

Working Drawing



TOPICS

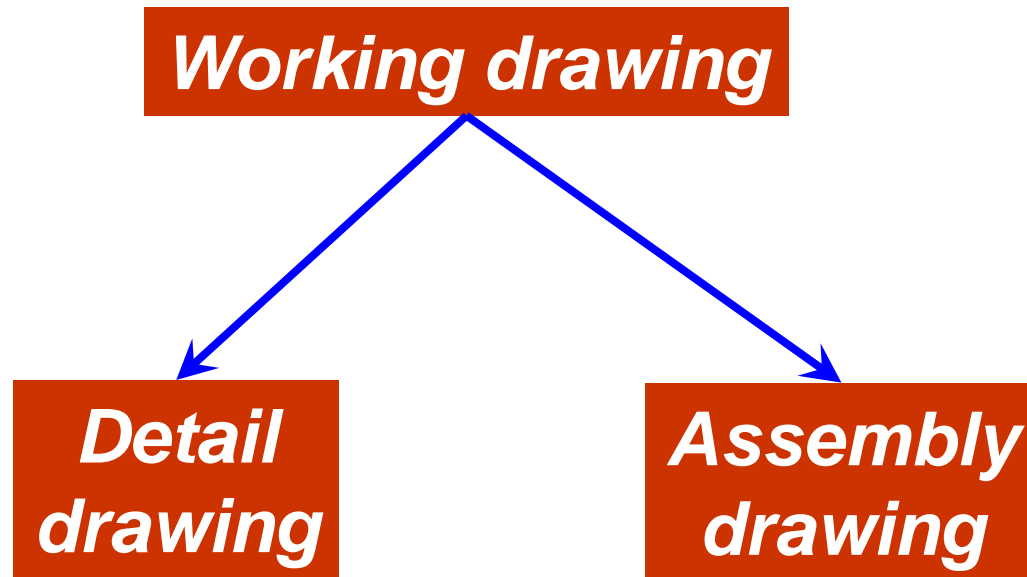
- Introduction
- Detail drawing
- Assembly drawing
- Assembly section
- Dimensioning

Introduction



DEFINITION

- ***Working drawing*** is a set of drawing used during the work of making a product.



DEFINITION

- ***Detail drawing*** is a ***multiview representation*** of a single part with ***dimensions and notes***.
- ***Assembly drawing*** is a drawing of various parts of a machine or structure assembled in their relative working positions.

PURPOSE

- ***Detail drawing*** conveys the ***information*** and ***instructions*** for manufacturing the part.
- ***Assembly drawing*** conveys
 1. completed shape of the product.
 2. overall dimensions.
 3. relative position of each part.
 4. functional relationship among various components.

Detail Drawing



INFORMATION IN DETAIL DRAWING

1. General information → Title block

2. Part's information

2.1 Shape description → Object's views

2.2 Size description → views

2.3 Specifications → Notes

GENERAL INFORMATION

- Name of company
 - Title of drawing (usually part's name)
 - Drawing sheet number
 - Name of drafter, checker
 - Relevant dates of action
(drawn, checked, approved etc.)
 - Revision table
- Unit
 - Scale
 - Method of projection

PART'S INFORMATION

Shape

- ❖ **Orthographic drawing**
- ❖ Pictorial drawing

Size

- ❖ **Dimensions** and Tolerances

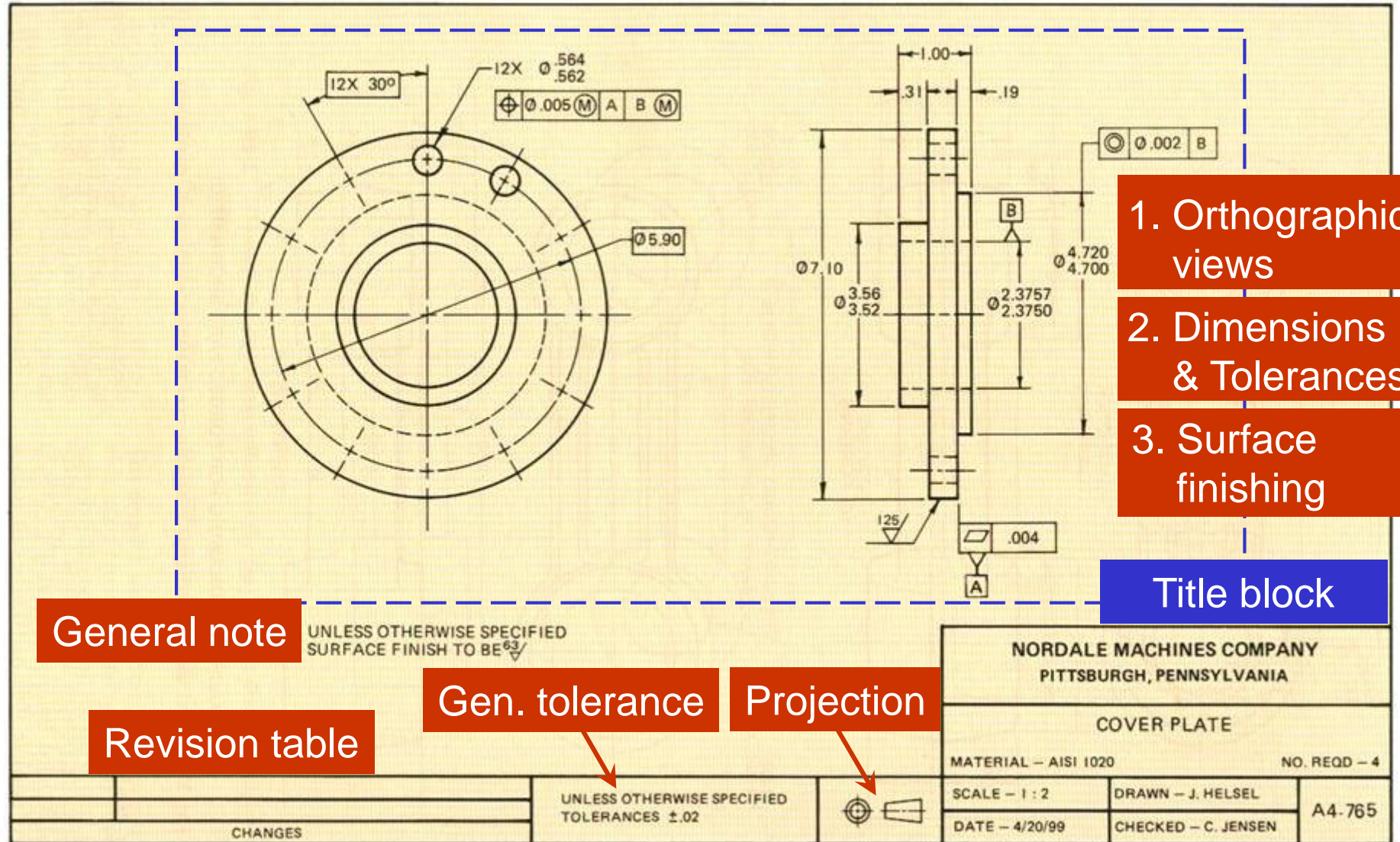
Specifications

- ❖ **Part number, name, number required**
- ❖ **Type of material used**
- ❖ **General notes**
- ❖ Heat treatment
- ❖ Surface finish
- ❖ General tolerances

RECOMMENDED PRACTICE

- Draw **one part** to **one sheet** of paper.
- If not the case,
 - apply ***enough spacing*** between parts.
 - draw all parts using the ***same scale***.Otherwise, the scale should be clearly note under each part's drawing.
- Standard parts such as ***bolt, nut, pin, bearing*** do not require detail drawings.

EXAMPLE : Interpreting detail drawing



Assembly Drawing



TYPES OF ASSEMBLY DRAWING

1. Exploded assembly drawings

The parts are separately display, but they are aligned according to their assembly positions and sequences.

2. General assembly drawings.

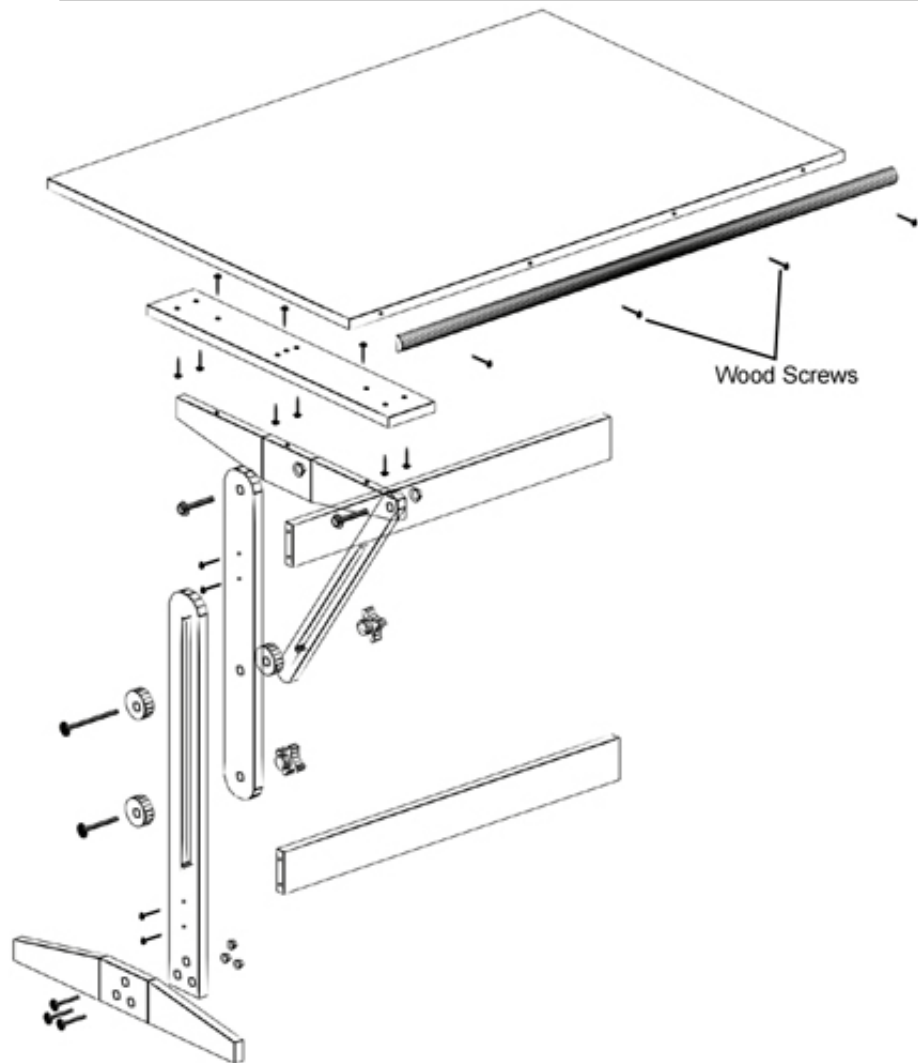
All parts are drawn in their working position.

3. Detail assembly drawings

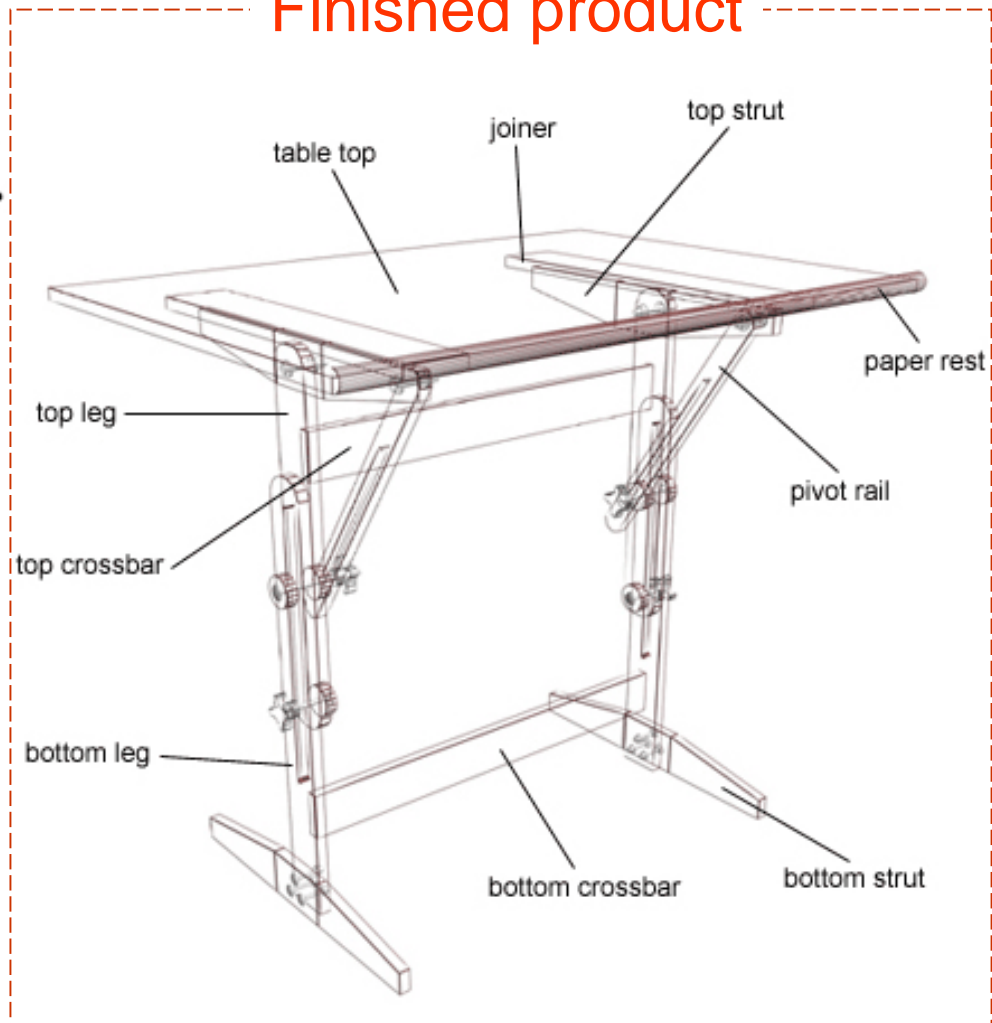
All parts are drawn in their working position with a completed dimensions.

1. EXPLODED ASSEMBLY

Pictorial representation



Finished product

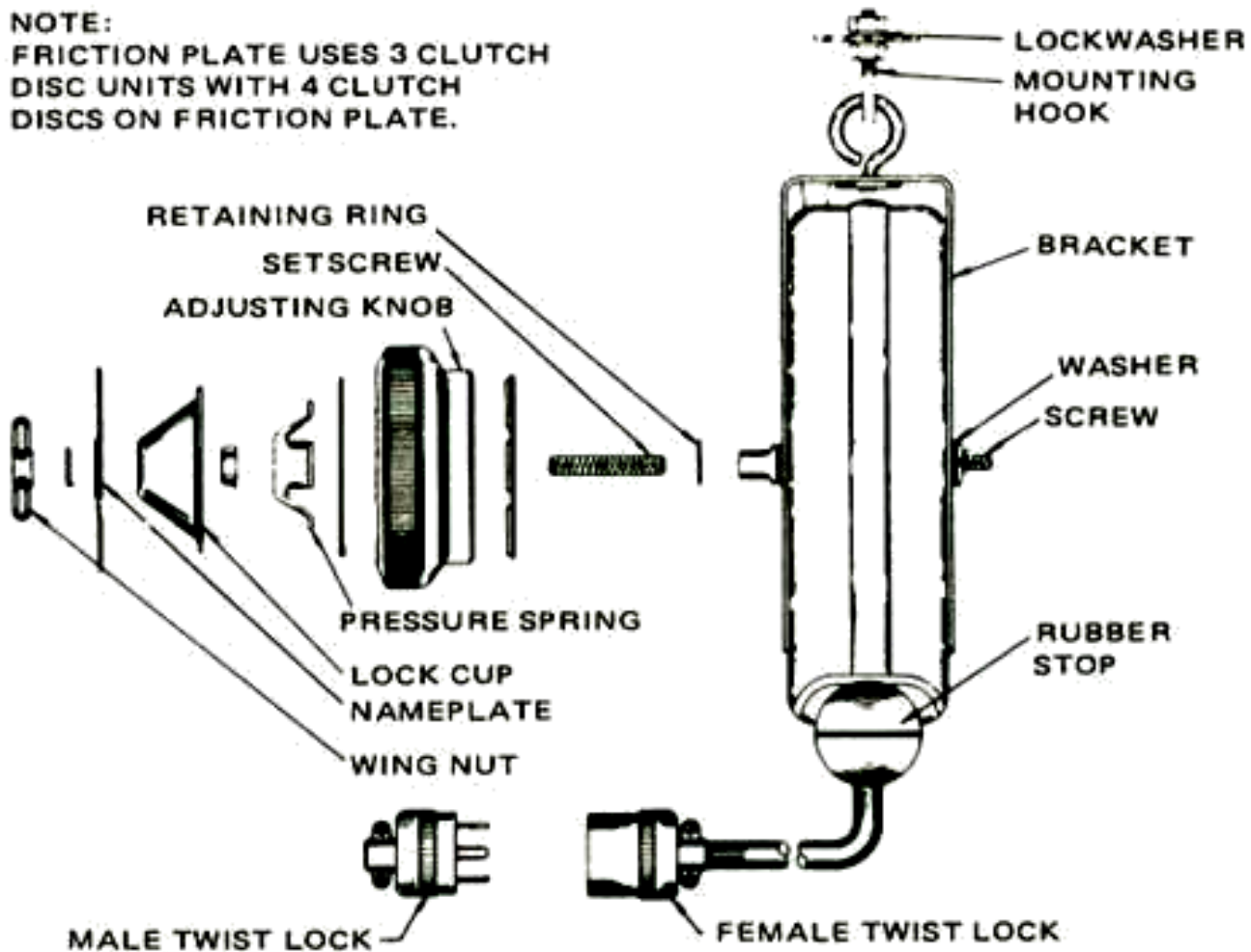


1. EXPLODED ASSEMBLY

Orthographic representation

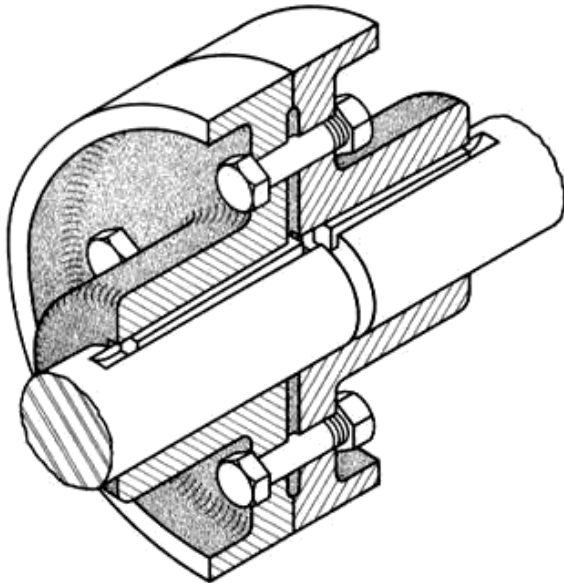
NOTE:

FRICTION PLATE USES 3 CLUTCH
DISC UNITS WITH 4 CLUTCH
DISCS ON FRICTION PLATE.

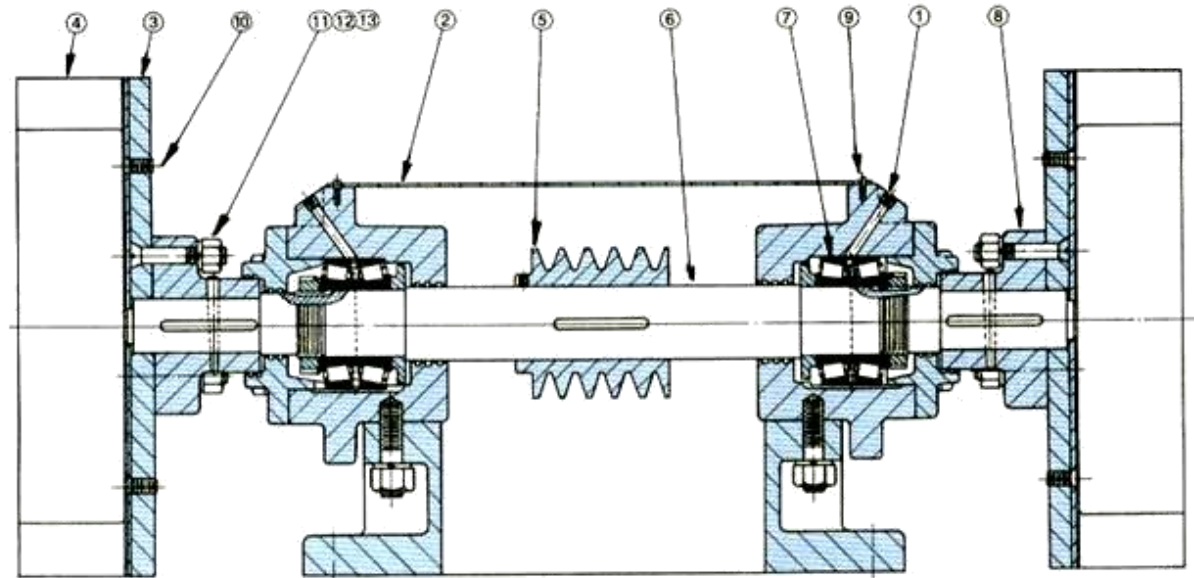


2. GENERAL ASSEMBLY

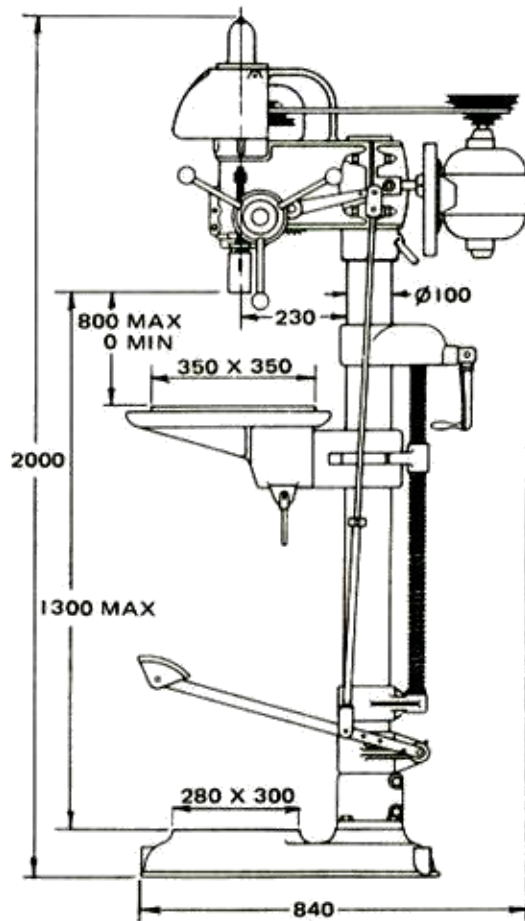
Pictorial



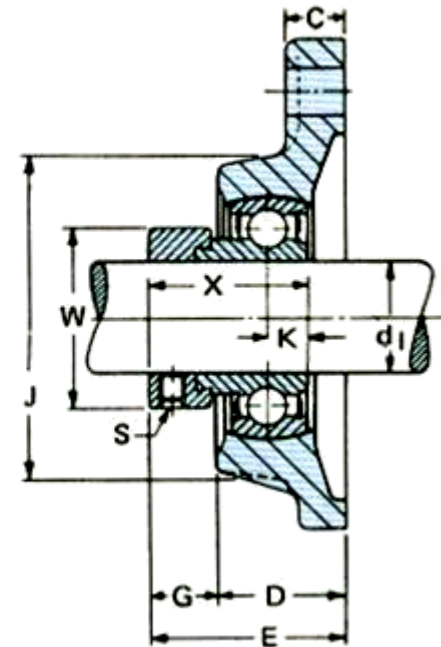
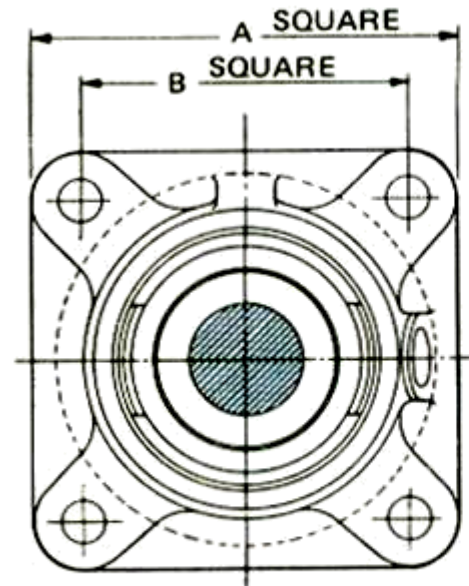
Orthographic



2. GENERAL ASSEMBLY



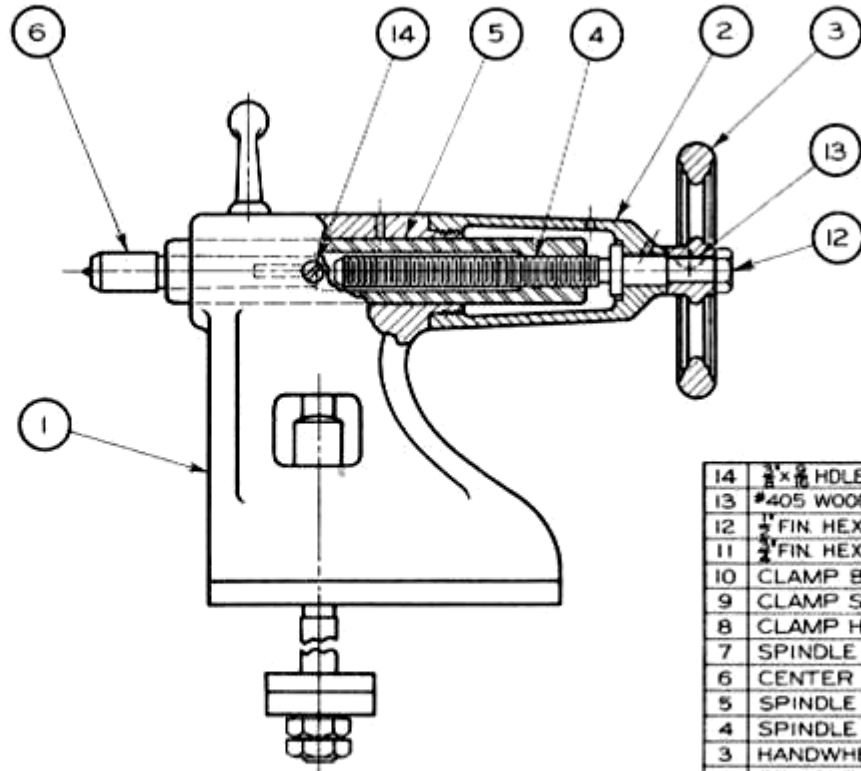
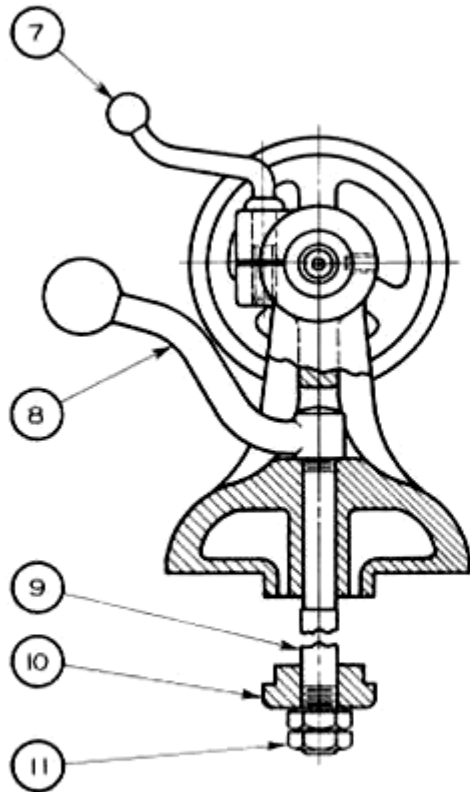
Only dimensions relate to machine's operation are given.



Only dimensions relate to machine's operation are given in tabulated form (not shown).

2. GENERAL ASSEMBLY

10D-603



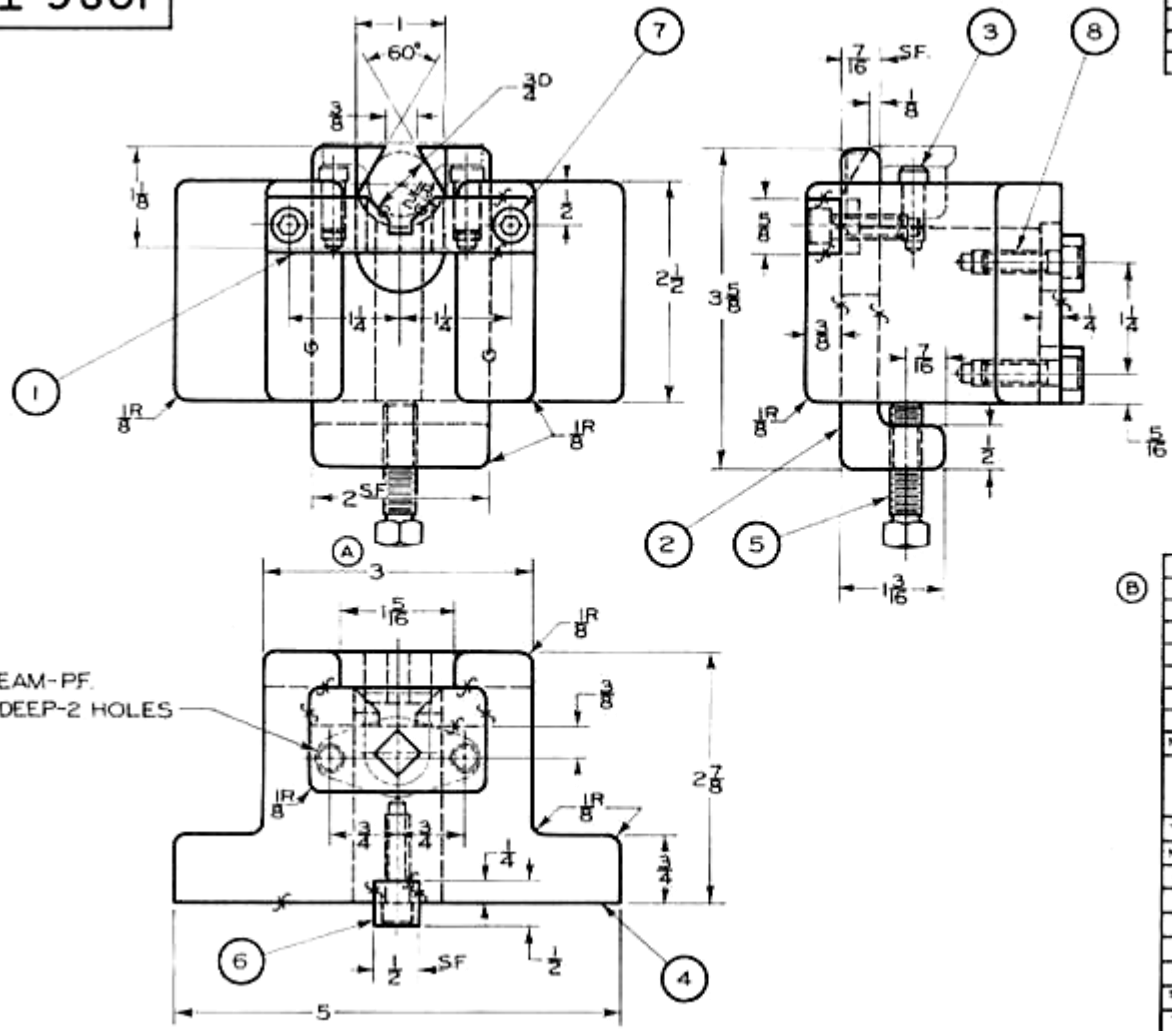
14	$\frac{3}{8}$ x $\frac{3}{8}$ HDLESS SET SCR. FL. DOG PT.		1
13	#405 WOODRUFF KEY		1
12	$\frac{1}{2}$ FIN. HEX. NUT		1
11	$\frac{3}{4}$ FIN. HEX. JAM NUT		2
10	CLAMP BLOCK	SAE.1112	1
9	CLAMP STUD	SAE.1112	1
8	CLAMP HANDLE	SAE.1112	1
7	SPINDLE HANDLE	SAE.1112	1
6	CENTER	SAE.1315	1
5	SPINDLE	SAE.1112	1
4	SPINDLE SCREW	SAE.1112	1
3	HANDWHEEL	C.I.	1
2	SPINDLE SCR BRG	C.I.	1
1	TAILSTOCK BASE	C.I.	1
NO.	PART NAME	MAT'L.	REQ'D.

TITLE ASSEMBLY OF TAILSTOCK			
MACHINE	10D	SHOP ORDER	1064
		DATE	3-20-54
DRAWN BY	J.R.S.	CHECKED	H.R.
		APPROVED	LMT
MATERIAL	HARDNESS		
HEAT TREATMENT			
LETTER	CHANGE	BY	DATE
JACKSON MACHINE CO. ST. LOUIS, MO.			10D-603

3. DETAILED ASSEMBLY

(working-drawing assembly)

1026-T-2



SYM	ALTERATIONS	DATE	BY	CHK
A	WAS 3/4	2-4-54	JMS	JM
B	WAS 1/4-20x1	3-6-54	JMS	JM

NO	PART NAME	STOCK SIZE	MAT	REQ
8	SOC HD SCR	1/4"-20x 3/8		2
7	SOC HD SCR	1/4"-20x 3/4		2
6	KEY (HDN & GR)	1/2 x 1/2 x 3/8	MS	2
5	SQ HD SET SCR	5/8-16 x 1 1/4		1
4	BASE	PATT. 1026-F2 C.1		1
3	PIN (HDN & GR)	1/4 x 3/4	TS	2
2	CLAMP (HDN & GR)	2 x 1 3/8 x 3 3/8	MS	1
1	V-BLOCK (* *)	5/8 x 1/2 x 3	MS	1

JOHNSON AIRCRAFT CO.
CHICAGO, ILL. TOOL DEPT.

TITLE: GRINDING FIXTURE
NAME BRACK OIL PIPE TOOL DISC GR FLANGE
OPERATION: GRIND FLANGE

DRAWN BY: J.Q.V. CHECKED: JPM
DATE: 2-2-54 APPROVED: J.G.M.

FOR PART NO. 1026 ORDER NO.

SHEET NO.	1	NO OF SHEETS	1	SIZE SHEETS	A	B	C	D
TOOL AND DRAWING NO.								
1026-T-2								

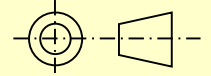
REMOVE SHARP EDGES UNLESS OTHERWISE SPECIFIED

REQUIRED INFORMATION IN GENERAL ASSEMBLY DRAWING

1. All parts, drawn in their operating position.
2. Part list (or bill of materials, BOM)
 1. Item number
 2. Descriptive name
 3. Material, MATL.
 4. Quantity required (per a unit of machine), QTY.
3. Leader lines with balloons around part numbers.
4. Machining and assembly operations and critical dimensions related to operation of the machine.

PLACING AN INFORMATION

(This course)



- Assembled parts
- Reference numbers

General notes

Part list

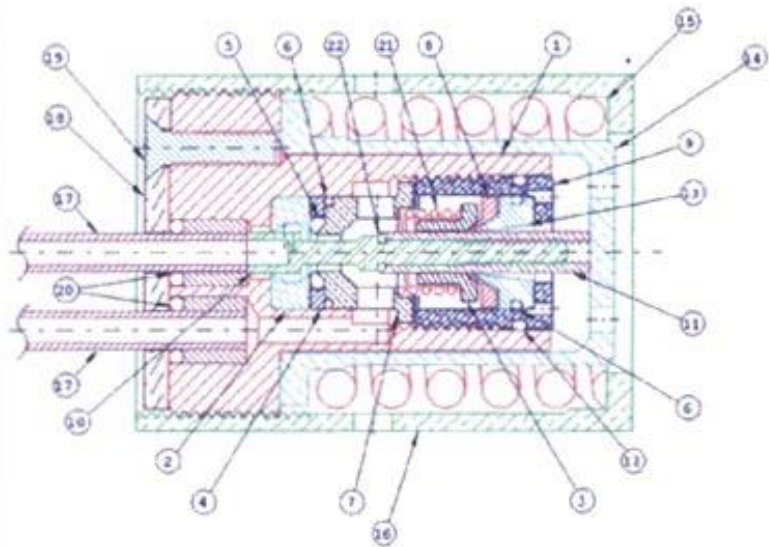
Title block

PART LIST (BOM) (This course)

- Locate above or beside the title block.
Fill the table from the bottom.

3	SET SCREW	1	Stainless Steel, M3 HEX SOCK CUP PT
2	SHAFT	1	Stainless Steel
1	SUPPORT	2	Cast Iron
NO.	PART NAME	REQD.	MATL. & NOTE

EXAMPLE : Another allowable place for BOM



The diagram shows a cross-section of a hydraulic regulator assembly. It features a central poppet stem with a sealing sleeve, surrounded by various seals, O-rings, and support structures. The assembly is housed within a manifold with two ports. The components are numbered 1 through 22, corresponding to the Bill of Materials table.

BILL OF MATERIAL				
FIND NO.	PART NO.	DESCRIPTION/TITLE	NO. REQD	REMARKS
1	BE2001	BODY	1	
2	BE2002	SEPT SUPPORT	1	
3	BE2003	SEAL SUPPORT	1	
4	BE2004	SPACER RING	1	
5		O-RING .100 I.D. x .040 W	1	
6		O-RING .220 I.D. x .032 W	2	
7	BE2005	MANIFOLD	1	
8	BE2006	TEFLON SEAL	1	
9	BE2007	RETAINING WFT	1	
10	BE2008	POPPET STEM	1	
11	BE2009	POPPET SEALING SLEEVE	1	
12		O-RING .055 I.D. x .032 W	1	
13	BE2010	SEAL SUPPORT	1	
14	BE2011	CAGE 1	1	
15		SPRING	1	
16	BE2012	CAGE 2	1	
17	BE2013	PORT TUBE	2	
18	BE2014	CLAMPING DISC	1	
19		BOLD DOWN PCREW	3	
20		O-RING .097 I.D. x .039 W	2	
21		ENERGIZER SPRING	1	
22		O-RING	1	

STONE ENGINEERING COMPANY
 A DIVISION OF THE SPAS CORPORATION
 305 MADISON ST., SUITE 2C MONTVILLE, AL. 35881

DRAWN BY: TLR APP. BY: _____
 DATE: 09/21/93 CHECKED: _____
 SCALE: 3:1 TOLERANCES: .001" UNLESS NOTED

TITLE: HYDRAULIC REGULATOR ASSEMBLY DRAWING NO.: BE1001

DATE	DESCRIPTION	DATE	BY	APPROV

STEPS TO CREATE ASSEMBLY DRAWING

1. **Analyze** geometry and dimensions of all parts in order to understand the *assembly steps* and overall shape of device or machine.
2. Select an appropriate view.
3. **Choose major parts**, i.e. parts that have several parts assembled on.
4. Draw a view of **major parts** according to a selected viewing direction.

STEPS TO CREATE ASSEMBLY DRAWING

5. Add detail view of the remaining parts at their working positions.
6. Apply ***section technique*** where relative positions between adjacent parts are needed to clarify.
7. Add ***balloons***, ***notes*** and ***dimensions*** (if any).
8. Create BOM.

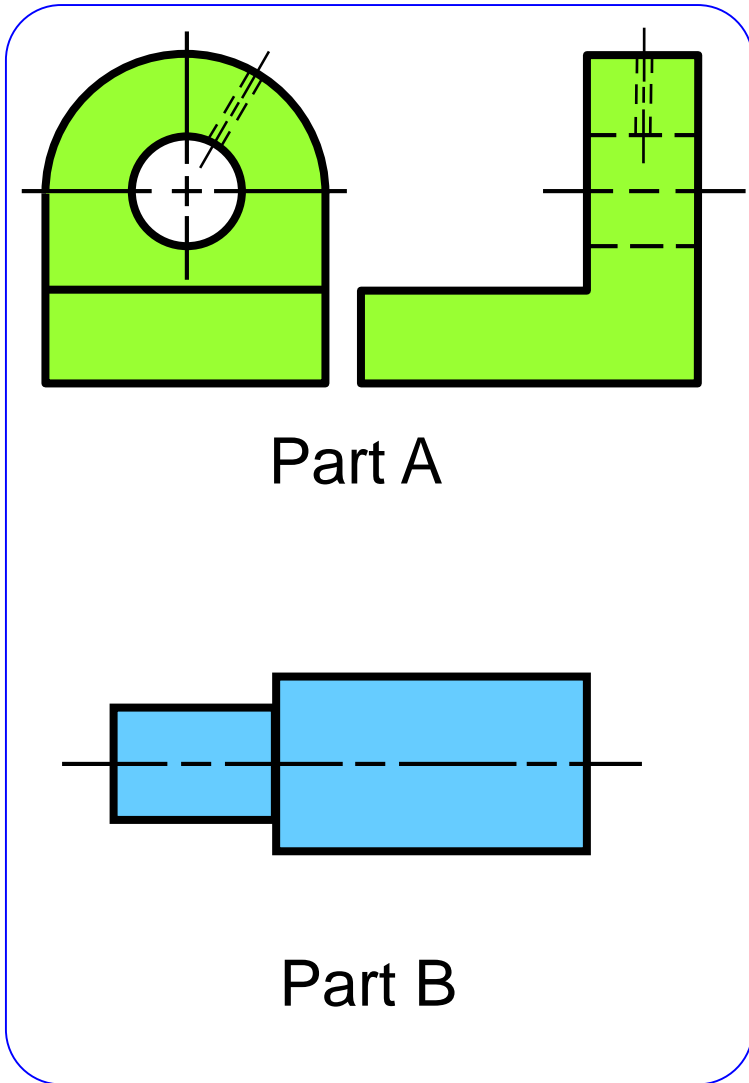
GENERAL PRACTICE

- The *number of views* can be one, two, three or more as needed, but it should be **minimum**.
- A good *viewing direction* is that represents all (or most) of the parts assembled in their working position.

GENERAL PRACTICE

- ***Hidden lines*** usually **omit** unless they are absolutely necessary to illustrate some important feature that the reader might otherwise miss.

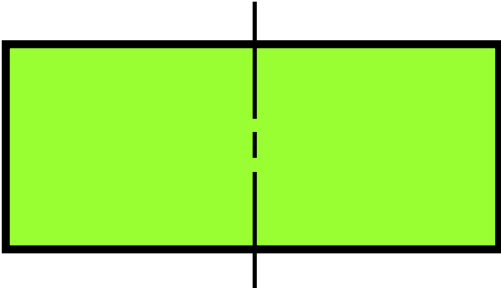
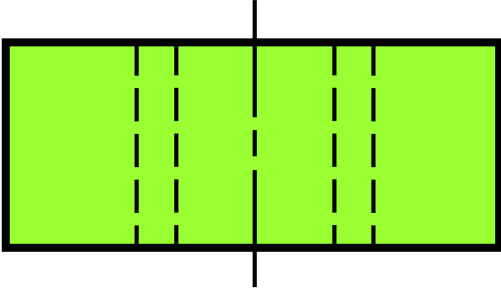
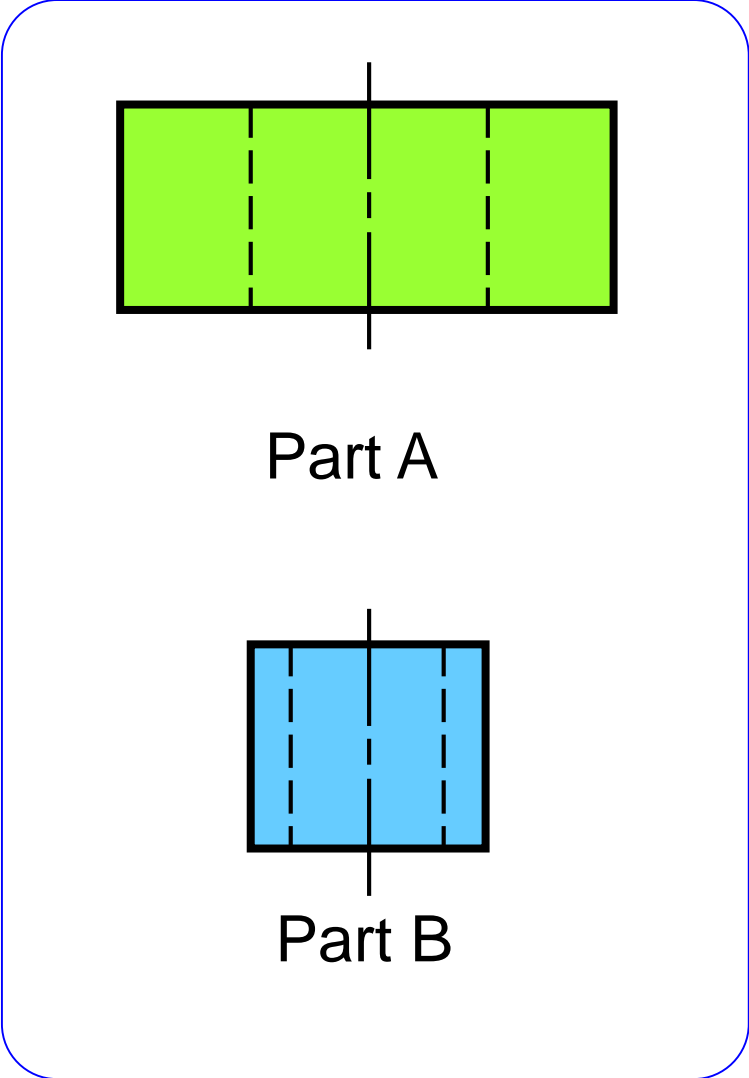
EXAMPLE : Hidden lines omit *or not* ?



Good

Poor

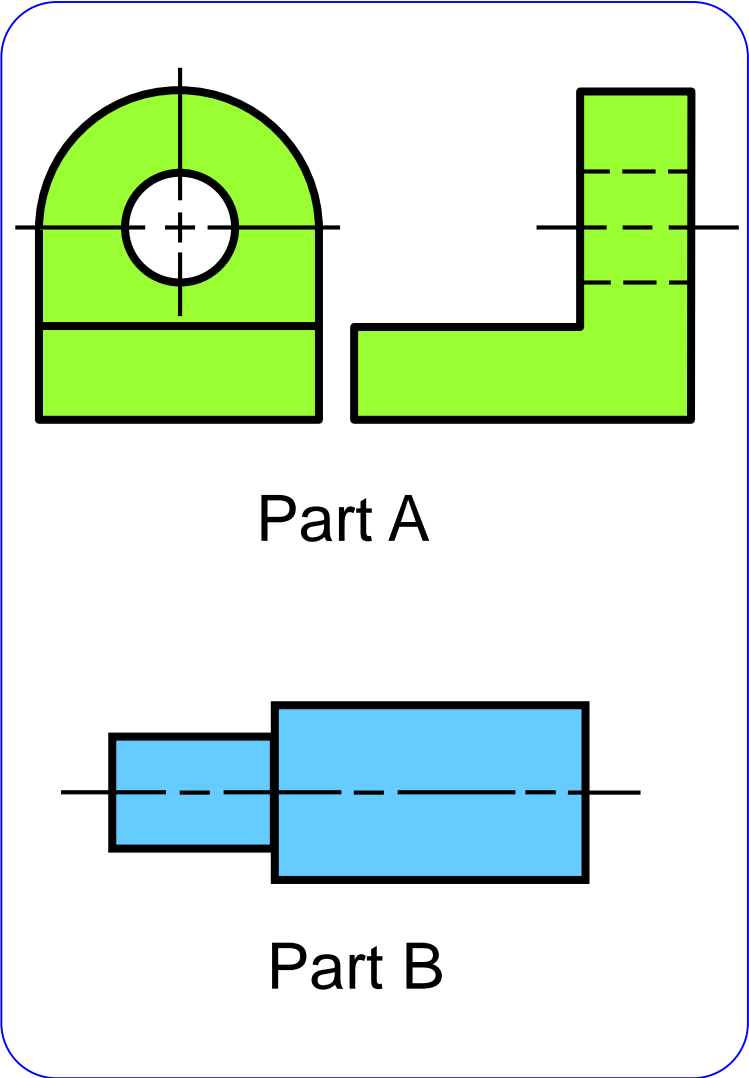
EXAMPLE : Hidden lines omit *or not* ?



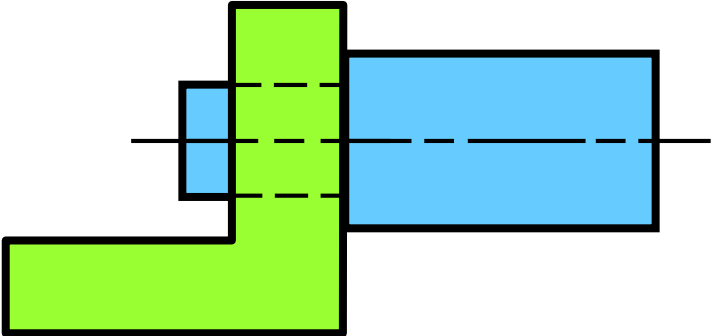
Good

Poor

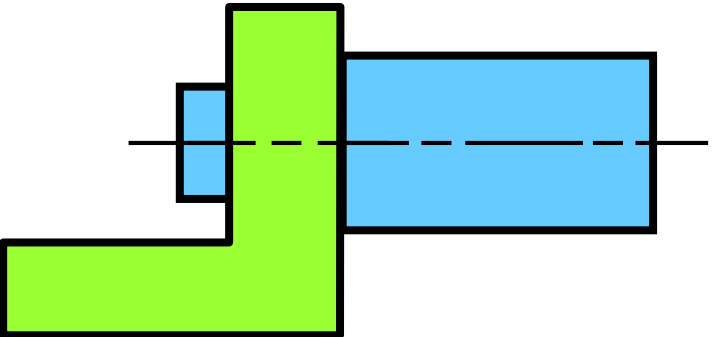
EXAMPLE : Hidden lines omit *or not* ?



A



B

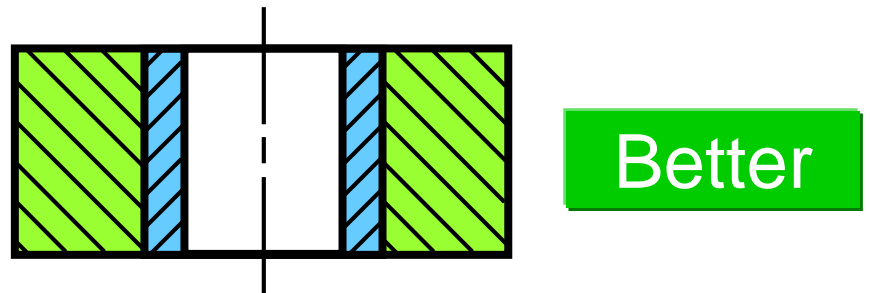
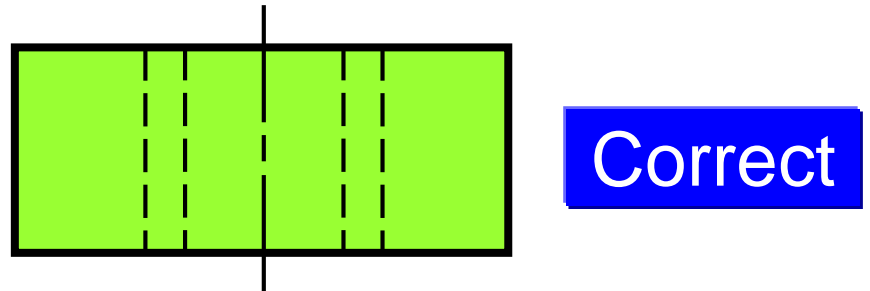
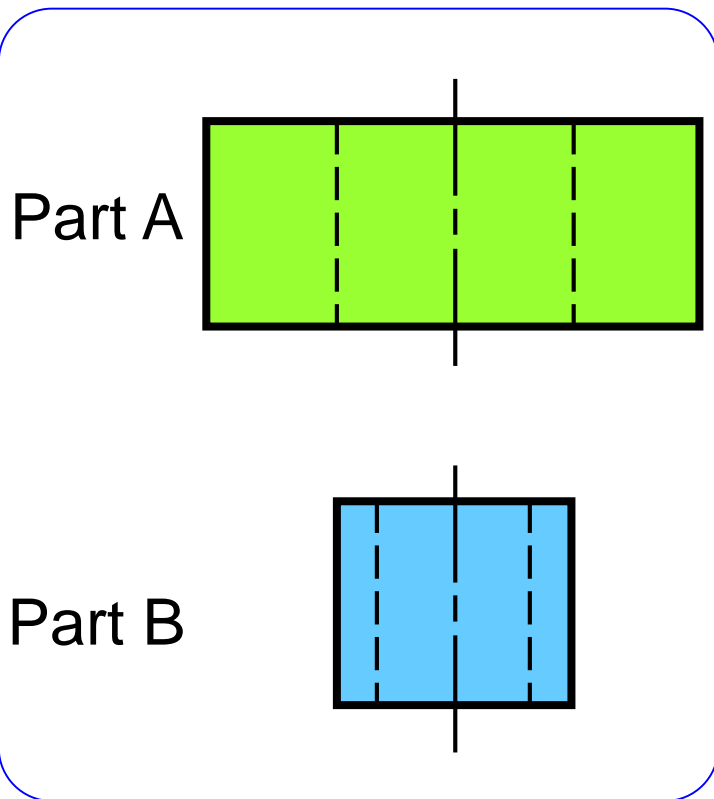


Good

Poor

GENERAL PRACTICE

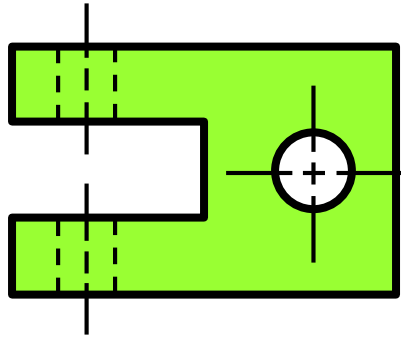
- **Section technique** is usually need to clarify the combination of the parts.
- Use **different** section line styles for adjacent parts.



SECTION LINE PRACTICE

- ***Do not*** draw section lines on sectional view of standard parts.
 - Threaded fastener
 - Washer
 - (longitudinal cut of) Solid shaft, Pin, Key

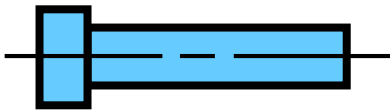
EXAMPLE 1 : Assembly steps



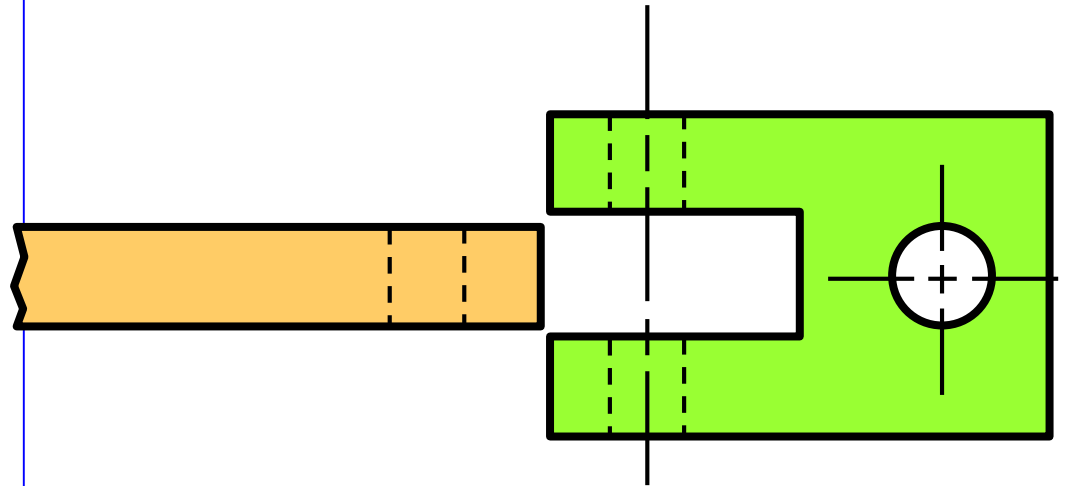
① CLEVIS, Steel, 1 REQD.



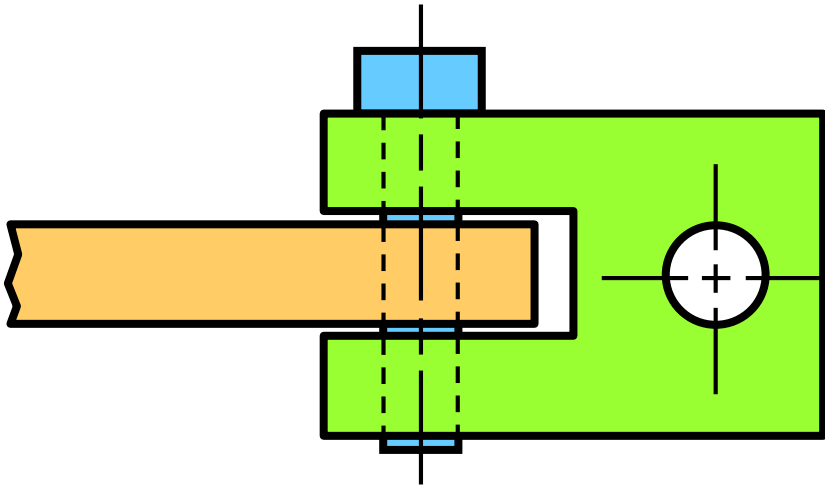
② ARM, Steel, 1 REQD.



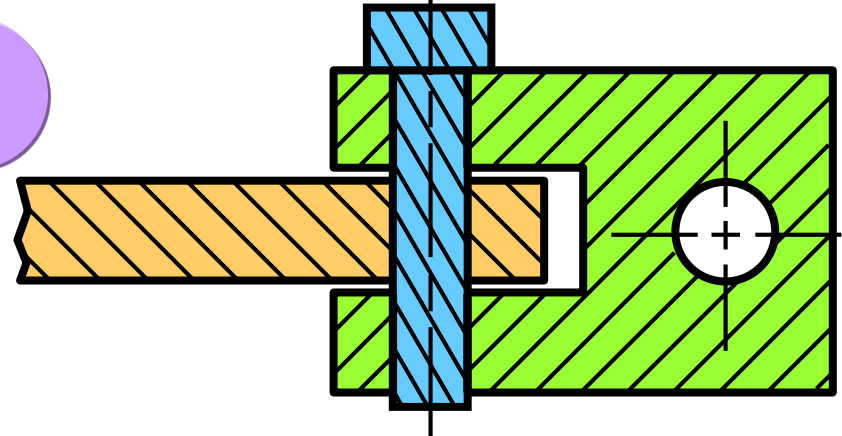
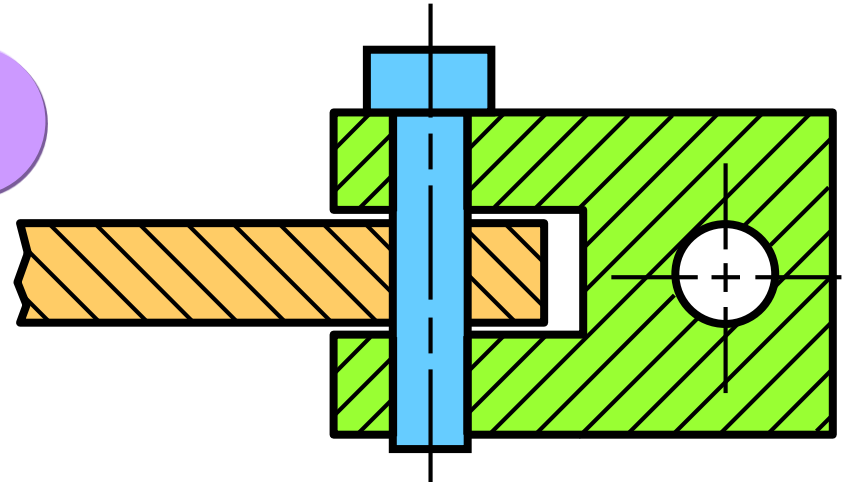
③ PIN, Steel, 1 REQD.



EXAMPLE : Section line practice



Which is an appropriate full section view of this assembly ?

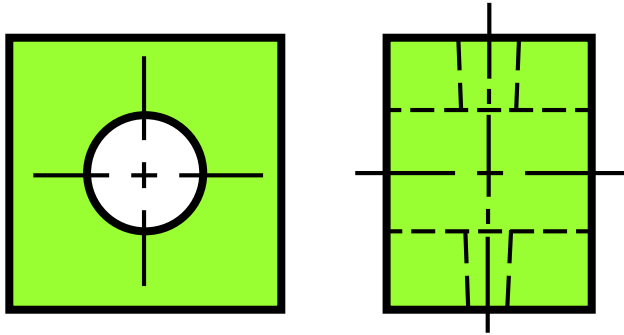


Good

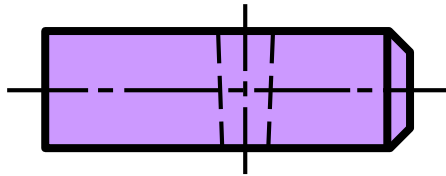
Poor

Color OFF ON

EXAMPLE 2 : Assembly steps



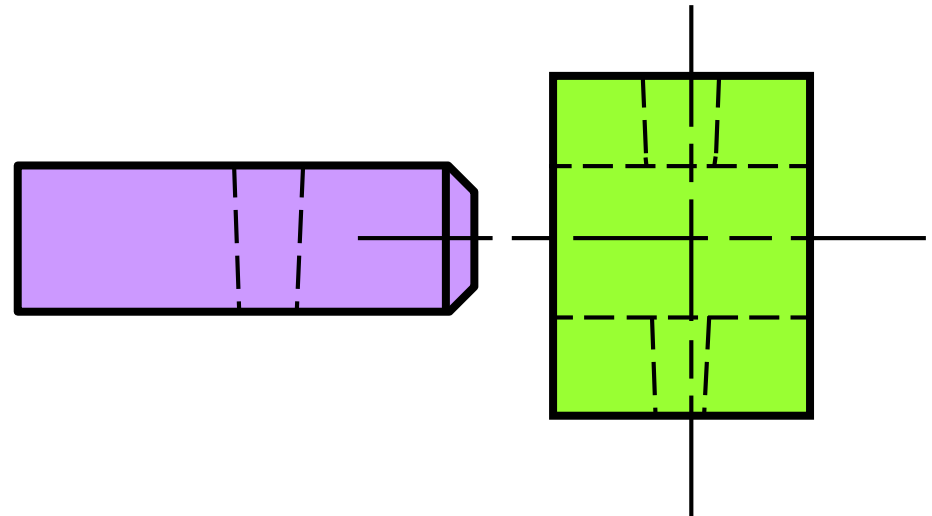
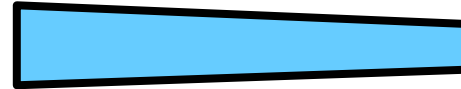
① SUPPORT, Steel, 1 REQD.



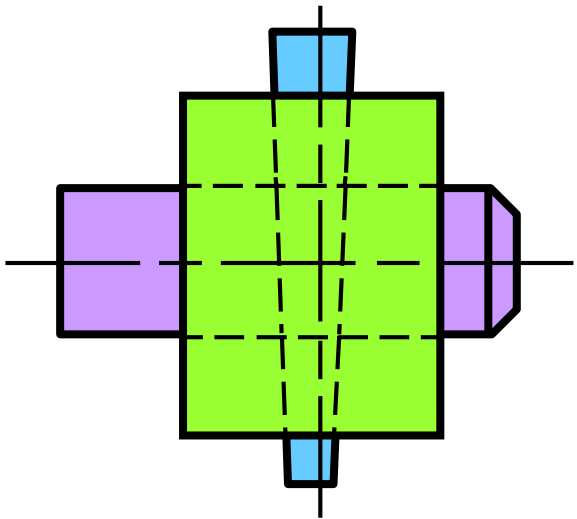
② SHAFT, Steel, 1 REQD.



③ TAPER PIN, Steel, 1 REQD.

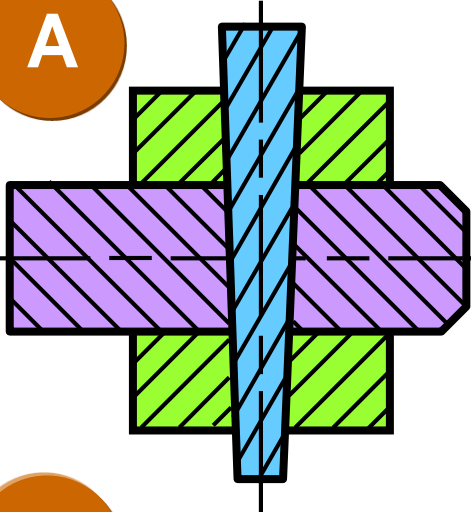


EXAMPLE : Section line practice

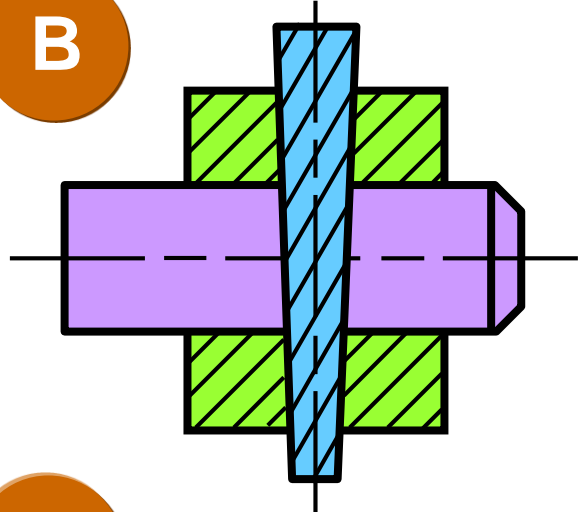


Which is an appropriate full section view of this assembly ?

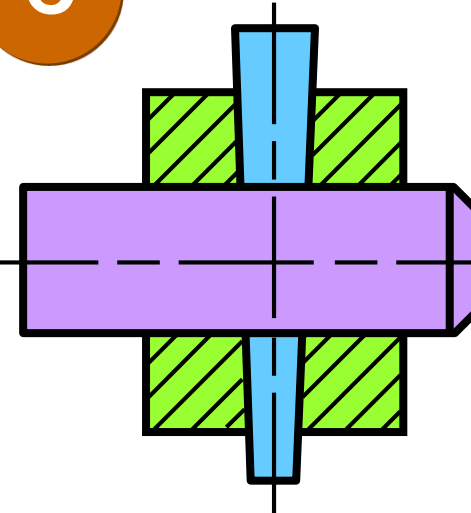
A



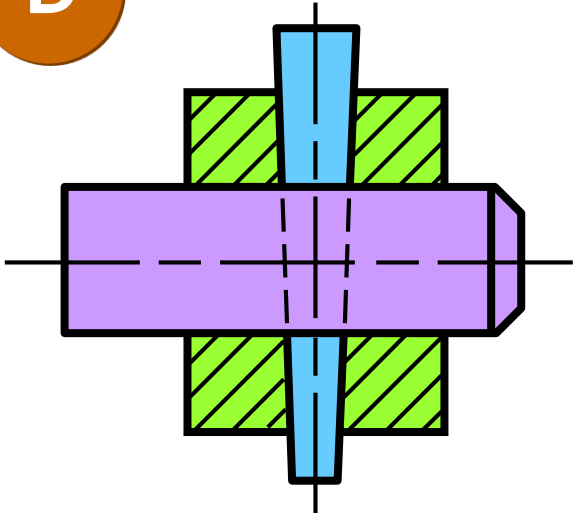
B



C



D



Good

Poor

Color OFF ON

LEADER LINE PRACTICE

- Drawn from the inside of the part to the balloon and placed a filled circle at the beginning of a line.
- Drawn in the *oblique* direction.

