

Power Delivery Operating

Main accountabilities

- **Switching of stations and lines**
- The operating group is responsible for writing (All switching requires a Planned Switching Procedure be completed that details all steps necessary to complete the intended task) and executing switching procedures for:
- *Functional Trip Test/ Relay Test* – This task involves the actual operation of all equipment inside the substation once a year. This requires moving load to other equipment or bypassing the equipment to check the operation of the equipment and its associated relays.

- *Equipment Clearance* – This is for the maintenance, repairs, upgrades to station equipment. Transformers , breakers, capacitors, gangs, circuit switchers, CT's, PT's.
- *Station Structure Clearance* - This is mainly for repairs and upgrades to station busses, insulators, conductors, fittings
- *Service Restoration* – The testing and restoration of stations or their components during an outage condition.

- *Line Clearance* – This is for maintenance, repairs, and upgrades to transmission lines. (525kV, 230kV, 100kV, 44kV)
- *All switching procedures for line switching that involves 2 or more areas are written by the TCC (Transmission Control Center). These procedures are executed by the local areas, but conducted by the TCC.
- *Load transfers* – This is transferring load from one Distribution circuit to another, Swapping stations from one transmission line to another and Swapping load around inside a station.

Breaker Job Functions



- Perform PM's at specific intervals
- Perform Mods as needed
- Troubleshoot breaker for problems
- Perform maintenance as needed
- Trouble Response

Transformer Job Functions

- Assemble/Disassemble
- Perform PM's when due
- Troubleshoot
- Perform maintenance as needed
- Perform Gas-n-Oil Analysis
- Trouble Response

Power Delivery Electrical

Central Region

What do we do?

- We install, commission, and maintain electrical systems in our substations.
- We build electrical panels for Duke's substations and F/H generating stations.
- Provide maintenance and service response to Duke's F/H generation stations.

Apparatus

- Breakers
- Transformers
- Capacitors
- Doble Testing

Breakers



Breaker PM



Transformers



Transformer Types



Power Delivery Electrical

Central Region

The electrical systems can be segmented
into different components

1. Fault protection
2. Control
3. Data acquisition and metering

1- Fault Protection

- Fault protection is provided by ***protective relaying*** whose purpose is to operate with other system components to minimize damage to the system and limit service interruptions.

What are faults?

- Anytime current is flowing outside its normal path is considered a fault.
- Examples would be equipment failure, lightening, animal and tree contacts, etc.

Why do faults need to be cleared?

- To limit equipment damage
- Isolate effected area
(Northeast blackout)

New “smart relays”

- Provide better protection
- Remote communication
- Failure alarms
- Remote setting changes
- Load profiling
- Data on fault magnitude
- Sequential event recording
- Fault location
- Breaker condition

Fault elimination provided by protective relaying



Protective relays



2 - Controls

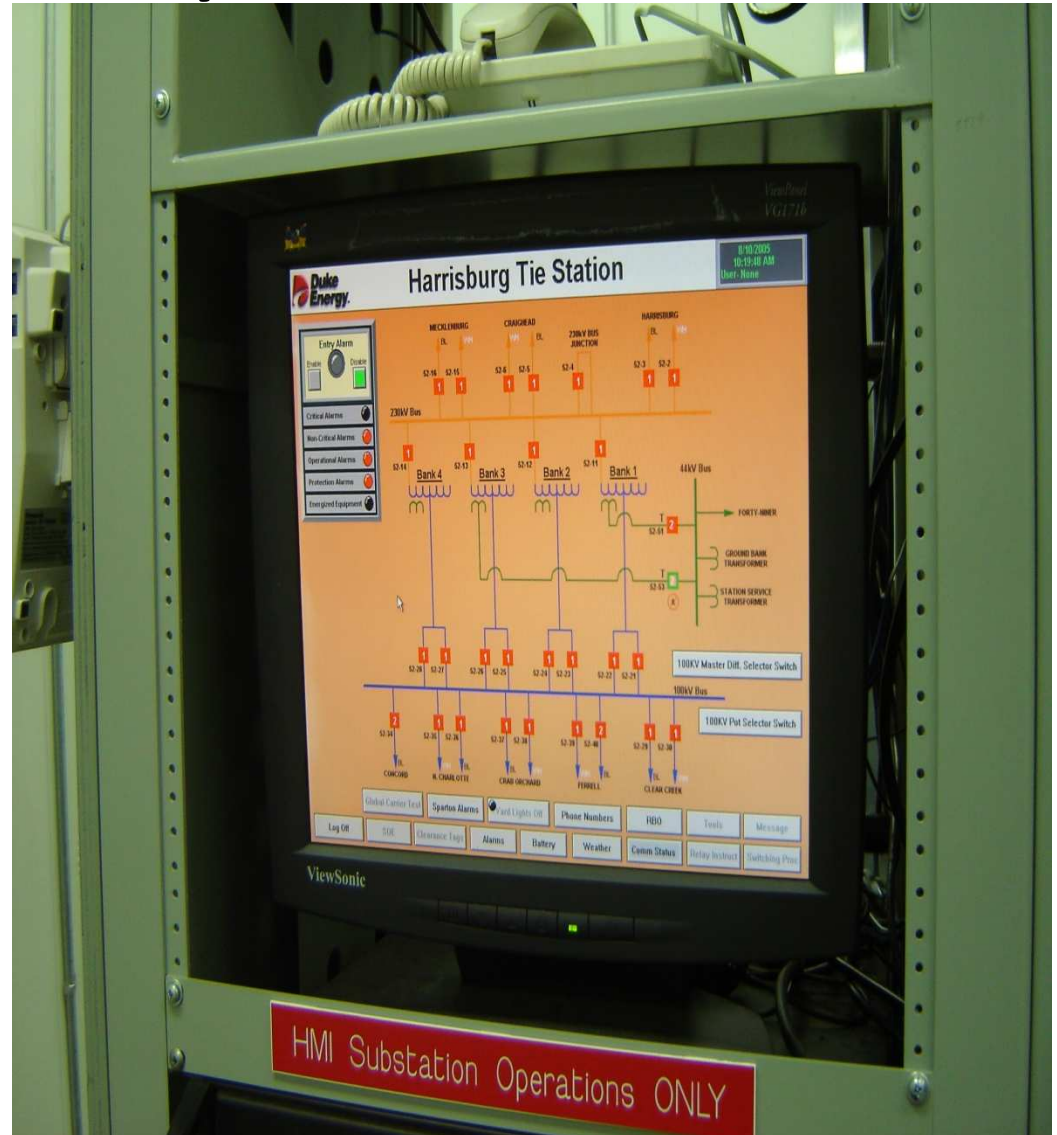
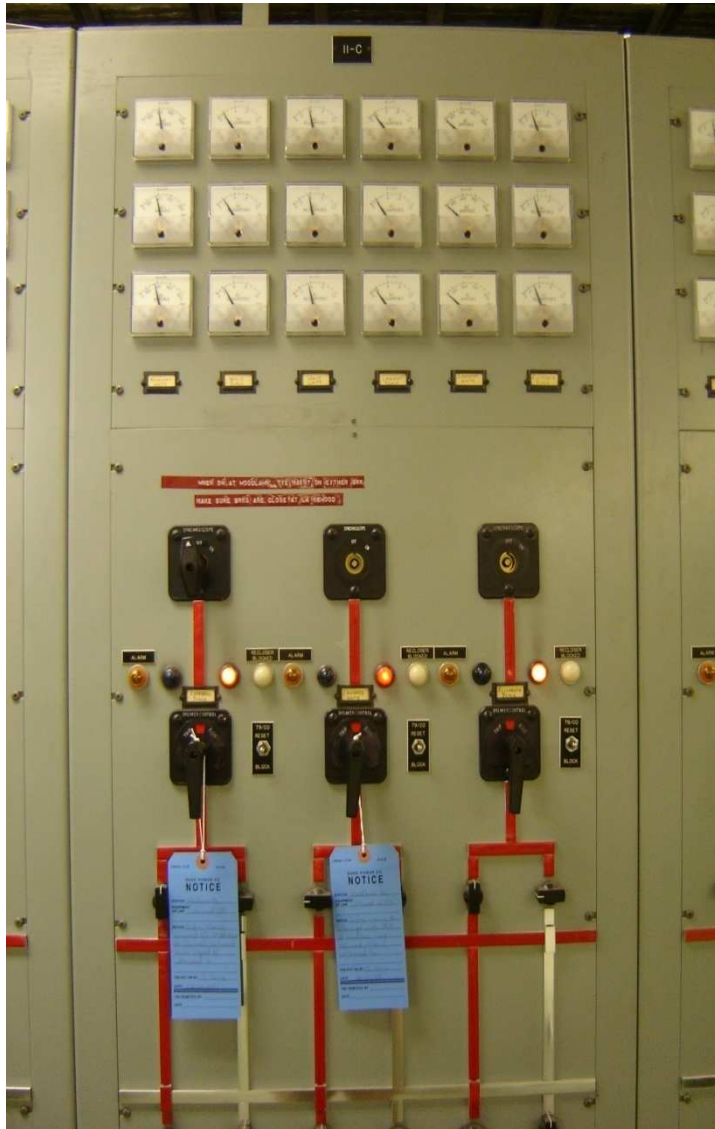
- Equipments in stations must be operated for maintenance or other purposes.
- Electrical crews have the responsibility to install and maintain

Cabling and panel wiring

Batteries that supply DC operating voltage,

Remote Terminal Units that supplies the TCC with load flow information and the ability to operate equipment remotely.

Control systems



3 - Data acquisition and metering

- The TCC and Grid Ops must have accurate data to reliably operate the system. Our relaying and metering devices provide the TCC and Grid ops power flow and equipment status information, as well as billing information for certain accounts.



Harrisburg Tie Station

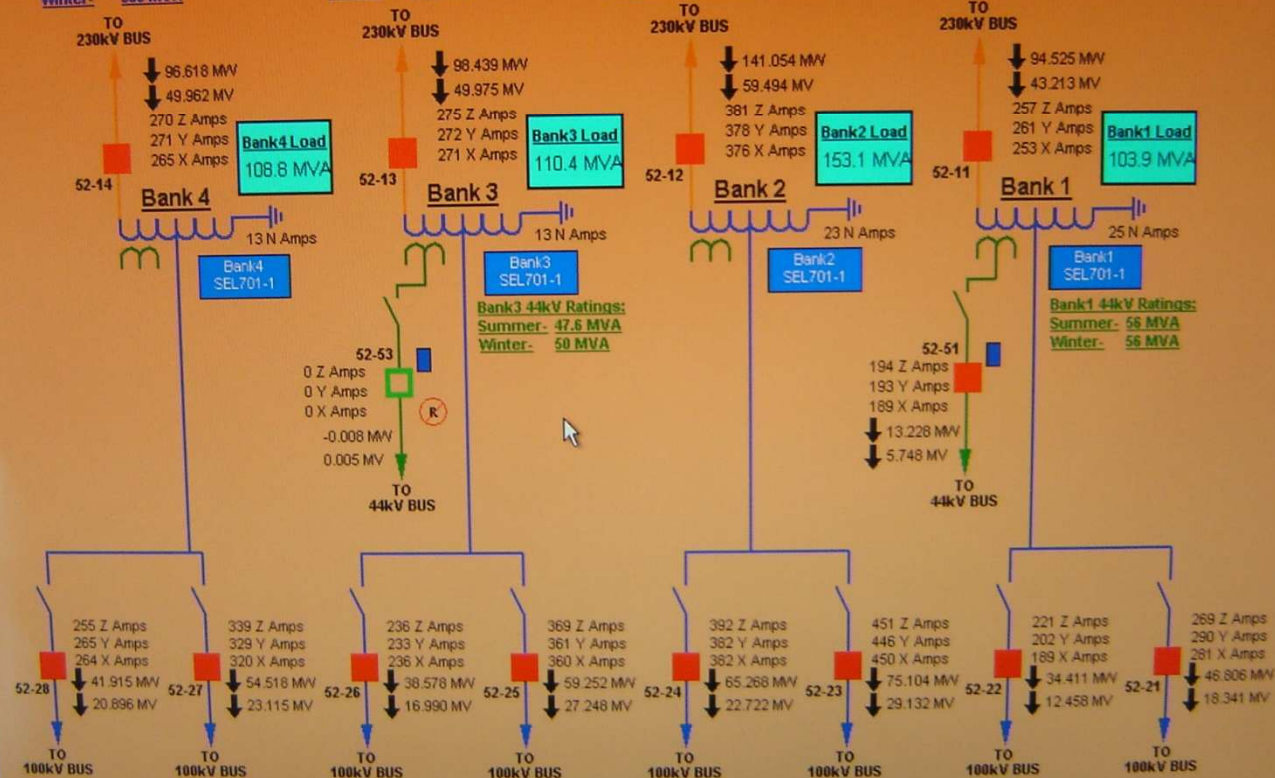
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Bank4 230kV/100kV Ratings:
Summer- 268.5 MVA
Winter- 300 MVA

Bank3 230kV/100kV Ratings:
Summer- 270.1 MVA
Winter- 300 MVA

Bank2 230kV/100kV Ratings:
Summer- 416.1 MVA
Winter- 446.2 MVA

Bank1 230kV/100kV Ratings:
Summer- 385.1 MVA
Winter- 315.5 MVA



Print Window

Station Overview

ViewSonic

Active Alarms List

Alarm Group Selection

[illegible]

ALL
ALL
Bank1
Bank2
Bank3
Bank4
Battery
Bus_Jct_230
Clr_Creek_BI
Clr_Creek_Wh
Concord_BI
Crab_Drch_BI
Crab_Drch_Wh
Craighead_BI
Craighead_Wh
Ferrell_BI
Ferrell_Wh
Harrisbrg_BI
Harrisbrg_Wh
Mecklenbg_BI
Mecklenbg_Wh
N_Charlot_BI
N_Charlot_Wh
SEL2030ALL