



PRINCIPLES OF POWER PLANT PERFORMANCE

(OP416)

KNOWLEDGE and EXPERIENCE is needed to develop and implement an effective heat rate monitoring and improvement program. HPC Technical Services will provide the knowledge. Then, with this knowledge, experience will be gained more rapidly as you're better prepared for the tasks at hand.

- Are high fuel costs having an impact upon your plant's bottom line? Improved efficiency can help survive these costs. In this course, we begin the engineers' learning process toward the accomplishment of this goal.
- Do long-term fuel contracts have you down? Improved efficiency can help lift you back up. Again, this is the beginning.
- Are you evaluating the competitive positioning of your plant? Improved efficiency will certainly improve your market positioning.
- **Are you new to this position and/or just been given these responsibilities?** If yes, this course gives you a significant head-start over the OJT approach.

This 4-day course is designed to provide your engineering staff, operating personnel, management and business staff with the KNOWLEDGE necessary to impact the bottom line.

Topical Outline includes: Review of Thermodynamics, Reference to ASME Power Performance Test Codes, Steam Generators, Steam Generator Combustion Theory & Equipment, Steam Turbines, Factors Influencing Turbine Efficiency, ASME Codes for Steam Turbines, Feedwater Heaters, Factors Affecting Heat Exchanger Performance, Centrifugal Pumps, Measuring Instruments, Evaluation

OBJECTIVES

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

1. Demonstrate a working knowledge of terminology associated with plant efficiency which is expressed using the term 'heat rate'.
2. Define the terms entropy, enthalpy, superheat, latent heat, sensible heat, etc.
3. Describe the thermodynamic processes involved with each component in the power plant cycle.
4. Describe how changes in heat rate affect operating costs.
5. Describe the principles of thermodynamics.
6. Describe the basic principles of boilers, steam turbines and heat exchangers
7. Describe how the boiler, turbine and heat exchangers affect heat rate.
8. List ten (10) common areas of efficiency loss in an operating power plant.
9. Describe the principles of plant efficiency testing using the ASME Performance Test Codes.
10. Describe use and principles of some of the performance related instruments found in a modern power plant.
11. State the principles of data evaluation.

WHAT YOU WILL RECEIVE

1. 1 copy of HPC Technical Services' textbook, OP416, [Principles of Power Plant Performance](#).
2. A "Certificate of Completion"

COURSE DATES / LOCATION / FEE

See www.hpcnet.com for detail on the course dates / locations / and registration fees.

HPC's 3-4-2 policy applies: Sign up 3 for the same course/date, pay in advance, and pay for only 2 (the 3rd participant is free)!

HPC Technical Services reserves the right to cancel any course/seminar within 10-working days of the scheduled date. Fees are 100% refunded or credited to another Seminar (clients' choice) if HPC should cancel any Seminar. HPC is not responsible for non-refundable airline tickets or other travel expenses under any circumstance.

INSTRUCTORS

All HPC instructors are educated 'experts' on the subjects they teach, with years of relevant hands-on experience (typically 20+ years), and have proven instructional skills. Brief resumes can be looked up on HPC's website, www.hpcnet.com.

COURSE OUTLINE

- I. **ASME Performance Test Codes:** Philosophy, History, Test Code Structure, and Application of Codes
- II. **Thermodynamics:** Laws of Thermodynamics, Power Plant Cycles, Heat Balance, Heat Rate, Incremental Heat Rate
- III. **Steam Generators:** Theory, Heat Transfer, Pressure Boundary Points, Fuel Considerations, Furnaces/Waterwall, Steam Drum Internals, Superheaters, Reheaters, Desuperheaters, Economizers, Auxiliary Equipment
- IV. **Steam Generator Combustion Theory & Equipment:** Theory and Equations, Fuel Analysis, Combustion Products, Calculations, Combustion Equipment, Efficiency Testing (Heat Loss Method, Efficiency Calculation, I/O Method), and Monitoring
- V. **Steam Turbine:** Turbine Theory; Turbine Types; Construction Details; Valves; Turbine Efficiency; Cycle Efficiency; Enthalpy Drop Test
- VI. **Factors Influencing Turbine Efficiency:** Steam Condition, Exhaust Loss, Size, Configuration, Use of Reheat, Feedwater Heater Operation, Mode of Operation, and Mechanical Condition
- VII. **ASME Performance Test Codes for Turbines:** Practical Aspects for Turbine Testing, Thermal Kits, Generator Corrections, Example of Simplified Test Calculations, Calculation of Change in Heat Rate from Change in Enthalpy Drop Efficiency, Determination of N2 Leakage, Calculation of Primary Flow, Diagnosis of Turbine Problems, Examples of Testing Programs
- VIII. **Power Plant Heat Exchanger:** Heat Transfer Theory, Condenser Testing (Considerations and Calculations of Test Results)
- IX. **Factors Affecting Heat Exchanger Performance:** Low Circulating Water Flow Rate, High Air Leakage, Fouled Tubes, High Inlet Water Temperature, Reduction in Load, Deaerator Theory and Construction
- X. **Centrifugal Pumps:** Pump Theory, Design & Construction, Testing Considerations and Monitoring Operation
- XI. **Measuring Instruments:** Temperature, Pressure, Flow, Electrical, Flue Gas, Data Logging Systems and Computers
- XII. **Evaluation:** Statistics, Test Design, Data Reduction and Trending

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. \$129 + 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, or performance audits? Yes we can. Call or contact Harold Parker, hparker@hpcnet.com for our rate sheets and any further information required.

POWER PLANT OPERATOR CERTIFICATION

This is one of the courses required for Power Plant Operator Certification.

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.

HPC TECHNICAL SERVICES
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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: _____

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 before
- Magazine advertisement
- Received a fax
- Received an email
- Other: _____