GENERATION CONTROLS:
Compliance with Generator Regulatory Technical Requirements

Kestrel Power Engineering is offering an open enrollment course on Generation Controls at several locations across North America in 2020. Please see our website at www.kestrelpower.com/training.htm for dates in your area. The course is designed for engineers and technicians and will cover the theory and practical aspects of testing, modeling and operation of generators, excitation systems, power system stabilizers and turbine governors with a focus on NERC and Regional regulatory compliance standards.

Background

The various organizations that oversee electricity reliability in North America have been in existence for decades with oversight provided by the North-American Electric Reliability Corporation (NERC). NERC’s mission is to ensure that the bulk electric system in North America is reliable, adequate and secure. In 1997, NERC developed a set of Operating and Planning standards for use throughout the North American industry (NERC Planning Standards, Part II System Modeling Data Requirements, approved by Board of Trustees, September 16, 1997). These Planning Standards included rules for the routine verification of generating unit performance and mathematical models.

Compliance with NERC standards was made mandatory in the US and Canada in 2006. The NERC standards which are the subject of this short training course were approved by NERC and Industry in December 2012. The technical standards that are the topic of this short training program are the following:

- MOD-025  Verification of Generator Gross and Net Reactive Power Capability
- MOD-026  Verification of Models and Data for Generator Excitation System Functions
- MOD-027  Verification of Turbine/Governor and Load Controls
- PRC-019  Coordination of Generator Voltage Regulator Controls with Unit Capabilities and Protection
- PRC-024  Generator Performance During Frequency and Voltage Excursions
- IESO Ontario Market Rules for Generator Owners
Course Description

The Generation Controls course is designed to instruct plant engineers and technicians on the core concepts of utility generators and associated control systems with a goal of familiarizing technical utility staff with the requirements of the latest NERC and ISO regulations and to help them identify their role in meeting these requirements within their organization. The material is tailored to cover the specific systems, configurations and operating scenarios associated with the attendees. Each requirement will be reviewed using the following approach:

- Review technical background material necessary to understand the topic and provide references for further study
- Review latest version of the applicable standard along with regional interpretations of the requirements
- Discuss methods of meeting technical requirements.
- Perform sample calculations, exercises and simulations illustrating the technical issues and test methods.

The course provides classroom based instruction and utilizes a comprehensive computer based course manual along with a generator controls simulation software package. This software package allows each attendee to perform interactive simulation exercises that are related to various course topics, such as: Generator Reactive Capability, Generator Voltage Control, Auto Voltage Regulator Tuning, Power System Stabilizer Operation and others. The simulations utilize accurate generator and control system models and allow the user to adjust settings, alter system configurations and control operation while viewing the simulated response on graphs and meters. The interactive simulations are an excellent means of better understanding the practical application of the course material.
Course Outline

Module 1: Reactive Power Capability
Review of Basic Power System Concepts
Basic concepts governing synchronously operating power systems
The power system and control
Power transfer in ac systems
Synchronous Generators
Energy conversion and the synchronous generator - generator terminal characteristics
Off-line and on-line operation
Reactive capability
MOD-025 Confirmation of Reactive Capability
Alternative methods (testing versus operating) voltage versus reactive limitations documentation requirements

Module 2: Excitation System Performance and Modeling
Excitation System Design
Excitation requirements imposed by the generator and by the power system
Common designs: bus-fed static, rotating dc systems, rotating ac systems
Automatic voltage regulation (AVR)
Reactive current compensation
Power System Stability and Stabilizers
Effect of excitation system on stability
Oscillatory stability of synchronous machines
Functional design of common stabilizers
MOD-026 Confirmation of Excitation Models and Performance
Alternative methods manufacturer’s data, testing, disturbance recording
Test instrumentation and procedures
Documentation requirements

Module 3: Coordination of Protection, Limiters with Generator Capability
Generator Capability
Overvoltage and V/Hz capability
Limited time field winding limits
Under-excited limitations
Excitation Limiters
Over-excitation limiters
Under-excitation limiters
Generator Protective Relays
Multi-function digital versus discrete relays
Fault versus overload relays
PRC-019 Coordination of Protection and Limiters with Unit Capability and
PRC-024 Generator Performance During Frequency and Voltage Excursions
Excitation limiters and relation to generator and system capability
Coordinating excitation limiters and protective relays
Test and documentation requirements
Review of PRC 005/25/26/27 requirements

Module 4: Verification of Turbine/Governor and Load Controls
Prime Movers
Common elements of utility prime movers
Steam, gas, hydraulic and wind turbines
Frequency Control and Governors
Speed governing of utility generation
Design of conventional mechanical-hydraulic governors
Design of electro-hydraulic governors
Permanent droop and deadband
Automatic generation control
MOD-027 Verification of Turbine/Governor and Load Controls
Methods of confirming unit response to system frequency variations
Course Information

Date: TBD

Time: M–T–W–TH 8:00–16:00; F 8:00–12:00

Location: Sandman Signature Mississauga Hotel
5400 Dixie Rd. Mississauga
L4W4T4
room reservation 905-238-0159
(or 1-800-SANDMAN)

Includes: Computer Based Instruction Manual
Simulation Software Package
Refreshments

Contact: Liz Diehl
Phone: (416) 317–6711
Email: liz@kestrelpower.com

Fee: $2795 per person
Group rates available

Cancellation Policy: Kestrel reserves the right to cancel the course and notify attendees 30 days in advance of the scheduled start date. Kestrel is not responsible for any non-refundable travel expenses.

Registration Form

First Name: ____________________________

Middle Initial: ____________________________

Last Name: ____________________________

Company: ____________________________

Address: ____________________________

Phone: ____________________________

Email: ____________________________

Plant Association: ____________________________

Generation Type(s):[ ] Coal[ ] Gas[ ] Hydro[ ] Nuclear[ ] Wind[ ] Other

NERC Region(s):[ ] FRCC[ ] MRO[ ] NPCC[ ] RFC[ ] SERC[ ] SPP[ ] TRE[ ] WECC

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