



**MANJUNG**  
**3 x 700 MW Thermal Power Plant**  
**Malaysia**

**ALSTOM**

**Power Turbo-Systems**  
Plants

## General Presentation

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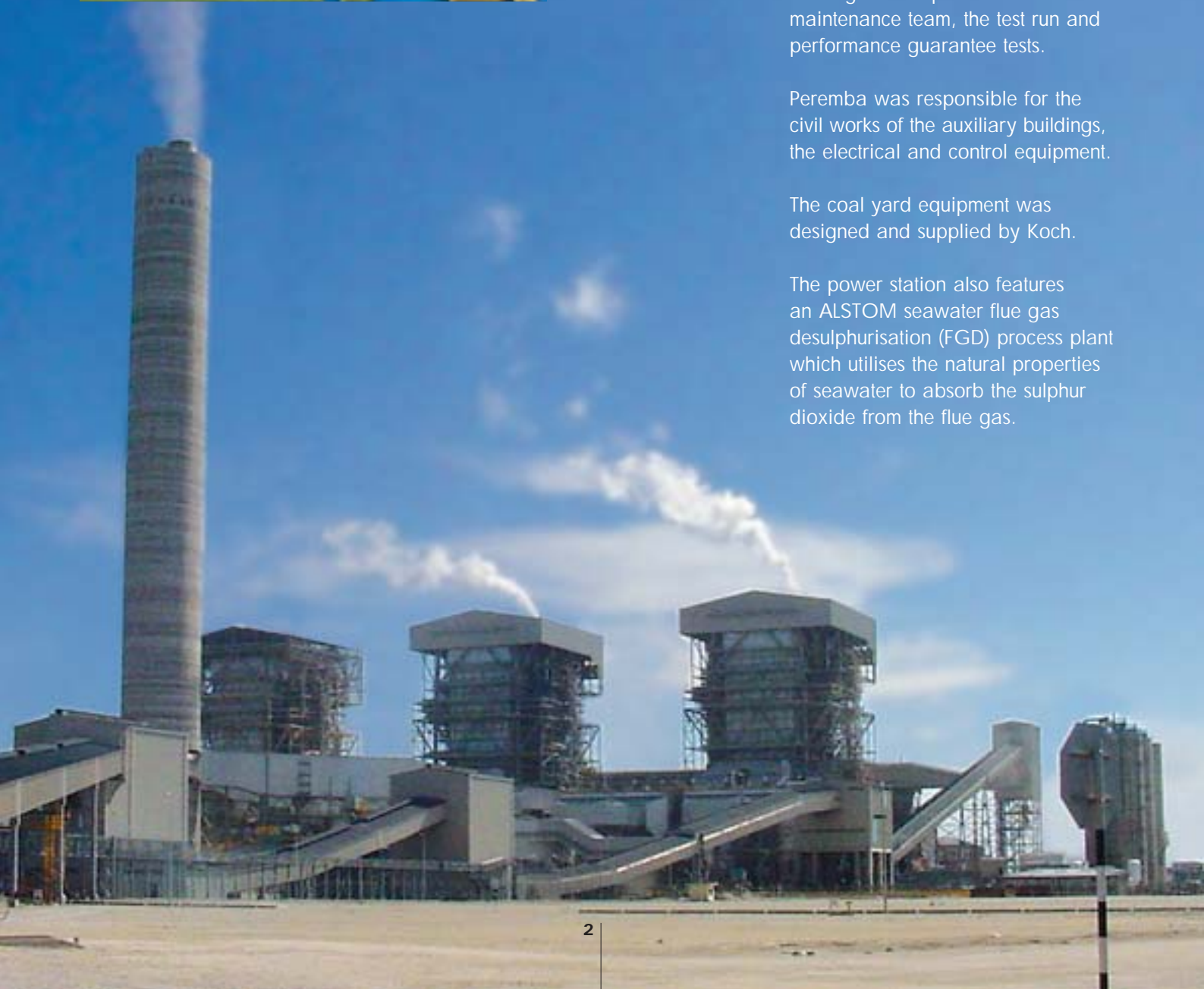
In July 1999, a consortium including Alstom Power and Peremba was awarded by TENAGA NASIONAL BERHARD JANAMANJUNG (TNBJ) for the supply of 3 x 700 MW units for the Manjung thermal power plant.

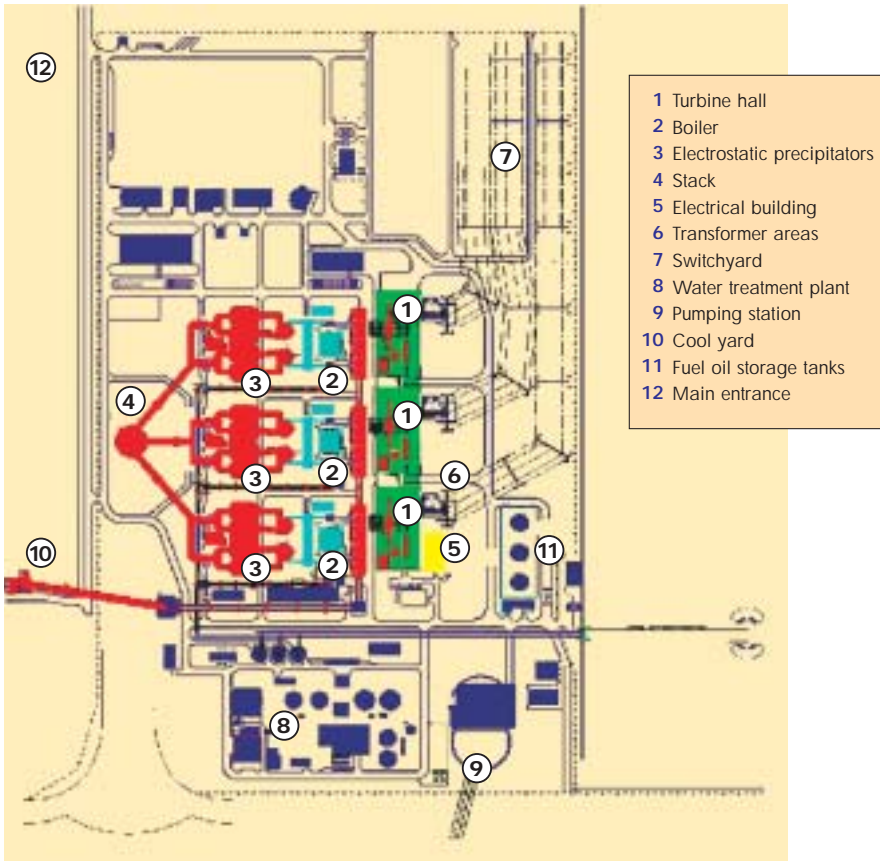
Alstom Power was responsible for the design and supply of the civil works of the power block, the equipment, the erection, the commissioning, the training of the operation and maintenance team, the test run and performance guarantee tests.

Peremba was responsible for the civil works of the auxiliary buildings, the electrical and control equipment.

The coal yard equipment was designed and supplied by Koch.

The power station also features an ALSTOM seawater flue gas desulphurisation (FGD) process plant which utilises the natural properties of seawater to absorb the sulphur dioxide from the flue gas.





## Layout

The Manjung power plant is located on a reclaimed island, about 10 km south of the nearest town Lumut, and approximately 288 km north of Kuala Lumpur.

The power blocks of the 3 units are identical. Their relative position in line allows the simultaneous construction of the 3 units.

Although compact, the design of the power block leaves sufficient equipment laydown space for the maintenance and main overhaul programme of the O & M contractors. The circulating water for the open cooling water circuit is taken from the sea.

The high voltage outgoing lines are connected to the 500 kV switchyard substation.



## Plant Description - Main Components

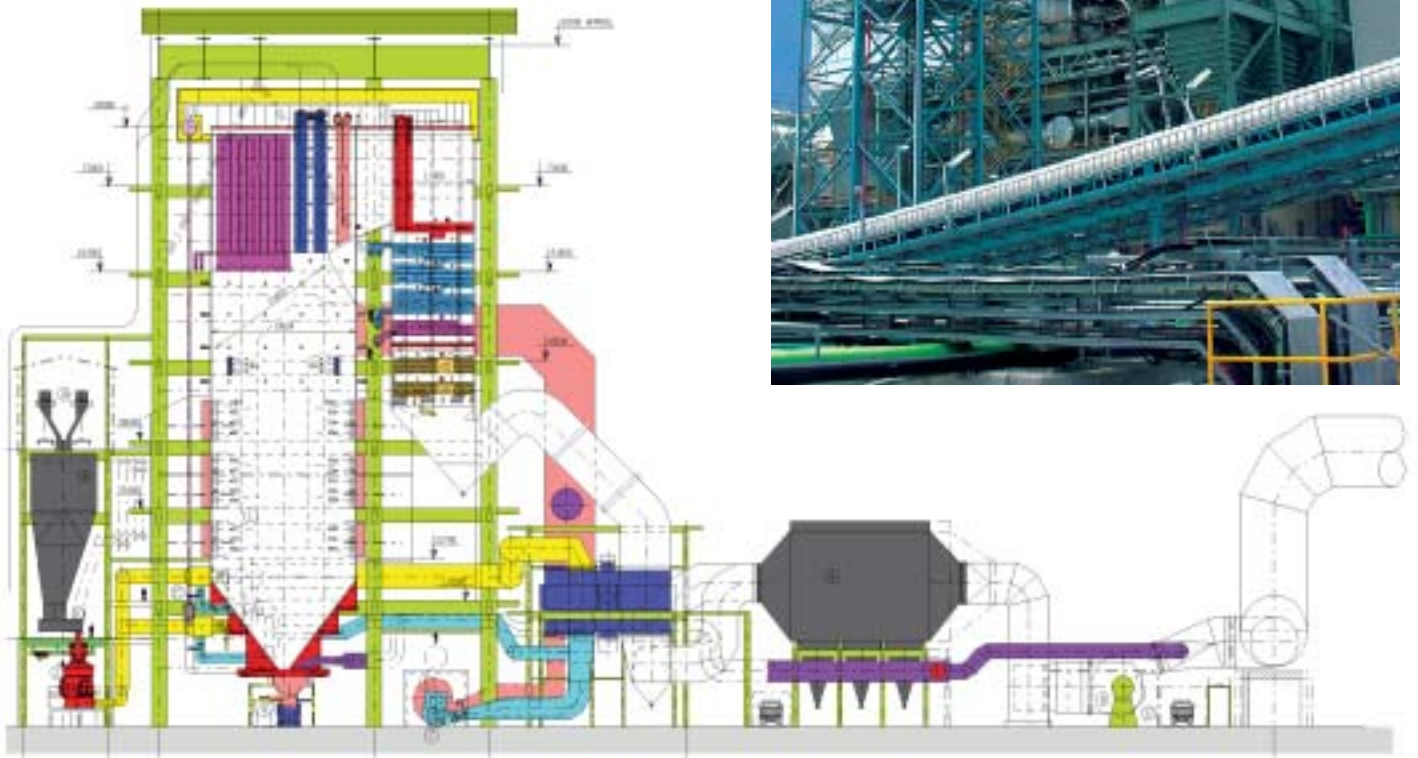
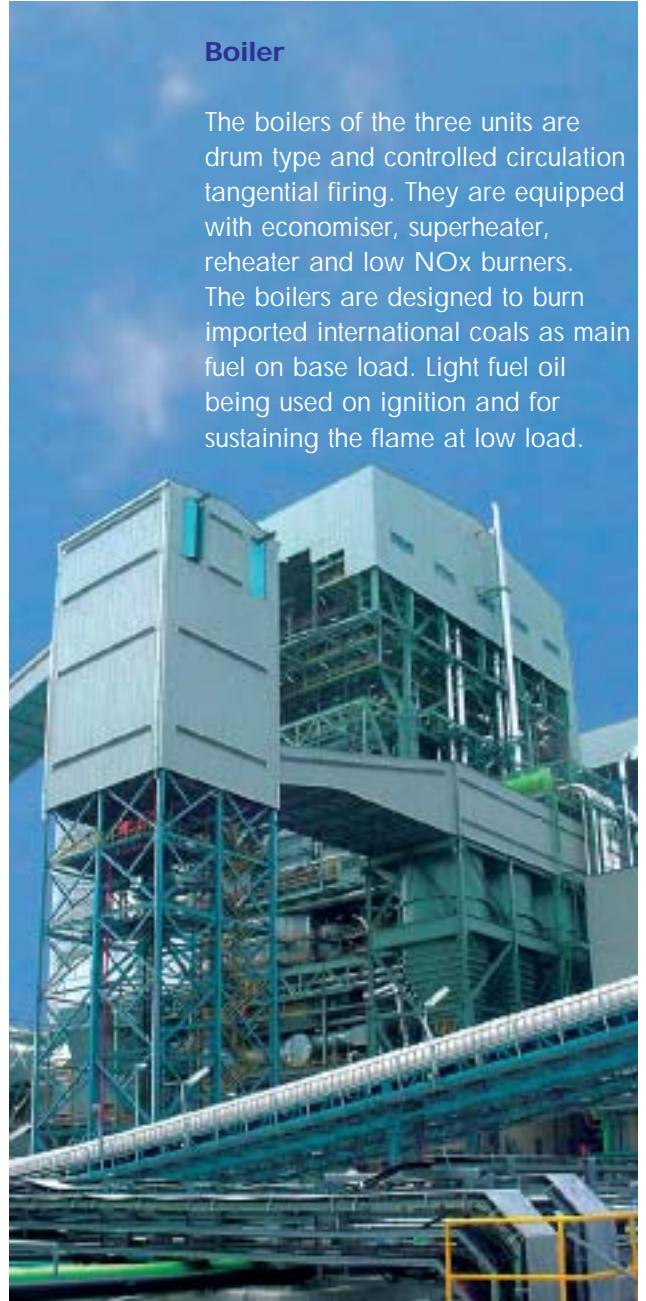


### Steam generator parameters

Life steam flow .....	2390 t/h
Life steam pressure .....	175 bars abs.
Life steam temperature .....	539°C
Feedwater temperature .....	277°C
Fuel .....	Coal
Ignition fuel .....	Light oil

### Boiler

The boilers of the three units are drum type and controlled circulation tangential firing. They are equipped with economiser, superheater, reheater and low NO<sub>x</sub> burners. The boilers are designed to burn imported international coals as main fuel on base load. Light fuel oil being used on ignition and for sustaining the flame at low load.



## Turbine

The turbine generator sets have a rated output corresponding to a nominal net power of 700 MW and have a rotating speed of 3000 rpm. The turbine is of axial flow design with all turbine and generator rotors directly coupled in tandem. The turbine consists of a high pressure (HP) turbine, an intermediate pressure (IP) turbine and two double flow low pressure (LP) turbines.

Standard proven turbine auxiliary systems are used wherever possible and the STG arrangement follows a simple, practical pre-engineered layout.

## Generator

The generator is a two-pole hydrogen and water cooled machine of the "Gigatop" type. The rotor winding and the stator core are hydrogen cooled.



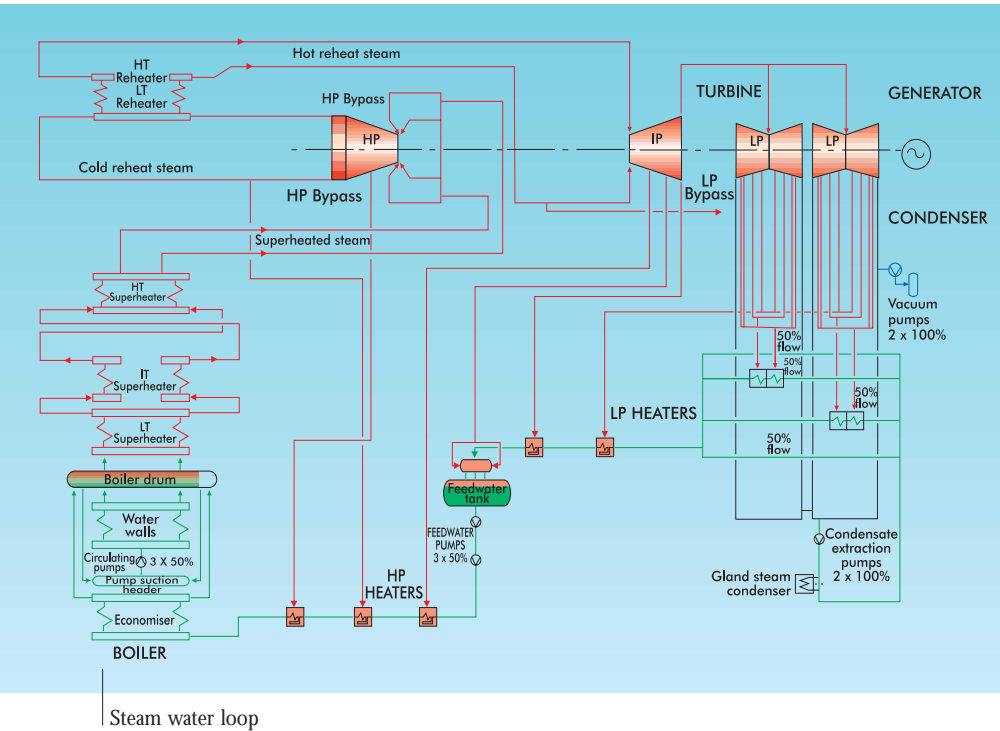
Steam parameters	
<b>at HP turbine throttle :</b>	
Pressure .....	175 bar
Temperature .....	540 °C
<b>at IP cylinder inlet :</b>	
Pressure .....	38 bar
Temperature .....	540 °C
<b>at LP cylinder inlet :</b>	
Pressure .....	3 bar
Temperature .....	240 °C

The stator winding and the terminals are directly water cooled. The machine is fitted with the seal oil, gas cooling and stator water cooling systems. Its excitation is provided by a static excitation connected to the slip ring unit.

Generator parameters	
Nominal rating .....	943 MVA
Power factor .....	0.85
Voltage .....	23 kV
Frequency .....	50 Hz
Short circuit ratio .....	0.51
Efficiency .....	98.9 %
H2 pressure .....	4 bar gauge
Excitation .....	Static



# Mechanical Equipment



## Circulating water pumps

The circulating water system takes cooling water from the sea to the three condensers by means of six 50% duty concrete volute type main cooling water pumps.

## Feedwater heating plant

The feedwater heating plant includes four LP heaters arranged in series, with LP1 & 2 located in the condenser neck, one feedwater tank equipped with a deaerator and three HP heaters. All the feedwater heating equipment is installed horizontally.

## Feedwater pumps

The feedwater pump system is composed of 3 x 50% feedwater motor-pump sets, each including :

- a booster pump,
- a main pump,
- a variable speed hydraulic coupling,
- a drive motor.

## Condensate extraction pumps

The condensate water is drawn from the condenser hotwell by two 100% motor-pump sets. Each pump is of the multistage, vertical type with barrel.

## Condenser

The condenser is of the single pass, surface type, comprising four titanium tube bundles. Each tube bundle has its own inlet and outlet water box such that the condenser can be considered as two half-condensers of two bundles in parallel. The condenser neck is connected to the LP turbine exhaust box by a suitable flexible bellow.



Condenser main characteristics	
Circulating water temperature .....	32 °C
Condenser pressure .....	85 mbar
Condensate extraction pumps	
Total manometric head .....	235 mWG
Flow rate .....	2042 m <sup>3</sup> /h
Speed .....	1480 rpm



HP heaters



## Electrical Distribution - Control and Instrumentation

### Electrical equipment

The electricity produced by the generator is transferred to the 500kV grid via a main three-phase core type transformer. Isolated phase busbars ensure the connection between the generator and the main transformer as well as the tap connection to the unit transformers.

In normal operation, the 11 kV network is supplied by the unit three-phase transformers from the generator 23 kV busbars.

Electricity is supplied to the unit auxiliaries at different AC voltages :

- High voltage (11 kV) to the main motors,
- Medium voltage (3.3 kV) to the medium motors,
- Low voltage (415 V) to the small motors,
- Low voltage (240V) to lighting and small power.

Four emergency diesel generators automatically supply the essential auxiliaries upon complete loss of AC voltage.

Each 220, 110 and 24 V DC system provides a secure power supply for the control and protection of the power plant.

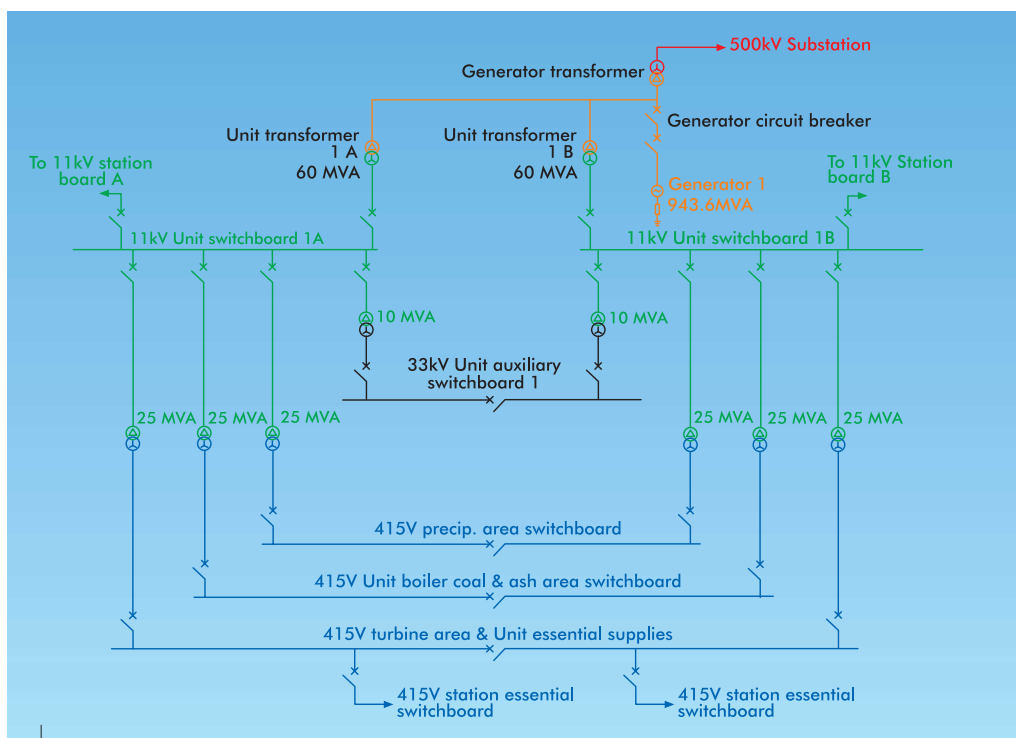
### Instrumentation and control

Three units share one common main control room. The unit control mode of the main systems (boiler, turbine, generator and feedwater plant) is centralised.

The centralised logic control equipment is using ABB control equipment. This is fully programmable electronic equipment.

The decentralised control equipment is operated using microprocessors and is of the programmable logic controller (PLC) type.

The analogue control system mainly includes a load controller for the boiler and feedwater plant, control and monitoring system for the turbine, excitation control system for the generator and an energy metering system.



Electrical single line diagram



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