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# Design and Analysis of Press Tool for Combining Notching and Piercing Operation

**Prof. Gaurav C. Rathod*, Prof. Vaibhav A. Ajmire, Rajkumar Baghel, Prof. Sumit L.Shinde**

**ABSTRACT:** Press tools are used to produce a particular component in large quantity, out of sheet metals where particular component achieved depends upon press tool construction and its configuration. In this study an attempt is made on to learn the press tool design, materials, manufacturing used for press tool and Design calculations involved in it. In this work, a real time design of a simple Piercing press tool is made along with analysis with different shear angles where the output is a Pierce hole and notch hole. The press machine is of mechanical type of 200 ton. Punch and Dies generally made from steel alloys. Based on carbon composition they are classified in P type, D type, H type. of all D type is having more carbon percentage which indirectly posses more strength. They are mainly used for making of tools. Here the problem statement of project is two combine these two piercing and notching operation. Which is now manufacturing separately i.e. two piercing by one punch and two notching operation with another punch. Based on the static analysis of punches in creo parametric with different shapes we can conclude that the Von Mises Stresses generates for all the punches with radial draft is lowest and also displacement is lowest as compared to other shape of punch. So punch with radial draft is selected for the punch design. Experimental validation is added to the future scope.

**Keywords:** Compound Die, Material Selection, Die Design, Modeling, Cost Estimation, Static Analysis of Punch

## 1. INTRODUCTION:

Metal forming is one of the manufacturing processes which are almost chip less. These operations are mainly carried out by the help of presses and press tools. These operations include deformation of metal work pieces to the desired size and shape by applying pressure or force. Presses and press tools facilitate mass production work. These are considered fastest and most efficient way to form a sheet metal into finished products. Here the problem statement of project is two combine these two piercing and notching operation. Which is now manufacturing separately i.e. two piercing by one punch and two notching operation with another punch

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*Prof. Gaurav C. Rathod*, Prof. Vaibhav A. Ajmire, Rajkumar Baghel, Prof. Sumit L.Shinde*
*gcrathod@vishwaniketan.edu.in*

*Mechanical Engineering Department Vimeet, Khalapur*

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Fig 1.Nothing Punch

Fig 2.Piercing Punch

**Types of Dies:-**

Dies are classified by type of operation perform & by type of construction of die.

1. **According to operation dies are classified as below:-**

a) Cutting Dies:-Blanking die, Piercing die, shaving dies , slitting dies, lancing dies, cropping dies, Trimming dies, notching dies etc.
b) Forming Dies:-Bending Dies, Deep draw, stamping dies , embossing dies, Press breaking dies etc

**2. According to method of operation:-**

a) A simple dies to perform only one operation.
b) Multi operation die -these dies are designed to perform more than one operation in one stroke of ram. These are further classified as below.
   1. Compound Die
   2. Combination Die
   3. Progressive Die
   4. Transfer Die

**1. Compound Dies:-**

It is the die in which two or more than two operations may be completed at one station (cutting operation).This die is considered as cutting dies in which different operations like piercing & blanking will take place at one station. This die is more accurate & economically in mass production .Normally for this type of die & its operation carried out on mechanical press. e.g. Clutch plates, Washer etc

**2. Combination Die:-**

It is combination die in which more than two operation may be completed at one station i.e. cutting operations and forming operation. e.g. Any cup shaped product (water glass).This die is not too much accurate & economical in mass production.

**3. Progessive Die:-**

Progressive die has series of station at each station one operation on work piece within one stroke of press machine & each time metal strip is transfer to next station. e.g. Washer (piercing operation at one station and blanking operation at next station).

**4. Transfer Die:-**

Unlike progressive die the metal strip is feed progressively from one station to another. In transfer die the already cut blanks are feed mechanically from one station to next station. e.g. Bicycle chains , Carburetors hole etc.

**Principle of metal cutting (mechanics of shearing):-**

The cutting of sheet metal in press work is shearing process. Punch is same shape of the die opening but the gap between the punch and die called as clearance . As punch apply pressure on metal strip then material enters into die cavity at that time material is subjected to both tensile and compressive stresses when it crosses elastic limit then after 1/3rd (one third) of material thickness then this material get fracture this only possible by providing optimum clearance between punch and die .If there is no optimum clearance then instead of fracture material will get bend. So their is need to provide optimum clearance between punch and die.

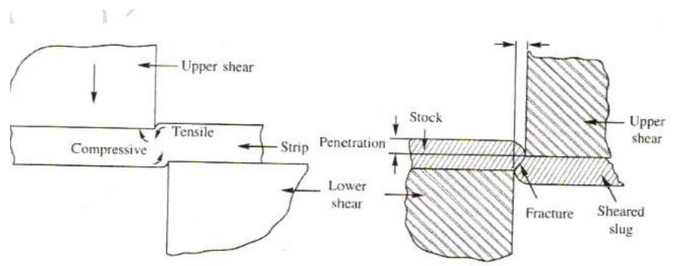


Fig 3 mechanics of shearing

**2. LITERATURE REVIEW:**

Vishwanath M.C - 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[4].

The tool wear curve obtained by Högman shows the relationship between tool wear and punch- die clearance. Fig4. shows that there is an optimal cutting clearance that gives the least tool wear for a given sheet material and thickness[5].

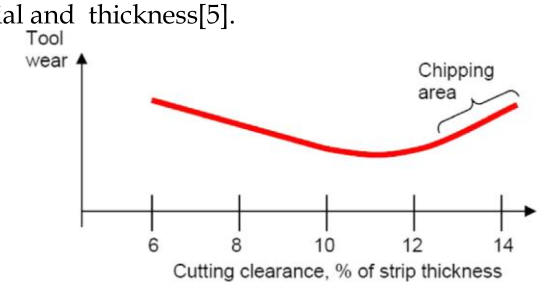


Fig. 4. Relationship between tool wear and punch die clearance obtained experimentally when blanking Docol 1400DP,1mm thick by Högman[5].

S.Y.Luo explains Back Pressure Plates are required if the pressure on punch exceeds 245N/mm² and also used if the punch diameter is less than four times the stock thicknessThe casting simulation technology has sufficiently matured and h

Subramanyam Pavuluri Stress analysis enables the designer to efficiently validate quality, safety, performance of the designed product. By using the

SOLID WORKS software the analysis is performed. In this software itself gets own parameters if we input the pressure value, selection of material [5]. The result is:

- The part deforms in displacements
- The product is static and constant over time
- The constant stress strain relationship in material.

## 3. MATERIAL SELECTION:

Press tools are generally made using HCHCr, Steel alloys with high carbon. But before that based on many factors like cost, strength, hardness, strain and many parameters selection should be made. The materials used are generally selected are D2,EN31.Mild Steel is used as supporting plate. Apart from that materials like D3, high carbide materials, chromium steels and high speed steels are also used.

**D2 STEEL:** This alloy is one of the Cold Work, high carbon, high chromium type tool steels. D2 is a deep hardening, highly wear resistant alloy. It hardens upon air cooling so as to have minimum distortion after heat treatment. Used for long run tooling applications where wear resistance is important, such as blanking or forming dies and thread rolling dies.

Table 1 Shows Material properties for different plates

| Sr.no | Description of Item | Material Selected |
|---|---|---|
| 1 | Punch & Die Block | D2 steel |
| 2 | Stripper | Cold rolled mild steel |
| 3 | Die Back Plate | Oil hardened steel |
| 4 | Punch Back Plate | Oil hardened steel |
| 5 | Guide Pillars & Bushes | Carbon Steel & Hardened ground steel |
| 6 | Punch Holder | Mild Steel |
| 7 | Top &Bottom Plate | Mild Steel |
| 8 | Allen Key Bolts | Mild Steel |

## 4. DESIGN CALCULATION:

**Force Calculation:-**

The plate is 10mm thickness in which two piercing hole and two notch of same profile has to be cut in one stroke of ram.

The dimension of profile is shown below.

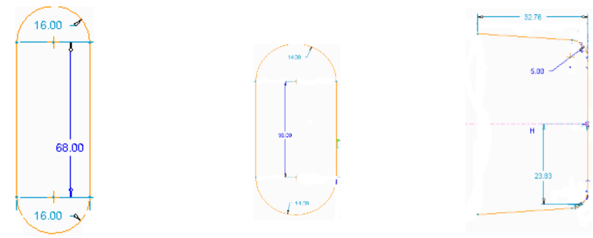


Fig: 5 Pierced hole 1 , Pierced hole 2 , Notches 1 & 2

**Pierced hole 1:-**

**perimeter**=2x68+2πR=2x68+2πx16=**236.53mm,**

**Cutting force**=perimeter x thickness of raw matl. x shear strength of matrl.=236.53 (mm) x 10 (mm) x28.28 (kg/mm2)=**66.89 ton,**

**Stripping Force** (50% of cutting force maximum)=**33.44 ton**

**Total Cutting force for Pierced hole 1**= Cutting force + Stripping Force =66.89 + 3.44= **100.35 ton**

**Pierced hole 2:-**

**perimeter**=2x36+2πx14=**160mm**,

**Cutting force=45.23 ton**,

**Stripping Force** (50% of cutting force maximum)= **22.31 ton**

**Total Cutting force for Pierced hole 2**= Cutting force + Stripping Force =45.23+22.31=**67.84 ton**

**Notches 1 & 2:-**

**Perimeter**=50+2x32.76=**115mm**,

**Cutting Force=32.5ton**,

**Stripping Force=16.02 ton**

**Total Force** =32.5+16.02=48.71x2=**97.52 ton**

So,

The total force required =100.33+67.84+97.52

=**265 ton**

## 5. DIE DESIGN & MODELLING:

1.Die Thickness=$\sqrt[3]{}$(cutting force) =$\sqrt[3]{}$(265)=64mm

2.Stripper thickness= 0.5die thickness + thickness of raw matl. =42mm

3.Die Back Plate thickness= 0.5stripper thickness=21mm

4.Bottom plate thickness=1.5 x Die thickness=96mm

5.Punch holder thickness=stripper thickness=42mm

6. punch back plate thickness = 0.5 stripper thickness=21mm

7.Top plate thickness=1.25 x Die thickness=80mm

8. **No. of bolts & Sizes**:-

Size of bolt=dc

Stripping force=π/4 $dc^2$ x n x shear strength of bolt

n= no. of bolts required

shear strength of bolt=55 to 56 kg/mm2 for mild steel & bolts are made from mild steel

n=8

132.5 x 1000= $\pi/4\ dc^2$ x 8 x 56

dc=19.4mm

so choose the bolt of M18

**9**. Minimum wall thickness=1.5dc+10=37mm

**Top Plate & Bottom Plate**: - Both are thick plate which is used for supporting other die element .The bottom plate which is fixed at bottom of the press tool & it is used for clamping press tool on machine tables.

The Top Plate which is attached at of top of press tool and it is to clamp the press tool to the ram of the machine. Both plate are used for locating & supporting the die assembly

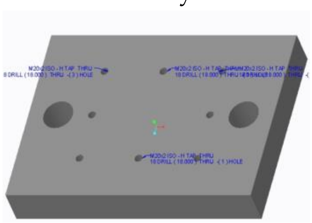

**Fig: 6 Top Plate**

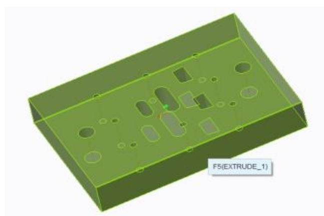

**Fig: 7 Bottom Plate**

**Back Plate (Die & punch):-**

These are also called as pressure plate .Both are placed so that the intensity of pressure does not became more on punch holder as well as die. Both plates distributes the pressure over wide area & so that the intensity of pressure on punch as well as die plate can be reduced (Reduce cutting forces).

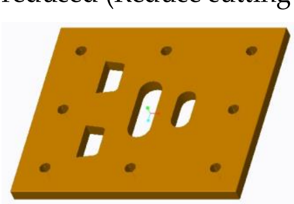

**Fig: 8 Die Back Plate**

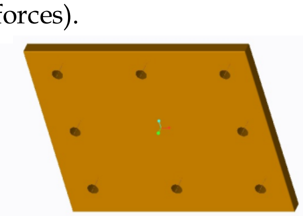

**Fig: 9 Die Back Plate**

**Die Plate & Stripper**:-

Die plate:-It is the female part of the press tool. It contains die cavity for required component.

Stripper:-It is a plate mounted over the die plate the main function of stripper as follows

1. To guide raw material strip.
2. It also guide sheet & punch.
3. To remove the stock from punch after piercing or blanking etc operation.
4. To hold proper stock in cutting or forming operations

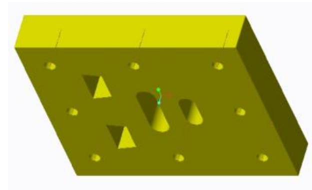

**Fig: 10 Die Plate**

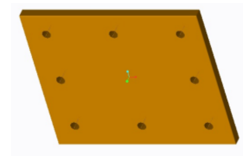

**Fig: 11 Stripper**

**5. Punch & Punch holder**:-

**Punch:-**A punch is a male member of complete die which mates or acts in conjunction with the female die to produce a desired effect upon the material being worked.

**Punch holder:-**For mounting punch by screw or inserting or providing a slots.

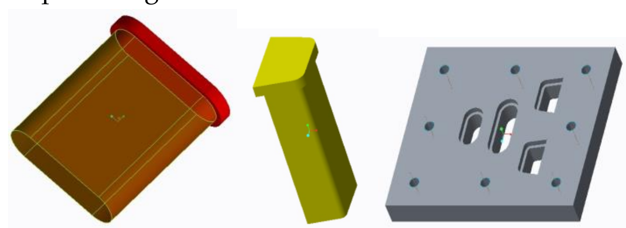

**Fig: 12 Pierce punch, notch punch Punch holder**

**6. Guide pillars and guide bushes**:-

These elements of die are responsible for the alignment of the lower and upper part of the die. It should withstand deflection during continuous production. Standard dimensions of these parts are used so that manufacturing would not be a problem when these are available in the market.

**Fig: 13 Guide pillars , guide bushes, Allen key**

**7.Other elements are**:-

I. Stopper :- To stop the strip
II. Pilot:-Used for guiding the punch
III. Feeder:-It is used for feed the metal strip into press tool by manually or automatic.

**8.Assembly:-**

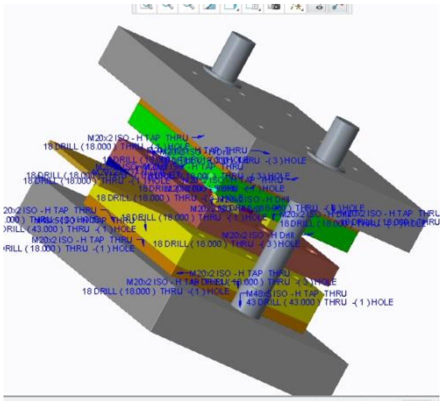

**Fig: 14 Assembly**

## 6. COST ESTEEMATION:

| Sr.no | Material | Cost per Kg (Rs) |
|---|---|---|
| 1 | D2 steel | 250 |
| 2 | Cold rolled mild steel | 120 |
| 3 | Oil hardened steel | 180 |
| 4 | Oil hardened steel | 180 |
| 5 | Carbon Steel & Hardened ground steel | 150 |
| 6 | Mild Steel | 55 |
| 7 | Mild Steel | 55 |
| 8 | Mild Steel | 160 |

**Die Block:-**

Material Cost=Mass x material cost/kg in Rs

=volume x density x 200

=(0.3745x0.320x0.064x7810) x 200

=60kgx 200

=Rs.1200

Wire cutting cost =Surface area of cutting x wire cutting 20 paise /sq.m =47713.92 x 0.20

=Rs.9543

Grinding Cost=Rs.4000

Drilling Cost=Rs.2000

Hardening Cost=Mass of Material(kg) x Cost of Hardening 100 Rs./kg =60 x 100

=Rs. 6000

Total cost for Die Block=Material Cost +Wire cutting cost + Grinding Cost+ Drilling Cost + Hardening Cost

=1200+9543+4000+2000 +6000=Rs.22743

**Die Back Plate:-**

Cost for Die Back Plate =Material Cost + Wire cutting cost + Grinding Cost + Drilling Cost + Hardening Cost

=(20x180)+(16737x0.2)+4000+2000 +2000=Rs.14947

**Bottom Plate:-**

Cost for Bottom Plate =Material Cost +Wire cutting cost +Grinding Cost+ Drilling Cost + Hardening Cost

=(182x55)+ (797x96x0.2) + 4000 + 3000+(182x100)

=Rs.50513

**Stripper Plate:-**

Cost for Stripper Plate =Material Cost +Wire cutting cost + Grinding Cost+ Drilling Cost + Hardening Cost

= (20x180)+(745.53x0.2)+4000+2000+2000=Rs.11750

**Stock Guide:-**

Cost for Stock Guide=Material Cost + Drilling Cost + Hardening Cost = (5.66x55) + 1000=Rs.1622

**Punches:-**

Cost for Punches =Material Cost + Wire cutting cost +Grinding Cost +Hardening Cost

=(10.5x200)+(80128x0.2)+8000+1050

=Rs.25286

**Punch Holder:-**

Cost for Punches =Material Cost + Wire cutting cost+ Grinding Cost+ Drilling Cost + Hardening Cost

=(20x55)+(14217x0.2)+4000+2000+2000 =Rs.11944

**Punch Back Plate:-**

Cost for Punch Back Plate =Material Cost +Grinding Cost + Drilling Cost=(20x180)+4000+2000=Rs.9600

**Top Plate:-**

Cost for Top Plate =Material Cost +Grinding Cost + Drilling Cost=(152x55)+4000+3000=Rs.15360

**Guide Pillars:-**

Cost for Guide Pillars =Material Cost + Grinding Cost =(30x180)+2000=Rs.7400

**Allen Key Type Bolt:-**

Cost of Allen Key Type Bolt=Material Cost

=Rs.3621

**So, The Total Cost Required for Press tool Design(approximately) =Rs.1,74,786/-**

## 7. RESULTS AND DISCUSSION:

### I. Methods of Reducing Cutting Force

For this, two methods are generally used: shear and staggering of punches.

1. **Shear**: The working faces of the punch or die are ground off so that these don't remain parallel to the horizontal plane but are inclined to it. This angle of inclination is called shear. This has the effect of reducing the area in shear at any one time and maximum force is much less. It may reduce by as much as 50 %.Wherever possible, double shear should be used so that the two shear faces neutralize the side thrusts which each sets up.

If the shear is quite big , say 2t or 3t, then the cutting edges of the tools will become too acute and liable to break away easily. However the shear must be at least equal to the percentage penetration.

2. **Staggering of punches**: As an effect similar to shear can be obtained by staggering two or more punches that all operate in one stroke of press. The punches are arranged so that one does not enter the material until the one before it has penetrated through. In this manner the cutting load may be reduced approximately 50 percent.

Calculation of Actual Reduced Force by Giving the Shear on Punches:-

When shear is provided on punch or die, then

Punch travel = K x t + Amount of shear ( I)

Where I = total inclination or shear on punch or die

Work done = F x { Kt + I},

Where F is the actual cutting force and it will be less than Fmaximum .

Since work done remains the same, therefore we have F x { Kt + I}= Fmaximum x Kt

Or I =(Fmaximum - F) x Kt/F

and F =(Fmaximum x Kt)/( Kt + I)

The above is true for single and double shear.

When Shear of t/3

F=(265x0.3x10)/(0.3x10+3.33)=125.59ton

when shear of 5mm

F=(265x0.3x10)/(0.3x10+5) =99.37 ton

when Shear of of 10mm

F=(265x0.3x10)/(0.3x10+10) =65 ton

when Radial Shear

F=(265x0.3x10)/(0.3x10+1.5)=176.66ton

## II. Analysis for Punch:-

By using the Creo Parametric software analysis is performed. In this software it we put the input force value, selection of material.

The result is:

Von Mises stresses.

Displacement magnitude fringe.

Principle stress vector.

**Pierced hole1:-**

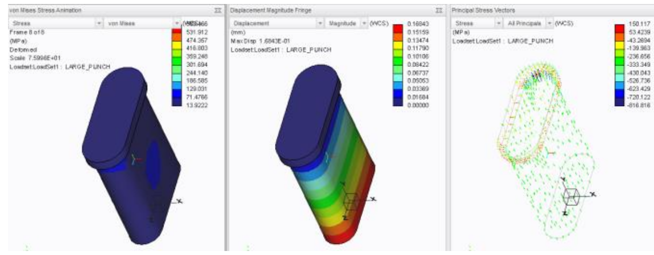

Fig. 15 shows Von Mises stresses, Displacement magnitude fringe, Principle stress vector generated in punch without any shear.

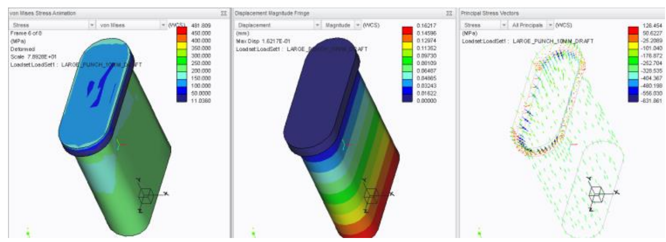

Fig. 16 shows Von Mises stresses, Displacement magnitude fringe, Principle stress vector generated in punch with 3.33mm shear.

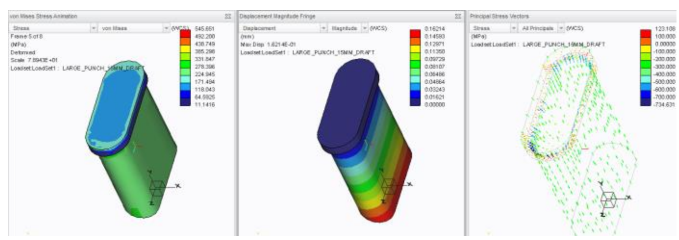

Fig. 17 shows Von Mises stresses, Displacement magnitude fringe, Principle stress vector generated in punch with 5mm shear.

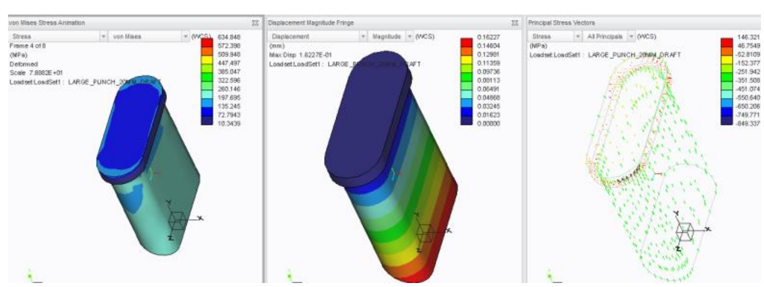

Fig. 18 shows Von Mises stresses, Displacement magnitude fringe, Principle stress vector generated in punch with10mmshear

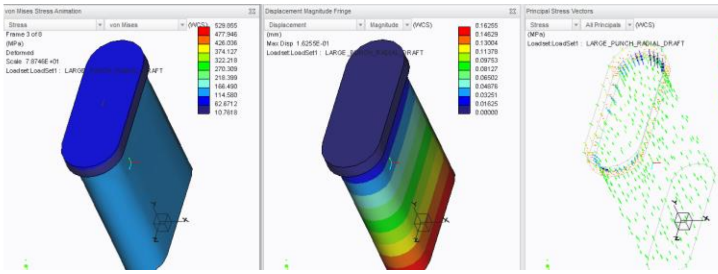

Fig. 19 shows Von Mises stresses, Displacement magnitude fringe, Principle stress vector generated in punch with radial shear.

Table 2 shows Von Mises stresses generated in large punch with different shear

| sr. no | punch with 3.33mm shear | force in ton | punch with 5mm shear | punch with 10mm shear | punch with radial shear | Plain punch |
|---|---|---|---|---|---|---|
| **1** | 481.809 | 84 | 545.65 | 634.84 | 529.85 | 589.46 |
| **2** | 450 | 84 | 492.2 | 572.94 | 477.94 | 531.91 |
| **3** | 400 | 84 | 438.74 | 509.94 | 426.03 | 474.35 |
| **4** | 350 | 84 | 385.29 | 447.49 | 374.12 | 416.8 |
| **5** | 300 | 84 | 331.84 | 385.04 | 322.21 | 359.24 |
| **6** | 250 | 84 | 278.39 | 322.59 | 270.3 | 301.69 |
| **7** | 200 | 84 | 224.94 | 260.14 | 218.39 | 244.14 |
| **8** | 150 | 84 | 171.49 | 197.69 | 166.49 | 186.58 |
| **9** | 100 | 84 | 118.04 | 135.24 | 114.58 | 129.03 |
| **10** | 50 | 84 | 64.59 | 72.79 | 62.67 | 71.47 |
| **11** | 11.036 | 84 | 11.14 | 10.34 | 10.76 | 13.92 |

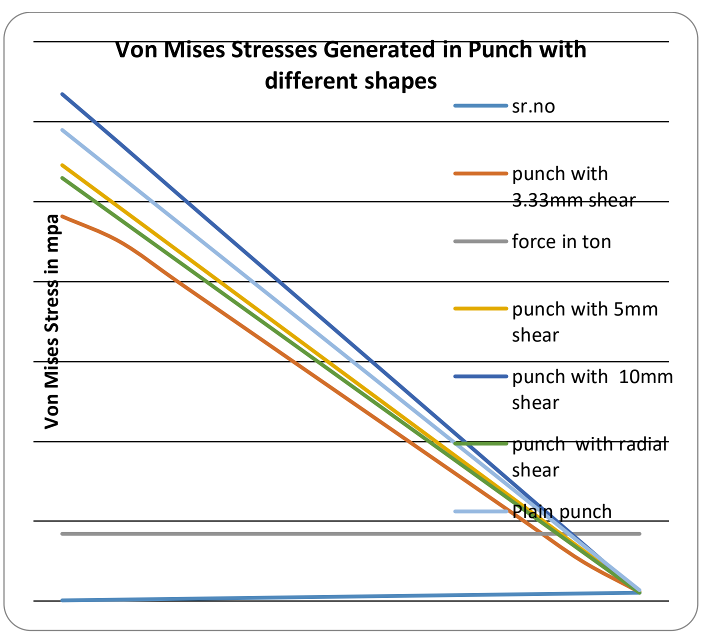


Fig. 20 Graph shows Von Mises stresses generated in large punch with different shear

Table 3 shows displacement generated in large punch with different shear

| sr.no | punch with 3.33mm shear | force in ton | punh with 5mm shear | punch with 10mm shear | punch with radial shear | Plain punch |
|---|---|---|---|---|---|---|
| 1 | 162 | 84 | 162 | 162 | 162 | 168.43 |
| 2 | 145 | 84 | 145 | 146 | 146 | 151.59 |
| 3 | 129 | 84 | 129 | 129 | 130 | 134.74 |
| 4 | 113 | 84 | 113 | 113 | 113 | 117.9 |
| 5 | 97 | 84 | 97 | 97 | 97 | 101 |
| 6 | 81 | 84 | 81 | 81 | 81 | 84 |
| 7 | 64 | 84 | 64 | 64 | 65 | 67 |
| 8 | 48 | 84 | 48 | 48 | 48 | 50 |
| 9 | 32 | 84 | 32 | 32 | 32 | 33 |
| 10 | 16 | 84 | 16 | 16 | 16 | 16 |
| 11 | 0 | 84 | 0 | 0 | 0 | 0 |

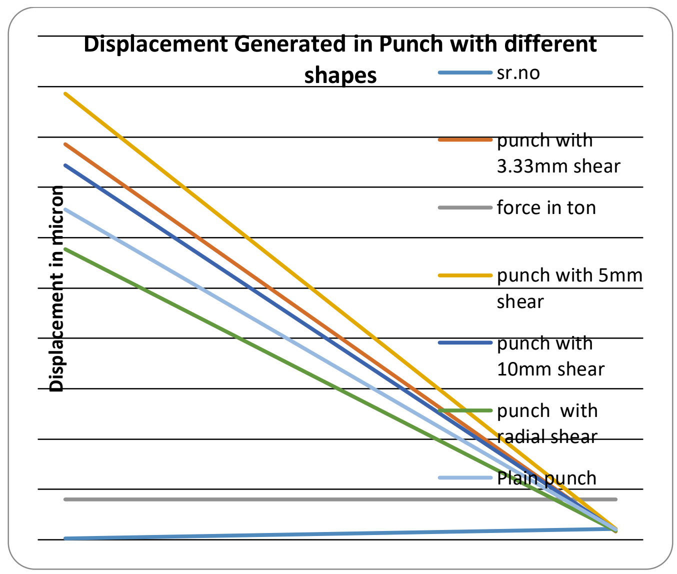


Fig. 21 Graph shows displacement generated in large punch with different shear.

Large punch with 3.33mm shear has lowest Von Mises Stresses as compared to the other shapes of punch However Displacement is too much high as compared to the other shapes of punch. Also the balancing of shear punches as compared to radial shear is difficult. Hence we cannot choose the punch with 3.33mm draft for the design. So the Von Mises Stresses generates in punch with radial shear and displacement is lowest as compared to other shape of punch is selected for the punch design

Similarly static analysis for notch punch and small punch is taken below

**Notch Punch 1&2 :-**

Table 4 shows Von Mises stresses generated in notch punch with different shear.

| sr. no | punch with 3.33mm shear | force in ton | punch with 5mm shear | punch with 10mm shear | punch with radial shear | Plain punch |
|---|---|---|---|---|---|---|
| 1 | 393.051 | 40 | 442.76 | 371.68 | 288.527 | 328.085 |
| 2 | 354.587 | 40 | 399.532 | 335.442 | 260.587 | 296.289 |
| 3 | 316.122 | 40 | 356.305 | 299.203 | 232.647 | 264.494 |
| 4 | 277.657 | 40 | 313.078 | 262.965 | 204.706 | 232.699 |
| 5 | 239.192 | 40 | 269.851 | 226.727 | 176.766 | 200.904 |
| 6 | 200.727 | 40 | 226.624 | 190.488 | 148.825 | 169.109 |
| 7 | 162.262 | 40 | 183.397 | 154.25 | 120.885 | 137.313 |
| 8 | 123.798 | 40 | 140.17 | 118.011 | 92.9441 | 105.518 |
| 9 | 85.3328 | 40 | 96.9426 | 81.7729 | 65.0036 | 73.7231 |
| 10 | 46.868 | 40 | 53.7155 | 45.5344 | 37.0631 | 41.9279 |
| 11 | 8.40318 | 40 | 10.4884 | 9.29603 | 9.12286 | 10.1328 |

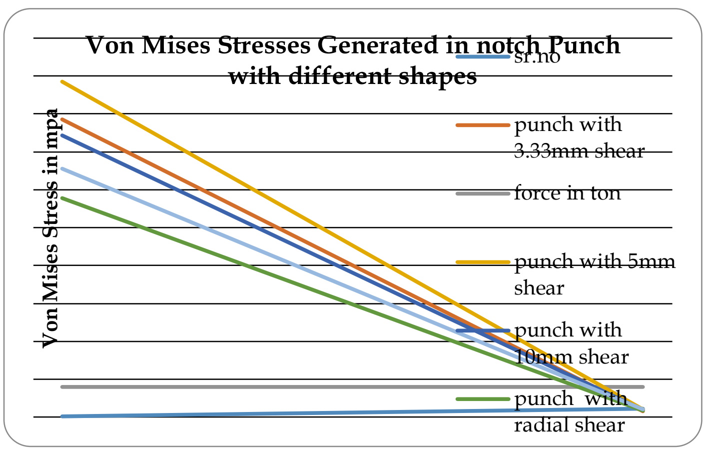


Fig. 21 Graph shows Von Mises stresses generated in notch punch with different shear.

Table 5 shows displacement generated in notch punch with different shear.

| sr. no | punch with 3.33mm shear | force in ton | punch with 5mm shear | punch with 10mm shear | punch with radial shear | Plain punch |
|---|---|---|---|---|---|---|
| 1 | 141.5 | 40 | 141.31 | 141.14 | 141.13 | 164 |
| 2 | 127.35 | 40 | 127.18 | 127.02 | 127.02 | 147.6 |
| 3 | 113.2 | 40 | 113.05 | 112.91 | 112.91 | 131.2 |
| 4 | 99.05 | 40 | 98.91 | 98.8 | 98.79 | 114.8 |
| 5 | 84.9 | 40 | 84.78 | 84.68 | 84.68 | 98.4 |
| 6 | 70.75 | 40 | 70.65 | 70.57 | 70.57 | 82 |
| 7 | 56.6 | 40 | 56.52 | 56.46 | 56.46 | 65.6 |
| 8 | 42.45 | 40 | 42.39 | 42.34 | 42.34 | 49.2 |
| 9 | 28.3 | 40 | 28.26 | 28.23 | 28.23 | 32.8 |
| 10 | 14.15 | 40 | 14.13 | 14.11 | 14.11 | 16.4 |
| 11 | 0 | 40 | 0 | 0 | 0 | 0 |

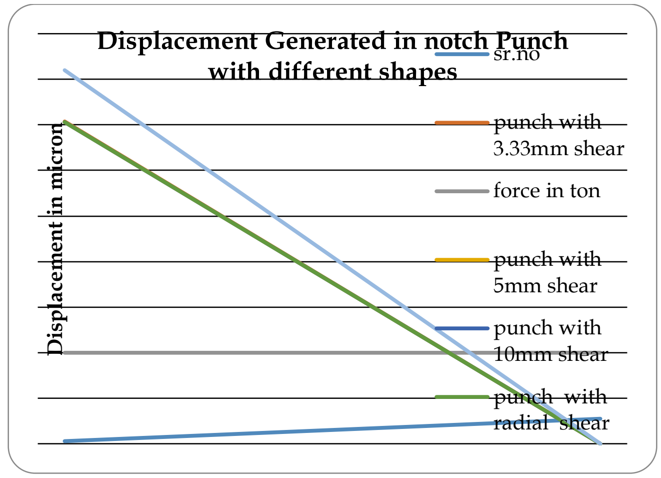


Fig. 22 Graph shows displacement generated in notch punch with different shear

The Von Mises Stresses generates in notch punch with radial draft is lowest and also displacement is lowest as compared to other shape of punch. So punch with radial draft is selected for the punch design.

**Small Punch:-**

Table 6 shows Von Mises stresses generated in small punch with different shear.

| sr.no | punch with 3.33mm shear | force in ton | punch with 5mm shear | punch with 10mm shear | punch with radial shear | Plain punch |
|---|---|---|---|---|---|---|
| 1 | 643 | 56 | 749 | 585 | 571 | 667 |
| 2 | 580 | 56 | 676. | 528 | 515 | 602 |
| 3 | 517 | 56 | 603 | 471 | 460 | 536 |
| 4 | 453 | 56 | 530 | 414 | 405 | 471 |
| 5 | 390 | 56 | 457 | 357 | 349 | 406 |
| 6 | 327 | 56 | 384 | 300 | 294 | 340 |
| 7 | 264 | 56 | 311 | 243 | 238 | 275 |
| 8 | 201 | 56 | 238 | 185 | 183 | 209. |
| 9 | 138 | 56 | 165 | 128 | 127 | 144 |
| 10 | 75 | 56 | 91 | 71 | 72 | 78 |
| 11 | 12 | 56 | 18 | 17 | 16 | 13 |

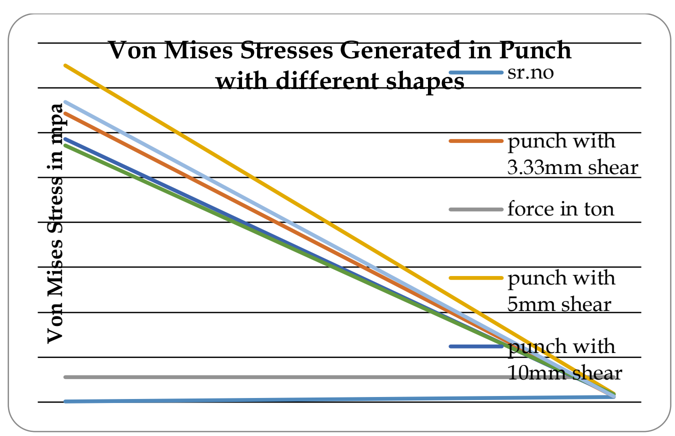


Fig. 23 shows Von Mises stresses generated in small punch with different shear.

Table 7 shows displacement generated in small punch with different shear

| sr.no | punch with 3.33mm shear | force in ton | punch with 5mm shear | punch with 10mm shear | punch with radial shear | Plain punch |
|---|---|---|---|---|---|---|
| 1 | 200.73 | 56 | 200.73 | 198.8 | 201.1 | 200.99 |
| 2 | 180.66 | 56 | 180.65 | 180 | 180.99 | 180.89 |
| 3 | 160.58 | 56 | 160.58 | 160 | 160.88 | 160.79 |
| 4 | 140.51 | 56 | 140.51 | 140 | 140.77 | 140.69 |
| 5 | 120.44 | 56 | 120.44 | 120 | 120.66 | 120.59 |
| 6 | 100.36 | 56 | 100.36 | 100 | 100.55 | 100.49 |
| 7 | 80.29 | 56 | 80.29 | 80 | 80.44 | 80.4 |
| 8 | 60.22 | 56 | 60.22 | 60 | 60.33 | 60.3 |
| 9 | 40.15 | 56 | 40.15 | 40 | 40.22 | 40.2 |
| 10 | 20.07 | 56 | 20.07 | 20 | 20.11 | 20.1 |
| 11 | 0 | 56 | 0 | 0 | 0 | 0 |

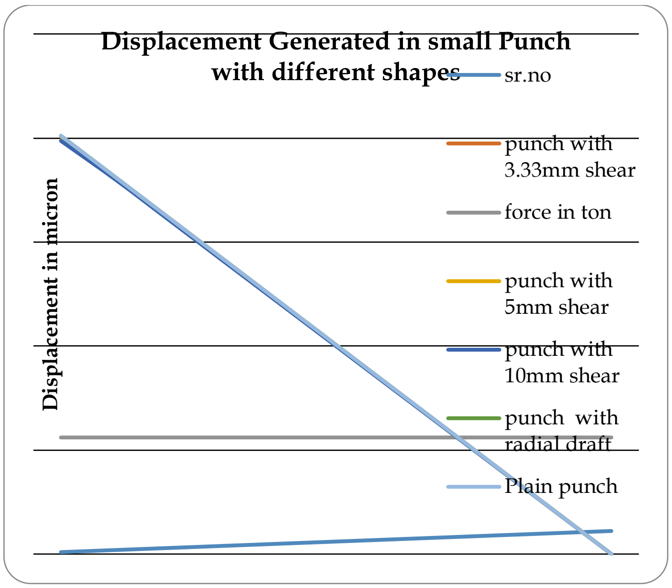


Fig. 24 shows displacement generated in small punch with different shear

The Von Mises Stresses generates in small punch with radial shear is lowest and also displacement is lowest as compared to other shape of punch. So notch punch with radial draft is selected for the punch design.

## 8. CONCLUSION:

The press tonnage required for the operation is above the capacity of the machine which exists. So it is required to use some force reduction method so that it is suitable for its existing press ton machine. Moreover the geometrical compatibility of the mechanical press and the designed combined press tool is excellent.

Based on the static analysis of punches in creo parametric with different shapes we can conclude that the Von Mises Stresses generates for all the punches with radial Shear is lowest and also displacement is also lowest as compared to other shape of punch. So punch with radial shear is selected for the punch design. The tools generally made from steel alloys. Based on carbon composition they are classified in P type, D type, H type. of all D type is having more carbon percentage which indirectly posses more strength. They are mainly used for making of tools.

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