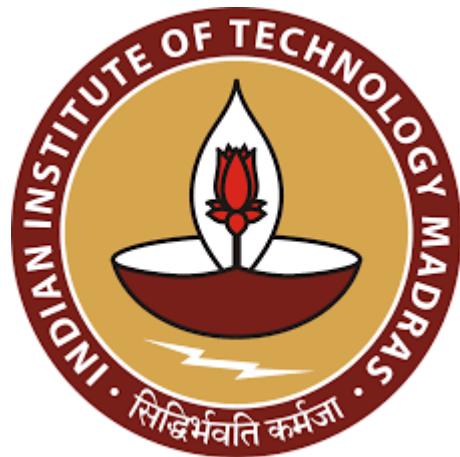


# ME1480 Engineering Drawing

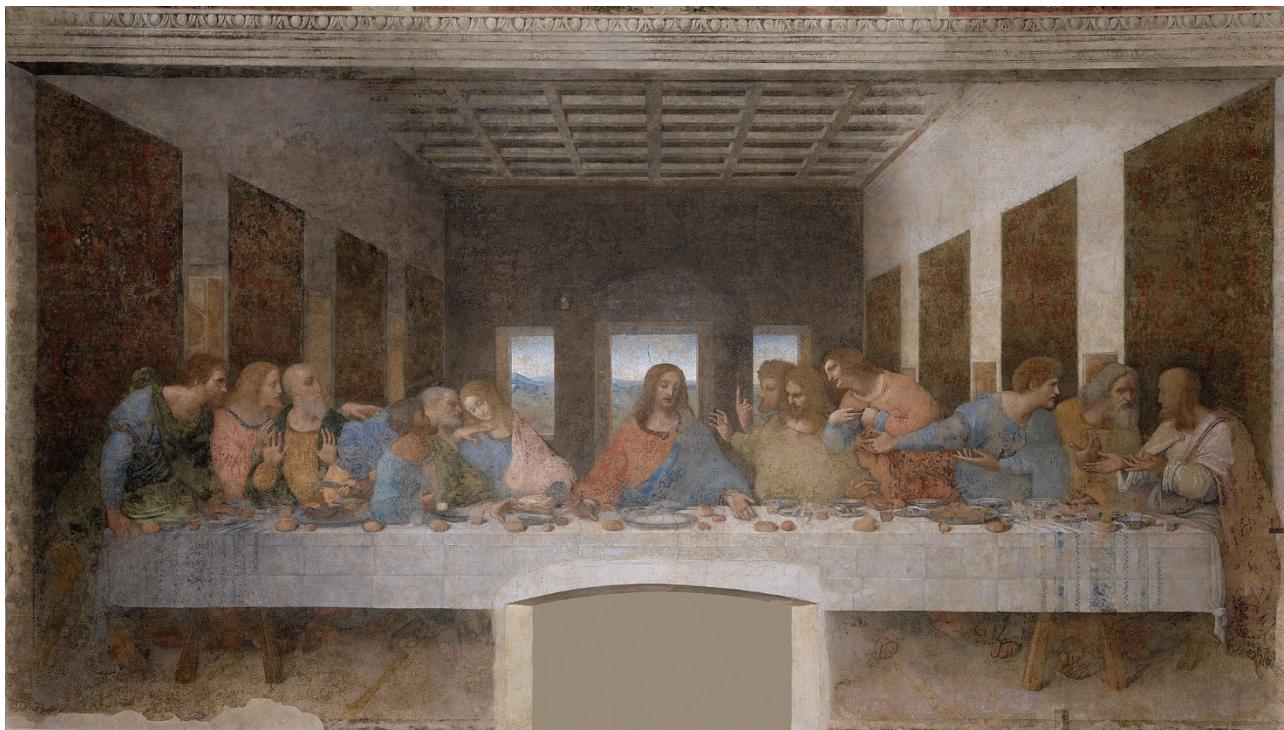


**Dr. Piyush Shakya**  
**Associate Professor**  
**Department of Mechanical Engineering**  
**Indian Institute of Technology Madras, Chennai**

# Introduction (Engineering Drawing)



Mind thinks in pictures. (Thoughts,  
Daydreaming, Dreams are **seen**)



A picture is worth  
thousand words.

The Last Supper

By Leonardo da Vinci,  
1498

# Introduction (Engineering Drawing)



Cave Drawing  
Bhimbetka (Bhopal)



Bison pursuing hunter

# Introduction (Engineering Drawing)

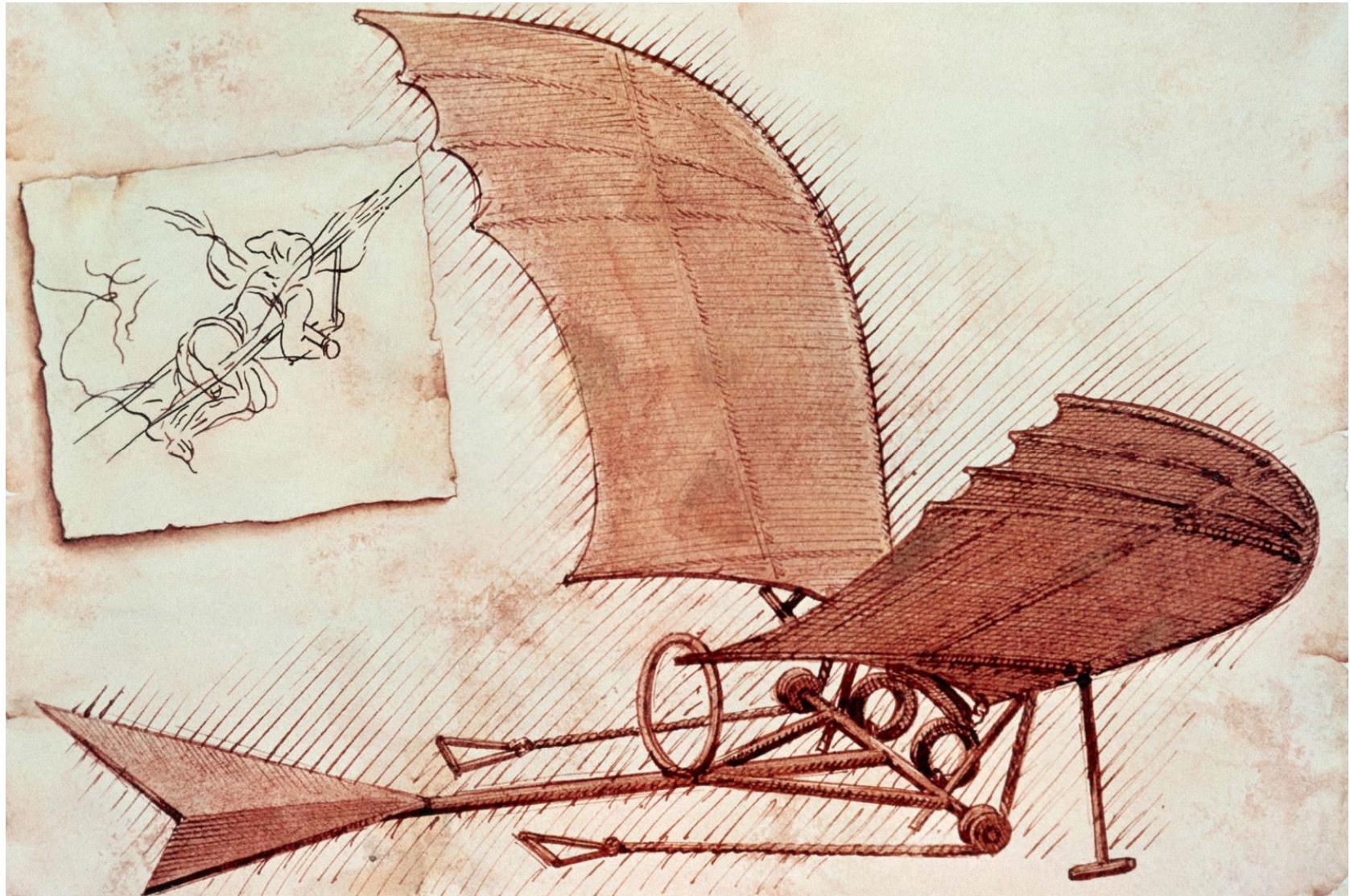


Charama, Kanker  
District, Chhattisgarh



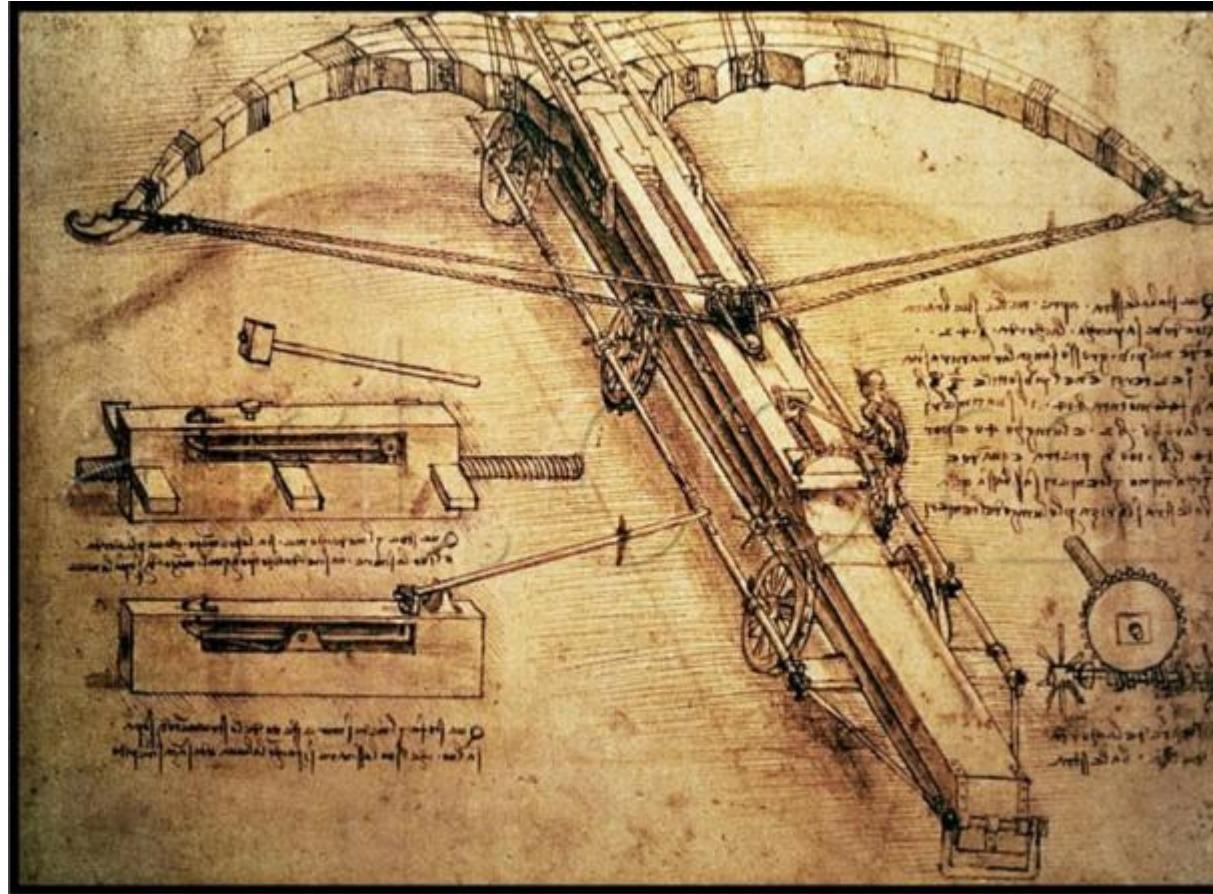
Depiction of UFO??

# Bright Idea (Freehand Sketch)

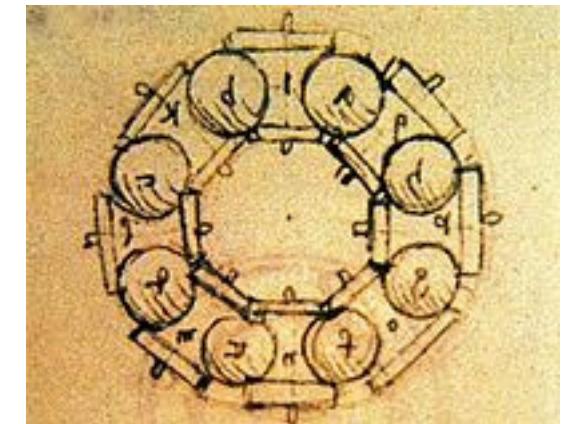


Flying Machine Leonardo Da Vinci

# Bright Idea (Freehand Sketch)



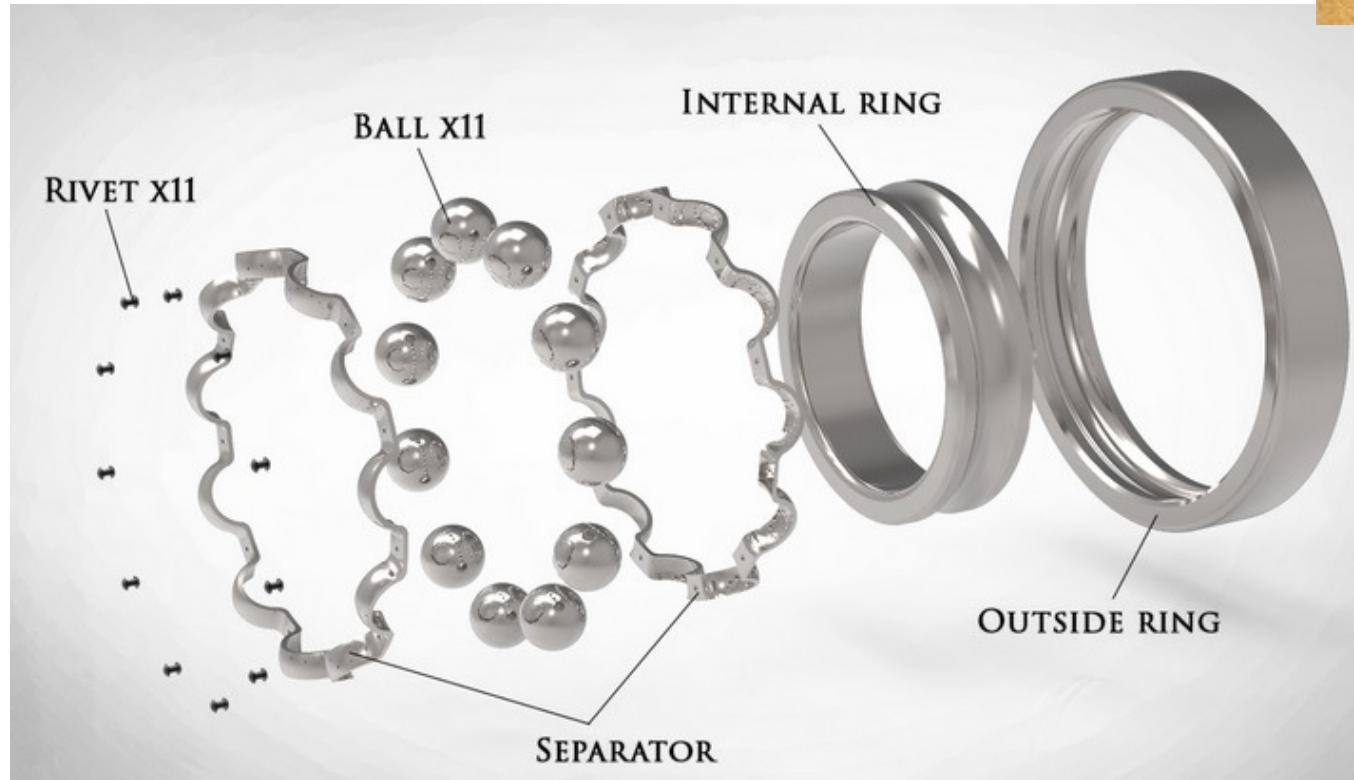
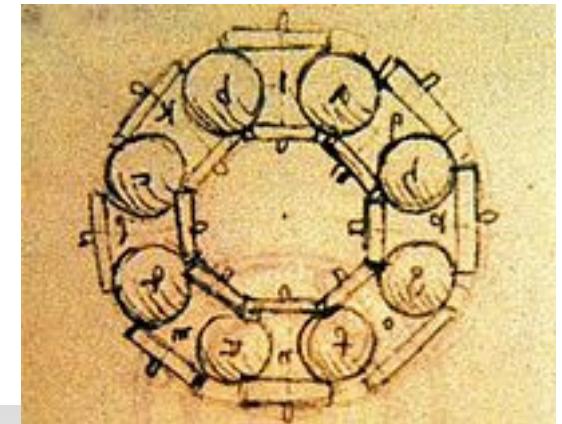
Catapult Leonardo Da Vinci



# Bearing

Written text is required to describe size, location and specification of the object.

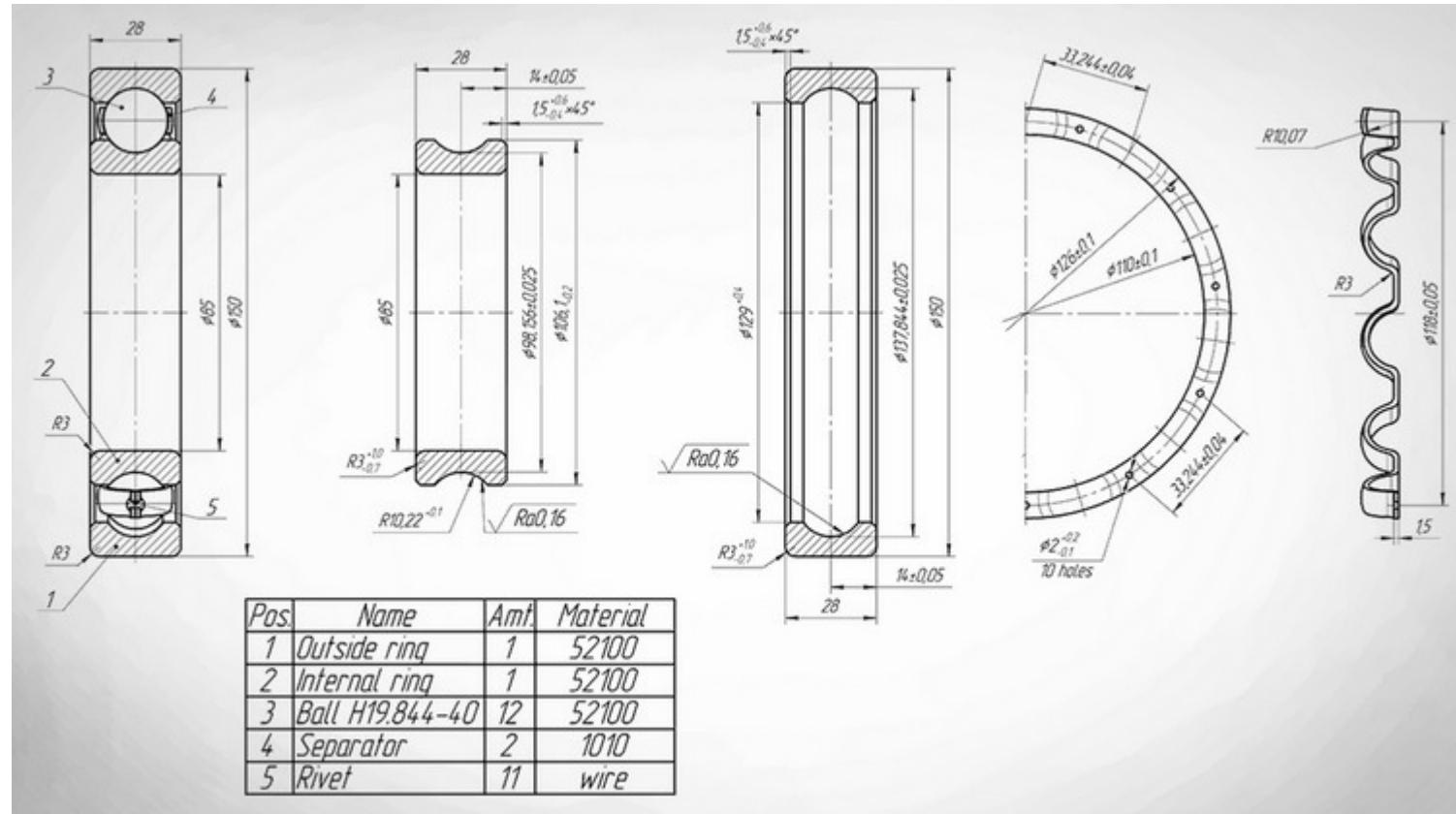
(Ensures easy reproduction with accuracy)



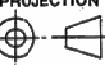
# Purpose of Engineering Drawing

1. To convey the geometric content of the part
2. Dimensions
3. Geometric details (hidden lines and surfaces, shapes, section views, etc.)
4. Manufacturing details
5. Tolerances
6. Surface roughness
7. Machining instructions and materials

# Bearing (Engineering Drawing)

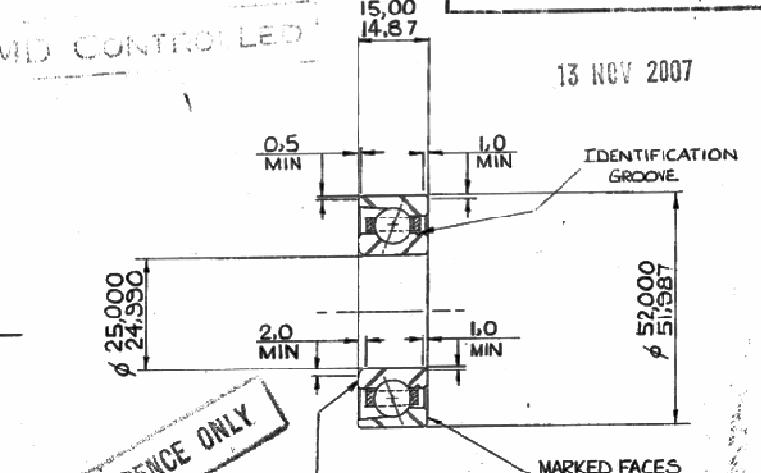


# Bearing (Actual Industry Drawing)

DESIGN	DESC. A/C BALL BEARING										THIS DRAWING MUST NOT BE SCALED	
BRG No.	34/LJT 25											
MOD.	A	B	C	D	E	F	G	H	J	K	PROJECTION	
NOTE No.	5214/46	8248/49										
PASSED	R.P.P.	A.H.P.										
DATE	11-12-80	4-12-84										

**AMD CONTROLLED**

13 NOV 2007



**FOR REFERENCE ONLY**

**CONTACT ANGLE 20°  
BRASS CAGE**

MARKEFACE OF OUTER TO BE FLUSH TO 0.025 ABOVE  
UNMARKEDFACE OF INNER WHEN A GAUGING LOAD OF 24.5N  
IS APPLIED TO MARKED FACE OF OUTER.

LUBRICATION - PACK FULL WITH GREASE CONFORMING TO  
RHP SPEC 57-01/A

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ENGINEERING REPORT OR DOCUMENT AND INFORMATION MAY NOT BE REPRODUCED OR  
COMMUNICATED TO A THIRD PARTY OR USED FOR ANY PURPOSE OTHER THAN THAT FOR WHICH  
IT IS SUPPLIED WITHOUT THE PRIOR WRITTEN CONSENT OF THE COMPANY.

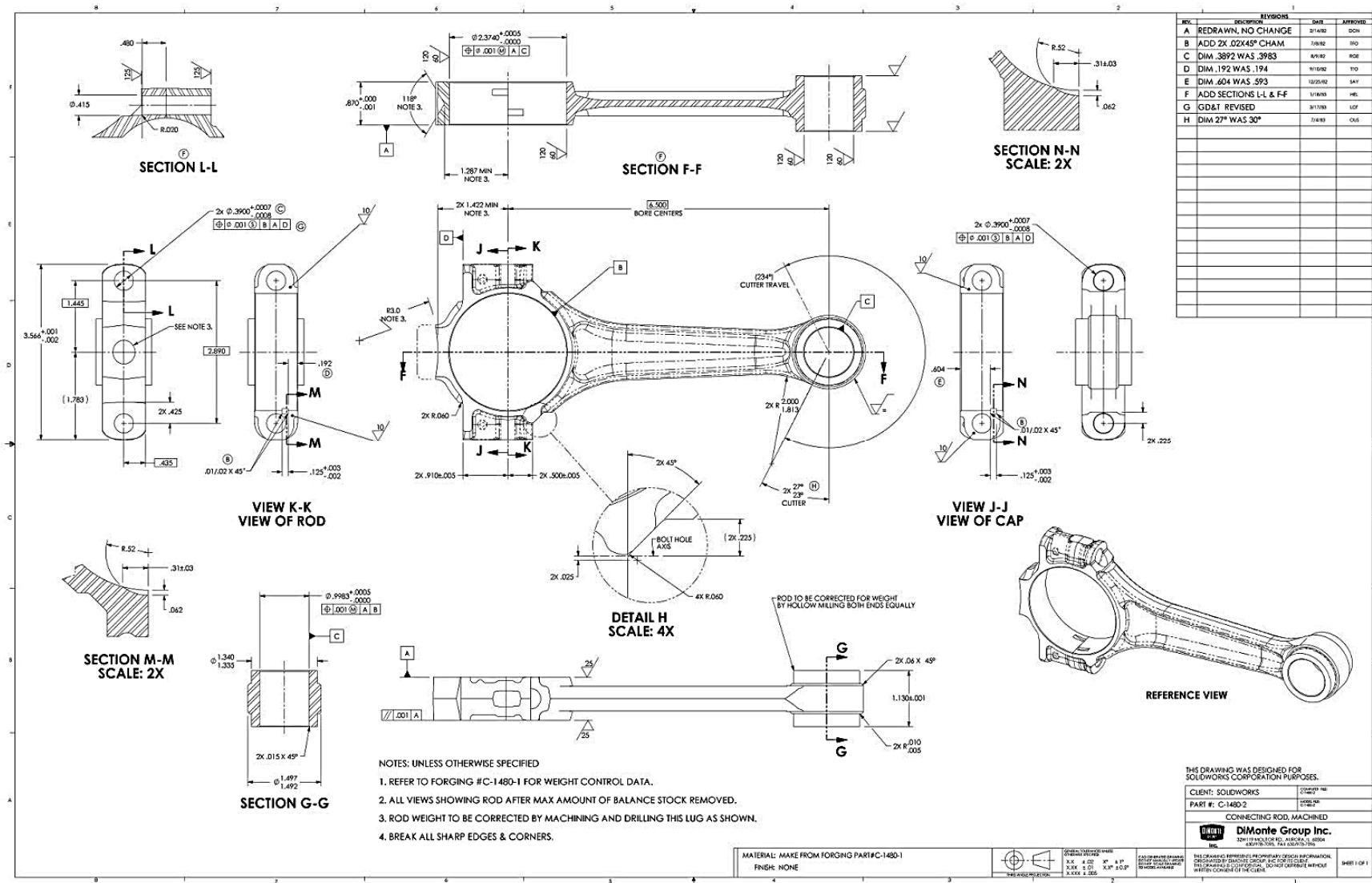
		RADIAL INTERNAL CLEARANCE	
		2.2 / 3.3 mm	

ISO BASIC LOAD RATINGS - NEWTONS		A4	RHP BEARINGS LIMITED	
DYNAMIC Cr. =	12 600 N		NEWARK	
STATIC Cr. =	8 500 N	DRN. RHP 11-12-80	DESIGN	DESC. A/C BALL BEARING
ORIGINAL CUSTOMER	TRUSTIN MORRIS	CKD. RHP 11-12-80	BRG No.	34/LJT 25
CUST. PRINT No.	2A 4299	APP'D	G.A.	
OUR FILING No.				

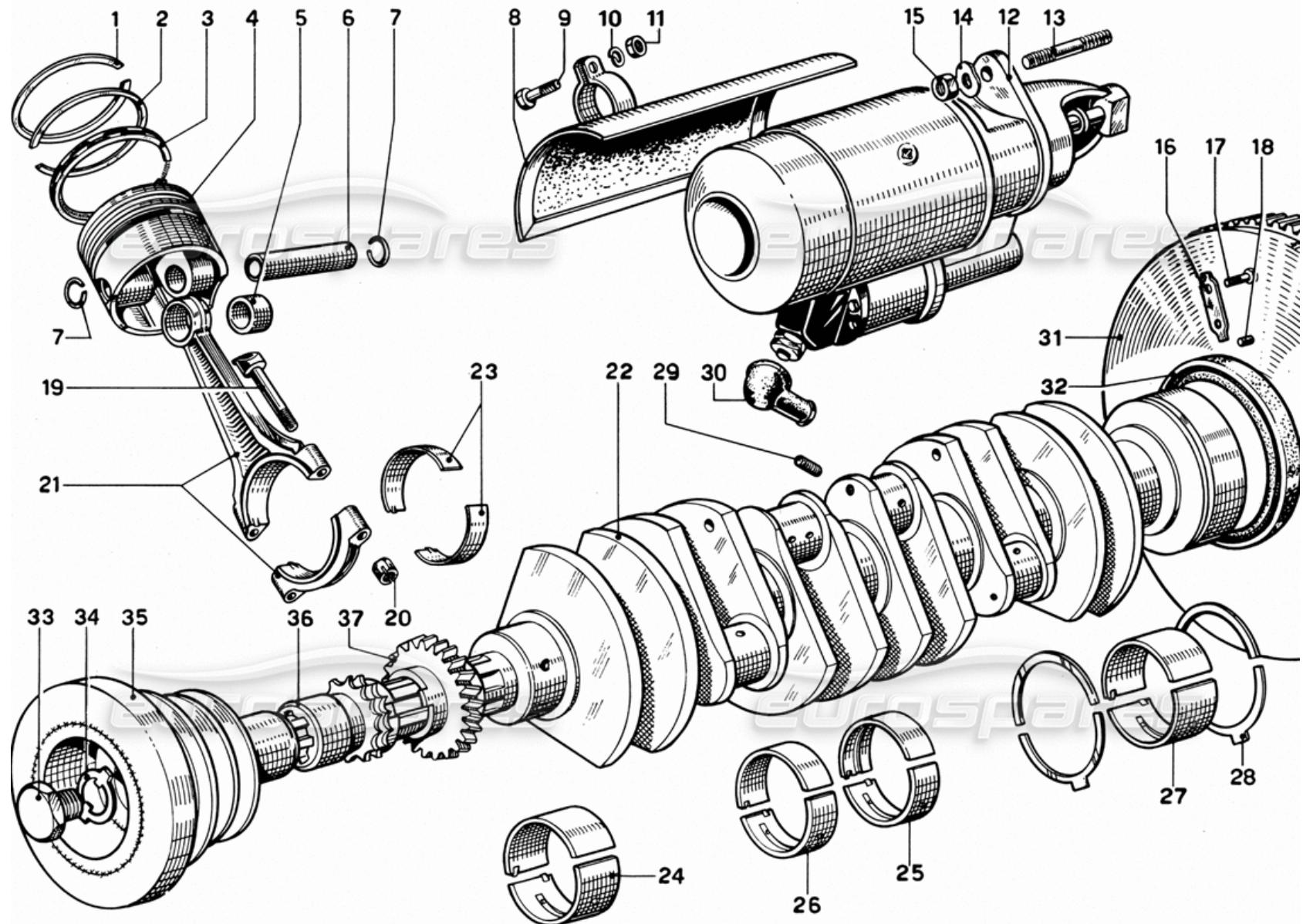
Admet P/2/225

# Applications (Engineering Drawing)

## Mechanical Engineering

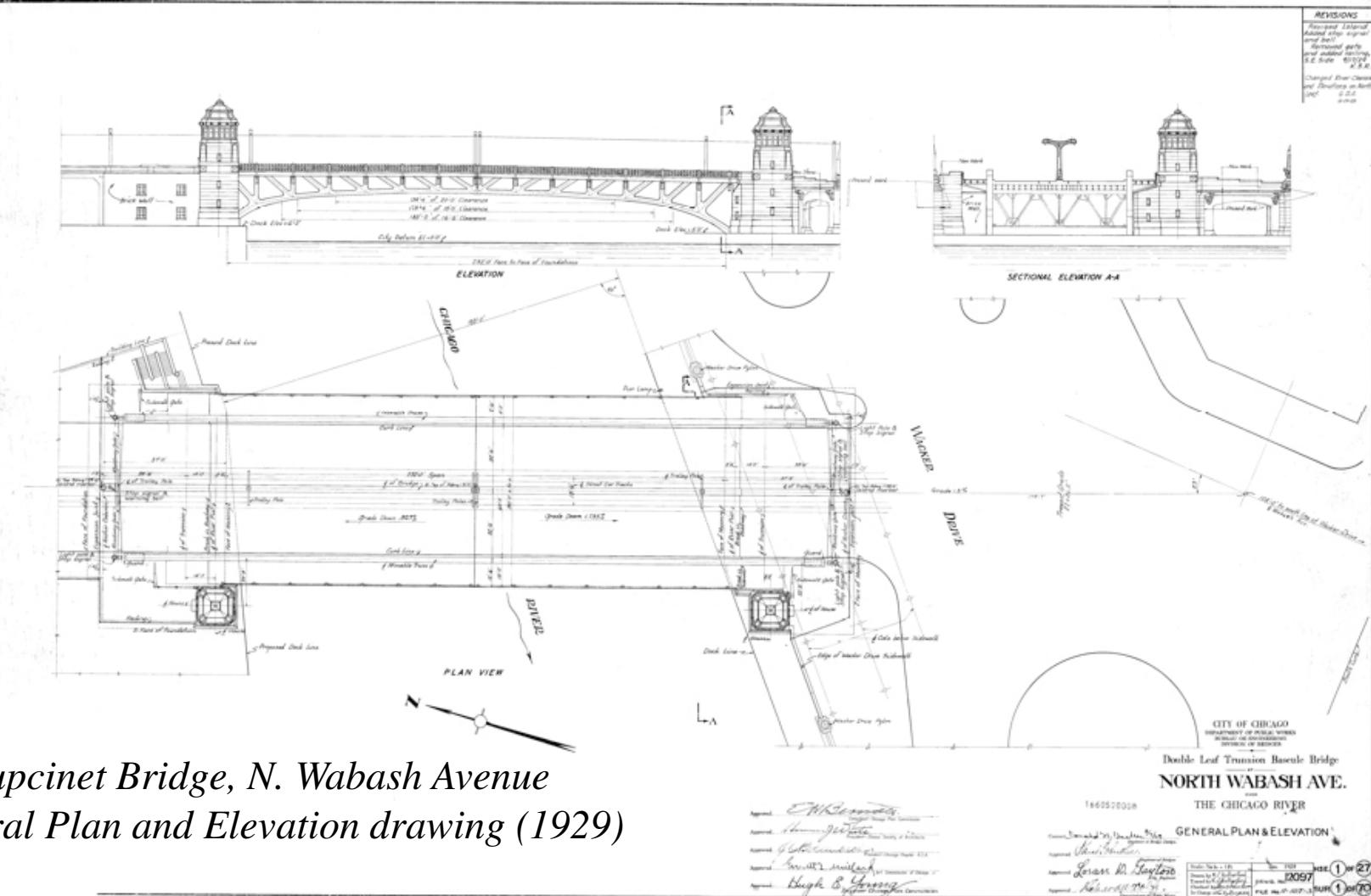


# Applications (Engineering Drawing)



# Applications (Engineering Drawing)

Civil Engineering (Buildings, Highways, Pipelines, Bridges, Water and Sewage systems.)

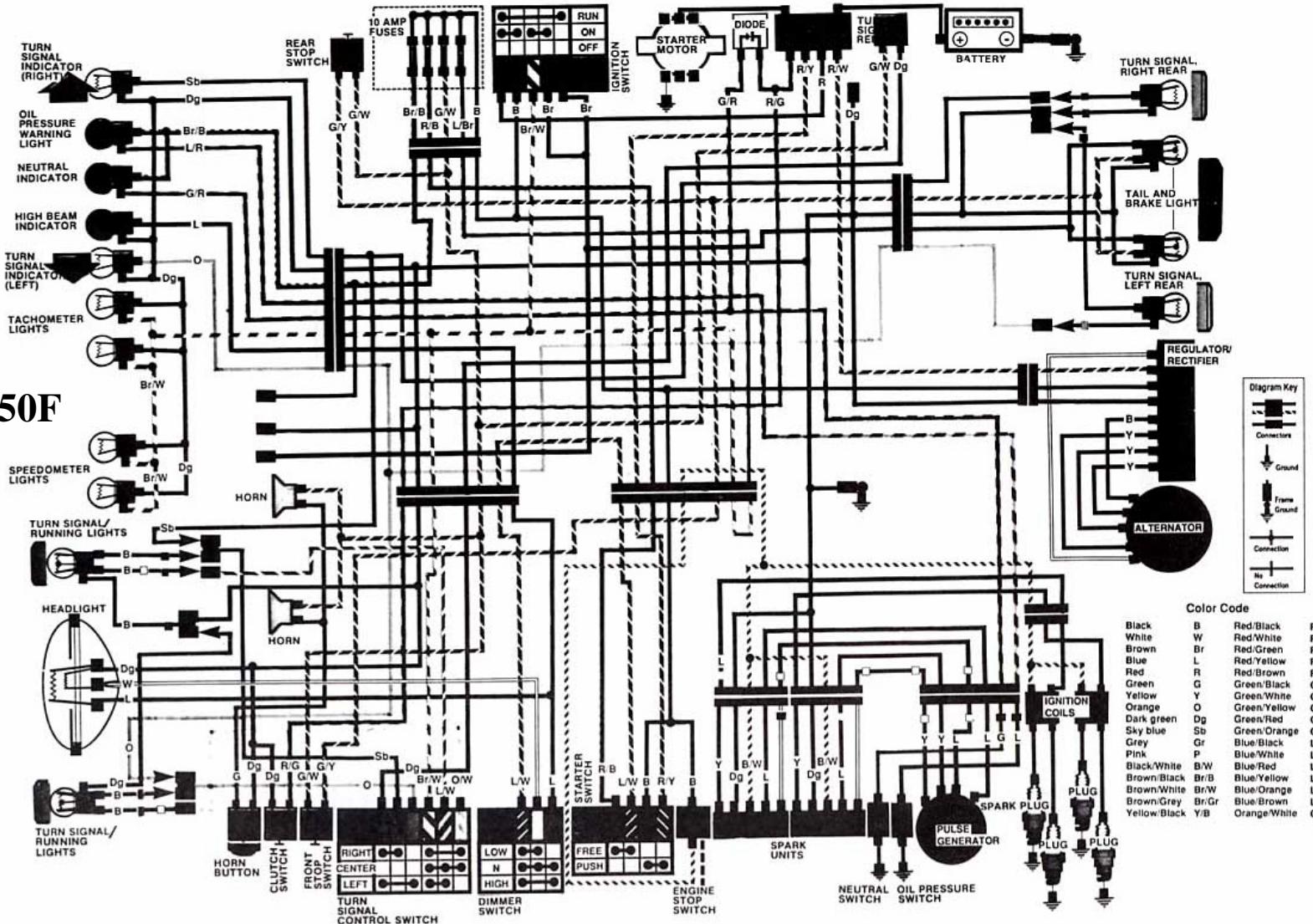


Irv Kupcinet Bridge, N. Wabash Avenue  
General Plan and Elevation drawing (1929)

# Applications (Engineering Drawing)

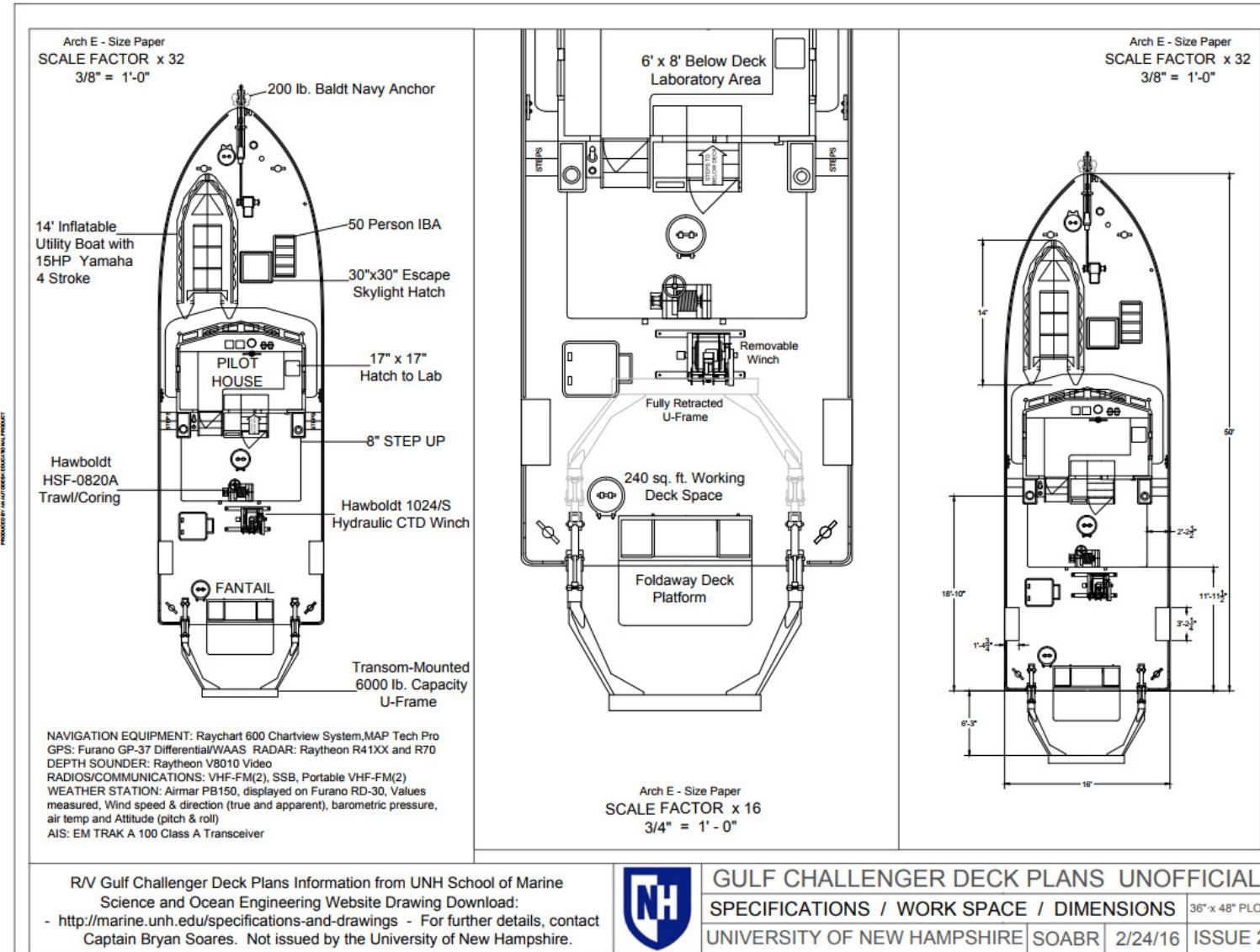
Electrical Engineering (Sensors, Wiring diagrams, Circuit diagrams.)

**Honda CB750F**



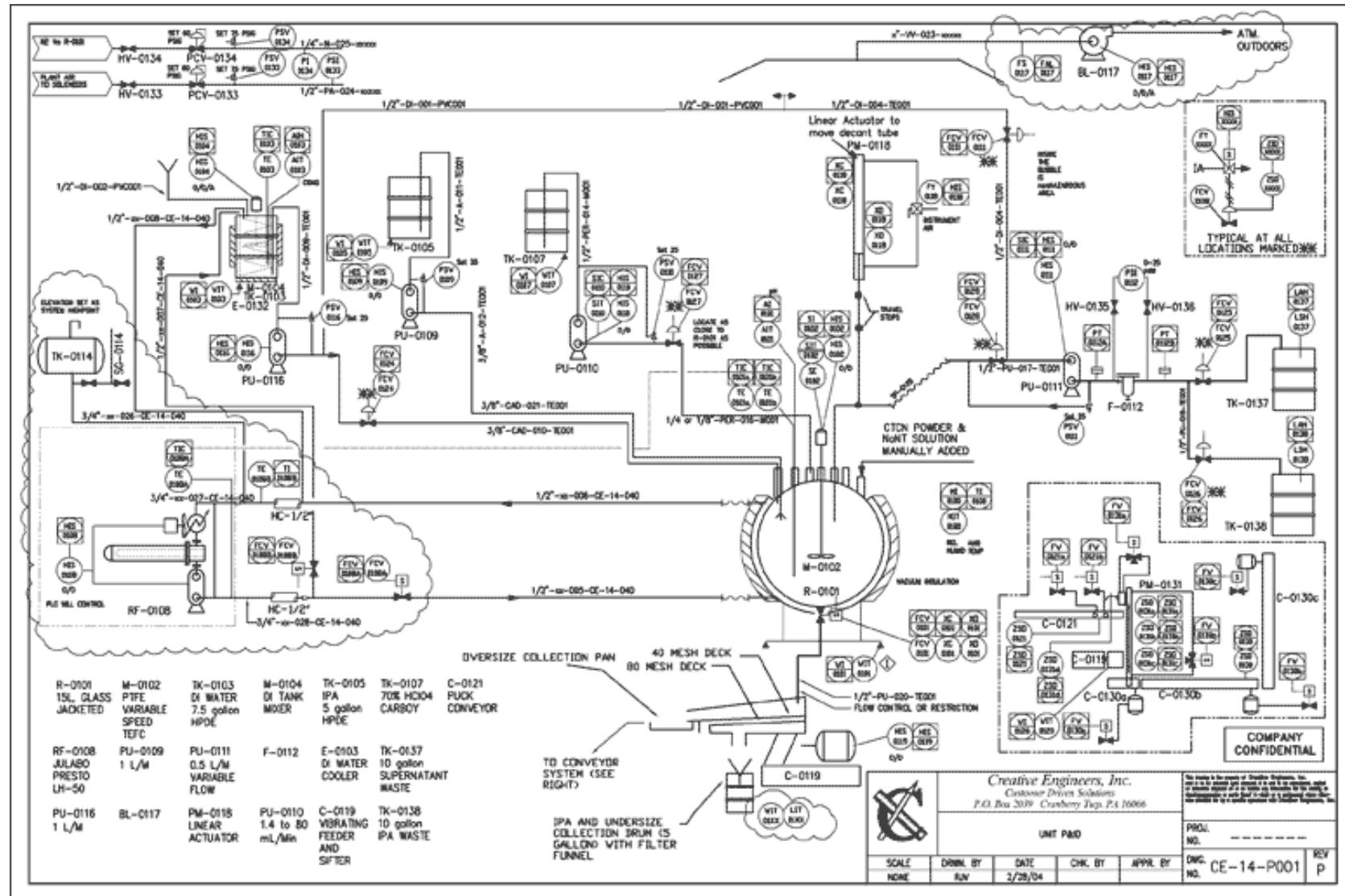
# Applications (Engineering Drawing)

Ocean Engineering (Deck plans, other equipment on ship.)



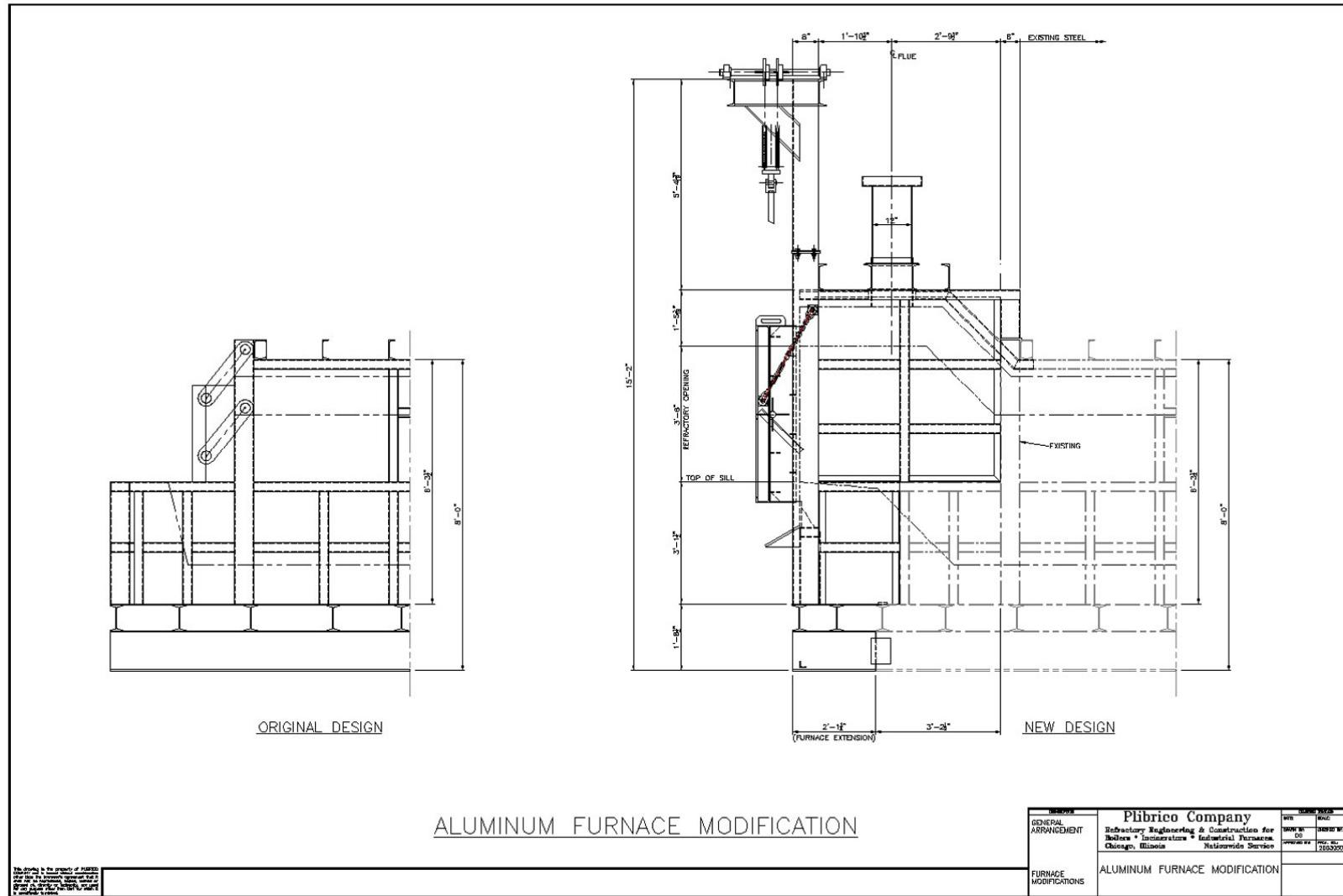
# Applications (Engineering Drawing)

# Chemical Engineering (Processing plant layout, piping)



# Applications (Engineering Drawing)

## Metallurgical and Materials Engineering (Furnace Drawing)



# Applications (Engineering Drawing)

Computer Science Engineering (Pen drive patent)

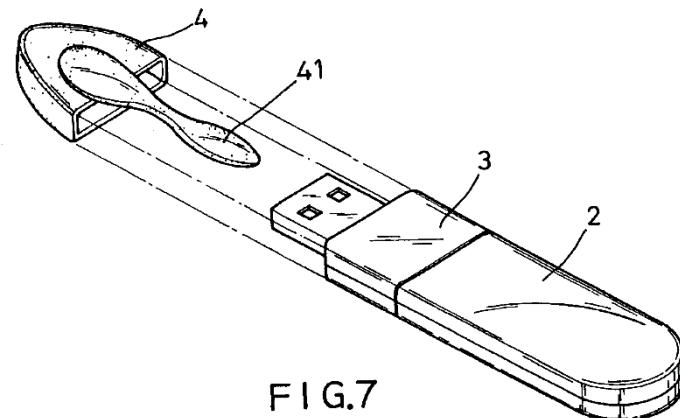
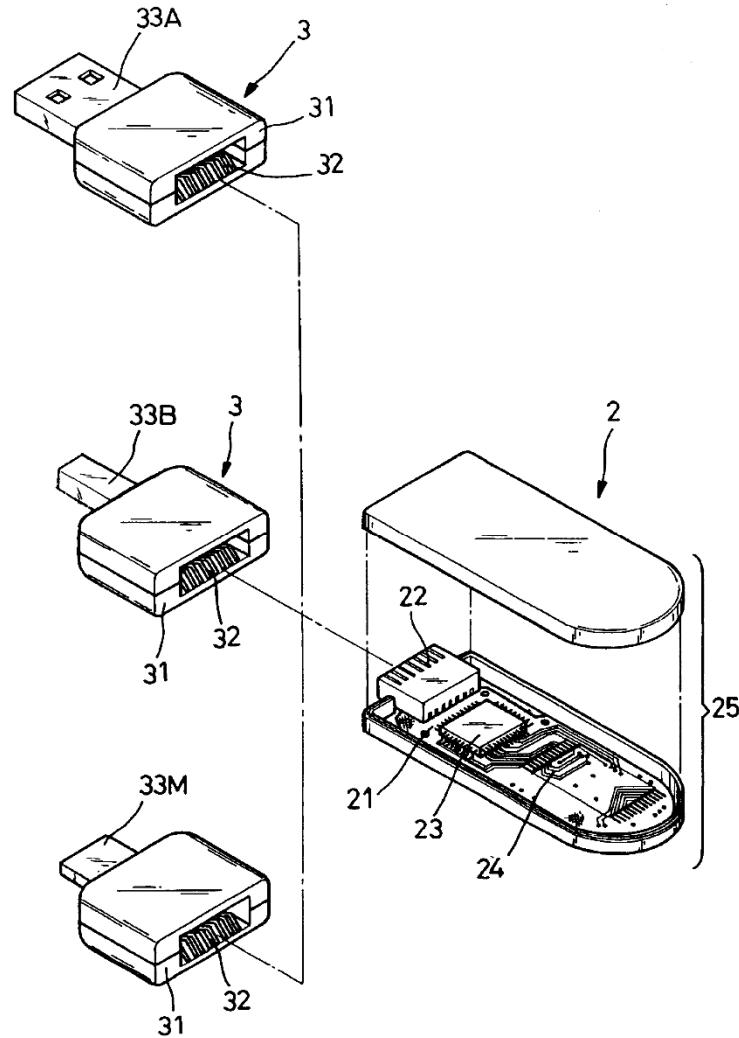


FIG.7

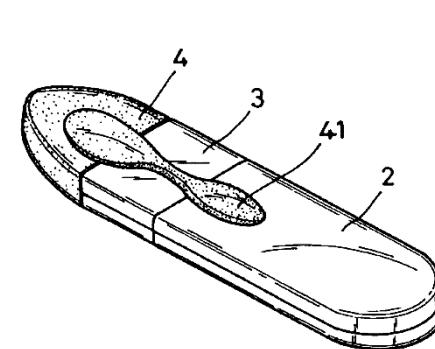


FIG.8

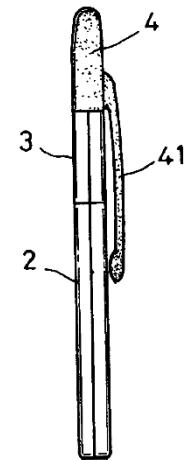


FIG.9

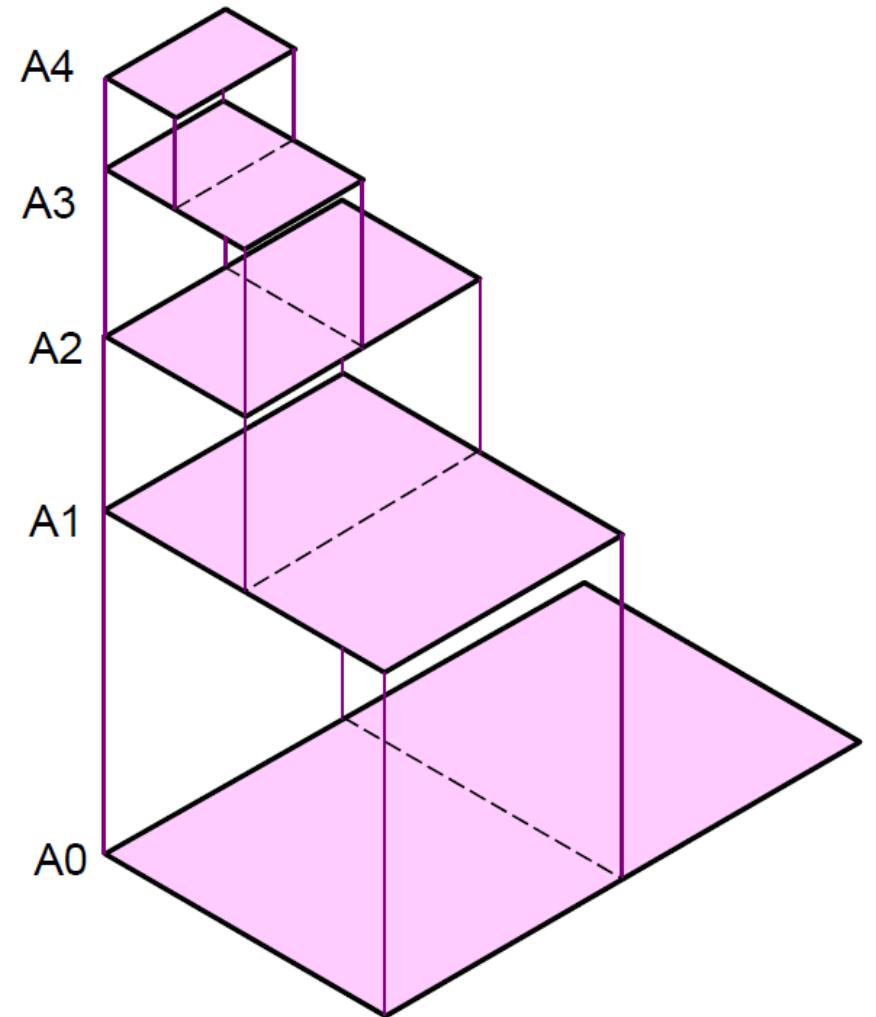
# Paper Size (A series)

1. The size of paper in A series varies from A0 to A10.
2. For the A0 size, the area of the paper is  $1m^2$ , with the ratio of length to width being  $\sqrt{2}: 1$ .
3. Therefore, the length and the width of A0 sheets are 1189 mm and 841 mm respectively.
4. For every successive paper size A1, A2 etc., the area becomes half of the previous size maintaining the same length to width ratio.
5. Therefore, the length of the succeeding size will be same as width of the preceding size (The length of A1 is same as width of A0).
6. ISO 216:2007 is a document issued by International Organization for standardization for governing various sizes of paper.

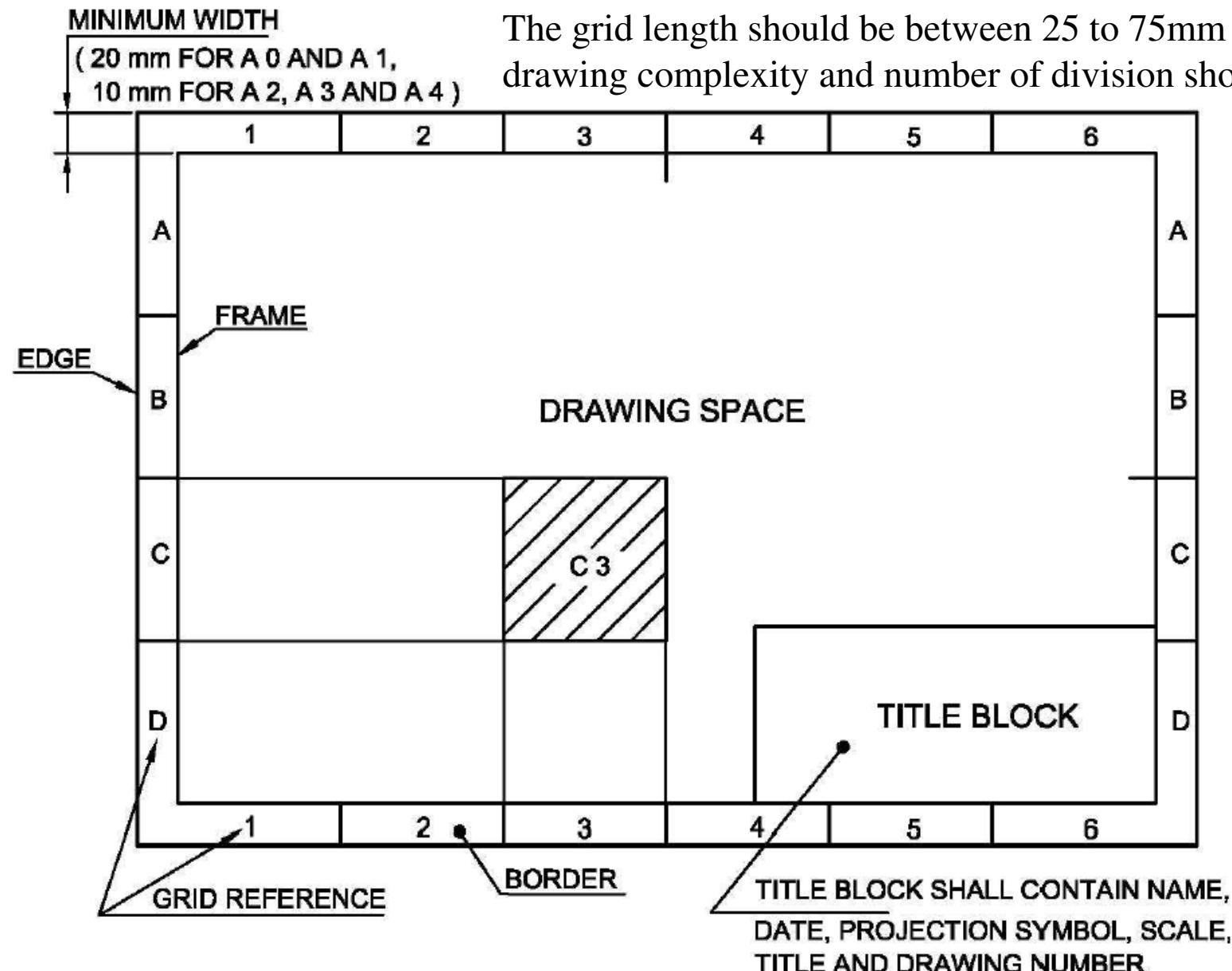
# Paper Size (A series)

Frequently used sizes:

Paper Size	Width (mm)	Length (mm)	Area (m <sup>2</sup> )
A0	841	1189	1
A1	594	841	0.5
A2	420	594	0.25
A3	297	420	0.125
A4	210	297	0.0625

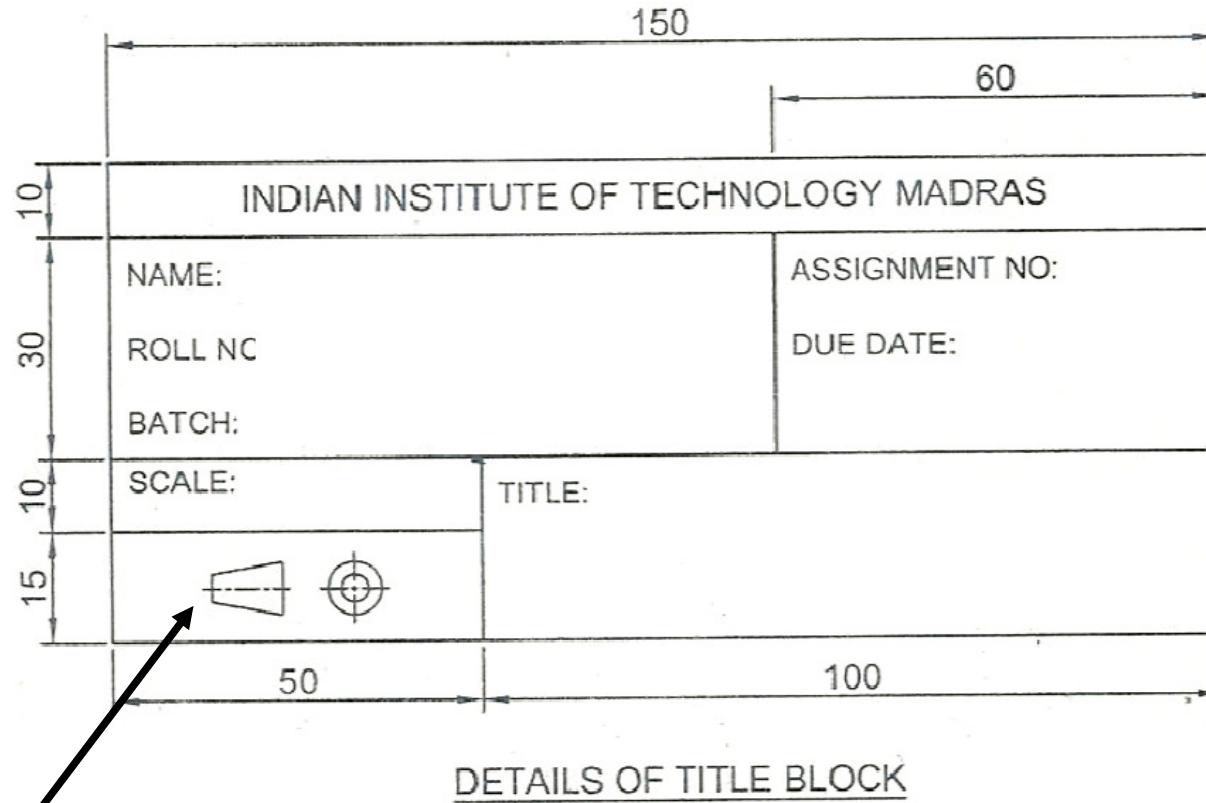


# Drawing Sheet Layout



# Title Block Layout

Title block shall contain the student's name, date of exercise, projection symbol, scale title, and drawing number.



Projection Method Symbol

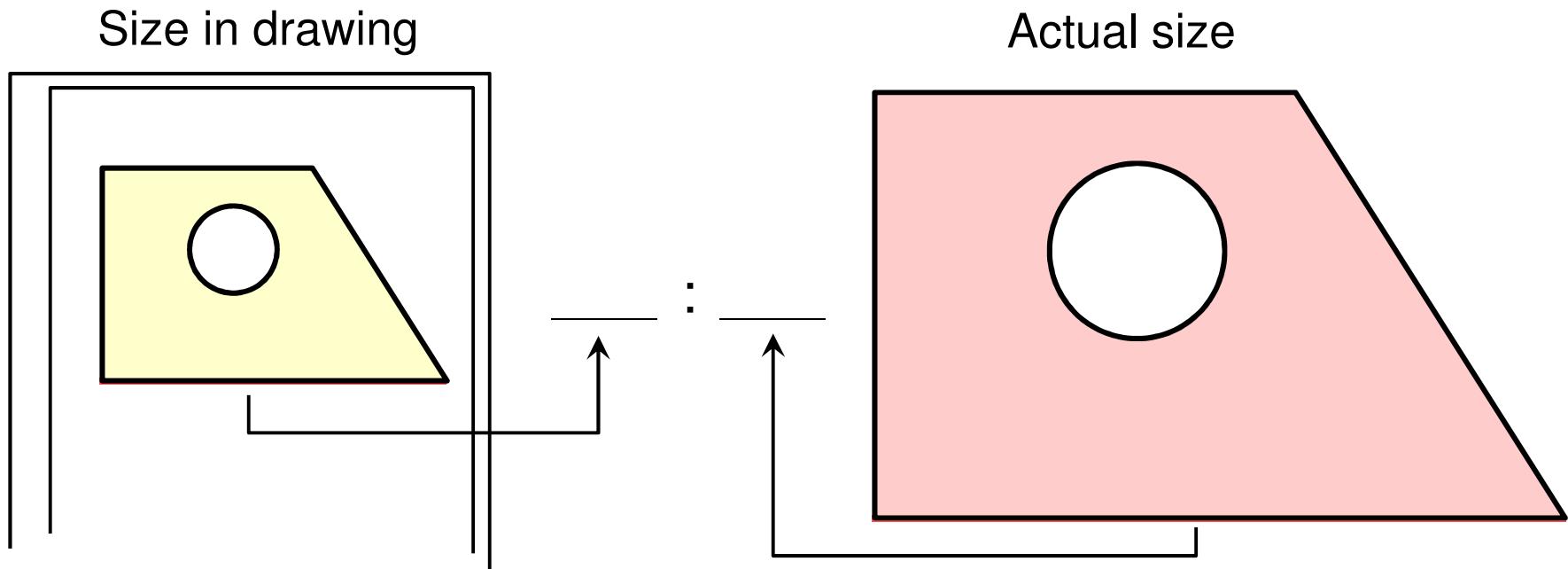
## DETAILS OF TITLE BLOCK

(Suggested for students)

ALL DIMENSIONS IN mm

# Drawing Scales

Scale is defined as the ratio of the linear dimensions of the object as represented in a drawing to the actual dimensions.



Dimension numbers shown in the drawing are correspond to “**true size**” of the object and they are **independent** of the scale used in creating that drawing.

# Drawing Scales



Actual  
Size

SCALE 1:1

for full size

SCALE  $X:1$

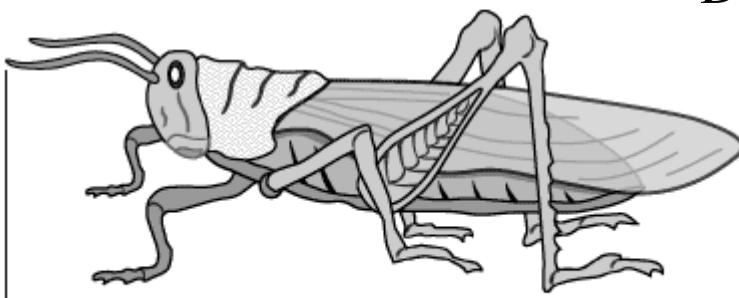
for *enlargement* scales ( $X > 1$ )

SCALE 1: $X$

for *reduction* scales ( $X > 1$ )



Drawing



**Exercise:** A mural of a dog was painted on a wall. The enlarged dog was 45 ft. tall. If the average height for this breed of dog is 3 ft., what is the scale factor?

**Solution:** 15:1

# Lettering & Dimensioning

- Text's style on the drawing must have the following 2 properties

## ***Legibility***

- Shape
- Space between letters
- Space between words

## ***Uniformity***

- Size (or text height)
- line thickness

## **Examples**

ESTIMATE **GOOD**

ESTiMaTE **Not uniform in style.**

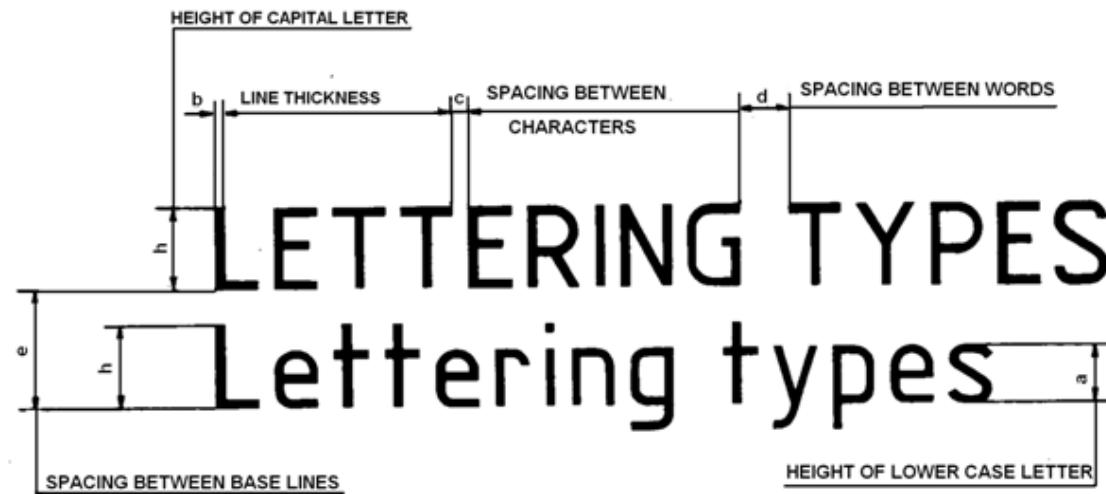
EST|MATE  
ESTIMATE **Not uniform in height.**

EST/MATE  
ESTIMATE **Not uniformly vertical.**

ESTIMATE  
ESTIMATE **Not uniform in thickness of stroke.**

EST | MATE **Inappropriate space between letters**

# Lettering Height



Specifications	Value	Size (mm)					
Capital letter height	h	3.5	5	7	10	14	20
Lowercase letter height	$a = (7/10)h$	2.5	3.5	5	7	10	14
Thickness of lines	$b = (1/10)h$	0.35	0.5	0.7	1	1.4	2
Spacing between characters	$c = (1/5)h$	0.7	1	1.4	2	2.8	4
Min. spacing b/n words	$d = (3/5)h$	2.1	3	4.2	6	8.4	12
Min. spacing b/n baselines	$e = (7/5)h$	5	7	10	14	20	28

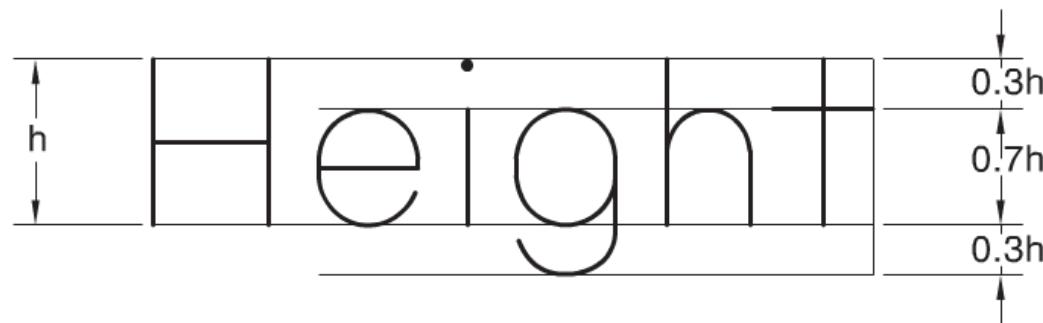
# Lettering Height

Lettering type B (Refer to BIS SP46(2003) for details)

Main title:  $h=7$  mm

Subtitles:  $h=5$  mm

Dimensions and notes:  $h=3.5$  mm



# Basic Line Types

Types of Lines	Appearance	Name according to application
Continuous thick line	_____	Visible line
Continuous thin line	_____	Dimension line Extension line Leader line
Dash thick line	— — — — —	Hidden line
Chain thin line	— — — — —	Center line

NOTE : We will learn other types of line in practical classes.

# Meaning of Lines

**Visible lines** represent features that can be seen in the current view

**Hidden lines** represent features that can not be seen in the current view

**Center line** represents symmetry, path of motion, centers of circles, axis of axi-symmetrical parts

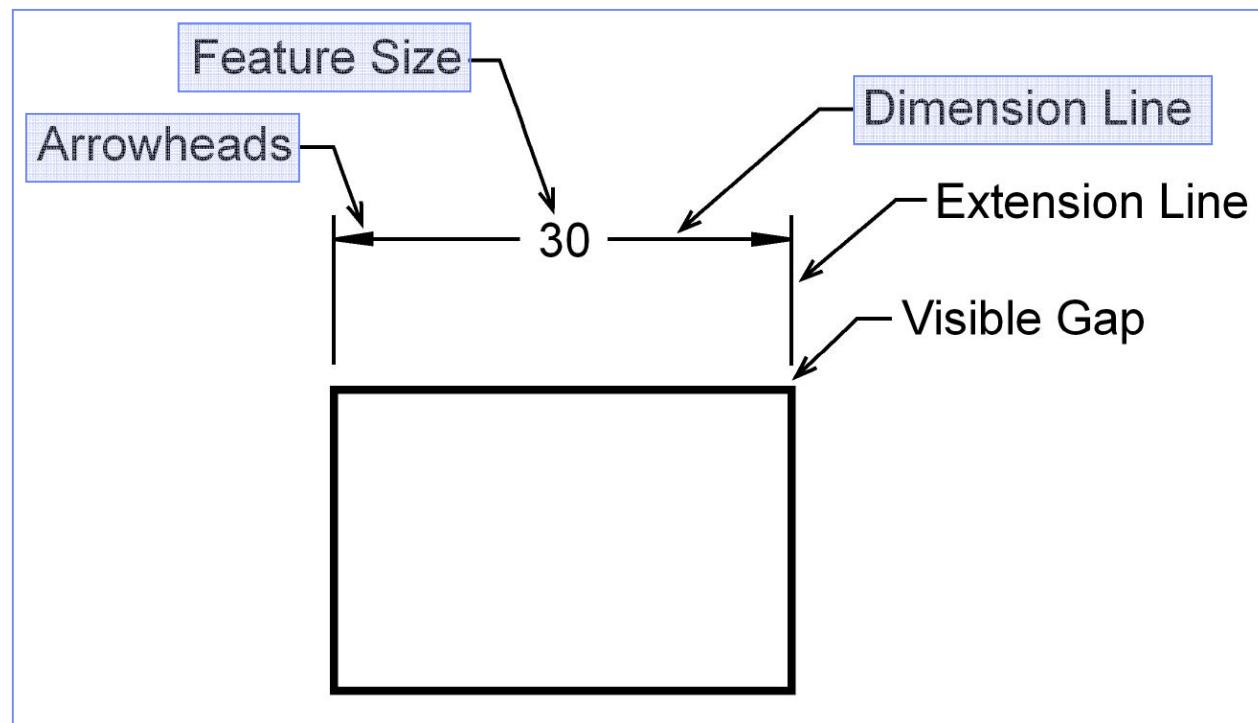
**Dimension and Extension lines** indicate the sizes and location of features on a drawing

# Lines used in Dimensioning

- Dimensioning requires the use of
  - Dimension lines
  - Extension lines
  - Leader lines
- All three line types are drawn ***thin*** so that they will not be confused with visible lines.

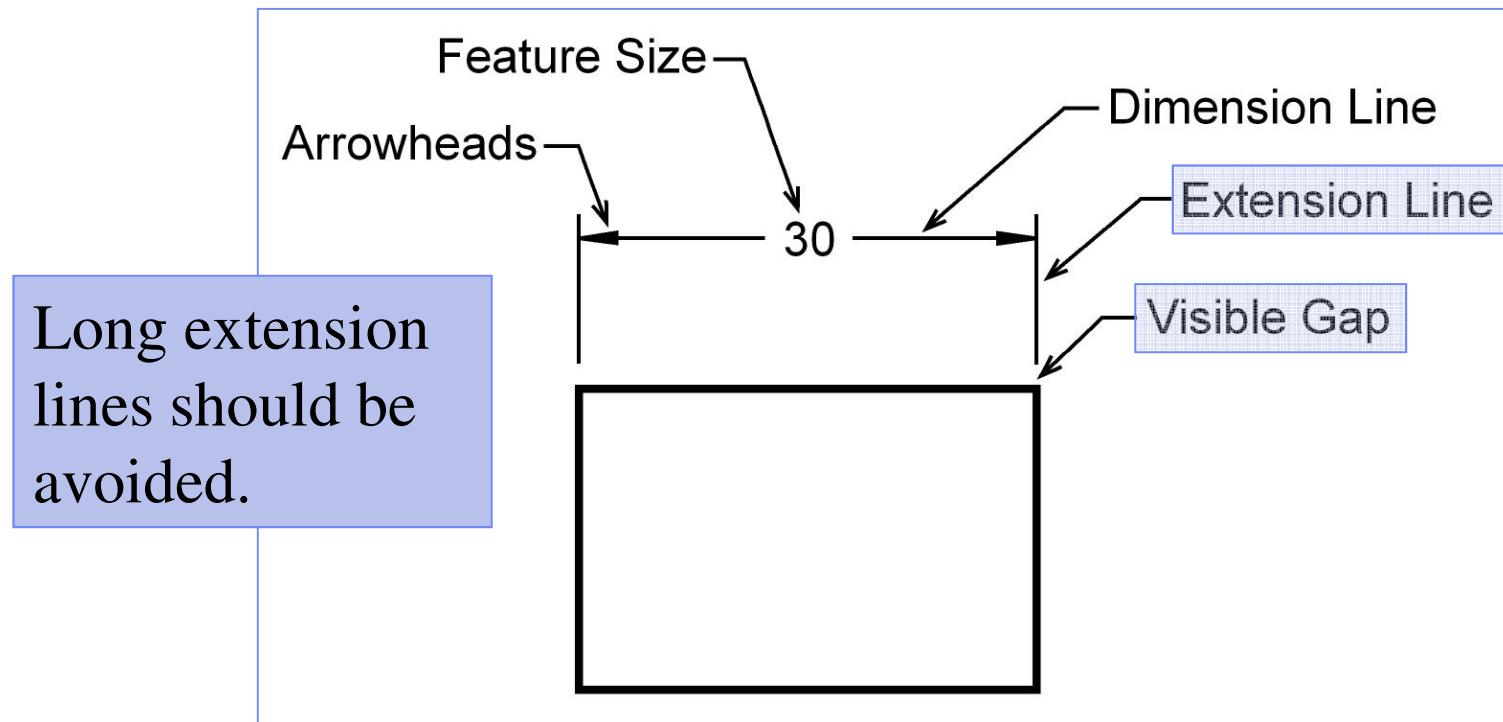
# Dimension Line

- **Dimension Line:** A line terminated by arrowheads, which indicates the direction and extent of a dimension.



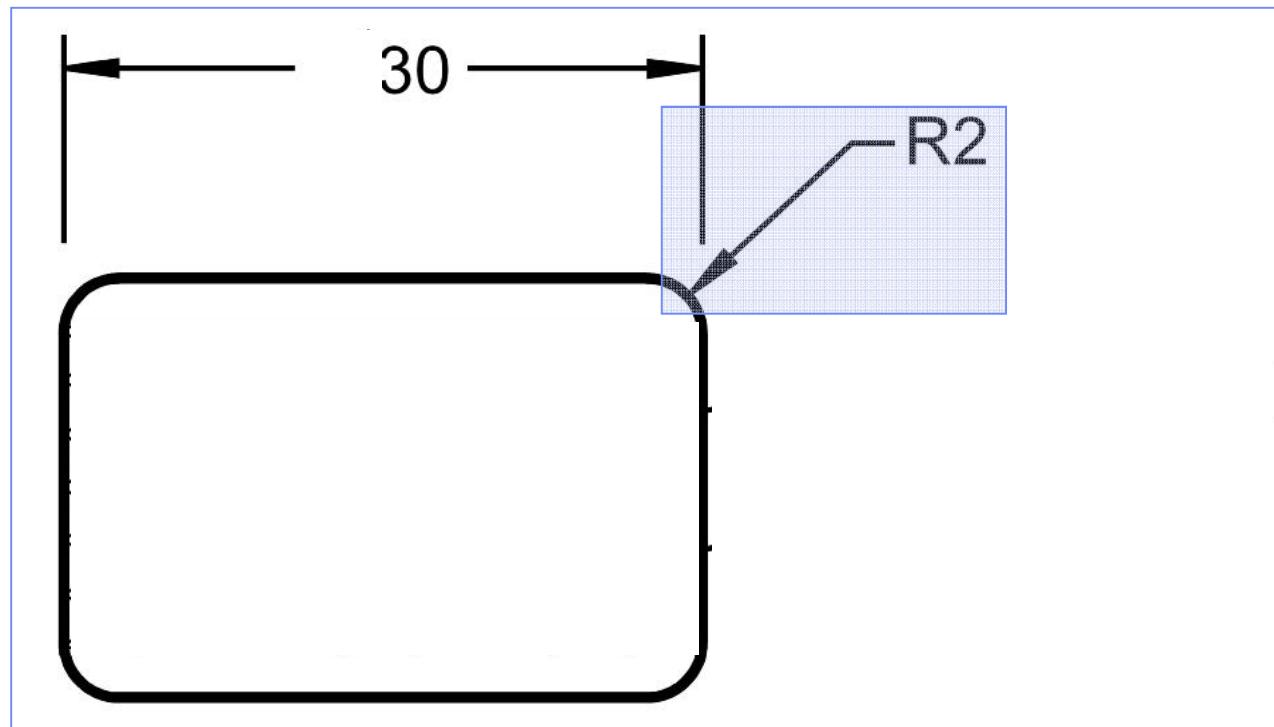
# Extension Line

- **Extension line:** An extension line is a thin solid line that extends from a point on the drawing to which the dimension refers.

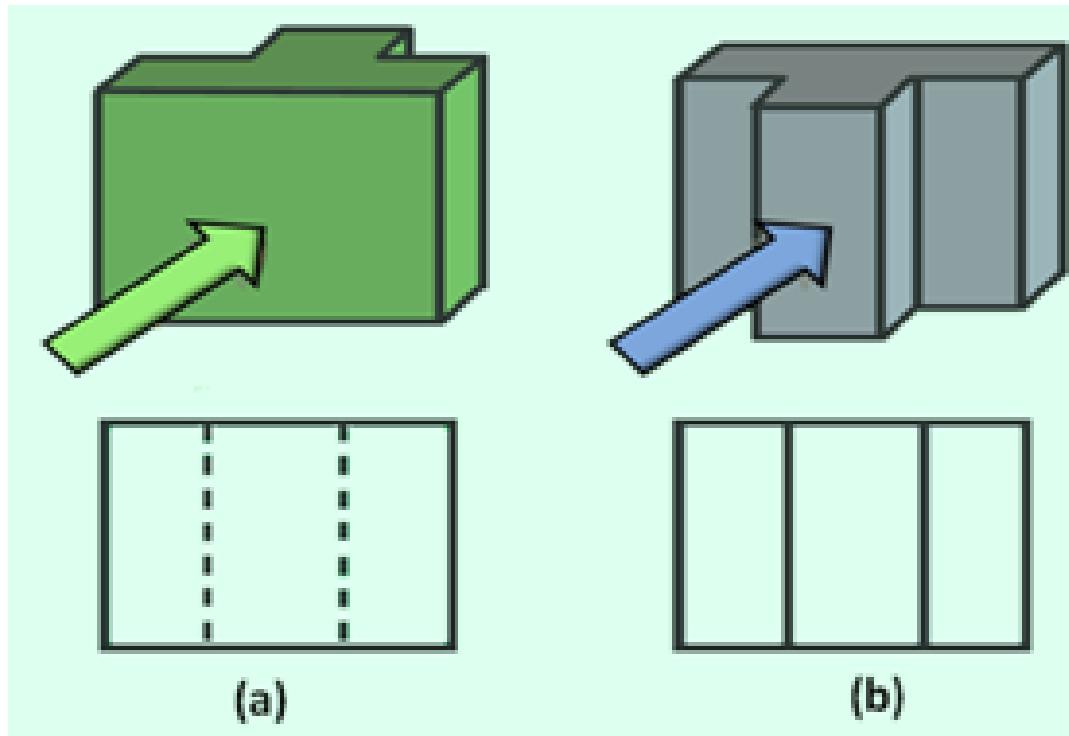


# Leader Line

- **Leader Line:** A straight inclined thin solid line that is usually terminated by an arrowhead.

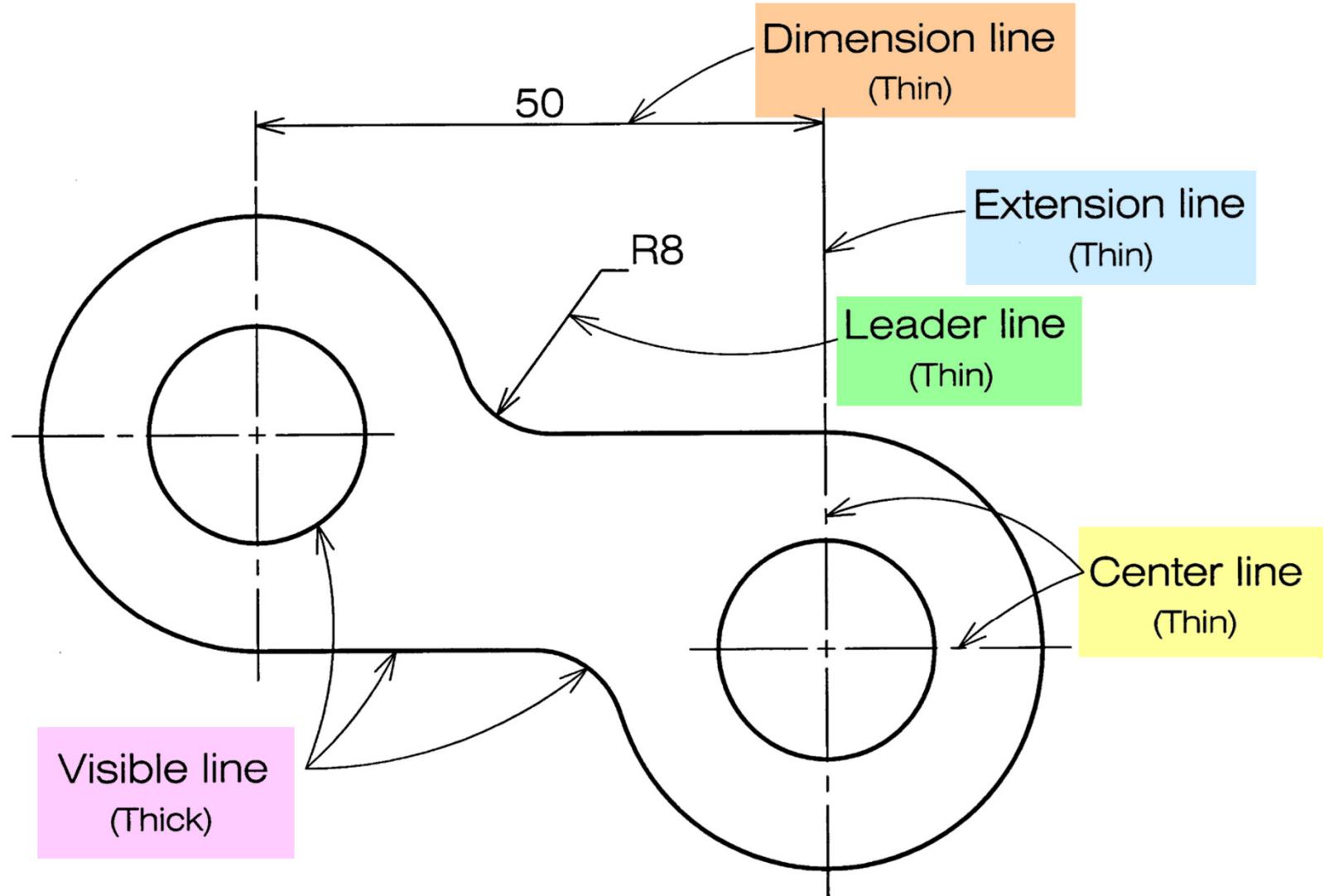


# Example



Hidden line Vs Visible line

# Example



# Guidelines

LINES, LETTERING AND DIMENSIONING			
LINE TYPES			
SL. No	LINE TYPE	APPLICATION	PENCIL TYPE
1	Continuous thick _____	Visible edges, Visible outlines	H (Medium grade)
2	Continuous thin _____	Construction lines, Guide lines, Projection lines, Dimension lines, Extension lines, Leader lines and Hatching lines	2H (Hard grade)
3	Dashed thick -----	Hidden outlines, Hidden edges	H
4	Chain thin - - - - -	Center lines, Axes, Lines of symmetry, Trajectories and Pitch circles	2H
5	Continuous thin free hand ~~~~~	Limits of partial or interrupted views	2H
6		Border lines, Lettering and Free hand sketching	HB (Soft grade)

SCALES			
TYPE	RECOMMENDED		
Enlargement scale	50:1	20:1	10:1
	5:1	2:1	-
Full size	1:1		
Reduction scale	1:2	1:5	1:10
	1:20	1:50	1:100
	1:200	1:500	1:1000
	1:2000	1:5000	1:10000

Drawing length of an element

Scale of a drawing / Representative fraction      =      Actual length of that element

# Guidelines

**LETTERING**

**Recommended letter sizes**

2.5 mm & 3.5 mm	- For Dimensioning & Marking	Shape identification symbol for dimensioning
5 mm	- For Writing notes & Subtitles	
10 mm	- For Title of the Drawing	

**Lettering Types:**

- 1) Vertical single stroke letters
- 2) Inclined single stroke letters

**Lettering sizes ratio:**

Height of the Upper case letters 'h'	(14/14) h	2.5	3.5	5	7	10	14	20
Height of the Lower case letters 'c'	(10/14) h	-	2.5	3.5	5	7	10	14

**DIMENSIONING METHODS**

Chain dimensioning      Parallel dimensioning

Linear dimensioning      Angular dimensioning

Diameter dimensioning for circles

Radius dimensioning for arcs

*Prepared for B.Tech - CS & MM 17, by S. RAVISUBRAMANIAN, ME CAE Lab, Machine Design Section, Dept. of Mechanical Engineering, IIT Madras, Chennai - 600 036*

30/01/2018



**Thank you**