Ground Faults
a General Overview

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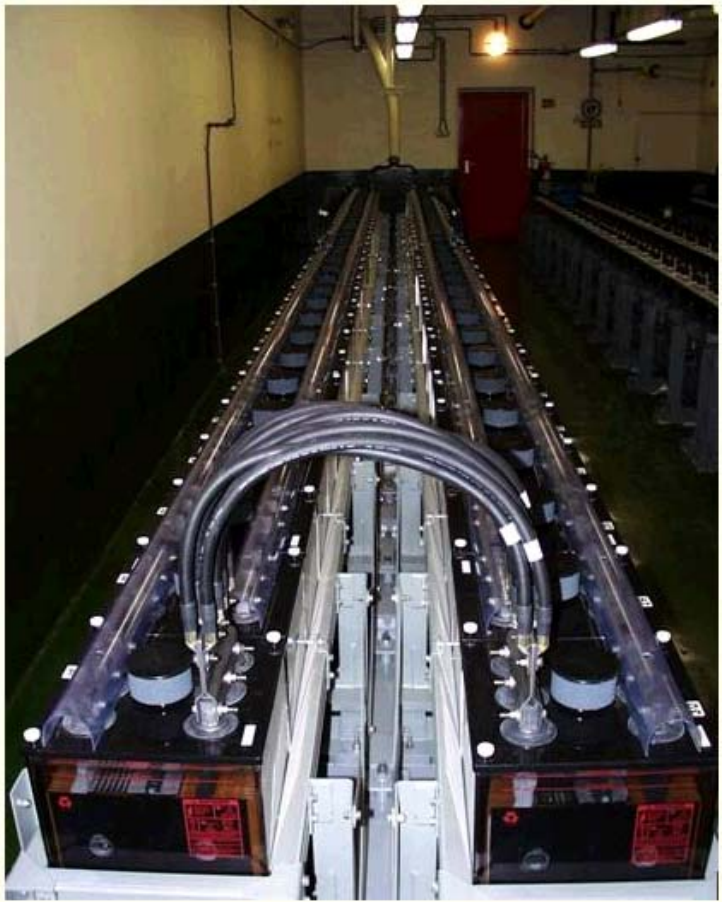
Why Have Battery Strings?

- The main objective of a battery system is to provide standby and emergency power to operate industrial, consumer, commercial or protective devices.



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Why Have Battery Strings?

- Some of these devices include emergency lighting units, uninterruptible power supplies, continuous process systems, operating controls, switchgear components and protective relays.

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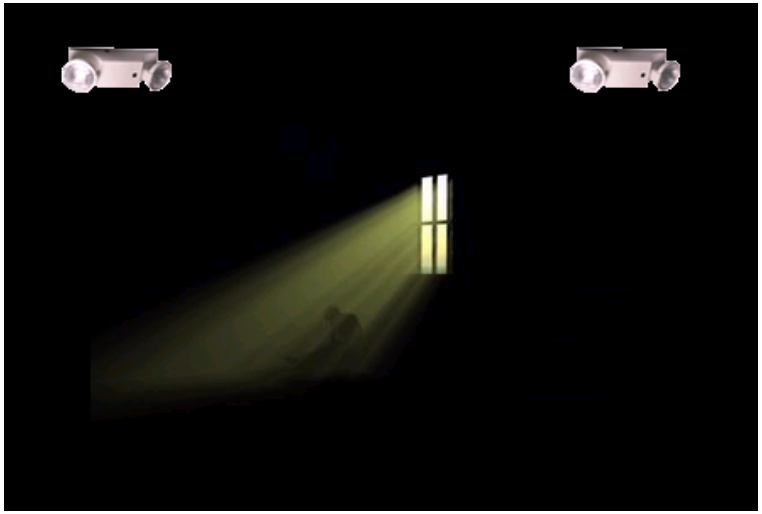
Why Have Battery Strings?

- In emergency situations, it is essential that these devices be in proper operating condition. Failure of a DC system or the battery can result in operational failure of the devices connected to that system.



Why Have Battery Strings?

- System failure can lead to loss of revenue, damage to equipment and/or injured personnel.

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Why Worry about Ground Faults?

- It is a common situation for a floating DC system to develop grounds within it. When a battery system is partially or completely grounded, a short circuit is formed across the battery and consequently may cause the protective device to fail to operate when needed.

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Causes of Ground Faults?

- Some causes of battery ground faults include the following problems which can occur on the battery string:
  - Leaking cells
  - Corrosion
  - Dirt

Causes of Ground Faults?

- Other causes of battery ground faults include the following problems:
  - Pinched Wire
  - Poor Insulation
  - Faulty Component

What did we use to do?

- Traditionally utilities and industrial complexes have gone to great lengths to find ground faults within their battery systems. However, locating these battery grounds proves to be a very elusive and time-consuming process.

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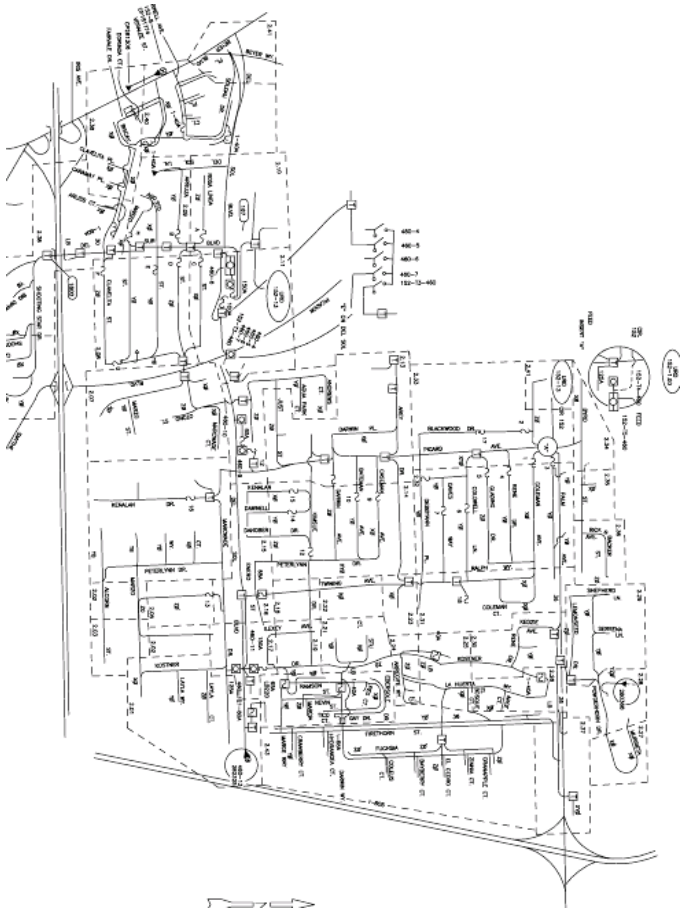
Sectionalizing

- The current ground-fault location method involves sectionalizing, or interruption, of DC branches to isolate the ground fault.



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Sectionalizing

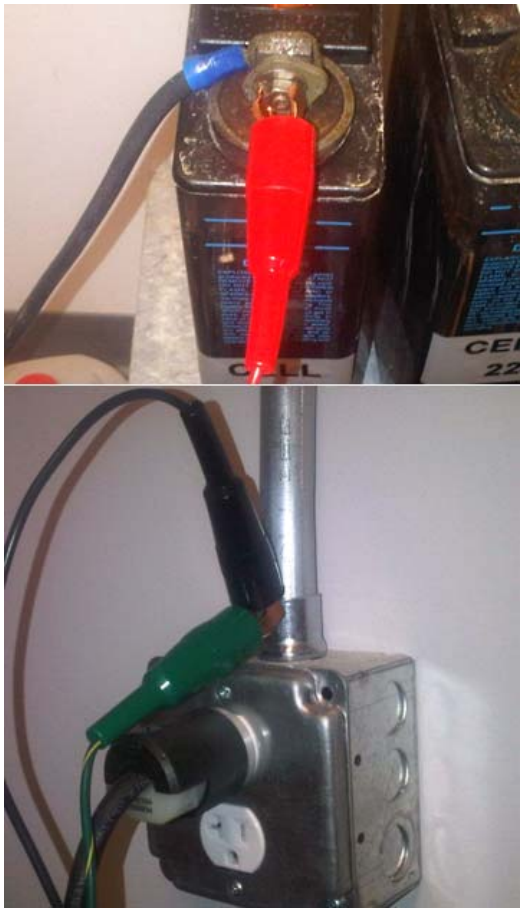
- Sectionalizing disables the system protection and has been known to cause inadvertent line and generator tripping. For this reason, many utilities have banned sectionalizing.

Low Frequency AC Testing

- Developments have led to a better test method; injecting a low-frequency AC signal and using that AC signal to locate the ground in the DC system. This method can be performed without sectionalizing the DC system and it reduces the fault locating time from days to hours.

Low Frequency AC Testing

- The AC injection method measures single or multiple ground faults by first injecting a low-frequency, 20 Hz AC signal between the station ground and the battery system.



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Ground Fault Locating

- Second, the resulting current is then measured by using a clamp-on sensing current transformer. From this, the resistance value can be calculated using the in-phase component of the circulating current, thus rejecting the effect of capacitive loads.

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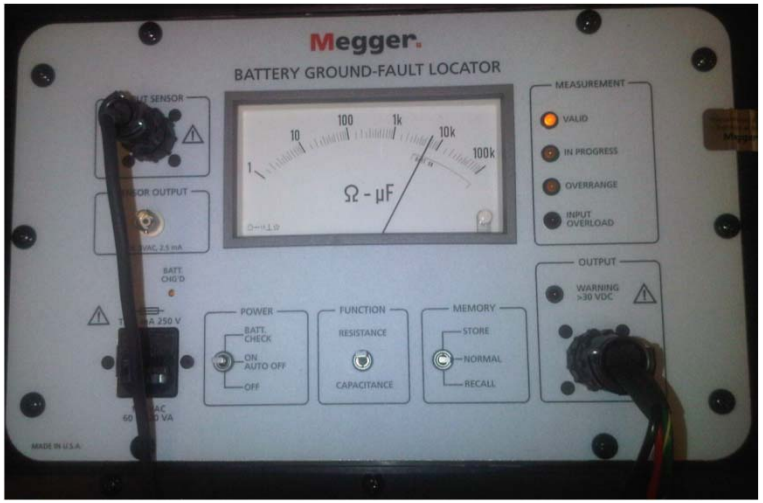
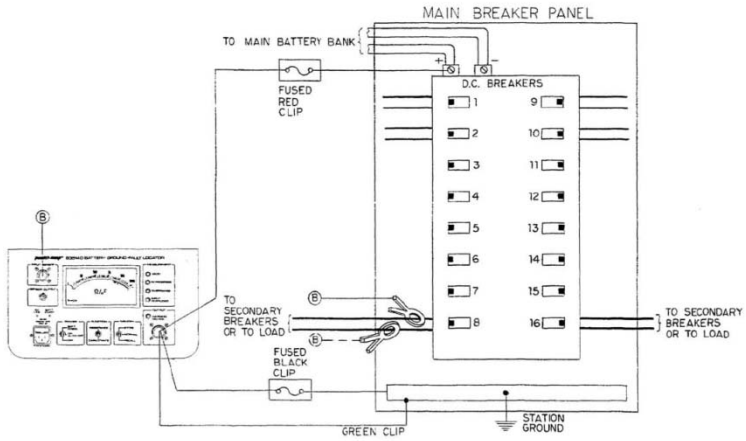
Ground Fault Locating

- Therefore, if the signal is injected at the battery terminal and the clamp-on CT is connected to the outgoing lead, the instrument will measure the total ground resistance present on the battery system.



Ground Fault Locating

- If the CT is clamped on a feeder, then the instrument will measure the ground resistance on that feeder.



Ground Fault Locating

- Faults can be traced easily regardless of the number of distribution panels or circuits because the “tracer” is merely following the strength of the AC signal.

Ground Fault Locating

- System integrity is maintained because it is an online AC test and is designed to prevent system trips.

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Solutions for Real World Applications