

CHAPTER XVI

POWER PLANT SYSTEMS FOR TELECOM. INSTALLATIONS.

16.1. GENERAL

16.1.1 This chapter discusses the power supply requirements for following Telecommunication Equipments:

Train Radio System.	Public Address System
Microwave/UHF Equipments.	Passenger Information Display System
Optic Fibre Equipments.	Close Circuit Television
Multiplexing Equipments.	Centralised Clock System
Telephone Exchanges.	Networking Equipments
RE Cable Repeater	PRS, FOIS, UTS etc.
Train Traffic Control Equipments	Voice Logging Equipments

16.1.2 All Telecom Equipments shall be provided with a reliable Power Supply.

16.1.3 Telecom System/Equipments like Public Address System , Passenger Information Display System, Close Circuit Television System, Centralised Clock System, Voice Logging Equipments, Networking Equipments, PRS, FOIS, UTS etc. operates on 230 V AC Power Supply.

16.1.4 Telecom System/Equipments like Train Radio System, Microwave/UHF Equipments, Optic Fibre Equipments, Multiplexing Equipments, Telephone Exchanges etc operates on 48 V DC Power Supply.

16.1.5 Tran Traffic Control Equipments and RE cable repeater operates on 12 V DC and 24 V DC Power Supply respectively.

16.1.6 If more than one type of system such as Radio Equipment, Cable Repeater, OFC Repeater and Train Radio are housed in the same room or adjacent rooms of the same building, only a common power plant shall be used for all such systems.

16.2. SOURCE OF AC POWER SUPPLY:

- (a) In RE area, traction supply from both up and down catenary will be provided through AT Transformer with auto change over arrangement.
- (b) Local supply shall be single phase or 3 phase depending upon the load requirement.
- (c) Diesel generator shall be installed wherever local supply is unreliable and AT supply is not provided.
- (d) **PROVISION OF SOLAR BASED POWER SUPPLY SYSTEMS:** Solar based power supply system can be planned in non RE area where reliable power supply is not available and;
 - (i) Clear and sunny weather is generally available throughout the year.
 - (ii) Sufficient space free from shadow and any other obstruction is available for installation of the solar panels.
 - (iii) Proper cleaning of dust particles, tree leaves or any other foreign material from the surface of solar panel is ensured.
 - (iv) Adequate provision is made for storage of power for at least five continuous sunless days.

16.3. DIESEL GENERATOR SUPPLY

16.3.1. Diesel Generator Capacity: The capacity of the generators shall be calculated based on the present load requirements plus the anticipated increase of load, if any, in the next five years period. Load requirement for all the equipments including aviation lights & emergency lighting of equipment room shall be included. Operation of the air conditioners from the diesel generators shall not be permitted.

16.3.2 Installation of Diesel Generator Set :

- (a) Diesel Generators: The diesel generators shall be installed as per the manufacturer's instructions. All mountings shall be rugged, durable and sufficiently strong to withstand vibrations occurring in the area of the site. Anti-vibration cushion should be provided between the floor of the DG Room and the DG set. Diesel Generator should be earthed as per manufacturer's specifications.
- (b) Automatic Changeover: The generator shall be provided with automatic changeover arrangements from mains to standby and vice-versa.
- (c) Exhaust Gas: Exhaust gas shall be thrown outside the building through suitable exhaust pipes properly fitted & mounted. All flexible pipe connections shall be screwed or flanged. A suitable silencer shall be fixed at the end of exhaust pipe.

(d) Type of cooling: All diesel generators shall be air cooled type.

(e) Fuel Tanks: For remotely monitored and controlled stations the fuel tanks shall be mounted on the top of the engine permitting fuel supply by gravity. The capacity of the tank shall be adequate to store fuels for at least 24 hours of operation at full load.

(f) Wiring and Cabling: The cables and wires from the generators shall be drawn through rigid conduits or enclosed in proper channels.

(g) Starting System: The diesel engine generator shall start electrically by a separate engine battery. In the event of failure of the electrical start it shall be possible to start the engine by manual hand cranking.

16.3.3 Control System of Diesel Generator Sets:

(a) The control system of the diesel generator sets shall broadly have following capabilities:

- (i) Detection of AC mains failure.
- (ii) Detection of deviation of the mains supply voltage and frequency beyond prescribed limits (50Hz±2Hz).
- (iii) Detection of overheating of engines.
- (iv) Detection of high/low output voltage and frequency from the generator.
- (v) Detection of restoration of AC mains supply.
- (vi) Detection of low lubricant oil pressure
- (vii) Detection of V belt failure.
- (viii) Hour meter: To monitor the total operative time of DG Set.

(b) The control system shall generate alarm condition in case of fault conditions such as :

- High engine temperature
- Low oil pressure
- Generator overload
- Generator output beyond limits.

(c) In case of fault condition the control system shall shut down the diesel generator and lock it out of service until the same is manually reset by the maintenance personnel.

(d) The control system shall incorporate manual controls to permit:

- Testing of generator sets.
 - Bypass the automatic control systems and connect the generator output to the load.

16.4

AC POWER SUPPLY DISTRIBUTION ARRANGEMENTS

- 16.4.1 Notwithstanding this Clause 16.4, all existing installations shall continue with existing arrangement of AC Power Supply Distribution for Telecom Equipments. However new installation shall follow the guidelines stipulated herein.
- 16.4.2 Incoming AC Power Supply from AT Transformer (through Automatic Changeover), Local Power Supply, Diesel Generator Power Supply, Solar Panel Power Supply shall be terminated in an AC Distribution Board.
- 16.4.3 This AC Distribution Board shall have facility of changeover from one incoming source to other.
- 16.4.4 Incoming AC Power Supply on AC Distribution Board shall be terminated through MCCBs & MCBs of adequate capacity.
- 16.4.5 Outgoing Single Phase AC Power Supply for individual Telecom Equipment from AC Distribution Board shall be through MCBs of adequate capacity.
- 16.4.6 Integrated Surge & Transient Protection Devices shall be provided in AC Distribution Rack for sensitive Telecom Equipments. Surge & Transient Protection shall be as per guidelines/specifications issued by RDSO.
- 16.4.7 AC Distribution Board shall have sufficient spare capacity to accommodate anticipated future expansion. AC Distribution Board can be “wall mounted metallic enclosure” or “floor mounted cubicle”.

16.5 DC POWER PLANT SYSTEM

- 16.5.1 Battery Chargers and Voltage Stabilizers: All Telecom installations shall be provided with float cum boost charger of adequate capacity as per latest RDSO specification. Wherever input voltage is often found to be having large variation beyond 160 V to 270 V, stabilizer of suitable capacity, conforming to RDSO specifications, shall be provided.
- 16.5.2 Number of Battery Banks & Mode of Operation: One set of battery on float mode working should normally be planned. At all manned stations and prone to lightning, two sets of battery banks shall be planned in charge-discharge mode of operation.
- 16.5.3 Type and Capacity of Battery: In a controlled environment where temperature variation is not very large, VRLA batteries can be used. Where temperature variation is large, low maintenance secondary cells should be provided. The batteries shall be of adequate capacities to deliver the full load for a period of at least 12 hours duration throughout its useful life, considering future requirement.
- 16.5.4 Load requirement: The load requirement shall be calculated based on the present load plus the anticipated increase of the load, if any, in the next five years period.

16.6 DC POWER SUPPLY DISTRIBUTION ARRANGEMENT

- 16.6.1 Notwithstanding this Clause 16.6, all existing installations shall continue with existing arrangement of DC Power Supply Distribution for Telecom Equipments. However new installation shall follow the guidelines stipulated herein.
- 16.6.2 Incoming DC Power Supply shall be terminated in a DC Distribution Board. DC Distribution Board can be “wall mounted metallic enclosure” or “floor mounted cubicle”.
- 16.6.3 Incoming DC Power Supply on DC Distribution Board shall be terminated through MCB of adequate capacity.
- 16.6.4 Outgoing DC Power Supply for individual Telecom Equipment from DC Distribution Board shall be through MCBs of adequate capacity.
- 16.6.5 DC Distribution Board shall have sufficient spare capacity to accommodate anticipated future expansion.

16.7 REQUIREMENT OF POWER SUPPLY ROOM(S):

- 16.7.1 Wherever secondary batteries are used, the stabilisers, chargers, distribution boards and the changeover switches shall be installed in a separate room adjacent to the battery room.
- 16.7.2 Wherever VRLA batteries are used, the stabilizers, chargers, distribution boards and the changeover switches may be kept in same room as VRLA Batteries.
- 16.7.3 Power Supply Room(s) shall be dry, cool, well lighted and well ventilated. Exhaust fans shall be provided to remove fumes in all Power Supply Rooms where secondary batteries are installed.
- 16.7.4 It is desirable that the window glasses shall be frosted or painted wherever necessary to prevent direct sun rays falling on the cells.
- 16.7.5 The Power Supply Room(s) shall have a water sink and universal (5A & 15A) electric power plug for connection to the hand lamp.
- 16.7.6 The Power Supply Room(s) where secondary batteries are installed shall be provided with acid resistant tiles on floor and the walls up to 1.5 M.
- 16.7.7 A thermometer to measure the room temperature should also be kept in the battery room.
- 16.7.8 All cable entry points should be rodent proof.

16.8 REMOTE MONITORING AND CONTROL SYSTEM:

16.8.1 The arrangement shall be approved by CSTE of the Railway. It shall have the following features.

- (a) All digital microwave, UHF links and OFC Communication System shall have the facility of remote monitoring and control of the power plant systems.
- (b) The control system of the power plant shall provide following vital alarms to the remote monitoring system
 - Mains failure
 - Diesel Generator failure
 - Battery set failure
 - Charger failure
 - Low level of fuel tank
- (c) The control system shall be capable of accepting and reacting to following vital commands from the remote monitoring centre.
 - Start diesel generator
 - Switch off the diesel generator set
 - Changeover from charger no. 1 to charger no. 2 or vice versa.
 - Changeover from battery set 1 to battery set 2 or vice versa

16.9 MAINTENANCE

16.9.1 Maintenance of Diesel Generator Set:

- (a) Fuel tank shall be cleaned periodically. Fuel shall be filled through a removable wire gauze filter which shall form part of fuel tank. Before filling up, unused fuel shall be decanted/replaced if the DG set has been idle for a considerable time.
- (b) Level of lubricating oil shall be checked (before every engine start by using a suitable dip stick, provided with the engine, wherever manual start is in vogue) and proper care shall be taken to maintain desired / recommended level. Lubricating oil shall be changed periodically as per manufacturers' data for engine hour run.
- (c) Diesel generator sets shall be overhauled in accordance with manufacturer's recommendation. It is preferable to have them overhauled by the manufacturer or his authorised representative.
- (d) Alternators shall be cleaned periodically by using high-speed air suction / blowing machine. Carbon blocks shall be checked for their sizes and rectangular shapes with square edges at the contact-surfaces and armature slots

shall be cleaned by using painting brush with hard bristles. Checking and cleaning of alternators shall be done once in every three months or as the situation warrants.

(e) Automatic Starting Device, where provided, shall be tested periodically for effective starting during power failures and low voltage condition.

(f) Flexible coupling between the engine and the alternator shall be checked for elongated holes and replaced in time.

(e) The no load and on load voltages of the alternator shall be maintained within limits and the Governor adjusted during periodic maintenance to the RPM specified and a steady output of 50Hz. The DG set shall run for 5-10 minutes on load to verify its proper working during periodic maintenance check.

(f) A log book shall be maintained at every location which shall bear the history of performance and maintenance of Diesel Generator Set together with the signatures of the maintainers and SE(Telecom).

(g) Wherever auto start is not reliable, the same shall be disconnected and steps taken for manual start /hand cranking of generator during power failure and also to stop the engine as soon as power supply resumes. Steps should be taken to rectify the auto start as early as possible.

(h) The log book shall be maintained as per proforma given in APPENDIX-I.

16.9.2 Maintenance Of Power Supply Equipment

(a) The working of battery charger shall be checked of proper working of switches, fuses etc.

(b) The power equipments shall be cleaned by a blower or any other device to remove dust.

(c) Wiring shall be checked to ensure that they are in good condition and connections are properly tightened up.

(d) Record of voltage and load current of all power equipments shall be maintained.

16.9.3 Maintenance Of Secondary Cells:

(a) Cable to connect battery terminals and load should use proper colour code of wires. Red and blue wire should be used to connect positive and negative terminals.

(b) The battery room shall be kept well ventilated, free from water, oil and dust. Surroundings of batteries shall be kept clean.

(c) Connecting cables shall be flexible and sufficiently long to prevent strain on the battery terminals. Connecting lugs shall be fitted to battery posts / terminals by using suitable nuts/bolts & tightened by using flat and spring / serrated washers. Lugs at the end of conductors, utilized for making connections, shall be crimped and brazed.

(d) The electrical connections shall always be kept tight. Check nuts should also be used to maintain firm connections.

(e) The terminals and connections shall be coated with pure vaseline or petroleum jelly to prevent corrosion. Grease shall not be used.

(f) The electrolyte shall be maintained at the correct level by topping up with only distilled water as and when necessary.

(g) Electrolyte loss due to spillage shall be replenished with proper amount of electrolyte of the same specific gravity as that of remaining electrolyte in the cell. Electrolyte of proper specific gravity prepared by using industrial grade acid and distilled water shall only be added with cells in fully charged condition and after sufficient time has been allowed to cool down the cells to room temperature. Electrolyte to a cell shall be added gradually in minimum quantity so as to attain the same specific gravity as that of other cells in the battery bank after a few cycles of charge/ discharge. Electrolyte shall not be added under any other circumstances.

(h) Each cell shall be tested as per maintenance schedule so that its voltage and specific gravity are within specified limits. Test results shall be recorded in the battery history card as per APPENDIX-II.

16.9.4 Periodic maintenance schedule of Power Supply Equipments is given in Appendix-III.

16.9.5 Records And Reports:

The inspector in-charge of Telecom Installation and remote control centre shall arrange to maintain;

a) The record of interruptions of main power supply and utilisation of the DG set with details of each duration.

b) Record of supply and utilisation of diesel fuel.

c) Prepare monthly interruption reports of mains supply/upkeep/utilisation of DG set and send to Sr.DSTE/Dy.CSTE(MW)/Dy.CSTE(Tele).

16.9.6 Records And Reports By Sr.DSTE/Dy.CSTE(MW)/Dy.CSTE(Tele):

Sr.DSTE/Dy.CSTE(MW)/Dy.CSTE(Tele) shall analyse the monthly report and take follow up action with concerned divisional officers as to minimise the interruption of the main power supply. Consistent long duration interruptions of the main supply and the follow up action taken should be brought to the notice of Chief Communication Engineer through special reports. He will also take follow up action to overcome the other problems in order to improve the performance of telecom system to the required level of efficiency.

MAINTENANCE SCHEDULE FOR POWER SUPPLY SYSTEM

EQUIPMENT	ITEM	MAINTAINER	SECTIONAL ENGINEER	SR.SECTIONAL ENGINEER
Battery Chargers	Cleaning & tightening of all connections	Weekly	-	-
	Checking of working	Weekly	-	-
	Measurement of voltages & load current	Weekly	Monthly (Every installation)	Quarterly (Every installation)
Batteries	Cleaning & tightening of all connections	Weekly	-	-
	Measurement of voltages and gravity	Weekly	Monthly (Every installation)	Quarterly (Every installation)

MAINTENANCE SCHEDULE OF THE DG SET

EQUIPMENT	ITEM	MAINTAINER	SECTIONAL ENGINEER	SR.SECTIONAL ENGINEER
Generator	Measurement of voltage on load/OFF load	Weekly	Monthly	Quarterly
	Load current	-do-	-do-	-do-
	Checking of lubricant	-do-	-do-	-do-
	Cleaning of DG Set	-do-	-do-	-do-

MAINTENANCE OF SOLAR PANEL

EQUIPMENT	ITEM	MAINTAINER	SECTIONAL ENGINEER	SR.SECTIONAL ENGINEER
Solar cell	Cleaning of Solar panel	Weekly	-	-

	Measurement of terminal voltage of solar panel	Weekly	Monthly	Quarterly
	Measurement of current of solar panel	-do-	-do-	-do-
