|  |  |
| --- | --- |
| **Internship Report** | |
| **Press Tool Design with Catia V5** | |
| **Design Calculations + 3D Design + 2D Drafting** | |
| **Insert the Image of the Press Tool Assembly** | |
| **Insert the Image of the Die Assembly** | **Insert the Image of the Punch Assembly** |
| Internship Report Submitted By | |
| **Your Name** | |
| Internship carried out at | |
| [**HTTPS://ELEARN.ROYAL-MECHANICAL.COM/**](HTTPS://ELEARN.ROYAL-MECHANICAL.COM/) | |
| An e-learning initiative from | |
| **Maxpertise Technology Labs Pvt. Ltd., Bengaluru.** | |

**About the Company**

[**https://elearn.royal-mechanical.com/**](https://elearn.royal-mechanical.com/)

|  |  |  |
| --- | --- | --- |
| [https://elearn.royal-mechanical.com/](HTTPS://ELEARN.ROYAL-MECHANICAL.COM/) is an online school for mechanical engineers owned by Maxpertise Technology Labs Pvt. Ltd. | | |
| The objective of [https://elearn.royal-mechanical.com/](HTTPS://ELEARN.ROYAL-MECHANICAL.COM/) is to offer job-oriented courses for mechanical engineers and bridge the gap between academia and the industry. | | |
|  | | |
| [https://elearn.royal-mechanical.com/](HTTPS://ELEARN.ROYAL-MECHANICAL.COM/) **offers job-oriented online courses in the below areas** | | |
|  | | |
| **CAD Skills** | **Technical Skills** | **Soft Skills** |
| * Catia v5 * Fusion 360 | * Tooling Design – Jigs, Fixtures, and Press Tools * Product Design – Automotive, Aerospace, and Industrial Automation. * Geometric Dimensioning and Tolerancing (GD&T) | How to Get Mechanical Engineering Jobs?Spoken English for Mechanical Engineers |
|  | | |
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| Please visit [https://elearn.royal-mechanical.com/](HTTPS://ELEARN.ROYAL-MECHANICAL.COM/) for more information. | | |

**Internship Certificate**

(After Printing the Report,

Replace this page with the

Internship Certificate provided by Maxpertise Technology Labs Pvt. Ltd.)

# The objective of this Internship

Below are the top three objectives of the Internship at Maxpertise Technology Labs Pvt. Ltd., Bengaluru.

|  |  |  |
| --- | --- | --- |
|  |  | **(3)** |
| **Learn Catia V5** | **Learn the Design of Blanking Die (Press Tool)** | **Design of Blanking Die (Press Tool)** |
| Learn the below-mentioned modules of Catia V5   * Sketcher workbench * Part design workbench * Assembly workbench * Drafting workbench | Learn the Design of Blanking Die for the "Power Screw Support Bracket" of a "Car Scissor Jack" | **Mini Project:** Design of Blanking die using Catia V5 for the below part.  **Insert the component/part drawing**  **(Refer to Sample Report for Reference)** |

Table 1: Objectives of Internship

# About Catia V5

Catia is a Software developed by the French company DASSAULT SYSTEMES, which is used for

* CAD (Computer-Aided Design)
* CAM (Computer-Aided Manufacturing)
* CAE (Computer-Aided Engineering)

Full-Form of CATIA is a Computer-Aided Three-dimensional Interactive Application.

Catia V5 is the most preferred design software by the world's leading companies in Automotive, Aerospace, Defence, Transportation, Medical Devices, Industrial Machinery, Ship Building, Architecture, Construction, Power, Petroleum, Engineering Services, and many more.

# About the Press & Press Tool

Press: A Press is a Machine that provides the Force necessary to cut/form the sheet metal workpiece

Press Tool: A "Press Tool" is a "Tool" which cuts or forms the sheet metal workpiece. "Press Tool" is also called "Stamping Die." Press Tool is used predominantly in the automotive industry.

# About Blanking

Blanking is a shearing operation performed on the sheet metal.

The Blank (Useful Product) is sheared from the Raw Material (Sheet Metal Strip)

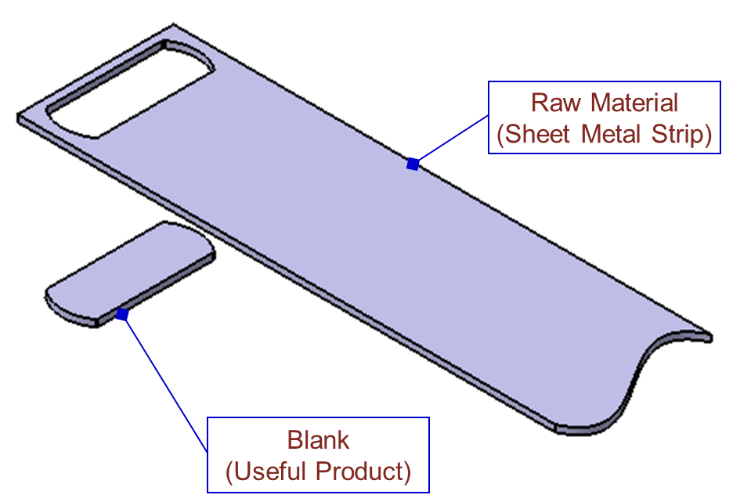


Figure 1: Blanking Operation

## Cutting Clearance

Cutting Clearance: The space/gap between Punch's cutting edge and the cutting edge of the die. Proper clearance is very much essential for the shearing to happen.

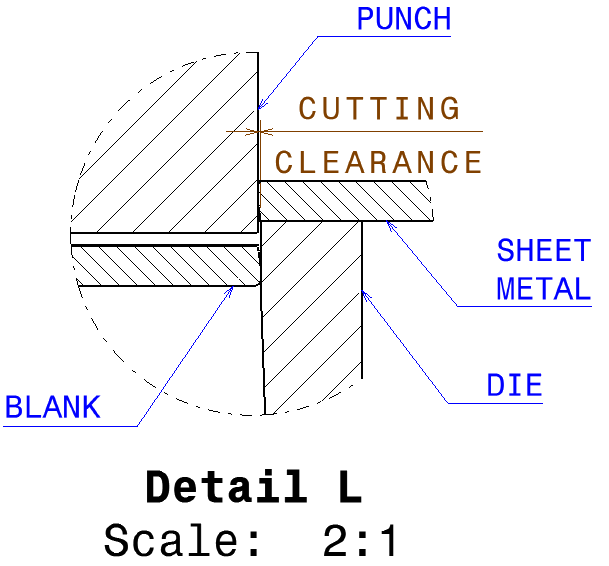


Figure 2: Illustration of Cutting Clearance

|  |
| --- |
| Cutting Clearance for Blanking (6% to 8% of sheet metal thickness) |
| Precision Blanking = 6% of sheet metal thickness |
| Ordinary Blanking = 8% of sheet metal thickness |

Table 2: Values of Cutting Clearance

# The Design Process

Below mentioned flow chart depicts the design process to design the Blanking Die (Press Tool)

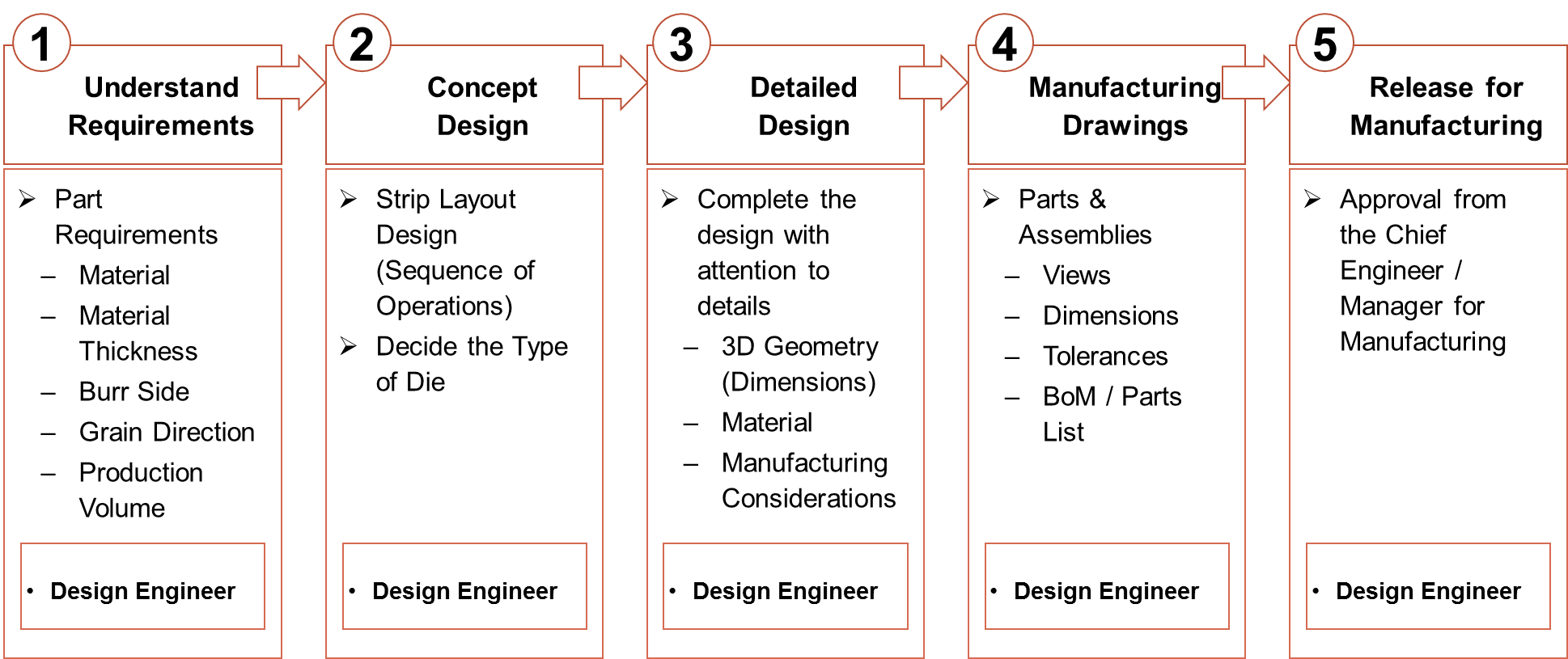


Figure 3: The Design Process

# Design of Blanking Die (Press Tool)

## Understand Requirements

Below mentioned drawing depicts the part drawing for which the Blanking die (press tool) is designed.

**Insert the component/part drawing**

**(Refer to Sample Report for Reference)**

Figure 4: The Part Drawing

### The Part Material

As per the part drawing, the part material is LOW CARBON HIGH STRENGTH COLD ROLLED STEEL AS PER IS 14491 of GRADE: 260Y

As per IS 14491, for LOW CARBON HIGH STRENGTH COLD ROLLED STEEL AS PER IS 14491 of GRADE: 260Y

σy = 260 N/mm2

σt = 350 N/mm2

### The Part Material Thickness

As per the part drawing, the part material thickness is 3.15mm.

## Concept Design (Strip Layout Design)

Below mentioned flow chart depicts the design process to design the Strip Layout.

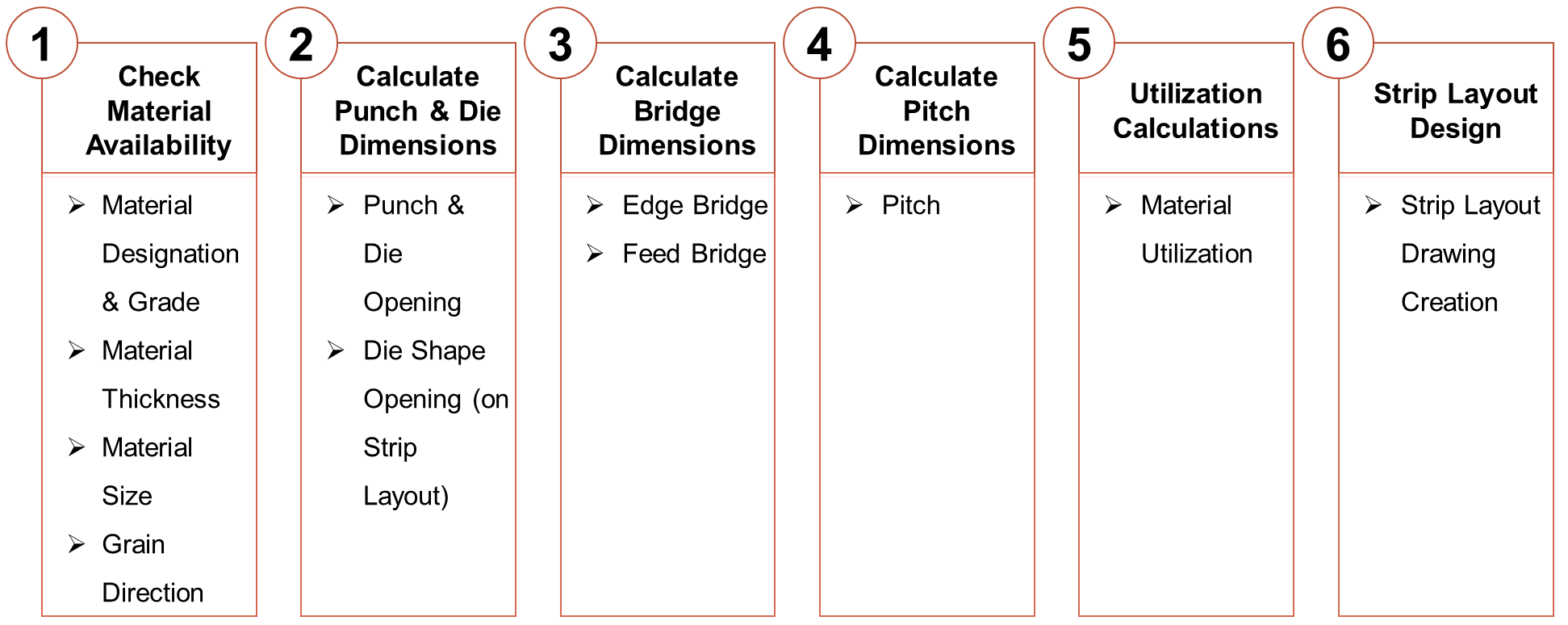


Figure 5: The Strip Layout Design Procedure

### Check Material Availability

Of all the sizes available with the material supplier, below mentioned raw material size is selected.

Length = 2500mm

Width = 1000mm



Figure 6: Raw Material Size

The Raw material can be slit along its length or its width.

|  |  |
| --- | --- |
| **Slit along Length** | **Slit Along Width** |
| A close up of a map  Description automatically generated | A close up of a map  Description automatically generated |

Figure 7: Raw Material Slitting

### Calculate Punch & Die Dimensions

|  |  |
| --- | --- |
| **Calculations – Cutting Clearance, Punch Shape & Die Shape** | |
| Cutting Clearance  (Considering Ordinary Blanking) | = 8% of sheet metal thickness |
| = 8% x 3.15 mm |
| = 0.252 mm |
|  | |
| Die Opening Dimension | = Component Dimension |
| **= Enter the Design Calculations to Calculate the Die Opening Dimension** |
|  | |
| Punch Shape Dimension | = Component Dimension - (2 \* Cutting Clearance) |
| **= Enter the Design Calculations to Calculate the Punch Opening Dimension** |

Table 3: Calculations – Cutting Clearance, Punch Shape & Die Shape

### Calculate the Bridge Dimensions

Feed Bridge is a function of the length of the component.

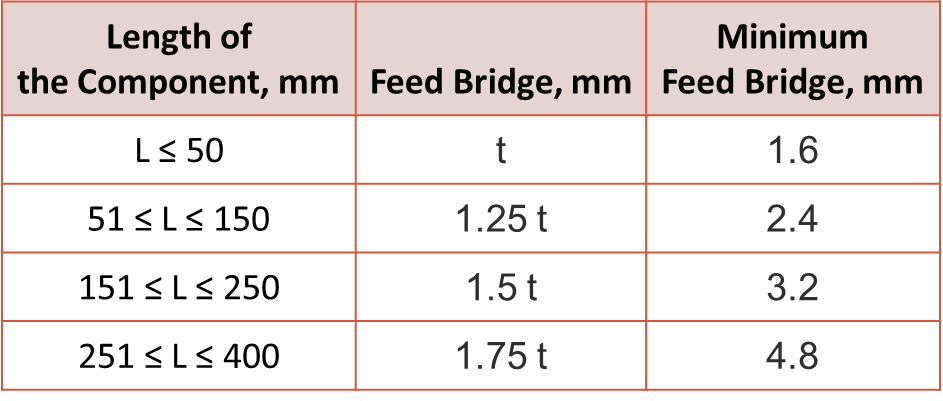


Table 4: Feed Bridge Dimensions

|  |  |
| --- | --- |
| **Calculations – Feed Bridge & Edge Bridge** | |
| Feed Bridge | = 1.25 \* t |
|  | = 1.25 \* 3.15 |
|  | **= 3.9375 mm** |
|  | |
| Edge Bridge | = 1.2 \* 3.9375 |
|  | **= 4.725 mm** |

Table 5: Calculations – Feed Bridge & Edge Bridge

|  |  |
| --- | --- |
| **Slit along Length** | **Slit Along Width** |
| **Insert the Image of the component being sheared, when raw material is slit along the length.**  **Indicate Feed Bridge Dimensions in the Image** | **Insert the Image of the component being sheared, when raw material is slit along the width.**  **Indicate Feed Bridge Dimensions in the Image** |

Figure 8: Feed Bridge Dimensions

|  |  |
| --- | --- |
| **Slit along Length** | **Slit Along Width** |
| **Insert the Image of the component being sheared, when raw material is slit along the length.**  **Indicate Edge Bridge Dimensions in the Image** | **Insert the Image of the component being sheared, when raw material is slit along the length.**  **Indicate Edge Bridge Dimensions in the Image** |

Figure 9: Edge Bridge Dimensions

### Calculate the Pitch

|  |  |  |  |
| --- | --- | --- | --- |
| **Slit along Length** | | **Slit Along Width** | |
| Pitch | = Edge Bridge + Shape Opening Width | Pitch | = Edge Bridge + Shape Opening Length |
|  | **= Enter the Design Calculations to Calculate the Pitch when the raw material is slit along the length** |  | **= Enter the Design Calculations to Calculate the Pitch when the raw material is slit along the width** |
| **Insert the Image of the component being sheared, when raw material is slit along the length.**  **Indicate Pitch Dimensions in the Image** | | **Insert the Image of the component being sheared, when raw material is slit along the length.**  **Indicate Pitch Dimensions in the Image** | |

Figure 10: Pitch Dimensions

### Calculate the Material Utilization

|  |  |  |  |
| --- | --- | --- | --- |
| **Calculations – Total Number of Components** | | | |
|  |  | **1. Slit along the Length** | **2. Slit along the width** |
| Strip Width | = | **Enter Design Calculations** | **Enter Design Calculations** |
| Strip Width with Tolerance | = | **Enter Design Calculations** | **Enter Design Calculations** |
| MMC of Strip Width | = | **Enter Design Calculations** | **Enter Design Calculations** |
| No. of Strips per Sheet Metal | = |  |  |
| = | **Enter Design Calculations** | **Enter Design Calculations** |
| No. of Components per Strip | = |  |  |
| = | **Enter Design Calculations** | **Enter Design Calculations** |
| Total No. of Components per Sheet Metal | = | No. of Strips per Sheet Metal x No. of Components per Strip | No. of Strips per Sheet Metal x No. of Components per Strip |
| = | **Enter Design Calculations** | **Enter Design Calculations** |

Table 6: Calculations – Total Number of Components

By slitting the sheet metal along its length, we produce more components.

|  |  |  |
| --- | --- | --- |
| **Utilization Calculations for Slit along the Length** | | |
| Total No. of Components per Sheet Metal | = | **Enter Design Calculations** |
| Area of Component | = | **Enter Design Calculations** |
| Material Utilization | = |  |
| = | **Enter Design Calculations** |

Table 7: Utilization Calculations

### Final Design of the Strip Layout Drawing

**Insert the Strip Layout Drawing**

**(Refer to Sample Report for Reference)**

Figure 11: Strip Layout Drawing

## Force and Tonnage Calculations

### Perimeter Calculations

**Insert the Component Perimeter Calculations Drawing**

**(Refer to Sample Report for Reference)**

Figure 12: Component Perimeter

|  |  |  |
| --- | --- | --- |
| **Perimeter Calculations** | | |
| Perimeter | = | **Enter Design Calculations** |
|  | = | **Enter Design Calculations** |

Table 8: Perimeter Calculations

### Shear Force Calculations

The formula to calculate the Shear Force is

***Fsh =***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Calculations – Shear Force** | | | | |
| **Fsh** | **=** | **Shear Force** | **tonnes** | **Enter Design Calculations** |
| p | = | Perimeter of Shear | mm | **Enter Design Calculations** |
| t | = | Thickness of Sheet | mm | = 3.15 |
| TS | = | Tensile Strength of Material | kg/mm2 | = 35.7 |

Table 9: Shear Force Calculations

### Tonnage Calculations

The formula to calculate the press tonnage is

***PT = 1.5 \* F sh***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Press Tonnage Calculations:** | | | | |
| **PT** | **=** | **Press Tonnage** | **tonnes** | **Enter Design Calculations** |
| Fsh | = | Shear Force | tonnes | **Enter Design Calculations** |

Table 10: Press Tonnage Calculations

### Press Selection & Specifications

Press Capacity / Tonnage ≥ Calculated Press Tonnage

We will design the press tool for the 40tonnes Press available in the production facility.

Below mentioned Press shall be used for component production.

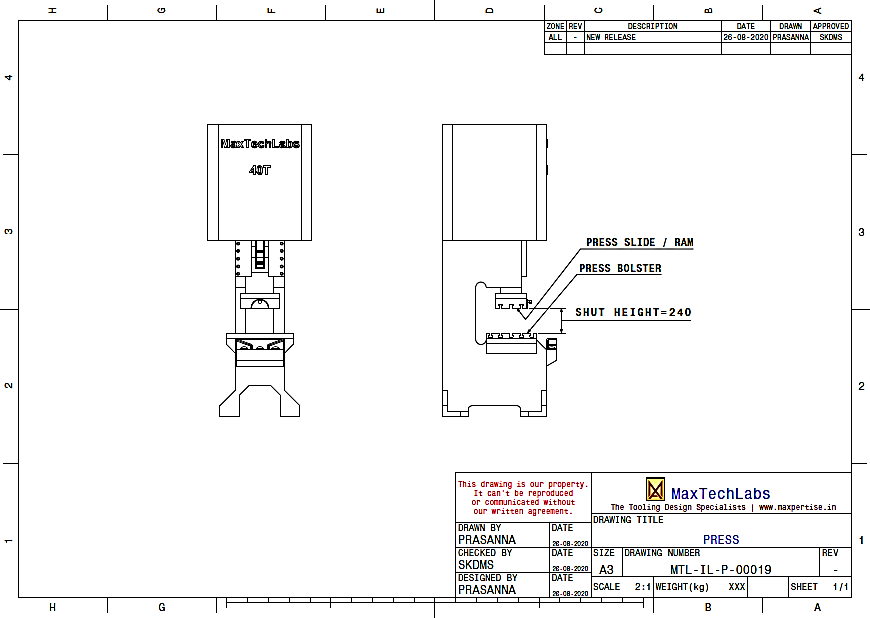


Figure 13: Press

Press Bolster Drawing is shown below.

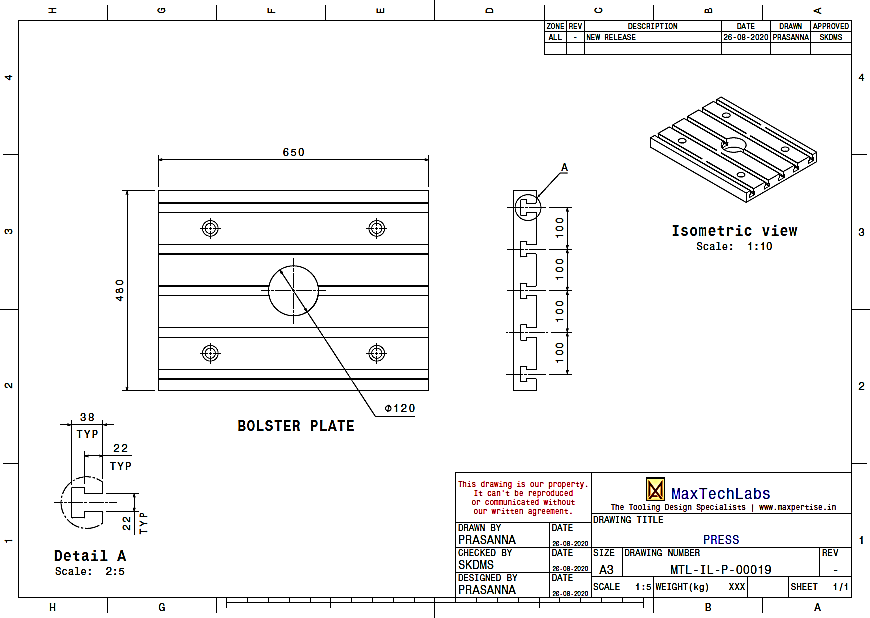


Figure 14: Press Bolster

The press Adapter Plate Drawing is shown below.

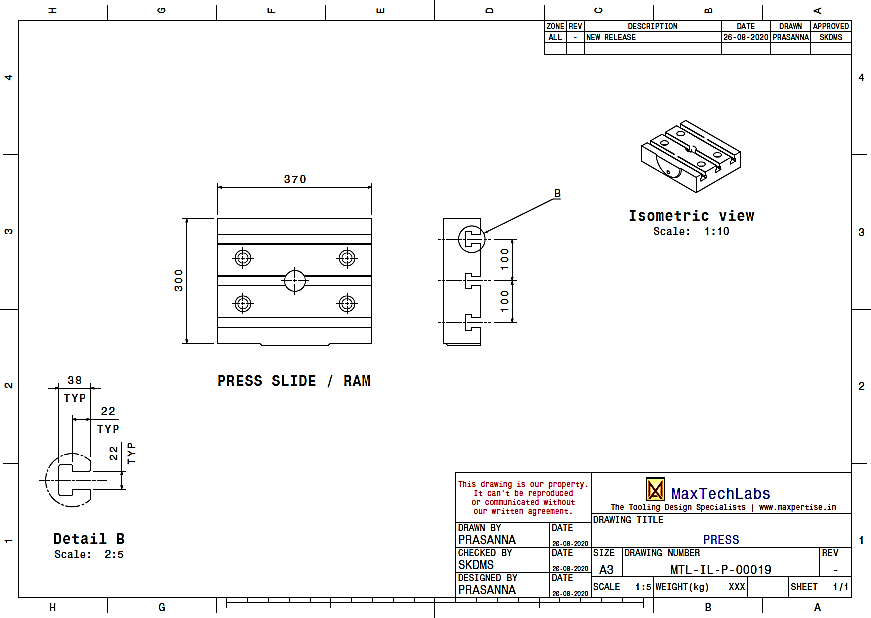


Figure 15: Press Adapter Plate

## Detail Design

The design of the press tool is created using Catia V5 software. All essential calculations related to the press tool design are outlined in this chapter.

### Die Plate

The die plate provides the cutting edge for shearing or blanking the sheet metal strip.

The formula to calculate the die plate thickness is

**Td (**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Die Plate Thickness Calculations** | | | | | | |
| 𝞭 | = | Max. Allowable Die Plate Deflection | mm | = 0.08 |  |
| Fsh | = | Shear Force | kg | **Enter Design Calculations** |  |
| L | = | Length of Die Plate | mm | **Enter Design Calculations** |  |
| E | = | Young's Modulus of Steel | Kg/mm2 | = 21.4 x 103 |  |
| W | = | Width of Die Plate | mm | **Enter Design Calculations** |  |
| **Td** | **=** | **The thickness of the Die Plate** | **mm** | **Enter Design Calculations** | **Enter Design Calculations** |

Table 11: Die Plate Thickness Calculations

The 3D design of the Die Plate using Catia V5 is shown below.

**Insert the Image of Die Plate**

**(Refer to Sample Report for Reference)**

Figure 16: Die Plate

### Locator Pin

The function of the locator pin is to locate the sheet metal strip along the feed direction.

The 3D design of the Locator Pin using Catia V5 is shown below.

**Insert the Image of Locator Pin**

**(Refer to Sample Report for Reference)**

Figure 17: Locator Pin

### Strip Guide Plates and the Strip Support Plate

The function of the strip guide plates is to guide the sheet metal strip.

The function of the strip support plate is to support the sheet metal strip.

The 3D design of the Locator Pin using Catia V5 is shown below.

**Insert the Image of Strip Gude Plates and Strip Support Plate**

**(Refer to Sample Report for Reference)**

Figure 18: Strip Guide Plates and Strip Support Plate

### Strip Pusher

The strip pusher's function is to push the sheet metal strip against the rear strip guide plate. The strip pusher is spring-loaded.

Below mentioned is the procedure for designing the spring.

Figure 19: Spring Design Procedure

|  |  |
| --- | --- |
| **Strip Weight Calculations** | |
| Strip Width, W | **Enter Design Calculations** |
| Strip Length, L | = 2500 mm |
| Strip Thickness, T | = 3.15 mm |
| Strip Volume, V | = W x L x T  **Enter Design Calculations** |
| The density of Steel ρ | = 0.000008 kg/mm3 |
| Strip Mass, m | = V x ρ  **Enter Design Calculations** |
| Acceleration due to Gravity, a | = 9.8 m/s2 |
| Strip Weight, F | = m x a  **Enter Design Calculations** |

Table 12: Strip Weight Calculations

|  |  |
| --- | --- |
| **Push Force Calculations** | |
| Strip Weight, F | = 44 N |
| Co-efficient of Friction (Steel on Steel), μ | ≈ 0.7 |
| Push Force, N | = μ x F  **Enter Design Calculations** |
| **The spring force ≥ Enter Design Calculations.** | |

Table 13: Push Force Calculations

|  |  |
| --- | --- |
| **Spring Length Calculations** | |
| SPACE AVAILABLE | **Enter Design Calculations** |
| SPACE AVAILABLE | 90% TO 95% OF THE TOTAL LENGTH (FREE LENGTH) |
| TOTAL LENGTH (FREE LENGTH) | =  **Enter Design Calculations** |
| Generally, Springs are available in steps of 5mm in length. | |
| **TOTAL LENGTH (FREE LENGTH)** | **Enter Design Calculations** |

Table 14: Spring Length Calculations

|  |  |
| --- | --- |
| **Spring Constant Calculations** | |
| COMPRESSED LENGTH | = SPACE AVAILABLE - STROKE  **Enter Design Calculations** |
| 2mm is the interference that we have designed between the Strip Pusher and the Strip | |
| We need the Push Force @ **Enter Design Calculations.** | |
| SPRING CONSTANT | =  =  **Enter Design Calculations** |
| Select a Spring with Spring Constant **≥** **Enter Design Calculations.** | |

Table 15: Spring Constant Calculations

|  |  |
| --- | --- |
| **Maximum Spring Deflection Calculations** | |
| MAXIMUM COMPRESSED LENGTH | = SPACE AVAILABLE – MAXIMUM STROKE  **Enter Design Calculations** |
| An additional 1mm is the clearance between the Strip and the Front Strip Guide Plate. | |
| MAXIMUM DEFLECTION | = x 100  **Enter Design Calculations** |
| Select a Spring with an allowable deflection **≥** **Enter Design Calculations.** | |

Table 16: Maximum Spring Deflection Calculations

|  |  |
| --- | --- |
| **Spring Selection (From Standard Catalogue)** | |
| Inner Diameter, Di | **Enter Design Calculations** |
| Outer Diameter, Do | **Enter Design Calculations** |
| Wire Diameter, d | **Enter Design Calculations** |
| Free Length, L | **Enter Design Calculations** |
| Maximum Force, N | **Enter Design Calculations** |
| Spring Constant, N/mm | **Enter Design Calculations** |
| Max. Allowable Deflection (% of Free Length) | **Enter Design Calculations** |

Table 17: Strip Pusher Spring Specifications

The 3D design of Strip Pusher using Catia V5 is shown below.

**Insert the Image of Strip Pusher**

**(Refer to Sample Report for Reference)**

Figure 20: Strip Pusher

### Die Back Plate

The function of the die backplate is to absorb energy/force coming from the die plate.

The 3D design of the Die Back Plate using Catia V5 is shown below.

**Insert the Image of Die Back Plate**

**(Refer to Sample Report for Reference)**

Figure 21: Die Back Plate

### Die Shoe

The function of the die shoe is listed below

* Absorbs the Force coming from the Die Plate.
* Used to Fasten the Die Assembly to Press Bolster using U-Slots
* Has Provision to mount the Guide Pillars.

The 3D design of Strip Pusher using Catia V5 is shown below.

**Insert the Image of Die Shoe**

**(Refer to Sample Report for Reference)**

Figure 22: Die Shoe

### Guide Pillar

Guide pillars and guide bushes are used to locate the die and punch assemblies.

Below mentioned is the procedure for designing the Guide Pillar.

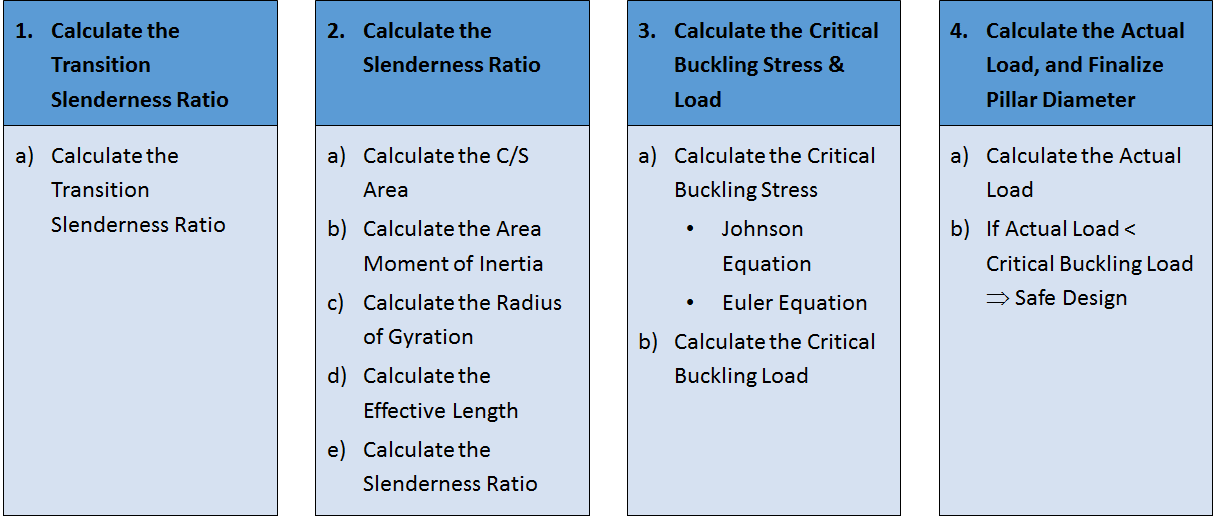


Figure 23: Design Procedure – Guide Pillar

The formula to calculate the Transition Slenderness Ratio is

**TSR =**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Transition Slenderness Ratio Calculations** | | | | |
| E | = | Young's Modulus of Steel | N/mm2 | = 210 x 103 |
|  | = | Yield Strength of Steel | N/mm2 | = 250 |
| **TSR** | **=** | **Transition Slenderness Ratio** | **-** | **Enter Design Calculations** |

Table 18: Transition Slenderness Ratio Calculations

The formula to calculate the Cross-Sectional Area is

**A =**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Cross Section Area Calculations (Guide Pillar)** | | | | |
| d | = | The diameter of the Pillar | mm | = 20 |
| A | = | Cross-Sectional Area | mm2 | **Enter Design Calculations** |

Table 19: Cross-Section Area Calculations (guide Pillar

The formula to calculate the Area Moment of Inertia Calculations is mentioned below.

**I =**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Area Moment of Inertia Calculations** | | | | |
| d | = | The diameter of the Pillar | mm | = 20 |
| I | = | Area Moment of Inertia | mm4 | **Enter Design Calculations** |

Table 20: Area Moment of Inertia Calculations

The formula to calculate the Radius of Gyration is mentioned below.

**Rg =**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **The Radius of Gyration Calculations** | | | | |
| I | = | Area Moment of Inertia | mm4 | **Enter Design Calculations** |
| A | = | Cross-Sectional Area | mm2 | **Enter Design Calculations** |
| Rg | = | Radius of Gyration | mm | **Enter Design Calculations** |

Table 21: Radius of gyration Calculations

The formula to calculate the Slenderness Ratio is mentioned below.

**SR =**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Slenderness Ratio Calculations** | | | | |
|  | = | Length of Pillar | mm | **Enter Design Calculations** |
|  | = | Effective Length of Pillar | mm | **Enter Design Calculations** |
| Rg | = | Radius of Gyration | mm | **Enter Design Calculations** |
| SR | = | Slenderness Ratio | - | **Enter Design Calculations** |

Table 22: Slenderness Ratio Calculations

The formula to calculate the Critical Buckling Stress is mentioned below.

**cr =**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Critical Buckling Stress Calculations** | | | | |
| E | = | Young's Modulus of Steel | N/mm2 | = 210 x 103 |
| SR | = | Slenderness Ratio | - | **Enter Design Calculations** |
| **cr** | **=** | **Buckling Stress** | **N/mm2** | **Enter Design Calculations** |

Table 23: Critical Buckling Stress Calculations

The formula to calculate the Critical Buckling Load is mentioned below.

**cr A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Critical Buckling Load Calculations** | | | | |
| cr | = | Buckling Stress | N/mm2 | **Enter Design Calculations** |
| A | = | Cross-Sectional Area | mm2 | **Enter Design Calculations** |
| cr | = | Buckling Load | N | **Enter Design Calculations** |

Table 24: Critical Buckling Load Calculations

|  |  |
| --- | --- |
| **Actual Load Calculations** | |
| Shear Force, Fsh | **Enter Design Calculations** |
| No. of Pillars | **Enter Design Calculations** |
| Actual Force / Pillar | **Enter Design Calculations** |
| Critical Buckling Load, cr | **Enter Design Calculations** |
| **cr > Actual Force/Pillar**  **Design is Safe** | |

Table 25: Actual Load Calculations

The 3D design of the Guide Pillar using Catia V5 is shown below.

**Insert the Image of Guide Pillar**

**(Refer to Sample Report for Reference)**

Figure 24: Guide Pillar

### Stroke End Block

The Stroke End Block acts as a stopper to indicate the bottom dead centre.

The 3D design of Stroke End Blocks using Catia V5 is shown below.

**Insert the Image of Stroke End Block**

**(Refer to Sample Report for Reference)**

Figure 25: Stroke End Block

### Die Assembly Lifting Hooks

The function of the lifting hooks is to lift the die assembly.

The 3D design of Lifting Hooks using Catia V5 is shown below.

**Insert the Image of Lifting Hooks**

**(Refer to Sample Report for Reference)**

Figure 26: Die Assembly Lifting Hooks

### Screws and Dowels for Die Assembly

The screws are used to fasten, and the dowels are used to locate the functionally critical parts.

Catalog parts in Catia V5 are used for the 3D assembly.

**Insert the Image of Screws and Dowels of Die Assembly**

**(Refer to Sample Report for Reference)**

Figure 27: Screws and Dowels for Die Assembly

### Blanking Punch

The Blanking Punch is combined with a Die Plate to Blank the sheet metal.

It has the cutting edge to shear the sheet metal.

For the blanking operation, the cutting clearance is provided on the Punch.

|  |
| --- |
| **Cutting clearance Calculations** |
| = 8% of the sheet metal thickness |
| = 0.08 x 3.15 = 0.252mm |

Table 26: Cutting Clearance Calculations

The 3D design of the Blanking Punch using Catia V5 is shown below.

**Insert the Image of Blanking Punch**

**(Refer to Sample Report for Reference)**

Figure 28: Blanking Punch

### Stripper Plate

The function of the Stripper Plate is to Strip the Sheet Metal Strip from the Punch.

The formula to calculate the stripping Force is

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Stripping Force Calculations** | | | | |
| Fst | = | Stripping Force | tonnes | **Enter Design Calculations** |
| Fsh | = | Shear Force | tonnes | **Enter Design Calculations** |

Table 27: Stripping Force Calculations

The formula to calculate the thickness of the stripper plate is

*Ts (*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Stripper Plate Thickness Calculations** | | | | |
| 𝞭 | = | Max. Allowable Stripper Plate Deflection | mm | = 0.08 |
| Fst | = | Stripping Force | kg | **Enter Design Calculations** |
| L | = | Length of Stripper Plate | mm | **Enter Design Calculations** |
| E | = | Young's Modulus of Steel | Kg/mm2 | = 21.4 x 103 |
| I | = | Moment of Inertia | mm4 |  |
| W | = | Width of Stripper Plate | mm | **Enter Design Calculations** |
| Ts | = | The thickness of the Stripper Plate | mm | **Enter Design Calculations** |

Table 28: Stripper Plate Thickness Calculations

Below mentioned is the procedure for designing the spring.

|  |  |
| --- | --- |
| **Push Force Calculations** | |
| **PUSH FORCE** | **= STRIPPING FORCE**  **Enter Design Calculations** |
| NO. OF SPRINGS | **Enter Design Calculations** |
| **PUSH FORCE / SPRING** | =  **Enter Design Calculations** |

Table 29: Spring push Force Calculations

|  |  |
| --- | --- |
| **Stripper Stroke Calculations** | |
| STRIPPER STROKE | = STRIP THICKNESS + PUNCH ENTRY INTO DIE + 1  **Enter Design Calculations** |

Table 30: Stripper Stroke Calculations

|  |  |
| --- | --- |
| **Spring Total Length Calculations** | |
| SPACE AVAILABLE | = COMPRESSED LENGTH + STRIPPER STROKE  **Enter Design Calculations** |
| SPACE AVAILABLE | 90% TO 95% OF THE TOTAL LENGTH (FREE LENGTH) |
| TOTAL LENGTH (FREE LENGTH) | =  **Enter Design Calculations** |
| Generally, Springs are available in steps of 5mm in length. | |
| **TOTAL LENGTH (FREE LENGTH)** | **Enter Design Calculations** |

Table 31: Spring Total Length Calculations

|  |  |
| --- | --- |
| **Spring Constant Calculations** | |
| COMPRESSED LENGTH | **Enter Design Calculations** |
| @60mm, we need the Push Force of **Enter Design Calculations** | |
| SPRING CONSTANT | =  =  **Enter Design Calculations** |
| Select a Spring with Spring Constant ≥ **Enter Design Calculations.** | |

Table 32: Spring Constant Calculations

|  |  |
| --- | --- |
| **Spring Maximum Deflection Calculations** | |
| MAXIMUM COMPRESSED LENGTH | **Enter Design Calculations** |
| TOTAL LENGTH (FREE LENGTH) | **Enter Design Calculations** |
| MAXIMUM DEFLECTION | = x 100  **Enter Design Calculations** |
| Select a Spring with an allowable deflection ≥ **Enter Design Calculations.** | |

Table 33: Spring Maximum Deflection Calculations

|  |  |
| --- | --- |
| **Spring Selection** | |
| **Free Length, L** | **Enter Design Calculations** |
| **Spring Constant, N/mm** | **≥ Enter Design Calculations** |
| **Maximum Allowable Deflection (% of Free Length)** | **≥ Enter Design Calculations** |
| Inner Diameter, Di | **Enter Design Calculations** |
| Outer Diameter, Do | **Enter Design Calculations** |
| Spring Constant, N/mm | **Enter Design Calculations** |

Table 34: Stripper Spring Specifications

The stripper plate's 3D design, the die spring, and the shoulder bolt using Catia V5 are shown below.

**Insert the Image of Stripper Plate, Stripper Springs, and Shoulder Bolt**

**(Refer to Sample Report for Reference)**

Figure 29: Stripper Plate, Stripper Springs, and Shoulder Bolt

### Punch Holder

The Function of the Punch Holder is to Hold and Accurately Position the Punch.

The 3D design of the Punch Holder using Catia V5 is shown below.

**Insert the Image of Punch Holder**

**(Refer to Sample Report for Reference)**

Figure 30: Punch Holder

### Punch Back Plate

The Function of the Punch Back Plate is to Absorb the Force coming from the Punch.

The 3D design of the Punch Back Plate using Catia V5 is shown below.

**Insert the Image of Punch Back Plate**

**(Refer to Sample Report for Reference)**

Figure 31: Punch Back Plate

### Top Plate

The Function of the Top Plate is listed below

* Holds all the parts of the Punch Assembly.
* Absorbs the Force coming from the Punch and the Punch Back Plate.
* Used to Fasten the Punch Assembly to Press Slide / Adaptor Plate using U-Slots
* Has Provision to mount the Guide Bushes.

The 3D design of the Top Plate using Catia V5 is shown below.

**Insert the Image of Top Plate**

**(Refer to Sample Report for Reference)**

Figure 32: Top Plate

### Guide Bush

Guide pillars and guide bushes are used to locate the die and punch assemblies.

The 3D design of the Guide bush using Catia V5 is shown below.

**Insert the Image of Guide Bush**

**(Refer to Sample Report for Reference)**

Figure 33: Guide Bush

### Punch Assembly Lifting Hooks

The function of the lifting hooks is to lift the Punch assembly.

The 3D design of Lifting Hooks using Catia V5 is shown below.

**Insert the Image of the punch Assembly Lifting Hooks**

**(Refer to Sample Report for Reference)**

Figure 34: Punch Assembly Lifting Hooks

### Screws and Dowels for the Punch Assembly

The screws are used to fasten, and the dowels are used to locate the functionally critical parts.

Catalog parts in Catia V5 are used for the assembly.

**Insert the Image of Screws and Dowels for Punch Assembly**

**(Refer to Sample Report for Reference)**

Figure 35: Screws and Dowels for Punch Assembly

# Manufacturing Drawings

All the manufacturing Drawings, including the assembly drawings of the Press Tools, are shown in this chapter. The drawings are created using Catia V5.

### Assembly Drawing (Sheet -1)

**Insert the Image of Assembly Drawing**

**(Refer to Sample Report for Reference)**

### Assembly Drawing (Sheet -2)

**Insert the Image of Assembly Drawing**

**(Refer to Sample Report for Reference)**