RESEARCH ARTICLE OPEN ACCESS

Repair and Rehabilitation of Faulty Deep Freezer

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Abstract:

The requirement for an authentic and trustworthy report on the repairs and rehabilitation of a faulty air conditioner is unavoidable. Many homes and offices use air conditioners to keep the temperature at a comfortable level. As a result, maintaining the air conditioner should be a top priority for everyone in order to avoid large expenditures on system repairs. As a result, this report is written for the benefit of those who are fortunate enough to have an air conditioner in their home. This report is based on basic and advanced research in order to facilitate easy reading and comprehension for the average person. This report begins with an introduction to the importance of an air - conditioner, the history, a description of the important components of the air - conditioner, the general maintenance and regular maintenance and servicing that one is expected to perform for the effective performance of the air-conditioner, and the faults discovered along with the repairs performed. As a result, certain sections of this report have been given advanced information pertaining to the repairs and calculations involving a faulty air conditioner, which will be beneficial to those interested in the repairs of the faulty air conditioner.

Keywords — **Optimisation, evaporator coil, performance, deep freezer, alternate refrigerants, overall heat transfer coefficient..**

INTRODUCTION:

All tropical countries have faced the problem of air pollution over the years. The relative humidity of air in most of the tropics is very low; thus, comfort is lacking among the populace, particularly in workplaces. As a result, workers' work rates are reduced, affecting a country's GROSS NATIONAL PRODUCT. To that end, engineers and scientists are investigating methods of providing comfort to people at home and at work. They developed an appliance known as an AIR CONDITIONER to help people maintain a cooler temperature. This appliance has been in use for a long time, but most users prefer to replace their old ones with new ones due to a lack of knowledge on how to maintain, repair, or even rehabilitate minor air conditioner faults. [1]

Deep Freezer:

It is an electron-mechanical device that maintains the temperature of a substance, space, or materials to the user's specifications, i.e. it produces artificial cooling. It works on the Reversed Carnot Cycle principle. That is, it absorbs heat at low temperatures and rejects it at high temperatures. The compressor converts the energy used in circulating the refrigerant around the circuit. The torque produced by the electric motor moves the crankshaft, which drives the piston via the connecting rod. The pumping effect of the piston creates high pressure on the refrigerant, causing it to move. The refrigerant returns to its initial state as a result of circulation and the associated change in state. [2]

The condenser in a deep freezer functions similarly to the radiator in an automobile. It cools the hot refrigerant gas by releasing heat into the surrounding environment and changing to liquid. The liquid is routed to the dryer, which collects moisture that could clog the metering device. The liquid refrigerant passes through the metering device, which expands the liquid into the larger cross sectional area evaporator pipe. The pipe is placed inside the Deep Freezer. A significant

amount of insulation is used to isolate the refrigerated space from the surrounding environment and its heating effect. One thing is certain: heat cannot be completely isolated from the refrigerated space. However, it must be kept to a bare minimum. Other modifications and appliances are installed for convenience, efficiency, and security. [3]

PHYSICAL MODEL:

Figure 1 depicts the physical model of the chest freezer under investigation. It is a hard top type chest freezer with a 400 L capacity. It has a temperature range of -18 C to -22 C. As shown in Figure 1, the condensing unit is integrated at the bottom corner of the freezer and is highlighted in red circle.

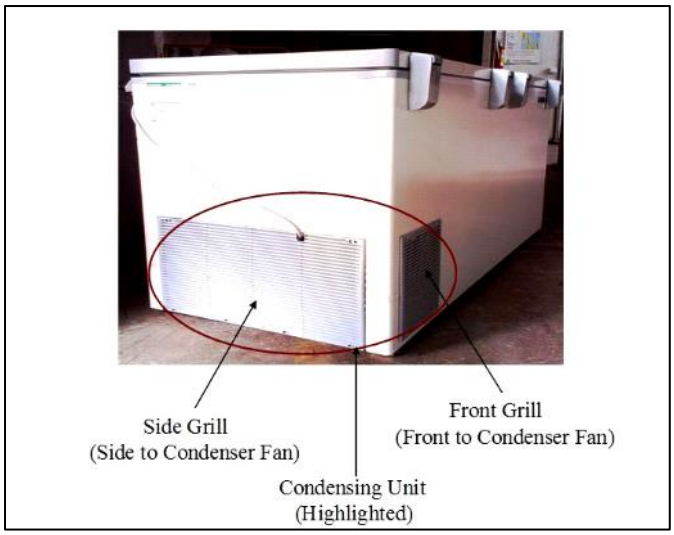

Figure 1: Physical model of chest freezer

Five thermal laws govern all refrigeration systems:

1. Fluids absorb heat when transitioning from a liquid to a vapour state and give up heat when transitioning from a vapour to a liquid.

2. If the pressure remains constant, the temperature at which a change of state occurs remains constant.

3. Heat only flows from a body at a higher temperature to a body at a lower temperature (hot to cold).

4. The use of metallic parts with high heat conductivity in the evaporating and condensing units (copper, brass aluminum).

5. Heat energy and other energy forces are interchangeable. Electricity, for example, can be converted to heat, heat to electrical energy, and heat to mechanical energy.

REFRIGERATOR REPAIR SERVICES:

Nowadays, it's difficult to imagine a home without a refrigerator. It not only keeps the food inside longer, but it also keeps bacteria from growing for a longer period of time. The humid climate of Kolkata is another reason why a refrigerator is required. It is not until a refrigerator breaks down that one realises how important it is. Refrigerators, like any other home appliance, require servicing and maintenance. In general, refrigerators last about 15 years, but their parts can fail. It will be difficult to find a trustworthy refrigerator service in this city, and you may be duped. Consider taking your broken refrigerator to a reputable fridge repair service centre in Kolkata. Newtack Company provides specialised professionals who can easily repair your fridge and provide you with genuine parts in the comfort of your own home. Here are a few common refrigerator problems.

Water leaks from the refrigerator: A drainage hole is located at the back end of the refrigerator, above the drawers. This opening leads to the evaporation tray located above the compressor. During normal refrigerator operation, water drains into this hole. When this hole becomes clogged by dirt or food, the water is forced back into the refrigerator, resulting in leakage. A skilled professional can easily resolve these issues in your home.

The thermostat is faulty: A faulty thermostat will be unable to send a signal to the start capacitor, resulting in your refrigerator not starting. A fridge

repair technician will replace this thermostat right away.

Refrigerator not cooling: In the freezer zone of a refrigerator, there are evaporator coils and a circulating fan. Excessive frost can result in poor cooling. A faulty evaporator fan is another common cause of refrigerator not cooling properly. The fan circulates cool air from the freezer to the refrigerator's other compartments. When the evaporator fan stops working, cool air cannot circulate inside the food section. As a result, the freezer remains cold, but the food section of your refrigerator does not cool.

Refrigerator noise problem: If your refrigerator is making a lot of noise, the condenser fan may be broken. A condenser fan is located near the compressor at the bottom of a frost-free refrigerator. A condenser fan circulates air over the condenser coil to remove heat generated during the refrigerant compression process. If your refrigerator is making a loud noise that appears to be coming from the freezer, the evaporator fan could be to blame. An evaporator fan is located in the freezer section of your refrigerator and circulates cool air in the food section.

Worn-out compressor: The refrigerator's compressor is a little loud and noisy. However, if the noise from the fridge becomes louder than usual, the compressor may be at fault. If the noise from the refrigerator continues to worsen, it is an indication that the compressor is about to fail. The most likely cause of the refrigerator making noise problem is a faulty compressor.

Motor failure: When the refrigerator's motor fails, it stops working. This part must be replaced if your refrigerator is to function properly. [4-5]

OBJECTIVES:

1. Research the various types of refrigerator repair services available.
2. To investigate the rehabilitation of deep refrigerators.
3. To investigate how five thermal laws affect refrigeration systems.
4. To conduct a refrigerator literature review.

REVIEW OF LITERATURE:

R12 was the refrigerant used in refrigerators before 2000. To meet the Montreal Protocol objectives, R12 must be replaced by either hydrocarbon mixtures or R134a/hydrocarbon mixtures without modifying the existing system (Mohanraj et al., 2009). Poggi et al. (2008) conducted a review of the relationship between the system architecture, cooling capacity, and refrigerant charge of the system. It was discovered that the cooling capacity versus refrigerant charge ratio is affected by the size of the components; additionally, the amount of refrigerant charge is influenced not only by the volumes of the heat exchangers but also by the volumes of the accessories. [6]

According to Baolian and Zhang (2006), a binary mixture of R744 and R290 at 71:29 mole fractions, used as an alternative to R13 in a cascade refrigeration system, has a higher COP and capacity. A 280l R134a-based domestic refrigerator's performance with liquefied petroleum gas (LPG) composed of R290, R600a, and R600 (60:20:20 by mass fraction) as an alternative (Fatouh and El Kafafy, 2006). R407C with 10% and 20% HC blend composed of 45% R290 and 55% R600a (by weight) as an alternative in window air conditioners without changing the mineral oil was tested (Jabaraj et al., 2006). It has been reported that a 19% increase in condenser tube length is required to accommodate these mixtures when compared to R22. R407C with a 20% HC blend was found to be a promising alternative to R22 in window air conditioners without changing the mineral oil, according to experimental results. [7]

Xuan and Chen (2005) investigated a ternary mixture of R161/R125/R143a (10:45:45 percentage by weight) and found that the physical properties of the R161 mixture are similar to those of R502 but have lower environmental properties than R502 and R404A. At low evaporator temperatures, the coefficient of performance (COP) of the R161

mixture is equal to that of R404A, and its discharge temperature is slightly higher than that of R404A. The ternary mixture had a higher COP than R404A at higher evaporator temperatures, but a lower discharge temperature. [8]

RESEARCH METHODOLOGY:

The experimental setup is designed in accordance with the load calculation, equipment selection, and optimisation for a 400 L chest freezer. The methodology begins with the selection of a compressor based on the load calculation, the optimal design of other equipment such as the evaporator coil, capillary tube, and condenser coil, and the optimization of the refrigerant charge quantity to withstand break-down conditions.

Books, educational and development journals, government papers, and print and online reference materials were just a few of the secondary sources we used to learn about the composition, use, and consequences of faulty deep freezers.

RESULT AND DISCUSSION:

The system is first charged with 400 g of charge per the compressor specifications, and then tested for temperature stability. Every 4 hours, 10 g of charge is removed from the system, and the system is tested for stability.

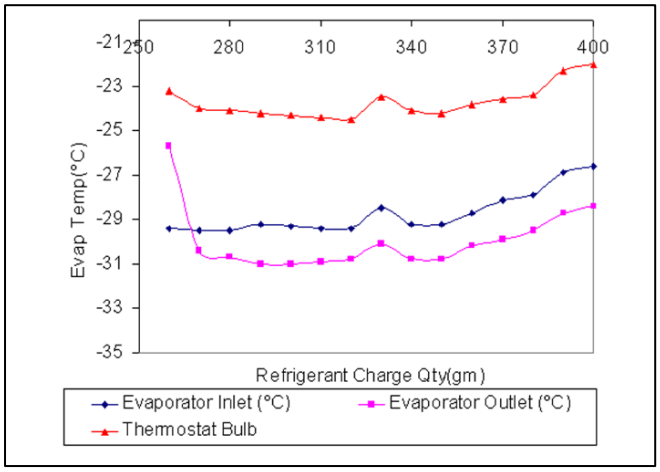

Figure 2: Evaporator temperature vs. refrigerant charge quantity

Figure 2 shows that at 1.89 A and a rated power input of 190 W, a 320 g charge is sufficient to maintain the mandatory stabilised temperature changes inside the freezer cabinet. [9]

Table 1: Inlet conditions for Coil Designer analysis

Inlet air flow		Refrigerant state	
Parameters	**Unit**	**Parameters**	**Unit**
Presser	Pa	Saturation temperature	K
Temperature	K	Saturation delta	K
Relative humidity (%)	-	Mass flow rate	Kg/s
Actual air flow rate (CFM)	Ft^3/min		

Coil Designer relies heavily on inlet conditions for both air and refrigerant. Table 1 shows the conditions chosen for this study from among the available inlet condition types. [10]

CONCLUSION:

The refrigeration system for a freezer is designed with strict standards to ensure that the system's quality and flexibility are not compromised. The system is designed for maximum efficiency at a low cost; efficient equipment design results in energy savings, which lowers operating costs. By removing dust particles or contaminants from the system, the overall system performance can be improved. The location of the freezer is also important in reducing the load on the system. The greater the temperature exposure, the greater the capacity and power requirements. Future work would include the development of an even more energy efficient freezer capable of operating in a variety of ambient conditions and with alternative refrigerants, making it more cost effective and feasible at breakdown conditions. In addition, a new chest freezer model with freezing temperatures below 0 °F and relative

humidity levels of 80-95% will be designed for frozen food storage.

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