IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 09, Issue 5 (May. 2019), ||S (VII) || PP 41-46

Design and Development of Drilling and Trimming Fixture for Shim

Mr.Ishwarrao Kandiwalsa[1].Mr. Prabhakar Tiwari[2] .Miss.Namrata Gajbiye[3].
Prof. Sanjay Sajjanwar[4]

[1, 2, 3] Department Of Mechanical Engineering ,Jhulelal Institute of Technology, Nagpur
[4]Asst.Professor, Department Of Mechanical Engineering ,Jhulelal Institute of Technology, Nagpur.

Abstrac:t *Aerospace grade product is always concern about safety & it is a very keen parameter for biulding any aerospace part. While the production of this components not a difference of microns acceptale in the quality checking. If it is arises in any section of the component then the whole component is rejected by the quality testing department. Hence to reduce the rejection of the components ,we are developing such a manufacturing layout which is not only going to reduce the cycle time for the manufacturing of component but also reduce the cost required for the manufacturing of component by giving alternative method for the traditional processes like water jet machining.Main outcome of the project to build a fixture which has to be used in the CNC machine to machined the raw material Phenolic Polyamide Kapton into Finished Product "Shim".Fixture in tooling industry contributes more to improve economy of production. It ensures quality and quick transition of parts.Now a days the concept single minute exchange of Die is very much popular in indusstry which we try to incorporate in our design . The fabricated fixture is used for trials of components. The time study conducted with samples and the results were recorded with manual cycle time.*

Keywords: - *Shim, Phenolic polyamide capton , Single flute end mill ,*

I. Introduction

There are various jig and fixtures available nowadays to hold the work piece at proper location for machining raw material or semi finished components.

We are dealing with the composite material phenolic polyamide Kapton which is a aerospace grade material. This is exclusively used for aerospace grade because the strength to weight ration is very high as compared to certain materials which are easily available.

This Phenolic Polyamide Kapton is material with thin laminated sheets having machinability not easy. Water jet machine is used for the machining of this material currently.

Fig 1 : Finished Shim component

A layer by layer development of laminated thin sheet along with the suitable adhesives bonding material gives the required strength to the component which is required for the aerospace grade products.
In this project we are going to develop jig and fixture for machining composite material phenolic polyamide Kapton to produce a aerospace grade product "Shim".

II. Literature Survey

According to the M. M. Korat , Dr. G.D. Acharya [1] in his paper "A review on current research and development in abrasive water jet machining(AWJM)"

Given Parts which are extremely difficult to machine are machined by using Water jet machining. Water jet machining is a environment friendly machining process. This paper reviews the research work carried out from the inception to the development of AWJM within the past decade . this paper reports on the AJWM

research relating to improving performance measures , monitoring and control of process , optimizing the process variables.

Abhishek Dikshit , Vikas Dave, M.R. Baid [2] in his paper "Water jet machining : An advance Manufacturing Process " describes role of water jet machining in heavy construction and general and particularly how it affects the regional contractors in northeast. The paper presents aspects regarding an innovative nonconventional technology , abrasive water jet machining . The paper also gives regarding other technological operations possible to be performed with abrasive water jet .

Author of the paper "A review on abrasive water jet Cutting " Sreekesh K, Dr. Govindan P [3]. This paper includes work on Water jet Machine. Omni directional cutting potential as well as minimal thermal and mechanical loading are few advantages of water jet machining. Material removal rate (MRR) and surface roughness (Ra), taper of cut, Width of cut are important quality parameters of AJWM.

According Sudhakar R. Lohar , Pravin R. Kubde [4]"Current research and development in abrasive Water Jet Machining (AWJM) : A Review "This paper reviews the research work carried out from the inception to the development of AWJM within past few years. It reports on the AJWM research relating performance measures improvement , monitoring ,and process control, process control variable optimization. This paper also discusses the future trends of research work in the area of AJWM.

According to the research paper titled as "Design and Analysis Fixtures for Aluminium Die Casting Component " published by B.Maharajan, Dr.S.Balasubramanian [5] given that Fixture in tooling industry contributes more to improve economy of production. It ensures quality and quick transition of parts. A novel design on a fixture for tapping holes for complicated profile petrol pump body made of aluminum die casting material. The fabricated fixture used for trials. The time study conducted with samples and the results we compared with manual cycle time. Improvement in reduced cycle time shown 50% and the rejection quantity due to unmatured threads, shifting of axis and end damage are reduced 1/50 batch. Fixtures like this can adopt to the mass production components in automobile, Aeronautics and manufacturing units.

Fig 2: Water Jet Machining

III. Present Work

Water jet machining is a machining process which is used for the production of shim. Water jet machine is a very large machine that is used for the production of a very small component. The size of component that has been produced is negligible as compared to the size of machine.

The running cost of water jet machining is Rs. 5000 per hour . Water jet machine requires large carpet area to install. Abrasive particle with the high velocity jet is used to remove the excess material from the component . Once the abrasive particles with water jet is used to remove material from the work piece , the slurry obtained is a waste material. Abrasives particles can not be reused second time. The atmosphere in which the machine is working very hazardous

So the cost of final product is increases at exponential level .

Developing jig and fixture for water jet machining is not economical. We have extensively researched for the option various alternatives by which we can satisfactorily build the parts as per the requirement.

IV. Experimental Set Up and Procedure:

Principle of location

In the design of jigs and fixtures, the location of the component is very important aspect to influence this accuracy of the finished product. The locating device should be designed such that each successive work piece when loaded and clamped will occupy the same position in the jig or fixture. The selection of work holding device mainly depends on the nature of work piece and requirement of the machining operation. Some of the principles to be followed for location of a work piece are explained below.

Consider a work piece placed free in space. Anybody in this condition has six degrees of freedom. Three of these freedoms are translation and remaining is rotation with respect to three mutually perpendicular axes is shown in fig.1.

The three freedoms of translations are:

(i) Move along 'X – X'.

(ii) Move along 'Y – Y'.

(iii) Move along 'Z – Z

Three freedoms of rotation are:

(i) Rotate about 'X – X'.

(ii) Rotate about 'Y – Y'.

(iii) Rotate about 'Z – Z'.

Thus, six degrees of freedom are obtained

To locate a work piece accurately, it is necessary to restrict it against movements in any of the six degree of freedom with the help of suitable locating pins.

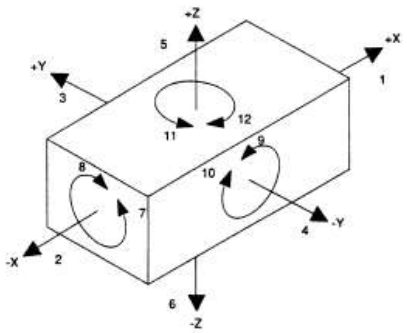

Fig 3 : Principal of location

Drilling Procedure in the fixture.

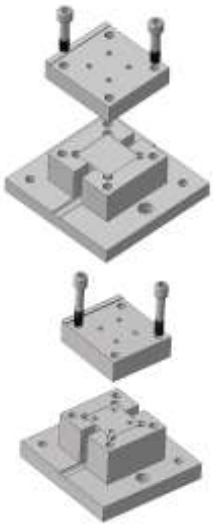

Fig 4 : Raw material fixed .

Fig 5: Part Drilled.

Fig 6 : Parts removed. .

Trimming procedure in fixture.

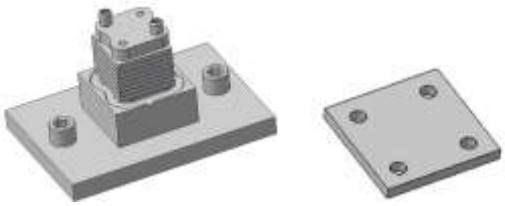

Fig 7 : Semi finished drilled component

V. Calculation Analysis:

All the trials are carried out on the Water jet machine as well as CNC machine results which are tabulated as below

Sr. No.	Parameter	WJM	CNC
1	Part load at a time	1 part	8 parts
2	Time to load 8 parts	8 min	1 min
3	Cycle Time per part	3 min	1 min
4	Cost per part	Rs. 53.7/part	Rs. 7.3/Part
5`	Total parts per shift (8 hour)	160 parts	480 parts
6	Expenditure per shift	Rs. 8592 per shift	Rs. 3504 per shift

Parts produced per 8 hours shift

=

For 8 hours total time in minute =8*60minute

=480 minutes

Production capacity for water jet machining for 8 hours is =

= 160 parts

Production capacity of CNC machine with Our Jig and fixture is =

= 480 parts

VI. Result Analysis:

01. Cycle time reduction is achieved by replacing water jet machine with the CNC machine.
02. Fatigue to the operator is minimized.
03. By placing 8 shims at a time production capacity per shift increases triple as compared to water jet machine.

VII. Result and Discussion:

By adapting the concept of SMED we have developed the fixture for CNC machine & then trials conducted to analyze results between water jet machine & CNC machine (VMC)

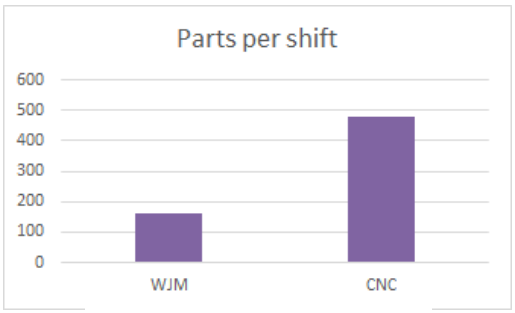

Fig 12 : Parts produced per shift

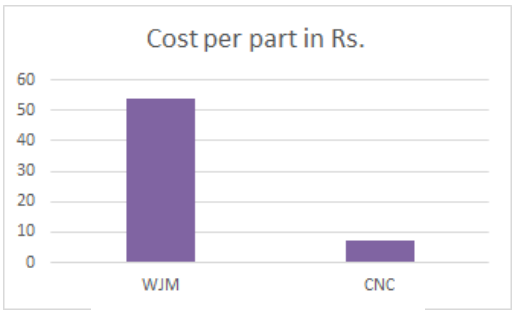

Fig 13 : Costing per part in Rs.

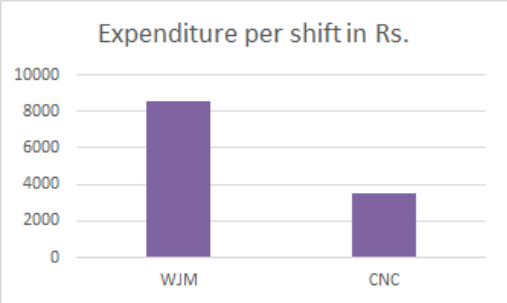

Fig 14: Operatng cost per shift in Rs

VIII. Conclusion

The conclusion from the trials after developing fixture for VMC to perform milling & trimming operation same as water jet machine. It is evident that productivity is increase by 300 % for VMC than waterjet machine and CPC is reduced to 86 % approximately in case of VMC compaed to water jet machine.

References

[1]. M. M. Korat , Dr. G.D. Acharya
A review on current research and development in abrasive water jet machining(AWJM)
Published in Int. journal of Engineering Research and applications ISSN:2248-9622; Vol 4,issue 1(version 2) ,January 2014,pp 423-432

[2]. Abhishek Dikshit , Vikas Dave, M.R. Baid
Water jet machining : An advance Manufacturing Process
Published in International Journal of Engineering research and General Science
Volume3,Issue2,Part 2, March-April,2015

[3]. Sreekesh K, Dr. Govindan P
A review on abrasive water jet Cutting
Published in International Journal of Recent advances In Mechanical Engineering (JJMECH) Vol 3, No.3 , August 2014

[4]. Sudhakar R. Lohar , Pravin R. Kubde
Current research and development in abrasive Water Jet Machining (AWJM) : A Review Published in International of Journal of Science and Research (IJSR) ISSN(online) :2319-7064
Index Copernicus Value(2013) : 6.14 Impact Factor(2014) :5.61

[5]. B.Maharajan , Dr.S.Balasubramanianp
Design and Analysis Fixtures for Aluminum Die Casting Component
International Journal of Innovative Research in Computer Science & Technology (IJIRCST)
ISSN: 2347-5552, Volume-5, Issue-4, July 2017
DOI: 10.21276/ijircst.2017.5.4.2