MACHINERY PARTICULARS

2-1 MAIN ENGINE

No.	One (1)
Type	MAN B&W 7S80ME-C9.2, two-stroke cycle, crosshead, reversible, with part load method of Exhaust Gas Bypass(EGB),marine diesel engine with exhaust gas turbocharger
Output (bhp)	
Maximum continuous output (MCO)	25,190 kW x 72 rpm
Normal output (80% MCO)	20,150 kW x abt. 67 rpm
Number of cylinders	7
Kind of fuel oil	Heavy fuel oil, diesel oil or gas oil Flash point: Not less than 60°C

Remarks: 1) Nitrogen oxides (NOx) emission control “Tier II standard” (2008 amendments of Annex VI to MARPOL 73/78) shall be applied.
2) Diesel oil and gas oil(sulphur content less than 0.1% m/m if regulation requirement) shall be used in the Emission Control Area in accordance with the maker’s recommendation.

2-2 SHAFTING AND PROPELLER

Propeller	One (1), solid, keyless type, nickel aluminum bronze
Direction of rotation	Clockwise at ahead condition (looking from aft)
Stern tube seal	Rubber sealing ring type
Number of sealing rings	Four (4) for aft and two (2) for fore

2-3 BOILER

A. Auxiliary boiler

No.	Two (2)
Type	Oil fired, two-drum, water tube type marine boiler
Evaporation	40,000 kg/h
Steam condition	2.16 MPaG, Sat.
Feed water temperature	60°C
Air temperature	38°C at forced draft fan inlet
Kind of fuel	Heavy fuel oil, diesel oil and gas oil*

B. Exhaust gas economizer

No.	One (1)
Type	Forced-circulation, fin or pin tube
Evaporation	1,450 kg/h
Steam condition	0.6 MPaG, Sat.
Feed water temperature	60°C

* Diesel oil and gas oil (sulphur content less than 0.1% m/m if regulation requirement)shall be used for cold start and in the Emission Control Area in accordance with the maker's recommendation.

2-4 PRIME MOVER FOR ELECTRIC GENERATOR

A. Generator diesel engine

No.	Three (3)
Type	Four-stroke cycle, trunk piston, marine diesel engine with exhaust gas turbocharger
Engine revolution	900 rpm
Generator rated output	1120 kW
Kind of fuel	Heavy fuel oil, diesel oil or gas oil

Remarks: 1) Nitrogen oxide (NOx) emission control “Tier II standard” (2008 amendments of Annex VI to MARPOL 73/78) shall be applied.

2) Heavy fuel oil shall be used for normal running condition including starting and stopping.

3) Diesel oil and Gas oil (sulphur content less than 0.1% m/m if regulation requirement) shall be used before long stop condition and low load operation in the Emission Control Area in accordance with the maker’s recommendation.

B. Emergency generator diesel engine

No.	One (1)
Type	Four-stroke cycle
Generator rated output	260 kW x 1,800 rpm
Kind of fuel	Gas oil

2-5 AUXILIARY MACHINERY

Driving motor capacity (kW and rpm) for the auxiliary machinery may be altered in accordance with the maker's recommendation.

A. Air compressor

Service	No.	Type	Dis. free air m^3/h	Dis. press. MPaG	Driving motor kW
Main air compressor	3	Reciprocating, water cooled	abt. 270	2.9	53

B. Air reservoir

Service	No.	Volume m^3	Pressure MPaG
Main air reservoir	2	abt. 15	2.94
Aux. air reservoir	1	0.1	2.94
Emergency shut-off valve air reservoir	1	0.1	0.7

C. Pump

Where two pumps are provided for main engine service, one is working and the other is stand-by in principle.

Service	No.	Type	Capacity m^3/h	Dis. press. MPaG	Suc. head m	Driving motor kW x rpm
Central cooling fresh water	3	Vertical centrifugal	600	20 mTH	0	55x 1,800
Jacket cooling fresh water	2	Vertical centrifugal	250	30 mTH	0	30 x 1,800
Main cooling sea Water *1	3	Vertical centrifugal	720	18 mTH	-5/0	55 x 1,800
Fuel oil supply	2	Horizontal screw	9	0.4	0	7.5 x 3,600
Fuel oil circulating	2	Horizontal screw	18	0.98	0.4MPaG	22 x 3,600
Main lubricating oil	2	Vertical centrifugal (tank mounting)	560	0.46	0	150 x 1,800
Stern tube lubricating oil	2	Horizontal gear	1.5	0.35	-5	0.75 x 1,200
Aux. boiler feed	2	Horizontal centrifugal	100	2.7	0	132 x 3,600
Exh. gas economizer feed	2	Horizontal centrifugal	6	2.7	0	22 x 3,600
Boiler water circulating	2	Horizontal centrifugal	30	30 mTH	2.16MPaG	5.5 x 3,600
Cargo oil pump condenser condensate	2	Vertical centrifugal	86	25 mTH	36 kPaA （490mmHg vacuum)	11 x 1,800
Aux. boiler Fuel oil burning	2	Horizontal screw	Boiler maker’s standard (one set stand-by)			
Gen. engine diesel oil	1	Horizontal screw	3	0.98	0	3.7 x 3,600
Gen. engine diesel Oil	1		Engine maker’s standard			Air driven

Service	No.	Type	Capacity m^3/h	Dis. press. MPaG	Suc. head m	Driving motor kW x rpm
Cargo oil pump condenser circulating *2	2	Vertical centrifugal	1350	10 mTH	0	55 x 900
I.G.S. cooling Sea water	1	Vertical centrifugal	360	50mTH	0	75x1800
I.G.S. seal water	2	Horizontal centrifugal	10	35mTH	0	3.7x3600
Fire, bilge and ballast	1	Vertical centrifugal with self-priming device	600/90 /360	120/80 mTH /50	0/0/-5	315/100/100 x 1,800/1,200 /1,200
Fire and bilge	1	Vertical centrifugal with self-priming device	90/245	80/30 mTH	0/-5	65 x 1,800
Bilge	1	reciprocating	5	0.34	-5	2.2 x 1,800
Bilge separator Serv.pump	1	reciprocating	5	0.34	-5	2.2 x 1,800
Sludge	1	Horizontal snake	7	0.44	-5	3.7 x 1,200
Fresh water	2	Vertical Centrifugal	5	65 mTH	0	5.5 x 3,600
Drink water	1	Vertical centrifugal	5	65 mTH	0	5.5 x 3,600
Hot water circulating	1	Horizontal centrifugal	2	5mTH	65	0.4x1800
Fuel oil transfer	1	Horizontal screw	30	0.35	-5	37 x 3,600
Diesel oil transfer	1	Horizontal Screw	30	0.35	-5	37 x 3,600
Marine gas oil transfer	1	Horizontal screw	30	0.35	-5	37 x 3,600
Air cooler chemical cleaning	1	Horizontal centrifugal	3	30 mTH	0	1.5 x 3,600
M/E hydraulic oil	2	Vertical centrifugal （tank mounting）	70	0.46	0	30x 3,600

Service	No.	Type	Capacity m^3/h	Dis. press. MPaG	Suc. head m	Driving motor kW x rpm
Hydraulic oil circ.	1	Horizontal gear	1	0.20	-5	0.75 x 1,200
Main L.O.purif.feed	2	Horizontal Gear	4.5	0.35	-5	2.2 x 1,200
Aux L.O.purif.feed	1	Horizontal Gear	1	0.35	-5	0.75 x 1,200
F.O.purif.feed	2	Horizontal Screw	6	0.30	0	5.5 x 3,600

Remarks:

1) *1 One(1) of the three(3) main cooling sea water pumps shall be provided with self-priming device.

2) *2 Two(2) cargo oil pump condenser circulating pumps shall be operated in normal condition.
3) The capacity and motor output of the oil pumps shall be based on the following viscosity.

Pump	Viscosity for pump capacity (cSt)	Viscosity for motor output (cSt)
Main lubricating oil	100	260
Fuel oil supply	5	1,000
Fuel oil circulating	5	1,000
Gen. engine diesel oil	5	260
Stern tube lubricating oil	35	1,000
Fuel oil transfer	5	1,300
Diesel oil transfer	5	1,300
Gas oil transfer	5	1,300
Main L.O.purifier feed	35	1,000
Aux L.O.purifier feed	35	1,000
F.O.purifier feed	5	1,000

D. Fan

Service	No.	Type	Capacity m^3/min	Static press. PaG	Driving motor kW x rpm
Aux. boiler Forced draft	2	Horizontal centrifugal	Boiler maker's standard (one set for each boiler)		
Engine room ventilating	2	Vertical axial	abt. 1600	400	30 x 900
Engine room ventilating	2	Vertical axial, reversible	abt. 1600	400	30 x 900
Workshop ventilating	1	Wall mounting	abt. 50	100	0.4 x 3000
Emergency generator room ventilating	1	Wall mounting	abt. 50	100	0.4 x 3000

E. Purifier

Service	No.	Type	Capacity l/h
Heavy fuel oil	2	Self sludge discharge (automatic operation) with water transducer	6,000
Main lub. oil	2	Self sludge discharge (automatic operation) with water transducer	4,500
Auxiliary lub. oil	1	Self sludge discharge (automatic operation) with water transducer	700

Remarks:

1) The capacity of purifiers shall be based on the oil of the following conditions:

Heavy fuel oil purifier

Viscosity	:	abt. 700 cSt at 50°C
Density	:	1,010 kg/m^3 at 15°C
Temperature	:	98°C

Main lub. oil purifier

Viscosity	:	abt. 100 cSt at 40°C (detergent oil for cross-head type engine)
Temperature	:	90°C

Auxiliary lub. oil purifier

Viscosity	:	abt. 150 cSt at 40°C (detergent oil for trunk piston engine)
Temperature	:	95°C

2) Driving motor output and rotation speed shall be in accordance with maker's standard.

3) Extremely low viscosity diesel oil or gas oil is not to be purified, in principle.

2-6 HEAT EXCHANGER AND DISTILLING PLANT AND AIR EJECTOR

A. Cooler

Service	No.	Type	Cold fluid (inlet) °C	Hot fluid (outlet) °C	Design base
Central fresh water	2	Plate	32 (S.W.)	36	(2 sets working, each of 60% capacity)
Main lubricating oil	1	Plate	36 (F.W.)	45	M/E MCO
Fuel oil	1	Plate	36 (F.W.)	40	M/E MCO and normal electric load
Diesel oil	1	Plate	36 (F.W.)	40	Normal electric load
Gas oil	1	Plate	Boiler maker's standard		Boiler maker's standard
Jacket cool.F.W.	1	Plate	36 (F.W.)	85	M/E MCO
Heating steam drain	1	Straight tube	36 (F.W.)	80	Excess steam dump or slop tank heating
Sample	1	Coil tube	35 (F.W.)	45	-
Hyd.control oil	1	Plate	36 (F.W.)	45	M/E MCO

Remarks: * The central fresh water cooler shall be so designed that two(2) coolers are used under the following condition:

- Main engine is operated at MCO.
- Two(2) generator engine is operated at rating output.
- The following auxiliaries are operated:
  Unit cooler for engine control room
  Unit cooler for engineer's workshop
  Heating steam drain cooler
  One(1) provisions ref. machine
  Air conditioning plant
  Distilling plant

B. Heater

Service	No.	Type	Max. steam pressure MPaG	Cold fluid (outlet) °C	Design base
Main fuel oil	2	Fin, pin, coil tube or U-tube	1.1	150	9,000 l/h (2 sets working)
Aux. boiler Fuel oil	2	Fin, pin, coil tube or U-tube	1.1	Boiler maker's standard	Boiler maker's standard (2sets working)
Purifier fuel oil	2	Fin, pin, coil tube or U-tube	1.1	98	6,000 l/h
Main purifier lub. oil	2	Fin, pin, coil tube or U-tube	1.1	90	4,500 l/h
Aux. purifier lub. oil	1	Fin, pin, coil tube or U-tube	1.1	90	700 l/h
Main engine jacket water	1	Straight tube	1.1	85	Main engine warming-up
Fresh water		Refer to Hull Part			

Remarks:

Each of the main fuel oil heaters and the aux. boiler fuel oil heaters shall be capable of passing the amount of fuel oil flow as the fuel oil circulating pump capacity.

C. Condenser

Service	No.	Type	Cooling water (inlet) °C	Condenser vacuum mmHg	Design base
Cargo oil pump	1	Horizontal straight tube	30	36.0kPaA	All cargo oil pumps

D. Distilling plant

Type	No.	Capacity ton/day	Sea water (inlet) °C	Heating water (inlet) °C	Salinity ppm
M/E jacket water heating type, low pressure	1	30	32	abt. 85	10

Related pump

Service	No.	Capacity Type	Total head m^3/h m	Driving motor kW x rpm
Ejector pump	1	Centrifugal		Maker's standard
Distillate pump	1	Centrifugal		Maker's standard

E. Air ejector

Service	No.	Type	Capacity	Suc.press.	Max.steam press.
Air ejector For C.O.P. Condenser	1	Single stage, single element	25 kg/h (dry air)	36.0 kPaA	2.16 MPaG

2-7 INERT GAS SYSTEM

Service	No.	Type	Capacity	Driving motor kW x rpm
Scrubber	1	Boiler flue gas	20,700 Nm3/h	-
Blower	2	Horizontal Centrifugal	10,350 Nm3/h	Maker’s standard
Top-up IGG	1	-	500Nm3/h	-

2-7 MISCELLANEOUS EQUIPMENT

Service	No.	Type	Capacity	Remarks
Universal machine tool	1	Lathe and drill	Lathe: Center distance 1,000 mm Drill: Capacity 38 mm	Electric motor driven
Grinder	1	Double head, dry	Diameter abt. 250 mm	Electric motor driven
Electric welder		Refer to Part IV Electric and Automation		
Gas welder	1	Acetylene		Acetylene bottle x 2 Oxygen bottle x 4
Engine room crane	1	Overhead travelling	Hoist 98 kN (10 t)[*1]	Hoist/Travel/Traverse Electric motor driven
Control air dryer	1	Membrane	Free air abt. 100 m^3/h	
Bilge separator	1	Automatic Oil discharge	5 m^3/h	Oil content of effluent: 15 ppm or below, with alarm
Incinerator	1	Solid waste and waste oil burning	1160 kW	IMO type
Sterilizer	1	Ultra-violet	2,000L/h	
Mineralizer	1	Mineral stone	2,000L/h	
Marine growth preventing unit	1	Cu-Fe iron generaion	abt.1,300 m3/h	With tank
Unit cooler for engine control room	1	Package	abt. 22 kW	Refrigerant: R407c
Unit cooler for engineer's workshop	1	Package	abt. 17 kW	Refrigerant: R407c

Remarks: * The capacity of the engine room crane is based on lifting a main engine cylinder liner, as the heaviest one.

2-8 TANK

The tank volume shall be an appropriate gross volume.

Service	No.	Volume* (m^3)	Heating coil area ratio (m^2/m^3)	Local level gauge	Remarks
Fuel oil service	2	90	abt. 0.1	Float	Hull construction, with heat insulation
Fuel oil settling	2	90	abt. 0.2	Float	Hull construction, with sloped bottom, heat insulation
Diesel oil service	1	60		Float	Hull construction
Gas oil service	1	60		Float	Hull construction
Emergency gen. engine fuel oil	1	2		Float	Installed in emergency generator room
Fuel oil overflow	1	80		Float	In double bottom, with heating coil near suction bellmouth
Main lub. oil sump	1	50		Float & Sounding pipe	In double bottom, with heating coil near main L.O. pump suction
Main lub. oil settling	1	60	abt. 0.1	Float	Hull construction
Main lub. oil storage	1	60		Float	Hull construction
Cylinder oil storage	2	120 (in total)		Float	Hull construction
Low TBN cylinder oil storage	1	30		Float	Hull construction
Scavenging box drain	1	1		Float	Hull construction
Air cooler chemical Cleaning	1	1		-	
Generator engine lub. oil settling	1	5	abt. 0.1	Float	
Hyd.oil sump	1	4.5		Float	
Generator engine lub. oil storage	1	8		Float	
Generator engine Lub. oil overflow	1	3.5		Float	

Service	No.	Volume* (m^3)	Heating coil area ratio (m^2/m^3)	Local level gauge	Remarks
Stern tube lub. oil	1	1.5		Float	
Stern tube aft seal oil	1		Maker's standard		
Turbine oil storage	1	2		Float	
H/T cooing fresh water expansion	1	1.5		Float	
L/T cooling fresh water expansion	1	2		Float	
Feed water filter	1	10		-	With filter
Fresh water hydrophore	1	1		Glass	
Drink water hydrophore	1	0.5		Glass	
Clean water drain	1	30		Sounding pipe	In double bottom
Treated sewage holding	1	30		Sounding pipe	In double bottom
Bilge	1	80		Sounding pipe	In double bottom
Bilge primary separating	1	4			
Waste oil collecting	1	90	abt. 0.2	Sounding pipe	In double bottom
Fuel oil Sludge	1	4		Sounding pipe	With steam injection
Lub.oil Sludge	1	3		Sounding pipe	With steam injection
Waste oil setting	2	5	abt. 0.5	Float	Heat insulation
Exhaust gas economizer washing water	1	5		-	

Remarks: The volume of hull-constructed tanks may be changed in accordance with engine room arrangement.

CALCULATION FOR THE CAPACITY OF F.O.SERVICE TANK REQUIRED BY SOLAS '96

F.O.SERVICE TANK BASED ON L.C.V.OF 41,000 kJ/kg

ITEM	UNIT	VALUE	REMARKS
MAIN ENGINE OUTPUT AT M.C.R.	kW	25190	
F.O.CONSUMPTION RATE OF M/E	kg/kW/h	0.1723	
SPECIFIC WEIGHT OF H.F.O.	kg/m^3	980	
F.O.CONSUMPTION OF M/E	m^3/h	4.43	
GENE.ENGINE OUTPUT AT NORMAL LOAD	kW	900	
F.O.CONSUMPTION RATE OF G/E	kg/kW/h	0.200	
SPECIFIC WEIGHT OF H.F.O.	kg/m^3	980	
F.O.CONSUMPTION OF G/E	m^3/h	0.18	
SUPPLY TIME	h	8	
REQUIRED VOLUME	m^3	36.90	
DECIDED VOLUME (GROSS VOLUME)	m^3	90	

D.O.SERVICE TANK BASED ON L.C.V.OF 42,700 kJ/kg

ITEM	UNIT	VALUE	REMARKS
MAIN ENGINE OUTPUT AT M.C.R.	kW	25190	
F.O.CONSUMPTION RATE OF M/E	kg/kW/h	0.1654	
SPECIFIC WEIGHT OF M.D.O.	kg/m^3	850	
F.O.CONSUMPTION OF M/E	m^3/h	4.90	
GENE.ENGINE OUTPUT AT NORMAL LOAD	kW	900	
F.O.CONSUMPTION RATE OF G/E	kg/kW/h	0.190	
SPECIFIC WEIGHT OF M.D.O.	kg/m^3	850	
F.O.CONSUMPTION OF G/E	m^3/h	0.20	
SUPPLY TIME	h	8	
REQUIRED VOLUME	m^3	40.82	
DECIDED VOLUME (GROSS VOLUME)	m^3	60	

G.O.SERVICE TANK

BASED ON L.C.V.OF 42,700 kJ/kg

ITEM	UNIT	VALUE	REMARKS
MAIN ENGINE OUTPUT AT M.C.R.	kW	25190	
F.O.CONSUMPTION RATE OF M/E	kg/kW/h	0.1654	
SPECIFIC WEIGHT OF M.D.O.	kg/m^3	850	
F.O.CONSUMPTION OF M/E	m^3/h	4.90	
GENE.ENGINE OUTPUT AT NORMAL LOAD	kW	900	
F.O.CONSUMPTION RATE OF G/E	kg/kW/h	0.190	
SPECIFIC WEIGHT OF M.D.O.	kg/m^3	850	
F.O.CONSUMPTION OF G/E	m^3/h	0.20	
SUPPLY TIME	h	8	
REQUIRED VOLUME	m^3	40.82	
DECIDED VOLUME (GROSS VOLUME)	m^3	60	