

# MACHINERY SPECIFICATIONS

*for the*  
CONSTRUCTION  
*of a*  
SINGLE SCREW TANKER  
DESIGN T2-SE-A1  
TURBO-ELECTRIC PROPULSION

UNITED STATES MARITIME COMMISSION

## PROPELLING MACHINERY

### General Description

The principal characteristics of the machinery installation are to be:

S.H.P. (Normal) 6000

S.H.P. (Maximum) 6600

Number of Screws, 1

Shaft R.P.M. at 6000 S.H.P. 90

Shaft R.P.M. at 6600 S.H.P. 93

The machinery installation is to be built to conform to the rules prescribed by the U. S. Coast Guard—Bureau of Marine Inspection and Navigation and the American Bureau of Shipping.

The specifications are intended to cover substantial machinery with no unnecessary finish in any part. All wearing, running or working parts to be of large proportions and carefully fitted and the entire machinery installation to be built in a thorough and workmanlike manner to insure efficient and satisfactory running.

The entire machinery installation will consist of items hereinafter specified and described and of a type, size and construction acceptable to the United States Maritime Commission.

The following specifications are to cover the installation of Turbo-Electric propulsion with all necessary auxiliaries and complete piping and wiring necessary for such machinery in accordance with modern practice governing such installation.

## MAIN PROPELLING MOTOR

Motor to be set on steel foundation and carefully lined up to thrust shaft with fitted cast iron

chocks and all holding down bolts to be fitted. Foundation and double bottom structure to provide watertight well under motor frame. Air cooler will be installed with necessary cooling water from main circulating pump discharge.

### **THRUST BEARING AND SHAFT**

The thrust shaft will be furnished with an integral flanged coupling for bolting direct to the propelling motor shaft and the shaft will be mounted in an approved type of thrust bearing which will be installed on a cast steel sub-base riveted to foundation. Thrust bearing will be bolted to sub-base with fitted bolts. Sub-base to have lip at forward and after ends to permit installation of fitted taper keys at each end of thrust bearing to allow quick realignment after thrust has been lifted to permit tail shaft being pulled.

### **PROPELLER SHAFT**

The shaft is to be of forged steel, in accordance with classification society's requirement. The shaft shall be made  $\frac{1}{4}$ " in excess of American Bureau of Shipping and Bureau of Marine Inspection and Navigation requirements. The propeller shaft in way of stern tube is to be fitted with a continuous centrifugally cast gun metal liner of suitable thickness. The after end of liner is to be carried into a recess in propeller hub where it is to be made watertight by means of a rubber ring and gland.

The after end of propeller shaft is to be tapered to fit the propeller hub bore and is to be threaded

to take the propeller nut, which is to be securely locked and covered with a fairwater. The interior of fairwater, end of shaft and nut are to be coated with Apexior #3.

For each fifth ship a spare propeller shaft complete with nut and keys is to be furnished and stowed at some suitable location. Stowage brackets to be provided on all ships.

## STERN TUBE

The stern tube is to be of cast steel. Details of construction and attachment to after peak bulkhead and to stern frame to be in accordance with Standard Marine practice.

There is to be a composition bushing in each end of stern tube, lined with sections of lignum vitae arranged to wear on end of grain. The after bushing may be stepped to permit withdrawal.

The inboard end of stern tube is to be fitted with a stuffing box and gland. The bearing bushings, stuffing box and gland are to be in halves to permit ready removal.

A rope guard is to be fitted at the after end of stern tube, extending between the stern casting and propeller hub.

A connection from the salt water system is to be provided for supplying flushing water to the stern tube bearings.

## PROPELLER

There is to be one solid, four bladed, right hand propeller of Manganese Bronze of suitable diameter and pitch. It is to be attached to the tapered

end of propeller shaft by keys and nut. The forward end of hub is to be counter-bored to fit the propeller shaft sleeve; the depth of counter-bore to be such as to leave an annular space around the shaft. The shaft in way of annular space is to be coated with red lead and oil.

The driving faces of the blades are to be hand finished and the backing faces ground smooth.

The propellers are to be swung on a mandril and accurately balanced. For each fifth ship a spare Manganese Bronze propeller is to be furnished, balanced, and finished complete and is to be stowed at an approved location. Stowage brackets to be provided (on deck) on all ships.

### **MAIN TURBO GENERATOR**

One (1) 5400 K.W. main turbo-generator set, 2300 volts, A.C. 3 phase, 62 cycle, 3720 R.P.M. Turbine to be operated with steam at 435# Gauge pressure, 720° F. total temperature, 28¼" Vac. with 80° F. seawater.

### **AIR COOLERS FOR TURBO-GENERATOR**

Suitable air coolers for main turbo-generator to maintain temperature of 40° Cent. with 85° F. seawater.

### **MAIN PROPULSION MOTOR**

One (1) 6000 S.H.P. normal at 90 R.P.M. also capable of developing 6600 S.H.P. at 93 R.P.M.

## **AIR COOLERS FOR PROPULSION MOTOR**

Suitable air cooler and fan will be provided of a capacity to suit propelling motor requirements—85° F. seawater.

## **MAIN CONDENSER**

Main condenser of suitable surface to condense steam for main turbo-generator and one (1) auxiliary turbo-generator together with necessary drains from Batterworth heaters to maintain 28 $\frac{1}{4}$ " vacuum with 80° F. seawater. Performance based on tubes 85% clean and water velocity through tubes 7 feet.

Condenser to be of the two-pass type with 12 foot effective tube length and to be suspended from the main turbine exhaust flange. Shell to be steel with cast iron water boxes, Admiralty metal tubes  $\frac{3}{4}$ " O.D. and 18 B.W.G., tube sheets to be  $1\frac{1}{8}$ " thick rolled Naval brass or Muntz metal as available. Tube supporting plates of steel. Tubes to be rolled into the tube sheets at both ends and suitable expansion element fitted in the steel shell. Water boxes and tube sheets to be electrolytically bonded. Interior of water boxes to be Apexior painted.

## **AIR EJECTORS FOR MAIN CONDENSER**

One two-stage air ejector of suitable capacity with inter and after condenser will be installed for main condenser.

## AUXILIARY GENERATING SETS

Two (2) 525 K.W. Auxiliary Generating Sets, 450 volts, A.C. 3 phase, 60 cycle.

## AUXILIARY CONDENSER

One (1) Auxiliary two-pass condenser of suitable surface to handle exhaust from two 525 K.W. Auxiliary Generator Units plus drains from Butterworth Heaters and to maintain  $28\frac{1}{4}$ " vacuum with 80° F. seawater. Performance based on tubes 85% clean and water velocity through tubes 7 feet.

Condenser shell to be steel, tubes to be Admiralty metal  $\frac{3}{4}$ " O.D. x #18 B.W.G., tube sheets  $1\frac{1}{8}$ " thick rolled Naval Brass or Muntz metal as available. Tubes rolled at both ends and shell fitted with expansion element.

## AIR EJECTOR FOR AUXILIARY CONDENSER

One two-stage air ejector of suitable capacity with inter and after condenser will be installed for auxiliary condenser.

## BOILERS

Each tanker will be equipped with two boilers designed to evaporate a total of 64,115 lb. of steam per hour at the normal rate of operation of which 59,815 lb. of steam is superheated and 4,300 lb. of steam is desuperheated. The working pressure at the superheater outlet will be 450 lb. and the steam temperature at least 725 deg. F.

The feed temperature to the boilers will be 300 deg. F.

The two boilers will be designed for a maximum continuous evaporation of 88,875 lb. of steam per hour of which 84,575 lb. of steam is superheated and 4,300 lb. of steam is desuperheated. The working pressure at the superheater outlet will be 450 lb. and the steam temperature for this condition will not exceed 764 deg. F. The feed temperature to the boilers will be 300 deg. F.

The guaranteed efficiency at the normal rate of operation will be a minimum of 88%.

The desuperheaters in each boiler will be designed to desuperheat a maximum of 5,000 lb. of steam per hour with a pressure drop through the desuperheater not exceeding 10 lb.

The boilers will be of the single pass, sinuous header, sectional type equipped with a 42 in. steam drum. There will be two rows of 2 in. tubes and two rows of 1¼ in. tubes below the superheater and the remainder of the tubes at the boiler bank will be 1¼ in. O.D. The exposed length of the boiler tubes will be 11 ft. 0 in.

The side and rear walls of the boilers will be equipped with watercooling employing a partially studded tube construction.

The furnace insulation will be arranged as follows:

Front walls—6¾ in. of firebrick, 1 in. of insulating block.

Side walls, where required—9 in. of firebrick, 2 in. of insulating brick, and 1 in. of insulating block.



The firebrick shall be good for 3,000 deg. F. and shall be B & W Jr. or equal. Insulating brick shall be B & W K-20 or equal. Insulating block shall be Johns Manville Supertex or equal.

Each boiler will be equipped with an air heater arranged for single pass gas flow and two pass air flow. The air heater elements will be 1½ in. O.D.

The boilers will be completely double cased up to and including the superheaters. However, above the superheaters the boilers and air heaters may be single cased, provided a welded casing construction is employed.

The boilers will be designed so that at the normal rate of operation the pounds of steam evaporated per square foot of steam generating surface will not exceed 6½ lb. actual evaporation, resulting in a boiler heating surface of not less than 4,932 sq. ft. The boilers will be designed for 500 lb. pressure and the high set safety valve on the drum will not exceed 500 lb. pressure.

The boilers will be built according to B.M.I.N. and A.B.S. requirements. Tools and spares which will be supplied will be in accordance with the B.M.I.N. and A.B.S. requirements.

Each boiler will be fitted with four standard mechanical atomizing oil burners of an approved type. These burners will be equipped with insulated cover plates and arranged for double front construction.

Each unit will be fitted with not less than six Valve-in-Head soot blowers, a periscopic type smoke indicator, a thermo-hydraulic type feed water regulator, one plain and one Eye-Hye type

gage glasses, in addition to the usual valves and fittings.

Combustion control equipment will be furnished complete in all respects, ready for installation by the shipyard. Compressed air for the operation of the control equipment will be obtained from the ship's supply of compressed air.

### **FORCED DRAFT FANS**

Three (3) forced draft fans, motor driven, one (1) for each boiler and one (1) stand-by. The capacity of each fan will be 15,000 C.F.M. against  $13\frac{1}{2}$ " S.P. requiring a 50 H.P. 1750 R.P.M. motor.

The forced draft fans shall be of the non-overloading type suitable for operating in parallel.

### **BOILER ROOM VENTILATING FAN**

Suitable for conditions in Boiler Room.

### **ENGINE ROOM VENTILATING FAN**

Suitable for conditions in Engine Room.

### **UPTAKE AND STACK**

Uptakes to be of  $\frac{3}{16}$ " plate, insulated with  $1\frac{1}{2}$ " thickness of 85% magnesia, hard finish over magnesia. Inner and outer stack of suitable diameter.

### **AIR DUCTS**

Air ducts of  $\frac{1}{8}$ " steel plate suitably electric welded and provided with access manholes and dampers as required for combustion control system. Air ducts to be provided with expansion joints.

## PUMP TABLE

No. of Units	Source	Type	Capacity G.P.M.	Pressure on Head
2	Fire and Batteries	Vertic. Centrifugal 2-Stage Motor Drives	50 H.P.	125 #
2	Main Feed	Vertic. Centrifugal Multi-Stage Turbine Drives	115 H.P.	575 #
1	Auxiliary Feed	Vert. Simplex—Dble. Acting 16" x 24" x 34"	110	575 #
2	Main Condensate	Vert. Centrifugal—3 Stage Motor Drives	25 H.P.	220 ft.
1	Auxiliary Condensate	Vertic. Centrifugal—2 Stage Motor Drives	15 H.P.	220 ft.
1	Sanitary	Vertic. Centrifugal—Single Stage Motor Drives	7½ H.P.	50 #
1	Main Circulating	Vert. Centrifugal Motor Drives	125 H.P.	25 ft.
1	Auxiliary Circulating	Vert. Centrifugal Motor Drives	20 H.P.	20 ft.
2	Engine Room Bilge	Vertic. Rotary Motor Drives	50 H.P.	40 #
1	Evaporator Feed	Vertic. Centrifugal Motor Drives	1 H.P.	30 #
2	Fresh Wash Water	Vertic. Centrifugal Split-Priming Motor Drives	2 H.P.	60 #

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## PUMP TABLE (Continued)

No. of Units	Service	Type	Capacity G.P.M.	Pressure on Head
2	Drinking Water	Horiz. Centrifugal Split-Priming Motor Drives	1 H.P.	60 #
2	Fuel Oil Service	Horiz. Rotary or Screw Motor Drives	7½ H.P.	375 #
2	Fuel Oil Transfer	Horiz. Rotary or Screw Motor Drives	20 H.P.	100 #
2	Lubricating Oil Service	Vert. Rotary or Screw Motor Drives	5 H.P.	30 #
1	Eng. Rm. Sht. Water Service	Horiz. Centrifugal—Single Stage Motor Drives	7½ H.P.	30 #
1	Refrig. Condenser Circulating	Horiz. Centrifugal Motor Drives	½ H.P.	58 ft.
1	Atmospheric Drain	Horiz. Centrifugal Motor Drives	40	40 #
1	For'd P.R. Bilge & Ballast	Vert. Duplex—DHds. Acting 10" x 7½" x 10"	300	100 #
1	For'd P.R. Fuel Oil Transfer	Vert. Duplex—DHds. Acting 14" x 14" x 12"	500	100 #
2	Main Cargo	Horiz. Centrifugal—2 Stage Motor Drives	200 H.P.	100 #
2	Cargo Stripping	Horiz. Rotary Mixer Drives	600	100 #
1	Cargo Stripping	Vert. Duplex—DHds. Acting 14" x 14" x 12"	700	100 #

**DESUPERHEATER (EXTERNAL TYPE)**

One (1) external type desuperheater, Elliott Cartridge type or equal, suitable for working pressure of 450# gauge, to desuperheat 40,000 lbs. of steam per hour from 450# gauge pressure and 765° F. total temperature down to 450# gauge pressure and 500° F. total temperature. Steam to desuperheater to be taken from main steam connection and to be supplied with water at 300° F.

## MATERIALS OF PIPING SYSTEMS

Service	Forms	Flanges	Fittings	Pressure Svcs.
Main steam	Seamless steel. X.H.—I.P.S.	Forged steel	Flanged cast steel	600
Auxiliary steam (Disher press.) 4" and above	Seamless steel X.H.—I.P.S.	Forged steel	Flanged cast steel	600
3½"-1", inc.	Seamless steel X.H.—I.P.S.	Forged steel	Flanged cast or forged steel	600
¾" and below	Seamless steel X.H.—I.P.S.	Forged steel unions	Screwed forged steel	600
Auxiliary steam 1½" ¾" and above	Seamless steel Std. wt.	Forged steel	Flanged cast steel	150
1½" to 1", inc.	Seamless steel Std. wt.	Forged steel	Flanged cast steel	150
¾" and below	Seamless steel X.H.—I.P.S.	Forged steel unions	Screwed Forged Steel or brass	150
M.P. Bleeder steam	Std. seamless steel	Steel, welded on	Flanged cast steel welded branches or welding fittings	150
Auxiliary exhaust ¾" and above	Std. seamless steel	Steel, welded on	Flanged cast steel welded branches or welding fittings	150
1½" and below	Std. seamless steel	Steel, welded on or cast unions	Flanged cast or forged steel or welding fittings	150

(Exhaust from Winches and Windlasses: seamless copper with  
bracing flanges and breast fittings)

Air Ejector sections  
Condst. pump sec.  
Condst. pump discharge

## MATERIALS OF PIPING SYSTEMS—(Continued)

Service	Pipes	Fittings	Flanges	Pressure	Pounds per Sq. In.
1" and above	S. D. copper	Forged steel		Flanged cast iron or brazed branches	125
1/2" and below Feed pump jets, Reverse feed jets, and Blowing (outside of tanks)	Rod Brass L.P.S.	Brass unions		Screwed Rod Brass	125
Ans. feed pump discharge to tanks					
2" and above	Std. seamless steel galvanized	Steel, welded on		Flanged cast iron, welded branches or welding fittings	125
1 1/2" and below	Std. seamless steel galvanized	Steel, welded on or mal. iron unions		Flanged cast iron, screwed mal. iron, welded branches or welding fittings gable.	125
Feed discharges 1" and above	Seamless steel X.H.—L.P.S.	Forged steel		Flanged cast steel	600
1/2" and below	Seamless steel X.H.—L.P.S.	Forged steel unions		Screwed Forged Steel	600
Reverse Feed (inside tanks)	Std. seamless steel galvanized	Steel, welded on		Flanged Cast Iron, Welded Branches or Welded Fit- tings, Galvanized	125
1 1/2" and below	Std. seamless steel galvanized	Steel, welded on or Forged Mal. Iron Unions, brass nuts		Flanged Cast Iron, Screwed Mal. Iron, Welded Branches or Fittings, Galvanized	125
Safety Valve Escape	Std. seamless steel galvanized	Steel, welded on		Flanged Cast Iron, Welded Branches or Welding Fit- tings, Galvanized	125

## MATERIALS OF PIPING SYSTEMS—(Continued)

Service	Pipe	Fittings	Fittings	Para. Nos.
Boiler Bleed 1" and above ¾" and below	Seamless steel X.H.—I.P.S. Seamless steel X.H.—I.P.S.	Forged steel Forged steel unions	Flanged cast steel Screwed forged steel	600 600
Lubricating Oil, suction, discharge drain and filling 2" and above 1½" and below	Sol. seamless steel  Sol. seamless steel	Steel, welded on or Mal. Iron Unions, Brass tees Forged steel	Flanged Cast Iron, Welded Branches or Welding Fit- tings  Flanged Cast Iron, Screwed Mal. Iron Welded Branches or Welding Fittings Forged Branches or Sol- dered Fittings	125  125 125
Lubricating Oil Branches to Bearings 1½" and above 1" and below	S.D. Copper  S.H. Copper or Brass	Screwed or Soldered type or Brass Unions	Screwed Brass Bronze Fittings or Soldered Fittings	125  125
Fuel Oil Suction Filling and Transfer 1" and above ¾" and below	Sol. seamless steel  Sol. seamless steel	Steel, welded on  Mal. Iron Unions	Flanged cast Iron Welded Branches or Welding Fit- tings  Cast Iron, Welded Branches, or Welding Fittings Flanged Cast Steel	125  125 600
Fuel Oil Service 1" and above ¾" and below	Seamless steel X.H.—I.P.S. Seamless steel X.H.—I.P.S.	Forged steel  Steel Unions	Screwed Forged Steel	600



## MATERIALS OF PIPING SYSTEMS—(Continued)

Systems	Pipes	Flanges	Fittings	Tests, Sth.
Fuel Oil Tank Roasting Colds	K.M. Seamless Steel	Welded Joints in Tanks	Welding Fittings or Cast steel	150
Crude Oil Suctions and Discharges	Std. seamless steel	Steel, welded on (1½-# Std.)	Flanged Cast Iron (Pipe Fittings)	125
Sea Suctions Overboard Discharges	Copper	Forged steel	Flanged Cast Iron or Bronze Branches	125
Salt Water Circulating and Service 2" and above	S.D. Copper	Forged steel		
1½" and below	S.D. Copper or Brass, L.P.S.	Forged steel or screwed Brass Unions	Flanged Cast Iron or Bronze Branches, Screwed Brass	125
Elbow 2" and above	Std. seamless steel galvanized	Steel, welded on	Flanged Cast Iron Welded Branches or Welding Fit- tings, Galvanized	125
1½" and below	Std. seamless steel galvanized	Steel, welded on or Mat. Iron Union, Brass seats galvanized	Flanged or Screwed Cast Iron, Welded Branches	125
Ballast	Std. seamless steel galvanized	Steel, welded on	Flanged Cast Iron Welded Branches or Welding Fit- tings, Galvanized	125
Fire Main and Butte- worth 2" and above	Std. seamless steel galvanized	Steel, welded on	Flanged Cast steel welded branches or welding fit- tings, Galvanized	200
1½" and below	Std. seamless steel galvanized	Steel, welded on or Mat. Iron Unions, Brass seats, galvanized	Flanged or Screwed Cast Steel, welded Branches or Welding Fittings, Galv.	100

## MATERIALS OF PIPING SYSTEMS—(Continued)

System	Pipes	Flanges	Fittings	Panel, Sub.
Sightglasses 2" and above	Red Brass	Red Brass or Brassing Metal	Red Brass	125
Sightglasses 1 1/2" and below	Red Brass	Red Brass or Brassing Metal	Red Brass	125
Expositor Blow Fresh Water (Cold)	Brass, I.P.S. Std. seamless steel galvanized	Screwed Brass Flanges Screwed Mal. Iron Unions, Brass Seats Galvanized	Screwed Brass Screwed Cast Iron Gals.	125 125
Fresh Water (Hot)	Std. Brass	Screwed Brass Unless	Screwed Brass Fittings	125
Sounding Pipes and Air Knives 2" and above	Std. seamless steel	Steel, welded on	Steel, Welded	125
1 1/2" and below	Std. seamless steel	Steel, welded on	Steel, Welded	125
Overflows	Std. seamless steel galvanized	Steel, welded on	Steel, Webbed	125
2" and above	Std. seamless steel galvanized	Mal. Iron Unions, Brass Seats, Gals.	Steel, Webbed	125
Overflows 1 1/2" and below	Seignior pig. X.H.—I.P.S.	Forged steel	Flanged Cast or Forged Steel	400
Drains (Boiler Press) 1" and above	Seignior steel X.H.—I.P.S.	Forged steel unions	Screwed Forged Steel	400
4" and below	Std. seamless steel	Steel, welded on	Flanged Cast Steel	125
Drains (150 pounds) 2" and above				

## MATERIALS OF PIPING SYSTEMS—(Continued)

System	Pipes	Flanges	Fittings	Remarks
1½"-1" inc.	Std. seamless steel	Steel, welded on	Flanged Cast or Forged Steel	150
¾" and below	Seamless steel X.H.—I.P.S.	Forged steel unions	Forged Steel or Bronze	150
Drains (Below 150 pounds) ¾" and above	Std. seamless steel	Steel, welded on	Flanged Cast Steel	150
1½"-1¼", inc.	Std. seamless steel	Steel, welded on	Flanged Bronze	125
1" and below	Seamless steel X.H.—I.P.S.	Mtl. Iron Unions, Bronze Seats	Screwed Mtl. Iron, Welded Branches or Welding Fit- tings	125
Salt water Drains	Std. seamless steel galvanized	Screwed Mtl. Iron Unions, Bronze Seats, Galv.	Screwed Cast Iron, Welded Branches or Welding Fit- tings, Galvanized	125
Heating Systems ¾" and above	Std. seamless steel galvanized	Forged steel	X.H.—M.I. or C.I., Screwed	125
1½" and below	Std. seamless steel galvanized	Forged steel unions	X.H.—M.I. or C.I., Screwed	125
Refrigerating Plant Froon	Copper Tubing	Cast steel with brass Adapters	Wrought Copper	125