

MIL-S-81087C

~~27 April 1981~~

SUPERSEDING

MIL-S-81087B

24 November 1976

MILITARY SPECIFICATION

SILICONE FLUID, CHLORINATED PHENYL METHYL POLYSILOXANE,
NATO CODE NUMBER H-536

This specification is approved for use by all Departments
and Agencies of the Department of Defense

1. SCOPE

1.1 Scope. This specification covers one type of chlorinated phenyl methyl polysiloxane fluid for use over a wide temperature range and having a high thermal stability (see 6.1). This silicone fluid is identified by NATO Code Number H-536 (see 6.4).

2. APPLICABLE DOCUMENTS

2.1 Issues of documents The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

FEDERAL

QQ-A-250/4	-Aluminum Alloy 2024, Plate and Sheet
QQ-S-698	-Steel, Sheet and Strip, Low-Carbon
QQ-S-766	-Steel Plate, Sheet and Strip-Corrosion Resisting
PPP-P-704	-Pails, Metal (Shipping, Steel 1 through 12 Gallons)

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MIL-B-26701	-Bottles, Screw Cap and Carboy, Polyethylene Plastic
MIL-D-43703	-Drums, Shipping and Storage, Molded Polyethylene

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

FSC 9150

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STANDARDS

FEDERAL

- FED STD 313 -Material Safety Data Sheets, Preparation and Submission of
- FED STD No 791 -Lubricants, Liquid Fuels, and Related Products, Methods of Testing

MILITARY

- MIL-STD-105 -Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-290 -Packaging, Packing and Marking of Petroleum and Related Products

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific acquisition functions should be obtained from the acquiring 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 indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM D 92 -Flash and Fire Points by Cleveland Open Cup, Test for
- ASTM D 97 -Pour Point of Petroleum Oils, Test for
- ASTM D 270 -Petroleum and Petroleum Products, Sampling
- ASTM D 445 -Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculations of Dynamic Viscosity), Test for
- ASTM D 974 -Neutralization Number by Color-Indicator Titration, Test for
- ASTM D 1298 -Density, Specific Gravity, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method, Test for
- ASTM D 1500 -Color of Petroleum Products (ASTM Color Scale), Test for
- ASTM D 2266 -Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method), Test for

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

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FOOD AND DRUG ADMINISTRATION

Federal Hazardous Substance Labeling Act (Public Law 86-613)

(Application for copies should be addressed to the Food and Drug Administration, Washington, DC 20204).

3. REQUIREMENTS

3.1 Qualification. The silicone fluid furnished under this specification shall be a product which is qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.4 and 6.3). The material supplied under contract shall be identical, within manufacturing tolerances, to product receiving qualification. Any change in the formulation of a qualified product will necessitate its requalification.

3.2 Material. The silicone fluid shall be a methyl chlorophenyl polysiloxane conforming to the requirements of this specification.

3.3 Chemical and physical requirements. The finished silicone fluid shall conform to the requirements specified in Table I

TABLE I. Chemical and physical requirements.

Requirements	Limits	Test Paragraph
Color, ASTM Standard No., max.	0 5	4 6.2
Viscosity, Centistokes		4 6 2
@-55° C (-67° F), max	3,500	
@ 40° C (104° F)	50-60	
@ 100° C (212° F)	15-19	
Pour point, max.	-75° C (-103° F)	4.6.2
Flash point, min.	290° C (554° F)	4 6 2
Fire point, min.	340° C (644° F)	4.6 2
Specific gravity @ 25°/25° C (77°/77° F)	1.03-1 06	4 6 2
Acid number, mg. KOH/g fluid, max	0 05	4 6.2
Lubricity, wear scar, mm, max	0 60	4 6 2
Volatility, percent weight loss, max	1 0	4 6.3
Gel time, 72 hrs @250° ±5° C (482° ±9° F)	No Gelling	4 6.4
Viscosity after gel test	700	
@40° C (104° F), Centistokes, max		
Oxidation and corrosion stability		4.6.5
Change in weight of each metal mg/sq cm., max	±0 10	
Change in viscosity @40° C (104° F), percent, max	±10	
Increase in acid number, max	0 20	
Corrosivity 1/	None	

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TABLE I (Continued)

Requirement	Limits	Test Paragraph
Solid particle contamination		4 6.6
Allowed number, max <u>2</u> /		
Particle size - 10-25 microns	5,000	
Particle size - 26-50 microns	500	
Particle size - 51-100 microns	75	
Particle size - over 100 microns	15	
Storage stability		4.6.7
Viscosity, after 6 wks @40° C (104° F), Centistokes	50-60	

1/ There shall be no pitting, etching, or visible corrosion on the surface of the metals when viewed under a magnification of 20 diameters. Staining (blackening of the surface) on mild steel shall not be cause for rejection

2/ For the automatic counting method, the allowable particles for the 10-25 micron range shall not exceed 10,000 particles

3 4 Toxicity The silicone fluid shall have no adverse effect on the health of personnel when used for its intended purpose Questions pertaining to the toxic effects shall be referred by the acquiring activity to the appropriate departmental medical service who will act as an advisor to the acquiring activity (see 4 6 8)

3.5 Workmanship The silicone fluid shall be manufactured by such processes as to produce a homogeneous and uniform product suitable for the purpose intended (see 4 6 9)

4 QUALITY ASSURANCE PROVISIONS

4 1 Responsibility for inspection Unless otherwise specified in the contract or purchase order, 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, unless disapproved by the Government The Government reserves the right to 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 2 Classification of inspections The inspection requirements specified herein are classified as follows

- 1 Qualification inspection (4 4)
- 2 Quality conformance inspection (4.5).

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4.3 Sampling.

4.3.1 Qualification inspection sample. The qualification sample taken in a clean-room environment shall consist of four 1-quart containers of silicone fluid. The manufacturer shall supply the qualifying laboratory with certified statements of prior tests showing that the sample being submitted conforms with all the requirements of this specification. Material Safety Data Sheets (3.4) shall also be prepared and submitted to the qualifying laboratory in accordance with FED-STD-313. The samples and reports shall be forwarded to the Naval Air Development Center, (Code 60612) Warminster, PA 18974. (qualifying laboratory) The samples shall be plainly identified by securely attached durable tags or labels marked with the following information:

Sample for qualification inspection
 SILICONE FLUID, CHLORINATED PHENYL METHYL POLYSILOXANE
 MIL-S-81087C
 Name of manufacturer
 Product code number
 Date of manufacture
 Submitted by (name) (date) for qualification inspection in
 accordance with the requirements of MIL-S-81087C under
 authorization of (reference authorizing letter) (see 6.3)

4.3.2 Quality conformance inspection samples The quality conformance inspection sample shall consist of a sample for tests (4.3.2.3), samples for examination of filled containers (4.3.2.4) and samples for determination of solid particle contamination count (4.3.2.5). Samples shall be labeled completely with information identifying the purpose of the sample, name of product, specification number, lot (batch) number, date of sampling, and contract number. Information samples (4.3.2.6) shall be forwarded to the qualifying activity (4.3.1). The samples shall be plainly identified by securely attached durable tags or labels marked with the following information:

Sample for Information
 Silicone Fluid, Chlorinated Phenyl Methyl Polysiloxane
 MIL-S-81087C
 Name of manufacturer
 Product code number
 Date of manufacture
 Lot (batch) number

4.3.2.1 Bulk lot A bulk lot (batch) is an indefinite quantity of a homogeneous mixture of material manufactured in a single plant run through the same processing equipment, with no change in ingredient material.

4.3.2.2 Packaged lot A packaged lot is an indefinite number of unit containers of identical size and type, offered for acceptance, and filled with homogeneous mixture of material from one isolated container, or filled with a homogeneous mixture of material manufactured in a single plant run.

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through the same processing equipment, with no change in ingredient material

4.3 2 3 Sample for tests A composite sample of silicone fluid in sufficient quantity to complete all quality conformance tests of this specification shall be taken from each lot in accordance with ASTM D 270. This sample shall be subjected to all the applicable quality conformance inspections. If the sample fails any of the quality conformance inspections, the inspection lot shall be rejected.

4.3 2 4 Sample for examination of filled containers. A random sample of filled unit containers and sample shipping containers fully prepared for delivery shall be selected from each lot of fluid in accordance with MIL-STD-105 at inspection level I and acceptable quality level (AQL) = 2.5 percent defective.

4.3 2 5 Sample for determination of solid particle contamination. Samples of filled and sealed containers shall be taken at such intervals as to be representative of each day's operation. The number of samples taken each day shall be the cube root (to the nearest whole number) of the total number of containers filled that day. The sample size and number of determinations (tests) per sample container shall be as follows:

1-quart (946.3 milliliters) Container - 100 milliliters, 1 test
5-gallon (18,925 litres) Container - 300 milliliters, 3 tests

The 1 quart container shall be thoroughly shaken immediately prior to withdrawing any sample. The 5 gallon container samples shall be withdrawn within 5 minutes after the container has been rolled on a mechanical roller for 3 minutes.

4.3 2 5 1 Conformation sample Any conformation of conformance samples for solid particle contamination testing shall be limited to a maximum of one-half the cube root (to the nearest whole number) of the total number of containers in the lot submitted for inspection.

4.3 2 6 Information sample The information sample shall consist of two 1-quart samples from each lot submitted for inspection.

4.4 Qualification inspection Qualification inspection shall consist of a review for approval of the submitted manufacturer's report and subjecting the qualification samples (4.3.1) to examination and testing in accordance with Table II. Materials and Safety Data Sheets (3.4) shall be prepared and submitted to the Qualifying Laboratory (4.3.1) in accordance with FED-STD-313.

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TABLE II Qualification inspection

Inspection	Requirement paragraph	Test Method paragraph
Color	3 3	4 6 2
Viscosity	3 3	4 6 2
Pour point	3 3	4 6 2
Flash point	3.3	4 6.2
Fire point	3 3	4.6 2
Specific gravity	3 3	4 6.2
Acid number	3.3	4.6 2
Lubricity	3 3	4 6.2
Volatility	3.3	4 6.3
Gel time	3 3	4 6 4
Oxidation and corrosion stability	3 3	4 6 5
Solid particle contamination	3 3	4 6 6
Storage stability	3 3	4.6.7
Toxicity	3.4	4 6 8
Workmanship	3.5	4 6.8

4.4 1 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 two-year intervals from the date of original qualification. The Government reserves the right to reexamine the qualified product whenever deemed necessary to determine that the product continues to meet any or all of the specification requirements.

4.5 Quality conformance inspection Quality conformance inspection shall consist of testing the sample for test (4 3 2 3) for all the requirements specified in section 3 (except toxicity (3 4) and storage stability (3 5)), examination of the samples of filled containers (4 3 2 4) for conformance with 5.1 and testing the sample for determination of solid particle contamination (4 3 2 5) for conformance with 3 3.

4.6 Methods of inspection test

4.6 1 Condition of inspection Unless otherwise specified, all inspections shall be conducted on the silicone fluid at a temperature of 25° ±2°C (77° ±3°F). Inspection shall be in accordance with Method 9601 of Federal Test Method Standard No. 791.

4.6 2 Test methods Tests shall be performed in accordance with Table III and paragraphs 4 6 3 through 4 6 9. Unless otherwise specified, physical and chemical values specified in section 3 apply to the average of the determinations made on the samples for those values which fall within any stated repeatability or reproducibility limits of the applicable inspection method.

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TABLE III Test Methods

Test	ASTM
Color	D1500
Viscosity	D445
Pour point	D97
Flash and fire point	D92
Specific gravity	D1298
Acid number <u>1/</u>	D974
Lubricity <u>2/</u>	D2266

1/ ASTM D974 shall be modified as follows. The solvent shall consist of equal volumes of toluene and n-butanol to which is added 6 ml of 0.5 percent bromocresol purple indicator per gallon. Before being added to the weighed sample of fluid, the solvent shall be neutralized by titration with 0.05 N alcohol KOH to a greenish-blue color. The samples shall be titrated to the same color.

2/ Except use a 50 kilogram load, approximately 25° C (77° F) Test Temperature and a speed of 600 revolutions per minute.

4.6.3 Volatility The following procedures shall be conducted. Weigh samples of 2.0 ± 0.2 grams (gm) of fluids into clean tared 50-ml pyrex beakers, all weights to ± 0.001 gm precision. Heat 24 hours at 150° ± 5° C (302 ± 9° F) in a circulating air oven. Cool in desiccator and reweigh. Then calculate as follows:

$$\text{Percent volatility} = \frac{W_1 - W_2}{W_1 - T} \times 100$$

Where W_1 = first gross weight
 W_2 = gross weight after heating
 T = tare of beaker

Run samples in triplicate and report average of two or more. If closest two results differ by more than 0.6 percent, repeat the test.

4.6.4 Gel time The following procedure shall be performed. Weigh 40 ± 5 gm of the fluid in tared 150-ml beakers and heat in a circulating air oven at 250° ± 5° C (482° ± 9° F) continuously for 72 ± 1 hours. The samples shall be inspected periodically until gelling occurs or until the time requirement is exceeded. Viscosity of the sample at 40° C (104° F) shall be determined at the end of the 72 hour test period. This test shall be run in duplicate. It is essential that the beakers used in this test be absolutely clean. A recommended cleaning procedure is as follows:

- 1 Wash beakers thoroughly with laboratory detergent and then rinse well to remove all traces of alkali.

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- 2 Rinse well with distilled water.
3. Rinse twice with isopropanol.
- 4 Rinse with acetone.
- 5 Dry in oven for 5 minutes.

4.6.5 Oxidation and corrosion stability The oxidation corrosion stability shall be determined in accordance with Method 5308 of Federal Test Method Standard No. 791, except that the test shall be conducted for 72 hours at $205^{\circ} \pm 3^{\circ}\text{C}$ ($401^{\circ} \pm 5^{\circ}\text{F}$)

The test specimens shall consist of the following metals. Stainless steel, type 410 (QQ-S-766); aluminum alloy, QQ-A-250/4, temper T-3 or T-4, titanium A-70; anode silver, 99.9 percent; and mild steel, QQ-S-698. These specimens shall be arranged in the form of a parallelogram with the silver specimen as the diagonal contacting the aluminum, stainless-steel vertex and the mild steel titanium vertex. The sample of finished product used in this test shall be tested for viscosity change and increase in Acid Number in accordance with 4.6.2.

4.6.6 Solid particle contamination Solid particle contamination shall be determined by testing in a clean dust-free environment in accordance with Method 3009 of Federal Test Method Standard No. 791, modified by using a 100-ml test sample of the silicone fluid and omitting the blank determination. Recorded observation shall include type, size, and distribution of any solid particles found on the grid filter. Particulate contamination may also be measured by the use of automatic particle counters in lieu of the optical procedure detailed in Method 3009 (see 6.4). Hi Ac Counter Model PC-203, PC-202, PC-305 or PC-320 specified for 5-channel counting, or equal, shall be used. Directions in the manual for respective instruments shall be followed (see 6.2.2.3). In case of a dispute between results of the different test methods authorized, a referee sample shall be taken. The referee sample shall be tested using the automatic particle counter method. In the case of testing samples from 5-gallon containers, the arithmetic average of the results of the three tests shall be considered the test result.

Should the particle count on any individual sample be considered excessive, two additional determinations on another sample from the same container may be used. The containers shall be thoroughly shaken immediately prior to withdrawing each 100-ml portion for such additional determinations. The arithmetic average of the two closer particle counts shall be considered the particle count for that sample.

After repeated counts, should the particle count of any individual container exceed the Table I limits, the case from which the quart bottle was selected or the 5-gallon container shall be rejected. Additional samples shall be taken from the cases or 5-gallon containers filled before and after the rejected case or 5-gallon container and tested for conformance with paragraph 3.3. This shall be done to isolate the contaminated case or 5-gallon container.

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4.6.7 Storage stability A 500 ml sample shall be stored at 40° C (104° F) for 6 weeks. Following storage period, the sample shall be tested for viscosity in accordance with 4.6.2.

4.6.8 Toxicity The contractor shall furnish the Toxicological data and formulations required to evaluate the safety of the material for the proposed use (see 4.4).

4.6.9 Examination of filled containers Each sample of filled container and shipping container shall be examined for defects of construction of the container and closure, evidence of leakage, improper quantity of contents, and unsatisfactory marking. Any container in the sample having one or more defects or under required fill shall be rejected, and if the number of defective containers in any sample exceeds the acceptance number for the appropriate sampling plan of MIL-STD-105, the lot represented by the sample shall be rejected. Rejected lots may be resubmitted provided that the contractor has removed or repaired all nonconforming containers.

5 PACKAGING

5.1 Packaging and packing The packaging and packing of the fluid shall be Level A, B, or commercial, as specified in the contract or order (see 6.2) in accordance with MIL-STD-290. Unless otherwise specified, the fluid shall be furnished in quart plastic bottles (without handles) conforming to MIL-B-26701 and 5-gallon steel containers conforming to PPP-P-704 or 5-gallon plastic containers conforming to MIL-D-43703. The quantity of the fluid, in gallons shall be as specified in the contract or order (see 6.2). All materials used in the construction of the containers shall be such as will not affect or be affected by the contained silicone fluid. Just prior to filling, all containers shall be examined to insure absolute absence of dirt, fibers, lint, water, or other foreign contaminants. Filled containers shall be sampled in accordance with 4.3.2.4 and examined in accordance with 4.6.9.

5.2 Additional marking In addition to the markings specified in MIL-STD-290, the following note shall appear on each container:

THIS FLUID SHOULD NOT BE MIXED WITH ANY OTHER LUBRICATING OIL (OR HYDRAULIC FLUID). WHEN REPLACING ANOTHER OIL WITH THIS FLUID, PARTS MUST BE DISASSEMBLED AND THOROUGHLY CLEANED WITH FRESH SOLVENT.

5.2.1 Labeling Labeling shall be in accordance with appropriate Federal Statutes and Regulations, e.g., Federal Hazardous Substance Labeling Act (Public Law 86-613), or as prescribed by the processing agency upon advice and recommendations of the departmental medical services.

6 NOTES

6.1 Intended use The silicone fluid is intended for use in lubricating, hydraulic, damping, and related applications over a wide temperature range including

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- a Hydraulic systems and servomechanisms.
- b Crankcases and gear boxes for mechanical drives and compressors, engines, and pumps
- c. Ball, sleeve and pivot bearings in instruments, electronic equipment, electrical motors, etc.
- d. Clocks and timing devices.
- e. Fluid transmissions.

NOTE Substitution of this fluid in systems or components designed for other fluid types should be avoided, unless service performance confirms its suitability.

NOTE This silicone fluid is not intended for general purpose applications.

6 1.1 Under conditions of exposure to air, this fluid is suitable for use in the -75° to $+220^{\circ}$ C (-103° to $+428^{\circ}$ F) temperature range For use in an inert atmosphere (air absent), this fluid is suitable for use in the -75° to $+260^{\circ}$ C (-103° to $+500^{\circ}$ F) temperature range.

6 1.2 Contamination

CAUTION

This silicone fluid should not be mixed with any other lubricating oil or hydraulic fluid. In many cases, other oils or the additives they contain are insoluble or immiscible with this special silicone. Mixing with insoluble or immiscible oils can cause crystalline or gummy deposits and residues which can lead to mechanical failure When replacing other oil with this fluid, mechanical parts must be disassembled and thoroughly cleaned with fresh solvent such as Stoddard solvent, mineral spirits, or toluene

6 2 Ordering data Acquisition documents should specify

- a Title, number, and date of this specification.
- b Type and size of containers (see 5 1)
- c Quantity (see 5 1)
- d Levels of packaging, packing, marking, and labeling, with requirements in detail (see 5 1 and 5 2)
- e Toxicological data requirements (see 3.4 and 4 4)
- f Contamination sample (see 4 3 2 5).

6 2 1 The fluid should be purchased by volume, the unit being a U S gallon (231 cubic inches) at 15.6° C (60° F)

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6.2.2 The following proprietary apparatus and materials or their equivalent may be used in the respective tests, where specified

6.2.2.1 Suitable Shell 4-ball wear testers are manufactured by the Roxanna Machine Works, St Louis, Missouri

6.2.2.2 The Millipore filter and accessories are manufactured by the Millipore Filter Corporation, Bedford, Massachusetts

6.2.2.3 Hi Ac Counter Model PC-203, PC-202 (see 4.6.6) may be obtained from the Hi Ac Instrument Division, Pacific Scientific Company, P O Box 3007, 4719 West Brooks Street, Montclair, CA 91763

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening 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 these requirements, 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 the Naval Air Systems Command, Department of the Navy, however, information pertaining to qualification of products may be obtained from the Aircraft and Crew Systems Technology Directorate, Naval Air Development Center, (Code 60612) Warminster, Pennsylvania 18974 (qualifying laboratory)

6.4 International standardization agreement. Certain provisions of this specification are the subject of an international standardization agreement with NATO (STANAG 1135 and 3713). When amendment, revision, or cancellation of this specification is proposed which will affect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels, including departmental standardization offices, if required.

6.5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodians

Army - ME
Navy - AS
Air Force - (11)

Preparing activity

Navy - AS
(Proj No 9150-0608)

International interest (see 6.4)

Reviewer activities:

Army - AV, AT, EL, MI
Air Force - (68)
DLA - PS

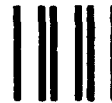
User activities

Army - WC
Navy - MC

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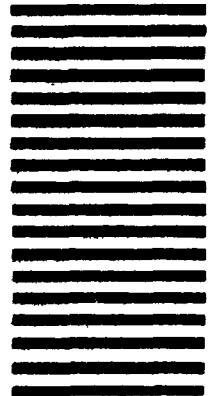
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