



ELECTRICAL SERVICES



OUR PROFILE

SGS offers a full range of electrical engineering services covering the commissioning test of new plant as well as the maintenance and continual condition monitoring and condition assessment of existing plant throughout Australia.

We have a large range of testing services and due to our accredited Quality Management System we ensure that your equipment is maintained. A broadly diversified range of industries are supported, including Oil and Gas, Mining and Construction, Wind Farm Industry, Utilities and Metals.

CAPABILITY STATEMENT

Our objective is to assist our clients in maximising electrical plant availability through reliable plant condition management rather than a mere condition monitoring and maintenance programme. With a multi-disciplined approach we are able to provide comprehensive and dependable solutions.

Good maintenance strategies and effective condition assessments ensure longevity and reliability of a significantly large capital investment. Down time costs money and the best return on investment occurs when equipment is running efficiently and when assets comply with regulations in relation to safety, quality and environmental issues.

Qualified, certified and highly experienced personnel ensure discipline specific expertise, ensuring advanced diagnostic

and technical services. Within these services the Electrical Engineering department specialise, deliver directly and are considered extremely competent. SGS owns and utilises some of the most advanced and accurate test equipment available.

EXPERIENCE

Our Electrical Engineering department holds many years of experience in Predictive and Preventive Maintenance services and will in turn offer a high level of success in the accurate interpretation of machinery and plant problems. A broadly diversified range of industries are supported, including Mining, Construction, Energy, Building Products, Pulp and Paper, OEM's, Food and Beverage, Transport, Oil and Gas and Power Plants.

Customer relations have grown and extended to major corporations and include: NT Power & Water, Synergy, Newcrest, Rio Tinto, Barrick Gold, BHP Billiton, W.A.C.H.S., Boral Group, BGC, Alcoa Aluminium, Water Corporation, Public Transport Authority, to name a few.

It is from this experience that SGS will provide a comprehensive, reliable and cost effective solution to you, ensuring complete plant coverage.

WORK METHODS

Our objective is to provide specialised testing, condition monitoring, research and analysis functions to our clients in accordance to all relevant statutory and customer requirements, standards, directives, specifications and procedures.

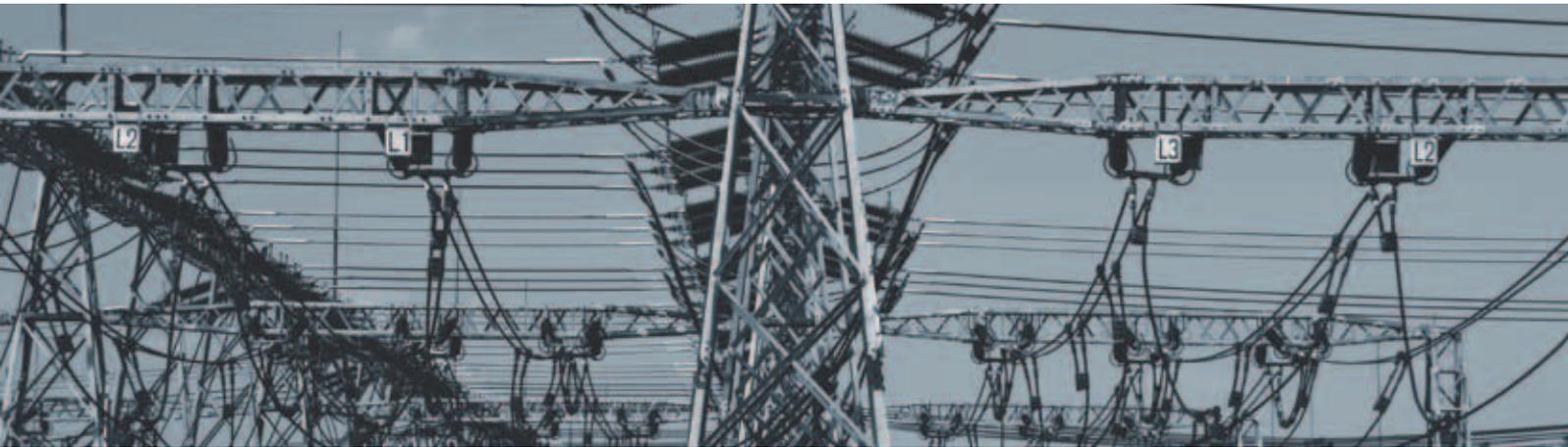
INNOVATIONS

All work performed is in accordance to the latest standards, procedures and industry best practices. In order to ensure synergy and guarantee the standard of work, written procedures are compiled for all tasks performed.

SUMMARY OF SERVICES

Our Electrical Engineering department can offer the following ranges of services

- Project Consultancy services
- Asset Management and Maintenance Planning
- Equipment Failure Investigations
- Substation and High Voltage Testing and Commissioning
- Protective Relay Testing
- Partial Discharge and Corona Survey Inspections
- High Voltage Cable Condition Assessments (including tan-delta and partial discharge identification and location)
- Thermographic Survey Inspections
- Transformer Insulating Oil Sampling, Testing, Analysis, Filtration and Reclamation services
- Third Party Supervisor



PROJECT CONSULTANCY SERVICES

Our subject matter experts and specialist service providers ensure that we provide value-adding services in a cost-effective and efficient manner.

Engineering Consulting services include

- System Planning, design and specifications
- Asset Maintenance Planning
- Client Representative Factory Witnessing
- Transformer Pre-Tank Inspections
- Equipment Performance and Condition Assessments
- Failure Mode and Effect Analysis (FMEA)
- Failure Investigations
- Maintenance, Testing and Condition Monitoring Procedures
- Work instructions and work procedures
- Operating procedures

ASSET MANAGEMENT AND MAINTENANCE PLANNING

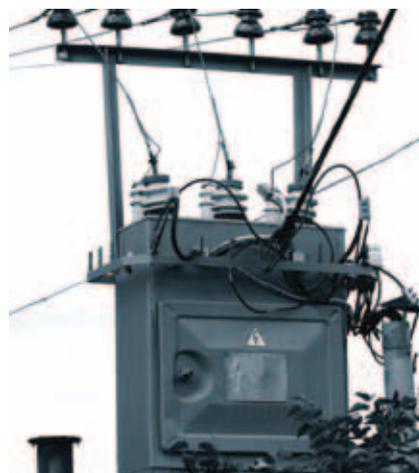
Our Maintenance Management services include

- Strategic Maintenance Planning
- Reliability and Failure Analysis
- Asset Tracking
- Co-ordination of plant maintenance outages
- Critical Plant Condition Monitoring
- Site Asset Registers

Our comprehensive maintenance management software provides holistic plant asset management services to our clients.

Best practices and international standards, with equipment bench-marked against both national and international standards.

Our recommended maintenance practices are in accordance with the International Electrical Test Association (NETA) and the Electrical Power Research Institute (EPRI).



EQUIPMENT FAILURE INVESTIGATIONS

Our highly trained and experienced subject matter experts and worldwide network of high voltage power plant experts ensure advanced diagnostics and root cause analysis of failures.

This include review of

- Equipment historical data
- Maintenance records
- Commissioning and test results

Based on the findings, SGS will provide recommendations to mitigate future failures.



HIGH VOLTAGE FIELD MAINTENANCE

SGS provides comprehensive and complete field maintenance, repair and testing services. Individually tailored maintenance service agreements for all secondary plant, primary plant and associated ancillary equipment include

- Condition Monitoring services
- Testing services
- Maintenance services
- On-site and workshop repair services
- Upgrades and Equipment Installation



SUBSTATION AND HIGH VOLTAGE EQUIPMENT TESTING AND COMMISSIONING

We specialise in testing, from initial commissioning, through to annual condition monitoring regimes.

Our capabilities include

- Power Transformers
- Regulating Apparatus
- Switchgear and switchboard assemblies
- Circuit-breakers and switches
- Instrument transformers
- Surge arresters
- Capacitors
- Reactors
- Outdoor bus structures
- Grounding systems
- DC systems
- Emergency systems
- Rotating machinery
- Motor control

PROTECTIVE RELAY TESTING

- Protection systems primary and secondary testing
- Fault studies, power system protection, grading co-ordination studies and audits
- Protection relay configuration, testing, repairs and calibrations
 - Electromechanical
 - Solid-State
 - Micro-processor controlled
- Communications and SCADA systems

PARTIAL DISCHARGE AND CORONA SURVEY INSPECTIONS

As almost all insulation breakdown starts from partial discharge (PD) activity, the monitoring of PD activity and its detection in the early stages of development is an important means of preventing insulation failure. However, the introduction and correct implementation of this diagnostic tool into an asset maintenance programme can provide cost benefit through more cost-effective asset management. Through the collection and processing of diagnostic test data, we provide plant owners with a better understanding of their plant condition.



SGS's integrated PD survey and monitoring solutions include both on-line and off-line testing, periodic as well as continuous monitoring. SGS can customise a programme that best suits your needs.

Technologies utilised by SGS include

- Ultrasonic
- Transient Earth Voltage (TEV)
- Ultraviolet camera with real-time video capturing

CORONA

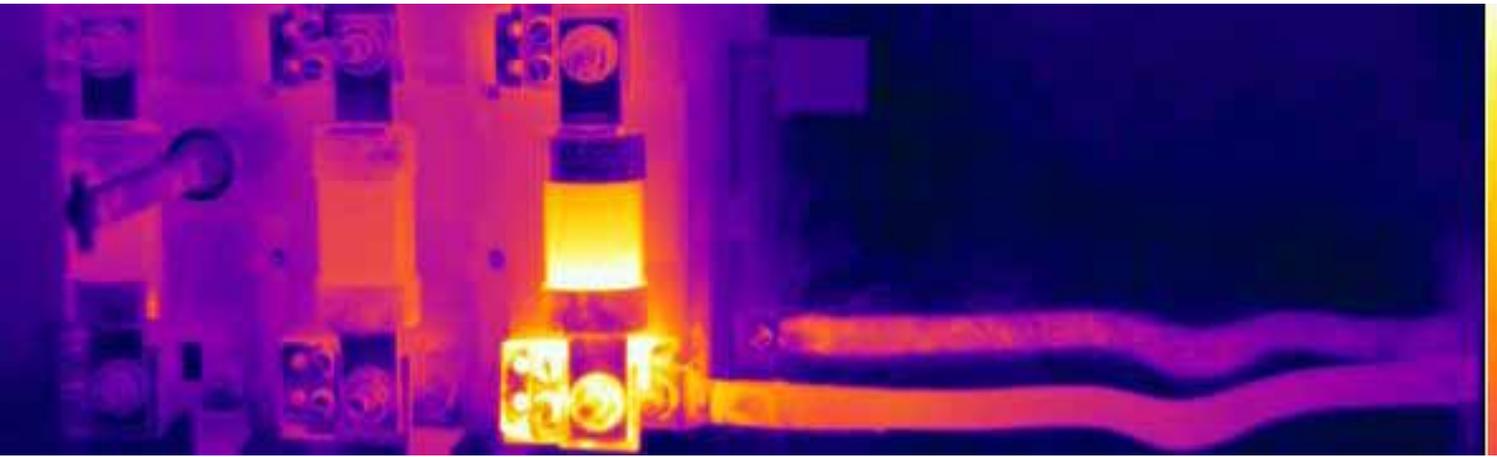
Although Thermographic Inspections are a well established maintenance tool, faults associated with corona may not necessarily generate heat and thus can go undetected. Corona Inspections do not compete with Thermographic Inspections, but in fact yield complimentary information.

Corona is a luminous partial discharge from conductors and insulators due to ionisation of the air. The level of discharge may change from time to time according to humidity and air temperature.

Corona is a problem that only worsens over time. It is largely a maintenance issue and it is important to conduct regular inspections as corona

- causes damage to insulators
- generates corrosive materials that shorten the life span of components
- indicates the location of faults
- indicates contamination on insulators
- indicates the effectiveness of line wash procedures





HIGH VOLTAGE CABLE CONDITION ASSESSMENTS

Power cables are the major arteries for electrical power and represent a large capital investment in any electrical power distribution system. They have to be reliable and failures inevitably results in long periods of service interruption, with costly repairs and loss of revenue.

Worldwide statistics indicate that more than half of the breakdowns in cable networks are caused by internal faults in the insulation system of the cable network.

In addition, cable condition assessments should form part of any cable replacement programme. A major part of the replacement decision making process is based on individual cable performance, which in turn, is based on cable condition.

Effective cable insulation diagnostics ensure a cost-saving. It assesses the cable insulation and allows the cable owner to prioritise replacement and/or refurbishment.

THERMOGRAPHY SURVEYS

Infrared Inspection of electrical equipment is now a widely accepted maintenance procedure.

It is easy to take a picture, but the correct interpretation, analysis and consequences of findings requires experience and knowledge.

For any thermography programme to be effective, a high level of knowledge is required. This includes not only knowledge with respect to the science of thermography, but also an in-depth knowledge of the equipment surveyed. Equipment knowledge includes individual operating characteristics, thermal characteristics and associated topics not only of the equipment, but all materials associated with that equipment.

Not only do we provide a detailed report of all anomalies detected, we also provide the client with recommendations regarding the corrective action to be taken. With over 50 years' collective industry experience, our Level 2 Certified

Thermographers have tacit knowledge of both High Voltage and Low Voltage electrical equipment. Our electrical survey expertise and experience include, but is not limited to



- High Voltage Switch Yards
- Indoor Switchgear
- Control Panels
- Switch Boards and Distribution Board
- Motor Control Centres
- Battery Rooms



TRANSFORMER INSULATING OIL SAMPLING, TESTING, ANALYSIS, FILTRATION AND RECLAMATION SERVICES

Transformers represent one of the larger investments that a company will make.

A recent study found that over a period of twenty years, approximately 13% of all transformer failures were due to inadequate maintenance.

It is important to have a preventative maintenance plan to ensure the continual operation of these units. Oil sampling and analysis plays a critical role in the overall maintenance and condition assessment of transformers and should form part of any preventive maintenance programme.

If a proactive approach is adopted based on the condition of the transformer oil, the life of transformers can be greatly extended.

The four functions of insulating oil are to provide cooling, insulation, protection against chemical attack and prevention of sludge build-up.

TRANSFORMER OIL SAMPLING

Our Electrical Engineering department provide on-site sampling, ensuring correct sampling techniques and therefore correct and accurate data analysis and interpretation. We also provide on-site theoretical and practical oil sampling training, ensuring that you, the plant owner, gain maximum benefit.

SGS operates one of the largest independent, NATA certified, insulating oil laboratories in Australia

- Accredited under ISO/IEC 17025
- Quality Assurance under ISO 9001, Licence No.: EG08/01357QA
- NATA Accreditation, No. 15506 (15529)

TRANSFORMER OIL DIAGNOSTIC INTERPRETATION SERVICES

Whilst our NATA accredited laboratory will provide test results and comments based on various international standards, our Electrical Engineering department will provide advanced analytical and interpretation services.

SGS has one of the most comprehensive data management systems and interpretation guides.

Our transformer subject matter experts, with over 20 years of discipline specific experience, will provide not only advanced analysis and interpretation, but will make recommendations based on our extensive database, including but not limited to

- Site and operation specific conditions
- Manufacturer specific
- Year of manufacture
- Power and voltage rating
- Preservation and cooling method
- Insulating oil make and type
- Year of manufacture
- Trending data

Our method of interpretation is based on

- IEEE Std C57.104 – 2008 (Total Combustible Gas Production Rates)
- IEC 60599 (provided the Total Combustible Gasses present are above 300ppm)
- Roger's Ratio
- Duval Triangle
- California State University Sacramento, Guidelines for Combustible Gasses
- Westinghouse Guidelines on Total Combustible Gasses
- Year of manufacture
- Trending data

This analysis will provide

- Determination of requirement for oil filtration or oil filtration and reclamation
- Identify and provide recommendations on maintenance issues
- Advanced warning of developing faults and monitoring of the rate of fault development
- Determination of improper use of units
- Status checks on new and repaired units
- Monitoring of units under overload
- A means of conveniently scheduling repair



FILTRATION AND RECLAMATION SERVICES

Oil sampling analysis provides indication of the oil quality. Based on the various parameters, either filtration or filtration and reclamation of the oil may be required. SGS owns and operates various units, ensuring the most cost-effective solution

- Transformer dry-out unit
- Mobile transformer filtration unit
- Complete Filtration and reclamation unit



TRANSFORMER DRY-OUT UNITS

Our dry-out units are used for the safe reduction of moisture content in the transformer core and cellulose insulation on-line, eliminating the need to take the transformer out of service.

The unit is equipped with GPRS communications that allows remote monitoring during operation. In an emergency, the unit will dial a dedicated mobile. Oil flow, pressure and temperature sensors on the unit will

isolate the transformer from the unit by triggering solenoids at the transformer tanks.

Vacuum and heat are used to eliminate moisture from oil. Particulate build-up is monitored by differential pressure levels, indicated locally and by remote telemetry. Particulate filters require periodic change-out according to the condition of the oil.

TRANSFORMER OIL FILTRATION

Water, even in minute quantities, is harmful in power equipment because it is attracted to the places of greatest electrical stress and this is where it is the most dangerous. Water accelerates the deterioration of both the insulating oil and the paper insulation, liberating more water in the process (heat catalysed).

This is a never ending cycle and once the paper insulation has been degraded (loss of mechanical strength) it can never (unlike the oil) be returned to its original condition.

Contaminants such as water, sediment and conducting particles reduce the dielectric strength of insulating oil.

Combinations of these tend to reduce the dielectric strength to a greater degree.

Filtration of the insulating addresses these issues and ensures that the oil is returned to near new oil quality.

TRANSFORMER OIL RECLAMATION

Acids in the oil originate from oil decomposition/oxidation products. These organic acids are detrimental to the insulation system and can induce corrosion inside the transformer when water is present. An increase in the acidity is an indication of the rate of deterioration of the oil with SLUDGE as the inevitable by-product of an acid situation which is neglected. Reclamation will remove the sludge as well as regenerate the oil to near new oil quality.

SGS offers transformer oil filtering and reclamation for

- Moisture
- Gasses
- Solids
- Acids
- Improvement of Interfacial Tension
- Improvement of Dissipation Factor

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