Ventilation of Toxic Air from the Paint and Plastics Manufacturing Industry

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Abstract— Heating, Ventilation and Air Conditioning (HVAC) system is arguably the, most complex system installed in the building and is responsible for a substantial component of the total building energy use. Maintaining optimal temperature and air circulation are the basis of a comfortable indoor environment .This role is played by HVAC (Heating), Ventilation and Air Conditioning) systems. The layout of a Paint and plastic industry is made by Autodesk REVIT software. A Complete ventilation system was designed to control the temperature, relative humidity and removal toxic air. In this project calculations were done by using the Revit software. After taking the plan, heating and cooling load calculations values were taken by the design department. The same values will be used in the Revit software at human comfort condition to get temperatures DBT, WBT and MEAN RANGE VALUE.

Keywords: HVAC, refrigerant, Plastics Manufacturing Industry, Toxic Air

I. INTRODUCTION

A. Heat Ventilation and Air- Conditioning

Air conditioning is used in most commercial properties, ranging from small shops and cafe's to large office buildings and public spaces. To meet these diverse applications, air conditioning systems have different heating and cooling capacities and come with various setups and layouts.

Many of our homes and most offices and commercial facilities would not become fordable without control of the indoor environment. The "luxury label" attached to air conditioning in earlier decades has given way to appreciate it practicality in making our live healthier and more productive. Along with rapid development in improving human comfort came the realization that goods could be produced better, faster, and more economically in a properly controlled environment.

B. History of HVAC

AUTOCAD is the software for mechanical, electrical, and plumbing designers and drafters. Creation and coordination of construction documents is more efficient with AUTOCAD more intuitive systems drawing and design tools. AUTOCAD also assessing our vision and enhance our efficiency because of its purpose-built software for MEP designers anddrafters. With AUTOCAD we are able to make changes much faster, thus help minimizing the financial impact, and make those changes in almost real time.

In 1902, a 25 – year – old engineer from New York named Willis Carrier invented the first modern Air Conditioning system. The mechanical unit, which sent air through water-cooled coils, was not aimed at human comfort, however; it was designed to control humidity in the printing plant where he worked.

The first modern electrical Air Conditioning unit was invented by Willis Carrier in 1902 in Buffalo, New York. After graduating from Cornell University, Carrier found a job at the Buffalo Forge Company.

Heating, Ventilation and Air Conditioning (HVAC) is the technology of indoor and vehicular environmental comfort. Its goal is to provide thermal comfort and acceptable indoor air quality. Air conditioners use chemicals that easily convert from a gas to a liquid and back again. This chemical is used to transfer heat from the air inside of a home to the outside air. The machine has three main parts. They are a compressor, a condenser and an evaporator. HVAC: Heating, Ventilating, and Air Conditioning (HVAC) equipment perform heating and/or cooling for residential, commercial or industrial buildings. The HVAC system may also be responsible for providing fresh outdoor air to dilute interior airborne contaminants such as odors from occupants, volatile organic compounds (VOC's) emitted from interior furnishings, chemicals used for cleaning, etc. A properly designed system will provide a comfortable indoor environment year round when properly maintained.

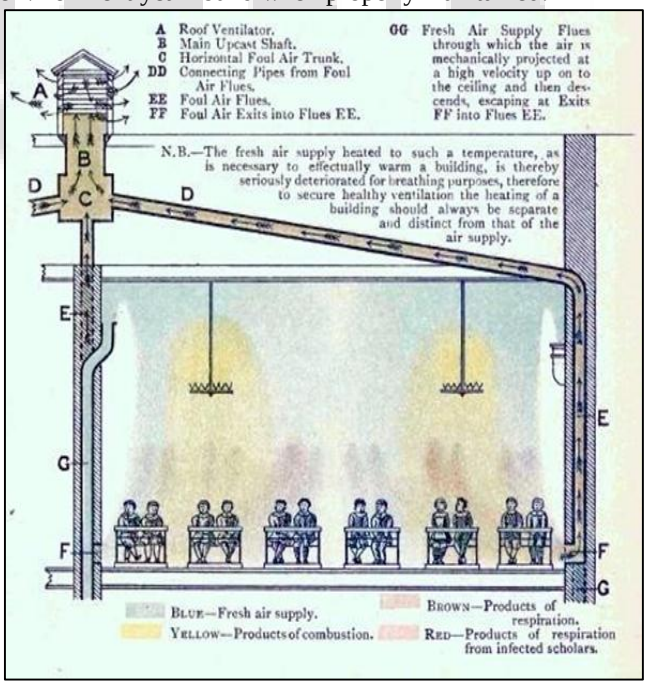

Fig. 1: Ventilation on the downdraught system, by impulsion, or the 'plenum' principle, applied to schoolrooms (1899)

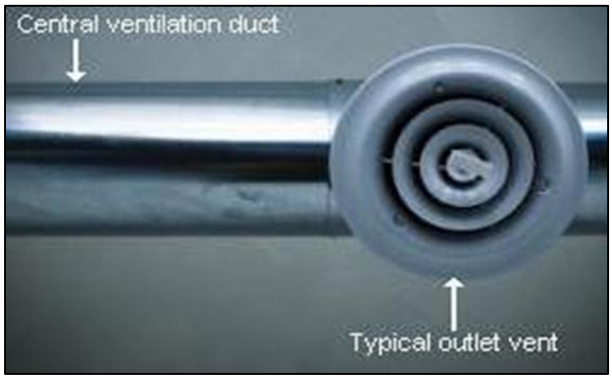

Fig. 2: Ventilation duct with outlet diffuser vent. These are installed throughout a building to move air in or out of rooms

Fig. 3: Rooftop HVAC unit with view of fresh air intake vent

C. Importance of HVAC

HVAC is an important part of residential structures such as single family homes, apartment buildings, hotels and senior living facilities, medium to large industrial and office buildings such as skyscrapers and hospitals, onboard vessels, and in marine environments, where safe and healthy building conditions are regulated with respect to temperature and humidity, using fresh air from outdoors.

Ventilating or ventilation (the V in HVAC) is the process of exchanging or replacing air in any space to provide high indoor air quality which involves temperature control, oxygen replenishment, and removal of moisture, odors, smoke, heat, dust, airborne bacteria, carbon dioxide, and other gases.

D. Refrigerant

A refrigerant is a substance or mixture, usually a fluid, used in a heat pump and refrigeration cycle.

Refrigeration is a process of moving heat from one location to another in controlled conditions. The work of heat transport is traditionally driven by mechanical work, but can also be driven by heat, magnetism, electricity, laser, or other means.

In most cycles it undergoes phase transitions from a liquid to a gas and back again. Many working fluids have been used for such purposes.

Fluorocarbons, especially chlorofluorocarbons, became commonplace in the 20th century, gerents used in various applications are ammonia, sulfur dioxide, and non-halogen but they are being phased out because of their ozone depletion effects. Other common refrey hydrocarbons such as propane.

1) Types of refrigerants

The most common types of refrigerants in use nowadays are presented below

- Halocarbons
- Isotropic refrigerants.
- Zoetrope refrigerants.
- Inorganic refrigerants like carbon dioxide, ammonia, water and air.
- Hydrocarbon refrigerants.

Halocarbons are generally synthetically produced. Depending on whether they include chemical elements hydrogen (H), carbon (C), chlorine (Cl) and flourine (F) they are named after as follows:

CFCs (Chlorofluorocarbons): R11, R12, R113, R114, R115
HCFCs (Hydro chlorofluorocarbons): R22, R123
HFCs (Hydro fluorocarbons): R134a, R404a, R407C, and R410a

2) Ducting

Ducts are conduits or passages used in heating, ventilation, and air conditioning (HVAC) to deliver and remove air. The needed air flows include, for example, supply air, return air, and exhaust air. Ducts commonly also deliver ventilation air as part of the supply air. As such, air ducts are one method of ensuring acceptable indoor air quality as well as thermal comfort.

II. LITERATURE SURVEY

[1] Jin, X. and Z. Du. 2006. "Fault Tolerant Control of Outdoor Air and AHU Supply Air Temperature in VAV Air Conditioning Systems Using PCA Method." Applied Thermal Engineering 26(11-12):1226-1237.

[2] Katipamula, S., M.R. Brambley, N.N. Bauman, and R.G. Pratt. 2003a. "Enhancing Building Operations through Automated Diagnostics: Field Test Results."In Proceedings of the Third International Conference For Enhanced Building Operation, held October 13-15, 2003, Berkeley, California. Texas A&M University, Energy Systems Laboratory, College Station, Texas.

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[4] Katipamula, S., M.R. Brambley, and L. Luskay. 2003c. "Automated Proactive Techniques for Commissioning Air- Handling Units," ASME Journal of Solar Energy Engineering, Transactions of the ASME, Special Issue on Emerging Trends in Building Design, Diagnosis and Operation 125(1):282-291.

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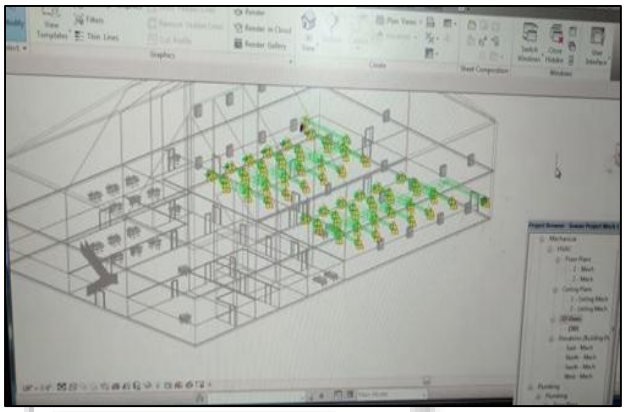
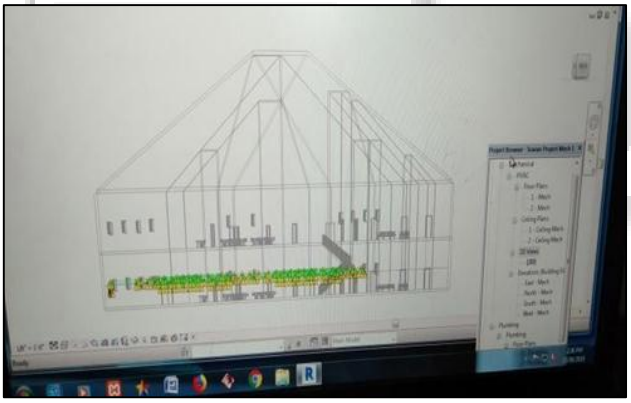
III. METHODOLOGY

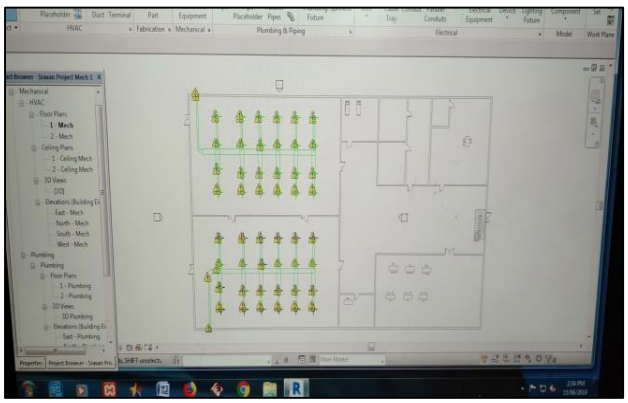
A. Civil Plan of Paint Industry

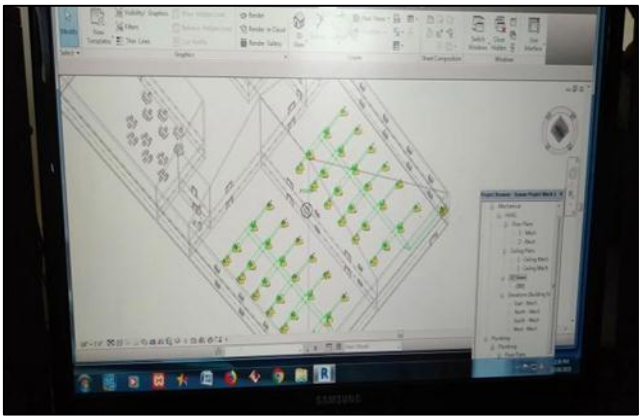


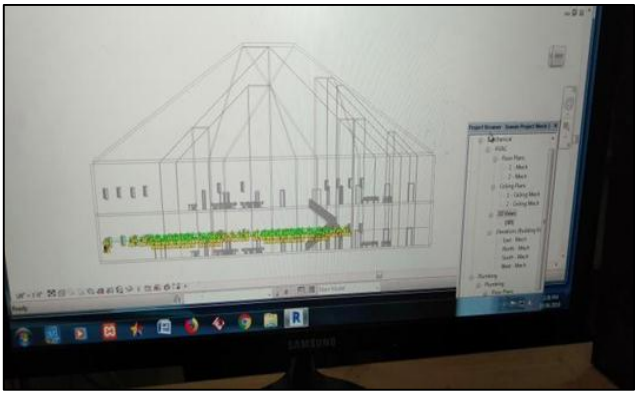


The civil plan is design or build with the RIVIT software that provided with BASE, CEILING, ROOFING and providing ducts and proper ventilation there by the heat load calculations.

B. Ducting:







IV. PLANNING

The paint and plastics manufacturing industry, when manufacturing process undergoing, the harmful toxic gases present in the building.so proper measures should takes place for the removal of toxic gases in the plastic and paint industry.

The civil plan is provided with the proper air ducts and air pump systems for the removal of toxic gases. The rooms are provided with the air conditioning and ventilation.

V. RESULTS AND DISCUSSIONS

From the above calculations the estimated values the temperatures of different regions were find out and the project summary is provided and the temperature excel sheets and provided

In this all the parameters were taken into consideration for high accuracy and proper estimation of suitable machine.

Based on the obtained temperatures for each location and season was done using Revit software. All the diagrams were shown in the civil plan. From this we can conclude that our estimated values are enough to establish the air conditioning system in the specified location. By using HVAC system energy consumption of the building is reduced as possible by avoiding unnecessary loses. This is one of the most well designed and most useful method in the present day installations.

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[1] Jin, X. and Z. Du. 2006. "Fault Tolerant Control of Outdoor Air and AHU Supply Air Temperature in VAV Air Conditioning Systems Using PCA Method." Applied Thermal Engineering 26(11-12):1226-1237.

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