Atomisation of Deburring Method from Manual Deburring to Vibratory Deburring to Minimize the Rejection during PPAP of New Development of Component

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Abstract— During Performing PPAP for new part development we came across a problem of burr formation which was going to impact on rejection and failure in the development. So in this article we have given how to overcome this problem by atomization by installing deburring machine instead of manual deburring. The burr formation is one of the most common and undesirable phenomenon occurring in machining operations, which reduces assembly and machined part quality. To remove the burrs, a costly and non-value-added process known as deburring is required for post-processing and edge finishing. A basic overview of burr formation and removal is presented in this paper. Due to vast applications of Mild Steel in many industrial sectors, such as automotive and aerospace industries, this paper describes the most highly used deburring edge finishing on machined parts. The main advantages, disadvantages, limitations, part quality and precision of these operations are presented. This can be beneficial for an adequate selection of deburring methods, cost reduction and production rate improvement.
Keywords: Mild Steel, Burr, Deburring, Edge Finishing

I. INTRODUCTION

The Production Part Approval Process (PPAP) is a standardized process in the automotive and aerospace industries that helps manufacturers and suppliers communicate and approve production designs and processes before, during, and after manufacture. Created in hopes to promote a clearer understanding of the requirements of manufacturers and suppliers, PPAP helps ensure that the processes used to manufacture parts can consistently reproduce the parts at stated production rates during routine production runs. For those in the automotive industry, the

PPAP process is currently governed by the PPAP manual Published by the Automotive Industry Action Group (AIAG).

PPAP is done for the development of the part on the basis of following documents mentioned below.

- Design record with all specification
- Authorized engineering change number (ECN)
- Customer Engineering Approval
- Process is defined
- Process is documented
- Linkages of process are established
- Process is monitored, analysed, and improved based on data
- Records are created, maintained, and retained
- Validation Test Report
- Control Plan
- PFD (Process Flow Diagram)
- Lab Test Report
- DFMEA (Design failure mode effect analysis)
- PFMEA (Process failure mode effect analysis)
- MSA Study

Burr formation is a major concern in the surface and edge finishing of work parts, which eventually leads to reduced work parts resistance, tool life and productivity rate. Therefore, it is necessary to limit the burr formation; otherwise the use of secondary operations known as deburring becomes essential. Throughout intensive research works during the last decades, the mechanisms of burr formation are very well understood and comprehensive and integrated strategies for burr prevention and minimization were introduced. However, particular attention should to be paid to deburring operations, which are in fact expensive, time consuming, non-productive and non-value added processes.

The main critical thing is the burr location on the number of edges which may lead to failure in part functioning by creating the resistance to operate in the bore of the assembly in the master cylinder. There are number of deburring method used for mild steel, so it is necessary to use the proper deburring method which will provide accuracy in finishing and removal of burr. Which will reduce the time as well as cost and it will affect in reduction of the rejection.
Manual deburring on deburring process may effect on the finishing and the dimensions, stresses, surface passivation and some time it may lead to formation of new burr can also take place.

In this paper we have explained the problem of burr which we came across developing the new part (Piston used in tandem master cylinder used in hydraulic braking system) and previously we were using manual deburring process which was leading the part to reject in the inspection in dimensional analysis so we changed the method of deburring process. This can be beneficial for production rate improvement, cost reduction and time consumption.

II. LITERATURE REVIEW

1) Seyed Ali Niknam and Victor Songmene.
"Deburring and edge finishing of aluminium alloys: A review" of the 12th International conference on Aluminium (INALCO 2013), At Montreal, 'October 2013'. In this review paper they have explained the various deburring processes for aluminium components and the finishing process. According to the review paper there are almost 122 deburring process and from it vibratory deburring is the most effective which we find easy and less expensive for the machined parts for turned parts for mild steel.
2) Mark A. Morris (2012)
This Book gives APQP as a means to achieve robust capable processes for special characteristics. This book give the fundamental understanding of the languages that guides APQP efforts, to use strategies to determine where the assess special characteristics

3) Ford motor company (2004) this handbook refers to technical assistance for the supplier to get the customer requirements. This book shows the timing and methodology for meeting all 18 requirements of AIAG published Production Part Approval Process (PPAP) for single line and multiple line Tier 1 Supplier manufacturing facilities. Global Phased PPAP is a Ford requirement specified in Ford PPAP Customer Specific Requirements

III. OBJECTIVE

– To improve deburring process by atomization of vibro deburring in production part approval process

IV. OVERVIEW OF BURR FORMATION

Edges on the work piece is called burr if measured more than zero mm.

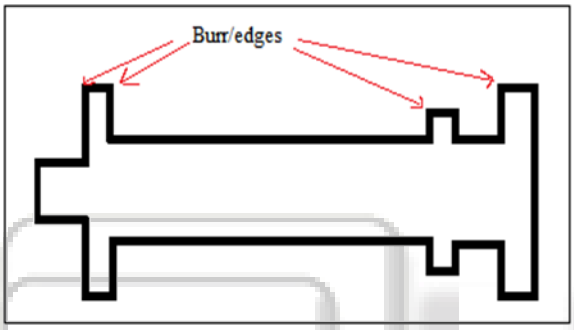

Fig. 1: Piston showing Burr/edges formation area.

Fig 1 shows where exactly the burr is formed this part is assembled in the tandem master cylinder as shown in the fig 2 below.

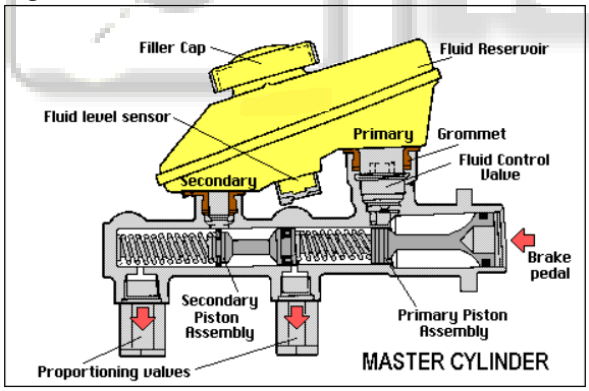

Fig. 2: Master Cylinder.

These primary and secondary pistons goes through machining processes like turning operations on CNC machines which lead to burr formation at edges. If the edges and burr is not removed it can lead to friction in cylinder and tear the rubber seals mounted on the cap.

V. DEBURRING OPERATIONS

Burrs have always been a serious concern in the surface and edge finishing of machined parts. According to, achieving an excellent edge quality when using deburring processes is often difficult. To better select the deburring processes, several classifications were proposed. The most complete one was made in, encompassing all deburring methods, from manual deburring to high technology finishing systems using CNC and industrial robots. Gillespie has identified 122 deburring and edge finishing processes which can be classified under following categories:

1) Mechanical deburring Processes.
2) Thermal deburring Processes.
3) Chemical deburring processes.
4) Electrical deburring processes.

The most frequently used deburring processes are mentioned below:

1) Manual deburring
2) Barrel deburring
3) Brush deburring
4) Centrifugal barrel finishing
5) Bonded abrasive deburring
6) Robotic deburring
7) Abrasive jet deburring
8) Electro chemical deburring
9) NC/CNC deburring.
10) Vibro - deburring.

A. Mechanical Deburring Processes:

During mechanical deburring processes, the burrs are reduced or removed by mechanical abrasion. Various mechanical deburring systems were developed. The overview of most highly used mechanical deburring methods for aluminium alloys will be presented in the following sections.

B. Manual Deburring:

Manual deburring is still known as the most widely used operation for many reasons, including extreme flexibility, low cost and lack of technology needed. According to manual deburring is associated with wasting of time and asset, fatigue, frustration, etc. Moreover, in most of industrial sectors, manual deburring is implemented in dry conditions by non-qualified operators. This consequently increases the waste rate and delay in production lines.

C. Other Deburring Methods:

Wide range of deburring methods which could be used for mild steel works parts were presented. Amongst, a deburring method for turned surfaces was proposed. In this work, an inductor producing a co-current magnetic field is adapted to the milling spindle. Ultrasonic deburring of mild steel work parts was reported. It was found that the distance between the horn and the work piece and size of abrasive are the governing factors on ultrasonic deburring. A deburring method using enhanced ultrasonic cavitation without abrasives was proposed.

D. Vibro-Deburring Machine:

Vibratory tumblers have an action similar to filing. The rotating weight shakes the tub in circular path during which the entire load is lifted up at angle and dropped. As the load falls the returns to the upward position applying angular forces and upward forces that cause shearing action where the parts and the media rub against each other.

Vibratory finishing systems tend to produce a smooth finish because the media essentially laps the parts. Since the load is moving as a unit, very fragile parts are quite safe in the vibrator. There is no tearing action or unequal

forces that tend to bend and distort parts. The larger the parts or media are, the faster the cutting action.

The amplitude and the frequency of the machine control's the finish of the parts and the deburring process occurs. The cycles of frequency may vary per minute as per the requirement from 900 to 3600 cycles.

Fig 3 shows the image of the tumbler used for the vibratory finishing.

1) Media (Finishing material/deburring material):

The media may be abrasive particles or stones combined with a liquid during the finishing of process. These help in support from not getting the part damaged.

Fig. 3: Vibratory tumbler

VI. Applications of Vibratory Tumbler

Deburr of the components. Radius descale, burnish, clean, and brighten a large number of relatively small work pieces.

VII. Conclusion

By reviewing deburring method', vibratory tumbler method is most suitable method for deburring process. The vibratory tumbler technique improves the deburring process by 10 % from existing techniques which leads to reduction in rejection of components (from 5 % to 2 %). It also reduces the lead for finishing and process.

Acknowledgement

The concept of group project was included in our engineering syllabus with the view to inculcate within us the application ability of the theoretical concept of production and design engineering to practical problems.

In completing our project titled "Production Part Approval Process" as per time estimate gives us immense pleasure and a feeling of achievement. During the course of project we encountered many problems which overcame with the able guidance of our project guide.

A brief mention of our efforts present on this project report. Project work has given us good exposure to practical region which in future is definitely going to help us….

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