

file
DEPARTMENT OF DEFENSE
NEGOTIATED CONTRACT

4-B. Walbridge Einy
DEPARTMENT OF THE
NAVY

CONTRACT NO.
NObs-81436

ISSUING OFFICE

NAME
BUREAU OF SHIPS

ADDRESS
WASHINGTON 25, D. C.

12/3/52

CONTRACTOR

W4-70070

NAME
WESTINGHOUSE ELECTRIC CORPORATION

ADDRESS
1625 K Street, N.W.
Washington 6, D.C.

CONTRACT FOR
Lot I - CVA60 Ships service power;
Lot II - Back-up Stock for CVA60.

AMOUNT
\$ 1,824,423.00

APPROPRIATION AND OTHER ADMINISTRATIVE DATA

APPROPRIATION: LOT I - 17X1611.53, Shipbuilding and Conversion, Navy; Expenditure Account 52103; Object Classification 099; Bureau Control Number 10000. Abstract vouchers to receiving activity.

LOT II - 17X1611.53, Shipbuilding and Conversion, Navy; Expenditure Account 52415; Object Classification 089; Bureau Control Number 70000. Abstract vouchers to receiving activity.

PAYMENT: The Contractor shall submit invoices in quadruplicate to the Naval Inspector. Public Vouchers will be prepared and payment will be made by the Navy Regional Accounts Office, Washington, D.C.

INSPECTION: At Contractor's Plant, Essington, Pennsylvania, by the Inspector of Machinery, U.S.N., Essington, Pennsylvania.

GENERAL PROVISIONS: The General Provisions of this contract consist of the General Provisions U.S. Standard Form 32, November 1949 edition, and the Additional General Provisions, Bureau of Ships 3-1-52, attached hereto, as modified in the Schedule.

C. 171
~~CONFIDENTIAL~~

ALL PARTIES
BUREAU OF SHIPS

PLAINTIFF'S EXHIBIT

WH-1102

REQUISITION NO: P.R. 560-284

This negotiated contract is entered into pursuant to the provisions of Section 2 (c) (1) of the Armed Services Procurement Act of 1947 (Public Law 413, 80th Congress), and any required determination and findings have been made.

THIS CONTRACT is entered into as of 3 December, 1952, by and between the United States of America, hereinafter called the Government, represented by the Contracting Officer executing this contract, and WESTINGHOUSE ELECTRIC CORPORATION

(NAME OF CONTRACTOR)

(i) a corporation organized and existing under the laws of the State of Pennsylvania

(ii) a partnership consisting of _____

(iii) an individual trading as _____

EXECUTED BY BOTH PARTIES

hereinafter called the Contractor. The parties hereto agree that the Contractor shall furnish and deliver all the supplies and perform all the services set forth in the attached Schedule, for the consideration stated therein.

DELIVERY: To be delivered, f.o.b. cars or on wharf, at or near Contractor's Plant, or when authorized by the Naval Inspector at subcontractor's works, for shipment on Government Bills of Lading, as follows:

To Receiving Officer, New York Naval Shipyard, Brooklyn 1, New York:

Items 1 and 2 and sixteen (16) of Item 4, at the rate of two (2) each of Items 1 and 2 and four (4) of Item 4 per month, beginning 1 March 1954, until completion.

Item 3, on 1 July 1954.

Item 5 and three (3) of Item 4, to Chief, Bureau of Ships, Department of the Navy, Washington 25, D.C., marked: "Attention Code 560G", on 1 July 1954.

To Receiving Officer, Ships Parts Control Center, Naval Supply Depot, Mechanicsburg, Pennsylvania:

Forty-one (41) of Item 4, on 1 July 1954.

Items 9 and 10, on 1 August 1954.

To Receiving Officer, Naval Supply Depot, Mechanicsburg, Pennsylvania:

Items 6 thru 8 and Item 12, on 15 July 1954.

Item 11, on 1 August 1954.

ITEM	SUPPLIES AND SERVICES	QNTY	UNIT	UNIT PRICE	EXTENSION
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LOT I

1	Generator set, steam turbine driven, 1500 kw (Max. rated, Package Type) 450 volts a-c complete with accessories	8	No.	\$187,000.00	\$1,496,000.00
2	Switchboard mounted control equipment for Item 1	8	Set	2,465.00	19,720.00
3	Onboard mechanical and electrical repair parts and tools for Items 1 and 2	1	Set	24,800.00	24,800.00

ITEM	SUPPLIES AND SERVICES	QNTY	UNIT	UNIT PRICE	EXTENSION
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LOT I (CONT'D)

4	Instruction book for Items 1 and 2	60	No.	(Price of Items 4 and 5 included in price of Items 1 and 2)	
5	Finished drawings for Items 1 and 2	1	Set		

TOTAL LOT I.....\$1,540,520.00

LOT II

6	Generator set, steam turbine driven, 1500 kw (Max. rated, Package Type) 450 volts a-c complete with accessories	1	No.	\$168,000.00	\$ 168,000.00
7	Switchboard mounted control equipment for Item 6	1	Set	2,465.00	2,465.00
8	Onboard mechanical and electrical repair parts and tools for Items 6 and 7	1	Set	11,438.00	11,438.00
9	SPCC, NSD, Mech. controlled stock electrical repair parts	1	Set	18,225.00	18,225.00
10	SPCC, NDS, Mech. controlled mechanical stock repair parts	1	Set	17,725.00	17,725.00
11	Bureau controlled stock repair parts for turbine and gear	1	Set	66,050.00	66,050.00
12	Instruction Book for Items 6 and 7	2	No.	(Price of Item 12 included in price of Items 6 and 7)	

TOTAL LOT II.....\$ 283,903.00

TOTAL LOTS I AND II...\$1,824,423.00

SPECIFICATIONS AND SPECIAL PROVISIONS:

All Items shall be in accordance with Bureau of Ships Contract Specification SHIPS G-823, dated 12 August 1952 and Addendum 2, dated 26 September 1952 with the following special requirements and exceptions:

Special Requirements:

Item 9 - The stock electrical repair parts shall consist of the onboard electrical repair parts as provided under Item 3 plus the items noted in paragraph 3.8.2.3 of referenced Bureau of Ships Contract Specification SHIPS G-823.

Item 10 - The stock mechanical (turbine and gear) repair parts for Item 10 shall consist of the onboard mechanical repair parts as provided under Item 3.

Exceptions:

A new paragraph 3.1.9 is added as follows:

"3.1.9 - The requirements of Specification MIL-R-2729 regarding division of reactive load and circulating currents for generators operating in parallel shall not apply. In lieu thereof, the following shall apply:

a. The maximum difference in reactive KVA supplied by one generator from that supplied by another generator, based on the continuous KVA rating of one machine, shall not exceed 15 percent at loads up to 90 percent full load, and 6 percent from 90 percent to full load.

b. The circulating current between generators operating at no load shall not exceed 7.5 percent of the continuous current rating of one generator at any generator frequency from plus 5 percent to minus 5 percent of rated frequency."

A new paragraph 3.2.10.3 is added as follows:

"3.2.10.3 - The requirement that steam connections together with steam chests, necessary valves, governors, and safety devices, piping, etc. shall be so arranged that they need not be disturbed in lifting of the turbine casings is deleted."

A new paragraph 3.2.10.4 is added as follows:

"3.2.10.4 - The requirement that Exhaust connections shall be circular and shall be located to permit installation of expansion joints, valve fittings, deck stuffing boxes, etc. is deleted."

Paragraph 3.2.14.1 is modified to read as follows:

"3.2.14.1 - Material shall be in accordance with Class A or Class B of Specification MIL-S-860."

A new paragraph 3.2.18.3 is added as follows:

"3.2.18.3 - Helical reduction gears shall be of the single or double reduction type, with the axis of the pinions and gear on the same horizontal plane. The requirement that the bearing caps shall be removable without lifting the gear case cover is deleted."

Add new sentence to end of paragraph 3.3.2 as follows:

"The condenser shell shall be an integral part of the unit sub-base."

REPAIR PARTS LIST FOR ITEMS 3 AND 8 THRU 11: Within thirty (30) days after the date of the contract or thirty (30) days after date of approval of plans involving repair parts, whichever is later, the Contractor shall submit a reproducible itemized list of repair parts, with prices, manufacturers' names and part numbers, such list being 8 x 10-1/2 inches in size. The prices shall equal the total price specified for a complete set of repair parts listed in the contract. Upon receipt of such list, the contract shall be amended to incorporate the list or a change order shall be issued to incorporate such items as the Bureau of Ships may select.

EXAMINATION OF RECORDS, DISPUTES, PRICE ESCALATION and PROGRESS PAYMENTS AND LIENS Clauses, attached hereto, form a part of this Schedule.

For purposes of escalation it is agreed that the nearest commercial equivalent of the equipment is established at \$94,250 per turbine generator in accordance with Westinghouse Electric Corporation Price List for 1500 KW, Geared Turbine Generator Units List 1185, page 5, dated 24 March 1952.

CMP CLASSIFICATION: Class "B" Product.

CERTIFICATION: DO-A-3; certified under CMP Regulation #3.

NG 70072

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Serial No. 5

SHIPS-G-823
ADDENDUM - 3
2 March 1953
SUPERSEDING
Addendum - 2
28 September 1952

J. B. Walbridge
Mound Eng

BUREAU OF SHIPS CONTRACT SPECIFICATION

GENERATOR SET, STEAM TURBINE

See C/N 3/4/53
jmm
3/4/53

This addendum forms a part of Bureau of Ships Contract Specification SHIPS-G-823, dated 12 August 1952.

Page 3, paragraph 3.1.2, line 3: Delete "1100 p.s.i.g." and substitute "1050 p.s.i.g."

Page 4: Add as paragraph 3.1.8:

"3.1.8 Steam consumption shall be measured on one unit only. Steam consumption shall not be measured during the 50-hour continuous full-load run."

Page 4, paragraph 3.2.1.2 (b): Delete.

Page 4: Add as paragraph 3.2.1.2.1:

"3.2.1.2.1 The turbine shall not be required to deliver rated power at less than 1050 p.s.i.g. steam pressure at the throttle."

Page 5, paragraph 3.2.1.4.3: Add "The turbine steam rate at 60 percent of rated load shall also be stated in bid proposals. This steam rate shall be based upon the vacuum obtainable at 60 percent load with 75°F. condenser circulating water injection temperature; this vacuum shall be stated in bid proposals."

Page 10, paragraph 3.2.20, line 2: After "exhaust" insert "valve seated by hand".

Page 11, paragraph 3.4.1, line 2: Delete "675" and substitute "395°".

Serial No. 31

SHIPS-G-823
12 August 1952

BUREAU OF SHIPS CONTRACT SPECIFICATION
GENERATOR SET, STEAM TURBINE

This specification is for use only with Bureau of Ships Contract NObs - 61 436
(Reference No. 560-284).

1. SCOPE.

1.1 This specification covers steam turbine generator sets for Naval shipboard use.

2. APPLICABLE SPECIFICATIONS, STANDARDS, DRAWINGS, AND PUBLICATIONS.

2.1 The following specifications, standards, and drawings, of the issue in effect on date of invitation for bids, form a part of this specification:

SPECIFICATIONS:

MILITARY:

- MIL-B-233 -- Boxes, Repair Parts.
- JAN-P-658 -- Packaging and Packing of Electrical Equipment and Spare Parts (Electronic, Electrical, and Electro-Mechanical).
- JAN-P-690 -- Puller, Brushing, Bearing, and Gear, Installing and Removing.
- MIL-S-853 -- Steel, Corrosion-Resisting: Bars and Forgings (Except for Reforging).
- MIL-S-854 -- Steel, Corrosion-Resisting: Plates, Sheets, Strips and Structural Shapes.
- MIL-S-860 -- Steel, Forging for Turbine Rotors (Heat-Treated).
- MIL-S-861 -- Steel, Corrosion-Resisting (for Turbine Parts).
- MIL-S-870 -- Steel Castings, Molybdenum Alloy.
- MIL-S-871 -- Steel, Molybdenum-Alloy Plates, Boiler.
- MIL-D-963 -- Drawings, Production (for Electrical and Mechanical Equipment for Naval Shipboard Use).
- MIL-B-1222 -- Bolt-Studs, Nuts and Bars, Round; Steel (for Service at Temperature Up to 585° F).

SHIPS-G-823

MILITARY (cont'd.)

- MIL-M-1940 - Motors, Alternating-Current (Shipboard Use).
- MIL-G-3087 - Generator Sets, Steam-Turbine-Driven,
Direct and Alternating Current (Naval Shipboard Use).
- MIL-B-15071 - Books, Instruction; Preparation, Contents and
Approval.
- MIL-S-15083 - Steel; Castings.
- MIL-R-15137 - Repair Parts for Electrical and Mechanical
Equipment (Naval Shipboard Use).
- MIL-C-15345 - Castings, Non-Ferrous, Centrifugal.
- MIL-C-15430 - Condensers, Surface (Naval Shipboard Use).
- MIL-S-15464 - Steel, Alloy, Chromium-Molybdenum; Castings.
- MIL-E-15465 - Ejector, Air; Assemblies.
- MIL-C-15730 - Coolers, Fluid (Lubricating Oil and Fresh Water,
Naval Shipboard Use).
- MIL-S-16113 - Steel, Plate, Structural, Black (Uncoated) and
Zinc-Coated (Galvanized).
- MIL-P-16298 - Preservation, Packaging, Packing, and Marking
of Electric Machines Having Rotating Parts
(Includes Associated Repair Parts).
- MIL-P-17286 - Preservation, Packaging, Packing, and Marking
of Propulsion and Auxiliary Steam Turbines and
Gears (Includes Associated Repair Parts).
- MIL-P-20167 - Steel, Plate, Marine Boiler.

NAVY DEPARTMENT

General Specifications for Inspection of Material.

BUREAU OF SHIPS

General Specifications for Machinery:

Section S39-2 - Thermal Insulation for Machinery and Piping.

Section S50-1 - Horizontal Turbines, General Auxiliaries.

Section S62-5 - Electric Power Distribution Protective Devices.

STANDARDS

MILITARY

- MIL-STD-10 - Surface, Roughness, Waviness, and Lay.
- MIL-STD-129 - Marking of Shipments.

DRAWINGS

BUREAU OF SHIPS

B-214 - Root Connections for Attaching Piping.

5000-S2803-F-841339 - Typical Identification Plates for Machinery.

(Copies of specifications, standards, and drawings required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

3. REQUIREMENTS

3.1. Complete turbine generator sets. -

3.1.1 Turbine generators. - The turbine generator sets shall be in accordance with Specification MIL-G-3087, except as otherwise specified hereinafter.

3.1.2 The turbine generator sets shall have the following classification:

Type required	Type II (a. c.).
Steam pressure (at throttle)	1100 p. s. i. g. 1050
Steam temperature (at throttle)	940° F. TT.
Exhaust pressure	27.5 inches Hg.
Parallel operation requirements	Parallel operation required.
Rating:	
KW	1500 kw. (max. rating).
Voltage	450 volts a. c.
Class of insulation	Class B or class H.
Degree of enclosure	Totally enclosed, water cooled.
Type of voltage regulator control	Rotary amplifier.
Regulators per switchboard	One main, one standby.
Repair parts	As specified herein.

3.1.3 Each turbine generator set shall be the package type comprised of the turbine, generator, reduction gear, sub-base (as needed), condenser, and oil coolers mounted as an integral unit. Integral hand lubricating oil pumps for starting shall be included in the package. Components in the package shall be arranged to occupy a minimum of space and to reduce weight to the lowest practicable figure consistent with other specification requirements.

3.1.4 The overall dimensions and weight of the complete turbine generator set including attached accessories shall not exceed the following:

Length - 16 feet 3 inches above grating level (not including generator rotor removal)

Width - 6 feet 6 inches

Total weight - 41,000 pounds

3.1.5 Each generator set shall be capable of withstanding without damage to the machine, the selective tripping test specified in Section 62-5 of General Specifications for Machinery.

3.1.6 The combined unit shall be designed to withstand class HI shock in accordance with the values shown on figure 1.

3.1.7 The combined unit shall be designed for satisfactory operation with the vessel rolling up to 30 degrees from the vertical to either side and with the vessel pitching 10 degrees from the normal horizontal plane.

3.1.8 *Steam consumption measured on 1 unit only, and not during 50 hour test.*

3.2 Turbines and gears. - The turbines and gears shall be in accordance with Section S50-1 of General Specifications for Machinery with the following modifications and exceptions:

3.2.1 General design and requirements. -

3.2.1.1 Exhaust conditions. - The turbines will not be required to exhaust to atmosphere.

3.2.1.2 Rated power requirements. - The turbines shall be capable of delivering rated power at the corresponding speed of the generator under the following emergency conditions:

(a) Steam pressure 10 percent greater than normal, other conditions as specified in 3.1.2.

~~(b) Steam pressure 20 percent less than normal, other conditions normal.~~

3.2.1.2.1 *Shall not deliver rated power at less than 10.50 psig at throttle.*

3.2.1.3 Overload power requirements. - The generator unit will not be required to carry kw. overload.

3.2.1.4 Steam consumption and economy. -

3.2.1.4.1 The contractor shall furnish estimated condition lines for 100 percent, 75 percent, 60 percent, and 25 percent load. The temperature and pressure for each stage shall be clearly indicated.

3.2.1.4.2 Turbines shall be designed for maximum economy at 60 percent of rated power.

3.2.1.4.3 Steam rate shall not exceed 9.63 pounds/kw./hr. at rated load and design steam and exhaust conditions. *WR at 60% rated load to be stated in bid. based on vac. obtainable at 60% load with 75°F injection. State this vac. in bid.*

3.2.2 Classification. - Turbines shall be of the multi-stage impulse type.

3.2.3 Drawings and instruction books. - Drawings and instruction books shall be as specified in 3.6 and 3.7.

3.2.4 Preservative coatings. - No painting shall be permitted on surfaces contacting oil.

3.2.5 Designation and marking. - Nameplates shall be in accordance with Drawing 5000-S2803-F-841839.

3.2.6 Heat insulation and lagging. - Insulation and lagging shall not be provided by the manufacturer. The manufacturer shall furnish a drawing including a bill of material showing application of plastic type lagging in accordance with Section S39-2 of General Specifications for Machinery. Use of metal lagging is prohibited. Means for holding insulation shall be attached to the turbine casing by the manufacturer prior to shipment. Insulation and lagging will be accomplished after installation of the turbine.

3.2.7 Lubrication and cooling. -

3.2.7.1 Oil cooling. - Internal cooling coils are prohibited. An external type oil cooler approved by the Bureau of Ships in accordance with Specification MIL-C-15730 shall be furnished.

3.2.7.2 Low pressure alarm. - A low oil pressure alarm contact maker shall be furnished.

3.2.7.3 Hand pump. - A hand oil pump for starting shall be furnished.

3.2.8 Piping and valves. - Root connections shall be in accordance with Drawing B-214.

3.2.9 Casings and steam chests. -

3.2.9.1 Material. -

3.2.9.1.1 Casings and steam chests shall be of cast carbon steel in accordance with class B of Specification MIL-S-15083, or carbon steel boiler plate in accordance with Specification MIL-P-20167 for temperatures up to 650° F., except that carbon steel may be used up to 750° F., with short time swings up to 775° F., provided the design compensates for the reduced allowable strength of the material; carbon-molybdenum cast steel in accordance with Specification MIL-S-870, or boiler plate, molybdenum alloy in accordance with Specification MIL-S-871 for temperatures up to 850° F., except that carbon-molybdenum steel may be used for temperatures up to 875° F., provided the design compensates for the reduced allowable strength of the material. Chrome-molybdenum cast steel in accordance with Specification MIL-S-15464, preferably with 1/4 percent vanadium added, for temperatures up to 975° F. When carbon steel is used for temperatures of 650° F. to 750° F., or carbon-molybdenum steel is used for temperatures of 850° F. to 875° F., the allowable stress is the stress rupture, or the stress for 0.1 percent plastic creep (both in 40,000 hours), whichever is less, modified by an appropriate safety factor.

3.2.9.1.2 Casings and steam chests may be built up by metallic arc welding of cast, rolled, or forged steel of suitable characteristics.

3.2.9.2 Drainage. - Ample provision shall be made for the drainage of all parts of turbine casings. Ample drain pockets shall be provided. Impulse stages shall be constructed so that water accumulation in diaphragm and casing recesses is prevented. If necessary, axial grooves may be cut along the lower wall of the steam path to permit flow from stage to stage toward the exhaust end. In particular, it shall not be possible for water to accumulate at any point to a sufficient depth to be touched by blades under any ordinary condition. Care shall be taken to avoid pockets formed by diaphragms having partial admission and having no steam path in the lower half to permit drainage. In such cases, drain holes may be drilled through the diaphragms.

3.2.10 Steam and exhaust connections. -

3.2.10.1 Safe working stress. - The safe working stresses which integral steam inlet and exhaust connections, connected to external piping systems, will withstand, shall be as specified on the turbine drawing.

3.2.10.2 Extraction. - Provision for extraction from turbine casing will not be required.

3.2.11 Bearings. -

3.2.11.1 Bearing shells and caps. - Bearing shells and caps shall be of boiler plate in accordance with class A or C of Specification MIL-P-20167 or structural plate in accordance with grade M of Specification MIL-S-16113. Equivalent materials of similar chemical composition may be substituted for those specified herein.

3.2.11.2 Precision inserts. - Precision insert type bearings as approved by the Bureau of Ships may be used. Such bearings will require repairs as hereinafter provided.

3.2.11.3 Bearing wear measurement. - Micrometer depth gages for measuring wear shall be supplied for all bearings on the turbines. Depth gage constants shall be stamped after installation in the vessel on small plates which are attached to each journal bearing cap by the turbine manufacturer. These gages shall be of a type which does not necessitate removal of bearing caps to take measurements. The micrometer graduations shall increase as the spindle is screwed down. One depth gage shall be supplied for each turbine. When the micrometer is not in use a collar type plug shall be used to close the spindle opening in the bearing cap and prevent the formation of burrs. All bearings shall be properly marked for determination of wear by the crown thickness method.

3.2.12 Thrust bearings. - Thrust bearing babbitt thickness shall be less than the axial clearance between the rotor and stationary parts so that, in the event of wiping of the entire babbitt thickness, the rotating element will not be damaged.

3.2.13 Glands and gland packing. -

3.2.13.1 Labyrinth packing rings. - Labyrinth packing rings shall be centrifugally cast bronze in accordance with 84-8-8 of Specification MIL-C-15345 or other material approved by the Bureau of Ships.

3.2.13.2 Gland packing. - Gland packing shall be labyrinth type, steam sealed.

3.2.13.3 Gages. - One gage may be mounted on the steam seal manifold and used to control gland seal steam to both glands.

3.2.14 Rotor and shafts. -

3.2.14.1 Material. - Material shall be in accordance with class A of Specification MIL-S-860.

3.2.14.2 Factor of safety. - At the maximum operating speed and with full load, the calculated minimum factor of safety based upon the proof stress of the class of steel used shall be 2.5.

3.2.14.3 Balancing. - If holes are drilled in turbine wheels either for balancing or for equalizing of pressure, the edges of the holes shall have a definite radius, and the surfaces, including the radii, shall be polished.

3.2.15 Nozzles and reversing chambers. -

3.2.15.1 Material. - Nozzles and reversing chambers shall be of corrosion-resisting steel in accordance with one of the following:

<u>Specification</u>	<u>Class</u>
MIL-S-853	3
MIL-S-854	3
MIL-S-861	a

3.2.16 Blades, blade packing, shrouding, etc. -

3.2.16.1 Material. - All blading material, except pins, shall be corrosion-resisting steel in accordance with Specification MIL-S-861. Packing pieces shall be integral with the blades. Blades shall be class a; shrouding shall be class b, except that Brinell hardness may be 160-240. Shroud stock shall be subjected to a 180-degree cold bend test without cracking. Where blades are secured in bucket wheels by pins, the pins shall be of high temperature bolt material in accordance with Specification MIL-B-1222.

3.2.17 Diaphragms and intermediate segments. -

3.2.17.1 Material. -

3.2.17.1.1 Diaphragms. - Diaphragms shall be of cast carbon steel (Specification MIL-S-15083, class B) or carbon steel boiler plate (Specification MIL-P-20167, class B) for temperatures up to 650° F., except that carbon steel may be used for temperatures up to 750° F., with short time swings to 775° F., provided the design compensates for the reduced allowable strength of the material; carbon-molybdenum cast steel in accordance with Specification MIL-S-870 or boiler plate, molybdenum alloy in accordance with Specification MIL-S-871 for temperatures up to 850° F., except that carbon molybdenum steel may be used for temperatures up to 875° F., with short

time swings to 900° F., provided the design compensates for the reduced allowable strength of the material. When carbon steel is used for temperatures of 650° F. to 750° F. or carbon molybdenum steel is used for temperatures of 850° F. to 875° F., the allowable stress is the stress rupture or the stress for 0.1 percent plastic creep (both in 40,000 hours), whichever is less, modified by an appropriate safety factor.

3.2.17.1.2 Nozzle partitions. - Diaphragm nozzle partition shall be of corrosion-resisting steel in accordance with class a of Specification MIL-S-861 or class 3 of Specification MIL-S-853.

3.2.17.1.3 Packing. - Diaphragm packing shall be labyrinth type of centrifugally cast bronze in accordance with 84-8-8 of Specification MIL-C-15345 or other material approved by the Bureau of Ships. Carbon packing will not be permitted.

3.2.18 Reduction gears and couplings. -

3.2.18.1 Tooth pressure. - The requirements that "for helical gears, expressed in pounds per linear inch of pinion face at the pitch circle shall not exceed 72-1/2 times the pitch diameter of the pinion in inches when the gear is transmitting the rated power" is not required. In lieu of this, the "K" factor shall not exceed 175.

3.2.18.2 Tooth finish. - Teeth shall be finished by grinding, shaving, or lapping, or combinations of same. The surface finish shall not exceed 15 micro-inches root mean square as measured along the pitch line for 80 percent of the tooth length parallel to the shaft axis by means of a Profilometer or brush surface analyzer being operated by skilled and experienced personnel. The tooth to tooth spacing shall not exceed 0.0002 inch as measured approximately on the pitch circle by a Maag Gear Wheel Company Model TMA pitch measuring instrument or equivalent thereof being operated by skilled and experienced personnel.

3.2.19 Governing and excess pressure protective requirements. -

3.2.19.1 Relief valve and back pressure trip settings. - The exhaust relief valve shall be set to lift at 10 p.s.i.g. and to give full relief at 30 p.s.i.g. The back pressure trip shall be set to operate at 5 p.s.i.g.

3.2.19.2 Speed regulation. - Speed regulation shall be as required by Specification MIL-G-3087.

3.2.19.3 The governor synchronizing motor shall be a single phase, readily reversible a. c. motor in accordance with Specification MIL-M-1940.

3.2.20 Exhaust pressure protection. - The contractor shall demonstrate that, with the exhaust and the steam inlet fully opened, pressure inside the turbine casing will not exceed 30 p. s. i. g.

3.2.21 Fittings. -

valve seated by hand.

3.2.21.1 Gages. -

3.2.21.1.1 Steam pressure gages shall be 4-1/2-inch diameter.

3.2.21.1.2 Gland seal steam pressure shall be measured by compound-retard type gages.

3.2.21.1.3 Revolution indicator. - Provision shall be made for use of a portable hand tachometer to set overspeed trips. Where this will unduly complicate design, a portable frequency meter graduated from 61 to 71 cycles per second may be furnished.

3.2.21.2 Sight-flow fittings and thermometers. - The turbines shall be fitted with combined sight-flow fittings and thermometers measuring oil outlet temperature from each journal and thrust bearing. In addition, thermometers will be fitted to measure inlet and outlet oil temperature at the oil cooler. Thermometer range shall be 30° F. to 240° F.

3.2.22 Performance. - Turbines and gears shall withstand performance tests specified in Specification MIL-G-3087 (combined unit tests).

3.3 Condensers. - The condensers shall be designed and constructed in accordance with type II, class A of Specification MIL-C-15430 and shall be an integral part of the package unit composed of the turbine, generator, and condensers.

3.3.1 Each condenser shall be designed to maintain 2.5 inches Hg. absolute pressure at the turbine exhaust flange when the turbo-generator is operating at full rated power.

3.3.2 The condensers shall be 2 pass with ordering tube length to suit the package unit.

3.4 Air ejectors. - The turbo-generator condenser air ejector assemblies shall be designed and constructed in accordance with type A of Specification MIL-E-15465. The air ejector assemblies shall not be a part of the package unit, but shall be designed for separate mounting.

3.4.1 The air ejector assemblies shall be designed for operation with steam conditions of 135 p.s.i.g. and ~~675~~ ³⁹⁵ FTT.

3.4.2 Each air ejector shall have sufficient capacity expressed in pounds per hour free dry air plus vapor to saturate at 7.5° F. below vacuum temperature to serve the condenser at full load condenser vacuum and also at 1.5 inches Hg. absolute partial load condition.

3.4.3 The allowable pressure drop when circulating full load condensate is 5 p.s.i.

3.4.4 There are no specific limitations as to weight, space, foundations, sizes, etc.

3.4.5 A gland exhaust condenser shall be provided. (An exhaust fan will be used but will not be furnished by the contractor.)

3.4.6 Steam supply valves and piping shall be furnished by the contractor. Control valves are not required.

3.4.7 Inter, after, and gland condensers shall be designed for 65 p.s.i. pressure from the condensate pumps.

3.5 Lube-oil coolers. - The turbo-generator lubricating oil coolers shall be designed and constructed in accordance with Specification MIL-C-15730 and shall form an integral part of the package turbo-generator condenser unit.

3.5.1 The oil coolers shall be type A, class 1 of Specification MIL-C-15730 for salt water cooling of the turbo-generator lubricating oil.

3.5.2 The cooler tubes may be of any of the sizes specified in Specification MIL-C-15730.

3.6 Instruction books. - Instruction books shall be in accordance with type C of Specification MIL-B-15071, except that an introduction section shall be included. The following equipment shall be covered in the instruction book:

- Steam turbine and any associated accessories
- Reduction gears
- Condensers
- Air ejectors
- Lube-oil coolers
- Generator
- Exciter
- Voltage regulator
- Manual control means
- Temperature indicating and alarm devices
- Governor motor
- Special devices on equipment

3.6.1 Instruction books shall contain reduced size prints of all approved drawings for electric equipment, and a list of all approved drawings indicating the manufacturer's and the Bureau of Ships drawing numbers in parallel columns. Books shall be approved by the Bureau of Ships prior to final printing.

3.6.2 Two copies of the finally approved instruction book shall be packed with each turbo-generator set at the time of shipment.

3.7 Drawings. - All drawings shall be master drawings in accordance with Specification MIL-D-963, and shall include information as required by the individual equipment specifications.

3.7.1 Surface roughness shall be specified on all mechanical drawings in accordance with Standard MIL-STD-10. Mechanical drawings shall be so complete in every detail as to permit manufacture of parts at a Naval shipyard.

3.7.2 Installation drawings. - Installation drawings shall include the following:

- (a) All connections, electrical and mechanical weights, overall dimensions, and other data necessary to clearly describe the equipment.
- (b) An outline of the identification plate showing all plate markings and the location of the plate.
- (c) Piping diagrams, showing recommended connections for oil, water, steam, and exhaust necessary for proper installation and operation of the unit.
- (d) Type numbers, ratings (volts, amperes, r.p.m., kw., etc.), and name of manufacturer, of all electric equipment.

3.7.3 All drawings shall be submitted to the bureau via the cognizant inspector for approval. Ten copies of the installation drawing shall be submitted within 90 days from the date of contract for forwarding to the installing activities. Drawings for the turbine, gear, condenser, air ejector, lube-oil coolers, generator exciter, and control equipment shall be submitted for approval within 120 days from the date of contract.

3.8 Repair parts and tools. -

3.8.1 Onboard repair parts and tools. - Onboard repair parts and tools shall be furnished in accordance with the individual equipment specifications supplemented as follows:

3.8.1.1 In the list of turbine repair parts in Section S50-1 of General Specifications for Machinery, "Bearings, ball type, etc., complete sets" is changed to read "Bearings, all types, complete sets" and "Bearings, sleeve type ----- etc." is changed to read "Bearing oil deflector rings, complete sets".

3.8.1.2 Repair parts and tools for the turbine, gear, and electrical equipment shall be furnished on the basis of 8 units per vessel for the units to be installed and on the basis of 1 per vessel for the stock unit. Repair parts for the condensers, air ejector assemblies, and lube-oil coolers shall be furnished on the basis of one set for each unit supplied.

3.8.1.3 Standard Navy stock numbers shall be obtained for all parts in accordance with Specification MIL-R-15137.

3.8.1.4 Turbine tools shall be provided in accordance with Section S50-1 of General Specifications for Machinery, except as follows:

3.8.1.4.1 Babbitting mandrels shall not be furnished.

3.8.1.4.2 Bridge gages shall not be supplied. In lieu thereof, all bearings shall be properly scribed for measuring wear by the crown thickness method.

3.8.1.4.3 Pulling tools shall be provided for ball bearings where a "complete" set of pullers under Specification JAN-P-690 is not adequate.

3.8.2 Stock repair parts. -

3.8.2.1 The Ships Parts Control Center, Naval Supply Depot, Mechanicsburg, Pennsylvania, controlled stock repair parts shall be furnished in accordance with Specification MIL-R-15137.

SHIPS-G-823

3.8.2.2 Bureau of Ships controlled stock repair parts for the turbine and gear shall consist of the following:

<u>Item</u>	<u>Quantity</u>
(a) Pinions with shafts. High speed pinions with shafts need not be duplicated if furnished as part of turbine rotor. Each pinion with shaft to be boxed individually.	3
(b) Gears with shafts. Each gear and shaft to be boxed individually.	2
(c) Throttle valve, complete, if actuated by governor or emergency tripping devices. Each valve to be boxed individually.	2
(d) Turbine rotor completely bladed and assembled with listing (a), if solid coupled to pinion. Each turbine rotor to be boxed individually.	1
(e) Complete sets of stationary impulse blading assembled in intermediate segment or blade holder. If blades are installed in turbine casing, 105 percent blading material shall be furnished. Each individual row of blading material to be separately boxed.	3
(f) Complete sets of rotating blading materials, including blades and all locking pieces, spacers, and undrilled or unpunched shrouding for all stages. Blading materials shall consist of material to be in a separate box.	3
(g) First stage nozzle complete. Each nozzle to be boxed individually.	2
(h) Complete sets, including springs, etc., of diaphragm packing, dummy seal strips, (105 percent) and labyrinth type gland packing when lifting casings is required. Each individual packing ring to be separately boxed.	3
(i) Complete set of nozzle diaphragms without labyrinth packing. Each individual diaphragm to be separately boxed.	2

3.8.2.3 Unless previously furnished, electrical shore repair parts shall include the following major components:

One complete stator rewind kit for the a. c. generator.
 One complete set of field (rotor) coils for the a. c. generator.
 One complete armature for the exciter.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 Inspection procedures. - The general inspection procedures shall be in accordance with General Specifications for Inspection of Material.

4.2 Tests shall be conducted on the turbo-generator units in accordance with Specification MIL-G-3087. Test results on the first generator and combined turbo-generator unit shall be forwarded to the Bureau of Ships for approval prior to shipment of the units.

4.3 Radio interference noise test. - Radio interference noise test shall be conducted in accordance with the manufacturer's standard procedure as approved by the Bureau of Ships. The results of radio interference noise tests shall not be cause for rejection of the generator.

~~5.~~ PREPARATION FOR DELIVERY

5.1 Preservation and packaging of electrical items. -

5.1.1 The generators and exciters shall be preserved and packaged in accordance with Specification MIL-P-16298.

5.1.2 The voltage regulators and rheostats shall be packaged and prepared for shipment in accordance with Specification JAN-P-658.

5.2 Preservation and packaging of turbines and gears. - The turbines and gears shall be preserved and packaged in accordance with Specification MIL-P-17286.

5.3 Preservation and packaging of condensers, air ejectors, and lube-oil coolers shall be in accordance with Specifications MIL-C-15430, MIL-E-15465, and MIL-C-15730, respectively. The air ejectors shall be packed for domestic shipment in accordance with Specification MIL-E-15465.

5.4 Packing. -

5.4.1 The complete turbo-generator units intended for shipboard installation shall be packed for domestic commercial shipment in accordance with Specification MIL-P-16298.

5.4.2 The complete turbo-generator unit intended for stock shall be packed for domestic shipment in accordance with Specification MIL-P-16298.

SHIPS-G-823

5.4.3 All onboard repair parts shall be packed in metal boxes in accordance with type M of Specification MIL-B-233.

5.5 Marking. - In addition to any special marking required by the contract or order, shipments shall be marked in accordance with Standard MIL-STD-129.

6. NOTES

6.1 Not applicable.

Notice. - When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

H.I. SHOCK DESIGN DATA
BASED ON YIELD POINT
OF MILD STEEL.

- VERTICAL
- - - - - ATHWARTSHIPS
- · - · - FORE & AFT

NOTE
THE ACCELERATIONS INDICATED
HEREON ARE TO BE USED AS A
SHOCK DESIGN GUIDE.

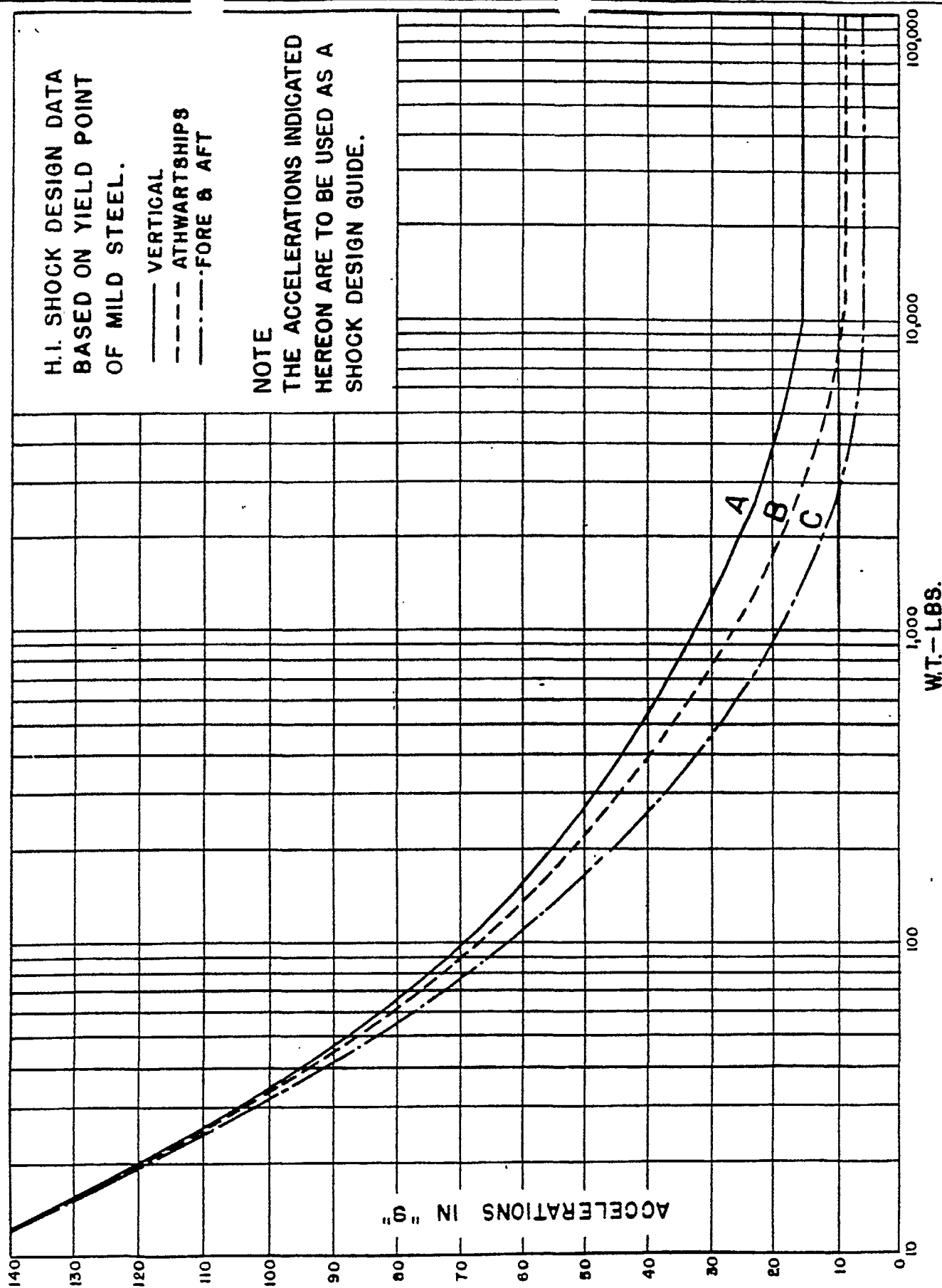


FIGURE 1