

Batteries

1. General

This addendum is issued to change and/or supplement the information contained in Bellcore Practice BR 790-100-655, Batteries.

2. Battery Types

- 2.1 Batteries used for telecommunications are either "flooded" lead acid type, or valve regulated lead acid (VRLA) type.
- 2.2 Flooded cells shall be used in all Central Office applications, unless they cannot possibly be accommodated due to floor space requirements. Flooded cells are further described as rectangular or round cells. The rectangular cells approved for use in the company have an expected life of 20 or more years when maintained at an optimum ambient temperature of 77°F. Round cells have an expected life of 40 or more years.
- 2.3 VRLA batteries are used in Remote Terminal (RT) applications where it is not practical to use flooded cells, either due to space requirements or maintenance requirements. VRLA batteries have an optimum life of 10 years or less. In the outside plant environment, expected battery life will be considerably less. Some manufacturers claim additional life, but these claims have never been borne out in accelerated life tests, or in actual field experience.
- 2.4 VRLA batteries use a recombinant technology. Hydrogen and oxygen gases produced within the cell are contained by the jar and pressure-regulated valve. However, the recombination efficiency is less than 100 per cent. Also, some gas escapes through the jar material leading to dry out, and ultimately, failure of the cell.
- 2.5 VRLA batteries are subject to thermal runaway. An increase in charge current, such as that caused by a shorted cell, or a high ambient temperature can lead to an increase in battery temperature because the battery cannot dissipate the additional internal heat. The temperature rise causes an increase in current (if a constant voltage charger is used), and the increase in current leads to further increase in temperature until the battery enters thermal runaway. Ultimately the batteries destroy themselves and may harm adjacent equipment.

3. Sizing Batteries

- 3.1 Minimum volts per cell (MVPC) used in calculating battery requirements for central office applications is 1.86. This satisfies the minimum voltage requirements of all central office switching and transport equipment in use today.

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3.2 An office previously engineered to another standard (i.e. 1.84 or 1.88) needs to be carefully analyzed prior to changing to the 1.86 standard. A lower MVPC has provided fewer batteries, but may have resulted in larger distribution cables. Arbitrarily increasing to the 1.86 standard may result in an unnecessary battery purchase. For example, a 1A ESS application may have used 1.84 MVPC. The 1.86 standard should be applied with the digital switch upgrade. Use of a higher MVPC, such as 1.88 or 1.90, may have resulted in use of smaller cabling, that will not be adequate at 1.86 MVPC. If the above considerations have been analyzed and it is determined that the plant will not sustain the 1.86 MVPC, the requirement of Paragraph 3.1 shall be waived.

3.3 MVPC for RT applications is 1.75.

4. Battery Reserve Time

4.1 Historically, the standard for battery reserve time has been a minimum of three hours in a central office equipped with automatic start and transfer engine-alternator. To this three hours additional time has been added to account for:

- A. Travel time if the office is unattended or partially attended.
- B. Time to connect a manual start engine-alternator to office loads.
- C. Time transport a portable engine to a site without a stationary engine.
- D. A factor to account for constant power loads (battery discharge tables are usually based on constant current discharge).

4.2 The new company standard for battery reserve time is as follows:

- A. For central offices equipped with a stationary standby engine-alternator (auto-start or manual start), provide 4 hours battery reserve, based on the constant current drain tables of the battery manufacturer. This will provide the 3-hour Bellcore recommendation (see BR 790-100-655), a reasonable amount of dispatch time, and also a component for constant power loads (typical of digital equipment). Note: If historic data or other special circumstances supports a dispatch time greater than 40 minutes, the power equipment engineer may add additional time to the battery reserve.
- B. For central offices without a stationary standby engine, provide a minimum battery reserve of 12 hours. This is based on an 8 hour criteria plus a factor of 4 hours for response and portable engine acquisition time. As offices reduce to this standard from the previous Southwestern Bell standard of 24 hours, consideration must be given to the number of offices serviced by each portable engine.
- C. Remote Terminals shall be provided with 8 hours battery reserve, unless equipped with a stationary AC engine alternator or DC generator. With an AC set, follow the criteria of 4.2.A (above). With a DC set, provide a minimum 3

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hour battery reserve.

Note: For battery reserve for Uninterruptible Power Systems, see Addendum 790-100-660, AC Power.

5. Battery Aging Characteristics

- 5.1 A cell should be replaced when it has reached 80 per cent of its rated capacity. Capacities can be checked by performing a discharge capacity test. In actual practice this test is quite laborious, and results are not usually available. Other information, such as physical condition of the battery, resistance or conductance test results, and other trouble conditions reported by Network Operations or Maintenance Engineering will be the basis of determining when the battery should be replaced.
- 5.2 Table 6-2, Temperature Versus Expected Life, in BR 790-100-655 does not accurately reflect the anticipated float life of the pure lead or lead-calcium batteries in use today.
- 5.3 The ideal ambient temperature for either flooded lead acid or VRLA batteries is 77°F. Each 15-degree rise in ambient temperature doubles the rate the battery ages. Lower temperatures (below 77°) will reduce the rate of aging, but at a reduction in battery capacity.

6. Other Considerations - VRLA Batteries

- 6.1 VRLA batteries shall be used with temperature-compensated chargers (rectifiers) and alarmed for high temperature.
- 6.2 Each string of VRLA batteries shall be provided with a disconnect arrangement. This is to meet the safety concerns of working with batteries in a confined space. The disconnect may be a quick-connect plug, a circuit breaker, or other suitable arrangement.
- 6.3 Because of premature aging of VRLA batteries, with a wide variation due to temperature extremes, the best means of determining the remaining life of a battery is through the use of conductance or resistance testing. Battery records should be maintained with the batteries indicating the initial test results at time of installation, and subsequent test results (minimumally once per year).
- 6.4 An approved battery monitoring system may be provided with VRLA batteries. Alarms from the monitoring system shall be as specified in the Alarm Standards Technical Manual.
- 6.5 If individual cells or blocks are replaced, the conductance or resistance of the new battery shall be matched with the rest of the string to optimize the life of the string.

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Placing a new battery in a string of batteries more than three years old is to be avoided.

7. Mixing Battery Types

7.1 With either flooded or VRLA batteries, the entire string is to be of a common manufacturer and type. Mixing battery types is not permitted.

8. Installing Batteries

8.1 Batteries sent to a staging or storage facility prior to installation must be recharged within six months of the date of manufacture.

8.2 Refer to TP76300 Installation Guide, or IJAH, for other battery installation criteria.