

REPORT ON REFRIGERATING MACHINERY AND APPLIANCES.

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(No. of Visits 14 + 31)

on the Refrigerating Machinery and Appliances of the EMPIRE GRACE Tons Gross 13477.90 Net 9440.50

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

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

Safety 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 4 Diameter 40"

Length of stroke 10" Working pressure 150 lb/sq. in. Diameter of crank shaft journals and pins 6 1/2" dia. 4" pins.

Width 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 4 stroke cycle 4 Single or double acting SA B.H.P. 480 x 4

No. of cylinders 6 Diameter 330 mm Length of stroke 580 mm Span of bearings as per Rule 400 mm

Maximum pressure in cylinders 700 lb/sq. in. Diameter of crank shaft journals and pins 280 mm 220 mm

Width and thickness of crank webs 297 mm 115 mm No. of sections in crank shaft 1 Revolutions of engine per minute 300.

AIR 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 If made under survey

No. of Receivers Cubic capacity of each Internal diameter thickness

Joints, lap welded or riveted longitudinal joint Material Range of tensile strength Working pressure by Rules

Electric Motors, type open type with canopy No. of 3 Rated 160 B.H.P. Kilowatts

R.P.M. at 220 at 200/300 revolutions per minute. Diameter of motor shafts at bearings 1 1/2"

Reduction Gearing Pitch circle diameter, pinion Main wheel Width of face

Distance between centres of pinion and wheel faces and the centre of the adjacent bearings, pinion Main wheel

Pinion shafts, diameter at bearings Main wheel shaft, diameter at bearings

Gas Condensers, No. of 3 each with 12 casings Cast iron or steel casings copper Cylindrical or rectangular cylindrical Are safety valves fitted

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 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

Free 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

Connected 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 revolutions per minute

Fan or electrically driven electrically Where spare fans are supplied are these fitted in position ready for coupling up

Brine Circulating Pumps, No. and size of, including the additional pump 4-6" centrifugal how worked electrically direct

Brine Cooling System, closed or open closed Are the pipes and tanks galvanised on the inside

No. of brine sections in each chamber N° 1 U.T. dk = 10, N° 1 M.T. dk = 10, N° 1 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

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. sq. in.	3000 lb. sq. in.	1500 lb. sq. in.	OK	
" SEPARATORS	17-9-41	do.	do.	do.	OK	
" MULTIPLE EFFECT RECEIVERS	23-5-41	do.	do.	do.	OK	
" CONDENSER COILS	19-6-41, 24-6-41, 22-7-41	do.	do.	do.	OK	
" EVAPORATOR COILS	19-6-41, 24-6-41, 1-8-41	do.	do.	do.	OK	
" CONDENSER HEADERS AND CONNECTIONS	25-7-41	do.	do.	do.	OK	
" CONDENSER CASINGS	7-10-41	10 to 15 lb. sq. in.	30 lb. sq. in.	✓	OK	
" EVAPORATOR CASINGS	13-8-41	10 to 15 lb. sq. in.	38 lb. sq. in.	✓	OK	
NH ₃ CONDENSER, EVAPORATOR AND AIR COOLER COILS AFTER ERECTION IN PLACE	18/10/41	30 lbs. sq. in.		90 lbs. sq. in.		
BRINE PIPING AFTER ERECTION IN PLACE	18/10/41	30 lbs. sq. in.				

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 23-25-25 / 3/41 Density of Brine 4 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 bearing with cap, bolts & nuts
 1 " " crankpin " " " " 3-8" 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.

J. Wells

Manufacturer.

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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. (After Peak)	F											
A												
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.	"	"	"	ford 12 1/2" 10 1/2"	1" stopped.		
FLOORS OF CHAMBERS	"	"	"	aft on tunnel deck	8" 10" 1" TTG.	—	—	—	—	—	—	
TRUNK HATCHWAYS												
THRUST RECESS, SIDES AND TOP												
TUNNEL SIDES AND TOP												
TUNNEL RECESS, FRONT AND TOP												
FRAMES OR REVERSE FRAMES, FACE												
BULKHEAD STIFFENERS, TOP												
BOTTOM												
AND FACE												
RIBBAND ON TOP OF DECKS												
SIDE STRINGERS, TOP												
BOTTOM												
AND FACE												
WEB FRAMES, SIDES												
BRACKETS, TOP												
BOTTOM												
AND FACE												
INSULATED HATCHES, MAIN												
BILGE												
MANHOLE												
HATCHWAY COAMINGS, MAIN												
BILGE												
HOLD PILLARS												
MAST, fore												
VENTILATORS												
Are insulated plugs fitted to provide easy access to bilge suction roses												
tank, air, and sounding pipes												
heels of pillars												
and manhole doors of tanks												
Are insulated plugs fitted to ventilators												
cargo ports												
and side lights												
Is the insulation of the lower hold floor and tunnel top in way of the hatchways protected												
if so, how												
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												
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												
Where Cooling Pipes pass through watertight bulkheads or deck plating, are the fittings and packing of the stuffing boxes both watertight and fireproof												
Cargo Battens. Dimensions and spacing, sides												
are cooling. vertical battens												
Are screens fitted over the brine grids at chamber sides												
hinged or permanently fixed												
Thermometer Tubes, No. and position in each chamber												
diameter												
are they fitted in accordance with Section 3, Clause 8												
Protection of Pipes. Are all pipes, including air and sounding pipes, which pass through or into insulated chambers, well insulated												
Draining Arrangements. What provision is made for draining the inside of the chambers												
Where scupper pipes, and drain pipes are fitted are means provided for blanking them off												
What provision is made for draining the refrigerating machinery room												
brine return room												
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.												

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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.

P. Marshall Builders.

Plans. Are approved Plans or Specifications forwarded herewith for the Refrigerating Machinery *no.* and Insulation *10. 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. 42

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.	Is Refrigerating Machinery Electrically Driven?	INSULATED CARGO CHAMBERS.	
No. of Units.	No. of Compressors.	System.	Makers.	Date of Construction.				No.	Capacity.
						Tons.			Cubic ft.
<i>3</i>	<i>6</i>	<i>Carr. Aubrey</i>	<i>fr. E. Hall Ltd.</i>	<i>1941</i>	<i>(1) Brine & Oil (2) Gran. Cork</i>	<i>168</i>		<i>14</i>	<i>495837</i>

Fee *£42: 0: 0* Fee applied for *1. 4. 1942* *Wm. Barrow* *D. Gemmell*
Travelling Expenses £ : : Received by me, *19* *S. 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. Barrow*

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

CERTIFICATE WRITTEN.



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