

Circuit diagrams

Circuit diagrams clearly and logically show the connection of components and how transfer of energy or signals through a circuit occurs. They are used to describe circuit operation and to assist understanding of the operation of the circuit. Their major application is in the area of circuit design, servicing and faultfinding.

Circuit diagram conventions

- Circuit diagrams may be either horizontally (obsolete) or vertically (modern) arranged.

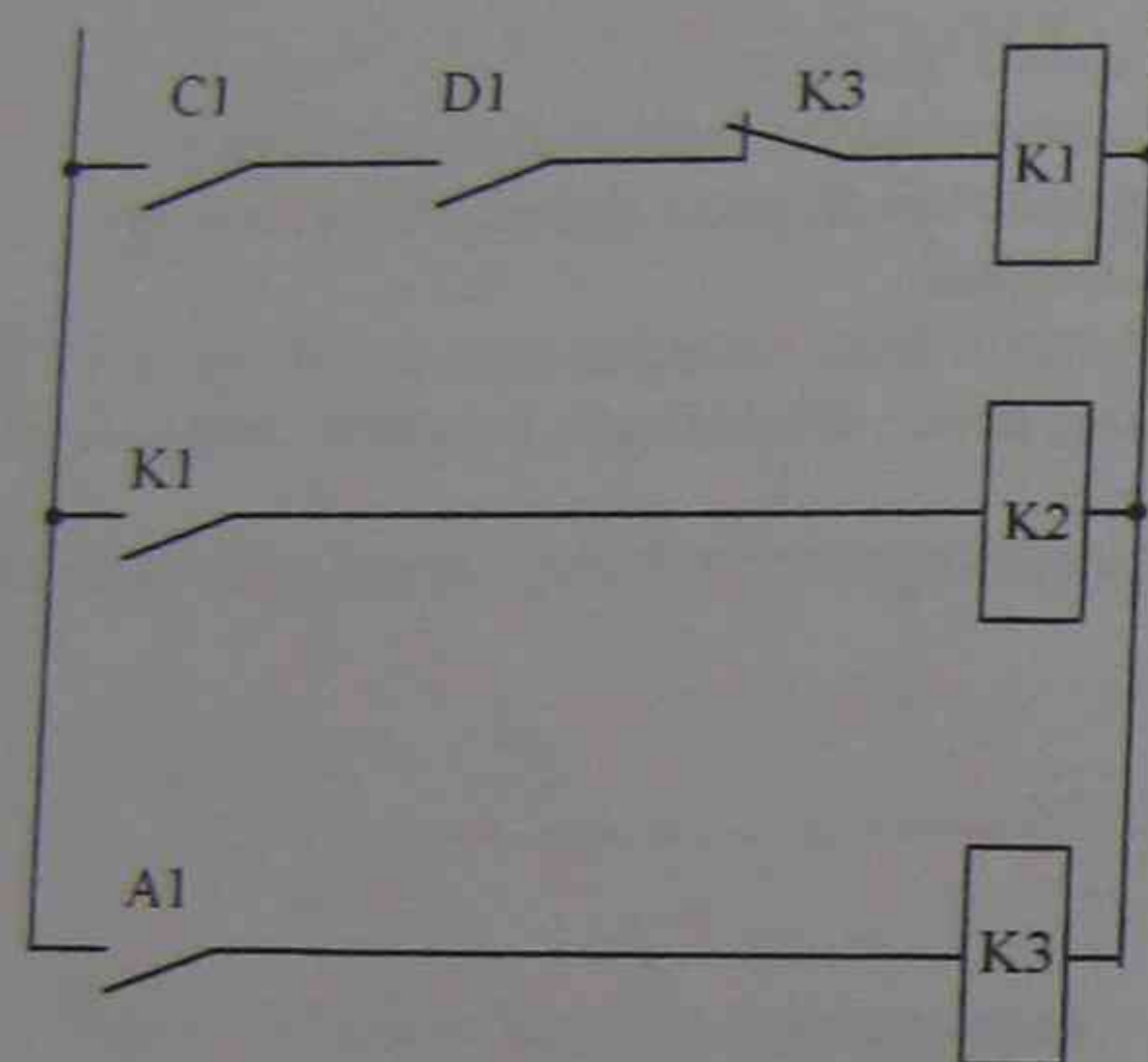


Figure 1 Circuit diagram-horizontal arrangement

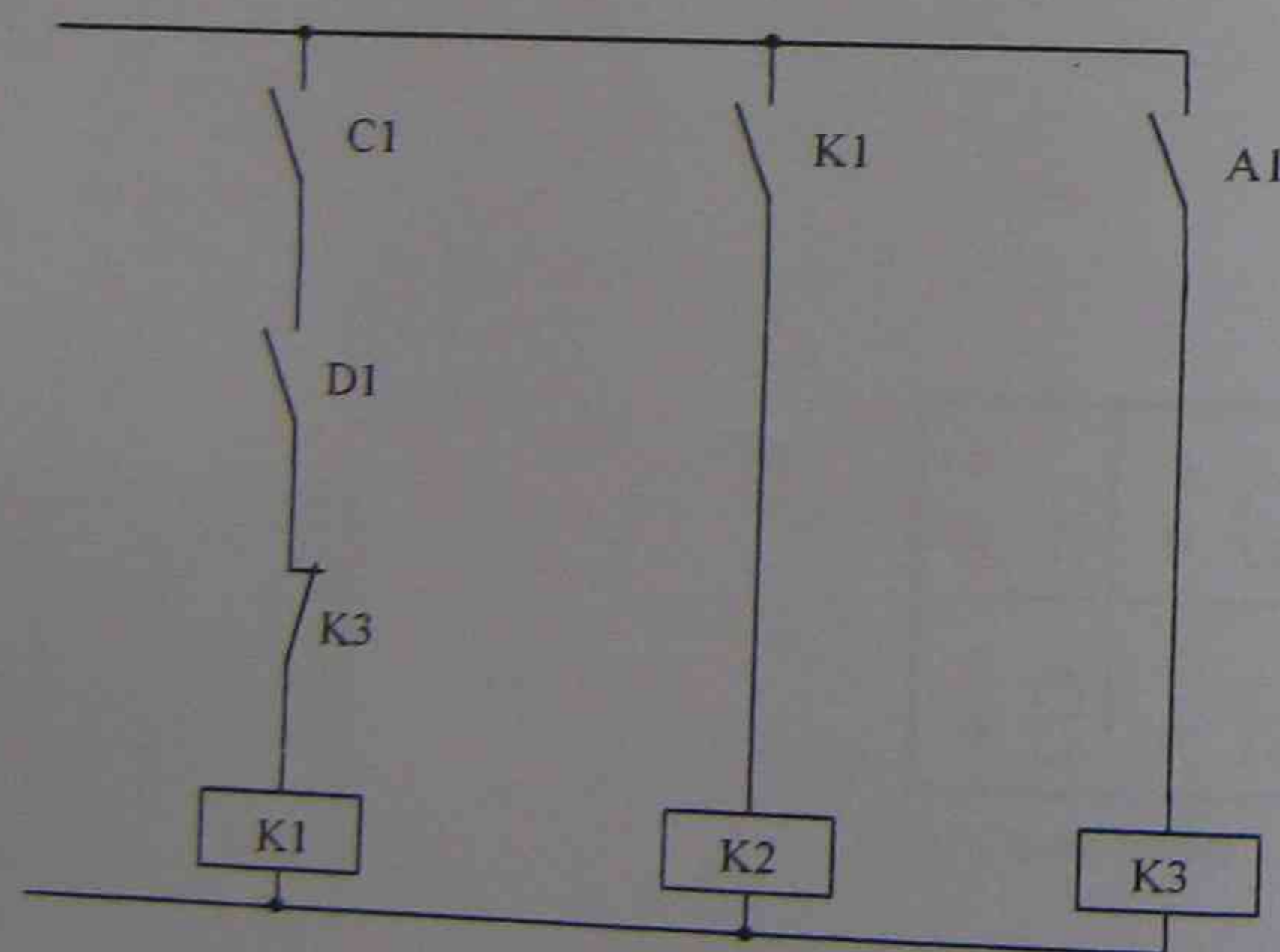
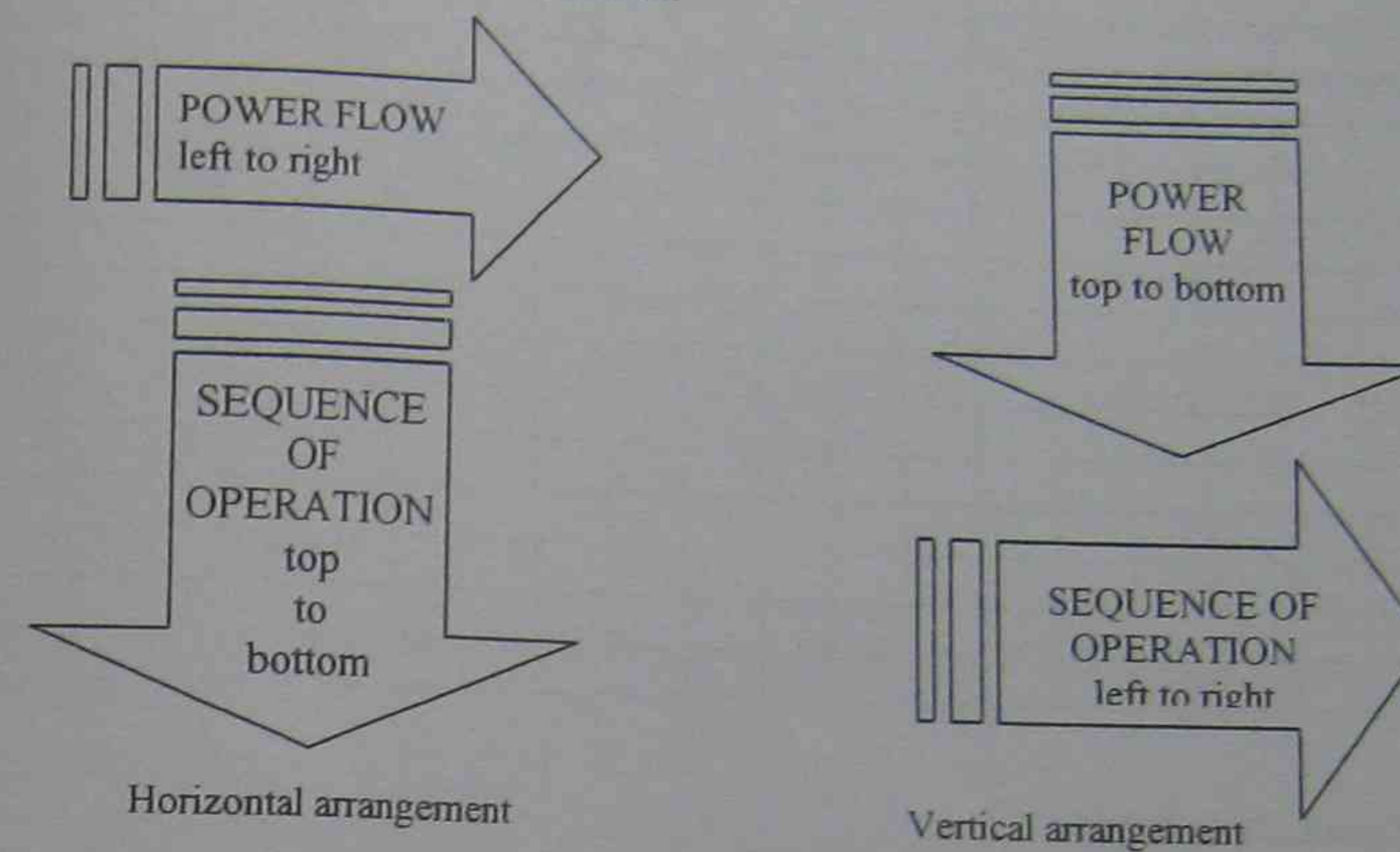
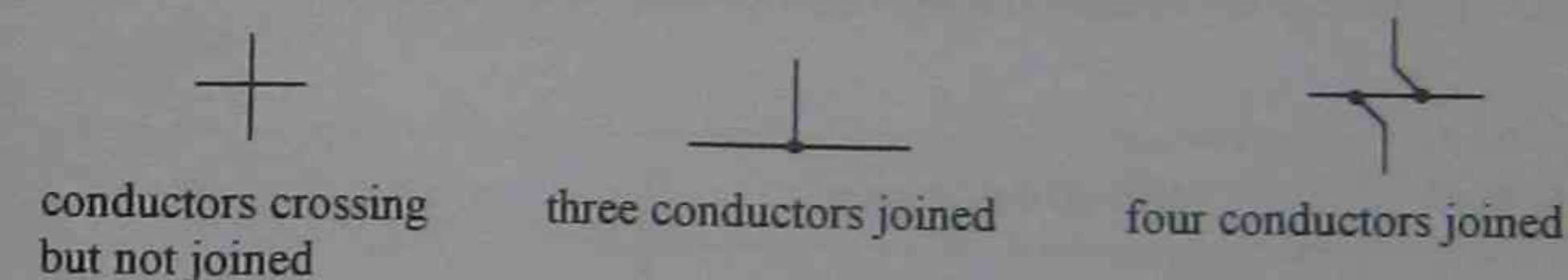


Figure 2 Circuit diagram-vertical arrangement

- power flow and sequence of operation:



- circuit diagrams are usually drawn in a 'detached representation' in which component parts of an item may be drawn remotely from one another.
- different line thicknesses are used to distinguish between power conductors —0.7 mm and control circuit conductors —0.35 mm
- the following diagram illustrates circuit conductors which cross or are joined:



- circuit diagrams are always drawn in the electrically:
 - cold condition or
 - reset condition or
 - shutdown condition
- this allows the state (on, off, open, closed) of all components to be determined when the circuit is turned off

Exercise

Produce a neat sketch of the circuit shown in Figure 3. Pay particular importance to correct proportioning of symbols. Use a 5 mm grid sheet.

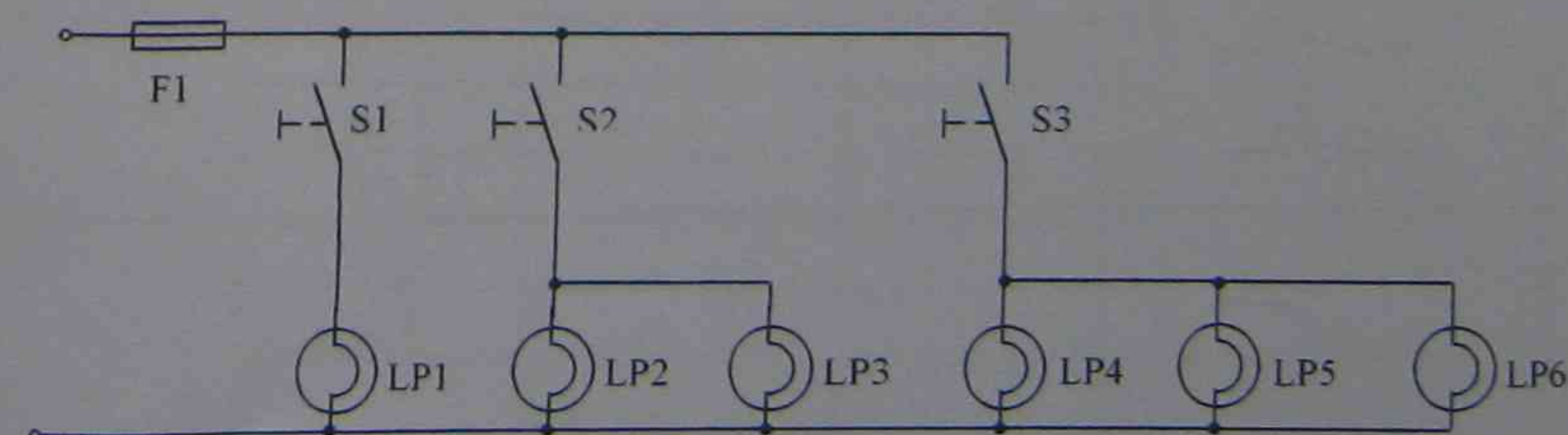
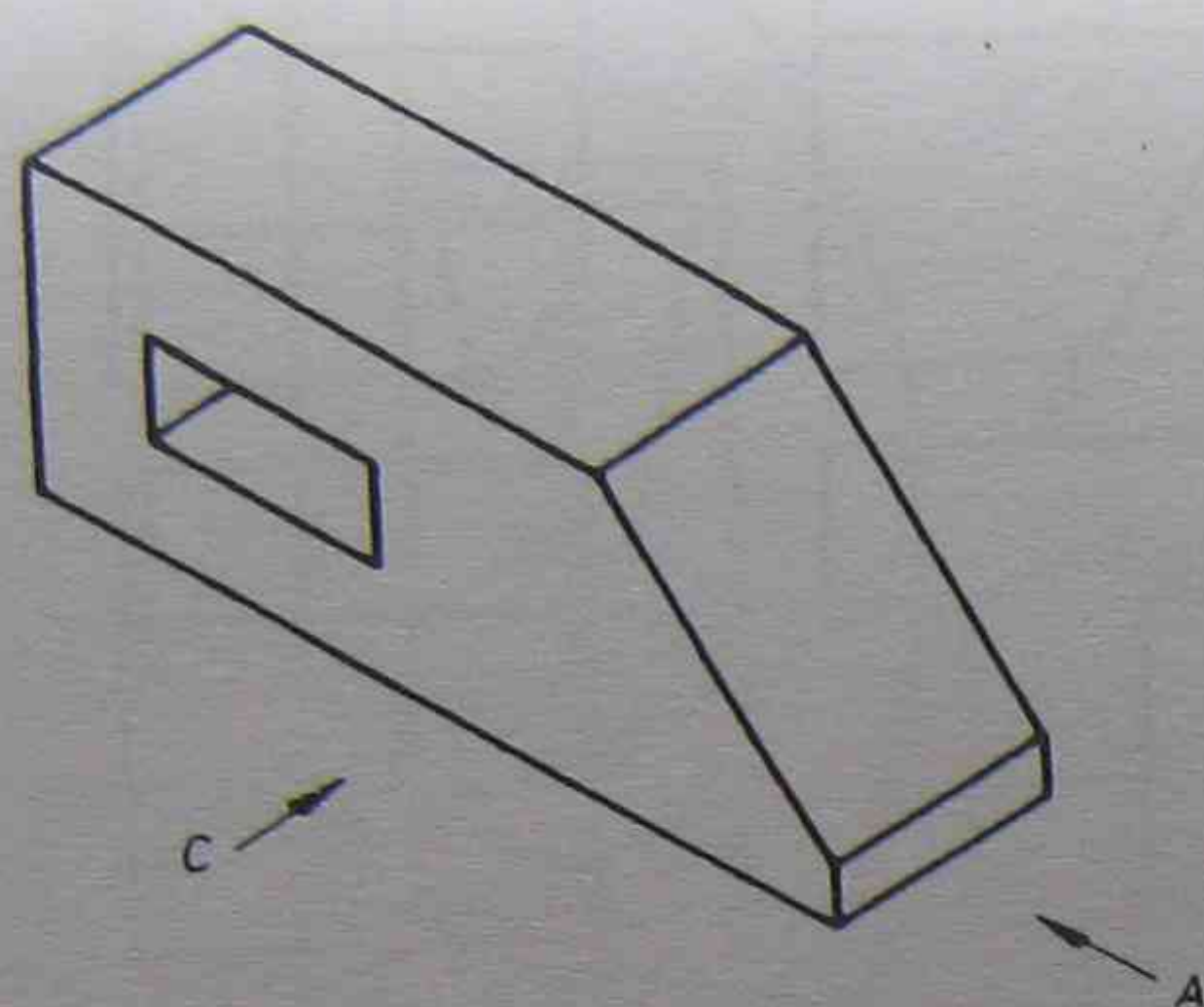


Figure 3 Circuit diagram-switching circuit

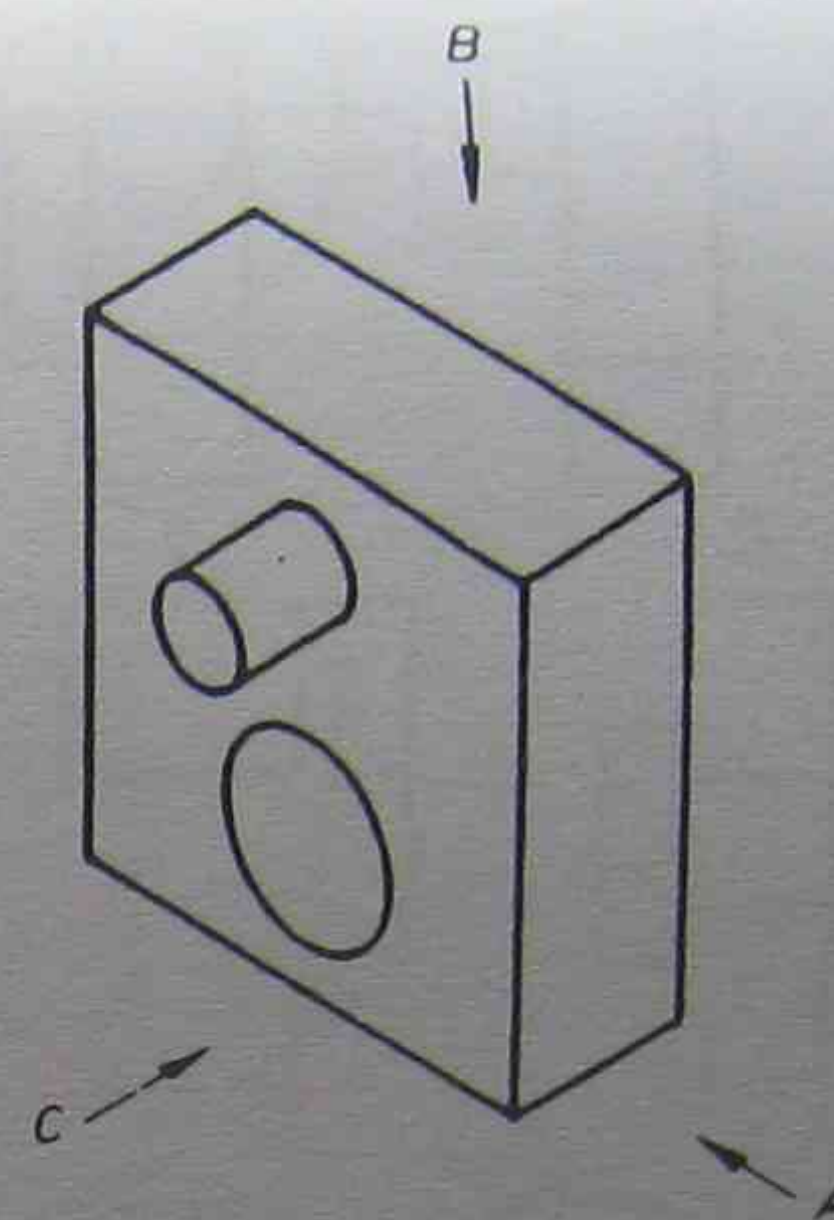
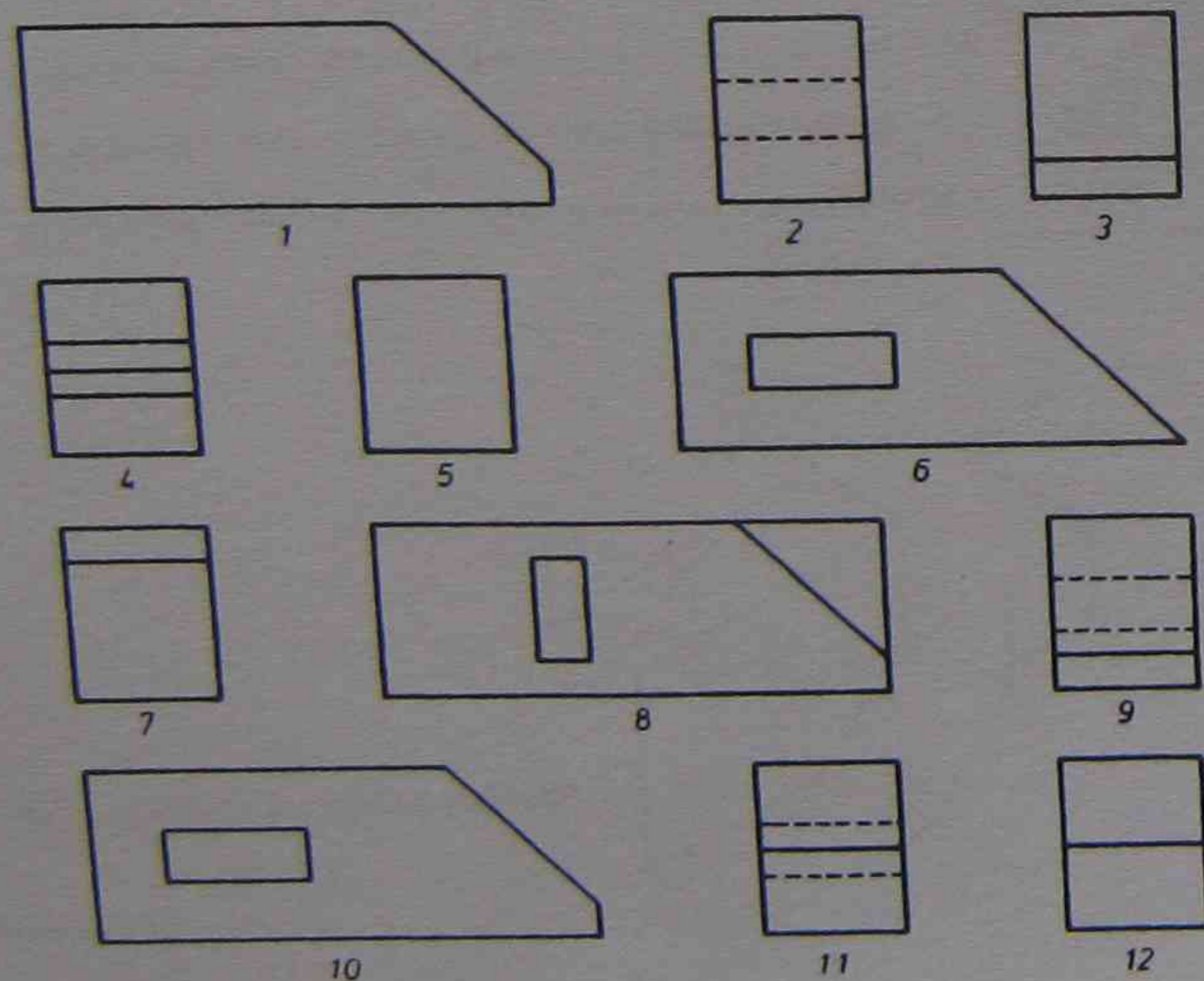
SELECT THE CORRECT VIEWS



Which drawing shows the view from Direction A?

Which drawing shows the view from Direction C?

A	
C	

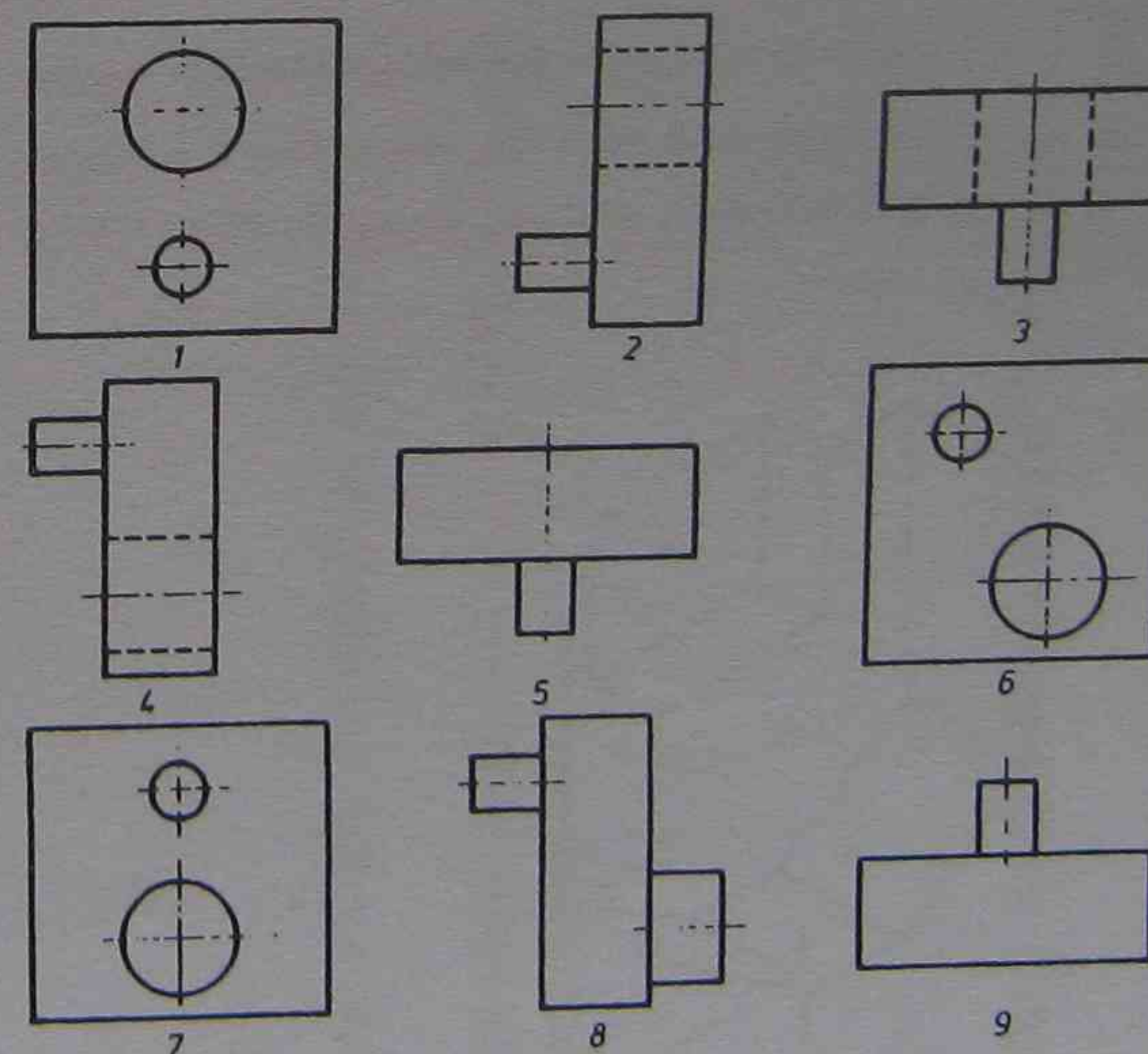


Which drawing shows the view from Direction A?

Which drawing shows the view from Direction B?

Which drawing shows the view from Direction C?

A	
B	
C	

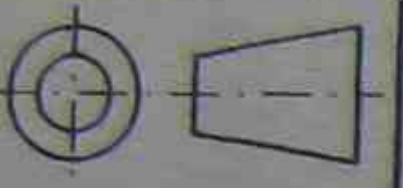
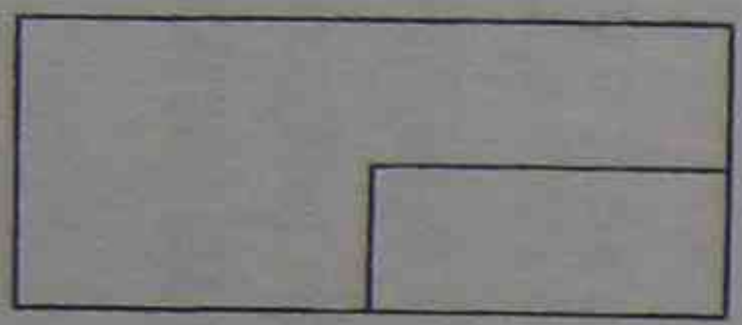
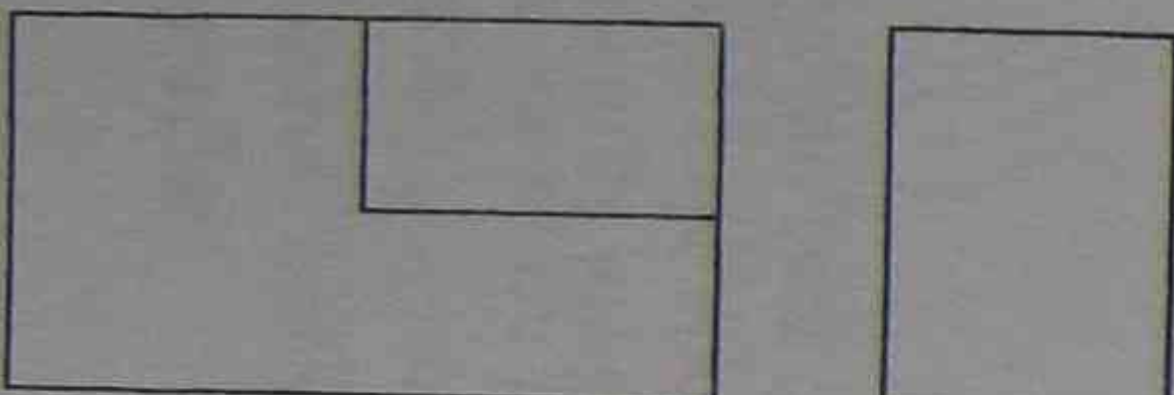

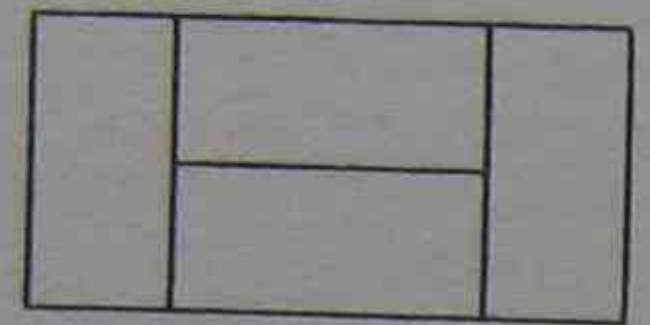
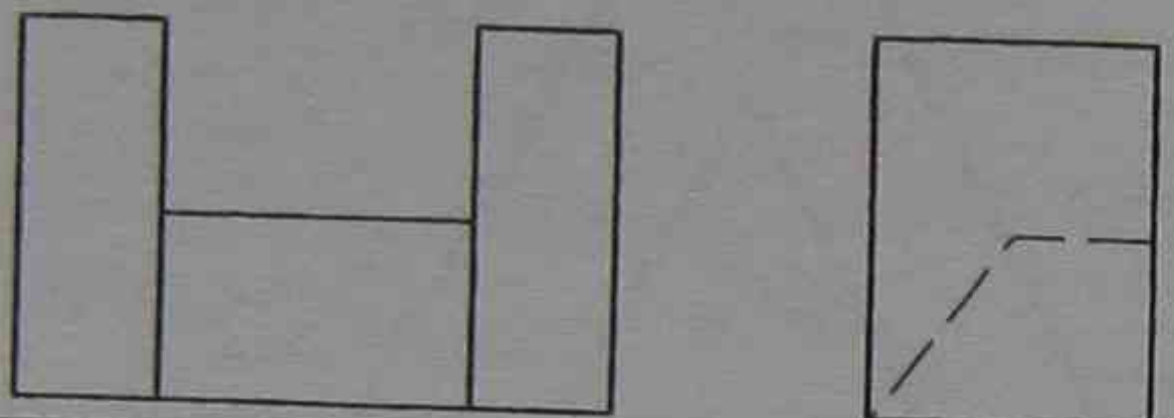

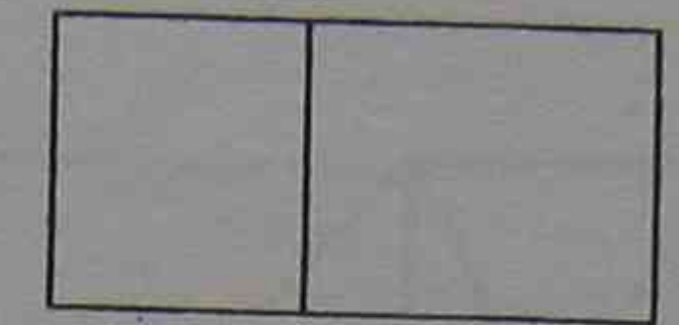
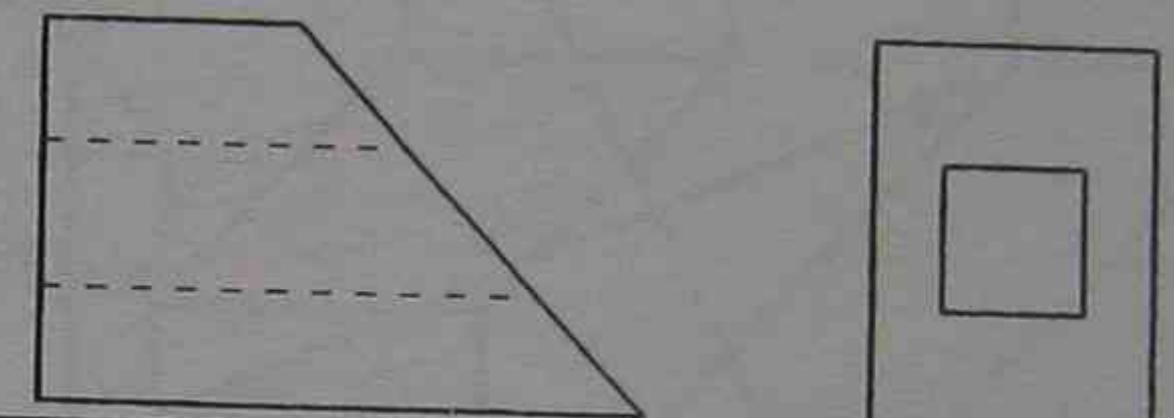

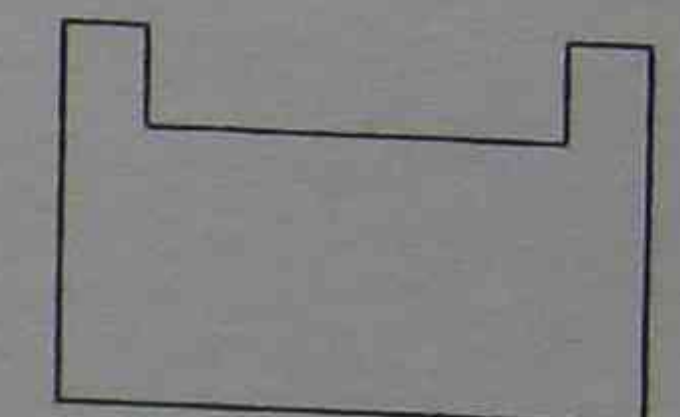
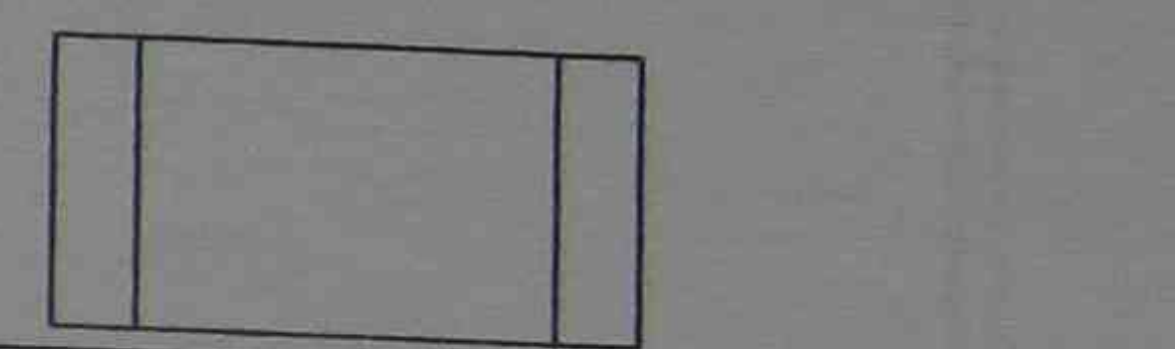

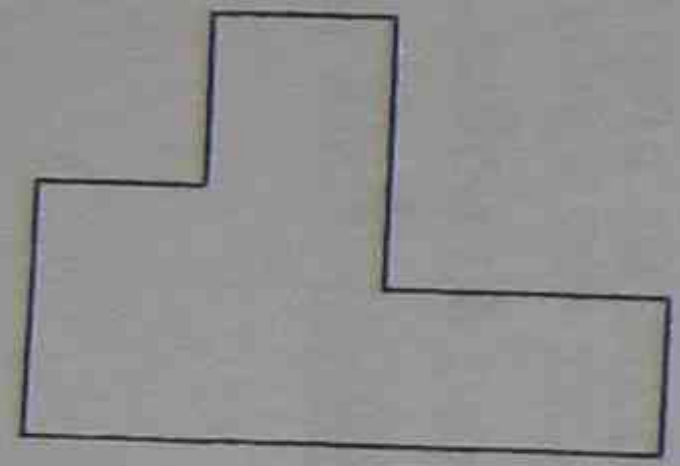
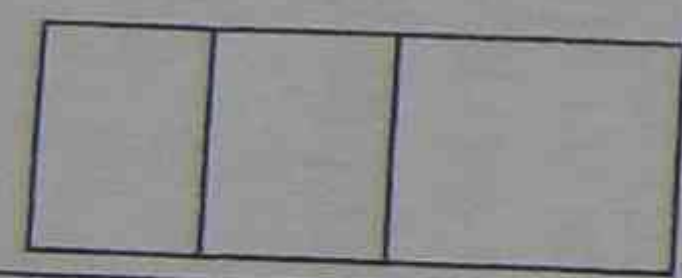
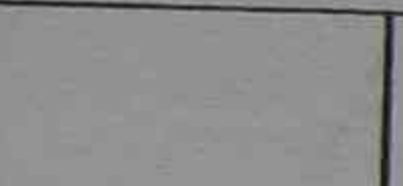
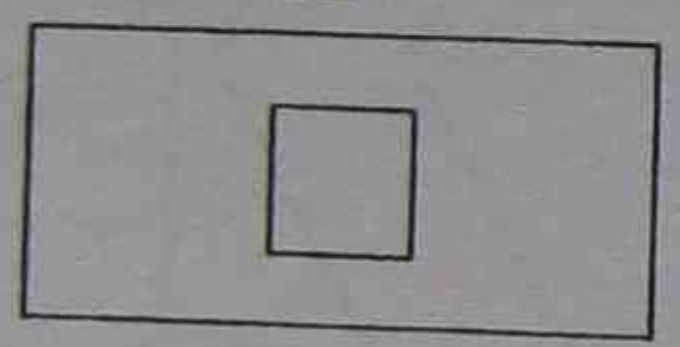
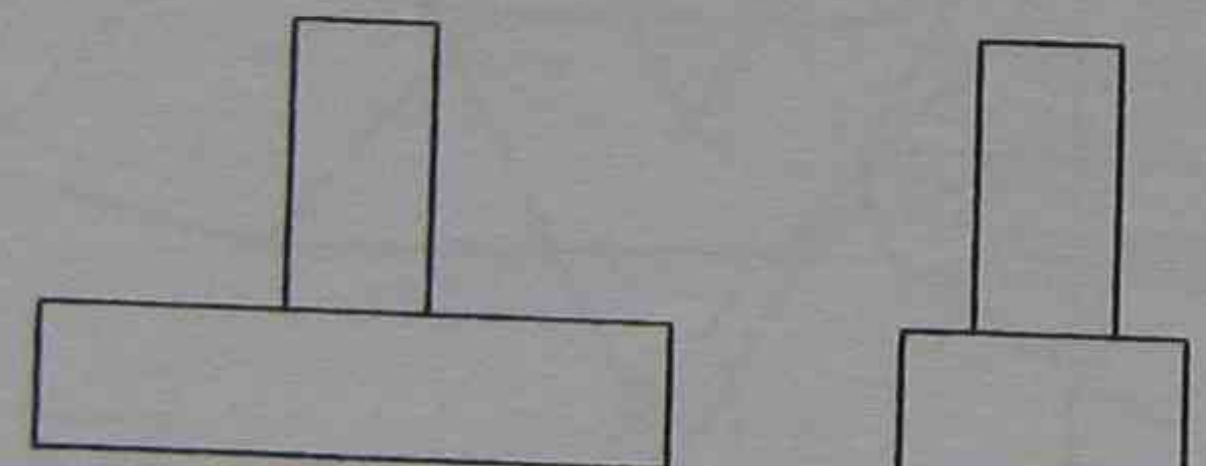
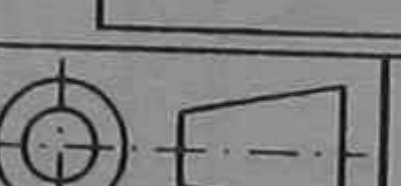
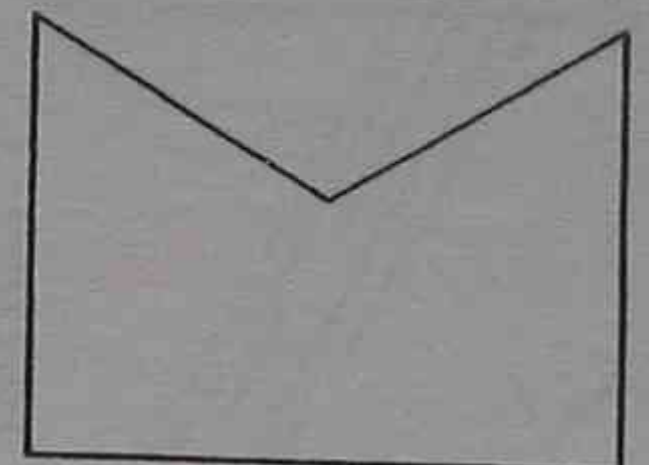

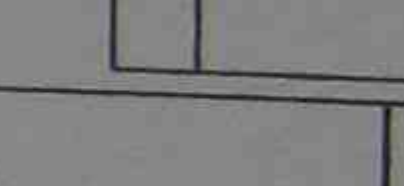
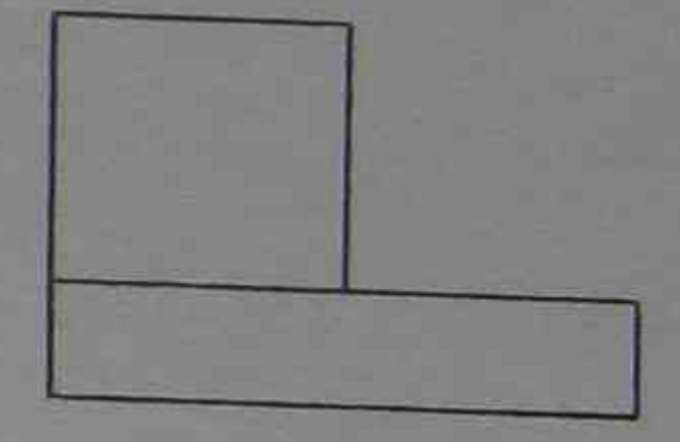
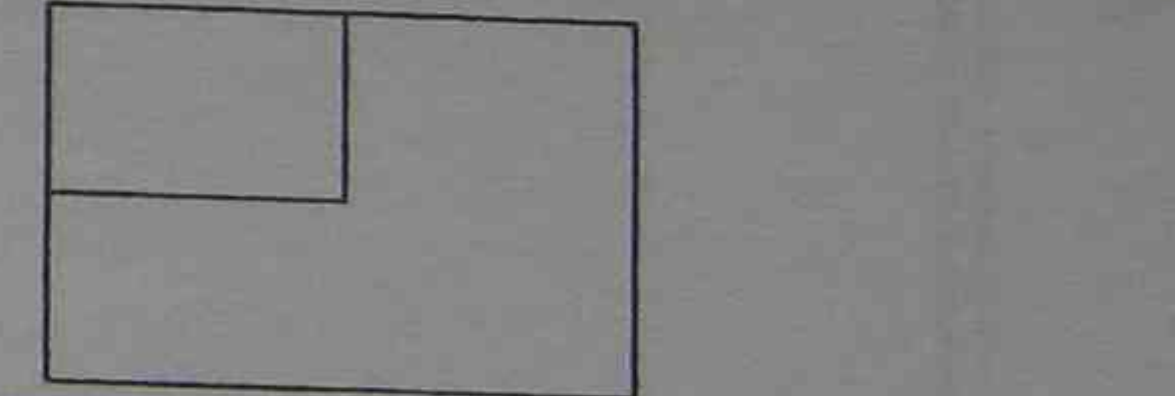
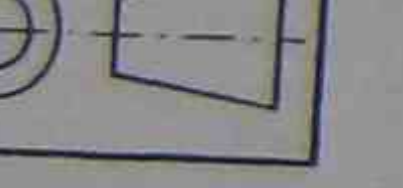
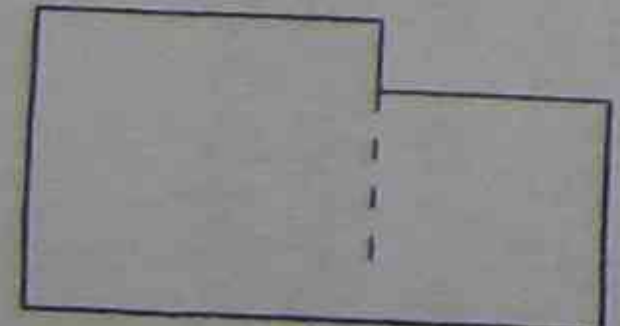
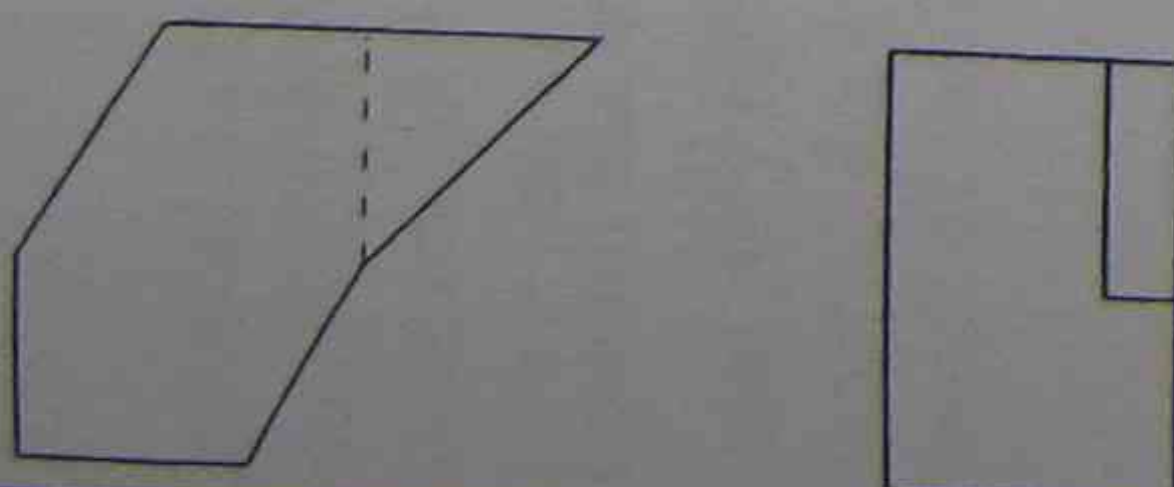

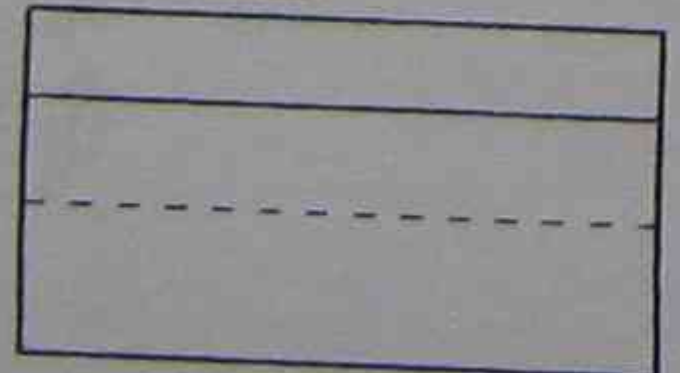
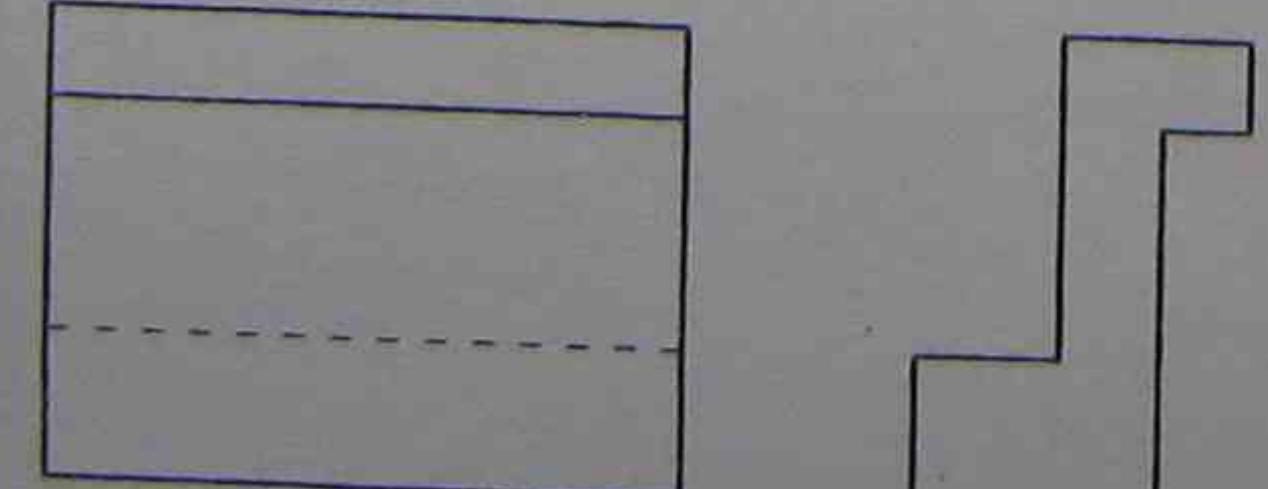

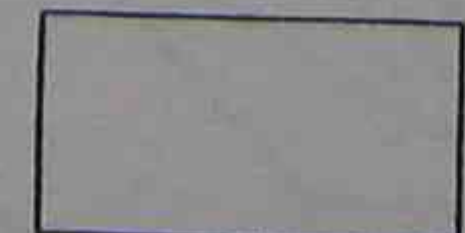
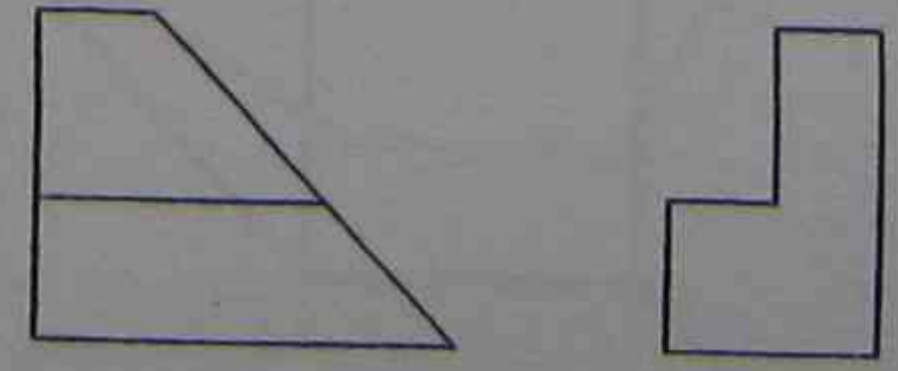

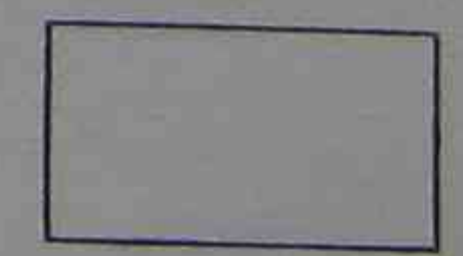
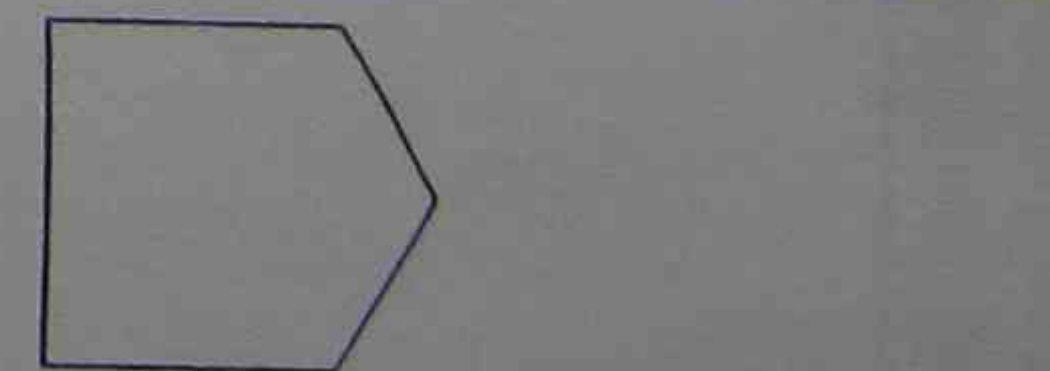


Type

3

Exercise 24

Below is a series of drawings, some complete, with no projection symbol, and some with missing lines with the projection symbol showing. In each supply the missing information to complete the drawing.

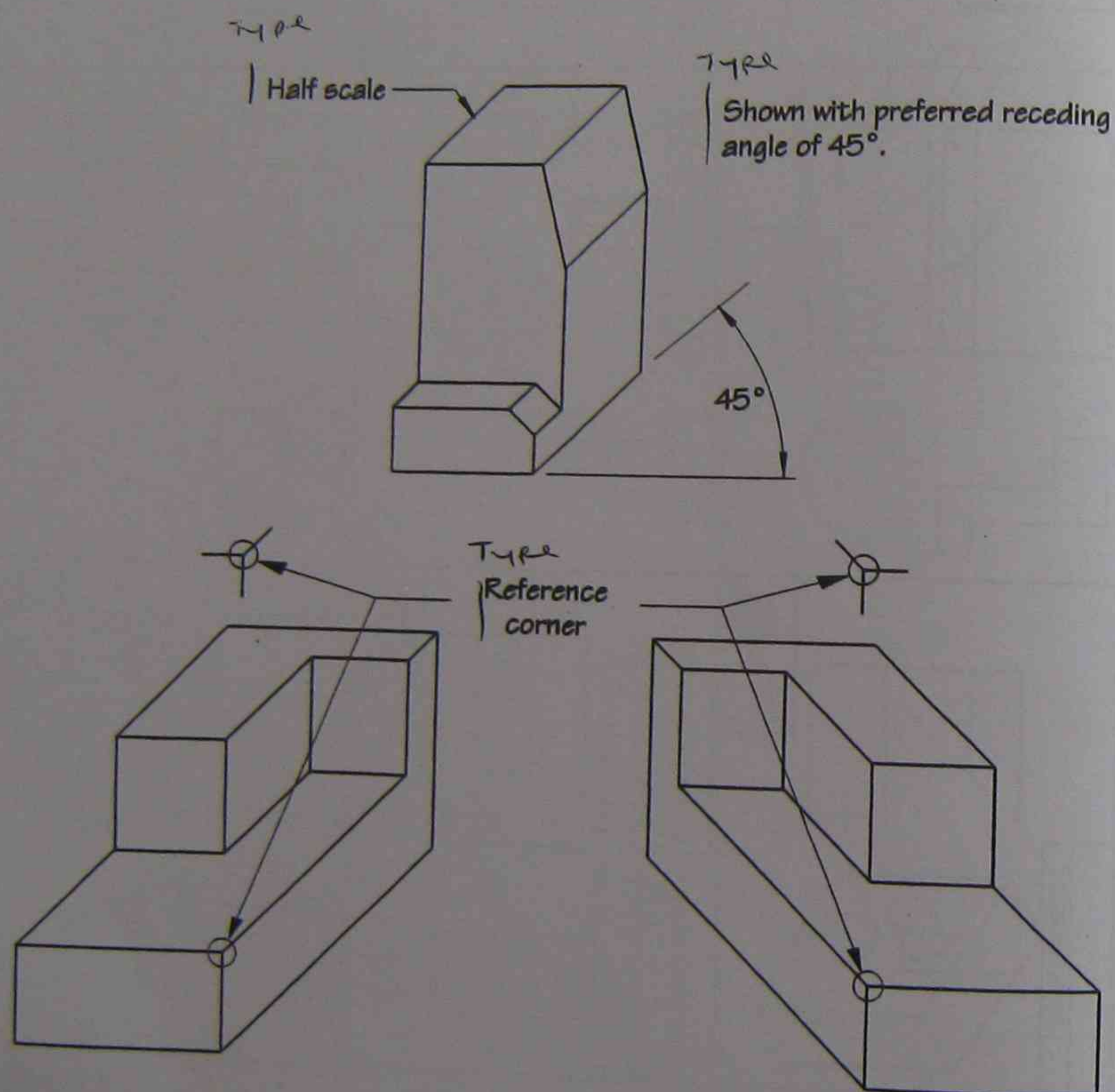
STUDENTS NAME

 MANUFACTURING & ENGINEERING
 EDUCATIONAL SERVICES DIVISION

Oblique drawings

This method of drawing objects is not very common and is not often used in technical publications.

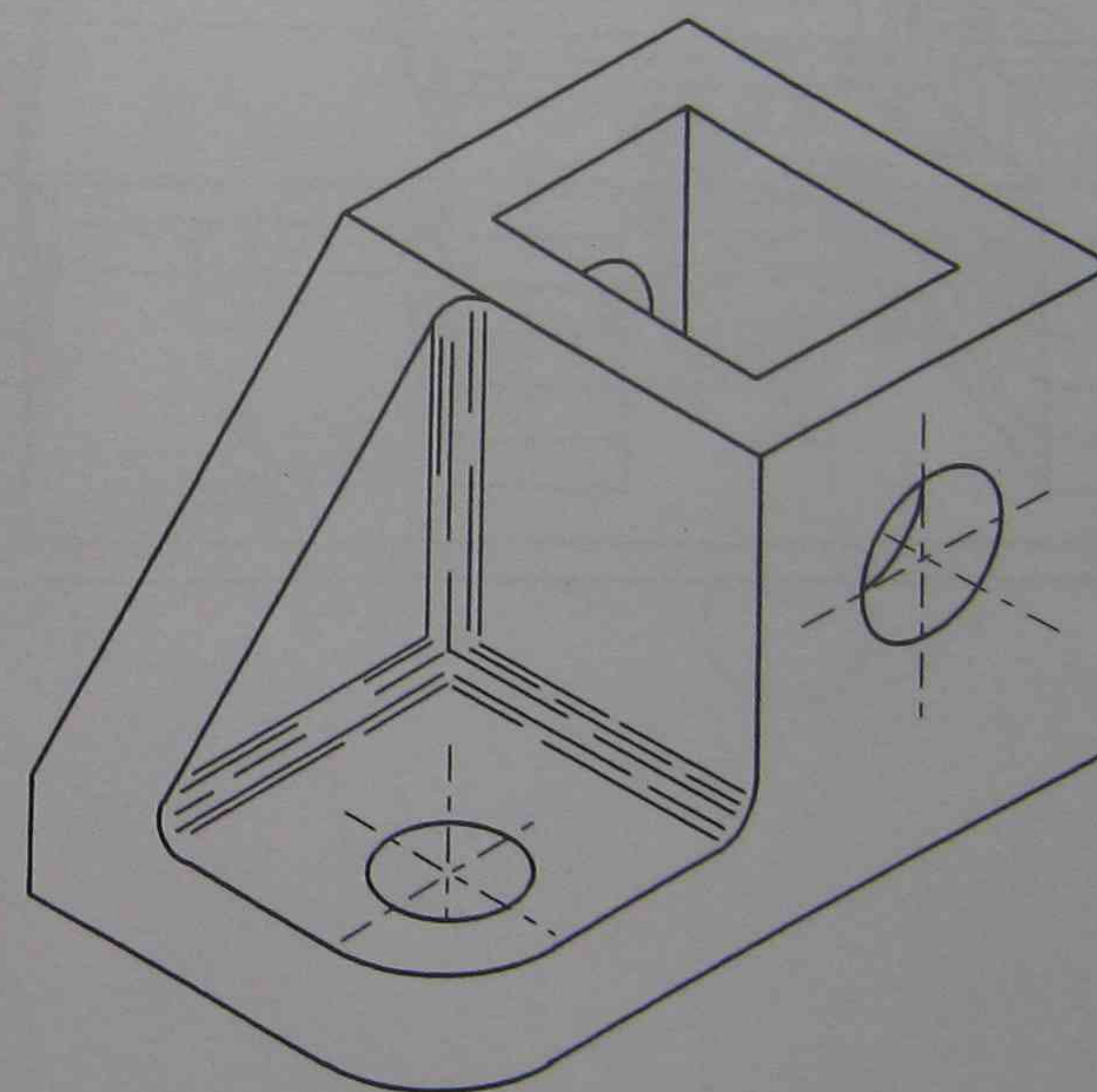
To make these drawings look somewhere in proportion, the receding 45° lines are drawn half size. This is not a set rule about 45° and half size lengths, however, the feature that identifies oblique is the fact that the front edge is drawn horizontal.



Isometric drawings

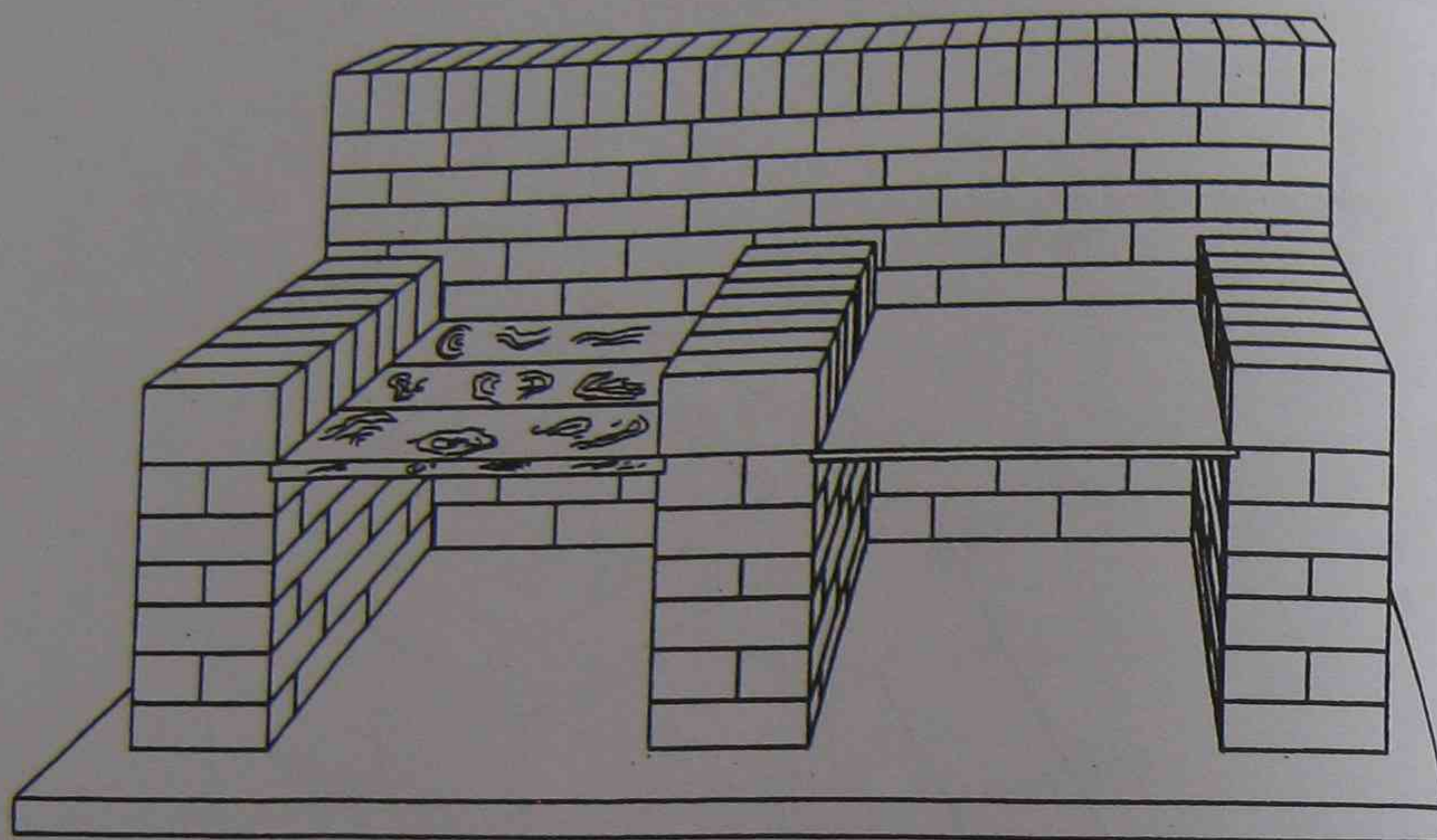
These are by far the most common pictorial drawings that are found in technical publications. All lengths are drawn full size and all edges recede at 30° from the horizontal as shown below. All circles and arcs on all faces are elliptical and no faces are a true shape.

The best way to do an isometric drawing is to imagine a box that would exactly hold the item you want to draw. Draw the box, using light construction lines, to show the height, length and width of the item. Then draw the item inside the box.



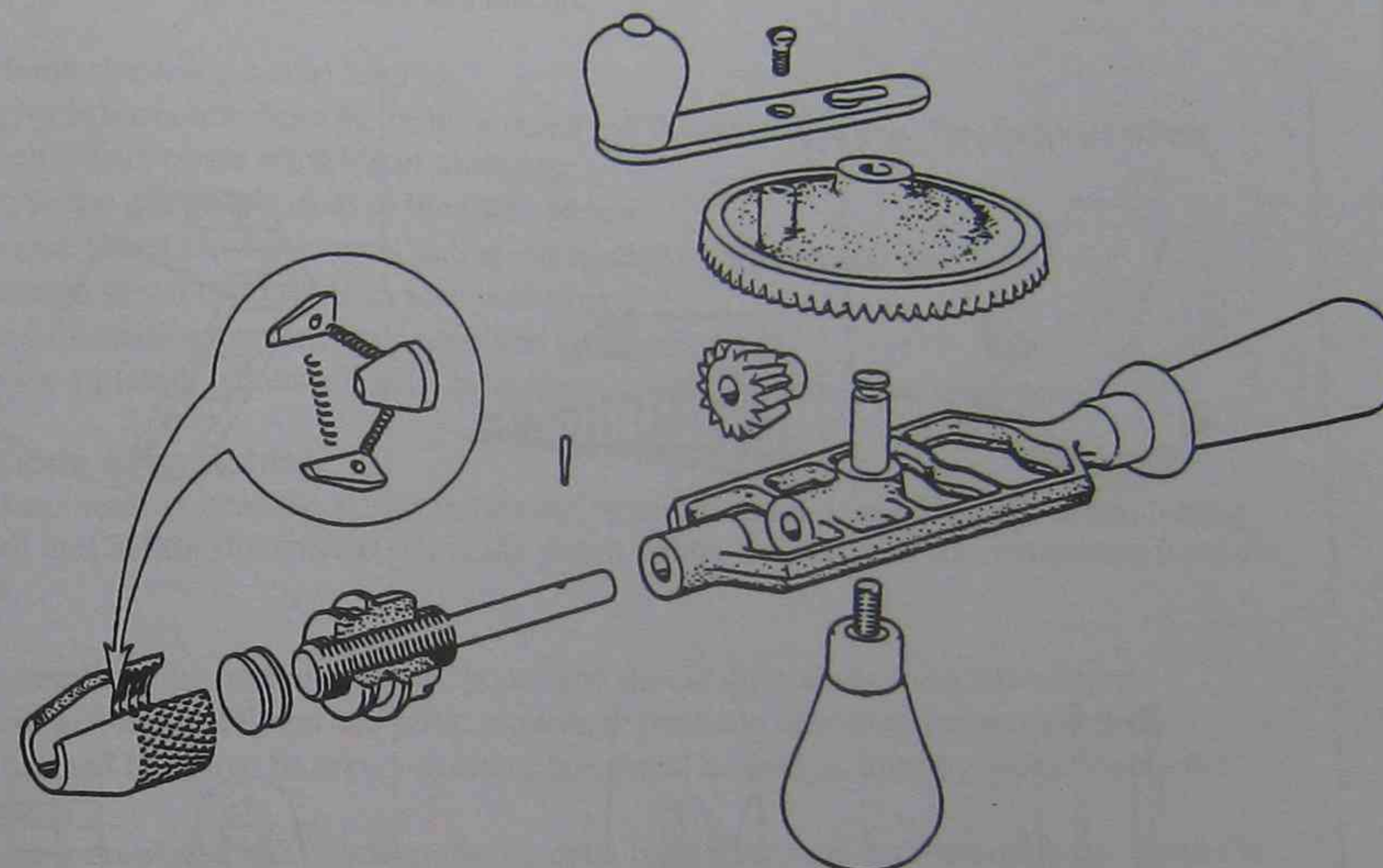
Perspective

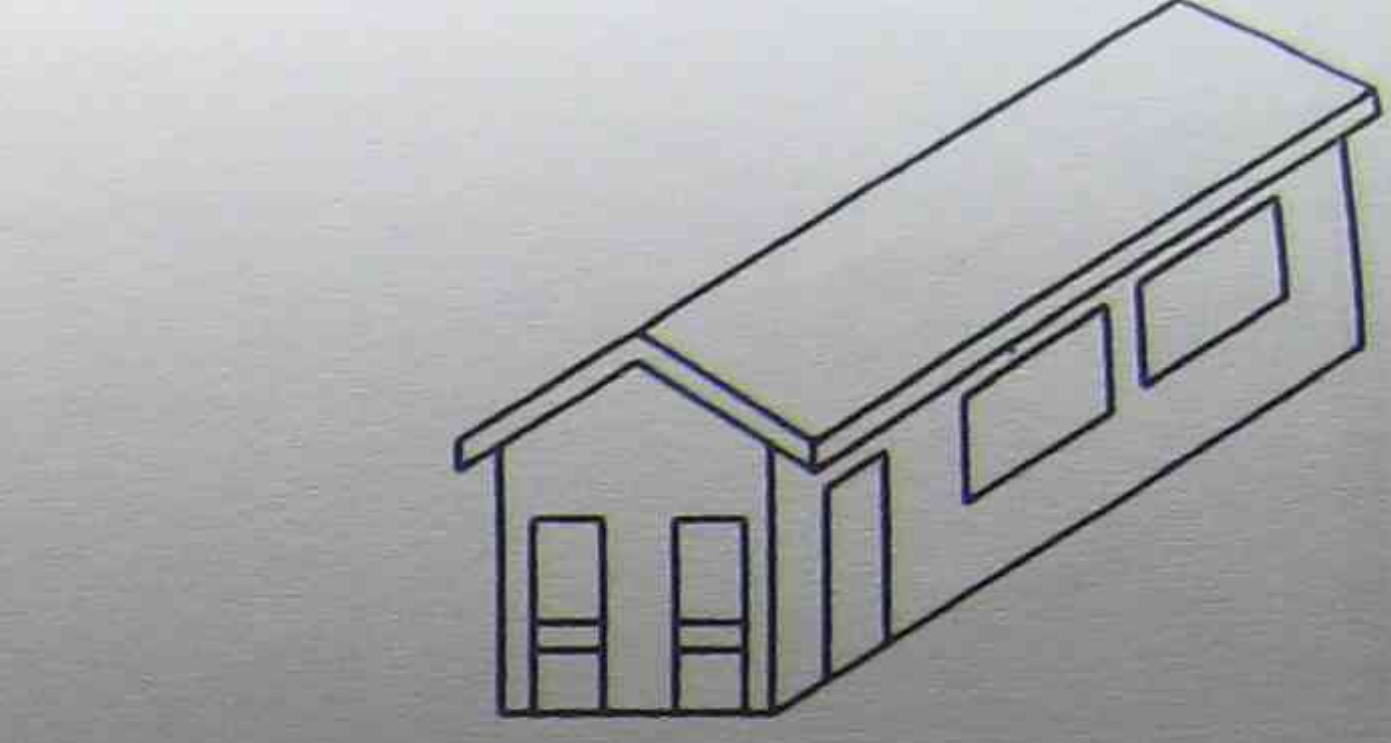
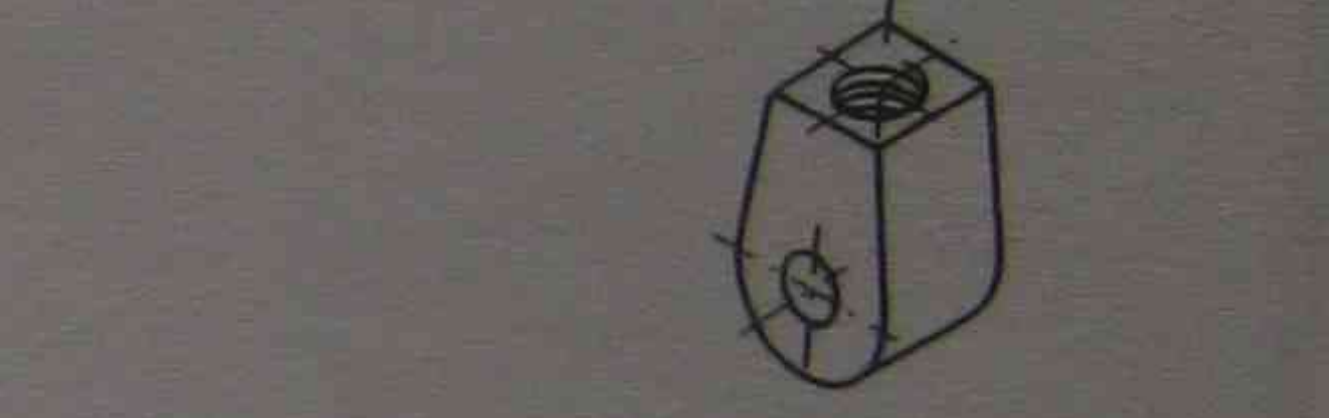
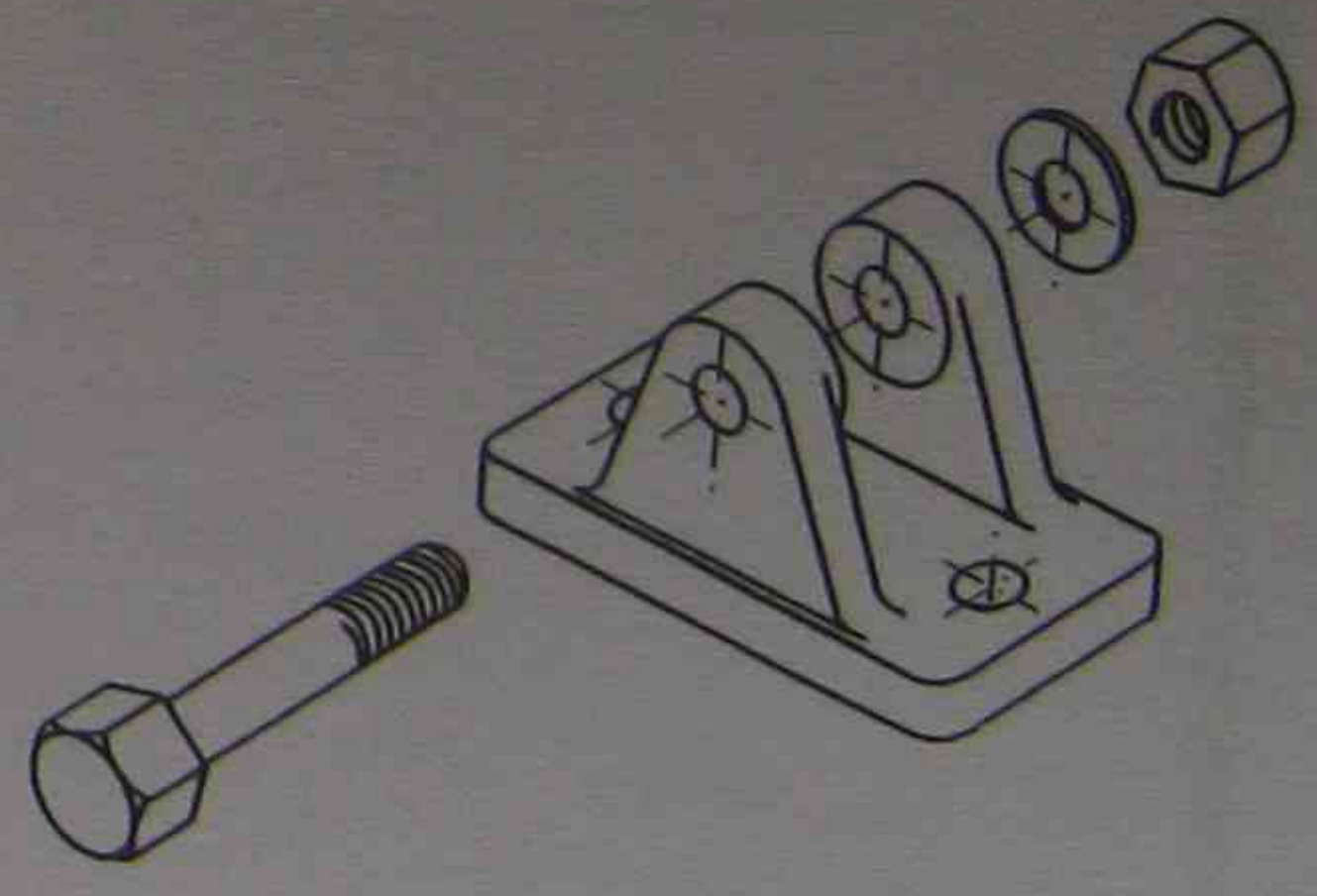
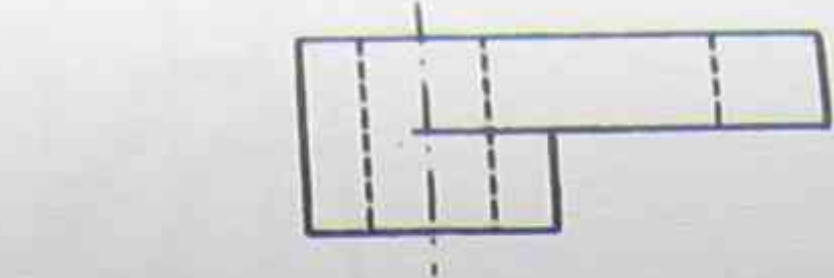
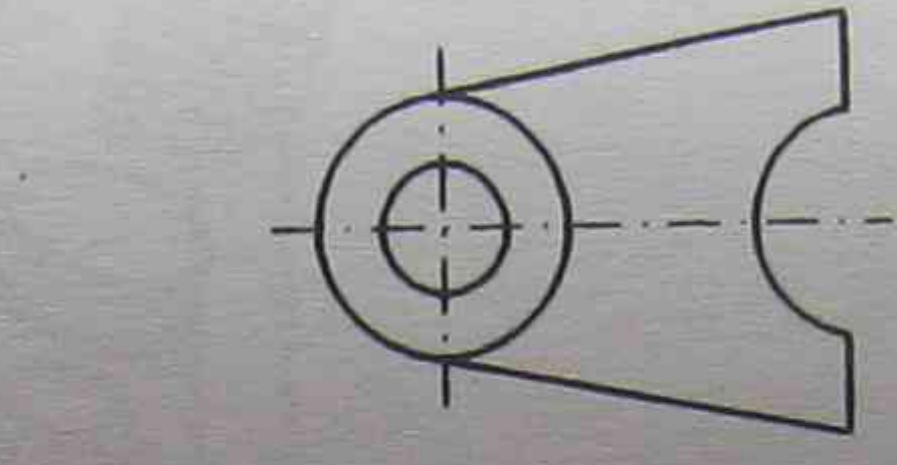
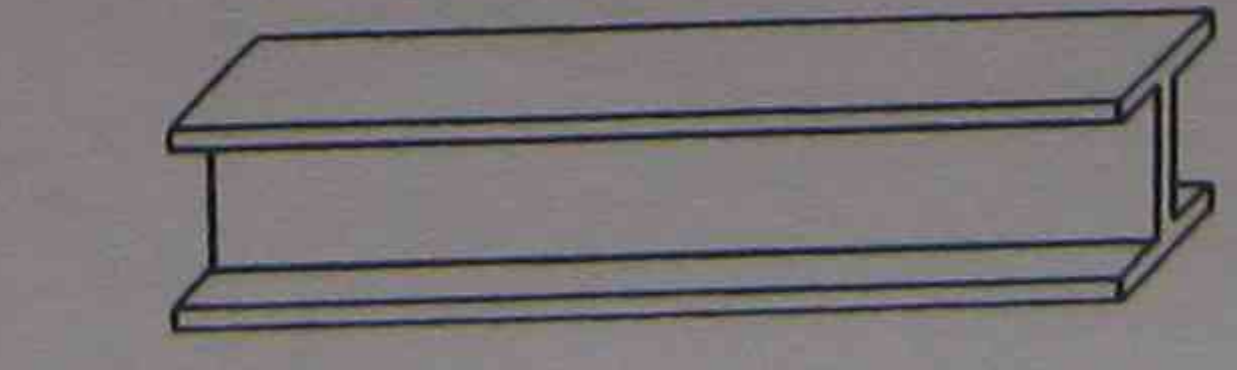
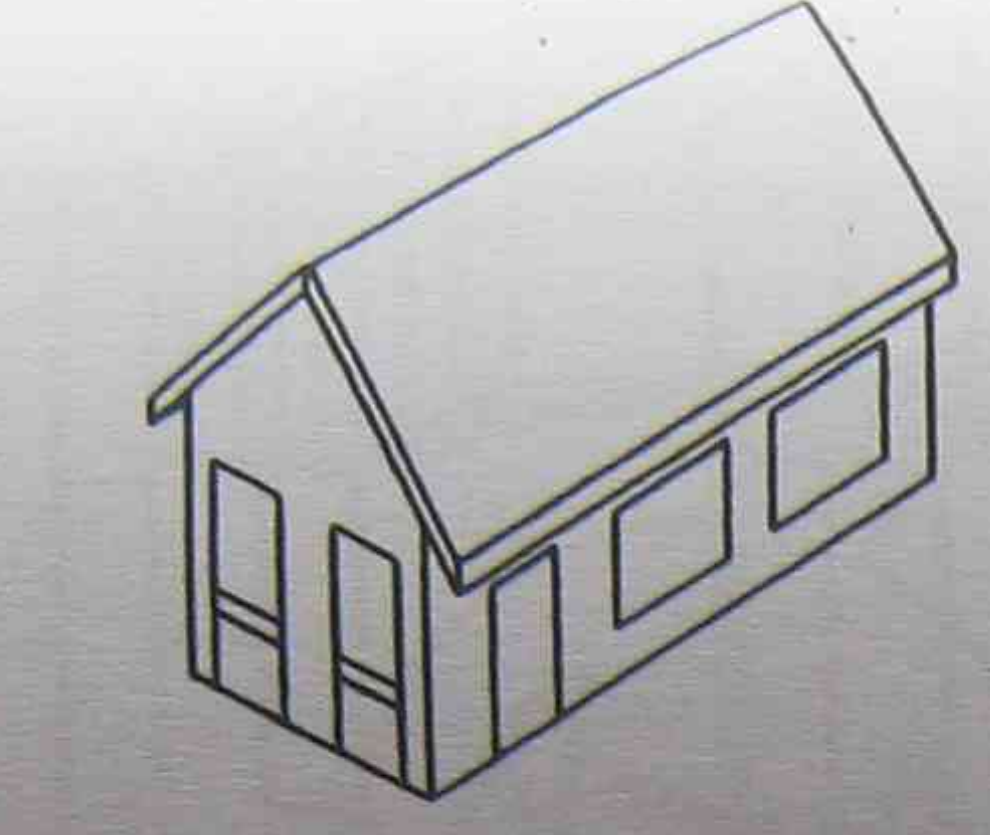
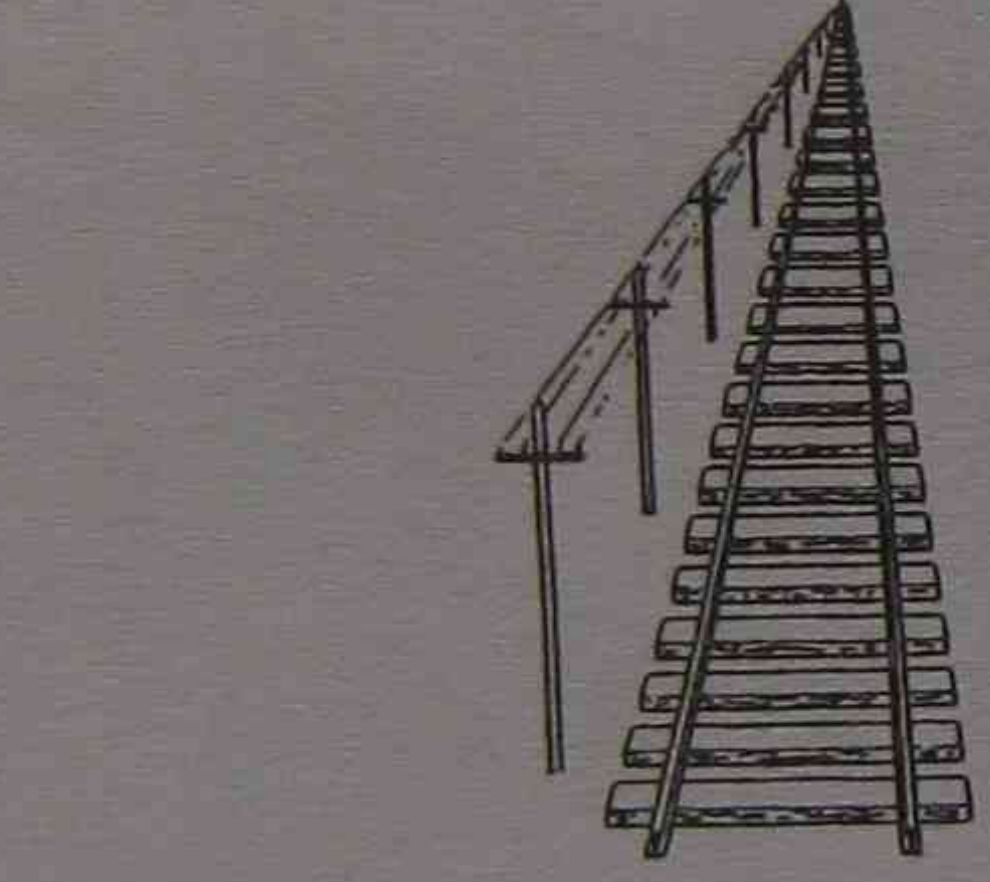
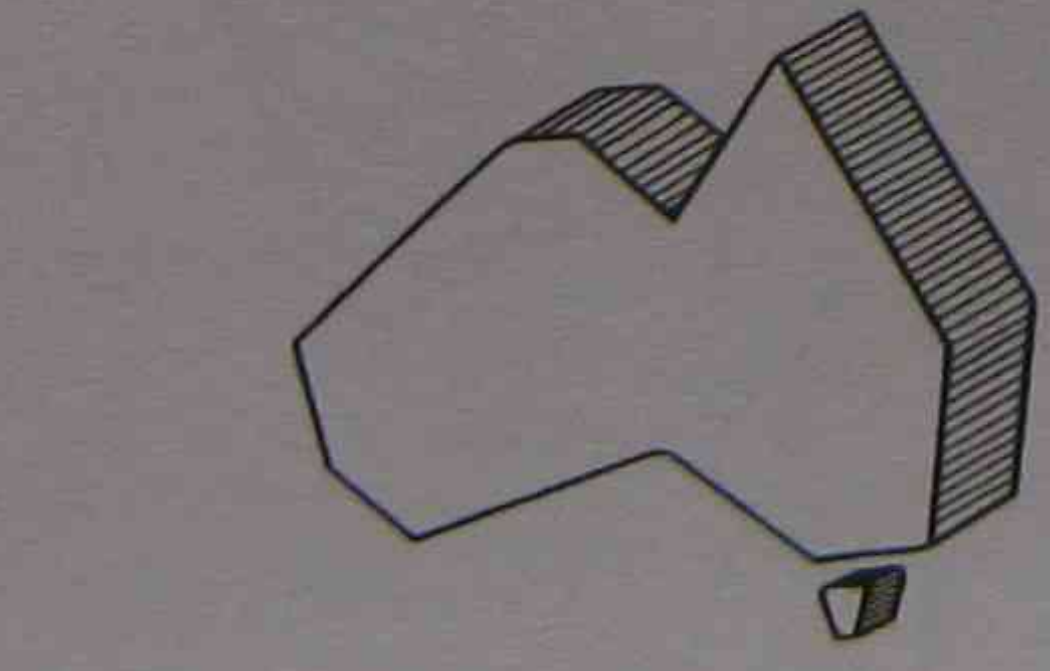
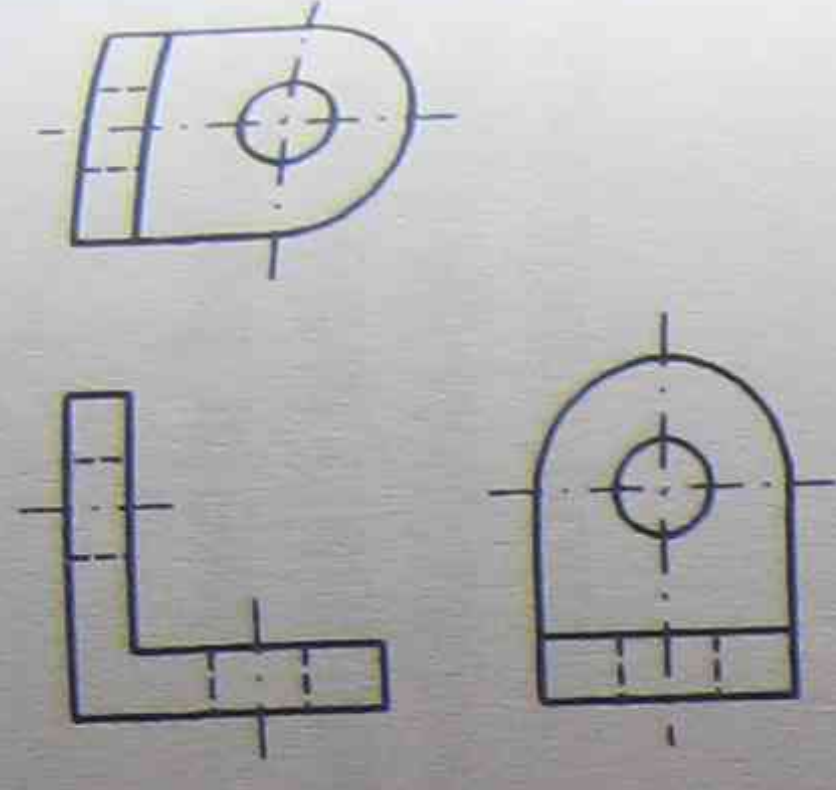
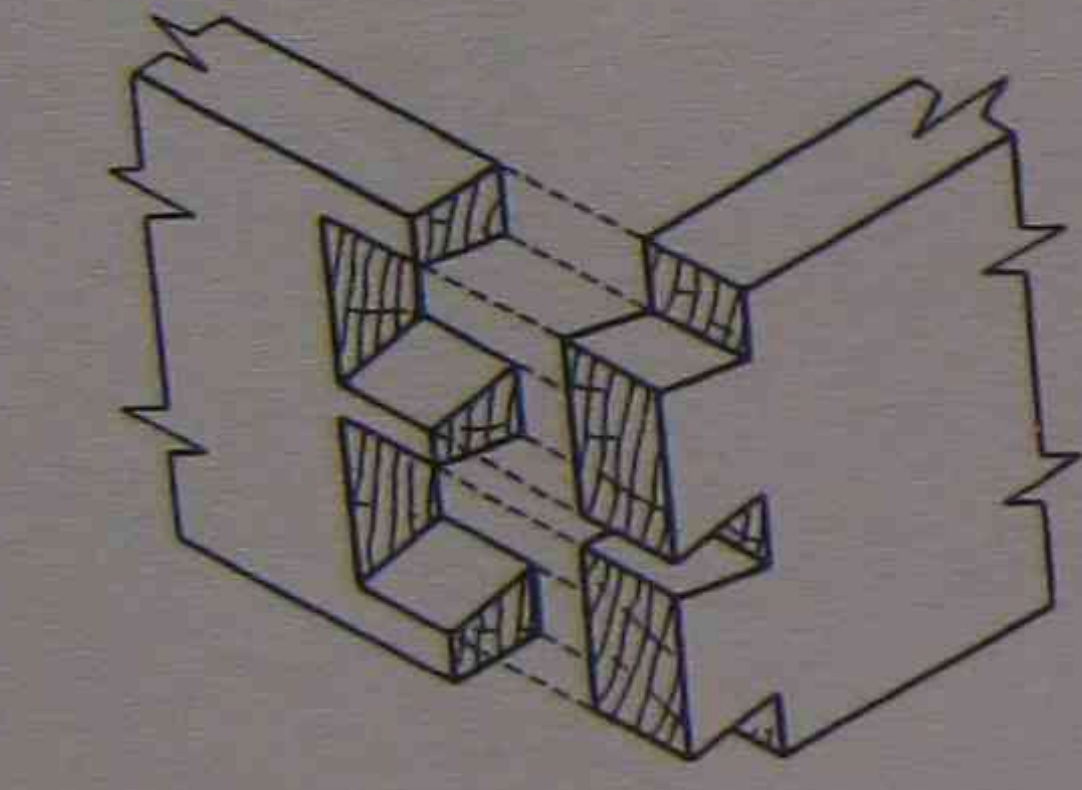
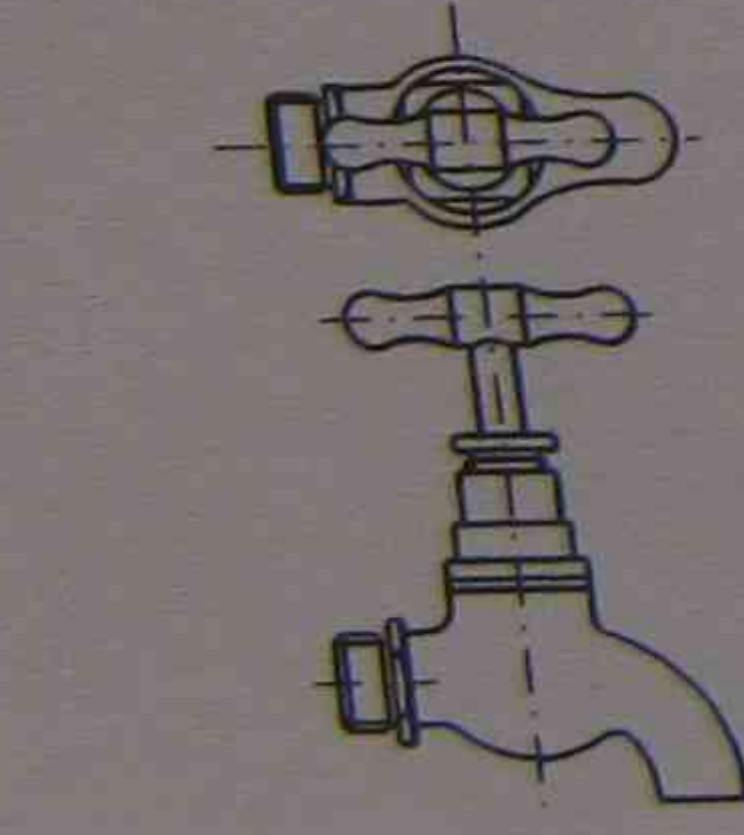
A method widely used to show construction and buildings as they appear to the eye on completion. The example below is a single point perspective. The lines of projection from the front eventually meet at one point.



Exploded view

This method is particularly good for showing those, who have little or no experience with reading diagrams, and with the ability to comprehend the assembly or dis-assembly of a mechanical component.





Free hand

Freehand sketching is used because it allows the drafter to write. Trade person

Sketching is used for reference or for proportion,

Freehand sketching

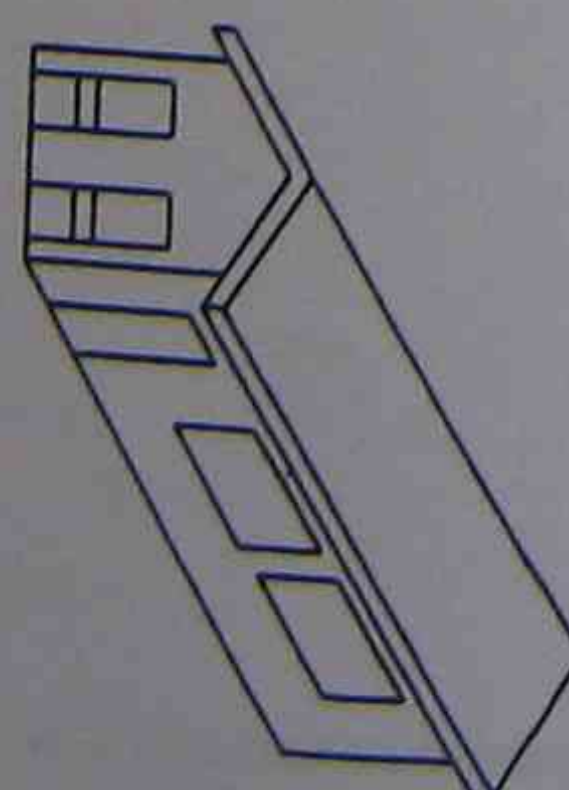
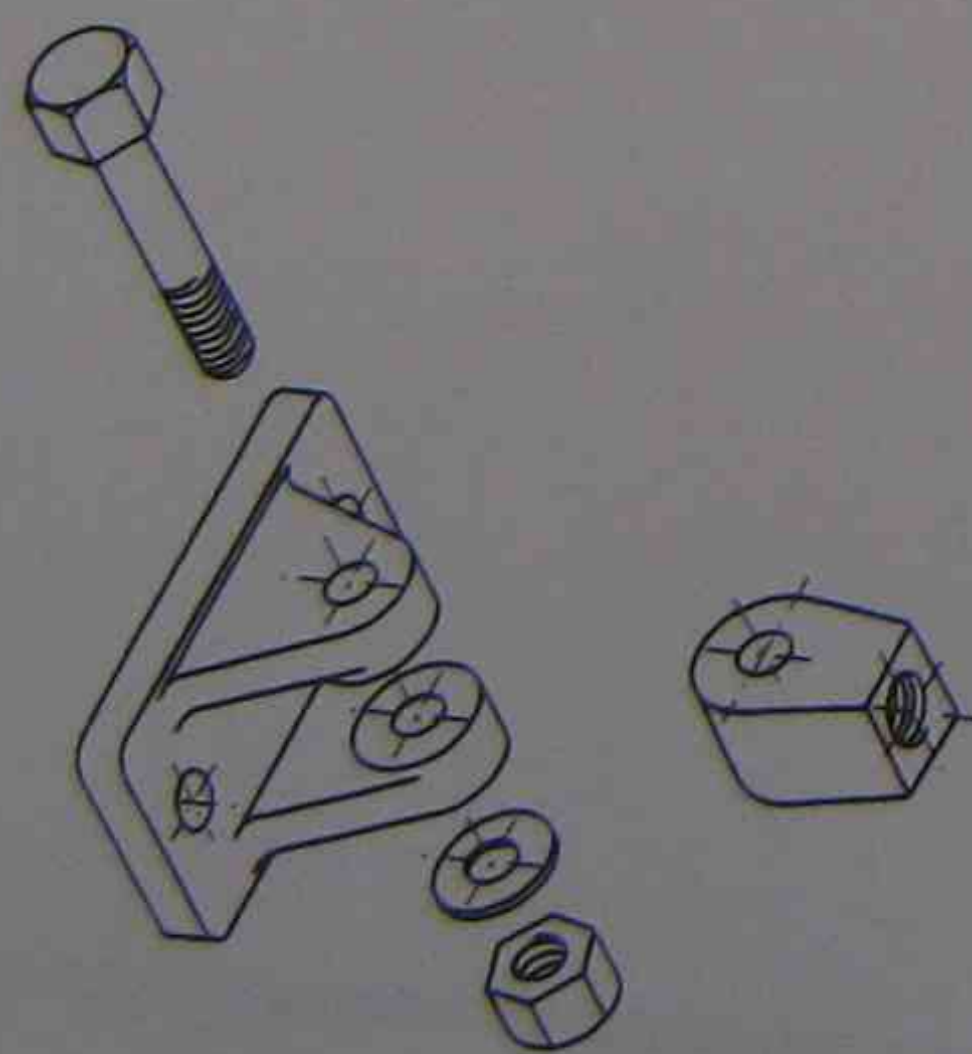
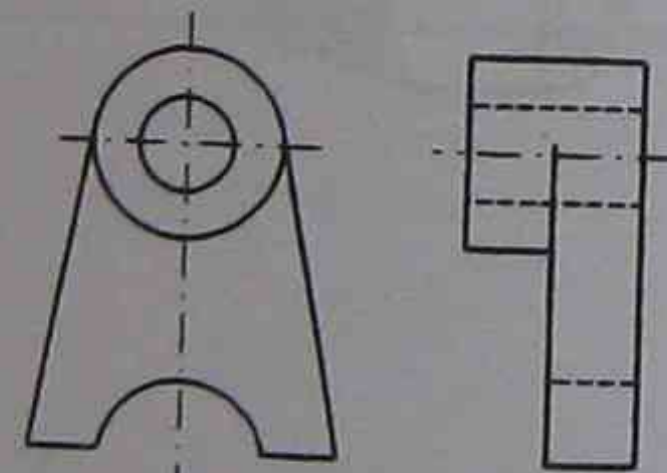
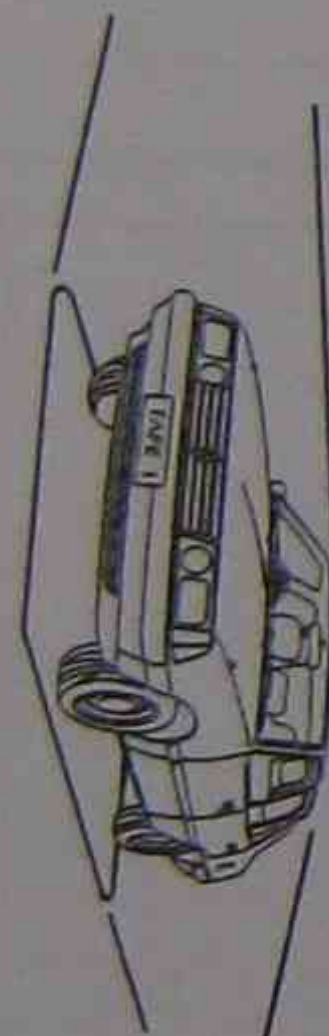
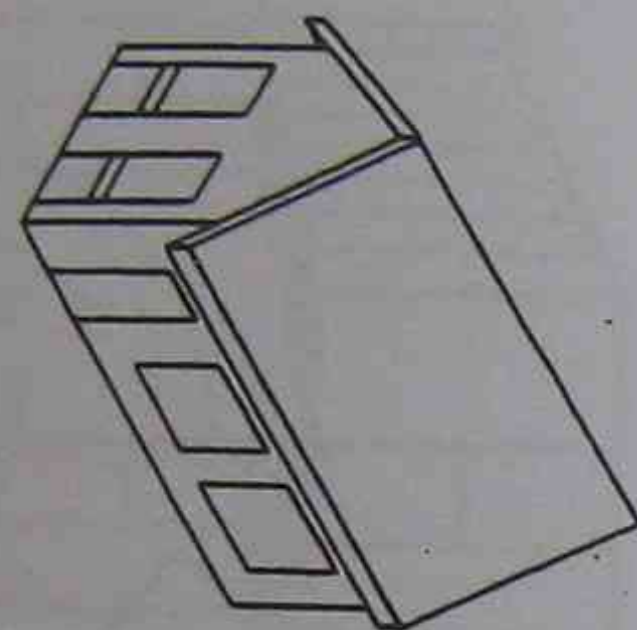
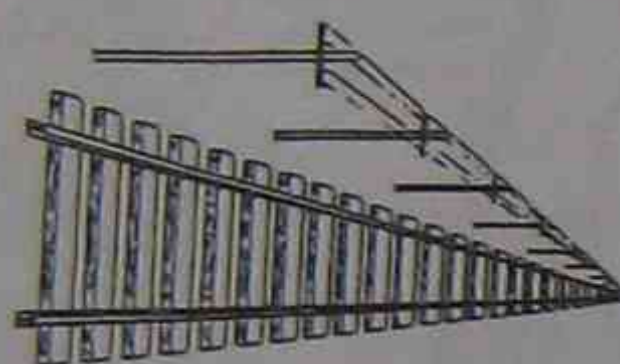
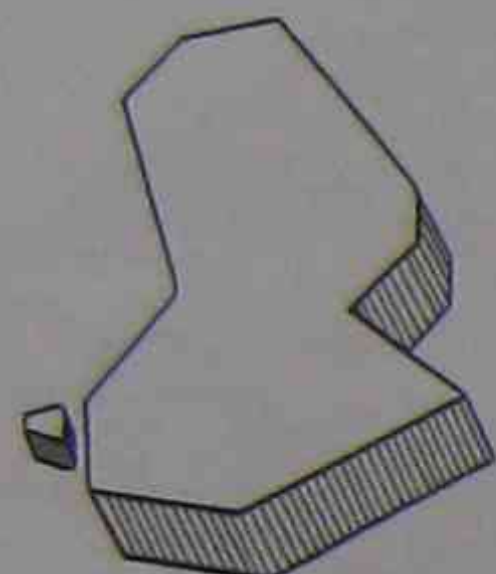
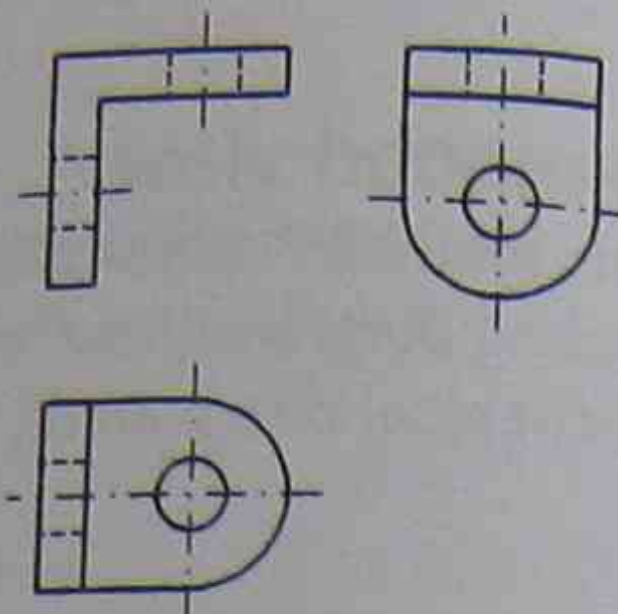
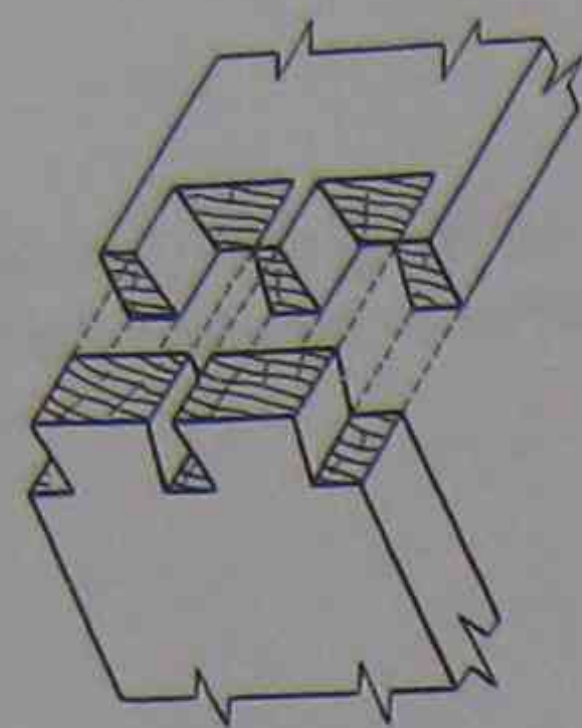
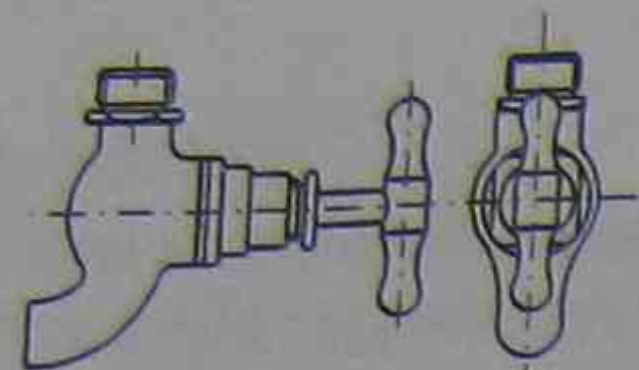
- give information
- give the equipment
- make sketches
- design sketches
- aid discussion
- give a picture

Methods

It is important to sketch and point.

- when drawing
- use a compass
- incline the paper
- when drawing the centre, smooth

- for large estimates



the pictorial methods used to produce the drawings shown. Place your answer on the line provided.

Free hand sketching.

Freehand sketching is an important method of communication at all levels of engineering because it allows you to describe things that you can't always describe in speaking or writing. Tradespersons use sketching skills to record and express ideas about a job to fellow tradespersons, apprentices, supervisors and engineers.

Sketching is a clear way to record technical ideas that may be needed later for manufacture or for reference. A sketch is not a rough drawing. It should be a clear image with its sizes in proportion, clearly dimensioned and labelled.

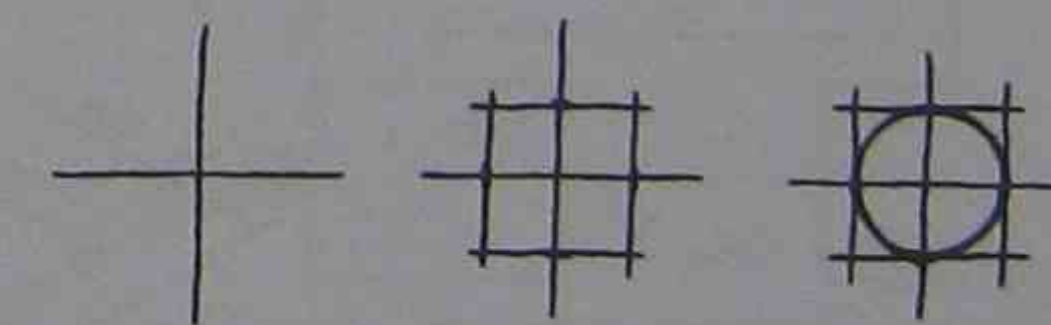
Freehand sketching can be used to:

- give information from the field or factory to the drawing office. This happens where equipment needs repairing or changing.
- give the designer's ideas to the draftsman
- make sketches of the layout and views needed for mechanical drawing
- design sketches to see if an idea will work
- aid discussion between engineers and tradespersons
- give a picture which will help to interpret a complex orthogonal drawing

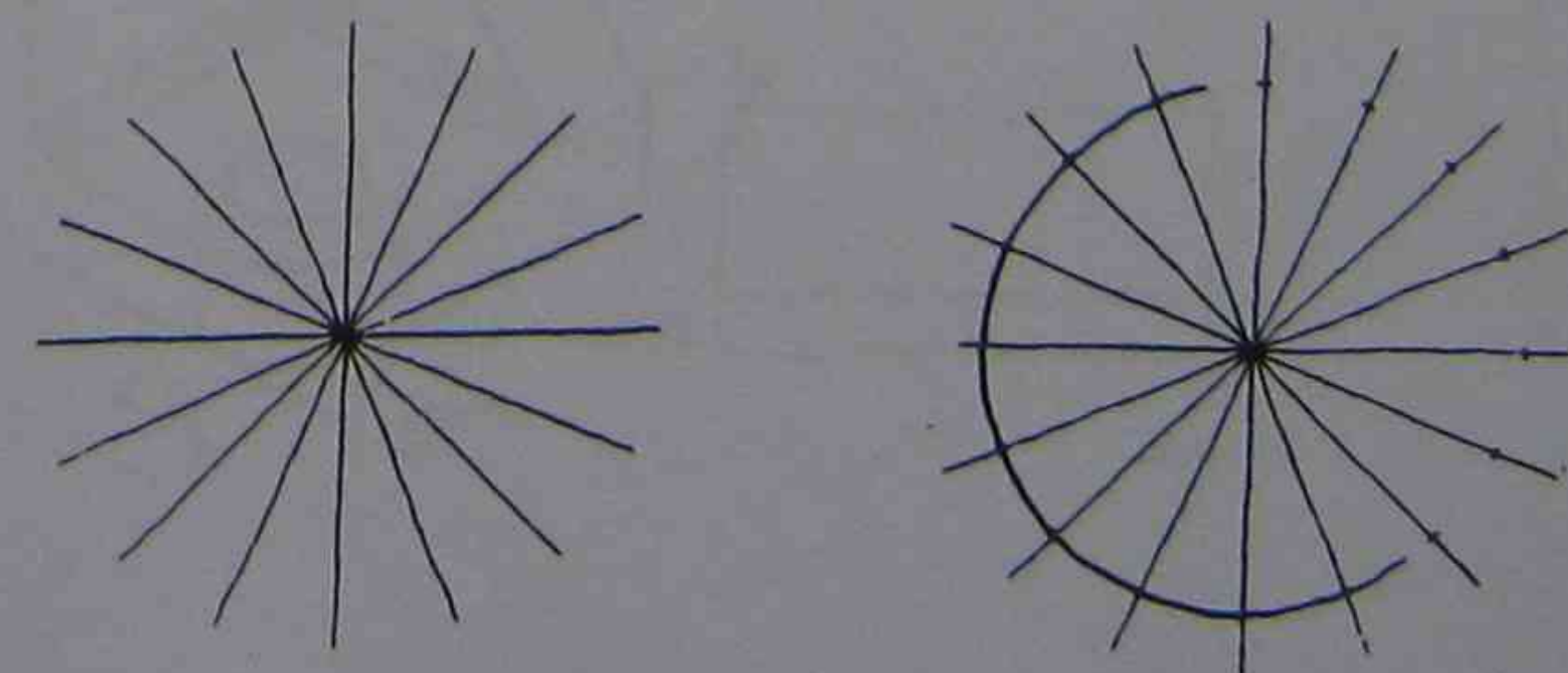
Methods of sketching

It is important to keep the sketch in proportion to the object. Use a H to HB pencil for the sketch and 3H for dimensions. Hold the pencil lightly about five to six centimetres from the point.

- when drawing horizontal lines, your hand should slide along from left to right.
- use a combined finger and wrist movement from top to bottom for vertical lines
- inclined lines may be drawn as either horizontal or vertical lines by repositioning the paper
- when drawing small diameter circles draw light horizontal and vertical lines. From the centre, where the lines cross, mark off the radii and draw a box. Join the points with a smooth even curve.

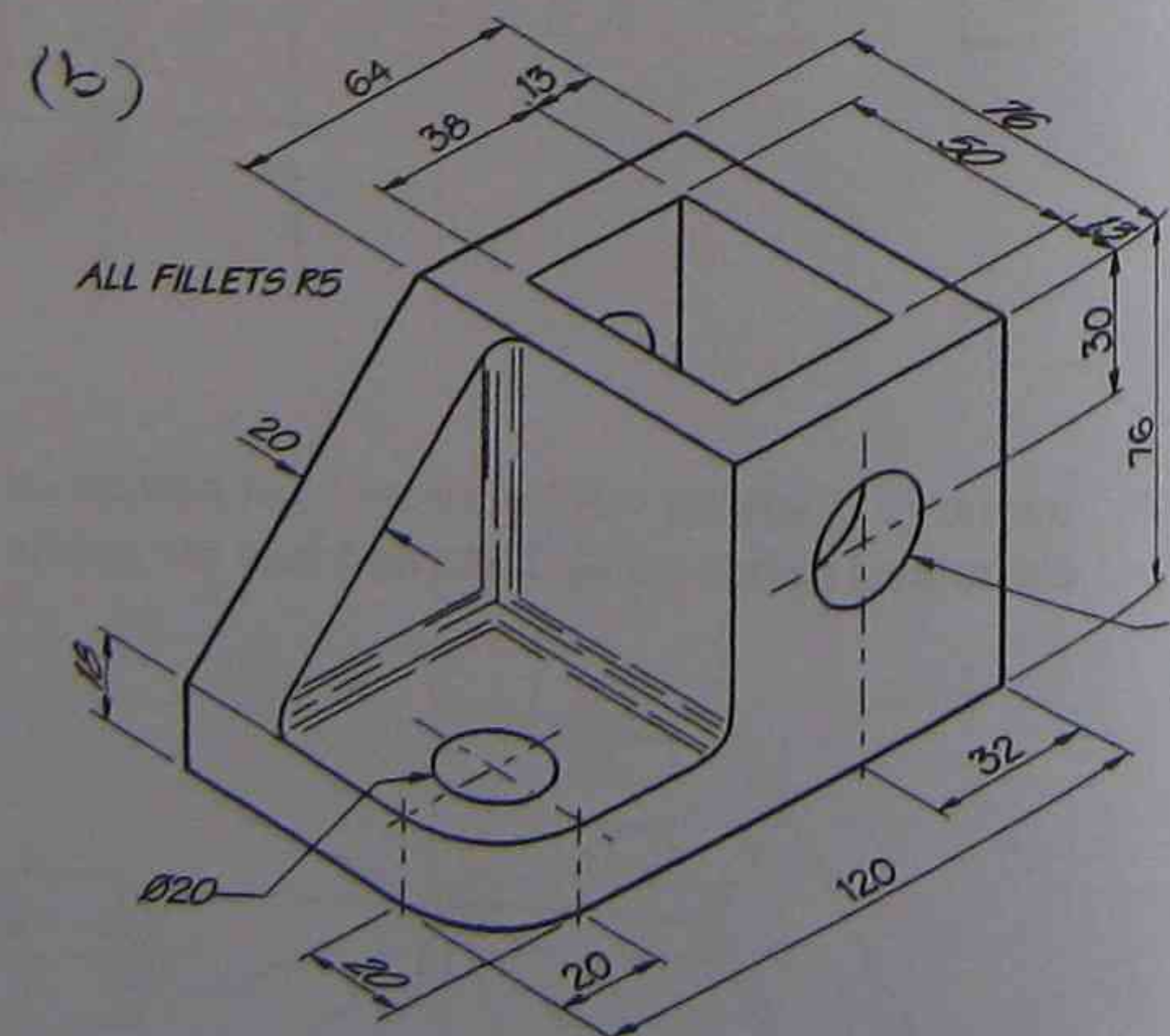
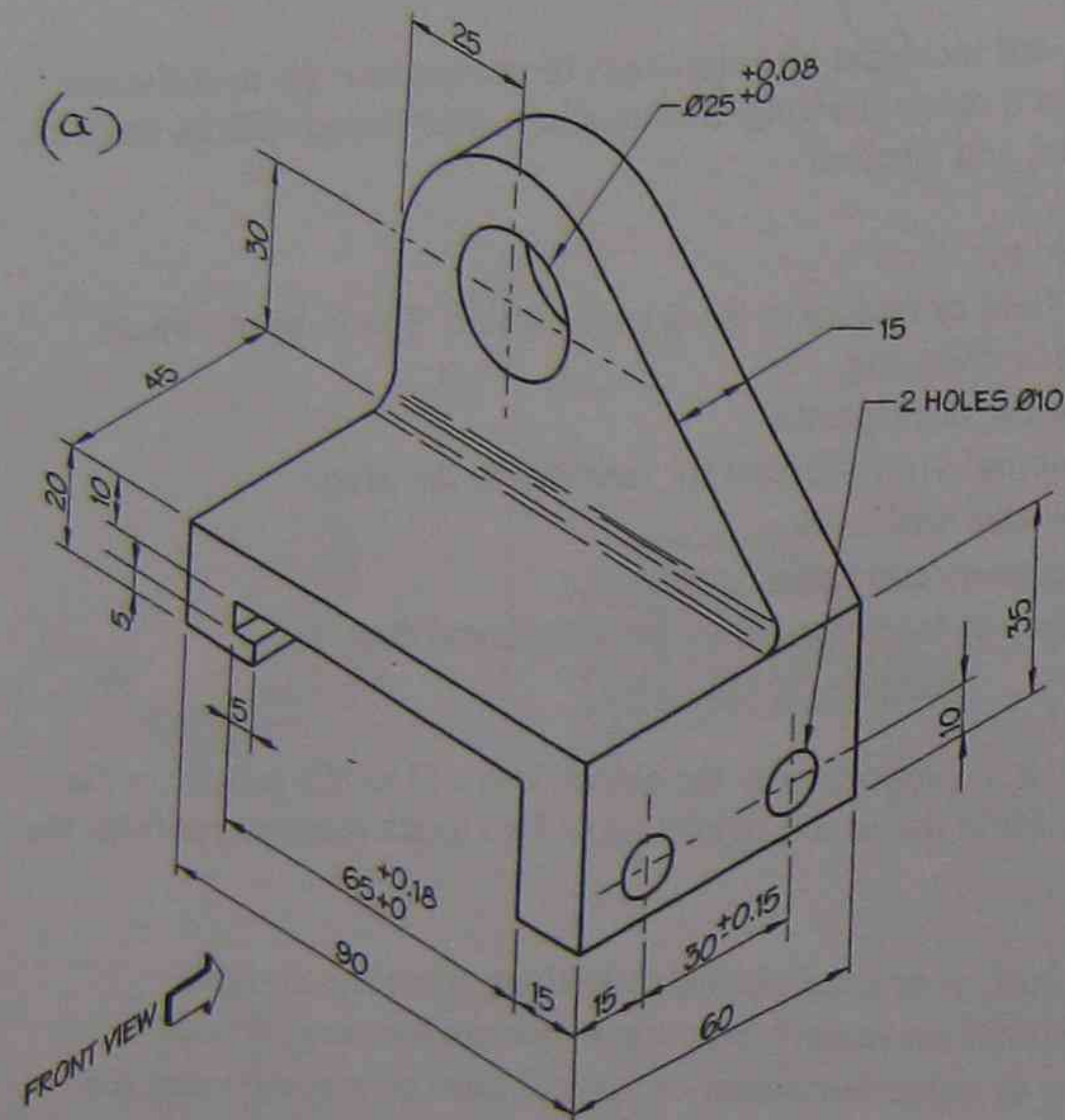


- for large diameter circles, draw light horizontal, vertical and slanting lines. Mark the estimated radius on all lines and join the points with a smooth even curve.



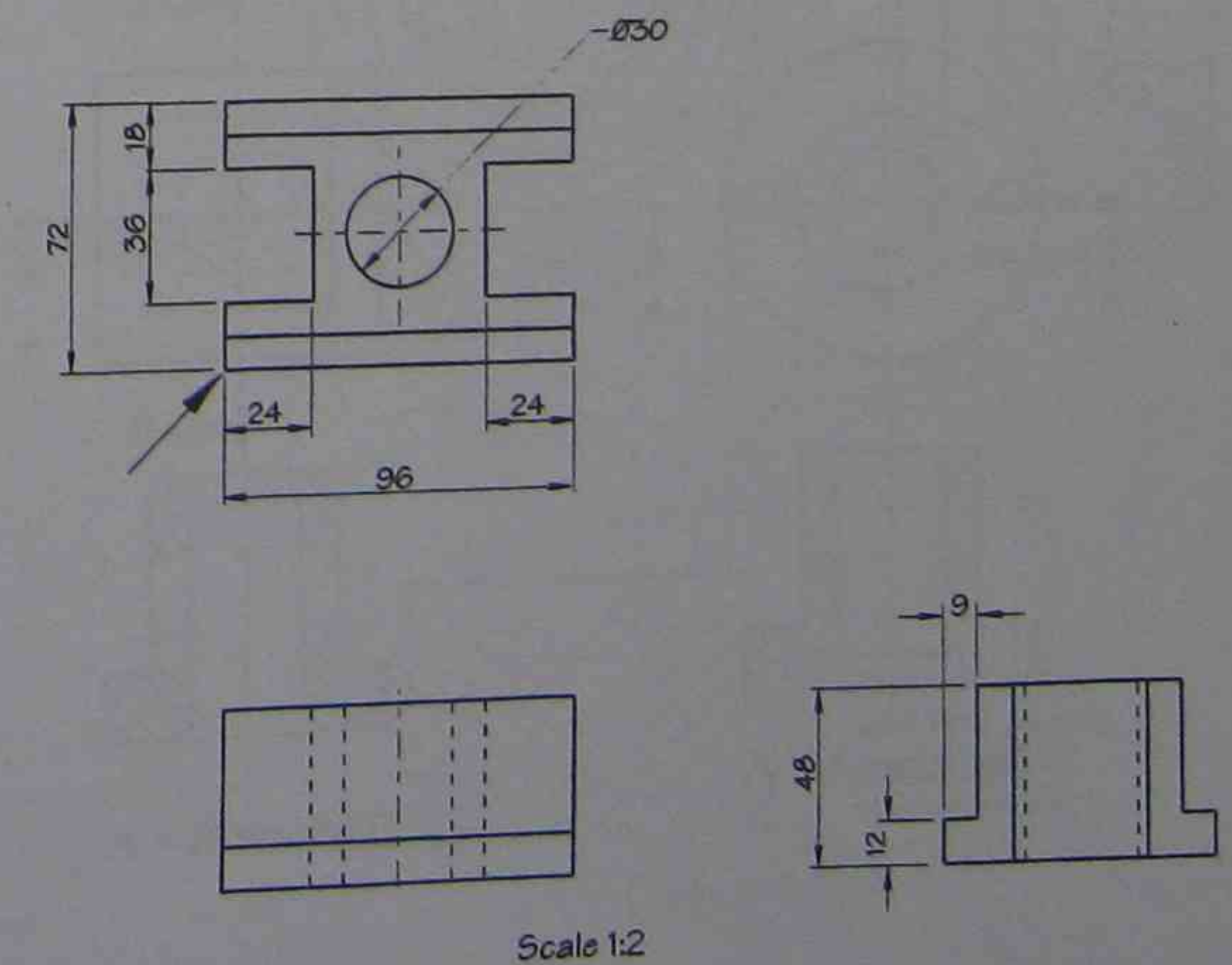
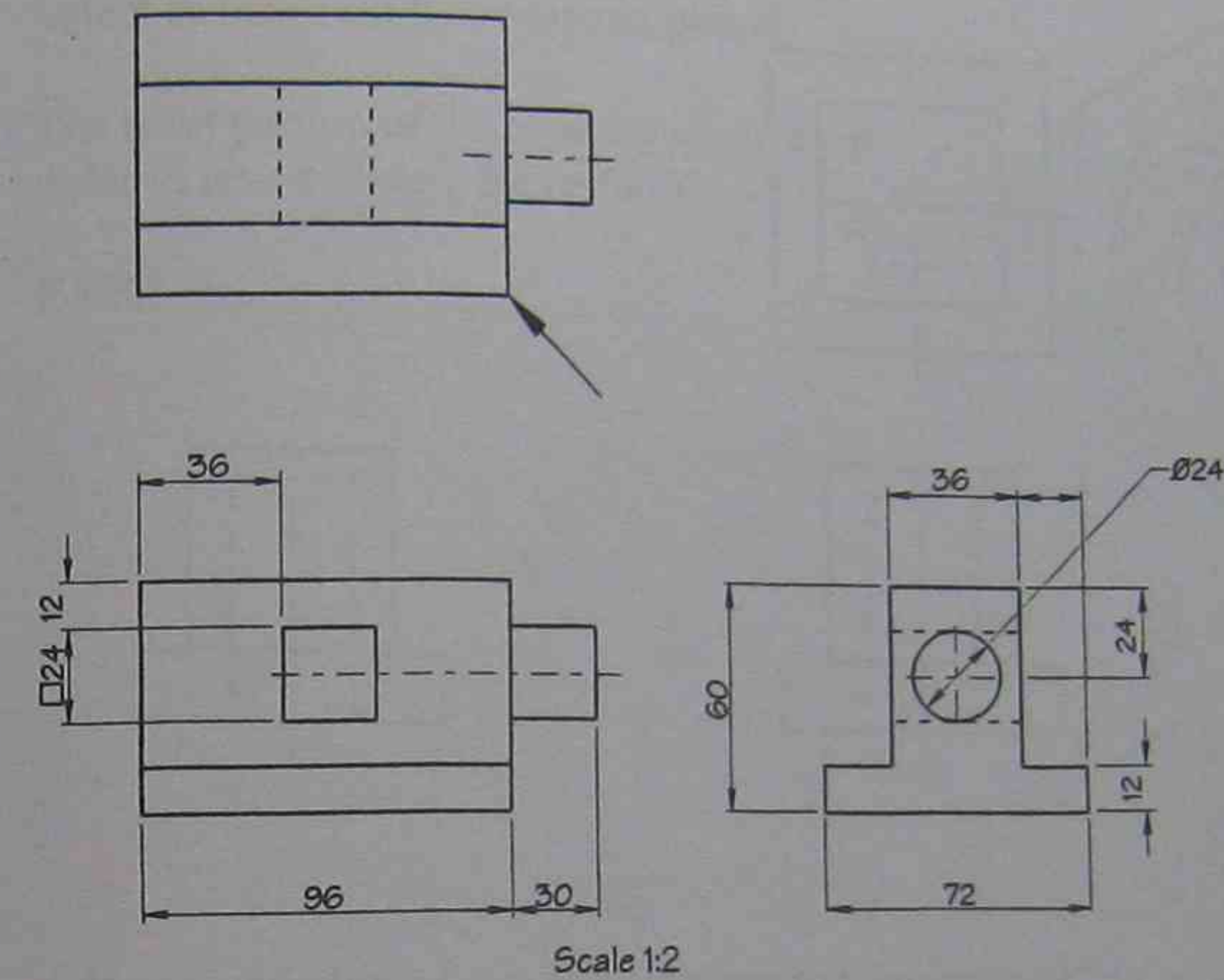
Exercise 5

Draw in freehand a front, top and left hand side view of the following two isometric drawings. Add all dimension required. Ensure the object is drawn to the correct proportions. Your teacher may supply grid paper to assist your drawing.



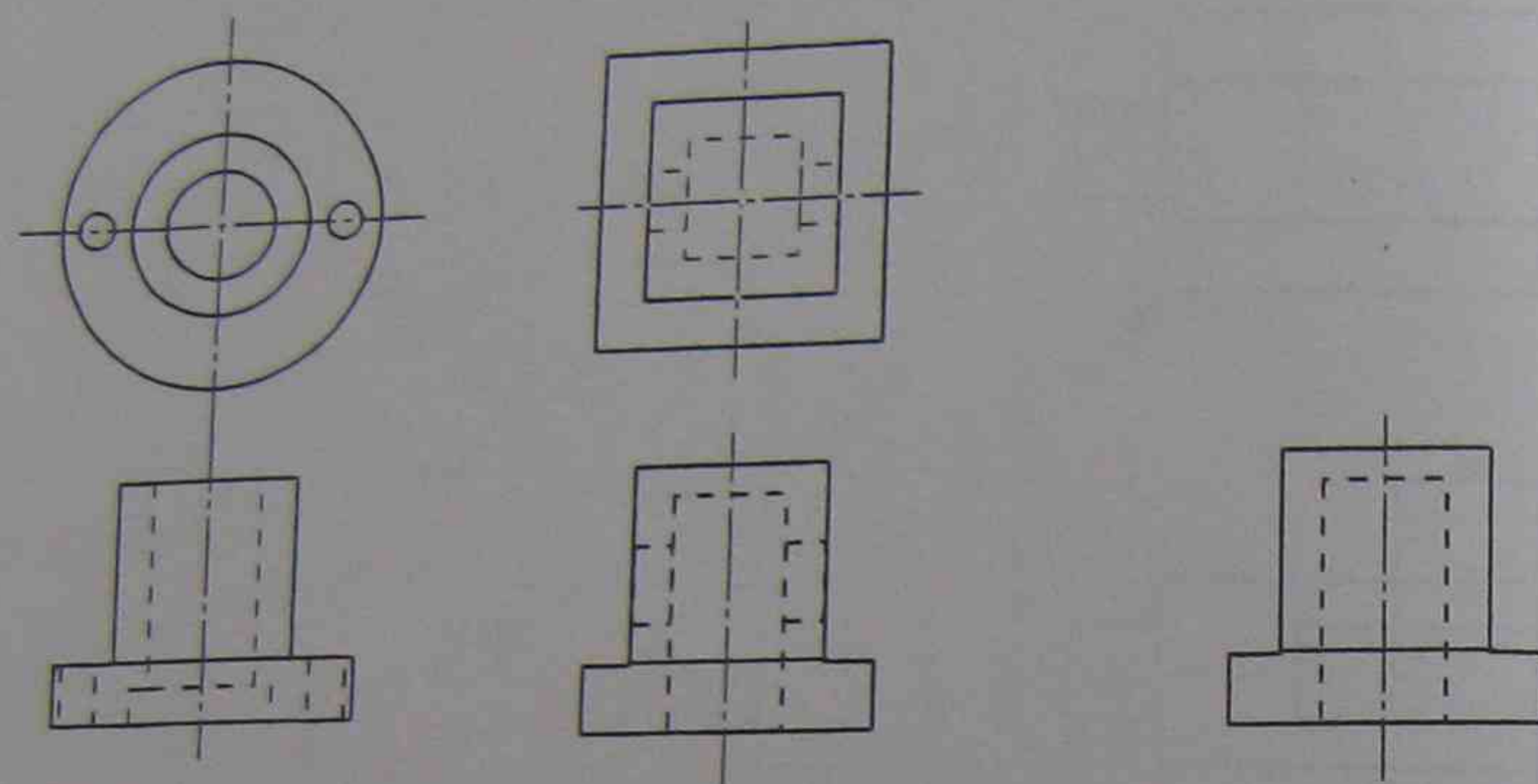
Exercise 6

Make an isometric drawing of the following two objects shown when viewed in the direction of the arrow. Dimension lines are not required. Your teacher may supply isometric grid paper to assist your drawing.

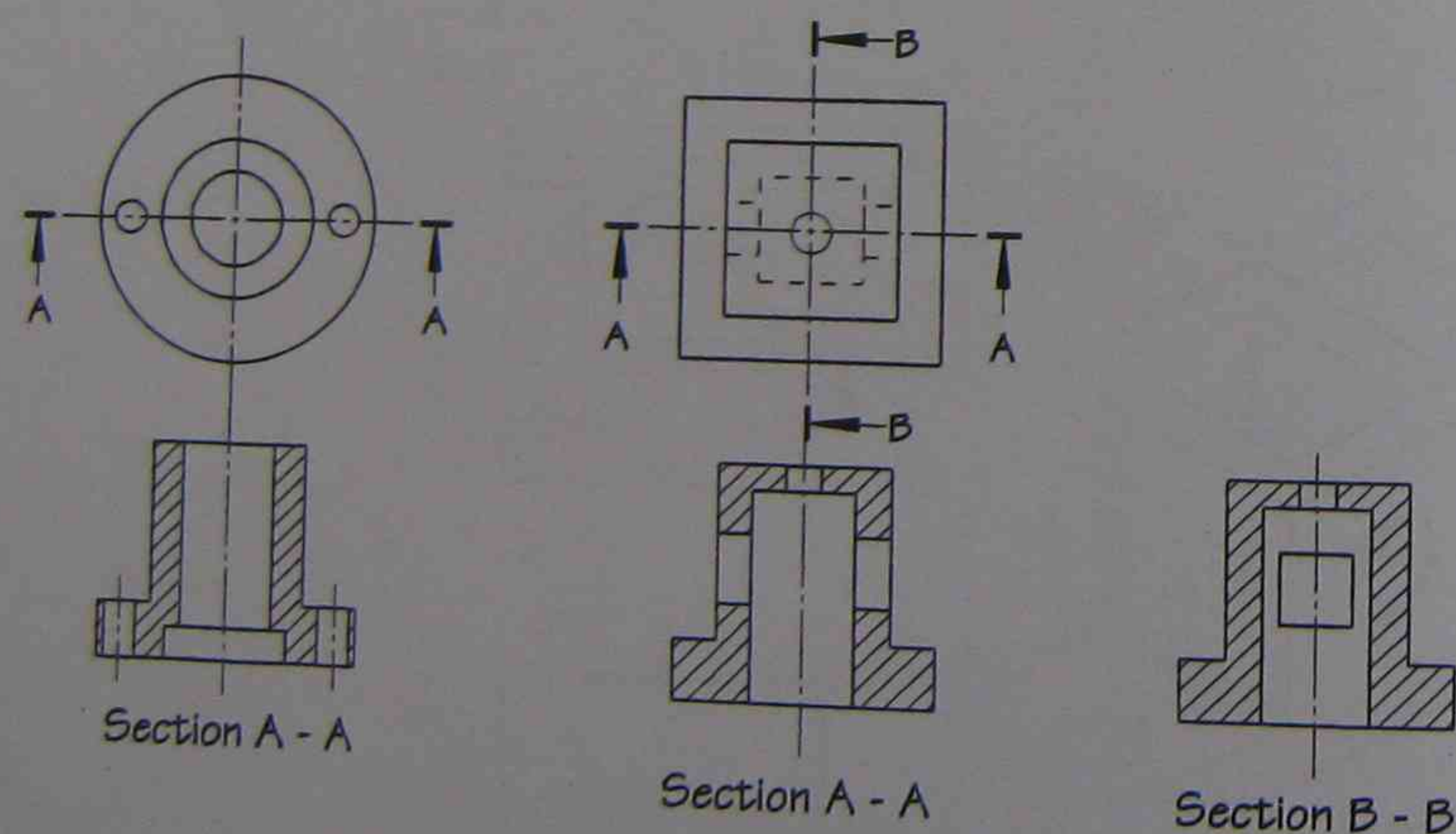


Sectioning

When drawing objects in orthogonal projection the internal or hidden features are shown as hidden outlines.



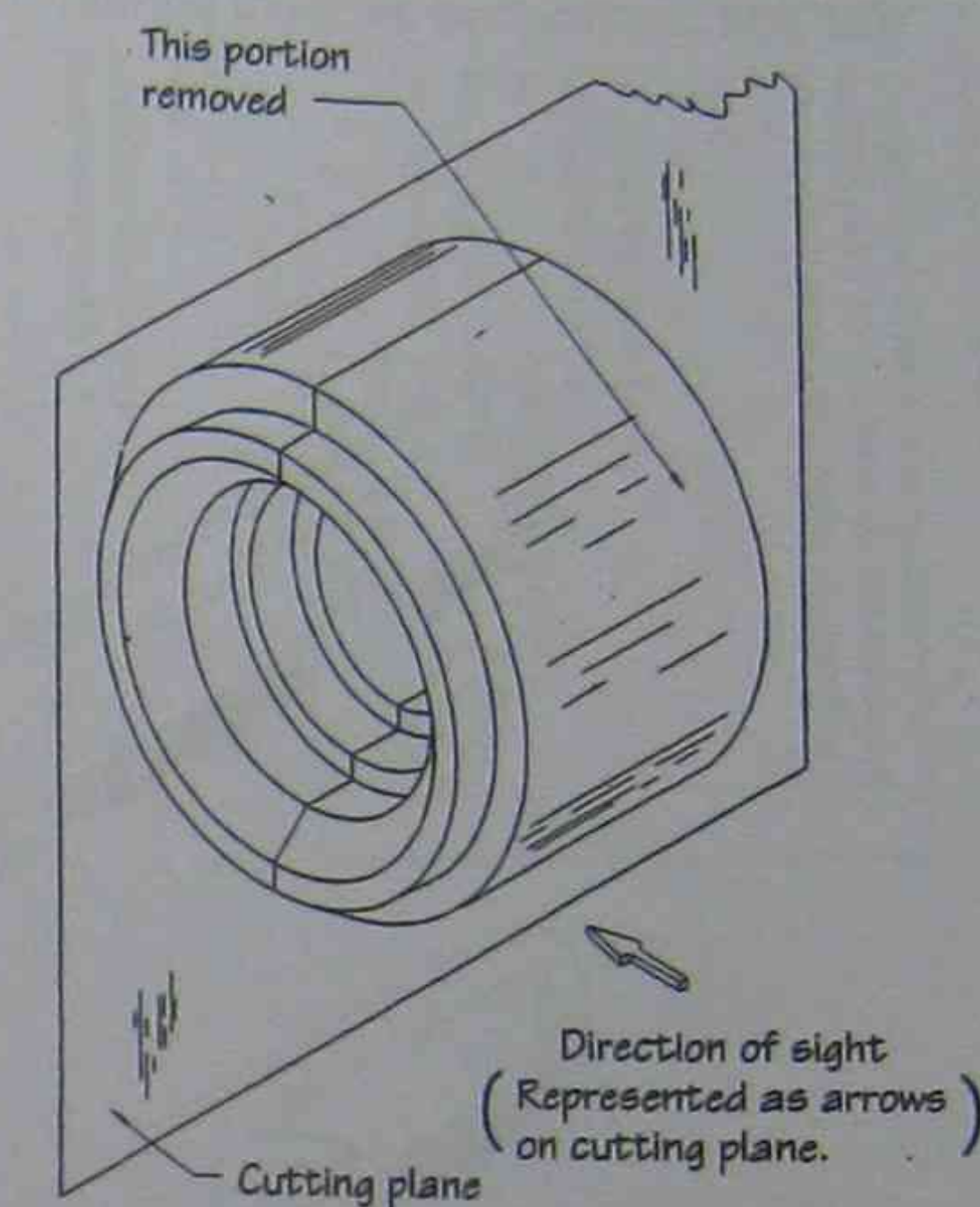
By using a drawing method known as "Sectioning" the same objects can be redrawn in such a way as to show normally hidden internal features as full outlines.



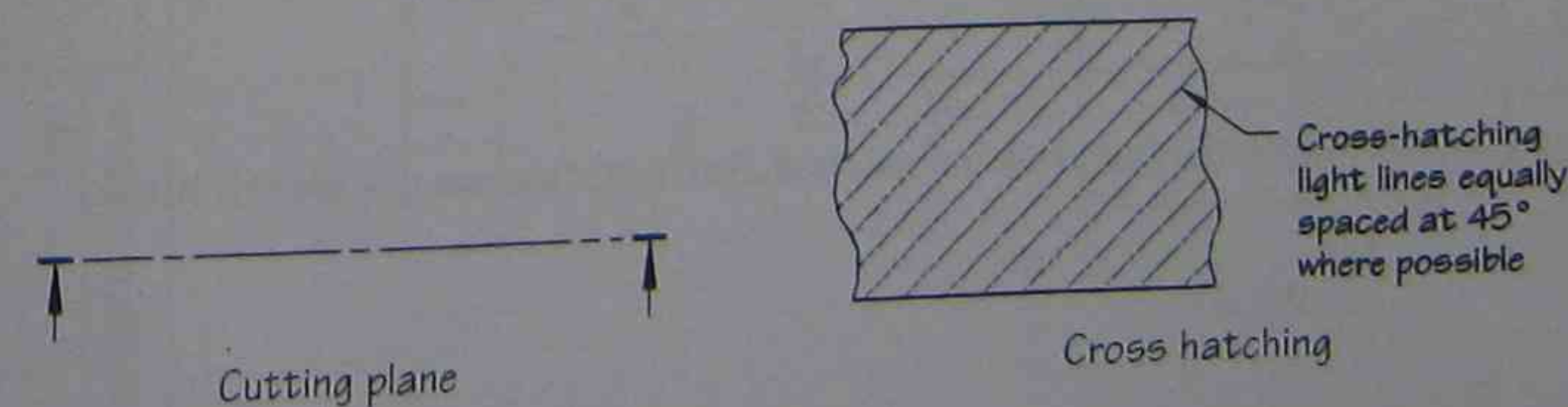
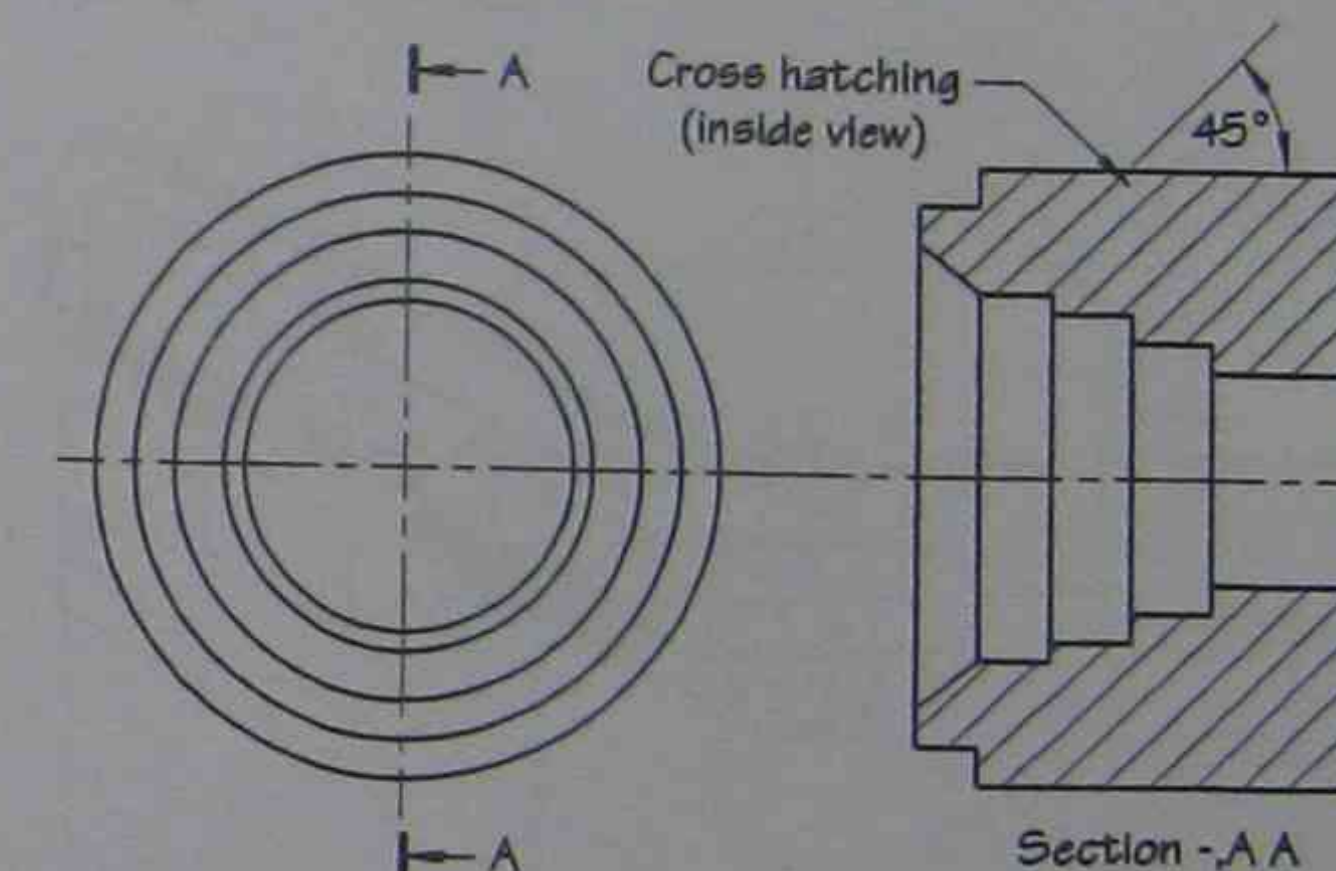
A sectional view is obtained by imagining an object as being cut by a 'cutting plane'.

The front portion of the object is removed in order to reveal clearly the features.

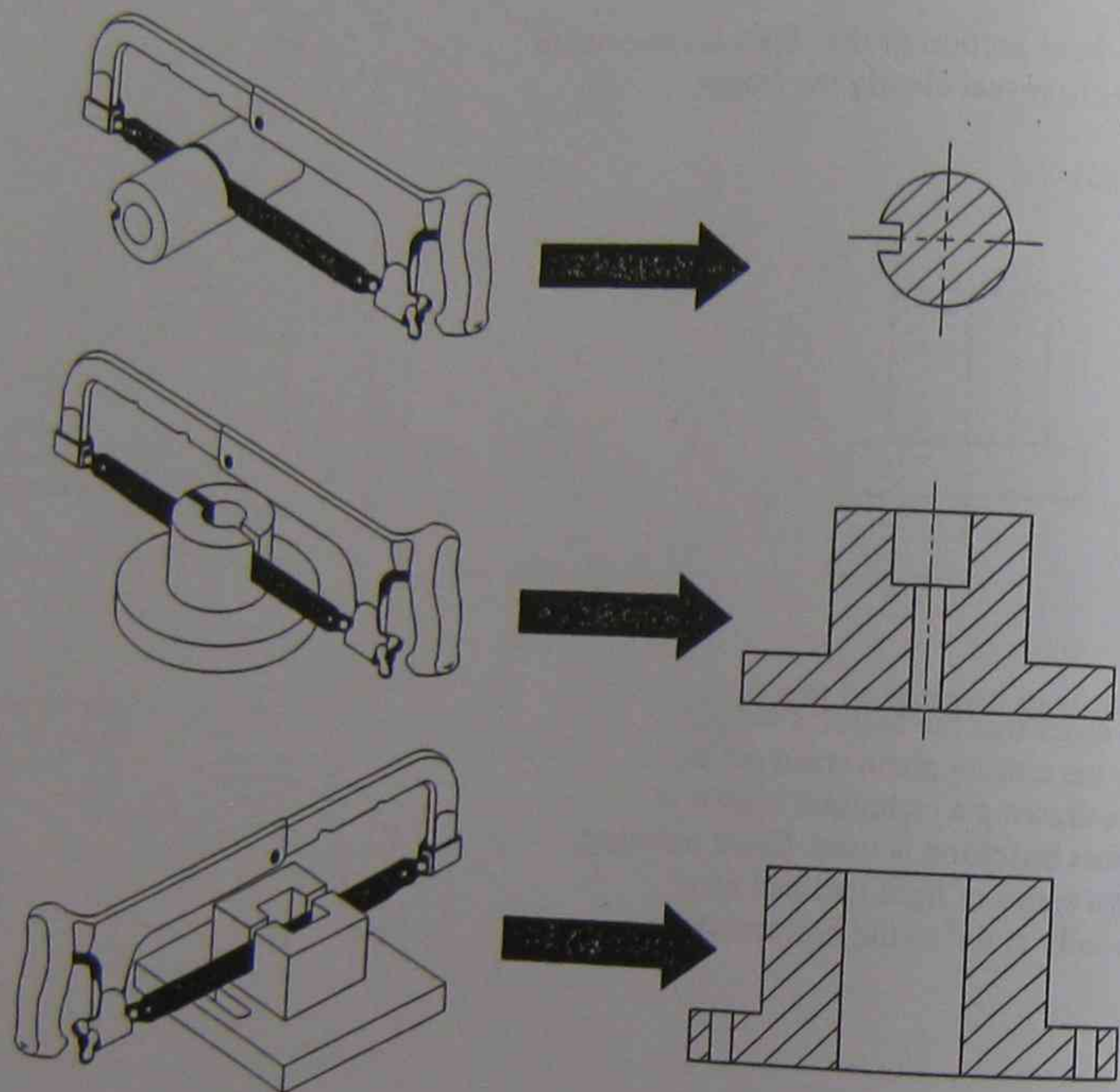
EA601-7-1



In order that the features cut out by the cutting plane stand out on the drawing a technique known as **cross hatching** is used. Cross hatching is a series of light inclined lines usually at 45° to the horizontal.



Another way of looking at a sectional view is to picture an object being cut by a hacksaw so that you can remove the front portion of the object to reveal internal features.



All surfaces cut by the hacksaw are hatched. Surfaces that are not are left blank.

Exercise 7 *Tape*

Complete the front view as section A - A. The cutting plane A - A is to be positioned to cut the top view along the horizontal centreline.

Add:

- cutting plane A - A
- cross hatching
- title: ADJUSTABLE GUIDE
- material: bronze
- tolerances: UNO
- linear ± 0.15
- angular $\pm 0^\circ 30'$

Hint:
Scribe line with dividers
2mm from long edge.

Hidden outline - (comparison)

DO NOT SCALE

Top View Dimensions: 100, 75, 55, 20, 15, 10, $R17.5$, $0.05/0.10/0.05$, $\phi 10.00$.

Front View Dimensions: 42, 12, 20, $\phi 20$, 5, WALL, $R10$, $1/16$, $1/16$.

ISSUE	DATE	ZONE	CHANGES	AMENDMENTS	ECN	BY	CKD
1							
2							
3							

UNLESS NOTED OTHERWISE TOLERANCES ARE:

LINEAR

ANGULAR

FINISH

DRAWN: JD
CHECKED: DB
APPROVED: ML
ISSUED: 7/3/98
RECORD OF ISSUE

MANUFACTURING & ENGINEERING ESD

TITLE:

SCALE: DRAWING NO. EA061 - 7 - 1

A3

Exercise 7 Type

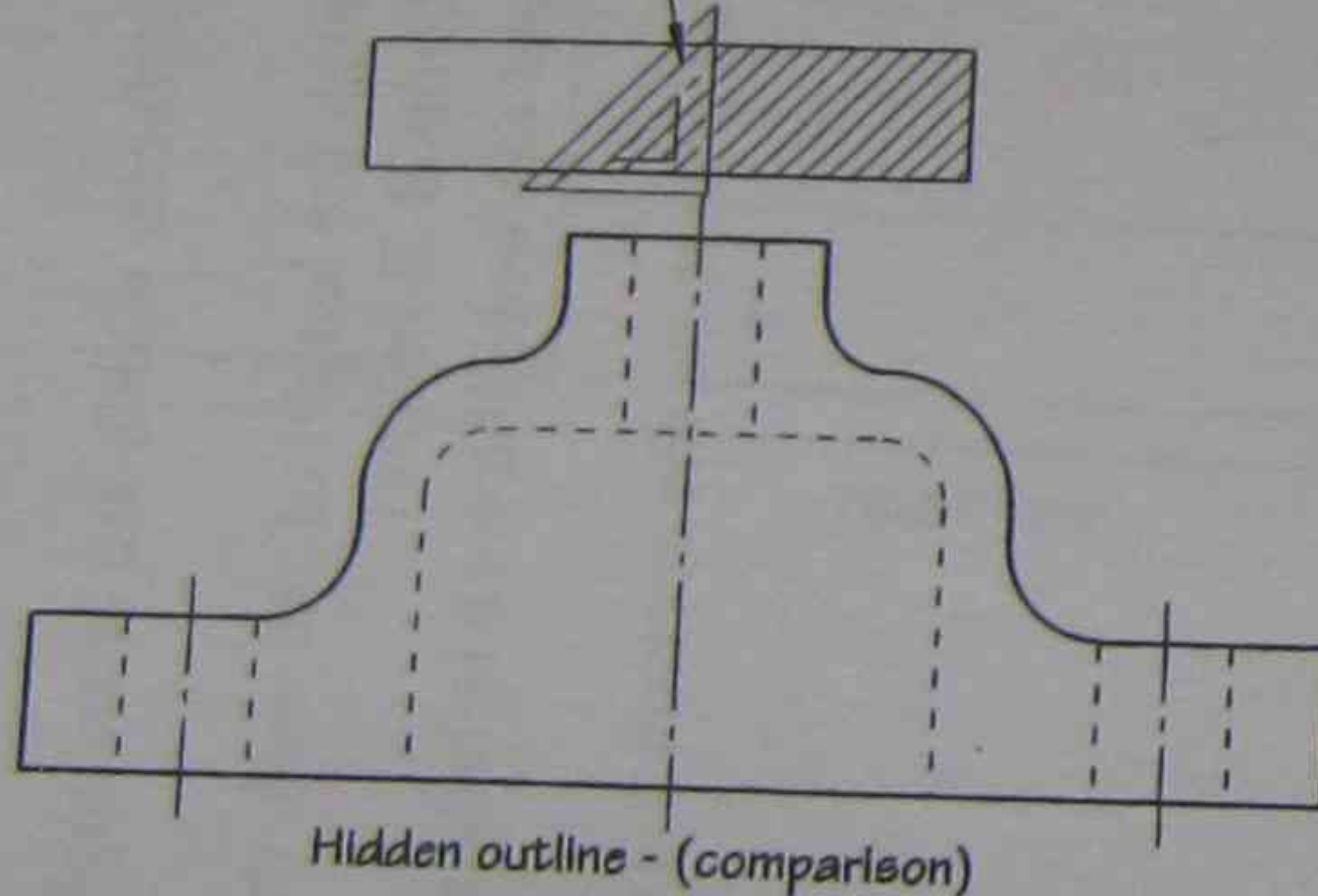
Complete the front view as section A - A. The cutting plane A - A is to be positioned to cut the top view along the horizontal centreline.

Add:

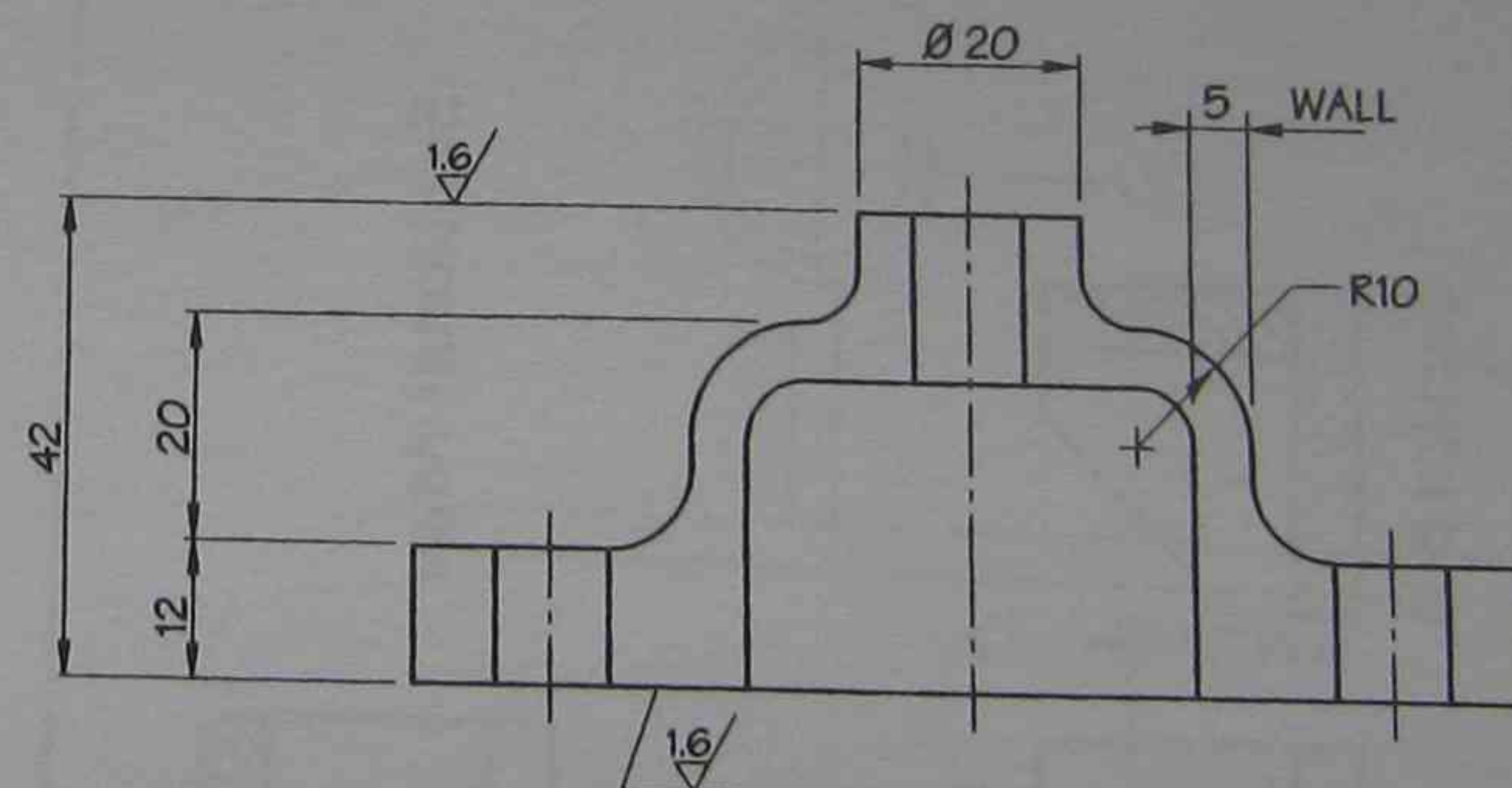
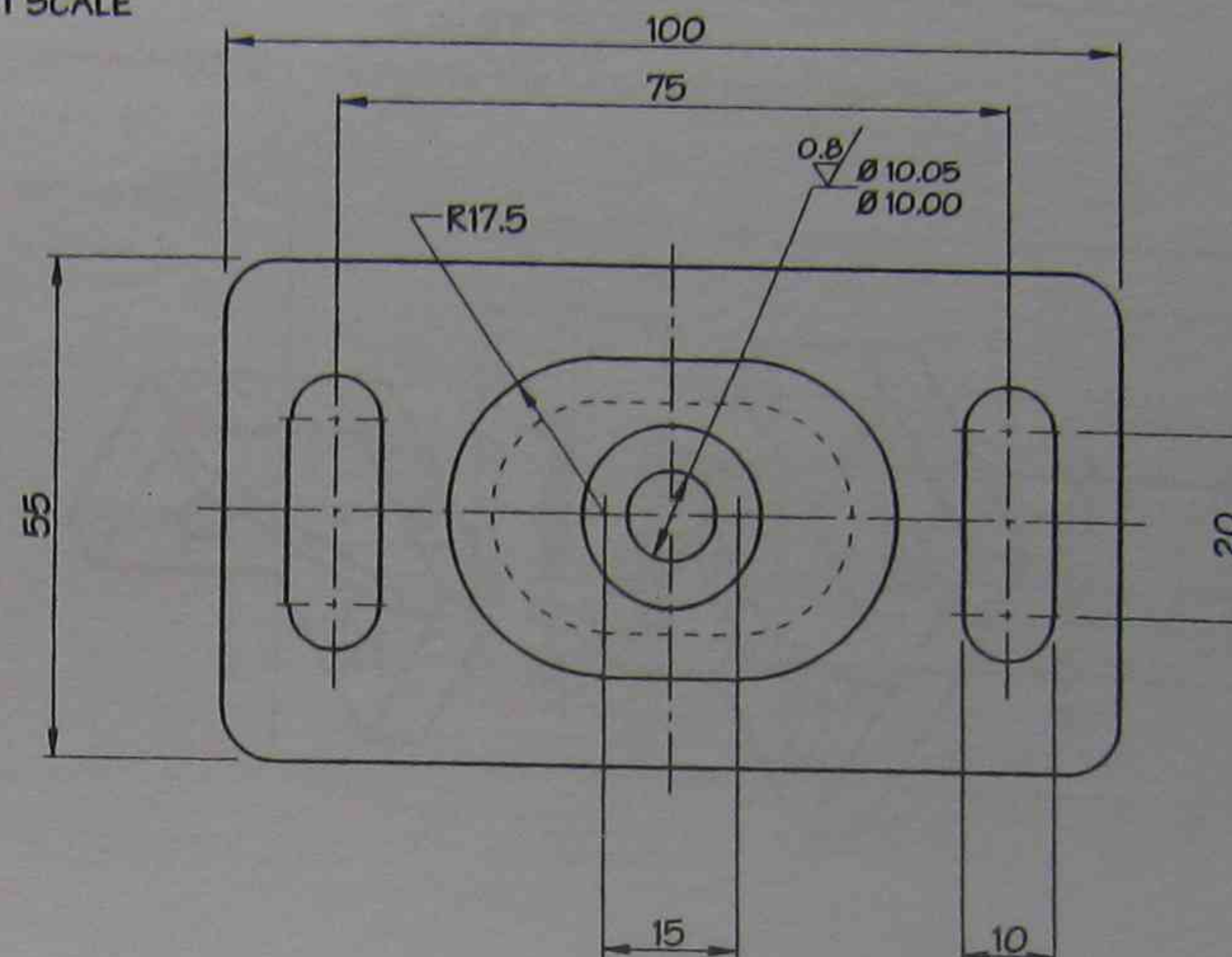
- cutting plane A - A
- cross hatching
- title: ADJUSTABLE GUIDE
- material: bronze
- tolerance: UNO
 - linear ± 0.15
 - angular $\pm 0^{\circ} 30'$

Hint:

Scribe line with dividers
2mm from long edge.



DO NOT SCALE

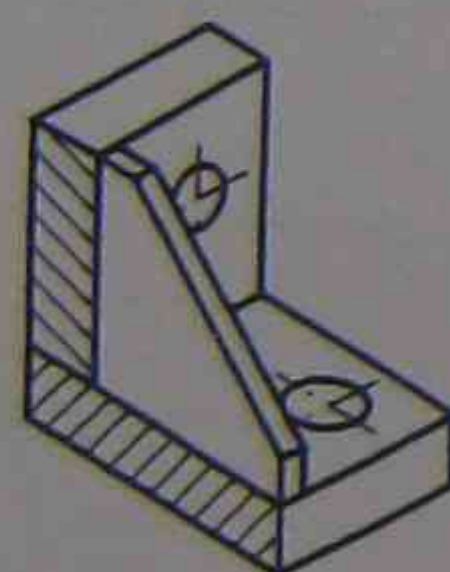
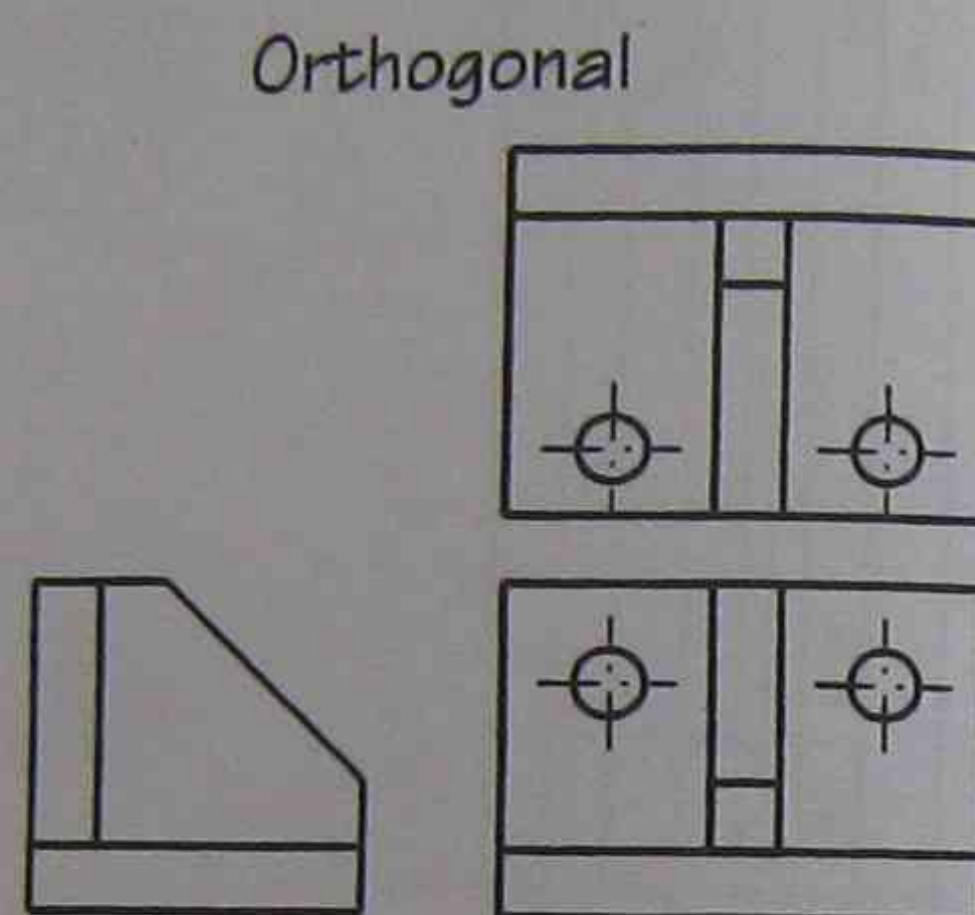
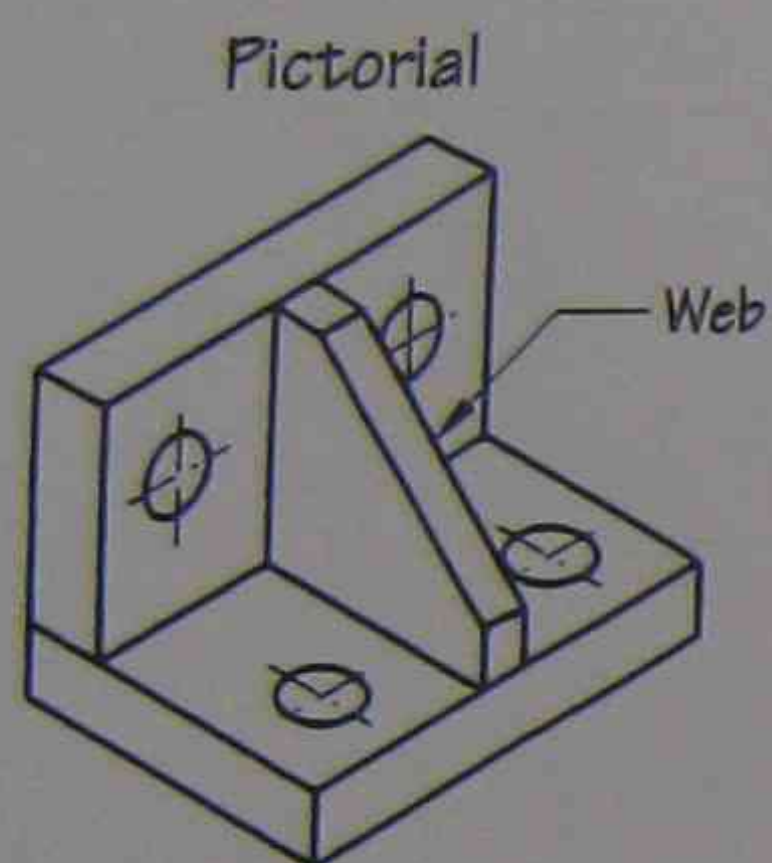


ISSUE			DATE			ZONE			CHANGES			ECN			BY			CKD			UNLESS NOTED OTHERWISE TOLERANCES ARE:			DRAWN			JD			TRACED			MANUFACTURING & ENGINEERING ESD		

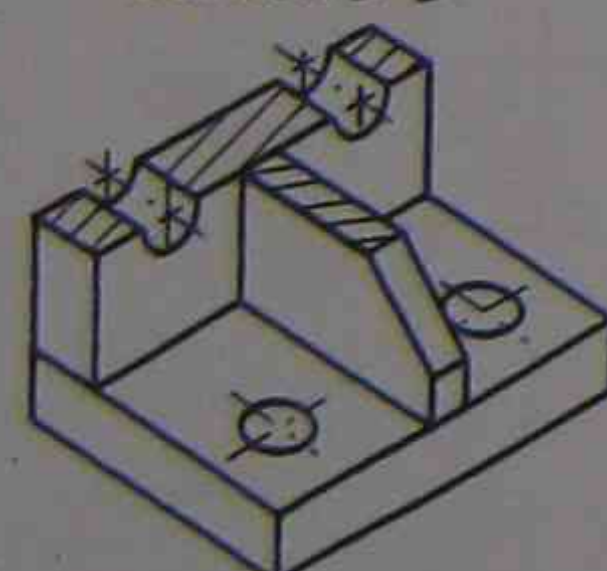
Sectioning webs

A web is a support piece between two surfaces, which are at an angle to each other. When sectioning webs:

- when the cutting plane cuts through the length of the web, the web is not cross hatched in the section view (Section B-B below)
- when the cutting plane cuts across the web, the web is hatched in the section view (Section A-A below)
- Hidden details (like holes) are not shown on the section view

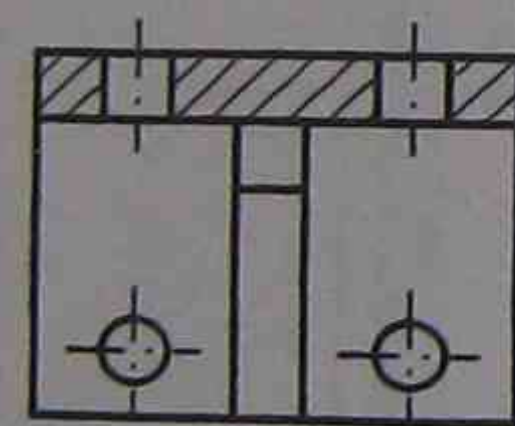


Section B-B

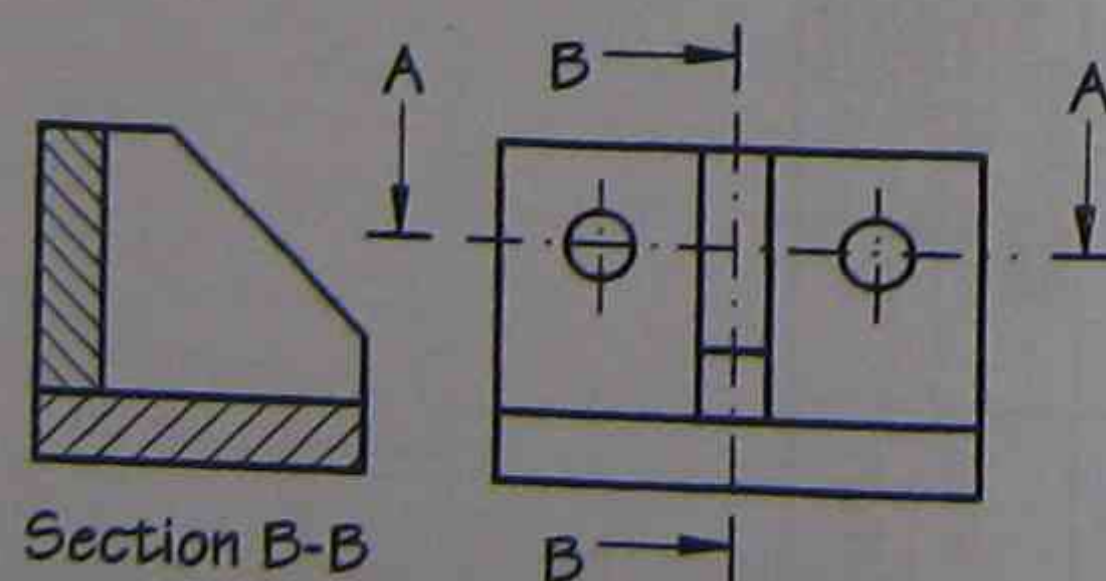


Section A-A

Sectional views

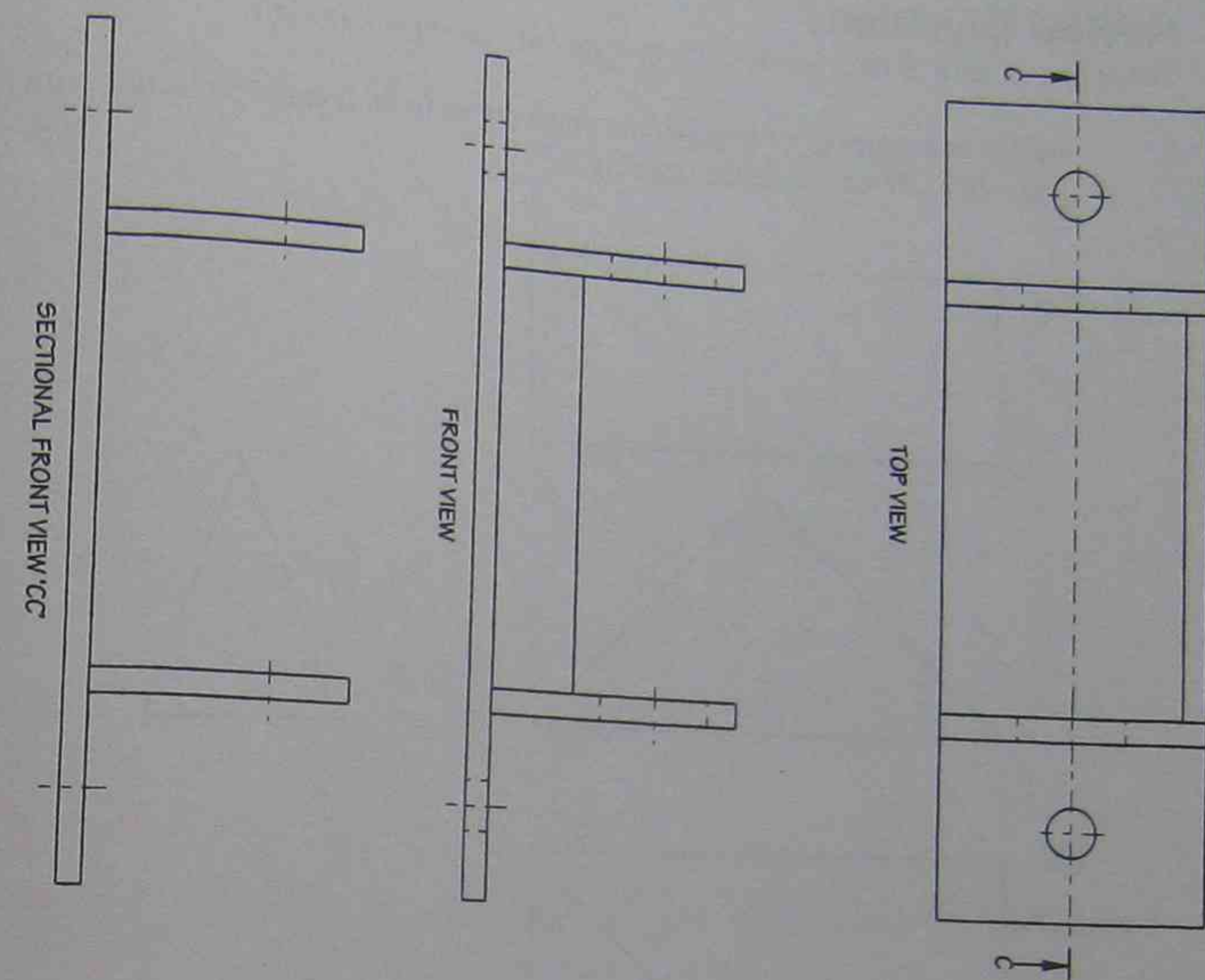


Section A-A

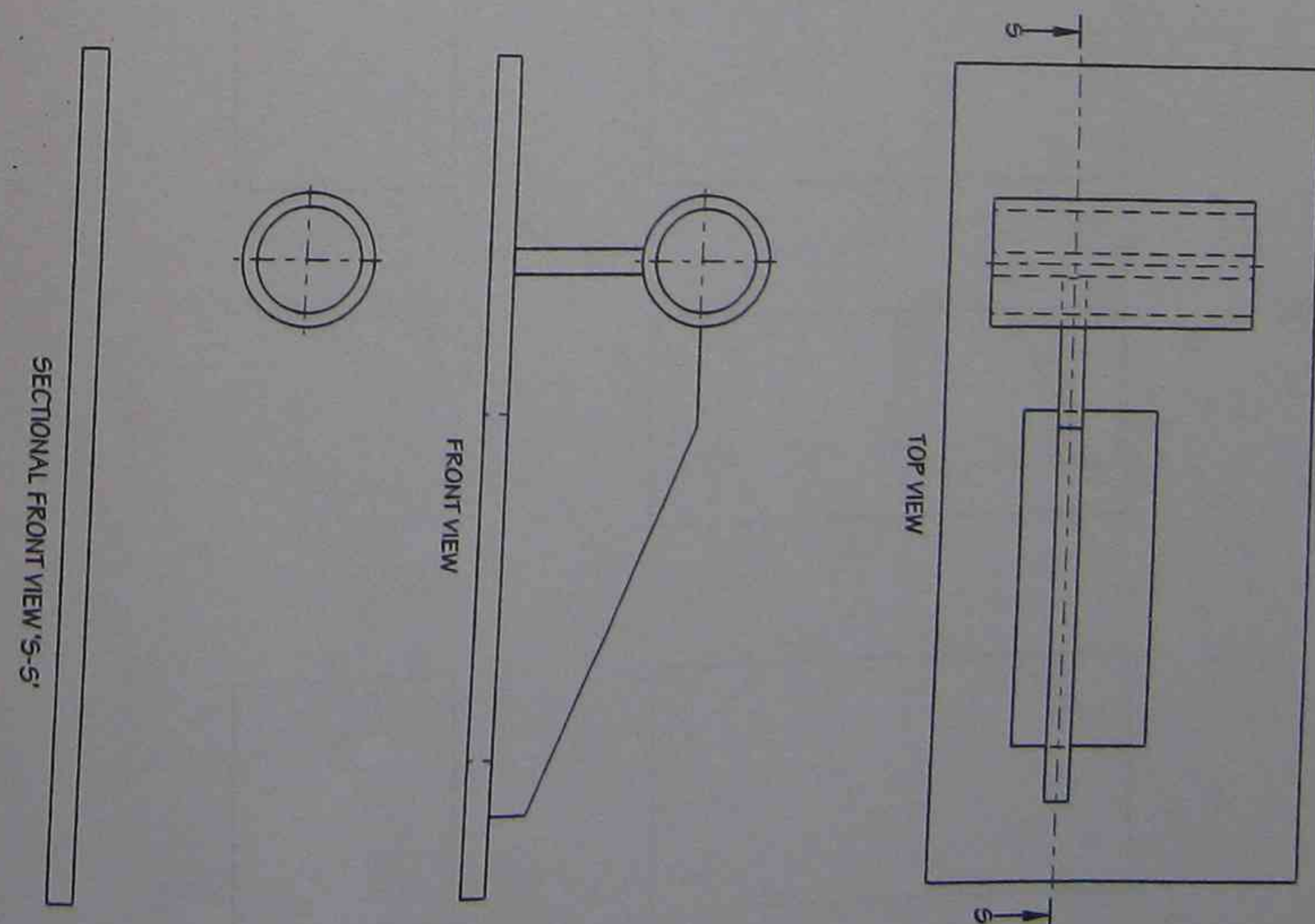


Section B-B

Exercise: ~~5~~ 8 Type 1 Complete the sectional front view 'CC'.



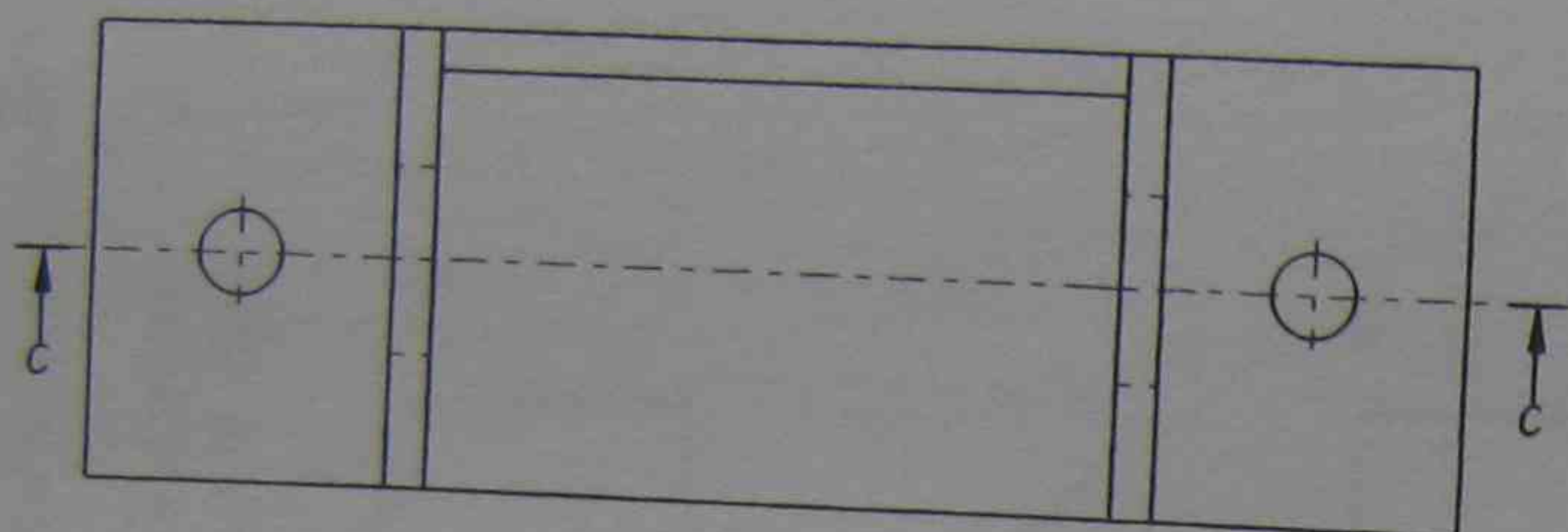
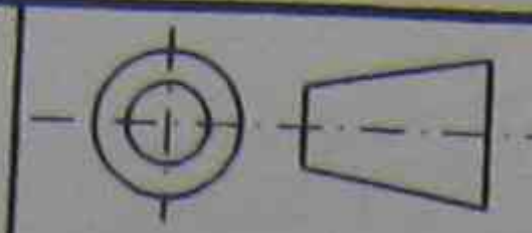
Exercise: ~~5~~ 9 Type 1 Complete the sectional front view 'SS'.



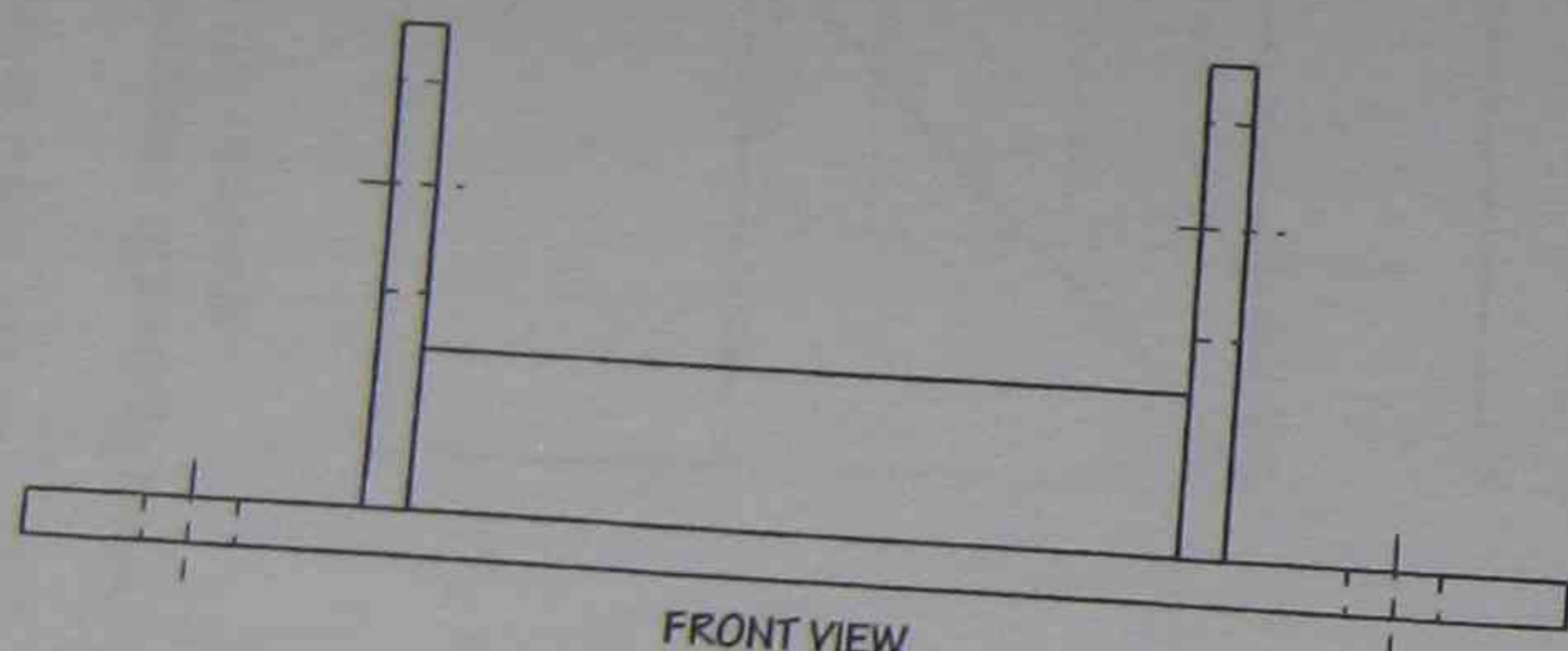
STUDENT'S NAME

MANUFACTURING & ENGINEERING
EDUCATIONAL SERVICES DIVISION

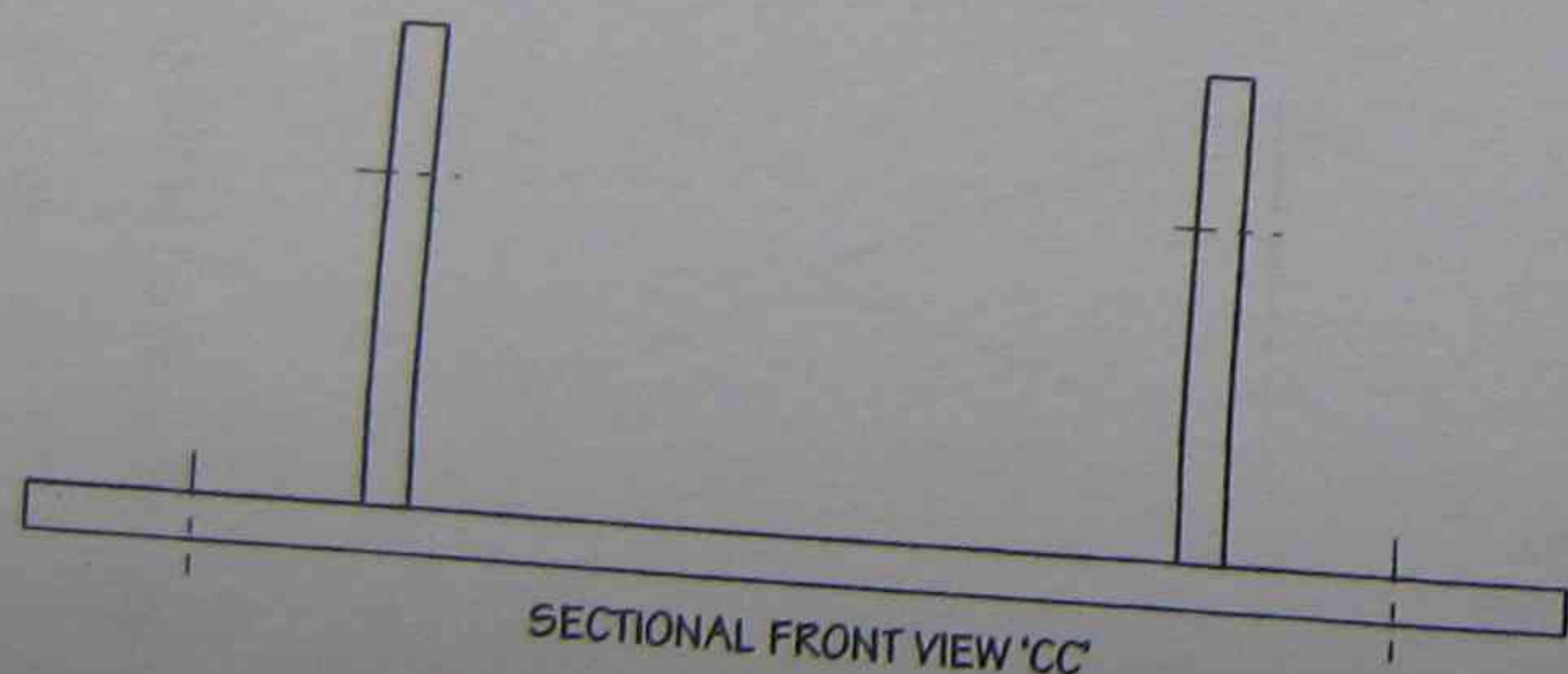
Exercise: ~~5-3~~ ⁸ TYPE . Complete the sectional front view 'CC'.



TOP VIEW

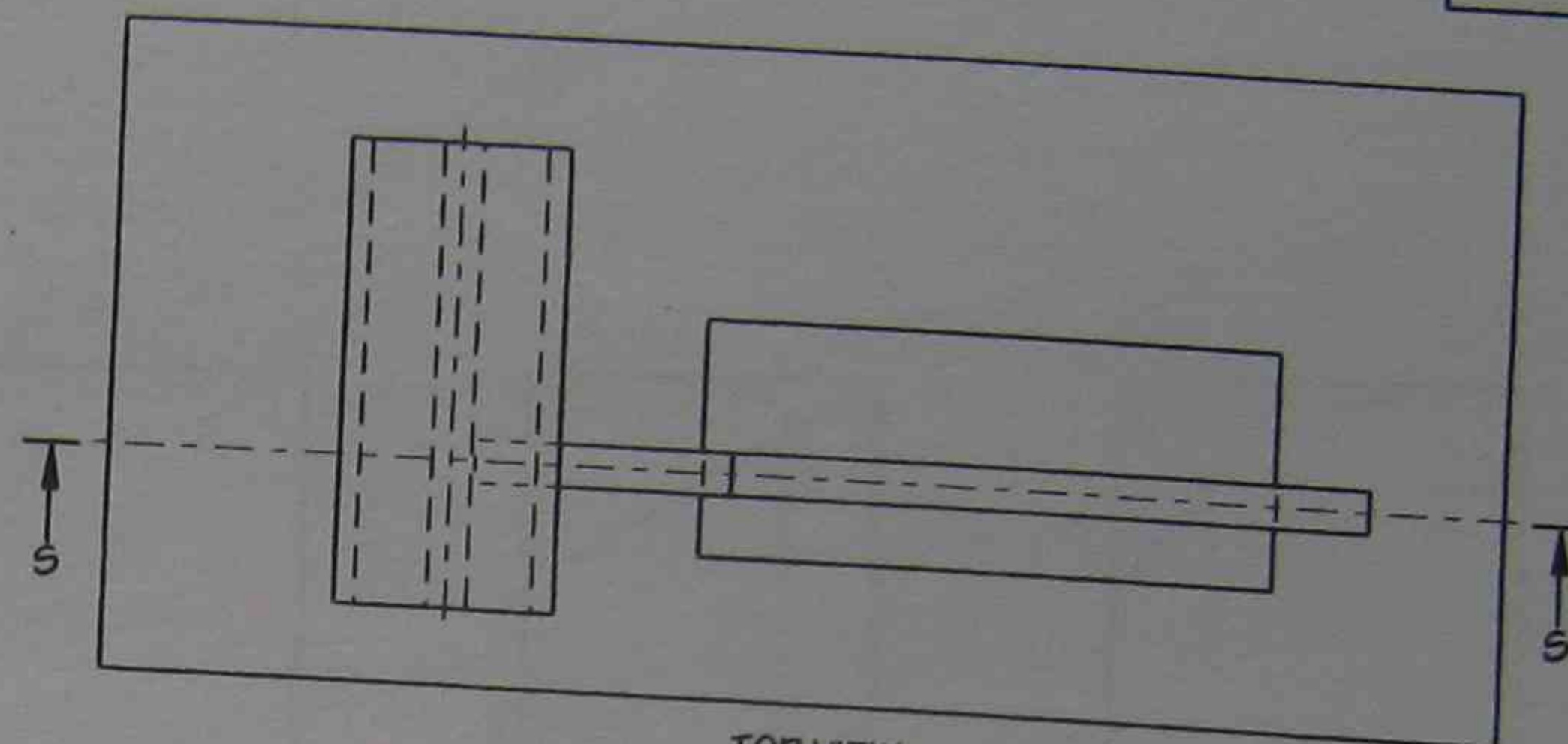
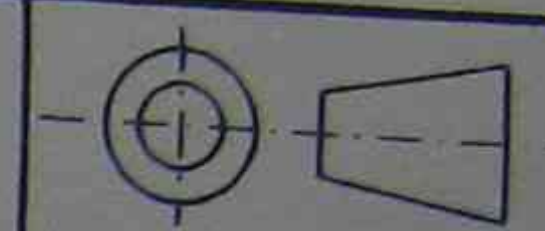


FRONT VIEW

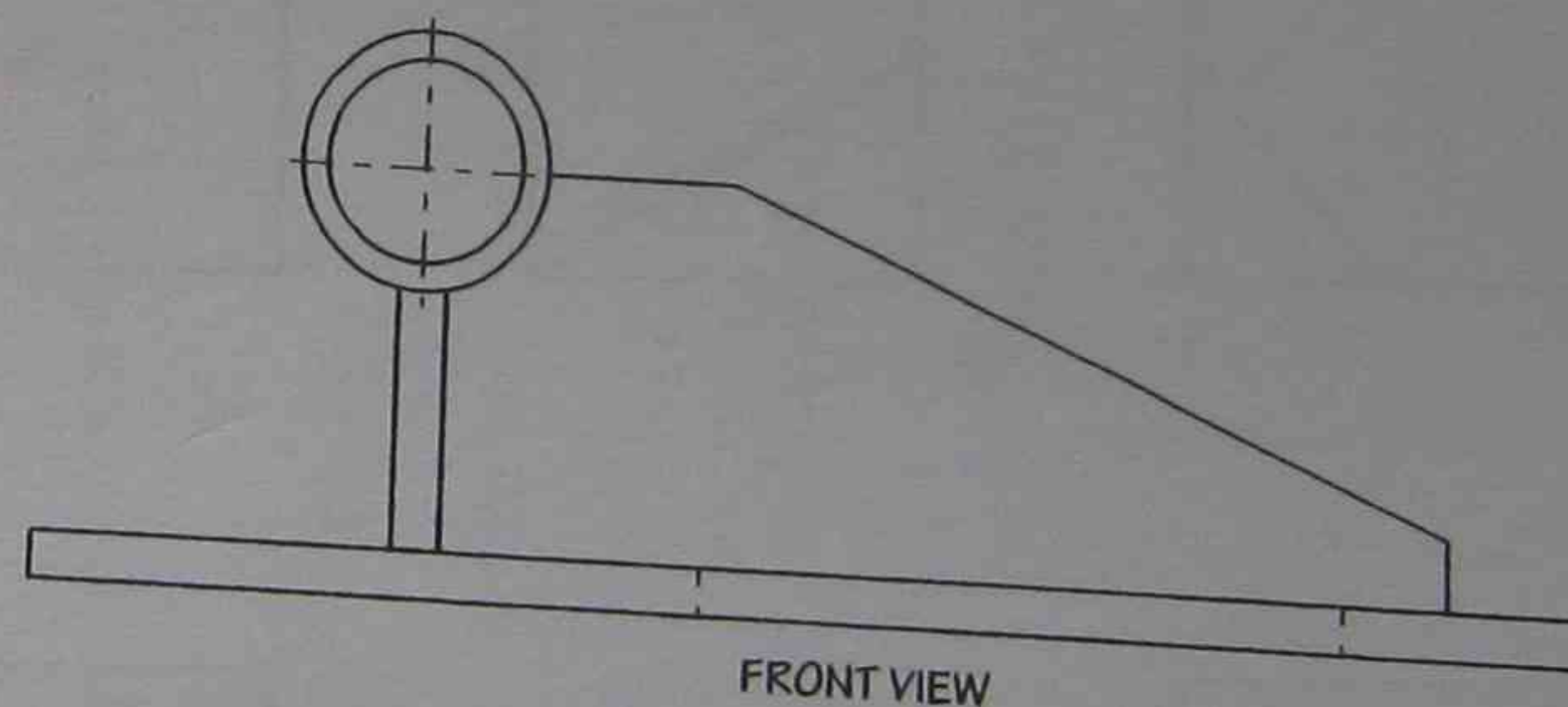


SECTIONAL FRONT VIEW 'CC'

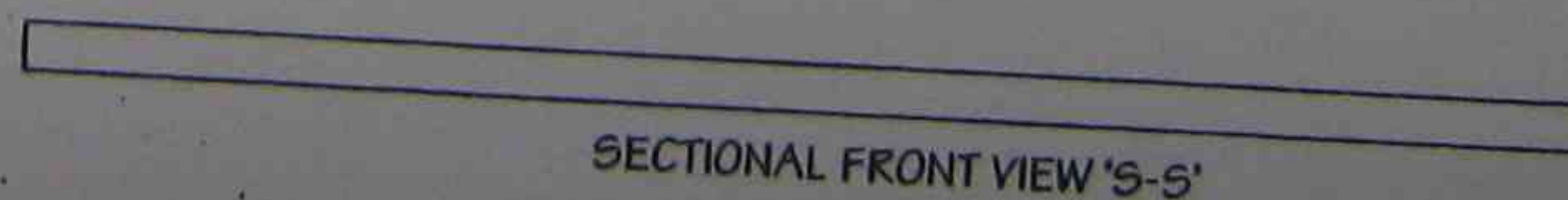
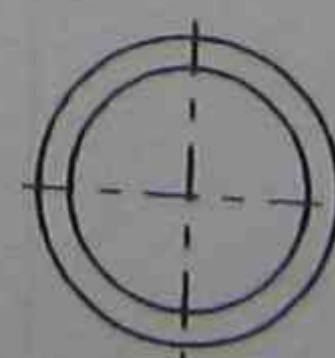
Exercise: ~~5-4~~ ⁹ TYPE . Complete the sectional front view 'SS'.



TOP VIEW



FRONT VIEW



SECTIONAL FRONT VIEW 'S-S'

STUDENTS NAME

MANUFACTURING & ENGINEERING
EDUCATIONAL SERVICES DIVISION

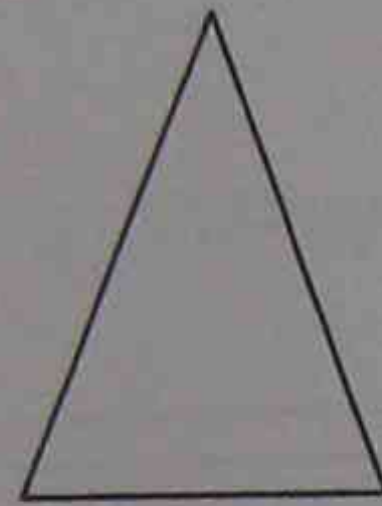
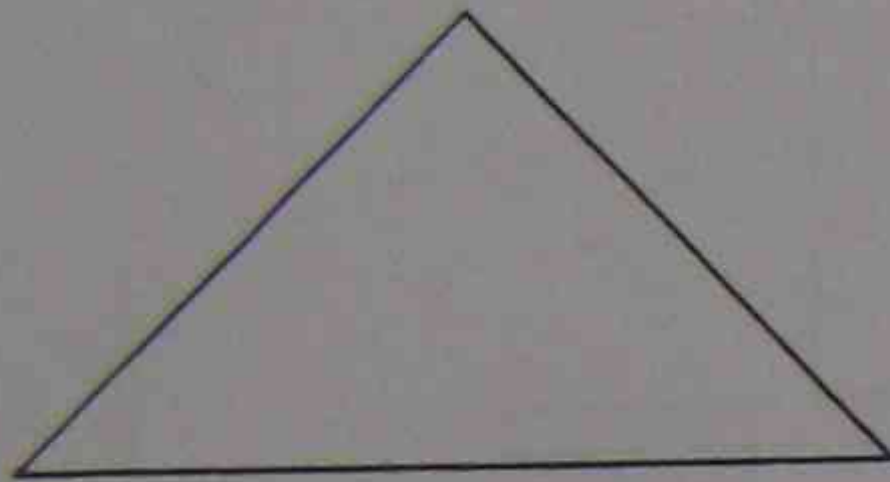
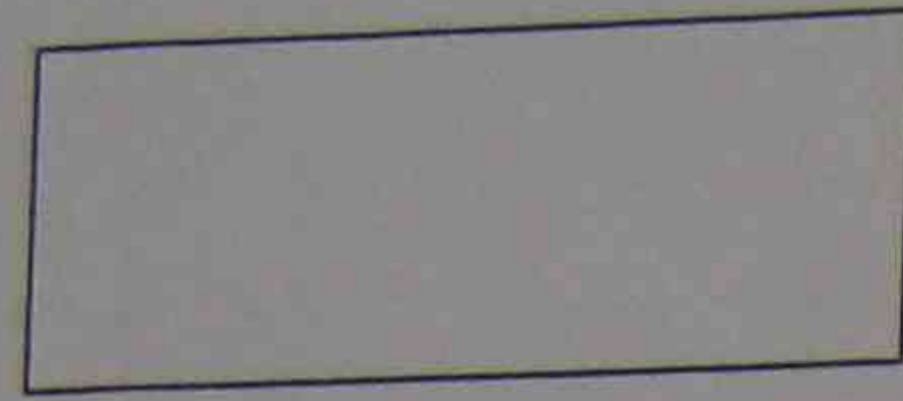


Review Questions

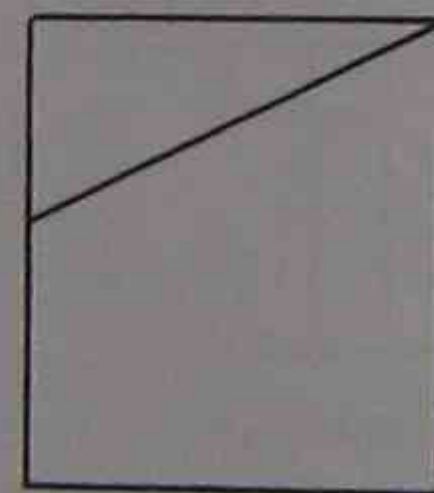
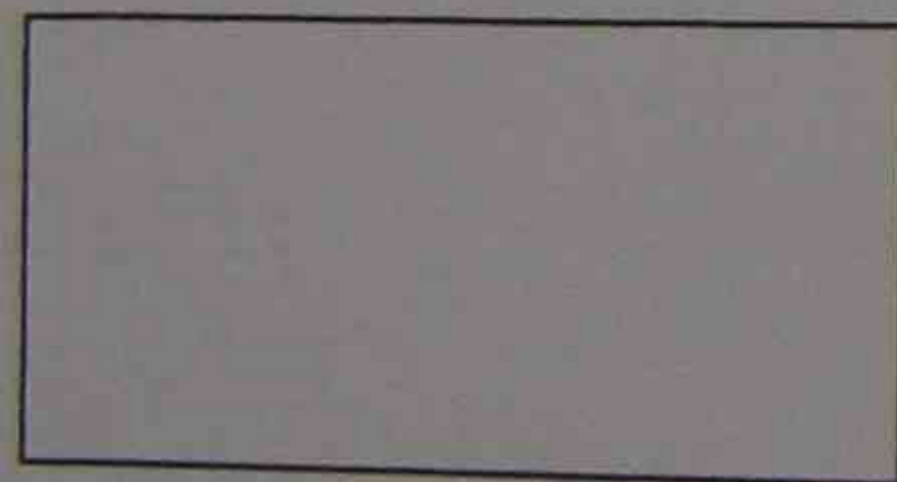
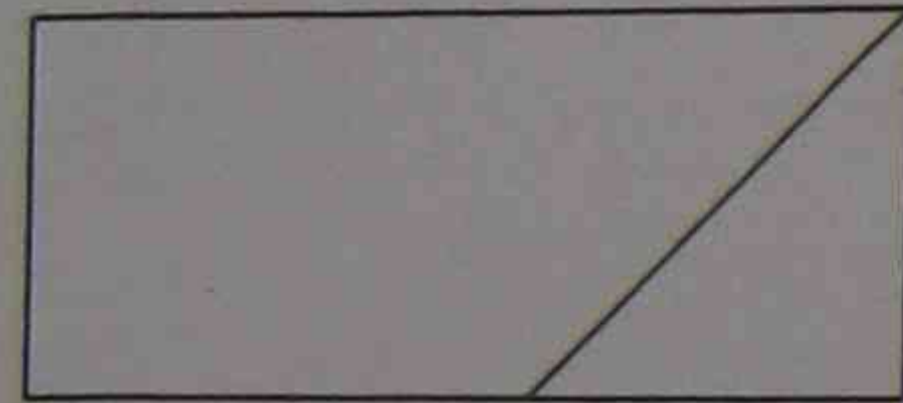
These questions will help you revise what you have learnt in this topic.

1. Below is a series of orthogonal drawings drawn in third angle projection with missing lines. In each, complete the drawing.

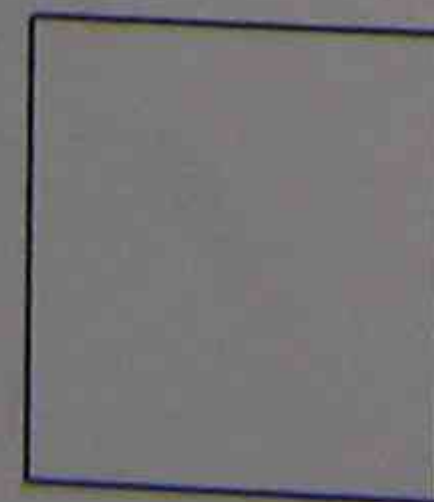
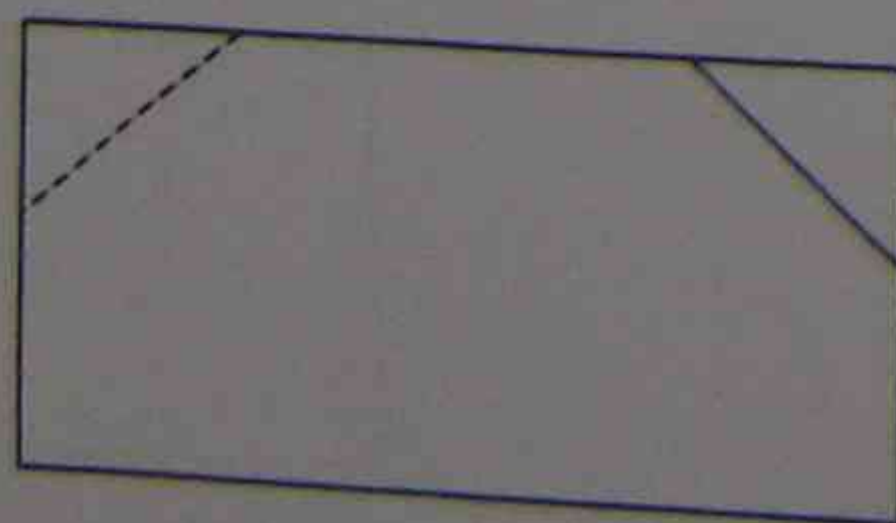
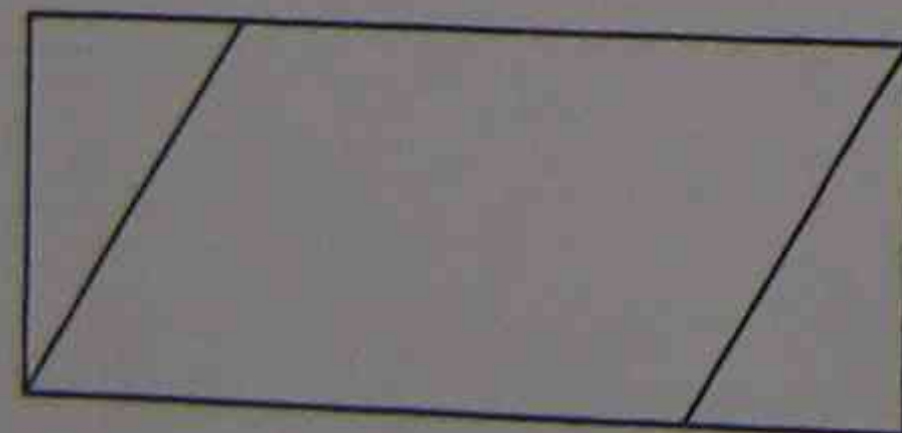
(a)



(b)



(c)



2. Using projection techniques, add the missing lines to the top view of the third angle projection drawing of figure 4 below.

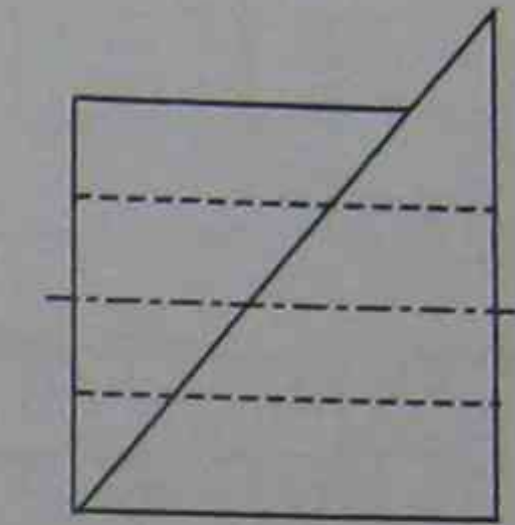
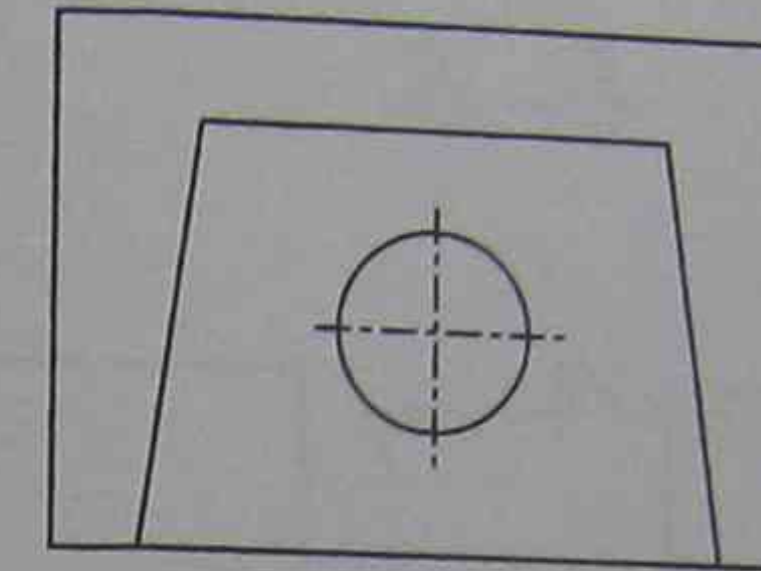
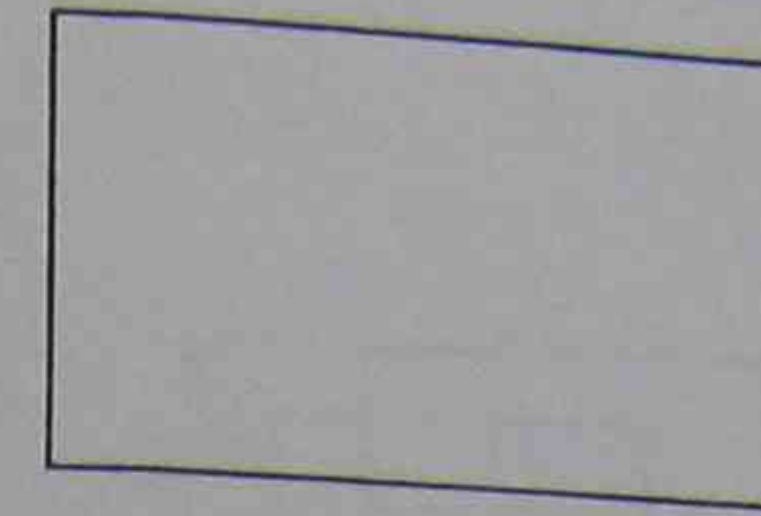


Figure 4

3. Using projection techniques, add the missing lines to the top view of the third angle projection drawing of figure 5 below.

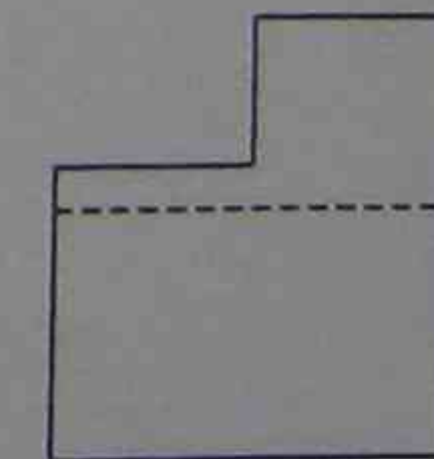
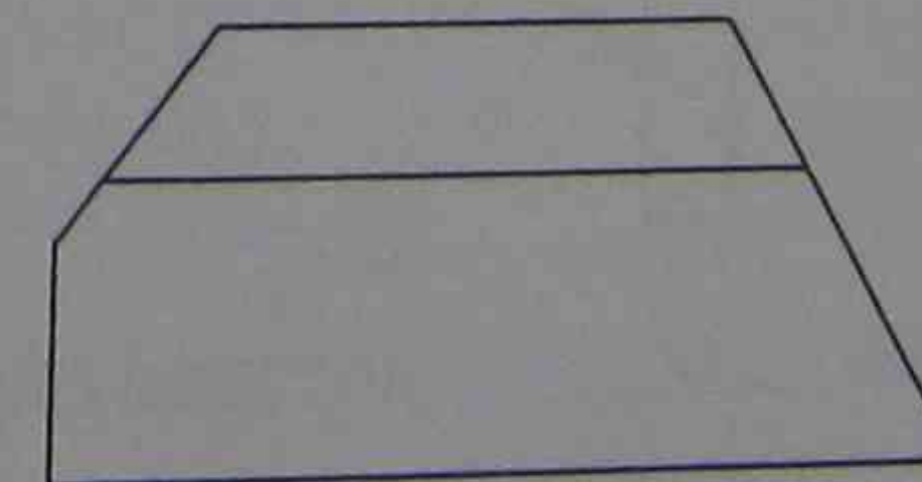
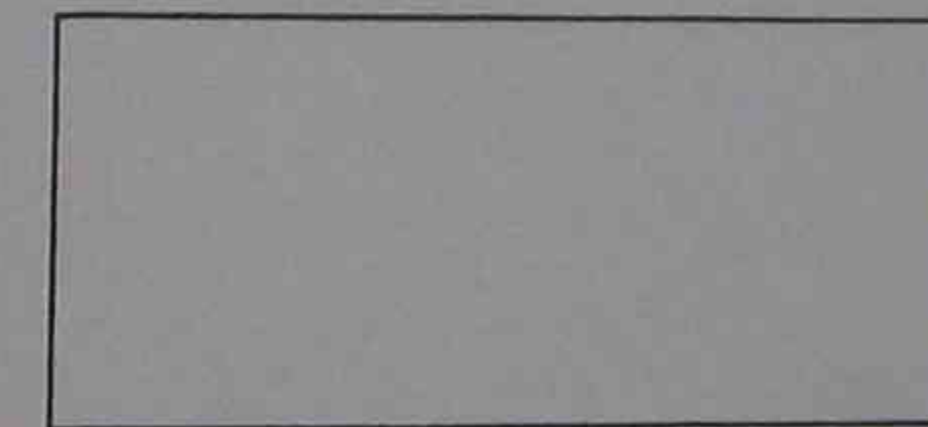


Figure 5

4. Using projection techniques, add the missing top view of the third angle projection drawing of figures 6 and 7 below.

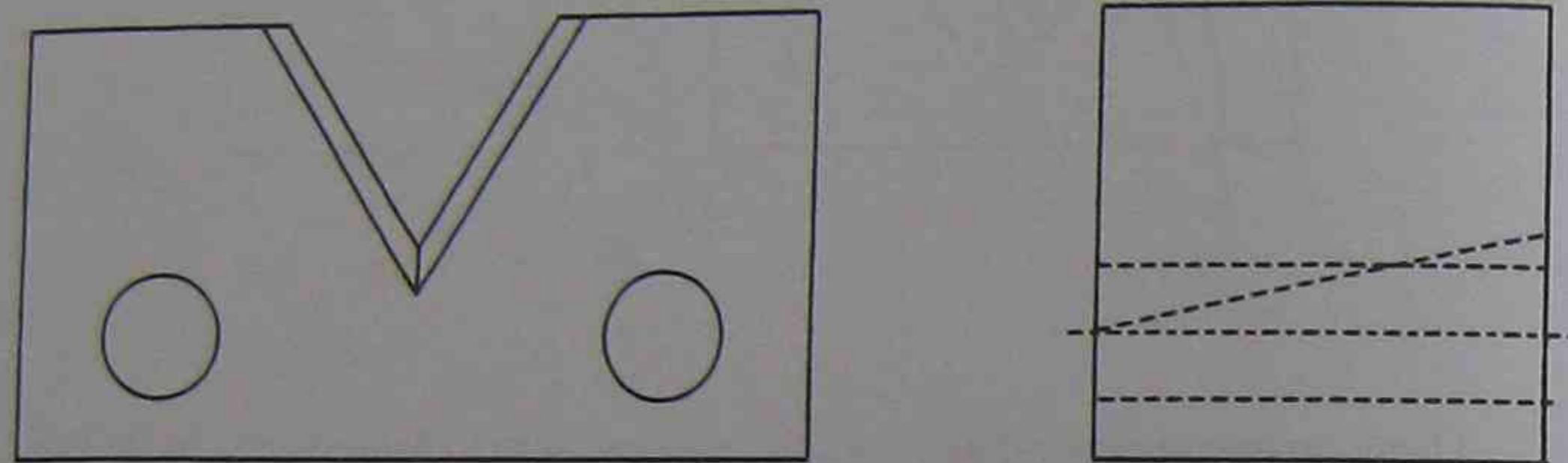


Figure 6

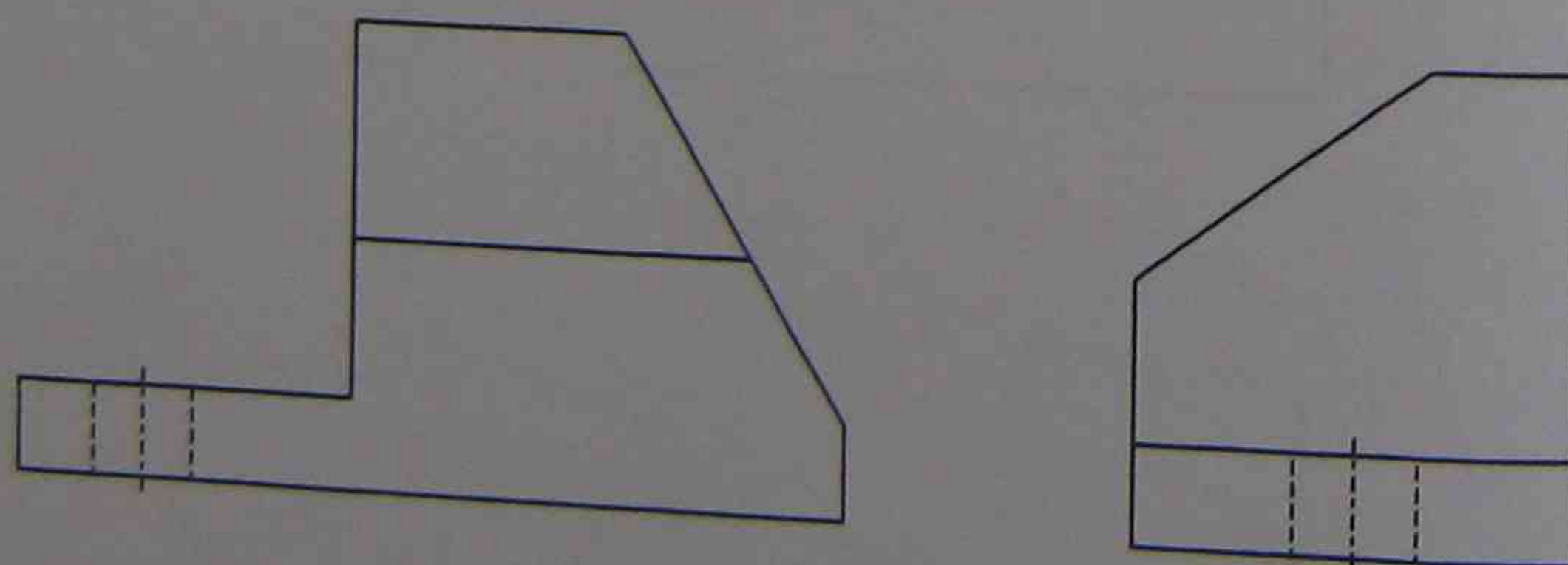


Figure 7

5. *A FREEHAND*
Draw an isometric drawing of the third angle projection drawings shown below

(a)

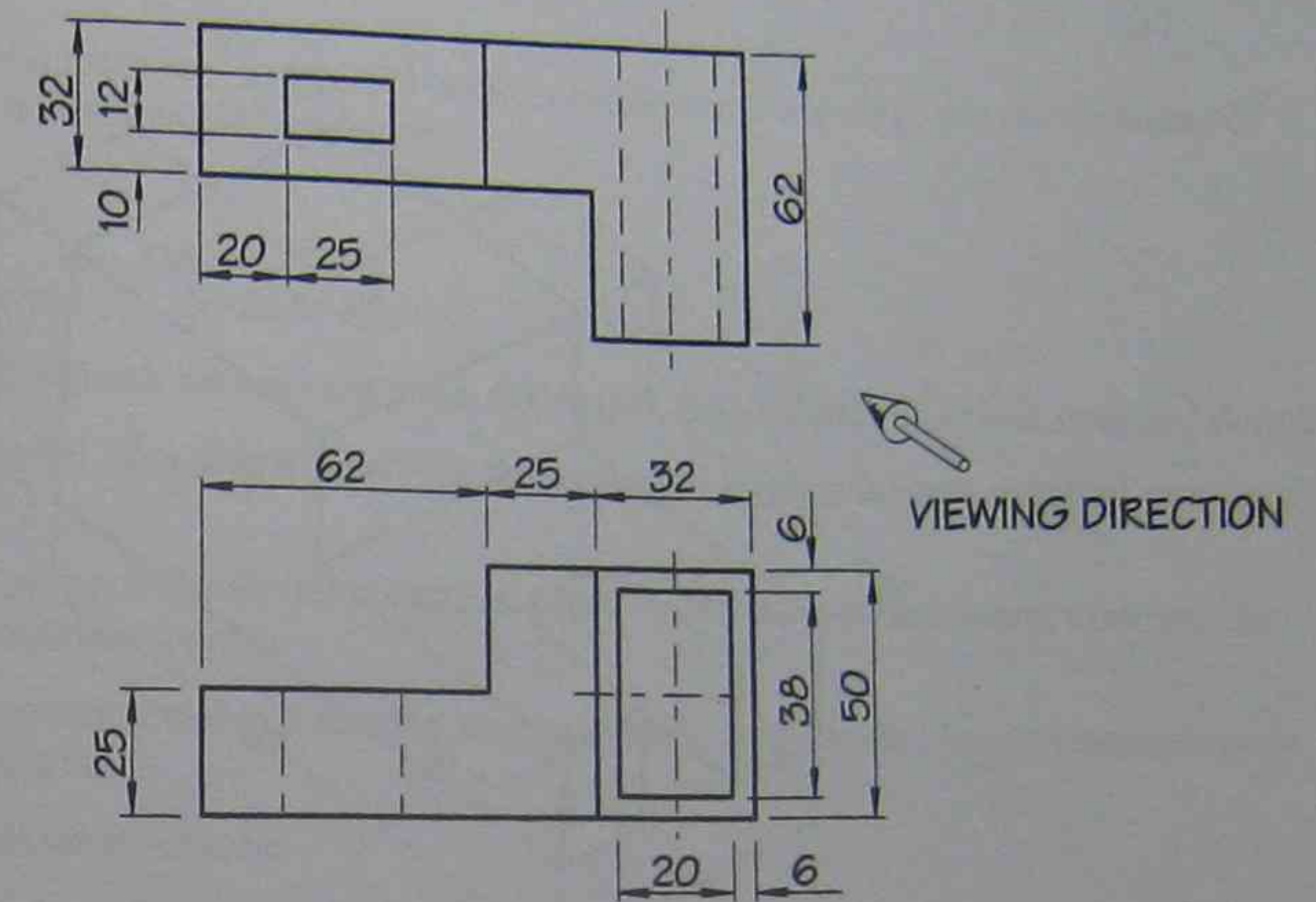


Figure 9

(b)

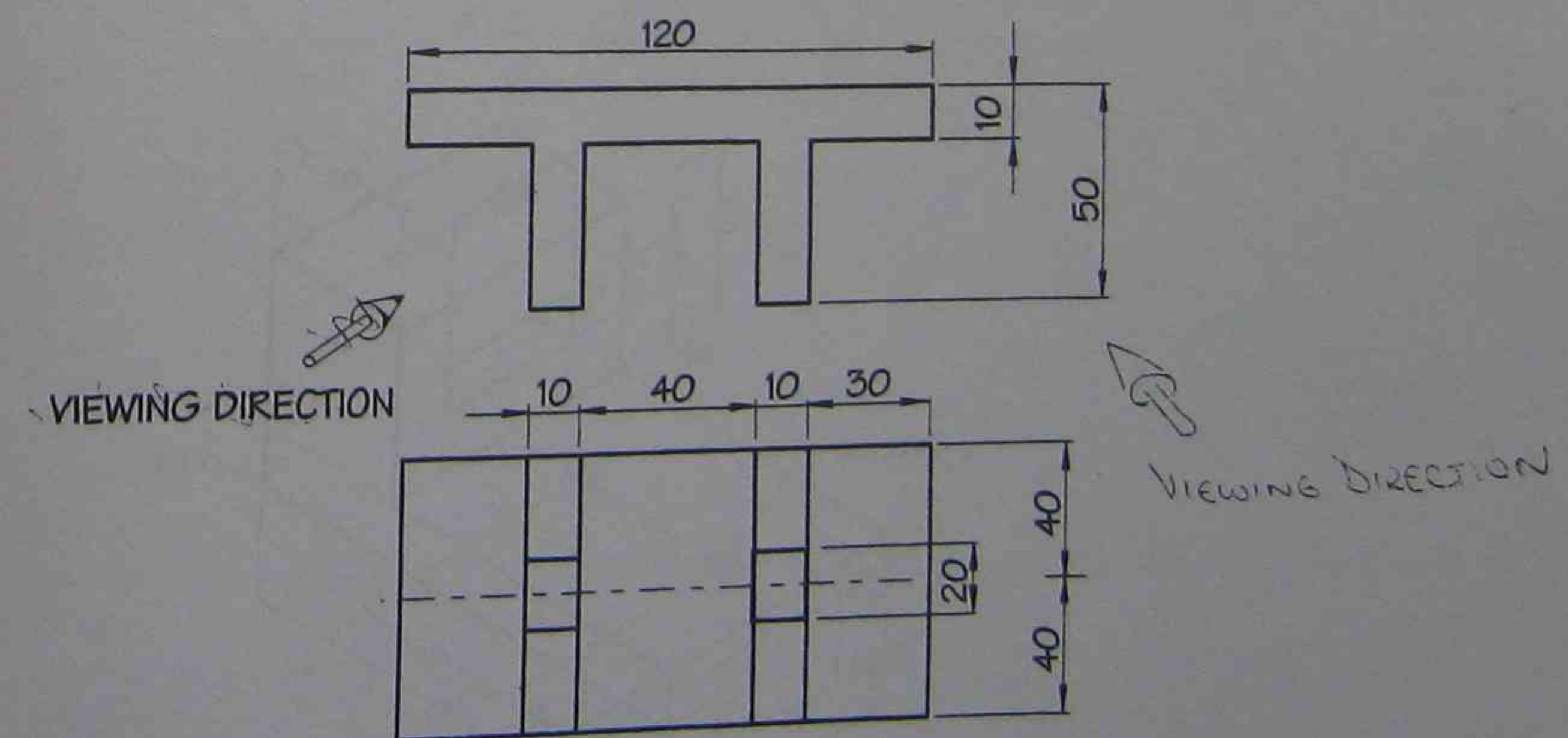


Figure 10

Draw in freehand a front, top and right hand side view of the following two isometric drawings.

(a)

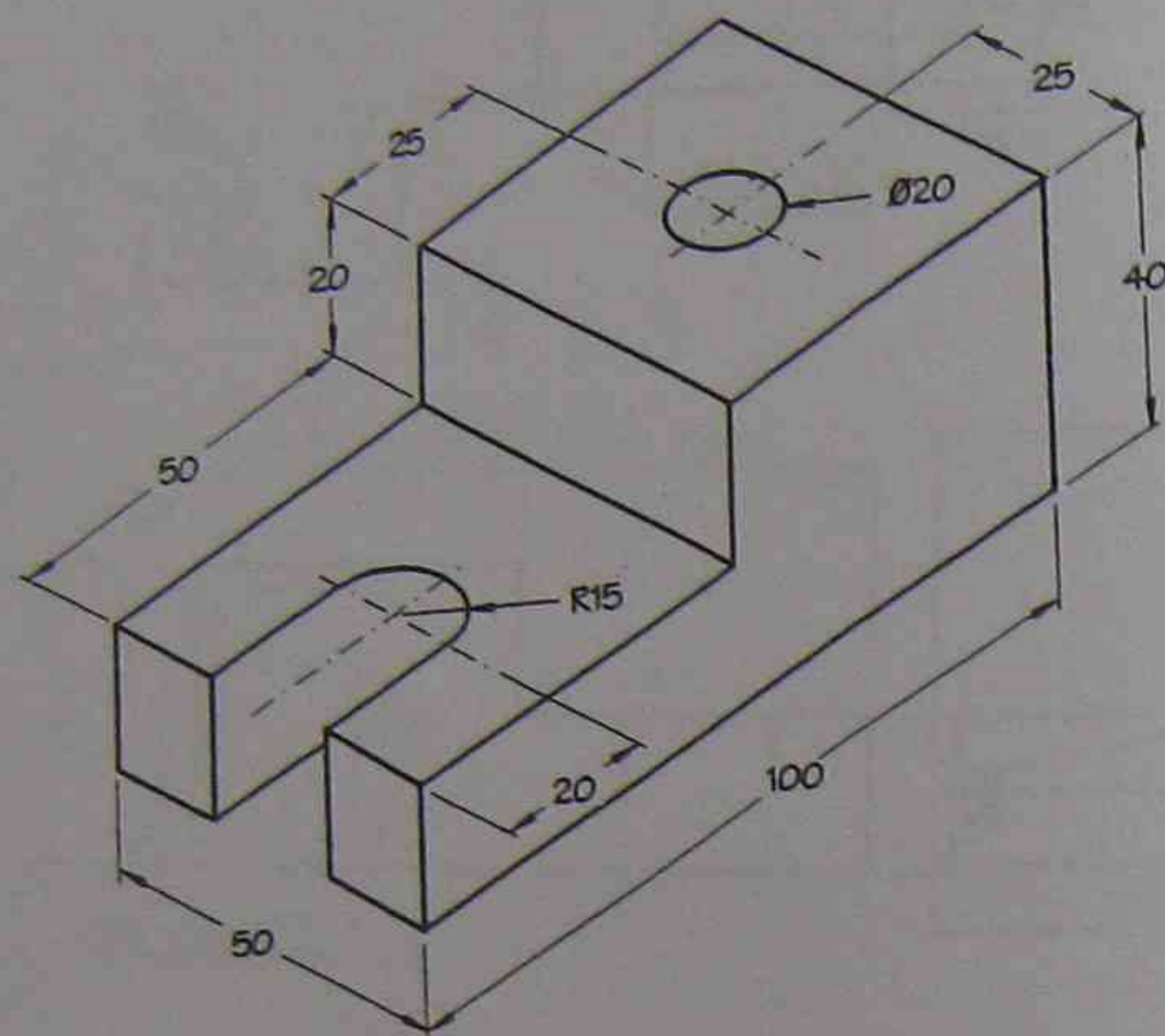


Figure 9

(b)

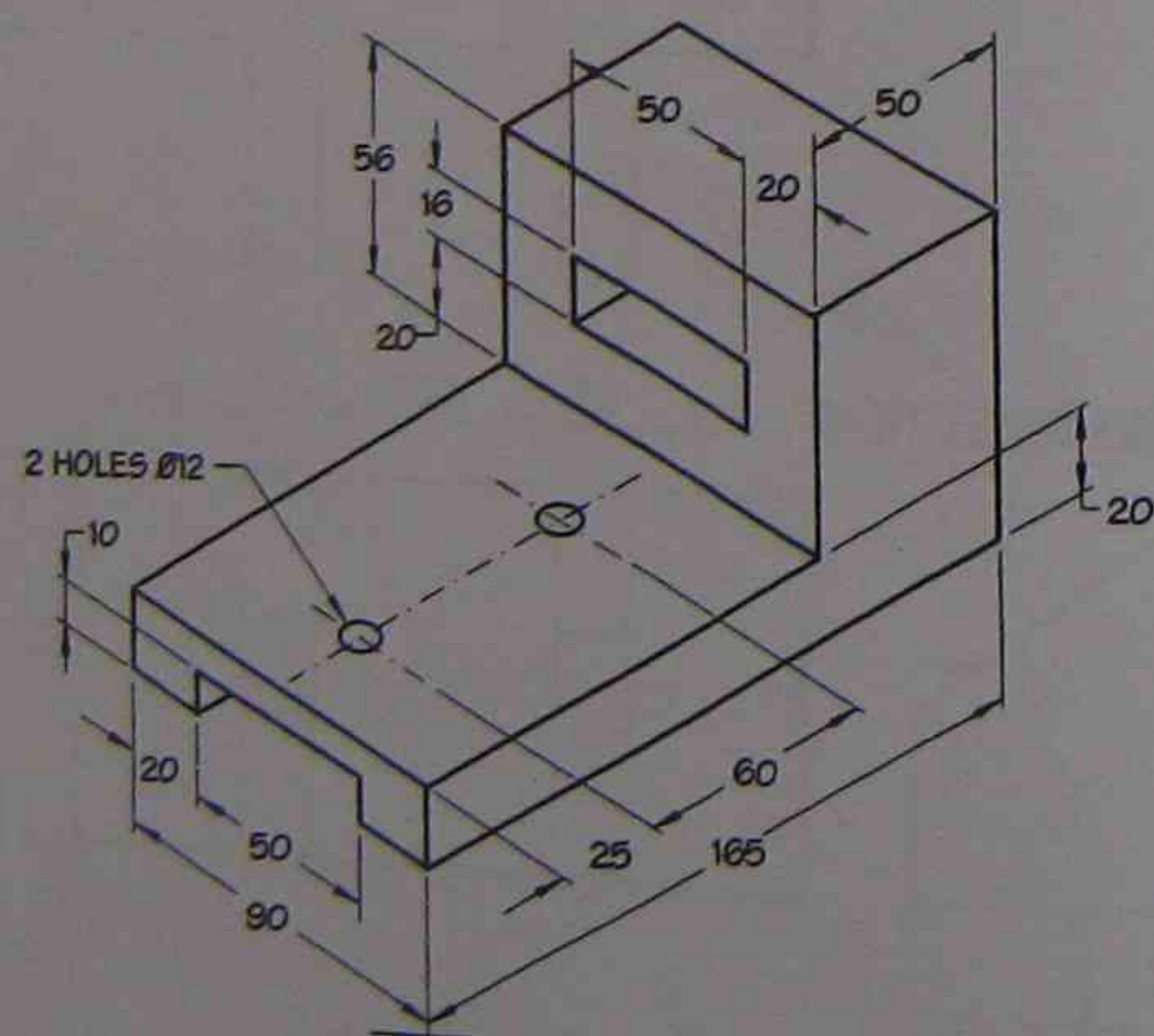


Figure 10

3 Architectural Drawings

Purpose

In this topic you will learn how to read and interpret architectural drawings for the locations of electrical circuits, accessories and appliances.

Objectives

At the end of this topic you should be able to:

- identify and distinguish between site plans, floor plans, detailed drawings and standard drawings
- use an architectural floor plan to determine the power and lighting layouts required in a domestic installation.
- use a site plan to locate the service point, consumers mains, main switchboard, distribution boards and/or builders supplies.
- use standard drawing scales to determine the actual lengths represented by dimensions on an architectural drawing.
- draw given dimensions to scale
- identify electrical symbols used with location diagrams
- read and interpret a floor plan to determine the location of the electrical accessories and appliances .
- use Australian standard symbols on a floor plan to show the location of the accessories and appliances as detailed in an electrical schedule.
- identify and locate luminaire switch positions from an architectural floor plan.

Introduction.

The installation of electrical services is a major part of any new building. Being able to correctly interpret a floor plan that shows the location of all electrical accessories and appliances to be installed is an essential task for an electrician who is involved in the installation of electrical wiring and equipment. This may include the installation of the following:

- lighting
- power
- heating (water, cooking and space)
- air-conditioning
- computing
- communications
- security
- audio-visual

There are two levels of drawing:

- **design drawings** where the ideas on room relationship, size and stylistic treatment are considered.
- **working drawings** that set down the finalised design together with all the information a builder or tradesperson needs to know in order to construct the work.

The plan/working drawing

The working plan consists of:

- floor plan
- site plan
- elevations (front, rear and sides)
- section
- details

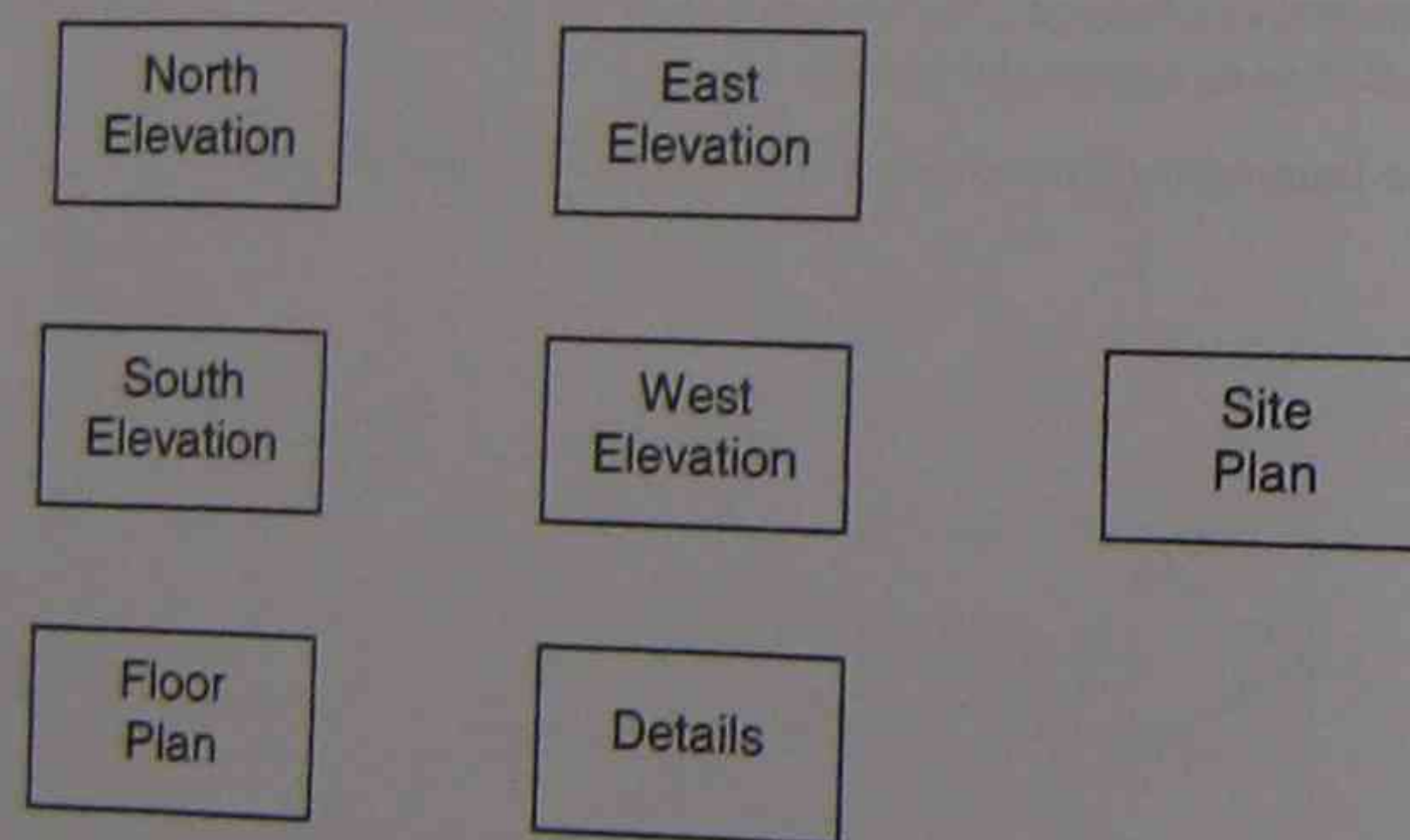


Figure 1 General layout of drawing sheet

Floor plan: a horizontal section through a building as viewed from above, showing the actual outline or shape of the building. Generally the view used by most electricians in carrying out their work. Information associated with a floor plan would include dimensions, wall thickness, position of windows and doors and width of openings. It also details positioning of electrical accessories and appliances.

Site plan: shows the outline of the building lot and the position of the building on the lot. Roads, services and other physical details may be shown.

Elevations: are views of the various sides of the building and show each side of the building as viewed at right angles. Sometimes the elevations are named in accordance with the building orientation, for example, north elevation, west elevation.

Section: a side view as if an exterior wall were removed. More correctly it is a 'cut' through a building at a certain point. Shows heights and internal structures that are not evident in the plans or elevation views.

Details: are larger scale drawings that show details of specific parts of a building or details relating to the installation of equipment such as the footing detail.

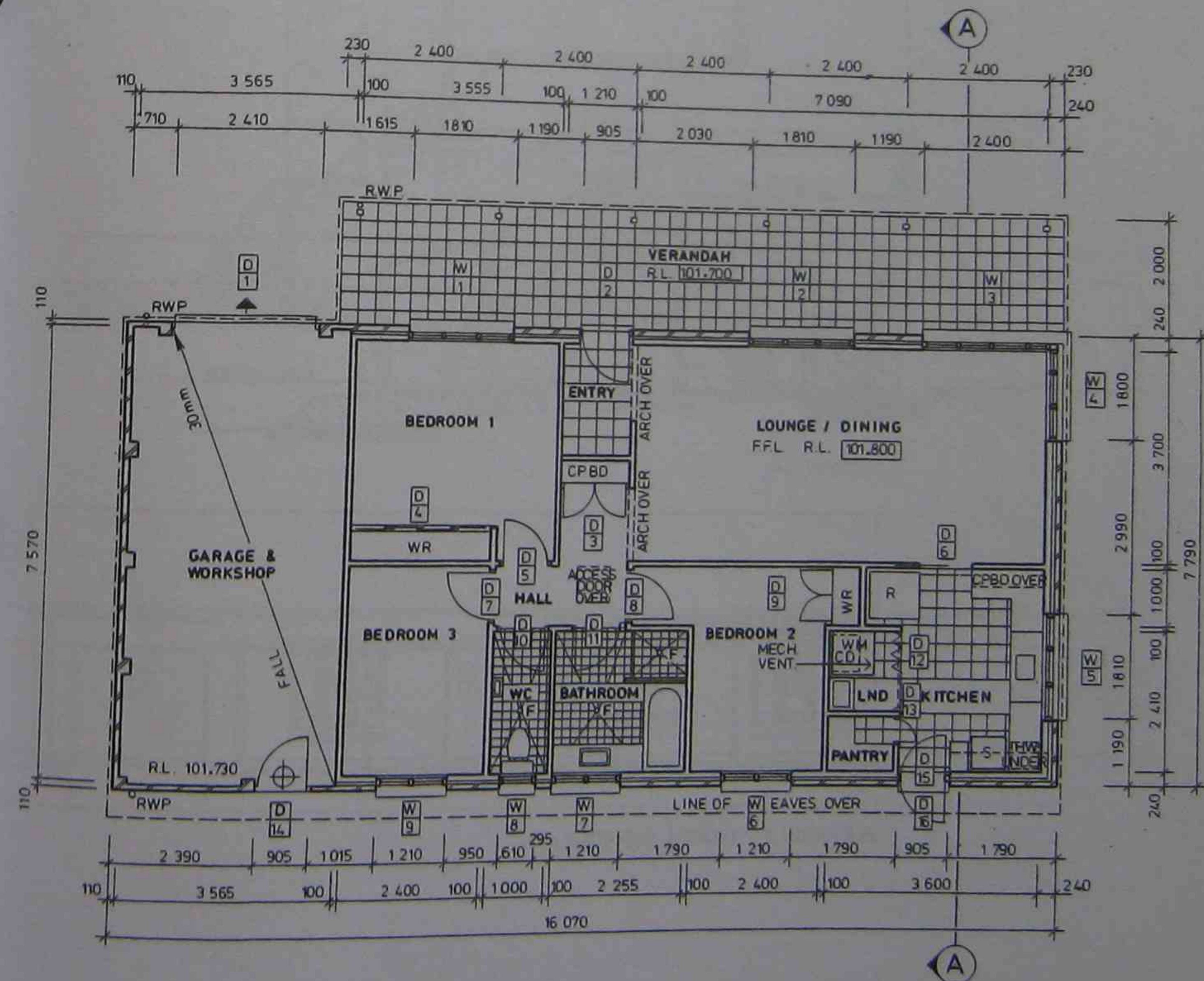


Figure 2 Floor plan

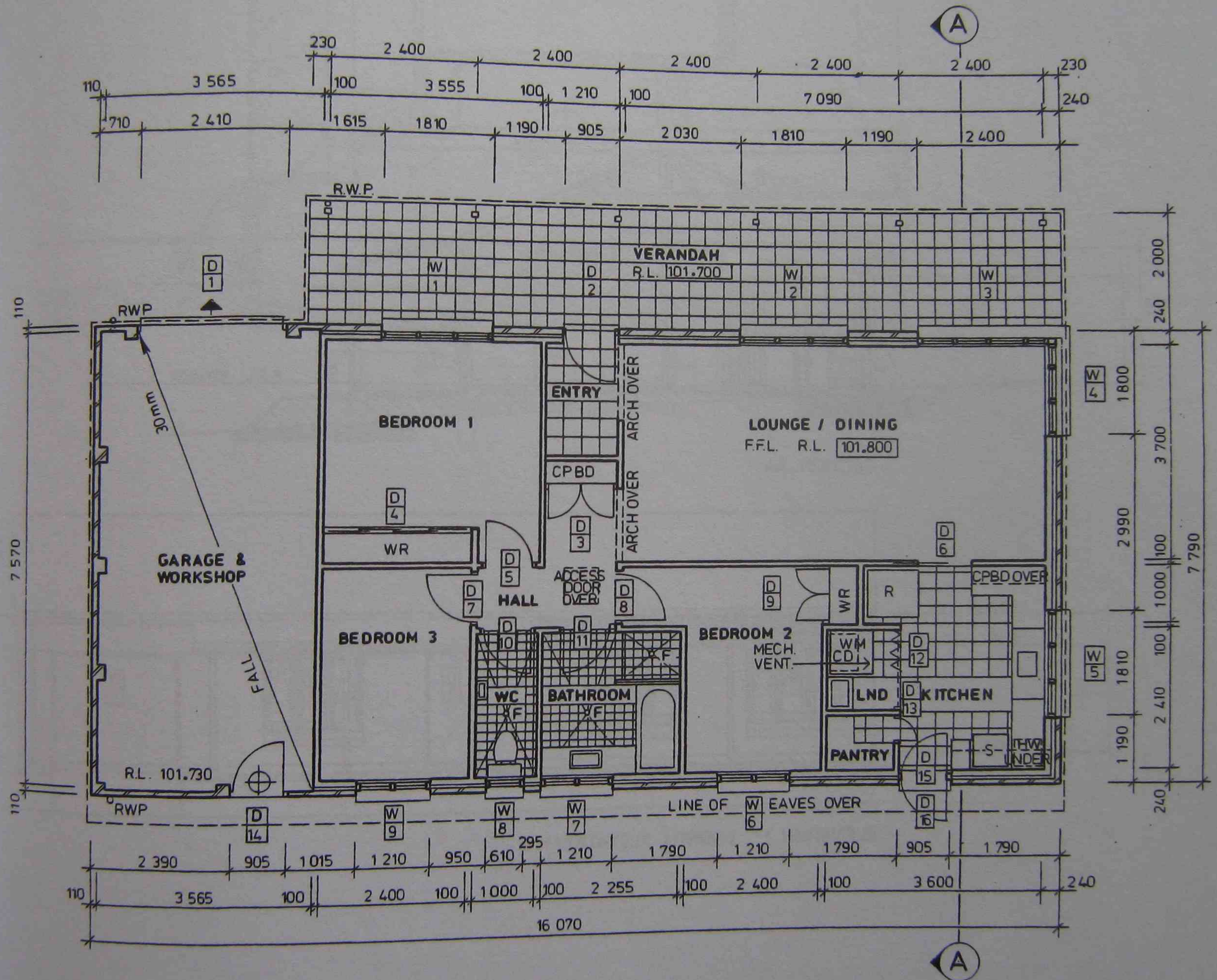


Figure 2 Floor plan

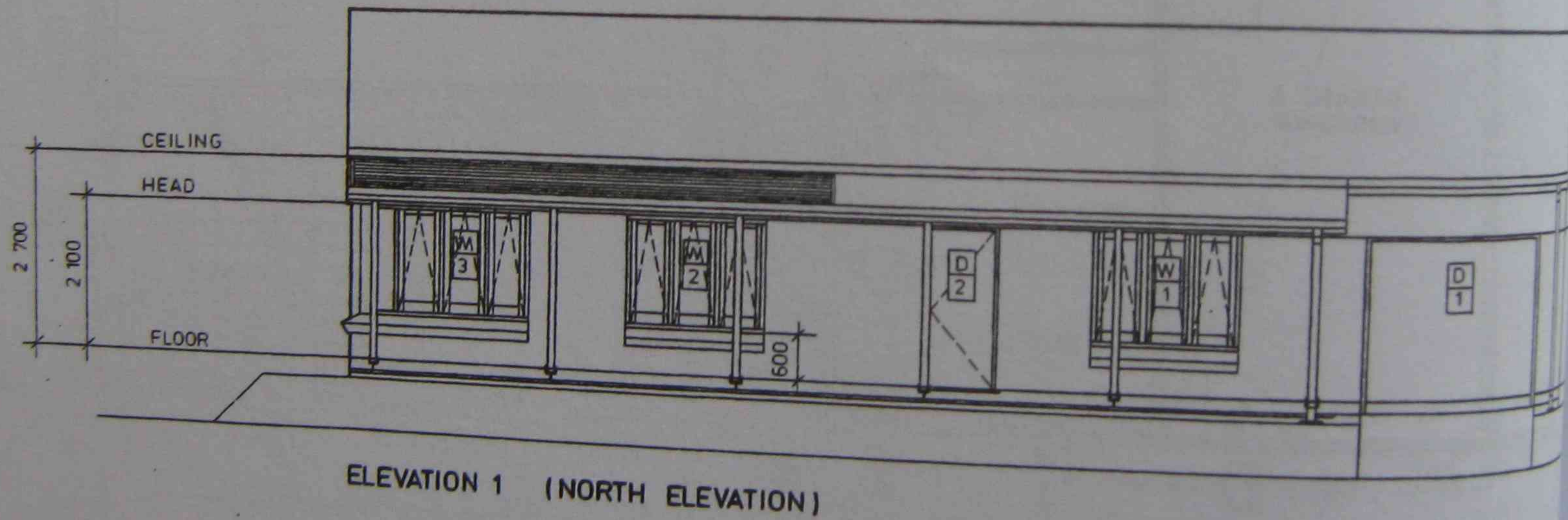
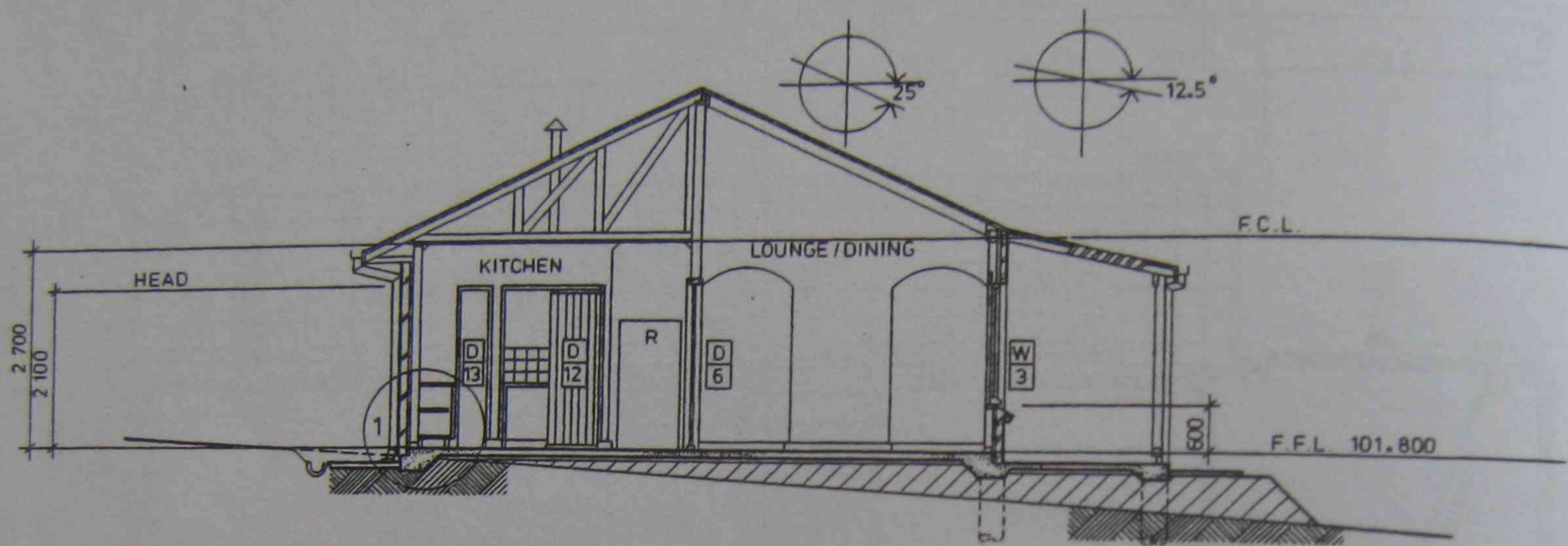


Figure 3 Section and Elevation

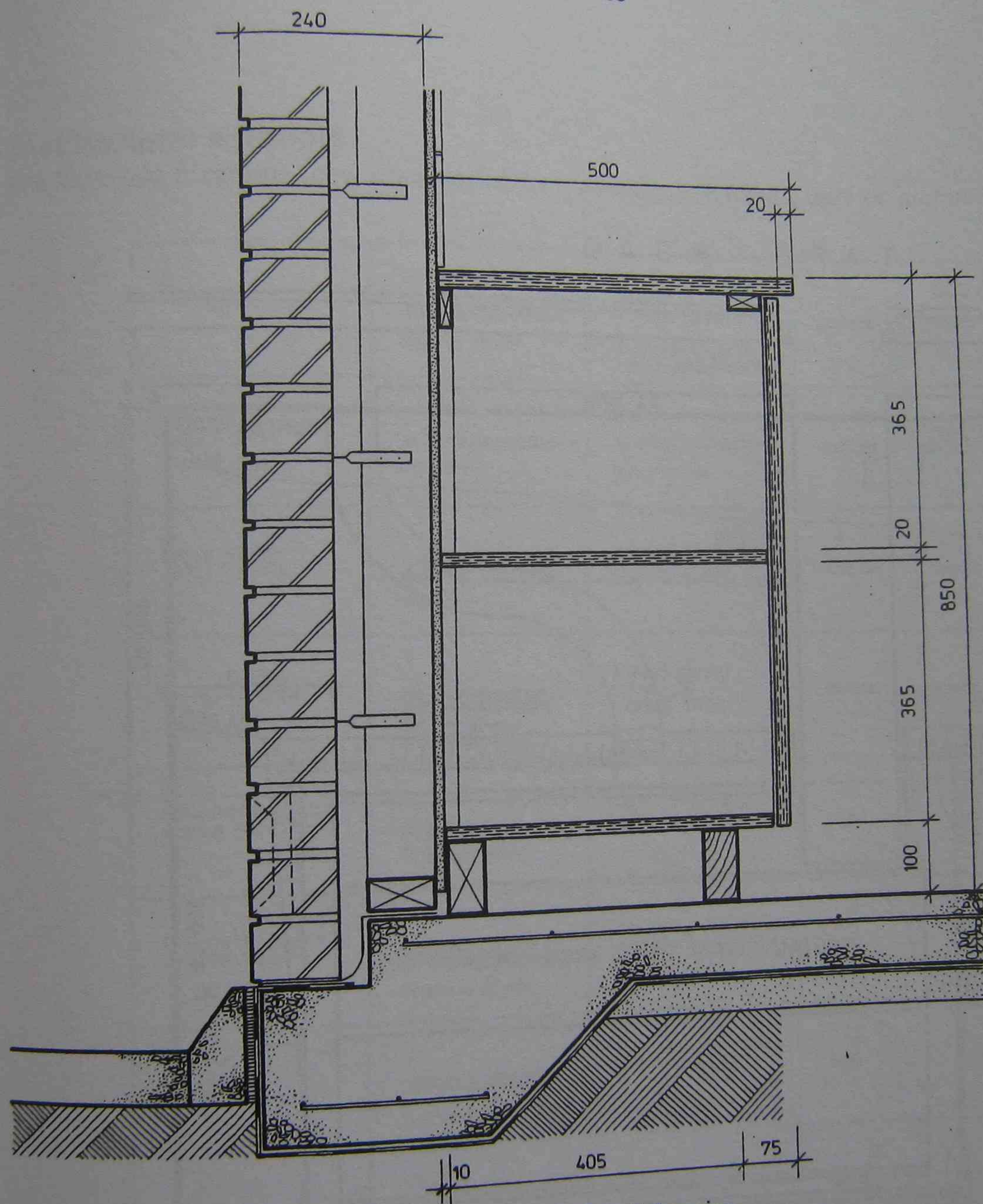


Figure 4 Detail drawing

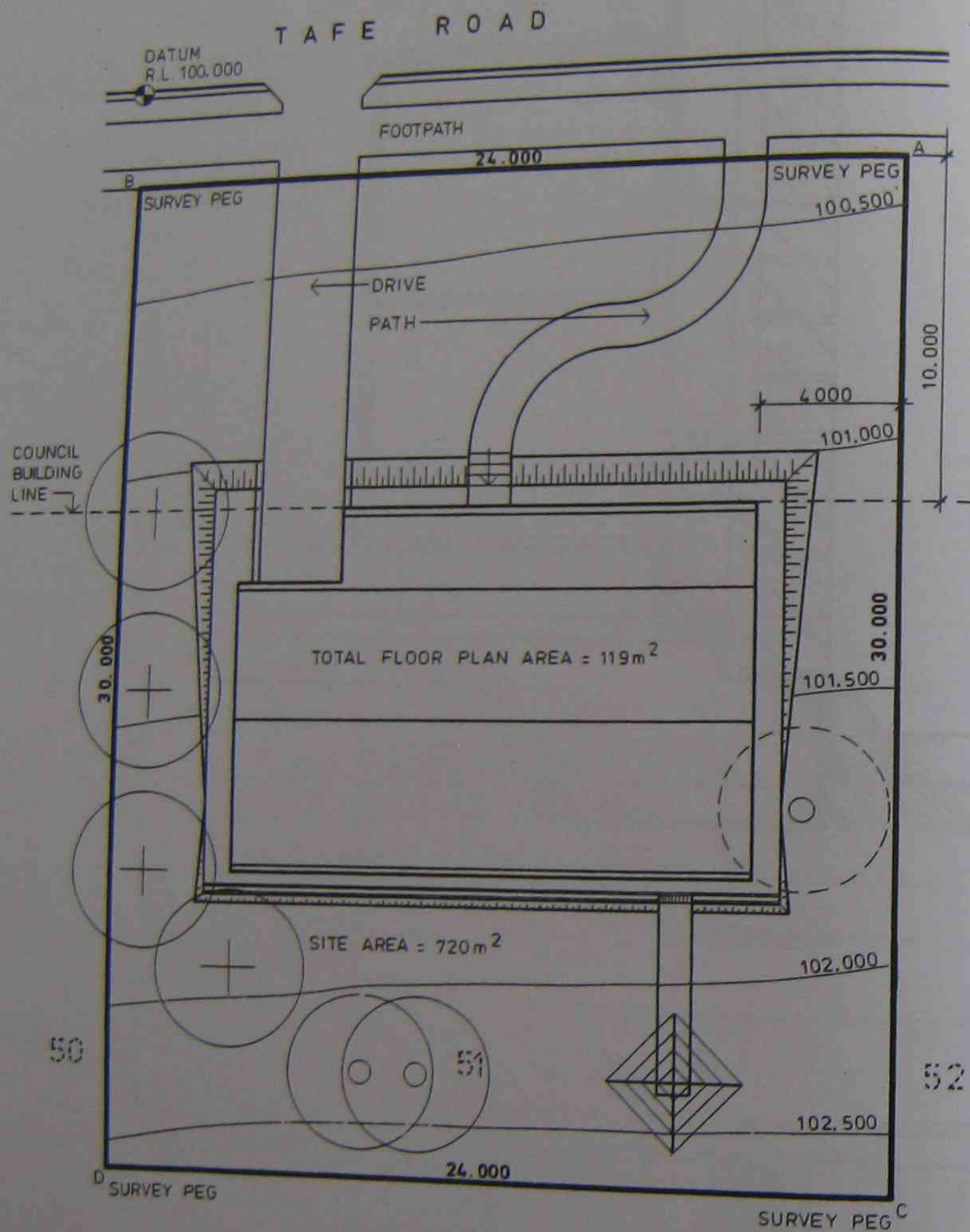


Figure 5 Site plan

Architectural symbols

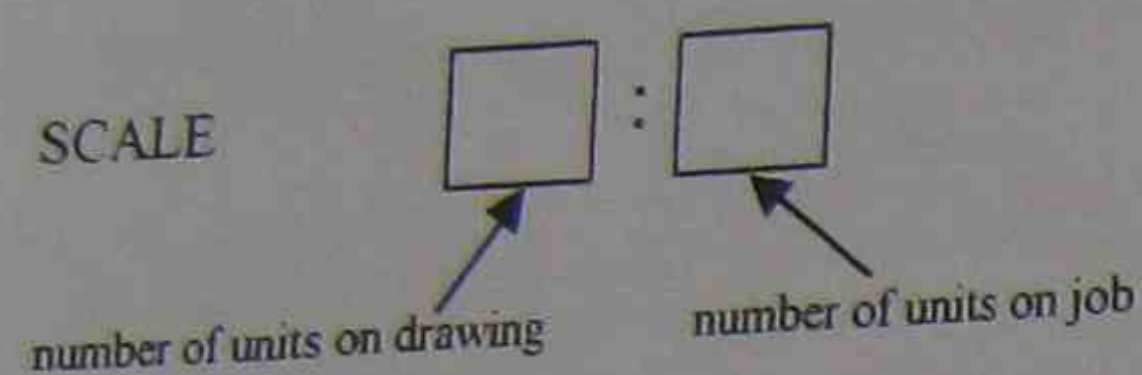
The following diagrams show examples of the conventions (symbols) used on architectural drawings.

TIMBER STUD	'Shaded grey' Chrome yellow	SINGLE SWING DOOR Arcs continued to indicate doors to fasten	
BRICKWORK SINGLE SKIN	Vermilion	SINGLE SWING DOOR Alternative	
BRICKWORK-CAVITY WALL	Vermilion	SINGLE DOUBLE-ACTING DOOR	
BRICK VENEER	Chrome yellow and vermillion	SINGLE SWING DUTCH OR STABLE DOOR	
CONCRETE BLOCK SINGLE SKIN	Prussian green	PAIR OF DOUBLE-ACTING DOORS	
CONCRETE BLOCK CAVITY WALL	Prussian green	IN-AND-OUT DOOR WITHOUT MULLION	
CONCRETE	Hooker's green deep	IN-AND-OUT DOOR WITH MULLION	
STONE	Vandyke brown	REVOLVING DOOR	
EXISTING WALL (Alterations, Additions) Alternatives a,b NOTE: Colour new work.	a. Heavy black for prominence b. Light outline Ghased	SLIDING DOORS 'A' - Sliding into a pocket 'B' - Sliding exposed on wall face	
GLAZED PARTITIONING		VERTICALLY OPENING DOORS	
WINDOW IN SINGLE SKIN WALL		ROLLING SHUTTER	
WINDOW IN CAVITY WALL (Internal skin)		UP AND OVER DOOR	
WINDOW IN CAVITY WALL (External skin)		FOLDING DOOR OR PARTITION CENTRED ON TRACK	
		FOLDING DOOR OR PARTITION TO ONE SIDE OF TRACK	
		SHOWER CURTAIN DRAPERIES, ETC	

Figure 6 Symbols representing walls, windows and doors

Architectural scales

The scale ratio of a drawing is expressed by inserting the word SCALE followed by two numbers separated by a colon in the appropriate portion of the title block.



Site plans	1:100	1:500	1:200	
Floor plans	1:200	1:100	1:50	1:20
Elevations	1:200	1:100	1:50	1:20
Sections	1:200	1:100	1:50	1:20
Details	1:10	1:5	1:2	1:1 (full size)

Table 1 Common scales used in the construction industry

Exercise 1

The lines shown in Table 2 represent dimensions from a drawing. For each line, measure its length in millimetres. Then determine the length the line must be drawn to for each of the scales shown and record these in Table 2

No.	Dimensioned line	Scale		
1		1:50	1:10	1:20
2				
3				
4				
5				
6				
7				
8				
9				
10				

Table 2

Exercise 2

On each of the ten lines shown in Table 3 mark the dimensions according to the specified length and scale for that line.

All measurements should start from the dimensioning symbol near the left hand side of the table and end with a similar symbol at the correct position along the line

No.	Line marked off to scale	Length	
1		10 500	1:100
2		9 750	1:100
3		5 000	1:50
4		4 450	1:50
5		6 700	1:200
6		890	1:10
7		58	1:1
8		12 000	1:500
9		3 475	1:100
10		1 280	1:50

Table 3

Electrical Services

When carrying out the installation of electrical services to a building, the electrician is generally required to interpret:

- **site plans:** to determine the location of the service point, consumers mains and sub mains, main switchboard and distribution boards, temporary builder's supply and other services such as gas, water, sewerage and telephone.
- **floor plans:** to determine the location of main switchboard and distribution boards, socket outlets (10 A, 15 A and 20 A), lighting points and associated switches, telephone and television outlets, appliances (range, hot plates and water heaters).
- **detail drawings:** to ascertain installation details for specific appliances or pieces of equipment.

The combination of the drawings mentioned above and the specifications for electrical wiring form the complete instructions for the electrical installation. The types of information contained in the electrical specification are:

- wiring methods and materials
- general method of layout
- type and make of accessories to be used
- mounting height of switches and outlets

Electrical architectural symbols

The location of all appliances and accessories that form part of the electrical installation are shown with the use of symbols on the floor plan. The symbols used generally have little or no resemblance to the actual appearance of the item represented.

The symbols used are specified in AS/NZS 1102.8 Graphical Symbols for Electrotechnology, Location Symbols – Power Supply Systems and Electrical Services for Buildings and Sites.

The centre of the symbol represents the centre of the appliance or accessory. To correctly locate items of equipment dimensions must be taken off the plan to the centre of the symbol. It is not always necessary to locate accessories in exactly the position shown on the plan, particularly socket outlets which are usually fixed to wall studs closest to the position shown on the plan.

The following diagrams show examples of the symbols used on electrical service sheets.

ELEMENT	SYMBOL	ELEMENT	SYMBOL
TELECOMMUNICATIONS, RADIO, TV APPARATUS		MISCELLANEOUS APPARATUS & APPLIANCES	
SOCKET SYMBOL FOR TELECOMMUNICATIONS GENERAL SYMBOL		THERMAL FIRE ALARM DETECTOR HEAD	
TELEVISION		WATCHMAN SYSTEM DEVICE OR KEY OPERATED SWITCH	
RADIO		MOTOR - GENERAL SYMBOL	
SOUND		GENERATOR - GENERAL SYMBOL	
AERIAL (Antenna) - GENERAL SYMBOL		CEILING FAN	
LOUDSPEAKER		RECTIFIER UNIT, D.C. POWER SUPPLY	
RADIO RECEIVING SET		ELECTRIC BELL	
GENERAL SYMBOL AMPLIFYING EQUIPMENT		ELECTRIC BUZZER	
TELEVISION RECEIVING SET		SIREN	
MICROPHONE		HORN	
TELEPHONE OUTLET - WALL		CLOCK	
TELEPHONE INSTALLED ON WALL		Coding is permissible, eg: B Battery S Slave D Digital ~ Synchronous M Master SK Spring reserve	
TELEPHONE OUTLET - FLOOR		CODING OF CABLES	
TELEPHONE INSTALLED ON FLOOR		ROUTING & CODING OF CONDUCTORS	
TELEPHONE SYMBOLS MAY BE ENCODED TO PROVIDE SPECIAL INFORMATION eg Intercom		WIRING LINE OR CABLE GENERAL SYMBOL	
THROUGH SWITCHBOARD		LINK BETWEEN A SWITCH AND ITS ASSOCIATED REMOTE SOCKET OR EQUIPMENT - ALTERNATIVE SYMBOL	
DIRECT LINE		UNDERGROUND LINE	
DISTRIBUTION POINT (Frame, box or block) For use on plan view of each floor		OVERHEAD LINE	
SWITCHBOARD, 40 LINE PMBX		CONSUMER'S MAINS	
SWITCHBOARD, 2+6 TABLE TYPE PMBX		UNDERGROUND SUB MAINS	
AUTOMATIC EXCHANGE EQUIPMENT			

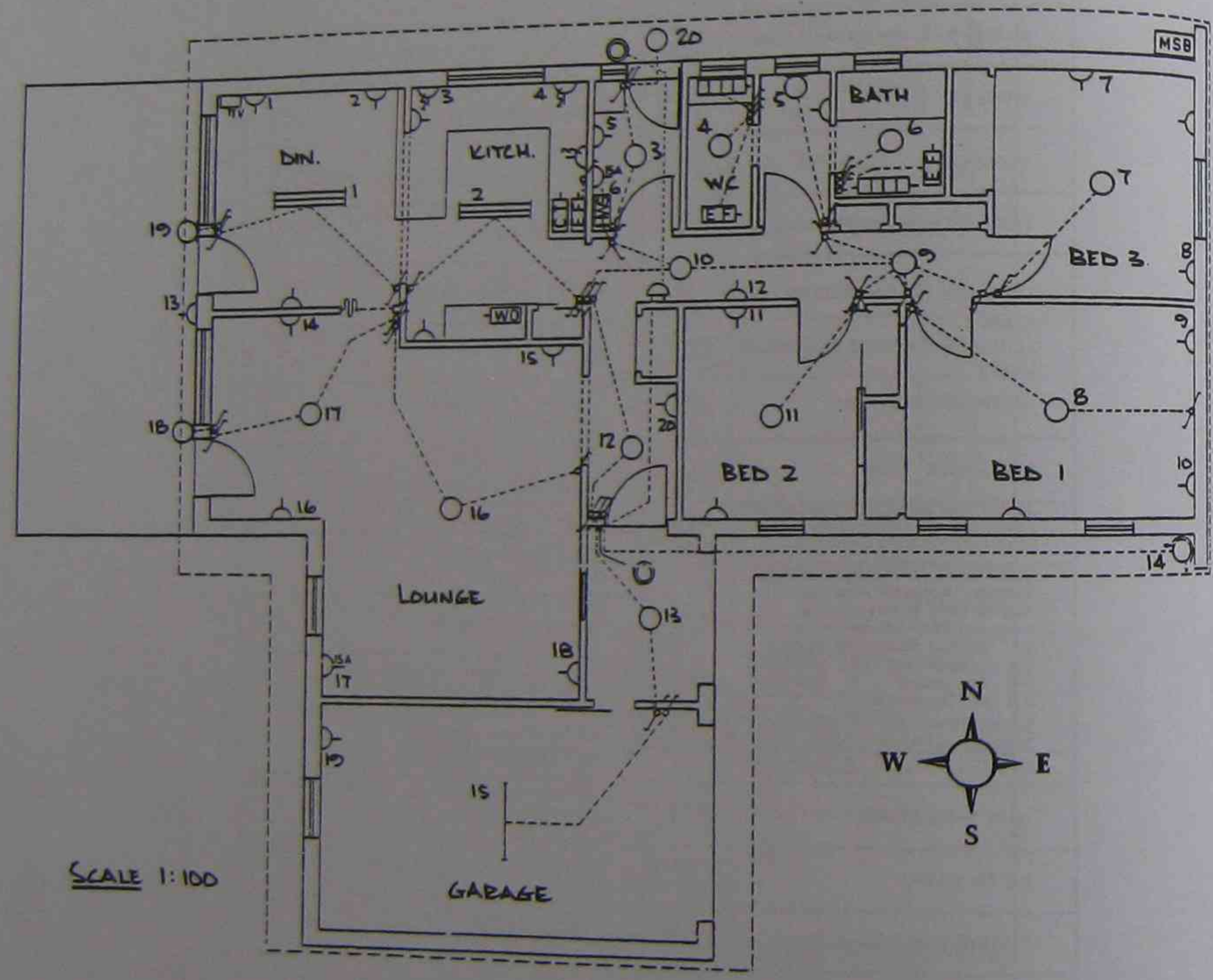
ELEMENT	SYMBOL	ELEMENT	SYMBOL
LUMINAIRES & DOMESTIC APPLIANCES		SWITCHES AND PUSH BUTTONS	
LUMINAIRE - GENERAL SYMBOL		ONE WAY SWITCHES, SINGLE, TWO AND THREE POLES	
LUMINAIRE FIXED TO WALL		SINGLE POLE PULL SWITCH	
THE NUMBER AND POWER OF LAMPS IN A GROUP MAY BE SPECIFIED eg Luminaire For Three 40 W Lamps		MULTI-POSITION SWITCH FOR DIFFERENT DEGREES OF LIGHTING	
LUMINAIRE WITH BUILT-IN SWITCH		TWO-WAY SWITCH	
EMERGENCY LIGHTING LUMINAIRE eg Standby or Escape Lighting		INTERMEDIATE SWITCH	
SIGNAL LAMP		LIGHT DIMMER, eg Switch with Variable Control	
WARNING, ALARM OR PANIC LAMP		PERIOD LIMITING SWITCH	
SPOTLIGHT		TIME SWITCH	
FLOODLIGHT		REMOTELY CONTROLLED EQUIPMENT	
LAMP WITH REFLECTOR		PUSH BUTTON	
LUMINAIRE FOR FLUORESCENT LAMP		LUMINOUS PUSH BUTTON	
Example LUMINAIRE FOR THREE FLUORESCENT LAMPS		RESTRICTED ACCESS PUSH BUTTON	
ALTERNATIVE SYMBOL		MANUALLY OPERATED FIRE ALARM	
DISCHARGE LAMP		SOCKET OUTLETS	
AUXILIARY APPARATUS FOR DISCHARGE LAMP - Only Used When Apparatus is Separated From The Luminaire		SOCKET OUTLET - GENERAL SYMBOL Symbol May Be Coded, eg 15A=15 Ampere, W.P. = Weather proof	
ELECTRICAL APPLIANCE - GENERAL SYMBOL. Accepted Abbreviation May Be Used To Specify, eg: HWS, Hot Water Service R Electric Range GD Garbage Disposal EF Exhaust Fan FH Fan Heater H Elec. Heater AC Air Conditioner		MULTIPLE SOCKET OUTLET eg. For 'n' Plugs	
ELECTRIC HEATER - ALTERNATIVE SYMBOL GRAPHIC CODING		SWITCHED SOCKET OUTLET	
DISTRIBUTION BOARDS		SOCKET OUTLET WITH PROTECTIVE EARTH CONTACT	
MAIN SWITCHBOARD		SINGLE PHASE SOCKET SWITCHED AND EARTHED	
METER BOARD		SOCKET OUTLET WITH PROTECTIVE INTERLOCKING SWITCH	
DISTRIBUTION BOARD		MULTI-PHASE SOCKET OUTLET	
MANUAL TELEPHONE EXCHANGE		MISCELLANEOUS	
AUTOMATIC TELEPHONE EXCHANGE		POINT OF ATTACHMENT	
FIRE INDICATOR BOARD		EARTH	
		BATTERY	
		LIGHTNING ARRESTER	

Figure 7 Symbolic representation for electrical service sheets

Exercise 3

From the floor plan of Figure 8 (scale 1:100) determine the location of the 20 socket outlets shown numbered on the floor plan. List and record in Table 4 the following information for each outlet:

- outlet details (eg single 10 A or double 10 A)
- room in which the outlet is located (eg lounge, kitchen, bedroom 1)
- location details (eg western wall, 500 mm from north-west (NW) corner)



Outlet No.	Outlet details	Room in which outlet is located	Location details
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Table 4 Details of outlets

Figure 8 Floor plan showing location of electrical accessories.

Exercise 4

From the floor plan of Figure 8 determine the location of all the lighting points. List in Table 4, the following information for each lighting point:

- switch details (eg one-way, two-way)
- room in which the lighting point is located (eg lounge, kitchen, bedroom 1)
- location details (eg room centre or western wall, 500 mm from north-west (NW) corner)

Light No.	Switching details	Room in which light is located	Location details
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Table 5 Lighting points and switching arrangements

Exercise 5

From the floor plan of Figure 8 identify five different types of appliances to be installed. List the following information in Table 6 for each appliance:

- type of appliance (eg wall oven, hot water service, heater)
- room in which the appliance is located (eg lounge, kitchen, laundry)
- the symbol used to identify the appliance

Type of appliance	Location	Symbol

Table 6 Appliances

Exercise 6

On the floor plan of Figure 9 draw the location of all lighting points and switching positions as detailed in the electrical schedule shown below. The following points will help you:

- the floor plan shown in Figure 9 is drawn to a scale of 1:100
- when locating symbols make the centre line of the symbol correspond to the centre line of the lighting point
- show switching positions for all lighting points, taking into account the type of switching required according to the schedule and the practical location for switches

Electrical Schedule – Lighting

Room	No. of Points	Switching	Location details
Porch	2	One-way	Wall brackets each side of door
Living	1	Two-way	Room centre
Dining	1	One-way	Room centre
Kitchen	1	Two-way	Room centre
Family	1	Two way	Room centre
Terrace	1	One-way	Terrace centre
Toilet	1	One-way	Room centre
Bath – laundry	1	One-way	Room centre
Bedroom 1	1	One-way	Room centre
Bedroom 2	1	One-way	Room centre

Exercise 7

On the floor plan in Figure 9 draw the locations of all socket outlets as detailed in the electrical schedule shown below. Note the following points;

- when locating symbols make the centre line of the symbol correspond to the centre line of the outlet
- be sure to correctly distinguish between single and double 10 A and 15 A outlets, by the use of appropriate symbols.

Electrical Schedule – Socket outlets

Room	No. of outlets	Type	Location details
Kitchen	1	Double 10 A	Southern wall 300 mm from SE corner
	1	Double 10 A	Southern wall 300 mm from SW corner
	1	Single 10 A	Eastern wall 500 mm from NE corner
Dining	1	Double 10 A	Western wall 450 mm from SW corner
Living	1	Double 10 A	Northern wall 300 mm from NW corner
	1	Single 10 A	Northern wall 300 mm from NE corner
	1	Single 15 A	Western wall 300 mm from SW corner
Bedroom 1	1	Single 10 A	Western wall 500 mm from NW corner
Bedroom 2	1	Double 10 A	Centre southern wall
Bath-laundry	1	Double 10 A	Centre eastern wall

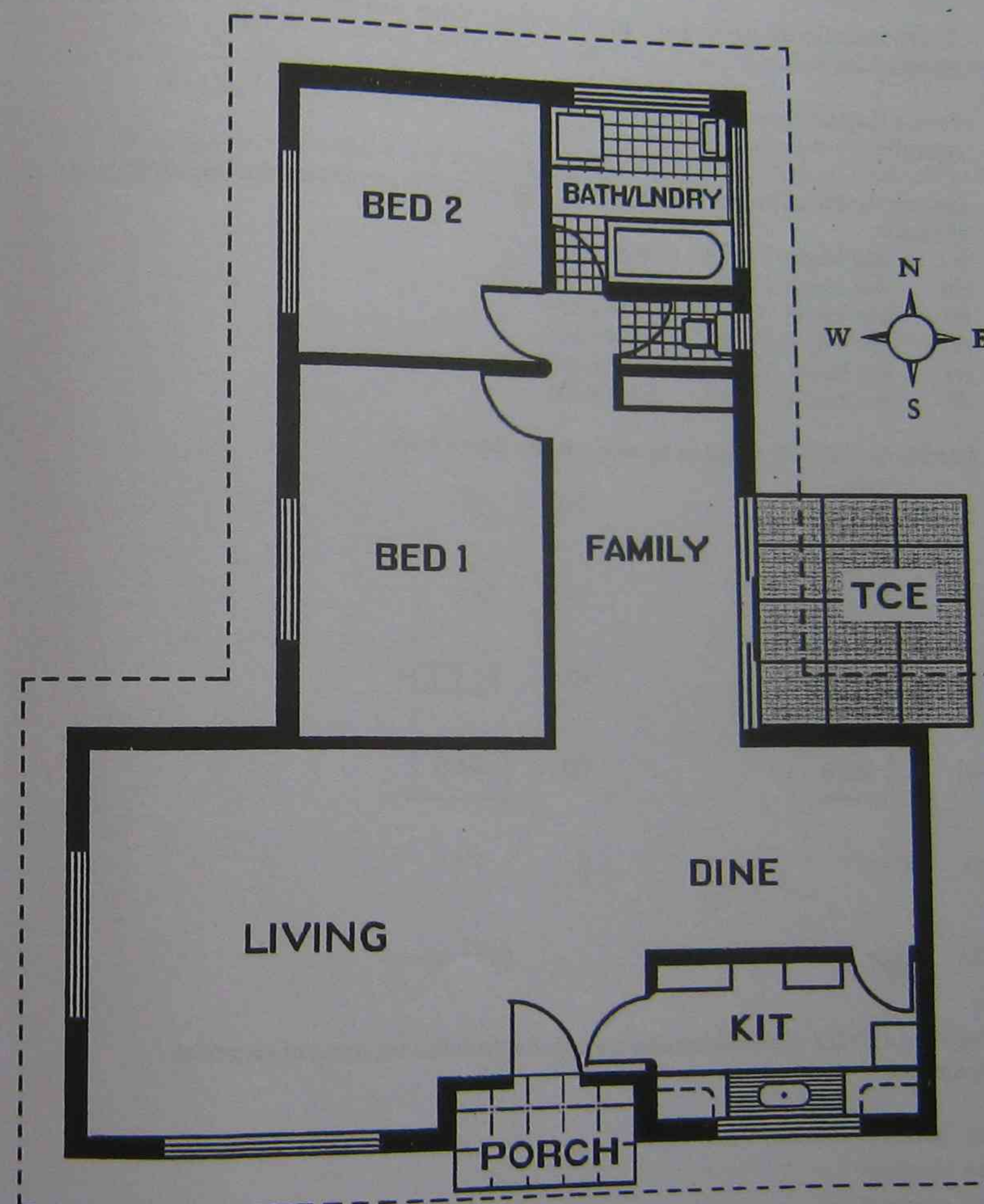




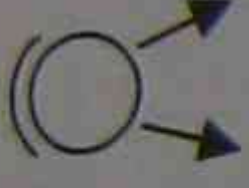



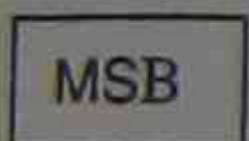
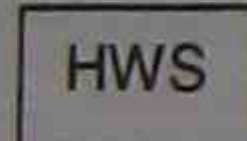

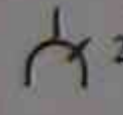
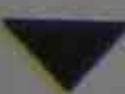
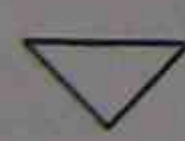
Figure 9 Floor plan

Review question

These questions will help you revise what you have learnt in this topic.

1. Briefly describe the difference between a site plan and a floor plan.
2. Briefly describe the function of a detailed drawing. Relate your answer to the installation of electrical services.
3. Draw a diagram showing the method used on a floor plan that shows one light point controlled by three switches.
4. Indicate the actual lengths of the following lines taking into account the drawing dimension and scale:

(a)	line length 75 mm	Scale 1:100
(b)	line length 5 mm	Scale 1:100
(c)	line length 60 mm	Scale 1:200
(d)	line length 27 mm	Scale 1:50
(e)	line length 13 mm	Scale 1:500
(f)	line length 3.5 mm	Scale 1:100
5. Identify the AS/NZS electrical location symbols shown below.

(a) 	(b) 
(c) 	(d) 
(e) 	(f) 
(g) 	(h) 
(i) 	(j) 
(k) 	(l) 
6. Draw the AS/NZS electrical location symbols for the following items of electrical equipment.
 - (a) luminaire, fixed to wall
 - (b) spotlight
 - (c) tubular fluorescent luminaire, two lamps
 - (d) distribution board
 - (e) meter board
 - (f) electric range
 - (g) exhaust fan
 - (h) pushbutton
 - (i) intermediate switch
 - (j) 15 A socket outlet

7. Explain why the 'point of entry' is not shown on the floor plan of a domestic installation.
8. Briefly explain the meaning of the term 'standard drawing'.
9. List five parts of an electrical installation that may have their location (or route) determined from a site plan.
10. Who has the responsibility of determining the cable routes for the various circuits of a domestic installation?

4 Building Structures, Materials and Sequencing

Purpose

In this topic you will learn about building terms and structures and the materials used in construction of different building types. You will also learn about the constructional sequence and intertrade relationship in the building sequence.

Objectives

At the end of this topic you should be able to:

- identify and describe the different types of footings and materials used.
- identify and describe the different types of floors and materials used
- identify and describe the different types of walls (external) and materials used
- identify and describe the different types of roofs and materials used
- identify and describe the different types of interior linings and materials used
- list the sequence of each constructional stage for brick, brick veneer and timber cottages.
- identify the stages at which the electrical first and second fixing occurs in the constructional sequence.
- list areas of cooperation between electrical and other building trades.

Introduction.

Prior to the commencement of any building or structure, plans and specifications are drawn which contain details regarding:

- type and arrangement of structure, including fittings
- position of the building on the site.

The details contained within these plans and specifications are used to determine the:

- type of wiring system
- type of supply system (underground or overhead)
- cables routes
- location of all fittings and appliances

Building structures

All buildings are constructed in the following steps:

- foundations
- footings
- floors
- walls
- roof

Foundations

The foundations are the actual ground on which the building is constructed. Depending on the type of footings and ground it is prepared by levelling, trenching, backfilling etc. to Building Regulations.

Footings

The footings consist of all the concrete strips, stumps, slabs and brick walls used to support the building.

Stumped footings consist of timber, concrete or steel posts or stumps to raise the building above the ground. They are employed mainly on sloping blocks or in hot climates for greater cooling.

Exercise 1

Names the arrowed parts on the diagram of Figure 1.

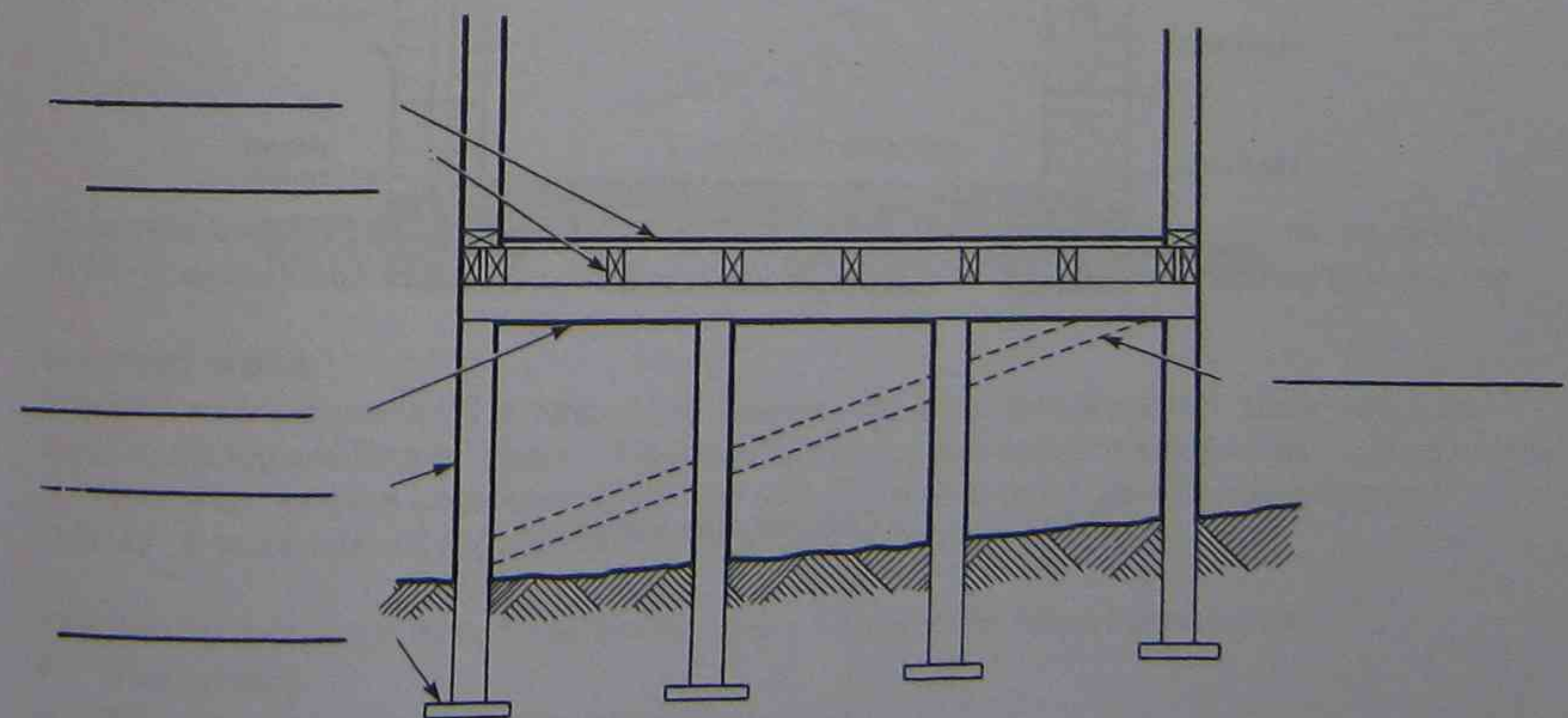


Figure 1 Stumped footings

82

Strip footings usually consist of a continuous reinforced concrete pour around the building as a base for the external walls. Concrete pads and brick or concrete piers support the floor and inner walls.

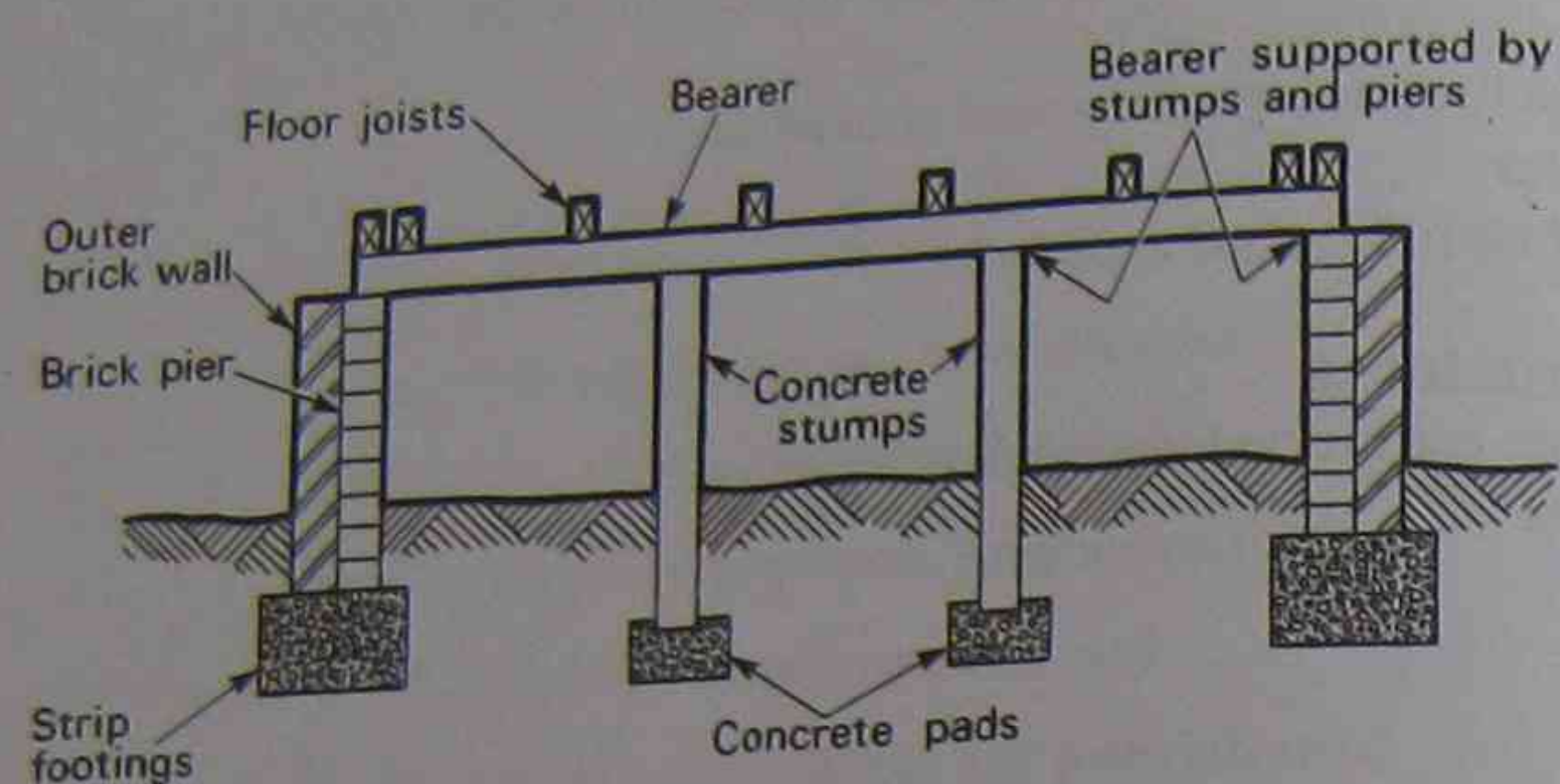


Figure 2 Strip footings

Concrete slab footings not only act as the support but also as the floor for the building. Some services involving plumbing, electrical, communications and gas must be installed before the pour.

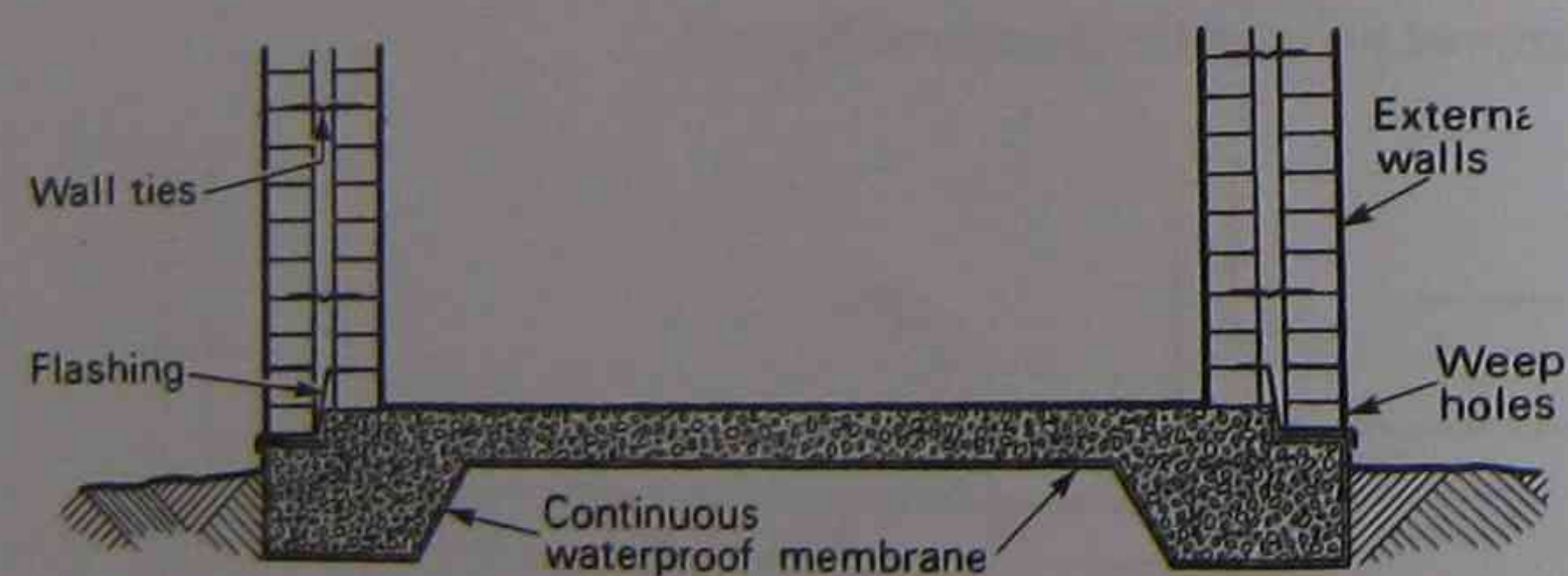


Figure 3 Concrete slab footings

Floors

Timber floorboards or sheets are the most common type of floorings. The floor is constructed so that **the external and internal piers support bearers**. Floor joists are nailed to the bearers and tongue and groove timber boards or flooring sheets are then nailed to the joists.

Exercise 2

Name the arrowed parts on the diagram of Figure 4.

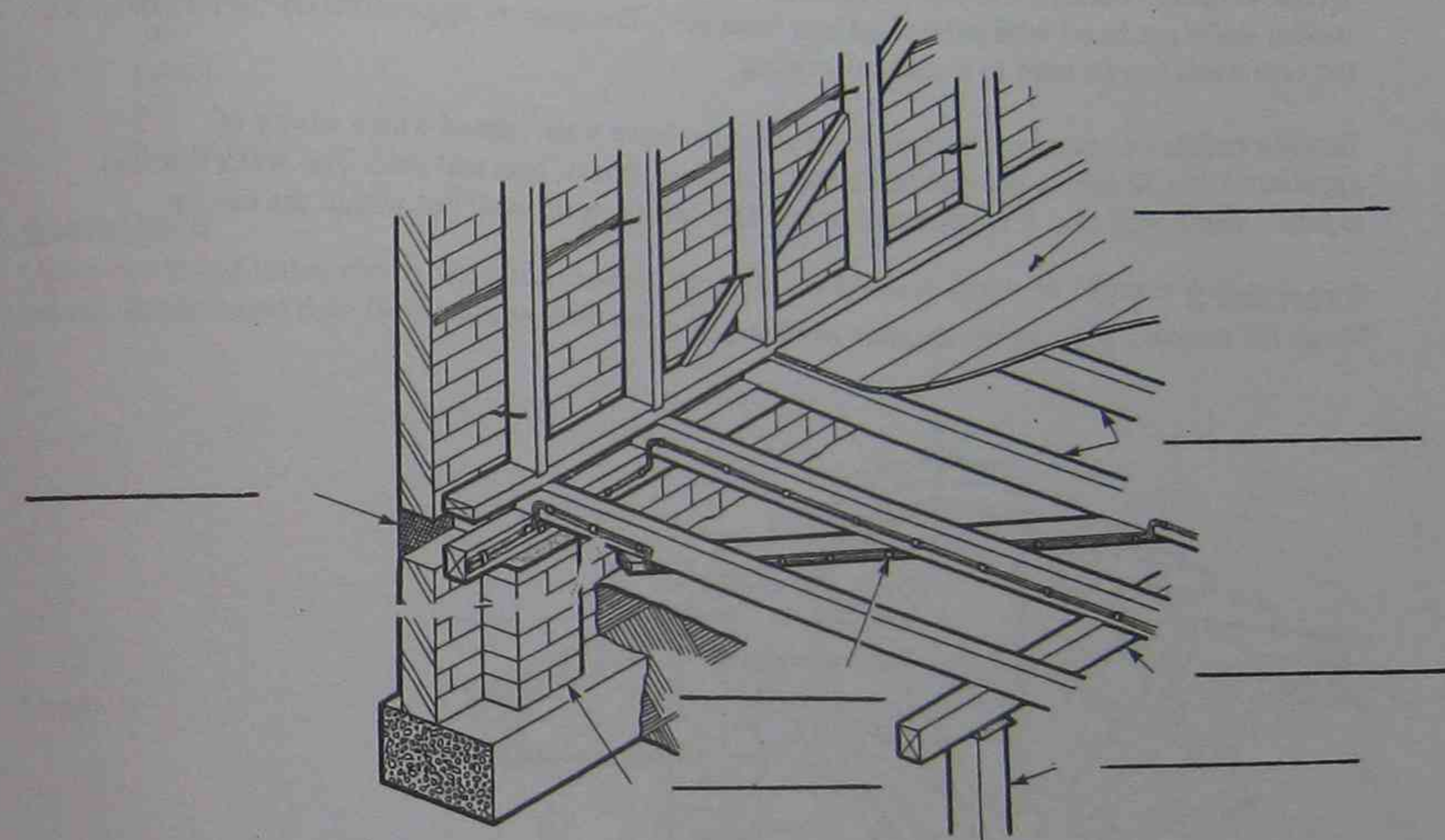


Figure 4 Timber floor

Concrete floors are as described previously, the slab mechanically screeded for a smooth surface. Multi-floor buildings may have extra timber or concrete floors depending on building type and use.

Internal walls

Framed wall: – constructed of timber, aluminium or steel. It consists of vertical 'studs' which are fixed to the top and bottom 'plates'. 'Noggings' are placed between each stud where required to stop the studs from warping from the weight of the roof. The wall is kept square by fitting diagonal 'braces'. It is the internal wall that carries the weight of the roof.

The internal face of the framed wall can be lined with any of the following materials:

- Plasterboard
- Fibrous cement sheets (bathrooms and laundries)
- Lath and plaster

Brick walls: – the bricks are laid in rows called 'courses' cemented together and are rendered or left as a 'feature' depending on the desired effect.

External walls

Framed wall: - constructed exactly the same as internal walls except the outside face is covered with a water proof lining such as:

- weatherboards
- fibrous cement sheets
- stucco
- sheets of brick tiles
- treated metal panels
- aluminium or plastic cladding

Brick veneer: - constructed with an inner timber frame with a single brick outer wall. The brick and timber walls are fixed with galvanised iron 'wall ties'. The space of approximately 50 mm between the two walls can be used to install any cabling.

Double brick: - constructed with an inner and outer brick wall, spaced with a cavity of approximately 50 mm to provide insulation against dampness, heat and cold. The walls are tied together using wall ties. It is permitted to rest TPS cables on the wall ties within the cavity.

Exercise 3

Name the arrowed parts on the diagram of Figure 5.

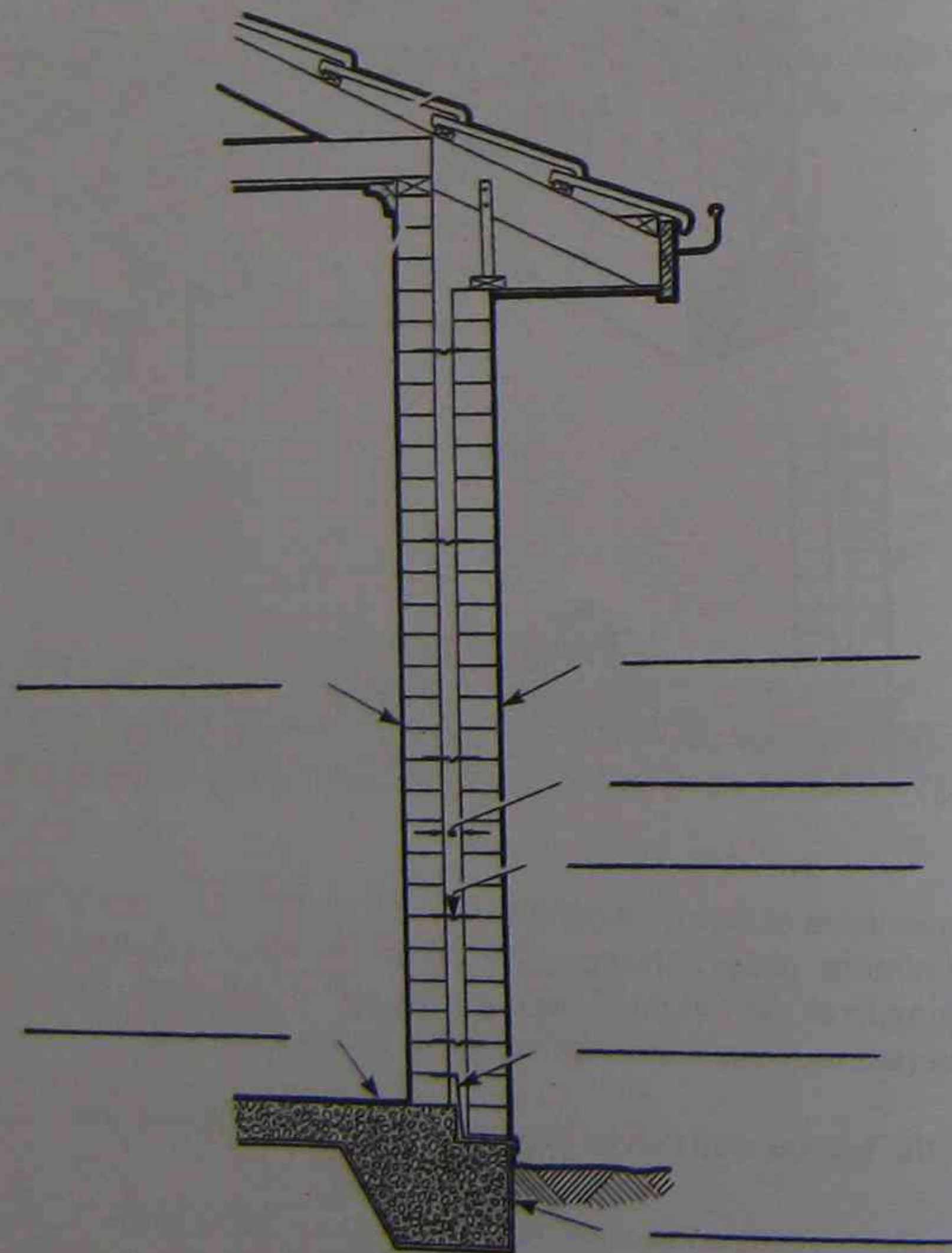


Figure 5 Double brick wall

Roofs

Then roof is the covering to give protection to the lower part of the building. Timber is the most common material used to construct domestic roofs. Common terms used in roofing are:

- rafters
- ceiling joists
- top wall plate
- purlins
- valley rafter
- roof battens
- struts
- ridge
- hanging beam
- tom
- fascia
- hip
- hip rafter

Exercise 4

Using the list of terms above, write the term next to its corresponding arrow on Figures 6 and 7 below. Some terms may be used more than once.

Figure 6

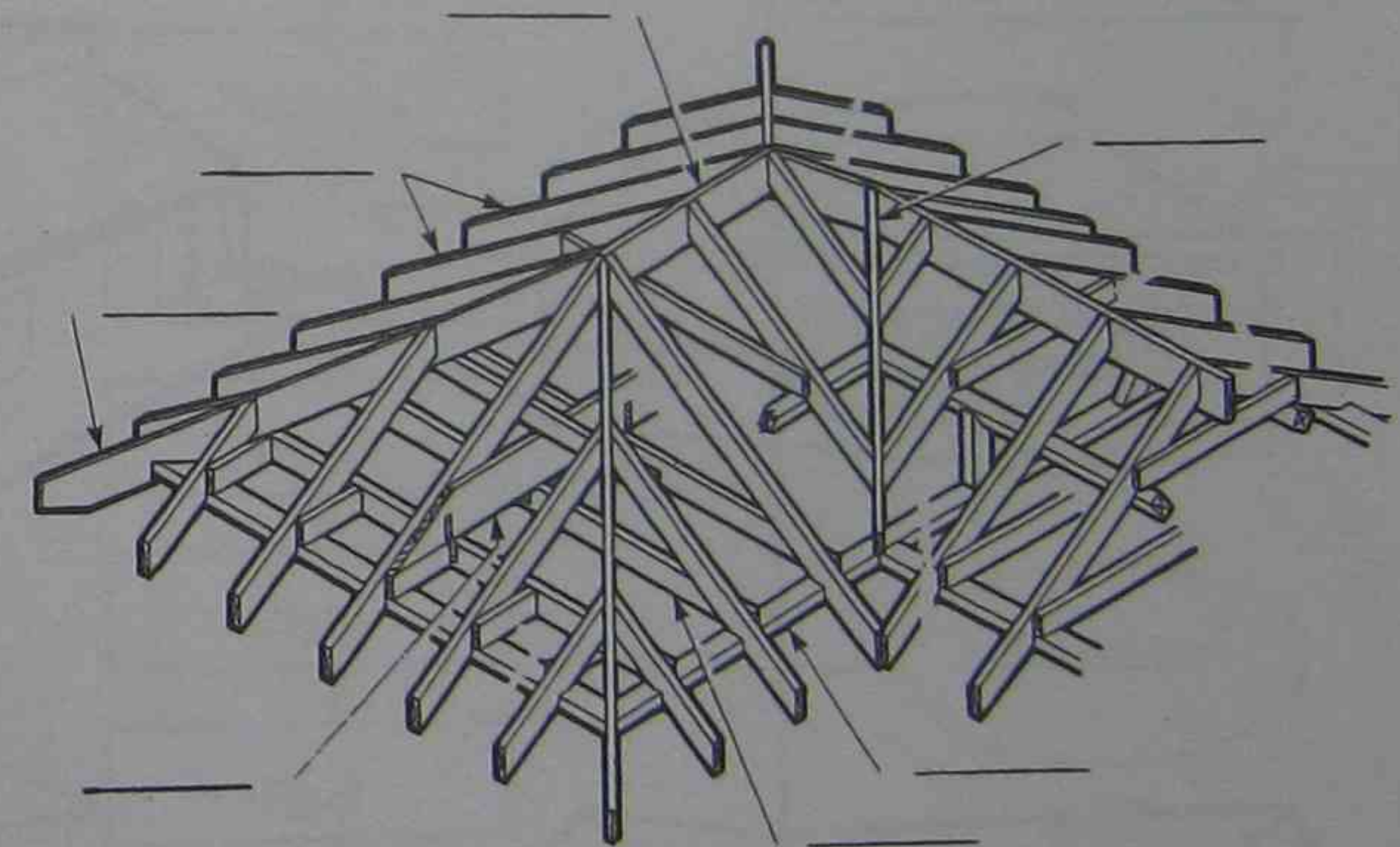
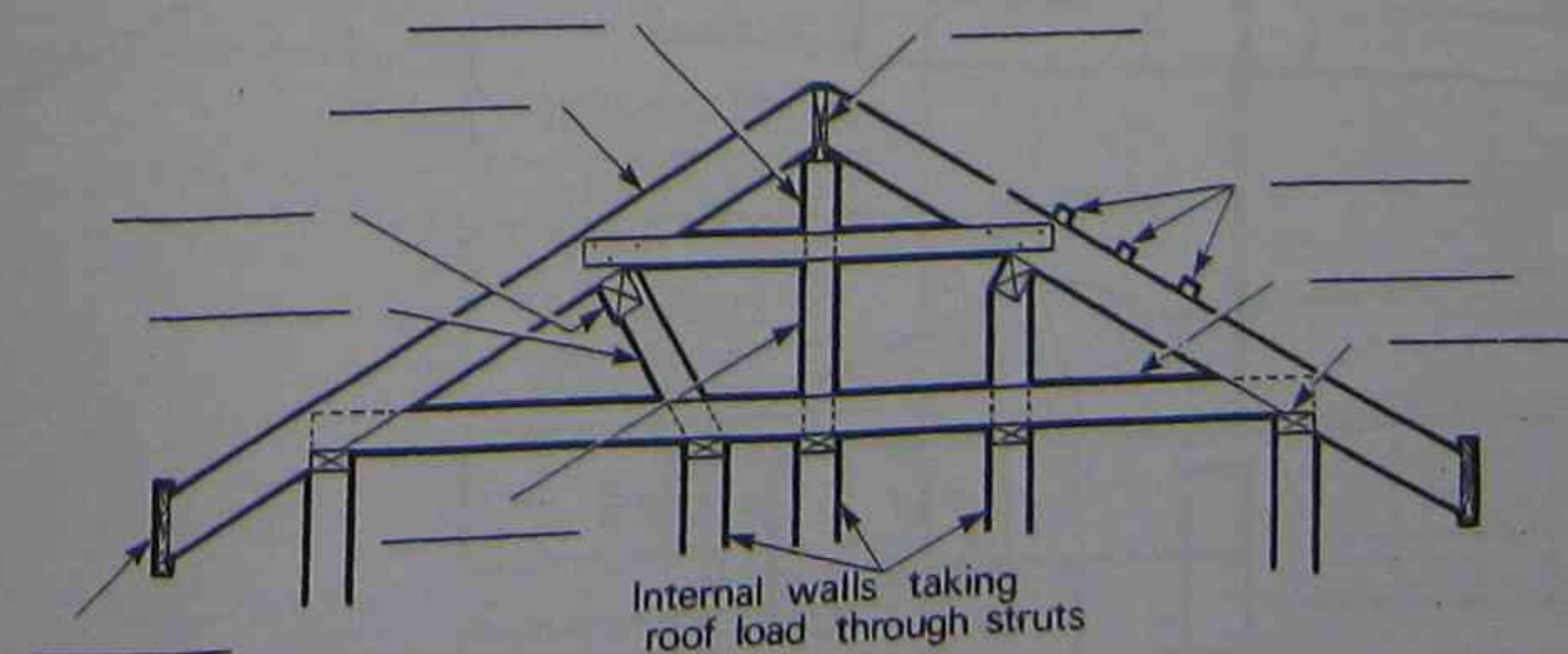


Figure 7



Roof covering

Roof covering used includes:

- terracotta tile
- galvanised steel
- fibrous cement sheeting
- malthoid on timer base
- colour bond sheeting

Roof types

Roof designs include:

- flat roof
- skillion roof
- low slope shed roof
- gable roof
- gable roof with dormer
- hipped roof
- gambrel roof
- mansard roof

Exercise 5

Identify the following roof types shown in Figure 8.

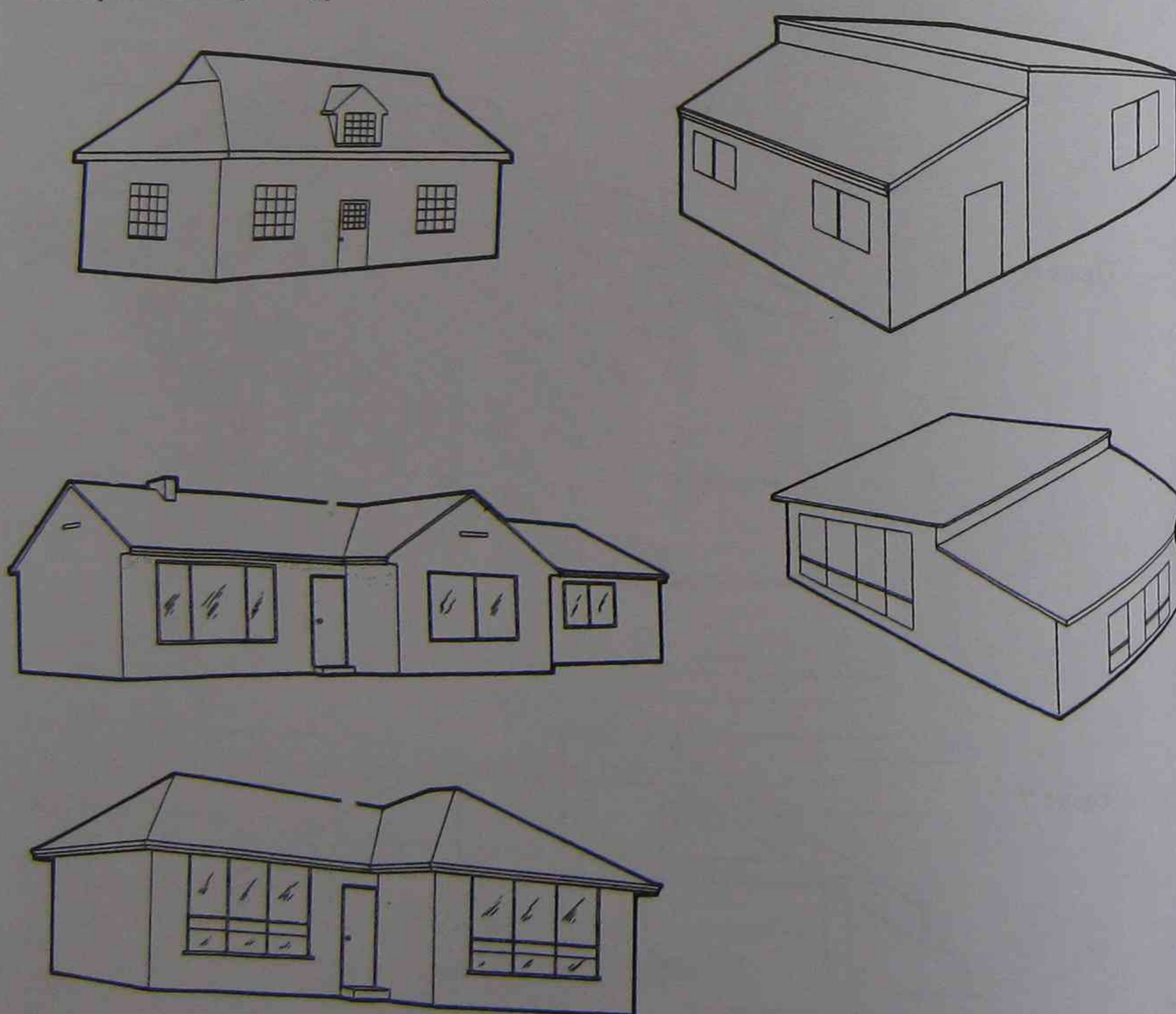


Figure 8 Roof diagrams

Structural Integrity

When installing wiring and equipment an electrician should ensure that any actions taken do not affect the structural integrity, fire integrity or contravene any building codes or regulations. The following points should be observed:

- consult with the builder or architect if unsure of the consequences of any alterations to the building
- the removal of any structural material will weaken the structure
- plan wiring routes using the shortest possible path
- holes drilled for wiring to pass through a wall, floor or roof should be made as small as possible
- never interfere with any damp course or waterproofing
- when installing equipment, make sure that the weight or any vibration will not affect the structures integrity

Construction sequence

An electrician must know the structural details of a building to ensure that all wiring is hidden (where practical) and must also know the appropriate times within the building sequence to install wiring and fit equipment such as switchboards, appliances and accessories.

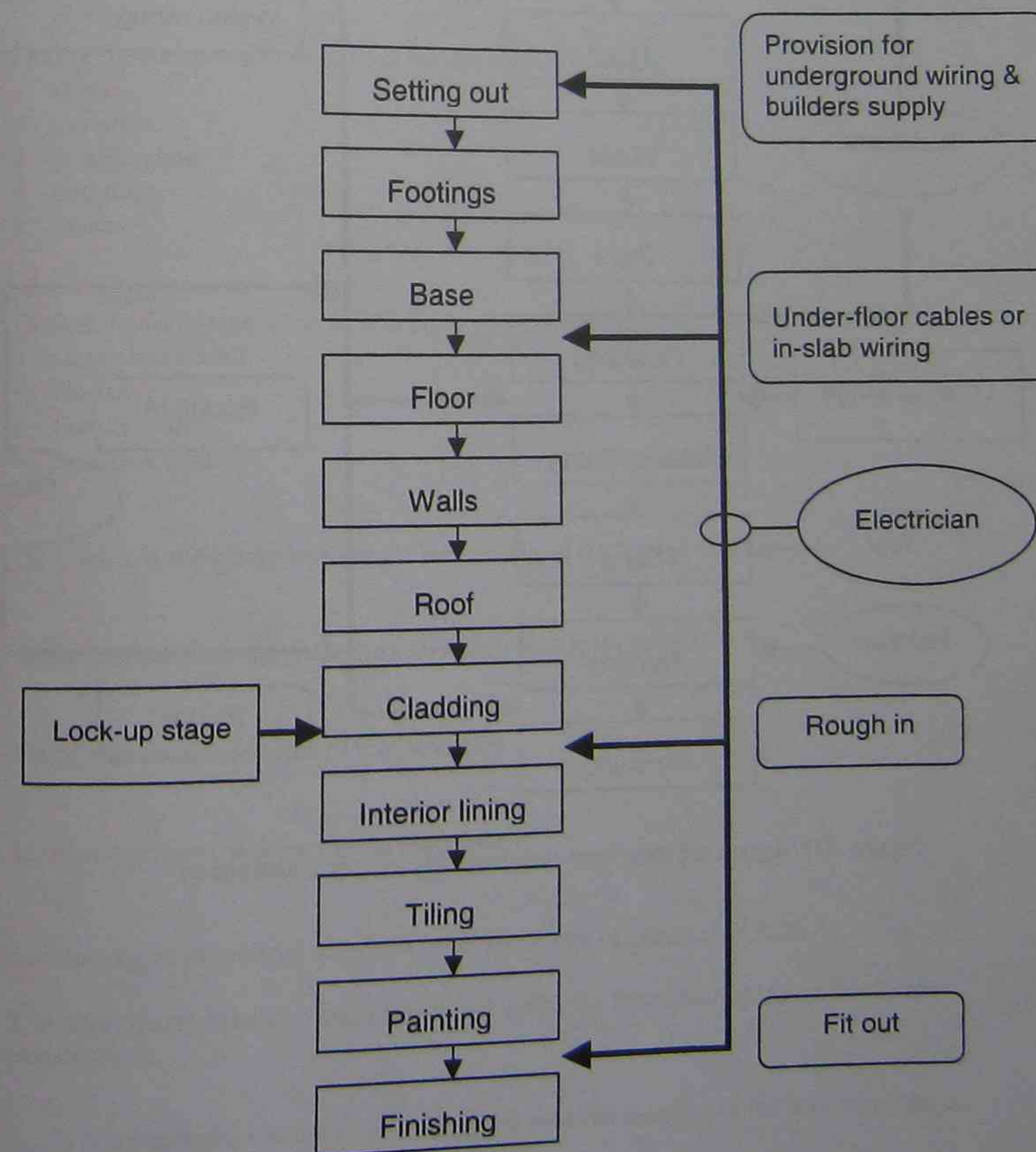


Figure 9 Points in the construction sequence where the electrician needs to perform work

Inter-trade relationship

The electrician must work in with all construction workers including the:

- builder
- bricklayer
- plumber
- tiler
- interior wall liner (plasterer)
- painter

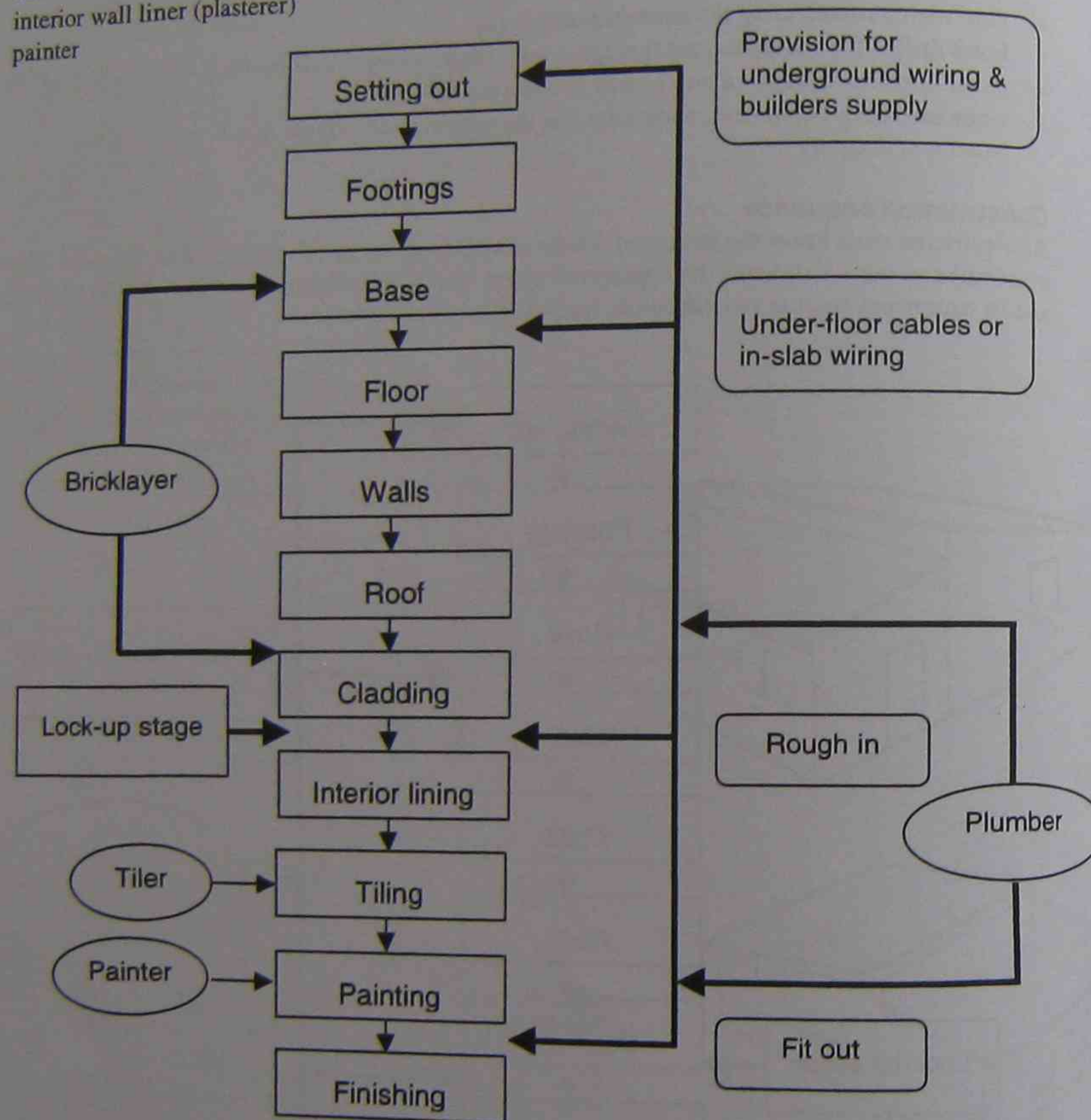


Figure 10 Diagram showing how each trade fits into the construction

Review questions

These questions will help you revise what you have learnt in this topic.

- Name the five main parts of a structure.
- State two reasons why the concrete slab footing is sometimes used in preference to the stump footing.
- Define the following terms used in timber floor construction:
 - floor joists
 - bearers
 - pier
 - floorboard
- Define the following terms used in framed wall construction:
 - studs
 - top plate
 - bottom plate
 - noggings
 - braces
- Define the following terms used in brick wall construction:
 - single brick wall
 - course
 - feature wall
 - rendered wall
- How wide is the cavity between the brick wall and the framed wall?
- What purpose does the wall cavity serve in a double brick wall?
- Name three common types of roof covering.
- In what circumstances are trussed roofs used?
- List two types of material an internal wall frame can be constructed from.
- List four materials used to clad the external walls of a house built using timber frame construction.
- In relation to the installation of wiring, describe the meaning of the following terms:
 - First fixing (rough in)
 - Second fixing (fit out)

13 List the six main areas of house construction.

14. When installing wiring in the cavity of a cavity wall, explain why it is important that the cables don't touch both the internal and the external walls.

15. The following is a list of constructional stages of a timber-framed cottage. Write these in the correct sequence.

base	footings
cladding	interior lining
finishing	painting
floor	setting out
roof	tiling
walls	

16. Indicate on your list from question 4 the point where an electrician carries out the first and second fixings (rough in and fit out).

17. Listed below are four tradespeople an electrician may work with on a building site. Give one reason why the electrician may need cooperation from each of them.

(a)	bricklayer
(b)	plasterer
(c)	concreter
(d)	plumber

5 Electrical Drawings

Purpose

In this topic you will learn about the major types of electrical diagrams used in the electrical/electronic industry along with their purpose, applications and uses. Some basic electrical symbols used in these diagrams and the process of converting circuit diagrams to wiring diagrams will also be introduced.

Objectives

At the end of this topic you should be able to:

- identify and distinguish between block, circuit, wiring and ladder diagrams
- state the purpose and application of block, circuit, wiring and diagrams
- explain why standard symbols are used to represent components on electrical diagrams
- list the conventions used in and the features of circuit diagrams
- convert a circuit diagram to a wiring diagram

Introduction

Electrical diagrams are used in industry as a means of communicating ideas, concepts or specific details. An understanding of and competence in using electrical diagrams is essential for all electrical/electronic tradespeople. The types of diagrams used include:

- block diagrams
- circuit diagrams
- single line diagrams
- wiring diagrams
- ladder diagrams

Block Diagrams

The block diagram is used to aid the understanding of the principle of operation of a circuit or system, while not providing detailed information. The diagram is a much simplified version of a circuit diagram and is used to give an overview of the circuit operation to aid understanding of the operation of a system.

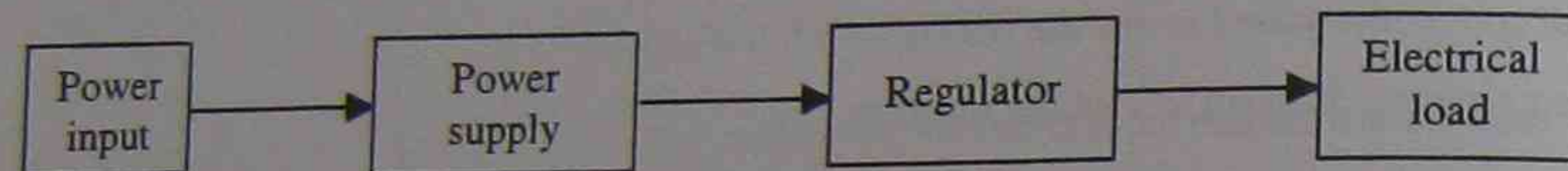


Figure 1 Block diagram of a regulated power supply

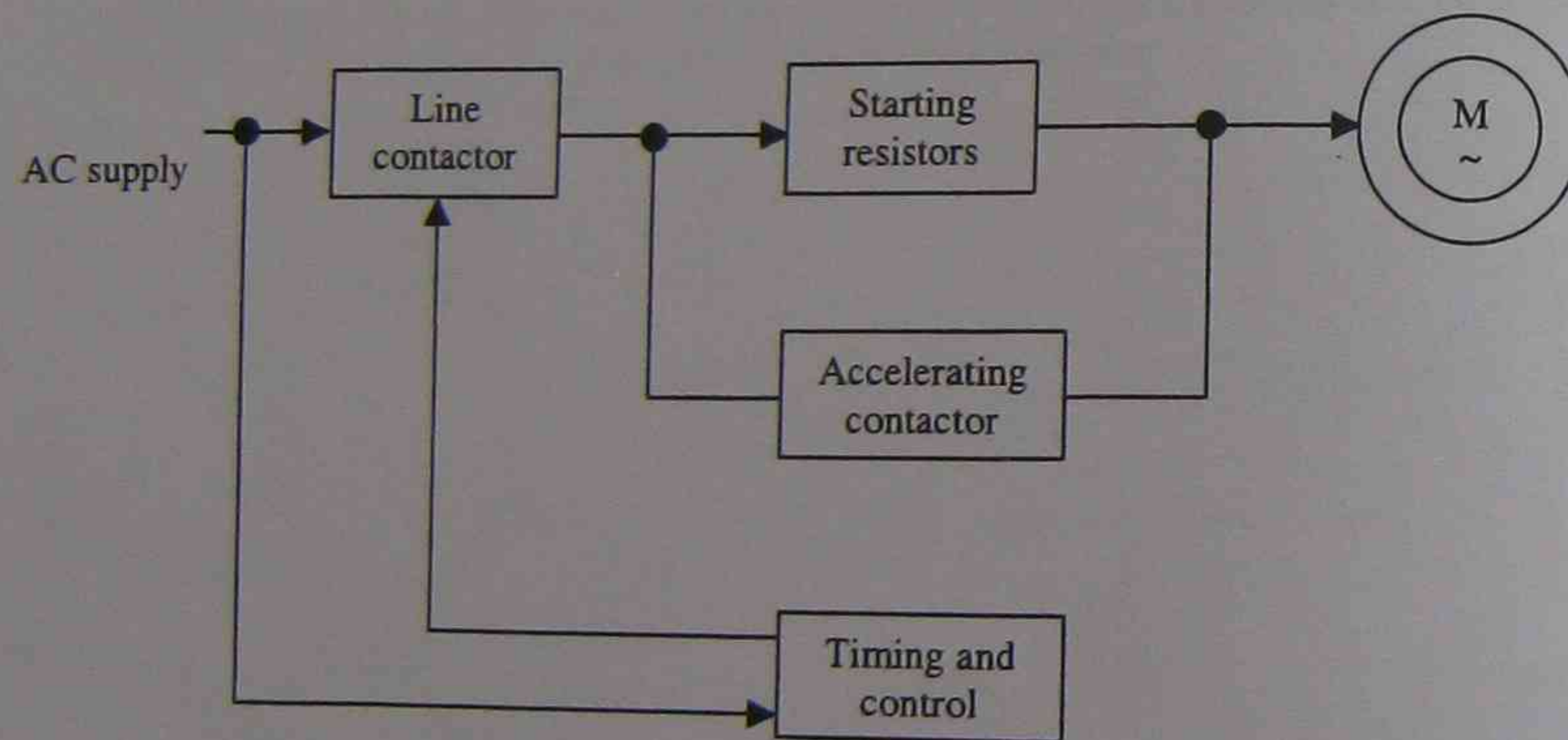


Figure 2 Block diagram of a motor starter circuit

Circuit diagrams

Circuit diagrams are a detailed diagram intended to describe the operation of a circuit. They are sometimes referred to as 'schematic diagrams'. They contain symbols representing components, or items of equipment, interconnected by lines representing conductors. The circuit symbols do not necessarily represent the physical appearance of the actual components. Similarly the layout of the diagram does not necessarily represent the actual physical layout of the equipment and wiring.

The purpose and application of circuit diagrams is:

- to provide detailed information on the operation of a circuit or system
- to assist in fault finding

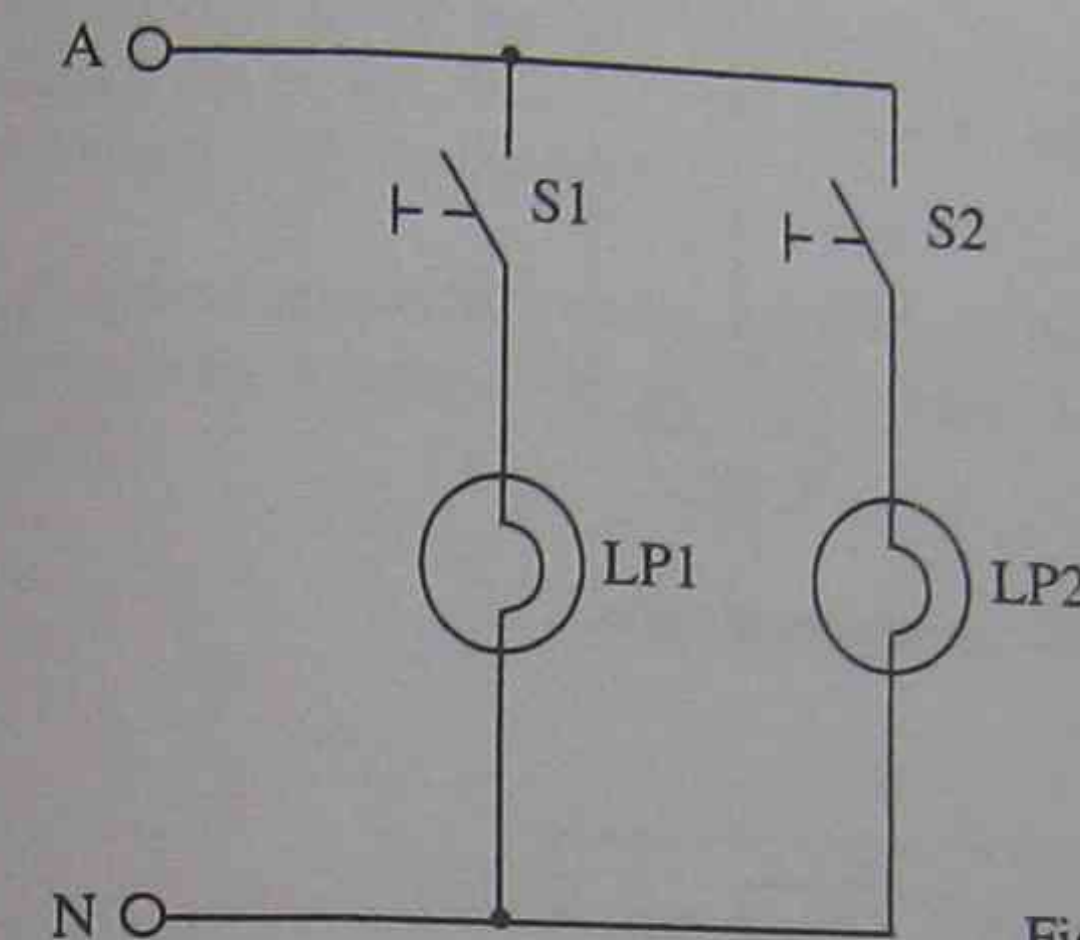


Figure 3 Circuit diagram of a basic lighting circuit

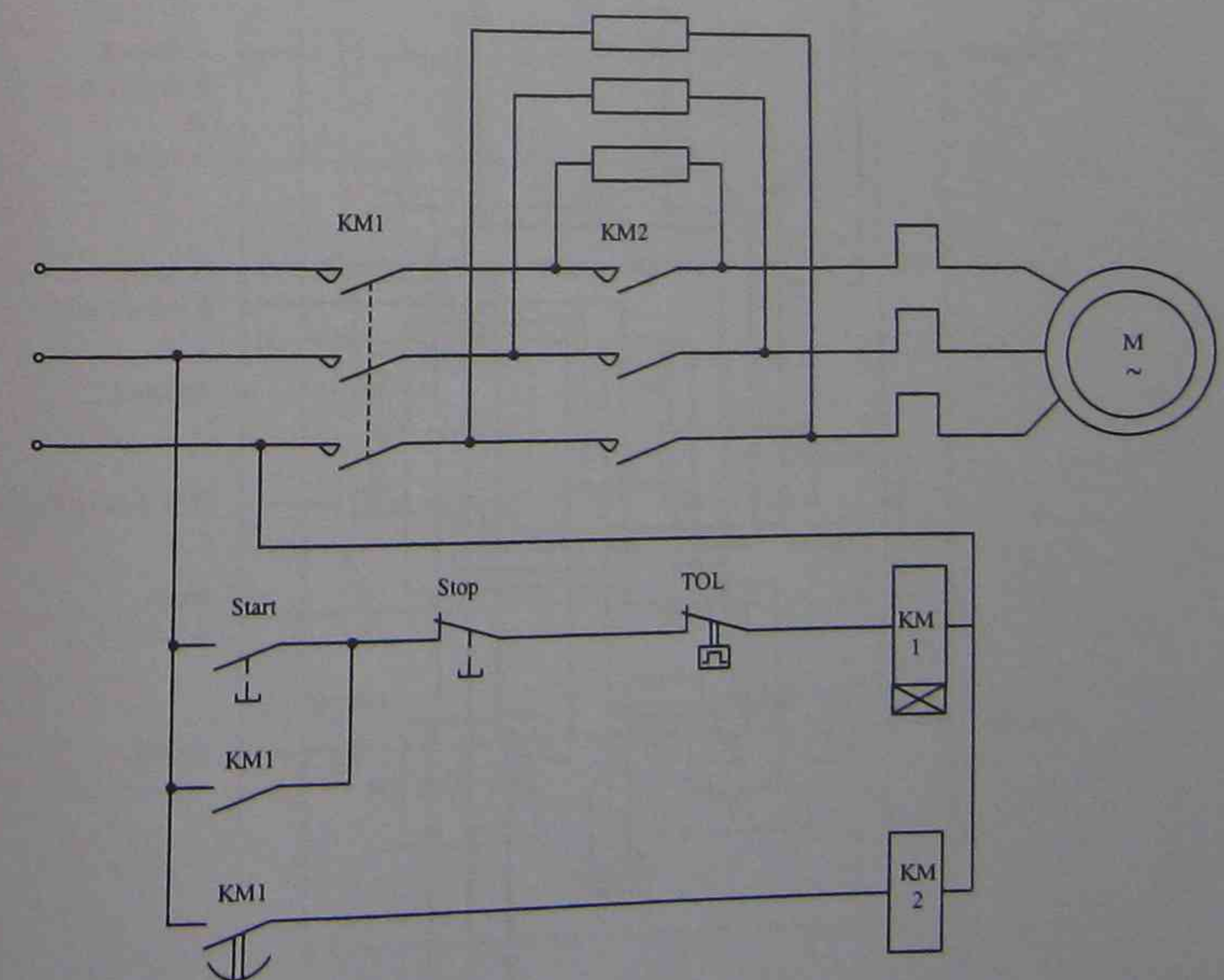


Figure 4 Motor starter circuit diagram

Wiring Diagrams

Wiring diagrams show the manner in which a circuit or system is actually wired and assembled. They are not normally drawn to scale, although a scaled drawing may be required to permit construction of the panel or enclosure.

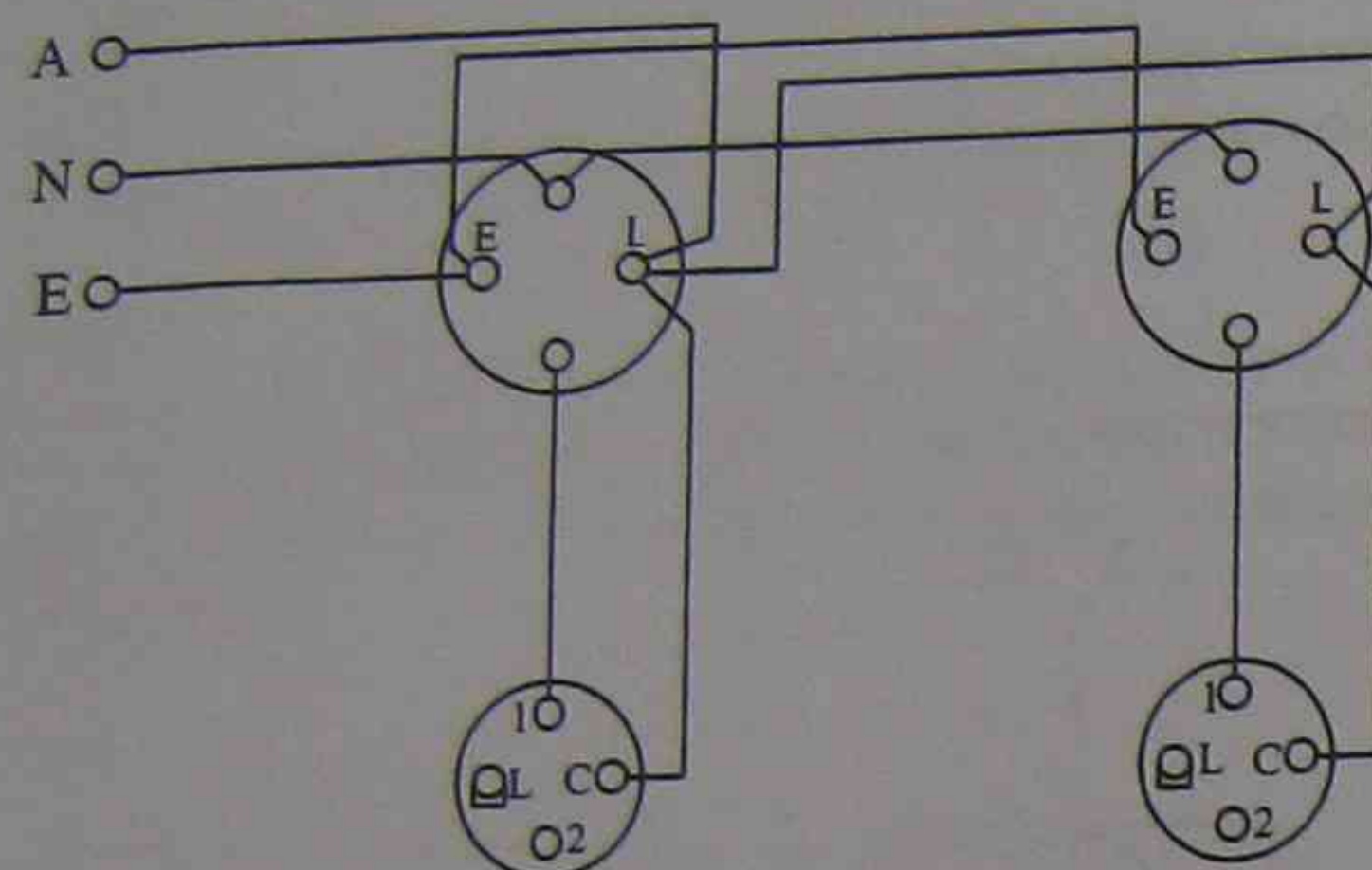


Figure 5 Basic light circuit wiring diagram

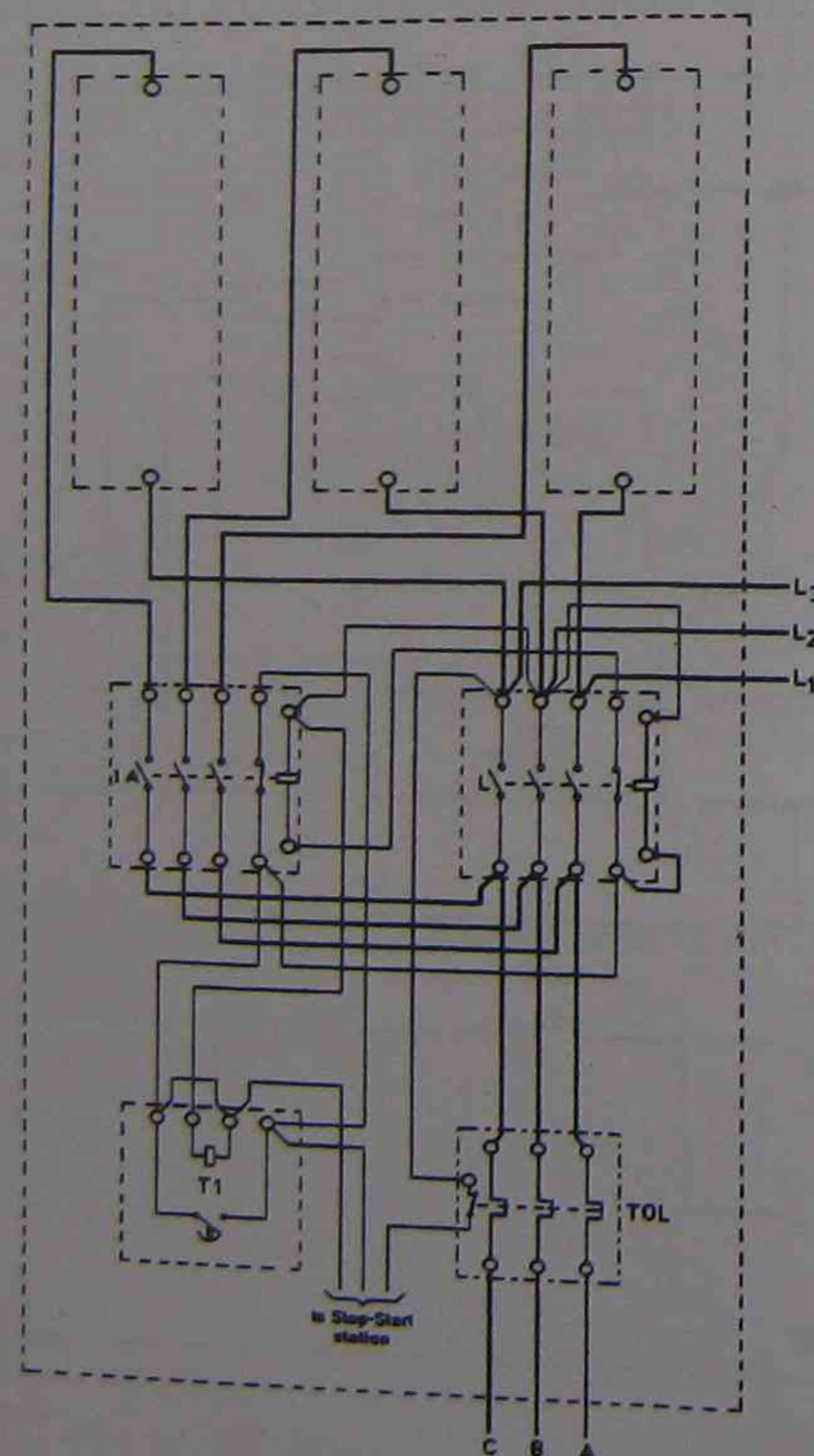


Figure 6 Automatic motor starter wiring diagram

Components in a wiring diagram are often drawn in a simplified manner in which the outline and external connections (terminals) are shown. All necessary connections are drawn from terminal to terminal. A number of conductors may be shown as being connected to a given terminal, however in a circuit diagram only one conductor appears to terminate at any given terminal.

Wiring diagrams are used almost exclusively to construct or wire a circuit. The diagram specifies all necessary connections, cable colour, type and size. They may be used for fault finding if it is suspected that the circuit has been subjected to some unauthorised or undocumented alterations or alternatively the actual circuit wiring has been proven to be faulty.

Ladder diagrams

Ladder diagrams are so named because of their appearance which consists of two vertical lines symbolising the power rails, between which are placed the 'rungs' which contain input devices on the left and output coils on the right.

These diagrams are usually associated with programmable logic controllers and are produced using software packages supplied by the manufacturer. The circuit is designed as the application program is developed.

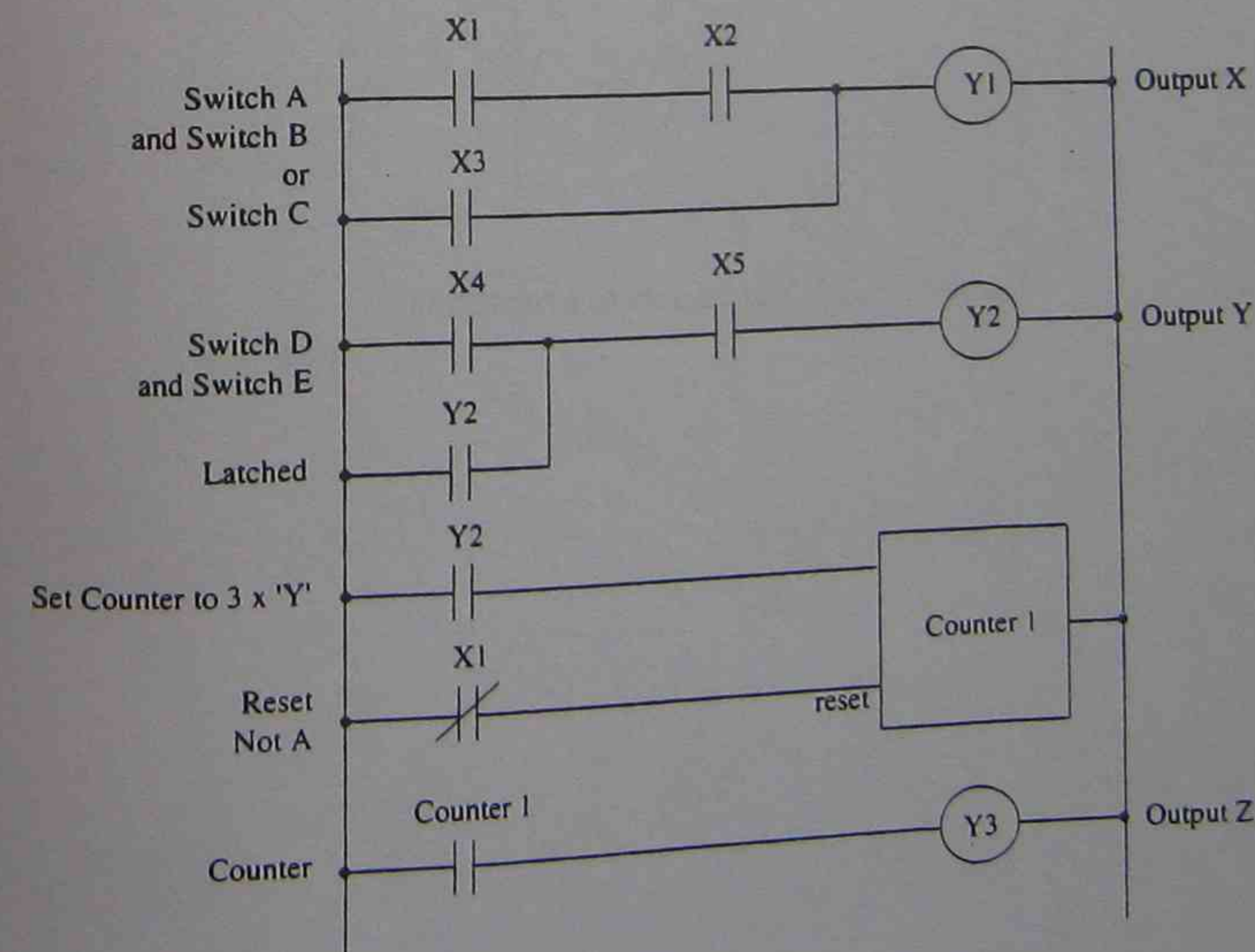


Figure 7 PLC ladder diagram

Single line diagrams

Single line diagrams are used to convey the general electrical principles of electrical installations or equipment and is limited to representing only the essentials. Two or more conductors are represented by a single line. Similarly multipole components are drawn in single pole form.

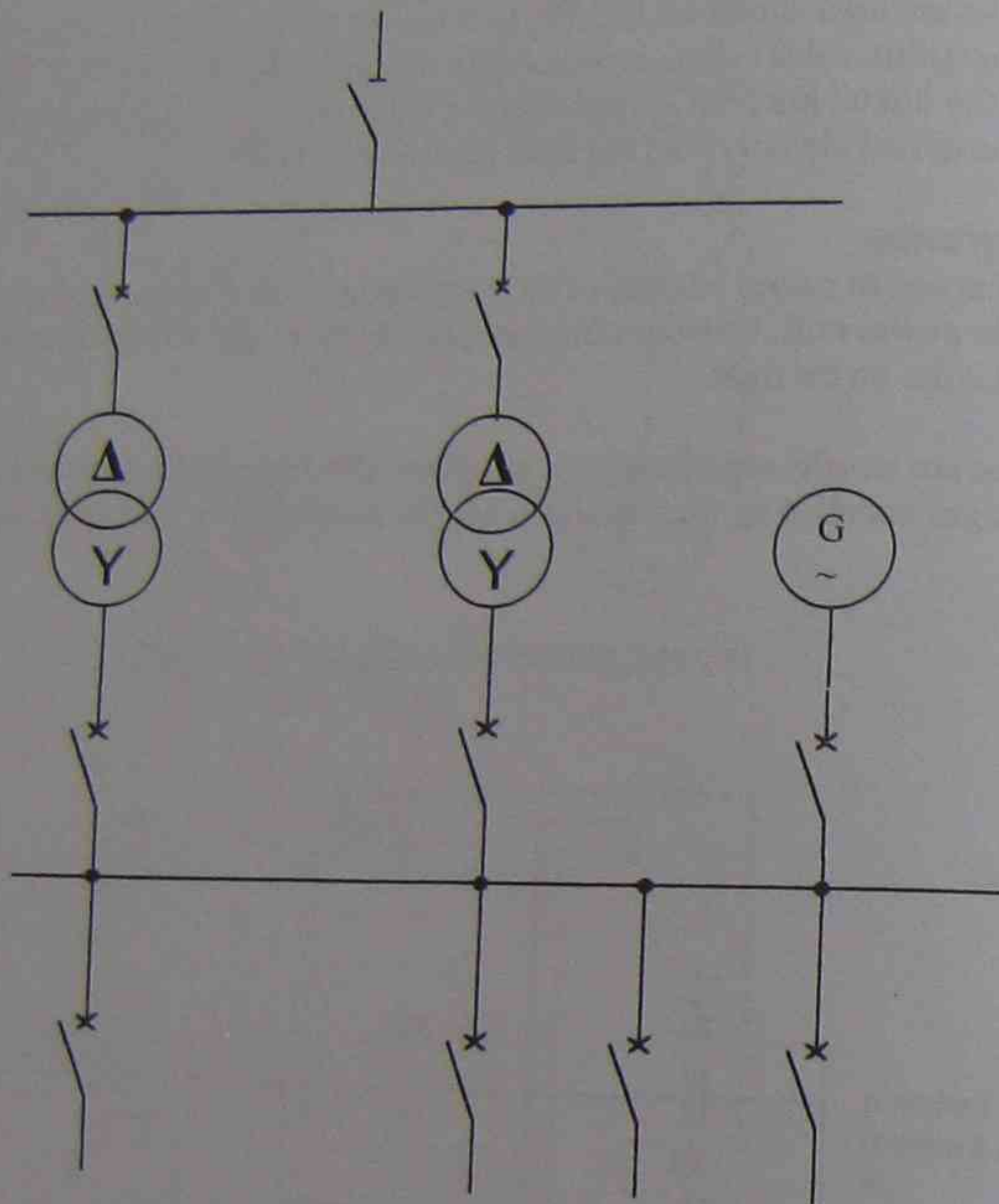


Figure 8 A single line diagram of a substation

Standard circuit symbols

A drawing symbol is a graphical representation of a component or item to be included in a diagram. The use of symbols allows:

- items to be included in a diagram in a simplified form as a symbol is generally easier to draw than the actual item.
- items, similar in appearance but differing in function can be easily distinguished in a diagram

The standard adopted in Australia for drawing symbols is the ISO (International Standards Organisation) standard. This allows diagrams from overseas countries to be more easily understood and allows communication of ideas between individuals or organization without the need for lengthy documentation accompanying every diagram. These symbols are laid out in AS/NZS 1102:1997(series) Graphical symbols for electrotechnical documentation.

Exercise 1

Using AS/NZS 1102 draw the symbols to represent the following components:

Single pole single throw switch – normally open, manually operated		Single pole single throw switch – normally closed, manually operated	
Fuse		Lamp - illuminating	
Lamp – signal		Double pole single throw switch – manually operated	
Double pole changeover switch – manually operated		Single pole 3 position switch – manually operated	
Intermediate switch – manually operated		Single pole push-button switch – normally open – non latching	

Converting circuit diagrams to wiring diagrams

- starting at the active terminal on the circuit diagram, number each component terminal as you progress around the diagram. Remember to change the number each time you pass through a component.
- number each conductor with the same number as the terminal it is connected to.
- start the wiring diagram by drawing all components in their correct position, showing all terminals.
- number each terminal with the corresponding number from the circuit diagram.
- using the circuit diagram as a guide draw a line between all terminals with the same number
- the lines should be equally spaced straight lines, neatly grouped, and at right angles when linking the appropriate terminals, with a minimum of crossovers.
- as you draw each line, mark it with a cross to indicate that the line has been drawn.
- continue until all lines have been drawn.

Practical exercise: Electrical diagrams

Task

To convert basic switching circuit diagrams to wiring diagrams and to connect the circuit to check its operation.

Objectives

At the completion of this practical you should be able to:

- convert a basic switching circuit diagram into a wiring diagram
- connect the components of a basic switching circuit and check that the circuit operates correctly
- use safe working practices when completing and/or modifying the circuit wiring.

Equipment

Your teacher will provide you with the specifications of the equipment *to be used*.

Specification

- AC power supply
- Lamp panel
- Switch panel
- Circuit testing device
- 4 mm connecting leads

Procedure 1 – Single lamp controlled by a single switch

1. For the circuit diagram shown in Figure 8 neatly sketch on the layout of Figure 9 the wiring diagram for the circuit.

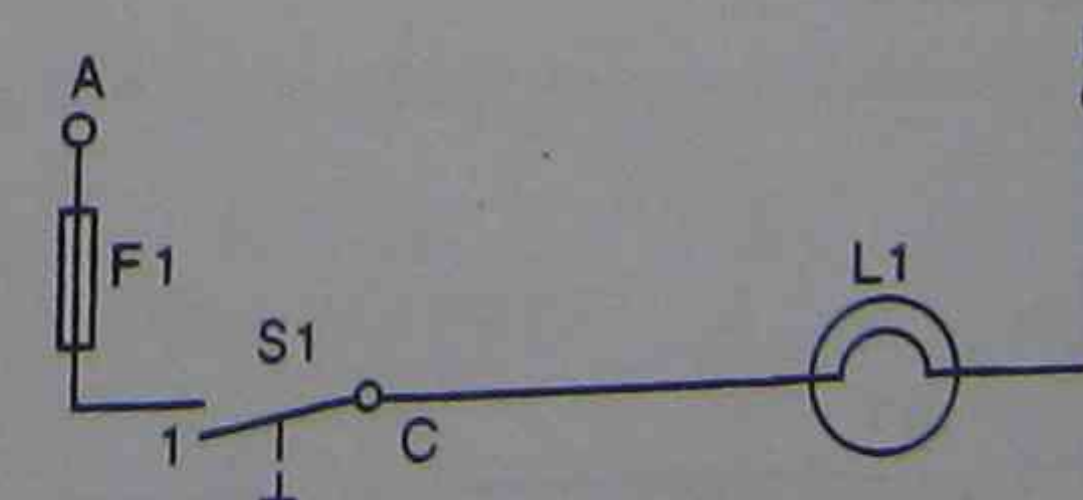


Figure 8 Circuit diagram

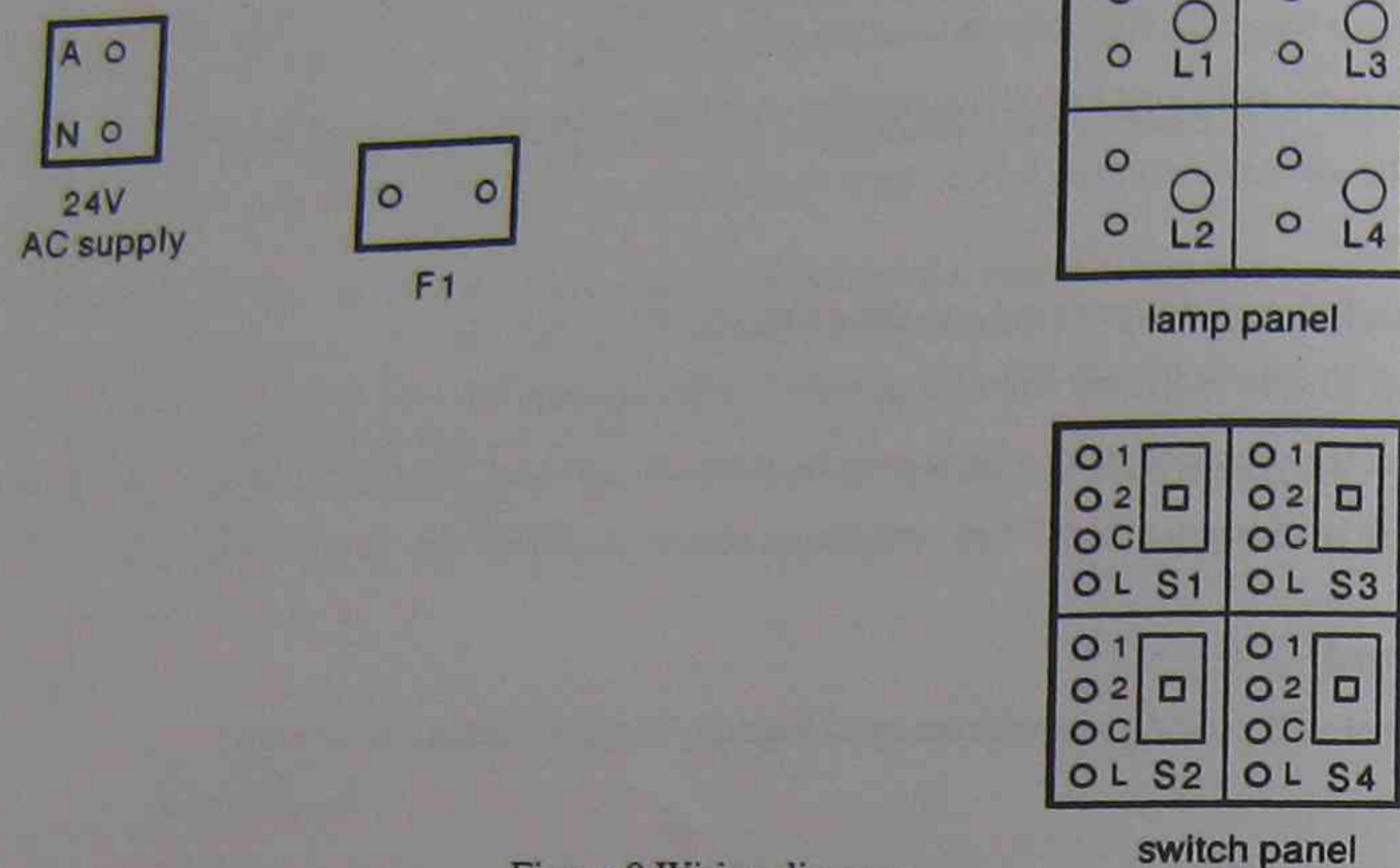


Figure 9 Wiring diagram

2. Connect the circuit by linking the components according to the wiring diagram.

Have your teacher check your circuit connections

3. Apply power to the circuit and check that the circuit operates correctly.
4. Turn off the power to the circuit and check that the circuit is safe to work on. If necessary correct any faults and retest the circuit.
5. With the power turned off, disconnect the circuit and leave the equipment and leads on the bench.

Procedure 2 – Single lamp controlled by parallel connected switches

6. For the circuit diagram shown in Figure 10 neatly sketch on the layout of Figure 11 the wiring diagram for the circuit.

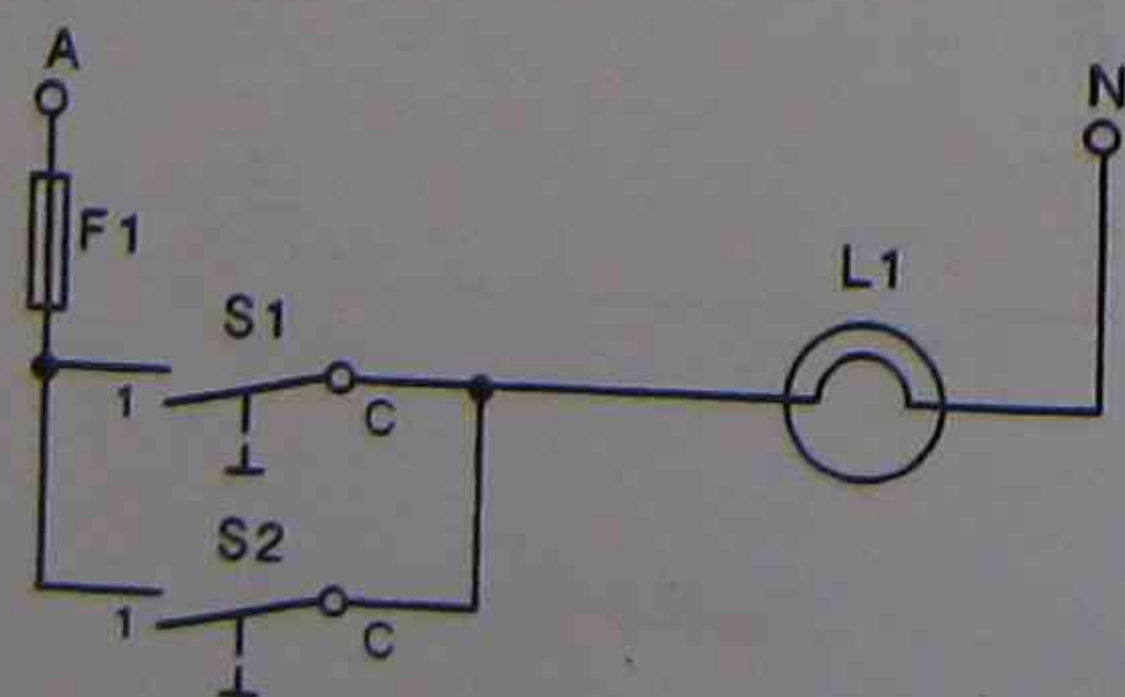


Figure10 Circuit diagram

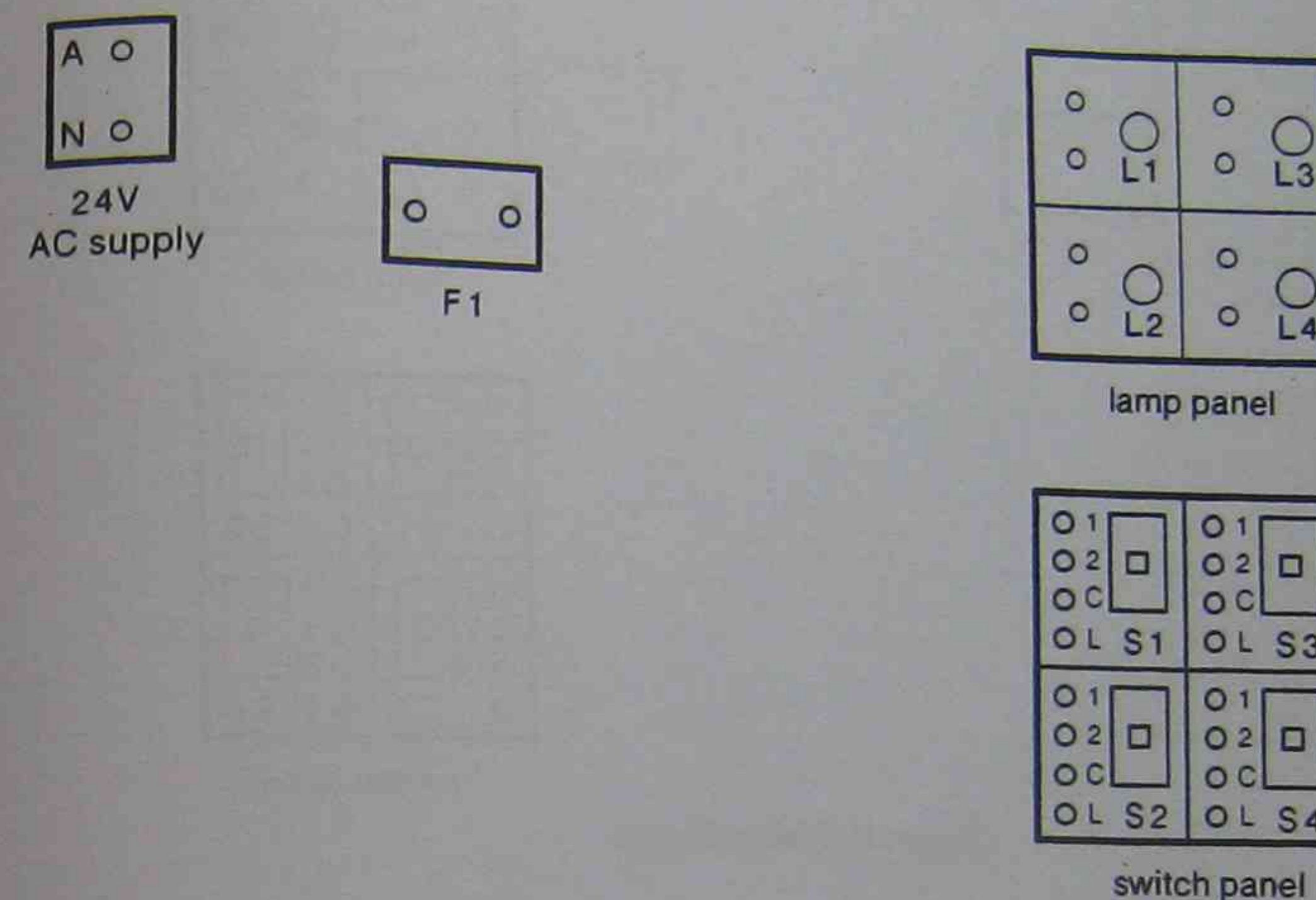


Figure 11 Wiring diagram

7. Connect the circuit by linking the components according to the wiring diagram.

Have your teacher check your circuit connections

8. Apply power to the circuit and check that the circuit operates correctly.
9. Turn off the power to the circuit and check that the circuit is safe to work on. If necessary correct any faults and retest the circuit.
10. With the power turned off, disconnect the circuit and leave the equipment and leads on the bench.

Procedure 3 Two parallel connected lamps controlled by a single switch.

11. For the circuit diagram shown in Figure 12 neatly sketch on the layout of Figure 13 the wiring diagram for the circuit.

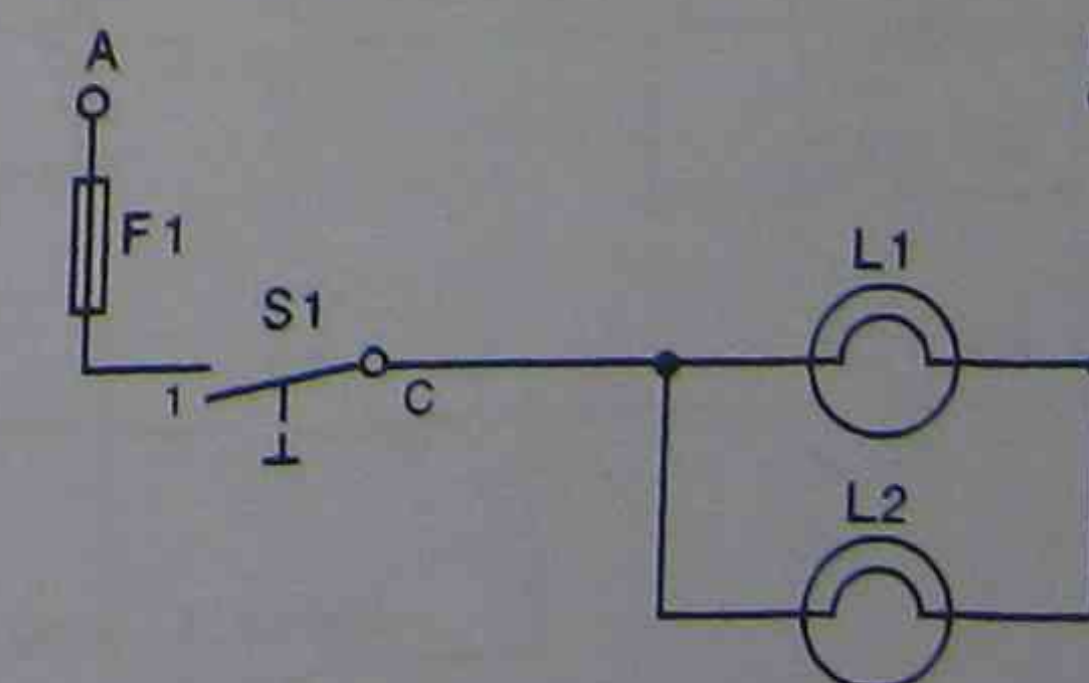


Figure12 Circuit diagram

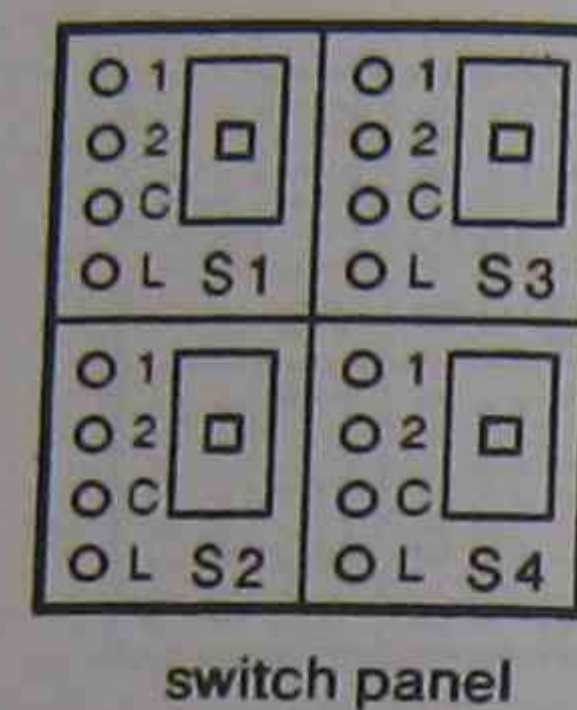
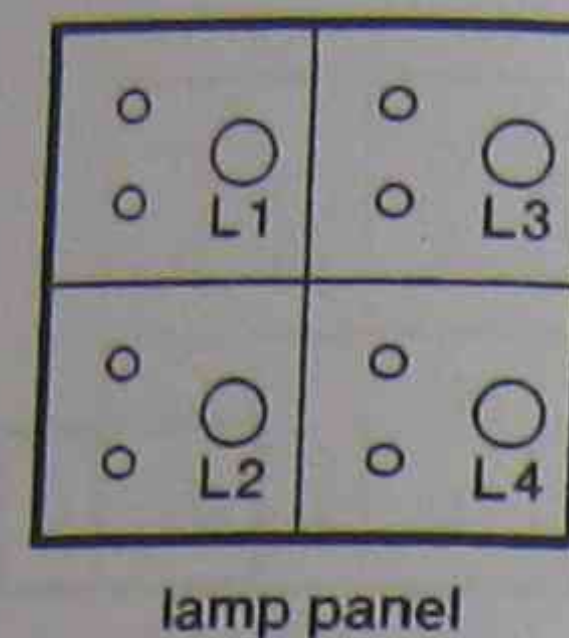
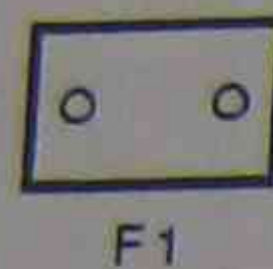
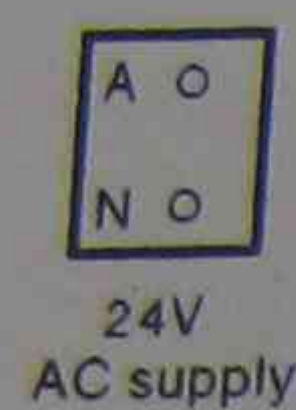


Figure 11 Wiring diagram

12. Connect the circuit by linking the components according to the wiring diagram.

Have your teacher check your circuit connections

13. Apply power to the circuit and check that the circuit operates correctly.
14. Turn off the power to the circuit and check that the circuit is safe to work on. If necessary correct any faults and retest the circuit.
15. With the power turned off, disconnect the circuit and leave the equipment and leads on the bench.

Procedure 4 Two parallel connected lamps individually controlled

16. For the circuit diagram shown in Figure 14 neatly sketch on the layout of Figure 15 the wiring diagram for the circuit.

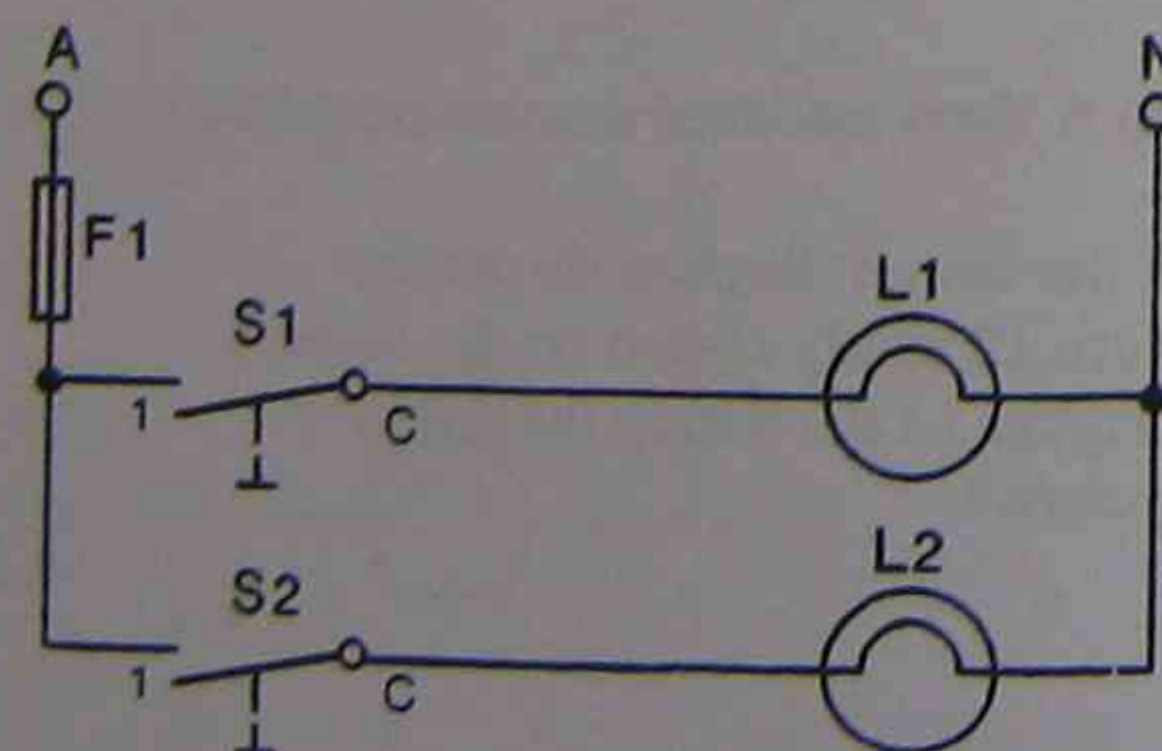


Figure14 Circuit diagram

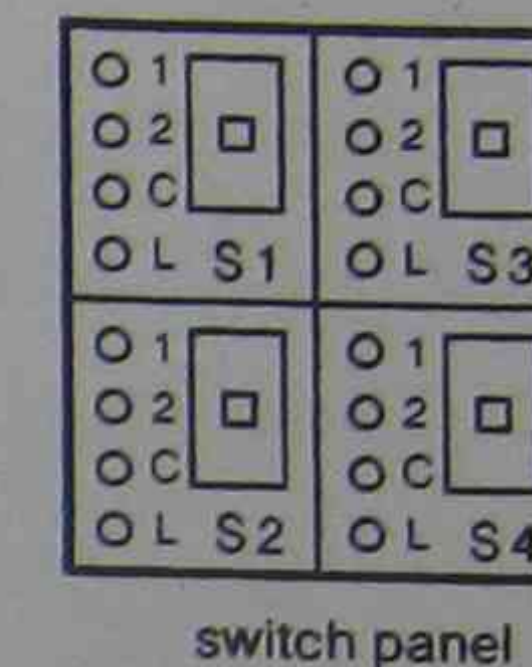
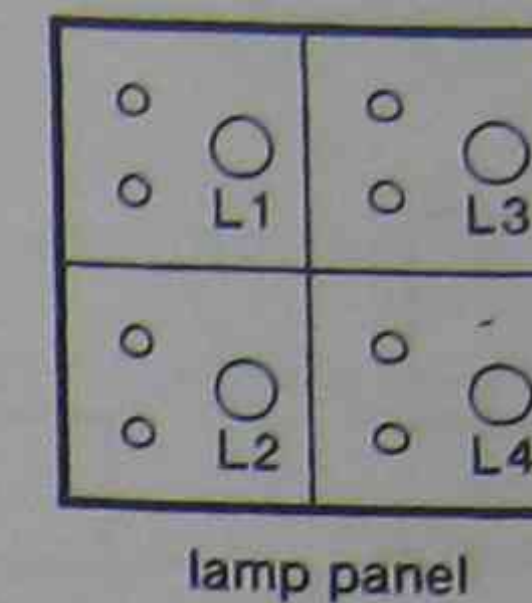
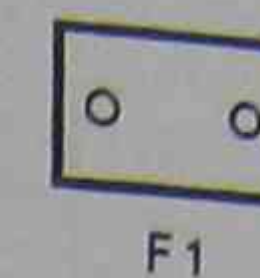
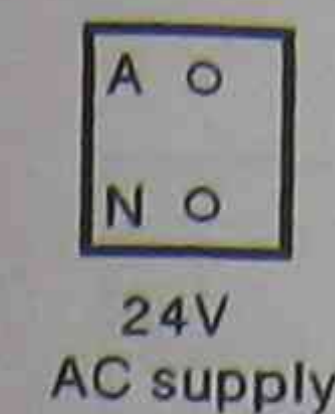


Figure 15 Wiring diagram

17. Connect the circuit by linking the components according to the wiring diagram.

Have your teacher check your circuit connections

18. Apply power to the circuit and check that the circuit operates correctly.
19. Turn off the power to the circuit and check that the circuit is safe to work on. If necessary correct any faults and retest the circuit.
20. With the power turned off, disconnect the circuit and leave the equipment and leads on the bench.

Procedure 5 Multiple lamp circuit

21. For the circuit diagram shown in Figure 16 neatly sketch on the layout of Figure 17 the wiring diagram for the circuit.

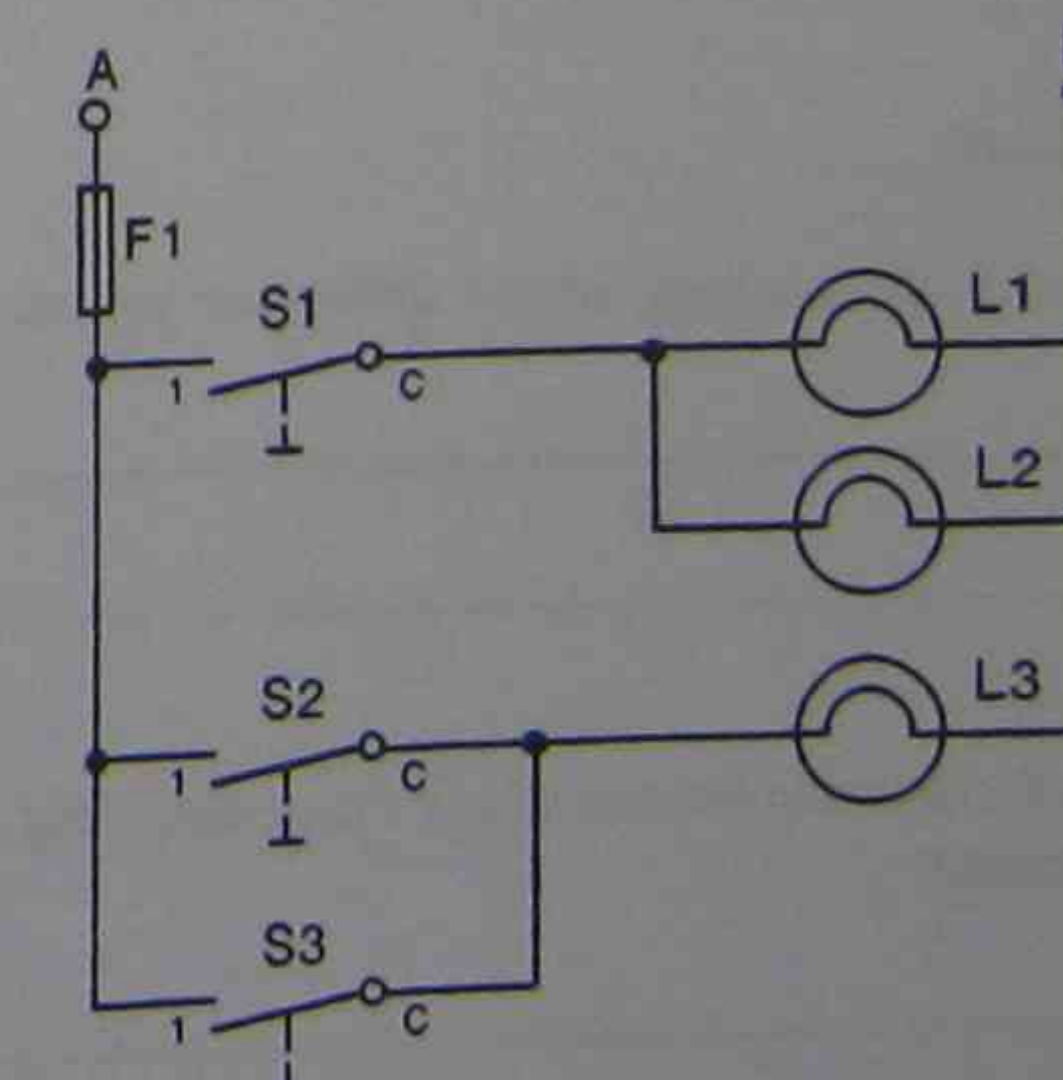


Figure16 Circuit diagram

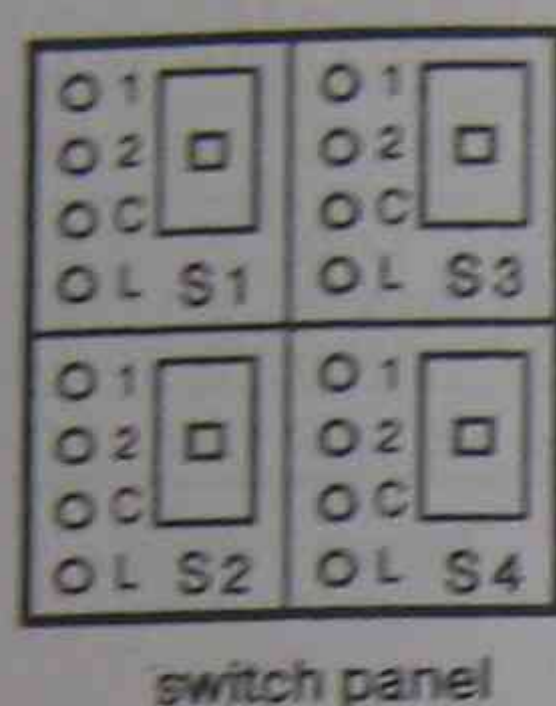
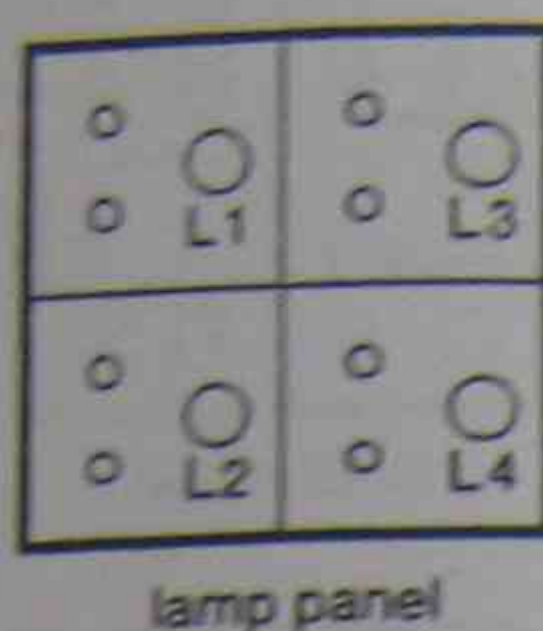
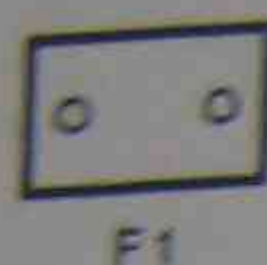
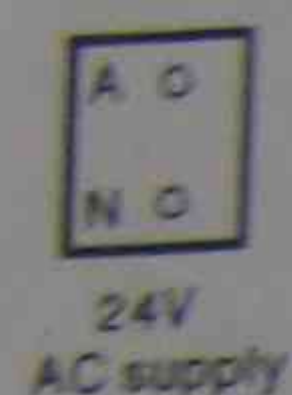


Figure 17 Wiring diagram

22. Connect the circuit by linking the components according to the wiring diagram.

Have your teacher check your circuit connections

23. Apply power to the circuit and check that the circuit operates correctly.
24. Turn off the power to the circuit and check that the circuit is safe to work on. If necessary correct any faults and retest the circuit.
25. With the power turned off, disconnect the circuit and leave the equipment and leads on the bench.

Observations

1. Identify the most significant difference between a circuit diagram and a wiring diagram.

2. Briefly describe the function of the numbering system employed on circuit and wiring diagrams.

3. Briefly explain why it is important to connect a circuit exactly in accordance with a prepared wiring diagram.

4. Outline a procedure to use when determining if it is safe to work on circuit wiring.

5. Briefly explain why it is necessary to convert circuit diagrams into wiring diagrams.

Have your teacher check your completed practical

Review question

These questions will help you revise what you have learnt in this topic.

1. The best type of electrical diagram to use when fault finding electrical equipment is a/an:
 - (a) circuit diagram
 - (b) wiring diagram
 - (c) block diagram
 - (d) architectural diagram
2. The best type of electrical diagram to use when constructing or assembling electrical equipment is a/an:
 - (a) circuit diagram
 - (b) wiring diagram
 - (c) block diagram
 - (d) architectural diagram
3. The best type of electrical diagram to use when determining the principle of operation of electrical equipment is a/an:
 - (a) circuit diagram
 - (b) wiring diagram
 - (c) block diagram
 - (d) architectural diagram
4. The electrical diagram that best displays the physical layout of electrical equipment is a/an:
 - (a) circuit diagram
 - (b) wiring diagram
 - (c) block diagram
 - (d) architectural diagram
5. The electrical diagram from which the detailed operation of electrical equipment is best obtained is a/an:
 - (a) circuit diagram
 - (b) wiring diagram
 - (c) block diagram
 - (d) architectural diagram

6. The type of electrical diagram that would most likely be used by an electrician installing equipment in a building is a/an:
 - (a) circuit diagram
 - (b) wiring diagram
 - (c) block diagram
 - (d) architectural diagram
7. Before wiring equipment according to a circuit diagram, it should first be converted to:
 - (a) a block diagram
 - (b) an architectural diagram
 - (c) a wiring diagram
 - (d) a simpler form
8. The electrical diagram that displays every conductor and termination in a circuit is a/an:
 - (a) circuit diagram
 - (b) wiring diagram
 - (c) block diagram
 - (d) architectural diagram
9. Before converting a circuit diagram into a wiring diagram it is essential that the:
 - (a) block diagram is developed
 - (b) architectural diagrams are referred to
 - (c) site plans are referred to
 - (d) physical layout of the equipment is determined
10. The components in a circuit diagram should be represented using:
 - (a) drawings of actual components
 - (b) standard symbols
 - (c) a numbering system
 - (d) block diagrams
11. Draw the Australian Standard symbol to represent:
 - (a) a single pole single throw switch, normally open, manually operated.
 - (b) a single pole double throw switch, manually operated.
 - (c) lamp - illuminating.
 - (d) lamp - signal.
 - (e) fuse.

12. The circuit shown in Figure 19 represents the switching circuit for the control of four lighting points. Using the equipment layout in Figure 20, develop and draw the wiring diagram for this circuit.

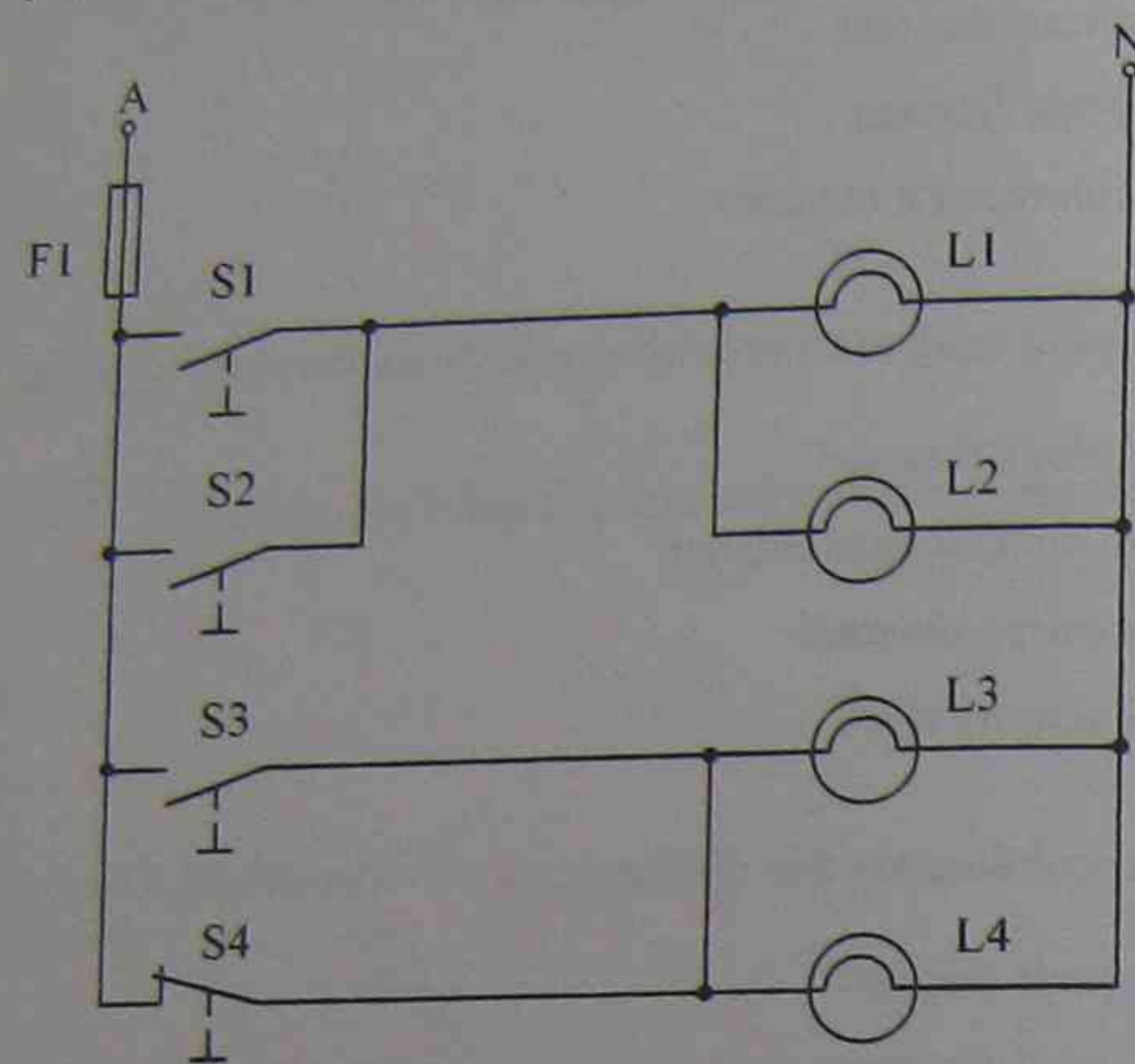


Figure 19 Circuit diagram – lighting control

6 Circuit Diagrams

Purpose

In this topic you will learn about the conventions used and techniques employed when sketching circuits. The concept and construction of switching charts will also be introduced.

Objectives

At the end of this topic you should be able to:

- list the conventions used in and the features of circuit diagrams
- describe the purpose of circuit diagrams in the electrical industry
- sketch basic circuit diagrams
- identify a range of symbols from Australian Drawing Standard AS/NZS 1102
- use a continuity testing device to construct a switching chart to identify the terminals of a switch
- connect equipment according to a circuit diagram and confirm the operation of the circuit.

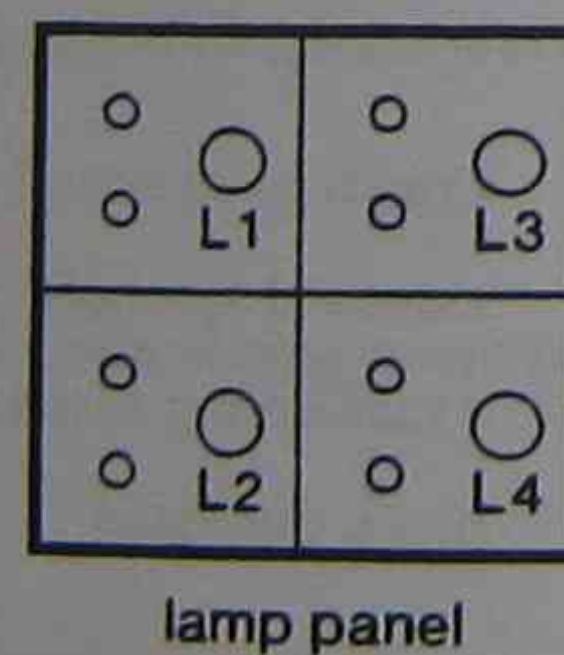
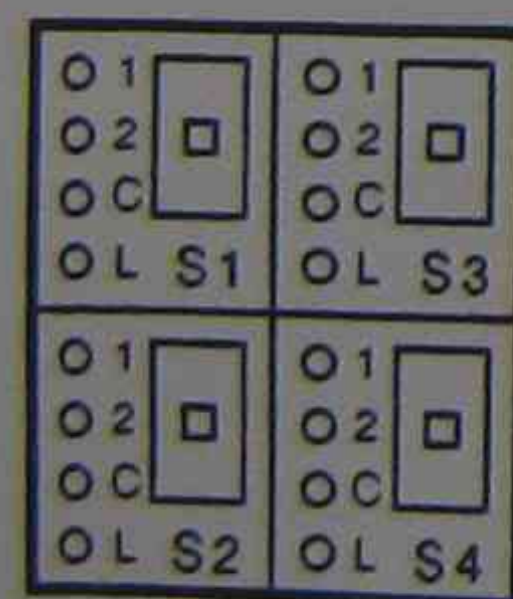
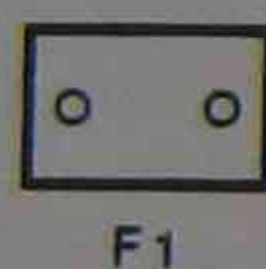
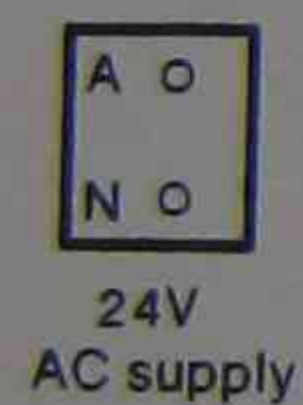


Figure 20 Equipment layout