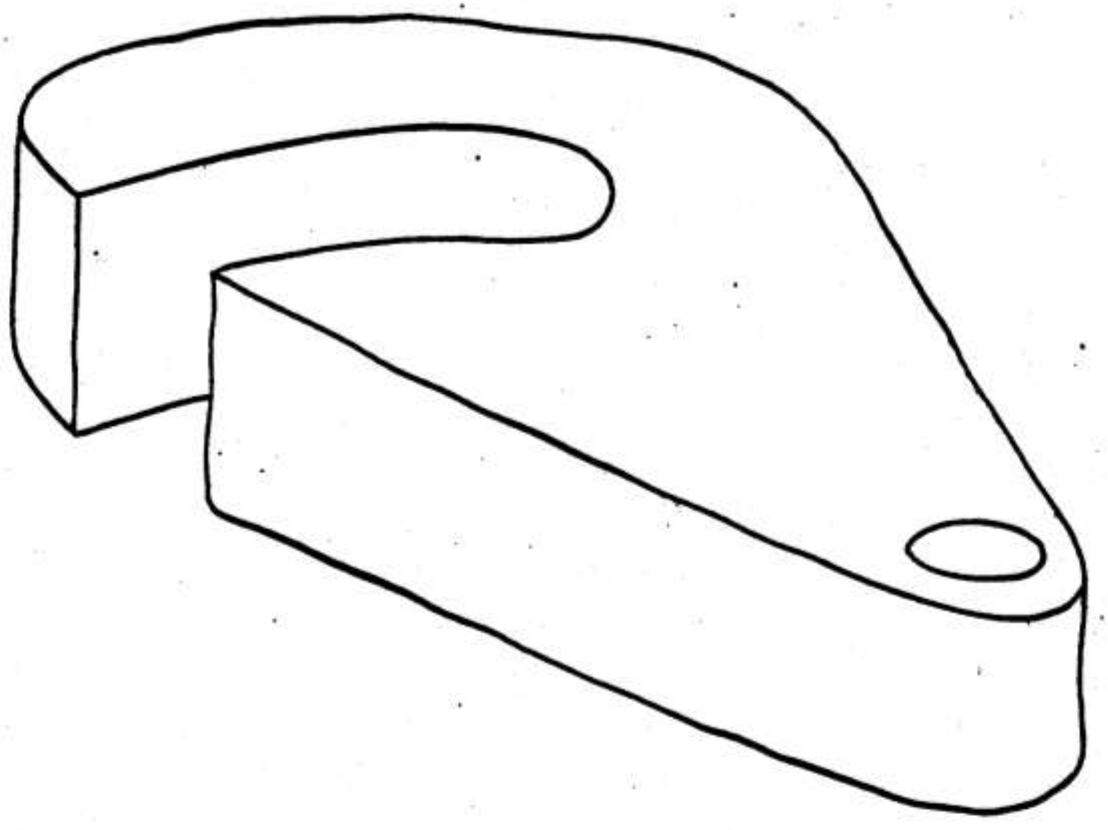
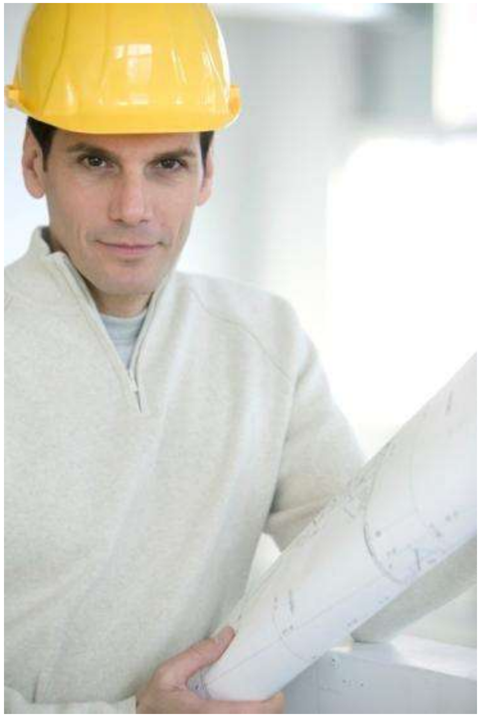
The Dairylea cheese wedge thingy



Basic Engineering Drawing

What is Engineering Drawing ?



GRAPHICAL COMMUNICATION

Engineering Drawing: definition

An **engineering drawing**, a type of technical drawing, is used to fully and clearly define requirements for engineered items.

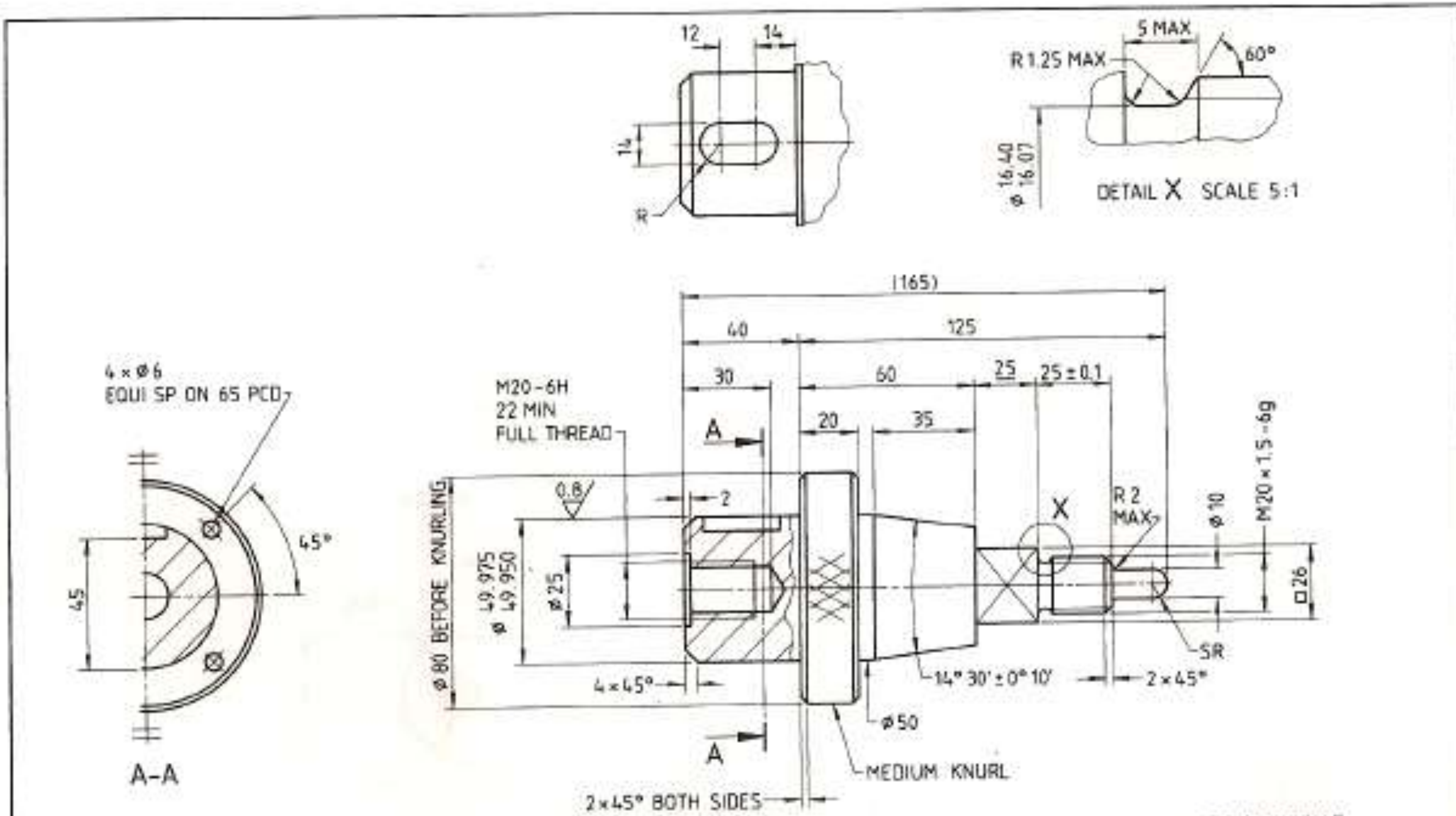
Technical Drawing: definition

Technical drawing, also known as **drafting** or **draughting**, is the act and discipline of composing plans that visually communicate how something functions or is to be constructed

Technical drawing is essential for communicating ideas in industry and engineering.

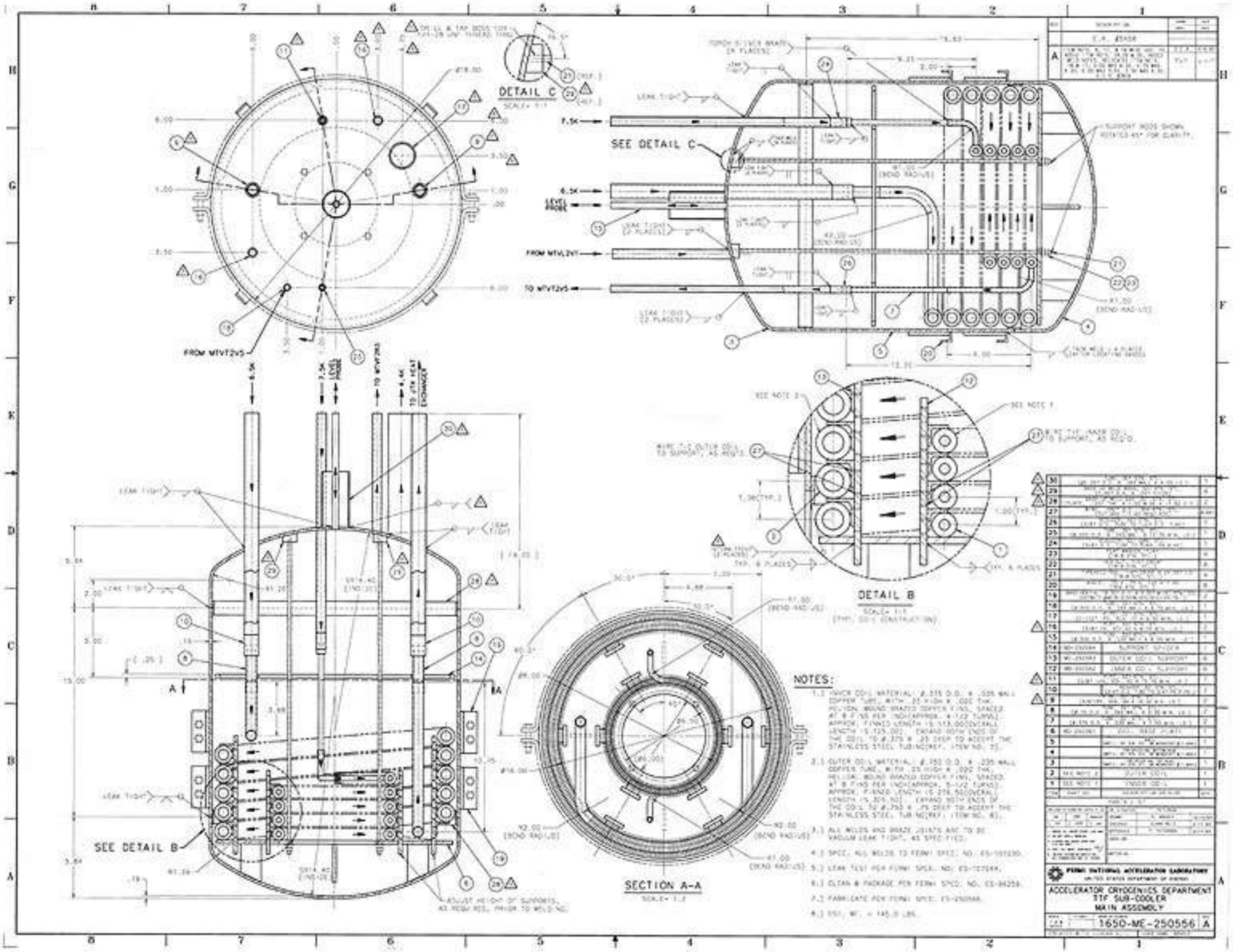
To make the drawings easier to understand, people use familiar symbols perspectives, units of measurement, notation systems, visual styles, and page layout.

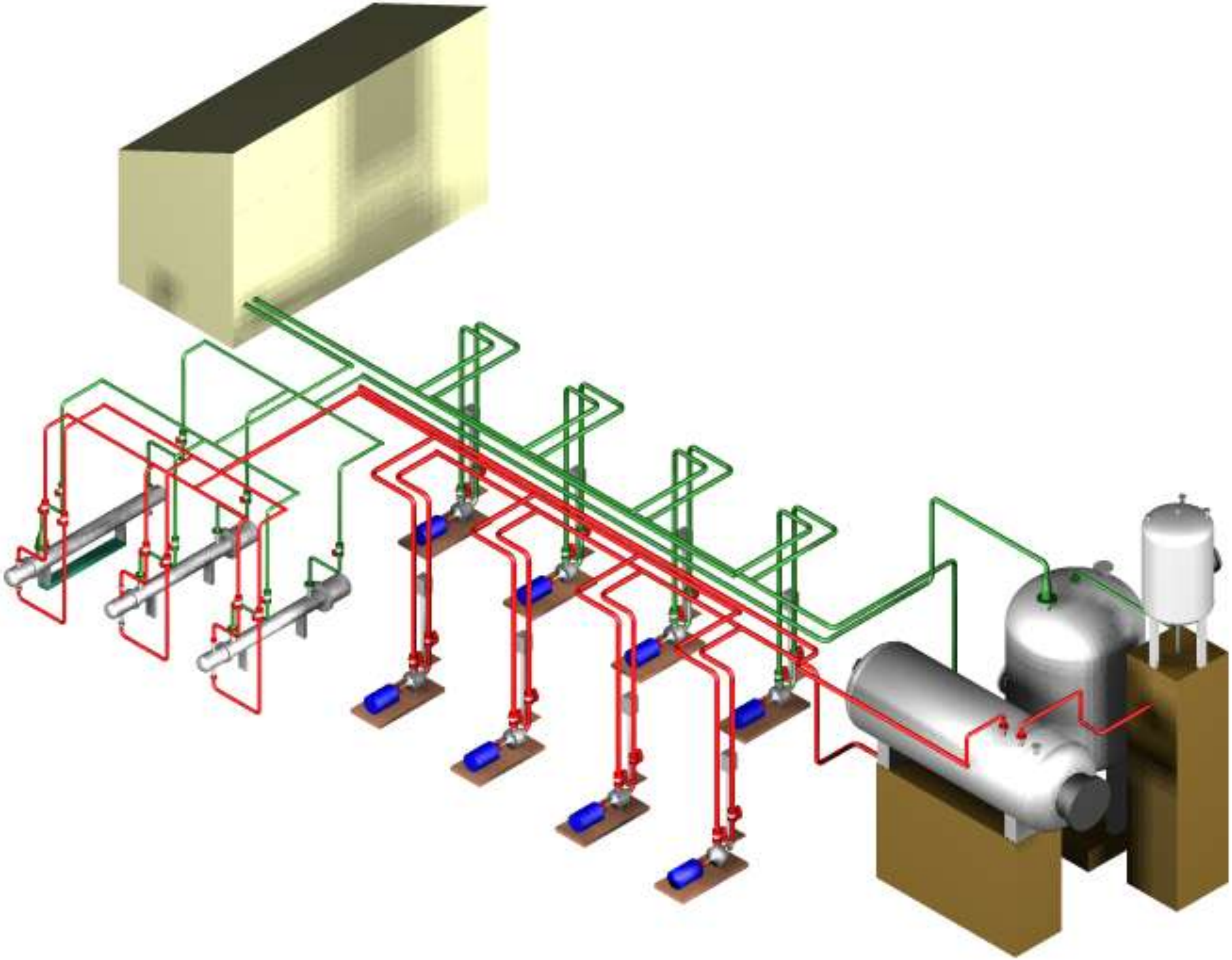
Together, such conventions constitute a visual language, and help to ensure that the drawing is unambiguous and relatively easy to understand

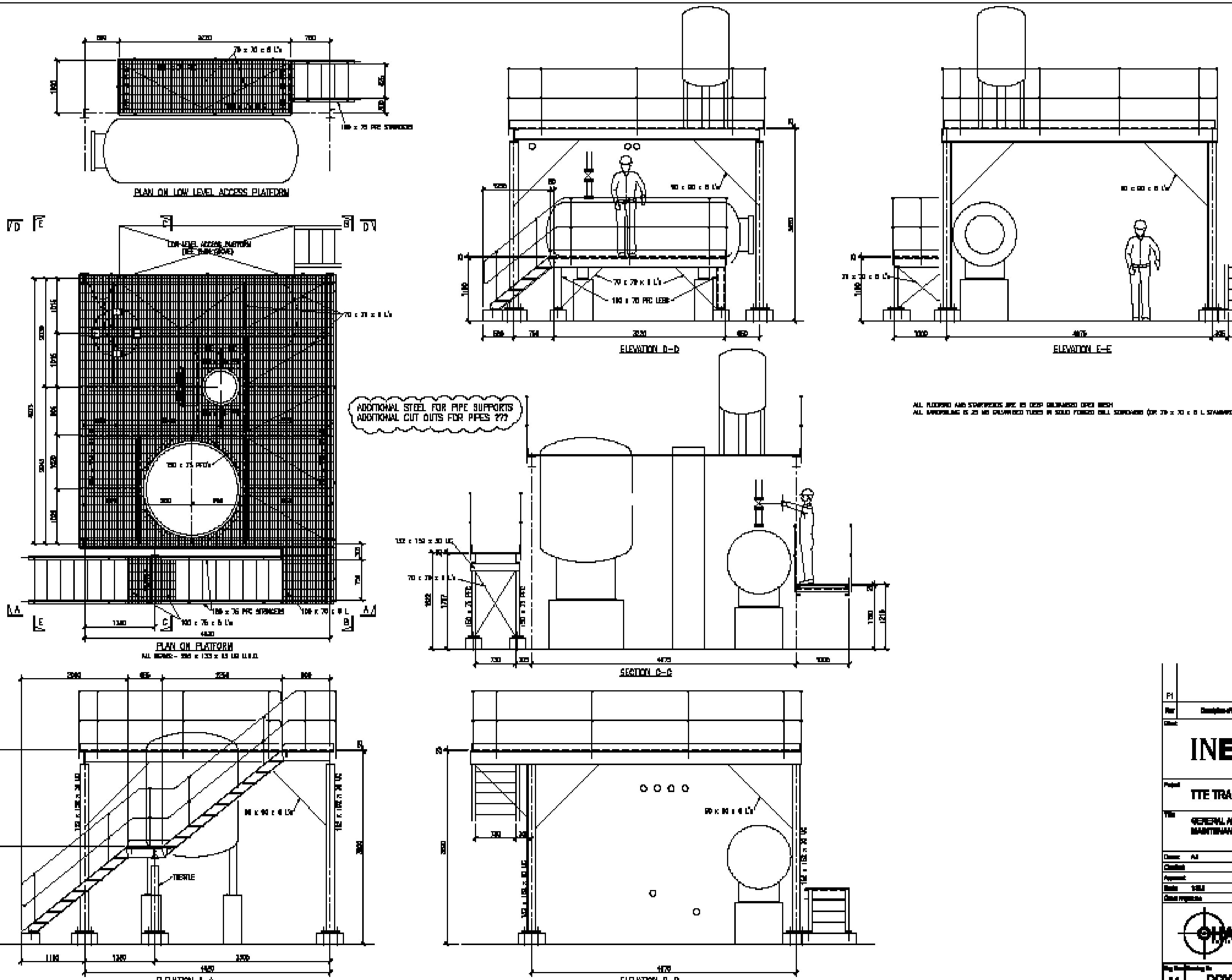


DO NOT SCALE

FINISH TO BS 1134 1.6 ALL OVER EXCEPT WHERE STATED THREADS TO BS 3643	TOLERANCE DIMENSIONAL ± 0.2 ANGULAR ± 2° UNLESS OTHERWISE STATED	MATERIAL STEEL TO BS 970 070M26	PROJECTION	DRAWN MAP DATE 86 06 17 CHECKED LD DATE 86 06 30	ORIGINAL SCALE 1:1	ALL DIMENSIONS IN mm CONNECTOR DRG NO. 2


DETAIL C
SEE DETAIL C
DETAIL B
SEE DETAIL B
SECTION A-A
LEAK TIGHT
FROM MTVT2V5
TO MTVT2V5
LEVEL PROBE
NOTES:
3.) ALL WELDS AND BRAZE JOINTS ARE TO BE VACUUM LEAK TIGHT, AS SPECIFIED.
FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY
ACCELERATOR CRYOGENICS DEPARTMENT
TTF SUB-COOLER
MAIN ASSEMBLY
1650-ME-250556
A





F1

INEOS Chlor

TTE TRAINING

GENERAL ARRANGEMENT OF MAINTENANCE PLATFORM

O'HARE

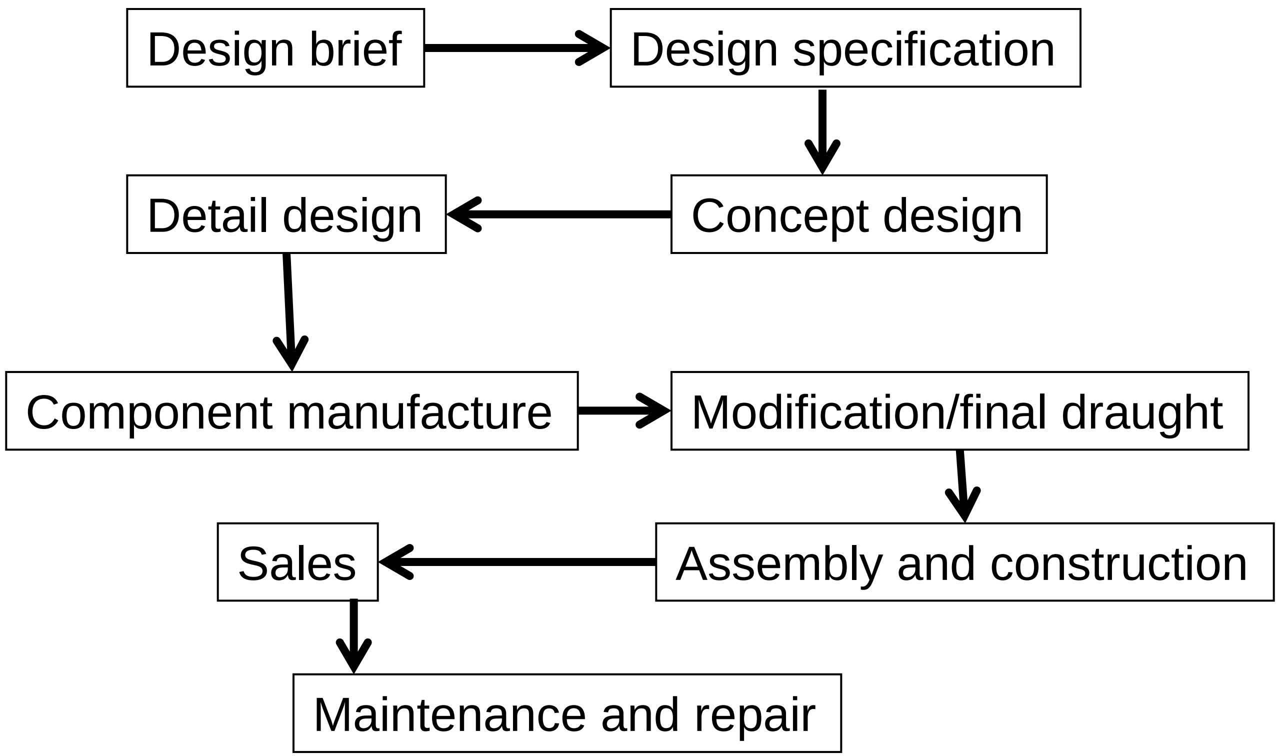
A1	PPX00060/3/63/00001
	F1

Design

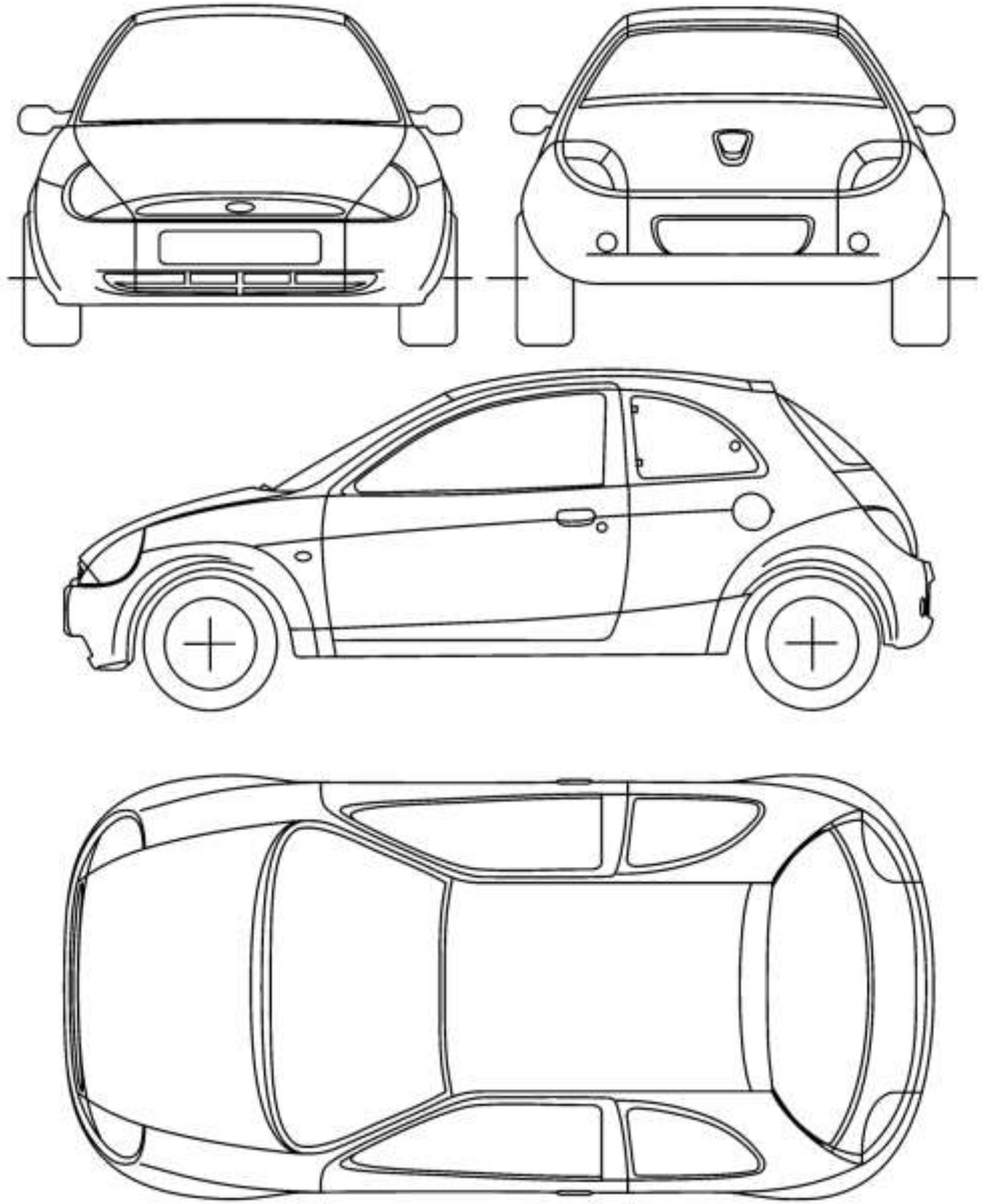
Design is the process by which the needs of the customer or the marketplace are transformed into a product satisfying these needs.

It is usually carried out a designer or engineer but requires help from other people in the company.

Design essentially is an exercise in problem solving. Typically, the design and manufacture of a new product consists of the following stages:




Ka



Design Standards

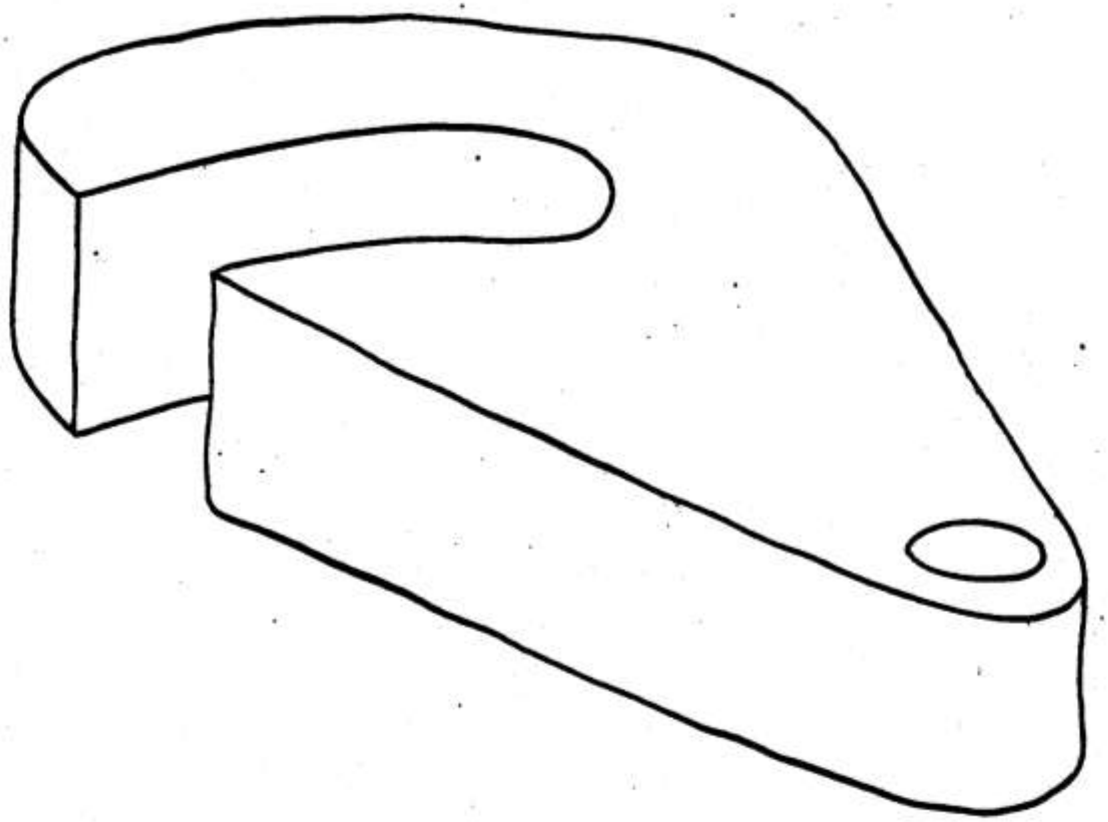
BS EN 8888:2004 Technical Product Documentation (TPD)
Specification for defining, specifying and graphically representing products

BS EN 8888 references standards covering all aspects of technical product documentation including:

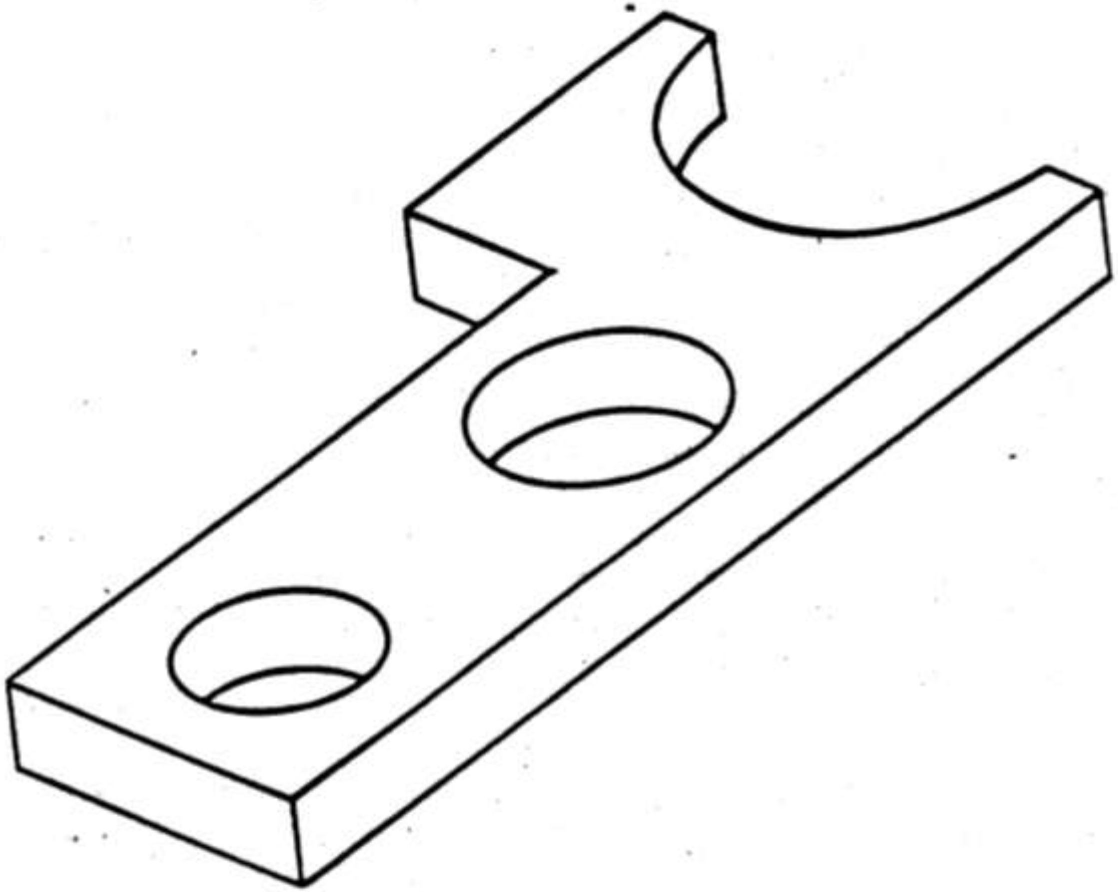
- Engineering Flow Diagrams,
- Representation of Engineering components,
- Lettering,
- Units/ quantities,
- Tolerancing,
- Geometric Product Specifications,
- Orthographic/Axometric representation,
- Handling of Computer based information
- Metrology etc. etc.

DRAWING TYPES

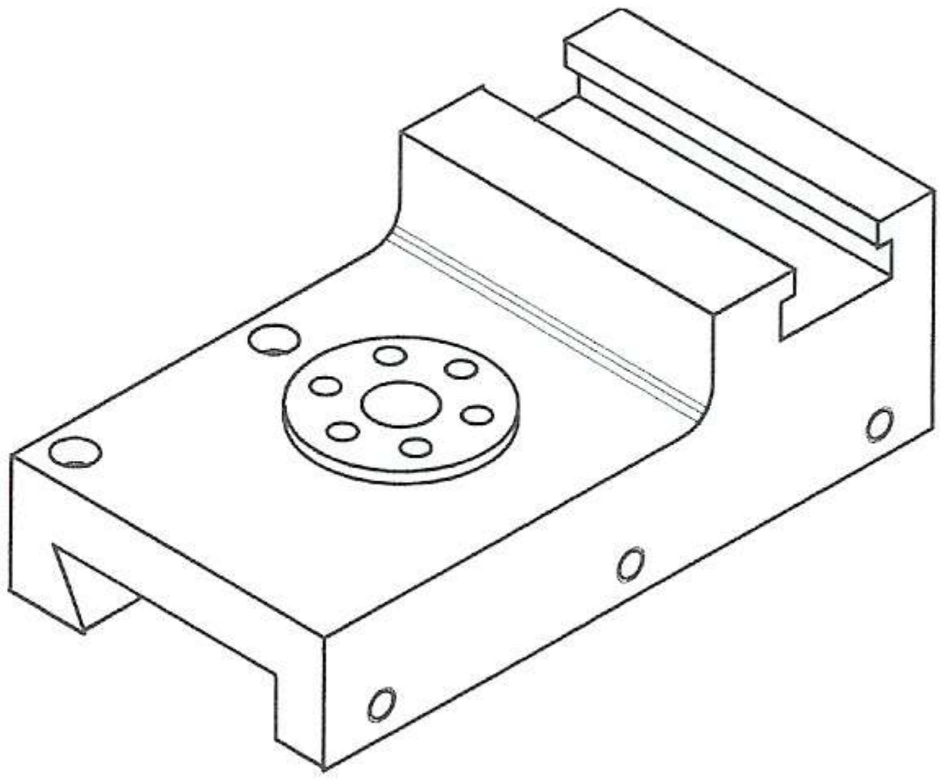
Freehand sketch



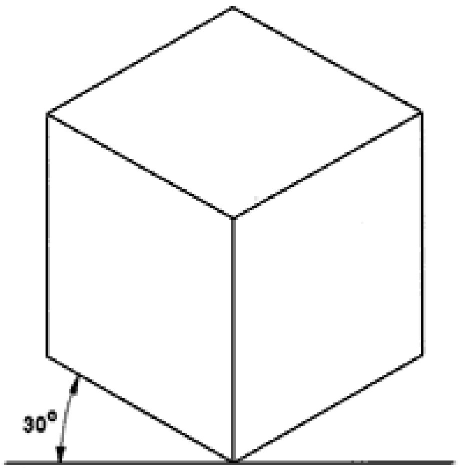
Pictoral sketch

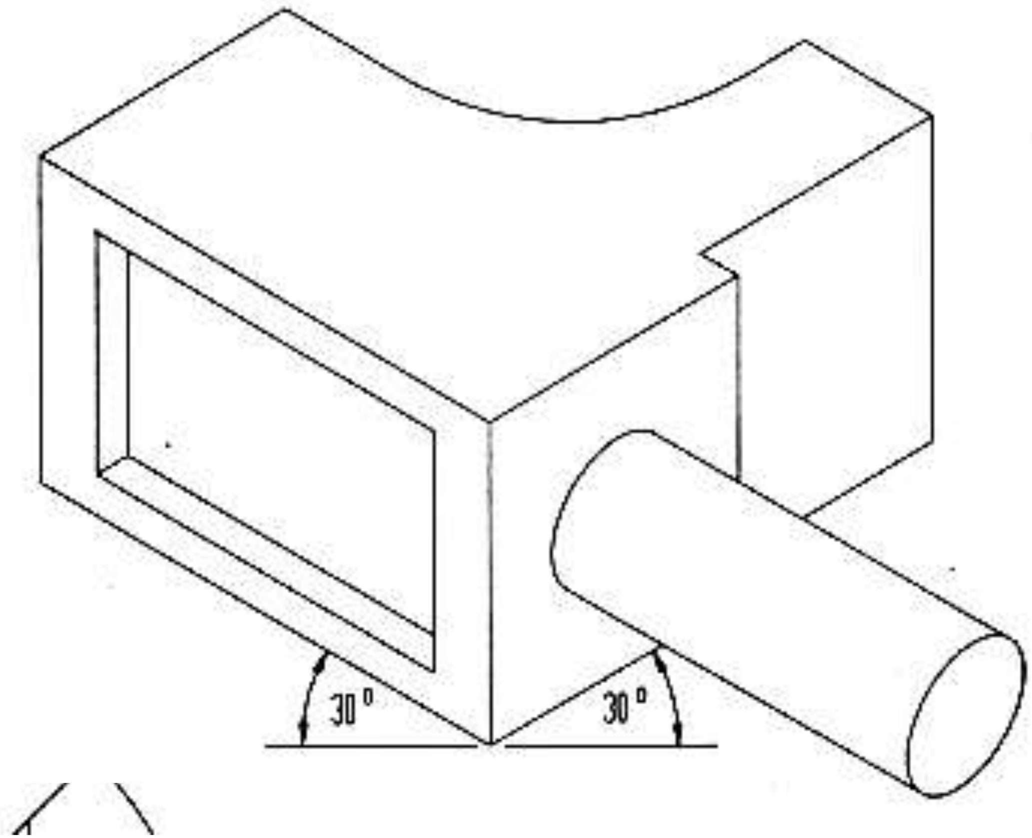


Pictoral Drawing - Isometric

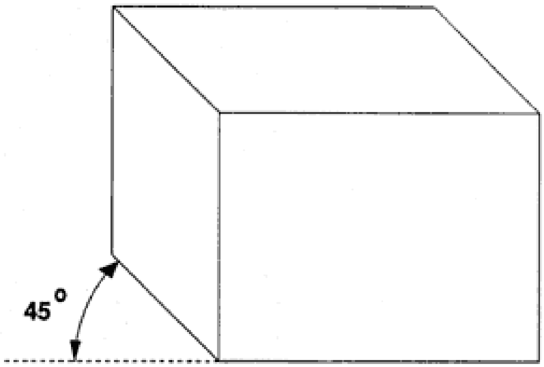


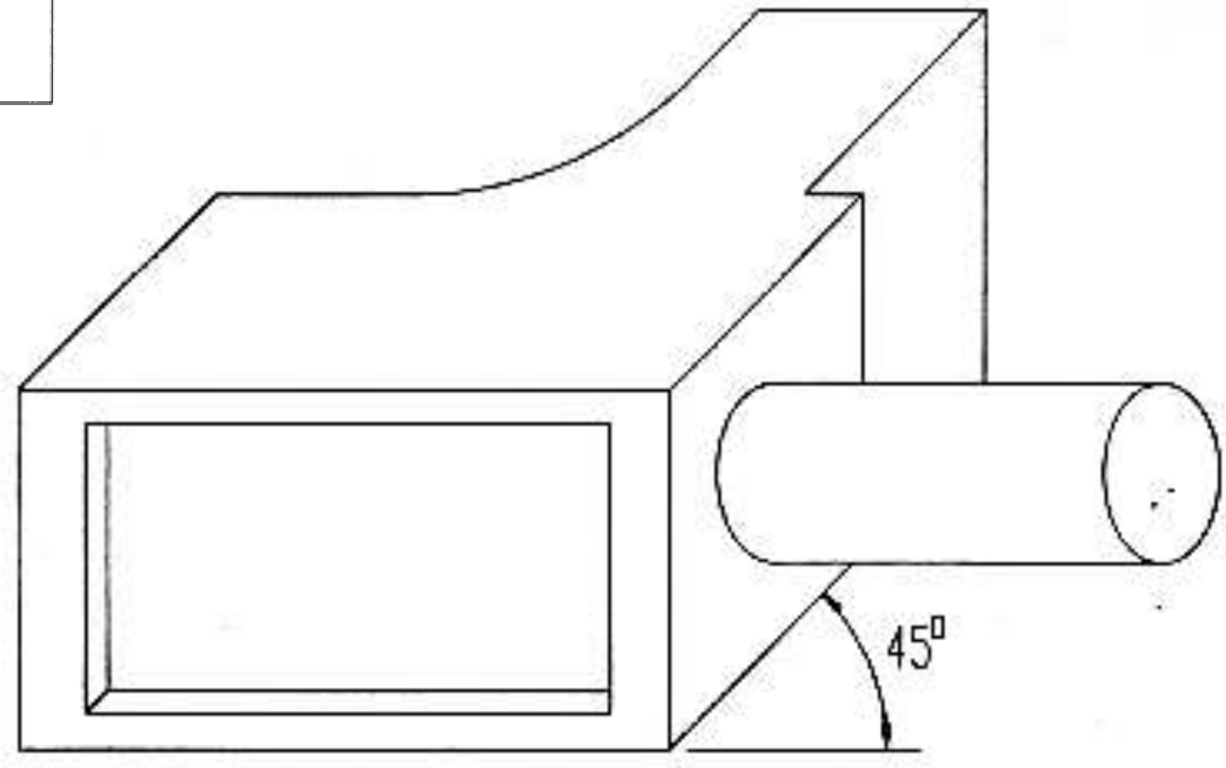
Pictoral Drawing - Isometric





Pictoral Drawing – Oblique



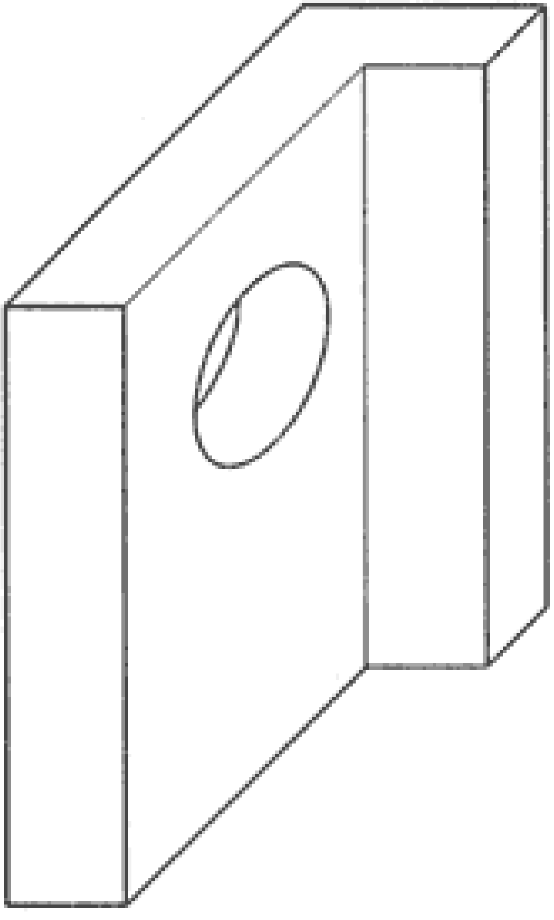


Pictoral Drawing – Oblique

Oblique with no 'foreshortening'

This view is drawn at full size. Notice how circle looks elongated

This is called “Oblique Cavalier”



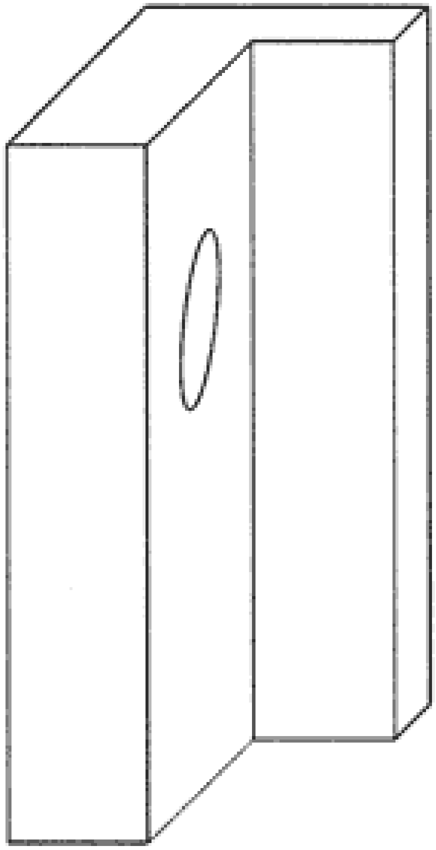
Pictoral Drawing – Oblique

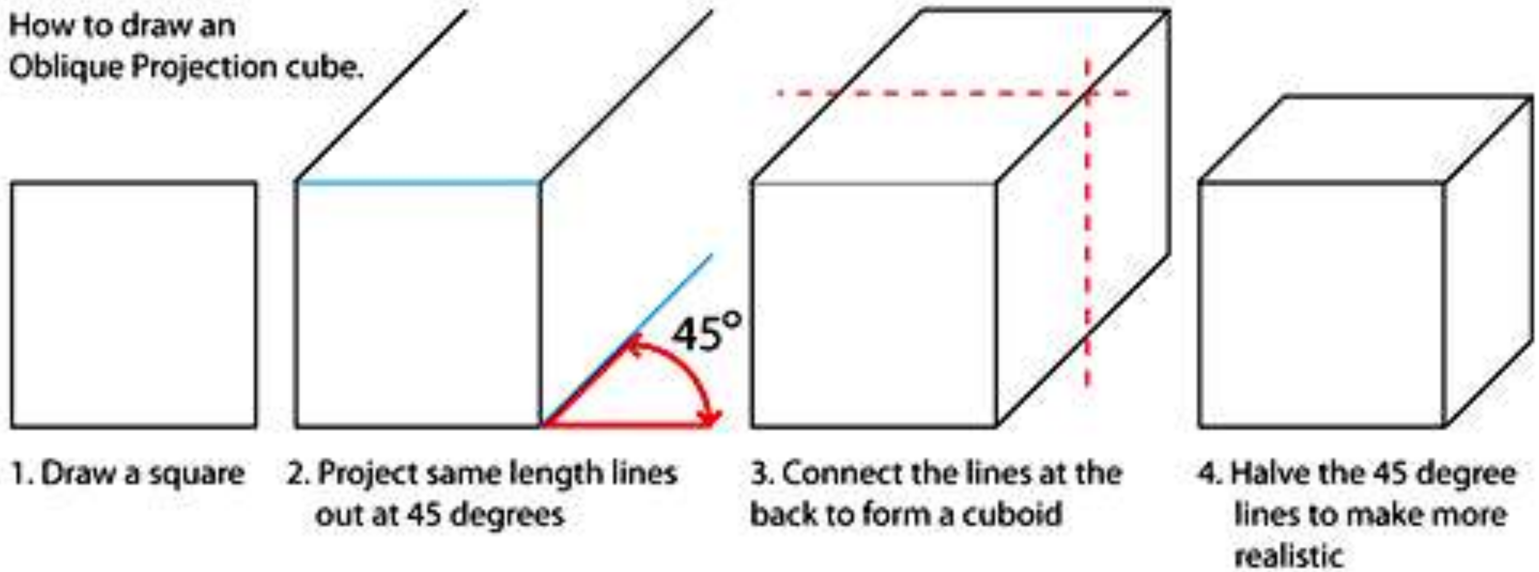
Oblique with 'foreshortening'

The side views are drawn in at a 45 degree angle. Standard practice is to 'foreshorten' the side views to provide a more convincing view of an object.

To foreshorten the side views, the objects side measurements are halved.

In this case, the sides are 50 mm long, but they have been drawn in at 25 mm.

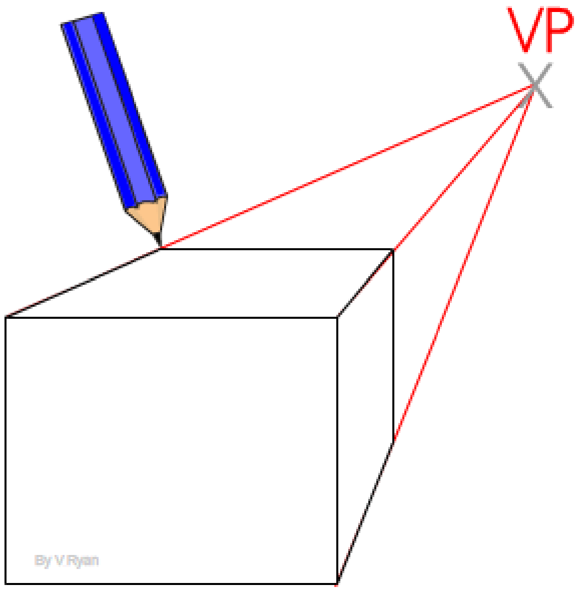



How to draw an
Oblique Projection cube.
45°
1. Draw a square
2. Project same length lines out at 45 degrees
3. Connect the lines at the back to form a cuboid
4. Halve the 45 degree lines to make more realistic

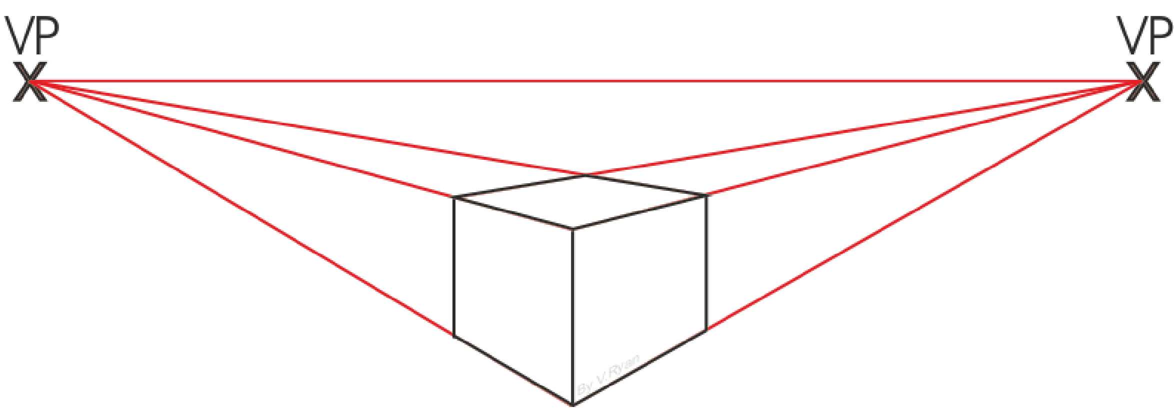
Perspective Drawings

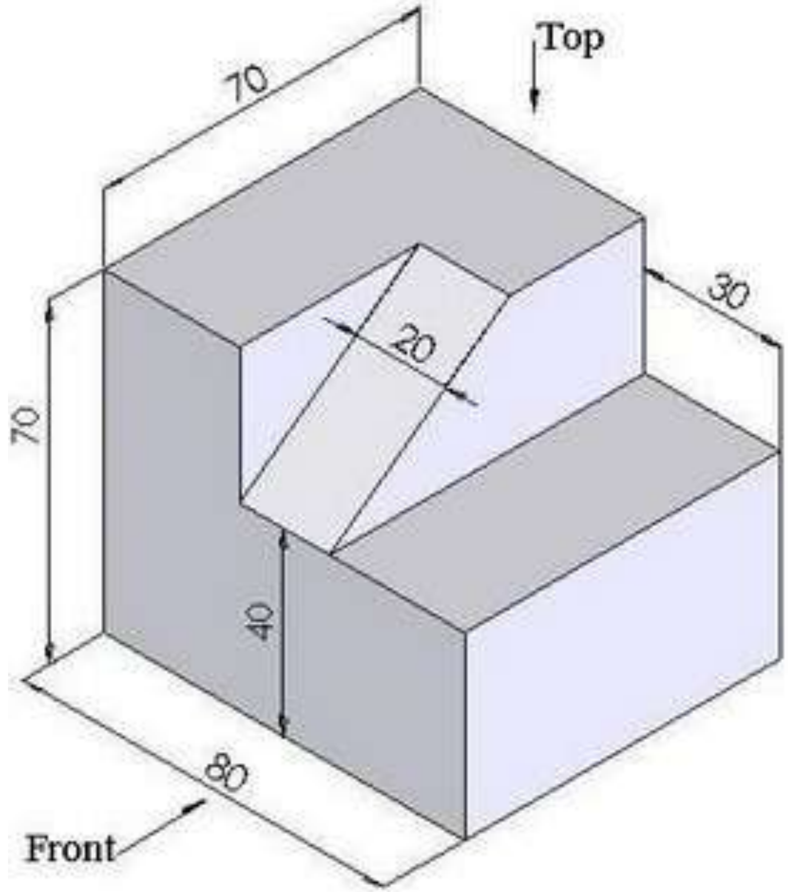
Using perspective, parallel lines converge to a point or points somewhere in the distance. This point is called the vanishing point (VP). This gives objects an impression of depth.

When drawing using one point perspective all objects vanish to one common point somewhere on the horizon.

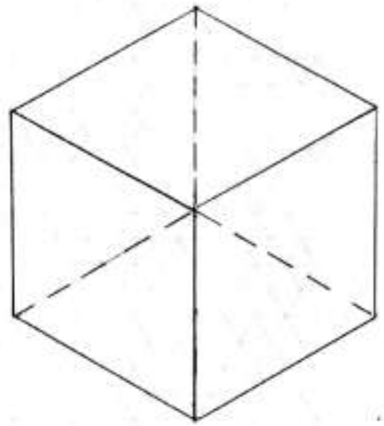


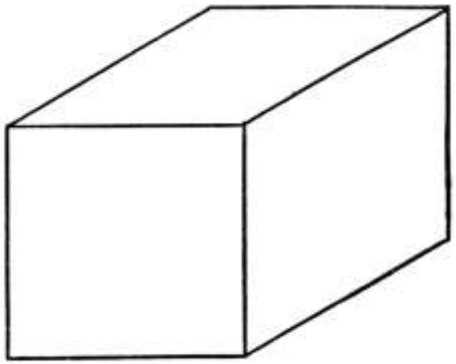
When drawing using two point perspective all objects vanish to two common points somewhere on the horizon.

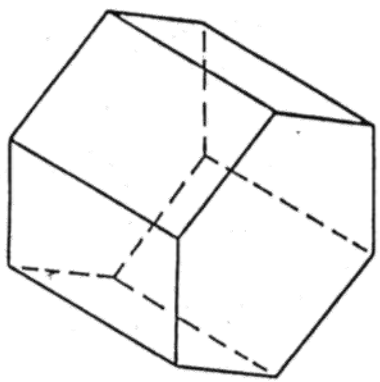


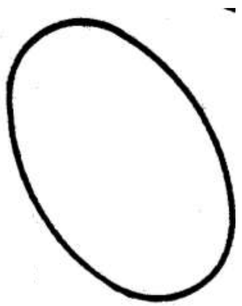


70
Top
30
20
70
40
80
Front



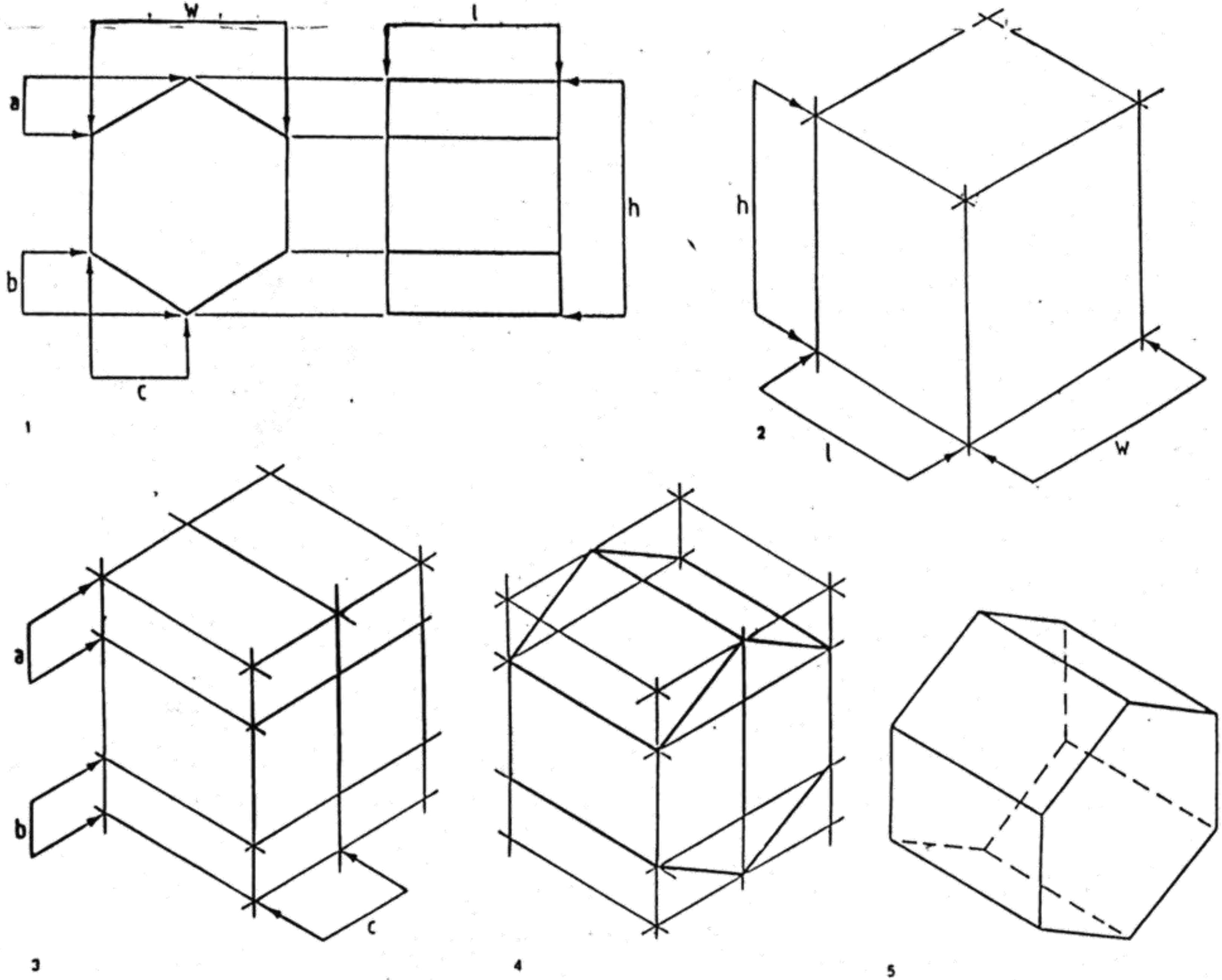




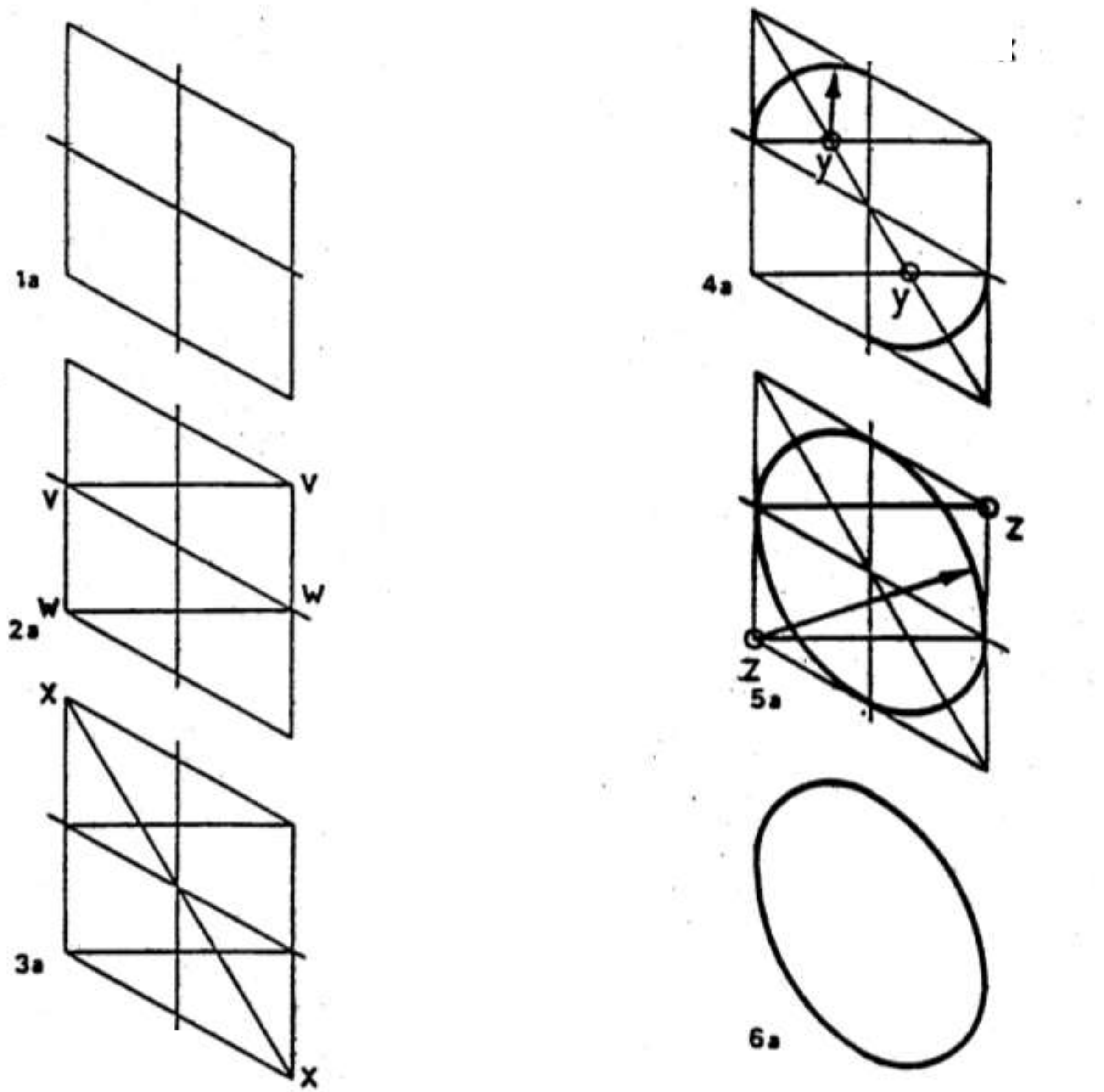


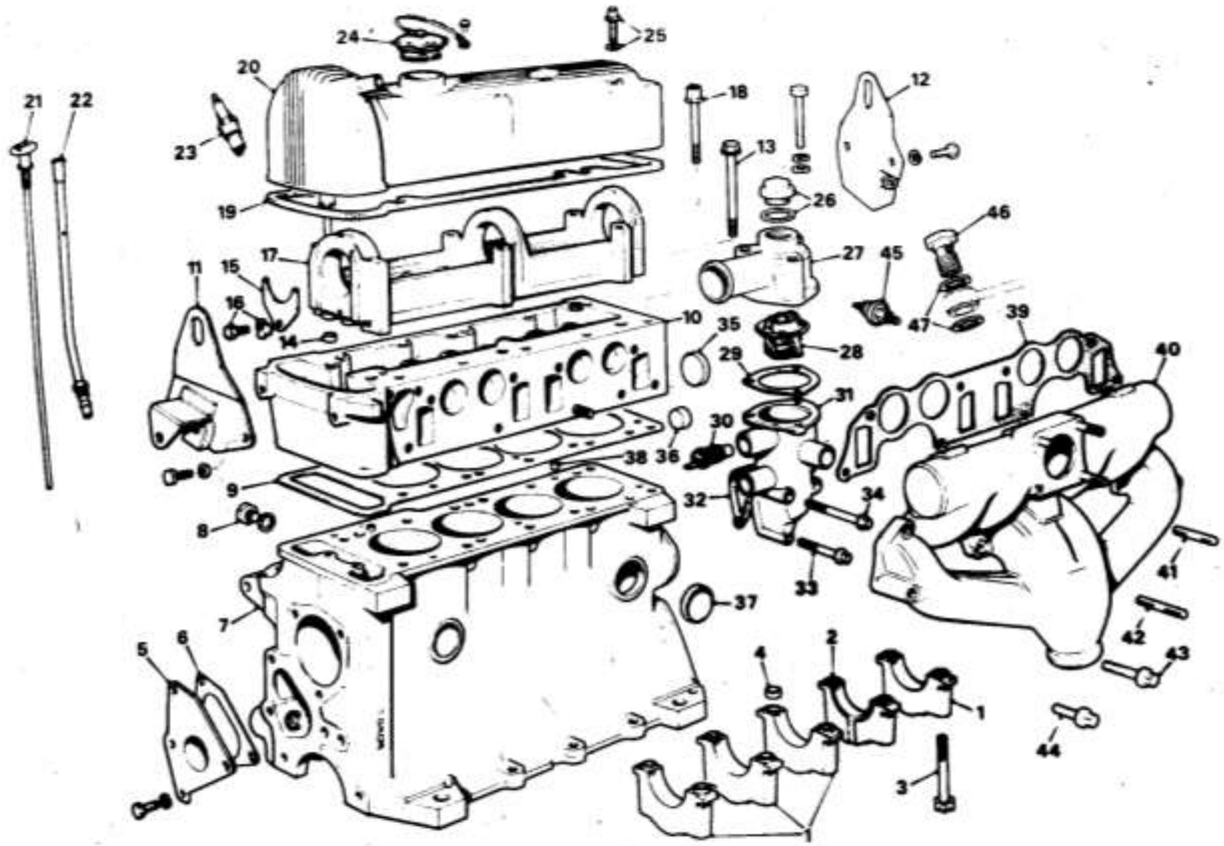
TITLE OF DRAWING
DATE GRP NO
NAME

w = 38
l = 40
h = 46
a = 12
b = 12
c = 19



Isometric circle 50mm dia





KEY TO THE ENGINE EXTERNAL COMPONENTS

No. Description

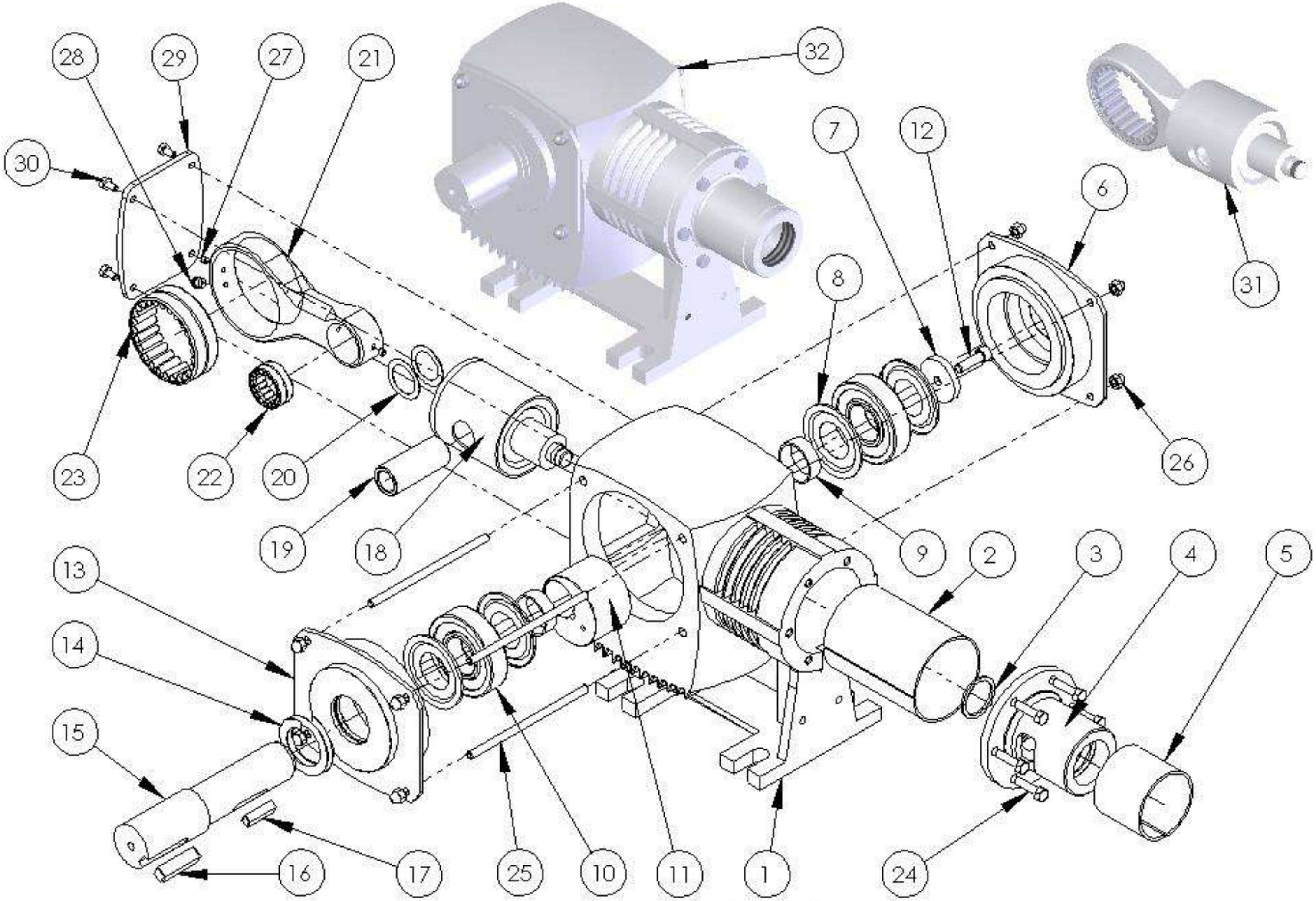
1. Main bearing caps
2. No. 4 thrust-main bearing cap
3. Set screw for main bearing cap
4. Ring dowel for main bearing cap
5. Engine front cover
6. Gasket for front cover
7. Cylinder block
8. Cylinder block drain plug and sealing washer
9. Gasket for cylinder head
10. Cylinder head
11. Engine lifting bracket-front
12. Engine lifting bracket-rear
13. Set screw for cylinder head
14. Ring dowel for camshaft carrier
15. Locating plate for camshaft
16. Set screw and lock washer

No. Description

17. Camshaft carrier
18. Set screw-carrier to cylinder head
19. Gasket for cover
20. Cylinder head cover
21. Oil dipstick
22. Oil dipstick tube
23. Sparking plug
24. Oil filler cap
25. Set screw and 'O' ring seal-cover to cylinder head
26. Filler plug and 'O' ring seal
27. Water outlet pipe
28. Thermostat
29. Gasket for water outlet pipe
30. Thermal transmitter
31. Thermostat housing

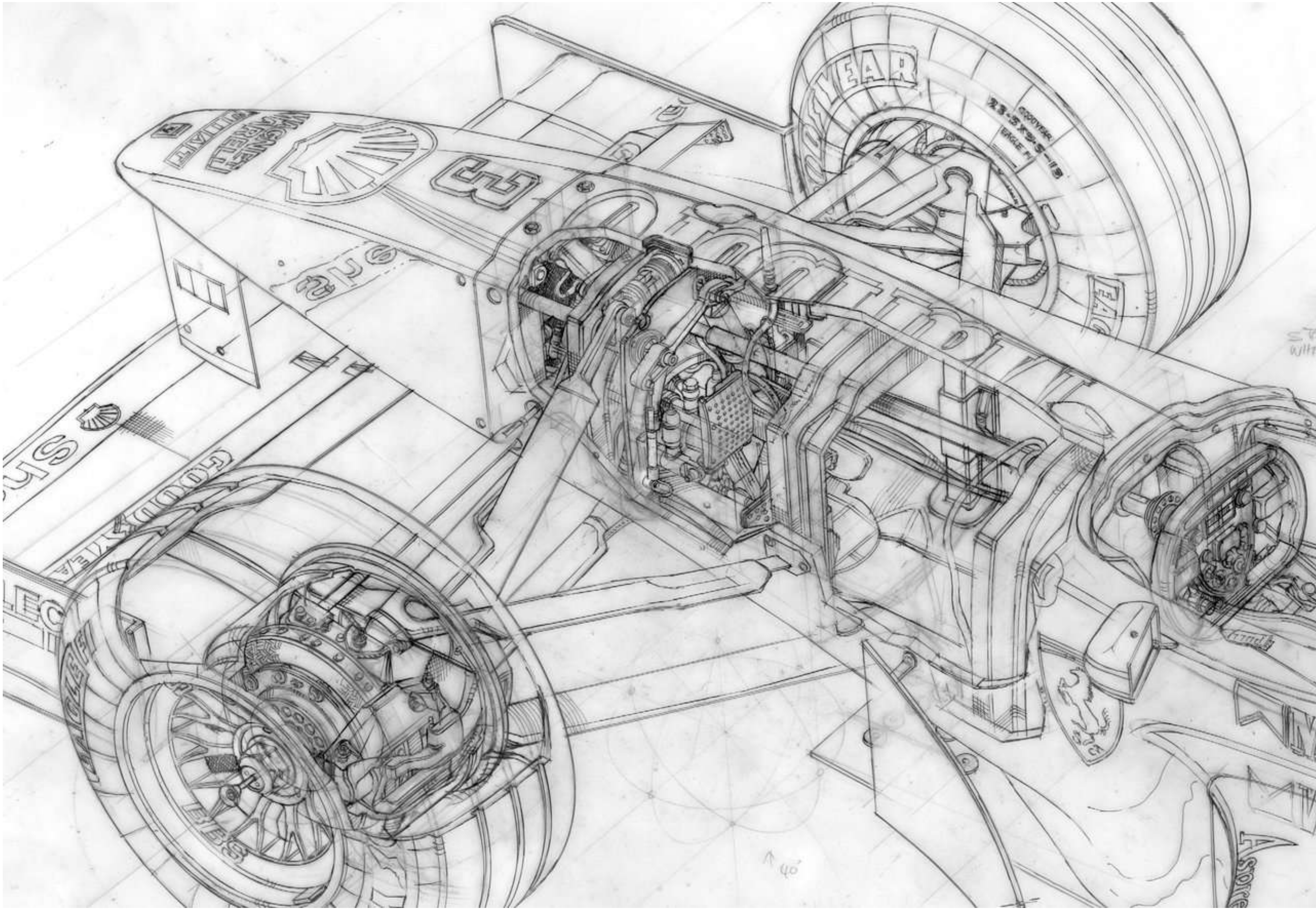
No. Description

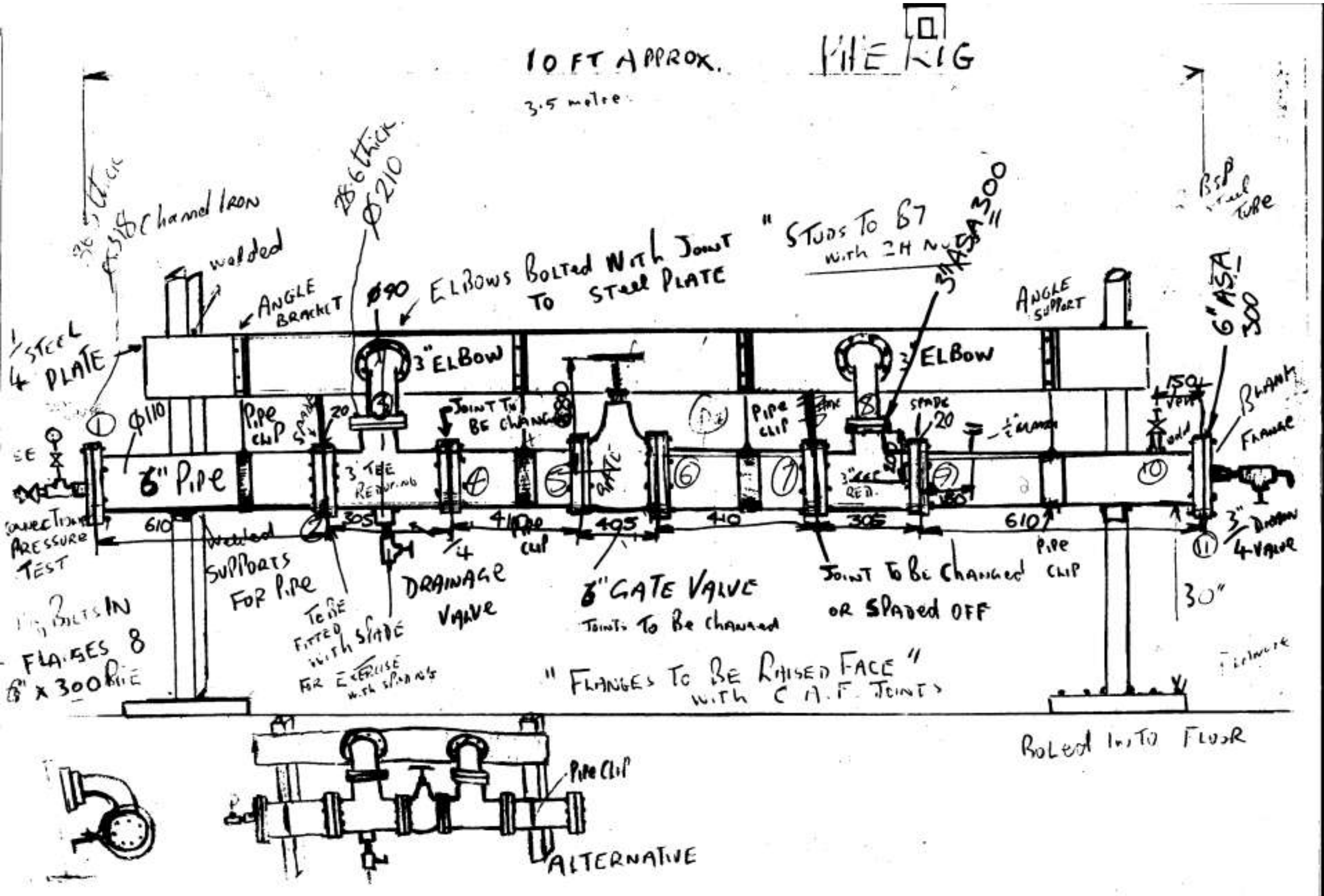
32. Gasket for thermostat housing
33. Short set screw for thermostat housing
34. Long set screw for thermostat housing
35. Core plug for cylinder head
36. Plug for main oil gallery
37. Core plug for cylinder block
38. Dowel for cylinder head
39. Gasket for inlet and exhaust manifold
40. Inlet and exhaust manifold
41. Short stud-carburettor to manifold
42. Long stud-manifold to cylinder head
43. Long set screw
44. Short set screw
45. Oil pressure switch
46. Screw for brake servo banjo union
47. Washers for banjo union



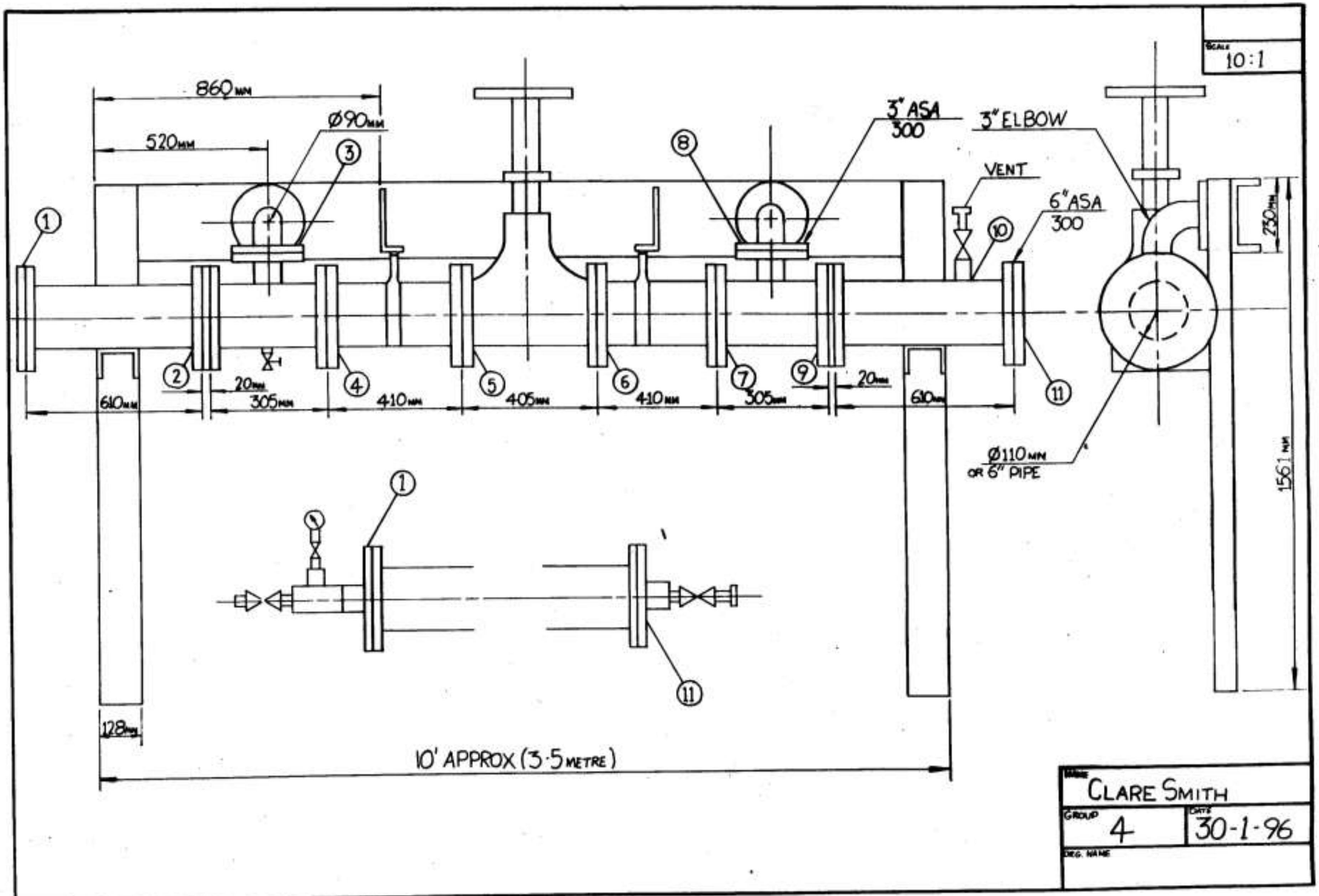
CR10029 CR100 POWER END

CRYOGENIC AND INDUSTRIAL SPARES LIMITED
TEL:+44(0)1493 732700 FAX:+44(0)1493 733277
E-mail: cryoind@btconnect.com
Web: www.cryogenicind.com

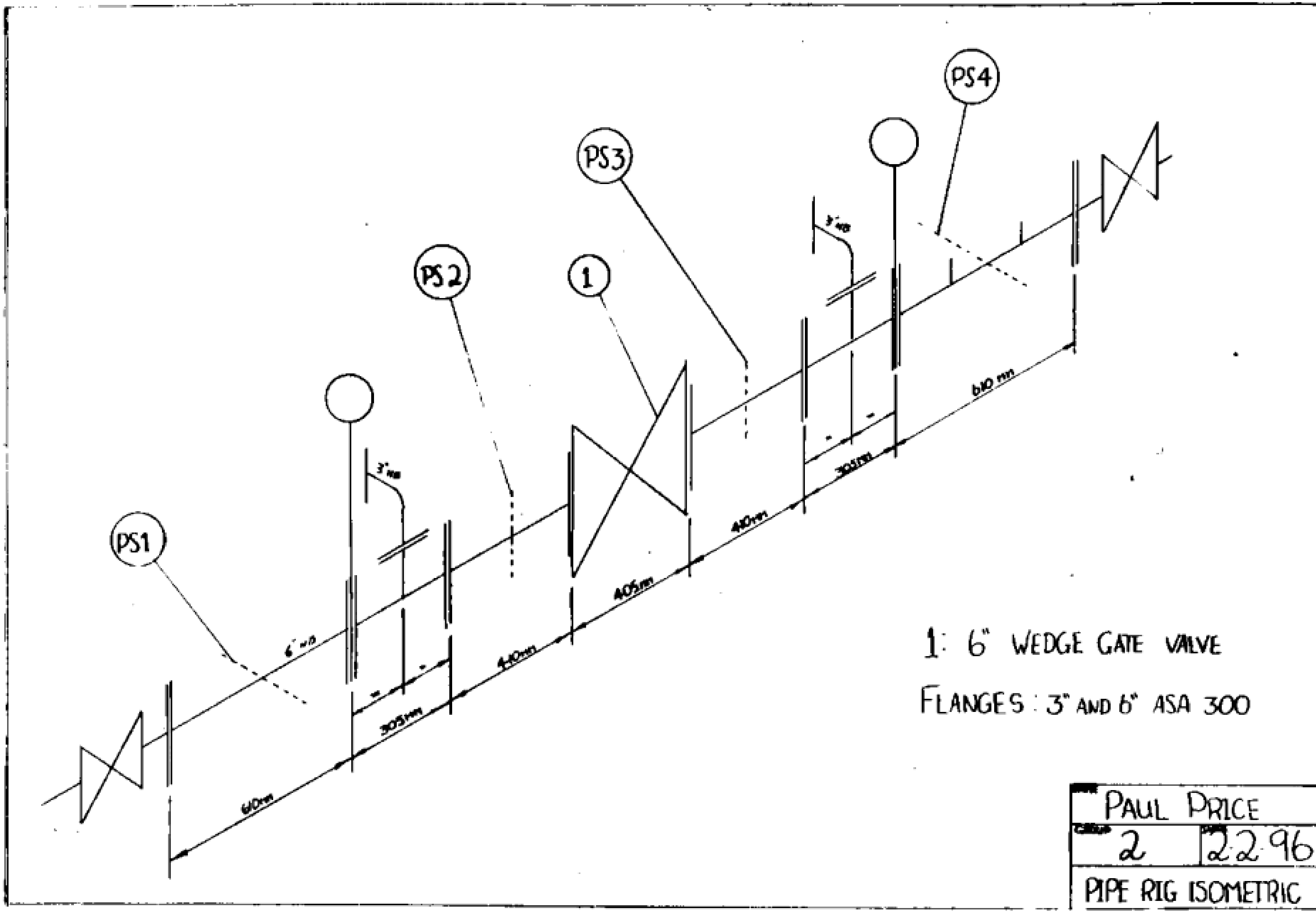

YEAR

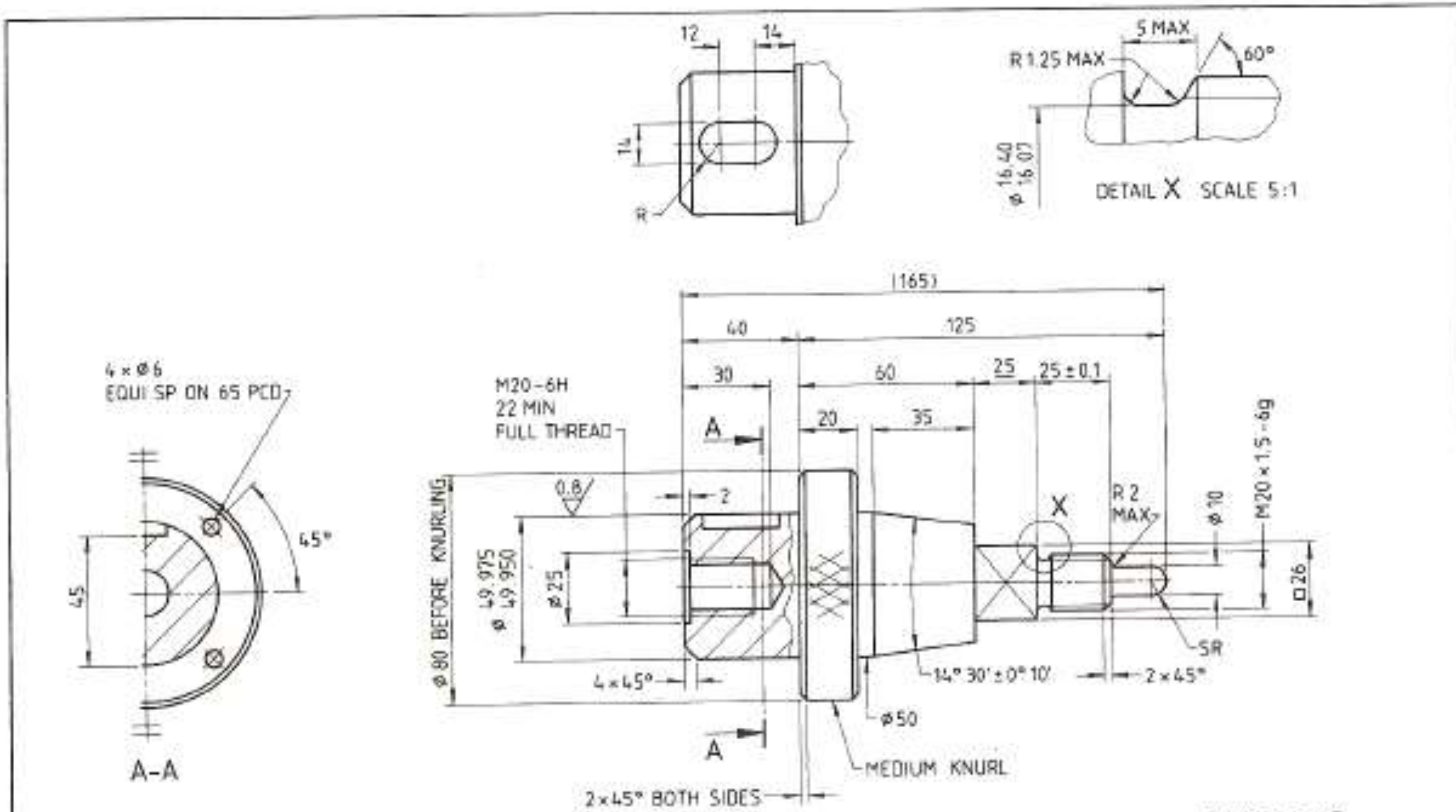


DIG FOR [illegible] BREAKING FLANGES



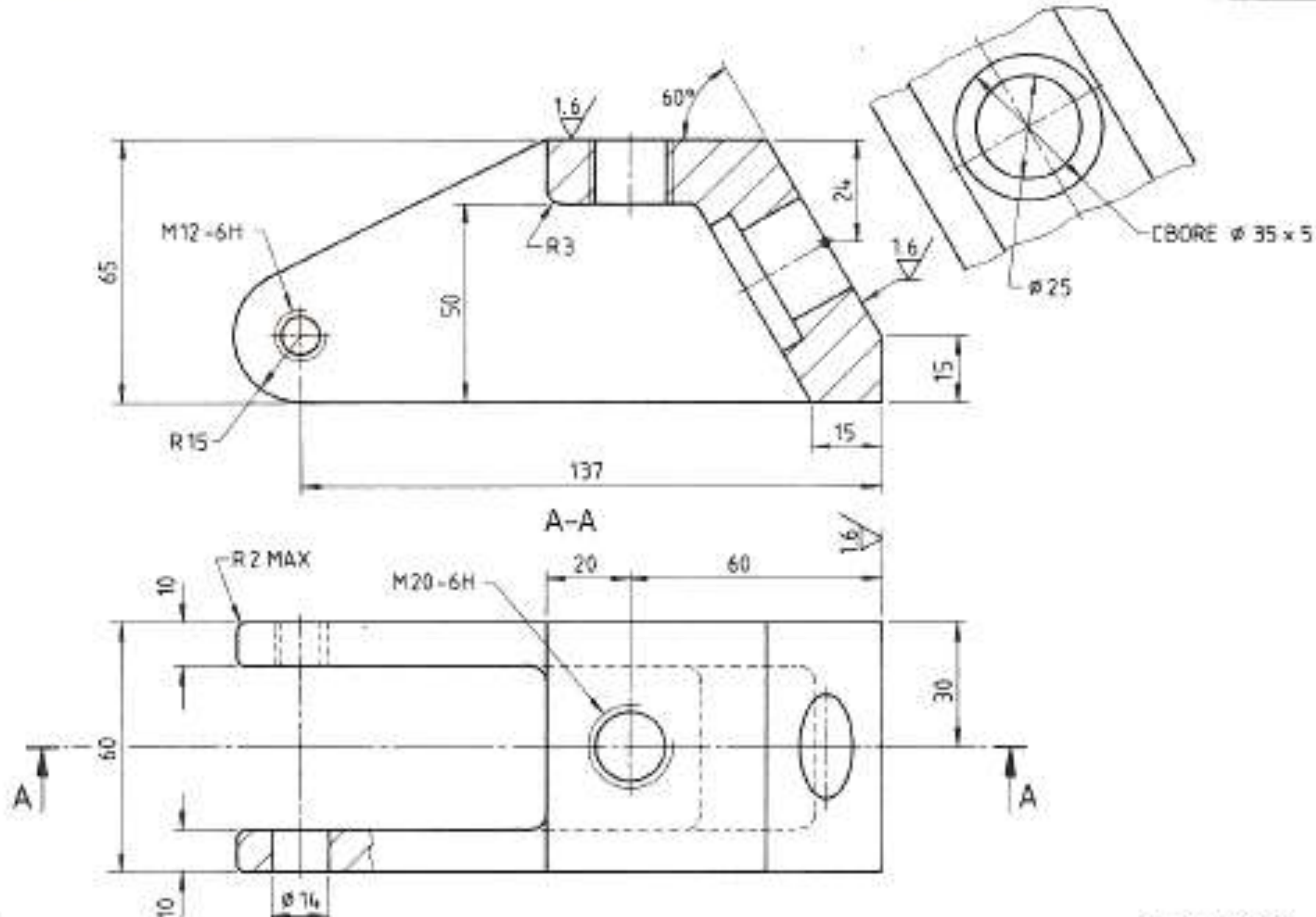
860MM
520MM
Ø90MM
3" ASA 300
3" ELBOW
VENT
6" ASA 300
230MM
1561 MM
Ø110 MM OR 6" PIPE
1
2
3
4
5
6
7
8
9
10
11
20MM
610MM
305MM
410MM
405MM
410MM
305MM
20MM
610MM
128MM
10' APPROX (3·5 METRE)
SCALE 10:1
NAME CLARE SMITH
GROUP 4
DATE 30-1-96
DRG. NAME


PS1
PS2
PS3
PS4
1
610mm
305mm
410mm
405mm
410mm
305mm
610 mm
1: 6" WEDGE GATE VALVE
FLANGES: 3" AND 6" ASA 300
PAUL PRICE
2
2.2.96
PIPE RIG ISOMETRIC



DO NOT SCALE

FINISH TO BS 1134 1.6 ▽ ALL OVER EXCEPT WHERE STATED THREADS TO BS 3643	TOLERANCE DIMENSIONAL ± 0.2 ANGULAR ± 2° UNLESS OTHERWISE STATED	MATERIAL STEEL TO BS 970 070 M26	PROJECTION	DRAWN MAP DATE 86 06 17 CHECKED LD DATE 86 06 30	ORIGINAL SCALE 1:1	ALL DIMENSIONS IN mm CONNECTOR	DRG NO. 2



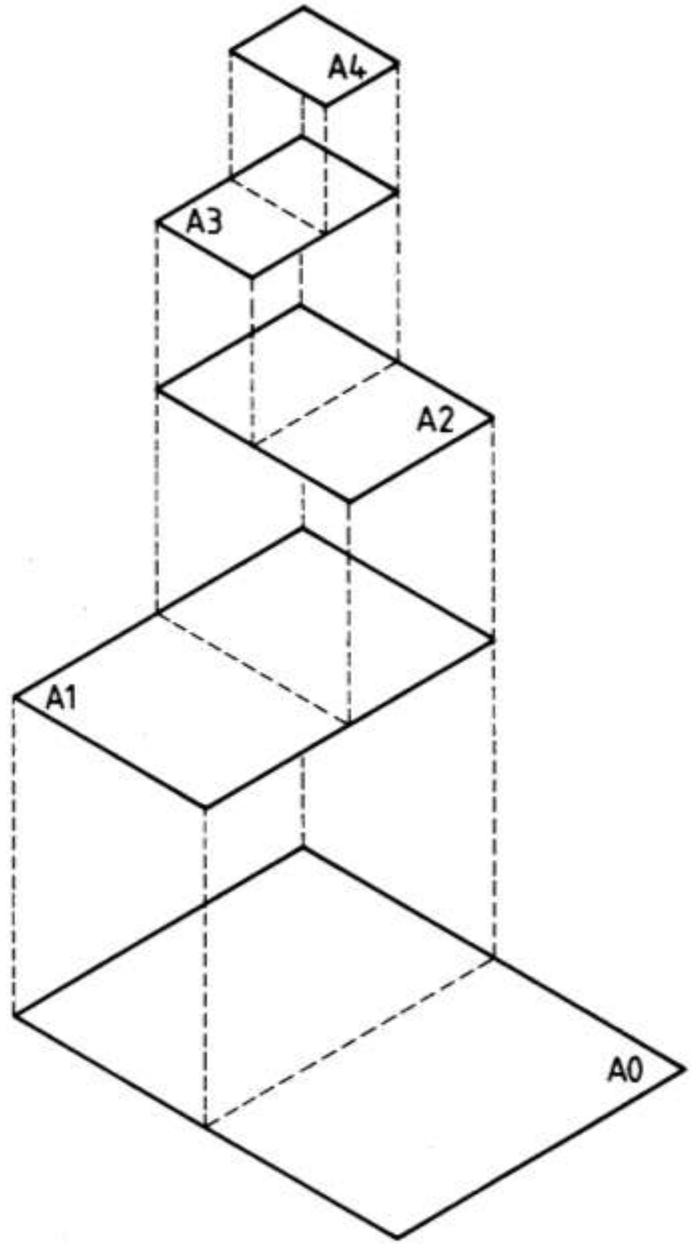
FILLET RADII R3 MIN

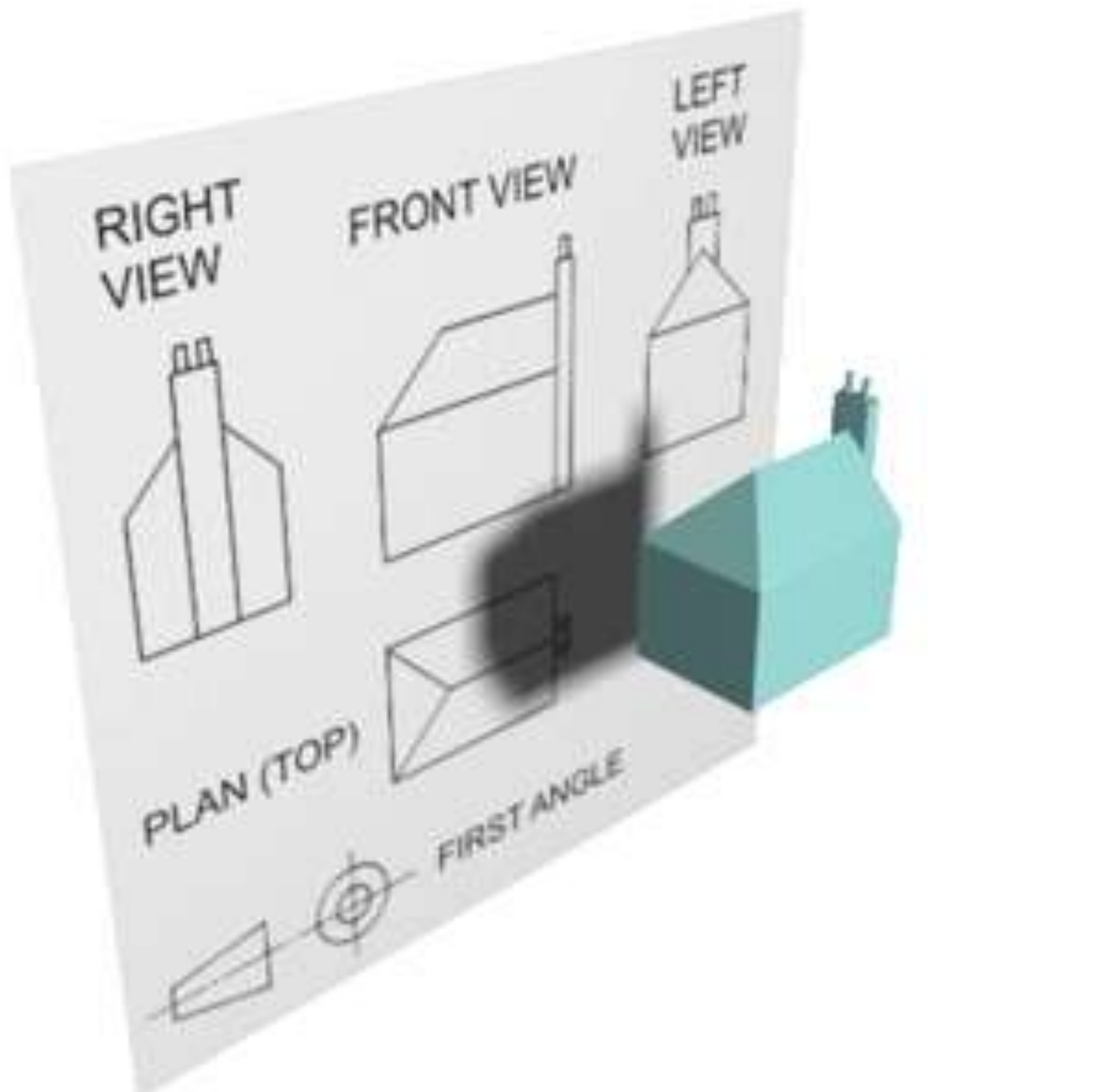
DO NOT SCALE

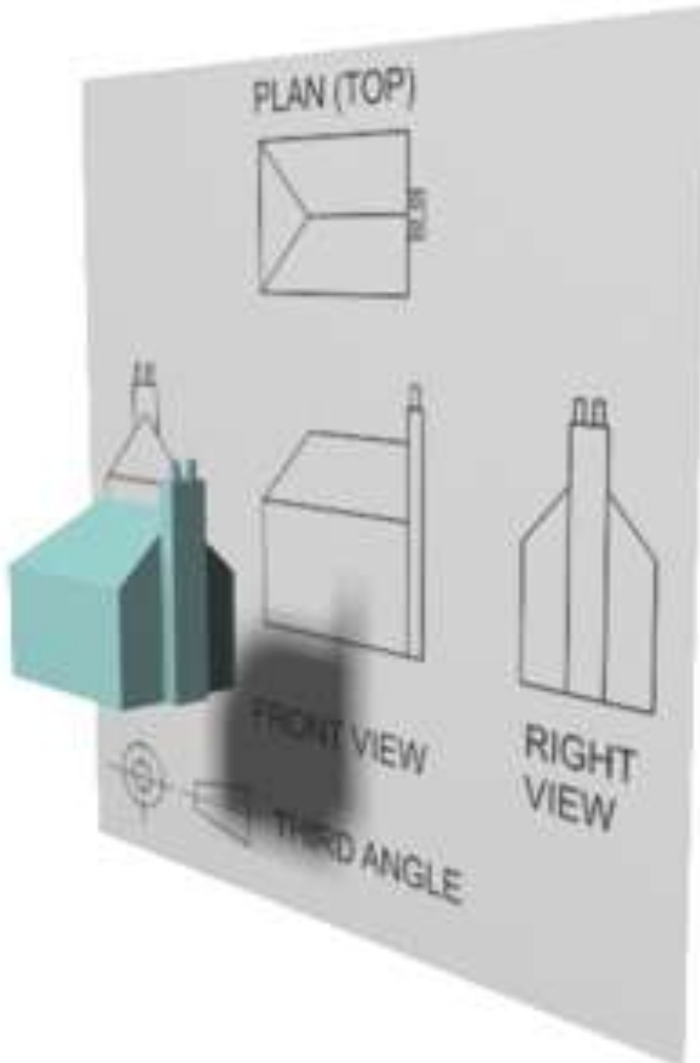
FINISH	TOLERANCE	MATERIAL	PROJECTION	DRAWN MAP	ORIGINAL	ALL DIMENSIONS IN mm	
AS CAST OR TO BS 1134	CAST DIMS ± 1.5	MALLEABLE IRON		DATE 86 06 10	SCALE	SWIVEL BRACKET	DRG NO.
WHERE STATED	MACHINED DIMS ± 0.2	TO BS 310		CHECKED RJW	1:2		1
THREADS TO BS 3643	ANGULAR DIMS ± 0° 30'			DATE 86 06 27			

A4 = 210 mm × 297 mm
A3 = 297 mm × 420 mm
A2 = 420 mm × 594 mm
A1 = 594 mm × 841 mm
A0 = 841 mm × 1189 mm
The sides of all sheets are in the ratio 1 : √2

A0 is nominally one square metre in area and forms the basis of the series

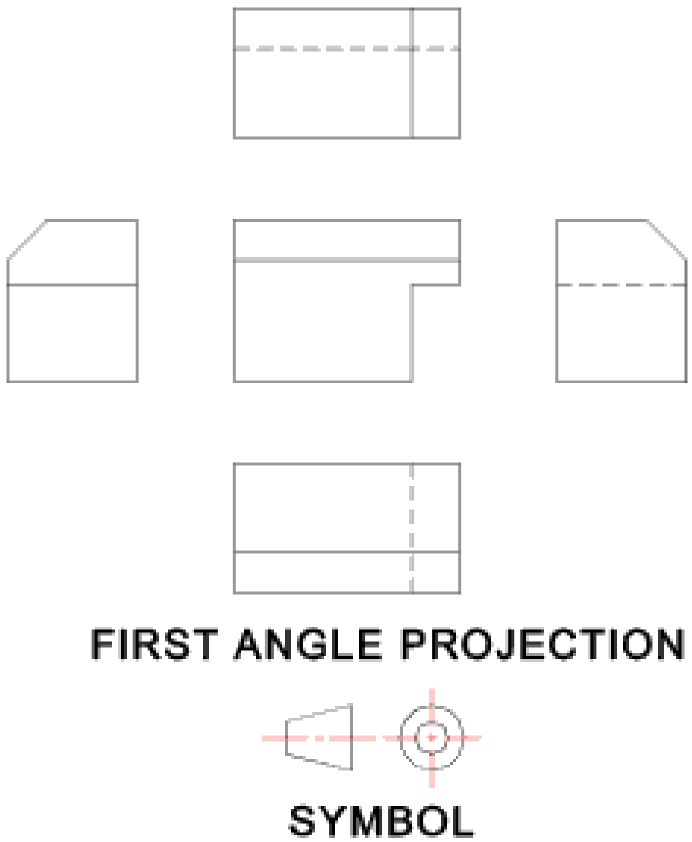


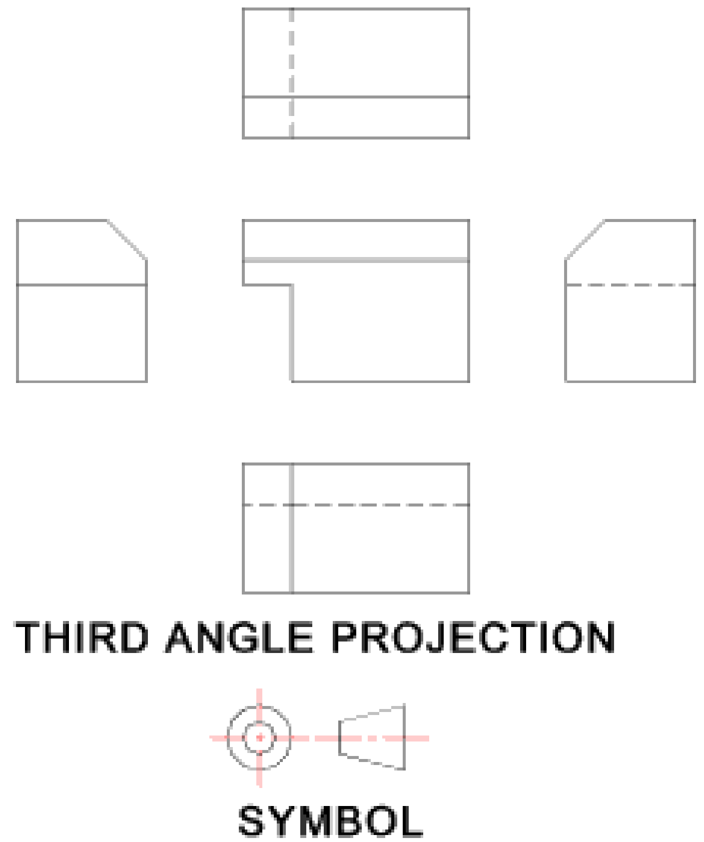

RIGHT VIEW
FRONT VIEW
LEFT VIEW
PLAN (TOP)
FIRST ANGLE

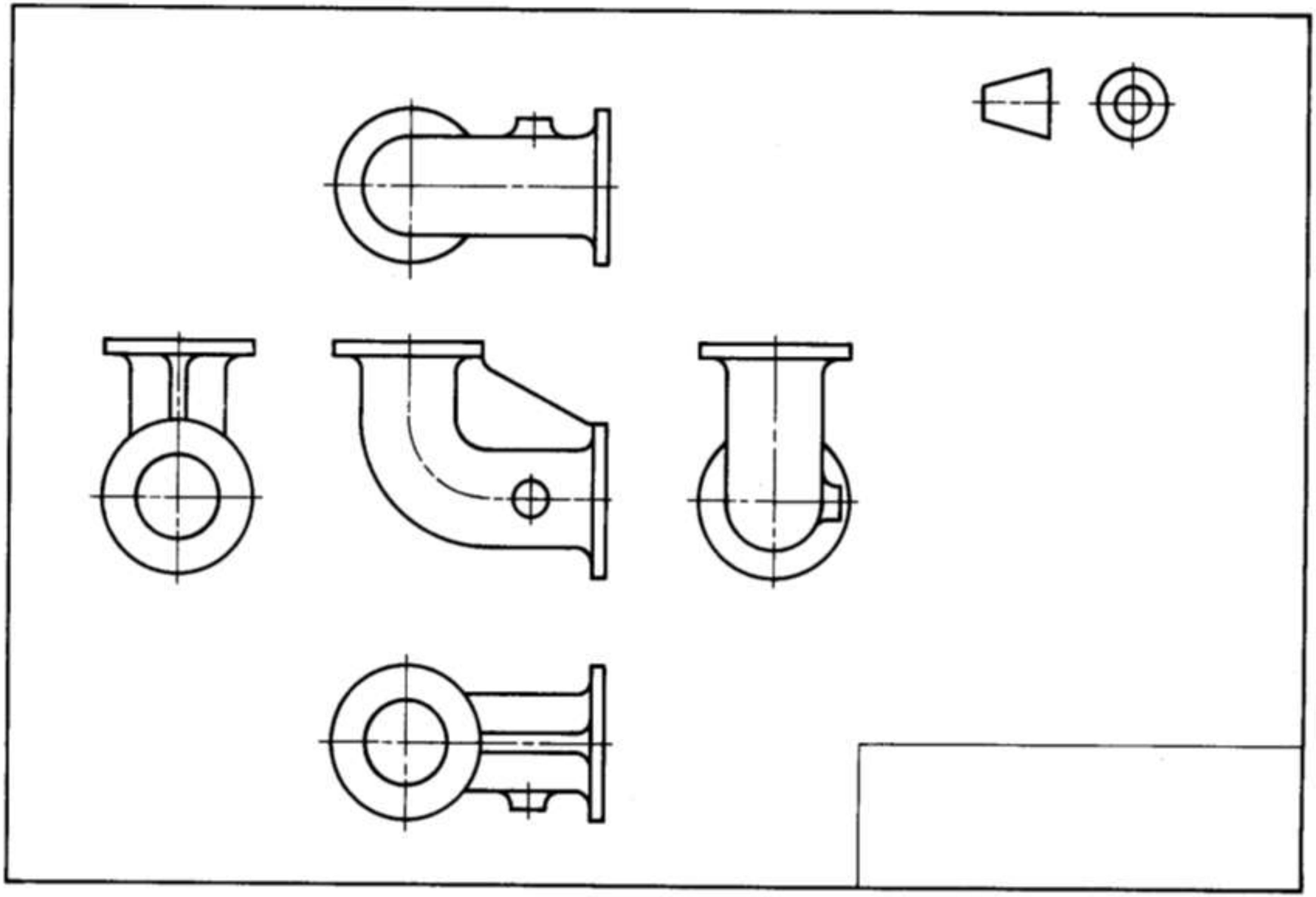

PLAN (TOP)
FRONT VIEW
RIGHT VIEW
THIRD ANGLE

Projections

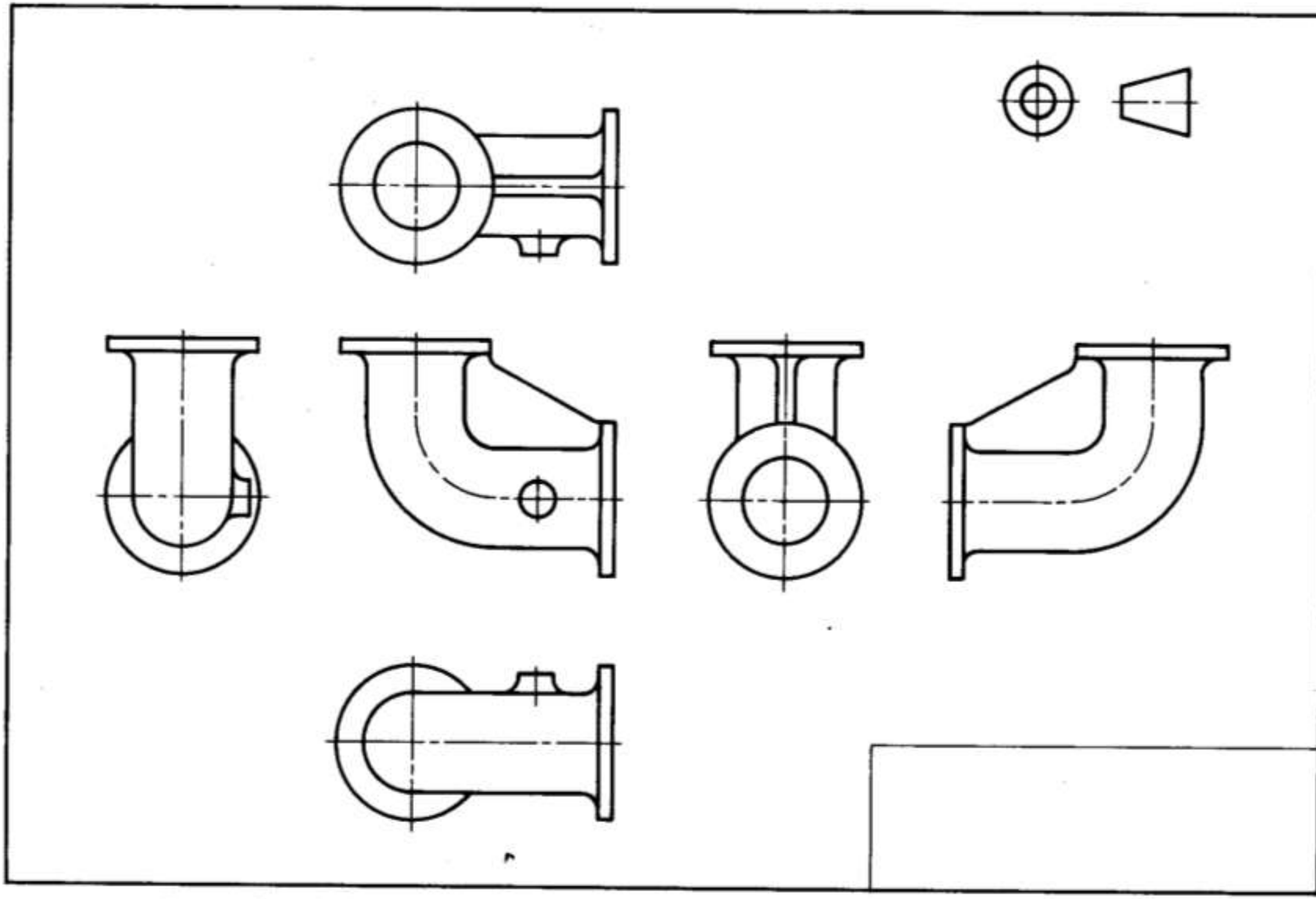
First angle and third angle projection methods are acceptable.



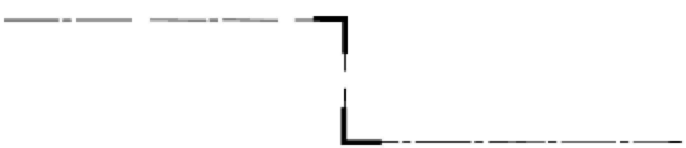


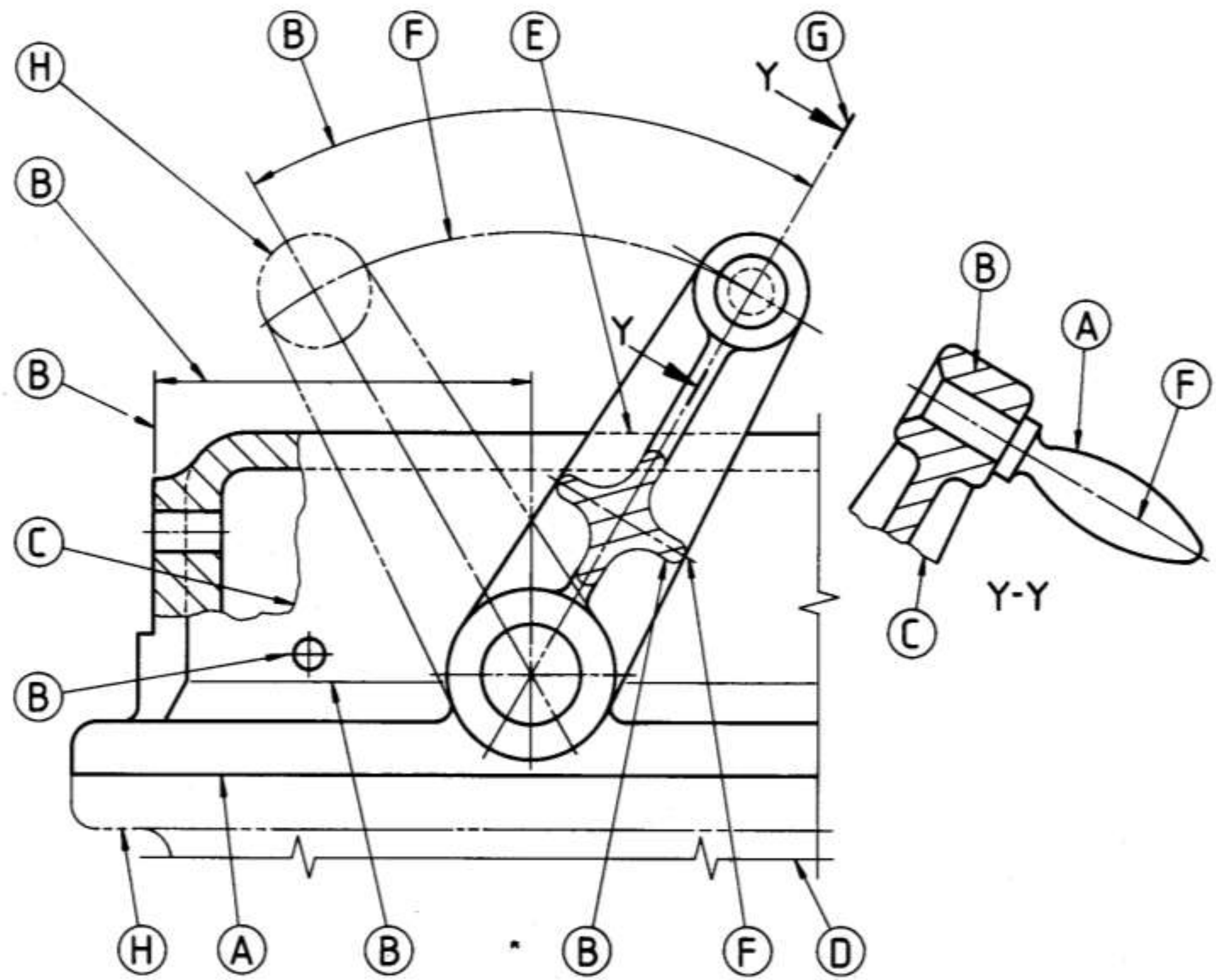


Example of first angle projection

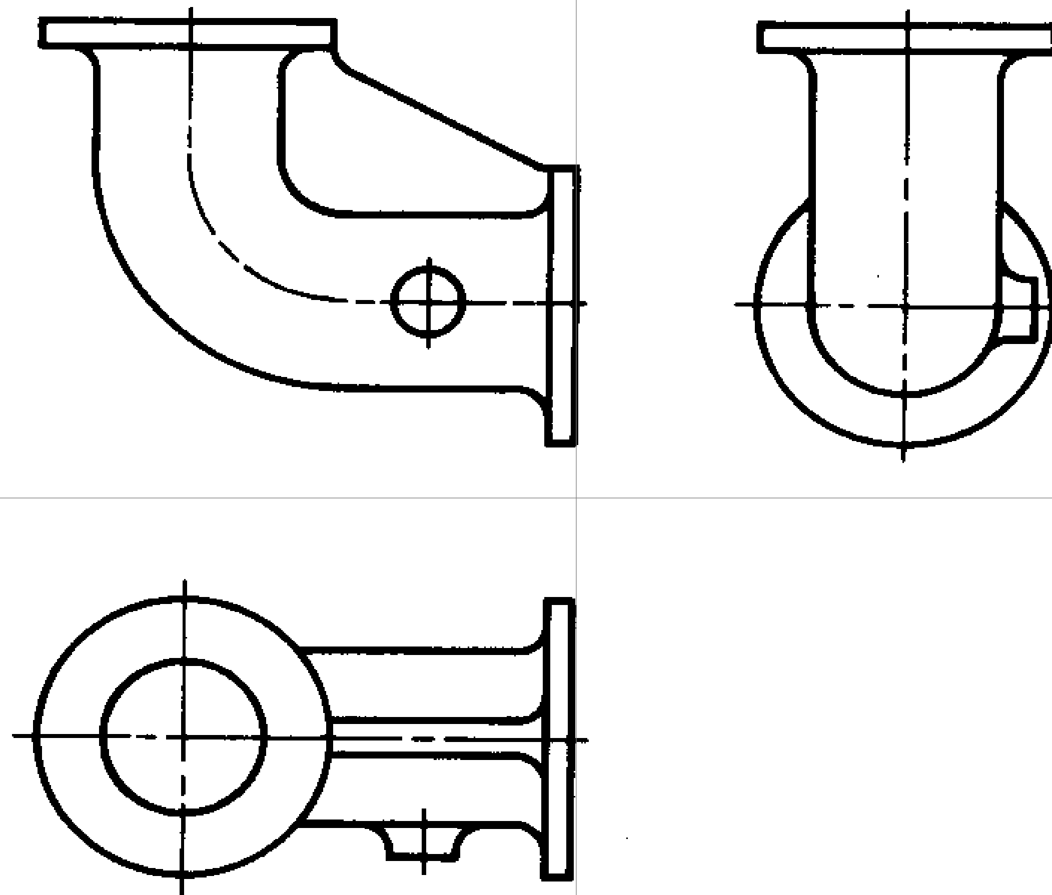


Example of third angle projection

Line	Description..........	Application
	Continuous Thick	Outline Edge
	Continuous Thin	Intersection.. Dimension.. Projection Leader.. Hatching
	Continuous Freehand	Limits of Partial or interrupted view
	Continuous Thin With Zigzags	Shortened Sections
	Dashed Thick	Hidden Outlines Hidden Edges
	Dashed Thin	Hidden Outlines Hidden Edges
	Chain Thin	Centre lines Lines of Symmetry
	Chain Thick	Special Surfaces
	Chain Thin Thick ends	Cutting Planes
	Chain Thin double-dashed	Centroidal Lines Initial Outlines Prior to Forming /Machining



Applications of the various types of line

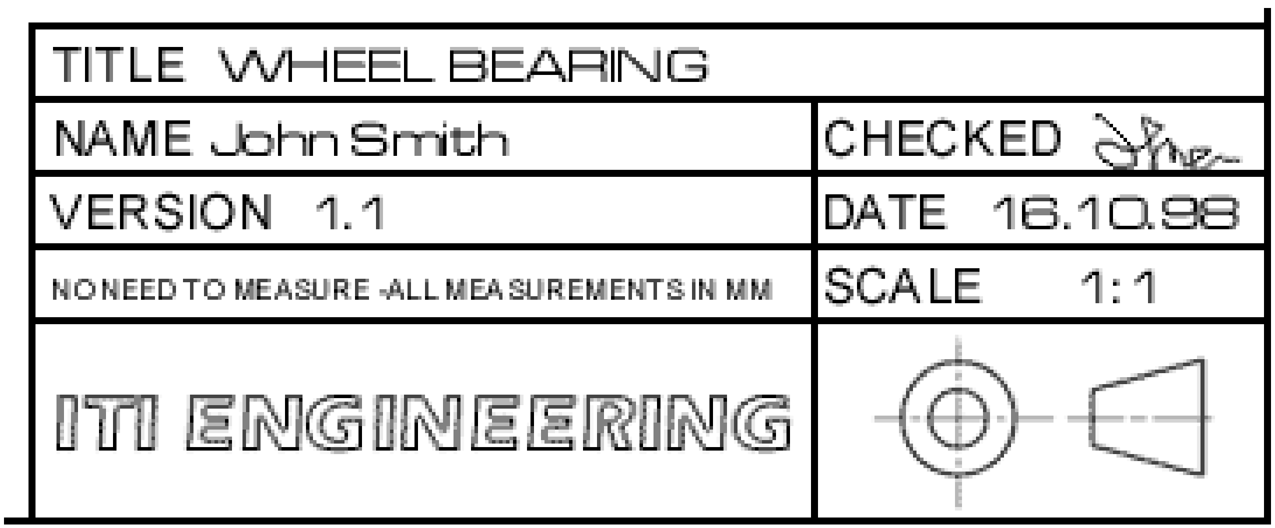


TITLE OF DRAWING	
DATE	GRP NO
NAME	

The layout of an engineering drawing

It is important that you follow some simple rules when producing an engineering drawing which although may not be useful now, will be useful when working in industry.

All engineering drawings should feature an information box. An example is shown below.



In general, capital letters should be used. Some suggested examples of letters and numerals are shown

ABCDEFGHIJKLMNOPQRST
UVWXYZ
1234567890

ABCDEFGHIJKLMNOP
QRSTUVWXYZ
1234567890

Examples of letters and numerals

Character height

The dimensions and notes should be not less than 3 mm tall. Titles and drawing numbers are normally larger.

Recommended scales

These are as follows:

Full size

1:1

On drawings smaller than full size (reduction scales):

1:2	1:5	1:10
1:20	1:50	1:100
1:200	1:500	1:1000

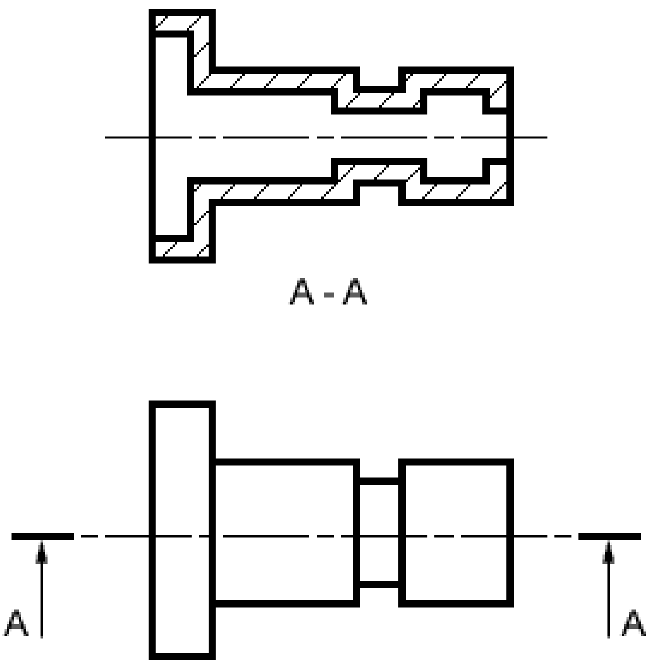
On drawings larger than full size (enlargement scales):

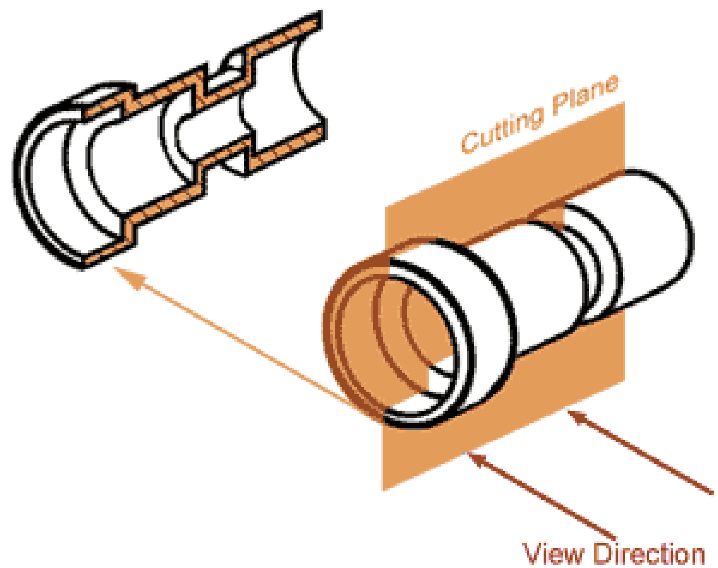
2:1	5:1	10:1
20:1	50:1	

Sections and sectional views are used to show hidden detail more clearly. They are created by using a cutting plane to cut the object.

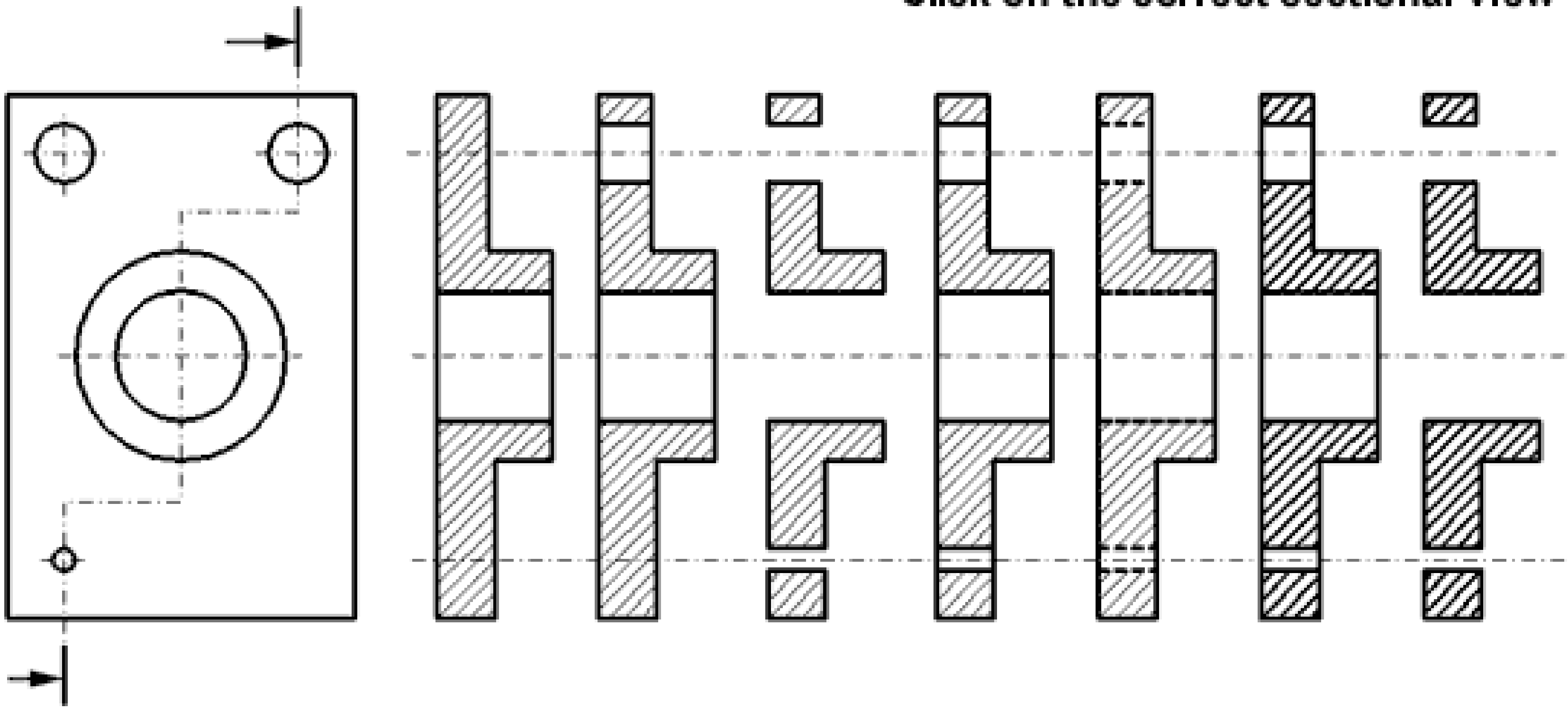
A section is a view of no thickness and shows the outline of the object at the cutting plane. Visible outlines beyond the cutting plane are not drawn.

A sectional view, displays the outline of the cutting plane and all visible outlines which can be seen beyond the cutting plane. The diagram below shows a sectional view, and how a cutting plane works.



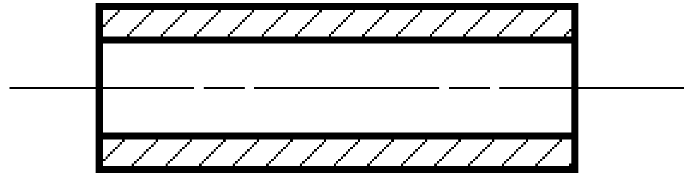


Click on the correct sectional view

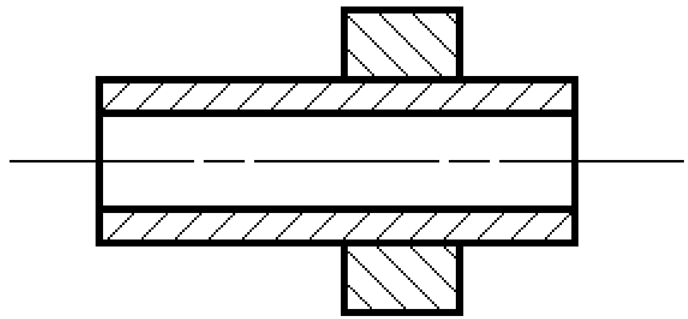


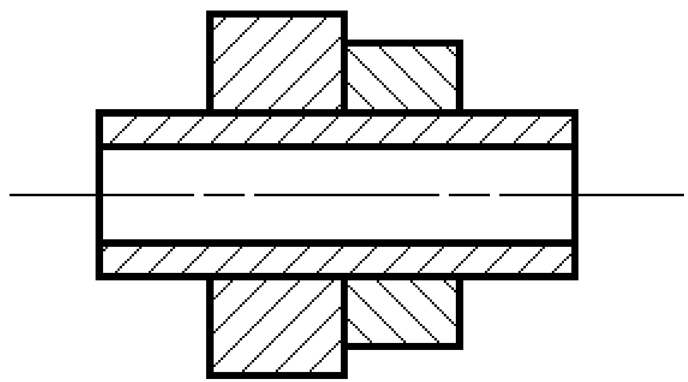
On sections and sectional views solid area should be hatched to indicate this fact. Hatching is drawn with a thin continuous line, equally spaced (preferably about 4mm apart, though never less than 1mm) and preferably at an angle of 45 degrees.

Hatching a single object



Hatching Adjacent objects

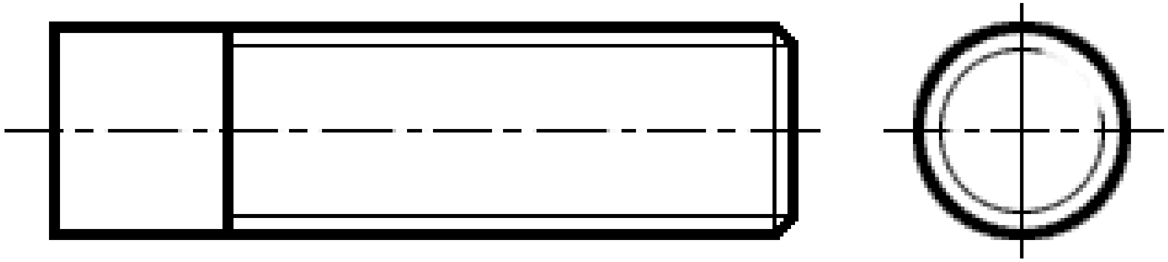


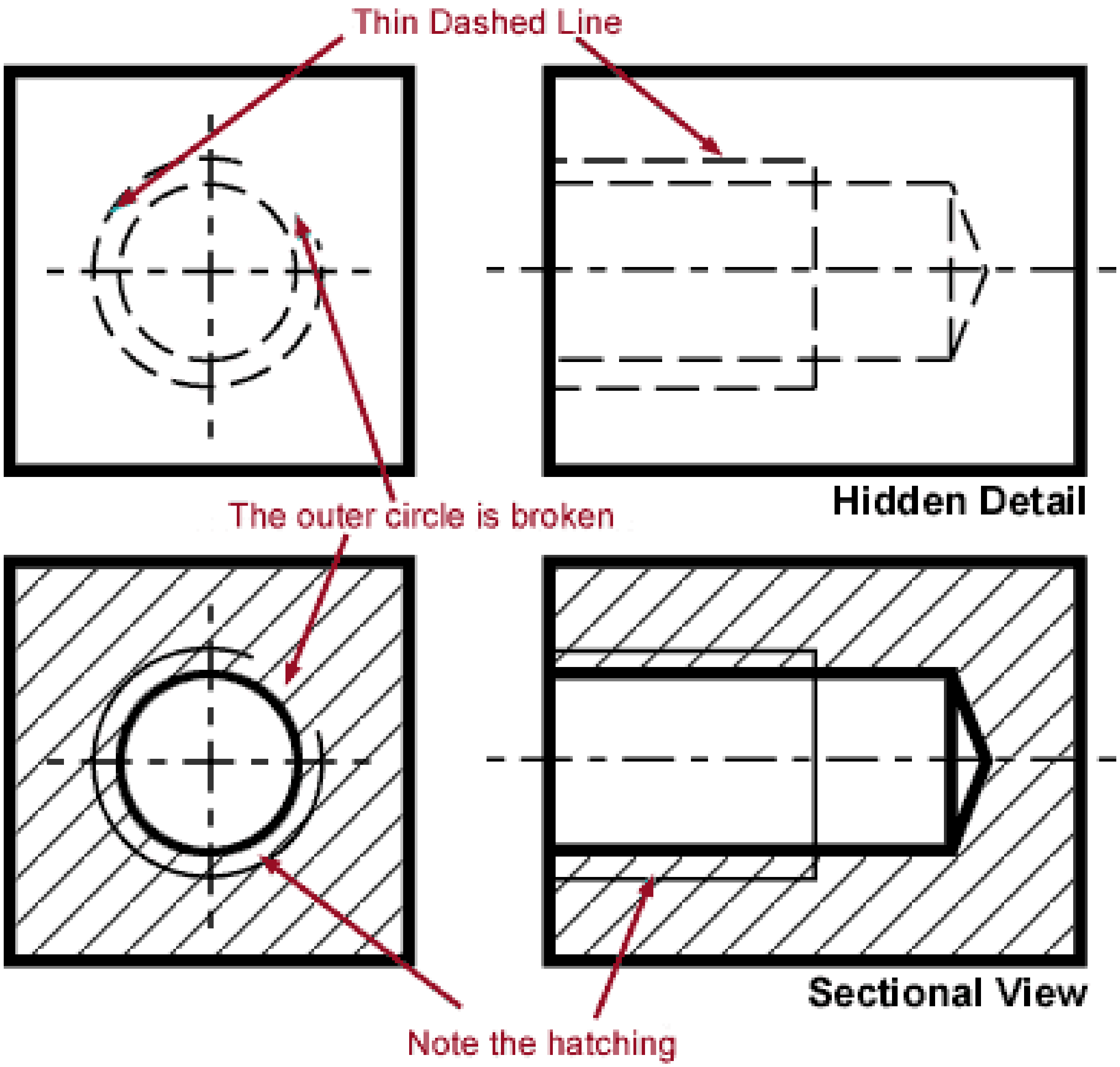


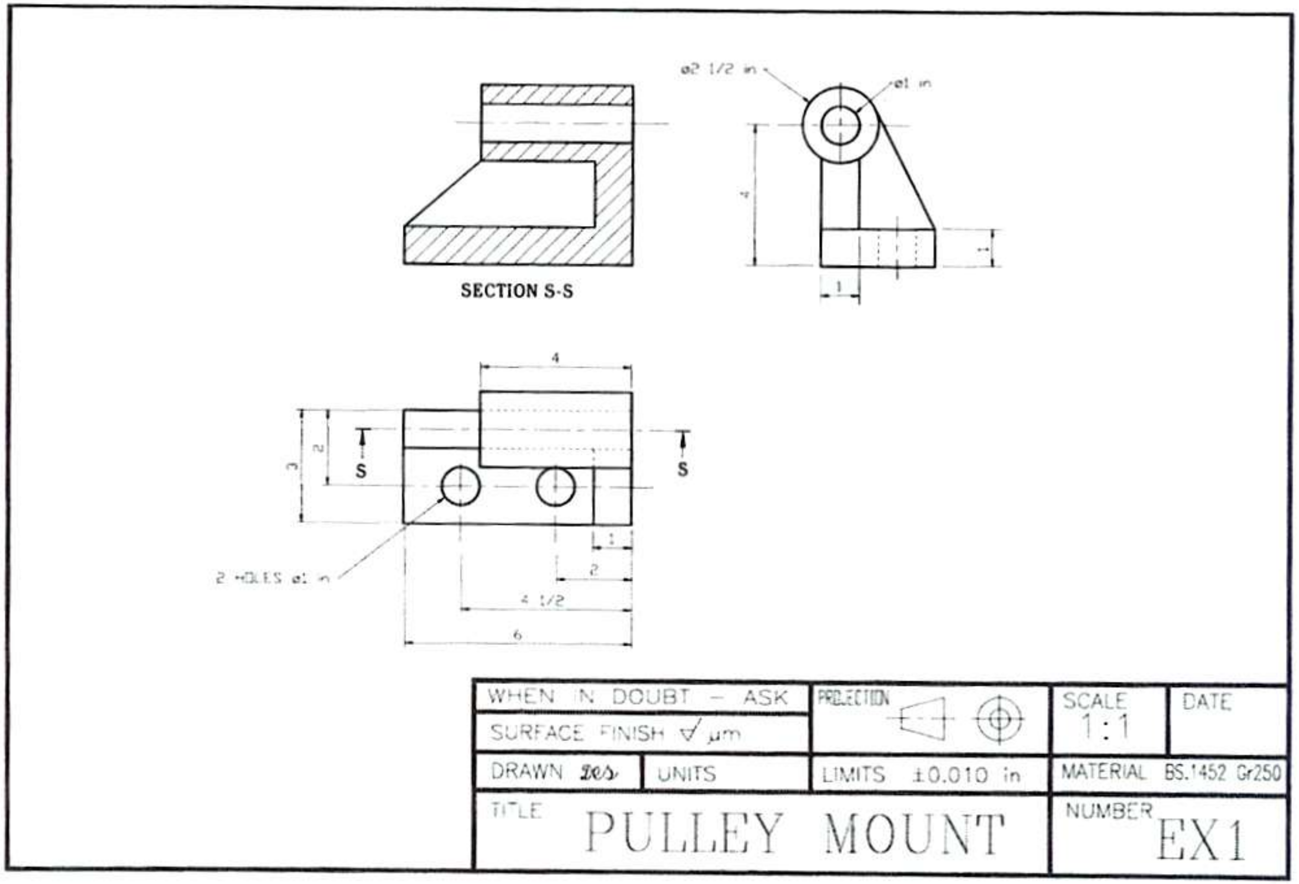
Drawing Conventions

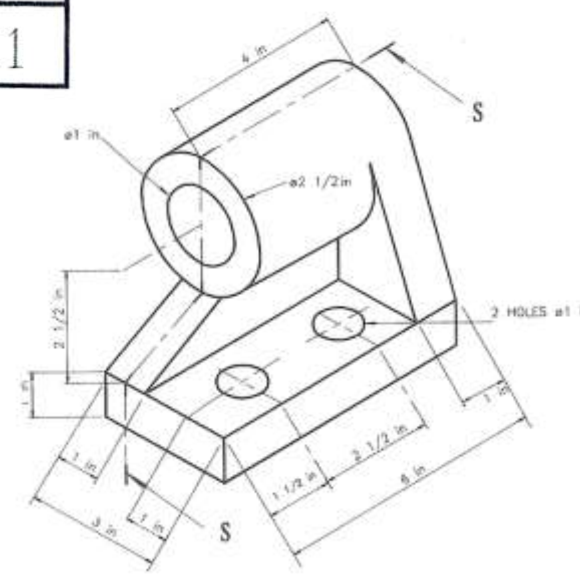
Threads are drawn with thin lines as shown in this illustration. When drawn from end-on, a threaded section is indicated by a broken circle drawn using a thin line.

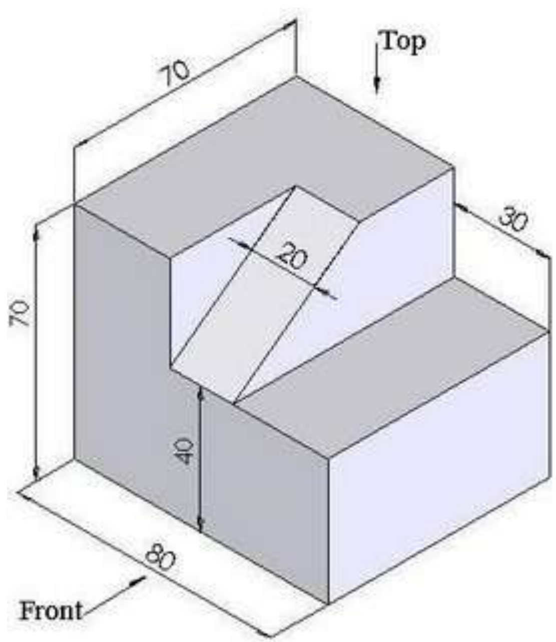
A threaded part

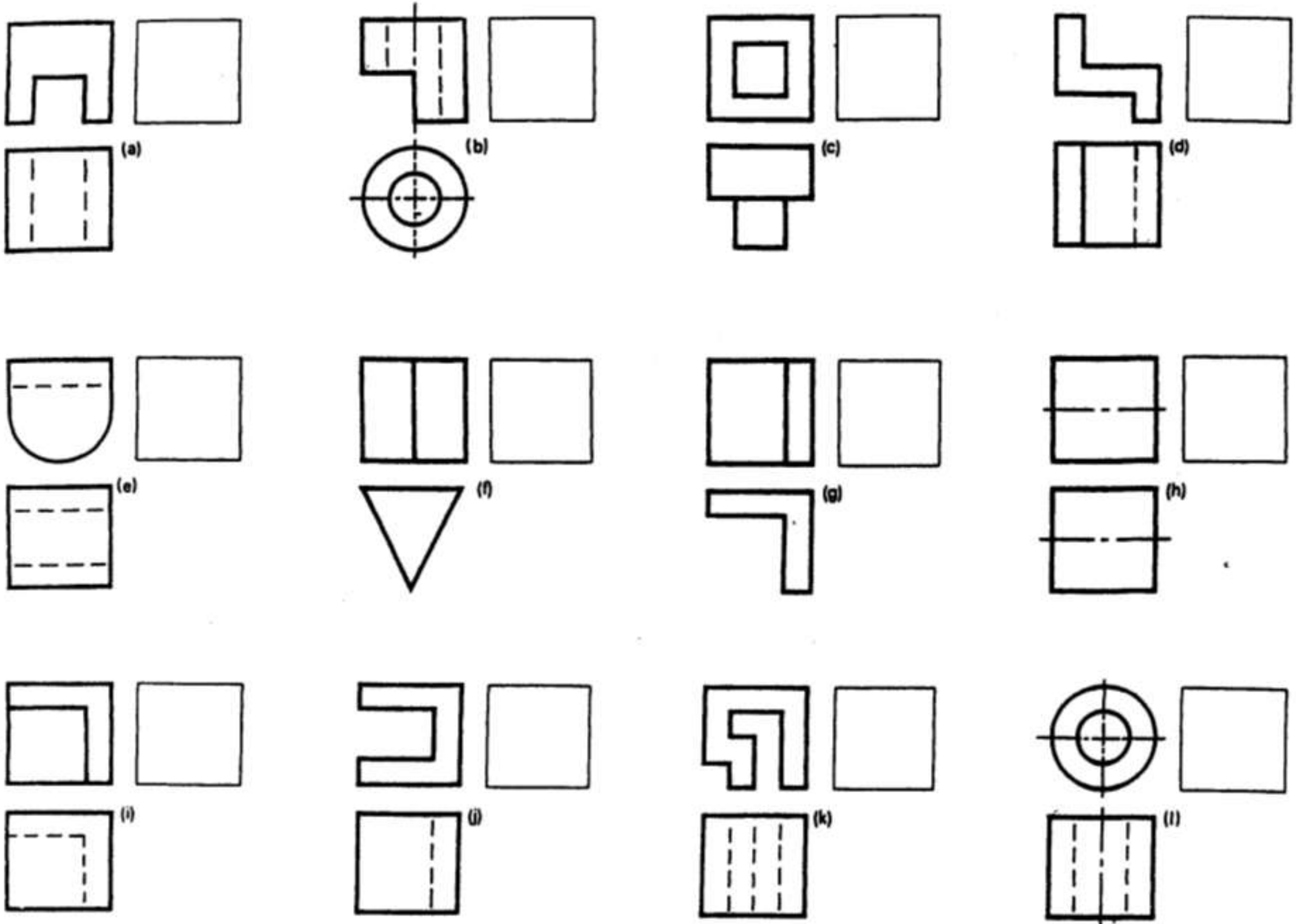


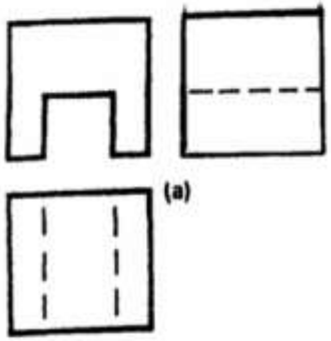

Thin Dashed Line
Hidden Detail
The outer circle is broken
Sectional View
Note the hatching

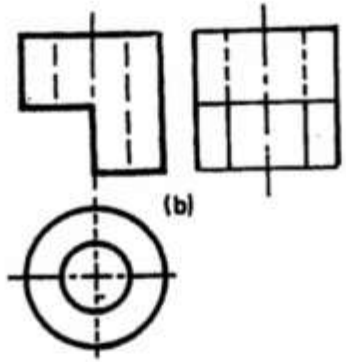

ø2 1/2 in
ø1 in
SECTION S-S
4
1
1
4
S
S
3
2
2 HOLES ø1 in
1
2
4 1/2
6
WHEN IN DOUBT – ASK
SURFACE FINISH ∀ µm
PROJECTION
SCALE 1:1
DATE
DRAWN
UNITS
LIMITS ±0.010 in
MATERIAL BS.1452 Gr250
TITLE PULLEY MOUNT
NUMBER EX1

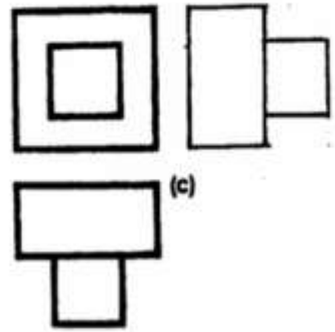

4 in
S
ø1 in
ø2 1/2in
2 HOLES ø1 in
2 1/2 in
1 in
1 in
1 in
2 1/2 in
1 1/2 in
6 in
1 in
3 in
S

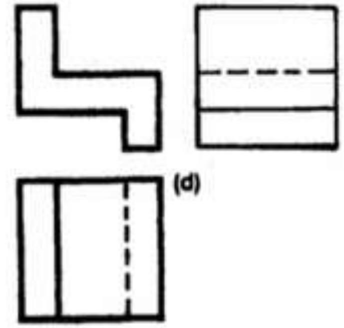

70
Top
30
20
70
40
80
Front

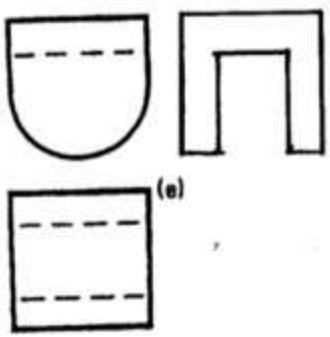

(a)
(b)
(c)
(d)
(e)
(f)
(g)
(h)
(i)
(j)
(k)
(l)

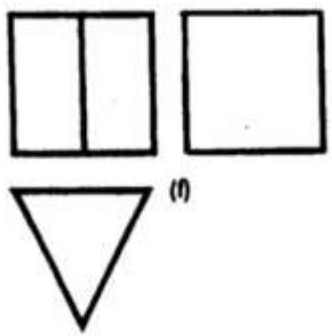

(a)

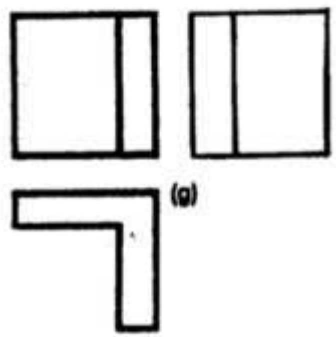

(b)

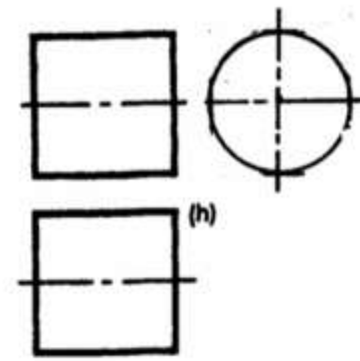

(c)

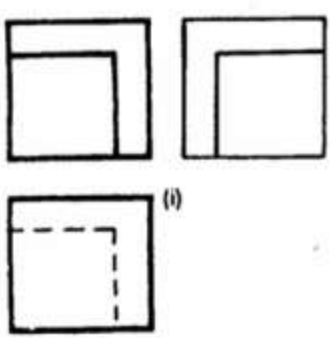

(d)

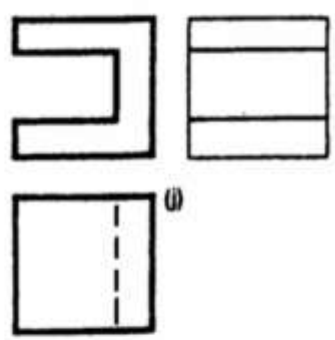

(e)

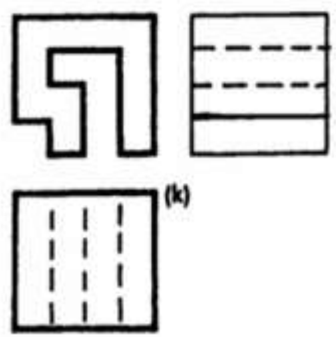

(f)

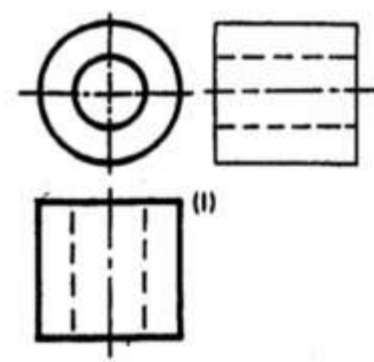

(g)


(h)

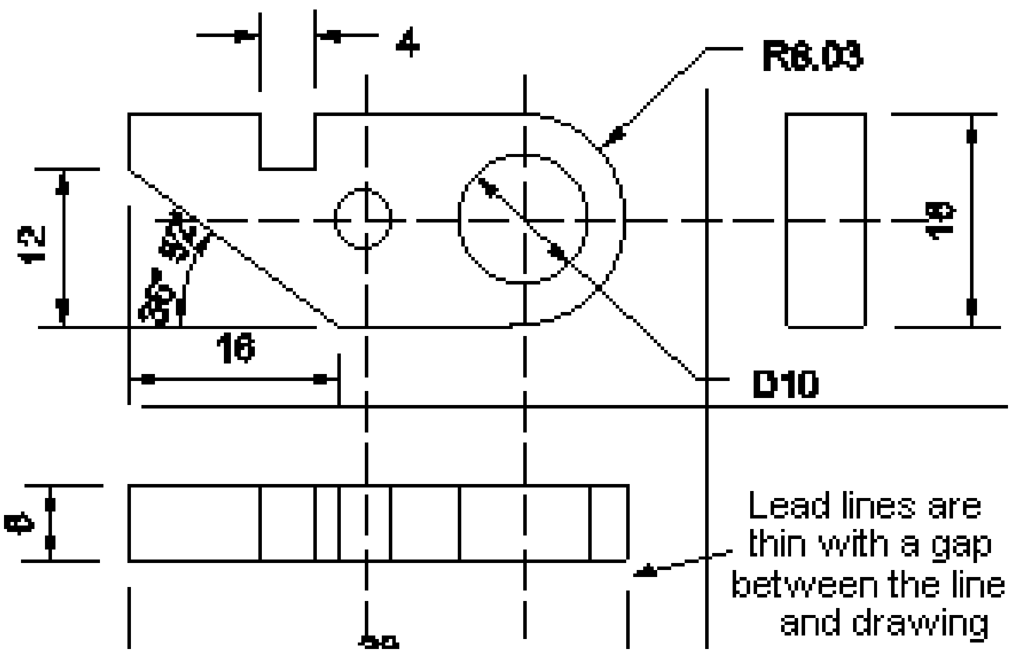

(i)


(j)


(k)


(l)

Conventions used when Dimensioning There are other conventions which you must follow when dimensioning an Orthographic Drawing.

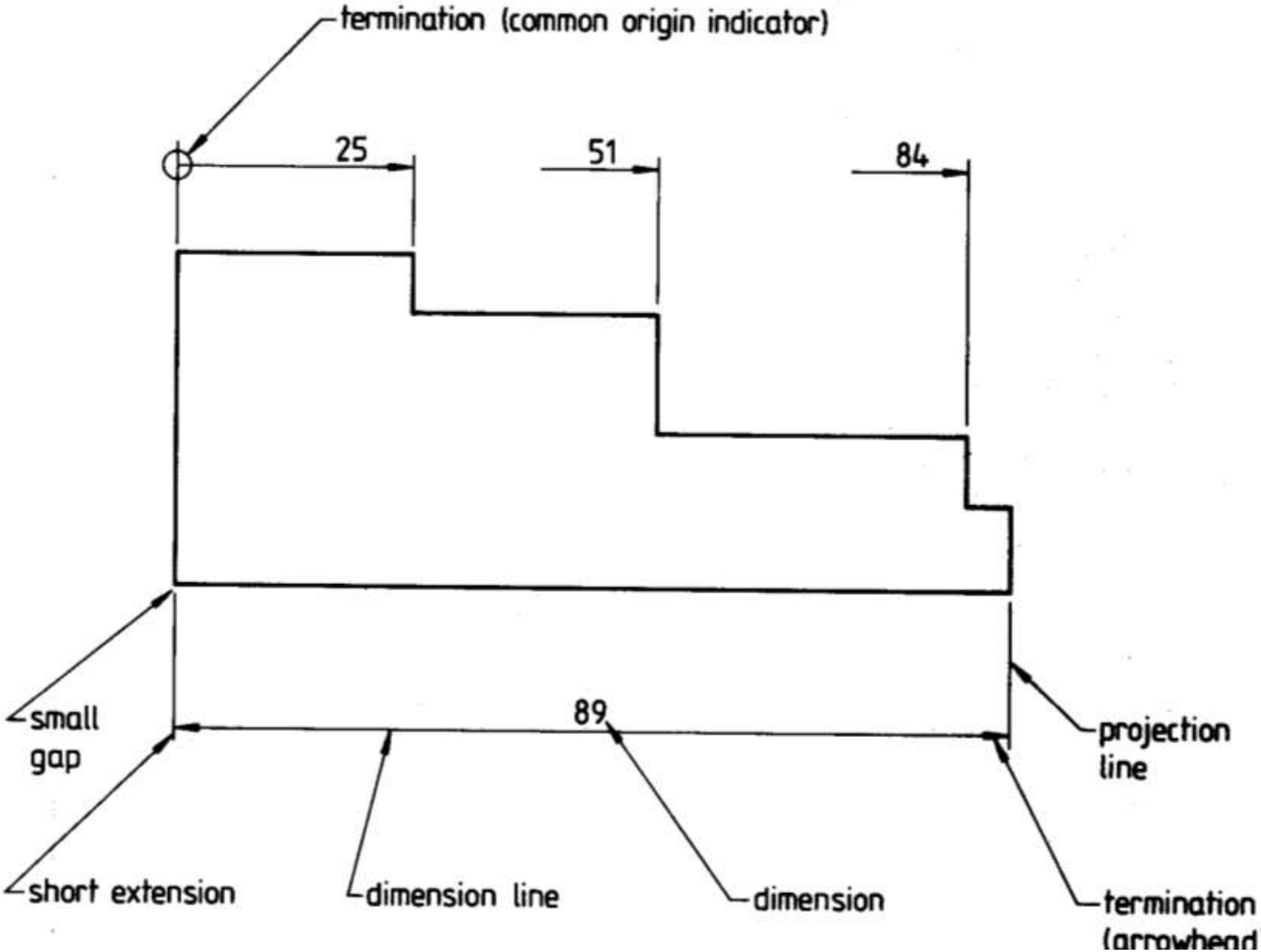


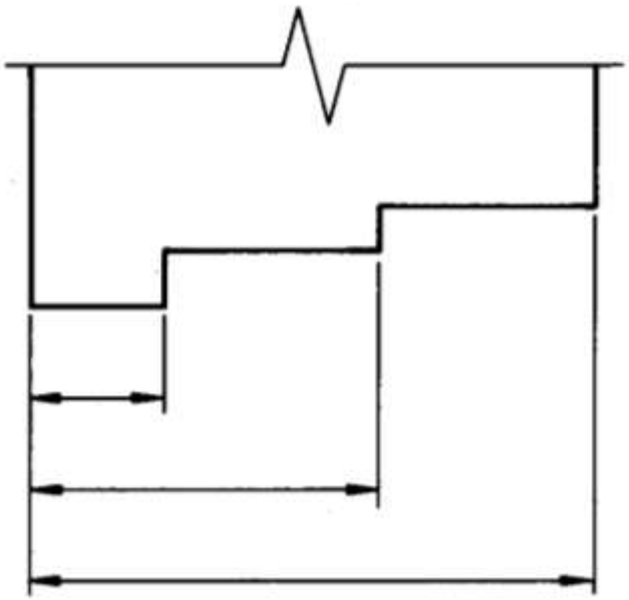
Projection Lines are thin with a 3mm gap between the line and the drawing.

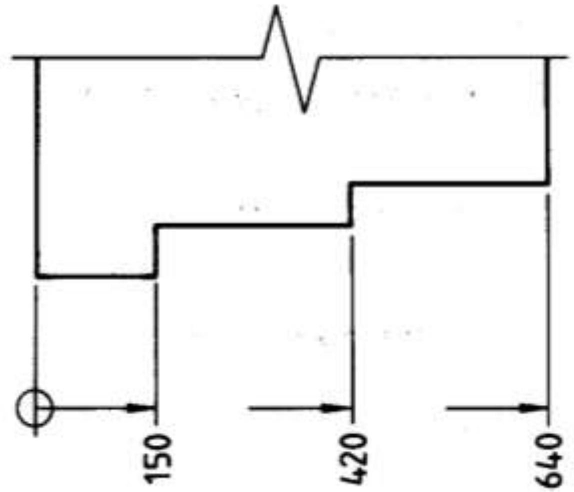
Dimension lines are thin and end in arrows 3mm in length.

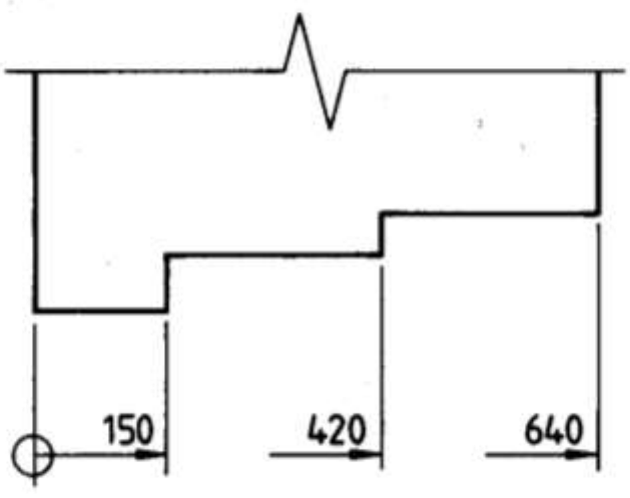
Dimensions are placed above dimension lines and are read from left to right

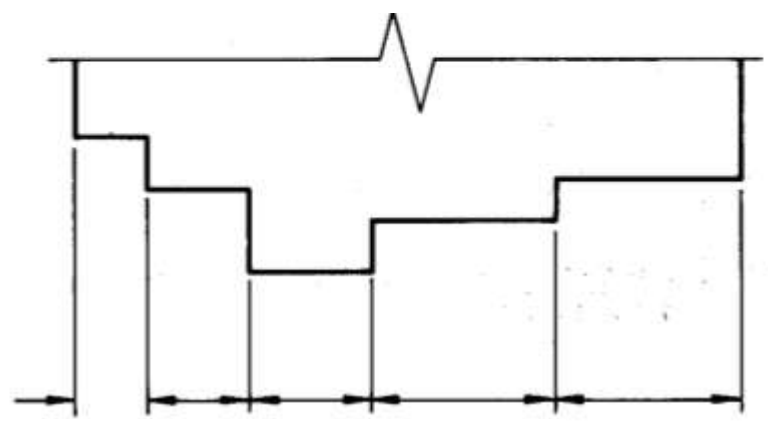
Abbreviations D (or Dia) and R (or Rad) are used to indicate Diameters and Radii.

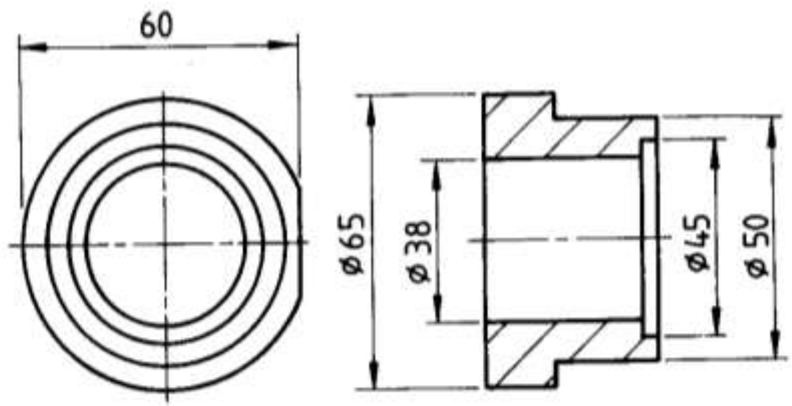

termination (common origin indicator)
25
51
84
89
small gap
short extension
dimension line
dimension
projection line
termination (arrowhead)



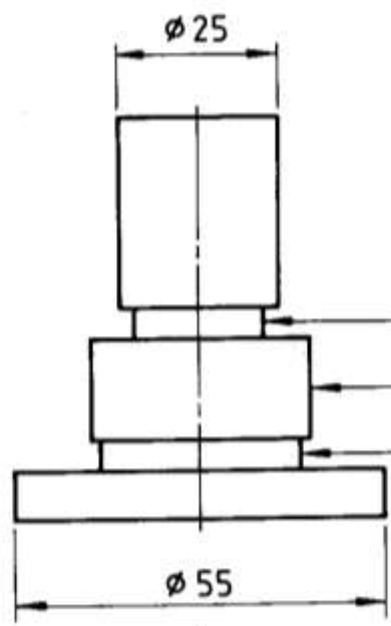

150
420
640


150
420
640

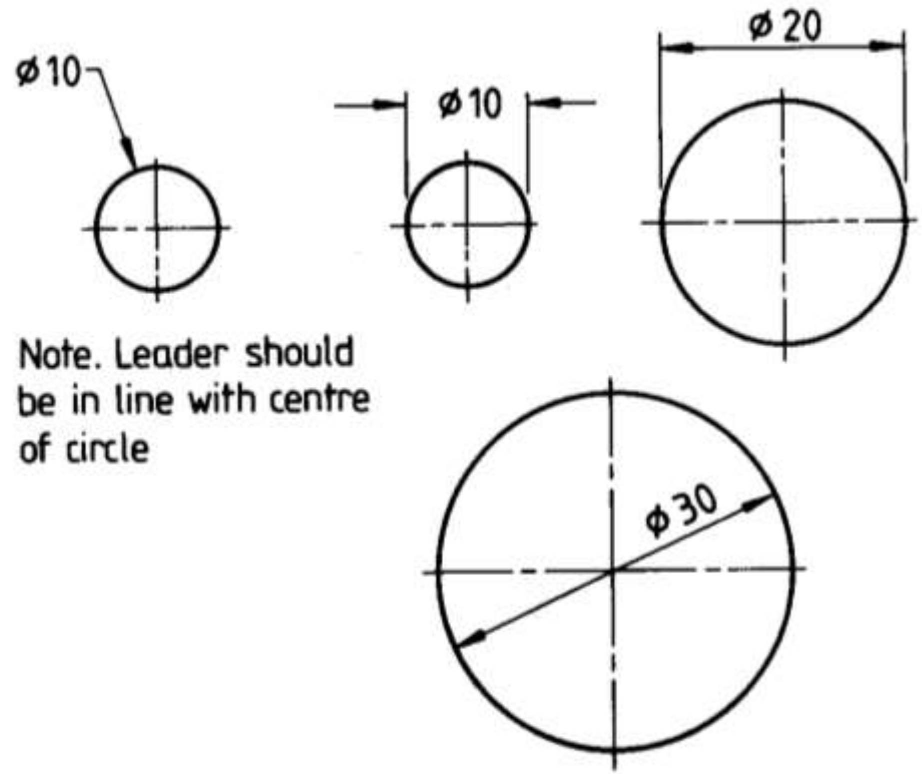




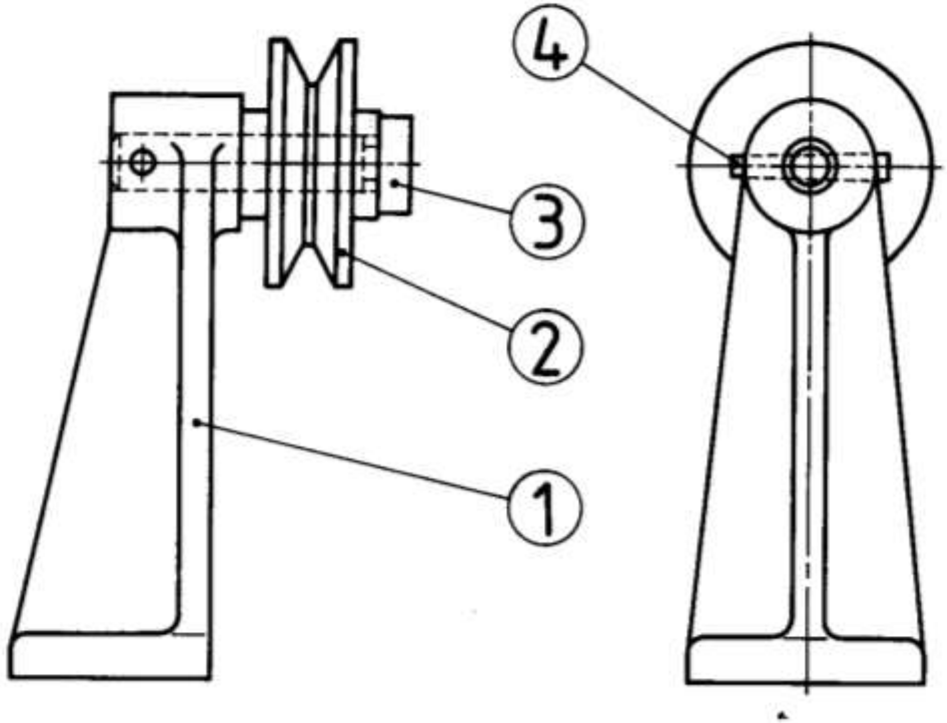
Dimensions of diameters placed on best view for clarity



Dimensions applied to features by leader lines

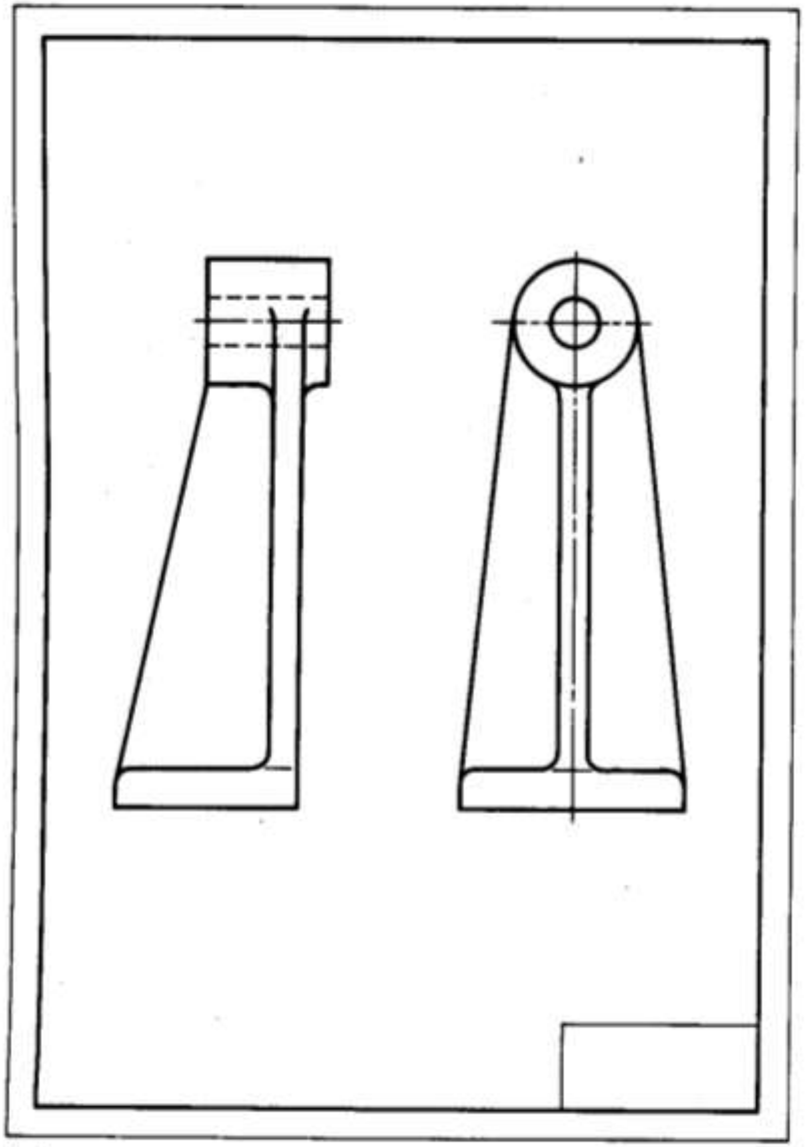


Dimensioning circles

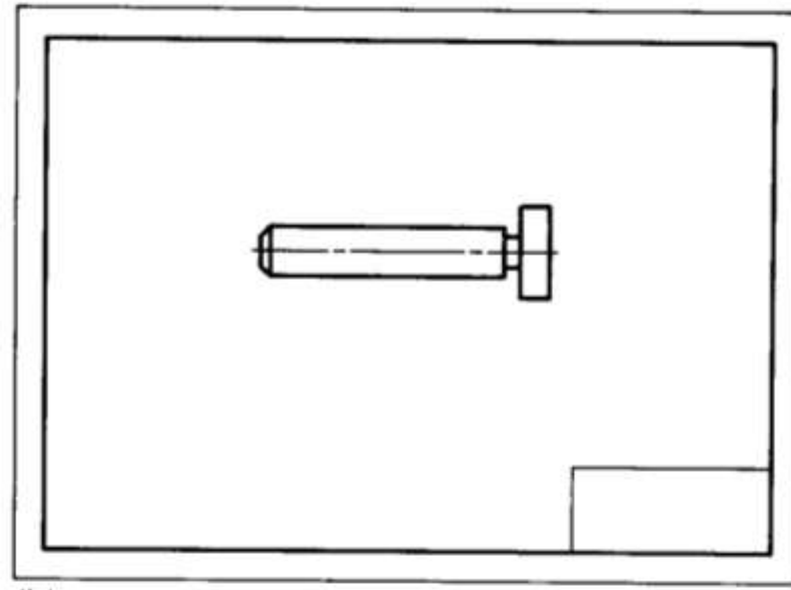


4	TAPER PIN	1
3	PIN	1
2	PULLEY	1
1	BRACKET	1
ITEM	DESCRIPTION	NO.OFF

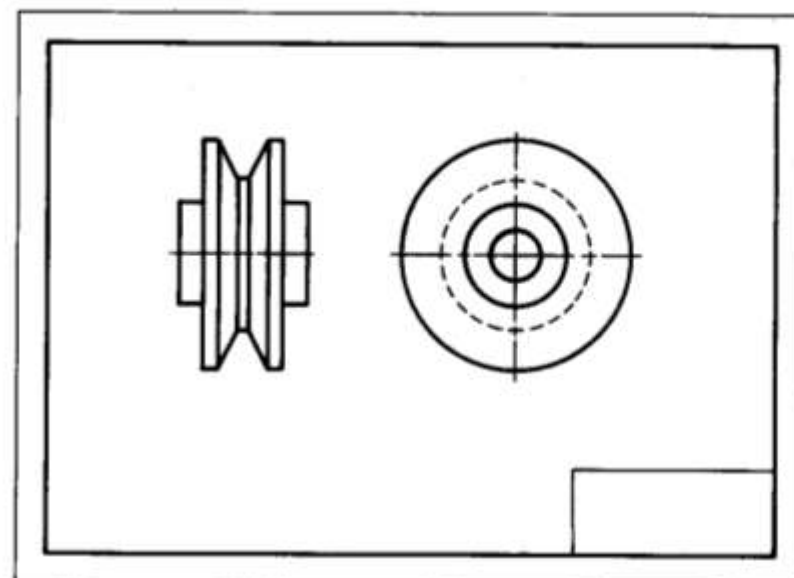
Assembly drawing



(a)

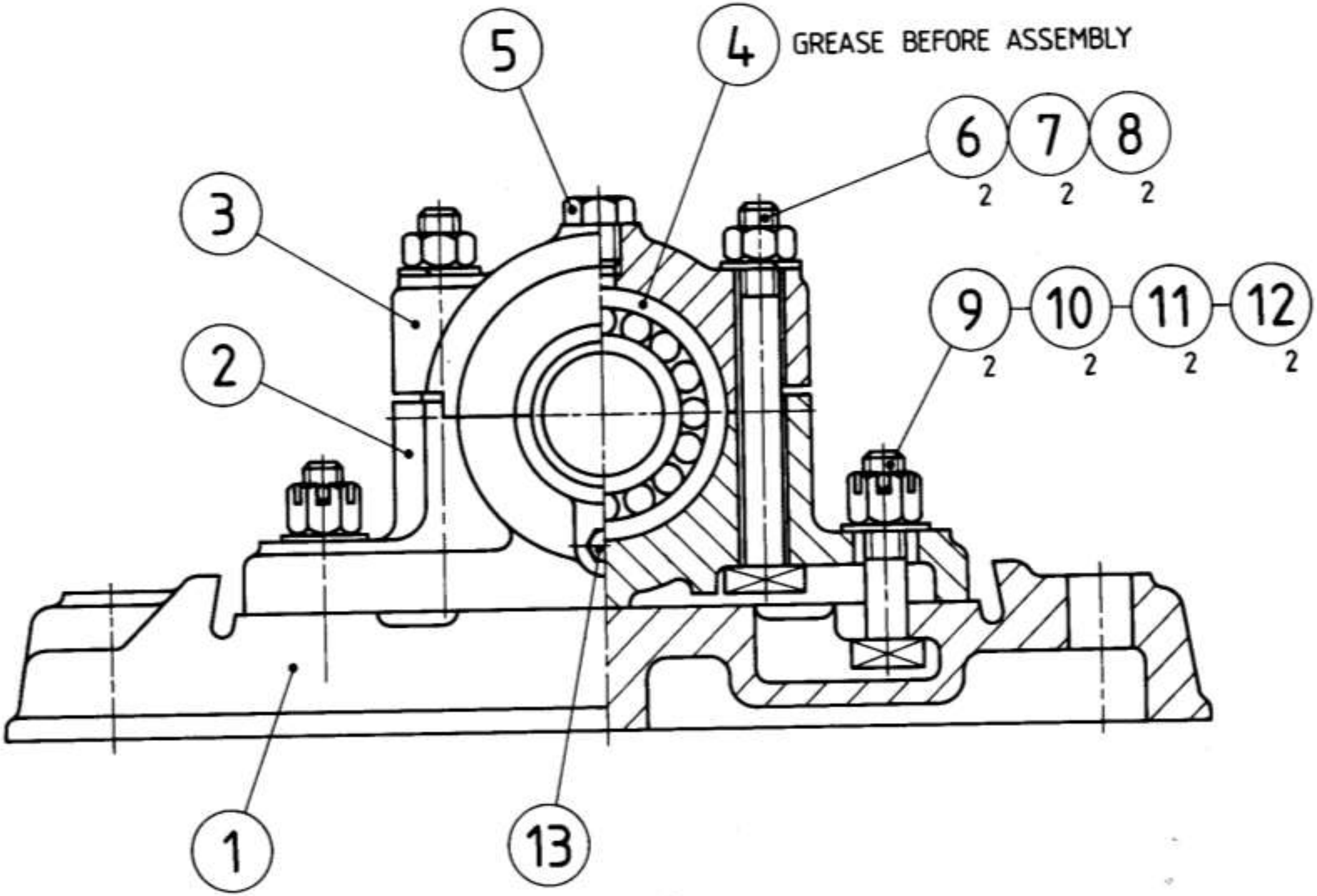


(b)

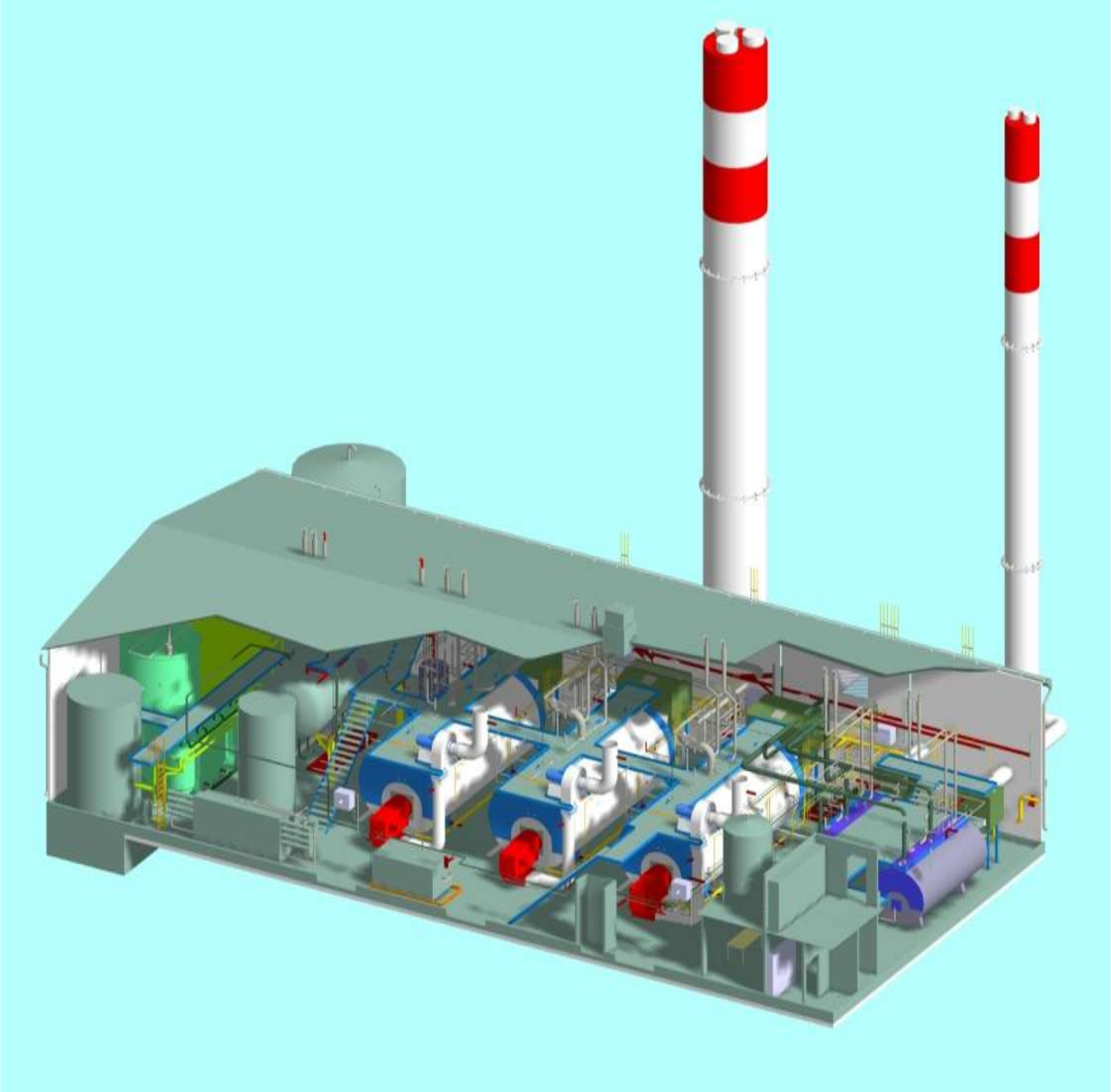


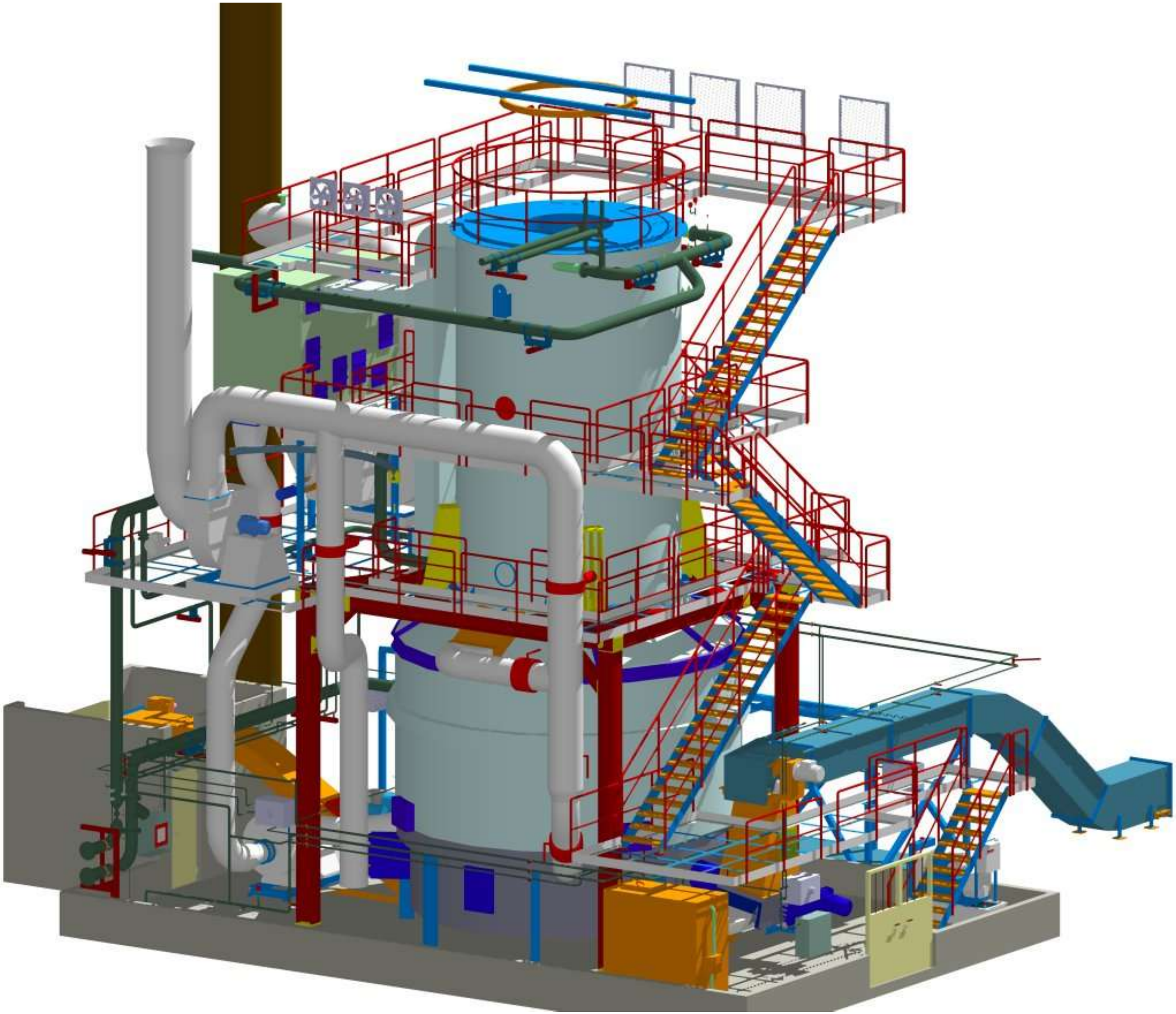
(c)

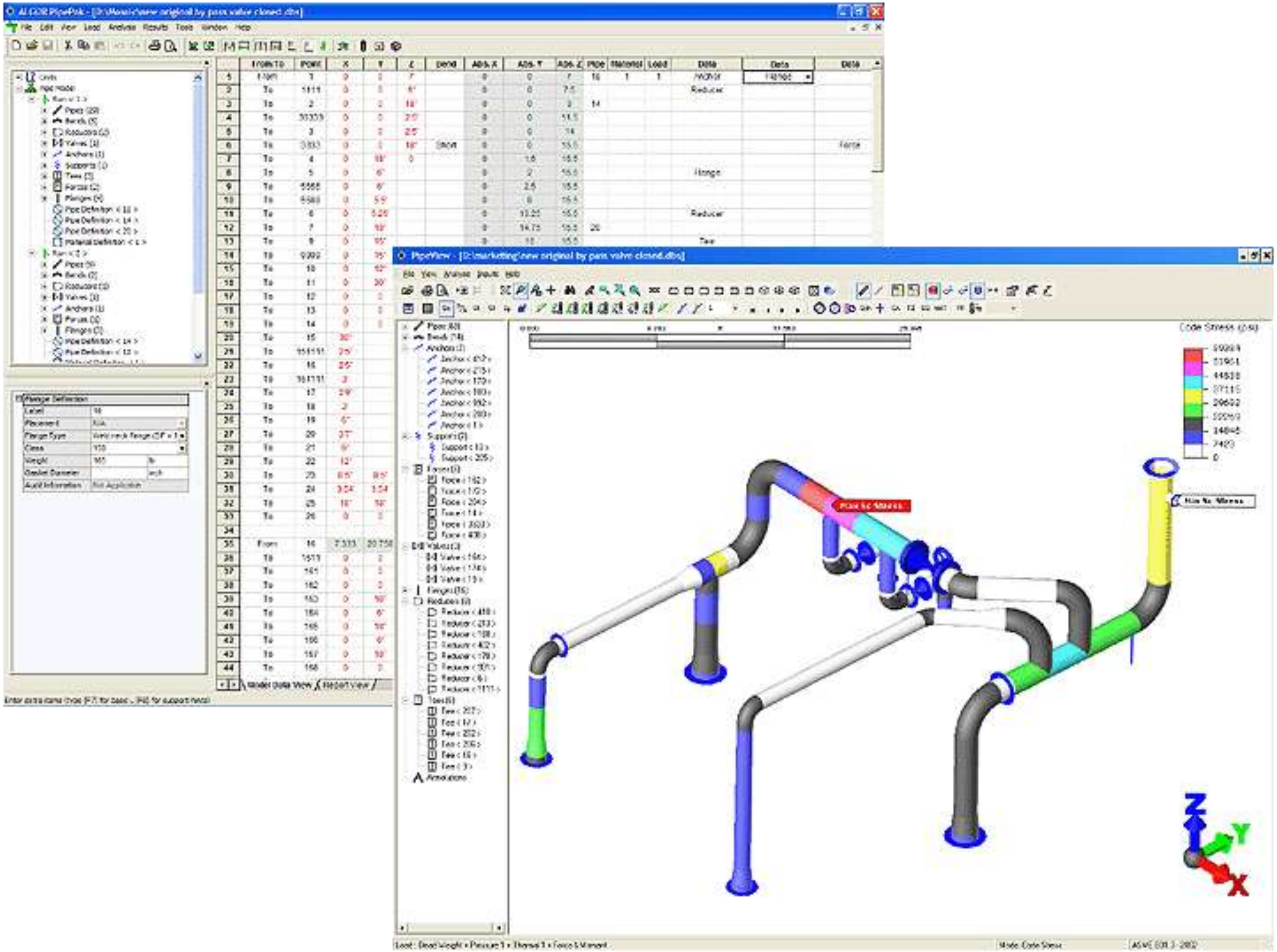
Detail (single-part) drawings

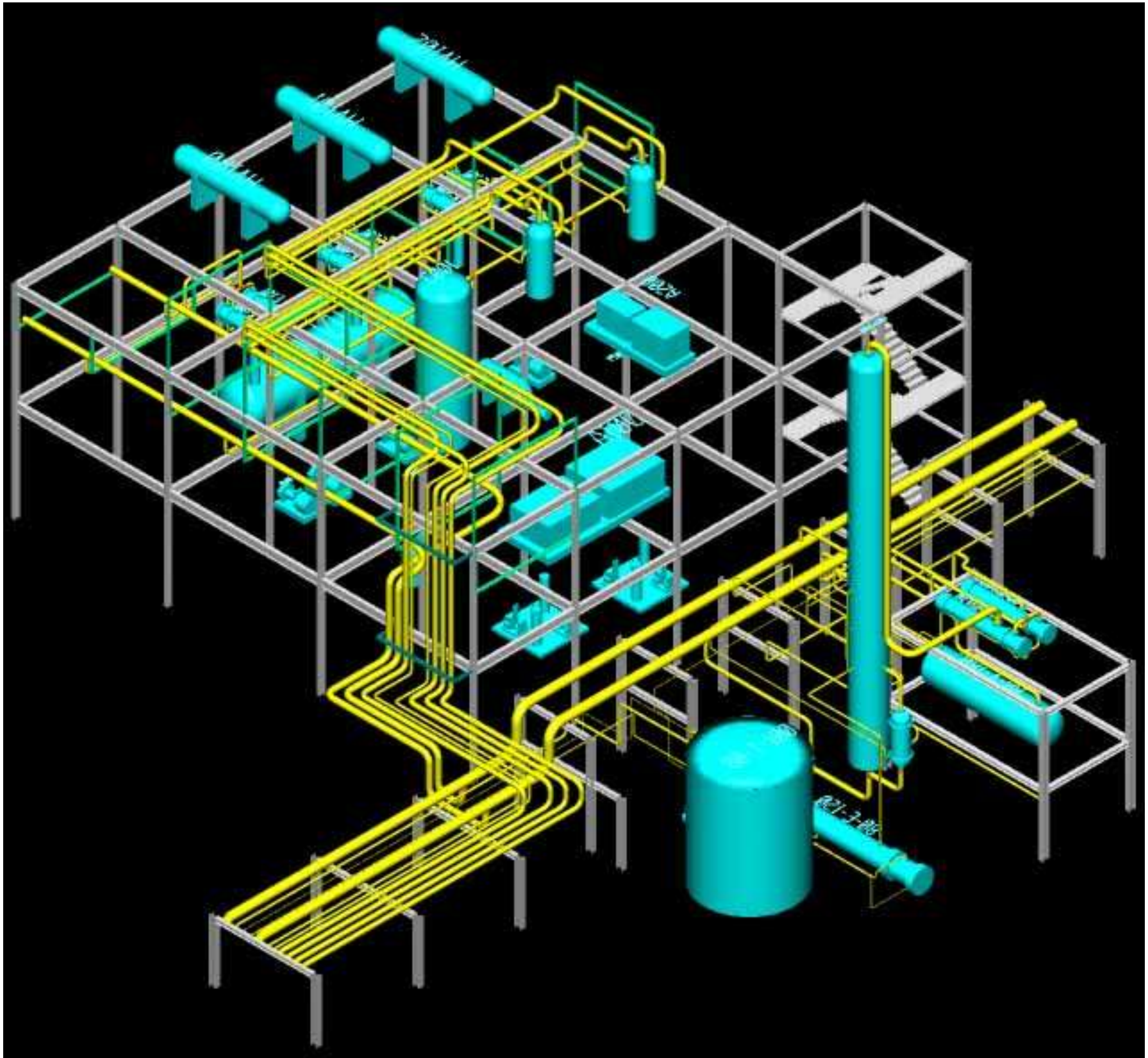


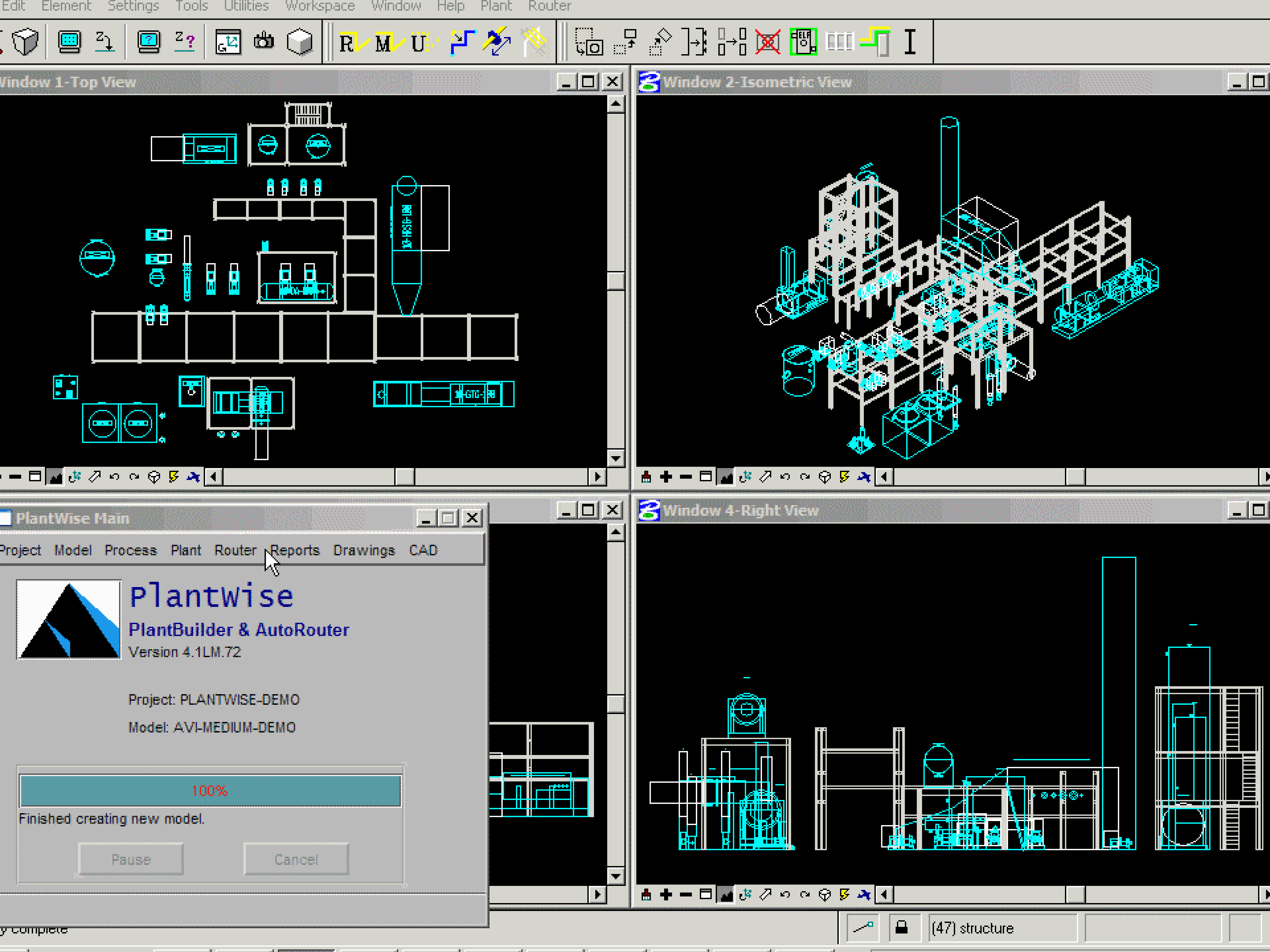
GREASE BEFORE ASSEMBLY
1
2
3
4
5
6
7
8
9
10
11
12
13
2






Code Stress (psi)
Z
Y
X



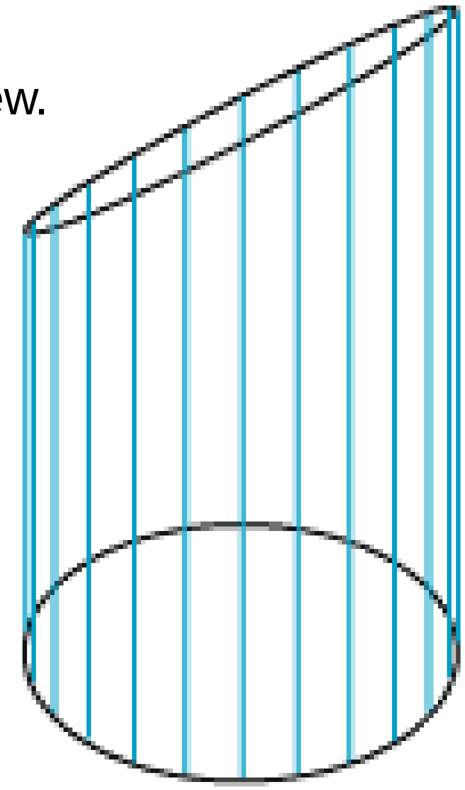

Edit Element Settings Tools Utilities Workspace Window Help Plant Router
Window 1-Top View
Window 2-Isometric View
Window 4-Right View
PlantWise Main
Project Model Process Plant Router Reports Drawings CAD
PlantWise
PlantBuilder & AutoRouter
Version 4.1LM.72
Project: PLANTWISE-DEMO
Model: AVI-MEDIUM-DEMO
100%
Finished creating new model.
Pause
Cancel
(47) structure

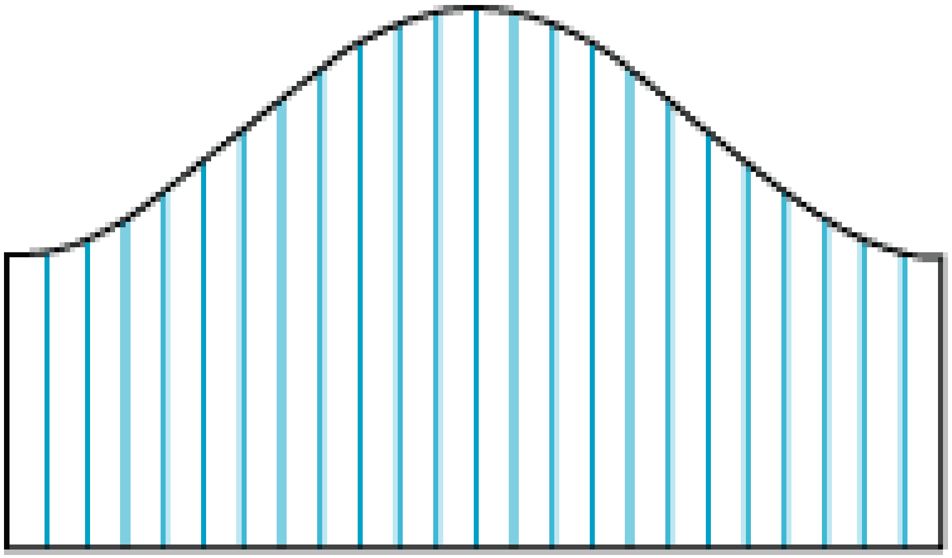
Where do we use parallel line development?

Parallel line development is used for the pattern development of pipe work, prisms, and any cylindrical shape.

Pattern development can be marked directly onto flat metal plate. The metal is then formed to shape.

This is a truncated cylinder shown in an isometric view.
Note the 12 equal spaces called chord lines



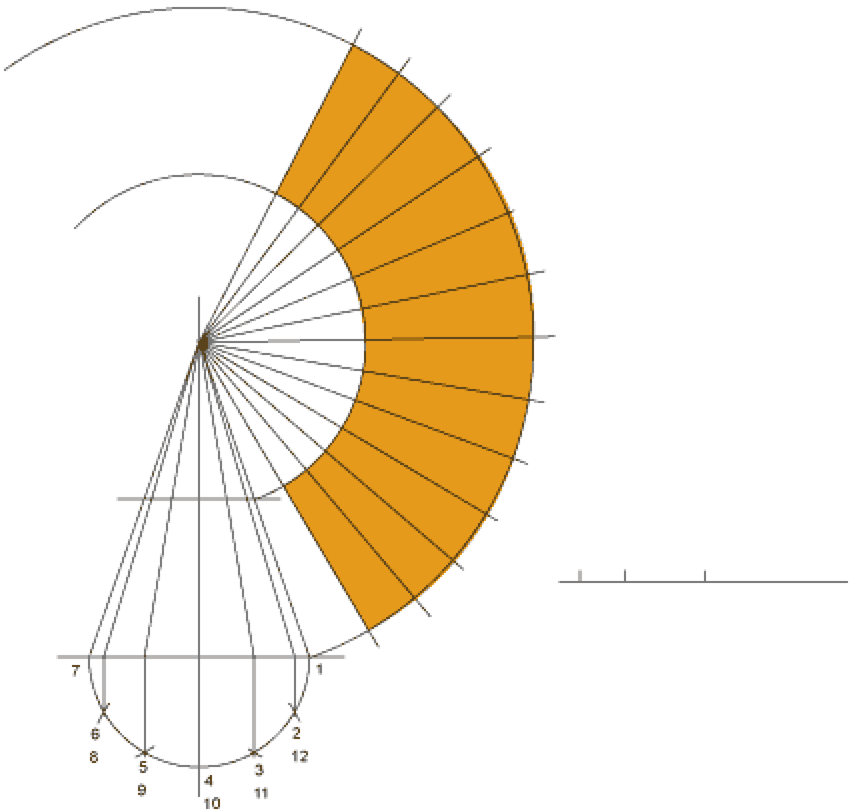


This is a pattern layout of a truncated cylinder, also known as a stretch out or template.

Radial line method

The radial line method of pattern development is used to develop patterns for objects that have a tapering form with lines converging to a common point, called the apex point.

The radial line method uses a series of radial generator lines drawn from a common apex point to develop a specified pattern or shape.



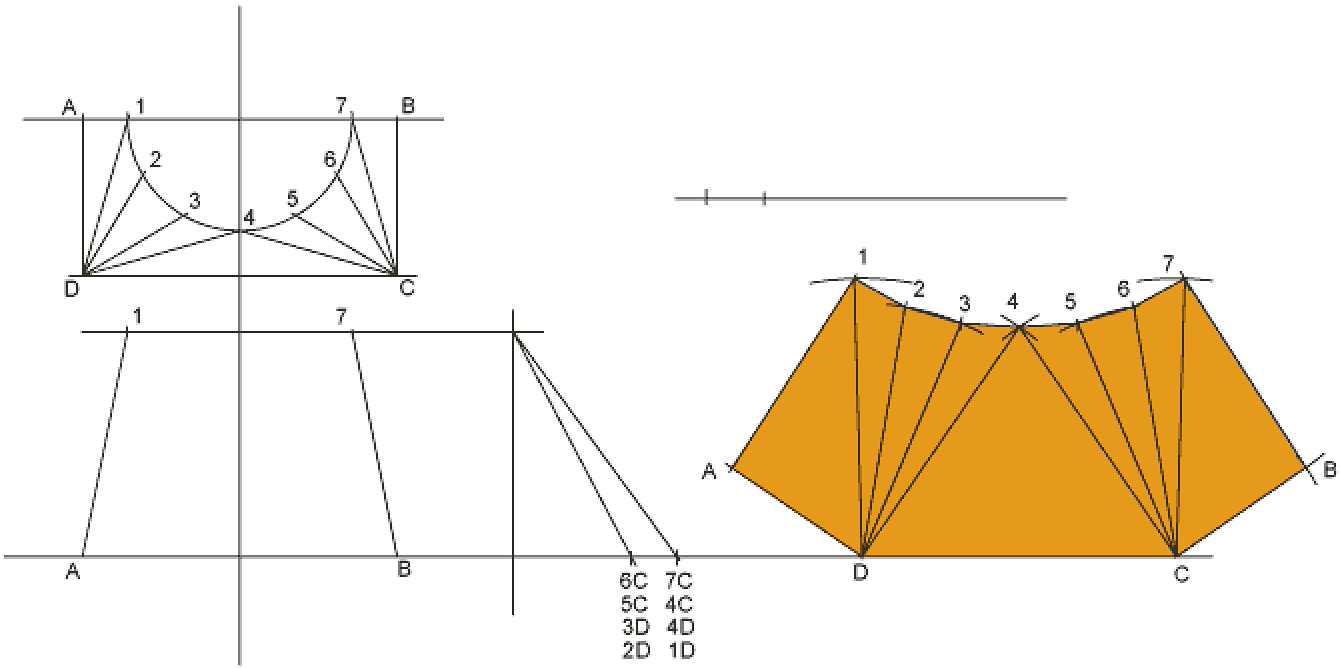
The triangulation method

To find the true length of very basic conical or transition shapes these fundamental rules must be applied.

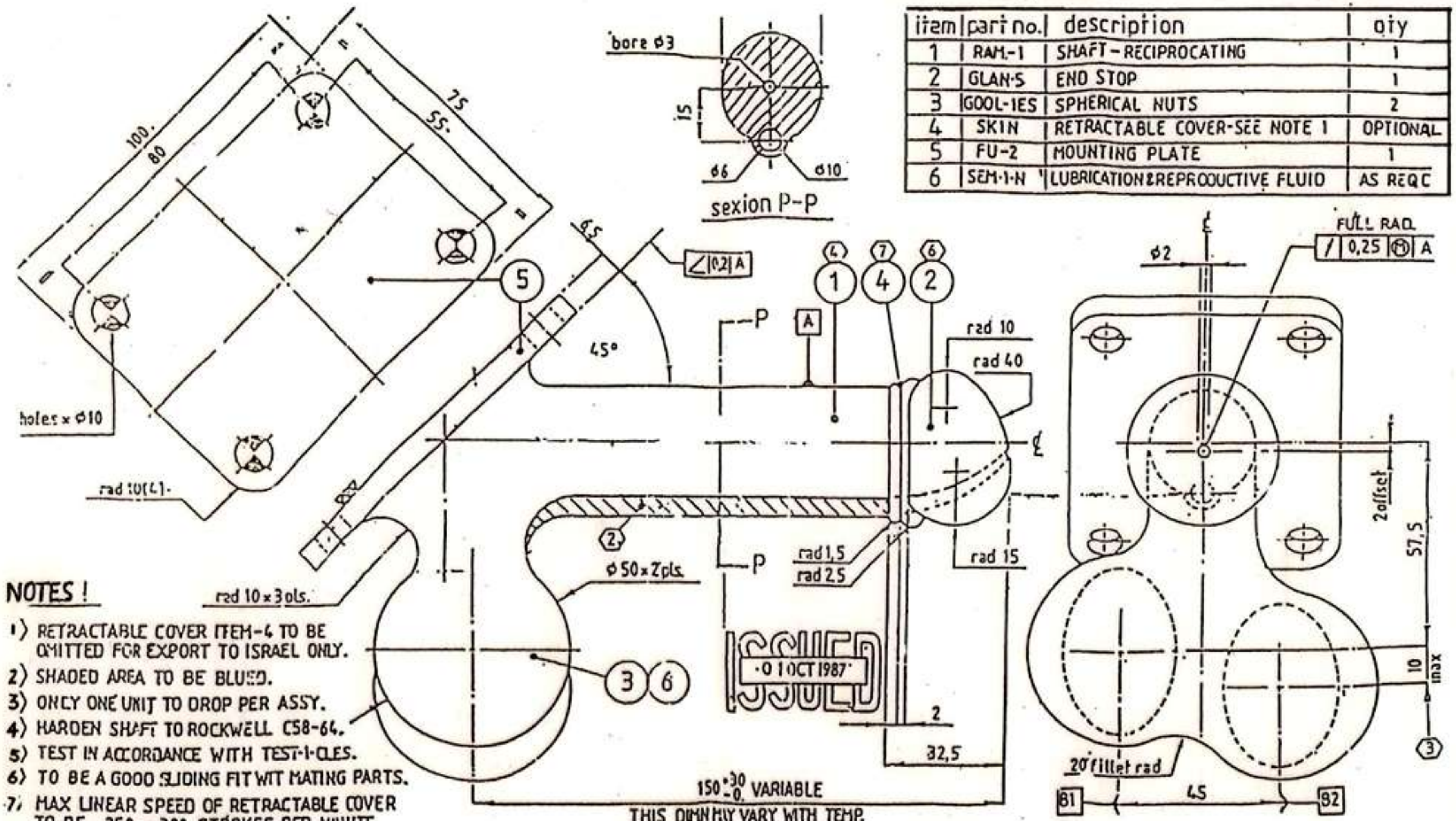
Generally two views are required.

The two most common views are top and front view.

Place the top view length view against the vertical height at 90 degrees.



item	part no.	description	qty
1	RAM-1	SHAFT – RECIPROCATING	1
2	GLAN-S	END STOP	1
3	GOOL-IES	SPHERICAL NUTS	2
4	SKIN	RETRACTABLE COVER-SEE NOTE 1	OPTIONAL
5	FU-2	MOUNTING PLATE	1
6	SEM-1-N	LUBRICATION & REPRODUCTIVE FLUID	AS REQD



NOTES !

1) RETRACTABLE COVER ITEM-4 TO BE OMITTED FOR EXPORT TO ISRAEL ONLY.
2) SHADED AREA TO BE BLUED.
3) ONLY ONE UNIT TO DROP PER ASSY.
4) HARDEN SHAFT TO ROCKWELL C58-64.
5) TEST IN ACCORDANCE WITH TEST-I-CLES.
6) TO BE A GOOD SLIDING FIT WIT MATING PARTS.
7) MAX LINEAR SPEED OF RETRACTABLE COVER TO BE 250—300 STROKES PER MINUTE.
8) FOR POSITIONAL TOLERANCES REFER TO. REFERENCE MANUAL KAMA SUTRA BOOK-1 CHAPTERS 1-12 PARAS 1-50.
9) FINISHED ASSEMBLY TO BE PACKED IN A DURABLE SAC MARKED WITH THE DRG.No. AND STAMPED WITH DATE OF EXPIRY.

FABRICATOR TO PROVE ERECTION.

FOR TENDER PURPOSES ONLY

GRADE X.L. 69	MATL HIGH. SPEED STEEL	CONTRACTOR LONGHORN DESIGN SERVICES – LITTLEHAMPTON			SECURITY CLASSIFICATION C.O.N.D.O.M. for INTERNAL CIRCULATION ONLY
NON DESTRUCTIVE TESTING 100 % PENETRATION	TOLERANCES ± 0,25 U.O.S.	DRAWN Ivor Biggun	CHECKED W.Anker	SCALE full size	PROJECT No. P.E.N. 15 MK.IV.
	SURFACE ROUGHNESS 1,6 Ra Max	TITLE RECIPROCATING ACTION REPRODUCTIVE 45° NUDGER and CLUSTER ASSEMBLY.			DRAWING No. 4-NIK-8 REV 0r