

# JCB ENERGY ELECTRIC POWER INDUSTRY

**♥** MADRID / SPAIN

































231 / 400 V - 50 Hz & 277 / 480 V - 60 Hz





#### **GENERATOR GENERAL INFORMATION**

GENERATOR	FREQUENCY	VOLTAGE	POWER FACTOR	SPEED	DIESEL I	ENGINE		ALTERN	ATOR		TYPE OF	GENER	RATOR O	UTPUT
Model	Hz	٧	Cos Q	Rpm	Brand	Model	Series	Brand	Model	Series	Operation	kVA	kW	А
								U			Standby	23,0	18,4	33,2
JCN 23	50	231/400	0.8	1500				ē			Prime	20,9	16,7	30,2
					ICN	E28C	CII.	ENERG	JCB	160LV	Continuous	14,6	11,7	21,2
					JCN	EZOC	EII	:הוֹ	JCB	160LX	Standby	28,0	22,4	40,5
JCN 28	60	277/480	0.8	1800			:20			Prime	25,5	20,4	36,8	
								~			Continuous	17,8	14,3	25,7

- Diesel Engines with Advanced Technology and Quality
- Alternators with Advanced Technology and Quality
- Low Exhaust Emission
- Control Panel Suitable for Flexible Application
- Patented Compact Designed and Sound proof Canopy
- Low Operating Cost, Suitable for Heavy-Duty
- Durability, Low Noise Level

- Tropical 50 °C Radiator, First Class Product Support
- Fuel Filter with Water and Particle Separator
- Low Fuel Consumption, Low Oil Consumption
- Global Technical Service and Maintenance Support
- Wide Range of Affordable Spare Parts
- High Quality and Reliable Technology
- Half Century Experience in Generator Manufacturing

#### STAND BY POWER RATING - (ESP):

ESP is applicable for supplying emergency power for the duration of the utility power outage. No overload capability is available for this rating. Under no condition is an engine allowed to operate in parallel with the public utility at the Stand by Power rating. This rating should be applied where reliable utility power is available. A Stand By rated engine should be sized for a maximum of an 70% average load factor and 200 hours of operation per year. This includes less than 25 hours per year at the Stand by Power rating. Stand By ratings should never be applied except in true emergency power outages. Negotiated power outages contracted with a utility company are not considered an emergency.

#### PRIME POWER RATING - (PRP):

Applicable for supplying electric power in lieu of commercially purchased power. Prime Power applications must be in the form of one of the following two categories:

#### **UNLIMITED TIME RUNNING PRIME POWER (ULTP):**

PRP (Prime Power) is available for an unlimited number of hours per year in a variable load application. Variable load should not exceed a 70% average of the Prime Power rating during any operating period of 250 hours. The total operating time at 100% Prime Power shall not exceed 500 hours per year. A 10% overload capability is available for a period of 1 hour within a 12-hour period of operation. Total operating time at the 10% overload power shall not exceed 25 hours per year.

#### LIMITED TIME RUNNING PRIME POWER (LTP):

LTP (Limited Time Prime Power) is available for a limited number of hours in a no variable load application. It is intended for use in situations where power outages are contracted, such as in utility power curtailment. Engines may be operated in parallel to the public utility up to 750 hours per year at power levels never to exceed the Prime Power rating. The customer should be aware, however, that the life of any engine will be reduced by this constant high load operation. Any operation

#### **CONTINUOUS POWER RATING (COP):**

COP is the power that the engine can continue to use under the prescribed speed and the specified environment condition in the normal maintenance period stipulated in the manufacturing plant. And Continuous Power is applicable for supplying utility power at a constant 100% load for an unlimited number of hours per year. No overload capability is available for this rating.





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# PAY ATTENTION TO THE POINTS BELOW IN PICKING AND USING THE GENERATOR

- \* Generators can work on Continuous Power at 70% of Prime power value if only all maintenances are done on time with original spare parts and high-quality oils that manufacturer advice.
- \* Generators should not operate below 50% of Prime Power value. In such a case, the engine will burn excessive oil and eventually have irreparable damage.
- \* If your need is 1000 kVA or above, you should prefer Synchronic Systems with 2-3 generators with failure back up and simultaneous aging.
- \* These points will provide advantage for you with purchasing and operating the generator.

## **GENERATOR DIMENSIONS AND TECHNICAL DRAWINGS**



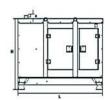


VALUES		OPEN TYPE GENERATOR	CANOPY TYPE GENERATOR
WIDTH	mm	597	1000
LENGTH	mm	1400	2000
HEIGHT	mm	1309	1190
WEIGHT (NET)	Kg	537	680
FUEL TANK CAPACITY	L	58	100

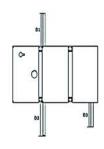
SYMBOL	OPEN	CANOPY
L	1400	2000
W	597	1000
Н	871	1740
S	438	80
Α	438	
В	438	
С	480	
D1		828
D2		828
D3		480
D4		
D5		











### **FUEL CONSUMPTION**

PERCENT OF PRIME POWER	1500 rpm	1800 rpm
TENDENT OF THINKE TOWER	l/hr	I/hr
110 %	5,85	7,02
100 %	5,33	6,37
75 %	4,07	4,87
50 %	2,82	3,38





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## **DIESEL ENGINE MAIN TECHNICAL PARAMETERS**

GENERAL		
Number of Cylinders		4
Configuration		Vertical, In Line
Aspiration		Naturally
Combustion System		Direct Injection
Compression Ratio		19.1:1
Bore	mm	85
Stroke	mm	100
Displacement	L	2,27
Governing Type		Mechanic
Governing Class		G2
Rotation		Counter clockwise
Firing Order		1-3-4-2
Emission		Tier II
Moments of Rotation Inertia		
Engine	Kg - m²	0,44
Flywheel	Kg - m²	2,55
Performance Rating	Ü	,
Speed Droop	%	≤3
Steady State Speed Band	%	≤0,5
FILTERS	70	20,0
Air Filter		Dry Type, Replaceable
Fuel Filter		With Water Separator
ruei riitei		vviiii vvaiei Separator
Oil Filter		Element Type, Particulate Trap
Oil Filter FLYWHEEL HOUSING AND FLEX COUPLING	217 (122)	Element Type, Particulate Trap
Oil Filter FLYWHEEL HOUSING AND FLEX COUPLING Flywheel Housing	SAE (J620)	Element Type, Particulate Trap 4
Oil Filter  FLYWHEEL HOUSING AND FLEX COUPLING  Flywheel Housing Flex Coupling Disc	SAE (J620) Inch (")	Element Type, Particulate Trap
Oil Filter  FLYWHEEL HOUSING AND FLEX COUPLING  Flywheel Housing  Flex Coupling Disc  TEST CONDITIONS	Inch (")	Element Type, Particulate Trap  4  7,5
Oil Filter  FLYWHEEL HOUSING AND FLEX COUPLING  Flywheel Housing Flex Coupling Disc		Element Type, Particulate Trap 4
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Oil Filter  FLYWHEEL HOUSING AND FLEX COUPLING  Flywheel Housing Flex Coupling Disc  TEST CONDITIONS  Ambient Temperature	Inch (") %	Element Type, Particulate Trap  4  7,5  25
Oil Filter  FLYWHEEL HOUSING AND FLEX COUPLING  Flywheel Housing Flex Coupling Disc  TEST CONDITIONS  Ambient Temperature  Atmospheric Pressure	Inch (") % KPa	Element Type, Particulate Trap  4 7,5  25 100
Oil Filter  FLYWHEEL HOUSING AND FLEX COUPLING  Flywheel Housing  Flex Coupling Disc  TEST CONDITIONS  Ambient Temperature  Atmospheric Pressure  Relative Humidity	Inch (") % KPa Rh (%)	Element Type, Particulate Trap  4 7,5  25 100 30
Oil Filter  FLYWHEEL HOUSING AND FLEX COUPLING  Flywheel Housing Flex Coupling Disc  TEST CONDITIONS  Ambient Temperature  Atmospheric Pressure  Relative Humidity  Max. Operating Intake Resistance	Inch (")  %  KPa  Rh (%)  KPa	Element Type, Particulate Trap  4 7,5  25 100 30 5
Oil Filter  FLYWHEEL HOUSING AND FLEX COUPLING  Flywheel Housing Flex Coupling Disc  TEST CONDITIONS  Ambient Temperature  Atmospheric Pressure  Relative Humidity  Max. Operating Intake Resistance  Exhaust Backpressure Limit  Fuel Temperature (Fuel Inlet Pump)  OVERALL DIMENSIONS	Inch (")  %  KPa  Rh (%)  KPa  KPa	Element Type, Particulate Trap  4 7,5  25 100 30 5 5 38±2
Oil Filter  FLYWHEEL HOUSING AND FLEX COUPLING  Flywheel Housing  Flex Coupling Disc  TEST CONDITIONS  Ambient Temperature  Atmospheric Pressure  Relative Humidity  Max. Operating Intake Resistance  Exhaust Backpressure Limit  Fuel Temperature (Fuel Inlet Pump)  OVERALL DIMENSIONS  Length*	Inch (")	Element Type, Particulate Trap  4 7,5  25 100 30 5 5 5 38±2
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Oil Filter  FLYWHEEL HOUSING AND FLEX COUPLING  Flywheel Housing  Flex Coupling Disc  TEST CONDITIONS  Ambient Temperature  Atmospheric Pressure  Relative Humidity  Max. Operating Intake Resistance  Exhaust Backpressure Limit  Fuel Temperature (Fuel Inlet Pump)  OVERALL DIMENSIONS  Length*  Width  Height	Inch (")  %  KPa  Rh (%)  KPa  KPa  °C  mm  mm  mm	Element Type, Particulate Trap  4 7,5  25 100 30 5 5 5 38±2  1087 597 749
Oil Filter  FLYWHEEL HOUSING AND FLEX COUPLING  Flywheel Housing  Flex Coupling Disc  TEST CONDITIONS  Ambient Temperature  Atmospheric Pressure  Relative Humidity  Max. Operating Intake Resistance  Exhaust Backpressure Limit  Fuel Temperature (Fuel Inlet Pump)  OVERALL DIMENSIONS  Length*  Width  Height  Dry Weight	Inch (")  %  KPa  Rh (%)  KPa  KPa  C  mm  mm	Element Type, Particulate Trap  4 7,5  25 100 30 5 5 5 38±2  1087 597
Oil Filter  FLYWHEEL HOUSING AND FLEX COUPLING  Flywheel Housing Flex Coupling Disc  TEST CONDITIONS  Ambient Temperature  Atmospheric Pressure  Relative Humidity  Max. Operating Intake Resistance  Exhaust Backpressure Limit  Fuel Temperature (Fuel Inlet Pump)  OVERALL DIMENSIONS  Length*  Width  Height  Dry Weight  *From front end of radiator to near end of air filter	Inch (")  %  KPa  Rh (%)  KPa  KPa  °C  mm  mm  mm	Element Type, Particulate Trap  4 7,5  25 100 30 5 5 5 38±2  1087 597 749
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Oil Filter  FLYWHEEL HOUSING AND FLEX COUPLING  Flywheel Housing Flex Coupling Disc  TEST CONDITIONS  Ambient Temperature  Atmospheric Pressure  Relative Humidity  Max. Operating Intake Resistance  Exhaust Backpressure Limit  Fuel Temperature (Fuel Inlet Pump)  OVERALL DIMENSIONS  Length*  Width  Height  Dry Weight  *From front end of radiator to near end of air filter  FAN  Diameter  Drive Ratio  Number of Blades	Inch (")  %  KPa  Rh (%)  KPa  KPa  °C  mm  mm  mm  kg	Element Type, Particulate Trap  4 7,5  25 100 30 5 5 38±2  1087 597 749 275  410 1,61:1 7
Oil Filter  FLYWHEEL HOUSING AND FLEX COUPLING  Flywheel Housing Flex Coupling Disc  TEST CONDITIONS  Ambient Temperature  Atmospheric Pressure  Relative Humidity  Max. Operating Intake Resistance  Exhaust Backpressure Limit  Fuel Temperature (Fuel Inlet Pump)  OVERALL DIMENSIONS  Length*  Width  Height  Dry Weight  *From front end of radiator to near end of air filter  FAN  Diameter  Drive Ratio	Inch (")  %  KPa  Rh (%)  KPa  KPa  °C  mm  mm  mm  kg	Element Type, Particulate Trap  4 7,5  25 100 30 5 5 5 38±2  1087 597 749 275





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# **DIESEL ENGINE MAIN TECHNICAL PARAMETERS**

COOLING SYSTEM			
Radiator Type	50ºC	Tropical	
Total Coolant Capacity	L	13	
Max. Perm. Coolant Outlet Temperature	ōC	103	
Max. Perm. Flow Resist. (Cool. System And Piping)	bar	0,5	
Max. Temperature of Coolant Warning	ōC	95	
Max. Temperature of Coolant Shutdown	ōC	98	
Thermostat Operation Temperature - Initial Open	ōС	68	
Thermostat Operation Temperature - Full Open	ōC	72	
Delivery of Coolant Pump	$m^3/h$	1,60	
Min. Pressure Before Coolant Pump	bar	0,15	
Radiator Face Area	m²	0,21	
Rows	Row	2	
Matrix Density	Per / Inch	15,5	
Material		Aluminum	
Width of Matrix	mm	438	
Height of Matrix	mm	480	
Pressure Cap Setting	kPa	90	
Estimated Cooling Air Flow Reserve	kPa	0,125	
Engine Pre Heater-Tube (with Circulation Pump)	W	1500	
LUBRICATION SYSTEM			
Total System	L	8	
Minimum Oil Level	L	7	
Nominal Motor Operating Temperature	ōC	40	
Lubricating Oil Pressure (Rated Speed)	bar	5	
Relief Valve Opens	kPa	352	
Oil / Fuel Consumption Ratio	%	≤ 0,3	
Normal Oil Temperature	ōС	110	
ELECTRICAL SYSTEM			
Voltage	V	12	
Starter	kW	3,2	
Alternator Output Ampers	Α	25	
Alternator Output Voltage	V	14	
Batteries Capacity	Ah	55	





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## **JCB ENERGY DIESEL ENGINE POWER RATINGS**

ENGINE MODEL	E28C		ENGINE FAMILY JC11		ENGINE SERIES	EII	
		TYPICAL GENERATOR OUTPUT (NET)		ENGINE POWER			
Speed (Rpm)	Type of Operation			Gross		Net	
		kVA	kWe	KWm	Нр	kWm	Нр
1500	Stand By(Maximum)	23,1	18,5	23,5	31,5	21,5	28,9
	Prime	21,4	17,1	21,4	28,7	19,9	26,7
4000	Stand By(Maximum)	27,5	22,0	28,2	37,9	25,9	34,8
1800	Prime	25,3	20,3	25,6	34,4	23,8	31,9

## **DIESEL ENGINE MATCHING PARAMETERS - 50 HZ**

50 HZ @ 1500 R/MIN		STAND BY	PRIME
Gross Engine Power	kW	23,5	21.4
Net Engine Power	kW	21,5	19,9
Fan Power Consumption (Belt Pulley Driven)	kW	1,5	1,5
Other Power Loss	kW	0,5	0,0
Mean Effective Pressure	MPa	0,83	0,75
Intake Air Flow	m³/min	1,25	1,25
Exhaust Temperature Limit	ōС	300	300
Exhaust Flow	m ³/ min	1,30	1,15
Boost Pressure Ratio		3,80	3,40
Mean Piston Speed	m / s	5,0	5,0
Cooling Fan Air Flow	m <sup>3</sup> / min	46,6	46,6
Typical Generator Output Power	kVA	23	21
HEAT REJECTION		STAND BY	PRIME
Energy in Fuel (Heat of Combustion)	kW	63,0	54,4
Gross Heat to Power	kW	23,5	21,4
Energy to Coolant and Lubricating Oil	kW	19,2	16,1
Heat Dissipation Capacity *	kW	-	-
Energy to Exhaust	kW	16,1	13,1
Heat to Radiation	kW	4,2	3,8

<sup>\*</sup>Intake Intercooled system





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## **DIESEL ENGINE MATCHING PARAMETERS - 60 HZ**

60 HZ @ 1800 R/MIN		STAND BY	PRIME
Gross Engine Power	kW	28,2	25,6
Net Engine Power	kW	25,9	23,8
Fan Power Consumption (Belt Pulley Driven)	kW	1,8	1,8
Other Power Loss	kW	0,5	0,0
Mean Effective Pressure	MPa	0,83	0,75
Intake Air Flow	m <sup>3</sup> / min	1,50	1,50
Exhaust Temperature Limit	ōС	360	360
Exhaust Flow	m <sup>3</sup> /min	1,57	1,38
Boost Pressure Ratio		4,50	4,10
Mean Piston Speed	m / s	6,0	6,0
Cooling Fan Air Flow	m <sup>3</sup> / min	55,9	55,9
Typical Generator Output Power	kVA	28	25
Typical Generator Output Power HEAT REJECTION	kVA	28 STAND BY	25 PRIME
	kVA kW		
HEAT REJECTION		STAND BY	PRIME
HEAT REJECTION Energy in Fuel (Heat of Combustion)	kW	<b>STAND BY</b> 75,1	<b>PRIME</b> 62,9
HEAT REJECTION  Energy in Fuel (Heat of Combustion)  Gross Heat to Power	kW kW	<b>STAND BY</b> 75,1 28,2	PRIME 62,9 23,8
HEAT REJECTION  Energy in Fuel (Heat of Combustion)  Gross Heat to Power  Energy to Coolant and Lubricating Oil	kW kW kW	<b>STAND BY</b> 75,1 28,2 23,0	PRIME 62,9 23,8 19,3
HEAT REJECTION  Energy in Fuel (Heat of Combustion)  Gross Heat to Power  Energy to Coolant and Lubricating Oil  Heat Dissipation Capacity *	kW kW kW kW	75,1 28,2 23,0	PRIME 62,9 23,8 19,3 -

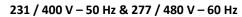
**JCB ALTERNATOR TECHNICAL PARAMETERS AND SPECIFICATIONS** 



ALTERNATOR TECHNIC	CAL PARAMETERS				
Insulation Class		Н	Field Control System		Self-Excited
Winding Pitch		2/3 - (N° 6)	A.V.R. Model	Standard	SX460
Wires		12	Voltage Regulation	%	± 1
Protection		IP 23	<b>Sustained Short-Circuit Current</b>	10 sec	300% (3 IN)
Altitude	m	1000	Total Harmonic (*) TGH / THC	%	< 5
Overspeed	rpm	2250	Wave Form: NEMA = TIF - (*)		< 50
Air Flow	m³/sec.	0.071	Wave Form: I.E.C. = THF - (*)	%	< 2
Bearing Drive	N/A	-	Bearing Non-Drive	Bearing	6306-2RZ
Rotor Winding	100%	Copper	Stator Winding	100%	Copper









## **ALTERNATOR SPECIFICATIONS**

50 HZ / 231-400V C	OSQ 0,8 / 1500 RF	PM							
STANDARD USING A	ALTERNATOR			OPTIONAL USING ALTERNATOR					
BRAND/MODEL	J@ENERGY.	JCB 160LX		LEROY-SO	OMER"	TAL040F	STAMFORE	SOL20	i
DUTY				Continuous				Stand By	
AMBIENT	C°			40°C				27°C	
CLASS / TEMP. RISE	C°			H/ 125° K				H/ 163° K	
SERIES STAR	V	380/220	400/231	415/240	1 Phase	380/220	400/231	415/240	1 Phase
PARALLEL STAR	V	190/110	200/115	208/120	220	190/110	200/115	208/120	220
SERIES DELTA	V	220	230	240	230	220	230	240	230
OUTPUT POWER	kVA	21,0	21,0	22,0	14,0	23,0	23,0	24,0	15,0
OUTPUT POWER	kW	16,8	16,8	17,6	11,2	18,4	18,4	19,2	12,0
60 HZ / 277-480V CO		М		OPTIONALI	ISING ALTER	NATOR			
	J@ENER	<b>GY</b> . JCB 160L)	,	OPTIONAL USING ALTERNATOR  LEROY-SOMER TAL040F			STAMFORD P1144D-S0L2-G		
BRAND/MODEL	) CLINEY	JCB 160L	(	LENOTS	OIVIEN	TALU4UF	SIAM	PI14	4D-30L2-G
DUTY				Continuou	S			Stand By	
AMBIENT	C°			40°C				27°C	
CLASS / TEMP. RISE	C°			H / 125° K				H / 163° K	
SERIES STAR	V	416/240	440/254	480/277	1 Phase	416/240	440/254	480/277	1 Phase
	V	208/120	220/127	240/138	-	208/120	220/127	240/138	-
PARALLEL STAR	•								
PARALLEL STAR SERIES DELTA	V	240	254	277	240	240	254	277	240



 $\mathsf{kW}$ 

20,0

20,8

20,8

13,8

22,4

23,2

23,2

15,4

**OUTPUT POWER** 



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### **CONTROL MODULE ALERTS**

Emergency Stop Malfunction
High Generator Frequency
Low Generator frequency, Low Load
Over Current, Unbalanced Current
Low Generator Voltage
High generator Frequency
Phase sequence error
Overload, Heat Sensor Broken
Low Water Level (Optional)
Low Oil Pressure, Reverse Power

Start Error, Stop Error
Magnetic Pickup Error
Charge Alternator Error
Unbalanced Load
Maintenance Time Alarm
Low Speed, High Speed
Broken Oil Sensor Cable
High Oil Temperature (Optional)
Low Fuel Level (Optional), High Battery Voltage
Low Battery Voltage, High Water Temperature
Electronic Can bus Errors (ECU)

### **CONTROL PANEL SPECIFICATIONS**



**Low Water Temperature** 



- Powder Painted Steel Panel with Lockable Door
- ATS (Automatic Transfer Panel)-Optional
- Control Module
- o Battery Charger
- Emergency Stop Button
- Terminal Blocks
- Load Output Terminal
- System Protection MSBs
- Circuit Breaker-Optional
- o LCD Screen
- Control Relays
- Backlit, 128x64 Pixels

#### **CONTROL MODULE TECHNICAL PARAMETERS**

Brand	JOENERGY.	Brand	Trans-MIDIAMF.232.GP
Dimensions	120mmx94mm.	Protection Class	IP65 From the Front
Weight	260 gr.	<b>Environmental Conditions</b>	2000 meters above sea level
Ambient Humidity	Max. %90.	Ambient Temperature	-20°C to +70°C
DC Battery Supply Voltage	8 - 32 V	Battery Voltage Measurement	8 – 32 V
Network Frequency	5 - 99,9 Hz	Mains Voltage Measurement	3 - 300 V phase -Neutral, 5 - 99,9 Hz
Generator Voltage Measurement	3 - 300 V	Generator Frequency	5 - 99,9 Hz
<b>Current Transformer Secondary</b>	5A	Working Period	Continuous
Charge Alternator Voltage Measurement	8 - 32 V	Charge Alternator Excitation	210mA &12V, 105mA &24V Nominal 2.5W
Communication Interface	RS-232	Analog Sender Measurement	0 - 1300ohm
Generator Contactor Relay Output	5A & 250V	Mains Contactor Relay Output	5A & 250V
Solenoid Transistor Outputs	1A with DC Supply	Start Transistor Outputs	1A with DC Supply
Configurable-3 Transistor Outputs	1A with DC Supply	Configurable-4 Transistor Outputs	1A with DC Supply





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#### **CONTROL MODULE FUNCTION**

Mains Voltage Level Control	Generator Voltage Level Control	3 Phase Generator Protections	3 Phase AMF Function	Alarm Horn
Network Frequency Level Control	Generator Frequency level Control	- High / Low Voltage	- High / Low Frequency	Heater Tube Thermostat Control
Engine Operating Option Control	Generator Current Level Control	- High / Low Frequency	- High / Low Voltage	Modbus and SNMP
Engine Stop Option Control	Generator Powder Level Control	- Current / Voltage Asymmetry	- High / Low Water Temperature	Working Hour
Engine Speed (RPM) Level Control	Generator work Schedule and Timing Control	- Overcurrent / Overload	- High / Low Load	Ground Leakage
Battery Voltage Options Times	Oil Pressure Controllers Control	Overheat Control	Mains., Generator ATS Control	Analog Modem
Check Engine Maintenance Times	Configurable Analog Inputs and Outputs	1 Phase or 3 Phase, Phase Selection	Network, Voltage, Frequency Display	Ethernet, USB, RS232, RS485
Communication Interfaces GPRS, GSM	Keeping Error Records of Past Events	Parameter Setting via Control Module	Parameter Setting via Computer	Selectable Protection Alarm / Shutdown
Engine Speed, Voltage, Earning	Configurable Programmable Digital Inputs and Outputs	Water Temperature Current and Frequency	Hours of Operation Phase sequence	Battery Voltage Oil Pressure

## SOUND PROOF CANOPY AND BASE FRAME (CHASIS) SPECIFICATIONS

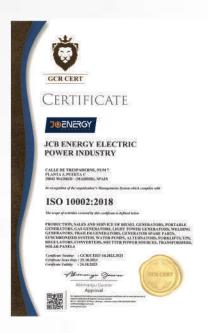


- Special, Registered JCB Energy Design and Colour
- A1 Quality DKP / HRU / Galvanized Steel
- Sensitive Twist on Automatic Press Brake
- Delicate Cut on Automatic Punch and Laser Bench
- Sensitive Welding on Robotic Welding Bench
- Chemical Cleaning Nano Technology Before Painting
- Robotic Painting with Electrostatic Powder Paint
- Drying and stabilizing on 200 ºC Ovens
- 1500 Hour Salt Test
- o Glass wool Isolation, A1 Class Material -50/+500 ºC
- Special Covering Over Glass Wool
- Best Sound Level (in Dba)
- Temperature Tests
- Rustproof Accessories

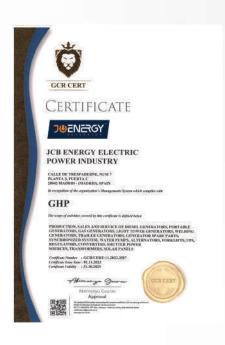
- Cable Exit Connectors and Glands
- Emergency Stop Button
- Fuel Level Gauge
- Fuel Drain Cap
- Fuel Inlet and Return Records
- o Impermeability Test for Fuel Tank
- Vacuumed Rubber Mounted
- High Quality weatherstrips
- High Quality Shock Absorbers
- Fuel Filling Cap (with ventilation)
- Lifting and Carrying Equipment
- Internal Exhaust Mufflers (Silencers)
- External Exhaust Mufflers (Silencers)
- Radiator water Filling Cap
- Daily Fuel Tank, External Fuel Tank

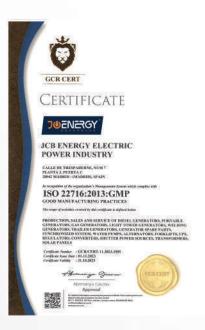


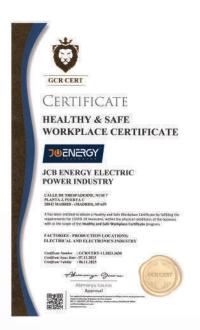
# **OUR CERTIFICATES**

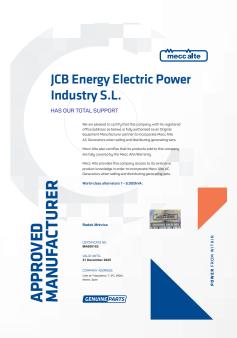




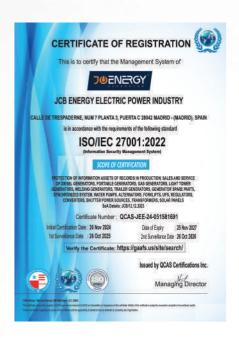






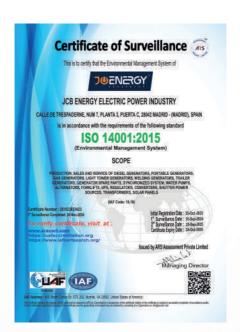


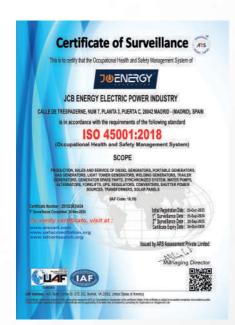














#### MANAGEMENT SYSTEM CERTIFICATE

Valid: 14 October 2023 – 13 October 2026

This is to certify that the management system of HD Hyundai Infracore Co., Ltd. Head Office &

Incheon Plant
489, Injung-ro, Dong-gu, Incheon, 22502, Republic of Korea
and the sites as mentioned in the appendix accompanying th

has been found to conform to the Environmental Management System standard: ISO 14001:2015

This certificate is valid for the following scope:
Design, Development, Manufacture, Servicing of Internal Combustion Engine for use in
Marine industry, aneral Industry and Automotive Industry, and Earth Moving
Testing of Earth Moving Equipment(Excavator and Wheel Loader).

Place and date: Barendrecht, 99 October 2023

For the issuing office: DMY - Business Assurance Zwolesoweg 1, 2964 LB Barendracht, Hetherlands







#### MANAGEMENT SYSTEM CERTIFICATE

Initial certification class: 03 January 2006 Spissed on OHSAS 18001)

HD Hyundai Infracore Co., Ltd. Head Office & Incheon Plant

480 Inlung-ro, Dong-gu, Incheon, 22502, Republic of Korea

has been found to conform to the Occupational Health and Safety Management Syst ISO 45001:2018

Place and date: Barendrecht, 99 October 2023













IRBHE SANKHEZ ROMMA MANAGER DE THE DEFARTMENT OF LEGAL ADVISONY SERVICES AND THE DATAINSE OF THE OFFICIAL CHARMER OF COMMERCE, HIGHERRY AND SERVICES OF MADRID, WITH REGISTERED OFFICE AT PLAZA DE LA MODERNORIOCA F, MADRID, TAYAN

CERTIFY. That, according to the background data on record at this Churchar and others produced by the Company

CB ENERGY ELECTRIC POWER INSUSTRY St., a Company with Tax LD. Nation B1975554, and its registress of those at street frequency may 7, 2000. Making is registered on 6 May 2004, under the heating of the 145 Section, companies, of the Economic Activities Tax Traffic Number 545 to preterm the National Activities of Company (Company).

Menufacture of electrical material for use and equipment.







REGISTRO GENERAL SALIDA

CÉASIO DE LA CÁMARA ORICIAL DE COMERCIO, INICIUSTRIA Y SERVICIOS DE MADRID, CON DOMICIUO SOCIAL EN LA PLAZA DE LA INDEPENDENCIA Nº 1, MADRID — ESPAÑA

CERTIFICA. Que de los antecedentes que obran en esta Corporación y da otros estábidos por la sociedad, musita:







