REDUCE REJECTION RATE OF CONNECTING ROD USIG DOE METHOD

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Abstract*- This paper focuses on Reduce rejection Rate of Connecting rod by Design of Experiments. In this Research work uses ½ Fractional Factorial Design Techniques. This research works divide in two parts. This paper present first part of research works. First part consists of control of Rejection rate consider six type of control parameter namely, 1 Central distance of rod, 2 Central distance of cap, 3 Rod face Symmetricity, 4 Cap face Symmetricity, 5 Assembly Hole of rod, 6 Assembly Hole of cap to select for the optimize condition for Reduce Rejection Rate of connecting rod. In this research work use Minitab statistically analysis software. ½ Fractional Factorial Design Experiments generate 32 Experiments design by help of Minitab software. In research work part two in performs Design analysis steps and also generation of results. This result suggests most affective parameters or significant parameters which are responsible behind the Rejection of connecting rod.*

Keywords: Statically analysis, Fractional factorial design, Central distance of rod (CD Rod), Central distance of cap(CD Cap), Rod face Symmetricity, cap face Symmetricity, Assembly Hole of rod, Assembly Hole of cap.

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1. INTRODUCTION

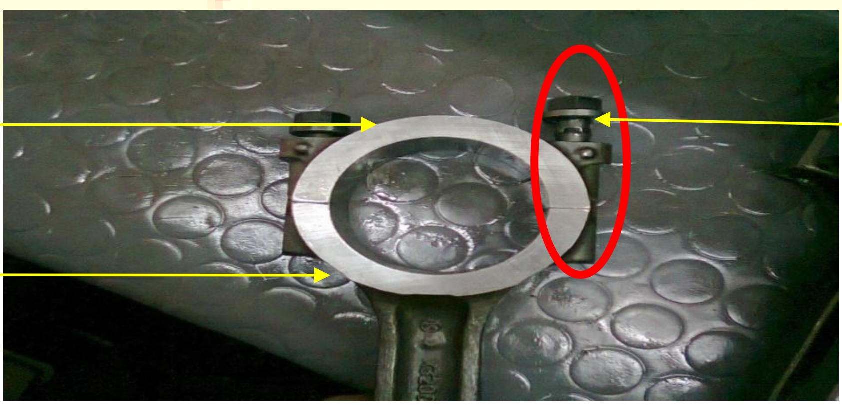
This paper deal with reduce rejection rate of connecting rod by using Design of Experiments with Minitab Statically analysis software. Experiments are performed today in many manufacturing organization to increase our understanding and knowledge of various manufacturing process. Experiments in manufacturing companies are often conducted in a series of trials or tests which produce quantifiable outcomes. For continuous improvement in product or service quality, it is fundamental to understand the process behavior, the amount of variability and its impact on processes. In engineering environment, experiment is often conducted to explore, Estimate or confirm. Exploration refers to understanding the data from the process. Estimation refers to determining the effect of process variables or factor on the output performance characteristic. Confirmation implies verifying the predicted results obtained from the experiments. In manufacturing process, it is often of primary interest to explore the relationship between the key input process variable (or factors) and the output performance characteristic (or quality characteristic). Statistical thinking and statistical method play an important role in planning, conducting, analyzing, and interpreting data from engineering experiments. When several variables influence a certain characteristic of the product the best strategies is then to design an experiments show that valid, reliable and sound conclusion can be drawn effectively, efficiently and economically. [12]

2. PROBLEM STATEMENT

Automobile industries produce mass quantity of connecting rod for heavy automobile vehicle. The main problem is Cap and Rod assembly bolt tight happen.

Cap

Rod



Assembly bolt

Photograph of Cap & Rod assembly bolt tight problem

Above figure indicate that connecting rod assembly has two main parts. Top part of this assembly called cap and bottom part is called rod. After complete all manufacturing operations When assemble of these two parts cap and rod assembly bolt tight happen. And bolt no rotate freely in the cap and rod assembly bolt hole. So Connecting rod goes in rejection. The Customer requirement is freely rotate bolt in the cap and rod assembly bolt hole with best quality. So this type of bolt tight problem is main reason for rejection.

3. CONSIDERABLE PARAMETERS [1]

1. Central distance of rod (CD.ROD)
2. Central distance of cap (CD.CAP)
3. Cap face Symmetricity
4. Rod face Symmetricity
5. Hole of rod
6. Hole of cap

3.1 Parameters Levels [1]

SR.NO	PARAMETER	LEVEL-LOW MM	LEVEL-HIGH MM
1	Central distance of rod	80.04	80.36
2	Central distance of cap	80.04	80.36
3	Cap face Symmetricity	19.10	19.50
4	Rod face Symmetricity	19.10	19.50
5	Hole of rod	12.200	12.218
6	Hole o cap	12.200	12.218

Table-1 Parameters levels values

3.2 Experiments Design Base on 1/2-Fractional Factorial Design Rule [8]

SR.NO	CD.ROD	CD.CAP	CAP FACE SYMMETRICITY	ROD FACE SYMMETRICITY	A.HOLE OF ROD	A.HOLE OF CAP
1	1	-1	-1	1	-1	-1
2	1	1	-1	1	1	-1
3	-1	1	1	1	-1	1
4	-1	1	-1	-1	-1	1
5	-1	-1	-1	-1	-1	-1

6	-1	-1	-1	-1	1	1
7	1	1	1	1	1	1
8	1	1	-1	1	-1	1
9	1	1	1	1	-1	-1
10	-1	1	-1	1	1	1
11	-1	-1	-1	1	1	-1
12	-1	-1	1	-1	-1	1
13	1	-1	-1	-1	-1	1
14	-1	1	1	1	1	-1
15	1	-1	-1	1	1	1
16	1	1	-1	-1	-1	-1
17	-1	-1	1	1	1	1
18	1	-1	1	-1	1	1
19	-1	-1	-1	1	-1	1
20	1	1	-1	-1	1	1
21	1	-1	1	-1	-1	-1
22	1	1	1	-1	1	-1
23	-1	-1	1	-1	1	-1
24	-1	1	-1	1	-1	-1
25	-1	1	1	-1	-1	-1
26	-1	1	-1	-1	1	-1
27	1	-1	1	1	-1	1
28	1	-1	1	1	1	-1
29	1	1	1	-1	-1	1
30	1	-1	-1	-1	1	-1
31	-1	-1	1	1	-1	-1
32	-1	1	1	-1	1	1

Table-2 1/2-Fractional Factorial Design for Experiments

3.3 Enter Values of high and low Level for all Parameters & Enter the number of OK Pieces out of 25 pieces. And prepare following table by use of Minitab statistically software. [1-8-7]

SR. NO	CD.ROD MM	CD.CAP MM	CAP FACE SYMMETRICITY MM	ROD FACE SYMMETRICITY MM	HOLE OF ROD MM	HOLE OF CAP MM	OK PIECES Out of 25
1	80.36	80.04	19.1	19.1	12.200	12.218	24
2	80.36	80.36	19.1	19.1	12.200	12.200	19

3	80.36	80.36	19.5	19.1	12.200	12.218	20
4	80.04	80.36	19.5	19.5	12.218	12.200	24
5	80.36	80.36	19.1	19.1	12.218	12.218	20
6	80.36	80.36	19.5	19.1	12.218	12.200	20
7	80.36	80.36	19.5	19.5	12.200	12.200	20
8	80.36	80.04	19.5	19.1	12.218	12.218	25
9	80.04	80.04	19.1	19.5	12.218	12.200	25
10	80.36	80.04	19.1	19.5	12.218	12.218	24
11	80.04	80.36	19.1	19.1	12.218	12.200	25
12	80.04	80.36	19.1	19.5	12.218	12.218	24
13	80.36	80.36	19.1	19.5	12.218	12.200	20
14	80.04	80.04	19.1	19.5	12.200	12.218	25
15	80.04	80.36	19.5	19.5	12.200	12.218	24
16	80.04	80.36	19.5	19.1	12.218	12.218	25
17	80.36	80.04	19.1	19.5	12.200	12.200	24
18	80.04	80.04	19.1	19.1	12.200	12.200	25
19	80.36	80.04	19.5	19.1	12.200	12.200	25
20	80.04	80.04	19.1	19.1	12.218	12.218	25
21	80.36	80.04	19.1	19.1	12.218	12.200	24
22	80.04	80.36	19.1	19.5	12.200	12.200	25
23	80.04	80.04	19.5	19.5	12.218	12.218	25

24	80.36	80.04	19.5	19.5	12.200	12.218	24
25	80.36	80.04	19.5	19.5	12.218	12.200	25
26	80.04	80.36	19.5	19.1	12.200	12.200	24
27	80.04	80.36	19.1	19.1	12.200	12.218	24
28	80.04	80.04	19.5	19.1	12.218	12.200	25
29	80.36	80.36	19.5	19.5	12.218	12.218	20
30	80.04	80.04	19.5	19.5	12.200	12.200	25
31	80.04	80.04	19.5	19.1	12.200	12.218	25
32	80.36	80.36	19.1	19.5	12.200	12.218	20

Table-3 Enter values of High/low level for all parameters

IV.RESULT

This research paper result indicates 32 Experiments Design involves High and low values of all the parameters and according to this design perform 32 Experiments and taking result out of 25 pieces. These ok pieces put in design table by use of Minitab software.This design table are very useful for perform of Design analysis step.

V. CONCLUSION AND FUTURE WORK

This paper described in detail use of the Design of Experiments method applied to reduce rejection of connecting rod. The six control parameter consider for control of rejection are 1 Central distance of rod, 2 Central distance of cap, 3 Rod face Symmetricity, 4 Cap face Symmetricity, 5 Assembly Hole of rod, 6 Assembly Hole of cap. Then decide their higher and lower values for Experiment by use of ½ fractional factorial design techniques. By this technique design 32 experiments. In each experiment had taken 25 sample of connecting rod. Collect all experiments result and input in Minitab statistical analysis software.

Future work will consist of analyze fractional factorial design and generate the result. This result will indicate most affective parameters or significant parameters which are responsible behind the rejection of connecting rod.

REFERENCES

1. Face Gear width prediction Using the DOE Method. By Michele Guingand , Didier Remond, Jean-Pierre de Vaujany.(Journal of Mechanical Design ,October 2008, Vol. 130/104502-1.ASME)

2. Thermal and Mechanical Loading Effects on the Reliability of Organic Flip Chip Package By. Teck Joo Goh(Journal of Electronic packaging , March 2001, Vol. 123/83 .ASME)

3. Sensitivity Analysis of a 2.5 kW Proton Exchange Membrane Fuel Cell Stack by Statistical Method. By. N. Rajalakshmi, G. Velayutham, K. S. Dhathathreyan.(Journal of Fuel cell Science and Technology , FEB 2009, Vol.6/011003-1.ASME)

4. Failure Analysis of Rapid Prototyped Tooling in Sheet Metal Forming—Cylindrical Cup Drawing. By. Y. Park, J. S. Colton.(Journal of Manufacturing Science and Engineering, Feb 2005, Vol.127/127.ASME)

5. Selective Laser Sintering Process Optimization for Layered Manufacturing of CAPA® 6501 Polycaprolactone Bone Tissue Engineering Scaffolds By. Brock Partee , Scott J. Hollister , Suman Das(Journalof Manufacturing Science and Engineering, May 2006, Vol.128/531.ASME)

6. Analysis of Molecular Beam Epitaxy Process for Growing Nanoscale Magnesium Oxide Films By. Ghulam M. Uddin , Zhuhua Cai , Katherine S. Ziemer , Abe Zeid , Sagar Kamarthi.(Journalof Manufacturing Science and Engineering, Jine 2010, Vol. 132/030913 .ASME

7. An Experimental Study of Bearing and Thread Friction in Fasteners By. S. A. Nassar H, El-Khiamy,G.C. Barber, Q. Zou ,T.S.Sun.(Journal of Tribology,April 2005, Vol/ 127263

8.Investigation to Study the Applicability of Solid Lubricant in Turning AISI 1040 steel By.Deep Mukhopadhyay, Sankha Banerjee , N. Suresh Kumar Reddy.(Journalof Manufacturing Science and Engineering, June 2007, Vol.129/521.ASME)

9.Fault Diagnosis of High Speed Rolling Element Bearings Due to Localized Defects Using Response Surface Method. By P. K. Kankar , Satish.C.Sharma , S. P. Harsha. (Journal of Dynamic system, Measurements and Control, May 2011, Vol 133/031001-1.ASME)

10. Jiju Antony -Design of Experiments for Engineers and Scientists

- ISBN: ISBN: 0750647094
- Publisher: Elsevier Science & Technology Books
- Pub. Date: October 2003

11. Issa Bass, -Six Sigma Statistics with Excel and Minitab - The McGraw-Hill Companies 2007

12.Douglas C. Montgomery – Design and Analysis of Experiments. John Willy and Sons publication, 2001

13.Springer - Introductions to Engineering Statistics and Lean Sigma Statistical Quality Control and Design of Experiments and Systems.

14.Gary W. Dehlert - Design and Analysis of Experiments. Library of congress catalogue publication, 2010

16. D.R. Cox - The Theory of the Design of Experiments. (Honorary Fellow Nuffield College Oxford, UK