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www.hpcnet.com

Course Information Letter ---- G310

GENERATORS: NORMAL / ABNORMAL OPERATION

G310

There are NO SMALL PROBLEMS when it comes to your GENERATOR!! Learn how modern generators work on the power system grid. Emphasis is placed on taking the magic out of generation operations as well as dealing with normal operations and those abnormal occurrences that could happen. Attending personnel learn what really happens in the air gap. An understanding of why and how the voltage / frequency varies is extremely important in being able to make the "best" operating decision. The interesting part of operating a generator is that you do not know when this information is going to be needed, and when this understanding is required there will be no time to consult the book nor call the subject matter expert. Learn what components are at risk and how. At the course conclusion we will review 12+ abnormal conditions and for each we'll discuss how the situation can develop, what are the symptoms, what protective relaying might exist, what are the proper actions, and if actions are not taken then what are the results. Be prepared! There are no small problems when it comes to your generator.

Combustion Turbines, Diesels, Hydroelectric Turbines, or Steam Turbine Drives. It makes no difference; we cover them all as it applies to safe and proper generator operation. This course is intended for Control Room Operators, Shift Supervisors, Engineers, Technicians, and Operation Superintendents/Supervisors who operate these generating units.

A **topical outline** includes: Generator Theory for Non-Engineers, System Operation, Generator Construction, Intro to Generator Controls, Generator Auxiliary Systems, Normal Operations, Abnormal Operations.

Take a test now:

1. Define a VAR.
2. When opening the generator circuit breaker, under which conditions should the unit be in auto? And, under what conditions should the unit be in manual? Why?
3. Describe when motoring the generator a concern?
4. What generator component is at risk if and when a negative sequence current event should occur? Why?
5. Can a stator ground cause other damage on the generator?

How did you do? With a little experience and this course you should have been able to answer each question in some degree of detail.

WHAT YOU WILL RECEIVE:

1. 1 copy of HPC Technical Services' textbook, Generator: Normal/Abnormal Operations, a $119 value, as written by Harold Parker. This text contains a significant number of equipment photographs, graphics and data tables. It is a valuable desktop reference in addition to being able to enhance the learning process. (This valuable text is available for purchase if you cannot attend – US$119).
2. A "Certificate of Completion" with 1.6 CEUs, authorized for issue by the International Associate of Continuing Education/Training.

COURSE DATES/LOCATION/FEE

For current dates / locations / prices, please see HPC's website, www.hpcnet.com.

OBJECTIVES: Upon completion of this course, participants will be able to:

1. Describe, in layman terms, synchronism and the interaction of magnetic fields within the generator air gap.
2. Describe how the North America grid is divided.
3. Describe the terms VAR and WATT using a description of energy flow and current/voltage.
4. Describe the proper procedure for preparing the generator for synchronous operation.
5. Demonstrate the ability to use the reactive capability.
6. Describe the various methods used to monitor generator temperatures.
7. Describe the generator response to frequency and/or voltage deviations.
8. List a minimum of 15 alarm conditions occurring on a generator where operator action may be required.
9. For each alarm condition listed:
    a. Describe the likely results (damage) resulting from no proper response.
    b. Describe, in layman terms, the device providing the annunciation.
    c. State whether automatic protective relaying exists and describe any actions taken.
    d. Describe how an operator may validate alarm conditions.
    e. Describe the most correct action to be taken upon validation.

COURSE OUTLINE

Day One

Course Introduction

Generator Theory for Non-Engineers: Fundamentals of Generator Design, Stator Armature Windings, Armature Reaction, Rotor Magnetic Fields, Generator Loads, Power Transfer and Load Angle, Active and Reactive Power, Power Factor, Power Flow, Generators Under Load

System Operation: Structure of Power System, Interconnections, Power Balance, and Frequency/Voltage Control

Day Two

Construction: Stator Frame, Stator Core, Stator Windings, Coolers, End Shield, Rotor Assembly, Rotor Forging, Field Windings, Retaining Rings, Collector Rings, Exciters, Collectors

Introduction to Generator Controls: Speed Governor Operation, Automatic Voltage Regulator, DC Excitation Systems, Rotating Exciters, Static Excitation Systems, Generator Rotor Angle, And Parallel Operation

Generator Auxiliary Systems Normal/Abnormal Operations: Hydrogen Systems, Seal Oil Systems, and Stator Winding Cooling Systems.

Normal Operation: Preparation for startup, Synchronizing (Manual and Automatic considerations), Loading, Reactive Capability Curves, Vee Curves, Unloading, Monitoring Temperatures, Shutdown Methods.

Abnormal Operations: Relationship Between Operation, Protection and Alarms, Alarms, Protection When Off-Line, Protective Actions for Generator Faults

Day Three (1/2 Day)

Abnormal Operation and Protection Recommendations that include System Steady and Dynamic Conditions, Frequency Deviations, Voltage Deviations, Instability, Loss of Synchronism, Stator Over Current, Stator Ground Fault, Stator Phase-to-Phase Fault, Over Voltage, Over Volts-Per-Hertz, Field Overheating, Field Ground, Loss of Excitation, Bearing Vibration, Synchronizing Errors, Motoring, Reduced Seal Oil Pressure, Loss of Stator Coolant, High Water Conductivity, Local Overheating, Unbalanced Armature Currents, Breaker Failure, System Back Up, Voltage Surges, Transmission Line Planned Switching, High Speed Reclosing, Accidental Energization

Course Conclusion & Certification Exam

FREQUENTLY ASKED QUESTIONS

- Will HPC Technical Services bring this course to our location for our personnel only? YES, call or email Stephen Parker, stparker@hpcnet.com for a price quotation.
- Will HPC Technical Services customize the presentation at our site to suit our particular needs? Yes.
- Is HPC Technical Services' textbook available for purchase as a reference document? Yes. $119 + S&H.
- What is the cost for HPC Technical Service to deliver this course at our location? Well, of course that can vary, but generally speaking, if you're planning on having 6+ attend, when considering your T&L, it is to your advantage to perform the course at your plant (office). You gain from the customization and price.
- Is this course available for e-Training? Getting close. Lecture one is currently available for on-line study and is recommended even if the stand-up lecture course is taken (since time is not a variable in e-Training). Remaining chapters are currently under development.
- Can HPC Technical Services provide troubleshooting "Technical Assistance" should the need occur? Yes we can. Call or contact Harold Parker, hparker@hpcnet.com for our rate sheets and any further information required.

GENERATOR OPERATOR CERTIFICATION:

Those who attend this course are automatically qualified to take HPC Technical Services' Certification Examination. This examination is offered at no additional expense to the participant. An 80% passing grade is required. The examination length will not exceed 2-hours. Those who complete this examination will receive a revised "certificate of completion" that recognizes this accomplishment along with two-copies of a "To Whom It May Concern" letter that states their accomplishment. (Two copies are provided, one for the participants' employer and one for the participants' personal file.)

Consult HPC's website, www.hpcnet.com, for detail on this certification program.

RECENTLY SATISFIED CLIENTS:

Alstom Power, AEP, AES Corporation - Air Products & Chemicals - Allegheny Power - American Municipalities of Ohio - Anchorage Municipal Power & Light - Arizona Public Service - Austin Energy - Baltimore Gas & Electric - Boulder (CO), City of - Central Power & Light -Consumers Energy - Crestbrook Forest Industries - Denver Water Department – Dominion Energy - Duquesne Light – Dynegy Northeast Energy – Entergy Operations - Exelon Nuclear Generation - Fort Drum Cogeneration - General Electric - GPU/Genco – Indian River County (FL) Sheriff Department - Kennecott Utah Copper - Kentucky Utilities - L&S Industries - MidAmerican Energy - New England Power – Nuclear Service Organization - Ogden Martin Systems - Owensboro Municipal Utilities – Progress Energy - Public Service of Oklahoma - Saguaro Power - Salt River -Project - SaskPower – Smurfit Stone - Southwestern Electric Power Company - Stewart and Stevenson Operations – TransAlta Utilities - United Power Association - US Army Corps of Engineers - US Generating - Washington Water Power System - Watson Cogeneration - West Penn Power - West Plaines Energy - West Texas Utilities - Wheelabrator Energy Systems

HPC INSTRUCTOR / CONSULTANT (S):

Harold Parker is the founder & President of H Parker & Company, Inc. Mr. Parker has worked in the "Power Generation" industry for 36 years, 14-years with GE as a Field Engineer, Start-Up Engineer, Technical Training Specialist and Manager. In 1983 Mr. Parker resigned from GE and started a training company, Schenectady Learning Systems, in Schenectady NY, which evolved into H Parker & Company, Inc. today. During this post-GE period, Mr. Parker was briefly employed as Manager Turbine-Generator Services with General Physics (2-years) and as a Field Engineer with Mechanical Dynamics & Analysis (2-years). Mr. Parker is the primary contributor to the development of the text used in this course presentation. Mr. Parker holds a BSME ('69 from Lawrence Institute of Technology), a MBA ('81 from the State University of New York @ Albany) and is a member of ASME and ASTD.

John Mitchell. John Mitchell is a multi-talented leader with over 33 years management, engineering, installation and maintenance experience in thermoelectric power plants. He is especially an expert in steam turbines, generators and their controls. Prior to June 2003 (when he accepted an early retirement package from GE), John was a Customer Training Specialist with the GE International Department. Other past responsibilities included being Manager, Engineering Services, Senior Application Engineer, Senior Service Engineer, Lead Training Specialist, Program Support Engineer, Instructor Technical Training, and Field Engineer. All of this on operation & maintenance of steam turbine generator hardware and controls.

Robert Johndrow. Bob Johndrow hired into GE as a field engineer on the same day as HPC's founder, Harold Parker. That was 36-syears ago. Since that date, Bob Johndrow has been a GE Field Engineer specializing in many disciplines including Generator Maintenance and Testing. Bob completed GE's Generator Specialist Training Program early in his career and has been involved in many generator design issues, mechanical maintenance, electrical testing, and troubleshooting O&M problems since then. Bob earned a BS in Industrial Distribution from Clarkson University in Potsdam NY and also has GE Six Sigma Green Belt Certification. Bob accepted an early retirement package late 2003 and has worked as an independent as well as being associated with HPC Technical Services since then. He resides in Rhode Island.

Stuart Fasser. Mr. Fasser earned his BS in Electrical Engineering from Union College, Schenectady, NY, in 1967. He retired in 2002 after 37 years of service with the General Electric Company including an early career in factory and field-testing of power generation equipment and concluded with 10 years of field engineering in the installation and service of excitation systems. As a field engineer assigned to GE International he installed new GE excitation systems on both gas and steam driven turbine-generators as well as trouble shooting and maintaining existing installations. His most recent installations included twenty-one EX2000 exciters on units in Egypt, Thailand, Korea and the United States. In these assignments he was responsible for installation of the exciters as well as their checkout and start-up. These activities included component checks, initial calibration, pre-roll simulation of operation and both off-line and on-line alignment and checkout. Stuart resides in Massachusetts.

Bob Fleming. Provides support in electrical engineering, topical areas. Specifically instructs HPC voltage regulator courses such as the Westinghouse WTA, WMA, WDR Exciters and generator operations. From 1996 to 2004 Bob worked for TCSA and developed voltage regulator upgrades, troubleshoots system problems. From 1969 to 1996, Bob worked for Westinghouse as a Generator/Exciter Specialist with extensive experience with installation, testing, rewinds and repairs of generators from 1-MW to 1500-MW. Bob resides in the Pittsburgh area.

John Marshall. Mr. Marshall, worked for GE 35 years in the power system service and installation business. 25 years of this time was in the international service business. During his career, Mr. Marshall's positions included Field Engineer, Service Supervisor, Technical Training Instructor and Senior Application Engineer. Mr. Marshall's work covered electrical power distribution and control of power generation equipment. His expertise is GE manufactured excitation systems for large and medium size generators used on gas and steam powered turbines. As a Technical Training Instructor for over 20 years, Mr. Marshall developed and presented training programs for GE manufactured excitation systems. As a Senior Application Engineer, Mr. Marshall's work included the upgrading/replacement of older excitation systems with GE's digital excitation system. His Field Service work was worldwide. BSEE degree from Virginia Polytechnic Institute and State University in Blacksburg, Virginia.

HPC TECHNICAL SERVICES
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REGISTRATION FORM

Company:_____

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Telephone:_____ FAX:_____

Course Number/Title: _____

Course Dates: _____/_____/_____ Thru _____/_____/_____

Course Location: _____ Course Fee: _____

PLEASE ENROLL THE FOLLOWING INDIVIDUAL (s) LISTED BELOW:

Student #1:_____ Email: _____

Student #2: _____ Email: _____

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