

## Transformer Service and Maintenance

### Critical Asset Support

Electrical power is the pulse of your plant. It's vital to your operations —but also dangerous and costly. When your electrical assets fail, profits and people can suffer. Enisave Solutions can help you increase the availability and safety of your electrical assets, resulting in fewer unexpected outages and accidents. Through electrical testing, maintenance and engineering services, we can deliver the information you need to make smarter, more profitable decisions about each asset in your electrical distribution system.

### Benefits

- Avoid substantial financial loss associated with service disruptions
- Eliminate unplanned downtime through cost-effective testing and maintenance
- Ensure ongoing reliability of electrical distribution systems

### Ensure optimum system performance, efficiency and safety with Enisave Solutions Transformer Services

Although large power transformers are among the most reliable equipment used in electrical power systems, failures can and do occur. When these unexpected failures occur it can cost you millions in lost production, lost income, and lost customers. Proper testing and maintenance performed on an annual basis can uncover a problem before a unit fails. If severe damage results, replacing a transformer can take several weeks resulting in serious financial and productivity losses. In many cases, a transformer can be repaired but only if the problem is caught before it escalates. The key to eliminating these unscheduled outages is proactive testing and maintenance. Information accumulated through routine inspections and periodic testing will usually provide warning of impending service problems. Recognizing the warnings of an impending failure requires careful analysis of the records to identify significant trends or unusual behaviour. Enisave Solutions will provide electrical testing, maintenance and engineering services to ensure that your company will have reliable power and avoid expensive outages related to transformer failure. Our transformer services are designed to improve each aspect of system reliability. And, we execute them seamlessly ensuring that your entire facility is protected around the clock, 365 days a year.

### Substation Maintenance

Enisave Solutions' delivers various on-site transformer and substation services including:

- Transformer Assembly and Installation & Removal
- On-site Inspection & Testing
- Insulation Testing
- Fluid / Oil Analysis & Condition Trending
- Insulating Fluid / Oil Reconditioning
- Failure / Fault Analysis
- Tap Changer Repair / Replacement
- Leak Repairs
- Gasket / Bushing Repair
- Substation Grounding
- Cooling Upgrades Turnkey Installation

Enisave Solutions can provide complete turnkey installation, replacement, upgrades or removal and disposal of your electrical equipment. Our technical staff will provide complete design, installation, commissioning and maintenance services for most transformers and related equipment.

## Commissioning & Start-up Services

The successful operation of a transformer is dependent on the proper design, installation, and start-up. Enisave Solutions' Commissioning and start-up Services will verify that the equipment has been properly installed to ensure reliable operation. Highly qualified personnel will use technologies and tests including:

- **Function testing of protection controls is performed** to ensure all protective devices are operating within normal specifications.
- **Insulation Power factor testing is used to measure** dielectric losses that determines the overall insulation condition of the windings, barriers, tap changers, bushings and oil.
- **Transformer turns ratio testing measures the turns** ratio of the transformer on the primary and secondary coils and verifies the actual voltage against the specified voltage ratio from the initial design.
- **Insulation resistance testing verifies insulation** integrity and proper installation by applying voltage to the dielectric barrier and measuring against specifications.
- **Winding resistance testing assures correct** connections and that there are no severe mismatches or open connections.
- **Frequency Response Analysis measures the input** voltage to a transformer to the output voltage and can determine whether there is any damage to the transformer windings that occurred during shipment or installation.

## Preventive Maintenance

The ongoing efficiency of electrical systems requires proper analysis, interpretation and service recommendations. Experienced Enisave Solutions engineers can provide complete preventive maintenance testing services to ensure the reliable operation of new and existing transformers. Using the same technologies and techniques described above, Enisave Solutions' experienced technicians will compare results against baseline measurements to determine overall transformer health.

## Online Predictive Maintenance

Our predictive maintenance services can be performed while your system remains energized, eliminating costly shutdowns. By performing the following, we can help you identify when a failure may occur so you can plan an outage instead of dealing with an emergency.

- **Visual Inspections are performed to inspect** cleanliness, cracked insulators and bushings, condition of paint, oil levels, oil leaks, oil / winding temperature gauges, nitrogen pressures, relay targets, and condition of grounds.
- **Infrared Thermal Testing** detects heat build-up, loose connections, and defective surge arrestors which are often a precursor to failure.
- **Ultrasonic Detection** identifies excessive corona which produces RF interference and may cause an insulator, bushing or surge arrester to fail. Ultrasonic detection can identify excessive corona before a failure occurs.
- **Nitrogen Gas Tests** are performed on nitrogen gas blanketed transformers. Gas samples are taken and two tests are performed including the Percent TCG test which identifies gas in the oil, often times caused by hot spots or overloading. The other test, Percent Oxygen, identifies a high oxygen content in the transformer which may indicate a "wet" atmosphere. Oxygen also accelerates the deterioration of oil.
- **Oil Analysis** is conducted to identify the properties essential to transformer oils and provides a more accurate assessment of their condition.

- **Partial Discharge Testing** can be performed while equipment is on or offline and can be a reliable indicator of insulation quality and its impact on overall transformer health and performance. It allows asset managers to prioritize capital and MRO investments before an unexpected outage occurs

## Fluid / Oil Processing Services

Fluids and oils circulate in large power transformers to insulate them from high voltage stresses — and they contaminate easily due to leaky seals and corrosion. Increased reliability and performance can result from a rigorous preventive maintenance program that purifies and filters these fluids over the life of the equipment. Enisave Solutions' advanced mobile oil processing equipment provides vacuum, filtration, degasification, and dehydration of fluids/oils to restore optimum dielectric strength, viscosity and insulation characteristics.

## Oil Analysis

When transformer oil deteriorates, sludge ultimately forms and coats the windings resulting in decreased cooling capacity and degradation of the solid insulation system. Proper oil analysis is critical in determining the operating efficiency of a transformer.

### Sample testing can include:

- Dielectric strength
- Acidity
- Interfacial tension
- Colour
- Sediment
- Dissolved gas analysis
- Dissolved water in oil analysis