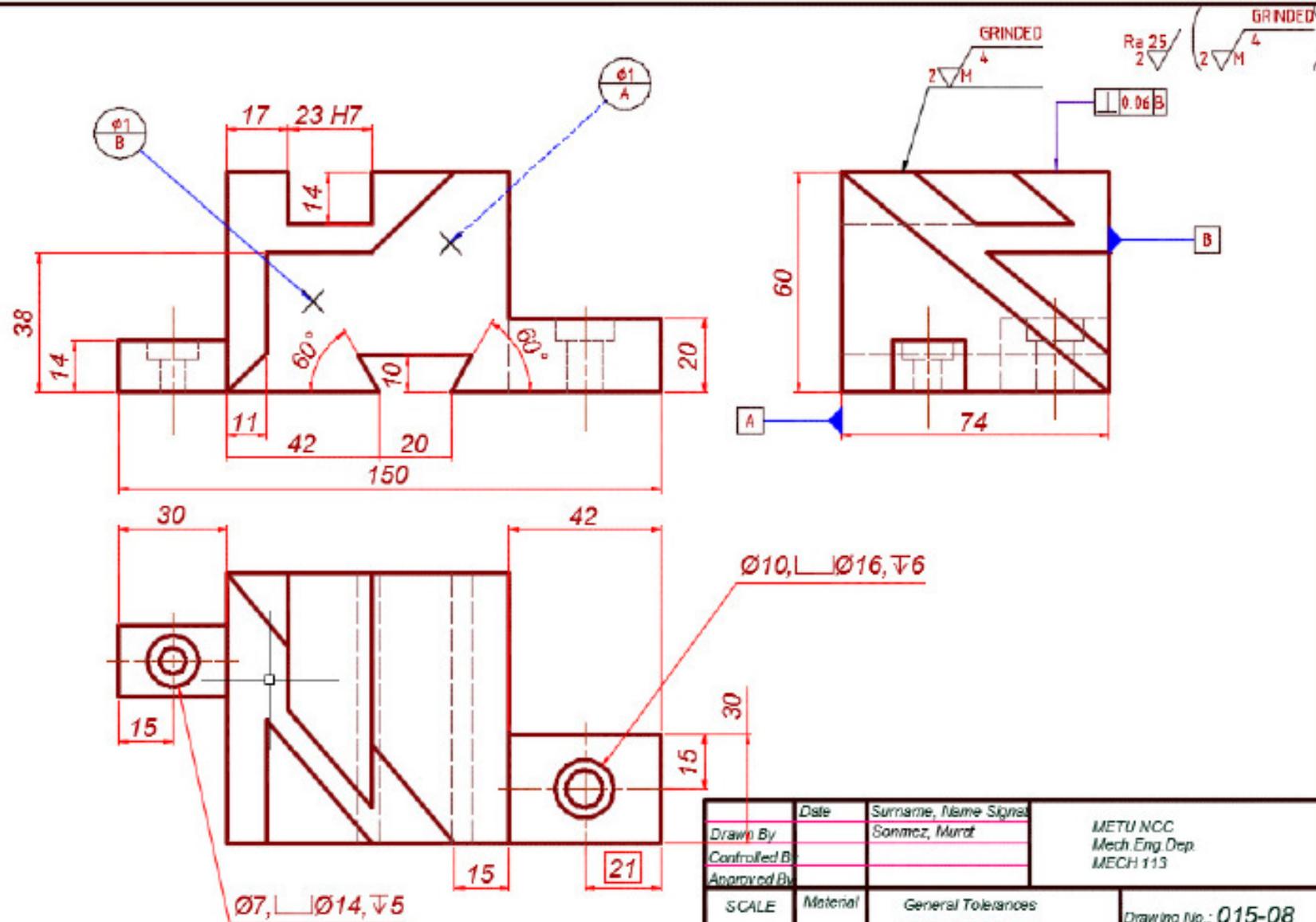


Drawing Papers

Types of Lines

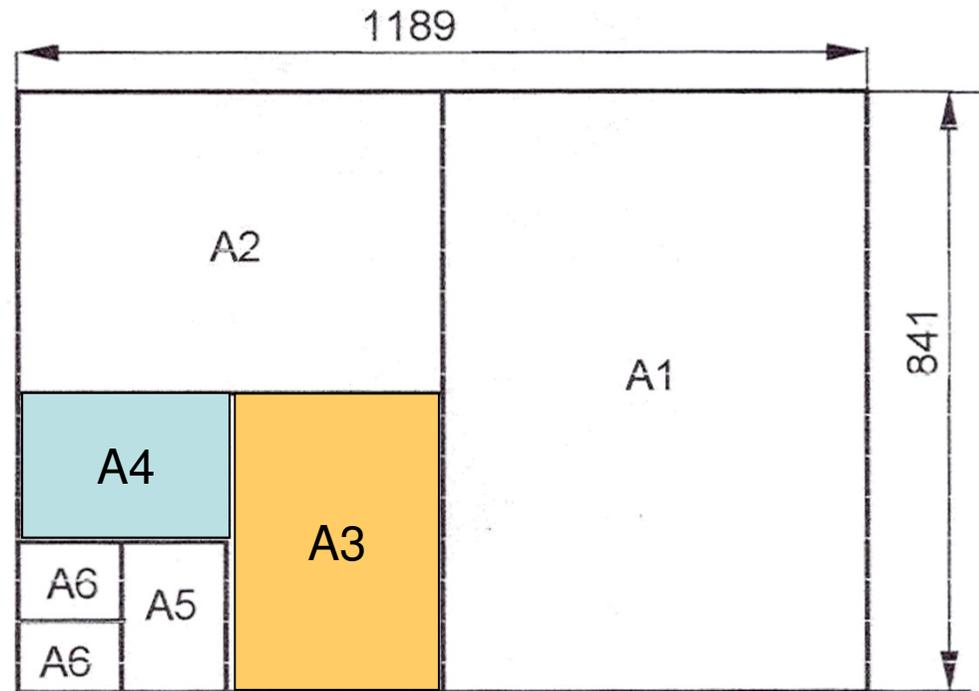
Lettering



| | | |
|---------------|----------------------|---|
| Date | Surname, Name Signat | METU NCC Mech. Eng. Dep. MECH 113 |
| Drawn By | Sonmez, Murat | |
| Controlled By | | |
| Approved By | | Drawing No.: 015-08 |
| SCALE | Material | General Tolerances |
| 1:1 | St-50 | ISO 2768-m |
| SI | | SLIDE BEARING |
| | | Replaced By: |
| | | Replaces: |

Standard Drawing Papers

| | |
|----|----------|
| A0 | 841X1189 |
| A1 | 594X841 |
| A2 | 420X594 |
| A3 | 297X420 |
| A4 | 210X297 |
| A5 | 148X210 |
| A6 | 105X148 |



Standard Drawing Sheet Sizes—Inches

$$A = 8.5 \times 11$$

$$B = 11 \times 17$$

$$C = 17 \times 22$$

$$D = 22 \times 34$$

$$E = 34 \times 44$$

Standard Drawing Sheet Sizes—Architectural USA

$$A = 9 \times 12$$

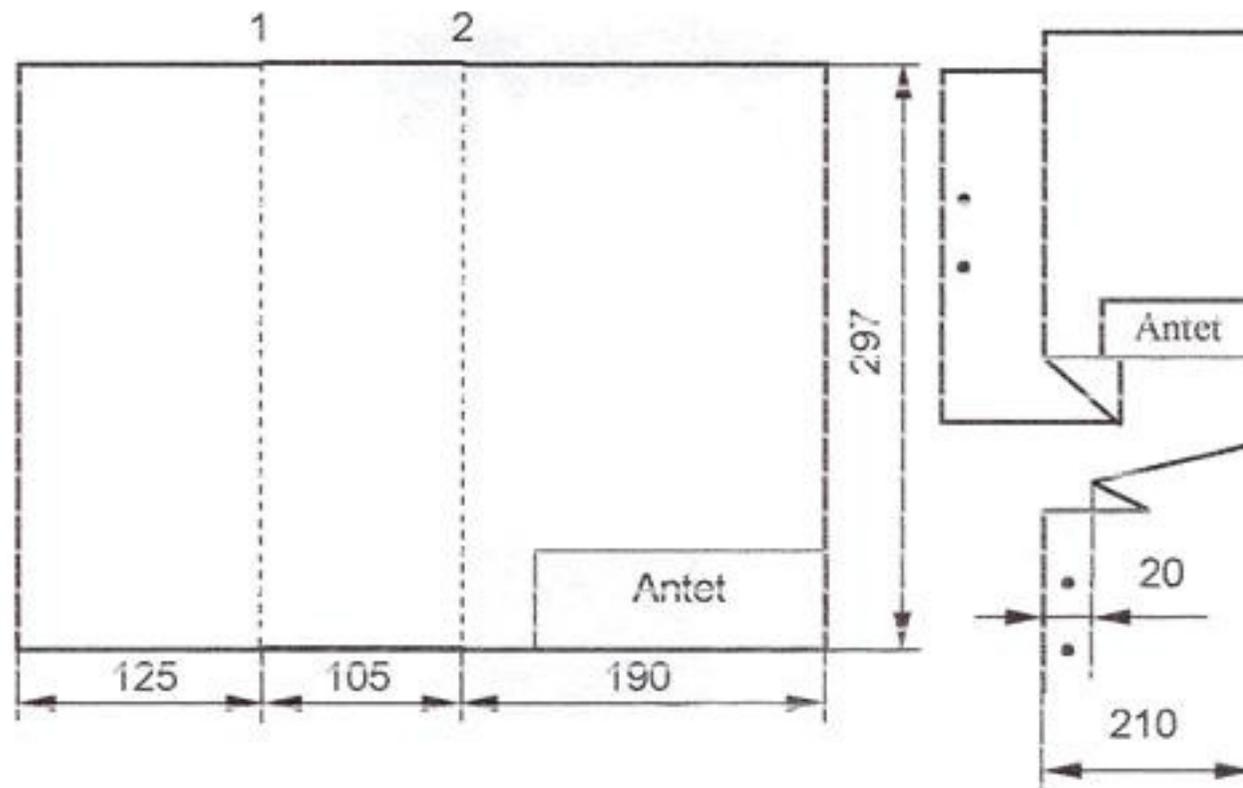
$$B = 12 \times 18$$

$$C = 18 \times 24$$

$$D = 24 \times 36$$

$$E = 36 \times 48$$

A3 Folding Method



1.6 - ELLE KATLAMALAR

1.6.1 - Dosyaya (Klasöre) Konulacak A Tipi Formaların Katlanması

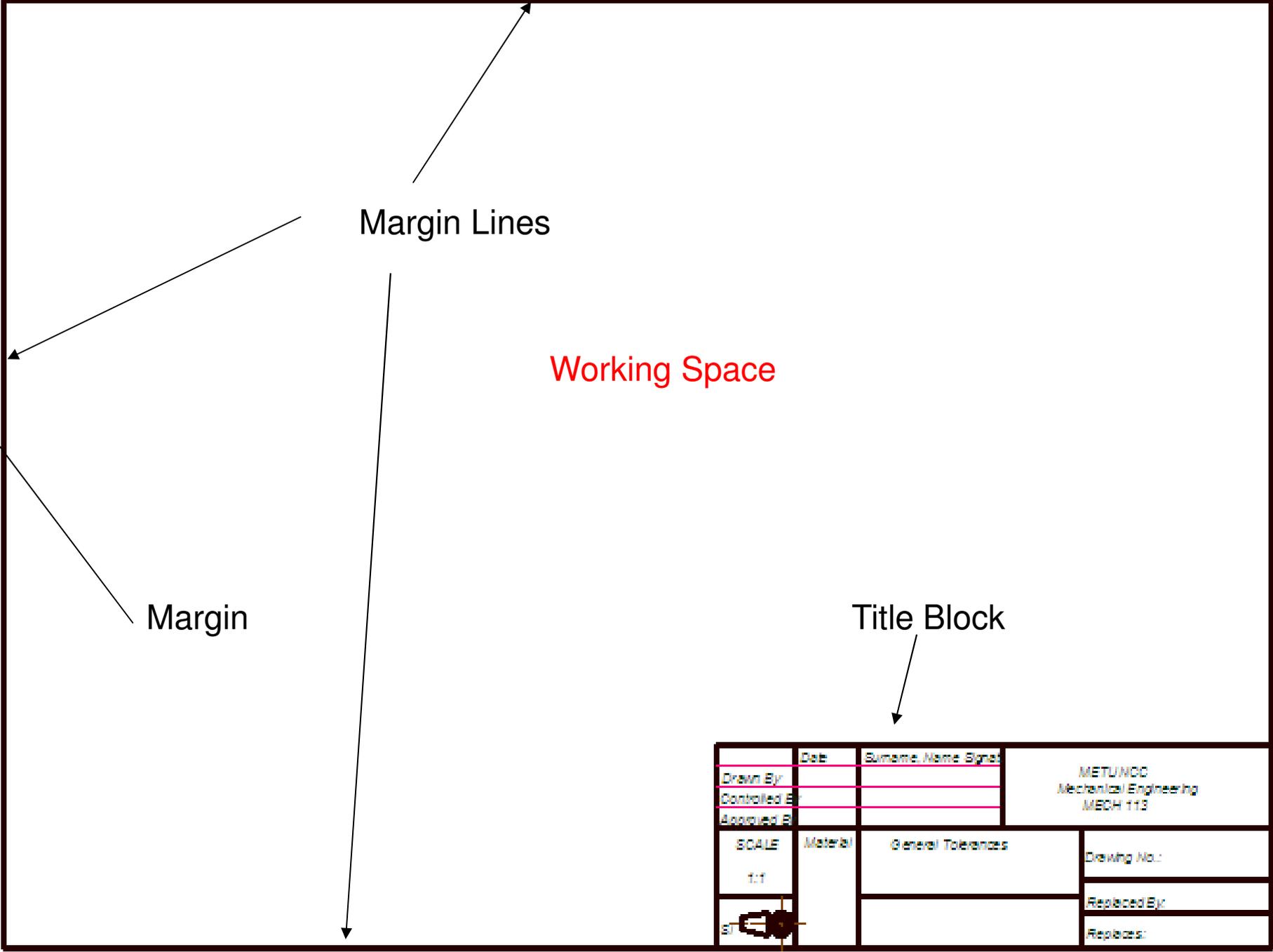
Ölçüler mm'dir

| Forma | Katlama Şeması | Boyuna Katlama | Enine Katlama |
|---------------------|----------------|----------------|---------------|
| 2 A0 1189 X 1682 | | | |
| A0 841 X 1189 | | | |
| A1 594 X 841 | | | |
| A2 420 X 594 | | | |
| A3 297 X 420 | | | |

1.6.2 - Dosyalanmayan (Körüklü Çanta veya Zarf İçine Konulan) C Tipi Formaların Katlanması

Ölçüler mm'dir.

| Forma | Katlama Şeması | Boyuna Katlama | Enine Katlama |
|---------------------|--|----------------|---------------|
| 2 A0 1189 X 1682 | <p style="text-align: center;">Boyuna Katlar</p> | | |
| A0 841 X 1189 | | | |
| A1 594 X 841 | | | |
| A2 420 X 594 | | | |
| A3 297 X 420 | | | |



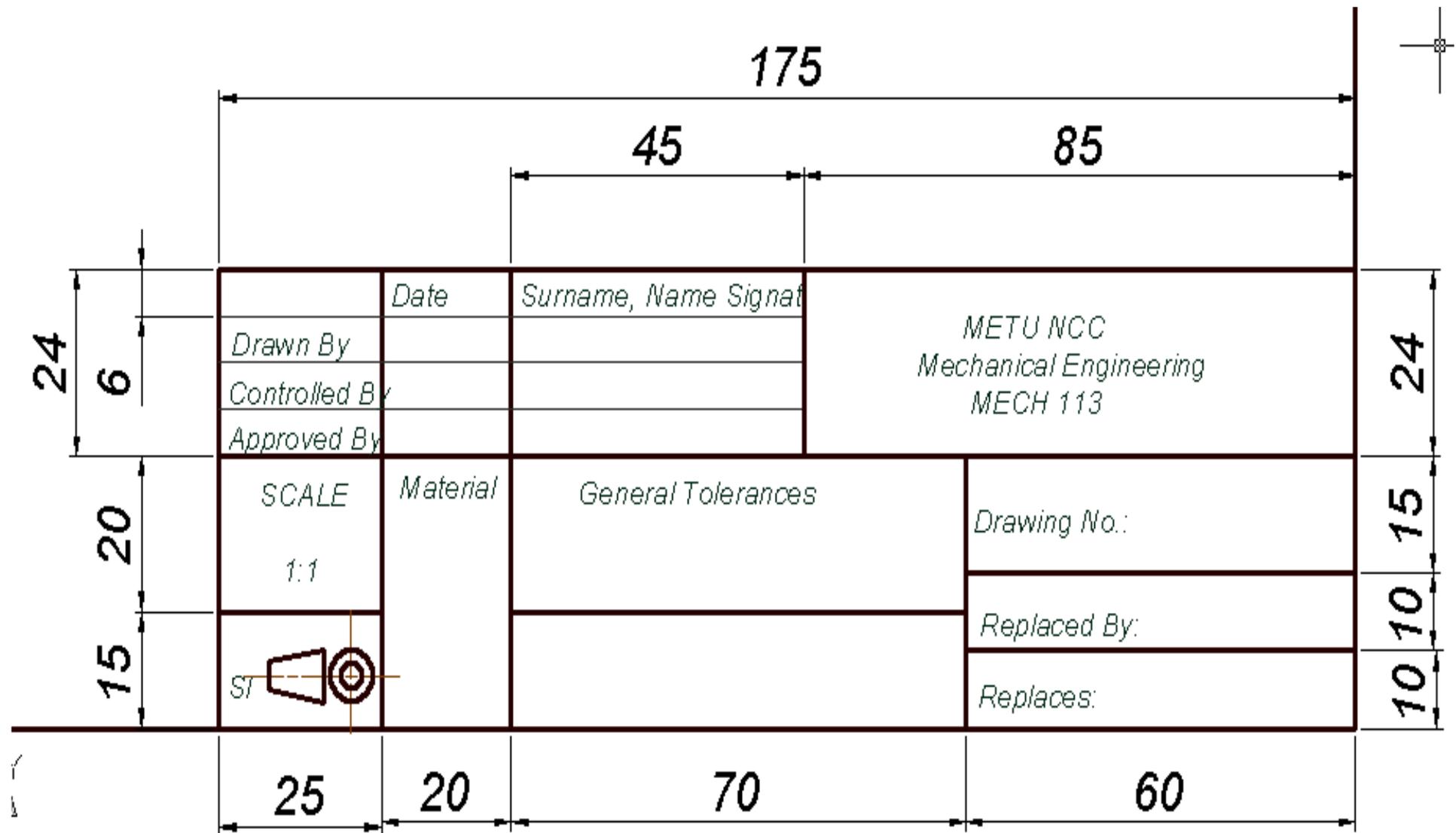
Margin Lines

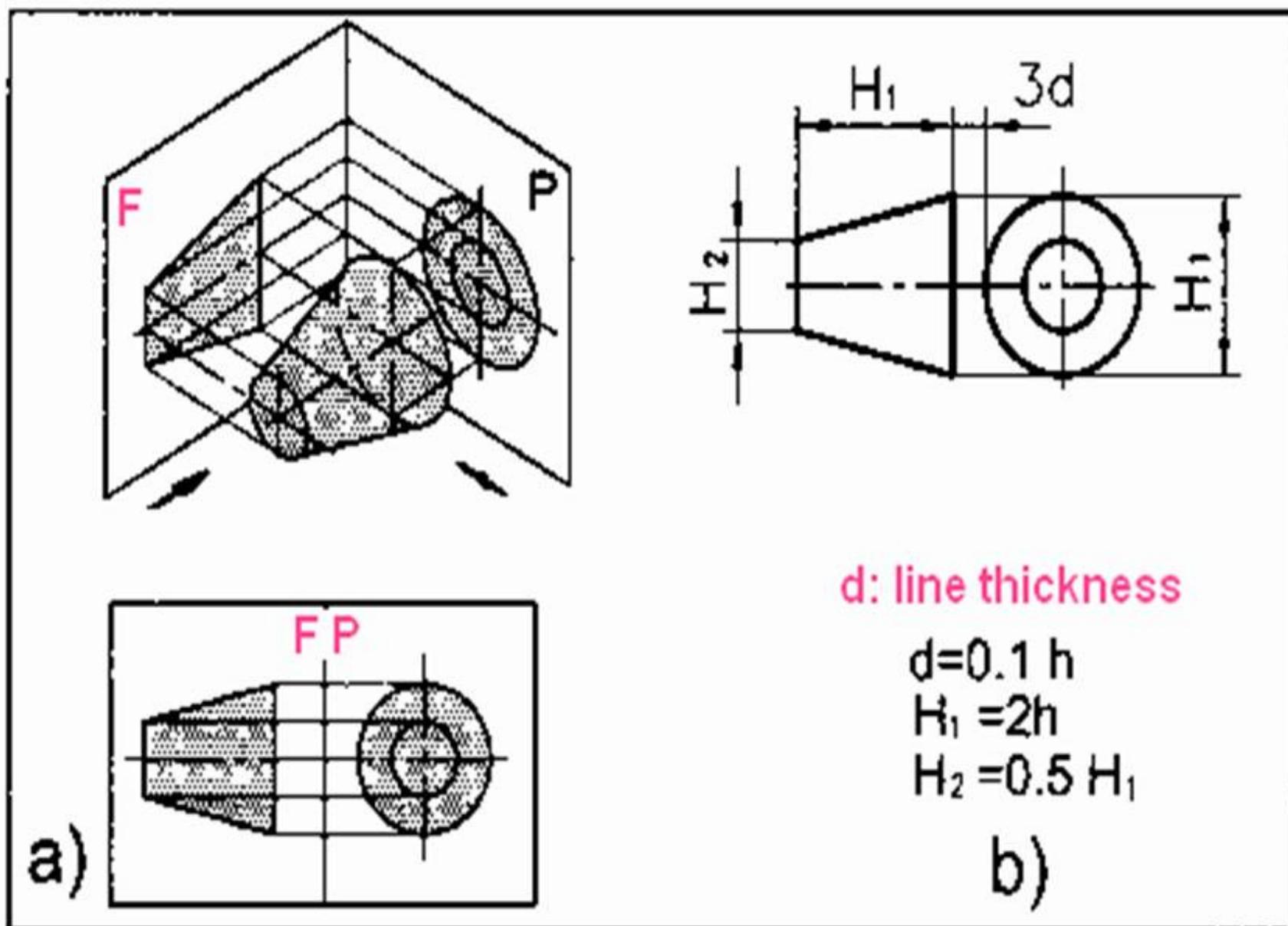
Working Space

Margin

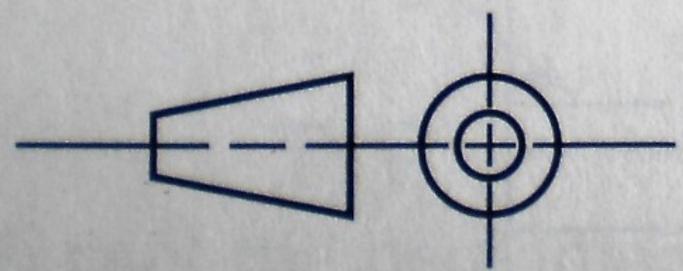
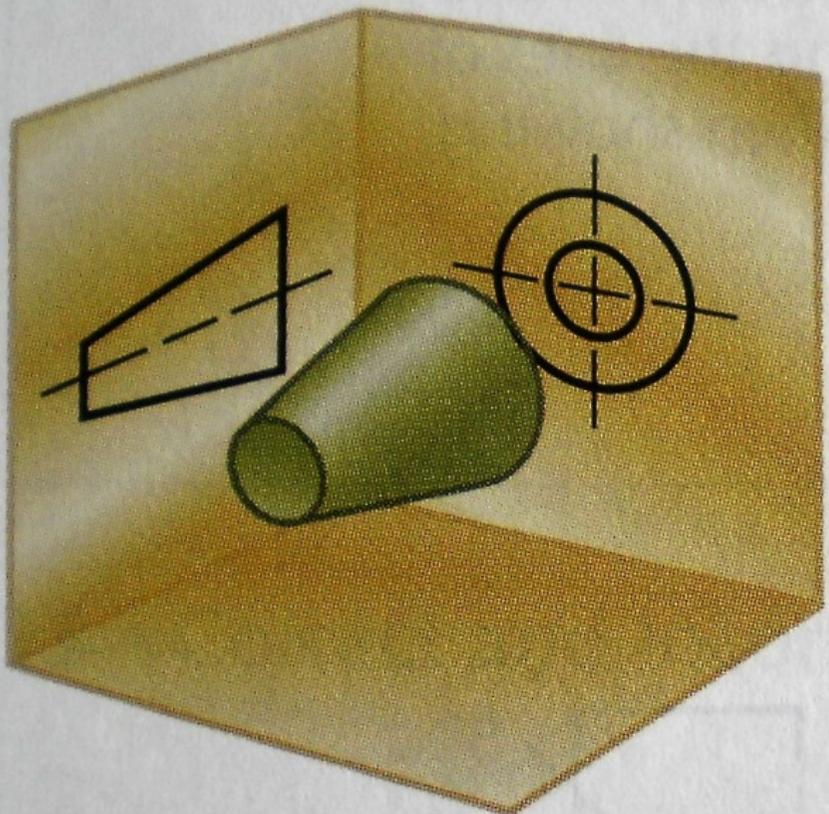
Title Block

| | | | |
|----------------|----------|-----------------------|---|
| | Date | Surname, Name, Signat | METUNCO Mechanical Engineering MECH 113 |
| Drawn By: | | | |
| Controlled By: | | | |
| Approved By: | | | |
| SCALE | Material | General Tolerances | Drawing No.: |
| 1:1 | | | Replaced By: |
| ST | | | Replaces: |

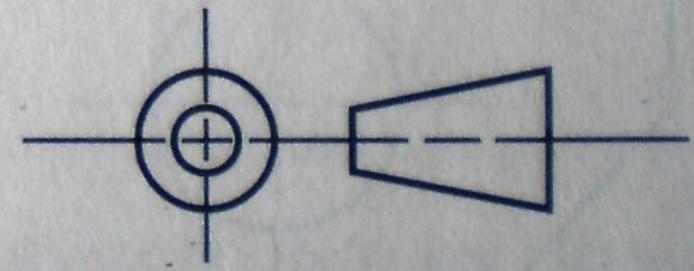
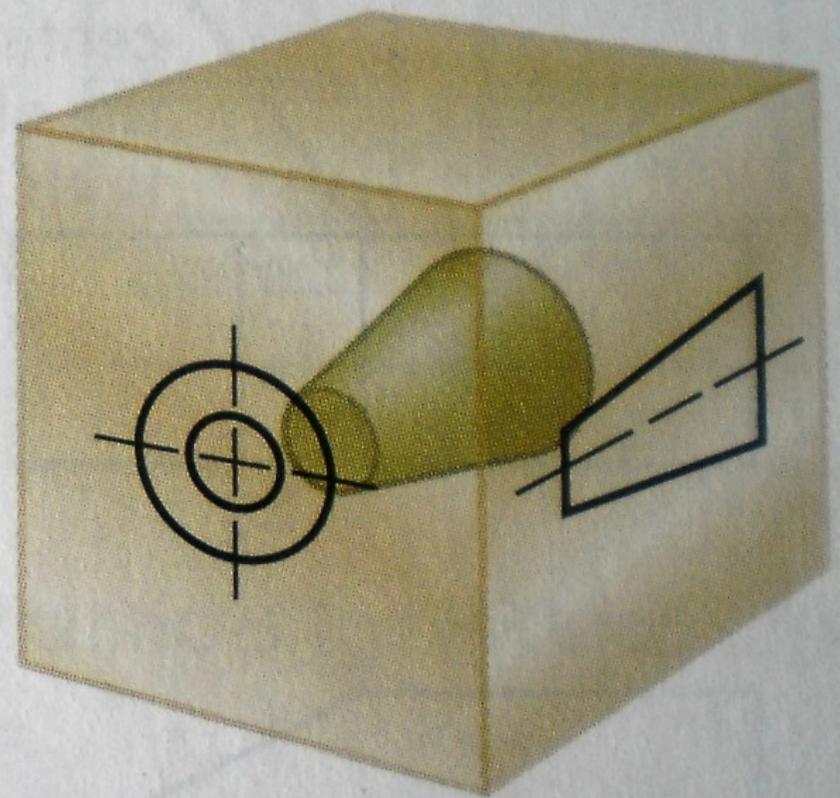




First Angle Projection Symbol

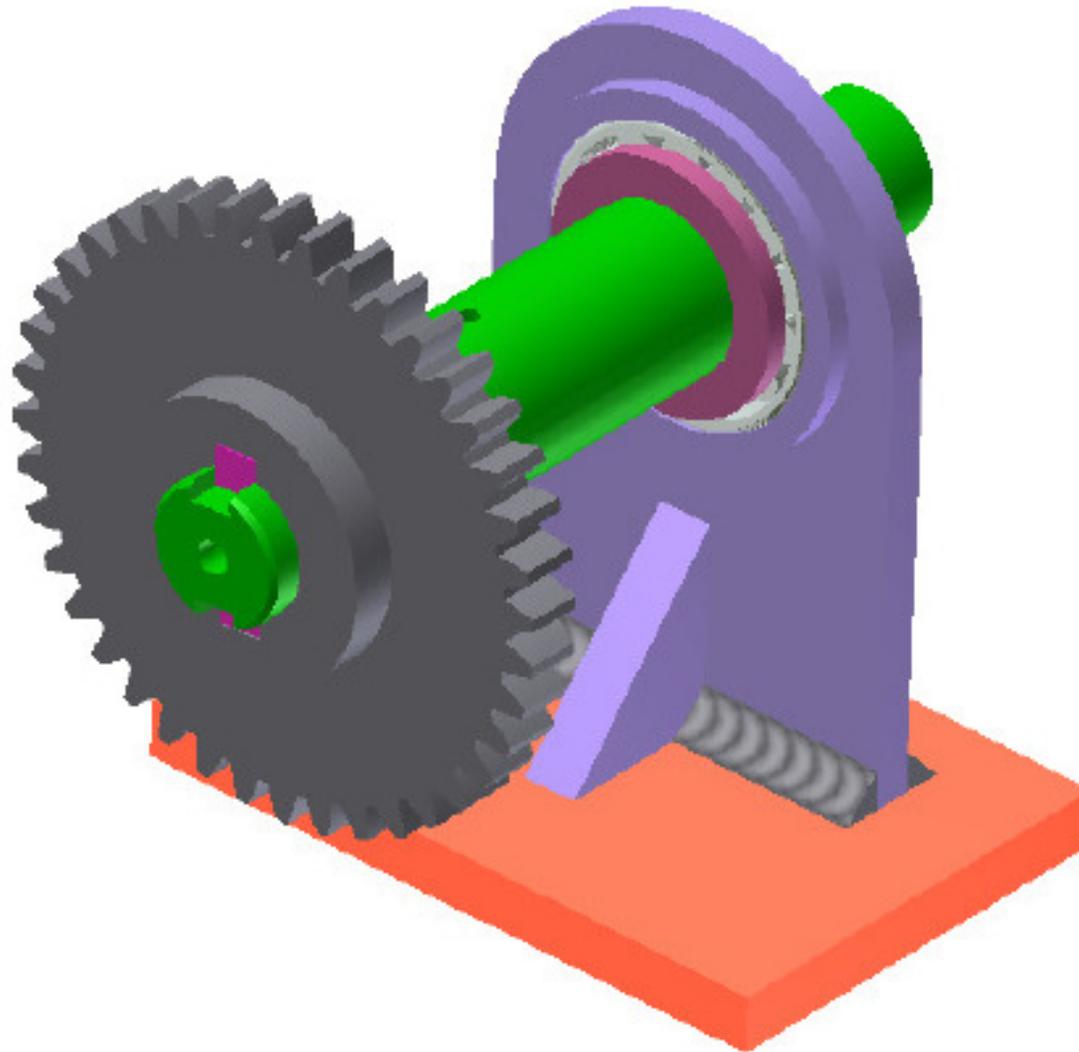


First-angle projection



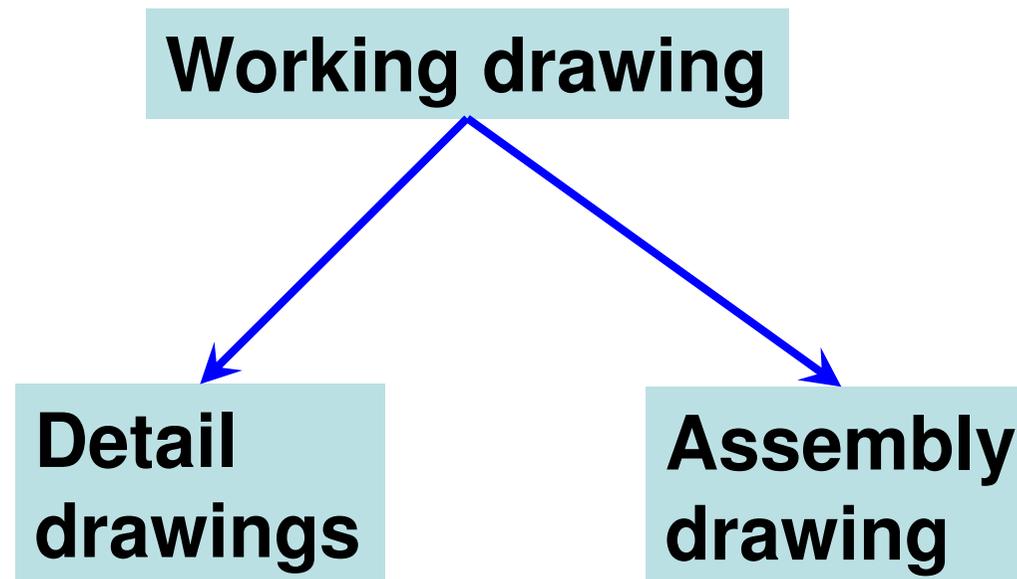
Third-angle projection

Assembly



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.

INFORMATION IN DETAIL DRAWING

1. General information → Title block

2. Part's information

2.1 Shape description → Object's

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

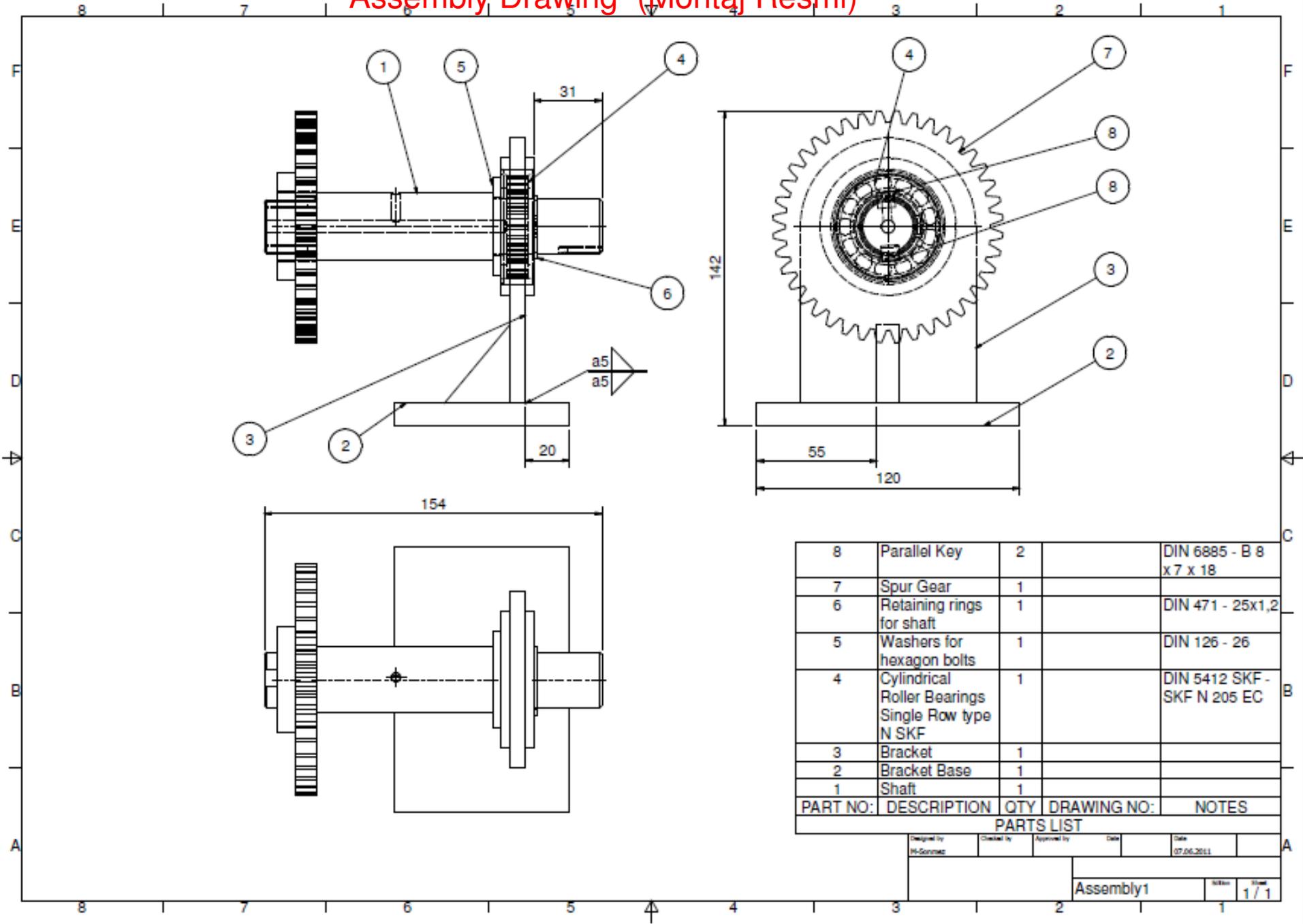
Size

- ❖ **Dimensions** and Tolerances

Specifications

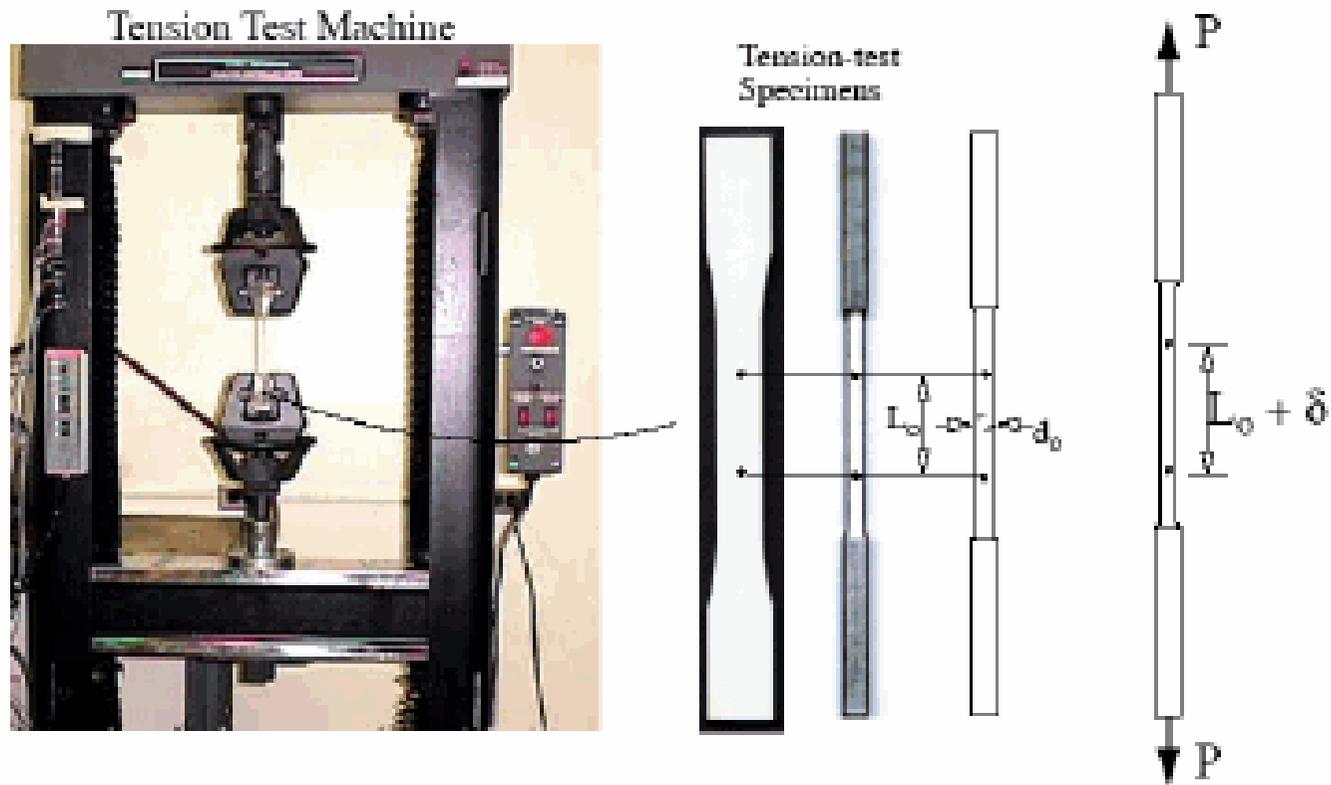
- ❖ **Part number, name, number required**
- ❖ **Type of material used**
- ❖ **General notes**
- ❖ Heat treatment
- ❖ Surface finish
- ❖ General tolerances

Assembly Drawing (Montaj Resmi)



| | | | | | |
|-------------------|---|-------------|-----|-----------------------------|-------|
| 8 | Parallel Key | 2 | | DIN 6885 - B 8 x 7 x 18 | |
| 7 | Spur Gear | 1 | | | |
| 6 | Retaining rings for shaft | 1 | | DIN 471 - 25x1,2 | |
| 5 | Washers for hexagon bolts | 1 | | DIN 126 - 26 | |
| 4 | Cylindrical Roller Bearings Single Row type N SKF | 1 | | DIN 5412 SKF - SKF N 205 EC | |
| 3 | Bracket | 1 | | | |
| 2 | Bracket Base | 1 | | | |
| 1 | Shaft | 1 | | | |
| PART NO: | | DESCRIPTION | QTY | DRAWING NO: | NOTES |
| PARTS LIST | | | | | |

| | | | | |
|-------------|------------|-------------|------|------------|
| Designed by | Checked by | Approved by | Date | Date |
| HA-Gormez | | | | 07.06.2011 |
| Assembly1 | | | | 1/1 |



$$\text{Stress} = \frac{\text{Force}}{\text{Cross-Sectional Area}}$$

$$\text{Strain} = \frac{\text{Change in Length}}{\text{Original Length}}$$

TYPES OF LINES

Çizgi Tipleri

(TS 88-20 ISO 128-20/ŞUBAT 2000)

| Nr. | Çizgi Tipleri | Çizimde Kullanma Yerleri | |
|------|--|---|--|
| 01.1 | Dar sürekli çizgi | 1-Zahiri ara kesit çizgileri 2- Ölçü çizgileri 3-Bağlama çizgileri 4- Kılavuz ve referans çizgileri 5-Tarama çizgileri 6- Yerinde döndürülmüş kesit çevreleri 7-Kısa merkez çizgileri 8- Vida dış dibi çizgileri 9- Ölçü çizgileri başlangıç ve bitiş noktaları 10- Düzlem yüzeyleri belirten köşegenler | 11-Yarı mamul ve işlenmiş parçaların bükme çizgileri 12-Ayrıntıların çerçevesi 13-Tekrarlanan elemanların gösterilmesi 14- Konik şekil elemanlarının koniklik başlama çizgileri 15-Tabakaların açılma çizgileri 16- İz düşüm çizgileri 17-Diyagram bölüntü çizgileri bitiş noktaları |
| | Dar sürekli serbest el çizgisi Dar sürekli zikzak çizgi | | 18- Bölünen,kısaltılan ve kısım olarak gösterilen parçaların koparma çizgileri |
| 01.2 | Geniş sürekli çizgi | 1-Görünen çevreler 2-Görünen kenarlar | 3-Vida uçları 4-Vidanın yararlanılabilir uzunluktaki sınırları 5-Diyagramların,haritaların,akış şemalarının esas çizgileri |
| 02.1 | Dar kesik çizgi | 1-Görünmeyen kenarlar 2-Görünmeyen çevreler | |
| 02.2 | Geniş kesik çizgi | | 3-İşlenmiş yüzey sınırlarının gösterilmesi |
| 03 | Aralıklı kesik çizgi | Kullanılma yeri belirtilmemiştir | |
| 04.1 | Dar noktalı uzun kesik çizgi | 1-Eksen çizgileri 2-Simetri çizgileri | 3-Dişlilerin bölüm dairesi 4-Delik eksen daireleri |
| 04.2 | Geniş noktalı uzun kesik çizgi | 1-Özel işlemler yüzeylerinin sınırlarının gösterilmesi (mesela, ısı işlem) | 2-Kesit düzlemleri izlerinin gösterilmesi |
| 05.1 | Dar iki noktalı uzun kesik çizgi | 1-Komşu (bitişik)parçaların çevreleri 2-Hareketli parçaların sınır konumları 3-Ağırlık merkezi çizgileri 4-Şekillendirilmiş parçalarınbaşlangıç çevreleri | 5-Kesit düzlemlerinin önünde bulunan kısımlar 6-Değişik uygulamaların çevreleri 7-Yarı mamüllerin bitmiş şekli 8-Özel alanların (bölgelerin) çerçevesi |
| 06 | Üç noktalı uzun kesik çizgi | Kullanılma yeri belirtilmemiştir | |
| 07 | Nokta nokta çizgi | Kullanılma yeri belirtilmemiştir | |
| 08 | Kısa kesik çizgili uzun kesik çizgi | Kullanılma yeri belirtilmemiştir | |
| 09 | İki kısa kesik çizgili uzun kesik çizgi | Kullanılma yeri belirtilmemiştir | |
| 10 | Noktalı kesik çizgi | Kullanılma yeri belirtilmemiştir | |
| 11 | Noktalı iki kesik çizgi | Kullanılma yeri belirtilmemiştir | |
| 12 | İki noktalı kesik çizgi | Kullanılma yeri belirtilmemiştir | |
| 13 | İki noktalı iki kesik çizgi | Kullanılma yeri belirtilmemiştir | |
| 14 | Üç noktalı kesik çizgi | Kullanılma yeri belirtilmemiştir | |
| 15 | Üç noktalı iki kesik çizgi | Kullanılma yeri belirtilmemiştir | |

Main Types of Lines

| | |
|--|--|
|  | solid line, full line, visible out line |
|  | Dashed line, invisible line Hidden Line |
|  | construction line, guide line(Transfer Line) extension line, dimension line ,Section Line (Cross-Hatching Line) |
|  | Center line |
|  | Cutting-plane line |
|  | Break line |
|  | Chain line |
|  | Phantom line |

Line Groups

| Line Group | Thickness of Lines | |
|------------------|--------------------|---------------------|
| | 01.2-02.2-04.2 | 01.1-02.1-04.1-05.1 |
| 0,25 | 0,25 | 0,13 |
| 0,35 | 0,35 | 0,18 |
| 0,5 ^a | 0,5 | 0,25 |
| 0,7 ^a | 0,7 | 0,35 |
| 1 | 1 | 0,5 |
| 1,4 | 1,4 | 0,7 |
| 2 | 2 | 1 |

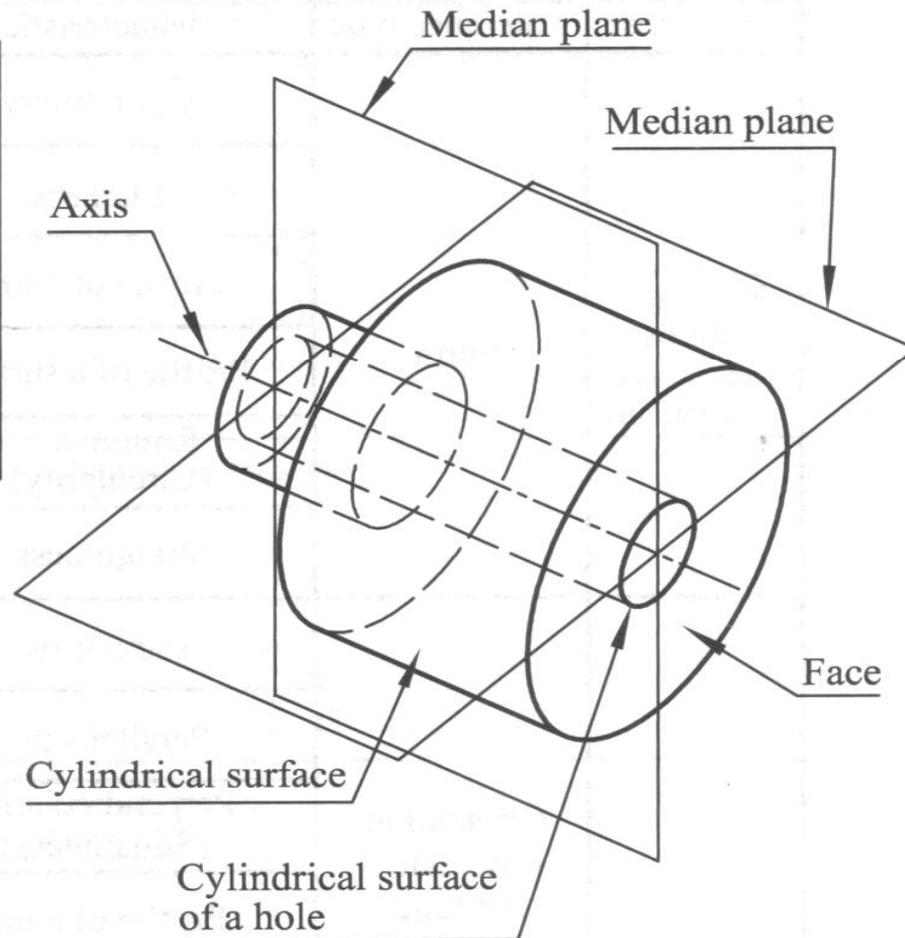
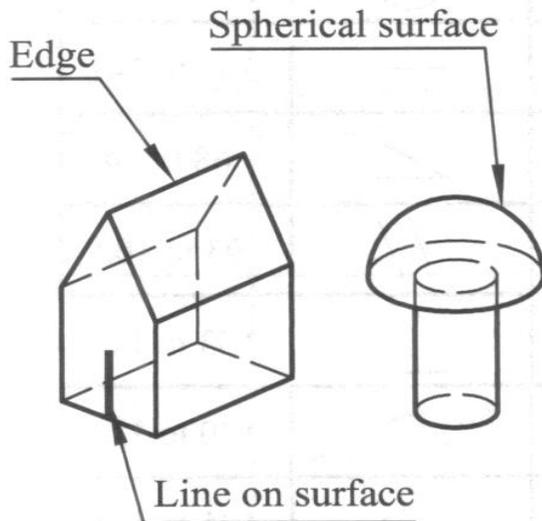
a : **Preferable**

| | | | | | |
|---|---|--|--|--|--|
| <p>.007"</p>  <p>.18 mm</p> | <p>.010"</p>  <p>.25 mm</p> | <p>.012"</p>  <p>.30 mm</p> | <p>.014"</p>  <p>.35 mm</p> | <p>.020"</p>  <p>.50 mm</p> | <p>.024"</p>  <p>.60 mm</p> |
| <p>.028"</p>  <p>.70 mm</p> | <p>.031"</p>  <p>.80 mm</p> | <p>.039"</p>  <p>1.00 mm</p> | <p>.047"</p>  <p>1.20 mm</p> | <p>.055"</p>  <p>1.40 mm</p> | <p>.079"</p>  <p>2.00 mm</p> |

SINGLE FEATURES

The following sketches illustrate some of the single features that could be on a component.

| Some examples of single features |
|----------------------------------|
| An axis |
| A cylindrical surface |
| A cylindrical surface of a hole |
| An edge |
| A face |
| A line on a surface |
| A median plane |
| A spherical surface |



Combinations of Single Features

The following sketch illustrates some combinations of single features that could be on a component.

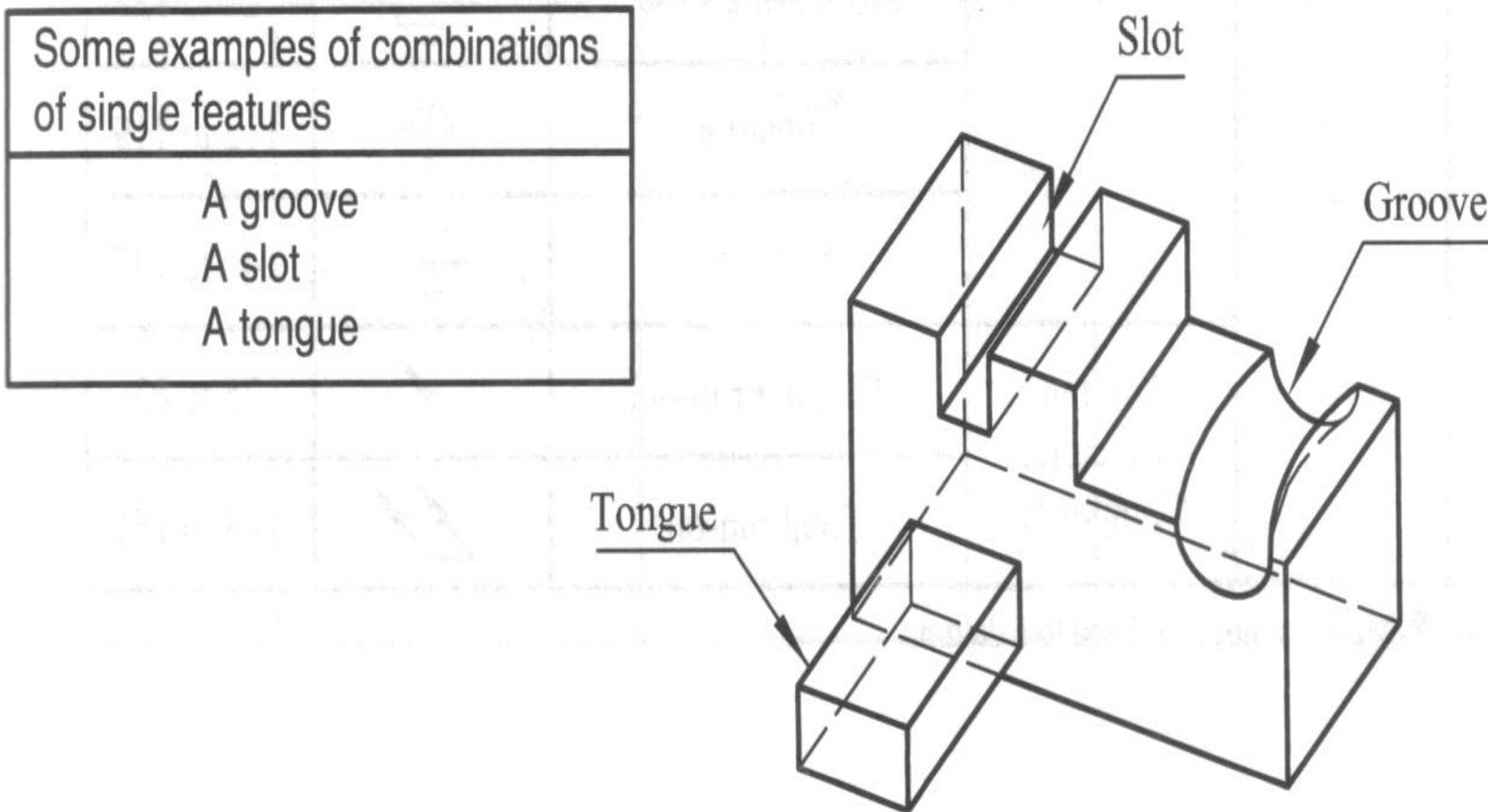
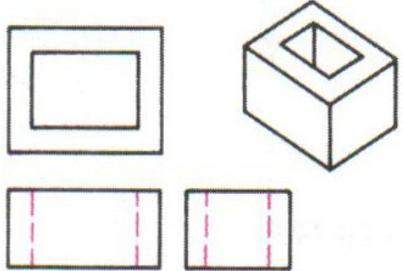
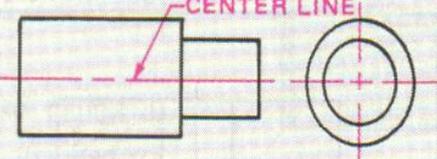
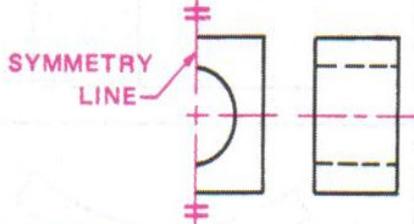
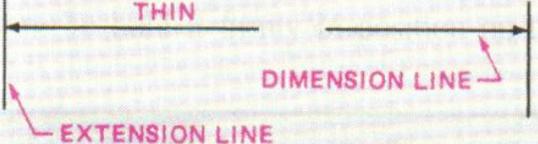
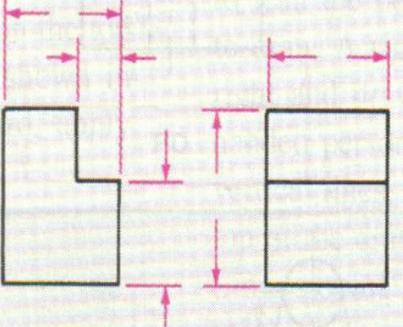


TABLE 4-1 Types of lines. (continued on next page)

| Type of Line | Application | Description |
|---|--|---|
| <p>Hidden line</p> <p>THIN</p>  |  | <p>The hidden object line is used to show surfaces, edges, or corners of an object that are hidden from view.</p> |
| <p>Center line</p> <p>THIN</p> <p>ALTERNATE LINE AND SHORT DASHES</p>  |  | <p>Center lines are used to show the center of holes and symmetrical features.</p> |
| <p>Symmetry line</p> <p>CENTER LINE</p> <p>THICK SHORT LINES</p>  |  | <p>Symmetry lines are used when partial views of symmetrical parts are drawn. It is a center line with two thick short parallel lines drawn at right angles to it at both ends.</p> |
| <p>Extension and dimension lines</p> <p>THIN</p> <p>EXTENSION LINE</p> <p>DIMENSION LINE</p>  |  | <p>Extension and dimension lines are used when dimensioning an object.</p> |

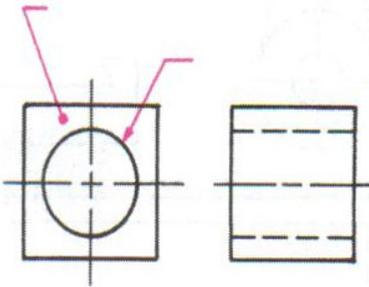
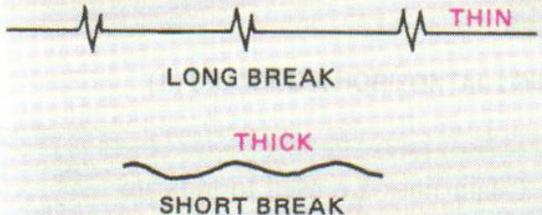
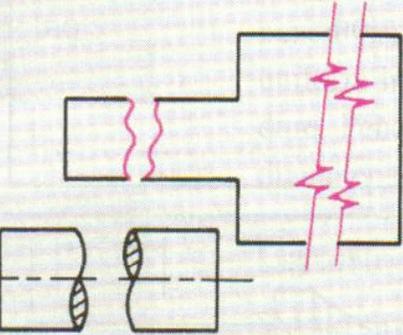
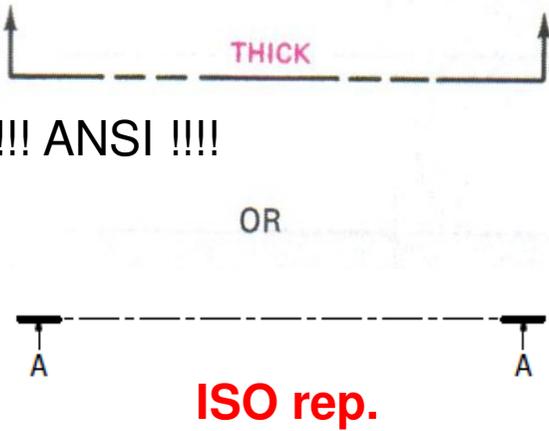
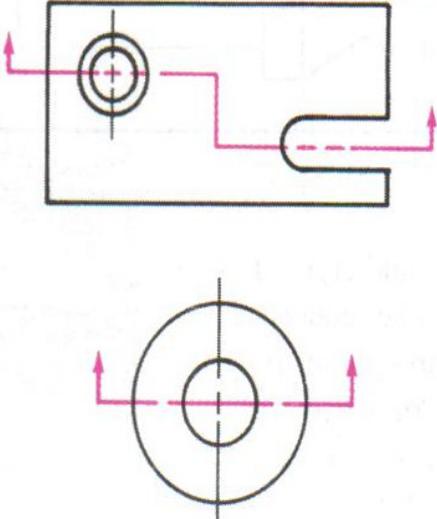
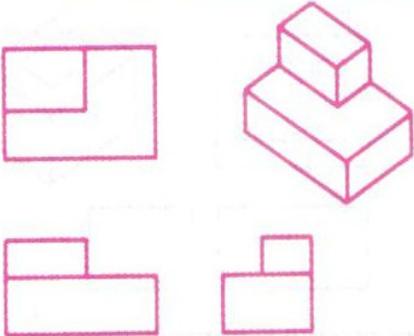
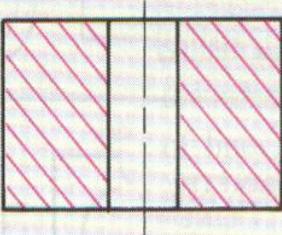
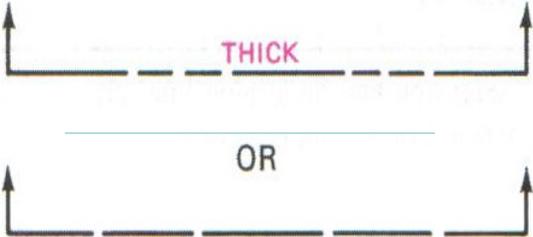
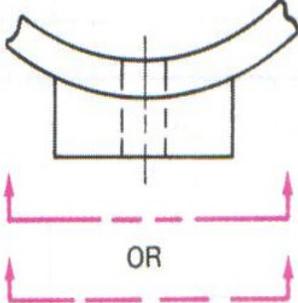
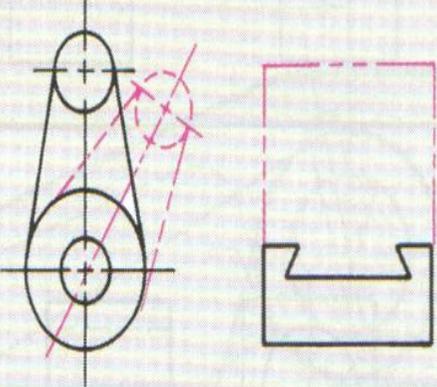
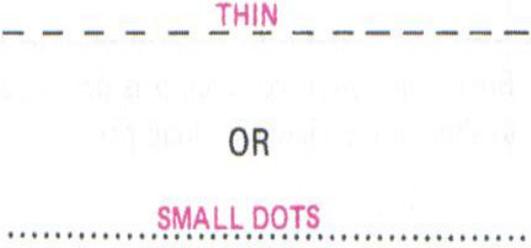
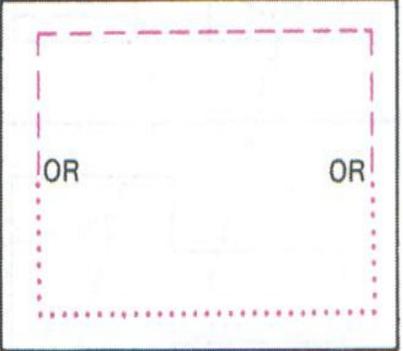
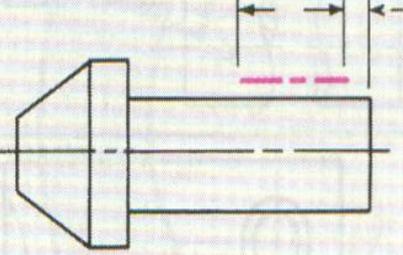
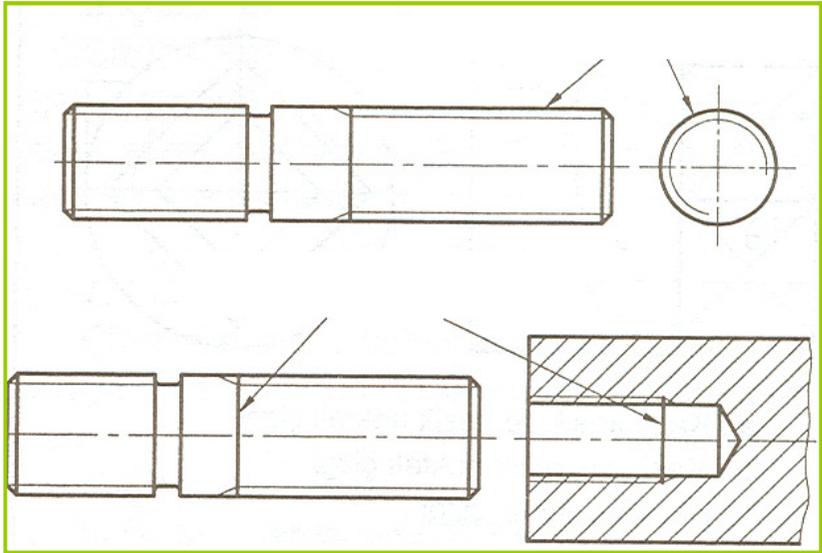
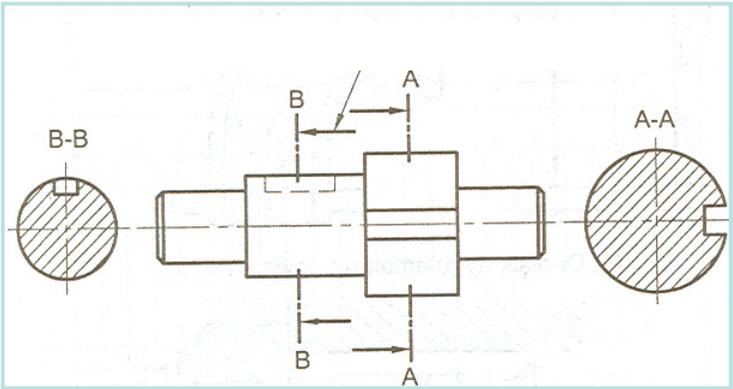
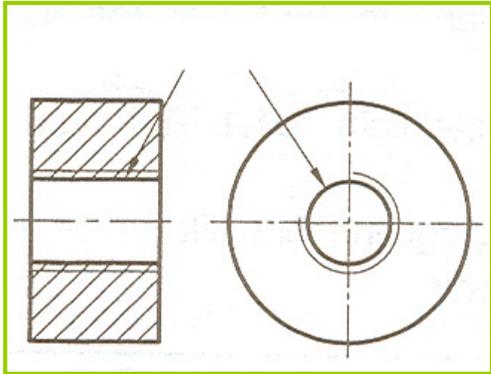
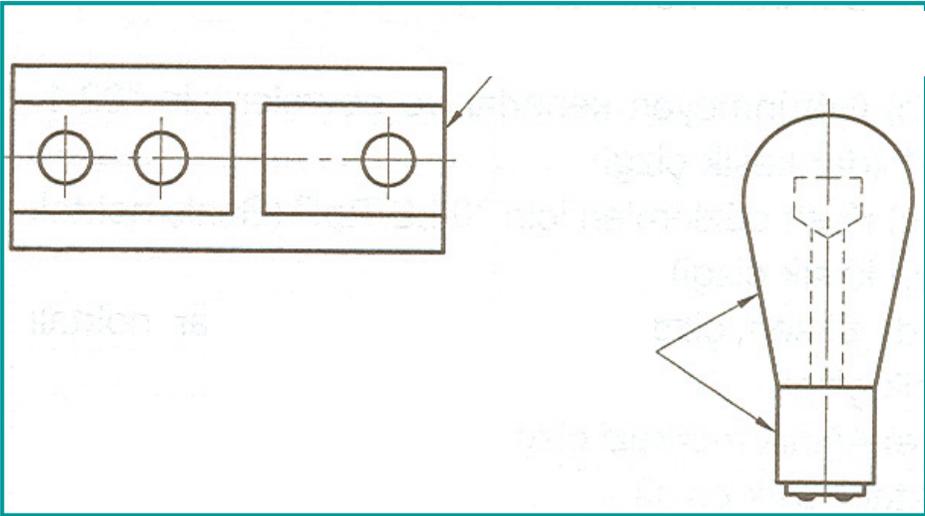
| | | |
|---|---|---|
| <p style="text-align: center;">Leaders</p>  |  | <p>Leaders are used to indicate the part of the drawing to which a note refers. Arrowheads touch the object lines while the dot rests on a surface.</p> |
| <p style="text-align: center;">Break lines</p>  |  | <p>Break lines are used when it is desirable to shorten the view of a long part.</p> |
| <p style="text-align: center;">Cutting-plane line</p>  |  | <p>The cutting-plane line is used to designate where an imaginary cutting took place.</p> |

TABLE 4-1 Types of lines. (continued)

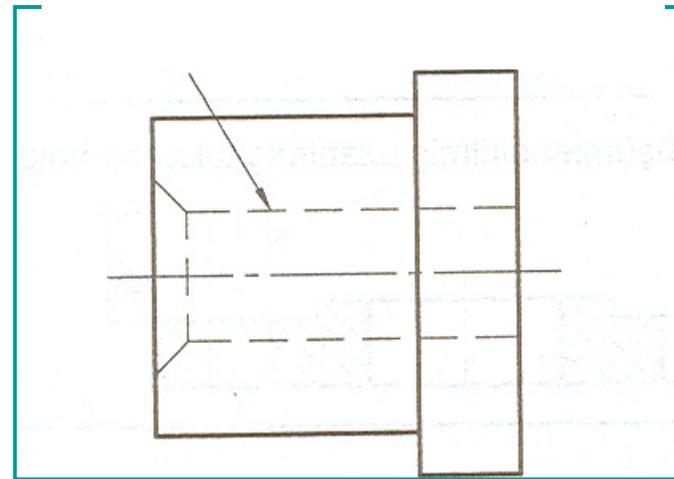
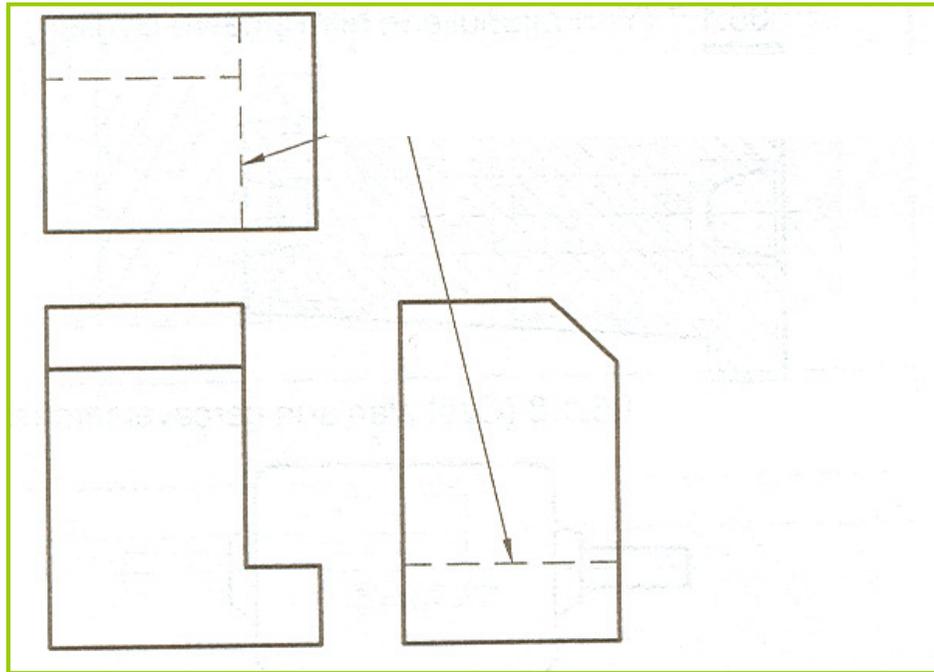
| Type of Line | Application | Description |
|---|---|---|
| <p data-bbox="533 368 680 400">Visible line</p> <p data-bbox="551 512 636 536">THICK</p>  |  | <p data-bbox="1420 368 1861 584">The visible line is used to indicate all visible edges of an object. They should stand out clearly in contrast to other lines so that the shape of an object is apparent to the eye.</p> |
| <p data-bbox="524 751 689 783">Section lines</p>  <p data-bbox="524 1002 667 1026">THIN LINES</p> |  | <p data-bbox="1420 751 1832 919">Section lining is used to indicate the surface in the section view imagined to have been cut along the cutting-plane line.</p> |
| <p data-bbox="483 1070 734 1102">Viewing-plane line</p> <p data-bbox="555 1166 640 1190">THICK</p> <p data-bbox="568 1270 622 1294">OR</p>  |  <p data-bbox="1128 1342 1173 1366">OR</p> | <p data-bbox="1420 1070 1839 1190">The viewing-plane line is used to indicate direction of sight when a partial view is used.</p> |

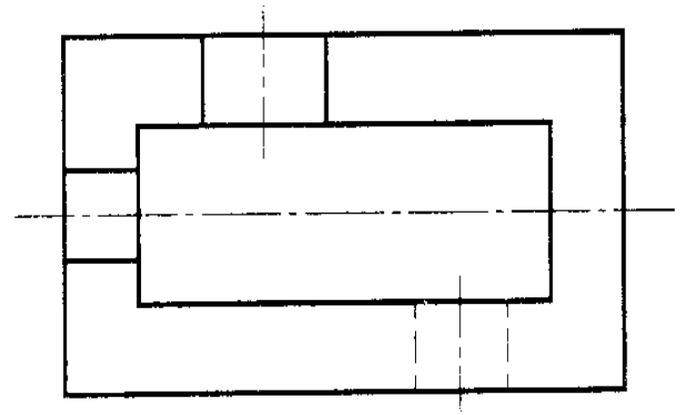
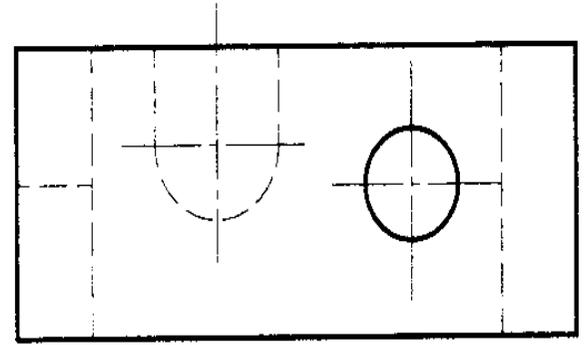
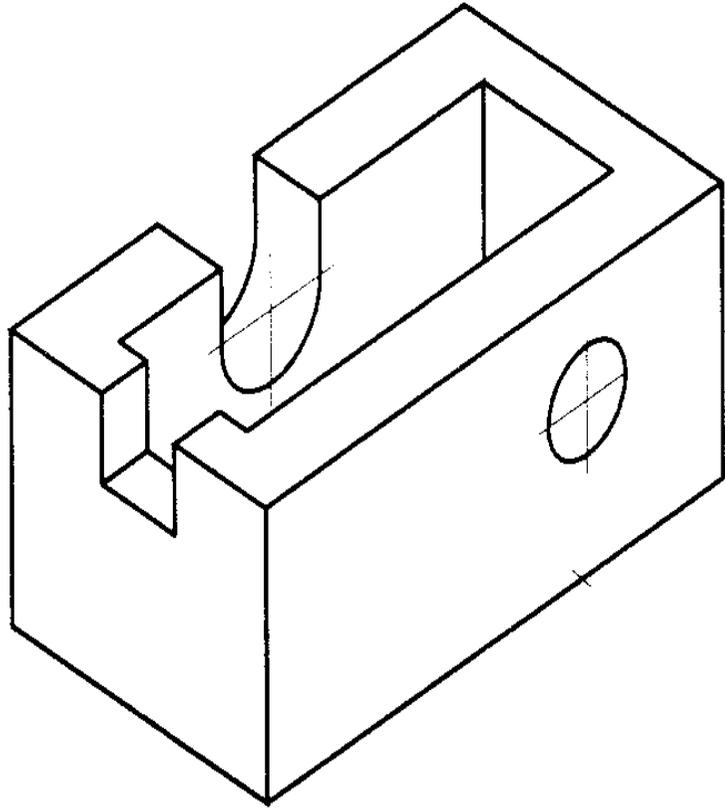
| | | |
|--|--|---|
| <p style="text-align: center;">Phantom line</p> <p style="text-align: center;">THIN</p>  |  | <p>Phantom lines are used to indicate alternate position of moving parts, adjacent position of moving parts, adjacent position of related parts, and repetitive detail.</p> |
| <p style="text-align: center;">Stitch line</p> <p style="text-align: center;">THIN</p> <p style="text-align: center;">OR</p> <p style="text-align: center;">SMALL DOTS</p>  |  | <p>Stitch lines are used for indicating a sewing or stitching process.</p> |
| <p style="text-align: center;">Chain line</p> <p style="text-align: center;">THICK</p>  |  | <p>Chain lines are used to indicate that a surface or zone is to receive additional treatment or considerations.</p> |

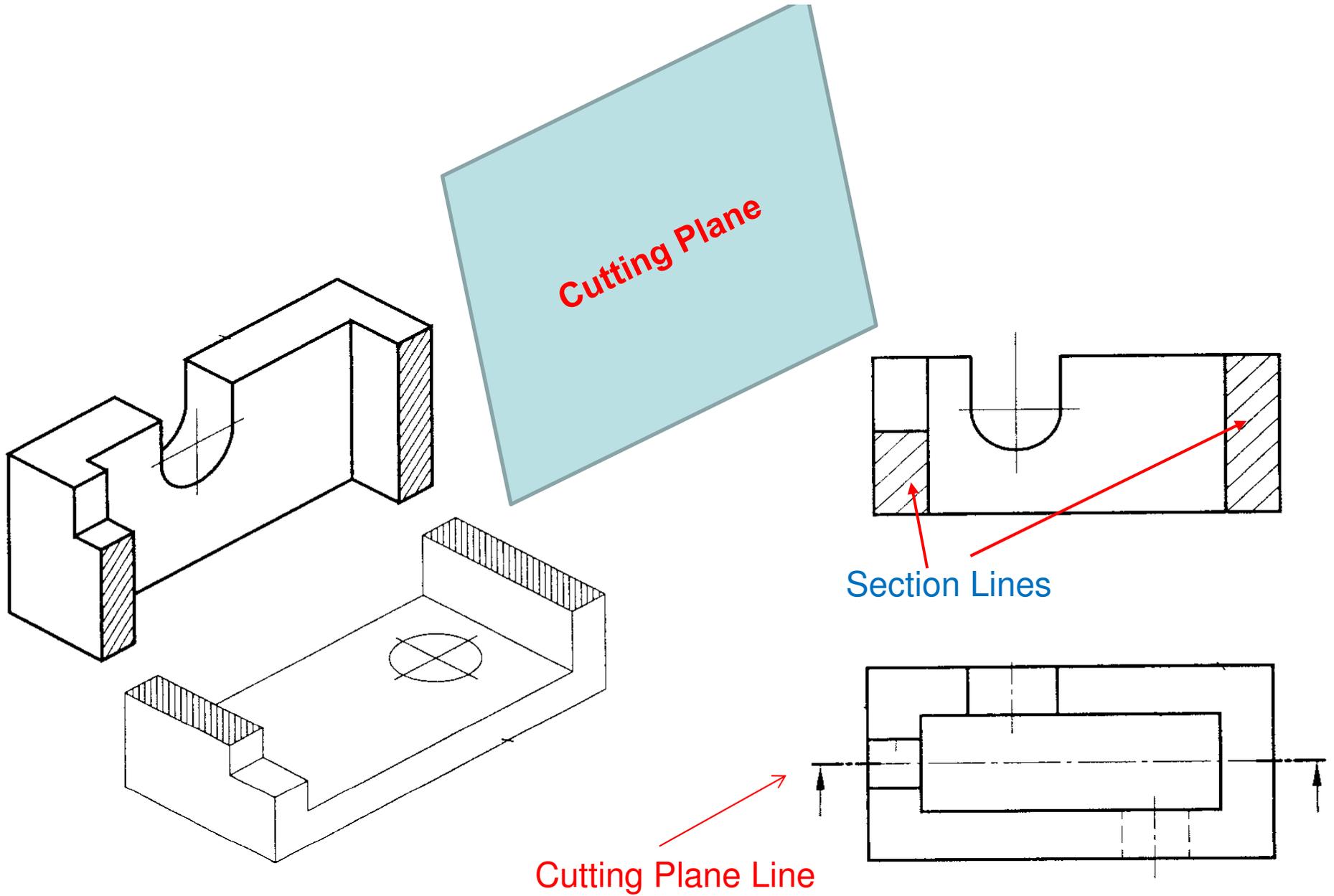
Visible Outline

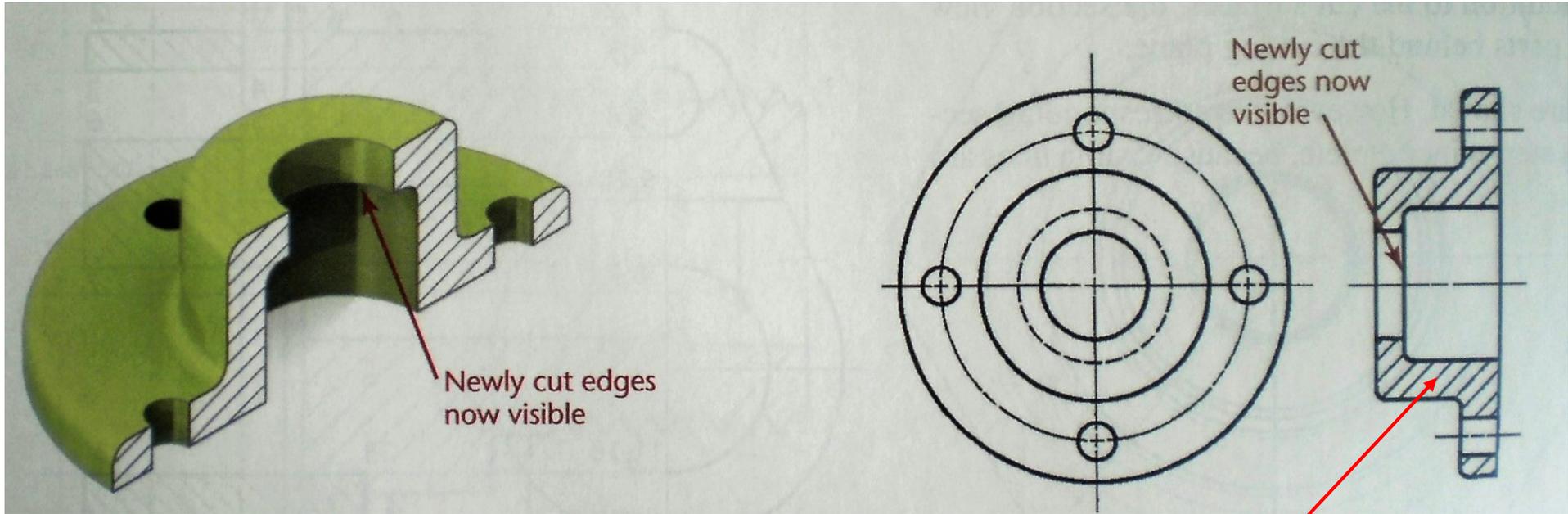


Hidden Lines



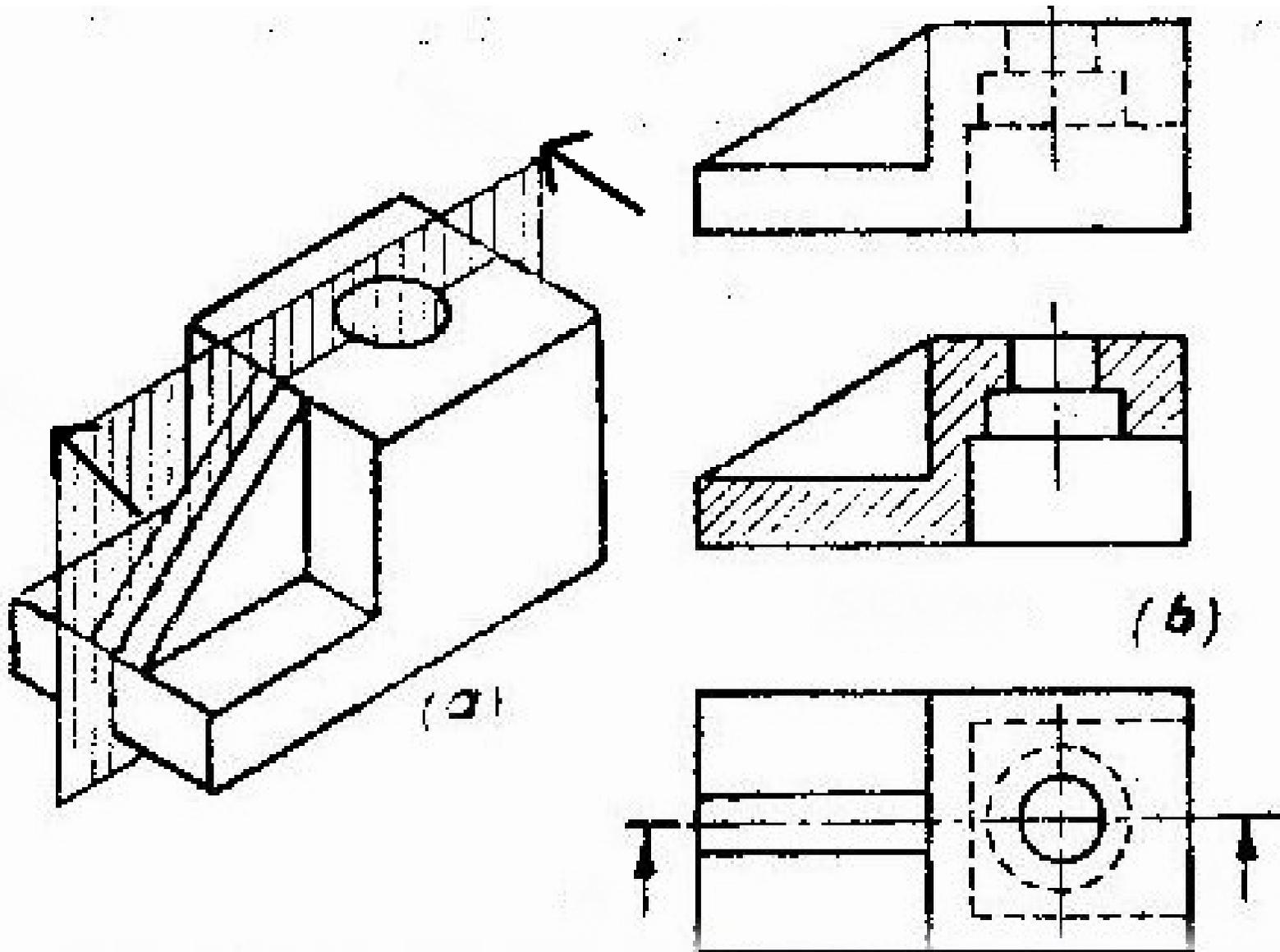




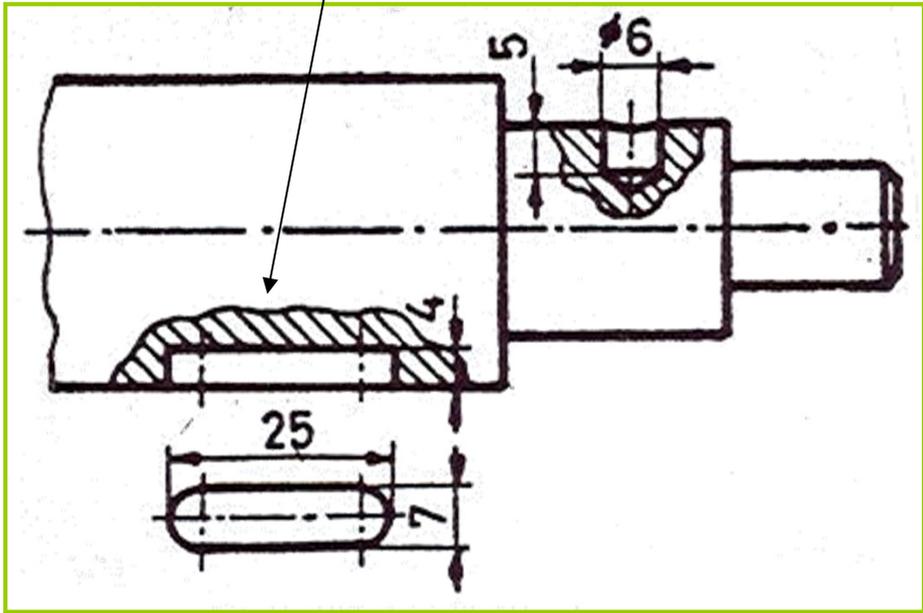
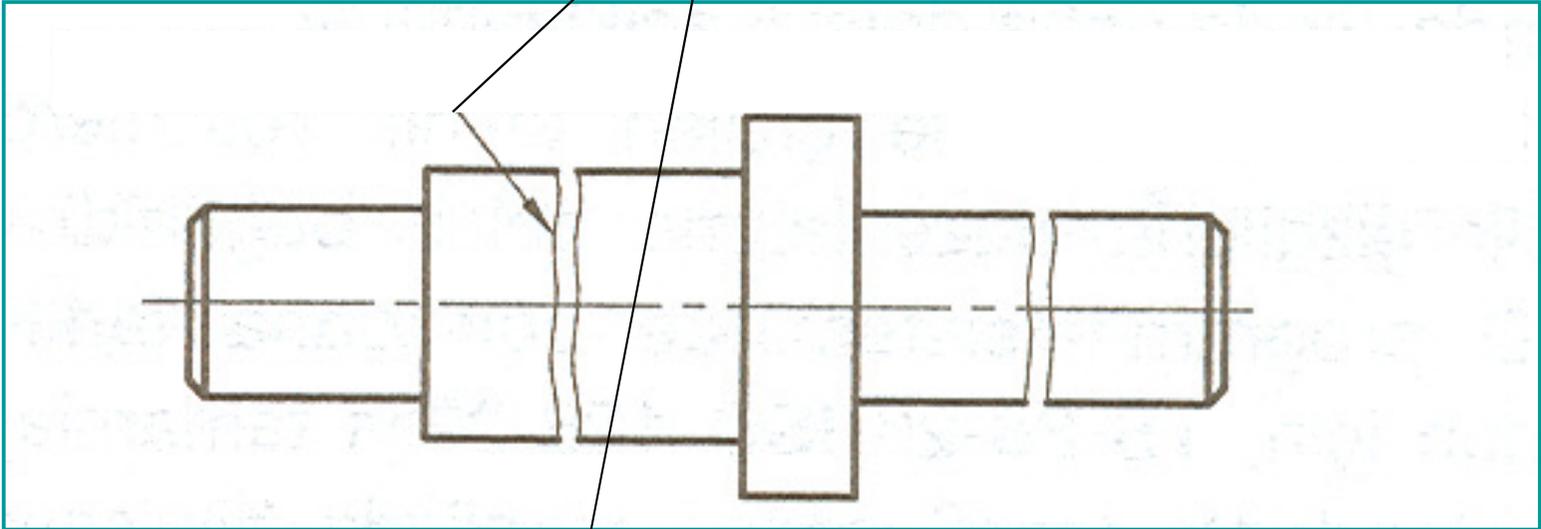


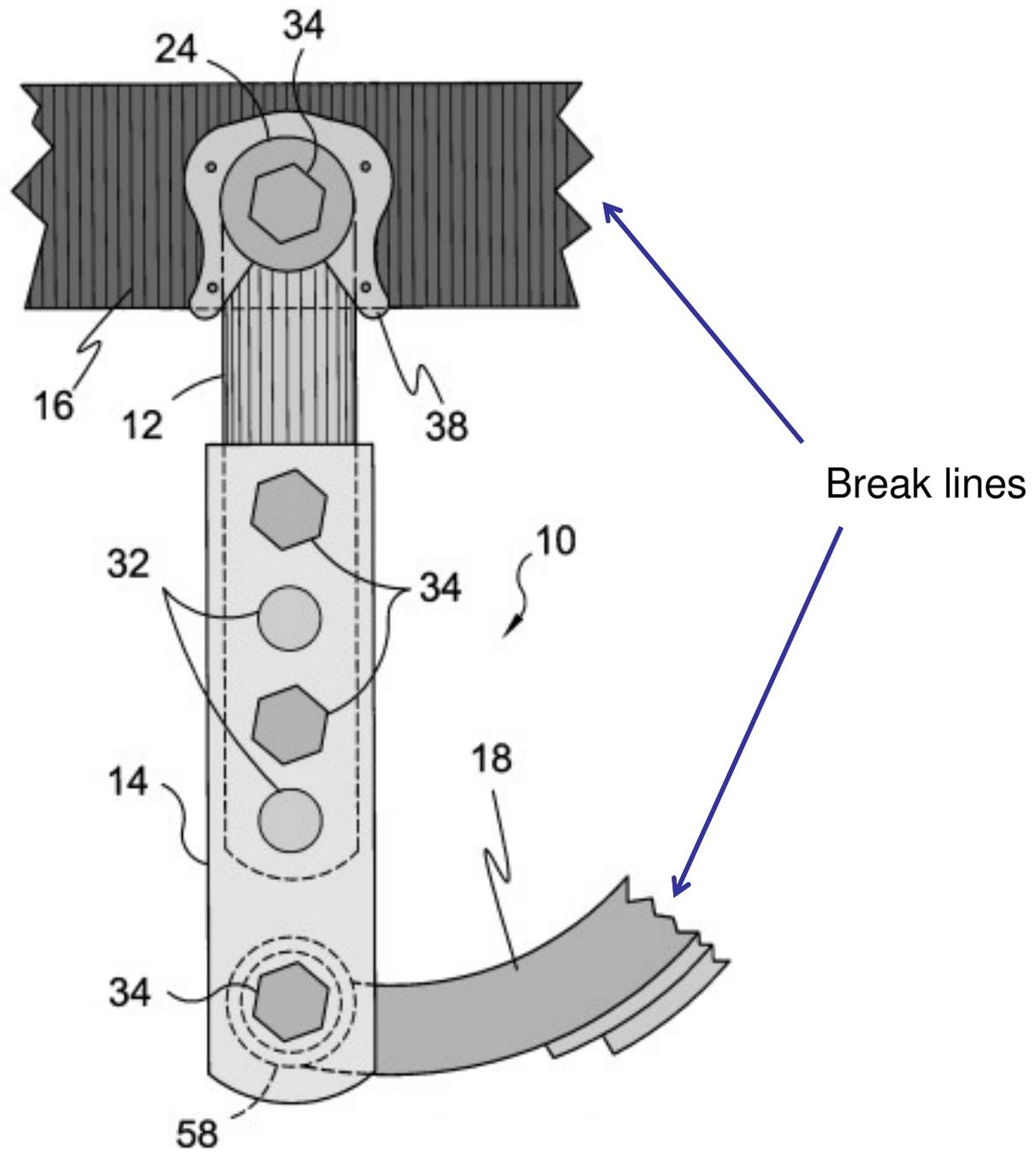
Section Lines: Cross-Hatching Lines

Full Sectional View

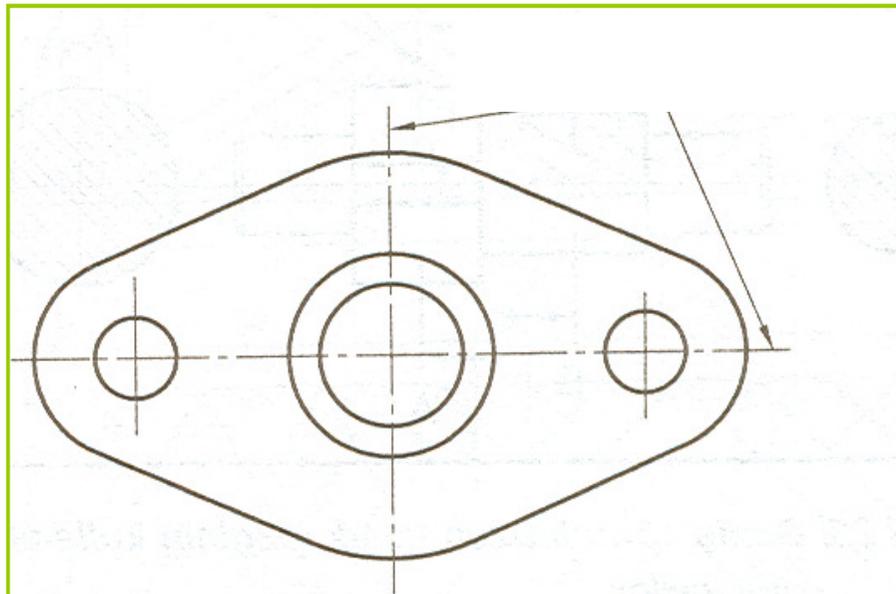
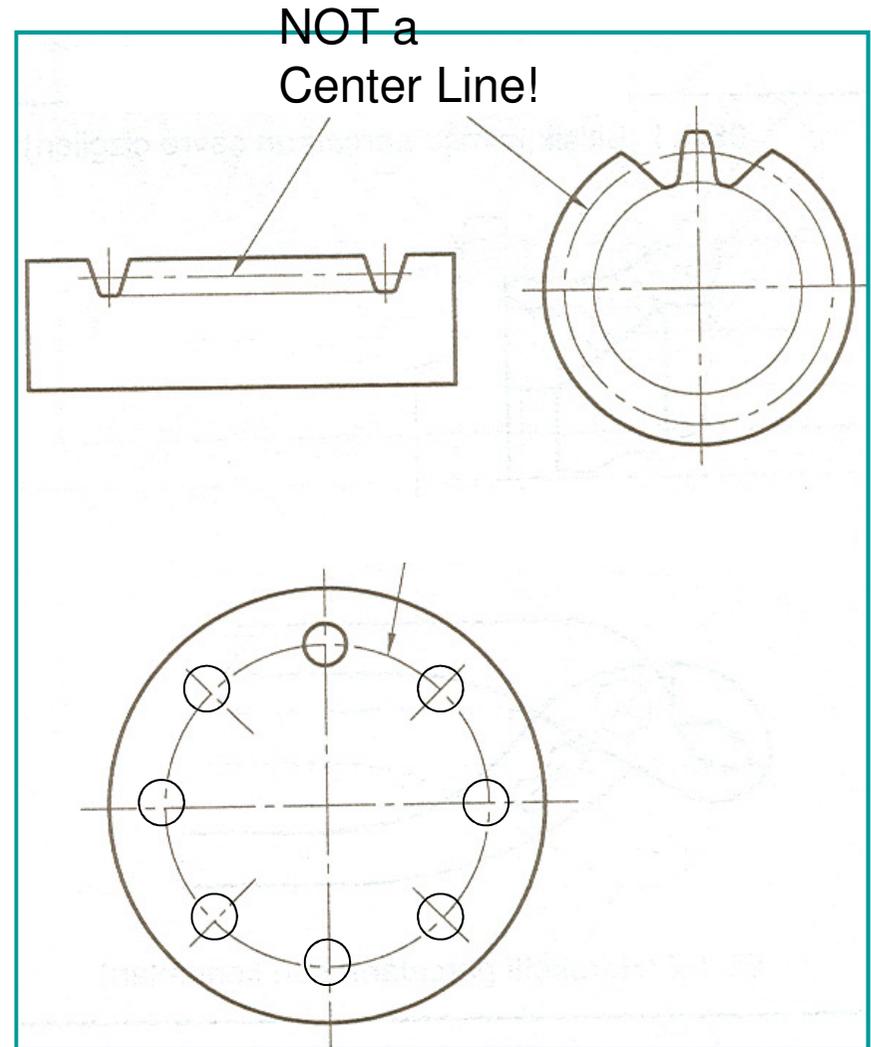
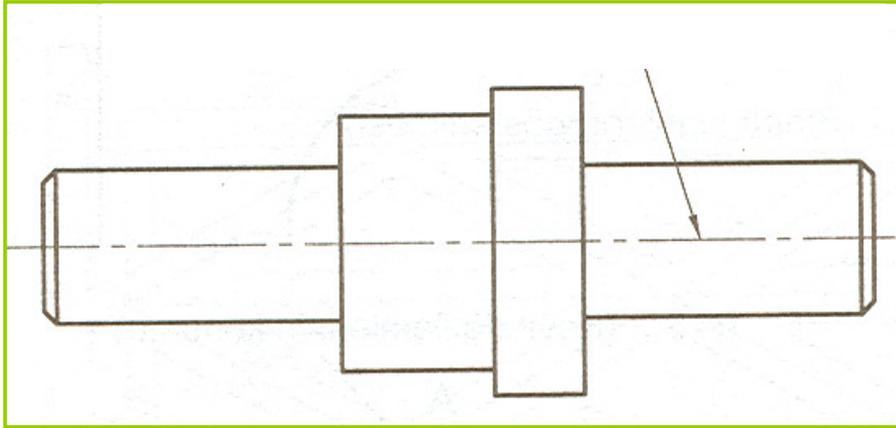


Break Line

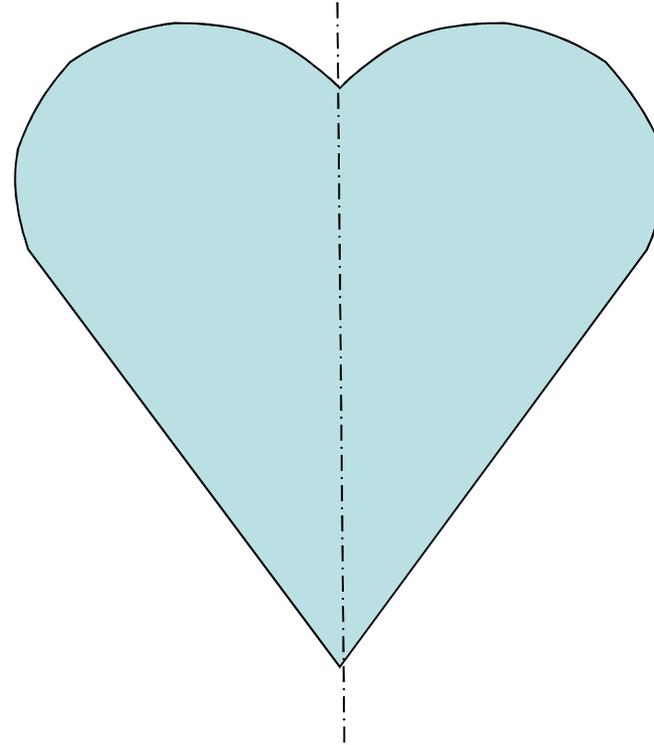
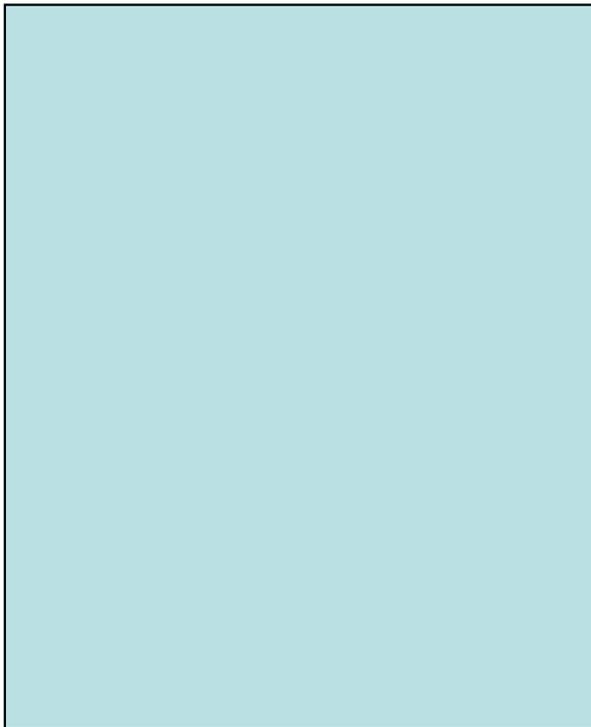




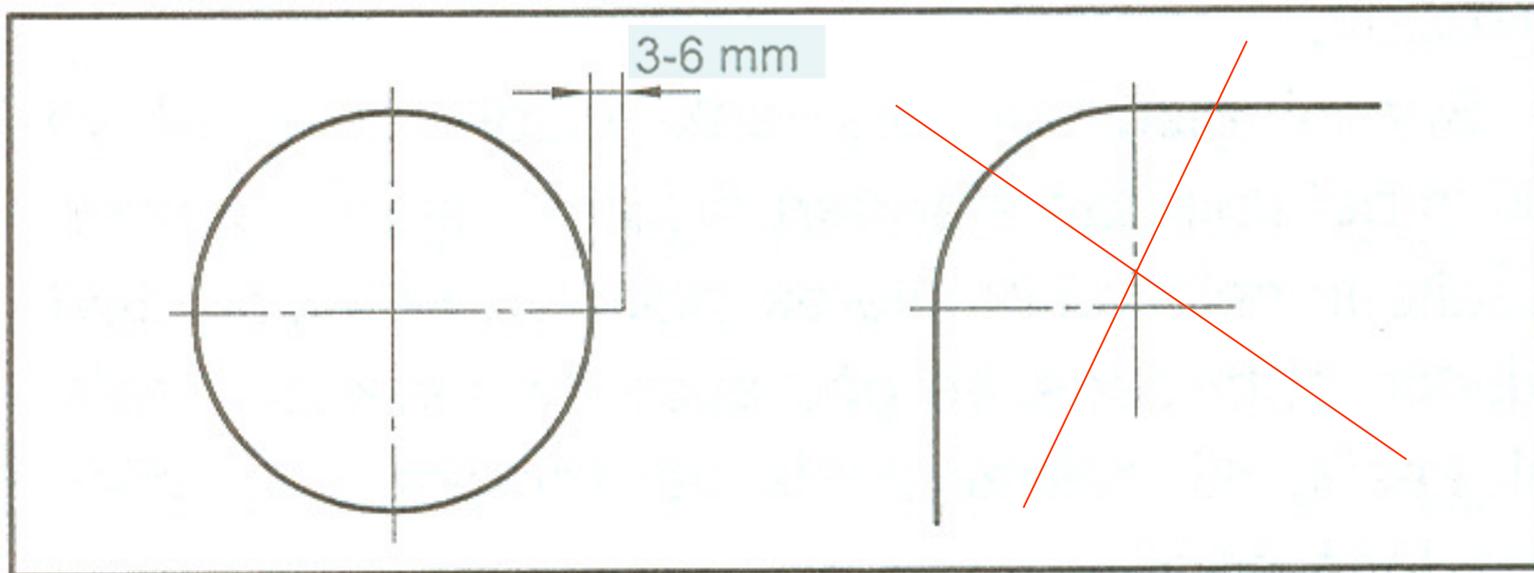
Center Line

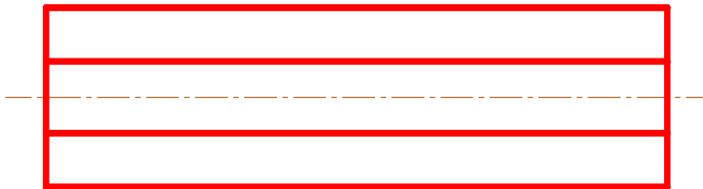
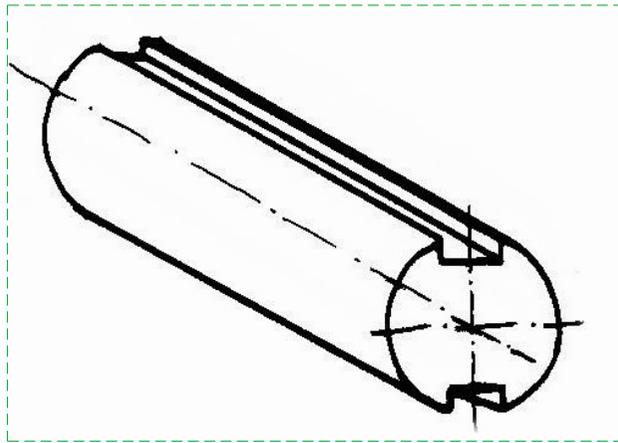


Show the axis of symmetry if the view has curved features

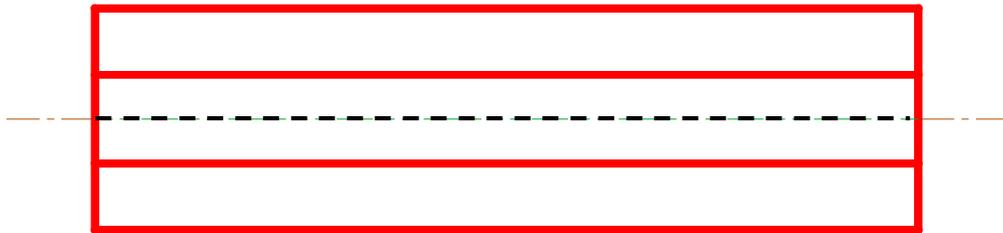
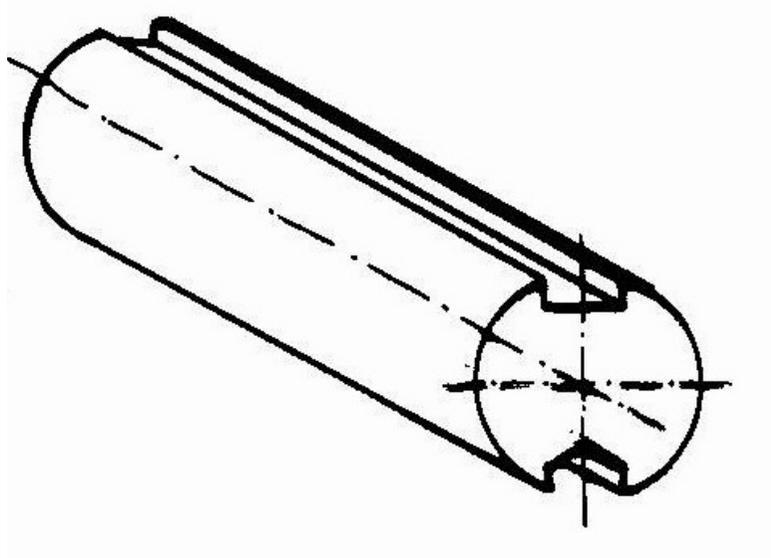


Details on Center Lines

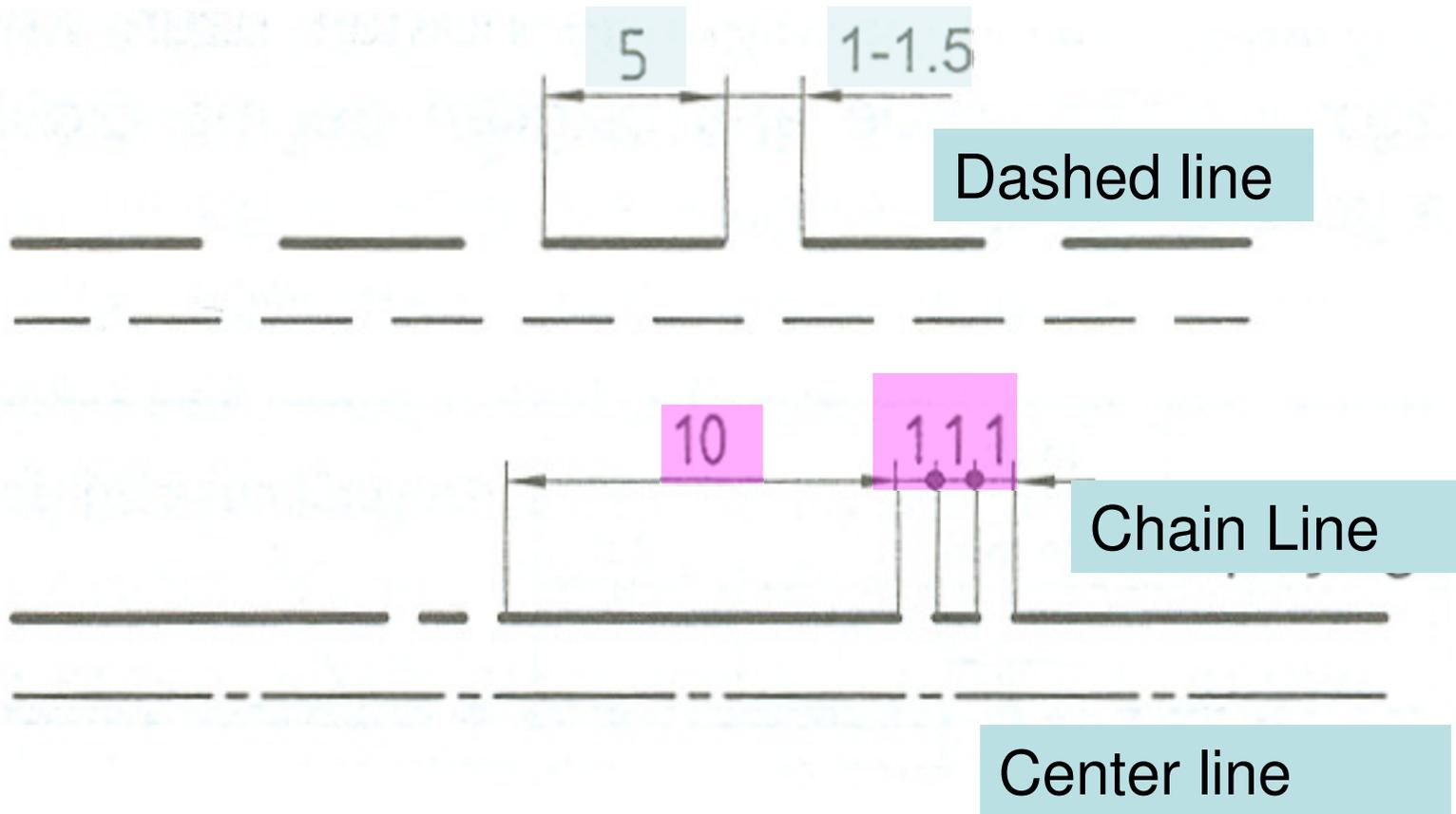




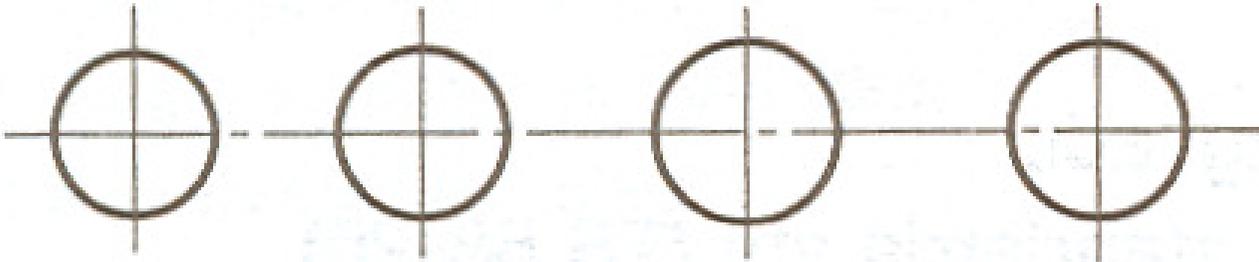
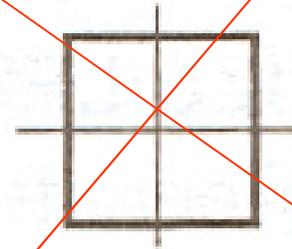
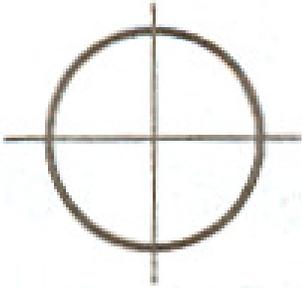
Priorities of Lines: 1. Visible Out Line 2. Hidden Line 3. Center Line



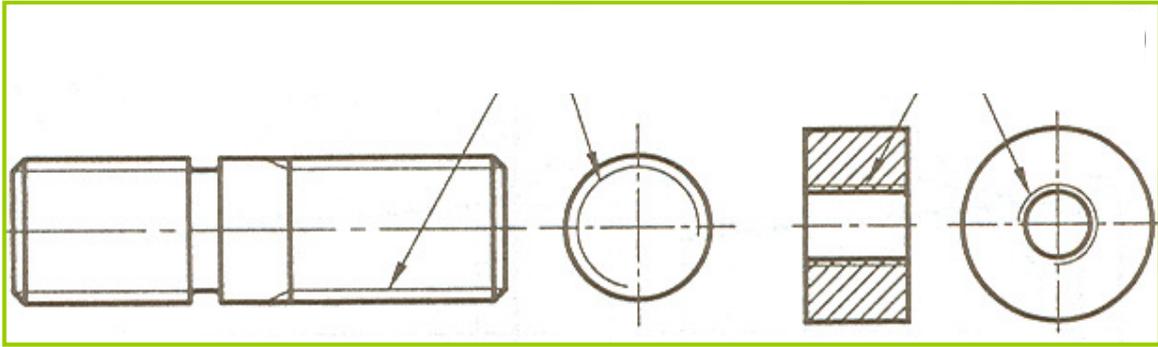
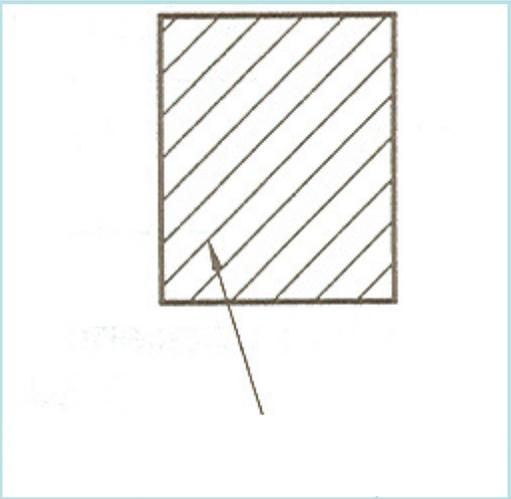
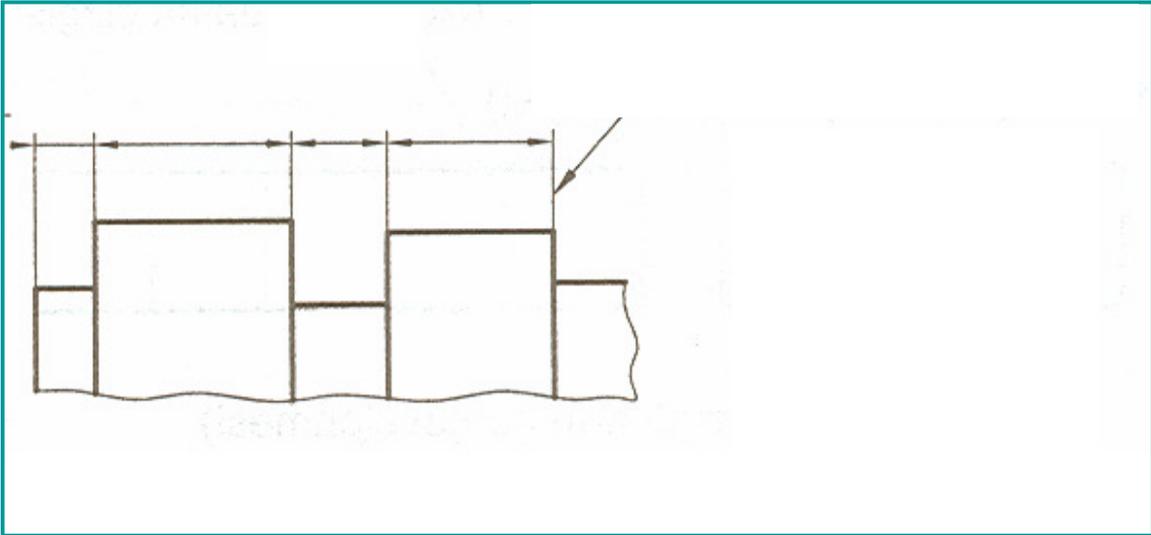
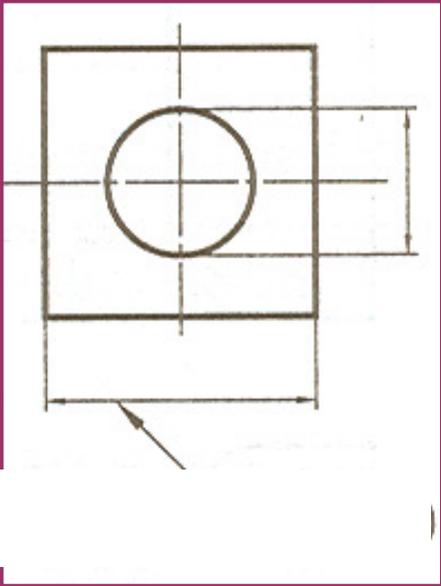
Lengths of Dashes



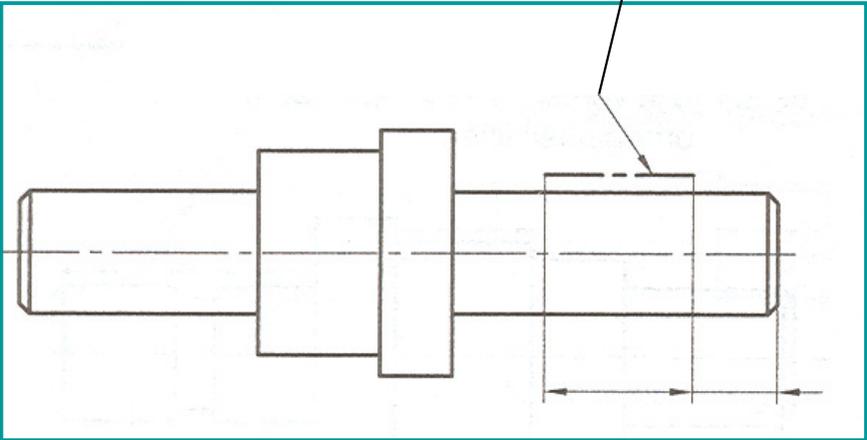
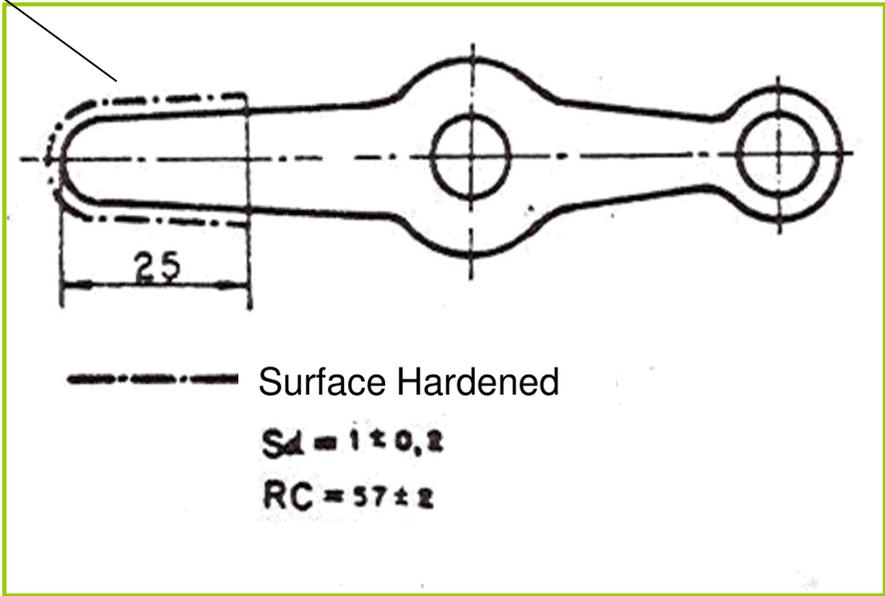
?



Construction Line, Extension Line, Dimension Line, Cross-Hatching Line, Guide Line

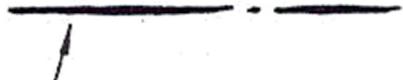


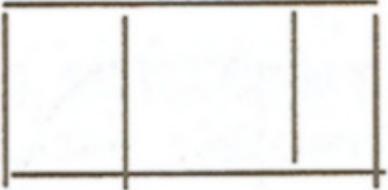
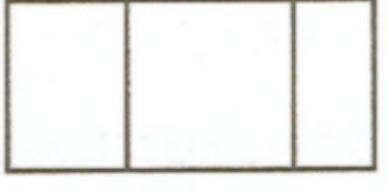
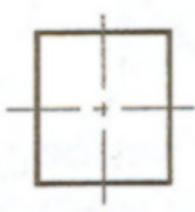
Chain Line



Line Quality

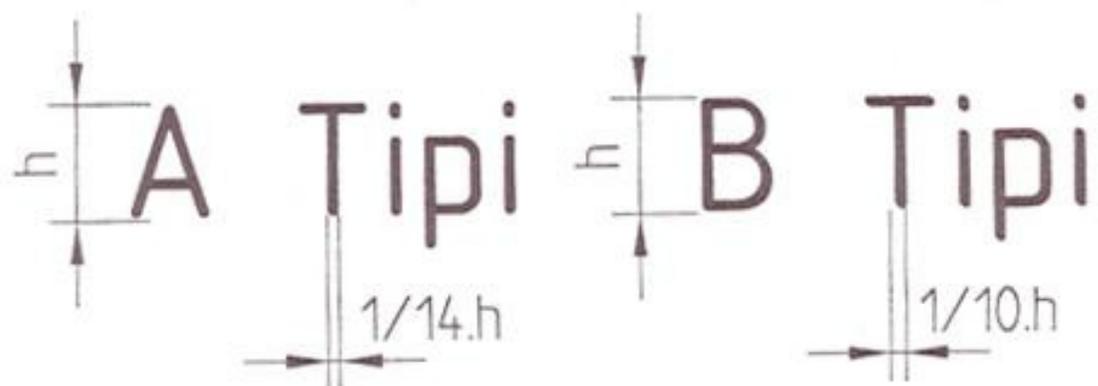
(Some details in board-pencil drawing)

| | | | | |
|----------|---|---|---|---|
| T |  |  |  |  |
| F |  |  |  |  |

| FALSE | TRUE |
|---|---|
|  |  |
|  |  |
|  |  |
|  |  |
|   |   |

Lettering

TS EN ISO 3098/1-2



B Type (1/10.h) Sizes

| | Ratio | Lettering Dimensions | | | | | | |
|----------------------------------|-------------------------|----------------------|------|-----|------|----|------|----|
| Height of upper case letters, h | $\frac{10}{10} \cdot h$ | 2.5 | 3.5 | 5 | 7 | 10 | 14 | 20 |
| Distance between Letters, a | $\frac{2}{10} \cdot h$ | 0.5 | 0.7 | 1 | 1.4 | 2 | 2.8 | 4 |
| Max. distance btw. rows, b1 | $\frac{19}{10} \cdot h$ | 4.75 | 6.65 | 9.5 | 13.3 | 19 | 26.6 | 38 |
| Normal distance btwn. rows, b2 | $\frac{15}{10} \cdot h$ | 3.75 | 5.25 | 7.5 | 10.5 | 15 | 21 | 30 |
| Min. distance btwn. rows, b3 | $\frac{13}{10} \cdot h$ | 3.25 | 4.55 | 6.5 | 9.1 | 13 | 18.2 | 26 |
| Height of lower case letters, c1 | $\frac{7}{10} \cdot h$ | 1.8 | 2.5 | 3.5 | 5 | 7 | 10 | 14 |
| Line thickness, d | $\frac{1}{10} \cdot h$ | 0.25 | 0.35 | 0.5 | 0.7 | 1 | 1.4 | 2 |
| Distance btwn. words, e | $\frac{6}{10} \cdot h$ | 1.5 | 2.1 | 3 | 4.2 | 6 | 8.4 | 12 |
| Distance of under line, f | $\frac{4}{10} \cdot h$ | 1 | 1.4 | 2 | 2.8 | 4 | 5.6 | 8 |

B Type(1/10.h)

(75° inclined)

A B C Ç D E F G G H I J K L M N
O Ö P Q R S S T U Ü V W X Y Z
a b c ç d e f g ğ h i j k l m n o ö
p q r s s t u ü v w x y z □
1 2 3 4 5 6 7 7 8 9 0 [V X
[(! ? : ; " - = + ± x . , √ % &)] Ø

B Type (1/10.h)

ABCÇDEFGHIJKLMNO
ÖPQRSŞTUÜVWXYZ
aabcçdefgiihklmnoö
qrsştuüvwxyz□
12345677890IVX
[(!|?;"- = + .,√± %&)]∅