iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** IV **Month of publication:** April 2018

DOI: http://doi.org/10.22214/ijraset.2018.4585

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue IV, April 2018- Available at www.ijraset.com

A Review on Reduction of Zero Production Tools in Press Shop Using Six Sigma Methodology

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***Abstract:** In any manufacturing industry numbers of tools are being used for manufacturing their products. Out of many tools our focus is on tools used in press shop for sheet metal forming. It is obvious that the tools used in an industry undergo regrinding and can break because of no. of reasons. This causes high maintenance cost, increase machine setup time, late delivery, production loss etc. The goal is to find these reasons and take steps to prevent it. It will be achieved by implementing six sigma DMAIC (Define, Measure, Analyze, Improve and Control) methodology.*
***Keywords:** Press tools, sheet metal forming, six sigma, and DMAIC Methodology.*

I. INTRODUCTION

Press shop includes the sheet metal forming processes. Sheet metal forming is the process in which a sheet of metal is deformed to the desired size and shape by applying pressure or force. It includes the processes like blanking, be

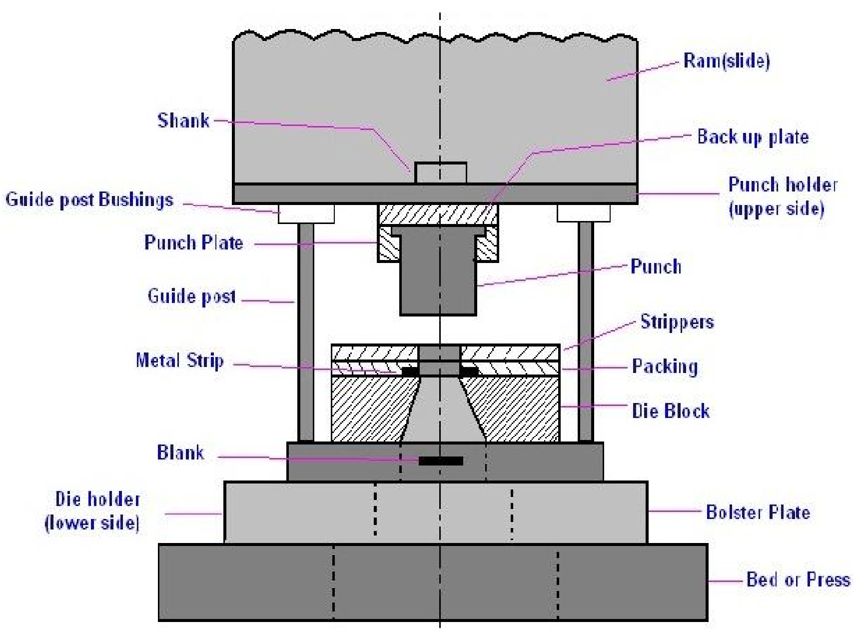

Fig. 1 Schematic diagram of component of die and punch assembly

nding, piercing, punching, coining etc. These are almost chip less manufacturing processes and are considered most efficient and fastest to form a sheet metal into finished product. It includes the parts like press tools, die, punch etc. to convert sheet metal into finished product. The press tools are classified on the basis of operation performed by tools like blanking tools, blending tools, parting tools etc. The fig shows the schematic diagram of components of die and punch assembly.

A. Zero production Tools

Those tools which are unloaded from machine without any production are called zero production tools. Productivity of these tools is zero.

II. SIX SIGMA

Different definitions have been proposed for Six Sigma, but they all share some common threads. Six Sigma is a method that provides organizations tools to improve the capability of their business processes. This increase in performance and decrease in process variation lead to defect reduction and improvement in profits, employee morale, and quality of products or services. Six Sigma quality is a term generally used to indicate a process is well controlled (within process limits ±3s from the center line in a control chart, and requirements/tolerance limits ±6s from the center line).

A. DMAIC Methodology

DMAIC is a data-driven quality strategy used to improve processes. It is an integral part of a Six Sigma initiative, but in general can be implemented as a standalone quality improvement procedure or as part of other process improvement initiatives such as lean.
DMAIC is an acronym for the five phases that make up the process:

1) *Define:* It include defining the problem statement and goal statement i.e. reduce the no. of zero production tools in press shop. By achieving goal we can able to minimize additional cost of maintenance, machine set up time, Production loss, and late delivery. It include all the tools in press shop.
2) *Measure:* It measure the problem and process where it is produced. Data collection is carried out about tool breakdown.
3) *Analyze*: The process to determine root causes of variation, poor performance (defects). Identify the causes of tool breakdown by brainstorming about possible root cause.
4) *Improve:* Improve the process by finding best solution to problem and making solution implementation plan. Compare the result after & before implementing solution.
5) *Control:* The process of validating the measurement system and evaluating capability is repeated to insure that improvement occurred. Steps are then taken to control the improved processes.

III. LITERATURE SURVEY

A literature review survey helps in getting knowledge about particular issue and gives information about the work done on that particular issue. There are numbers of research papers are reviewed regarding my project "Reduction of Zero Production Tools in Press Shop" are as follows

Amol Totre [1] conducted the analysis of the factors affecting the blanking process. He take factors like clearance, tool wear, sheet metal thickness, material, punch geometry out of which clearance, thickness & tool wear is important factors. Clearance value of the various material is depend on the thickness of material & the type of material. The blanking energy increase with increase in sheet metal thickness & vice versa. Punch geometry affects the punch stress, temperature as well as punch life.

Vaditake S.S. [2] discusses influence of process parameters of blanking such as thickness of copper sheet, punch-die clearance and punching tool wear radii on burr height formation on blanking product. MATLAB Optimization toolbox and the function 'Particle swarm' coupled with Design of Experiments (DOE) technique to optimize the selected process parameters to minimize burr formation on blanked part. Experiment is carried out on mechanical press of 10 ton on copper sheet material. By taking different value of clearance, thickness and tool wear radii he found that tool wear is most affecting factor and then punch die clearance on second and last sheet metal thickness.

Pawan Kumar Rai [3] take the factors which include man (operator awareness, skill of operator), machine (press machine alignment, clearance between die & punch), material (raw material grade and thickness) and method (part handling). He then give brief knowledge that how this factors produces burrs on blanked part and how to minimize it by taking proper care.

H. Y. Chan and A.B. Abdullah [4]. In this study, a comprehensive review on sheet metal blanking burr formation and the responsible parameters are discussed. The paper also presents the current challenges facing by the manufacturer as well as researcher on burr problem and outlined some of the remedial measures to overcome this problem. In addition, the authors raised the problem on measurement of the burr as the size of the component become smaller and level of precision is higher.

Martin Grünbaum [5] studied the effect of high cutting speed on different parameters of blanked parts. He done this experiments on four different materials low carbon steel, high strength steel, copper and aluminium. The clearance was taken between 3% to 24% and cutting speed between 0.5 ft. /sec to 12 ft. /sec. It is observed that the quality improvement of blanked part for steel at higher speed is more than that of aluminium and copper. In order to determine the reachable cutting speeds and to calculate the energy required for blanking, velocity-stroke curves were obtained. In addition, blanking simulations with DEFORM 2D have been performed. The results obtained are then compared with experimental results. Hence this paper conclude that higher the cutting speed, higher part edge quality improvement can be obtained.

Jacek Mucha [6] in his paper described about the effect of punch-die clearance, tool material and tool coating on the wear of blanking tool. The feasibility analysis for various materials used for production of the tools for punching the generator sheets is presented. The punches are made up of high-speed steel M2, sintered steel M3:2, and tungsten carbide, have been used during experiments. The blanking sheet used is of the industrial silicon steel sheet (Si=1.43%) plate M530–50A (old designation EP530–50A), of thickness g=0.5±0.02 mm has been used. Experiment are carried out with different tool material with and without coating of Tin and with clearance from 0% to 8%. It is found that Tools made of M2 exhibit the poorest wear resistance and that of tungsten carbide has best wear resistance.

H. Makich [7] developed a method for measuring the volume of burr and is based on the use of 3D topographical images. Here he uses the microscope Infinitefocus Alicona. The punch wear is calculated by combination of a mathematical model to the geometric shape of punch. It gives the geometry variation of the punch with respect to number of press stroke. He concluded that increase in burr volume with the increase in number of press stroke.

Vivek D. Barhate [8] design the progressive die in which former operation is piercing and is followed by blanking. The material used for work piece is mild steel and for this the clearance is 5%. He then done the analytical force analysis for parts like top plate, bottom plate, guide pillar, die punch. Die punch is made up of D2 steel. The modeling is done by CATIA software. Then analysis of die parts are done using ANSYS software and thus obtained results are identical to numeric results. Hence he concluded that the total tonnage required for saddle plate manufacturing is 178 Tones including 20% of the Factor of safety. There is for that range the press available in Mungi Engineers Pvt. Ltd. is 200 Tones. So this press is used for manufacturing saddle plate.

Amit Yadav [9]. This paper presents the implementation of Six-sigma methodology for reducing rejection of automobile part (clutch) in an industry. The DMAIC methodology has been used to achieve quality level. He uses supporting tools like process flow chart, Cause & effect diagram, and Pareto chart. By implementing six sigma in an industry he provide breakthrough improvement in industry. He noticed that after six sigma implementation, rejection of clutches reduced from 15 out of 220 to 2 out of 220 in single shift, which is a huge reduction of 87%, reduction in DPMO (Defect per million output) from 68181 to 9090.9, Increase in process sigma level from 2.99 to 3.86, which is increased by 30%.

IV. OBJECTIVES

A. Reduce no. zero production tools in press shop.
B. Increase productivity of components manufactured in company using six sigma methodology.
C. Decrease the value of DPMO and thus increase the sigma level.

V. CONCLUSION

By using six sigma methodology and its various tools it is quiet easy to reduce the numbers of zero production tools in press shop. The current sigma level is 2.46 and it can be increase to high level by implementing various six sigma tools in an industry.

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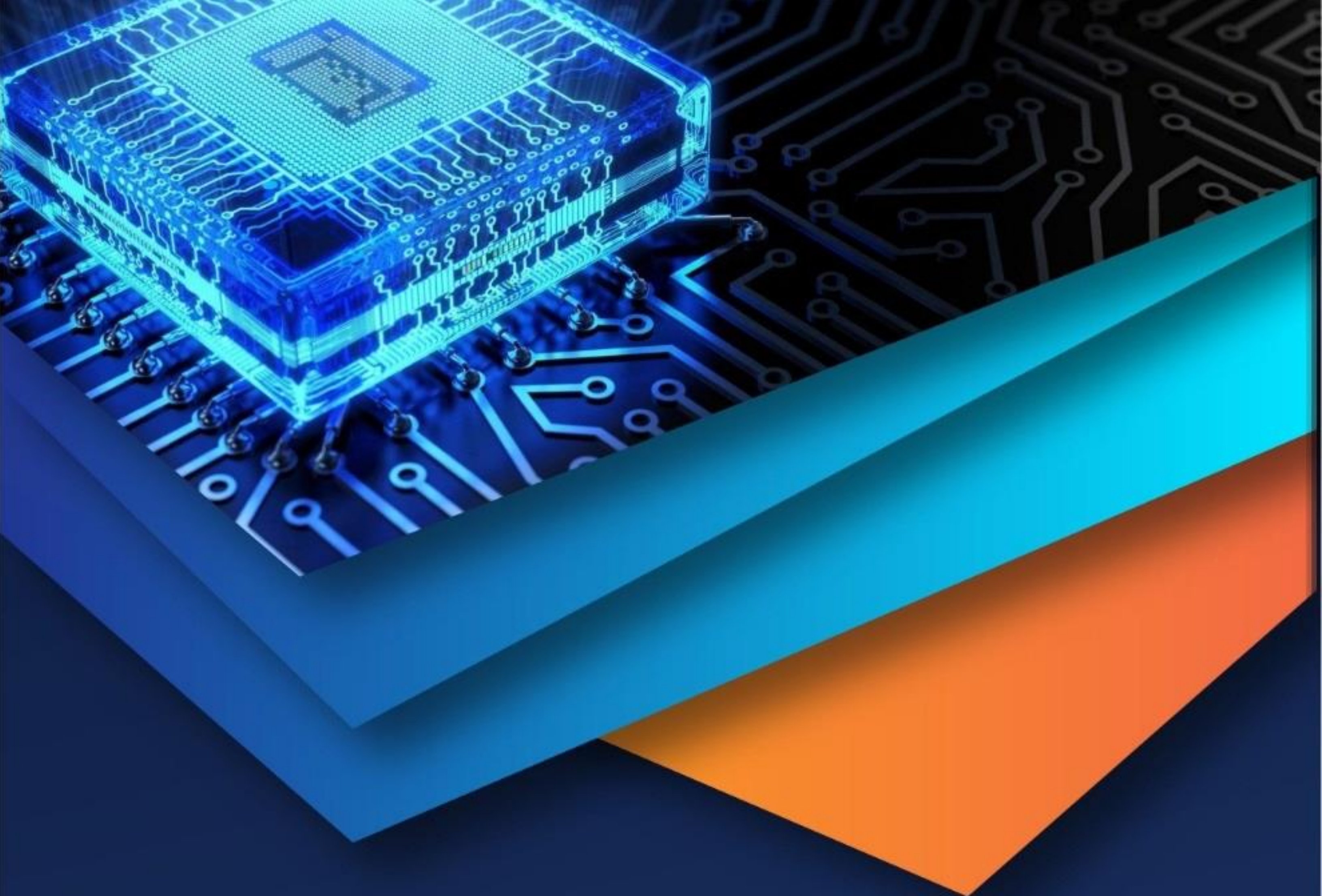

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