

PROVISIONAL VESSEL PARTICULARS (FORM C)

LPG/C.ECO ENIGMA

UPDATED 04/10/2018

Specifications of the vessel and the gas installation which are representations by the Owners.

(A) VESSEL'S CHARACTERISTICS

PREAMBLE

Name : **ECO ENIGMA**
 Owner : **Golden Shadow Inc.**
 Flag : **MARSHALL ISLANDS**
 Build : **MURAKAMI HIDE SHIPBUILDING CO LTD**
 Date on Service : **14th April, 2015**
 Class : **Class NK**

GRT International : **4,258** Suez : **4,932.35**
 Panama : **3,637.00**

NRT International : **1,376** Suez : **4,054.65**
 Panama : **3,637.00**

Is vessel build according to USCG regulations? : **Yes.**
33 CFR Part 155, 156, 159 & 164
46 CFR Part 153
46 CFR Part 154 (COC) except Alaska
 RINA regulations? : **IMO COMPLIANCE**
 Japanese regulation? : **IMO COMPLIANCE**

Has vessel received USCG approval? : **USCG Certificate to be obtained at the 1st call of US port**
 RINA approval? : **CLASS NK APPROVAL**

HULL

LOA : **99.98 M**
 LBP : **93.53 M**
 Breadth : **17.50 M (Moulded)**
 Depth : **7.80 M (Moulded)**
 Summer Draft : **6.15 M (Moulded) (LPG98%) (VCM76%)**
 Air draft at full load condition : **26.90 M (est)**
 Air draft at ballast load condition : **29.14 M (est)**

Estimated draft with full cargo and full bunkers are as follows.

Product	Draft Fore' (m)	Draft Aft'(m)	Draft Mean (m)	Corresponding Deadweight (t)
Propane	4.35	6.13	5.24	3506.52
VCM	5.39	6.89	6.14	4752.58
Isoprene	5.50	6.80	6.15	4752.58
i-Butane	4.62	6.33	5.47	3820.23

Propeller immersion :

Propane	Aft draft	At	6.13m correspond.	: 109.30%
VCM	Aft draft	At	6.89m correspond.	:130.70 %
Isoprene	Aft draft	At	6.80 m correspond.	: 128.17 %
i-butane	Aft draft	At	6.33 m correspond.	: 114.93 %

COMMUNICATION EQUIPMENT

Call letter	:	V7KV2
Radio Station normally watched	:	VHF, MF/HF, SAT-C, SAT FBB
Radio MF/HFNBDP	:	538006211 ECEN X
Radio MF/HF TEL/DSC	:	2180 KHZ
VHF	:	CH. 16
Satellite Communication	Inmarsat 'C'	: 453841265 ECEN X
	Inmarsat 'F'	: 773131250

MACHINERY

Main Engine x 1	.	Type and make	:	HITACHI – MAN B&W, 5L35MC6.1
	.	Service power	:	3,250kW x 210 min-1 (MCR)
		No of Cylinders		5 Cylinders
		Cyl Bore x Stroke		350φ x 1,050
	.	Grade of fuel used	:	I.F.O. (380 mm2/s @ 50 deg. C)
Auxiliaries		Type and make (Electrical)		TAIYO, AC450V x 3φ x 60Hz 360kW x 1,200min-1
		(Mechanical)		YANMAR, 6NY16L-SW
		Grade of fuel used		M.D.O. (Maximum 14 mm2/s @ 50 deg. C)
		No off		2 sets
Emergency Gen		Type		MITSUI ZOSEN MACHINERY, F5L912, MDG-50E
		No off		1 set
Boiler		Type		MIURA, VWH-600E
		Evaporation		538 kg/h (Actual Evaporation)
		Max Design Pressure		0.7 MPa
		Feed Water Temp		60 deg.
		No off		1 set
Exhaust Economiser		Type		MIURA, KF-101F
		Evaporation		438 kg/h (at M/E 90% load)
		No off		1 set
Air Compressors (Main)		Type / Capacity		J.P. SAUER & SOHN, WP45L
		No off		2 sets
Air Compressors (Emergency)		Type		J.P. SAUER & SOHN, WP15L
		No off		1 set

Fuel Oil Purifier	Type No off Capacity	ALFA LAVAL, PA615 2 sets 900 ltr/h (at 380 cst 50 deg. C)
Lub Oil Purifier	Type No off Capacity	ALFA LAVAL, PA615 1 set 1,100 ltr/h (at 150 cst 40 deg. C)
Evaporator	Type Capacity	ALFA LAVAL, JWP-16-C50 8 ton/day
Fresh Water Sterilizer	Type Capacity	NIPPON CONTROLS, L-N201F 2.0 M3/h
Fresh Water Mineraliser	Type / Capacity	N/A
Waste Oil Incinerator	Type Capacity	MIURA, BGW-20N WASTE OIL 24.3 Kg//H (Max. Capacity) SOLID WASTE 20.0 KG/H
Oily Water Separator	Type Capacity	HEISHIN, HFM-200 2 M3/h
Sewage Treatment plant	Type Capacity	TAIKO, SBH-25 For 25P (Discharge Pump 4M3 x 0.2)
Hot Water Set (Calorifier unit)	No off	1 set
Steering Gear	Type Duty Capacity Hydraulic pump unit	RV21-017 170 kN.M LVPO17-210ROL

Speed

In Moderate weather:

About: 13.00 Knots @ CSR with 15% sea margin at VCM Loaded condition

CONSUMPTION/ DAY

Main Engine	HFO	Abt 12.50 ton/day at Normal Sea-going (85%, HFO 380cst)
Aux. Engine	DO	Abt 0.90 ton/day at Normal Sea-going (/MGO) Abt 1.00 ton/day when loading(MGO) Abt 2.00 ton/day when discharging (MGO)
Boiler		ABT 0.50 ton/day when in port (MGO)

Permanent bunker capacity (100%)

HFO : 436.58 m³(est)
 Diesel :146.14 m³(est)
 Fresh Water : 148.32 m³(est)

(B) CARGO INSTALLATIONS

1. Transportable products and respective quantities, calculated in accordance with IMO – maximum filling formula. (Tonnes)

	100% (CBM)	98% (CBM)		
NO.1 CARGO TANK	Abt. 2,500	Abt. 2450		
NO.2 CARGO TANK	Abt. 2,500	Abt. 2450		
T O T A L	Abt. 5,000	Abt. 4,900		
	SPSV (bar g)	Ref. Temp. (deg. C.)	Density at (Ref. Temp.)	Corresponding Quantity (MT)at 98%
Propylene	17.65	45.0	0.470	2302
Propane	17.65	45.0	0.459	2248
B/P MixtureBasis c3/30% + C4/70%	17.65	45.0	.533	2710
n-Butane	17.65	45.0	0.548	2684
i-Butane	17.65	45.0	0.526	2576
Butadiene	17.65	45.0	0.588	2280
Butylene	17.65	45.0	0.565	2768
V.C.M. (75% D 0.914) Due to Summer Draft	17.65	45.0	0.914	3500
Isoprene	17.65	45.0	0.656	3214
Pentanes	17.65	45.0	0.600	2940
Pentene	17.65	45.0	0.611	2992
B/P Mixtures Basis c3/30% + C4/70%	12.75	45.0	0.533	2710
n-Butane	12.75	45.0	0.548	2684
i-Butane	12.75	45.0	0.526	2576
Butadiene	12.75	45.0	0.588	2280
Butylene	12.75	45.0	0.565	2768
V.C.M.	12.75	45.0	0.872	3500
Isoprene	12.75	45.0	0.656	3214
Pentanes	12.75	45.0	0.600	2940
Pentene	12.75	45.0	0.611	2992

Note(1): In case of USCG, propylene, propane and B/P mixtures are not to be carried except the vapour pressure of B/P mixtures is not more than 12.75 bar g, 13.0 kg/cm² @ 45°C

Note(2): On and after, the pressure value in parentheses is shown as a conversion value

Mixing ratio of above mentioned B/P mixtures is as follows:

Butane 35 wt% and propane 65 wt%

2. Other transportable products N/A

3. TANKS

3.1	Design pressure (Vapour) -IGC	:	17.7 bar (G) for IGC-Code
	- USCG	:	12.7 bar (G) for U.S.C.G.
3.2	Valve setting	:	High: 17.7 bar (G), Low: 12.7 bar (G)
3.3	Maximum vacuum obtainable	:	0.0 bar (G)
3.5	Maximum temperature acceptable	:	45 deg. C
3.6	Minimum temperature acceptable	:	- 10 deg. C
3.7	Hydrostatic Test Pressure	:	26.48 bar (G)

4. LOADING RATE (TONS/HOUR) – For Full Cargo Parcels

Ex-atmospheric storage with gas	:	1 tank	:	about 450 m³ per hour
Return	:	2 tanks	:	about 790 m³ per hour

Remarks:

5. CARGO PUMPS

5.1	Type	:	WartsilaSvanehoj A/S
	How many	:	2 Sets
	Maximum specific gravity	:	0.965
5.2	Capacity (CMB/Hour)	:	300 m³/h at 110m TH / 250m³/h at 120m TH
	Two speed or variable speed	:	Two speed
	Rated kW (each)	:	130 kW at 1800 min⁻¹
	Working pressure maximum	:	17.65 bar G
5.3	Location	:	On top of each Cargo Tank
	Removable	:	Permanent Type
5.4	Booster pumps	:	Yes (1 set) Maximum Specific Gravity 0.90
	Type	:	Horizontal
	Maker	:	WartsilaSvanehoj A/S
5.5	Capacity (CMB/Hour)	:	300 m³/h
	Working pressure	:	17.65 bar G
5.6	Location	:	Midship catwalk, Stbd.side above stbd. manifold
5.7	Time to discharge a full liquid cargo using all pumps against back pressure at pump	:	
	1 bar	:	10 Hours basis on below
	5 bars	:	12 Hours basis discharge in butadiene
	10 bars	:	31 hours (Basis 8inch connection) – In spore last call
5.8	Nominal back pressure when working	:	
	In series corresponding head	:	N/A
	Maximum back pressure	:	N/A
	Nominal pressure at rail (propane)	:	14.8Barg at 110 m Total Head (based on 9 barg tank pressure)
5.9	What amount of cargo remains in tanks after completion pumping before stripping:	:	

- liquid : **No remaining liquid cargo after pumping**
- vapour :

NOTE: To reduce pressure by 1 bar/tank:- 3.8 hrs.

6. STRIPPING

- 6.1 Stripping system, if any : **N/A**
- 6.2 Time required to remove all traces of liquid cargo as stated in 5.9 for:
 - LPG : **N/A**

7. CARGO COMPRESSORS

- 7.1 Type : **Vertical water-cooled 1 stage double acting**
- Make : **TANABE PNEUMATIC MACHINERY CO., LTD.**
- How many : **2 sets**
- Piston displacement : **About 460 m³/h**
- Rated Kw : **75kw**
- Stroke : **177.8 mm**
- Max discharge pressure : **20 bar g**
- Pressure differential : **4 bar Maximum 7 bar at single action**
- No of Revolutions : **540 min⁻¹**
- 7.2 Are compressors oil free : **Yes**
- 7.3 Can they reliquefy VCM without risk : **N/A**
- 7.4 State time to bring full cargo of butane to atmospheric pressure from : **N/A**

8. INERT GAS SYSTEM (N2 Generator) : TYPE: N2 PSA MAKER: MAYEKAWA Co. Ltd.

- 8.1 Does the vessel use inert gas? : **Yes.**
- If so, state utilization and quantities :
- 8.2 Can the vessel produce inert gas? : **Yes.**
- If so, state type and composition of gas produce:
 - Nitrogen: 97.0 % to 99.9%**
 - 97.0% : Abt. 250 NM3/h**
 - 98.0% : Abt. 240 NM3/h**
 - 99.0% : Abt. 210 NM3/h**
 - 99.5% : Abt. 185 NM3/h**
 - 99.9% : Abt. 130 NM3/h**
- Discharge Capacity : **Abt. 185 NM3/h at N2 Purify 99.5%**
- 8.3 Maximum production obtainable : **Abt. 185 NM3/h at N2 Purify 99.5%**
- NOTE:- Above quantities obtained at engine room temperature **45° C**
- 8.4 State if there are storage facilities for inert gas onboard:
 - Size : **1.5M3**
 - Pressure : **10 bar**

- 8.5 State if any shore supply of nitrogen may be required: :
- for what purpose : **Shore supply of nitrogen is required in order to reduce oxygen contents in cargo tanks less than 0.5% by volume or to save time for inerting.**
 - what quantities : **It depends on the requirement of oxygen contents of cargo tanks and time required.**

9. GAS FREEING

- 9.1 State method used giving all details : **1. Discharge remaining cargo in cargo tanks as much as possible.**
2. Purge remaining cargo in cargo tanks with inert gas produced by nitrogen generator on board the vessel.
3. After the atmosphere inside cargo tanks being reached the area well lower than critical dilution line, purge the atmosphere inside cargo tanks with open air by using portable fan or cargo compressors or nitrogen generator (air mode)
- 9.2 State time required including stripping : **Abt. 5 days (remain 0.2 vol%)**

10. CHANGING GRADE

- 10.1 From completion discharge of cargo Propane, time required in hours and inert gas in CBM required to reach a tank and gas installation atmosphere of less than 100 ppm of Propane in Vapour phase.
Time required:
- 10.2 Can this operation be carried out at sea? : **Yes.**
- 10.3 Can the ship measure the number of ppm in vapour phase? : **Yes.**
- 10.4 Has vessel deck tank for changing grade/cooling operations? : **N/A**
- 10.5 Deck tanks : **No Deck Tanks**
Capacity :
Purpose :

11. **COOLING BEFORE LOADING** : **No cooling plant on board the vessel.**

12. CARGO HEATER

- 12.1 Type : **Shell and Tube**
12.2 Inside Diameter **700 mm**
12.3 Overall length **5800 mm**
12.4 Cargo flow rate **300 m³/h**
12.5 Min Inlet Temp **-48 ° C**
12.6 Min Outlet Temp **-10 ° C**
12.7 Required Sea water Capacity **500 m³/h (min.18 ° C)**
12.8 Design Pressure **20 bar G (2.0 MPa g)**

- 12.9 Hydrostatic Test Pressure **30 bar G (3.0 MPa g)**
 12.10 Tightness Test Pressure **20 bar G (2.0 MPa g)**
- 12.0 State discharging rate for propane to be brought from atmospheric pressure

13. CARGO VAPORIZER

In case vapour gas is needed to feed compressors, can vessel produce its own if no shore available: **No**

14. REFRIGERATING APPARATUS

- 14.1 Is it independent of cargo? : **N/A**
 Is so, state cooling agents :
- 14.2 What minimum temperature can be maintained : **N/A**
- 14.3 What time required at sea to lower by 1°C the full cargo of : **N/A**

15. MEASURING APPARATUS

What gauges on board? **Float type level gauges (Local & Remote reading)**
 Type : **MUSASINO, LMC-VA**
 Location : **1 set for each tank**

16. SAMPLES

- 16.1 State how tank atmosphere samples can be taken and where from?
Cargo samples for vapour and liquid can be taken from the following positions;
1. Fixed sampling connection at tank domes
2. Through drain connection of cargo manifold
3. Close loop sampling system is equipped
4. Through pressure gauge tube connection of tank top
- Standard of fitting? :
- 16.2 Same question for cargo : **Same as above**
- 16.3 Are sample bottles available on board? : **No**

17. CARGO LINES

- 17.1 Is ship fitted with a port and starboard cargo manifold? : **Yes.**
- 17.2 Position of cargo manifold
 - distance from stern (AP) : **53.19 M**
 - distance from stem (FP) : **46.79 M**
 - height above deck : **1.40 m for Liquid manifold**
 - distance from ship's rail : **2.60 M**
 - underside keel to manifold : **9.20 M**
- 17.3 Liquid line
 - flange-size : **8 inches**

	- type	:	ANSI 300 LB
Gas line			
	- flange-size	:	5 inches
	- type	:	ANSI 300 LB
		:	
17.4	What reducers on board For Liquid line (low temperature)		200A(8B) x ANSI300lb * 250A(10B) x ANSI300lb – 1 set 200A(8B) x ANSI300lb * 150A(6B) x ANSI300lb – 1 set 200A(8B) x ANSI300lb * 125A(5B) x ANSI300lb – 1 set 200A(8B) x ANSI300lb * 100A(4B) x ANSI300lb – 1 set 200A(8B) x ANSI300lb * 80A(3B) x ANSI300lb – 1 set 200A(8B) x ANSI300lb * 200A(8B) x ANSI150lb – 1 set 200A(8B) x ANSI300lb * 150A(6B) x ANSI150lb – 1 set 200A(8B) x ANSI300lb * 100A(4B) x ANSI150lb – 1 set 200A(8B) x ANSI300lb * 200A(8B) x JIS20K – 1 set 200A(8B) x ANSI300lb * 150A(6B) x JIS20K – 1 set 200A(8B) x ANSI300lb * 100A(4B) x JIS20K – 1 set
	For Vapor line (normal temp.)		125A(5B) x ANSI300lb * 100A(4B) x ANSI300lb – 1 set 125A(5B) x ANSI300lb * 80A(3B) x ANSI300lb – 1 set 125A(5B) x ANSI300lb * 50A(2B) x ANSI300lb – 1 set 125A(5B) x ANSI300lb * 150A(6B) x ANSI150lb – 1 set 125A(5B) x ANSI300lb * 125A(5B) x ANSI150lb – 1 set 125A(5B) x ANSI300lb * 80A(3B) x ANSI150lb – 1 set 125A(5B) x ANSI300lb * 50A(2B) x ANSI150lb – 1 set 125A(5B) x ANSI300lb * 125A(5B) x JIS20K – 1 set 125A(5B) x ANSI300lb * 100A(4B) x JIS20K – 1 set
	Blind Flange for Manifold	:	ANSI#300-200A – 2 sets ANSI#300-125A – 4 sets
17.5	Is ship fitted with stern discharge?		N/A
	- Liquid line - diameter	:	
	- flange – size	:	
	- type	:	
18. HOSES			
	Are serviceable hoses available on board?	:	No Cargo Hoses are Onboard
18.1	Two pieces, each	:	N/A
	Length	:	
	Diameter	:	
	Flange-size	:	
	Type	:	
	Bending radius	:	
18.2	Minimum temperature acceptable	:	N/A
	Maximum pressure acceptable	:	
18.3	For what products are hoses suitable?	:	N/A

19. CRANES

- Hose cranes : **Yes.**
- Where situated : **Midship**
- Lifting capacity : **5.0 t**
- Working radius : **13.0 m/R**

20. SPECIAL FACILITIES

- 20.1 How many grades can be segregated? : **No segregation**
- 20.2 How many cooled? : **No cooling plant**
- 20.3 Can vessel sail with slack cargo tanks? : **No. (Depends on stability calculation)**