Power Train Siemens design based 440 MW - 50 Hz dual fuel (gas/oil) fired

Unused, orginally packed, OEM warranty/guaranty available

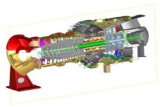
LOHRMANN GROUP

LOHRMANN INTERNATIONAL POWER PLANT DIVISION

- CCGT-440 MW main technical features
- Technical descriptions:
  - GT description
  - HRSG description
  - ST description

CCGT- 440 MW Main technical features

- Exclusive offer of brand new base load power train CCGT - 440 MW
- Manufacturing of all main components **completed in 2013**
- All components stored under conservation and ready for timely shipment
- Heat Balance Diagram composed as block type unit: one GT + one HRSG + ST



GAS TURBINE	
ANSALDO	**291** MW Gas Turbine, single shaft, cold end drive, annular combustor, heavy duty

STEAM TURBINE	
ANSALDO	**167** MW Steam Turbinethree cylinder type

HRSG	
NOOTER ERICKSSEN	HRSG horizontal flow type, equipped with natural gas post-firing

- Direct contracts with power train manufacturers
- Equipment with basic design approval
- The system can potentially work for district heating

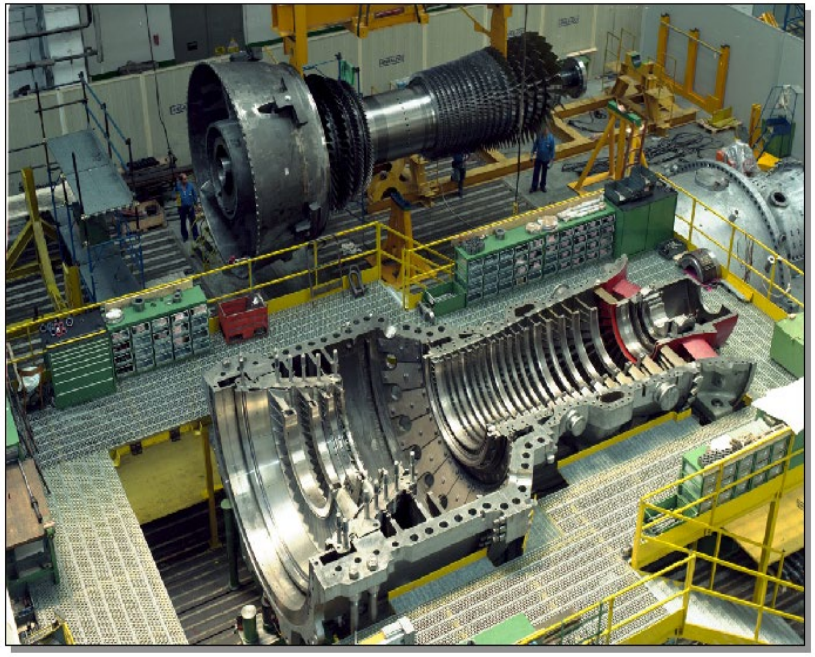
CCGT-440 MW Main technical features

GT set includes:

- Electrical generator
- Static starter (SFC)
- Excitation system

Operation mode:

- Heat balance diagram allows to start operation depending on unit thermal condition:
  - **Cold startup** (after 36 hours outage) – less than 100 times during total operation life
  - **Warm startup** (less than 36 hours of outage) – less than 1900 times during total operation life
  - **Hot startup** (within 1-8 hours of outage) – less than 8000 times during total operation life)
- Main fuel : gas; reserve fuel: diesel
- Isolated operation of GT is not envisaged
- The CCGT operates on variable pressures' mode



AE94.3A final assembly area

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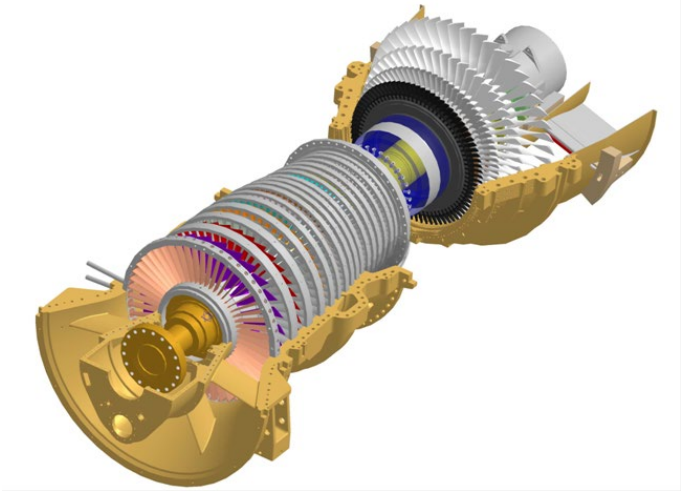
Technical description: Gas Turbine AE94.3A4

Single shaft GT comprising :



- 15 stage compressor
- 4 turbine stages
- Single shaft rotor with central tie rod
- 2 bearings
- Axial discharge
- Generator driven at compressor side
- Hydraulic Clearance Optimization system
- Annular type combustion chamber lined with individual and replaceable ceramic tiles
- 24 hybrid burner for fuel gas and fuel oil
- Variable Inlet Guide Vanes
- All vanes and blades replaceable with rotor in place

The GT shall be with dual fuel burners: dry low NOx burners for natural gas operation and water injected for low NOx emission during light oil operation

GAS TURBINE AUXILIARIES

- Fuel Gas System
- Lubrication oil system with lube oil tank
- fuel gas flow metering for performance test only;
- Advanced Compressor Cleaning System (ACCS);
- set of tools for initial assembly and inspection;
- set of major inspection tools and a set of standard tools
- Air intake system
- Exhaust gas system
- Noise enclosure complete with relevant ventilation system and fittings
- CO2-firefighting system
- Control system
- Fuel gas system

GENERATOR

- 350 MVA
- 50 HZ
- 17,5 KV
- PF 85%
- Water-Cooling

ELECTRIC SYSTEM

- Thermo-coupling
- Temperature control
- Current transformer
- AD-LV Switch
- DC Switch
- Battery
- Battery Converter

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Technical description: HRSG

- HRSG – horizontal three-flow HRGS manufactured by “Nooter Eriksen”.
- HRGS: with horizontal profile, drum-type, three pressures mode (HP, IP, LP) with natural circulation at steam generating circuit with intermediate reheating.
- Discharge of wasted gas is through dedicated chimney.

Ambient tº	**ºC**	**- 47**	**+ 1,2**	**+ 15**
Relative GT load factor	**%**	**100**	**100**	**100**
Exhaust Gas Temperature after GT	°C	536	557	572
Exhaust Gas Flow Rate after GT	kg/s	713	717	675
Natural gas (NG) consumption for re-combustion at HRSG	m^3 /h	9120,56	7233,55	7233,55
NG net heating value	kJ/kg	48675,89	48675,89	48675,89
Exhaust gas tº at HRSG inlet section (after re-combustion)	ºC	633,3	632,9	652
Exhaust gas flow rate at HRST inlet section (after re-combustion)	kg/s	714,74	718,38	676,38-
High Pressure Loop				
Steam pressure after HP re-heating	MPa	13,43	13,49	13,40
Steam tº after HP re-heating	ºC	578,6	578,6	578,6
Steam flow rate after HP re-heating	t/h	323,787	325,408	323,184
Intermediate pressure loop				
Steam pressure after IP re-heating	MPa	3,410	3,430	3,400
Steam tº after IP re-heating	ºC	338,2,2	338,8	338,9
Steam flow rate after IP re-heating	t/h	47,628	47,484	43,992

Technical description: HRSG

Low pressure loop				
Steam pressure after LP re-heating	MPa	0,518	0,506	0,499
Steam tº after LP re-heating	ºC	275,2	268,7	267,3
Steam flow rate after LP re-heating	t/h	47, 652	47,484	45,768
Reheating loop (Cool Re-heating)				
Steam Pressure at HRSG re-heating section inlet	MPa	3,41	3,43	3,40
Steam tº at HRSG re-heating section inlet	ºC	381,7	381,5	381,4
Steam flow rate at re-heating section inlet	t/h	317,484	319,104	316,908
Reheating loop (Hot Re-heating)				
Steam Pressure at HRSG re-heating section outlet	MPa	3,28	3,30	3,27
Steam tº at HRSG re-heating section outlet	ºC	575,6	575,4	580,0
Steam flow rate at re-heating section outlet	t/h	365,136	366,588	362,676
Exhaust gas tº at HRSG chimney inlet	ºC	90,8	91,9	91,7
Steam pressure after IP re-heating	MPa	3,410	3,430	3,400
Steam tº after IP re-heating	ºC	338,2,2	338,8	338,9
Steam flow rate after IP re-heating	t/h	47,628	47,484	43,992

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Technical description: Steam Turbine AE RT20-33

Steam Turbine AE RT20-33 is n°1 tandem-compound reheat steam turbine and consists of a high pressure (HP) section, an intermediate pressure (IP) section and a low pressure (LP) section, double flows type, with vertical downward exhaust.

The steam turbine has one connection for district heating purpose that operates as controlled extraction in district heating mode by means of a butterfly valve, hydraulically operated, installed in the cross over pipe.

The main components of the steam turbine are:

- Turbine outer and inner casings of HP, IP and LP sections
- Reaction type blading
- Precision forged last stage blades
- HP, IP and LP rotor
- Integral expansion sleeve coupling

Total life cycle – 25 years with replacement (renovation) of spare parts and components,
Heatproof elements life cycle = 200 k hours.