



# Fabrication of Water Heater/Cooler using Refrigeration system

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## ABSTRACT

*This water heater cum cooler makes the study of water-cooling system using a compressor in Refrigerator system. The main aim in developing this device is to develop a multifunctional unit which can provide both hot water and cold water using the regular refrigeration cycle. The refrigeration cycle is a thermodynamic heat pump cycle which is a conceptual and Mathematical model for heat pump, air conditioning refrigeration systems.*

*The refrigerant R-22 /F-22 (FLORON – 22) is used as medium which absorbs and removes heat from the water and subsequently rejects the air in the atmosphere. The Main difference between this water cooler & Heater and Traditional water Heater & Cooler used domestically is this comprises of a compressor functioning of this system. Whereas, that Traditional Heater, Cooler has condenses and has 2 switches to combine working & it's a Non – Cyclic process. Their capacity is less. Circuit is different Power consumption is more. This is more effective and controllability is more. Constant refilling of water is necessary.*

*This is a cyclic process which uses both condenser and evaporator. Water storage space is more. Power consumption is less. Usage is easy usage.*

**KEYWORDS:** Compressor, Refrigerant, Condenser, Evaporator, Accumulator, Water heater/Cooler.

## 1. INTRODUCTION

Refrigeration involves the process of removing heat from a body and cooling it to a lower temperature than the actual. Refrigerators are used for the refrigeration process.

Heat and cold are two different entities associated with temperature. Body temperature is measured by a thermometer. We prefer to wear light coloured cotton clothes when it is hot. We prefer to wear light coloured cotton clothes when it is hot. We prefer to wear dark-coloured polyester clothes when it is cold as per

the weather. Heating is the process of upkeeping the heat in the body. Refrigeration is the process of cooling space.

Any substance capable of absorbing heat from another required substance can be used as refrigerant i.e. ice, water, air or brine. A mechanical refrigerant is a refrigerant which will absorb the heat from the source and dissipate the same to the sink or in the form of latent heat. The physical properties will enable them to repeat continuously a liquid to gas and gas to liquid transformation. Air was used as a refrigerant in many

refrigerant system in olden days considering as safest refrigerant. Ammonia, carbon dioxide and Sulphur dioxide were used for domestic and commercial purposes until ferons were available. The refrigerants are classified in to two groups: 1. Primary refrigerants 2. Secondary refrigerants Primary refrigerants directly take the part in the refrigerants system where secondary refrigerants are first cooled with the help of the primary refrigerants and are further used for cooling purpose. The main aim behind developing this device is to develop a multifunctional unit which can provide cold water along with regular air conditioning cycle. The refrigerant is used as the medium which absorbs and removes heat from the space to be cooled and subsequently rejects that heat elsewhere. This heat of the refrigerant is used to cool the water, which can be then used for drinking purposes. The air cycle is the conventional vapor compression cycle.

This process was witnessed, in the Greeks and Romans period to cool their food with ice transported from the mountains. Preservation of the food is the main idea which leads to the development of the refrigeration process. Refrigeration inhibits the growth of microorganisms like bacteria, yeast and mold thus helping in the destroying of food items. It is mainly used to store foodstuff at low temperatures for a longer period of time. Some products can be stored for months and even for many years. Water when freezed becomes ice which is the key ingredient of many processes. Packed snow and ice could be preserved for months.

## 2. DESCRIPTION OF COMPONENTS



1. Refrigerant
2. Compressor
3. Evaporator
4. Condenser
5. Capacitor
6. Storage tank
7. Accumulator

**1. Refrigerant:** -The term 'refrigeration' may be defined as the process of removing heat from a substance under controlled conditions. It also includes the process of reducing and maintaining the temperature of a body below the general temperature of its surroundings. In other words, the refrigeration means a continued extraction of heat from a body

For example, if some space (say in cold storage) is to be kept at  $-2^{\circ}\text{C}$  (271K), we must continuously extract heat which flows into it to leakage through the walls

Heat which is brought into it with the articles stored after the temperature is once reduced to  $-2^{\circ}\text{C}$  (271K). Thus in a refrigerator, heat is virtually being pumped from a lower temperature to a higher temperature. According to Second Law of Thermodynamics, this process can only be performed with the aid of some external work. It is thus obvious that supply of power (say electric motor) is regularly required to drive a refrigerator.

Theoretically, a refrigerator is a reversed heat engine or a heat pump which pumps heat from a cold body and delivers it to a hot body. The substance which works in a heat pump to extract heat from a cold body and to deliver it to a hot body is called a refrigerant.

**2. Compressor:** -The compressor is the pump that enables the flow of the refrigerant. The compressor works by increasing the pressure and temperature of the vaporized refrigerant. There are different types of compressors for refrigeration applications. Reciprocating, rotary, and centrifugal compressors are the most common among refrigeration units. The compressor is the heart of the refrigeration system. The compressor acts as the pump that moves the refrigerant through the system. Temperature sensors start the compressor's action. Refrigeration systems cool objects through repeated refrigeration cycles.



### Tropicalized Rotary Compressor

**3. Evaporator:** This is the part of the refrigeration system that is doing the actual cooling. Because its function is to absorb heat into the refrigeration system (from where you don't want it), the evaporator is placed in the area to be cooled. The refrigerant is let into and measured by a flow control device, and eventually released to the compressor. The evaporator consists of finned tubes, which absorb heat from the air blown through a coil by a fan. Fins and tubes are made of metals with high thermal conductivity to maximize heat transfer. The refrigerant vaporizes from the heat it absorbs in the evaporator.



**4. Condenser:** The condenser, or condenser coil, is one of two types of heat exchangers used in a basic refrigeration loop. This component is supplied with high-temperature high-pressure, vaporized refrigerant coming off the compressor. The condenser removes heat from the hot refrigerant vapor gas vapor until it condenses into a saturated liquid state, as known as condensation. A condenser in simple terms is a cooling device. Every refrigeration system and power plant use condensers to condense refrigerant vapors or steam and is known as a heat rejector. Actually, it turns superheated and highly pressurized vapor into a subcooled liquid.

**5. Capacitor:** The run capacitor of the refrigerator is an important component in its start up relay. The run capacitor assists the refrigerator compressor, which should only run for a few minutes in any given hour. If it runs longer than that, the compressor can overheat or its motor can burn out.

**6. Accumulator:** The accumulator protects the system components. It is located on the low-pressure side of the circuit between the evaporator outlet and the compressor suction port. The accumulator has different roles: To provide compressor protection, preventing compressor failure due to liquid slugging.



### APPLICATIONS:

The refrigeration has also wide applications in

- Submarine ships,
- Aircraft and
- Rockets

### OBJECTIVES:

- In any Refrigeration system heat energy is lost to the surroundings and it goes as a waste. The work deals with the utilization of the out coming heat

energy is to produce hot water in the water cooler. There by we are utilizing the heat lost and also reducing the heat in the condenser to get maximized cold water.

- The circuit used in this work is same as that of the available water cooler. This concept of utilizing the
- heat energy evolved to the surrounding can be applied in any refrigeration systems.

#### ADVANTAGES:

- Cheap and abundant refrigerant, highly reliable: Air is used as refrigerant, which is easily available and inexpensive.
- Charging of refrigerant is very easy.
- Design and construction is simple, No complicated parts and its maintenance cost is low.

#### 3. CONCLUSION

- By using a water cooler and heater you can save 30% of the energy consumed. Besides, this experiment can be used in cooling rooms, offices and halls and also cools water becomes a universally accepted option in India too.
- Depending on specific situations, this runs parallel to, compete with or even replace air conditioning system. When that happens the cost of water cooling and air conditioning devices will come down dramatically.

#### FUTURE AND SCOPE:

Refrigeration already accounts for about a sixth of humanity's electricity usage, and the demand is only expected to grow as countries such as China and India busily build US-style systems of their own. In the next seven years, analysts predict, the global refrigeration market will quadruple in size.

#### Conflict of interest statement

Authors declare that they do not have any conflict of interest.

#### REFERENCES

- [1] J. Preethiban, "Invention and Design of Watercooler Cum Air Conditioner" in JOURNAL OF INDUSTRIAL ENGINEERING AND ADVANCES, VOLUME 2, ISSUE 1, PAGE 1-4 © MATJOURNALS 2017.
- [2] Vinay Vishwanath, Rohan Jikar, "Water Dispenser System Using Air Conditioner" in INTERNATIONAL JOURNAL OF

ENGINEERING SCIENCE INVENTION, ISSN (ONLINE): 2319-6734, ISSN (PRINT): 2319 - 6726, VOLUME 4, ISSUE 8, AUGUST 2015, PP.21-32. [3] A. Kaur, S. K. Singh, R. Parwez et al., "Power generation using speed breaker with auto streetlight," International Journal of Engineering Science and Innovative Technology (IJESIT), vol. 2, no. 2, 2013.

- [3] S.P. Mane, Dr.K.P. Kolhe, "Development of Refrigerator Cum Chill Water Dispenser System Using R134a" in INTERNATIONAL ENGINEERING RESEARCH JOURNAL, SPECIAL EDITION, PGCON-MECH-2017.
- [4] S.P. Mane, Dr.K.P. Kolhe, "Development of Refrigerator Cum Chill Water Dispenser System Using R134a, R600a & R290 Refrigerant: A Review" in IJSART - VOLUME 3, ISSUE 5 - MAY 2017, ISSN [ONLINE]: 2395-1052.
- [5] Pankaj Sayare, R. S. Mohod, "A Review on Fabrication of Combined Refrigerator cum Air Conditioning cum Water Heater Unit by VCRS" in IJIRSET, VOLUME 6, SPECIAL ISSUE 1, JANUARY 2017, ISSN (ONLINE): 2319 - 8753, ISSN (PRINT): 2347 - 671.
- [6] A. S. Dhunde, Prof. K. N. Wagh, Dr. P. V. Washimkar, "An Effective Combined Cooling with Power Reduction for Refrigeration cum Air Conditioner, Air Cooler and Water Cooler: A Review" in INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH AND GENERAL SCIENCE VOLUME 4, ISSUE 2, MARCH-APRIL, 2016, ISSN 2091-2730.
- [7] Sura Sankeerthan, Samba Sai Karthik, Pasurla Nandakishor Reddy, Dr. V.V. Prathibhabharathi, "Fabrication of Water Cooler cum Air Conditioner" in INT. JOURNAL OF ENGINEERING RESEARCH AND APPLICATION, ISSN: 2248-9622, VOL. 7, ISSUE 6, (PART -7) JUNE 2017, PP.06-08.
- [8] Vinay Vishwanath, Rohan Jikar, "Water Dispenser System Using Air Conditioner" in INTERNATIONAL JOURNAL OF ENGINEERING SCIENCE INVENTION, ISSN (ONLINE): 2319-6734, ISSN (PRINT): 2319 - 6726, VOLUME 4, ISSUE 8, AUGUST 2015, PP.21-32.