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DESIGN &THERMAL ANALYSIS FOR ECONOMIZER USING CREO & ANSYS SOFTWARE

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ABSTRACT

An economizer is a used with boiler to retain the heat generated from boiler combustion and hence to improve the efficiency of the boiler. The flue gases which exits from boiler chamber are found very hot and are used to preheat boiler feed water. The economizer modeled in Creo-Parametric software and is imported to ANSYS software for the purpose of thermal analysis. Stress concentration in economizer tube is reported several times from the user industries. The problem is tried to solve by suggesting the clamping type improvement i.e. use of 'C' clamped economizer tubes to reduce stress concentration at clamping surface of tube. Also alternate material of economizer tube is tested i.e. titanium alloy instead of steel tubes. The result compared von-mises stresses, total deformation of economizer tube, strain energy and elastic strain for all cases under consideration i.e. full clamp tube and 'C' clamp tube both with material steel and titanium alloy respectively.

INTRODUCTION

Economizer is used and applied to save cooling costs. If the compressor can be off and required cooling is achieved, Energy saving can be noted and considered. When the outside temperature is low then it is cost saving to switch off compressor and outside air is taken in to the cooling needs of the building, same is the function of an Economizers saves remarkable amount of energy. They may waste energy are not maintained and running properly. Economizers are considered as expire and not usable if experts and technicians cannot maintain them at economical cost.

Economizer Types

- Fluid economizers and
- Air economizers.

ECONOMIZER MAINTENANCE

The facts written below are strictly to be maintained and cross checked to maintain economizer to work with efficiency and effectiveness.

- Outdoor thermostat setting and enthalpy control.
- Outdoor thermostat condition.
- Economizer mixed air thermostat setting for proper working.
- Proper lubrication.
- Minimum damper position adjustment.
- Proper response of the system with call for cooling initiated by thermostat.
- Economizer damper motor to be work with proper function and should be in good condition.
- Proper wiring / electrical terminations.

ECONOMIZER EFFICIENCY

Location of economizer is somewhere between boiler and chimney and objective is to utilize flue gases heat which are generally released outside system through chimney. Economizer efficiency can be defined as ratio of the heat gained by the feed water crossing via economizer tubes and the heat given away by the hot flue gases passing over the tubes of the economizer.

Economizer efficiency = ma (t2 - t1) / mf × Cp (tf1 - tf2)

Where,

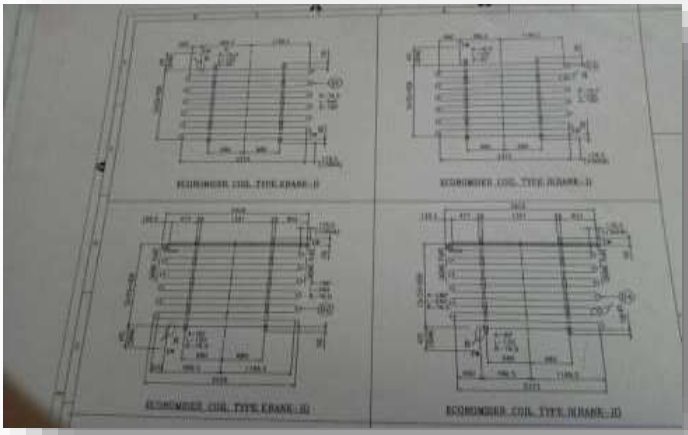
ma = mass of steam produced per kg of fuel burnt

mf = mass of flue gases produced per kg of fuel burnt.

Cp = specific heat of flue gases

PROBLEM IDENTIFICATION

In present research work the modal is to be created using Creo 2.0. The research is focused to the thermal analysis of the economizer using ANSYS simulation software. It will also include the economizer performance and problem solution like erosion and depreciation of economizer. Following is the part modelled geometry and dimensions in Creo 2.0.



Economizer drawing 1 taken for research problem

Original Economizer tube

The dimensions of the economizer tube assembly are taken as: Tube

id = 50.8 mm

Tube thickness = 3.667 mm

Inlet/Outlet cylinder id = 219.10

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mm Number of tubes = 22
Economizer overall size = 2873 X 4622 X 1906

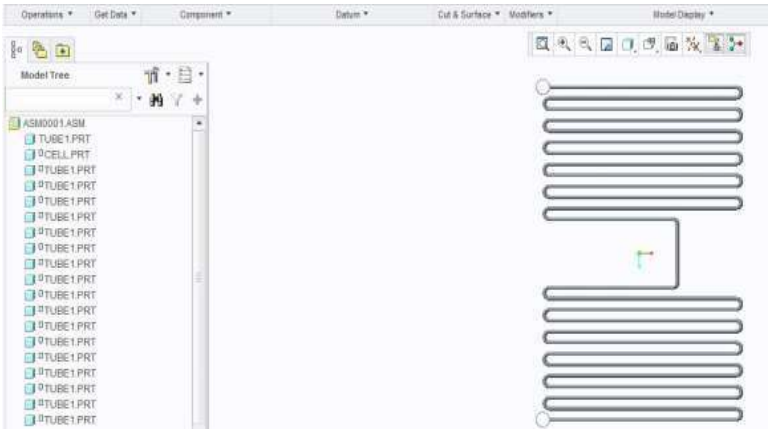
METHODOLOGY

Design of economizer was made in Creo Parametric software with dimension stated as above. After designing, import the design in the Ansys software and define the various mechanical property like elastic modulus, density, poisson ratio after describing all mashing of design and after meshing, define the thermal boundary condition. After defining boundary conditions, analysis was done and obtained the result. After obtaining the result we change the geometry of economizer and put another inside layer of another material inside the economizer tube which behave like scale or corrosion in the tube and applying the same boundary condition and again obtain the result. After obtaining the result we compare both the result and made conclusion.

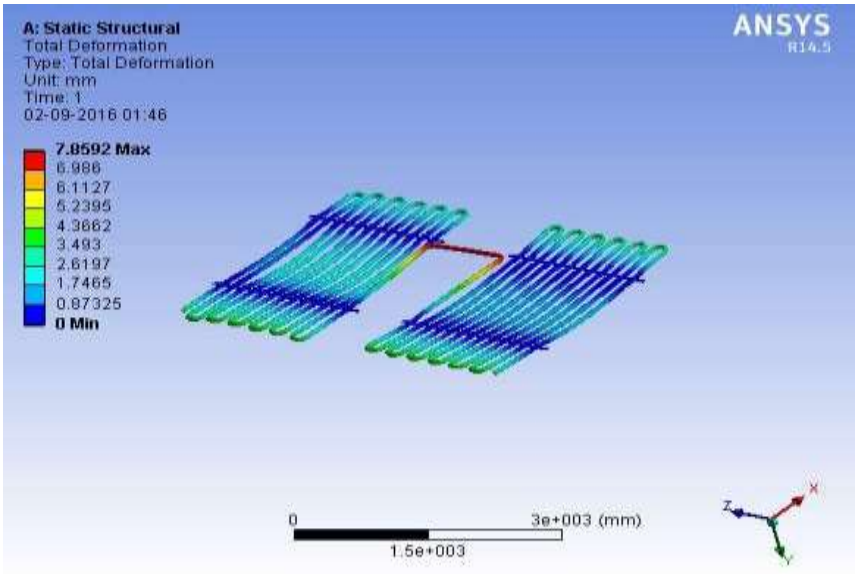
DATA COLLECTION AND ANSYSANALYSIS

Modeling of economizer in Creo software and then imported to Ansys for further stress and heat transfer analysis. The dimensions of the economizer tube assembly are taken as. Tube inner diameter = 50.8 mm Tube thickness = 3.667 mm Inlet/Outlet cylinder id = 219.10 mm Number of tubes = 22 Economizer overall size = 2873 x 4622 x 1906

ECONOMIZER ASSEMBLY



TOTAL DEFLECTION FOR STEEL TUBE 'C' CLAMP ECONOMIZER



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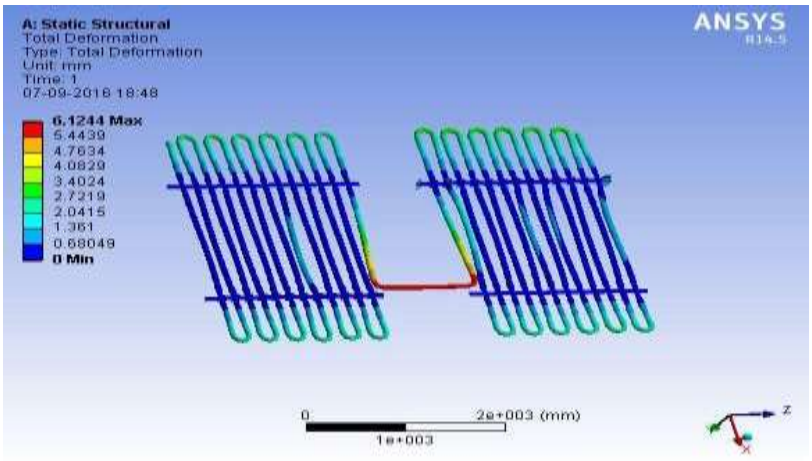
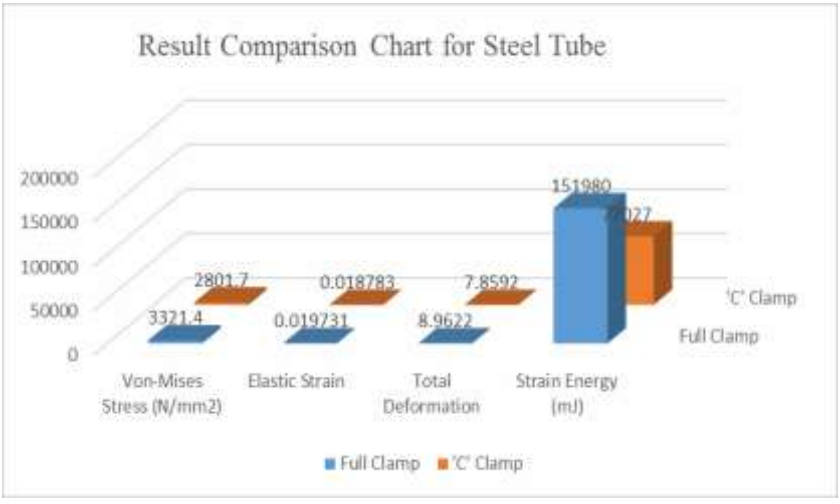
TOTAL DEFLECTION FOR TITANIUM TUBE FULL CLAMP ECONOMIZER



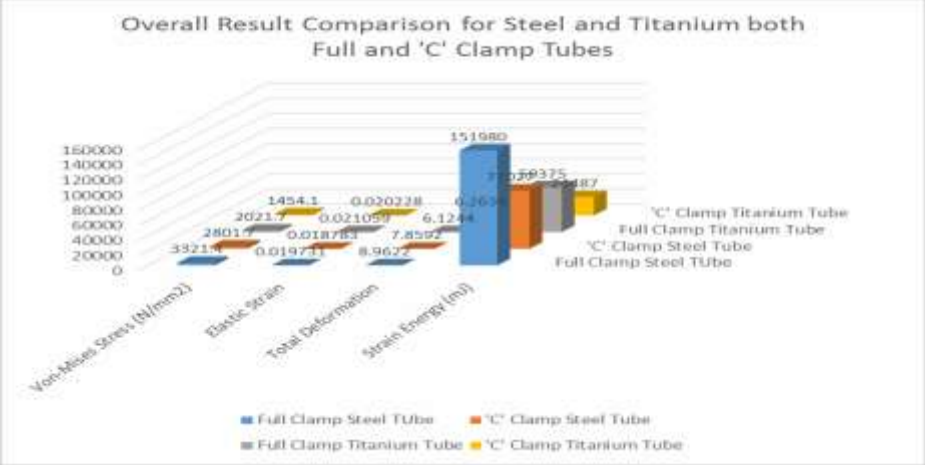
OVERALL RESULT

	Clamp Type	Von-Mises Stress (N/mm^2)	Elastic Strain	Total Deformation (mm)	Strain Energy (mJ)
Steel	Full Clamp	3321.4	0.019731	8.9622	151980
	'C' Clamp	2801.7	0.018783	7.8592	77027
Titanium Alloy	Full Clamp	3321.4	0.019731	8.9622	151980
	'C' Clamp	2801.7	0.018783	7.8592	77027

COMPARISONS FOR BOTH FULL AND 'C CLAMP TUBES



OVERALL RESULT COMPARISON FOR STEEL AND TITANIUM BOTH FULL AND 'C' CLAMP TUBES



CONCLUSION

Two final options are available for change to improvement, the material only can be changed from steel to titanium, it will improve the tube performance. And the titanium alloy material with clamp type 'C' can be addopted to impliment most effective results concluded from ANSYS thermal analysis for Economizer tube performance under thermal action.

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