Standby AC Plants
(and DC Generators)

1. General

1.1 This addendum is issued to change and/or supplement the information contained in BR 790-100-659, Standby AC Plants.

2. Determining Engine Requirements

2.1 Most central offices, and some remote terminals, are equipped with on-site, stationary, standby AC plants. Additional sites may be provided a stationary, standby AC plant when justified economically, or to meet regulatory or service requirements.

2.2 A review of central office or RT power requirements is usually made at the same time as an addition of telephone equipment. Included in this review is an estimate of the total Kilowatt (KW) demand for the office.

2.2 When an engine-alternator is already installed, the projected KW requirements for the end of the power engineering period (normally 2 years) must be checked against the capacity of the engine. If the engine is capable of handling the projected load, no action need be taken.

2.4 If an installation of an engine is warranted or if an existing engine is not adequate to handle the projected load, the new engine-alternator should usually be sized to handle requirements for an 8 to 10 year period. Dependent on floor space availability, an existing engine may either be replaced with a larger engine or left in place and paralleled with one or more new (same or different size) engines. Floor space considerations may warrant the provision of a larger or smaller engine than that required to handle the 8 to 10 year projected load.

2.5 The minimum load placed on an engine shall not be less than the stated value provided by the manufacturer of that particular model.

2.6 A standby plant should be adequate to support the telephone equipment loads essential building loads, and special loads during a commercial power failure. In some smaller offices, all building equipment may be supplied power from the standby plant.

2.7 An engine-alternator must be sized to meet its demand (peak) AC load rather than its connected (steady state) load. There is a delay in the starting of the engine-alternator following commercial power outage. When the engine-alternator comes up to full voltage all the plant rectifiers will be energized. They will carry the equipment load and charge the batteries at the same time. The full output of all rectifiers including the spare may be required depending on how deeply the batteries are discharged.

2.8 All new or replacement engine-alternators shall be sized to accommodate air conditioning load. Air conditioning load may be placed on an existing engine-alternator if sufficient capacity exists.

3. Engine Start Equipment

3.1 Almost all diesel engine-alternator sets are arranged for electric start via a dedicated string of engine start batteries. Some of the larger diesel engines use compressed air for starting. All gas turbines are electric start.

3.2 Separate strings of start batteries shall be provided for each engine to insure start reliability. Adequate, essential AC power must be available for the input requirements of the start battery charger.

3.3 If a compressed air starter is used, air reserve must be sufficient for a minimum of four starts.

4. Automatic Start and Transfer

4.1 All new engines shall be equipped with automatic start and transfer capability.

4.2 Existing manual start engines should be upgraded to automatic start and transfer as the opportunity arises (i.e. engine replacement, or major office upgrade).

5. Fuel and Fuel Systems

5.1 Diesel fuel shall be used with all new or replacement engine-alternators, with the exception of small DC generators.

6. Fuel Tank Sizing Factors

6.1 In general, a new tank shall be sized to supply enough fuel at three-quarters full for 72 hours continuous operation of the engine-alternator.

6.2 If at all possible, fuel reserve should be accommodated in a day tank and/or Above-ground Storage Tank (AST), to avoid the expense of meeting local and federal codes for buried fuel tanks.

6.3 The useful life of diesel fuel is no more than 18 to 24 months, untreated. Oversizing a fuel tank may result in additional maintenance expense for treating and cleaning fuel, and cleaning of the fuel tank. Network Operations should be encouraged to routinely run an engine a sufficient number of hours to turn the fuel over about once every two years.

6.4 If calculated running time (based on demand load) should fall below 72 hours, tank facilities should be upgraded using the following criteria:

A. If the location is in Bellcore Earthquake Zone 4, upgrade the tanks on a next job basis.
B. In all other locations with running time capability less than 24 hours, upgrade on a next job basis.

C. In all other locations with running time between 24 and 54 hours, upgrade on a next major power job basis.

6.5 Availability of fuel may allow smaller fuel reserve.

6.6 In some larger offices, a smaller reserve may be provided because of the limited space available for fuel tanks.

6.7 If the tank being added is the last one that can be installed on the site, then the design period should be the exhaust date of the building site.

7. Other Considerations - Standby AC Plants

7.1 A diesel engine is water-cooled requiring a radiator. Two cooling arrangements are available:

- Engine mounted radiator
- Remote radiator and circulation system

The engine mounted radiator is pressurized and requires no water piping to the set. Standard radiators are provided with each set. When there is insufficient space available for provision of an engine mounted radiator and the associated air duct, or there is no access for exhaust of the heated air, a remote radiator may be provided.

7.2 Normally a single engine is preferred for applications up to 2000 KW. Local building configurations may dictate the need for multiple engines. To parallel a second standby AC engine-alternator with the one currently in service, additional equipment must be installed on the in-service set as follows:

- Cross current compensation
- KW/KVAR selector switch
- KVAR or power factor meter
- Synchronization lights (for manual synchronization)
- Automatic synchronizer with controls and indicators.
- Load sharing module (if required)
- Reverse power relay.

7.3 Real Estate Management shall be consulted when selecting the location of any standby engines installed in an office. The location is usually determined at the time a new building or addition is planned. The floor space must be adequate to handle the

standby engine and its associated equipment. Where possible, the engine should be located against a non-growth wall to avoid relocation when a building addition is required. Calculations should also be made to insure the adequate availability of intake air (both ventilation and combustion) and the adequate size and position of the exhaust stack. Building codes now require that all engines be enclosed in a fire wall because of the potential fire hazard associated with the fuel.

7.4 Technical staff maintains an engine specification document that is used by a power equipment engineer in preparing a Request for Quotation. Please refer to technical staff for the most recent issue of this document.

8. Other Considerations - DC Generator Set

8.1 In 1997, the company approved the use of stationary standby DC generator sets for backup power at facilities requiring a high level of power system reliability, but too small to warrant the use of a standby AC plant. At this time, the largest approved set is rated at 5.5 KW. Applications include:

A. Critical RT sites.
B. Repeater sites.
C. Small CDO's.

8.2 Theory of operation of the DC generator set is as follows:

The 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 an interval of about fifteen minutes to recharge the starting battery and cool the engine.

8.3 Use of a DC generator set provides unlimited backup during outages (to the limits of the fuel supply). Having the stationary set at the site eliminates the problems of dispatching a portable engine 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 (see guidelines below) may of themselves nearly pay for the DC generator set.

8.4 A DC generator shall normally be sized to carry the ultimate DC load of the site. If the ultimate load will exceed 5.5 KW, it must be sufficient to carry the existing connected load.

8.5 At sites with a DC generator set, provide a minimum 3 hours battery reserve.

8.6 Because of the way the DC generator set operates, it eliminates the need for a working spare rectifier. Thus, the number of rectifiers provided in the DC plant is based on the connected load.

8.7 The fuel of choice for DC generator sets is 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 engineer shall work with the local fuel distributor, engine distributor, and local municipality to determine the best storage arrangement for the site.

8.8 If a DC generator is being considered, consultation with the Right of Way (ROW) group is critical due to public acceptance and proximity to residential and business developments. The ROW is usually the customer contact in negotiations and obtaining the property.

8.9 Although a reliable alternative, the DC generator set does require regular maintenance, including oil, filter, and spark plug replacement, cleaning, and start battery replacement. It is recommended that a yearly maintenance program be purchased from the local engine distributor, until such time as enough of these units are deployed in a geographical area to economically justify self maintenance.

9. Standby AC Plant Engineering Responsibilities

9.1 Considerable coordination is required between the power equipment engineer and the Real Estate Management group when placing, upgrading or replacing a standby AC power plant. The chart following lists the major items of coordination and the responsible parties.

Item	Responsible	
	REM	Equipment Engineer
1. Items to be tied to emergency AC bus	X	X
2. Determining load and sizing engines	X	X
3. Portable or stationary operation		X
4. Selection of engine starting equipment		X
5. Location of engine and associated equipment	X	X
6. Should fire wall be provided	X	
7. Generator output voltage	X	X
8. Auto start and transfer	X	X
9. Sizing air intake louvers and filters	X	X
10. Sizing exhaust flue or stack	X	X
11. Sizing auxiliary venting equipment	X	X
12. Sizing exhaust louvers	X	
13. Remote or engine mounted radiator	X	X
14. Size and type of fuel storage tank	X	X
15. Location of fuel tanks	X	X
16. Recondition and/or modify engine		X
17. House service cabinet termination for emergency engine	X	X
18. Make provisions to meet the requirements of the Emergency Portable Engine Connection Plan BSP 155-002-900MP	X	X
18. Employing parallel operation of engines	X	X
19. Fuel lines	X	X
20. Sound attenuation	X	
21. Structural design	X	