

chapter sixteen

Projects

16-1 Introduction

This chapter presents two large projects: the Milling Vise and the Tenon Jig. The projects are intended to serve as group projects or as large individual projects.

16-2 Project 1: Milling Vise

Figure 16-1 shows a milling vise. The subassemblies, detailed drawings, and BOMs are included.

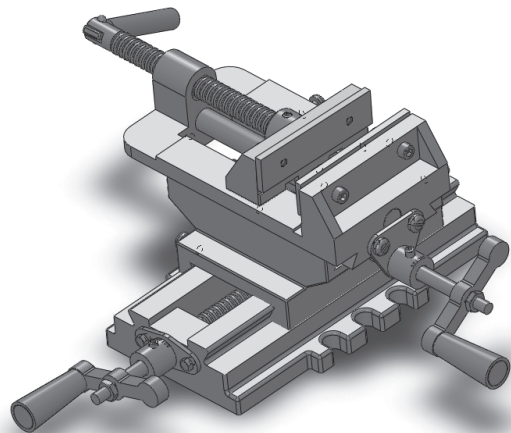
Complete the following or as it is assigned by your instructor.

1 The Milling Vise

See Figure 16-1.

- A. An assembly drawing.
- B. A BOM; include Item Numbers, Part Numbers, Descriptions, and Quantities

Figure 16-1
Milling Vise



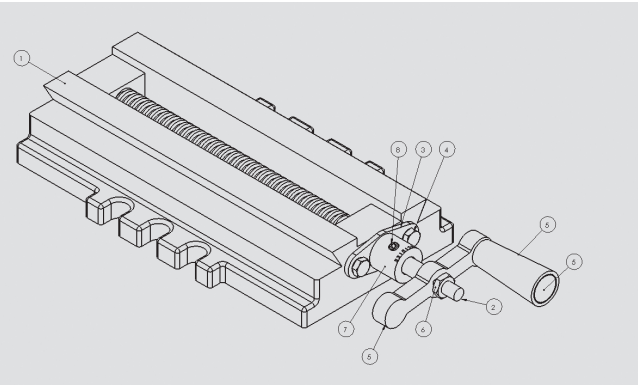
2 Base Subassembly

See Figure 16-2.

- A. An assembly drawing
- B. A BOM
- C. Dimensioned drawings of each part that is used in the subassembly.

Figure 16-2

Base Subassembly



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	BU2012-B	BASE	1
2	P100-20A	ACME, BASE	1
3	BU-313	PLATE, COVER, BASE	1
4	M6 × 1.0 × 16	SCREW, SLOTTED CAP	2
5	PN311-1A	HANDLE, SUBASSEMBLY	1
6	M8 × 1.25	NUT, HEX	1
7	ENG-2	COLLAR	1
8	M6 × 1.0 × 10	SET SCREW-CONE	1

Figure 16-5

Collar

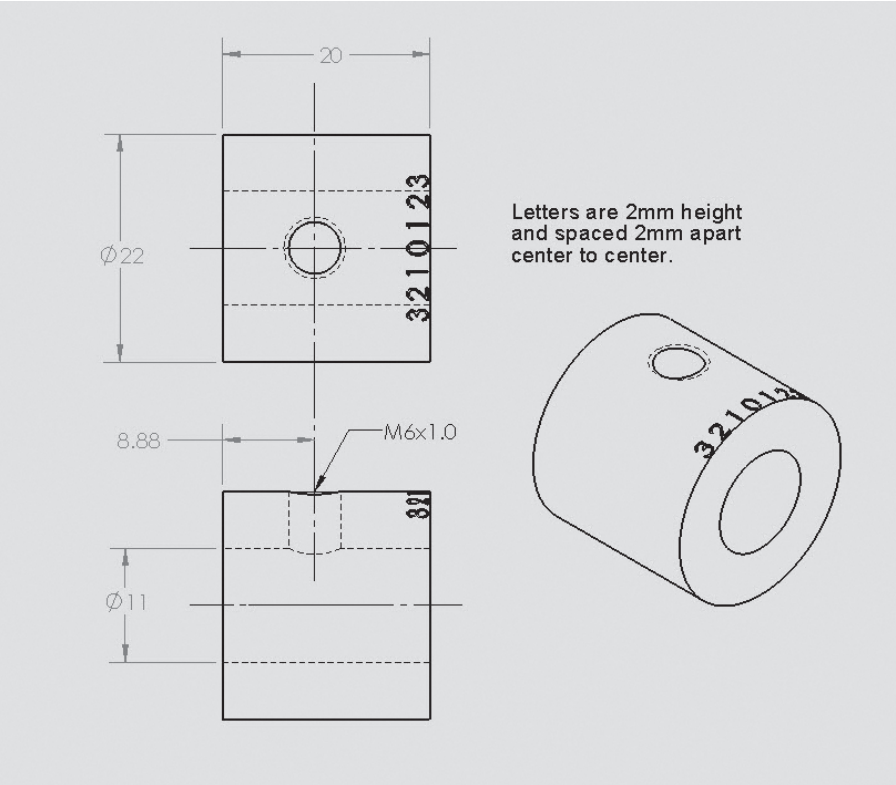


Figure 16-6

Plate, Cover, Base

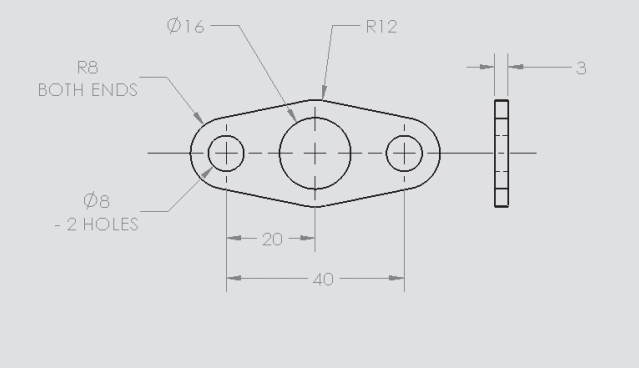
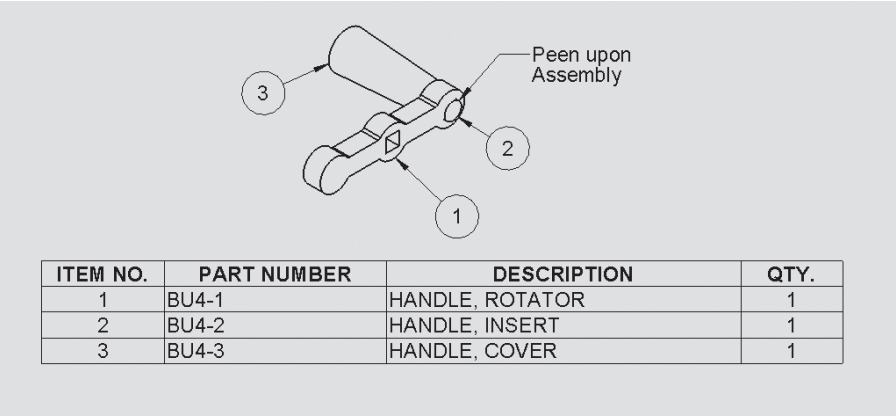


Figure 16-7

Handle Subassembly



Handle, Rotater

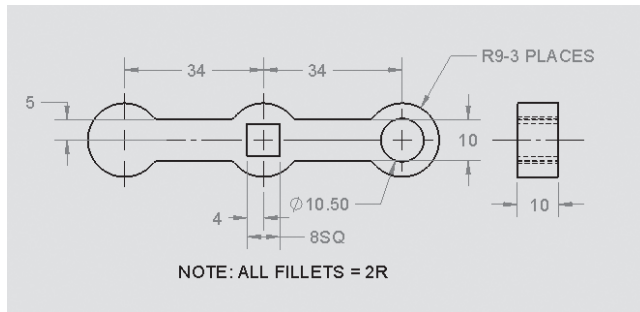


Figure 16-8

Handle, Insert

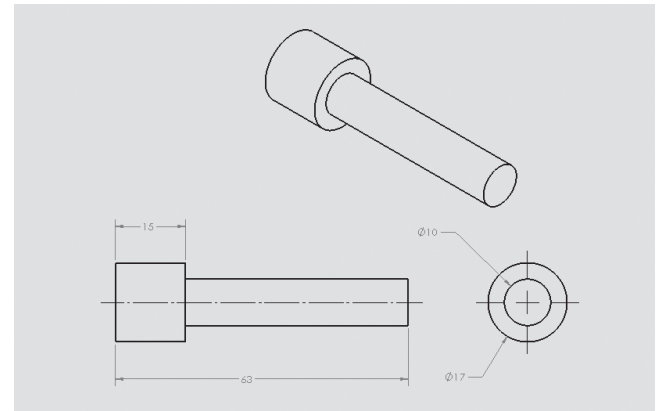
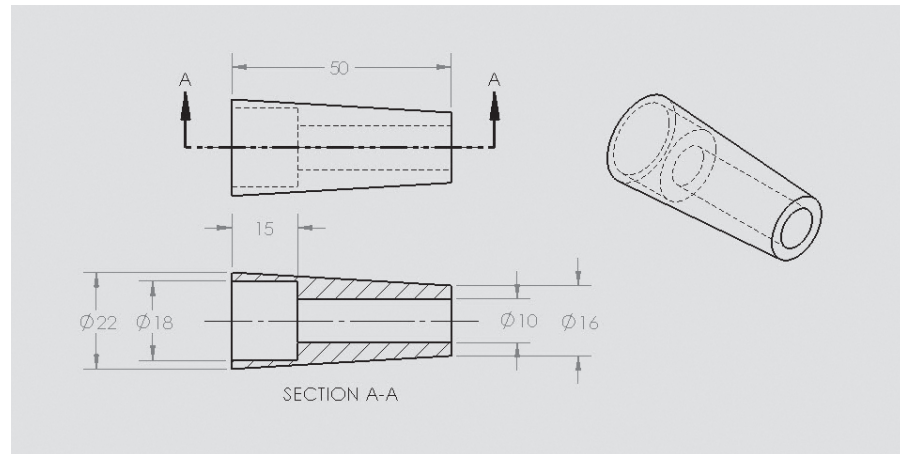


Figure 16-9

Figure 16-10

Handle, Cover



NOTE

Standard parts do not need drawings, but require manufacturer's part numbers listed in the BOM.

3 Middle Subassembly

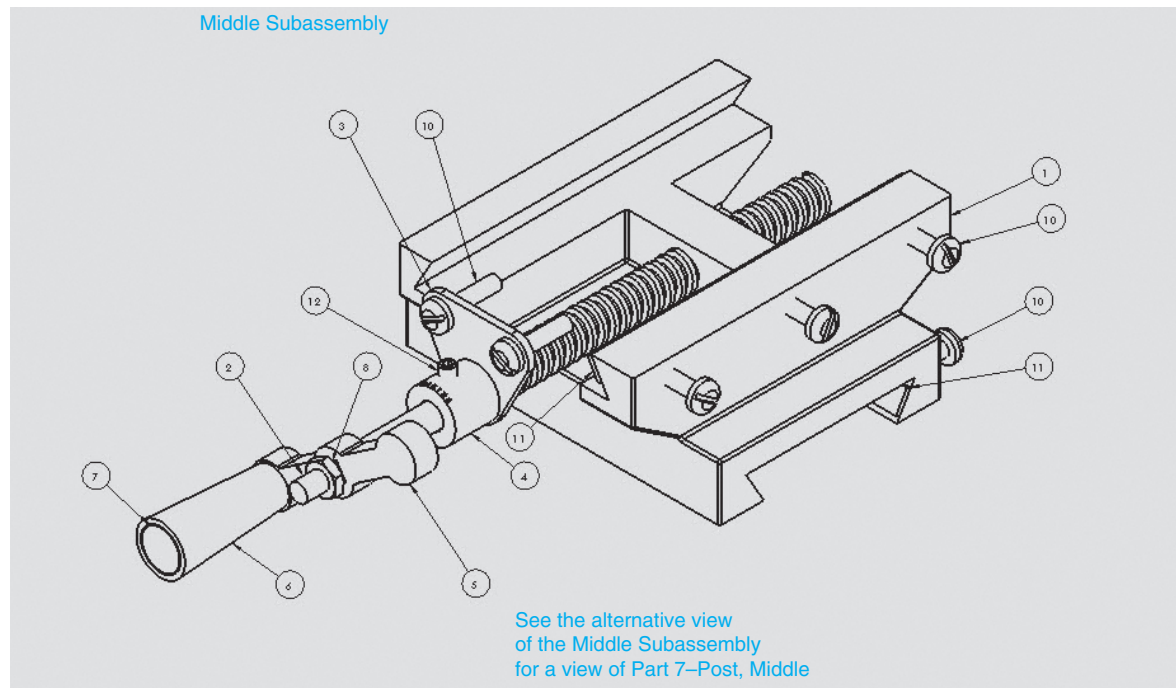
See Figure 16-11.

- A. An assembly drawing
- B. A BOM
- C. Dimensioned drawings of each part that is used in the Subassembly

NOTE

Standard parts do not need drawings, but require manufacturer's part numbers listed in the BOM.

Middle Subassembly



Middle BOM

Middle Subassembly BOM

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	S51-2A	SUPPORT, MIDDLE	1
2	P200-24	POST, ACME, MIDDLE	1
3	WIT-130	PLATE, END	1
4	ENG-2	COLLAR	1
5	PN311-1A	HANDLE, SUBASSEMBLY	1
6	M8 X 1.25	NUT, HEX	1
7	P155B	POST, MIDDLE	1
8	M6 x 1.0 x 25	SCREW, PAN	8
9	SP-33	BAR, SPACER	2
10	M6 x 1.0 x 16	SET SCREW, SOCKET	1

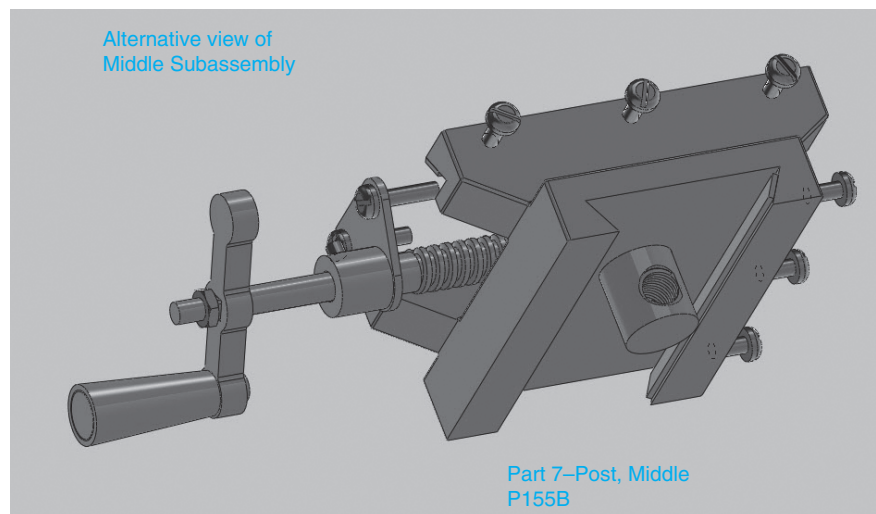


Figure 16-11

Dimensioned and tolerance drawings of the parts that make up the Base Subassembly are as follows:

Figure 16-12a and 16-12b Middle Subassembly

Note that Figure 16-12a shows a dimensioned drawing of the Support, Middle, but does not include any fillets. Fillets were omitted for clarity. Figure 16-12b is a 3D of the Support, Middle, that shows the fillets. Use the fillets shown in Figure 16-12b as a guide to applying fillets.

Middle Subassembly

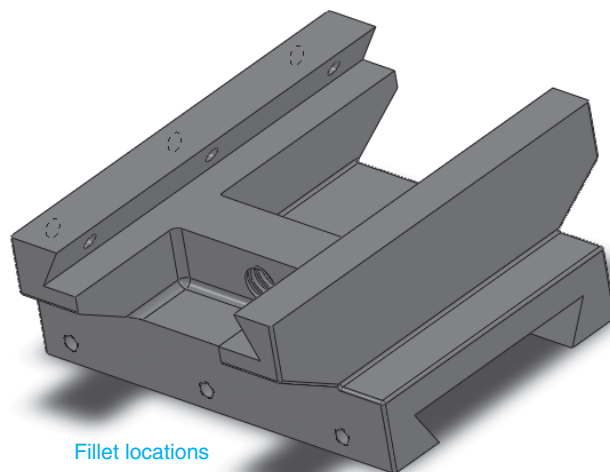
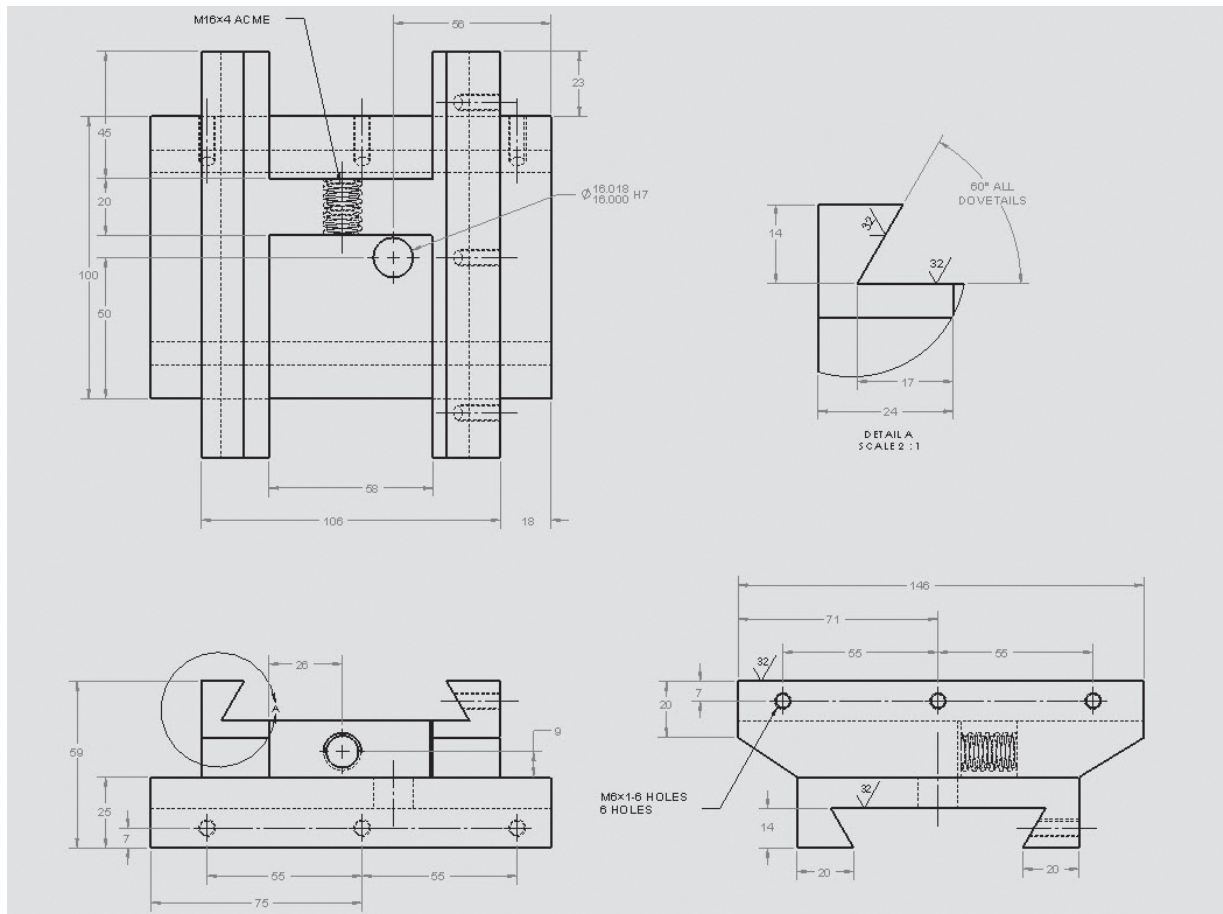


Figure 16-12

[illegible]

Technical drawing of a mechanical part showing a top view and a side view.

Top View Dimensions and Annotations:

- Overall width: 32
- Distance from center to side holes: 16
- Height: 12
- Central hole diameter: $\varnothing 12$
- Side holes diameter: $\varnothing 8$ BOTH SIDES
- Side hole radius: R8 BOTH SIDES
- Bottom fillet radius: R12

Side View Dimensions and Annotations:

- Thickness: 4

Technical drawing of a mechanical part showing a top view and a side view.

Top View:

- Outer diameter: $\varnothing 27$
- Inner diameter (hole): $\varnothing 16.012$ (tolerance $k6$)

Side View:

- Outer diameter: $\varnothing 16.012$ (tolerance $k6$)
- Inner diameter (hole): $\varnothing 16.012$ (tolerance $k6$)
- Height of the central section: 12.0
- Total height: 28
- Chamfer: $2 \times 45^\circ$
- Thread: M1 6x4 ACME

Note: Aligns with the acme, Base on the Base Subassembly

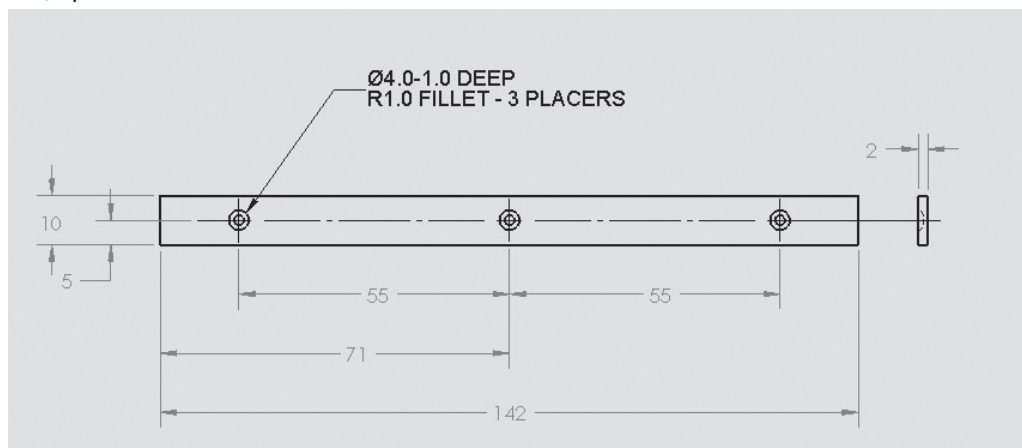
4 Top Subassembly

- A. An assembly drawing
- B. A BOM
- C. Dimensioned drawings of each part that is used in the Subassembly

NOTE

Standard parts do not need drawings, but require manufacturer's part numbers listed in the BOM.

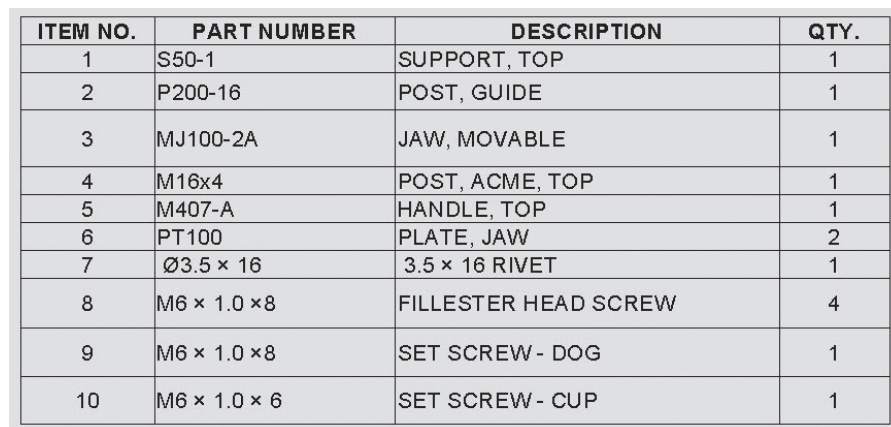
Bar, Spacer

**Figure 16-16**

Dimensioned and tolerance drawings of the parts that make up the base subassembly are as follows:

Figure 16-17a and Figure 16-17b Top Subassembly

Top Subassembly



Technical drawing of a mechanical assembly showing a front view, a side view, and a section A-A.

Front View: Shows a rectangular plate with a central circular hole and two smaller holes on either side. Dimensions include a total width of 200, a central hole diameter of $\phi 16$, and a distance of 60 between the side holes. The plate has a thickness of 12 and a central raised section of height 21. The side holes are $\phi 7-2$ and are spaced 22 apart. The central hole is $\phi 16$ and is spaced 26 from the side holes. The plate has a total height of 104 and a central raised section of height 28. The side holes are spaced 20 from the bottom edge. The plate has a total width of 200 and a central raised section of height 28. The side holes are spaced 20 from the bottom edge. The plate has a total height of 104 and a central raised section of height 28. The side holes are spaced 20 from the bottom edge.

Side View: Shows the profile of the plate with a central raised section. Dimensions include a total width of 200, a central hole diameter of $\phi 16$, and a distance of 60 between the side holes. The plate has a thickness of 12 and a central raised section of height 21. The side holes are $\phi 7-2$ and are spaced 22 apart. The central hole is $\phi 16$ and is spaced 26 from the side holes. The plate has a total height of 104 and a central raised section of height 28. The side holes are spaced 20 from the bottom edge. The plate has a total width of 200 and a central raised section of height 28. The side holes are spaced 20 from the bottom edge. The plate has a total height of 104 and a central raised section of height 28. The side holes are spaced 20 from the bottom edge.

Section A-A: Shows a cross-section of the plate with a central hole and two smaller holes on either side. Dimensions include a total width of 200, a central hole diameter of $\phi 16$, and a distance of 60 between the side holes. The plate has a thickness of 12 and a central raised section of height 21. The side holes are $\phi 7-2$ and are spaced 22 apart. The central hole is $\phi 16$ and is spaced 26 from the side holes. The plate has a total height of 104 and a central raised section of height 28. The side holes are spaced 20 from the bottom edge. The plate has a total width of 200 and a central raised section of height 28. The side holes are spaced 20 from the bottom edge. The plate has a total height of 104 and a central raised section of height 28. The side holes are spaced 20 from the bottom edge.

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Figure 16-19

Post, Acme, Top
Post, Acme, Top

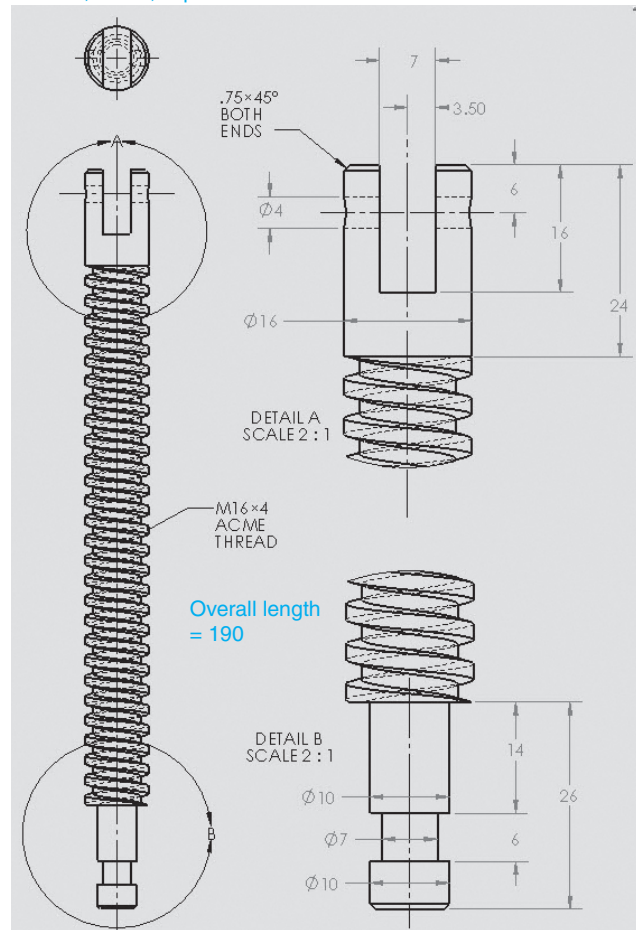


Figure 16-20

Post, Guide

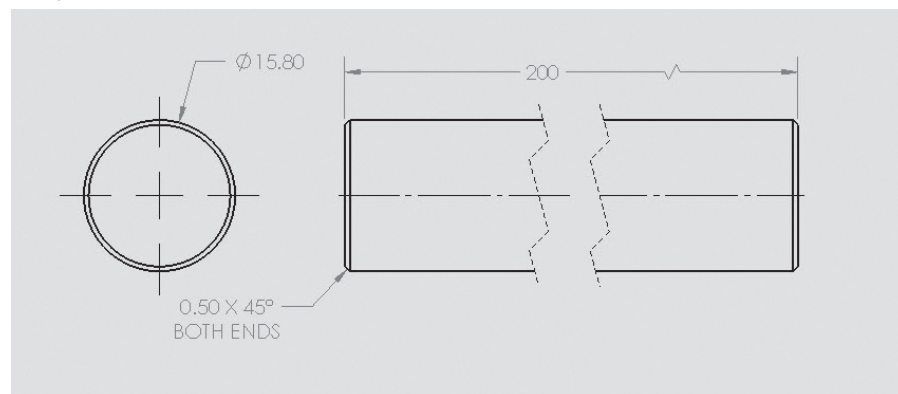


Figure 16-21a and 16-21b Jaw, Movable

Note that Figure 16-21a shows a dimensioned drawing of the Jaw, Movable, but does not include any fillets. Fillets were omitted for clarity. Figure 16-21b is a 3D of the Jaw, Movable, that shows the fillets. Use the fillets shown in Figure 16-21b as a guide to applying fillets.

Jaw, Movable

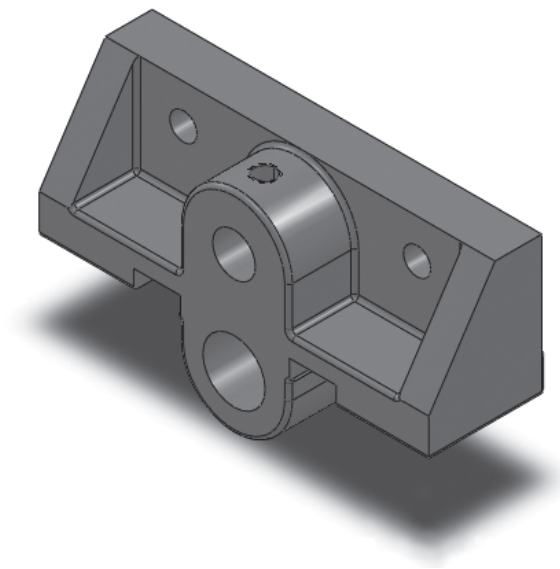
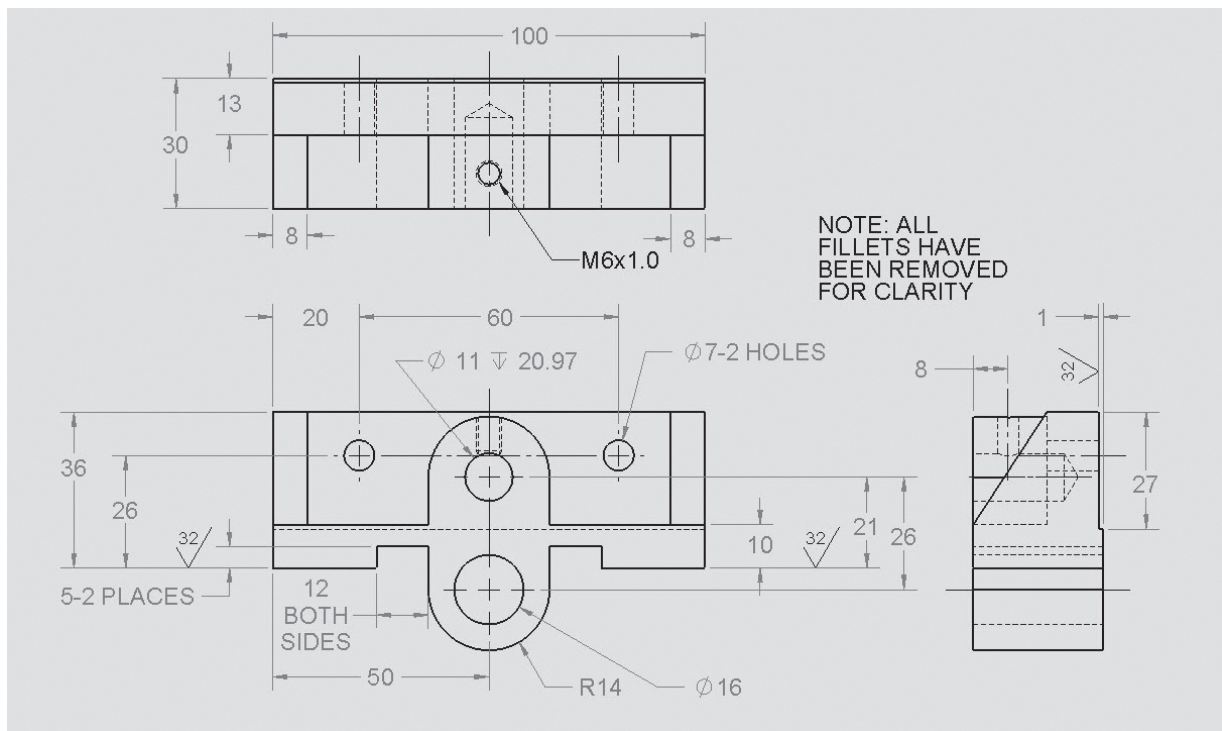


Figure 16-21

Figure 16-22

Handle

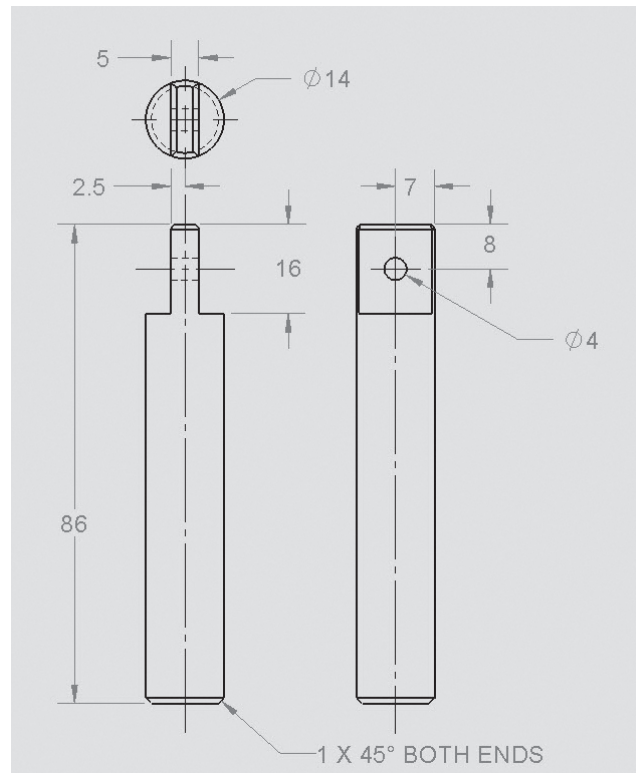
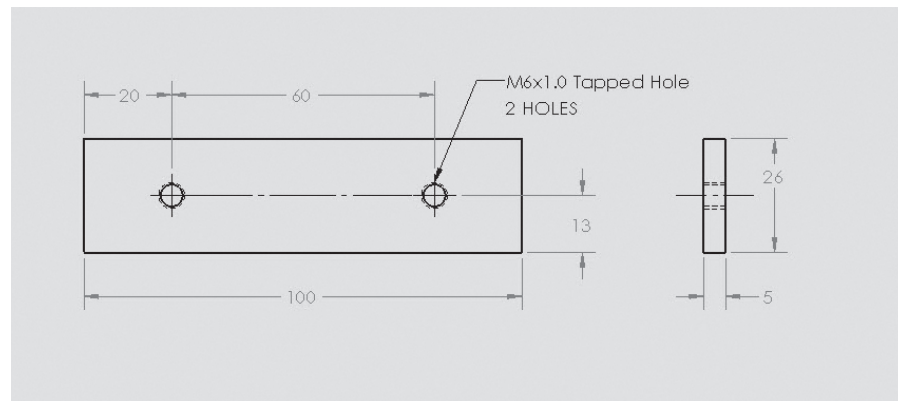


Figure 16-23

Plate, Jaw



16-3 Project 2: Tenon Jig

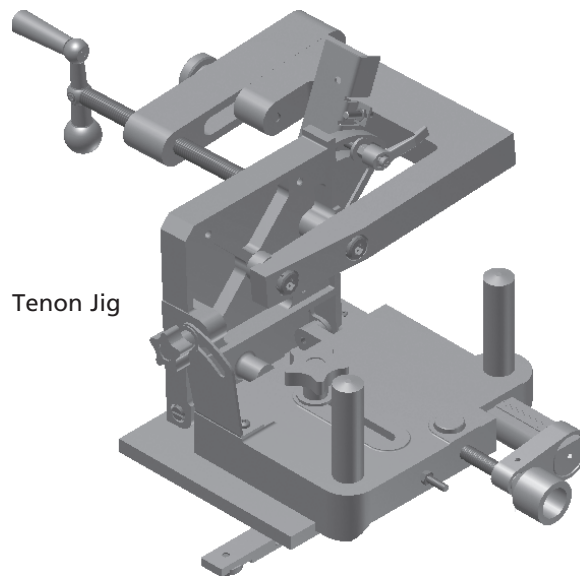
The Tenon Jig has four main subassemblies: Clamping, Vertical, Base Plate, and Guide Plate. There are other parts that are used in the final assembly. This is intended to be a group project, but could be done by one person. Complete the following assignments:

A. Draw the Clamping Subassembly.

- 1 Create a BOM for the Clamping Subassembly.
- 2 Complete drawings for each part.
- 3 Create dimensioned drawings of each part.
- 4 Create an Exploded Assembly drawing with balloons referencing each part to the BOM.

- B. Draw the Vertical Subassembly.
- 1 Create a BOM for the Vertical Subassembly.
 - 2 Complete drawings for each part.
 - 3 Create dimensioned drawings of each part.
 - 4 Create an Exploded Assembly drawing with balloons referencing each part to the BOM.
- C. Draw the Base Plate Subassembly.
- 1 Create a BOM for the Base Plate Subassembly.
 - 2 Complete drawings for each part.
 - 3 Create dimensioned drawings of each part.
 - 4 Create an Exploded Assembly drawing with balloons referencing each part to the BOM.
- D. Draw the Guide Plate Subassembly.
- 1 Create a BOM for the Guide Plate Subassembly.
 - 2 Complete drawings for each part.
 - 3 Create dimensioned drawings of each part.
 - 4 Create an Exploded Assembly drawing with balloons referencing each part to the BOM.
- E. Create an Assembly drawing of the Tenon Jig.
- 1 Create a BOM for the Tenon Jig.

Figure 16-24a



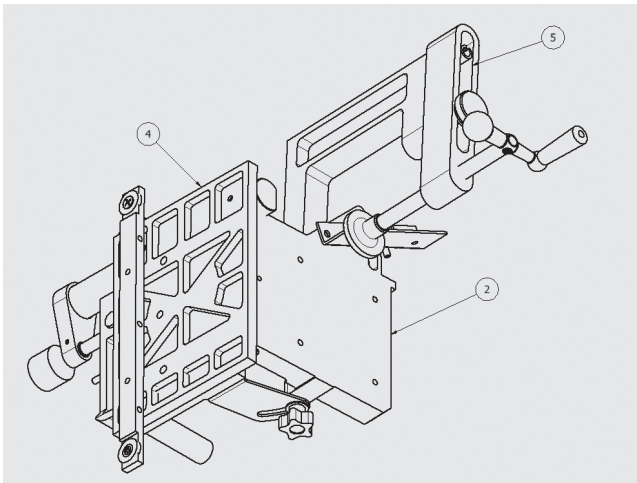


Figure 16-24b

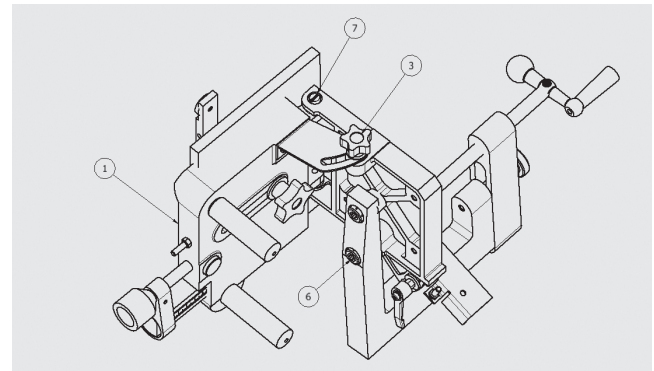


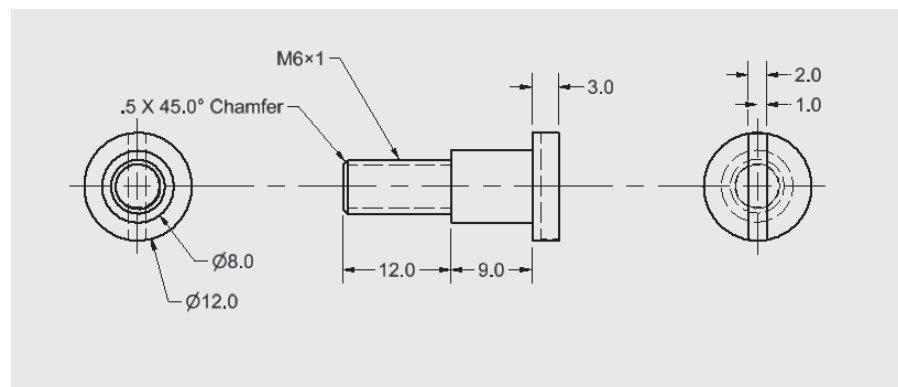
Figure 16-24c

Figure 16-24d

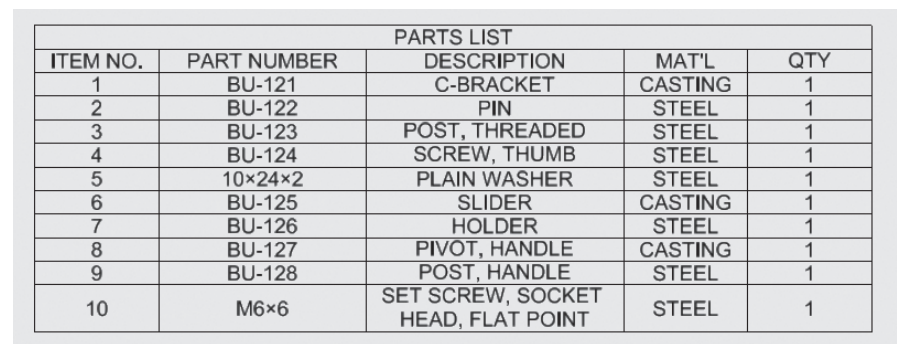
PARTS LIST				
ITEM	PART NUMBER	DESCRIPTION	MATERIAL	QTY
1	SA-1	BASE SUB-ASSEMBLY		1
2	SA-2	VERTICAL SUB-ASSEMBLY		1
3	SA-3	ADJUSTER SUB-ASSEMBLY		1
4	SA-4	GUIDE SUB-ASSEMBLY		1
5	SA-5	CLAMP SUB-ASSEMBLY		1
6	M10x1.5 x 25	DRILLED FORGED HEAXAGON SOCKET HEAD CAP SCREW	MILD STEEL	2
7	SA-6B	SLOTTED HEAD MACHINE SCREW	MILD STEEL	2

Figure 16-24e

Slotted Head Machine Screw
PN: SA-6B



A 3D model of a C-clamp, showing its L-shaped body, a threaded rod with a handle, and a circular base plate.



Technical drawing of a C-Bracket (PN: BU-121) showing three views: front, side, and end view. The drawing includes dimensions in millimeters and a note: "NOTE: ALL FILLETS = R5".

Front View Dimensions:

- Total Height: 208.0
- Top Section Height: 132.0
- Top Section Width: 24.0
- Top Section Hole Diameter: $\varnothing 12.0$ - 2 HOLES
- Bottom Section Hole Diameter: $\varnothing 18.0$ - 2 HOLES

Side View Dimensions:

- Total Length: 163.0
- Top Section Length: 128.0
- Top Section Height: 28.0
- Top Section Width: 12.0
- Bottom Section Width: 24.0
- Bottom Section Length: 14.0
- Bottom Section Hole Diameter: $\varnothing 12.0$ - 2 HOLES

End View Dimensions:

- Total Height: 132.0
- Top Section Height: 10.0
- Top Section Hole Diameter: $\varnothing 12.0 \pm 16.0$
- Bottom Section Hole Diameter: M8x1.25
- Bottom Section Height: 54.0
- Bottom Section Width: 16.0
- Bottom Section Hole Diameter: $\varnothing 12.0$ - 2 HOLES

Other Dimensions:

- Top Section Fillet Radius: R12.0
- Bottom Section Fillet Radius: R12.0
- Bottom Section Fillet Radius: R12.0

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Pin
PN: BU-122

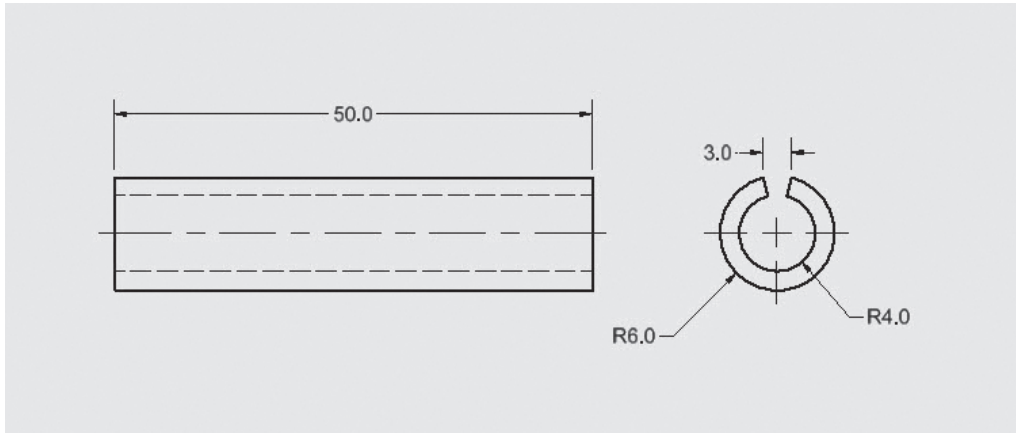


Figure 16-27

Post Threaded
PN: BU-123

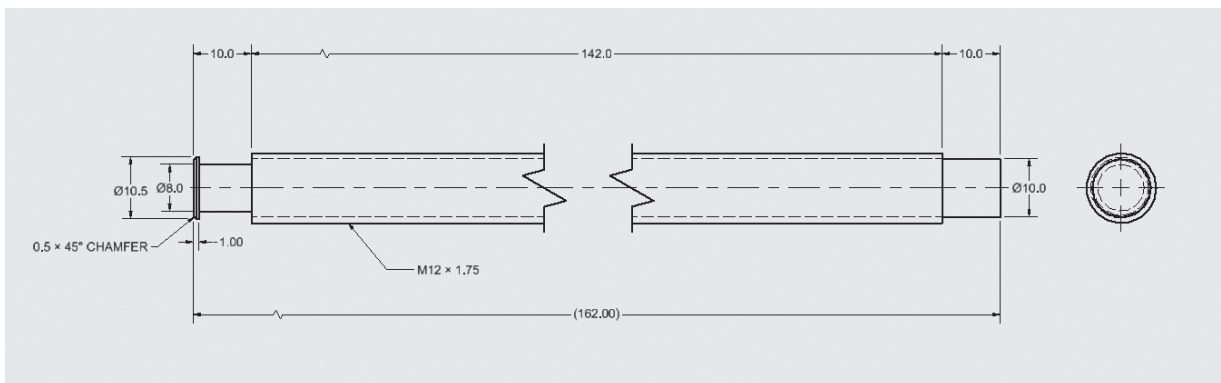


Figure 16-28

Screw, Thumb
PN: BU-124

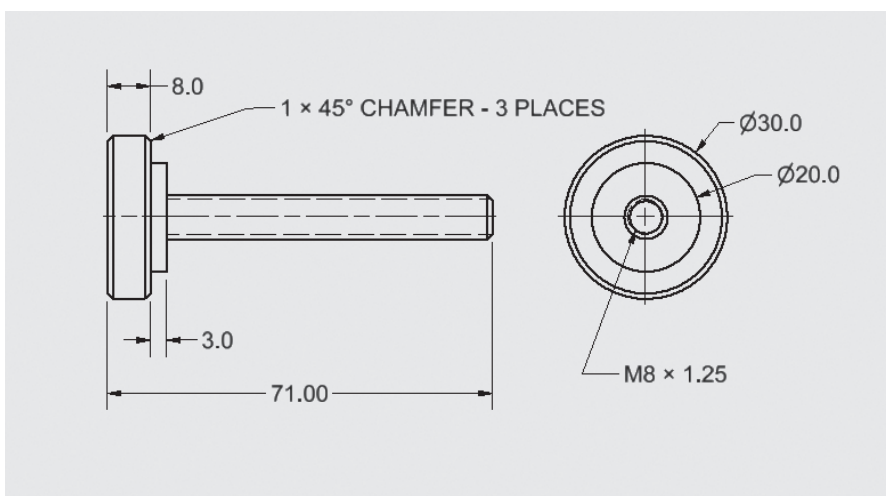


Figure 16-29

Slider
PN: BU-125

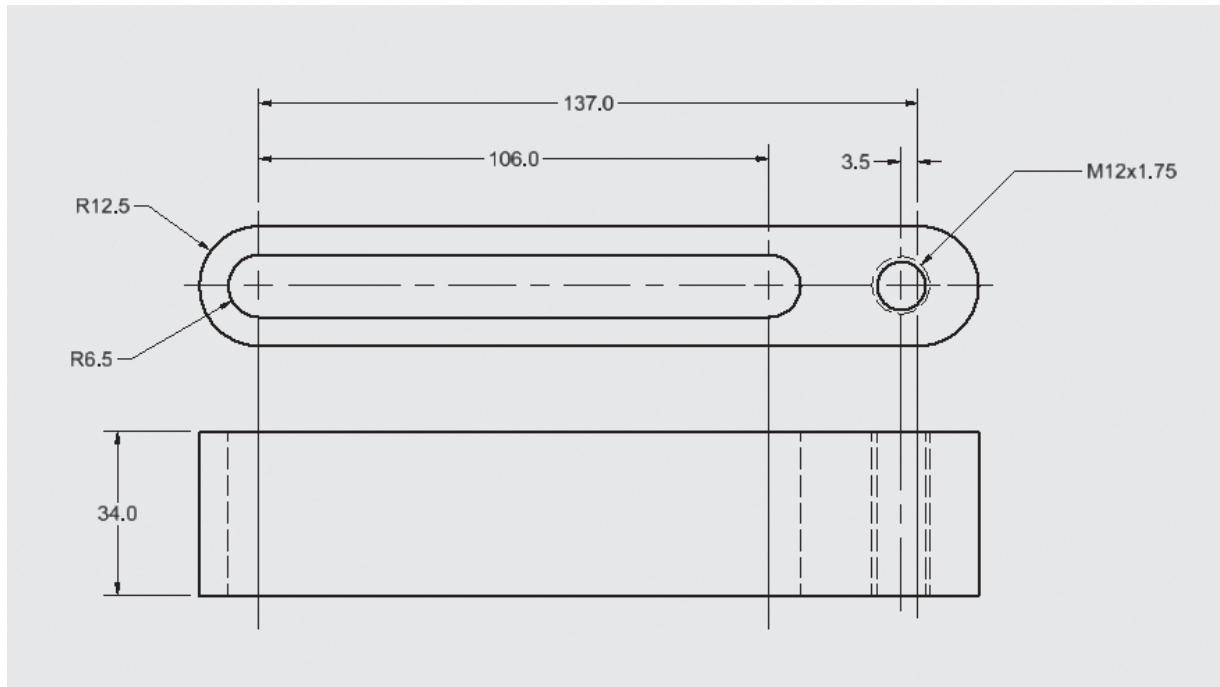


Figure 16-30

Holder
PN: BU-126

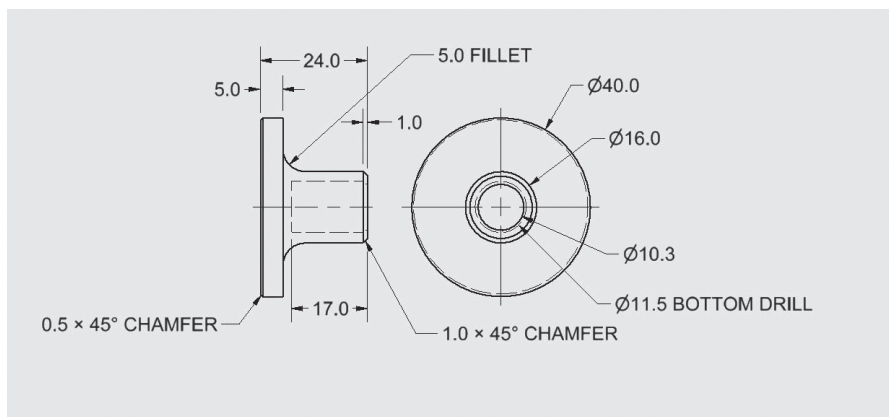
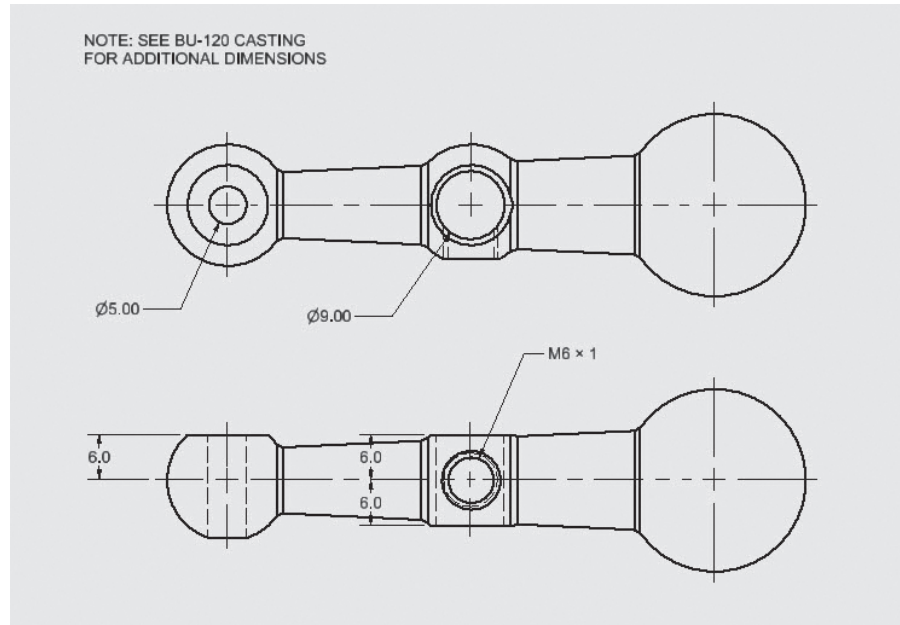


Figure 16-31

Figure 16-32

Pivot, Handle
PN: BU-127



Casting for Pivot, Handle

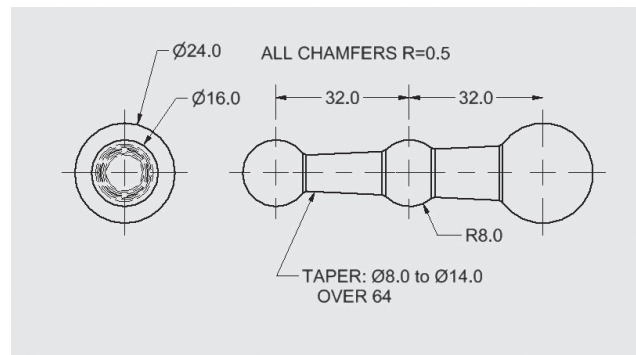


Figure 16-33

Post, Handle
PN: BU-128

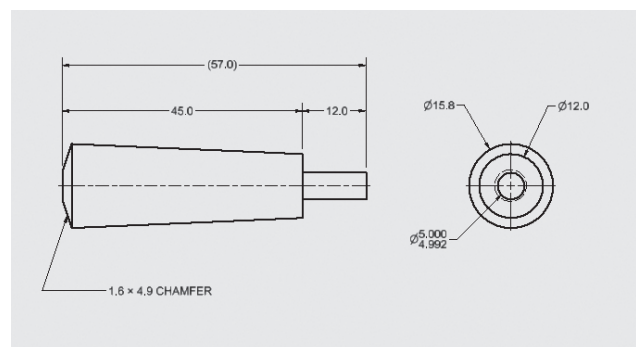
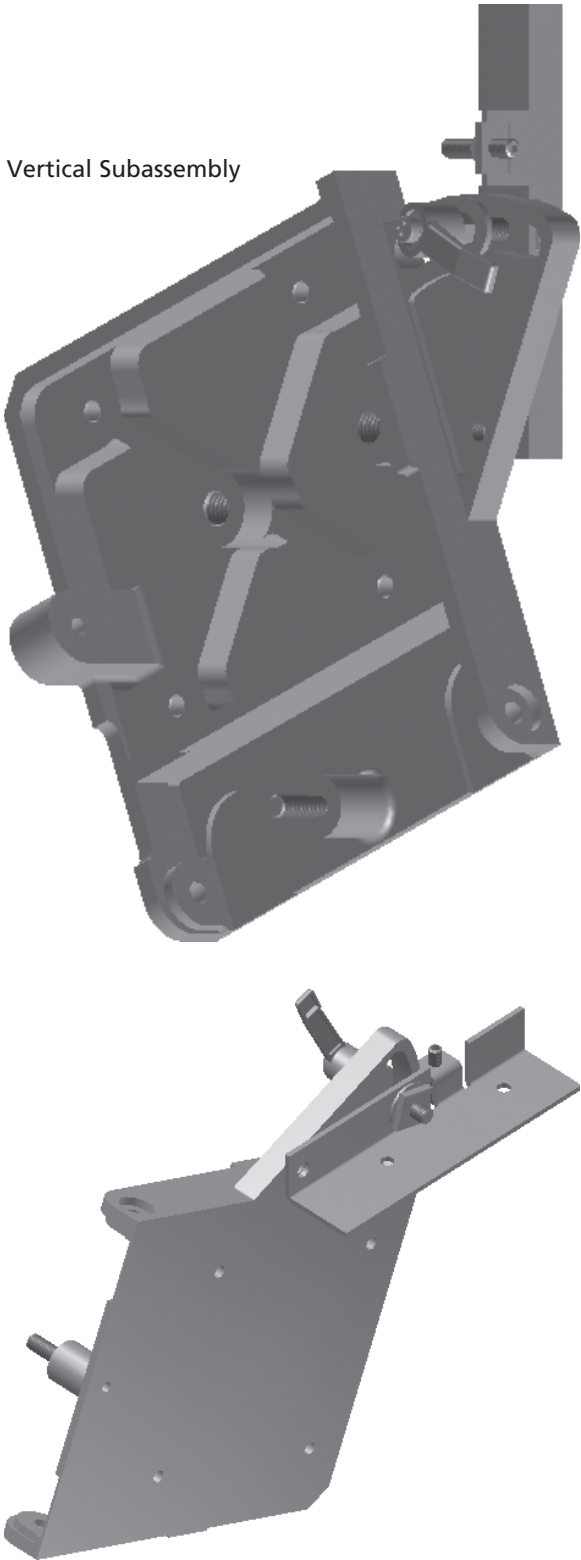


Figure 16-34

Vertical Subassembly



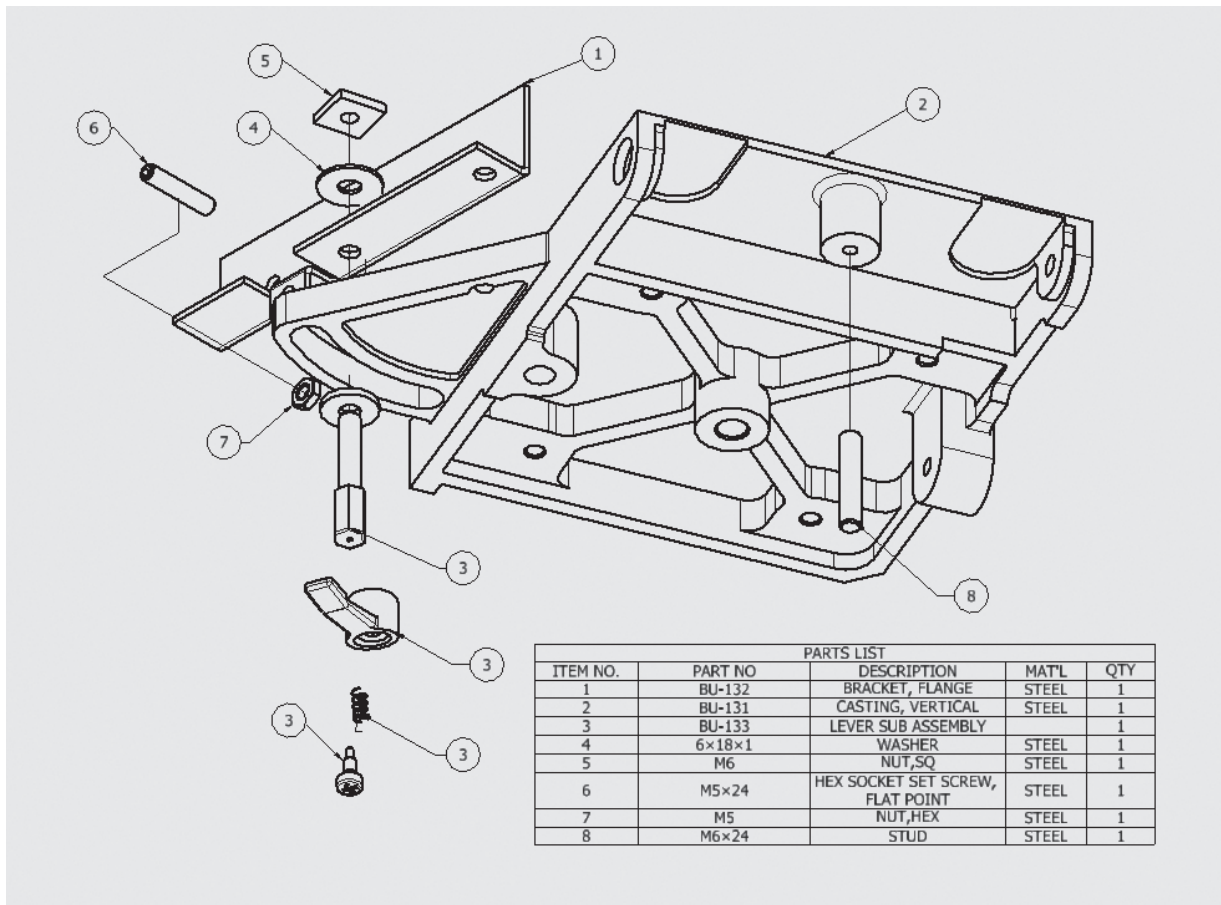


Figure 16-35

Bracket, Flange
PN: BU-132

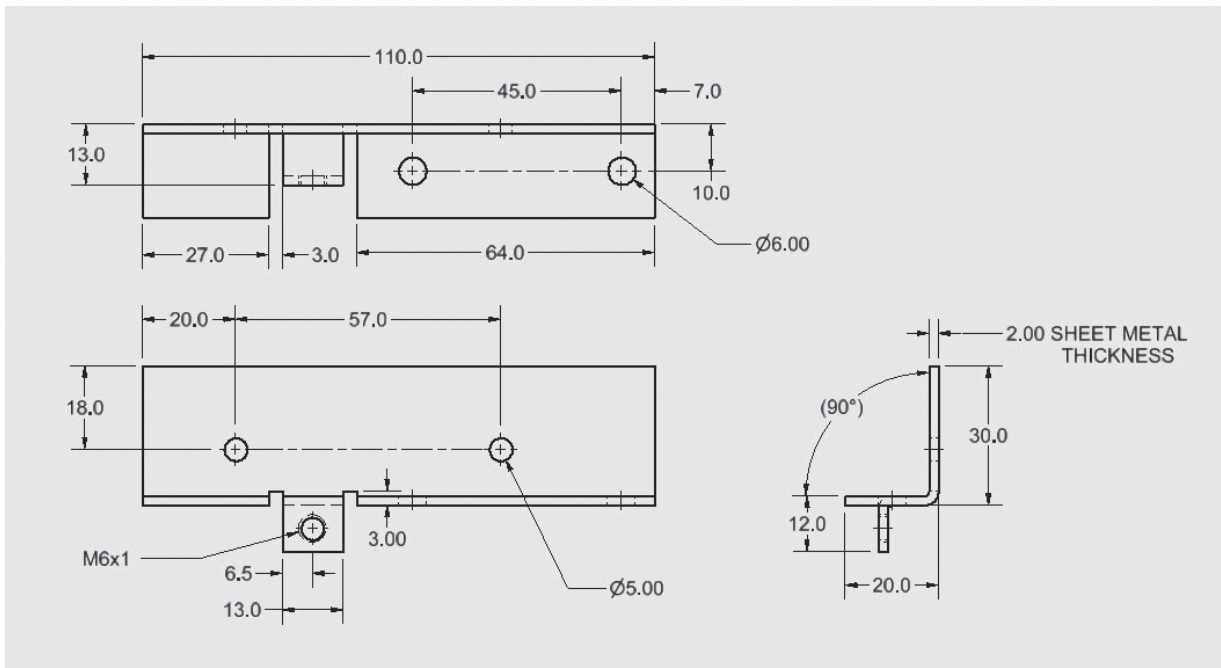


Figure 16-36

Figure 16-37a

Casting, Vertical
PN: BU-131

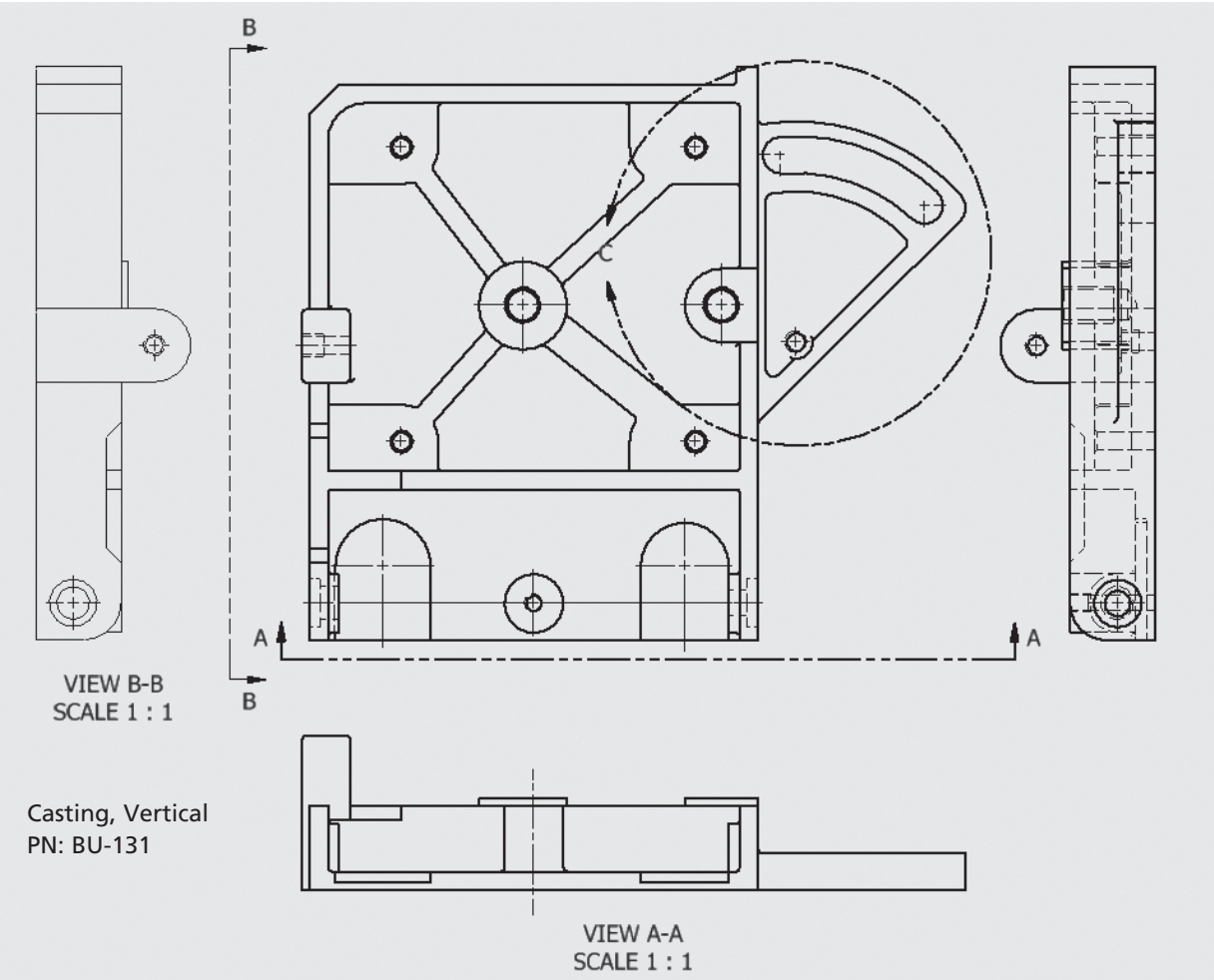
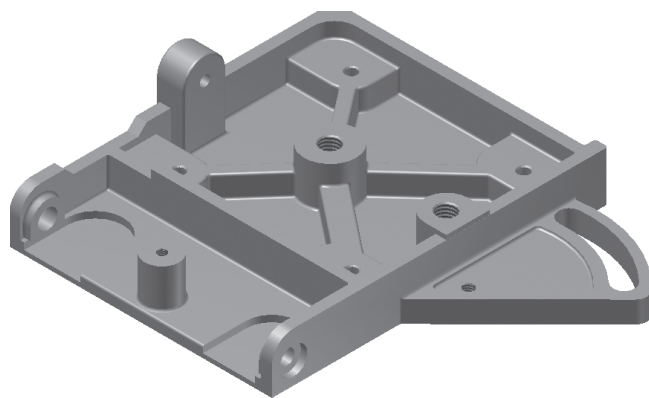


Figure 16-37b

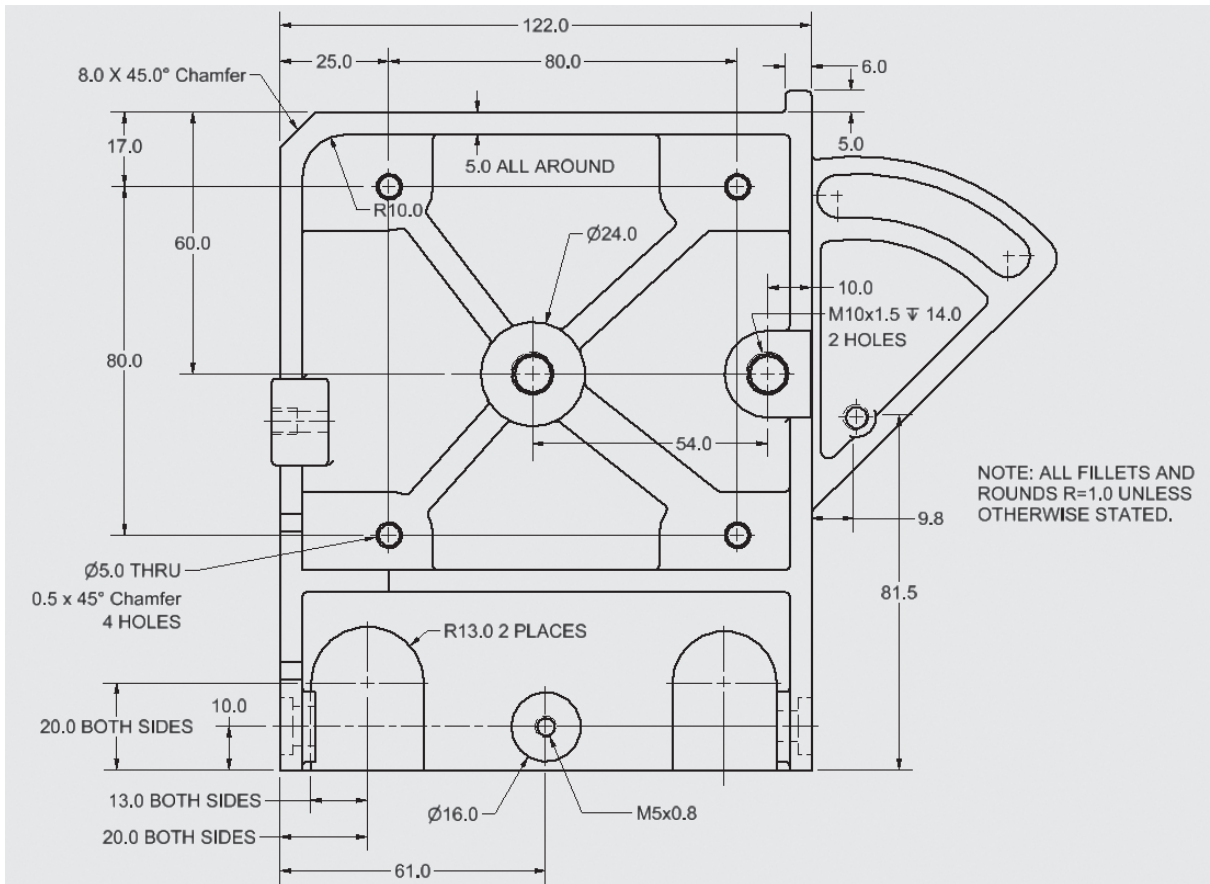


Figure 16-37c

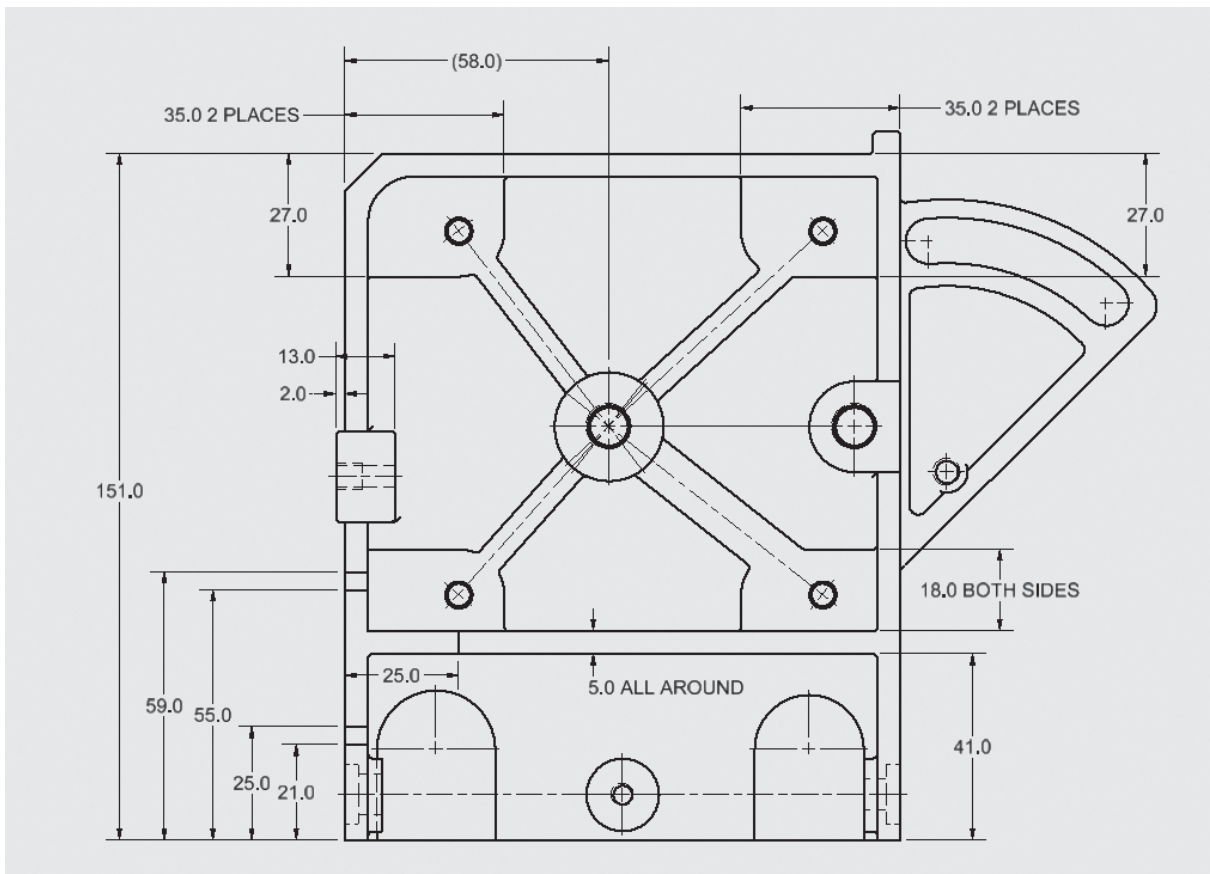


Figure 16-37d

Technical drawing of Detail C, a mechanical part. The drawing shows a cross-section of a component with a semi-circular outer profile and a rectangular base. Key features and dimensions include:

- Dimensions:**
 - 6.2 (Horizontal distance from the vertical centerline to the start of the top fillet)
 - 45.2° (Angle of the top outer profile)
 - 2.0 (Horizontal distance from the vertical centerline to the start of the bottom fillet)
 - 5.2 (Horizontal distance from the vertical centerline to the center of the bottom hole)
 - 8.0 ± IS // TO EDGE (Horizontal distance from the vertical centerline to the edge of the bottom hole)
- Radiuses:**
 - R60.0 (Top outer radius)
 - R51.0 (Top inner radius)
 - R5.0 (Bottom outer radius)
 - R5.0 BOTH ENDS (Bottom inner radius at both ends)
 - R2.0 - 3 PLACES (Small fillets at three locations)
 - R4.5 (Radius of the bottom hole)
 - R41.0 (Radius of the bottom fillet)
- Features:**
 - Two circular holes on the left side.
 - A central hole with a diameter of 8.0 ± IS.
 - A fillet labeled "RUNOUT" at the bottom center.
 - A fillet labeled "M6x1" at the bottom center.

DETAIL C
SCALE 2 : 1

Technical drawing of a mechanical part, labeled VIEW B-B, showing dimensions and features. The drawing is a cross-section view of a vertical component. Key dimensions include a total height of 76.0, a top width of 23.0, and a central horizontal section with a width of 32.0. A hole is specified as M6x1. Other dimensions include 2.0, 10.0, 20.0, 4.0, 10.0, and 13.0. The drawing also shows a circular feature with a diameter of 9.0 and a hole with a diameter of 13.0.

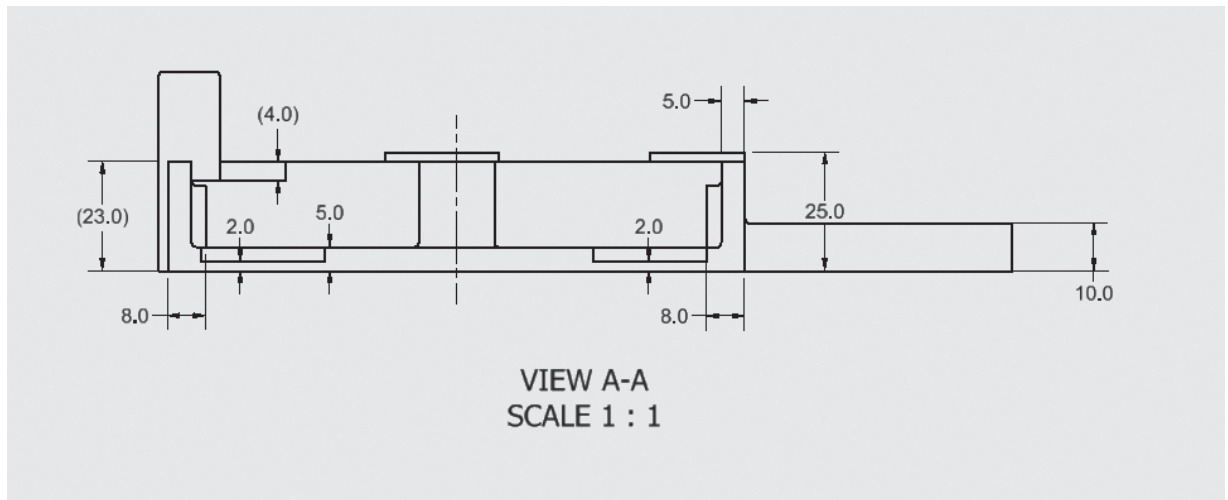
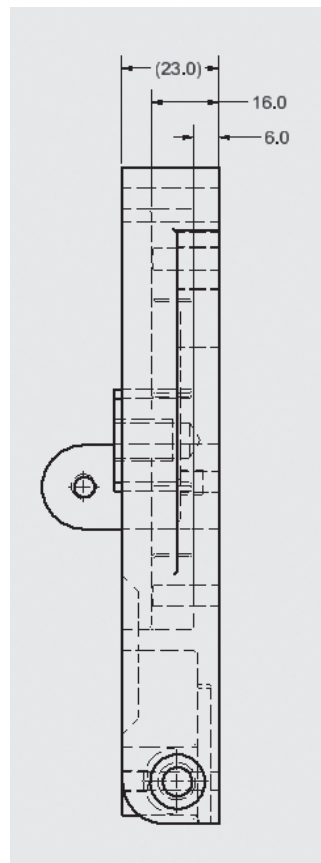


Figure 16-37g

Figure 16-37h

Right Side View



Lever Subassembly
PN: BU-133

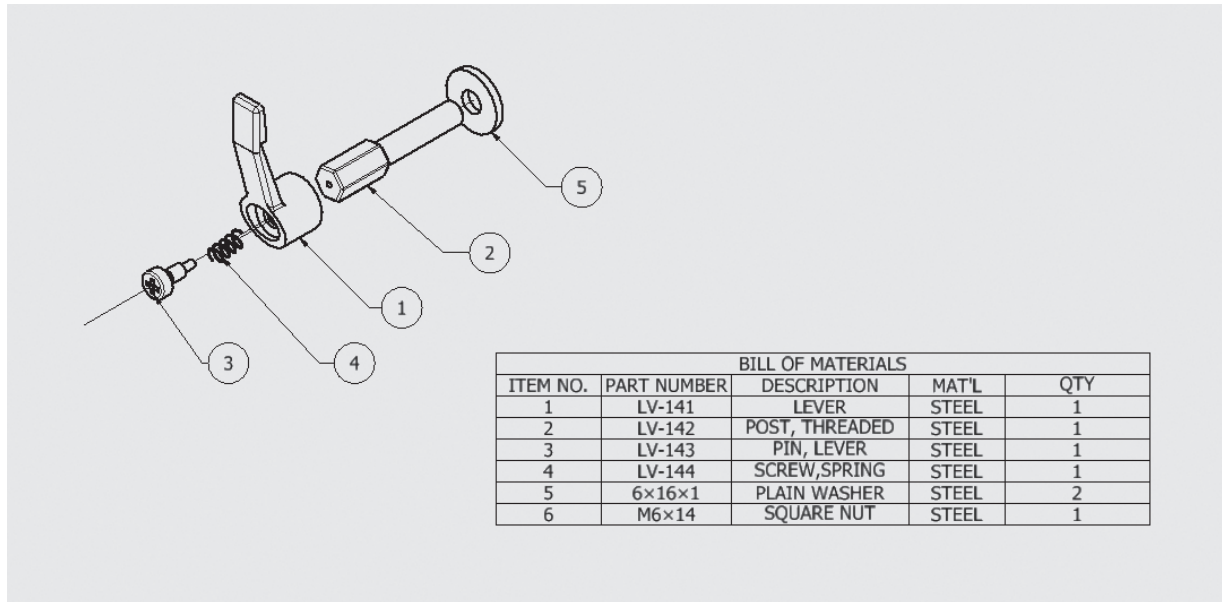


Figure 16-38a

Lever
PN: LV-141

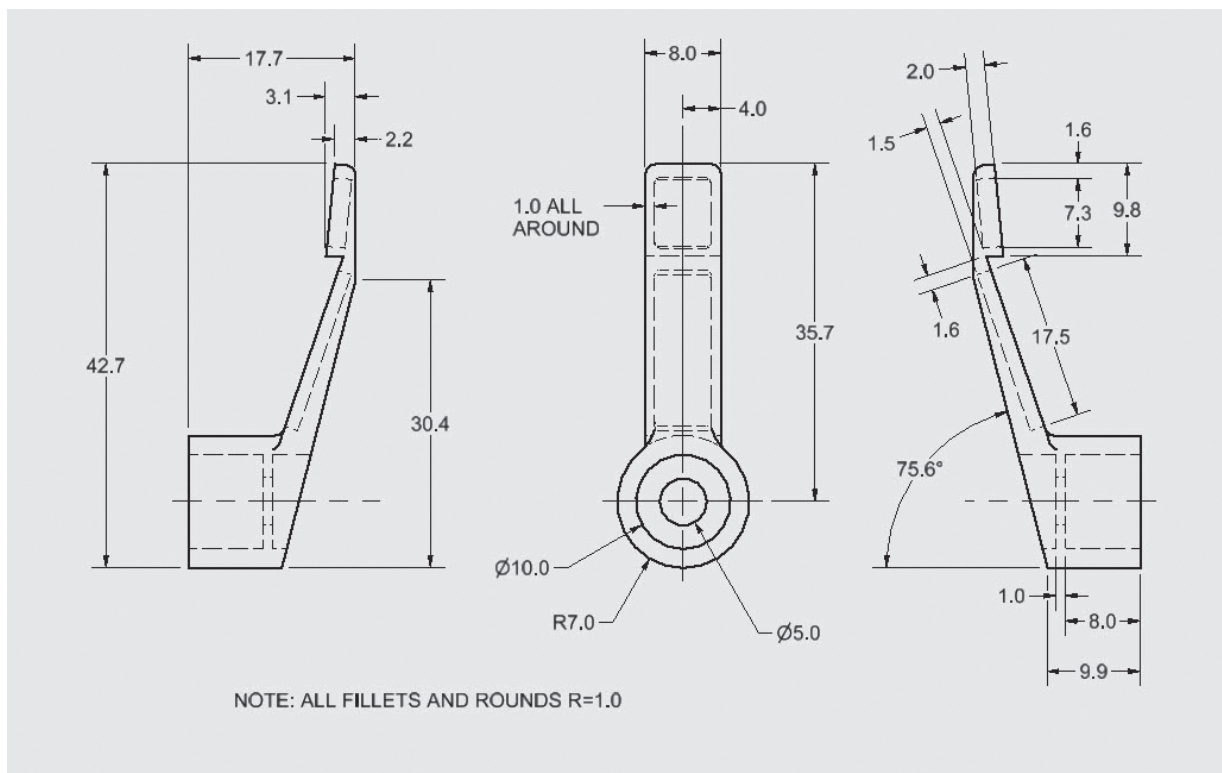


Figure 16-38b

Figure 16-38c

Post, Threaded
PN: LV-142

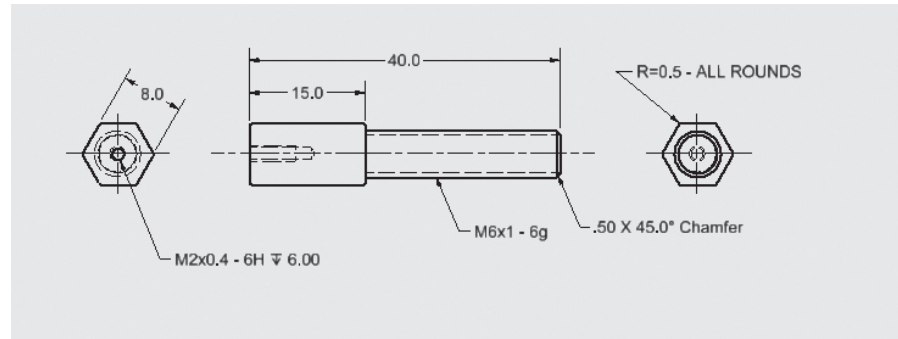


Figure 16-38d

Pin, Lever
PN: LV-143

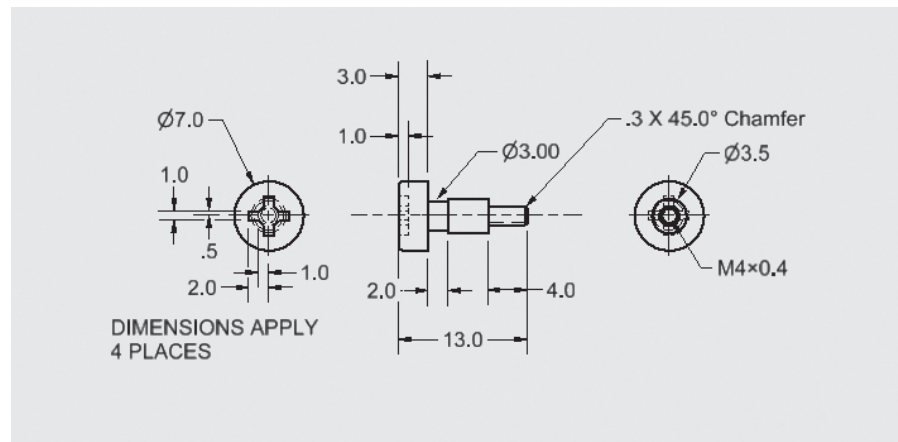


Figure 16-38e

Screw, Spring
PN: LV-144

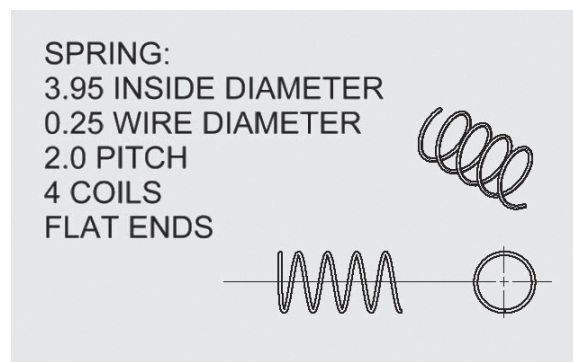


Figure 16-39a

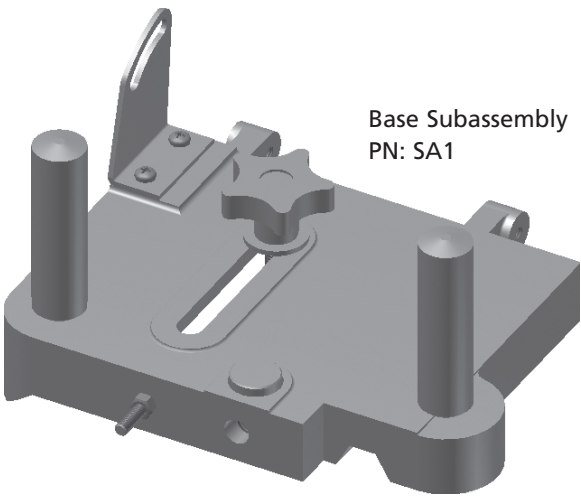


Figure 16-39b

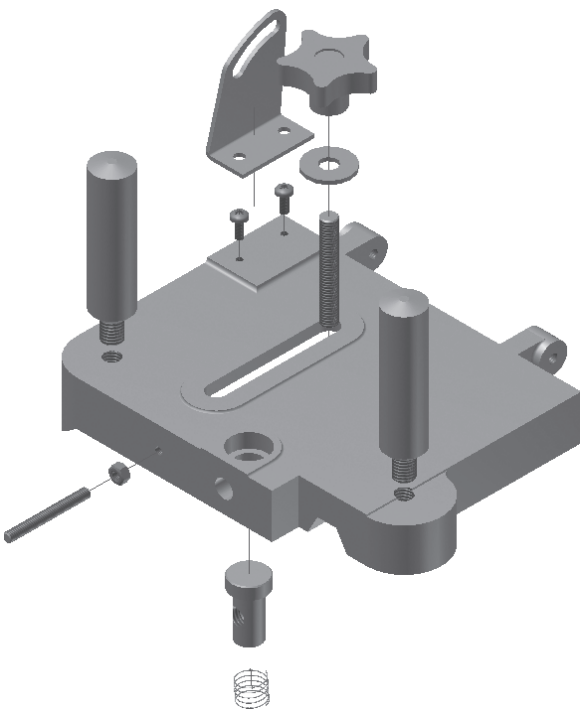


Figure 16-39c

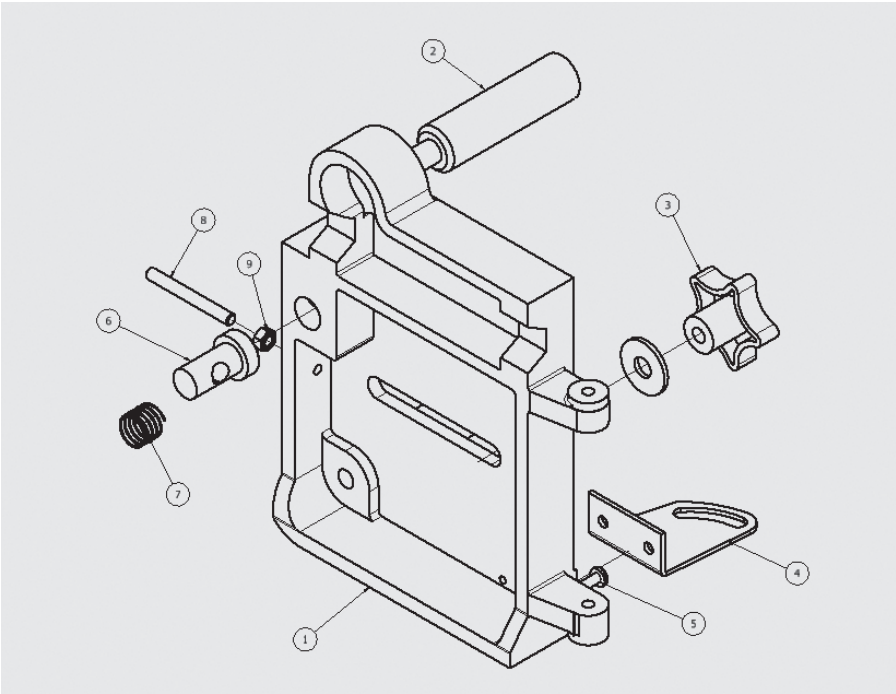


Figure 16-39d

PARTS LIST				
ITEM	PART NUMBER	DESCRIPTION	MATERIAL	QTY
1	BU-306-A	PLATE, BASE	CAST STEEL	1
2	P53-A2	POST, HANDLE, LARGE	STEEL	2
3	H5-21	LARGE KNOB SUB-ASSEMBLY		1
4	BU202	CLIP, BASE	STEEL	1
5	M4x0.7 x 10	Cross Recessed Pan Head Machine Screw	STEEL, MILD	2
6	P23-402	POST, RELEASE	STEEL	1
7	BU-003	SPRING	PIANO WIRE	1
8	M5x45	STUD	STEEL	1
9	M5	HEX NUT	Steel	1

Figure 16-40a

Plate, Base
BU-306-A

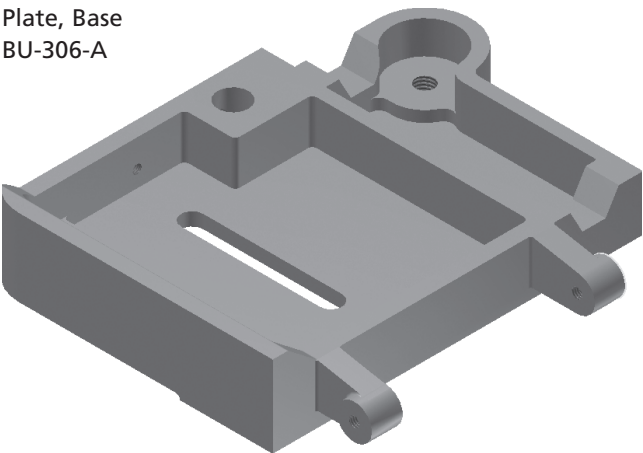


Figure 16-40b

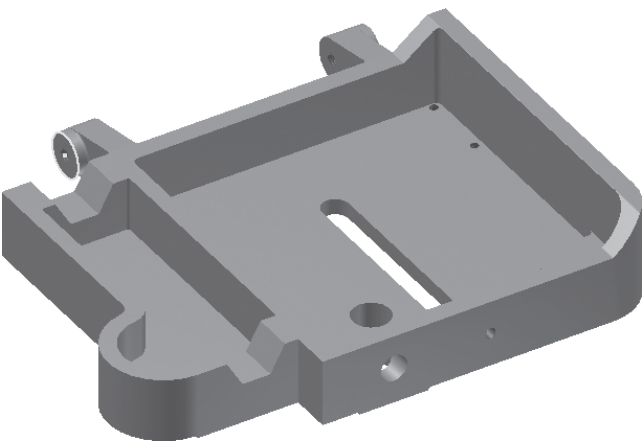
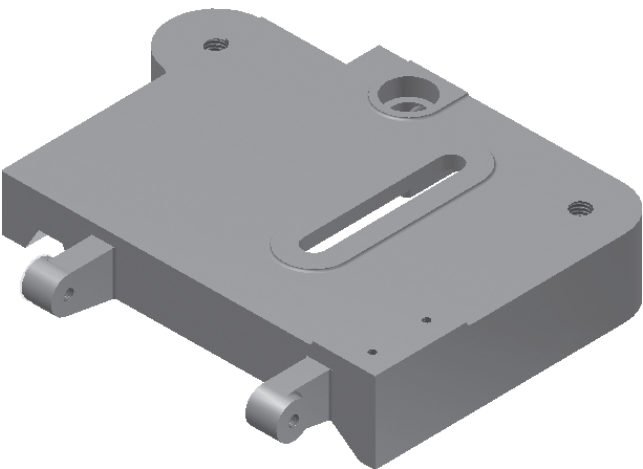


Figure 16-40c





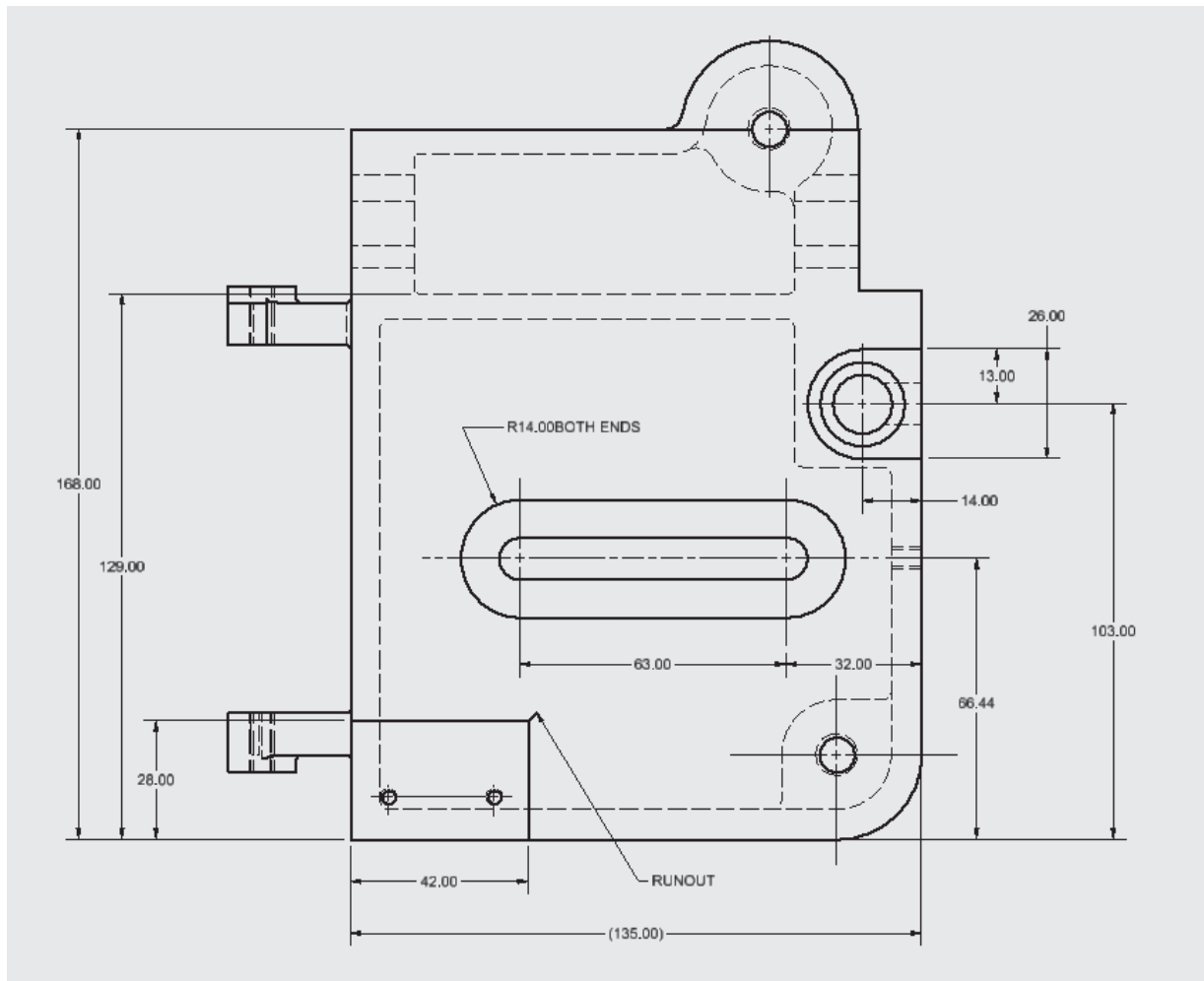


Figure 16-40f

Figure 16-40g

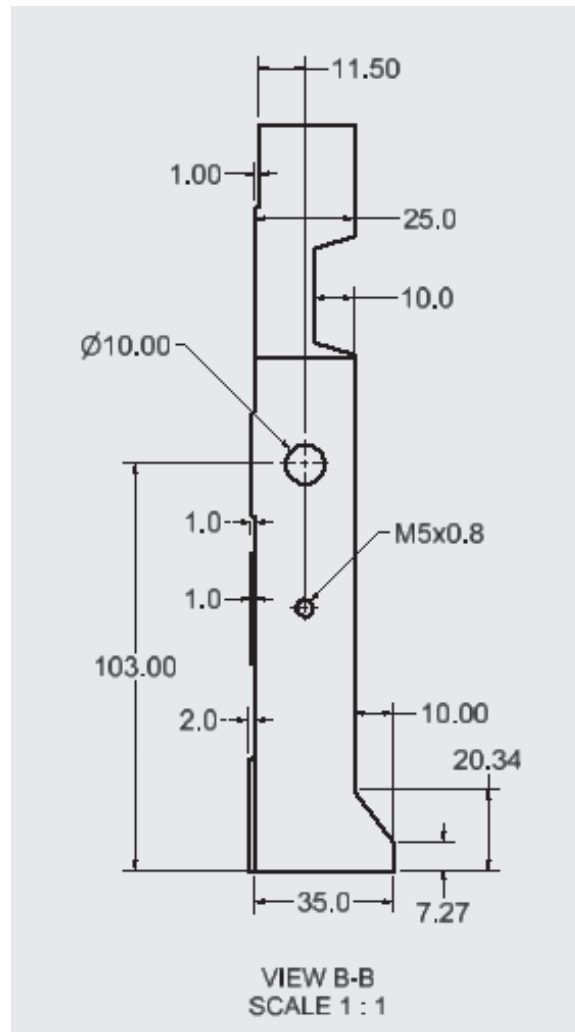


Figure 16-40h

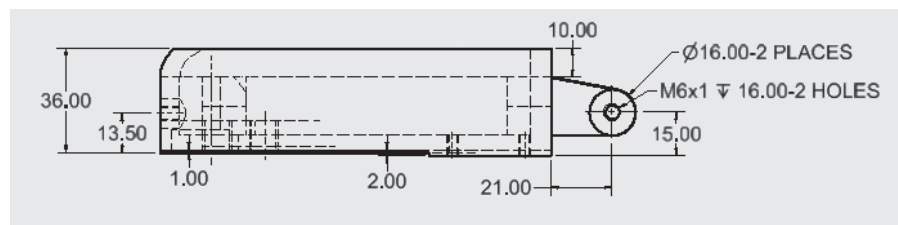
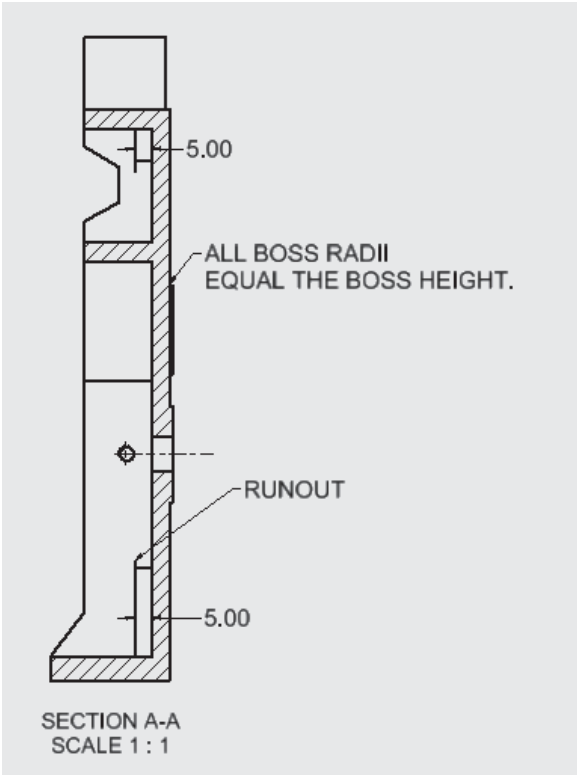


Figure 16-40i



Post Handle, Large
PS3-A2

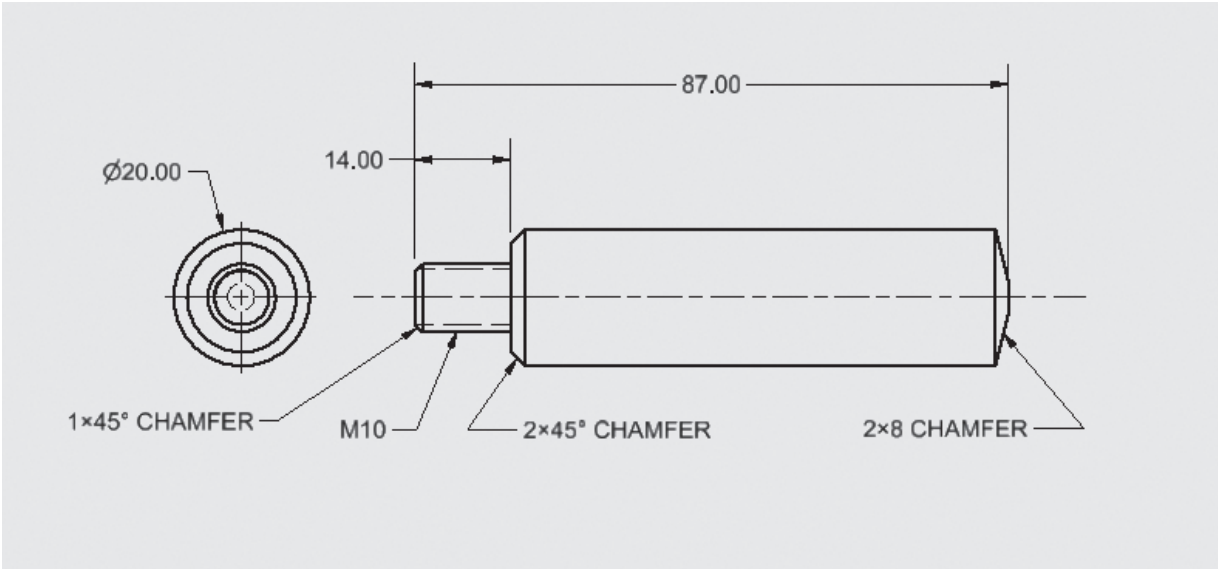


Figure 16-41

Large Knob Subassembly
PN: HS-21

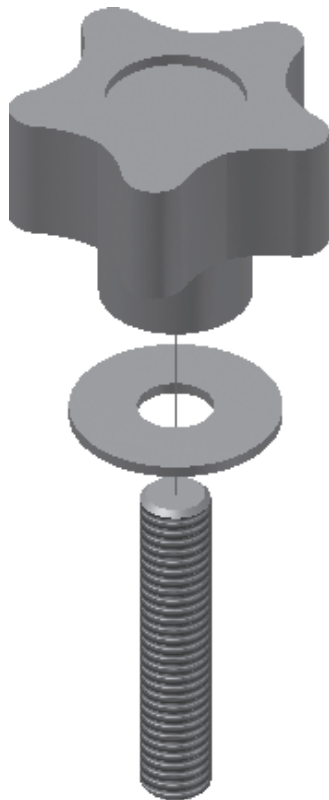


Figure 16-42a

Large Knob Subassembly
PN: HS-21

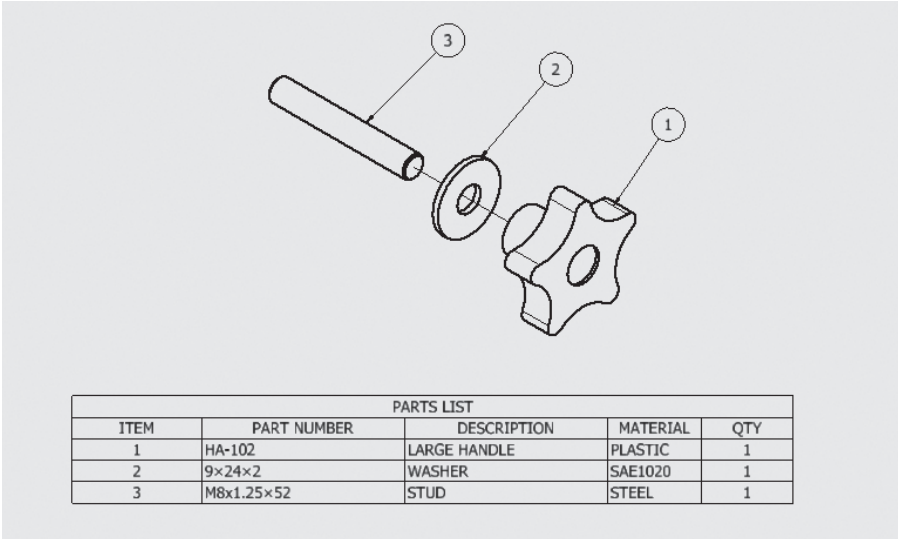
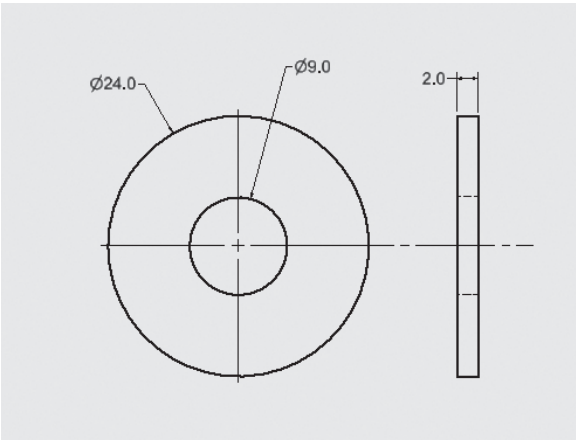


Figure 16-42b

Figure 16-42c

Washer
9 × 24 × 2



Large Handle
PN: HA-102

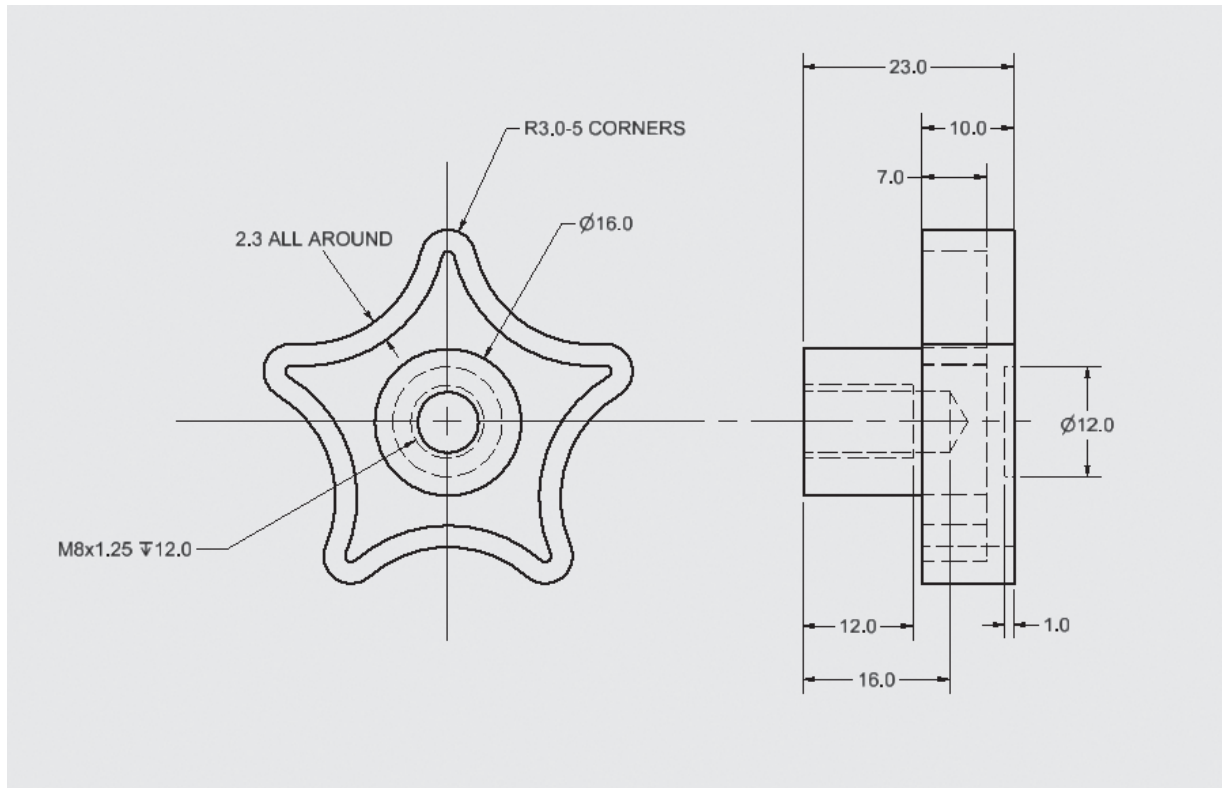
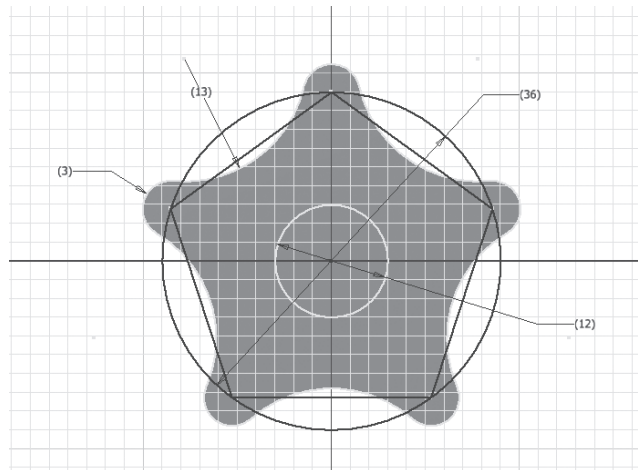


Figure 16-42d

Figure 16-42e

Layout for Large Handle



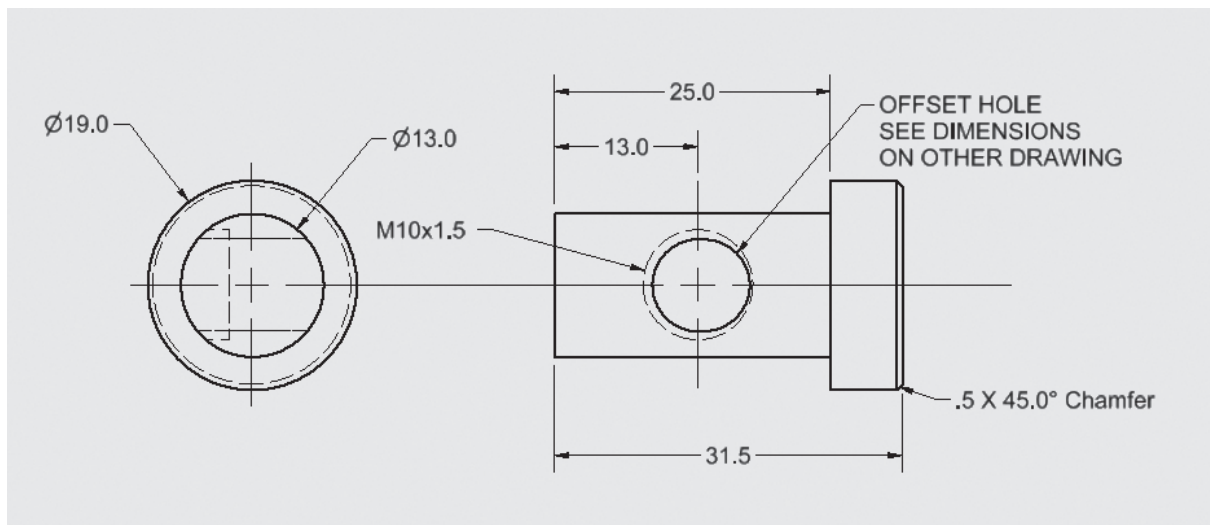


Figure 16-44b

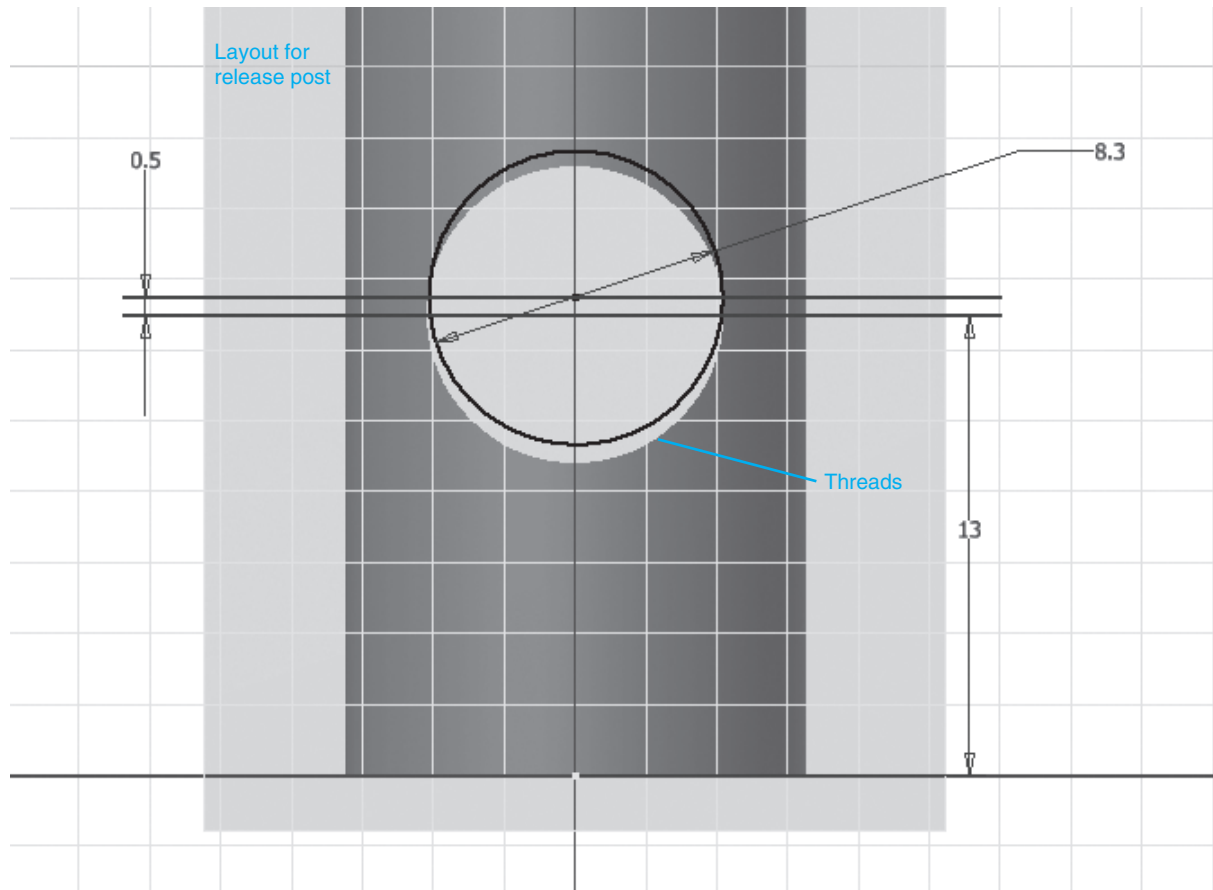


Figure 16-44c

Figure 16-45

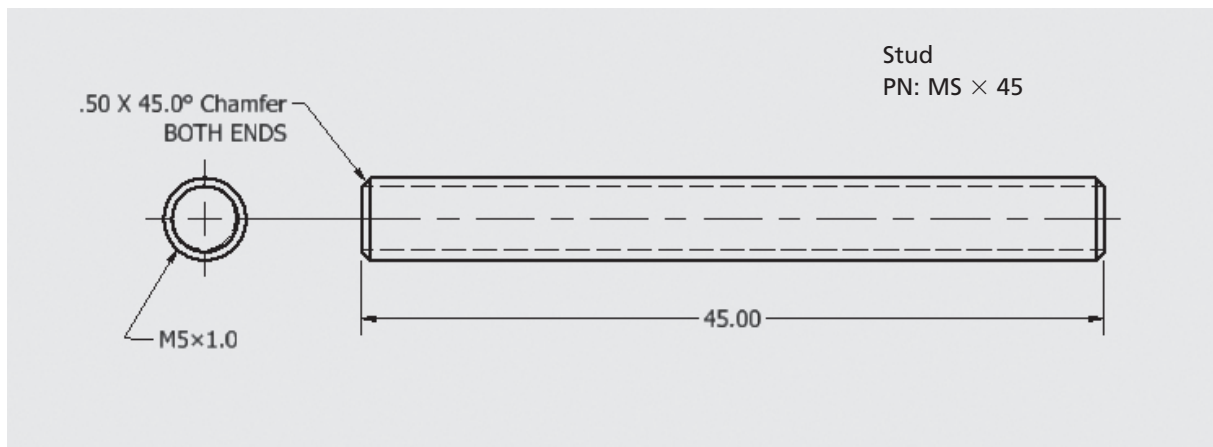
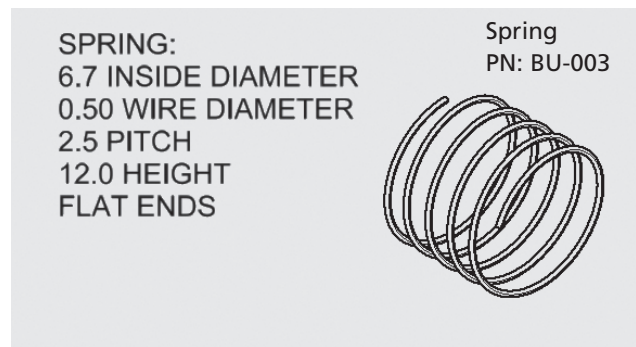


Figure 16-46

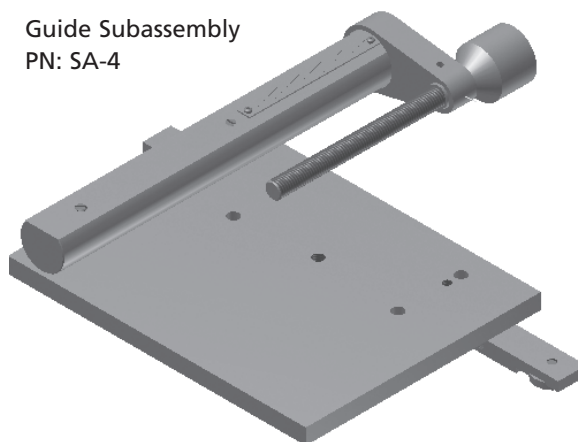


Figure 16-47a

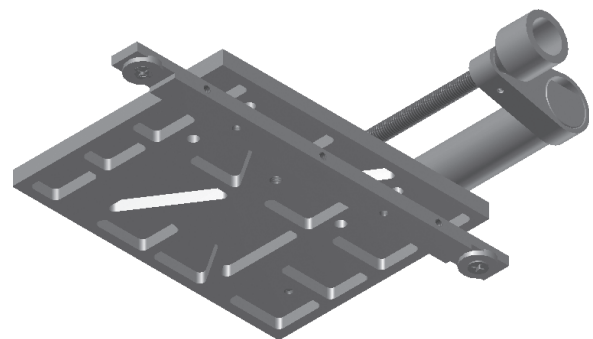


Figure 16-47b

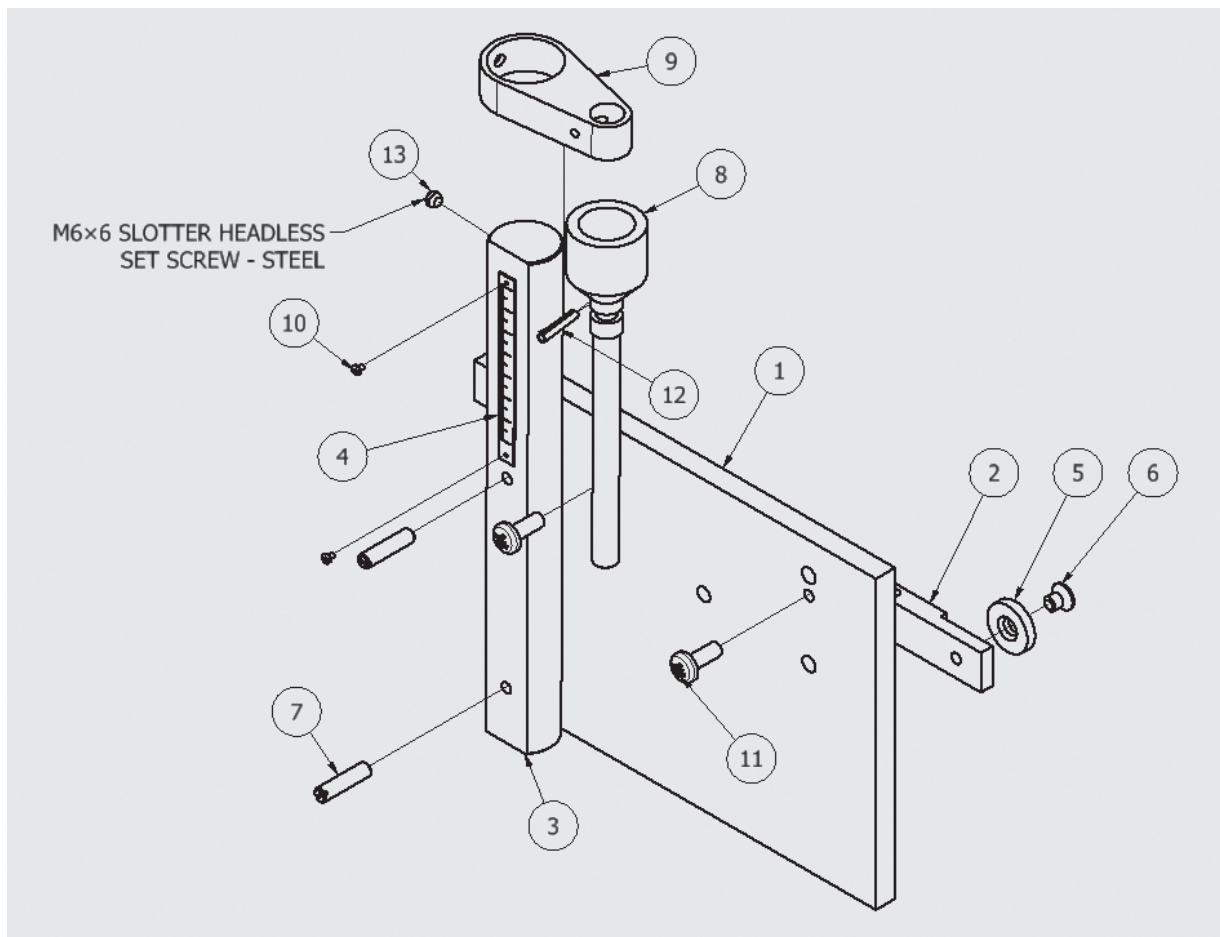


Figure 16-47c

PARTS LIST				
ITEM	PART NUMBER	DESCRIPTION	MATERIAL	QTY
1	G101-A1	PLATE, GUIDE	STEEL	1
2	G101-A2	BAR, GUIDE	STEEL	1
3	G101-A3	POST, GUIDE	STEEL	1
4	RR-6-40	RULER	STEEL	1
5	RG-1005	ROLLER, GUIDE	STEEL	2
6	M6x1 x 8	Cross Recessed Flat Countersunk Head Machine Screw	MILD STEEL	2
7	M6 x 25	Slotted Headless Set Screw - Flat Point	Steel	2
8	G103-2	SCREW, GUIDE	Steel	1
9	G101-4A	PLATE, GUIDE	STEEL	1
10	M2x0.4 x 3	Cross Recessed Pan Head Machine Screw	MILD STEEL	2
11	M6x1 x 16	Cross Recessed Pan Head Machine Screw	MILD STEEL	2
12	G101-63	PIN, HOLDER	STEEL	1

Figure 16-47d

Plate, Guide
PN: G101-A1

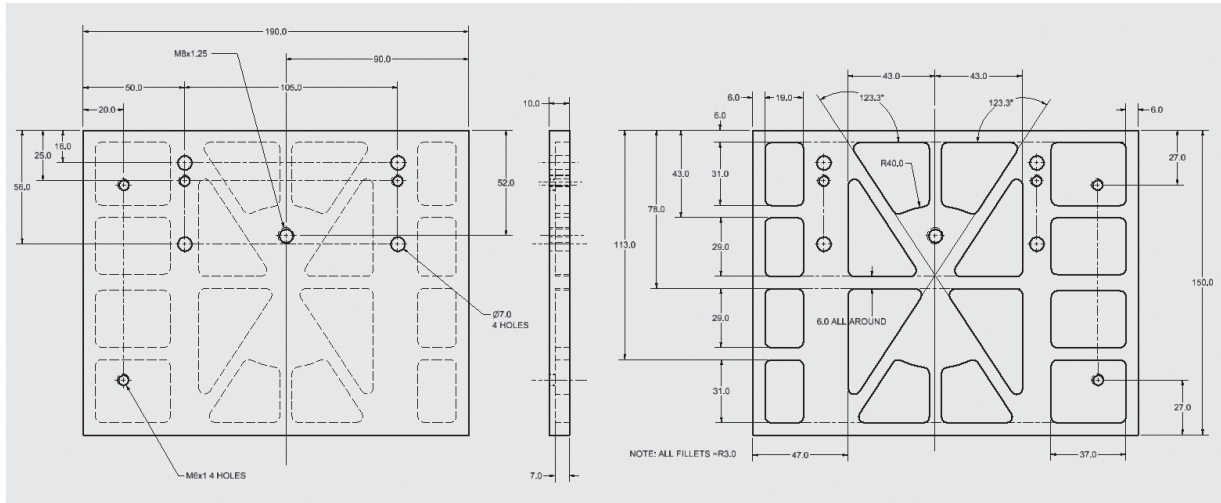


Figure 16-48

Bar, Guide
PN: G101-A2

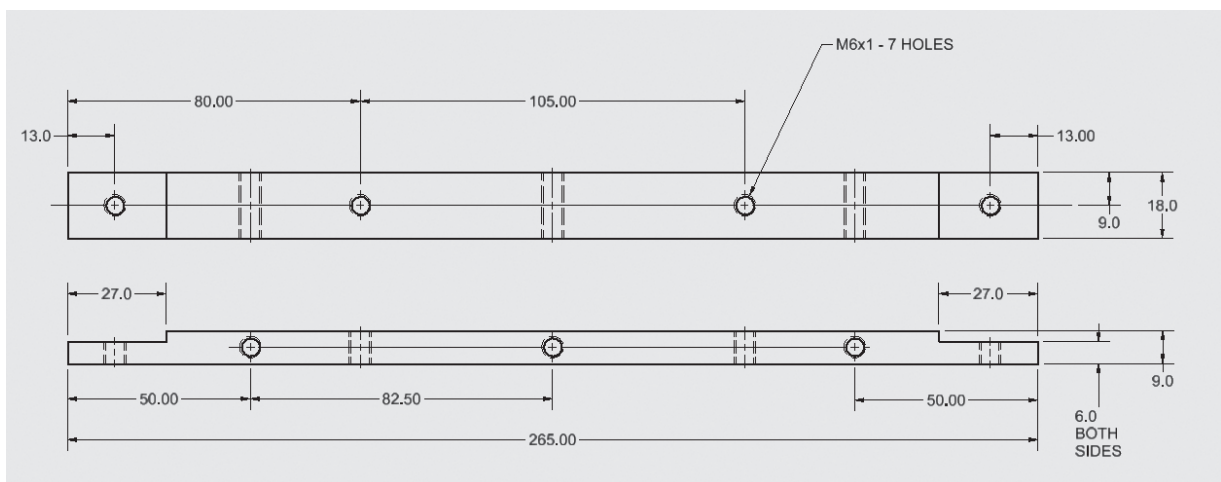


Figure 16-49

Post Guide
PN: G101-A3

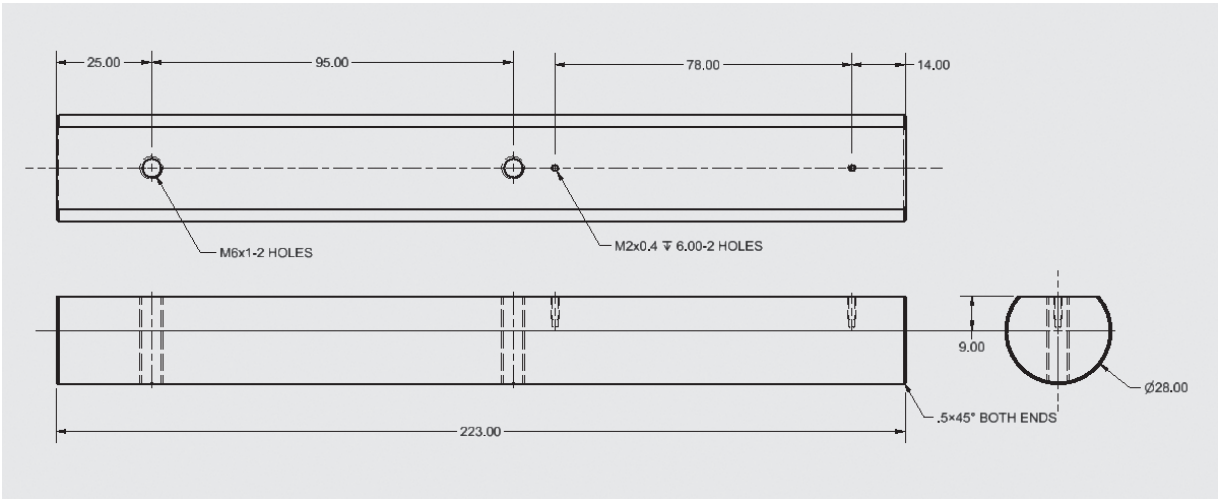


Figure 16-50

Figure 16-51

Ruler
PN: RR-6-40

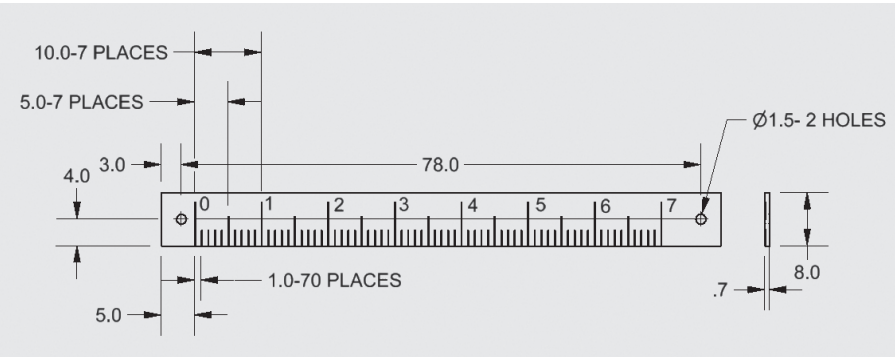
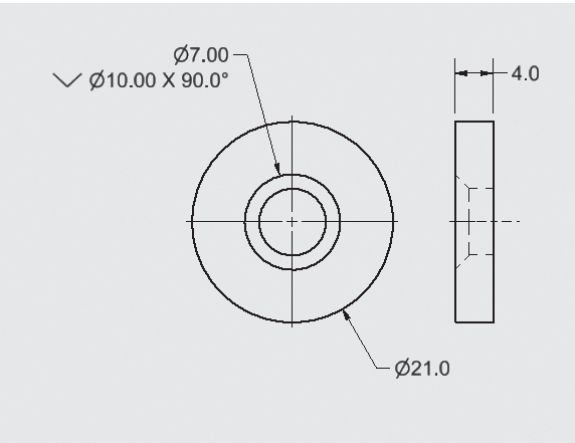


Figure 16-52

Ruler, Guide
PN: RG-1005



Screw, Guide
PN: G103-2

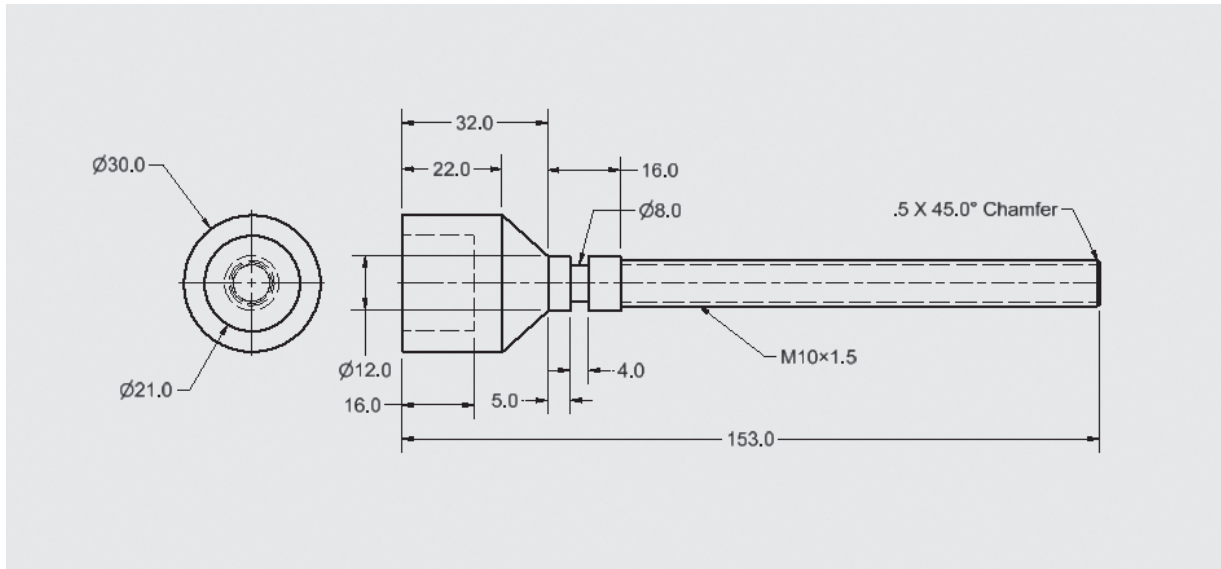


Figure 16-53

Plate, Guide
PN: G101-4A

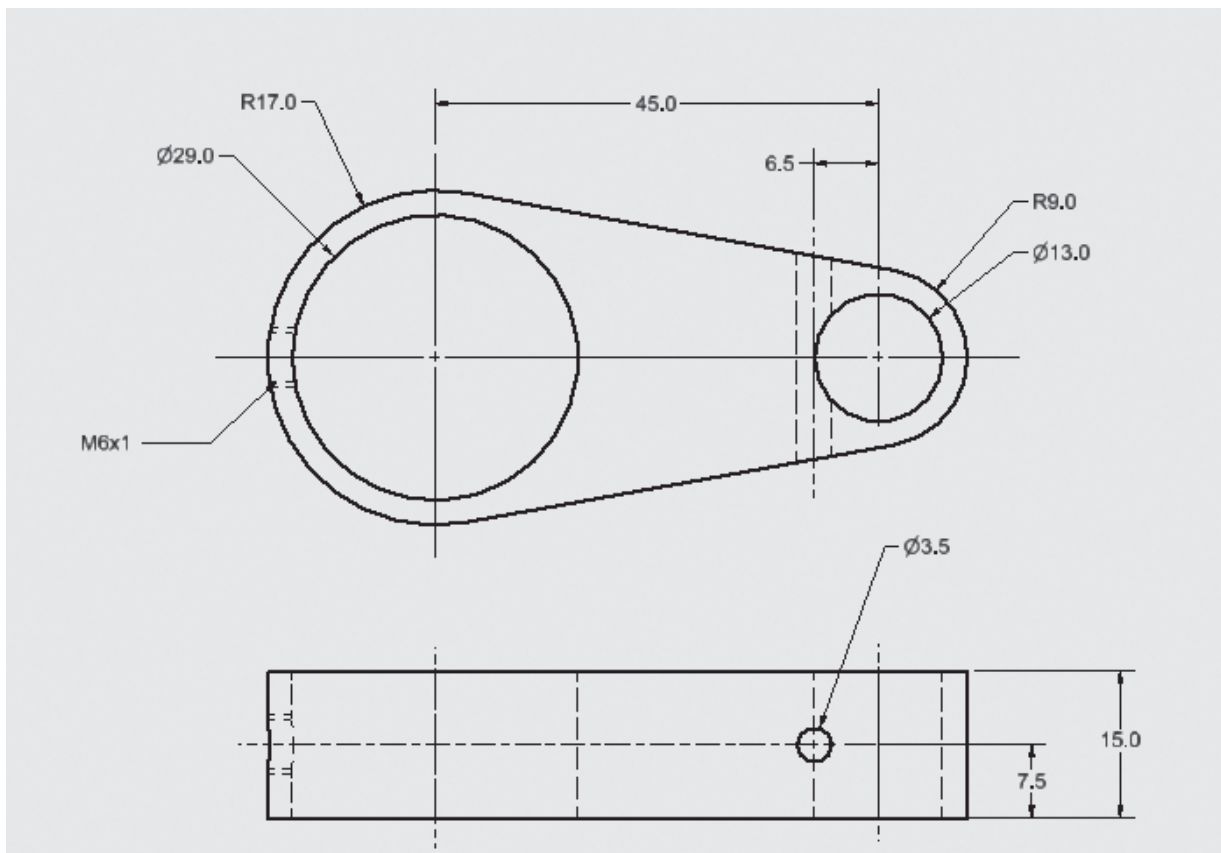


Figure 16-54

Figure 16-55

Pin, Holder
PN: G101-63

