

7 x 16V32/40 MAN HFO Complete Power Plant

Plant Description

52 MW Diesel/HFO Power Plant

Engines & Accessories - Radiator cooling type

Diesel Engines are sixteen-cylinder four-stroke type for stationary installation, turbocharged and charge-air cooled of design, clockwise rotation. System is manufactured and accordingly will be connected to 34,5 kV distribution system by means of transformers included in the system described below. YOM is 2000 and 2001. Commissioning is in 2001.

Engine Quantity : 7 engines with accessories as described below

Engine Type: Type: 16 V 32/40

Continuous rating as per ISO standards 3046-1:1995 measured at the crankshaft flange when using suitable fuel as described.

A: nameplate power

- at site 800 m above sea level
- up to an ambient air temperature of max. (28 deg.C)
- and a charge-air cooling water temperature of (38 deg.C)

7600 kW at 750 rpm

The engines covered under this Specification are only used approx. for 7,000 hours on a “base load” type operation and can be considered new. During this operation, engines have proved to be highly reliable and availability for this period has been approx. 95%. Therefore in this context ;

7 Engines with standard equipment equipped for operation on heavy oil up to 700 mm²/s (cSt) at 50 deg.C corresponding to 7000 sec. Redw. 1/100 deg.F and shop acceptance run of the engines made by Diesel fuel and subject engines have been running on heavy fuel oil successfully approx. 7000 hours on “base load” basis.

Other Special Equipment and conditions ;

7 Turbine cleaning device (dry cleaning by granulate)
additional to the washing device

1.0 Tools and Spares:

- 1 Set of Consumables (gaskets and seals only) spare and 1 set of tools (incl. 2 interlocking devices) for turbocharger
- 1 Set of standard and special tools for servicing and inspection of the engines.
(Tools for erection of the complete plant are to be provided by the contracting company and such tools will remain the property of this company).
- 1 Set of hydraulic hand pump with hydraulic tightening devices
- 1 Electric valve cone grinder for inlet and exhaust valves
- 1 Electric valve seat grinder for the inlet and exhaust valve seats in the cylinder heads
- 1 Electronic firing pressure gauge
- 1 Setting device to check the start and end of delivery of the injection pumps
- 1 Grinding-in device for grooves in cylinder liners and the joint faces in cylinder head
- 1 Pneumatic honing tool for the cylinder liner
- 1 Extraction tool for the bolts of the crankshaft counter weights
- 1 Mounting and removing device for the main bearing covers from the crankcase
- 1 Installing/dismantling tool for the torsional vibration damper
- 1 Installing/dismantling tool for the charge air cooler
- 1 Grinding tool for the fuel injection pipes
- 1 Test kit for jacket water
- 1 Chemicals for replenishment of jacket water test kit
- 1 Test kit for engine lube oil and fuel
- 1 Chemicals for replenishment of lube oil test kit

3 Foundation Equipment (engines) :

Data regarding static and dynamic forces acting has been calculated and applied in this project.

- 7 Flexible coupling (sized according to vibration calculation).
- 7 Steel foundation frame with integrated lube oil service tank for engine.

Assembly ; Engines and generators assembled on the foundation frame at the factory and will be delivered accordingly.

1.4 Control and Monitoring Equipment

- 7 Scope of equipment for monitoring and operating the engine and for the monitoring and control of auxiliaries has been installed in a control cabinet.
- 1 Additional device exists for monitoring and controlling the common auxiliaries.
- 1 Pressure switch fitted, installed in the Diesel oil circular pipeline
- 1 Pressure switch installed in the heavy fuel oil circular pipeline
- 1 Resistance thermometer installed in the heavy fuel oil circular pipeline
- 7 Extension of transmitters for monitoring and operating the engine, as well as monitoring and controlling the auxiliaries when using a screen (standard monitor) system.
- 7 Oil mist detector VN 115 with measuring tube heating, engine-mounted
- 7 Resistance thermometer Pt 100 at each crankshaft bearing,
- 7 Engine Power Management System (EDS-D + PCU)

1.6 Safety and Protection Equipment;

- 7 Flywheel cover (mounted)
- 7 Free-standing platform, floor plates, railing and stair

1.7 Common Systems / Modular Design

7 Auxiliary module comprising:

- LUBRICATING OIL:
- HT-COOLING WATER CIRCUIT:
 - HT-service pump with motor
 - HT-temperature regulating valve, with electrical actuator
- LT-COOLING WATER CIRCUIT:
 - LT-service pump with motor
 - LT-temperature regulating valve with electrical actuator
- Leakage lubricating oil and fuel oil
- Control Panel

Lubricating Oil System;

2.1 Engine Lubricating Oil:

7 Set of lube oil piping inside power house including fittings, adaptors, flexible pipe connections and mounting elements, with supports where applicable

7 Lube oil flow rate measuring device

2.2 Secondary-Lubricating Oil System (Cleaning):

7 Separator module for lube oil cleaning consisting of:
separator (self-cleaning), effective service rating max. 2.35 m³/h

1 Set of standard commercial tools for lube oil separator

1 Intermediate sludge tank approx. 1 m³ capacity

1 Sludge pump for discharge the intermediate sludge tank,
with electric motor

1 Set of piping inside the engine room and outside up to the tank farm

2.3 Lube Oil Supply / Discharge System:

1 Supply pump to storage tank. approx. 2 m³/h with electrical motor

1 Storage tank for clean oil, 30 m³ capacity to be set up in tank farm,

1 Used oil tank, 30 m³ capacity to be set up in tank farm

- 1 Transfer pump from storage tank to the lube oil service tank approx. 2 m³/h
- 1 Discharge pump for used oil tank with electric motor and attached pressure limiting valve capacity approx. 2 m³/h,
- 7 Replenishing system to top up the spent lube oil when the engine running
- 2 Set of piping inside and outside of the power house and pump house up to the tank farm with fittings and mounting elements, tracer-type heating (steam) and insulation material (where applicable), supported where necessary. The tanks are installed in the tank farm suction and delivery piping between power house and tank farm are calculated to be approx. 80 m each).

3 Cooling Water System;

3.1 HT COOLING WATER : (for charge air stage 1, cylinder cooling)

- 7 Two-circuit radiator cooling system for installation in the open air,

This system is designed for an ambient air temperature of max. (40 deg.C),

- 7 Monitoring equipment for regulating the engine cooling water temperature
- 7 Expansion tank of (two part design) 2 x 250 lt. capacity for HT and LT circuit with mechanical level indicator (MBD) (+ MIN alarm contact)
- 7 Set of piping inside engine room and to radiator cooling system (distance cooling system to engine room is planned to be max. 30 m) with fittings, adaptors and mounting elements, supports where necessary
- 7 Set of flexible pipe connections for anti-vibration mounting of the generating set

3.1.a Cooling Water Preheating System (HT circuit):

- 1 Electrical preheater set for jacket water
- 7 Plate-type heat exchanger for the preheating of engine cooling water, with thermometers

- 7 Temperature control valve (thermostat) for the preheating of engine cooling water, with thermometers
- 7 Set of piping for the preheating of engine cooling water, with fittings and mounting elements, supports where necessary
- 7 Set of piping for preheating circulation for the preheating of engine cooling water with fittings and mounting elements, supported where necessary

3.4 Nozzle Cooling Water System:

- 7 Nozzle cooling water module internally piped
- 7 Set of piping inside engine room with fittings, adaptors and mounting elements, with supports where necessary
- 7 Set of flexible pipe connections for anti-vibration mounting of the set

3.5 Mains Water Supply:

- 2 Cooling water collecting tank with mech. level indicator approx. 3000 liter capacity
- 2 Replenishing pump for cooling water systems
- 4 Set of piping inside power house with fittings and mounting elements, with supports where necessary
- 4 Set of piping outside power house to all engine systems and to the water storage tank, with fittings and mounting elements, with supports where necessary
- 1 Water treatment plant (water softening) for make-up water (engine cooling water)

4.6 Charge Air Cooling Water System: (in case of radiator cooling)

- 7 Temperature regulating valve with electric actuator to be fitted in the LT cooling water piping
- 7 Monitoring equipment for charge-air temperature regulating before cylinder to prevent formation of condensed water and increase of the charge-air temperature in case of low-load operation.

- 7 Monitoring equipment for temperature regulating the LT cooling water.
- 7 Set of piping inside the engine room and to radiator cooler (30 m distance from engine room)
- 7 Set of flexible pipe connections for vibration-free mounting of the set

5 Fuel System:

5.1/5.6 Heavy Fuel Oil System: (pressurised)

- 1 Diesel oil storage tank, approx. 500 m³ capacity to be set up in the tank farm.
- 2 Storage-tank for dirty HFO approx. 2000 m³ capacity to be set up in the tank farm,
- 1 Service tank for cleaned HFO, approx. 150 m³ capacity to be set up in the tank farm
- 1 Set of Diesel oil supply pumps to fill up the Diesel oil storage tank
- 1 Diesel oil flow meter
- 1 Set of Diesel oil supply pumps
- 1 Set of HFO supply pumps to fill up the storage tanks for dirty HFO
- 1 Heavy fuel oil flow meter, between unloading station and HFO storage tank
- 1 Set of HFO supply pumps
- 1 Set of piping for HFO and Diesel oil between the unloading station (buffer tank) and the tank farm
- 1 Set of piping for Diesel oil (to and from the power house approx. 80 m)
- 1 Set of piping for HFO. To and from the power house approx. 80 m
Insulation will be done if necessary.

1 Fuel oil filter module

7 Fuel oil module,

7 Set of piping inside engine room for HFO and Diesel oil supports where necessary

7 Set of flexible pipe connections for vibration-isolated mounting of the generating set
HFO piping will be insulated if necessary based on ambient conditions

5.4 Heavy Fuel Oil Purification: (jointly for the power station)

3 Separator module for heavy fuel oil purification

1 Set of standard commercial tools for the HFO-separator

2 Sludge tank approx. 30 m³ capacity one each for fuel and lube oil sludge

2 Sludge pump for discharging the the sludge tank with motor and attached pressure relief valve delivery volume approx. 2 m³/h, motor approx. 0.75 kW

3 Set of piping inside the pump house with fittings and mounting elements
HFO piping will be insulated if necessary based on ambient temperatures

1 Set of sludge piping between pump house and sludge tank with fittings, mounting elements, tracer-type heating (steam) and insulation material (if necessary), with supports where necessary

Sludge piping will be insulated based on ambient temperatures if necessary.

6.1 Combustion Air System: With oil-bath rotary filter

7 Oil-bath rotary filter with electric motor

7 Baffle-type silencer

7 Set of intake air pipe with adapter

upstream of each turbocharger with holders

- 7 Rubber expansion joint, upstream of each turbocharger with counterflange
- 7 Set of insulating material with jacketing, loose, for acoustic insulation of the baffle-type silencer and of combustion air pipes inside engine room

6.5 Exhaust Gas System:

- 7 Exhaust gas silencer outside power house, with counterflanges. silencing effect approx. 35 dB (A)
- 7 Set of exhaust gas pipes up to the exhaust gas silencer
- 7 Adaptor upstream of each turbocharger with expansion joint and counterflange
- 14 Exhaust gas expansion joints DN 1100 made of stainless steel, with carbon steel flanges (St 37-2)
- 14 Exhaust gas flanges DN 1100 made of carbon steel (St 37-2)

7 Compressed Air System:

7.1 Main System: (for intermittent operation)

- 2 Compressor module (30 bar) air cooled, with intercooler and final cooler and electric motor approx. 22 kW jointly mounted on a frame with switch and control device
- 7 Starting air receiver 1500 l capacity working pressure 30 bar,
- 3 Set of piping between starting air compressor and starting air receiver
- 7 Set of piping between starting air receiver and engine accessories
- 1 Pressure reducer (30 to 7 bar) with water trap, dirt trap, safety valve and piping
- 7 Set of flexible pipe connections for anti-vibration mounting of the set

7.2 Secondary System:

- 1 Lower pressure compressor plant for 10
- 7 Set of piping for working air inside power house, with quick-coupling connection, fittings and pressure reducer
- 7 Set of piping for working air outside power house, with quick-coupling connection

8.0 Heat Recovery System: (steam system)

3 boilers as described will be supplied to generate sufficient steam required for the plant

8.1 Steam Distribution System:

- 1 Set of piping for steam distribution within the power house and the pump house. Steam pipes will be insulated for safe operation.

Balance of Plant :

Civil works ; subject plant's civil works will be based on the offered layout. Offered plant is based on the existing design concept and drawings.

Power house will be (60,8 mt x 16,5 mt as per project).

Water Treatment and Reverse Osmosis system; an 8 m³/h capacity raw water treatment system and a 2,5 m³/h reverse Osmosis system together with necessary equipment

Various Tanks ; the project covers supply and erection following tanks made of carbon steel and/or fiber glass for usage in various areas ;

- 2 ea 2500 m³ fuel oil storage tanks (insulated and heated if necessary)
- 1 ea. 600 m³ capacity Diesel fuel tank
- 1 ea. 150 m³ capacity clean fuel oil tank (daily storage tank)
- 2 ea. 30 m³ water tank
- 3 ea. 1 m³ various purpose (sludge, leaked oil etc) tanks.

Heat Recovery Type Boilers ; 3 ea., of 2,5 m³ capacity operating at 8 bar pressure, will supply the required steam for the plant when the Diesel generator sets are in operation. The offered system includes also the electrification, design and duct and bypass systems.

Start up Boiler ; 1 ea. scotch type boiler to produce 8 bar steam (2,5 m³/h capacity) running on Diesel Oil as fuel.

Fire Fighting system ; 1 ea. 200 m³ storage capacity (underground made of concrete) water storage tank, two pumps (one diesel and one electric operated) will be needed

Discharge Pumps ; 3 ea. (2 operating one standby) fuel oil discharge pumps to discharge fuel oil from trailer trucks to the fuel oil storage tanks.

Weighing Scale ; 1 ea. heavy duty weighing scale to weigh the trailer trucks bringing in Fuel Oil will be needed.

Lime Milk and Gypsum tanks ; 2 ea. 300 m³ storage capacity tanks for storage of Lime Milk to be used for desulphurisation and also storage of the gypsum.

Denox sytem ; 7 ea. Denox system placed behind exhausts of engines complete with cathalysts and control systems for the elimination of Nox gases as per environmental regulations issued by the EC.

Desox system ; one complete Desox system with suitable capacity, to eliminate the Sulphur in the exhaust gases required by the environmental regulations complete with control systems. The stack (scrubber) is made of stainless steel. The DESOX unit operates according to emission requirement of the EC.

Engineering works ; necessary to integrate the units stated above, electrification, erection and assembly and preparation of the as built diagrams.

Miscellaneous:

Connection to Grid ; via 2 ea. 10.3 – 34,5 kV transformers (equipped with on-load tap Changers. Medium voltage and low voltage systems complete together with power metering (produced and sold power excluding internal consumption).

Painting ; 1 primer and 1 finish coating of the pipes as well as paint for marking the individual systems with circles and arrows (on the pipes as exists)

Power house crane ; 1 ea. carrying capacity 2 tons. span 15 m.
Crane rails 57 m long. for assembly on crane runway with fastening material

1 Set of hoists for maintenance of Diesel engine auxiliaries in the pump house and power house.

1 Black-start-Diesel generating set 250 kVA for automatic starting and synchronising of one Diesel genset only.

7 Power house forced draft ventilation with axial-flow fan and adjusting louvre (with noise damper 25 dB(A) without air filter);

- 1 Set of necessary instruments for all tanks within the tankfarm
(e.g. float switches, level switches, thermometer, etc.)

As stated above, all equipment and instruments electronic or electrical and mechanical, including the Diesel Generating sets, water pumps comprising the power plant to produce 52 MWe by using HFO as fuel (starts made with diesel oil), have been used for approx. 7000 hours of operation and will be disassembled and made ready for delivery.

The system has been designed to be connected to 34,5 kV distribution system via 34,5 kV transformers (two sets) and therefore similar point of connection is needed or the engines directly can be connected to 10.3 switchgear or to transmission system directly as the generators of the engines are 10.3 kV.



