7762AA Electrical Distribution (1)

Module Teacher-- U Kyaw Naing (Joe) Delivery mode= 4 hrs per weeks x 9 weeks= 36 Hrs

Main text book recommended for 7762AA Electrical Distribution

2832P Distribution and Utilization A
(Published by Department of Technical and Further Education-NSW)

Unit	**Contents**	**Module/ Learning Outcomes**
Unit 1 of 2832P	Design concept, character of plant, size and character of load, type of power supply to load, service requirement + 7762AA Module book	7762-AA Learning outcome 1
Unit 2 of 2832P	Transmission line construction Mechanical properties, overhead lines conductors, damper, fitting, insulator, OH line construction and maintenance regulations, sag etc +7762AA Module book	7762AA Learning outcome 2 + Some components of Learning outcome 3
Unit 3 of 2832P	Voltage regulation, control, transformer impedance+7762AA Module book	7762-AA Learning outcome 4

Australian Standards-
AS 1026, 1023, 1034, 1042, 1078,1117,1158,1190,1202,1220,1222,1243,1284,1359, 1360,1469,1531,1675,1680,1746,1767,1768,1798,1824,1883,1930,1931,2005,2006,2184,2209,2263,2264,2326,2374,2421,3000,3116,3274

Other text books

Text book	**Learning Outcomes of 7762AA Module**
Generation, Transmission and Utilization of Electrical Power By AT Starr	Supporting reference
Basic Training Manual 16-12 Electrical Trades-Cable, conduits, busbar	Some components of Learning outcome 3
Electrical Distribution Engineering	Support for Learning outcome 1,3
Electrical Power Distribution & Transmission	Support for Learning outcome 2,
Electrical Power Transmission System-By R Robert Eata, Edward Cohen	Support for Learning outcome 1,2,
Site Surveying & Levelling By John Clancy + Internet downloaded article-Software package for line route survey + Transmission line mechanical design (Electrical Power Transmission System)	Survey for transmission line construction site and route + contour map of Learning outcome 2 especially for Line Design Project

Day (1)
Learning Outcome 1.1 Describe common system for electrical distribution

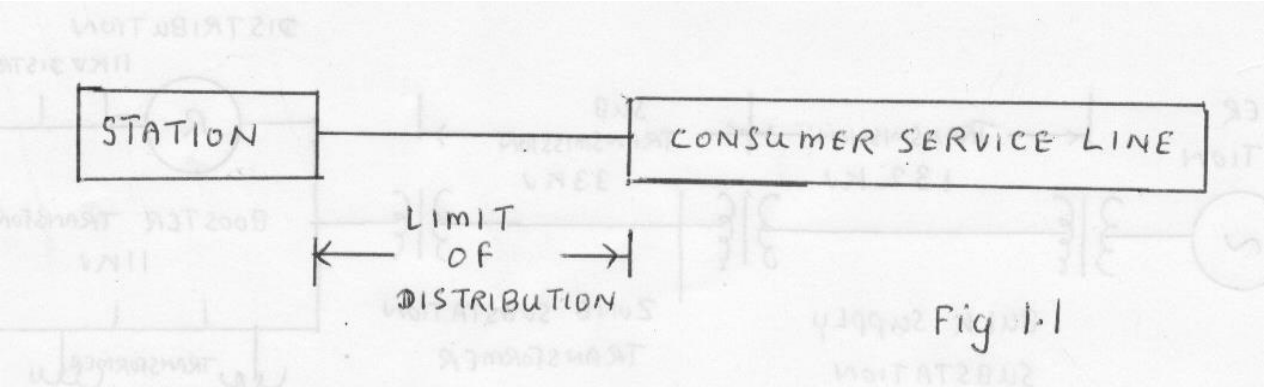
The electrical distribution system contains the following equipments.

1. Power generating equipments
2. Primary and secondary distribution systems including feeders, transformers, switch gears, protective equipments and stand by generating plant.
3. Motor drives, heaters, oven, associated wiring and control equipments
4. Lighting equipments, lighting wiring circuits
5. Electrical and electronic control, instrumentation systems
6. \Auxiliary systems
7. Special items such as welding, batteries, rectifiers, electro plating equipments, lifts, industrial trucks, air-conditioners
8. Communication equipments

9. Yard, roadway, protective lighting

Limit of Distribution

Figure 1.1



System of distribution

- Overhead distribution
- Underground distribution
- Combined overhead and underground distribution

Learning outcome 1.2 State their relative merit and voltage levels

Overhead lines

- Less expensive
- Extreme higher voltage
- Continual stresses
- Exposure to varying climate conditions
- Subject to mechanical wears/ corrosion
- Need to be periodically replaced

Higher spacing between conductors---- Higher current rating
----- Higher circuit inductance

Larger conductor sizes----- Higher load capacity
------ Higher expenses

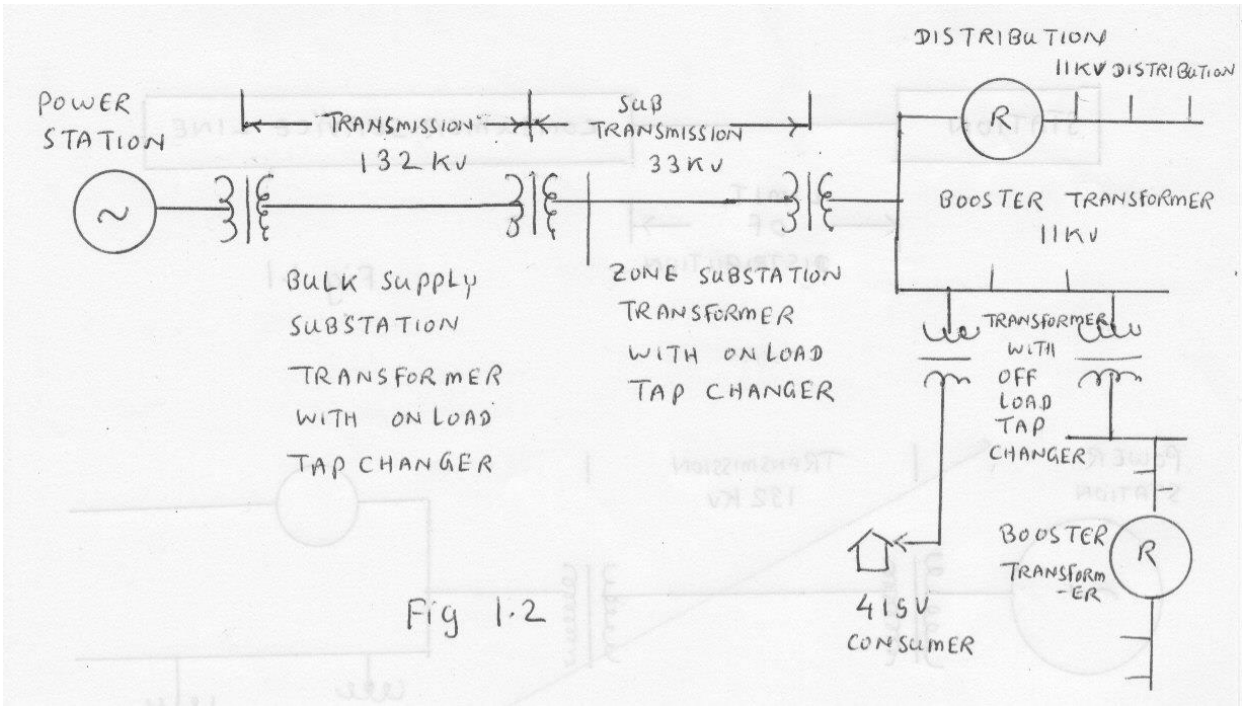
Standard distribution voltages ASCI 1969

Standard voltages for 3 phase system are

415V (Voltage to neutral 240V)
11KV, 22KV, 33KV, 66KV

Learning outcome 1.3 Interpret the diagrams of distribution systems

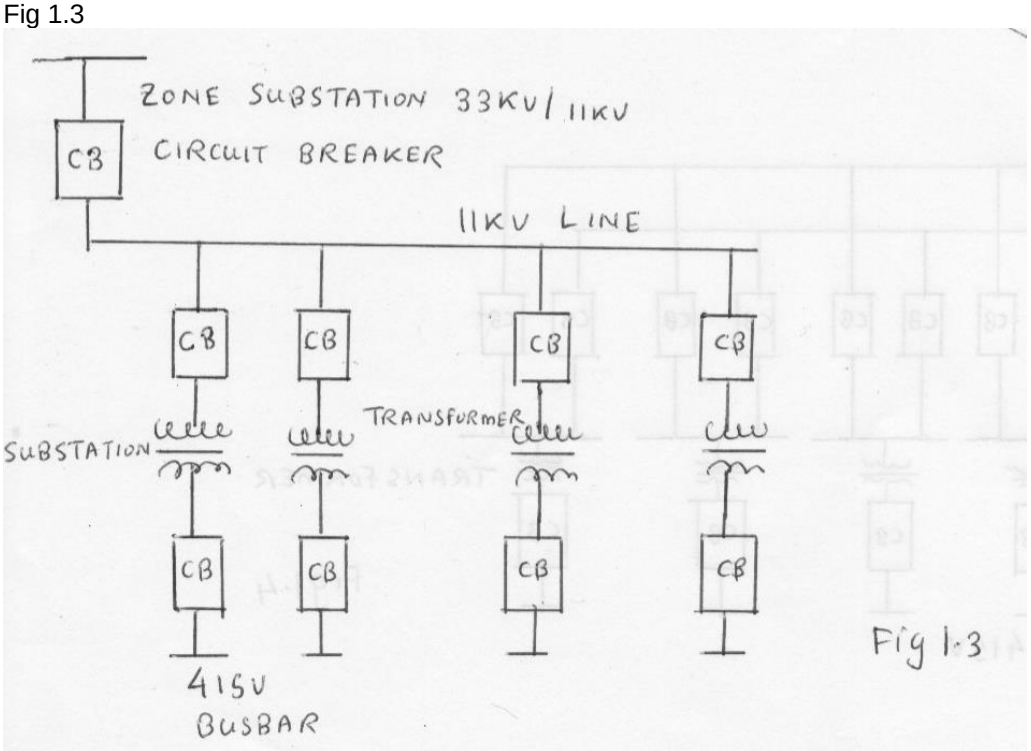
Fig 1.2



Types of feeders

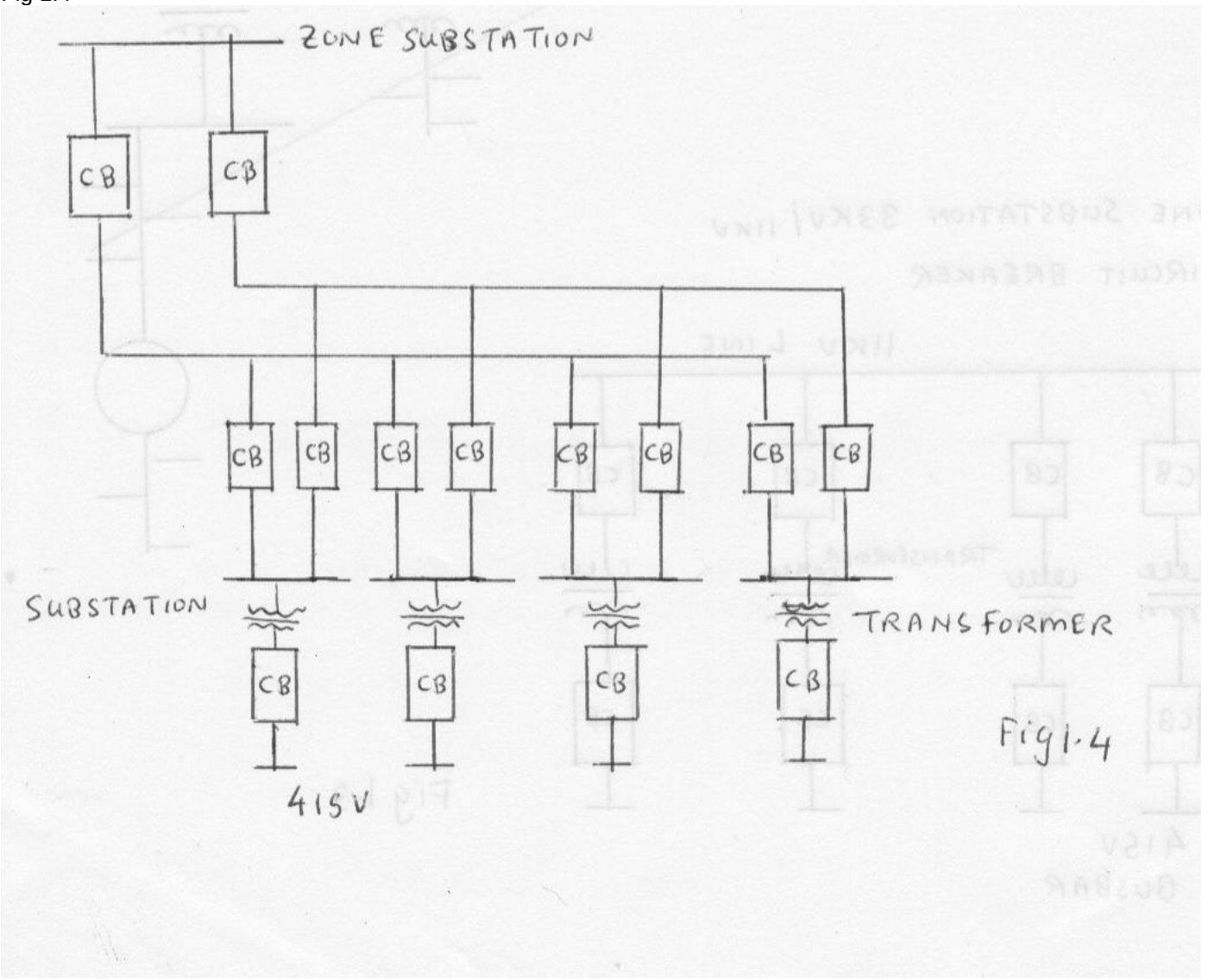
Radial feeder

Fig 1.3

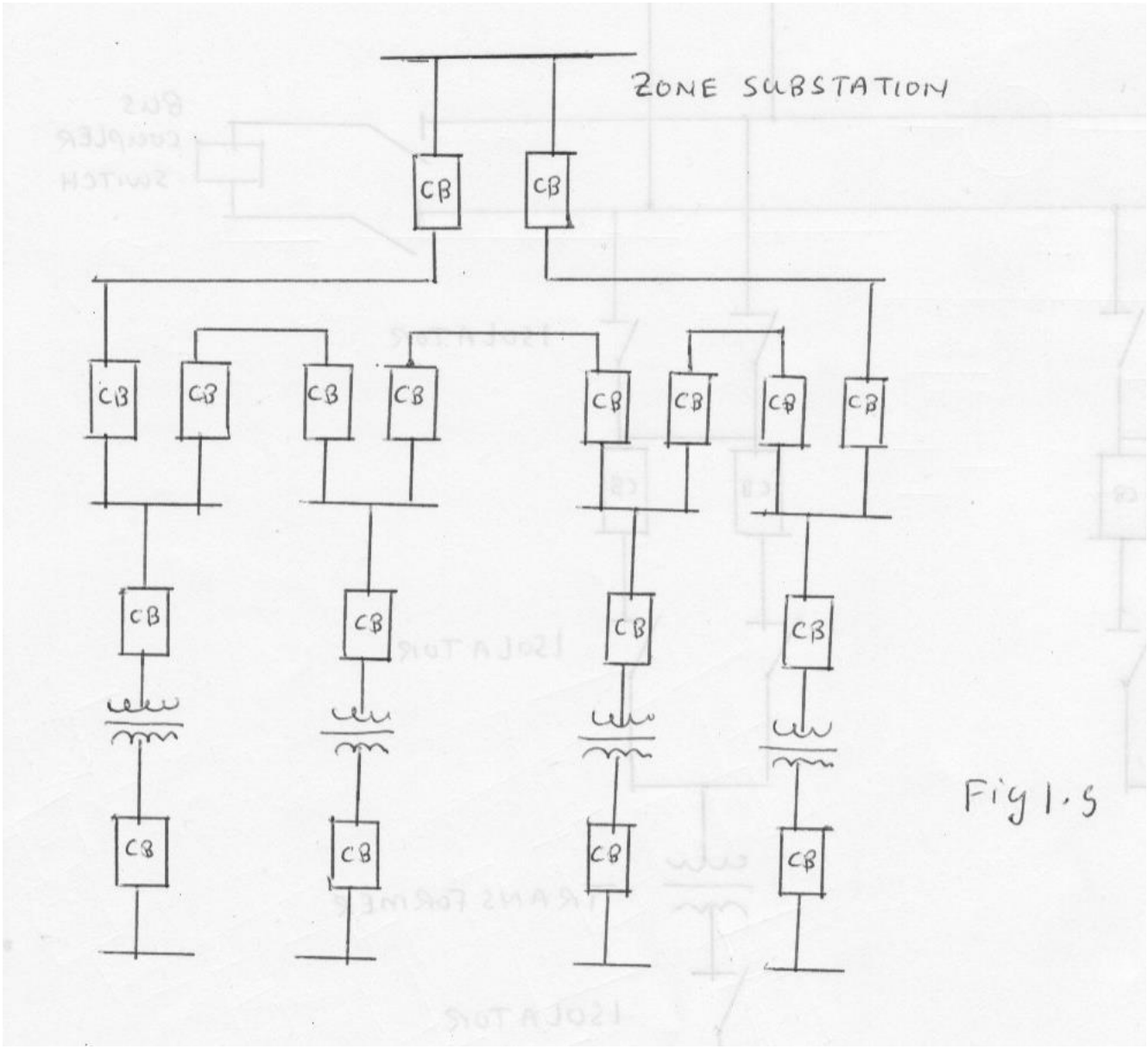


Parallel Feeder

Fig 1.4



Ring main feeder
Fig 1.5



Substation busbar arrangement

For easy maintenance, means must be provided for isolators and circuit breakers. Earthing switch is to be provided for earthing of high voltage equipments.

Single busbar

Fig 1.6

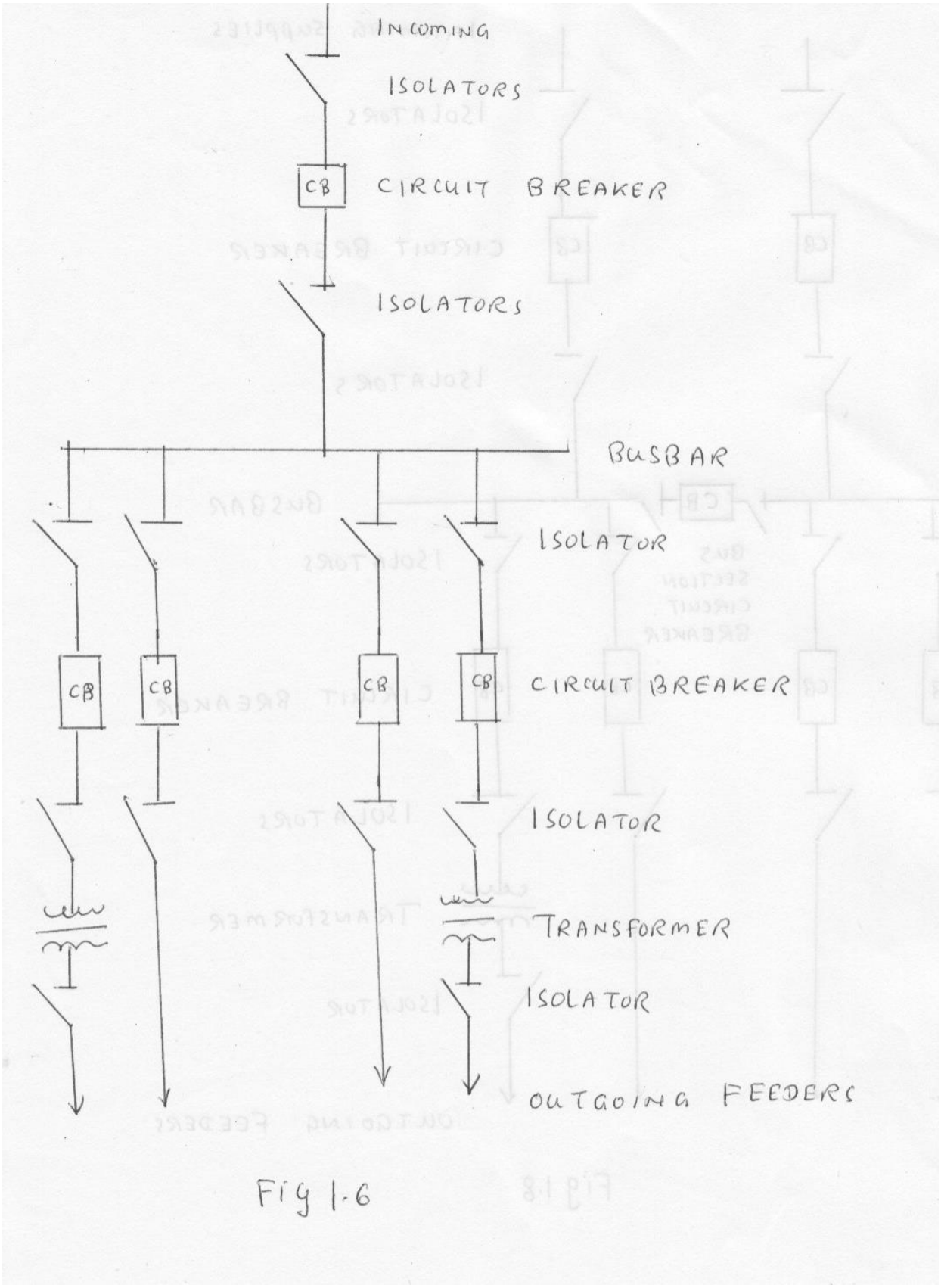


Fig 1.6

Duplicate busbar

Fig 1.7

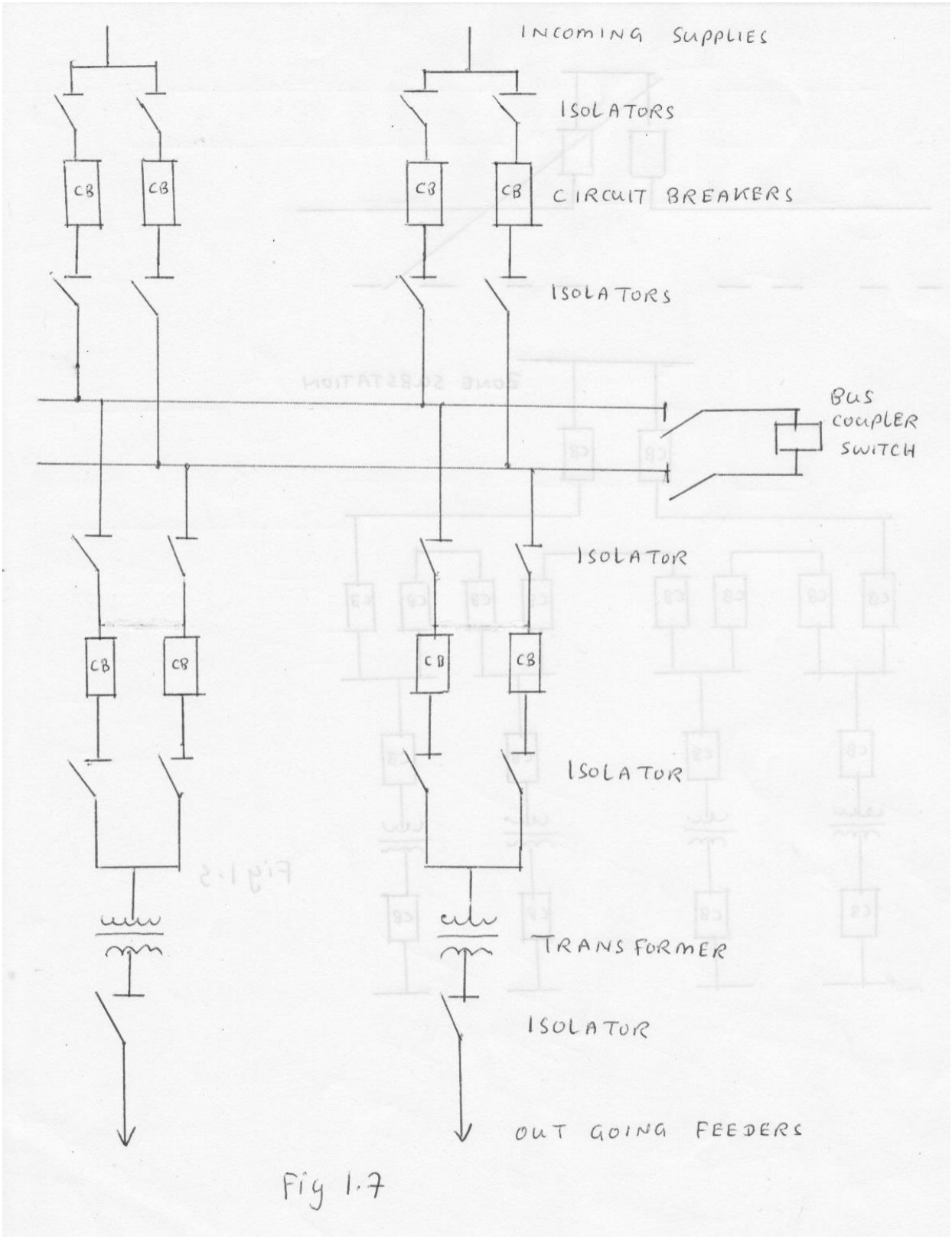
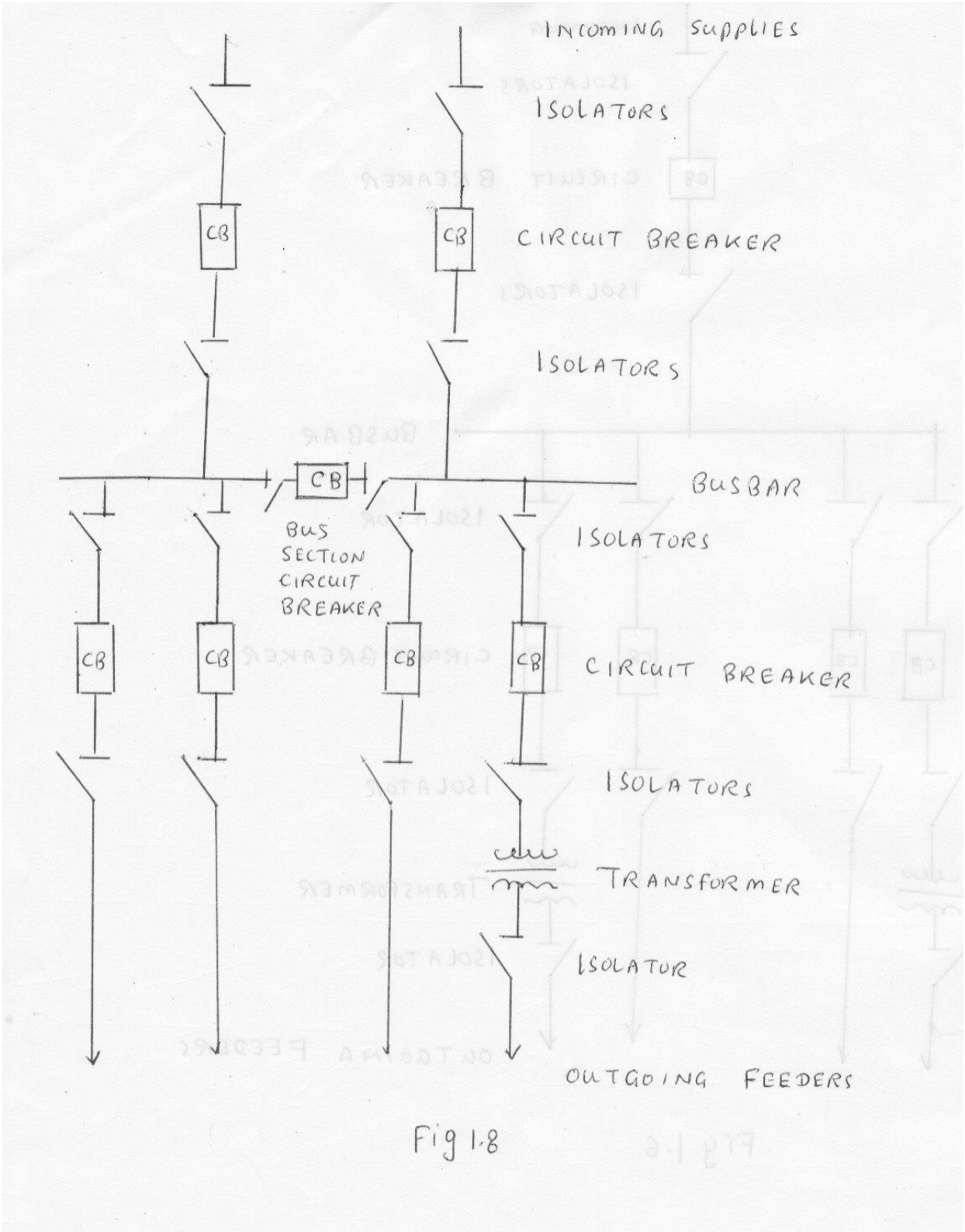

INCOMING SUPPLIES
ISOLATORS
CB
CB
CB
CB
CIRCUIT BREAKERS
ISOLATORS
BUS COUPLER SWITCH
ISOLATOR
CB
CB
CB
CB
ISOLATOR
TRANSFORMER
ISOLATOR
OUT GOING FEEDERS

Fig 1.7

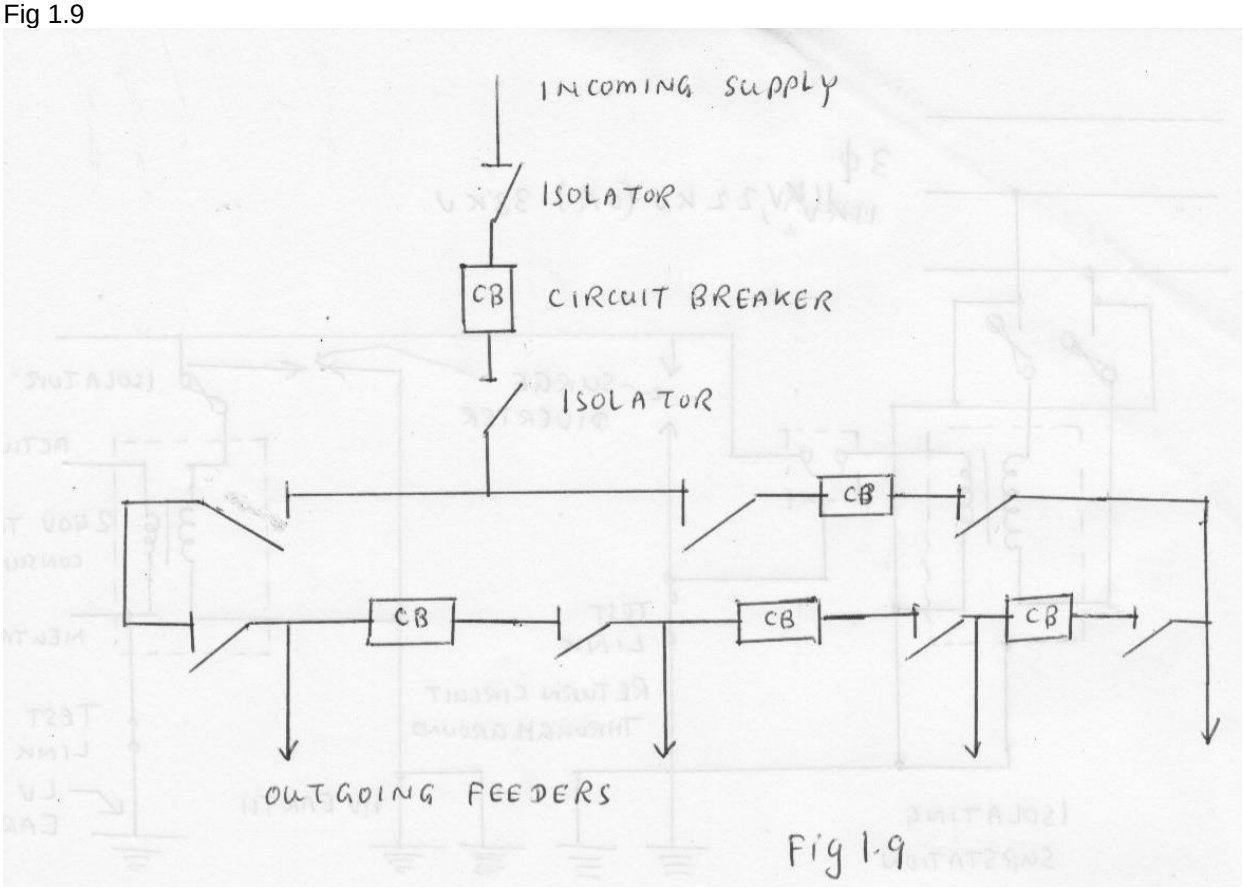
Sectionalize busbar system

Fig 1.8



Ring busbar

Fig 1.9



Learning outcome 1.4 Recall terminating pertaining the distribution system

Technical terms for electrical distribution

Reserve

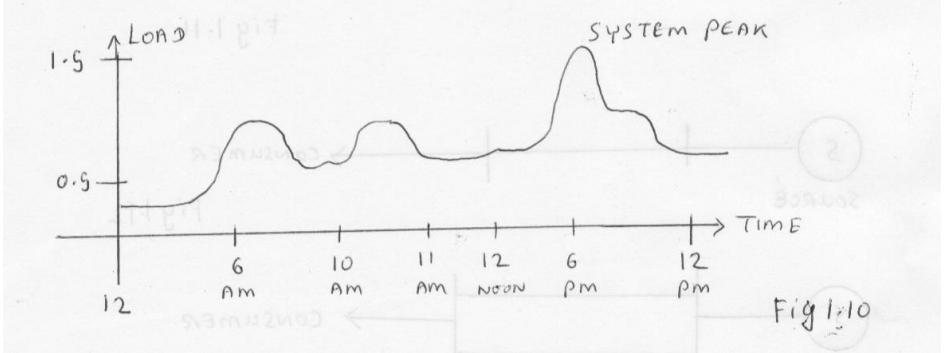
Reserve is that portion of an electric utility's available generating capacity tahat is not producing electricity at a given time.

Spinning reserve

The generating capacity that is being driven at the proper speed to provide proper voltage but is not producing power. Spinning reserve can provide power to the system almost instantaneously if the system load is increased or a generator must be taken out of service.

Diversity
Load changes during a period of time.

Fig 1.10



Demand Factor

$$\text{Demand factor} = \frac{\text{Maximum load}}{\text{Total connected load}}$$

Consumer Factor

An individual consumer is not opt to be using all of the electrical devices that constitute his or her connected load at the same time.

Maximum demand

Actual load is used by consumer creates demand for electrical energy that varies from hour to hour over a period of time but reaches its greatest value of same point. This may be called the consumer's instantaneous demand.

Coincidence factor

The ratio of the maximum coincident total demand of a group of consumers to the sum of the maximum demands of each of the consumer

$$\text{Coincidence factor} = \frac{\text{Maximum coincident total demand of a group of consumers}}{\text{Sum of maximum demands of each of consumers}}$$

Utilization factor

The ratio of the maximum demand of a system to the rated capacity of the system.

$$\text{Utilization factor} = \frac{\text{Maximum demand of the system}}{\text{Rated capacity of the system}}$$

Diversity Factor

The ratio of the sum of maximum demands of each of the component loads to the maximum demand of the load as a whole.

$$\text{Diversity Factor} = \frac{\text{Sum of maximum demands of each of the component load}}{\text{Maximum demand of the load as whole}}$$

Some natures of industrial loads

Industrial Heating

Space heater, oven baking, heat treating, enamelling, furnace, steel brass, welders, high frequency heating devices.

Electric furnances draw the heavy current of less intermittently during the part of the heat treatment process and fairly lesser current for the rest.

Electronic loads

Radio, TV, Laser equipments, digital time and timing devices, rectifiers, oscillators, high frequency current production.

TUTORIAL EXERCISES

Q1.
Discuss the relative advantages and disadvantages of the following systems of electrical distribution.

(a) radial feeder (b) Parallel feeder (c) Ring main feeder

Answer will be discussed in the class.

Q2.
A transformer supplies a group pf four feeders which have individual maximum demands of 2.5, 2.4, 4.3 and 1.6 MVA. If the diversity factor of the system is 1.82, determine the maximum demand on the transformer.

Answer

$$\text{Diversity Factor} = \frac{\text{Sum of the individual maximum demands}}{\text{Maximum demand of the transformer.}}$$

$$1.82 = \frac{2.5 + 2.4 + 4.3 + 1.6}{\text{Maximum demand of the transformer.}}$$

$$\text{Maximum demand of the transformer} = \frac{2.5 + 2.4 + 4.3 + 1.6}{1.82}$$

Maximum demand of the transformer= 5.93 MVA

Q3

A house has the following loads

5 lights each 80watts
1 stove 1000watts
5 power points each 100 watts
1 air-conditioner 1000 watts

If maximum demand is 2000 watt, calculate the demand factor.

Total connected load

Equipment		Power
Light	5 x 80 watts	400 watts
Stove		1000 watts
Power point	5 x 100 watts	500 watts
Air-conditioner		1000 Watts
	Total connected load	2900 watts

$$\text{Demand factor} = \frac{\text{Maximum demand}}{\text{Total connected load}}$$

$$= \frac{2000}{2900}$$

$$= 0.68$$

Q4
State 3 classifications of distribution system

Answer
- Overhead distribution
- Underground distribution
- Combined overhead and underground distribution

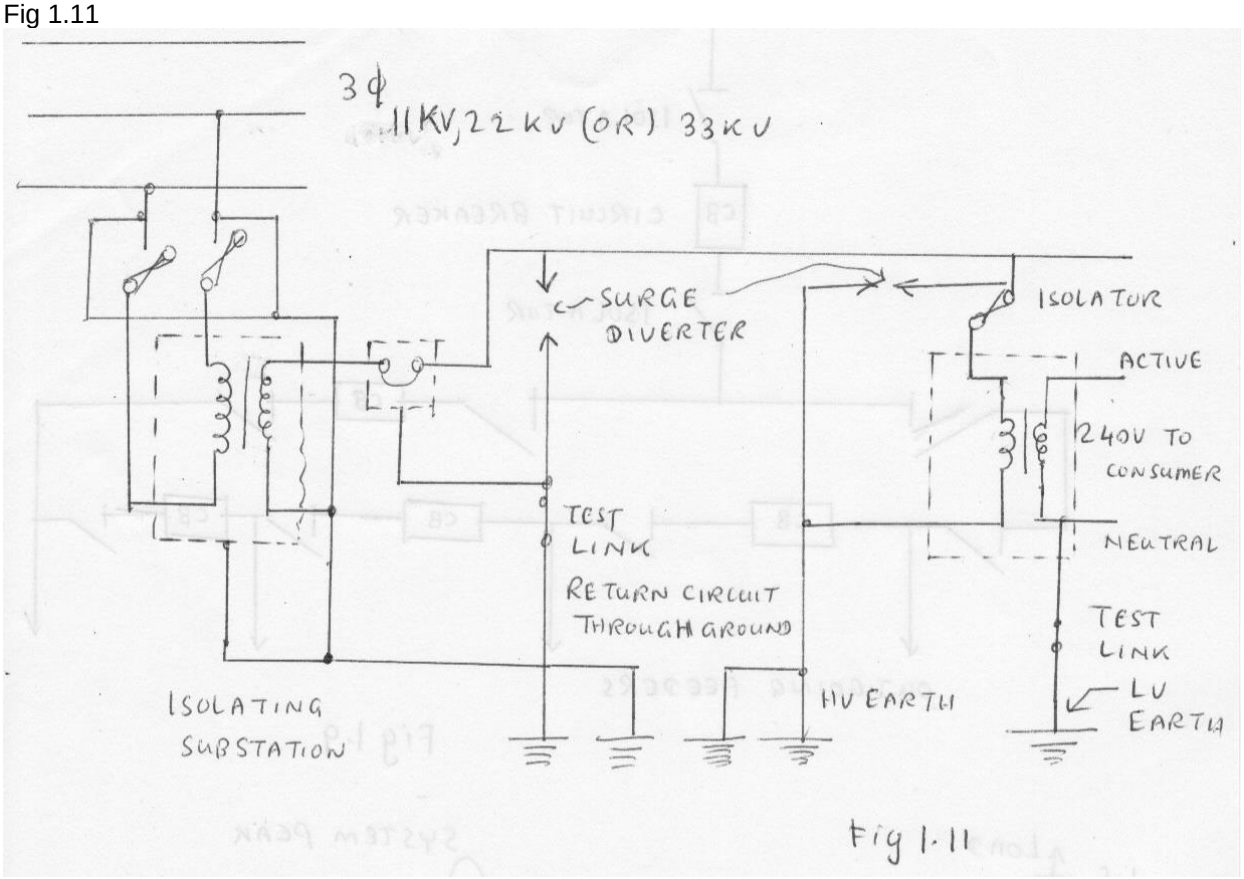
Q5
State the standard voltages for 3 phase distribution system

Answer

415V, 11KV, 22KV, 33KV, 66KV

Q6
Sketch abd describe a single wire earth return (SWER) system

Fig 1.11

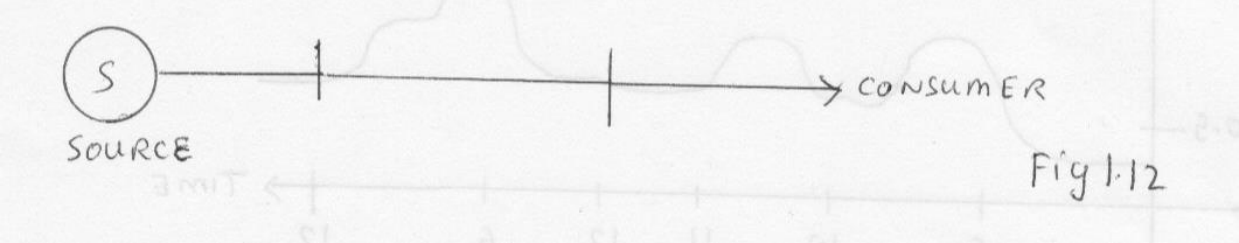


Q7
Sketch three types of feeders that are commonly used for distribution system and describe the merit of each type

Answer

Radial feeder

Fig 1.12

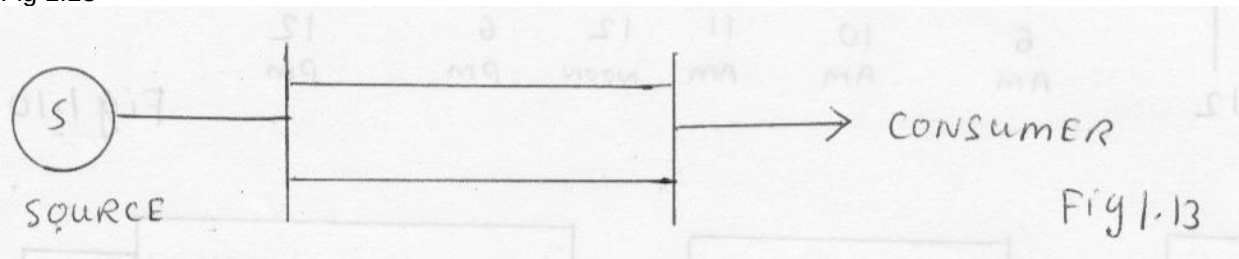


Advantage-- Simple to build and maintain

Disadvantage-- Unreliable

Parallel Feeder

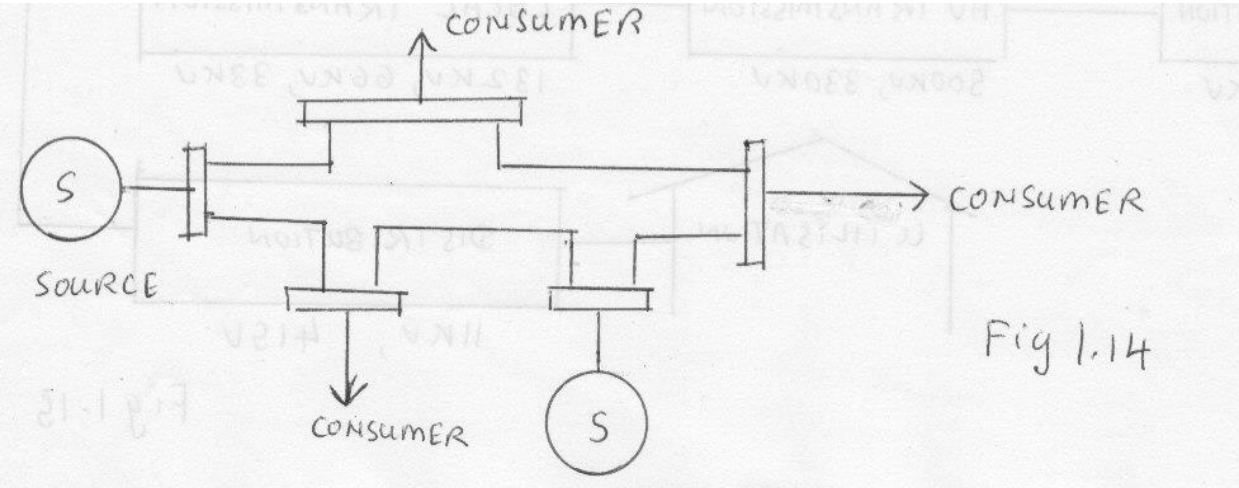
Fig 1.13



Advantage-- Reliability is improved over radial feeder
Disadvantage- Expensive and more complex to operate

Ring main feeder

Fig 1.14



Advantage-- Very reliable due to multiple sources and two ways of power flow

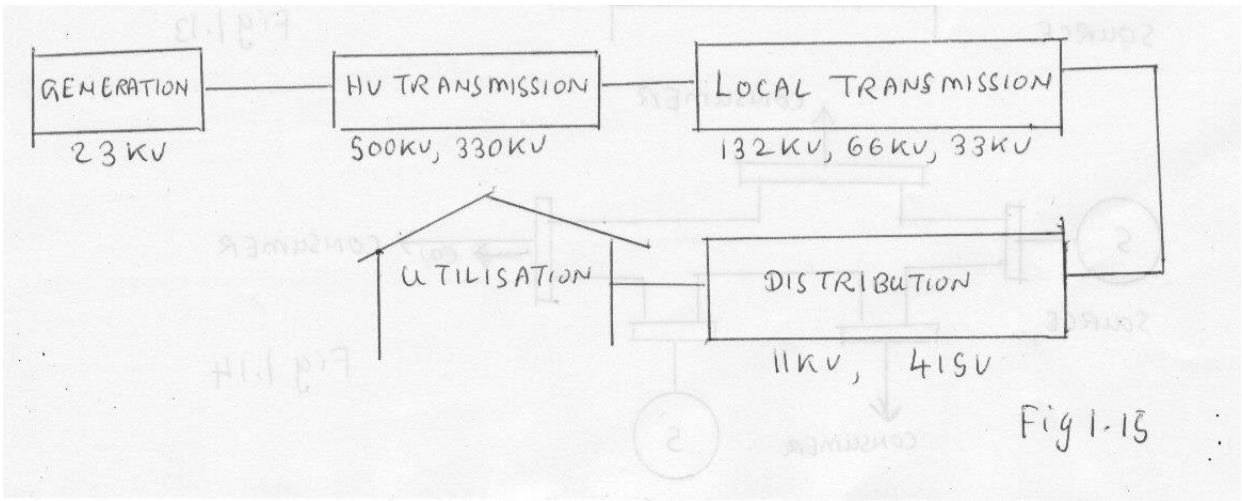
Disadvantage-- Very expensive and complicated to operate

Q8

Draw a block diagram of a power system from generation to utilisation and on it, show typical voltages

Answer

Fig 1.15



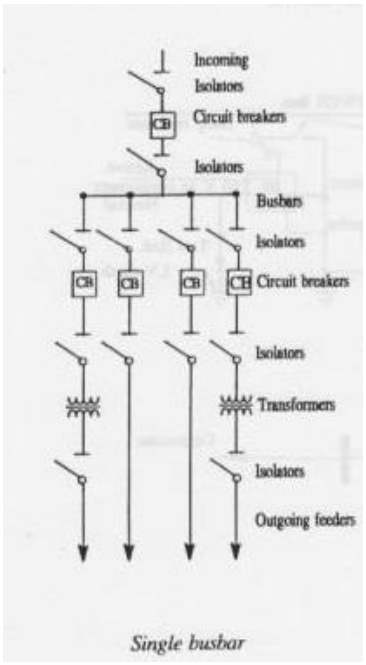
Q9

Sketch the following busbar arrangements
-Single busbar
-Sectionalise busbar
-Ring busbar
-Duplicate Busbar

Answer

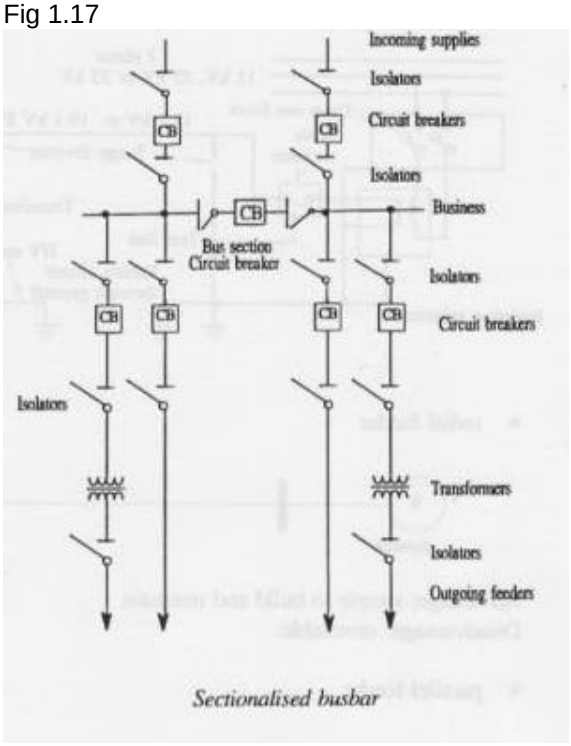
Single busbar

Fig 1.16



Sectionalise busbar

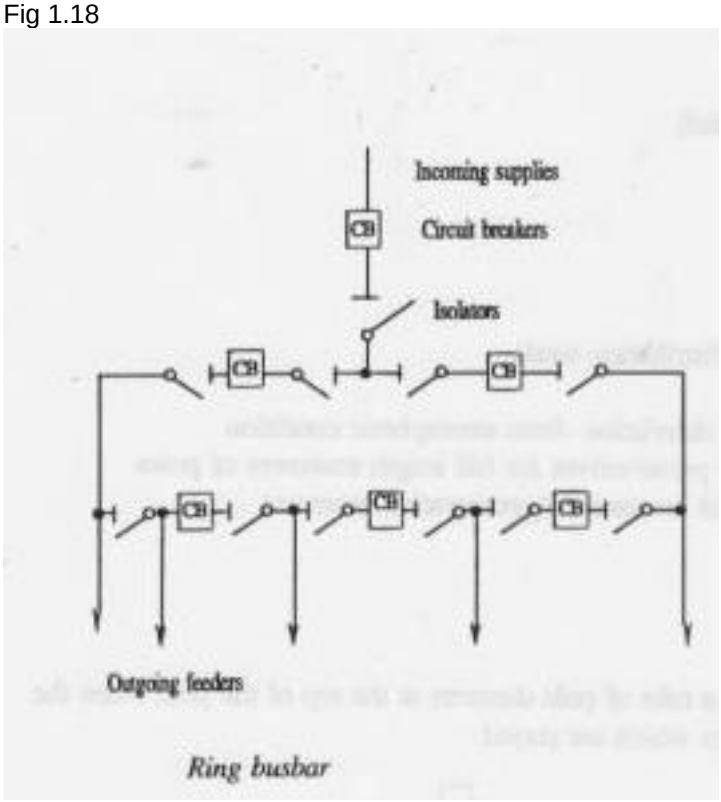
Fig 1.17



Sectionalised busbar

Ring busbar

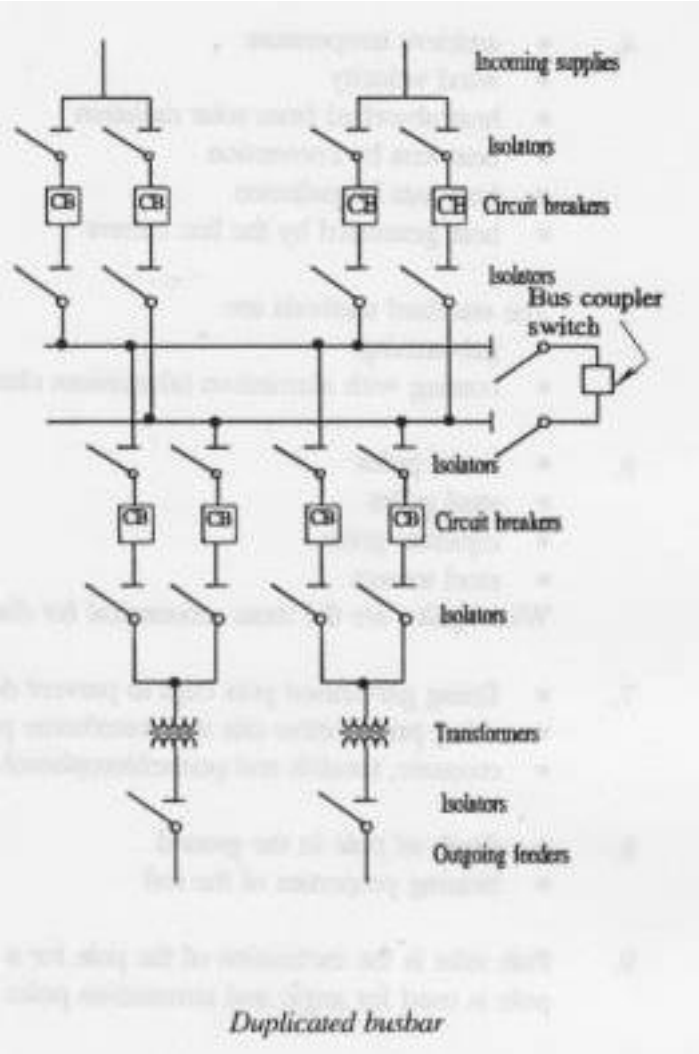
Fig 1.18



Ring busbar

Duplicate busbar

Fig 1.19



Duplicated busbar