Notice

- Before using this equipment, read the Guide to Operations/Operating manuals, related manuals, and use the equipment correctly.
- The various usage conditions (temperature, voltage, humidity etc.), usage purposes (run time, applications etc.), functions (ranges, charactristics etc.), terminology and expressions given in this catalogue are based on Yanmar Energy System Co., Ltd. standards.
- Please confirm the product specifications by reviewing the specification, product drawings, operation manuals and other technical documentation.

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CERTIFICATION INTERNATIONAL ISO 14001:2004 Cert No: CI/5129E UKAS ENVIRONMENTAL MANAGEMENT 063

CERTIFICATION INTERNATIONAL ISO 9001:2000 Cert No: CI/5129 UKAS QUALITY MANAGEMENT 063

CE 0063 0063BT3337

- This catalogue is effective from August 2009.
- Specifications in this catalogue are subject to change without notice in order to incorporate improvements, etc.
- Product colours in this catalogue may differ slightly from those of actual products.

Printed in Japan
001H0-G00140 September 2009Ⓗ

YANMAR

Micro Cogeneration System
General Catalogue, September 2009

CP Series

Micro Cogeneration System

YANMAR ENERGY SYSTEM CO.,LTD.

COMPANY PROFILE

MISSION

We, the YANMAR group, strive to create new and meaningful value together in partnership with our worldwide customers.
We will be innovators and leaders in harnessing energy, while contributing to an environmentally sustainable society, through the delivery of unrivaled products and services.

MESSAGE

Total global system centred around customer satisfaction.

Yanmar's long experience and technical mastery of engine manufacturing has provided the base for the precise manufacture of a range of complete product systems.
Our efforts are devoted to ensuring that customers are fully satisfied with the performance of the unique products made by Yanmar.
Yanmar has created a total group system based around customer satisfaction to eusure the specialized capabilities of each part of the global Yanmar group are used to the full to provide perfect Yanmar brand function and guarantee.

Business Sectors — Yanmar Group

Industrial/ Construction Machine Sector

- Industrial engines
- Construction machines
- General-purpose equipment (Lighting equipment, Portable generators)

Marine Sector

- Pleasure boats, Fishing boats
- Marine system equipment
- Propulsion engines
  Auxiliary engines

Agricultural Sector

- Agricultural machines
- Hobby farm equipment
- Agricultural facilities

Environmental Sector

- Environmental equipment
- Environmental facilities
- Cool containers

Energy Sector

Yanmar Energy System Co., Ltd.

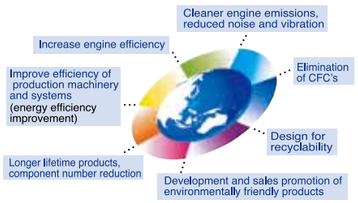
- Micro gas cogeneration systems
  - ・Natural gas
  - ・LP gas
  - ・Biogas
- Air conditioning systems
  - ・Gas engine heat pumps
- Power generating systems
  - ・Emergency diesel power generation systems
  - ・Pump drive systems
  - ・Cogeneration systems
  - ・Emergency gas turbine power generation systems
  - ・Continuous power generation systems
- Solar power plants

Overview of Yanmar Energy System Co., Ltd.

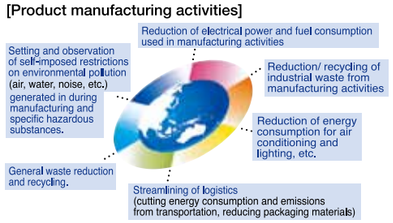
Yanmar's energy system business strives to offer power generation/drive/air conditioning systems best suited to customers' needs, with "energy", "ecology", and "economy" foremost in mind. The company also extends comprehensive support through the life cycle of each of these systems.

Global Environmental Charter: Yanmar Group's guiding principle to protect the global environment

[Product development activities]



[Product manufacturing activities]



ISO9001/14001

CERTIFICATION INTERNATIONAL — ISO 14001:2004 Cert No: CI/5129E — UKAS ENVIRONMENTAL MANAGEMENT 063
CERTIFICATION INTERNATIONAL — ISO 9001:2000 Cert No: CI/5129 — UKAS QUALITY MANAGEMENT 063

Awards in Japan for the Micro Cogeneration System (CP Series)

Received five awards between 2000 and 2009 for technology, reliability and marketability.

Awards in Japan for the 350 kW Cogeneration System

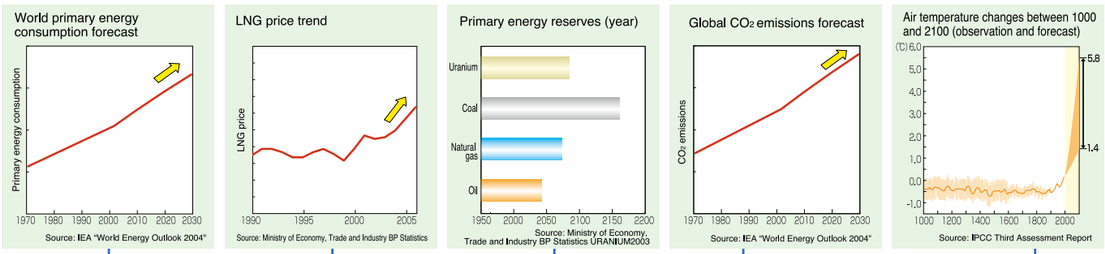
Excellent Energy-Saving Equipment Award (the Japan Machinery Federation President Award) in 2005

Awards in Japan for GHP Systems

Japan Gas Association Technology Award in 2002 for development of Geo-multi products
Japan Gas Association Technology Award in 2006 for development of ultra high efficient GHP products
Electric Utility Load Leveling Equipment and Systems Award (Promotion Award) in 2007 (by Heat Pump & Thermal Storage Technology Center of Japan)

Yanmar Micro Cogeneration Systems Use Advanc ed Technology to Concurrently Supply Electrical Power and Thermal Energy -Achieving High Efficie ncy, Cost Savings and Low Environmental Impact.

Yanmar cogeneration systems: considerate to people and the global environment



Global energy supply-demand problems

Global environmental problems

Highly efficient, clean gas cogeneration systems help overcome global energy demand-supply problems as well as global environmental problems.

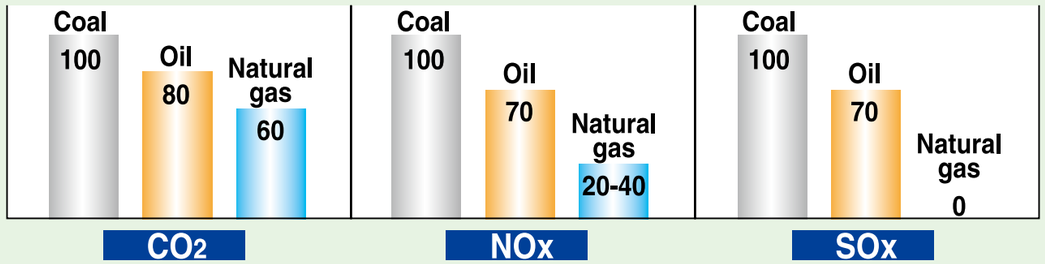
What is a micro cogeneration※1 (CHP※2)

By generating electrical power at the required location (on-site generation/distributed power) using a gas engine driven electrical power generator powered by fuel such as natural gas, which has a low environmental impact,we can reduce losses associated with electrical power transmission and use the heat energy that is produced for heating or cooling. This is micro cogeneration.

※1 Yanmar's Micro cogeneration definition: generating output is less than 100 kW
※2 CHP: Combined Heat and Power

Comparison of CO_2, NOx, SOx emissions

< Substance amounts generated by fossil fuels in combustion. (coal=100) >

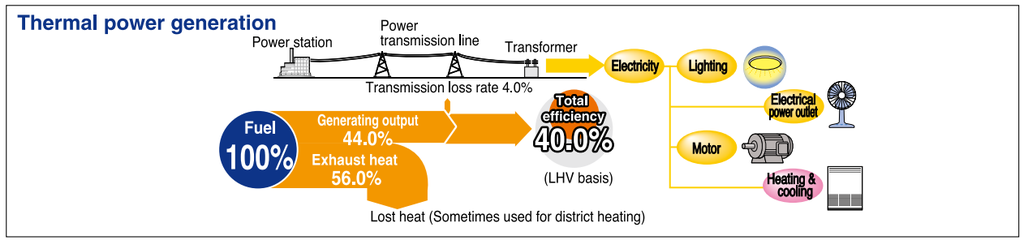


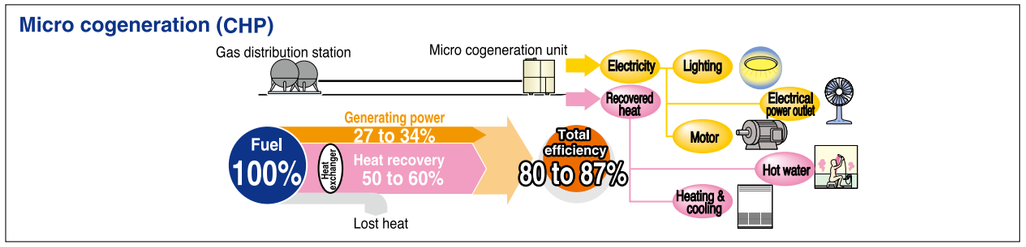
Natural gas is kinder to the environment than other fossil fuels, since the amount of CO_2, NOx and SOx etc. generated emissions are comparatively small.

Source: Natural Gas Prospects 2010, 1988/IEA

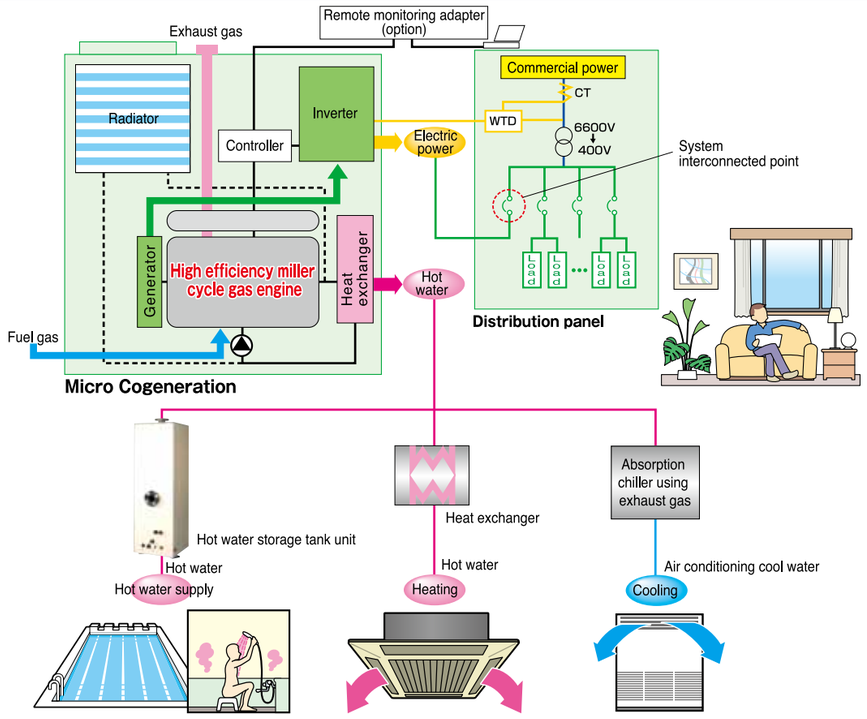
Comparison with a thermal power station

Cogeneration systems offer higher overall efficiency than typical conventional electrical power generation, this makes a great contribution to saving energy, cost reduction and reduced environmental impact (lower CO_2 emissions).





Micro cogeneration system example



Energy & cost savings

High efficiency contributes to energy and cost savings

1. Electricity + Effective waste heat usage system
2. High efficiency Lean-burn Miller cycle GAS ENGINE
   - Powered by YANMAR designed high performance gas engine.
3. High efficiency electrical POWER GENERATOR
   - Permanent magnetic high-frequency power generator
4. High efficiency INVERTER.
   - Reverse power type (standard)
   - Non reverse power type (option)

Environmental

1. Contributes to reduction of green house gas emissions.
   - Powered by natural gas clean fuel
   - Reduces the amount of primary energy consumption.
     This means reduction of CO_2 emissions.
2. Low operation noise
   - 4WE : 51dB (A)
   - 10WE : 54dB (A)
   - 25WE : 62dB (A)
     (at 1m distance, 1.2m height)
     Anechoic environment conversion value (with radiator fan stopped)

High reliability

- High quality
- Long maintenance interval
  10,000 Hours(Gas type : Natural Gas)
  6,000 Hours(Gas type : Biogas)
- 4,000 units of CP series have been installed in Japan. (5 kW, 9.9 kW, 25 kW, 35 kW)

Easy installation

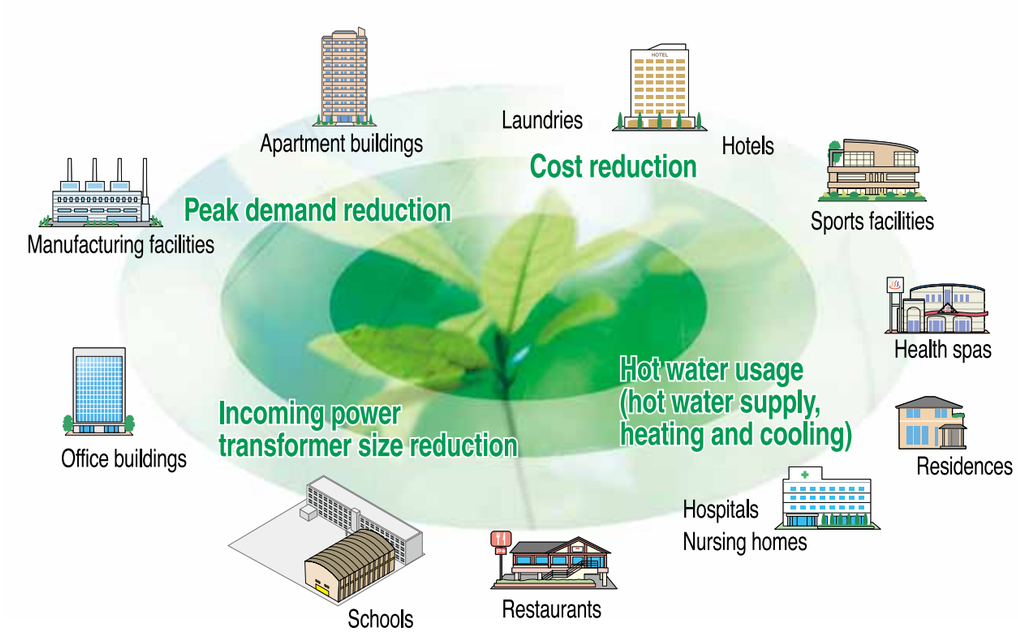
1. Easy grid connection using inverter
   - Grid connection relay and synchronisation device
   - Complies with G83 (UK connection guideline : CP4WE, CP10WE)
2. Wide range of equipment options

High functionality

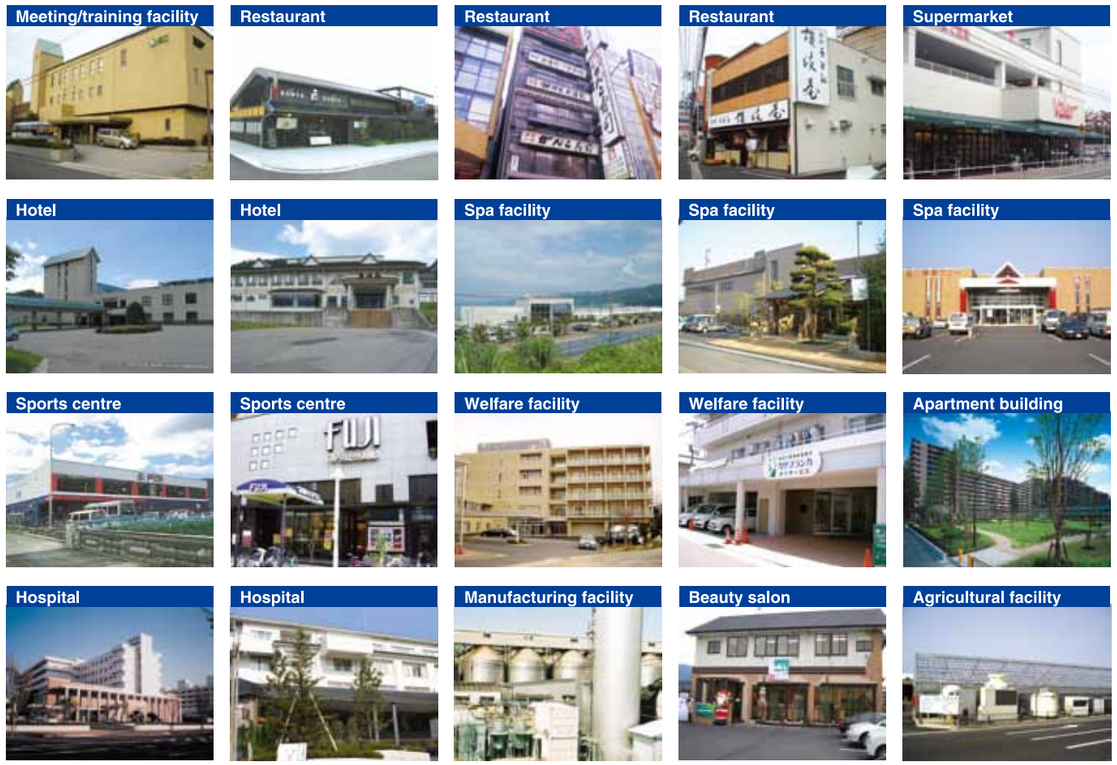
1. Advanced system controller
   - Operation schedule control
   - Operation rotation control/group control
   - Multiple-unit operation
   - Start & stop power demand control
   - Monitor functions
2. Remote monitoring system
   - Operating condition confirmation
   - Operational data confirmation
   - Operation reports

   Note: Separate contract is required.

Micro Cogeneration Applications



Applications (in Japan)

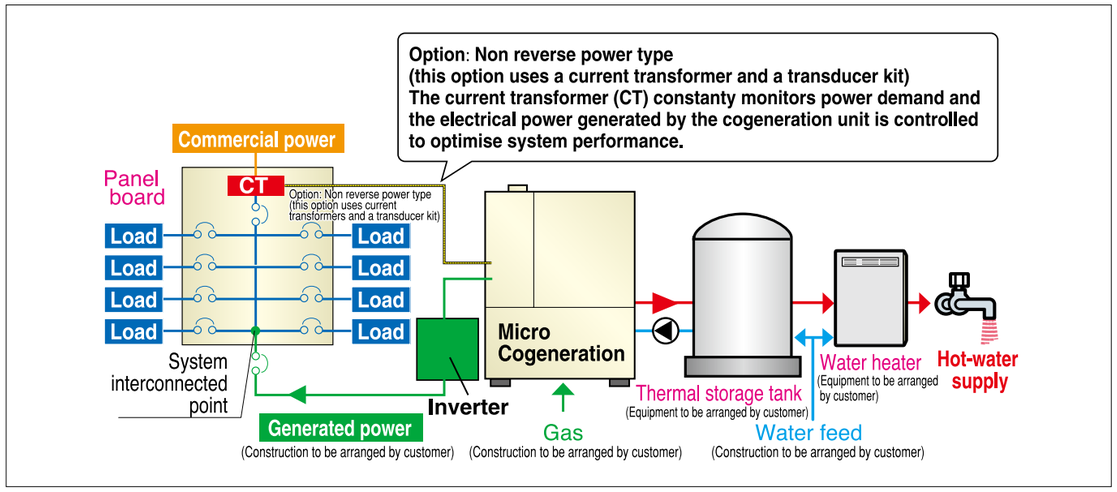


Lineup of CP W Series

CP W Series			CP4WE	CP10WE	CP25WE-TN	CP25WE-TL	CP25WE-TM	CP25WE-TF
OUTPUT	Rated output ※1	kW	3.87	10.00	25.00			
	Frequency	Hz	50	50	50			
	Voltage	V	230	400	400			
Electrical generation efficiency		%	26.7	30.7	33.5	33.0	31.7	30.7
Total efficiency		%	84.5	84.0	85.0	84.0	84.0	84.0
Exhaust heat recovery temperature		℃	65	70 (MAX78)	MAX85			
Operating sound levels ※2		dB (A)	51	54	62			
Transmission method		—	Inverter	Inverter	Inverter			
Number of phases / wires		—	Single phase / two wires	Three phases / four wires	Three phases / four wires			
Power control	Reverse power type	—	standard	standard	standard			
	Non Reverse power type	—	option	option	—			
Multiple unit operation			3 units schedule by group/ schedule rotation by unit	3 units schedule by group/ schedule rotation by unit	8 units schedule by group/ schedule rotation by unit			
Gas type		—	Natural gas group E,H	Natural gas group E,H	Natural gas group E,H	Natural gas group L,LL	Biogas type CH_4 density:80~90%	Biogas type CH_4 density:60~70%
Maintenance interval		Hours	10,000	10,000	10,000	10,000	6,000	6,000
Remote monitoring system ※3		—	option	option	option			
Ambient temperature	-5 to +40 ℃	—	standard	standard	standard			
	-15 to +40 ℃	—	option	option	option			

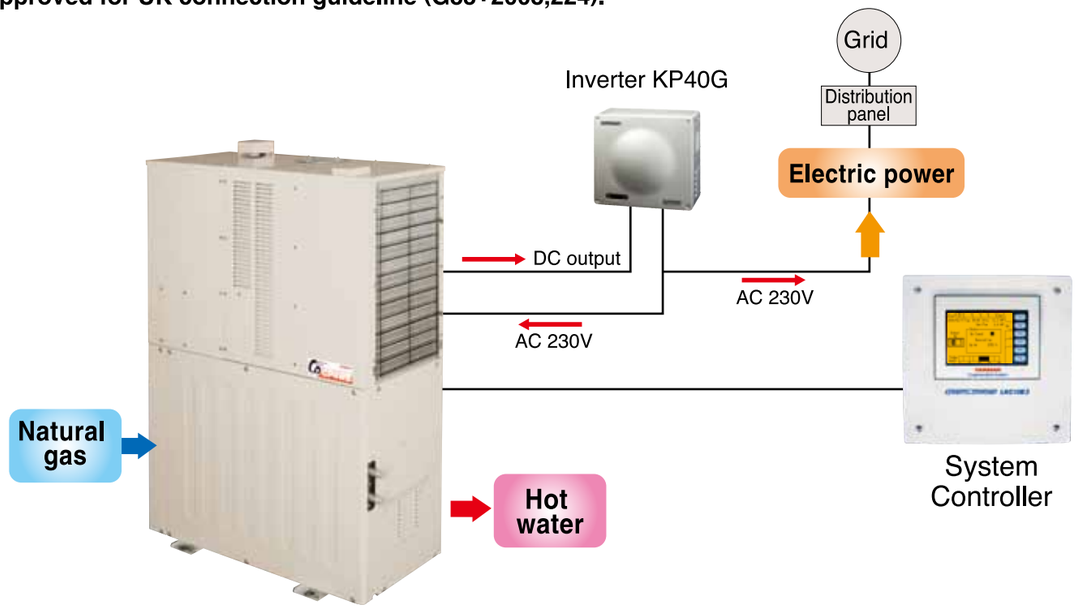
※1 Power consumption by the CP unit is included.
※2 Values are the maximum of anechoic readings measured in 4 directions at a point 1m from the unit, 1.2m above the ground with the heat exchanger fan off.
※3 Separate contract is required.

System Flow



CP4WE Inverter Interconnected Type

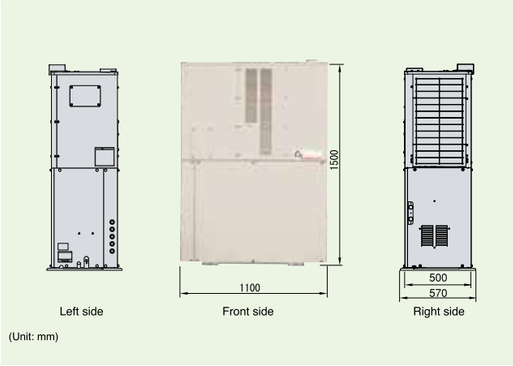
Approved for UK connection guideline (G83：2008,224).



Main Specifications

	Model		Unit	CP4WE
Output	Rated output		kW	3.87*1
	Frequency		Hz	50
	Voltage		V	AC230
	Current		A	16.0
	Phase/wires		–	Single phase, two wires
	Power factor		%	97 or more
Heat Recovery	Recovered heat		kW	8.38
	Hot-water temperature	Inlet	˚C	60
		Outlet	˚C	65
	Hot-water flow rate		L/min	24.3*2
Efficiency	Overall efficiency		%	84.5
	Electrical generation efficiency		%	26.7
	Exhaust heat recovery ratio		%	57.8
Sound Pressure Level	For rated load	Radiator fan stopped	dB (A)	51
		Radiator fan operating		53
		–		–
Power Supply	Voltage		ACV	230
	Startup current		A	13 (average electric current)
	Power consumption (rated)	Radiator fan stopped	kW	0.19
		Radiator fan operating	kW	0.28
		Space heater (below 5 ˚C)	kW	0.25 (for cold regions)
Fuel	Consumption (LHV basis)		kW	14.5*3
	Gas type		–	Natural gas(group E,H)
	Gas supply pressure		mbar	20
Dimensions	Width		mm	1,100
	Depth		mm	500 (570 including protrusions)
	Height		mm	1,500 (1,555 including cover)
	Net weight		kg	410 (including cooling water and lubricant)

Outline Drawing of Gas Cogeneration Main Unit



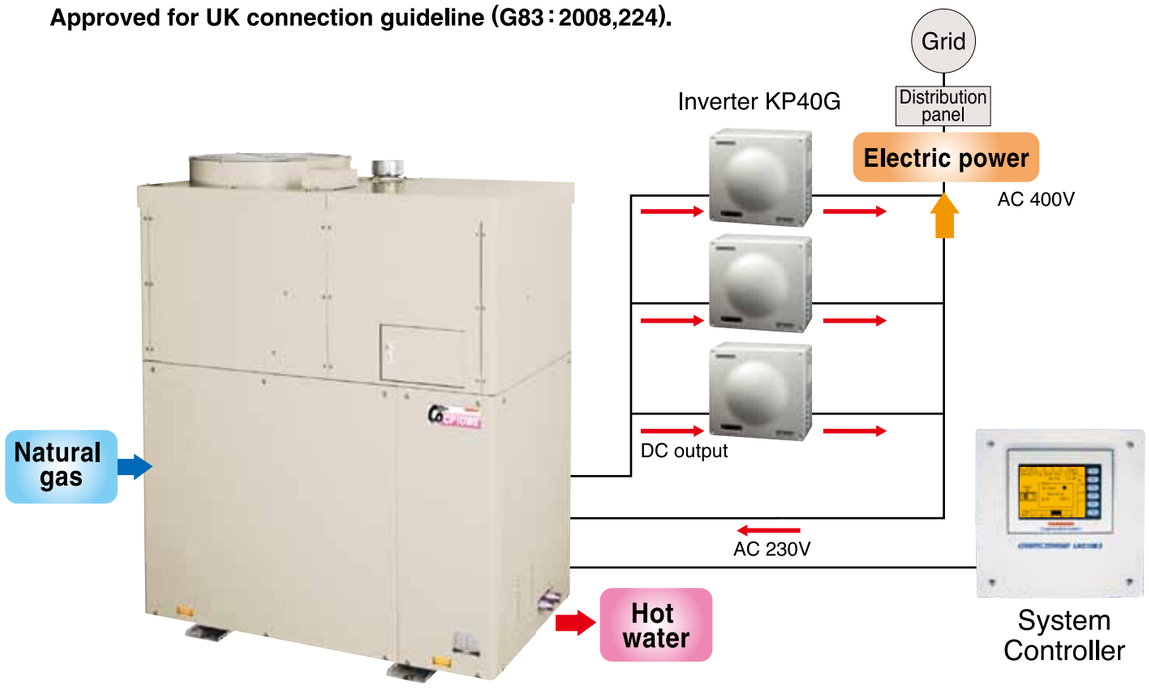
(1) The heat recovery and efficiency values are those for rated output in standard atmospheric conditions.
(2) The oeprating sound levels are maximum values measured in 4 directions at a point 1 m from the side of the unit and 1.2 m above the ground in an anechoic room simulation. The sound levels during actual operation are usually higher than the simulated values due to ambient noise and echoes.
(3) The values for the external dimensions do not include piping, piping connections, or protruding parts.
(4) The amount of fuel consumption is based on lower calorific values.
(5) As for G83, the examination was carried out by New and Renewable Energy Centre(NaREC) in U.K..
*1. Power consumption is included. *2. Max. of +5%; 25.5 L/min *3. Tolerance +5% is not included.

Options

Items	Type	Items	Type
Heater kit (for ambient temperature -5˚C to -15˚C)	HHC4W	Exhaust pipe extension joint	EKC4W
Anti vibration mount	BKC5B	Flexible exhaust pipe	JKC4W
System controller	LKC10B3UK	Drain syphon (short type, long type)	SPW1S, SPW1L
Wall mount box for system controller	RKC20C	Neutralizer (drain filter)	DFB19E
Remote monitoring adapter (wall mount type)	CLCW2B1	Radiator exhaust air direction change duct	FKA5B
Transducer kit (for non reverse power operation)	TRC4W		

CP10WE Inverter Interconnected Type

Approved for UK connection guideline (G83：2008,224).



Main Specifications

	Model		Unit	CP10WE
Output	Rated output		kW	10.00*1
	Frequency		Hz	50
	Voltage		V	AC400
	Current		A	14
	Phase/wires		–	Three phases, four wires
	Power factor		%	97 or more
Heat Recovery	Recovered heat		kW	17.3
	Hot-water temperature	Inlet	˚C	65
		Outlet	˚C	70 (MAX78)
	Hot-water flow rate		L/min	48.2*2
Efficiency	Overall efficiency		%	84.0
	Electrical generation efficiency		%	30.7
	Exhaust heat recovery ratio		%	53.3
Sound Pressure Level	For rated load	Radiator fan stopped	dB (A)	54
		Radiator fan operating		56
		–		–
Power Supply	Voltage		ACV	230
	Startup current		A	22.6 (average electric current)
	Power consumption (rated)	Radiator fan stopped	kW	0.28
		Radiator fan operating	kW	0.53
		Space heater (below 5 ˚C)	kW	0.50 (for cold regions)
Fuel	Consumption (LHV basis)		kW	32.6*3
	Gas type		–	Natural gas(group E,H)
	Gas supply pressure		mbar	20
Dimensions	Width		mm	1,470
	Depth		mm	800 (900 including protrusions)
	Height		mm	1,790
	Net weight		kg	790(including cooling water and lubricant)

Outline Drawing of Gas Cogeneration Main Unit

(1) The heat recovery and efficiency values are those for rated output in standard atmospheric conditions.
(2) The oeprating sound levels are maximum values measured in 4 directions at a point 1 m from the side of the unit and 1.2 m above the ground in an anechoic room simulation. The sound levels during actual operation are usually higher than the simulated values due to ambient noise and echoes.
(3) The values for the external dimensions do not include piping, piping connections, or protruding parts.
(4) The amount of fuel consumption is based on lower calorific values.
(5) As for G83, the examination was carried out by New and Renewable Energy Centre(NaREC) in U.K..
*1. Power consumption is included. *2. Max. of +5%; 50.6 L/min *3. Tolerance +5% is not included.

Options

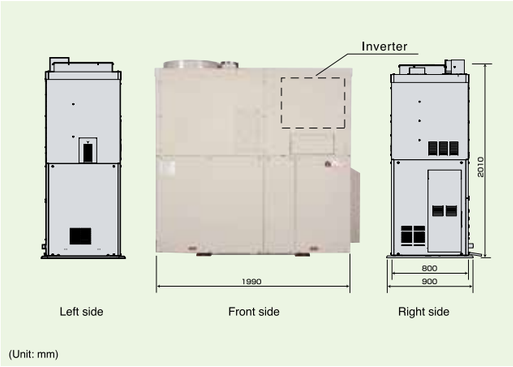
Items	Type	Items	Type
Heater kit (for ambient temperature -5˚C to -15˚C)	HHC10W	Exhaust pipe extension joint	EKC10W
Anti vibration mount	BKC10B1	Flexible exhaust pipe	JKC10W
System controller	LKC10B3UK	Drain syphon (short type, long type)	SPW1S, SPW1L
Wall mount box for system controller	RKC20C	Neutralizer (drain filter)	DFB19E
Remote monitoring adapter (wall mount type)	CLCW2B1	Radiator exhaust air direction change duct	FKA10B
Transducer kit (for non reverse power operation)	TRC10W		

CP25WE-TN･TL Inverter Interconnected Type

Main Specifications

	Model		Unit	CP25WE-TN	CP25WE-TL
Output	Rated output		kW	25.00*1	
	Frequency		Hz	50	
	Voltage		V	AC400	
	Current		A	35.4	
	Phase/wires		–	Three phases, four wires	
	Power factor		%	97 or more	
Heat Recovery	Recovered heat		kW	38.4	38.7
	Hot-water temperature	Inlet	˚C	70	
		Outlet	˚C	75（MAX85）	
	Hot-water flow rate		L/min	110*2	
Efficiency	Overall efficiency		%	85.0	84.0
	Electrical generation efficiency		%	33.5	33.0
	Exhaust heat recovery ratio		%	51.5	51.0
Sound Pressure Level	For rated load	Radiator fan stopped	dB (A)	62	
		Radiator fan operating		64	
		–		–	
Power Supply	Voltage		ACV	230	
	Startup current		A	46.0（Mean current）/AC200V	
	Power consumption (rated)	Radiator fan stopped	kW	0.93	
		Radiator fan operating	kW	1.35	
		Space heater (below 5 ˚C)	kW	0.75	
Fuel	Consumption（LHV basis）		kW	74.6*3	75.8*3
	Gas type		–	Natural gas (group E,H)	Natural gas (group L,LL)
	Gas supply pressure		mbar	15-30	
Dimensions	Width		mm	2,150	
	Depth		mm	800 (900 including protrusions)	
	Height		mm	2,010 (2,060 including the exhaust outlet)	
	Net weight		kg	1,320 (including cooling water and lubricant)	

Outline Drawing of Gas Cogeneration Main Unit



(1) The heat recovery and efficiency values are those for rated output in standard atmospheric conditions.
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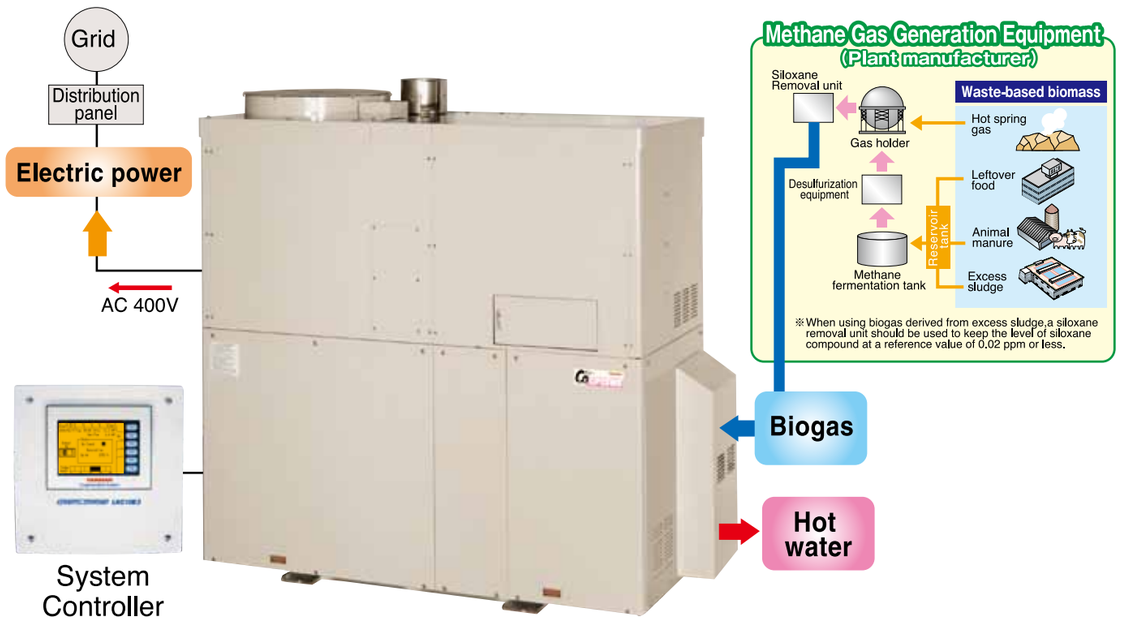
(3) The values for the external dimensions do not include piping, piping connections, or protruding parts.
(4) The amount of fuel consumption is based on lower calorific values.
*1. Power consumption is included. *2. Max. of +5%; 116 L/min *3. Tolerance +5% is not included.

Options

Items	Type	Items	Type
Heater kit (for ambient temperature -5˚C to -15˚C)	HHC25W	Exhaust pipe extension joint	EKC25W
Anti vibration mount	BKC25B	Flexible exhaust pipe	JKC25W
System controller	LKC10B3UK	Drain syphon (short type, long type)	SPW1S, SPW1L
Wall mount box for system controller	RKC20C	Neutralizer (drain filter)	DFB19E
Remote monitoring adapter (wall mount type)	CLCW2B1	Radiator exhaust air direction change duct	FKA25

Biogas type

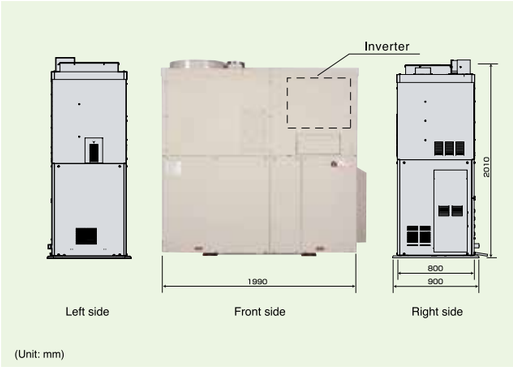
CP25WE-TM･-TF Inverter Interconnected Type



Main Specifications

	Model		Unit	CP25WE-TM	CP25WE-TF
Output	Rated output		kW	25.00*1	
	Frequency		Hz	50	
	Voltage		V	AC400	
	Current		A	35.4	
	Phase/wires		–	Three phases, four wires	
	Power factor		%	97 or more	
Heat Recovery	Recovered heat		kW	38.7	40.6
	Hot-water temperature	Inlet	˚C	70	
		Outlet	˚C	75（MAX85）	
	Hot-water flow rate		L/min	110*2	116*2
Efficiency	Overall efficiency		%	84.0	
	Electrical generation efficiency		%	33	32
	Exhaust heat recovery ratio		%	51.0	52.0
Sound Pressure Level	For rated load	Radiator fan stopped	dB (A)	62.0	
		Radiator fan operating		64.0	
		–		–	
Power Supply	Voltage		ACV	230	
	Startup current		A	46.0	
	Power consumption (rated)	Radiator fan stopped	kW	0.93	
		Radiator fan operating	kW	1.35	
		Space heater (below 5 ˚C)	kW	0.75	
Fuel	Consumption（LHV basis）		kW	75.8*3	78.1*3
	Gas type		–	Biogas CH_4 density 80～90%	Biogas CH_4 density 60～70%
	Gas supply pressure		mbar	15-25	
Dimensions	Width		mm	2,150	
	Depth		mm	800 (900 including protrusions)	
	Height		mm	2,010 (2,060 including the exhaust outlet)	
	Net weight		kg	1,320 (including cooling water and lubricant)	

Outline Drawing of Gas Cogeneration Main Unit



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(3) The values for the external dimensions do not include piping, piping connections, or protruding parts.
(4) The amount of fuel consumption is based on lower calorific values.
*1. Power consumption is included. *2. Max. of +5%; 116 L/min *3. Tolerance +5% is not included.

Options

Items	Type	Items	Type
Heater kit (for ambient temperature -5˚C to -15˚C)	HHC25W	Exhaust pipe extension joint	EKC25W
Anti vibration mount	BKC25B	Flexible exhaust pipe	JKC25W
System controller	LKC10B3UK	Drain syphon (short type, long type)	SPW1S, SPW1L
Wall mount box for system controller	RKC20C	Neutralizer (drain filter)	DFB19E
Remote monitoring adapter (wall mount type)	CLCW2B1	Radiator exhaust air direction change duct	FKA25

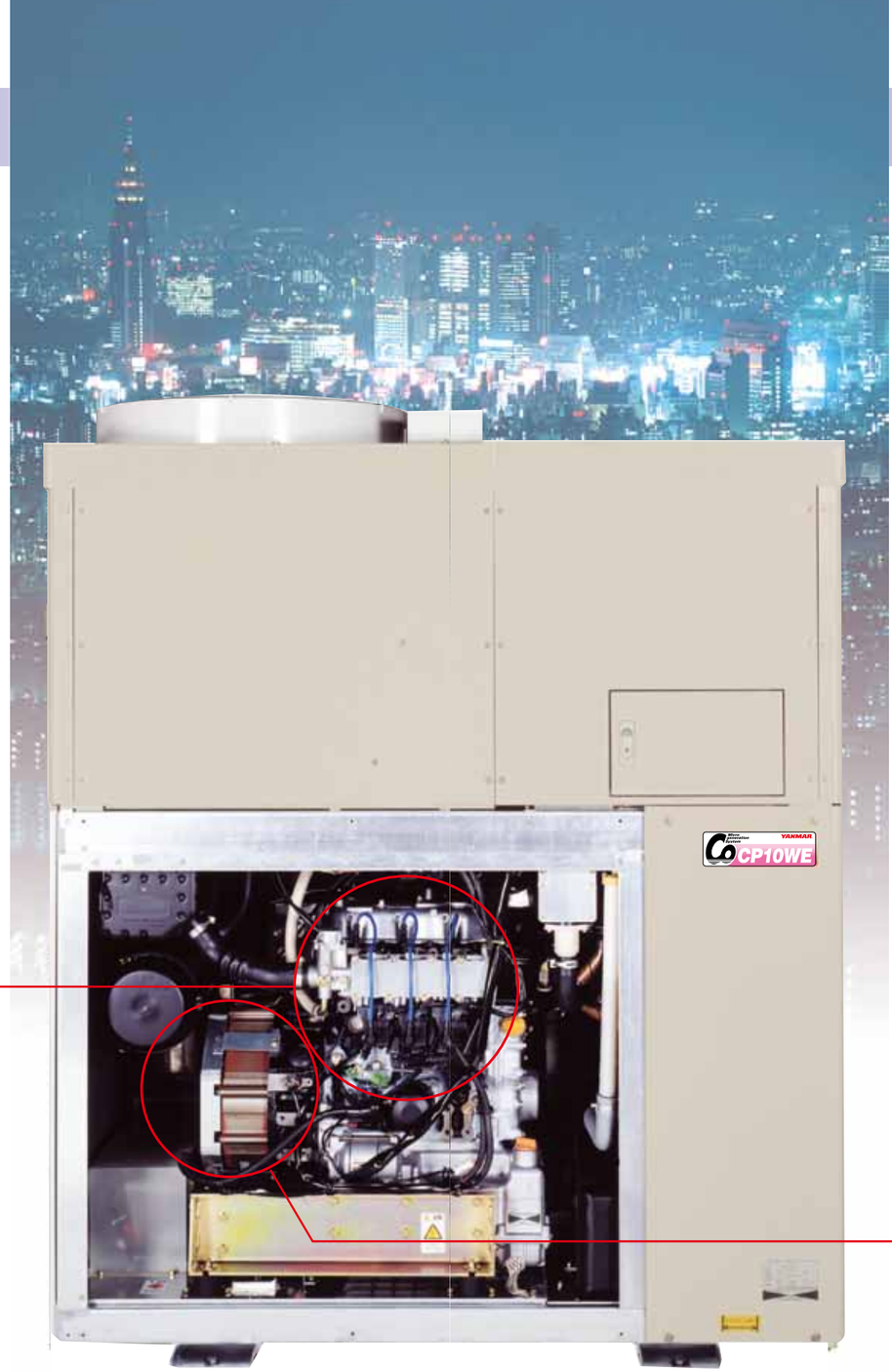
Gas Engine

Technologically Advanced and Reliable Lean-burn Miller Cycle Gas Engine

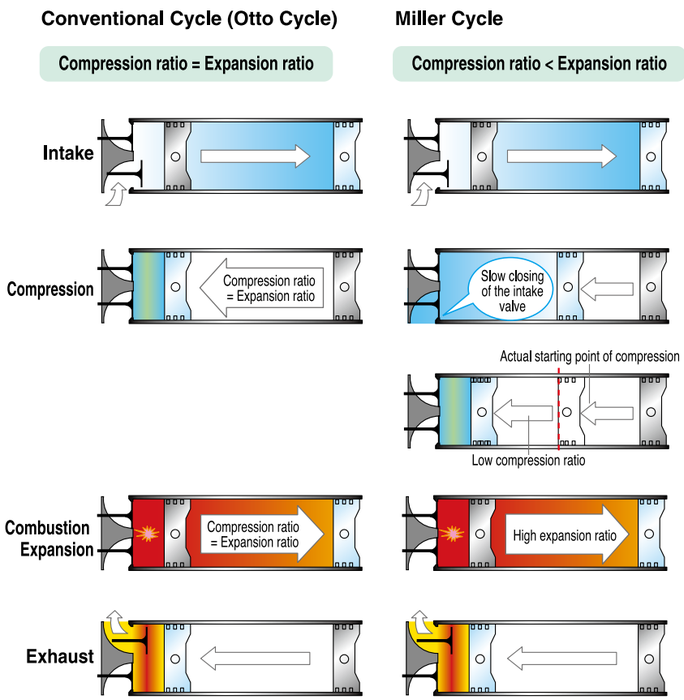
This engine's basic features include accurate rhythm and power performance, generated by a special piston.

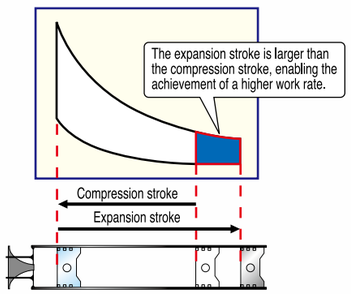
The lean-burn system optimizes ignition timing and matches the excess intake air, this reduces NOx and gives low-fuel consumption.
Furthermore, the adoption of the Miller Cycle type engine creates even higher operating efficiency. The engine offers a maintenance interval of 10,000※1 or 6,000※2 hours, which is one of the industry's longest for a cogeneration gas engine.

※1 : Natural gas type
※2 : Biogas type



Miller Cycle



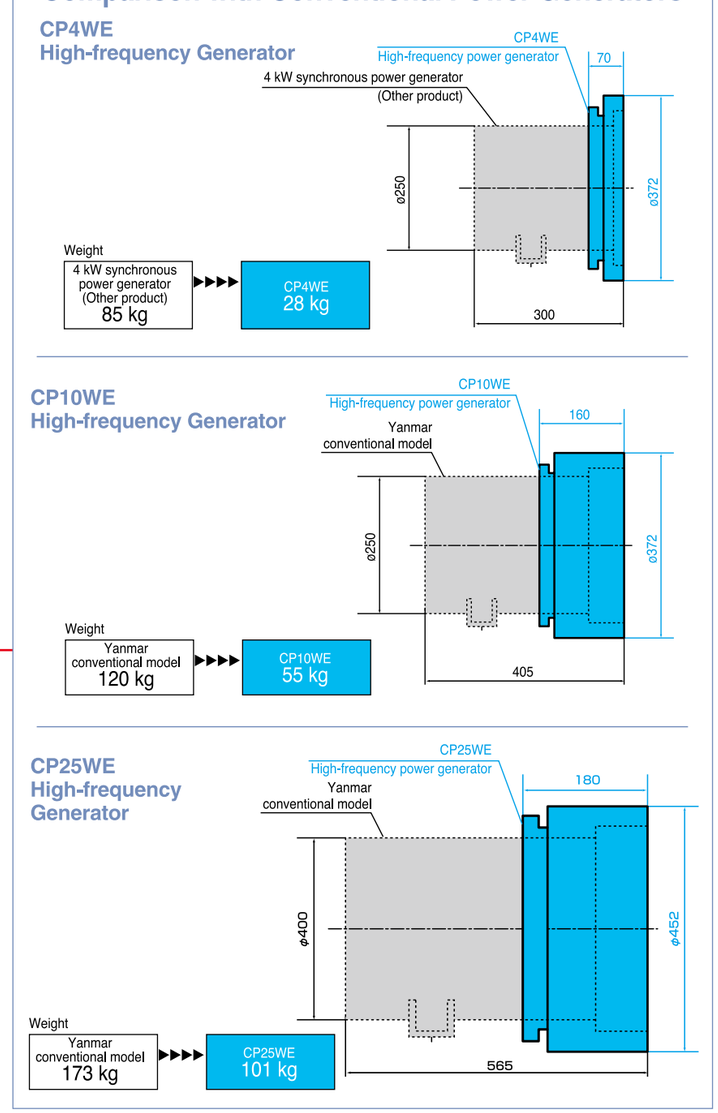


Generator

Compact and High-performance

The CP Series, which has a higher performance compared to existing generators, has realized a generating efficiency of over 90%. YANMAR has succeeded in making lighter and more compact generators.

Comparison with Conventional Power Generators



Inverter

Inverter Cogeneration Package

The blending of generated power and commercial power is made possible by inverter linking.

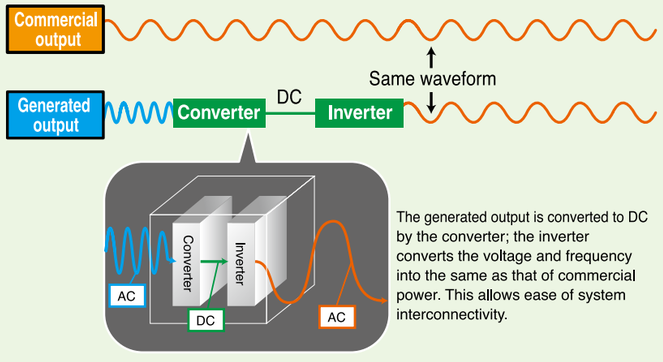
The innovation of the CP Series is demonstrated by its unprecedented inverter linking and the inverter's built-in protective relay. This makes system linking to commercial power easy, and has resulted in the reduction of initial cost and engineering work.
This inverter has an industry-leading conversion efficiency. It has made the utilization rate of compact generators 100%, which had been difficult to attain.

CP4WE, CP10WE Inverter

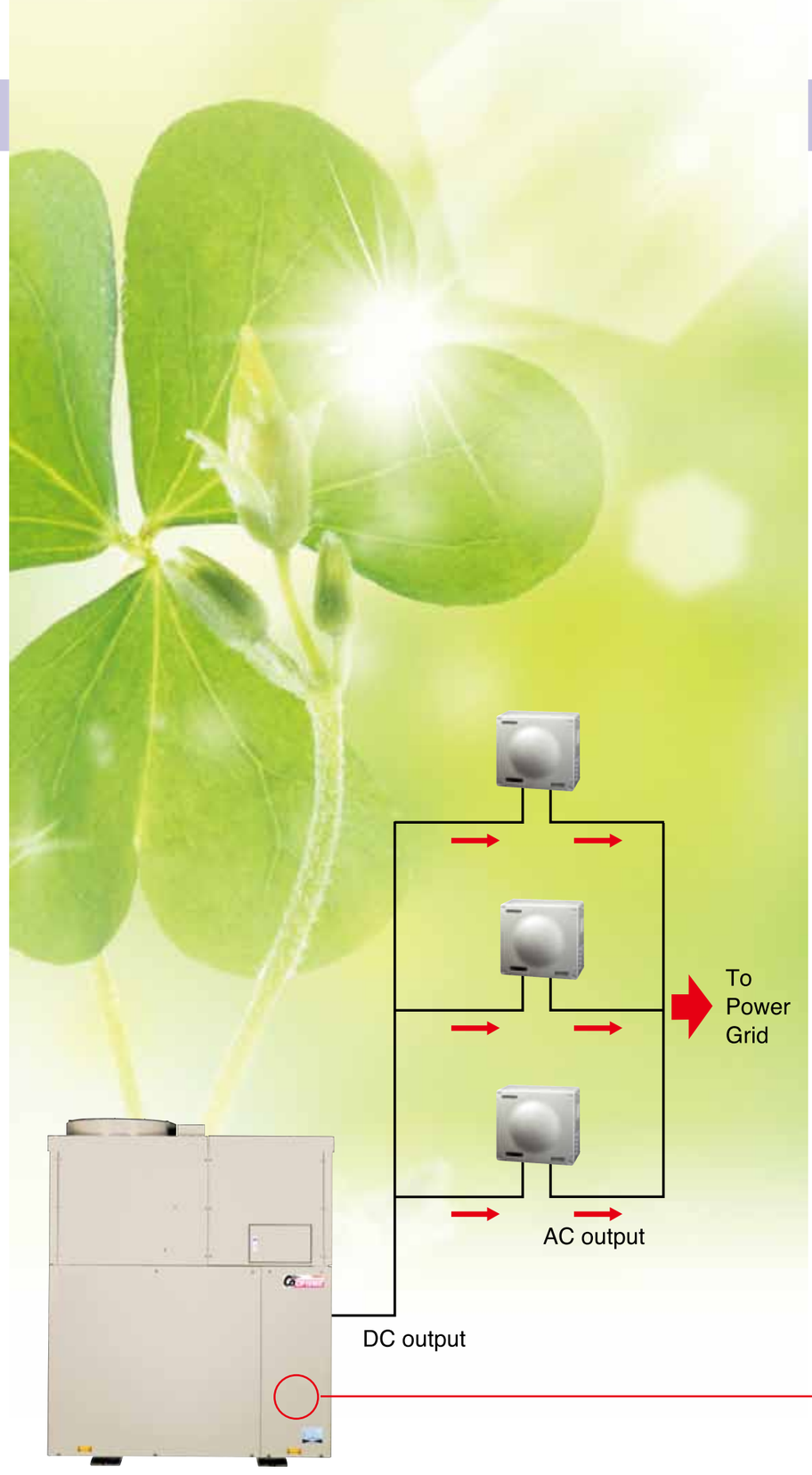
Rated capacity	4 kW ※1
Number of output phase	CP4WE:Single phase two-wires system CP10WE:Three phase four-wires system
Protective relay for linking	Overvoltage, undervoltage, frequency increase, frequency decrease reverse power protection(option), detection of individual operation

※1 Power consumpion is included.

Configuration and Image



The generated output is converted to DC by the converter; the inverter converts the voltage and frequency into the same as that of commercial power. This allows ease of system interconnectivity.



Heat Exchanger

The Development of the Extremely Compact Heat Exchanger

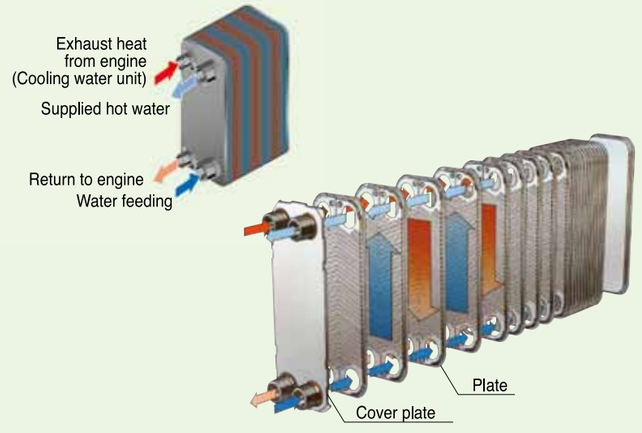
The real significance of cogeneration package is to utilize engine exhaust heat as energy.

The development can be seen even in the heat exchanger, which is the core of the CP Series.
The CP Series units adopt a brazed heat exchanger, which is approximately one fifth more compact than conventional tubular heat exchanger for the same performance.
The CP Series units do not need rubber gaskets or clamping bolts that conventional models need, and corrosion resistance and heat resistance have been dramatically improved.

Brazed Heat Exchanger

Material of plate	SUS316
Material of cover plate	SUS316

Configuration and Flow



System Controller

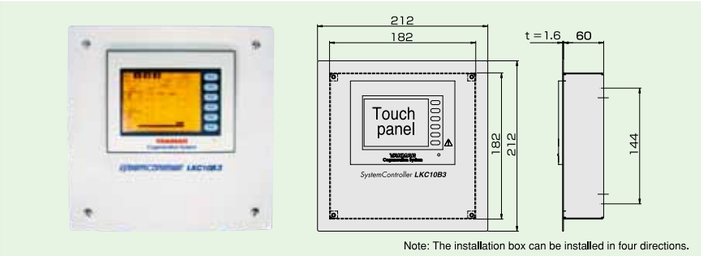
Seeking the best balance

This energy balance is achieved by the action of the CP series system controller.

The CP series system controller constantly monitors power demand and controls the CP system output to achieve the optimum balance between power demand and CP system power output. With remote power monitoring capability and calendar-based operation set easily via the large sized touch sensitive LCD screen, the CP series system controller ensures that CP series operation can be seamlessly matched to the needs of the user.

※1 Non reverse power type(option)

LKC10B3UK



Setting functions
- Scheduled operation
- Manual operation
- Holiday setting
- Operation start power, operation stop power
- Multiple unit operation (number of units, rotation, group operation)
- Buzzer on/off

Monitor functions
- Setting values, setting value confirmation
- Running data (generated power, incoming power, voltage, current etc.)
- Alarm displays (history, alarm condition, reset condition)

Alarm setting functions
*Only for resettable alarms
(Please refer to the operation manual for details)

Emergency stop functions

maximum number of units

	CP4WE	CP10WE	CP25WE
LKC10B3UK	3	3	8

System Controller Screen Image

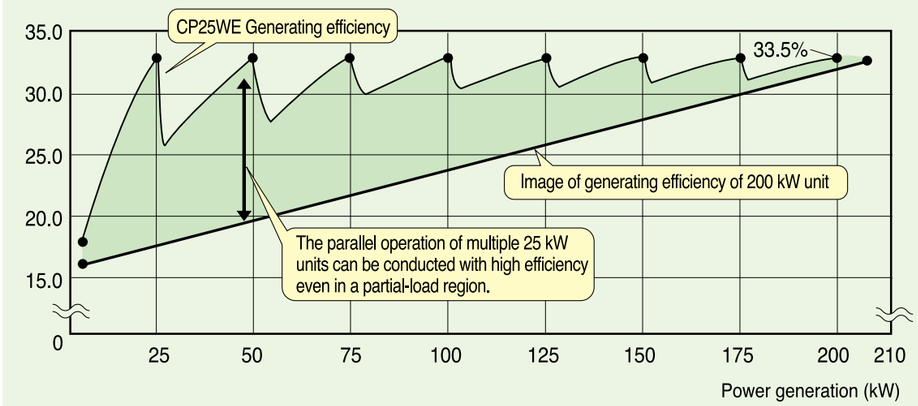
Single unit operation screen | Multiple unit operation screen | Multiple unit operation setting screen | Scheduled operation setting screen | Calender setting screen | Alarm display screen

Key Advantages of Cogeneration Systems

Control of Multiple-unit Operation

The system controller (sold separately) enables the use to control the operation of multiple units (up to 8 units). High-efficiency operation on partial load is possible by controlling the number of units in operation.

Generating Efficiency (%) for CP25WE



Rotation operation balances the operating hours of each unit, this enables the maintenance costs are reduced by being able to do maintenance on all the units during the same maintenance period.
The appropriate number of units for the required load operate, and units are operated on a rotation basis in order to keep the operating hours of each unit nearly equal.

Example of rotation operation by 3 units