International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in

Vol.4., Issue.1., 2016
(Jan-Feb)

RESEARCH ARTICLE

ISSN: 2321-7758

IMPLEMENTATION OF STATISTICAL PROCESS CONTROL IN MANUFACTURING INDUSTRY

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ABSTRACT

Statistical Process control (SPC) is an important tool used widely at manufacturing field to monitor the overall operation. SPC can be applied to all kind of manufacturing operations. The significant application of the SPC analysis elements to the operation will make the process more reliable and stable. For the project, shock and vibration mount manufacturing process were selected. Important role of the mount is providing vibration isolation and shock absorption. Generally, shock & and vibration mount consists of vulcanized rubber bonded to metal part facilitating load distribution and installation. For the study of mount product number AKCC 85E is selected. Deflection of the mount is checked by applying load on it with the help of deflection load test machine. The quality control (QC) data were obtained and further analysis on the data was done by using MINITAB software. The analyzed data were compared and the root problems and errors were identified. Based on the root causes recommendations were implemented in the process and again data was analyzed by MINITAB software.

KEYWORDS: Statistical Process control (SPC), Control charts, Shock and vibration mount, manufacturing process, rejection reduction, MINITAB.

INTRODUCTION

Generally, shock & and vibration mount consists of vulcanized rubber bonded to metal part facilitating load distribution and installation. Rubber being a soft, viscoelastic material have a unique combination of elastic (spring) and viscous (damping) properties makes it such a useful material for vibration and shock mount. The manufacturing of each components of the mount must be very much precise to control the quality of the mount. In order to keep the production of the mount in control to an accurate and effective process control method is required. (SPC) involves statistical techniques to measure and analyses the variation in processes. Most often used for manufacturing processes, the intent of SPC is to monitor product quality and maintain processes to fixed targets. The consistent, aggressive and committed use of SPC to bring all processes under control, recognize and eliminate special causes of variation, and identify the capability of all operations is a key requirement.

SPC is defined as prevention of defects by applying statistical methods to control the process.

OBJECTIVES

Objective of this projects are:

1. Implement the SPC tool in the shock & vibration mount manufacturing process.
2. Improve the quality of the product.
3. Reduce the rejection rate.

SCOPE OF WORK

Firstly, a comprehensive literature review has been conducted to determine the best statistical method. Thereafter QC data were obtained and manufacturing process were analyzed using SPC tool. Lastly improve method of manufacturing process were proposed based on the analysis outcome.

METHODOLOGY

Implementation of Statistical Process Control in manufacturing process is done with association of control charts. In this research paper we adopted the control chart method to observe and control the process along the manufacturing process line. Individual and moving range charts has been suggested for this research and according to the control charts, results and discussion is presented

LITERATURE REVIEW

In "Implementation of Statistical Quality Control (S.Q.C.) In Welded Stainless Steel Pipe Manufacturing Industry" byKapil Banker, Amit Patel, Diptesh Patel focused on the statistical quality control tool to overcome the ovality problem in the stainless steel welded pipe production. To analyze the data, they used X bar and R chart and results are obtained.

They conclude that in Apurvi industries the main defect observed was ovality in stainless steel welded pipe. The ovality defect has been eliminated by adjusting the expanding pressure in the expanding machine. Expanding machine has been used for maintaining circularity of the pipe. If the pressure of machine is exceeded than ovality defect is developed in the pipe. They observed in the conceptual model of statistical process control, that productivity is increased after implementing the statistical quality control in Apurvi industries.

In "statistical process control for the process industries" by John A. Shaw focused on statistical quality control charts. He observed that the process is unstable when value of X bar goes beyond control limits. Also sub grouping of four to five measurements is important part of X bar chart. He also introduced an alarm system for process industries,when the measured variable is out of statistical control limit alarm will be triggered.

He concluded that Statistical process control has served as an important tool in the discrete parts manufacturing industries to improve product quality, reduce variability, and decrease cost. It is being adopted by many companies in the chemical process industries, in part due to pressure from their customers. In some areas within the chemical industry, SPC has proven to be a useful and successful tool. Its applicability must be examined in all areas of the chemical industry, application by application. Two primary considerations should govern its acceptance for each individual application: the ability of SPC to produce meaningful results, and the need for SPC as compared to other statistical and non-statistical tools**.**

In "Failure Analysis of Machined Component Using Statistical Control Tools" byHashmi Riyaz Ahmed Abdul Hasan Dr. ShyamSonwane focused on the quality improvement in manufacturing process by using statistical process control tool. For the study break liners were selected.From root cause analysis they found that variation in thickness is because of the die taper in the press mould were not as per the specification due to which thickness was excess.

They conclude thatthe SPC tools are beneficial for overall improvement of industry. By implementing SPC tool the several problems like increase in the rate of rework, rejections and variation is reduced.

RESULTS AND DISCUSSION

Firstly, SPC tool were implemented to the batch of 110 AKCC 85E mount. From control charts it is found that there are some points which are out of control limits and also rejections are in the manufacturing process. To improve the process root-cause analysis were done and recommendation are implemented in the process for further analysis.

Tolerance limit for AKCC 85E mount is 1±0.4 mm. For the analysis batch of 110 mount were selected and individual chart and moving range chart are plotted as subgroup size is 1 for the process. Analysis is done by MINITAB software and results are as follows:

Sample no.	Deflection (mm)	Sample no.	Deflection (mm)	Sample no.	Deflection (mm)	Sample no.	Deflection (mm)
1	1.07	31	1.04	61	1.14	91	1.01
2	1.07	32	1.01	62	1.15	92	1.07
3	1.08	33	1.13	63	1.08	93	1.10
4	1.08	34	1.22	64	1.04	94	1.24
5	1.19	35	1.21	65	1.03	95	1.09
6	1.05	36	1.21	66	1.15	96	1.08
7	1.02	37	1.12	67	1.17	97	1.04
8	1.02	38	1.26	68	1.15	98	1.11
9	0.98	39	0.99	69	1.04	99	1.08
10	1.14	40	1.16	70	1.12	100	1.27
11	1.08	41	1.21	71	1.03	101	1.17
12	1.15	42	1.04	72	1.07	102	1.00
13	1.23	43	1.08	73	1.05	103	0.97
14	1.14	44	0.96	74	0.98	104	1.17
15	1.10	45	1.22	75	1.10	105	1.21
16	0.95	46	1.09	76	1.08	106	1.33
17	1.03	47	1.13	77	1.27	107	1.22
18	1.00	48	1.18	78	1.00	108	1.30
19	0.93	49	1.03	79	1.10	109	1.08
20	1.02	50	1.07	80	1.11	110	1.06
21	1.03	51	0.95	81	1.13		
22	1.08	52	1.04	82	1.23		
23	1.26	53	1.27	83	1.08		
24	1.04	54	1.27	84	0.98		
25	1.01	55	1.06	85	1.05		
26	1.14	56	1.14	86	1.14		
27	1.07	57	1.05	87	1.07		
28	1.06	58	1.19	88	1.01		
29	1.19	59	1.00	89	1.08		
30	1.13	60	1.05	90	1.07		

Fig. 1Test Result

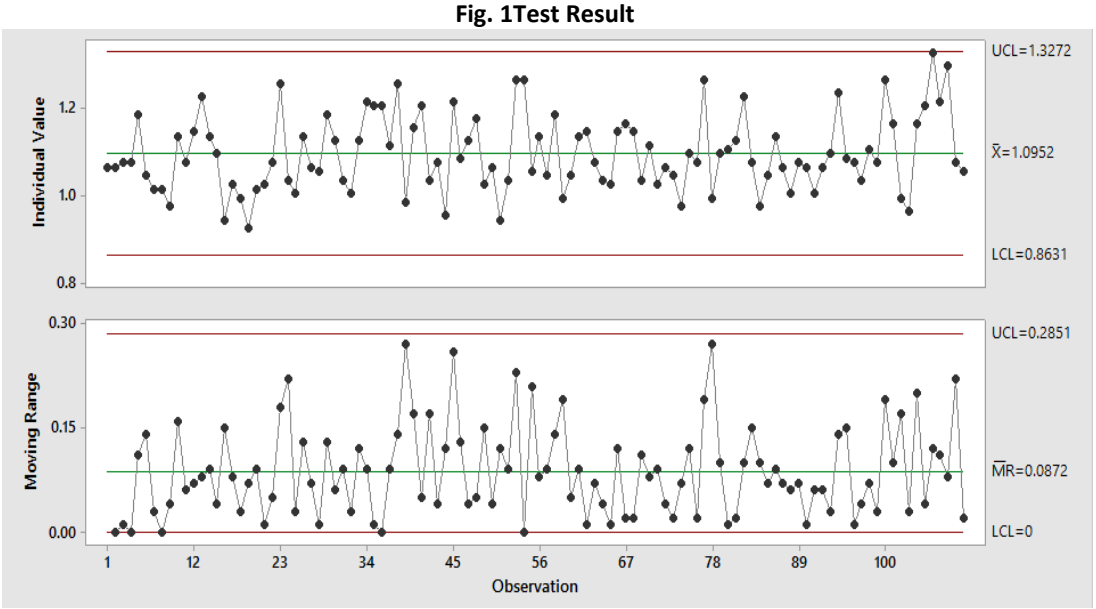

Fig 2 Individual and Moving Range Chart

Table 1 Result Table

	Before	After
Mean (mm)	1.2579	1.0952

As per the result table and control charts, all AKCC 85E mounts are within specification with the mean 1.0952 mm which is 1.2579mm before implementation of spcand all the points are in control limits.

CONCLUSION

As the manufacturing process of AKCC 85E mount faces several problems like rejection, rework and out of control points. So implementation of SPC tool control these variations and reduce the rework and rejection rate and also control and monitor the process.

During the manufacturing process to eliminate the assignable causes rubber making process is improved and recommendations are implemented. From result it can be conclude that attempt is successful. Mean value for the deflection is improved and also no mount was rejected during the manufacturing process. From that we can conclude that quality of mounts are increased.

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