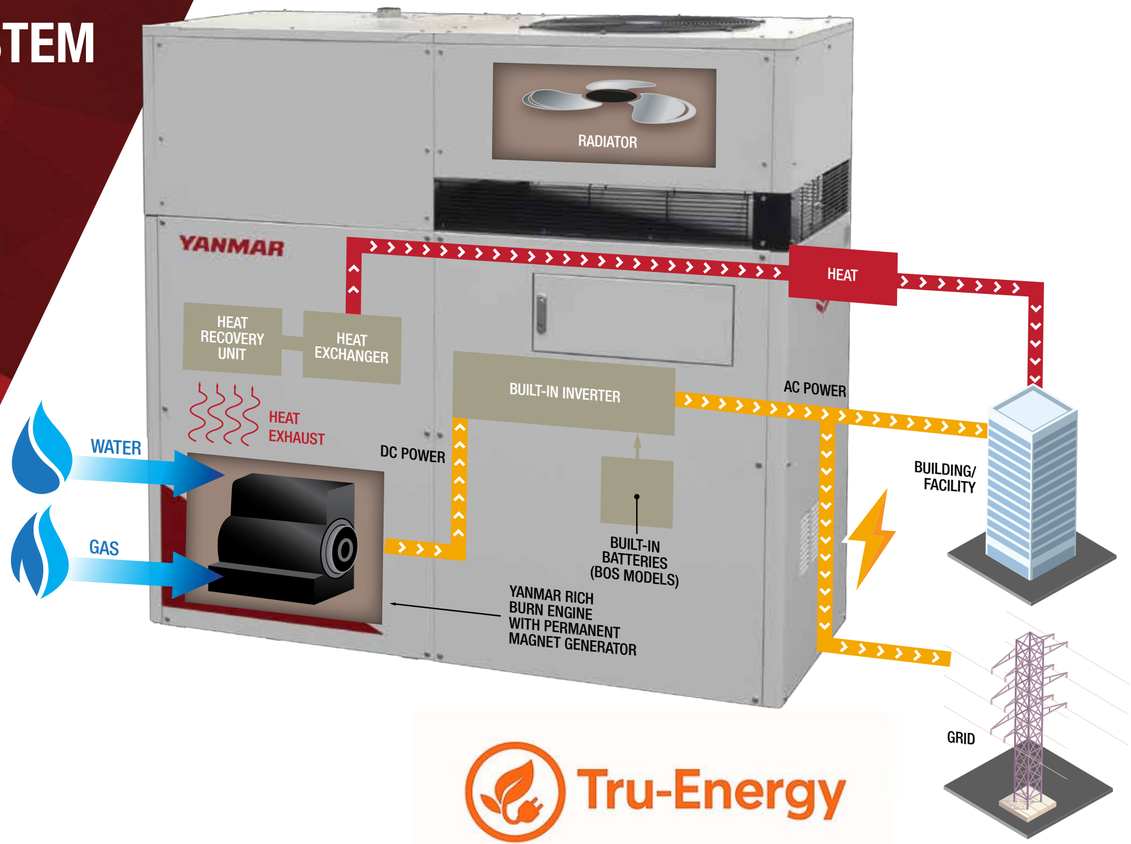

YANMAR
Now offered by
Tru-Energy
A DIVISION OF
HELIOS MECHANICAL SERVICES
TRU-ENERGY
COMBINED HEAT AND
POWER SYSTEMS
by Yanmar
www.Tru-Energy.ca

YANMAR'S COMBINED HEAT AND POWER SYSTEM

A DIFFERENT MINDSET = GAME CHANGER

When thinking about heat and power for commercial buildings, traditionally two important, but separate, systems come to mind—one for hot water and one for electricity. YANMAR's Combined Heat and Power (CHP) system revolutionizes this by combining two independent functions into one comprehensive system. Using natural gas, YANMAR's CHP system generates heat with on or off-grid electricity as a by-product of this process.

When compared to using hot water boilers in conjunction with conventional power from the grid, our environmentally-friendly system is over 50% more efficient. Whether you are replacing your current systems or supplementing your established configuration to take advantage of the many benefits of CHP, our system provides significant cost savings over its lifecycle.



CHP BENEFITS

// RELIABILITY

The CHP system utilizes the same high-quality engine YANMAR is known for worldwide, offering superior power and trusted reliability. When combined with our CHP system modularity and minimal maintenance requirements, you experience reliable, uninterrupted heat and power.

// HOT WATER AT A FRACTION OF THE COST

In conventional systems relying on centralized power plants, the thermal energy created goes unused. With the CHP system, heat is created, and can be used to heat or pre-heat domestic hot water, for radiant heating, for desiccant dehumidification or other purposes.

// MAXIMUM EFFICIENCY

YANMAR's CHP system generates electrical energy at the point of use, your building. By avoiding transmission and distribution losses that occur when electricity travels over power lines, the CHP system is more efficient than centralized power.

// ENERGY INDEPENDENCE

The CHP system ensures electricity is available to your building(s) even when the grid fails or in remote areas.

// ENVIRONMENTALLY RESPONSIBLE

The CHP system is powered by clean natural gas, lowering your primary energy consumption and reducing your greenhouse gas emissions by up to 50% when compared to conventional means.

// EASE OF INTEGRATION

Our modular CHP system installs simply, and integrates into a variety of existing thermal and electrical systems. Plus, the built-in inverter makes for an easier connection to the grid.

MAXIMUM ENERGY EFFICIENCY

USING YANMAR'S ADVANCED TECHNOLOGY, THE CHP SYSTEMS ARE DESIGNED FOR HIGH EFFICIENCY AND REDUCED LIFECYCLE COSTS.

YANMAR's CHP systems thermal energy recovery technology captures the heat created when the system generates electricity. While this heat is typically wasted during conventional power generation (gen sets), CHP system effectively recovers it, avoiding energy losses that stem from the generation of heat and power from separate systems. This energy can then be used to heat or to pre-heat your domestic water supply, provide radiant heating or assist with desiccant dehumidification.

Because our CHP system was designed to generate heat and electricity at the point of use, it also prevents the 60% or more energy loss that occurs when electricity travels over power lines. Additionally, our system relies on built-in, high-efficiency components, including a proven rich burn YANMAR natural gas engine, permanent magnet generator and inverter for high reliability and lower installation and building integration costs. In fact, our inverter matches the power it generates with centralized power.

When you combine these factors, the YANMAR CHP system's overall efficiency is 88%, which translates to reduced operating costs and a greater return on investment over the life of the system.

ENVIRONMENTALLY RESPONSIBLE

YANMAR's CHP system can reduce your carbon footprint (CO_2 emissions) by as much as 50% compared with conventional energy generation.

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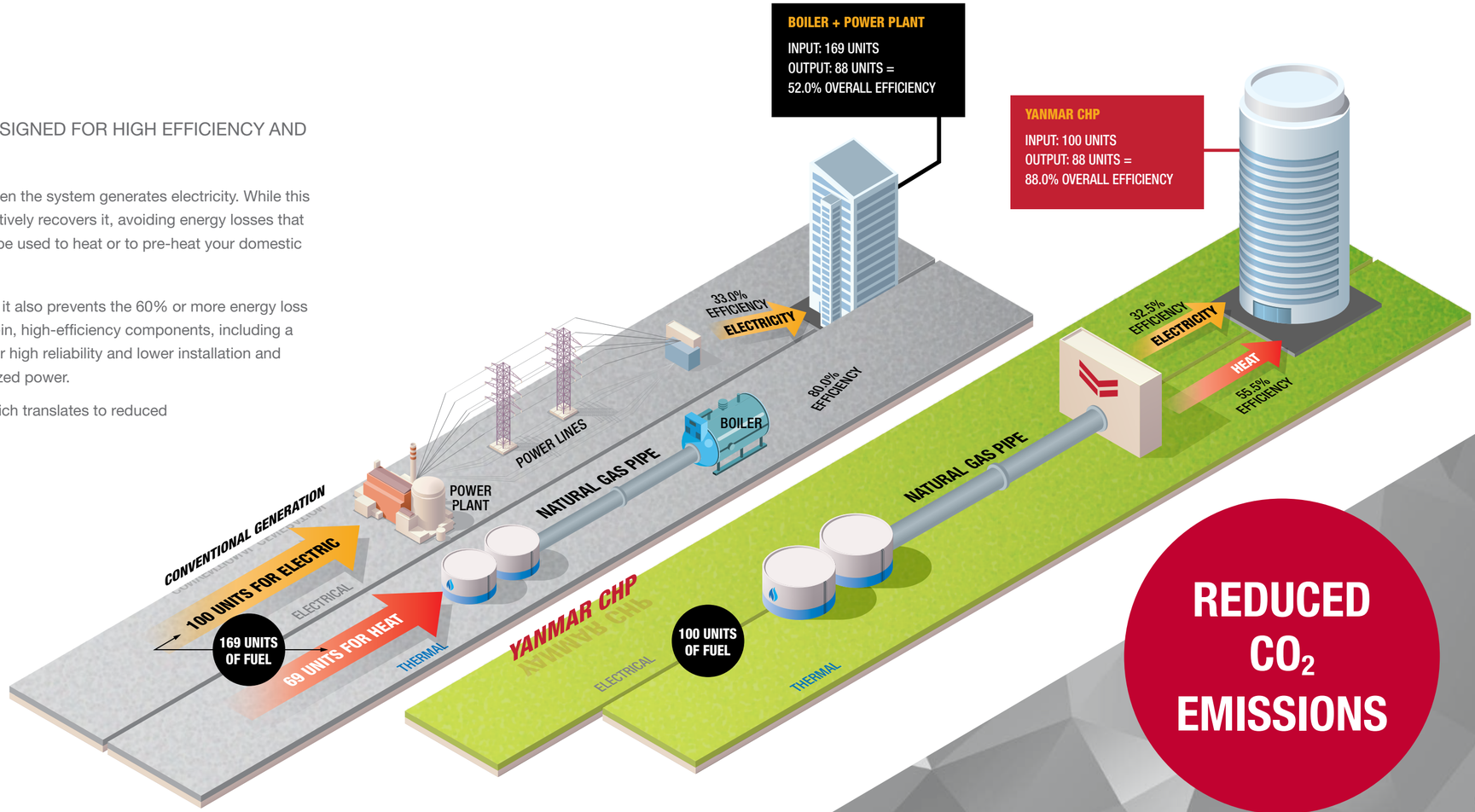


REDUCED CO_2 EMISSIONS

ENERGY INDEPENDENCE

CP35D

Designed for use in multi-unit housing, hotels, restaurants, office buildings and other commercial facilities, YANMAR's 35 kW CHP units produce heat with electricity as the by-product. The CP35D provides water at an outlet temperature of up to 190º and at a high flow rate of 46.5 gallons per minute (GPM).

It can act also as your primary power source, so that you are no longer solely reliant on the grid for electrical energy. Depending on the amount of power and energy needed, your building(s) may require one or multiple units to comprise the system, as well as a synchronization device for grid interconnections. These models are UL2200, CSAC22.2 No 14-13, CSAC22.2 No 100-04 and UL1741SA1547 certified.

CP35D units are flexible, so that they can be implemented into new construction as well as retrofitted into older buildings. With retrofitting, a system can be used in conjunction with your current hot water heating system and/or with the grid, or you can use it to replace these systems entirely.

CP35D(Z)

UNINTERRUPTED POWER EVEN DURING A BLACKOUT

YANMAR's CP35D(Z) unit features Blackout Start, ensuring your heat and electricity remain uninterrupted even during a blackout. YANMAR's high-efficiency built-in inverter converts the CHP's generated electrical output into DC voltage and frequency with built-in protection, and the ability to provide complete power for buildings located in remote areas or off-grid.

YANMAR CP35D

QUIET OPERATION

With an operational noise output of only 63 dB(A), YANMAR's 35 kW CHP system is extremely quiet, working well in both indoor and outdoor environments. Our anti-vibration mount provides an additional level of noise reduction, resulting in quiet performance that goes undetected.

INSTALLATION VERSATILITY

YANMAR's compact, modular CP35D units can be combined to form a larger CHP system for use across multiple buildings or a variety of configurations.

RADIATOR-FREE OPTION

For indoor installations such as mechanical and boiler rooms where connecting existing ductwork or installing new ductwork is not possible, we offer a radiator-free option for both our standard and blackout start models.

EDUCATION FACILITIES

HOSPITALITY

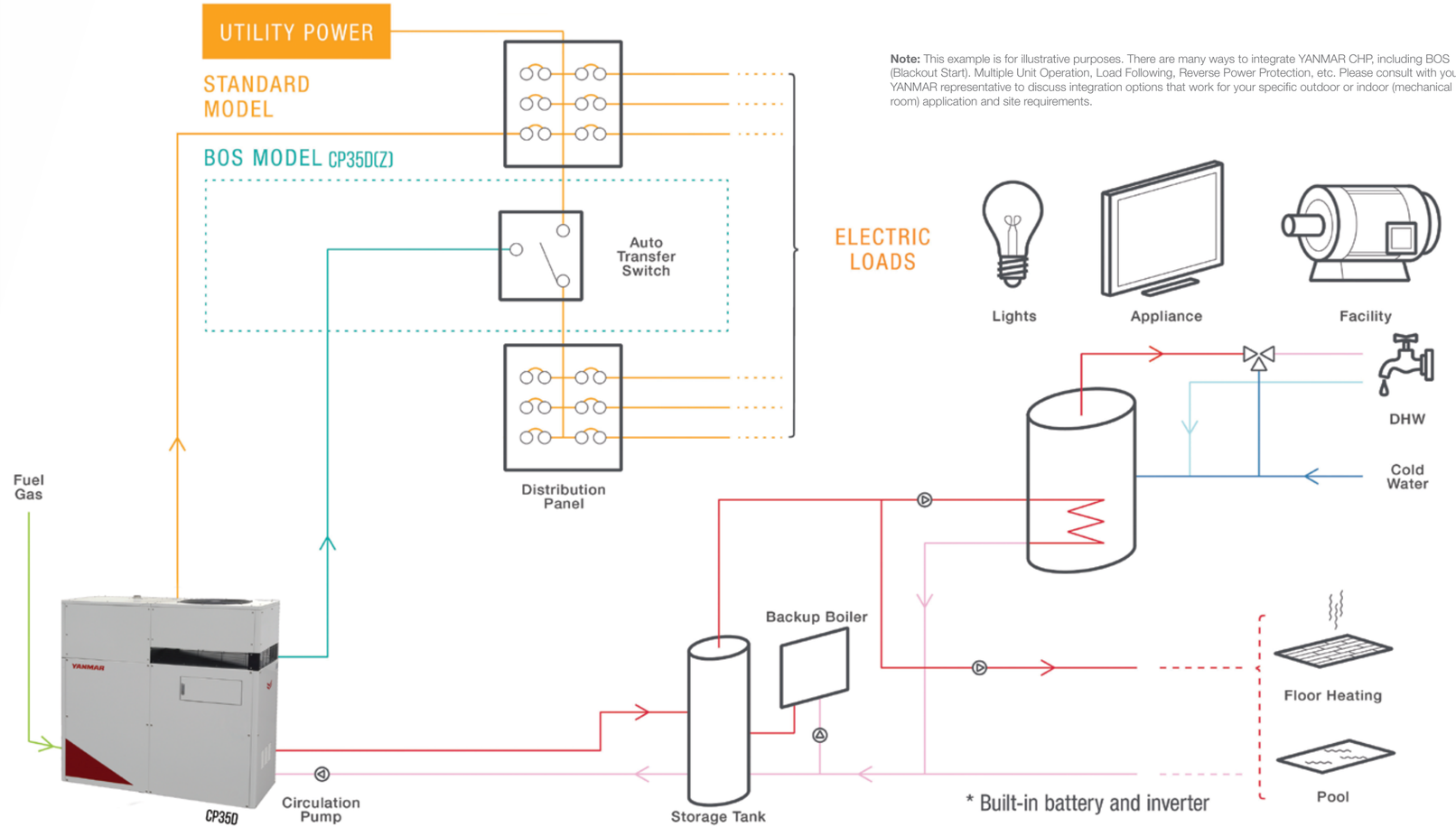
MULTI-UNIT HOUSING

OFFICE BUILDINGS

BUILDING CONFIGURATION

CHP technology can be used in almost every province, though the technology is mainly found in areas with high concentrations of commercial activity, high electricity prices and energy policies that favor Combined Heat and Power. CHP is ideally suited for facilities that have a high demand for heat
(a high thermal load) and in areas where electricity costs more than $0.10 per kilowatt-hour.

However, even in less-urban areas where power loss is a greater concern, there are no worries with YANMAR's CHP technology. Because even in the case of electricity loss, our machines are black start capable – without access to a power grid they switch seamlessly to natural gas and provide their own power. Who needs a grid with all that power already right at your fingertips?



Note: This example is for illustrative purposes. There are many ways to integrate YANMAR CHP, including BOS (Blackout Start). Multiple Unit Operation, Load Following, Reverse Power Protection, etc. Please consult with your YANMAR representative to discuss integration options that work for your specific outdoor or indoor (mechanical room) application and site requirements.

ACCESSORIES

We have several accessories to customize your CHP installation. Below are two main accessories related to system operation and monitoring. For more information on all of our accessories, please visit www.Tru-Energy.ca

System Controller

- // Displays system performance on main screen
- // Flexible scheduling of system operation during holidays/vacations
- // Allows peak shaving for reduced electrical consumption
- // Enables synchronized service of all units by rotating unit operation daily
- // Select heat or electrical operation to maximize savings and benefits
- // Improves troubleshooting accuracy for minimal interruptions in operation

Remote Monitoring System

- // Convenient off-site system monitoring 24/7/365 via the Internet
- // Enables off-site troubleshooting by notifying your YANMAR service provider of any issues
- // Signals when to schedule maintenance
- // Enables users to run daily, monthly and annual operation reports, including running hours, heat output, power output and start/stop times
- // Calculates cost savings and greenhouse gas emission reductions over time

HOW MUCH CAN YANMAR SAVE YOU?

Find out by asking your Tru-Energy representative for a customized site performance summary. Based on your potential system configuration, usage patterns, utility costs, taxes, incentives and other important data, we can calculate your short and long term savings by month or year. We'll even show you how long it will take for the system to pay itself off and provide a return on investment, which may surprise you.

Get started on your performance summary today by visiting www.Tru-Energy.ca

LIFECYCLE COSTS

IMPROVED LIFECYCLE COSTS

YANMAR's CHP system was designed from the ground up to offer lower operating and infrastructure costs. When you combine this with its maintenance requirements, the lifecycle cost of a YANMAR system is significantly lower compared to other systems.

HIGH QUALITY, HIGH RELIABILITY

We control the quality of our systems from start to finish. Our systems rely on our own high-efficiency YANMAR engines, which are known around the globe for their reliability. Our built-in inverter also provides a higher quality electrical output than synchronous generators. This long-term durability means less service requirements and reduced labor costs over the life of the CHP units.

LESS MAINTENANCE FOR MORE SAVINGS

YANMAR's units run maintenance-free for 7,500 hours; less maintenance means more savings in the long run.

REDUCED ENERGY COSTS

In many areas, natural gas is less expensive than electricity, enabling YANMAR CHP system users to reduce operating costs and benefit from significant electrical cost savings.

ENERGY EFFICIENT

By generating heat and electricity at the point of use, the CHP system avoids energy loss, utilizing less fuel and maximizing efficiency for a reduction in operation costs.

YANMAR WARRANTY PROGRAMS

YANMAR STANDARD LIMITED WARRANTY

- // 2 years / 15,000 hours* from commissioning
- // Real 100% direct "factory-backed" non-declining warranty

YES PRODUCT PROTECTION

- // Available coverages include scheduled preventive maintenance and extended warranty for
  - // 10 Years / 30,000 Hours*
  - // 10 Years / 60,000 Hours*
- // Real 100% factory-backed, non-declining extended warranty
  - // Coverage includes units and other YANMAR CHP installation accessories purchased as part of a YANMAR CHP system.

**Whichever comes first*

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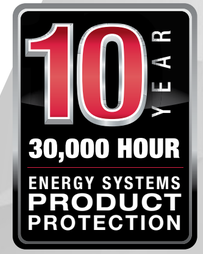

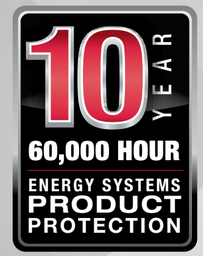

SYSTEM SPECIFICATIONS NATURAL GAS ENGINE UNIT

MODEL				CP35D2-TNUG	CP35D2Z-TNUG
OUTPUT	Rated output		kW	35.0 *2 *3	35.0 *2 *3
			kVA	--	35.0 *2 *3
ELECTRICAL QUALITY	Frequency		Hz	60	
	Voltage		V	AC 208	
	Current		A	97.2	
	Phase and Wire		-	3 phase, 3 wire	
	Power Factor		%	0.95 to 1.00	
	Interconnected output	Output voltage range	V	To follow commercial voltage	
				AC208V ± 10%	
		Output frequency range	Hz	To follow commercial voltage	
				60 ± 4%	
		Current distortion rate	%	In conformity to IEEE1547	
	Independent output	Output voltage range	V	--	AC208V ± 10%
		Frequency accuracy	-	--	± 1
		Current waveform distortion rate	%	--	5 % or less (All the area, power factor 1.0)
ELECTRICAL CHARACTERISTICS	Input voltage		V	AC208	
	Starting current		A	AC46 (Average current)	
	Rated Power Consumption	Radiator fan stop	kW	0.50	
		Radiator fan run	kW	1.00	
HEAT OUTPUT (HEAT RECOVERY)	Rated recovered heat		kBTU/hr (kW)	204.1 (59.8)	
	Rated temperature (at Rated hot water flow)	Inlet	°F (°C)	167.0 (75.0)	
		Outlet	°F (°C)	176.0 (80.0) (Max: 190.4 (88.0))	
	Rated hot water flow		gal/min (L/min)	46.5 (176.0) when outlet temp. 176°F (80) 45.4 (172.0) when outlet temp. 190.4°F (88)	
GROSS EFFICIENCY*1	Overall efficiency		%	88.0	
	Generating efficiency		%	32.5	
	Exhaust heat recovery rate		%	55.5	
FUEL	Type		-	Natural gas	
	Consumption (LHV base)		kBTU/hr (kW)	367.6 (107.7)	
	Pressure	Standard	in.WC (kPa)	8.03 (2.0)	
		Working range	in.WC (kPa)	8.0 - 10.0 (2.0 - 2.5)	

MODEL				CP35D2-TNUG	CP35D2Z-TNUG
ENGINE	Manufacturer		-	YANMAR CO.,LTD.	
	Name of engine		-	4GP98S-GCN	
	Form		-	Vertical series water cooling four cycles	
	Number of cylinder		-	4	
	Cylinder inside diameter / stroke		inch (mm)	3.86×4.33 (98×110)	
	Total engine displacement		cubic inch (L)	0.20248 (3.318)	
	Continuous rating output		kW	37.8	
	Engine Speed	Rated	min-1	1,800	
	Combustion system		-	Stoichiometry	
	Spark system		-	Full transistor	
	Handling of NOx		-	Stoichiometric combustion + Ternary catalyst	
	O2 sensor		-	Two units for use	
	Starting system		-	Electric starting by AC/DC conversion	
	Starter motor		V	DC12	
	Lubricant		-	YANMAR genuine oil (W-GXL)	
	Lubricant volume		gal (L)	35 (132) (ENGINE + SUB TANK: 24 (90)) (MAIN TANK:11 (42))	
	Weight		lb. (kg)	529 (240)	
	Dimensions	Width	inch (mm)	30.12 (765)	
		Depth	inch (mm)	25.59 (650)	
		Height	inch (mm)	30.12 (765)	
INVERTER	Manufacturer		-	REXXAM CO., LTD.	
	Model		-	YP35-TZU1	
	Rated Output		kW	35.0	
			kVA	--	35.0
	Inverter system	Interconnected (On-grid)	-	Self-excited voltage type current control system	
		Independent (Off-grid)	-	--	Self-excited voltage type voltage control system
	Switching system		-	PWM system	
	Insulation system		-	Non-insulated transformer-less system	
	Control system	Power Control	-	Output power constant control system	
		Reverse power flow prevention control	-	Reverse power prevention control by measuring reverse power flow	
	Interconnected switch	Manufacturer	-	Mitsubishi Electric Corporation	
		Model	-	SD-N80	

MODEL				CP35D2-TNUG	CP35D2Z-TNUG
INVERTER	Independent Switch	Manufacturer	-	Mitsubishi Electric Corporation	
		Model	-	SD-N80	
	Inverter built-in protection relay		-	OVR, UVR, OFR, UFR, Individual operation detection function (active, passive)	
BATTERY	Manufacturer		-	-	- (Site Arrangement)
	Model		-	-	Type IEC61056
	Nominal voltage		V	-	12
	Rating capacity		Ah	-	80/20
GENERATOR	Manufacturer		-	OHATSU	
	Model		-	CP35D1	
	Form		-	Permanent magnet type synchronous generator	
	Protection Class		-	Open type (IP00)	
	Number of phase/wire		-	3 phase, 3 wire	
	Number of poles		-	16	
	Excitation system		-	Permanent magnet type	
	Insulation class	Armature coil	-	F type	
	Bearing system		-	Directly coupled to flange (no bearings)	
CIRCUIT BREAKER	Main circuit breaker (MCB1)	Manufacturer	-	MITSUBISHI ELCTRIC	
		Model	-	NF250-SVU	
		AT/AF	A	150 / 225	
	Main circuit breaker (MCB1J)	Manufacturer	-	-	MITSUBISHI ELECTRIC
		Model	-	-	NV250-SVU
		AT/AF	A	-	150 / 225
COOLING WATER	Filling amount		gal (L)	9.5 (36.0) (Including reserve tank)	
	Antifreeze	Type	-	YANMAR genuine LLC (Ethylene glycol L201) *4	
		Concentration	%	50	
	Cooling water pump	Type	-	Magnet driving system spiral type	
	Water/Water heat exchange	Type	-	Brazed plate type	
		Secondary side withstanding pressure	psi (MPa)	71.295 (0.49)	
		Material of heat transfer plate	-	Stainless	
		Secondary water stockpile	gal (L)	0.89 (3.36)	
CONTROL	Number of connectable units *6	System controller (LKC30CW, 30DW, 40DW)	units	16	
	Number of independent parallel operation		unit	-	8

MODEL				CP35D2-TNUG	CP35D2Z-TNUG
PACKAGE	Dimensions	Width	inch (mm)	78.74 (2,000)	
		Depth	inch (mm)	31.50 (800) (Including the width of the leg 35.43 (900))	
		Height	inch (mm)	81.30 (2,065)	
	Weight (Including cooling water and lubricant)		lb. (kg)	3,064(1,390)	3,086(1,400)
	Cover thickness		inch (mm)	0.06 (1.6)	
	Remote monitoring adapter		-	CLCW2B1 (Option)	
	Piping Size	Fuel gas inlet	-	NPT 1	
		Hot water inlet / outlet	-	NPT 1•1/2	
	Operation Noise	Radiator fan stop	dB(A)	63	
		Radiator fan in operation	dB(A)	65	
	Maintenance interval		Hours	7,500	
	Acceptable range of back pressure	Extension of exhaust	-	23.0 lb/ft2 (0.145psi (1.0kPa)) or less	
		piping	-	4.2 lb/ft2 (0.03psi (200 Pa)) or less	

MODEL			CP35D2-TNUG	CP35D2Z-TNUG
COATING COLOR	CP Panel	-	Munsell 6.8Y8.7/0.2	
	System controller (Option)	-	Munsell 2.5Y9/1	
ACCESSORIES	Operation annual, Installation work manual, Wiring manual, Test run manual, Drain hose			

*1: Test Condition: Temperature 15degC, Humidity 30%, Altitude 0m, with fuel gas maximum heat value in EPA regulation.
*2 : Includes electricity consumption.
*3 : The output values depending on the installation conditions.
*4 : When hot water is employed for beverage use, install a heat exchanger between a co-generator body and water faucets.
*5 : When the number exceeds a controllable limit, plural controllers are necessary.
*6 : Any data may change without notice.
* : Main specifications are subject to change without notice.

CONFORMING STANDARDS AND REGULATIONS

NO.	STANDARD & LAWS	NOTES
	(1) SYSTEM	
1	UL2200	Standard for Safety Stationary Engine Generator Assemblies
2	CSA C22.2 No.100	Motors and Generators
3	CSA C22.2 NO.14	Industrial Control Equipment
	(2) ENGINE	
1	EPA	
	(3) INVERTER	
1	UL1741SA *1	Inverters, Converters, Controllers and Interconnection (On-grid) System Equipment for Use With Distributed Energy Resources
2	IEEE1547	Interconnecting (On-grid) Distributed Resources with Electric Power Systems
3	CSA-C22.2 NO.107.1	General Use Power Supplies

*1: The effective completion date for UL1741SA compliance is September 2019.

YANMAR

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