It is necessary that the work should be properly and securely held on for machining operations, a VISE is an effective work holding device.

Vises: Vises are the most common appliances for holding work on table due to its quick loading and unloading arrangement. There are mainly three types of vises commonly used,

- Plain vise
- Swivel vise
- Tool makers universal vise

Plain Vise: the plain vise bolted directly on the table on the T-slots. The vise may be fastened to the table with the jaws set at right angles to the table T-slots. Work is clamped between the fixed and movable jaws and for holding work pieces of irregular shape special jaws are used.

Swivel vise: the swivel vise is used to mill angular surface in relation to a straight surface without removing the work from the vise. In construction it may be considered a plain vise, which is mounted on a circular base graduated in degrees. The base is clamped on the table by means of T-slots.
SWIVEL VISE:

Fig- (1) shows a machinist bench vise with swivel base.

The Swivel Vise can be rotated and contains a scale graduated in degrees at its base to facilitate machining at any angle on a horizontal plane. The vise can secularly fasten castings, forgings and roughed surface work pieces. The jaws can be positioned between the jaws to accommodate work pieces of any shapes and sizes. By loosening the bolt, which is used to clamp the vise to its graduated base, the vise may be moved to hold the work piece at any angle in a horizontal plane. To set the swivel base at the right angle and properly aligned with the spindle a test indicator could be clamped to the machine arbor and check made to determine the setting by transverse or longitudinal feed, depending upon position of vise jaw.

Bench Vise is a work holding device consisting of a pair of movable and fixed jaws. The jaws clamp on to the work-piece using the lateral motion provided to them using a spindle. The spindle with V-THREADS is rotated using a handle (lever). The jaws move closer as the lever is rotated in the clockwise direction and move away when turned in the anticlockwise direction.

The work piece is supported on a base plate with a bore of dia > dia of spindle (space for clearance) the inside, within this bore internal threading is provided for proper engagement of spindle and base plate threads for producing the required motion.

A clamping arrangement to be provided for proper rigid fixture of Vice on tabletop.

The material to be used for the VISE is: MS.

The base plate dimensions are : 300mm*110mm*9mm.

The spindle dia : 16.1mm

The lever dia : 9mm
The required machining operations to be performed are:

- Facing, chamfering, turning to provide clamping surface to jaws.
- External Square threading on the spindle.
- Drilling, Boring and internal threading on base plate.
- Drilling on the spindle and threading on lever to fit into the spindle for application of manual load.
- C-clamp for clamping the Vice on the table.

**Vise Installation**

This vise hardware is adaptable for installation in a variety of positions, and on different styles of bench tops. The key to successful installation is careful planning and preparation. Installed properly, your vise will give a lifetime of useful, daily service.

**First: Choose vise position and jaw size**

This vise can be mounted in a variety of positions, depending on your working style and bench type. Assuming you’re right handed, typical mounting positions would be either towards the left of the front edge of your bench, or the right end of your bench. Carvers will probably find the end position most useful, as will those who will most often clamp wide, flat work like doors and wide panels. If the vise will mostly be used to hold small parts, or narrow boards on edge for jointing, the bench’s front edge will likely be the best option. Just be sure that the location you choose doesn’t interfere with bench legs or aprons.

**Jaw size** is determined by a combination of bench top thickness and width, the mounting style you choose, and your preference.

**Jaw Material:** Traditional bench (and vise jaw) materials include European beech and hard maple; where these species are for sale they’re usually available in 8/4 thickness. Birch and white oak are also good, tough woods to consider. If you’ve made your own top, you’ll have your own preference.

**Jaw Thickness:** We recommend that jaws be at least 1-5/8 inches thick, which allows both secure fastening to the hardware, and room to accommodate dog holes (either square or 3/4 inch round) in the front jaw.

**Jaw Length:** For the small vise, recommended jaw length is 12 to 15 inches. The large vise can accommodate jaws up to 18 inches long; anything longer subjects the vise to excessive racking, which can shorten its life.
Jaw Depth: the starting point for determining jaw depth is throat depth. Throat depth is the vertical distance from the top edge of the jaw (flush with the bench top) down to the top of the main screw. Throat depth is the optimal throat depth range. Any less compromises the size of work you’ll be able to handle; much more than 4 inches will mean you’re clamping work too far above the main screw, which makes it possible to stress your mounting setup beyond its limits.

For most bench tops, you’ll need to mount a spacer between the vise carriage and the bench top in order to get adequate throat depth.

Spacers be built up from thicknesses of MDF, particle board, or Masonite, all of which are relatively crush-resistant.

For both large and small vises, throat depth is equal to bench thickness PLUS 1/2 spacer thickness. Spacer thickness PLUS 1/2 = throat depth.

Once you have spacer thickness and throat depth set, you can determine jaw depth as follows:

Small vise: 444fADuE4bAV DDpT@
        EPuADs4BeFBh4T ABkFDsS4PDTS4Rpac444thick
        inc4444444444444v(Re:4m(Ji,Pm Ja64dSPt(4e0Pa,R "@n" @ 4Hi"Bn$Rs PLR 2Pa"@r Ph(Bk.@s24P
PS -04 Hn''@e2
Bore jaws:

1) Bore and counter bore for any hardware you’ll use to mount the rear jaw to the bench. Be sure to allow for washers if you’ll be using lag screws to mount the rear jaw.

2) Clamp the jaws together as they’ll be once the jaw is installed. Be especially careful that the ends and the top edges are aligned. 3) On a drill press, bore the three holes for the guide rods and main screw, starting at the rear face of the rear jaw and with a scrap block under the front jaw. The indicated hole diameters allow ample clearance; if you wish to use other diameters measure carefully to be sure you leave clearance.

Typical parts are - Guide Rods, Main Screw

Regular Vise dimensions: 3/4” 1-1/8”
Large Vise: 1” 1-1/4”

Third: Mount rear jaw

Attach the rear jaw to the bench top with large screws (#12, #14) or 1/4” lag screws, gluing if desired and appropriate. Mount the rear jaw so that its top edge protrudes 1/16” above the bench top. Turn the bench top upside down.

Fourth: Mount carriage, spacer and front jaw

1) Place any spacers and the vise carriage on the bench underside, with the lead screw boss towards the rear jaw.
2) Slide the front jaw onto the guide rods, and then thread the main screw and guide rods into the vise carriage.

3) With the jaws slightly open, move the lead screw boss snug against the back jaw, center the guide rods and main screw in the rear jaw holes, and clamp the vise carriage in place (if no bench holdfast or deep-throated clamps are available, you may have to improvise a clamping caul to do this).

4) Close the vise so front and rear jaws are just in contact, and then tap the front jaw so that its ends and top edge are flush with those of the back jaw.

5) Close the vise firmly and check that the vise carriage is in contact with the rear jaw.

6) Using a sharp punch, awl, or drill bit, mark hole centers for mounting the vise carriage to the bench underside. For 1/4” carriage bolts, bore 7/32” diameter pilot holes.

   Using lag screws and washers, fasten the vise carriage to the bench.

7) Using a sharp punch, awl, or drill bit, mark hole centers for mounting the vise carriage to the bench underside. For 1/4” carriage bolts, bore 7/32” diameter pilot holes.

   Using lag screws and washers, fasten the vise carriage to the bench.

   When setting hole depth, take into account faceplate thickness (9/32” for regular vise; 7/16” for large vise).

Fifth: Final fitting and troubleshooting

1) Open vise at least half way. Does it operate smoothly? If not, check for paint or other foreign matter in the threads or in the guide rod holes.

2) Close the vise so the jaws nearly touch again, and check whether the jaws are parallel.

   If they aren’t, loosen the vise carriage mounting screws, close the vise firmly, retighten the screws, and check for parallel again.

3) Remove the vise front, then take the front jaw off of the front as888bDP 8DeAVE8ReAR B@w8@fD8vARe8BaRRaAFe8@f8PlAB888 Carefully plane or sand a 2-degree taper on the clamping face of the front jaw. This ensures that object888tADpED AF T@e8VaSD AR8e8@dDD FR@rEDq8@IGFg8ThE8888 ed8888888888e28m X "@ ,@d$8o.8a Pl Je28b88t$@p.Ra2@l88t Bk(Jg @ 4Hi.8s(Hm @1Jg Ph$8o4Pe28b.Pt.H S@g$8o&8t(@ &Ro.P *@w.8 48 8@d @ (@n$@e Jf Po4R "@o(8e,8a.@ .Bc$8a.@ (R 2@t(Rf Bt.Ry,8p,@n$8t(@ *@w @d&@s Bl4Rh Ri4@ 4He Be.Bh Po0
@i.Pe.@n"@:
2) **Bench and Pipe Vise:** The bench and pipe vise is a dual-purpose vise. It has rough jaws and a swivel base similar to the machinist's bench vise. However, it also has built-in pipe jaws. Bench and pipe vises are usually bolted to a workbench or table. They are used for holding or clamping heavy objects, holding pipe for cutting and threading, and for forming and shaping metal.
3) **Clamp base Bench Vise**: The clamp base bench vise is a lightweight, portable machinist’s vise. It is attached to a table or bench with the mounting clamp. It has rough jaws for holding material and may have a swivel base. Clamp base bench vises are used to hold light materials or in areas where a heavier vise is not available.

![fig(4)- clamp base bench vise](image)

**PROCESS SHEET:**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Operation</th>
<th>Tool dia (mm)</th>
<th>Spindle speed ‘N’ (rpm)</th>
<th>Feed ‘S’ mm/min</th>
<th>Dept of cut ‘A’ (mm)</th>
<th>Machining time (hr: min: sec)</th>
<th>Cutting speed (mm/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FACING</td>
<td>16</td>
<td>450</td>
<td>50</td>
<td>0.2</td>
<td>00:01:56</td>
<td>22.61</td>
</tr>
<tr>
<td>2</td>
<td>THREADING</td>
<td>6</td>
<td>71</td>
<td>0.2</td>
<td>0.1</td>
<td>00:09:13</td>
<td>12.25</td>
</tr>
<tr>
<td>3</td>
<td>DRILLING</td>
<td>25</td>
<td>1990</td>
<td>100</td>
<td>10</td>
<td>00:04:25</td>
<td>156.24</td>
</tr>
<tr>
<td>4</td>
<td>TAPPING</td>
<td>4</td>
<td>71</td>
<td>0.2</td>
<td>0.1</td>
<td>00:03:14</td>
<td>12.25</td>
</tr>
</tbody>
</table>
Fig- shows the drafting of the assembled vise

STEP-BY-STEP MACHINING PROCESSES DONE:

CUTTING:

A hex-saw blade was used for cutting the material to the required dimensions.

The dimensions of cut parts being:

<table>
<thead>
<tr>
<th>Name</th>
<th>material</th>
<th>dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jaws</td>
<td>ms</td>
<td>110mm<em>45mm</em>8mm</td>
</tr>
<tr>
<td>Base plate</td>
<td>ms</td>
<td>300mm<em>110mm</em>9mm</td>
</tr>
</tbody>
</table>
Circular Plate: ms 160mm(Dia)*20mm(thickness) & 145mm(Dia)*16mm(thickness)

**FACING:**

Facing was performed on the spindle/shaft of dia 16mm and 300mm length using the turning tool on the lathe machine. The spindle speed 450 rpm.

**THREADING:**

The pitch is set at 4 and the speed adjusted to 71 RPM and the threading operation was performed for the length of 260mm, with a feed of 0.2mm for a depth of thread of 2mm. Threading tool was used for this purpose on the lathe machine.

**DRILLING:**

Drilling was performed on the base plates, drill hole, cut being concentric for both the plates base plates. The drilling was performed for inserting the coupling for allowing the top plate to rotate easily on the base plate and a provision for locking of the same was provided.

**TAPPING:**

Tapping was performed on the locking nut to create threading for screwing the nut to lock the two base plates. The dimension of the locking nut is 6mm.

**WELDING:**

All the assembly parts were welded using **arc-welding apparatus.** The vise was welded to the top swivel plate and the welded arrangement was then coupled with the base (stationery plate).

**PAINTING:**

The apparatus was painted to prevent corrosion of machine parts by rusting.

**LUBRICATION AND OILING:**

The threaded portions are oiled and lubricated to provide effective engagement of threads and prevent corrosion.
CONCLUSION:

THE BENCH VISE HAS BEEN MADE TO THE SPECIFICATIONS AND THE PROCESS SHEET GENERATED.

SALIENT FEATURES:

THE BENCH VISE HAS NUMEROUS APPLICATIONS AND CAN BE MOUNTED VIA T-BOLTS TO ANY WORK TABLE FOR MILLING AND OTHER MACHINING OPERATIONS.

THE SALIENT FEATURE OF THIS BENCH VISE IS THAT ITS, ANGULAR POSITION CAN BE CHANGED AND ADJUSTED TO ANY DIRECTION DEPENDING ON THE WORK TO BE DONE. THE VISE HAS BEEN CALIBERATED IN DEGRESS FOR THE SAME.

ANALYSIS OF SCREW USING COSMOS EXPRESS

1. Introduction
2. File Information
3. Materials
4. Load & Restraint Information
5. Study Property
6. Stress Results
7. Displacement Results
8. Deformation Results
9. Design Check Results
10. Appendix

1. Introduction

Summarize the FEM analysis on Part6

2. File Information

Model name: Part6
Model location: C:\Documents and Settings\GANESH-MARUTHI\Desktop\bench\Part6.SLDPRT
Results location: D:\chandramuki
Study name: COSMOSXpressStudy (-Default-)

3. Materials

<table>
<thead>
<tr>
<th>No.</th>
<th>Part Name</th>
<th>Material</th>
<th>Mass</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Part6</td>
<td>[SW]Cast Carbon Steel</td>
<td>0.460288 kg</td>
<td>5.90113e-005 m^3</td>
</tr>
</tbody>
</table>

4. Load & Restraint Information
5. Study Property

<table>
<thead>
<tr>
<th>Mesh Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesh Type:</td>
</tr>
<tr>
<td>Mesher Used:</td>
</tr>
<tr>
<td>Automatic Transition:</td>
</tr>
<tr>
<td>Smooth Surface:</td>
</tr>
<tr>
<td>Jacobian Check:</td>
</tr>
<tr>
<td>Element Size:</td>
</tr>
<tr>
<td>Tolerance:</td>
</tr>
<tr>
<td>Quality:</td>
</tr>
<tr>
<td>Number of elements:</td>
</tr>
<tr>
<td>Number of nodes:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Solver Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality:</td>
</tr>
<tr>
<td>Solver Type:</td>
</tr>
<tr>
<td>Name</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Plot1</td>
</tr>
</tbody>
</table>

Part6-COSMOSXpressStudy-Stress-Plot1

JPEG
7. Displacement Results

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Min</th>
<th>Location</th>
<th>Max</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plot2</td>
<td>URES: Resultant displacement</td>
<td>0 mm</td>
<td>(7.99365 mm, -0.318741 mm, 300 mm)</td>
<td>0.00412484 mm</td>
<td>(6.47214 mm, 4.70228 mm, 0 mm)</td>
</tr>
</tbody>
</table>
8. Deformation Results

<table>
<thead>
<tr>
<th>Plot No.</th>
<th>Scale Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7284.5</td>
</tr>
</tbody>
</table>
9. Design Check Results
10. Appendix

Material name: [SW]Cast Carbon Steel
Description:
Material Source: Used SolidWorks material
Material Library Name:
Material Model Type: Linear Elastic Isotropic

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
</table>

Elastic modulus | 2e+011 | N/m^2
---|---|---
Poisson's ratio | 0.32 | NA
Mass density | 7800 | kg/m^3
Yield strength | 2.4817e+008 | N/m^2

**Note:**

COSMOSXpress design analysis results are based on linear static analysis and the material is assumed isotropic. Linear static analysis assumes that: 1) the material behavior is linear complying with Hooke’s law, 2) induced displacements are adequately small to ignore changes in stiffness due to loading, and 3) loads are applied slowly in order to ignore dynamic effects.

Do not base your design decisions solely on the data presented in this report. Use this information in conjunction with experimental data and practical experience. Field-testing is mandatory to validate your final design. COSMOS press helps you reduce your time-to-market by reducing but not eliminating field tests.
MANUFACTURING MINI PROJECT

SWIVEL BENCH VISE

SUBMITTED BY:

ANAND VIJAYKUMAR 03BME018
ANBAZHAGAN 03BME019
ARPIT DIXIT 03BME025
DEEPANKAR 03BME038
GAURAV CHOUDHARY 03BME046