

Avail Opportunities for Expert Services & Diagnostics

CENTRAL BOARD OF IRRIGATION & POWER



JOINS HANDS WITH

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION



In the following Field Services

- Mechanical Diagnostics & Residual Life Assessment
- Electrical Diagnostics
- Power System and Power Quality
- Energy Management

MECHANICAL DIAGNOSTICS & RESIDUAL LIFE ASSESSMENT (RLA)

1.1 INTRODUCTION

Remaining Life Assessment (RLA) of mechanical equipment of power & process plants becomes necessary because in-service equipment such as boilers, turbines, internal combustion engines, reactors etc., undergo structural & micro-structural damage through thermo-mechanical, electrical & chemical interaction with the environment. ERDA is recognized by Central Boiler Board (CBB) as well-known remnant life assessment organization under Indian Boiler Regulations, 1950. This enables it to undertake independent RLA assignments all over the country. The experience base of ERDA in mechanical diagnostics includes 150 boilers and 75 turbines.

1.2 Major Equipment Assessed for Structural Integrity and RLA

(Thermal / Hydro / Nuclear Power Plants & Process Plants)

- Steam Generators
- Turbines
- Process Piping
- Reactors & Pressure Vessels
- Furnaces
- Mechanical Handling Equipment & Gearing

1.3 NDT Services for Structural Integrity

1.3.1 On-line

- Modal Analysis
- Insitu Vibration Analysis
- Infrared Thermography
- Noise & Sound Analysis
- Shock Pulse Metering
- Visual Inspection

1.3.2 Off-line

- Visual Inspection
- Dimensional Measurements
- Liquid Penetrant Testing
- Magnetic Particle Inspection – Yoke, Coil & Prod
- Magnetic Field Measurement
- Ultrasonic Flaw Detection, TOFD, Phased Array
- Ultrasonic Thickness Measurement
- Ultrasonic Hydrogen Embrittlement
- Eddy Current Testing
- In-Situ Metallography and Hardness
- In-Situ Chemical Analysis
- Ferrography & Deposit Analysis
- In-Situ Oxide Scale Measurement
- Remote Visual Inspection Videoscopy, Fibroscopy and Boroscopy
- Modal Analysis

1.4 RLA Services for Steam Generators

(Approved by Central Boiler Board, Government of India)

1.4.1 Steam Generator Components Assessed :

- Economizer & Subsystems
- Convective & Radiative Super Heaters (main/reheat)
- Water Wall
- Drum & Headers
- Piping Systems
- Coal Mills & Combustors and Associated Systems
- Support Systems, Structures & Ceiling



Eddy Current testing in Progress



Dimension Measurement in Progress



Turbine Rotor



Steam Drum & Piping



NDT Tests in Progress on Stator of Hydro Generator

1.4.2 RLA Techniques used for Steam Generators

- Visual Inspection
- Dimensional & Thickness Measurements
- Liquid Penetrant Testing
- Magnetic Particle Inspection
- Ultrasonic Testing
- Insitu Metallography, Positive Material Identification & Hardness Measurements
- Videoscopy
- Deposit Analysis, Corrosion, and Erosion Assessment
- Computational Fatigue – Creep Life Prediction

1.5 RLA Services for Turbines

1.5.1 Turbine Components (HP/IP/LP) Assessed:

- Rotor
- Blading
- Casing & Parting Plane Studs
- Steam Admission Components & Glands
- Stop & Control Valves
- Steam Piping
- Condenser
- Bearings, Barring Gear and other Associated Systems / Components

1.5.2 RLA Techniques used for Turbine

- Visual Inspection
- Dimensional Measurements
- Liquid Penetrant Testing
- Magnetic Particle Inspection
- Ultrasonic Testing
- Insitu Metallography, Positive Material Identification and Hardness Measurements
- Deposit Analysis & Erosion / Corrosion
- Modal Analysis of Blading
- FOD Analysis
- Borosonic Inspection
- Eddy Current Evaluation
- Wedge Tightness Test (on stator of generator)
- Computational Creep and Fatigue (LCF + HCF) Life Prediction using FEA

1.6 RLA Services for Reactors, Piping & Small Process Boiler

1.6.1 System Assessed

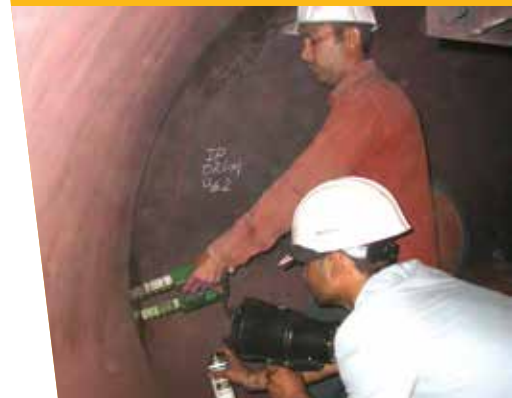
- Main Vessel / Piping and its Associated Support Structures

1.6.2 RLA Techniques used for Reactors, Piping & Small Process Boilers

- Visual Inspection
- Dimensional & Thickness Measurements
- Liquid Penetrant, Magnetic Particle, and Ultrasonic Testing
- Insitu Metallography & Hardness



Overview of Boiler



MPI Test in Progress on Steam Generator Components



UT - Thickness in progress



Videoscopy in Steam Drum



NDT Test on Turbine Components



X-Ray Diffractometer

1.7 RLA Services for Hydro Plants

1.7.1 Components Assessed

1.7.1.1 Hydro Turbine

- Turbine Shaft
- Shaft Coupling Bolts
- Runner Blades
- Guide Vanes
- Thrust Bearing Pads
- Lower Guide Bearing Pads
- Penstock Gate Shaft

1.7.1.2 Hydro Generator

- Stator Winding
- Rotor Field Winding
- Core

1.7.2 RLA Techniques used for Hydro Turbines :

- Visual Inspection
- Liquid Penetrant, Magnetic Particle, & Ultrasonic Testing
- Dimensional Measurements
- Corrosion / Erosion / FOD Damage Assessment
- Wedge Tightness Test (on Stator of Generator)

1.8 Laboratory Evaluation Services (as part of RLA Scope)

- Tensile Testing Including UTS, YS & % Elongation
- Microstructure Examination & Hardness
- Chemical Analysis
- Flattening & Flaring Test
- Hydrogen Embrittlement
- Weight Loss Analysis
- Deposit Analysis
- SEM (Scanning Electron Microscopy)
- EDAX (Energy Dispersive X-Ray Analysis)
- XRD (X-Ray Diffraction)

1.9 Special Trouble Shooting Services for Hydropower Plants :

- Bearing Vibration Analysis using FFT Technique
- Pressure Pulsation Measurement and Analysis
- Analysis of Water Flow System using CFD
- Checking Quality of Poles in Hydro Generator
- Ventilation Studies in Hydro Generator
- Analysis of Failures of Bearings of Turbine / Generator
- Analysis of Lubrication System in-case Water Contamination is Suspected

1.10 Upgrading Studies of Existing Hydropower Plants :

- Vibration / Pressures Pulsation Measurement
- CFD Studies on Runner and Guide Blades
- Checking Adequacy of Existing Ventilation System
- Checking Penstock Vibrations

2.1 Introduction

The crucial concern of power/process plant management, the world over, is the cost of reliable operation of plants. Setting up of new plants is prohibitively expensive due to stringent environmental and safety concerns, uncertainties of financial return and extended lead times for new plants. The factors cited above have been the primary drivers for carrying out technical assessment of power plants for prolonging their operation. Thus operation of plants and equipment till the end of their useful, rather than design life, is the 'Mantra' being adopted. ERDA provides a wide range of diagnostics service for health assessment of Electrical equipment of Power Plants. The experience base of ERDA in electrical diagnostics includes more than 350 transformers, 1000 motors and 75 generators.

2.2 Power / Process Plant and Industrial Equipment Monitored

Major equipment monitored by the diagnostics group in power / process plant are Generators, Transformers, Switchgear, Pumps, Cables, Motors, Lightning Arresters etc. Assessment is done in both off-line and online modes:

- On Line - Continuous / Periodic
- Off Line - Machined Assembled mode
 - Machine Disassembled mode

Online condition monitoring is possible during running condition of equipment and it detects problems in their early stage so that rectification can be undertaken before occurrence of a severe fault.

Off-line monitoring requires shut down which consumes time. It is recommended to carry out both on-line and off-line condition monitoring for determining the exact condition of the equipment.

Techniques used :

2.2.1 Transformers :

2.2.1.1 On-line

- Partial Discharge (PD) using Acoustic Emission Analysis
- Partial Discharge (PD) using TEV & AA
- Thermography

2.2.1.2 Off-line

- C & Tan Delta Measurement
- Sweep Frequency Response Analysis (SFRA)
- Dielectric Response Analysis (DIRANA)
- Partial Discharge (PD) Testing of HV Equipment
- Insulation Resistance & Polarization Index
- Transformer Oil & DGA
- Furan & DP

2.2.2 Motors / Generators (Rotating Electrical Machines) :

2.2.2.1 On-line

- On-Line Partial Discharge (PD) using HFCT, TEV & AA
- Motor Current Signature Analysis (MCSA)
- Acoustic Emission Analysis
- Vibration Analysis
- Thermography

2.2.2.2 Off-line

- C & Tan Delta Measurement
- On-Line Partial Discharge (PD) Measurement
- Insulation Resistance & Polarization Index
- ELCID (Electromagnetic Core Imperfection Detection)
- Motor Circuit Analysis (MCA)
- Non-Linear Analysis
- RSO (Recurrent Surge Oscillograph) Test

2.2.3 Cables

2.2.3.1 Offline

- VLF based tan delta & PD (for MV & HV Cables)
- Polarisation Index (PI) and Insulation Resistance
- Time Domain Reflectometry (TDR) for Cable Fault

2.2.4 Switchyard Equipment

2.2.4.1 Online

- PD surveys of switchyard equipment



PD Survey of Switchyard Equipment



Diagnostic Testing of 200 MVA Transformer in a 400 kV Switchyard



On-line Condition Monitoring of Lightning Arrester



Current Signature Analysis



ELCID Test on Generator Stator



VLF Tan Delta Test Set Up-1

3.1 Power System Studies

ERDA's Electrical Power Systems (EPS) cell is the most preferred service provider in Power sector to TRANSCOs, DISCOMs, Regulatory Commissions and Industries for more than two decades. Landmark achievements of this group include special studies such as Evaluation of Parallel Operation charges (first time done in the country) based on which judgements were released by honourable commission.

ERDA is equipped with various power system analysis software such as MiPower, etap, EMTP-RV, MATLAB to conduct following power system studies:

- Load Flow
- Short Circuit/Fault Level Studies
- Transient Stability/Dynamic Stability
- Relay Co-ordination
- Protection Audit
- Insulation Co-ordination
- Transmission Planning and Power Evacuation
- Power Quality
- Sub- Synchronous Resonance
- Reactive Power Compensation
- Performance Analysis of FACTS Devices

Power System studies are being carried out frequently for various TRANSCOs, DISCOMs, Regulatory Commissions and Industries for more than two decades.

3.2 Specialized Services for Power Distribution Sector

- AT&C loss calculations
- Design of High Voltage Distribution Systems (HVDS)
- Consultancy for Distribution System Improvement
- Preparation of Detailed Project Reports (DPRs)
- Third Party Supervision and Inspection of Electrification Works (under various Government Scheme like DDVGJY, IPDS etc.)
- GPS Survey and Preparation of Single line Diagrams

3.3 Power Quality Assessment and Mitigation

Increased penetration of renewables into the grid combined with ever increasing non-linear loads have increased focus on power quality assessment and mitigation. ERDA is equipped with state-of-the-art instrumentation for providing all required critical power quality assessment service as per following details.

3.3.1 Services Offered

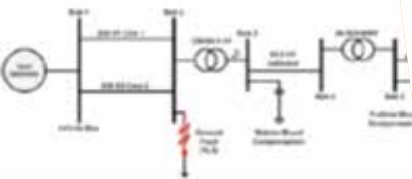
- Voltage and current harmonics measurement as per IEEE 519
- Flicker measurement as per IEC 61000-4-15
- DC current injection into grid as per CEA guidelines
- Current and voltage distortion
- Sag and swell measurements
- Current and voltage unbalance
- Phase shifting and reactive power
- Voltage dips and short term overvoltage
- Switching surge measurements

3.3.2 Sectoral Customers

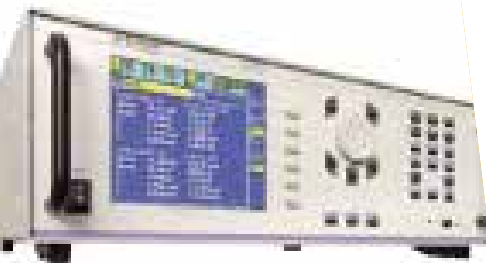
- Renewable energy power plants
 - Wind farms
 - Solar PV plants
- Steel industry
- Paper industry
- Cement industry
- Railway traction system
- Induction furnace plants, etc.



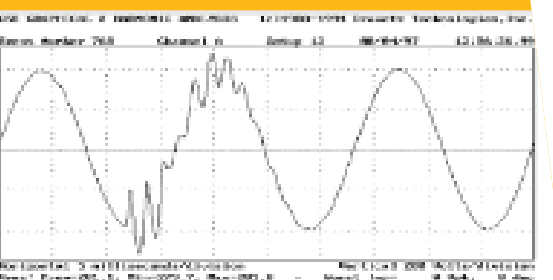
Flicker Meter



Wind Integration Issues



Power Analyzer



Power Quality Analysis

4.1 Introduction

ERDA has been providing field technical services in energy management for more than two decades now and has built up respectable expertise & experience base in this specialized area, with more than 275 audits out of which 141 audited entities are generating units of power plants. These audits have resulted in identification of savings potential of upto 64% for electrical energy and 43% for thermal energy with no cost savings potential of 50%. ERDA has recently introduced a new service for energy optimization of power plants. This new service is "Performance Efficiency Testing (PET) of Power Plants" as per ASME PTC energy efficiency test codes, using state-of-the-art data acquisition system built around a wired network of high accuracy pressure and temperature sensors, high accuracy class flow measurement devices and three phase energy meters.

4.2 Key Energy Management Services Provided by ERDA

- Perform, Achieve & Trade (PAT) Scheme Related Measurements & Analysis
- Performance Efficiency Testing (PET) of Thermal Power Plants as per ASME PTC Codes Using Time Series Based Data Acquisition and Trending
- Energy Efficiency of Electrical Equipment / Machinery (Motors, Pumps, Fans, Blowers, Chiller Compressors, Compressors, Transformers, Capacitor Banks, Lighting Loads, HVAC Systems, etc.)
- Energy Efficiency of Mechanical & Thermal Equipment / Machinery (Heaters, Steam Generators / Boilers, Condensers, Cooling Towers, Steam Ejectors, Furnaces, Reactors, Turbines, etc.)
- Process Modeling of Chemical / Metallurgical Process Reactors of Ferrous and Non-Ferrous Plants
- Energy Audit of Ferrous and Non-Ferrous Manufacturing Processes
- Heat and Mass Balance Analysis
- Second Law Analysis
- Exergy and Availability Analysis
- Computation Fluid Mechanics Analysis for Process Equipment Optimization
- R&D in Renewable Energy
- Conducting Seminars and Workshops on Energy Conservation and Energy Auditing

Our Experience Base and Partial list of Clients

A partial list of esteemed clients include Private and Public Sector Organizations Utilities and Industries such as NTPC, PGCIL, IOCL, GAIL, GNFC, GSECL, GETCO, ABB, Areva, Alstom, EMCO, Voltamp, Crompton Greaves, Siemens, L&T, Reliance, Bharat Bijlee, Kirloskar, GSFC, GIPCL, NPCIL (RAPS, TAPS MAPS, NAPS & KAPS), SKF, FAG, HINDALCO, ISPAT Industries, Essar Steel, Essar Power, ULTRATECH Cement, KRIBHCO, TATA Steel, JSPL, ONGC, IPCL, CSERC, GERC, UPERC, REC, Dadra & Nagar Haveli, MoP, DHBVN, MESCOM, Adani, GACL, various OEMs etc.



Measurement in progress



Flue gas Analysis in Progress



Wind Velocity Measurement in Progress



Coal Mill Performance Test in Progress



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