Current state of plant

Functioning as a peak and emergency centre

Statistics

Accumulated operating hours:

D1-2-3-6-7: 43000 to 48000 hrs
D4-5: 53000 to 57000 hrs
D8: 33000 hrs

Layout of the plant

Index:

- Diesel building
- 75 meter chimneys
  Individual exhaust pro diesel
- Filter wells
- Cooling water supply
- Cooling water drainage
- Turbine building
- Separators building
- Tank park
- Pump building
- Water treatment
- Transformer cells
- Transformer building 36/150 kV

Facility's

Diesel building

Administrative wing

- Social section
- Technical section
- Administrative section

Machine Room

- Diesel groups (8 pieces)
- Foundation blocks
  Solid foundation blocks 180 m3
  Loose foundation blocks 240 m3
- Compressors
  compressed air – 25 bar: start air for diesel and steering force
- Compressed air tanks
- Crane (75 Ton / 5 Ton)

Technical wing

- Emergency services for diesels
- Recuperation boilers
- Silencers
- Tanks for fuel, lubrication, cooling water
- Degassifier
- Air filters
- Vacuum pumps

Turbine building

- Steam turbine
- Auxiliary Condenser

Seperator building

- Four fuel seperators
- Storage tanks of lubrication oil

Tank park

- Fuel supply by ship or tanker
- 4 tanks for extra heavy oil or palm oil (2.500 m3)
- 3 tanks for purified extra heavy oil (175 m3)
- 2 tanks for heating oil (300 m3)
- 1 sludge tank (80 m3)
- 1 waste water tank (40 m3)

Local water treatment

- Demineralisation installation
- Storage tanks demineralised water

Composition of the plant

Diesel groups

General

- 8 diesel groups
  Each group is autonomous
  7 diesel groups of 10 MW
  1 diesel group of 13 MW
- Layout in 2 blocks
  4 diesels a block
  1 booster transformer (13.8 / 36 kV) per block

Features of the diesels

Specifications diesels 1 – 7

- Constructor ACEC-MAN
- Type 14V 52/55
  14 cylinders – v shaped
  52 cm bore/ 55 cm stroke
- 1.000 HP pro cylinder
  total of 14.000 HP
- Weight of 150 tons

Specifications diesel 8

- Constructor ACEC-MAN
- 18 cylinders with a total power of 18.000 HP

Common specifications of the diesels

- 428 rpm
- Individuel injection pumps
- Fuel consumption for each diesel 2.200 kg/h at full load
  Normal operation on HFO (Heavy Fuel Oil)
  Working on MDO (Marien Diesel Oil) during start and stop
- Diesels equipped with turbos
  Revelations of turbo at full power are +- 10.000 rpm
  Combustion pressure at full load +- 2.5 bar
- Efficiency
  +- 40% Elektrical
  +- 37% Fleu gas
  +- 23% Cooling water

Safeguards diesels

Shut-down of diesel can be caust by the following safety messures

- Excesive speed
- Lubrication oil pressure to low
- Cylinder Cooling water temperature is too high
- Cylinder Cooling water temperature is too low
- Injection cooling water pressure too low
- Oil mist detection
- Electrical safety alternator
- No 110 V DC – Driving circuit
- No 220 V AC – Control circuit

Controls of diesel engines

- Temperature control lubrication oil
- Temperature control cylinder cooling water
- Temperature control combustion air
- Temperature control lubrication oil prior to separator
- Viscosity control of fuel
- Level control recuperation boiler
- Flow control “Woodward” on diesel engine
- Load control diesel engine

Alternators

- Constructor ACEC-Charleroi
- Power 14.300 kVA (Before Diesel 1 – 7)
- Power 18.300 kVA (Before Diesel 8)
- Voltage 13,800 V
- 428 rpm
- Generation dynamo with external excitation 110 V DC

Safeguards alternators

- Surge protection
- Overcurrent protection
- Differential protection
- Backflow protection
- Ground protection stator
- Ground protection rotor
- Excitation control

Control of alternators

- Voltage control
- Cos φ control

Secondary equipment diesels

Electrically powered secondary equipment

- Lubricating oil pump (110 kW)
- Lubrication Oil Filter
- Internal cooling pump (85 kW/ 600 m3/h)
- Internal cooling water filter
- Cylinder cooling water pump (37kW)
- Cylinder water injection pump
- Fuel pump
- Viscosity meter
- Leakage tank fuel
- Pump daily tank filling
- Lubrication oil separator
- Feed pump lubrication oil separator
- Feeding pump recuperation boiler
- Circulation pump recuperation boiler (out of service)
- Air filter
- Cooling ventilator generator
- Ventilators

Heat exchangers

- Lubrication oil cooler
- Cylinder cooling water cooler
- Heat exchanger cooling water injection
- Turbo coolers
- Heat exchangers alternator cooling
- Fuel heater
- Oil heater
- Cylinder cooling water heater

Reservoirs

- Carter lubrication oil tank (10.000 l)
- Cylinder lubrication oil tank
- Re-greasing tank
- HFO or Palm oil day tank (5.000l)
- Mixing tank fuel
- Leaking tank lubrication oil
- Leaking tank fuel
- Sludge tank lubrication oil separator
- Expansion tank cylinder cooling water
- Expansion tank injection cooling water

Recuperation tanks

Heat recuperation of exhaust gasses for the production of steam

Characteristics

- Exhaust gas temperature before recuperation boiler ± 360 °C
- Exhaust gas temperature after recuperation boiler ± 120 °C
- Produced steam 7 bar - 250 °C - 5 Ton/h

Composition
Water tube boiler

- Evaporator
- Super heater
- Steam drum

Steam turbine – Auxiliary condenser

Steam turbine
Constructor ACEC Gent

Condensation steam turbine 4 MW	8.000 RPM
Drive of asynchronous generator	1.500 RPM
Condenser under vacuum	(30 mbar)

Efficiency of the plant with steam turbine

- Electric energy diesel groups	+- 40 %
- Cooling water loss diesel groups	+- 23 %
- Remaining losses diesel exhaust after heat recuperation	+- 23 %
- Electricity production with steam turbine	+- 4 %
- Cooling water loss turbine groups	+- 10 %
Net electric efficiency plant	**+- 44 %**

Secondary equipment steam turbine

- Internal cooling pump
  DC motor with adjustable speed (125 m3/h)
- Siphon pump
- Taprogge pump
- Vacuum pumps (2 pcs)
- Condensate extraction pumps (2 pcs)
- AC lubrication oil pump
- DC auxiliary oil pump
- Slip motor

Safeguards steam turbine
Shut down steam turbine can happen because of the following precautions

- Too much speed
- Pressure to high in condenser (low vacuum)
- Bearing temperature too high
- Lubrication oil pressure too loo
- Air to cool down the generator is too hot
- Electrical safety generator
- No 110 V DC – Driving circuit
- No 380 V AC – Control circuit

Controls steam turbine

- Speed control " Woodward"
- Steam pressure control "Askania"
- Level control condenser

Asynchronous generator turbine
Constructor ACEC Charleroi
Power 14.300 kVA
Voltage 13.800 V
Speed 1500 rpm

Safeguards Asynchronous generator turbine
- Minimum voltage protection
- Surge protection
- Overcurrent protection
- Differential protection
- Backflow protection
- Ground protection
- Overload protection

Auxiliary condenser
To condense steam when the steam turbine does not function properly
Switched on automatically when the steam pressure gets too high.
Automatic pressure control

Secondary equipment help condenser
- Internal cooling water pump
- Condensate extraction pump

General secondary equipment

Diesel engine
Diesel engine 650 kVA
- Necessary for “blackstart” of the plant
- Possible for parallel functioning on LS net

Boiler “Elboma”
Fire tube boiler 7 bar / 5 ton
- Rotating burner functioning on MDO or palm oil
- Works at lower pressure then recuperation boilers
- Steam production at shut down of the plant
  Heating of buildings (winter)
  Heating fuel
  Heating of oil for the diesels
  Heating of the cylinder cooling water for the diesels

Steam circuit
2 steam collectors
- Steam supply by boiler “Elboma” or recuperation boilers
  Steam pressure 7 bar / 250 degrees
- Supply water for boilers comes from de gassifier
- Condensate collected in 3 condensation tanks
  Diesel building
  Separator building
  Turbine building

Fuel deposit and treatment

Supply of fuel by ship or truck

- Supplied fuel stored in 4 tanks
- Cleaning of the fuel by means of 4 fuel separators
  Removal of impurities and water
- Cleaned fuel stored in 3 tanks
- Fuel waste (sludge) stored in sludge tank
- Electric tracing for heating of the fuel lines

Cooling water system

Cooling water for cooling of the diesel groups and the condenser steam turbine

- Dual supply channel
- Double filter in stallion consisting of a coarse filter and a fine filter
- Level measurement at the supply channel
- Dual outlet channel
- Temperature and oxygen measurement at inlet and outlet

Vacuum installation

Necessary for suckson at the internal water pumps

- 3 vacuum pumps
- Switched on 2 vacuum collectors

Compressed air circuit

Compressed air for diesels

- 3 compressors “Hatlapa” for 25 bar
  Starting air for diesels
  Steering air for control
- Double compressed air collector in diesel building

Compressed air tools

- 1 compressor for 7 bar
- Entire compressed air system for the plant (7 bar)

Water treatment

Treatment of the water for the steam boilers

- De-ironing installation
- Reversed osmosis
- Demineralisation

Waste water

Treatment of industrial waste water so in will be suitable for discharge

- Rainwater from tank park, discharge location of trucks and transformer cells discharged through oil separator.
- Drainage water of boilers, concentrate of reversed osmoses and regeneration water of the demineralisation installation will be discharged by a neutralisation installation.

Wastewater from oil separators diesel building and separation building will be removed

Electrical installations

High voltage

Switchboard 13.8 kV

- Double rail system
- Switching cell alternators
- Switching cell for transformers 13.8 kV / 36 kV (Connection with HS board 36 kV)
- Switching cells for transformer 13.8 kV / 380 V (Low voltage for plant)
- Connection cells between both rail systems
- Longitudinal separation between the 2 blocks
- Ground security switch board 13.8 kV

Transformers

- Transformers 70 MVA – 36/13.8 kV (transformer 3 & 4)
  Connection between HS board 13.8 kV and HS board 36 kV
- Transformers 2.200 kVA – 13.8 kV/380 V (transformer 1 & 2)
  Low-voltage for the plant
  (Transformer 1 for feeding block I)
  (Transformer 2 for feeding block II)

Low voltage

Low voltage boards 380/220 V AC

- Net system IT net
- General low voltage boards
  Block I & Block II
- Low voltage distribution boards
- Lighting boards

Low voltage boards 110 V DC

- General LS boards 110 V DC
- Emergency lighting

Control boards

- Control boards for diesels and turbine
- Control boards for general installations

Dispatching
Monitoring and control centre

Control console diesels

- Separate panel per group
  Measurement of speed, voltage, current and temperatures
  Control of main switch, automatic control
  Alarm diesels
- Central control panel
- Synoptic board low voltage
  Alarms high voltage board 13.8 kV, low voltage boards
  Measurement of load, Cos φ
  Control load management, Cos φ control

Control board turbine

- Control panel turbine
  measurement of revolution speed, load, steam pressure
  Control of main switch, speed control and pressure control
  Alarms
- Control board general services
  Control of lighting
  Distribution of 110 V DC and 220 V AC dispatch
  Alarms
- Control board steam
  Measuring steam pressure
  Control secondary condenser
  Alarms
- Control board fuel
  Alarms

Control board automatic control

- Distribution of power circuits 110 V DC and 220 V AC diesels
- Controls speed, load, Cos φ
- Control board synchronisation
- PLC for remote monitoring central

Desk dispatching

- Remote control Scadacec for central and cogeneration
- Telephone installation
- Cameras
- Access control

Activities

- Control of pre heating diesels
- Starting auxiliary diesels
- Starting general secondary machinery
- Starting secondary machinery turbine and auxiliary condenser
- Synchronisation of groups
- Load regulations of the groups
- Monitoring alarms from central