Dust Removal of Grinding and Milling Machines

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***Abstract* - A complete air conditioning system was designed to control the indoor environment conditions like temperature, relative humidity, air movement, etc. in an economical way. The modern commercial industries have observed that many control rooms and operator compartments in the milling and grinding machines industry do not have filtration systems capable of maintaining low dust concentrations in these areas. In this study at an industry, to reduce respirable dust concentrations in a control room that had no cleaning system for intake air, infiltration pressurization and diffuser system originally designed for enclosed cabs was modified and installed. This system was composed of two filtering units: one to filter outside air and one to filter and recirculate the air inside the control room**

***keywords* - Heating, Ventilation, and Air-Conditioning (HVAC), Air Handling Unit, Refrigeration cycle, Heat load estimation. [1]**

1. INTRODUCTION

An air conditioner cools and dehumidifies the air as is passes over a cold coil surface. The indoor coil is an air-to-liquid heat exchanger with rows of tubes that pass the liquid through the coil. Finned surfaces connected to these tubes increase the overall surface area of the cold surface thereby increasing the heat transfer characteristics between the air passing over the coil and liquid passing through the coil. The type of liquid used depends on the system selected. Direct-expansion (DX) equipment uses refrigerant as the liquid medium. Chilled-water (CW) can also be used as a liquid medium. When the required temperature of a chilled water system is near the freezing point of water, freeze protection is added in the form of glycols or salts. Regardless of the liquid medium used, the liquid is delivered to the cooling coil at a cold temperature.

In the case of direct expansion equipment, the air passing over the indoor cooling coil heats the cold liquid refrigerant. Heating the refrigerant causes boiling and transforms the refrigerant from a cold liquid to a warm gas. This warm gas (or vapor) is pumped from the cooling coil to the compressor through a copper tube (suction line to the compressor) where the warm gas is compressed. In some cases, an accumulator is placed between the cooling coil and the compressor to capture unused liquid refrigerant and ensures that only vapor enters the compressor. The compression process increases the pressure of the refrigerant vapor and significantly increases the temperature of the vapor. The compressor pumps the vapor through another heat exchanger (outdoor condenser) where heat is rejected and the hot gas is condensed to a warm high-pressure liquid. This warm high-pressure liquid is pumped through a smaller copper tube (liquid line) to a filter (or filter/dryer) and then on to an expansion device where the high-pressure liquid is reduced to a cold, low pressure liquid. The cold liquid enters the indoor cooling coil and the process repeats.[2]

2. LITERATURE SURVEY

Today, modelling and simulation are established techniques for solving design issues in several engineering and other disciplines. Wide range of tools is available in field of design, analysis, and optimization of system performance. Design, test, operation, and management of HVAC systems rely progressively on modelling and simulation techniques. Such techniques together with model-based analysis of HVAC systems provide an important tool facilitating the users to carry out thorough tests of the systems by emulating their performance on a computer. Similarly, numerous optimizations.

Mr. Johnathan wood VRF air-conditioning systems owe their growing popularity to their ability to meet a wide range of requirements, as Tony Nielsen explains. The primary function of all air-conditioning systems is to provide thermal comfort for building occupants. There is a wide range of system types available, staring with the basic window-fitted unit through to the very latest VRF (variable refrigerant flow) equipment. While a client looking for the best life-cycle cost will need to balance capital cost with long-term operating costs, efficiency and predicted VRF systems provide cooling and heating using refrigerant (R407C or R410A) as the working fluid. There are two basic types of VRF system cooling/heating-only and energy-recovery.

Tianzhen hong A VRF system's ability to control the refrigerant mass flow rate according to the cooling and/or heating load enables the use of as many as 60 indoor units with differing capacity 1989 2010 1989 2010 1989 2010 1989 2010 in conjunction with one single outdoor unit. This unlocks the possibility of having individualized comfort control simultaneous heating and cooling in different zones, and heat recovery from one zone to another. The new VRF model in Energy Plus V8 developed by LBNL, was used for VRF system simulation in this study.

Hussain shah Variable refrigerant flow (VRF) system is a mature heating, ventilation and air conditioning (HVAC) technology which simultaneously heat and cool area through extracting heat from an area which needs cooling and transfer heat to another area. Variable refrigerant flow (VRF) systems are installed with air conditioner inverter that adds a dc inverter which drives the control of compressor that modulates heat or cooling in the area. The compressor unit of variable refrigerant flow (VRF) are installed on the roof of the building, and heat & cool refrigerant are connected through piping connected to condition the building.

Ir Jan Henson "Application of Modelling and Simulation to HVAC Systems," HVAC modelling and simulation is relatively complex from a user and developer point of view. For a user, the complications grow with the level of explicitness due to increasing requirement of user knowledge of HVAC system and the number of system definition

parameters. But the availability of data pertaining to those parameters from manufacturer is decreasing and analyses have become more complicated. Similarly, the difficulties increase with the explicitness and detail for a developer. This is due to the interactions among the components of the HVAC system or HVAC system with the building.
FW Yu and KT Chan "Modelling of a condenser-fan control for an air-cooled centrifugal chiller," In the recent years, various modelling and simulation approaches have been extensively used in different research activities for HVAC system performance analyses. Several studies were related to HVAC modelling at component, control, and system levels. At component level, models of air and water cooled chillers were developed in TRNSYS to analyse their performance with various control strategies.
F. Calise, M. Dentice d'Accadia and A. Palombi, "Transient analysis and energy optimization of solar heating and cooling systems in various configurations," Three different configurations of solar heating and cooling system with LiBr-H2O absorption chiller and evacuated tube collector were investigated. The first configuration was designed for the maximum cooling load using an electric chiller. as auxiliary cooling system. The solar collector area was sized to balance only a fraction of the maximum load. Finally, in the third configuration, no electric chiller was used and a gas-fired boiler was used as back-up. The simulation model was developed in TRNSYS for the detailed optimization of their energy performance. The results of the optimization suggested that the first configuration was able to achieve the best energy performance.
A. Angelis and AM Papadopoulos, "Application of multi criteria analysis in designing HVAC systems," A method was proposed for choosing the best possible HVAC systems in new and existing buildings. The method used a combination of multi-criteria decision-making tool and building simulation tool to compare the six different HVAC systems. HVAC system was modelled by coupling TRNSYS and COSMIS simulation tools. Multi-criteria method Electric III was applied for decision making.[3]

3. METHODOLOGY

3.1 Step by Step Process Involved In Design

1. Site Selection
2. Industry Layout in Revit Software
3. Analysis
4. Installation of Ducts
5. Diffusers

3.2 Working Principle

All Air Systems
As the name suggests, Air is used as the media in an all air system. Air transports thermal energy from the conditioned space to the HVAC plant. As shown in figure 1, In these systems air is processed in the A/C plant namely AHU (Air Handling Unit). AHU consists of Dampers, Mixing chambers, Filters, Cooling/ Heating coils, Humidifiers, Fans/ Blowers etc. in a packaged cabinet. This processed air is then supplied to the conditioned spaces through Air Distribution system. Air Distribution system consists of Ducts, Dampers and Diffusers. This air extracts (or supplies in case of winter) the required amount of sensible and latent heat from the conditioned space. The duct that supplies the air to spaces is called Supply Air Duct (SAD). The return air from the conditioned space is conveyed back to the plant, where it again undergoes the required processing thus completing the cycle. The duct that returns the air from spaces to A/C plant is called Return Air Duct (RAD). Adequate Fresh air is always supplied by AHU to maintain Ventilation and Indoor Air Quality (IAQ). ASHRAE 62.1 standards are followed for ventilation, mostly. Outside Fresh air and Return air are balanced in proportion by rule 'Supply Air = Return Air + Fresh Air'. Since Fully treated air is supplied by AHU, no further processing of air is required by terminal units in the conditioned space. All air systems can be further classified into. [4]

3.1 Basic structure

Effective system zoning: A HVAC system can be controlled via a single zone stratagem or a multizone strategy. With a single zone strategy, all areas served by the system receive the same amount of heating, cooling or air conditioning as defined by the control logic of the unit. However, different areas have different end energy use requirement depending on a number of factors as out lined in section 2 above. Areas with similar end energy use requirements should be grouped and served from the same HVAC system. This will ensure the optimum amount of heating, cooling or ventilation is provided to the spaces when required.

The modern commercial industries has observed that many control rooms and operator compartments in the milling and grinding machines industry do not have filtration systems capable of maintaining low dust concentrations in these areas. In this study at an industry, to reduce respirable dust concentrations in a control room that had no cleaning system for intake air, a filtration pressurization and diffuser system originally designed for enclosed cabs was modified and installed. This system was composed of two filtering units: one to filter outside air and one to filter and recirculate the air inside the control room. [4]

3.2 Autodesk Revit Software

Autodesk Revit is building information modelling software for architects, landscape architects, structural engineers, MEP engineers, designers and contractors. The original software was developed by Charles River software, founded in 1997, renamed Revit technology corporation in 2000 and acquired by auto desk in 2002.the software allows users to design a building and structure and its component in 3D,annotate the model with 2D drafting element, and access building information from the building model data base. Revit is 4D BIM capable with tools to plan and track various stages in building life cycles, from the concept to construction and later maintenance and demolition.[5]

3.3 Tools used in Revit Software

WALL

Creates a non-structural wall in the building model.

DOOR

Adds doors to the building model and use the type selector to specify the type of door to add, or load the desired door family into the project.

WINDOW

Adds windows to the building model and use the type of selector to specify the type of window to add or load the desired window family into the project.

CEILING

Creates a ceiling at a specified distance above the level in which it resides.

ROOF

Creates a roof using the building footprint to define its boundaries.

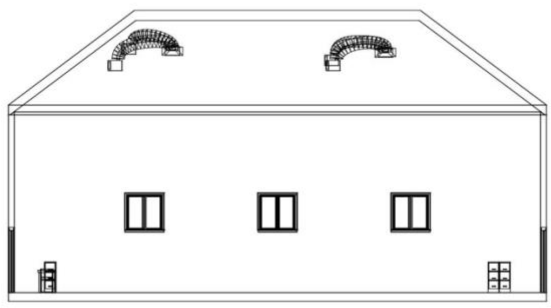
FLOOR

Creates a floor for the current level of the building model and to align the floor with existing walls, use the pick wall tool. The floor is offset downward from the level on which it is created.

DIFFUSER

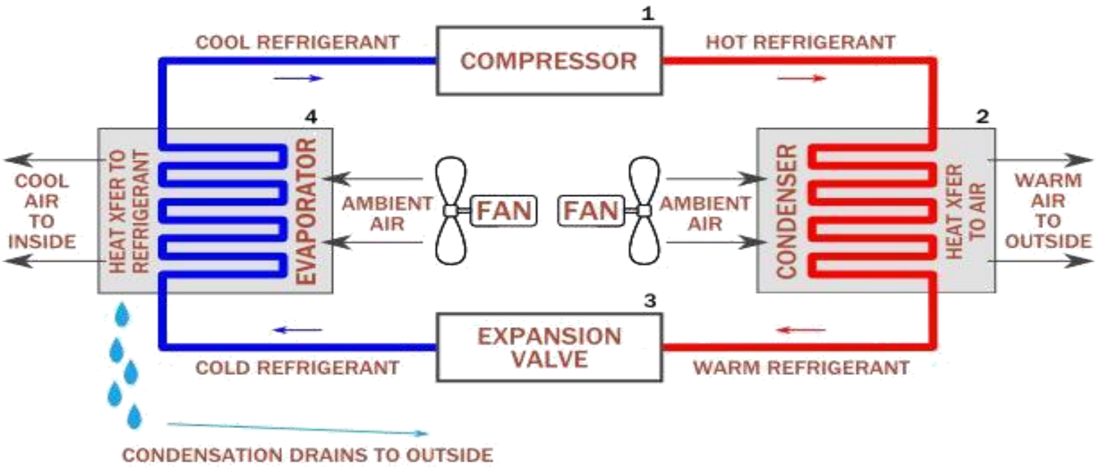
Diffuser is "a device for reducing the velocity and increasing the static pressure o a fluid passing through a system”. Diffusers are used to slow the fluid's velocity wile increasing its static pressure. A typical, subsonic diffuser is a duct that increases size in the direction of flow. [6]

3.3 Civil Plan



Civil Plan for Industry (front view)

3.4 Circuit Diagram



6. RESULTS AND CONCLUSION

Volume of room = 2500m3
Flow rate = 33.3m3/sec
= 33,300lit/min
= 555lit/sec
M- fan module-940lps
Air flow rate of machine = 943.89lit/sec
Calculated = 555/6 = 92.5lit/sec
Duct size = 300×300
Final temperature = 30°C

HVAC System plays a critical role in the wheel of factors contributing to product quality in small scale industry by providing this specific setup room space conditions needed to make quality products it must be properly designed installed, validated by professionals monitored and maintained as a part of continuous validation/revalidation of critical system. [7]

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