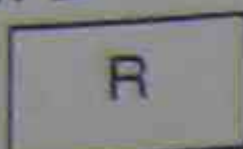





Section D1. (A) (B) (C) (D) (E) 

2. (A) Digital
 (B) Single fluorescence
 (C) Luminous push button
 (D) Weather proof
 (E) In the kitchen

Theory test 2**Section A**

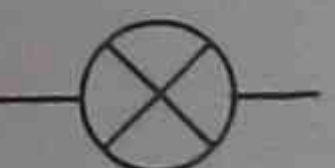

1. (A) single exterior brick cladding with an air space to an interior brick cladding
2. (D) roof is supported by the interior frame
3. (D) position of the structure on the land
4. (A) 1.2 mm
5. (D) after tiling and painting of interior walls
6. (D) active
7. (C) circuit diagram
8. (D) wiring diagram
9. (B) block diagram
10. (D) wiring diagram
11. (D) wiring diagram
12. (C) 30°
13. (B) switching chart of the switch

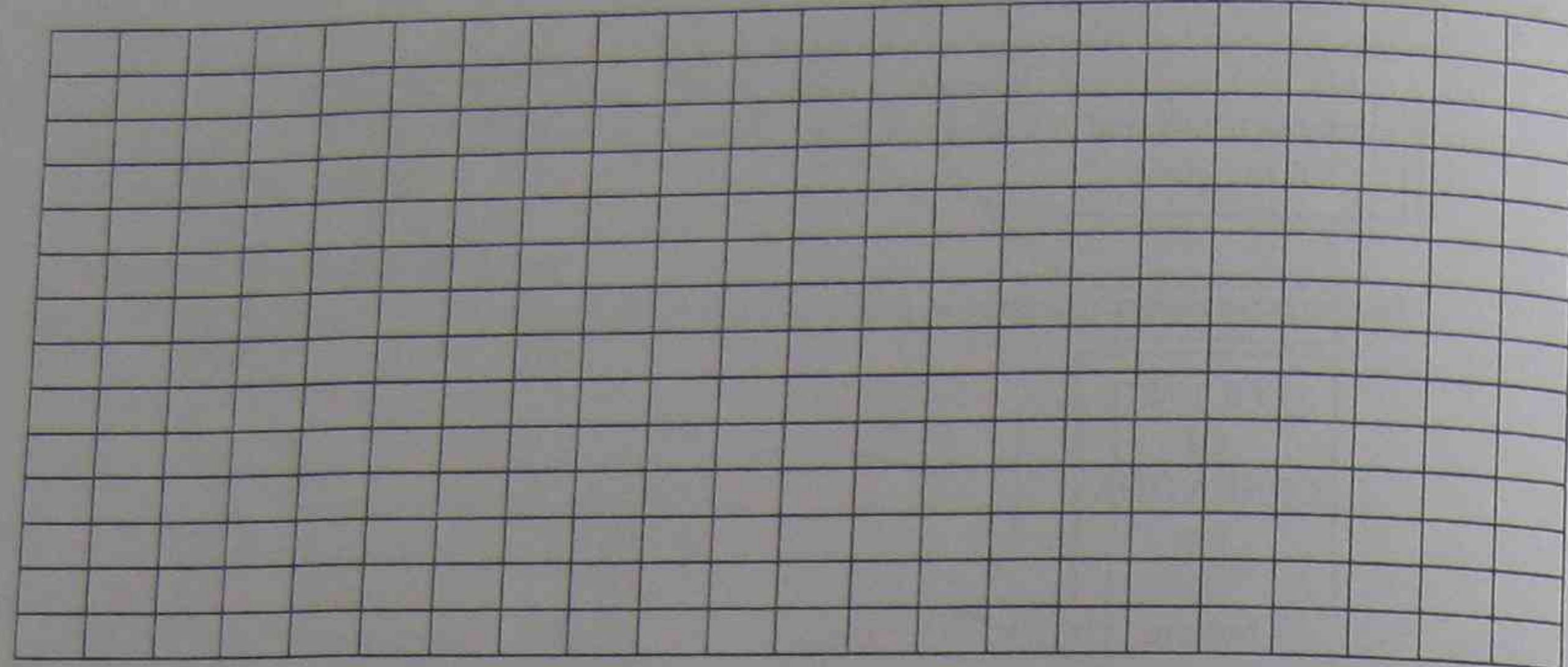
14. (C) the operation of the circuit

15. (C) cold condition

Section B

1. Top
2. Bottom
3. Continuity tester, ohmmeter etc.
4. Site plan
5. Floor plan
6. Intermediate
7. 8. 9. 10. Any four of setting out, footings, base, floor, walls, cladding, interior lining, tiling, painting, finishing

Section C1. 2. 3. 4. 5. 



Standard switch symbols

- 'single pole' switches are designed to make or break a circuit in one conductor.
- 'multi-pole' switches are designed to simultaneously make or break the circuit in more than one conductor

Exercise

Identify the following switch symbols and draw a free hand sketch of the switch in the space provided in the table. (Note that the symbols shown in the table are sometimes shown with different orientation).

AS/NZS 1102 symbol	Switch description	Free hand sketch

AS/NZS 1102 symbol	Switch description	Free hand sketch

Table 1 Switch symbols

Switching charts

Switching charts are used when testing switches to determine:

- closed contacts
- open contacts
- looping terminals
- indicating devices such as neon's

Suitable test equipment for testing switch continuity:

- ohmmeter
- continuity tester
- circuit testers such as combicheck or similar

The following table is an example of a switching chart for a HPM type 770 switch. The X indicates continuity between the switch terminals indicated.

Terminals	Resistance	
	Toggle up	Toggle down
C - 1		X
C - 2	X	
C - L		
1 - 2		
1 - L		
2 - L		

Table 2 Switching chart

Practical exercise: Switching charts

Task

To test switching devices to determine the terminal configuration of the switches. You will also convert circuit diagrams into wiring diagrams and connect each circuit.

Objectives

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

- construct switching charts for various electrical accessories using a suitable test instrument
- determine from each chart the terminal configuration for each device
- convert a circuit diagram to a wiring diagram and then connect and test the circuit

Equipment

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

	Specifications
▪ AC voltage supply	_____
▪ Lamp panel	_____
▪ Switch panels	_____
▪ Fuse or circuit breaker panel	_____
▪ Testing device	_____
▪ Connecting leads	_____

Procedure

1. Switch 1 – as supplied by your teacher

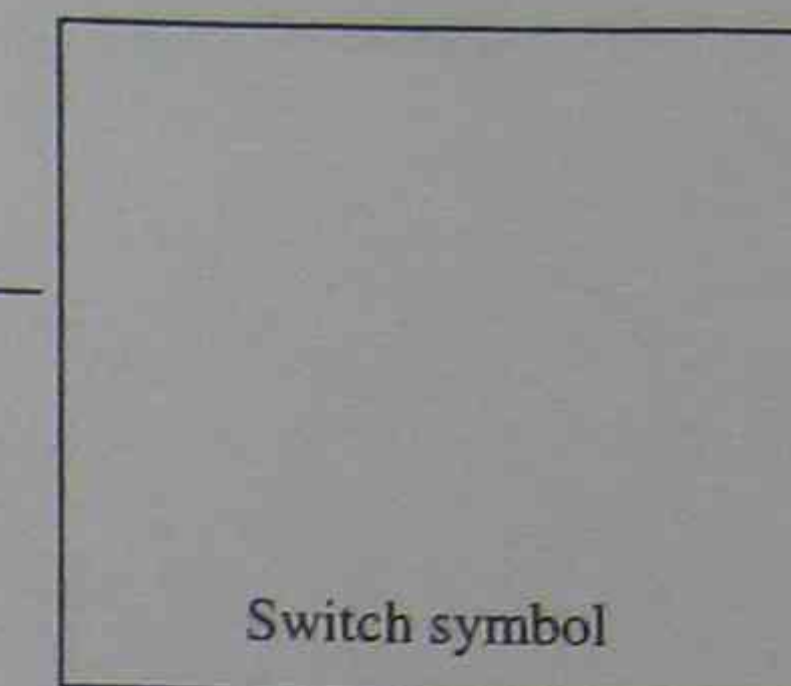
- Draw in the space below the switching chart for the switch. Remember to take into account the:
 - number of terminals
 - number of switch positions

Switching chart – switch 1

- Using a suitable testing device, check for continuity between each terminal combination for each position of the switch toggle. Place a cross in the appropriate square in the table to indicate continuity.

- Number the switch terminals on the diagram according to your results.
- From the results of the chart determine the type or function of the switch and draw the symbol of the switch. Number the switch terminals on the diagram according to the results you obtained.

Switch type: _____



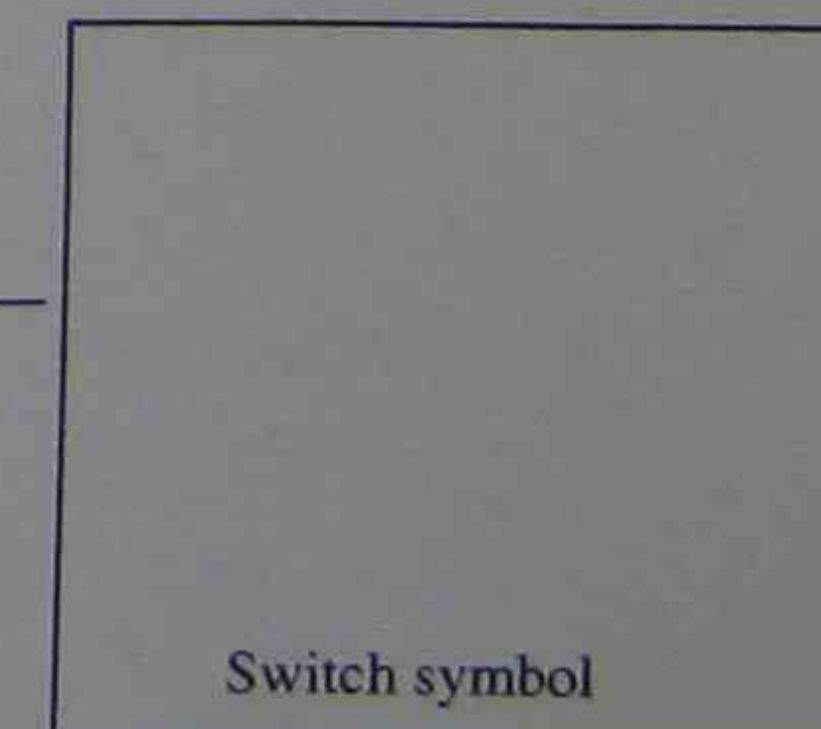
2. Switch 2 – as supplied by your teacher

- Draw in the space below the switching chart for the switch. Remember to take into account the:
 - number of terminals
 - number of switch positions

Switching chart – switch 2

- Using a suitable testing device, check for continuity between each terminal combination for each position of the switch toggle. Place a cross in the appropriate square in the table to indicate continuity.
- Number the switch terminals on the diagram according to your results.
- From the results of the chart determine the type or function of the switch and draw the symbol of the switch. Number the switch terminals on the diagram according to the results you obtained.

Switch type: _____



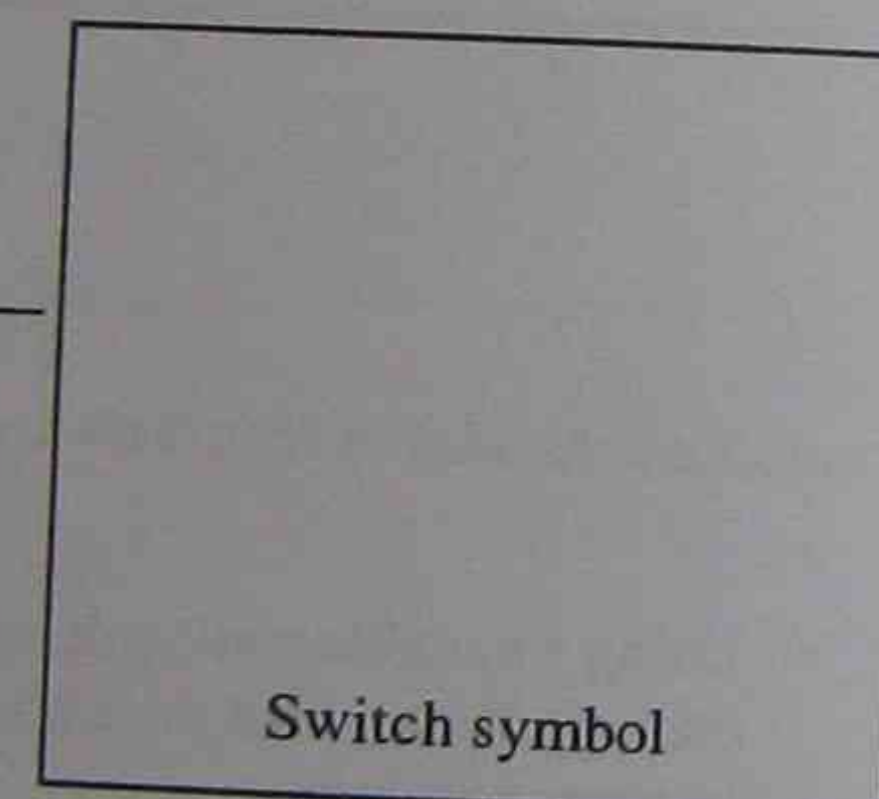
3. Switch 3 – as supplied by your teacher

- Draw in the space below the switching chart for the switch. Remember to take into account the:
 - number of terminals
 - number of switch positions

Switching chart – switch 3

- Using a suitable testing device, check for continuity between each terminal combination for each position of the switch toggle. Place a cross in the appropriate square in the table to indicate continuity.
- Number the switch terminals on the diagram according to your results.
- From the results of the chart determine the type or function of the switch and draw the symbol of the switch. Number the switch terminals on the diagram according to the results you obtained.

Switch type: _____



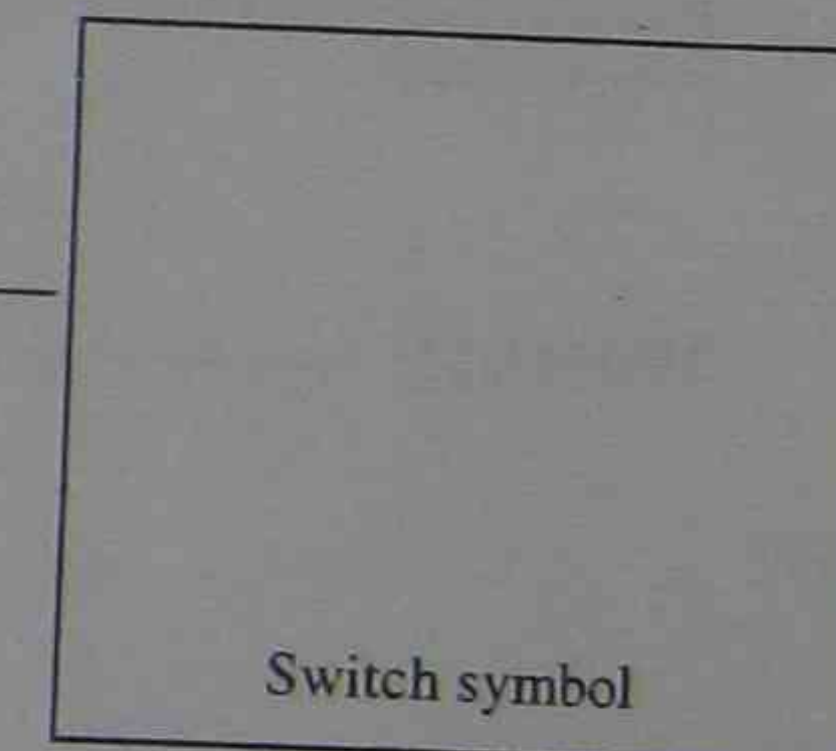
4. Switch 4 – as supplied by your teacher

- Draw in the space below the switching chart for the switch. Remember to take into account the:
 - number of terminals
 - number of switch positions

Switching chart – switch 4

- Using a suitable testing device, check for continuity between each terminal combination for each position of the switch toggle. Place a cross in the appropriate square in the table to indicate continuity.
- Number the switch terminals on the diagram according to your results.
- From the results of the chart determine the type or function of the switch and draw the symbol of the switch. Number the switch terminals on the diagram according to the results you obtained.

Switch type: _____



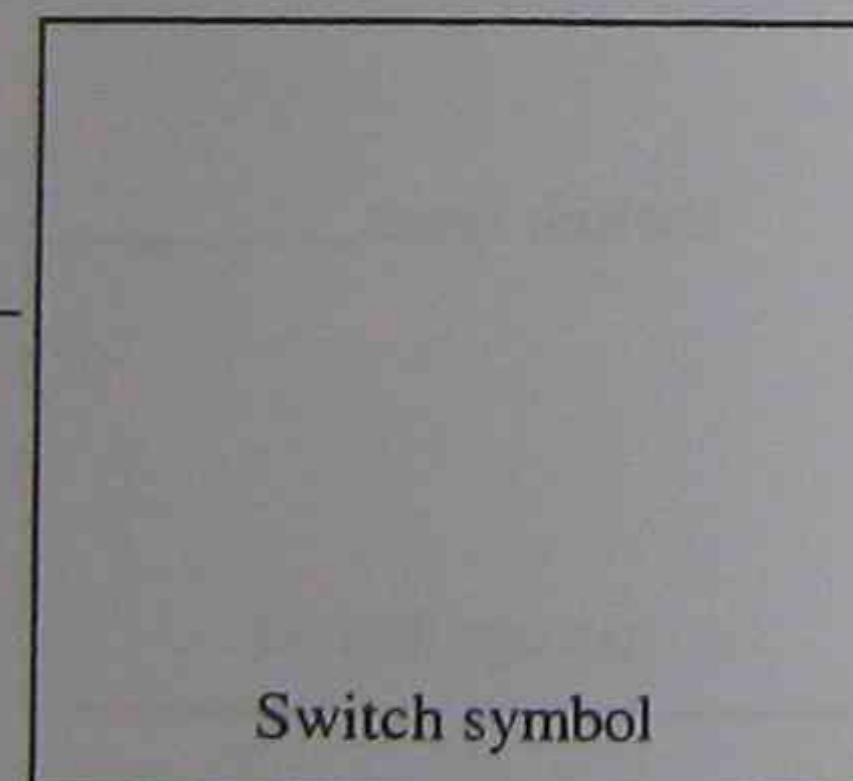
5. Switch 5 – as supplied by your teacher

- Draw in the space below the switching chart for the switch. Remember to take into account the:
 - number of terminals
 - number of switch positions

Switching chart – switch 5

- Using a suitable testing device, check for continuity between each terminal combination for each position of the switch toggle. Place a cross in the appropriate square in the table to indicate continuity.
- Number the switch terminals on the diagram according to your results.
- From the results of the chart determine the type or function of the switch and draw the symbol of the switch. Number the switch terminals on the diagram according to the results you obtained.

Switch type: _____



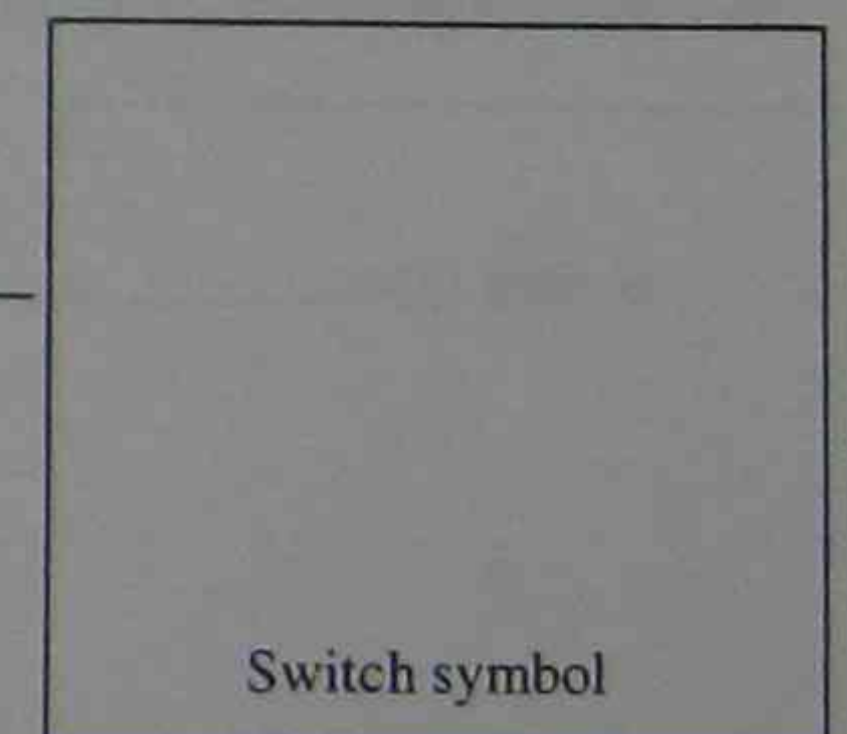
6. Switch 6 – as supplied by your teacher

- Draw in the space below the switching chart for the switch. Remember to take into account the:
 - number of terminals
 - number of switch positions

Switching chart – switch 6

- Using a suitable testing device, check for continuity between each terminal combination for each position of the switch toggle. Place a cross in the appropriate square in the table to indicate continuity.
- Number the switch terminals on the diagram according to your results.
- From the results of the chart determine the type or function of the switch and draw the symbol of the switch. Number the switch terminals on the diagram according to the results you obtained.

Switch type: _____



Switch 7 – as supplied by your teacher

- Draw in the space below the switching chart for the switch. Remember to take into account the:
 - number of terminals
 - number of switch positions

Switching chart – switch 7

- Using a suitable testing device, check for continuity between each terminal combination for each position of the switch toggle. Place a cross in the appropriate square in the table to indicate continuity.
- Number the switch terminals on the diagram according to your results.
- From the results of the chart determine the type or function of the switch and draw the symbol of the switch. Number the switch terminals on the diagram according to the results you obtained.

Switch type: _____

Switch symbol

8. Switch 8 – as supplied by your teacher

- Draw in the space below the switching chart for the switch. Remember to take into account the:
 - number of terminals
 - number of switch positions

Switching chart – switch 8

- Using a suitable testing device, check for continuity between each terminal combination for each position of the switch toggle. Place a cross in the appropriate square in the table to indicate continuity.
- Number the switch terminals on the diagram according to your results.
- From the results of the chart determine the type or function of the switch and draw the symbol of the switch. Number the switch terminals on the diagram according to the results you obtained.

Switch type: _____

Switch symbol

Have your teacher check your completed practical

Procedure 2 – Conversion of circuit diagram to a wiring diagram

1. For the circuit in Figure 4 select suitable switches to perform the switching functions shown in the circuit diagram. Label each switch with the switch type and place terminal numbers for each switch on the circuit diagram

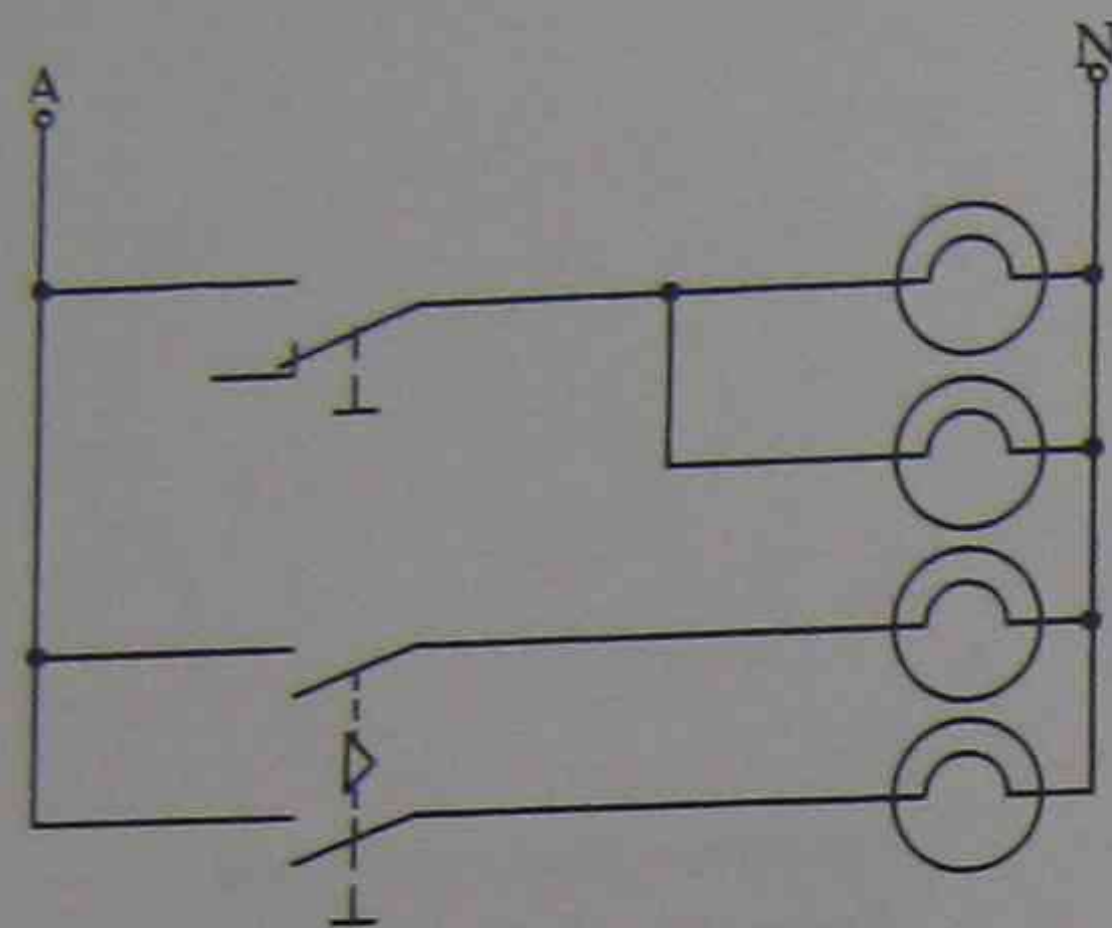


Figure 4 Circuit diagram – switching circuit

2. Convert the circuit diagram shown in Figure 4 to a wiring diagram. Sketch the appropriate switch and lamp panels to show the layout of the equipment.

Figure 5 Wiring diagram – switching circuit

3. Connect the circuit using your wiring diagram as a guide. Place the equipment on the bench to match the layout of the diagram.

Have your teacher check your wiring connections

4. Energise the circuit and test its operation. If necessary, follow the teacher's instructions on finding any faults.

Have your teacher check your completed practical

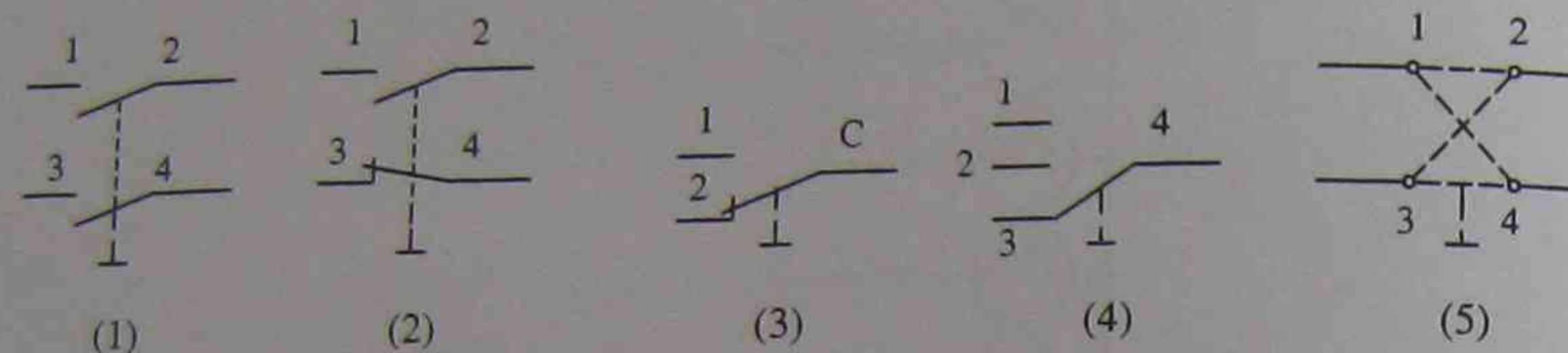
5. When the circuit has been tested turn off the supply and check that the circuit is 'dead'. Disconnect the circuit and return all equipment to its proper place.

Review question

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

1. The following symbols and switching charts represent various switching devices. Identify which switching chart applies to each of the switches and:

- describe the function of the switch, such as – single pole single throw (SPST) switch.



Terminals	Toggle	
	Up	Down
1 - 2		
1 - C		X
1 - L		
2 - C	X	
2 - L		
C - L		

Switching chart 1

Switch No.:

Switch function:

Terminals	Toggle	
	Up	Down
1 - 2		X
1 - 3		
1 - 4	X	
2 - 3	X	
2 - 4		
3 - 4		X

Switching chart 2

Switch No.:

Switch function:

Terminals	Toggle	
	Up	Down
1 - 2		X
1 - 3		
1 - 4		
2 - 3		
2 - 4		
3 - 4	X	

Switching chart 3

Switch No.:

Switch function:

Terminals	Toggle	
	Up	Down
1 - 2		
1 - 3		X
1 - 4		
2 - 3		
2 - 4		
3 - 4		X

Switching chart 4

Switch No.:

Switch function:

Terminals	Toggle		
	1	2	3
1 - 2			
1 - 3			
1 - 4	X		
2 - 3			
2 - 4		X	
3 - 4			X

Switching chart 5

Switch No.:

Switch function:

2. Convert the circuit diagram shown in Figure 6 to a wiring diagram. Draw the wiring diagram using the layout shown in Figure 7.

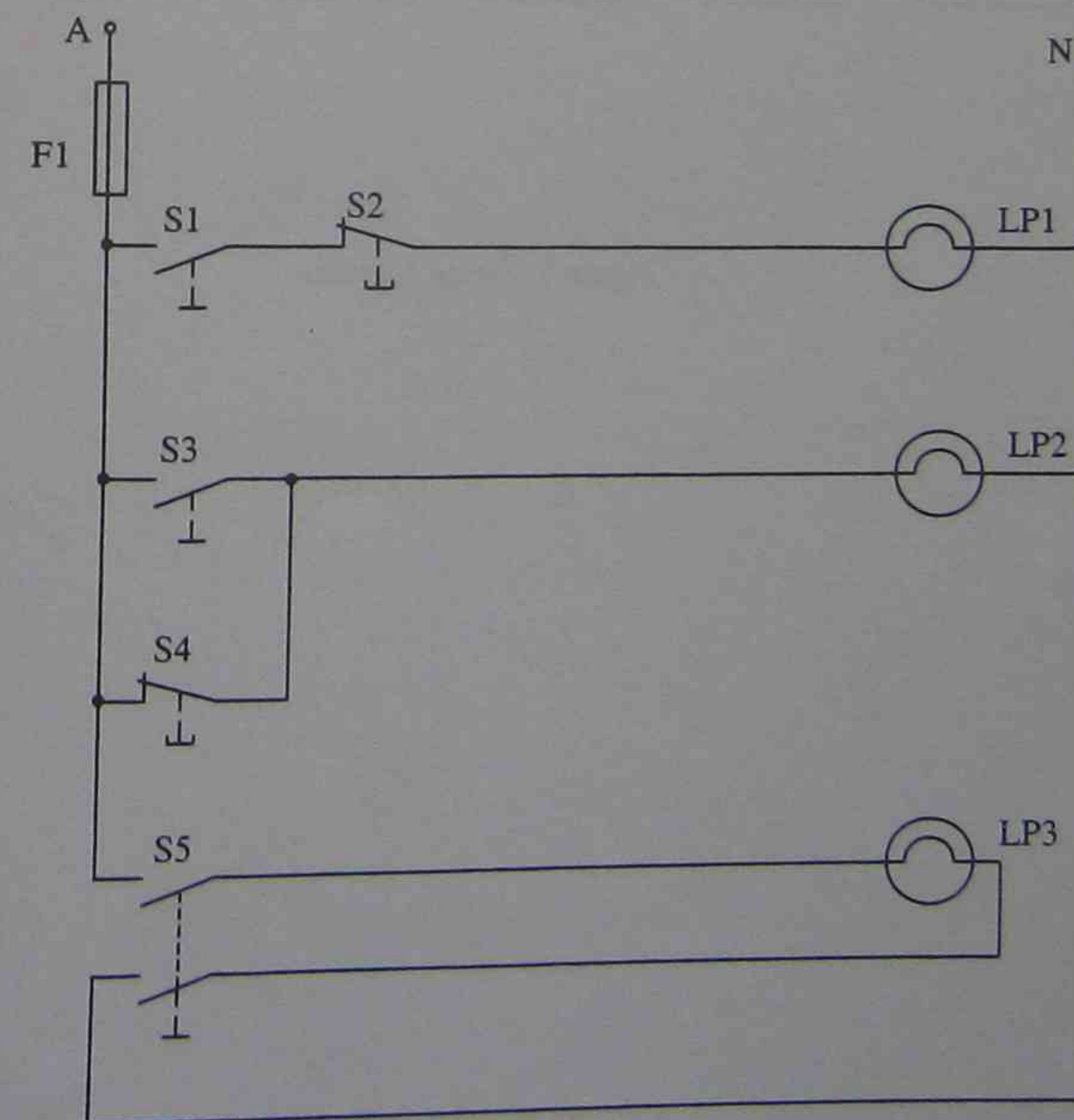


Figure 6 Circuit diagram – lighting control

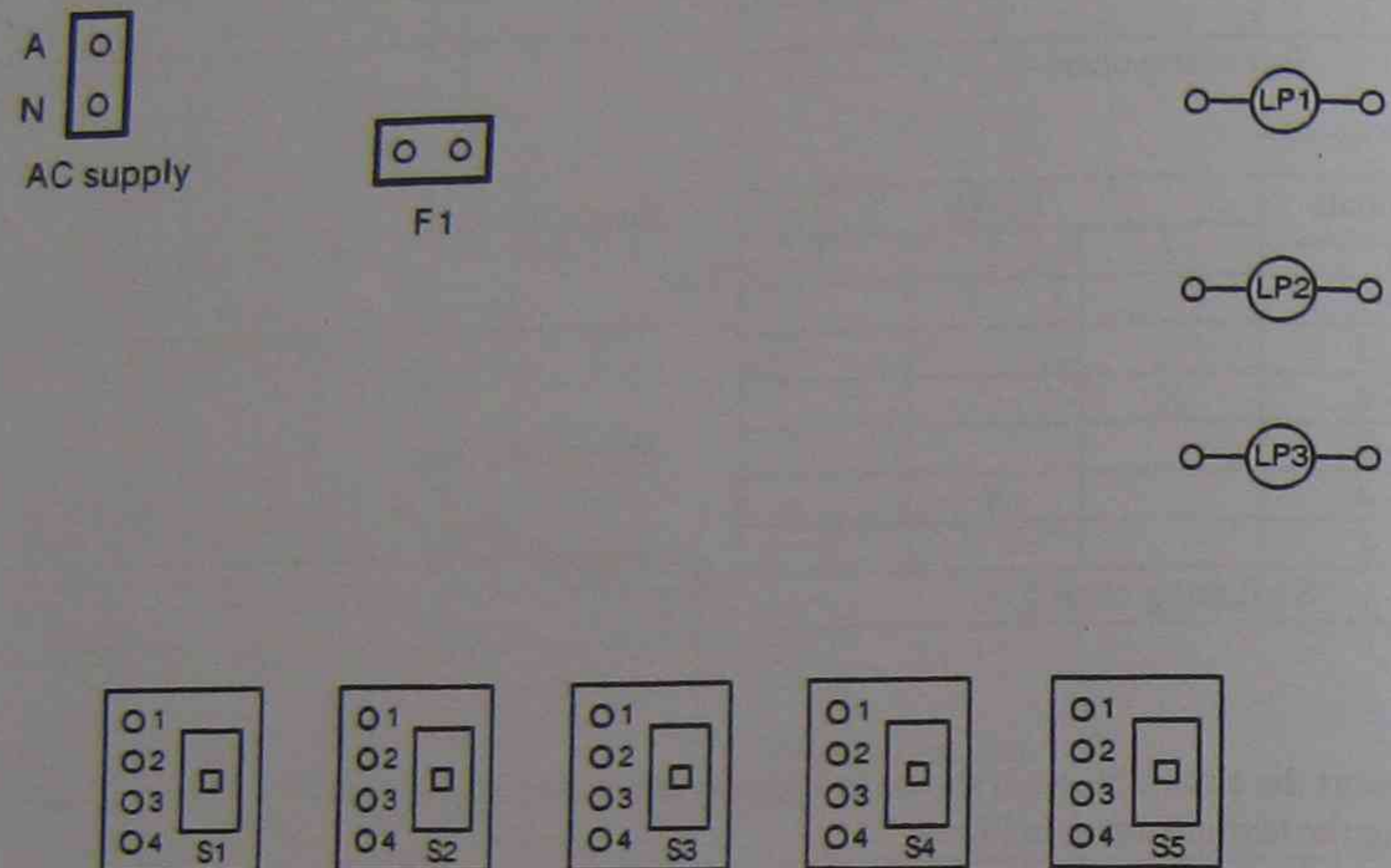


Figure 7 Wiring diagram

7 Light circuits 1

Purpose

In this topic you will learn about the wiring of lighting circuits using the 'loop at the light' method.

Objectives

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

- describe the 'loop at the light' method of wiring lighting circuits
- draw the circuit diagram for the lighting circuit of an installation that incorporates one-way, two-way and two-way and intermediate switching of lighting points
- draw the circuit diagram for the lighting circuit of an installation that incorporates one-way, two-way and two-way and intermediate switching of lighting points, where the 'loop at the light' method of wiring is used.
- determine the cabling requirements for a lighting circuit, which is to be installed using the 'loop at the light' method of wiring.
- install the accessories and complete the wiring for a lighting circuit incorporating one-way and two-way switching of lighting points using the 'loop at the light' method.
- confirm correct operation of the circuit and test it for compliance with AS/NZS 3000.

Introduction

In most electrical installations the wiring of lights and its associated control is a major part. The use of the floor plan and electrical location symbols determine the position of lighting points and associated switching. The electrical layout shown on the floor plan gives no indication of the actual circuit wiring. It is the responsibility of the electrician to determine the wiring required on site.

Wiring methods

Different wiring systems are used in various installation conditions and applications, such as:

- thermoplastic insulated (TPI) cables in metal and PVC conduits
- thermoplastic sheathed (TPS) cables without further protection
- mineral insulated metal sheathed (MIMS) cables
- steel wire armoured (SWA) cables

The selection of a particular wiring system is based on the installation environment. The actual wiring method is determined by the need to minimise the:

- amount of cable required
- installation time
- need to minimise the number of connections at a given terminal

The two most common approaches used for the wiring of general lighting circuits are the:

- 'loop at the light' method
- 'loop at the switch' method

Both methods provide access to all conductor connections at the circuit accessories eliminating the need for multiple junction boxes.

The loop at the light method of wiring

AS/NZS 3000 requires that all lighting points be provided with an earthing conductor and for this reason twin and earth TPS cables are predominately used. By using the loop at the light method of wiring, a TPS twin and earth cable would be run from the switchboard to the lighting point and a two core TPS cable is run between the lighting point and switch. Figure 1 shows the wiring for looping from the light.

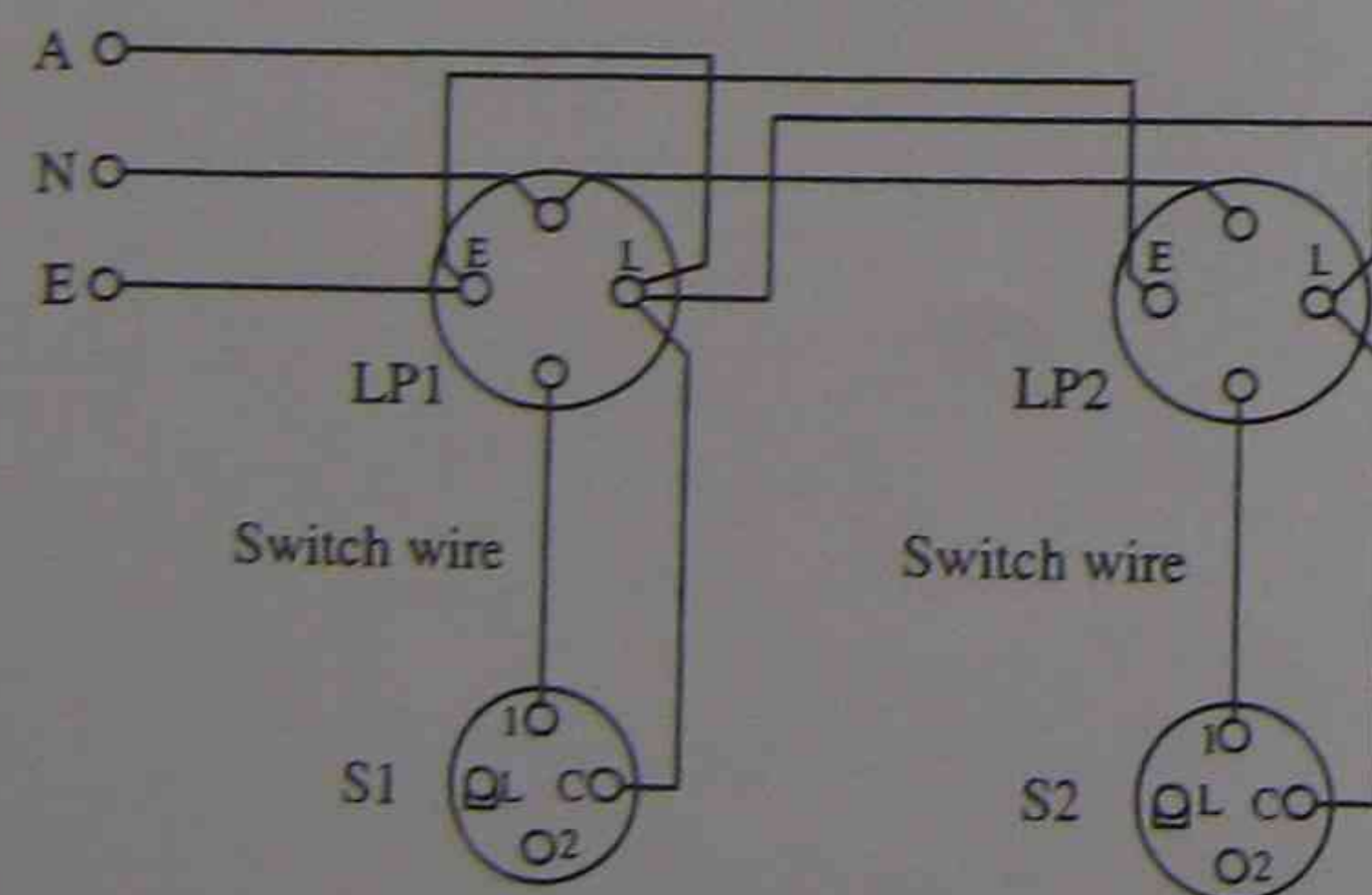


Figure 1 Wiring diagram

When using the loop at the light method the active, neutral and earth conductors are loop at the lighting point and a switch drop is taken from each lighting point to its switch.

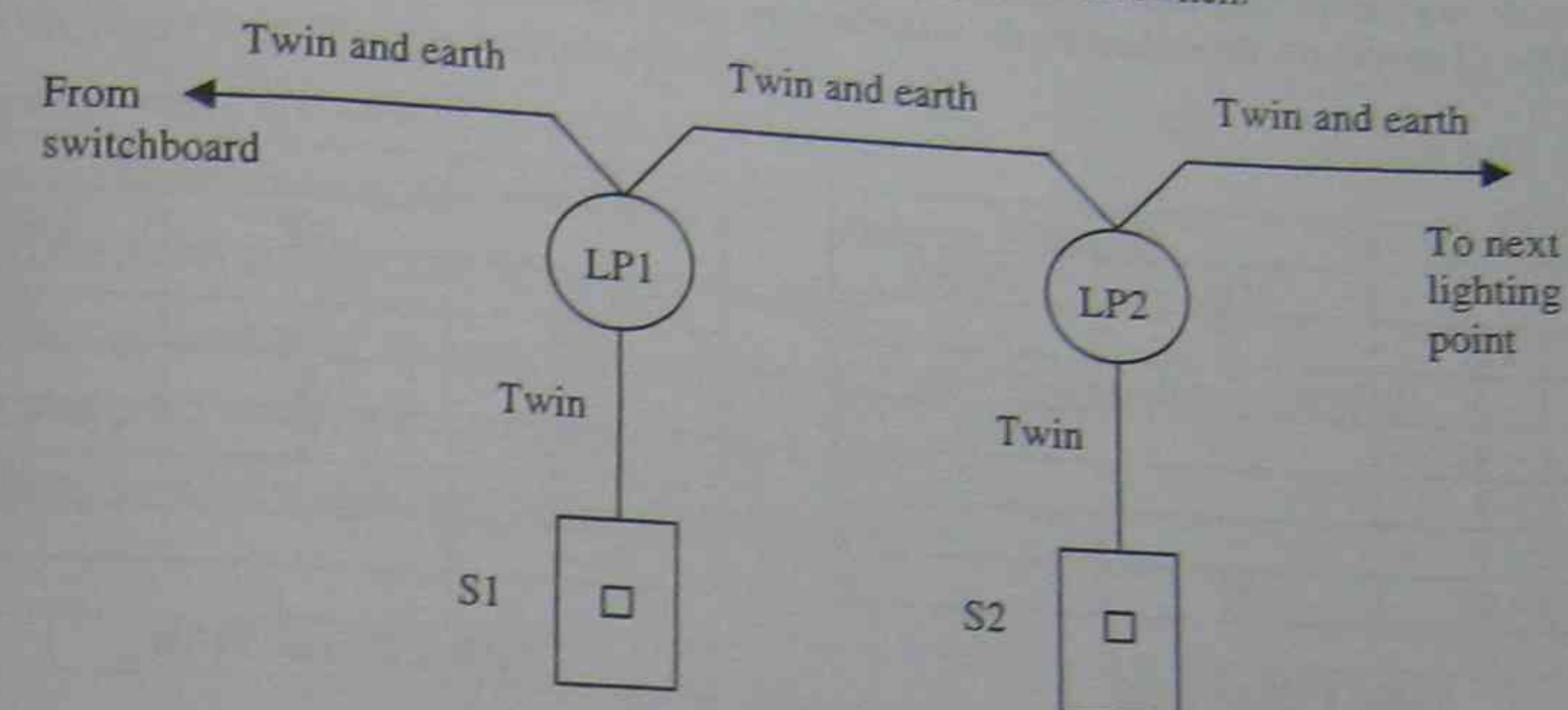


Figure 2 Single line diagram cable arrangement

The 'loop at the light' method is the most commonly used wiring system for TPS installations and is equally applicable to other wiring systems.

Multi-position switching

Two-way switching is used to control a light or lights from two positions such as at an entry and exit door.

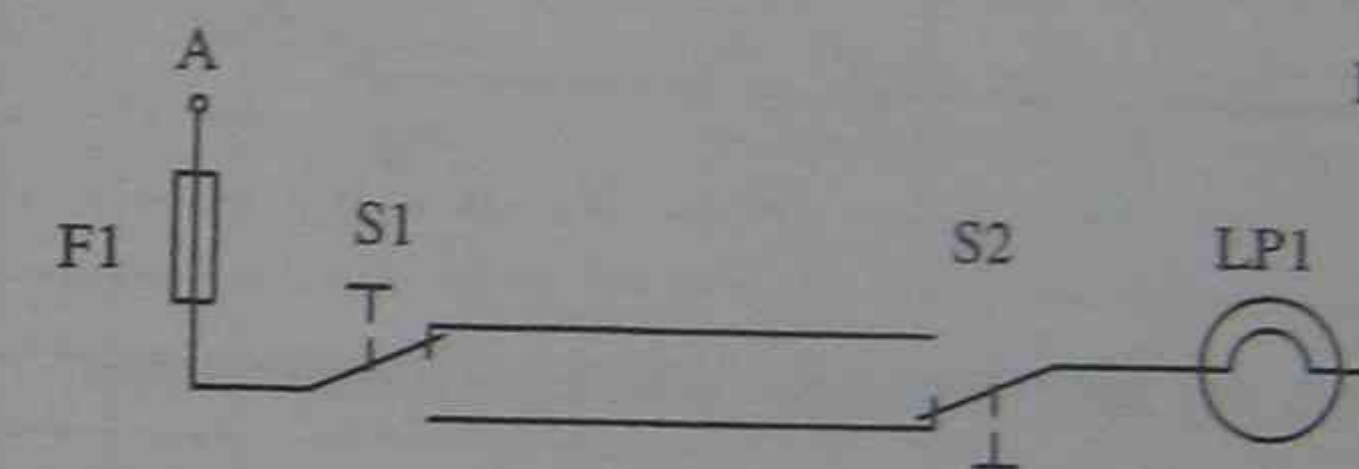


Figure 3 Circuit diagram of two-way switching

Exercise

Convert the circuit diagram of Figure 3 to a wiring diagram on Figure 4 below. Label all TPS twin and earth, TPS twin and SDI cables.

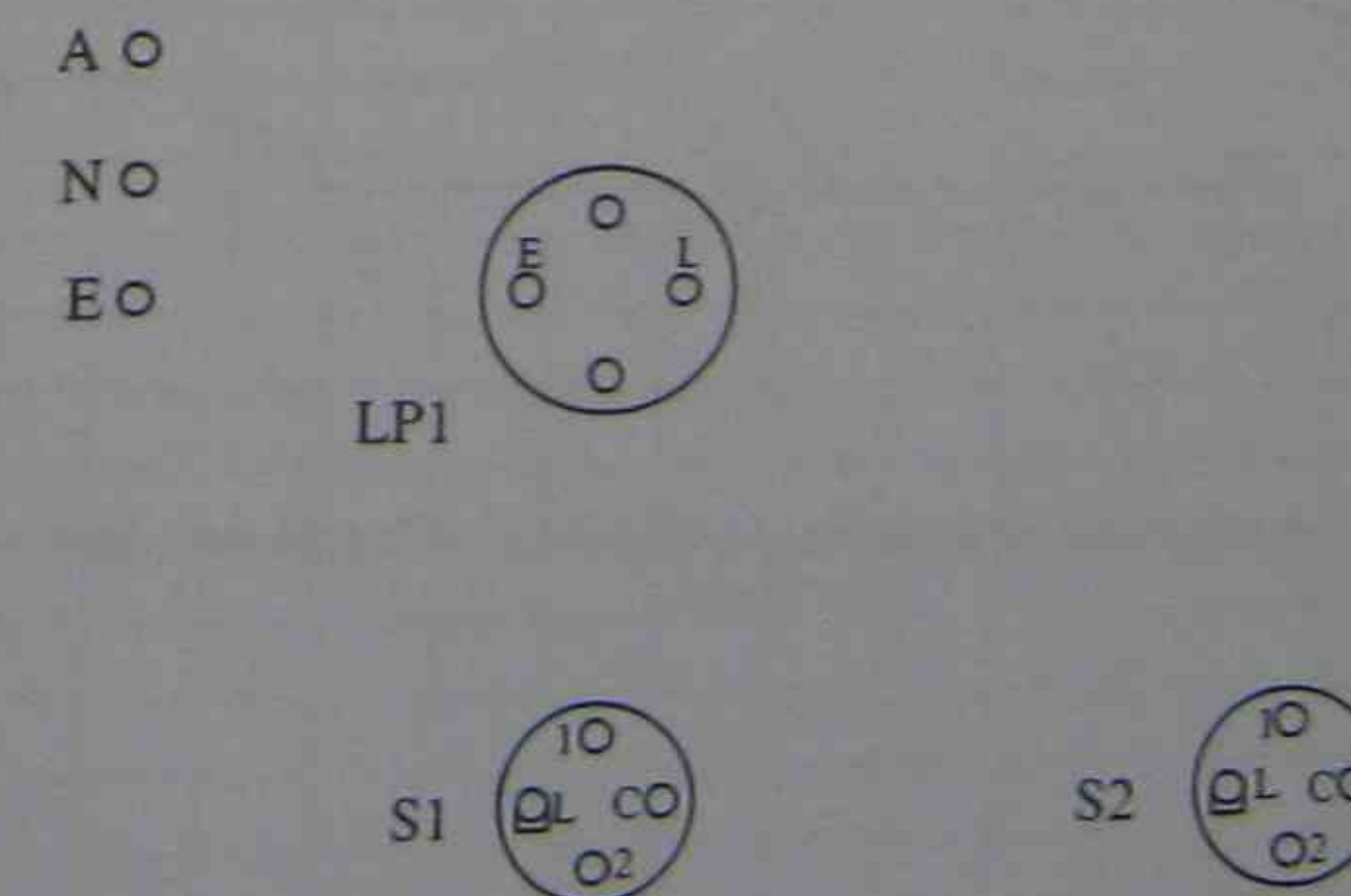


Figure 4 Two-way switching wiring diagram

Intermediate switching is an extension of two-way switching but allows ON/OFF control from any of three or more switching positions. Unlike two-way switches, intermediate switches differ in their allocation of terminals, depending on the manufacturer, such as Clipsals 30 MI and HPM's 770/1.

Terminals	Toggle	
	Up	Down
1 - 2	X	
1 - 3		
1 - 4		X
2 - 3		X
2 - 4		
3 - 4	X	

Table 1 HPM 770/1

Terminals	Toggle	
	Up	Down
1 - 2		
1 - 3		X
1 - 4	X	
2 - 3	X	
2 - 4		X
3 - 4		

Table 2 Clipsal 30 MI

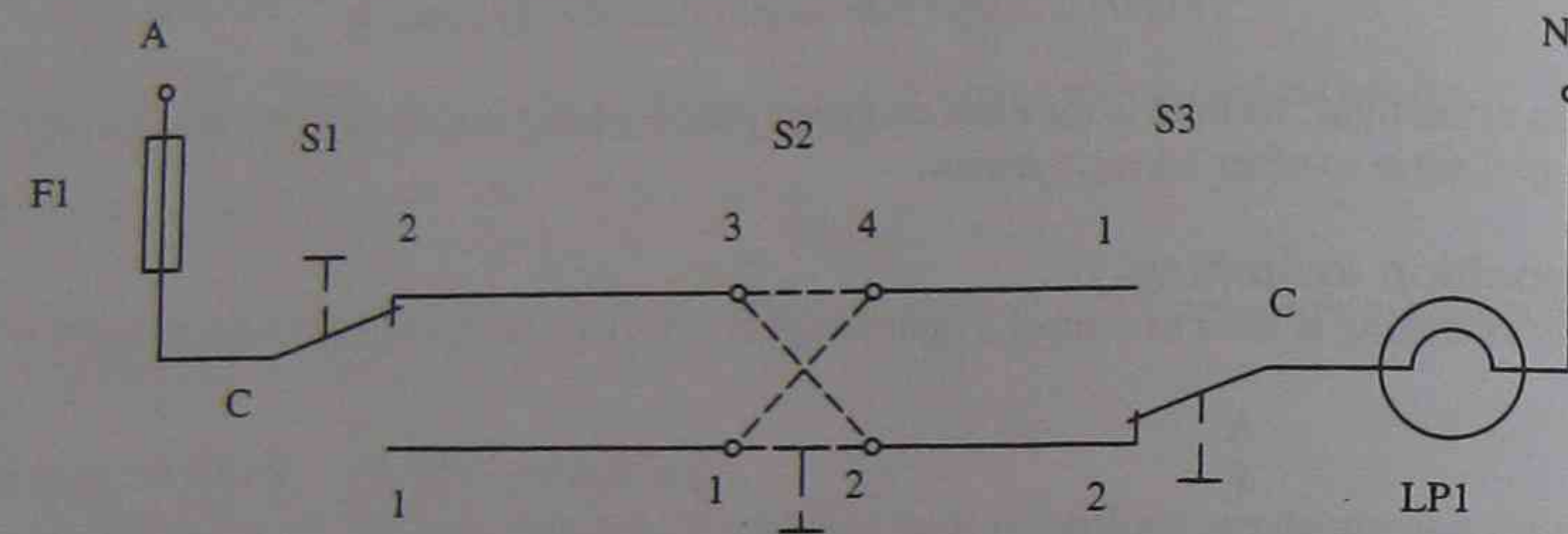


Figure 5 Two-way and intermediate switching – HPM switches

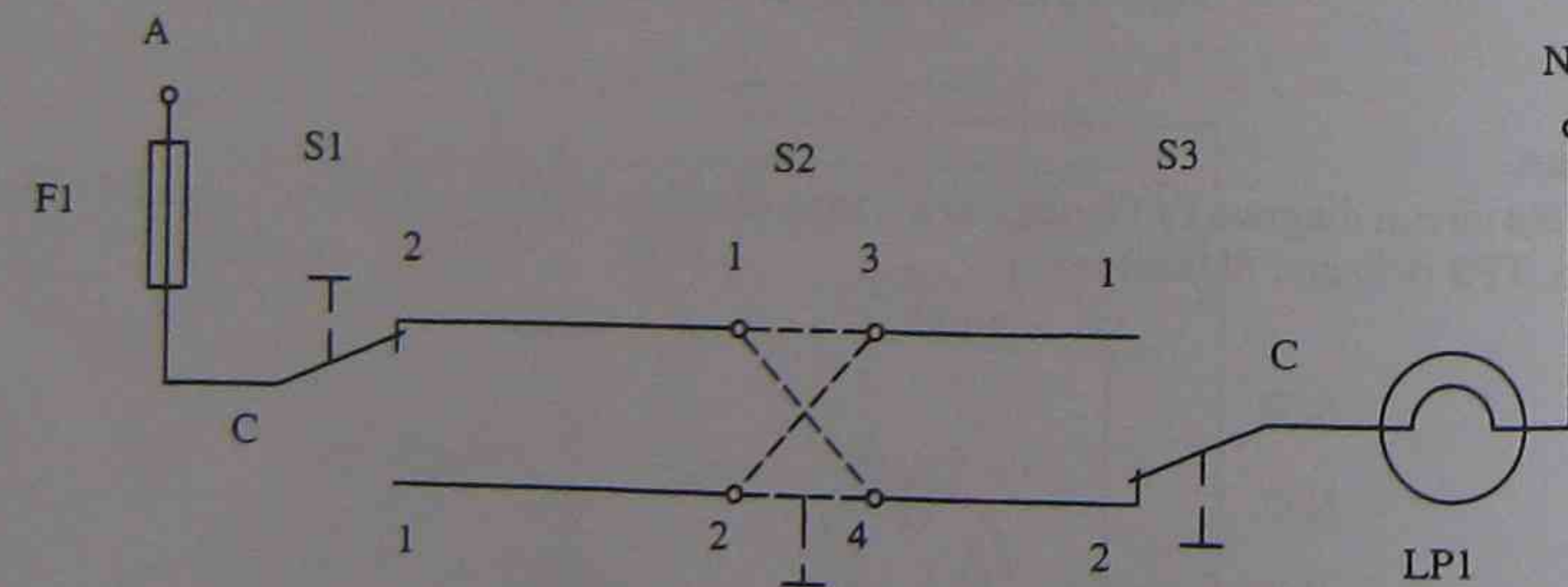


Figure 6 Two-way and intermediate switching – Clipsal switches

A complete lighting circuit.

Exercise

Draw the circuit diagram for the following circuit description:

- lighting point 1 is controlled by switch 1
- lighting point 2 is controlled by switches 2 and 3 (two-way switching)
- lighting points 3, 4 and 5 are controlled by switch 4
- lighting points 6 and 7 are controlled by switches 5, 6 and 7 (intermediate switching)
- lighting point 8 and 9 are controlled by switch 8
- lighting point 10 is controlled by time delay switch 9

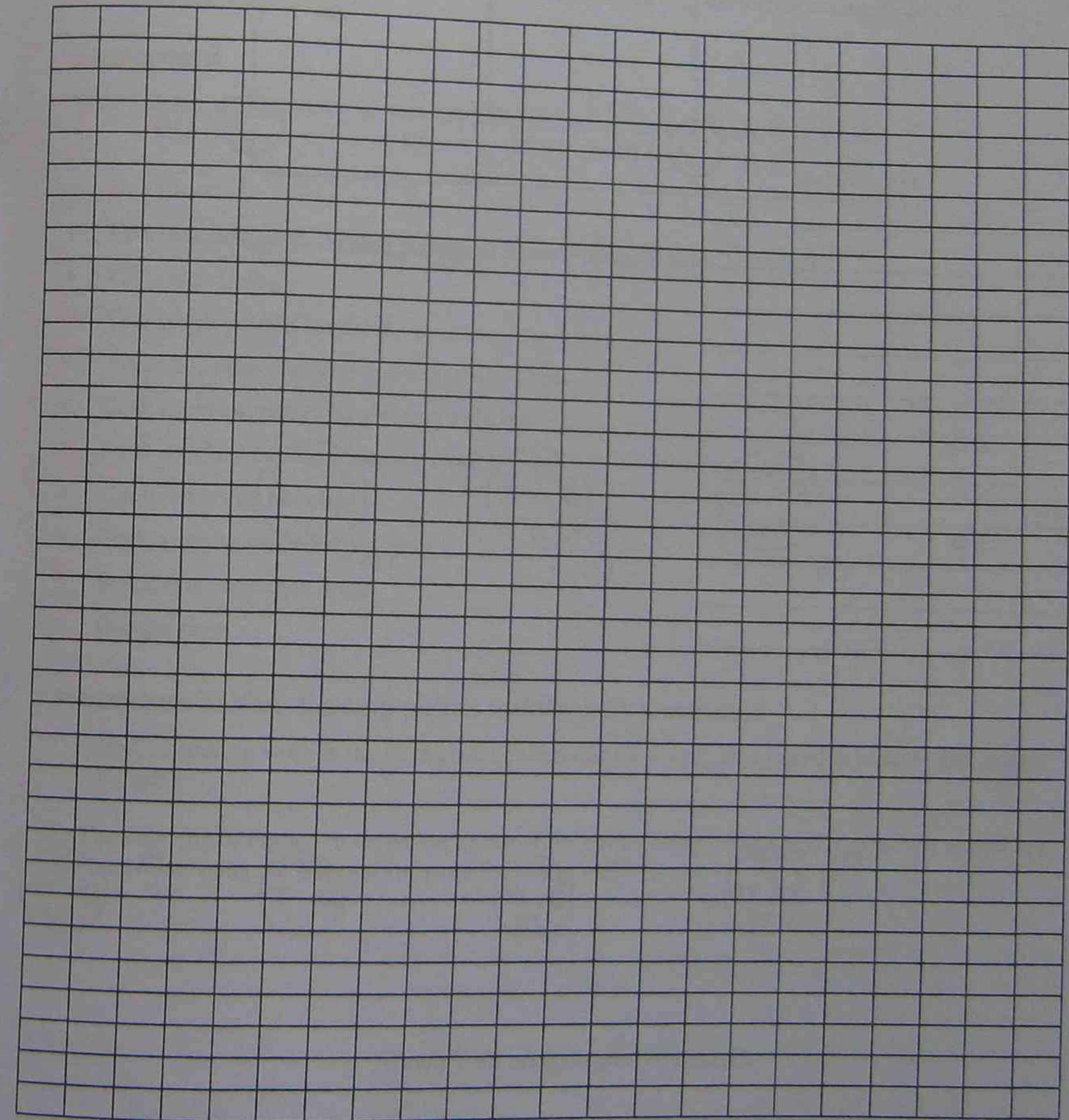


Figure 7 Complete lighting circuit

Multiple lighting points

Exercise

From the circuit diagram of Figure 8 below of multiple lighting points, develop the wiring diagram on Figure 9 and indicate on your drawing all TPS twin and earth, TPS twin and SDI cables.

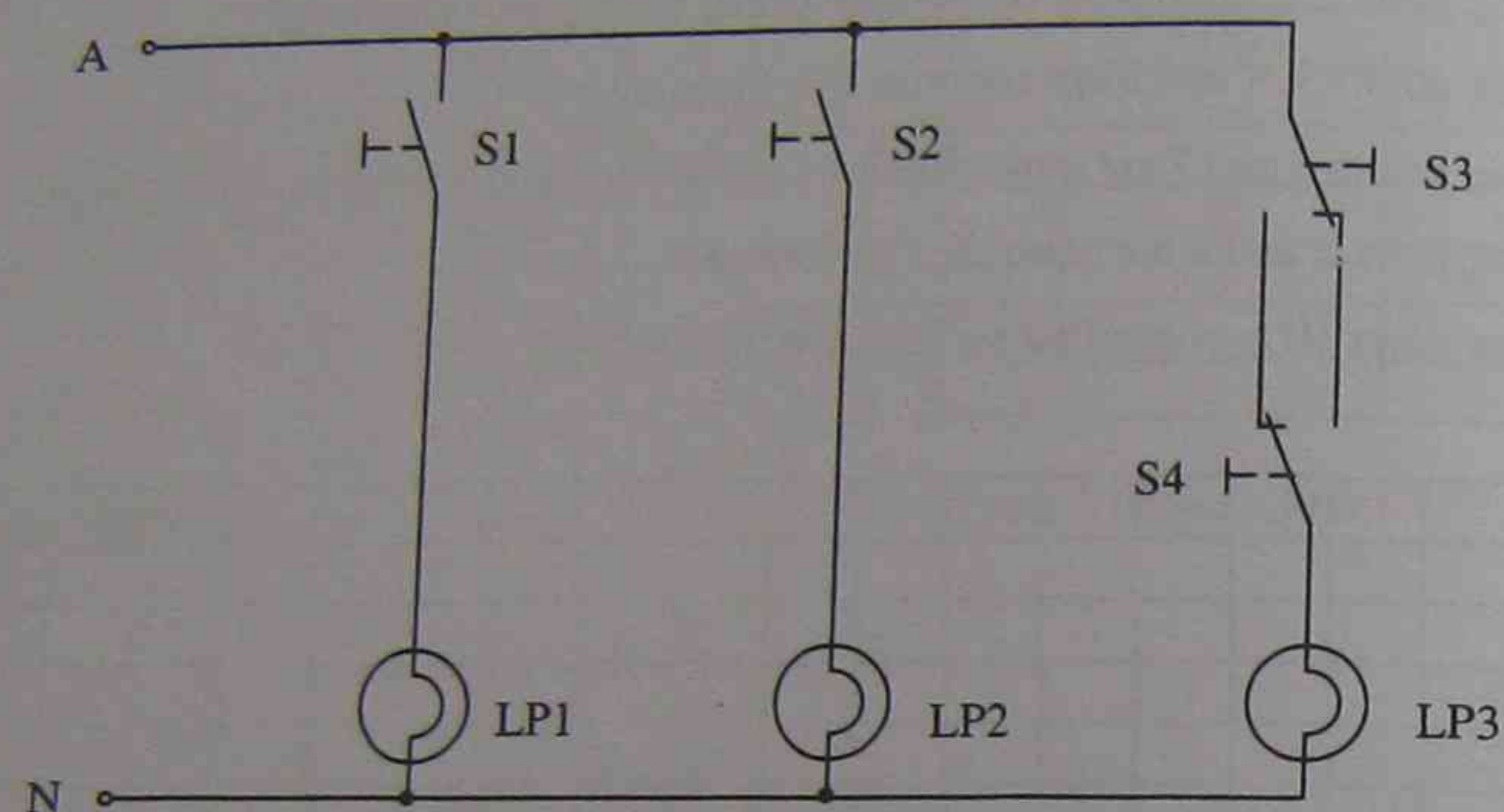
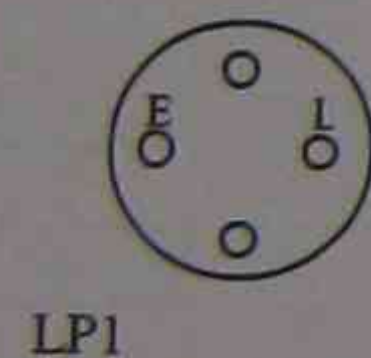


Figure 8 Circuit diagram – multiple lighting points

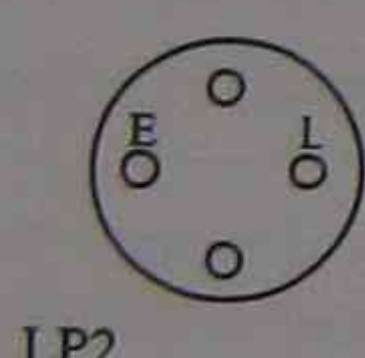
A O

N O

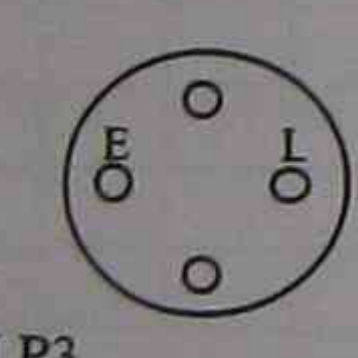
E O



LP1

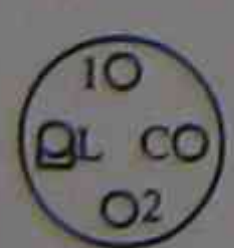


LP2

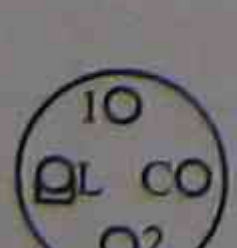


LP3

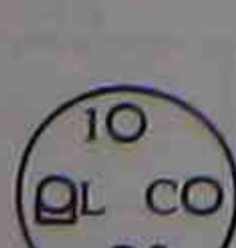
S1



S2



S3



S4

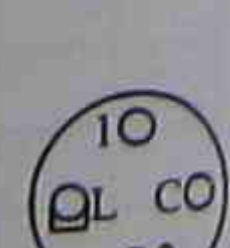


Figure 9 Wiring diagram for Figure 5

Practical exercise: The loop at the light method of wiring

Task

To use TPS cables to wire a lighting circuit using the 'loop at the light' method of wiring.

Objectives

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

- use TPS cables and the 'loop at the light' method of wiring to connect two lighting points controlled by individual switches
- use TPS cables and the 'loop at the light' method of wiring to extend an existing light circuit by adding an extra lighting point controlled by two-way switching
- test these circuits for correct operation and compliance with the testing requirements of AS/NZS 3000

Equipment

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

- Hand tools
- TPS twin and earth cable
- TPS twin cable
- TPS single double insulated
- Three BC batten holders and mounting flanges
- Four standard pattern single gang switches
- Four standard pattern mounting blocks
- Cable clips and pin clips
- Test lamps to suit voltage supply
- Insulation resistance tester
- Danger tags

Specifications

Procedure 1: Two lighting points individually controlled

1. Before starting work in the work area, confirm that the supply being used is isolated and danger tagged.
2. The drawing of Figure 10 shows the layout of the circuit being constructed. Obtain the necessary equipment using the diagram and parts list as a guide.

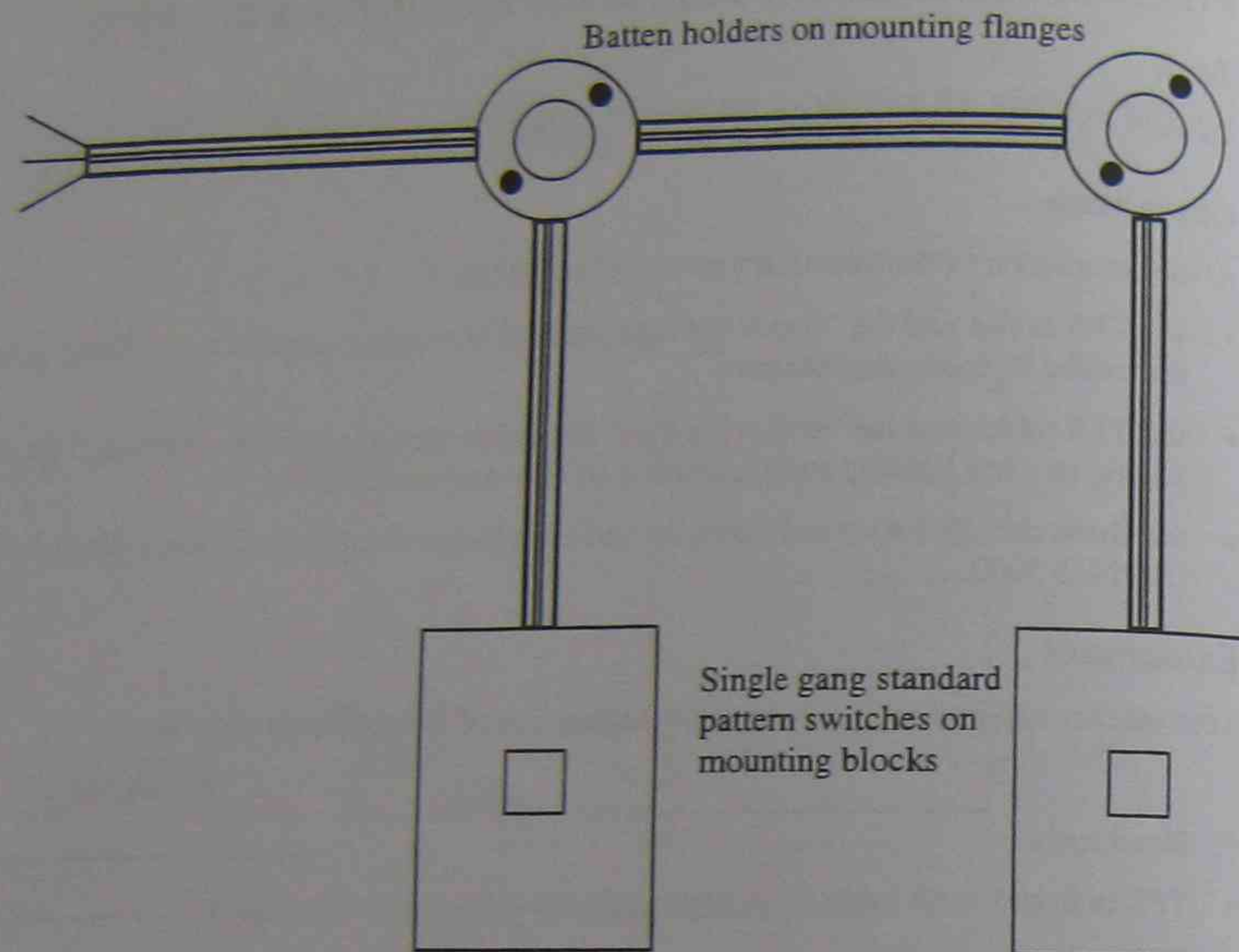


Figure 10 Equipment and cable layout

3. On the above diagram, mark the location dimensions as indicated by your teacher. Also indicate which are twin and earth and twin cables.
4. In the space below draw a completed wiring diagram of the lighting circuit using the 'looping from the light' method.

Figure 11 Wiring diagram

5. Install your wiring and accessories as instructed by your teacher. The following points may assist you:
 - leave approximately 100 mm of cable tail behind each accessory
 - approximately 15 mm of sheath should remain inside the accessory
 - use two screws to mount all accessories
 - twist the stranded conductors of the earth wire
 - twist conductors together when more than one cable is to be installed in a terminal
 - double back the conductor where only one cable is to be inserted into a terminal
6. Before connecting the to the supply test the insulation resistance of the circuit with the switches in both the off and on positions:
 - insulation resistance between the active and neutral conductors
 - insulation resistance between the active and earth
 - insulation resistance between the neutral and earth conductors.

? If you obtain a reading of less than infinity, ask your teacher for assistance

7. With the supply isolated, correctly connect the circuit to the supply terminals. Remove the danger tag and turn on the supply.
8. Confirm that the circuit operates correctly. If not, follow the teacher's instructions to diagnose the fault.

Have your teacher check your completed practical

9. Isolate the circuit and fit a danger tag to the isolating device. Confirm circuit isolation using test lamps or a multimeter.

Procedure 2: Adding a lighting point controlled by two-way switching

1. The drawing of Figure 12 shows the layout of the additions to the circuit to be installed. Obtain the necessary equipment using the diagram and parts list as a guide.

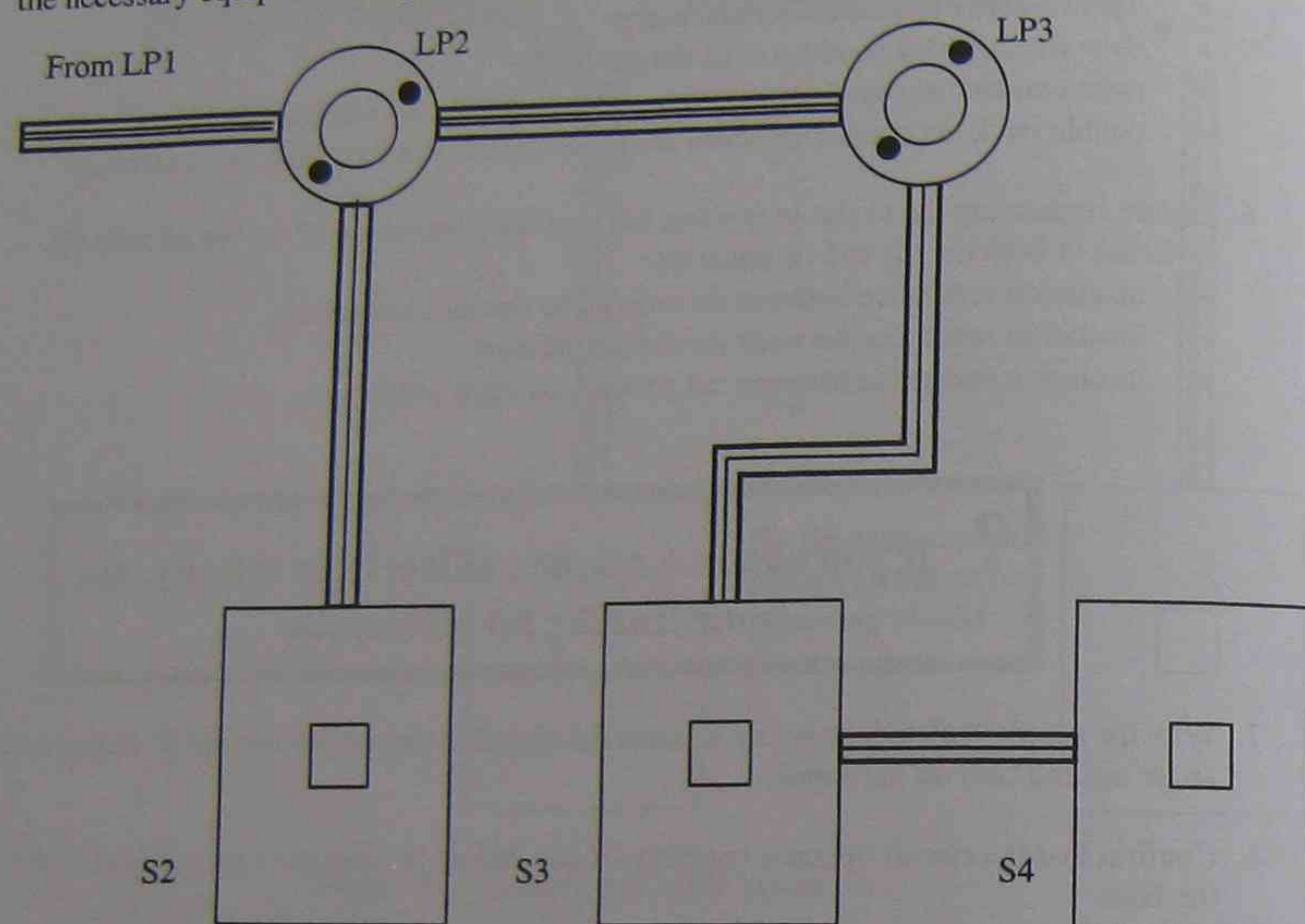


Figure 12 Equipment layout – two-way lighting circuit

2. On the above diagram, mark the location dimensions as indicated by your teacher. Also indicate which are twin and earth and twin cables.
3. In the space below draw a completed wiring diagram of the lighting circuit using the 'looping from the light' method.

Figure 13 Wiring diagram

4. Install your wiring and accessories as instructed by your teacher. The following points may assist you:
 - leave approximately 100 mm of cable tail behind each accessory
 - approximately 15 mm of sheath should remain inside the accessory
 - use two screws to mount all accessories
 - twist the stranded conductors of the earth wire
 - twist conductors together when more than one cable is to be installed in a terminal
 - double back the conductor where only one cable is to be inserted into a terminal
5. Before connecting the to the supply test the insulation resistance of the circuit with the switches in both the off and on positions:
 - insulation resistance between the active and neutral conductors
 - insulation resistance between the active and earth
 - insulation resistance between the neutral and earth conductors.

? If you obtain a reading of less than infinity, ask your teacher for assistance

6. With the supply isolated, correctly connect the circuit to the supply terminals. Remove the danger tag and turn on the supply.
7. Confirm that the circuit operates correctly. If not, follow the teacher's instructions to diagnose the fault.

Have your teacher check your completed practical

8. Isolate the circuit and fit a danger tag to the isolating device. Confirm circuit isolation using test lamps or a multimeter.
9. Carefully dismantle the equipment, remove the danger tag and return all equipment to its proper place.

Review question

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

1. Briefly explain what is meant by the 'loop at the light' method of wiring.

Questions 2 to 7 are about the circuit described below

A lighting circuit consists of the following:

- lighting point 1 controlled by switch 1
- lighting point 2 controlled by switch 2
- lighting points 3 and 4 (parallel connected) controlled by switch 3
- lighting point 5 controlled by switches 4 and 5 (two-way switching)
- lighting points 6 and 7 (parallel connected) controlled by switches 6, 7 and 8 (two-way and intermediate switching)
- lighting point 8 controlled by switch 9

2. Draw the circuit diagram for the lighting circuit.

3. Complete the diagram of Figure 14 by drawing the cable arrangement for the lighting circuit. TPS cables and the 'loop at the light' method of wiring are to be used. On the diagram clearly show the types of cable to be used (eg SDI, twin, twin and earth).

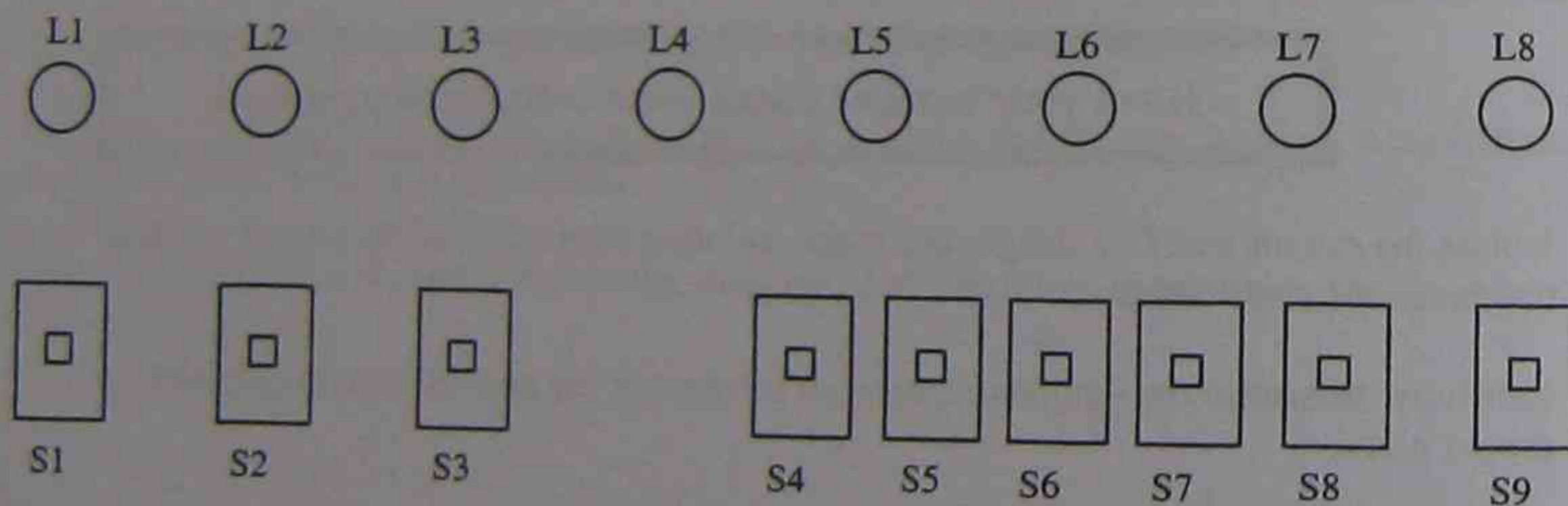


Figure 14 Lighting circuit cable arrangement

4. Complete the wiring diagram of Figure 15 by drawing the connections required at lighting point 2 and switch 2. Also show the incoming and outgoing conductors.

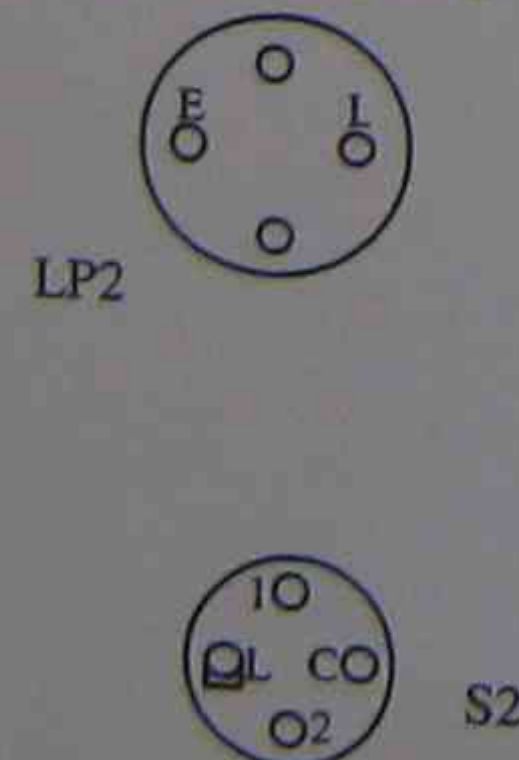


Figure 15 Wiring diagram for lighting point 2 and switch 2

5. Complete the wiring diagram of Figure 16 by drawing the connections required at lighting points 3 and 4 and switch 3. Also show the incoming and outgoing conductors.

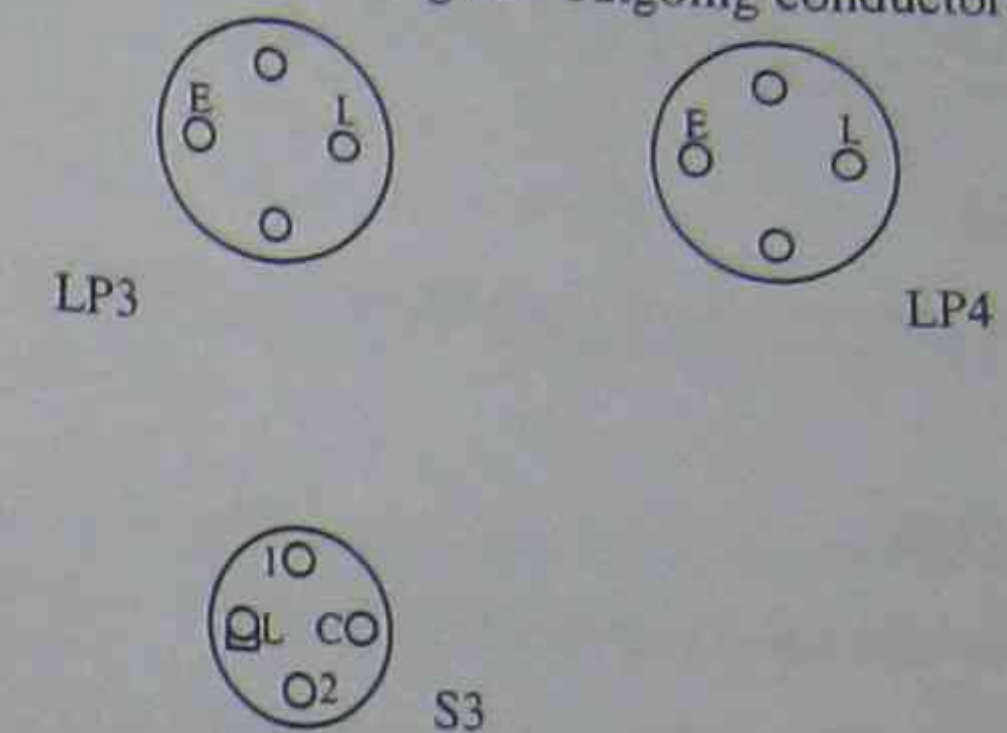


Figure 16 Wiring diagram for lighting points 3 and 4 and switch 3

6. Complete the wiring diagram of Figure 17 by drawing the connections required at lighting point 5 and switches 4 and 5. Also show the incoming and outgoing conductors.

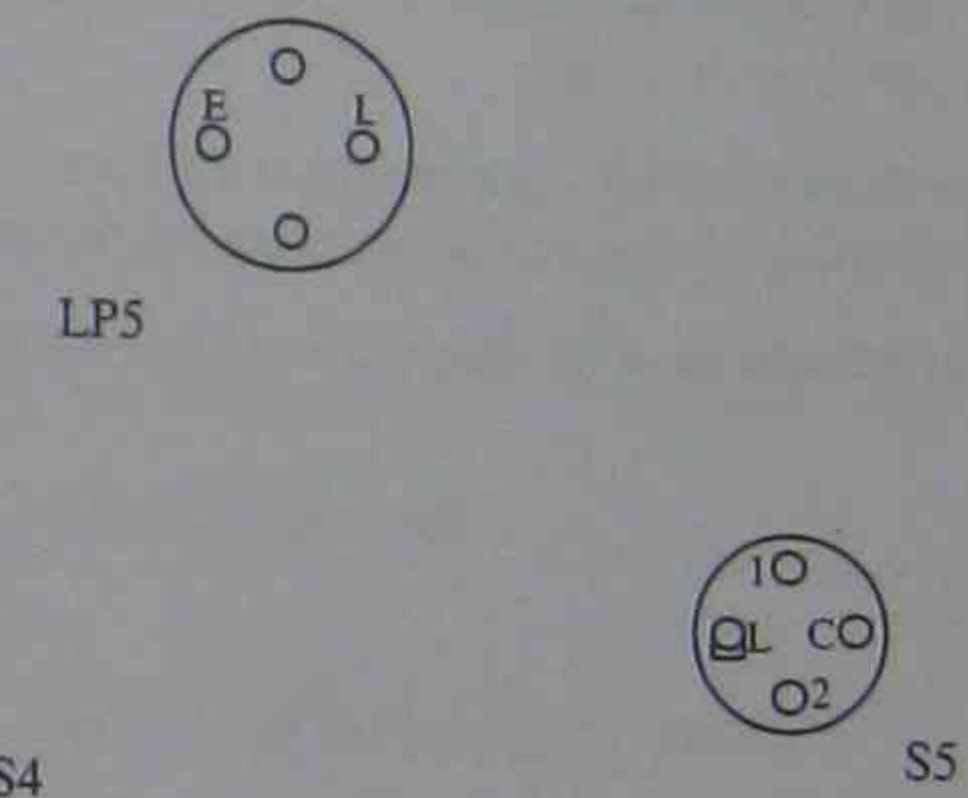


Figure 17 Wiring diagram for lighting point 5 and switches 4 and 5

7. Complete the wiring diagram of Figure 18 by drawing the connections required at lighting points 6 and 7 and switches 6, 7 and 8. Also show the incoming and outgoing conductors. The intermediate mechanism should be a HPM type.

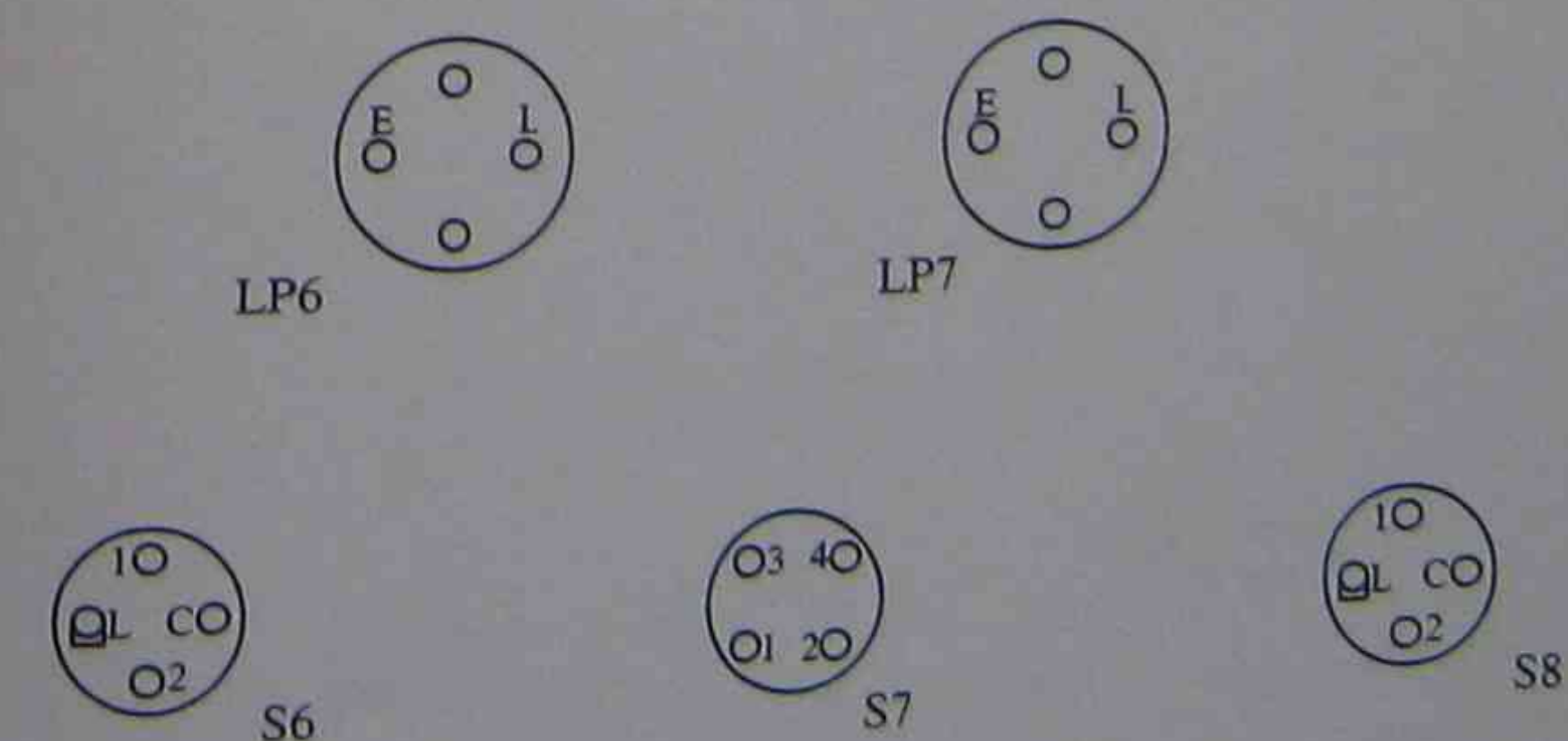


Figure 18 Wiring diagram for lighting points 6 and 7 and switches 6, 7 and 8

8 Light circuits 2

Purpose

In this topic you will learn about the wiring of lighting circuits using the 'loop at the switch' method of wiring.

Objectives

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

- describe the 'loop at the switch' method of wiring lighting circuits
- draw the circuit diagram for the lighting circuit of an installation that incorporates one-way, two-way and two-way and intermediate switching of lighting points
- draw the circuit diagram for the lighting circuit of an installation that incorporates one-way, two-way and two-way and intermediate switching of lighting points, where the 'loop at the switch' method of wiring is used.
- determine the cabling requirements for a lighting circuit, which is to be installed using the 'loop at the switch' method of wiring.
- install the accessories and complete the wiring for a lighting circuit incorporating one-way and two-way switching of lighting points using the 'loop at the switch' method.
- confirm correct operation of the circuit and test it for compliance with AS/NZS 3000.

The loop at the switch method of wiring

The 'loop at the switch' method is an alternative to the 'loop at the light' method of wiring. It is a particularly useful wiring method when there is little space for cables at the lighting point. For example, where a two storey building is constructed with exposed beams on the ceiling of the lower floor, generally giving little space for cables in the ceiling of the lower floor.

This method is not used to the same extent as the loop at the light method due to the lack of space behind switches that are mounted on door architraves.

As the name suggests, the supply active, neutral and earth conductors are looped at the switches of the lighting point. See Figure 1. A 'riser' is taken to each lighting point from its associated switch.

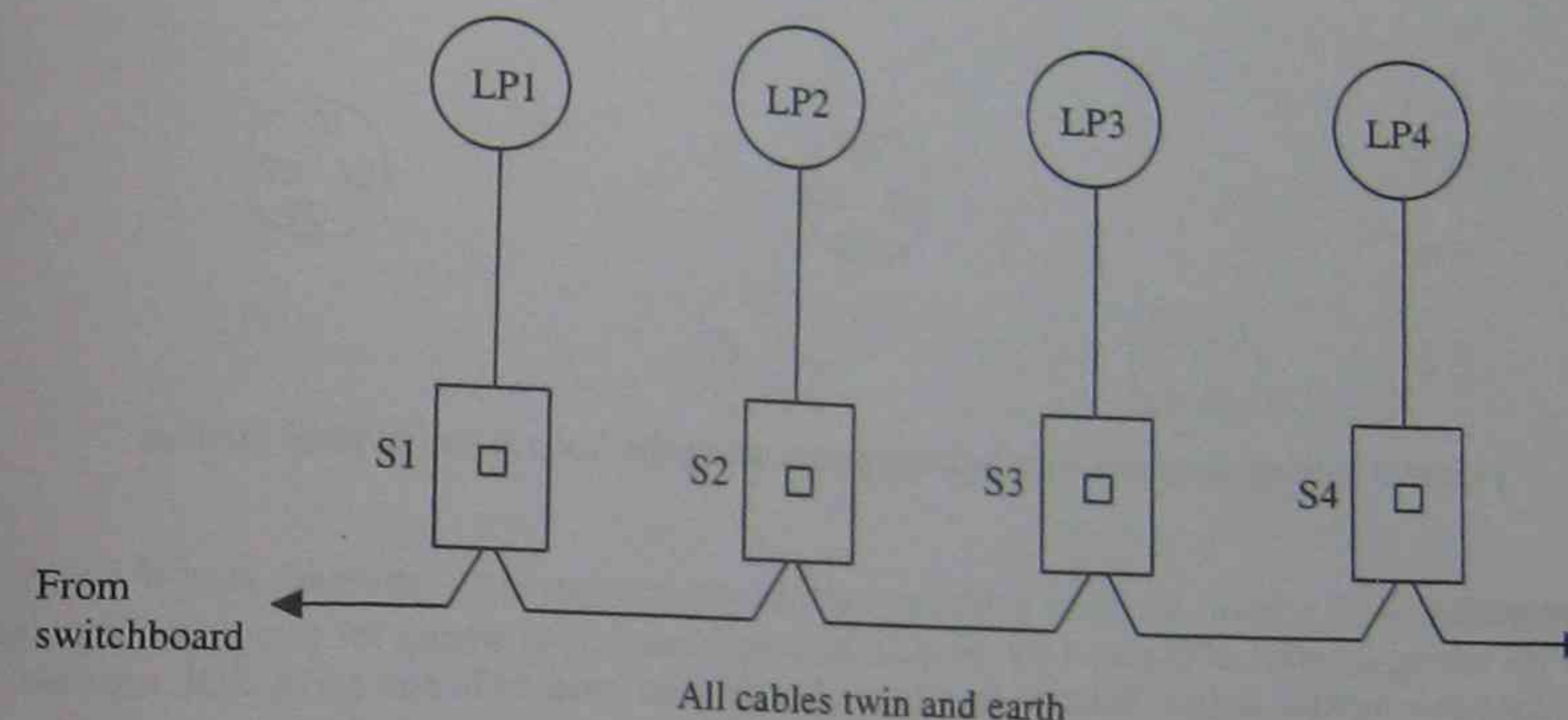
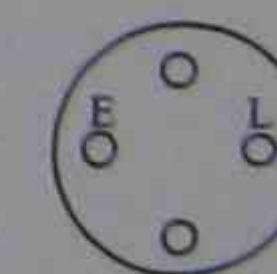


Figure 1 Cabling arrangement – 'loop at the switch' method

Exercise 1

Draw the wiring diagram on Figure 2 for 'loop at the switch' method of wiring. Indicate each type of cable used (eg twin, twin and earth, SDI)



A O

N O

E O

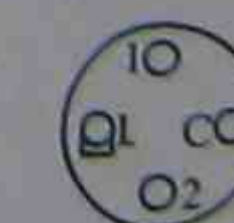


Figure 2 Wiring diagram – 'loop at the switch'

Exercise 2

Draw the wiring of diagram of Figure 3 to incorporate two lighting points using 'loop at the switch' method of wiring. Indicate each type of cable used (eg twin, twin and earth, SDI)

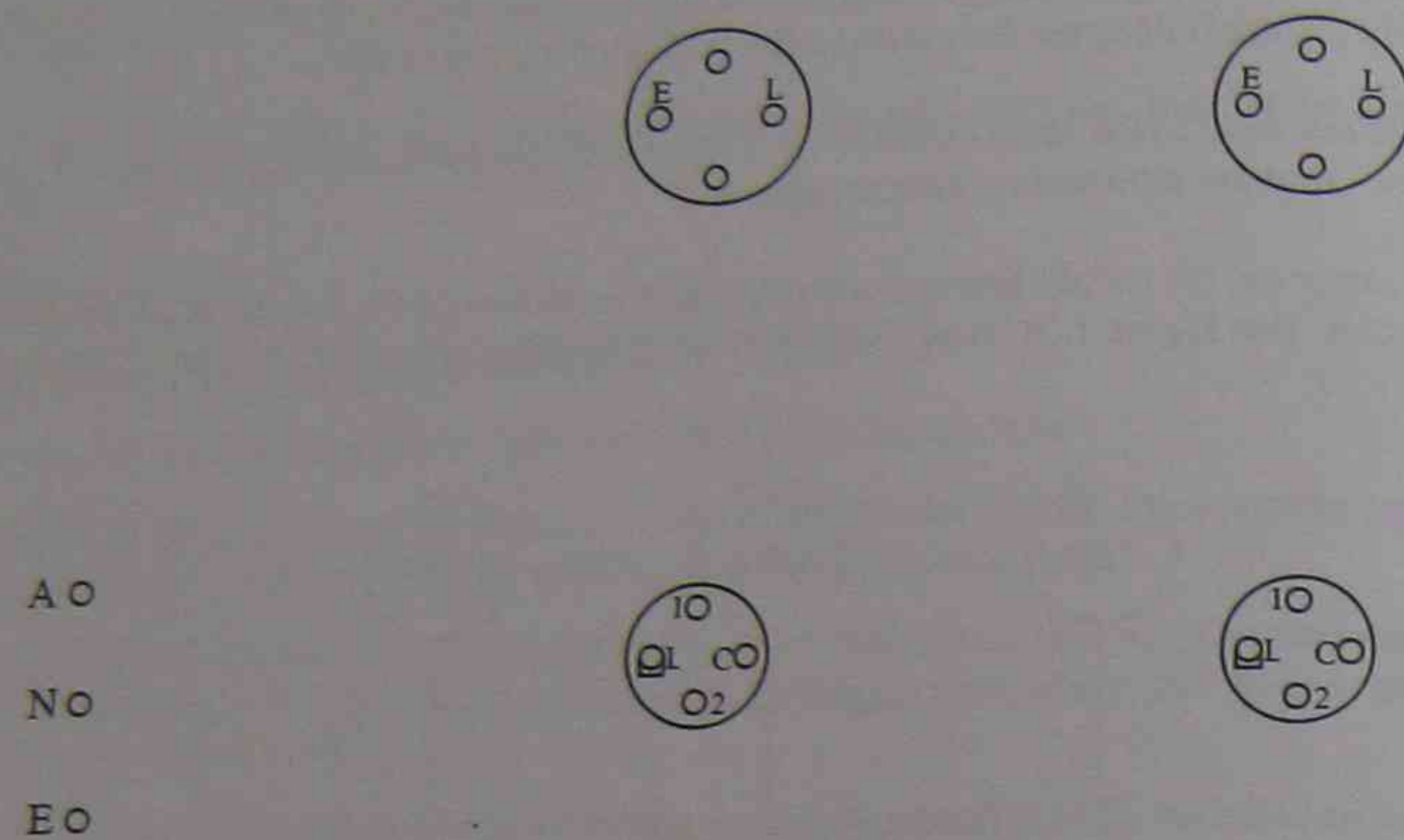


Figure 3 Wiring diagram – two lighting points using the 'loop at the switch' method

Exercise 3

Draw the wiring diagram of Figure 4 for 'loop at the switch' method of wiring for two-way switching controlling two lighting points. Indicate each type of cable used (twin, twin and earth, SDI, separate earth).

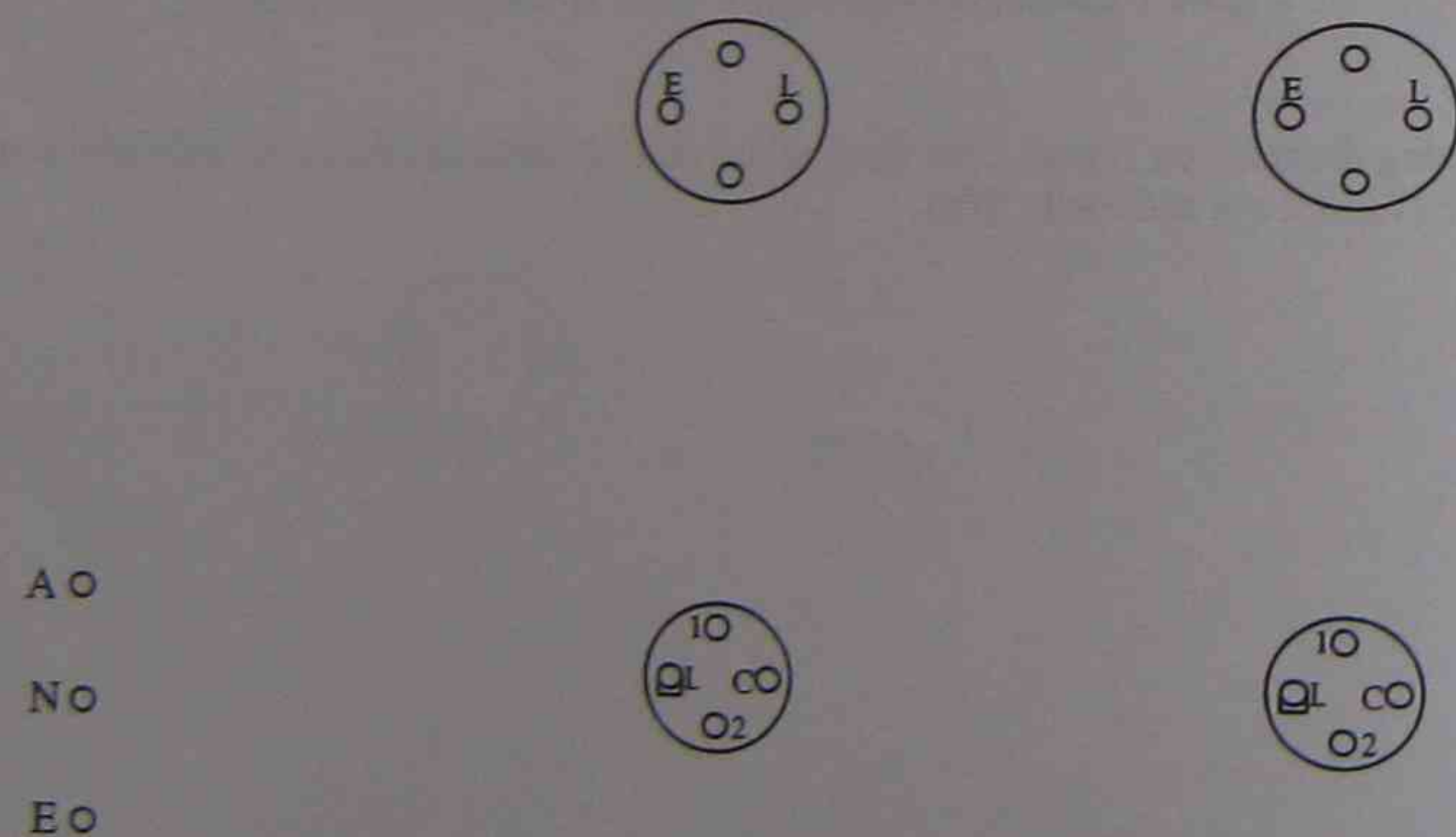


Figure 4 Wiring diagram – two lighting points controlled by two-way switching using 'loop at the switch' method of wiring.

Two-way and intermediate switching**Exercise 4**

Draw the wiring diagram of Figure 5 for 'loop at the switch' method of wiring for two-way and intermediate switching controlling one lighting point. Indicate each type of cable used (twin, twin and earth, SDI, separate earth).

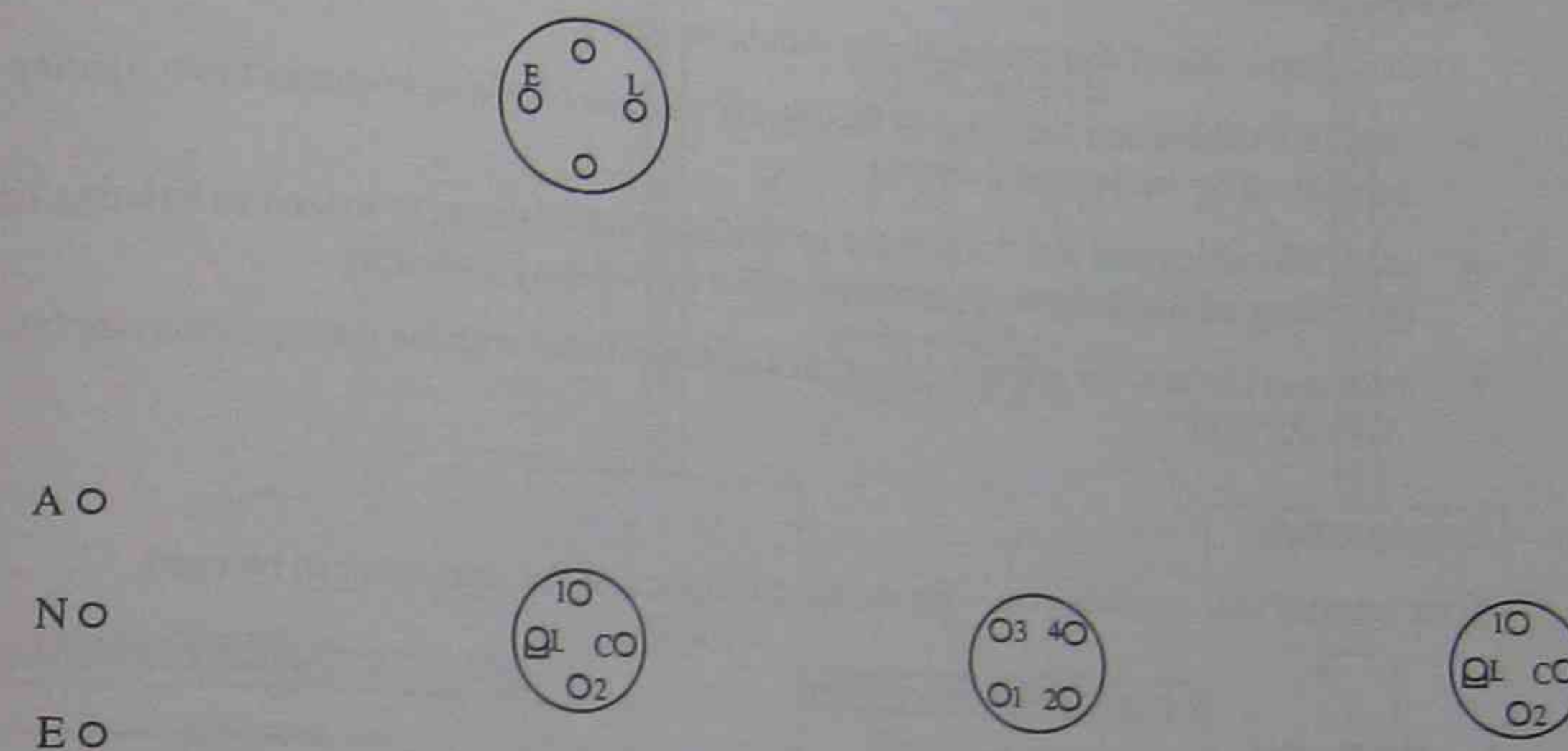


Figure 5 Wiring diagram – two-way and intermediate switching using the 'loop at the switch' method

Practical exercise: The loop at the switch method of wiring

Task

To use TPS cables to wire a lighting circuit using the 'loop at the switch' method of wiring.

Objectives

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

- use TPS cables and the 'loop at the switch' method of wiring to connect two lighting points controlled by individual switches
- use TPS cables and the 'loop at the switch' method of wiring to extend an existing light circuit by adding an extra lighting point controlled by two-way switching
- test these circuits for correct operation and compliance with the testing requirements of AS/NZS 3000

Equipment

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

Specifications

- Hand tools
- TPS twin and earth cable
- TPS twin cable
- TPS single double insulated
- Three BC batten holders and mounting flanges
- Four standard pattern single gang switches
- Four standard pattern mounting blocks
- Cable clips and pin clips
- Test lamps to suit voltage supply
- Insulation resistance tester
- Danger tags

Procedure 1: Two lighting points individually controlled

1. Before starting work in the work area, confirm that the supply being used is isolated and danger tagged.
2. The drawing of Figure 6 shows the layout of the circuit being constructed. Obtain the necessary equipment using the diagram and parts list as a guide.

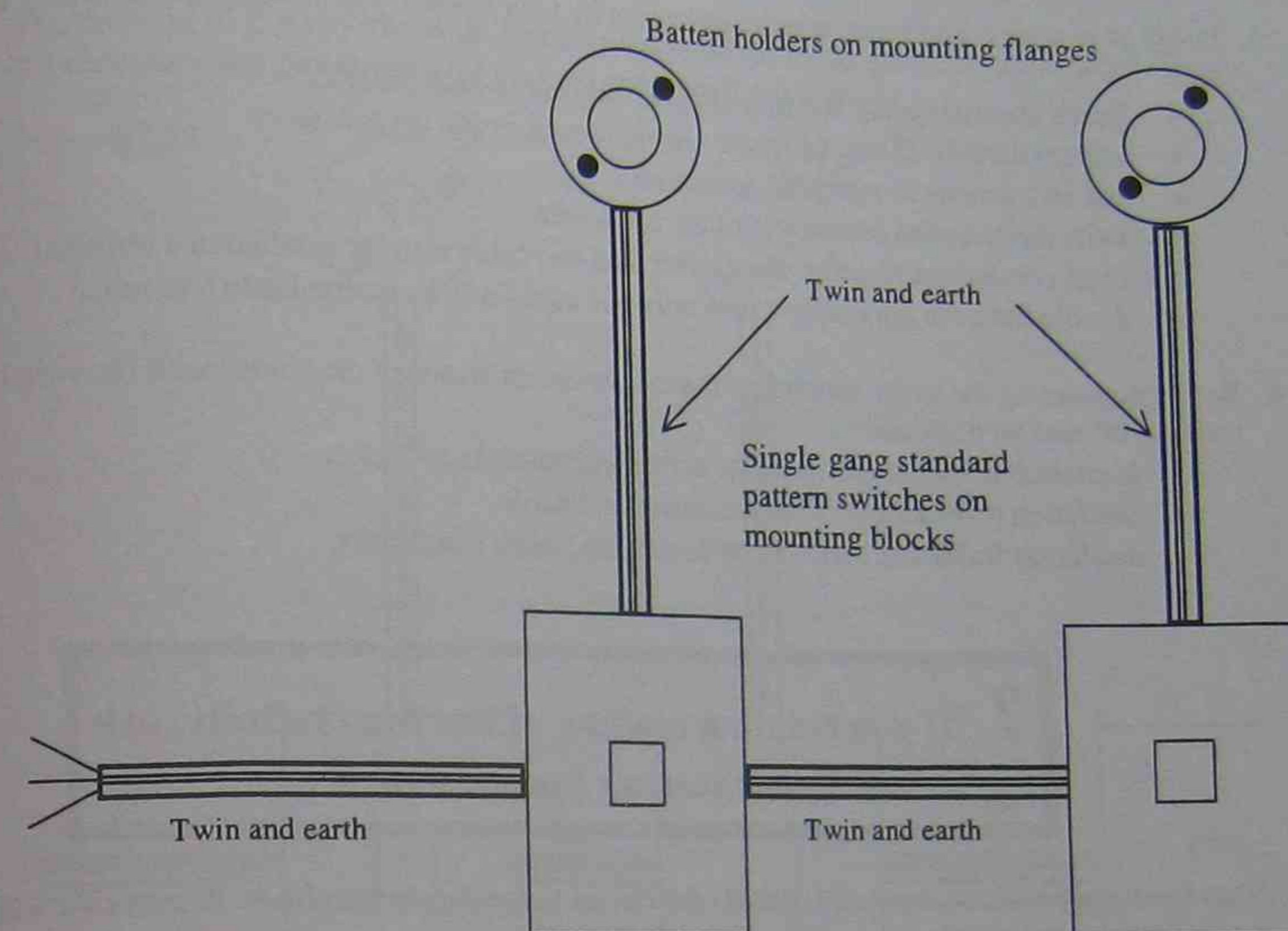


Figure 6 Equipment and cable layout

3. On the above diagram, mark the location dimensions as indicated by your teacher.
4. In the space below draw a completed wiring diagram of the lighting circuit using the 'looping from the switch' method.

Figure 7 Wiring diagram

5. Install your wiring and accessories as instructed by your teacher. The following points may assist you:

- leave approximately 100 mm of cable tail behind each accessory
- approximately 15 mm of sheath should remain inside the accessory
- use two screws to mount all accessories
- twist the stranded conductors of the earth wire
- twist conductors together when more than one cable is to be installed in a terminal
- double back the conductor where only one cable is to be inserted into a terminal

6. Before connecting the to the supply test the insulation resistance of the circuit with the switches in both the off and on positions:

- insulation resistance between the active and neutral conductors
- insulation resistance between the active and earth
- insulation resistance between the neutral and earth conductors.

? If you obtain a reading of less than infinity, ask your teacher for assistance

7. With the supply isolated, correctly connect the circuit to the supply terminals. Remove the danger tag and turn on the supply.

8. Confirm that the circuit operates correctly. If not, follow the teacher's instructions to diagnose the fault.

Have your teacher check your completed practical

9. Isolate the circuit and fit a danger tag to the isolating device. Confirm circuit isolation using test lamps or a multimeter.

Procedure 2: Adding a lighting point controlled by two-way switching

1. The drawing of Figure 7 shows the layout of the additions to the circuit to be installed. Obtain the necessary equipment using the diagram and parts list as a guide.

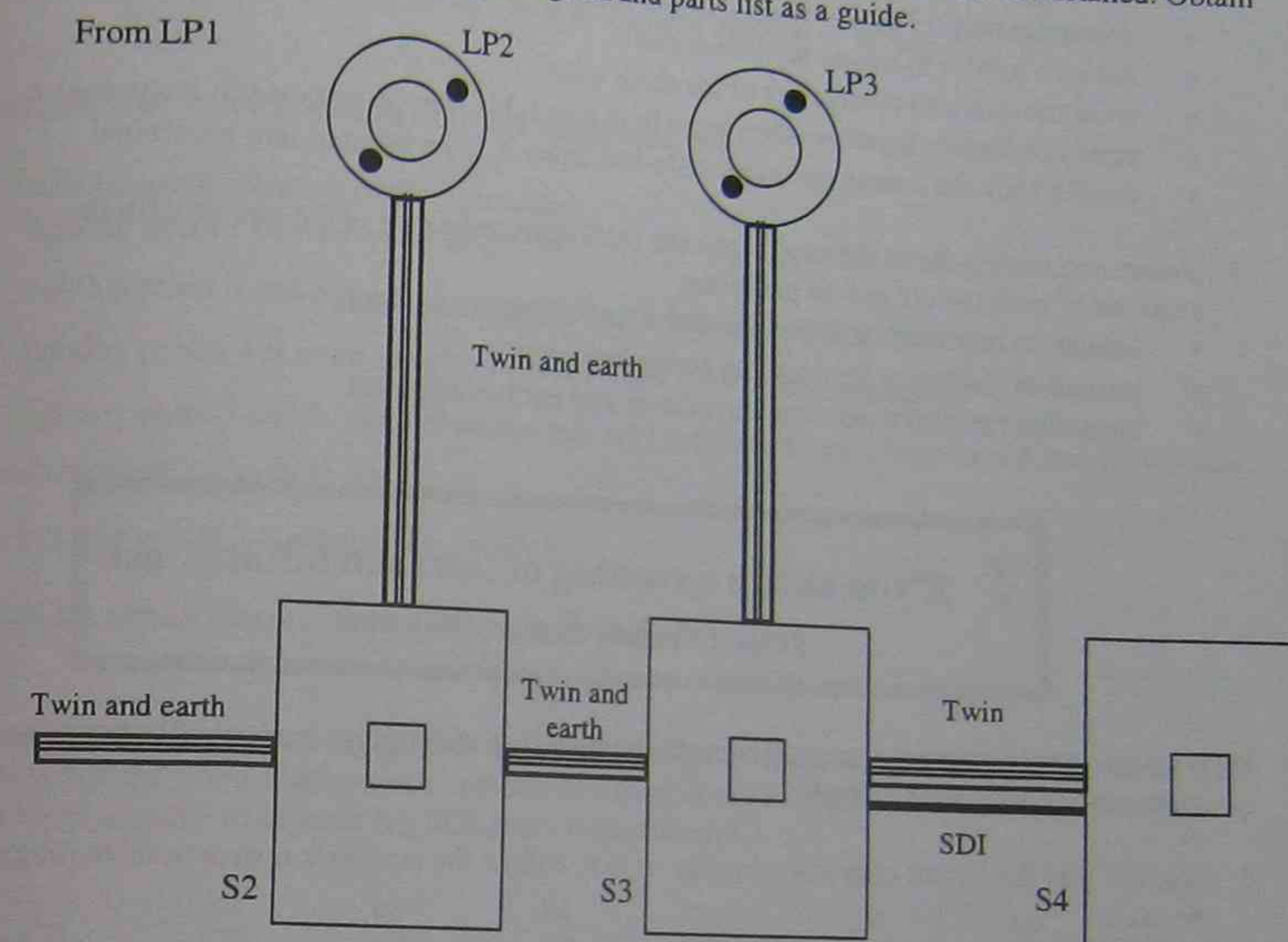


Figure 7 Equipment layout – two-way lighting circuit

2. On the above diagram, mark the location dimensions as indicated by your teacher. Also indicate which are twin and earth and twin cables.
3. In the space below draw a completed wiring diagram of the lighting circuit using the 'looping from the light' method.

Figure 8 Wiring diagram

4. Install your wiring and accessories as instructed by your teacher. The following points may assist you:

- leave approximately 100 mm of cable tail behind each accessory
- approximately 15 mm of sheath should remain inside the accessory
- use two screws to mount all accessories
- twist the stranded conductors of the earth wire
- twist conductors together when more than one cable is to be installed in a terminal
- double back the conductor where only one cable is to be inserted into a terminal

5. Before connecting the to the supply test the insulation resistance of the circuit with the switches in both the off and on positions:

- insulation resistance between the active and neutral conductors
- insulation resistance between the active and earth
- insulation resistance between the neutral and earth conductors.

? If you obtain a reading of less than infinity, ask your teacher for assistance

6. With the supply isolated, correctly connect the circuit to the supply terminals. Remove the danger tag and turn on the supply.
7. Confirm that the circuit operates correctly. If not, follow the teacher's instructions to diagnose the fault.

Have your teacher check your completed practical

8. Isolate the circuit and fit a danger tag to the isolating device. Confirm circuit isolation using test lamps or a multimeter.
9. Carefully dismantle the equipment, remove the danger tag and return all equipment to its proper place.

Review question

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

1. Briefly explain what is meant by the 'loop at the light' method of wiring.

Questions 2 to 7 are about the circuit described below

A lighting circuit consists of the following:

- lighting point 1 controlled by switch 1
- lighting point 2 and 3 (parallel connected) are controlled by switch 2
- lighting points 4 is controlled by switches 3 and 4 (two-way switching)
- lighting point 5 and 6 (parallel connected) are controlled by switches 5 and 6 and 7 (two-way and intermediate switching)
- lighting points 7 controlled by switch 8

2. Draw the circuit diagram for the lighting circuit.

3. Complete the diagram of Figure 8 by drawing the cable arrangement for the lighting circuit. TPS cables and the 'loop at the switch' method of wiring are to be used. On the diagram clearly show the types of cable to be used (eg SDI, twin, twin and earth).

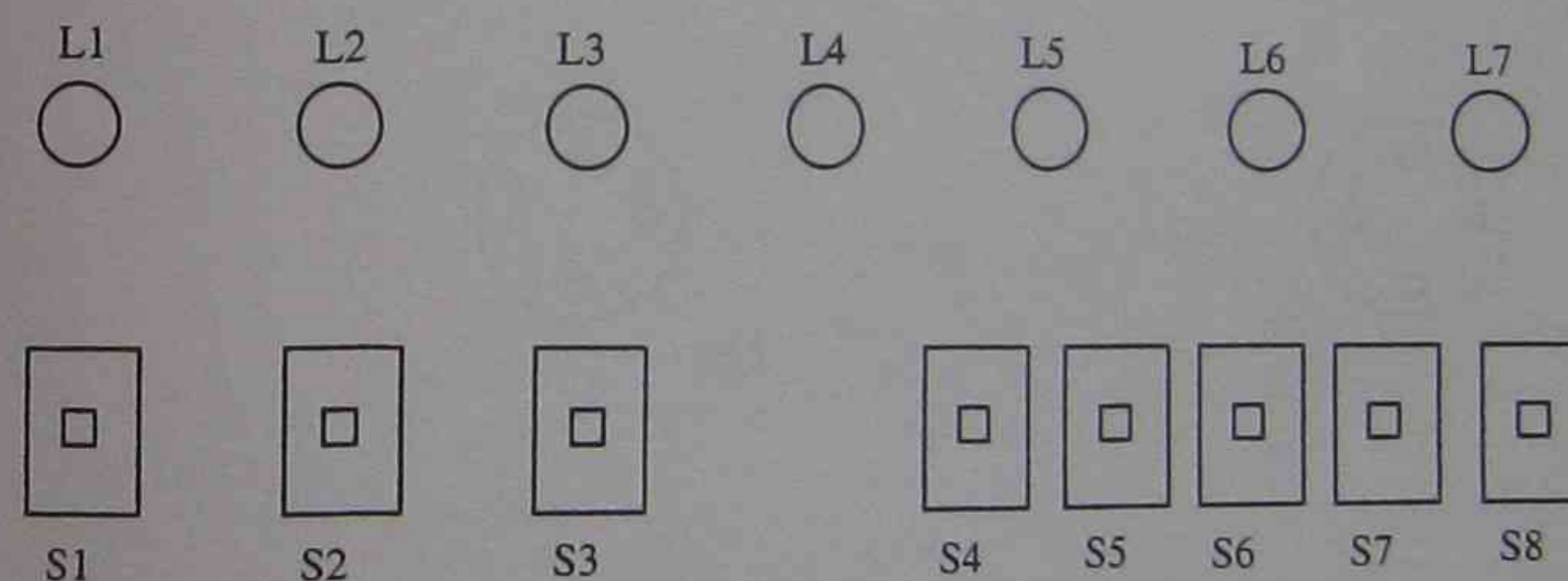


Figure 8 Lighting circuit cable arrangement

4. Complete the wiring diagram of Figure 9 by drawing the connections required at lighting points 2 and 3 and switch 2. Also show the incoming and outgoing conductors.

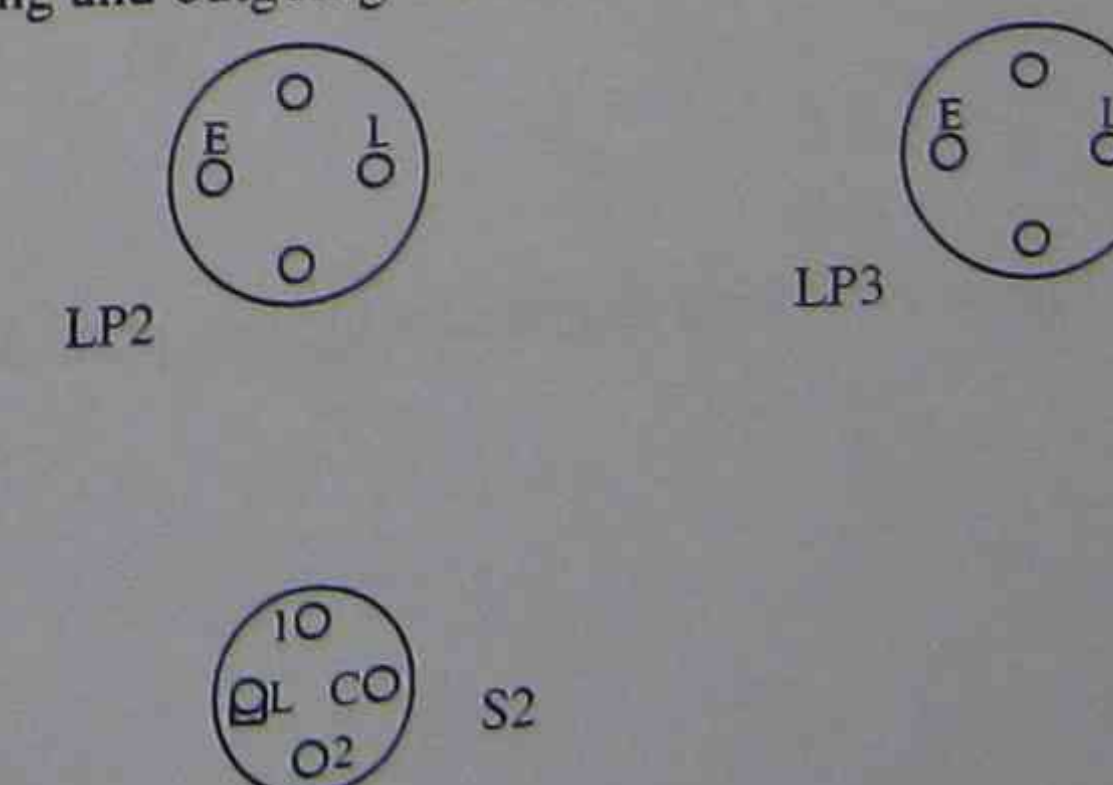


Figure 9 Wiring diagram for lighting points 2 and 3 and switch 2

5. Complete the wiring diagram of Figure 10 by drawing the connections required at lighting point 4 and switches 3 and 4. Also show the incoming and outgoing conductors.

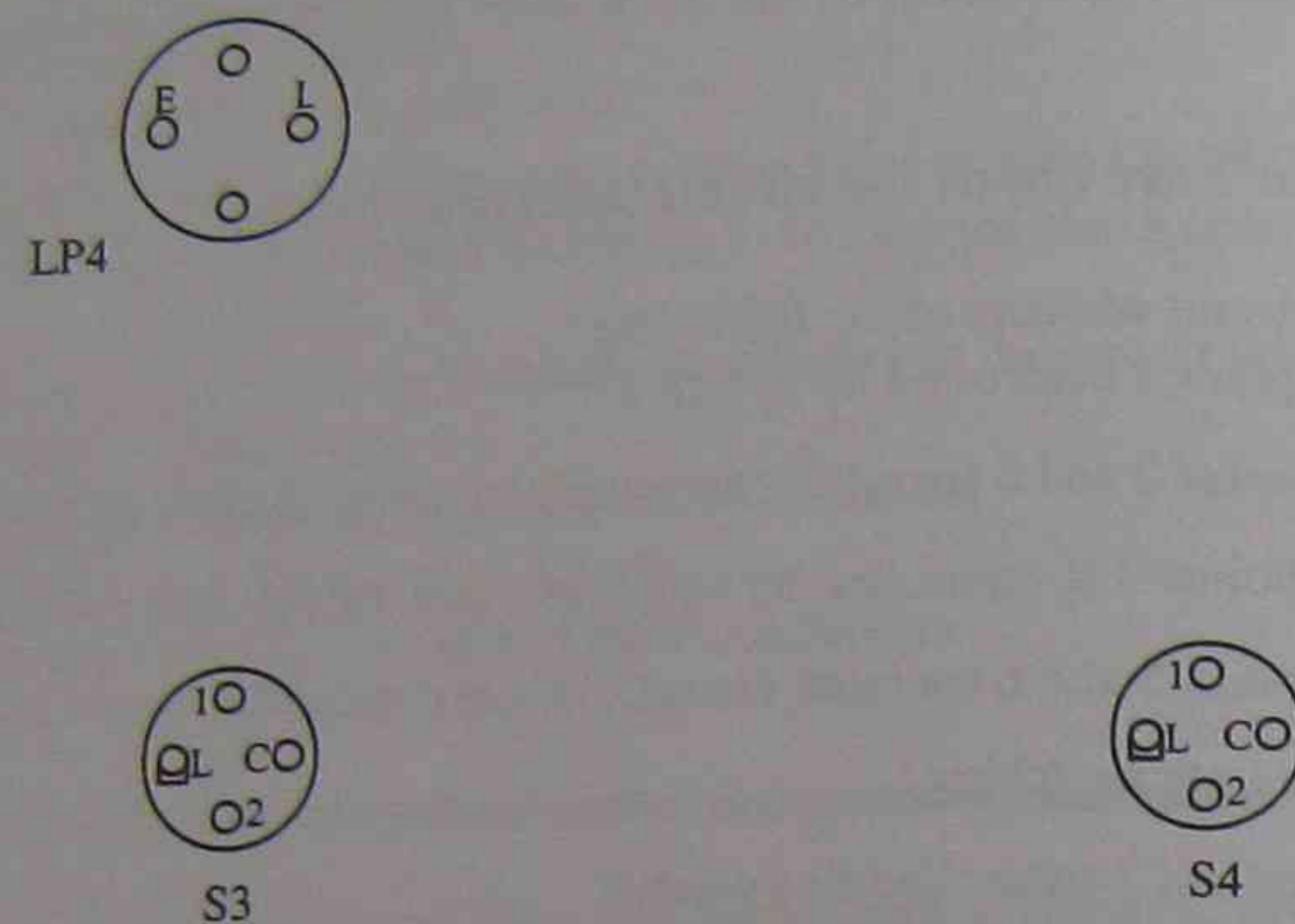


Figure 10 Wiring diagram for lighting point 4 and switches 3 and 4

6. Complete the wiring diagram of Figure 11 by drawing the connections required at lighting points 5 and 6 and switches 5, 6 and 7. Also show the incoming and outgoing conductors. The intermediate switch should be a Clipsal type.

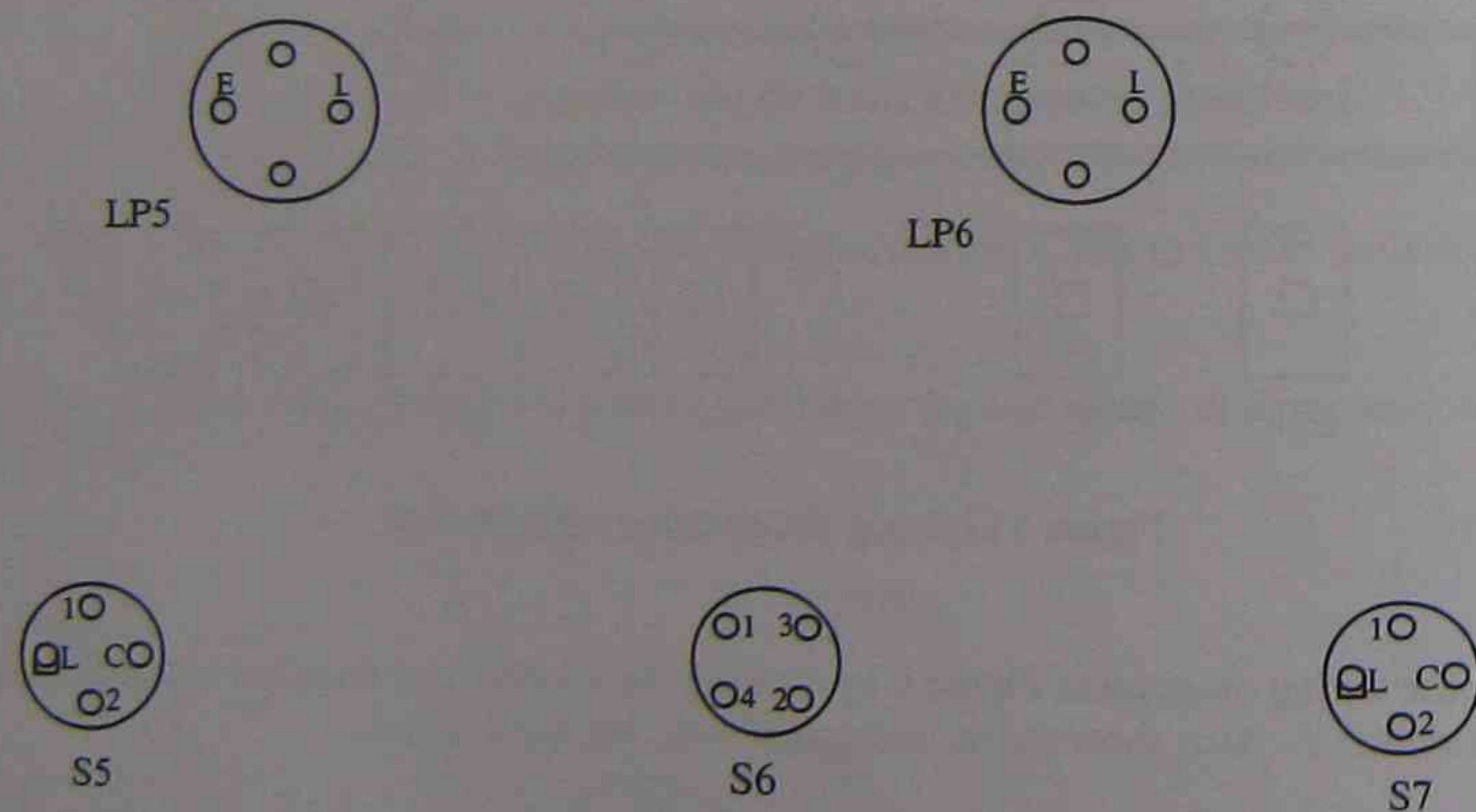


Figure 11 Wiring diagram for lighting point 5 and 6 and switches 5, 6 and 7

Sample Assessment

Sample theory test 1

Time allowed 1 hour

Total marks available for this test are 100

Section	Marks
Section A	/40
Section B	/20
Section C	/20
Section D	/20
Total	/100

Student equipment required

- Non-programmable calculator
- Pens, pencils, erasers
- Rule

Section A – 40 marks

For each question, mark the correct answer in the space provided on your answer sheet. Total marks available in this section is 40. Each question is worth 2 mark.

1. A drawing that shows a general overview of the complete job, with arrangement of parts and a list of parts is called a/an:
(A) assembly drawing
(B) detail drawing
(C) pictorial drawing
(D) sub-assembly drawing
2. A drawing with all the details you need to manufacture the part is called a/an:
(A) assembly drawing
(B) detail drawing
(C) pictorial drawing
(D) sub-assembly drawing
3. The area of the basic A0 drawing sheet is:
(A) 0.5 m^2
(B) 0.75 m^2
(C) 1.0 m^2
(D) 1.72 m^2
4. What type of lines are drawn to indicate the centre of a circle?
(A) continuous – thick
(B) continuous – thin
(C) dashed
(D) chain
5. The ϕ is used when dimensioning a drawing to indicate to a:
(A) diameter
(B) radius
(C) taper
(D) slope
6. An object has a dimension of 455 mm and is drawn to a scale of 1:5. The length of the line would be drawn at:
(A) 455 mm
(B) 45.5 mm
(C) 91 mm
(D) 9.1 mm
7. Which of the following is not an example of pictorial drawing:
(a) isometric
(b) orthogonal
(c) axonometric
(d) oblique
8. The drawing that consists of a number of systematically arranged views of the faces of an object is called a/an:
(A) oblique drawing
(B) orthogonal drawing
(C) axonometric drawing
(D) chevalier drawing
9. The orthogonal projection systems recommended by AS/NZS 1100 is:
(A) first angle projection
(B) second angle projection
(C) third angle projection
(D) fourth angle projection
10. The pictorial drawing which has all edges receding at 30° from the horizontal is called a/an:
(A) trimetric projection
(B) dimetric projection
(C) isometric projection
(D) perspective projection
11. The method of drawing used to show hidden or internal features is called:
(A) Sectioning
(B) Scaling
(C) Detailing
(D) Internal rendering
12. The part of a plan/working drawing that is used to show the heights and internal structures of a building is called the:
(A) elevation plan
(B) section plan
(C) site plan
(D) floor plan
13. The scaled dimensions used on a floor plan of a building are usually shown in:
(A) metres
(B) centimetres
(C) millimetres
(D) square millimetres

14. The type of footing that consists of a continuous reinforced concrete pour around the building is a base for the external walls is called:
- concrete slab footing
 - strip footing
 - stumped footing
 - pier and beam footing
15. External walls of brick with an internal timber frame are called:
- feature walls
 - double brick walls
 - stucco walls
 - brick veneer walls
16. When working in the scrawl space of a roof it is essential to walk only on the:
- rafters
 - ceiling joists
 - purlins
 - battens
17. The sub floor timber used to support the floor joist is called:
- the bearers
 - the piers
 - the bottom plate
 - the studs
18. The vertical members of a timber framed wall are called the:
- studs
 - noggings
 - braces
 - lintel
19. The horizontal pieces of timber fixed between studs are called;
- studs
 - noggings
 - braces
 - lintel
20. The weight of the roof of a building is supported by:
- the external walls
 - the internal walls
 - the roof hanging beams
 - the roof purlins

Section B

Marks

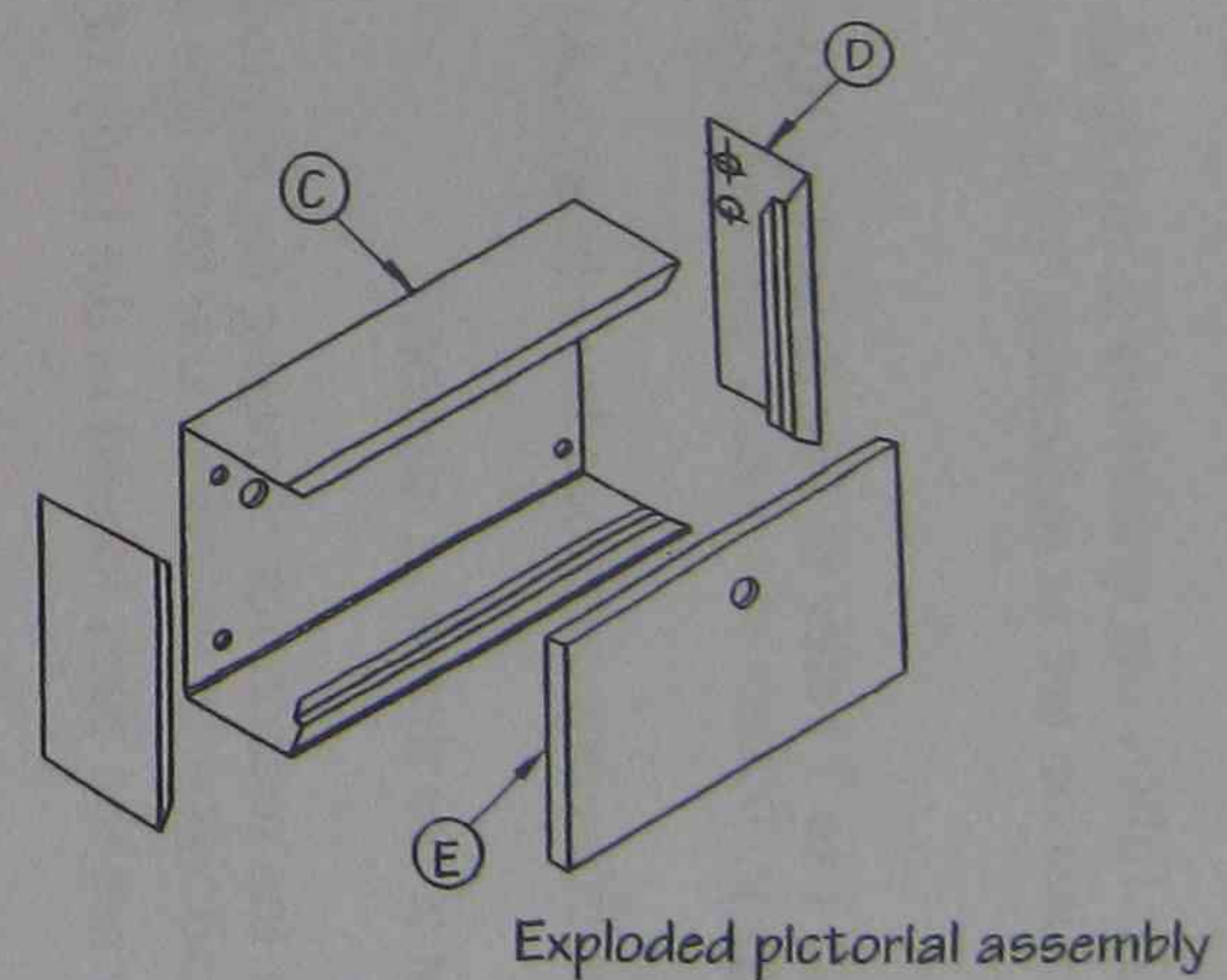
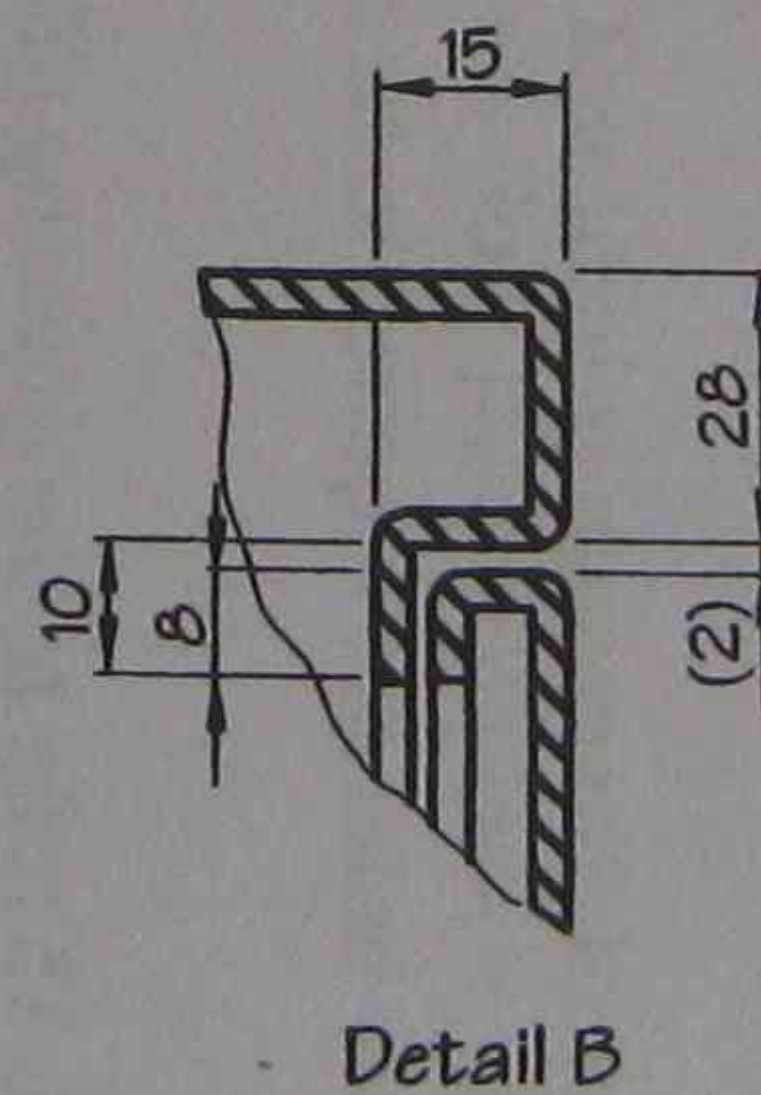
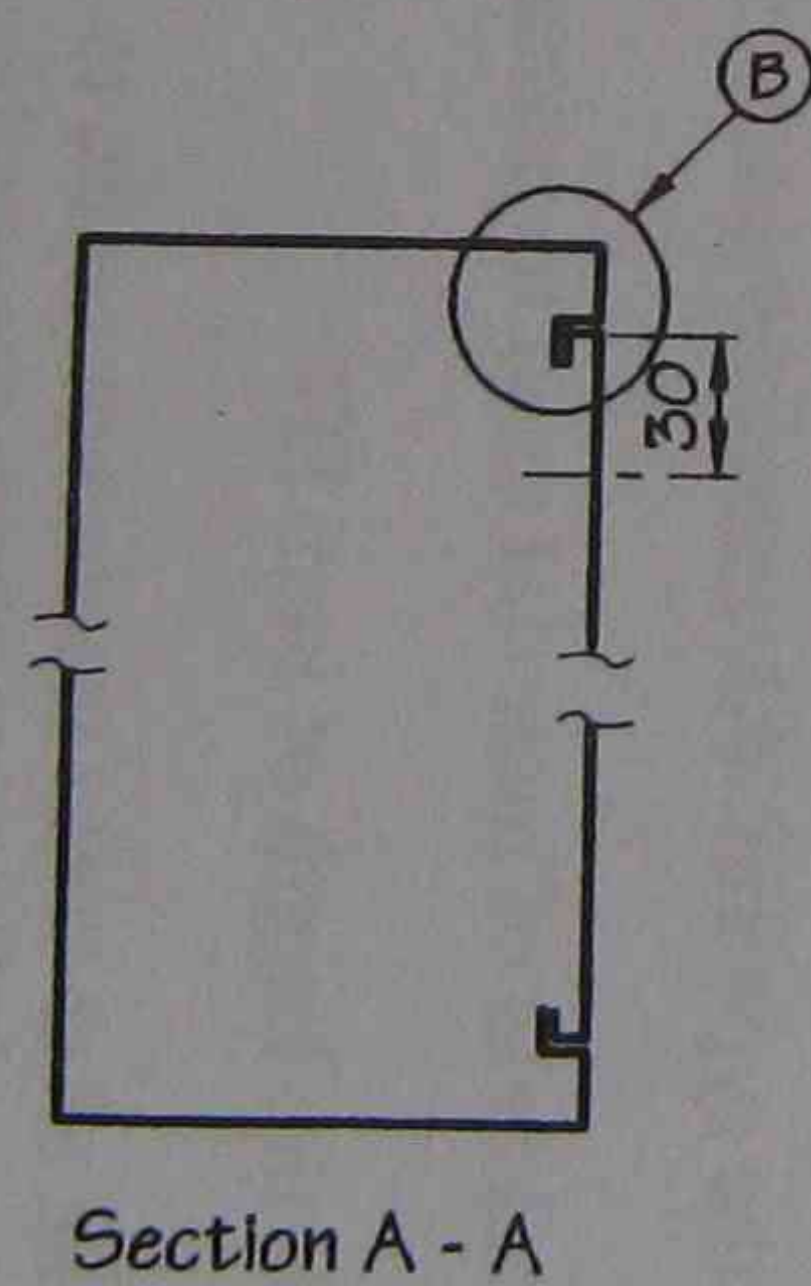
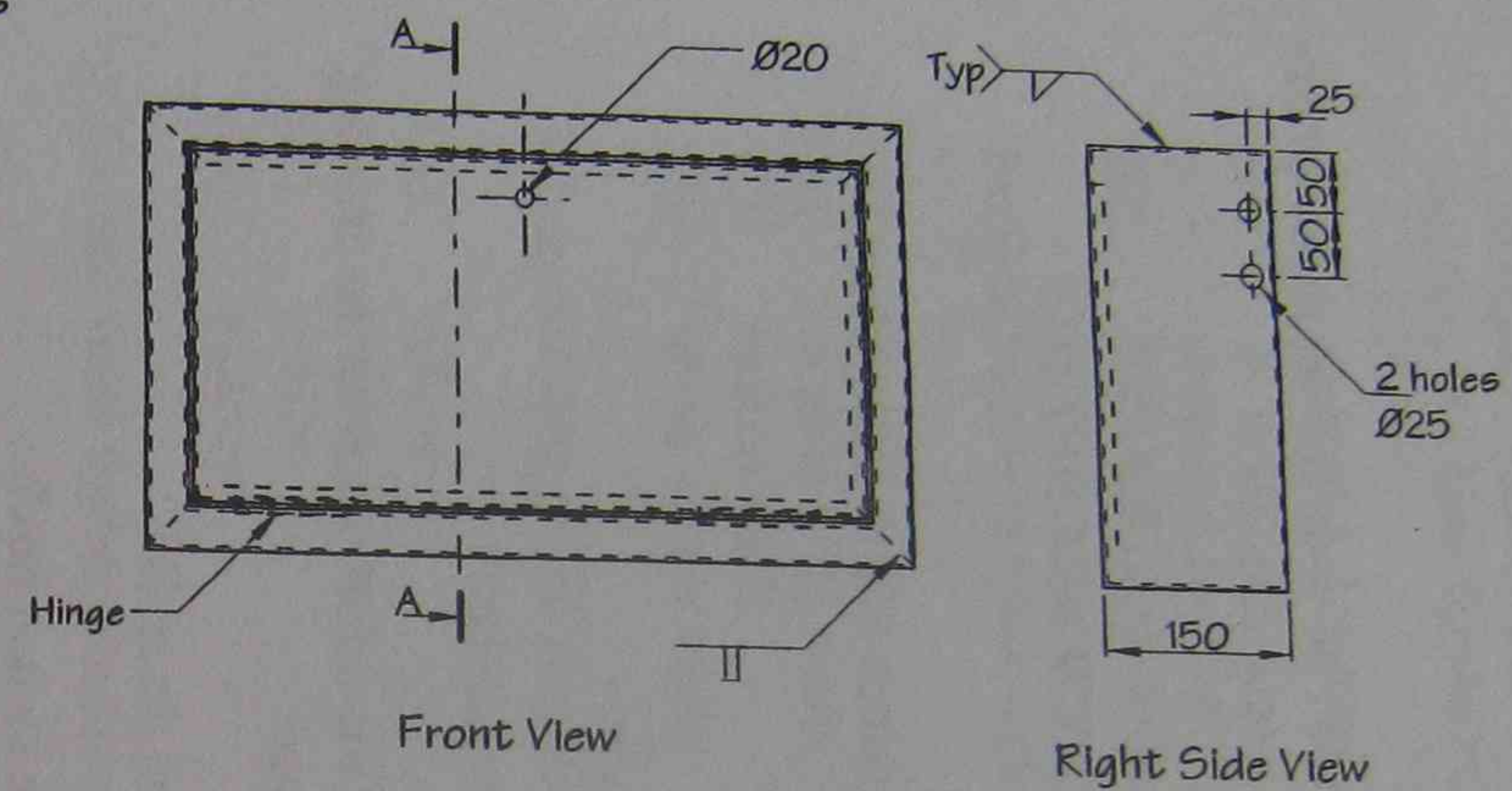
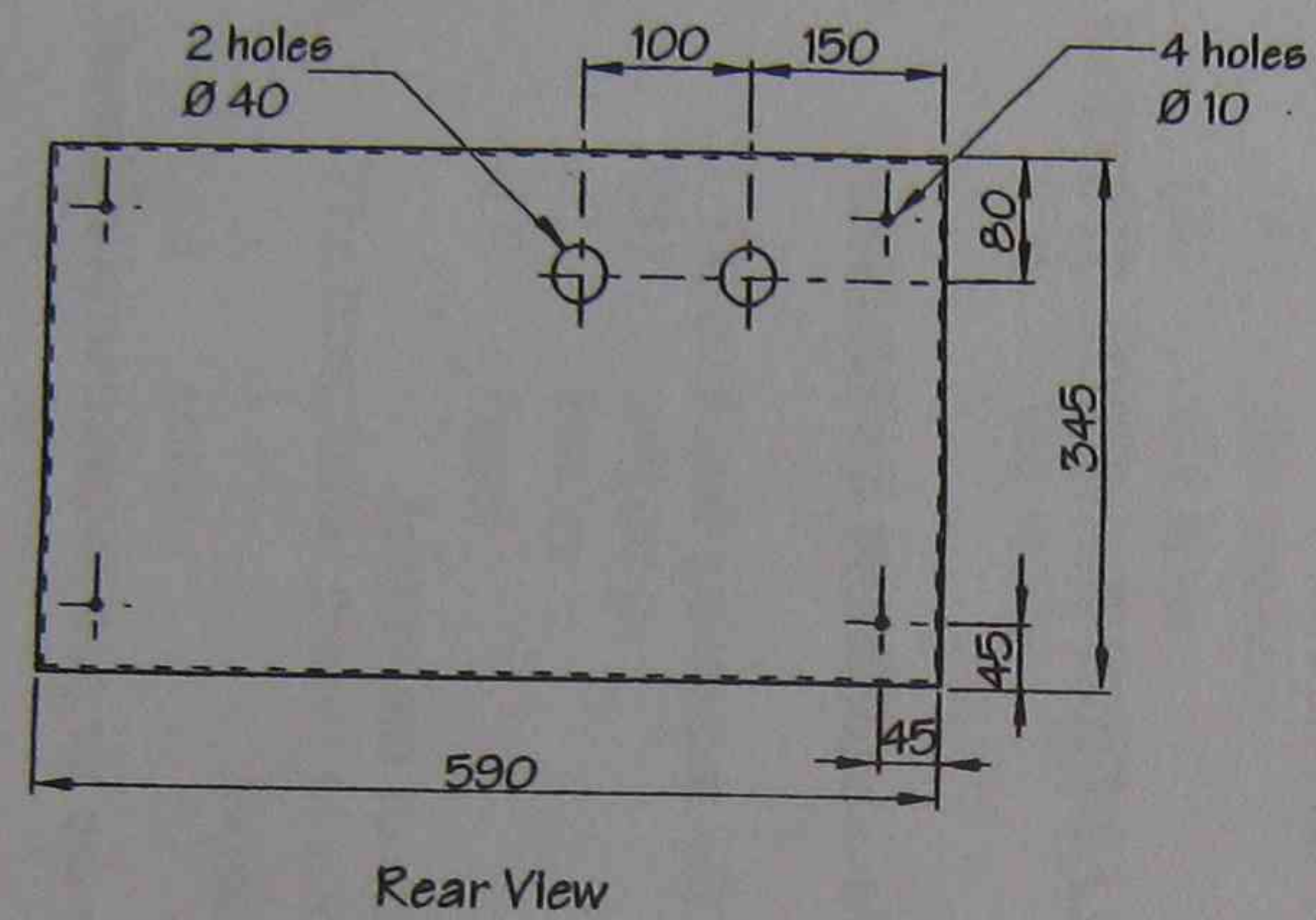
Answer the following questions in the space provided on your answer sheet. Marks for each question are as indicated. This section is worth 20 marks.

Questions 1 to 7 refer to the drawing titled SWITCH BOX DETAIL ASSEMBLY.

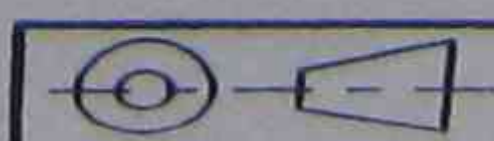
- 2 1. What drawing methods have been used to produce this drawing sheet?
- 1 2. What is the drawing number?
- 1 3. State the reason for showing the exploded view.
- 1 4. How are the ends joined to the body of the switch box?
- 2 5. Could you manufacture the switch box from the information on the drawing? Yes/NO. Supply two reasons for your response.
- 1 6. What type of dimension is indicated by (2) on detail B?
- 2 7. How many holes are required to be cut in the switch box?

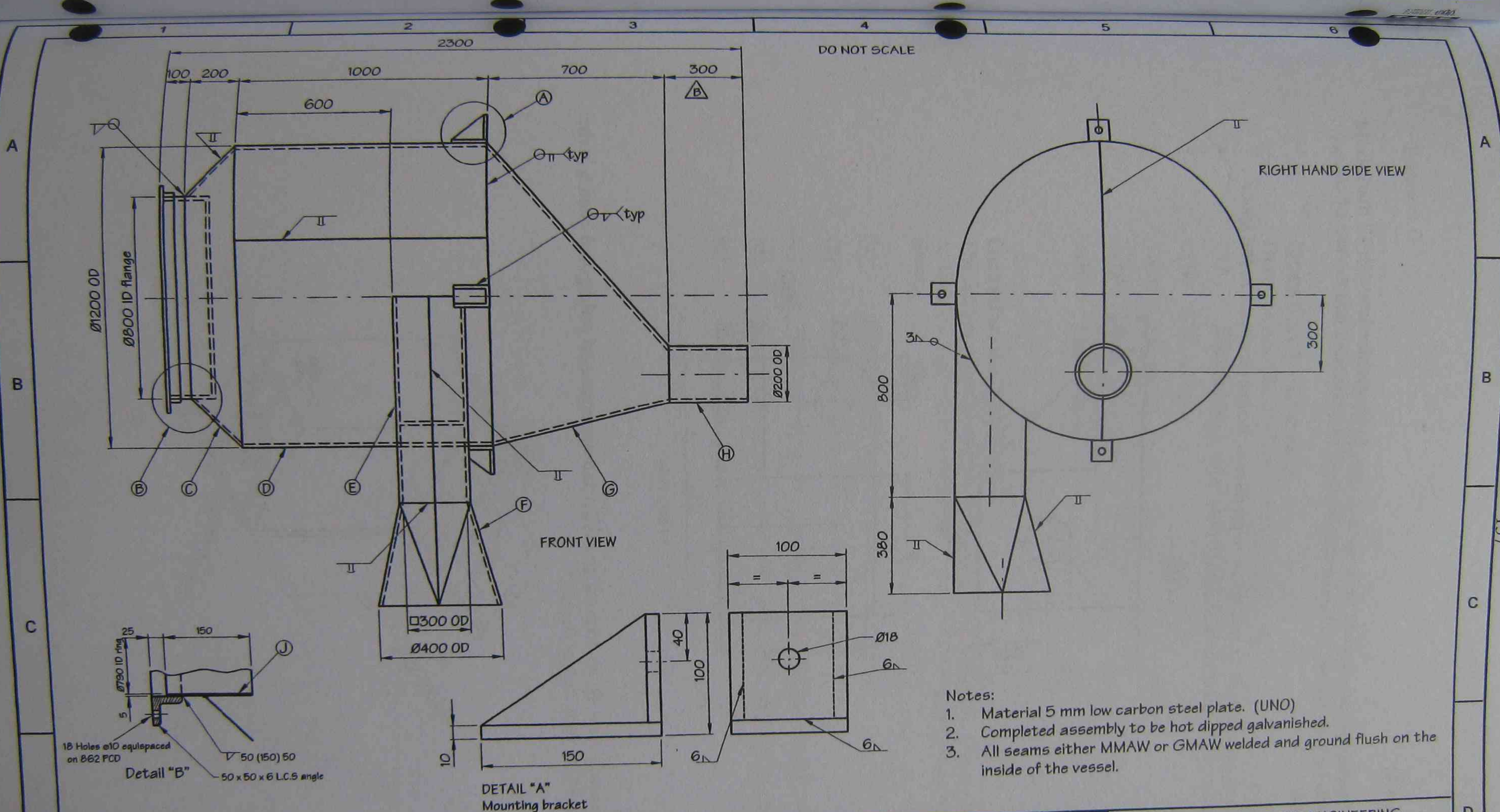
Questions 8 to 15 refer to the drawing titled AIR POLLUTION CONTROL SYSTEM SCRUBBER DETAIL ASSEMBLY.

- 2 8. Name the type and thickness of material used to manufacture the scrubber.
- 1 9. The thickness of material used to manufacture the mounting brackets is?
- 1 10. What is the length of item H?
- 1 11. State the after-weld treatment given to the inside of the vessel.
- 2 12. Why is the drawing classed as a detailed assembly?
- 1 13. How many drawing sheets are there relating to the air pollution control system?
- 1 14. What was the length of item H on the original drawing?
- 1 15. What do the letters UNO indicate?




TITLE						SWITCH BOX DETAIL ASSEMBLY	
DRAWN BY		ORDERED BY		SCALE	DATE	DRG N°	
ASC		WB		NTS	27.2.98	46217	





- Notes:
1. Material 5 mm low carbon steel plate. (UNO)
 2. Completed assembly to be hot dipped galvanized.
 3. All seams either MMAW or GMAW welded and ground flush on the inside of the vessel.

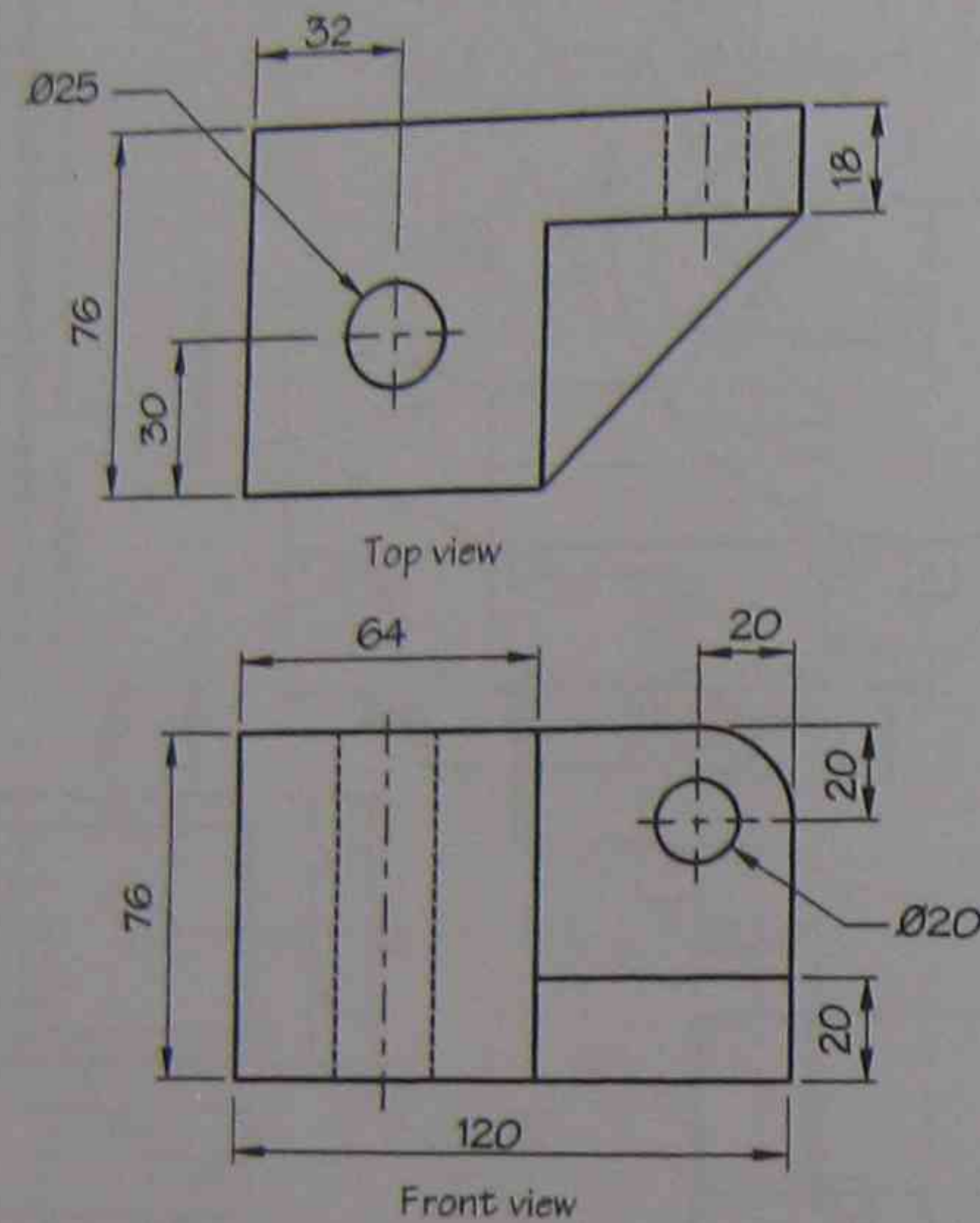
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AMENDMENTS													FINISH NAURAL FREE OF BURRS		<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/>													

Section C

The following questions require freehand drawings. Each question is worth 10 marks. Marks will be awarded for attention to detail, correct proportioning and the use of correct line types.

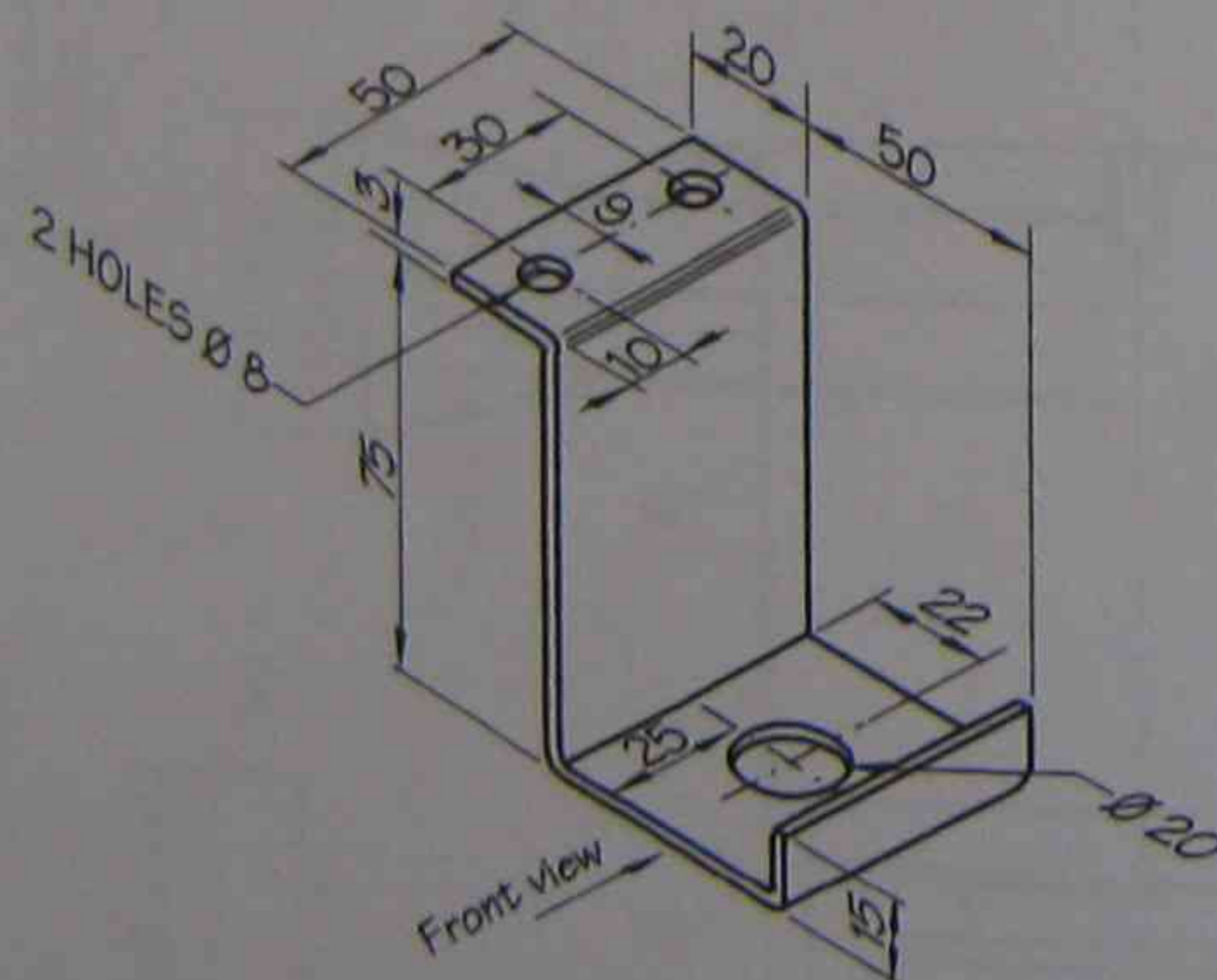
Question 1

Use the orthogonal views shown below to produce an isometric sketch in the space provided on your answer sheet. **DO NOT** dimension the drawing.



Question 2

Use the isometric view shown to produce a freehand-dimensioned orthogonal sketch in the space provided on your answer sheet.



Section D

Marks

Answer the following questions in the space provided on your answer sheet. Marks for each question are as indicated.

Question 1 - 10 marks

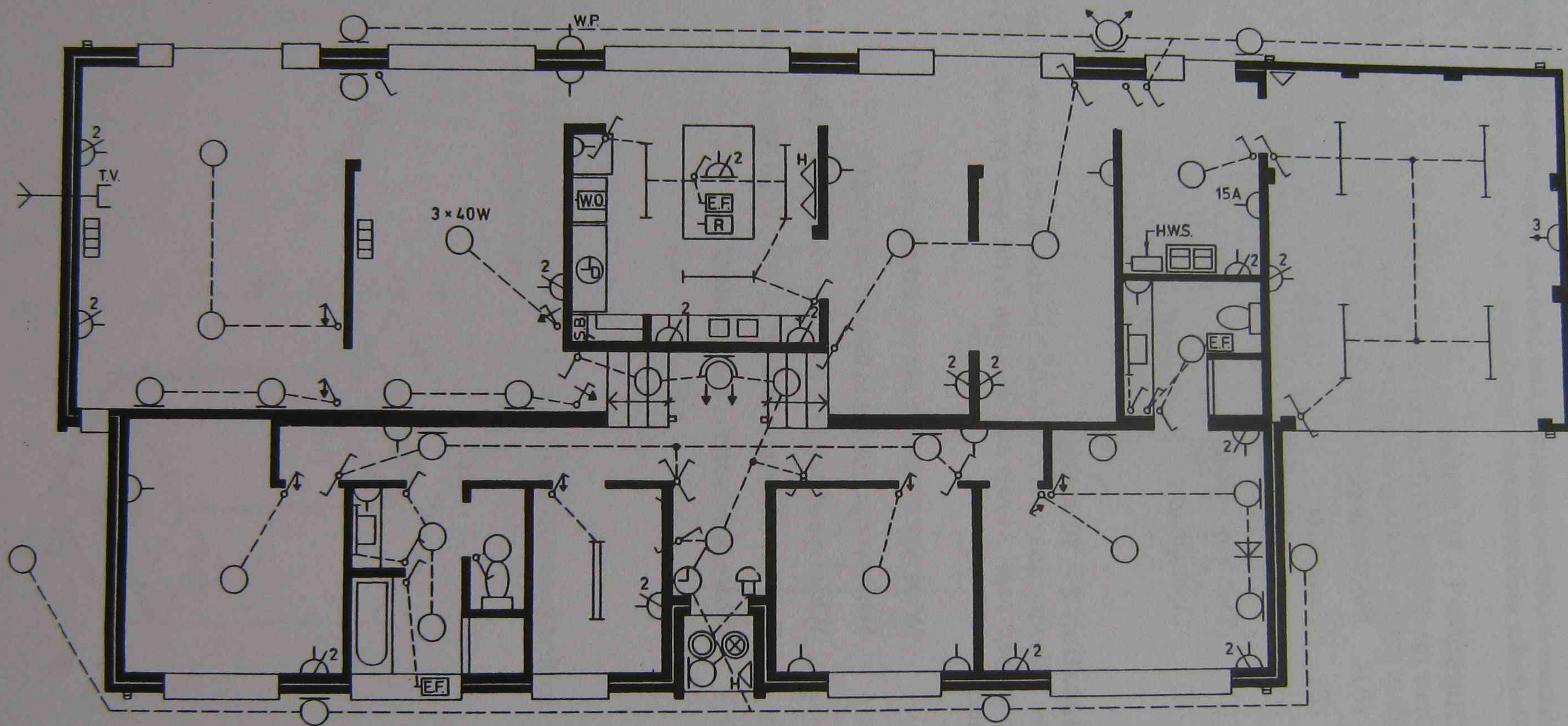
Draw the AS/NZS 1102 symbol for the following:

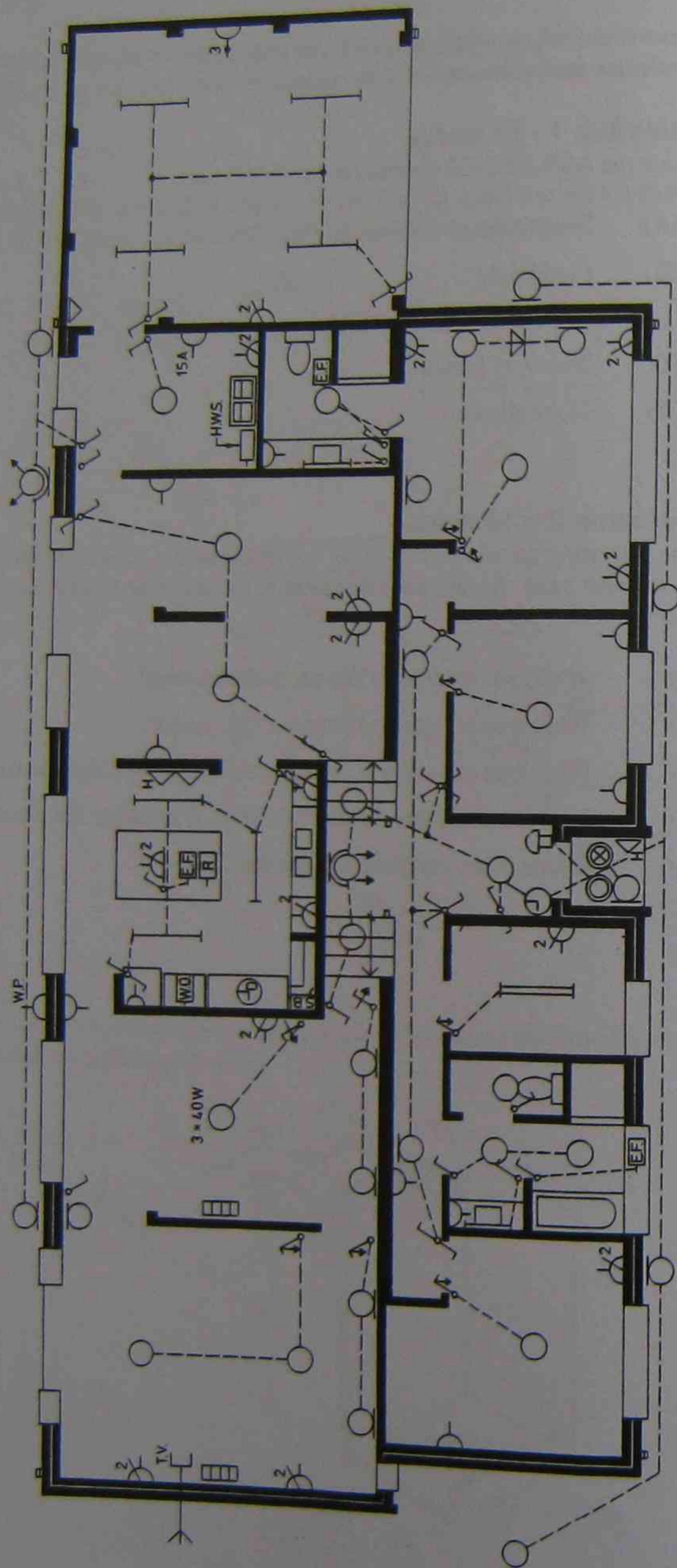
- | | | |
|---|-----|---------------------------|
| 2 | (A) | Electric range |
| 2 | (B) | Flood light |
| 2 | (C) | Double 10 A socket outlet |
| 2 | (D) | Two way switch |
| 2 | (E) | Light dimmer. |

Question 2 - 10 marks

The following questions refer to the electrical layout shown on the house plan on the next page. Answer each question in the space provided on your answer sheet.

- What type of clock is shown in the kitchen?
- What type of lighting is used in the garage?
- What type of switch is used to control the wall light at the entry?
- Two socket outlets are labelled W.P. What does this mean?
- Where is the switch board located?





Sample theory test 2

Time allowed 45 minutes

Total marks available for this test are 100

Section	Marks
Section A	/15
Section B	/10
Section C	/10
Total	/35

Student equipment required

- Non-programmable calculator
- Pens, pencils, erasers
- Rule

Section A

For each question, identify the most correct response by placing a cross in the box of the identifying letter in the column corresponding to the question number on the answer sheet provided. If you make a mistake place a line through the incorrect answer and mark correct answer as before.

- Brick cavity construction is:
 - single exterior brick cladding with an air space to an interior brick cladding
 - timber frame with internal and external timber cladding
 - single exterior brick cladding with timber frame and plaster-board interior cladding
 - single exterior brick cladding with metal frame and plaster-board interior cladding
- In a brick veneer construction the:
 - interior cladding is brick
 - exterior cladding is timber veneer
 - roof is supported by the brick cladding
 - roof is supported by the interior frame
- A site plan details the:
 - floor plan
 - all elevations
 - elevation from one side only
 - position of the structure on the land
- The measured length from a plan having a scale of 1:50 is 58 mm. The actual distance on the job is:
 - 1.2 mm
 - 2 900 mm
 - 1.2 m
 - 2.9 mm
- The light fittings, switches and socket outlets are usually installed:
 - after fixing of the interior lining
 - after completion of wall tiling
 - prior to installation of internal cladding
 - after tiling and painting of interior walls

- The loop terminal of a batten holder would contain which of the following cables when using the loop-at-light method?
 - neutral
 - earth
 - switch wire
 - active

- The electrical diagram shown in Figure 1 is an example of: the
 - architectural diagram
 - block diagram
 - circuit diagram
 - wiring diagram

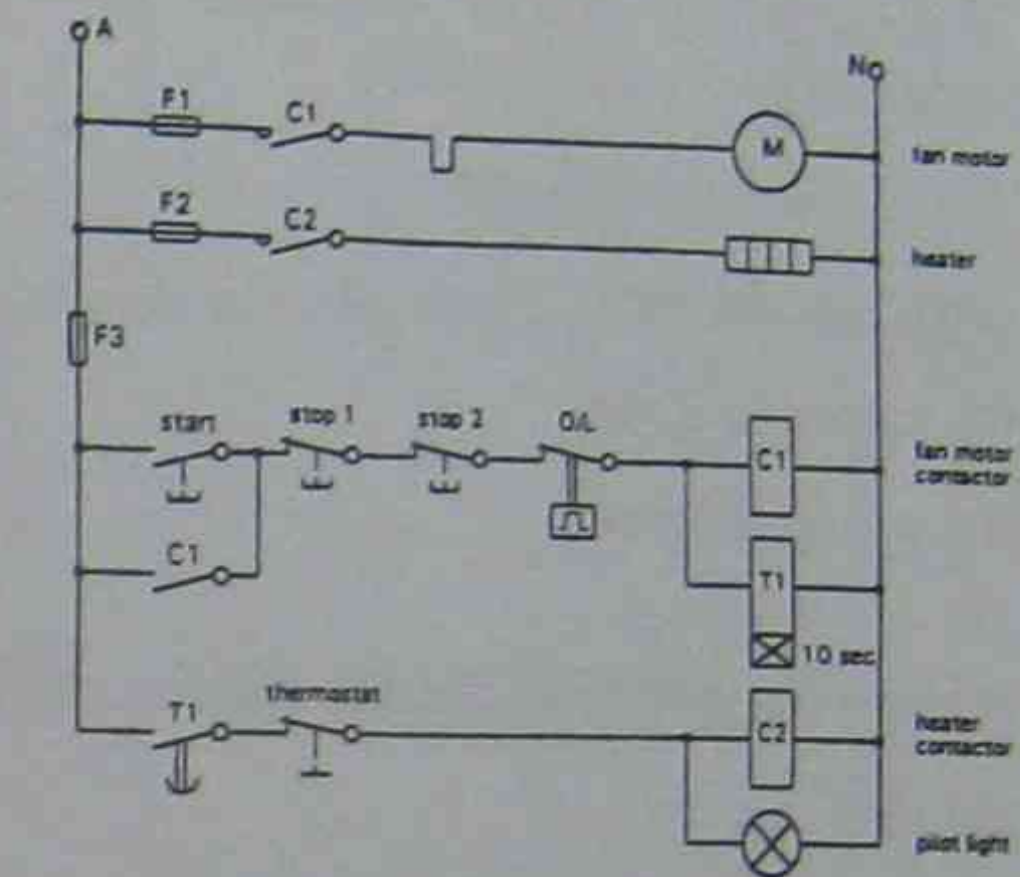


Figure 1

- The electrical diagram shown in Figure 2 is an example of: the
 - architectural diagram
 - block diagram
 - circuit diagram
 - wiring diagram

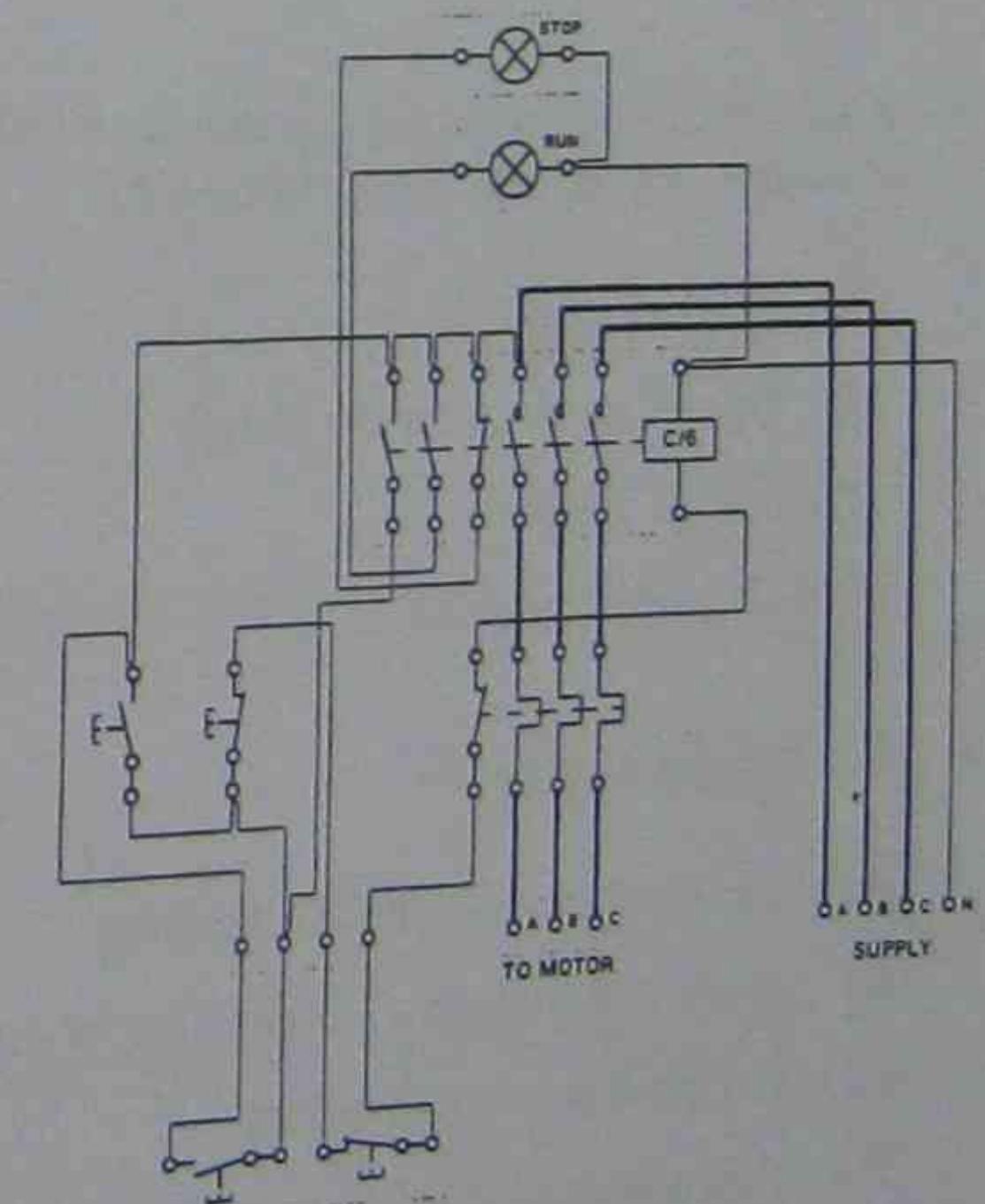


Figure 2

- The overall operation of electrical equipment is best obtained from the:
 - architectural diagram
 - block diagram
 - circuit diagram
 - wiring diagram

10. The most suitable electrical diagram for constructing or assembling electrical equipment is the:
- (A) architectural diagram
 - (B) block diagram
 - (C) circuit diagram
 - (D) wiring diagram
11. The electrical diagram containing information relating to the physical layout and connection of a circuit is the:
- (A) architectural diagram
 - (B) block diagram
 - (C) circuit diagram
 - (D) wiring diagram
12. The moving arm of a normally open switch is drawn at an angle of:
- (A) 15°
 - (B) 20°
 - (C) 30°
 - (D) 45°
13. When developing a wiring diagram for a lighting circuit that contains an unknown type of switch, you should first develop a/an:
- (A) block diagram
 - (B) switching chart for the switch
 - (C) circuit diagram
 - (D) electrical schedule
14. A circuit diagram shows:
- (A) the location of items in a building
 - (B) every conductor and termination in a circuit
 - (C) the operation of the circuit
 - (D) the relationship between sections of a circuit
15. Circuit diagrams are always drawn in the electrically:
- (A) energised condition
 - (B) hot condition
 - (C) cold condition
 - (D) on condition

Section B – 10 marks

Write the answers to the following questions in the space provided on your answer sheet. Each correct answer is worth one mark

If the power flow in a circuit diagram is from left to right then the sequence of operation is from (1) to (2)

A (3) is a suitable test instrument for determining the action of a switch in relation to its terminals.

The two major diagrams an electrician would use during the construction of a dwelling are (4) and (5)

A (6) switch is used with two-way switches to achieve three-way switching

There are approximately 8 constructional phases associated with a residential dwelling. One of these phases is the roof. Any four other phases are (7), (8), (9) and (10)

Section C – 10 marks

Draw your answers to the following questions in the space provided on the answer sheet. Each correct answer is worth 2 marks.

1. Draw the Australian Standard symbol for a signal lamp
2. Draw the Australian Standard symbol for a normally closed push-button switch.
3. Draw the Australian Standard symbol for a single pole single throw switch.
4. Draw the Australian Standard symbol for a time delay switch.
5. Draw the Australian Standard symbol for a spot light (architectural diagram)

End of Module Practical Test 1

Observe safe working practices during this practical test

Instructions

- Total marks for this test is 30
- All tasks are to be attempted
- Marks for each task are as indicated
- No part marks for each task will be awarded
- You have 30 minutes to complete all 4 tasks
- All answers to be entered on the answer sheet provided
- All work to be performed on an individual basis

Task 1 – Switching Charts – 9 Marks

Equipment (to be provided by your teacher)

- Switch 1
- Switch 2
- Switch 3
- Test equipment
- Connecting leads

Procedure

- Draw the switching chart for each switch taking into account the number of terminals and switch positions.
- Use a multimeter or continuity tester to determine the bridging positions.
- Complete the switching charts by indicating with an X in the chart for that switch, the bridging positions for all possible toggle positions.
- Draw the switching charts in the spaces provided on your answer sheet.

Task 2 – Single position switching – 5 Marks

Equipment (to be provided by your teacher)

- Switch panel
- Lamp panel
- Test equipment
- Connecting leads

Procedure

- On your answer sheet, design a lighting circuit to control two parallel connected 24 V lamps from a single switch position.
- Using the appropriate switch and light panels connect the circuit with 4 mm leads.
- Have your teacher check your circuit operation.

Task 3 – Two-way switching – 6 Marks

Equipment (to be provided by your teacher)

- Switch panel
- Lamp panel
- Test equipment
- Connecting leads

Procedure

- On your answer sheet, design a lighting circuit to control a single 24 V lamp from two positions using two-way switching.
- Using the appropriate switch and light panels connect the circuit with 4 mm leads.
- Have your teacher check your circuit operation.

Task 4 – Two-way and intermediate switching – 10 Marks

Equipment (to be provided by your teacher)

- Switch panel
- Lamp panel
- Test equipment
- Connecting leads

Procedure

- On your answer sheet, design a lighting circuit to control a single 24 V lamp from three positions using two-way and intermediate switching.
- Using the appropriate switch and light panels connect the circuit with 4 mm leads.
- Have your teacher check your circuit operation.

End of Module Practical Test 2 – Looping methods

Observe safe working practices during this practical test

Instructions

- Total marks for this test is 35.
- To obtain maximum marks for this test, the circuit must be wired correctly, operate according to the specifications and have no unsafe wiring or connections.
- Part marks may be awarded.
- You have 2 hours to complete this task.
- All work to be performed on an individual basis.

Equipment required (to be supplied by your teacher)

- TPS twin and earth
- TPS twin
- TPS single
- Three batten holders
- Three batten holder mounting flanges
- Three standard pattern single gang switches
- Three standard pattern mounting blocks
- Cable clips
- Test equipment

Procedure

- Install and connect a lighting circuit according to the following:
 - lighting point 1 is controlled by switch 1
 - lighting point 2 is controlled by switch 2
 - lighting point 3 is controlled by switch 3
- The circuit cabling is to be installed so that:
 - lighting points 1 and 2 and their associated switches are installed using the 'loop at the light' method of wiring
 - lighting point 3 and its associated switch are installed using the 'loop at the switch' method of wiring.
 - An earth wire is run to each lighting point in accordance with the requirements of AS/NZS 3000.
- The diagram below shows the approximate physical layout of the components for the lighting circuit. **Your teacher will supply you with the dimensions of the layout.**

- When you have completed the job, ask your teacher to assess it. **DO NOT APPLY POWER TO THE CIRCUIT UNTIL IT HAS BEEN ASSESSED.**

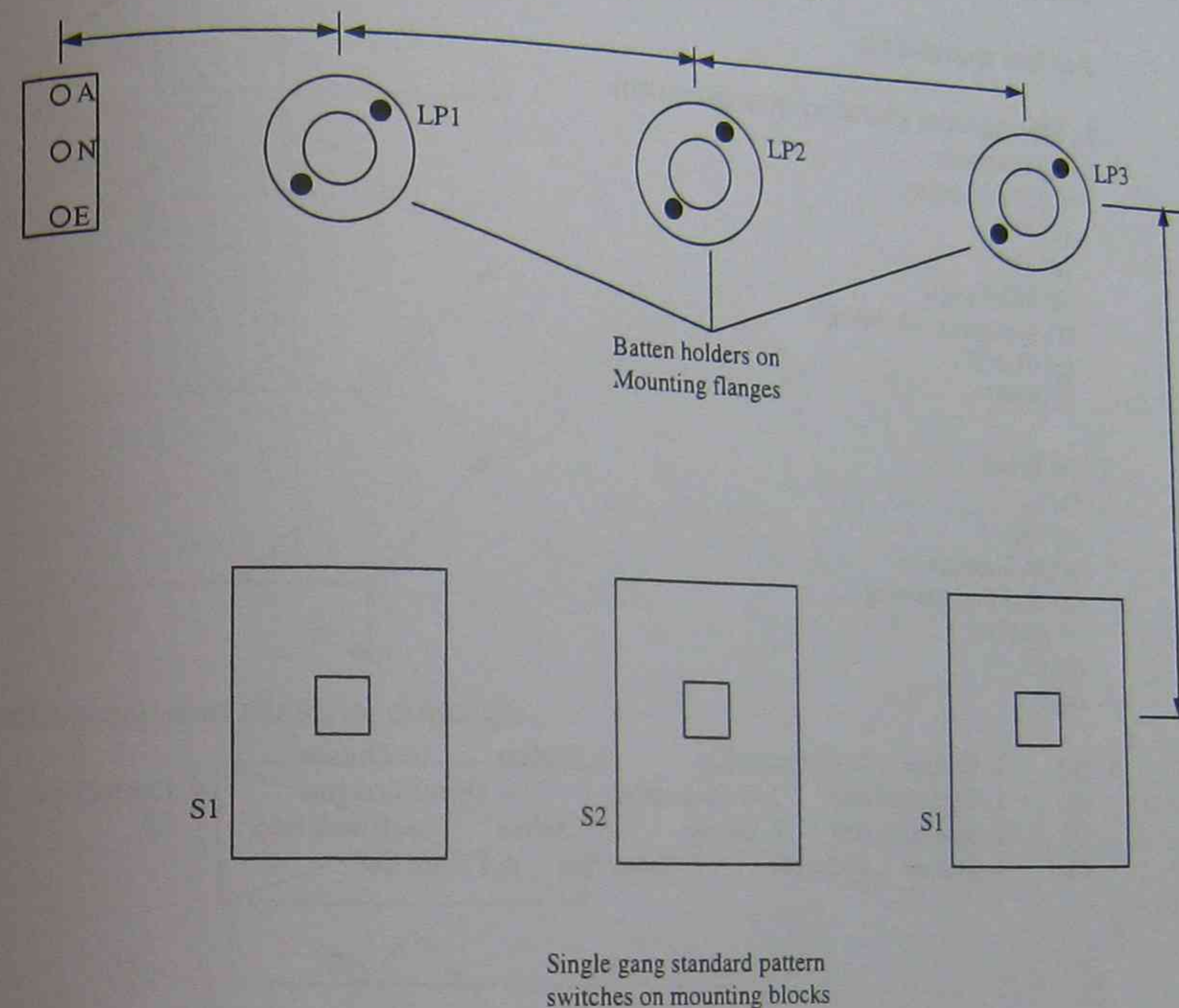


Figure 1 Lighting circuit layout

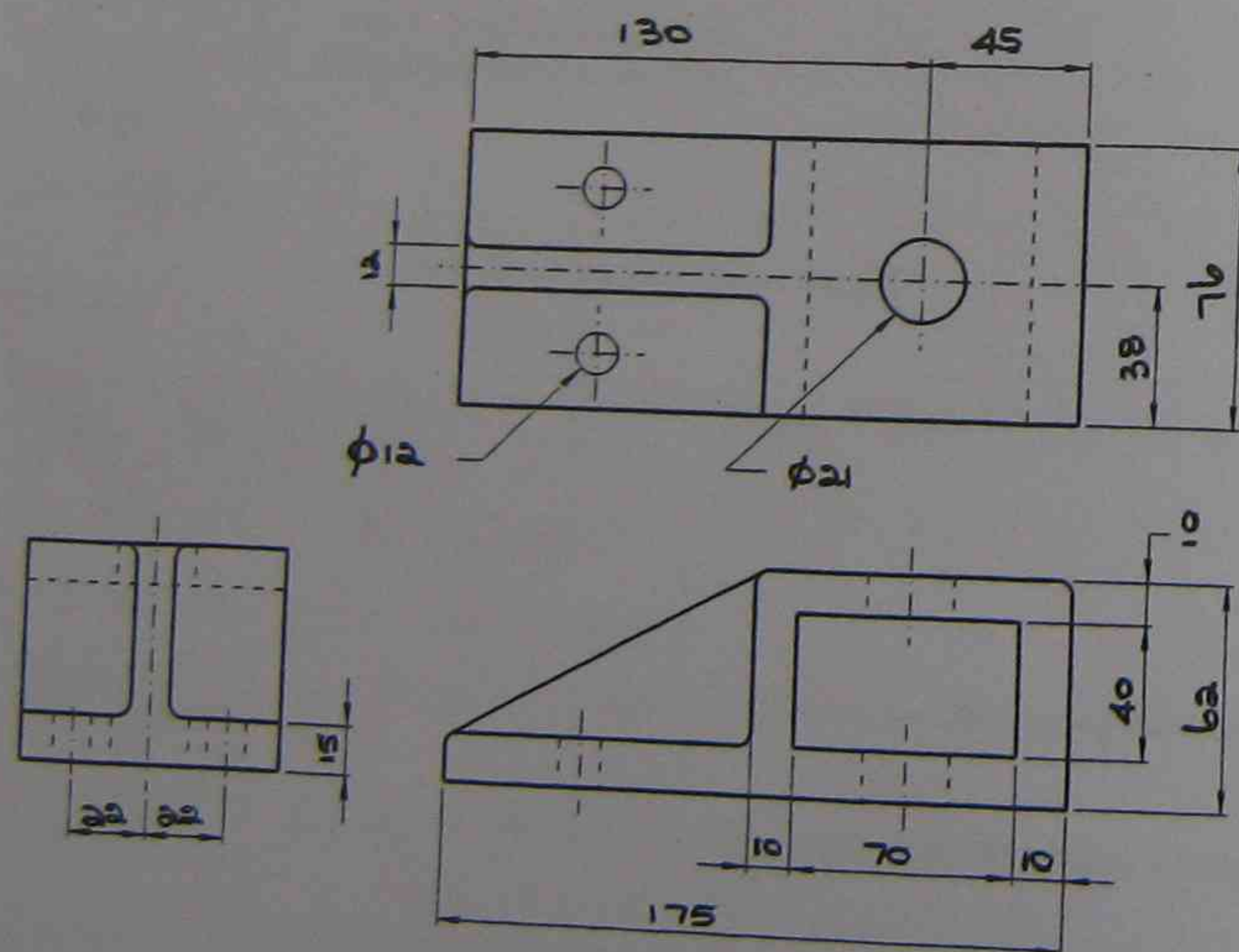
Answers

Review questions

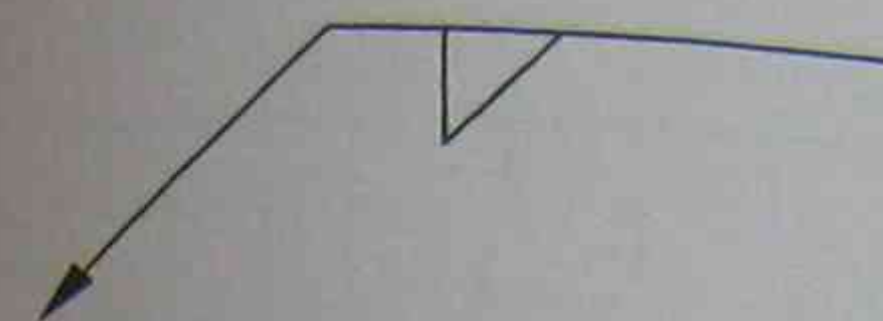
1. Mechanical drawing interpretation

1. (a) Assembly
(b) Wheel puller
(c) 7
(d) 11
(e) Third angle
(f) Symbol in title block
(g) 97-503
15-10-97
2. (a) Detail
(b) 6
(c) WL
(d) Millimeters
(e) Noted on drawing
(f) AS1100
(g) C
(h) 1
3. (a) 1. Outline 2. Extension line 3. Outline 4. Outline
(b) 1. Extension line 2. Hidden outline 3. Dimension line 4. Centre line
(c) 1. Extension line 2. Outline 3. Outline 4. Break line
(d) 1. Outline 2. Outline 3. Break line 4. Centre line

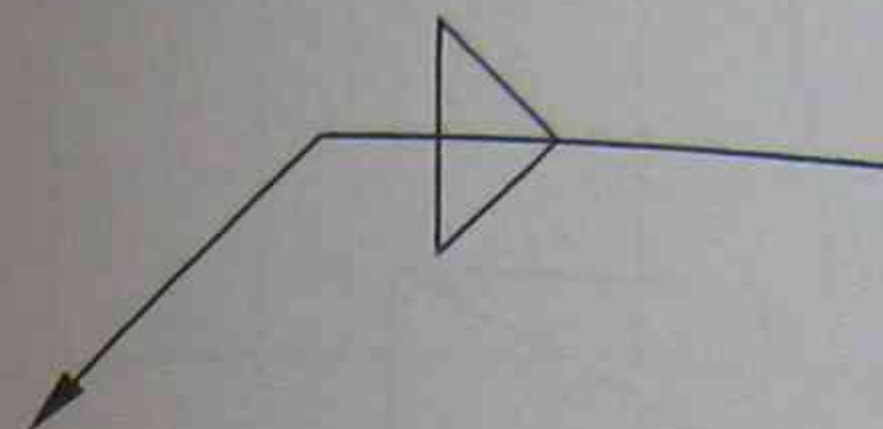
4.



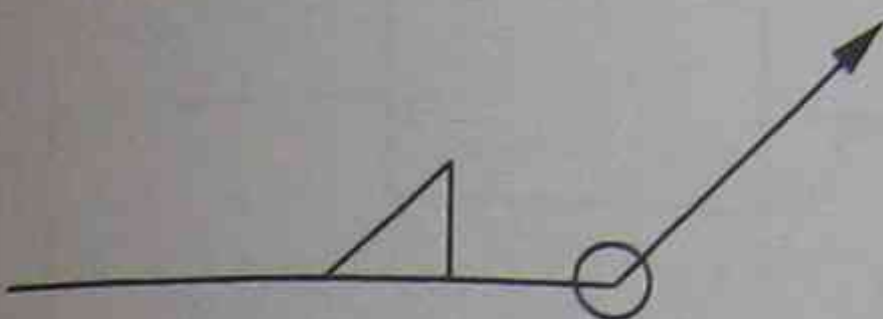
5. (a)



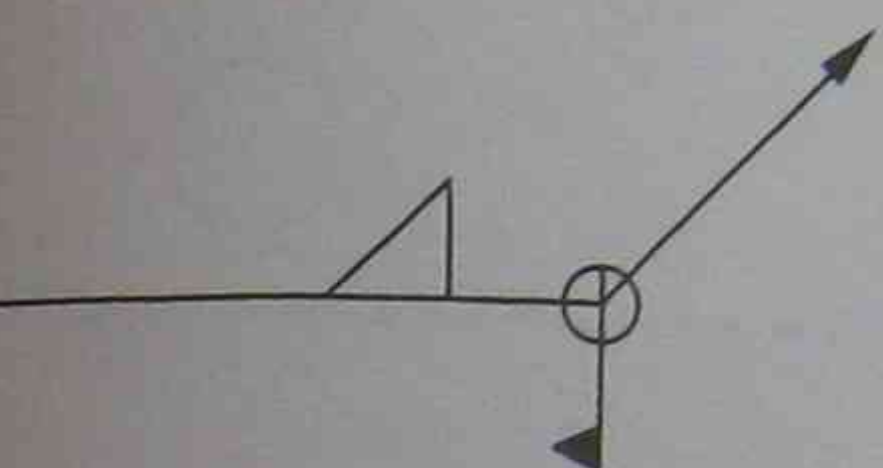
(b)



(c)



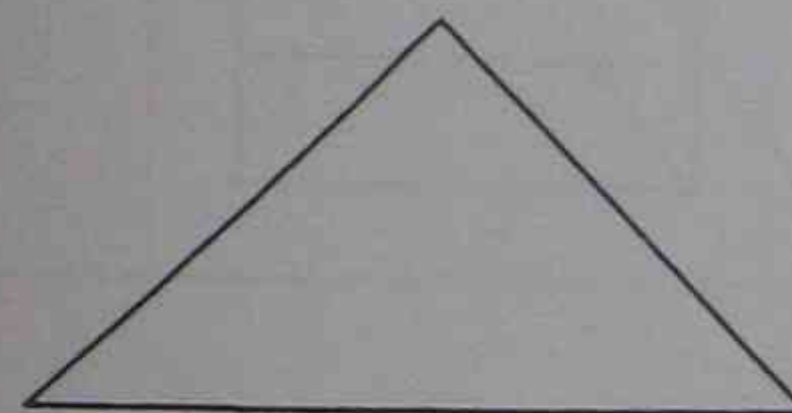
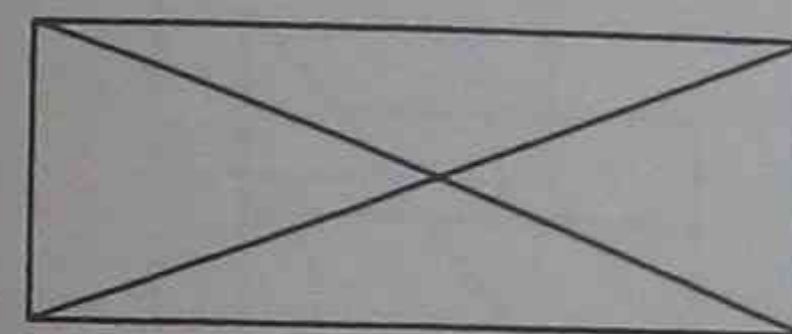
(d)



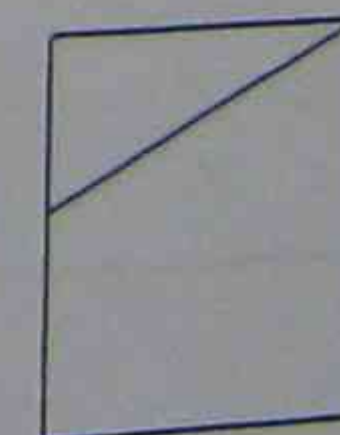
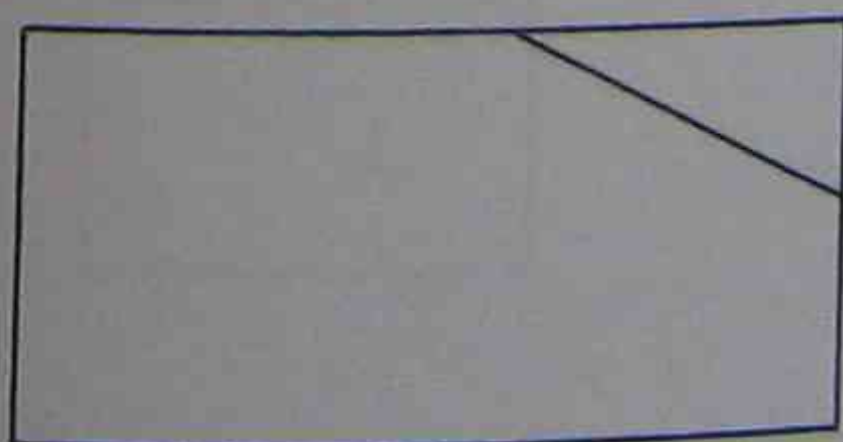
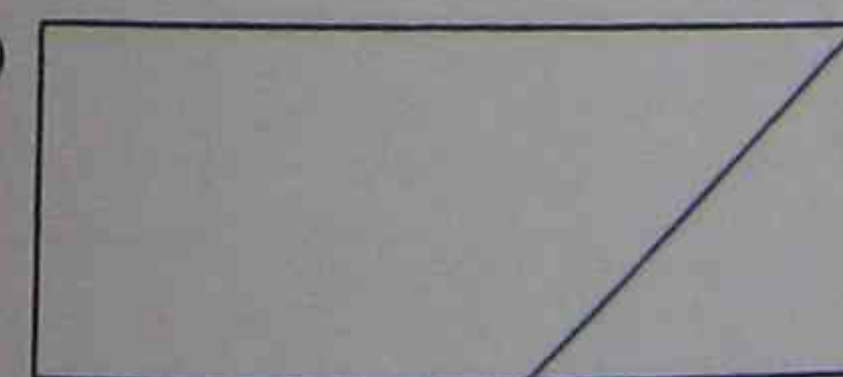
2. Orthogonal and pictorial drawings

1.

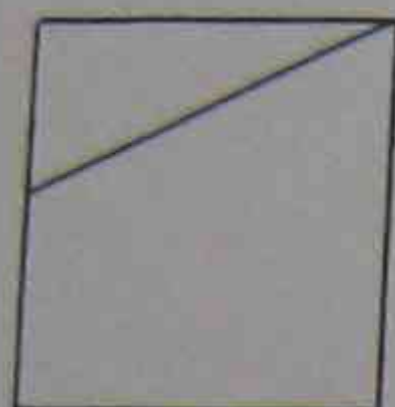
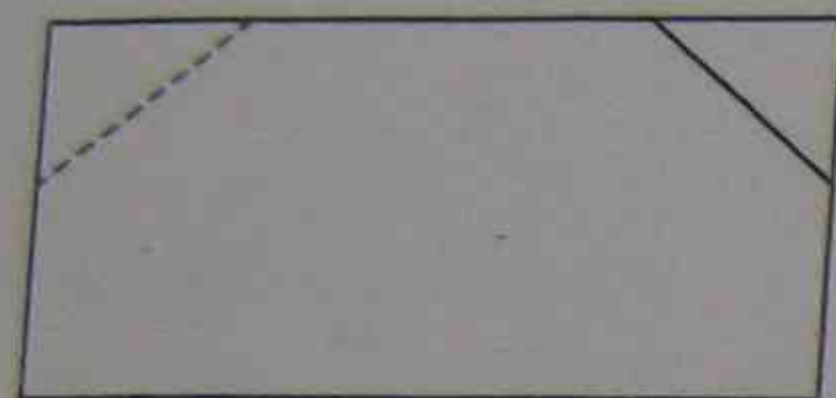
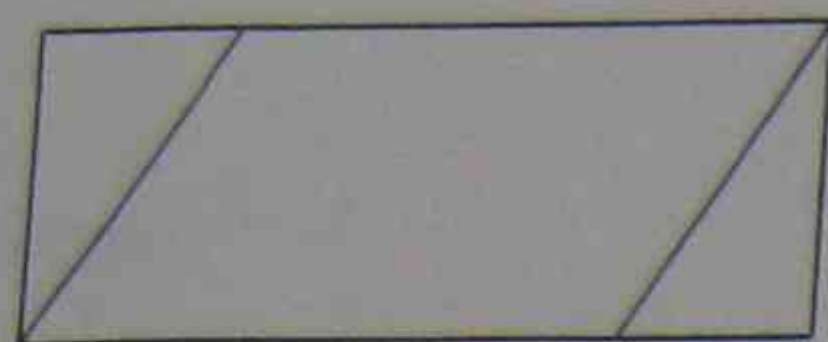
(a)



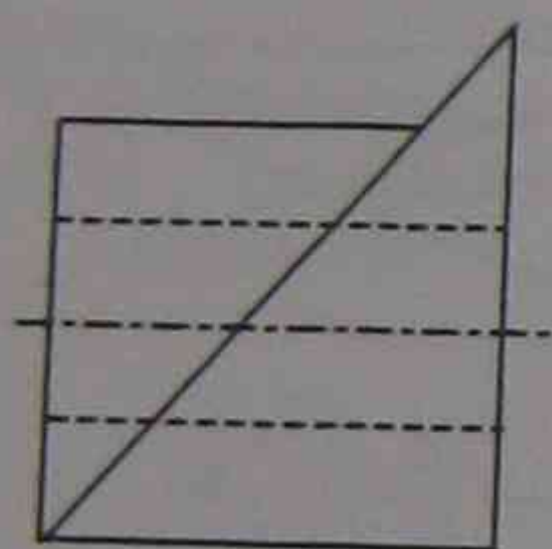
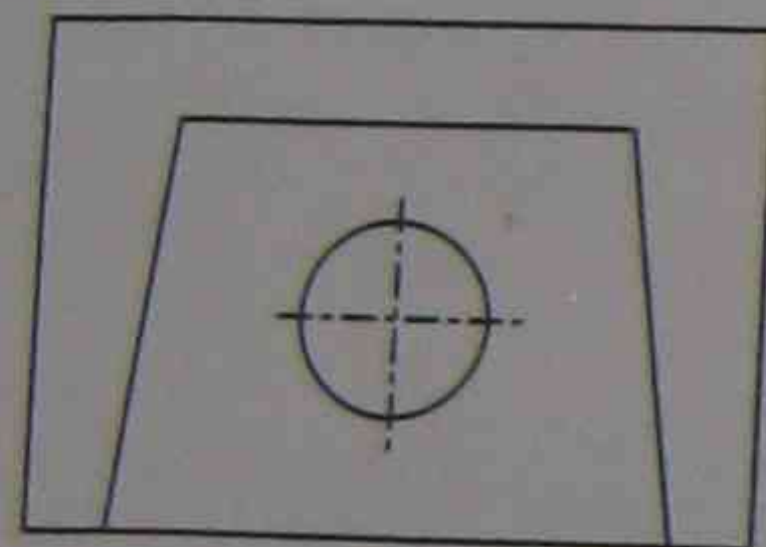
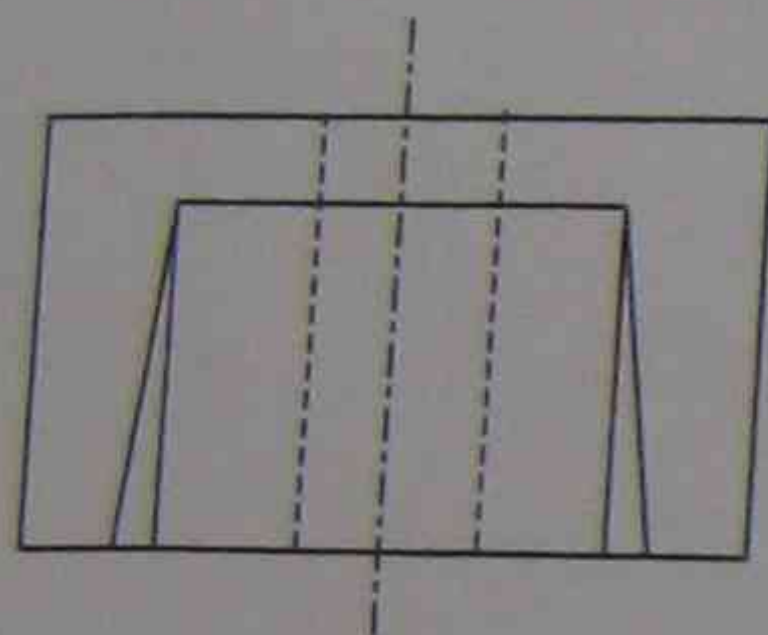
(b)



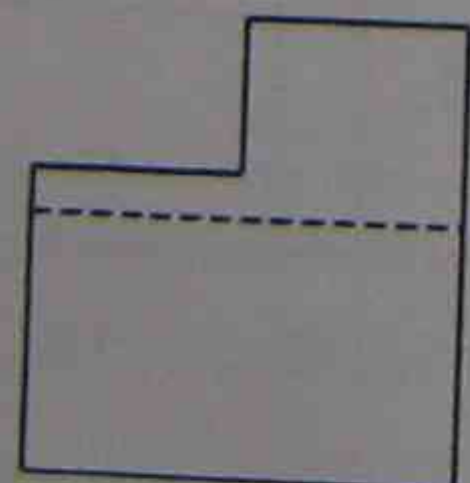
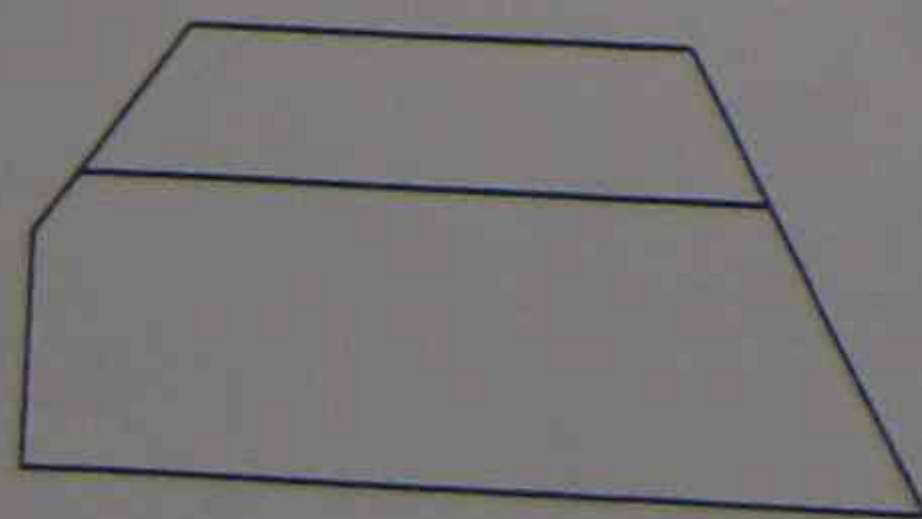
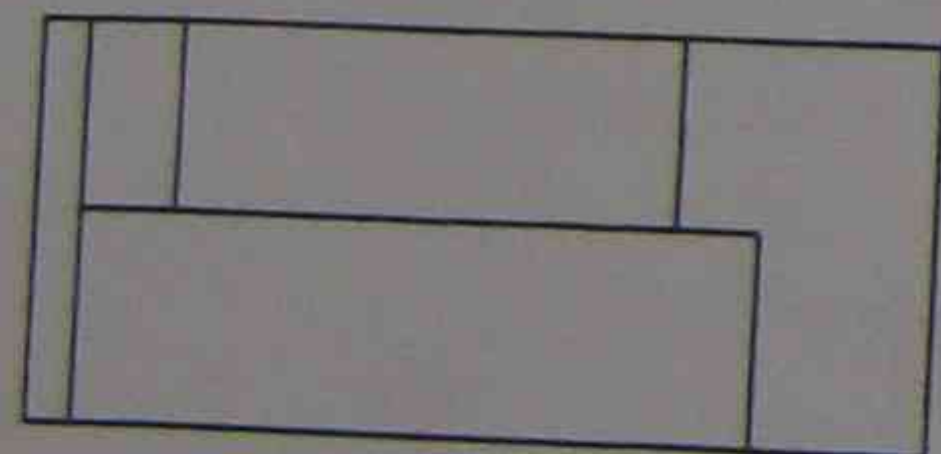
(c)



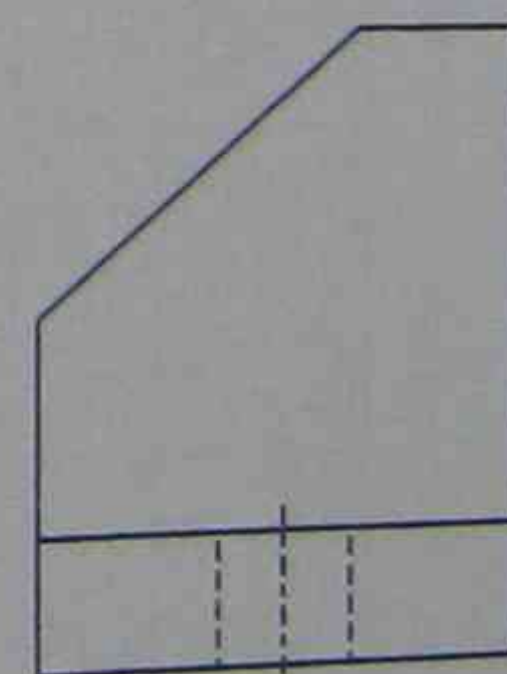
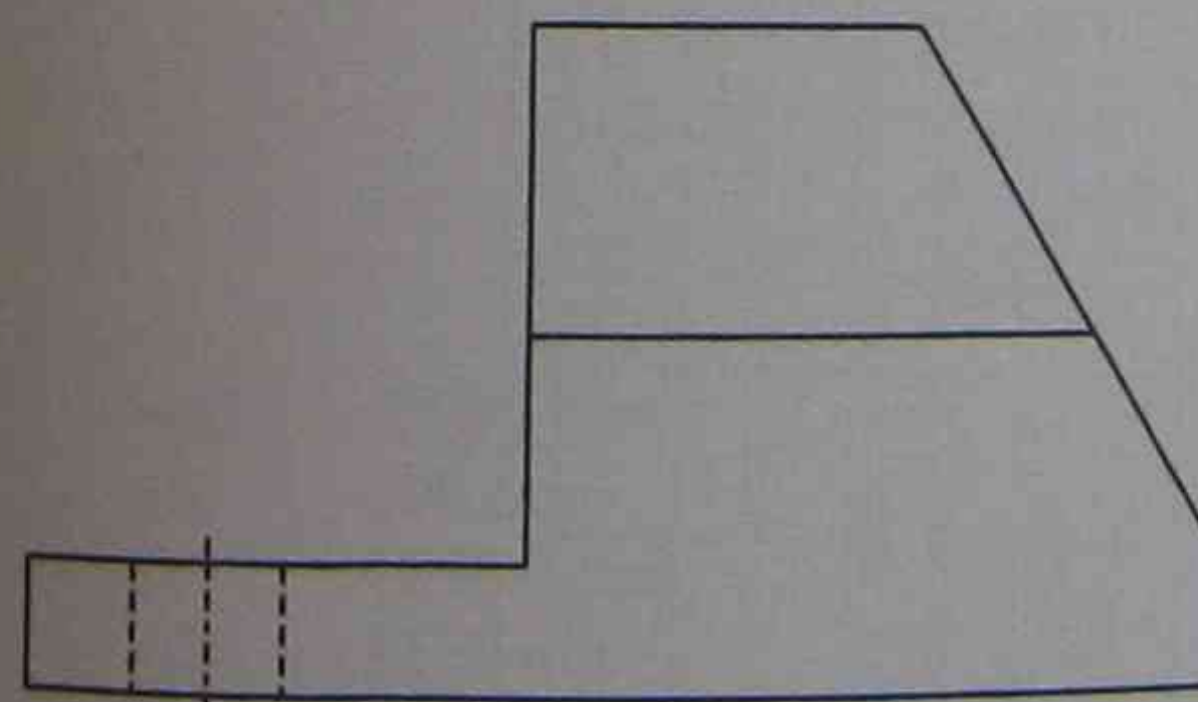
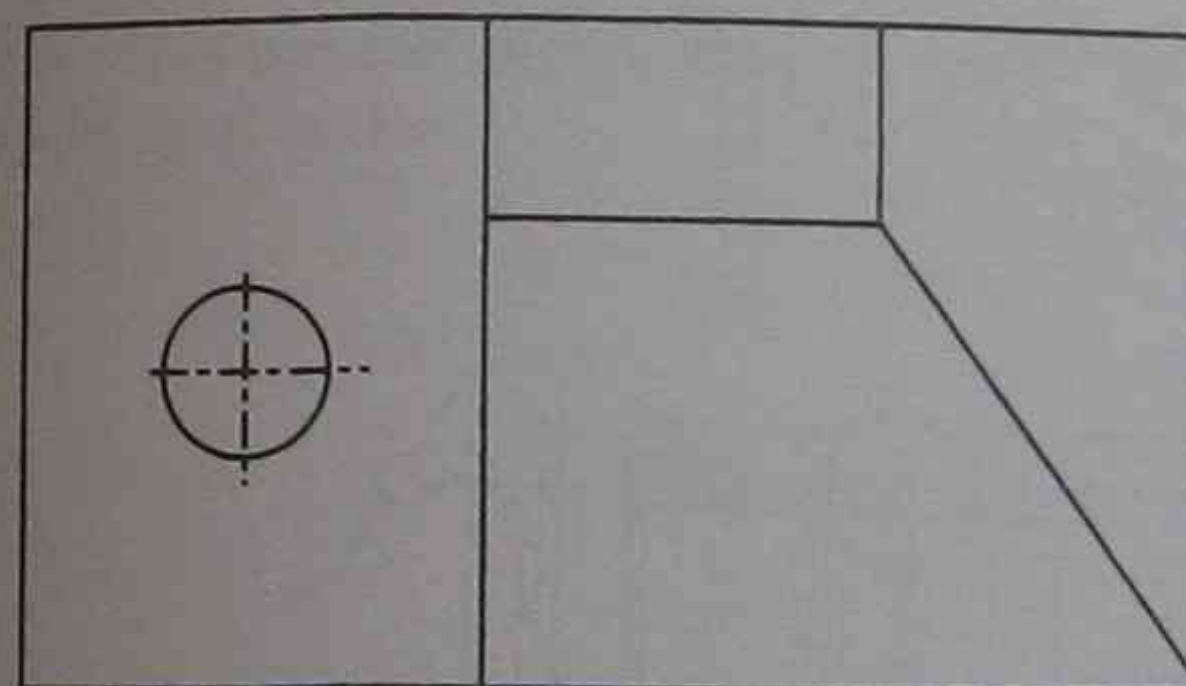
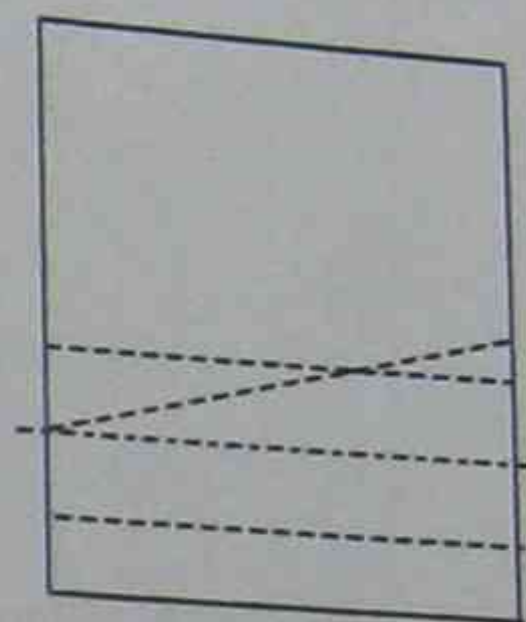
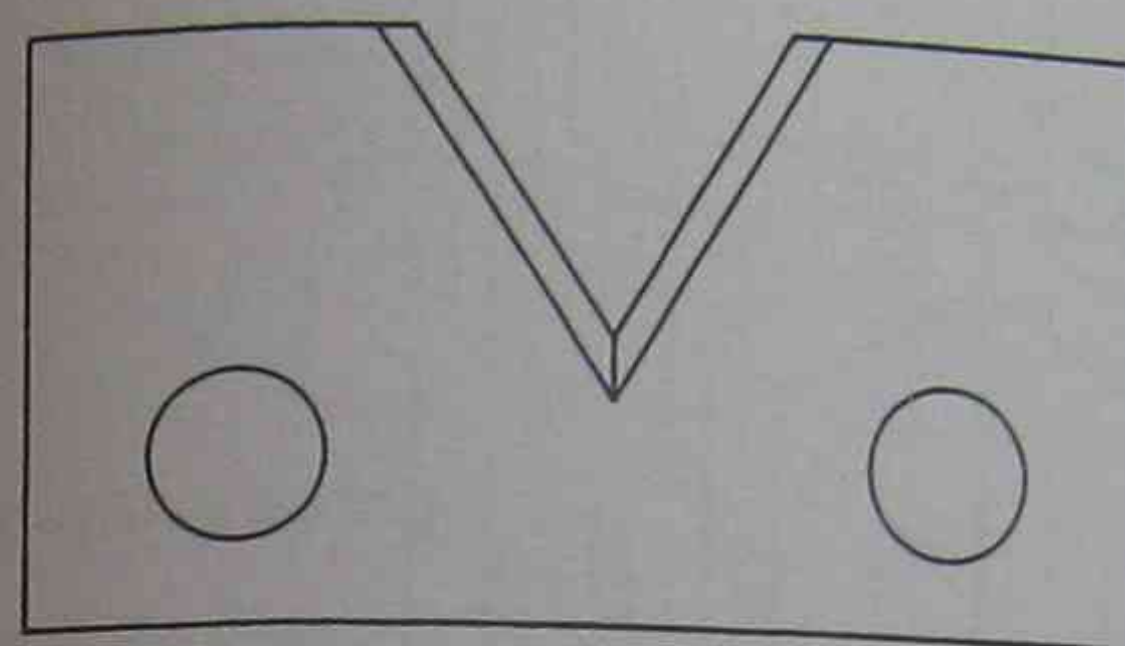
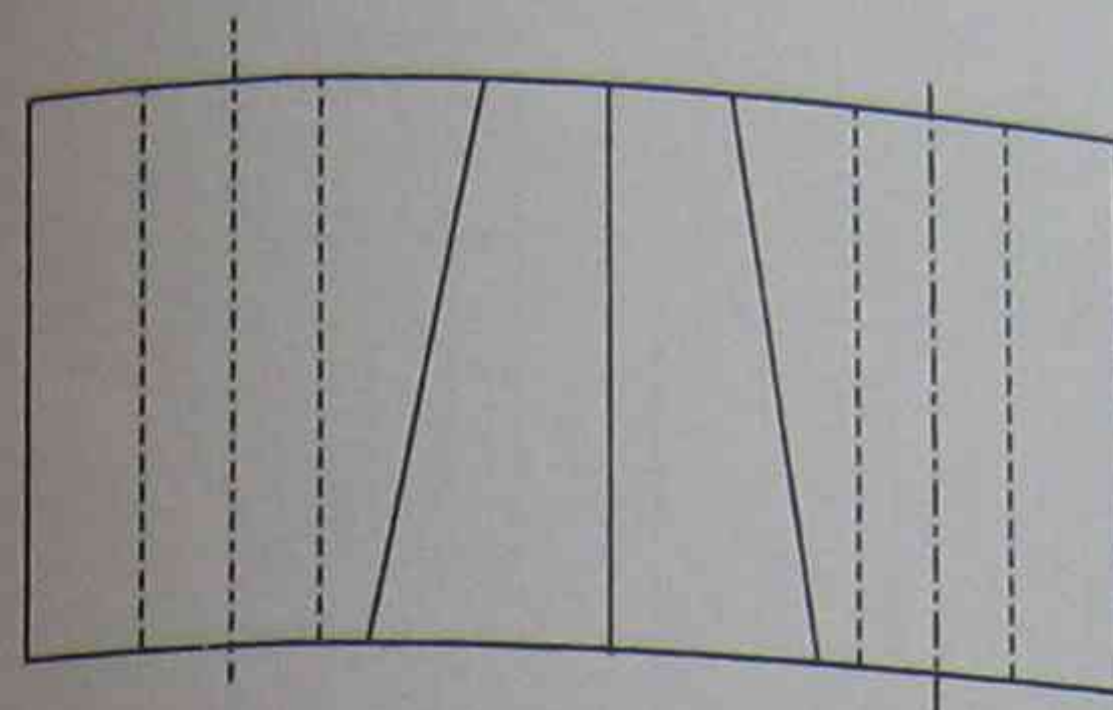
2.



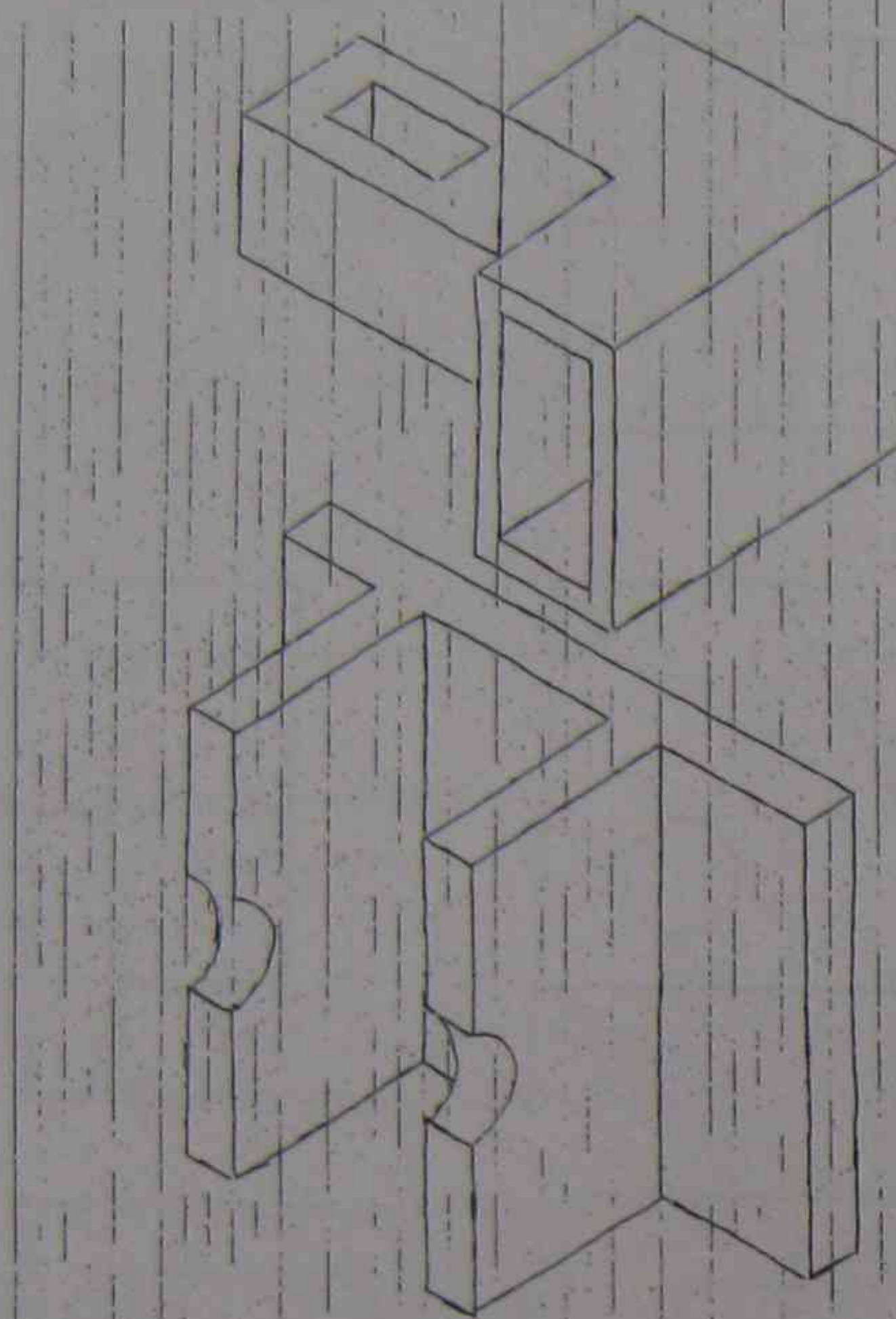
3.



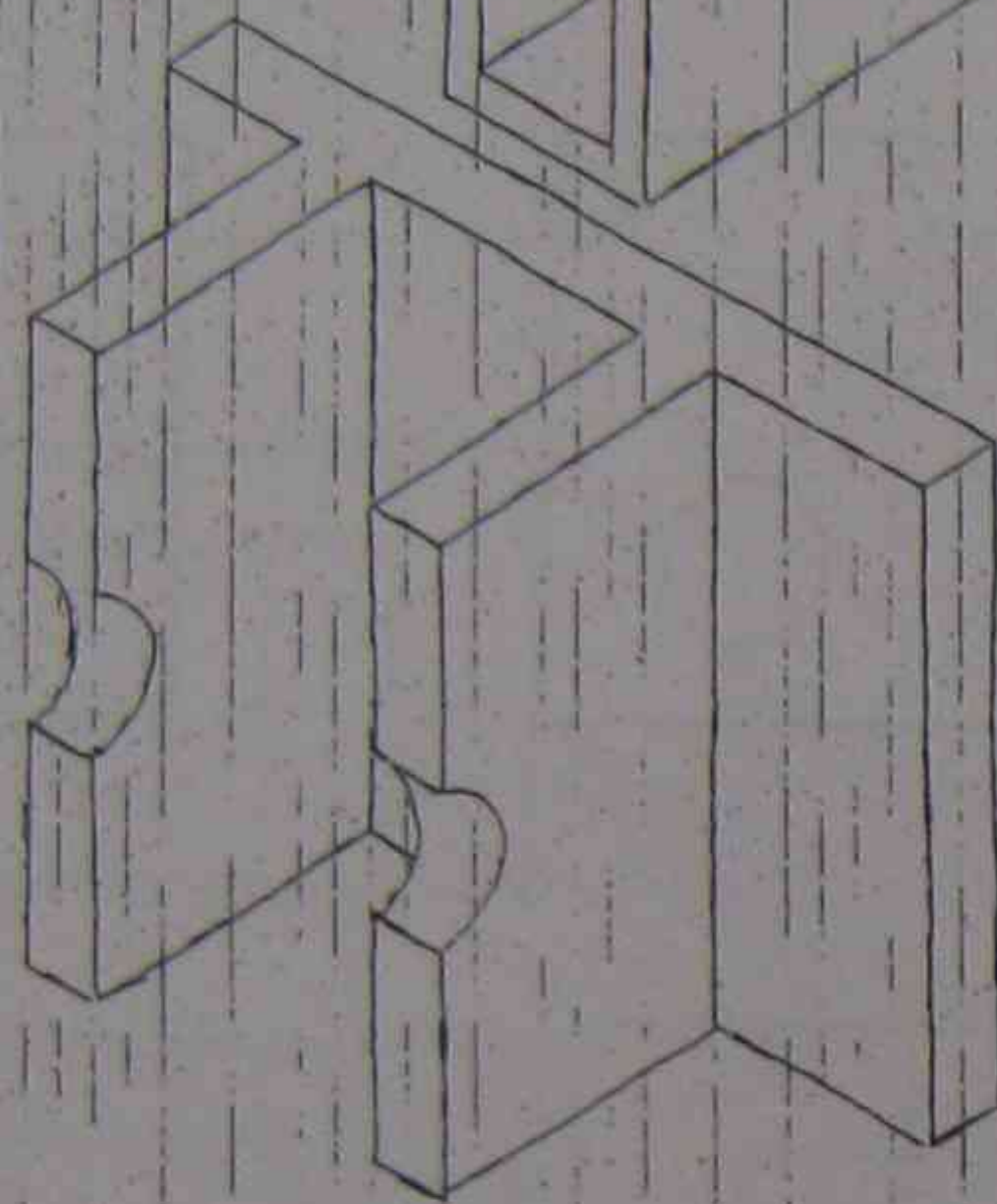
4.



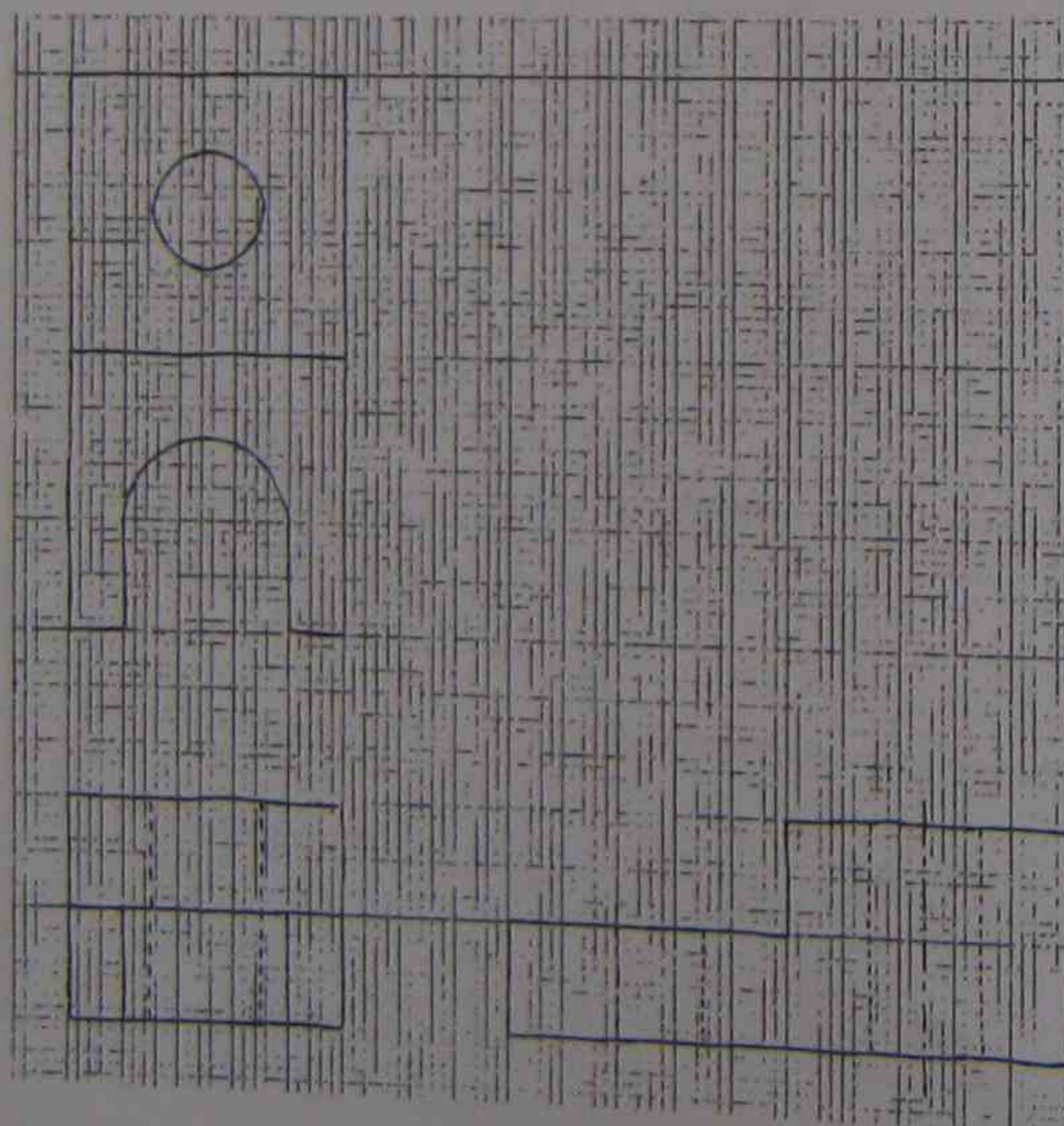
5. (a)



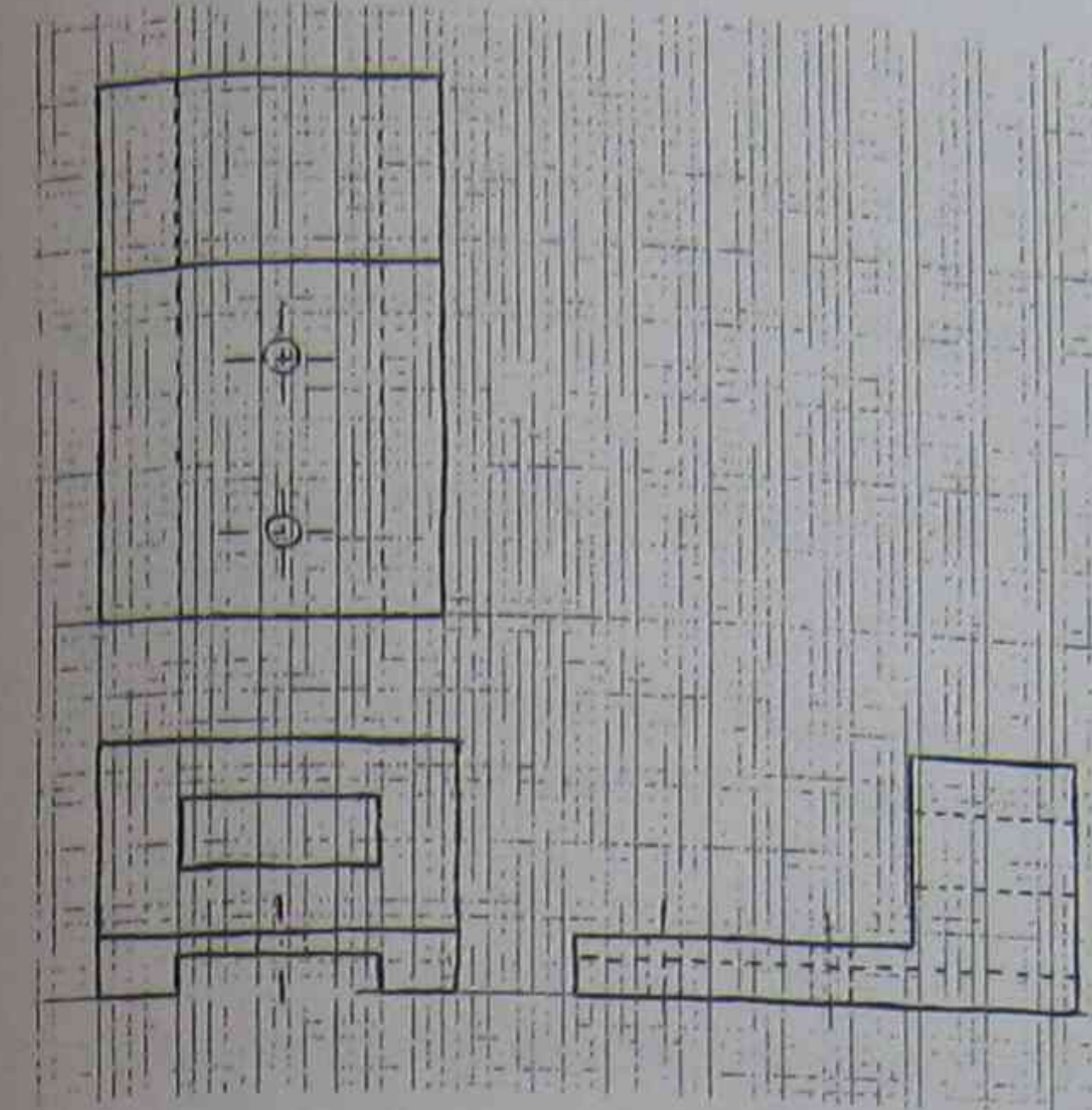
(b)



6 (a)



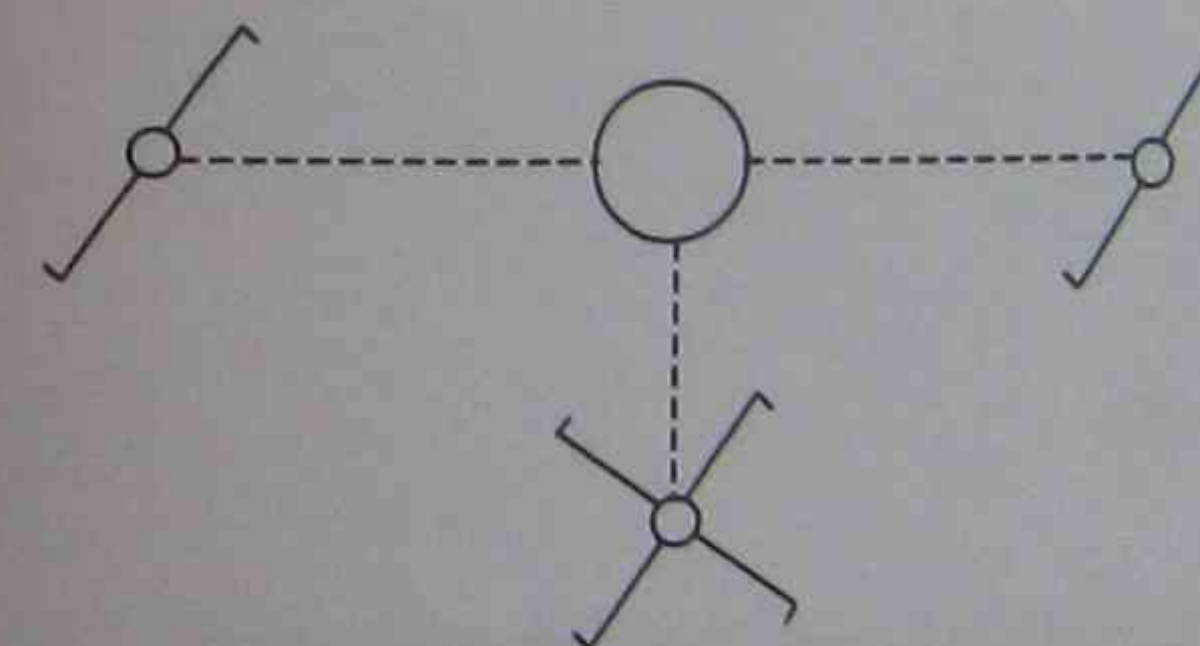
(b)



3. Architectural drawing

1. A site plan shows the outline of the building lot and the position of the building on the lot. A floor plan shows a horizontal section through a building as viewed from above, showing the actual outline or shape of the building
2. A scale drawing that shows details of specific parts relating to the installation of equipment such as position of outlets.

3.







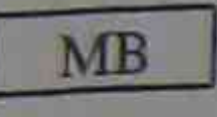
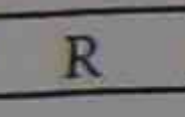


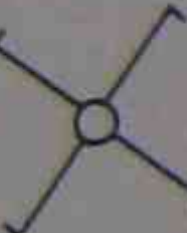
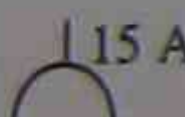
4.

- (a) 7500 mm
- (b) 500 mm
- (c) 12 000 mm
- (d) 1350 mm
- (e) 6 500 mm
- (f) 350 mm

5.

- (a) luminaire
- (b) two way switch
- (c) floodlight
- (d) one way, single pole switch
- (e) fluorescent luminaire – one tube
- (f) electric heater
- (g) main switch board
- (h) hot water service
- (i) socket outlet
- (j) multiple outlet

- (k) telephone installed on wall
(l) wall telephone outlet

6. (a) 
 (b) 
 (c) 
 (d) 
 (e) 
 (f) 
 (g) 
 (h) 
 (i) 
 (j) 

7. Usually determined by the Supply Authority
8. "Standard drawings" may be produced for project homes for the same outlay
9. Underground mains. Overhead mains, main switchboard, distribution boards, temporary builders supply, submains, etc.
10. The electrician in conjunction with the architect/builder



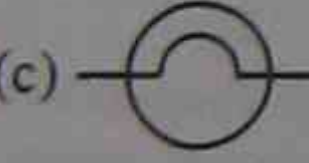
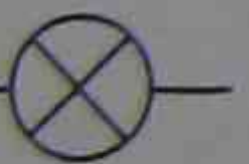
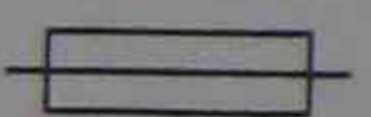
4. Building structures, materials and sequencing

1. foundation, footing, floor, walls and roof
2. It acts as the footing as well as the floor, is far stronger and less labour intensive
3. Floor joist – a timber member spanning between walls or other supports
 Bearers – a subfloor timber supporting the floor joists
 Pier – a column or post supporting floor bearers, beams, etc.
 Floorboard – material used in floor construction; the surface underfoot.

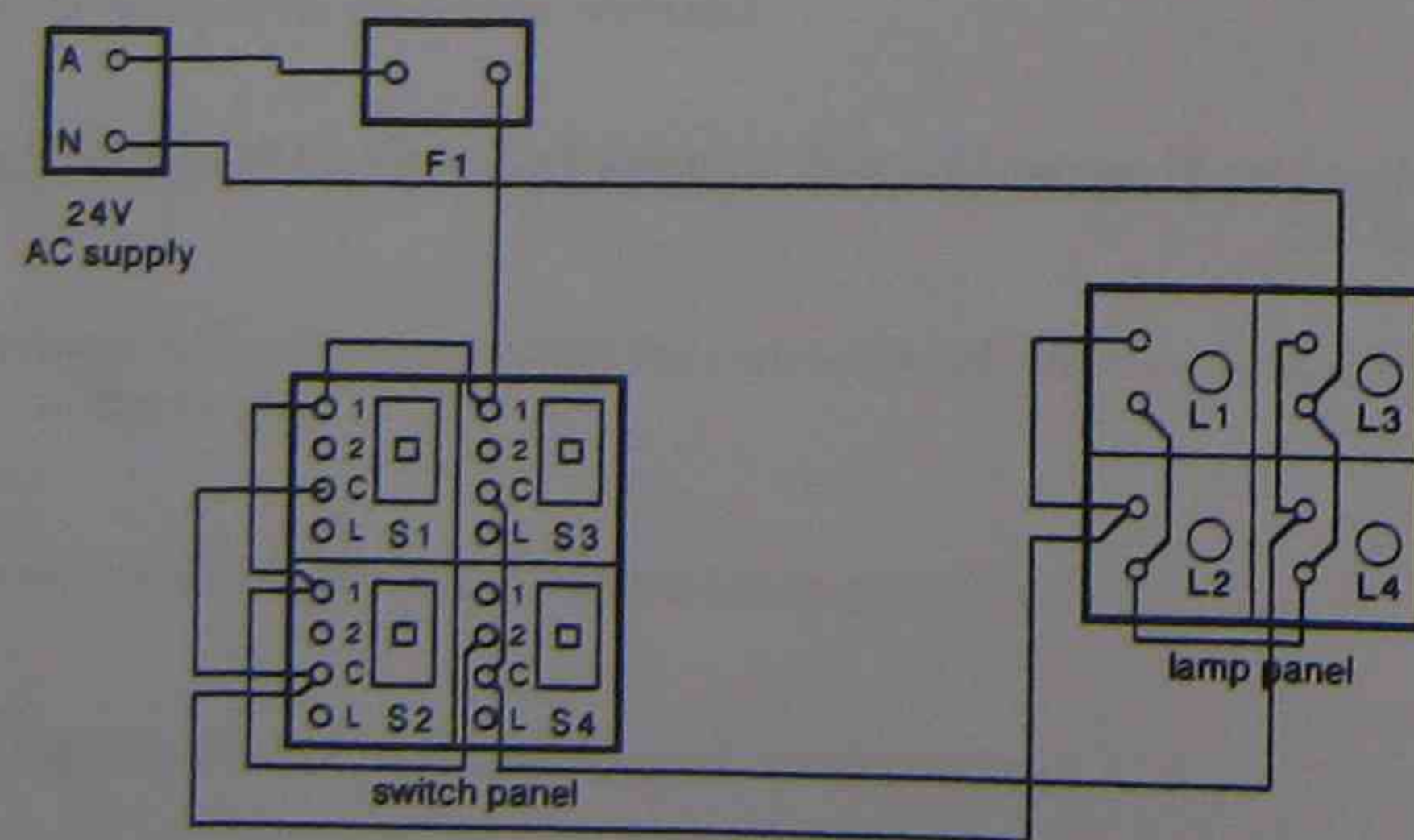
4. Studs – the vertical members in the wall framework
 Top plate – the top horizontal member of a timber framed wall
 Bottom plate – the bottom horizontal member of a timber framed wall to which the studs are fixed
 Noggings – a horizontal piece of timber fixed between studs
 Braces – a length of timber or metal fixed at an angle across other timbers to give rigidity to the structure
5. Single brick wall – wall framing of timber or metal is enclosed externally by a veneer of brickwork (one brick deep)
 Course – a row of bricks
 Feature wall – usually an internal wall to highlight some feature of the brick
 Rendered wall – a layer of cement mortar is applied to the face of the wall
6. Approximately 50 mm
7. To provide insulation against dampness, heat, cold, etc.
8. Tile – terracotta or cement, steel sheets, fibrous cement sheets, malthoid on timber frame, etc.
9. To span large distances without supports
10. Plasterboard, fibrous cement sheets, hardboard, lath and plaster, etc.
11. Weatherboards, fibrous cement sheets, stucco, sheets of brick tiles, treated metal panels, plastic wallboards, etc.
12. (a) Switchboard, cabling, wall brackets etc are installed
 (b) Accessories and appliances are connected – ready for inspection.
13. (i) roof
 (ii) ceiling
 (iii) walls
 (iv) floor
 (v) sub-floor
 (vi) footings
14. So that the surface of the cables do not provide a path for moisture from the external wall to cross the cavity to the internal wall.
15. Setting out
 Footings
 Base
 Floor
 Roof
 Cladding
 Interior lining
 Tiling
 Painting
 Finishing
16. First fixing – after cladding
 Second fixing – after painting
17. (a) installation of switchboard, wall boxes, conduits, point of attachment, etc
 (b) Plasterer – bring cables through plasterboard
 (c) Concreter – installation of conduits or underground cable runs

- (d) Plumber – location of hot water pipes, installation of cables away from hot water pipes, zone areas in bathrooms, laundries etc, equipotential bonding

5. Electrical drawing

1. (A) Circuit diagram
2. (B) Wiring diagram
3. (C) Block diagram
4. (B) Wiring diagram
5. (A) Circuit diagram
6. (D) Architectural diagram
7. (C) A wiring diagram
8. (B) Wiring diagram
9. (D) Physical layout of the equipment is determined
10. (B) Standard symbols
11. (a)  (b)  (c) 
(d)  (e) 

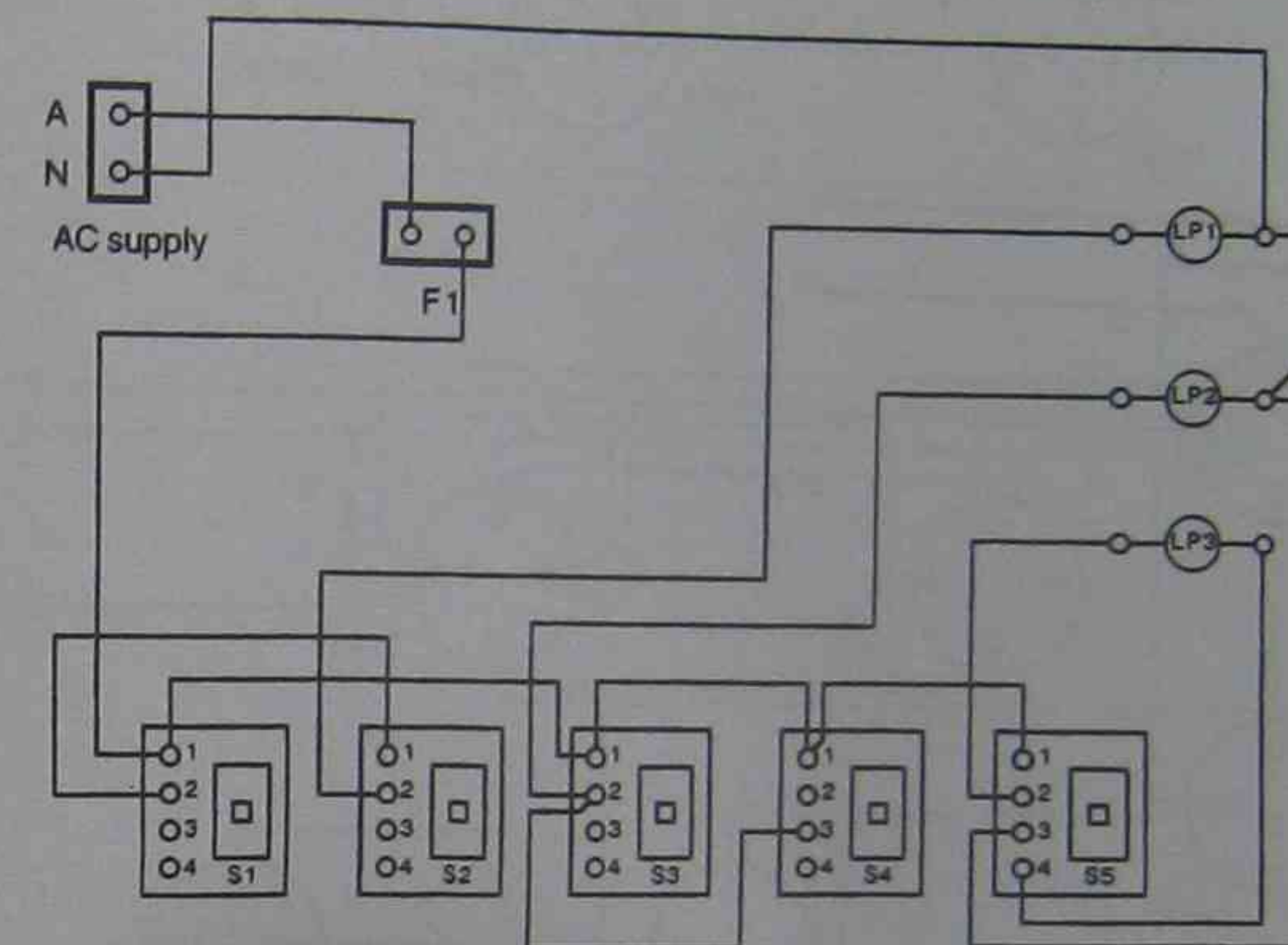
12.



6. Circuit diagrams

1. Switching chart 1
Switching chart 2
Switching chart 3
Switching chart 4
Switching chart 5
- Switch No. 3 Single pole double throw
Switch No. 5 Intermediate
Switch No. 2 Double pole changeover
Switch No. 1 Double pole single throw
Switch No. 4 Single pole three position

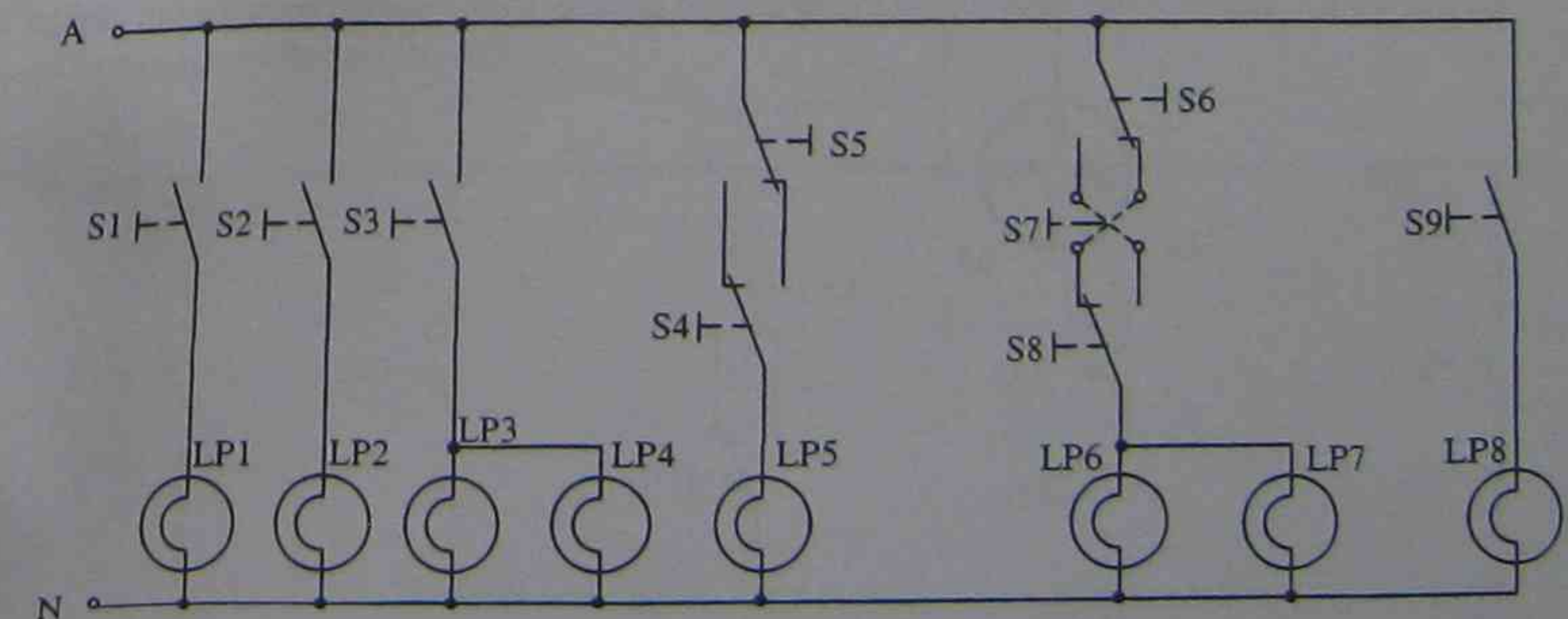
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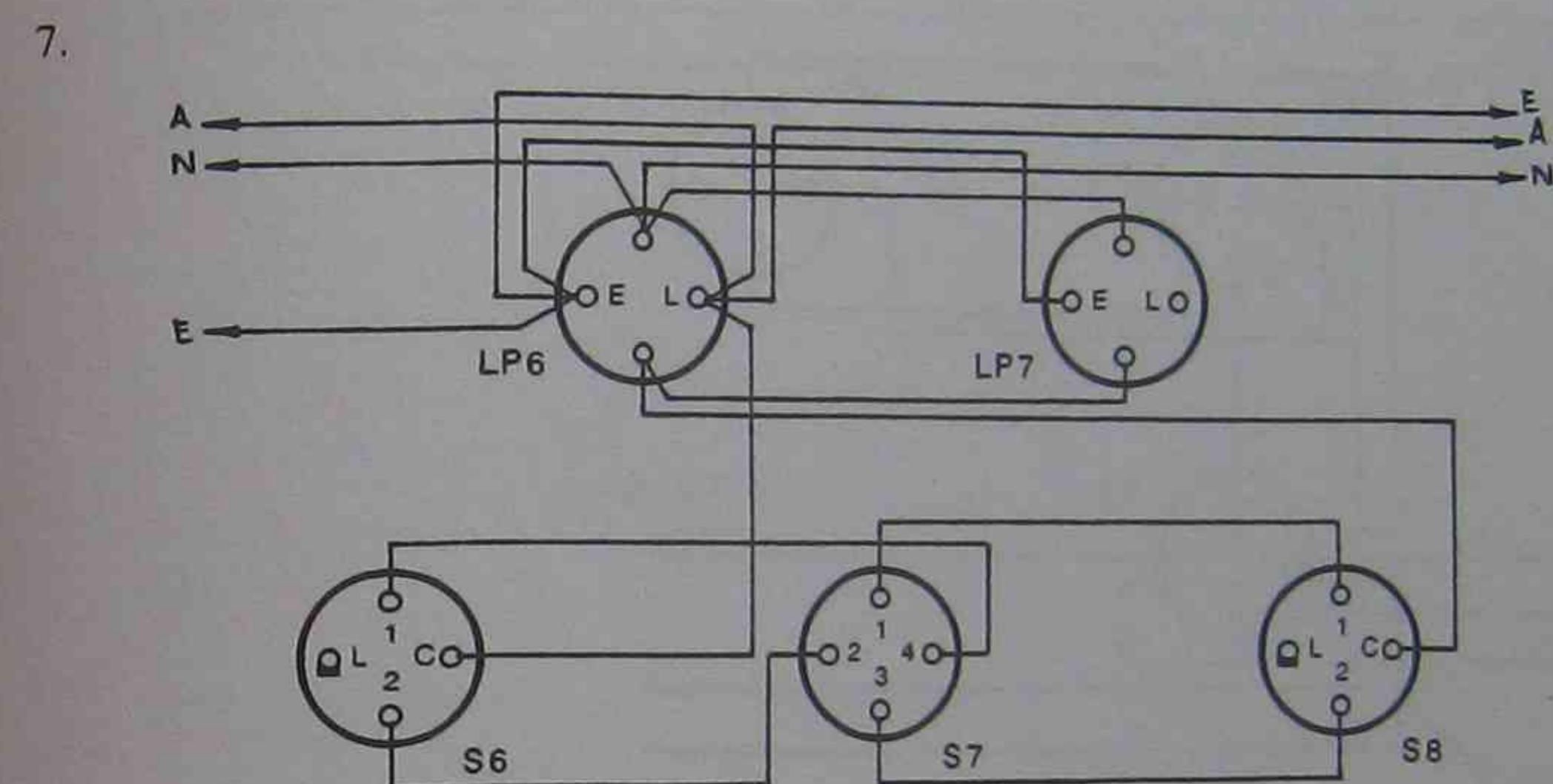
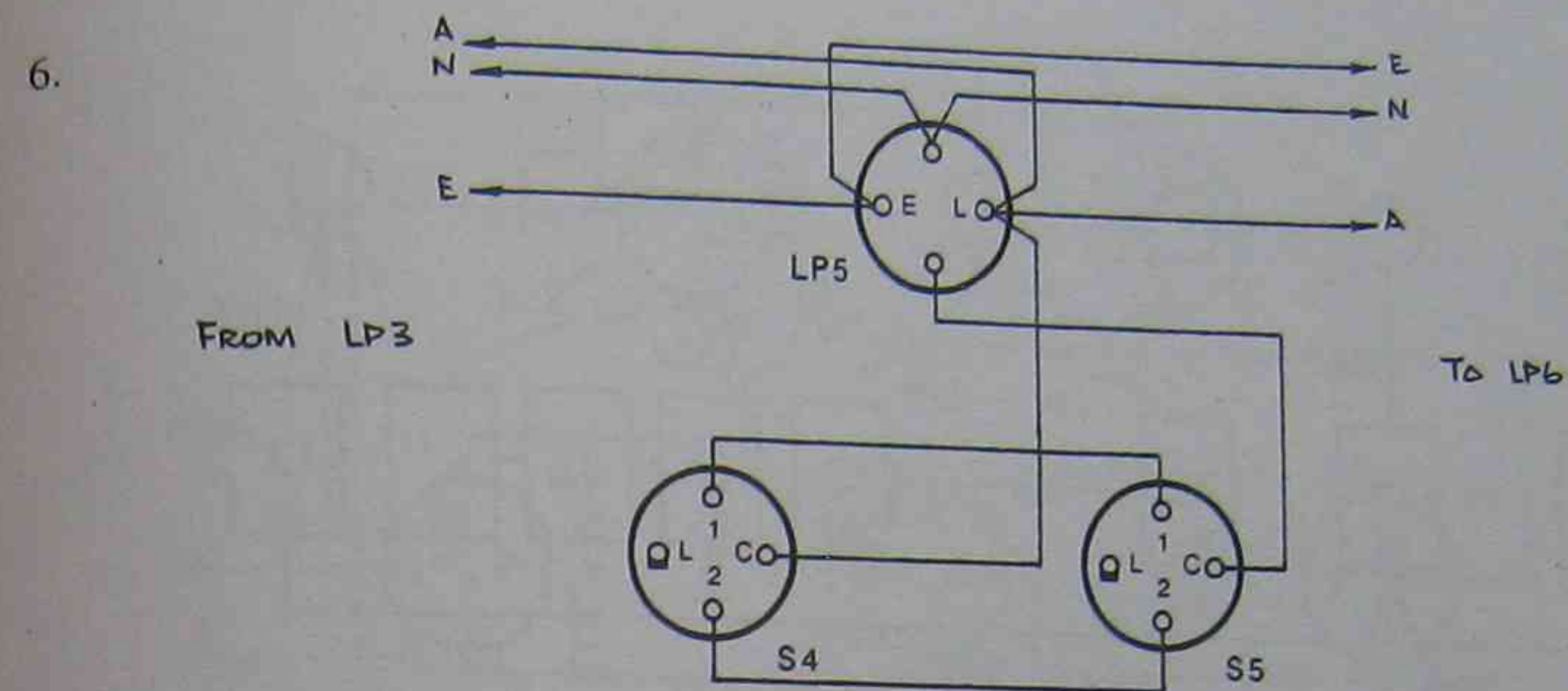
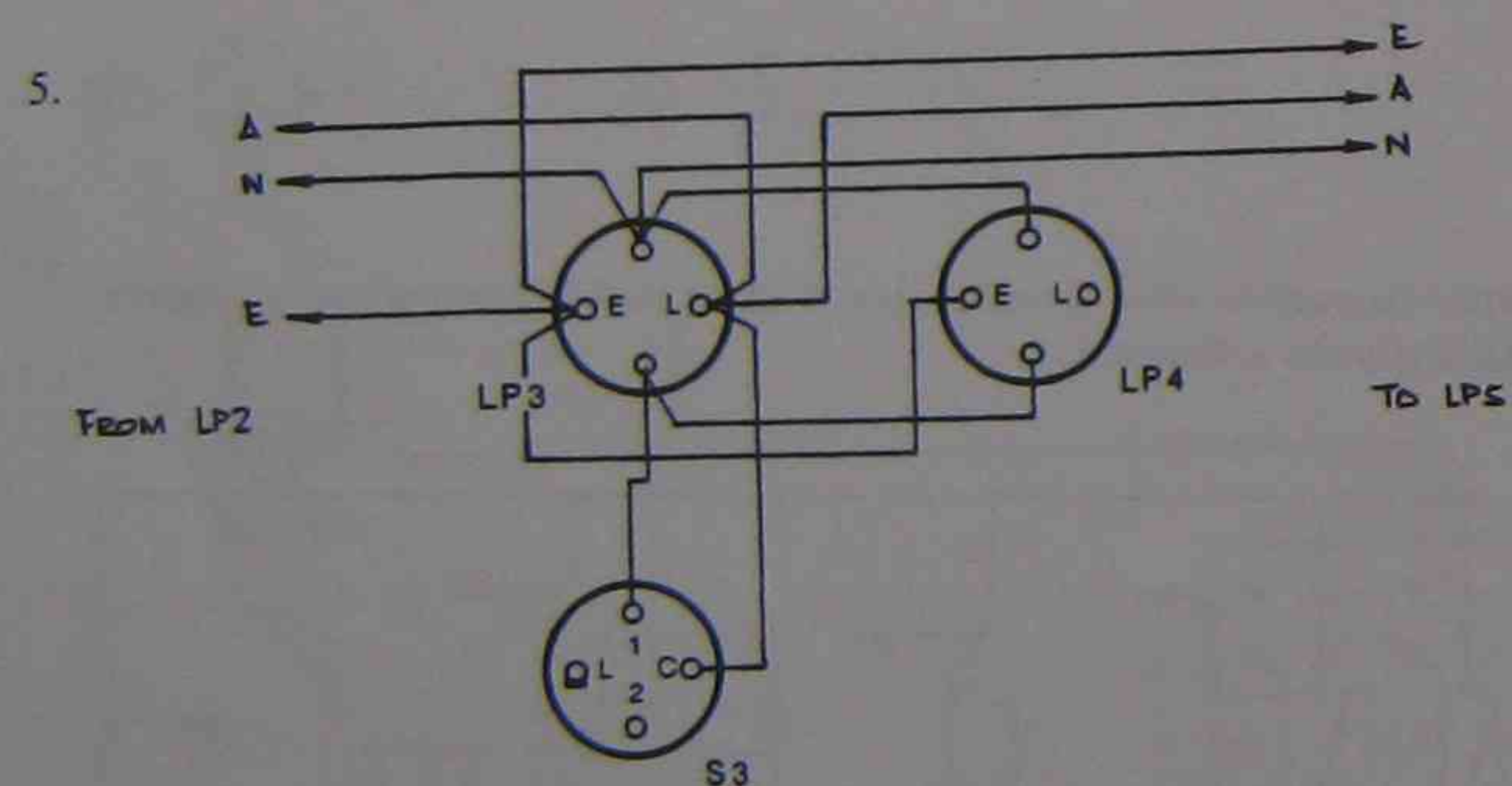
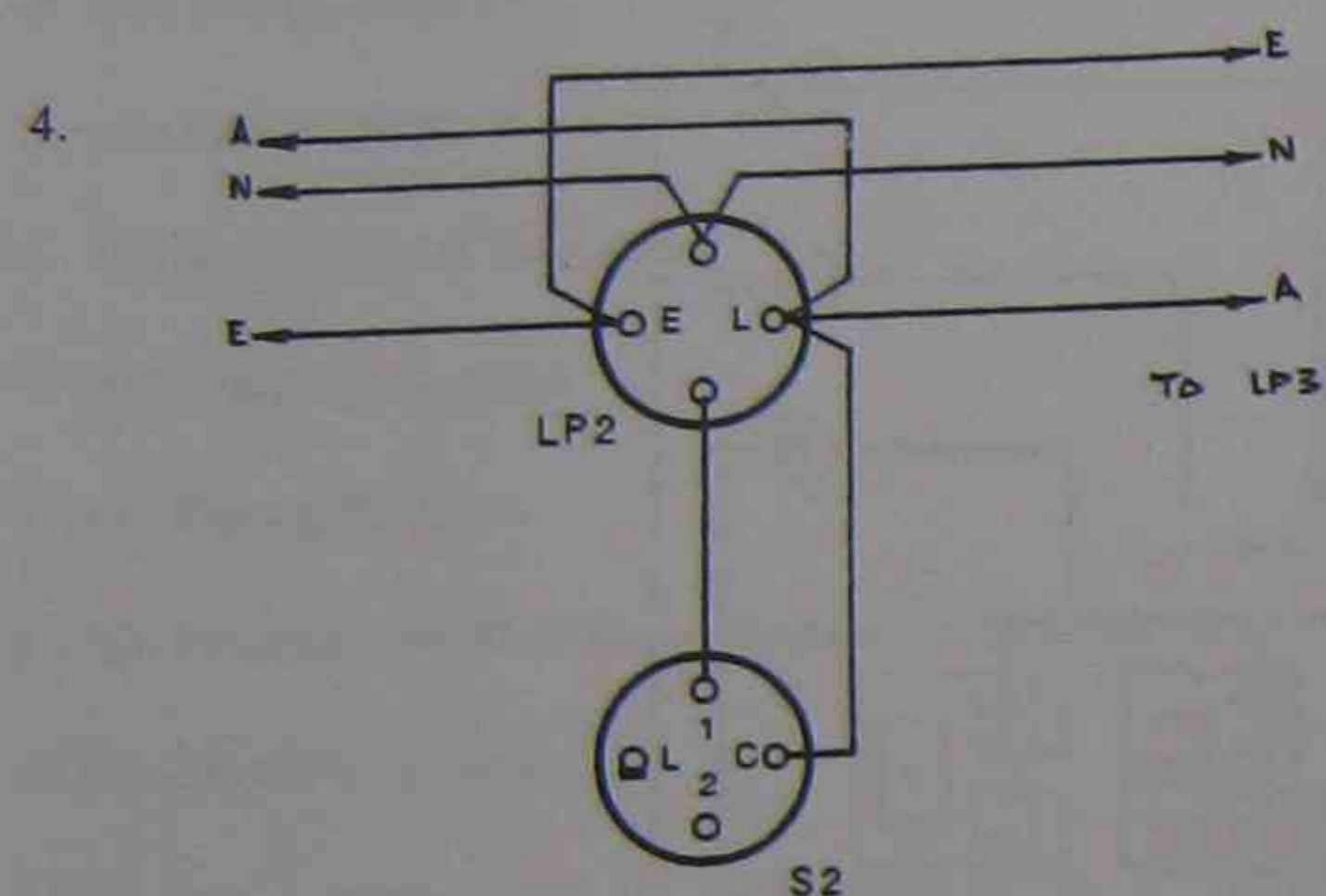
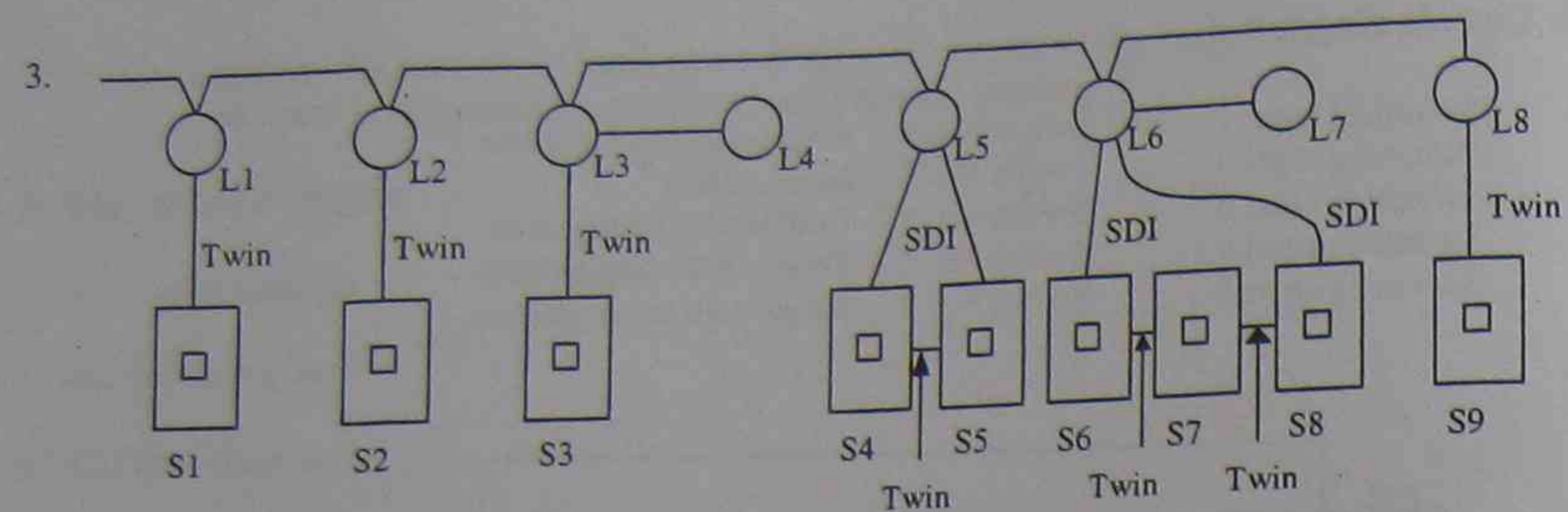


7. Light circuits 1

1. The supply cables incorporating active, neutral and earth are run to each lighting point. All cables are looped from each lighting point to the next.

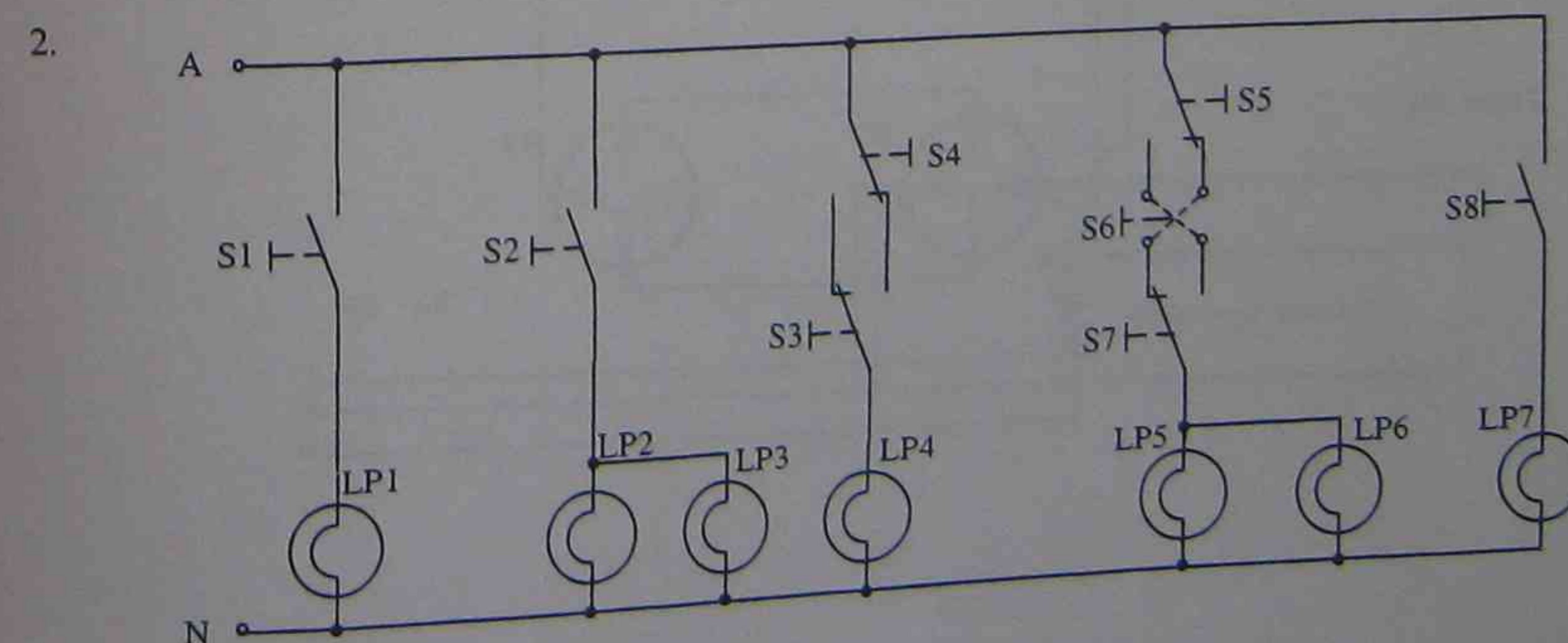
2.





8. Light circuits 2

1. The supply cables incorporate active, neutral and earth are run to each light switch. All cables are looped from each switch to the next.



Hand-drawn wiring diagram of a three-phase motor control circuit. The diagram shows three phase motors: LP2, LP3, and S2. LP2 and LP3 are connected in parallel to the main supply lines. S2 is connected to the same supply lines but also has a separate control circuit. The control circuit for S2 is connected to the main supply lines through a 2-screw connector. The diagram is labeled "FROM S1" and "TO S2".

The diagram illustrates the electrical connections for a three-phase motor (LP4) and two control switches (S3 and S4). The motor has terminals labeled E, LO, and a common terminal. The switches (S3 and S4) have terminals labeled 1, 2, L, and CO. The connections are as follows:

- FROM S2 (Power Supply):**
 - Line N connects to the common terminal of switch S3.
 - Line E connects to the common terminal of switch S4.
 - Line A connects to the common terminal of switch S3.
- TO SS (Load):**
 - Terminal 1 of switch S3 connects to the common terminal of switch S4.
 - Terminal 2 of switch S3 connects to the common terminal of switch S4.
 - Terminal L of switch S3 connects to the common terminal of switch S4.
 - Terminal CO of switch S3 connects to the common terminal of switch S4.
- Motor (LP4) Connections:**
 - The common terminal of switch S3 connects to the E terminal of the motor.
 - The common terminal of switch S4 connects to the LO terminal of the motor.

A note indicates that a "2 SCREW CONNECTOR" is used to join the common terminals of switches S3 and S4.

FROM S3

N

E

A

S5

S6

S7

2 SCREW CONNECTOR

TO SB

Theory test 1

Section A

1. (A) assembly drawing
2. (B) detail drawing
3. (C) 1.0 m^2
4. (D) chain
5. (A) diameter
6. (C) 91 mm
7. (B) orthogonal
8. (B) orthogonal drawing
9. (C) third angle projection
10. (C) isometric projection
11. (A) sectioning
12. (B) section plan
13. (C) millimetres
14. (B) strip footing
15. (D) brick veneer walls
16. (B) ceiling joists
17. (A) the bearers
18. (A) studs
19. (B) noggings
20. (B) the internal walls

Section B

1. Orthogonal and exploded pictorial
2. 46217
3. To provide clarity of assembly
4. Fillet and butt welded
5. No. Material type and thickness not specified, Hinge details and position not specified
6. An auxiliary dimension

7. Nine (9)

8. Low carbon steel, 5mm

9. 10 mm

10. 300 mm

11. Welds to be ground flush

12. The drawing shows how the scrubber is assembled and all the details needed to manufacture it.

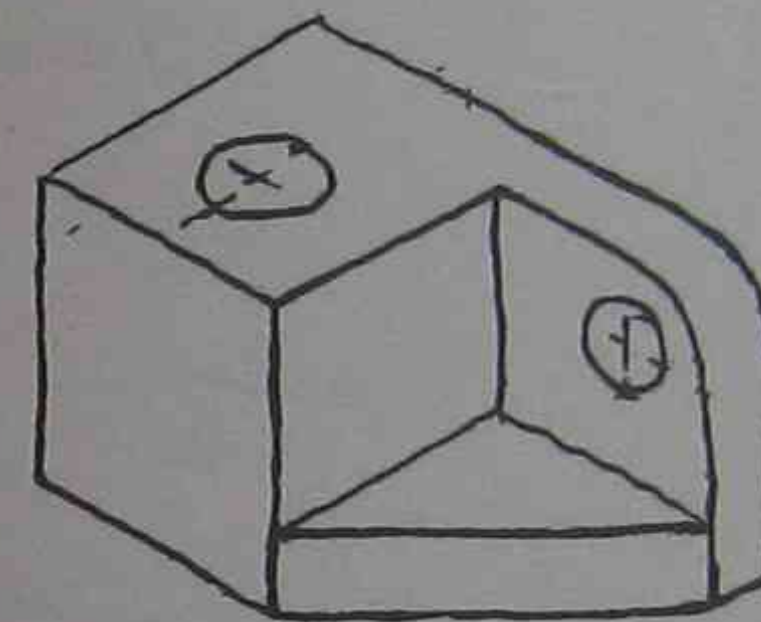
13. Eight (8)

14. 290 mm

15. Unless notes otherwise.

Section C

1.



2.

