Installation of VRV System at Millennium Hospital

[1]Mohd Naushad Aalam, [2]Mohammad Tajuddin, [3]Izhan Ali, [4]Namrata V. Lotia
[1]UG Student, [2]UG Student, [3]UG Student, [4]Asst. Professor
[1]Department of Mechanical Engg.
[1]Anjuman College of Engineering and Technology Sadar, Nagpur, India

Abstract: Variable Refrigerant Volume system is the Heating, Ventilation and Air Conditioning (HVAC) type in the building. VRV system is a type of multiple indoor unit system that uses variable refrigerant flow control to provide human with the ability to maintain individual zone control in each cabin and floor of a building.VRV used in Building is made by DIKIN Heavy Industries that was completely installed in 2011 with two pipes system format. The objectives of this study are to gain knowledge about the Variable Refrigerant Volume system. This paper represent then variable refrigerant flow system technology, including advantages and disadvantages for consumer, possible impact on the electric consumption, applications recommendations, and technology. Also suggested that what is griping back the technology.

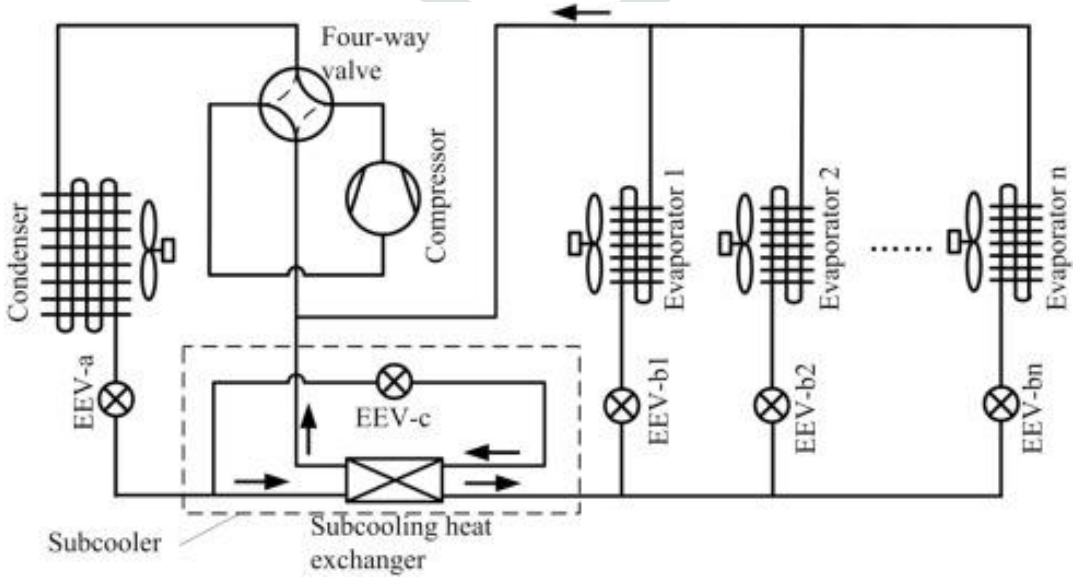
Index Terms – Components,

I. INTRODUCTION

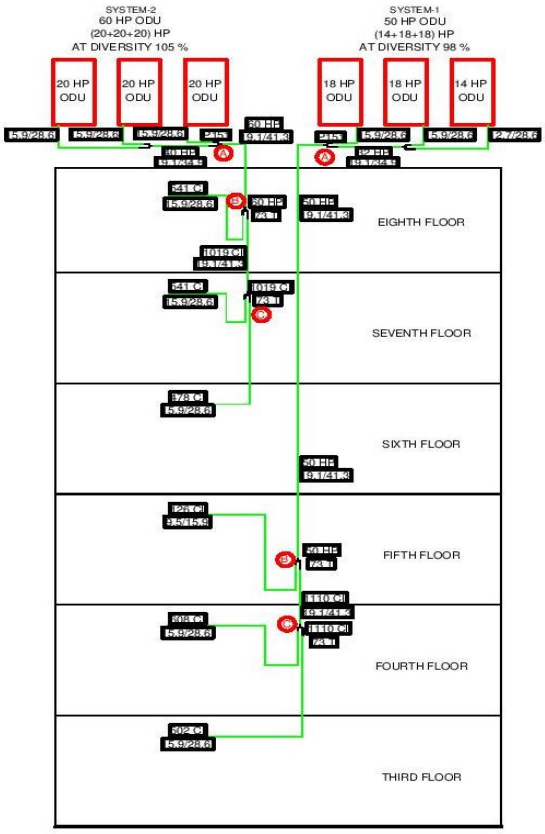
VRV (Variable refrigerant Volume systems vary the flow of refrigerant to according to heat load. The ability to maintain the amount of refrigerant flow that is provided to fan coil units located throughout a structure makes the VRF technology standard for applications with different heat loads. VRV systems are available either as H.P. systems or as heat regenerating systems for those applications where heating and cooling is required simultaneously. In addition to providing superior relief, VRV systems offers different types of design, saving of energy, with cheap installation cost. This paper will sketch the advantages of variable refrigerant volume system, describe the benefits offered by the most advanced VRV available, and illustrate general guidelines for finding a heat pump system V/S a heat recovery system. The main function of all ACs is to provide thermal relief for human beings. There are many kind obtainable air conditioning systems available, starting from the window AC to the small split systems, to the heavy chilled water systems, and currently to the variable refrigerant flow (VRV) systems. The term VRV contains the ability of the system to maintain the quantity of refrigerant flowing to the evaporators, enabling the use of many more evaporators of differing capacities and configurations, individualized relief control, simultaneous heating and cooling in different zones, and heat recovery from one zone to other.

II, WORKING OF VRV SYSTEM

VRV system connects multi indoor unit with single outdoor unit. Ductless products are fundamentally different from ducted systems in that heat is transferred to or from the space directly by circulating refrigerant to indoor units (evaporators or condensers) located near or within the conditioned space. (When the indoor units are in the cooling phase they act as evaporators and when they are in the heating phase they act as condensers.) In contrast, conventional ducted systems transfer heat from the space to the refrigerant by circulating air (in ducted systems) or water (in chillers) throughout the building. VRV systems are advance type of ductless multi-split systems, allowing many indoor units to be connected to every outdoor unit and providing additional functions as equally heating and cooling and heat recovery. VRV heat pump systems permit heating in all of the indoor units, or cooling of the all the units, not simultaneous heating and cooling. Heat advancing systems provide simultaneous heating and cooling as well as heat recovery to reduce energy use during the heating season. Over the last 14 years the technology has advanced in a number of areas.



III. CONNECTIONS BETWEEN INDOOR & OUTDOOR UNIT:



VRV PIPING RISER DRAWING

IV. CALCULATIONS

CALCULATIONS FOR SINGLE ROOM OF HOSPITAL:

Step One

Calculating area in square feet of the space to be cooled, and multiply it by 31.24

Area = length x width x 31.24
=13x11x31.24

=4468.74 BTU

Step Two

Calculate the heat gain through the windows and walls
Assume, heat gain by windows and wall is nearly 4000 BTU

Step Three

calculate the heat generated by people, allow 600 BTU/ person.

Occupant = number of people x 600
=3x600
=1800 BTU

Step Four

Calculate the heat generated by each item-tube lights, LED screen etc.

Equipment BTU = total equipment watts x 3.4
= 300x3.4 =942 BTU

Step Five

calculate the heat generated by lighting.

Lighting BTU = total lighting watts x 4.25
=100x4.25
=425 BTU

Step Six

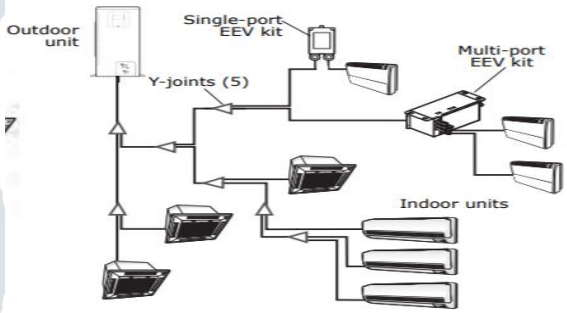
Total heat load (in BTU) = Area + Total Window + Occupant + Equipment + Lighting
=4468.75+4000+1800+942+425

Total heat load BTU = 11635.75 BTU

1 TR = 12000 BTU
Therefore 1TR high wall indoor is required

V. COMPONENTS USED IN INSTALLATION OF VRV

5.1 PIPING



Normally copper pipe is use. This is different in diameter. Normally 10 fit in length is available for piping Basic length of pipe in diameter(mm) is 6,10,12,16,19,22,28,35,42 Refrigerant piping diameter, thickness, and temper is selected according to length.

5.2 INSULATION

It helps to minimize the high noise level, absorb the vibration generated through the system, and prevent the spread of fire and adding good strength to the walls & ceilings. Good material can also protects the pipes being insulated from rash environmental conditions such as Ultra violet light, salt, water, dusts, chemical and oil. Other characteristics may include the ability to inhibit the growth or viruses, bacteria. The material is use for insulation is ELASTOMIC RUBBER.

5.3 REFNET

Many people do not realize that almost all vrv manufacturers do not allow the use of a standard refrigeration T. the majority of manufacturers required the installation of speciality fitting that they provides that is call a refnet or Y branch fitting, in addition to the speciality fitting itself every manufacturer has particular piping requirements that must be adhered to for proper system function. Post we are going to

find the impact of the refnet in the estimating, coordi-nation, and installation condition of a VRV project. We will be using the piping rules specific to the LG and DAIKIN VRV system.

5.4 BRAZING TORCH

As chlorofloro carbon refrigerants are phased out, there are much discussion about braze joint requirements for the new replacement blends. There are two reasons why contractors should pay closer attention to brazing quality.

- The alternative of CFC, such as R-410A, operate at pressures considerably greater than today's refrigerants such as R-22. For example, at 70°F the R-22 operating pressure is 120 PSIG, while R-410A is 200 PSIG. Currently, R-410a refrigerant is significantly more costly than R-22 so if you have a leak, the lost refrigerant will cost more to change.
- The related development is the transition to greater SEER air conditioning ratings. To satisfy the government mandated 13 SEER, other manufacturers will increase coil size. This usually means more brazed joints. It will not affect the contractor, HVAC manufacturers have an added incentive to improve braze quality.

5.5 COMMUNICATION CABLE:

This unit is the most important link between the indoor unit and outdoor Unit which transmit the signal from indoor unit to PLC.

5.6 AIR CONDITIONING DEVICES:

Window Air Conditioner: This type of unit is designed to cool a single room. In this type of air conditioner all the components such as, condenser, compressor, expansion valve & coil, evaporator and cooling coil are merged in a single box. This unit assembled in the window. Because of this, it is not the most pleasing option available. Therefore if you are looking to cool a single room, it is the most cost-effective option around.

Split Air Conditioner: This unit is comprised of two parts: the outdoor, which houses the compressor, condenser and expansion valve; and the indoor, which is comprised of the evaporator coil and cooling fan. The split air conditioner can be used to cool many rooms.

Packaged Air Conditioner: In packaged AC is perfect for cool multiple rooms & large space in home or office. The two possible arrangements with the package unit are. The first one, all the components, the compressor, condenser, expansion valve and evaporator are housed in one box. The cooled air is impact by the high capacity centrifugal blower and it flows through the ducts through various rooms. The second arrangement is the condenser& compressor are housed in same casing.

Central Air Conditioning System: central air conditioning system is used primarily to cool large buildings, houses, offices, entire hotels, factories, etc. This system is comprised of a large compressor that has the capacity to produce hundreds of tons of air conditioning. If you have a large area to cool, this may be the only way to go.

5.7 EXPANSION DEVICE: Expansion valve is the main element to a VRV; this cycle that makes air conditioning possible. A basic refrigeration cycle consists of 4 major elements: compressor, condenser, metering device and an evaporator. Refrigerant passes through a circuit containing these 4 elements, air conditioning occurs. The system starts when refrigerant enters the compressor in a low-pressure, temperature, gaseous form. The gaseous refrigerant is compressed by the compressor to a high-pressure and high-temperature gaseous state. gas then enters the condenser. The condenser cools the gas to a high-pressure liquid by transferring heat to a lower temperature medium, usually ambient air.

5.8 OUTDOOR UNIT

1. **CONDENSER:** condenser is generally use to cool the refrigerant of a refrigeration system, in which heat is absorbed by the vapor refrigerant in the evaporator followed by the compression of the refrigerant by the compressor. The high temperature & high pressure state of the vapor refrigerant is then convert to the liquid at the condenser.

2. **AIR HANDLING UNIT :**

An **Air handling unit** (**AHU**), is a device used to circulate air as part of HVAC system. An air handling unit is usually a large metal box containing a centrifugal blower. The heating and cooling elements, air filter of13microns, cooling coil, blower again 8 microns filter and HEPA filter is also used. AHU connected to a duct system that divide the conditioned air through the building and returns it to the AHU.

VI. FUTURE SCOPE AND CONCLUSION :

As in the current scenario we are suffering from the shortage of energy resources and also we are switching to words non-conventional sources of energy such as sun, wind etc. to generate more and more energy from it so in that case VRV system will continued to works as a contribution in power saving and also in preventing the environment from greenhouse gasses.

VII. REFERENCES :

- ASHRAE HANDBOOK 2018:BY American Society of Heating, Refrigerating and Air-Conditioning Engineer
- Refrigeration & Air conditioning 2006 : By R.S. Khurmi
- https://www.daikinindia.com/products-services/vrv
- https://www.airconditioning-systems.com/
- https://www.sciencedirect.com/science/ar