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Tapping Tool Cost Analysis in CNC Vertical Milling Centre

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Abstract: ***Tapping process is a key process in CNC machining because of its difficulty to hold close tolerances. Selecting the most economical tapping tool, also keeping in mind the performance of the tool, is a big challenge. During this study, different tapping tools with same material specificationmanufactured by different manufacturers have been taken into consideration, to select the most suitable tool.***
In industries, it is mandatory to produce the component at a competitive price with better quality. During this study different types of tapping tool by various manufacturers have been taken intoconsideration with same material composition. And also to find the relationship between the previous operational performances in the computer numerical control system has also been taken into consideration.
According to this study, it has been found out that the tool manufactured by Emuge is most economical, with respect tothe number of components produced per tool, in the batch of tapping tools under consideration.
Keywords: Tapping Tool, Cost Analysis, CNC, Vertical Milling Centre.

I. INTRODUCTION

Metal industries need to grow new materials that to have corrosion resistance and mechanical strength with high resistance to carbon dioxide, chlorides and other oxidizing components display in the oil extraction medium [1]. High Speed Steel (HSS) tool is preferred for the machining process where quality and hardness are required. [2].
The criticality of tapping process in Computerized Numerical Control (CNC) machine is its difficulty to meet close tolerances [3]. In Industrial machining operations, tapping is still regularly used. Although the performance of thread forming tools have risen and the field of application has grown, tapping remains a very common procedure [4].
Especially due to modern computer numerical controls (CNC), tapping in a manufacturing procedure is elementary to implement. Based on the large number of internal threads, e.g. in the automotive industry, the process stability and productivity of tapping should not be underestimated. In Industries, it is mandatory to maintain the cost effectiveness with quality. During this study different types of tapping tool by various manufacturers have been taken intoconsideration with same material composition [5]. And also to find the relationship between the previous operational performances in the computer numerical control system has also been taken into consideration.

II. EXPERIMENTAL WORK

The operation is carried out in a vertical machining center. The operations carried out are Drilling and Tapping on a copper (Cu) component. The component produced is Cu component which is used in Industrial circuit breakers. The component has a cylindrical bottom which consists of 7 tapped holes.
For a Tapping operation, it requires a predrilled hole smaller than the minor diameter of the tap is required. So, a drilling operation is required before tapping operation.
Figure 1 shows the vertical milling center which was used to perform the operation. The machining parameters for the drilling and tapping process are shown in table 1 and table 2 respectively.
Tapping tool used in the process is shown in figure 2.Both the tool bit's drilling and tapping are made of High Strength Steel (HSS) tool material with same material composition.

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Figure: 1 Vertical Milling center

Figure: 2 Tapping Tool

Table: 1 Drilling operation parameters in VMC

Parameter	Descriptions
Part Name	Contact
Operation Number	130
Number of Edges	1
Machine Number	DTC 400 XL
Tool Name	7.45 Drill
Speed (rpm)	400
Feed (mm/min)	550

Table: 2Tapping operation parameters in VMC

Parameter	Descriptions
Part Name	Contact
Operation Number	130
Number of Edges	1
Machine Number	DTC 400 XL
Tool Name	M8x1.25 - 64 Tap
Speed (rpm)	340
Feed (mm/min)	425

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A tool is used till it produces a defect free component by answering the thread plug gauge. If a component doesn't answer the gauge, the wear in the tool will be checked and the new tool will be changed. The number of tools used per manufacturer varies due to tool life. If a manufacturer shows promising tool life, many tools have been used for the trial. The cost per piece is calculated by dividing total components produced by the tool by cost of the tool. Tooling cost by manufacturer = cost per piece × no. of components produced by maufacturer

III. RESULT AND DISCUSSION

Table3:Comparison of Tool Make with their Tool Life & Cost

Manufacturer	Tool Price (Rs.)	Average No. of piece	Cost/Piece (Rs.)	No. of Tools Used	No. of Components by Manufacturer	Total Tooling Cost by Manufacturer (Rs.)
Guhring	4763	300	15.88	11	3300	52,393
YG	1650	100	16.50	4	400	6,600
Dormer	3325	280	11.88	4	1120	13,300
ET	2500	100	25.00	2	200	5,000
OSG	5440	350	15.54	3	1050	16,320
Emuge	1246	250	4.98	9	2250	11,214

Here tool life in the tapping process is plotted for tapping tools fromdifferent tool manufacturers such as Emuge and Guhring. Each of this tapping tool bit taken for 3 trials as mentioned in table 3. Drill bit tool life for previous drilling process with 4 trials are mentioned in table 4. The tool wear was identified by the checking the dimension of the tool. The condition of tool wear for tapping tool bit and drilling tool bit have also been recorded.

Table4: Total Tooling Cost & Average Tooling Cost/ Piece

Descriptions	Values
Total No. of Components	Rs.8320
Total Cost on Tooling (Rs.)	Rs.104827
Average Tooling Cost/Piece (Rs.)	Rs.12.6

Gurhing, OSG, Dormer have higher machining specification than the other tool manufacturer. Due to this the above tools have higher manufacturing cost. YG, ET and Emuge tools shows lower machining parameters than the other tool manufacturer. This results in lower tool cost.

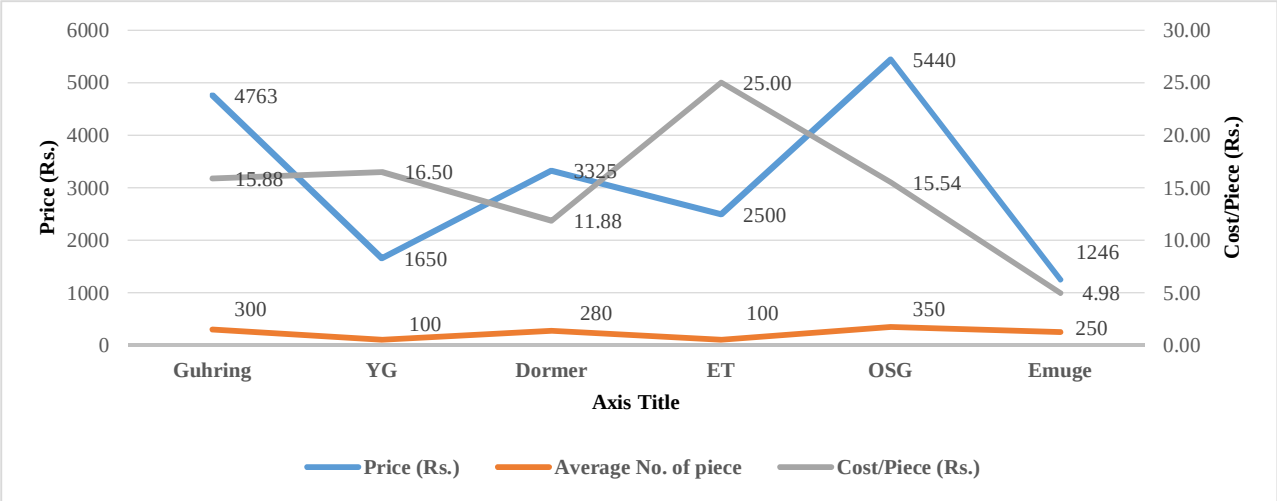

Figure 3: Cost Analysis

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Guhring and OSG shows higher cost value of around Rs. 4500 to Rs. 5500 and average produced components are 300 & 350. YG and ET's tapping tool worn out after 100 components as average and their prices comes around Rs. 1650 &Rs. 2500. Dormer produces average of 280 components with tool price asRs. 3225. This all above tools shows higher price range per components than the Emuge as cost/component as Rs. 4.98 with average components produced is 250 with price range of Rs. 1250.

IV. CONCLUSION

The results of this study provides us a direct comparison between various tapping tools used in industry today. Among the tools under consideration, the tool manufactured by Emuge is found out to be most economical. Also, it also provides a methodology that is recommended to be used to choose the most economical tool, as per components produced by the tool, rather than just the cost per tool purchased.

V. ACKNOWLEDGEMENTS

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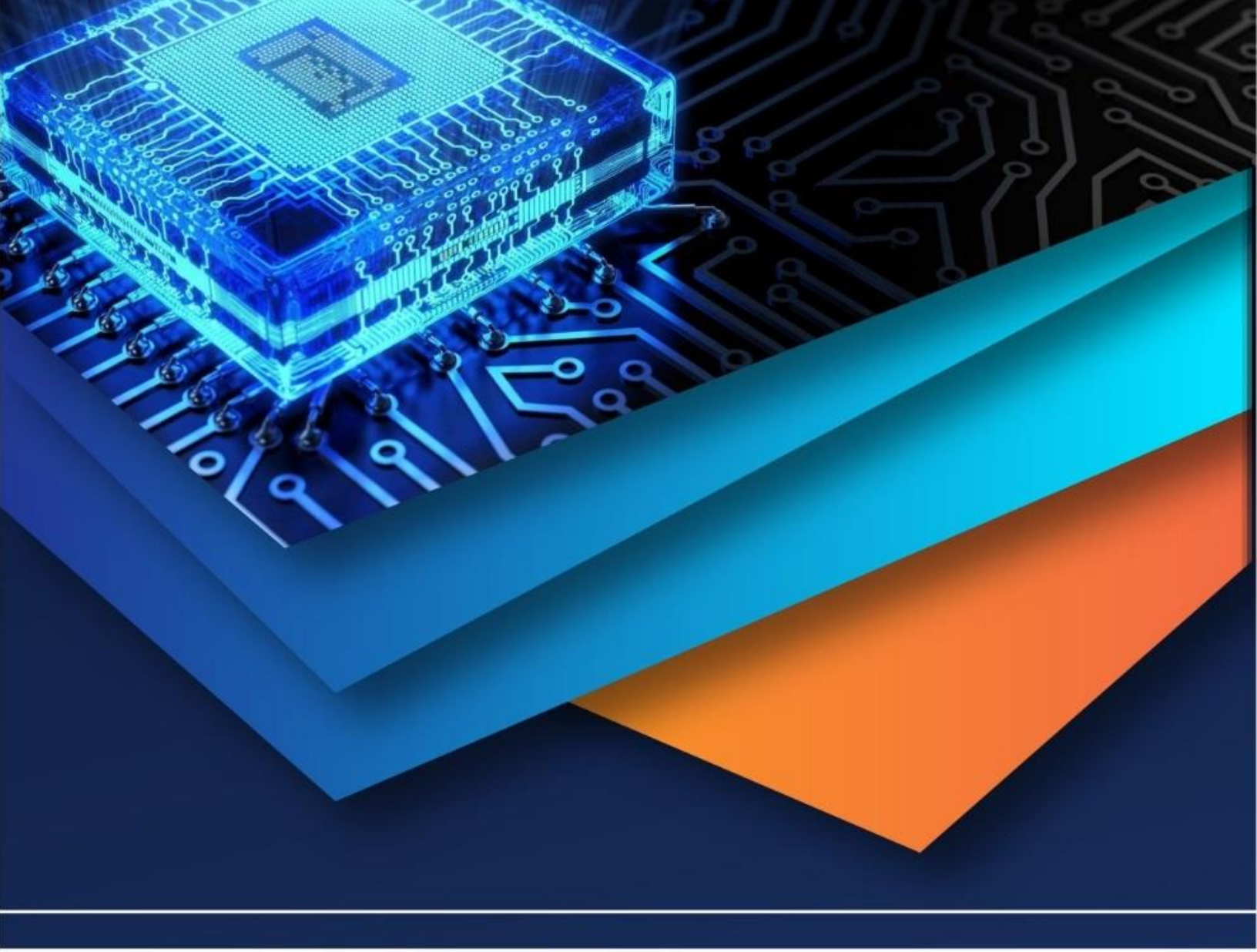

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