

INFORMATION OF THE  
SYSTEM PROTECTION DEPARTMENT  
B.E.S. & T. UNDERTAKING

[ Information mandatory under Section 4 of Chapter II of Right to Information Act, 2005]

#### **4.(b) (i)} The particulars of the department, functions and duties**

Name of the Department	System Protection Department
Address	2 <sup>nd</sup> Floor, Technical Training Centre Bldg., BEST Wadala Depot, Wadala, Mumbai- 400 031.
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##### **1.0 Formation of System Protection Department**

The erstwhile Meters and Relays Department was carrying out three major functions viz., Meters, Relays and HV metering. In the advent of the Electricity Act, 2003, a need was felt to restructure the Electric Supply Branch to segregate the activities as Field Operating establishment, Customer Care establishment, Planning Establishment and Ancillary Establishment for smooth working and flexibility in horizontal mobility of the personnel for better utilization. Accordingly while restructuring the supply branch the Meters & Relays Department was bifurcated into two departments as Meters Department under Customer Care establishment (Supply Business) and System Protection Department under Field Operating establishment (Wire Business) vide Administrative Order no. 359 dated 07.09.2011. The System Protection Department has been kept under the direct control of Chief Engineer (Maint. / Work). System Protection department has started its functioning from 22nd October 2011 and its office is located at 2<sup>nd</sup> floor, T.T.C. building, Wadala Depot.

##### **1.1 Organization of the department:**

The department set up is shown in the attached organization chart. Please refer **Annexure- I**. The activities of the department are mainly related with five O & M Divisions. Hence each zone of O & M Divisions is assigned to Three Assistant Engineers.

## 2.0 **Activities of System Protection Department :**

The System Protection department is responsible for carrying out activities of testing and maintenance of all the relays installed in various Receiving stations for the protection of our 110 kV, 33 kV and 11 kV network. The discriminative tripping is the backbone of any distribution system since it helps in isolating the exact fault area and thus avoids the unnecessary revenue loss which otherwise would have incurred if the healthy network also would have tripped along with faulty network. At present (till February 2013) there are 54 nos. of RSS, out of which 4 nos. are 110 kV RSS. In addition to the above 9 nos. of new RSS are in pipeline and are expected to be commissioned in the recent future. Besides tripping messages are also attended by the System Protection Department for investigation and for taking corrective measures, if any.

## **The Functions and duties of department**

### **I) Technical Functions**

1.0 The System Protection Department carries out following major functions

- i) Setting and testing of Relays & other equipments prior to commissioning of new RSS
- ii) Setting and testing of Relays & other equipments prior to replacement of equipments in existing RSS
- iii) Routine maintenance which includes inspection, testing and attending defects of CT, PT and Relays
- iv) Tripping investigations and remedial actions
- v) Trip coil testing of DSS Breakers at Distribution Workshop, Kussara
- vi) Study of drawings of various equipments received from manufacturers
- vii) To adopt proper protection system
- viii) To derive the relay setting for adopted protection system.

**1.1** The above functions consists of following activities

**a) Routine Testing**

- i) Outgoing Feeder Relay testing
- ii) Capacitor Feeder Relay testing
- iii) Transformer Relay testing
- iv) OCB overhauling
- v) AVR inspection and overhauling

**b) Tripping**

- i) Transformer tripping investigation
- ii) Feeder tripping investigation
- iii) Defective AVR repairs / replacement
- iv) Defective CT & PT replacement
- v) Defective Relay replacement

**c) New commissioning and replacement jobs**

- i) Noting of details & rough drawings
- ii) HV CT and NCT testing
- iii) LV CT testing
- iv) HV & LV PT testing
- v) Through testing
- vi) RD & REF Stability testing
- vii) Report & maintaining Fair History book
- viii) RVT testing
- ix) Conventional relay replacement by Numerical Relay in South Zone.

**d) Commissioning of new SCADA System**

- i) HV, LV and NCT testing
- ii) HV & LV PT testing

- iii) Through testing
- iv) RD & REF Stability testing
- v) Report & maintaining Fair History book
- vi) Commissioning of AREVA make relays on feeder.

e) **Miscellaneous**

- i) Materials arrangement
- ii) Office work

## **II) Establishment and Administrative Section Function**

### **1.0 Activities :**

#### **1.1 Establishment:**

- i. Maintaining staff position
- ii. Initiating various proposals relating to Establishment matters
- iii. Keeping staff record, file, register etc.

#### **1.2 Administrative :**

- 1.2.1 Procurement of stationary & material
- 1.2.2 Arranging various payments
- 1.2.3 House-keeping
- 1.2.4 Initiating various proposals relating to Administrative matter
- 1.2.5 Keeping records

### **2.0 Records and Registers**

#### **2.1 Registers**

##### **2.1.1 Establishment**

- 2.1.1 Staff Record, Bus Token
- 2.1.2 Staff position, Superannuation
- 2.1.3 Final Dues Payment
- 2.1.4 Service Record File Movement

## 2.2 **Dispatch:**

Inwards/Outward/File movement/Tenders & Inspection Forms/Purchase Forms

## 2.3 **Administration :**

Bill Voucher, Deputation, Brief-case, Verification of Registration of Motor cars, Computer repairing & servicing, Inventory, Overtime, Sunday working, Purchase Form, Issue of Napkins/ Soap, Leave, Attendance, Zerox copy records, Imprest Cash, Annual Maintenance Contract of Computer/ Printers, Casual Labour Attendance & Payment, etc..

## 2.4 **Files:**

### 2.4.1 Establishment & Administration

### **2.4.2** Miscellaneous

## **4.(b)(ii)} The powers and duties of System Protection Department Officers and Employees**

<b>Designation</b>	<b>Grade</b>	<b>On Roll Staff</b>
<b>i) Officers</b>		
Superintendent	A-4	1
Assistant Engineer	A-5	4
Foreman General	P1/T-8	1
Asst. Admin. Officer	A/GVIII	1
<b>ii) Technical Staff</b>		
Foreman	P1/T7	4
Asst. Foreman	P1/T6	1
Tradesman	P1/T3	1
Nawghany	P1/T1	4
<b>iii) Administrative Staff</b>		
Clerk {Supervisor (P)}	A/GVII	1
Shop Recorder {Supervisor (P)}	A/GVII	0

Sepoy	A/GV I	1
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## 1.0 **The Powers and Duties of Superintendent** :

Superintendent, System Protection Department is over all in-charge of System Protection Department. He is directly reporting to Deputy Chief Engineer(D/N) for efficient administration and functioning of the department.

### 1.1 **Duties & Responsibilities**

1.1.1 He is overall in-charge of the activities mentioned under para D (3.0)

1.1.2 To ensure smooth and satisfactory working of the department.

1.1.3 To supervise the activities of the department as mentioned under para D (3.0)  
and guide the officers and staff under his control.

1.1.4 To initiate new methods / developing supportive work atmosphere  
for economizing and increasing efficiency of the department.

1.1.5 To control the budget grants.

1.1.6 Attending different departmental/ outdoor meetings.

1.1.7 Complying with Standing Orders/ Service Regulations.

1.1.8 Guiding for preparing MIS/Administrative Report.

1.1.9 Guiding for preparing different proposals/reports.

1.1.10 To prepare proposals for purchase of new equipments considering  
the new development in the relaying field.

1.1.11 To approve protection system adopted for various R.S.S.

1.1.12 To approve settings adopted for various R.S.S.

1.1.13 To sublet satisfactory training of Probationary Engineers. Senior

Stipendiary Apprentices

1.1.14 To visit at work site for ensuring programming of the numerical relays at the

time of commissioning of Receiving Sub Stations and to ensure relay

testing, through testing and stability test of Receiving Sub Stations Transformers.

1.1.15 To attend Tender Committee meeting.

1.1.16 To carry out Inspection of new material purchased and clear the Inspection Memo.

1.1.17 To assist Assistant Engineer to offer the comments on specification & drawing

of Control Relay Panel, Primary switchgear, Secondary switchgears & Bus Section

switchgears used in RSS & 11kV switchgears including RMU in DSS.

## 1.2 **Administrative Functions**

1.2.1 To sanction Leave Forms of A & B grade Officers working in System Protection Department.

1.2.2 To certify the attendance of the officers and staff and to sanction of various types of Bills vouchers, Taxi Bills, Xerox Bills etc.

1.2.3 To approve payment advices of various types of monthly allowances payable to officers and staff, casual labour payments.

1.2.4 To determine the staff requirement for smooth working of the department. To take up the matter with higher authorities and concerned panel chairmen for filling up of the vacancy.

1.2.5 Writing of Confidential reports of Officers & staff working under him.

Supervision of Officers & staff working under him.



Drafting inter-departmental notes and letters.

1.2.6 Recommending tenders for procurement of Materials/equipments.

1.2.7 Attending different inter-departmental/ outdoor meetings.

1.2.8 Complying with Standing Orders/ Service Regulations.

1.2.9 Assisting Assistant Engineers for preparing MIS/Administrative Report.

1.2.10 Assisting Assistant Engineers for preparing different proposals/reports.

1.2.11 Assisting Assistant Engineers for budget provision.

## **2.0 The Powers and Duties of Assistant Engineers**

### **2.1 Duties & Responsibilities**

There are four posts of Assistant Engineers in the System Protection Department for five zones i.e. Central North, North East, North West, South & Central South. Assistant Engineers are responsible to Superintendent Engineer for the major activities mentioned under para D (3.0) and shall carryout:

2.1.1 To derive setting of protective relay for adopted protection system.

2.1.2 Repairs, setting and testing of Protective relays in Receiving Sub-Stations.

2.1.3 Current and Potential transformer testing in Receiving Sub-Stations.

2.1.4 Repairing, setting and testing of AVR's i.e. Automatic Voltage Regulating relays.

2.1.5 CT and Trip Coil testing of OCB/VCB/RMU in Distribution Workshop, Kussara.

2.1.6 Procurement of equipment/Instrument, tools and spares for System Protection Department.

2.1.7 Up-keeping an account of relays, AVR's and other equipments / instruments of System Protection Department.

- 2.1.8 Carry out pre-commissioning tests on equipments/ instruments of Receiving Sub stations
- 2.1.9 Carry out pre-commissioning tests on equipments of Distribution Sub stations as and when required.
- 2.1.10 Commissioning of new protective relays on trial basis.
- 2.1.11 Preparing commissioning report of Receiving Sub stations.
- 2.1.12 Initiating proposals for scrapping of protective relays, equipments/instruments, tools, auxiliary C.T.'s etc.
- 2.1.13 Carrying out tripping investigation in the Receiving Sub Stations & preparing tripping investigation report.
- 2.1.14 Inspection of Materials received against Purchase Order.
- 2.1.15 To sublet satisfactory training of Probationary Engineers. Senior Stipendiary Apprentices
- 2.1.16 To program the numerical relays at the time of commissioning of equipments in new / existing Receiving Sub Stations.
- 2.1.17 To carryout testing of Current and Potential transformers in Receiving Sub-Stations.
- 2.1.18 To carry out commissioning tests i.e. relay testing, through testing and stability tests of Transformers in Receiving Sub Stations.
- 2.1.19 To carry out commissioning tests i.e. relay testing, through testing of feeders in Receiving Sub Stations.
- 2.1.20 To offer the comments on specification & drawing of Control, Alarm Relay Panel, Primary switchgear, Secondary switchgears & Bus Section switchgears used in RSS & 11kV switchgears including RMU in DSS.

2.1.21 To prepare different formats for relay testing and through testing of Outgoing feeders, Capacitor feeder and Power Transformer to ease testing.

2.1.22 To arrange repairing of protection relays, instruments, AVRs, Auxiliary relay from Manufacturer and administrative procedure thereof.

## 2.2 **Administrative Functions**

2.2.1 Sanction Leave Forms of Staff working in System Protection Department.

2.2.2 Certify the attendance, Taxi Bills, Xerox Bills, and Overtime etc.

2.2.3 Writing of Confidential reports of staff working under him.

2.2.4 Supervision of staff working under him.

2.2.5 Drafting inter-departmental notes and letters.

2.2.6 Recommending tenders for procurement of Materials/equipments.

2.2.7 Attending different departmental/ outdoor meetings.

2.2.8 Complying with Standing Orders/ Service Regulations.

2.2.9 Assisting Sectional Head for preparing MIS/Administrative Report.

2.2.10 Assisting Sectional Head for preparing different proposals/reports.

2.2.11 Forwarding statement of Group Incentive Bonus.

**2.2.12** Assisting Sectional Head for budget provision.

## 3.0 **The Powers and Duties of Foreman General (T-8)**

### 3.1 **Duties and Responsibilities**

Foreman General is responsible to Assistant Engineer for the following activities for the jobs mentioned under para D (3.0).

- 3.1.1 Arranging testing equipments for relay setting and testing at site.
- 3.1.2 Repairs and testing of protective relays, Automatic Voltage Regulating relays in Receiving Sub Stations.
- 3.1.3 CT and Trip coil testing of RMU/VCB in Distribution Workshop, Kussara.
- 3.1.4 Procurement of various electrical/electronic items and stationary for the relay testing crew.
- 3.1.5 Keeping account of spares parts, relays, auxiliary C.T.'s etc. pertaining to System Protection Department.
- 3.1.6 Maintaining/updating various registers of System Protection Department.
- 3.1.7 Maintaining different technical drawing, documents of protection system equipments, testing equipment, instruments etc.
- 3.1.8 Carrying out Pre-commissioning test of protection system at Receiving Sub Stations.
- 3.1.9 Carrying out tripping investigations as & when required.
- 3.1.10 Preparing and forwarding tripping investigation reports.
- 3.1.11 Attending complaints pertaining to protection system received from concerned departments.
- 3.1.12 Supervision of staff working under him.
- 3.1.13 Writing report after completion of job.
- 3.1.14 Ensuring that all the jobs/activities assigned to him are carried out in reasonable time.
- 3.1.15 Ensuring that the quality of the job assigned is maintained.

- 3.1.16 Assisting SCADA installation crew for checking the healthiness of circuits.
- 3.1.17 Maintenance of different registers, files associated with Commissioning of Receiving Sub Stations equipments/ instruments and Routine Relay Testing.
- 3.1.18 The job completion message shall be lodge in the respective Control.
- 3.1.19 Ensuring that vehicles and log books are maintained properly.
- 3.1.20 To maintain the fair history books for each RSS with all technical details and connection diagrams as per actual wiring carried out.
- 3.1.21 To carry out activities as mentioned under para D (3.0)
- 3.1.22 Recommended leave forms of staff working under him.
- 3.1.23 Assisting SSP/AESP for preparing MIS and Annual Report.
- 3.1.24 Preparing and forwarding incentive statements to TIE Department.
- 3.1.25 Maintaining Leave Attendance Register of staff working under him.
- 3.1.26 Any other work in emergency entrusted by officers.
- 3.1.27 To arrange repairing of protection relays, instruments, AVRs, Auxiliary relay from Manufacturer.
- 3.1.28 To carryout Current and Potential transformer testing in Receiving Sub-Stations.

#### 4.0 **The Duties and Responsibilities of Foreman (T-7)**

##### 4.1 **Duties and Responsibilities**

Foreman is responsible to Foreman General for the following activities and for the jobs mentioned under para D (3.0).

- 4.1.1 Repairs and testing of protective relays Receiving Sub-Stations.

- 4.1.2 Repairing and testing of AVR i.e. Automatic voltage Regulating relays in Receiving Sub Stations.
- 4.1.3 CT and Trip coil testing of VCB/RMU in Distribution Workshop, Kussara.
- 4.1.4 To carryout Current and Potential transformer testing in Receiving Sub-Stations.
- 4.1.5 To maintain electrical/electronic items, tools kit & spares allotted for relay testing.
- 4.1.6 Maintaining/ Up keeping equipments/instruments pertaining for relay testing.
- 4.1.7 Ensure that vehicle log book is maintained properly.
- 4.1.8 Submitting report of defective relays/equipments attended.
- 4.1.9 Any other work in emergency entrusted by officers.
- 4.1.10 If called, he shall report in shift duty.
- 4.1.11 Testing of relays in Receiving Sub Stations and carry out the adjustments to get the required relay characteristic.
- 4.1.12 To carry out through testing of transformer and feeders in Receiving Sub Stations.
- 4.1.13 To carry out stability tests of transformer in Receiving Sub Stations.
- 4.1.14 To carry out the pre-commissioning tests in case of New/Re-modeling of Receiving Stations.
- 4.1.15 To Assist Foreman General / Assistant Engineer to carry out Tripping Investigation in Receiving Sub Stations.
- 4.1.16** To carry out activities as mentioned in Technical manual under para D (3.0).

## **5.0 The Duties and Responsibilities of Assistant Foreman (T-6)**

## **5.1 Duties and Responsibilities**

The Assistant Foreman is responsible to Foreman for the following activities and for the jobs mentioned under para D (3.0).

- 5.1.1 Assisting to Foreman to carry out outdoor/indoor repairing/overhauling of protective relays/instruments, relay testing set etc.
- 5.1.2 Attending complaints pertaining to protection system.
- 5.1.3 Reporting distribution workshop for VCB/RMU testing.
- 5.1.4 Submitting reports of damaged/repared relays/instruments etc.
- 5.1.5 Assisting to Foreman during site testing.
- 5.1.6 Cleaning of control panels, relays & feeder panels & its associated wiring in the Receiving Sub Stations.
- 5.1.7 Assisting to Foreman General/Foreman/Nawghany for material shifting.
- 5.1.8 If called, he shall report in shift duty.
- 5.1.9 Any other work in emergency entrusted by officers/supervisor.
- 5.1.10 Routine inspection of Automatic Voltage Regulating Relay (AVR) & attending AVR complaints.
- 5.1.11 Assisting to Foreman for CT & Trip coil testing of Distribution Sub-Station Breaker in Distribution workshop, Kussara.
- 5.1.12 Assisting Foreman General/Foreman for Pre-commissioning tests at Receiving Sub Stations.
- 5.1.13 Assisting Foreman General/Foreman for repair/replacement and testing of protective relays.

- 5.1.14 Cash purchase of electronic/electrical items.
- 5.1.15 Submitting reports of damaged/repared relays, AVRs etc. to Foreman General.
- 5.1.16 Any other job as and when instructed by officers/supervisors.
- 5.1.17 Assisting testing crew for loading/unloading relay testing equipments/instruments.

## **6.0 The Duties of Nawghany:**

### **6.1 Duties**

- 6.1.1 Loading/unloading of relay testing & equipments safely.
- 6.1.2 Assisting testing crew while carrying out relay testing activity.
- 6.1.3 Cleaning the relay testing set/ instruments before carrying out testing.
- 6.1.4 He should take initiative for learning different activities carried out in the  
in the System Protection Department.
- 6.1.5 If called, he shall report in the shift duty.
- 6.1.6 If required, he should dispatch files/reports etc. to other departments.
- 6.1.7 To guard relay testing set/ instruments.
- 6.1.8 Cleaning of relay store room
- 6.1.9 To maintain his day to day diary.
- 6.1.10 Cleaning of vehicle.
- 6.1.11 Assisting Officers and Admin. Staff whenever needed.
- 6.1.12 Intimating to the officer/supervisor if any abnormality/accident occurred.
- 6.1.13 Cleaning of control/relay panel & feeder panels in the Receiving Sub-Stations.
- 6.1.14 Any other work as and when instructed by officers/supervisors.



## **7.0 Duties and Responsibilities of Administrative Officers and Staff of System Protection Department**

### **7.1 The Powers and Duties of Assistant Administrative Officer**

Assistant administrative officer shall be responsible to Superintendent System Protection for establishment and administrative matters of the department.

7.1.1 To ensure proper maintenance of Staff Record Files

7.1.2 To ensure proper maintenance of the attendance registers

7.1.3 To ensure proper maintenance of the register for office equipment and furniture

7.1.4 Controlling budget grants

7.1.5 To ensure proper maintenance of the filing system of the department

7.1.6 To ensure proper maintenance of the Imprest Cash account.

7.1.7 Complying with the provisions of various statutory Acts, viz. Factories Act, Payment of Wages Act, Worker's Compensation Act, etc.

7.1.8 Complying with Standing Orders & Service regulation

7.1.9 To assist for preparing deputation allowance, cash advances & JE bills and maintaining its register

7.1.10 To ensure proper maintenance of Incoming and outgoing papers record (dispatch work)

7.1.11 Putting up notes for filling up vacancies and following them up.

7.1.12 Ensuring that staff records are maintained properly

7.1.13 Ensuring that the attendance sheets/registers are maintained and initiating

cases for taking action against the staff, having irregular attendance

7.1.14 Preparing the establishment schedule and Capital & Revenue budgets

7.1.15 Putting up sanction forms for purchase of dead stock and capital

items and maintaining the register up to date

7.1.16 Ensuring proper maintenance of filing system and ensuring that all the papers

are properly and correctly filed

7.1.17 Compiling administration reports

7.1.18 Ensuring that all procedure regarding administrative matters are properly

followed in accordance with the Service Regulations / Standing Orders

7.1.19 Supervision of clerical staff

7.1.20 Ensuring that all office records are properly maintained

7.1.21 Ensuring that outward bill memos are correctly prepared within a reasonable time

7.1.22 Ensuring that all returns with respect to Employment Exchange, statement

of performance, targets, monthly report of absenteeism, etc are sent in time

7.1.23 Controlling stationary items

7.1.24 Initiating and following up the cases for procurement of materials, timely

issue of monsoon apparels/ uniforms allowance and stitching allowance,

diaries, etc.

7.1.25 Initiating notes pertaining to staff matters, such as filling up of post,

creation / abolition of post scholarships, advances, recovery statements

etc and procurement of capital and dead stock items.

7.1.26 Monitoring timely submission of monthly statements.

**8.0 The Duties of Clerk/Supervisor (P) :**

8.1 The Clerk/Supervisor (P) is responsible to AAOSP for following duties & functions:

8.1.1 Preparation of monthly statements like tenders & Inspection Forms, pending cases, VIP statements, etc.

8.1.2 Receiving and sending papers and files, etc.

8.1.3 Initiate various notes & letters regarding establishment and staff matters.

8.1.4 Releasing final bills follow up of Establishment proposals.

8.1.5 Putting up proposals for silver medal and wrist watch on BEST Day.

8.1.6 Issue of Uniform allowance, stitching charges and washing allowance advice etc.

8.1.7 Preparing payment advice for Field Duty, Hazardous and Distribution loss Allowance/Overtime/Meal Allowance, casual labour payment etc.

8.1.8 Preparing Bill Vouchers towards the payment of Deputation, Medical Reimbursement, Car Advance, etc.

8.1.9 Verification of Motor Driving Licence

8.1.10 Issue of Service Certificates and general certificates, Identification notes

8.1.11 Sending Monthly, quarterly, half yearly, yearly and occasional statements regarding establishment matters to various departments.

8.1.12 Checking of various applications like P.F./Society Loan, Medical reimbursement, Housing Loan Subsidy, Pension and application from Ex-employees children's for employment, etc. for certification.

8.1.13 Filing of Staff Record papers.

- 8.1.14 Keeping Inward/Outward file movement, Tender & Inspection Forms,  
Purchase Forms
- 8.1.15 Compilation of files
- 8.1.16 Filing of all office file papers
- 8.1.17 Work regarding payment of Scholarship
- 8.1.18 Any other work entrusted by AAOSP

**9.0 The Duties of Shop-Recorder/Supervisor (P):**

- 9.1 The Shop-Recorder/Supervisor (P) is responsible to AAOSP for following duties & functions:
  - 9.1.1 Attending Administration queries
  - 9.1.2 Initiating proposals like procurement of any material etc.
  - 9.1.3 Maintaining Inventory & related works
  - 9.1.4 Keeping Imprest cash and maintaining its registers, bills of purchase through Imprest cash etc.
  - 9.1.5 Follow up of Stores proposals of System Protection Departments
  - 9.1.6 Procurement of material which is a non-stock items
  - 9.1.7 Collecting information for System Protection Department
  - 9.1.8 Sending Work Requisition regarding complaints for civil work and its follow up
  - 9.1.9 Procuring stationary
  - 9.1.10 Assisting AAOSP in preparing Revenue & Capital Budgets
  - 9.1.11 Motor Vehicle Statement and related work
  - 9.1.12 Initiating Purchase Forms and keeping Sanction Forms Register
  - 9.1.13 Preparation of outward Bill Memos and related work
  - 9.1.14 Maintaining attendance, leave record and Keeping LTA records of all staff of the department
  - 9.1.15 Producing leave record for promotion assessment, silver medals etc.
  - 9.1.16 Preparing daily e-job sheet of casual labours and staff.

- 9.1.17 Preparing payment advice for Field Duty, Hazardous and Distribution loss Allowance/Overtime/Meal Allowance, casual labour payment etc.
- 9.1.18 Preparing bill voucher for payment of hiring charges of vehicle.
- 9.1.19 Maintaining attendance of Graduate Apprentice / Trainee Apprentice and forwarding their progress report to DETIE
- 9.1.20 Filing of all papers of System Protection Departments in their respective files
- 9.1.21 Any other work entrusted by AAOSP.

## 9.2 **Sepoy :**

The sepoys will carry out following duties and functions:

- 9.2.1 Receiving papers, files etc. from various departments/ sections / staff and forwarding the same to the concerned department/sections/ staff on getting acknowledgment, whenever it is necessary.
- 9.2.2 Forwarding dispatch to various offices of the Undertaking and other private parties whenever required and also collecting the same back from those offices.
- 9.2.3 To deliver Undertaking's letter / Memo at the residence of employees and officers
- 9.2.4 Collecting the keys of the department to open the department in the morning and depositing the same to Security post after closing the department in the evening.
- 9.2.5 To open the department's doors, windows in the morning, to clean the tables  
& chairs of the staff and closing the same in the evening
- 9.2.6 To attend bell of cabins and calls of the staff
- 9.2.7 To make arrangements of tea/coffee

## 4.(b)(iii) } i) **The procedure followed in the decision making process including channels of supervision and accountability in case of technical activities**

Sr. No.	Decision Making Process	Channels of Supervision	Accountability
1	Commissioning of new RSS & Replacement jobs in existing RSS	SSP	AESP
1.1	Derive relay setting for New RSS & replacement job	SSP	AESP
1.2	Writing a nameplates of switchgears, Breakers, Current Transformers, Potential Transformers, CARPs and Power Transformers in rough book & Fair Book	Charge Engineer / Foreman General	Foreman / Asst Foreman
1.3	Drawing of CT & PT circuits in rough book & Fair Book	AESP	Foreman
1.4	Testing of Current Transformers by Omicron make CT Analyser	AESP	Charge Engineer / Foreman General, AESP
1.5	Testing of Potential Transformer	AESP	Charge Engineer/ Foreman General
1.6	Setting & testing of relays	AESP	Charge Engineer/ Foreman General
1.7	Testing of Tap-Change Control Relays	Charge Engineer / Foreman General	Foreman/Asst. Foreman
1.8	Tightening of all connections	Charge Engineer / Foreman General	Foreman/Asst. Foreman
1.9	Through testing from CT end as per testing sheet	AESP	Charge Engineer/ Foreman General
1.10	RD & REF Stability Testing as per testing sheet	AESP	Charge Engineer/ Foreman General
1.11	Confirmation for tripping of HV Breakers on different protection and transformer commands	AESP	Charge Engineer/ Foreman General
1.12	Prepare a Fair book for each job	AESP	Charge Engineer/ Foreman General
1.13	Log a message for completion of work at Supervisory/System Control	AESP/SSP	Charge Engineer / Foreman General
1.14	Logging of message from control in the logbook provided in the dept.	AESP/SSP	Charge Engineer / Foreman General
1.15	Co-ordination of System Protection Dept. and SCADA (T&E Dept.) for SCADA job	AESP/SSP	Charge Engineer / Foreman General
1.16	Co-ordination of System Protection Dept. with various O&M Divisions for outages for Routine Testing jobs & Tripping Investigation.	AESP/SSP	Charge Engineer / Foreman General
2.0	Routine relay testing of Transformer	AESP/SSP	Charge Engineer / Foreman General
3.0	Routine relay testing of Feeder	Charge Engineer / Foreman General	Foreman
4.0	OCB overhauling	Foreman	Foreman/ Asst. Foreman
5.0	AVR inspection and overhauling	Foreman	Foreman/ Asst. Foreman
6.0	Tripping Investigation	AESP/SSP	Charge Engineer / Foreman General
7.0	Replacement of Defective relays, CTs & PTs	AESP	Charge Engineer / Foreman General
8.0	To mark attendance of staff and their books for outdoor and indoor activity	SSP	AESP
9.0	Arrangement of vehicle, Transportation of Material & Tools.	AESP/SSP	Charge Engineer / Foreman General
10.0	Procurement Tools & Equipments for carrying out	AESP/SSP	AESP

**ii) The procedure followed in the decision making process including channels of supervision and accountability in case of administrative activities**

Sr. No.	Decision Making Process	Channels of Supervision	Accountability
1	As regards to the various administrative functions carried out by the administrative staff as mentioned in duties and responsibilities of the administrative staff, the administrative work is carried out as per the set procedure /policies/ guidelines issued and approved by management vide various circulars, Administrative Order, Procedure Order, S.R. & S.O. etc.	AAOSP/SSP	The concerned administrative staff initiating the work during the course of duty.

**TECHNICAL MANUAL AND WORK PROCEDURES**

**a) TERMINOLOGY**

- 1.0 **Protective System:** is a team of protection relays, circuit breakers, CT's, PT's, Secondary control cables, trip circuit, battery system accessories etc. A combination of protective gear designed to secure under predetermined conditions, usually abnormal, the disconnection of an element of a power system, or to give an alarm signal or both.
- 2.0 **Protective Scheme:** The co-ordination arrangement for the protection of one or more elements of power system.
- 3.0 **Protective Relay:** A relay is designed to initiate disconnection of a part of an electrical installation or to operate a warning signal, in case of a fault or other abnormal condition in the installation. A device designed to produce sudden pre-determined changes in one or more electrical circuits after the appearance of certain conditions in the electrical circuit controlling it.

- 3.1 Relays are compact analog, digital and numerical devices that are connected throughout the power system to detect intolerable or unwanted conditions within an assigned area such that to maintain a high degree of service continuity and limit the equipment damage.
- 4.0 **Protected Zone:** A portion of a power system protected by a given protection system or a part of that protective system.
- 5.0 **Main Protection:** Protection normally expected to take the initiative in case of a fault in the protection zone.
- 6.0 **Back up Protection:** Protection provided to act as substitute for the main protection in the event of failure or inability of the latter.
- 6.1 **Relay Back-up:** An arrangement, which provides an additional relay using the same or alternate principle of operation from that of the main relay (It is preferable to have separate C.T. and if necessary separate P.T. for relay backup)
- 6.2 **Circuit Breaker Back-up:** An arrangement at the next which provides isolation from source when circuit breaker nearest to fault fails to open or in case there is failure of the secondary current or voltage. (It is usually of a time delay relay operated from the main protection and connected to trip all the incoming feeders.)
- 6.3 **Remote Back-up:** An arrangement at the next station in the direction towards source, which trips after a delayed time if the circuit breaker in the faulty section is not tripped.
- 7.0 **Instantaneous Relay:** A relay, which operates and resets with no intentional time delay.



- 8.0 IDMT Inverse Definite minimum time relay:** An inverse time relay having an operating time that tends towards a minimum definite value with increase in electrical characteristic quantities.
- 9.0 Setting:** The limiting value of a characteristic or energizing quantity at which the relay is designed to operate under specified conditions.
- 9.1 Plug Setting Multiplier (PSM):** A range of current setting for varying the relay operating current provided in the relay.
- 9.2 Time Setting Multiplier (TMS):** A means of adjusting the travel of the disk and thereby varying the time of operation of the relay for a given value of the fault current.
- 9.3 Pick-Up (PU):** A relay is said to pick-up when it changes from the unenergized position to the energized position.
- 9.4 Drop Out:** A relay drop out when it moves from energized position to unenergized position.
- 10.0 Burden:** The loading imposed by the circuits of the relay on the energized power source or sources, expressed as the product of voltage and current (Volt –amperes or Watts if PC) for a given condition which may be either at setting or at rated current or voltage.
- 11.0 Characteristic Curve:** The curve showing the operating value of the characteristic quantity corresponding to various values or combinations of the energizing quantities.
- 12.0 Residual Current:** The algebraic sum of all the currents in a system is Residual Current.
- 13.0 Residual Voltage:** The algebraic sum of all the phase to earth voltages in a system is Residual Voltage.
- 14.0 Knee Point Voltage:** The sinusoidal voltage of rated frequency applied to secondary terminals of a current transformer, all other winding being open circuited, which when increased by 10% Causes the exciting current to increase by 50%.

**b) PRINCIPLE OF PROTECTIVE SYSTEM**

Every electrical equipment is designed to work under specified normal conditions. In case of short circuits, earth faults etc. an excessive current will flow the windings of the

connected equipment and cause abnormal temperature rise, which will damage the winding. Further it may cause total shunt down of unit, which will result in heavy loss of revenue.

A fault in electrical equipment is defined as a defect in its electric circuit due to which flow of current is diverted from the intended path. Faults are caused by breaking of conductors or failure of insulation.

Fault impedance is generally low and fault currents are generally high. During the faults, the voltages of three phases become unbalanced and the supply to the neighboring circuit is affected. Fault currents being excessive, they can damage not only faulty equipment but also the installation through which the fault current flows.

There are several causes of faults occurring in a particular electrical system. Faults can be minimized by improved system design, improved quality of equipment, better and adequate protective system, better operation and maintenance etc. however, fault cannot be eliminated.

**c) FUNCTIONS OF PROTECTIVE SYSTEM**

- 1) To sound an alarm, so that the operator may take some corrective action.
- 2) To close the trip circuit of circuit breaker so as to disconnect a faulty component during an abnormal fault condition such as overload, under voltage, temperature rise, unbalanced load, reverse power, under frequency, short circuit etc.
- 3) To disconnect the faulty parts as quickly as possible as to minimize the damage to the faulty part and to prevent subsequent faults.
- 4) To localize the effect of fault by disconnecting the faulty part from healthy parts causing least disturbances to the healthy system (to improve the system stability and service continuity).

d) **REQUIREMENT OF PROTECTIVE SYSTEM**

Protective system should have following qualities

1.0 **Selectivity:** The protective system should discriminate between abnormal and normal conditions. It is ability of protective system to determine the point at which the fault occurred and should isolate the only faulty portion from remaining healthy system to minimize or no damage to system.

2.0 **Speed:** Protective system should disconnect a faulty element as quickly as possible, in order to improve power system stability, minimize the damage and to increase the possibility of second type of fault development.

$$\begin{aligned} \text{Fault Clearing Time} &= \text{Relay Time} + \text{Breaker Time} \\ &= \text{Fault Instant (Relay Pick Up) to Closing of relay contact} \\ &\quad + \text{Closing of relay contacts to Final breaker OFF.} \end{aligned}$$

The relay time of fast relay is in order of few cycles. Modern protective relay has operating time of about 1 cycle. For Inverse Definite Minimum Time (IDMT) relays, relay time can be adjusted between 6 seconds to 60 seconds.

3.0 **Sensitivity:** It is capability of relay to operate reliably under the actual minimum fault condition. It is desirable to have the protection as sensitive as possible in order that it shall operate for low value of actuating quantity.

**Stability:** It is quality of protective system so that it remains inoperative and stable for fault beyond the protective zone.

**Reliability:** The protective system should not fail to operate in event of faults in protected zone. Also there should not be component failure of protective system.

6.0 **Adequateness:** Protection provided for any equipment should be adequate.

e) **RELAY CLASSIFICATION:**

- 1) **Protection Relays:** which detects defective lines, defective apparatus or other dangerous conditions on Power system and gives command to trip one or more breakers which desired to operate. e.g. O/C, E/F, U/V etc.
- 2) **Auxiliary Relays:** This operates in response to operation of parent relays e.g. Master Trip relay.
- 3) **Monitoring Relays:** Which verify the conditions on power system or in protection system e.g. Trip supervision relay.
- 4) **Regulating Relays:** Which are activated when an operating parameter devices from pre-determined limits e.g. AVR relay.

f) **Classification of Relays according to operating Input quantity:**

- 1.0 Relays operate when quantity rises / drops above/below a specified value.
- 1.1 Current operated relay : O/C for Overload, E/F for Earth fault
- 1.2 Voltage operated relay: U/V,O/V
- 1.3 Power operated relay: Directional relay or Reverse power relays
- 1.4 Pressure operated Relay: PRV
- 1.5 Frequency operated relay: U/F, O/F, df/dt
- 1.6 Temperature operated relay: OTI,WTI

g) **Classification of Relays according to operating time:**

1. Instantaneous relay: operate in negligibly time interval
2. Definite time lag relay: operate after set time lag

3. Inverse Definite Minimum Time (IDMT) relay: operate as per characteristic curve selected.

### TYPICAL CHARACTERISTIC CURVE FOR RELAY

Formula for time of operation of IDMT relays

$$\begin{aligned} 3 \text{ sec Normal Inverse:} &= (0.14 \times \text{TMS}) / \{(I_f/I_n)^{0.02} - 1\} \\ 1.3 \text{ sec Normal Inverse:} &= (0.06 \times \text{TMS}) / \{(I_f/I_n)^{0.02} - 1\} \\ 0.6 \text{ sec Normal Inverse:} &= (0.028 \times \text{TMS}) / \{(I_f/I_n)^{0.02} - 1\} \\ \text{Very Inverse:} &= (13.5 \times \text{TMS}) / \{(I_f/I_n)^1 - 1\} \\ \text{Extreme Inverse:} &= (80 \times \text{TMS}) / \{(I_f/I_n)^2 - 1\} \end{aligned}$$

#### **h) Classification of Relays according to performance category:**

1. Directional relay
2. Distance relay
3. Differential relay

#### **i) Classification of Relays according to operating principle:**

- 1.0 Electromechanical relay
- 2.0 Static/Solid state relay
- 3.0 Microprocessor/numerical relay

##### **1.0 Electromechanical Relay:**

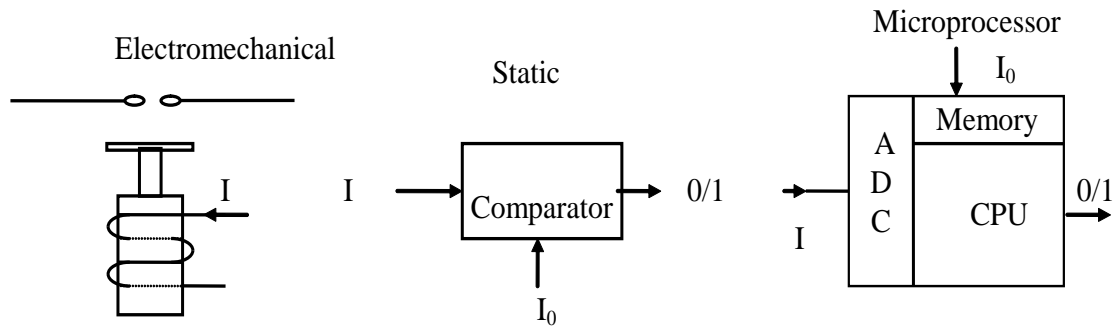
An electrical relay in which the designed response is developed by the relative movement elements under the action of a current or voltage input circuit.

##### **2.0 Static/Solid State Relay:**

Static relays are those in which the measured AC quantities are manipulated in analog form and converted in to binary voltages. Logic circuits or microprocessor compare the phase relationships of binary form to make a trip decision.

##### **3.0 Numeric Relay:**

Numeric relays are those in which the measured AC quantities are sequentially sampled and converted in to numeric data form. A microprocessor performs mathematical and logical operations on the data to make a trip decision.



## Examples of Relay Panels



Old Electromechanical



Microprocessor-Based Relay

The Numerical relay have data acquisition capabilities and provide useful service data such as load current, fault current and others parameters, historic data, fault data. These relays have programmable settings, programmable input and output relay contact and continuous self-monitoring against any internal failures.

# Advantages of Digital Relays



## Standard device numbers for relay as per ANSI Code:

- 2 :Timer relay
- 27 : U/V relay
- 59 : O/V relay
- 59N : Neutral displacement relay
- 50 : Instantaneous O/C relay
- 51 : I.D.M.T O/c relay
- 50N : Instantaneous E/F relay
- 51N : I.D.M.T. E/F relay
- 67 : Directional O/C relay
- 67N : Directional E/F relay
- 64R : Restricted E/F relay
- 64S : Standby E/F relay
- 87 : Differential relay
- 49 : Thermal O/L relay
- 63 : Transformer Aux Faults (Oil temp, Winding Temp, buchholz, OSR, PRD)
- 52 : Circuit breaker
- 52a : Circuit breaker No contact
- 52b : Circuit breaker NC contact
- 86 : Master trip/ Inter trip relay
- 25 : Synchro Check relay

95 : Trip circuit supervision relay

j) **Procedural Work:**

1.0 **Overview**

1.1 **PROTECTION SYSTEM OF THE B.E.S.T. NETWORK**

The BEST Undertaking, on behalf of the BRIHAN MUMBAI MAHANAGARPALIKA is the licensee for distribution of electric power within the City limits of MUMBAI.

Bulk power at 110 / 33 / 22 kV voltage levels is transmitted from TPC's five main receiving stations at Carnac, Parel, Dharavi, Mahalaxmi and Backbay through underground cables to BEST's 54 nos receiving sub stations in BEST System. These are bifurcated into 5 zones namely North West, North East, Central North Zone, Central South and South Zones for operational convenience.

**110 kV RSS – 4 Nos -** Khetwadi (CS), DBA RSS (CN),  
Nariman Point (S) & Backbay RSS (S)

**33kV HT Room – 4 Nos -** Jalan Mill (CN), Peninsula (Dawn Mill) (NW),  
Futurex Marathon(CN) & VSNL (NW).

**33kV kV DSS – 1 Nos –** Morarji Mill (NE)

**33kV – 22kV / 11kV – 6.6 kV RSS – 45 Nos –**

**North East Zone –** Sion Fort, Wadala, Raoli Hill, Kingsway, KEM Hospital,  
Sewree, Swan Mill RSS

**North West Zone –** Dharavi, PMGP, Mahim Causeway, Mahim, Prabhadevi,  
Nestle, Worli, Shitaladevi, Standard Mill RSS

**Central North Zone –** Mahalaxmi, Pochkhanwala, Parel, Kussara, Mazgoan  
Dock, Byculla, Tardeo, Mumbai Central, Nair Hospital,  
Lovegroove, Lalbaug, Worli Dairy RSS

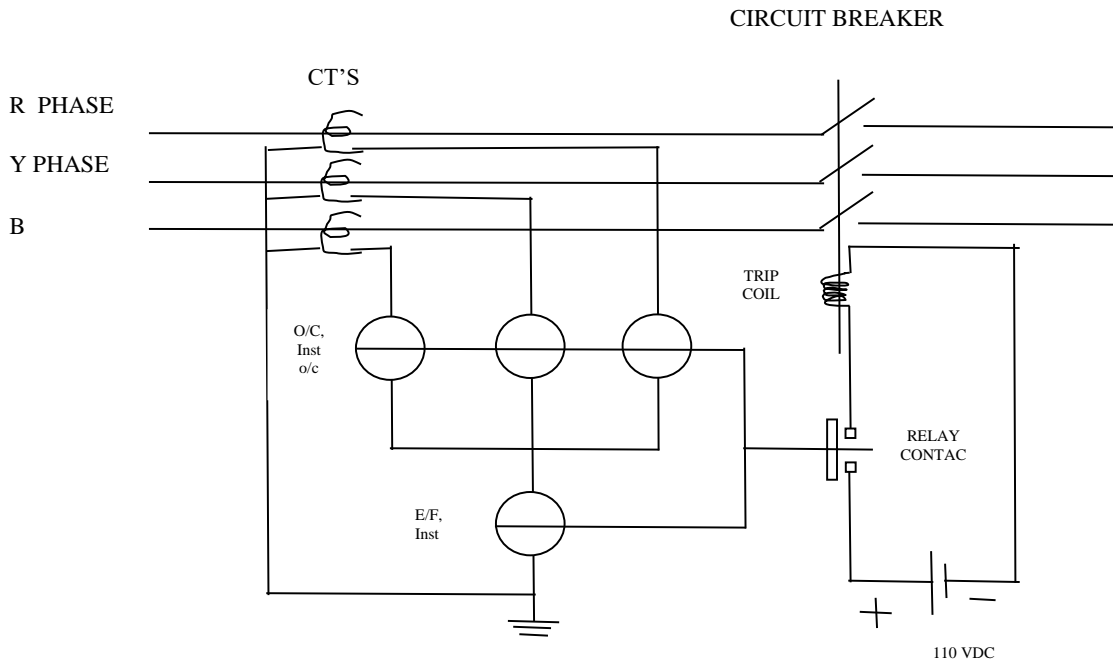
**Central South Zone –** Esplanade, Mumbadevi, Girgaum, Neapean Sea, Nimkar  
Marg, Malabar Hill, Masjid, J J Hospital, Grant Road

**South Zone –** Navy Nagar, Colaba, G T Hospital, Marine Drive, Apollo,  
Hutatma Chowk, Naval Dock, Ballard Estate

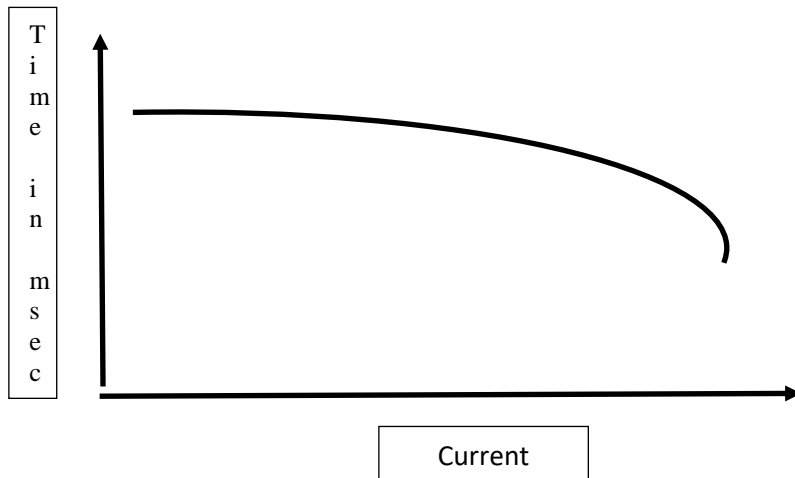


The BEST Undertaking has installed 100 MVA (110/33kV, YnYn0), 45 MVA (110/11-11kV, YnZn11), 16-20 MVA (33/11kV, Dyn1), 16 MVA (33/11kV, Dyn1), 10 MVA (22/11-6.6 kV, Dyn1) and 3.2 MVA (33kV/415-415Volts, DZn0Zn0) power transformers with neutral star point solidly earthed. The power transformers are provided with OLTC gear to regulate and maintain the 6.6 kV or 11kV voltages fairly constant. The typical single line diagram of RSS is as below

Protection gear comprises of current & potential transformers, relays inter-connecting wiring, contractors, trip coils etc. Control & Trip circuit of switchgears at 110KV / 33KV / 22KV Receiving Sub Stations operate on 110VDC supply. The method of tripping used is shunt tripping i.e. trip coil is operated separately by 110VDC supply in Receiving Stations



The relays current setting and time setting are based on either Definite Minimum Time (DMT) principle or Inverse Definite Minimum Time (IDMT) depending on the type of relays used.



### 1.1.1 PROTECTION IN RECEIVING SUBSTATION

At **110kV RSS level**, we have adopted following types of protections

On HV side of Transformer –Dir & Non Dir O/C & E/F, U/V, O/V.

On LV side of Transformer –Dir & Non Dir O/C & E/F, U/V, O/V

For Transformer protection – Ratio Differential protection HV  
 HV Restricted Earth Fault (REF) protection  
 LV Restricted Earth Fault (REF) protection  
 Buchholz Relay  
 Pressure Release Device (PRD)  
 Oil Surge Relay (OSR)  
 OTI & WTI Trip

For Outgoing Feeder – Non Dir O/C & E/F

At **33kV & 22kV RSS level**, we have adopted following types of protections

- a) On HV side of Transformer – Non Dir E/F, Non Dir O/C, U/V, O/V.
- b) On LV side of Transformer – Non Dir E/F, Non Dir O/C, U/V, O/V
- c) For Transformer protection – Ratio Differential protection  
LV Restricted Earth Fault (REF) protection  
Buchholz Relay  
  
Pressure Release Device (PRD)  
  
Oil Surge Relay (OSR).
- d) For Outgoing Feeder – Non Dir E/F, Non Dir O/C
- e) For Capacitor Feeder – Non Dir E/F, Non Dir O/C, U/V, O/V, NDR

#### 1.1.2 **PROTECTION IN DISTRIBUTION SUBSTATION**

Further, it is step down to 11-6.6 kV voltage levels by distribution transformers 11kV/415 Volts at DSS. 11kV network is connected in ring but operated in radials.

At DSS level, OCB/VCB of outgoing feeder has combined overload protection for

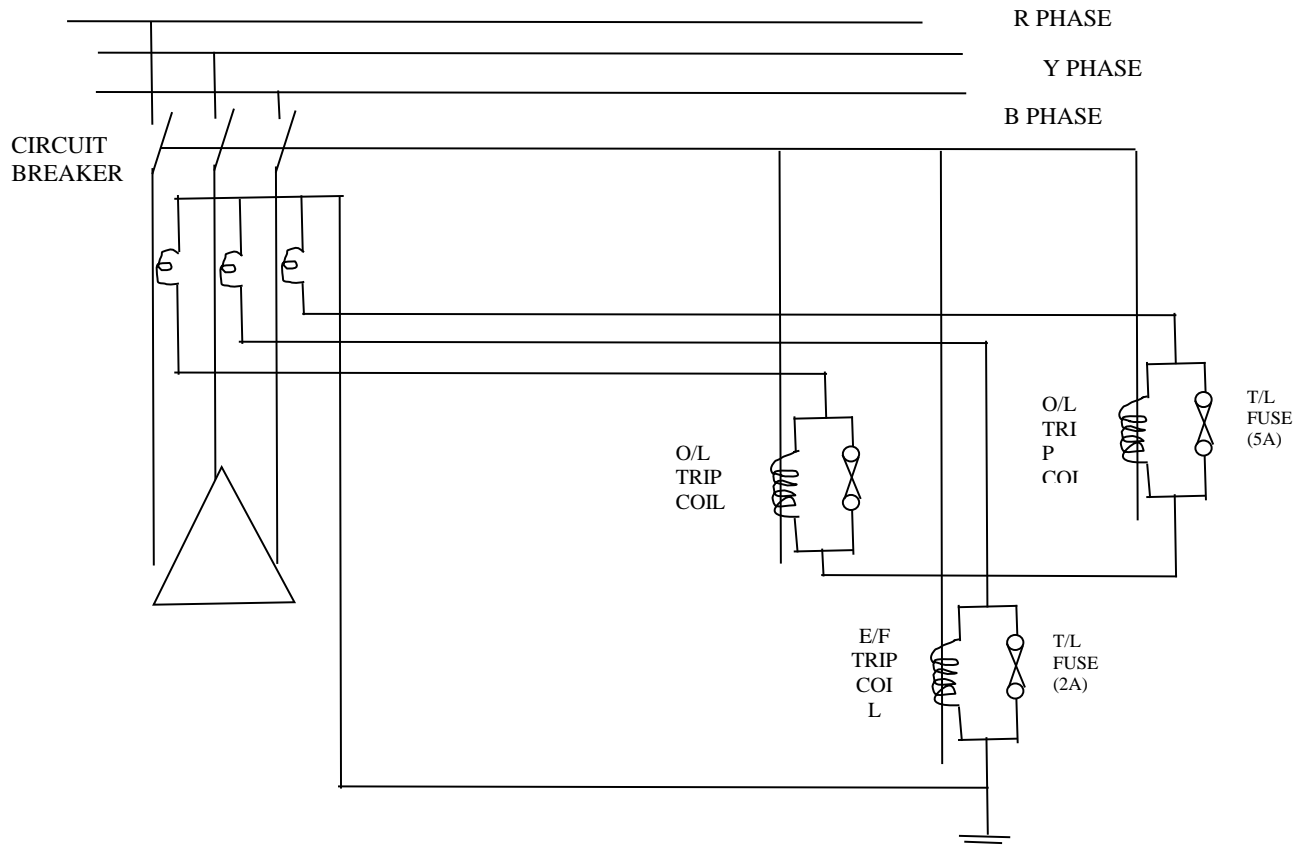
Overload on R & B Phase and earth fault on neutral circuit. OCB/VCB of transformer feeder has combined overload protection for Overload on R & B Phase but earth fault protection is kept without T/L fuse on neutral circuit for instantaneous Earth fault.

The method of tripping in DSS is “Series tripping” i.e. the trip coils are operated directly by CT’s current. DSS breakers are normally provided with two O/L trip coils in R & B phase and one earth fault trip coil in return neutral of three star connected CT’s secondary circuit. The time lag (T/L) fuses are connected across these trip coils, O/L trip coil and earth trip coils are of size of 5 amps and 2 amps respectively.

Due to overload or short circuit or earth fault in network, 5 Amps / 2 Amps or more current flows through the T.L. fuses of overload trip coil / E/F trip coil respectively. TL

fuse blows and current starts flowing through O/L / E/F trip coil which causes tripping of circuit breaker.

### SERIES TRIPPING IN DSS OUTGOING FEEDER SWITCHGEAR



#### 1.1.3 PROTECTION IN LV NETWORK

Transformer secondary is connected to LV bus bar through copper links and transformer breaker protects HV side of transformer.

Distributors are provided with 315 Amps HRC fuses at LV boards and LV pillars which provide protections against faults on distributors.

At service position, 400A / 200A fuse base are provided with 400A and 200A HRC fuses. At large LV installations, switch fuse unit of appropriate size is provided.

Re-wirable fuses in branch cutouts of 100A, 63A, 32A, 16A are provided at branches feedings meters. These branch cutouts are provided on Meter Boards to protect the meter against fault in the consumer's installation.

#### **1.1.4 PROTECTION OF 33kV/22kV CABLES:**

a) **UNDER VOLTAGE RELAY :**

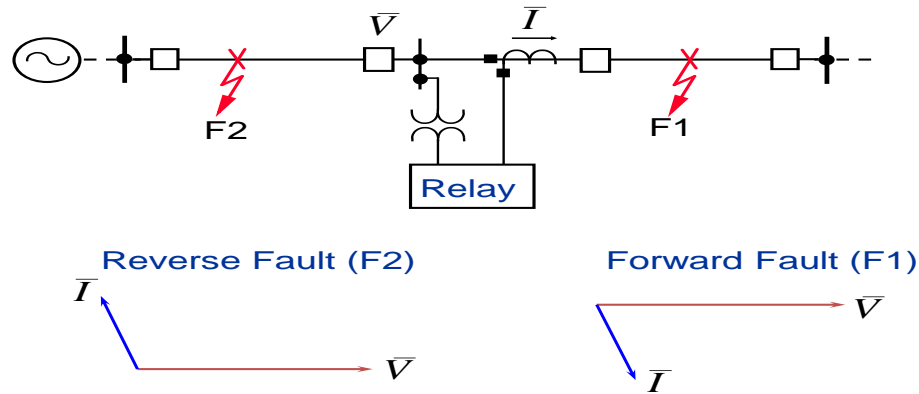
Any fault occurring on 33KV/22KV cable operates protection gear at TATA's Receiving Stations. When 33KV/22KV supply fails we get the indication at the Receiving Station and Supervisory/ System Control Room. At Receiving Station, we are having under voltage relay which gives indication of supply failure on 33KV/22KV side.

b) **DIRECTIONAL OVER CURRENT & EARTH FAULT RELAY :**

Normally B.E.S.T. network is radial right from Tata's transformer up to LV network. But, when carrying out operation for load transfer, we keep power transformers in parallel either of the same Receiving Station or of different Receiving Stations. In the said circumstances if a fault occurs on 33kV / 22kV cable, then the affected bus section will be reverse fed by other power transformer (after switchgear at the TATA's Receiving Station has tripped). To avoid this, we use Directional over current and earth fault relay, which operates (indicating power flow is reverse i.e. from 11kV to 22/33 kV side). This protection scheme is typically employed on 110kV & 33kV sides in 110kV RSS.

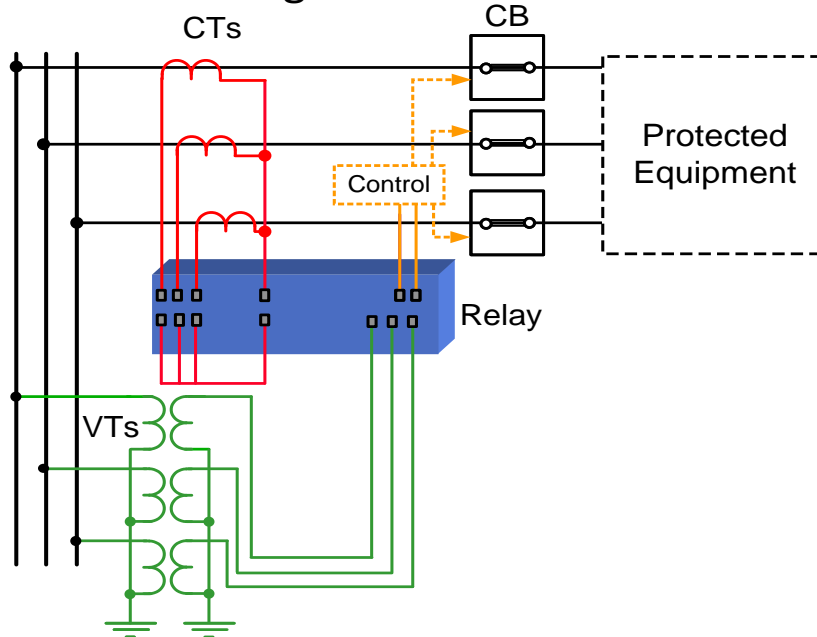
# Directional Overcurrent Protection

## Basic Principle



### 1.1.5 PROTECTION OF POWER TRANSFORMERS: OVER CURRENT AND EARTH FAULT RELAY (O/C+E/F):

#### Three-Phase Diagram of the Protection Team



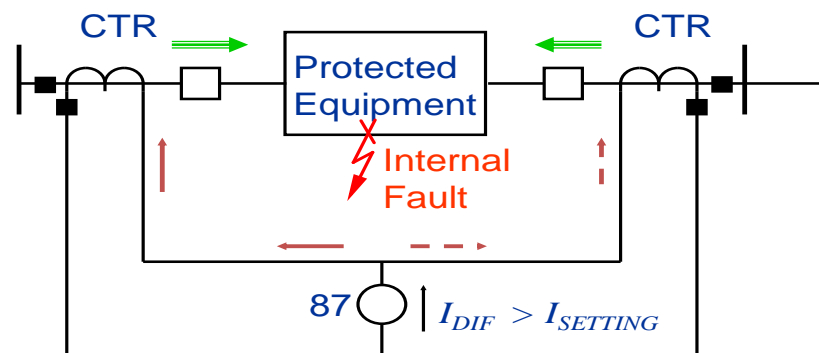
Transformer is protected by Non Directional IDMT & Instantaneous type 3-phase over current and Earth fault relay on 33KV/ 22KV side and by Non Directional IDMT type 3-phase over current and Earth fault relay on 11KV side.

**a) RESTRICTED EARTH FAULT RELAY : (REF RELAY)**

Restricted Earth Fault (REF) Relay operates on the Merz-Price Circulation current principle with CTs of identical ratio and ratings in LV CT and NCT. This relay operates only when fault occurs between secondary of the power transformer up to 11KV bus bar and neutral of transformer which is protection zone for REF relay. The relay is connected across the parallel combination of CTs in High Impedance mode.

**a. DIFFERENTIAL RELAY**

## Differential Protection Principle



**Relay Operates**

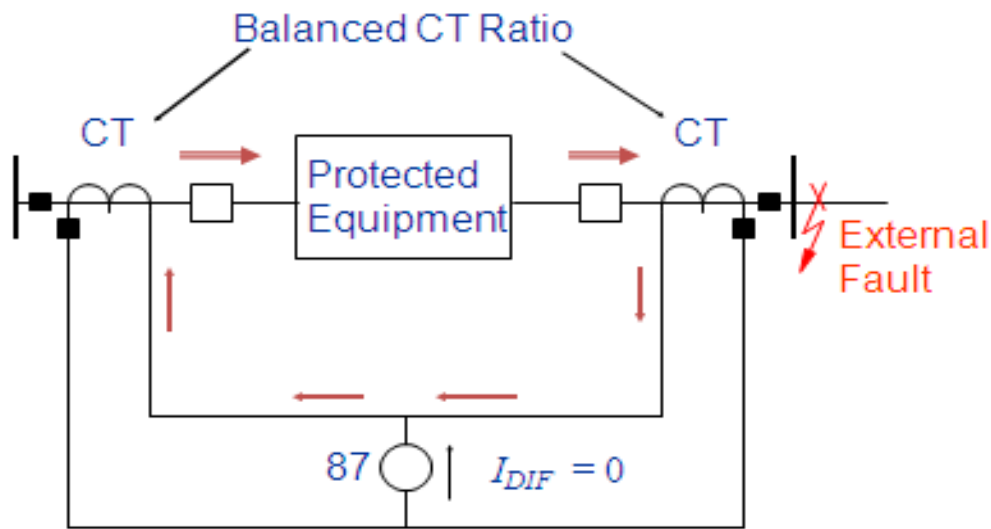
Differential relay is used to detect any internal fault on HV or LV winding of the transformer. This relay operates on the Merz-Price Circulation current principle. As long as there is no fault in the transformer then current on 33kV / 22kV and 11kV side is the same. So there is no current in the differential relay.

Due to fault in the transformer (Internal Faults), there is an imbalance between primary current and secondary current, which operates the relay. Thereby, cause tripping of 33 kV / 22 kV and 11 kV breakers to isolate power transformer.

Protection gear of differential relay is designed with due care of No load current, Inherent phase shift in winding of transformers and Change of turns and so current ratio due to OLTC operations.

During External Faults: when there is external fault in network of transformer, fault current flows in both HV as well as LV side CT's causing resulting zero current in operating coil of differential relay.

## Differential Protection Principle



No Relay Operation if CTs Are Considered Ideal

### b) **BUCHHOLZ RELAY :**

Buchholz relay is fitted between the transformer main tank and conservator. If any fault e.g. core bolt insulation failure, short circuit in laminations, loss of oil due to heavy



leakage occurs in the HV or LV winding of transformer resulting in local heating of oil and gas formation, then these gases is trapped in the Buchholz relay. It cause operation of upper float and gives an alarm, which give some idea of nature of fault.

If serious nature of fault inside the transformer due to short circuit between phases, winding earth faults, bushing failure it operate both floats provided in buchholz relay and gives the trip command to primary & secondary breakers of transformer.

c) **PRESSURE RELEASE DEVICE : (PRD)**

This device operates during excessive pressure developed in the transformer main tank due to internal fault occurred in it & it will give the direct tripping command to primary & secondary circuit breakers.

d) **OIL SURGE RELAY : ( OSR)**

This relay is fitted between the OLTC & Conservator. If any fault occurs in the OLTC of transformers resulting in local heating of oil and gas formation, then these gases is trapped in the OSR & it will give the direct tripping command to primary & secondary circuit breakers.

Trip commands of Buchholz relay, PRD and OSR are wired up through Ratio Differential relay to get disturbance recordings at time of fault.

**i. DIFFERENT TRANSFORMER PROTECTION**

Fault Type	Needed Protection
Phase-Phase faults	Differential, Over current
Phase-Earth faults	Differential, Earth Fault, Restricted Earth Fault
Inter-turn Faults	Differential, Buchholz
Core Faults	Differential, Buchholz
Tank Faults	Differential, Buchholz, Tank Earth Fault
Over Heating	Thermal Overload

## 1.2 INSTRUMENT TRANSFORMERS

The magnitude of current and voltage in a power system are usually too high to be handled by the secondary equipments like measuring instruments and relays, control circuits. Therefore, the instruments produce a scaled down replica of the primary input quantities within the accuracy. The measuring instruments and protective relays are connected in secondary circuit of instrument i.e. current and voltage transformers.

## 1.3 CURRENT TRANSFORMERS (CT)

Primary current is not controlled by condition of secondary circuit in current transformer. Hence, primary current is dominant factors in the operation of current transformer. The performance requirements of the instrument transformers depend upon their applications. CTs classified into three basic types.

- a) **Measuring Current Transformer:** Measuring Current transformers used for measurement handle steady current closed to rated values. Ammeters, Energy Meters etc are connected in measuring CT circuit.

Measuring CTs are specified in term of Accuracy Class, rated VA Burden and Instrument Safety Factor (ISF).

**Instrument Safety Factor:**

It is the ratio of instrument limit primary current to the rated primary current. Instrument limit current of a metering current transformer is a maximum value of primary beyond which current transformer core becomes saturated.

Accuracy Class – 0.1, 0.2, 0.5S, 0.5, 1, 3

VA Burden – 5, 10, 15, 30

ISF – 5, 10

For metering core, we have adopted 0.5 class for outgoing feeders and 0.5S for HV & LV side CTs with ISF = 5.

- b) **Protection Current transformers:** Protection current transformers used for protection handle fault quantities in multiple of rated values. Protection relays, trip are connected in protection CT circuit. Current transformers step down current high value to low value.

Protection CTs are specified in term of Class, rated VA Burden and Accuracy Limit Factor (ALF). Standard errors are specified at rated current and ALF times rated current with rated burden connected. For given CT, VA and ALF are inversely related. If connected burden is less than rated, ALF would increase.

Standard Error Class - 5P, 10P, 15P

ALF - 5, 10, 15, 20, 30

VA Burden – 5, 10, 15, 30

For protection core, we have adopted 5P20 class, 15 VA for outgoing feeders, HV & LV side CTs. This means that CT will have a Composite Error (difference between Ideal Sec current and actual sec current) of +/- 5% at 20 times rated current and a ratio error of +/- 1% at rated current with rated connected burden of 15VA.

- c) **Protection CTs for Special Application:** For balanced protections like Differential, REF, where balance is required between the associated CTs with close tolerance.

For such applications, CTs of class PS are used which are specified in term of Knee Point voltage ( $V_k$ ), Magnetising current ( $I_m$ ) at  $V_k$  and at  $V_k/2$ , CT secondary resistance ( $R_{ct}$ ).

For class PS CTs, the turn ratio errors are limited to 0.25% which helps in maintaining balance between the protection systems during the fault condition.

Specification / Name plate of PS class core:

CT ratio = 300/5

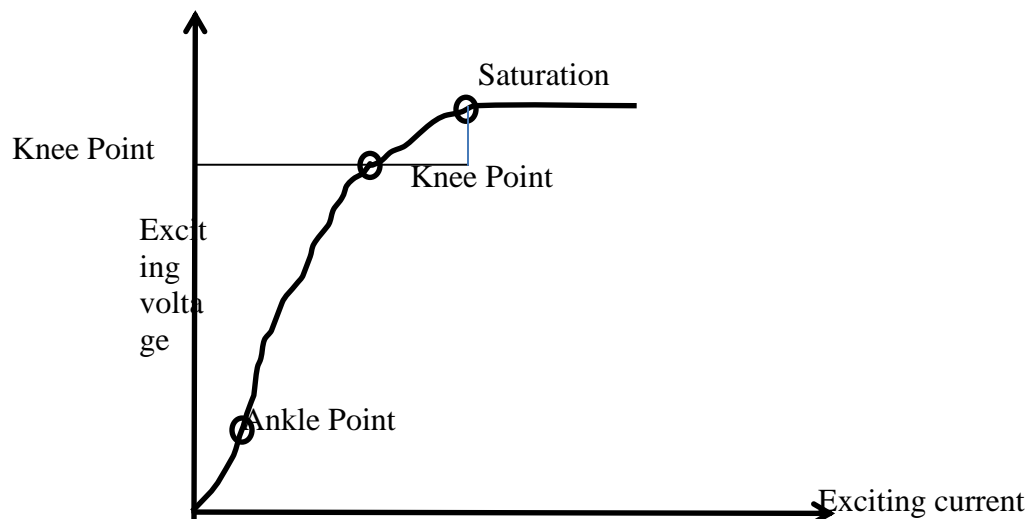
$V_k \geq 104$  Volts

$I_m$  at  $V_k/2 = 50$  mA

$R_{CT}$  at  $75^\circ\text{C} = 0.3$  ohm

Magnetizing Characteristic of CT: the magnetizing characteristic of a CT is a plot between secondary applied voltage the corresponding magnetizing current taken by the CT. The excitation curve can be divided into Ankle point, linear region, Knee point and saturation.

The knee point is defined as a point on the excitation curve where a 10% increase in the secondary voltage would cause 50% increase in exciting current.



#### 1.4 EFFECTS OF SECONDARY OPEN CIRCUIT:

The primary current of CT is independent of its secondary loading. With shorted secondary (directly or through the connected burden), the counter flux produced by the secondary keeps the core flux below the saturation level.

Load current in electrical system always flows through CT primary. If the secondary gets open circuited with the primary carrying current, the entire primary current will behave as excitation current and is spent in magnetizing the core, producing high core flux. This results in increased secondary voltage. This develops extremely high pulses of voltage which may not be measured by voltmeter. But this voltage may breakdown the CT insulation and may cause accident to personnel. That is why **CT secondary should not be kept open and should always be shorted.**

## **1.5 CURRENT TRANSFORMER DETAILS:**

We are using different types of CTs in systems from 110kV to 11kV voltage level. CTs are specified for Insulation level, rated primary current and Short Circuit Withstand current.

Service Voltage: System Voltage in which CT is to be installed e.g. 11kV, 22kV, 33kV and 110kV etc.

Rated primary current: It is value of rated current of equipment at CT location which CT should carry continuously.

Rated Secondary current: Rated secondary current is specified as 1A or 5A. It is preferred to use 5A as secondary current for indoor panels where internal wiring length is short and 1A where wiring length i.e. control cable length is long. It is value of rated current of equipment at CT location which CT should carry continuously.

Short Time Withstand Current: It is maximum fault current value which CT can withstand for short time rated. A current transformer is overloaded while system short circuit currents are flowing and will be short-time rated. Normally system fault current is considered as value of STC even though real fault current is less.

Standard times for which the CT must be able to carry rated short-time current (STC) are 0.25, 0.5, 1.0, 2.0 or 3.0 seconds. Specified values for STC are 18.4 KA for 3 Sec for 11kV CT and 26.3KA for 3 Sec for 33 kV CT.

## **1.6 CURRENT TRANSFORMER TESTING**

CT is tested for Ratio, Polarity and Knee Point Voltage. Earlier CT testing is carried out by Conventional method i.e. using primary injection set, dimmer, energy meter, voltmeter and ammeter. This method involves typical connection of many conventional instruments and manual calculations.

Recently, Omicron make CT Analyser set was purchased. Voltage and current is injected from secondary side of CT. Values of current and voltage is sensed at Primary and secondary terminals of CT. Final results are derived from these values in CT Analyser.

### **1.6.1 CT RATIO AND POLARITY TEST:**

### **1.6.2 CT KNEE POINT VOLTAGE TEST:**

## **1.7 POTENTIAL TRANSFORMERS (PT)**

Whenever the values of voltage in a power circuit are too high to permit convenient direct connection of measuring instruments or relays, coupling is made through voltage transformers. Voltage transformers are much like small power transformers, differing only in details of design that control ratio accuracy over the specified range of output.

The performance requirements of the instrument transformers depend upon their applications. PTs classified into three basic types.

- a) Measuring Voltage Transformer: Measuring VTs used for measurement handle steady voltages closed to rated values. Voltmeters, Energy Meters etc are connected in measuring VT circuit.

Measuring VTs are specified in term of Voltage Ratio, Accuracy Class, Rated VA Burden and Rated Voltage Factor.

Accuracy Class –0.1, 0.2, 0.5, 1, 3

VA Burden – 5, 10, 15, 30

Voltage factors, with the permissible duration of the maximum voltage is 1.2 continuous & 1.5 for 30 sec between line and earth in an effectively earthed network.

Rated Voltage Factor (Vf): The voltage factor (Vf) is an upper limit of operating voltage, expressed in per unit of rated voltage. This is important for correct relay operation and operation under unbalanced fault conditions on unearthed or impedance earthed systems, resulting in a rise in the voltage on the healthy phases.

For metering core, we have adopted 0.5 class for HV & LV side VTs with Voltage factor = 1.2 continuous & 1.5 for 30 sec. This means that VT will have a % Ratio Error of +/- 0.5% at 80% to 120% of rated voltage with rated connected burden of 50VA.

Protection Voltage transformers: Protection VTs used for protection to handle fault quantities in multiple of rated values. Protection relays are connected in protection VT circuit. VTs step down high voltage value to low voltage value.

For protection purposes, accuracy of voltage measurement may be important during fault conditions, as the system voltage might be reduced by the fault to a low value.

Protection VTs are specified in term of Voltage Ratio, Accuracy Class, Rated VA Burden and Rated Voltage Factor.

Accuracy Class –3P, 6P

VA Burden – 5, 10, 15, 30

Voltage factors, with the permissible duration of the maximum voltage is 1.2 continuous & 1.5 for 30 sec between line and earth in an effectively earthed network.

For protection core, we have adopted 3P class, 50 VA for HV & LV side VTs. This means that VT will have a % Ratio Error of +/- 3% at 5% to 1.2 times rated voltage with rated connected burden of 50VA.

## **1.8 CAPACITOR BANK PROTECTION**

### **1.8.1 Under-Voltage protection:**

During power failure, it is essential that capacitor bank should trip and should not be re-energized till it discharges to safe value of 50 Volts or less. This is reason for providing 5 minutes delays for capacitor feeder in closing circuit when capacitor switched OFF or Tripped.

This relay should be instantaneous type with low voltage setting. Voltage setting value is decided to 80% of normal voltage.

### **1.8.2 Over-Voltage protection:**

Over voltage protection is provided for tripping capacitor bank when system voltage exceeds the maximum permissible voltage i.e. 110% of the rated voltage. This relay should be instantaneous type.

### **1.8.3 Neutral Displacement Protection:**

This type of protection is required I case of a single star connected capacitor bank. Primary winding of the Residual Voltage Transformer (RVT) is connected in Delta to capacitor bank and the secondary winding of RVT is connected in open delta. Two secondary terminals of RVT are wired up to NDR relay.

Under balanced condition of the capacitor bank, voltage across the open delta terminals is almost Zero. But in event of failure of one or partial unit in a capacitor bank, neutral is shifted and this is reflected on the open delta terminals. This unbalanced voltage value is specified value depends on numbers of units in capacitor bank. A setting for NDR is selected as 5 Volts for 1 Sec.

The modern Numerical relay does not require open delta voltage from RVT. But this relay requires 3phase, 4wires voltage of Star connected secondary winding of RVT and this relay derive Open Delta Voltage internally.



## **2.0 TESTING AND MAINTENANCE OF PROTECTION RELAYS**

Unlike other equipment, the protection relays remain without any operation until a fault develops. For a reliable service and to ensure that the relay is always vigilant, proper maintenance is must and must be carried out periodically.

### **2.1 MAINTENANCE TESTS:**

Maintenance tests are done in field periodically. The performance of relay is ensured by better maintenance. Basic requirement of sensitivity, selectivity, reliability and stability can be satisfied by proper maintenance.

Due to operating conditions in substation, dirt and dust may accumulate on relays, relay contacts. To avoid this relays are to be cleaned periodically.

Loose electrical connection can cause extra and may result in false operation of relay. To avoid this, all the relay connections are to be tightened every now and then.

To confirm that relay operation at the particular setting under particular conditions for which the relay is meant for operation, we should perform number of tests on relays periodically (ROUTINE RELAY TESTING).

To confirm the breaker operation by closing of relay contacts by operating relay for particular protection (THROUGH TESTING).

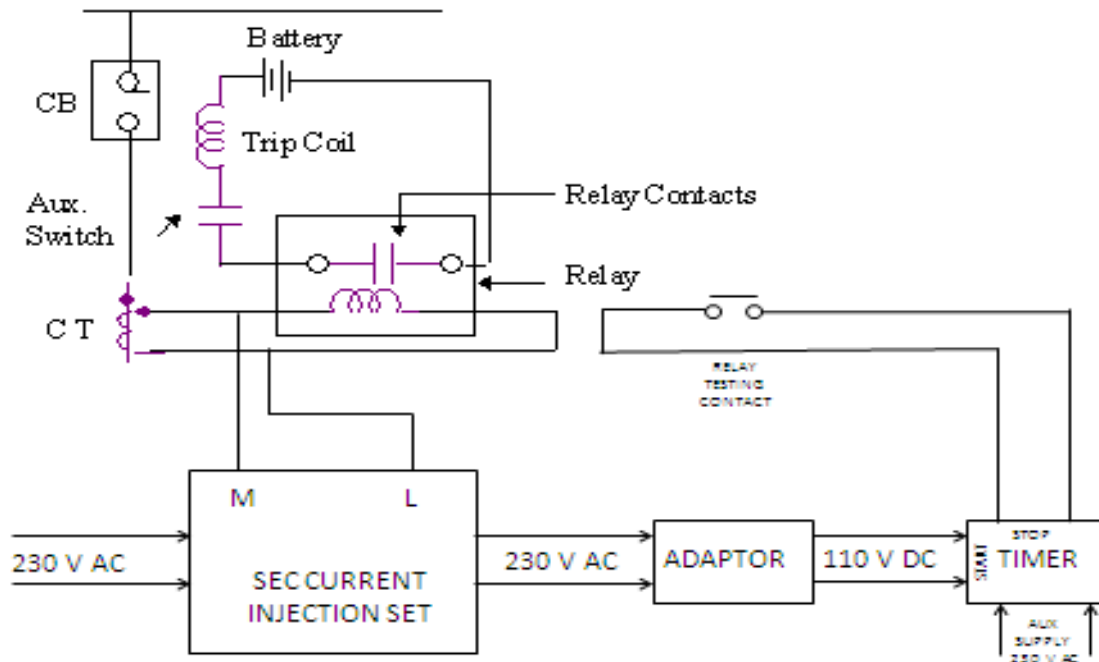
Secondary injection tests i.e. relay testing, tripping tests are to be carried out at least once in a year.

### **2.2 SECONDARY CURRENT INJECTION TEST SET**

Secondary current injection set is used to carry out secondary injection tests, is used to inject current in CT secondary circuit to checks operation of relays and tripping of breaker. It comprises calibrated variable current and voltage supplies and timer devices which used for relay testing and obtaining their characteristics.

Secondary injection does not check overall system including CT's. It is rare occasion for fault in CT, secondary test is sufficient for routine testing.

In System Protection Dept, there are 4 nos of 1 phase conventional type secondary current injection set. There are 3nos(Doble – 1 no &Ponova – 2 nos) of laptop operated 3 phase secondary current injection sets with 3 phase current and 3 phase voltage outputs.



### 2.3 PRIMARY CURRENT INJECTION TEST SET

Protection relays are fed from a CT's secondary in the switchgear to be protected. Primary current injection testing checks all parts of the protection circuit by injecting the test current through the primary circuit of CT's. Primary current injection set comprises current supply unit, control unit and other accessories. Test set can give variable output current by means of built-in auto transformer. Set is connected to AC single phase supply. The output is connected to primary circuit of CT and can be varied by control unit of the set. Using the primary current injection set, relay pickup and tripping of relays can be checked. This test set is used for carrying out Stability tests for Restricted Earth Fault (REF) test.

### 2.4 ROUTINE RELAY TESTING:

Steps to be followed in Routine Relay Testing

Cleaning of protection Relay, Auxiliary relays

All the connections from CT & PT end to relay terminals are to be tightened

Setting of relay is checked for assigned values and parameter as per testing sheet.

Testing of individual relay for each protection function

Through Testing from CT end to check relay operation for its each protection function.

Confirm tripping of breaker as per tripping scheme.

## 2.5 **COMMISSIONING TESTS:**

Commissioning tests are field tests to prove the performance of relays circuit in actual service while carrying out new commissioning jobs and replacement jobs.

Steps to be followed in commissioning tests

Checking wiring on basis of the circuit diagram / drawing

Current Transformer (CT) testing for CT ratios, Polarity, Knee point voltage.

Potential Transformer (PT) testing for PT ratios, Polarity, Phasing.

Relay setting and individual relay testing by secondary current injection set.

Checking secondary circuit by injecting current by secondary current injection set and confirm tripping of the breaker by operating relay for particular protection (THROUGH TESTING).

Stability tests for Ratio Differential (RD) test by energizing primary side at reduced voltage i.e. from 415 Volts, 3 phase source.

Stability tests for Restricted Earth Fault (REF) test by primary current injection test set.

## 2.6 **RATIO DIFFERENTIAL (RD) STABILITY TEST**

RD Stability test is carried out at time of commissioning, replacement jobs and tripping of transformer on RD & REF relay indication.

Material required – 3 core copper cable

Confirm that HV and LV circuit breakers are OFF and Isolated and Tap position of OLTC at tap no 5 (Normal tap).

While carrying RD Stability test, Secondary side of power transformer is shorted before Circuit breaker and after LV CT's.

Remove the 33/22kV Incoming cable in HV Breaker and connect 415 Volts, 3 phase, 3 wire, 50 Hz supply through 63/100Amps ICTP in HV switchgear to charge power

transformer. Take HV breaker at Service position and check On & OFF operation of HV Breaker from Control panel.

Check Ph-Ph & Ph-N voltage at ICTP. Insert fuses and switch ON ICTP. Check Phase-Phase & Phase-N supply at connection in HV breaker. Switch ON HV Breaker which will charge the transformer.

As per RD Stability format for particular relay, note down reading for HV & LV side currents on HV, LV relays and Multi Function Meters and HV & LV side currents, Operating currents (Differential / Spill currents), Restraining currents and REF current on RD relay.

Confirm that primary value of HV, LV side currents shall be match with calculated value for particular MVA capacity and CT ratio.

## 2.7 **RESTRICTED EARTH FAULT (REF) STABILITY TEST**

REF Stability test is carried out at time of commissioning, replacement jobs and tripping of transformer on REF relay indication.

Material required – Single core copper welding cable, Primary current injection set, Tong Tester, Multimeter

Confirm that HV and LV circuit breakers are OFF and Isolated.

While carrying REF Stability test, connect current cables of primary current injection set as per drawing for R phase NORMAL connection i.e. POWER FLOW Condition as per Power Flow so that LV CT and NCT should be in current circuit.

Inject 50 Amps current and confirm that primary value of current of LV side & NCT side shall be same.

Increase Injected current by primary injection set up to 300 Amps and As per REF Stability format for particular relay, note down reading for LV side currents on LV relays and Multi-Function Meters and LV side & NCT side currents, Operating current (REF Differential current) on RD relay.

Confirm that Operating (REF Differential) current in RD relay should be Zero and there is no tripping on REF relay.

SHORT the Stabilizing Resistor and Repeat the above procedure in Normal condition.

Repeat the above procedure for Y & B Phase in Normal condition.

NOTE: While carrying out above REF Stability current, as we are injecting 300 amps current in LV side of transformer there is tripping of RD relay. Thus we can confirm the operation of RD relay by primary injection testing.

Interchange P1 & P2 connection either at NCT or Line CT to create for FAULT condition i.e. ABNORMAL Connection.

Inject 50 Amps current in R phase in abnormal condition & WITHOUT shorting Stabilizing resistor. Note down reading for LV side currents on LV relays and Multi-Function Meters and LV side & NCT side currents, Operating current (REF Differential current) on RD relay.

Ramp up current slowly and observe REF differential current on RD relay. Confirm that when REF differential current about to set value of REF setting, there is tripping of REF relay.

SHORT the Stabilizing Resistor and Repeat the above procedure for R phase in abnormal condition.

Take HV & LV breakers at TEST position and check tripping of both breakers through Master Trip relays on operation of REF relay by injecting current in ABNORMAL condition without shorting the Stabilizing resistor.

### **3.0 DETAILS OF THE WORK CARRIED OUT WHILE PERFORMING FOLLOWING JOBS**

<b>I) REPLACEMENT OF PRIMARY SWITCHGEAR</b>	
i	Writing of Switchgear and Breaker nameplates in rough book.
ii	Writing of Current transformers nameplates along with drawing in rough book.

iii	Drawing of CT current circuit up to Terminal block in LV compartment in rough book showing CT Terminals, CT Ferrules and Terminals Blocks.
iv	Pictorial diagram of CT showing P1 & P2, CT Terminal Block, Location of S1, S2 & S3) showing actual location in switchgear.
v	Writing of Potential transformers nameplates along with drawing in rough book.
vi	Drawing of PT current circuit up to Terminal block up to LV compartment in rough book showing PT Terminals, PT Ferrules and PT Terminals Blocks.
vii	Pictorial diagram of PT showing Primary Terminals, PT Terminal Block, Location of a, a1 & n) showing actual location in switchgear.
viii	Testing of Current transformers by Omicron make CT Analyser from Terminal Blocks in current circuit
ix	Testing of Potential transformers for Ratio Test after removing PT from switchgear.
x	Testing of Potential transformers for Ratio test for both ratio while PT is at service position in switchgear. Check voltage at Terminal Blocks in LV compartment.
xi	Transformer Relay setting by respective relay software through Laptop if required.
xii	Relay testing by 3 phase current injection set (Doble/PONOVO) as per testing sheet.
xiii	As per CT polarity and Power flow, finalise of CT Star point on HV side for O/C+E/F & RD protection
xiv	Tightening of all connection.
xv	Through testing from CT end as per testing sheet.
xvi	RD Stability Testing as per testing sheet
xvii	Confirmation for tripping of HV Breakers on different protections and transformer commands.
xviii	Confirmation of HV & LV voltage on relay display and Terminal blocks.
xix	Fair work of all Nameplate, CT & PT Diagrams and CT & PT circuits from CT & PT terminal to Relay terminals.
xx	Log a message for completion of work at Supervisory / System Control.
<b>II) REPLACEMENT OF BUS SECTION</b>	
i	Writing of Switchgear and Breaker nameplates of Incomer, Outgoing and Capacitor feeders in rough book.
ii	Writing of Current transformers nameplates of Incomer, Outgoing and Capacitor feeders along with drawing in rough book.
iii	Writing of Serial Numbers of all CTs in rough book.
iv	Drawing of CT current circuit up to Terminal block in LV compartment of Incomer, Outgoing and Capacitor feeders in rough book showing CT Terminals, CT Ferrules and Terminals Blocks.

v	Pictorial diagram of CT showing P1 & P2, CT Terminal Block, Location of S1, S2 & S3) showing actual location in switchgear.
vi	Writing of Potential transformer nameplates (PT Unit & PT Assembly) along with drawing in rough book.
vii	Drawing of PT current circuit up to Terminal block up to LV compartment in rough book showing PT Terminals, PT Ferrules and PT Terminals Blocks.
viii	Pictorial diagram of PT showing Primary Terminals, PT Terminal Block, Location of a, a1 & n) showing actual location in Incomer switchgear.
ix	Testing of Current transformers by Omicron make CT Analyser from Terminal Blocks in current circuit
x	Testing of Potential transformers for Ratio Test after removing PT from switchgear.
xi	Testing of Potential transformers for Ratio test for both ratio while PT is at service position in switchgear. Check voltage at Terminal Blocks in LV compartment.
xii	Collection of all data required for calculation of Relay setting
xiii	Calculation of relay setting and its tabulation
xiv	Bus section Relay setting by respective relay software through Laptop.
xv	Bus section Relay testing by 3 phase current injection set (Doble/PONOVO) as per testing sheet.
xvi	Transformer Relay setting by respective relay software through Laptop if required.
xvii	Transformer Relay testing by 3 phase current injection set (Doble/PONOVO) as per testing sheet.
xviii	As per CT polarity and Power flow, finalise of CT Star point on HV side for O/C+E/F & RD protection
xix	Tightening of all connections.
xx	Through testing from CT end as per testing sheet.
xxi	REF Stability Testing as per testing sheet
xxii	RD Stability Testing as per testing sheet
xxiii	Confirmation for tripping of HV & LV Breakers on different protections and transformer commands.
xiv	Confirmation of HV & LV voltage on relay display and Terminal blocks.
xxv	Fair work of all Nameplate, CT & PT Diagrams and CT & PT circuits from CT & PT terminal to Relay terminals.
xxvi	Log a message for completion of work at Supervisory / System Control.
<b>III) REPLACEMENT OF CONTROL, RELAY &amp; ALARM PANELS</b>	
i	Writing of CARP nameplates, Relay details (Make, Models, Sr Nos) in rough book.
ii	Collection of all data required for calculation of Relay setting
iii	Calculation of relay setting and its tabulation

iv	Relay setting by respective relay software through Laptop.
v	Relay testing by 3 phase current injection set (Doble/PONOVO) as per testing sheet.
vi	As per CT polarity and Power flow, finalise of CT Star point for O/C+E/F, RD, REF protection
vii	After installation of CARP, Drawing of CT current circuit up to relay terminal in rough book showing Terminals Blocks with ferrules.
vii	Drawing of PT voltage circuit up to relay terminal in rough book showing Terminals Blocks with ferrules.
ix	Tightening of all connections.
x	Through testing from CT end as per testing sheet.
xi	REF Stability Testing as per testing sheet
xii	RD Stability Testing as per testing sheet
xiii	Checking of all transformer commands from marshalling box.
xiv	Confirmation for tripping of HV & LV Breakers on different protections and transformer commands.
xv	Confirmation of HV & LV voltage on relay display and Terminal blocks.
xvi	Fair work of all Nameplate, CT & PT Diagrams and CT & PT circuits
xvii	Log a message for completion of work at Supervisory / System Control.

#### **IV) REPLACEMENT OF POWER TRANSFORMER**

i	Writing of power transformer nameplates in rough book.
ii	Collection of all data required for calculation of Relay setting for new transformer
iii	Calculation of relay setting and its tabulation
iv	Relay setting by respective relay software through Laptop.
v	Relay testing by 3 phase current injection set (Doble/PONOVO) as per testing sheet.
vi	Change the HV, LV & NCT CT ratio as per setting sheet
vii	As per CT polarity and Power flow, finalise of CT Star point for O/C+E/F, RD, REF protection
viii	After installation of CARP, Drawing of CT current circuit up to relay terminal in rough book showing Terminals Blocks with ferrules.
ix	Change the PT ratio as per new transformer ratio.
x	Drawing of PT voltage circuit up to relay terminal in rough book showing Terminals Blocks with ferrules.
xi	Tightening of all connections.



xii	Through testing from CT end as per testing sheet.
xiii	REF Stability Testing as per testing sheet
xiv	RD Stability Testing as per testing sheet
xv	Checking of all transformer commands from marshalling box.
xvi	Confirmation for tripping of HV & LV Breakers on different protections and transformer commands.
xvii	Confirmation of HV & LV voltage on relay display and Terminal blocks.
xviii	Fair work of all Nameplate, CT & PT Diagrams and CT & PT circuits
xix	Log a message for completion of work at Supervisory / System Control.
<b>V) COMMISSIONING OF NEW RECEIVING SUBSTATION</b>	
<b>a) Commissioning of Primary Breaker</b>	
i	Writing of Switchgear and Breaker nameplates in rough book.
ii	Writing of Current transformers nameplates along with drawing in rough book.
iii	Drawing of CT current circuit up to Terminal block in LV compartment in rough book showing CT Terminals, CT Ferrules and Terminals Blocks.
iv	Pictorial diagram of CT showing P1 & P2, CT Terminal Block, Location of S1, S2 & S3) showing actual location in switchgear.
v	Writing of Potential transformers nameplates along with drawing in rough book.
vi	Drawing of PT current circuit up to Terminal block up to LV compartment in rough book showing PT Terminals, PT Ferrules and PT Terminals Blocks.
vii	Pictorial diagram of PT showing Primary Terminals, PT Terminal Block, Location of a, a1 & n) showing actual location in switchgear.
viii	Testing of Current transformers by Omicron make CT Analyser from Terminal Blocks in current circuit
ix	Testing of Potential transformers for Ratio Test after removing PT from switchgear.
x	Testing of Potential transformers for Ratio test for both ratio while PT is at service position in switchgear. Check voltage at Terminal Blocks in LV compartment.
xi	Fair work of all Nameplate, CT & PT Diagrams and CT & PT circuits
<b>b) Commissioning of Secondary Bus Section</b>	
i	Writing of Switchgear and Breaker nameplates of Incomer, Outgoing and Capacitor feeders in rough book.
ii	Writing of Current transformers nameplates of Incomer, Outgoing and Capacitor feeders along with drawing in rough book.
iii	Writing of Serial Numbers of all CTs in rough book.

iv	Drawing of CT current circuit up to Terminal block in LV compartment of Incomer, Outgoing and Capacitor feeders in rough book showing CT Terminals, CT Ferrules and Terminals Blocks.
v	Pictorial diagram of CT showing P1 & P2, CT Terminal Block, Location of S1, S2 & S3) showing actual location in switchgear.
vi	Writing of Potential transformer nameplates (PT Unit & PT Assembly) along with drawing in rough book.
vii	Drawing of PT current circuit up to Terminal block up to LV compartment in rough book showing PT Terminals, PT Ferrules and PT Terminals Blocks.
viii	Pictorial diagram of PT showing Primary Terminals, PT Terminal Block, Location of a, a1 & n) showing actual location in Incomer switchgear.
ix	Testing of Current transformers by Omicron make CT Analyser from Terminal Blocks in current circuit
x	Testing of Potential transformers for Ratio Test after removing PT from switchgear.
xi	Testing of Potential transformers for Ratio test for both ratio while PT is at service position in switchgear. Check voltage at Terminal Blocks in LV compartment.
xii	Collection of all data required for calculation of Relay setting and its tabulation.
xiii	Bus section Relay setting by respective relay software through Laptop.
xiv	Relay testing by 3 phase current injection set (Doble/PONOVO) as per testing sheet.
xv	Fair work of all Nameplate, CT & PT Diagrams and CT & PT circuits for Outgoing & Capacitor Feeders

<b>c) Commissioning of Power Transformer</b>	
i	Writing of power transformer nameplates in rough book.
ii	Change the HV, LV & NCT CT ratio as per setting sheet
iii	As per CT polarity and Power flow, finalise of CT Star point for O/C+E/F, RD, REF protection
iv	After installation of CARP, Drawing of CT current circuit up to relay terminal in rough book showing Terminals Blocks with ferrules.
v	Change the PT ratio as per new transformer ratio.
vi	Drawing of PT voltage circuit up to relay terminal in rough book showing Terminals Blocks with ferrules.
vii	Fair work of all Nameplate of transformer.

<b>d) Commissioning of Control, Relay and Alarm Panels</b>	
i	Writing of CARP nameplates, Relay details (Make, Models, Sr Nos) in rough book.
ii	Collection of all data required for calculation of Relay setting

iii	Calculation of relay setting and its tabulation
iv	Relay setting by respective relay software through Laptop.
v	Relay testing by 3 phase current injection set (Doble/PONOVO) as per testing sheet.
vi	As per CT polarity and Power flow, finalise of CT Star point for O/C+E/F, RD, REF protection
vii	After installation of CARP, Drawing of CT current circuit up to relay terminal in rough book showing Terminals Blocks with ferrules.
viii	Drawing of PT voltage circuit up to relay terminal in rough book showing Terminals Blocks with ferrules.
ix	Tightening of all connections.
x	Through testing from CT end as per testing sheet.
xi	REF Stability Testing as per testing sheet
xii	RD Stability Testing as per testing sheet
xiii	Checking of all transformer commands from marshalling box.
xiv	Confirmation for tripping of HV & LV Breakers on different protections and transformer commands.
xv	Confirmation of HV & LV voltage on relay display and Terminal blocks.
xvi	Fair work of all Nameplate, CT & PT Diagrams and CT & PT circuits
xvii	Log a message for completion of work at Supervisory / System Control.

#### **4.0 TRIPPING INVESTIGATION:**

- 4.1 Whenever there is any tripping of Transformers and outgoing feeders in system reported by O&M Departments. Such as Power Transformer tripping, feeder tripping, Power Transformer tripping along with feeder tripping, tripping without relay indication, tripping of feeder breaker for downward fault, etc. The tripping investigation is carried out to ascertain the correct operation of protection relays, analysis of operation of relays, type of fault in the system.
- 4.2 For carrying out tripping investigation, outage of transformer/feeder is taken.
- 4.3 Initially, we carry out through testing without disturbing protection system. Then relay characteristic is verified by secondary current injection method. For proper co-ordination, suitable action like increase/decrease TMS setting value etc. is done. For finding out the

cause of tripping, the necessary data such as SCADA report, fault report, fault event data recorded in the relay and disturbance recorder data is analyzed. If setting is changed, same is kept under observation.

- 4.4 The tripping investigation report is lodged in respective Controls and forwarded to concerned O&M Department.

## **5.0 PROCEDURE IN RESPECT OF TESTING OF TAP-CHANGE CONTROL RELAYS**

### **5.1 General:**

All Power Transformers installed in our Receiving Sub Stations are provided with on-load tap-change gear i.e. the taps of transformer can be changed when the transformer is on load. This tap change gear can be operated manually by checking or electrically by remote control or automatic control.

- 5.2 All the automatic voltage regulating relays (AVR) are inspected for the correct operation of OLTC. The automatic operation of tap-change control can be described as follows:

**5.2.1** Automatic Voltage regulating relay, which is sensitive to change in voltages, is connected across secondary side of Potential Transformer installed on 110kV side of Power transformer. Whenever the Secondary voltage of Power Transformer increases or decreases by 150 Volts, the secondary voltage of Potential Transformer will increase or decrease by approx.1.5voltage (P.T. ratio 11000/110 Volts). This change in voltage starts the voltage regulating relay which immediately gives impulse to a timing relay. If the system voltage remains in this condition for more than 60 seconds, timer completes and an electrical impulse is given to operate on load tap change gear (OLTC) to lower or raise the tap to maintain voltage within permissible limit.

## **4.(b)(iv)) The norms set for discharge of functions**

Activities of System Protection Department and Standard Man- Minutes required for measured activities and output per month

Sr. No.	Sr. No. as per GIB Scheme no.51	Activity Description	Std. Man-Minutes	Avg. Output per month
1)	29	<b>Relay Testing in RSS with annunciation relay</b>		
	a)	On outgoing feeders		
	i)	Conventional Relay	287	40
	ii)	Numerical Relay	145	18.23
	b)	On Capacitor Panel		
	i)	Conventional Relay	305	6.38
	ii)	Numerical Relay	241	2.69
	c)	On Transformer control panel for 33/22 kV		
	i)	Conventional Relay	960	8.21
	ii)	Numerical Relay	0	0
	d)	On transformer Control Panel for 110 kV		
	i)	Conventional Relay	1027	3.38
	ii)	Numerical Relay	0	
2)	30	<b>Relay testing in DSS</b>	480	
3)	31	<b>OCB testing in</b>		
	a)	Distribution workshop	240	27.13
	b)	Substation	480	0
4)	32)	<b>Inspection of Tap change control panels in RSS</b>	130	26.46
5)	45)	<b>Relay overhauling in RSS while testing</b>		
	a)	On outgoing feeders		
	i)	Conventional Relay		
	ii)	Numerical Relay		
	b)	On capacitor panel		
	i)	Conventional Relay		
	ii)	Numerical Relay		

Sr. No.	Sr. No. as per GIB Scheme no.51	Activity Description	Std. Man-Minutes	Avg. Output per month
	c)	On Transformer control panel for 33/22 kV		
	i)	Conventional Relay		
	ii)	Numerical Relay		

	d)	On transformer Control Panel for 110 kV		
	i)	Conventional Relay		
	ii)	Numerical Relay		
6)	46	<b>Relay overhauling in DSS while testing</b>		
7)	56)	<b>Attending to relay complaints (investigation of mal-operation of relays in Receiving Sub-Station)</b>		
8)	60)	<b>Work in connection of new relay/ new relay panels</b>		
9)	61)	<b>Attending to complaints of AVR</b>		
10)	72)	<b>Attending to relay complaints (investigation of mal-operation of relays in Receiving Sub-Station)</b>		
11)	75)	<b>Work in connection of new relay/ new relay panels</b>		

**4.(b)(v) The rules, regulations, instructions, manuals and records held and used by employees of the department for discharging functions**

Please refer Annex- III

**4.(b)(vi) The statement of the categories of documents that are held by department or under its control**

Please refer Annex- IV

**4.(b)(vii) The particulars of any arrangement that exists for consultation with or representation by the members of the public in relation to the formulation of its policy or implementation thereof :-**

Not applicable to System Protection Department

**4.(b)(viii)) A statement of the boards, councils, committees and other bodies consisting of two or more persons constituted as its part or for the purpose of its advice and as to whether meeting of those boards, councils, committees and other bodies are open to the public or the minutes of such meetings are accessible for public :-**

Not applicable to System Protection Department

**4.(b)(ix)) A directory of its officers and employees:-**

Sr. No	Name of Officer/Staff	Designation	Grade	Ch.No.	P.S.No of March,2021
1	Shri S.S.Gawde	Superintendent	A-4	212903	163/02
2	Shri S.N.Pawar	Asst. Engineer	A-5	215153	163/02
3	Shri G. S. Bains	Asst. Engineer	A-5	215166	163/02
4	Shri S. D. Suryawanshi	Asst. Engineer	A-5	213278	163/02
5	Shri S.V. Shaha	Asst. Engineer	A-5	215422	163/02
6	Shri A.K.Hajare	Foreman General	T-8	403821	163/02
7	Shri J.N.Patil	Foreman	T-7	403874	163/02
8	Shri P.P.Redij	Foreman	T-7	403883	163/02
9	Shri S.R.Satkar	Foreman	T-7	403884	163/02
10	Shri N.S.More	Foreman	T-7	403885	163/02
11	Shri V.R.Borate	Assistant Foreman	T-6	403867	163/02
12	Shri S.G.Wairkar	Painter	T-3	408767	463/02
13	Shri A.B.Pawar	Nawghany	T-1	411102	463/02
14	Shri D.B.Gamare	Nawghany	T-1	411177	463/02
15	Shri S.M.Shirke	Nawghany	T-1	413322	463/02
16	Shri Z.S.Jadhav	Nawghany	T-1	413401	463/02
17	Shri S.R.Surve	Asst.Admin. Officer	A/G VIII	212492	163/02
18	Smt. T.M.Velankar	Supervisor(P)	A/G VII	212801	163/02

19	Smt. S.A.Kirte	Jamadar(P)	A/G II	280756	163/02
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**4.(b)(x)) The monthly remuneration received by each of its officers and employees including the system of compensation as provided in its regulations: - As on February 2021**

Sr. No.	Name of Officer/Staff	Designation	Basic Pay (Rs.)	Monthly Remuneration (Basic+DA+HRA)
1	Shri S.S.Gawde	Superintendent	72700	98900
2	Shri S.N.Pawar	Asst. Engineer	60750	82515
3	Shri G. E. Bains	Asst. Engineer	63550	73608
4	Shri S.D. Suryawanshi	Asst. Engineer	69550	94688
5	Shri S.V. Shaha	Asst. Engineer	59400	80681
6	Shri A.K.Hajare	Foreman General	50500	58533
7	Shri J.N.Patil	Foreman	41045	56038
8	Shri P.P.Redij	Foreman	40240	54945
9	Shri S.R.Satkar	Foreman	40240	54945
10	Shri N.S.More	Foreman	40240	54945
11	Shri V.R.Borate	Assistant Foreman	39775	54304
12	Shri S.G.Wairkar	Painter	34940	47689
13	Shri A.B.Pawar	Nawghany	30635	41610
14	Shri D.B.Gamare	Nawghany	30635	35483
15	Shri S.M.Shirke	Nawghany	24365	33094
16	Shri Z.S.Jadhav	Nawghany	24365	33094
17	Shri S.R.Surve	Asst.Admin. Officer	56550	76969
18	Smt. T.M.Velankar	Supervisor(P)	42575	57916
19	Smt. S.A.Kirte	Jamadar(P)	30635	41610

**4.(b)(xi)) The budget allocated to each of its agency, indication the particulars of all plans, proposed expenditures and reports on disbursement made:-**



No direct budget allocation is proposed by department for capital expenditure. The budget provision for the individual job undertaken by the department for dead stock and capital expenditures is made by the department

**The budget allocation :-**

**The plan proposed:-**

Not applicable to System Protection Department

**4.(b)(xii) The manner of execution of subsidy program including the amount allocated and the details of beneficiaries of such program: -**

Not applicable to System Protection Department

**4.(b)(xiii) Particular of recipients of concessions, permits or authorization granted by it:-**

Not applicable to System Protection Department

**4.(b)(xiv) Details in respect of the information, available to or held by it, reduced in an electronic form:-**

The work of System Protection Department is not directly related with outside peoples. The information in respect of working procedure in respect of activities carried out by the department and the information in respect of officers and staff is available in the electronic form on the Undertaking's website [www.bestundertaking](http://www.bestundertaking).

**4.(b)(xv)) The particulars of facilities available to citizens for obtaining information including the working hours in a library or reading room, if maintained for public use :-**

No such library or reading room is provided.

**4.(b)(xvi)) The names, designation and other particulars of the public information as may be prescribed and thereafter updated these publications every year:-**

**Public Information Officer :**

**Shri. S.N. Pawar**

**Assistant Engineer, System Protection Department**

**Appellaet Authority :**

**Shri. S.S.Gawde**

**Superintendent, System Protection Department**

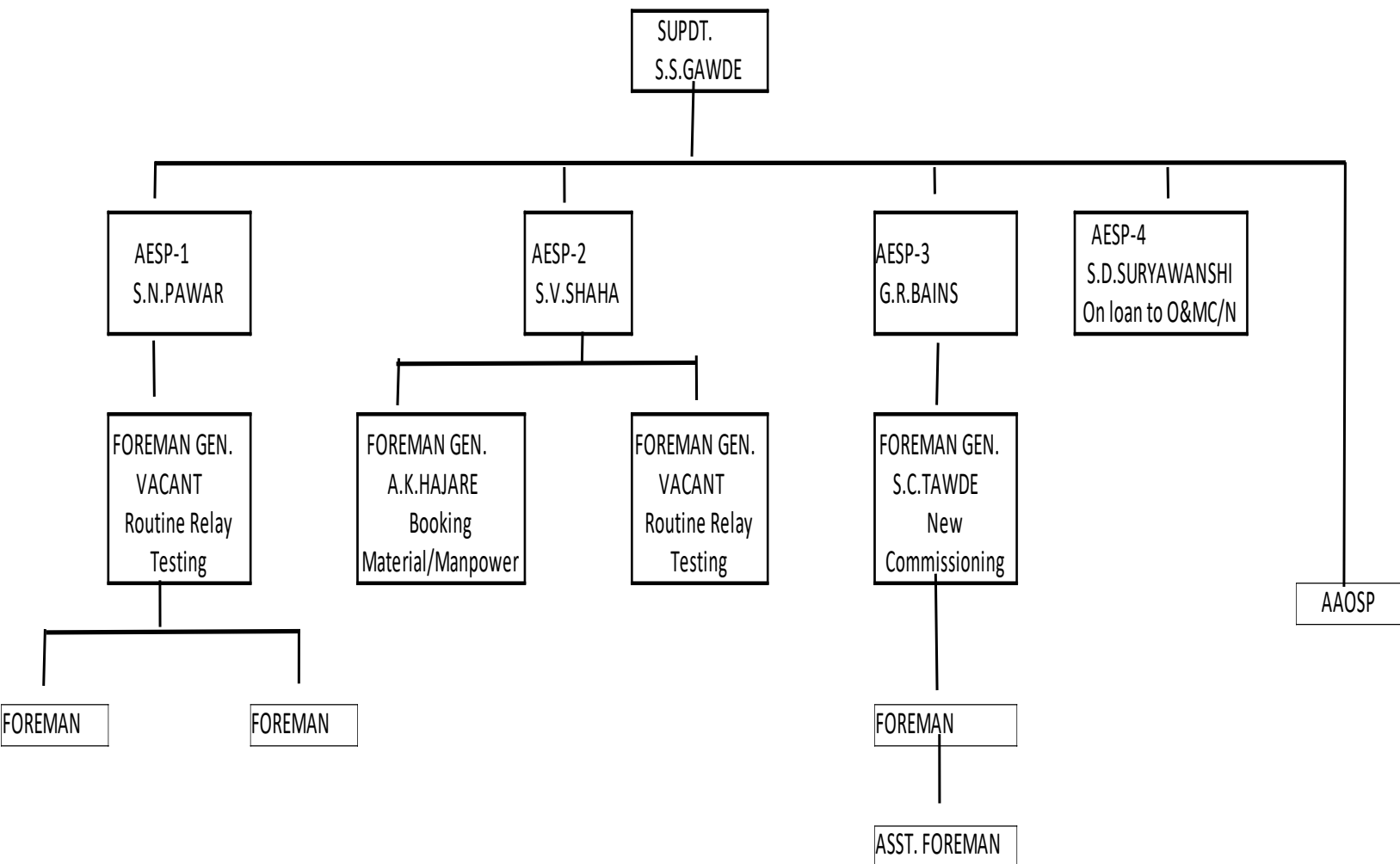
**4.(b)(xvii)) Such other information as may be prescribed: - NIL**





# Annex- I

## SYSTEM PROTECTION DEPARTMENT ORGANISATION CHART



# **SYSTEM PROTECTION DEPARTMENT**

## **Annex - III**

**The rules, regulations, instructions, manuals and records held and used by employees of the department for discharging functions**

Sr No	DESCRIPTION
1	110 / 33kV, 110/11kV EQUIPMENTS DRAWINGS
2	33 kV EQUIPMENTS DRAWINGS
3	11 kV EQUIPMENTS DRAWINGS
4	OTHER EQUIPMENTS DRAWINGS
5	CATALOGUE FILE
6	SPECIFICATION FILE
7	DOCUMENTS
8	EQUIPMENTS
9	GENERAL
10	RSS
11	RELAY ORDER FILES
12	ESTABLISHMENT FILES *
13	STORES FILES *
14	ADMINISTRATIVE FILES *
15	TRAINING FILES *
16	STATSTICAL FILES *
17	STUDY FILES *
18	STAFF SERVICE RECORDS FILES *

\* Please refer Annex- IV

**110 / 33kV, 110/11kV EQUIPMENTS DRAWINGS**

Sr No	FILE NAME	DESCRIPTION	Category
1	SP/PROT/EQ.DRG.A1	110 kV GIS Breaker TOSHIBA Make of KHETWADI RSS	C
2	SP/PROT/EQ.DRG.A2	110/11 kV UE Make CP/RP of NARIMAN PT. RSS	D
3	SP/PROT/EQ.DRG.A3	110 kV GIS BKR AEG Make of NARIMAN POINT RSS	C
4	SP/PROT/EQ.DRG.A4	110 kV GIS NISSIN Make of BACKBAY RSS	B
5	SP/PROT/EQ.DRG.A5	110/33 kV ABB Make CP/RP of BACKBAY RSS	B
6	SP/PROT/EQ.DRG.A6	110 kV ABB Make Out Going Panel For NP1 & NP2 Of BACKBAY RSS	B
7	SP/PROT/EQ.DRG.A7	110/33/11 kV ABB Make ANNUNCIATION Panel Of BACKBAY RSS	B
8	SP/PROT/EQ.DRG.A8	110 kV ABB Make CP/RP For 110KV Incomer 1,2,3 of BACKBAY RSS ABB Volume 3c	B
9	SP/PROT/EQ.DRG.A9	110/11-11 kV CP/RP 45 MVA of BACKBAY RSS	B
10	SP/PROT/EQ.DRG.A10	Backbay RSS Bus Transfer & Disconnecter Panel & CP/RP Bus Transfer Scheme	B
11	SP/PROT/EQ.DRG.A11	Metering Panel of 110 kV BACKBAY RSS	B
12	SP/PROT/EQ.DRG.A12	Disturbance Recorder, Busbar Protection & Mosaic Mimic Board of 110 kV Backbay RSS	C
13	SP/PROT/EQ.DRG.A13	145 kV GIS LOCAL CONTROL PANEL OF KHETWADI RSS	C
14	SP/PROT/EQ.DRG.A14	110 kV GIS ABB Switchgear BACKBAY RSS Drawing Volume 3A	B
15	SP/PROT/EQ.DRG.A15	TATA's GRANT ROAD Drawing For 110 kV KHETWADI RSS	C
16	SP/PROT/EQ.DRG.A16	Drawing For Areva Make CARP at Nariman Point RSS.	B
17	SP/PROT/EQ.DRG.A17	ABB Make Alarm & Warning Panel For Khetwadi RSS Type CAP	B
18	SP/PROT/EQ.DRG.A18	ABB Make Control & Relay Panel For Khetwadi RSS Type KRTA - 1	B
19	SP/PROT/EQ.DRG.A19	33kV Incoming Feeder C & R PANEL Easan Reyrolle.	B

**33 kV EQUIPMENTS DRAWINGS**

Sr No	FILE NAME	DESCRIPTION	Category
1	SP/PROT/EQ.DRG.B1	33 kV Voltas SF6 Breaker Drawing	C
2	SP/PROT/EQ.DRG.B2	33 kV ABB SF6 Breaker Drawing Nair Hosp. RSS	B
3	SP/PROT/EQ.DRG.B3	33 kV Siemens GIS Breaker Drawing Dharavi RSS	D
4	SP/PROT/EQ.DRG.B4	33 kV ABB GIS Breaker Drawing Backbay RSS	C
5	SP/PROT/EQ.DRG.B5	33 kV Siemens VCBs at 110 kV Khetwadi RSS	D
6	SP/PROT/EQ.DRG.B6	33 kV CP/RP Panels (Numerical) Siemens Drawing	B
7	SP/PROT/EQ.DRG.B7	33 kV Sw/Gr Drawing Jyoti Make	D
8	SP/PROT/EQ.DRG.B8	33/22 kV ABB Make SF6 Sw/Gr Drawing Malbar Hill RSS	D
9	SP/PROT/EQ.DRG.B9	33/22 kV ABB Make Primary Switchgear Drawing	D
10	SP/PROT/EQ.DRG.B10	33 kV Siemens Make CP/RP Drawing	D
11	SP/PROT/EQ.DRG.B11	33 kV ABB Make 1500 MVA SF6 Sw/Gr Drawing	D
12	SP/PROT/EQ.DRG.B12	33/11 kV CP/RP Areva Make	B
13	SP/PROT/EQ.DRG.B13	33/22/11 kV CP/RP Areva Make New Updated Drawing	B
14	SP/PROT/EQ.DRG.B14	33 kV, 1500 MVA, VCB, Indoor, Sw/Gr Areva Make Drawing	B
15	SP/PROT/EQ.DRG.B15	33/22/11 kV Transformer CP/RP Type DTRCR Easun ReyRolle Make Drawing	C
16	SP/PROT/EQ.DRG.B16	33 kV ER MAKE CP/RP FOR 33 KV POWER TRANSFORMER (REV-B Dtd. 18.04.07 (NEW ER PANEL)	B
17	SP/PROT/EQ.DRG.B17	Siemens Make 36 kV GIS at 33 kV Receiving Substation (Compact RSS)	D
18	SP/PROT/EQ.DRG.B18	ER Make CARP (CSPC Relay) at Grant Road 33 kV Receiving Substation (Drg No ER 1360)	D
19	SP/PROT/EQ.DRG.B19	ER Make CARP (CSPC Relay) at Various 33 kV Receiving Substation (Drg No ER 1463)	D
20	SP/PROT/EQ.DRG.B20	ABB Make 33 kV, 1500 MVA, SF6, Indoor, Sw/Gr Drawing (Year 2009), ML-1, Colaba-3, Tardeo-2,3	B
21	SP/PROT/EQ.DRG.B21	ER make CARP for 33kV Radially connected DSS (Morarji Mill 33kV / 415 Volts) Drg No 1601	B
22	SP/PROT/EQ.DRG.B22	ABB Make 33 kV, 1500 MVA, SF6, Indoor, RMU, Motorised	B
23	SP/PROT/EQ.DRG.B23	CGL make VCB, 1500MVA, Switchgears	B
24	SP/PROT/EQ.DRG.B24	36KV GIS SWGR Schneider Electric	B

**11 kV EQUIPMENTS DRAWINGS**

Sr No	FILE NAME	DESCRIPTION	Category
1	SP/PROT/EQ.DRAWING.D1	11 kV Siemens VCB Breaker Drawing.	D
2	SP/PROT/EQ.DRAWING.D2	11 kV Biecco VCB Breaker Drawing	D
3	SP/PROT/EQ.DRAWING.D3	11 kV C & G VCB Breaker Drawing.	B
4	SP/PROT/EQ.DRAWING.D4	11 kV Jyoti VCB Breaker Drawing.(ABB Relay)	D
5	SP/PROT/EQ.DRAWING.D5	11 kV Jyoti VCB Breaker Drawing.(L & T Relay)	D
6	SP/PROT/EQ.DRAWING.D6	11 kV GEC VCB Breaker Drawing.	D
7	SP/PROT/EQ.DRAWING.D7	11 kV S & S VCB Breaker Drawing.	D
8	SP/PROT/EQ.DRAWING.D8	11 kV Jyoti VCB Breaker Drawing.(With Static Jyoti Relay)	D
9	SP/PROT/EQ.DRAWING.D9	11 kV Voltas VCB Breaker Drawing.	D
10	SP/PROT/EQ.DRAWING.D10	11 kV RMU Drawing.	D
11	SP/PROT/EQ.DRAWING.D11	11 kV, 250 MVA Alstom DSS Sw/Gr VMX Drawing	
12	SP/PROT/EQ.DRAWING.D12	11 kV, 350 MVA, Alstom RSS Sw/Gr A To D Drawing	B
13	SP/PROT/EQ.DRAWING.D13	11 kV OCB BY VCB Sw/Gr VMX Alstom Drawing	B
14	SP/PROT/EQ.DRAWING.D14	11 kV Jyoti Sw/Gr Wiring Diagram, Argus Relay	B
15	SP/PROT/EQ.DRAWING.D15	11 kV, 350 MVA, VCB Areva Make Switchgear Drawing	D
16	SP/PROT/EQ.DRAWING.D16	11 kV, 350 MVA, VCB Alstom Make Switchgear Drawing with Areva Relay	B
17	SP/PROT/EQ.DRAWING.D17	11 kV, 350 MVA, VCB Biecco Make Switchgear Drawing with Areva Relay	B
18	SP/PROT/EQ.DRAWING.D18	11 kV, 350 MVA, VCB Siemens Make Switchgear Drawing with Siemens Relay	D
19	SP/PROT/EQ.DRAWING.D19	ER Make 11 kV, 350 MVA Switchgear Drawing (Dharavi)	C
20	SP/PROT/EQ.DRAWING.D20	ER Make 11 kV 350 MVA Switchgear Drawing (Worli Dairy RSS)	B
21	SP/PROT/EQ.DRAWING.D21	Schneider Make 11 kV, 350 MVA Swgr Drawing (Nariman Point RSS)	B
22	SP/PROT/EQ.DRAWING.D22	11kV ERL make VCB switchgear Drawing (Nimkar Marg, Girgaum)	B
23	SP/PROT/EQ.DRAWING.D23	11 KV VCB Control Panel STELMEC	B



**OTHER EQUIPMENT DRAWINGS**

Sr No	FILE NAME	DESCRIPTION	Category
1	SP/PROT/EQ.DRAWING.E1	AVR	B
2	SP/PROT/EQ.DRAWING.E2	Primary And Secondary Injection Set	B
3	SP/PROT/EQ.DRAWING E3	OLTC Internal Wiring Diagram	D
4	SP/PROT/EQ.DRAWING.E4	EE Make Relay (Internal Wiring Diagram)	D
5	SP/PROT/EQ.DRAWING.E5	INTERNAL CIRCUIT OF RELAY TYPE B-3 Reyrolle Make	D
6	SP/PROT/EQ.DRAWING.E6	Internal Circuit Of Relay Reyrolle O/C, E/F	D
7	SP/PROT/EQ.DRAWING.E7	Areva Make Frequency Relay Panel Drawing	B
8	SP/PROT/EQ.DRAWING.E8	SCADA Drawing under Areva SCADA Project (Wadala, Sitaladevi, Dharavi, KEM BS No 2, Nestle, Sewree)	B

**CATALOGUE FILE**

Sr No	FILE NAME	DESCRIPTION	Category
1	SP/Prot/Cat - 1	Ashida Relay Numeric Protection Relay Protection for Power System and Master Mind	D
2	SP/Prot/Cat - 2	Siemens Relay	D
3	SP/Prot/Cat - 3	L & T Relay	D
4	SP/Prot/Cat - 4	GEC Alstom Numeric Relay	D
5	SP/Prot/Cat - 5	Jyoti Static Relay	D
6	SP/Prot/Cat - 6	Easun ReyRolle Electromechanical Relay and Other catalogues	D
7	SP/Prot/Cat - 7	Easun ReyRolle Numerical Relay	C
8	SP/Prot/Cat - 8	DuoBais Auxilliary Argus-8 Relay	C
9	SP/Prot/Cat - 9	SEG Relay for DSS	C
10	SP/Prot/Cat - 10	ABB Relay for DSS	C
11	SP/Prot/Cat - 11	ABB SPACOM Relay VOLUME 1	C
12	SP/Prot/Cat - 12	ABB RE Series Relay CPRP RELAY	C
13	SP/Prot/Cat - 13	ABB Relay SPAEC 538C & 531C, SPAJ 115C, SPAD346, KAD(SBHA& SS) RAICA RXCSF and PSU 14, TSR ICM21, Transformer Terminal	C

Sr No	FILE NAME	DESCRIPTION	Category
14	SP/Prot/Cat - 14	ABB relay SPAEC (010, 011) SACO, SPAF(140C & 340C)	D
15	SP/Prot/Cat - 15	ABB Buyers SUTOR (1991 - 9L)	D
16	SP/Prot/Cat - 16	ABB make Numerical Meter Protection relay type SPEM 14(7)	D
17	SP/Prot/Cat - 17	ABB make Protection Relay in Theory and Application	D
18	SP/Prot/Cat - 18	ABB make SPAEC-310C, SPAC 312C Feeder Terminal	D
19	SP/Prot/Cat - 19	ABB make meters / Transducers / Disturbance Recorder other relays Volume II	D
20	SP/Prot/Cat - 20	ABB make 110kV Backbay RSS Operation Manual Volume III	D
21	SP/Prot/Cat - 21	ABB make SPAJ-160C	D
22	SP/Prot/Cat - 22	Protection / Aux. CT PT & Core Balance CT	D
23	SP/Prot/Cat - 23	Safety Manual for Electrical system	B
24	SP/Prot/Cat - 24	Multimeter, Tong Testor, Variac, Timers	B
25	SP/Prot/Cat - 25	Primary & Secondary Current Injection set (Doble)	B
26	SP/Prot/Cat - 26	Transducers	B
27	SP/Prot/Cat - 27	HRC Fuse Characteristics	B
28	SP/Prot/Cat - 28	Doble Protest User Guide	B
29	SP/Prot/Cat - 29	A.V.R.	B
30	SP/Prot/Cat - 30	Annunciation Panels of RSS	B
31	SP/Prot/Cat - 31	11kV Switchgear of Different makes	D
32	SP/Prot/Cat - 32	3-phase circuit breaker Analyser	D
33	SP/Prot/Cat - 33	Gas Operated Relays for Transformers	D
34	SP/Prot/Cat - 34	List of Publications of CBIP	D
35	SP/Prot/Cat - 35	Software Manual for Spec. Relay	D
36	SP/Prot/Cat - 36	Cable fault location technique ROBOTRON (M/s. PCI Ltd.)	D
37	SP/Prot/Cat - 37	Areva MICOM over current Relay P-111 Theory Application P-128 and 124, 121	B
38	SP/Prot/Cat - 38	Alstom MICOM P-125 / P-126 / P-127 Dir & Non-Dir. Relay	B
39	SP/Prot/Cat - 39	SIEMENS make multi-functional Protective relay with Bay Controller (SIPROTECH 7SJ-62 V4-2)	B

Sr No	FILE NAME	DESCRIPTION	Category
40	SP/Prot/Cat – 40	Siemens make Differential Protection Relay for Transformer Generator for Motor Bus Bar SIPROTECH 7UT612 V4-0	B
41	SP/Prot/Cat – 41	Ashida Electronics Pvt.Ltd. Operation Manual for OC/EF Protection Relay	B
42	SP/Prot/Cat – 42	Areva training on MICOM Master Class	B
43	SP/Prot/Cat – 43	Doble India - Power System Prot. Notes Steady State Automated Relay testing & Dynamic Relay testing	B
44	SP/Prot/Cat – 44	Easun Reyrolle Ltd. Hosur (Transmission & Distribution)	B
45	SP/Prot/Cat – 45	VATECH REYROLLE Technical Duobias-M Transformer Protection	B
46	SP/Prot/Cat – 46	ABB Feeder Terminal SPAEC-310C SPAC 312-C	C
47	SP/Prot/Cat – 47	Multi-function meter RISHAB make	C
48	SP/Prot/Cat – 48	CSPC PL-300 Multi-function Protection	B
49	SP/Prot/Cat – 49	MICOM P631, P632 & P634 Transformer Differential Protection Panel	B
50	SP/Prot/Cat – 50	Operation Manual (Cat) for multi-function meter (SATEC) Meter used in Easun Reyrolle (CPRP)	D
51	SP/Prot/Cat – 51	Product Selection Guide Selec	D
52	SP/Prot/Cat - 52	MICOM- P921 / P922 / P923 Voltage & Frequency Relays Areva make (Technical Guide)	B
53	SP/Prot/Cat - 53	Catalogue and O & M Manual for Areva make CPRP at Nariman Point RSS	B
54	SP/Prot/Cat - 54	Integrated Catalogue and O & M Manual for Areva make CPRP at Nariman Point RSS	B
55	SP/Prot/Cat – 55	Micom P127, P632, MVAAM21, MVAJM25, MVAXM25 Areva Relay	B
56	SP/Prot/Cat – 56	Catalogue and Manual for ER make CPRP (CSPC Relay) at Grant Road RSS	B
57	SP/Prot/Cat – 57	Catalogue and Manual for OMICRON make CT Analyser	B
58	SP/Prot/Cat – 58	Manual for ABB make 33kV 1500MVA SF6 switchgears	B
59	SP/Prot/Cat – 59	Manual for PONOVA make 3 phase Current Injection Set	B
60	SP/Prot/Cat – 60	Megger Catalogue for Current Injection Set	B
61	SP/Prot/Cat – 61	ELSPEC Product Catalogue	C
62	SP/Prot/Cat – 62	BENDER product catalogue	C
63	SP/Prot/Cat - 63	MICOM P141/ P142 / P143 Feeder Management Relay Tech. Manual	C

**SPECIFICATION FILE**

Sr No	FILE NAME	DESCRIPTION	Category
1	SP/Prot/Sp - 1	145kV GIS SW.GR.	C
2	SP/Prot/Sp - 2	11kV, 350 MVA VCB SW/GR.	C
3	SP/Prot/Sp - 3	CP/RP for 33/11kV RSS	C
4	SP/Prot/Sp - 4	36kV GIS SW/GR. 110kV BACKBAY RSS SP.NO.1220395	C
5	SP/Prot/Sp - 5	110/33kV CP/RP and Metering Panel for 110kV BACKBAY RSS SP.NO.A-440195	C
6	SP/Prot/Sp - 6	110V DC, Portable Power Supply SP.NO.9802	B
7	SP/Prot/Sp - 7	Primary Current Injection set	B
8	SP/Prot/Sp - 8	Secondary Current Injection set	B
9	SP/Prot/Sp - 9	Variac, Single Phase SP.NO.9804	C
10	SP/Prot/Sp - 10	AVR	B
11	SP/Prot/Sp - 11	Digital Time Interval Meter (Timer)	B
12	SP/Prot/Sp - 12	Digital Tong Tester and Multimeter	B
13	SP/Prot/Sp - 13	33kV, SF-6 Sw/Gr. SP.NO.1220181	C
14	SP/Prot/Sp - 14	11kV, 2300 MVA Cap. Bank 11kV Reactor	C
15	SP/Prot/Sp - 15	11kV 250 MVA Sw/Gr. for DSS	C
16	SP/Prot/Sp - 16	High Speed Tripping Relay for SP.NO.9902	C
17	SP/Prot/Sp - 17	O/C. + E/F Relay	C
18	SP/Prot/Sp - 18	Capacitor Protection Relay	C
19	SP/Prot/Sp - 19	Differential & RE/F Relay	C
20	SP/Prot/Sp - 20	Bus Bar Protection	C
21	SP/Prot/Sp - 21	Auto Transformer Protection	B
22	SP/Prot/Sp - 22	Under/Over Voltage Protection	B
23	SP/Prot/Sp - 23	Motor Protection	C
24	SP/Prot/Sp - 24	R.M.U.	B
25	SP/Prot/Sp - 25	Distribution Transformer	B
26	SP/Prot/Sp - 26	11kV 250 MVA VCB for DSS Automation	B

Sr No	FILE NAME	DESCRIPTION	Category
27	SP/Prot/Sp - 27	Core Balance C.T.	C
28	SP/Prot/Sp - 28	HRC Fuses	B
29	SP/Prot/Sp - 29	DC Supply unit	B
30	SP/Prot/Sp - 30	For 90 MVA Power Transformers	B
31	SP/Prot/Sp - 31	For 400 kV CP for MSEB	C
32	SP/Prot/Sp - 32	Supply, installation, testing commissioning & maintenance of 11kV 350 MVA Indoor VCB Switchgear with local SCADA, SPEC. NO. 1250102 Part - I	B
		Supply, installation, testing commissioning of 11kV, 350 MVA, Indoor, VCB Switchgear SPEC.NO.1250109. (DGMES Approved) Part - II	B
33	SP/Prot/Sp - 33	36kV GIS SW/GR. For SENAPATI BAPAT MARG RSS	B
34	SP/Prot/Sp - 34	Control, Relay Alarm and Metering Panel for Dr. B. Ambedkar RSS, SPEC No 440605	B
35	SP/Prot/Sp - 35	145 kV GIS for Dr. B. Ambedkar RSS SPEC No 440605	B
36	SP/Prot/Sp - 36	Frequency Relay Panel	B
37	SP/Prot/Sp - 37	HP Compaq make Laptop Computer	C
38	SP/Prot/Sp - 38	11kV, 350 MVA, Indoor, VCB Switchgear (Spec no 1250107)	B
39	SP/Prot/Sp - 39	Control, Relay and Alarm Panel for Nariman Point 110kV RSS	B
40	SP/Prot/Sp - 40	Control, Relay and Alarm Panel for 33kV Radial (Open Ring) Operated Network (Compact RSS) (Spect No 044B00009)	C
41	SP/Prot/Sp - 41	36kV GIS at 33kV Receiving Substation (Compact RSS) (Spect No 1390006)	B
42	SP/Prot/Sp - 42	Control, Relay and Alarm Panel for 110kV Khetwadi RSS and 33kV Grant Road RSS (Spect No 0440008)	B
43	SP/Prot/Sp - 43	Portable Single Phase Secondary Current Injection Set for Relay Testing	B
44	SP/Prot/Sp - 44	33kV SF6 Insulated Metal Enclosed Indoor Extensible RMU with VCB, Spec No 1350010	B
45	SP/Prot/Sp - 45	11 KV 350 MVA Indoor VCB SP No. 1250013 (Comments)	B
46	SP/Prot/Sp - 46	11 KV 250 MVA Indoor VCB SP No. 1390112	B
47	SP/Prot/Sp - 47	11 KV 250 MVA Indoor VCB SP No. 1390113 ( Horizontal Type)	B
48	SP/Prot/Sp - 48	33 KV 1500 MVA Indoor SF 6 VCB Switch Board Panel Set SP No. 122B0013	B
49	SP/Prot/Sp - 49	33 KV 1500 MVA VCB SW. GR. Bus Coupler For Futurex, Peninsula & Elphinston Order No. 4200968672 ABB	B
50	SP/Prot/Sp - 50	11 kV 350 MVA VCB Indoor for 18 RSS	B

## DOCUMENT

Sr No	FILE NAME	DESCRIPTION	Category
1	SP/Prot/Doc - 1	Fault Level Calculation	B
2	SP/Prot/Doc - 2	Steady State / Transient / Dynamic Relay Testing	B
3	SP/Prot/Doc - 3	BEST Protection System	B
4	SP/Prot/Doc - 4	CT/PT	B
5	SP/Prot/Doc - 5	Cable Fault locating technique	B
6	SP/Prot/Doc - 6	Feeder Protection	B
7	SP/Prot/Doc - 7	Power Transformer Protection	B
8	SP/Prot/Doc - 8	Bus Bar Protection	B
9	SP/Prot/Doc - 9	Oil Filled Cables	B
10	SP/Prot/Doc - 10	SCADA	B
11	SP/Prot/Doc - 11	Capacitor & Reactor Protection	B
12	SP/Prot/Doc - 12	Distribution Transformer Protection	B
13	SP/Prot/Doc - 13	Motor Protection	B
14	SP/Prot/Doc - 14	Tata Fault Level & Relay Settings 2	B
15	SP/Prot/Doc - 15	Earth Mat	B
16	SP/Prot/Doc - 16	Electro Static Discharge & Control	B
17	SP/Prot/Doc - 17	IE Rule and Act	B
18	SP/Prot/Doc - 18	Distance Protection	B
19	SP/Prot/Doc - 19	Thermal Overload Protection	B
20	SP/Prot/Doc - 20	Harmonics	B
21	SP/Prot/Doc - 21	Communication Protocol	B
22	SP/Prot/Doc - 22	Integrated Protection Control and Communication Benefits and C.B.I.P.	B
23	SP/Prot/Doc - 23	AVR Document	B
24	SP/Prot/Doc - 24	Transformer Protection Guide	B
25	SP/Prot/Doc - 25	Core Balance CT	B
26	SP/Prot/Doc - 26	Indian Electricity Rules 1937	B

Sr No	FILE NAME	DESCRIPTION	Category
27	SP/Prot/Doc - 27	Instrumentation & Control	B
28	SP/Prot/Doc - 28	Electricity Bill 2003	B
29	SP/Prot/Doc - 29	Protection, Measurement & Control	B
30	SP/Prot/Doc - 30	O&M Manual for C&G make 16 MVA 33/11kV Transformer for Ballard RSS	B
31	SP/Prot/Doc - 31	Seminar Documents	B
32	SP/Prot/Doc - 32	NPTI Power System Protection Manual, Bangalore	B
33	SP/Prot/Doc - 33	Training Program on Power System Protection at ESCI, Hyderabad	B
34	SP/Prot/Doc - 34	Technical Data version Jan 2008 IEC 61850/103, Protocol, Tap Charger Control & Transformer Monitoring System	B
35	SP/Prot/Doc - 35	Training Program on Power System Protection, Selection & Application of Numerical Relays at ESCI, Hyderabad	B

## EQUIPMENTS

Sr No	FILE NAME	DESCRIPTION	Category
1	SP/Prot/Eq - 40	SCADA System for RSS (AREVA SCADA Project File)	B
2	SP/Prot/Eq - 44	CP/RP for 33/11kV Power Transformer	C
3	SP/Prot/Eq - 44A	Frequency Relay Panel	B
4	SP/Prot/Eq - 52	11kV 250 MVA VCB to DSS Automation & Distribution Automation	B
5	SP/Prot/Eq - 103	Core Balance (Split Core) CT / Protection	C
6	SP/Prot/Eq - 107	Potential Transformer / RVT / NDR	B
7	SP/Prot/Eq - 122	33kV, 1500 MVA, VCB / SF6 Switchgear	B
8	SP/Prot/Eq - 125	11kV, 350 MVA, VCB RSS Switchgear	B
9	SP/Prot/Eq - 128	OCB for DSS / VCB Testing in Workshop	B
10	SP/Prot/Eq - 134	11kV R.M.U. at DSS	B
11	SP/Prot/Eq - 135	33kV R.M.U. at 33kV DSS / HT Room	B
12	SP/Prot/Eq - 139	11kV, 250 MVA, VCB DSS Switchgear	B
13	SP/Prot/Eq - 141	Distribution Transformer	B

Sr No	FILE NAME	DESCRIPTION	Category
14	SP/Prot/Eq - 201	Primary & Secondary Current Injection Set	B
15	SP/Prot/Eq - 202	AVR Correspondence	B
16	SP/Prot/Eq - 203	Auxiliary Current Transformer	B
17	SP/Prot/Eq - 204	Repairing of defective Relays from outside parties	B
18	SP/Prot/Eq - 205	PC correspondence	B
19	SP/Prot/Eq - 206	Procurement of equipment / instrument / tools ( Copies of Doble proposal Secondary Current Injection Set)	B
20	SP/Prot/Eq - 207	Procurement of relays / AVRs	B
21	SP/Prot/Eq - 208	Repairing of equipment / instrument / tools	B
22	SP/Prot/Eq - 209	Scrapping of equipment / instrument / tools	B
23	SP/Prot/Eq - 210	Scrapping of relays	B



24	SP/Prot/Eq - 212	Relay correspondence	B
25	SP/Prot/Eq - 213	Relay connection details for Relay testing	B
26	SP/Prot/Eq - 216	Relay for Capacitor protection	B
27	SP/Prot/Eq - 217	Measurement of Switchgears Operation timings	B
28	SP/Prot/Eq - 218	Testing equipments / instrument Inventory	B
29	SP/Prot/Eq - 219	List of defective relays	B
30	SP/Prot/Eq - 221	Compact Sub-station	B
31	SP/Prot/Eq - 222	Distribution Automation in North Zone	B

### GENERAL

Sr No	FILE NAME	DESCRIPTION	Category
1	SP/Prot/Relay - 1	Statistical data of Relay Section	A
2	SP/Prot/Relay - 2	Trial installation of Relay	C
3	SP/Prot/Relay - 3	DSS SW/GR Test Reports / Relay Testing	C
4	SP/Prot/Relay - 4	MIS of Relay section	B
5	SP/Prot/Relay - 5	Stores Correspondence / Stores Procedures	B
6	SP/Prot/Relay - 6	11kv changeover	B
7	SP/Prot/Relay - 7	Coordination meeting with TPC (TATA Coordination)	B
Sr No	FILE NAME	DESCRIPTION	Category
8	SP/Prot/Relay - 8	SCADA correspondence	B
9	SP/Prot/Relay - 9	Routine Relay testing programme / Relay Retrofitting Schedule / Outage Schedule	B
10	SP/Prot/Relay - 10	ISI specification ETDC	B
11	SP/Prot/Relay - 11	Tripping investigation messages	B
12	SP/Prot/Relay - 12	Tender Recommendations Secondary Current Injection Set	B
13	SP/Prot/Relay - 13	E-mails received & sent	B
14	SP/Prot/Relay - 14	Tender for comments	B
15	SP/Prot/Relay - 15	Classified list of Indian Standards	B
16	SP/Prot/Relay - 16	General – Monsoon Booking	B
17	SP/Prot/Relay - 17	TATA Correspondence	B
18	SP/Prot/Relay - 18	KLG ISSUES RELATED RSS	B
19	SP/Prot/Relay - 19	Schedule of Estimates & Schedule of Charges	B
20	SP/Prot/Relay - 20	Drawings for comments	B
21	SP/Prot/Relay - 21	Drawing for comments SBM 36kV GIS	B
22	SP/Prot/Relay - 22	Drawing for comments SBM 36kV GIS Sw/Gr.	B
23	SP/Prot/Relay - 23	Drawing for comments CP/RP 33/22/11kV Areva	B
24	SP/Prot/Relay - R24	Drawing for comments CP/RP 33/22/11kV Transformer Protection	B

25	SP/Prot/Relay - R25	Drawing for comments 110kV SBM RSS CP/RP	B
26	SP/Prot/Relay - R26	Drawing on comments 110kV Nariman Point RSS CARP AREVA	B
27	SP/Prot/Relay - R27	Comments on Drawing of Areva make 11kV 350MVA VCB Switchgears	B
28	SP/Prot/Relay - R28	Comments on Specification of 11kV, 350 MVA VCB Switchgears (Nariman Point RSS)	B
29	SP/Prot/Relay - R29	Comments for 33kV 1500MVA ABB make SF6 switchgear	B
30	SP/Prot/Relay – R30	Comments on drawings of ER make Control Relay & Alarm Panels for various RSS – Suitability of protection relays	B
31	SP/Prot/Relay – R31	Comments on Drawing 11kv VCB FOR NARIMAN POINT RSS-AREVA MAKE	B
32	SP/Prot/Relay – R32	Comments on drawing on relay based SCADA in N & CN ZONE by M/S Areva.	B
33	SP/Prot/Relay – R33	Comments on drawing submitted by M/S.CGL for 11kV VCB Swgr for DSS(2011)	B
Sr No	FILE NAME	DESCRIPTION	Category
34	SP/Prot/Relay – R34	Comments on drawing submitted by M/S.EASUN REYROLL for 11kV VCB for RSS.	B
35	SP/Prot/Relay – R35	Comments on drawing submitted by M/S.EASUN REYROLL for CARP	B
36	SP/Prot/Relay – R36	Comments on drawing submitted by M/S. CGL for 33kV VCB Switchgear for RSS.	B
37	SP/Prot/Relay – R37	Comments on drawing of 11kV VCB for N P RSS submitted by M/S. AREVA	B
38	SP/Prot/Relay – R38	Comments on drawing submitted by M/S. CGL for 33kV VCB for RSS.	B
39	SP/Prot/Relay – R39	Comments on drawing of Indoor, 33kV RMU submitted by M/S. ABB	B

**RELAY ORDER FILES**

Sr No	FILE NAME	DESCRIPTION	Category
1	SP/Prot/Order/0-1	Easun Rey Rolle Relay (Part – I, II & III)	B
2	SP/Prot/Order/0-2	Doble USA make 3-Phase Secondary current injection Set	B
3	SP/Prot/Order/0-3	Siemens Relay	B
4	SP/Prot/Order/0-4	L & T Relay	B
5	SP/Prot/Order/0-5	Areva (Alstom) Relay (Part - I & II)	B
6	SP/Prot/Order/0-6	Motawani Instruments	B
7	SP/Prot/Order/0-7	ABB Relay	B
8	SP/Prot/Order/0-8	Accord Enterprises	B
9	SP/Prot/Order/0-9	Ashida Electronics	B
10	SP/Prot/Order/0-10	Bieeco Lawrie	C
11	SP/Prot/Order/0-11	Omicron CT Analyser (Datalock)	B
12	SP/Prot/Order/0-12	EMCO make AVR	B
13	SP/Prot/Order/0-13	PONOVA make 3 Phase Current Injecting Set - SCOPE	B
14	SP/Prot/Order/0-14	Aplab SCR Pre-regulated Bench Rack	B

**CATEGORY WISE PERIOD: A - INDEFINITE PERIOD B - 5 YEARS C – 3 YEARS D - 1 YEAR**

**DETAILS OF VARIOUS REGISTERS**

Sr. No.	Description	Classification
1	Despatch Inward Register	C
2	Despatch Outward Register	C
3	Peon Despatch Book	C
4	Inventory Register	A
5	Sunday / Holiday Working Register	B

6	O. T. Register	B
7	Permanent Staff Register	A
8	Attendance Register (Muster) Permanent Staff	B
9	Attendance Register ( Muster) Casual Labour	B
10	Daily Booking Register	B
11	Imprest Cash Book Register	B
12	Reimbursement of Taxi Fare Register	B
13	Tea Bill Register	C
14	Casual Labour Jobsheet Book	C
15	Service Termination Book	B
16	Leave Register ( A & B Grade Officers)	B
17	Leave Register ( Staff )	B
18	Issue of Napkin & Soap Register	D
19	S. R. File movement Register	A
20	Trainee / Apprentices Attendance Register	B
21	P. F. Book	C
22	P. F. Register	B
23	D. L. Book	C
24	Material Requisition Book	D
25	Material Despatch Book	C
26	L.T. A. Register	C

**CATEGORY WISE PERIOD: A - INDEFINITE PERIOD B - 5 YEARS C – 3 YEARS D - 1 YEAR**

# SYSTEM PROTECTION DEPARTMENT

## Annex- IV

### The statement of the categories of documents that are held by or under department's control

Sr. No.	File No	Description	Category
1	All files as mentioned in Annex-III	<b>The rules, regulations, instructions, manuals and records held and used by employees of the department for discharging functions as per the list attached in Annex-III, However These files will be scrapped after 5 year when the equipment is obsolete or taken out of service.</b>	A
		<b>ESTABLISHMENT FILES</b>	
2	Est.1	Establishment Schedule- staff strength	A
3	Est.2	Creation of post(proposals)	A
4	Est.3	Revalidation of Post	A
5	Est.4	Appointment	A
6	Est.5	Probation/Confirmation	B
7	Est.6	Promotion-Promotion policy	B
8	Est.7	Reversion	B
9	Est.8	Transfer	B
10	Est.9	Separation	A
11	Est.10	Trade Test	B
12	Est.10A	Representation to B.C.	B
13	Est.11	Grading of Staff	A

Sr. No.	File No	Description	Category
14	Est.12	Seniority List	B
15	Est.13	Acting Arrangement	B
16	Est.14	Deputation	B
17	Est.15	Loan Arrangement	C
18	Est.16	Attendance	B
19	Est.17	Leave	B
20	Est.18	Working Hours	C
21	Est.19	Discipline & Disciplinary Action	B
22	Est.20	Standing Orders	A
23	Est.21	Service Regulation	A
24	Est.22	Fidelity Insurance	B

25	Est.23	Overtime/Holiday Working	B
26	Est.24	Meal Allowance	C
27	Est.25	Other allowance	C
28	Est.26	Payment & Recoveries	B
29	Est.27	ID/BT(Bus Pass)	C
30	Est.28	Uniforms - Clothing	B
31	Est.29	Periodical Returns(Ex.Employee)	C
32	Est.30	Festival Advance	C
33	Est.31	Grains	C
34	Est.32	Quarters	B
35	Est.33	Scholarship	C
36	Est.34	PF/SF/EMF/FP Scheme & Gratuity	C
37	Est.35	Welfare	C
38	Est.36	Certificates - Circular for issue of certificates, copies of certificates issued to employees	C
39	Est.37	Civil Defence	C
40	Est.38	Accident & Assaults (Except Ele. Acc)	C
41	Est.39	Medical	C
Sr. No.	File No	Description	Category
42	Est.40	Residential Address	C
43	Est.41	Voluntary Subscription	D
44	Est.42	Qualification & Experience for post	A
45	Est.43	Employees State Insurance	C
46	Est.44	Incentive Bonus Scheme	B
		<b>STORES</b>	
47	Stores - 1	Stores matters & Procedures	A
48	Stores - 2	Specification ISI	A
49	Stores -3	Literature Technical Data	B
50	Stores - 4	Stores Material Catalogue	A



51	Stores - 5	Stock position of vital item	C
52	Stores -6	Requirement of Material	C
53	Stores - 7	Annual Contract	B
54	Stores - 8	Material Test Report/Inspection Report	B
55	Stores - 19	Scrapping & disposal	B
56	Stores - 26	Purchase form/Tender/Quotation	B
		<b>ADMINISTRATIVE FILES</b>	
57	Adm.1	Vehicles	C
58	Adm.2	Telephones & Telecomm.	C
59	Adm.3	Office Building	C
60	Adm.4	Office Accommodation	A
61	Adm.5	Locks & Keys	B
62	Adm.6	Office Furniture & Equip- Capital	A
63	Adm.7	Office Furniture & Equip- Dead Stock	A
64	Adm.8	Tools & Equip Capital	A
65	Adm.9	Tools & Equip Dead Stock	A
66	Adm.10	Stationary & Printing	D
67	Adm.11	Capital Inventory	A
<b>Sr. No.</b>	<b>File No</b>	<b>Description</b>	<b>Category</b>
68	Adm.12	Departmental Manual	A
69	Adm.13	Administrative Report	A
70	Adm.14	BEST Committee & Corporation matters	B
71	Adm.15	Circulars	B
72	Adm.16A	Procedure Orders-Guidelines	A
73	Adm.17	Delegation of powers	A
74	Adm.18	Administrative Orders	A
75	Adm.19	Confidential Papers	A
76	Adm.20	Security Arrangement	B
77	Adm.21	Theft & Properties	B

78	Adm.22	Strikes	C
79	Adm.23	Records Classification	A
80	Adm.24	Audit queries	B
81	Adm.25	Accounts matters	B
82	Adm.27	Budget Estimates	B
83	Adm.28	Budget Control	B
84	Adm.31	Supply Branch Conference	A
85	Adm.34	Stores & Engineering Conference	B
86	Adm.40	Union Matters	B
87	Adm. 41	Public Relations.	C
88	Adm.45	Canteen	C
89	Adm.46	Imprest Cash	B
90	Adm.48	Meeting of Other Departments	B
91	Adm.49	Reports on visits & inspection	C
92	Adm.52	Awards/Rewards to employee	B
93	Adm.58	Instruction given by AGMS/CES	A
<b>Sr. No.</b>	<b>File No</b>	<b>Description</b>	<b>Category</b>
		<b>TRAINING</b>	
94	Trg.1	Training - Policy & Suggestions.	C
95	Trg.2	Training - in outside institutions.	C
96	Trg.3	Training - Prob Engr./SSA/Engg. Student.	C
97	Trg.5	Training in M.V. Driving.	C
98	Trg.9	Technical Lectures and Visits	C
99	Trg.11	Workers Education Scheme	C
		<b>STUDY</b>	
100	Study - 11	Computerization	B

101	Study - 15	I.B. Scheme & Operational Efficiency.	A
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<b>STATISTICS</b>			
102	Stat - 28	Management Information.	A
103	Stat - 29	System Coincide KVA Maximum Demand (MD).	C
104	Stat - 36	Monthly Statistical Returns of Electric Supply	A
105	Stat - 53	Schemes - Monthly Reports of Pending Cases.	C
<b>STAFF RECORDS</b>			
106		Service Record Files of the Officers & Staff	

**CATEGORY WISE PERIOD: A - INDEFINITE PERIOD B - 5 YEARS C – 3 YEARS D - 1 YEAR**

