Analysis of Die and Punch used for Deep Drawing Operation using F.E.A for Daulat Industries, Gaddi Godam, Nagpur

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Abstract— In this paper, in a deep drawing operation carried in Daulat Industries, Gaddi godam, Nagpur. It involves the analysis of Die and Punch used for deep drawing operation. The objective of the project is to design and analyses the die and punch used for deep drawing operation, to determine the part specification as it can bear the load of 50kg, to determine the blank size, to simulate the deep drawing operation, to increase the quality of product. This project involved gathering of functional and structural requirements of Die and Punch used for deep drawing operation, Finite element Modelling, Finite Element Analysis. The result is explained on the basis of a comparative analysis of probable designs.

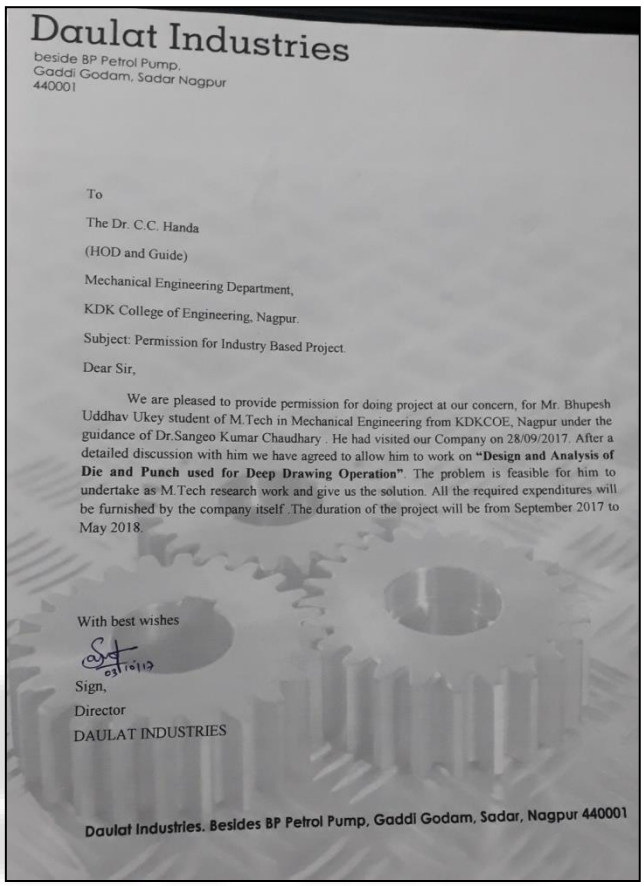
Key words: Die, Punch, F.E.A

I. INTRODUCTION

Sheet metal fabrication plays an important role in the metal manufacturing world. Sheet metal is used in the production of materials ranging from tools, hinges, to automobiles etc. Sheet metal fabrication ranges from deep drawing, stamping, forming, and hydro forming, to high-energy-rate forming (HERF) to create desired shapes.

During drawing of sheet into the die, there is thickening of the sheet upto 12%. Therefore, clearance is provided between the punch and die. The radial clearance therefore is equal to the sheet thickness plus the thickening of sheet.

Punch pushes the bottom of the sheet into the die cavity. The flat portion of the sheet under the holding plate moves towards the die axis, then bends over the die profile. After bending over the die profile the sheet unbends to flow downward along the side wall.



Daulat Industries
beside BP Petrol Pump,
Gaddi Godam, Sadar Nagpur
440001

To
The Dr. C.C. Handa
(HOD and Guide)
Mechanical Engineering Department,
KDK College of Engineering, Nagpur.

Subject: Permission for Industry Based Project.

Dear Sir,

We are pleased to provide permission for doing project at our concern, for Mr. Bhupesh Uddhav Ukey student of M.Tech in Mechanical Engineering from KDKCOE, Nagpur under the guidance of Dr.Sangeo Kumar Chaudhary . He had visited our Company on 28/09/2017. After a detailed discussion with him we have agreed to allow him to work on **"Design and Analysis of Die and Punch used for Deep Drawing Operation"**. The problem is feasible for him to undertake as M.Tech research work and give us the solution. All the required expenditures will be furnished by the company itself .The duration of the project will be from September 2017 to May 2018.

With best wishes

Sign,
Director
DAULAT INDUSTRIES

Daulat Industries. Besides BP Petrol Pump, Gaddi Godam, Sadar, Nagpur 440001

II. DATA ACCUMULATION

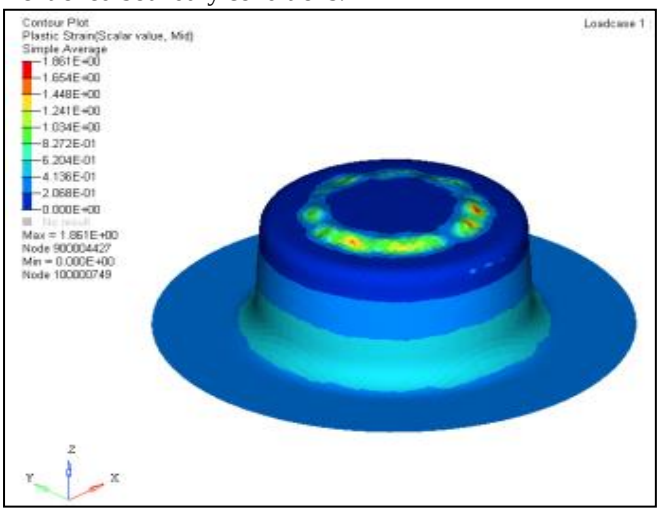
- Cup diameter (d) = 60mm
- Cup height (h) = 31mm
- Cup thickness (t) = 1mm
- 2mm deep feature with 38mm diameter,
- 10mm center hole and 4mm mounting holes can be drilled with drilling machine
- Material specification of product
- yield stress = 275 MPa

GRADE	Tensile Strength Mpa (kg/mm^2) min	ELONGATION (%) MIN. (Guage length 50 mm) Thickness (mm)					
		≥ 0.25 < 0.40	≥ 0.40 < 0.60	≥ 0.60 <1.00	≥ 1.0 < 1.6	≥ 1.6 < 2.5	≥ 2.5
D	275 (28)	32	34	36	37	38	39
DD	275 (28)	34	36	38	39	40	41
EDD	275 (28)	36	38	40	41	42	43

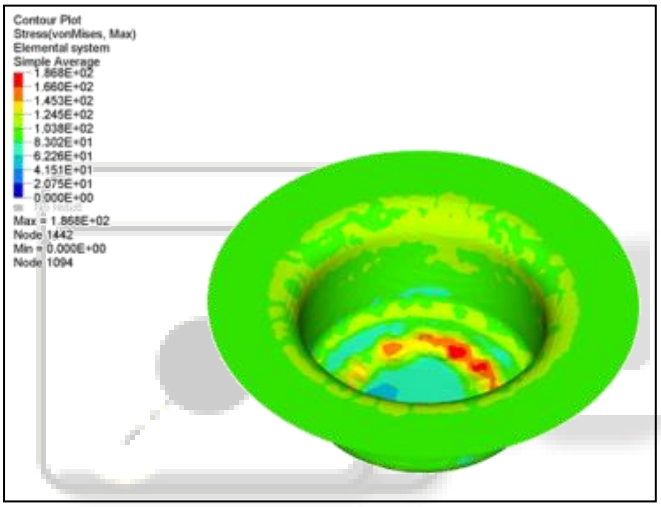
Table 1: Mechanical Properties

III. SIMULATION 1

A Deep drawing simulation is performed with above mentioned boundary conditions:

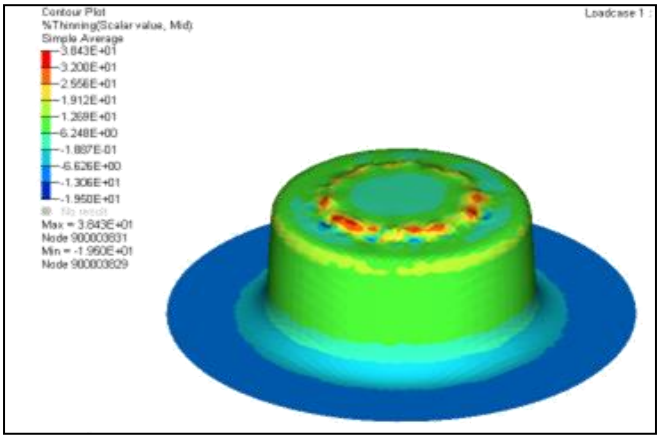


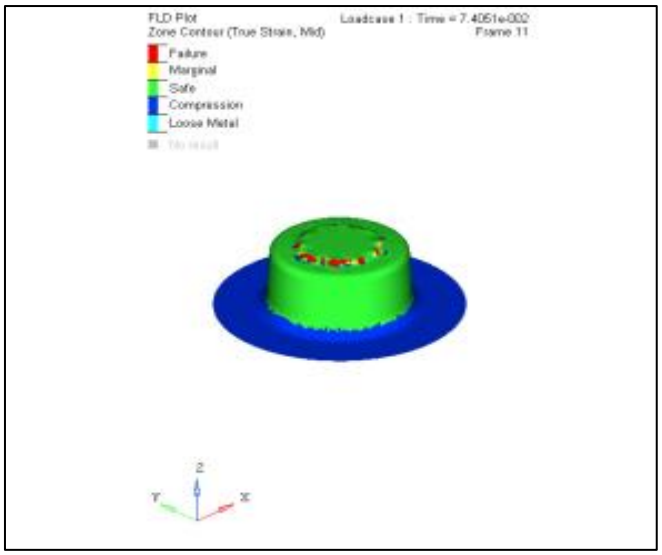
Maximum Strain = 1.8



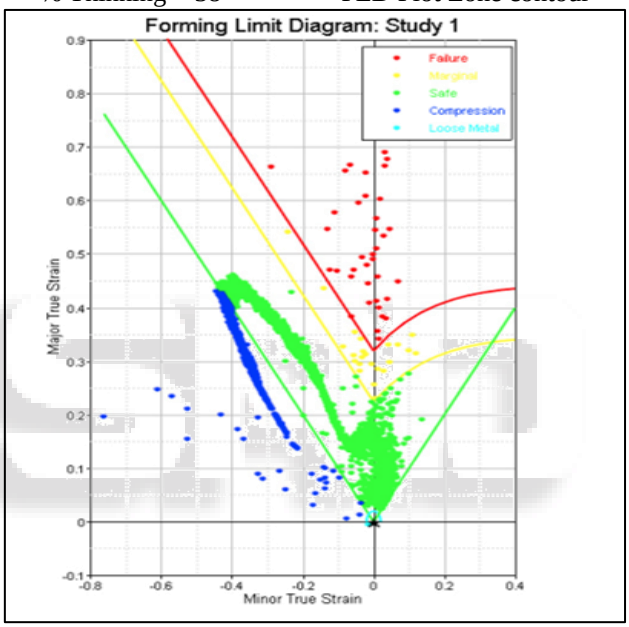
Maximum Stress = 186 MPa

A. *Deep Drawing Simulation 1 Results:*





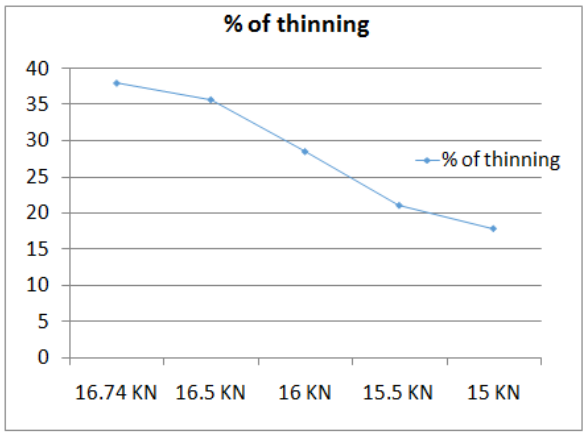
% Thinning = 38 FLD Plot Zone contour



FLD Plot

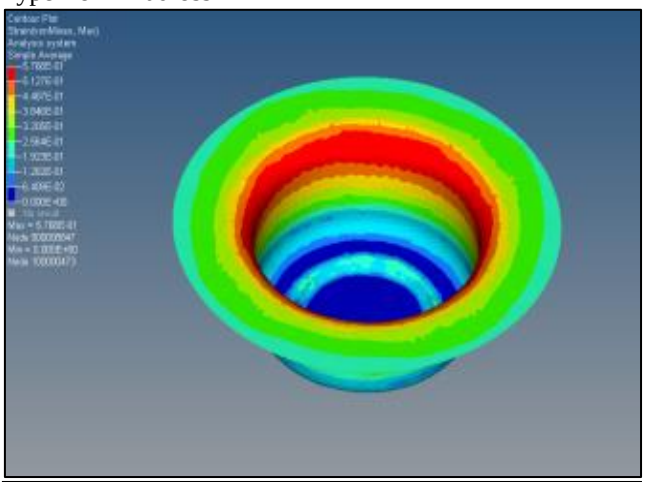
There are several factors affecting the deep drawing process but binder force and punch force are most affecting factors.

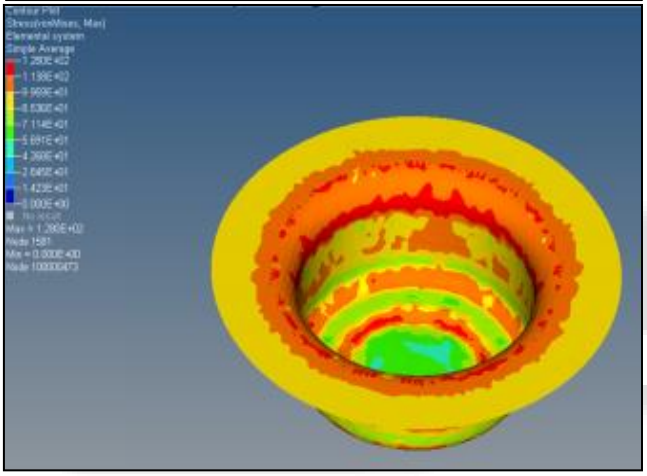
From the simulation 1 we have observed that part is tearing off in final form. By varying these two factors iterative we can achieve desired results.



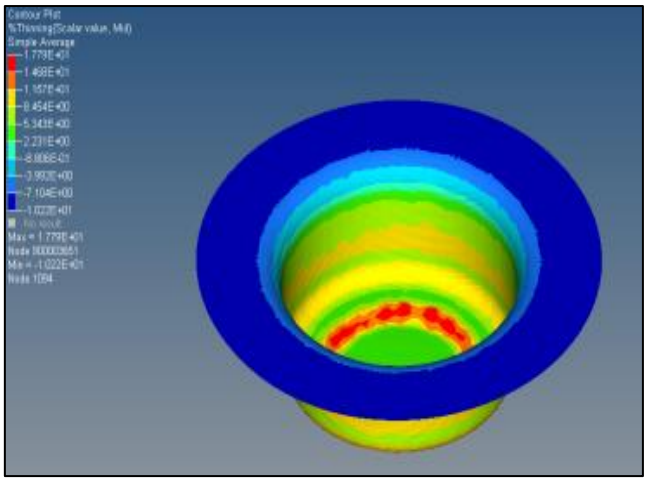
IV. SIMULATION 2

To successfully form the component several iteration was performed. To conduct the study for different coefficient friction, blank holding force and punch speed values as shown in are considered and different study performed with HyperForm Radioss

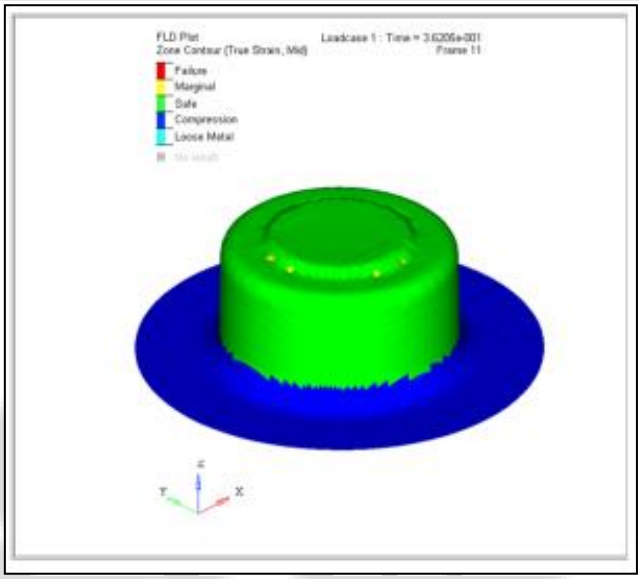




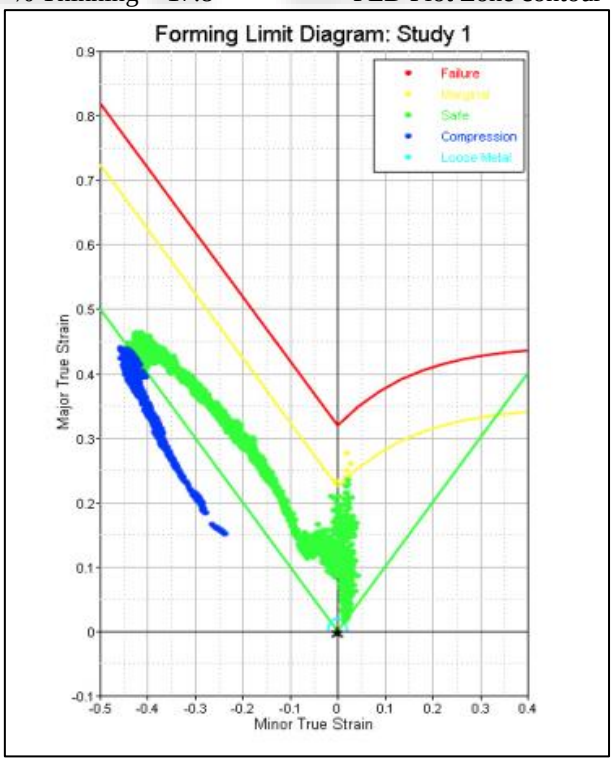
Maximum Strain = 0.5 Maximum Stress = 128 MPa



% Thinning = 17.8



FLD Plot Zone contour



FLD Plot

V. RESULT DISCUSSION

In a Deep drawing process most influencing factors are corner dimensions of the Die and Punch for the final product quality. In this project final dimensions of blank, Die and Punch is carried out by performing design calculations, Cad modeling and Deep drawing simulation. Obtained dimensions are shown below

Parameter	Value
Blank diameter	130 mm
Die corner radius	7.6 mm
Clearance between wall of punch and die cavity	1.22 mm
Nominal die diameter	59.925 mm
Maximum die diameter	60.015
Nominal punch diameter	57.485
Minimum punch diameter	57.425
Blank holding force	15 KN
Draw force	75KN

VI. CONCLUSION

The purpose of this research is to obtain optimal design for die and punchused for deep drawing operationthrough material selection and design criteria of die and punch, environmental conditions for placement, economy and commissioning. For bending and shearing operation they have particular machine but for drawing operation they require die and punch as per the specification of part to be manufactured. They manufactured the punch and die of simple parts but the manufacturing of die and punch for deep drawing operation is very difficult for them due to the lack of CAD and FEA techniques. So it is concluded that in existing process, the material get failed and defect occur in it. So deigned new die and punch by data accumulation, design calculation and to validate it, simulation is carried out.

REFERENCES

[1] S. P. Avadhani , Pratik Phadnis, Nikhil R , SushantPundalikPatil "Design and Analysis of Blanking and Piercing die punch "International Research Journal of Engineering and Technology Volume: 04 Issue: 05 Department of mechanical engineering, GIT, Belgaum, KARNATAKA, INDIA
[2] Vivek D. Barhate, Dr. Sachin G. Mahakalkar, Dr. A. V. Kale "Design and Analysis of Progressive Die for an Industrial Part" International Journal of Science and Research Kruti Institute of Technology & Engineering (KITE), Raipur, Chhattisgarh, India.
[3] TEH SOON CHIANG "DESIGN AND SIMULATION OF DIE AND PUNCH FOR SHEET METAL ON ROUND BENDING" Bachelor of Mechanical Engineering Faculty of Mechanical Engineering Universiti Malaysia.
[4] A Design Calculating System for Deep Drawing Die by Using Simulation Model by KadhimM. Abed, Thi_Qar University Journal for Engineering Sciences, Vol. 2, No. 4
[5] RupaliChavan, NavneetPatil "International Journal of Mechanical and Industrial Technology Design, Development and Analysis of Press Tool for an Industrial Part" S.S.B.T's College of Engineering And Technology, Jalgaon, India
[6] Chandra Pal Singh, GeetaAgnihotri "Study of Deep Drawing Process Parameters: A Review " International Journal of Scientific and Research Publications Research Scholar, Mechanical Engineering, MANIT BHOPAL.
[7] B.V.S.Rao, G. Chandra Mohan Reddy, G. Krishna Mohana Rao, P.V.R.Ravindra Reddy "Numerical Analysis On The Effect Of Various Parameters On Fracture Limit For Deep Drawn Cups", Department of Mechanical Engineering, CBIT, Gandipet, Hyderabad
[8] P.V.R. Ravindra Reddy, B.V.S.Rao, G.Chandra Mohan Reddy, P. Radhakrishna Prasad, G. Krishna Mohan Rao "Studies on Wrinkling and Fracture Limits in Deep Drawing of Cylindrical Cup" Department of Mechanical Engineering, CBIT, Gandipet, Hyderabad
[9] Amir Mostafapur&SattarAhangar& Reza Dadkhah "Numerical and experimental investigation of pulsating blankholder effect on drawing of cylindrical part of aluminum alloy in deep drawing process".
[10] Ch. Mastanamma ,K.Prasada Rao ,Dr.M.Venkateswara Rao, "Design and Analysis of Progressive Tool" Department of Mechanical Engineering, Bapatla Engineering College, Bapatla, Guntur, India.

