



500 Tallevast Road • Suite 101
Sarasota, FL 34243 USA
Tel: 941-747-7733 • Fax: 941-746-5374
www.hpcnet.com

Course Information Letter ---- TG201

STEAM TURBINE GENERATOR FUNDAMENTALS TG201

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, and exciter: all are covered as to their fundamental function.

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

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 how the turbine expands and why it is important.
7. Explain the function of the various steam valves.
8. Describe full arc and partial arc operation.
9. Trace the flowpath for steam turbine auxiliary systems.
10. Describe the major components of the steam turbine auxiliary systems.
11. Describe the component parts of the generator.
12. Describe the three circuits that are basic to the AC generator operation.
13. Describe the major components of the generator auxiliary systems.
14. Trace a flow path through the generator auxiliary systems.

WHAT YOU WILL RECEIVE:

1. 1 copy of HPC Technical Services' textbook, TG201, Steam Turbine Generator Fundamentals, Written by Joseph Markey, Revised by Dan Anderson, Ray Militello and Harold Parker. It is a valuable desktop reference in addition to being able to enhance the learning process.
2. A "Certificate of Completion" with 1.6 CEUs, authorized for issue by the International Associate of Continuing Education/Training.

TG201 Steam Turbine Generator Fundamentals

www.hpcnet.com

COURSE DATES/LOCATION/FEE

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

COURSE OUTLINE

- I. **Operating Principles:** Fundamental Theory, Impulse and Reaction Turbines
- II. **Turbine Component Construction:** Turbine Sections, Shells, Casings, Cylinders, HP-IP/LP, Nozzles/Diaphragms, Stationary Blades, Turbine Seals, Turbine Rotors/Spindles, Blades/Buckets, Standards/Pedestals, Bearings
- III. **Main/Aux. Steam Valves:** Steam Chests, Main Stop/Throttle Valve, Control/Governor Valve, Reheat Valves, Auxiliary Steam Valves
- IV. **Unit Descriptions**
- V. **Turbine Operations:** Prewarming, Starting and Loading, Full Arc Admission, Partial Arc Admission, Turbine Supervisory Instruments
- VI. **Steam Turbine Auxiliary Systems:** Lube Oil System, Shaft Sealing System, High Pressure Fluid System
- VII. **Generator Fundamentals:** The Power System, DC and AC, Power System Components, System Frequency, System Voltage, System Load Demand, System Generator Capacity
- VIII. **Generator Operating Principles:** Electro-Magnetic Principles, Exciter/Field Current, Magnetic Circuit, Stator Winding Circuit, Synchronous Speeds and RPM, Losses and Cooling
- IX. **Generator Construction:** Stator, Frame, Coolers, High Voltage Bushings, Stator Core, Stator Windings, Conductor Cooling, End Shields, Generator Bearings, Rotor, Forging, Field Windings, Collector Rings & Brushes, Exciters, House Generators
- X. **Generator Auxiliary Systems:** Gas Control System, Generator Shaft Seal System, Stator Water Cooling System, Stator Oil Cooling System
- XI. **Certification Examination**

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:

AES Corporation, Alliant Energy, Alstom Power, AmerenUE, American Crystal Sugar, Associated Electric Cooperative, Aurora Energy LLC, Bruce Power (Canada), Cargill Fertilizer, Consumers Energy, Dominion Energy, Dynegy Northeast, El Paso Electric, Electric Energy, Entergy Operations, First Energy Corporation, Florida Power Corporation, GE Contractual Services, Georgia Power, Great River Energy, Hitachi America, Hitachi Canada, Holland (MI) Board of Water & Light, Hydro Quebec, Inland Eastex, International Paper, Jackson County Resource Recovery, Kentucky Utilities, Korea Hydro & Nuclear Power, KSL Services, L&S Electric, Lansing (MI) Board of Water & Light, Lincoln Pulp & Paper, Mechanical Dynamics & Analysis, Michigan State University, MidAmerican Energy, Millenium Power Services, Mirant Corp, Montenay Power, National Grid, Nebraska Public Power District, Nuclear Management Corporation, Ocean State Power, Orlando (FL) Utilities Commission, Packaging Corporation of America, Pennsylvania Power & Light, Progress Energy, Renewal Parts Maintenance, Santee-Cooper, SaskPower, Sinclair Oil Company, Southern California Edison, Southern Company, Southside Landfill, Tampa Electric, TransAlta Utilities, Turbine Diagnostic Services, TurboCare, US Navy, US Sugar, Wisconsin Public Service, Woodward Governor Controls, Xcel Energy

TG201 Steam Turbine Generator Fundamentals

www.hpcnet.com

STEAM TURBINE CERTIFICATION:

This course, Steam Turbine Generator Fundamentals, is part of HPC's Certification Programs listed below.

1. Steam Turbine Field Engineering Certification
2. Steam Turbine Mechanical Maintenance Technician Certification
3. Steam Turbine I&C Maintenance Technician Certification

Those who attend this course are automatically scheduled to take HPC Technical Services' Certification Examination. This examination is scheduled as part of the course schedule and 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.)

Completion of this certification program can be accomplished by taking individual courses at the most workable student pace or by taking the courses all at one time (lump-sum). The Steam Turbine Field Engineering Certification program can be taken lump-sum, if interested:

Session 1 – January / February 2009

07 January 2009	.....2.5-days ...	TG201	..... Steam Turbine Generator Fundamentals	.....Sarasota FL	.....	\$1,395
12 January 2009	.....5-days	OP105	..... Mechanical & Electrical Principles	.....Sarasota FL	.....	\$1,595
19 January 2009	.....4.5 days ...	TG327	..... Steam Turbine Operation Practices & Alarm Response	.....Sarasota FL	.....	\$2,195
26 January 2009	.....3-days	TG316	..... Steam Turbine Overhauls	.....Sarasota FL	.....	\$1,595
29 January 2009	.....2-days	TG412	..... Steam Turbine Repair	.....Sarasota FL	.....	\$1,395
2 February 2009	.....4.5 days ...	TG331	..... "Hands-On" Steam Turbine Maintenance	.....Sarasota FL	.....	<u>\$2,095</u>
						\$10,270

Session 2 – July/August 2009

08 July 2009	.....2.5-days ...	TG201	..... Steam Turbine Generator Fundamentals	.....Sarasota FL	.....	\$1,395
13 July 2009	.....5-days	OP105	..... Mechanical & Electrical Principles	.....Sarasota FL	.....	\$1,595
20 July 2009	.....4.5 days ...	TG327	..... Steam Turbine Operation Practices & Alarm Response	.....Sarasota FL	.....	\$2,195
27 July 2009	.....3-days	TG316	..... Steam Turbine Overhauls	.....Sarasota FL	.....	\$1,595
30 July 2009	.....2-days	TG412	..... Steam Turbine Repair	.....Sarasota FL	.....	\$1,395
03 August 2009	.....4.5 days ...	TG331	..... "Hands-On" Steam Turbine Maintenance	.....Sarasota FL	.....	<u>\$2,095</u>
						\$10,270

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

INSTRUCTOR (S):



Ray Militello Mr. Militello has approximately 40-years experience maintaining steam turbine generator equipment. He has worked as a Field Representative for GE Installation & Service Department as well as a Turbine Repair Specialist for GE Apparatus Repair Division. Additionally, Mr. Militello was employed as a Supervisor - Maintenance and Maintenance Planning with Southern California Edison Company. Ray also worked as Manager, Maintenance Training Services with HPC Technical Services for 4-years before joining the Elliot Company as a service shop manager. For the last four years, Mr. Militello has been performing independent contractor work as a consultant, technical writer, and maintenance training instructor for the utility industry. Ray recently re-joined HPC's staff and is again bringing his excellent hands-on field experience into our classrooms for the benefit of all who attend. Ray resides in Bradenton FL.



Harold Parker is the founder & President of H Parker & Company, Inc. Mr. Parker has worked in the "Power Generation" industry for 40 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 major 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, IEEE and ASTD. Harold resides in Bradenton FL.

TG201 Steam Turbine Generator Fundamentals

www.hpcnet.com



Dan Anderson Mr. Anderson 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 Engineers License for Minnesota, a Chief NIULPE Certificate, NIULPE Instructor and Examiners Certificate, Chief ASOPE Certificate, an ASME – QFO Certificate, and is a Member of ASME. Dan resides in Bradenton FL.

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 onsite 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-upgrades. 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.



Douglas Lemmo, P.E. 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 has been closely aligned with HPC as he has instructed many of our courses and provided site-engineering support on HPC contracts. Doug resides near Boston MA.



Art Hinch, P.E. Mr. Hinch has worked in the Power Generation industry for 30+ years. During the 1974-1980 period, Mr. Hinch was employed by GE and was responsible for the installation of multiple large steam turbine generators (fossil and nuclear) and for multiple steam and gas turbine generator outages. To 1992 Mr. Hinch worked as an independent consultant in the south and southwestern regions. During this time frame he worked many turbine-generator outages on GE, Westinghouse, and Siemens units. In addition he worked the start up of a 1300-MW turbine generator unit. In 1992 Art signed on with Arkansas Nuclear One as a senior engineer in the turbine group where he worked primarily in the planning and implementing of turbine generator outages (GE and Westinghouse units). In 2003, Art accepted an early retirement package and has again functioned as an independent engineer, an associate of HPC Technical Services. In this capacity Art has worked multiple steam turbine generator outages on a variety of manufacturers as well as being primary instructor on a number of courses that HPC offers. Art resides near Little Rock, AR.



John Mitchell Mr. Mitchell is a multi-talented leader with over 33 year's 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.

TG201 Steam Turbine Generator Fundamentals

www.hpcnet.com

Joe Byrd Mr. 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 Mr. 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.

HPC TECHNICAL SERVICES
500 Tallevast Road, Suite 101, Sarasota, FL 34243
Telephone: 941-747-7733 FAX: 941-746-5374
Website: www.hpcnet.com

REGISTRATION FORM

Company: _____

Plant: _____

Address: _____

City/State/Zip: _____

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: _____

Taking advantage of HPC's 3-4-2 Policy: Send 3, Pay for 2 when paying in advance.

Student #3: _____ Email: _____

ENROLLED BY: _____ **Email:** _____

Date: _____

METHOD OF PAYMENT

- Check to Follow: _____
- Check Enclosed #: _____
- MC/Visa/AMEX #: _____
Expiration Date: _____ CV Code: _____
- Purchase Order #: _____

Please advise how you found out about this course initially.

- Website search
- Fax advertisement
- Magazine advertisement
- Familiar with HPC
- HPC mailing
- Other: _____