

Standby AC Plants (and DC Generators)

1. General

This addendum is issued to change and/or supplement the information contained in BR 790-100-659, DC Plants. This is a merged practice (MP), and provides standards for SBC.

1.1. Definitions:

- **Block Load** – The total of all loads which may be simultaneously presented to a standby generator at the instant of transfer.
- **In-Rush** – This term is typically applied to the instantaneous over current drawn by rectifiers immediately upon being turned on. It is a result of the time it takes for a magnetic field to build up around the transformer cores and provide a suitable back-EMF to promote efficient operation of the rectifiers.
- **Re-Charge Load** – This is the power-plant load that exists after a battery discharge event. It may be expressed as A.C. re-charge load, i.e., the total of the A.C. load measured in Kilowatts pulled by all the rectifiers. Or it may be expressed as D.C. re-charge load i.e. the total of the D.C. outputs of all the rectifiers measured in amperes. For the purpose of this practice we will only be interested in A.C. re-charge load.
- **Steady-State** – This is the current that is drawn by any load after it has stabilized. That is, after all surges, in-rushes, and recharge loads have fallen back to normal.
- **Surge** – The momentary over-current which is drawn by most motor loads upon start-up. This start-up current is typically nearly double the current which is drawn once the motor reaches its normal operating speed under full load.

1.2 Standby gensets found in SBC Central office are designed, engineered, and maintained based on the “Standby use (classification)” under block loaded conditions.

2 Determining Engine Requirements

2.1 Most central offices are equipped with a stationary standby genset. Other sites are equipped with the connections necessary for the use of portable standby Engine/Alternators sets. Determination of which sites require stationary standby gensets shall be made by SBC Power Engineering staff based upon economical availability, office size, regulatory and service requirements.

2.2 Typically, stationary standby genset (including DC type) 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

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that may warrant the deployment of a stationary DC Generator 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 power engineering representative shall make the final determination.

- 2.3 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, a power planning evaluation (e.g. budgetary allowances, scheduling and job specification assembly) shall begin when the existing Engine/Alternator set has reached 80% of the present capacity (a capacity alert will also occur in PowerPro). This planning trigger is to insure that any change or replacement occurs before the existing Engine/Alternator(s) exceeds 100% capacity. 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 10 year projected load.
- 2.4 Under run conditions, the actual load placed on an engine shall not be less than the manufacturers minimum stated value of that particular model. In some cases the Power COE may engineer an artificial load (load bank) to insure the engine runs at the minimum recommended levels that may be found in the first several years of deployment. This artificial load may be in the form of CRE building load(s) or supplemental installed load banks.
- 2.5 A standby genset should be adequate to support the telephone equipment loads essential building loads and certain HVAC loads during a commercial power failure. In some smaller offices, all building equipment may be supplied power from the standby plant.¹
- 2.6 In addition to projected Central Office growth, a standby genset must be sized to meet its block loaded demand AC requirements, based on normal building AC recovery.², rather than its connected (steady state) load. There is a delay in starting the engine-alternator following a 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.
- 2.7 All new or replacement standby gensets shall be sized to accommodate air conditioning load. Air conditioning load may be placed on an existing engine-alternator if sufficient capacity exists. Once the HVAC system has been integrated

¹ See load chart in BSP 790-100-652MP

² BSP 002-217-157 Central Office Power Equipment Load Test and Operational Review par 5.7

into the standby load calculation, it is now considered a part of the network load, for any future calculations.

- 2.8 Even though various forms of standby AC generation may be found on the market today and may be considered, based on specific application restrictions, the reciprocal diesel is still considered the most efficient, economical, and reliable power source found today. Therefore, the diesel technology remains the SBC Standard.

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. If a compressed air starter is used, air reserve must be sufficient for a minimum of four starts.
- 3.2 All new and replacement engine start battery applications shall include redundant start batteries. See the SBC Approved Product List, Engine Start Battery Product Approval Notices and Woodduck Drawing Web page for specific application information. 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 applications shall be equipped with automatic start and transfer capability.
- 4.2 Existing manual start engines should be considered for upgrade to automatic start and transfer as the opportunity arises (e.g. engine replacement/addition, or major office upgrade). However, economic factors should support this upgrade in lieu of total replacement. Factors include; current load demand, forecasted growth, engine life expectancy, cost differential, etc.

5. Fuel and Fuel Systems

- 5.1 Diesel fuel is considered the primary fuel choice. However, specific application restrictions may employ alternative fuels.
- 5.2 Environmental Management (EM) tank and monitoring system specifications are available through EM, however, minor alterations to these standard specs should be made to accommodate local, state codes.
- 5.3 Environmental permits and/or tank registrations are required by state/local environmental regulatory agencies often prior to installation, therefore, SBC-EM

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shall be notified as early as possible of planned tank additions and replacements to assist the SBC project manager in obtaining appropriate compliance documents.

EM provides Spill Prevention Control and Countermeasure (SPCCs) Plans when required at facilities with aboveground tanks. The plans must be fully implemented prior to the tank(s) being fueled. As SPCC plans are based on cumulative aboveground storage volumes and regulatory requirements are subject to change, contact EM.

Additionally, if a tank removal is part of a new tank system installation/upgrade, contact EM at 866-I WANT EM (866-492-6836).

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, and 96 hours at full fuel capacity for the continuous operation of the engine-alternator.

6.2 Availability of fuel may allow smaller fuel reserve. Any decision to limit the fuel storage shall be a joint decision between NP&E engineering, Network Operations LFO and SBC-EM.

6.3 Various local codes will dictate the specific fuel tank arrangement. The most efficient and cost effective decision shall prevail.

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

Where applicable, the set mounted radiators shall be the first choice.

7.2 Normally a single engine is preferred for applications up to 1500 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)

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- Reverse power relay.

7.3 Corporate Real Estate (CRE), SBC-EM and the NP&E Floor Space Planner shall be contacted 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.

7.4 SBC NP&E Power Technical Staff maintains an engine specification document (BSP 790-100-658MP and 790-100-658JP) that is used by a power equipment engineer in preparing a Request for Quotation. These detailed documents shall be used in preparation, justification and engineering of new genset applications.

7.5 Environmental permits to install and/or operate are required by most state/local environmental regulatory agencies prior to generator installation, therefore, EM shall be notified as early as possible of planned generator additions and replacements.

8. Other Considerations - DC Generator Set

8.1 Standby DC generator sets may be used 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. DC generators cannot be used in applications where the need exists to support any AC powered systems. Applications include:

- A. Critical RT sites (per criteria listed in Section 2)
- 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

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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.

8.4 A DC generator shall be sized to carry the ultimate DC PFL load of the site.

8.5 At sites with a DC generator set, provide a minimum of 4 hours battery reserve.

8.6 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.

8.7 If a DC generator is being considered for an RT application, 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.

8.8 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 quarterly 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.

8.9 Environmental permits to install and/or operate are required by most state/local environmental regulatory agencies prior to generator installation, therefore, EM shall be notified as early as possible of planned generator additions and replacements.

9. Standby AC Plant Engineering Responsibilities

Considerable coordination is required between the power equipment engineer, CRE, SBC-EM and the NP&E Space Planner when placing, upgrading or replacing a standby AC power plant. 13-State joint methods have been created to support these efforts and shall be followed to insure a properly completed project.