Planning & Structure
DC Power Plants, AC & DC Generation Sets

1. General

1.1 This addendum is issued to change, delete and supplement the information contained in BR 790-100-652. This is a merged practice (MP), and provides standards for Southwestern Bell, Pacific Bell, Nevada Bell, Ameritech and Southern New England Telephone (SNET).

1.2 The SBC LEC Power Equipment Engineer shall follow the appropriate Floor Space Planning Guide M&P when determining the floor assignment for new DC Power Equipment and Standby Engine/Alternator Sets. The SBC LEC Power Equipment shall utilize all required forms to request the appropriate floor space from CSPEC and to notify Corporate Real Estate (CRE) when appropriate.

1.3 The following are definitions of the appropriate terms used within the TP76400, TP76300 and the BSP series.

- Busy Hour Load (BHL):
  The amount of current required to provide adequate power to all loads placed on the power system during office peak operating conditions.

- Power Fail Load (PFL):
  The amount of current required to provide adequate power to all loads placed on the power system during commercial AC failure. To determine power fail load the BHL is added to any stand-by inverter loads that would only be present during AC failure and then multiplied by a factor of 1.15. The factor of 1.15 is applied to accommodate the increase of discharge current required as the voltage decreases.

- Minimum Volts Per Cell (MVPC):
  The minimum voltage to which each cell in a battery string can be allowed to discharge to and still maintain required operation of all equipment served. Reference BSP 790-100-655 MP for further information of this topic.

- List 1 Drain:
  Represents the average busy-hour current required at normal operating voltages.

- List 2 Drain:
  Representing the peak current required to operate equipment load under worst case operating conditions.

- Essential load:

Loads that must operate during prolonged loss of commercial power and must be connected to the standby AC Engine/Alternator system. It must be able to tolerate an interruption on the order of 5 seconds or more. Typical interruption times range from 10 to 90 seconds, for automatic standby Engine/Alternator systems, and extend to 15 minutes or more, for manual systems.

- Protected load:
  Loads that must operate during prolonged loss of commercial power and can only tolerate minimal interruption times. These minimal interruption times may range from a few milliseconds to approximately 5 seconds. For DC fed equipment the battery plant provides this power and for AC equipment a DC fed inverter shall provide the power. The allowable interruption time for protected power equipment should be chosen to match the requirement of the load.

  For example, a motor-driven inverter with a 5-second transfer time is sufficient for equipment with marginal protection requirements. However, critical services may require uninterrupted power. This may be provided by an inverter connected to the battery plant or by a UPS. All protected loads shall have long-term backup.

2. DC POWER SYSTEMS

2.1 Planning Intervals - RT Power

In planning power for a remote terminal (RT), the SBC LEC Power Equipment Engineer shall consider the ultimate PFL when fully equipped. The amount of rectifier capacity and battery capacity shall be designed for incremental growth (generally 2 years), so that unneeded capacity is not provided until required.

2.2 Planning Intervals - CO Power

In planning power for a central office, the SBC LEC Power Equipment Engineer shall consider the ultimate capacity of the PFL. Although specific regulatory agencies have defined our floor space reservation policies, ultimate power plant sizing should be done with at least a ten-year view[1]. Incrementally, the power plant equipment should be selected to provide present capacity requirements plus current year projection drains and two years growth.

In the deployment of secondary distribution bays the SBC LEC Power Equipment Engineer shall consider the actual load as well as the available fuse positions. Generally a new BDFB should be deployed when the existing has reached 80% of its usable fuse position capacity or 50% of the actual load.

2.3 Operating Voltage Limits

[1] Refer to the most current issue of the Floor Space M&P for the listed reservation limitations by state and or Local Exchange Carrier

Going forward the specific MVPC that shall be used is as follows:

- Flooded lead acid cells shall use a MVPC of 1.86 volts per cell.
- RT applications with Nickel Cadmium (NiCd) cells shall use 1.10 volts per cell.
- RT applications with Valve Regulated Lead Acid (VRLA) cells shall use 1.75 volts per cell.

The specific float voltage in various situations shall be as follows:

- Flooded lead acid cells shall use 2.17 volts per cell with a 24-cell string floating at 52.08 V.
- RT applications with Nickel Cadmium (NiCd) cells shall use 1.43 volts per cell with a 38-cell string floating at 54.4 V .
- RT applications with VRLA cells shall use 2.25 volts per cell based on a 24-cell string floating at 54 V.

2.4 Current Drains

The SBC LEC Power Equipment Engineer shall use List 1 drains to size major components of the power plant and List 2 drains to size discharge feeders and fuses. For more detailed information on such drains refer to BSP 790-100-656-MP.

2.5 Power Plant Models

Model power plants have been developed in coordination with our major approved power equipment suppliers as aids in engineering and to help reduce installation costs. The model power plant layouts are recommended for use whenever possible. The standard drawings for modeled power plants and power related equipment resides on the Common System Web page.[2] Standard drawings for packaged manufacturer models are currently available through the product supplier.

3. STANDBY AC ENGINE/ALTERNATOR SETS

Most central offices, and some remote terminals (RT's), are equipped with stationary standby Engine/Alternator Sets. Other sites are equipped with the connections necessary for the use of portable standby Engine/Alternators sets. Determination of which sites require the stationary Engine/Alternator sets shall be made by SBC Power Engineering staff based upon economical availability, office size, and regulatory and service requirements.

[2] At the release of this issue, limited standard drawing are available on the web. This "work in progress' project will continue to be enhanced.

Generally, stationary standby Engine/Alternator sets are not deployed to RT's. This being based upon cost studies showing that the use of batteries in RT's for a full 8 hours of reserve is the most economical and reliable method. Situations that may warrant the deployment of a stationary Engine/Alternator set to a RT site would be; sites that require more than 8 hours of reserve, sites where 8 hours of reserve cannot be provided, and locations that are too distant or difficult to reach within 8 hours. The local SBC LEC Power Engineering representative shall make the final determination.

3.1 Planning Intervals

An evaluation of central office or RT power requirements should be made at the time new network equipment is being added. Included in these reviews shall be an estimate of the total Kilowatt (kW) demand for the office. The SBC LEC Power Equipment Engineer, Power Maintenance Engineer and CRE representative shall use that information with other pertinent site data to determine specific Engine/Alternator set requirements.

3.1.1 Existing Engine/Alternator Set Augmentation

Projected kW requirements for an engineering period of 3 years shall be evaluated against the present capacity of the Engine/Alternator set. If the set is capable of handling the projected load, no action need be taken. The SBC LEC Power Equipment Engineer shall place a site on their "Engine/Alternator Replacement List" when the Engine/Alternator set is not rated to accommodate the projected 3-year load, or the set has been identified as being a reliability risk.

Due to capital expense related to Engine/Alternator sets, sufficient time must be allowed for the engineering, furnishing, design and installation of the unit. To insure the load does not exceed the design limitations of the existing Engine/Alternator set, power planning (e.g. budgetary allowances, scheduling and job specification assembly) should begin when the existing Engine/Alternator set has reached 80% of the present capacity. The SBC LEC Power Equipment Engineer shall prioritize the necessary capacity and reliability issues to determine the hierarchy of Engine/Alternator jobs to be completed.

3.1.2 New Engine/Alternator Set

Projected kW requirements for an engineering period of 10 years shall be determined and evaluated in conjunction with established customer base, economics, regulatory requirements, company requirements, and network reliability issues. The SBC LEC Power Equipment Engineer shall determine if and/or when a stationary standby Engine/Alternator set is required based upon that data.

3.2.3. Minimum Equipment Served

The following table outlines the minimum power requirement of specific equipment to be supported by the Standby AC power. The definitions at the beginning of this document define the requirements of essential and protected power.

ELEMENT	Essential	Protected
Network elements (switch, transport, data, CLEC equipment, power alarm reporting devices, etc		X
Network Equipment work center (MAP, MCC, etc) used to interface network elements		X
Internal Telephone System supporting the Network Elements	X	X
Uninterrupted Power Supplies (UPS)	X	
Air Compressors – dehydrators	X	
Fuel pumps, battery chargers and other AC power devices related to the standby engine/alternator set	X	
Air supply to the engine/alternator set when forced air is needed	X	
Furnace pumps (where used)	X	
Engine/Alternator Fuel Transfer Pumps (where used)		X
Sump pumps (where used)	X	
Air supply to equipment floors with temperature sensitive equipment	X	
Cooling of areas occupied by revenue producing equipment (including chilled air equipment and air handlers)	X	
Elevator - One per elevator bank in buildings over three floors	X	
Water pumps related to the fire protection system	X	
Lighting in Equipment areas	X	
Tower Lights (if applicable)	X	
Outside perimeter gate opening devices and their card readers		X
Exit lights/Stairwell lights		X
Electronic door access devices		X
Fire protection reporting equipment	X	
Building automation control systems		X
Exterior Security Lighting	X	

4. STANDBY DC GENERATION SETS

In 1997, SBC approved the use of stationary standby DC generator sets for back-up power at small sites requiring a high level of power system reliability, but too small to warrant the use of a standby AC plant. The largest approved set is rated at 5.5 kW. Applications include:

- Critical Remote Terminal (RT) sites.
- Repeater sites.
- Small Community Dial Offices (CDO).

4.1 The DC generator set controller assembly monitors the AC power into the facility, and also the output voltage of the DC power plant. In the event of a commercial AC power failure, or if the DC power voltage falls below a preset level, the generator set will automatically operate to provide DC power. When the generator set is on-line, it operates in parallel with the DC power plant. When AC power is restored and /or the DC power voltage returns to normal, the generator shuts down after a fifteen-minute interval to recharge the starting battery and cool down of the engine.

4.2 The use of a DC generator set provides backup during outages limited only by the fuel supply. Having the stationary set at the site eliminates the problems of dispatching a portable engine/alternator to a site during severe weather or widespread disaster, and mitigates the problem of theft of portable AC units in disasters. Plant investment, compared with a standby AC plant, is significantly reduced. DC loads require a smaller generator, there is no need for an automatic transfer switch, fuel storage and delivery is much less complex, and installation costs less. Reduced battery and rectifier requirements may in and of themselves nearly pay for the DC generator set.

4.3 The fuel for DC generator sets should be natural gas. If natural gas is not available, the alternative is LP gas. A minimum of 24 hours of fuel (LP gas) storage shall be provided. The SBC LEC Power Equipment Engineer shall work with the local fuel distributor, engine distributor, and local municipality to determine the best storage arrangement for the site.

4.4 When a DC generator is being considered, the SBC LEC Power Equipment Engineer shall consult with the Right of Way (ROW) group due to public acceptance and proximity to residential and business developments.

4.5 When deploying a DC generator set the SBC LEC Power Equipment Engineer shall ensure the presence of appropriate regular maintenance. The system requires maintaining oil, filter, and spark plug replacement, cleaning, and start battery replacement. If there is no yearly maintenance program available with the SBC organization the SBC LEC Equipment Engineer shall purchase one from the local engine distributor.