

- Work with superintendent and bookkeeper
- Assist president for future planning
- Assist co-workers
- Teach apprentices

SUPERINTENDENT:

- Visit each job site daily
- Discuss each job in detail with job foremen
- Discuss each job in detail with general contractor weekly
- Maintain good relationship with other traders
- Take care to maintain good attitude among foremen and workers
- Prepare purchase orders
- Order inspections
- Take care of all correspondences regarding job
- Maintain good relationship with inspectors
- Prepare estimates for job
- Teach apprentices
- Maintain office.

KUBERUNATH BALANAGU

STUDENT NO: 372003863

ASSIGNMENT

SUBJECT: E071

COURSE

ADVANCE DIPLOMA IN ELECTRICAL
ENGINEERING

TEACHER

Kyaw Naing

(1) What connects are included in NSW Electrical Service Rules?

Section (1) – General Requirement

- Safety / Notification of Service Work / Connection / Disconnection

Section (2) – Under Ground Service

- Service Route / Accessing / Crossing / Service Cable Installation

Section (3) – Over Head Service

- Service Point / point of Attachment / Cable Jointing

Section (4) – Service and Metering Equipments

- Location / Accessibility / Unstable Location

Section (5) – Special Small Services

Section (6) – Capacitor Installation

Section (7) – High Voltage Installation

Section (8) – Alternative Source of Supply

2) What are the aspects of electrical contracting?

The aspects of electrical contracting are

- Trade Competency
- Specification and Standards
- Business Aspects
 - Business Nature
 - Risk Assessment
- Project Planning / Project Management
 - Material (Material Management)
 - Service Schedule
 - Time Plan
 - Financial Plan
 - Technical Expertise
 - Human Resources Plan
- Legal Aspects
 - Contract Law
 - OHS Standards
 - Industrial Rules Regulation

3) Before performing sale and marketing, what questions are to be raised?

Questions for performing Sale and Marketing are

- What does our market look like for next year?
- What are the long term forecasts for the markets we are in?
- Who are our chief competitors?
- What are their strengths and weakness?
- Should we look in to a different type of market?
- What will it take to get in to these markets?
- Are there any profitable new markets opening up?
- What is our most profitable type of work?
- Can we get more of these types of jobs?
- Do we really need them?
- Who are our best customers?
- Are they happy with the services which they provide from us?

4) What are the required Australian Standards for 11KV OH conductors?

The Australian Standards for 11KV OH conductors are

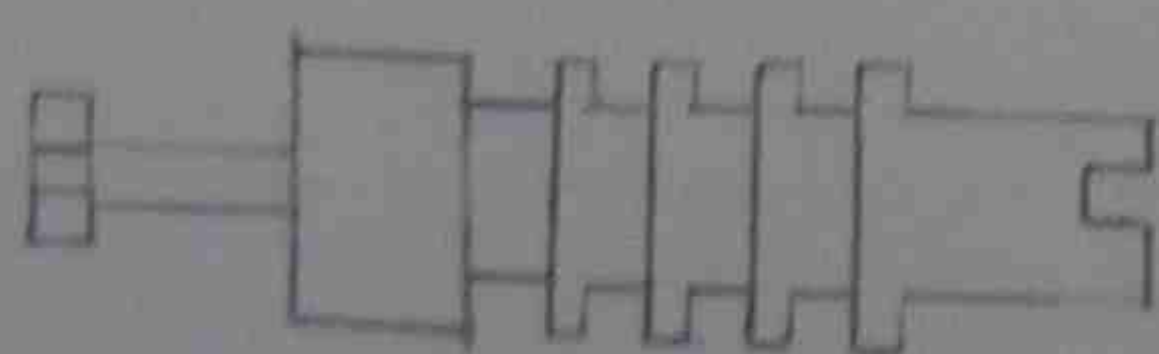
- Covered Conductor (CCT) AS 3675
- Bare Conductor (BC) AS 1222, AS 3607, AS1531, AS1746
- Aerial Bundled Cable (ABC) AS 3599.1, AS 3599.2

5) Describe the clearance requirement for OH Conductors?

The clearance requirements for OH Conductors are

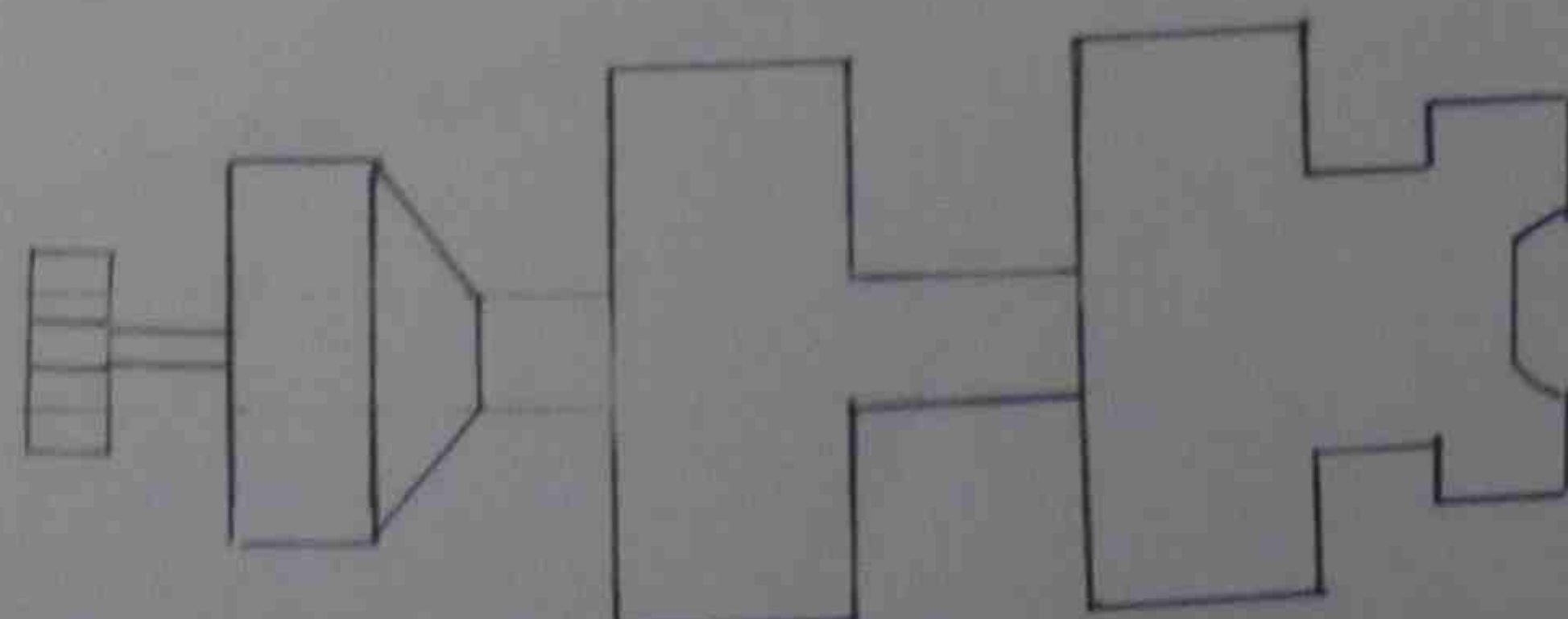
Location	Clearance
Over the carriage way of roads	7.5m
Over the ground other than the carriage way of roads	6m
No access for vehicle or mobile plants	5m

6) Sketch insulator & surge arresters and describe the components?



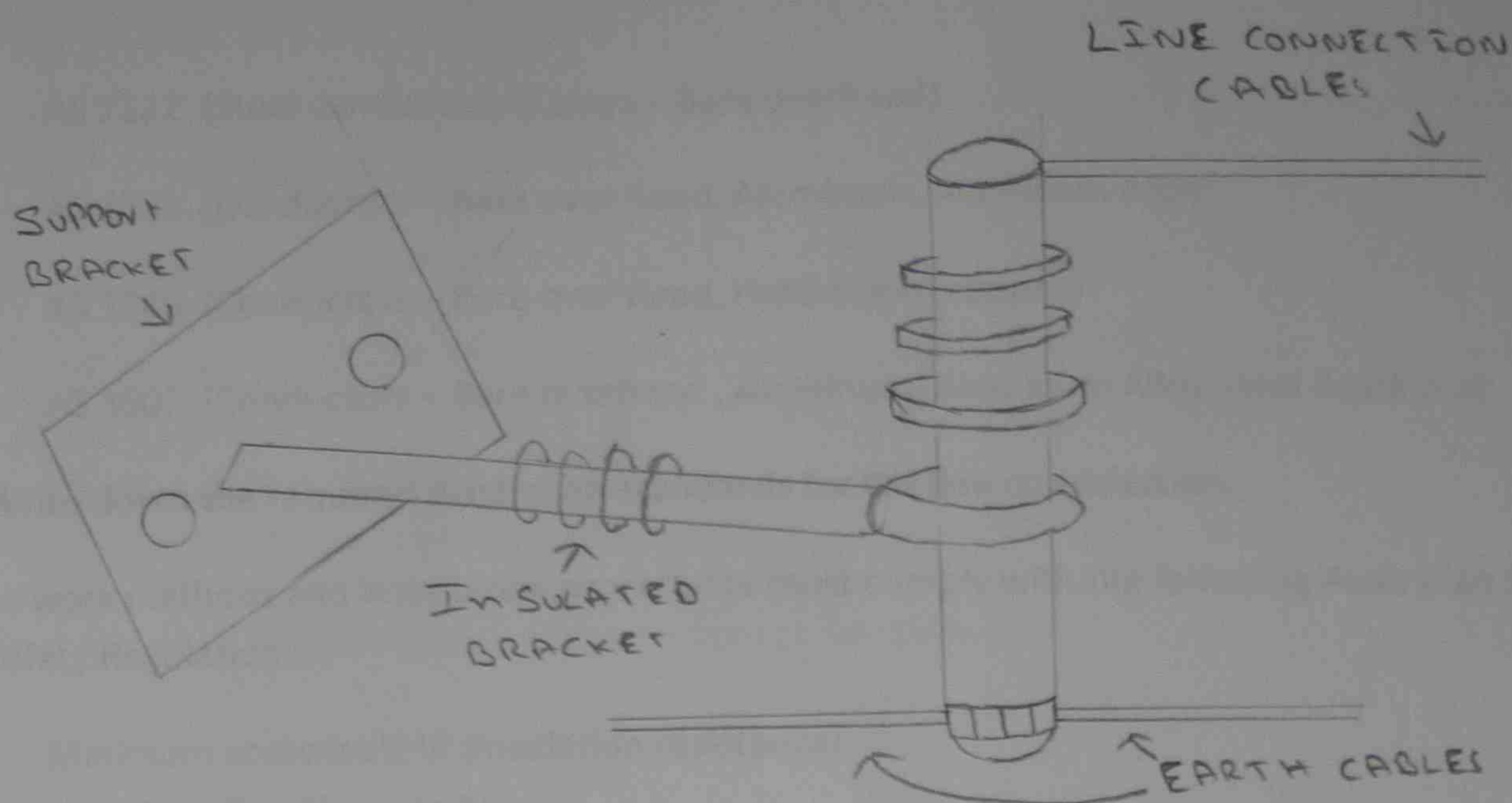
MORLYNN PIN POST

INSULATOR



NCK PIN POST

SURGE ARRESTERS



7) Write the requirements for top switches and pole transformers?

Pole Top Switches: # Non enclosed isolating switches

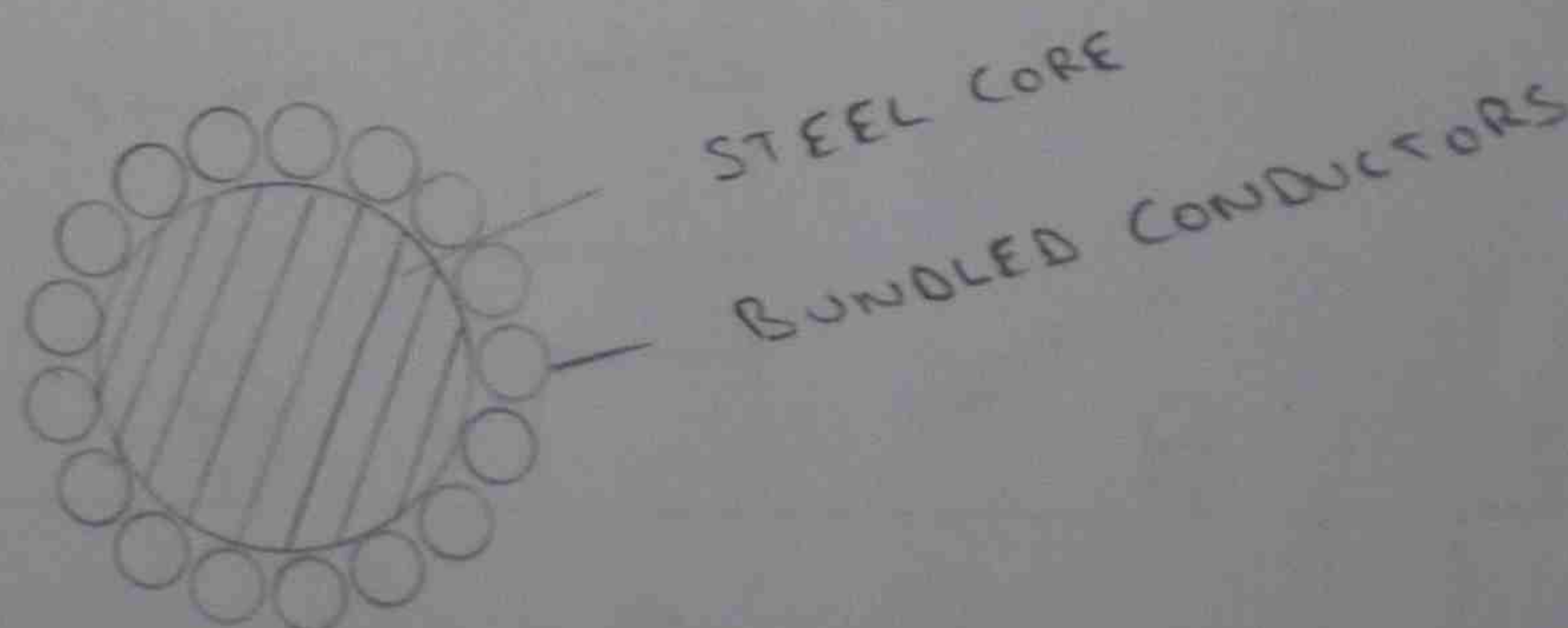
Load break interrupters

Pole Transformers: Pole transformers can only be connected to cross-arm mounted covered conductors

8) Describe angle of deviation requirement and required construction for insulator construction.

Angle of Deviation	Required Construction
Vertical construction > 30 deviation	Strain clamp and strain rod arrangement
Horizontal construction ≤ 25 deviation	Pin post (single cross arm)
≥ 25 but < 50	Pin post (Double cross arm)
≥ 50	Strain clamp and strain rod arrangement

9) Write the specifications for HV aerial bundled cables.



AS 1222 (Steel conductors & stays – Bare overhead)

AS 1531 (Conductors – Bare over head, Aluminum, Aluminum Alloy)

AS 1746 (Conductors – Bare over head, Hard drawn copper)

AS 3607 (Conductors – Bare overhead , Aluminum, Aluminum Alloy Steel Reinforce)

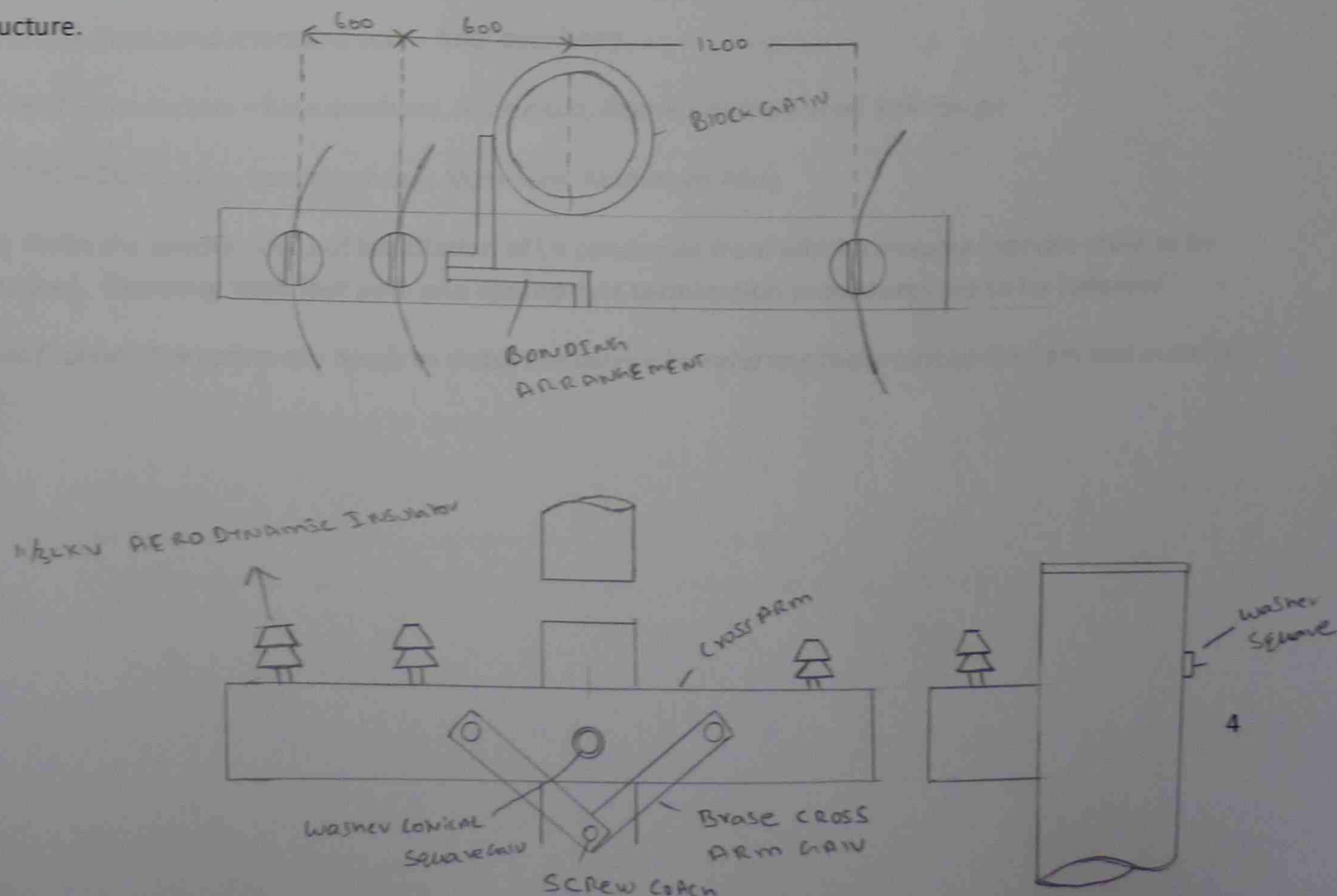
10) Write down the required Australian standards for OH line construction.

The work methods and installation procedures must comply with the following Australian Standards and Safety Regulations.

- Minimum acceptable IR (Insulation resistance)
 - 400 m Ω Phase to Phase
 - 100⁺ m Ω Phase to Earth
- AS 1307.2 Surge arresters – metal oxide type for AC system
- AS 1824.1 Insulation Co-ordination
- AS 1824.2 Insulation Co-ordination Application type
- AS 3675 Conductors – covered overhead for working voltage 6.35/11KV
- AS 3599.1 Electrical Cable, Aerial Bundled
- AS 3766 Fittings for Aerial Bundled Cable
- ESAAHB Guideline & maintenance of OH
- 1999 Distribution & Transmission Line

11) Sketch 11KV pin construction, cross arm structure and provide the materials list. Describe safety testing. Also provide relevant Australian standard references.

The contractor to provide technical construction service for 11KV, pin construction 2700 cross structure.



Safety Testing: All 11KV installations must be Insulation Resistance (IR) tested before commissioning (or) before Re-energizing after alternation.

Phasing and Insulation Resistance:

- All new and existing HV Mains and apparatus capable of being paralleled or inter connected with the existing HV distribution system is phased.
- Phasing must also be tested.
- 11KV installations – test with 1000V insulation tester 100 m Ω range.

12) Describe tools and materials storage system at worksite?

The tools and materials storage system at work site are

- Provide appropriate storage place, material handling procedure and insurance cover for materials.
- Keep the track of tool
- When the project is going on, record the used material & prices (Management Accounting)
- Verify material list with your project plan and schedules.
- Make the policy that tool must be returned to storage as soon as the job is finished.

13) Write the specifications for LV OH conductor, fitting, erection, fusing and de-energizing procedures?

Specification for low voltage over head conductors:

AS 3560 – Electric Cables - XLPE insulated – Aerial bundled for working voltage up to 0.6 / 1KV

AS 3766 – Mechanical fitting for low voltage aerial bundled cables

AS 1222 – Steel conductors and stay – bare over head

AS 3607 – Conductors – Bare overhead, Aluminum, Aluminum Alloy Steel Reinforced

As 1531 – Conductors, bare overhead, Aluminum, Aluminum Alloy

14) Write the specifications of installation of LV conductor from which consumer service main to be attached. Clearance from foot path and appropriate termination procedures are to be followed?

Specification: The contractor needs to install the service by referring the provided diagram and material list.

Fittings:

- Fittings need to comply with AS 3766 Mechanical fitting for low voltage aerial bundled cable.
- Are insulated sleeves needed to be used. Lugs must be heat shrink, 95mm² LV, M213-50 cambre die.
- LV suspension must be provided as necessary.
- The clearance of LV cable from structures must be followed as per attached table.

Location	Minimum clearance	
	ABC	Bare
Vertically above any structure	2.7m	3.7m
Vertically above structure where person can stand	0.1m	2.7m
In any direction from any radio TV aerial	0.1m	1.5m
In any direction from those parts of any structure not normally accessible to persons	0.1m	0.6m

Erection: Pulling tension must not exceed 4KN.

Immediate support: Angle of deviation

Mid Spam Joint: Must be avoided

LV Suspended services: Suspended services may be used where consumer poles cannot be used for a Three Block Spacing, for narrow frontage blocks or to avoid property crossing.

Fuse or Link Disconnecter: A Fuse or link Switch Disconnecter can be installed either as a Link Switch or a Fuse Switch. Each unit includes:

- A pole mounting Bracket
- A set of 3, 630A Link Blades
- A link storage Kit

Ground clearances for new LV aerial conductors are:

- Over the carriage way of roads – 6 meters
- Over ground other than the carriage way of road - 6 meters
- Over ground which by its nature cannot be traversed by vehicle or mobile plant – 5 meters

15) What are the steps to be followed for purchasing?

Material account is 50 → 70% of most electrical projects. Purchasing is a very important function.

Steps for purchasing:

- Verify that your material list is correct.
- Make photo copy of your estimate sheet (cover up price & labour figures)
- Break down your material list in to sections.
- Give copies of the material list to your local suppliers.
- Issue purchase orders to low bidders provided, they can give you the proper material and deliver them on time.

16) Draw Purchase order.

Purchase order

Dated: 15/09/11

To,

Shipped to,

Global Supply Co

Ausgrid

Shipping Instruction: Deliver as directed

Deliver the following - As per specified here in

{Price information and delivery procedures}

List: # 12 Thin Copper Wire 200m

10 Thin Copper Wire 300m

Submit Invoice

Bearing this P.O.Number

Company Name:

Received and Acknowledged By:

Dated:

Getting Submittal: Especially, this is very important for the contracts. Incorrect or late submittal can be cause Expensive delays.

Delivery schedule: Make sure your sales person to call the factory to verify delivery dates.

Avoid back Order:

Daily Diary

Name:

Job Name:

Date:

Job Number:

Men Working:

Weather:

Deliveries:

Inspections:

Comments:

17) What information are to be included in writing the specifications for hazardous identification.

If the specification for plant / Equipment / Project where the risk to Occupational Health and Safety exist, the specification should outline the information for OHS.

- The suggestion to operator how to work
- Instruction and advice on tools/materials and equipment regarding safe working and safe operation.
- Outline any possible unsafe practice and the things to avoid.

To get the complete information, the writer of specification should ask the working personals for the flowing aspects.

18) Write a safety instruction for working near LV installation and system.

The contractors must follow the following electrical safety procedures:

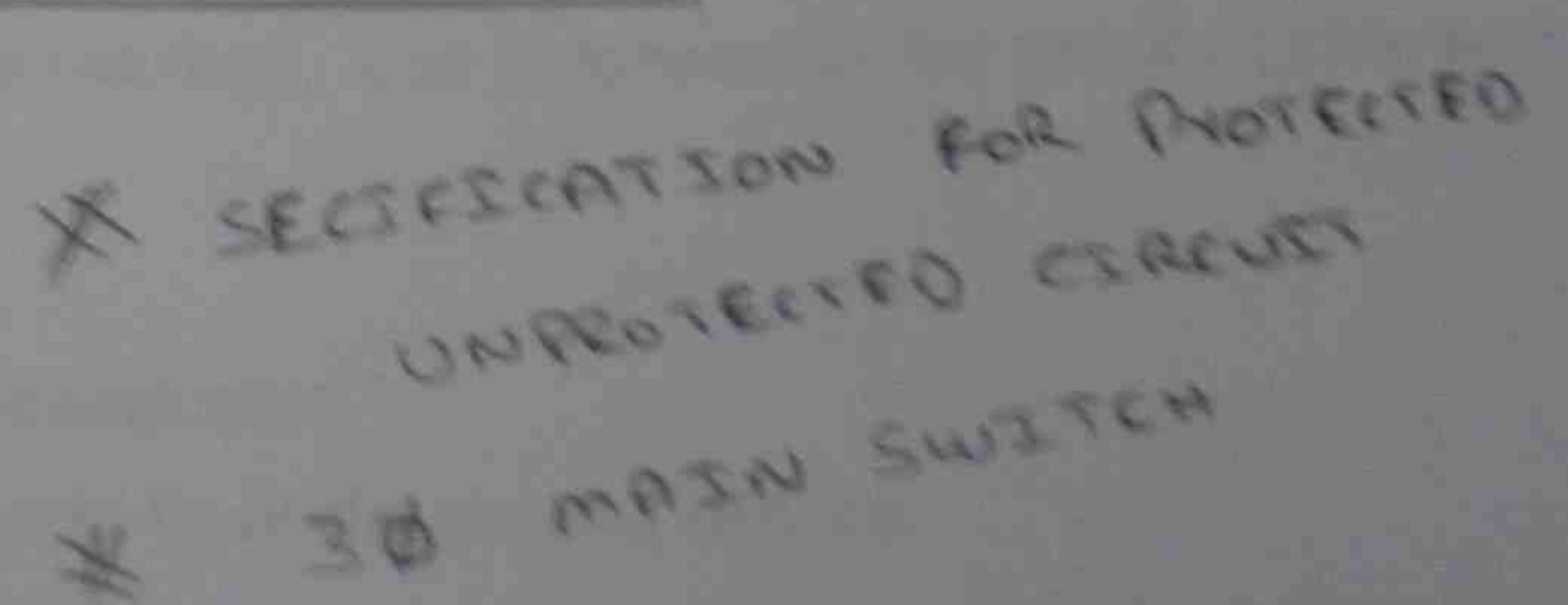
- Measure voltages between phases and earth, Place the appropriate warning notice.
- Measure the voltage of the metal frame work close to live exposed conductors.
- Take care on working with capacitors as voltage may exist across undercharged capacitors.
- Test the multiple supply source of possible live condition.
- Must follow electrical testing or operating equipments with open encloses in hazardous area as defined by AS 3000:2007
- Appropriate warning sign to be placed on coils and bar high voltage of possible HV.

19) Prepare a general safety advice for the employees who are modifying the existing electrical installation or system.

The contractor must be aware of:

- Testing must be done prior to touching
- Identify the electrical equipments and must include clear labeling
- The electrical equipment to be work on must be isolated from all source of supply.

- 20) Provide an electrical installation diagram and specification for main power supply for 1 phase and 2 circuits. Sketch an electrical installation diagram and write the specification.



Main Supply Wire: The main supply wire must have the approximate size and the calculation of the size must be in accordance with maximum demand and AS 3008 requirement.

Main Switch: Main switch must be accordance with AS 3000:2007. Its location and accessibility must be in accordance with AS 3000:2007.

RCD: RCD must be capable of protecting two circuits. This size of RCD must be compatible with the circuit current and voltage. RCD must follow AS 3000:2007.

Sub Main/Over Load Protection: Over Load Protection device classification must be appropriate to circuit over current protection requirement. The operation time must meet the protection time requirement.

The protection circuit breakers must be clearly labeled on the main switch board and the devices that they protect must be indicated.

Final Sub-circuit: The size of final sub circuit wire must be appropriate size. So that the voltage drop must not exceed $\pm 5\%$ of supply voltage.

The connections for final sub-circuit, the junctions are to be clearly indicated on the diagram and are to be provided with accessibility for future modification and renovation.

21) Explain the features of residential electrical contracting work.

The nature of residential electrical work is different from large commercial contracts. Planning, Estimation, Quotation and Installing are to be completed in a short time with short notice. Job lay out; Pre Job planning is to be referred to previous experiences in several times. The following are installation procedures in residential works:

- UN load all materials and tools that will be used that day. Place all materials and tools in an accessible and central location.
- Run an extension cord to the power source.
- Fill and hang the required cable dishes.
- Mount all of the electrical boxes.
- Mount plaster rings for low voltage outlets.
- Drill all holes and notch any framing members as required.
- Install cable exactly shown on plans, As each are is completed, highlighted it by marker.
- Install service panel and connector before mounting panel.
- Bring all cables in to panels. Be sure that all are marked. Use a connector for service cable and cover the panel front with cupboard.
- Mount and wire meter base
- Drive ground rod and run grounding electrode conductor.
- Install service riser for over head service or drop in to underground service.
- Splice all branch circuit cables.

- Double check the entire job to be sure that everything is completed. Load all materials and tools back in to truck. Thoroughly clean up the job site.

22) What are the components of telecommunication system?

All data communication system has the following components:

- Source of Data (Transmitter/line driver)
- Communication link (Transfer the message to receiver at the other end in form of voltage)
- The receiver of the data where the signal converted back into a form that can be used by local electronics circuitry.

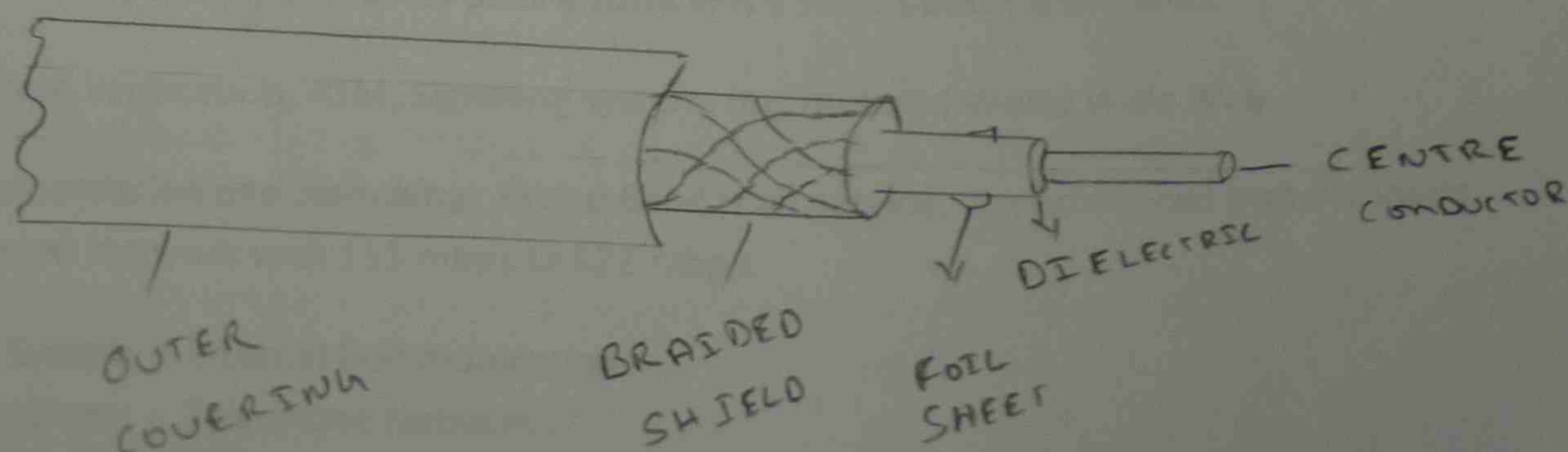
23) What are the important facts in writing of telecommunication specifications?

Important facts in writing of telecommunication specifications are:-

- The type of electrical signal used to transmit the data
- The type of loads used for each symbol being transmitted
- The meaning of the symbols
- How the flow of data is controlled
- How to detect and correct errors.
- *Protocol*: Type of characters being transmitted.
- *Transmission media*: There are four types of media that can be used in transmitting information. 1) Copper wire, 2) Coaxial cable, 3) Optical fibre, 4) Wireless
- *Loading*: Load coils are frequency added to loops longer than 5.4km. Load coils are low pass filters.

24) Sketch coaxial cable and indicate the components.

Coaxial cable consists of a single strand of copper running down the axis of the cable. Outer shielding by insulator.



25) What are to be included in telecommunication specification?

The specification for telecommunication system are

- The types of electrical signal
- Type of load
- Type of transmission media
- Type of protocol
- The kind of switching system.

26) Describe the types of end-Office switching and accessories.

Types of end-Office switching and accessories are

Switching system	Operation	Method of Switching	Type of control	Type of network
Manual operator	Manual	Space/analogue	Human	Plug/Lord/Jack
Step by Step	Electro Mechanical	Space/analogue	Distributed stage by stage	Stepping switch train
Cross Bar	Electro Mechanical	Space/analogue	Common control	Cross bar Switch
ESS Electronic Switching System	Semi Electronic	Space/analogue	Common control	Reed Switch
			Stored program control	Reed Switch
	Electronic	Time/Digital	Stored program common control	Pulse code modulation

27) Explain the followings

(a) **Pocket Switching:** The information being transmitted is not sent in real time over a dedicated circuit. It is stored in a nearby computer until a sufficiently sized packet is on hand.

- Credit card verification, ATM, Signaling system, Internet and World Wide Web.

(b) **Digital Transmission and Switching:** Broad Band is an service. Asynchronous transfer mode (ATM). High Speed Network with 155 mbps to 622 mbps.

- Closed System - Internal Communication
- Open System - Telephone Networks
- ISO - International Organization for Standard

- ITU - International Telecommunication Union
- TSS - Telecommunication Standardization Sector
- ANSI - American National Standard Institute
- IEEE - Institute of Electrical and Electronic Engineers.

28) Explain the international telecommunication standards in group 3 & 4.

Group (3) Universal Protocol for Sending Fax Documents across Telephone Line

Group (4) A Protocol for sending Fax document over ISDN Network

- V21 Standard for full Duplex Communication (USA-Bell 103, 300 Bells in Japan & Europe)
- V22 Half Duplex Communication at 1200 bps in Japan and Europe and in USA – Bell 212A
- V29 Half Duplex Modem, sending & Receiving Data across telephone lines at 1200, 2400, 9600 bps
- V32 Full Duplex Modem Sending and Receiving Data across phone lines at 4800 or 9600 bps
- V34 Full Duplex Modem Sending and Receiving Data across phone line at 28200 bps
- V42 Error Detection standard for High Speed Modem.
- V90 Standard for Full Duplex Modem Sending and receiving data across phone lines at 56600 bps
- X25 Packet Switching protocol for WAN
- X400 Universal Protocol for Email
- X500 Addressing format so all Emails can be linked together.

29) Explain the insurance for electrical contracting.

Insurance: Appropriate Insurance cover for all equipments, Assets, Tools, Materials, Staff and Professional service must be arranged.

The Insurance cover needs to be regularly updated depending on market value of assets, Expansion and complexity of the Electrical Service.

Three main types of insurance are there

- General Liability Coverage
- Comprehensive Automobile Liability Coverage
- Workmen's Compensation Coverage.

General Liability Coverage: Supplementary Package may be required from time to time depending on expansion or changing nature of the contract works.

Completed Operation Coverage: A general liability covers losses while the contractor is on the job but not after completed operation coverage fill this gap.

Board Form of Property Damage Coverage: It covers the damage to another person's property while working on site.

XCU Coverage: Explosion, Collapse, Underground. It is important for contractor who does a lot of underground work.

30) Write the specifications for domestic electrical installation.

Main Switch Board: Specially controls projects and usually measures the supply to a whole installation.

Clause 0.5.85: A Switch Board from which the supply to the whole installation can be controlled.

Clause 0.5.54: All electrical wirings, Accessories, Fittings, Consuming devices control and protective gear and other equipment associated with wiring situated in any building.

The installation is deemed to commence at consumer terminal.

Clause 0.5.55: Domestic installation in a private dwelling (or) that portion of an installation associated with an individual flat or living unit.

Clause 0.5.56: an installation incorporating

- A number of domestic installation
- A number of non-domestic installations
- Any combination of domestic and non-domestic installation.

Distribution board: Distribution board is generally fed from a Sub main to control and protect a portion of an installation.

Clause 2.16.11.1: The supply to every installation shall be controlled on the main switch board by main isolation switch.

Clause 2.11.6.1.2: The number of main switches installed at any main switch board shall not exceed six.

Clause 2.1.6.1.3: Main switches shall be readily accessible. Shall not be more than 2m above ground floor or platform.

Clause 2.21.1.12:

General: The main switch board shall not be located not more than one floor above or below. An entrance to the building and shall be within easy access to such entrance.

Multiple Installation: In multiple installation, the main switch board shall not be located with in any domestic installation.

Restricted Locations:

- A switch board shall not be installed within 0.9m above the ground floor or platform in domestic and multiple installations.
- A switch board shall not be installed within a fire isolated stair way, passage ways, ramp or similar means of emergency exit from building.

31) Explain the electrical regulation clauses for wiring systems.

Flat TPS cables can run in

- Unenclosed in ceiling spaces
- Inside plaster board lined walls and partitions
- Inside skirting trunking and floor duct

Trunking & Duct:

Clause 0.5.90 Duct: A pipe of 750mm diameter or greater

Clause 0.5.94: Trunking a trunk or through for housing and protecting electrical cables and conductors.

Clause 0.5.97: Wiring enclosure a pipe, tube, duct or cable trunking fixed or supported in position with appropriate protection.

Clause 3.26.1: Metallic conduit used for the protection of cables in the following situations where exposed to severe mechanical damage. In class 1 Zone and class 1 Zone 1 hazardous areas. For the supply to fire and smoke control equipments. Evacuation equipments and fire.

32) Describe the paper work in electrical contracting.

Paper work consists of involves, billing, payroll, purchase order, etc.,

Key factors in processing paper work smoothly

- Having enough information
- Getting the information when needed
- Having enough people to handle the work.

Purchase Order

- One Copy → Vendor
- One Copy → Folders to check all invoices
- One Copy → P.O file. (Purchase Order)

Billings

- One Copy → Job folder
- Two Copy → Customer

The customer should return one copy with

Time Cards

- One Copy → Pay Roll
- One Copy → Job Folder

Incoming Invoices

- One Copy → Job Folder
- One Copy → Book Keeper's amount payable basket

32) Draw a service form.

Service Order

Billed:

Customer _____

Address _____

Phone _____

Job Address _____

Job Phone _____

Description _____

Job Assigned To: _____ Date: _____ Completed: _____

Material	
Invoice	Amount

Labour	
Date	Hour

Other

Rate:

Quoted Amount: _____

33) Write down the aspects of cutting cost.

The aspects of cutting cost are

- Buying materials more cheaply (market survey, judge price and quality)

- Making it easier for supplier (it will make it easier for your supplier to sell you material that is not subject to unfair competition)
- How much should I pay judge with total amounts & benefits
- Store the commodity items in mass at the time of discount offered on bidding price.

34) Write the steps for pulling cable into conduit.

Pulling cables in to conduit

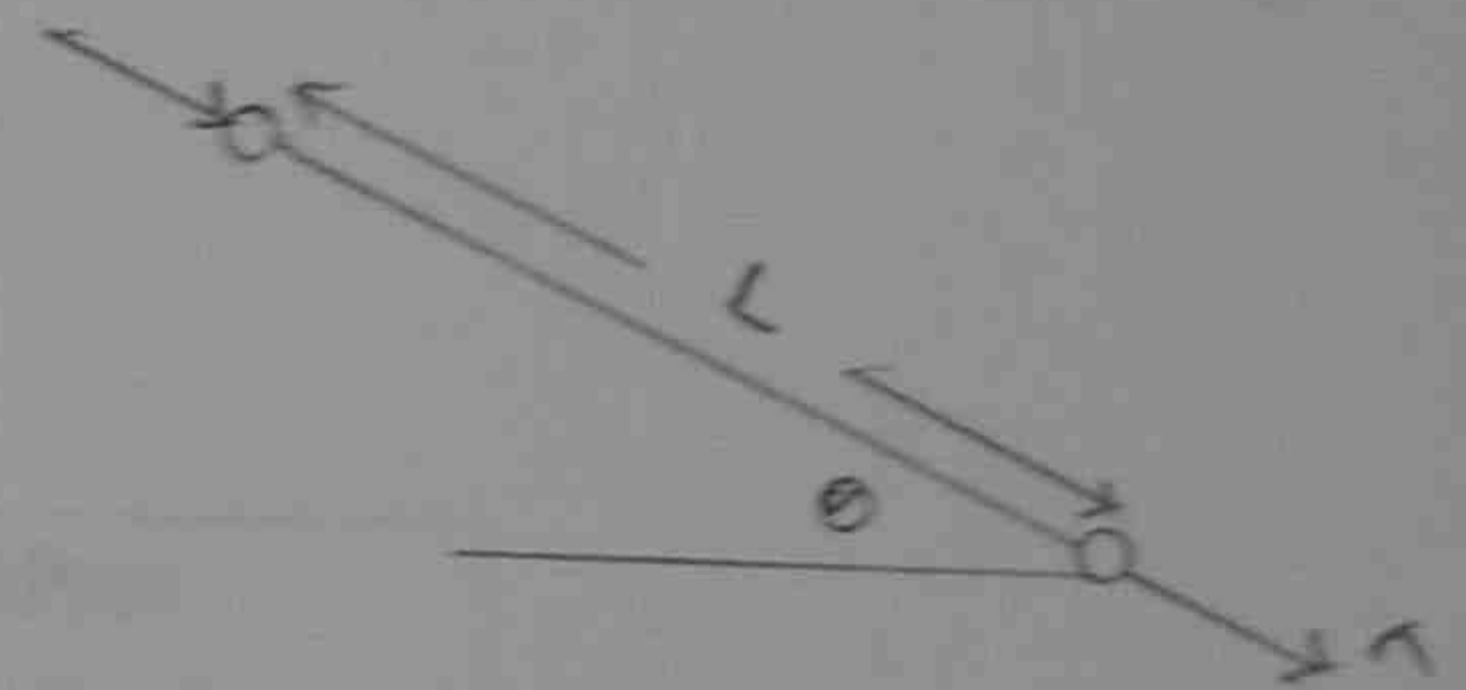
- T_0 = Tension at the commencement of a section (N)
- T = Tension at the end of a section (N)
- M = Mass of cable per unit length (Kg m^{-1})
- μ = Coefficient of friction in a given section
- W = Equivalent cable force per unit length $98/\text{m}$ (N-m^{-1})
- L = Length of straight level section (m) or length of inclined section (m)
- R = Radius of horizontal bend (m)
- θ = Angle of subtended arc in bend (Radian)
- F = Side wall force (Nm^{-1})

STRAIGHT SECTION



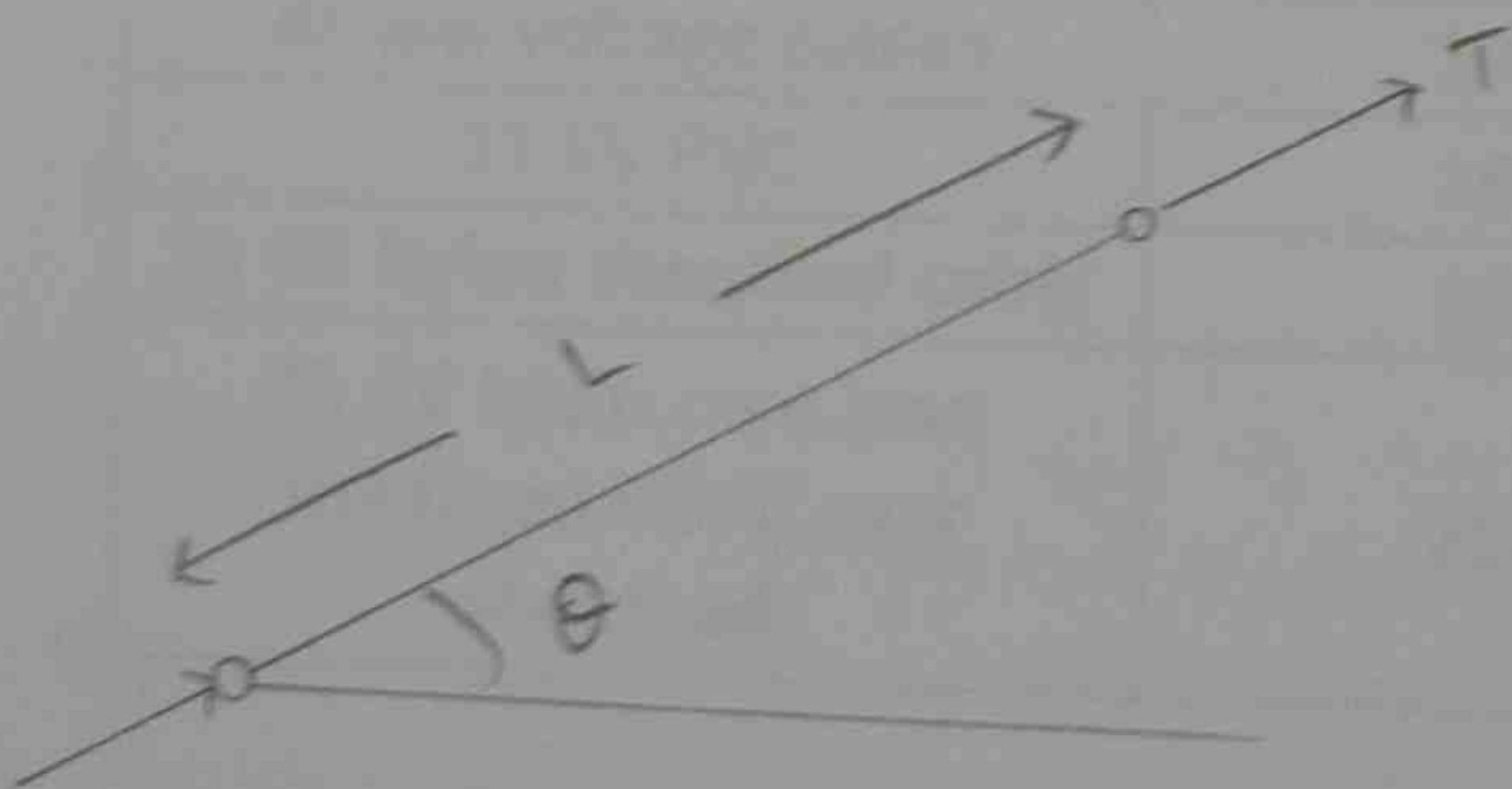
$$T = T_0 + \mu WL$$

DOWNWARD INCLINE



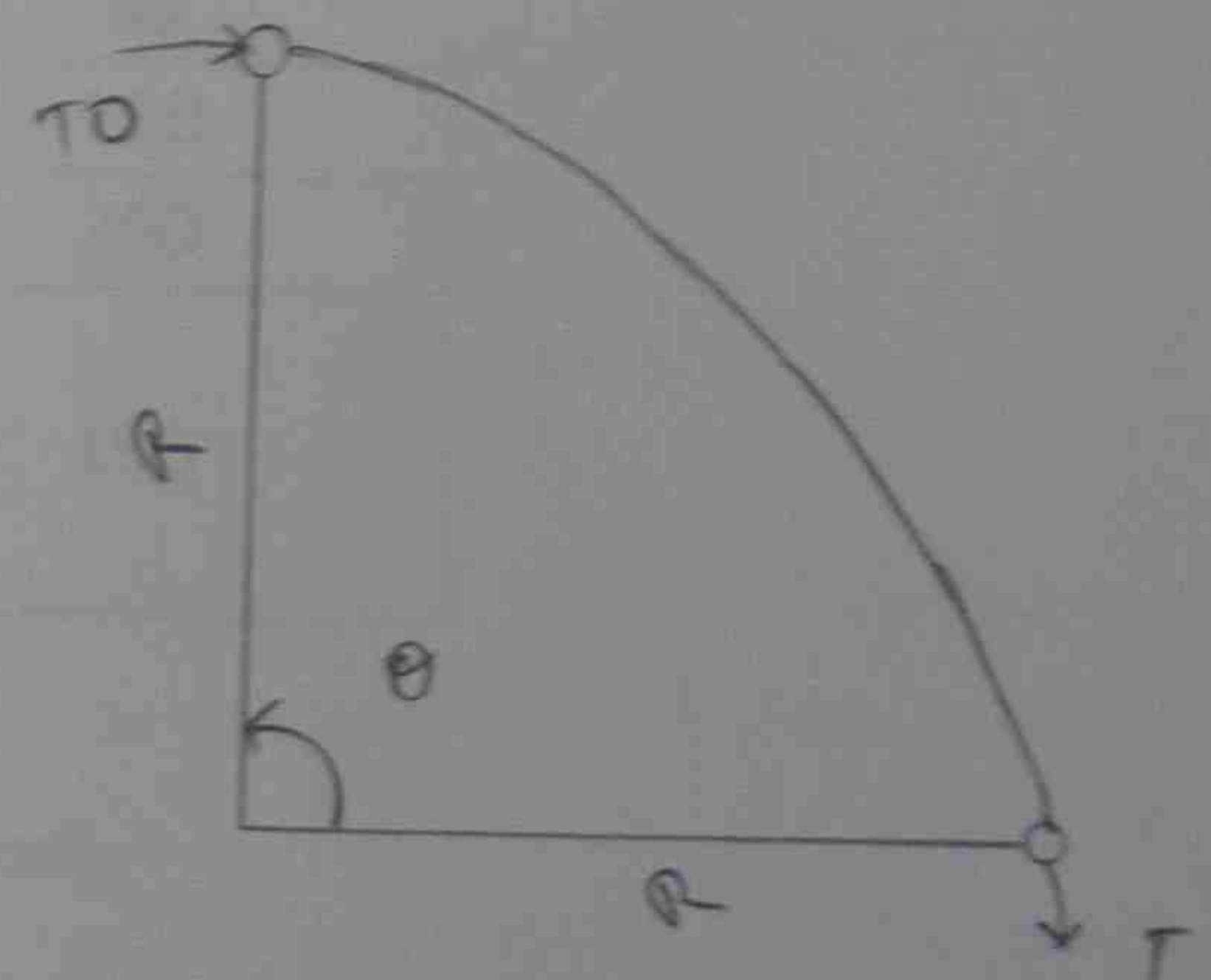
$$T = T_0 - WL(\sin \theta - \mu \cos \theta)$$

UPWARD INCLINED



$$T = T_0 + WL(\sin \theta + \mu \cos \theta)$$

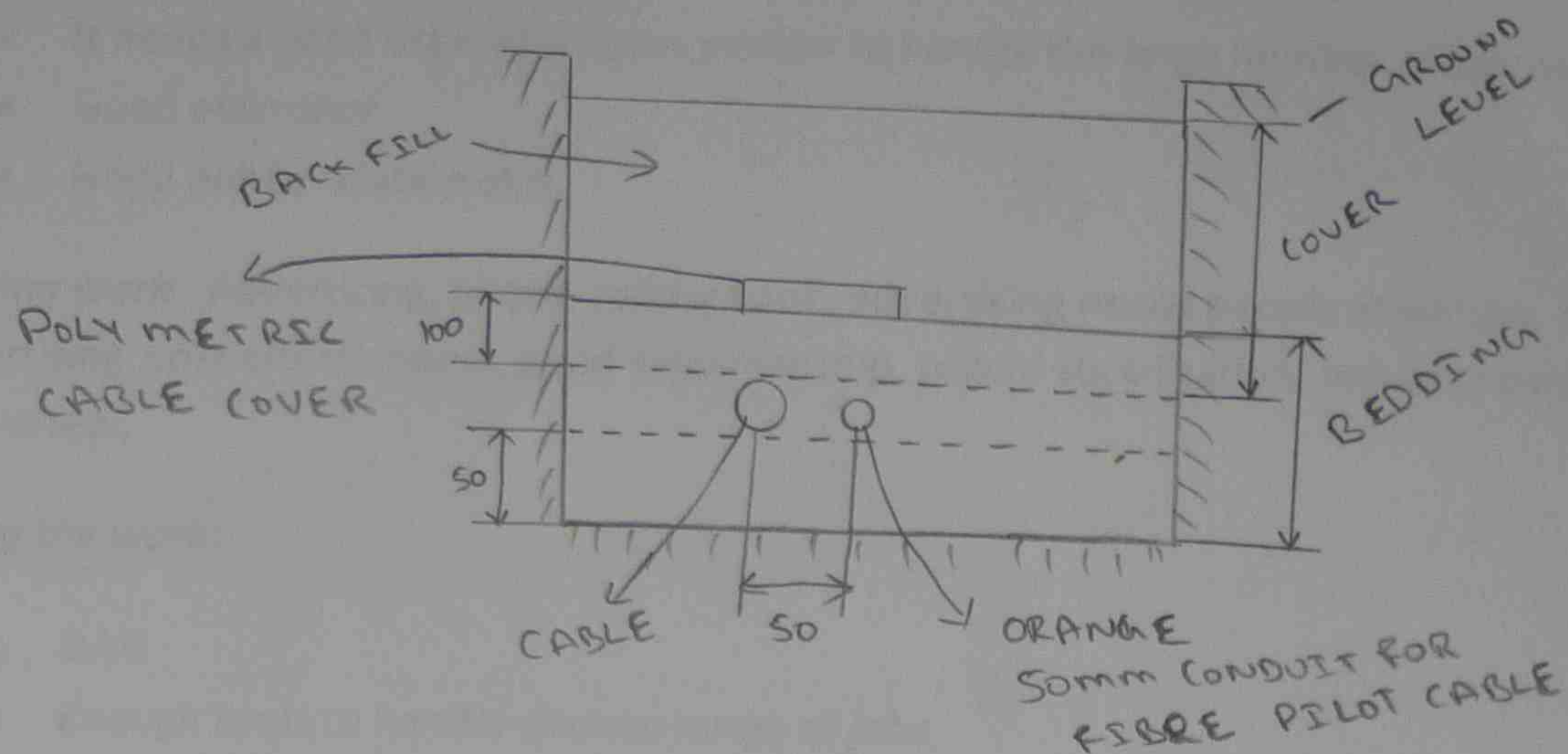
HORIZONTAL BEND



$$T = T_0 \cosh \mu \theta + \sqrt{(T_0)^2 + (W R)^2 \sinh^2 \mu \theta}$$

$$\cosh \theta = \frac{e^{\theta} + e^{-\theta}}{2}$$

35) Write the bending radii requirement for 11KV cable.



- Cables laying operations shall employ sufficient central to ensure that no damage is caused to newly laid cables.
- Cable joints shall be installed in a straight section of trench with at least 2 meters of straight cable at either side of the joint

The following table must be utilized to determine the bending radius minimum internal bending radius

Cable type	During installation	After installation
Less than or equal to 25mm diameter	6D	4D
Greater than 25mm dia	4D	6D
All low voltage cables	12D	8D
11 KV PVC	18D	12D
11 KV Nylon sheathed cable	30D	20D
11 KV Multi core lead sheathed HDPE over sheathed	25D	15D

36) Explain the management planning requirement for service work.

Service work is not for every contractor nor can it be done well in every location. It is important to make a bold distinction between service work and new construction work. Certainly they both involve installing electrical materials.

- It needs a large enough market to sustain a service business. Usually this requires a population of at least 250,000 in your area

- You needs to have an electrician who can handle the pressure that service work place upon then
- It needs to handle more paper works for service work
- It needs a good estimator/sales person to handle the large number of estimates
- Good estimator
- Good public relation skill.

Getting work: Advertising, phone yellow book, advertising needs people attention, creativity in advertising, cost effectiveness, good salesmanship, phone socialization, financial back ground, bank guarantee.,

Doing the work:

- UAN
- Enough tools to handle diverse range of jobs
- Electrical + Mechanical + Electronics equipments /tools
- Related fields & multi skills
 - Electrical +Plumbing
 - Housing + Data Cabling + Telecom cabling
 - Electrical fitting + Sheet metal + Mechanical fitting etc.,
- Diversed range of catalogues and supplier information's.
- Source of spare parts and ordering information.
- Material request preparation skills.

37) Write the specifications for concrete work.

All concrete shall be in accordance with the requirements of AS3600.

- Cement:** Cement shall be type GP general purpose Portland cement
- Fine Aggregate:** Fine aggregate must be clean, sharp, hard, durable grain. Uniform in quality and free from harmful amount of soft or flaky particles, dust, lumps, loam, clay, slag, organic or other deteorious substances complying with AS2758.1.
- Coarse Aggerates:** Coarse aggerates shall comply with AS 2758.
- Testing Aggerates:** Testing aggerates shall comply with AS 1141.
- Water:** Water shall comply with the provisions of AS 3600
- Reinforcement:** Reinforcement shall be either steel bars complying with AS 4671 or hard drawn steel wire complying with AS 4671. It shall be accurately cut to size and bend to shape and shall be free from scale oil and loss rust.

38) Write the specification for cable pulling.

The pulling tension of power cable shall not exceed manufactures specification.

Installing cables in substations & switching stations:

- Notice for access must be requested

- Necessary screens or protective devices shall be installed
- Weather proof labels shall be attached to all cables ends installed in substations.

Installing cables in Kiosk type substation: All cables shall be laid to that they enter perpendicular to HV & LV access doors of the Kiosk. Internal bending radius shall not be less than manufactures specification.

Installing cables in cable risers: Cables installed in cable risers shall be clamped at a maximum of 1 m intervals. Cable clamps shall be non ferrous materials and directly bolted to cable riser walls.

Back fill materials: The back fill materials should restore the sub grade of original condition which may be achieved by replacing the excavated materials in the same position from which they were excavated.

RTA, Local council must satisfy backfill materials. Building materials and contaminated substances including hazardous must not be used in back fills.

39) Explain electrical contracting for speciality work.

Specialty work is almost always more profitable than regular electrical installation on a percentage basis. There are two divisions of specialty work.

- Special types of installations
- Special service to specific types of customers

Special types of installations: Telephone work, Fire Alarm System, security Systems, Television system, Lightning Protection System, Traffic Lighting Installations, High Voltage work.

Growing Area of specialist works:

- Energy Management
- Lightning Protection – Greatly determined by Geography
- Fire Alarm Work – (Related to building industry)
- Telephone work/cable TV Telecommunication

40) Explain design & build work.

Design & build work are

- The amount of competition for job is far less, sometimes nonexistent.
- The Electrical contractor is compensated for providing the design service that is usually done by an engineer.
- The customer usually gets a better price for the same quality of work by using a qualified design/build contractor.
- Co-operation during the construction process is usually better on design/build projects than on contract bid projects.

- Design /Build work usually carries less risk than other types of electrical Constricting.

Requirements:

- The contractor must develop a great deal of trust in his customers.
- The contractor must offer the customer a better value for money
- The installation must be done in a first class manner
- The contractor and all of his personnel's must maintain a high standard of courtesy to the customers
- The customers' interest must take precedence over the contractors
- The Electrical contractor must have ability to perform installation properly
- The Electrical Contractors ability to handle all details of designs
- The project must meet all codes.

41) Write the design standard or OH development.

Design standards for over head development NS0109

- Service from the existing low voltage reticulation system
- Direct distributor (415/240V)
- Customer substation (11KV/415/240v) substation size = 400 Kva

Where the supply is taken direct from a customer substation, the customer's main switch board shall be located adjacent to the substation.

Underground/Over Head Policy:

Urban Area: Low voltage reticulation, low voltage and aerial bundled cables shall be used as standard construction.

HV Reticulation: The construction shall be either of open wire construction type or covered conductor type.

Low Voltage: Wind velocity 1 m/s for Sydney, 0.5 m/s for Hunter and Maximum design temperature 50°C. Over Head services shall be installed in accordance with NSW service and installation rules.

Street Lighting Cables:

Minimum cable standard 16mm² two core copper XLPE Insulated PVC Sheathed Cable.

Four Core 16mm² two core copper XLPE Insulated PVC Sheathed Cables may be used.

42) Describe cable installation & bonding procedure.

All civil work, construction and bonding of cables must be carried out in accordance with

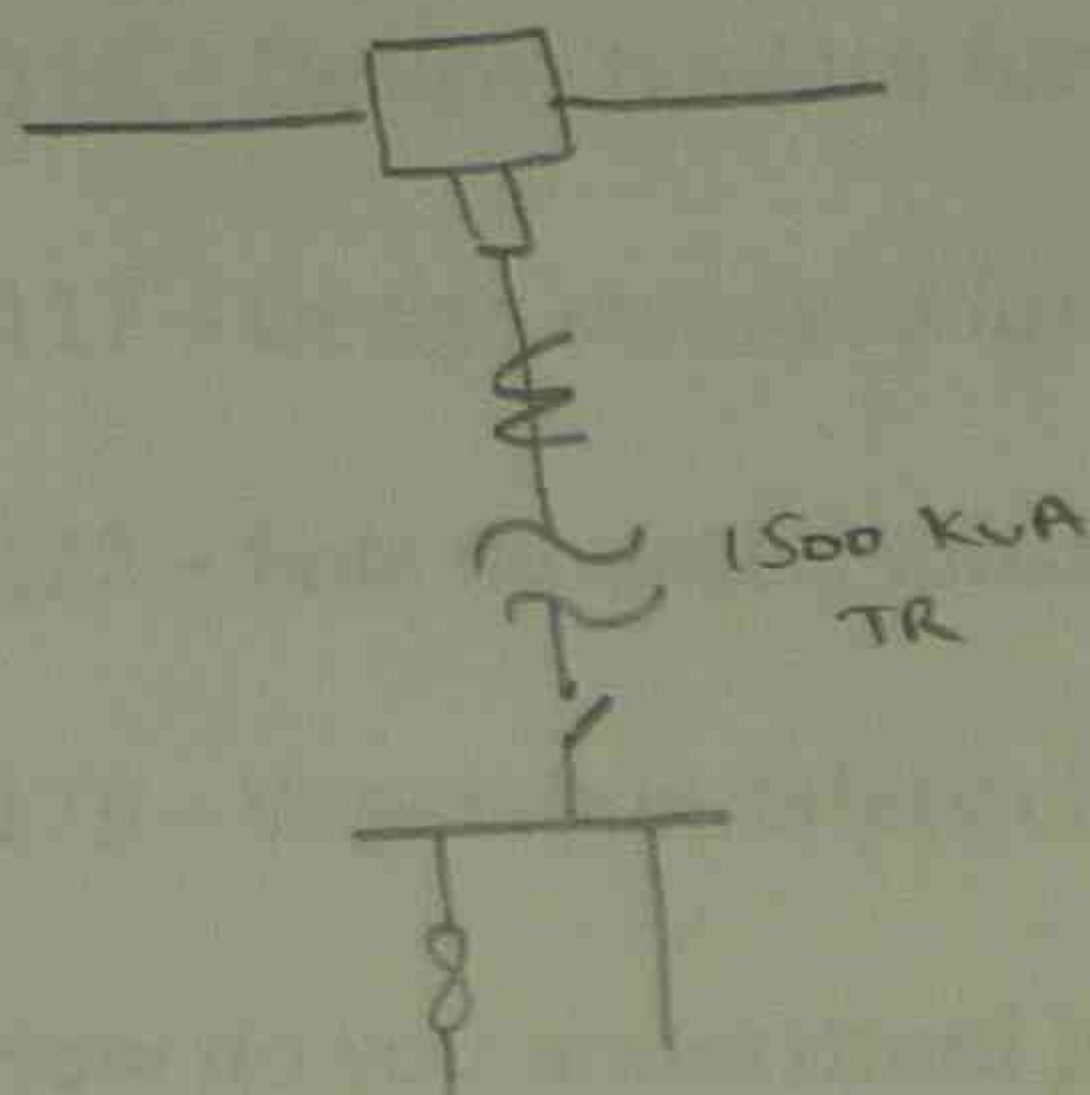
NS0125 – Specification for Low Voltage overhead Conductor

NS0126 – Specification for High Voltage overhead conductor

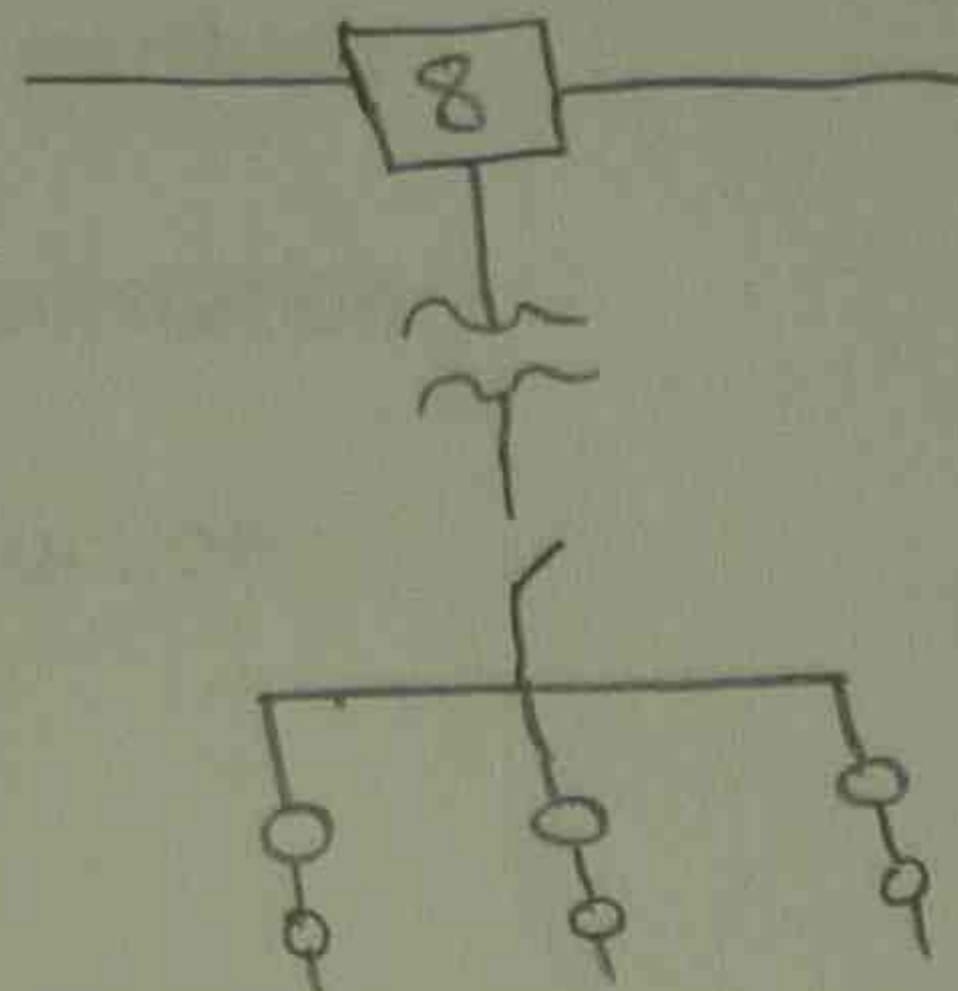
NS0128 – Specification for Pole installation & Removal

43) Explain various types' distribution substations with sketches.

I-TYPE KISOK

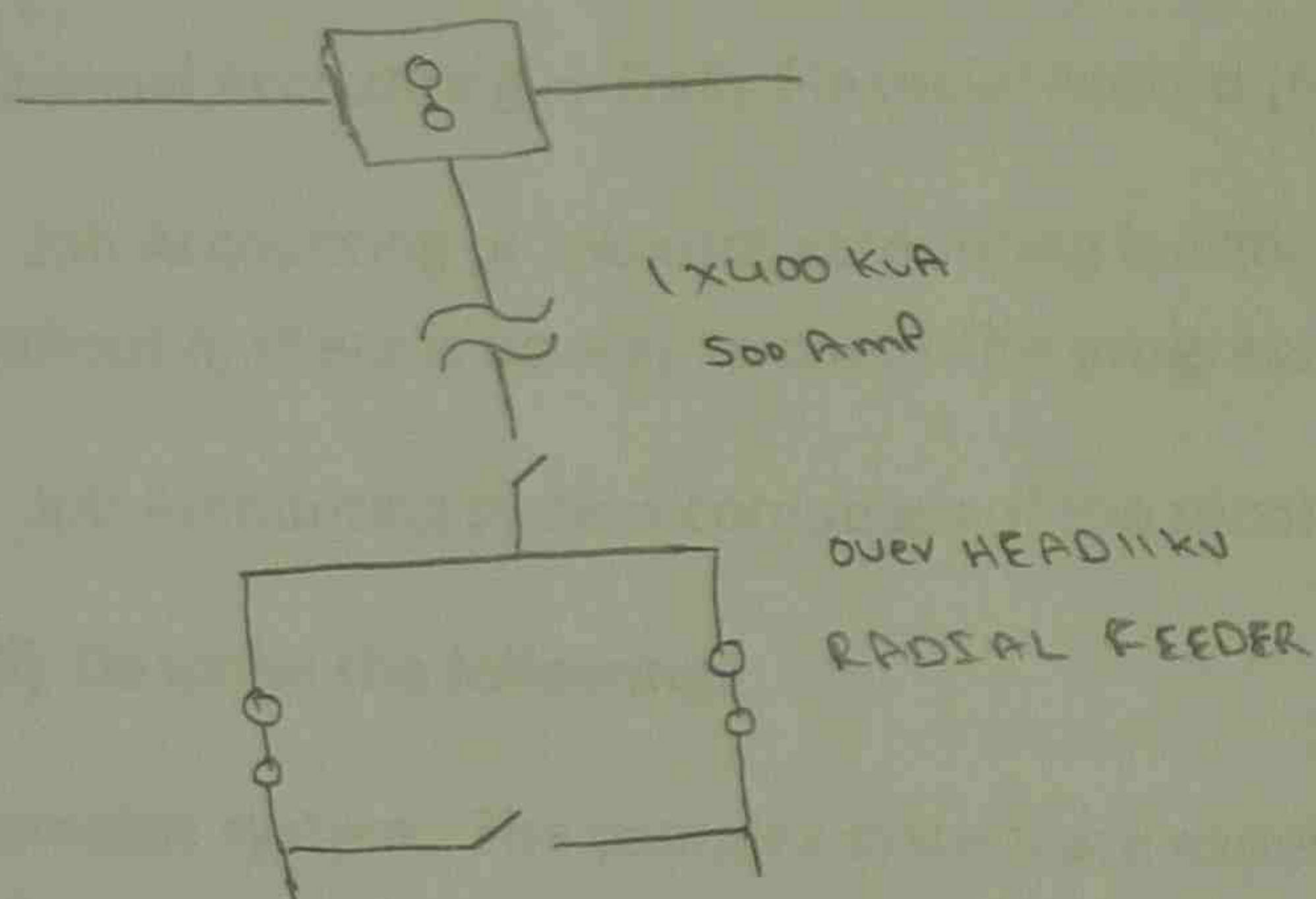


CHAMBER SUBSTATION



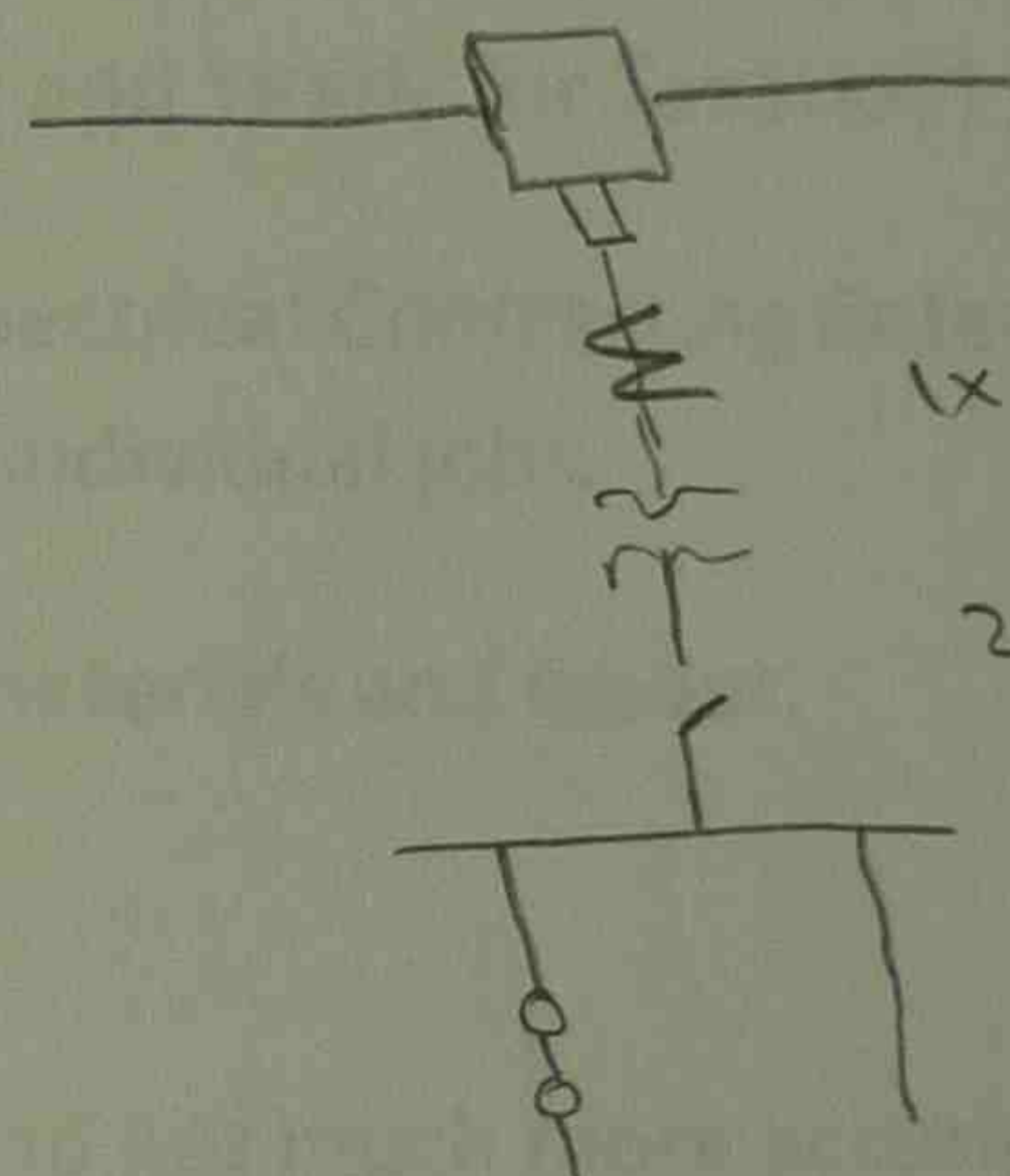
1X 1000KVA
TRANSFORMER
OVER HEAD 11KV
RADIAL FEEDER

H-TYPE KISOK



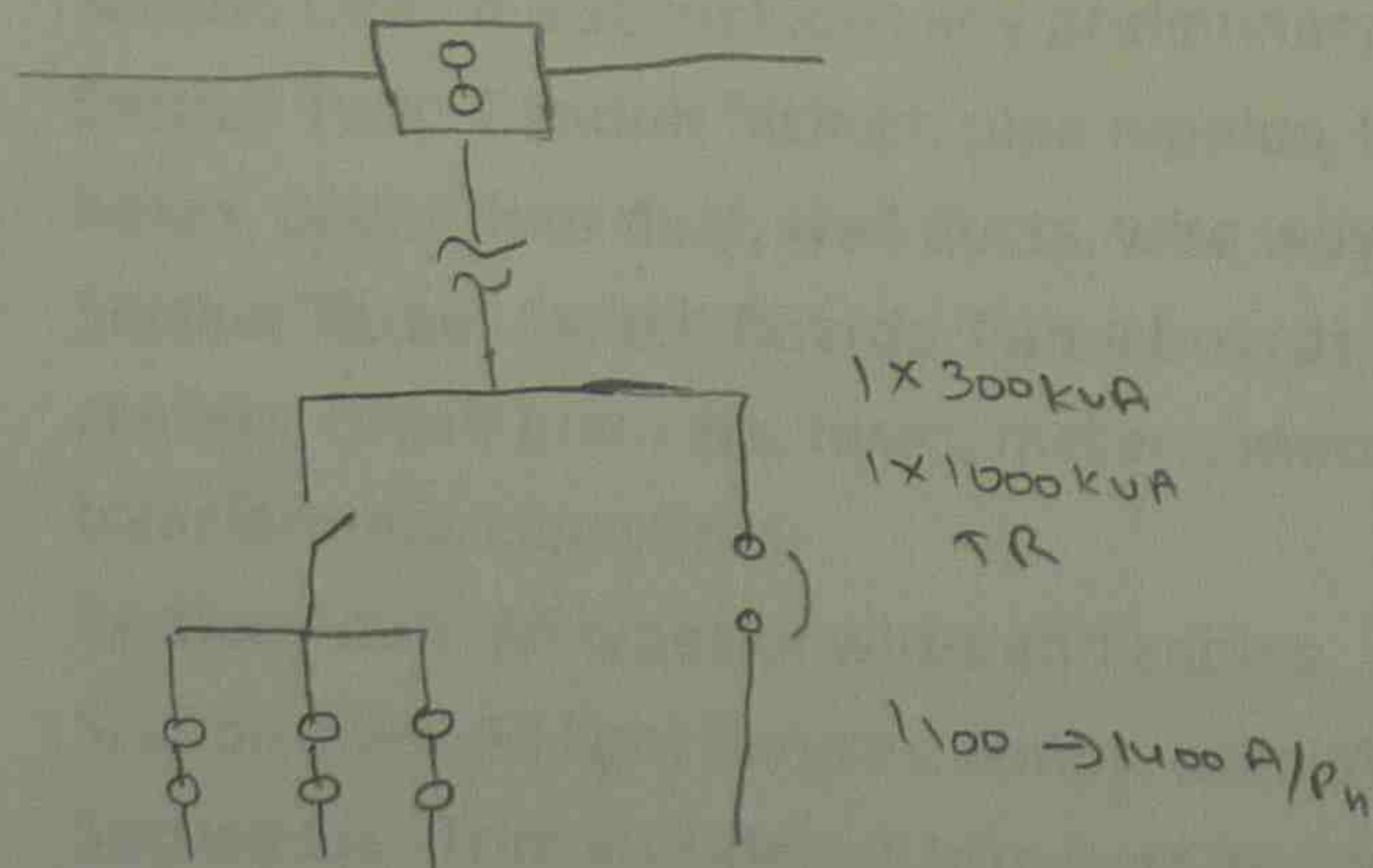
1X 400 KVA
500 AMP
OVER HEAD 11KV
RADIAL FEEDER

K-TYPE KISOK



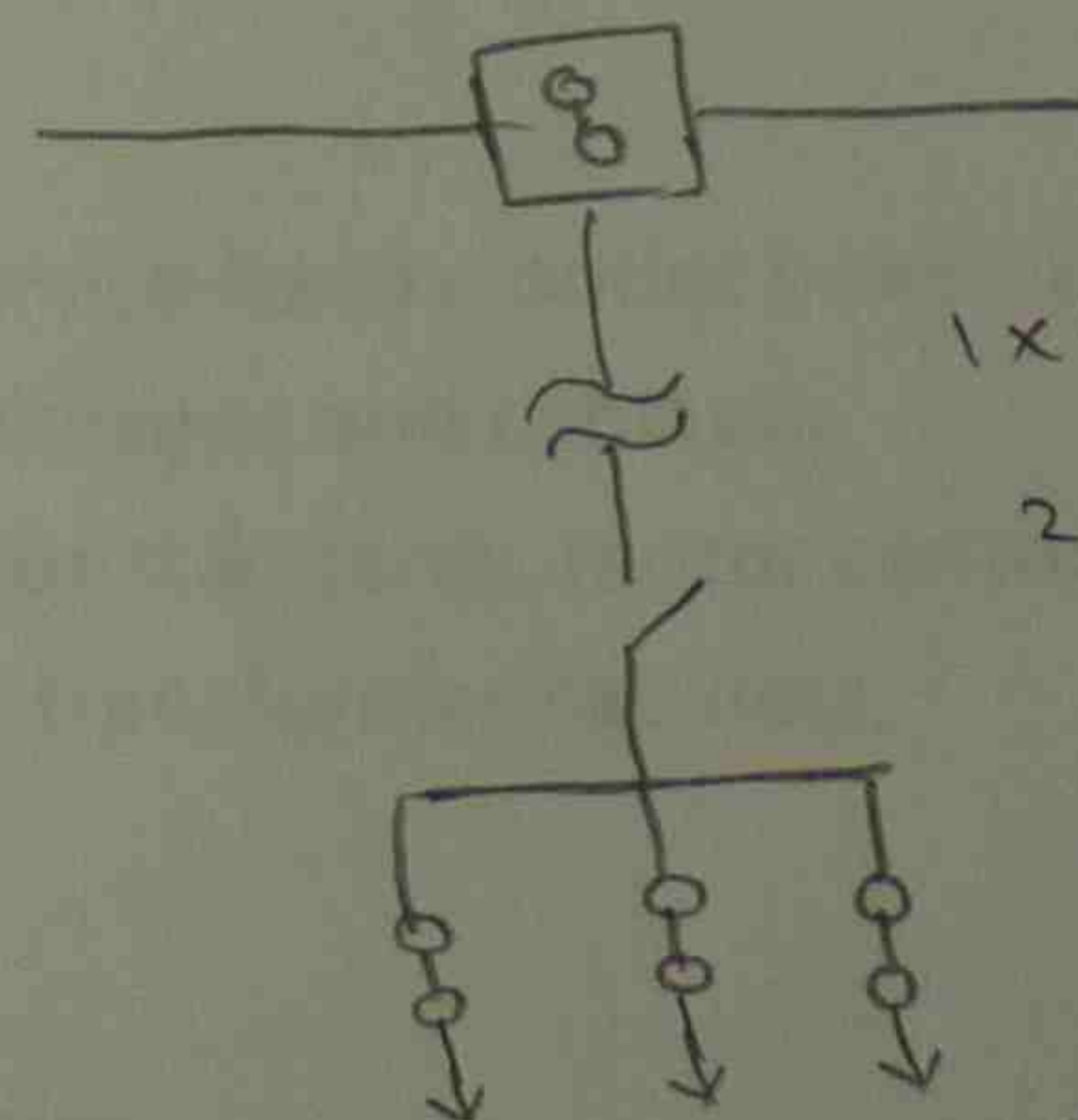
1X 1500 KVA
2000 AMP/PH

LARGE ORION KISOK



1X 300KVA
1X 1000KVA
TR
1100 → 1400 A/PH

J - KISOK



1X 160KVA - 1X 160 KVA
200 → 400A
UH 11KV RADIAL
(6)
CLOSED NETWORK
FEEDERS

The following standards are to be applied for substation sitting, selection, site selection, electrical construction and pole positioning.

NS 0113 – Site selection - Civil Design

NS 0114 - Electrical Design Standard for chamber type substation

NS 0116 – Design standard for distribution earthing

NS 0117 – Design standard for kiosk type substation

NS 0122 – Pole mounted substation construction

NS 0179 – Vegetation safety clearance.

44) How do you understand job accounting?

Accounting → Financial Accounting

→ Managerial/Cost/Job Accounting

Financial Accounting → Daily Financial Record (Monthly, Quarterly and Yearly for Taxation)

Job Accounting or Job cost accounting is critical to almost any Electrical Contracting Enterprise without it; there is no way to check the progress and outcomes of individual jobs.

Job Accounting system composes of the records of the cost of materials and labour.

45) Describe the followings

Complex system: The complex system are expensive to operate and not much more accurate. Any information will need clarification before it can be used.

Sectional Systems: The sectional system is designed for simplicity. The job is divided in to several sections which are accounted for separately.

- Section One: It also includes any preliminary Job set up.
- Section Two: Conduit fittings, pipe nipples, bushing, straps, service heads, outlet boxes, pull boxes, under floor duct, wall ducts, wire ways, cable trays, enclosures and cabinets.
- Section Three: Switch Boards, Panel boards, load centers, motor standards, motor control centers, circuit breakers, fuses, meters, meter centers, current transformer cabinets, transformers, capacitors.
- Section Four: All types of wires and cables
- Section Five: All light fixtures, lamps, special hangers, track, poles
- Section Six: Trim includes all trim outs and equipment connections. It consists of switches, flexible conduit connections, low voltage relays.

- Section Seven: Fire alarm systems, sound system, CCTV, security system, Special Hospital system, Emergency power system, Energy Management system, Lightning Protection system.

46) Sketch job order form and job record form.

Job Name: _____

Job Number: _____

Section: _____

Week Ending	Hours	Hours to date	Materials	Material to Date	%	Purchase order No.	Complete

Estimated Hour: _____ Estimated Materials: _____ Final Review: _____

Job Review:

Job Name: _____ Job Number: _____ Reviewer: _____ Date: _____

Sections	Hours	Materials	Estimated Hours	Estimated Material	Hours Result	Material Result

47) Write the specification of laying of UG cable up to 22KV.

Specification for laying of underground cable up to 22KV (NS130)

- HV and LV cable installations in Sydney central business district are generally pit and duct configurations.
- All excavation and cable laying operations shall be carried out with the least possible obstruction to traffic.
- AS 1742 manual of uniform traffic control devices

- Road and Traffic Authority 'Traffic control at worksites manual'
- Works in progress signs must be displayed
- Environmental requirement, environmental impact assessment shall be conducted prior to the commencement of work.
- All distribution cables shall be laid in approved conduits across roadways to allow for future system alternations with minimal civil work.
- Where cable route crosses concrete formed drive ways special precautions shall be taken to ensure minimal damage to such drive ways.
- All new rail crossings should allow for all poles. The ends of conduit banks to be located off rail property.
- Conduits should be run the full width of the rail corridor.
- For all new installations, a minimum of one orange 50mm conduit for the purpose of optic fibre cable must be installed with every trenched underground cable.
- The proposed excavation for trenches, Pitts and kiosk sites must be set in accordance with Australian Specification 1152.
- Dimensions of trench depend on number and types of cables, number of conduits, and location of trenches and shared trenching agreement.

48) Write the procedures for installation of conduits with sketches.

Unplasticized poly vinyl chloride (UPVC) orange conduits for underground cabling as a minimum standard

Conduit Size	General Application
50mm	LV service in accordance with NSW service & Installation rules, Fibre optic cable to support electricity network
100mm	LV service supplies from LV Pitts
125mm	Distribution cables (HV, LV and Street Lighting
150mm	11KV 500mm ² 3 core cable complex installations

Installation Type	Conduit
State Rail crossings, conduits in footways, Local & regional road way crossings	125mm Light duty PVC AS/NZ 2053.2
LV service	100mm 4 PVC AS/NZ 2053.2
LV Domestic service, Substation chambers , Fibre optic	50mm Heavy Duty PVC AS/NZ 2053.2

Conduit coupling – use socket arrangement PVC solvent cement for mating surfaces

Conduit Bend – Appropriate bending radius

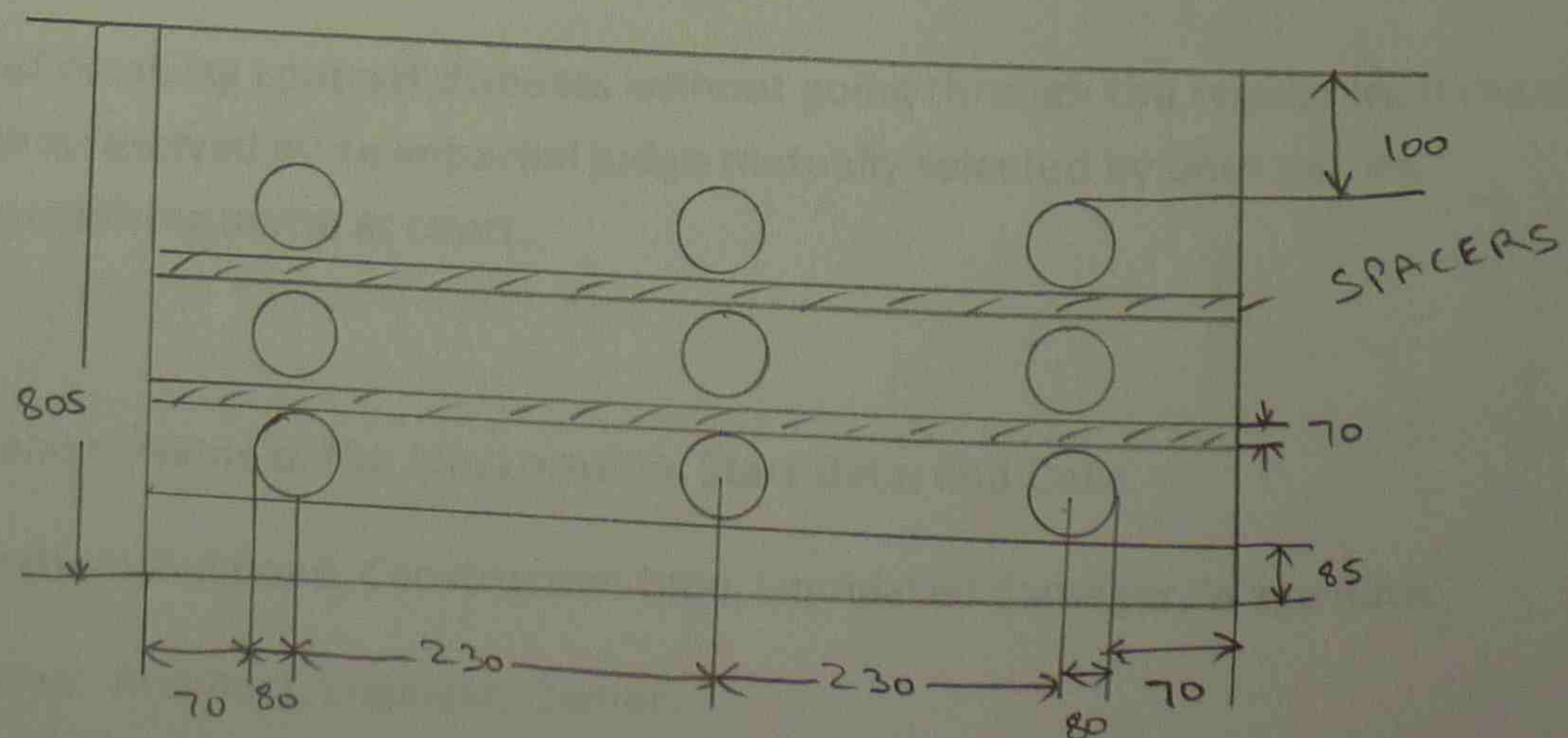
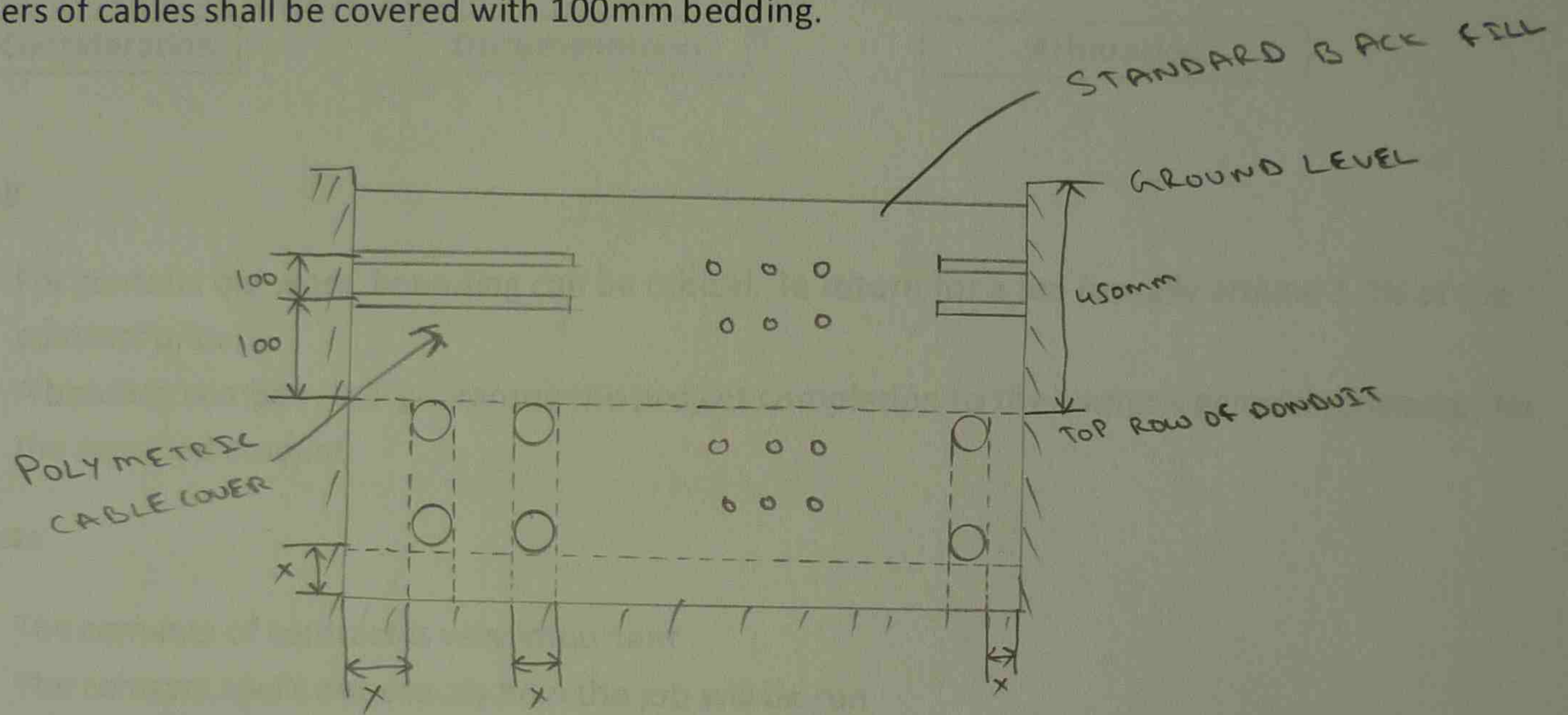
Sealing – All conduits must be sealed against water & foreign materials use moulded plastic plugs

Laying conduit – Pay attention for crossings

Standard conduit & cable spacing:

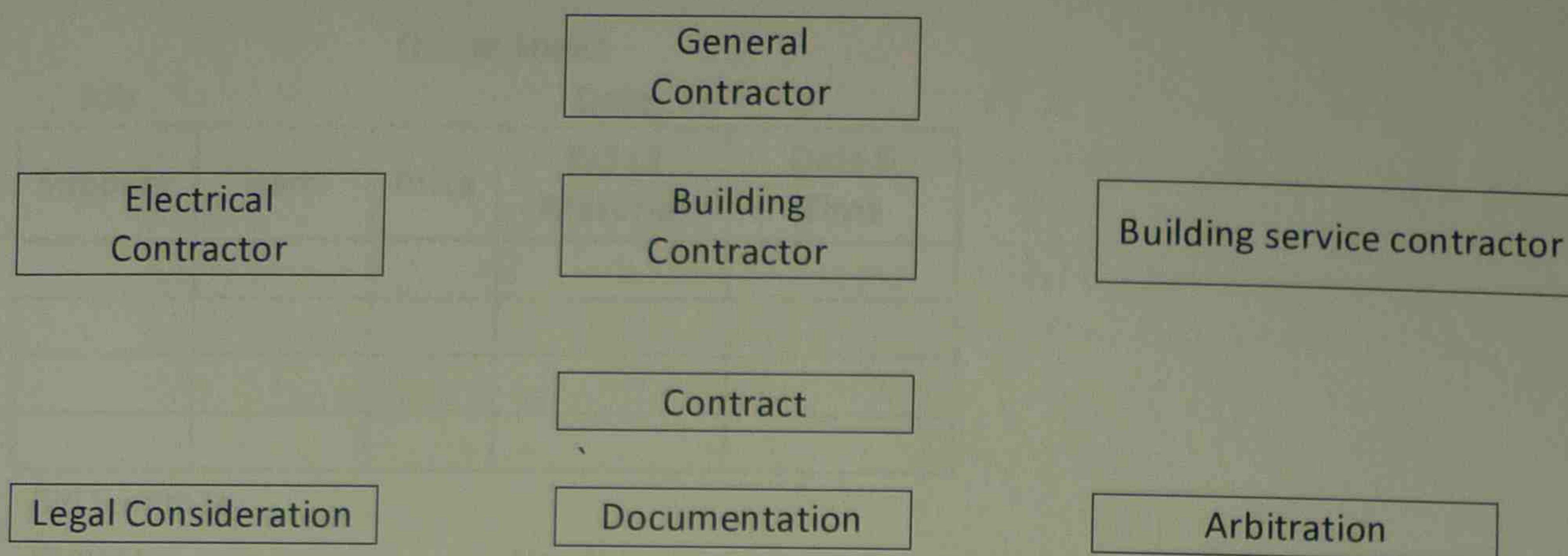
- 50mm for 125mm conduit
- 70mm for 150mm conduit

Top layers of cables shall be covered with 100mm bedding.



49) Explain

Contract bid work:



Bonding:

- For contract bid work, bonding can be critical. In return for a fee (usually around 1.2% of the contract price)
- A bonding company will guarantee the project completion to the owner's general contractor for the specified amount.

Contracts:

- The contents of contract is very important
- The contract spells out exactly how the job will be run.
- Need to clarify the meaning of contract by Attorney.
- Try to make reasonable change to contract.

Documentations: Oral communication is virtually impossible to prove at court. Job delays, change orders, early acceptance etc., must be formally written down.

Arbitration:

- A method of resolving contract disputes without going through the regular legal channels.
- The dispute is resolved by an impartial judge mutually selected by both parties.
- Cheaper in resolving matter at court.

Bidding:

Bidding Information: Name of the Job, Location, Start Date, End Date.

Financial Information: Bid Bond, Construction time, Liquidated damages, Wage Rate.

Design Information: Architect, Engineer, Owner.

50) Provide sample quotation form.

Quote Sheet				
Job			Date	
Supplier	Item	Price	Bill of Material	Date & Time

Bid Summary	
Project	Hours
Material	Job Cost
Finance	Net Cost
	Total

51) Explain the protection system for 11KV/22KV feeders.

These feeders will normally be provided with the followings

- 3 ϕ over current
- Earth fault
- High set instantaneous over current
- Sensitive earth fault
- Earth fault indicator

Reclosing will be provided at the source substation by all protections other than sensitive earth fault.

The reclosing will be one reclose attempt after a nominal 10sec delay and then lock out.

Reclosing will be rendered non operative

- During switching between feeders
- During line work
- During tree trimming
- On bush fire designated feeders on the day of fire danger.

Line Reclosers: Pole mounted line reclosers will be used in over head line feeders. In provides with protection, reclosing and remote control faultities.

52) Explain the protection of LV OH Network.

All 415V Overhead bare conductor or Aerial Bundled conductors (ABC) are to be protected by current limiting. HRC fuses at distribution substations. Maximum rating of Overhead LV network fuse 400 Amp.

- Every pole substation to have surge arresters at transformer HV terminals
- Every pole substation and ground substation to have surge arresters at transformer terminals or LV busbar.
- Every HV underground to overhead connection shall have surge arresters fitted.
- All surge arresters must comply with AS 1307 in respect to – spark performance
- Surge arresters are to be installed at line reclosers
- No surge arresters are to be installed at line switches or links
- Earthing system must comply with NS 0116.
- Pin insulators on timber cross arms are not to be bonded together because it will reduce Bill.

54) Explain (a) Design parameters (b) Supply quality (c) Reliability

Design Parameters:

Maximum LV Distributor loading → Must not exceed 75% of normal rating.

Maximum voltage drop → $\pm 6\%$ of normal 240V supply at LV

The designed maximum voltage drop in LV distributor must not exceed 9V at extremities. When the distributors is loaded to 75% of normal rating.

Supply Quality:

Use of arc furnace welding machines, frequent start large motors, X-ray units comply with NSW service rule clause 9.8 to 9.14.

Reliability:

Alternative supply to LV distributors must be provided from adjacent distribution centre where practicable.

55) Explain sectional job schedule.

Job Name _____

Date Prepared _____

Job Number _____

BY _____

Section(1) Slab, Site, Temp – Hours – Worker/Week

Section(2) Interior Race Way - Hours - Worker/Week

Section(3) Distribution Equipment – Hours – Worker/Week

Month	JAN				FEB			
WEEK	1	2	3	4	1	2	3	4
Section(1)								
Section(2)								
Section(3)								
Total								

57) Sketch (a) Composite Schedule (b) Cash flow schedule

Composite Schedule:

Date Prepared _____ BY _____

Month	JAN				FEB			
	1	2	3	4	1	2	3	4
WEEK								
Section(1)								
Total number of workers needed								

Cash flow Schedule:

Prepared BY _____ Date _____

Month	JAN				FEB				Mar			
WEEK	1	2	3	4	1	2	3	4	1	2	3	4
\$ Labour												
\$ Material												
Sub Total												
Over Head												
Total Cash Needed												
Money Received												
Cash Flow + (or) -												
Cumulative Cash Flow + (or) -												

58) Explain office management & responsibility.

Owner

Mon – Friday

AM – Assist superintendent or others in getting the day started.

See to it that everybody is working and happy

Other activities

PM - Make sure that everyone is getting their work done

Other activities

Saturday

AM – Review all jobs, General review and Planning

PM – Other activities

59) Describe the duties of estimator

Monday – Thursday

AM – Plan the day's work. Assist superintendent or others as required to get them started

See salesmen etc From 8:30 to 9:30AM

Prepare Estimated Bid Jobs, Plan Jobs etc.,

PM – Prepare estimate etc.,

Talk to sales person, superintendent etc as required from 4PM until end of the day. Take care of any messages on clip board.

Friday:

AM – Review all jobs with superintendent. Check invoices, purchase orders, job accountings etc., Prepare billing, change order etc., Return approved invoices to bookkeepers for payment. Return job folders to bookkeepers. Give billings information to bookkeepers or secretary for preparation.

PM – Preparer estimates, see salesman as required. Take care of messages

60) Write the duties of superintendent

SUPERINTENDENT

Monday –Thursday

AM – Get everyone going; work out any problems with scheduling or materials. Superintendent should be the first person at the office in the morning preferably one hour before anyone else. Visit job sites. Co-ordinate with foreman, inspectors, architects, engineers etc.,

PM – Prepare any change orders, correspondences, orders, schedules billings, estimates etc.,

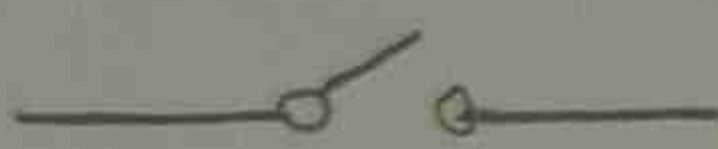
Friday


AM – Review all jobs with estimator, Check invoices, purchase orders, job accounting. Prepare change orders, bills etc.,

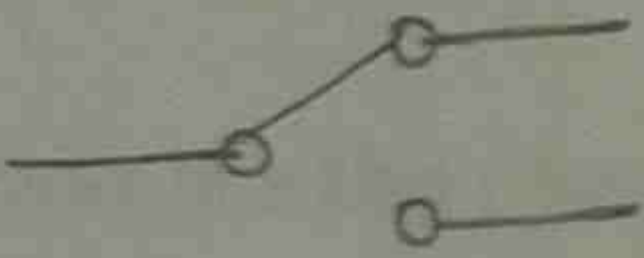
PM – visit all job sites or other activities as required.

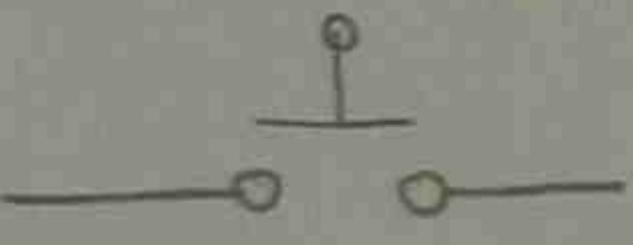
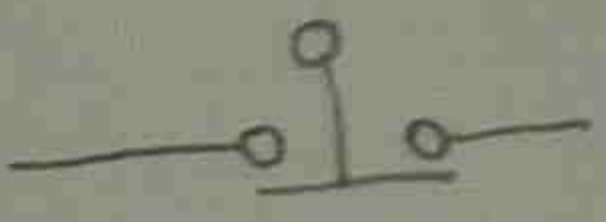
61) Sketch the following switches.

(a) NO, SPST (b) NC, SPST (c) SPDT (d) Push button

(a)  Normally OPEN, SINGLE POLE, SINGLE THROW

(b)  NORMALLY CLOSED, SINGLE POLE, SINGLE THROW

(c)  SINGLE POLE, DOUBLE THROW

(d)  (NO SPST)  (NC SPST) PUSH BUTTON

62) Describe (a) knife Switch (b) Rotary selector switch

Knife Switch: The knife switch is used extensively for controlling main power circuits.

Rotary selector switch: The Rotary switch is often used on test equipment and other multi function low power equipments.

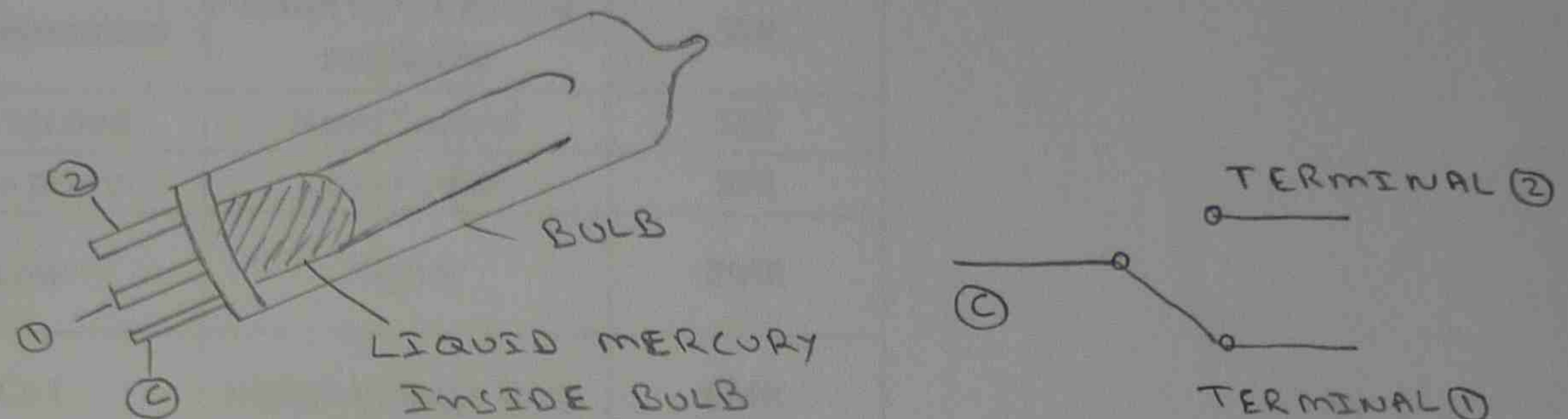
63) Explain (a) Limit switch (b) Manual motor starter (c) Mercury switch (d) Relay

Limit Switch: Limit switches have two basic uses. First they serve as safety devices to keep objects between certain physical boundaries.

Second, limit switches are used to control industrial processes that use conveyors or elevators.

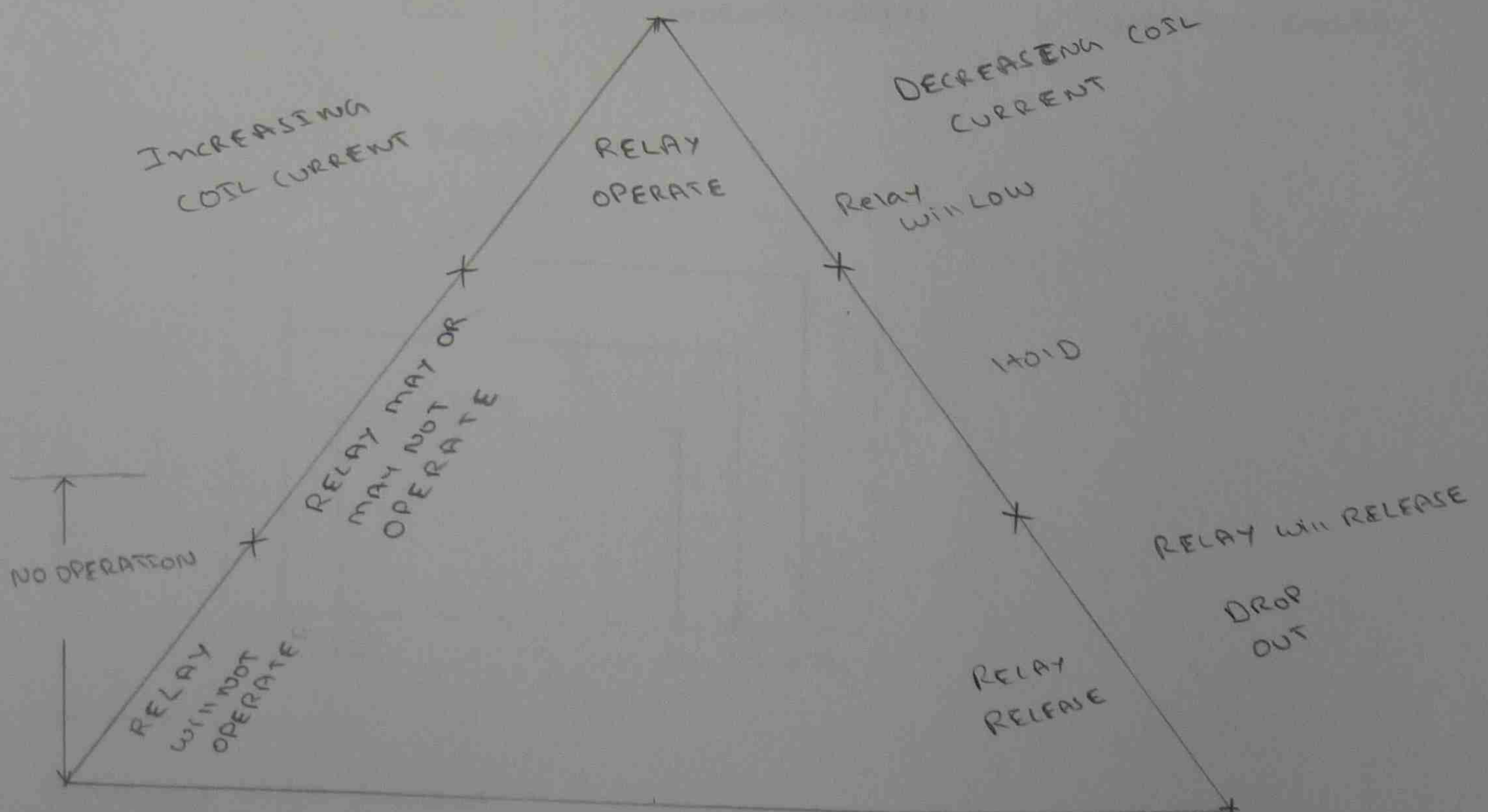
Manual Motor Starter: The manual starter is used to start or stop AC & DC motors.

Mercury Switches:



Relay: A relay is a critical component of many control systems because they offer an indirectly operated Electrical switch that can be used for remote control and to control high current devices with low current control signal.

64) What are the characteristics of contracting?

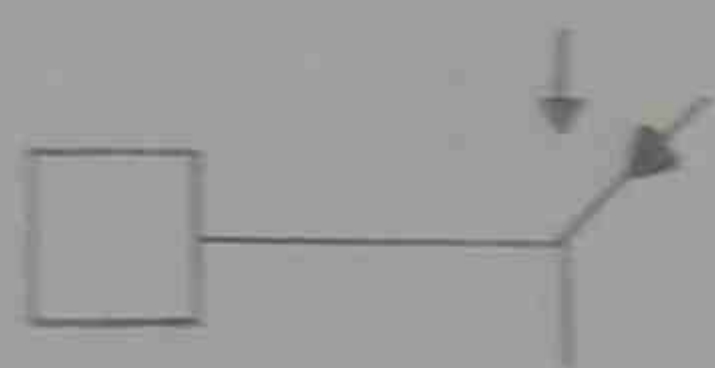


65) Describe any three types of electromagnetic relay.

Electro Magnetic Relay (EMR) and Solid State Relay (SSR)

CHARACTERISTICS	EMR	SSR	ADVANTAGE
Life	100,000 to Millions of cycle	No moving part Last Life	SSR
Isolation	Infinite dielectric Isolation	No Dielectrically Isolated	EMR
EMI	EMI Generation	Noise Generated is negligible	SSR
Speed	Mili second	Hand Second	SSR
Operate Power	More power	Loss Power	SSR
Contact Voltage Drop	Low	Higher	EMR
Thermal Power Dissipation	Coil	Higher Voltage Drop	EMR

66) Sketch standard relay symbol.



RELAY



COIL

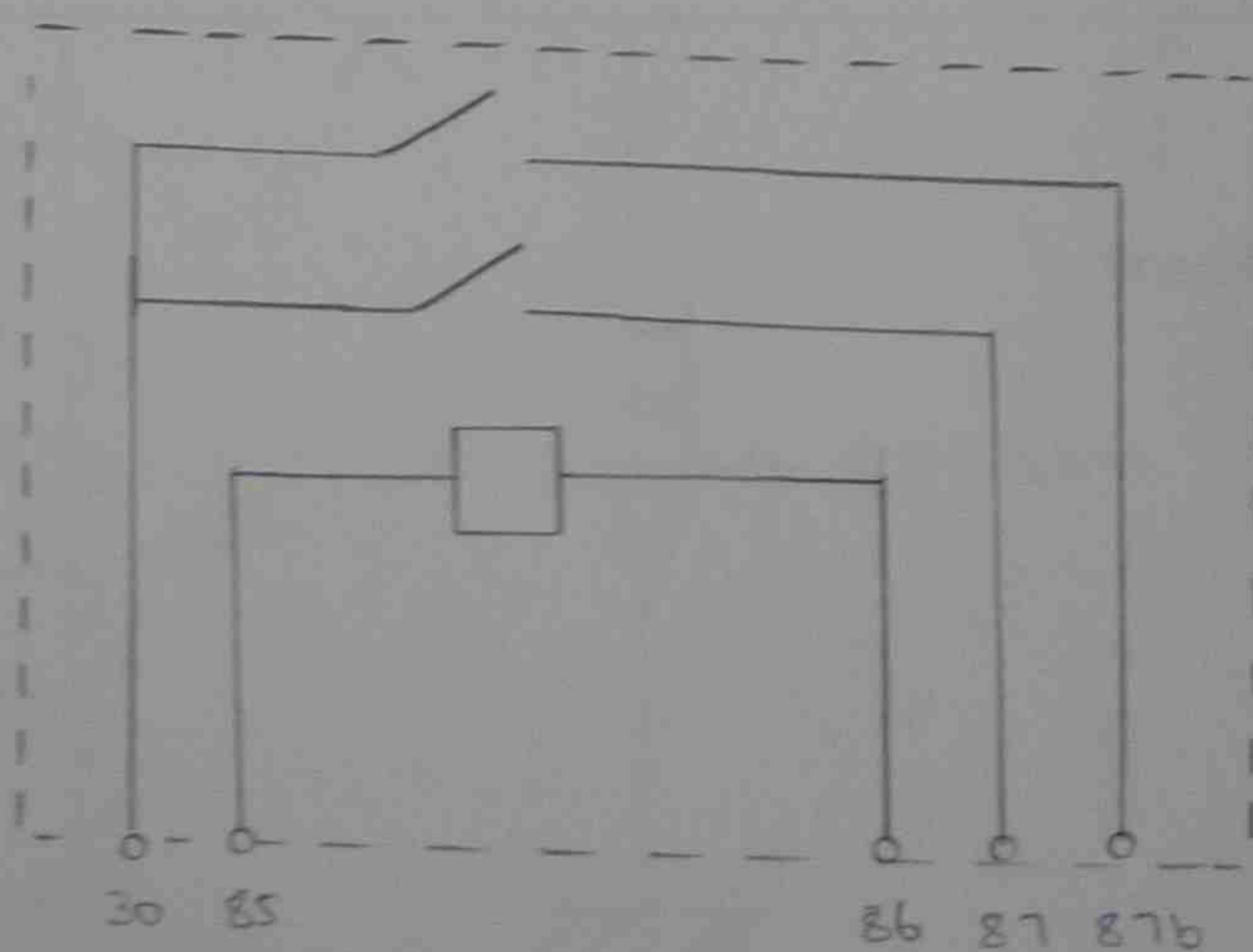


NORMALLY OPEN



NORMALLY CLOSED

RELAY LOGIC



30 - Common CONTACT

B7 - NORMALLY OPEN CONTACT

B7a - NORMALLY CLOSED CONTACT

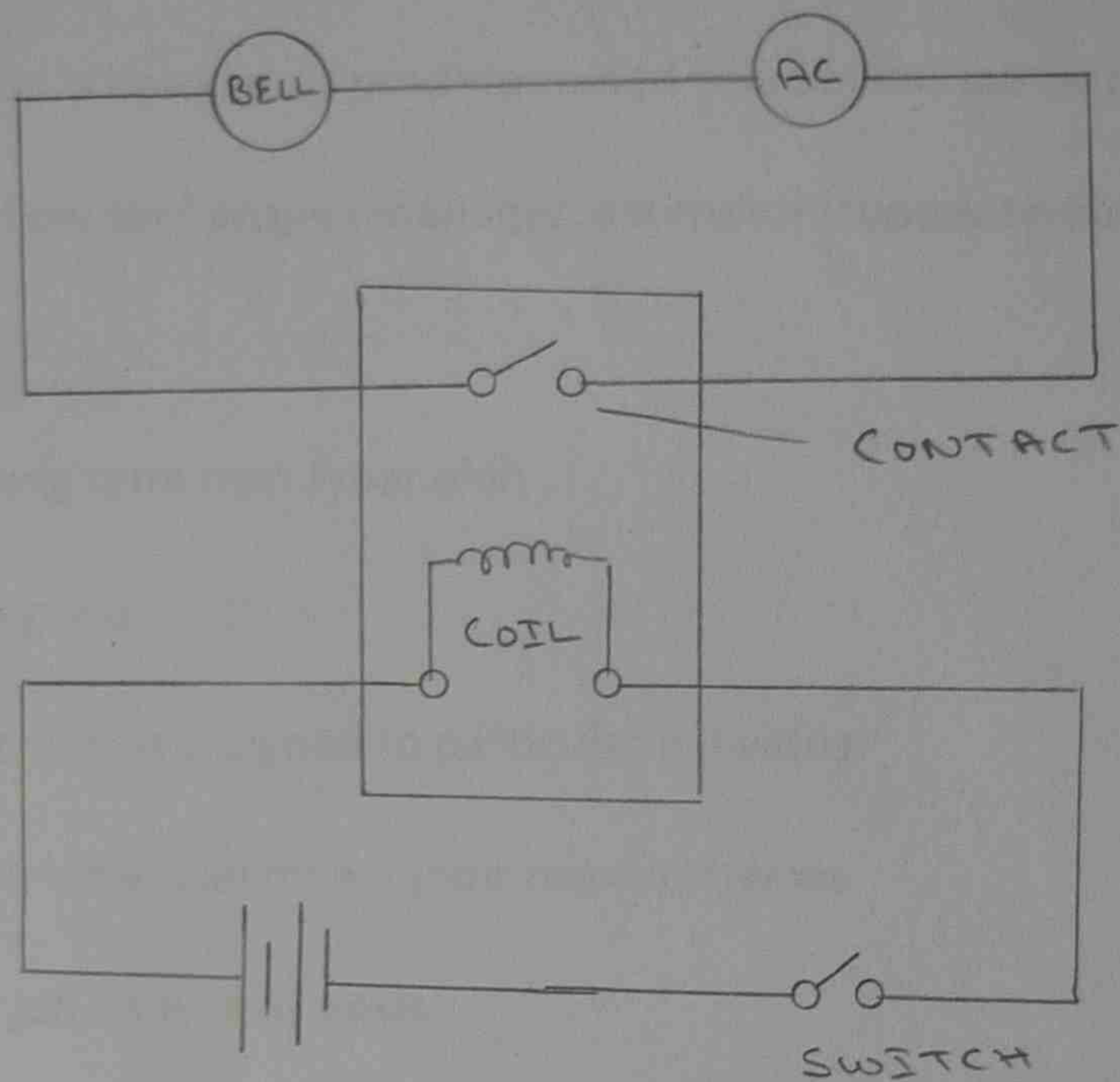
B5 - COIL WINDING ①

B6 - COIL WINDING ②

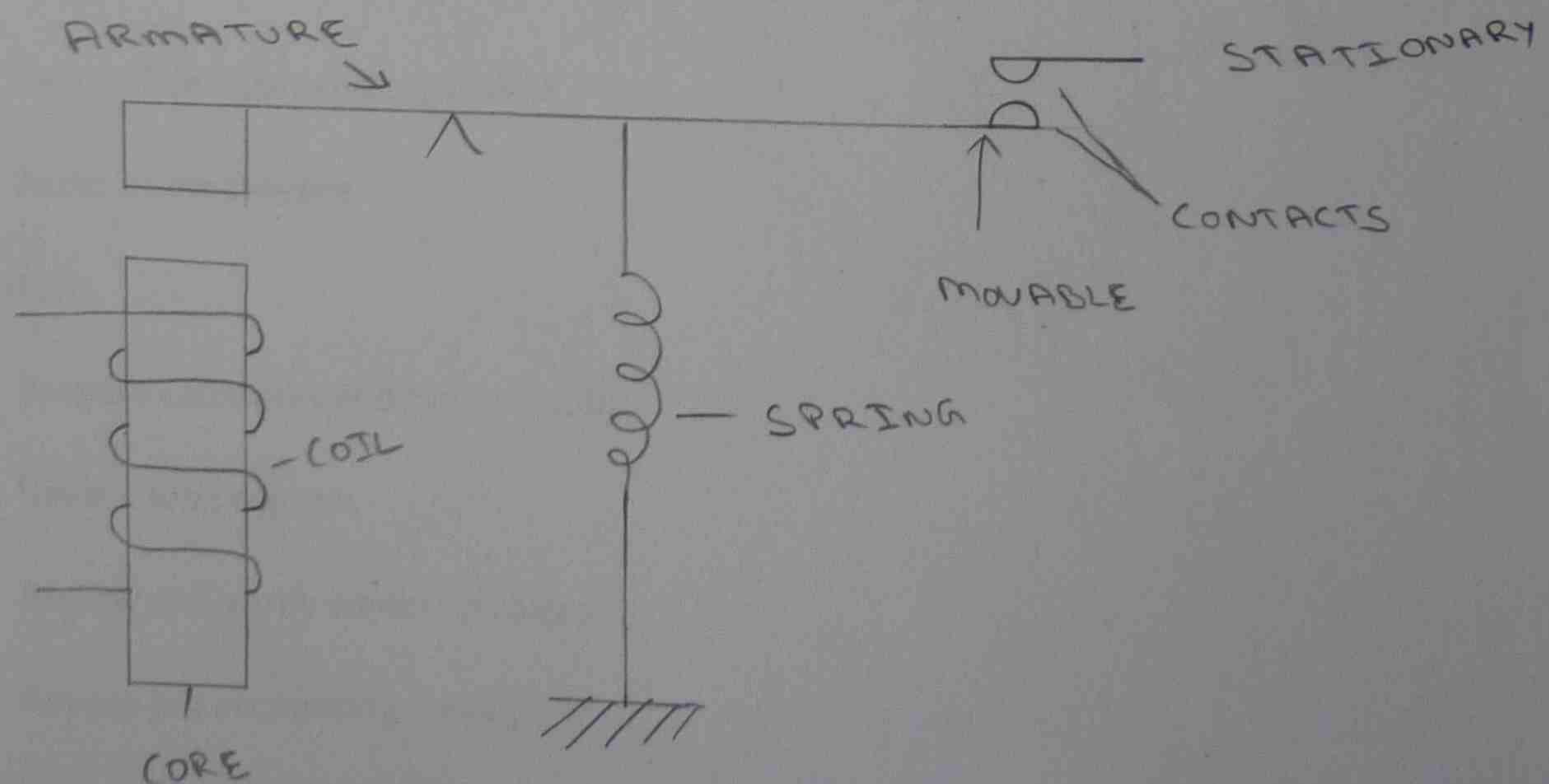
67) Explain the followings with sketches (a) Relay (b) Solid state relay (c) Electro-mechanical relay

(a) **Relay:** A Relay is a critical component of many control systems because they offer an indirectly operated electrical switch that can be used for remote control and to control high current devices with low current control signal.

(b) **Solid state relay:**



(c) **Electro-Mechanical Relay:**



68) Explain any four different types of relay.

Types of relays are

- Latch in – contact cock in either energised /De-energised position
- Inter lock – One operation prohibits another operation
- Sequence – Operates two or more sets of contacts in predetermined sequence
- Marginal – Operation is based on a predetermined value of coil current and voltage.

69) Explain the functions of owner/ project manager, estimator, superintendent

Owner /Project Manager

- Prepare company long term plan /year plan
- Review monthly progress
- Verify that major activity is assigned to particular individual
- Make sure that each individual meets their responsibilities
- Review each major job on weekly basis
- Keep every body in the company happy and working
- Stay in touch with customers
- Meet consultant/attorney/insurance salesman once a month
- Keep office clean and organized
- Assist all employees

ESTIMATER:

- Prepare estimates and bid new jobs
- Review job progress
- Review and verify weekly invoices
- Review job accounting weekly
- Stay & update new products