

Project : CATERPILLAR CM GENSETS PROJECT
(RADIATOR COOLING)

2 x 16CM32, 6.3 kV, 50 Hz

ITEM	DESCRIPTION	Quantity	TUS(S)PL Supply	Customer Supply	Remarks
GENSET PORTION					
1.1	DIESEL ENGINE - CATERPILLAR 16CM32	2	✓		
1.2	Additional engine components (mounted on the engine)				
	Electric turning devices	2	✓		
	Gauge panels	2	✓		
	Governors	2	✓		
	Electric emergency shutdown device	2	✓		
	Engine Bearing Temperature Monitoring	2		✓	
1.3	Coupling and Mounting of Diesel Engine				
	Elastic coupling	2	✓		
	Set of spring elements for engine mounting	2	✓		
	Set of elastic pipe connections	2	✓		
	Flywheel cover	2	✓		
	Service platform	2		✓	
	Engine embedded mounting plate	2		✓	
1.4	Engine Control				
	Manual control panel on engine	2	✓		
	Starting solenoid valve	2	✓		
	Set of electronic speed setting equipment	2	✓		
1.5	MECHANICAL EQUIPMENT (SHIPPED LOOSE) COMPRESSED AIR SYSTEM				
	Starting Air Non Return Valve on Engine	2	✓		
	Starting air compressor, Electric Motor Driven	1		✓	
	Starting air compressor, Diesel Motor Driven	1		✓	
	Starting air receiver (500 liters) 30 bar	1		✓	
	Automatic drain device for starting air receiver	1		✓	
	Automatic drain device for starting air pipes	1		✓	
	Pressure reducing valves	1		✓	
	Set of piping material for 30 bar air supply	2		✓	
	Set of valves for 30 bar air supply	2		✓	
	Set of piping material for 7 bar air supply	1		✓	
	Set of valves for 7 bar air supply	1		✓	
	Set of pressure indicators	1		✓	
	Air filter	1		✓	
1.6	CHARGE AIR SYSTEM				
	Charge air filter	2	✓		
	Charge air silencer	2	✓		
	Charge air compensator	4	✓		
	Two stage charge air cooler (part of the engine)	2	✓		
	Turbo inlet transition nozzle	4	✓		
	Differential Air Pressure gauge for Charge air filter	2		✓	
	Set(s) of Support for pipes of combustion air system	2		✓	
	Set of pipes, ducts for charge air system	2		✓	
1.7	DIESEL OIL SYSTEM				
	Diesel oil pressure pump with strainer (part of HFO/DO prepressure module)	1		✓	
	Diesel oil pre-pressure valve (part of HFO/DO prepressure module)	1		✓	
	Diesel oil mech. counter incl. strainer (part of HFO/DO prepressure module)	1		✓	
	Diesel oil storage tank (200,000 ltrs)	1		✓	
	Diesel oil storage tank level indicator, instruments, etc.	1		✓	
	Diesel oil storage tank filling pump(s) / unloading station incl. strainer	1		✓	
	Diesel oil storage tank flow meter	1		✓	
	Diesel oil intermediate tank (10,000 ltrs)	2		✓	
	Diesel oil intermediate tank level indicator, instruments, etc	2		✓	
	Diesel oil service tank (10,000 ltrs)	2		✓	
	Diesel oil service tank level indicator, instruments, etc.	2		✓	
	Diesel oil service tank filling pump(s)	2		✓	
	Diesel oil flowmeter filter	2		✓	
	Diesel oil flowmeter	2		✓	
	Diesel oil leak fuel tank(s) (1,000 ltrs)	2		✓	
	Diesel oil leak oil tank evacuation pump(s)	2		✓	
	Set of piping material for diesel oil system	2		✓	
	Set of valves and fittings for diesel oil system	2		✓	

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ITEM	DESCRIPTION	Quantity	TUS(S)PL Supply	Customer Supply	Remarks
1.8	EXHAUST GAS SYSTEM				
	Turbocharger including transition nozzle (part of engine)	4	✓		
	Exhaust gas expansion joints after engine	4	✓		
	Exhaust gas expansion joints before silencer	2	✓		
	Set of stop chocs for exhaust gas duct	1	✓		
	Exhaust gas silencer	2	✓		
	Set(s) of piping material for exhaust gas system(s) up to exhaust silencer	2		✓	
	Set(s) of insulating material for exhaust gas system(s) up to exhaust silencer	2		✓	
	Set(s) of Support for exhaust piping and exhaust silencer	2		✓	
	Piping for exhaust silencer drain	2		✓	
	Exhaust Tail Pipe	2		✓	
1.9	NOX SYSTEM				
	NOx Reactor /Catalyst Housing	2		✓	
	Air receiver 10 bar (2,000 ltrs) for NOX System	2		✓	
	Air compressor, Electric Motor Driven	2		✓	
	Stainless Steel Mixing Tank (10,000 ltrs)	1		✓	
	FRP Urea Tank (20,000 ltrs)	1		✓	
	FRP Demin Water Tank (20,000 ltrs)	1		✓	
	Electrical Centrifugal Pump	1		✓	
	Set(s) of cabling and accessories	1		✓	
	Dosing Control Panel and Electrical System	1		✓	
	Set(s) of Stainless Steel Piping for NOx System	1		✓	
	Set(s) of Compress air piping for NOx System	2		✓	
	Set(s) of Valve Compress air piping for NOx System	2		✓	
	Set(s) of Support Compress air piping for NOx System	2		✓	
1.10	COOLING WATER (CW) SYSTEM (TWO CIRCUIT COOLING)				
	Radiator HT	2	✓		
	Radiator LT	2	✓		
	Combined water / lube oil service unit (water circuit)	2	✓		
	Each Module consist of :				
	- HT cooling water pump	1	✓		
	- HT cooling water temperature control valve	1	✓		
	- LT cooling water pump	1	✓		
	- LT inlet temperature control valve	1	✓		
	- Cooling water preheating unit	1	✓		
	- Cooling water preheating pump - Centrifuge pump	1	✓		
	- Cooling water valve	1	✓		
	- Pressure, temperature Indicator	1	✓		
	- Piping on module	1	✓		
	- Panel on module	1	✓		
	- Skid assembly and fabrication of module	1	✓		
	Cooling water compensation tank(s) (HT & LT)	4		✓	
	Hydrophore unit, consisting of:	1		✓	
	- Pressure pump, 3.6 m3/hr, 5 bars	2		✓	
	- Cooling water pressure tank, 500 ltrs, 5 bars	2		✓	
	Initial fill of water treatment chemicals for engine cooling water circuit	1		✓	
	Cooling water main storage tank (3,000 ltrs)	2		✓	
	Cooling water filling pump	2		✓	
	Cooling water maintenance tank	1		✓	
	Cooling water maintenance tank filling pump	1		✓	
	Deaerator	2		✓	
	Cooling water filling pump unit to expansion tank, 3.6 m3/hr, 2 bars	2		✓	
	Set of piping material for CW system	2		✓	
	Set of Pressure Indicator	2		✓	
	Set of valves for CW system	2		✓	
1.11	HEAVY FUEL OIL SYSTEM				
	HFO fine filter(s)	2	✓		
	HFO circulating module:	2	✓		
	Components per HFO circulating module:				
	- 3 way change over valve	3	✓		
	- Mixing tank(s) (100 ltrs)	1	✓		
	- Circulation pump	1	✓		
	- HFO final preheater(s)	1	✓		
	- Viscosity control device(s)	1	✓		
	- Fuel oil cooler	1	✓		
	- Fuel flow meter	1	✓		
	- Piping on module	1	✓		

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	- Trace heating on module	1	✓		
	- Pipe insulation on module	1	✓		
	- Leak fuel oil tank(s) (1,000 ltrs)	1	✓		
	- Leak oil tank evacuation pump(s)	1	✓		
	- Strainer	1	✓		
	- Pressure indicators	1	✓		
	- Skid assembly and fabrication of module	1	✓		
	HFO separator unit	1	✓		
	Components of Module per module:				
	- Separator(s) (1 w + 1 stby)	2	✓		
	- Separator control(s)	2	✓		
	- Separator pump(s)	2	✓		
	- Preheater(s)	2	✓		
	- Separator sludge tank(s)	1	✓		
	- Sludge tank evacuation pump(s)	1	✓		
	- Piping on module	1	✓		
	- Trace heating on module	1	✓		
	- Operating Panel	1	✓		
	HFO/DFO prepressure module:	1	✓		
	Components per HFO/DFO prepressure module:				
	- 3 way change over valve	1	✓		
	- HFO pressurising pump(s) (1 w + 1 stby)	2	✓		
	- HFO prepressure valve(s)	1	✓		
	- HFO automatic filter(s)	1	✓		
	- HFO pressurising pump strainer	1	✓		
	- Flowmeter	1	✓		
	- Pressure indicators	1	✓		
	- Piping on module	1	✓		
	- Trace heating on module	1	✓		
	- Pipe insulation on module	1	✓		
	- Skid assembly and fabrication of module	1	✓		
	HFO storage tank, heated (400 tons)	1		✓	
	HFO storage tank filling pump(s) / unloading station incl. strainer	2		✓	
	HFO storage tank level indicator, instruments, etc.	2		✓	
	HFO Settling Tank (10,000 ltrs) , heated and insulated	2		✓	
	HFO Settling tank filling pump(s) incl. strainer	2		✓	
	HFO Settling Tank level indicator, instruments, etc	2		✓	
	HFO service tank (10,000 ltrs) , insulated	2		✓	
	HFO service tank level indicator, instruments, etc	2		✓	
	Set of material for pipe trace heating throughout power plant	2		✓	
	Set of insulation material for pipes and system components	2		✓	
	Set of piping material for HFO system	2		✓	
	Set of valves and fittings for HFO system	2		✓	
1.12	LUBE OIL SYSTEM				
	Lube oil force pump (part of the engine)	2	✓		
	Lube oil deep pan (part of the engine)	2	✓		
	Combined water / lube oil service unit (lube oil circuit)	2	✓		
	Each Module consist of :				
	- Lube Oil Prelube Pump	1	✓		
	- Lube oil heat exchanger	1	✓		
	- Lube oil automatic filter	1	✓		
	- Lube oil duplex filter	1	✓		
	- Lube oil temperature control valve(s)	1	✓		
	- Piping on module	1	✓		
	- Lube oil valve(s), 3 way valve	1	✓		
	- Pressure, Temperature Indicator	1	✓		
	- Panel on module	1	✓		
	- Skid assembly and fabrication of module	1	✓		
	Lube oil separator module:	2	✓		
	Components per separator module:				
	- Separator c/w electric motor	1	✓		
	- Separator control	1	✓		
	- Lube Oil Separator pump	1	✓		
	- Lube Oil Separator preheated unit	1	✓		
	- Lube Oil Separator sludge tank	1	✓		
	- Sludge tank evacuation pump	1	✓		
	- Piping on module	1	✓		
	Lube Oil storage tank (5,000 ltrs)	1		✓	
	Lube Oil Receiving Pump	1		✓	

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ITEM	DESCRIPTION	Quantity	TUS(S)PL Supply	Customer Supply	Remarks
	Lube Oil Receiving Hose and Hose reel (20 m)	1		✓	
	Lube Oil Transfer Pump	1		✓	
	Lube Oil Transfer Pump Suction filter	1		✓	
	Lube Oil Flowmeter	1		✓	
	Lube Oil Flowmeter filter	1		✓	
	Lube Oil drain tank for maintenance (5,000 ltrs)	1		✓	
	Lube Oil emptying pump	1		✓	
	Mobile Lube Oil transfer pump	1		✓	
	Set of piping material for lube oil system	2		✓	
	Set of valves for lube oil system	2		✓	
1.13	THERMAL OIL SYSTEM				
	Heat Recovery Unit / Thermal Oil Heater	2		✓	
	Feeding Device: (Including Panel Control)				
	- Circulating Pump	2		✓	
	- Air Separator	1		✓	
	- Strainer	2		✓	
	- Sets of valve	1		✓	
	- Sets of Press and Themp Indicator	1		✓	
	- Sets of piping on skid	1		✓	
	- Skid assembly and fabrication of module	1		✓	
	Storage / Filling Tank :				
	- Filling Tank	1		✓	
	- Filling pump - gear pump	1		✓	
	- Strainer	1		✓	
	- Sets of valve	1		✓	
	- Sets of piping on skid	1		✓	
	- Skid assembly and fabrication of module	1		✓	
	Oil expansion tank	1		✓	
	Supports/Structures etc required for thermal oil heaters	2		✓	
	Hot oil supply pipes, fittings, etc.	2		✓	
	Cool oil return pipework from all consumers	2		✓	
	Pipes, valves, etc., for fill and drain system	2		✓	
	Insulation and cladding for all thermal oil supply and return pipework	2		✓	
	Pipe supports, clamps, and other hardware	2		✓	
	Cabling and accessories	2		✓	
	Thermal oil	2		✓	
1.14	OTHER ACCESSORIES				
	Set of local thermometers, manometers and level indicators for TUS(S)PL supply components	1	✓		
	Set(s) of bolts for alternator and engine fastening	2	✓		
	Set(s) of coupling elements between engine and alternator	2	✓		
	Lot of dowels for equipment supplied by TUS(S)PL	1	✓		
	Overhead bridge crane, cap. 20/5 tons	1		✓	
	Lot of paint for pipes and components	2		✓	
	Set(s) of embedded material	2		✓	
	Set of tools needed for the installation	1		✓	
	Sets of pipe and cable tray support	2		✓	
	Lot(s) of grouting material and silicon for genset(s)	2		✓	
	Lot of dowels for equipment not supplied by TUS(S)PL	2		✓	
	Set of labels, valve tags, etc., for TUS(S)PL supply items	2		✓	
	Set of labels, valve tags, etc., for non-TUS(S)PL supply items	2		✓	
	Trench covers, access platforms to auxiliary equipments, etc	2		✓	
1.15	TOOLS				
	Set of basic engine tools	1	✓		
	Set of basic turbocharger tools	1	✓		
	Set of DIN tools	1	✓		
	Lathe Machine for Valve Seat	1	✓		
	Crank web deflection dial gauge	1	✓		
	Micrometer for cylinder liner	1	✓		
	Ruler for cylinder liner micrometer	1	✓		
	Maximator pump for hydraulic tightening device	1	✓		
	Electronic fire pressure measuring device	1	✓		
	Electric valve grinder	1	✓		
	Set(s) of special HFO separator tools	1		✓	
1.16	SPARE PARTS				
	Set of spareflexible connections	1	✓		

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	Engine spare parts	1	✓	✓	
	Set of HFO separator spare parts for 8,000 hrs operation	1		✓	
2	GENSET CONTROL AND MONITORING				
2.1	Local control panel	2	✓		
2.2	Common control panel	1	✓		
2.3	Set of remote instruments for engine	1	✓		
2.4	Powerstation SCADA	1	✓		
2.5	Set of remote instruments for TUS(S)PL supplied power plant equipments	1	✓		
2.6	Set of IRM Module (interconnection Remote module for MCC)	2		✓	
3	GENERATOR				
3.1	Generator with AVR & rotating diode failure detector	2	✓		
3.2	Set of generator differential protection CTs in generator terminal box	2	✓		
3.3	Set of vibracon elements for generator mounting	2	✓		
4	ELECTRICAL PLANT EQUIPMENT				
4.1	Medium voltage switchboard consisting of :				
	Switchgear, 20 kV				
	- Out going SF6 breaker, 630 A	2		✓	
	- Metering	1		✓	
	- Auxiliary transformer feeder, 630 A	1		✓	
	Switchgear, 6.3 kV				
	- Direct Incoming metalclad cubicle and breaker, 1250 A	2		✓	
	- Incoming CT/PT	2		✓	
4.2	Low voltage (400VAC) switchboard consisting of :				
	Power distribution board	1		✓	
	Engine MCC	2	✓		
	Radiator MCC	2	✓		
	Panel for common station auxiliaries with emergency genset control	1	✓		
	- IRM box for above panel	1	✓		
	Panel for fuel treatment house	1		✓	
	- IRM box for above panel	1	✓		
	Panel for fuel unloading station	1		✓	
4.3	Transformer				
	Station transformer 8000 kVA, 6.3 kV/ 20 kV	2		✓	
	Auxiliary Transformer 1250 kVA, 20 kV/400 V	1		✓	
4.4	Lead Acid Battery 24 VDC, included in local control & common control panel	1	✓		
	Lead Acid Battery 110VDC	1		✓	
4.5	Cables, and its accessories for:				
	- MV power from Genset to Panel 6.3kV	2		✓	
	- MV power from Panel 6.3 kV to Step up transformer	2		✓	
	- MV power from Step up transformer to 20 kV Panel	2		✓	
	- MV power from 20 kV Panel to auxiliary Travo	1		✓	
	- LV power from Transformer to MCC Main Distribution Panel	1		✓	
	- LV power from Main Distribution Panel to Auxiliary Equipment	2		✓	
	- Control Cables	2		✓	
	- Equipment earthing system materials and installation hardware	2		✓	
	- Site earth matting and hardwares	2		✓	
	- Lightning protection system	2		✓	
	- Emergency Lighting	2		✓	
	- Cable termination kits, including cable lugs, etc.	2		✓	
	- Cable trays, consumables and tooling	2		✓	
4.6	Neutral earthing resistor	1		✓	
	Manual Operation - Neutral Switch	2		✓	
4.7	Lighting system inside Power House and surround Power House	1		✓	
5	SERVICES				
5.1	FACTORY TEST				
	Standard Factory test of engines	2	✓		Already completed
	Standard Factory test of generators	2	✓		Already completed
5.2	TRANSPORTATION (TUS(S)PL SUPPLY PORTION)				
	Packing of imported equipment	2	✓		