Combined Heat and Power Plant - 53 MW

Gas turbine

Make	General Electric
Type	LM6000 PB DLE
Serial number	190-204
Capacity	40 MW

Generator

Make	Brush
Type	Synchronous
Speed	3000 rpm
Voltage	10,5 kV
Capacity	63,5 MVA

Steam turbine

Make	Siemens
Type	Extraction condensing turbine
Speed	7135 rpm
Capacity	12,3 MW
Extraction pressure 1	13 barg
Extraction temp 1	210°C
Extraction pressure 2	3 barg
Extraction temp 2	160°C

Gearbox gasturbine

Make	Maag
Speed in	3611 rpm
Speed out	3000 rpm
Capacity max	52,2 MW

Gearbox steamturbine

Make	Flender -Graffenstaden
Speed in	7135 rpm
Speed out	3000 rpm
Capacity max	13 MW

HRSG

Make	Schelde Breda Boilers
Type	Vertical, two pressure HRSG, forced circulation.
Additional firing	No

HP

Pressure	62 bar
Temperature	433°C
Capacity	42,8 Ton/h

LP

Pressure	4 bar
Temperature	172°C
Capacity	16,7 Ton/h

Stack temperature is 112°C.

Condenser

Make	GEA
Type	Dry air cooled condenser
Nr of rows	2
Nr of fans per row	3
Pressure	0.1 bara
Temperature	46°C
Capacity	39,5 MW
Own use (max)	180 kW

Air ejectors condenser

First vacuum in the condenser is made with a hogging ejector. For maintaining the vacuum an (redundant) ejector set is used.

Lubricating oil system gasturbine

The lubricating oil system of the gasturbine is for the gasturbine only.

Hydraulic starter unit gasturbine

The gasturbine is equipped with a hydraulic starter.

Lubricating oil system generator and gearbox gasturbine

The generator and the gearbox of the gasturbine have their own lubrication oil system.

Lubricating oil system steamturbine and gearbox

The steamturbine and the gearbox of the steamturbine have their own lubrication oil system.

HP Feedwaterpumps

The boiler is equipped with separate HP and LP feedwater pumps (redundant pumps).

HP feedwater pump (2x)

Make	Sulzer
Type	MC 50-220/12
Temperature	65°C

Pressure	73,5 bar
Capacity	52 m^3/h
Power	153,3 kW

LP Feedwaterpumps
The boiler is equipped with separate HP and LP feedwater pumps (redundant pumps).

LP feedwater pump (2x)

Make	Sulzer
Type	MB 50-180/5
Temperature	105°C
Pressure	18,6 bar
Capacity	68,9 m^3/h
Power	44 kW

Feedwatertank
The feedwatertank has also the function of de-aerator.

Make	Stork
Working pressure	1.2 bar
Working temperature	105°C
Gross capacity	39 m^3
Net capacity	29 m^3
Diameter	2.5 m
Length	7.8 m

HP circulating pumps
For the HRSG two HP circulating pumps are installed.
HP circulating pump (2x)

Make	Sulzer
Type	ZF 200-4315
Temperature	279°C
Pressure	65,4 bar
Capacity	257,4 m^3/h
Power	14,7 kW

LP circulating pumps
For the HRSG two LP circulating pumps are installed.

LP circulating pump (2x)

Make	Sulzer
Type	ZA 150-2250
Temperature	150°C
Pressure	7,7 bar

Capacity	128,2 m^3/h
Power	7 kW

Atmospheric drain system
The boiler and steam piping are equipped with an atmospheric drain system. The steam of this system is used to heat the feedwatertank. The water is drained to the sewer.

Vacuum drain system
The steamturbine is equipped with a vacuum drain system. The water from this system is pumped to the feedwatertank.

Condensate pumps
In the installation two condensate pumps are installed.

Condensate pumps (2x)

Make	KSB
Type	C65-250 C7
Pressure	7 bar
Capacity	80 m^3/h
Power	30 kW

Closed cooling water system
The internal cooling water system is a demi water/glycol filled system to cool all parts of the installation which are in need for cooling (generator, lub oil, water quality).

The system contains:
- Air cooled cooling water coolers
- Circulating pumps
- Expansion tanks

Air cooled cooling water coolers

Make	GEA
Type	Air cooled cooler
Nr of fans	2
Pressure	6 bar
Own use (max)	50 kW

Cooling water circulating pumps
To circulate the water through the cooling water system two identical circulation pumps are mounted.

Cooling water circulating pump (2x)

Make	KSB
Type	CPK-Sm 150-315
Pressure	4,2 bar

Capacity	360 m³/h
Power	31,3 kW

Air compressors and air dryer
The compressed air station consists of:

- Working air compressor and air dryer
- Instrument air compressor and air dryer
- Air storage tanks
- Instrument air dryer

Air compressor (2x)

Make	Atlas Copco
Type	ZR90
Pressure	7,5 bar
Capacity	216 l/s

Adsorption dryer (2x)

Make	Atlas Copco
Type	MD200
Capacity	227 l/s

Instrument air after dryer

Make	Atlas Copco
Type	CD110
Capacity	108 l/s

Chemical monitoring
To measure and to maintain the water- and steam quality a quality monitoring station is installed.
The quality measurements of the scope are in scope, rest is out of scope.

DCS
The overall automation system for the installation (excluding the gasturbines) is Siemens T2000.

Electronics gasturbine
The automation of the gasturbine is the Woodward NetCon C. This automation accommodates all criteria for the gasturbine, such as: start- and stop curves, controls, alarms and trips.

Electronics steamturbine
The automation of the steamturbine is the Siemens Symadyn D. This automation accommodates all criteria for the steamturbine, such as: start- and stop curves, controls, alarms and trips.

Electronics generator
The generator panel accommodates all criteria for the generator, such as:
synchronising, trips, load curves, controls, alarms and trips.

Own use transformers
For own use two transformers are installed, one 10 kV – 400 V transformer, and one 10 kV – 690V transformer. Both transformers are of the "dry" type.

MCC's
All 400V and 690 V E-motors are switched from a central Motor Control Centre, located in the electrical room.

110V= emergency installation
In case of emergency (loss of grid) the lubricating oil pumps, emergency lighting etc. will be fed by batteries.
Two sets of 110V batteries are installed, of which one (BTA) is in scope. Also two battery chargers are installed, of which one (BTM10) is in scope.

24V= emergency installation
In case of emergency (loss of grid) the automation and DCS will be fed by 24V= batteries.
Two sets of 24V batteries are installed, of which one (BTD) is in scope. Also two battery chargers are installed, of which one (BTN10) is in scope.

Gascompressor
In case the natural gas pressure is too low to drive the gasturbine at full load, a gascompressor is installed. The gascompressors is accommodated in a separate station.

Gascompressor

Make	NEA
Type	1 TV 50
Pressure	45 bar
Capacity	265 m^3/h

Fire detection
The fire detection system is Siemens and comprises the whole installation. The fire detection operates the various fire extinguishing systems.