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Thermal Analysis of Bleed in Steam Turbine Casing

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ABSTRACT

The objective is This project is about bleed style and analysis, as well as a tool for transporting a store like a steam and providing a way to totally eject the shop from the bleed pocket. The need for a casing and unharness mechanism that can entirely eject a store has grown in importance. Once the steam from a modern high-performance rotary engine is released, the static and thermal masses on this store might force it to aggressively impact the bleed pocket construction before falling far from the pocket.

Bleed is the amount of steam production from a rotary engine that passes through a pipe and exits at the rotary engine's end. This leak feeds the heater (low and high) as well as the deaerator, extending the unit's efficacy. The bleed steam is the steam that has previously worked on the blades of a rotary engine. Currently, we have the option of condensing the steam in a condenser or using it to heat feed water. Design and analysis of bleed, and most importantly, a tool for transporting a store like a steam, and providing ways for completely ejecting the store from the bleed pocket. The need for a casing and unlock device that can completely eject a shop is becoming more important. The static and thermal hundreds on this shop might force steam from a modern superior rotary engine to aggressively contact the bleed pocket construction before falling far from the pocketThe purpose is The goal of this paper is to provide a tool for steam-powered store transportation as well as a technique to completely eject the store from the bleed pocket. It is now more necessary than ever to have a casing and unharness mechanism that can completely expel a storage. The static and thermal loads on this shop may drive it to violently contact the bleed pocket structure once the steam from a contemporary high-performance rotary engine is discharged before falling far from the pocket.

Bleed is the volume of steam produced by a rotary engine that leaves the engine's end via a pipe. This leak increases the effectiveness of the device by feeding both the deaerator and the heater (low and high). The steam that has previously operated on a rotary engine's blades is known as "bleed steam." Currently, we have the choice of either heating feed water with the steam or condensing it in a condenser. Most crucially, a tool for moving a shop like a steam train and offering means of totally ejecting the store from the bleed pocket. Bleed design and analysis. The need for a case and unlock tool that can entirely eject a store is growing. Steam from a contemporary, improved rotary engine could be forced to aggressively touch the bleed pocket structure before dropping far from the pocket because to the static and thermal hundreds on this shop.

Keywords: Job Satisfaction, Sustainable Development, Policy For Higher Education

I. INTRODUCTION

A device for transporting a store, like a steam, and equipped with mechanisms for positively ejecting the store from the bleed pocket are the focus of the design and study of bleed in this case. It has become more urgent than ever to develop a case and release mechanism that would successfully expel a storage. The static and thermal stresses on this store may cause it to aggressively contact the bleed pocket structure when steam is expelled from a contemporary, high-performance turbine before falling away from the pocket.

Steam turbine enclosure

These configurations include cross compound, tandem compound, and single casing turbines. The simplest design, single casing units attach a generator to a single casing and shaft. When two or more casings are directly connected together to power a single generator, a tandem compound is utilised. In a cross compound turbine configuration, two or more shafts that are not in line drive many generators, many of which run at various speeds. Many big applications often use a cross compound turbine.

Bleed is the quantity of steam that leaves the turbine's final stage via a pipe. To improve unit efficiency, this leak enters to feed the deaerator and low- and high-temperature water heater.

Actually, the steam that has previously worked on turbine blades is the bleed steam. We now have the choice of using that steam to heat feed water or condense it in the condenser. Option 1 won't provide us with any usable energy since the heat will be transferred to cooling water and then to the atmosphere through cooling towers. Flange

For strength, such as the flange of an iron beam such as an I-beam or a T-beam; or for attachment, a flange is an external or interior ridge, or rim (lip).

II. LITERATUTR REVIEW

The calculations for several 900 MW power unit designs for advanced 700/720 C ultra-supercritical steam parameters with a single and double steam reheat are presented in this study. By using double steam reheat, it is possible to increase power unit efficiency by 1.1%. Due to the significant temperature fluctuations in the input water heaters, the shift to such high steam parameters, and particularly the temperature of reheated steam, entails material and thermodynamic issues. Regarding this, an idea is put out for changing the feed water heater system utilising an auxiliary extraction-backpressure turbine that is supplied steam from the cold reheat steam line. Water heaters, which in the traditional arrangement are supplied by the intermediate pressure turbine, are fed with steam from the bleeds and the turbine output. The efficiency benefit from using an extra steam turbine is no more than a 0.2% increase. However, the decreased temperature variations in the feed water heaters and the streamlined design of the IP portion of the main turbine are this solution's biggest benefits.

Raising the live and reheated steam characteristics significantly improves the efficiency of electricity production, which is crucial for reducing the use of fossil fuels and greenhouse gas emissions. The development of building materials that can withstand such a wide range of temperature and pressure values will be crucial to the construction and operation of power units for advanced ultra-supercritical steam parameters of 700/720C.

The efficiency of the system with the AT is inferior than the efficiency of the system without it at pressure values greater than roughly 9.5 MPa. Only two exchangers remove the temperature difference, but these are the ones where the issue is most severe. In systems with an auxiliary turbine, the live steam mass flow must be increased in order to maintain the unit's power capacity since a lesser mass flow is reheated.

3. OBJECTIVE

- To understand the structural analsis of steam turbvine casing and bleed
- To know the steam flow in bleed pocket by CFD analysis
- To estimate the diameter of bleed pocket by analysis
- To understand the bolt pre tension analysis

4. RESEARCH METHODOLOGY

Develop an easy-to-use and easy-to-understand analysis procedure for free and forced vibration problems in rotor dynamics.

To determine the free and forced frequency of a single rotor systems and to understand the concepts of mode shapes

Develop harmonic frequency response function estimation

5. FINITE ELEMENT ANALYSIS (FEA)

A strong tool for finding a numerical solution to a variety of engineering problems is the finite element technique. Any complicated form or geometry for any material under various boundary and loading circumstances may be handled by the approach due to its wide applicability. The finite element method's generality satisfies the analytical needs of the complex engineering systems and designs of today, where it is often impossible to find closed form solutions to the governing equilibrium equations. Furthermore, it is a useful design tool that enables designers to do parametric design studies by taking into account a variety of design situations (different forms, materials, loads, etc.) and analysing them to choose the best design. The technique was developed in the aerospace sector as a tool to investigate stress in intricate aircraft components. It evolved from an approach to aircraft design known as matrix analysis. Both scholars and practitioners are using the strategy more often. The fundamental idea behind the finite element approach is that a body or structure may be broken down into tiny, "finite element"-style components with finite dimensions. After then, the original body or structure is seen as an amalgamation of various components joined at a limited number of joints known as nodes or noda.

STEADY-STATE THERMAL ANALYSIS

Using steady-state thermal analysis, one may identify the temperatures, thermal gradients, heat flow rates, and heat fluxes that are brought on by thermal loads that don't change over time in an item. A system's or component's response to stable thermal loads is computed using a steady-state thermal analysis. To assist establish beginning conditions, engineers often undertake a steady-state study before undertaking a transient thermal analysis. A transient thermal study may also include a steady-state analysis as its last stage, carried out after all transitory effects have subsided. The ANSYS software allows for the execution of a steady-state thermal study.

STATIC ANALYSIS OF SINGLE ROTOR SYSTEM

5.1. GEOMETRY

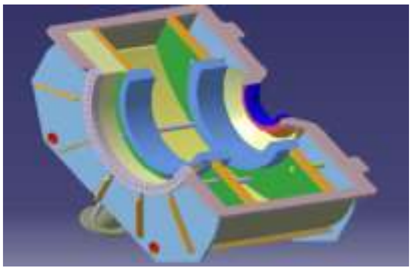


Fig 5.1, Isometric view of bleed in steam turbine casing

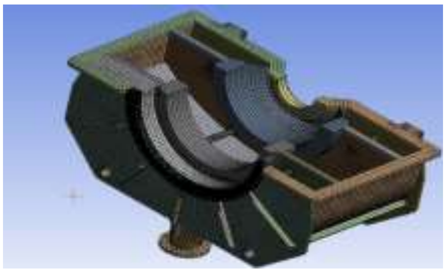
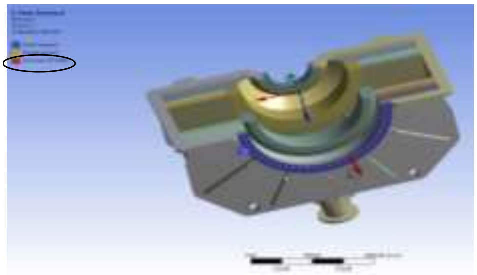


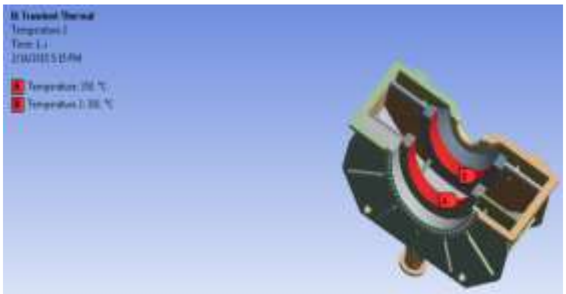
Fig 5.2 View of meshing

Hex Dominant Meshing Method, where a free hex dominant mesh is created. This option is recommended for bodies that cannot be swept. The mesh contains a combination of tet and pyramid cells with majority of cell being of hex type. Hex dominant meshing reduced element count.

BOUNDARY CONDITION LOAD APPLIED –TEMPERATURE AND ROTATIONAL VELOCITY

The load is in the form of rotational velocity in rad/sec. The load is applied in steps of 0%, 50%, 100%, 121%, 100%, 50%, & 0%.The 100% load is 6920rpm=724.75 rad/s. The load applied is entered in tabular data. The load is applied in the Z-Axis on the Bladed Disc assembly. The figure [4.7] is shown below.





Result and observation

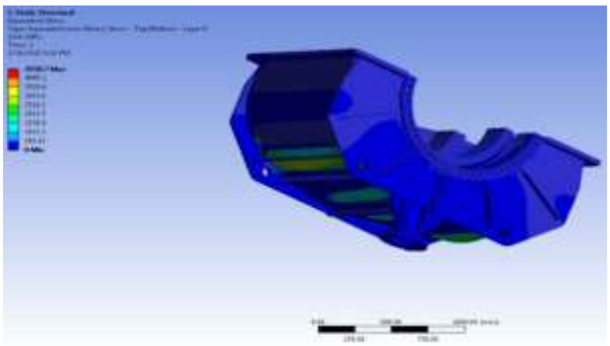


Figure 5.11

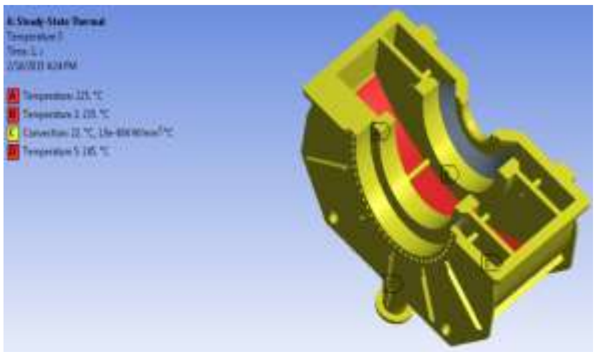


Figure 5.12

The figure 5.11 shows results of transient thermal analysis of casing the temperature will be maximum at the start which is initially taken as 350°c.the figure 5.12 shows results of transient thermal analysis of bleed pocket .the temperature of steam entering bleed pocket is around 100°c.

Flange Analysis

Design of Flange

- Contact type – frictionless contacts between surface to surface contact pairs.
- Fine mesh required – flange fillet Bolt hole, bolt head, Shank corners
- load considerations – pressure -15mpa , bolt pretension- 49000N
- Force on flange to separate the joint= area x pressure=22954.18x 15=344312.7N

Materials	Young's modulus (E) MPa	Poisn's ratio	Thermal conductivity KW/mm/^{0}C	Coefficient of linear exp.(α) mm/^{0}C	Allowable stress MPa
Flange (A182F11)	170000	0.3	0.047	1.2 e-5	**248.2**
Bolt (IS1364)	170000	0.3	0.047	1.2 e-5	**723.9**
Gasket (S316)	164000	0.2	0.02	0.3 e-5	**206.8**

8. CONCULISION

The report's work is an effort to construct a bleed-in steam turbine with a certain size. A thorough examination of the available literature was done to investigate the many uses and elements of steam turbine bleed. To develop the various components of the bleed, an appropriate design process was selected among the options. CATIA is widely used to create components using many sorts of procedures. Then, in the CATIA Assembly phase, all the components are put together to create a full turbine, which is then examined in Ansys 14.5 Due to their many uses, Bleed, which are still relatively new on the market, are garnering a lot of interest. A complex technical product like bleed is always being developed. Before the bleed is ready for market consumption, there is still more design work to be done. To be appropriate for real applications, the design process must take into account a number of other factors. Another area of continuing study is the production of such intricate forms in tiny sizes. Even better bleeds might be produced with further investigation into the design and manufacturing process.

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