SWITCHYARD SYSTEM

BC1-SS-11-SD

TRAINING SYSTEM DESCRIPTION

NRG ENERGY, INC.

BIG CAJUN 1

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PREFACE

This Training System Description has been designed to assist you in meeting the requirements of Module BC1-SS-11 Big Cajun 1 Switchyard System of the Plant Operator Training Program. It contains information about the Big Cajun 1 Switchyard System. This includes system function, flow path, and details about the major system components and operation.

You should review each chapter objective. In doing so you will be better prepared to learn the required information. You should also walk down the system and identify the components and controls. Should you have additional questions about the system, ask your supervisors.

A separate document, Switchyard System Operating Procedure BC1-SS-11 -SOP, covers detailed operation of the Big Cajun 1 Switchyard Systems.

SWITCHYARD SYSTEM

BC1-SS-11

TRAINING SYSTEM DESCRIPTION

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References

Big Cajun 1 System Descriptions and Procedures Book – Volume VII

Plant Walkdown

1.0 System Introduction

Chapter Objectives:

1. Describe the functions of the Switchyard System.
2. State, from memory, the functions of the Switchyard System.
3. Draw a simplified Switchyard System diagram.
4. Describe the flow path and how the Switchyard System performs its function.
5. List the normal Switchyard System operating parameters.

1.1 System Function

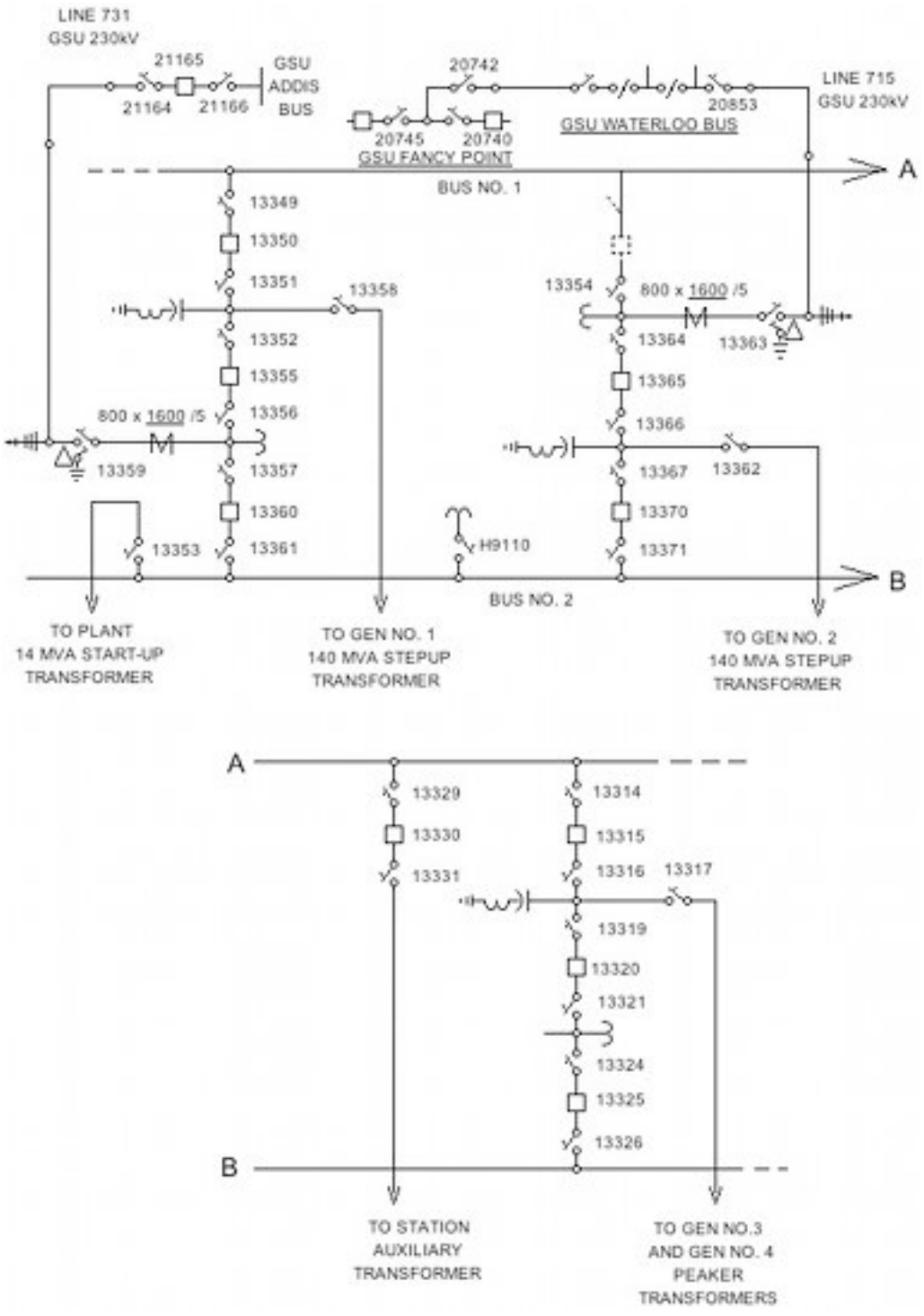
The Switchyard System combines output from the four plant Generators (Units 1 through 4) and transmits the combined output to different service areas.

1.2 Basic System Description

The Switchyard System consists of a Ring Buss which carries current to various Current Transformers (CTs) that control voltage of current that is routed to transmission substation for delivery to the grid and current that is used by the Plant to operate equipment, provide electricity for lights and standard outlets.

1.3 System Flowpath

Electricity leaves the Generator at 13.8 kV and passes through a Step-up Generator, which increases the voltage to 240 kV. The electricity is transmitted out from the Transformer in 2 lines. The lines pass through a motor-operated Line Disconnect Switch, then an Oil Circuit Breaker (OCB). There are a total of 5 OCB's and 11 Line Disconnect Switches with 1 Line Disconnect Switch on each side of each OCB for Units 1 and 2. Units 3 and 4, the Peakers, have a total of 4 OCB's and 8 Line Disconnect Switches. The OCB's and Line Disconnect Switches form a Ring Bus. Leaving the Ring Bus are 2 high voltage transmission lines. They are Line 715 (Fancy Point) and Line 731 (Addis). Each High Voltage Line has a manual Nitrogen Disconnect to isolate it from the Plant Ring Bus if necessary.



Drawing 1 – Switchyard System One Line

Figure 1 – Switchyard

2.0 System Major Components

Chapter Objectives:

1. Describe how the Switchyard System components perform their functions and how they interface with other system components.
2. Draw from memory a diagram of the Switchyard System showing major components
3. State from memory, the names and functions of major Switchyard System components.
4. Describe the construction of and flow paths through the major components.

The Switchyard System consists of the following equipment:

1. Motor Operated Switch (MOS)
2. Line Disconnect Switch

3. Oil Circuit Breaker (OCB)
4. Nitrogen Line Disconnect Switch
5. Potential Transformer
6. Current Transformer
7. Lightning Arrestor

2.1 Motor Operated Switch

Each MOS controls two Line Disconnect Switches, which are used to isolate an OCB.

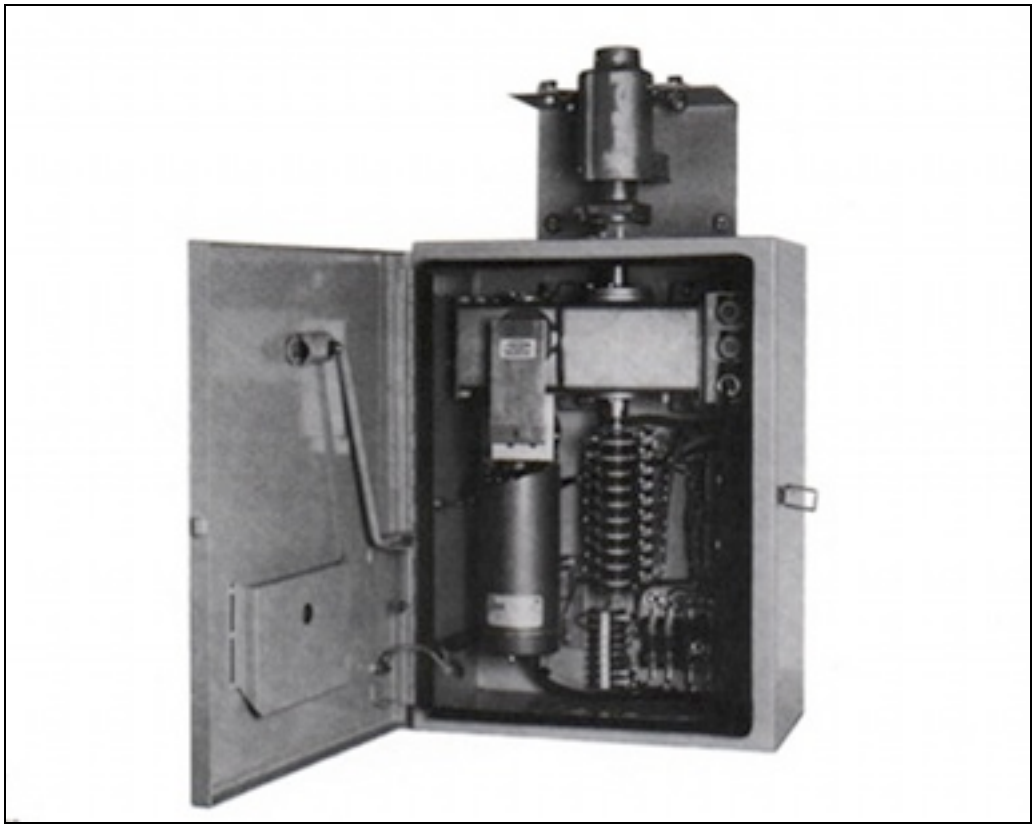


Figure 2 – MOS

2.1.1 MOS Data

Manufacturer	Turner Electric
Model	SF-100 or SF-200
Nominal rating	120 MW
Heat rating	9,900 Btu/kW in simple cycle configuration
Net plant efficiency at 3,600 rpm under ISO conditions	35 percent
Self-sustaining speed	2304 rpm

2.1.2 MOS Controls

Each MOS is controlled by a switch in the Control Room. If necessary for an emergency, the MOS can be operated manually at the breaker using a hand crank. Remove the cotter pin or padlock to release the hand crank. This also gives access to the port cover. When the port cover is displaced, remove the metal guard and fit the hand crank onto the manual crank shaft.

2.2 Line Disconnect Switch

The Line Disconnect Switch is a Vertical Break, Air Break Switch. The Line Disconnect Switches are controlled by MOS's. Line Disconnect Switches are used to isolate an OCB so the OCB can be taken out of service.

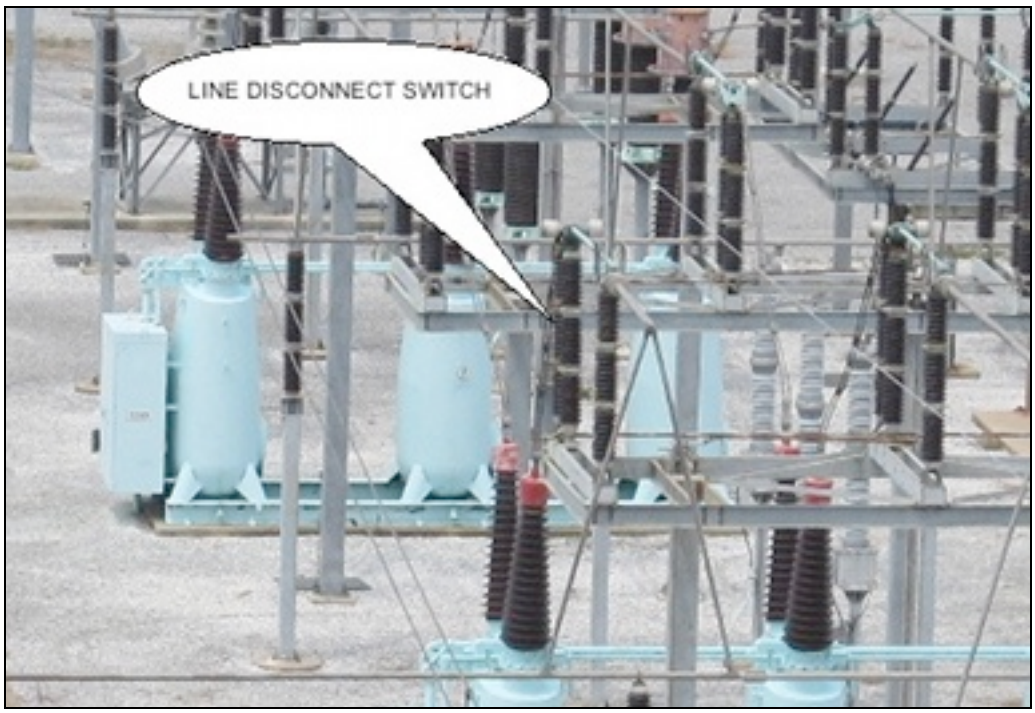


Figure 3 – Line Disconnect Switch

2.2.1 Line Disconnect Switch Data

Manufacturer	Turner Electric
Model	MK40A
Orientation	Upright
Ratings	345 kV through 765 kV
Ratings A	1200, 1600, 2000, 3000, 4000 Amperes

2.3 Oil Circuit Breaker

OCB's are circuit breakers used to switch circuits and equipment in and out of the Switchyard System. OCB's are oil filled to provide cooling and to prevent arcing wen the Switch is activated.

Figure 4 – OCB

2.3.1 OCB Data

Manufacturer	Westinghouse
Breaker Type	2300GW20,000
Rated kV	230
Amp	2000
30 MVA	20,000
Type	GW

2.4 Nitrogen Line Disconnect Switch

The Nitrogen Line Disconnect Switch is used for interrupting small blocks of power at transmission voltages under circumstances that do not justify the high cost of a circuit breaker or require a breaker's fault interrupting ability, in this case on transmission lines to the Waterloo and Fancy Point substations.

The Nitrogen Line Disconnect Switch is the same switch as the Line Disconnect Switch (MK40A), but uses nitrogen instead of air to open the switch.

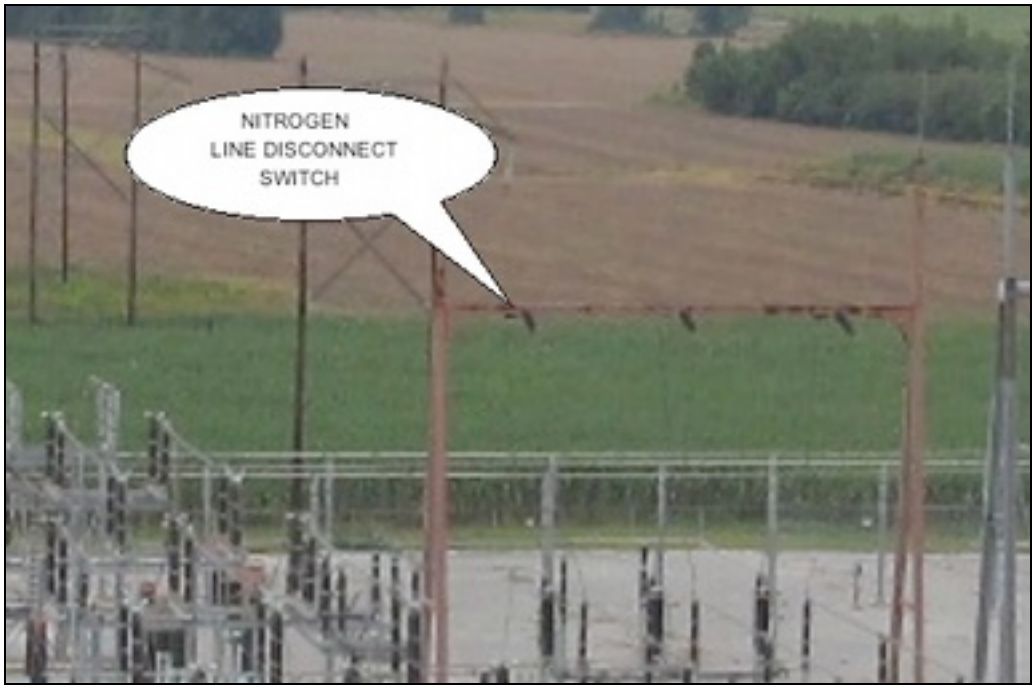


Figure 5 – Nitrogen Line Disconnect Switch

2.4.1 Nitrogen Line Disconnect Switch Data

Manufacturer	H. K. Porter Company, Inc.
Model	JT-1
Orientation	Upright

2.5 Potential Transformer

Potential Transformers are a special kind of transformer that allows meters to take readings from electrical service connections with higher voltage (potential) than the meter is normally capable of handling without a Potential Transformer.

2.6 Current Transformer

A Current Transformer is a type of instrument transformer that is designed to produce either alternating current or alternating voltage proportional to the current being measured.

2.7 Lightning Arrester

Lightning Arresters are designed to limit surge voltage to a safe value by discharging the power frequency flow current.

Figure 6 – Lightning Arrester

3.0 System Operation

Chapter Objectives:

Describe the Switchyard System operation during:

- System Startup
- Normal Operation
- System Shutdown

NOTE: This System operation section is included for instructional purposes only, and should not be used as an operating procedure.

3.1 Switchyard System Startup

The Switchyard System remains in service at all times.

3.2 Switchyard System Normal Operation

Normal operation of the Switchyard system includes the following procedures:

Procedure for Opening OCB and Line Disconnect Switches

__1. Ensure a Switching Order is generated and followed step by step.
__2. Call the Control Room and have the Operator open the desired OCB.
__3. Open the Line Disconnect Switch on one side of the OCB. Be sure the person opening the Line Disconnect Switch is standing on the grounded grading and is wearing rubber gloves.
__4. Open the Line Disconnect Switch on the other side of the OCB.
__5. Lock the two (s) Line Disconnect Switches and the OCB down and place tags.
__6. Notify ECC that the Switching Order is complete and the OCB is isolated.

Procedure for Checkout of the MOS Prior to Opening

__1. Review the Switching Order with Operators that will be performing the Switching.

__2. Using the Print of the Switchyard, have the Operators review the Switching Order again, explaining the steps and the objective to be accomplished.

__3. After everyone is in full agreement that the operation to be performed is correct and safe, the Shift Supervisor will accompany the Operator to the Switchyard as a safety precaution during the performance of the operation.

__4. The Shift Supervisor will instruct each Operator in his Shift to be aware of and comply with signs placed on MOS 13362 and 13358. Such as, "If MOS is open, check OCB's to be open before closing switch. If MOS is closed, check OCB's to be open before opening switch."

__5. The Operator is to fill in the time and sign his name to the appropriate spaces on the Switching Order as each step is completed.

__6. After all the steps have been completed, the Shift Supervisor will call ECC to finalize the Switching Order.

Procedure for Taking a Line Out of Service

__1. Receive the Switching Order from the dispatcher.

__2. Open the OCB on one side of the Line.

__3. Open the OCB on the other side of the Line.

__4. Charge the Nitrogen Gas System on the Nitrogen Line Disconnect Switch for the Line to be taken out of service.

__5. Open the Nitrogen Line Disconnect Switch.

__6. Open the inside Line Disconnect Switch on the first OCB.

__7. Open the inside Line Disconnect Switch on the other OCB.

__8. Pull Potential Transformer fuses on the Line.

__9. Have ECC place grounding straps on the bus side of the Nitrogen Line Disconnect Switch.

__10. Close the Nitrogen Line Disconnect Switch.

__11. Place grounding straps on the line side of the Nitrogen Line Disconnect Switch.

__12. Reopen the Nitrogen Line Disconnect Switch.

__13. Remove grounding straps from the bus side of the Nitrogen Line Disconnect Switch.

__14. Close the inside Line Disconnect Switches for the two (2) OCB's.

__15. Close the two (2) OCB's

__16. Place call to ECC after completing the Switching Order.

3.3 System Shutdown

The Switchyard System is never shut down as it is essential to Plant operation.