

DESCRIPTION OF THE BARGE

The Floating power plant has been designed for base load application, intended for parallel operation with a public supply system. The power generation part consists of a Six 11.52 MW DG-set using a Sulzer 16ZAV 20S diesel engine as a prime mover driving the generator generating the electrical power.

The operation of the diesel generating sets is carried out from the control room. The barge is equipped with a cooling tower using Sea water for Central cooling System.

MAIN DIESEL GENERATING SETS

All diesel engines are of four stroke, direct injected, turbocharged, intercooled design.

Make	:	New Sulzer Diesel France
Configuration	:	Vee
Number of Engines	:	Six
Engine Type	:	16 ZAV 40S
Number of Cylinders	:	16
Cylinder Bore	:	400 mm
Stroke	:	560 mm
Speed	:	514 rpm
Mean piston speed	:	9.56 m/s
Mean effective pressure	:	23.89 bar
Swept volume per cylinder	:	28.15 m ³
Compression ratio	:	12:1
Direction rotation		
Facing towards flywheel	:	Clockwise
Rate Output	:	11520 Kw

ENGINE AND GENERATOR SERIAL NUMBER

<u>ENGINE NO.</u>	<u>ENGINE SERIAL NO.</u>	<u>MANUFACTURING DATE</u>
1	740354	
2	740355	
3	740391	
4	740392	
5	740393	
6	740394	

ELECTRICAL GENERATOR

Generator

Manufacturer	ABB
Manufacturer's type n°	HSG 1600S14
Applicable Standard	IEC 34

Rated Output	140,000 kVA
Power Factor	0.8
Rated Voltage	13.8
Rated Current	586A
Frequency	60 Hz
Synchronous Speed	514 rpm
Insulation Class	F
Temperature Rise Class	B
Bearing Type	Sleeve bearing
Terminals	6, bottom mounted
Connection	Star
Degree of Enclosure protection (IEC 34-5)	IP21
Cooling Method(IEC 34-6)	Air open circuit
Overspeed	120% of rated speed
Overload	110% of the rated load

Generator:

Serial No:

No.1	-	4549197
No.2	-	4549198
No.3	-	4549199
No.4	-	4549200
No.5	-	4549201
No.6	-	4549202

TANKS

BARGE TANK CAPACITIES

TANK NAME	DURA 2 (cu.m.)
HFO Tank	330
Service tank # 1	111.7
Service tank # 2	111.7
Settling tank S1	251.33
Settling tank S2	251.33
Settling tank P1	251.33
Settling tank P2	251.33
Marine Diesel Oil	
M. D. O. Service S1	55.8
M. D. O. Service S2	55.8

Lube Oil tank	
L.O. Storage #1	55.85
L.O. Storage #2	55.85
L.O. Sump # 1	19.76
L.O. Sump # 2	19.76
L.O. Sump # 3	19.76
L.O. Sump # 4	19.76
L.O. Sump # 5	19.76
L.O. Sump # 6	19.76
Potable Water # 1	55.85
Potable Water # 2	55.85
Fresh Water Tank	
Fresh Water # S1	55.85
Fresh Water # S2	55.85
Fresh Water # S3	55.85
Fresh Water # S4	55.85
Sludge Tank	
Sludge tank # 1	143.61
Sludge tank #2	143.61
Oily bilge tank	39.69
Dirty Oil tank	
Dirty oil tank # 1	39.69
Dirty oil tank # 2	39.69

MECHANICAL AUXILIARY SYSTEM

HEAVY FUEL OIL SYSTEM

The heavy fuel oil is transferred into the settling tanks by the fuel barge transfer pump unit. The settling tanks are equipped with electronic level indicator and alarm for overflow protection. The settling tanks are fitted with steam heater so as to keep the temperature of the HFO @ 40 - 60 °C

The fuel coming from the settling tank is transferred by the separator feed pump to the Fuel separator skid where the fuel is purified. Purified fuel is led to the day tank. A three-way valve is fitted at the outlet of each separator skid. Should the daily tanks level be very high, this three way valves would then be actuated and allow the flow to be led back to the settling tanks. The day tank is fitted with steam heater so as to keep the temperature of HFO @ 40 - 60 °C.

To enhance further the quality of fuel for engine consumption Fuel pass through a booster module skid. Fuel is transfer from day tank to the booster skid by a HFO feed pump. In every engine one booster module skid is assign.

HFO SEPARATOR FEED PUMP

No. of units	4 units
Unit assignment	2 unit for 1 HFO separator skid 1 for continuous operation, 1 for stand by operation
Pump capacity	2 - 12 m ³ / hr
Working Pressure	4 bar
Motor Output	4.7 kW
RPM	1750
Manufacturer	AZCUE

HFO SEPARATOR

No. of units	4 units
Units assignment	1 per 3 engines, the other 2 were on stand by mode.
Manufacturer	Westfalia
Model	OSB 35/40
Capacity	14000 L/h max
Speed of motor shaft	1,745 rpm
Frequency	60 Hz
Power	13.5 kW
Bowl Speed	6,600 rpm
Service Temp.	90°C to ± 5%

HFO FEED PUMP

No of unit	4 units
Unit Assignment	2 units per 3 engines. 1 unit for continuous operation, 1 unit for stand by mode
Pump Capacity	9.5 m ³ / hr
Working Pressure	6 bar
Motor output	4.7 kW
RPM	1750
Manufacturer	AZCUE

BOOSTER MODULE SKID

Mixing tank

No. of Unit	6
Unit Assignment	1 for every engine
Capacity	280 liters

Booster Pump

No. of Units	6
Unit assignment	1 unit for every engine
Pump Capacity	8 m ³ / hr
Working Pressure	10 bar
Motor Output	6.3 kW]
RPM	1750
Manufacturer	AZCUE

Fuel end heater

No. of Units	6
Unit Assignment	1 unit for every engine
Heating medium	Steam
Working Temperature	110°C to 120°C
Heating Capacity	100 kW
Type	Plate
Manufacturer	APV

Fuel Filter

No. of Units	12
Unit Assignment	2 for every engine, 1 Automatic filter, 1 emergency manual filter, 1 on service, 1 on Stand by.
Filter Grade	30 microns
Manufacturer	BOLL Filter

Viscosimeter

No. of Units	6
Unit Assignment	1 for every engine
Mode of Operation	Viscosity Control & Temperature Control

LIGHT FUEL OIL SYSTEM

The light fuel oil is transferred from the storage tank by the transfer pump unit to the day tank and from the day tank the system is connected via a change-over valve to the heavy fuel oil system. System consists of one transfer pump unit. Strainers, common base frame of steel, control panel for automatic/hand operation and interconnecting pipes, valves, seals, flanges are included.

Diesel Oil Feed pump

No. of Units	2
Unit assignment	1 unit per 3 engines
Pump Capacity	10.8 m ³ / hr

Working Pressure	4 - 6 bar
Motor Output	3.3 kW
Rpm	1750
Make	AZCUE

LUBRICATING OIL SYSTEM

Each engine has a lube oil sump tank equipped with level indicator. Upon low level, alarm signal will be send to the Control room and filling pump will be open by the Control room operator via a remote control. Filing pump will draw oil from the Oil Storage tank. Pump will automatically stop when the required levels are obtained.

Engine is lubricated by two different system, but using the same lube oil.

Oil from sump tank via Main Lube oil pump will go through the oil cooler then to the engine parts. After lubricating and cooling the engine parts, oil will drip down & go back to the sump tank. On the other system oil will be pump to the separator for purification. Purified oil will be temporarily stored to the expansion tank. Oil will flow to the cylinder lubricator by means of gravity. After lubricating the cylinder, oil will drip down and flows back to the oil sump tank.

Lube Oil Filling Pump

No. of Units	2
Units Assignment	1 unit for 3 engines,
Pump Capacity	4.4 m ³ / h
Working Pressure	4 bar
Motor Output	1.7 kW
RPM	1750
Manufacturer	AZCUE

Main Lube oil Pump

No. of Units	6
Unit Assignment	1 for every engine
Pump Capacity	180 m ³ / hr
Working Pressure	6 - 8 bar
Motor Output	86 kW
RPM	1150
Manufacturer	AZCUE

Lube Oil Cooler

No. of Units	6
Unit Assignment	1 per engine
Capacity	1238 kW
Working Temp.	50 - 65 °C
Type	Plate
Make	APV

Main Lube Oil Filter

No. of Units	12
Unit Assignment	2 unit per engine, on series operation

Type	Auto Simplex
Filter Grade	30 microns
Make	MOATTI

Lube Oil Indicator Filter

No. of Units	12
Unit Assignment	2 per engine, 1 unit on service, 1 on stand by.
Type	Manual duplex
Filter Grade	60 microns
Make	BOLL FILTER

Lube Oil Separator

No. of unit	6
Unit Assignment	1 unit per engine
Manufacturer	Wesfalia
Model	OSA.20.25.066
Capacity	4000 L/h
Speed of motor shaft	1,745 rpm
Frequency	60Hz
Motor Output	8.5 kW
Bowl Speed	7500 rpm
Service Temp.	95°C ± 5%

Lube Oil Separator Feed Pump

No. of Units	6
Unit Assignment	1 unit per separator
Pump Capacity	4.4 m ³ / hr
Working Pressure	4 bar
Motor Output	1.7 kW
RPM	1750
Manufacturer	AZCUE

Separator Lube oil Heater

No. of Units	6
Unit Assignment	1 per separator
Type	Plate
Heating Medium	Steam
Service Temp.	95 °C ± 5%
Make	APV

Separator Lube Oil Filter

No. of Units	6
Unit Assignment	1 unit per Separator
Type	Manual Simplex
Filter Grade	10 microns
Manufacturer	BOLL FILTER

STARTING AIR

STARTING AIR / CONTROL AIR / SERVICE AIR SYSTEM

STARTING AIR

Two compressors on skid supply air at 30 bar. The air is stored in four starting air receiver equipped w/ automatic and manual water drain. Pressurised air is fed to the engine during starting process. The system includes pressure switches for automatic starting and stopping of air compressor, oil and water separator, control panel for automatic or manual operation, pressure reduction valve for control and service air usage.

Air compressor

No. of Units	2
Manufacturer	HATLAPA
Type	L8011
Capacity	85 m ³ / hr
RPM	1750
Input Power	19.5 kW
Starting Air receiver	4
Starting Air Capacity	2.6 m ³

INSTRUMENT / CONTROL AIR

A compressor supplies air compressed up to 7 bar. Air is stored in the control air bottle equipped with automatic and manual water drain. This air is being used in the pneumatic control instrument.

Air compressor

No. of Unit	1
Manufacturer	Atlas Copco
Capacity	60 m ³ / h
Working Pressure	7 bar
Input Power	8.6 kW
Control Air bottle Capacity	1 m ³
Manufacturer	EGIM

SERVICE AIR

A compressor supplies air compressed up to 7 bar. The air is then stored in the service air bottle equipped with automatic and manual water drain. It is also interconnected with the control air system in case of emergency. Service air is being used in cleaning and other maintenance work.

Air compressor

No. of Unit	1
Manufacturer	Atlas Copco
Capacity	60 m ³ / hr.
Working Pressure	7 bar
Input Power	8.6 kW
Service Air bottle Capacity	500 L
Manufacturer	EGIM

COOLING SYSTEM

The diesel engines are cooled by two separate circuits consisting of high temperature (HT) circuit for cooling cylinder heads and cylinder liners and low temperature circuit (LT) for cooling the charge air, fuel nozzle water cooling and lubricating oil.

In Low temperature circuit, Cooling water will pass first to the 2nd stage charge air cooler then to the fuel nozzle & Lube oil cooler, then to the 1st stage charge air cooler and flows back to the central cooler and do the same cycle. Some of the LT cooling water will go to the High temperature circuit.

High temperature circuit ensures the cooling of the liners, cylinders cover, and turbochargers. HT cooling water then flows out of the engine and enters the air separator. The function of air separator is to vent air bubbles, steam, gas that might have built-up in the system. H.T. cooling water is regulated by TCV a temperature regulating valve. TCV might recirculate the water or return it to the LT. TCV function is to maintain the working temperature of the engine whatever may be the load.

Cooling water is then cooled in the central cooler by Sea water from the cooling tower. Sea water which is locally available is being used as medium in Central cooler.

Cooling Tower

No. of Unit	12
Unit assignment	2 units per engine
Capacity	6429 kW max
Manufacturer	HAMON

Cooling Tower Make-up Pump

No. of Unit	3
Unit Assignment	2 units on service, 1 unit stand by
Pump Capacity (Combine)	100 m ³ / h
Working Pressure	2.5 bar
Motor Output	15kW
Rpm	3600
Manufacturer	Opal

Raw Water Circulating Pump

No. of Unit	6
Unit Assignment	1 unit per engine
Pump Capacity	480 m ³ / h
Working Pressure	2 - 5 bar
Motor Output	50 kW
RPM	1750

Central Cooler

No. of Units	6
Unit Assignment	1 unit per engine
Capacity	6429 kW
Manufacturer	APV

Low Temperature Water Pump

No. of Units	6
Unit Assignment	1 unit per engine
Pump Capacity	180 m ³ / hr
Working Pressure	2 - 7 bar
Motor Output	21.5 kW
RPM	1750
Manufacturer	AZCUE

High Temperature Water Pump

No. of Units	6
Unit Assignment	1 per engine
Pump Capacity	150 m ³ / hr
Working Pressure	4 - 5 bar
Motor Output	34 kW
Rpm	1750
Manufacturer	Azcue

Fuel valve Cooling Water

No. of units	6
Unit Assignment	1 unit per engine
Pump Capacity	8 m ³ / hr
Working pressure	4 bar
Motor Output	4.7 kW
RPM	1750
Manufacturer	Azcue

Cylinder Water Transfer Pump

No. of unit	2
Unit Assignment	1 unit per 3 engine
Pump Capacity	5 m ³ / hr
Working Pressure	3 - 4 bar
Motor Output	1.25
Rpm	3450
Manufacturer	Azcue

Cylinder Water Drain Tank

No. of Unit	2
Unit Assignment	1 unit per 3 engines
Tank Capacity	5 m ³

EXHAUST GAS SYSTEM

The two exhaust gas manifolds are connected to the exhaust silencer. This one is fitted with a condensate and rinsing water draining device with hydraulic seal so that the water can be drained off without any risk for exhaust gases expelling in the lower levels of the power plant.

The engine 1, 3, 4 & 6 are fitted with an exhaust gas boiler on the top part of the exhaust silencers. The gas outlet of this one is connected with a chimney.

Exhaust Gas Stack

No. of Unit	6
Unit assignment	1 per engine
Manufacturer	VIBRACHOC

Exhaust Gas Silencer

No. of Unit	6
Unit assignment	1 per engine
Attenuation	25 db with fire arrestor
Manufacturer	VIBRACHOC

CHARGE AIR SYSTEM

The charge air, drawn from the atmosphere, is filtered in the oil bath automatic air filter, passes through the air intake silencer, then to the charge air cooler and to the charge air receiver.

Oil bath Filter

No. of Units	12
Unit assignment	2 units per engine
Filter speed	1 revolution per 24 hr
Manufacturer	AAF

Charge Air Silencer

No. of Unit	12
Unit assignment	2 units per engine
Attenuation	18 db
Manufacturer	AAF

HEAT RECOVERY SYSTEM

Treated water from the Feed water tank is fed to the steam drum. Water in the steam drum is being recirculated to the Exhaust gas boiler(EGB). The plant is equipped with 4 EGB. The heat of exhaust gases from the engine is transferred to the water circulation in the boiler making the water to evaporate partly. The steam/water emulsion leaves the boiler and flows into the steam drum where water and steam are separated. Steam flows to the common steam consumers of the power plant. Steam used in the heaters will condense and will flows back to the Feed water tank. The water being separated from the steam at the steam drum will be re-circulated to the EGB.

Steam drum is equipped with a level-regulating device. In case of high level, excess water will be return to the feed water tank. In case of low level steam drum feed pump will be activated.

A Pressure control valve (PCV) regulates steam pressure. In case of high pressure steam is being diverted to an air-cooled steam condenser where steam is being condensed and flows back to the feed water tank.

In case of plant shutdown an auxiliary boiler can pre-heat the plant.

Exhaust Gas Boiler

No. of Unit	4
Unit Assignment	Engine No. 1, 2, 3 & 4
Steam Capacity	1.6 ton / hr
Working Pressure	7 bar

Design Pressure	10 bar
Design Temperature	250°C
Manufacturer	Seratherm

Boiler Circulating Pump

No. of Unit	4
Unit Assignment	EGB # 1,3, 4, & 6
Pump Capacity	9 m ³ /hr
Working Pressure	7 bar

Steam Drum

No. of Unit	1
Unit Assignment	1 unit for Barge
Volume Capacity	3.6 m ³
Working Pressure	7 bar
Design Pressure	10 bar
Manufacturer	Seratherm

Auxiliary Boiler

No. of Unit	1 unit
Steam Capacity	1.6 ton / hr
Type	Diesel fired
Manufacturer	AALBORG

BLACK START DIESEL GENERATING SET

The emergency generating set is installed to provide power to the essential equipment during blackout condition due to failure of the main diesel generating sets or main bus bar.

Black Start Engines

No. of Unit	1
Manufacturer	Perkins
Model	P450
Rated Power	468 kVA
Rated Voltage	460 V
Rated Frequency	60 Hz
No. of Cylinders	8
Configuration	Vee
Rpm	1800

OVERHEAD CRANE

Jib Crane

Type	HSC 42 - 50 – 7
Max. Load	5 Tons
Max. Outreach	7 m
Min. Outreach	1.75 m
Max. Lifting Height	28 m

Motor Capacity	20kW
Manufacturer	ACTA

TRANSFORMER

MAIN TRANSFORMER (STEP-UP)

Rated Power	:	47 MVA ONAF/ 33 MVA ONAN
Frequency/Phases	:	60 Hz / 3
Connection	:	YN d11
Rated Voltages		
Primary	:	13.8 kV
Secondary	:	120 kV

STATION AUXILIARY TRANSFORMER

Rated Power	:	2000 kVA
Rated Voltages	:	
primary	:	13.8 kV
secondary	:	480 V
No. of Phases	:	3