MIL-T-38219B(USAF)
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SUPERSEDING
MIL-T-38219A(USAF)
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MILITARY SPECIFICATION

TURBINE FUEL, LOW VOLATILITY, JP-7

This specification is approved for use by the Department of the Air Force and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers one grade of aviation turbine fuel designated JP-7.

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

Military

MIL-I-27686	Inhibitor, Icing, Fuel System

STANDARDS

Federal

FED-STD-313	Material Safety Data Sheets, Preparation and the Submission of
FED-STD-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 of Petroleum and Related Products

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASD/ENES, Wright-Patterson AFB, OH 45433-6503, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting 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. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

American Society of Testing and Material Publication

ASTM D86	Distillation of Petroleum Products, Standard Method for
ASTM D93	Flash Point by Pensky-Martens Closed Tester, Standard Test Methods for
ASTM D130	Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test, Standard Method for
ASTM D270	Sampling Petroleum and Petroleum Products, Standard Method of
ASTM D381	Existent Gum in Fuels by Jet Evaporation, Standard Test Method for
ASTM D445	Kinematic Viscosity of Transparent and Opaque Liquids (And the Calculation of Dynamic Viscosity) Standard Test Method for
ASTM D484	Hydrocarbon Dry Cleaning Solvents (Doctor Test)
ASTM D1094	Water Reaction of Aviation Fuels, Standard Test Method for
ASTM D1266	Sulfur in Petroleum Products (Lamp Method) Standard Test Method for
ASTM D1298	Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method, Standard Test Method for
ASTM D1319	Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption, Standard Test Method for
ASTM D2276	Particulate Contaminant in Aviation Turbine Fuels, Standard Test Method for
ASTM D2382	Heat of Combustion of Hydrocarbon Fuels by Bomb Calorimeter (High-Precision Method), Standard Test Method for
ASTM D2386	Freezing Point of Aviation Fuels, Standard Test Method for
ASTM D2550	Water Separation Characteristics of Aviation Turbine Fuels, Standard Test Method for
ASTM D3120	Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry, Standard Test Method for
ASTM D3227	Mercaptan Sulfur in Gasoline, Kerosine, Aviation Turbine, and Distillate Fuels (Potentiometeric Method), Standard Test Method for
ASTM D3241	Thermal Oxidation Stability of Aviation Turbine Fuels (JFTOT Procedure), Standard Test Method for
ASTM D3338	Estimation of Heat of Combustion of Aviation Fuels, Standard Method for
ASTM D3343	Estimation of Hydrogen Content of Aviation Fuels, Standard Method for
ASTM D3701	Hydrogen Content of Aviation Turbine Fuels by Low Resolution Nuclear Magnetic Resonance Spectrometry, Standard Test Method for
ASTM E77	Verification and Calibration of Liquid-in-Glass Thermometers, Standard Method for

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

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Preproduction. This specification provides for preproduction testing.

3.2 Materials. The fuel shall consist completely of hydrocarbon compounds except as otherwise specified herein, or as approved by the acquisition activity.

3.3 Chemical and physical requirements. The chemical and physical requirements of the finished fuel shall conform to those listed in section 3 and table I when tested in accordance with the applicable test methods. Requirements contained herein are absolute and are not subject to correction for tolerance of test methods.

3.3.1 Storage stability. The finished fuel shall conform to the requirements of section 3 and table I for at least one year when tested in accordance with 4.5.2.

3.4 Additives. The additives listed herein may be used singly or in combination in amounts not to exceed those specified (see 6.3). The type and amount of each additive used shall be reported. Additives other than those listed in the following paragraphs will be permitted only by special authorization from the acquisition activity.

3.4.1 Antioxidants. The following active inhibitors may be blended separately or in combination into the fuel in total concentration not in excess of 8.4 pounds of inhibitor (not including weight of solvent) per 1,000 barrels of fuel (9.1 g/100 US gal, 24 mg/liter or 109 mg/imp. gal (UK)) in order to prevent the formation of gum:

a. 2,6 ditertiary butyl, 4-methylphenol

b. 2,4 dimethyl, 6 tertiary butylphenol

c. 2,6 ditertiary butylphenol

d. Mixed tertiary butylphenol composition:
   75 percent 2,6 ditertiary butylphenol
   10 to 15 percent 2,4,6 tritertiary butylphenol
   10 to 15 percent ortho-tertiary butylphenol.

TABLE I. Chemical and physical requirements and test methods.

Requirements	Values	Test Method ASTM Standards
Aromatics, vol %, max	5	D1319
Mercaptan sulfur, wt %, max 1/	0.001	D3227
Sulfur, total wt %, max	0.1	D1266 or D3120
Distillation, deg C (deg F)		D86 2/
Initial boiling point, min. temp.	182 (360)	
10% Recovered, min. temp.	196 (385)	
20% Recovered, min. temp.	206 (403) 3/	
50% Recovered, max. temp.	Report	
90% Recovered, max. temp.	260 (500)	
End point, max. temp.	288 (550)	
Residue, vol %, max	1.5	
Distillation loss, vol %, max	1.5	
Flash point, min, °C (°F)	60 (140)	D93
Density, kg/m^3, min (°API, max) at 15°C	779 (50)	D1298
Density, kg/m^3, max (°API, min) at 15°C	806 (44)	D1298
Vapor pressure, kPa (psi) at 149°C, max	20.7 (3.0)	4/
Vapor pressure, kPa (psi) at 260°C, max	331 (48.0)	4/
Freezing point, deg C (deg F), max	-43.3 (-46)	D2386
Viscosity, at -20°C, centistokes, max	8.0 5/	D445
Heating value, net heat of combustion MJ/kg (Btu/lb), min	43.5 (18,700)	D2382, D3338
Hydrogen content, mass percent, min	14.4	D3343, D3701 6/
Copper strip corrosion, 100°C (212°F), max	1b	D130
Thermal stability		7/
JFTOT, change in pressure drop in 5 hours, mm Hg, max	25.0	
JFTOT, delta TDR Spun, max	12	
Existent gum, mg/100 ml, max	5.0	D381
Particulate matter (total solids)		D2276 8/
FOB origin deliveries, mg/l max	0.3	
FOB destination deliveries, mg/l max	0.5	

TABLE I. Chemical and physical requirements and test methods - Continued.

Requirements	Values	Test Method ASTM Standards
Water reaction, interface rating, max	1b	D1094
Separation rating, max	(1)	
Water separometer index, modified, min	85	D2550
Fuel system icing inhibitor		9/
Percent vol, max	0.15	
Percent vol, min	0.10	
Thermal precipitation rating, max	B-2	10/

1/ The mercaptan determination may be waived at the option of the inspector if fuel is "doctor sweet" when tested in accordance with ASTM D484 (sec 4c).

2/ A condenser temperature of 0°C to 4.4°C (32°F to 40°F) shall be used. To insure accurate IBP data the operator must cut back on the heating rate when the vapor/condensate ring rises to within about 25 mm (1 inch) of the vapor tube. The reduced heating rate allows the thermometer to more accurately reflect the true vapor temperature when the first condensate is collected.

3/ The temperature reading at the 20 percent recovered point shall be corrected for the emergent stem in accordance with ASTM E77, paragraph 13 (b).

4/ Test shall be performed in accordance with the vapor pressure test in appendix A.

5/ Until an ASTM thermometer calibrated for the -20°C condition becomes available, this test may be conducted at -34.5°C (-30°F) with a maximum allowable viscosity of 15.0 centistokes.

6/ Mass hydrogen content may be calculated using ASTM D3343 or measured using ASTM D3701. In case of conflict ASTM D3701 shall apply.

7/ For specific test conditions see 4.5.1.

8/ Filter not less than 3.79 1 (1 gal) of fuel to determine the total solids.

9/ Test shall be performed in accordance with FED-STD-791, method 5327.

10/ Thermal precipitation test shall be conducted in accordance with the procedure in appendix B. Color standards used are those specified for use with ASTM D2276, appendix A3.

3.4.2 Metal deactivator. A metal deactivator, N,N' - disalicylidene-1, 2 propanediamine, may be added in an amount not to exceed two pounds of active ingredient per 1,000 barrels of fuel (2.2 g/100 US gal, 5.8 mg/liter or 25 mg/imp gal (UK)).

3.4.3 Icing inhibitor. The fuel system icing inhibitor shall conform to MIL-I-27686.

3.4.4 Lubricity additive. A lubricity additive, PWA-536, shall be added in an amount not less than 200 parts per million (ppm) (weight/weight) and not more than 250 ppm (weight/weight).

3.5 Odor. The odor of the fuel shall not be nauseating or irritating. No substances of known dangerous toxicity under usual conditions of handling and use shall be present.

3.6 Material safety data sheets. Material safety data sheets shall be prepared and submitted in accordance with FED-STD-313. Material safety data sheets shall also be forwarded as specified in 4.6.

3.7 Workmanship. When examined visually, the finished fuel shall be water white, free from undissolved water, sediment, or suspended matter and shall be clean and bright at the ambient temperature or at 70°F whichever is higher.

4. QUALITY ASSURANCE PROVISIONS

4.1 *Responsibility for inspection.* Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, 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 and testing of the turbine fuel shall be classified as:

a. Preproduction inspection

b. Quality conformance inspection.

4.3 Preproduction inspections. Test requirements of 3.3.1 will be complied with prior to bid on any product required under this specification.

4.4 Quality conformance inspections. Quality conformance tests for the acceptance of individual lots shall consist of tests for all requirements specified in section 3 except storage stability.

4.4.1 Inspection lot

4.4.1.1 Bulk lot. A bulk lot is defined as an indefinite quantity of a homogeneous mixture of material offered for acceptance in a single isolated container; or manufactured in a single plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient material.

4.4.1.2 Packaged lot. A packaged lot is defined as an indefinite number of 55-gallon drums or smaller unit containers of identical size and type, offered for acceptance, and filled with a homogeneous mixture of material from one isolated container; or filled with a homogeneous mixture of material manufactured in a single plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient material.

4.4.2 Sampling

4.4.2.1 Packaged lot. Take a random sample of packed containers from each lot in accordance with MIL-STD-105 at inspection level II and acceptable quality level (AQL) = 2.5 percent defective. Examine the sample in accordance with 4.4.3.1.

4.4.2.2 Sampling for tests. Take samples for tests in accordance with ASTM D270. Test the samples in accordance with 4.5 for compliance with section 3 requirements.

4.4.2.3 Special samples. One 55-gallon drum of fuel from the first production lot that represents the product offered to the Government under an initial contract will be forwarded to the Air Force Wright Aeronautical Laboratory (POSF), Wright-Patterson AFB, OH 45433. Test data shall accompany the 55-gallon sample showing the results of tests required by 3.3. The Government will perform tests as necessary to confirm or validate the company's test results. Thereafter, at the option of the acquisition activity, a 55-gallon drum, or a sample acceptable to POSF, representative of each lot of fuel produced under any Government contract shall be forwarded to the same address cited above. A complete report of analysis shall be forwarded to the same address for all lots of fuel produced under any Government contract. Failure of any tests, conducted within 12 months after receipt of fuel sample, shall render the contractor ineligible for further contract award pending verification of the quality of the product to the satisfaction of the acquisition activity.

4.4.3 Inspection. Perform inspection in accordance with method 9601 of FED-STD-791.

4.4.3.1 Examination of the preparation for delivery. Examine samples taken in accordance with 4.4.2.1 for compliance with MIL-STD-290 with regard to fill, closure, sealing, leakage, packaging, packing, and marking requirements. Reject any container having one or more defects or under the required fill. If the number of defective or underfilled containers exceeds the acceptance number for the appropriate plan of MIL-STD-105, reject the lot represented by the sample.

4.5 Test methods. Tests to determine conformance to chemical and physical requirements shall be conducted in accordance with FED-STD-791 or ASTM standards, using the applicable methods as listed in table I, except for the following.

4.5.1 Thermal stability. The thermal stability test shall be conducted using ASTM D3241 (JFTOT), as modified below. The heater tube shall be rated for deposits using the Alcor Mark 8A Tube Deposit Rater (TDR) as modified in accordance with appendix C or the Alcor Mark 9 TDR (see 4.5.1.2a).

4.5.1.1 Test conditions

a. Heater tube temperature at maximum point: 355°C (671°F)

b. Fuel system pressure: 3.45, MPa (500 psig)

c. Fuel flow rate: 3.0 ml/minute

d. Test duration: 300 minutes

e. Quantity of test fuel: 1 liter

4.5.1.2 Test results. The fuel sample is acceptable if all the following criteria are met:

a. The maximum differential between the post test and the pretest TDR Spun rating does not exceed 12 TDR units. Both before and after the JFTOT test, the heater tube shall be rated at 2 mm increments over the length of the heater tube from 20 mm to 50 mm using the modified Mark 8A or Mark 9 TDR. The maximum delta increase in the TDR ratings (i.e., the maximum difference between the post test and pretest TDR rating) shall be reported. If the maximum increase in the TDR rating does not exceed 12 TDR units, the results are satisfactory.

b. The maximum differential pressure across the test filter shall be reported. The results are satisfactory if the differential pressure drop does not exceed 25 millimeters of mercury.

4.5.2 Storage stability. The storage stability test on the finished fuel shall be conducted by placing 53 gallons ±1 gallon of the fuel in a 55-gallon, 18-gauge, ICC 17E uncoated steel drum. The filled drum shall then be stored at 130°F for one year (12 months). At the end of the one-year (12-month) storage period, the product will be subjected to all of the test requirements of table I, as supplemented by section 4.

4.5.3 Vapor pressure. The vapor pressure test shall be conducted in accordance with appendix A.

4.6 Material safety data sheets. Material safety data sheets prepared as specified in 3.6 shall be submitted to the contracting activity.

5. PACKAGING

5.1 Packaging, packing, and marking. Packaging, packing, and marking shall be in accordance with contract requirements.

6. NOTES

6.1 Intended use. The JP-7 fuel covered by this specification is intended for use in aircraft gas turbine engines.

6.2 Ordering data. Acquisition documents should specify the following:

a. Title, number, and date of this specification

b. Method of delivery

c. One copy of the certificate of analysis listing those items in table I should be forwarded to the following organization for each batch of fuel acquired under this specification.

AFWAL/POSF
Wright-Patterson AFB, OH 45433.

d. The acquisition activity shall state if the contractor is to be required to submit a 55-gallon drum of fuel, or a sample acceptable to the Air Force Wright Aeronautical Laboratory (POSF) (see 4.4.2.3).

6.3 Precaution of mixing inhibitors. To prevent any possible reaction between the concentrated forms of different inhibitors (see 3.4), the fuel contractor is cautioned not to commingle inhibitors prior to their addition to the fuels.

6.4 Notice to contracting officers. The fuel covered by this specification is not intended for general acquisition. It is a limited production item to be consumed only by systems using engines that require this product. The contracting officer should contact the following organization if clarification of requirements is required:

AFWAL/POSF
Wright-Patterson AFB, OH 45433.

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.

Custodian:
Air Force - 11

Review activity:
Air Force 68

Preparing Activity:
Air Force - 11

Proj Nr 9130-F124

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APPENDIX A

VAPOR PRESSURE TEST

10. SCOPE

10.1 The test covered by this appendix is designed to determine the vapor pressure of JP-7 jet fuel by distillation and vapor reflux methods.

20. METHOD A - DISTILLATION

20.1 Perform distillation according to ASTM D86.

20.2 If 20 percent distillation point fails between 360°F and 420°F and there is not more than 50°F difference between the initial boiling point and 20 percent fuel evaporated point, read the vapor pressure directly from figure 1.

20.3 Record and report the results.

30. METHOD B - VAPOR REFLUX

30.1 Apparatus. The apparatus for this test shall include the following:

a. Vacuum pump

b. Powerstat

c. Magnetic stirrer, Teflon-coated stirring bar magnet

d. Heating mantle, Glas-Col 500 ml

e. Flask, pyrex round bottom, 500 ml, short neck T joint 24/40 with thermometer well

f. Pyrex T joints 24/30 and 10/30

g. Condenser, reflex, Friedrichs with T joint 24/30

h. Thermometer, mercury T joint 10/30, 75 mm, immersion 10°C to 250°C

i. Thermometer, mercury, 76 mm, immersion 10°C to 260°C

j. Manometer, U tube

k. Rubber tubing, vacuum and medium wall

l. Stopcock, needle valve, brass 1/4 inch

m. Condenser, cold finger, size 10, 300 mm

n. Dewar flask, vacuum.

30.2 Solutions. None.

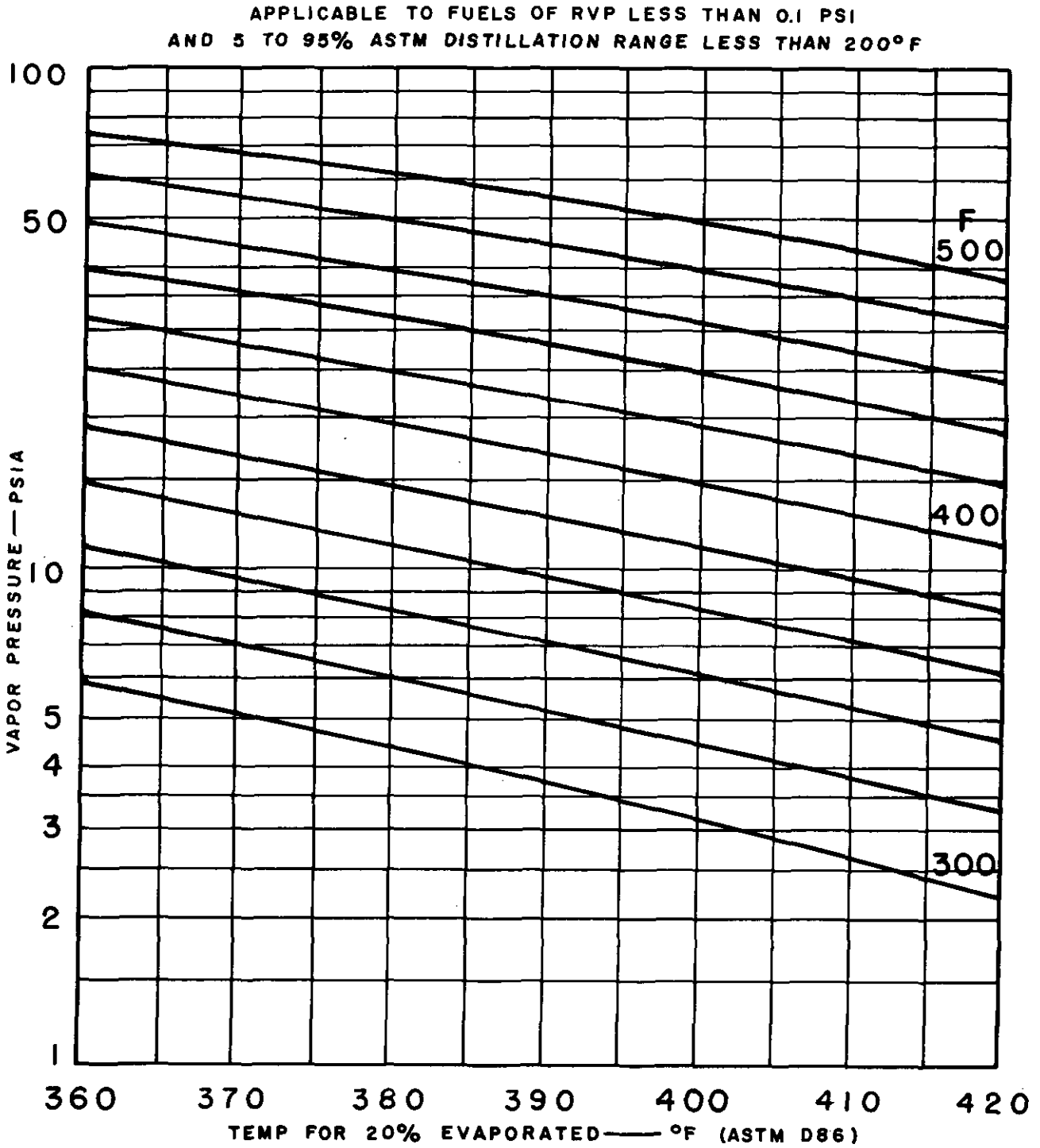

FIGURE 1. Vapor pressure reading - distillation method (see A20.2).

30.3 Procedure

a. Sample preparation

(1) Transfer 600 ml of the sample into a large separatory funnel.

(2) Shake the funnel for 1 to 2 minutes and then let contents settle for 15 to 20 minutes.

(3) Draw off lower 100 ml of fuel and discard.

b. Assemble apparatus in accordance with figure 2.

c. Place 300 ml of the prepared sample in the 500-ml flask.

d. Place ice around cold finger in the Dewar flask.

e. Begin the stirring action and carefully evacuate the system to degas the sample. The system shall be evacuated at ambient temperatures for a period of 10 minutes.

f. Control of temperature and pressure.

(1) Slowly increase the temperature of the contents of the flask by varying the powerstat.

(2) At no time shall the sample be allowed to bump the flask or boil up into the condenser.

(3) If the magnetic stirrer makes a thumping sound, an indication of too rapid increase in temperature, reduce the setting of the powerstat.

(4) A bleed valve is provided so that a continuous stable vacuum is maintained.

(5) With proper adjustment of temperature and pressure, a reflux action is noted within the neck of the condenser. (Refluxing shall be to the same height for each run.)

(6) When refluxing reaches an equilibrium at this level, the temperature of the reflux vapor will agree within 4°C of the liquid.

(a) If the two temperatures do not agree within 4°C, change the system pressure, increase temperature, and repeat temperature-pressure measurements until stable reflux conditions are met.

1/ Stable reflux conditions shall be those where the temperatures, pressure, and height of reflux in the condenser do not change on three successive readings at 3-minute intervals.

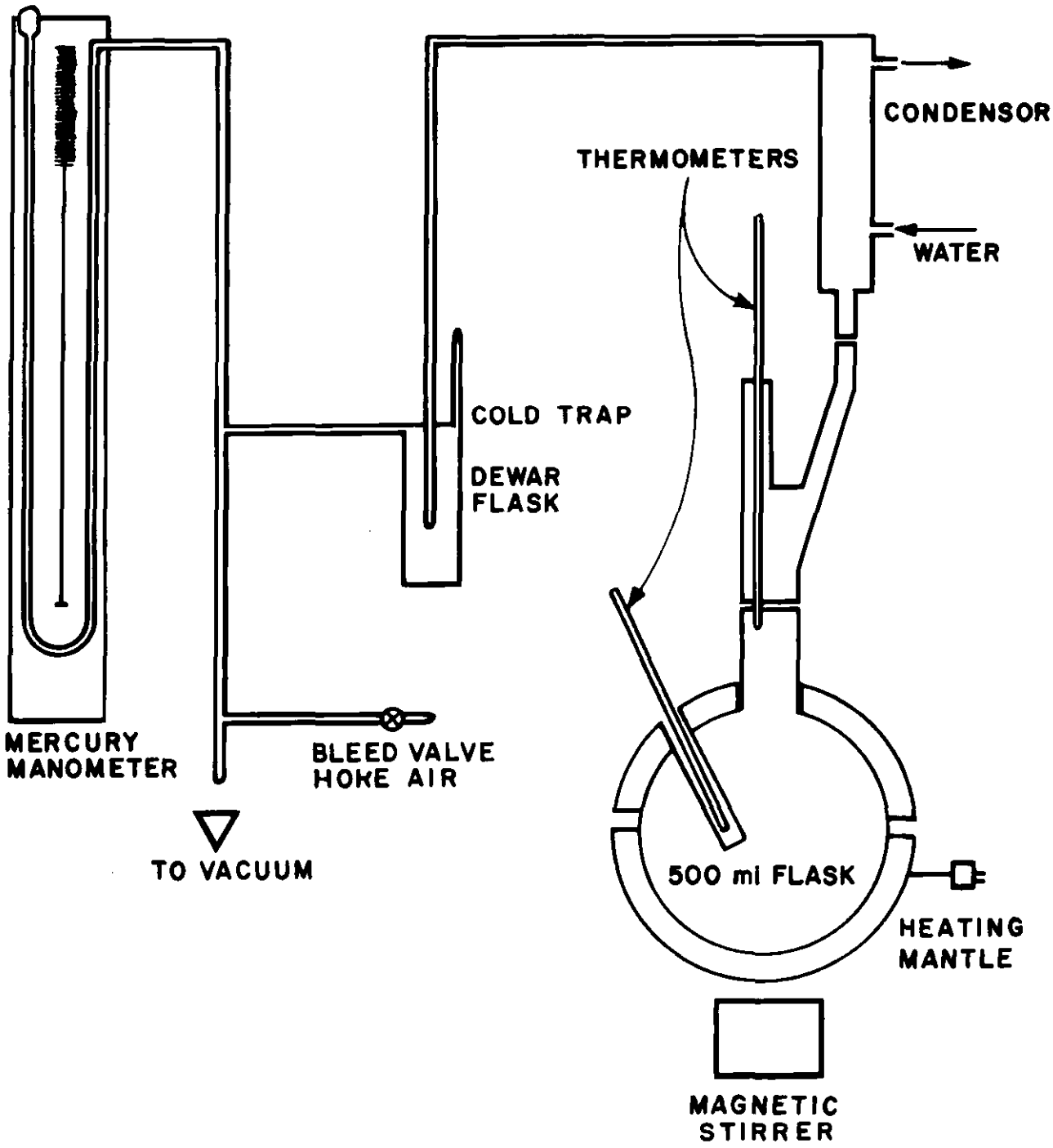

FIGURE 1. Vapor pressure reading - distillation method (see A20.2).

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g. Change the system pressure, increase the temperature, and repeat the temperature-pressure measurements over the entire pressure range up to atmospheric pressure. A minimum of four stable reflux conditions (boiling points) shall be obtained.

h. Record the temperature of the liquid, temperature of the vapor, and pressure of the system at stable reflux conditions.

i. Correct the pressure as shown by the manometer for variations in barometric pressures.

j. Allow the fuel to cool to ambient temperature and pressure.

k. Remove sufficient fuel from the flask and perform distillation according to ASTM D86.

30.4 Calculations

30.4.1 Report of results

a. Plot on semilog paper the reciprocal of absolute temperature on the abscissa versus the log of vapor pressure in psi on the ordinate for each boiling point.

b. Draw a smooth curve through the boiling points obtained, extending the lines slightly at each end.

c. Report the results of corrected vapor pressure as determined by the vapor reflux method from the prepared graph at desired temperature.

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APPENDIX B

THERMAL PRECIPITATION OF JET FUEL INSOLUBLES

10. SCOPE

10.1 The thermal precipitation test covered in this appendix measures the tendency of low volatile hydrocarbon fuels to precipitate insolubles under specified thermal stress. A representative sample of fuel is heated to 300°F, held at 300°F for two hours, cooled to room temperature, then a portion filtered through a Millipore filter to collect any insoluble material. Resultant filter color is compared against a standard color code chart.

20. SPECIMEN

20.1 Three gallons of sample fuel shall be used for this test.

30. APPARATUS AND MATERIALS

30.1 The apparatus and materials for this test shall include the following:

a. Apparatus

(1) Fuel Preconditioning Unit including Fuel Reservoir Assembly Model No. 2200, Erdco Engineering Corp. The unit shall be capable of maintaining fuel at 300°F ±5°F.

(2) Vacuum pump - free-air capacity, 33.4 liters per minute, Model No. 1406-H, Welch Mfg Co, or equivalent

(3) Fuel filtration unit - Model XX2004720, Millipore Corporation

(4) Oven - Capable of maintaining a temperature of 180°F ±5°F

(5) Color standards specified for use in ASTM D2276, appendix A3

b. Materials

(1) Filter Paper - 0.45-micron pore size, 47-mm diameter, Type HA, Millipore Corporation

(2) Precipitation naphtha conforming to ASTM D91-61, prefiltered through 0.45-micron filter paper. A pure parafinic hydrocarbon such as pentane may be substituted for precipitation naphtha.

(3) Aluminum foil

(4) Lint-free cloth - Consolidated Electrodynamics Corporation, PN 18560, or equivalent

(5) Fuel thermal precipitation color standard (see 6.4 of basic specification)

(6) Pentane - prefiltered through 0.45-micron filter paper

(7) Petri dish - Milliport Corporation, PN PD 1004700

40. PROCEDURE

40.1 Preparation of test filter papers shall be as follows:

a. With forceps, place the filter paper in the precleaned filtration unit and assemble with filtering flask and vacuum pump. Start the pump.

b. Decant three 25-ml increments of naphtha into the filtration unit. Allow each increment to filter completely through the paper before adding the next increment.

c. Turn the vacuum pump off and relieve vacuum in the filtration unit.

d. With forceps, carefully remove the filter paper from the filtration unit and place in an oven maintained at 180°F $\pm$5°F for 30 minutes.

e. With forceps, remove the filter paper from the oven and place it in a petri dish. Close the dish.

40.2 Preparation of the filtering flask and fuel reservoir shall be as follows:

a. Flush the filtering flask with 200 ml of naphtha.

b. Air dry the filtering flask.

c. Flush the fuel reservoir with 400 ml of naphtha.

d. Dry the fuel reservoir interior by wiping with a lint-free cloth or washing with pentane and allowing to air dry.

40.3 Preparation of the test fuel and the heating cycle operation shall be as follows:

a. Filter three gallons of test fuel through two filter papers in accordance with the step in 40.4.

b. Cover the fuel filtration unit with aluminum foil.

c. Place the test fuel in the precleaned fuel reservoir using care to prevent the inclusion of airborne matter.

d. Assemble the reservoir assembly using care to check and tighten the water-cooling coil.

e. Close the water inlet valve.

f. Turn the main power switch on.

g. Turn the heater selector switch to medium.

h. Set the temperature controller to 300°F. A temperature of 300°F shall be attained in 100 to 120 minutes.

i. Maintain the temperature at 300°F ±5°F for 120 minutes.

j. After the 120-minute heating cycle, turn the heater selector switch to off.

k. Open the water inlet valve. The fuel temperature shall drop to 80°F ±5°F in 30 to 45 minutes.

l. When the fuel has cooled to 80°F ±5°F, close the water inlet valve. Disassemble the fuel reservoir.

m. Cover the open reservoir with aluminum foil.

40.4 Filtration of the test fuel shall be performed as follows:

a. With forceps, place the prepared filter paper from 40.1e in the precleaned filtration unit and assemble the unit with filtering flask and vacuum pump. Start the pump.

b. Filter one gallon (3.785 ml) of the fuel from 40.3 within one hour using a graduated cylinder using care to prevent airborne contamination by covering the filtration unit and graduated cylinder with aluminum foil during filtration.

c. Wash the filter paper and inside walls of the filtration unit with three 25-ml increments of naphtha. Allow each increment to filter completely through the filter paper before adding the next increment.

d. Repeat steps B40.1c through B40.1e.

e. Compare the filter paper color with the color standards using the precedure described in A3.6.1.1 and A3.6.1.2 of Appendix A3, ASTM D2276. Report the test results in accordance with paragraph A3.7.1 of Appendix A3, ASTM D2276.

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APPENDIX C

ALCOR MARK 8A TUBE DEPOSIT RATER MODIFICATIONS

10. SCOPE

10.1 This appendix gives instructions for the modification of the Alcor Mark 8A Tube Deposit Rater (TDR) so that accurate measurements of the Delta Spun TDR ratings can be obtained.

20. SUMMARY

20.1 JFTOT heater tubes often have a pretest Spun TDR rating of zero or below when rated using the Mark 8A TDR in accordance with ASTM D3241. This occurs because the surface finish of the heater tube test section is difficult to control and new heater tubes have pretest ratings ranging from about -5 TDR units to about +5 TDR units. To accurately compensate for differences in the pretest ratings of the JFTOT heater tubes, the pretest rating is subtracted from the post test rating to obtain the Delta Spun TDR rating. However, the production model of the Mark 8A TDR cannot rate tubes below the 0 TDR level since the range of the meter is 0 to +50 TDR units. By replacing the original meter with a digital millivolt meter that can read both positive and negative voltages, accurate positive and negative TDR values can be obtained. (Note that following the modification instructions given below, 1 millivolt (mv) will equal 1 TDR unit.) This appendix gives the necessary instructions for making this change.

30. APPARATUS

30.1 Alcor Mark 8A Tube Deposit Rater in accordance with ASTM D3241, Alcor Incorporated, 10130 Jones Maltsberger Road, P.O. Box 32516, San Antonio TX 78284.

30.2 Digital millivolt meter with a minimum scale range of $\pm$50 mv and a minimum accuracy of $\pm$2 percent at 50 mv. The digital millivolt meter must have its own internal power supply that is compatible with available AC power. A suitable meter is the Simpson Model 2850, Part Number 22984, with a range of $\pm$199.9 mv and input power requirements of 120/240 vac, 50 to 400 Hz.

30.3 A 1000 ohm resistor, 1/4 watt (required for Option 2 below).

30.4 Suitable electrical wiring, connectors, and other hardware for electrically connecting the digital millivolt meter to the Mark 8A TDR and, if desired, for physically attaching the digital millivolt meter to the Mark 8A TDR.

40. PROCEDURE

40.1 Option 1 - Leave the Existing Meter in Place - This option will enable the use of the TDR with either the existing meter or with the digital millivolt meter, but not concurrently. The two meters will not give identical readings; therefore, the TDR must be calibrated using the meter selected for use.

40.1.1 Connect the digital millivolt meter in parallel with the existing meter. Holes may have to be drilled in the TDR case to bring out electrical leads from the existing meter terminals to the digital millivolt meter. The 1000 ohm resistor is not used with this option. It is suggested that the face of the existing meter be covered when using the digital millivolt meter to avoid confusion.

40.2 Option 2 - Replace the Existing Meter - This option is recommended as there will be a small, but significant, difference in the readings of the digital millivolt meter and the existing meter using Option 1 and some confusion could arise with both meters operational.

40.2.1 Remove the existing meter from the Mark 8A TDR. Connect the 1000 ohm resistor between the two leads that were connected to the existing meter. Connect the digital millivolt meter in parallel with the 1000 ohm resistor. With the existing meter removed, leads from the TDR to the digital millivolt meter can be brought out through the front of the TDR as there will be a 2 inch diameter hole where the meter was located. If the digital millivolt meter gives negative readings during calibration, reverse the leads leading to the digital millivolt meter.

40.3 It may be possible to find a suitable digital millivolt meter that can be installed within the TDR case in lieu of the original meter. However, most digital millivolt meters are considerably deeper than the original TDR meter and there may not be sufficient room to accommodate the new meter within the TDR case. It may be possible, however, to obtain digital meters that have a detachable display that could be mounted on the front of the TDR with the remainder of the digital meter located within the TDR case (if there is room) or attached to the side or back of the TDR.

40.4 Some users may want to connect the AC power input to the digital meter through the TDR on-off switch.

50. CALIBRATION

50.1 The calibration procedure using the digital millivolt meter is the same as with the original meter. The Low Cal and the High Cal controls are used to adjust the meter readings to agree with the calibration tube ratings as before. Note that the greater sensitivity of the digital millivolt meter may cause some jitter, but this should only be in the tenth of a millivolt (i.e., TDR unit) range.

60. OPERATION

60.1 Mark 8A Tube Deposit Rating Methods - See Section 9.2 of ASTM D3241.

60.2 Delta Spun TDR - With the digital millivolt meter, negative TDR readings are possible and the sign (i.e., plus or minus) of the TDR rating must be recorded as well as the TDR value. To obtain the Delta Spun TDR rating the pre-test rating must be algebraically subtracted from the post test rating. The Delta Spun TDR shall be determined along the length of the JFTOT tube from position 14 to position 56 at 2 mm increments and the largest value shall be reported.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

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
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

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