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Deburring methods for Elimination of Chips in the Internal tubes of front fork

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Abstract - *One of the most significant problems encountered in machining, particularly in CNC operations , is that of burr formation. Burrs usually comprise of work piece material which has been plastically deformed during the machining process and projects beyond the desired edge of the work piece. The adverse effects of burrs depend on the component application but may include; stress concentration and related fatigue failure and increased wear on components and tools involved in the manufacture of the part. The minimisation or eradication of burrs produced during the drilling and milling and grooving process is therefore of the utmost importance. Currently the focus is on minimizing burr formation through optimisation of process control parameters. Burr formation is nothing but chip generation However it is possible to reduce the size of the burr, but it is not possible to eliminate it entirely. Although various companies have tried to develop methods for deburring drilling and milling burrs, these invariably involve extra process steps and increase cycle times and increased costs. A combined machining operation would provide the optimum solution, with provision of necessary modification in existing process for elimination of chip generation, the burr removal while not significantly increasing cycle time.*

Key Words: Drilling, Burr, Deburring …

1. INTRODUCTION

In the present period of globalization, enterprises are receiving new technology and methods to create products to compete and survive in the market.

With rapid increase in demand of production, manufacturing industries need to increase their potentials in production & effectiveness to compete against their competitors. At the same time, the production process has to be ready with the ability to have abated costs with higher proficiency. Hence the route to simplify the problem regarding the production is of paramount importance. Although the machinability of most aluminium alloys can be classified as relatively easy when the tool wear and the cutting energy are considered, these materials could however raise some concerns when the chip formation and the burr formation are of concern.

Burr formation, a phenomenon similar to chip generation, is a common problem that occurs in several industrial sectors, such as the aerospace and automobile sectors. It has also been among the most troublesome impediments to high productivity and automation, and largely affects the machined part quality. To ensure competitiveness, precise and burr-free components with tight tolerances and better surface finish are needed and required. Intensive research conducted during the last decades has laid out the mechanisms of burr formation and deburring in a very comprehensive fashion, and has introduced integrated strategies for burr prevention and minimization. Despite all the improvements realized, there are still many challenges encountered in understanding, modeling and optimizing the burr formation process and size, through production growth and cycle time reduction. Furthermore, acquiring a solid knowledge on deburring methods and the links between them and burr size is strongly recommended.

2. LITERATURE REVIEW

Deburring and burr control are two possible ways to deal with burrs. For both, an insight into current research results are presented. Finally,a number of case studies on burr formation, control and deburring in *Burrs—Analysis, control and removal*. [1]

Aurich et al. (2009), state that burrs are sharp and may cause small injuries on finger to assembly workers. Furthermore, they may become loose during operation on a product and provoke damages. [2]

Kilickap (2010) and Et.al. studied the modeling and optimization of burr height in the drilling of aluminum alloy and stated that lower feed rates and cutting speeds are preferred.[3]

Burr formation can be controlled at different stages of manufacturing which are design, process planning, and tool path planning and also by improving material properties, tool engagement condition, tool geometry and cutting parameters such as feed, speed and depth of cut. [4]

Aurich et al.stated that burr formation could not be prevented fully rather, it could be minimized by additional deburring operation. But According to Narayanswamiet al.additional deburring may also damage the object.

2.1 Problem Statement

According to the research of Aurich that burr formation could not be prevented completely rather, it could be

minimized by additional deburring operation. But According to Narayanswamiet al.additional deburring may also damage the object. The problem was that the components was not able to fulfill the customer requirements. The company's actual production was very less as compared to customer requirement as formation of burr while machining of front fork tube of aluminium alloy while milling, boring, and grooving, drilling operation, while cleaning the tubes by pneumatic high pressurized air some burr was remained in the tube which affected the warranty complaints from the customers and company quality too. This remained burr in tube leads to the failure of oil seal during working, that leads to the coming out of oil from the tubes . That burr generation also lead to rejection of 4000 components on quaterly basis. An extra manpower is required for cleaning the tubes and due to human errors, affects the quality of product and company also. We saw that this method has many problems like labour fatigue, labour idle time, damage to costly parts, etc. part .

As we have stating that additional deburring and burr formation could be prevented fully in the industry specially on CNC m/c while machining.

A. **Impact at Customer end**- due to burr warranty complaints from customers are increasing due to brakage of oil seals of front fork while it is in operation .

B. **Impact at Company end-** This affecting companys Quality and production as failure may likely to be increased.

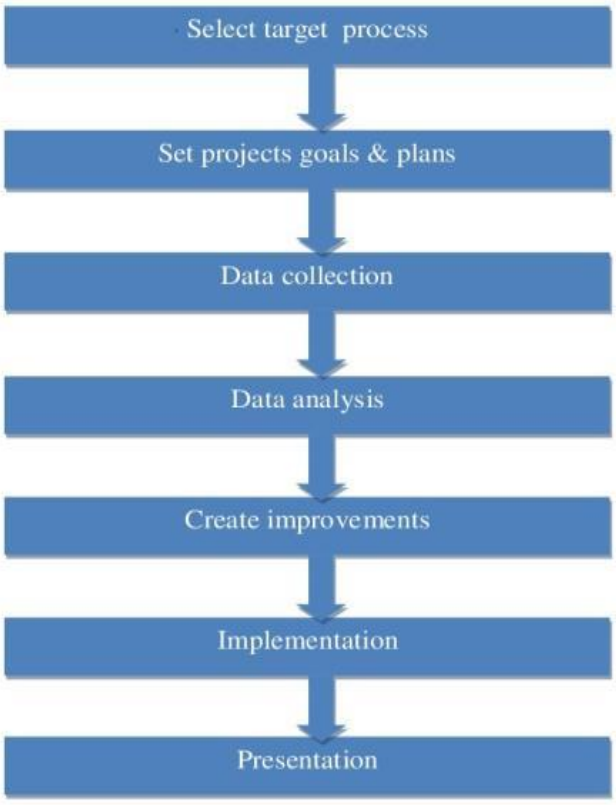
2. 2 OBJECTIVES

The given objectives are to be predicted while doing this project work are given below,

- To develop new techniques in order to eliminate the chip formation during machining.
- To provide modification in existing m/c process to optimize process and reduce manufacturing cycle time.
- To reduce delays, and damage.
- To promote safety and improve working conditions.
- To maintain or improve product quality.
- To promote productivity.
- To silent continuous transport.
- To reduce man power. (Labor fatigue)
- To productivity will increase and time will save.
- To less accident prone.
- To reduce damage to costly products.
- One-time investment.

2.3 Methodology and Process flow

Methodology is the Systematic, Theoretical analysis of the methods applied to a field of study or the theoretical analysis of the body of methods and principles associated with a branch of study. The below flow chart shows the sequential operation/steps that will be performed during the project process.



3. METHODOLOGY ASSESSMENT

The first step in chip reduction program is to understand the current state. This means completing a detailed process map to understand the flow of materials and maximum generation of burr of particular operation and paperwork through the organization. During the process of generating this map, there is an opportunity to identify value added vs. non-value-added activities.

3.1 DATA COLLECTION

The purpose of data collection is to provide a basis for analysis, However, before data can be collected, a data collection plan needs to be developed. The data is collected to identify the maximum burr formation in machining for particular m/c operation and improve the area for process modification and implementation of new techniques and bottleneck station in which this new process modification m/c operation carried out and to analyze and eliminate them.

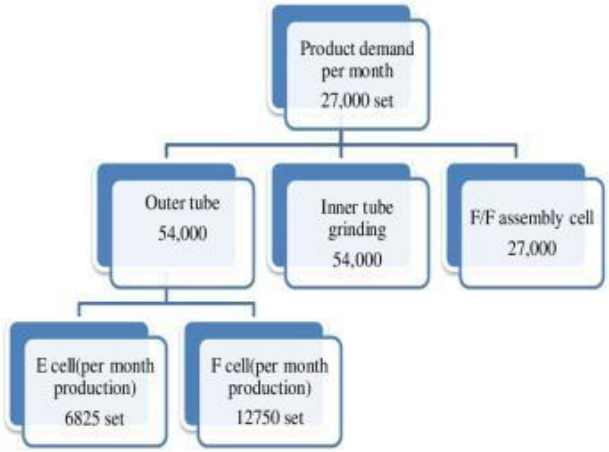


Fig -1: Production of tubes in cells.

Total sets produced per month in outer tube cell = Total sets produced per month in E – cell + Total sets produced per month in F – cell = 6825 +12750

= 19575 set/month

Interval =27000 - 19575 = 7425 set /month

Quarterly Production = 20975*3 **= 62,925 sets**

Rejection of parts due to burr **= 4000 out of 75000 .**

4. PROPOSED SOLUTIONS-

Instead of this conventional technique ,the modified process and simple techniques and solutions are used and need to be implemented with least cost. Encompassing all deburring methods, from manual deburring to high technology finishing systems using CNC.

1.By using frame type structure as deburring m/c usually operated by compressed air however it need additional man and cost involving for high pressure air through air gun.

Provision of Additional pressure line of existing coolent system

2.. By using through coolent pump having capacity 2-3 bar coolent pressure used for I.D. cleaning of tube with provision of flushing jets usually dia of nozzles kept 3mm as burr generated having size upto 5mm.

3. ID Flushing stand with proxy sensor used to avoid bypass of ID cleaning activity (Poka-Yoka).Fixture provided with nylon material having clearance of 2mm between tube surface and nozzle.

4 .Chip Flushing Program added in VMC Part programming rotate fixture from 360° to 720°and also add to interlock circular interpolation in grooving program.

5. CONCEPT DRAWING

A. Solution 1

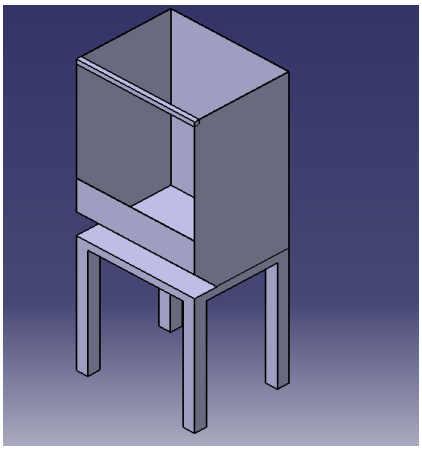


Fig -2: Frame type structure used for deburring tubes.

B. Solution 2

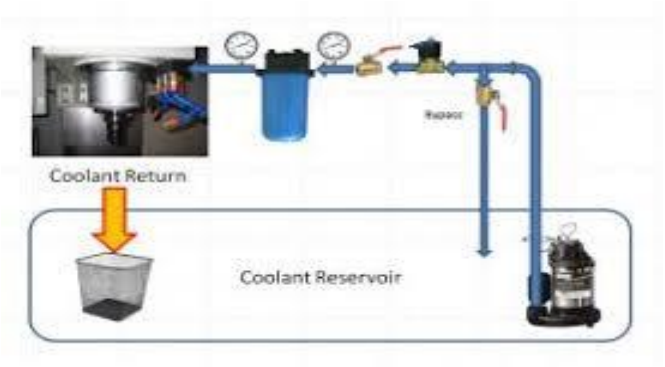


Fig -3: Additional pressure line to bypass from coolent pump.

In above figure req of component such as pump,pressure gauges and regulator ,non return valve,nozzle jets used for flushing. As pump used is integral part of m/c , no separate provision is made.

C. Solution 3

Fig -4: Pressure line with proxy sensor in poka-yoka.

3. RESULT & CONCLUSIONS

By providing modification in process we have improved the production rate in outer tube machining cell from 21,150 set/month to 24,000 set/ month as time required for deburring using manual deburring method in (sol 1)is significantly reduce by following other modified techniques described in proposed solution in which labour work completely eliminated.

It has given good results, in profit also. and reduces extra man hours required for deburring.

BEFORE

AFTER

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