

RMU: THE MV SWITCHGEAR

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ABSTRACT : The main objective of the project is to install RMU (Ring Main Unit) in the electrical power distribution network is to provide a safe, reliable and efficient way to switch, protect and control the distribution system i.e., easy make and break of the network, fault finding in the network, Control and protection of the load network. The Ring main units are used to isolate the faulty portion of the feeder network, taking care of protection of the equipment and to maintain the continuity of power supply to customers. The RMU provides a high degree of safety and reliability, and it is easy to install, maintain and operate. Ring main units also reduce the need for manual intervention by linemen, as they can be programmed to automatically switch to a backup power supply in the event of a power outage. The ring main unit is small in size and can adapt to all kinds of buildings. It can be used for long-term stable power supply and infrequent high voltage switching operation. Ring main unit, because of its inherited properties is now widely used in residential buildings, public places, factory buildings and other buildings, especially in medium and small capacity compact stations. It can also be controlled from substation itself by employing Supervising control and data acquisition (SCADA) System by inbuilt Feeder remote terminal unit (FRTU) provision which used to analyze the system functioning with the help of multifunction transducers by Modbus communication channel and transfers the real time data to control center. The controller makes decision based on the data obtained from the FRTU.

I.INTRODUCTION :

The power system is a network which consists of generation, transmission and distribution

- **Primary transmission:** The electric power at 132 kV is transmitted by 3-phase, 3-wire overhead system to the outskirts of the city. This forms the primary transmission.
- **Secondary transmission:** The primary transmission line ends at the receiving station, which usually lies at the outskirts of

system. The supply of electrical power is done through some form of generation (e.g., a power plant), the transfer is done through a transmission line and distribution system distributes the electrical power to residential and industrial applications.

In generating stations, the fuel (e.g. coal, water, nuclear energy) is converted into electrical energy. The usual generation voltage is 11 kV. To reduce costs in the transmission of electricity, 3-phase transformers are used to raise the voltage from 11 kV to 132 kV at the generating station. The use of higher voltages for the transmission of electricity has many advantages such as saving on conductor material and better transmission performance. The transmission and distribution is shown in the figure 1.1.

Transmission system is a network of electrical components used to transmit power from the generating station to the user in a reliable, efficient, and cost-effective manner. The transmission system also helps to ensure that the electricity is delivered at the right voltage and frequency.

the city. The voltage is then decreased to 33kV by step-down transformers at that station. From this point, a 3-phase, 3-wire overhead system carries the electric power at 33kV to various sub-stations located throughout the city to create a secondary transmission.

- **Distribution system** is the final stage in the delivery of electric power; it carries electricity from the transmission system to individual consumers.
- **Primary distribution:**The secondary distribution line ends at the sub-station (SS) where the voltage is decreased from 33 kV to 11kV, 3-phase, 3-wire. The 11 kV lines run along the important roadsides of the city. This forms the primary distribution. Large customers (requiring more than 50 kW) are usually supplied power at 11 kV for further processing in their own sub-stations.
- **Secondary distribution:**The final stage in a Power System is the distribution of electric power from the primary distribution line (11 kV) to distribution sub-stations (DS) or Distribution Transformers. These sub-stations are located near consumers, and reduce the voltage to 400 V, 3-phase, 4-wire for secondary distribution. The single-phase residential lighting load is connected between any one phase and neutral, whereas 3-phase, 400 V motor load is connected across 3-phase lines directly.

Fig 1. single line diagram of power station

- The ring main unit is having a flexible combination made up of 3

to 5 total switch boxes to satisfy the power supply needs of various power distribution network junctions. The switch uses SF6 gas for executing load break operation.

- The main function of the ring main unit (RMU) is to link the multiple feeder network.

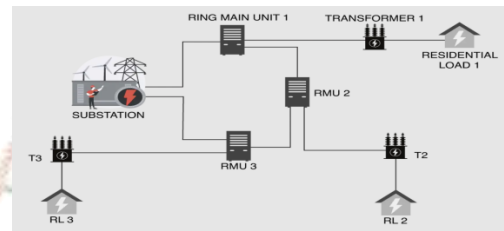


Fig 2. Ring main unit

This helps to increase the stability of the power supply i.e. the loop function of ring mainnetwork.

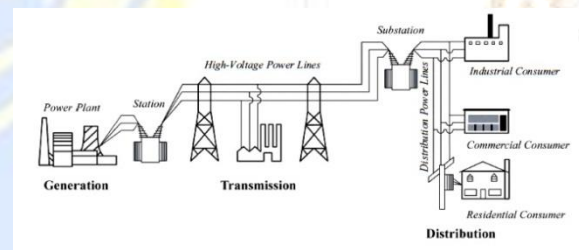
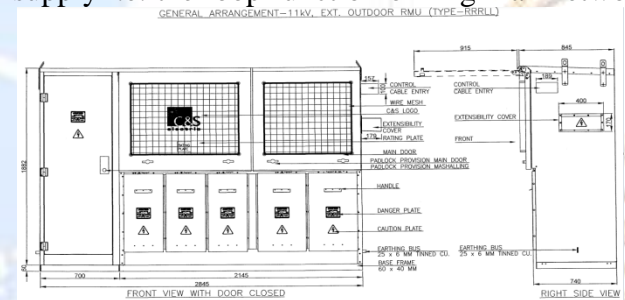


Fig 3 .Distribution Network



Fig 4 .Front View of Ring main unit

II.OBJECTIVE:

The main objective of the project is to install RMU (Ring Main Unit) in the electrical power distribution network is to provide a safe, reliable and efficient way to switch, protect and control the distribution system i.e., easy make and break of the network, fault finding in the network, Control and protection of the load network.

The Ring main units are used to isolate the faulty portion of the feeder network, taking care of protection of the equipment and to maintain the continuity of power supply to customers. The RMU.

III.RING MAIN UNIT FUNCTION:

The Ring Main Units (RMU) are electrical cabinets used in the power distribution network for various purposes, such as input power switching for transformer stations and outgoing feeder networks. They are equipped with a circuit breaker and relays that can enhance their capacity to protect selectively, prevent the transformer's surge current from operating inappropriately, and detect phase-

TYPES OF RMU:

Ring main units (RMU) are categorized into two types based on the place of installation:

1. Indoor Type
2. Outdoor Type

a. Based on the structure:

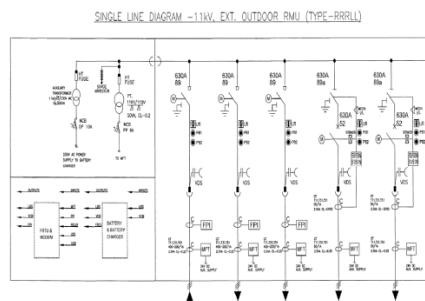
- Extensible
- Compact

b. Based on the kind of arc stamping in the gas chamber:

- Electrical insulation cabinet in an air environment
- Electrical insulation cabinet in a vacuum environment

to-phase fault currents and modest earth intensity. Compared to medium voltage explosives, they offer more protection.

IV SINGLE LINE DIAGRAM OF RING MAIN UNIT:



CODE/SYMBOL	DESCRIPTION	CODE/SYMBOL	DESCRIPTION
85	LEIS WITH EARTH SWITCH	MCB	MINIATURE CIRCUIT BREAKER
85a	DISCONNECTOR	F	FUSE(LT/HT)
52	CIRCUIT BREAKER (VACUUM TYPE)	-FC	CAPACITIVE VOLTAGE INDICATOR(CVCI)
M	MOTOR	PT-CO/3 E	POTENTIAL TRANSFORMER
CC	CLOSING COIL	CT	CURRENT TRANSFORMER
94	ANTIPUMPING RELAY	NC	NORMALLY CLOSE CONTACT
TC	TRIPPING COIL	NO	NORMALLY OPEN CONTACT
90/90M/90/3M	OVER CURRENT & EARTHFAULT RELAY	TC+	SERIES TRIP COIL
IN	BREAKER SPRING CHARGING SWITCH	MFT	MULTI FUNCTION TRANSUCER
11	BREAKER NO CONTACT	AR	AUXILIARY RELAY
LN	LOCAL/REMOTE SELECTOR SWITCH	AR FOR FRTU	AUXILIARY RELAY FOR FRTU
PB	PUSH BUTTON	TV	LEIS MOTOR CONNECTORS
SA	SURGE ARRESTOR	AT-CO/3 E	AUXILIARY TRANSFORMER

Symbols of components in ring main unit

- Electrical insulation cabinet in SF6 gas environment

c. Based on the voltage level:

- 11KV Voltage level
- 24KV Voltage level
- 36KV Voltage level

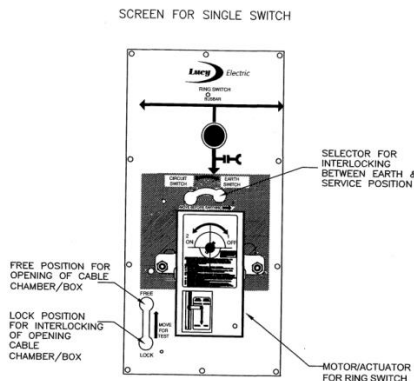
The following types of combination are available in the market

V COMPONENTS OF RING MAIN UNIT:

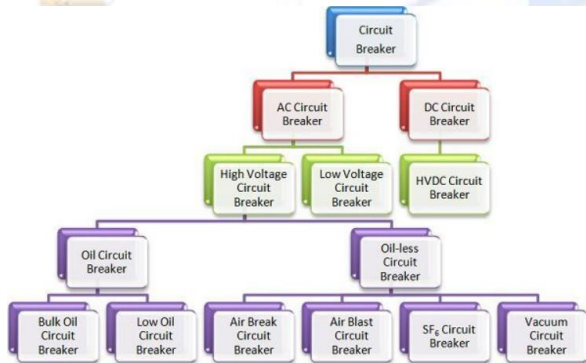
The main components of Ring main unit are listed below:

1. Load break switch (LBS)
2. Circuit breaker
3. Current Transformer (CT)
4. Potential Transformer (PT)
5. Over Current and Earth Fault Relay
6. 24V Battery Charger with Battery

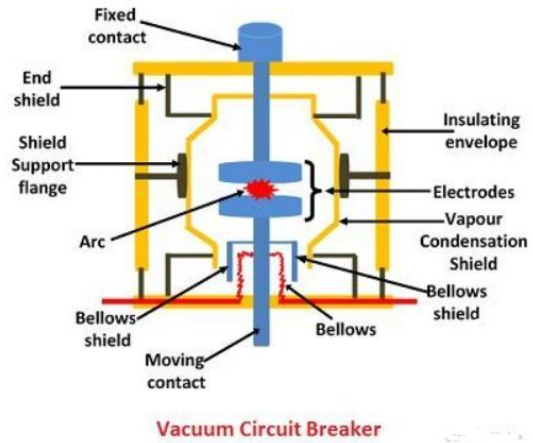
A. LOAD BREAK SWITCH (LBS):



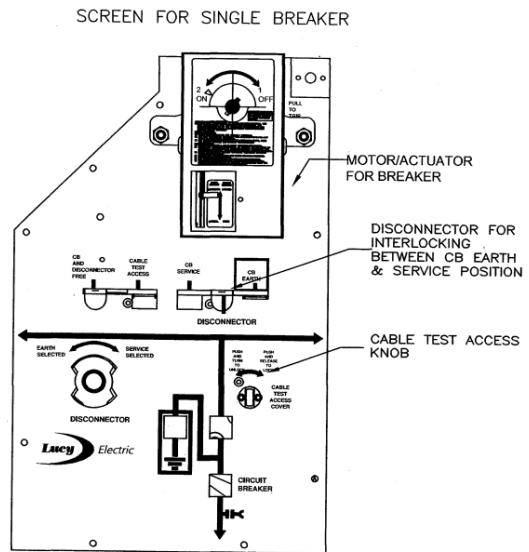
B. CIRCUIT BREAKER:



C. VACUUM CIRCUIT BREAKER:

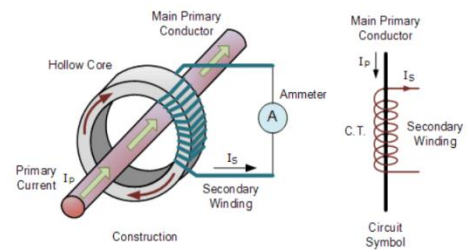


D. CURRENT TRANSFORMER (CT):



E. POTENTIAL TRANSFORMER (PT):

Current Transformer



F.OVER CURRENT AND EARTH

FAULT RELAY

A relay is an automatic device which senses an abnormal condition of electrical circuit and closes its contacts. These contacts in turns close and complete the circuit breaker trip coil circuit hence make the circuit breaker tripped for disconnecting the faulty portion of the electrical circuit from rest of the healthy circuit.

. Types of Over Current Relay:

1. Instantaneous overcurrent relay
2. Definite time overcurrent relay
3. Inverse time overcurrent relay
4. Directional overcurrent relay

G.24V BATTERY CHARGER WITH BATTERY:

The main function of Battery is used to provide DC power supply to the RMU Components such as Circuit breaker, Relay and Load break switch disconnecter.

A battery charger, or recharger, is a device used to put energy into a secondary cell or rechargeable battery by forcing an electric current through it.

Rating:26Ah Battery and charger, input-230V AC, Output-24V DC



Ampere hour Battery

Pre commissioning Tests for Switchgear PT:

The pre- commissioning tests to be conducted in systematic manner for Potential Transformers to ensure the healthiness and performance of the equipment.

Pre commissioning tests for PT are:

1. Insulation Resistance measurement Test:This test is conducted to ensure the insulation healthiness of the primary and secondary windings by measuring the insulation resistance value.

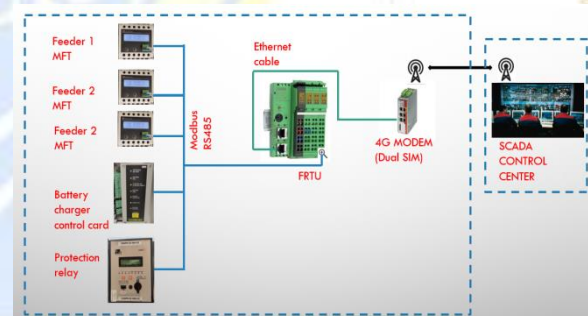
The Above test to be conducted at following points

- a) Primary to Earth
- b) Primary to Secondary
- c) Secondary to Earth

Between Secondary Cores

.FRTU DATA BASE CONFIGURATION & MAINTENANCE SOFTWARE TOOL

FRTU database configuration & Maintenance software tool shall be required to perform the database modification, configuration, compilation and documentation. The database compiler shall provide error detection services. It shall also perform the downloading of the compiled database into the FRTU database.



VI. CONCLUSION AND FUTURE

SCOPE:

The Ring Main Unit employed in power distribution network ensures to prevent the voltage supply from dropping off at various load substation. In a typical urban ring main arrangement, the loss of supply is immediately replenished through manual switching, and it increases the reliability of medium voltage supply in case one of its section fails to function. Despite

being at the same meeting point, both ends of the ring are capable of supplying power in every distribution transformer located within the ring.

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