IMPROVEMENT OF INTERLOCKING THIN SHEET METAL IN JOINING USING PLASTIC DEFORMATION PROCESS

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IMPROVEMENT OF INTERLOCKING THIN SHEET METAL IN JOINING USING PLASTIC DEFORMATION PROCESS

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A report submitted in partial fulfillment of the requirement for the award of the degree of B.Eng. (Hons.) Manufacturing Engineering

Faculty of Manufacturing Engineering

UNIVERSITI MALAYSIA PAHANG

20 JUNE 2016

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LIST OF SYMBOLS

D_D	Die diameter
t_1	Thickness of upper sheet
t_2	Thickness of lower sheet
D_P	Punch diameter

LIST OF ABBREVIATIONS

CO_2	Carbon Dioxide
DIN	Deutsche Industrie Norm
TIG	Tungsten, inert gas
MIG	Metal, inert gas
AS/NZS	Australian/New Zealand standard
FSW	Friction stir welding

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ABSTRACT

The automobile industry, in particular, uses clinching in certain parts of the vehicle body. Clinching is also used in furniture and computer industries, in different kind household appliances as well as in ventilation and air conditioning products. Clinching is the mechanical clamping methods to join sheet metal without extra components, which use the special tools to form a mechanical interlock between the sheets metal. Normally, the tools of mechanical clinching are a punch and a die. The first procedure to carry out this research is by design the suitable punch and die shape in joining two sheet metals. All the parameters that involve in fabricating the punch and die shape such as the diameter of die, the diameter of punch, punch stroke, die depth and the thickness of the sheet, the point that must be emphasis. This all factors are related to each other. If the parameters are not suitable, it may cause the interlocking between two sheets will not happen. Thus, no joining process are occur. For the die diameter, it must consider the size of punch diameter and also the thickness of sheet metal for in being fabricate. This is because if it too large or too small, it may cause the defect to occur which are button separation mode for the large size of die diameter and neck fracture for the small size of die diameter. Meanwhile, for the punch stroke, it must consider the die depth and also the thickness of the sheet metal. If the small punch stroke are apply at thick sheet metal and small die depth, it may cause the joining between the two sheets will not occur. Hence, die depth and the thickness of the sheet metal should be emphasized before deciding the punch stroke to ensure the interlocking will occur.

ABSTRAK

Dalam industri kereta, khususnya, menggunakan ‘clinching’ di bahagian-bahagian tertentu badan kenderaan. ‘Clinching’ juga digunakan dalam penghasilan perabot, industri pembuatan komputer, peralatan rumah dan juga pada penyaman udara. ‘Clinching’ adalah kaedah pengapit mekanikal untuk mencantumkan kepingan logam tanpa menggunakan komponen tambahan, yang menggunakan alat-alat khas untuk membentuk butang kekunci mekanikal diantara kepingan logam tersebut. Biasanya, alat-alatnya adalah penekan dan acuan. Prosedur pertama untuk menjalankan kajian ini adalah dengan mereka bentuk penekan dan acuan yang sesuai untuk mencantumkan dua kepingan logam. Semua parameter yang terlibat dalam mereka bentuk peneken dan acuan adalah diameter acuan, diameter penekan, strok penekan, kedalaman acuan dan ketebalan kepingan logam, perkara yang mesti diberi penekanan. Semua faktor ini berkaitan antara satu sama lain. Jika parameter tidak sesuai, ia boleh menyebabkan tidak akan berlakunya kekunci diantara kedua-dua logam. Oleh itu, tidak ada proses penyambungan yang berlaku. Untuk diameter acuan pula, ia perlu mengambil kira saiz diameter penekan dan juga ketebalan kepingan logam sebelum direka bentuk. Ini kerana jika ia terlalu besar atau terlalu kecil, ia boleh menyebabkan kecacatan berlaku iaitu ‘butang mod pemisahan’ bagi saiz diameter acuan yang besar dan ‘patah leher’ bagi saiz diameter acuan yang kecil. Sementara itu, untuk strok penekan, ia perlu mengambil kira kedalaman acuan dan juga ketebalan logam. Jika strok penekan yang kurang digunakan pada kepingnan logam yang tebal dan kedalam acuan yang dalam, akan mengakibatkan cantuman tidak berlaku. Oleh itu, kedalaman acuan dan ketebalan kepingan logam perlu dititik beratkan sebelum mengambil kira strok penekan untuk memastikan cantuman saling akan berlaku diantara kedua-dua kepingan logam.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

In this chapter, it's discussed about the project background, the problem of the project, the objectives of the project and also the project scope.

1.2 PROJECT BACKGROUND

This title project is about improvement of interlocking thin sheet metal in joining using plastic deformation process. First of all, the method used in these joining two sheets metal is mechanical clinching. Clinching is the mechanical clamping methods to join sheet metal without extra components, which use the special tools to form a mechanical interlock between the sheets.

Normally, the tools of mechanical clinching are a punch and a die. The sheets are forces between the punch and die causing the sideways movement of the material to form an interlocking button. This method not requires electricity or heat which used in welding. Furthermore, it is a cold forming process and suitable to be used on coated and painted materials and can be used for joining dissimilar materials. The common materials that can be clinched are low carbon and micro alloyed steels, stainless steel, coated steels and also lightweight materials such as ductile aluminum alloys.

Clinching commonly used in the automotive, electrical and electronics, where it often replaces welding. This process has low cost, because of low energy which single step process using no consumable. It's also fast and easy automation.

1.3 PROBLEM STATEMENT

In joining two sheets metal, the strength is very emphasis. In clinching, the strength of the joined materials is mainly affected by the shape of punch and die. Thus, the shape of punch and die must be optimizing to ensure the material joined has high strength. Furthermore, it also to prevent the fracture in the materials such as neck fractures mode and button separation mode.

1.4 OBJECTIVES

The objectives of this project are:-

- To investigate the effect of die and punch shape to get the strongest joining of two sheets metal,
- To prevents the defects in joining two materials especially the neck fracture mode and button separation mode,
- Analyze the suitable parameters for punch and die.

1.5 PROJECT SCOPES

To achieve the projects objectives, all the parameters that involve in improvement of interlocking thin sheet metal such as the diameter of die, the diameter of punch and the thickness of the sheets must be emphasis. This is very important because it's affected the strength of joined materials. Moreover, few tests must be run to observe the strength in joining two sheets metal such as impact test and tensile test.

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