Thermal Analysis of Aluminum Tube Condenser at Varies Temperatures

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Abstract— Requirement of freezer design are changes for various needs and application. This advanced refrigeration we can use varies condition like preserving fruits, vegetables, soft drink manufacturing industries. Further it can be developed that the number of fish industries and also in food are usually highly increased by freezing if quick freezing is employed. The conventional freezers could not increase quickly with this higher rate of freezing. By the development of this advanced freezer, the challenge of quick freezing has been met to enhance effective preservation. In this system modified and developed advanced condenser may be used with higher efficiency to the freezer. The advanced freezer may be manifolds for normal flow of the refrigerant or they may be connected for parallel flow. This type of freezer especially useful used in heavy load condition and fish industry cooling system installation where unusual heavy load condition.

Keywords: coefficient of heat dissipation, stainless

I. Introduction

Conventional food preservation is done by keeping the food inside chambers having evaporator coils around it. This chamber is insulated from the surroundings by a casing. The vapor compression system is the most widely used system. A copper tube freezer consisting of two side square shaped freezer connected in series and having a cooling load of 0.5 kw is to be designed .installing formed tubing between two metal plates which are brazed together at the edges form the plate surface evaporators. The heat transfer take place from the food to the freezer surface through the air gap.AS air is a bad conductor of heat, the freezer rate is low and the time consuming .the freezer rate was increased by development of the freezer. Only compact able food scan utilize his method. The plate freezer under consideration is a multi-plate freezer. In the plate freezer there are two plates through which the refrigerant expands. The food is placed between the plates are brought closer so the food gets pressed to pre-determined pressure as the plate are in direct contact with the food there is better heat transfer and hence the freezing rate is increased. The plate freezer there are two plates through which the having a high heat transfer coefficient. The plates are brought close manually. Compare to the conventional method of freezing this method takes only a quarter of the time required to bring 1 kg of meat from 30^0c to 20^0c, the freezing rate increased about 4 times.

This is the most important reason why plate freezers are replacing conventional freezing equipment in the recent past The plate freezer the evaporator plates are arranged in series. The refrigerant after compression enters the condenser where the latent heat is rejected.

The it is passed through a drier filter to remove moisture and dust particle from the liquid refrigerant. The expansion device used is capillary tube. The refrigerant enters the evaporator plates which are arranged in series.

An accumulator is provided before the suction line to prevent any liquid refrigerant entering the compressor. The four major equipment of the plate freezer, viz, the compressor, condenser, evaporator and expansion device, each have their individual characteristics which are functions of evaporator and condenser temperature Cooling coils of passing Refrigerant goes into the gas tank condenses as in air-cooled condensers. Air passing through the outer surface of the coil, a portion of the evaporation of atomized water in the opposite direction brings the cooling effect still occurs (as is the same with the cooling tower). Thus, the condensation temperature of the condenser and hence pressure is reduced to a lower level. Outer surface of the coil, in order to meet the effect of the formation of low coefficient of heat transfer film is provided with ribs to enhance field. However, in modern evaporative condensers, pipe outer surface achieve high heat transfer coefficient to achieve a good result in wetness and wingless straight pipes are used. Whether continuous manner with a pump in water from the water collection chamber in the lower level of the condenser to a nozzle group printed at the top of the cooling coil and sprayed from nozzles. This water evaporates about 3-5% (approximately 6 to 7.5 liters / h per ton / for refrigerated) is transferred into the air, the water tank, water continuously through the float valve is provided. However, this addition of water in the condenser and the output increases normally continuously reaches the highest level. The temperature of the water taken from Refrigerant temperature starts to drop the temperature by receiving heat of vaporization of water showed an increasing trend. As a result, the water temperature rises at the entrance of the cooling coil (air wet bulb temperature is rising quite in this section) and subsequently begins to fall instead of approaching the temperature of the inlet air. Collecting pool water temperature, a stable operation is reached much change. Evaporative condensers usually on the roof and outside of the building, but put into building air inlets and outlets may also be provided with channels from galvanized sheet. Winter operation of the device outside of the building measures should be taken against freezing is concerned. In applications in building cold wet air volume passing through the channel that will be taken in case of condensation in the duct should be kept in mind, and measures must be taken to disposing of the water. app building will conserve energy when applied as an integrated exhaust fan and an exhaust system. As the air cooled condenser with evaporative condensers work well during cold weather should prevent the formation of condensation pressure is too low with a particular true objective to have snappy warmth quick move in an evaporator, the material used for the improvement of an evaorator twist should be a tolerable conductor of warmth. The material, which is not affected by the refrigerant, ought to in like manner be picked. Since metal are best transmitters of warmth, Therefore they are always used for evaporators. Iron and steel can be used with each fundamental refrigerant.

Metal and copper are used with regardless of refrigerants from antacid, Aluminum should not be used with Ferro 12

II. LITERATURE REVIEW

In ancient circumstances, man found that his amusement would last amid times when sustenance was not accessible if put away in the coolness of a give in or stuffed in now. In China before the main thousand years, ice was gathered and put away.

Jews, Greeks, and Romans set a lot of snow in to capacity pits dove in to the ground and protected with wood and straw. The old Egyptians filled earthen jugs with bubbled water and put them on their rooftops, accordingly presenting the jarsm to night's cool air. In India, eative cooling was utilized. At the point when a fluid izes quickly, It extends rapidly. The rising atoms of suddenly increment their active vitality and this expansion is suffocate from the prompt surroundings of the. These surroundings are subsequently cooled.

The middle of the road organize in the historical backdrop of cooling nourishments was to include synthetics like sodium nitrate or potassium nitrate to water making the temperature fall. Cooling wine by means of this strategy was recorded in 1550, similar to the words" to refrigerate"

The primary refrigeration was exhibited by William Cullen at the University of Glasgow in 1748. Cullen let ethyl ether bubble in to an incomplete vacuum; he didn't, be that as it may, utilize the outcome to any handy reason.

Ice was first delivered financially out of channel road in New York City to Charleston, South Carolina in 1799. Sadly, there was very little ice left when the shipment arrived. New Englanders Frederick Tudor and Natthaniel Wyeth saw the potential for the ice business and altered the business through their endeavors in the principal half of the 1800s. Tudor who wound up known as the "Ice King", concentrated on delivery ice to tropical atmospheres. He explored different avenues regarding protecting materials and fabricated icehouses that diminished dissolving misfortunes from 66 percent to under 8 percent. With contrived a strategy for rapidly and efficiently cutting uniform squares of ice that changed the ice business, making it conceivable to speed dealing with methods away, transportation and conveyance with less waste.

In 1805, an American creator, Oliver Evans, planned the primary refrigeration machine that utilized vapor rather than fluid. Evans never developed his machine, yet one like it was worked by an American doctor, John Gorrie.

In 1842, the American doctor John Gorrie, to cool sickrooms in a Florida healing center, outlined and manufactured an air-cooling mechanical assembly to treat yellow-fever patients. His essential rule that of packing a gas, cooling it by sending it through transmitting curls, and after that extending it to bring down the temperature further—is the one frequently utilized as a part of fridges today. Surrendering his medicinal practice to take part in tedious experimentation with ice making, he was conceded the principal U.S. patent for mechanical refrigeration in 1851.

Business refrigeration is accepted to have been started by an American representative, Alexander C. Twinning, in 1856. Instantly subsequently an Australian James Harrison, analyzed the coolers utilized by Gorrie and twinning and presented - pressure refrigeration to the blending and meatpacking enterprises.

Ferdinand carre of Frane built up a to some degree more mind boggling framework in 1859. Not at all like eatlier pressure machine, which utilized air as a coolan, carre's hardware contained quickly extending alkali. Smelling salts melts at a much lower temperature than water and is along these lines ready to ingest more warmth.) Carr;s iceboxes were generally utilized, and pressure refrigeration progressed toward becoming, and still is, the most broadly utilized technique for cooling. Be that as it may, the cost, size and intricacy of refrigeration frameworks of the time, combined with the poisonous quality of their smelling salts coolants, kept the general utilization of mechanical fridges in the home.

III. ALUMINUM CONDENSER ANALYSIS

Aluminum must have sufficient strength to resist the mechanical and thermal stresses developed during braking. To satisfy these requirements the drum material should possess a high thermal conductivity, thermal capacity, and low coefficient of thermal expansion, modulus of elasticity, high strength, sufficient hardness and a suitable metallurgical structure. The steady state thermal analysis calculates the effects of steady thermal loads on the aluminum. Transient thermal analysis determines temperatures that vary over time.

loads, it can use either a function tool to define an equation or a function describing the curve and then apply the function as a boundary condition, or it can divide the load versus time curve into load steps.

Temperatures that a transient thermal analysis calculates can be used as input to structural analysis for thermal stress evaluations.

IV. FABRICATION PROCESS OF ALUMINUM TUBE CONDENSER

A. *Selected Compressor*

Specifications:

Compressor power = 1/8

hp = 93.2watt

No. of Port = 3

Discharge dia. = (4/16inches)

Motor Power = 1/2 hp

Capacity = 195 lts.

Current Flow = 1Amp.

Voltage = 230V

Frequency = 50 Hz

B. *Selected Copper tube*

Specification
Total length of the 5/6' Al tube was 8 meter

5/6' Al tube for evaporator
¼ tubes joining the tubing's (4 feet)
Capillary tube for expansion (12 feet)
Selected Condenser
Specifications:

Diameter of tube = 3.86 x10-3 m

Ratio of fin area to bare area = 15

Length of tube = 5.7m

Face area = 0.40m x 0.48m

Material = aluminum

Capillary Tube Specifications:

Diameter = 3.66 x 10-3 m

Length = 2. 25m

C. Selected Evaporator

Specifications:

Diameter of the tube = 9.525 x 10-3 m

Material Selected = Copper

Area of the copper plates = 0.445m x 0.365m

Thickness of the plates = 5 mm

Weight = 750gm

No. of Plates = 2

D. Selected Cabinet Specifications:

Size of Cabinet = 0.5m x 0.3m x 0.1m

Volume of Cabinet = 15 litters

Material = Thermopolis Sheet and wood

E. Other selected components

Relay for electrical connections
Condenser Air-cooled; for condensing the liquid

Gas (Freon 12) Refrigerant

Oil for lubrication

Brazing rod for brazing the tubing's

Lead For soldering

Wooden planks for making the outer cabinet

Wheels For transport

Wires For electrical connections insulating the wires

Thermopolis sheets To cover the sides of the table

F. Tools Required

– Soldering Iron
– Brazing Rod
– Tube Cutter
– Hammer
– Carpentry Tools
– Charging Line Gauge
– Hand Shut-off Valve
– Vacuum Pump
– Cutting Flair

V. RESULT AND DISCUSSION

Operational Conditions
Measurements of different parts

1) Dia. of Capillary tube = 0.3 +.01x6.6 = 0.366cm
2) Dia. of Evaporative coil = 2.5 +.04x5.8 = 4.5 cm
3) Dia. of Condenser coil = 1.1 +.01x5= 1.15cm
4) Dia. of Charging port = 1.4+.01x6 = 1.46cm
5) Dia. of Discharge port = 1.1 + .01x5.8= 1.15cm

Temperature of Various Components (in °C)

Time (in min.)	Lower Plate	Upper Plate	Compressor	Condenser
5	29.7	30.4	38	36
10	24.2	21.9	40	43.4
15	29.3	28.3	46	40.4
20	31	30	51.2	44.1

Refrigerant Mass Flow Rate (g/s) 0.35
Air Mass Flux (kg/m2 s) 5
Refrigerant Inlet Pressure (MPa) 1.3177
Air Inlet Temperature 28 ^{O}C
Refrigerant Inlet Temperature 50^{O}C
Refrigerant Condensation Temperature 36 ^{O}C
Warm conductivity of, Convective warmth exchange cofficient,
Inside film hello there = 15 W/m2k
Accordingly,
Warmth led inside the evaporator because of invasion
Q = (T1-To) 2π rh
Around =2.2174Watt
=2.2174j/s
=8kj/hr
Qact for one tone 3516.85kj/hr
Add up to cooling load on the unit,
Q add up to = 2(Q infiltare+ Q genuine) =2(8+3516.85) =2(3318.6) kj every hour =6637.2Kj/h
=1.844 Kwatt
= 0.512 TR
=0.5 TR
Work done by blower per kg of refrigerant,

W=(0.589) (h2-h1) =(0.589+0.377) (205-185.36) =18.49kj/min =0.3165kw

Coefficient of performance of refrigeration unit

$$Cop = (Q_c/W_c)$$
$$= 1.844/0.3165$$

VI. CONCLUSION

The advanced freezer it is to be expressed of further improvements are finished by extra plans in the present created fastest freezer then the cost of the domestic and vitality sparing with fake courses of action of existed frameworks additionally basic outline change of freezer framework to diminishing the vitality investment funds and new freezer frameworks alteration of configuration to expanding the execution of refrigeration framework to diminishing the warmth delivered by the condenser by persistent utilization of framework by showering fastest freezer cooling oil and game plans of cooling fast to the evaporator to diminishing over high cool generation effectively cool increasing and gathering was multiplied . Keeping in perspective of monetary viewpoints we have endeavored to create a cooler which would vitality sparing and work profoundly great. In this the primary piece of intrigue is the body which is anything but difficult to manufacture and at less costs. Presently with this the limit of cooler has high.

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