S P E C I F I C A T I O N S

HULL NO. 301

Specifications of

BULK ORE CARRIER

for

NORTHWESTERN MUTUAL LIFE

INSURANCE COMPANY

Builders

GREAT LAKES ENGINEERING WORKS

River Rouge, Michigan

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G E N E R A L

SPECIFICATION INTENT G-1

These specifications describe a bulk ore carrier for service on the Great Lakes and St. Lawrence river. The vessel is to be well found and completely equipped by the Builder in accordance with modern Great Lakes practice for vessels of this type.

The design of the vessel is to be executed by the Builder. He is to undertake the construction and is to furnish all necessary materials, equipment and labor.

CHARACTERISTICS G-2

Length overall	720'-0"
Length between perpendiculars ...	700'-0"
Breadth molded	75'-0"
Depth molded to spar deck	38'-6"
Design summer draft	26'-4"
Deadweight at summer draft, long tons	25,400
Shaft horsepower	7,000
Service speed at 25'-0" draft - MPH	15.85

Vessel to be of welded steel construction with forecastle, texas house and pilot house forward and with poop and deck house aft. Four cargo holds are to be

provided. Twenty cargo hatches are to be installed, hatches to be spaced 24'-0" apart. Hatch covers to be handled by an electro-hydraulic hatch crane.

Propulsion plant to consist of a single bronze propeller driven by geared turbines with steam supplied by two coal burning, stoker fired bent tube boilers.

Steering gear to be electro-hydraulic and coupled to a balanced rudder.

CLASSIFICATION G-3

The vessel is to receive the highest classification of the American Bureau of Shipping, viz.,

Hull Class: ✠ AI (E) - Great Lakes and St. Lawrence River Service

Machinery Class: AMS

The classification society - the American Bureau of Shipping - is hereinafter designated by the initials A.B.S.

All classification fees are to be paid by the Builder.

STANDARD OF CONSTRUCTION G-4

The design and construction are to comply with the current edition of "Rules for the Building and Classing of Steel Vessels", published by the A.B.S.

STANDARD OF CONSTRUCTION (continued) G-4

The design and construction are to comply with the current regulations of all Government agencies having jurisdiction, specifically including the following:

United States Treasury Department - Coast Guard

United States Treasury Department - Bureau of Customs

Federal Security Agency - Public Health Service

Federal Communications Commission

INSPECTION G-5

The Owner and/or his accredited inspectors shall be free to inspect the manufacture of materials and the fabrication, erection and testing of the hull, propelling machinery and auxiliary machinery.

The manufacture of materials and the fabrication, erection and testing of the hull, propelling and auxiliary machinery are to be subjected to:

(a) The Special Survey of the A.B.S.

(b) Inspection by Governmental agencies having jurisdiction

Inspectors are to have access to the workshops, pre-fabrication sites and to the vessel at all reasonable times.

Inspectors shall not request changes to work if this has been executed in accordance with approved plans.

MATERIALS AND WORKMANSHIP G-6

All materials used in the construction of the vessel and its equipment shall be of good commercial quality and suited to the intended application.

All steel used to be mild steel.

Where manufacturer's or trade names are used in these specifications, it is to be understood that this has been done for the purpose of establishing a base respecting quality and suitability. The use of such names is not intended to restrict choice; materials of equal quality and suitability may be substituted subject to approval by the Owner.

Workmanship shall be in accordance with best Great Lakes practice.

DRAWINGS G-7

The Builder is to prepare all design and working plans necessary to construct the vessel.

Drawings are to be submitted and promptly approved by the Owner, the A.B.S. and the interested Government agencies.

Upon completion of the vessel, the Owner is to be furnished with two prints of each of the principal drawings, one set for his office record and the other set is to be placed aboard the ship.

PROGRESS PHOTOGRAPHS G-8

At intervals of two weeks during construction, progress photographs will be taken and two unmounted 8" x 10" prints of each photograph will be furnished to the Owner.

DRYDOCKING G-9

Subsequent to launching, the vessel is to be drydocked for inspection of the bottom shell. When in drydock, all temporary launching clips, fittings, etc., are to be removed from the shell and this latter is to be cleaned and painted.

If internal inspection of the vessel immediately after launching reveals damage resulting in serious leaks, the vessel is to be placed immediately in drydock for repair.

TRIALS G-10

The Builder shall satisfactorily operate all items of hull equipment, machinery, piping and electrical equipment after completion of installation. Following the foregoing pre-trial tests, trials shall be held as follows:

(a) Dock Trial

A dock trial of six hours duration shall be held. Main propulsion machinery and auxiliaries to be run at as near normal operating power as vessel location permits.

All other ship's systems shall be successfully operated.

All dock trials shall be at the Builder's responsibility and expense.

All necessary adjustments for satisfactory operation shall be made and deficiencies rectified prior to sea trial.

(b) Sea Trial

Upon completion of dock trials, sea trials of sufficient duration to accomplish the following shall be held:

1. Adjust Compasses
2. Anchor and Windlass Tests
3. Maneuvering and Steering Gear Tests
4. Four hour continuous operation at normal horsepower
5. General observation check of all machinery operation

The prospective crew of the vessel shall operate the vessel during the sea trials.

Guarantee engineer shall be provided by the Builder for principal power equipment together with necessary observers for compilation of data. Builder shall furnish

all necessary coal, lubricating oil, water, and shall also furnish subsistence for the trial crews.

After returning to the dock directly following the end of the sea trial, a visual examination of the main turbine gears shall be made in the presence of the representatives of the Owner, U.S.C.G. and A.B.S.

After satisfactory completion of sea trials, all adjustments found necessary by reason of the trials shall be made. The vessel shall be cleaned, such touch-up painting as may be necessary shall be completed and deficiencies remedied.

Fuel and other consumable supplies remaining aboard after the trial shall be purchased by the Owner from the Builder at the cost to the Builder.

(c) Post Delivery

At a mutually agreeable date after delivery, trials shall be held to determine and record the performance of the vessel in actual service. The operation of the vessel

and its equipment shall be by the vessel's normal crew and at the Owner's expense. The Builder shall have representatives present to take and record performance data.

HULL

GENERAL ARRANGEMENT H-1

The vessel will be arranged with a continuous spar deck from bow to stern, tank top from fore peak bulkhead to after peak bulkhead and with side tanks extending from the fore peak bulkhead aft into the machinery space.

The forward end of the hull will be divided into a fore peak tank, a dark hold and crew quarters on the main deck. Superstructures forward will be a forecastle, a texas house and a pilot house.

The midship part of the hull will be divided into four cargo holds. A longitudinal tunnel will be fitted, port and starboard, above the side tanks. Twenty cargo hatches are to be fitted on the spar deck, each about 11'-0" long by 54 feet wide. Steel watertight hatch covers are to be provided and these are to be handled by an electro-hydraulic hatch crane.

The tank top in the midship body will be six feet high. The center girder will be watertight and the side tanks and double bottom will be divided by watertight divisions to form six ballast tanks, port and starboard, forward of the machinery space.

The after end of the hull will be divided to form a coal bunker, the machinery space and an after peak tank.

GENERAL ARRANGEMENT (continued) H-1

Superstructures aft will be a poop with a deck house above.

Accommodations for four guests and the Captain are to be provided in the texas house; the remainder of the crew are to be housed on the spar deck forward and aft and on the main deck forward.

The guests' dining room, officers' dining room, crew's mess and the commissariat spaces are to be arranged in the after deck house.

FRAMING H-2

The fore peak and the cruiser stern will be formed with cant frames.

Through the cargo hold, the deck, tunnels, tank top and bottom shell will be longitudinally framed while the side tank sides and shell in way of the side tanks will be framed transversely with regular frames spaced 3 feet, web frames spaced 12 feet. Arches are to be fitted to support the spar deck, spaced 24 feet.

Transverse framing is generally to be used in the dark hold and machinery space.

Special consideration is to be given to the framing at the forward and after shoulders. Framing in this vicinity to be supported by ample stringers so the stringer and framing system will minimize the effects of impacts at the locks and docks.

PLATING H-3

Plating shall be of scantling required by the American Bureau of Shipping.

Main hull plating thicknesses may be reduced at the ends in accordance with A.B.S. requirements except the shell plating forward between the light and load waterline is to retain its midship thickness. Under the anchor pockets doubling plates or special heavy insert plates are to be installed.

WELDING H-4

The hull shall generally be of all welded construction. Butts and seams are to be prepared in accordance with A.B.S. requirements and every effort is to be made to maintain fair surfaces.

Proper welding procedures shall be developed by the Builder during the construction to minimize locked in stresses and distortion.

Where material is to be welded and riveted, the riveting is to be completed prior to welding.

Structural welding is to be inspected by means of gamma ray photographs and the Builder is to take 200 such photographs.

STEM H-5

The stem is to be of rolled steel of scantling required by the A.B.S. It shall be well secured to the

STEM (continued) H-5

center vertical keel and supported through its length by suitable breast hooks. Shell plating is to be welded direct to the stem bar.

STERNFRAME H-6

The sternframe is to be of cast steel. It may be manufactured in two or more convenient pieces and then welded together at the ship.

The foot shall extend forward to the after peak bulkhead; the shoe is to be of ample section to support the rudder bottom pintle. The propeller post is to be of symmetrical streamlined section. The upper end of the arch is to be formed into a boss to support the rudder carrier.

Shell plating shall be attached to the sternframe by welding.

RUDDER H-7

The rudder shall be of the double plate balanced type and be of symmetrical section. A fairing cone is to be fitted in way of the propeller boss. Rudder is to be supported by a bottom pintle and by a neck bearing at the sternframe. Rudder coupling to be arranged so rudder may be removed without disturbing equipment inside the hull.

BULKHEADS H-8

There will be four watertight bulkheads constructed in accordance with A.B.S. requirements. The fore peak,

BULKHEADS (continued) H-8

forward cargo hold and after cargo hold bulkheads will extend to the spar deck while the after peak bulkhead will extend to the main deck.

There will be three screen bulkheads in the cargo space dividing this into four holds. Screen bulkheads will be constructed of 15.3 pound plating stiffened with 6"x6"x½" angles welded toe down, horizontally and vertically, both sides.

COAL BUNKER H-9

The coal bunker will be arranged aft of the after cargo hold bulkhead. It will be serviced from a bunker hatch about the level of the poop deck. Bunker hatch to be fitted with sliding steel covers.

Two day bunkers are to be provided on the after face of the coal bunker.

TANK TOP H-10

The vessel will be fitted with a 25.5 pound plate tank top through the cargo hold. Tank top to be stiffened with 8"x13.75# longitudinal channels spaced about 12 inches apart. Tank top to be all welded and located at 6 feet above the baseline in the cargoholds and sloped aft in the machinery space to about 5 feet above the base.

FOUNDATIONS H-11

Steel foundations are to be provided as necessary for all machinery, tanks, heavy equipment and fittings which may be required to support heavy loads. Foundations are to be of welded construction.

The turbine, turbine gear and thrust bearing foundation are to be constructed as an integral part of the hull.

CREW ACCOMMODATIONS H-12

Accommodations are to be provided for the following:

In Single Rooms	In Double Rooms
1 - Captain	3 - Wheelsmen
1 - First Mate	3 - Watchmen
1 - Second Mate	3 - Deckwatch
1 - Third Mate	3 - Deckhands
1 - Chief Engineer	3 - Oilers
1 - First Asst. Engr.	3 - Firemen
1 - Second Asst. Engr.	3 - Coalpassers
1 - 2nd Second Asst. Engr.	1 - Cook
1 - Third Asst. Engr.	2 - Porters
1 - Steward	1 - Waiter

In addition to the rooms listed above, two - 2-man spare rooms are to be provided - one forward and one aft.

All sleeping rooms to have adjoining bathrooms and adequate closet space.

Captain and chief engineer are to have offices adjoining their sleeping quarters. A general office is to be provided for the engineers on the main deck aft.

The following facilities are also to be provided:

1 - Officers' Dining Room

1 - Crew's Mess Room

2 - Recreation Rooms

2 - Laundries

Officers' and Crew's Luggage Rooms

Linen and Blanket Stores

Soiled Linen Locker

Cleaning Gear Lockers

Locker Room in Engine Room

Crew rooms are to be outfitted approximately as follows:

Single Rooms

1 - Double Bed 54" x 78"
1 - Coil Spring
1 - Innerspring Mattress
2 - Pillows
1 - Set Berth Curtains
1 - Double Life Preserver Rack
1 - Chiffonier
1 - Mirror
1 - Desk
1 - Desk Lamp
1 - Side Chair
1 - Easy Chair
1 - Wastebasket
1 - Radio Shelf
1 - Set Pullman Curtains
1 - Set Drapes
Carpet - Wall to Wall
Carpet Underlayment
Canvas Runners

Double Rooms

2 - Single Berths with Drawers
2 - Coil Springs
2 - Cotton Felt Mattresses
2 - Pillows
2 - Sets Berth Curtains
1 - Chiffo Desk
1 - Mirror
1 - Side Chair
1 - Arm Chair
1 - Wastebasket
1 - Set Pullman Curtains
1 - Set Drapes
1 - Radio Shelf
Carpet Runners

Bathrooms

1 - Shower
1 - Lavatory
1 - Water Closet
1 - Medicine Cabinet
1 - Bath Stool
1 - Towel Bar
1 - Soap Dish
1 - Soap Holder and Grab Rail
1 - Toilet Paper Holder
1 - Bath Mat
1 - Shower Curtain
1 - Tumbler Rack
1 - Toothbrush Rack

CREW ACCOMMODATIONS (continued) H-12

In general, furniture is to be of steel. The foregoing outfit list is intended to be indicative and actual outfit lists are to be worked out with the Owner to suit his requirements.

GUEST ACCOMMODATIONS H-13

Accommodations are to be arranged in the texas house for four guests. Two sleeping rooms are to be provided, each with two single beds, two bathrooms, a guest lounge and an adjoining small pantry.

A guests' dining room is to be provided in the after deck house.

Guest accommodations are to be decorated and outfitted in accordance with decorative schemes submitted by the Builder and approved by the Owner.

COMMISSARIAT SPACES H-14

These are to be located in the after deck house and are to include galley, pantry, and galley store rooms.

Equipment to include:

2 - Ranges - Hotpoint Model HRB-7

1 - Broiler

1 - Fry Kettle

1 - Dishwasher - Hobart Model LM-2T

1 - Peeler - Hobart Model 6115

1 - Mixer - Hobart Model A-200

COMMISSARIAT SPACES H-14

1 - Slicer - Hobart Model 1512-D

1 - Garbage Disposal - Hobart Model FW-150-2

2 - Toasters

1 - Coffee Urn - Amcoin Model 4BB

1 - Griddle - Hotpoint Model HG2

1 - Meat Block

2 - Double Sinks

1 - Baker's Table

2 - Reach-In Refrigerators

1 - Reach-In Deep Freeze

1 - Galley Server

Additional cupboards, dressers and other items to be supplied as determined by the final approved layout of the galley and pantry.

In general, equipment is to be of stainless steel.

CABIN, GALLEY AND PANTRY OUTFITS H-15

Outfits are to be supplied by the Builder in accordance with lists to be submitted and approved by the Owner. The following lists are to be prepared:

(a) Cooking Utensils - stainless steel
(b) Tinware
(c) Aluminumware
(d) Woodenware
(e) Tableware
(f) Galley Cutlery
(g) Chinaware
(h) Glassware
(i) Miscellaneous Galley Equipment
(j) Linen List

COMFORT INSULATION H-16

Accommodations and living areas exposed to the weather are to be insulated with Johns-Manville Spintex insulation. The under side of the spar deck in the machinery space is to be insulated in way of accommodations over, and this insulation is to be covered with sheet metal.

The extent of the insulation is to be in accordance with U. S. Coast Guard regulations.

Insulation to be secured by Nelson studs on approximately 12" centers. Insulation shall be held 4" above the deck on all exposed deck house sides.

JOINER WORK H-17

In the accommodations, linings are to be applied to the side shell, to deck house sides, and to steel partitions in rooms on the stiffener side. The flush side need not be lined, provided the steel is fair. Linings are to be Johns-Manville marine sheathing - 1/2" SB-1.

Single partitions are to be of J.M. - Marinite 3/4" - SB-2. Double partitions are to be of J.M. - marine sheathing 1/2" - SB-1.

Partitions and linings are to be stopped about 4" above decks and a removable steel baseboard fitted.

Ceilings are to be J.M. - marine sheathing 3/8" - SB-1. Ceilings in the pilot house, mess room and dining rooms are to be J.M. acoustical units.

JOINER WORK (continued) H-17

All joiner work is to be supported on light gauge steel furring.

Linings in the guests' accommodations are to be J.M. decorative marine veneer.

DECK COVERINGS H-18

Pilot house and chart room floors to be laid with deck composition and covered with vinyl tile.

Decks in bathrooms for passengers, Captain and Chief Engineer to be covered with ceramic tile laid in cement. Bathrooms for remainder of crew to be laid with Marbelite.

DOORS H-19

Weathertight and watertight steel doors are to be fitted at entrances to the deck erections as required under the freeboard regulations. Doors to be Overbeke-Kain, supplied complete with steel frame.

Steel interior joiner doors are to be fitted in the living spaces. Doors to be 1-1/4" thick, hollow metal and overall height to be about 6'-6". Doors to staterooms and work spaces to be 26" wide, bathroom and closet doors 24" wide, locker doors to be 18" wide and 1" thick.

Screen doors to be fitted to all outside doors, except doors to the pilot house. Screen doors to be of steel construction with two panels, the lower panel to be fitted with a protective grill of 1/2" mesh.

DOORS (continued) H-19

Paint locker doors to be of steel plate fitted with an automatic closing device.

Doors to be fitted with chromium plated hardware.

AIRPORTS H-20

Airport sizes are to be:

(a) In quarters - 18" diameter
(b) Windlass room - 14" diameter
(c) Main deck aft - 10" diameter

Deadlights are to be arranged to hinge downward and airport and deadlight in the open position are to be bounded by a suitable steel airport box in way of linings.

WINDOWS H-21

The pilot house and chart room will be fitted with metal framed windows. Opening windows to be crank operated. Windows to be fitted with plate glass. Individual drains to be provided at all window pockets. Two electrically heated windows are to be provided adjacent to the center window. These heated windows to have pendulum wipers installed. Special windows are to be fitted in the passenger lounge.

HEATING SYSTEM H-22

An adequate steam heating system is to be provided. Convectors of adequate sizes are to be located in all living spaces and in the pilot house, laundries, washrooms and pantries and galley. Convectors to be Trane, or equal.

HEATING SYSTEM (continued) H-22

Convectors in passenger spaces are to be of the recessed type, the openings being fitted with decorative grills.

FIRE EXTINGUISHERS H-23

Fire stations, hoses, axes and other equipment to be furnished as required by U. S. Coast Guard.

Foam type extinguishers with spare charges are to be provided in the living quarters and dry chemical type fire extinguishers are to be provided for the paint rooms.

CANVAS H-24

Canvas covers are to be provided to protect exposed equipment. Covers to be made of #6 waterproof duck, shaped to suit the equipment and provided with draw cords for securing.

Covers to be properly identified and a storage space for them is to be provided.

ANCHORS AND CHAINS H-25

Vessel to be provided with three 12,000 lb. stockless anchors - two bowers and one stream.

Each anchor to be connected with 90 fathoms of 2-3/8" high strength chain. Chains to be made up from 15 fathom shots, each joined by a connecting link. Inboard end of chain to be secured in chain locker.

LINE AND WIRE OUTFIT H-26

Mooring lines - 8 to be furnished - each 1-1/8" diameter, 6x19 galvanized improved plow steel, 550 ft. long, with an 8 ft. eye and 2 rubber covered beckets, spliced in one end. Six lines to be wound on the drums of each of the six winches and the remaining two to be stowed on reels.

Tow line pendant - 1 to be furnished - 1-3/8" diameter , 6x37 galvanized improved plow steel, 25 ft. long. One end to be fitted with a galvanized drop forged open socket with pin and the other end with a drop forged closed socket.

Tow lines - 4 to be furnished - 8" circumference 3-strand manila line, each 150 ft. long. One end of each line to have an eye splice and thimble.

Wrecking line - 1 to be furnished - 1-1/2" diameter, 6x19 galvanized improved plow steel, 600 ft. long. One end to be fitted with an 8 ft. splice and becket. Wrecking line to be stored on a reel.

Heaving lines - 10 to be furnished.

CHOCKS AND BITTS H-27

Vessel to be furnished with:

2 - 3-roller chocks - 1 at the bow and 1 at stern.

6 - 12" closed chocks - 4 forward and 2 aft.

2 - pedestal fairleads - 1 forward and 1 aft.

CHOCKS AND BITTS (continued) H-27

4 - 14" bitts - 2 forward and 2 aft.

8 - Oldman chocks - type B - on spar deck.

8 - open chocks - 12" - on spar deck.

2 - bulwark chocks - 12" - on spar deck.

10 - bitts - 12" - on spar deck.

The 3-roller chocks at the bow and stern comprise of two side sheaves and one bottom pipe roller.

LIFESAVING EQUIPMENT H-28

2 - 31-person oar propelled aluminum lifeboats.

2 - sets sheathed screw hand operated boom type davits.

2 - double drum electric lifeboat winches.

1 - 15-person life raft.

Life buoys and life preservers to be furnished in accordance with U.S.C.G. requirements.

NAVIGATION EQUIPMENT H-29

The Builder will furnish and install all navigating equipment listed as follows:

1 - Radar, Raytheon 16 inch and 10 centimeter, complete with screen, rotating base, amplifier and 12'-0" antenna mounted on the foremast.

1 - Master Gyro Compass, Sperry master system, with four (4) repeaters as follows: in pilot house, forward of the pilot house and outside wings of the pilot house. (Radar and radio direction finder repeaters to be furnished with units.)

1 - Bearing Circle.

1 - Course recorder, Sperry to be located in Captain's office.

1 - Radio direction finder, RCA model AR-8714, fixed loop mounted on the centerline of the pilot house.

1 - Radio telephone, Lorain, both AM and FM, together with the small Lorain weather receiver.

1 - Sounding machine, complete with outrigger boom and leads.

2 - Set of sounding leads and lead lines (1-20 fathom, 1 deep sea).

2 - 9" diameter spherical magnetic compasses fitted in Morrison Constellation type binnacles, calibrated in points and degrees, complete with compensating equipment. One will be located in the pilot house and one at the aft steering station.

2 - Bearing indicators, mounted port and starboard in the pilot house.

1 - Message case, metal, watertight.

3 - Clocks, 6" diameter, Chelsea, or equal, eight-day with ship's bell striking, fitted with chromium plated bronze cases, hinged bezel rings located as follows:

Chief Engineer's office

Captain's office

Passenger's lounge

1 - Clock, 8" diameter, Chelsea, or equal, eight-day with ship's bell striking, fitted with chromium plated bronze cases, hinged bezel rings, located in the pilot house.

1 - Clock, 8-1/2" diameter, non-striking, located in engine room.

3 - Clocks, 6" diameter, non-striking, one in galley, one in passageway forward and one aft.

1 - Rudder angle indicator, Henschel, located at the forward end of pilot house above windows.

2 - Shaft revolution indicators, one generator, indicating both ahead and astern revolutions per minute, located at the forward end of the pilot house above windows and at the engine room main control console.

1 - Shaft revolution counter, indicating total shaft revolutions, located at engine room main control console.
This instrument may be made part of the shaft revolution indicator.

1 - Engine order telegraph system.

1 - Mate's order telegraph system.

2 - Electrically operated Typhon whistles.

1 - Manually operated steam working whistle with a wire pull in the pilot house.

2 - Search lights, one located on the pilot house roof with controls in the pilot house, and one located at the aft end of the poop deck. The forward search light will be Carlisle and Finch, 19" incandescent aluminum, pedestal base, with lever control and twist lock, mogul base, 3 contact for two-filament lamp. Standard height and control length, as shown

on Carlisle and Finch catalog, Fig. #2, dated June 1, 1952. The after search light will be the same as above, one three-position switch, marked "Flood-Off-Beam" for 115 volt A.C. operation, for each search light, mounted in the pilot house, and the pedestal on the poop deck respectively.

1 - Public address system.

2 - Clinometers, located in the pilot house and engine room respectively.

2 - Aneroid barometers, one in pilot house and one in Captain's office.

2 - Thermometers, one reading inside and one reading outside temperatures, located in pilot house.

4 - Boxes of flares, and containers for flares.

1 - Set of charts of the Great Lakes.

2 - Protractors, navigating, with arms.

1 - Pair compass, 6" in length.

2 - Sets of 8" dividers.

2 - 12" triangles.

2 - Pair, 7 x 50 prism binoculars, Bausch and Lomb, with coated lenses and individual focus, complete with case and binocular boxes.

1 - Glass, chart reading, 3-1/4" diameter, approximate 8" focal length.

The following items will be furnished by the Builder and will be stowed as directed by the Owner or his representative:

QUANTITY	ITEM
8	1-1/2" towline shackles
4	Detachable anchor chain links
3	Snatch blocks for 1-1/8" wire rope
3	Snatch blocks for 1-3/4" wire rope
3	Double wood blocks for 7/8" line
3	Single wood blocks for 7/8" line
1	Coil manila line, 7/8", 1600 feet
1	Grommet set
6	Balls marline
6	Balls sail twine
12	Sail needles
3	Sail palms
2	Serving mallets, wood
3	Marline spikes, various sizes
4	Fids, 2 large and 2 small
2	Set of stencil letters and numbers, brass, 1" and 1-1/2"
1	Brass stencil plate with the ship's name in 3" letters
6	4" - #437 Paint brushes
6	3" - #437 paint brushes

QUANTITY	ITEM
6	2" - #542 varnish brushes
6	1" - #542 varnish brushes
6	1" - #444 flat sash brush
6	#6 - #505 round sash brush
6	#6 - #607 pencil brush
6	7" - paint rollers complete
6	9" - paint rollers complete
6	13½" paint rollers complete
3	7" paint roller covers
3	9" paint roller covers
3	13½" paint roller covers
6	#500 paint roller trays
6	#1000 paint roller trays
6	Extension handles, aluminum 14'
1	Brush & box for stencil blacking
1	Spray gun, hose and 5 gallon tank
6	Stage planks, 3 - 12' and 3 - 14'
2	Dozen deck brooms, #32 all corn
8	Cargohold brooms
5	XZIT degreasing solvent, gallons
200#	Tri Sodium Phosphate
2	Ivory soap, cases
2	Crest soap, cases

QUANTITY	ITEM
2	Chic cleanser, cases
2	Comet laundry soap, cases
200#	Near white wiping cloths
300#	Oakite cleaner compound
1	Oakite steam scrub gun
6	Long handled scrub brushes
6	Short handled scrub brushes
4	50' lengths, 1" deck hose
4	50' lengths, 1½" deck hose, extra beyond U.S.C.G. requirements
2	1" hose nozzles, brass
2	1½" hose nozzles, brass
8	Kapok life vests
8	Hard hats
6	Long handled scraper
1	Saw, cross-cut
1	Saw, rip
6	Wood chisels, various
1	Hand drill, 1/4" electric
1	Spike maul with 36" handle
1	Spoke shave
1	Set drills, 1/16" to 1/4" by 1/64th inch increments

QUANTITY	ITEM
1	Brace
1	Set wood augers to 1"
6	Screw drivers, 8", 10", 12"
4	Crescent wrenches, 6", 8", 10", 12"
2	Pipe wrenches, 14"
1	Hammer, machinist, 14 ounce
1	Hammer, claw, 20 ounce
1	Carpenters tool chest
1	Plane, jack
1	Wood smooth plane, 8"
1	Set cold chisels, 3/8th" to 1" by 1/8th" increments
4	Hammers, sledge, various weights
1	Carpenters square
4	Pinch bars
1	Bench grinder, 6", 1/3 H. P. electric
1	Vise, 4", swivel, with pipe jaws and anvil back
6	Pliers, 6" combination
12	Files, assorted
1	Chipping hammer, air (Chicago Pneumatic Company - #CP-407)
1	Wood mallet, 3" x 6" head
1	Tool board for Mates' storeroom
1	Claw hatchet

QUANTITY	ITEM
2	General purpose hand trucks, rubber tired
1	Oil stone
12	Pails
2	Stepladders, aluminum, 6' and 3'
12	Airport windjammers for 18" airports
1	Adding machine, National Adding Machine Co. Model 77-H
1	Check writer
2	Typewriters
2	Barrel hooks, large S-373 Laughlin
6	Pair safety goggles
12	Ore shovels, #3-342-1/2
1	Waste can, 10 gallon, with foot operated cover
2	Canvas luggage bags
1	20' Pike pole with galvanized sharp boat hook
1	36' Jacobs ladder, in 3 - 12' sections
6	Centering bar for hatch covers
1	Small sounding board
1	Sounding bar 6'-0" long
1	Sounding bar 3'-0" long
1	Boatswain's chair
3	Caulking tools for iron (heavy) 1/2" point
1	Caulking tools for iron (light) 1/4" point

PAINTING H-31

Before paint is applied, surfaces are to be cleaned; all rust, grease and foreign matter are to be removed together with as much mill scale as possible.

In general, all steelwork is to receive two coats of paint except interior of ballast tanks, which will receive one coat of red lead, and interior of cargohold up to main deck level, which will not be painted.

Joiner linings are to receive two coats of paint on the exposed side; concealed side is not to be painted.

The Builder is to submit a detailed painting schedule to the Owner for approval.

HATCHES H-32

Twenty (20) watertight cargo hatches are to be provided to the cargohold. Covers are to be of steel construction, mounted on 24 inch coamings and secured by "Kestner" hatch clamps.

Steel sliding covers are to be furnished for the coal bunker hatch. Bunker covers to be operated by an electric winch.

STEERING GEAR AND TRANSMISSION HE-1

There will be one electro-hydraulic steering gear of the "Rapson slide" type. The ram group will consist of two rams and four cylinders. The attachment of the cross-head to the stock will have a strength in excess of that of the stock. No hand or auxiliary steering gear will be required.

The ram group will be supplied with high pressure oil by either or both of two, reversible delivery, variable stroke, hydraulic pumps. Each of these pumps are to be driven by a wound rotor, 440 volt, 60 cycle, 3 phase, constant speed marine motor.

The ship's rudder will be of the balanced type and each steering gear pump will be driven by a 40 HP motor. On this basis the performance shall be:

Hard Over to Hard Over 45° plus 40°, or 85° total, in 36.5 seconds with single pump operation (2.33° per second).

Hard Over to Hard Over 45° plus 40°, or 85° total, in 18.88 seconds with both pumps operating (4.5° per second).

Each pump will develop the maximum ram pressure required by the rudder torque and only the oil gallonage pumped determines the aforementioned speed differences between one or two pump operation.

The arrangement of pumps, piping and valves shall be such that:

When both pumps are running they shall automatically be connected to the ram group in parallel.

When either of the two pumps shall stop or be stopped, the oil supplied by active pump will not circulate through the inactive pump and full pressure will be supplied to the ram group when demanded by the rudder forces.

When both pumps have been stopped, the ram grouped will be blocked hydraulically.

The motor of each pump, the Sperry Gyro Pilot, the auxiliary steering transmission and the rudder angle indicator shall each be energized by separate circuits directly from circuit breakers on the main switchboard. A double throw transfer switch for the two motor circuits and for the two transmission circuits shall be incorporated to meet U. S. Coast Guard rules.

Transmission - Steering

There shall be three stations of power control:

(1) Forward Electric Transmitter (Sperry - in wheel house)

(2) Forward Electric Auxiliary Transmitter (Synchro-Tie - in wheel house)

(3) Trick Wheel (in steering compartment)

No emergency hand steering means will be provided.

WINDLASSES HE-2

Forward Windlass

This windlass shall be electrically driven and of a size and power to handle the two forward anchors. Motor to be waterproof type.

After Windlass

This windlass shall be electrically driven and of a size and power to handle the after anchor. Motor to be waterproof type.

MOORING WINCHES HE-3

There shall be a total of six mooring winches installed, three forward and three aft. Each machine shall be an automatic tension, Johnson-type, Series "210" electric mooring winch, capable of handling 1-1/8" plow steel wire rope and of automatically maintaining the line pull constant at any valve between 5,000 and 15,000 pounds, as selected. Each winch shall be equipped with a 50 HP, 230 volt, DC marine waterproof motor and tension control system of variable voltage type.

Five of the winches will have control stations port and starboard. The extreme after winch will have its control station at the winch.

Mooring Winch Motor Generator Sets

There will be two motor generator sets for mooring winches. One to be located forward and one aft. Each

motor generator set shall consist of a 75 HP, 440 volt, 60 cycle, 3 phase motor, three special variable voltage motor generators and one common exciter.

COAL HATCH WINCH HE-4

An electric winch shall be provided for operating the coaling hatch of the ship's main coal fuel bunker. Motor to be watertight type.

HATCH CRANE HE-5

A traveling bridge crane shall be provided and installed on the spar deck for handling the cargo hatch covers. It will travel on standard 40-pound rails, supported by stools from the spar deck and located outboard of the hatches, port and starboard.

The hoist will be a commercial divided drum electric hoist and brake with cable, sheaves and hooks for attachment at two points on the hatch cover.

The power for travel will be supplied by a reversible electric motor driving through an adjustable speed hydraulic coupling. The crane will drive on all four wheels by means of enclosed gears. Both magnetic and foot-operated hydraulic brakes will be supplied.

Electric current shall be supplied to the crane at 440 volts, 60 cycle, 3 phase, through a flexible cable from suitably located deck outlets. Motors to be watertight type.

HATCH CRANE (continued) HE-5

A cable reel of constant tension type shall be provided to eliminate slack and a level winder shall be fitted to prevent reel pile up. Reel will be driven by a 1 HP motor driving through a variable speed hydraulic coupling with adjustable control to give automatic straight line tension on the cable.

DAVIT HOISTS HE-6

Two electric hoists shall be furnished and mounted on special davits, one port and one starboard at the after portion of the vessel. Each shall be capable of handling a normal load of 2,000 pounds, at a hoisting speed of 32 feet per minute. Motors to be watertight type.

LADDER HOIST HE-7

One electric hoist shall be furnished and installed aft near the main mast and rigged for handling the after ladders. Motor to be watertight type.

SEWAGE UNITS HE-8

Two sewage disposal units shall be furnished and installed, one forward and one aft. They shall receive sewage and drainage from the ship's soil system and process it for disposal and pump it overboard. The units shall be complete with tanks, chlorine equipment, pumps and motors together with integral piping. Motors to be marine, 440 volt, 60 cycle, 3 phase.

REFRIGERATION MACHINERY HE-9

The refrigeration units shall be of Freon-type, with motor driven compressors of a capacity to serve the refrigerator arrangement selected. Current to be 110 volt, single phase. Refrigerant lines to be properly insulated.

CABIN VENTILATION HE-10

All living quarters will be provided with mechanical ventilation. The ventilation systems will consist of a mechanical forced air supply system and a natural exhaust system except that an exhaust fan will be provided in the galley and that mechanical ducted exhaust systems be provided for all bathrooms and/or toilets. Supply air for cabins shall first pass through filters and then tempering coils before being distributed to the quarters.

MACHINERY SECTION

GENERAL M-1

The propelling machinery shall consist of a 7000 shaft horsepower cross compound turbine and double reduction gearing driving a single screw.

Steam shall be generated by two water tube boilers of bent-tube, two-drum type, coal fired by spreader type stokers with continuous ash discharge. Automatic combustion control shall be provided.

Electric current shall be produced by two 400 KW turbo generators with two 100 KW Diesel generator sets as stand-bys. A 30 KW Diesel generator emergency set shall be installed for emergency lighting.

Power circuits shall be 440 Volt, 3 Phase, 60 Cycle.

Lighting circuits, heating boiler requirements and unit space heaters shall be 110 Volt, Single Phase.

The power plant shall be located in the after end of the vessel and shall be arranged with the turbine aft, the boilers in the middle and the coal bunkers at the forward end of the machinery space.

All auxiliary units to be motor driven with the exception of the emergency units as noted.

GENERAL (Continued) M-1

All of this equipment shall be built to meet the requirements and pass inspection of the U.S.C.G. Vessel Inspection Service and the American Bureau of Shipping for service on the Great Lakes and St. Lawrence Seaway.

PROPULSION TURBINE AND GEARS M-2

The turbine of this unit shall be of cross-compound type composed of one high pressure and one low pressure turbine arranged in series and connected through flexible couplings to double reduction gears. It shall be rated as follows:

Normal Power - 7000 SHP - 105 RPM - 28½" Vacuum

Maximum Power - 7700 SHP - 108½ RPM - 28½" Vacuum

Steam Pressure at Throttle ------- 450 PSIG

Total Temperature at Throttle ---- 750 Degrees F.

ASTERN POWER

The astern turbine shall be designed to develop not less than 80 per cent of normal ahead torque at 50 per cent of normal ahead revolutions per minute at normal ahead steam flow. The astern turbine may be incorporated in either the ahead or the astern turbine casing.

EXTRACTION

There shall be three points of extraction provided to supply feed heaters and evaporator.

MAIN REDUCTION GEAR

This unit shall be of double helical reduction type with pinions arranged so that the main condenser may be located below the low pressure turbine. A thrust bearing of Kingsbury type shall be incorporated to take the propeller thrust.

The "K" factor shall not be more than 75 in the second reduction.

The lubricating system shall be of the pressure type with oil supplied by the ships main and auxiliary lubricating oil pumps.

GENERAL REQUIREMENTS

The turbine-gear manufacturer shall furnish the unit complete with all necessary control and governing mechanisms, attached piping, thrust bearing, instruments, tools and necessary spares for Great Lakes Service.

The throttle and maneuvering valves shall be furnished with the turbine. These maneuvering valves shall be operated through connecting shafting from a "Control Console" located forward of the turbine.

MAIN TURBINE TEST

The turbine and gears to be thoroughly tested at the factory to the full satisfaction of the American Bureau of Shipping. Test reports and calculated steam consumption charts over speed range to be furnished.

MAIN BOILERS M-3

There shall be furnished and installed two stoker fired, single pass, 2 drum, bent tube boilers complete with superheaters, desuperheaters, air heaters, complete brick and insulation, air puff soot blowers, stokers with drives and motors, forced draft fans with inlet dampers and motors, overfire air fans and motors, combustion control, smoke indicators, induced draft fans and other boiler appurtenances.

The boilers shall be designed for 525 PSIG and shall meet the rules and pass the inspection of the U. S. Coast Guard Vessel Inspection Service and the American Bureau of Shipping for Marine Service.

Characteristics of each boiler shall be as follows:

Operating Pressure at Superheater Outlet	- 470 PSIG
Steam Temperature - Deg. F. - at Superheater Outlet	- 755 Normal
Superheater Safety Valve set at	- 495 PSIG
Drum Safety Valve set at	- 525 PSIG
Total Steam per hour @ Normal 7000 SHP load	- 30,000#
Max. Continuous Steam per hour	- 33,600#

Desuperheater - 10,000# per hour from 765° F. to 500° F.

Furnace to be designed with water cooled side and rear walls with refractory front wall.

Air Heaters - horizontal, tubular, two pass air side, single pass gas side and fitted with dampers for air by-passing during low loads.

Casing shall include fly ash hoppers at ship's centerline, fitted with connections for cinder return system.

STOKERS

Each boiler shall be fired by spreader stokers, with grates of the continuous ash discharge type, discharging ash at the firing end. Stokers to be Detroit Stoker Company or equal - grate surface 109 square feet per boiler. There shall be 2 spreader units and 2 coal chutes per boiler.

COMBUSTION CONTROL

Boilers to be fitted with either electric or air actuated automatic combustion control. It shall be complete with master control, damper operators for forced and induced draft fans and for coal feeders. The combustion control system shall maintain constant steam header pressure by automatically regulating the fuel and air supply to the furnaces in accordance with the demand for steam. One boiler meter per boiler shall be furnished to record steam flow, air flow, and integrate steam flow. The control equipment shall include the necessary panel and shall include two 3 unit multipointer draft gauges.

GENERAL

Boilers and stokers shall include the necessary A.B.S. spares, also special tools.

STEAM TURBO-GENERATORS M-4

There shall be two turbo-generators each of 400 KW rating, 450 volts, 60 cycle, 3 phase - 0.8 power factor continuous based upon 50° C. ambient. To be capable of 25 per cent overload for two hours.

Turbines to operate at 450 PSIG steam pressure, 750° F. steam temperature, and exhaust into 1½" Hq absolute.

Generator and exciter to be of enclosed type with air cooler.

Voltage regulators to be included.

To meet requirements of A.B.S. and U.S.C.G.

A.B.S. spares to be furnished.

DIESEL GENERATORS - STAND-BY AND AUX. SERVICE M-5

Two 100 KW 6-cylinder 1200 RPM Diesel generating sets shall be installed in the machinery space. Current to be 450 volt, 60 cycle, 3 phase, 0.8 power factor. The engine shall be radiator-cooled and fitted with a special fan capable of discharging the heated air to the outer atmosphere through a duct. Unit shall include electric starting equipment, heavy duty starting batteries, battery charger, mufflers, vibration mounts and voltage regulators. A.B.S. spares to be included. Units to meet requirements of American Bureau of Shipping and U. S. Coast Guard Vessel Inspection for Marine Service.

EMERGENCY DIESEL GENERATOR M-6

One 30 KW, 110 volt, 60 cycle, single phase Diesel generator set shall be furnished complete with accessories, voltage regulator, power and distribution panels, and automatic transfer switch. This emergency generator set and panel shall be mounted on the boat deck to meet the requirements of the U. S. Coast Guard Vessel Inspection Service for emergency lighting.

MAIN CONDENSER AND AIR EJECTOR M-7-1

One marine surface type condenser shall be mounted directly beneath the low pressure turbine. The condenser will either support the low pressure turbine or be supported by the low pressure turbine. It shall be a 2-pass type of about 6500 square feet cooling surface. It shall have a welded steel shell and welded steel water boxes. It shall be capable of condensing 48000 pounds of steam per hour to 1½ inches Hq, using 8600 GPM of 75.0 degree F. cooling water. It shall have 3/4" diameter #18 BWG Admiralty metal tubes.

The main air ejector shall be a twin element, two stage ejector unit complete with a tubular inter and after condenser. The ejectors shall be mounted directly on the inter and after condenser shell. Steam pressure to the ejectors will be 175 PSIG.

AUXILIARY CONDENSERS AND AIR EJECTOR M-7-2

There shall be two 650 square foot auxiliary condensers

of surface type, one to serve each 400 KW turbo generator. Each auxiliary condenser shall be of three pass type and capable of condensing the steam from one 400 KW turbo-generator at 100 per cent rating and maintain 1½ inches Hq, using water for cooling at 75 degrees F.

One auxiliary air ejector shall be installed. It shall serve either or both condensers.

PUMPS M-8

The following pumps shall be furnished and installed:

M-8-1 Two (2) Main Circulating Pumps, each 5100 GPM. Vertical, split case, ball bearing, centrifugal pump driven by a vertical 2-speed, 2-winding 440 volt, 60 cycle, 3 phase marine motor. These pumps serve main condenser, auxiliary condensers and oil coolers.

M-8-2 Two (2) Main Condensate Pumps, each 150 GPM. Vertical, two stage, split case, ball bearing, centrifugal pump driven by a vertical, constant speed, 440 volt, 60 cycle, 3 phase marine motor. These pumps draw from the main condenser and deliver through the low pressure feed system to the deaerating heater.

M-8-3 Two (2) Auxiliary Condensate Pumps, each 25 GPM. Horizontal, two stage, ball bearing centrifugal pump driven by a horizontal constant speed 440 volt, 60 cycle, 3 phase marine motor. These pumps draw from the auxiliary condensers and discharge through the low pressure feed system to the deaerating heater.

M-8-4 One (1) Main Feed Pump, 175 GPM.

Vertical motor driven 7 stage, 3600 RPM, Ingersoll Rand feed pump, with alloy steel channels. 100 HP, 440 volt, 60 cycle, 3 phase motor - constant speed.

M-8-5 One (1) Auxiliary Feed Pump, 175 GPM.

Vertical turbine driven 7 stage, 3600 RPM Ingersoll Rand feed pump, with alloy steel channels. 100 HP turbine, 440 PSIG desuperheated steam exhausting to 15 pounds B.P.

M-8-6 One (1) In-Port Feed Pump, 50 GPM.

Vertical motor driven 14 stage, 3600 RPM, Ingersoll Rand feed pump, with alloy steel channels. 40 HP, 440 volt, 60 cycle, 3 phase constant speed motor.

M-8-7 One (1) Main Lubricating Oil Pump, 250 GPM.

DeLaval 1MO, vertical motor driven lubricating oil pump with 440 Volt, 60 cycle, 3 phase constant speed marine motor. Serves main turbine and gear.

M-8-7 One (1) Auxiliary Lubricating Oil Pump, 250 GPM.

DeLaval 1MO, vertical turbine driven lubricating oil pump. Serves main turbine and gear in emergency.

M-8-8 One (1) Atmospheric Drains Tank Pump, 30 GPM.

Horizontal centrifugal or turbine type pump driven by a 440 volt, 60 cycle, 3 phase marine motor - constant speed, float controlled flow. Pumps all miscellaneous condensate drains from atmospheric drain tank and delivers them to low pressure feed line ahead of the deaerating feed water heater.

M-8-9 One (1) Forward Condensate Return Pump, 5 GPM.

Horizontal turbine type pump, motor driven, complete with tank and float. Collects drains from forward quarters heating system and pumps them aft to atmospheric drains tank located in machinery space.

M-8-10 Two (2) Ash Sump Pumps, each 400 GPM.

Horizontal centrifugal motor driven special pump for handling ash and water. "V"-belt driven by a 440 volt, 60 cycle, 3 phase constant speed motor. Draws from main boiler ash sumps and pumps overboard.

M-8-11 One (1) Engine Room Bilge Pump, 200 GPM.

Marlow self-priming centrifugal pump driven by a 5 HP, 440 volt, 60 cycle, 3 phase marine motor. Serves engine room bilge and discharges overboard.

M-8-12 Two (2) Fire Pumps, each 200 GPM.

Either vertical or horizontal, two stage, split case, ball bearing, 1750 RPM, centrifugal pump. To be fitted with a wound rotor, 440 volt, 60 cycle, 3 phase marine motor, so that speed may be reduced from 1750 RPM. This pump serves main fire and deck line and emergency cooling. Full speed for fire service and reduced speed, gallonage, and pressure for deck and/or cooling service.

M-8-13 One (1) Cooler and General Service Pump, 250 GPM.

Either vertical or horizontal, single stage ball bearing, 1750 RPM constant speed centrifugal pump driven by a 440 volt, 60 cycle, 3 phase constant speed marine motor.

M-8-14 One (1) Sanitary Fill Pump, 150 GPM.

Horizontal, ball bearing, single stage centrifugal pump, driven by a 440 volt, 60 cycle, 3 phase constant speed marine motor. This pump used to fill potable water tank.

M-8-15 Four (4) Sanitary Pressure Pumps, each 35 GPM.

Horizontal, turbine type pump, driven by 440 volt, 60 cycle, 3 phase constant speed marine motor. Two of these pumps serve after potable water system and two serve forward potable water system.

M-8-16 Four (4) Main Ballast Pumps, each 7000 GPM.

Vertical, split case, ball bearing, single stage centrifugal pump driven by constant speed, 440 volt, 60 cycle, 3 phase marine motor.

M-8-17 One (1) Auxiliary Ballast or Stripper Pump, 2000 GPM.

Vertical, split case, ball bearing, single stage, centrifugal pump with 440 volt, 60 cycle, 3 phase motor. To draw from discharge side of ballast manifold and discharge overboard. No sea suction fitted.

M-8-18 One (1) Heating Boiler Feed Pump, 6 GPM.

To be a turbine type, multi-stage, motor driven pump to deliver feed water to heating boiler at 200 PSIG. Motor to be a 110 volt, single phase drip-proof marine motor. This pump, located in lower engine room, will draw from the atmospheric drain tank and discharge to the heating boiler on the boat deck. It will be controlled by the heating boiler drum water level.

M-8-19 Two (2) Feed Water Treatment Pumps

Each to be a Milton Roy, or equal, 110 volt, single phase, motor driven proportioning pump of correct size for injecting boiler water treatment chemicals into the feed system.

M-8-20 One (1) Boiler Test Pump

To be a 12"-1 3/4"x12" simplex steam pump for boiler testing and suitable for operation using either 100 PSIG steam or air as a power medium.

MOTORS FOR PUMPS

All motors shall meet the requirements of the U. S. Coast Guard Vessel Inspection Service and the American Bureau of Shipping for Marine Service. They shall be drip-proof, 40 degree C. rise at 50 degree ambient.

A.B.S. motor spares shall be furnished.

Turbine drives shall also meet the requirements of the aforesaid regulatory bodies.

MISCELLANEOUS MACHINERY SPACE AUXILIARIES M-9

M-9-1 Two (2) Air Compressors

Two stage, either water or air cooled, V-belt driven air compressors complete with 25 HP, 440 Volt, 60 cycle, 3 phase drip-proof motors. Units complete with inter and after coolers

vibration mounts and accessories. They shall be of suitable capacity to serve the requirements of flue blowing and combustion control.

M-9-2 One (1) Lubricating Oil Centrifuge

Purifier to be of 375 gallons per hour capacity of lubricating oil and equipped with integral pumps. It shall be driven by a 1½ HP, 440 volt, 60 cycle, 3 phase marine motor.

M-9-3 One (1) Hypo Chlorinator

A hypo chlorinator shall be furnished and installed in the potable water filling system.

M-9-4 Two (2) Ballast Primers

The ballast primers shall consist of high capacity low level ejectors, steam actuated, complete with condensers and control tank.

M-9-5 Four (4) Coal Elevators

Each coal elevator shall be a "Dayton" 8-inch elevator, having a capacity to lift 8000 pounds of coal from the main coal bunker to the ship's day bunkers. The lower boot shall be constructed of stainless steel and the lower coal inlet openings shall be fitted with worm operated sliding gates. Each unit shall be driven by a 5 HP, 440 volt, 60 cycle, 3 phase marine gear motor manually started and automatically shut off. One spare gear motor per ship shall be included. Two only worm operated sliding gate hand-firing openings in the main bunker bulkhead. Coal will run from day bunkers by gravity to the four stoker hoppers through four stainless steel 16" diameter chutes. Each chute will be

fitted with a Stock Equipment Company totally enclosed, gear operated shutoff gate.

M-9-6 Two (2) Main Whistles

There shall be one Typhon DV300 and one Typhon DV425 whistle furnished and installed.

M-9-7 One (1) Heating Boiler

The heating boiler shall consist of one "Cyclotherm" oil burning packaged unit complete with burner, fan and controls. It shall have a capacity of 2000 pounds of steam per hour and shall meet the requirements of the U. S. Coast Guard Vessel Inspection Service and the American Bureau of Shipping for a working pressure of 150 PSIG in marine service. It shall be installed in a separate room on the boat deck. Its feed pump will be installed in the lower engine room. It shall serve the quarter's heating system before and after the ship's navigation season and furnish steam for miscellaneous uses during lay up and fit out.

M-9-8 Five (5) Unit Heaters

Five unit heaters of suitable size shall be installed in the machinery space using steam from the main or the heating boilers. Their fans shall be driven by 110 volt, single phase motors.

M-9-9 One (1) Lathe

To be a 16"/24" swing by 8 foot bed "South Bend", or equal, lathe with necessary accessories and driven by a 440 volt, 60 cycle, 3 phase marine motor.

M-9-10 One (1) Drill Press

To be a Buffalo Forge, or equal, 20" drill press, complete with 440 volt, 60 cycle, 3 phase marine motor.

M-9-11 One (1) Power Hack Saw

This unit shall have a maximum capacity of 6"x6" stock and shall be motor driven.

M-9-12 One (1) Pedestal Grinder

This unit shall be a two-wheel unit, complete with motor and eye shade and will be installed in the machinery space.

M-9-13 One (1) Engine Room Crane

The bridge of this crane travelling fore and aft shall be hand operated and rated at 10 tons. On this bridge shall be mounted an electric hoist travelling athwartship and capable of lifting 7½ tons. The travel of this hoist will be hand operated.

M-9-14 One (1) Gangway Trolley System

A monorail system shall be installed at the machinery space gangway doors and shall be fitted with one trolley and a 2-ton hand operated, geared chain hoist.

M-10-1 Two (2) Lubricating Oil Coolers

To be of shell and tube type designed to properly cool the lubricating oil of the main propulsion unit.

M-10-2 One (1) Lubricating Oil Heater

To be of shell and tube type designed to properly condition the propulsion turbine lubricating oil centrifuging.

M-10-3 One (1) Gland Seal Condenser

To be of shell and tube type to be installed in the low pressure feed system between the after condenser and the first stage heater and shall condense gland steam leakage from the turbines. It shall be fitted with a motor driven exhaust fan to produce a slight vacuum within the gland seal condenser.

M-10-4 One (1) First Stage Heater

To be of the shell and tube type installed in the low pressure feed water system between the gland seal condenser and the deaerating feed water heater to raise the temperature of the feed water using steam from the low pressure extraction point of the main turbine.

M-10-5 One (1) Deaerating Feed Water Heater

There shall be furnished and installed one marine type deaerating feed water heater with external shell and tube type vent condenser. It shall have 67000 pound per hour heating

capacity and a 1400 gallon storage capacity. Heater shall meet an oxygen guarantee of .005 cc per litre. Heater to be about 6 feet in diameter. It shall be equipped with a controlled overflow and a remote reading Eye-Hi level indicator.

M-10-6 One (1) Third Stage Heater

To be a shell and tube type heater with waterside of 600 pound class design and steamside to withstand 150 PSIG. It shall capacity to handle 67000 pounds of water per hour and it will receive it's steam from the high pressure extraction point of the main turbine. It will be installed in the high pressure boiler feed line between the main feed pumps and the boiler drums.

M-10-7 One (1) Make-Up Evaporator

To be of vertical shell and coil marine type using a coil pressure of about 100 PSIA, and a vapor pressure of 35 PSIA. The vapor will discharge to the deaerating heater. The capacity shall be 2000 pounds per hour.

M-10-8 One (1) Evaporator Feed Heater

To be of horizontal shell and tube type. It will heat make-up water to the evaporator using the coil condensate from the evaporator as a heating medium. It shall be mounted in the make-up line between the evaporator coil and the coil trap with the trap level above the level of the heater.

M-10-9 One (1) De-Icing Heater

To be of vertical shell and tube type installed in the ship's fire and deck line. It will use saturated reduced pressure steam as a heating medium and the condensate trap shall be installed above the lower tube sheet to reduce the condensate temperature to 150° F. It shall have a capacity to heat 120 GPM of lake water from 80° to 150° F.

M-10-10 Two (2) Quarters' Hot Water Heaters

These heaters may be either of the side arm type or of the submerged U-tube type. Each shall have a storage capacity of 180 gallons and a heating capacity of 250 GPH from 40° F. to 150° F. when supplied with steam at 12 PSIG. One of these will be used forward, the other aft.

M-10-11 One (1) Galley Hot Water Heater

To be of similar type to "quarters" heater except that storage capacity to be 40 gallons and the heating capacity to be 80 GPH from 40° to 180° F.

FANS - MACHINERY SPACE M-11

Two (2) Forced Draft Fans

Furnished with boilers - see M-3

Two (2) Cinder Return Fans

Furnished with boilers - see M-3

M-11-1 Two (2) Induced Draft Fans

Each fan shall be a Sirocco double inlet 2/3 double width induced draft fan of a capacity to properly handle the boiler outlet gas and have a reasonable margin of safety. It shall be V-belt driven by a 440 volt, 60 cycle, 3 phase two-winding, two-speed marine motor.

M-11-2 Two (2) Engine Room Ventilating Fans

Each to be American Blower Company HS type, or equal, having a capacity to draw 20,000 CFM through filters and deliver it through ducts throughout the machinery space. Motors 440 volt, 60 cycle, 3 PH marine.

M-11-3 Two (2) Boiler Room Ventilating Fans

Each to be a propeller duct fan having a capacity equal to the required combustion air for one main boiler and to draw through fillers and discharge through ducts to the boiler room.

M-11-4 Two (2) Engine Room Exhaust Fans

Two propeller type fans mounted in upper engine room bulkhead to draw entrapped hot air from the engine room and discharge it to the upper boiler room. To be motor driven.

Lubricating Oil Storage

Two (2) tanks, one for clean oil and one for used oil. Each tank shall be of a capacity to hold the oil contained in the main geared turbine lube oil system.

Three (3) service oil tanks, each to have 60 gallons capacity and be equipped with a hand pump.

Air Tanks

Two (2) air tanks to serve the needs of the compressed air system. Constructed to meet the requirements of the regulatory bodies.

Feed Water Storage Tanks

See Hull Specifications

Potable Water Tanks

See Hull Specifications

One (1) Atmospheric Drain Tank

To be installed in lower engine room to receive heating and miscellaneous drains.

M-13-1 Propeller

The propeller shall have four manganese bronze blades and a steel hub. It shall be about 19 feet, 6 inches in diameter and its' structure shall meet the requirements of the American Bureau of Shipping. Two spare blades and seven studs and nuts shall be furnished.

M-13-2 Tail Shaft

The tail shaft shall be constructed to American Bureau Great Lakes rules. It shall have an integrally forged coupling on its forward end and a taper fit, key and nut at the after end to suit the propeller hub. The diameter of the shaft in way of the stern tube bearings shall be increased over the required body diameter to allow for possible future installation of bronze sleeves. No bronze sleeves are contemplated in the initial construction.

M-13-3 Stern Tube

Combined fabricated and cast steel shall be used for this tube. Bearings at both ends shall be fitted with bronze sleeves filled with micarta. Stuffing box to be fitted at forward end.

M-13-4 Line Shaft

There will be one section of line shaft fitted between the tail shaft and the gear shaft. It shall be supported by one steady bearing at its center.

M-13-5 Coupling Bolts

Coupling bolts shall be of the fitted taper type with nuts fitted.

ARRANGEMENT OF MACHINERY M-14

The equipment in the machinery space will be arranged on five levels as follows:

Lower Floor (about 9½ feet above base line)

Main Propulsion Gears
Main Condenser
Auxiliary Condensers
Main Circulating Pumps
Main Condensate Pumps
Auxiliary Condensate Pumps
Lubricating Oil Pumps
Lubricating Centrifuge and Heater
Atmospheric Drain Pump and Tank
Heating Boiler Feed Pump
Fire Pumps
General Service or Cooler Pump
Oil Coolers
Bilge Pump
Sanitary Fill Pump
Hypochlorinator
2 Sanitary Pressure Pumps
In-Port Feed Pump
Ballast Manifold
4 Main Ballast Pumps
1 Auxiliary Ballast Pump
Ash Sumps
Ash Sump Pumps
Potable Water Tanks

Handling Deck (about 18 feet above base line)

1 Sewage Unit
2 - 400 KW Turbo Generators
Main Switchboard
Control Cubicles for Machinery Space
Main Turbine
Main Maneuvering and Control Console
Combustion Control Panel
Laboratory Sink and Test Stand
Main Feed Pump
Auxiliary Feed Pump
Main and Auxiliary Air Ejectors
Gland Leak off Condenser
Work Bench
Main Boilers, Stokers and Firing Floor
Coal Elevators
Boiler Test Pump
Cinder Return Fans

Main Deck (about 29 feet above base line)

Steering Gear & Transmission
Refrigerating Machinery
Chief Engineer's Office
Locker Room
Laundry
Spare Parts Room
Paint Locker
Toilet Room
Lube Oil Storage Tanks
Machine Shop
Mooring Winch Motor Generator Set
Mooring Winch Control Cubicle
2 - 100 KW Diesel Generator Sets
Air Compressors and Tanks
Evaporator and Evaporator Feed Heater
Ballast Primers
De-Icing Heater
Aft Quarters Water Heater
Galley Water Heater

ARRANGEMENT OF MACHINERY (Continued)

Spar Deck

Engine Room Crane (directly below)
Engine Room Ventilating Fans
Boiler Room Ventilating Fans
Engine Room Exhauster Fans (directly below)
Coal Elevator Drives

Poop Deck (8½ feet above Spar Deck)

Induced Draft Fans
Forced Draft Fans
First Stage Feed Heater
Third Stage Feed Heater
30 KW Emergency Diesel Generator
Heating Boiler

Stack

The main stack shall house the deaerating heater and the main whistles.

Lower Floor

This lower floor shall be of "Gary" 1"x3/16" close mesh galvanized grating, or equal. To be supported by steel angle supports except between ash sumps and coal bunker bulkheads, where floor plate shall be used.

Handling Deck

Generally, this deck shall be constructed of steel plate. The open area around the main turbine unit shall be fitted with "Gary" 1½"x3/16" close mesh galvanized grating, or equal. The firing area between the boiler fronts and the coal bunker bulkhead shall be floor plate.

Gratings

Gratings shall be provided at Main Deck, Spar Deck, Poop Deck, House Top and at intermediate levels to provide suitable access to equipment.

Stairs

Stairs shall be provided for access to and from various levels. Treads to be "Gary" close mesh galvanized, or equal, equipped with non-slip nosings. Stair angle to be approximately 35 degrees.

Handrail

To be #14 gauge seamless steel tubing, welded joints. To be double rail type.

VENTILATION - MACHINERY SPACES M-16

Engine room fans (see M-11) shall draw through filters and discharge to port and starboard mains under spar deck. Branch mains to be led to various levels to distribute the air throughout the engine room. Diffusers to be fitted at outlets where needed.

Boiler room fans (see M-11) shall draw through filters and discharge down through ducts to firing and lower levels. Diffusers to be fitted at outlets where required.

Engine room exhaust fans (see M-11) shall be fitted in upper engine room bulkhead and discharge direct into boiler room.

It is the intent to fill the machinery space with fresh air with exit flow through boiler room and out through main stack to atmosphere.

COMBUSTION AIR DUCTS M-17

Air ducts shall connect each forced draft fan with its related air heater. Expansion joints to be installed therein.

BREECHING M-18

Breechings shall connect each air heater to each induced draft fan inlet. These breechings shall be constructed of 3/16"

BREECHING (Continued) M-18

steel plates with suitable connecting flanges at the air heater and the induced draft fan inlets. Damper frames and leaf dampers shall be fitted at each fan outlet. The breechings shall have provision for expansion. They shall be insulated with 1½" thickness of 85% magnesia block chinked with 1/2" thick asbestos cement. Block to be properly wired and secured. This covering to be lagged with #20 gauge galvanized steel.

STACK M-19

An outer stack constructed of 3/16" steel suitably stiffened shall be installed. Its size shall be sufficient to house the inner stacks, the deaerating heater and the main whistles.

There shall be two inner stacks, one for each boiler. These stacks shall extend approximately 24 inches above the outer stack, and each shall be of proper area to handle the gases from one boiler.

Owner's insignia to be mounted on outer stack.

Inner stacks to be insulated to prevent personal injury from burns.

PIPING GENERAL M-20

Piping shall be run in accordance with diagramatic plans, which shall be prepared by the Contractor.

Piping shall be led as directly as possible with sufficient flanged joints for ready accessibility to facilitate removal or overhauling of valves or machinery. However, the number of joints shall be held down to the practical needs of the system involved, since an excessive number of joints, particularly in the high pressure piping, increases leak hazards.

As far as practicable, piping shall be kept away from switchboards and electric wiring.

The use of gate valves in Class I high pressure steam lines shall be avoided.

Pipe bends shall be used wherever practical in preference to fittings and provision for expansion shall be provided in all lines subject to temperature variations.

All extraction lines shall be fitted with special non-return valves at the turbines.

Provision to be made throughout for winter drainage.

PIPING MATERIALS

All piping to be in accordance with the rules of the U. S. Coast Guard Vessel Inspection Service and the American Bureau of Shipping for Marine Service on the waters of the "Great Lakes".

All engine room piping throughout to be run with steel pipe or seamless steel tubing, standard or extra heavy weights, as may be required to suit the pressure of the system which it serves.

Globe, angle, gate and check valves to be of Crane Company manufacture and to meet marine rules for the service intended.

Reducing valves to be "Leslie", or equal, and shall be protected by strainers.

Special valves, regulators, etc., to be selected from sources whose product best suits the application for which they are intended.

Safety valves to be "Consolidated", or equal.

All Class I piping gaskets to be "Flexitallic".

All hot surfaces of piping and equipment shall be insulated so that the insulated surface temperature will not exceed 145 degrees F. This will require the use of standard magnesia covering, double standard magnesia covering, high temperature covering, and/or a combination of high temperature and magnesia covering, dependent upon the service temperature of the pipe or unit being insulated.

In the case of piping: pipe, valves, fittings and flanges shall be covered.

Pipe covering shall be canvassed and painted. Pipe covering shall be lagged with sheet galvanized metal only where subject to damage.

Equipment to be Insulated

Exposed Portions of Boiler Drums
Exposed Portions of Circulating Tubes (if any)
Breeching
Induced Draft Fans
Portions of Inner Stacks
Deaerating Heater
Stage Feed Water Heaters
Evaporation
Quarters and Galley Hot Water Heaters
Steam Turbine Cylinders
Ejectors

In addition to heat insulation, such cold water piping causing sweating shall be covered with hair felt.

2 - Boiler Meters (see M-3) shall be provided. They shall record steam-flow - air-flow and integrate steam flow for each boiler. Their steam orifices shall be installed in the main super heater steam lines downstream from the superheater outlet stop valves.

1 - Steam Flow Meter shall be installed in the common line to the 400 KW generators.

1 - Feed Water Flow Meter shall be provided to record and integrate total water fed to the boiler plant.

Main steam header pressure, steam temperature at each boiler superheater outlet, feed water temperature to boiler and flue gas temperature at each air heater outlet shall be recorded either by means of a separate recorder, or recorders, or the pens may be incorporated with the flow meters if practical.

Remote reading water level indicators shall be provided for boilers and deaerating heater.

Gauges and thermometers shall be provided where necessary to indicate operating conditions in the various systems.

One absolute pressure gauge shall be furnished for main condenser.

Instruments for combustion control are included with combustion control (see M-3).

A propeller revolution counter shall be furnished and installed with a transmitter driven from the propeller shafting

with an integrator and indicator in the engine room and an indicator only in the pilot house.

A King Telegauge Unit shall be provided for the ballast system with board and instruments mounted adjacent to the main ballast manifold and having an instrument for each ballast tank with pipe connections thereto.

Two King Telegauges to be provided for lubricating oil storage tanks.

WORK BENCHES, LOCKERS AND SHELVING M-23

Three work benches shall be provided in the machinery space. One to be located in the lower engine room, one on the handling deck and one in the machine shop. Tool boards to be included.

Fourteen (14) metal clothes lockers to be installed in locker room for use by engine division crew.

Suitable shelving and bins shall be fitted in enclosed rooms in the machinery space for the stowage of tools and spare parts.

ENGINEERS' OUTFIT - HAND TOOLS, VISES, HAND INSTRUMENTS M-24

The engineers' outfit will be provided in accordance with a list submitted for owner's approval.

MACHINERY SPACE FIXED CO^2 EQUIPMENT M-25

Fixed CO^2 equipment shall be fitted as required by the regulatory bodies in the following spaces:

Heating Boiler Room on Poop Deck
Emergency Generator Room on Poop Deck
After Paint Locker

NOTE: For forward lamp room and for all portables, see Hull Specification.

SPARE PARTS M-26

Spare parts for electric motors, generators, switchboard, and controls shall be furnished in accordance with the recommendations of the American Bureau of Shipping for Great Lakes Service.

Mechanical spare parts for turbines and Diesels shall be furnished in accordance with American Bureau of Shipping recommendations for Great Lakes Service.

One set of bearings shall be furnished for each design of pump.

A recommended set of spares shall be furnished for the air compressors.

Two propeller blades and one set of seven-propeller hub studs and nuts shall be furnished (see M-13).

One set of main shaft coupling bolts for one coupling shall be furnished.

This contract does not include a spare tail shaft, rudder stock, rudder or shoe.

ELECTRICAL SPECIFICATIONS

GENERAL E-1

All electric installations will conform to the latest recommended practices of the American Institute of Electrical Engineers (A.I.E.E. #45), the rules of the appropriate classifications society, the regulations of the United States Coast Guard Vessel Inspection Service, and the Federal Communication Commission.

Electrical work should incorporate all the features of good engineering design, latest approved materials and methods of installation.

On completion of electrical installation, all wiring and electrical equipment supplied by the Contractor will be thoroughly tested for electrical and mechanical defects, and where required, such defects will be corrected.

All motors, throughout the vessel, will be operated on 440-volt, 3-phase power, except for certain motors which, owing to their application, will be operated on 110-volt, single-phase power.

All lighting will be 110-volts, A. C.

Feeder Cables

All power and lighting feeder cables will be stranded, varnished-cambric insulated, impervious-sheathed, galvanized or bronze basket-weave armored power cable, unless otherwise noted.

Distribution

Distribution of power from the Main Switchboard will generally include one or more of the following arrangements:

From Main Switchboard to a branch circuit for individual controller and motor; to a sub-panel or control cubicle; to a distribution panel and then via a branch to a controller and motor; to a transformer and thence to a 110-volt lighting or power circuit; to several sub-panels and thence to sub-feeders and branches.

Wherever possible power and lighting systems will be kept separate. All panels, cubicles, safety switches, controllers, motors and other electrical devices will be so located that they will be readily accessible for easy removal, service and repair, and will be properly grounded wherever necessary.

All units exposed to weather or severe moisture will be water-proof. Elsewhere they will be drip-proof.

FITTINGS AND FIXTURES

All fittings and fixtures will be of approved marine type, suitable for the service specified.

LIGHTING FIXTURES E-1

Lighting fixtures throughout the vessel will be of an approved marine type, and shall be installed in accordance with United States Coast Guard and A.I.E.E. #45 requirements to serve adequately each compartment.

Special care should be exercised to provide sufficient lighting at all stairways, ladders, landings and accesses to insure maximum protection, convenience and safety.

MOTORS

All motors throughout this installation to be marine type per American Institute of Electrical Engineers Code 45 to American Bureau of Shipping specifications and U. S. Coast Guard Marine Inspection Requirements.

Motors 1 HP and above to be drip-proof, ball bearing 50° C. ambient, 40° C. rise, Class A insulation, 440-volt, 60-cycle, 3-phase, squirrel cage, except as noted.

Motors below 1 HP to 1/3 HP to be totally enclosed water-proof, 50° C. ambient, 40° C. rise, marine type, squirrel cage, preferably 1750-RPM, 440-volt, 60-cycle, 3-phase.

Motors below 1/3 HP to be marine type, 110-volt, 60-cycle, single-phase.

GENERATORS E-2

See Machinery Section Subjects M-1, M-4, M-5, and M-6.

SWITCHBOARDS E-3

Contractor shall furnish and install dead front switchboards and spare parts to control and distribute the output of the generators.

MOTOR CONTROLS E-4

All electric motors shall be controlled by suitable motor starters, complete with spare parts and accessories such as remote master switches, indicating lights and interlocks. Insofar as practicable, starters will be grouped in a control cubicle, or cubicles.

LIGHTING - GENERAL E-5

All lighting shall be 110-volt, single-phase, 60-cycle, to be supplied by 440-volt/110-volt transformers. Contractor shall furnish and install two (2) banks of lighting transformers, one forward and one aft. Lighting power shall be distributed by lighting panels.

Where possible, all lighting fixtures will be Russell & Stoll, E. W. Mink, or equal.

Lighting for a typical room shall consist of the following:

1 - Ceiling Light
1 - N.W.T. Switch for Ceiling Fixture
1 - Berth Light for each Berth
1 - Bulkhead Light
3 - N.W.T. Outlets

LIGHTING - GENERAL (Continued) E-5

Bathrooms

1 - W.T. Bulkhead Light (for shower)
1 - W. T. Ceiling Light
1 - N.W.T. Switch (located outside bathroom space)
1 - Mirror Light with Receptacle

Lighting fixtures and receptacles for the machinery spaces, working spaces, cargo hold and deck lighting shall be W. T. Russell and Stoll fixtures, or equal, suitable for the particular locations.

Receptacles shall be standardized insofar as possible so that one plug design will fit all receptacles except specials.

EMERGENCY LIGHTING & EMERGENCY CIRCUITS E-6

Special emergency circuits and lighting will be provided to comply with the U. S. Coast Guard Electrical Engineering Requirements for Emergency Lights, Emergency Communication Systems & Gyro. - USCG Regulation CG259, Part 112.

SHORE POWER E-7

One 440-volt, 3-phase shore power receptacle, complete with plug, 300 feet of portable 3-wire cable and cable rack will be provided.

MISCELLANEOUS POWER E-8

Miscellaneous power for quarters' ventilation fans, lifeboat winches, deck utility winches, refrigeration equipment, and machine tools shall be supplied by power panels located close to the loads.

GALLEY POWER E-9

Transformers and power panel to supply 230/118 volt power to the galley equipment will be furnished.

DIESEL STARTING BATTERY E-10

See Machinery Section - Par. M-5 and M-6.

GENERAL ALARM E-11

A general alarm system complete with bells, fuse boxes, battery and battery charger will be provided.

STEERING GEAR E-12

See Machinery Specification - Par. HE-1.

WINCHES & WINDLASSES E-13

See Machinery Specification - Par. HE-2 and HE-3.

NAVIGATING LIGHTS E-14

A navigating light system consisting of the following will be furnished:

1 - Navigating Light Panel
1 - Range Light
2 - Side Lights
1 - Head Light
2 - Out-of-Command Lights
4 - Anchor Lights (2 forward, 2 aft)
1 - Towing Light

WHISTLES E-15

Whistles shall be electrically controlled from the pilot house and wings. One whistle shall have a hand pull operated from the pilot house.

Working whistle shall be hand operated.

See Listing of Navigation Instruments on Page 26.

ENGINE TELEGRAPH E-16

An engine telegraph system will be installed with transmitter in pilot house and a receiver in the engine room. System to be complete with wrong direction bell, power failure alarm panel, and constant ringing relay panel.

See Listing of Navigation Instruments on Page 26.

DOCKING TELEGRAPH E-17

A docking telegraph system with a transmitter in the pilot house and a receiver on the spar deck aft of the after house will be provided.

See Listing of Navigation Instruments on Page 26.

R.P.M INDICATOR E-18

Shaft R.P.M. indicator will be installed with indicators in the pilot house and engine room.

See Listing of Navigation Instruments on Page 26

TRIM INDICATORS E-19

Two (2) trim indicators will be installed, one forward and one aft, each complete with transmitter and indicating lights.

ENGINEER'S ALARM PANEL E-20

An alarm panel will be installed in the engine room. Alarm panel will indicate by lights and siren any unusual operating condition of the vital machinery.

RUDDER ANGLE INDICATOR E-21

A rudder angle indicator will be installed consisting of one transmitter and two indicators, one indicator in the pilot house and one at the after steering station.

See Listing of Navigation Instruments on Page 25.

GYRO-COMPASS E-22

A Sperry Gyro Compass consisting of the following will be furnished:

1 - M.G. Set
1 - Master Compass
1 - Control Panel
1 - Power Failure Alarm Panel
3 - Remote Mounted Repeaters

See Listing of Navigation Instruments on Page 24.

RADAR E-23

One Radar will be provided.

See Navigation Instruments on Page 23.

SEARCHLIGHTS E-24

Two searchlights, 1000 watts each, will be installed; one forward and one aft. Searchlights shall be controlled from the deck below by means of extension handles.

See Listing of Navigation Instruments on Page 26.

SHIP-TO-SHORE TELEPHONES E-25

Two ship-to-shore radios will be provided. Radios will be complete with antennas and remote mounted hand sets.

See Listing of Navigation Instruments on Page 24.

RADIO DIRECTION FINDER E-26

One RCA Model A.R.-8714, fixed loop, radio direction finder will be installed in the pilot house.

See Listing of Navigation Instruments on Page 24.

PUBLIC ADDRESS SYSTEM E-27

A public address system will be provided complete with amplifier, subset, directional speaker and six (6) water-tight talk-back stations.

See Listing of Navigation Instruments on Page 27.

SOUND POWERED TELEPHONE SYSTEM E-28

Two sound powered telephone systems will be provided. Each system will have telephones located at the following spaces:

Navigating System:

1. Pilot House
2. Engine Room
3. Steering Gear Room
4. Aft Steering Station
5. Master Gyro Compass Room
6. Emergency Generator Room

Ship's Service System:

1. Pilot House
2. Engine Room
3. Captain's Room
4. Chief Engineer's Room
5. Galley
6. First Mate
7. First Assistant Engineer's Room