

Chapter 12

Assembly Drawings



Topics
Exercises





Assembly : Topics

Summary

12.1) Definitions

12.2) Views Used in Assembly Drawings

12.3) Things to Include/Not Include

12.4) Standard Parts

- Specifications for General Fasteners
- Specifications for Bolts and Nuts
(Advanced Topic)



Assembly: Exercises

Exercise 12-1: Section lines in assemblies

Exercise 12-2: Working drawing package



Assembly Drawings

Summary

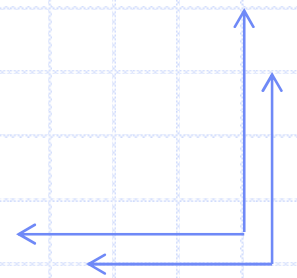


Summary

➤ What will we learn in Chapter 12?

- How to create an assembly drawing.
- How to create a standard parts sheet.

➤ Key Points.

- Assembly drawings show how individual parts fit together to make a machine.
 - A standard parts sheet contains purchased items.
- 



Assembly Drawings



12.1) Definitions

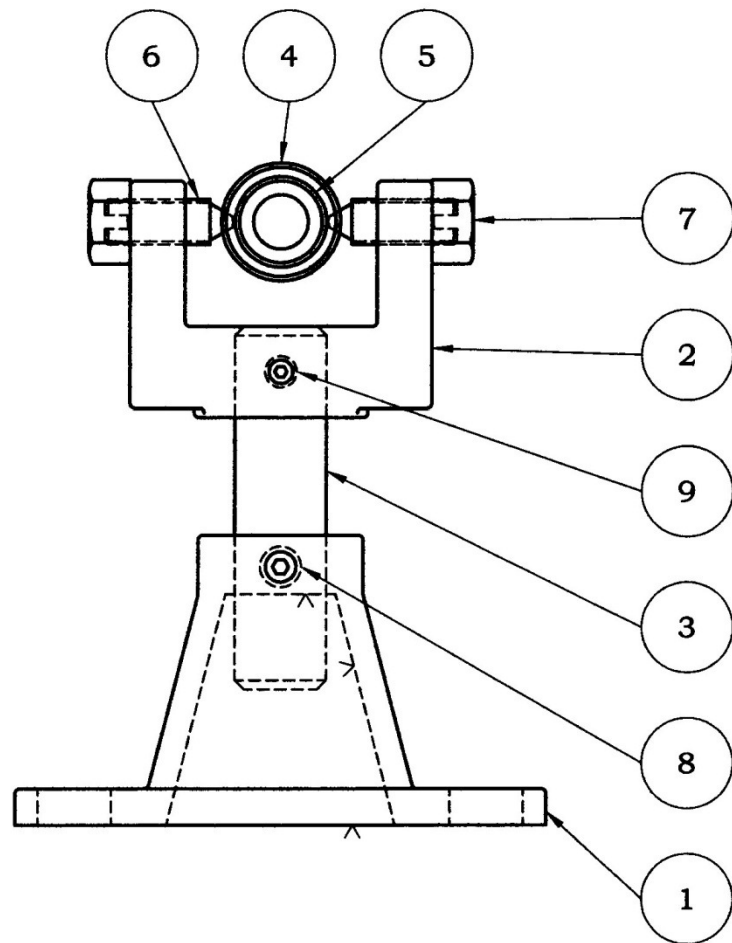


Assembly Drawing

➤ What is an assembly drawing and why do we need them?

An **assembly drawing** is a drawing of an entire machine or system with all of its components located and identified.

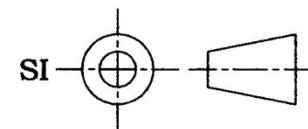
We need to know how to put the machine together.



PART #	PART NAME	REQ'D	MAT
1	BASE	1	CAST IRON
2	FORK	1	CAST IRON
3	POST	1	1020 STEEL
4	SLEEVE	1	1020 STEEL
5	BUSHING	2	BRASS
6	CONICAL SET SCREW	2	STEEL
7	M10x1.5 HEX NUT	2	STEEL
8	M9x1.25 SET SCREW	1	STEEL
9	M7x1 SET SCREW	1	STEEL

Parts List
(Bill of Materials)

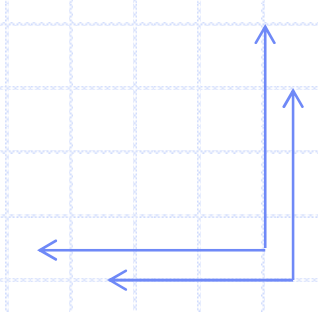
Part#'s



DRAWN BY: KIRSTIE PLANTENBERG	SHEET #: 1	# OF SHEETS: 8	SCALE: 1.5 / 1
PART NAME: SHAFT SUPPORT	PART #: -	MAT: -	REQ'D: 1



Subassembly Drawing

- **Subassembly:** Two or more parts that form a portion of an assembly.
 - Can you think of some examples of subassemblies?
 - A car differential
 - A motorbike engine
 - A compressor in an AC
- 



Definitions

- Does an assembly drawing normally show size?

No. Its job is to locate parts.

- How do we show the size of an individual part?

A **detail drawing** is a drawing of an individual part, which includes an orthographic projection and dimensions.



Working Drawing Package

- **Working Drawing Package:** A packet of drawings that gives the specifications necessary to manufacture a design.

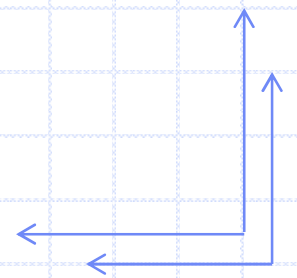
- A typical working drawing package includes;
 - an *assembly drawing*
 - *detailed drawings*
 - and a *standard part sheet*

A **standard part sheet** contains information about purchased items and will not be discussed in this course.



Drawing Order

➤ Drawings included in a working drawing package should be presented in the following order.

- Assembly drawing (first sheet)
 - Part Number 1
 - Part Number 2
 -
 - Standard parts sheet (last sheet)
- 



Assembly Drawings

12.2) Views Used in Assembly Drawings



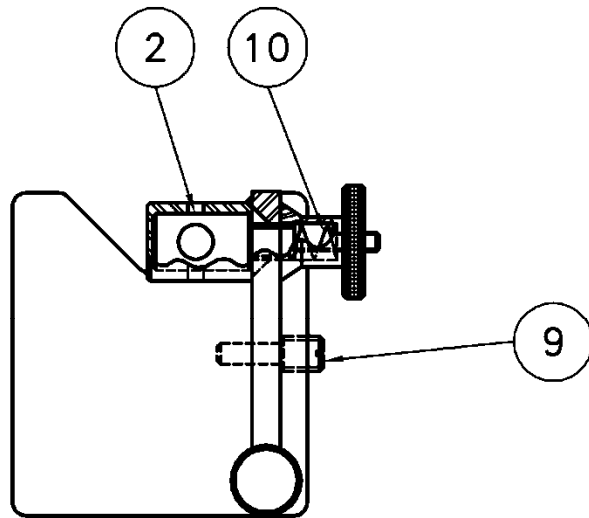


Selecting Views

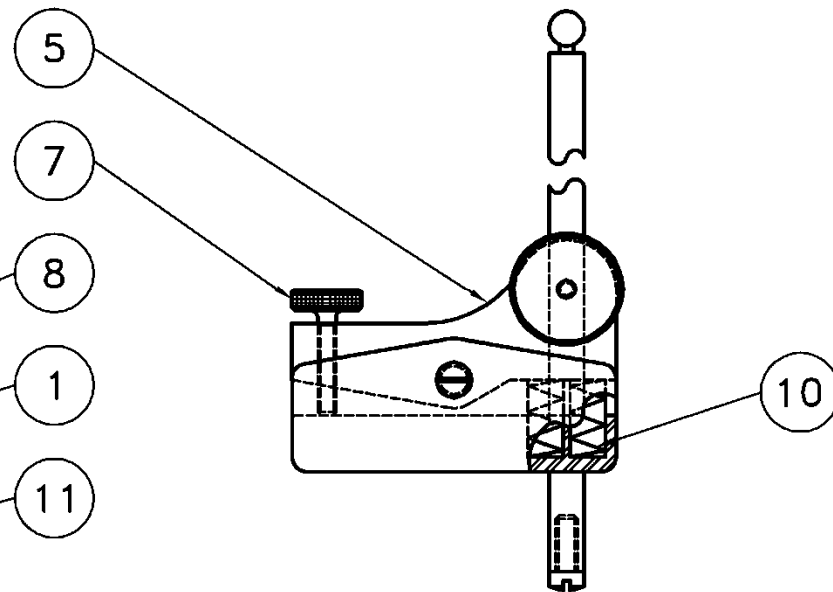
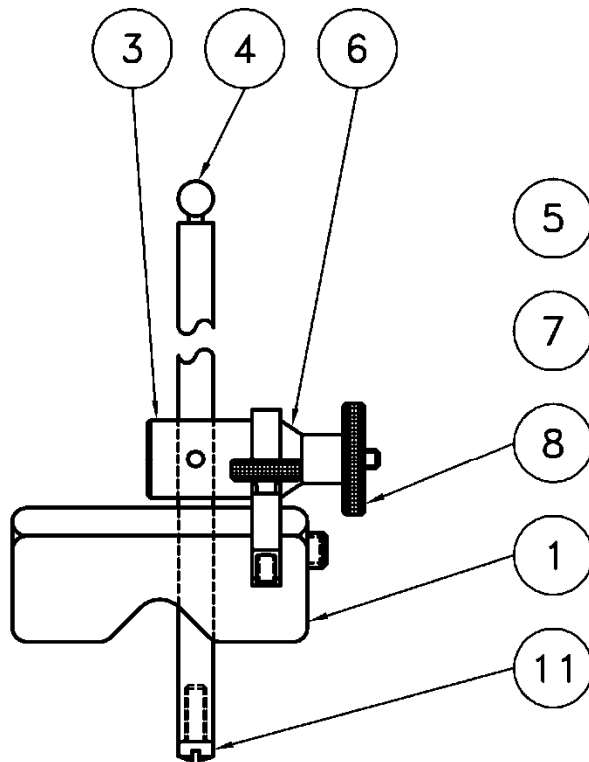
- Does an assembly drawing need a **FRONT, TOP and RIGHT SIDE** view?

Sometimes

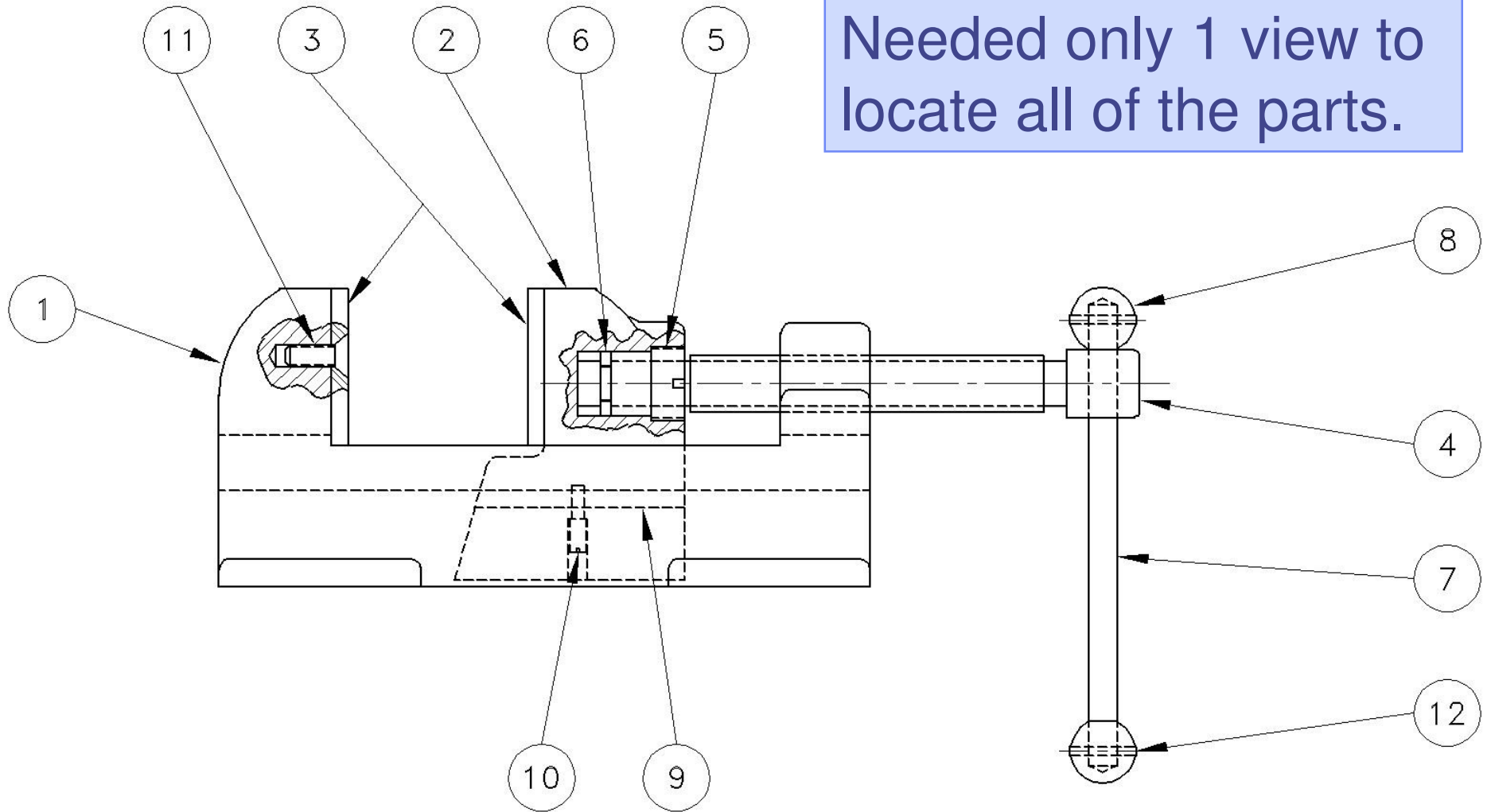
- We need as many views as it takes to identify and locate each part.
 - It may only take one view.



Needed 3 views to
locate all of the parts.



Needed only 1 view to
locate all of the parts.





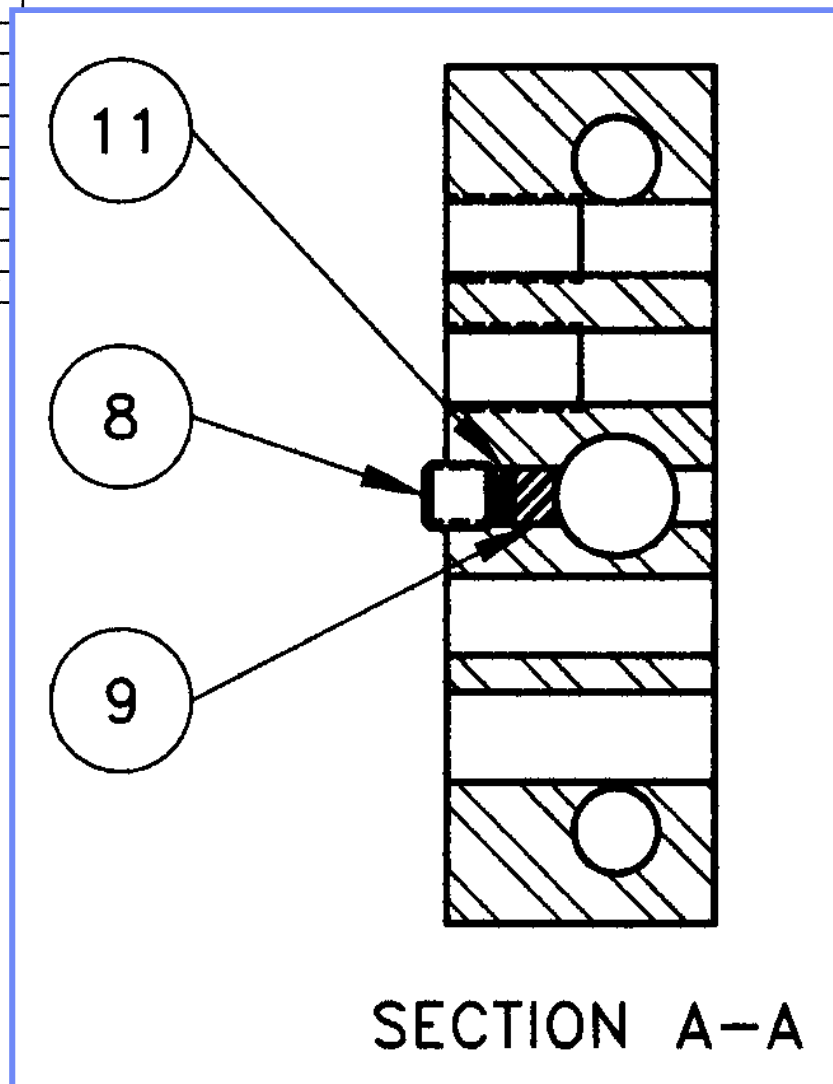
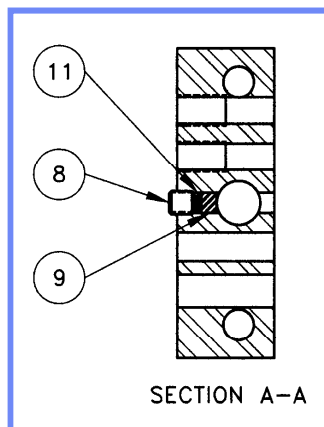
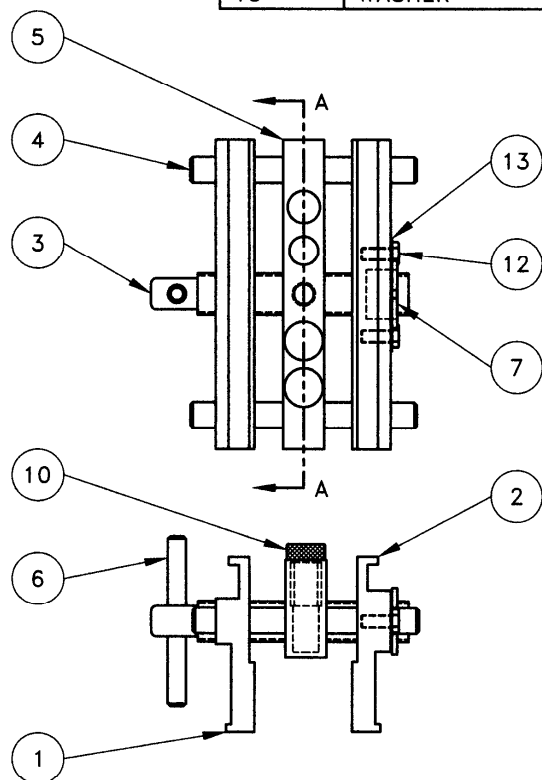
Sectional Views

➤ Sectional views are used quite often when drawing assemblies.

➤ Why?

Assemblies often have parts fitting into or overlapping other parts and we need to look inside the assembly to see clearly.

PART #	PART NAME	REQ'D	MAT
1	FRONT PLATE	1	3003 ALUMINUM
2	REAR PLATE	1	3003 ALUMINUM
3	SCREW	1	1020 STEEL
4	GUIDE ROD	2	1020 STEEL
5	CENTER PLATE	1	1020 STEEL
6	HANDLE	1	1020 STEEL
7	THREAD INSERT	1	3003 ALUMINUM
8	HEX SOC SET SCREW	1	STEEL
9	PLUNGER	1	1020 STEEL
10	DRILL BUSHING	4	1120 STEEL
11	SPRING	1	4015 STEEL
12	HEX HD SCREW	2	STEEL
13	WASHER	2	3003 ALUMINUM



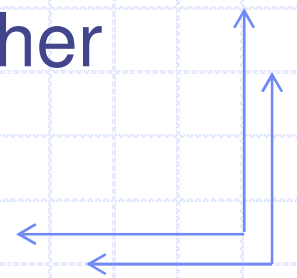
DRAWN BY: KIRSTIE PLANTENBERG	# OF SHEETS: 11
PART NAME: DOWELING FIXTURE	SHEET #: 1
PART #: -	SCALE: 2:1
MAT: -	REQ'D: 1

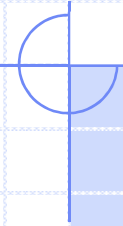


Section Hatch in Assemblies

➤ **Section Hatch:** Section hatch in adjacent parts are drawn in opposing directions.

- In the largest area, section hatch are drawn at 45°
- Next largest = 135° (- 45°)
- Additional areas = 30° and 60°
- Smaller areas = The distance between the section hatch may also be varied to further distinguish between parts.





Exercise 12-1

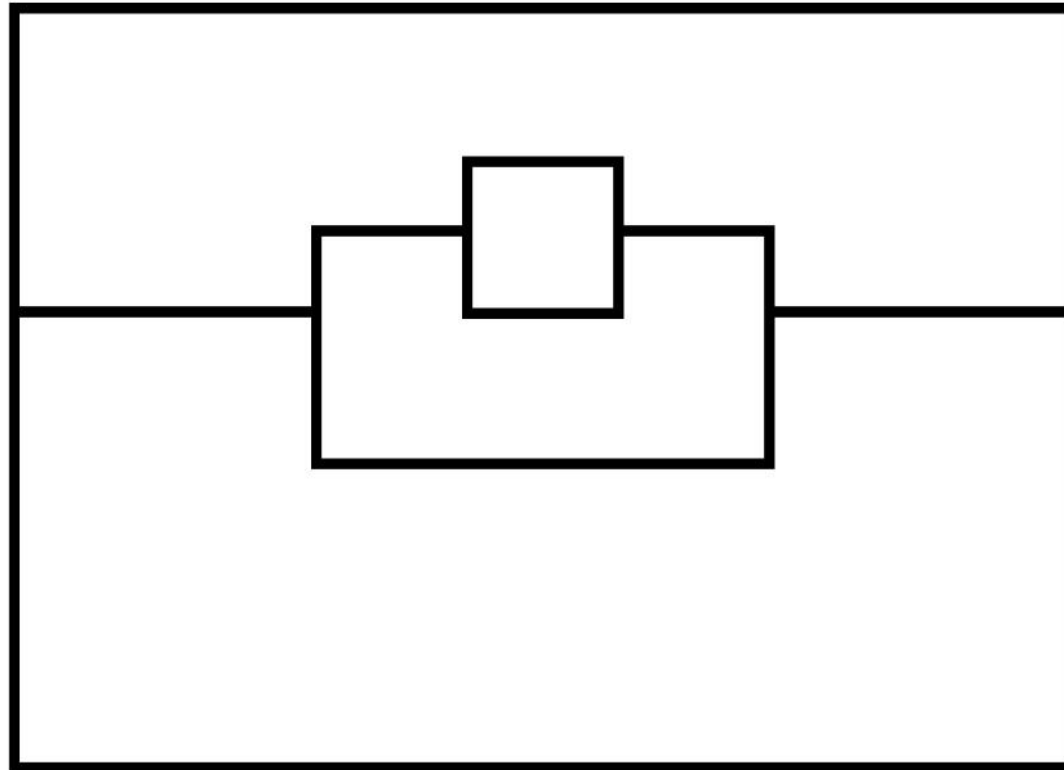


Section hatch in assemblies

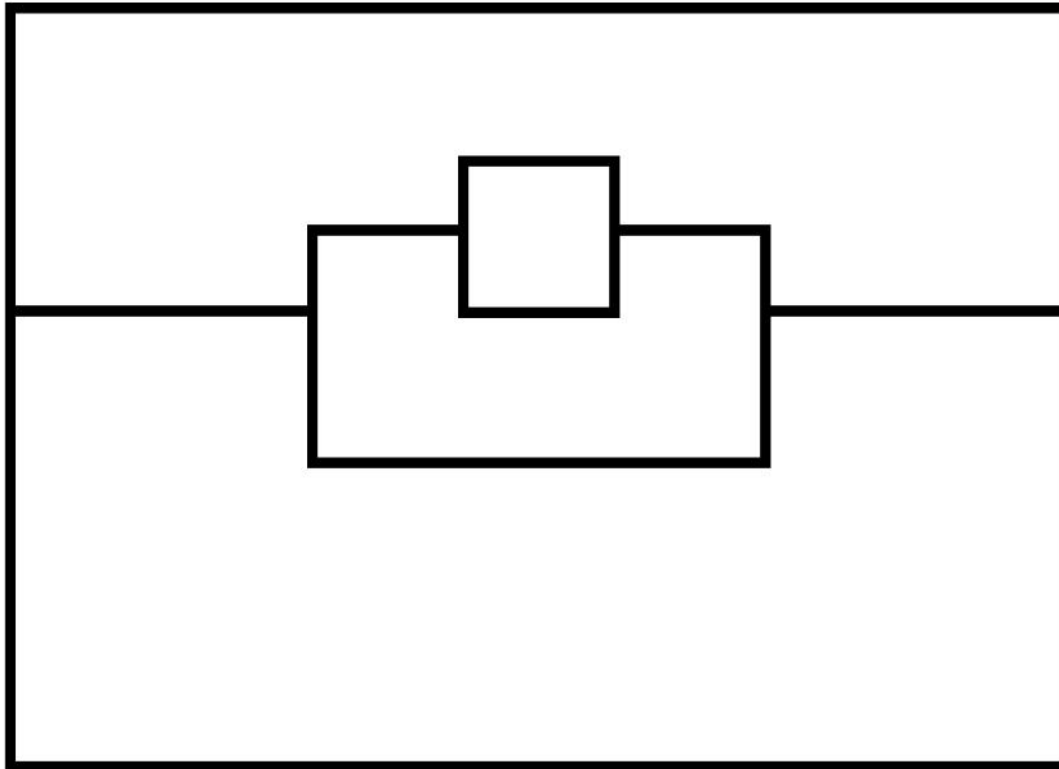


Exercise 12-1

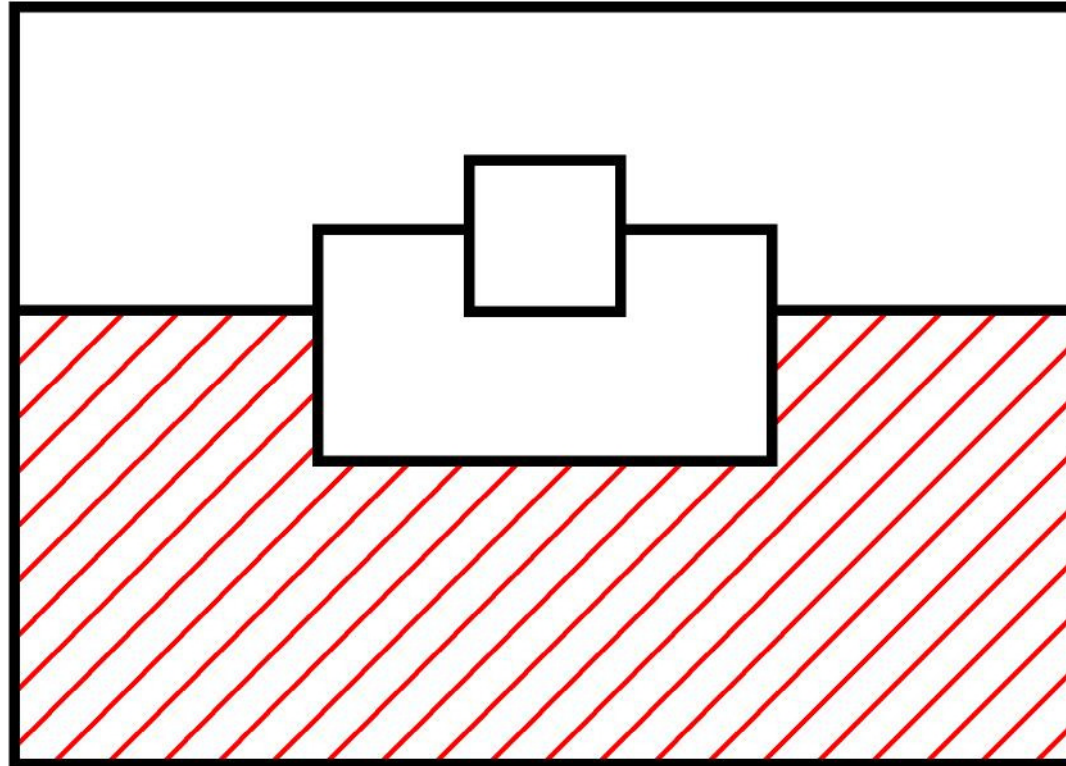
- Draw the section hatch for the assembly shown.



Fill in the section hatch is the largest area.

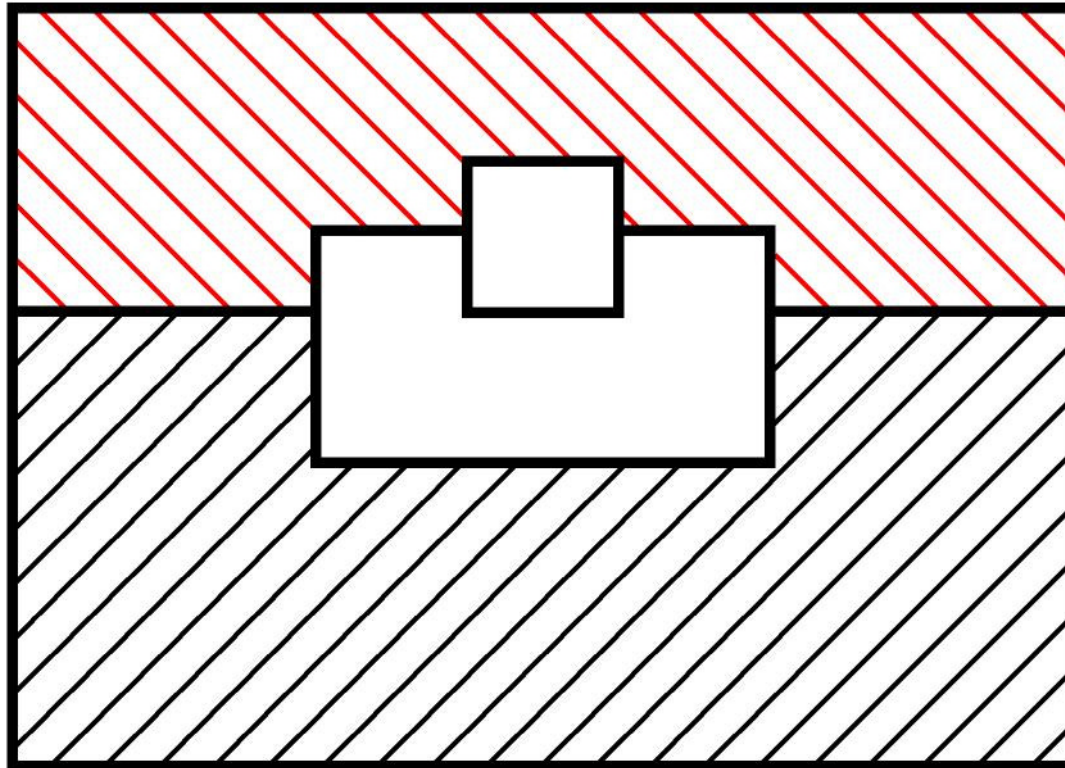


Fill in the section hatch is the 2nd largest area.



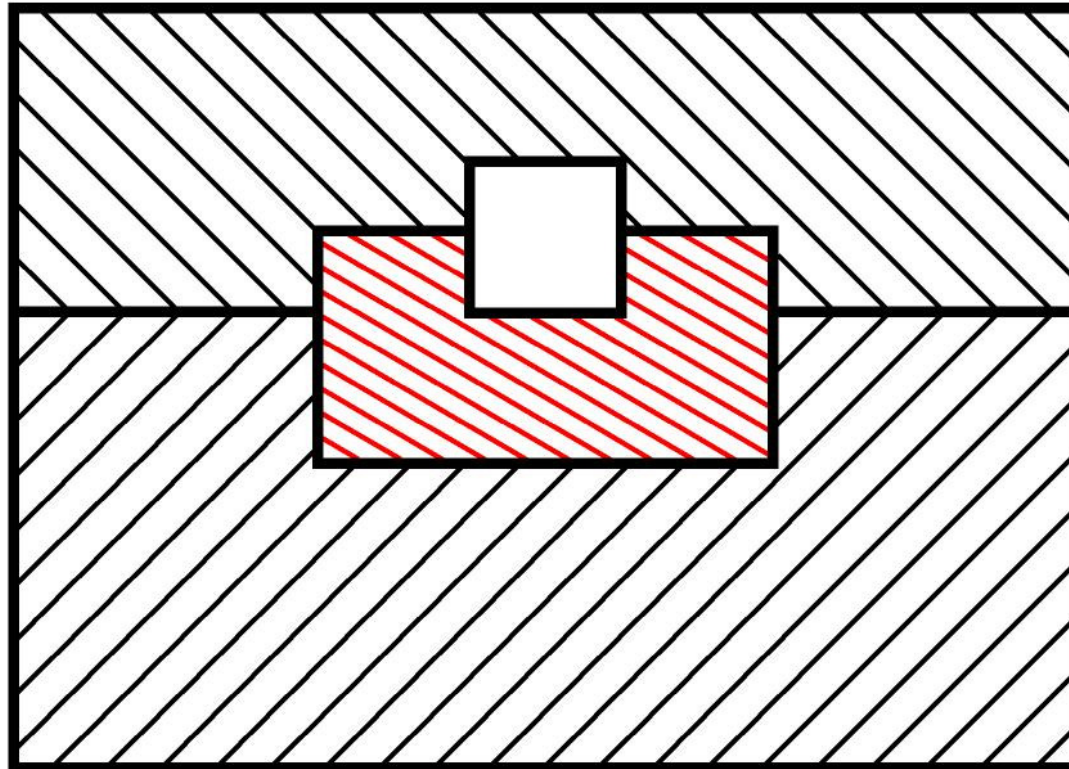
45°

Fill in the section hatch is the next largest area.

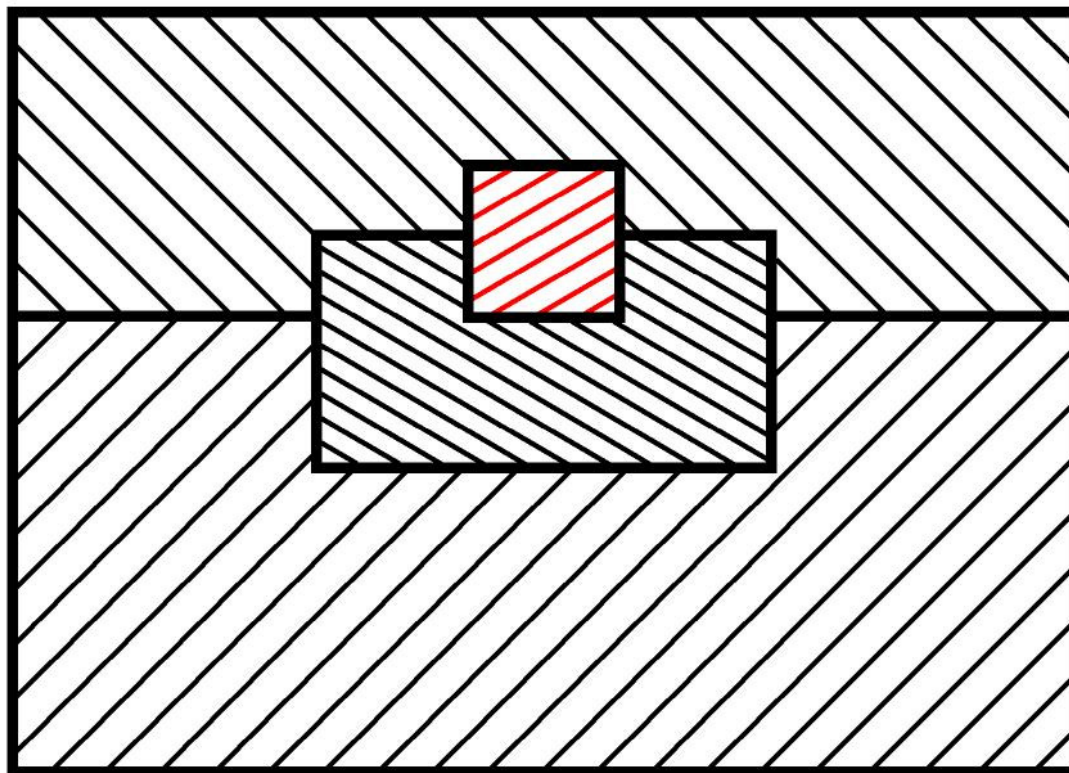


-45°

Fill in the section hatch is the last area.



-30°, smaller spacing



30°



Assembly Drawings

12.3) Things to Include/ Not Include



Things to Include / Not Include

- **When deciding what to include in an assembly drawing remember;**
 - The purpose of an assembly drawing is to show how the individual parts fit together.
 - It is not used as a manufacturing print.



Things to Include / Not Include

➤ **The assembly drawing should not look overly cluttered.**

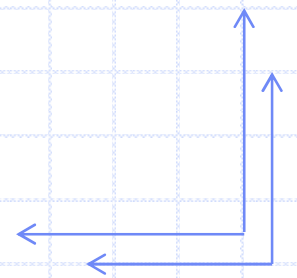
→ Some lines that are necessary in a detailed drawing may be left off the assembly drawing to enhance clearness.



Hidden Lines

➤ Do we include hidden lines?

Usually

- They should be used wherever necessary for clearness.
 - They should be left off when they impair clearness.
 - When a section view is used, hidden lines should not be used in that view.
- 



Dimensions


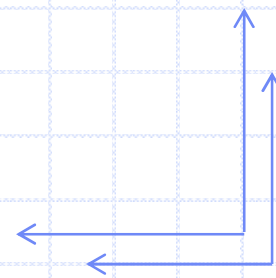
➤ Do we include dimensions?

Usually not

- As a rule, dimensions are not given on assembly drawings.
- If dimensions are given, they are limited to some function of the object as a whole.

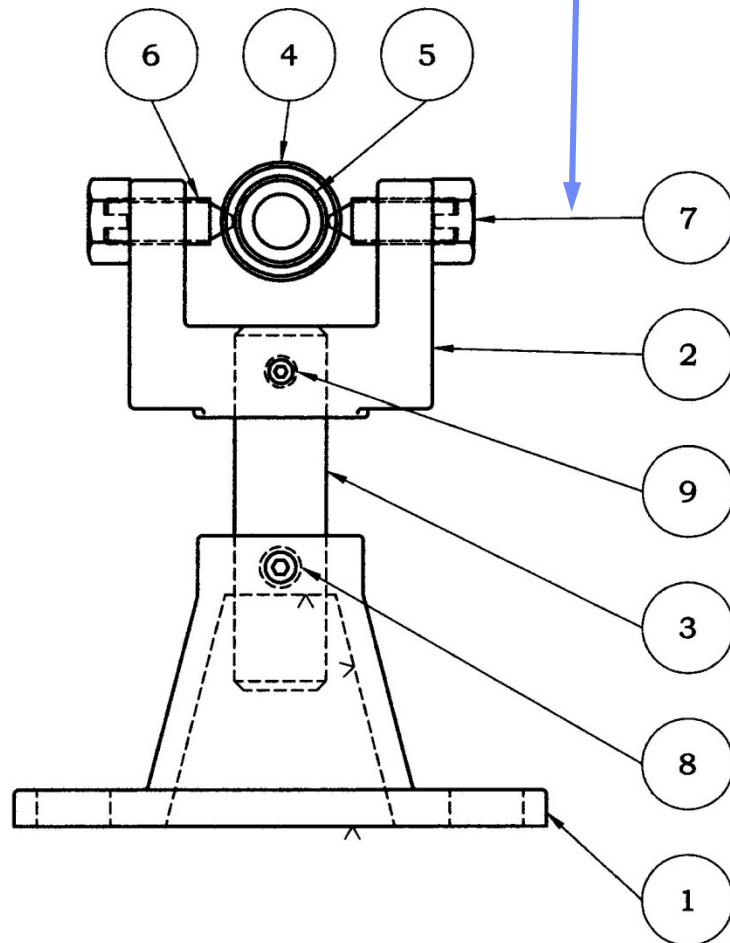


Identification

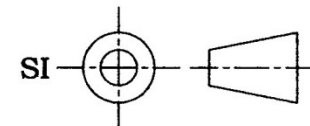
- **Ballooning:** A part is located and identified, in an assembly drawing, by using a circle containing the part number and a leader line that points to the corresponding part.
- 
- 

Leader lines point to the corresponding part.

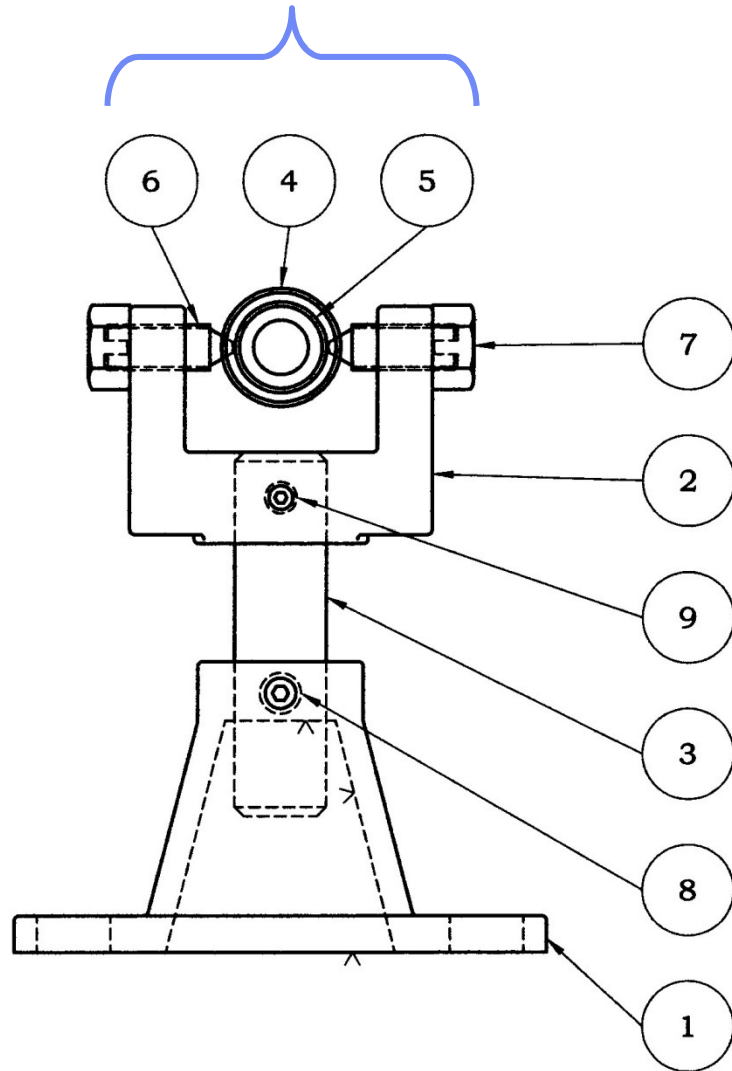
PART #	PART NAME	REQ'D	MAT
	BASE	1	CAST IRON
	FORK	1	CAST IRON
	POST	1	1020 STEEL
	SLEEVE	1	1020 STEEL
	BUSHING	2	BRASS
6	CONICAL SET SCREW	2	STEEL
7	M10x1.5 HEX NUT	2	STEEL
8	M9x1.25 SET SCREW	1	STEEL
9	M7x1 SET SCREW	1	STEEL



Balloons containing part numbers.

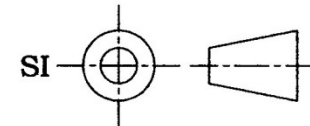


DRAWN BY: KIRSTIE PLANTENBERG	SHEET #: 1	# OF SHEETS: 8	SCALE: 1.5 / 1
PART NAME: SHAFT SUPPORT	PART #: -	MAT: -	REQ'D: 1

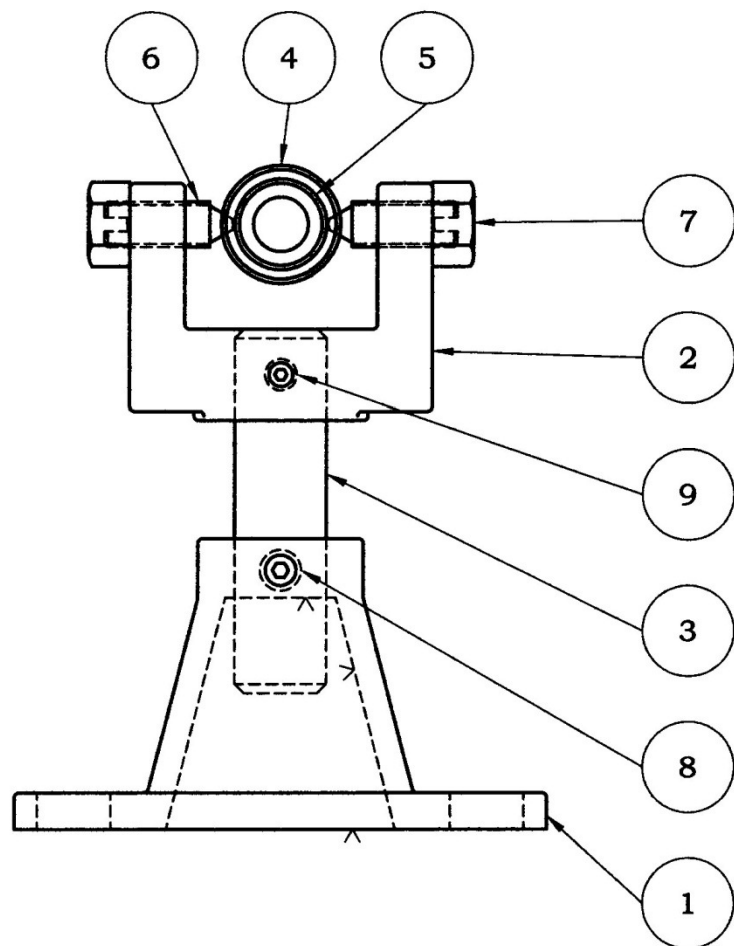


PART #	PART NAME	REQ'D	MAT
1	BASE	1	CAST IRON
2	FORK	1	CAST IRON
3	POST	1	1020 STEEL
4	SLEEVE	1	1020 STEEL
5	BUSHING	2	BRASS
6	CONICAL SET SCREW	2	STEEL
7	M10x1.5 HEX NUT	2	STEEL
8	M9x1.25 SET SCREW	1	STEEL
9	M7x1 SET SCREW	1	STEEL

Balloons are placed in orderly horizontal or vertical rows.

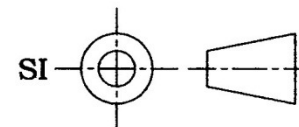


DRAWN BY: KIRSTIE PLANTENBERG	SHEET #: 1	# OF SHEETS: 8	SCALE: 1.5 / 1
PART NAME: SHAFT SUPPORT	PART #: -	MAT: -	REQ'D: 1



PART #	PART NAME	REQ'D	MAT
1	BASE	1	CAST IRON
2	FORK	1	CAST IRON
3	POST	1	1020 STEEL
4	SLEEVE	1	1020 STEEL
5	BUSHING	2	BRASS
6	CONICAL SET SCREW	2	STEEL
7	M10x1.5 HEX NUT	2	STEEL
8	M9x1.25 SET SCREW	1	STEEL
9	M7x1 SET SCREW	1	STEEL

The leader lines;
 - should not cross,
 - be as parallel as possible.



DRAWN BY: KIRSTIE PLANTENBERG	SHEET #: 1	# OF SHEETS: 8	SCALE: 1.5 / 1
PART NAME: SHAFT SUPPORT	PART #: -	MAT: -	REQ'D: 1

Parts List / Bill of Material

- The **parts list** is an itemized list of the parts that make up the assembled machine.

PART #	PART NAME	REQ'D	MAT
1	FRONT PLATE	1	3003 ALUMINUM
2	REAR PLATE	1	3003 ALUMINUM
3	SCREW	1	1020 STEEL
4	GUIDE ROD	2	1020 STEEL
5	CENTER PLATE	1	1020 STEEL
6	HANDLE	1	1020 STEEL
7	THREAD INSERT	1	3003 ALUMINUM
8	HEX SOC SET SCREW	1	STEEL
9	PLUNGER	1	1020 STEEL
10	DRILL BUSHING	4	1120 STEEL
11	SPRING	1	4015 STEEL
12	HEX HD SCREW	2	STEEL
13	WASHER	2	3003 ALUMINUM

Parts List / Bill of Material

- Parts lists contain the
 - part number, part name, the number required and the material of the part.

PART #	PART NAME	REQ'D	MAT
1	FRONT PLATE	1	3003 ALUMINUM
2	REAR PLATE	1	3003 ALUMINUM
3	SCREW	1	1020 STEEL
4	GUIDE ROD	2	1020 STEEL
5	CENTER PLATE	1	1020 STEEL
6	HANDLE	1	1020 STEEL
7	THREAD INSERT	1	3003 ALUMINUM
8	HEX SOC SET SCREW	1	STEEL
9	PLUNGER	1	1020 STEEL
10	DRILL BUSHING	4	1120 STEEL
11	SPRING	1	4015 STEEL
12	HEX HD SCREW	2	STEEL
13	WASHER	2	3003 ALUMINUM

Parts List / Bill of Material

➤ Parts lists contain the

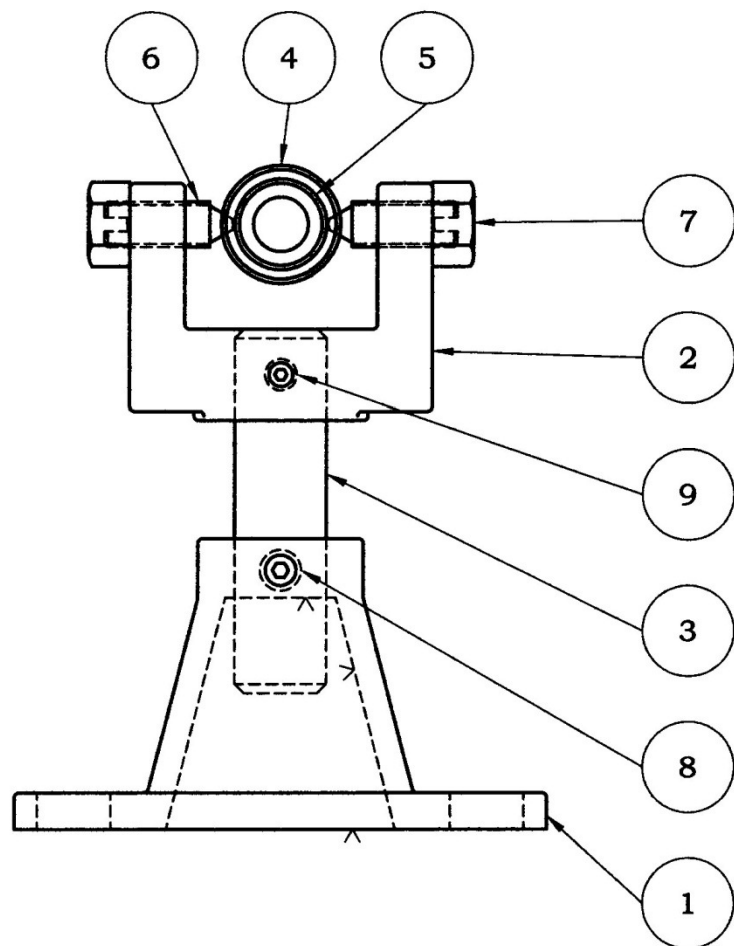
→ Other information can be included, such as, stock sizes of materials and weights of the parts.

PART #	PART NAME	REQ'D	MAT
1	FRONT PLATE	1	3003 ALUMINUM
2	REAR PLATE	1	3003 ALUMINUM
3	SCREW	1	1020 STEEL
4	GUIDE ROD	2	1020 STEEL
5	CENTER PLATE	1	1020 STEEL
6	HANDLE	1	1020 STEEL
7	THREAD INSERT	1	3003 ALUMINUM
8	HEX SOC SET SCREW	1	STEEL
9	PLUNGER	1	1020 STEEL
10	DRILL BUSHING	4	1120 STEEL
11	SPRING	1	4015 STEEL
12	HEX HD SCREW	2	STEEL
13	WASHER	2	3003 ALUMINUM

Parts List / Bill of Material

- Parts are listed in order of their part#.
- Part#'s are usually assigned based on the size or importance of the part.

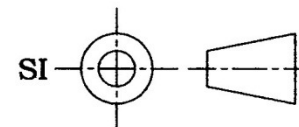
PART #	PART NAME	REQ'D	MAT
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2	REAR PLATE	1	3003 ALUMINUM
3	SCREW	1	1020 STEEL
4	GUIDE ROD	2	1020 STEEL
5	CENTER PLATE	1	1020 STEEL
6	HANDLE	1	1020 STEEL
7	THREAD INSERT	1	3003 ALUMINUM
8	HEX SOC SET SCREW	1	STEEL
9	PLUNGER	1	1020 STEEL
10	DRILL BUSHING	4	1120 STEEL
11	SPRING	1	4015 STEEL
12	HEX HD SCREW	2	STEEL
13	WASHER	2	3003 ALUMINUM



PART #	PART NAME	REQ'D	MAT
1	BASE	1	CAST IRON
2	FORK	1	CAST IRON
3	POST	1	1020 STEEL
4	SLEEVE	1	1020 STEEL
5	BUSHING	2	BRASS
6	CONICAL SET SCREW	2	STEEL
7	M10x1.5 HEX NUT	2	STEEL
8	M9x1.25 SET SCREW	1	STEEL
9	M7x1 SET SCREW	1	STEEL

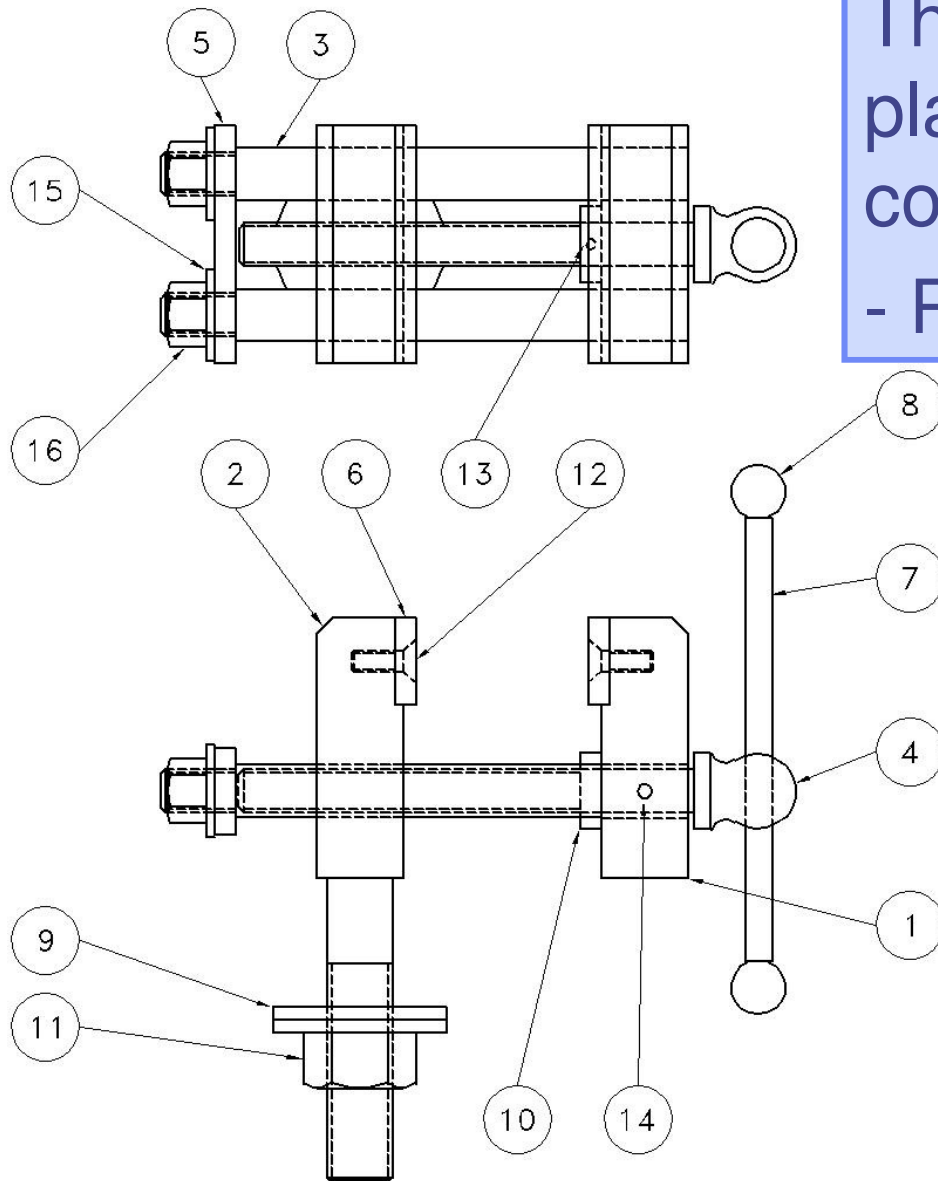
The parts list may be placed in the upper right corner of the drawing.

- Part# 1 is at the top.



DRAWN BY: KIRSTIE PLANTENBERG	SHEET #: 1	# OF SHEETS: 8	SCALE: 1.5 / 1
PART NAME: SHAFT SUPPORT	PART #: -	MAT: -	REQ'D: 1

The parts list may be placed in the lower right corner of the drawing.
- Part# 1 is at the bottom.



16	GUIDE NUT	2	—
15	GUIDE WASHER	2	—
14	JAW PIN	2	—
13	COLLAR PIN	1	—
12	FLAT HEAD SCREW	4	—
11	JAW NUT	1	—
10	COLLAR	1	1020 ST
9	JAW WASHER	2	—
8	REMOVABLE BALL	2	CRS
7	HANDLE	1	CRS
6	JAW INSERT	2	1020 ST
5	SPACER	1	CRS
4	SCREW	1	CRS
3	GUIDE BAR	2	1020 ST
2	STATIONARY JAW	1	CRS
1	MOVABLE JAW	1	CRS
PART #	PART NAME	REQ'D	MAT

DRAWN BY: KIRSTIE PLANTENBERG

SHEET #: 1

OF SHEETS: 11

DATE:

SCALE: 1:2

PART NAME: MACHINIST'S VISE

PART #: —

MAT: —

REQ'D: 1



Assembly Drawings

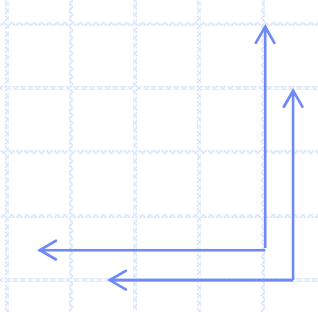


12.4) Standard Parts





Standard Parts

- **Standard parts include any part that can be bought off the shelf.**
 - They do not need to be drawn.
 - Purchasing information is given on the standard parts sheet attached to the back of the working drawing package.
- 

Standard Parts Sheet Example



Part Name

9

COMPRESSION SPRING
ø8 I.D.
LENGTH = 46
.4 WIRE
12 COILS
5120 STEEL
1 REQ'D

11

M8x1.25
HEX HEAD CAP SCREW
LENGTH = 30
MAT = BRASS
4 REQ'D

Part Number

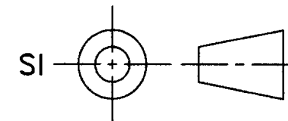
10

PLAIN WASHER
7.2 x 16 x 1.7
1115 STEEL
1 REQ'D

12

SPRING PIN
ø2 O.D.
LENGTH = 14
DOUBLE SIZE
1 REQ'D

Information needed to purchase the item



DRAWN BY: KIRSTIE PLANTENBERG	SHEET #: 10	# OF SHEETS: 10	SCALE:
PART NAME:	PART #:	MAT:	REQ'D:

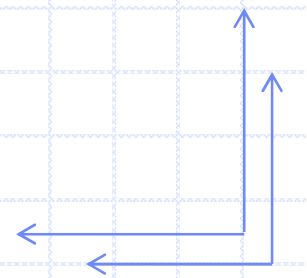


Standard Parts

- What type of information should be included?

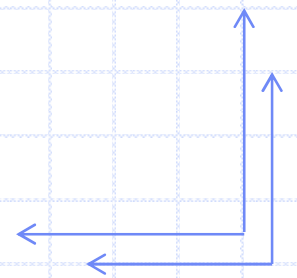


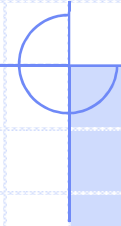
General Fastener Specifications

- Thread specification (for threaded fasteners)
 - Name of fastener
 - Head/Point style or shape (if applicable)
 - Fastener length or size
 - Fastener series
 - Material
 - Special requirements (coatings, finishes, specifications to meet)
 - REQ'D (i.e. number required)
- 



Bolts and Nuts Specifications

- Thread specification contained in the thread note
 - Style of head and name of the bolt or nut
 - Length of bolt
 - Material
 - Special requirements (coatings, finishes, specifications to meet)
 - REQ'D (i.e. number required)
- 



Exercise 12-2

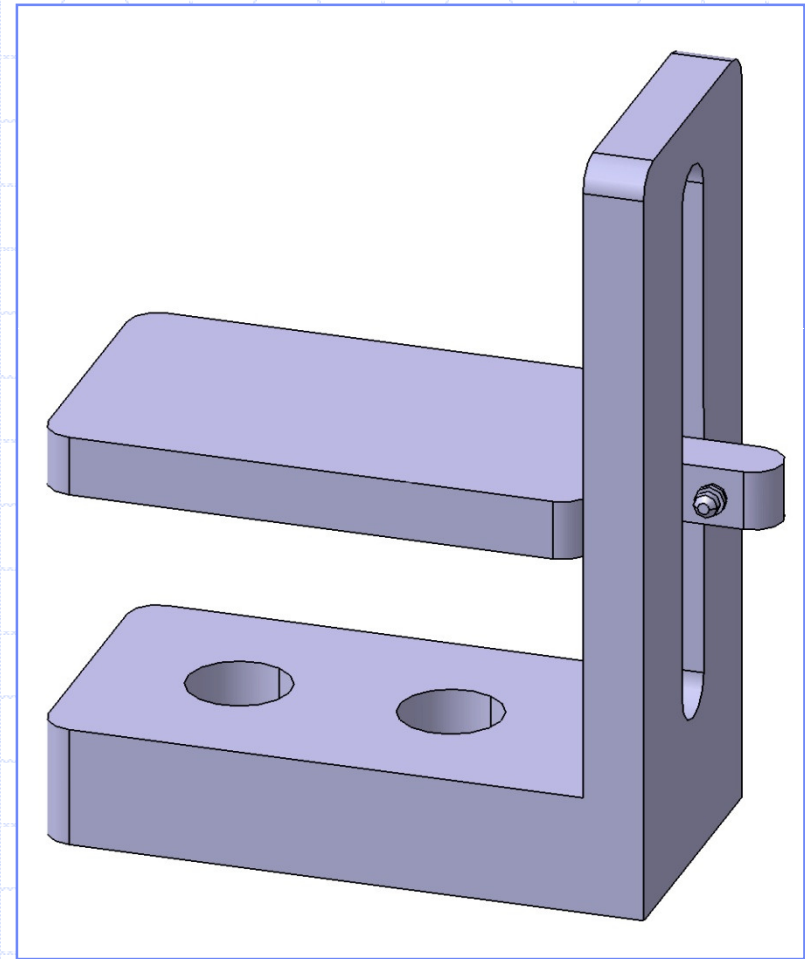


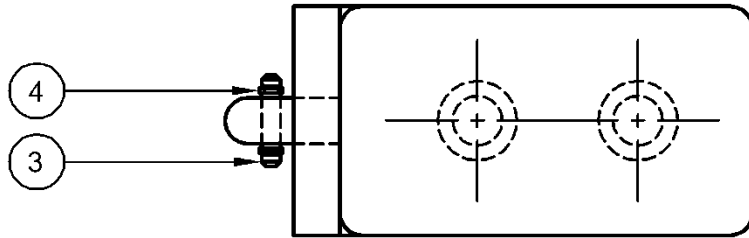
Working drawing package



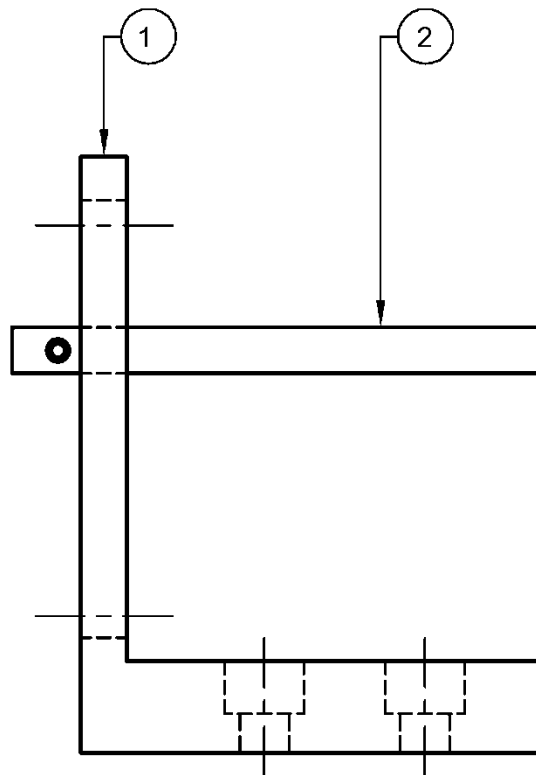
Exercise 12-2

- Draw an assembly drawing of the *Clamp* shown.
- Draw detailed drawings of the individual parts.
- Create a standard parts sheet





PART #	PART NAME	REQ'D	MATERIAL
1	BASE	1	STEEL
2	WEIGHT PLATE	1	STEEL
3	PIN	1	HRD STEEL
4	SNAP RING	2	-



Assembly Drawing

DRAWN BY: K. PLANTENBERG

SHEET #: 1

OF SHEETS: 5

DATE: 2007-5-17

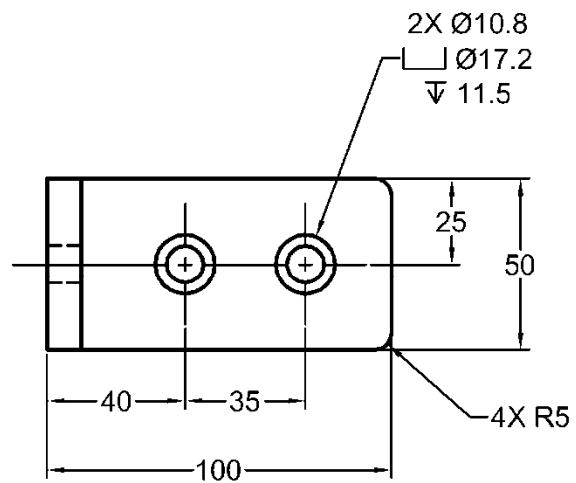
SCALE: 2:3

PART NAME: CLAMP

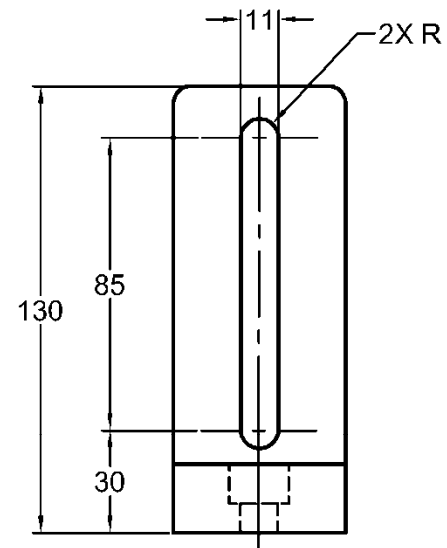
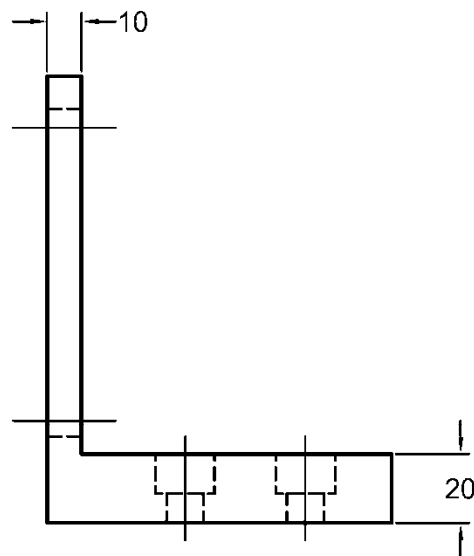
PART #: -

MAT: -

REQ'D: 1



Part 1 Drawing



DRAWN BY: K. PLANTENBERG

SHEET #: 2

OF SHEETS: 5

DATE: 2007-5-17

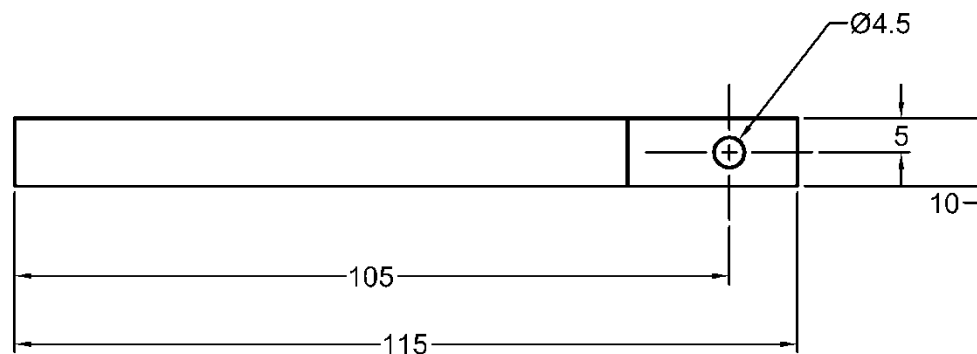
SCALE: 1:2

PART NAME: BASE

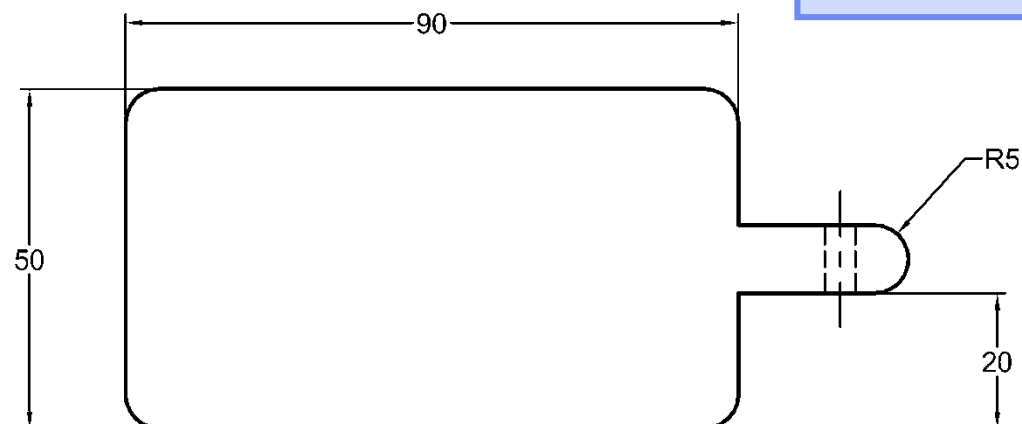
PART #: 1

MAT: STEEL

REQ'D: 1

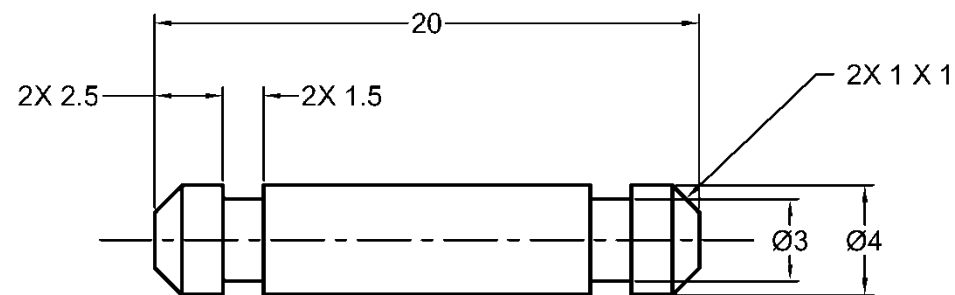


Part 2 Drawing



DRAWN BY: K. PLANTENBERG	SHEET #: 3	# OF SHEETS: 5	DATE: 2007/05/17	SCALE: 1:1
PART NAME: WEIGHT PLATE	PART #: 2	MAT: STEEL	REQ'D: 1	

Part 3 Drawing



DRAWN BY: K. PLANTENBERG

SHEET #: 4

OF SHEETS: 5

DATE: 2007-5-17

SCALE: 4:1

PART NAME: PIN

PART #: 3

MAT: HARDENED STEEL

REQ'D: 1

Part 4

Standard Part Sheet

4

SNAP RING
OD = 5
ID = 3
THICKNESS = 1
REQ'D = 2

DRAWN BY: K. PLANTENBERG	SHEET #: 5	# OF SHEETS: 5	DATE: 2007-5-17	SCALE: -
PART NAME: -	PART #: -	MAT: -	REQ'D: -	



Assembly Drawings

The End