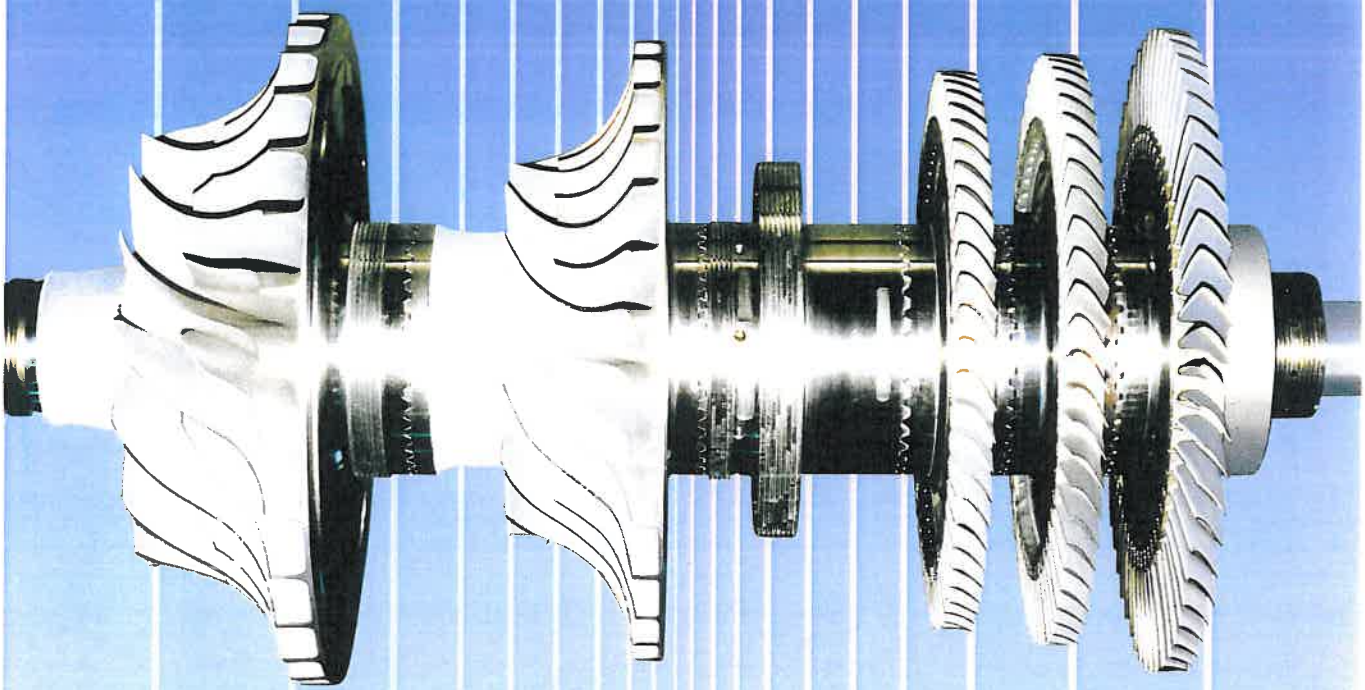
KAWASAKI GAS TURBINE GENERATOR SETS

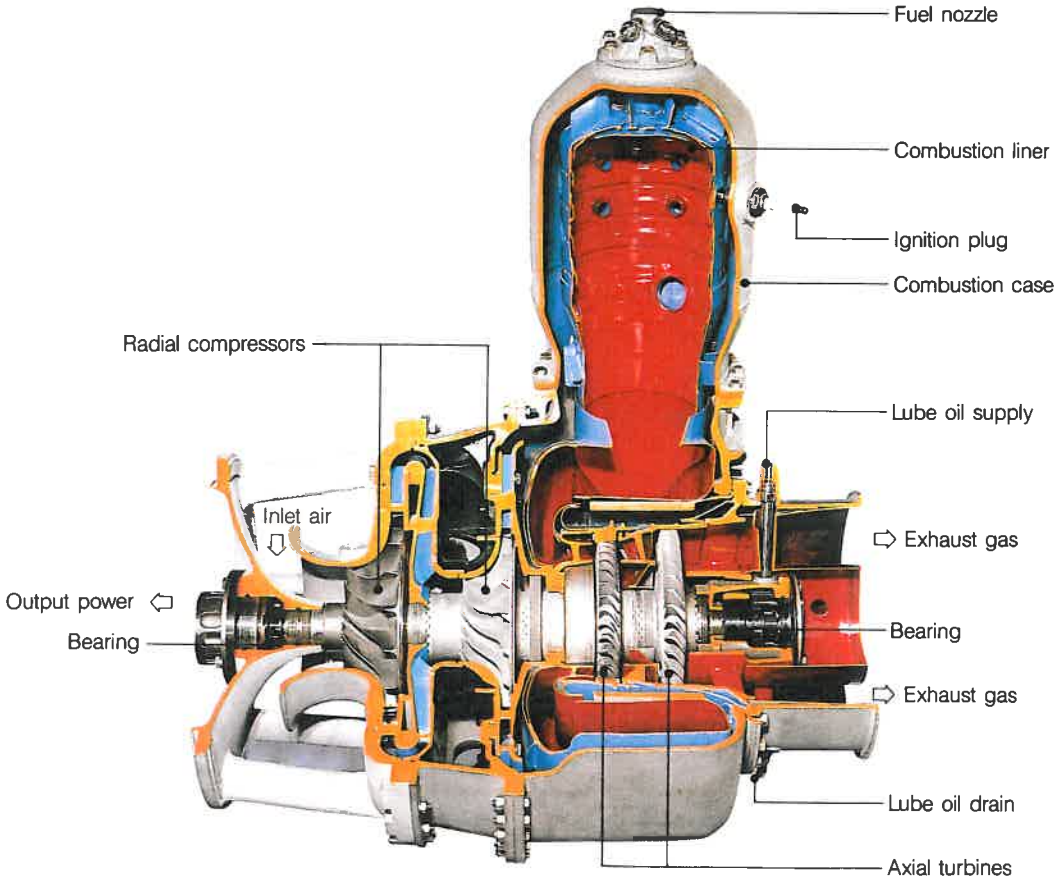


KAWASAKI
HEAVY INDUSTRIES, LTD.

GAS TURBINE—An Ideal Prime Mover for Generator Set
KAWASAKI—A World-Leading Gas Turbine Manufacturer

The gas turbine was invented in the late 18th century, and since then, its excellent advantages have dominated the market as a prime-mover of aircraft for many years.
Now it has come to the power generation market after improvements in efficiency, production costs, etc. Kawasaki gas turbines, developed with our own technologies based on years of experience in aircraft jet engines, are now ready for service for your standby, baseload and co-generation requirements. Kawasaki, now ranked as a market leader in gas turbine generator sets, is further expanding their production line with the latest technologies.

Akashi Works



CO-GENERATION MODEL (GPC/GPCC series)

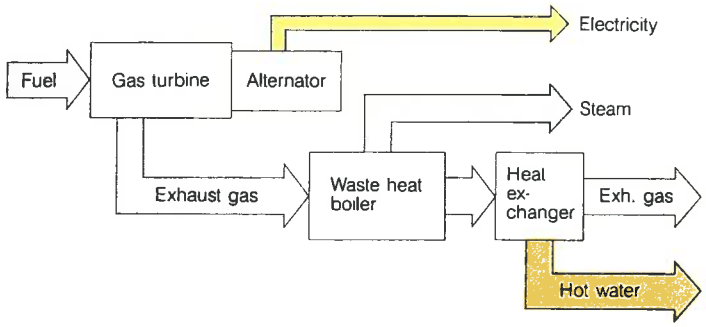
Kawasaki co-generation GPC series are suitable for supply of both electricity and heat simultaneously. The heat in exhaust gas can be utilized in a waste heat boiler into steam for an absorption chiller, process steam, drying-process, etc. The complete co-generation system is designed for automatic operation including start-up/power and heat supply/shut-down of the system with alarm/protection systems.
Kawasaki Cheng-cycle co-generation system (GPCC series) is available as a flexible co-generation system. The excess steam is injected into the turbine to increase power and to save fuel consumption.
Kawasaki provides complete co-generation systems as Kawasaki is the only company in the world to manufacture gas turbines, waste heat boilers, absorption chillers, and other related equipment under one name.

PARTICULAR ADVANTAGES

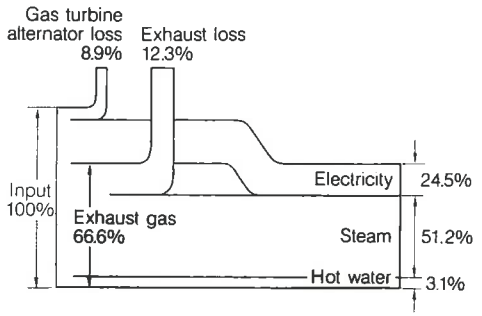
1. High temperature exhaust gas
The exhaust gas of gas turbines is at high temperature and clean. It can be utilized for direct drying purposes.

2. High pressure steam
High temperature exhaust gas makes it possible to be recovered in a waste heat boiler to produce high pressure steam.

● Typical system schematic



● Heat balance




2 × 500 kW at chemical factory


1 × 1,000 kW at food factory


1 × 1,400 kW at soap-powder factory


1 × 1,320 kW at rubber factory


1 × 1,350 kW at chemical factory


1 × 2,000 kW Cheng-cycle system at turbine factory

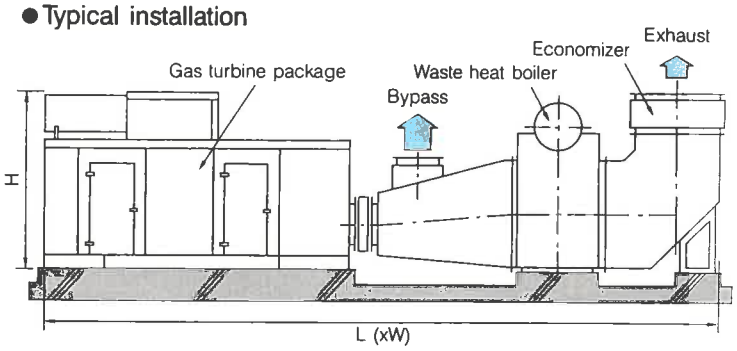
●System Specifications (Complete co-generation system)

Model	Turbine model	Fuel type	Output (kW)	Fuel consumption	Steam production		Air conditioning with steam			System dimensions (m)		
					Evaporation (kg/hr)	Hot water (Mcal/hr)	Chilling capacity (USRT)	Heating (Mcal/hr)	Hot water (Mcal/hr)	L	W	H
GPC06	S2A-01	Natural gas	620	265 Nm^3/hr	2,250	100	480	1,350	100	11.5	2.0	2.5
		Liquid fuel	600	260 kg/hr		—			—			
GPC15	M1A-13	Natural gas	1,430	505 Nm^3/hr	4,300	160	910	2,530	160	13.5	2.4	3.2
		Liquid fuel	1,400	493 kg/hr		—			—			
GPC30	M1T-13	Natural gas	2,800	1,016 Nm^3/hr	8,400	300	1,820	5,060	300	15.5	2.8	3.6
		Liquid fuel	2,700	981 kg/hr		—			—			

Above specs subject to change without notice.

Note: Conditions:
1. Ambient temp: 15°C
2. Altitude: 150 m above sea level
3. Inlet/Exhaust dust loss: 100/250 mmWg
4. Alternator efficiency: 93% (GPC 06), 95% (GPC 15/30)
5. LHV of fuel: natural gas 9,940 kcal/Nm^3. liquid fuel 10,100 kcal/kg
6. Waste heat boiler: steam pressure 830 kPa water supply temp. 60°C

●Typical installation

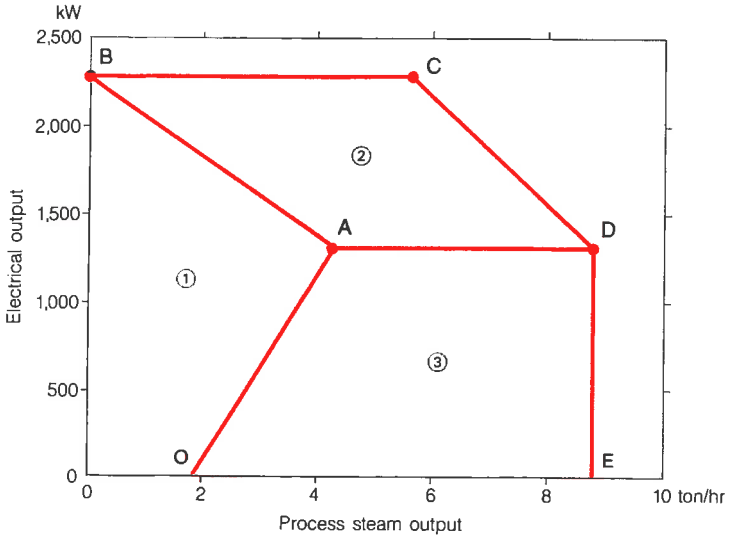


●GPCC15 System Specifications (Cheng-cycle co-generation system)

Natural gas (liquid fuel)

Item		Operating point A	B	With optional duct burner C	D
Output	kW	1,300 (1,250)	2,300 (2,230)	2,300 (2,230)	1,300 (1,250)
Injection steam	ton/hr	0.5 (0.5)	4.7 (4.5)	4.7 (4.5)	0.5 (0.5)
Process steam output	ton/hr	4.3 (4.0)	0 (0)	5.5 (5.3)	8.5 (8.2)
Turbine fuel	$\times 10^6$ kcal/hr	5.3 (5.3)	6.2 (6.1)	6.2 (6.1)	5.3 (5.3)
Supplemental fuel	$\times 10^6$ kcal/hr	0 (0)	0 (0)	3.6 (3.6)	2.6 (2.5)
Electrical efficiency	%	21.0 (20.5)	32.0 (31.5)	—	—
Overall efficiency	%	74.0 (70.0)	32.0 (31.5)	56.5 (55.5)	84.0 (82.0)

Note: Ambient temp.: 15°C
Ambient press: Sea level
Steam press: 1,520 kPa
Water supply temp.: 15°C
Fuel: Natural gas (liquid fuel)



① Variable steam injection rate and turbine firing temp. No supplemental firing.
② Variable steam injection and supplemental firing rates.
③ Variable turbine firing temp. and supplemental firing rate. No steam injection.