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Reduction of Post Burning Blow holes by using Shainin Techniques in Automotive Batteries

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Abstract:-- **:- Battery is one of the vital components used in automobiles. The main purpose of battery is to start the engine, to run the light system and other sound systems like music, horn etc. Once the engine is ignited and starts running, power for electrical system of the automobile will be supplied by alternator. Modern automobiles batteries are lead acid type using six cells connected in series so as to obtain 12 volts system. Keeping in view the vital role of a battery in an automobile, the battery should be made with high quality, durability and defect free. However, defective batteries would be rejected at quality check (QC) phase in the manufacturing industry. These rejections at QC should not be more, as it may reduce the productivity. The company should identify the root cause for such defects, which are responsible to brand battery as defective and also a rejection.**

Index Terms: Shainin tools, Product/Process search, Variable search, Suspected source of variation SSV's).

1. INTRODUCTION

The demand placed on an organization in today's global business environment are driven by customer satisfaction as well as the fulfillment of expectation of the stakeholders regarding cost reduction Improving business performance and maintaining a competitive advantage. Dorian Shainin, was an influential American quality consultant, aeronautics engineer, author, and college professor who was named an Honorary member in 1996, worked more than 60 years to improve the professional approach to industrial problem solving. He is best known for the "Shainin techniques," practical tools he developed to help manufacturers solve problems, including problems that had been considered unsolvable.

2. SHAININ TECHNIQUES

The Shainin methods are essentially known to produce leap forward upgrades in eliminating chronic quality issues. These are profoundly successful in pinpointing towards the underlying driver and approving .In order to know the complete information of the project each and every accept should be clearly studied. Post burner is a fully automatic burning machine designed to weld the cylindrical bushing of automotive battery to a qualified depth of burn, after battery has finished the container and cover .When the machine's contact detection system determines that the optimum parameters have been met the post burning is initiated. If the blow holes are seen on the battery post then the battery is rejected and the failure is reported on the operator control machine is designed for joining post and the container on lead acid batteries. Shainin introduced several no of power full tools. Among those powerful tools, he considered Design of Experiments as the centre piece among those powerful tools, he considered Design of Experiments as the centerpiece. Shainin DOE basically works at eliminating suspected process variables (Xs) mostly by using seven different tools:

1. Multivari Analysis.
2. Variable Search.
3. Paired Comparison.
4. Component Search
5. Product/Process search.
6. Full Factorials.
7. B vs. C (Better vs Current) Analysis.
8. Scatter Plots or Realistic Tolerance Parallelogram Plots.

2.1 Product/Process Search:

SSV's related to the process parameters or input materials which can be measured in both good and bad parts, 'Product process search DOE tools used Examples Temperature

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,Pressure Pouring input material where in dimensions get changed during Processing like .Drill dia in the case of loose and the tight problem.(Good &bad parts are selected based on the response/effect of the problem defined).

2.2 Variable search:

When the problem is due to design parameters of Product/Process, and Parameters are greater than 3.

It can be used for problem solving only when all the related SSV's are eliminated and the cause is confirmed as process design is also used for existing Process optimization to arrive at an Optimal setting for cost, productivity and quality.

2.3 Paired Comparison:

It Can be used only when the SSVs are measurable on both Good & Bad Products.(Good & Bad parts are selected based on the response /effect of the problem defined).

2.4 Concentration Chart:

Concentration Chart is mostly used for the attribute type of defects to identify It's intensity at various location / sector. Is used when defect can generate at multiple streams from the process and streams are too high to apply MultiVari Analysis. Example: Dents, Scratches, Burrs, Paint peel off, Dust, Porosity & Blow Holes in casting.

2.5 Component Search:

When problem is on an assembled product& the assembly can be disassembled and re-assembled without damaging parts. Response can be either attribute or Variable Is used for assembly related problems (HV Failure, Leakage, Vibration, Pressure Drop etc.).

2.6 Modify Component Search:

When problem is on an assembled product & if some parts get damaged during

2.7 Multi Vary Analysis:

When input material is not the Cause of the problem and process is the only cause of the problem .Response has to be Variable.

2.8 Full Factorial:

When the problem is due to design parameters of Product/Process parameters are ≤ 3, Process to be optimized for <=3 Design parameters.

2.9 B vs C:

When root cause of the problem Or optimal setting for a process is identified and it has to validated.

2.10 Variation analysis:

When the action on root cause is implemented and type of control to be decided for monitoring. This can be done both for Root X as well as Big Y Is used to identify the type of controls (monitoring method) that are required for the action implemented so that the problem does not reoccur again due to the same root cause.

Is done only when Product dimensions are the root cause for the problem.

3. CASE STUDY IN AUTOMOTIVE BATTERIES

Introduction to DMAIC cycle:

a.Once the project is selected, the first stepis we needed to DEFINE the Problem in phase -1.

b.The next step is to use DOE techniques to pin point the root cause of the problem. This is done in phase-2

c.When the root cause(s) are pin pointed, we have to plan and implement Process Improvement action . This is done in IMPROVEMENT PHASE. Root cause is also validated in phase-3.

d.Once the process improvement actions are implemented, we need to ensure that the actions stay permanent in process. This is done in phase-4.

DMAIC Process:

a) Phase- : Define.

b) Phase-2: Measure and Analysis.

c) Phase-3: Improve.

d) Phase-4: Control.

PHASE-1: DEFINE

Problem Define

During the study it is observed that Max rejections are due to blow holes and more rejections are particularly observed in the B19 model . If the batteries are rejected the batteries are sent to rework. So if the rejected quantity increases the rework percentage is also increase. This study helps to reduce the rework percentage from 0.15% to 0.03%.

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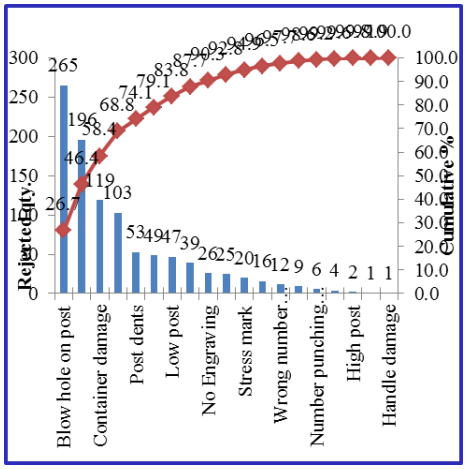
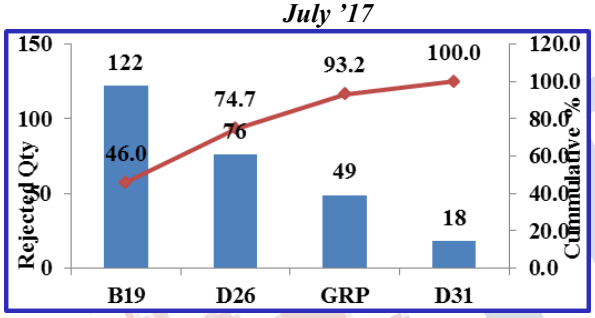


First level stratification of problems from KPI (April'17 to July '17



Rejected quantity in particular battery type

Steps to define the problem:

In order to define the problem the following steps had to be followed they are

1. Under standing the problem.
2. Data collection.
3. Analysis to identify the possible causes for the problem.
4. Identification of SSV's (Suspected Sources of variation) in order to find the root cause of the problem.

Problem selection

By following the above steps four root causes are selected that are leading to the problem they are

1. Grease applied on post.
2. Post projection high.
3. Post burning torch parameters.
4. Condensed water particles in mould.

PHASE-2: MEASURE AND ANALYSIS

Grease applied on post:

Trail runs has been conducted to know what are the Root causes that are leading to the problem .Before the Post burning operation the Grease had to be applied for the free movement of the post burning head. During the trail runs the max and min values fall in the same category so it is not a cause.

Post projection height high:

During the Type change the post projection height should be adjusted. If it is not adjusted correctly for certain type more rejections takes place. From the trail runs it is observed that max &min values fall in the same category so it is not a cause.

Condensed water particles in mould:

After the post burning operation is done the post should be cooled by using cold water .Trail run has been conducted and observed max &min values fall in the same category so it is not a cause.

Design parameters causing the problem:

So Parameters has to be changed to reduce the rejections.

PHASE-3: IMPROVE:

+ Setting			
Trial Run	Production	Rejected	% Rejected
1	950	0	0
2	950	1	0.105
3	950	0	0

Rejections are reduced to zero .So the problem is solved and the target is achieved.

PHASE-4: CONTROL:

The defects due to blow holes in Post burning is reduced .

RESULTS & CONCLUSIONS

After implementation of Modifications in parameters Optimization of the Process Parameters, the Post burning due to Blow holes is totally eliminated in this particular model type.

Benefits:

1. Elimination of quality complaint

2. Improved productivity
3. Operator fatigue reduction in rework
4. Rejections reduced
5. Learned shainin tools
6. Problem solving methodology in shop floor

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