

| METRIC |
 DOD-G-85733(AS)
 25 April 1986

MILITARY SPECIFICATION

GREASE, HIGH TEMPERATURE, CATAPULT SYSTEM

This Specification is approved for use within the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements for one type and grade of a high temperature grease for uses at temperatures from -29°C to 260°C and for brief periods of use at temperatures up to 370°C (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks The following specifications, standards, and handbooks form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

STANDARDS

FEDERAL

FED-STD-313	Material Safety Data Sheets, Preparation and Submission of
FED-STD-791	Lubricant, Liquid Fuel and Related Products, Methods of Testing

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Systems Engineering and Standardization Department (Code 93), Naval Air Engineering Center, Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 9150

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MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-290	Packaging of Petroleum and Related Products

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

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 217	Cone Penetration of Lubricating Grease
ASTM D 2265	Dropping Point of Lubricating Grease Over Wide Temperature Range
ASTM D 2595	Evaporation Loss of Lubricating Greases Over Wide Temperature Range
ASTM D 2596	Extreme-Pressure Properties of Lubricating Grease (Four-Ball Method)
ASTM D 3336	Performance Characteristics of Lubricants Greases in Ball Bearings at Elevated Temperatures

(Application for copies should be addressed to the American Society for Testing and Material, 1916 Race Street, Philadelphia, PA 19103).

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. The grease furnished under this specification shall be products which are qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.3.1 and 6.3).

3.2 First article. The contractor shall furnish samples for first article inspection when specified (see 4.5, 6.2.1e).

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3.3 Materials. The composition of the grease is not limited, except that it shall contain a suitable corrosion inhibitor and no graphite or powdered metal.

3.4 Physical properties. The finished grease shall conform to the requirements specified in Table I and 3.4.1.

TABLE I. Physical properties.

Characteristics	Requirements	Test paragraph
Penetration, worked	300-345	4.7.2
Dropping Point, °C minimum	232	4.7.2
Salt spray (galvanic corrosion)	Pass 1/	4.7.2
Boiling water immersion after 10 minutes	Pass 2/	4.7.2
Evaporation, at 177°C percent weight loss, maximum	11	4.7.2
Grease Life, 3,400 RPM Modified bearing speed @ 260°C, hours to failure, minimum	100	4.7.2
Load carrying ability load wear index, kgf, minimum	60	4.7.2
weld load, kgf 3/	400	4.7.2
after 24 hours @ 150°C	800	4.7.2
Storage stability, after 6 months at 38° ± 3°C maximum 4/	30 points	4.7.3
Grease solidification at 205°C 260°C and 370°C maximum during 3 cycles each	1000 psi	4.7.4
High Temperature Residue	Pass 5/	4.7.5

- 1/ After a test period of 48 hours, the steel disk shall show no corrosion in the area contacted by the brass clip. Slight corrosion in the area adjacent to the edge of the brass clip shall be acceptable.
- 2/ A thin film of oil or light scum shall not be cause for rejection.
- 3/ To convert from kilograms - force to newtons, multiply by 9.806.
- 4/ Change in test value from the original worked penetration.
- 5/ After allowing to cool to room temperature, plates will be easily separated with spatula. Residue will be dry, friable, and flaking. When wiped, leaves a highly polished slippery surface.

3.4.1 Service test. The service test shall be initiated upon completion of all laboratory tests. The grease shall be found to be acceptable when subjected to field evaluation, as specified in 4.7.6.

3.5 Workmanship. The grease shall be manufactured by such processes as to produce a homogenous and uniform product suitable for the purposes intended.

3.6 Material safety data sheets. Material safety data sheets shall be prepared and submitted in accordance with FED-STD-313. The grease shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the

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contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting agency (see 4.3.2 and 6.2.1f).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.3).
- b. First article inspection (see 4.4).
- c. Quality conformance inspection (see 4.5).

4.3 Qualification inspection

4.3.1 Qualification sample

4.3.1.1 Laboratory inspection sample. The laboratory inspection sample shall consist of one 4.54 kg can of grease. The sample shall be forwarded to the Aircraft and Crew Systems Technology Directorate, Naval Air Development Center (Code 60612), Warminster, PA 18974 (qualifying activity). The sample shall be plainly identified by a securely attached durable tag or label marked with the following information:

Sample for qualification inspection
 Grease, High Temperature, Catapult System
 Name of manufacturer
 Product code number
 Batch number
 Date of manufacture
 Submitted by (name) (date) for qualification inspection in
 accordance with DOD-G-85733(AS) under authorization of (reference
 authorizing letter) (see 6.3).

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4.3.1.2 Service test samples. Service test samples shall be forwarded in accordance with instructions contained in the authorizing letter granting service test, which will be sent to the manufacturer on satisfactory completion of all laboratory tests. The activity to perform the testing shall be designated by the qualifying laboratory. The supplier shall provide a 150kg of grease to the designated test facility for this evaluation. In addition to the identification in 4.3.1.1 each sample container shall be labeled in 5.08 cm bold lettering with the words SERVICE TEST SAMPLE, GREASE, HIGH TEMPERATURE, CATAPULT SYSTEM.

4.3.2 Test reports. Two copies of the manufacturer's test report, containing complete quantitative test data showing that material submitted for qualification conforms to the requirements of this specification, shall be submitted with the qualification sample. The test report shall also contain location and identity of the plant which produced the sample tested. Material safety data sheets shall be prepared in accordance with FED-STD-313 and submitted with the test reports.

4.3.3 Retention of qualification. In order to retain qualification of a product approved for listing on the Qualified Products List (QPL), the manufacturer shall verify by certification to the qualifying activity, that the manufacturer's product complies with the requirements of this specification. The time of periodic verification by certification shall be in two-year intervals from the date of original qualification. The Government reserves the right to re-examine the qualified product whenever deemed necessary to determine that the product continues to meet any or all of the specification requirements.

4.3.4 Qualification inspection tests. Qualification inspection tests shall be as specified in Table II.

TABLE II. Qualification inspection tests.

Inspection	Paragraph	
	Requirement	Test method
Penetration, worked	3.4	4.7.2
Dropping Point	3.4	4.7.2
Salt spray	3.4	4.7.2
Boiling water immersion	3.4	4.7.2
Evaporation	3.4	4.7.2
Grease Life	3.4	4.7.2
Load carrying ability	3.4	4.7.2
Storage stability	3.4	4.7.3
Grease solidification	3.4	4.7.4
High Temperature Residue	3.4	4.7.5
Service Test	3.4.1	4.7.6

4.4 First article inspection. The manufacturer when specified shall submit to the Qualifying Laboratory (4.3.1.1) two 2.27 Kg samples and one 150 kg sample of grease taken from the first production lot of grease processed under the first contract or order after the product has passed qualification inspection (see 6.3). The tests to be performed shall be at the discretion of the Qualifying Laboratory but shall be limited to the requirements of 3.4 and

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3.5 and the test methods of 4.7.2 through 4.7.6. Delivery of the grease shall not be delayed pending completion of testing on the first article samples by the Qualifying Laboratory. The samples shall be plainly identified by securely attached durable tags or labels marked with the following information:

Sample for First Article Inspection
Grease, High Temperature, Catapult System
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Name of Manufacturer
Date of Manufacture
Lot (Batch) Number

4.5 Quality conformance inspection. The quality conformance inspection of the grease shall consist of all examinations and tests required under this specification except for storage stability and service test.

4.5.1 Lot formation. A lot shall consist of all the grease produced by one manufacturer, at one plant, from the same materials, and under essentially the same conditions provided the operation is continuous and does not exceed a 24 hour period. In the event the process is a batch operation, each batch shall constitute a lot (see 6.4).

4.5.2 Sampling.

4.5.2.1 For examination of filled containers. A random sample of filled containers, fully prepared for delivery, shall be selected from each lot of grease in accordance with MIL-STD-105, inspection level I, acceptable quality level (AQL), 2.5 percent defective.

4.5.2.2 For tests. The sample for tests shall consist of two 2.27 Kg samples of grease taken at random from filled containers from each lot of grease. The lot shall be unacceptable if either sample fails to comply with any of the requirements for the tests specified in 4.7.2 and 4.7.4.

4.6 Test conditions. Test conditions shall be in accordance with 4.7 and the physical values specified in section 3 apply to the average of determinations made on the sample.

4.7 Methods of examinations and tests.

4.7.1 Examinations. Each of the filled containers, selected in accordance with 4.5.2.1, shall be examined for defects of the container and closure, for evidence of leakage, and for unsatisfactory markings to determine conformance with 5.1. Each sample container shall also be weighed to determine the amount of contents. If the number of defective containers exceeds the acceptance number of the sampling plan specified in 4.5.2.2, the lot shall be rejected.

4.7.2 Tests. The samples, selected in accordance with 4.5.2.2, shall be tested in accordance with Table III to determine conformance with the requirements specified in 3.4.

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TABLE III. Methods of Tests.

Characteristics	FED-STD-791 Method	ASTM
Penetration, worked	-	D217
Dropping point	-	D2265
Salt Spray	5322 1/	-
Boiling water immersion	3463 2/	-
Evaporation	-	D2595
Grease Life	-	D3336
Load Carrying ability 3/	-	D2596

- 1/ Test cabinet and temperature shall be in accordance with method 4001 using a 5 percent salt concentration.
- 2/ Duration of test shall be 10 minutes. Specimen size shall be $5 \pm .1$ grams and 500 milliliters shall be the volume of water.
- 3/ For the second weld load test place a sufficient volume of the grease in a clean glass container for 24 hours in an oven at $149^\circ \pm 5^\circ\text{C}$.

4.7.3 Storage stability. The worked penetration after storage shall be determined on a sample of grease which has been stored in a 0.5 kg oil-tight container for 6 months at a temperature of $38^\circ \pm 3^\circ\text{C}$ subsequent to the original determination of the penetration. The penetration after storage shall be determined in accordance with ASTM D 217.

4.7.4 Grease solidification.

4.7.4.1 Apparatus. The solidification properties of the grease shall be determined using the test rig illustrated in Figure 1 that consists of a 5.08 cm x 5.08 cm x 10.16 cm steel block (A) modified to include a .64 cm grease channel (C) and a .32 cm x .16 cm groove (D) with a base plate (F) fastened to block (A). The grease shall be pumped through a grease fitting (B), into channel (C) and through groove (D) until a solid ribbon of grease exits from outlet parts (E, E'). The grease shall be pumped with a modified grease gun with a 10,000 psi pressure gauge (Figure 2).

4.7.4.2 Procedure. Grease shall be pumped through the test rig until all interior channels are filled with grease and then the rig shall be placed in an oven maintained at the required temperature for a 24 hour period. The test rig shall then be allowed to cool to room temperature and a measurement shall be made of the pressure required to force new grease through the test rig. This procedure shall be repeated over three cycles for each temperature. A pressure over 1000 psi during any cycle indicates significant grease composition degradation and constitutes a failure. The test shall be performed at 205°C, 260°C and 370°C.

4.7.5 High Temperature Residue.

4.7.5.1 Apparatus. The high temperature residue properties of the grease shall be determined using the test configuration illustrated in Figure 3. It consists of two steel plates (A) put together with a thin film of grease between them.

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4.7.5.2 Procedure. Place a small amount of grease between the plates and press evenly leaving a $1\text{mm} \pm 0.1\text{mm}$ film between the plates. Heat the plates for 24 hours at 260°C . After allowing to cool to room temperature, plates can be easily separated with a spatula. The residue will be dry, friable, and flaking. When wiped, leaves a highly polished and slippery surface. A fail criteria shall be the appearance of a gummy residue or a coke-like formation difficult to wipe away.

4.7.6 Service test. Service test shall consist of evaluating the functional suitability of the grease in the Low Loss Launch Valve installed in the catapult over a six month period.

5. PACKAGING

5.1 Preservation and packing. The grease shall be preserved and packed in accordance with MIL-STD-290. The type and size of the containers and the level of preservation and packing shall be as specified by the acquisition activity (see 6.2).

5.2 Marking. In addition to any special marking required by the contract or order, shipping containers and palletized unit loads, when applicable, shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The high temperature grease is intended for use at temperatures of -29°C to 260°C and brief exposure to temperatures up to 370°C . This lubricant is intended for use with low loss launch valves on a catapult launching engine.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification
- b. Quantity desired
- c. Size and type of container (see 5.1)
- d. Applicable levels of preservation and packing (see 5.1)
- e. First article, when specified
- f. Specify FAR clauses 52.223-3

6.3 Qualification. With respect to products requiring qualification, awards may be made only for products which are, at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List, whether or not such products have actually been so listed by that date. The attention of the contractors is called to this statement and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is Commander, Naval Air Systems Command, Attn: AIR-5304C, Washington, DC 20361; however, information pertaining to qualification of products may be obtained from the Ship and Shore Installation Engineering Department, Code 91234, Naval Air Engineering Center, Lakehurst, NJ 08733-5100.

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6.4 Batch. A batch is defined as that quantity of material which has been manufactured by some unit chemical process and subjected to some physical mixing operation intended to make the final product substantially uniform.

6.5 Subject term (keyword) listing.

Catapult systems
Catapult launch valves
Grease
Grease, high temperature

Preparing activity:
Navy - AS
(Project No. 9150-N755)

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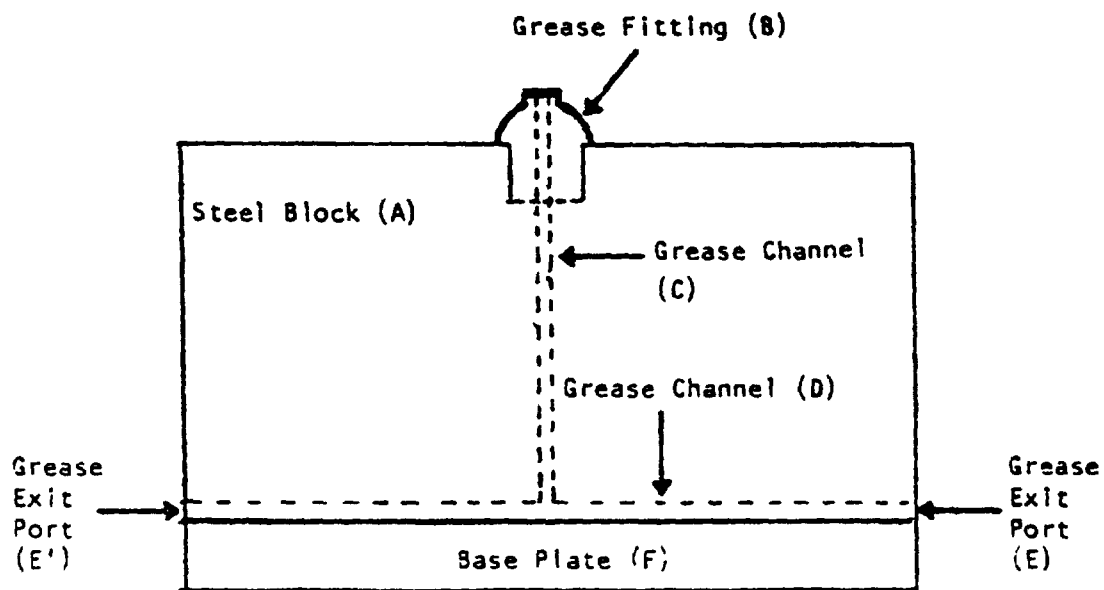


FIGURE 1. Test Configuration used for Measuring Grease Solidification Properties

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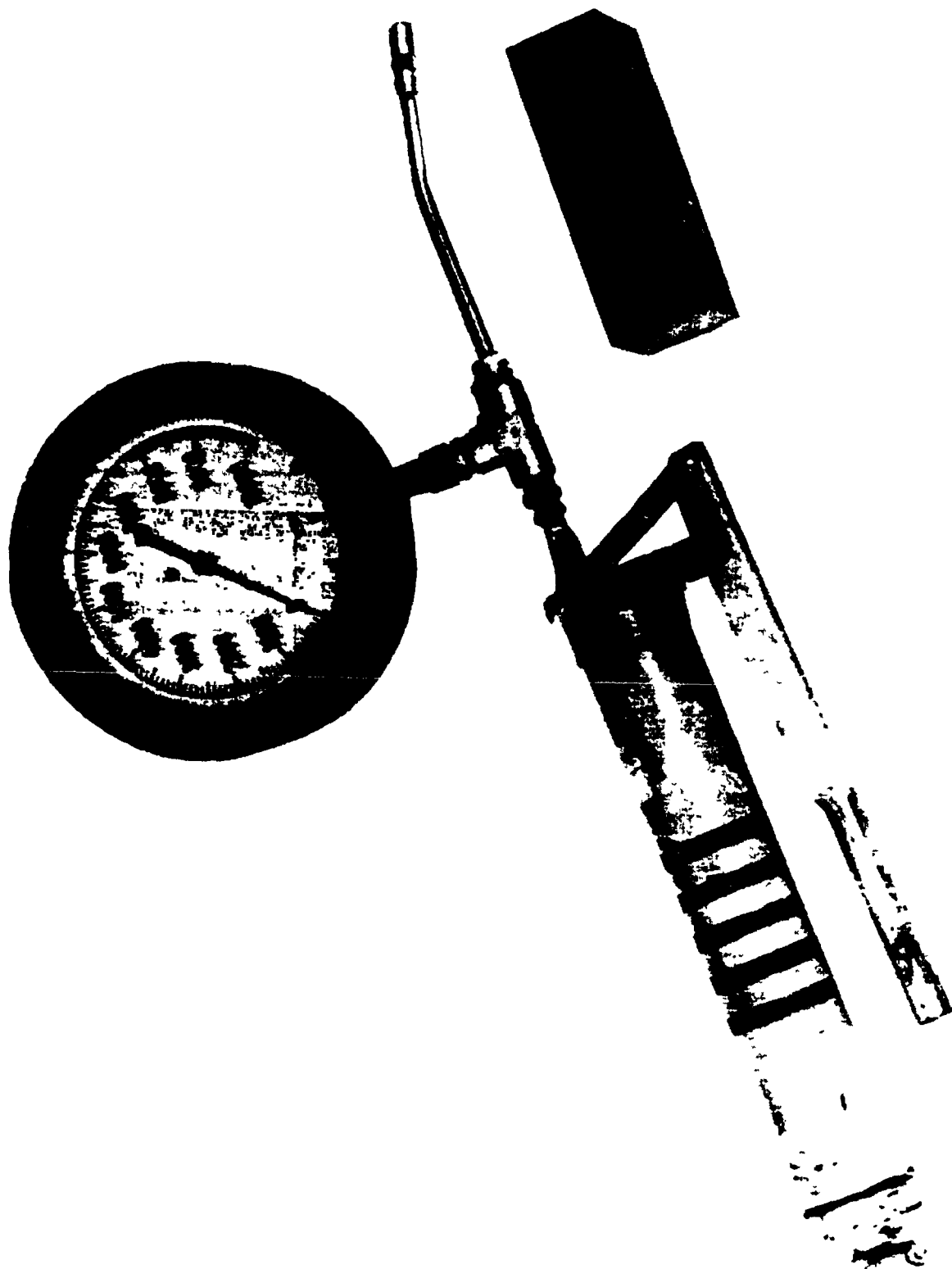


FIGURE 2 Test Rig and Grease Gun Used to Measure Grease Solidification Properties

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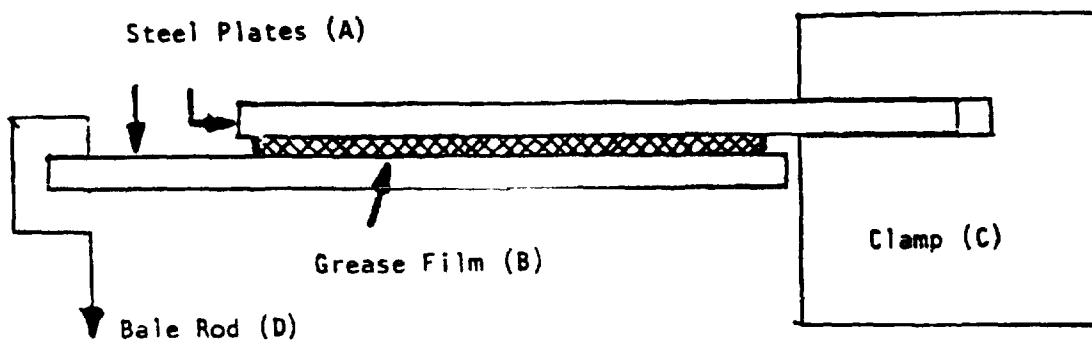


FIGURE 3. Test Configuration Used for High Temperature Residue Test

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NOTE This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

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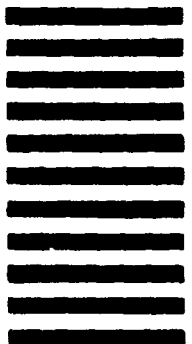
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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1 DOCUMENT NUMBER DOD-G-85733(AS)		2 DOCUMENT TITLE GREASE, HIGH TEMPERATURE, CATAPULT SYSTEM	
3a. NAME OF SUBMITTING ORGANIZATION		4 TYPE OF ORGANIZATION (Mark one) <input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER (Specify) _____	
b ADDRESS (Street, City, State, ZIP Code)			
5 PROBLEM AREAS			
a. Paragraph Number and Wording			
b. Recommended Wording			
c. Reason/Rationale for Recommendation			
6 REMARKS			
7a NAME OF SUBMITTER (Last First MI) - Optional		b WORK TELEPHONE NUMBER (Include Area Code) - Optional	
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