

# Experimental and Investigation of Tool Design for Reheater

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## Abstract

Reheater is a set of tubes located in the boiler exhaust steam from the high pressure turbine is guided to the boiler for reheating and from there to the intermediate and low pressure turbines. High reheating temperature improve the output and efficiency of a power-plant The construction of re heater coil bend is consider out by using nipple bended the machine can bend a tube only up to a length 10m. The TIG welding process carried out. Which cost is high and simultaneously cycle time increases. The rectify the difficulties and new die is create a design for R142 It cost less than the TIG welding cycle time also reduces and the terminal former mounting in the system bender

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## I. Introduction

The boiler is a major part used in a all the power plant and they produced large amount of heat can be generated to produce the power. The power plant consist of more number of components there are Super heater ,Reheater ,Turbine, Economizer ,Generator ,The major reheating component is reheater. The coil can reheat the steam and increase it temperature. In boiler the major use of the component is reheater. Reheater is a component used to reheat the steam and increase the temperature in the circuit of reheater. The reheater can consist of 12 circuits of coil they are heat treated in the furnace and the coil can be heated the steam enter into it in generally the coil can be make for 10m and they coil can be cut and make a TIG welding and cost of the welding is high.In boiler the major use of the component is reheater. Reheater is a component used to reheat the steam and increase the temperature in the circuit of reheater.The reheater can consist of 12 circuits of coil they are heat treated in the furnace and the coil can be heated the steam enter into it in generally the coil can be make for 10m and they coil can be cut and make a TIG welding and cost of the welding is high. We investigate the problem identified in this process to rectify by the new method. In this process we implemented the STB(straight tube butt) joining can be implemented to rectify the older method to increased the coil production up to 20m and also reduced the cost of the welding process. By using the STB joint we make a 50 joint per hour and it's cost is very less compare to TIG welding

## II. Literature Survey

A three-dimensional numerical model for simulating flow and heat transfer in the reheater of a boiler is presented. The aim is to describe, as well as possible, the geometry of the reheater and to be able to perform different mass flows of steam along each of the tube serpentines. [1]

The design of the heat exchangers follows the TEMA standards. A high evaporator pinch point may lead to a higher investment cost in the reheater. A high evaporator pinch point may lead to a higher investment cost in the reheater. [2]

A single tube model is proposed to evaluate the wall temperature .Effect of excessive higher gas temperature and steam temperature. Higher mass flow rate will decrease the heat flux from the tube metal to the steam. [3]

The velocity and temperature distributions at the section of the final reheater inlet had been taken into account when the designated coal was burned, the pressure difference in the air box, and the downward inclination of the secondary air injection. In order to effectively avoid the boiler reheater and superheater pendant metal overheating [4]

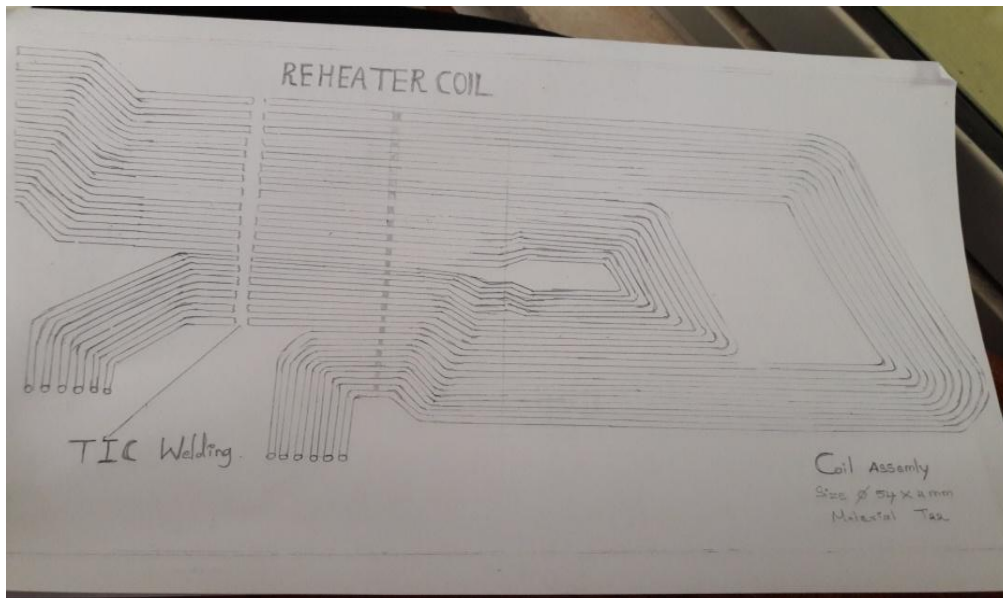
The problem of modeling and control of a three-stage steam reheating process in a steam power plant is considered in this paper. Hybrid MPC based on this model then becomes a promising candidate approach to control. [5]

Boiler corrosion is due to highly alkaline or acidic conditions of the boiler water. The present work has been aimed at investigating the corrosion behaviour of T22 (2.25 Cr-1 Mo) boiler steel TIG weldments in neutral and alkaline media. The parent metal and weld root regions are chosen as regions of exposure for the study made at room temperature and at 100 °C.[6]

### III. Problem Identification

#### Existing Method

A coil is a set of tubular product which has been used in boiler. The coil consists of 12 circuits. The circuit outer diameter is greater than inner diameter. In thermal power plant there exists of 51 coils. The reheater coil can be cutting for offset bending for move to the nipple bender. The offset part can be joined by using the TIG welding manually to form a coil. The construction of coil is considered by using a nipple bender the machine can bend a tube up to 10m. Material Identification: It can be identified by its product group 16; the design of coil is independent. The material of the reheated can be identified by three following methods, Colour coding, Spectrometer and Stencilling.

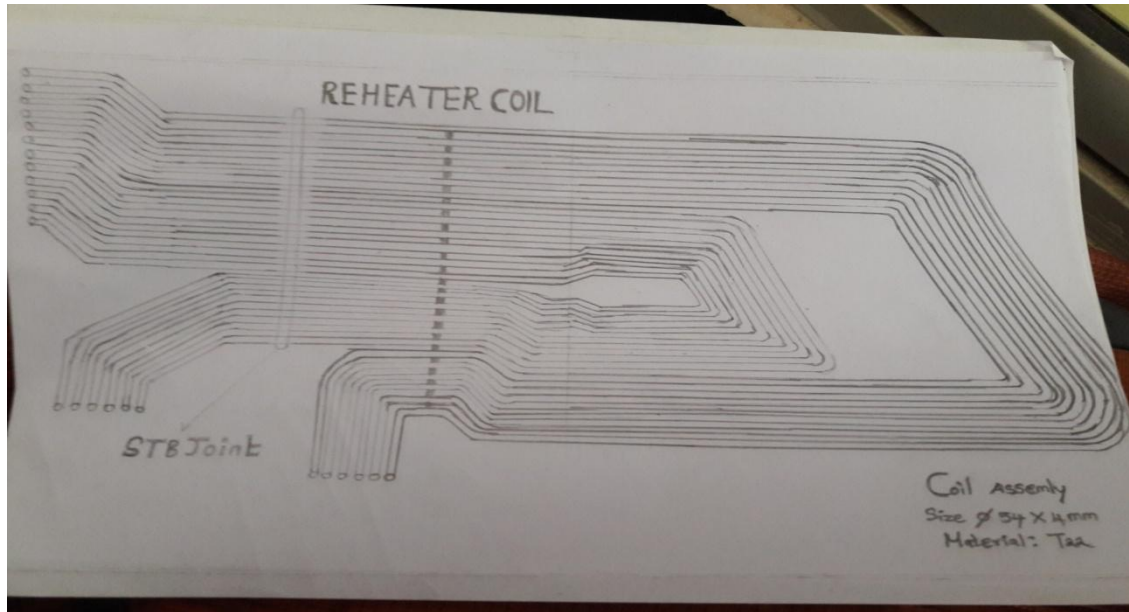


#### Problem Identified

- The total cycle time for manufacturing the coil is very high.
- The bend has to be done with gap min rotary bending machine, hot corrected to correct dimension.
- The hot correction operation is not accurate and may damage the tubes.
- Heavy tool marks found on the tubes which has to be ground and checked for thickness, if the thickness does not match the requirement it should be discarded .
- This will require more additional tubes are required.
- The output in bending machines is also poor and cannot match the requirement.
- The quality of the bend is also very poor and cannot the inspection also consumed.

#### New Method

A new method has to be identified to replace the bending operation from system bender machine. We implement the new method to rectify the difficulties facing in the already existing process. We decided to design a terminal former die to used in system bender machine to bend the tubes. In system bender machine where there is rotary movement. To make a bend at 120° and the tool can be changed the design. In previous method they using the TIG welding process to construct a coil up to 10m but we implemented the STB welding to increase the length up to 20m in the system bender. The cost of the process can be less compare to previous existing method. In this process we used the tool design with the radius of R142 to make the coil. The present offset is of two types, Two bends with equal depth and pitch and Two bends with different depth



**Problem Rectified:**

- The total cycle time for manufacturing the coil is not required.
- The tube length can be done of any length upto 20m.
- The hot correction operation is not required.
- No tool marks were found on the tubes.
- This will marks found on the tubes.
- No TIG joints required additional tubes for rework.
- No need for inspection as no tool marks were observed and the profile of the bend was also exactly according to the drawing.
- No need for radiographic testing as the TIG joints was eliminated.
- Time taken to complete the bending operation for boiler-100 press per shift(1press=2bends).

**Before implementation Bending is carried out in Rotary Machine**

- Tube length of only 10m can be done
- TIG joints had to be introduced for coil formation
- Grinding the tool marks of the bending operation has to be done
- Hot correction is required
- More time required for inspection for checking the quality of the bend after hot correction and grinding the tool marks
- Time taken to complete the bending operation for boiler -50 bends per shift

**After implementation Bending is carried out in Rotary Machine**

- Tube length can be done of any length upto 20m
- No TIG joints required. The coil can be directly formed with the fully bend tubes
- No tool marks were found on the tubes
- No need for hot correction
- No need for inspection as no tool marks were observed and the profile of the bend was also exactly according to the drawing
- No need for radiographic testing as the TIG joints were eliminated
- Radiographic testing has to be done on all joints
- Times taken to complete the bending the operation for boiler -100 press per shift(I press=2bends)

**TESTING**

There are three types of testing conducted

- Fluoroscopy testing
- Air testing
- Hydro testing

### **Fluoroscopy testing**

It is the test in which used to identify the porosity and also detect the crack of the joint portion. The passing x-ray can identify the defects on the pipes like crack, porosity and upercut it can be by the fluoroscopy test.

### **Air testing**

It is the basic test used in all the pipes. To find the leakage and also strength of the pipes through the circuit. In this method the air can be passing through the pipe to the inlet valve which high pressure. Air can be strike the bend of pipe line they doesn't obtained a crack on a pipe the strength of the pipe is identified.

### **Advantages of Reheater coil**

- The inevitable effect of use of higher pressure in power plants is that, the saturation line is reached which is highly undesirable.
- The reheating reduce 4 to 5% fuel consumption with a corresponding reduction in the fuel handling
- The reheat cycle reduces the steam flow of 15 to 20% with corresponding reduction in the boiler, turbine and feed handling equipment capacities
- The wetness of the exhaust steam with the reheat cycle is reduced to 50% of the Rankine cycle with a corresponding reduction in the exhaust blade erosion.
- Lower steam pressures and temperatures and less costly materials can be used to obtain the required thermal performance
- A reduction in the steam volume and heat to the condenser is reduced by 7 to 8%. Therefore the condenser size and cooling water requirement are also reduced by the same proportion
- The size of the Low pressure (LP) turbine blades is reduced because specific volume is reduced by 7 to 8%

## **IV. Conclusion**

It has been identified that there are many difficulties over the current existing process to rectify this difficulties we suggested to replace the bending machine from CNC Nipple Bender Machine to system Bender by designing a new die in System Bender machine, by doing so the length of the tube can be extended up to 20m. The cycle time reduces comparing to previous method parallel inspection do not require Radiographic testing too as the TIG joints are eliminated and STB is suggested. This brings the profit of about Rs.1,02,57,606 per year. The products bend profit obtained by implementing the new die is being inspected by Quality Council (QC) and it is approved for further process.

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