

**MIL-L-15719A****6 MAY 1952****SUPERSEDING  
MIL-G-15719(SHIPS)  
15 OCTOBER 1950**

**MILITARY SPECIFICATION**

**LUBRICATING GREASE**

**(HIGH-TEMPERATURE, ELECTRIC MOTOR,  
BALL AND ROLLER BEARINGS)**

*This specification was approved by the Departments of the Army, the Navy, and the Air Force for use of procurement services of the respective Departments.*

**1. SCOPE**

1.1 This specification covers high temperature grease (type HTG) for the lubrication of ball and roller bearings only, primarily for lubricating class H insulated (silicone) electric motors with heat-stabilized ball bearings. Under no circumstances should it be applied to bearings in which the main action involves the sliding of metal on metal, as in journal bearings, spiral gears, gear trains, and similar applications. The normal temperature range of the grease is 0° to 300°F.

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

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

**SPECIFICATIONS****FEDERAL**

- NN-B-591 —Boxes, Fiberboard, Wood-Cleated (for Domestic Shipment).
- NN-B-601 —Boxes, Wood - Cleated-Plywood, (for Domestic Shipment).
- NN-B-621 —Boxes, Wood, Nailed and Lock-Corner.

- NN-B-631 —Boxes, Wood, Wire-bound (for Domestic Shipment).
- QQ-C-501 —Copper, Bars, Plates, Rods, Shapes, Sheets, and Strips.
- UU-T-116 —Tape, Paper, Gummed, Water-Resistant.
- VV-L-791 —Lubricants, Liquid Fuels, and Related Products; Methods of Inspection, Sampling, and Testing.
- LLL-B-631 —Boxes, Fiber, Corrugated (for Domestic Shipment).
- LLL-B-636 —Boxes, Fiber, Solid (for Domestic Shipment).

**MILITARY**

- JAN-P-105 —Packaging and Packing for Overseas Shipment—Boxes, Wood, Cleated Plywood.
- JAN-P-106 —Packaging and Packing for Overseas Shipment—Boxes, Wood, Nailed.
- MIL-B-107 —Boxes, Wood, Wire-bound (Overseas Type).
- JAN-P-108 —Packaging and Packing for Overseas Shipment—Boxes, Fiberboard (V-Board and W-Board), Exterior and Interior.
- JAN-P-138 —Packaging and Packing for Overseas Shipment—Boxes, Wood, Fiberboard-Lined.

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### NAVY DEPARTMENT

#### General Specifications for Inspection of Material.

### STANDARDS

#### MILITARY

#### MIL-STD-129—Marking of Shipments.

(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.)

**2.2 Other publications.**—The following publication, of the issue in effect on date of invitation for bids, unless otherwise stated, forms a part of this specification:

#### AMERICAN SOCIETY FOR TESTING MATERIALS

#### Standards on Petroleum Products and Lubricants.

(Application for copies should be addressed to the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.)

### 3. REQUIREMENTS

**3.1 Qualification.**—The electric motor ball and roller bearing high temperature lubricating grease (type HTG) furnished under this specification shall be a product which has been tested and has passed the qualification tests specified in section 4 (see 6.2).

**3.2 Composition.**—The grease shall be a smooth homogeneous mixture of a poly-methylphenyl silicone fluid and a lithium soap free from any abrasive or other undesirable fillers as impurities. Minor proportions of additives to improve oxidation stability, rust inhibition, mechanical stability, texture and wear resistance may be included. Compositions made up of other fluids and/or soaps will be considered provided they meet all the other requirements of this specification.

**3.3 Appearance.**—The lubricant shall be completely homogeneous, and shall be of a

smooth consistency free from lumps or granulation.

**3.4 Odor.**—Any odor of rancidity or perfume shall be sufficient cause for rejection.

**3.5 Corrosion.**—When tested for corrosion of copper as specified in 4.4.2, the grease shall show no decomposition, change in color or consistency, nor shall the copper strip show any evidence of green or black discoloration, etching or corrosion. A brown stain on the copper strip shall not be considered as evidence of corrosion.

**3.6 Penetration.**—The worked penetration of the qualification grease sample shall not be more than 330 nor less than 260. The penetration of succeeding lots shall not differ from the penetration value established on qualification by more than  $\pm 15$ , but in no case shall it be more than 330 nor less than 260.

**3.7 Dropping point.**—The dropping point shall be not less than 375°F. Furthermore, the dropping point of any succeeding lot shall not differ from the dropping point established on qualification by more than 15°F., but in no case shall it be less than 375°F.

**3.8 Dirt.**—The grease shall not contain dirt or other foreign particles exceeding the following limits:

7,500 per cubic centimeter (cc.) of 25 microns diameter or above.

1,600 per cc. of 75 microns diameter or above.

None of 125 microns diameter or above.

**3.9 Water resistance.**—When tested for water resistance as specified in 4.4.6, not more than 20 percent of the grease shall be washed from the bearing.

**3.10 Bleeding.**—Not more than 12 percent bleeding shall occur during 100 hours at 300°F.

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**3.11 Evaporation.**—The grease shall not lose more than 2.0 percent of its weight after 50 hours at 300°F.

**3.12 Oxidation stability.**—The grease shall not cause a pressure drop of more than 5 pounds per square inch (p.s.i.) oxygen pressure after a 50-hour period at 300°F.

**3.13 Work stability.**—When tested as specified in 4.4.10, the penetration of the grease immediately after the mechanical working shall not be increased to more than 375.

#### **3.14 Base fluid.**

**3.14.1 Nature of base fluid.**—The base fluid shall consist of a liquid polymethylphenyl silicone or other suitable fluid that is miscible in all proportions with the base fluids used in all greases previously qualified under this specification.

**3.14.2 Viscosity of base fluid.**—The viscosity at 210°F. of the base fluid of the grease of succeeding lots shall not differ from that of the fluid used to manufacture the grease of the qualifying lot by more than  $\pm 10$  percent. The viscosity temperature coefficient of the fluid shall not vary from that of the qualifying lot by more than 0.03.

**3.15 Apparent viscosity.**— The apparent viscosity of the grease shall not exceed 10,000 poises at a shear rate of 20 reciprocal seconds when tested as specified in 4.4.11.

**3.16 Low temperature torque.**—During the test specified in 4.4.12, the test bearing, filled with the grease, shall turn its first complete revolution in each direction in not more than 15 seconds.

**3.17 Performance.**—The grease shall show an average useful life of 2,000 hours or more.

### **4. SAMPLING, INSPECTION, AND TEST PROCEDURES**

**4.1 Inspection procedures.**—For Navy purchases, the general inspection procedures

shall be in accordance with General Specifications for Inspection of Material.

**4.2 Qualification tests at a Government laboratory.**—Qualification tests shall be conducted at the Naval Engineering Experiment Station, Annapolis, Md. These tests shall consist of the tests specified in table I.

**4.2.1 Samples.**—For qualification tests, a 10-pound sample of grease and a 1-pint container of base fluid without additives will be required. When a manufacturer submits a grease of other composition than that specified in 3.2 for qualification tests, the required samples shall be accompanied by a certified copy of supporting test data indicating compliance with this specification.

#### **4.3 Lot acceptance tests.**

**4.3.1 Sampling.**—For lot acceptance tests, a 1-pound sample of grease and a 1-pint sample of the base fluid, without additives will be required from each lot. The sample of grease shall be selected in accordance with method 800.2 of Specification VV-L-791. The sample of grease selected shall be taken in the original container (8-ounce collapsible tubes) without disturbing the contents.

**4.3.2 Tests.**—Lot acceptance tests shall be conducted at the Naval Engineering Experiment Station, Annapolis, Md. These tests shall consist of the tests specified in table II. For Air Force purchases, inspection shall be in accordance with method 960.1 of Specification VV-L-791.

**4.3.3 Acceptance or rejection of lots.**—If the grease or base fluid tested fails in any of the lot acceptance tests specified in table II, the entire lot shall be rejected. A rejected lot may be reprocessed by the manufacturer and may be resubmitted for lot acceptance tests, but only after the manufacturer has demonstrated that the cause of failure has been corrected to the satisfaction of the Government inspector.

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TABLE I.—Qualification tests

Property to be tested	Test paragraph	Unit of value	Value
Appearance -----	4.4.1	-----	Observation.
Corrosion -----	4.4.2	-----	Observation.
Worked penetration -----	4.4.3	Tenths of a millimeter	330-260.
Dropping point, minimum -----	4.4.4	Degrees, F.	375
Dirt count, maximum -----	4.4.5	Count/cc.	7,500 of 25 microns or above; 1,600 of 75 microns or above; None of 125 microns or above.
Water resistance, maximum -----	4.4.6	Percent	20.
Bleeding, maximum -----	4.4.7	Percent	12.
Evaporation, maximum -----	4.4.8	Percent	2.0.
Oxidation stability, maximum -----	4.4.9	p.s.i.	5.
Work stability, maximum -----	4.4.10	Tenths of a millimeter	375.
Apparent viscosity, maximum -----	4.4.11	Poises	10,000.
Low temperature torque average -----	4.4.12	Seconds	15.
Performance, minimum -----	4.4.13	Hours	2,000.
Viscosity of base fluid -----	4.4.15	Poises	For record only.
Viscosity temperature coefficient of base fluid -----	4.4.16	-----	For record only.

TABLE II.—Lot acceptance tests

Property to be tested	Test paragraph	Unit of value	Value
Appearance -----	4.4.1	-----	Observation.
Corrosion -----	4.4.2	-----	Observation.
Worked penetration -----	4.4.3	Tenths of a millimeter	Qualification value $\pm 15$ .
Dropping point -----	4.4.4	Degrees, F.	Qualification value $\pm 15$ .
Dirt count, maximum -----	4.4.5	Count/cc.	7,500 of 25 microns or above; 1,600 of 75 microns or above; None of 125 microns or above.
Water resistance, maximum -----	4.4.6	Percent	20.
Bleeding, maximum -----	4.4.7	Percent	12.
Evaporation -----	4.4.8	Percent	2.0.
Oxidation stability, maximum -----	4.4.9	p.s.i.	5.
Work stability, maximum -----	4.4.10	Tenths of a millimeter	375.
Apparent viscosity, maximum -----	4.4.11	Poises	10,000.
Low temperature torque -----	4.4.12	Seconds	15.
Nature of base fluid -----	4.4.14	-----	Miscible in all proportions with qualified fluid.
Viscosity of fluid base -----	4.4.15	Percent	Qualification value $\pm 10$ percent.
Viscosity temperature coefficient of base fluid -----	4.4.16	-----	Qualification value $\pm 0.03$ .

**4.4 Test procedures.** — Unless otherwise specified, all tests shall be conducted on unworked grease.

**4.4.1 Appearance.**—A suitable portion of the grease shall be worked with a spatula on a clean glass. During working, the grease shall show no nonuniformity and shall spread with a straight edge to a smooth, glossy, level surface.

**4.4.2 Corrosion resistance.** — Prepare a strip of clean copper conforming to Specification QQ-C-501, 1.75 by 0.25 by 0.02 inch, bent midway between the ends at an angle of 45°. Dip the copper strip for 15 to 20 seconds into an aqueous solution containing 25 percent by weight  $H_2SO_4$  and 25 percent by weight  $HNO_3$ . Wash immediately in distilled water and give a bright dip for 15 seconds in an aqueous solution of approximately 2 percent  $H_2SO_4$  by weight and 5 percent  $K_2Cr_2O_7$  by weight. Wash well in distilled water and dry for 30 minutes in an oven maintained at approximately 212°F. (The metal must not be touched with the fingers at any time during or after cleaning.) Remove the copper strip from the oven and cool to room temperature. Place 4 grams of sample grease in a glass dish, insert the copper strip horizontally into the grease so that one-half of the copper strip is immersed and place the test dish into a Norma-Hoffman bomb at  $210 \pm 5^\circ F.$ , and  $110 \pm 0.25$  pounds per square inch (p.s.i.) initial oxygen pressure. At the end of 20 hours of test, remove the glass dish. Visually examine the copper strip and the sample of grease for compliance with 3.5.

**4.4.3 Penetration.**—The worked penetration of the grease shall be determined in accordance with method 31.1 of Specification VV-L-791.

**4.4.4 Dropping point.**—The dropping point of the grease shall be determined in accordance with method 142.1 of Specification VV-L-791.

**4.4.5 Dirt count.**—Dirt in the grease shall be determined in accordance with method 300.5 of Specification VV-L-791.

**4.4.6 Water resistance.**—A 204K Conrad Type 8-ball bearing shall be packed with 4.0 grams of grease and clamped in the tight fitting housing which allows the inner race to turn freely, mounted on a horizontal shaft, and rotated at 600 revolutions per minute (r.p.m.). A fine stream of distilled water, initially at room temperature and not permitted to exceed 49°C. (120°F.) circulating at the rate of 5 milliliters (ml.) per second shall be directed against the end plate of the housing from a one-millimeter (mm.) capillary connected to a pump taking suction from the reservoir of water under the bearing so that it impinges on the end plate one-quarter of an inch above the outer opening of the bearing housing, as shown on figure 1. Operation shall be continued for one hour when the bearing shall be removed, dried at 82°C. (180°F.) and reweighed to determine the grease loss. This grease loss divided by the weight of the grease used in packing the bearing shall be reported as the percent grease loss.

**4.4.7 Bleeding.**—The bleeding of the grease shall be determined in accordance with method 32.1 of Specification VV-L-791, with the following exceptions:

- (a) The test shall be conducted at  $300 \pm 1^\circ F.$
- (b) The joint in the 60-mesh cone shall be crimp-locked rather than soldered.
- (c) The duration of the test shall be 100 hours.

**4.4.8 Evaporation.**—Evaporation of the grease shall be determined in accordance with test method for Evaporation Loss of Lubricating Greases and Oils, Designation D972-48T of the American Society for Testing Materials Standards on Petroleum Products and Lubricants with the following exceptions:



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- (a) The test shall be conducted at  $300^{\circ} \pm 1^{\circ} \text{F}$ .
- (b) The duration of the test shall be 50 hours.

**4.4.9 Oxidation stability.**—The oxidation stability of the grease shall be determined in accordance with method 345.3 of Specification VV-L-791, with the following exceptions:

- (a) The test shall be conducted at  $300^{\circ} \pm 1^{\circ} \text{F}$ . A suitably controlled air bath may be substituted for the oil bath, if desired.
- (b) The duration of the test shall be 50 hours.

**4.4.10 Working stability.**—The working stability of the grease shall be determined in accordance with method 31.3 of Specification VV-L-791.

**4.4.11 Apparent viscosity.**—The apparent viscosity of the grease shall be determined in accordance with method 30.6 of Specification VV-L-791 except that the test shall be performed at  $0^{\circ} \text{F}$ . by placing the apparatus in a suitable low-temperature box or cold bath. The grease shall be cooled to the test temperature in approximately 2 hours and maintained at this temperature for a period of 2 hours prior to making the viscosity determinations.

**4.4.12 Low temperature torque.**—These tests shall be carried out with a 204K Conrad type, 8-ball bearing in a cold box capable of holding the temperature variation of the bearing during the test to not more than  $\pm 1^{\circ} \text{C}$ . ( $\pm 1.8^{\circ} \text{F}$ ). A suitable design of the cold box is shown on figure 2. The test bearing shall be packed with  $3.0 \pm 0.1$  grams of grease, distributed on both sides of the bearing, and worked in so that no grease extends beyond the faces of the races. The bearings then shall be placed in a close-fitting housing similar to that shown on figure 3, so that the radial clearances between the inner race and the edge of the housing shall be 0.008

$\pm 0.002$  inch. The bearing shall be rotated for approximately 100 revolutions in each direction at a speed not exceeding 200 r.p.m. The bearings shall be mounted on a spindle such as that shown on figure 3 and cooled to  $0^{\circ} \text{F}$ . in not more than  $1\frac{1}{2}$  hours and held at this temperature for a period of two hours. During the cooling period the test spindle shall be rotated two complete revolutions in each direction at intervals of 15 minutes. A torque of 2,000 gram-centimeters shall be applied and the time for a complete revolution of the spindle recorded. After 15 minutes, the same torque shall be applied in the opposite direction and the time for the first complete revolution redetermined.

**4.4.13 Performance.**

**4.4.13.1 Motor test set.**—Two squirrel cage induction motors, class H silicone insulated, of suitable capacity and with adjustable pitch diameter pulleys shall be belted together so that one functions as a motor and the other as a generator. The generator may be arranged to supply its power to the driving motor. Temperature of the outer race of the test bearing shall be regulated by adjusting the load on the motor (i.e., adjusting the speed of the driven unit). A single shielded, steel retainer, deep groove, single row, Conrad type, number 310, stabilized ball bearing shall be used for the test bearing. By stabilized bearing is meant a bearing whose dimensions do not increase more than 0.0001 inch per inch of diameter during 2,500 hours at  $300^{\circ} \text{F}$ . This bearing shall be mounted on the end opposite the pulley end of the driving motor.

**4.4.13.2 Test procedure.**—The test bearing shall be packed with  $20 \pm 0.2$  grams of the grease, evenly distributed throughout the bearing. The test bearing shall then be mounted on the pulley end of the driving motor with the shield toward the winding. The end bell of the motor shall be packed with  $25 \pm 0.2$  grams of grease. The motor shall be assembled and the test set operated at  $1,700 \text{ r.p.m.} \pm 75 \text{ r.p.m.}$  continuously for

150 hours each week. The temperature of the test bearing shall be  $300 \pm 9^\circ\text{F}$ . measured by a thermocouple in contact with the outer race. The temperature of the inner race shall be higher than the outer race. The temperature differential between the inner and outer races shall not exceed  $20^\circ\text{F}$ . The outer race temperature shall be controlled by regulating the load on the driving motor. When the outer race temperature is regulated to  $300^\circ \pm 9^\circ\text{F}$ . by the load on the motor, no further changes in the load shall be made until failure has occurred, except to compensate for changes in ambient temperatures that affect the bearing temperature.

**4.4.13.3 Failure.**—Failure of the grease will be indicated by a sudden increase in power consumption (tripping of the motor controller overload relay), excessive vibration, or squealing, a broken bearing, or stalling of the motor upon starting. The grease shall be considered as having failed if the total operating time at  $300^\circ\text{F}$ . is less than 2,000 hours. Duplicate runs shall be made. If one result is less than 2,000 hours, a third run shall be made and the arithmetical average of all three runs shall be used as the life value of the grease.

**4.4.14 Nature of base fluid.**—The base fluid shall be examined for conformance with 3.14.1.

**4.4.15 Viscosity of base fluid.**—The viscosity at  $210^\circ\text{F}$ . of the base fluid of the grease shall be determined in accordance with method 30.5 of Specification VV-L-791.

**4.4.16 Viscosity temperature coefficient.**—The viscosity temperature coefficient shall be calculated from the following formula:

Viscosity temperature coefficient =  $1 - \frac{n_{210}}{n_{100}}$   
 $n_{100}$  and  $n_{210}$  are the kinematic viscosities at  $100$  and  $210^\circ\text{F}$ ., respectively.

## 5. PREPARATION FOR DELIVERY

**5.1. Packaging for domestic or oversea shipment.**—The grease shall be packaged in

8-ounce collapsible metal tubes. The tubes shall have a diameter of approximately 2 inches and shall have sufficient length to hold 8 ounces of contents. The tubes shall be made of lead or aluminum; shall have a minimum wall thickness of 0.0085 inch; and shall be furnished with an open-end spout having a minimum inside diameter of one-quarter of an inch and fitted with a knurled or irregular shaped cap to facilitate opening. After filling, tubes shall be suitably folded and/or clipped to prevent leakage. Each tube shall be furnished with a corrugated fiberboard protector for the clipped end of the tube.

**5.1.1 Intermediate packaging.**—Ten filled tubes shall be packaged in two rows of five tubes each, cap end up, in a partitioned fiberboard container conforming to compliance V or W5s of Specification JAN-P-108. The partitions shall be of the half-slotted, full height type, of the same material as the container, and shall provide a snug-fitting cell for each tube. All seams, joints, and closures of the container shall be sealed with water-resistant gummed tape conforming to Specification UU-T-111.

## 5.2 Packing.

**5.2.1 For domestic shipment.**—The intermediate packages, prepared as specified in 5.1.1, shall be packed in unlined shipping containers in quantities not exceeding the gross weight limitations for the containers, except that in no case shall the gross weight of the packed container exceed 200 pounds. The containers used shall be fiber, fiberboard, plywood, or wood boxes conforming to Specification LLL-B-631, LLL-B-636, NN-B-591, NN-B-601, NN-B-621, or NN-B-631 correspondingly.

**5.2.2 For oversea shipment.**—The intermediate packages, prepared as specified in 5.1.1, shall be packed in quantities not to exceed a maximum gross weight of 70 pounds for the packed shipping container. The shipping containers do not require waterproof case liners. The containers used shall be ply-

wood or wood boxes conforming to Specification JAN-P-105, JAN-P-106, MIL-B-107 or JAN-P-138 accordingly.

### 5.3 Marking.

**5.3.1 For identification.**—Each filled tube shall have its contents identified by lithographing with black, noncorrosive, weather resistant, waterproof ink that will not smear or rub off. Each intermediate container shall have its contents identified by stenciling or imprinting on the container proper, or on a label securely affixed to the container and covered with a transparent waterproof material. The identification data on the tube and on the intermediate container shall show the stock number, quantity, nomenclature, date filled, packed by (manufacturer or installation), and the warning statement contained in 6.3, in addition to any other information that may be specified.

**5.3.2 For shipment.**—In addition to any special marking specified in the contract or order, shipments shall be marked in accordance with Standard MIL-STD-129.

## 6. NOTES

**6.1 Ordering data.** — Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Whether packing for domestic or oversea shipment is required (see 5.2 and 5.3).

**6.2** In the procurement of products requiring qualification the right is reserved to reject bids on products that have not been subjected to the required tests and found satisfactory for inclusion on the Military

**Qualified Products List.** The attention of suppliers is called to this requirement, and manufacturers are urged to communicate with the Bureau of Ships, Navy Department, Washington 25, D.C., and arrange to have the products that they propose to offer to the Army, the Navy, or the Air Force tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products covered by this specification may be obtained from the Chief of the Bureau of Ships, Navy Department, Washington 25, D. C.

**6.3 Physiological effects.** — The silicone fluid of this lubricant will produce mild irritation of the eye if introduced in even very small amounts, as by rubbing the eye with a finger contaminated with traces of the grease. The effect passes within 24 hours and special care should be exercised to avoid contact of the grease with the eyes or surfaces near them.

**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.

#### Custodians:

Army—Ordnance Corps  
Navy—Bureau of Ships  
Air Force

#### Other interest:

Army—ESigT  
Navy—AMCOsY.





## DESIGN DATA

VOLUME OF INSULATION  
VOLUME OF TANK (LESS FINS)

9870 cu. in.  
490 cu. in.

VOLUME OF CHAMBERS (TOTAL)

4180 cu. in.

AREA OF RADIATOR FINS

2185 sq. in.

TOTAL RADIATION SURFACE

4748 sq. in.

VOLUME OF FOUR SPINDLES

28.3 cu. in.

TANK 22 GAGE COPPER - FINS 24 GAGE COPPER

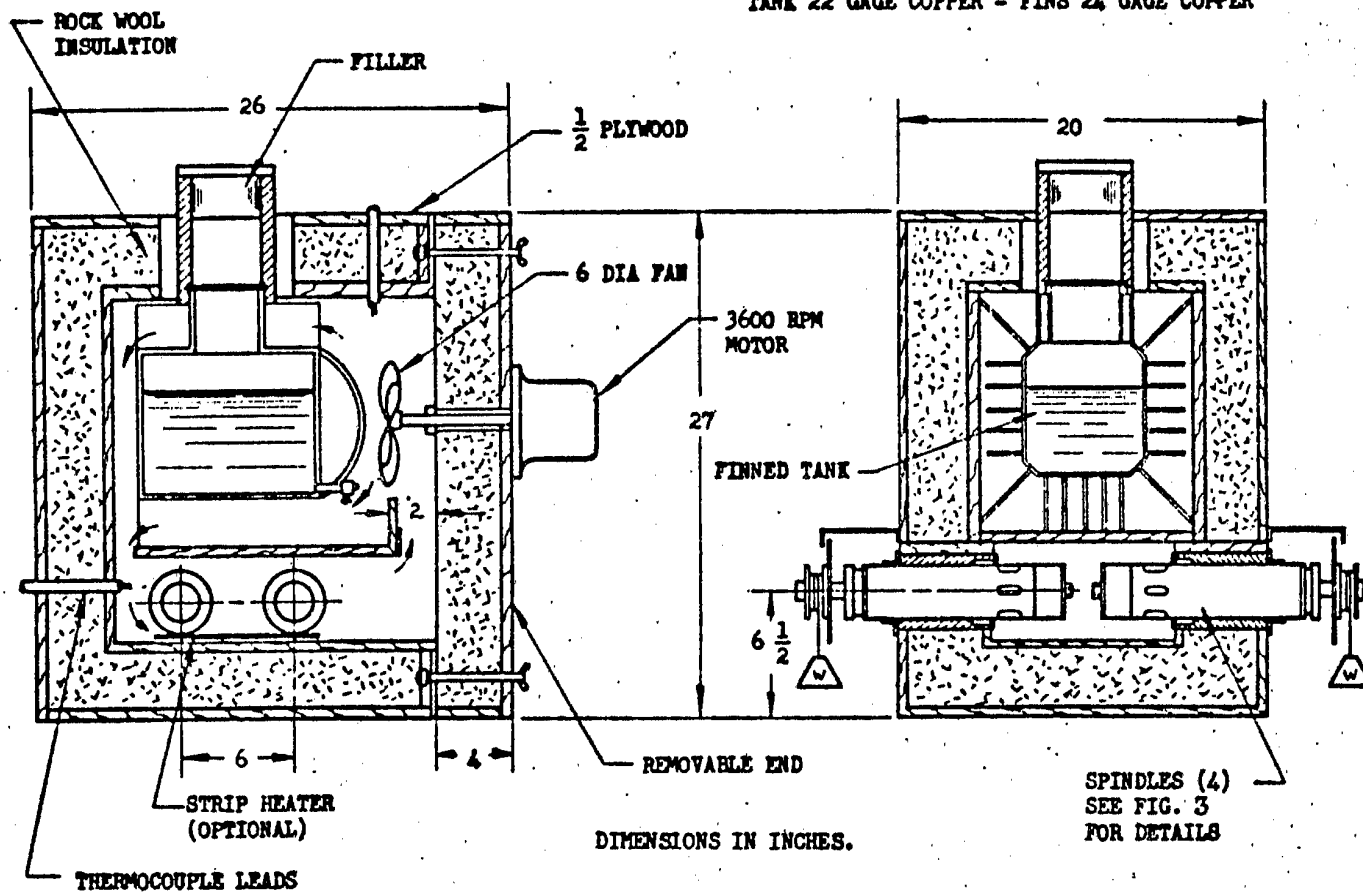
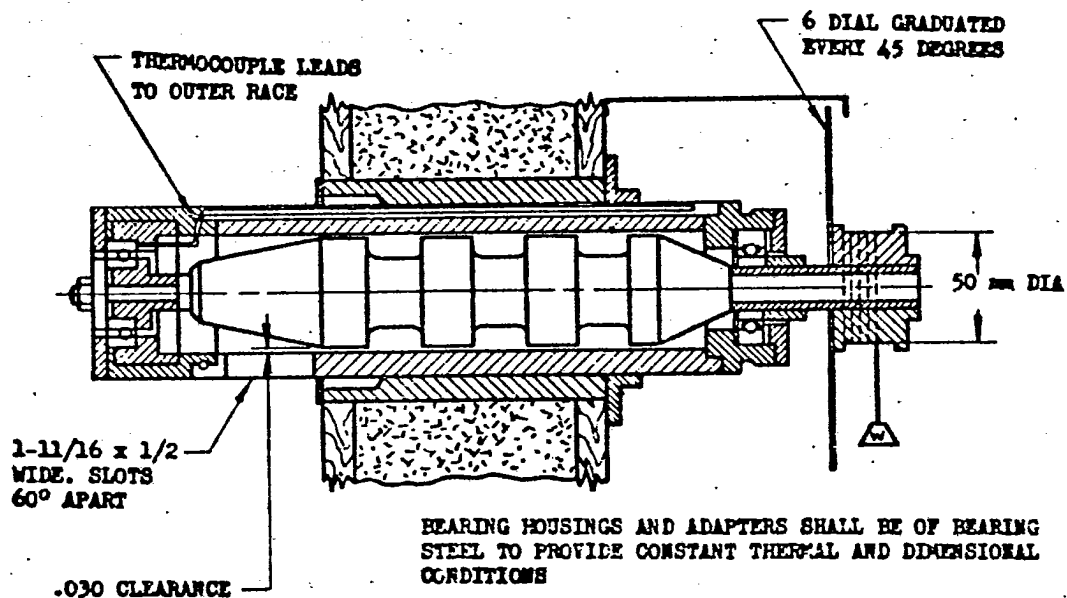


FIGURE 2.—Cold test chamber.



## TEST SPINDLES (4 REQUIRED)

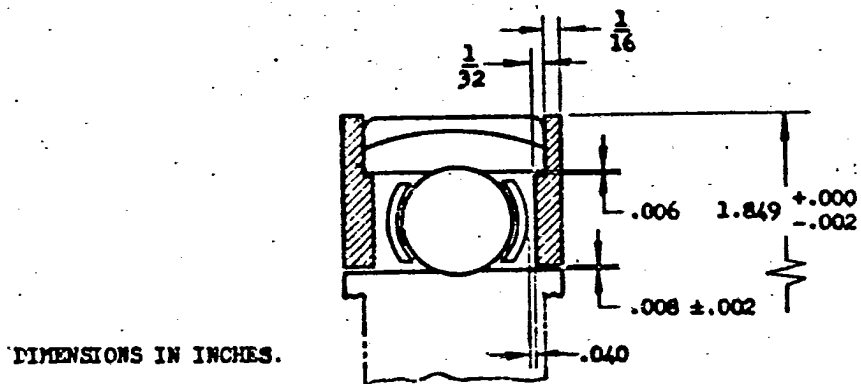
BEARING GREASE SHIELDS  
(2 REQUIRED PER SPINDLE)

FIGURE 3.—Details of spindles and bearing shields.