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Rework Reduction in Upper Cross Member

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1. INDRODUCTION

Now-a-days in mass production, it is often required data to automate the manufacturing processes that were conventionally done manually. In presence, various welding techniques are used for the welding processes such as CO2 welding or Electric arc welding, TIG (tungsten inert gas welding), in that, various fixtures are used for various welding processes but in many applications, we use some techniques which does not work efficiently & accurately. Moving the electrode along the welding line is a skill full work and especially for circular components it becomes much more difficult.

Many different energy sources can be used for welding, including a gas flame, an electric arc, a laser, an electron beam, friction, and ultrasound. While often an industrial process, welding can be done in many different environments, including open air, under water and in outer space. Regardless of location, welding remains dangerous, and precautions are taken to avoid burns, electric shock, eye damage, poisonous fumes, and overexposure to ultraviolet light.

1.1 PROBLEM ON HAND

Gestamp weld shop supply total 30 welded assemblies for Skoda Auto VW India for underbody built. Out of 30, 29 assembly is having Note 3 that means is quality of part is good need no any rework requirement. Upper cross member is only assembly required for 100% checking to insure the quality of product due to variation in assembly after Mig welding. Rework percentage of upper cross member is up to 40 to 50%.So in order to achieve customer demand we need to improve our product quality by eliminating rework. The cost of rework is about Rs 2.0 Lakh per month. Rework is carried out with Hook & Flange rework and welding rework. About 3% cases are rejected.

1.2 IMPORTANCE OF THE PROBLEM

There is management target to reduce the rework cost & produce the upper cross member parts first time right with build in Quality. The average rework is very high (40 to 50% of the production). The rework time is 3 minutes. Monthly rejection scrap is 550 to 600 Kg. Thus it is wastage of manpower, machine hours and cost employed on reduction.

As per agreement between company management and clients we need to manufacture product with quality and as per design standards. First of all no any deviation in assembly and if there is any deviation in part then it is consistent. The requirement of upper cross member for customer per shift is 300 units and per month 7500 unit and in this manufactured production need to rework each assembly and after rework need to check in checking fixture for whether it ok or not ok. Thus this project had been taken up to fulfil the aggregate customer's demand.

1.3 PROBLEM STATEMENT

1.3.1 DETAILS OF PROBLEM

Upper cross member assembly is completed in 2 stages, Resistance welding and MIG welding. In resistance welding fixture is used for welding locating, holding and clamping of Centre bearing and corner bracket. After resistance welding part loaded in 2nd stage MIG welding for Hook welding. This process is carried out with manual MIG welding. After completing this 2 stages deviation in assembly ISO fix bracket in X&Z and gap between rear wheel house to upper cross member and corner assembly LH/Rh side. This process requires rework. The rework area is shown in the following figure which is not conforming the standard dimensions.

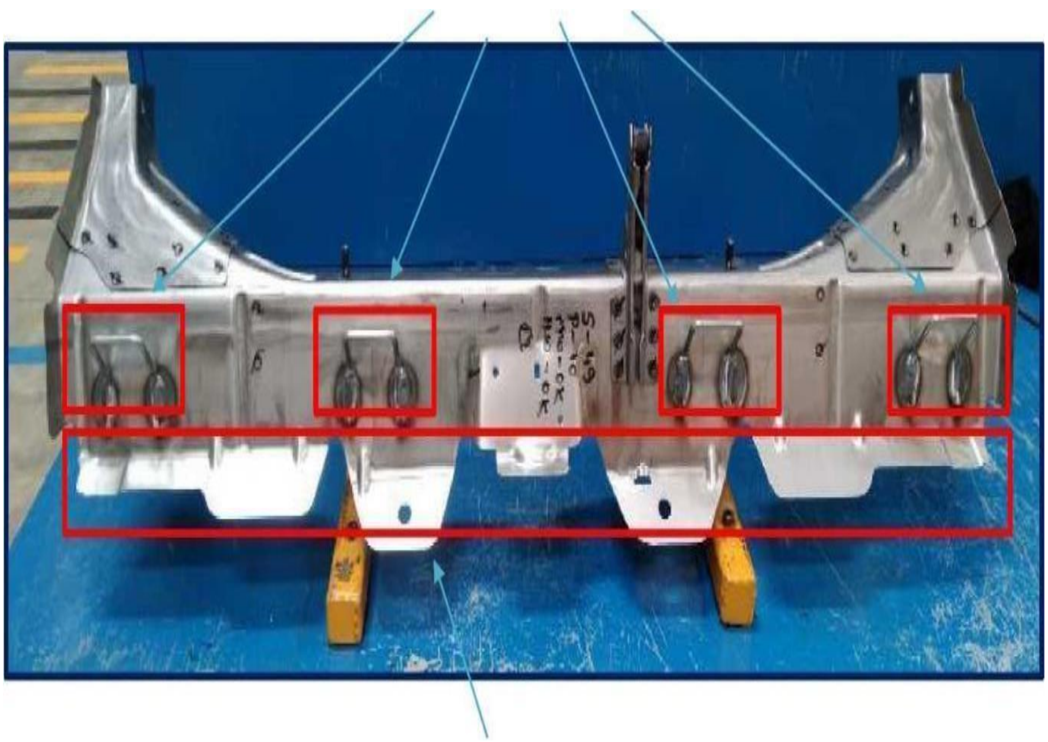


Fig 1: Matching flange area of ISO fix bracket

1.3.2 HISTORICAL PERSPECTIVE

In above 3.1 table showing the month wise non conformity and as per the data percentage of rework is calculated for problem description. Average rework is 42% and rejection is 3%

Table 3.3: Total Cost

Name of machine		Cross member_5QP.814.149			
Month	Manpower in hr.	Scrap weight in Kg	Cost of rework	Cost of rejection	Total Cost
Aug-21	207	504	103450	31192	165677
Sep-21	276	540	137800	33420	212560
Oct-21	266	486	133000	30078	202978
Nov-21	186	585	93100	36205	157235
Dec-21	296	819	147950	50687	243022
Average	246	587	123060	36316	196294

1.4 OBJECTIVES:

1) To review the manufacturing process and identify causes of rework and rejection.

2) To take initiative for improving process and suggest corrections

3) To change tool and reduce vibrations

4) To monitor the process for 3 months after implementation

5) Reduce Rework cases by 50%.

6) Cost Saving.

2 LITERATURE REVIEW

S.K Sharma et.al; (2008). The electrode is a continuous stream of wire, with a direct current source, fed at a continuous rate through the welding gun. Carbon dioxide gas is supplied directly to the welding zone, which acts to protect the area from atmospheric contaminants. The wire electrode, produces an 'arc', in the same way as electric arc (stick) welding, which heats the welding area and fuses the wire electrode with the base metal (metal being welded).

O. P. Gupta and A. De, (1998) states that **-** MIG welding is ideal for aluminum, mild steel, stainless steel, copper and copper alloys.

This research paper **Nicol C, Anderson, (2014)** this is relevant to our case. This case study demonstrates how the Lean Six Sigma methodology can be applied successfully in the turnaround industry to address issues such as reducing welding defects.

Arc welding in any form can be dangerous if proper precautions are not taken as per **American Welding Society, (2004).** Since MIG employs an electric arc, welders must wear suitable protective clothing, including heavy gloves and protective long sleeve jackets, to minimize exposure to the arc itself, as well as intense heat, sparks and hot metal.

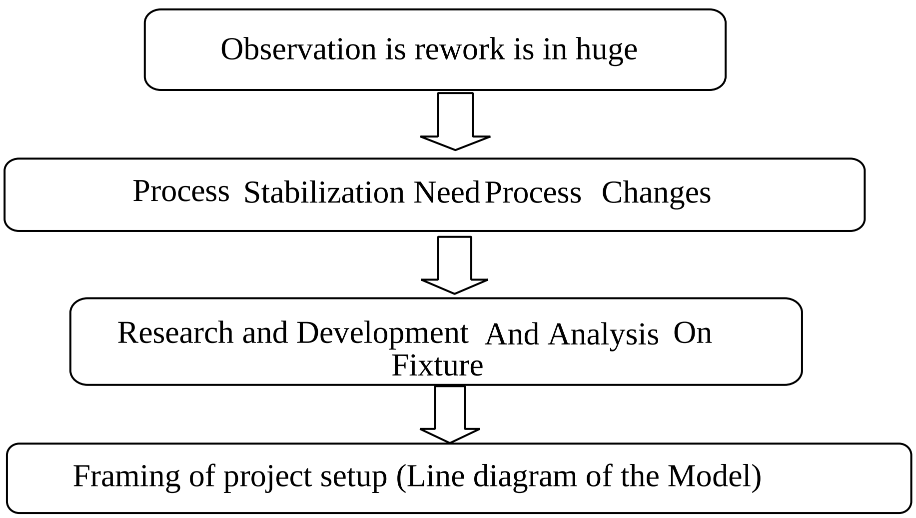
3 METHODOLOGY

3.1 PROCEDURE

We will undertake the detailed study for the MIG welding and spot welding for the sheet metal process. Various alternatives we have found during research and study. The most suitable alternatives will adopted for action. In order to reduce the rework upper cross member first of all we have examined the process of assembly. Stage wise analysis done for the process variation. Stage wise assembly checking with CMM for the process variation. MIG welding and spot welding station CMM report compared for process variation. Fixture correction done for the process stabilization.

3.2 METHODOLOGY OF WORKING PROCESS

Flow Chart For Working Process



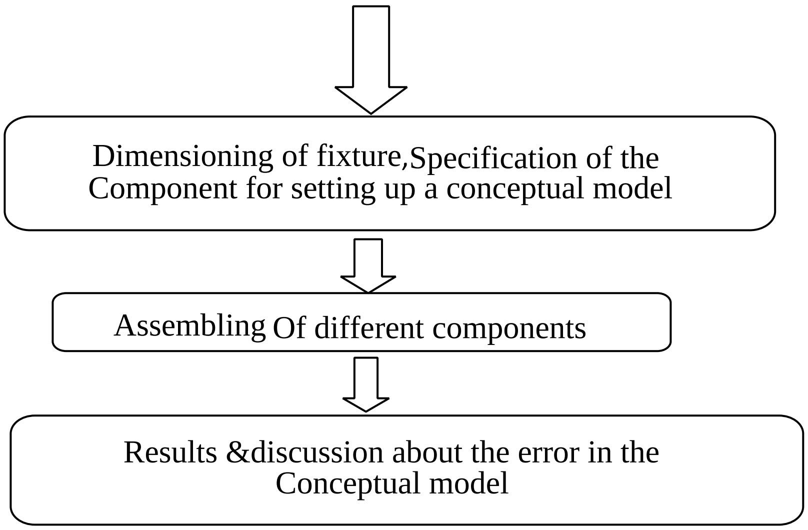


Chart 1: Flow Chart for Working Process

SYSTEM DESIGN

Specification:

- **Size of Block:**

  Length - 90 mm

  Width – 70 mm

  Height – 28 mm

- **Material of Block : Copper**

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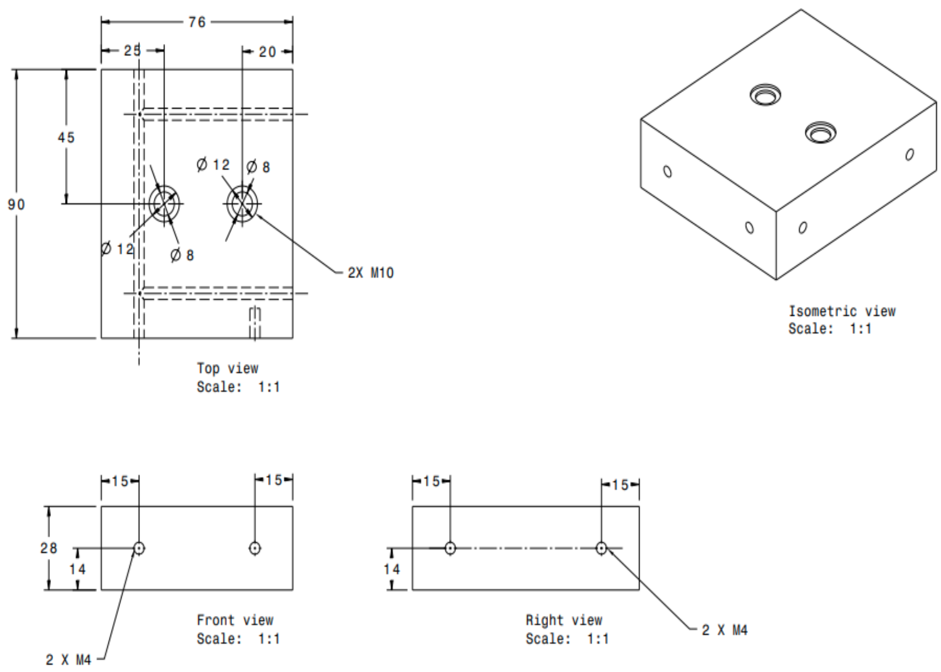

Fig 2 : Heat Exchanger copper unit 2D

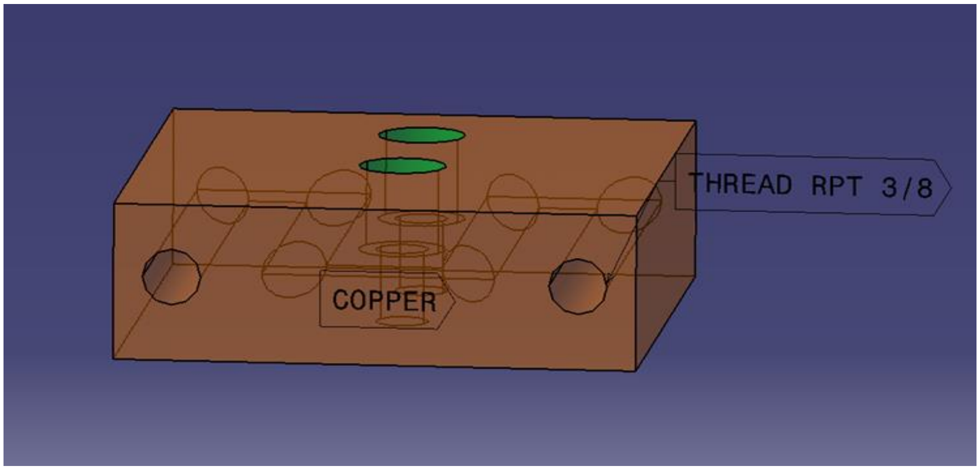

Fig 3 : Heat Exchanger copper unit 3D

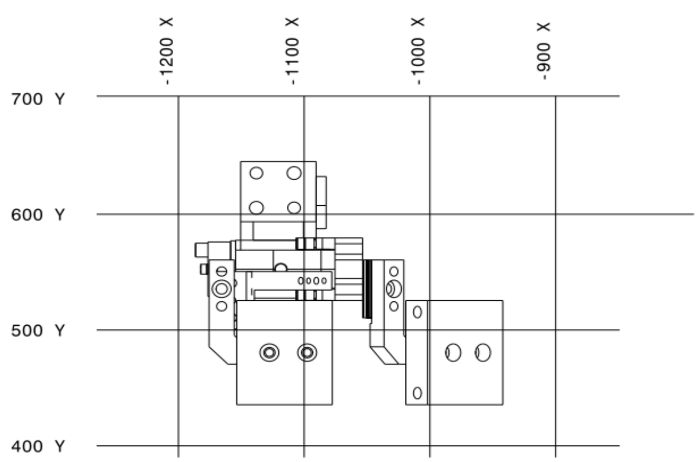

Fig 4 : 2D diagram With X & Y axis dimension

11 BILL OF MATERIAL:

Sr.No	Componet Name	Quantity	Cost/Part
1	Pnumatic Cylinder	4	14900
2	5/2 DEV	1	1520
3	1/8*10 Connector	8	60
4	Flow Control Valve1/8	8	215
5	Hose Pipe	8 Mtr	1000
6	T Connector (M10)	2	150
7	Copper Block	4	4300
8	Grub Screw (M4)	12	10
9	M10 Allen Bolt	8	125
10	Myler	4	525

3.12 ADDITION OF WATER COOLING BLOCK

In this section we have added water cooling block on fixture on each hanger welding area for heat dissipation. In previous process there is no any cooling arrangement for the upper cross member to avoid welding distortion. Water cooling block for the process is as shown in blows figure.

Fig. 5: With Copper Unit Addition

This is the process we have used to avoid welding distortion.

PROCESS CHANGE FOR THE 20MM MAG WELD LENGTH

In this section we have reduced the MAG welding length to reduce the welding distortion in process. Due to this we have got saving in welding material consumption and also in other resources required for the process.

Fig. 6 : MIG Weld Before

Fig7 : MIG Weld After

4 RESULT AND DISCUSSION

4.1 RESULT

1. Reduce the Rework cost upto 50%.
2. Man Hours save
3. Reduction in Rejection cases
4. Reduction in Scrap weight.
5. Improvement in Quality performance
6. Improve Productivity.
7. Easy to preventive Maintenance
8. Reduction in maintenance cost.

We have described the details of corrective actions which are recommended during the project work. All these actions are carried out in the month of April and project is implemented. Necessary drawings and concept behind it is explained. Each section is devoted for a recommendation.

In order to reduce the rework and rejection in upper cross member, we have examined process and find out root cause for the process. After root cause analysis we have decided action for the process.

In this process we have found welding distortion in upper cross member after welding to reduce the welding distortion we have added water cooling block in area of the hook welding for heat dissipation. Operator having different in each shift and skill also having different. So to reduce MAG welding issues we have implemented robotic welding for quality improvement in welding. In hook to eliminate dimensional variation we have added hook profile myler and also reduced the weld length 30mm to 20mm to reduce the heat dissipation in upper cross member.

REDUCTION IN REWORK CASES

In this section we have presented the rework of upper cross member before and after implementation of the project. We have already given 8 moth before data and 4 month after implementation of the project. The following histogram shows the before and after rework of upper cross member assemblies. It indicates the improvement in process after implementation of the project.

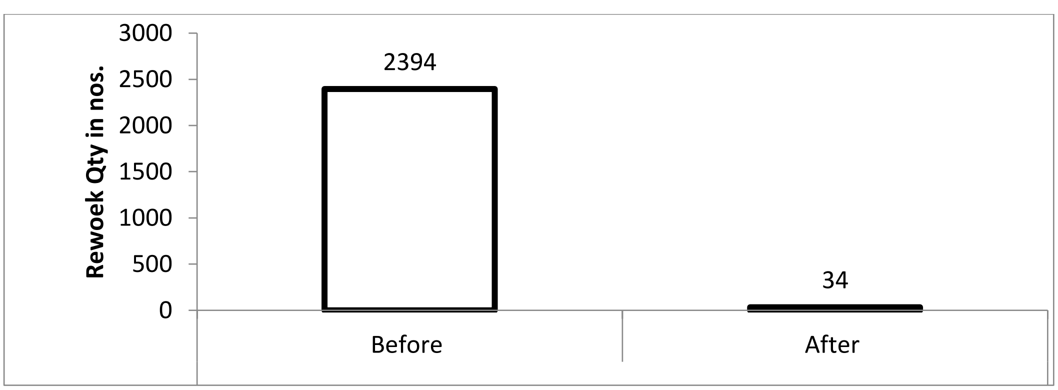

Chart – 2 : Rework quantity before and after (in Nos.)

REDUCTION IN REJECTION CASES

In this section we have described the rejection cases reduced after implementation of the project. In this before we have average rejection cases per month is about 65 quantities after implementation of the project we have reduced to average 11nos. rejection from the welding process.

Graph not proper give month wise rejection before and after here using scatter plot and bar diagram for average.

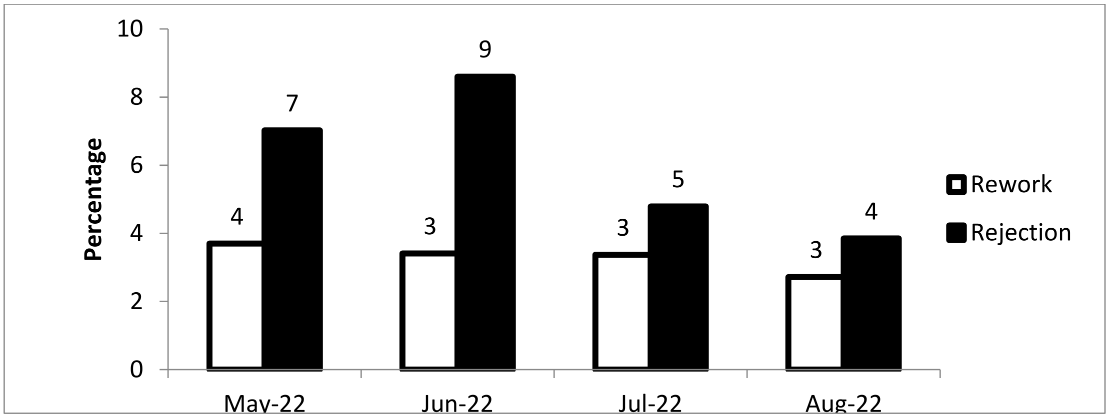

Chart – 3 : Reduction per month and % reduction.

MAN-HOURS SAVED

In This section we have described the total man-hours saved after implementation of the project. In this we have calculated total man-hours lost on the basis of rework time. Before implementation of this project average loss of man-hours per month is 269 hours after implementation of the project man-hours loss reduced to average 17 hours per month. Total average percentage reduction in man-hours is 94%.

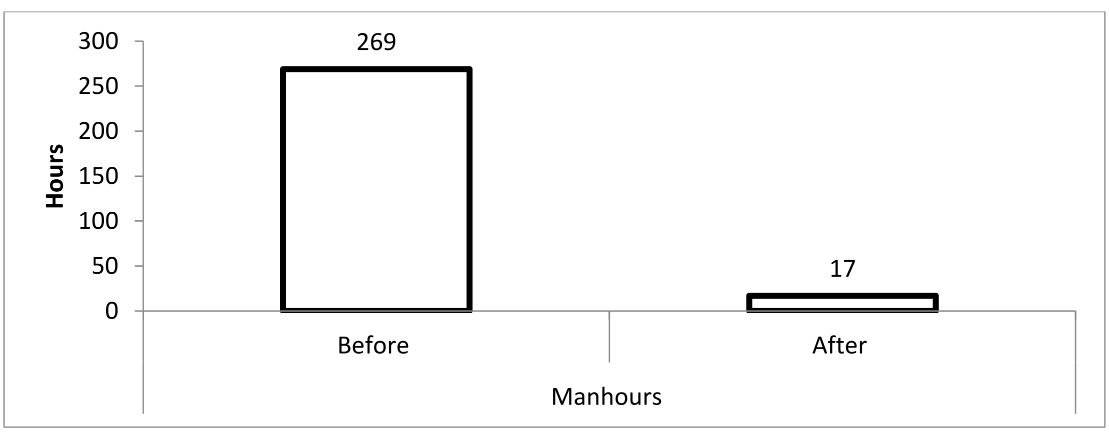

Chart – 4 : Man-hours loss before and after in hours

COST OF REWORK SAVED

In this section we have described the cost saving in rework after implementation of the project. In this project we have saved cost in various resources used for the rework activity like, electricity, welding wire, shield gas and manpower required for rework activity. Consumption of the resources decreases as the rework decreases.

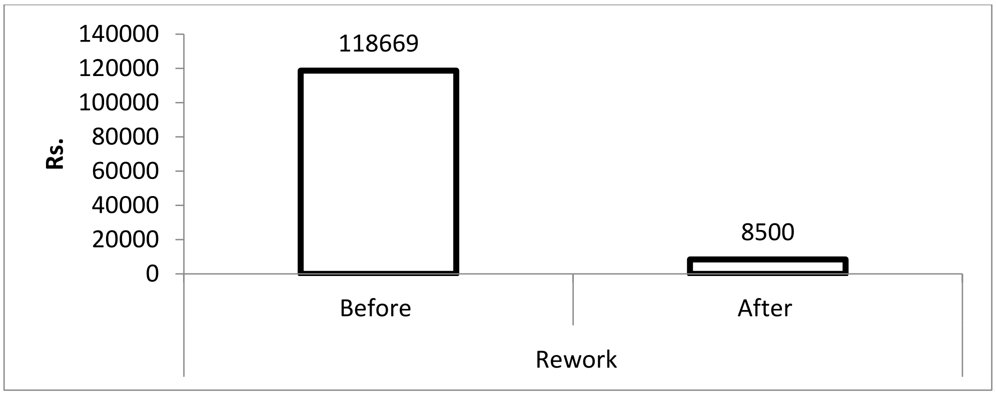

Chart – 5 : Rework cost before and after in Rs.

COST OF REJECTION SAVED

In this section we have described the average rejection cost reduced after implementation of the project. Rejection cost is based on the rejection of the assemblies Rejection cost is 557 Rs. for the single assembly. So rejection value is calculated on the basis of rejected count into Rs. 557.

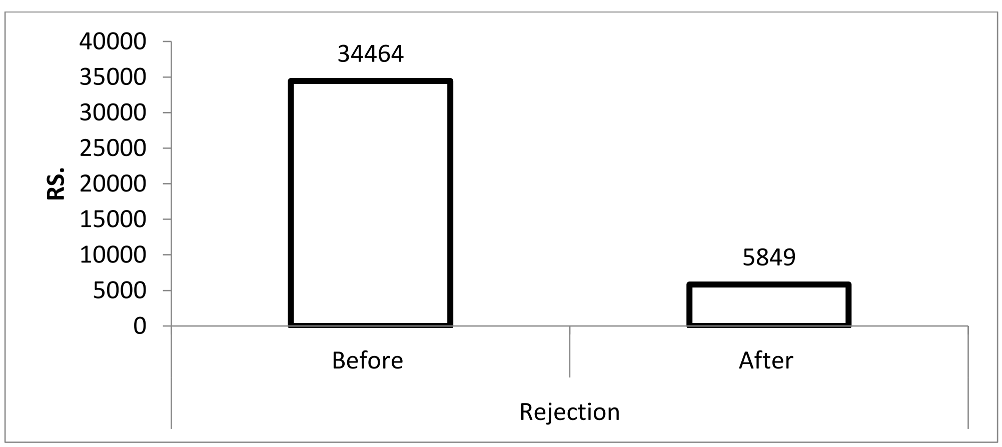

Chart – 6 : Rejection cost before and after in RS.

5 CONCLUSION

The use time analysis (pareto chart, Histogram) and cause effect diagram helped to identify the correct causes of failures by which the suitable countermeasures are developed and implemented, By Adding Copper cooling block and Reduce the length of welding

The average production per month is 5500. Before implementation of this project 45% average rework is there for process. Now the customer demand for quality perspective is high so we need to reduce this rework and improve quality of the product. In this rework process require resources also high it's also impacting cost for the product. This project is to fulfill the customer demand and the improving rework cost up to 80% of the present situation.

Also, quality improvement and Reduce rework in assembly. Company will enjoy benefits of improved lead time, quality. We gained unique experience of integrating and evaluating theory and practical aspects of design. This helps us to extract valuable knowledge and data. We are sure that this valuable experience will be helpful in our future in all aspect.

6 FUTURE SCOPE

The water cooling system is very cheap & less cost process so we used that process to reduce temperature. The "Cooling System in MIG Welding by using Water cooling System" can also be applicable in TIG welding. It enhances the production rate as well as improves the quality of the welding. It has a wide range of applications such as Automobile, Aerospace, and Marine and can also be used in small workshops. The liquid cooling systems becoming the priority cooling solution in the future, there is always a scope for education and economic viability. The cooling system is the most important factor in manufacturing sector

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