

# A Design and Development of Special Purpose Machine (SPM) For Drilling and Tapping Operation

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## ABSTRACT

This paper discuss the case study and comparison of productivity of component using vertical machining centre (VMC) and special purpose machine (SPM) for drilling and tapping operation. In this case study, the SPM used for drilling operation ( $\varnothing 9$ ), linear tapping operation of ( $\varnothing 10$ ) of John Deere Tractor cylinder block. In this paper the following studies are carried out 1. Time saved by component handling (loading and unloading), using hydraulic clamping, 2. Increase in productivity both qualitative and quantitative, 3. Less human intervention, indirectly reduction in operator fatigue, 4. Cost saving, and 5. Increase the profit of company.

**Keywords:** VMC, SPM, Drilling and Tapping Operation

## I. INTRODUCTION

Special purpose machine is part of multi-tasking machine. This is new approach to increase the productivity of organization. If we compare between ordinary machine and special purpose machine in terms of time, costs, number of steps involved, etc. The multi-tasking machine is preferred choice. The technology of SPM is decided upon the principles of minimization of cost, improved productivity and improved safety, better safety etc., which possess with high initial investment, etc., S special purpose machine is part of multi-tasking machine. This is new approach to increase the productivity of organization. If we compare between ordinary machine and special purpose machine in terms of time, costs, number of steps involved, etc. The multi-tasking machine is preferred choice. SPM is higher degree mechanism in which human participation is replaced by mechanical, electrical, fluid power technologies capable of doing physical effort and even mental work as in case of CNC machines. In some simultaneous SPM also demands accurate sensing, recall, memory storage, physical effort or movements requires special sensors for controlling the technologies processes.

## II. SETUP DETAILS

The SPM is designed for operation of John Deere Tractor cylinder block, in which operations are for UNIT A drilling ( $\varnothing 9$ ), UNIT B-linear tapping of ( $\varnothing 10$ ). All two operations are performed simultaneously. In this SPM first it is required design three units according to their specific operations. The units are given below

UNIT A- Unit A used for operation of 1 hole of  $\varnothing 9$ . Unit A contains spindle unit, jig and fixture, gear box, slide way, motor and hydraulic unit. First the job is placed from operator side by using rollers. Then job is placed correctly by using locating pin, and then hydraulic swing cylinder is used to clamp the job. Then the cycle is start the spindle unit is feed to the job by using slide way. The slide way is operated by using hydraulic power pack. The gear box and motor is mounted on slide way. For gear box the 3 phase induction motor of 2 hp of 6 poles and speed of 900 r.p.m. is selected. From this unit operation of 1 hole of  $\varnothing 9$  is performed. The design of gear box, hydraulic power pack, slide way and selection of motor is done according to specific requirement. The drilling operation is completed in 12 sec.

UNIT B-. In unit B the tapping operation of  $\varnothing 10$  is performed. It is linear tapping operation. The unit B contains pitch feed unit, motor and column. For this

operation the pitch feed unit is used. When cycle start the pitch feed unit remains steady and the tapping tool travel along required path. For this operation the motor of 1 hp 8 pole of 560r.p.m. is selected. The motor and pitch is mounted on a column. The tapping operation is completed in 22 seconds.



WORKING . Operations are for UNIT A- drilling ( $\varnothing 9$ ), UNIT B-linear tapping of  $\varnothing 10$ , all above two operations are performed simultaneously by using SPM. The job loading and unloading time is 60 seconds. Hence the total time is 99 seconds, which is cycle competed in 94 seconds. In early days the all operations are performed by using vertical machining Centre (VMC). In operation of drill holes ( $\varnothing 9$ ) and operation of tapping ( $\varnothing 10$ ) Hence For total operation the time required is 54 seconds. Because the cost of operation is very high, total machine is block only for two operation and this is not economical for any industry and also skilled worker is required. The comparison between SPM and vertical machining Centre (VMC) is given below in tabular form

Parameter	VMC	SPM
Machine cost	Rs. 40,00,000	Rs1,13,944
Jobs/day	200	200
Cyclic job time	54 seconds	99 seconds
Job cost/job	Rs. 46	Rs. 26

Hence by using the VMC machine requires high cost, due to this the production cost is high. But by using SPM the total operation cost is reduced up to only just Rs. 26. Hence reduce the operation cost with the production rate, can produce 6000 jobs can be competed in one month and save Rs.1,20,00 per month.

#### CASE STUDY

##### Time calculation chart

UNIT		A	B
TOOL MATERIAL		H.S.S	H.S.S
TOOL DIA.	MM	9	10
CUTTING SPEED	M/MIN	25.43	17.58
SPINDLE SPEED	RPM	900	560
FEED/REV.	MM	0.08	1.9
MACHINING TIME	Sec	12	22
IDEL TIME	Sec	5	
TOTAL TIME	Sec	17	22
LOAD & UNLOAD TIME	Sec	40	20
CYCLE TIME	Sec		99

5. Increase the profit of company: Increased production rate, reduced production costs, reduced labor cost which minimizes the production costs. In recent days the company gets the maximum job order, which is have to be completed is less time. Greater the production rate maximum profit. When 6000 jobs competed then machine cost will become nil. After words it will give profit to company. The cost justification is given in following table

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Machine cost	Rs. 40,00,000	Rs 1,13,944
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### III.CONCLUSION

The concept of SPM fabricated as an experimental set up can be extended to an industrial application with

further modification in the design that is optimization of design process to achieve quality in machine as per the operation requirement. On a whole, it is concluded that the SPM is an developing process through the rate at which it should be introduced will have to be carefully planned in order to bring social justice and to accue economic benefits.

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