

REPORT ON REFRIGERATING MACHINERY AND APPLIANCES.

(Received at London Office 30 OCT 1941)

Date of writing Report 30 OCT 1941 When handed in at Local Office 30 OCT 1941 Port of London ^{21st Aug. 1941} _{april 1st 1942}
 No. in Reg. Book. Survey held at London. Date: First Survey 23rd May Last Survey 10th October 1941
 (No. of Visits 14 + 31)

on the Refrigerating Machinery and Appliances of the EMPIRE GRACE Tons ^{Gross 13477.90} _{Net 9440.51}
 Vessel built at Belfast By whom built Harland & Wolff Ltd Yard No. 1051 When built 1941
 Managers Shaw Savill & Albion Co. Ltd Port belonging to Belfast Voyage ✓
 Owners Ministry of War Transport
 Refrigerating Machinery made by J. E. Hall Ltd Machine Nos. 10805 10806 10807 When made 1941
 Insulation fitted by Harland & Wolff When fitted 1942 System of Refrigeration Air Brine
 Method of cooling Cargo Chambers Brine + Air Insulating Material used granulated cork
 Number of Cargo Chambers insulated 14 Total refrigerated cargo capacity 551,340 cubic feet.

DESCRIPTION OF REFRIGERATING MACHINERY. Where placed Upper dk., midships.

Refrigerating Units, No. of 3 No. of machines 3 Is each machine independent yes
 Total refrigeration or ice-melting capacity in tons per 24 hours 168 tons Are all the units connected to all the refrigerated chambers yes
 Compressors, driven direct or through single reduction gearing. Compressors, single or double acting single If multiple effect compression no
 Relief valves or safety discs fitted yes No. of cylinders to each unit 2 Diameter of cylinders 5"
 Diameter of piston rod 2 1/4" Length of stroke 10" No. of revolutions per minute 260 normal 300 max
 Motive Power supplied from 4 Diesel driven Electric Generators
 (State number of boilers, oil engines or electric generators supplying the motive power.)

~~Steam Engines, high pressure, compound, or triple expansion, surface condensing. No. of cylinders ✓ Diameter ✓
 Length of stroke ✓ Working pressure ✓ Diameter of crank shaft journals and pins 6 1/2 jls. 4" pins.
 Breadth and thickness of crank webs 9" x 4 1/2" No. of sections in crank shaft 300 Revolutions of engines per minute 300 max
 Oil Engines, type Horizontal, 2 or 4 stroke cycle Single or double acting SA B.H.P. 480 x 4
 No. of cylinders 6 Diameter 330 1/4 Length of stroke 580 1/4 Span of bearings as per Rule 400 1/4
 Maximum pressure in cylinders 700 lbs Diameter of crank shaft journals and pins 280 1/4 220 1/4
 Breadth and thickness of crank webs 297 1/4 115 1/4 No. of sections in crank shaft 1 Revolutions of engine per minute 300.~~

~~DR RECEIVERS:—Is each receiver, which can be isolated, fitted with a safety valve as per Rule
 In the internal surfaces of the receivers be examined main engine What means are provided for cleansing their inner surfaces
 Is there a drain arrangement fitted at the lowest part of each receiver See If made under survey~~

~~No. of Receivers 3 Cubic capacity of each See list attached Internal diameter See list attached thickness See list attached
 Joints, lap welded or riveted longitudinal joint See list attached Material See list attached Range of tensile strength See list attached Working pressure by Rules See list attached~~

~~Electric Motors, type open type with canopy No. of 3 Rated 160 B.H.P. Kilowatts See list attached
 Speeds 220 at 200/300 revolutions per minute. Diameter of motor shafts at bearings See list attached~~

~~Reduction Gearing ✓ Pitch circle diameter, pinion See list attached Main wheel See list attached Width of face See list attached
 Distance between centres of pinion and wheel faces and the centre of the adjacent bearings, pinion See list attached Main wheel See list attached
 Pinion shafts, diameter at bearings See list attached Main wheel shaft, diameter at bearings See list attached~~

~~Gas Condensers, No. of 3 each with 12 casings Cast iron or steel casings Copper Cylindrical or rectangular cylindrical Are safety valves fitted yes
 Casings yes No. of coils in each 1 Material of coils Copper Can each coil be readily shut off or disconnected yes~~

~~Water Circulating Pumps, No. and size of 2-4" Rotary centrifugal how worked electrically Gas Separators, No. of 6~~

~~Gas Evaporators, No. of 3 Cast iron or steel casings steel Pressure or gravity type pressure If pressure type, are safety valves fitted yes
 Pipes fitted vent pipes No. of coils in each casing 13 Material of coils S.D. Steel Can each coil be readily shut off or disconnected yes~~

~~Direct Expansion or Brine Cooled Batteries, No. of 14 Are there two separate systems, so that one may be in use while the other is being
 freed of snow no No. of coils in each battery See list attached Material of coils 1 1/2" bore S.D. Steel Can each coil be readily shut off or
 disconnected yes Total cooling surface of battery coils 31,800 sq ft Is a watertight tray fitted under each battery yes~~

~~Circulating Fans, Total No. of 18 each of See list attached cubic feet capacity, at See list attached revolutions per minute See list attached
 Man or electrically driven electrically Where spare fans are supplied are these fitted in position ready for coupling up See list attached~~

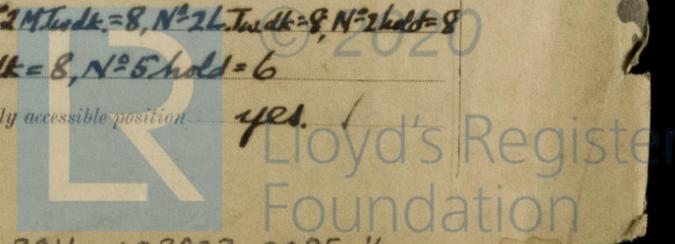
~~Brine Circulating Pumps, No. and size of, including the additional pump 4-6" centri. how worked electrically direct
1-2" 1-4" x 4 1/2" V.D. ram how worked electrically thro' worm gearing
 Brine Cooling System, closed or open closed. Are the pipes and tanks galvanised on the inside See list attached~~

~~No. of brine sections in each chamber N° 1 U. T. dk. = 10, N° 1 M. T. dk. = 10, N° hold = 10, N° 2 U. T. dk. = 8, N° 2 M. T. dk. = 8, N° 2 L. T. dk. = 8, N° 2 hold = 8
N° 3 M. T. dk. = 8, N° 3 L. T. dk. = 8, N° 3 hold = 8, N° 4 M. T. dk. = 8, N° 4 hold = 6, N° 5 M. T. dk. = 8, N° 5 hold = 6~~

~~Can each section be readily shut off or disconnected yes. Are the control valves situated in an easily accessible position yes.~~

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Are thermometers fitted to the outflow and to each return brine pipe yes Where the tanks are closed are they ventilated as per Rule yes
 Where the tanks are not closed is the compartment in which they are situated efficiently ventilated
 Are the number and capacity of the machines and the number of pumps and sea connections in accordance with Section 2, Clause 1 of the Rules yes
 Is the exhaust steam led to the main and auxiliary condensers ✓

HYDRAULIC AND OTHER TESTS.

DESCRIPTION.	Date of Test.	Working Pressure.	Hydraulic Test Pressure.	Air Test Pressure.	Stamped.	REMARKS.
ENGINE CYLINDERS (IF TESTED)	5-9-41					
GAS COMPRESSORS	17-9-41	1000 lb. □	3000 lb. □	1500 lb. □	✓	
" SEPARATORS	17-9-41	do.	do.	do.	✓	
" MULTIPLE EFFECT RECEIVERS	none					
" CONDENSER COILS	23-5-41, 24-5-41, 19-6-41, 24-6-41, 22-7-41	do.	do.	do.	✓	
" EVAPORATOR COILS	19-6-41, 24-6-41, 1-8-41	do.	do.	do.	✓	
" CONDENSER HEADERS AND CONNECTIONS	25-7-41, 10-10-41	do.	do.	do.	✓	
" CONDENSER CASINGS	7-10-41	10 to 15 lb. □	30 lb. □	✓	✓	
" EVAPORATOR CASINGS	13-8-41	10 to	38 lb. □	✓	✓	
NH ₃ CONDENSER, EVAPORATOR AND AIR COOLER COILS AFTER ERECTION IN PLACE	18/10/41					
BRINE PIPING AFTER ERECTION IN PLACE	18/10/41	30 lbs		90 lbs		

Have important steel castings and forgings been tested in accordance with the Rules yes.
 Cooling Test. Has the refrigerating machinery been examined under full working conditions, and found satisfactory yes.
 Dates of test 23-24-25 / 3/41 Density of Brine + by TWADDLE hydrometer
 Temperatures (when the cargo chambers are cooled down to the required test temperatures) See attached list.
 or, delivery and return air at direct expansion or brine cooled batteries & outflow and return brine -5°F & -2°F
 atmosphere 42-52°F cooling water inlet and discharge 44°F & 47°F gas in condensers 62-65°F and evaporators -11, -13°F
 the average temperature of the refrigerated chambers 3.5°F and the rise of temperature in these chambers upon the expiration of 12 hours
 time after the machinery and cooling appliances have been shut off 5°F or +25°F per hour.

SPARE GEAR.

Are the working parts of the machines, pumps and motors respectively, interchangeable yes
 Has the spare gear required by the Rules been supplied yes.
 Additional Spare Gear Supplied:-
 36 lubricator piston leathers, 36 addl. springs for comp. valves, 2 springs for water relief valves
 36 " gland " , 1 crankshaft for compressor, 2 " " brine " "
 1 set of 2 leather moulds, 36 safety valve discs, 2 springs for CO₂ safety valves
 1 pair main bearing shells, lined W.M., with bolts & nuts, 1 pair crosshead bearings with cap, bolts & nuts
 1 " " crankpin " " " " " 3-1/8" CO₂ valves + 9 spare pins for same
 2 pairs CO₂ pipe flanges, 2 CO₂ gauges, 1 hydrometer, 12 thermometers, 1 separator drain plug.
 1 spindle & impeller for circ. water pumps, 1 set of brushes for same. 1 fitted box for comp. parts
 1 " " " large brine pumps, 1 " " " for large brine pumps } 1 pump bucket
 1 " " " small " " " small " " } complete for ram
 brine pump.

ELECTRICAL SPARES.

	FOR MACH. MOTORS	FOR BRINE PUMP MOTORS
Armature	1	1
Shunt coils	6	4
Series "	6	interpoles 4
Half bearings	4	box bearings 8 total
Carbon brushes	19	36 total
Brush holders	1	3
Controller spares	1 set	1 set

One fan of each size for armatures

FAN MOTORS.

1 motor } for each
 1 set brushes } size fan
 1 brush arm } fitted
 1 set bearings }
 24 brush springs - total
 1 set controller spares for
 every 3 or less of each size fan.
 1 spare rotor for each size fan.

The foregoing is a correct description of the Refrigerating Machinery.

DESCRIPTION OF INSULATION.

IN LOWER HOLD CHAMBERS.						IN 'TWEEN DECK CHAMBERS. forward of 25f, three tween decks, elsewhere two.					
	Air Space.	Outer Lining.	Non-conducting Material.	Thickness of ditto.	Inner Lining.	Air Space.	Outer Lining.	Non-conducting Material.	Thickness of ditto.	Inner Lining.	
BULKHEADS.	FRAME No. 87f (Fore Peak) A	None	None	gran cork	12"	1" TTG.	None	None	Gran Cork	12"	1" TTG.
	FRAME No. 53f	F	"	"	"	15 1/2"	"	"	"	8", 7"	"
		A	"	"	"	3 1/2"	"	"	"	4"	"
	FRAME No. 25f	F	"	"	"	12 1/2"	"	"	"	8", 7"	"
		A	"	"	"	3 1/2"	"	"	"	4"	1" TTG, 1" TTG
	FRAME No. 1f	F	"	"	"	12 1/2"	"	"	"	12"	1" TTG.
		A	-	-	-	-	-	-	-	-	-
	FRAME No. (Boiler Room) F										
	A										
	FRAME No. 28a (Engine Room) A	None	None	gran cork	12"	1" TTG.	None	None	Gran Cork	12"	1" TTG.
	FRAME No. 51a	F	"	"	"	3 1/2"	"	"	"	4"	"
		A	"	"	"	9 1/2"	"	"	"	8"	"
	FRAME No. 70a	F	"	"	"	3 1/2"	"	"	"	4"	"
		A	"	"	"	9 1/2"	1" TTG + gal. st. pl.	"	"	9"	1" TTG + Gal. st. pl.
	FRAME No. F										
A											
FRAME No. (After Peak) F											
SIDES	None	None	gran cork	12 1/2", 14"	1" TTG.	None	None	Gran Cork	12 1/2", 10"	1" TTG.	
OVERHEADING	"	"	"	12 1/2"	1" stopped.	"	"	"	12 1/2", 10 1/2"	1" stopped.	
FLOORS OF CHAMBERS	"	"	"	8" 10" fwd. aft on tunnel deck	1" TTG.	-	-	-	-	-	
TRUNK HATCHWAYS	✓										
THRUST RECESS, SIDES AND TOP	above as floor of chamber aft below 10" oiled cotton 1/2" + 1" TTG. + Gal. st. pl.										
TUNNEL SIDES AND TOP	as for floor of chamber aft										
TUNNEL RECESS, FRONT AND TOP	forward of 70a, as for floor of chamber aft										

FRAMES OR REVERSE FRAMES, FACE 1/2" hair felt ✓

BULKHEAD STIFFENERS, TOP ✓ BOTTOM ✓ AND FACE 1/2" hair felt ✓

RIBBAND ON TOP OF DECKS 3ft, 2" slab cork + 1" reinforced asphalt

SIDE STRINGERS, TOP solid wood nosing. BOTTOM ✓ AND FACE 3/4" hair felt ✓

WEB FRAMES, SIDES ✓ AND FACE ✓

BRACKETS, TOP ✓ BOTTOM ✓ AND FACE ✓

INSULATED HATCHES, MAIN 6" cowhair, dble lining ✓ BILGE 5" cowhair, dble lining ✓ MANHOLE 5" cowhair, dble lining ✓

HATCHWAY COAMINGS, MAIN 14" x 6 1/2" pitch pine ✓ BILGE 11" x 2 1/2" pitch pine ✓

HOLD PILLARS 3/4" hair felt + 2" manilla rope, except two at fore end No 2 hatchway with 2" gran cork, wood lined ✓

MAST fore 10" gran. cork 1" lining ✓ VENTILATORS ✓

Are insulated plugs fitted to provide easy access to bilge suction roses Yes ✓ tank, air, and sounding pipes Yes ✓ heels of pillars No ✓

and manhole doors of tanks Yes ✓ Are insulated plugs fitted to ventilators ✓ cargo ports Yes ✓ and side lights ✓

Is the insulation of the lower hold floor and tunnel top in way of the hatchways protected Yes ✓ if so, how 2" elm doubling ✓

Oil Storage Tanks, where adjacent to the insulated chambers, state what provision has been made for ventilating the air space between the insulation and the bulkhead plating No air space. Bofferdam between bulkhead and midship oil fuel bunkers ✓

and for draining the tank top ✓

Fireproof Insulation. Is the insulation and woodwork fireproof in way of bunkers or any surfaces exposed to excessive heat none exposed ✓

Where Cooling Pipes pass through watertight bulkheads or deck plating, are the fittings and packing of the stuffing boxes both watertight and fireproof Yes

Cargo Battens, Dimensions and spacing, sides 3'3" WP over bilges floor fwd spaced 12" tunnel top on bulkheads, clear of ✓

are cooling vertical battens 2" x 1 3/4" spaced 18", all fixed. hinged or permanently fixed ✓

Are screens fitted over the brine grids at chamber sides ✓

Thermometer Tubes, No. and position in each chamber as approved plan

diameter 2 1/2" internal are they fitted in accordance with Section 3, Clause 8 Yes

Protection of Pipes. Are all pipes, including air and sounding pipes, which pass through or into insulated chambers, well insulated Yes

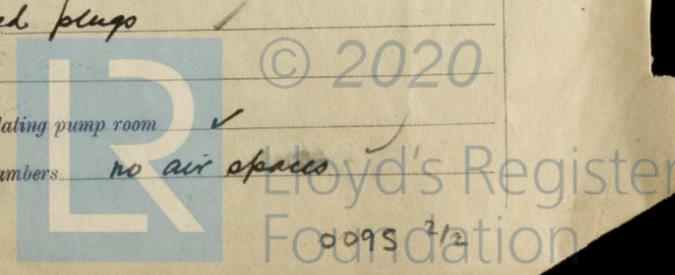
Draining Arrangements. What provision is made for draining the inside of the chambers scuppers to bilges ✓

Where scuppers, scupper pipes, and drain pipes are fitted are means provided for blanking them off screwed plugs ✓

What provision is made for draining the refrigerating machinery room scuppers ✓

brine return room scuppers ✓ fan room ✓ water circulating pump room ✓

Are all air spaces behind insulation arranged to drain to the bilges, bilge wells, or gutterways of the respective chambers. no air spaces ✓



Sounding Pipes, No. and position in each chamber situated below the load water line *As approved plan to luges, also thermometer tubes*

Diameter *2 1/2* Are all sounding pipes in way of insulated chambers fitted in accordance with Section 3, Clause 11 *Yes*

Are all wood linings tongued and grooved *Yes, overhead stopped* Are cement facings reinforced with expanded steel lattice *None*

How is the expanded metal secured in place

How are the cork slabs secured to the steel structure of the vessel *Bedded in betamen in ribbands*

Air Trunkways in Chambers. Are the arrangements satisfactory and in accordance with the approved plans *Yes*

Are they permanently fixed or collapsible, or portable *Fixed*

Where air trunkways pass through watertight bulkheads, are they fitted with watertight doors *None* Are the door frames efficiently insulated *Yes*

Are insulated plugs supplied for the doorways *Yes* Where are the doors worked from *Yes*

Cooling Pipes in Chambers, diameter *1 1/2* **Minimum thickness** *7 W.G.* Are they galvanised externally *Yes*

How are they arranged in the chambers *In grids, in sections as air coolers, brine service pipes bedded in granulated cork in casing*

Thawing Off, what provision is made for removing the snow from the cooling pipes in the chambers *brine heating*

The foregoing is a correct description of the Insulation and Appliances.

A. Marshall Builders.

Plans. Are approved Plans or Specifications forwarded herewith for the Refrigerating Machinery *No.* and Insulation *No. App Plans at Widdingham*

Is the Refrigerating Machinery and Appliances duplicate of a previous case *No* If so, state name of vessel *Yes*

If the survey is not complete, state what arrangements have been made for its completion and what remains to be done *Complete.*

General Remarks (State quality of workmanship, opinions as to class, &c.) *The refrigerating machinery has been constructed under special survey and the materials and workmanship are good and it will be eligible for the notation + Lloyds R.M.C. (with date) when the installation and testing have been satisfactorily completed*

The insulation has been fitted under special survey and the material and workmanship are good.

The machinery has been efficiently installed and tested under working conditions with satisfactory results and the installation is eligible in our opinion to have a notation in the Society's Register Book of + LLOYD'S R.M.C. H. + 2

It is submitted that this vessel is eligible for THE RECORD, + Lloyds Rule 4.42 *Shun 10.4.42.*

PARTICULARS TO BE ENTERED IN REGISTER BOOK.

REFRIGERATING MACHINES.					System of (1) Refrigerating (2) Insulating the Chambers.	Ice melting capacity per 24 hours. Tons.	Is Refrigerating Machinery Electrically Driven?	INSULATED CARGO CHAMBERS.	
No. of Units.	No. of Compressors.	System.	Makers.	Date of Construction.				No.	Capacity. Cubic ft.
<i>3</i>	<i>6</i>	<i>carb. dicy</i>	<i>fr. E. Hall Ltd.</i>	<i>1941</i>	<i>(1) Bone & Co. (2) Gran. Cork</i>	<i>168</i>	<i>Yes</i>	<i>14</i>	<i>495837</i>

Fee *£42:0:0* Fee applied for *17.4.1942* *Wm. Balfour* *D. Gemmell*
 Travelling Expenses *£* Received by me *19* *K. Shaw* Surveyor to Lloyd's Register.

Committee's Minute *FRI. 10 APR 1942*

Assigned *+ Lloyds R.M.C. 4.42*
White (fees) done
see log
Wm. Balfour

CERTIFICATE WRITTEN



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Certificate to be sent to Messrs Shaw Savill & Albion Co Ltd London