

CPSA Course / Lesson Plan



Course Outline

The CPSA (Certified Pump System Auditor) course aims to train engineers and technicians over a four-day period to understand the importance of pumping systems and how to identify the opportunities available to the client to reduce their operating costs.

The course is split into three parts;

- QPSAT (as mandated by US DOE) this consists of theory, practical work and an exam.
- Solutions course, this consists of theory and class worked examples
- ISO 14414 – theory and details of the requirements of the standard.

For the QPSAT element the following five requirements have been deemed necessary to assess the parameters of a pumping system and the components within the system that can cause unnecessary waste.

- System considerations, including static, frictional and total head
- Bernoulli equation terms – and how they relate to one another (e.g., pressure – elevation relationships in a static system)
- Ability to apply the PSAT and Valve Tool software, including pump head calculations, system curve estimation, and the logging and retrieval of logged data.
- Thorough understanding of manufacturer pump performance curves, how they relate to field data, and possible causes for pumps deviating from manufacturer curves
- Ability to apply pump affinity laws

The Syllabus covers the following topics

QPSAT Syllabus (3 days)

- Energy Saving Opportunities
- Life Cycle Costing
- Contingency Planning
- Application of PSAT (Pumping System Assessment Tool)
- Bernoulli Principle
 - For Ideal fluid
 - For real fluids
 - Modification for the addition of energy into the principle
 - Applying principle to component losses and determining impact of components
 - How to assess component head losses for various types
- Pump Performance Characteristics
 - Description of pump curves

- Understand different presentations of data
- How to calculate pump efficiency
- How to construct a pump curve
- Motor Performance Characteristics
 - Description of motor performance characteristic
 - Impact of various motor sizes to pump loads
 - Impact of motor efficiency to pump load
- Affinity Laws
 - Impeller diameter change calculations to pump performance
 - Pump speed change calculations to pump performance
- Pump Operation
 - Solo operation curve
 - Summation to produce parallel operation curves (similar and dissimilar pump characteristics)
 - Summation to produce series operation curves
- Development of System Curves
 - How to construct system curves (what is static head and how to measure static head)
 - Friction head definition
 - Definition of system curve to determine when the system is static dominated, or friction dominated
 - Plot of pump curves onto system curves
 - Impact of
- Class working (range of simple to complex examples)
- Practical work utilising a test rig to take practical field data
- How to obtain field data
 - Different types of instruments (flow, head, power, efficiency)
 - Instrument uncertainty
 - How to assess data without instruments
- Case Studies
- Exam (4 hours)
 - Exam tests all the course from calculation of pressure through to taking measurements from the test rig and utilisation of the software.

Solutions Course (3/4 day)

- Background and overview
 - Tools to be used
 - Load profiling development
 - Load profile analysis
 - Determining supply and demand impact
- Process Control Application (Paper stock)
 - Process description
 - Class worked example (initial PSAT analysis)
 - Class worked example (valve tool analysis)
 - Class worked example determining saving potential from system
 - Steps taken to clarify loss and methodology to obtain energy reduction
 - Load profile analysis (and how to do it)
 - Logged data analysis (8 different components)
 - Class worked example on load profile
 - Solutions implemented to reduce operating costs
- Municipal Water Application
 - System description (station level and network level)
 - Plant assessment at station level (and class worked example)
 - Development of system curve and review of pump curve against curve(class)
 - Network assessment at expanded level
 - Discussion into various options to reduce the operating cost at both the station level and the network level, including plant and operational control changes
- Data development
 - Histogram development exercise
- Common Solutions Discussion
 - Variable speed drives
 - Impeller modification
 - Pump rehabilitation
 - Plant replacement
 - Addition of pumps (parallel / series)
 - Combinations

ISO 14414 (1/4 day)

- Background and development of the standard
- Requirements of the standard
- Analysis required to meet the standard
- Sample report that complies with the standard

Lesson Plan

Day 1	Day 2	Day 3	Day 4
QPSAT	QPSAT	QPSAT	Solutions & ISO 14414
10:00 – 10:30 Registration	9:00 Start	9:00 Start	8:00 Start
Morning Session	Morning Session	Morning Session	Morning Session
Introduction & energy opportunities	PSAT continued	Day 1 & 2 recap	Solutions course
Life cycle costing	Test rig demo and class taking data	PSAT worked Examples	
Contingency planning	System curve measurements	Pump Efficiency calculations	
Bernoulli	Energy Saving discussion	Questions	
Lunch	Lunch	Lunch	Lunch
Bernoulli conti.	Practicalities of field measurement	Exam – 4 hours	Solutions course
Pump Curves	PSAT & Valve tool examples		ISO 14414 lecture
PSAT software and worked class examples	Case studies		
End 17:30	End 17:30	End 17:30	End 16:00