

Technical Specification

including performance data

Project 3 x 9CM25 – rev 0.

consisting of

**3 Caterpillar Diesel Generator sets
Type 9CM25**

with site output of:

**2470 bkW at each engine flywheel
rated 750 rpm**

at site conditions of:

< 50 m altitude

32 °C maximum average ambient temperature

40 °C maximum ambient temperature

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1.1. Engine

1.1.1. Caterpillar Diesel Engine 9CM25

a) Engine Basic Data

ISO 3046 / 1 Conditions:

Continuous power output at ISO conditions	2 700	bkW
reference conditions:		
maximal air temperature	25	°C
altitude	0	m
relative air humidity at maximal air temperature	80	%
charge air temperature behind aftercooler	45	°C
coolant temperature before charge air cooler	25	°C

Continuous Power Output at Site

Continuous power output	2470	bkW
at the following ambient conditions:		
Maximum air temperature	40	°C
Average air temperature in the hottest month (reference)	32	°C
altitude	<50	m

Specific Fuel Consumption at Site

Brake Specific Fuel Consumption at 100% load (with engine driven pumps and with 5% tolerance) at the following ambient conditions:	191.0	g/kWh
Reference temperature	28	°C
altitude	<50	m

Lube Oil Consumption

At any load	0, 6	g/kWh
Tolerance	+/- 0.3	g/kWh

Load Application

The load application on preheated engine and the recovery of engine speed after sudden load increase is acc. ISO 8528 / 5.
The engine can be started and stopped with HFO if preheated.

Vibrations

Permissible vibration for the engine acc. to ISO 8528 / 9

b) Engine Description

Main Information

Configuration	in line	
Number of cylinders	9	
Bore	255	mm
Stroke	400	mm
Speed	750	1 / min
Mean piston speed	10	m/s
Mean effective pressure	23.5	bar
Swept volume of cylinder	20.4	l
Rotation counter clockwise acc. to ISO 1204		
Weight of complete genset	53	(t)
Dimensions L x l x h	9075x2456x3946	cm

Cylinder Block

One piece design
Under slung crank shaft
Cooling water free cylinder block
Set of safety devices against overpressure in the crankcase
Designed for direct elastic engine mounting

Drive

Fully balanced crank shaft
Sectionized camshaft and cam followers
Split connection rod
Two pieces pistons with lube oil shaker cooling
Liners with anti wear ring

Fuel System

Direct injection 1600 bar
One high pressure injection pump per cylinder with emergency stop cylinder
Double wall high pressure pipe to cylinder
Integrated nozzle cooling using lube oil Engine designed for operation with HFO up to 350 cST/50°C acc. CIMAC H55 and K55
Duplex filter engine mounted with differential pressure monitoring
(see "Light Fuel Oil System")

Lube Oil System

Engine driven lube oil pump (see "Lube Oil System")
Duplex filter engine mounted with differential pressure monitoring (see "Lube Oil System")
Main lube oil pipe integrated into cylinder block

Cooling Water System

Two stage charge air cooler (see "Combustion Air System")
Water free cylinder block
Engine driven cooling water pumps (1 HT- and 1 LT-pump)
Multimedia ring with integrated connections for

- water
- starting air
- combustion air
- lube oil
- fuel

Starting System (see chapter "Compressed Air System)

Main starting air valve solenoid operated for remote starting
Capable of manual starting
One starting air valve per cylinder controlled by control air distributor
One starting air valve per cylinder of one bank controlled by control air distributor
Compressed air starting arranged above piston

Combustion Air Intake System

2 stage charge air cooler with stainless steel water separator
2 steel inlet valves per cylinder with armoured un cooled seats and rotators

Exhaust Gas System

1 turbocharger type KKB R 4/3-25
designed for pulse supercharging
designed for constant pressure supercharging
lubricated by engine lube oil
2 Nimonic outlet valves per cylinder with armoured-cooled seats, rotators and steel shafts
Exhaust gas pipe with one expansion joint per cylinder, connected to the cylinder head by clamps
Expansion pieces in exhaust gas pipe before turbocharger

c) Factory Test and Certificates

Factory Test

Standard acceptance test run on the Caterpillar test bed using a water brake

d) Preservation, Painting, Labels

Preservation

Standard preservation up to 6 months

Painting

Engine painted in CAT yellow

Manual

O&M Manual in English

Labels

Set of labels in English

e) Additional Engine Components

3 Turning Devices

Electric motor driven turning device mounted separately including contactor and pushbutton with cable. Engine start interlock if turning gear is engaged.

1.2. Engine Accessories

1.2.1. Engine Control and Monitoring

3 Local Control Panels

each for mounting adjacent to the genset, assembled in metal enclosed cubicle for wall mounting, with front door, including

- automatic and manual stop input signals
- starting interlock input signals
- speed recording system for overspeed, firing speed and minimum speed (n-min)
- start/stop logic, controlled by the diesel start
- service hour counter

In order to integrate with the DICARE ONLINE diagnostic program, the exhaust gas monitoring equipment must be integrated in the alarm system and the alarm system must be designed for data transfer to a DICARE pc via a serial port.

Function:

generator set data collection
data transfer
supervision
synchronizing

1 DICARE online Program

3 Electric Emergency Shutdown Devices

24 V DC, fitted on engine, with pushbutton for manual emergency stop

3 Manual Engine-Mounted Control Panels

fitted on engine, each with:

- 1 gauge board, fitted on engine, with 1 set liquid damped pressure gauges each for fuel, lubricating oil, fresh water, starting air and charge air
- 1 set thermometers on the engine for fuel (in case of heavy fuel only), lubricating oil, fresh water and charge air
- 1 set liquid damped exhaust gas dial thermometers

Electric remote speed indicator, consisting of:

- 1 rpm pick-up, fitted on engine
- 1 indicator, 96x96 mm, fitted in gauge board
- 1 indicator, separate, 144x144 mm, without interior illumination

control panel with start/stop key
fixed minimum speed in local control
mechanical shut-down device
change-over of control functions from engine to remote control

1 Set of Mounted Instruments for Diesel Genset

- high lubeoil temperature at engine inlet (alarm/analogue sensor)
- lubeoil temperature at engine inlet above danger level (alarm/reduction or engine stop)
- high fresh water temperature at engine outlet (alarm/analogue sensor)
- fresh water temperature at engine outlet above danger level (alarm/reduction or engine stop)
- high charge-air temperature at engine inlet (alarm/analogue sensor)
- high lubeoil level in lubeoil tank of base frame (alarm)
- low lubeoil level in lubeoil tank of base frame (alarm)
- high exhaust gas temperature after turbocharger (alarm)
- detection of water in charge-air duct (alarm)
- leak fuel level (alarm)
- alarm contact for high differential pressure at fuel filter (alarm)
- alarm contact for high differential pressure at lubeoil filter (alarm)

1 Set of Loose Remote Instruments for Plant

(switches are supplied by CPGS only if the corresponding plant component is also included in the CPGS scope of supply)

- 1 low differential fuel pressure at circulation pump (alarm)
- 1 low differential fuel pressure at circulation pump (start of stand-by pump)
- 1 low fuel pressure at pressure pump (start of stand-by pump)
- 1 low/high fuel viscosity at engine inlet (alarm)
- 1 low fuel oil level in mixing tank (alarm)-high lubeoil temperature at engine inlet (alarm/analogue sensor)

1.2.2. Coupling and Mounting of Engine

3 Couplings between Engine and Generator

Elastic coupling between engine and generator

3 Sets for Resilient Mounts

mounting: on baseframe

set with Spring Elements

for direct elastic mounting of the engine on concrete foundation block including bolts and grouting material

3 Sets of elastic pipe connections

for connections to the engine

3 Engine / Generator Base Frame

with integrated lube oil tank

3 Oil Tanks for Base Frame

3 Factory Assembly

of engine and generator on the common baseframe

1.2.3. Engine Tools NOT INCLUDED

1.3.1. Compressed Air System

3 Starting Air Non Return Valves before Engine

1.3.2. Combustion Air System

There is one combustion air system for each engine.
This system provides filtered air to the engine for combustion.
The combustion air silencers provide attenuation at the engine noise transmitted through the combustion air ducts.

The combustion air system consists of:

3 Combustion Air Filters

Design: oil bath filter

Technical data:

flow rate	16200	m ³ /h
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3 Rain Hoods for Combustion Air Filters

3 Expansion Joints

for combustion air system, manufactured from cloth

1.3.3. Exhaust Gas System

The exhaust gas system converts part of the energy carried by the exhaust gases into mechanical energy for the compression of the charge air by the turbochargers. The system provides noise attenuation and delivers the exhaust gases to the stack respectively to the environment. Exhaust gas boilers for heat recovery are described under "Steam System" respectively "Hot Water System".

The exhaust gas system consists of:

3 Turbochargers

with transition nozzle, Type KBB R 4/3-25, fitted counter flywheel end

Technical data:

nom. diameter inlet combust. air	500	mm
nom. diameter outlet exhaust gas	500	mm

with compressor cleaning device and washing connection for the turbine

3 Exhaust Gas Compensators after Turbochargers

designed for elastic mounting of the engine

3 Additional Compensators

designed for the exhaust gas system

Technical data:

nominal diameter 600 mm

1.3.4. Fresh Cooling Water System

3 HT thermostat

Fitted to engine

3 Engine Cooling Water Preheater, fitted on engine base frame

consisting of: electric preheater, pump and switch box (separate - supplied loose)

1.3.5. Light Fuel Oil System NOT INCLUDED

The light fuel oil system (LFO) is designed to store fuel oil for (no field) days of full load operation of all engines.

It provides clean fuel oil to the engines at the required pressure.

The light fuel oil system consists of:

1 LFO Prepressure Module - Combined with HFO

pre-assembled by CPGS

components in LFO system:

1 LFO Prepressure Pump (per module)

design: gear pump

drive: electric motor

Technical data:

capacity	2.6	m ³ /h
pressure	10	bar

2 LFO Prepressure Valves, incl. the required safety valve (per module)

Technical data:

nominal diameter	25	mm
operation pressure	10	bar

1.3.6. Heavy Fuel System (designed for 500 cSt/50°C) NOT INCLUDED

The heavy fuel oil (HFO) system is designed for storage and treatment of HFO.

It provides fuel to the engines at the required degree of purity, viscosity and pressure.

The heavy fuel system system consists of:

1 HFO Prepressure Module - Combined to LFO

pre-assembled by CPGS

components in HFO system:

1 HFO Automatic Filter (per module)

Technical data:

nominal diameter	100	mm
mesh size	10	µm

1 HFO Prepressure Pump (per module)

design: gear pump

drive: electric motor

Technical data:

capacity	2.6	m ³ /h
pressure	10	bar

1 HFO Prepressure Pump (standby) (per module)

design: gear pump
drive: electric motor
Technical data:

capacity	2.6	m ³ /h
pressure	10	bar

1 HFO Prepressure Valve, incl. the required safety valve (per module)

Technical data:

nominal diameter	25	mm
operation pressure	10	bar

1 HFO - LFO Switch Over Valve (per module)

remote controled from the control room

3 HFO Circulation Module (without standby pumps)

1 LFO Diesel Oil Cooler (per module)

for cooling of fuel during diesel oil operation
cooling medium: cooling water

Technical data:

design heat	9	kW
surface	0.8	m ²

1 HFO Final Preheater (per module)

Technical data:

design heat	43	kW
surface	3.8	m ²

2 Fuel Peak Pressure Dampers (per module)

design: diaphragm

1 HFO Circulation Pump (per module)

design: gear pump
drive: electric motor

Technical data:

capacity	3.6	m ³ /h
pressure	5	bar
speed	1450	1/min
power demand	0	kW

1 HFO Flow Meter for Engine (per module)

design: sliding vane meter

1 HFO - LFO Switch Over Valve (per module)

remote controled from the control room

1 HFO Viscosity Control Device (per module)

with control unit for steam heated final preheater

1 Heating TCV to Final Preheater (per module)

design: electronic, electric motor actuator

Technical data:

nominal diameter	25	mm
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1 HFO Mixing Tank (per module)

with all required connections

Technical data:			
	rated capacity	50	l

3 HFO Fine Filters

design: fitted on engine

Technical data:			
	nominal diameter	40	mm
	mesh size	34	µm

1.3.7. Lube Oil System

The lube oil system is designed to provide lube oil at proper purity, temperature and pressure to the engine(s).

The lube oil system consists of:

1 Main Lube Oil Pump

engine driven

Technical data:			
	capacity	89	m ³ /h
	delivery head	10	bar

3 Main Lube Oil Pump Strainers

Technical data:			
	nominal diameter	150	mm
	mesh size	2	mm

1 Prelubrication Lube Oil Pump

fitted on base frame, electric motor driven

1 Automatic Lube Oil Backflushing Filter

fitted on engine

3 Lube Oil Service Modules

pre-assembled by CPGS

components on module:

1 Lube Oil Plate Cooler

1 Lube Oil Thermostat

1.3.8. Steam System

Client Scope of Supply!

1.3.9. Ventilation System

Client Scope of Supply!

1.3.10. Waste Disposal System

Client Scope of Supply!

1.3.11. Other Accessories

1 Lifting Frame for Engine

(to be returned to CAT factory)

