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Design of Weather Cowl/Rain Hood for Silencers

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ABSTRACT: The measurement of the steam flow performance of interior natural ventilation opening in the silencers is very much important in all types of Industry. This project is to design of weather cowl and analysis of fluid flow through the weather cowl to increase the velocity of fluid (Steam) reduces the back pressure and prevents bottom outer surrounding of the weather cowl attachments. The design of weather cowl model done using Creo Parametric 8.0 software and it is analyzed using the ANSYS Fluent Version 15.0 Software, Analysis with the parameters like flow of Pressure, Velocity with Boundary conditions. In this analysis the back pressure is 50% reduced and it's attached to the silencers to prevent the bottom surrounding exhaust flow also reduced. So that life of the weather cowl will be increased.

KEYWORDS:

Back pressure reduction
Hood design to the Silencers
Model – CREO parametric 8.0 Software
CFD – ANSYS Fluent Version 15.0

I. INTRODUCTION

A cowl is a usually hood-shaped covering used to increase the draft of a chimney and prevent backflow. The cowl, usually made of galvanized iron, is fitted to the chimney pot to prevent wind blowing the smoke back down into the room below. Undoubtedly named after the resemblance of many designs to the cowl garment worn by monks, they have been in use for centuries. When using an open fire to heat a room the smoke rises through a flue to a chimney pot on the roof. Under normal conditions the warm air from the fire will rise up the chimney emitting the smoke with it and dispersing it at rooftop level where it is less of a nuisance. In strong winds the pressure of the wind may overwhelm the updraft and push the airflow in reverse down the flue. Smoke will then fill the room it is intended to heat posing a health and fire risk, causing discomfort and dirtying furnishings in its path. In strong winds the pressure of the wind may overwhelm the updraft and push the airflow in reverse down the flue. Smoke will then fill the room it is intended to heat posing a health and fire risk, causing discomfort and dirtying furnishings in its path. When raw coal rather than smokeless fuel is burnt, the amount of smoke may be considerable and measures to prevent backflow occurring are a necessity.

A secondary function is to prevent birds and squirrels from nesting in the chimney. They often also act as a rain guard to keep rain from going down the chimney. A metal wire mesh is sometimes added as a spark arrestor. Wooden cowls were used on oasts to prevent the ingress of rain into kilns, and create a flow of air through the kiln. The advantage of using cowls is that they reduce the chance of animals, debris and rain from entering the ducting system. High Velocity and Swedish Cowls are used to increase draft / velocity to prevent backflow or re-entrainment of product or fumes back into the building.

II. RELATED WORK

Jamie Goggins et al [1] "An investigation of a passive opened top-end pipe as an alternative solution for passive soil depressurization systems for indoor radon mitigation". Investigations were performed with controlled and natural wind

conditions. Test results confirmed that the passive opened top-end pipe can be used as an alternative solution for indoor radon concentration mitigation at low additional construction cost. The principle of the pipe test rig used was developed based on the pipe work configuration for the controlled wind; a fixed wind velocity can be created by regulating the speed of the fan using a fan controller. Experimental tests were conducted to examine the behavior of a passive opened top-end pipe as an alternative solution for the passive soil depressurization system to minimize indoor radon concentration.

Ben Richard Hughes et al [2] Work investigates a novel closed loop thermal cycle containing cylindrical heat pipes integrated with a roof mounted circular wind tower to achieve internal comfort. The present work successfully classified the sustainable operation of natural ventilation systems in regions encompassing hot and moderately human or hominid climatic conditions. The ANSYS FLUENT 14 commercial code was used to simulate the airflow through the wind tower model and heat pipe multi-phase flow with coupled heat and mass transfer analysis on the geometry matrix. Patch independent CFD tetrahedron meshing technique was utilized wherein the boundary conditions applied on the faces and volumes of the computational domain. The enclosure (the flow domain) was set at a distance from geometry. The computational model involving the macro climate was run with wind speeds. Velocity and pressure contour plots were used to assess the ventilation performance of each configuration. Utility of natural ventilation carries significant importance in reducing airconditioning loads and its required power consumption for buildings and residential dwellings.

Naghman Khan et al [3] "A review on wind driven ventilation techniques". Wind driven ventilation designs with respect to traditional means such as wind towers and more modern techniques including turbine ventilators and wind catchers. Air inlets and inlet grilles play a vital role in naturally ventilated buildings by controlling and facilitating airflow. Consequently, accurate flow field modeling on roofs is encouraged and some advice is given on this. In designing cowls it is essential not to impede airflow too much otherwise an unbeatable resistance in the duct and cowl will significantly handicap airflow. Consequently, design guides are available from many bodies for example CIBSE in the UK. The two principle concepts used are the doomed roof and roof vent evaluated in various configurations.

Miscellaneous wind driven ventilation techniques have been reviewed and categorized. A summary of their features and typical flow rates. It is worthwhile to mention that it was difficult to find data on flow rates for some large scale devices.

Andreas Pfeiffer et al [4] "Modeling of cowl performance in building simulation tools using experimental data and computational fluid dynamics". The study focuses on a specific modeling strategy, applied within a building simulation program, for a cowl used in a hybrid ventilation system. The method is progressively simplified to produce four variants, which chiefly vary according to their level of detail and, hence, the associated modeling effort. Wind pressure coefficients at facade, above roof and in the cowl are needed for all model variants. Some of the investigated variants rely on CFD computations of airflow around the building to determine these values. The suction effect of a cowl chiefly depends on the prevailing wind flow conditions, cowl characteristics and exhaust mass flow rate. The value of some of these parameters varies during the computation period. More-over, interdependencies exist in that the exhaust mass flow is itself influenced by the suction effect. A time-dependent computational method therefore needs to be adopted in modeling such systems. The suction effect of cowls to depend on both local wind velocity and local wind direction. Ideally, therefore, the airflow fields around the building need to be known for various wind directions and with regard to the specific structural geometry. The CFD method is particularly suitable for the analysis of airflow Above the roof, while a three-dimensional model is always required for the computation of airflow around buildings. To avoid modeling errors, various criteria relating to the calculation domain and computational grid need to be observed in selecting the calculation domain. Laboratory measurement of the acoustical and airflow performance of interior natural-ventilation openings and silencers.

Murray Hodgson et al [5] The objective was to create and characterize a purpose-built test facility, and use it to measure the combined acoustical and airflow performance of a number of ventilators of interest, to understand and optimize it, and provide design guidelines to practitioners. The paper discusses the characterization of ventilator performance, and methods and theory for measuring it. The design and performance of a purpose-built, two-room laboratory facility are described. The facility was used to investigate the performance of a non-acoustical grille, an acoustical louver, slot ventilators, crosstalk silencers and a novel door-vent silencer. Laboratory measurements, in a purpose-built testing facility, have been made for several ventilator configurations of interest: a non-acoustical grille, an acoustical louver, slot ventilators, cross-talk (CT) silencers and a novel door-vent silencer. From the results, and those of associated field tests. Non-acoustical grilles should be avoided. Adding a grille to a ventilator halves the flow rate for a given pressure loss. Grilles have negligible effect on acoustical transmission. Crosstalk silencers can have high combined acoustical and airflow performance compared to other types of silencer tested. Their acoustical performance

can be improved by increasing the length of the acoustically-lined flow path; within reasonable limits, this increase in length does not actually increase, air flow.

III. METHODOLOGY

- Shell - SA 516 Gr 70 material - 6 mm thickness
- Cone - IS 2062 E250 material - 6 mm thickness
- Top Shell - IS 2062 E250 material - 3 mm thickness
- Top Side - SA 516 Gr 70 material 6 mm thickness □ Bird Mess - SS 307 material

SA 516 Gr 70 material

ASTM A516 Grade 70 Plate is also called out as ASME SA516-70. This steel plate grade is a medium carbon alloy that also contains amounts of manganese, phosphorus, sulfur, and silicon. A516 is primarily used for service in welded pressure vessels where improved notch toughness is required.

IS 2062 E250 material

The properties are high tensile strength, high yielding strength, good dimensional accuracy, good weld ability, good formability, heat treatable, sturdy construction, toughness, pitting resistance, oxidation resistance, stress corrosion cracking resistance, crevice corrosion resistance, etc.

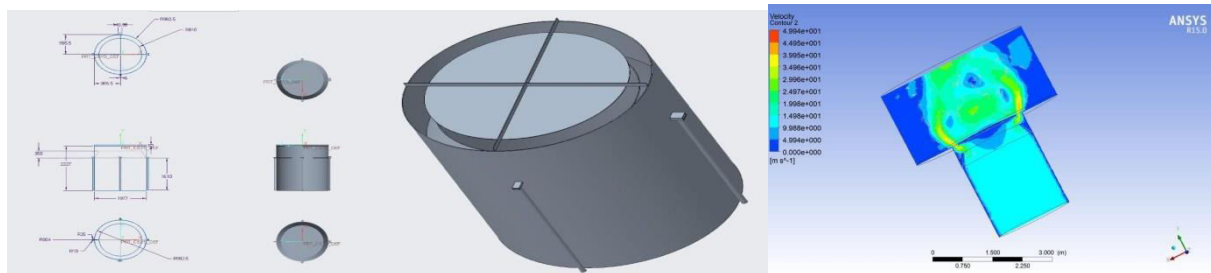
SS 307 material

PHILSTAIN 307 is a lime-titanic stainless steel electrode which may form the deposited metal of 19%-9%Ni-5%Mn stainless steel with the perfect structure of austenite. The deposited metal has excellent crack resistibility and has easy work hardening.

IV. EXPERIMENTAL RESULTS

CFD Analysis Software (ANSYS Fluent 15.0)

Ansys a product of Ansysinc. Is a world's leading, widely distributed and popular commercial CAE package. It is widely used by designers/analysis in industries such as aerospace, automotive, manufacturing, nuclear, electronics, biomedical, and much more. Ansys provides simulation solution that enables designs to simulate design performance directly on the desktop. In this way, it provides fast efficient and cost efficient product development from design concept stage to performance validation stage of product development cycle.



a.Design

b.3D model

c.Analysis

IV. CONCLUSION

This project given by the Acoustic India private Limited, Trichy. The company explains to the drawbacks of existing model of weather cowl. The major drawbacks of the weather cowl is transition flow to create the back pressure, some of the exhaust flow gas are downward to spread the surrounding of the cowl outer side. The designs of weather cowl



model with two different parts are done by using Creo Parametric 8.0 Software with three different materials of SA 516 Gr 70 material, IS 2062 E250 material, SS 307 material for the parts. To assemble the parts to create the new 3D model of weather cowl. Analysis was done with industry need conditions and it is achieved with the above model and analysis.

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