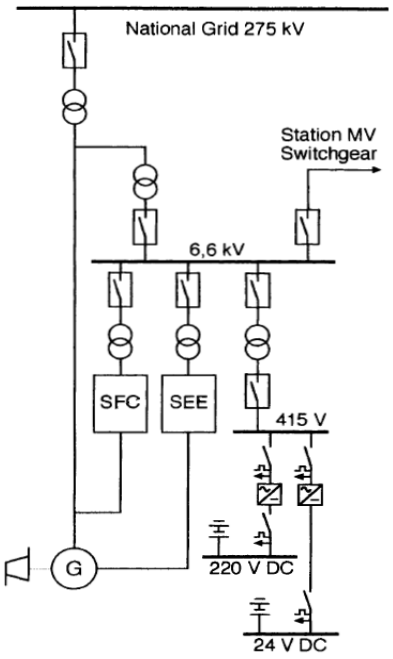
Maintenance of Batteries in Power Plants

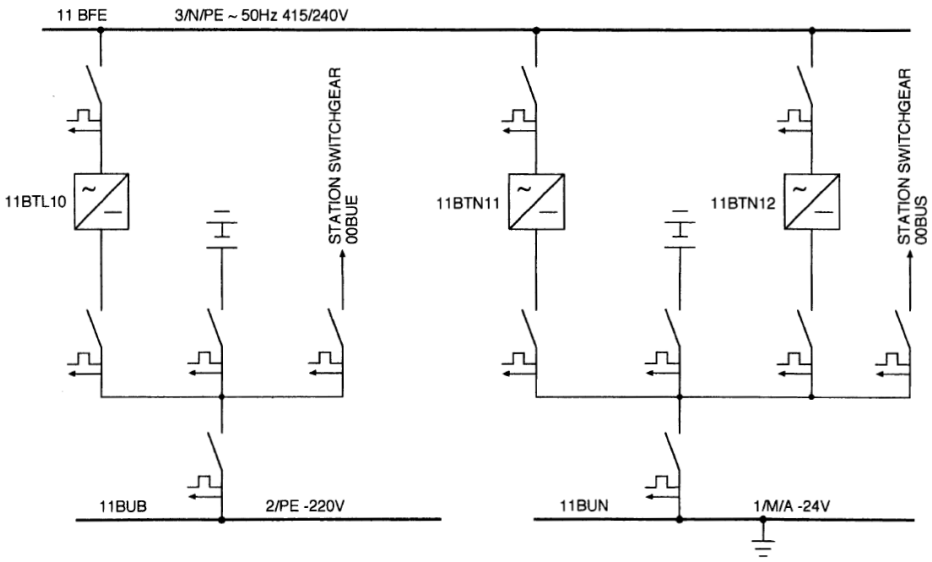
Introduction

Battery banks in a Power Plant are one of the most important equipment and no O&M personnel would not dispute its importance. The entire power plant's control system (DCS), protection system and more importantly DC operated Emergency Lube oil pumps etc., are put into operation when there is a loss of AC entirely or partially in the power plant.

In a typical power plant system, battery banks readily provide direct current (DC) electricity to the Emergency Lube Oil pumps which play a crucial role when there is a loss of AC power supply. The DC operated emergency lube oil pumps ensure a continuous circulation of lube oil to the generator bearings when there is a loss of AC power supply. DC electricity is able to restore power to critical loads by converting to alternating current (AC) by means of an inverter to supply AC power supply for all crucial AC lube oil pumps and valves to bring the machine to a safe shutdown.

Emergency DC system also supply power to critical components such as the protection relays and circuit breaker trip and close functions. The DC electricity, also used directly by I&C loads in the plant ensures always, the availability of important machine data or parameters to the turbine controllers (DCS system) and plant operation regardless of any power supply interruption. A typical scheme is shown below:





Typical DC Switchgear in a power plant.

Battery banks are the heart of almost every emergency system. Failures of the battery system may cause damages to critical load equipment i.e. the gas turbine, the main mechanical component that is essential for power generation plants. The cost incurred due to damages on the gas turbine can be astounding, when compared to the cost of preventive maintenance of battery banks. Repairs may have taken months and cost millions of dollars.

In industrial applications, mainly three types of batteries are used:

1. Vented Lead Acid Batteries
2. Valve Regulated Lead Acid (VLRA) Batteries
3. Nickel Cadmium Batteries

Different types of battery cells may require different type of maintenance.

Vented Lead Acid Batteries

Vented lead acid batteries are the oldest type of rechargeable batteries and are very common in power plants. These types of batteries require periodical maintenance to ensure the batteries are in good condition. VLA batteries consist of flat lead plates immersed in a pool of electrolyte (sulphuric acid + water). A chemical reaction takes place and the electrochemical process converts chemical energy to electrical energy.

Often, the VLA batteries require periodical maintenance and inspection at least every 6 months. The service life of Vented Lead Acid battery cell can last up to 6-7 years, as per the manufacturers.

Valve regulated lead acid batteries (VRLA)

Valve regulated lead acid batteries (VRLA), also known as maintenance free or sealed battery is a type of lead acid rechargeable. However, unlike the traditional flooded lead acid battery, the VRLA batteries do not require constant maintenance. Because of their construction, VRLA batteries do not require regular addition of water to the cells. VRLA batteries, however, still require cleaning and regular functional testing.

Valve regulated lead acid batteries works on gas recombination principle which means that the oxygen evolved at the positive plates will largely recombine with the hydrogen ready to evolve on the negative plates, creating water and thus preventing water loss. The design construction of the battery eliminates the emission of gases on overcharge, room ventilation requirements are reduced and no acid fume is emitted during normal operation. This reduces the requirement of inspection and maintenance. Due to the electrolyte cannot be tested by hygrometer to diagnose improper charging, this reduces the battery life. The normal service life of VLRA batteries is approximately 5 years.

Nickel-Cadmium Batteries

The nickel–cadmium battery (NiCd battery or NiCad battery) is a type of rechargeable battery using nickel oxide hydroxide and metallic cadmium as electrodes. Nickel-Cadmium batteries emit hydrogen and oxygen gas as a byproduct. However, there are no corrosive gases like in the case of lead acid batteries. Water consumption for Ni-Cd batteries is relatively low and only low maintenance is required. Normal service life is 6 – 7 years, as per manufacturers. Due to the advantages, these batteries are generally more expensive.

Maintenance

Due to the importance of the battery system in a power plant, it is crucial to ensure that the batteries are well maintained. A good preventive maintenance practice can ensure that the battery system is able to meet the emergency run time requirements for the critical system that is connected to it. In many cases, due to poor battery maintenance, the life of the batteries could not reach the purported service life.

Effective maintenance must be regular, comprehensive and consistent. Good maintenance approach includes visual inspections, voltage, conductance, (impedance) current and temperature measurements as well as battery capacity testing to identify and detect early signs any individual battery is deteriorating which may endanger the integrity of the entire string.

Batteries need maintenance, testing and replacement more than any other power-related component. Depending on the type of battery, vented lead acid, valve regulated lead acid or Nickel-Cadmium batteries; different maintenance approach that is applicable should be considered. The frequency of battery inspection, quarterly or half-yearly should be determined. The best way to determine when to do battery capacity testing is by monitoring the battery with internal resistance measurements.

Battery capacity testing allows us to locate weak cells and faulty intercell connectors. By identifying the weak cells at early stage allows us to plan effectively on when to replace the battery cell. Determining the battery capacity allows us to picture the condition of the battery, and where it is on its predicted life curve.

Battery failure can lead to very expensive downtime due to damages on critical plant equipments. Therefore, battery maintenance should not be taken ignored.

We, the team of **VJIKKS ENGG POWER (M) SDN BHD**, can provide our maintenance services to achieve the best in optimizing the reliability of the battery banks in your power plant.

Our team of personnel have put in 15-20 years of hands on experience on battery maintenance. The team has successfully implemented many innovative methods in maintenance of batteries like

- Extension of battery bank life up to the expiry period of PPA (21 years) of a typical power plant, with minimum cost, without replacing the whole battery bank which is always recommended by the manufacturers after 6-7 years.
- Capacity testing on the battery banks by using the plant facilities itself and at prudently set limits.

We can be contacted and discussed to hire our expertise on various types of battery maintenance to ensure that the battery banks connected to the essential part of your system are always reliable to achieve the required availability of your power plant.