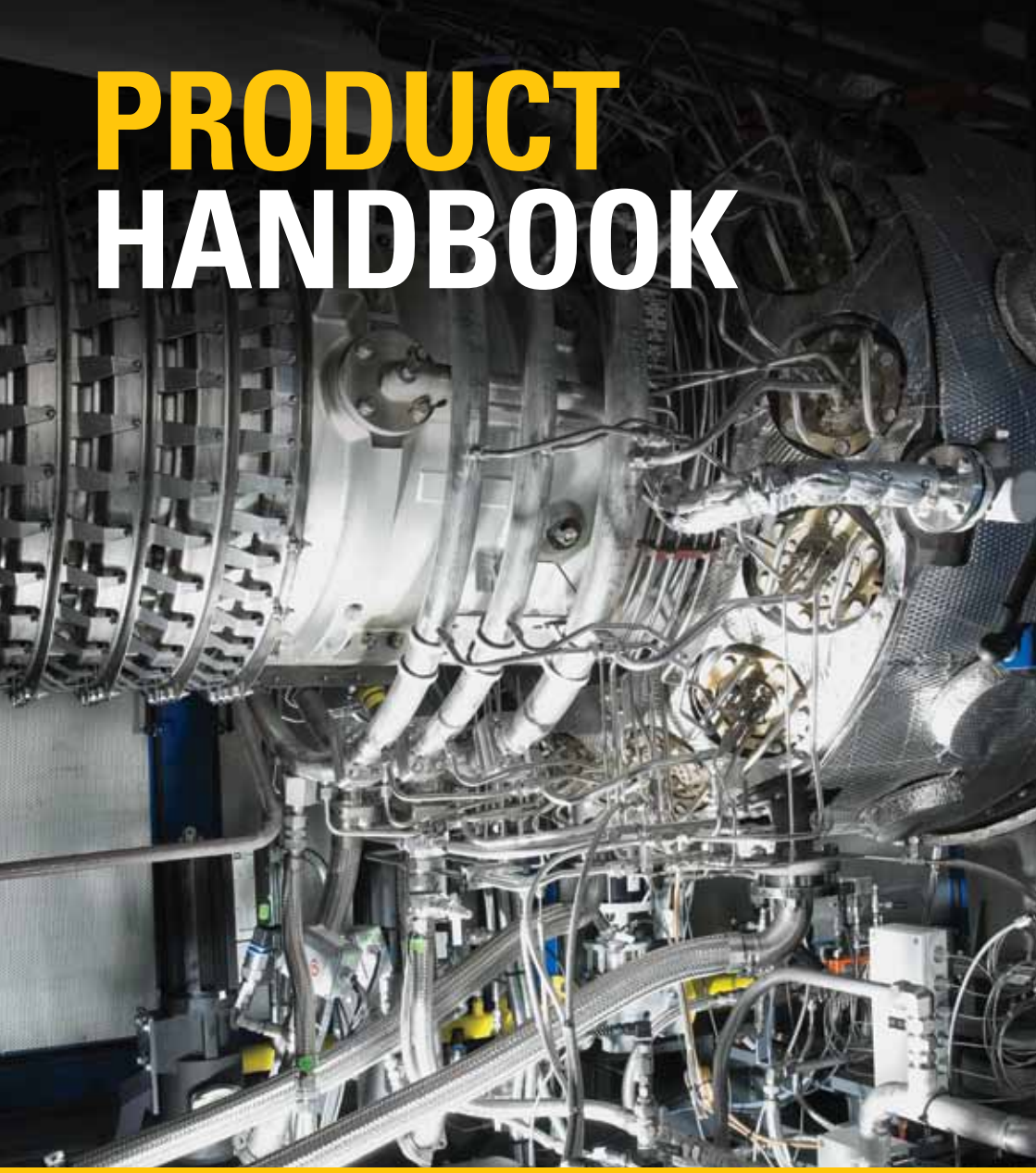
PRODUCT HANDBOOK



Energy in all we do

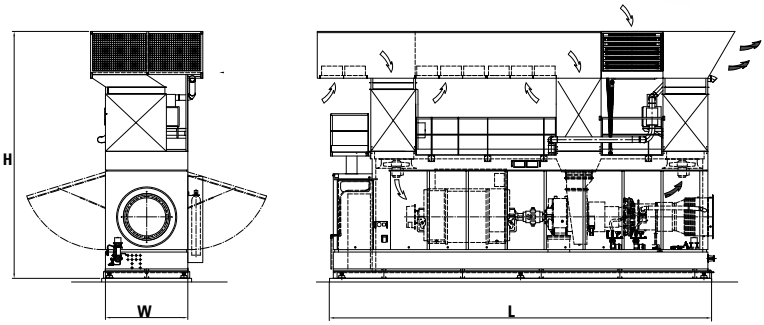
Turbomach

A Caterpillar Company

GAS TURBINE GENERATOR PACKAGES PRODUCT OVERVIEW
1 TO 22 MW

Including (standard supply)

- Gas turbine, Reduction Gear Box, Generator
- Starting equipment
- Gas fuel system
- Lubrication system
- Turbine compressor cleaning system
- Base frame
- Spring dampers
- Enclosure
- Air filtration system
- Integrated control system
- Fire detection and extinguishing equipment
- Electrical cables
- Erection, commissioning and tests



PRODUCT RANGE

TurbineType	version	ISO[1] Output Power	ISO[1] Heat rate	Fuel Input	Electrical Efficiency	Exhaust gas Flow	Exhaust gas Temp.	Fuels[2]	Comtustion Systems Available[3]
		MW	kJ/kWh	MJ/s	%	kg/s	°C		
SATURN 20	T-1601	1.20	14'810	5.0	24.3	6.5	506	NG/LF/LPG/LBTU	S, WI
CENTAUR 40	T-4700	3.51	12'900	12.6	27.9	19.0	443	NG/LF/LPG/LBTU	S, DLE, WI
CENTAUR 50	T-6201	4.60	12'266	15.7	29.3	19.1	509	NG/LF/LPG/LBTU	S, DLE, WI
MERCURY 50	T-6401	4.60	9'350	12.0	38.5	17.8	374	NG/LBTU	DLE
TAURUS 60	T-7901	5.67	11'427	18.0	31.5	21.8	510	NG/LF/LPG/LBTU	S, DLE, WI
TAURUS 65	T-8401	6.30	10'945	19.2	32.9	21.1	549	NG	DLE
TAURUS 70	T-10801	7.96	10'503	23.2	34.3	26.9	508	NG/LF/LPG/LBTU	S, DLE
MARS 90	T-13002	9.87	10'827	29.7	33.2	40.2	465	NG/LF/LPG/LBTU	S, DLE, WI
MARS 100	T-16002	11.35	10'934	34.5	32.9	42.6	484	NG/LF/LPG/LBTU	S, DLE, WI
TITAN 130	T-20501	15.00	10'227	42.6	35.2	49.8	496	NG/LF/LPG/LBTU	S, DLE
TITAN 250	T-30002	21.75	9'256	55.9	38.9	68.2	463	NG	DLE

1) ISO conditions: Sea level, 15°C, no gas path losses
2) NG = natural gas; LF = liquid fuel; LPG = liquified propane gas; LBTU = low BTU gas
3) S = standard combustion system; WI = water injection; DLE = *SoLoNOx*

TurbineType	Generator Voltage	Steam Production[4] @ 10 bar(a) saturated	Steam Production[4] @ 10 bar(a) saturated, fired to 800°C	Additional fuel input to reach 800°C	Steam Production[4] @ 10 bar(a) saturated, fired to 1100°C	Additional fuel input to reach 1100°C	Chilling Capacity[6]	L	W	H[5]	Weight[5]
	kV	t/h	t/h	MJ/s	t/h	MJ/s	MJ/s - m³/h	m	m	m	t
SATURN 20	0.4	3.9	7.6	2.4	11.6	5	3'728 - 641	6.0	1.8	7.6	14
CENTAUR 40	6.3, 11	8.9	21.5	8.3	33.8	16	8'933 - 1'563	10.0	2.2	6.6	40
CENTAUR 50	6.3, 11	11.5	22.2	6.8	34.4	15	10'878 - 1'871	10.0	2.2	6.6	45
MERCURY 50	6.3, 11	5.9	19.8	9.3	31.3	17	3'744 - 644[7]	13.7	2.9	6.7	52
TAURUS 60	6.3, 11	13.2	25.3	7.8	38.9	17	12'412 - 2'134	10.0	2.2	6.6	45
TAURUS 65	6.3, 11	14.5	24.5	6.5	38.0	15	13'436 - 2'311	11.0	2.2	6.6	56
TAURUS 70	6.3, 11	16.2	30.9	9.7	48.5	21	15'328 - 2'636	12.6	2.9	9.4	68
MARS 90	6.3, 11	20.7	47.0	16.5	72.0	33	20'648 - 3'551	14.9	2.9	9.7	84
MARS 100	6.3, 11	24.0	50.1	16.6	76.7	34	23'404 - 4'025	14.9	2.9	9.7	85
TITAN 130	6.3, 11	29.8	59.0	18.7	89.6	39	28'391 - 4'882	15.6	2.9	10.0	90
TITAN 250	11	36.2	80.5	28.3	122.9	56	34'820 - 5'988	18.2	3.4	14.0	99

4) Site Conditions for Steam production:
Sea level, 15°C, 75 mmH2O inlet loss, 250 mmH2O exhaust loss
Natural gas fuel; Full load; Feed water temperature: 105°C, 100% condensate return, no deaerator, no blowdown
5) H & Weight = including Filter system and for outdoor installation
6) Chilling capacity is calculated based on two stages Exhaust Chiller with Exhaust Temperature in/out aprox. 500/170°C, chilled water outlet/inlet temperature 7/12°C. Condensation temperature 26°C maximum.
7) Single stage Exhaust Chiller

All specifications are for reference only, subject to change without notice.

GAS TURBINE GENERATOR PACKAGE

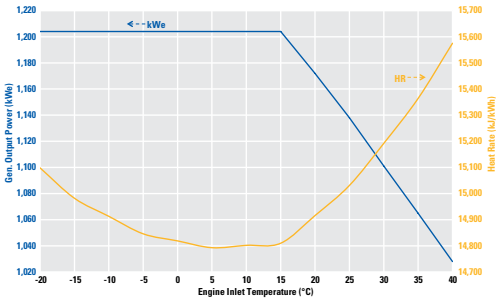
SATURN 20

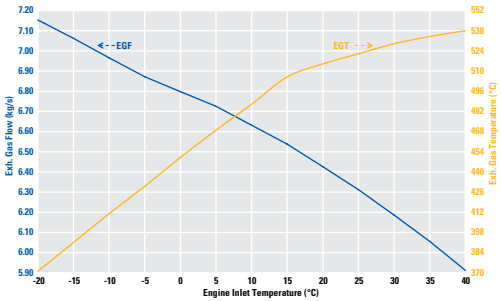
TURBINE TYPE: SATURN 20 (T 1601)
Main data (ISO, no losses)

Electrical power:	MW	1.20
Heat rate:	kJ/kWE-hr	14'810
Fuel input:	MJ/s	4.95
Efficiency:	%	24.32
Exhaust gas flow:	kg/s	6.54
Exhaust gas temp.	°C	506
Fuel:		NG/LF/LPG/LBTU
Start system:		AC
Gen. Voltage:	kV	0.4
Comb. Syst. Avail.:	*	S/WI

*S = standard combustion system; WI = water injection; DLE = *SoLoNOx*

CORRECTION CURVES





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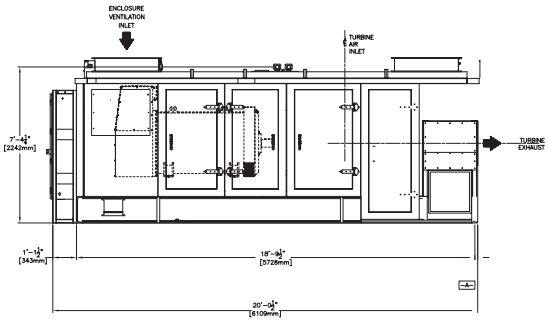


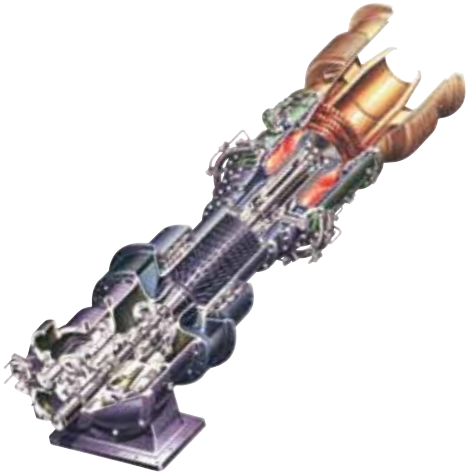
GAS TURBINE GENERATOR PACKAGE

CENTAUR 40

TURBINE TYPE: CENTAUR 40 (T 4700)
Main data (ISO, no losses)

Electrical power:	MW	3.51
Heat rate:	kJ/kWE-hr	12’900
Fuel input:	MJ/s	12.59
Efficiency:	%	27.90
Exhaust gas flow:	kg/s	18.99
Exhaust gas temp.	°C	443
Fuel:		NG/LF/LPG/LBTU
Start system:		AC
Gen. Voltage:	kV	6.3 or 11
Comb. Syst. Avail.:	*	S/WI/DLE

*S = standard combustion system; WI = water injection; DLE = *SoLoNOx*



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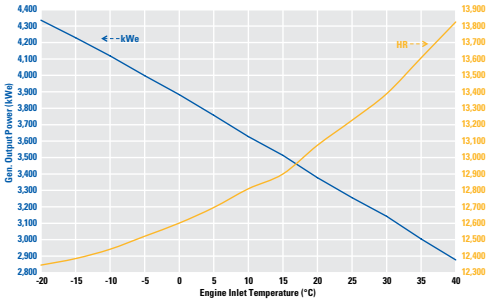

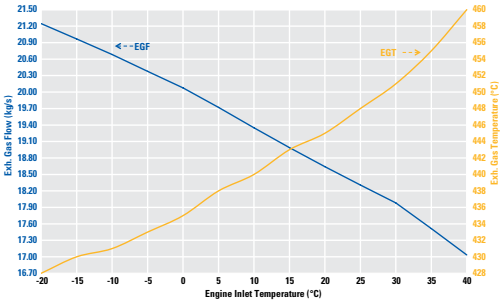

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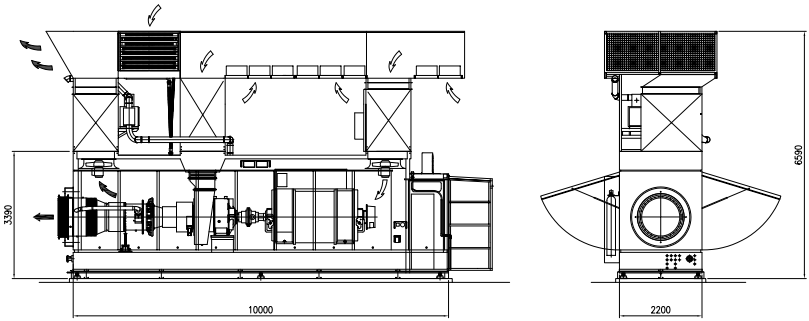


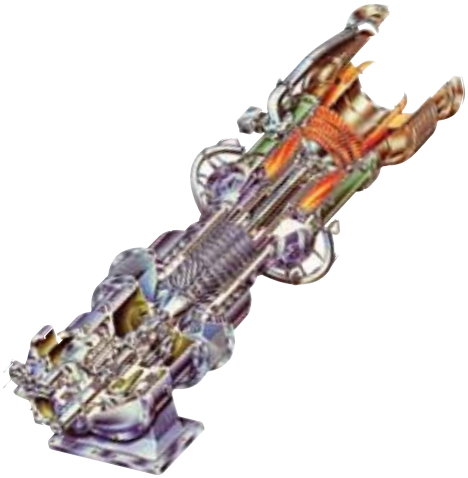
GAS TURBINE GENERATOR PACKAGE

CENTAUR 50

TURBINE TYPE: CENTAUR 50 (T 6201)
Main data (ISO, no losses)

Electrical power:	MW	4.60
Heat rate:	kJ/kWE-hr	12’266
Fuel input:	MJ/s	15.68
Efficiency:	%	29.34
Exhaust gas flow:	kg/s	19.08
Exhaust gas temp.	°C	509
Fuel:		NG/LF/LPG/LBTU
Start system:		AC
Gen. Voltage:	kV	6.3 or 11
Comb. Syst. Avail.:	*	S/WI/DLE

*S = standard combustion system; WI = water injection; DLE = *SoLoNOx*



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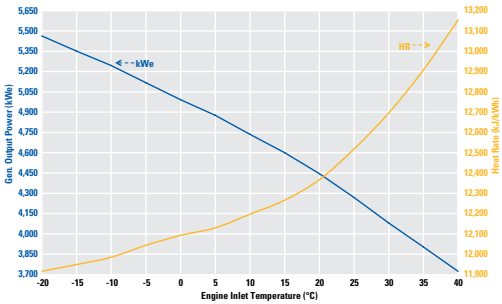

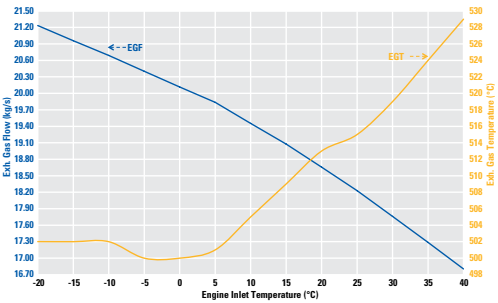

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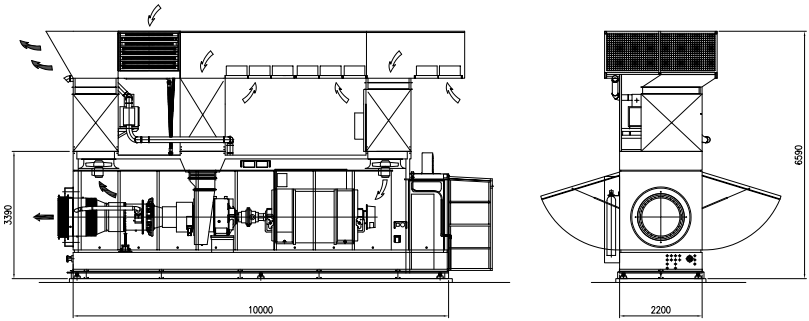


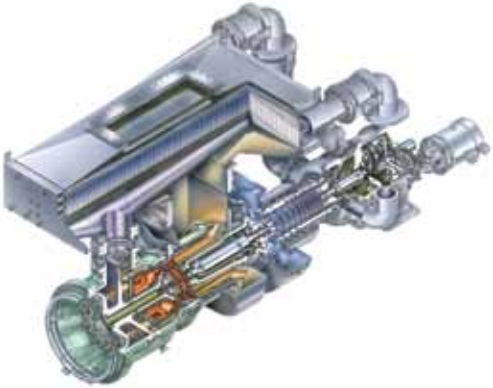
GAS TURBINE GENERATOR PACKAGE

MERCURY 50

TURBINE TYPE: MERCURY 50 (T 6401)
Main data (ISO, no losses)

Electrical power:	MW	4.60
Heat rate:	kJ/kWE-hr	9'350
Fuel input:	MJ/s	11.95
Efficiency:	%	38.49
Exhaust gas flow:	kg/s	17.82
Exhaust gas temp.	°C	374
Fuel:		NG/LBTU
Start system:		AC
Gen. Voltage:	kV	6.3 or 11
Comb. Syst. Avail.:	*	DLE

*S = standard combustion system; WI = water injection; DLE = *SoLoNOx*



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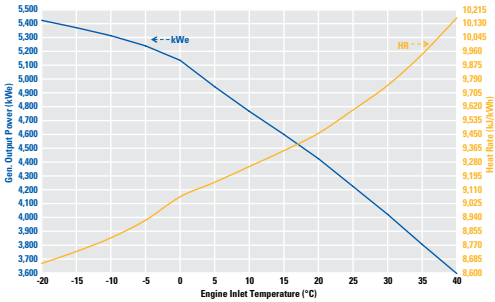

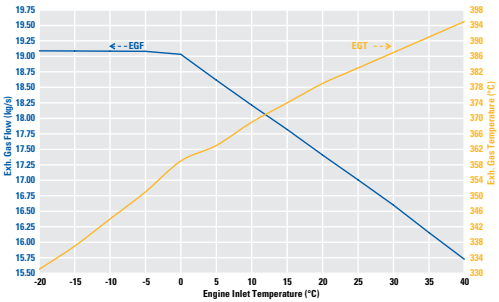

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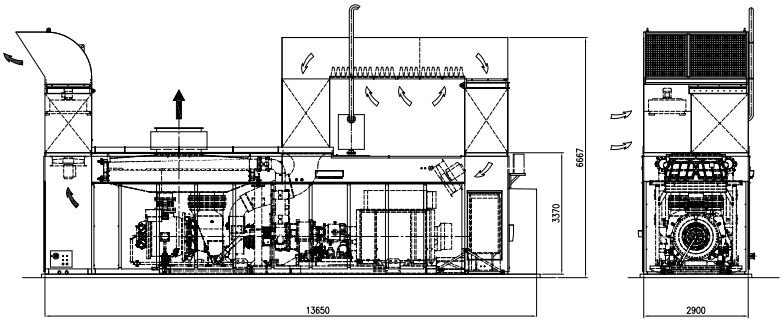


GAS TURBINE GENERATOR PACKAGE

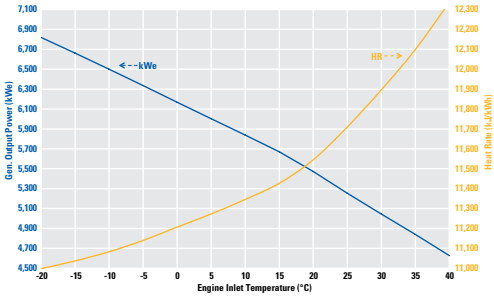
TAURUS 60

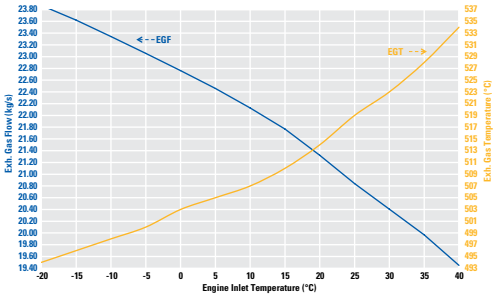
TURBINE TYPE: TAURUS 60 (T 7901)
Main data (ISO, no losses)

Electrical power:	MW	5.67
Heat rate:	kJ/kWE-hr	11'427
Fuel input:	MJ/s	18.00
Efficiency:	%	31.50
Exhaust gas flow:	kg/s	21.77
Exhaust gas temp.	°C	510
Fuel:		NG/LF/LPG/LBTU
Start system:		AC
Gen. Voltage:	kV	6.3 or 11
Comb. Syst. Avail.:	*	S/WI/DLE

*S = standard combustion system; WI = water injection; DLE = *SoLoNOx*

CORRECTION CURVES





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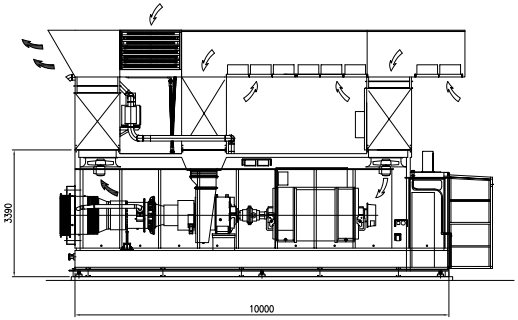
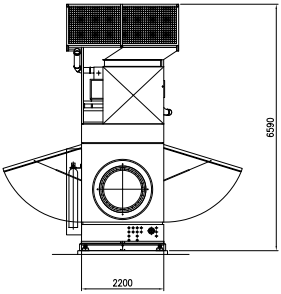




GAS TURBINE GENERATOR PACKAGE

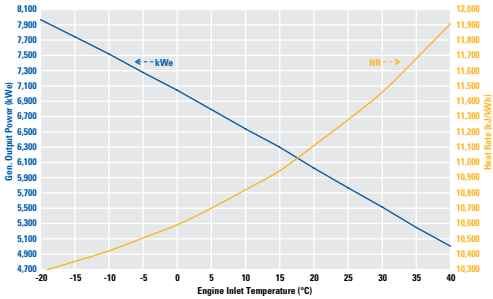
TAURUS 65

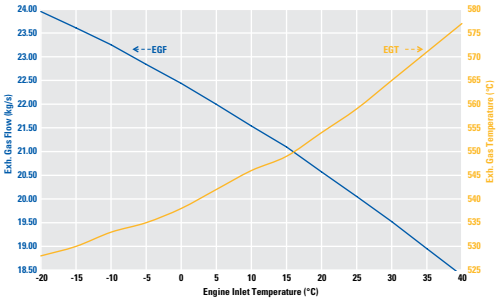
TURBINE TYPE: TAURUS 65 (T 8401)
Main data (ISO, no losses)

Electrical power:	MW	6.30
Heat rate:	kJ/kWE-hr	10’945
Fuel input:	MJ/s	19.16
Efficiency:	%	32.88
Exhaust gas flow:	kg/s	21.10
Exhaust gas temp.	°C	549
Fuel:		NG
Start system:		AC
Gen. Voltage:	kV	6.3 or 11
Comb. Syst. Avail.:	*	DLE

*S = standard combustion system; WI = water injection; DLE = *SoLoNOx*

CORRECTION CURVES





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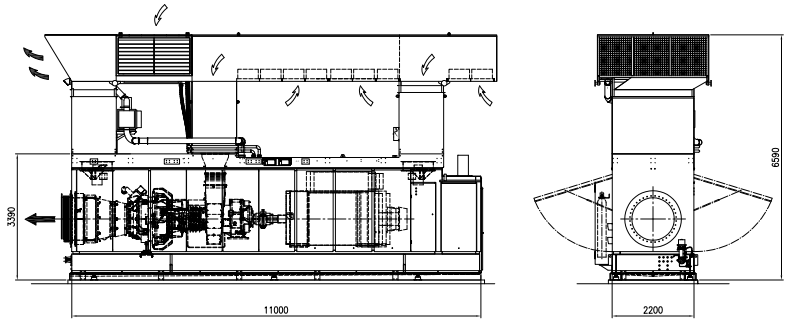


GAS TURBINE GENERATOR PACKAGE

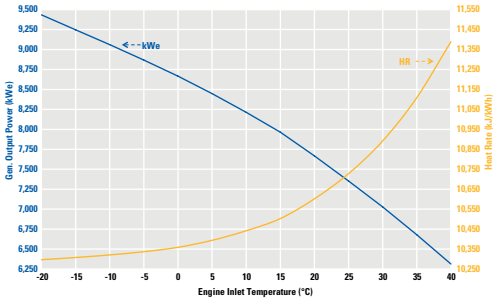
TAURUS 70

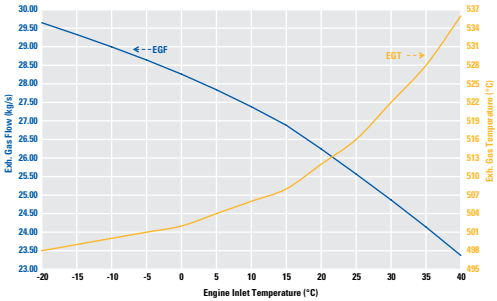
TURBINE TYPE: TAURUS 70 (T 10801)
Main data (ISO, no losses)

Electrical power:	MW	7.96
Heat rate:	kJ/kWE-hr	10’503
Fuel input:	MJ/s	23.24
Efficiency:	%	34.27
Exhaust gas flow:	kg/s	26.88
Exhaust gas temp.	°C	508
Fuel:		NG/LF/LPG/LBTU
Start system:		DC
Gen. Voltage:	kV	6.3 or 11
Comb. Syst. Avail.:	*	S/DLE

*S = standard combustion system; WI = water injection; DLE = *SoLoNOx*

CORRECTION CURVES





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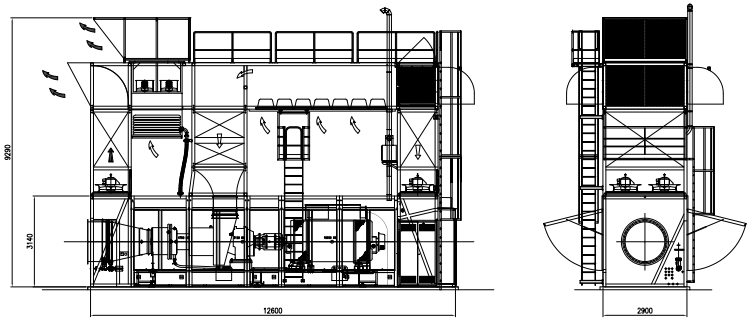


GAS TURBINE GENERATOR PACKAGE

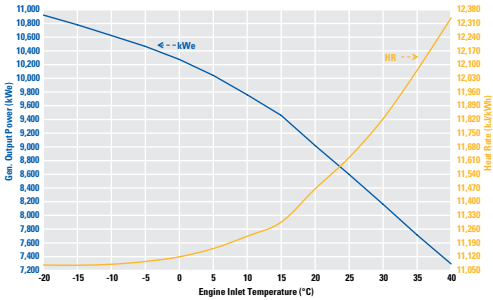
MARS 90

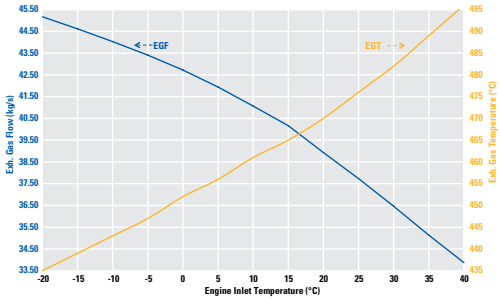
TURBINE TYPE: MARS 90 (T 13002)
Main data (ISO, no losses)

Electrical power:	MW	9.87
Heat rate:	kJ/kWE-hr	10'827
Fuel input:	MJ/s	29.69
Efficiency:	%	33.24
Exhaust gas flow:	kg/s	40.16
Exhaust gas temp.	°C	465
Fuel:		NG/LF/LPG/LBTU
Start system:		AC
Gen. Voltage:	kV	6.3 or 11
Comb. Syst. Avail.:	*	S/WI/DLE

*S = standard combustion system; WI = water injection; DLE = *SoLoNOx*

CORRECTION CURVES





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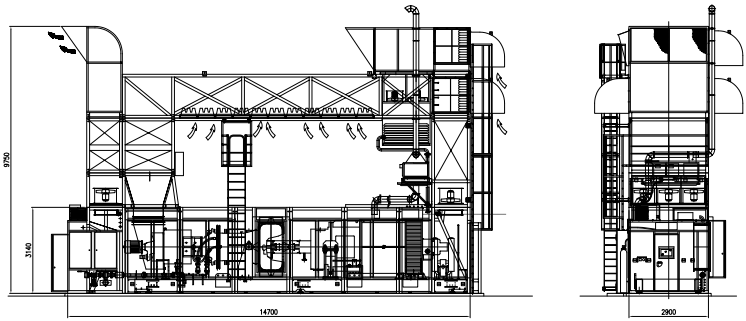


GAS TURBINE GENERATOR PACKAGE

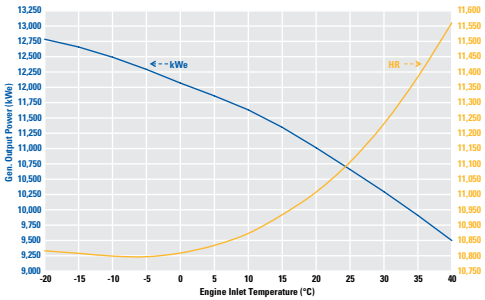
MARS 100

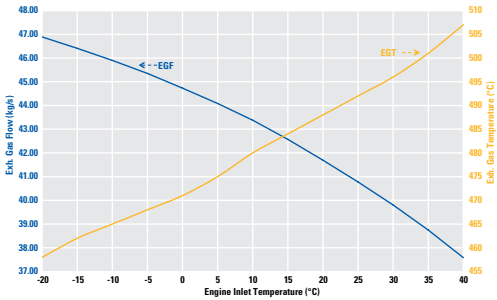
TURBINE TYPE: MARS 100 (T 16002)
Main data (ISO, no losses)

Electrical power:	MW	11.35
Heat rate:	kJ/kWE-hr	10'934
Fuel input:	MJ/s	34.47
Efficiency:	%	32.92
Exhaust gas flow:	kg/s	42.57
Exhaust gas temp.	°C	484
Fuel:		NG/LF/LPG/LBTU
Start system:		AC
Gen. Voltage:	kV	6.3 or 11
Comb. Syst. Avail.:	*	S/WI/DLE

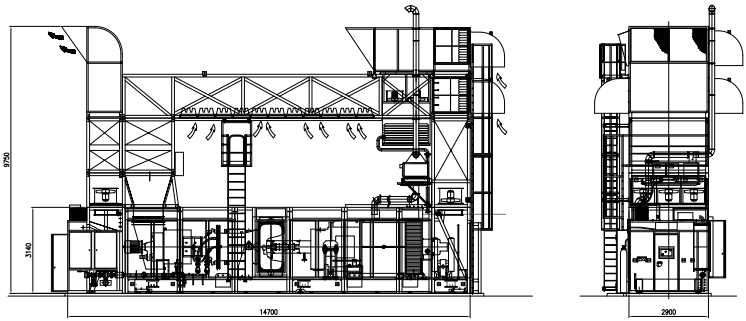
*S = standard combustion system; WI = water injection; DLE = *SoLoNOx*

CORRECTION CURVES





TYPICAL LAYOUT



GAS TURBINE GENERATOR PACKAGE

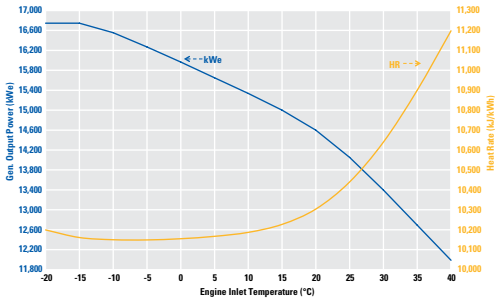
TITAN 130

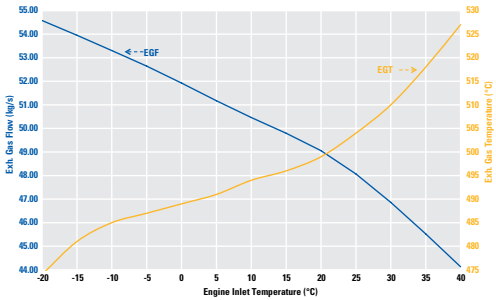
TURBINE TYPE: TITAN 130 (T 20501)
Main data (ISO, no losses)

Electrical power:	MW	15.00
Heat rate:	kJ/kWE-hr	10’227
Fuel input:	MJ/s	42.62
Efficiency:	%	35.19
Exhaust gas flow:	kg/s	49.79
Exhaust gas temp.	°C	496
Fuel:		NG/LF/LPG/LBTU
Start system:		DC
Gen. Voltage:	kV	6.3 or 11
Comb. Syst. Avail.:	*	S/DLE

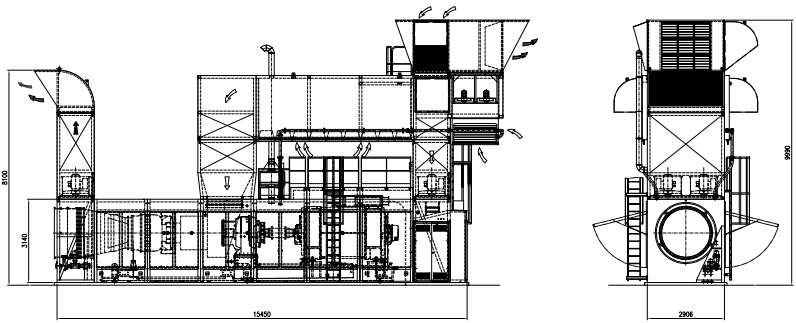
*S = standard combustion system; WI = water injection; DLE = *SoLoNOx*

CORRECTION CURVES





TYPICAL LAYOUT



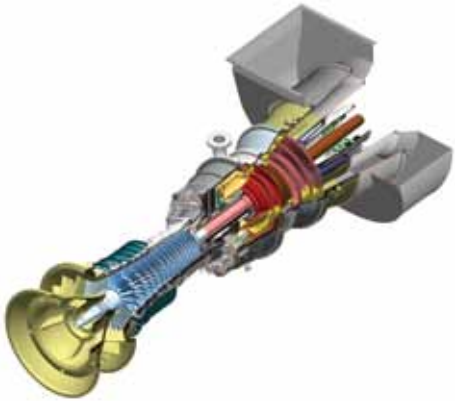
GAS TURBINE GENERATOR PACKAGE

TITAN 250

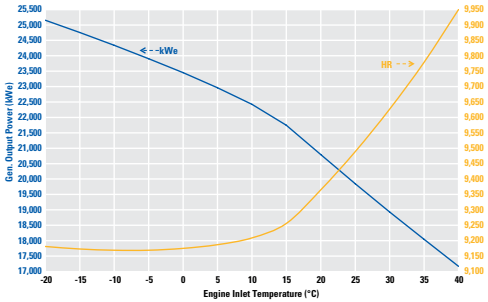
TURBINE TYPE: TITAN 250 (T 30002)
Main data (ISO, no losses)

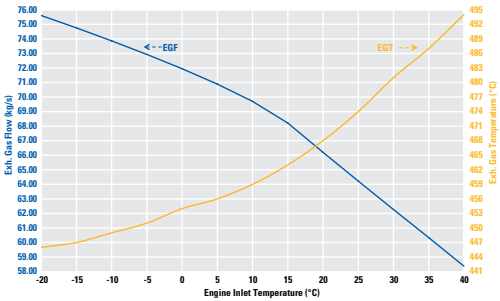
Electrical power:	MW	21.75
Heat rate:	kJ/kWE-hr	9'256
Fuel input:	MJ/s	55.92
Efficiency:	%	38.89
Exhaust gas flow:	kg/s	68.21
Exhaust gas temp.	°C	463
Fuel:		NG
Start system:		AC
Gen. Voltage:	kV	11
Comb. Syst. Avail.:	*	DLE

*S = standard combustion system; WI = water injection; DLE = *SoLoNOx*

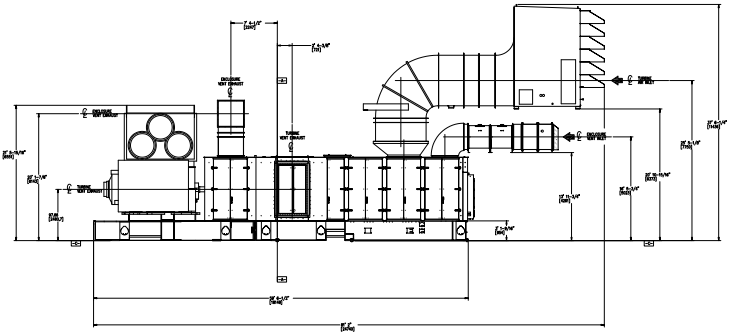


CORRECTION CURVES





TYPICAL LAYOUT



CUSTOMER SERVICES

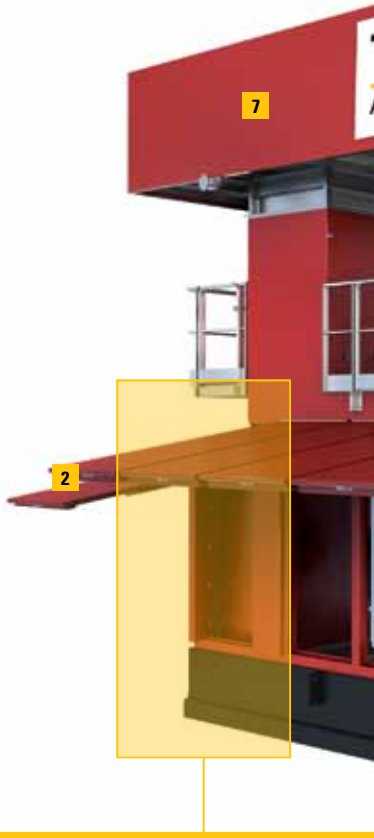
- MAINTENANCE
- LONG-TERM SERVICE AGREEMENTS
- REMOTE DIAGNOSTICS WITH *INSIGHT SYSTEM*
- SUPPLY OF CERTIFIED SERVICE PARTS
- EQUIPMENT OVERHAUL
- GAS TURBINE EXCHANGE PROGRAM
- GAS TURBINE FIELD REPAIR
- UPGRADES, RETROFITS AND PLANT MODIFICATIONS

These services can be provided in the frame of maintenance agreements, individually tailored to meet your requirements. Contracts are generally grouped under the following contractual models:

PMC: Preventive Maintenance Contract
BUOA: Beneficial Use Overhaul Agreement
EMC: Extended Maintenance Contract
FMC: Full Maintenance Contract (or Long Term Service Agreement)
O&M: Operation and Maintenance

	PMC	BUOA	EMC	FMC	O&M
Operation or Operation Supervision					●
Service parts				●	●
Troubleshooting & Repair on Package or Plant				●	●
Turbine unscheduled OH and Repair			●	●	●
Turbine scheduled OH or Pro Rata Warranty		●	●	●	●
Annual boroscope Inspection of GT & RGB	●	●	●	●	●
Annual maintenance on Package or Plant	●	●	●	●	●

WATT'S
INSIDE OUR PACKAGE



1 . ENCLOSURE
The enclosure protects the package from weather, and reduces operational noise, allowing an outdoor installation. This eliminates the need for a building and saves investment cost. Modular panels allow the entire enclosure to be disassembled in sections.

2 . ENCLOSURE DOORS
Doors allow full access to every side of the package making inspection and maintenance operations fast, safe and easy.

3 . BASE FRAME
The base frame integrates all subsystem components with gas turbine and generator and allows an easy and fast single-lift installation or relocation

4 . SPRING DAMPERS
The spring dampers absorb operational vibrations and minimise the requirements for the foundation, allowing an installation practically anywhere.

5 . MAINTENANCE PROVISIONS
The package is designed for ease of maintenance, with built-in maintenance devices. Provisions to remove the generator and gas turbine are integrated in the package design. This safes time and cost during maintenance.

6 . FILTER STRUCTURE FOR COMBUSTION AIR
Can be configured to local conditions and allows for installation of inlet air cooling.

7 . AIR FILTER SYSTEM FOR GENERATOR COOLING AND VENTILATION AIR

8 . GAS TURBINE
Solar industrial gas turbines combine ease of maintenance with highest reliability, durability and efficiency. This guarantees you the best payback throughout the lifetime of the plant.

9 . REDUCTION GEAR
Matches gas turbine rotational speed to speed of generator rotor.

10 . GENERATOR
Transforms mechanical energy into electrical power.

11 . SUBSYSTEMS
Air, Fuel, Oil and Start Subsystems are fully integrated and tested before shipment. This safes time and cost on site.

12 . STARTING SYSTEM

13 . FUEL SYSTEM

14 . LUBE-OIL SYSTEM
with integrated lube-oil cooler

15 . CONNECTIONS
The simple interfaces guarantee an easy and fast installation and integration. This saves time and cost on site.

16 . INTERFACE CONNECTIONS
- fuel
- instrument air
- 400V auxiliary power
- medium voltage power
- connection to compressor washing system

CONTROL SYSTEM
The advanced control system can operate the package completely automatically, and allows easy communication with other systems. This provides equipment safety, operator convenience and low operating cost.

CONTROL ROOM
The control and electrical systems are housed in a tightly sealed and air-conditioned control room, which is integrated on the package. This eliminates the need for a separate control room and associated construction costs.

CABLING

The interconnecting cabling is installed and tested before shipment. This guarantees highest quality and reliability.

AUXILIARY POWER SWITCHGEAR

BATTERY SYSTEM

HUMAN MACHINE INTERFACE (HMI)

The user-friendly interface can be operated locally or via the remote operator station. This guarantees an optimum operation of your equipment.

OPTIONS AVAILABLE

some of the available options are:

- alternative fuel capability (gas, liquid, low BTU)
- water injection or *SoLoNOx* combustion system for lowest emissions is available for most turbines
- packaging designed for a wide variety of environmental conditions
- combustion air inlet chilling
- generator voltages of 6.3 or 11 kV

ABOUT US

Turbomach is a leading provider of industrial gas turbine-based cogeneration systems.
We are fully dedicated to our power generation markets, leveraging the experience with over 4500 power generation units installed worldwide. Together with Solar Turbines, Turbomach is part of a diverse multi-talented team of more than 6000 employees with decades of experience working as a global team committed to the common goal of delivering complete customer satisfaction.

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