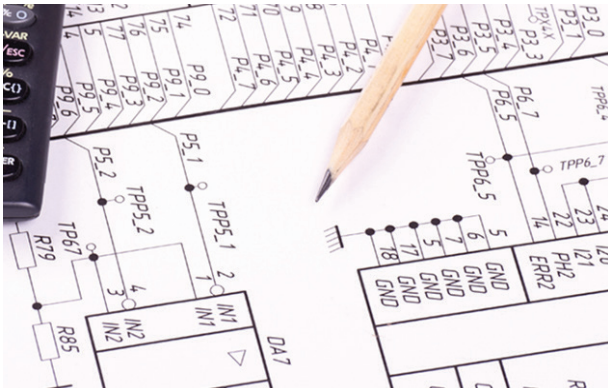
# Engineering Analysis: The Foundation of Safety



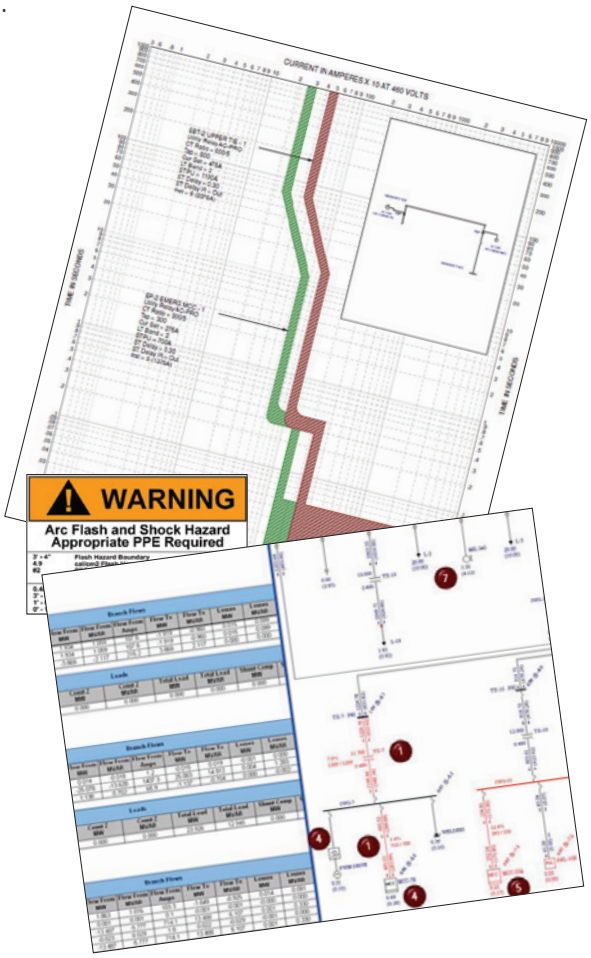
**For almost a half a century Canal** has provided electrical design, engineering and service around the clock to the merchant marine, naval and coastguard fleets in Canada, primarily in the Great Lakes Basin. From the heaviest Ice Breaker, the largest Bulker, Warships, Tugs and Research Vessels, Fish Boats, Cruise Vessels and Ferries and from the oldest to the newest, we have been there and kept them moving.

**A proper understanding of the power plant is essential for safe and predictable operation of your vessels and installations.**
Often vulnerabilities do not present themselves until something goes wrong, with damaging – and possibly dangerous – consequences.

Whether you are a vessel designer, shipbuilder, or operator, **Canal's Engineering Analysis** services are designed to ensure that your plant is well designed, suitably rated, properly protected, and compliant with the requirements of industry rules and regulations (such as those of the Marine Classification Societies).

Canal performs a range of studies on power systems including **Load Analysis, Power Flow, Transient Analysis, Harmonic Analysis, Short Circuit and Coordination Studies**, and **Arc Flash Hazard Analysis.** In cases where new equipment must be selected, or mitigating action taken for an existing power plant, Canal is able to offer advice and solutions.

At Canal, we use state-of-the-art electrical engineering software to perform analysis of our customers' power systems in accordance with appropriate standards, such as ANSI or IEC. For new builds we ensure that appropriate equipment is selected and correctly adjusted to provide the best possible protection and risk reduction. For existing power plants, we can verify equipment and settings, checking that they are appropriate and safe. Analysis is performed by, or under the direct supervision of, Canadian Licensed Professional Engineers.




For more information, please contact us at 905-685-9293 or 1-844-814-0620

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An **ELECTRICAL LOAD ANALYSIS** lists and quantifies electrical loads in a structured manner, allowing for load and utilization factors. Not all loads run at their rated maximum power, and usage can be periodic and normally depends upon vessel operational scenarios. A thorough Electrical Load Analysis allows the plant to be evaluated against the load, checking power generation capacity and infrastructure sizing for peak load conditions and for redundancy. A Load Analysis is usually required for construction of a new vessel, but it should be repeated when significant changes are made to the vessel (such as the later addition of significant electrical loads).

A **POWER FLOW STUDY** (also referred to as a 'Load Flow Study') is a numerical analysis that computes the magnitude and direction of power flow, both real and reactive, in each branch of a power distribution network. The study specifies voltage drops at each point in the system and can identify overloaded infrastructure (transformers and conductors). It is also an important tool in evaluating the efficiency of a power generation and distribution system.

**TRANSIENT ANALYSIS** examines the behavior of the plant under rapidly changing conditions, such as those caused by step increases in load, large motor starts or transformer inrush.

In modern vessel systems, increasing use of semiconductor-based power conversion equipment (typically large drives) introduces non-linearity in loading. In other words, the current into the load is non-sinusoidal (or pulsed). This in turn can distort the plant sinusoidal voltage, potentially affecting or damaging any equipment connected to the common bus.

**HARMONIC ANALYSIS** computes the magnitude and nature of this distortion using a model of the plant sources and loads. From this analysis it can be determined if the distortion exceeds maximum permitted levels and if equipment may be at risk.

A **SHORT CIRCUIT AND COORDINATION STUDY** is considered to be essential for the safe design of a power plant. This evaluates the fault current available at various points in the distribution system, allowing the interrupting capability of switchgear to be verified along with the proper bracing of conductors. The response of protective devices (breakers, fuses and protection relays) is modelled to ensure that faults are properly discriminated.

An **ARC FLASH ANALYSIS** is also considered essential for modern power generation and distribution design, and it is now a Classification Society requirement for new-builds. There are significant safety risks associated with insufficient arc flash protection. An arc flash event occurs where fault current flows through a plasma formed across an air gap. The event is characterized by a blinding flash, intense heat and a blast effect as melting material rapidly expands.

An Arc Flash Analysis is best performed in conjunction with the Short Circuit and Coordination Study as it relies upon the same numerical model. The arcing fault currents established by the analysis are not the same as the 'bolted' fault currents used for equipment evaluation, and breaker performance (type and setting) is determined with both considerations in mind. The energy released during an arc flash event – a function of the available arcing fault current and the time before a trip - is calculated, along with a 'rating' for the risk at each location. Based on this, warning labels are produced dictating levels of personal protective equipment and stating the boundaries of safe approach. In some cases, further measures to mitigate the risk may be recommended as a result of the study.

## About Canal

Canal provides services to government, industrial, commercial and marine clients in Canada from our headquarters at the hub of the Great Lakes Region in St. Catharines, Ontario.

Want to learn more? Visit www.canal.ca

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