BATTERY STANDARDS – FLOODED

CENTRAL OFFICE POWER SYSTEMS

1. INTRODUCTION

This is the Verizon Standard for Central Office Batteries. This standard is to be followed by battery suppliers, installers and by Verizon engineering and maintenance personnel. This document establishes *minimum standards* for the Verizon Company. It does not preclude individual States or localities from exceeding these standards, where local conditions warrant or require it.

This standard summarizes and supplements the following Telcordia document:

TR-EOP-000232 Generic Requirements for Lead-Acid Storage Batteries
(For paper copy, call Vendocs on 703-974-4137)

The above referenced document will remain the principal battery reference. In the event of conflict between the Telcordia document and this standard, this standard shall take precedence.

The lead-acid storage batteries used by Verizon are designed to supply continuous power to telecommunications equipment during the loss of commercial AC power to the rectifiers of central office plants. The battery plant is also intended to provide filtering between rectifiers and communications equipment. Individual cells are connected in series creating 23 or 24 cell strings in order to provide the required voltage and battery reserve per Verizon engineering standards.

The battery strings are required to provide infrequent and unpredictable discharges of duration ranging from a few minutes to several hours. Under normal power conditions, the strings are floated at constant voltage. Whenever these discharges occur, they are followed by a constant voltage recharge and then continuous float operation. Verizon currently deploys a wide variety of batteries, ranging from 100 ampere-hours to 4000 ampere-hours.

1.1 GENERAL

Whenever this practice is reissued, the reason(s) for reissue will be provided in this paragraph.

(a) This practice replaces all previous Bell Atlantic and GTE documents.

(b) Unless specifically noted all information will apply to flooded battery applications.

(c) Issue 5 updated sections 2.1.7, 2.1.10, 4.10.1, 4.13.1, and 6.5.1.

2. MATERIAL

2.1 Flooded Cell Material & Operational Requirements

Flooded cells shall meet the following requirements:

2.1.1 Flooded cells shall be designed for continuous float voltage of 2.17 to 2.20 volts per cell, and shall be capable of being fully recharged at this voltage after a complete discharge. Recharge efficiency shall be at least 95%.

2.1.2 Cells shall be constructed with lead-calcium or pure lead grids.

2.1.3 Cells shall have a life expectancy of at least 20 years at an ambient temperature of 77-80 degrees F with minimum end-of-life capacity of 80%.

2.1.4 All cells shall be capable of being fully discharged at the 3-hour rate to 1.75 volt per cell 3 times every year over their operating lifetime.

2.1.5 The Coup de Fouet voltage at the 3-hour rate shall not fall below the minimum listed voltage of the following string configurations:

- 23 cell string = 1.96 volts per cell
- 24 cell string = 1.88 volts per cell

2.1.6 Transparent containers are required that will allow interior inspection of each cell. Containers shall have a Limiting Oxygen Index (LOI) greater than 28% or V-0 listing.

2.1.7 Cell posts shall be manufactured in a manner that will allow each cell to be placed on the battery rack with the cell plates either parallel or perpendicular to the stand rails. This option will allow for the power engineer to orientate the battery plates either parallel or perpendicular to the battery stand rails, as required. It will also allow the edge of all plates within each cell to be visible for maintenance inspections or allow cell crystallization to be seen, depending on the office requirements.

2.1.8 Cells shall have permanently labeled information to include the following:

- Name of manufacturer
- Manufacturer battery type
- Battery size in A.H. (for the 8-hour discharge to 1.75 volt per cell)
- Nominal voltage
- Date of manufacture (e.g.: 10/01, 10/2001, etc.)
- Serial number including code of manufacturing location
- Torque and re-torque value for connections
- Chemical composition of the cell

- Polarity of cell posts

2.1.9 Cell matching shall be used to ensure maximum float stability within the respective battery string.

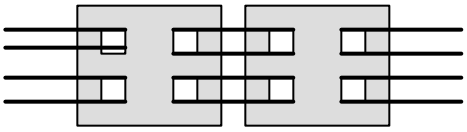
2.1.10 Individual cell voltage shall be within +/- 0.05 of the Verizon standard battery cell voltage with the battery string operating at float voltage.

2.1.11 Each cell shall be equipped with a venting device specifically designed to prevent the ingestion of airborne contaminants, and minimize the possibility of an explosion, if spark or flame is inadvertently introduced near the cell.

2.1.12 All cell jars should be pressure tested at the factory to ensure that all seals meet minimal requirements.

2.1.13 Cell post will be of a type that will allow the connection of cells using dual strap connectors.

Example:



2.2 Battery Racks

Battery rack construction and requirements standards are:

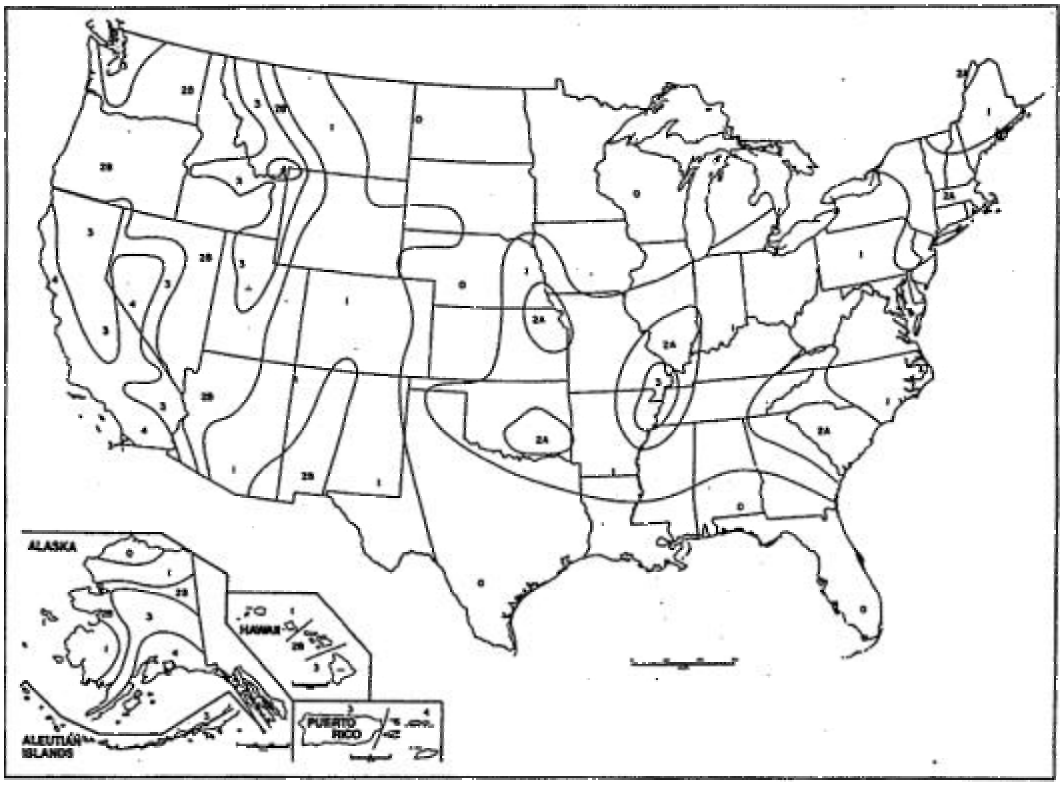
2.2.1 Battery racks for square jar batteries shall be constructed of metal with acid-resistant paint and reinforced shelves. The shelves or rails of the battery rack shall be protected by non-conductive, acid-resistant plastic placed under the battery.

2.2.2 Metallic battery racks will be pre-drilled to accept 2-hole crimp type (compression) copper lugs to enable the battery rack to be grounded.

2.2.3 Polyester-glass battery racks shall be provided for round cell batteries.

2.2.4 Inter-tier cable support brackets will be incorporated into battery racks.

2.2.5 All battery racks shall be manufactured in compliance with minimum Seismic Zone 1 standards or for regional seismic requirements, whichever is greater, as described in Section 4 (Environmental Requirements) of TR-NWT-000063 (NEBS)



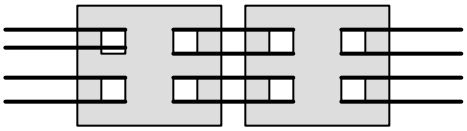
2.2.6 Maximum height of stands plus battery shall not exceed 8 feet.

2.3 Accessories for Flooded Cells

Accessories for flooded cell requirements are:

2.3.1 Inter-cell connectors shall be lead-plated copper. Dual cell connector sets shall be used, as appropriate, so that one connector may be removed for maintenance. Dual strapping of cells is required for post maintenance cleaning to maintain continuity of the connections.

Example:



2.3.2 Battery post terminal-plates shall be lead plated copper.

2.3.3 Cable lugs connected to cell posts or post terminal-plates shall be lead-plated copper. All other connectors and bus bar associated to battery shall be copper or clad copper.

2.3.4 The battery string's collection (splice) bar will be copper, and be pre-drilled to accept 2-hole, crimp type (compression) copper lugs. This requirement is to relieve cable termination forces from the battery terminals.

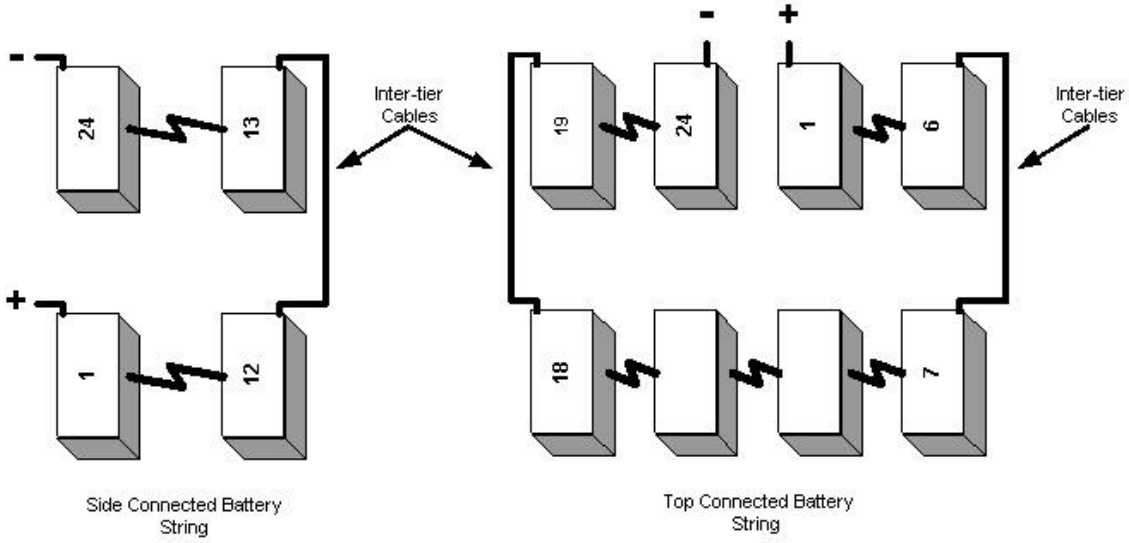
2.3.5 The battery supplier shall provide 1 hydrometer with holder and drip cup and thermometer for each battery string.

2.3.6 The battery area should have appropriate signs posted in the immediate area to satisfy OSHA, Right to Know Laws and all applicable notices as required.

2.3.7 Spill containment is an engineering decision based on the factors of the individual areas (PUC requirements, Earthquake zones, special requirements, etc.). Spill containment systems shall meet all Uniform Fire Code, Article 64, and Section 80 requirements. They are also to meet National Fire Protection Association and all regional, state and local requirements, as they may apply.

2.3.8 Any items deemed specialized to the installation and maintenance of the batteries (tools, etc.) will be included as part of the accessories.

2.3.9 Inter-tier cell connector cables shall be sized to carry the maximum available amperage with a minimum voltage drop at the rated 1-hour level to 1.75 volts per cell. There are two configurations used as described below:



2.4 Equipment Drawings & Documentation

Equipment drawings and documentation should contain the following:

2.4.1 Four complete sets of all documentation shall be provided free of charge on all equipment including, but not limited to planning, engineering, installation, maintenance, testing, and trouble shooting. Such documentation shall include all relevant drawings, (i.e.: wiring diagrams, schematics-including nominal voltage levels at test locations, face equipment drawings, text and materials, MSDS, and parts lists). One set of the above described documentation shall be provided and properly filed at the location of the battery installation.

2.4.2 Battery discharge curves, tables and Coup-de-Fouet for battery-sizing purposes shall be provided. The tables shall provide the cells various discharge ampere capacities for every hour, (1 through 10) in hour increments for each of the following specified end cell voltage: 1.75, 1.80, 1.84, 1.86, 1.88, 1.90, 1.92, 1.94 and 1.96 volts with hours reserve at 77 degrees F.

2.4.3 This information shall allow a trained technician to troubleshoot any system component of

the battery plant system.

2.4.4 Suppliers shall supply Verizon with staff support to develop methods and procedures specifically for Verizon if the present information provided is insufficient for Verizon's needs.

2.4.5 Detailed escalation procedures for all equipment shall be provided in the basic manual provided with the equipment. If software for engineering is available, it shall be included in the documentation package.

2.4.6 Microfiche/AutoCAD drawings and all on-going updates of microfiche/AutoCAD drawings shall be provided to Verizon at no charge.

2.5 Warranty

The supplier warrants to Verizon that materials furnished will be free of defect in design, material, workmanship and will conform to and perform in accordance with the specifications, drawings and samples including, without limitation, the requirement that the batteries shall deliver 80% or better of its rated capacity for its rated life expectancy. The supplier also warrants to Verizon that services will be performed in a workman like manner to Verizon's satisfaction. All warranties shall survive inspection, acceptance of material and payment. Unconditional guarantee means that the warranty shall cover and be effective and enforceable under all circumstances, conditions and situations without regard to the manner in which, or conditions under which the batteries are operated in any Verizon application.

Note: Verizon will not accept a requirement of periodic boost-charges as a condition for maintaining a string's warranty per manufacturer.

2.6 Functional Requirements

2.6.1 The battery will operate with little or no degradation in ambient temperatures between 74F to 80F. The battery will take charge from a nominal –48 volt rectifier system and support the electronic load bus.

2.6.2 The battery will be capable of being stored with little or no loss of charge state (very low self-discharge rate).

2.6.3 Provisioning

- Cells of different Specific Gravity shall not be mixed within a string.
- Strings of different Specific Gravity shall not be mixed within a power plant.

- Cells of different ampere-hour capacity shall not be mixed within a string.

2.6.4 Battery installation will conform to Verizon standard practices. The Battery Plant will be permanently labeled with:

- the string number
- date of installation
- float voltage value
- equalize voltage value (if applicable)
- alarm voltage threshold values

A completed Verizon initial battery form showing the successful completion of all required initial charging and capacity testing will be provided prior to placing the battery cell/string on to the Verizon network.

2.7 Power Conductors

All DC power cable installed between the Battery String and power plant components shall be in compliance with TR-NWT-000347, "*Generic Requirements for Central Office Power Wire*." All electrical conductors, connectors, and bus bars shall be copper or tinned copper.

3. ENGINEERING

3.1 Provisioning

Provisioning requirements:

3.1.1 Lead Antimony battery strings shall not be used. Lead Antimony cell replacement due to faults is allowed in existing battery strings only.

3.1.2 Cells of different Specific Gravity shall not be mixed within a string.

3.1.3 Strings of different Specific Gravity shall not be mixed within a power plant.

3.1.4 Cells of different ampere-hour capacity shall not be mixed within a string.

3.1.5 Where feasible, it is recommended that each power plant shall have a minimum of 2 battery strings.

3.2 Reuse

Reuse requirements:

3.2.1 Battery reuse shall be based on economics of battery life versus new.

3.2.2 Prior to reuse, the following tests and observations shall be conducted on the batteries:

- The service life and age of the battery shall be reviewed.
- Battery records shall be reviewed for proper maintenance activity
- The battery shall be tested for:
  - Correct voltage
  - Specific gravity
- The battery shall be inspected for:
  - Jar / case condition (cracks, leaks, etc.)
  - Plate condition (plate growth, lead sulfate crystals, etc)
  - Flame arrestor and cap
- Appropriate testing shall be performed to verify the remaining capacity of the batteries (e.g.: resistance test, conductance test, etc.)

3.2.3 Prior to reuse, cells shall be equalized/freshened prior to being placed on line.

3.2.4 Round cells list 1, 2, 3, & 4 with post corrosion categories 4 and 5 shall not be used.

Post categories 1 & 2 may be reused.

3.3 Sizing Of Battery Strings

The sizing of battery strings to meet the required reserve time must consider the following:

3.3.1 Minimum volts per cell required by the loads served by the power plant.

3.3.2 Voltage drops between the batteries and the loads.

3.3.3 Increased current due to constant-power loads including loading variables.

3.3.4 Additional power-failure loads

3.3.5 Additional capacity for future engineering growth.

3.3.6 Reserve shall be engineered to 80% of the actual capacity rating. This will allow sufficient time to engineer, order, and install additional batteries before the capacity limit is exceeded.

3.3.7 The following table is an indication as to how battery reserve time is to be determined.

Offices with Auto Start/Auto Transfer Generator	3 Hour Reserve Time
Offices with Manual Start/Manual Transfer Generator	4 Hour Reserve Time
Offices with a portable generator assigned to it permanently	5 Hour Reserve Time
Offices with no generator assigned to it	8 Hour Reserve Time

3.3.8 In addition, some states may require a reserve of no less than 4 hours. Where applicable, reserve hours shall conform to the designated State Regulatory Agency/Commission requirements of that state. An automatic start/transfer portable engine shall be considered a permanent engine for the determination of battery reserve hours required.

3.4 Monitoring

Monitoring recommendations are as follows:

3.4.1 It is recommended that flooded batteries be monitored for threshold deviations such as float voltage, battery temperature, etc.

3.5 Environment Requirement

Environment requirements are as follows:

3.5.1 Battery Room temperature shall be maintained at 77 – 80 degrees ? F. Battery room humidity shall be maintained between 20% and 55%.

3.5.2 Air Flow/Hydrogen: Battery rooms shall have sufficient airflow (at least 2 air changes per hour so that hydrogen may not achieve a 1% concentration with batteries on charge).

3.6 Storage

3.6.1 Batteries placed in storage shall be monitored for open cell voltage at regular intervals. The environment of the battery storage area shall be maintained at 77 degrees F (+/- 3). A boost charge shall be performed (when required) per manufacture's recommendations and documentation will be provided to Verizon to verify that boost charges and battery storage guidelines have been followed to ensure the integrity of the battery.

3.6.2 Batteries taken off of float for longer than six (6) months may be impractical for reuse.

3.7 Location

Battery plant location requirements:

3.7.1 Locating batteries near heating/cooling equipment shall be avoided at all times. A maximum deviation of 5 degrees F shall be maintained between batteries and battery strings.

3.7.2 Batteries shall not be installed in direct sunlight.

3.8 Disconnects in Central Offices

Battery disconnect devices shall not be provided in telephone power plants.

3.9 Floor Loading

Requirements for floor loading shall be found in the Verizon Power Standards on DC Power Plants, and Physical Protection and Electrical Compatibility.

3.10 Safety

Safety requirements for the battery plant:

3.10.1 Plant safety shall conform to OSHA requirements

3.10.2 Operations Department shall provide battery safety equipment (i.e., spill-kits, first aid eye wash kits, goggles, rubber gloves, and aprons etc.). Eyewash equipment must be within close proximity to battery equipment. Safety equipment shall be located near the entrance of the battery room or close to battery area.

3.10.3 Safety and Warning signs shall be posted in close proximity and shall include emergency contact numbers and battery chemical composition.

3.10.4 Electric Static Discharge "ESD" protection shall be provided in all installations.

3.10.5 ESD should be performed prior to all battery maintenance functions or when any contact is made with the battery plant.

Warning: ***Avoid creating sparks, including those from static electricity or use of an open flame since the gas is explosive when sufficiently concentrated. Before performing each individual work operation, firmly touch a grounded rack to discharge the static electricity from your body. (refer to BA 790-900-100 and other Verizon practices that apply).***

4. BATTERY INSTALLATION

Reference Documents

- Verizon Installation Practice IP 72201
- Telcordia Document GR-1275-CORE
- Vendors Installation Manual
- Verizon Initial Battery Installation / Baseline Battery Readings Record
- Verizon Initial Battery Capacity Test Record

4.1 General

4.1.1 Cells of different manufacturers shall not be placed in the same string(s).

4.1.2 Cells from different manufacturers may be placed in parallel strings.

4.1.3 When replacing cells in a string, the replacement cells shall have the same ampere-hour capacity, the same number of plates, the same plate chemistry, and shall be of the same manufacturer.

4.2 Cell Unpacking, Cleaning and Inspection

4.2.1 The installer shall inspect all cells upon delivery to the job site. Any defective cells shall be identified and reported to the Verizon field engineer.

4.2.2 After inspection the cells shall be wiped down per manufacturer's installation requirements.

4.2.3 Containers and covers shall be free from cracks and leakage or spillage of electrolyte.

4.2.4 Battery racks, stands, cabinets, and miscellaneous equipment shall be clean and free from corrosion.

4.2.5 Anti-explosion caps shall be dry, clean, and undamaged.

4.3 Hardware and Accessories

4.3.1 All connection hardware (bolts, nuts, and washers) on cell post connections shall be stainless steel.

4.3.2 Intercell connector straps shall be lead plated copper.

4.3.3 Intertier cables shall be appropriately sized to carry maximum load of the battery.

4.4 Preparation of Cell Posts, Straps, and Plates

4.4.1 The battery manufacturer's cleaning method/procedure shall be used.

4.4.2 Power tools shall not be used when cleaning lead plated surfaces**.**

4.4.3 The Installer shall provide equipment and protective devices for their personnel to clean lead surfaces safely**.**

4.5 Moving and Installing

4.5.1 Cells in a string are to be voltage matched and dated**.**

4.5.2 Explosion proof vents with dust caps and shipping plugs shall be fitted to each cell being moved.

4.5.3 Use proper hoist to lift cells from shipping crates to battery stand. Do not lift by the posts.

WARNING

Lead-acid batteries generate hydrogen gas. Before batteries are moved, they should be taken off charge to vent for a minimum of 24 hours before the shipping plugs are installed and the cells moved. Precautions shall be taken to avoid electrostatic discharge (ESD) that could initiate explosions within a battery cell.

4.6 Cell Charging

4.6.1 One cell shall be selected as the "Temperature Reference Cell" within each string. The cell shall be designated "TR". The 1st and/or last cell shall not be a Temperature Reference Cell. Record the temperature reference cell number in the appropriate box on the storage battery charge report.

4.6.2 A temperature reference cell shall be selected and designated in each tier if a string is located on more than one tier.

4.6.3 Temperature reference cells shall not be located at the end of a row of cells, next to a heating source, near windows, or over a working counter-cell.

4.6.4 Batteries shall be charged per manufacturer's specifications. Monitoring by the Installer shall prevent overcharging of batteries.

4.6.5 Proper electrolyte levels are as follows:

- Maximum Level - Top of the top line
- Minimum Level - Top of the bottom line

4.6.6 Only on initial charge may the electrolyte level rise above the maximum level line. Electrolyte levels are pre-adjusted by the manufacturer to be between the level lines when the cells are floated per manufacturer’s specifications.

4.6.7 If excessive electrolyte is to be removed from a battery cell it should be performed by an authorized representative of the battery manufacturer and not by a Verizon employee. The excess electrolyte shall be stored in an approved container(s). Contact the Verizon Safety, Health and Environmental organization for disposition of all electrolyte. The Installer shall note removals on the battery initial charge records.

4.6.8 Record the following before stopping the initial charge:

- Total hours of charge
- Temperature taken at the "temperature reference cell"
- Presence or absence of crystals for each cell

4.6.9 Cells should never be handled during initial/boost charge or for 24 hours thereafter.

4.6.10 After a satisfactory initial charge, there should be no lead-sulfate crystals or gray coloration present on the plates or straps when examined with a flashlight. Normally only the positive strap will be accessible for examination. In some arrangements, the edges of the positive plates will also be visible. The visible positive elements shall be black or dark brown and totally free of any diamond-like crystals or gray coloration. The disappearance of crystals normally occurs in three distinct phases:

- Phase 1: Black and crystalline
- Phase 2: Gray and lightly crystalline
- Phase 3: Black or dark brown and crystal free

4.6.11 The disappearance of crystals or gray coloration occurs from top to bottom during initial charge. To ensure total absence of crystals or gray coloration, inspection for crystals shall be concentrated at the bottom of the positive plate vertical columns. Crystals can readily be seen on the positive plate. The flashlight is held close to the jar at an angle of approximately 45 degrees. The lead-sulfate crystals will appear as sparkling diamond-like reflecting particles or as a gray coloration.

4.6.12 Cells which are not free of crystals after the initial charge, may be shorted. If some cells are still crystalline after the initial charge, proceed per manufacturer's recommendations.

4.6.13 For cells shipped dry, follow the same requirements for the end of the initial charge.

4.6.14 Lead-acid flooded cells shall be equipped with an approved flame arrestor in the vent opening.

4.6.15 Vents shall be located on the aisle side.

4.6.16 Installed batteries shall be charged to manufacturer's specifications.

4.6.17 Float voltage and specific gravity shall be maintained as required by the manufacturer and/or Verizon

4.6.18 Only thermometers approved for use with storage batteries shall be provided and/or used.

4.7 Battery Storage

Batteries placed in storage shall be monitored for open cell voltage at regular intervals. The environment of the battery storage area shall be maintained at 77 degrees F (+/- 3). A boost charge shall be performed (when required) per manufacturer’s recommendation and documentation will be provided to Verizon to verify that boost charges and battery storage guidelines have been followed to ensure the integrity of the battery.

4.8 Capacity Testing

All batteries shall be capacity tested prior to placement on to the Verizon network.
Reference IEEE Std 450 (flooded)

4.9 Initial Conditions

4.9.1 Verify that the battery has had an initial charge, and has been floating at the proper voltage level. The initial charge shall have been performed more than 3 days, but less than 7 days,

prior to the start of the capacity test.

4.9.2 Check all battery connections and make sure that all connectors are clean and tight.

Note: Connection electrical continuity can be established by the following one of the test methods below:

- DRLO (micro-ohm) measurements
- Milli-volt measurements during capacity test

Reference IEEE 484-1987

4.9.3 Review the initial charge records for proper specific gravity readings and open circuit cell voltages.

4.9.4 Verify the proper ambient temperature in the battery environment (77 f +/- 3 degrees).

4.10 Capacity Test Time and Discharge Rate

4.10.1 The recommended procedure is to make the test time the same length as the critical period for which the battery is sized (ie. 3 hr, 4 hr, 5 hr or 8 hr.). Consult with the Verizon engineer for the proper time period.

4.10.2 The discharge rate depends on the test time selected. It should be a constant current load equal to the manufacture's rating of the battery for the selected test time length. Consult the battery vendor discharge tables for the battery, time period, end cell voltage level to find the amp load.

4.11 Capacity Test Procedure

4.11.1 Disconnect the charger from the battery.

4.11.2 Connect the load to the battery.

4.11.3 Start the discharge, measure the individual cell voltages and continue to adjust the load in order to maintain the selected discharge rate (as the voltage drops, the current will tend to rise. Some load devices can compensate for this automatically).

4.11.4 Maintain the discharge rate as the battery terminal voltage decreases to a value equal to the designed 45.00 volt string voltage.

Reference:

- 1.88 volts per cell for 24 cell systems
- 1.96 volts per cell for 23 cell systems

4.11.5 Sometime during the discharge, take and record cell measurements (the best time is approximately 75% of the timeline).

4.11.6 At the end of the test period measure and record the string and cell voltages.

4.12 Capacity Test Results

4.12.1 Determining battery capacity: use the following equation to determine the battery capacity.

% capacity at 25 degrees C (77 degrees F) = Ta / Tr x 100

where:

Ta = actual time of test to the specified terminal voltage (45.00 volts)

Tr = rated time to specified terminal voltage

4.13 Post Capacity Test Activities

4.13.1 If the battery is within 80 % of the rated capacity then:

- Recharge the battery at the vendor "initial charge" voltage requirements. When charge current has stabilized (no further reduction in current for 3 hours) the batteries can be placed on to the Verizon network.

- Using a portable charger, match the string voltage to the active bus and connect the battery to the Verizon network. Voltage match threshold of 0 volts +/- 0.25.

4.13.2 If the battery is not within 80% of the rated capacity, contact your power group and/or the battery vendor.

Note: test form in development

4.14 Charging Records

4.14.1 A storage battery record must be maintained on each battery throughout the battery installation, charging and testing phases. The Verizon Initial Battery Installation / Baseline Battery Readings Record and Verizon Initial Battery Capacity Test Record is the only accepted method.

4.14.2 Completed battery reports shall be distributed to the manufacturer and the Verizon representative as identified in the MOP.

4.15 String Transitions

4.15.1 Specific requirements for string transitions are to be negotiated between the Installer and Verizon's Field Engineer, Power Supervisor, and Central Office Supervisor and documented in the MOP.

4.16 Battery Removal

4.16.1 Old battery cells must be removed promptly from the site once they are disconnected.

4.16.2 Details of the battery removal shall be outlined in a Method Of Procedure (MOP). The MOP shall include: Verizon Environmental Affairs hotline telephone number 1-800-386-9639 option 2.

4.16.3 Material safety data Sheets (MSDS) shall be available on site and attached to the MOP for the battery that is being removed.

4.16.4 Battery cells are to be handled as hazardous materials.
Reference: IP 72201 section 5

4.16.5 A portable spill containment kit shall be present on site and in close proximity to the battery being removed. The portable spill containment kit shall be of a size to accommodate a minimum of one battery cell electrolyte content. In the event of a spill Verizon Environmental Affairs must be contacted immediately at telephone number 1-800-386-9639 option 2.

4.16.6 Warnings shall be posted at the work site from the job start until complete removal of all hazardous materials from the job site is accomplished.

4.16.7 Environmental laws shall be strictly adhered to throughout the removal procedure.

4.17 Battery Disposal

4.17.1 Battery disposal shall be accomplished as outlined in Verizon Environmental Affairs guidelines and procedures. The Verizon Environmental Affairs web page is located at URL: http://safety.verizon.com/environment/index.shtml

4.17.2 Call Environmental Affairs at 1-800-386-9639 option 2, 24 hours a day for information regarding vendor identification and directions for containment and cleanup of battery acid spills.

4.17.3 All regulated hazardous materials generated during any installation or removal effort shall be disposed of in accordance with federal, state, or local law.

4.17.4 Environmental laws shall be strictly adhered to throughout the procedure.

4.17.5 A Manifest List, issued by Verizon Environmental Affairs is required.

5. MAINTENANCE

5.1 Battery Voltage

5.1.1 Batteries shall be floated in conformance with the manufacturers' specifications and Verizon standards pertinent to switching technology.

5.2 Battery Records (Filed at site)

5.2.1 Battery history records shall be available throughout the life of the battery and shall include the following information:

- Initial charge results recorded on Verizon standard form
- Initial capacity test results recorded on Verizon standard form
- Record of periodic voltage and specific gravity readings
- Record of corrective and preventative maintenance performed
- Manufacturer's product manual for installation, maintenance and operation
- Ambient room temperature
- Information given above shall be included in an Engineering database and updated, as required.

5.3 Battery Routines

5.3.1 All battery routines shall be completed as scheduled according to Verizon standard battery routines.

5.3.2 Battery routines are located on the TSS Power web page at URL:

http://nocwww.irngtx.tel.gte.com/cgi-bin/PowerIndex.cgi?state=Routines

5.3.3 Battery routine forms are located on the Verizon e-web in the job aids category at URL:

http://baimsa.verizon.com/telecom/it/eforms/

6. BATTERY – EMERGENCY GUIDELINES FOR ACID SPILLS

6.1 General

6.1.1 This section provides general guidelines for handling battery cell cracks and acid spills. The following organizations should be contacted immediately for assistance with the specific situation:

- Safety, Health & Environment (Hotline)
  800-386-9639 option 2
- Network Service Assurance Center (Power Maintenance Engineering)
  800-699-6722

6.1.2 In this section, battery cell electrolyte shall be referred to as “acid”.

6.1.3 Do not spread soda on acid spills inside of a building to avoid producing irritating vapors and depleting the room of oxygen.

6.1.4 Personal safety is the primary consideration when dealing with battery acid spills. Hazards include: corrosive acid, irritating vapors, hydrogen explosion potential, and electrical hazards.

6.2 Safety Equipment

6.2.1 The following safety equipment must be worn during all work operations near an acid spill:

- Splash-proof safety goggles
- Full face shield
- Acid resistant gloves
- Acid resistant apron
- Acid resistant boots

6.2.2 An AND-07 ANDAX BATTERY PAC or equivalent should be on site for minor clean-ups and large spill containment.

6.3 Small Spills

6.3.1 Small battery acid spills are defined amounts of acid less than 1 pint (16 ounces) with a surface coverage of less than 5 ft^2.

6.3.2 If the spill is in a readily accessible, open area with no major equipment contamination it may be cleaned-up by properly trained Verizon personnel. Wear all protective clothing as covered in section 6.2.

6.3.3 The acid should be absorbed using the pads from an AND-07 ANDAX BATTERY PAC spill kit or equivalent. Place the used pads in the plastic bags provided in the kit, secure with nylon tie and place in the normal trash.

6.3.4 Wash any residual acid with a Sodium Bicarbonate / water solution (1/4 lb. Soda per 3 gallons of water) several times. Avoid splashing or spreading the solution. Rinse the area several times with plain tap water.

6.4 Large Spills

6.4.1 Large battery acid spills are defined as amounts over 1 pint or with coverage of over 5 ft^2.

6.4.2 The following actions should be taken in the recommended sequence as listed below. The sequence may be changed based on the conditions of the specific situation.

(1) Evacuate personnel
(2) Assess the situation
(3) Report the spill
(4) Ventilate the area
(5) Contain the acid
(6) Remove the electrical hazard
(7) Remove the hydrogen explosion hazard
(8) Remove damaged cell

6.5 Evacuate Personnel

6.5.1 Evacuate all non-response (Haz-Mat) personnel from the immediate vicinity of the spill and minimize work activity to the clean up operation only. Avoid operating light switches or other spark-producing electrical equipment near the spill.

6.6 Assess the Situation

6.6.1 Assess the magnitude of the spill. This should include an estimate of the volume of the spill, the total surface area of the spill, the location of the spill, and is the spill from a working battery string.

6.6.2 Determine what, if any, equipment has been contaminated.

6.7 Report the Spill

6.7.1 Report the spill to the Verizon Environmental, Health and Safety group, Power Maintenance Engineering. **800-386-9639 Option 2**

6.8 Ventilate the Room

6.8.1 Ventilate the fumes and vapors to the outside if possible. Open doors, windows, and place fans, if available, to direct fumes away from occupied space and electronic equipment.

6.9 Contain the Acid

6.9.1 Wear all protective clothing as covered in paragraph 6.2.

6.9.2 Using approved acid containment materials, socks and pads, place them as a dam to stop the spread of acid. Dam all floor drains, floor openings and cable holes in the immediate vicinity of the spill.

6.9.3 Only trained haz-mat responders should attempt to absorb and remove large acid spills.

6.10 Removal of Electrical Hazard

6.10.1 If the acid spill is from a cell in a working battery string and the acid level is below some or all of the internal plates of the cell, the cell must be disconnected from the string immediately. Hydrogen gas will be present in the cell and the surrounding area. Spark, static discharge or any type of ignition source should be eliminated from the problem cell area.

6.10.2 First, disconnect the battery string that contains the leaking cell from the plant the farthest point away from the problem cell. (This should not be attempted if the string is under heavy discharge or recharge of more than 10 amps.) This may be done by removing all inter-cell connectors between 2 cells. Then remove the string connection to the battery bus and ground bus, which will reduce the hazard of other cells from spilled electrolyte.

6.10.3 The leaking cell inter-cell connectors should be removed only after purging the hydrogen gas from the cell and surrounding area.

6.11 Removal of Hydrogen Explosive Hazard

6.11.1 Before performing any work near a leaking battery cell with the electrolyte level below the internal plates, the cell and surrounding area must be purged of any hydrogen accumulation with an inert gas (nitrogen or helium). Nitrogen is readily

available in Verizon outside facility maintenance groups and will be referred to for our use. Technicians working near the leaking cell must discharge ESD buildup away from the cell.

6.11.2 Obtain nitrogen gas tank with a pressure regulator and a small diameter hose that will fit into the cell's fill hole. Secure the tank away from the leaking cell to permit the operation of the battery hoist. Set the regulator for a gentle (1-3lb) flow of nitrogen. Extend the hose to the cell and flow the nitrogen over the cell. Remove the cell's fill cap, insert the hose into the cell and purge for 15 minutes. Continue purging if possible during the hoisting and removal operation.

6.11.3 The cell should now be safe for disconnecting inter-cell connectors and its removal from the battery stand.

6.12 Removal of Leaking Cell

6.12.1 Leaking cells with exposed plates must be purged with nitrogen before disconnection or removal as covered above.

6.12.2 The residual acid in the exposed plates will permit them to self-discharge that can cause harmful vapors and sufficient heat to melt the battery container. The cell must be removed from the building and/or stabilized by submersing in water within 5 hours of plate exposure.

6.12.3 If possible, the leaking cell should be immediately placed in the authorized HAZMAT vendors' containment vessel. It should be removed from the building and transported to an approved disposal site.

6.12.4 If the cell cannot be safely removed from the premises, it should be placed in a heavy-duty polypropylene plastic container and moved to a secure area outside of the building. The cell and container should be filled with water to dilute the acid, reduce self-discharge and prevent internal sparking. Place absorbent socks and pads to prevent the spread of any spills to storm sewers or drains.

6.12.5 If the cell cannot be removed from the building, it should be placed in a heavy-duty polypropylene plastic container and moved to a secure area away from occupants and equipment. The cell and container should be filled with water as stated above. Place absorbent socks and pads to prevent the spread of any spills. Dam all floor drains, floor openings and cable openings in the immediate vicinity of the cells.