Solution of Manufacturing Defects in Connecting Rod

[1]Parekh Rajesh, [2]Parmar Prutviraj, [3]Patel Akshay kumar, [4]Rathod Mayur kumar

Students of B.E.
Quality Control Department,
Amul Pvt. Ltd., Rajkot, INDIA

***Abstract*—We have found two problems in manufacturing of connecting rod, cap tight and oversize of big end diameter during inspection of connecting rod. Therefore we have analyzed all manual machining process to get solution of these two problems. In captight problem the cap is very tight with rod due to this cap can't separate from connecting rod with normal force. There for induced in assembling of engine. The crank is fitted in to the big end diameter of connecting rod. If the big end diameter of connecting rod is more than design diameter than many problems induced like stroke problem, extra noise, power noise and vibration in engine and the efficiency of engine will reduced. We are trying to get solution for this above two problems. The various components of our paper are already defined on the style sheet, as illustrated by the portions given in this document.**

***IndexTerms*—Connecting rod (cap, big end, shank, small end), cap tight, over size**

I. INTRODUCTION

The connecting rod is a major link inside reciprocating piston engine, the connecting rod connects the piston to the crank or crankshaft. A rod which transmits power or motion or both from one moving part to another moving part is called connecting rod. Connecting rods also converts rotating motion into reciprocating motion. Before the development of engines

A connecting rod is rigid component, it may transmit either a push or a pull and so the rods may rotate the crank both halves of a revolution, i.e. piston pushing and piston pulling.

The big end of the connecting rod connects to the crankpin to provide a pivot point on the crankshaft. Connecting rods produces as one piece or two-piece components. A *rodcap* is a removable section of a two-piece connecting rod that provides a bearing surfacefor the crankpin journal. The rod cap is attached to the connecting rod with two cap screws for installation and removal from a crankshaft.

Connecting rod connects the piston to the crankshaft and is responsible for transferring power or force from the piston to the crankshaft and sending it to the transmission. There are different types of materials and manufacturing methods used in the creation of connecting rods. Steel and aluminum are the most used materials as connecting rod. The common types of production processes are casting, forging and powdered metallurgy.

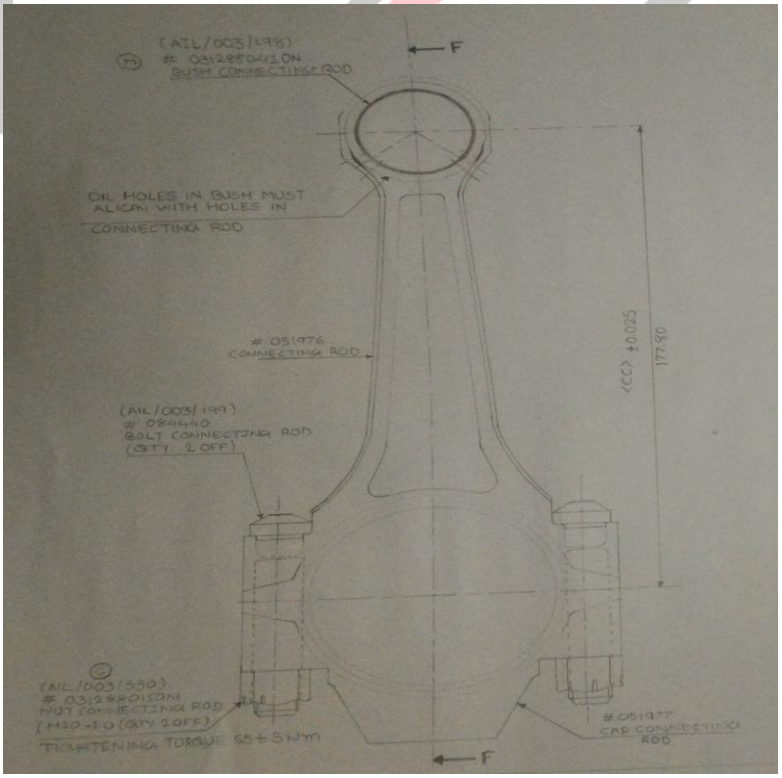

Fig. Connecting Rod

Connecting rod consists of-

1. A pin end (Small end)
2. A shank section (Middle)
3. A Crank End (Big End)
4. Stud and Cap
5. Bush

II. PROBLEM STATEMENT

During the visit of Amul Industries Pvt. LTD., we understand the different processes related to manufacturing of connecting rod. Forging is the primary process which is used for manufacturing of connecting rod and after various machining process carried out for get desired dimension and surface finish. After systematic inspections of connecting rod , we have found problem of Cap Tight and oversize of big end diameter of connecting rod.

So we have selected the problem of Cap tight and oversize of big end diameter of connecting rod for finding out the possible solution. Cap tight and oversize of big end diameter problems are in connecting rod results in increases the rejection and decreases the quality of product.

Due to Cap tight problem in the connecting rod, there will be loss of time for separate the cap and due to oversize of big end diameter of connecting rod there will be both wastage of time and material. So we do some study on the design and manufacturing process of connecting rod to understand the reason of this two problem.

III. MANUFACTURING OF CONNECTING ROD

Our manufacturing process is drop forging. Forging process produces parts of superior mechanical properties with minimum waste of material. In this process, the starting material has a relatively simple geometry; this material is plastically deformed in one or more operations into a product of relatively complex configuration. Forging generally requires relatively expensive tooling. Thus, the process is economically attractive when a large number of parts must be produced and/or when the mechanical properties required in the finished product can be obtained only by a forging process.

Material and Metallurgical process specification of DI-3200:

1. **Material:**

The material code of DI-3200 is En16C. in addition of optional material code is S48C STEEL TO MS G4051 AS PER M & M STD M-6501 CLASS 1.

After the forging process carried out many chemical analysis are shown in following Table:

MATERIAL			C%	Mn %	Si%	S%	P%	Cr %	Mo %	Ni %	Cu%	Al%	V%
S48C	AS PER SPEC.	MIN	0.45	0.75	0.10	-	-	0.20	-	-	-	0.025	-
		MAX	0.51	0.90	0.35	0.050	0.035	0.30	-	-	-	0.040	-
HEAT CODE	**BP**	**Actual**	**0.48**	**0.81**	**0.29**	**0.025**	**0.013**	**0.23**	-	-	-	**0.027**	-
HEAT NO.	**C28626**												

Table no. 3.1 Chemical Analysis

Metallurgy Analysis result is shown on following table:

HEAT TREATMENT: Quenched and tampered					
MICROSTRUCTURE	**AS PER SPEC.**	Fine tempered Martensite	**ASTM GRAIN SIZE**	**AS PER SPEC.**	
	ACTUAL	Tempered mertensite with Traces of ferrite partial decarb:- 0.05mm		**ACTUAL**	7ASTM
MICROSTRUCTURE / GRAINFLOW:- N.A.					

IV. VARIOUS MACHINING PROCESS

The various machining process related with connecting rod are:

1. BIG END FACE TURNING 1ST SIDE
2. BIG END FACE TURNING 2ED SIDE
3. BIG END FACE GRINDING ROD 1ST AND 2ED SIDE
4. SMALL END DRILLING AND FINAL BORING AND CHAMFER
5. SMALL AND CHAMFER
6. CAP TOP FACE
7. ROUGH PARTING FACE ROD + CAP
8. NUMBER MARKING
9. RIB TURNING
10. BOLT AND NUT SEATING FACE
11. FINAL PARTING FACE ROD + CAP
12. BIG END PRE-BORING
13. BOLT HOLE PRE DRILLING
14. BOLT HOLE DRILLING FINAL
15. COUNTER ON ROD BOLT HOLE
16. DEBURRING CLEANING AND BOLT PRESSING
17. INSPECTION AND ASSEMBLY
18. BIG END FACE GRINDING ROD 1ST AND 2ED SIDE
19. DEMAGNETISING
20. BIG END FINAL BORING
21. BIG END CHAMFER
22. SMALL END 1ST AND 2ED FACING
23. SMALL END CHAMFER BOTH SIDE
24. OIL HOLE DRILLING AND INSIDE CHAMFER
25. SMALL END BUSH PRESSING
26. DISMENTAL OF ROD AND CAP
27. NOTCH MILLING
28. DEBURRING, CLEANING, INSPECTION, ASSEMBLY
29. BIG END HONING
30. SMALL END BUSH BORING
31. SMALL END CHAMFER

V. REASONS OF THE PROBLEM IN C.R

(i) REASONS FOR CAP TIGHT IN CONNECTING ROD:

In rough and final bolting operation there were possibilities of improper alignment of connecting rod in fixture due to extra metal chips on fixture.

There is some possibility of wearing out of bearing in machine spindle.

There is a possibility of improper tool change frequency monitoring.

Some small chips of metal is exist in bolt hole or stick with bolt. They act as as resistance while separating cap from rod which is known as cap tight.

If bolt hole has minus centre distance and also if bolt is damaged.

(ii) REASONS FOR OVERSIZE OF BIG END DIAMETER:

Separate oversize connecting rod after final boring and they should be tick marked.

And then in rough honing the time of machining should be reduced in these C.R.

Therefore the material removal in rough honing is less due to which we can control the oversized of Big end diameter.

Final honing is operated manually therefore there is more removal of material which may be result in oversize of Big end diameter.

Due to wearing of honing material.

Due to improper tool changing frequency monitoring.

VI. SOLUTION OF PROBLEM

The various solution given by us to eliminate or reduce the problem of Cap tight and Over size of big end diameter of C.R. are given below:

- CAP TIGHT

  We reduced fixture alignment frequency from 3 months to 1 month for better accuracy.

  We reduced TCFM (Tool Change Frequency Monitoring) of drilling operation from 70 pieces to 50 pieces.

  We also reduced alignment frequency of tool holder cylinder of drilling machine from every month to every week.

  We reduced the allowances of C.D. of cape and rod from 72 ± 0.15 to 72 ± 0.30 for better accuracy.

  We also reduced the tolerance different of cap and rod for better and accurate fitting.

  We used air gauge for measuring diameter in place of bore gauge because bore gauge has chances of error and its precision and accuracy is less in comparison to air gauge.

- OVER SIZE OF BIG END DIAMETER

  Fit cap and rod with the help of stud. Use ideal torque. Don't use different torque. Use torque in the range of 52 Nm to 63 Nm with the help of Automatic torque machine.

  When applying torque, put collate in Big end bore to avoid oval shape of big end.

  We reduced TCFM in final boring operation from 80 pieces to 60 pieces.

We have a thought to put Air Gauge in mandril of honing machine during honing operation. We are also doing research on same. The work of air gauge will be:

If big end diameter of C.R. will be more than standard diameter then air gauge will sense it and indicate operator because if we take C.R. in rough honing then material will be more removed already.

VI. SUMMARY

A connecting rod is rigid component, it may transmit either a push or a pull and so the rods may rotate the crank both halves of a revolution, i.e. piston pushing and piston pulling.

The big end of the connecting rod connects to the crankpin to provide a pivot point on the crankshaft
Connecting rods produces as one piece or two-piece components. A *rodcap* is a removable section of a two-piece connecting rod that provides a bearing surfacefor the crankpin journal. The rod cap is attached to the connecting rod with two cap screws for installation and removal from a crankshaft.

During assembly of engine, there is problem of removing cap from connecting rod. Cap can't be removed by normal effort. Therefore there is time wastage and result into decreased productivity. Due to oversize of big end diameter the problem induced in running engine like vibration, unnecessary noise, improper fitting of crank in big end diameter of connecting rod. There is risk of failure of connecting rod at big end

VII. ACKNWOLGEMENT

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REFERENCES

[1] Leela Krishna vegi, venugopalvegi, "Design and Analysis of connecting rod using Forged Steel", International Journal of Scientific & Engineering Research, Volume 4,
Issue 6, June2013, Vol. 32, 2002.

[2] Kuldeep B, Arun L.R, Mohammed Faheem, "Analysis and Optimization of Connecting rod using ALFASiC Composites", International Journal of Innovative
Research in Science, Engineering and Technology, Vol. 2, Issue 6, June 2013.

[3] K. Sudershan Kumar, Dr. K. Tirupathi Reddy, Syed AltafHussan, "Modelling and analysis of two Wheeler connecting rod", International Journal of Modern Engineering
Research, Vol -2, Issue- 5, pp-3367-3371, Sep-Oct-2012.