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Design and Analysis of Compound Die for Tractor Weight Box

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Abstract – *The compound die was used in the industry for the production of different components for the automobile parts in the industry. The study deals with the design and analysis of the compound die for the manufacturing of the components for the tractor weight box in the manufacturing industry. The study deals with the operation of a single stroke where pressing tool can be used for punching and piercing operations. After analysis, the right hand corner of the compound die showed the maximum deformation.*

I- INTRODUCTION

Many industries use sheet metal cutting as a major production step. Nowadays, its importance has become more pronounced due to the advancement in technology. Dies are generally customized to the item they are used to produce which range from simple paper clips to complex pieces used in advanced technology. Compound dies are widely used in sheet metal industries for the manufacturing of pierced blanks with good accuracy. To carry out tasks efficiently and productively, industries demand high-quality compound dies with a long life. Two or more than two operations can be performed in compound dies and are thus more complex compared to other sheet metal dies such as progressive, bending, drawing, etc. It involves various components such as punches, strippers, die sets, die blocks, knockout bars, dies gauge, etc. Therefore, Die design is a complex subject and a large part of tool engineering. Thus the design of dies is done considering key thumb rules and past experiences of the people working in the industry. Notching is a cutting methodology throughout that a tinny scrap piece is eliminated from the skin fringe of a work material. Notching is usually operated by hand, low-production method. A die could be a special tool employed in producing industries to cut or form. Products produced with dies vary from easy paper clips to advanced items employed in advanced technology. S.B. Gaikwad et al [1] mainly focus on combining pressing and piercing operations which are done separately. Compound die operations are performed to increase the production rate, reducing the production cost and the time cycle from 30 to 40 sec using suitable design. Pawan Kumar Rai et al [2] discussed the imperfections such as burr formation that are common in the sheet metal industry which after a specified limitit takes the form of

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defect. So, for reducing this defect the authors suggested that the flatness of the block should be maintain in 0.02 – 0.05 mm, punch should guide in stripper plate in case of piercing, all dowel holes should be reamed. Gaurav C. Rathodet.al [3]develop a press tool for piercing and notching made for sheet metal component. It shows a study of static analysis of the punch. They also discuss a detailed study of various materials to be used for different components of the die, depending upon their importance, the efficiency of the die and the various factors affecting them .M Subramanian et al[4] focuses on the designing of press tool to be used in the production of the stay bracket, also modeling of the components such as die block, stripper, bottom plate, top plate, blanking punch and analyzing the stress and deflection on the components. It was found that the results of FEM and analytical are in acceptable range. N. Jyothirmayiet al [5] presented the design and fabrication of a compound die that combines blanking and piercing operations. The combined operations are used to design and develop the hexagonal washer of M15 bolt.The successfully designed die is being currently used in the Metal forming Lab of Chaitanya Bharathi Institute of Technology, Hyderabad.Amit D. Madake, et.al [6] modeled the sheet-metal die and punch for the automotive or consumer appliance industries. The high carbon high chromium (HCHCr) material was used for die and Oil hardening non shrinkage (OHNS) grade was used for making punch. The analysis done by Unigraphics NX-6software and mathematical analysis were nearly found suitable for the punch and die.Sachin Jadhav, et.al [7] studied the sheet metal forming problems are typical in nature since they involve geometry, boundary and material non-linearity. Drawings part involves many parameters like punch and dies radius, clearance, lubrication, blank holding force and its trajectories etc. So designing the tools for part drawing involves a lot of trial and error procedure. Vishwanath M.C, et.al [6] discussed the selection of any multi-operation tool, such as progressive die or combination Die, is justified by the principle that the number of operations achieved with one handling of the stock and produced part is more economical than production by a series of single operation dies and a number of handling for each single die.

II -DESIGN OF PARTS

2.1 : Design of Press tool

Fig.1: Front view of press tool

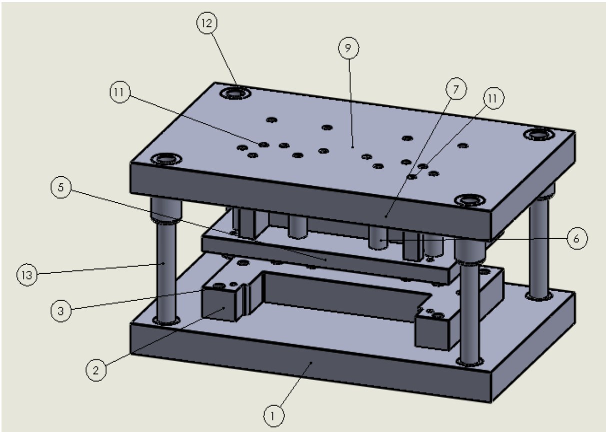

Fig.2: Dimensions of Die

ITEM NO.	PART NUMBER	QTY.
1	BOTTOM PLATE	1
2	DIE PLATE	1
3	die bolt	9
4	dowel fixed	2
5	STRIPPER PLATE	1
6	PU BUSH	8
7	punch assembly	1
8	piercing punch	2
9	TOP PLATE	1
10	bolt pu bush	8
11	punch bolt	8
12	PILLAR BUSH	4
13	PILLAR	4

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Table: 2.1: Dimension of press tool components

Part No.	Part Name	Dimensions
1	Base plate	310 x 300 x 55
2	Guide pillar	Ø30mm Length 270 Fillet R2
3	Die 1	55mm thick
4	Die 2	55mm thick
5	Stripper plate	269 x 149.66 x 20
6	Rectangular guide pins	129.55 x 25 x 50
7	Top plate	310 x 310 x55
8	Punch plate	269 x 149.66 x 20
9	Punch 1	93.7 x 113.41 x 20
10	Punch 2	Length = 93.7 thickness = 20
11	Punch plate elevator	269 x 149.66 x 20
12	Guide bush	OD = 50 ID = 30 Length = 100 Fillet = R2
13	Locking screw	M8 Length = 100
14	Die locking pins	Length = 36 Head Ø = 11 Thread = M8

III -STRUCTURAL ANALYSIS OF PRESS TOOL

3.1 Total deformation:-

It is defined as the square root of the sum of squared stretching deformation and squared shearing deformation, is an invariant independent of the coordinate system used.

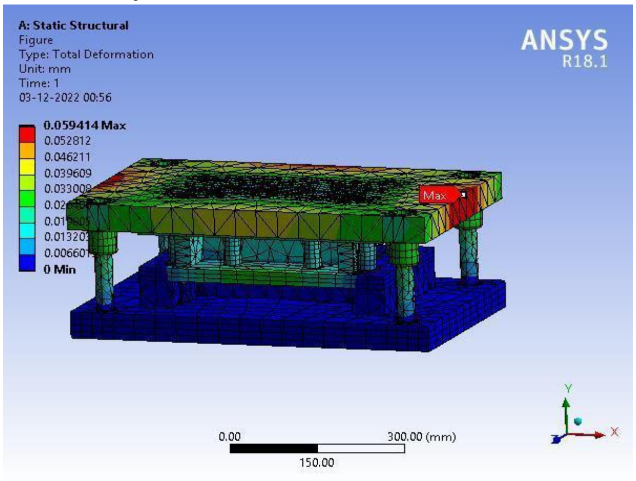

Fig.3: Total deformation

3.2 Equivalent stress :-

Equivalent stress is widely used to represent a material's status for ductile material. Engineers use this simple scalar value to determine if the material has yield or failed.

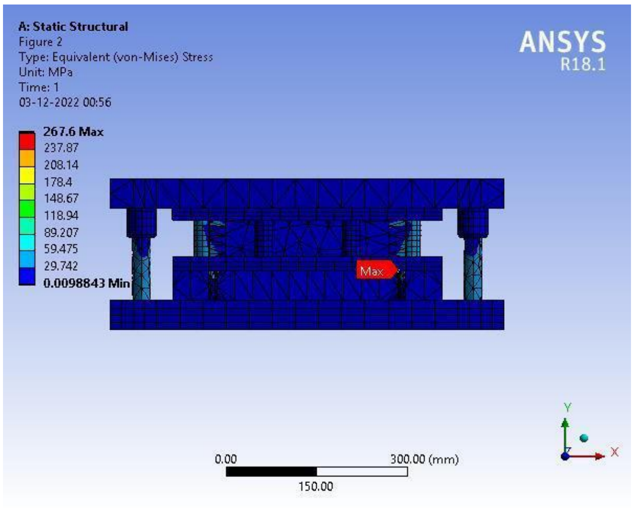

Fig.4: Equivalent stress

3.3 Maximum and minimum principal stress

The maximum principal stress failure predictor (MPSFP) design rule (Samuel and Weir, 1999) states that if a component of brittle material is exposed to a multi axial stress system, fracture will occur when the maximum principal stress anywhere in the component exceeds the local strength. The minimum amount of normal stress acting on the main plane is called the minimum principal stress.

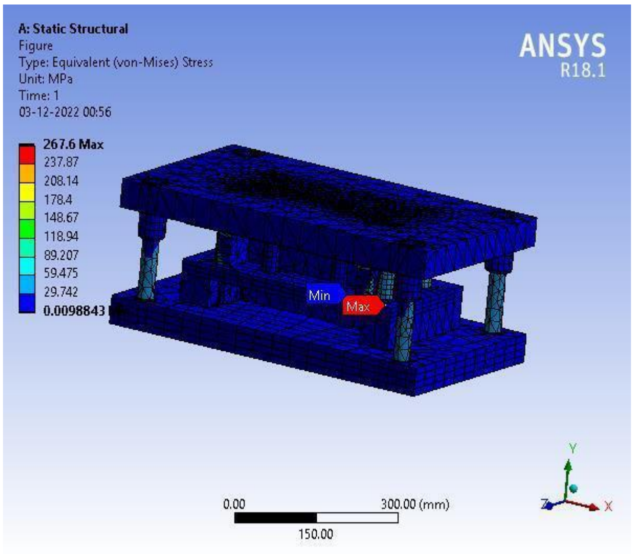

Fig.5: Maximum and minimum principal stress

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IV- CONCLUSIONS

1) The maximum total deformations are5.9414e-002 and maximum and minimum equivalent stresses are 9.8843e-003 MPa and 267.6 MPa respectively.
2) The deformation is highest in the right hand corner of the punch.
3) After simulation the compound die is used in 5S industries, MIDC, Hingna, Nagpur.

REFERENCES

[1] *GaikwadShital, SonawaneJyoti, KalamkarKamini, Kale Aditya,Design And Development of Compound Die, Proceedings of Second Shri Chhatrapati Shivaji Maharaj QIP Conference on Engineering Innovations Organized by Shri Chhatrapati Shivaji Maharaj College of Engineering, Ahmednagar In Association with Novateur Publications JournalNX-ISSN No: 2581-4230 February, 2019,pp.405 -408.*

[2] *RaiPawanKumar ,Aas Mohammad , HasanZakirJafri,Causes &Preventation of Defects (Burr) In Sheet Metal Component, International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 ,Vol. 3, Issue 4, Jul-Aug 2013, pp. 511-515.*

[3] *RathodGaurav,Raut. D. N,AdlingeSamadhan, Study and Analysis of Press Tool Design,International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181,Vol. 6 Issue 07, July – 2017,pp.40-45.*

[4] *M Subrahmanyam and A Mokhalingam, Design and Analysis of Press Tool to Produce Radiator Stay Bracket, International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181, Vol. 5 Issue 06, June-2016, pp.829-835.*

[5] *N. Jyothirmayi and B. V. S. Rao, The design and fabrication of a compound die to make hexagonal washer, International Journal of Mechanical and Production Engineering Research and Development (IJMPERD) ISSN (P): 2249-6890; ISSN (E): 2249-8001 Vol. 9, Issue 4, Aug 2019, pp.517-528.*

[6] *MadakeAmit , NaikVinayak , KulkarniSwapnil , Development of a Sheet-Metal Component with a Forming Die Using CAE Software Tools (Hyper form) For Design Validation and Improvement,International Journal of Modern Engineering Research (IJMER) , ISSN: 2249-6645,Vol. 3,Issue. 3,2013, pp-1787-1791.*

[7] *JadhavSachin, MoreSunil, KulkarniSwapnil, Die design for formed component using inputs from FEA for determining the most suited values for the design/ process parameter,International Journal of Advanced Engineering Research and Studies E-ISSN2249–8974,2014,pp.84-85.*

[8] *Vishwanath M.C, Dr.Ramni, Sampath Kumar L ,"Design of progressive draw tool", International Journal of Scientific and Research Publications, Volume 3, Issue 8, August 2013 ,1 ISSN 2250-3153.*