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Course Information Letter ---- TG301

STEAM TURBINE GENERATOR MAINTENANCE

TG301

Planning, scheduling, and implementing a steam turbine-generator outage can be one of the most demanding tasks you perform. Especially, when problems are found that were not anticipated (and there are always these kinds of problems). In the class we will learn to better plan the work (from a technical perspective). Once the work is planned, as we know, the next task is to work the plan. Here is where the surprises can occur. Some components will not disassemble according to procedure – what are your options? Some components do not meet OEM specifications – what are your options? Some components won't go back together according to procedure – again, what are your options? These options usually involve repair / replace / reuse decision making. Effective decision making is a function of your knowledge of the importance of this component, your understanding of recommended tolerances, and your understanding of how different options can impact the schedule and/or cost of this outage. Complicating this issue is a strong need to make outages shorter in length, AND longer in frequencies between outage. It's simple: You need to do more with less time and money available. This course is intended to help you (or your staff) make better steam turbine-generator maintenance decisions.

Topical Outline includes: Planning, Scheduling and Decision Making; Maintenance of Shells, Casings & Rotors; Journal and Thrust Bearings; Couplings, Steam Valves; Generator Maintenance; Steam Path Alignment; and Job Wrap Up.

HPC Technical Services course on Steam Turbine Generator Maintenance is, perhaps, one of the most popular courses we offer. The course targets those individuals who have a need to better understand the maintenance process. This includes engineers (who have not yet received formal training on this topic), experienced-mechanics, mechanical maintenance foremen, planners and management.

Over the past couple years the most commonly received comment is, "I wish I had taken this course 10-years ago." Well, the truth is, 10-years ago our course wasn't nearly as good as it is now. In 2001, when we reorganized our instructor staff, this course underwent a long overdue revision. This revision was significant, and you can benefit!

COURSE DATES/LOCATION/FEE

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

OBJECTIVES: Upon completion of the course the participants should be able to:

1. List steam turbine-generator operational and safety issues that typically cause the scheduling of a maintenance outage.
2. List the considerations that must be included when developing an outage plan or schedule.
3. Describe the major considerations when making a replace/reuse/repair decision.
4. Describe the procedures necessary for the safe and effective disassembly and reassembly of steam turbine generator components.
5. Describe the purpose and operation of the major steam valves.
6. Describe the disassembly and reassembly of the major steam valves.
7. List the five (5) most common causes of steam path damage and their possible affects upon future operation.
8. Describe three (3) common causes steam path defects and their impact upon turbine efficiency and reliability.
9. Describe the type and purpose of clearance and alignment measurements commonly taken during the disassembly and reassembly of a steam turbine generator.
10. Describe the measuring instruments used to determine steam turbine generator component clearances.
11. List and describe the various non-destructive examinations performed during disassembly of the steam turbine generator.
12. Describe the common procedures for cleaning and inspecting steam turbine generator components.
13. Describe the criteria used to evaluate steam turbine generator defects.
14. Describe the common repair methods for repair of steam turbine components.
15. Describe the purpose of conducting a steam path audit, and how that audit would be accomplished.
16. Describe the common types and operation of journal and thrust bearings.
17. Describe the common causes of bearing damage.
18. Describe the measurements required to determine oil clearances.
19. Describe common bearing inspection and repair procedures.
20. Describe the considerations to be taken into account when evaluating alignment of steam turbine generator components.
21. Describe the methods used to properly align steam turbine generator components.
22. Demonstrate the ability to perform the necessary calculations to align steam turbine generator components.
23. List and briefly describe the electrical tests often performed on generator components.
24. State the purpose of each electrical test listed.
25. Describe the proper disassembly, inspection and reassembly of a generator hydrogen seal.

COURSE SYNOPSIS

Monday

Planning, Scheduling and Decision Making: This presentation is intended to provide participants with an understanding of those major items that must be considered PRIOR to commencing a scheduled turbine-generator outage. Discussion will also include those items we need to consider when making repair/replace/reuse decisions.

Turbine Shells, Casings & Rotors: Two hours into the course and we're into the meat! This lecture is intended to prepare the participant to safely and efficiently disassemble/reassemble major turbine components, as well as improve inspection/repair techniques, communications on equipment, and make better replace/repair/reuse decisions. Presentations include specific discussions on the different types of distress typically found on these components.

Tuesday

Turbine Shells, Casings & Rotors continues for ½ day.

Journal & Thrust Bearings: Learn the different types of bearings and their applications, disassembly/reassembly procedures, inspection techniques, and typical types of distress as well as causes.

Couplings: Learn what types of couplings are used on T-G sets, how torque is transferred, how to properly disassemble/reassemble, how to inspect, what measurements to take, and what they mean.

Wednesday

Steam Valve Maintenance: Learn the purpose of the various steam turbine valves, how to properly disassemble/reassemble, how to inspect, what are the typical types of distress, what measurements to take, and what they mean.

Generator Maintenance: Learn how a large AC generator is constructed, how to disassemble major components, what are the typical types of distress, how to clean, routine repair, and why generator inspection/testing is so important. This presentation also includes an introduction to the various electrical test techniques.

Thursday

Alignment: Learn how to properly take clearance/alignment and how to evaluate. Discussions include how to calculate and make moves for stationary equipment such as diaphragms and inner shells. Discussions also include how to take coupling rim/face readings, how to calculate moves to correct for coupling misalignment, and how to calculate and make moves to bearings to accomplish alignment objectives.

Friday

Job Wrap-Up: Learn what kind of data should be recorded following the outage, and what checks to make as we prepare to return the equipment to service.

Steam Turbine Field Engineer / Mechanic 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. This significant textbook is available, in full COLOR, for $219 + S&H.
- Is this course offered as a "self-study"? Yes. The fee is US$995. The fee includes one textbook, instructor email (or phone) interaction, examinations for each chapter of study, and a final exam.
- 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 the planning and implementation of our outages? Yes we can. Call or contact Harold Parker, hparker@hpcnet.com for our rate sheets and any further information required. When you receive this rate sheet we recommend you re-read the biographies listed below. You can describe this level of expertise with one word: Wow!

WHAT YOU WILL RECEIVE:

1. 1 copy of HPC Technical Services' full COLOR textbook, Steam Turbine Generator Maintenance, a $219 value, as written by Harold Parker, with technical support by Robert Doughty, Doug Lemmo, Bill Newbury and John Mitchell. 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 full-color text is available for purchase if you cannot attend – US$219).
2. A "Certificate of Completion" with 2.9 CEUs, authorized for issue by the International Associate of Continuing Education/Training.

STEAM TURBINE MAINTENANCE CERTIFICATION:

There are two levels of certification (Both levels require this course):

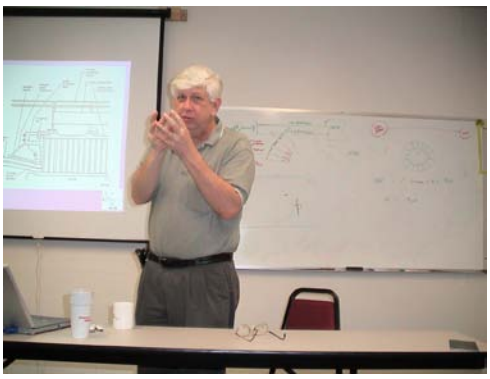
1. Engineer
2. Mechanical Technician

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.

SATISFIED CLIENTS:

A/C Power, AEC, Alabama Power, Alberta Power Limited, Allegheny Energy, Alstom Power, Ameren CIPS, Ameren UE, American Electric Power, American Crystal Sugar, Amoco Oil, Aqualectra, Arkansas Nuclear One, Arizona Public Service, Associated Electric Cooperative, ATCO Electric (Canada), Austin Electric Department, Baltimore Gas & Electric, Basin Electric Power Cooperative, Bechtel Corporation, Bismarck State College, Boralax-Stratton Energy, Calpine Corporation, Cajun Electric Cooperative, Cardinal Company of Canada, Cargill Fertilizer, Carolina Power & Light, Central California Power Agency, Central Hudson Gas & Electric, Central Illinois Lighting, CF Industries, Champion International, Chevron Geothermal (Indonesia), CLECO Power, Commonwealth Edison, Conectiv, Consolidated Edison, Consumers Energy, Covanta Energy, Crawsfordsville Electric, Light & Power, Dairyland Power Cooperative, Daishowa-Marubeni International LTD (Canada), Dartmouth College, Dayton Power & Light, Delmarva Power & Light, Detroit Edison, Dominion Energy, Domtar (Canada), Dragon Sandblasting (Canada), Duke Energy, Eastern Power Developers, Edison Mission Energy, El Paso Electric, Edmonton Power, Electric Energy Inc., Energea Cogeneracion y Termico SL (Spain), Entergy Louisiana, Entergy Operations, EPCOR, Equistar Chemicals, Erving Paper Mills, Exelon Corp, First Energy Corporation, Fort James Marathon LTD, General Chemical, General Physics Corporation, Georgia Power, Golden Valley Electric Assosciation, Grand Island (NE) City Utilities, Hitachi Canada, Holland (MI) Board of Water & Light, Iberdrola Ingeneria y Conclutoria, Inberinco (Spain), Illinois Power, Indianapolis Power & Light, Industrial Risk Insurers, Intermountain Power Service, Irving Pulp & Paper, Kennecott Copper, Keyspan Energy, Korea East-West Power, Korea Midland Power, Korea Nuclear & Hydro, Korea Plant Services & Engineering, Korea Western Power, LGE Power Services, Lakeland Department Electric & Water, Lower Colorado River Authority, Massachusetts Municipal Wholesale Electric Cooperative, Mead Paper Company, MidAmerican Energy, Miller Brewery Company, Minnesota Power, Minnkota Power, Montenay Power, Nebraska Public Power District, New Brunswick Power, New York Power Authority, New York State Electric & Gas, Niagara Mohawk, Northern Atlantic Energy Services, Northern Indiana Public Service, Nova Scotia Power, Nuclenor (Spain), Ocean States Power, Ogden Martin, Ohio Electric Power Cooperative, Oklahoma Gas & Electric, Omaha Public Power District, Ontario Hydro, Ontario Power Generation, Orlando Utilities Commission, Otter Tail Power, OxyChem, PacifiCorp, Pacific Gas & Electric, Pennsylvania Power & Light, Pinetree Power Fitchburg, Port Townsend Paper, Power Resources, PPL Inc., Progress Energy, Public Service Colorado, Public Service New Mexico, Puerto Rico Electric Power Authority, Reliant Energy, Ryegate Associates, Salt River Project, Santee Cooper, SaskFerco (Canada), SaskPower (Canada), Sherwin-Alumina, Sierra Pacific Power, SITCA, Southern California Edison, Southern Company, Southern Indiana Gas & Electric, Southern Nuclear, Southwestern Public Service, Springfield City Utilities, Suncor (Canada), Syncrude (Canada), Tampa Electric, Tata Steel (India), Tennessee Valley Authority, Texas Utilities, TPS Generacione of Guatamala, TransAlta Utilities (Canada), Turbine Generator Maintenance, United Power Associates, US Air Force, US Generating, US Sugar, Valero Aruba Refinery, Vattenfall (Denmark), Virginia Electric Power, Waste-Management Energy, WE Energies, Weldwood of Canada, Western Resources, West Plains Energy, Westmoreland LG&E, Wheelabrator Energy Systems, Willamette Industries, Wisconsin Public Service, Xcel Energy

INSTRUCTOR (S):



Harold Parker is the founder & President of H Parker & Company, Inc. Mr. Parker, along with Mr. Douglas Lemmo (see below) were significant contributors to the development of the Steam Turbine Generator Maintenance training program used by GE for the "advanced" training of their field engineering force. 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, ASTD and IEEE. Harold resides in Bradenton FL.

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 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. Doug resides in 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 in Arkansas.

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 returned to HPC as a full-time staff instructor in 2006 and again our clients will benefit from his hands-on experience. Ray resides in Bradenton

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.

Eldon Bearden Mr. Bearden has 21 years experience in the power generation industry, 10 of them with GE. He started his career as a GE field engineer providing technical services for installations and maintenance (1976-1981 and 2000-2004). Here he was responsible for the installation and startup of a number of large steam turbine-generators and frame 7 gas turbines as well.

In addition to the installation work, he also performed maintenance service on a variety of fossil, nuclear and combined cycle sites. Recently Mr. Bearden accepted a position with HPC as an instructor to teach steam turbine and gas turbine courses. He will also provide site engineering support on HPC contracts during the outage season.

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. He also was the field-engineering supervisor with overall responsibility for construction testing, initial start up and operations of a 600 MW coal fired generating plant. Later, as an employee of one of the larger independent turbine-generator service corporations, he worked as a start up and maintenance engineer on turbine-generators of all sizes from nearly all the major manufacturers. 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 in Pittsburgh PA.

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 in Connecticut.

HPC TECHNICAL SERVICES
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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: _____

Student #2: _____

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

Student #3: _____

Enrolled by: _____ Date: _____

METHOD OF PAYMENT

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

HOW DID YOU LEARN OF THIS COURSE

- ☐ Attended HPC courses in the past.
- ☐ Received an email.
- ☐ Received a fax.
- ☐ Received a HPC update mailing.
- ☐ Internet search
- ☐ Other: _____