 1821, even though the basis of artificial modern refrigeration dates back to 1748 with William Cullen experiments. More on history of refrigeration can be found in the paragraph Refrigeration Research on page Refrigeration. [1] Adsorption, sometimes is referred to solid sorption. [2] It is very similar to absorption refrigeration (note that the second letter is different). The difference is that in adsorption refrigeration, the refrigerant or adsorbate vapour molecules adsorb onto the surface of a solid instead of dissolving into a liquid. In an adsorption system, an adsorber adsorbs the refrigerant vapour into a solid, while in an absorption system, an absorber absorbs the refrigerant vapour into a liquid. [1] Adsorption refrigeration also includes a generation process where refrigerant vapour molecules desorb from the solid. The characteristics of the adsorbate/refrigerant pair is crucial in determining the system performance of an adsorption refrigeration system. [3][1] The typical system performance indicators for an adsorption refrigeration system are the coefficient of performance and the specific cooling effect. [3] The refrigerants used in adsorption systems are ammonia, water, or methanol, etc, which all experience phase changes between the vapor and liquid states - the same as in vapor compression refrigeration; while the adsorbent is a solid, such as silica gel, activated carbon, zeolite, [1] For example, an adsorption refrigeration device with active carbon fiber as the adsorbent and ammonia as the refrigerant was designed. [2] Adsorption refrigeration has been extensively researched in recent years because the technology is often noiseless, non-corrosive and environmentally friendly.[4] The heat source for adsorption refrigeration can be: Fossil fuel, Bio fuel, Waste heat, Solar thermal energy. [1] Adsorption refrigerators are available in the marketplace and are mainly used to produce chilled water from waste heat. Gas adsorption heat pumps are not currently available in the UK, but are just being introduced in Europe as small water or ground source packaged units that provide domestic, low-temperature, space heating.[5] References ^ a b c d e R.E. Critoph, R.E. (2007). "Adsorption Refrigeration Research at Warwick" (PDF). warwick.ac.uk. Retrieved 2020-05-31. ^ a b Vasiliev, L. L; Mishkinis, D. A; Antukh, A. A; Vasiliev, L. L (2001-04-01). "Solar–gas solid sorption heat pump". Applied Thermal Engineering. 21 (5): 573–583. doi:10.1016/S1359-4311(00)00069-7. ISSN 1359-4311. ^ a b Rupam, Tahmid Hasan; Islam, Md. Amirul; Pal, Animesh; Saha, Bidyut Baran (2020-07-05). "Adsorption thermodynamics and performance indicators of selective adsorbent/refrigerant pairs". Applied Thermal Engineering. 175: 115361. doi:10.1016/j.applthermaleng.2020.115361. ISSN 1359-4311. ^ Goyal, Parash; Baredar, Prashant; Mittal, Arvind; Siddiqui, Ameenur. R. (2016-01-01). "Adsorption refrigeration technology – An overview of theory and its solar energy applications". Renewable and Sustainable Energy Reviews. 53: 1389–1410. doi:10.1016/j.rser.2015.09.027. ISSN 1364-0321. ^ "Gas driven heat pumps" (PDF). London: Department for Business, Energy & Industrial Strategy. September 2016. Retrieved from " February 25, 2019 The generation of low-grade waste heat in the chemical industry is in abundance. Through this waste heat, one can generate hot water at 50 0C – 100 0C. However, most of the heat goes unused. The development of new technologies now has bought effective change in the utilization of this waste heat. It can be used for air conditioning and process cooling in an eco-friendly manner to optimize energy efficiency. Why Recover Waste Heat? Various operations in industries emit a significant amount of greenhouse gases and waste heat which are mostly rejected in the atmosphere via cooling towers. The waste heat emitted in the atmosphere is the by-product of the inefficiencies in the industrial processes and represents wastage of money, resources and opportunities. The major sources of waste heat generation are; Process Heating Generation of Steam Heating and Cooling of Fluids and Gases Generation of Power How Can Waste Heat Be Utilized? There are numerous ways to utilize waste heat emerging from manufacturing plants, depending on the needs of the industry. Organizations use thermal driven chillers, absorption chillers or adsorption chillers based on their preferences. However, adsorption chillers are the most widely used equipment for utilizing waste heat. The chillers have been a part of the manufacturing industries for a long time. With the evolution of technology, the adsorption chillers manufacturers have also developed eco-friendly chillers. The advanced tech in these chillers uses inert adsorbent (Silica) and refrigerant (Water) to produce chilled water for air conditioning and process cooling. Which is a Better Choice? In the past, manufacturers used thermally driven chillers to utilize waste heat; however, such chillers required high upkeep and maintenance. Then there are the absorption chillers that depend on the corrosive solution of lithium bromide salt that corrodes the steel shell and copper tubing of the unit. Moreover, as the absorption chillers produce hydrogen, they require costly palladium cells in their unit to remove hydrogen. The lithium bromide solution in absorption chillers tends to solidify within the system while it is under operation. This change in state causes major problems in the working efficiency of the machine. Thus, the chillers require a dedicated caretaker to keep its working smooth. On the other hand, adsorption chillers utilize silica as their desiccant and municipal water as their refrigerant. There are no chemicals like lithium bromide, ammonia, CFC’s of Freons used in these chillers. By refraining from the use of these chemicals, the risks of hazardous material leaks and aggressive corrosion is reduced. Moreover, as adsorption chillers also use eco-friendly technology, they do not harm the atmosphere. Adsorption chillers also reduce upkeep and maintenance significantly as they use silica gel instead of the lithium bromide solution. The number of moving parts in adsorption chillers is also comparatively low; therefore, they do not require regular attention that is necessary in case of absorption chillers. To decrease revenue losses and atmospheric pollution, manufacturing industry executives need a perfect solution to utilize the low-grade heat that remains unused. With the embedment of new technologies, adsorption chiller manufacturers can provide you with a product whose total cost of ownership in almost one-third that of absorption chillers. Therefore, if you are looking for a cost-effective, and eco-friendly solution to utilize the waste heat, adsorption chillers are the perfect solution for you. Absorption chiller occupies vital position in an HVAC system. Absorption chiller is an equipment which uses a heat source, a refrigerant and an absorbent for producing chilled or hot water. In the types of chillers,along with vapor compression water chiller or electric chiller, absorption cooling system is also used in many applications. Absorption chillers produce chilled water under vacuum conditions for the purpose of air-conditioning and technology process. Basic components of Vapor absorption chillers Absorption chillers in its simplest form (single stage) consist of following main parts: Generator Condenser Evaporator Absorber Heat exchanger Refrigerant Pump Solution pump Working Principle of Absorption Chiller 1. Function of Generator in absorption chiller In generator of absorption chillers weak solution is heated by operating steam (steam absorption chillers),hot water or flue gases in indirect fired absorption chillers.While direct fired absorption chillers are Natural gas, Diesel or Kerosene Oil Operated.After heating in generator solution is concentrated and high temperature refrigerant vapors are produced.After generator process in a chiller high temperature and pressure refrigerant vapors travel to condenser. A strong solution enters absorber through heat exchanger in exchanging heat with weak solution . 2. Function of Condenser in absorption chiller Refrigerant vapor from generator is condensed in condenser by cooling water. Condensation is constant pressure process where refrigerant (water) gives off its heat to cooling water .In this way refrigerant heat is carried to atmosphere.In water cooled chillers, cooling water recycles after exchanging heat with air in cooling towers of same HVAC system. 3. Function of Evaporator in absorption chiller Refrigerant from condenser flows to evaporator .In this compartment of absorption chiller,refrigerant gets vaporized by taking heat from chilled water.Refrigerant from evaporator refrigerant pan is pumped over the evaporator tubes with the help of refrigerant pump.Flow of refrigerant over evaporator tubes evaporates the refrigerant thus producing refrigeration effect, and evaporates to form vapor by absorbing heat of chilled water flowing through tubes.In this way,evaporation takes place at constant pressure process where refrigerant gets latent heat from chiller water. Chiller absorption takes place here in absorber. Chilled water is cooled and return to the system of customer. 4. Function of Absorber in absorption chiller Produced refrigerant vapor enters absorber, and absorbed by strong solution in the absorber. In this way,strong solution is diluted by absorbing refrigerant vapor in absorber . Heat generated is carried to atmosphere by cooling water. 5. Function of HVAC Solution Pump in absorption chiller This weak solution is transferred by solution pump to generator for concentration.Pumps are components in absorption cooling systems which require electric energy for its operation.Weak solution from the absorber is pumped into the generator through heat exchanger. This process is continued, and refrigeration effect is repeated.
what is absorption chiller how it works. how does a absorption chiller work

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