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Course Information Letter ---- TG203

INDUSTRIAL STEAM TURBINE-GENERATOR FUNDAMENTALS

TG203

This course has been designed for individuals who are new to steam turbine-generator operations and maintenance. It also provides an excellent review for individuals who have been involved with steam turbine-generators, but have not received formal training. In this course we discuss the basic theory of operation and apply that theory to a discussion of components that immediately follows. If one is to operate, maintain, or manage steam turbine generator functions then one needs to know why it works as it does, what are some of the design differences, and what is the significance of the various components. Nozzles, blades, shells, rotors, valves; all are covered as to their function. On the generator; frame, core, armature windings, rotor, field windings, exciter: all are covered as to their fundamental function.

Topical Outline includes: Steam Turbine Operating Principles, Component Descriptions, Steam Valves, Steam Turbine Auxiliary Systems, Intro to Turbine Controls, Generator Operating Principles, Generator Component Descriptions, and Generator Auxiliaries..

HPC's instructional staff on this topic is significant. The materials were developed by those who have been working on steam turbine-generators their whole career.

OBJECTIVES:

At the completion of this course the participant will be able to:

1. Describe the function of turbine nozzles.
2. Describe the function of turbine blades/buckets.
3. Describe the energy conversions that take place in impulse and reaction turbines and identify where the conversions occur.
4. Describe the function of various steam turbine components.
5. Describe the areas where the turbine is sealed and why.
6. Explain the function of the steam valves: SV, V1, V2.
7. Provide a fundamental description of an extraction steam turbine control system.
8. Trace the normal flow path for common steam turbine auxiliaries.
9. Describe the major components making up the steam turbine auxiliaries.
10. Describe the three circuits that are basic to AC generators operation.
11. Describe the function of AC generator major components.
12. Trace the normal flow path for common generator auxiliaries.
13. Describe the major components making up the generator auxiliaries

WHAT YOU WILL RECEIVE:

1. 1 copy of HPC Technical Services' textbook, TG203, Industrial Steam Turbine Generator Fundamentals,
2. A "Certificate of Completion" with 1.9 CEUs, authorized for issue by the International Associate of Continuing Education/Training.

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COURSE OUTLINE

- I. **Operating Principles:** Brief Review of Thermodynamics, Fundamental Theory of Turbine Operation, Impulse and Reaction Stages
- II. **Turbine Component Construction:** Turbine Sections, Shells, Casings, HP-LP, Nozzles/Diaphragms, Stationary Blades, Turbine Seals, Turbine Rotors, Blades/Buckets, Standards, Bearings
- III. **Steam Valves:** Steam Chests, Main Stop Valve, Control Valve (V1), Extraction Control Valve (V2 and V3), Auxiliary Steam Valves
- IV. **Turbine Auxiliaries:** Lube Oil, Hydraulic, and Gland Seal Systems
- V. **Extraction Turbine Controls:** 3 Laws of Steam Turbine Controls, Speed/Load Control, Extraction Pressure Control, Overspeed Protection
- VI. **Generator Components:** Stator, Rotor, Exciters, House Generators
- VII. **AC Power Generation:** Fundamentals of Generator Design, AC Power, Power Flow
- VIII. **Generator Auxiliaries:** Seal Oil and Hydrogen Systems

COURSE DATES/LOCATION/FEE

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

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. \$95 + 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.
- Can HPC Technical Services provide "Technical Assistance" in conducting functional checkouts or troubleshooting problems? Yes we can. Call or contact Harold Parker, hparker@hpcnet.com for our rate sheets and any further information required.

RECENT SATISFIED CLIENTS:

American Crystal Sugar, Cargill Fertilizer, GE Contractual Services, Holland (MI) Board of Water & Light, Inland Eastex, International Paper, Jackson County Resource Recovery, Lincoln Pulp & Paper, Packaging Corporation of America, Sinclair Oil Company, Southside Landfill, TurboCare, US Sugar

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INSTRUCTOR (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.



Dan Anderson is the primary instructor for this course. Dan started his career in the US Navy as a Boiler Technician. After his discharge Dan was a civilian instructor for the US Navy at Great Lakes Naval Training Center. While there Dan instructed Navy personnel in the four-phase steam cycle including balance of plant equipment. In 1990 Dan returned to Minnesota and received his Minnesota State Chief A Engineers license. After a few years in the position as Chief Boiler Engineer For Green Giant Co. and Maintenance Manager for Minnesota Energy, Dan went to work for Hutchinson Utilities Commission in Hutchinson, Minnesota. His position there was Operator 1. His operational responsibilities included GE LM 6000 Combined Cycle, GE Frame 5 Simple Cycle, and a GE Frame 3 Combined Cycle. He also had operations of 6 Diesel Engines for power production. Dan joined HPC Technical Services, June 2001. His main area of instruction is Gas Turbine/Combine Cycle Fundamental, Steam Turbine/Generator Fundamentals, Mechanical Maintenance Courses, and The Boiler Training. Dan currently holds a Chief A Engineers License for Minnesota, A Chief NIULPE Certificate, NIULPE Instructor and Examiners Certificate, Chief ASOPE Certificate, and is a Member of ASME.



Douglas Lemmo, PE. Mr. Lemmo has 35 years experience in the power generation industry, 31 of them with GE. Within GE he was initially employed as a field engineer (1971-1976). Here he was responsible for the installation and startup of a number of large and medium steam turbine generators and the feed pump turbines. In addition to this installation work, Mr. Lemmo also performed maintenance service on a variety of nuclear, fossil and marine turbine units. After leaving the field, Mr. Lemmo taught in GE's Field Engineering Development Center. Here his specialty was steam turbine generators, installation, alignment and maintenance. After a couple years instructing, he accepted a position selling maintenance and repair services. In 1982, Mr. Lemmo was the Project Manager for a Waste-to-Energy site. Later projects included a modernization of a hydroelectric facility and the management of the installation of a few combined cycle sites. In 2002, Doug left GE and founded Power Generation Consulting Services, which focuses primarily on the operation, maintenance and repair of steam turbine generators. In this last position, Doug has been closely aligned with HPC as he has instructed many of our courses and provided site-engineering support on HPC contracts.

Robert Doughty. Mr. Doughty has more than 30 years of experience in start up, maintenance and operation of both large and small turbine-generators. Bob started his career as a power plant instrumentation technician while he completed his BS degree in Engineering Technology (1976) at the University of Houston. He has worked as a start up and field engineer for one of the major turbine-generator OEM's and as a consulting engineer, supporting the initial operation of two nuclear fueled power plants. His most recent position (1999) as the President of Turbine Services, Inc., has allowed him to continue to provide on site technical direction, start up and controls adjustments for several major turbine inspections in the range of 35 to 835 MW. He is experienced in electro-hydraulic and mechanical governor control systems and turbine valve and control system up-grades. Bob is a member of ASME (18 years) and has worked closely with HPC on multiple projects, training as well as field service. Bob resides near Pittsburgh PA.

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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. John resides in Schenectady NY.

Joe Byrd. Joseph Byrd has over 29 years of experience in the power industry, concentrating in the area of turbine-generator controls and operations. He graduated from North Carolina State University in December 1978 with BS in Mechanical Engineering. He began his career in January 1979 as a Field Engineer, and subsequently a Start-Up Engineer with GE and was lead Start-up Engineer on five turbine-generator installations. He left GE in 1986 to consult directly to utilities on control systems calibration and maintenance with MD&A. In June 2008, he ended his relationship with MD&A and became available to HPC to instruct. His primary areas of expertise are GE manufactured Large Steam and Mechanical Drive Turbine MHC control systems as well as EHC systems. Joe resides near Raleigh NC.

Robert Johndrow. Bob Johndrow has 35+ years experience as a Field Engineer working on steam turbine generators. His experience includes steam turbine generator maintenance and testing, as well as considerable work on the steam turbine controls. His work on the steam turbine Mechanical Hydraulic Controls included work on nuclear (BWR) units, fossil applications, and industrial 3-arm governors. 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 near Hartford CT.