

SEC COMBINED CYCLE PRODUCTS

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ABOUT US

Shanghai Electric (SEC) is a large integrated equipment manufacturing enterprise specialized in energy equipment, industrial equipment and integration services. As the core business of Shanghai Electric Group, a large comprehensive equipment manufacturer, Shanghai Electric Power Generation Group (SECPG) specializes in power generation equipment manufacturing, power plant engineering and services.

Gas turbine industry joins the market through the integrated management platform of SECPG. SECPG unifies the management activities related to Gas turbine industry including equipment supply, engineering contracting and after-sale services. This integrated management platform provides the market with one-stop customer experience, from market tracking, project bidding, project management to after-sale service. SECPG unifies all of its subordinate equipment manufacturers, with internal collaboration, unified coordination and integrated advantages, providing the market with the most optimized solution of Combined Cycle Power Plants.



CATALOG

Combined Cycle Typical Configuration

03

Gas Turbine

05

AE94.3A (F Class)

AE94.2 (E Class)

AE64.3A (f Class)

AE94.2KS (E Class)

Steam Turbine

12

— Apply to F Class Gas Turbine

— Apply to E Class Gas Turbine

— Apply to f Class Gas Turbine

Generator

17

— Apply to F Class Gas Turbine

— Apply to E Class Gas Turbine

— Apply to f Class Gas Turbine

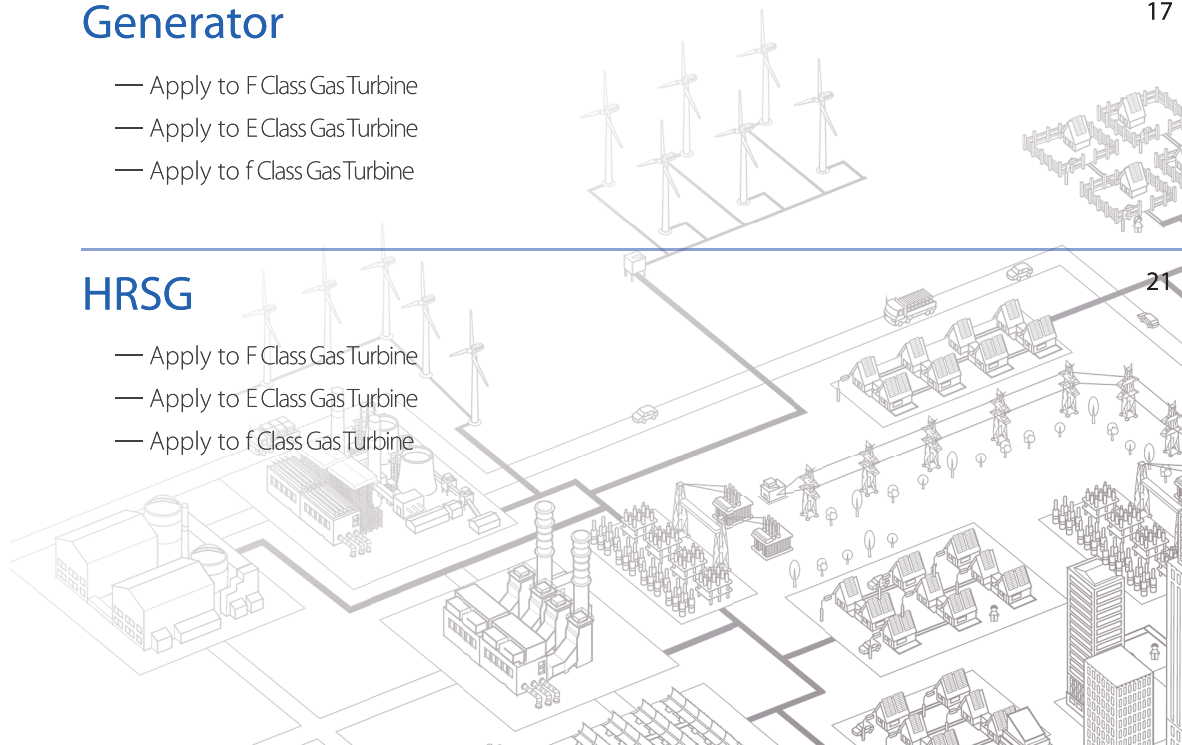
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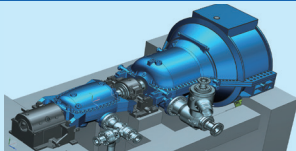
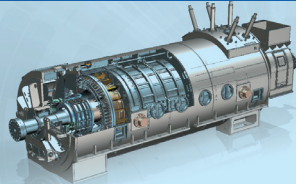
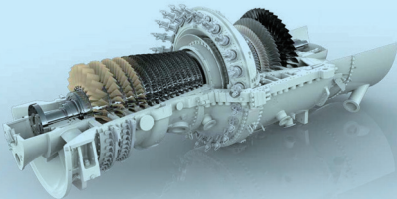
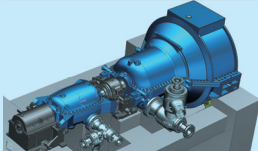
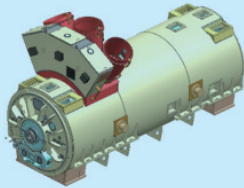
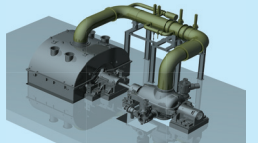
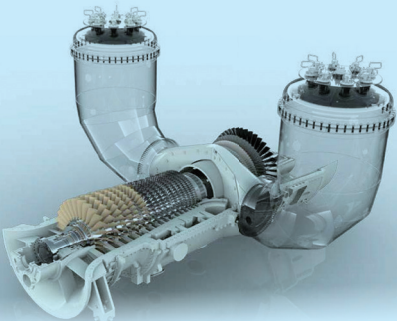
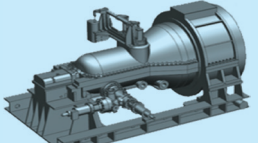
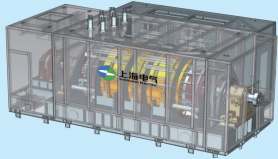
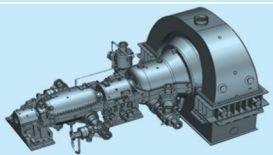

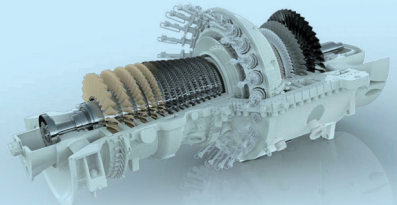
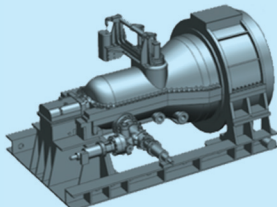
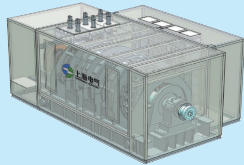

— Apply to F Class Gas Turbine

— Apply to E Class Gas Turbine

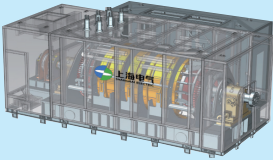
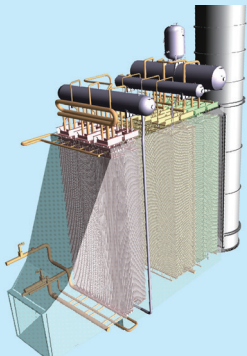
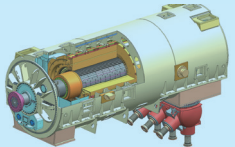
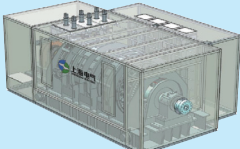
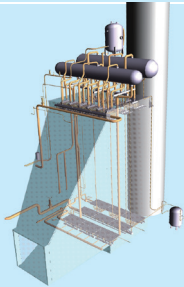
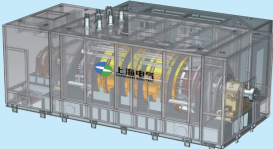
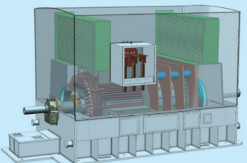
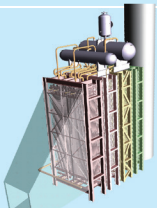
— Apply to f Class Gas Turbine



Combined Cycle Typical Configuration

Configure	GT	ST	GT Generator
AE94.3A F Class 1 on 1 Single-shaft		 HS+ILA Dual-casing Module	
AE94.3A F Class 1 on 1 Multi-shaft	 AE94.3A	 HS+ILA Dual-casing Module	
AE94.3A F Class 2 on 1 Multi-shaft		 HI+LD Dual-casing Module	
AE94.2 E-Class 1 on 1 Multi-shaft	 AE94.2	 IL/HIL Single-casing Module	
AE94.2 E-Class 2 on 1 Multi-shaft		 IS+LD Dual-casing Module	
AE64.3A f-Class 1 on 1 Multi-shaft	 AE64.3A	 IL/HIL Single-casing Module	
AE64.3A f-Class 2 on 1 Multi-shaft			

PS. All data followed are provided by ISO-ambient condition and taking no account of exhaust dust loss.
Different back pressure will lead to different CCPP output and efficiency.

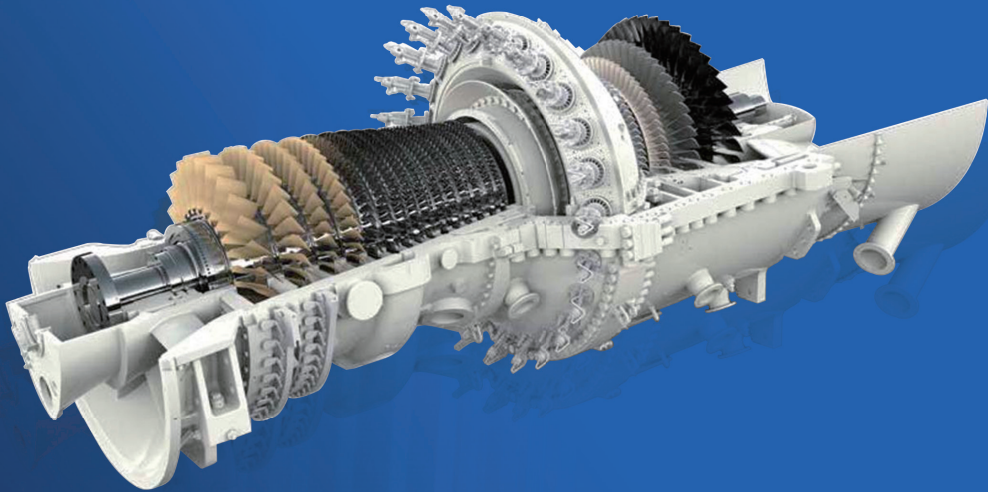
ST Generator	HRSG	CCPP Output & Efficiency	Extraction Capacity
500MW Class Hydrogen & Water Inner Cooled Generator (Top Lead)		≥ 483 MW $>59.7\%$	(Industrial): $<3.0\text{MPa}, \geq 250\text{t/h}$
 150MW Air Cooled Generator		≥ 483 MW $>59.7\%$	(Industrial): $<3.0\text{MPa}, \geq 250\text{t/h}$ (District): $\geq 300\text{t/h}$ (NC) $\geq 400\text{t/h}$ (NCB)
 300MW Class Generator	284.3(63.8)(53.9)/13.57(3.43)(0.46) Triple Pressure, Horizontal Gas Path, Natural Circulation	≥ 966 MW $>59.7\%$	(Industrial): $<3.0\text{MPa}, \geq 500\text{t/h}$ (District): $\geq 650\text{t/h}$ (NC) $\geq 800\text{t/h}$ (NCB)
 100MW Air Cooled Generator		~ 270 MW $>53.1\%$	(Industrial): $<4.0\text{MPa}, \geq 200\text{t/h}$ (District): $\geq 200\text{t/h}$ (NC) $\geq 300\text{t/h}$ (NCB)
 200MW Air Cooled Generator	245.1(62.2)/8.40 (0.61) Double Pressure, Horizontal Gas Path, Natural Circulation	~ 541 MW $>53.2\%$	(Industrial): $<4.0\text{MPa}, \geq 450\text{t/h}$ (District): $\geq 450\text{t/h}$ (NC) $\geq 600\text{t/h}$ (NCB)
 40MW~80MW Air Cooled Generator	 106.1(17.6)/7.34(0.68) Double Pressure, Horizontal Gas Path, Natural Circulation	~ 117 MW $>54.7\%$	$\sim 80\text{t/h}$ or according to Clients' Requirements
		~ 234 MW $>54.7\%$	$\sim 150\text{t/h}$ or according to Clients' Requirements

Gaoyao CCGP Project

- 2×400MW (F class), Gas Turbine, Steam Turbine, Generator, Condenser, HRST
- Order signed in June, 2012



AE94.3A (F Class) Gas Turbine



The AE94.3A achieves features as follow:

- High Efficiency
- Startup fast
- Operational Flexible
- Cost effective
- Environmental sustainable
- Smart maintenance approach

Performance Parameter

Gas Turbine Power Output	≥325 MW
Gas Turbine Efficiency	≥40.1%
Compressor Pressure Ratio	20
NOx Emission	≤50 **mg/Nm ³
Fuel Gas Consumption	24.3 Nm ³ /s
Turbine Exhaust Temperature	589°C
Exhaust Gas Mass Flow	750kg/s
Size	10.8m×5.1m×4.9m
Weight	316t

*ISO-Ambient condition without inlet and exhaust pressure losses.

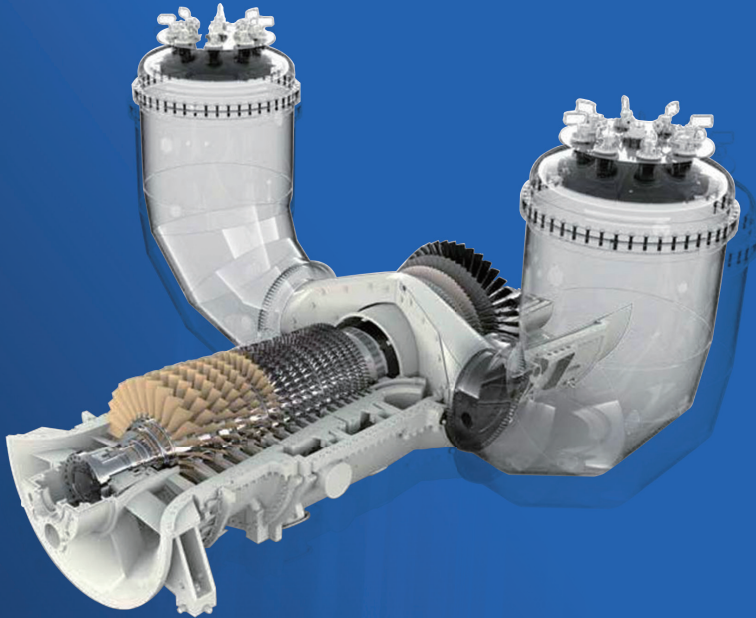
** 30mg/Nm³ Option available

Hai Dian North CCGP Project

- 1×200MW (E class), Gas Turbine, Steam Turbine, Generator, Condenser
- Order signed in Dec., 2011



AE94.2 (E Class) Gas Turbine



The AE94.2 achieves features as follow:

- High Efficiency
- Startup fast
- Operational Flexible
- Environmental sustainable
- Smart maintenance approach

Performance Parameter

Gas Turbine Power Output	~185 MW
Gas Turbine Efficiency	≥36.2%
Compressor Pressure Ratio	12
NOx Emission	≤50 **mg/Nm ³
Fuel Gas Consumption	15.3 Nm ³ /s
Turbine Exhaust Temperature	541°C
Exhaust Gas Mass Flow	555kg/s
Size	9.6m×4.0m×4.0m
Weight	186t

*ISO-Ambient condition without inlet and exhaust pressure losses.

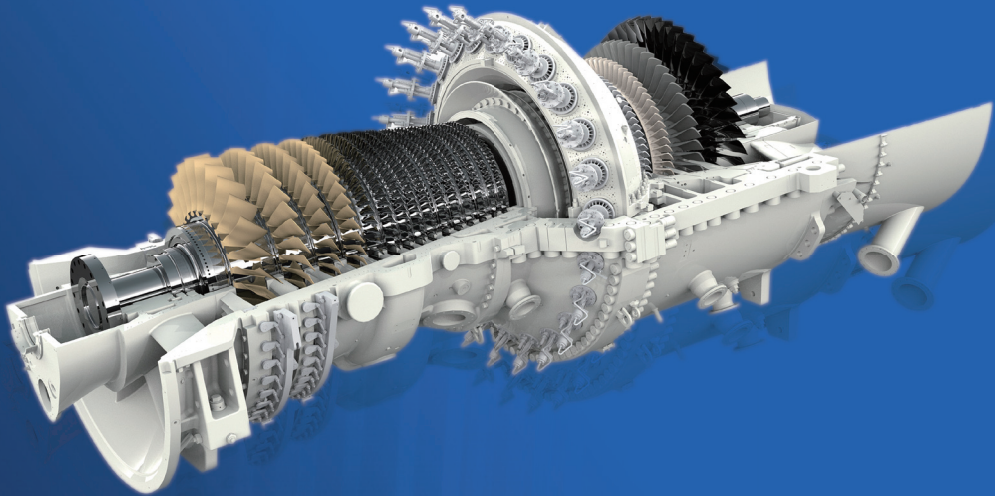
** 30mg/Nm³ Option available.

Huadian Jiangmen

- 2x100MW (f Class), Gas Turbine, Generator
- Order signed in April., 2014



AE64.3A (f Class) Gas Turbine



The AE64.3A achieves features as follow:

- High Efficiency
- Operational Flexible
- Environmental sustainable
- Smart maintenance approach

Performance Parameter

Gas Turbine Power Output	~78 MW
Gas Turbine Efficiency	≥36.5%
Compressor Pressure Ratio	18.2
NOx Emission	≤50 **mg/Nm ³
Fuel Gas Consumption	6.4 Nm ³ /s
Turbine Exhaust Temperature	573°C
Exhaust Gas Mass Flow	215kg/s
Size	5.9m×3.1m×3.1m
Weight	60t

*ISO-Ambient condition without inlet and exhaust pressure losses.

** 30mg/Nm³ Option available.

ISAB Energy Priolo

- 2x162MW / 516MW
- November, 1998
- August, 1999

Elettra GLT Servola

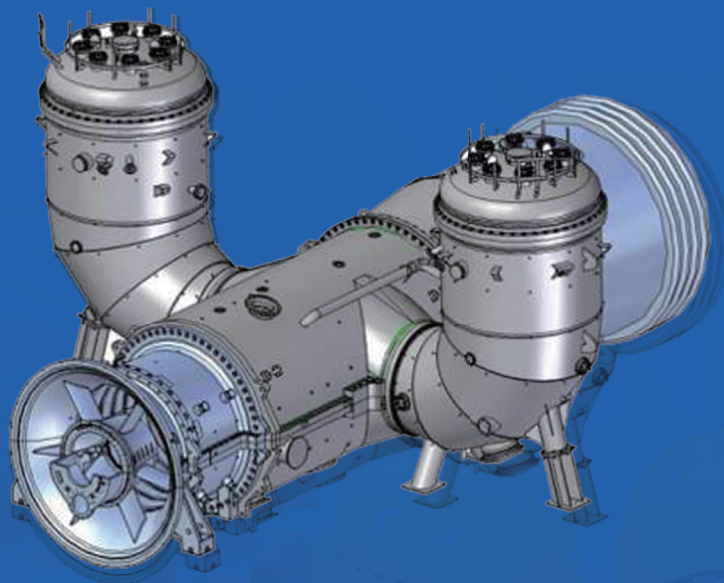
- 1x110MW / 170MW
- August, 2000
- November, 2000

EniPower Ferrera E.

- 1x166MW / 255MW
- March, 2004
- March, 2006



AE94.2KS (E Class) Gas Turbine



The AE94.2KS achieves features as follow:

- High Efficiency
- Startup fast
- Fuel adaptability
- Flexible and convenient maintenance

Performance Parameter

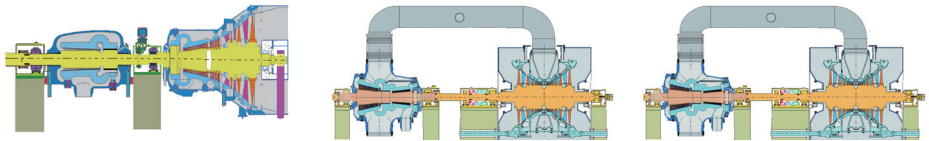
Gas Turbine Power Output	~180MW
Gas Turbine Efficiency	≥39%
Compressor Pressure Ratio	12
NOx Emission	≤50 **mg/Nm ³
Heat value range	2.8MJ/kg~3.5MJ/kg
Turbine Exhaust Temperature	550°C
Exhaust Gas Mass Flow	520kg/s
Size	9.8m×4.0m×4.0m
Weight	187t

*ISO-Ambient condition without inlet and exhaust pressure losses.

** 30mg/Nm³ Option available.

Steam Turbine For CCGP

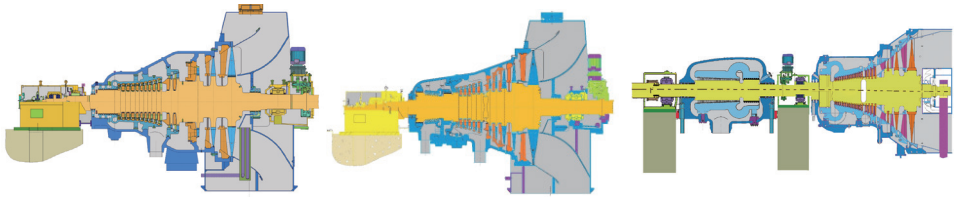
— Apply to F Class Gas Turbine



Performance Parameter

	1 on 1 Single Shaft / Multi-Shaft Configuration Dual-casing module	1 on 1 Multi-shaft Configuration Dual-casing Module	2 on 1 Multi-Shaft Configuration Dual-casing module
Type	Dual-casing, Reaction, Triple-Pressure, Axial Exhaust, N/NC Type	Dual-Casing, Reaction, Triple-Pressure, Reheat, Downward Exhaust, NC/NCB Type	Dual-Casing, Reaction, Triple-Pressure, Reheat, Downward Exhaust, NC/NCB Type
Output Range	135~160 MW	135~160 MW	~300 MW
Admission Parameter	HP: ~13MPa / 560°C IP: ~3.1MPa / 550°C LP: ~0.45MPa / 245°C	HP: ~13MPa / 555°C IP: ~3.3MPa / 550°C LP: ~0.5MPa / 245°C	HP: ~13MPa / 555°C IP: ~3.3MPa / 550°C LP: ~0.65MPa / 240°C
Admission Capacity	HP: ~280t/h IP: ~60t/h LP: ~50t/h	HP: ~280t/h IP: ~60t/h LP: ~50t/h	HP: ~560t/h IP: ~120t/h LP: ~100t/h
Extraction Capacity	NC: ~250t/h	NC: ~300t/h NCB: ~400t/h	NC: ~650t/h NCB: ~800t/h
Extraction Pressure	<3 MPa	<3 MPa	<3 MPa
Extraction Solution	HP Exhaust	HP Exhaust /IP Exhaust/IP	HP Exhaust / IP Exhaust / IP
Characteristic	SSS Clutch	LP Disconnection On Line, SSS Clutch	LP Disconnection On Line, SSS Clutch

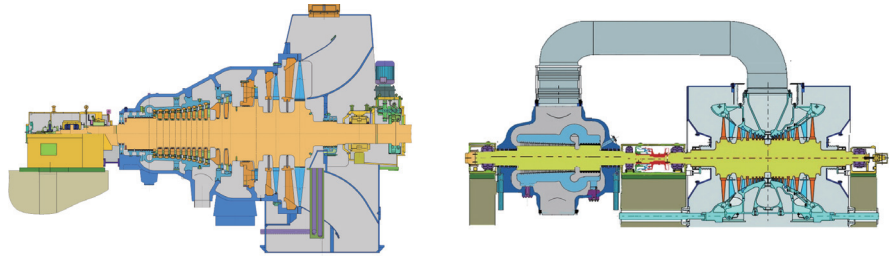
— Apply to E Class Gas Turbine 1 on 1 Configuration



Performance Parameter

	Single-casing module	Single-casing module	Dual-casing module
Type	Single-casing, impulse, double pressure, downward exhaust, condensing/extraction turbine	Single-casing, impulse type, double pressure/triple pressure, downward exhaust, condensing/extraction turbine	Dual-casing, reaction type, triple pressure, Axial Exhaust/downward exhaust, condensing/extraction/back pressure turbine
Output Range	~85 MW (ISO condensing condition)	~85 MW (ISO condensing condition)	~85 MW (ISO condensing condition)
Admission Parameter	HP: ~7.7Mpa / 520°C LP: ~0.6Mpa / 220°C	HP: ~9.2Mpa / 520°C LP: ~0.6Mpa / 212°C	HP: ~7.7Mpa / 520°C LP: ~0.5Mpa / 220°C
Admission Capacity	HP: ~240t/h LP: ~50t/h	HP: ~200t/h LP: ~20t/h	HP: ~240t/h LP: ~50t/h
Extraction Capacity	~200t/h	/	~200 (300) t/h
Extraction Pressure	0.15~4.0 MPa	/	0.15~4.0 MPa
Extraction Solution	Cylinder Valve/Rotary Diaphragm	Cylinder Valve/Rotary Diaphragm	Cylinder Valve/Rotary Diaphragm/ IP exhaust LP Disconnection On Line
Characteristic	Capacity of assembled shipment, ultra long overhaul interval. (Another axial exhaust type)	Capacity of assembled shipment, ultra long overhaul interval. (Another axial exhaust type)	Automatic Plant Start-up and Shut down(APS), ultra long overhaul interval.

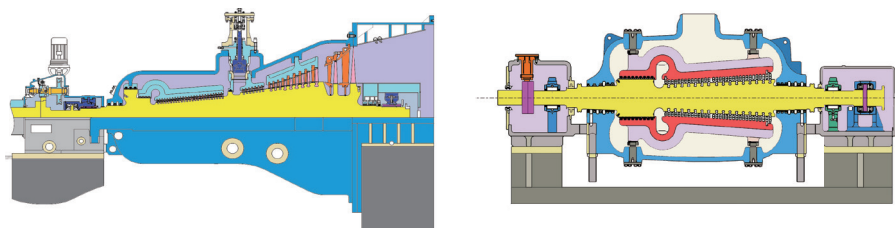
— Apply to E Class Gas Turbine 2 on 1 Configuration



Performance Parameter

	Single-casing module	Dual-casing module
Type	Single-casing, impulse type, double pressure, Axial Exhaust/downward exhaust, condensing/extraction turbine	Dual-casing, reaction type, double pressure/triple pressure, Axial Exhaust/downward exhaust, condensing/extraction/back pressure turbine
Output Range	~170 MW (ISO Condensing Condition)	~170MW (ISO Condensing Condition)
Admission Parameter	HP: ~7.7Mpa / 520°C LP: ~0.6Mpa / 220°C	HP: ~7.7Mpa / 520°C LP: ~0.6Mpa / 220°C
Admission Capacity	HP: ~470t/h LP: ~90t/h	HP: ~470 t/h LP: ~90t/h
Extraction Capacity	~450t/h	~450 (600) t/h
Extraction Pressure	0.15~4.0 MPa	0.15~4.0 MPa
Extraction Solution	Cylinder Valve/Rotary Diaphragm	Cylinder Valve/Rotary Diaphragm/IP exhaust LP Disconnection On Line
Characteristic	Capacity of assembled shipment, ultra long overhaul interval. (Another axial exhaust type)	Automatic Plant Start-up and Shut down(APS), ultra long overhaul interval, LP Disconnection On Line

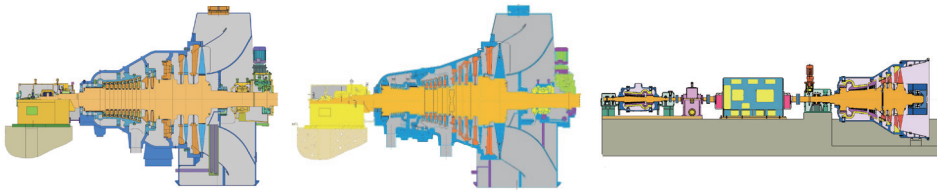
— Apply to f Class Gas Turbine 1 on 1 Configuration



Performance Parameter

	Single-casing module-condensing type	Single-casing module-back pressure type
Type	Single-casing, Reaction, double-Pressure, Axial Exhaust/downward exhaust, condensing/extraction turbine	Single-casing, Reaction, double-Pressure, Axial Exhaust/downward exhaust, back pressure turbine
Output Range	~39 MW (ISO Condensing Condition)	~10 MW
Admission Parameter	HP: ~7Mpa / 560°C LP: ~0.6Mpa / 260°C	HP: ~7Mpa / 560°C LP: /
Admission Capacity	HP: ~108 t/h LP: ~18 t/h	HP: ~108 t/h LP: /
Extraction Capacity	~80t/h	Back pressure exhaust
Extraction Pressure	0.15~4.0 Mpa	According to clients
Extraction Solution	Cylinder Valve/Rotary Diaphragm	Back pressure exhaust
Characteristic	Automatic Plant Start-up and Shut down(APS), ultra long overhaul interval, Capacity of assembled shipment	Automatic Plant Start-up and Shut down(APS), ultra long overhaul interval, Capacity of assembled shipment

— Apply to f Class Gas Turbine 2 on 1 Configuration

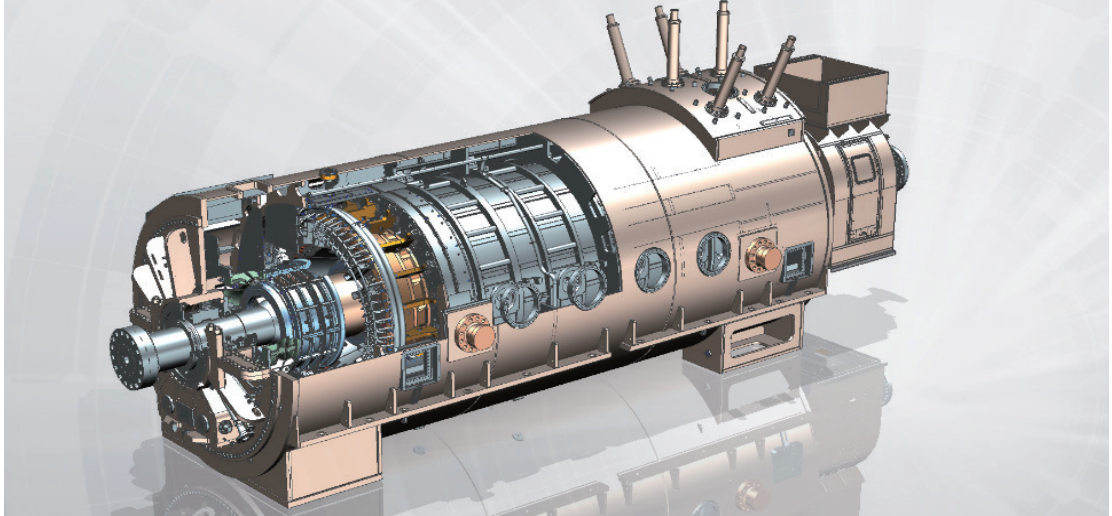


Performance Parameter

	Single-casing module	Single-casing module	Dual-casing module
Type	Single-casing, impulse type, double pressure, Axial Exhaust/downward exhaust, condensing/extraction turbine	Single-casing, impulse type, double pressure/triple pressure, downward exhaust, condensing/extraction turbine	Dual-casing, reaction type, triple-pressure, Axial Exhaust/downward exhaust, condensing/extraction turbine
Output Range	~78 MW (ISO Condensing Condition)	~80 MW (ISO Condensing Condition)	~83 MW (ISO Condensing Condition)
Admission Parameter	HP: ~7Mpa / 560°C LP: ~0.6Mpa / 260°C	HP: ~9.3Mpa/565°C LP: ~0.6Mpa / 260°C	HP: ~9.3Mpa / 565°C LP: ~0.4Mpa / 220°C
Admission Capacity	HP: ~210 t/h LP: ~35 t/h	HP: ~190 t/h LP: ~35 t/h	HP: ~190 t/h LP: ~20 t/h
Extraction Capacity	~150t/h	/	~100 t/h
Extraction Pressure	0.15~4.0 Mpa	/	0.15~4.0Mpa
Extraction Solution	Cylinder Valve / Rotary Diaphragm	Cylinder Valve / Rotary Diaphragm	Cylinder Valve/HP exhaust
Characteristic	Capacity of assembled shipment, ultra long overhaul interval	Capacity of assembled shipment, ultra long overhaul interval. (Another axial exhaust type)	Automatic Plant Start-up and Shut down(APS), ultra long overhaul interval

Generator For CCPP

— Apply to F Class Gas Turbine 1 on 1 Single-shaft Configuration

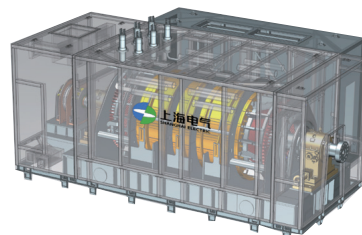
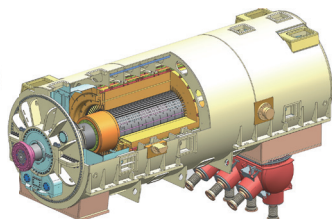
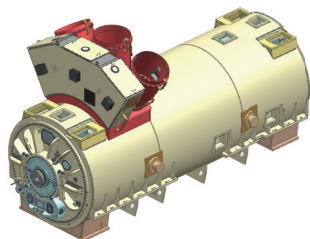


Performance Parameter

500MW class water & hydrogen cooled Generator

Type		QFSN-500-2
Rated Capacity	MVA	589
Rated Active Power	MW	475
Rated Voltage	kV	20
Rated Power Factor		0.85 lagging
Efficiency		99.03%
Cooling Method		Stator Winding, Water Inner Cooled, Rotor & Stator Core, Hydrogen Cooled.
Stator Dimension	m	9.7×4×4.3
Rotor Dimension	m	11.6×1.4×1.4
Rotor Weight	t	65
Transportation Method		Generator Integral Transportation With Rotor

— Apply to F Class Gas Turbine



300MW class water & hydrogen cooled Generator

Apply to 1 on 1 Multi-shaft F Class CCPP Gas-turbine (Top Lead)
Apply to 2 on 1 Multi-shaft F Class CCPP Steam-turbine (Bottom Lead)

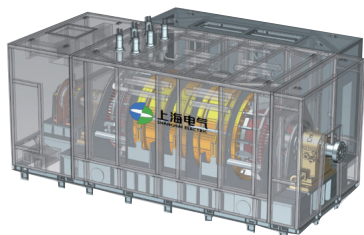
150MW class air cooled Generator

Apply to 1 on 1 Multi Shaft F Class CCPP Steam-turbine

Performance Parameter

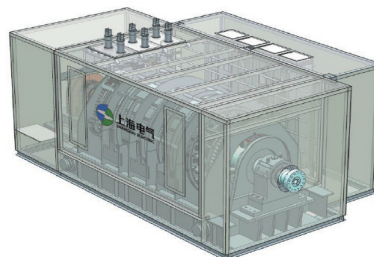
Type		QFSN-300-2 (top lead)	QFSN-300-2 (bottom lead)	QF-150-2
Rated Capacity	MVA	353	353	176.5
Rated Active Power	MW	300	300	150
Rated Voltage	kV	20	20	15.75
Rated Power Factor		0.85 lagging	0.85 lagging	0.85 lagging
Efficiency		99%	99%	98.78%
Cooling Method		Stator Winding, Water Inner Cooled, Rotor & Stator Core, Hydrogen Cooled.	Stator Winding, Water Inner Cooled, Rotor & Stator Core, Hydrogen Cooled.	Air Cooled
Stator Dimension	m	9.6×3.8×4.3	9.6×3.8×3.9	11×4.2×3.8
Rotor Dimension	m	11.4×1.2×1.2	11.3×1.2×1.2	11.5×1.2×1.2
Rotor Weight	t	53	53	42
Max Transportation Weight	t	205	207	210
Transportation Method		Generator Transportation With Rotor And Stator Separated		Generator Integral Transportation with rotor

—— Apply to E Class Gas Turbine



200MW class air cooled Generator

Apply to 1 on 1 Multi-shaft E Class CCPP Gas-turbine (Top Lead)
Apply to 2 on 1 Multi-shaft E Class CCPP Steam-turbine (Bottom Lead)



100MW class air cooled Generator

Apply to 1 on 1 Multi Shaft E Class CCPP Steam-turbine

Performance Parameter

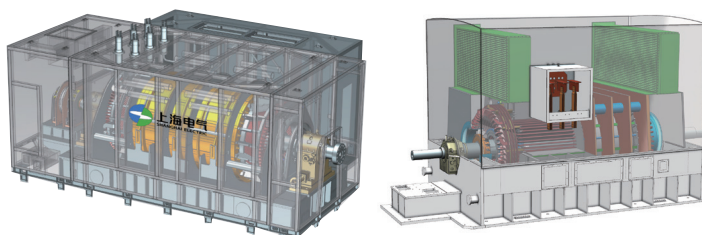
Type		QF-200-2	QF-100-2
Rated Capacity	MVA	235.3	117.6
Rated Active Power	MW	200	100
Rated Voltage	kV	18	10.5
Rated Power Factor		0.85 lagging	0.85 lagging
Efficiency		98.84%	98.83%
Cooling Method		Air Cooled	Air Cooled
Stator Dimension	m	11.8×4.3×3.8	8.9×3.6×3.6
Rotor Dimension	m	11.8×1.2×1.2	9.2×1.1×1.1
Rotor Weight	t	47	29
Max Transportation Weight	t	240	150
Transportation Method		Generator Integral Transportation with rotor	Generator Integral Transportation with rotor

—— Apply to f Class Gas Turbine

40MW~80MW Generator Series

QF-80-2 Apply to 1 on 1 Multi-shaft f Class
CCPP Gas-turbine and 2 on 1 Multi-shaft f
Class CCPP Steam-turbine

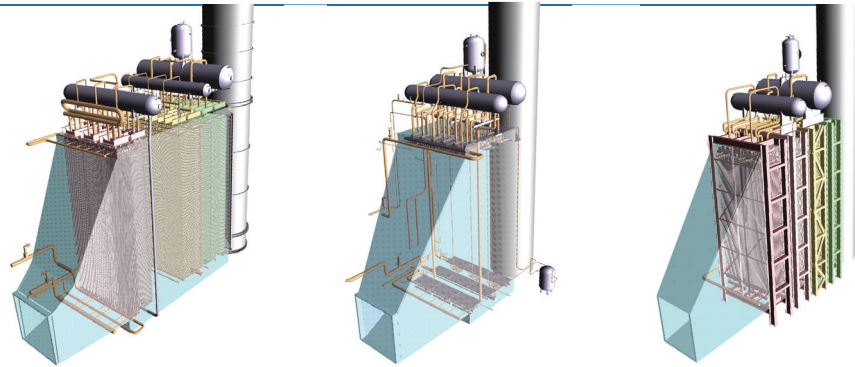
QF-40-2 Apply to 1 on 1 Multi-shaft f Class
CCPP Steam-turbine



Performance Parameter

Type		QF-80-2	QF-40-2
Rated Capacity	MVA	100	50
Rated Active Power	MW	80	40
Rated Voltage	kV	10.5	10.5
Rated Power Factor		0.8 lagging	0.8 lagging
Efficiency		98.6%	98.2%
Cooling Method		Air Cooled	Air Cooled
Stator Dimension	m	8.6×3.8×3.6	7×1×1
Rotor Dimension	m	8.7×1.1×1.1	7.4×3×2.7
Rotor Weight	t	28	18
Max Transportation Weight	t	147	100
Transportation Method		Generator Integral Transportation with rotor	Generator Integral Transportation with rotor

HRSG for CCPP



Performance Parameter

	Apply to F Class Gas Turbine	Apply to E Class Gas Turbine	Apply to f Class Gas Turbine
HP Steam	284.3 t/h, 562°C, 13.57MPa	245.1 t/h, 528.4°C, 8.40MPa	106.1 t/h, 560°C, 7.34MPa
IP Steam	63.8 t/h, 337°C, 3.43MPa	N/A	N/A
RH Steam	342.2 t/h, 552°C, 3.28MPa	N/A	N/A
LP Steam	53.9 t/h, 243°C, 0.46MPa	62.2 t/h, 222.5°C, 0.61MPa	17.6 t/h, 260°C, 0.68MPa

Structure Parameter

Boiler Type	Triple Pressure, Horizontal Gas Path, Natural Circulation	Double Pressure, Horizontal Gas Path, Natural Circulation	Double Pressure, Horizontal Gas Path, Natural Circulation
Boiler Size	~40m×13m×37m	~33m×10m×34m	~25m×8m×24 m
Stack Diameter	7.6m×60m/80m	6.5m×60m	4m×40m
Max Transportation Size	~27.8m×4.8m×3.1m	~25m×4.6m×3.0m	~19m×3.6m×3m
Max Transportation Weight	~191t	~160t	~100t

Technical Features

Inlet duct for the compound; HARP; multiple inlet-outlet pipes; reinforced drainage arrangement; modular design and manufacture.



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