DC Power Systems

304B Chapter 9.4

Objectives

1. Identify the purposes of the DC power systems.
2. Recognize the purpose, function and operation of the following:
    a. Batteries
    b. Battery Chargers
3. Explain the flowpaths and arrangement of the VDC electrical divisions for normal, abnormal and emergency conditions.

Objectives

4. Given plant conditions, describe the effect that DC power systems have on the following:
    a. Normal AC power
    b. Emergency AC power
    c. 120 VAC Power System
    d. Reactor Core isolation Cooling (RCIC) System
    e. High Pressure Coolant Injection (HPCI) System
    f. Automatic Depressurization (ADS)
    g. Residual Heat Removal (RHR) System
    h. Core Spray (CS) System
    i. Reactor Protection System (RPS)

Purpose

The purpose of the DC Power System is to provide highly reliable 125 VDC and 24 VDC to selected equipment required for safe shutdown of the plant and to loads that are essential for normal plant operation.

125 VDC System

The 125 VDC system

- ESF control systems
- ESF equipment required to restore emergency AC supplies
- ESF equipment that must operate at all times
- Non-safety related systems

125 VDC

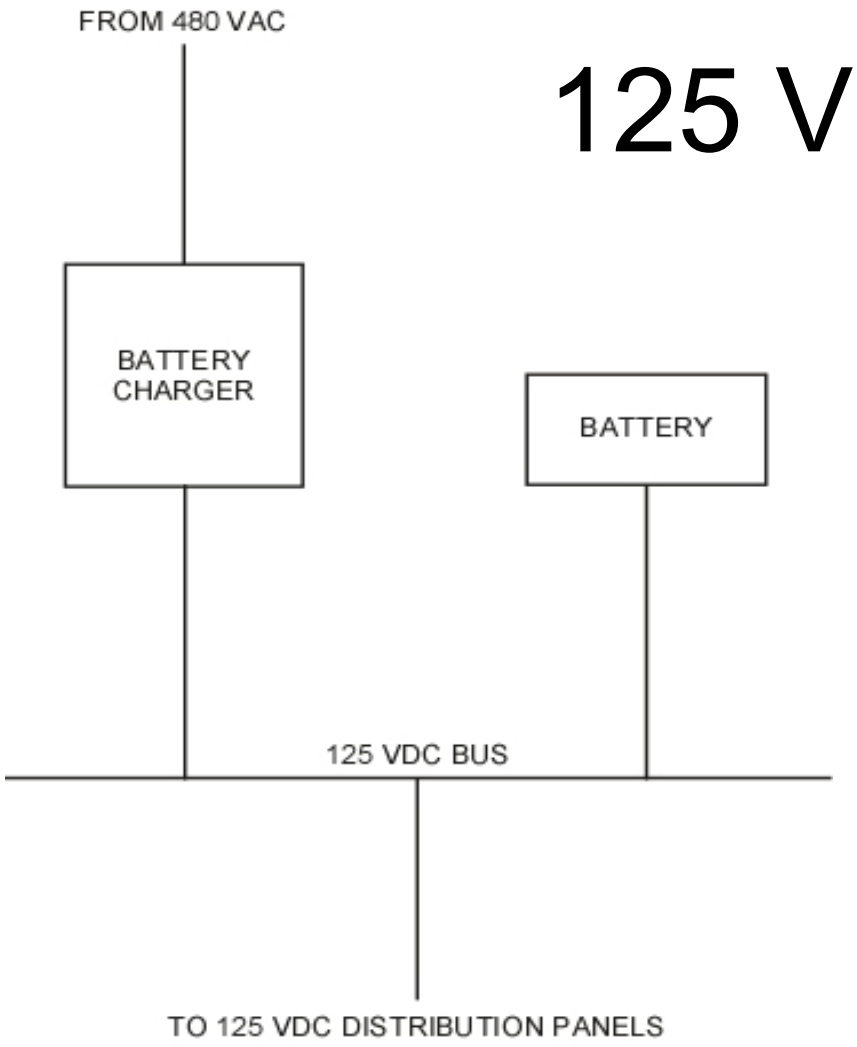

FIGURE 9.4-1 Typical 125 VDC Distribution

Each 125 VDC distribution bus has two power sources:

A solid state battery charger powered from a 480 VAC bus and a 125 VDC battery.

125 VDC Battery Chargers

- normal source of power to the 125 VDC buses
- transformer rectifier units cooled by natural convection
- rated at 300 amps of continuous output
- rectifiers are SCRs
- smoothing circuit to reduce DC ripple

125 VDC Division I

Motor operated valves for:

Reactor core isolation cooling (RCIC)

Pump motors for:

RCIC condenser vacuum pump
RCIC condenser condensate pump
Diesel generator 101 fuel oil pump

Non-safety related loads:

Plant process computer (via uninterruptible power supply)

125 VDC Division I

Control power for:

Backup scram trip system A
Reactor high level trip system C
High pressure coolant injection (HPCI) system (backup isolation controls)
RCIC system
Nuclear steam supply shutoff system (NSSSS), division I
Automatic depressurization system (ADS), division I
Residual heat removal (RHR) system
Core spray (CS) system, division I
Steam leak detection system, division I
Recirculation pump trip system, division I
4160V and 480V emergency switchgear, division I
Diesel generator 101
Safety related ventilation systems, divi-sion I
Auxiliary relay panel, division I
CO_2 detection panel, relay room, division I
Field flashing for diesel generator 101

125 VDC Division II

Motor operated valves for:

- HPCI system
- Main steam line drain system
- RHR system
- Reactor water cleanup system (RWCU)

Pump motors for:

- HPCI turbine bearing oil pump
- HPCI condenser vacuum pump
- HPCI condenser condensate pump
- Diesel generator 102 fuel oil pump

Non-Safety Related:

- None

125 VDC Division II

Control power for:

- Backup scram trip system B
- Reactor high level trip system B
- HPCI system
- RCIC system (backup isolation controls)
- NSSSS, division II
- ADS, division II
- RHR system, division II
- CS system, division II
- Steam leak detection system, division II
- Recirculation pump trip system, division II
- 4160V and 480V emergency switchgear, division II
- Diesel generator 102
- Safety related ventilation systems, divi-sion II
- CO_2 detection panel, relay room, division II
- Field flashing for diesel generator 101

125 VDC Division III

Motor operated valves for:

Diesel generator 103 fuel oil pump

Control Power for:

Diesel generator 103

4160V and 480V emergency switchgear, division III

Safety related ventilation systems, division III

CO2 detection panel, relay room, division III

Non-Safety Related:

Uninterruptible power supply

24 VDC

- provides electrical power to the source and intermediate ranges neutron monitoring systems
- 24 VDC power system is not safety related
- separate and unrelated 24 VDC system that supplies radwaste and process radiation monitoring systems

24 VDC

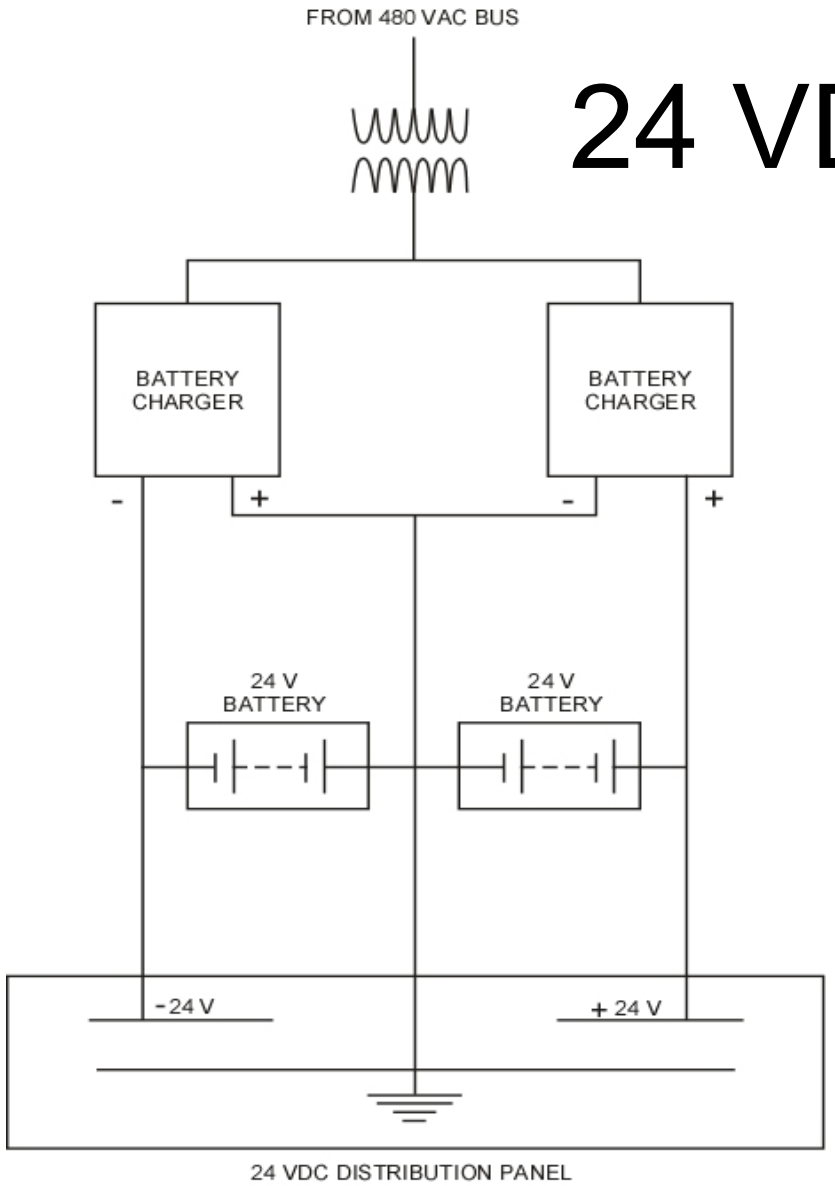

FIGURE 9.4-2 Typical 24 VDC Distribution

There are two separate 24 VDC distribution buses. Each bus consists of three battery taps:

Positive (+24 VDC)
Negative (-24 VDC)
Ground (0 VDC)

Each 24 VDC distribution bus has two power sources:
•A solid state battery charger powered from a 480 VAC bus
•A 24 VDC battery.

Operation

- Normal
- Infrequent
- Abnormal / Emergency

Interfaces

- Normal AC power
- Emergency AC power
- 120 VAC Power System
- Reactor Core isolation Cooling (RCIC) System
- High Pressure Coolant Injection (HPCI) System
- Automatic Depressurization (ADS)
- Residual Heat Removal (RHR) System
- Core Spray (CS) System
- Reactor Protection System (RPS)

Review

- 125 VDC
- 24 VDC
- Batteries
- Battery Chargers
- Operation

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Are there any questions?