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Course Information Letter ---- TG327

STEAM TURBINE OPERATION PRACTICES & ALARM RESPONSE

TG327

When things go wrong, with respect to steam turbine operations, they go wrong quickly!

- Packing rubs can occur for what might appear to be, no apparent reason. Your gut reaction on what to do, when a packing rub occurs, can be seriously wrong! Learn the concepts here and be prepared.
- One moment all is fine, and the next moment the alarms are dancing off the wall (or CRT). Could it be a water induction incident? The next few minutes of decision making and operator action is critical! Learn how the turbine is impacted and what one should or should not do.
- We often hear that there are two lines of defense against overspeed. Learn, exactly what they are and what they are not!
- Haven't seen that vibration trend before. What does it mean? Learn what data needs to be collected to answer this question and how to come to an answer as well.
- The lube oil temperature is 110^{o}F while on turning gear. So what? Learn why this can be an issue.
- ….. and the list of issues go on.

This course is intended to have a positive impact upon steam turbine operator decision-making. The course specifically targets Control Room Operators, wannabe CRO, and Shift Supervisors. Engineers can benefit as well. It has been HPC's experience that all too often that the procedures for starting up and loading a steam turbine are based upon hand-me-down communications. Too often, equipment has been improved but procedures have not. Too often, equipment has been replaced, but the procedures have not been altered. This course is not intended to develop or discuss procedures, but is, instead, directed toward development, in the operational personnel, a thorough "understanding" of what considerations the ideal procedures are based upon. HPC believes that if personnel thoroughly understand the operating concepts the result will be less forced outages, improved efficiency and improved availability.

Emphasis is on those steam turbines driving large generators. HPC's "Steam Turbine Operating Practices & Alarm Response" course is instructed by experienced OEM engineers. A topical outline includes: Review of Steam Turbine Operating Theory, a Review of Steam Turbine Components, Auxiliary Systems, Thermal Stress, Turbine Supervisory Instrumentation, Steam Turbine Control Concepts, Normal Operation, Failure Modes, and Abnormal Operations. The discussion on Normal Operation is to include Methods of Prewarming, Starting and Loading Instructions, Load Change Considerations, and Normal Shutdowns. The discussion on Abnormal Operation is to include: Eccentricity Issues, Packing Rubs, Effect of Synchronizing Errors, Lube Oil Problems during Startup, Water Induction (an in-depth discussion), Overspeed (Normal, Emergency and Destructive), Vibration Trends as a Telltale of Operational Problems, Differential Expansion Issues, Effects of Frequency Deviation, Vacuum Breaking, High Exhaust Hood Temperatures, Over Pressure/Temperature at Inlet, and Feedwater Heater Removal.

COURSE DATES/LOCATION/FEE

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

OBJECTIVES:

Upon completion of this course the participants will be able to:

1) Describe those steam turbine components that are susceptible to damage in abnormal operating conditions.
2) Describe the type of damage that could occur and what the operator can (or cannot) do to correct for the situation.
3) Describe in detail the function of the turbine support systems, procedural issues, “typical” abnormal conditions, and operator corrective action.
4) Draw a simple block - diagram that describes all the elements of steam turbine controls: speed, load, and pressure control, the generation of a servomechanism signal, feedback and regulation.
5) Describe the function of each of the block diagram elements drawn.
6) Describe each of those operating parameters monitored by turbine supervisory instruments.
7) Describe operating conditions where an eccentricity detector is used to include detailed discussion on what is acceptable (or not acceptable) and operator actions.
8) Describe operating conditions where a shell expansion detector is used to include detailed discussion on what is acceptable (or not acceptable) and operator actions.
9) Describe operating conditions where a differential expansion detector is used to include detailed discussion on what is acceptable (or not acceptable) and operator actions.
10) Describe the causes of steam turbine vibration to include data to be recorded, detailed discussion on how to recognize the major causes of turbine vibration, and operator actions.
11) Describe normal steam turbine start-up procedures.
12) Describe normal steam turbine shutdown procedures.
13) List and describe those actions that can be taken by operations to minimize efficiency losses.
14) List abnormal conditions often experienced in operating steam turbines, and for each abnormal condition discussed: Describe any operational symptoms, Describe how the steam turbine is at risk, Describe typical controls’ automatic response, and Describe required (recommended) operator response.

WHAT YOU WILL RECEIVE:

1. 1 copy of HPC Technical Services' textbook, Steam Turbine Operation Practices & Alarm Response, a $195 value, as written by Harold Parker.
2. A "Certificate of Completion" with 2.9 CEUs, authorized for issue by the International Associate of Continuing Education/Training.

COURSE OUTLINE

Monday

Steam Turbine Fundamental Review: Theory, Turbine Sections and Component Descriptions
Turbine Systems: Lubricating Oil Systems, Gland Steam and Water Seal Systems and Hydraulic Power Unit (where applicable). Emphasis is on abnormal operations as opposed to being a "system description".
Turbine Supervisory Instrument Location & Function: Eccentricity, Speed Detection, Valve Position, Vibration, Shell Expansion, Differential Expansion, Metal Temperatures

Tuesday

Steam Turbine Control Concepts: Speed Control, Load Control, Limiters, Flow Control, Extraction Turbines, Overspeed and Reset System, Overspeed Trip

Wednesday

Turbine Normal Operations: Thorough Examination of the Cause and Effect of Thermal Stress, Starting and Loading Procedures (including what the OEM didn’t tell you), Drains, Pre-warming Procedures, Normal Operations, Load Changes, Shutdown
Minimizing Performance Loss
Failure Modes

Thursday

Vibration Analysis as an Indicator of Abnormal Operating Conditions: Oil Whip, Bowed Rotors, Packing Rubs (Low Speed versus High Speed), Mechanical Unbalance, Resonant Vibration, Coupling Unbalance, Cracked Rotors,
Abnormal Conditions: Detection, Potential Results and Operator Action to Prevent Loss: Loss of Turning Gear, Extended Turning Gear Operation, Inability to Stay on Turning Gear during Prewarm, Abnormal Cooler Discharge Oil Temperatures, Bearing Wipes, Water Induction, Excessive Differential Expansion, Axial Rubs, Low Speed Operation, Sling-Shot Starts, Low Frequency Operation, High Exhaust Hood Temperatures, Vacuum Breaking, Over Pressure, Over Temperature, Loss of Boiler, Inlet Pressure Fluctuations, Valve Oscillation, Governor Bobble, Full-Load Rejection, Hot Restarts, Feedwater Heater Removal

Friday

Abnormal Conditions: Detection, Potential Results and Operator Action to Prevent Loss Continued…
Periodic Tests
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. $195 + 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 perform an audit of our operating procedures, or an In-Service Inspection? Yes we can. Call or contact Harold Parker, hparker@hpcnet.com for our rate sheets and any further information required.

STEAM TURBINE MAINTENANCE CERTIFICATION:

There are two levels of certification (both levels require this certification or TG301).

1) Mechanical Maintenance Technician
2) Field Engineer

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.

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

7 January 2009	3-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 Operations & 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	$2,095
					$10,270

Session 2 – July/August 2009

8 July 2009	3-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 Operations & Alarm Response**	**Sarasota FL**	**$2,195**
27 July 2009	3-days	TG316	Steam Turbine Overhauls	Sarasota FL	$1,595
30 July2009	2-days	TG412	Steam Turbine Repair	Sarasota FL	$1,395
3 August 2009	4.5 days	TG331	"Hands-On" Steam Turbine Maintenance	Sarasota FL	$2,095

RECENT SATISFIED CLIENTS: ATCO Electric, Consumers Energy, Doosan Heavy Industries, Entergy Operations, Gainesville Regional Utilities, Korea Nuclear & Hydro Power, Owensboro Municipal Utilities, Phosphate Corporation of Saskatchewan, Progress Energy, SaskPower International, Turbine Diagnostic Services

INSTRUCTOR/CONSULTANT (S):

Harold Parker is the founder & President of H Parker & Company, Inc. Mr. Parker, along with Mr. John Mitchell (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, IEEE, and ASTD. Harold resides in Bradenton FL.

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.

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. Since then he has been involved in the commissioning of several steam turbine generators where he was responsible for the turbine controls, auxiliaries, startup sequence and the generator. 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. Mr. Johndrow resides in Connecticut.

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. Joe resides near Raleigh NC.

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:_____ 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: _____ Date: _____

METHOD OF PAYMENT

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- ☐ MC/Visa/AMEX #:_____
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Please advise how you found out about this course initially.

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