Experimental Investigation on Fixture in Fuel Pipe by Using Rockwell Coupling Method (RC)

[1] R.Harimaheswaran, [2] P.Viswabharathy, [3] A.Arockia Felix, [4] D.Baranidharan, [5] A.Nandha kumar, [6] R.Nandha kumar
[1, 2] Assistant Professor, Department of Mechanical Engineering, Shivani College of Engineering & Technology, Trichy, Tamilnadu, India.
[3,4,5,6] UG Scholar, Department of Mechanical Engineering, Shivani College of Engineering & Technology, Trichy, Tamilnadu, India.

Abstract – A fixture is a device for locating, holding and supporting a work piece during a manufacturing operation. It is a production tool that located holds, and supports, the work securely so the required machining operations can be performed. These work holders are designed for applications where the cutting tools cannot be guided as easily as a drill. And it is main purpose of accurate drilling operation. With fixtures, an edge finder, center, finder, or gages block position to the cutter. It must correctly locate a work piece in a given orientation with respect to a cutting tool. And its secure the work piece in that location for the particular processing operation. And they attached to safety locking belt also connected in a fixture. It can be used to operation that requires a precise relationship in the position of a tool to a pipe.

Index Terms – Boiler, Generators, Transformer, Boiler Drum, Fixture, Rockwell coupling.

1. INTRODUCTION

1.1 BOILER – OVERVIEW

Boiler are pressure vessels designed to heat water or produce steam, which can be used to provide space heating and service water heating to a building. In most commercial fired burner. Oil fired burners and electric resistance heaters can be used as well. Steam is building heating applications, the heating source in the boiler is a natural gas preferred over hot water in some applications, including absorption cooling, kitchens, laundries, sterilizers, and driven equipment.

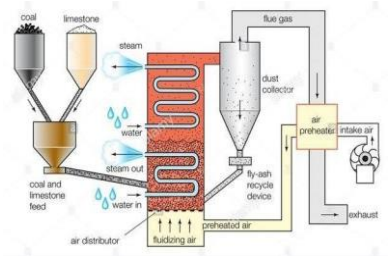

Fig 1.1 boiler overview

A typical 600 MW boiler weight around 14000 Tons in which pressure parts weight is 6000 Tons. Our product lines& Links (pressure parts) contribute to 1850 Tons in a boiler. The working temperature& pressure of L&L is 566.8 degree centigrade (max.)&281.2kg/sq. cm (max.). During fabrication, the preheating temperature is 220 deg. C & the post– heating temperature is 200 deg. C. The post weld heat treatment (PWHT) or stress Relieving (SR) is done for 760 deg. C soaking temperature for a maximum soaking time of 240 minutes.

1.2 WORKING OF PRESSURE AND TEMPERATURE

Boilers are classified as either low pressure or high pressure and it constructed to meet ASME Boiler and Pressure vessel code requirements. Low pressure boilers are limited to a maximum working pressure of 15 psig (pound force per square inch gauge) for steam and 60 psig for hot water. Most boilers used in HVAC applications are low pressure boilers, High pressure boilers are constructed to operate above the limits set for low pressure boilers, and are typically used for power generation operating water temperatures for hot water boilers are limited to 250 F.

1.3 SECTORS

- 3Power
- Transmission
- Industry
- Transportation
- Renewable Energy
- Oil & Gas
- Defense

1.4 PULVERIZER

In the direct firing system medium speed bowl mills are used. Pulverizes are used to crush the coal into particles of micron size. Hot primary air is sent into the pulverizer to dry the coal and to carry the pulverizer are selected depending upon the characteristics of the fuel used and the amount of fuel fired this selection is done taking care of the worst coal anticipated. Only Pulverizer supply fuel to one elevation. The coal and

air mixture temperature at mill outlet is maintained constant by varying, the cold tempering air and hot primary air.

1.5 SUPER HEATERS

Normally in our coal fired boilers here are three stages of super heaters.

1. Low temperature super heater
2. Platen super heater
3. Final super heater

The platen SH is located just at the exit of the furnace where it receives major portion of the heat absorption as radiation. This super heater can be called as radiant SH also. The low temperature SH is kept in the low gas temperature zone where the entire heat transfer is by convection.

1.6 REHEATER

Reheater is provided in boilers of 110MW capacities and above. For small capacity boilers the reheat cycle may not be economical. In the case of industrial boilers there will not be any usually made of metal or plastic, through which a Liquid or gas can flow. In the case of our coal fired utility boilers the reheater is located in between the platen SH and final SH.

1.7 ECONOMIZER

Economizer and air heater are called the heat recovery surfaces because they recover the low temperature heat leaving super heaters. Since the feed water entering boiler is around 2400 C, high temperature heat recovery is done using feed water.

1.8 AIR HEATER

Air heater is located downstream of economizer. The air heater heats the primary air and the secondary air. In all over 200/210 MW unit's tri-sector regenerative type tri-sector air heater is used.

2. LITERATURE REVIEW

PD Krush and TJ Munson. et al. (2004) This form is use for on deep cored Stratigraphic holes. It can be modified to suit other type of drilling.

M Dachyar, Novandra Rhezza pratama.et al. (2013) Decision making in a project is a complex undertaking. Uncertainties organization that is surrounded by inherent uncertainties to overcome this complexity, we need a project evaluation.

Alison M.Forsyth, Eshwan Ramudu, Helen Louise Hindal, and Dana R. Lazarus.et al. (2014) A manual well-drilling pilot project based on the water for all International drilling method was undertaken in a small rural community in the Dominican Republic. Water testing for determining the level of biological and chemical contaminants was used to better assess the water needs of the community.

3. PIPE

A pipe is a long, round, hollow object. A water pipe is any pipe or tube designed to transport treated drinking water/ portable water to consumers building. They offer according to sizes

1. Large diameter main pipes, which supply entire towns.
2. Smaller branch lines that supply a street or group of buildings.
3. Small diameter pipes located within Individual buildings

3.1 MATERIALS USEDFOR CONSTRUCTION OF PIPES

- Pipe comes in several types and sizes, they can be divided into three main categories, metallic pipes, cement pipes and plastic pipes.
- Metallic pipes include steel pipes, galvanized iron pipes and cast iron pipes.
- Cement pipes include concrete cement pipe and asbestos cement pipes.
- Plastic pipes include plasticized polyvinyl chloride (PVC) pipes.

3.2 TYPES OF PIPES

- Cast iron (CI) pipes
- Steel pipes
- Galvanized iron (GI) pipes
- Copper pipes
- Plastic or polythene or PVC pipes
- Asbestos cement (AC) pipes
- Concrete pipes
- Polypropylene pipes

3.3 STEEL PIPES

A steel pipes are comparatively expansive, but they are strongest and most durable of all water supply pipes.

3.4 ADVANTAGES

- Steel pipes are highly efficient, and it is possible to use a smaller diameter of the pipe made from steel than pipes made from other materials.

- The mass flow rate for stainless steel pipe is much higher per diameter than many other materials. This can save on the cost of the pipes without sacrificing flow rate.
- Unlike plastic pipes, steel pipes are 100 percent recyclable, when the pipes are no longer needed, they can be melted down and turned back onto other useable metal pieces in other industries.

3.5 DISADVANTAGES

- Difference of heat transfer, unless for bonded aluminum or copper base, thermal conductivity is very poor.
- It is often more expensive many people think that is a onetime purchase, worth the investment.
- It is difficult to fabricate and since it is not that much malleable as compared to other metals therefore it is difficult in case of repair or re work being done.

3.6 USES

- Water mains
- Sewerage system
- Industrial water lines
- Plant piping
- Deep tube wells
- Casing pipes
- Pipe lines for natural gas

3.7 PIPE CONSUMABLE DETAILS

Table 3.1Pipe Consumable Details

MATERIAL	BASE MATERIAL	COLOUR CODES
Stainless steel	SA 106Gr	Red
P12	SA 335P12	Black Red
P22	SA 335P22	Blue Red
P91	SA 235P91	Brown Red
P92	SA 213TP 347 H	Black Yellow

3.8 FUEL PIPE

A fuel line is a hose used to bring fuel from one point in a vehicle to another or from a storage tank to a vehicle. It is commonly made of reinforced rubber to prevent splitting and kinking.

3.9 STEAM PIPE

It means any pipe through steam passes, if

1. The pressure at which steam passes through such pipe exceeds 3.5kg/ cm^2 above atmospheric pressure.

2. Such pipe exceeds 254 mm in internal diameter and the pressure of steam exceed 1kg/ cm2 above the atmospheric pressure, And include in either case any connected fitting of steam pipe.

4. DRILLING

Drilling is a cutting process that uses a drill bit to cut a hole of circular cross section in solid materials. Tool which makes hole is called as drill bit or twist drill. The drill bit is usually a rotary cutting tool, often multipoint. The bit is pressed against the work piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work piece, cutting off chips (swarf) from the hole as it is drilled. In rock drilling, the hole is usually not made through a circular cutting motion, though the bit is usually rotated. Instead, the hole is usually made hammering a drill into with quickly repeated short movements. The hammering action can be performed from outside the hole (top hammer drill) or with in the hole (down the hole drill, DTH). Drills used for horizontal drilling are called drifter drills. In rare case, specially shaped bits are used to cut holes of non-circular cross section, a square cross section is possible.

4.1 TYPES OF DRILLING MACHINE

- Portable drilling machine
- Bench drilling machine
- Radial drilling machine
- Pillar drilling machine
- Gang drilling machine
- Multiple drilling machine

4.2 PORTABLE DRILLING MACHINE

Fig 4.1Portable Drilling Machine

It is very small, compact and self-contained unit carrying a small electric motor inside it. It is very commonly used for drilling holes in such components that cannot be transported to the shop due to their size or weight or where lack of space does not permit their transportation to the bigger type of

drilling machine. In such cases, the operation is performed on the site by means of the portable electric drill.

4.3 RADIAL DRILLING MACHINE

This mechanism is very useful because of its wider range of action. Its principal use in drilling holes on such work is difficult to be handling frequently. Which the use of this mechanism the tool is moved to the design process instead of moving the work tool breaking the later in position of drilling.

Fig 4.2 Radial drilling machine

4.4 REVERSE CIRCULATION DRILLING

Reverse circulation drilling is a method drilling which uses dual wall drill rods that consist of an outer drill rod with an inner tube. These hollow inner tubes allow the drill cuttings to be transported back to the surface in a continuous, steady flow. It is uses rods with inner and outer

3tubes, the drill cuttings are returned to surface inside the rods. The drilling mechanism is a pneumatic reciprocating piston known as a hammer driving a tungsten steel drill bit. Reverse circulation, drilling is a tried and true drilling method in certain circumstances. Driller usually uses it on large diameter holes because it is faster and easier to clean the hole.

Fig 4.3 Reverse circulation drilling

4.5 DRILLING MACHINE OPERATION

- Reaming
- Boring
- Counter boring
- Counter sinking
- Spot facing
- Tapping

4.6 REAMING

It is a process of smoothing the surface of drilled holes with a tool. This tool is called as reamer. Initially a hole is drilled slightly smaller in size. Drill is replaced by reamer. Speed is reduced to half that of the drilling. It is the operation of finishing a hole to bring it to accurate size and have a fine surface finish. This operation is performed by means of a multi tooth of tools called reaming.

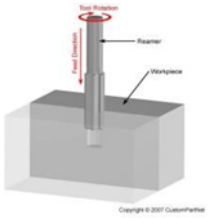

Fig 4.4 Reaming

4.7 BORING

It is process carried on a drilling machine to increase the size of an already drilled hole. Initially a hole is drilled to the nearest size and using a boring tool the size of the hole is increased. It is an operation used for enlarging a hole to bring it to the required size and have a better finish.

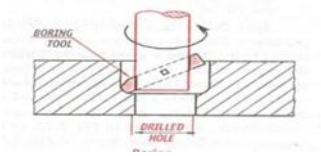

Fig 4.5 Boring

4.8 COUNTER BORING

This process involves increasing the size of a hole at only one end. Cutting tool will have a small cylindrical portion called pilot. Cutting speed

= Two-third of the drilling speed for the same hole. This operation is used for enlarging only a limited portion of the hole is called counter boring.

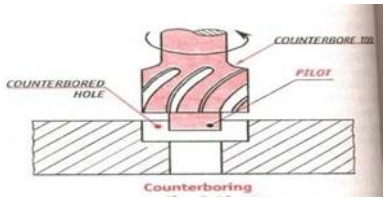

Fig 4.6 Counter boring

4.9 COUNTER SINKING

This is an operation of making the end of a hole into a conical shape. Cutting speed = half of the cutting speed of drilling for

same hole. It is the operation used for enlarging the end of a hole to give it a conical shape of short distance.

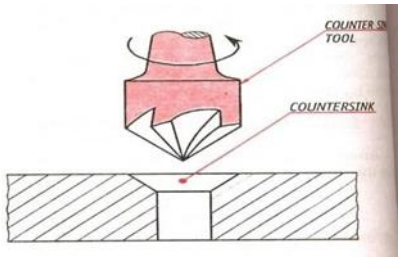

Fig 4.7 Counter sinking process and tool

Fig 4.8 Counter sinking process and tool

4.10 SPOT FACING

It is a finishing operation to produce flat round surface usually around a drilled hole, for proper seating of bolt head or nut. It is done using a special spot facing tool.

Fig 4.9 Spot facing

Fig 4.10 Spot facing tool

4.11 TAPPING

Fig 4.11 Tapping

It process of cutting internal threads with a thread tool called as tap. Tap is a fluted threaded tool used for cutting internal thread. Cutting speed is very slow. It is the operation done of following internal threads by means of the tool called tap.

5. COUPLINGS

Couplings are used to connect two shafts for torque transmission in varied applications. It may be to connect two units such as a motor and a generator or it may be to form a long line shaft by connecting shafts of standard lengths say 6-8m by couplings. Coupling may be rigid or they may provide flexibility and compensate for misalignment. They may also reduce shock loading and vibration. A wide variety of commercial shaft couplings are available ranging from a simple keyed coupling to one which requires a complex design procedure using gears or fluid drives etc.

5.1 TYPES OF COUPLING

- Rigid coupling
- Sleeve coupling
- Clamp coupling
- Flange coupling
- Flexible coupling
- Universal joint
- Oldham coupling
- Flexible shaft
- Miscellaneous coupling

5.2 RIGID COUPLING

Since these coupling cannot absorb any misalignment the shaft to be connected by a rigid coupling by a rigid coupling must have good lateral and angular alignment.

5.3 SLEEVE COUPLING

One of the simple types of rigid coupling is a sleeve coupling which consists of a cylindrical sleeve keyed to the shafts to be connected. Normally sunk keys are used and in order to transmit the torque safely it is important to design the sleeve and the key properly. The key design is usually based on shear and bearing stresses.

5.4 CLAMP COUPLING

A typical clamp coupling essentially consists of two half cylinders which are placed over the ends of the shafts to be coupled and are held together by through bolt.

5.5 FLANGE COUPLING

It is a very widely used rigid coupling and consists of two flanges keyed to the shafts and bolted.

5.6 FLEXIBLE COUPLING

As discussed earlier these couplings can accommodate some misalignment and impact. A large variety of flexible couplings are available commercially and principal features of only a few will be discussed here.

5.7 OLDHAM COUPLING

These couplings can accommodate both lateral and angular misalignment to some extent. An Oldham coupling consists of two flanges with slots on the faces and the flanges are keyed or screwed to the shafts.

A cylindrical piece, called the disc, has a narrow rectangular raised portion running across each face but at right angle to each other. The disc is placed between the flanges such that the raised portions fit into the slots in the flanges. The disc may be made of flexible materials and this absorbs some misalignment.

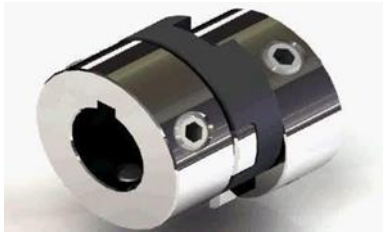

Fig 5.1 Oldham coupling

6. DRILLING FIXTURE AND RC RILLING

6.1 THERMAL POWER PLANT SITE VIEWS OF FUEL PIPE

Fig 6.1

Fig 6.2

Fig 6.3

Fig 6.1&6.2&6.3 fuel pipe site view

6.3 PROBLEM DEFINITION

- Reference line marking parallel to pipe axis.
- Drill hole center marking
- Drill hole reference line marking
- Measure pipe circumference

6.4 MORE RC HOLES IN FUEL PIPE DRILLING

- Operator
- Process
- Facilities
- Raw material
- Work center

6.5 OPERATORS

It consisting of more than operators are using, they are separately operate by a method.

- Gas cutting
- Welding
- Bridge piece breaking
- Marking
- Dummy Fit up

6.6 DRILLING FIXTURE FOR FUEL PIPE RC DRILLING

Fig 6.6 Drilling fixture for fuel pipe RC drilling

6.7 WORKING AND TRIAL IMPLEMENTATION

1. JOB IS LOCATED IN THE FIXTURE

If a job to be fixed in a fixture. And its tightly lock in safety belt, the adjustable rollers are used to adjusting the job. It takes place to fix in fixture.

2. REFERENCE LINE PUNCHING

When a fixed job is placed to marking a reference line in near the edge of pipe end and Centre pitch of the job.

Fig 6.8 Reference line punching

3. THE FIRST HOLE IS DRILLED

A fixed job drilled by a marked place using in reverse circulation drilling method.

Fig 6.9 First hole is drilled

4. JOB IS ROTATED & LOCKED WITH THE PITCH LOCK PIN

When a safety belt is removed and rotates the job to turn over the next drilling place. The job rotated by using of roller bed and it is locked by a pitch lock pin and tightly fixed a safety belt.

Fig 6.10 job is rotated & locked with the pitch lock pin

Fig.6.11 pitch lock pin

6.8 PARETO CHART(COMPARISON OF BEFORE AND AFTER)

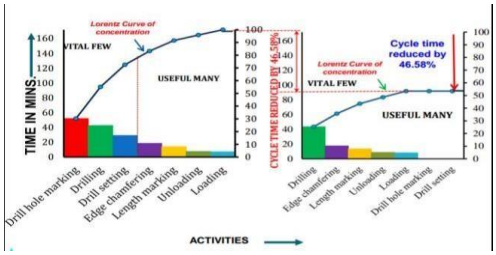

Fig 6.12 comparison of pareto chart

6.9 COMPARE THE BOTH OPERATION

BEFORE

Fig 6.13 Drilling operation (Before)

AFTER

Fig 6.14 Drilling operation (After)

6.10 FIXTURE DESIGED MODEL USING CATIA PITCH LOCK PIN IS HOLDING PIPE BY LIFTING THE CRANK LIVER

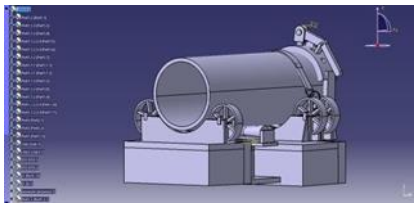

Fig 6.15 Pitch lock pin is free from the pipe by doing not lifting of crank liver

7. CALCULATION

Outer diameter of the pipe is 660mm,

Inner diameter of the pipe is 634.8mm,

Thickness of the pipe is 12.6mm.

Drill hole diameter is 48mm

Thickness of the pipe 12.6+12.6=25.2mm

Outer dia-Inner dia= 660-634.8=25.2mm

The drill hole is taken at a distance from the one end of the pipe is=120mm

The point of drilling holes can be calculated by using the formula πD/16 the diameter is 660mm and the 16 holes want to drill in the pipe so it comes the value of the center point distance between the each drill holes is

πD/16 in mm

π x 660=2073.451mm

2073.451/16=129.59mm

Thus the center point between each drill holes has been taken as a distance is 129.59mm.

8. CONCLUSION

We aimed to reduce the cycle time and achieved a cycle time reduction of 46%. And RC holes marking eliminated and drill setting is time reduced. Drilling output is increased.

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