

## **D C PLANTS**

### **1. General**

1.1 This addendum is issued to change and/or supplement the information contained in BR 790-100-654, DC Plants. This is a merged practice (MP), and provides standards for Southwestern Bell, Pacific Bell and Nevada Bell.

### **2. Engineering Guidelines for New -48 Volt Rectifier Plants**

#### 2.1 Steps in Plant Sizing

- A. Make a list of all the equipment that will be using power from the power plant being engineered (i.e. converter plants, switching systems, transmission systems, inverters, etc.).
- B. Determine the normal and emergency dc voltage limits of the equipment. For central office, it is recommended that emergency dc voltage limits be equated to 1.86 volts per battery cell. This satisfies the requirements for all switching and transmission equipment presently used in company. For RT power, use 1.75 volts per cell.
- C. Determine the List 1 current drains of all the equipment on the list for the estimated period (up to 10 years), for the ultimate sizing of the plant.
- D. Total the drains for the present load plus 2 years projected growth and use this total to determine rectifier and battery requirements for the initial plant. (Note: RT power - we emphasize the use of List 1 drains in sizing rectifiers and batteries)
- E. In general, a busbar plant will be used if the ultimate sizing of the plant is or will be above 4000 amps.
- F. Select rectifiers based on AC voltage and phase requirements. 480V AC shall be used if available (C.O. applications). For RT, single phase 120/208V or 240V AC is the preferred choice.
- G. The engineer shall select a model from the approved list that most closely meets the requirements. If an appropriate model does not exist, then material shall be selected from the current list of approved products endorsed by the Common Systems - Cross Functional Sourcing Team. Contact technical staff for further information.

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- H. Two Power Distribution Service bays(cabinets) shall be provided per battery plant. These shall be separately fed from the house service board. Normally, the power equipment engineer specifies the AC bays (cabinets) and Real Estate Management provides the AC inputs. These bays (cabinets) are dedicated for use with the battery plant. In CDO applications with rectifiers smaller than 200 amps, the use of a single Power Distribution Cabinet will suffice. This paragraph does not apply to RT power.
- I. Select the battery strings using methods outlined in Addendum 790-100-655 MP.
- J. Lay out the floor plan of the power equipment. Reserve sufficient space (with floor space planner) to allow for maximum growth of the plant. Coordinate with Real Estate Management to assure floor loading is sufficient to support the weight of batteries and plant. Also, determine if air handling is sufficient to assure the minimum number of air exchanges per hour for the batteries provided. If local codes require acid spill containment, the power equipment engineer will be responsible for providing containment to meet the code.

## 2.2 Rectifier Requirements

- 2.2.1 Use the connected-equipment List 1 (busy hour busy season) current drains to find the base number of rectifiers required.
- 2.2.1 Provide one more rectifier than is required to carry the load. This is a working spare, so that failure of any one rectifier in the plant does not cause the batteries to discharge. Thus if N rectifiers are required to carry the load, at least N+1 rectifiers are provided. The working spare rectifier is always the largest capacity rectifier in the power plant, and is often referred to as the maintenance spare rectifier.
- 2.2.2 The engineering criteria documented in BR 790-100-654 provides adequate recharge capacity in applications with flooded batteries. A 1.2 recharge factor will be used when determining rectifier requirements. The maintenance spare is included in this 20% charging capacity. The recharge factor will assure that batteries are sufficiently (nominally 95 %) recharged within a 24 hour period to protect against a subsequent power outage.
- 2.2.3 If valve regulated lead acid batteries are used, **DO NOT** add a recharge factor. Excess charge capacity is a significant contributor to the risk and severity of thermal runaway.

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- 2.2.4 Individual rectifiers shall be sized so that the capacity of no single unit is greater than  $\frac{2}{3}$  of the discharge load as measured at float voltage. This will ensure that no single malfunctioning rectifier will be able to drive the plant to a high voltage condition.
- 2.2.5 On all new power plants, the engineer shall provision rectifiers of the same capacity, manufacturer and type, both initially and for growth.
- 2.2.6 On existing power plants, provisioning rectifiers of the same capacity, manufacturer and type is strongly recommended. There are locations that have mixed rectifier types. Change out of these rectifiers to meet this recommendation is not economically justified.
- 2.2.7 When upgrading/modernizing a power plant, the new controller and the new rectifiers shall be from the same manufacturer. If rectifiers are not being added, choice of the controller will depend on the rectifier types in place.
- 2.2.8 Low voltage disconnects **SHALL NOT** be used. (An exception is with DMS-10. When DMS-10 is replaced, the low voltage disconnect circuit shall be disabled.)
- 2.2.9 Power plants with end cell switches shall be considered for replacement on an individual case basis. The considerations for replacement are the present condition of the plant, its maintenance history, availability of spare parts and services, the criticality of services supported and other local factors.

### **3. Engineering Converter Plants**

#### 3.1 Converter Plant Considerations

- 3.1.1 When a converter plant is considered for "large" loads (e.g. loads greater than 100 amperes), consideration should also be given to a battery plant. The cost of the extra energy consumed by a converter plant (resulting from the additional conversion) may be higher, over the life of the plant, than the cost of a battery plant. In certain instances, a large load converter plant may be desirable to help add load to an underutilized battery plant and thus increase its energy efficiency. An economic study can be undertaken to determine the more cost effective configuration for a particular application..

#### 3.2 Steps in Plant Sizing

- 3.2.1 A converter plant is sized based on the connected equipment's peak current drains. A converter plant does not have short term overload capability and cannot absorb short term current demands above the total converter output (as batteries do in rectifier plants). Enough converter capacity must be provided for possible short term peaks.

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- A. Make a list of all the equipment that will be using power from the converter plant (e.g. repeater lines).
- B. Determine the normal and emergency dc voltage limits of the equipment.
- C. Determine peak current drains.
- D. Total the drains per voltage and use this total to find the converter capacity necessary for the plant(s).
- E. Project the maximum current drain for the Estimation Period.
- F. Select the converter plant(s) and associated features (e.g. plant capacity, distribution panels).
- G. Lay out a floor plan for the power equipment.

### 3.3 Working Spare

3.3.1 A plant should include one more converter (as a working spare) than is required for the total peak current drains. If any one converter fails, the remaining converters will not be overloaded.

### 3.4 Sizing of Load Distribution Facilities

3.4.1 Unlike battery plants, converter plants have a limited amount of output energy available for clearing short-circuit faults. If the load fuses and/or circuit breakers are of too large an amperage (either individually or cumulatively) with respect to the total available plant output capacity, the plant may be unable to clear short-circuit faults and may shut down due to low output voltage. No discharge fuses and/or circuit breaker larger than the installed converter capacity less one working spare will be used. When a converter plant is installed to replace an existing battery plant, the discharge fuses must be checked and downsized if necessary to meet this requirement.

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