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Quality Investigation of A Ring Part of Aero Engine

Sri Harsha R[1], Ch. Hemanthkumar[2,] B. D. Y. Sunil[3]
[1,2]UG Student Department of Mechanical Engineering, institute of Aeronautical Engineering, Hyderabad, Telangana, INDIA
[2]Associate Professor & Head, Department of Mechanical Engineering, Institute of Aeronautical Engineering, Hyderabad, Telangana, INDIA

***Abstract*:- In every manufacturing industry is quite common that deviations do occur in the process of manufacturing the parts or components. If every deviated part is scrapped then the company will shut down due to loss. At this point quality department plays a major role in manufacturing industry to identify the deviation, rectify the deviation and correct the manufacturing process so that the same deviation is not raised in future. So quality department is mainly categorized into quality assurance, quality control and quality engineering. Every department has its own importance in a manufacturing industry. The summary of the role of quality control and quality assurance department is that to identify deviation in manufactured product, Find out the root cause of the deviation, rectify the deviation and see to that same deviation is not raised in future.**

INTRODUCTION

Quality assurance (QA)/quality control (QC) department is responsible for ensuring the quality of products and services produced by their company. They oversee the manufacturing of products and they are involved in every stage of making a product from development and manufacturing to packaging. The Material Review Board (MRB) usually finds its dealing with product nonconformity caused by all sorts of evidence of poor design management. The main target of MRB is to reduce rejections and thereby reducing the loss of the company, to do so they have to find out the root cause of the defect and workout on the Root Cause Corrective Action (RCCA) that has to be implemented on the part so that the manufacturing design of the part satisfies the blueprint of the part. Based upon the RCCA the MRB takes decision whether the part has to be done rework, eNMS, scrap. The present project deals with the analysis and RCCA of ring part of an aero engine.Ordinarily, estimations were taken outwardly utilizing hand devices or an optical comparator. Notwithstanding, these instruments require critical time and have restricted precision. Then again, anorganize estimating machine (CMM) measures the stature, width, and profundity of the part utilizing coordinate handling innovation. Moreover, such machines can consequently gauge the objective, record the deliberate information, and acquire GD&T estimations. A facilitate estimating machine (CMM) is either a contact model that utilizations contact tests, a circular item used to perform estimations, or a non-contact model, which utilizes different techniques like cameras and lasers. A few models intended for the auto business can even quantify targets bigger than 10m (30 ft) in size.

The upside of the arrange estimating machine (CMM) is that it can quantify things that are hard to gauge with other estimating machines with high exactness. For instance, it is hard to quantify the three-dimensional directions of a particular point (opening, and so on) from the virtual beginning with a hand device like a caliper or micrometer. Likewise, estimation utilizing virtual focuses and virtual lines and mathematical resistances are troublesome with other estimating machines, however can be estimated with a 3D CMM machine. Regularly, most CMMs are scaffold or gantry-types as found in the graph. The circular contact point appended to the tip of the test is applied to the article on the stage, and the facilitate values in three measurements (X, Y, Z) are indicated and estimated.

It is primarily utilized for three-dimensional estimation of kicks the bucket, for example, car parts and different mechanical parts, three-dimensional items like models, and estimation of contrasts from drawings.

MAIN CONTENT

Analysis Phase

- Problem Statement

Inner Diameter unclear surface after honing operation

- Part number selected for study
  - 2H.008.01.0.07
- Last manufacturing process stage where the Problem is generated
  - Fine Boring
- Process stages where the problem is inspected currently

\- Plateau Honing, Final Inspection

GOOD PART

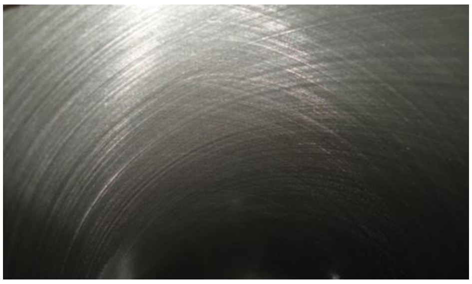

Fig 6.1.1 OK Part without Inner diameter unclear surface

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DEFECT PART

Fig 6.1.2 Defective part with Inner diameter unclear surface

From Process Mapping & FMEA the following SSV's are identified and listed below

Sl.No	Suspected Source of variations
1	Inner diameter size from Fine boring
2	Inner diameter Taper at fine boring operation
3	Inner diameter ovality at fine boring operation
4	Concentricity from fine boring operation

Table 6.1.2 Suspected sources of variations

Defect Concentration Chart

Concentration Chart is used to find out whether Inner Diameter unclear surface is concentrated in a particular region or can come at multiple locations (For initial investigation)

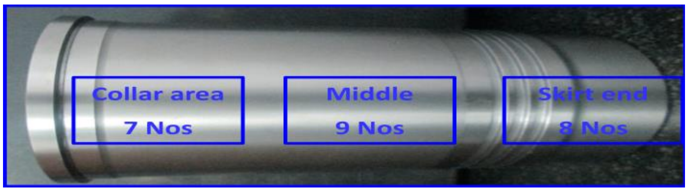

Fig 6.1.4 Defect Concentration

Conclusion: Since Inner Diameter unclear surface observed at Top, Center & Bottom places of the Component. So, decided to study at all locations.

Sl.No	Suspected Source of variations	PC	PPS	CS	MCS	MVA	VS	FF	CC
1	Inner diameter size from Fine boring		√						√
2	Inner diameter Taper at fine boring operation		√						
3	Inner diameter ovality at fine boring operation		√						
4	Concentricity from fine boring operation		√					√	

Table 6.1.3 Selection of Tools

PC – Paired Comparison, PPS – Product/Process search, CS – Component search MCS – Modified Component search

MVA – Multivari analysis VS – Variable search, FF – Full factorial, CC – Concentration chart

1. Inner Diameter size from Fine Boring

Sr. No	Inner Diameter (104.800 - 104.840)	Result (ID unclear surface OK/Notok)	Response (BOB or WOW)
281	104.810	ok	BOB
96	104.813	Not ok	WOW
224	104.816	Not ok	WOW
7	104.817	Not ok	WOW
310	104.817	ok	BOB
72	104.827	Not ok	WOW
336	104.828	Not ok	WOW
385	104.828	Not ok	WOW
181	104.828	ok	BOB
208	104.829	ok	BOB
12	104.838	ok	BOB
333	104.839	ok	BOB

Table 6.1.4Inner Diameter size from Fine Boring

- 6 Nos BOB & WOW parts were selected
- After arranging in ascending order Count = 0

Conclusion - Since count = 0, the parameter Inner diameter size at fine boring operation is not creating the problem.

2. Inner Diameter Taper at Fine Boring operation

Sr.No	Taper (0.025 max)	Result (ID unclear surface OK/Notok)	Response (BOB or WOW)
93	0.013	Not ok	WOW
184	0.014	Not ok	WOW
396	0.014	ok	BOB
365	0.015	Not ok	WOW
321	0.015	Not ok	WOW
165	0.015	Not Ok	WOW
42	0.015	Ok	BOB
272	0.016	ok	BOB
9	0.017	ok	BOB
285	0.017	ok	BOB
159	0.022	ok	BOB
149	0.023	Not ok	WOW

Table 6.1.5Inner Diameter Taper at Fine Boring operation

- 6 Nos BOB & WOW parts were selected
- After arranging in ascending order Count = 0

Conclusion - Since count = 0, the parameter Inner diameter Taper at fine boring operation is not creating the problem.

3. Inner diameter ovality at fine boring operation

Sr.No	Ovality (0.040 max)	Result (ID unclear surface OK/Notok)	Response (Good or Bad)	
228	0.025	ok	BOB	
398	0.026	Ok	BOB	3
84	0.027	ok	BOB	
373	0.030	Not ok	WOW	
396	0.032	ok	BOB	
132	0.034	ok	BOB	
14	0.035	ok	BOB	
112	0.036	Ok	BOB	
11	0.044	Not ok	WOW	
286	0.045	Not ok	WOW	
356	0.052	Not ok	WOW	4
307	0.056	Not ok	WOW	

Table 6.1.6Inner diameter ovality at fine boring operation

- ➢ 6 Nos BOB &WOW parts were selected
- ➢ After arranging in ascending order Count = 7

Conclusion - Since count > 6, the parameter Inner diameter ovality at fine boring operation is creating the problem.

4. Concentricity at fine boring operation

Sr.No	Concentricity (0.250 max)	Result (ID unclear surface OK/Notok)	Response (BOB or WOW)	
98	0.090	Ok	BOB	
149	0.090	Ok	BOB	
311	0.100	Ok	BOB	6
356	0.110	Ok	BOB	
397	0.200	Ok	BOB	
63	0.210	Ok	BOB	
17	0.210	Not Ok	WOW	
7	0.230	Not Ok	WOW	
304	0.240	Not Ok	WOW	6
69	0.240	Not Ok	WOW	
210	0.250	Not Ok	WOW	
249	0.250	Not Ok	WOW	

Table 6.1.7Concentricity at fine boring operation

- ➢ 6 Nos BOB& WOW parts were selected
- ➢ After arranging in ascending order Count = 12

Conclusion - Since count >6, the parameter Concentricity at fine boring operation is creating the problem.

Improvement Phase

Tool used: Better Vs Current

Data collection: "B" condition will be with process improvement &"C" condition will be without process improvement.

Here "B" condition & "C" condition can be alternated. The changes implemented in the process can be reversible.

Parameters	- Setting
Speed	500 RPM
Feed	0.25 mm / rev
Clamping Pressure	10 Kg/cm^2

Table 6.1.8B Condition

Parameters	- Setting
Speed	450 RPM
Feed	0.30 mm / rev
Clamping Pressure	5 Kg/cm^2

Table 6.1.9 C Condition

- ▪ By reducing clearance from 0.050 to 0.030 mm between skirt diameter and bottom locator at fine boring operation

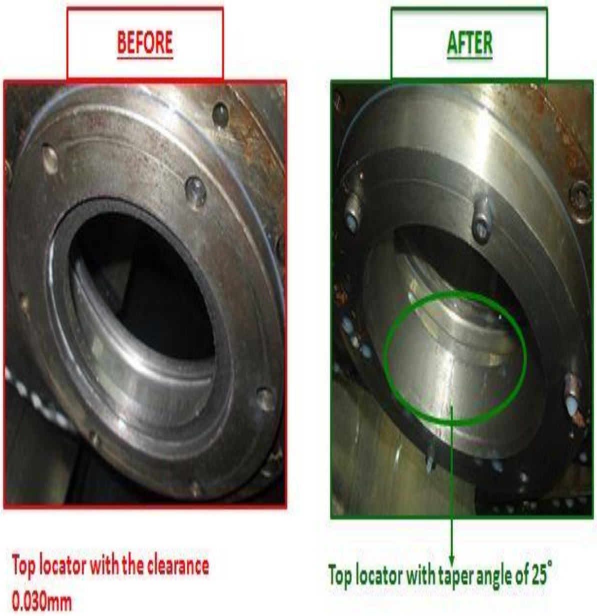

Fig 6.1.5By providing taper angle 25° top locator at fine boring operation

Provided Top locator with taper angle 25 degrees

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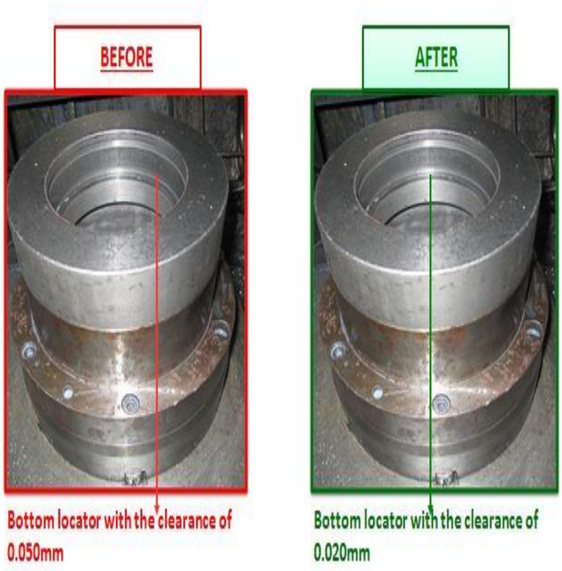

Fig 6.1.6 Reduced bottom locator with skirt diameter clearance from 0.050 to 0.020

RESULTS AND DISCUSSIONS

The purpose of this research paper is accomplished by identifying a deviation in the part using CMM machine during manufacturing process of a component then by properly performing RCCA (root cause corrective action) we got to know what is the root cause of the deviation i.e. tool worn. So, the tool has been corrected by modifying its parameters of use as a result the parts which are manufactured in future will not get same deviation raised. The corrected tool is used to rework the part so that it is not rejected and also matches the blueprint of the part. This is the procedure done in a regular manufacturing industry to reduce the scrap and reduce the loss of the company and thereby increasing the profits of the company.

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