

LINEMAN'S TESTING LABORATORIES OF CANADA LIMITED

POWER TECHNICAL SERVICES DIVISION

Delivering Solutions for Power System Reliability & Sustainability



Design, Spec, Procure, Install, Commission, Trouble-Shoot, Maintain & Repair Life Cycle Management





416-742-6911 | 800-299-9769 | www.ltl.ca

Power Technical Services





* All services applicable to all sectors





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Trusted Since 1958

Since 1958, Lineman's Testing Laboratories ("LTL") has been trusted to deliver cost-effective and comprehensive solutions for power system reliability, from start-to-finish. With the resources of a diversified and industry-experienced team, a commitment to providing service to our clients that is of a high industry standard, and our ability to pull from an extensive inventory of electrical apparatus (including Transformers and Switchgear), LTL is ideally suited to assist companies in effectively managing their electrical systems, ensuring the continued success of their business.

As a privately owned Canadian company serving the utility, industrial and commercial sectors across Canada, LTL successfully maintains a loyal customer base and is recognized and respected for its integrity, and long-term business relationships. LTL provides the services of three divisions: Power Technical Services; LTL Utility Supply; and, NAIL-accredited High Voltage Testing, Calibration and Factory Authorized Tool and Equipment Repair Services. LTL's knowledgeable product specialists and customer care representatives offer support in the selection of required tools and equipment for the task at hand, pulling from an expansive inventory of utility tools, electrical apparatus and pole line equipment. LTL services - tests, inspects, calibrates, repairs - the utility tools and protective equipment we supply.

We pride ourselves in staying abreast of new and changing legislation, and our comprehensive electrical services are conducted in accordance to all applicable industry standards, including NETA. As well, we have extensive experience with NERC reliability standards.

As an advocate for worker safety, LTL presents to prominent organizations and is an active member of numerous associations for the promotion of safety awareness in the workplace, including the UCA (Utility Contractors Association), EDA, ESA/ECRA, OEL, and IHSA. Lineman's Testing Laboratories is represented on the NAIL Board of Directors for the development of uniformity and setting standards in testing, and the ASTM F18 Technical Committee for setting standards and establishing best practices for the protection of the electrical worker.

At LTL, we have the skills, knowledge and the tools to ensure your electrical systems are operating at optimum efficiency.

Our Team

We have established a dedicated and diverse team -- all specialists within their field -- many of whom have enjoyed long-term employment with LTL. All team members receive on-going industry-related training for the purpose of skills development, personal worker safety and compliance. Our team includes:

- Electrical Engineers
- Structural Engineers
- Electrical Engineering Technicians/Technologists
- Master Electricians
- Construction Electricians
- PLC/Control Technicians

- Linemen
- High Voltage Cable Technicians
- Oil Processing Technicians
- Customer Service Representatives
- Professional Sales People
- Trainers/Facilitiators





Field Testing & Commissioning

Lineman's Testing Laboratories' Power Technical Services team includes Professional Engineers and Certified Engineering Technologists. The approach we take on commissioning does not stop at equipment testing. We review the entire design philosophy and functionality to ensure the final system will operate correctly.

• Power Equipment Testing

- Circuit Breakers air, oil, vacuum, SF6
- Transformers
- Power Cables
- Air and Load Break Switches
- Switchgear
- Gas Insulated Switchgear (GIS)
- Instrumentation Transformers PTs, CT, CVTs
- Grounding Systems
- Load Centres
- DC Systems Battery Banks, Chargers

• Protection Relay Testing & Calibration

- All Protection Relay Types and ANSI Functions:
 - Transmission Line
 - Breaker
 - Bus

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- Transformer
- Feeder
- Generator
- Capacitor Banks
- Disturbance Recordings/SER Relays
- Microwave/Free-Wave Radio Communications Equipment
- SCADA/RTU Systems
- End-to-End Testing Tele-Protection Schemes, Telemetry
- Tripping Devices



- As-Built Redline Drawings
- Factory/Site Acceptance Testing
- Protection System Functional Testing
- HONI "COVER" Sign-Offs
- Outage Planning





Substation Construction/Upgrades

Engineered electrical power systems since 1967, LTL projects include design and installation, as required, for:

- traditional open air substations
- TLO and padmount substations
- tamperproof equipment substations
- dry type transformer substations
- metalclad substations

Whether upgrading and retrofitting an existing facility or installing a new state-ofthe-art service, LTL works in partnership with our clients to create custom solutions for maximum system performance through cost-effective methodology.

We have established close working relationships with an extensive supplier network, the power utilities, and the Electrical Safety Authority (ESA) to ensure expedited approvals and timely delivery of equipment orders.

To minimize emergency downtimes and avoid project delays, LTL inventories a wide selection of surplus, new and used transformers, switchgear, fuses, lightning arresters, insulators, towers, poles and other related equipment. All equipment is available for sale and immediate delivery. LTL's extensive inventory allows for quick repairs when required, and our generator rentals offer temporary power solutions for unplanned power outages, as well as emergency call-outs.



Servicing your construction needs, we offer:

- Any type of Transformer installation
- High voltage cable work
- Tower design and erection
- All methods of terminal pole construction
- Overhead and underground line construction
- High ampacity electrical equipment service work for
 Utility, Commercial, and Industrial applications
- All related civil work, including equipment base and duct bank installation

Substation Maintenance

AVOID COSTLY DELAYS & PRODUCTION DOWNTIME

LTL offers customized service programs to suit most operational requirements, ensuring compliance to the OES code, regulations and insurance requirements. Performed and directed by in-house, skilled and certified technicians, all work is performed to applicable standards.

Service is followed up with a detailed engineering report noting results, defects, recommendations, and quotes, if required.

All data collected is recorded for historical reference and is used to monitor the electrical system's overall performance from year-to-year.

LTL's ability to pull from an extensive inventory of new and used transformers, switchgear, fuses, lightning arresters, insulators, towers, poles and other related equipment allows for quick repairs when required. Our generator/Transformer rentals offer temporary power solutions for unplanned power outages, as well as emergency call-outs.

Early detection of electrical equipment weakness or potential hazard through regular (minimum annual) substation maintenance can reduce production downtime and associated costs, as well as improve safety conditions for system operating personnel. Ensure insurance coverage is maintained by performing regular substation maintenance.

Proper maintenance anticipates fatique before imminent failure.





PROLONG TRANSFORMER LIFE AND AVOID UNTIMELY DOWNTIME COSTS

• Oil Services (On & Off-Site)

- Complete oil sampling and results analyses
- Degasification
- Reduce moisture content in oil and coils
- Oil replacement (various methods)
- Nitrogen blanket / vacuum fill
- Filtration
- Oil regeneration by environmentally-friendly mobile plant
- PCB management solutions

Maintaining transformer oil quality allows the transformer to perform to design criteria during adverse conditions.

• Field Services

- Bushing replacement
- Gauge repair, replacement
- Tap changer maintenance, repair and replacement
- Gasket replacement/leak termination
- Repair seam welds
- Replace damaged cooling fins
- Rust-resistant paint coating
- Transformer assemble/disassemble, transportation
- Commissioning and testing services

Avoid long-term temporary power costs, plus hoisting and shipping costs synonymous with repairs at factory.











PROTECT YOUR INVESTMENT AND ENVIRONMENT: **Recycle, Reuse, Regenerate**

Lineman's Testing Laboratories' fully automated, state-of-the-art mobile oil regeneration process is an environmentally friendly and costeffective solution to extending the life of your transformer. Meeting MOE requirements, LTL's system uses a relatively low amount of electricity and can process up to four million litres of oil before changing the filter medium; the filter medium is then disposed of as clean fill. Other methods can produce oil impregnated contaminated waste.

It is generally accepted that the useful life of a transformer is determined by the residual strength of the cellulose insulation and not by its oil properties. This is because the oil can be reconditioned by conventional treatment, but the paper degrades through an irreversible process of depolymerisation. The paper and the oil aging processes proceed at different rates and produce different chemical by-products; thus, the timing of oil maintenance procedures may not coincide with requirements to preserve the paper insulation.

The lifetime of the paper depends on the stability of the oil; when the oil deterioriates, degradation of the cellulose fibers accelerates. It is preferable to use a good quality oil from the beginning rather than wait for irreversible deterioration of the paper. As the transformer design criteria and performance expectations are based on new transformer oil, on-going oil maintenance is a must. Weak oil performance not only allows for transformer insulation system deterioration, but also creates a vulnerable situation under fault, heaving loading and other stresses. Indicative lifetime of insulation @ 80 degrees celsius is 40 years if 1% moisture in paper; 10 years if 3% moisture in paper.

By maintaining the oil at near new conditions at all times, the transformer's life can be significantly prolonged and the risk of dielectric breakdown reduced.

Transformer Oil Processing Services

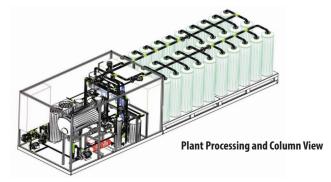
- Filtration: particle removal
- Dehydration: water removal
- Degasification: removal of gas
- Purification: includes all of the above
- Regeneration: acidity, colour
- Desludging: sludge removal
- Anti-oxidant: DBPC inhibitor additives
- Core dry-out
- Vacuum fill
- Complete oil sampling with full report (five-way, gas, PCB, furans, water content)
- Mode 60 oil sales and oil removal program
- PCB management solutions

Oil Regeneration Benefits

- Regenerated oil performs as new or better
- Improved transformer reliability
- Transformer performs to manufacturer nameplate criteria, increasing fault/over-voltage capabilities
- Protects integrity of internal components
- Extends infrastructure/transformer life cycle
- Reduces capital expenditure



State-of-the-Art Mobile Oil Regeneration Plant







Tx Oil Before and After Regeneration

Plant Control Room



Processing & Vacuum System



Plant Filtration Columns

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Infrared Thermography (IR Scanning)

NO COSTLY SHUTDOWNS OR LOSS OF PRODUCTION

The process of infrared scanning is non-contact, non-invasive and is performed during plant production. Thermographic imagers detect layers of the light spectrum invisible to the human eye, and poduce heat signatures for analyses.

NOT ALL PROGRAMS ARE THE SAME

Many programs provide a digital and infrared photo log of equipment, leaving the customer to interpret if action is required. Many perform scans with equipment panels and doors closed because they are not certified or equipped for scanning in the vicinity of exposed, energized equipment. Some equipment can't be accessed while energized, and must be isolated to investigate the overheating source.

Lineman's Testing Laboratories' crews include staff who are fully certified in IR scanning, licenced electricians, and technicians with the qualifications and expertise to conduct full and proper inspections of all electrical equipment. Equipped and protected with the proper arc flash safety gear (thereby removing liability to the customer), our thermographers open required panels, allowing for accurate identification of hot spot locations through internal imaging. This is of utmost importance when determining what hot spots are critical to ongoing equipment performance from those which are less immediate and can be addressed during regular annual preventative maintenance.

LTL SCANNING PROGRAMS SET US APART

- State-of-the-art imaging equipment
- Certified thermographic technicians
- Licenced, qualified field personnel
- Personnel well versed in OES Code
- Visual inspection as part of program
- Open door policy for IR scanning
- Ac Flash trained and equipped personnel
- Engineering review/report with recommendations

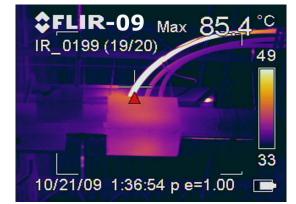
LTL recommends scanning twice a year under load for all electrical equipment in industrial and commercial environments where system reliability and continuous operation is essential. Electrical apparatus faulting-to-ground, or phase-to-phase, can produce an explosive force with intense heat. Plant personnel and persons within the vicinity can be seriously injured. By minimizing electrical equipment failures, IR scanning can reduce a potentially serious risk to your plant personnel.











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Certified Factory-Trained S&C Supported Contractor

PMH AND PME PAD-MOUNT SWITCHGEAR REFURBISHING

LTL's factory-trained technicians support and complement S&C's vision for a complete customer service package that ensures in-service S&C equipment is maintained in an expedient manner, to manufacturer specifications for design and safety. LTL offers:

- Equipment exchange programs
- Maintenance programs
- Painting
- Testing
- Commissioning

LTL's factory-trained technicians ensure in-service S&C equipment is maintained to manufacturer specifications for design and safety, using original equipment parts.

We service all switchgear, including, but not limited to, PMH and PME pad-mounted gear, offering complete restoration to near-new quality.

LTL's full service offering includes pick-up of equipment at the customer site, removal from inservice yard locations, and service tailored to individual customer requirements.

Emergency Power Solutions

• 24-Hour Emergency Services - Utility, Commercial & Industrial Sites

Professional troubleshooting and round-the-clock services in conjunction with a well planned inventory supply ensures timely recovery and reduced incidence of downtime.

- Power Outage Contingency Plans
- Installations
- Repairs
- Splicing
- Terminations
- Underground Cable Fault Locating
- Temporary Cable Supplies

Equipment Rentals

LTL stocks a range of transformers and switchgear available for expedient delivery. We buy, sell, lease and repair new and used equipment with our customers in mind. Normal industry lead times for these products can range from several weeks to several months, with projects often being delayed. LTL ensures the products are there when you need them.

Our expertise is reflected in our ability to anticipate your needs in advance, and our huge inventory demonstrates our commitment to customer satisfaction. We offer full delivery and set-up of all equipment.

- Generators
- Transformers
- Metalclad Switchgear
- Switches
- Towers
- Fuses











Engineering

LTL's professional engineering group works closely with our clients from start-to-finish ensuring all projects meet client requirements and are completed on-time and within budget. LTL takes into consideration municipal and provincial authority regulations and standards when preparing the design model.

Protection System Design/Upgrades

Replace existing aging protection and control equipment for added reliability and functionality

- Full design, install, and commissioning
- Protection philosophy is modeled with the existing system to match functionality
- New equipment is incorporated into existing racks or prefabricated panels for integration
- Specification and design in AutoCAD format

Protection Relay Panel Design & Fabrication

- Custom solutions
- Full design, integration, install, and commissioning

NERC Requirement Consulting

NERC (North American Electric Reliability Standards) define the reliability requirements for planning and operating the North American bulk power system and are developed using a results-based approach that focuses on performance, risk management, and entity capabilities. LTL provides the following comprehensive program:

- Site data collection
- Assessment of equipment capabilities and protection settings
- Report with recommendations for correcting equipment issues identified
- Correction/repair work , retrofit, replacement
- Test reports compliant with NERC requirements for proof of compliance

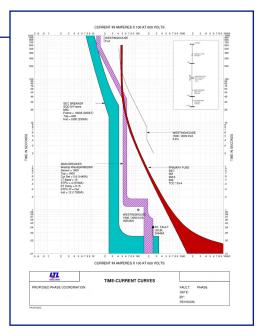
SCADA/HMI

SCADA systems (Supervisory, Control And Data Acquisition), play a vital role in the operation of Power Utilities. LTL has widespread experience with various types of communications protocols and industry standards, and provides the following:

- Design and drawings
- HMI screens
- Points list creation
- Procurement

Protection & Control Houses

- Complete substation controls in a box
- Reduce overall cost with pre-engineered integrated protection and control designs
- Industry proven components for harsh climates and environmental disasters
- Modular panel design for scalability
- Factory tested, and functionally verified with as-built drawings
- CSA Z462 Compliant Arc Flash Hazard Analyses
- Electrical power system specification/substation engineering/ design engineered models
- Engineering plan submissions to authorities
- Co-ordination studies for substation protective devices
- Substation ground grid studies and resistance testing
- Power quality studies: Power factor/harmonic solutions
- Troubleshooting and problem analysis







Protection & Control Relay System Engineering

Reliable electrical systems are the heart of your business. Lineman's Testing Laboratories delivers high performance, cost-effective technical solutions. Our approach to engineering is to understand our clients' needs with the vision of additional benefits and functionality from modern P&C trends.

With extensive experience in custom applications and system integration, LTL offers a turnkey solution for retrofitting or upgrading and replacing outdated protection relays.

- Engineering services extending from 600V systems to 500kV control buildings
- Integrating modern IED (Intelligent Electronic Devices) to SCADA systems
- Protection system upgrades including investigation of existing protection systems and decommissioning
- Capability with multi-vendor protection relays
- Up-to-date designs with evolving grid and cyber security requirements such as NERC PRC/CIP (North American Electric Reliability Corporation)
- Value added benefits of multi-function relaying
- Design concepts with reliability, maintenance, and flexibility in mind
- Integration services available to interface with third party installations
- Co-ordination studies and TCC graphs

At LTL, our engineering team understands the challenges of constructability when on site changes are encountered. We will work to ensure the final product goes through the proper Engineering Change Notice process to ensure quality control.









Protection & Control Panel Fabrication

The LTL team has experience in providing protection and control panels to power industries, from high voltage transmission to municipal distribution systems.

Our quality control and testing services avoid costly impact on site installation and commissioning time.

- Pre-wired panels allow for easy cost-effective integration into an existing system
- Factory acceptance testing, and witness testing services ensures a reliable
 product
- · Relays are pre-programmed with settings and fully function-tested
- CSA inspection and certification
- Connection Wiring Diagrams/Electrical Arrangement drawings can be provided
 as per client's requirements
- Wiring can be compiled simply from client's requirements, I/O lists, or major equipment shop drawings

Pre-commissioning services are also available for relay settings provided by the client. These are put through our engineering review process to identify any issues before they get to site.



Complete Substation Controls in a Box

Integrated modular packages offer cost savings and quality, providing a pre-engineered, fully integrated, protection, control, and automation solution.

- Design-build solutions tailored to customers specific needs
- Termination racks allow for easy interface wiring on site
- Modular AC and DC power and auxiliary systems
- Dedicated battery bank rooms include ventilation and automatic fan controls
- Meets or exceeds all national building codes, including fire rating, temperature, wind extremes, and seismic activity
- Built to post-disaster construction specifications

INDUSTRIES

- Utilities & Industrials
- Green Power Generation (Wind/Solar)
- Co-Generation Plants
- Hydro-Electric
- Oil & Gas





CSA Z462 Compliant Arc Flash Safety Programs

Protecting electrical workers since 1958, Lineman's Testing Laboratories has been a trend setter by establishing test and inspection standards for electrical insulating equipment and protective devices. With the advent of arc flash hazard legislation, LTL has developed arc flash compliant safety programs to mitigate risk for workers exposed to electrical hazards.

LTL's Arc Flash Safety Program includes a CSA Z462-compliant Arc Flash Hazard Study, labeling of all applicable electrical equipment, supply of required personal protective equipment (PPE) from our extensive inventory, and online or classroom training.

Proper safety practices and on-going personnel training can minimize the likelihood of electrical injuries and fatalities due to shock, electrocution, arc flash and arc blast. At risk are employees who work on or near exposed energized electrical conductors or circuit parts including electrical maintenance personnel, operators, troubleshooters, electricians, linemen, engineers, site safety personnel, or anyone exposed to energized equipment of 50 volts or more.

Performed by qualified engineers and technicians, LTL's comprehensive arc flash hazard studies determine potential arc flash incident energies and boundaries, shock hazard boundaries, and personal protective equipment required for energized electrical system equipment tasks for the system studied. LTL personnel performing the work abide by the same program and utilize arc flash PPE to ensure their safety while working in the vicinity of energized electrical equipment.

LTL's arc flash hazard studies include:

- Site assessment and data collection
- Single line diagrams
- Short circuit and protective device coordination
- Equipment labeling
- Detailed arc flash analysis report
- Remediation of non-compliant issues
- Protective equipment supply and training

LTL is your single, reliable source for arc flash safety.







LINEMAN'S TESTING LABORATORIES' SERVICE & REPAIR CENTRES

Servicing tools and equipment since 1958, we take great pride in exceeding customer expectations for the supply, testing, calibration, repair of tools, and recertification of personal protective equipment. LTL's specialized technicians ensure proper handling of all equipment when in our facilities. To ensure compliance, all equipment is tested to applicable standards or as directed by our customers. We offer assistance in establishing both testing and calibration schedule intervals to ensure your equipment is reliable and ready to go when you are!

NAIL-Accredited High Voltage Testing & Calibration

- Insulating Rubber Gloves
- Blankets
- Cover-Up
- Line Hose
- Gas Detection Equipment
- Metering & Instrumentation













Factory-Authorized Tool/Equipment Repair & Inspection

- Battery & Hydraulic Tools
- Grounding Assemblies
- Live Line Tools
- Hoists & Chain Jacks
- Fall Protection Equipment
- Work Performed by Certified Technicians
- Replacement parts in stock
- Automatic equipment replacement programs
- Loaner program available



















GLOVES - RUBBER & WORK

Gloves Sleeves Glove Bags Glove Care

COVERUP - RUBBER & FIBER

Pole Guards Line Hose Rubber Blankets

LIVE LINE TOOLS

Grip-All Sticks, Switch Sticks Link Sticks & Measuring Sticks Live Line Platforms & Ladders Universal Tool Accessories

GROUNDING & JUMPERS

Live Line Jumpers Grounding Clamps Grounding Cables Grounding Accessories Earth Anchors

PERSONAL PROTECTION

Arc Flash Clothing & Accessories Head, Face & Eye Footwear Sunscreen & Insect Repellent

FALL PROTECTION & CLIMBING

Harnesses Lanyards Self-Retracting Lifelines (SRLs) Belts Pole Chokers

Mobile Outfitting Rig

Insulating Rubber Gloves/PPE, Utility Tools and Related Equipment

Largest stocking Canadian Distributor of Salisbury by Honeywell Insulating Rubber Gloves and related PPE
Extensive product inventory; thousands of quality brand name products from industry leading manufacturers

METERS & TESTERS

Potential Indicators Phasing Sticks Contamination Meters Digital Multi-Meters Clamp Meters

TOOLS

Lineman's Apprentice Starter Kit Insulated Hand Tools Uninsulated Hand Tools Loadbust /Spiking Tools Cable Scorers & Strippers Shovels & Rakes Hammers & Diggers Accessories & Bits

CUTTERS & CRIMPERS

Battery Powered Hydraulic Manual Compression Dies Shell Actuated Wedge Tools

UNDERGROUND &

CONFINED SPACE Gas Detection

Tents & Shelters Ladders

TRAFFIC SAFETY

Traffic Cones Signs, Paddles and Flags Apparel Delineators Sign Systems

RIGGING

Grips Hoists Hoist Accessories Slings Nylon & Wire Rope Load Binders Reel Lifting Device Shackles/Chains

TRUCK

Custom Truck Kits Digger Derrick Truck Kit Wheel Chocks **Outrigger Pads** Hinges & Rubber Accessories **Truck Body Accessories Reels & Accessories Tool Organizers** Safety Hooks **Platform Tool Trays Tool Boards** Platform Covers Liners & Scuff Pads Tool Holders **Temporary Ground Mats Bags & Pouches Buckets & Accessories** Aprons Chainsaw Scabbard **Miscellaneous Platform Equipment**

LIGHTING & ACCESSORIES

Flashlights

Lanterns

FORESTRY

Carabiners Pruners Pole Saw Heads & Saw Blades Fiberglass Sticks Couplers & Fittings Rope Fall Protection (refer to Fall Protection & Climbing) Chainsaw Protection

STRINGING

Travellers Pulling Equipment Swivels Dynamometer Ropes

PAINTS & CLEANERS

Cleaning & Lubricants Inverted & Fluorescent Paints

ELECTRICAL APPARATUS & POLE LINE EQUIPMENT

Crimp/Compression Connectors Wedge Switch

ACCESSORIES

IR Windows Ground Protection Mats Protective Cases Heat/Cold Shrink Splices & Connectors Terminations Tapes

LTL UTILITY SUPPLY's mobile tool and equipment truck will be touring a city near you. We carry a wide selection of hand-picked specialty tools and equipment for the utility, forestry and industrial sectors.







Utility Supply | Toronto Store | Edmonton Showroom | Hours: Mon-Thu 8am - 4:30pm, Fri 8am - 4pm

LTL Utility Supply store and showroom shelves are stocked and LTL Product Specialists are available to answer all questions as well as assist with compliant product selection and fitting. For your convenience, we offer insulating equipment and tools pre-certified and ready to go!



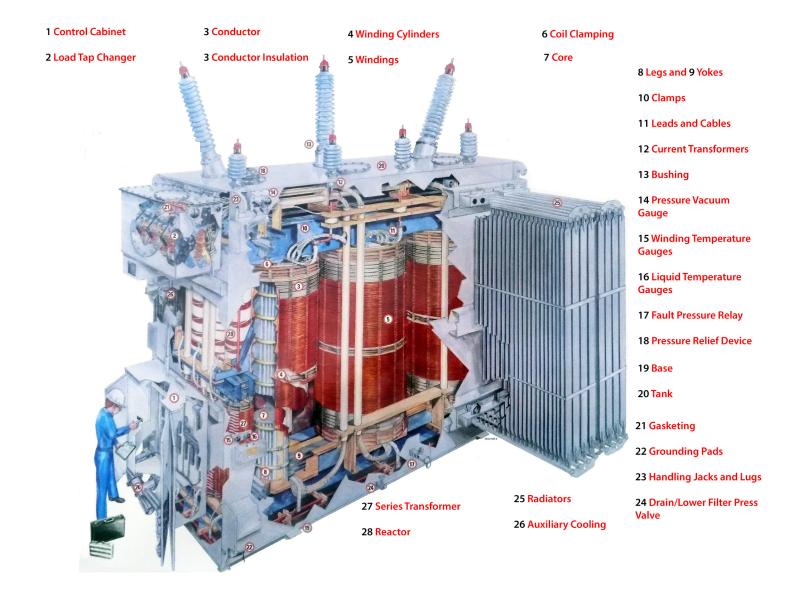


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Note: Services available in Ontario only.





For additional information, please contact: **POWER TECHNICAL SERVICES DIVISION** 46 Meridian Road, Toronto, ON M9W 4Z7 Tel: 416-742-6911 | Toll-Free: 800-299-9769 Email: caf@ltl.ca