

Development of Pumping Ring in 5 Axes VMC

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Abstract: *This project is about development of various parts used in the industry that uses VMC machines like 7 Axes and 5 Axes and by finding the alternative method for development of such a part or component which positively reduces the cost and time required to manufacture the part. The development of pumping ring using 5 Axes machine is the alternative method used over another method which uses 7 Axes machine which is costly and time consuming, the 7 Axes machine is indeed the most advanced VMC machine in the market providing the work output more precisely and accurate. It is time consuming and costly as compared to 5 Axes VMC machine, when we take this particular component in consideration the 5 Axes VMC machine is more reliable as compared to 7 Axes VMC machine as 5 Axes VMC provides the similar work output and precision.*

Keywords: Centrifugal Pump, Mechanical Seal, 5 Axes VMC/ 7 Axes VMC, Machine Alternate Manufacturing Proces, Reduce Of Cost

I. INTRODUCTION

Mechanical seals have gained widespread acceptance among pump users in various industries. They have become the preferred choice for ensuring safe and reliable containment in certain applications. While dual seals may be considered optional in other services, major seal manufacturers can provide regulatory guidelines on their usage and offer assistance in evaluating their economic viability.

The utilization of dual seals is crucial in achieving secure and dependable fluid containment, leading to cost savings in pump maintenance. Presently, the manufacturing cost of pump rings is considerably high due to the complex structural geometry involved. These rings require specialized 7-axis VMC machines for manufacturing, which are scarce in the market. Consequently, the manufacturing cost of this component remains elevated. Our objective is to reduce the cost of this part by exploring alternative manufacturing sources and methods. This could involve leveraging 5-axis VMC machines to achieve a cost reduction for the pumping ring.

II. LITERATURE SURVEY

EXPERIMENTAL ANALYSIS OF CENTRIFUGAL PUMP Gavit Bhaveshkumar R1, More Ketankumar v2, Mishra Adarshkumar3, Mr. Vishal Naik4

During the experimental investigation, we closely monitored and analyzed the pump's behavior. Through a series of comprehensive tests, we gained valuable insights into its operational characteristics and how it responded when the valve was manipulated. Our observations led us to conclude that the pump exhibits a higher volumetric flow rate when operating at increased frequencies (Hz) and higher RPMs, resulting in an amplified water flow.

Consequently, we constructed a performance curve by varying the pump's speed using distinct characteristic

2.1 Objectives

Following are our project objectives:

- To identify alternate manufacturing process
- To reduce cost of part
- To design and develop the part by using the alternative method.
- Increase The Productivity Rate Of Part.

III. METHODOLOGY

- Step 1:- Identification of problem
- Step 2:- Design of Mechanical Part: This phase involves the design of various elements such As design of ring
- Step 3:- Design evaluation : on paper manual drawing for fabrication purpose and selecting dimensions
- Step 4:- Machining of part in 5 AXIS machine with desired manufacturing process
- Step 5 :- Testing the overall quality of Part
- Step 6 :- Cost saving study considering current part cost

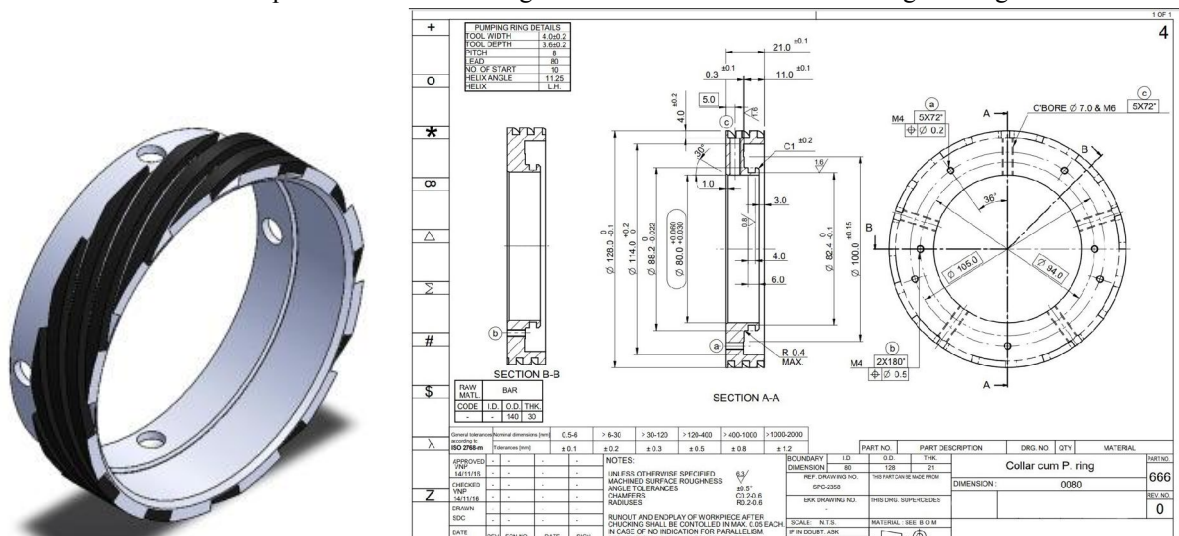
IV. PROBLEM STATEMENT

Ensuring the safe and dependable containment of fluids often results in the avoidance of pump maintenance costs, particularly when the utilization of dual seals is obligatory. Presently, the manufacturing cost of pump rings is significantly elevated due to the intricate structural geometry involved. These rings can only be manufactured using specialized 7-axis VMC machines.

Given the scarcity of 7-axis VMC machines in the market, the manufacturing cost of this particular component remains high. Our primary objective is to reduce the cost associated with this part. To achieve this, we aim to explore alternative manufacturing sources and methods. By implementing innovative approaches, such as utilizing 5-axis VMC machines, we anticipate a reduction in the cost of producing pumping rings.

V. PROJECT DESIGN

Design of Mechanical Part: This phase involves the design of various elements such As design of ring :



Machining of part in 5 AXIS machine with desired manufacturing process :



Fig. 5 Axes machine

Enhancing the drilling process through the utilization of 5-axis machines:

The implementation of 5-axis CNC machining enhances the drilling process, delivering superior quality parts. By harnessing the capabilities of 5-axis machines, we can access tighter and more intricate angles, resulting in impeccably finished components. This advanced technology not only ensures a cleaner finish but also enables significant time and cost savings compared to 7-axis machines.

Cost saving study considering current process cost :

The cost analysis chart depicts the difference between the 5 Axes and the 7 Axes VMC manufacturing process while the cost required to manufacture the part is drastically reduced by using a 5 Axes VMC as compared to the 7 Axes VMC. Hence the same precision and accuracy can be achieved by using the 5 Axes VMC and it also reduces the cost and saves the time

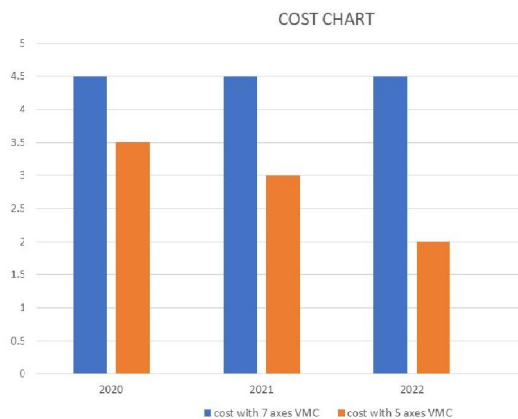


Fig. Cost chart (cost analysis)

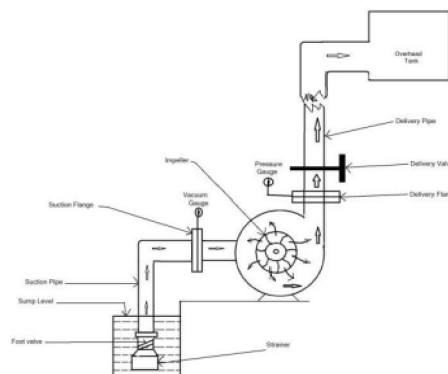
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Experimentation/testing on project setup :

Testing: Centrifugal Pump, Mechanical Seal, Types of Failures

Through a series of comprehensive tests, we evaluated the performance of centrifugal pumps to identify the most effective and efficient sealing method using mechanical seals. These seals exhibit exceptional capabilities in handling high temperatures and operating at high RPM speeds.

The experimental study and utilization of these sealing methods allowed us to prevent hydraulic failures, ensuring optimal efficiency and improved pump operation.



Development of project setup/model :



Fig. Pumping ring (manufactured using 5 Axes VMC)

VI. CONCLUSION

1. Presently, the manufacturing cost of the pump rings is considerably high due to the intricate structural geometry involved. The complexity of these rings makes their manufacturing process challenging and not straightforward. Typically, the production of these rings requires specialized 7-axis VMC machines, which are scarce in the market. Consequently, the manufacturing cost of this component remains elevated. Our primary objective is to reduce the cost associated with producing this part. By exploring alternative manufacturing sources and methods, we aim to achieve cost reduction, potentially by utilizing 5-axis VMC machines.

2. Streamlining Setups Through its expanded range of motion, a 5-axis machine has the capability to precisely cut every part, including areas around the work-holding device. This unique feature alone has the potential to significantly reduce the number of setups required, eliminating the need for a dozen setups that would have been necessary otherwise. With a 5-axis machine, there is no longer a need to wait at the machining center to remove the part, reposition it, readjust the fixtures, and resume cutting repeatedly. This allows you to focus your attention on other projects while the 5-axis machine operates autonomously. It serves as an ideal solution for running parts without constant supervision, optimizing productivity and efficiency.

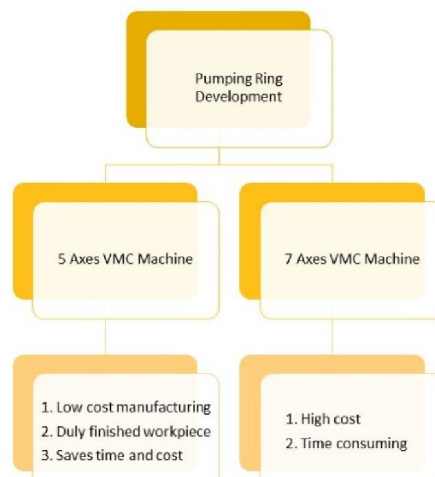


Fig. comparison chart

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