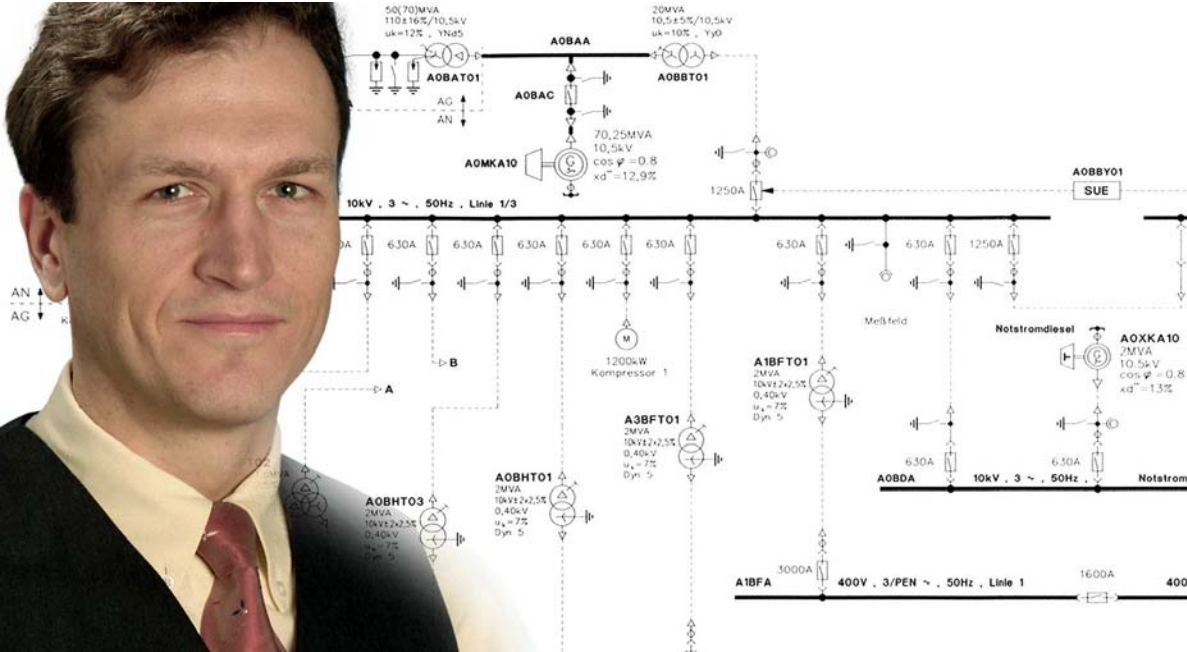


Plant Electrical Systems

Electrical System Engineering



Plant Electrical Systems Electrical System Engineering

Electrical Balance of Plant (eBoP)

A huge demand on the provision of an uninterrupted power supply is nowadays a MUST.

ABB offer's some of the best engineering resources and products in the power energy and automation sectors. ABB has the capability, experience and it's own technologies to deliver "turnkey" Electrical Systems and Packages of plant (eBoP) tailored to plants, such as oil & gas fired combined cycle power plants, coal fired boiler power plants and hydro power plants as well as industrial sized turbine and boiler power applications.

We will be responsible for the complete engineering, supply, manufacture, delivery to site, installation, commissioning, testing, and quality of the eBoP plant supplied. Direct controlled overall engineering and project management functions enables us to insure the best performance and quality of engineering workmanship and deliveries.

Through innovative electrical power applications we help utilities to built and maintain reliable power system installations safely and efficiently offering cost effective solutions that guarantee results.

Our capability has enabled us to supply turnkey balance of plant units to a variety of customers all over the world.

ABB Electrical Balance of Plant solutions include the following equipment, systems and services:

- Electrical System Engineering
- Facility Management
- Generator Auxiliaries
- Emergency Systems
- Low Voltage Systems
- Medium Voltage Systems
- Power Unit Connection
- High Voltage Systems



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Electrical System Engineering

We help utilities to build and maintain reliable power system installations safely and efficiently.

We can help you to analyze your generation and transmission system and to advise the necessary actions to achieve the required power stability and reliability considering cost effective solutions.

ABB is a system integrator in the automation of power plants of all types, water and industrial process businesses. Coupled with ABB's innovative products in low, medium and high voltage electrical equipment, generator excitation, protection and synchronizing systems. Our core competence is to match customer need with customer related energy and control process.

ABB's ICE solution includes the integration of instrument and control together with electrical energy systems for new projects, retrofit projects and high-tech-component based projects to achieve the most economical and reliable solution in the operation of above-mentioned process businesses during project lifetime, this includes:

- Project consultant
- Project feasibility study

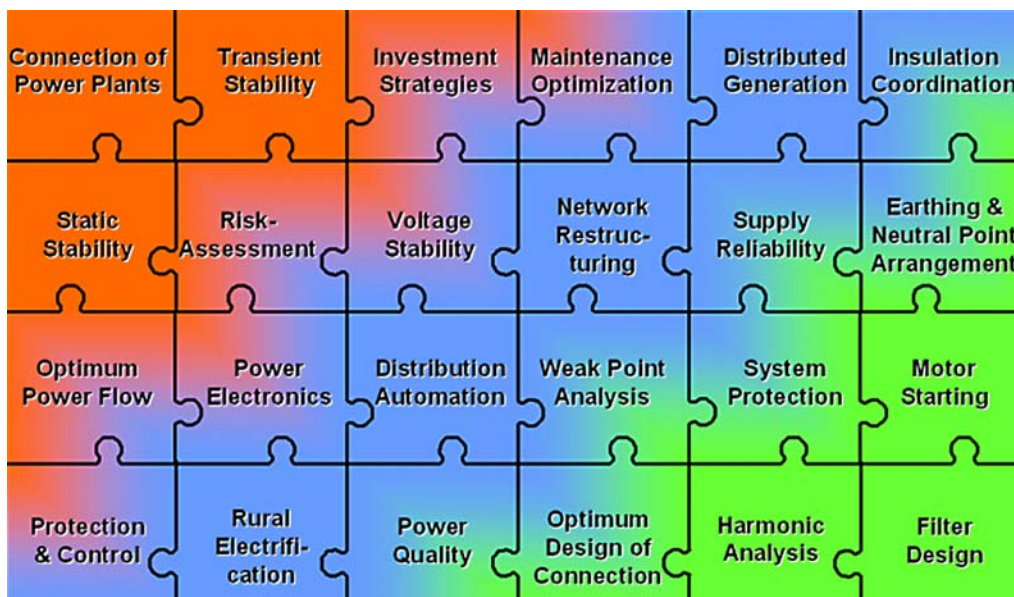
- Project chance and risk management
- Project proposal
- Project management and execution
- Project deliveries, installation and commissioning
- Project operation and service management

Our engineers specific tasks for electrical system engineering are:

- Site assessment (rehabilitation)
- System analysis and SLD
- Short circuit and load calculations
- Component sizing
- Cable sizing calculations
- Earthing and lightning calculation
- Setting and selectivity calculation

And again of course the integration of IC and E systems to create ONE system which complies with the international standards and fulfils the service and operational needs of your plant in one economical solution that insure safety of personal, reliability of power supply and quality of product.

We want to be your preferred partner for this task. You can trust us.



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Electrical System Engineering

Site Assessment (Rehabilitation)

Our ICE solution is the integration of instrument, control and electrical system for, among others, retrofit projects to achieve the most economical and reliable solution during project lifetime.

If you require advice on modernization of your aging electrical systems, desire to take advantage of recent developments in automation technology or wish to ensure certain flexibility in power supply toward your consumers, ABB is the right partner.

ABB experts can visit and examine your power facilities and their network interfacing to obtain the necessary information, which enable us to prepare the corresponding economical solutions and alternatives. Depending on the condition of your present electrical equipment ABB will recommend their repair, maintenance, upgrading or replacement schemes.

You can profit from our engineering and power process experience and know-how in the energy and automation fields, reflected in our site assessment report aiming to optimize your investments.

System Analysis and SLD

Our innovative systems calculation tools assist you to achieve reliable and economical power supply.

We can help you to analyze your generation and transmission system and to advise in a study the necessary actions to achieve the required power stability and reliability considering cost effective solutions.

After the decisions for the type and size of the generating or transmission units have been taken, we can design the necessary electrical system configuration considering safety and efficiency aspects according to international standard. We will be able to drawdown the outline single line diagrams of the power plant or transmission network required (s. drawing at the title). This may include among others:

- Power Unit Connection including generator circuit breakers and bus ducts connections
- All voltage levels of substation switchgear equipment including circuit breakers and switches
- Unit and auxiliary transformers
- Substations control, metering and protection systems
- Stand-by power system including emergency and auxiliary power supply
- Motors and frequency converters
- High-speed transfer devices
- Cabling systems
- Synchronization, excitation and automatic voltage regulation systems
- Monitoring systems
- Transmission lines
- Station automation systems

ABB planning and information system tool is designed for analyzing and optimizing all voltage levels of electricity networks.

Other auxiliary systems such as fire fighting; HVAC (heating ventilation and air conditioning), communication and lighting equipment will be designed during detailed engineering.

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Short Circuit and Load Calculations

Our planning system tool is designed for analyzing and optimizing all voltage levels of electricity networks.

Knowledge of the expected short-circuit currents and loads in an installation is essential to achieve the correct design, layout and selection of the switching stations and the line-side connected network.

The short-circuit current and load calculations therefore help to solve the following tasks:

- Dimensioning of electrical equipment on the basis of (dynamic) stresses on closing and opening as well as the thermal stress
- Designing the network protection system
- Compensation and earthing
- Interference problems (e.g. in relation to telecommunication lines)

Based on decades of engineering and implementing electrical balance of plant systems ABB has developed engineering tools with modular structures allowing them to be quickly adapted to specific plant applications, fulfilling all customers needs at reasonable cost.

Component Sizing

Our short-circuit current and load calculations are essential for component sizing.

After performing the short-circuit current and load calculations we will be able to drawdown the outline Single Line Diagram (SLD) of the power plant or transmission network required indicating ratings of foreseen equipment and systems.

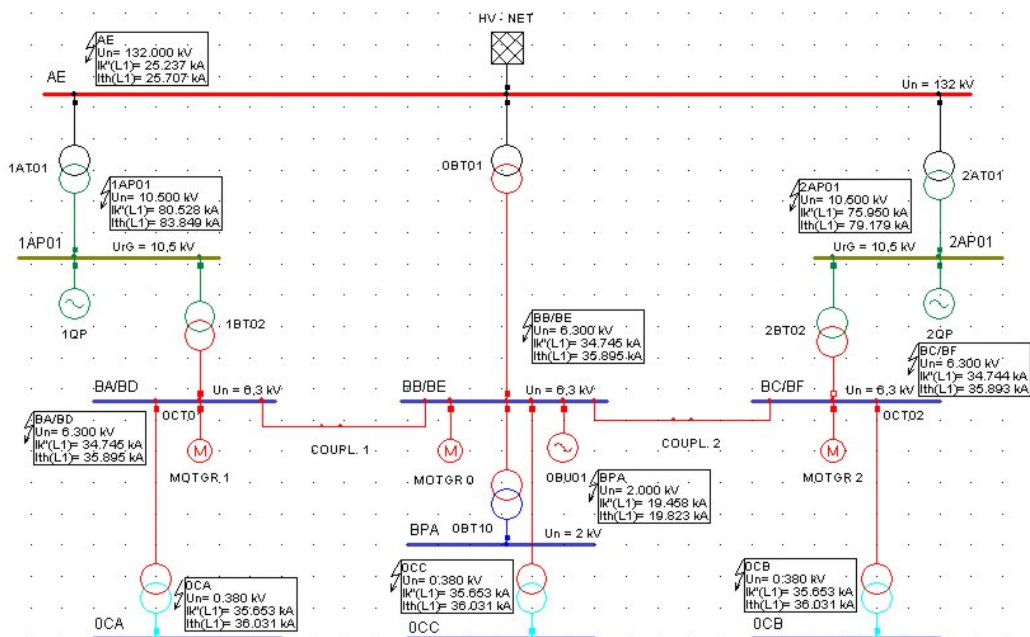
The upper limit value of the fault currents determine:

- Power rating of the circuit breakers
- Mechanical design of the installation
- Thermal design of the equipment
- Electrical design and configuration of earthing system
- Maximum permissible interference in telecommunication systems

The lower limit value of the fault currents determine:

- Protective relays and their settings

Through innovative planning tools and our specialized engineers we help our client to design the reliable power system installations safely and efficiently offering cost effective solutions that guarantee results.



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Cable Sizing Calculations

Our short-circuit current and load calculations are essential for cable sizing.

The cross-sections of cables between the switchgear and their connected loads must be calculated in relation to the operating conditions and cable length.

Factors influencing the cross-section of cables are:

- Permitted loading, ambient temperature and laying methods
- Thermal short-circuit strength
- Permitted voltage drop along the cable run under normal conditions, and also during the starting phase when feeding motors
- Response of protective devices in the event of overloads and the smallest possible short-circuit current to interrupt dangerous touch voltage

ABB developed program makes it possible to carry out this comprehensive calculation for every current circuit. This program selects the appropriate minimum cross section of cable. With the aid of program parameters, the range of cable types to be used can be limited and the number of parallel cables for a given cable cross-section can be determined. This insures the most economical solution to the benefit of our clients.

Earthing and Lightning Calculations

Our short-circuit current and load calculations are essential for earthing & lightning sizing.

Generally earthing systems have the purpose to protect life and property in the event of short-circuit and earth fault as well as lightning and switching operation.

Damages caused by lightning strikes cannot be completely prevented either technically or economically. However, the probability of direct lightning strikes can be greatly reduced on the basis of model experiment, measurements and years of observation.

ABB have the capability to design your earthing and lightning systems to avoid unplanned outages and minimize damages to ensure utilities safe and efficient operation of their electric power supply.

Results	Maximum phase-to-earth peak voltages at generator bus		Generator circuit-breaker	
	ON	OFF	ON	OFF
Capacitive transferred peak voltage	0.42	87.47	Ucap / kV	
Inductive transferred peak voltage	29.82	135.77	Uind / kV	
Maximum r.m.s. operating voltage (l.v.)	11.55	11.55	Uo / kV	
Total peak voltage	30.51	156.28	Utot / kV	

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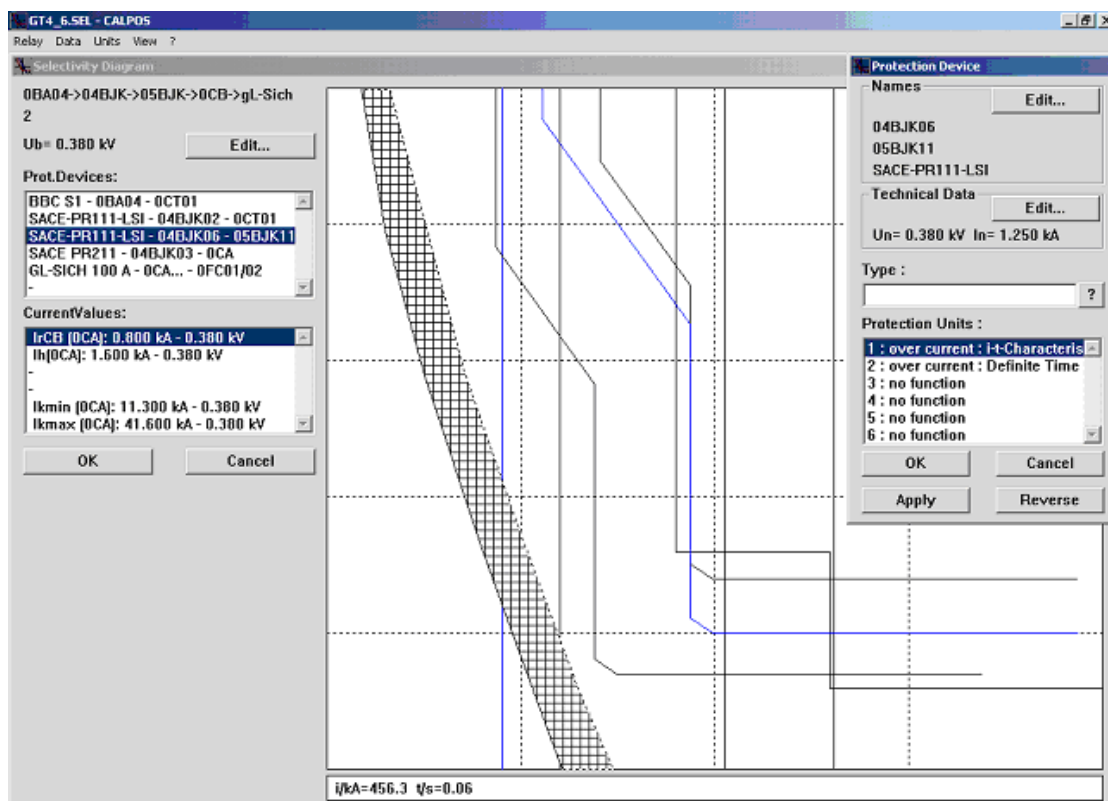
Setting and Selectivity Calculation

Our short-circuit current and load calculations are essential to determine required protective relays and their settings.

Various protection devices are available to protect generators, transformers, cables, bus bars and consumer's switchgears. The purpose of these devices is to detect faults and isolate them selectively and quickly from the network to ensure that the consequences of the fault in a network are limited as much as possible. With today's high fault levels and highly integrated networks, faults have far-reaching consequences, both direct consequences, such as damaged equipment and indirect, such as loss of revenues due to unplanned outages. Protection relays must therefore act very fast and selectively with maximum possible reliability and availability.

Calculation of expected short-circuit currents in an installation is essential to determine the lower limit value of the fault currents, accordingly design of the protection system and selection of the protection relays and their settings.

ABB ensures you the most reliable and economical system through our experienced engineering staff, that understand the needs of your plant safety, reliability and availability based on experiences in power plant processes.



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