STEAM TURBINE COMPONENTS, ROTORS AND CASINGS

26 – 27 APRIL 2017, KUALA LUMPUR, MALAYSIA

TOPICS COVERED

- Overview of Steam Turbines Types and Operating Principles.
- Steam Turbine Components What Are They Made From and Why?
- Coating Technologies
- Steam turbine component damage, degradation and factors which limit component life
- Common Repair Techniques for Turbine Components
- What is failure analysis?
- Failure Investigation
- How Steam Turbine Components Fail

Expert Course Faculty Leader

Dr. Maxine Watson
Director, MorrisWatson
Training Course Objectives

- Develop a detailed knowledge of the materials used in steam turbine components, how they degrade and how they fail
- Gain an understanding of how operation affects component degradation failure modes and life span
- Discover the methods used in determining failure causes
- Understand the knowledge that can be gained from on-site and laboratory investigations
- Learn how materials, manufacturing and in-service created defects can promote failure
- Become familiar with common causes of steam turbine component failures using real life examples
- Participate in interactive technical discussions

Your Expert Faculty

DR. MAXINE WATSON

SPECIALISED PROFESSIONAL COMPETENCE

Maxine has a first class BSc (Hons) in Metallurgy and Microstructural Engineering for which she was awarded the Institute of Metallurgists Royal Charter Prize for outstanding achievement, and a PhD in Engineering undertaken for the UK Atomic Energy Authority. She has over 33 years’ experience in metallurgy and materials engineering, specialising in the life assessment and prevention of failures in rotating machinery. Maxine has leads root cause failure analysis investigations and provides independent advice and expert witness reports for legal (criminal and civil) and insurance cases and for other investigatory bodies e.g. government safety and defence agencies and in power generation, industrial plant and equipment, aero and rail accident investigations.

PROFESSIONAL BACKGROUND

Before moving to New Zealand she held several senior positions in the UK including Head of Power and Utilities, for ESR Technology, Head of Metallurgy and Materials Engineering with the Engineering, Safety and Risk Division and the Rail Division (ex British Rail Research) of AEA Technology in the UK. The ESR division incorporated three UK National Centres of Excellence – The National Centre of Tribology, The National Non-Destructive Testing Centre and the Pump Centre (UK centre of excellence in pumps and pumping system technology) and one European Centre of Excellence, the European Space Tribology laboratory. She began her career in the Nuclear Industry with the United Kingdom Atomic Energy Authority (UKAEA), Harwell Research Laboratories where she worked on Advanced Cooled Gas Reactor and Fast Reactor power programmes. She worked on design, build, commissioning and decommissioning issues for UK nuclear power stations and conventional power plant and performed many failure investigations and life assessment programmes including gas and steam turbines, valves, bearings, gearboxes, pumps and conveyor plant.

Maxine is the Chair of the Australia and New Zealand Gas Turbine Users Forum and also regularly Chairs industry events such as Asia Powertech, Singapore Gas Turbines and the Australia Gas Turbines Conference. Maxine also devises and presents training courses for GTUF, IIR Australia and ibc Asia in root cause failure analysis, metallurgy for engineers, gas and steam turbine failure investigation, surface engineering and gas turbine life assessment and for the American Society for Mechanical Engineers (ASME) in gas and steam turbine failure investigation and in gas turbine rotor life management.
Day 1: Steam Turbine Components

Overview of Steam Turbines Types and Operating Principles.

Steam Turbine Components What Are They Made From and Why?
- Design and operating concepts controlling material selection
- Steam Turbine Metallurgy
- Properties generated by heat treatment
- Manufacturing techniques and defects produced

Coating Technologies
- Metallic coatings
- Non-metallic coatings

Steam turbine component damage, degradation and factors which limit component life
- Turbine section, HP, IP, LP and expansion
- Rotating Components
  - Blade materials – specific properties required for turbine blades
  - Rotors, shafts materials
- Turbine stationary components
  - Casings/Cylinders,
  - Diaphragms/Nozzles
  - Blades
- Ancillary’s
  - Valves
  - Seals
  - Bearings

Common Repair Techniques for Turbine Components
- Factory repairs and site repair techniques
- Methods of repair
- Qualifying repairs

DAY 2: Steam Turbine Component Failure Investigation and Common Failure Mechanisms

What is failure analysis?
- Failure investigation techniques
- Failure analysis methods and techniques
- Root cause failure analysis
- Discuss operational failures and what can be learned from carrying out failure analyses

Failure Investigation
- How to undertake a failure investigation
- On-site evidence collection
- Laboratory failure investigation techniques
- Learning from performing certain examinations
- Essentials of a good report and understanding reports

How Steam Turbine Components Fail
- Common modes of failure illustrated with case study
- How operation affects failure modes
- Materials defects which lead to failure
- Common causes steam turbine component failure focusing on:
  - Steam Turbine Blading
  - Discs, Rotors, Shafts, Hollow Rotor Forgings
  - Blade Rings, Shells, and Diaphragms
  - Bearings and Lubrication Systems
  - Sealing For Steam and Oil
  - Main and Auxiliary Steam Valves Stop, Throttle, Governor, Control, Non-Return, Admission, Extraction etc.
# OTHER AVAILABLE COURSES

<table>
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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>4 Pillars of Transformer Condition</td>
<td>Making IPP &amp; Renewable Energy Projects Contract Frameworks Bankable</td>
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<tr>
<td>Advanced Project Finance for Power</td>
<td>Managing Complex Projects for Power and Utilities Professionals</td>
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<tr>
<td>Advanced Technical Report Writing &amp; Presentation Skills</td>
<td>Medium Voltage &amp; High Voltage Switchgear</td>
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<td>Advanced Turnaround Shutdown &amp; Outage Management</td>
<td>Metallurgy for Engineers</td>
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<td>Ancillary Services in Competitive Electricity</td>
<td>Mechanical Engineering for Non-Mechanical Engineers</td>
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<td>Asset Management for the Power Industry</td>
<td>Mini Hydro Project Analysis</td>
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<td>Best Practice Renewable Energy Capital &amp; Project Management</td>
<td>MKV Speedtronic Control System</td>
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<td>Biomass Power Generation</td>
<td>MK VI Speedtronic Control System</td>
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<td>CFB Combustion for Boiler Operations</td>
<td>Nuclear Energy Project Planning &amp; Economics</td>
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<td>Clean Development Mechanism and Carbon Markets</td>
<td>Nuclear Power</td>
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<td>Coal Contracts</td>
<td>Offshore Platforms Electrical Systems Design &amp; Illustrations</td>
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<td>Combined Cycle Power Plants Operation</td>
<td>Operations of Coal Fired Power Plants</td>
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<td>Competency Management System for the Power Industry</td>
<td>Power Generation Commissioning, Operations &amp; Maintenance</td>
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<td>Design &amp; Operations of Circulating Fluidized Bed Boiler</td>
<td>Power Generation Operation, Protection &amp; Excitation Control</td>
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<td>Developing &amp; Structuring Public-Private Partnership (PPP) for Infrastructure</td>
<td>Power Plant Chemistry for Chemist &amp; Chemical Engineers</td>
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<td>Effective Tender Process Management for Power &amp; Utilities</td>
<td>Power Purchase Agreements</td>
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<td>Electrical Hazop (eHazop) Studies for the Power Industry</td>
<td>Programmatic CDM</td>
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<td>Electricity Demand-Side Management</td>
<td>Project Management for Power and Utilities</td>
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<td>Electricity Industry Design</td>
<td>Relay Protection in Power Systems</td>
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<td>Electricity Network Planning</td>
<td>Reliability Centered Maintenance Masterclass</td>
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<td>Electricity Retail Contracts</td>
<td>Reliability Engineering</td>
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<td>Electricity Theft</td>
<td>Renewable Energy Development &amp; Investment</td>
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<td>Electricity Trading Essentials</td>
<td>Renewable Energy Integration</td>
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<td>Energy Efficiency</td>
<td>Risk Based Inspection</td>
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<td>EPC Contract Management for Power &amp; Utilities</td>
<td>Risk Management in Power Markets</td>
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<td>Essentials of Coal Markets and Trading</td>
<td>Root Cause Analysis</td>
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<td>Essentials of Power Trading</td>
<td>Rotating Equipment Maintenance &amp; Reliability</td>
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<td>Excitation Systems</td>
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<td>Feed-In Tariffs for PV Systems</td>
<td>SCADA &amp; Power Systems</td>
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<td>Finance for Non-Finance Professionals in Power &amp; Utilities</td>
<td>Smart Grid</td>
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<td>Fitness-For-Service API 579 &amp; High Energy Piping Life Management</td>
<td>Spare Parts Optimisation</td>
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<td>Fundamentals of Geothermal Energy</td>
<td>Supercritical and Ultra-Supercritical Coal-Fired Power Plant</td>
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<td>Gas &amp; LNG Contract Negotiation</td>
<td>Ultra Low NOx Gas Turbine Combustion</td>
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<td>Gas Turbine Generator Selection, Operation &amp; Maintenance</td>
<td>Uninterruptible Power Supply</td>
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<td>Gas Turbine Hot Gas Paths, Rotors &amp; Failure Analysis</td>
<td>Vibration Analysis &amp; Condition Monitoring</td>
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<td>Gas Turbine Major Inspection &amp; Overhaul</td>
<td>Waste to Energy Plant Operations</td>
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<td>GE Gas Turbine Operations Simulation Based</td>
<td>Water Treatment and Corrosion Control for Steam</td>
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<td>HRSG Design, Operations &amp; Understanding, Controlling of HRSG Damage</td>
<td>Generation and Power Production</td>
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<td>HV Substation Design &amp; Construction</td>
<td>Writing Effective Standard Operating Procedures (SOP) for Power &amp; Utilities Professionals</td>
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<td>IEC for Utilities</td>
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<td>Integration of Distributed Generation</td>
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<td>Introduction to Carbon Capture &amp; Storage</td>
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<td>Introduction to Clean Coal Technology</td>
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<td>Introduction to Power Systems</td>
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<td>Keeping Electrical Switchgear Safe</td>
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<td>Leadership &amp; Team Dynamics for Power &amp; Utilities</td>
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<td>LNG Fundamentals</td>
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<td>LNG Markets &amp; SPOT Trading</td>
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<td>Maintenance Planning &amp; Scheduling</td>
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[www.poweredgeasia.com](http://www.poweredgeasia.com)
Frequently Asked Questions (FAQs)

1. Does PowerEdge have other programmes than those listed?
   We have more than 200 programmes that we are capable of running. All we need is for you to contact us and request for the preferred programme and we will be able to develop it.

2. Where is PowerEdge based?
   PowerEDGE is headquartered in Singapore but we run our training programmes in different venues around Asia.

3. What does PowerEdge do?
   We are a Power & Utilities Training Specialist.

4. Can this course be done in our city?
   It absolutely can. Get in touch with us to request for a training programme to be carried out in your city.

5. Can you reduce the price of our preferred course?
   While our price has been reduced before it is even launched, we are always happy to help you with further discounts.

6. Can you change the dates of the course?
   If you have a special requested date, let us know and we will arrange another session for you.

7. Who are the companies that will be participating?
   This varies from a diversity of Power Operators, Regulators, Financiers, to Vendors in the Power & Utilities industry.

8. Where is the venue for the course?
   We usually engage a 4 to 5 star hotel meeting room to ensure the comfort of our participants.

9. How many delegates should we expect for each course?
   This varies from 15 to 20 participants. Class sizes are kept small to allow trainers to focus better on each participant.

10. What are the different payment modes?
    We accept Visa/MasterCard, cheques, bank transfers and cash on site.

11. Is accommodation included when I sign up for a course?
    Accommodation is not included in the course fee but we are always happy to advise on available accommodations.

12. Can I get a cheaper accommodation through PowerEdge?
    We will be pleased to help you negotiate a better rate with hotels.

13. Is lunch provided during the course?
    We provide lunch and 2 tea breaks every day during our training programmes.

14. Are the training materials included once I have signed up for a course?
    Yes, training and course materials are included in the course fee.

15. Will there be a certificate for the course?
    Yes, there will be a certificate of participation upon completion of a course.

16. Who are PowerEdge trainers?
    They are expert consultants and practitioners with many years of experience in the subject matter that they deliver on.

17. Are PowerEdge trainers competent?
    We have received numerous favourable feedbacks on our trainers from past participants.

18. Can PowerEdge assist with Visa travel applications?
    We can assist in advising you on the relevant procedure(s) and embassies/consulates that provide Visa for travel purposes.

19. Can we purchase training materials without attending a course?
    Unfortunately this option is not available as training materials are specially developed for courses.

20. Can course content be tweaked to cater to our needs?
    Of course! Just let us know your request and we will get the trainer to assist in carrying it out.
**STEWART TURBINE COMPONENTS, ROTORS AND CASINGS**  
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<tr>
<th>Programme</th>
<th>NORMAL PRICE</th>
<th>EARLY BIRD</th>
<th>GROUP OF 3 or More</th>
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<tr>
<td>2 Day</td>
<td>SGD 3,699</td>
<td>SGD 3,499</td>
<td>SGD 3,099</td>
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**ATTENDEE DETAILS**

Name .................................................................................................................. Job title .................................................................................................................................
Tel .................................................. Department ........................................ Email ..................................................................................................................

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**COMPANY DETAILS**

Organisation name ................................................................................................Industry ............................................................................................................
Address ..................................................................................................................
Postcode.................................................................................................................... Country..........................................................................................................
Tel .......................................................................................................................... Email ..................................................................................................................

**PAYMENT POLICY**

By Cheque/Bank Draft: Make Payable to PowerEdge Pte Ltd.
By Telegraphic Transfer: Please quote AE1 with the remittance advise
Account Name: PowerEdge Pte Ltd.
Bank Address: 65 Chula Street OCBC Centre, Singapore 049513
All bank charges and payment in Singapore dollars (SGD) to be borne by payer. Please ensure that PowerEdge Pte Ltd receive the full invoiced amount.

**STUDENT POLICY**

Payment is due in full at the time of registration. Full payment is mandatory for event attendance. I agree to PowerEdge Pte Ltd payment terms
* GST: Exclusive price is only applicable for overseas corporate customers subject to qualifying conditions.

You may substitute delegates at any time. POWEREDGE PTE LTD does not provide refunds for cancellations. For cancellations received in writing more than seven (7) days prior to the training course you will receive a 100% credit to be used at another POWEREDGE PTE LTD training course for up to one year from the date of issuance. For cancellations received seven (7) days or less prior to an event (including day 7), no credits will be issued. In the event that POWEREDGE PTE LTD cancels an event, delegate payments at the date of cancellation will be credited to a future POWEREDGE PTE LTD event. This credit will be available for up to one year from the date of issuance. In the event that POWEREDGE PTE LTD postpones an event, delegate payments at the postponement date will be credited towards the rescheduled date. If the delegate is unable to attend the rescheduled event, the delegate will receive a 100% credit.

**ON SITE TRAINING**

- Keeping Electrical Switchgear Safe
- Introduction to Power Systems
- Excitation Systems
- Fundamentals of Power Generation

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- (65) 6741 9927
- (65) 67478737

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