

# Power Transformer Services Overview



TOGETHER WE POWER THE WORLD®



*The Doble KnowledgeBase contains decades of statistically significant data including 25 million test results on over 350,000 types of electrical apparatus, manufacturers' service advisories, and thousands of documented client experiences in the form of technical reports, case studies and presentations.*

## Complete Diagnostic Solutions – That's the Doble Difference

Doble has been a trusted name in transformer diagnostic solutions for over 90 years. Doble's unique business proposition combines three elements - diagnostic test instruments, expert consulting and testing services, and the world's largest resource library of related knowledge - into complete diagnostic solutions.

Doble Power Services offers the following:

- Expert consulting services
  - Specification writing and review
  - Factory audits
  - Proposal evaluation
  - Design review
  - Independent test witnessing
- Laboratory services
- Forensic analysis
- On-line substation survey
- Condition assessment services
  - Asset health review
  - On-site condition assessment
- Advanced and routine testing
  - Commissioning/acceptance testing
  - Partial discharge (UHF)
  - IR and RFI survey
  - Acoustic
  - Insulation condition (power factor, capacitance, insulation resistance)
  - Electrical/magnetic (winding resistance, excitation current)
  - Mechanical (SFRA, leakage reactance)
- Doble "Life of a Transformer" seminar



## Why Doble Power Services?

### Extensive Global Experience

Doble has more than 70 engineers with extensive experience in transformer and power systems engineering applications.

### Independent Expert Opinion

Trust Doble's expert consulting & testing services for unbiased diagnosis and assessment of critical assets.

### Doble Peer Review Process

When you hire Doble, you are hiring the shared experience of our entire engineering team. Each Doble field service report is reviewed by at least one other transformer consulting engineer to ensure the highest level of consulting services and knowledge-based solutions.

### Doble KnowledgeBase

Provides valuable benchmark data for use in evaluating test results on your equipment.

For more information on this year's Doble "Life of a Transformer" Seminar and other Doble events, visit

[www.doble.com/events](http://www.doble.com/events)



Behind every Doble solution is 90 years of knowledge and expertise.

## Expert Consulting Services

Procurement of large transformers has become global, driven by capacity shortfalls and an ongoing search for cost-effective purchasing. Doble engineers undertake this for our customers in preparing specifications, evaluating proposals, auditing individual factories for capability and performance, performing design reviews and fingerprinting new transformers prior to and after installation.

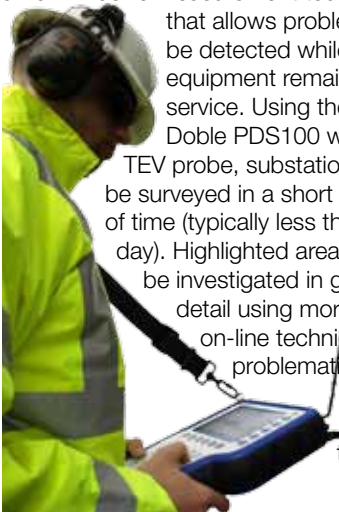


## Laboratory Services

Doble has been providing laboratory services to the electric power industry since the 1930s. More than 200 different analytical tests and variations are offered on a routine basis encompassing both solid and liquid insulation. Doble lab analysts are considered to be the preeminent experts in DGA, oil quality and corrosive sulfur analysis.

## On-line Substation Surveys

A partial discharge survey from Doble is a non-invasive measurement technique that allows problems to be detected while the equipment remains in service. Using the advanced Doble PDS100 with HFCT/TEV probe, substations can be surveyed in a short amount of time (typically less than one day). Highlighted areas can then be investigated in greater detail using more focused on-line techniques, and problematic areas can be targeted for off-line testing.



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**Doble Engineering Company**  
Corporate Headquarters  
85 Walnut Street  
Watertown, MA 02472 USA  
tel +1 617 926 4900  
fax +1 617 926 0528  
www.doble.com

## Forensic Analysis

If expensive assets reach their end of life point sooner than expected, it is important to figure out why. Doble conducts failure analysis involving a review of operating and maintenance records, oil analysis, on-site inspections and tests, and microscopic, infrared and x-ray analysis.



Doble's vast database of historical transformer failures, test results and design reviews are used to obtain the most accurate analysis possible. Detailed reports are prepared explaining the failure mechanism, original root cause and recommendations.

## Condition Assessment Services

### Asset Health Review

Doble will review operations, maintenance, DGA, loading history and abnormal event service records given to Doble by the customer. This review will give an overview of transformer condition and provide a basis for additional investigation.

### On-site Condition Assessment

This assessment determines the fitness of the transformer for continued service. It includes a review of the asset health review report, an external visual inspection and a full suite of off-line tests. The customer will receive a comprehensive report indicating areas of concern and recommendations.



## Why test power transformers for partial discharge?

When transformers demonstrate increasing rates of gas generation, it's important to test them for partial discharge (PD) to determine if the gassing is coming from PD or other sources.

### CASE STUDY

Manufacturer:  
**General Electric**

Year:  
**1983**

Rating:  
**230/69 kV, 22/32/40/45 MVA**

Expansion/Preservation system:  
Nitrogen blanket

Transformer showed an increasing rate of gas generation (from 1.2 ppm/day to 27 ppm/day of H<sub>2</sub>). Since these were heavily loaded units, the owner was extremely concerned about PD.

### Possible sources of hydrogen:

- Partial discharge activity  
– H<sub>2</sub>, some methane
- Stray gassing  
– When high almost all H<sub>2</sub>
- Free water reaction with iron  
– All H<sub>2</sub>
- Electrolysis of free water in galvanized valves  
– H<sub>2</sub> & oxygen
- Overheating of core  
– Almost all H<sub>2</sub>
- Some steels and galvanized materials  
– All H<sub>2</sub>
- Improperly cured primer  
– Observed high H<sub>2</sub>

*Through our advanced laboratory and partial discharge testing services, Doble determined that the problem was free water in valves. When flushed out well, H<sub>2</sub> levels went back to normal levels.*

**Doble is ISO Certified**  
**Doble is an ESCO Technologies Company**

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