

INCH POUND

MIL-R-62259A(AT)
17 March 1989
SUPERSEDING
(See 6.4)

MILITARY SPECIFICATION

RADIATOR: ENGINE COOLANT

This specification is approved for use by the US Army Tank-Automotive Command, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers a coolant-to-air, two-pass, counter flow, automotive-type radiator which has been hardened for nuclear survivability purposes. The engine coolant radiator will be referred herein as a radiator.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specification, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document 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 (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Tank-Automotive Command, ATTN: AMSTA-GDS, Warren, MI 48397-5000, 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 2930
DISTRIBUTION STATEMENT A Approved for public release; distribution is unlimited.

MIL-R-62259A(AT)

SPECIFICATIONS

FEDERAL

O-A-548	Antifreeze Coolant, Engine: Ethylene Glycol, Inhibited, Concentrated.
GG-P-455	Plates and Foils, Photographic (Photosensitive Anodized Aluminum).
QQ-B-613	Brass, Leaded and Nonleaded: Flat Products (Plate, Bar, Sheet and Strip).
QQ-C-390	Copper Alloy Castings (Including Cast Bar).
QQ-C-576	Copper, Flat Products with Slit, Slit and Edgerolled, Sheared, Sawed, or Machined Edges (Plate, Bar, Sheet, and Strip).
QQ-P-416	Plating, Cadmium (Electrodeposited).
W-L-800	Lubricating Oil, General Purpose, Preservative (Water-Displacing, Low Temperature).

MILITARY

MIL-P-514	Plates, Identification, Instruction and Marking, Blank.
MIL-A-11755	Antifreeze, Arctic Type.
MIL-A-53009	Additive, Antifreeze Extender, Liquid Cooling System.

STANDARDS

MILITARY

MIL-STD-130	Identification Marking of US Military Property.
MIL-STD-889	Dissimilar Metals.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 \ Avenue, Philadelphia, PA 19120-5099.)

2.1.2 ~~Other Government documents~~, drawings and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DRAWING

ARMY

12297938

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Radiator, Engine Coolant

(Copies of the drawing listed above required by the offerors/contractor in connection with specific acquisition functions should be obtained from the procuring activity, or as directed by the contracting officer.)

PUBLICATIONS

MRC-82304-MRC/SD-EP-82-027 - (U) Nuclear Survivability Criteria for the IFV/CFV Systems, dated 9 September 1980 (Published by the US Army Nuclear and Chemical Agency).

(Copies of the publication listed above required by the offerors/contractor in connection with specific acquisition function should be obtained from Commander, US Tank-Automotive Command, ATTN: Contracting Officer, Warren, MI 48397-5000.)

2.2 Non-Government 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 are those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of documents cited in the solicitation (see 6.2).

AIR MOVEMENT AND CONTROL ASSOCIATION, INC. (AMCA)

AMCA 210-74 - Laboratory Methods of Testing Fans for Rating Purposes.

(Application for copies should be addressed to Air Movement and Control Association, 30 West University Drive, Arlington Heights, Illinois, 60004.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A308 - Steel Sheet, Cold - Rolled, Long Terne Coated.
ASTM B36 - Brass Plate, Sheet, Strip and Rolled Bar.

(Application for copies should be addressed to Air Movement and Control Association, 30 West University Drive, Arlington Heights, Illinois, 60004.)

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

2.3 Order of presedence In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article¹. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.4.

3.2 Materials. Materials used in this specification shall be as specified herein and in referenced specifications, standards and drawings. Materials shall be free from defects that could affect the performance or serviceability of the finished products (see 4.7.1).

3.2.1 End Tanks, baffle and headers. The end tanks, baffle and headers shall be made of brass conforming to QQ-B-613, alloy 260, temper optional (see 4.7.1).

3.2.2 Side supports and core reinforcements The side supports and core reinforcements shall be longe terne coated sheets conforming to ASTM A308 coating designation LT01 (SEE 4.7.1).

3.2.3 Core tubes. The core tubes shall be 0.009-inch wall; and shall be solder coated inside and outside; and shall be made of material conforming to either a or b (see 4.7.1).

- a. Brass conforming to QQ-B-613, alloy 230, temper optional.
- b. Brass conforming to ASTM B36, alloy 230.

3.2.4 Core fins The core fins shall be made of copper conforming to QQ-C-576, annealed. The core-fins shall be 0.0030/0.0038 inch thick and shall have hemmed front and rear edges (see 4.7.1).

3-2.5 Inlet and outlet bosses. The inlet and outlet bosses shall be made of brass conforming to QQ-C-390, alloy C83600 to C83800. type optional, as cast (see 4.7.1).

3.2.6 Dissimilar metals The radiator shall be designed and fabricated to minimize galvanic corrosion in dissimilar metal couples as specified in MIL-STD-889 (see 4.7.1).

3.2.7 Interior preservation The interior surfaces of the radiator shall be fogged with lubricating-oil conforming to W-L-800 (see 4.7.1).

3.2.8 Recycled, virgin and reclaimed materials. There are no requirements for the exclusive use of virgin materials. The use of recycled or reclaimed (recovered) materials is acceptable provided that all other requirements of this specification are met (see 6.5.2 and 4.7.1).

3.3 Design and construction The radiator shall be constructed in accordance with Drawing 12297938 and as specified herein. The spacing of the continuous-fin across the full depth of the core shall be no greater than 11 fins per inch and core area shall be not less than 1072 square inches (see 4.7.2 and 6.2).

3.3.1 Weight. The dry weight of the radiator shall not exceed 320 pounds (see 4.7.3).

3.3.2 Compatibility with coolant. The radiator shall be capable of service with water or antifreeze conforming to MIL-A-11755, or O-A-548, in any combination, and with water and inhibitor conforming to MIL-A-53009 (see 4.7.1).

3.4 Performance.

3.4.1 static pressure When subjected to internal air pressure of not less than 25 pounds per square inch gage (psig) for not less than 5 minutes, the radiator shall show no evidence of structural damage, deformation or leakage (see 4.7.4.1)-

3.4.2 Cooling capacity. With an air mass flow rate of 1240 ± 20 pounds per minute (lb/min) at an inlet temperature of 130 ± 1 degree Fahrenheit ($^{\circ}\text{F}$), and a coolant flow rate of 165 ± 2 gallons per minute (gpm) at an inlet temperature of not less than 237°F , the radiator shall transfer heat at a rate of not less than 23,000 British thermal units (Btu) per minute (see 4.7.4.2).

3.4.3 Air pressure drop. Air pressure drop through the radiator core shall be no greater than 4.5 inches of water, with an air mass flow rate of 1240 ± 20 lb/min at an inlet temperature of $130 \pm 1^{\circ}\text{F}$ (see 4.7.4.3).

3.4.4 Coolant pressure drop. Coolant pressure drop through the radiator shall be no greater than 9 psig at 165 k 2 gpm at an inlet temperature of $237 \pm 1^{\circ}\text{F}$ (see 4.7.4.4).

3.4.5 Endurance. When subjected to 8,000 internal hydrostatic pressure cycles of 0 to 18 to 0 psig at the rate of 4 to 8 cycles per minute using coolant at 210 to 250°F , the radiator shall show no evidence of deformation, leakage, or rupture and subsequently meet the requirements of 3.4.1 (see 4.7.4.5).

3.5 Environmental.

3.5.1 Shock. The radiator shall show no evidence of structural damage, deformation, or leakage after being subjected to a 10 gravity (g) sawtooth shock pulse for a duration of 11 millisecond (ins) and subsequently meet the requirement of 3.4.1 (see 4.7.5.1).

3.5.2 Vibration The radiator shall show no evidence of structural damage deformation or leakage after being subjected to vibration levels of 1.5g (in lower frequencies) and 4.2g (upper frequencies) at a sweep frequency range of 5 to 500 to 5 hertz (Hz) with a sweep time of 15 minutes. Subsequently the radiator shall meet the requirement of 3.4.1 (see 4.7.5.2).

3.5.3 Nuclear survivability. The radiator shall withstand the thermal and overpressure levels specified in CONFIDENTIAL document MRC-82304-MRC-SD/EP-82-027, Nuclear Survivability Criteria for IFV/CN Systems (U), dated 9 September 1980, and published by the US Army Nuclear and Chemical Agency and subsequently meet the requirement of 3.4.1 (see 4.7.5.3)

3.6 Reliability.

3.6.1 Raidator system compatibitliy To assure radiator compatibility with mating system, performance under vehicle operational environment and adequate reliability, the radiator shall be installed in the vehicle and operated for a minimum of 6000 miles. The mileage shall be apportioned over the road conditions specified below. The radiator shall show no evidence of a drip (see 6.5.1), structural damage, deformation> or rupture (see 4.7.6.1)

<u>Road conditions</u>	<u>Operating miles (minimum)</u>
Paved roads	1,260 miles
Secondary roads	2,700 miles
Cross-country	2,040 miles

3.6.2 Mean miles between failure (MMBF). The radiator, when installed in the vehicle and operated as specified in 3.6.1, shall demonstrate a minimum reliability of 6000 MMBF. The MMBF shall be calculated by dividing the total number of vehicle miles by the number of radiator reliability failures (see 4.7.6.2).

3.7 Identification marking^{*}

3.7.1 Nameplates. The radiator nameplate shall conform to MIL-P-514, type III, composition A, class 2, or composition C. Composition C material shall conform to GGP-455, type II, grade A, class 1. Nameplate shall be attached with fasteners which shall be electro-chemically compatible with the radiator material, or suitably plated in accordance with QQ-P-416, type 11, to resist corrosion (see 4.7.2).

3.7.2 Marking- The radiator shall be identified with vendor's identification marking specified on Drawing 12297938 in accordance with MIL-STD-130 (see 4.7.2).

3.8 Workmanship. Workmanship shall be of the quality to provide radiators free from defects that would affect their serviceability or appearance or present safety hazards to operating and maintenance personnel (see 4.7.2).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection Unless otherwise specified in the contract or purchase order (see 6.2), the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein, except for nuclear survivability and reliability tests which are the responsibility of the procuring activities. Except as otherwise specified in the contract or purchase order (see 6.2), 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 or witness any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall 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 ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

- a. First article inspection (see 4.4).
 1. Preproduction inspection (see 4.4.1).
 2. Initial production inspection (see 4.4.2).
- b. Quality conformance inspections (see 4.5).
 1. Examination (see 4.5.2).
 2. Acceptance tests (see 4.5.3).
- c. Control tests (see 4.6).

4.3 Inspection conditions. Unless otherwise specified (see 6-2), all inspections shall be conducted under the following conditions:

- Air temperature $73 \pm 18^{\circ}\text{F}$
- :: Barometric pressure $28.5 + 2$ inches of mercury (Hg)
- 3
- c. Relative humidity 50 ± 30 percent

4.4 First article inspection. When first article is required, first article inspection shall be performed on preproduction and initial production samples as specified herein. Approval of the first article sample by the Government shall not relieve the contractor of the obligation to supply radiators that are fully representative of those inspected as a first article sample. Any changes or deviation of the production units from the first article sample shall be subject to the approval of the contracting officer.

4.4.1 Preproduction inspection. When specified (see 6.2), preproduction inspection shall be performed on the preproduction samples in accordance with the inspection specified in table I.

4.4.2 Initial production inspection. When specified (see 6.2), initial production inspection shall be performed on initial production samples in accordance with the inspection specified in table I.

4.4.3 First article inspection failure. Deficiencies found during, or as a result of, first article inspection shall be cause for rejection of the first article sample until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiency. Any deficiency found during, or as a result of, first article inspection shall be evidence that all items already produced prior to completion of the first article inspection are similarly deficient unless contrary evidence satisfactory to the contracting officer is furnished by the contractor. Such deficiencies on all items shall be corrected by the contractor. The Government will not accept products until first article inspection is completed to the satisfaction of the contracting officer.

4.5 Quality conformance inspection.

4.5.1 Sampling.

4.5.1.1 Lot formation. An inspection lot shall consist of all the radiators of one type and part number, from an identifiable production period, from one manufacturer, submitted at one time for acceptance.

TABLE I. Classification of Inspections.

Title	Requirement	Inspection	First Article										Quality Conformance		Control 1/		
			Preproduction					Initial Production					Examination	Test 100%	SN	1	2
			Sample No. (SN)					Production									
			1	2	3	4	5	1	2	3	SN						
CONTRACTOR INSPECTION:																	
Materials and construction	3.2 thru 3.2.8, and 3.3.2	4.7.1	X	X	X	X	X	X	X	X	X	X	X				
Defects (see table II)	3.3, 3.7, and 3.8	4.7.2	X	X	X	X	X	X	X	X	X	X	X				
Weight	3.3.1	4.7.3	X		X	X	X	X	X	X	X	X	X				
Performance																	
Static Pressure	3.4.1	4.7.4.1	X	X	X	X	X	X	X	X	X	X	X				
Cooling capacity	3.4.2	4.7.4.2	X	X	X	X	X	X	X	X	X	X	X				
Air pressure drop	3.4.3	4.7.4.3	X	X	X	X	X	X	X	X	X	X	X				
Coolant pressure drop	3.4.4	4.7.4.4															
Endurance	3.4.5	4.7.4.5		X									X				
Environmental																	
Shock	3.5.1	4.7.5.1		X									X				
Vibration	3.5.2	4.7.5.2	X							X							X
GOVERNMENT INSPECTION:																	
Nuclear survivability	3.5.3	4.7.5.3	X	X													
Reliability	3.6	4.7.6		X		X	X										

1/ Samples for control tests shall be selected from radiators that have passed QCI.

4.5.1.2 Sampling for examination. Samples for quality conformance examination shall be selected in accordance with general inspection level II of MIL-STD-105.

4.5.2 Examination.

4.5.2.1 Acceptable quality level. Each sample selected in accordance with 4.5.1.2 shall be examined to determine conformance to the following acceptable quality levels (AQL) on the basis of percent defective.

<u>Classification</u>	<u>AQL</u>
Major	2.5
Minor	4.0

4.5.2.2 Classification of defects. For examination purposes, defects shall be classified as listed in table II.

TABLE II. Classification of defects.

Category	Defect	Method Inspection
Critical	None	
<u>Major</u>	<u>AQL 2.5% Defective</u>	
101	Assembly incomplete or improperly constructed (see 3.3).	Visual
102	Incorrect dimensions affecting interchangeability (see 3.3).	SIE 1/
103	Improper marking (see 3.7.2).	Visual
104	Improper nameplate and faulty attachment (see 3.7.1)	Visual
105	Faulty workmanship affecting safety and serviceability (see 3.8).	SIE
<u>Minor</u>	<u>AQL 4.0% Defective</u>	
201	Incorrect dimensions not affecting interchangeability (see 3.3).	SIE
202	Faulty workmanship affecting appearance (see 3.8)	Visual

1/ SIE = Standard Inspection Equipment.

4.5.3 Acceptance test (100% inspection). Each radiator shall be subjected to the static pressure test specified in table I.

4.5.3.1 Failure. Failure of the radiator to pass the static pressure test shall be cause to reject the item unless corrective action acceptable to the government has been taken.

4.6 Control tests. Control tests shall be conducted on two radiators from each lot of 400 units consecutively produced, or two during each 6 month period, whichever occurs first. The radiator shall be subjected to the tests specified in table I.

4.6.1 Failure. Failure of any radiator to pass any of the specified control tests shall be cause for the Government to refuse acceptance of the production quantity represented, until action taken by the contractor to correct defects and prevent reoccurrence has been approved by the government.

4.6.2 Disposition of samples Sample radiators which have been subjected to control tests shall not be delivered on the contract.

4.7 Methods of inspection.

4.7.1 Materials and construction. Conformance to 3.2 thru 3.2.8 and 3.3.2 shall be determined by inspection of contractor records providing proof or certification that design, construction, processing, and materials conform to requirements. Applicable records shall include drawings, specifications, design data, receiving inspection records, processing and quality control standards, vendor catalogs and certifications, industry standards, test reports, and rating data.

4.7.2 Defects. Conformance to 3.3, 3.7 and 3.8 shall be determined by examination for defects listed in table II. Examination shall be visual, tactile, or by measurement with standard inspection equipment.

4.7.3 Weight. To determine conformance to 3.3.1, the radiator less coolant shall be weighed.

4.7.4 Performance.

4.7.4.1 Static pressure To determine conformance to 3.4.1, apply internal air pressure of not less than 25 psig for a period of 5 minutes. The radiator shall show no evidence of structural damage, deformation or leakage.

4.7.4.2 Cooling capacity To determine conformance to 3.4.2, the radiator shall be connected to a test setup as shown in figure 1 or figure 2. Airflow through the radiator shall be adjusted to 1240 ± 20 lb/min. Adjust air temperature to $130 \pm 1^\circ\text{F}$. Water shall be pumped through the radiator at a rate of 165 ± 2 gpm. Set coolant inlet temperature at 237°F

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with an operating pressure of 14 to 16 psig. Temperature indicator probes shall be no greater than 6 inches from the radiator inlet and outlet. Measure the change in air temperature through the radiator and the change in coolant temperature through the radiator to determine the net heat transfer. The radiator shall transfer heat at a rate not less than 23,000 Btu per minute.

4.7.4.2.1 Alternate test. Cooling capacity To determine conformance to 3.4.2, the radiator shall be connected to a test setup as shown in figure 2 or figure 1. Airflow through the radiator shall be adjusted to 1240 ± 20 lb/rein. Adjust the air temperature to $80 \pm 10^\circ\text{F}$. Water shall be pumped through the radiator at a rate of 165 ± 5 gpm. Set coolant inlet temperature at $180 \pm 5^\circ\text{F}$ with an operating pressure of 14 to 16 psig. Temperature indicator probes shall be no greater than 6 inches from the radiator inlet and outlet. Measure the change in air temperature through the radiator and the change in coolant temperature through the radiator to determine the net heat transfer. Extrapolate the results to the conditions set forth in 3.4.2. The extrapolate heat transfer rate shall not be less than 23,000 Btu per minute-

4.7.4.3 Air pressure drop. To determine conformance to 3.4.3, the radiator shall be connected to a test setup as shown in figure 1 or figure 2. With the system operating as specified in 4.7.4.2, the air pressure drop across the radiator core shall be measured using the pitot tubes and an incline manometer or equivalent method.

4.7-4.4 Coolant pressure drop. To determine conformance to 3.4.4, the radiator shall be connected to a test setup as shown in figure 1 or figure 2. With the system operating as specified in 4.7-4.2, the water flow rate shall be 165 ± 2 gpm, the water pressure drop across the radiator shall be no greater than 9 psig.

4.7.4.5 Endurance. To determine conformance to 3.4.5, the radiator shall be positioned in its normal vehicle position in a 100% ethylene glycol circulatory system. Not less than 8,000 pressure cycles of 0 to 18 to 0 psig at a frequency of 4 to 8 cycles per minute shall be pneumatically applied into the closed loop circulatory system. Coolant temperature shall be 210 to 250 oF. (Note: Pressure rise and decay rates should be linear to avoid spikes). At the conclusion of the endurance test, the radiator shall be subjected to the static pressure test as specified in 4.7.4.1.

4.7-5 Enviromental.

4.7.5.1 Shock. To determine conformance to 3.5.1, the radiator shall be mounted to the shock test fixture on its resilient mounts, filled with coolant, and oriented as it is installed in the vehicle. Three shocks in each direction shall be applied along three mutually perpendicular axes of radiator for a total of 18 shocks. The pulse shall produce a sawtooth

waveform of 10g amplitude over a duration of 11 ms (see figure 3). At the conclusion of the shock test, repeat the static pressure test as specified in 4.7.4.1.

4.7.5.2 Vibration. To determine conformance to 3.5.2, the radiator shall be mounted to the vibration test fixture on its resilient mounts, filled with coolant, and oriented as it is installed in the vehicle. Subject the radiator to vibrations along three mutually perpendicular axes in accordance with the test level specified in figure 4. The time schedule shall be 15 minutes for sweep frequency range of 5 to 500 to 5 Hz. When radiator resonances below 5 Hz are measured, the test curves shall be extended to 2 to 500 to 2 Hz and the sweep time shall be 18 minutes. The frequency of applied vibration shall be swept over the specified range logarithmically in accordance with figure 5. The specified sweep time is that of an ascending plus a descending sweep time and is twice the ascending sweep time shown on figure 5 for the specified range. After the test the radiator shall be subjected to the static pressure test as specified in 4.7.4.1.

4.7.5.3 Nuclear survivability. When specified (see 6.2), two preproduction radiators (samples number 1 and 2), which were subjected to and passed the inspections listed in table I, shall be tested by the Government for conformance to nuclear survivability (see 3.5.3)- After nuclear testing is completed, the radiators shall be subjected to the static pressure test as specified in 4.7.4.1 and the dimensional requirements of 3.3.

4.7.6 Reliability. When specified (see 6.2), reliability testing shall be performed by the government.

4.7.6.1 Radiator system compatibility verification. To determine conformance to 3.6.1, two preproduction radiators shall be installed in two test vehicles. The test vehicles shall be operated under conditions that approximate vehicle initial production tests, for a minimum of 6,000 miles each. The road conditions and mileage apportionment shall be as specified in 3.6.1, radiator system mating compatibility and performance under vehicle operational environment shall be evaluated for conformance to 3.6.1. Reliability failures shall be observed and recorded.

4.7.6.2 Reliability MMBF verification. To determine conformance to 3.6.2, the reliability of the radiator shall be verified by experiencing no more than two failures during 12,000 miles of vehicle operation. A failure is defined as radiator replacement due to inability to meet the requirements specified in 3.6.1 (i.e. drip, structural damage, deformation or rupture). Radiators that develop leakage in the form of a seep or droplet (see 6.5.1) shall not be cause for radiator replacement. Radiators that fail before the test vehicle have completed 12,000 miles of operation shall be replaced as soon as the failure occurs. Testing shall then be resumed until 12,000 miles

of operation have been completed. Replacement radiators shall be randomly drawn from the same preproduction lot as the failed radiators. Radiators that must be replaced due to damage incurred as a result of failure of another component of the test vehicle shall not be classified as a reliability failure.

5. PACKAGING

5.1 ~~Preservation packaging . packing, marking~~ Preservation, packaging, packing, and marking for the desired level shall be in accordance with the applicable packaging requirements specified by the contracting authority (see 6-2).

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful but is not mandatory.)

6.1 Intended use. Radiators covered by this specification are intended for use on the M2 and M3 Bradley fighting vehicle system (BFVS).

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and the date of this specification
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
If first article inspection is required (see 3.1).
- ;; Title, number, and date of applicable drawings (see 3.3).
- e. If responsibility for inspection should be other than as specified (see 4.1).
- f. If inspection conditions should be other than specified (see 4.3).
- g. If preproduction inspection is required (see 4.4.1).
- h. If initial production inspection is required (see 4.4.2).
- i. If nuclear testing by the Government is required (see 4.7.5.3).
- j. If reliability testing by the Government is required (see 4.7.6).
- k. Applicable level and packaging standard or packaging data sheet (see 5.1).

6.3 first article When first article inspection is required, the contracting officer should provide specific guidance to offerers on: whether the sample(s) should be a preproduction sample, a first article sample, an initial production sample, a first production item or a standard production item from the contractor-s current inventory; the number of samples to be inspected as specified in table I; and (when applicable) the specific tests

to be performed on each sample. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4 Supersession data This specification revises MIL-R-62532(AT), dated 10 October 1986, in order to incorporate the requirements of FMC specification drawing 12292156, dated 11 **December** 1986.

6.5 Definitions.

6.5.1 Terms. The following terms are used in this specification to define various forms of leakage:

- a. Seep: Any evidence of fluid beyond the seal that does not result in the formation of a droplet.
- b. Droplet: Any evidence of fluid beyond the seal where droplet forms but does not fall.
- c. Drip: Any evidence of fluid beyond the seal where droplet forms and falls.

6.5.2 Recovered materials "Recovered materials" means materials that have been collected or recovered from solid waste (see 6.5.2-1).

6.5.2.1 Solid waste. "Solid waste" means (a) any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility; and (b) other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. It does not include solid or dissolved material in domestic sewage, or solid or dissolved material in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Clean Water Act, (33 U.S.C. 1342 et seq.), or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.) (Source: Federal Acquisition Regulations, section 23.402).

6.6 Subject term (key word) listing

Cooling capacity.
bunter-flow, two pass, engine coolant.
Internal hydrostatic pressure.
Nuclear survivability harding.
Radiator system compatibility.
Reliability failure.

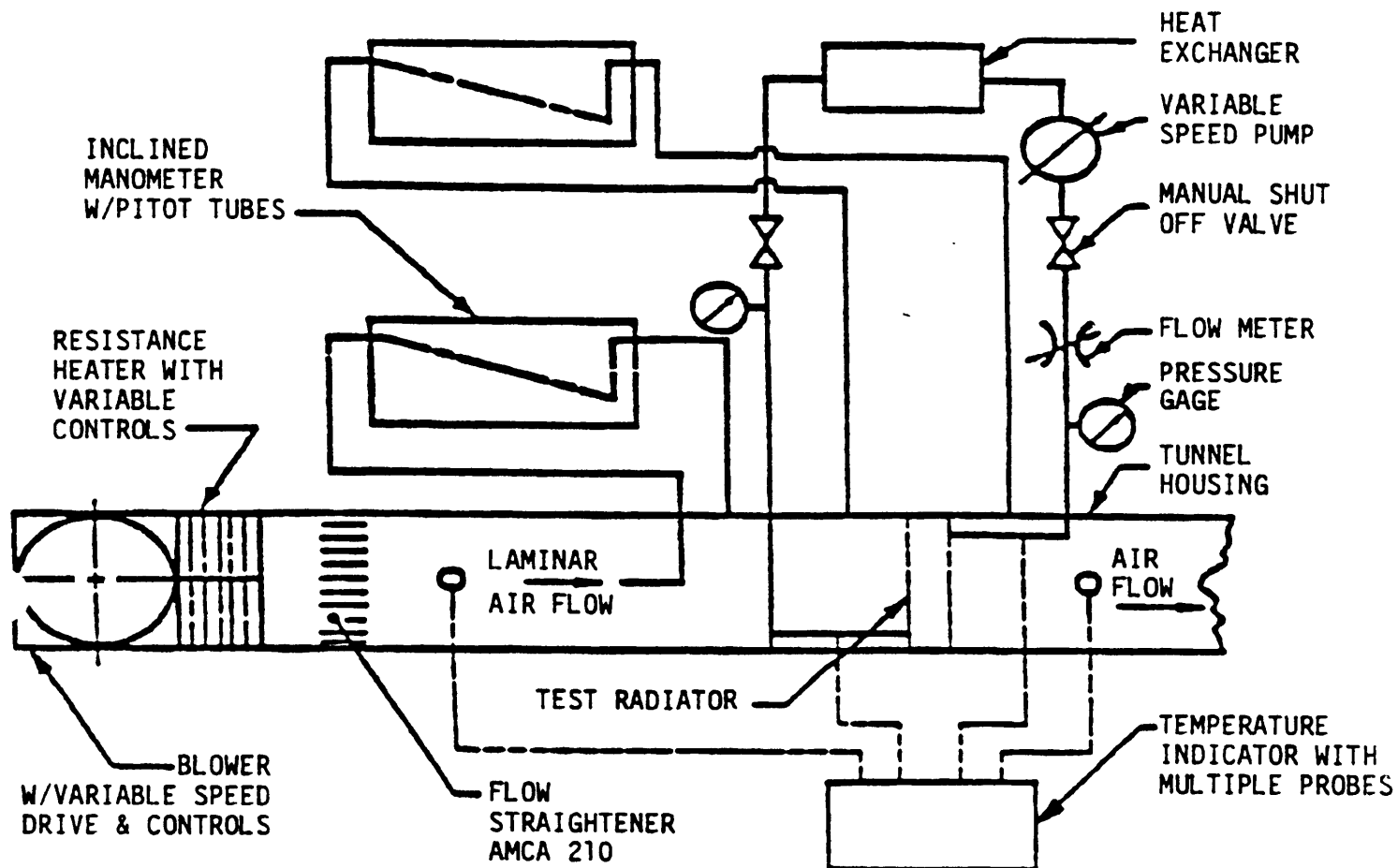


FIGURE 1. Test setup.

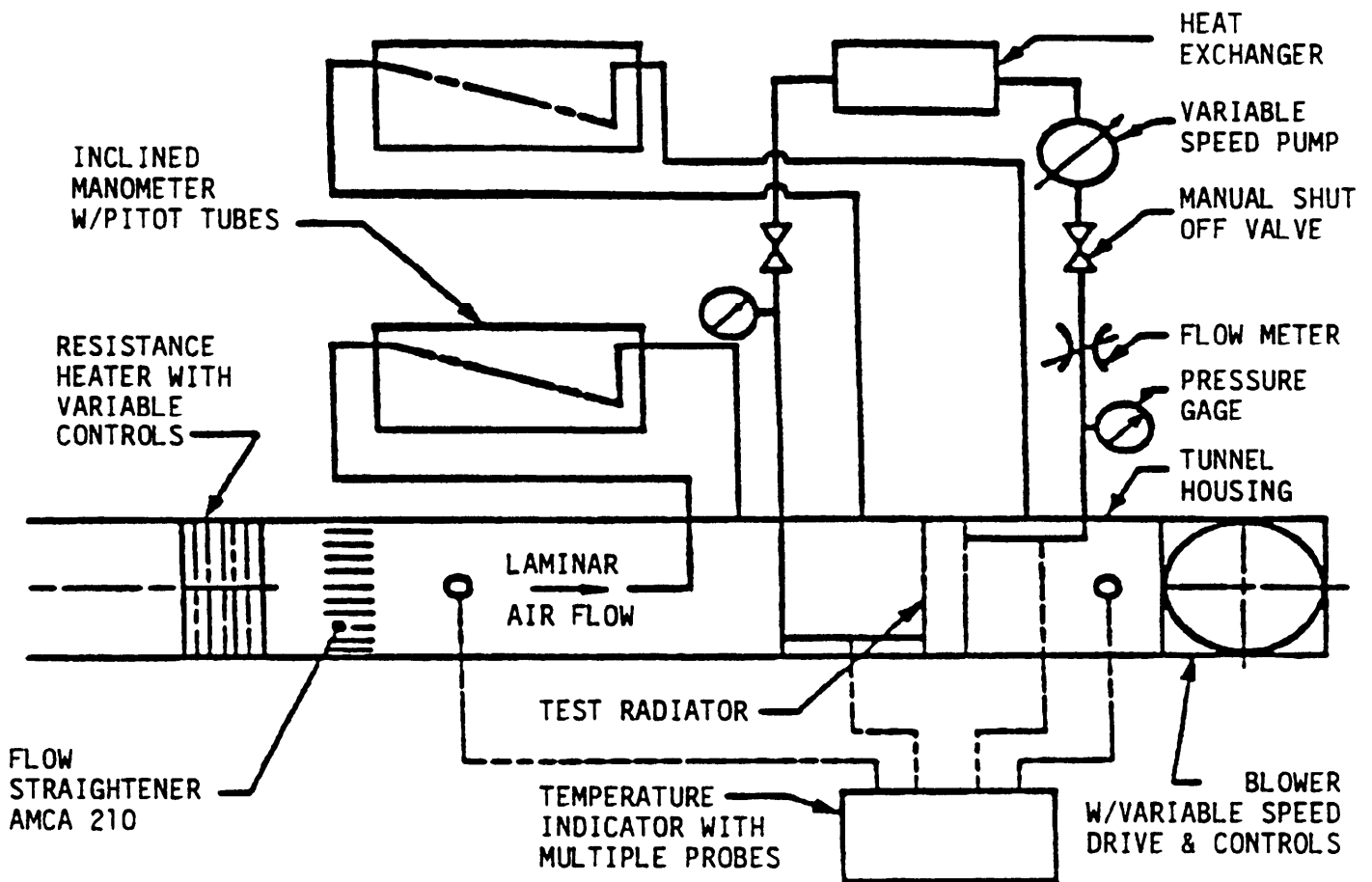
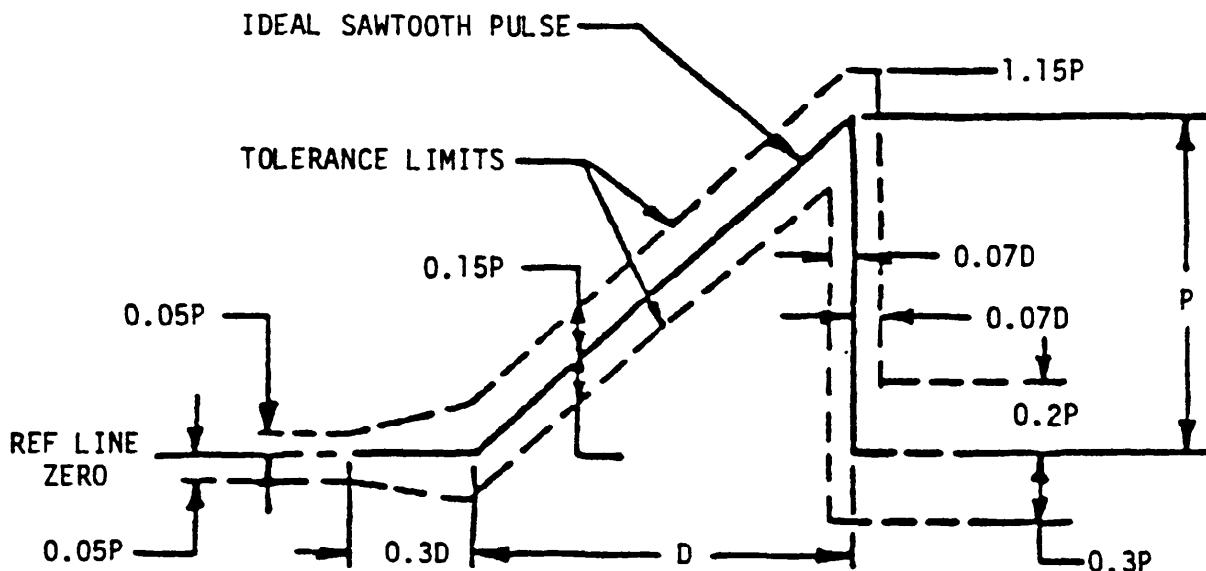


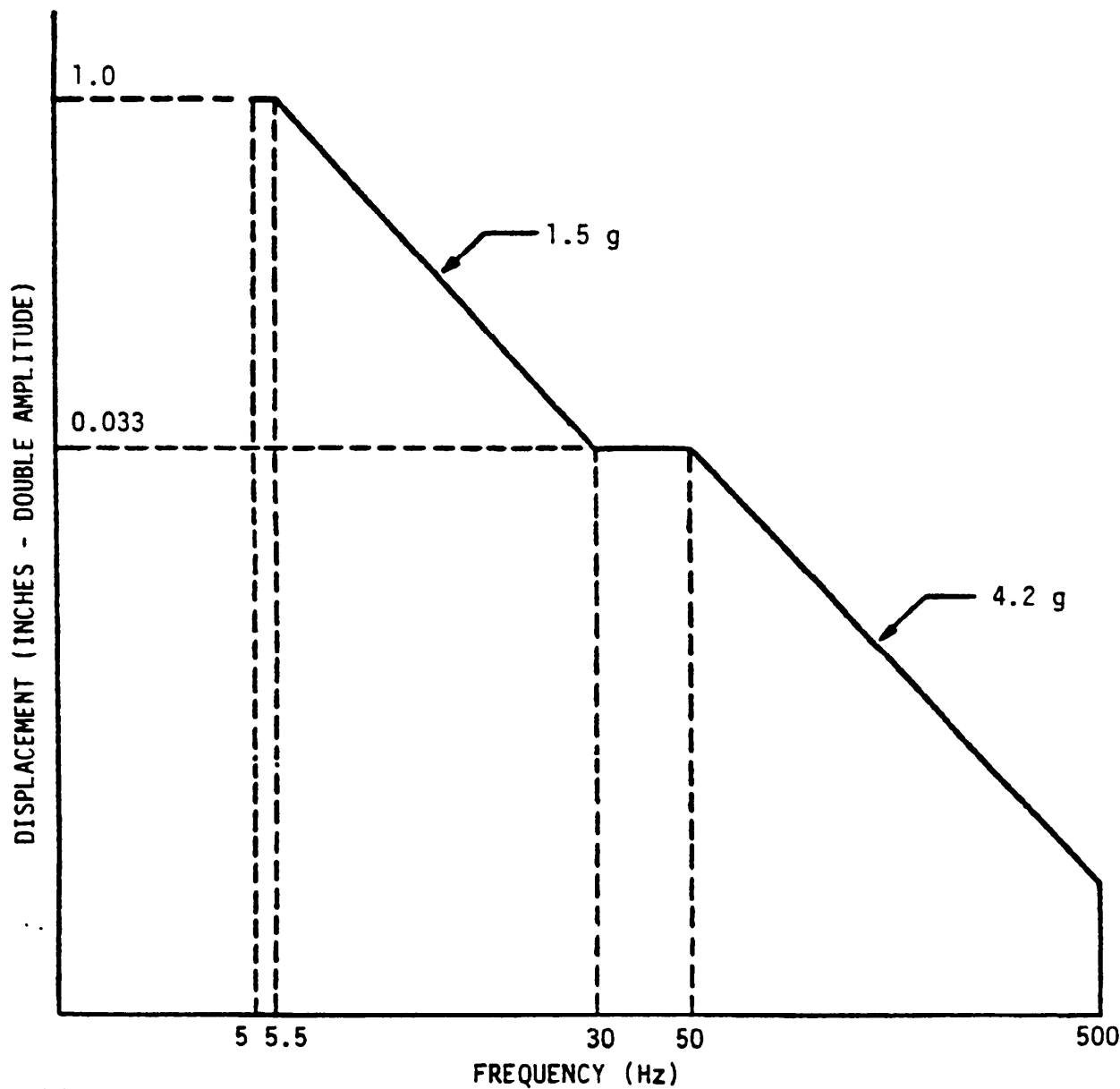
FIGURE 2. Alternate test setup.



P = Peak value = 10 g
D = Nominal duration = 11 ms

NOTE: The oscillogram shall include a time about $3D$ long with a pulse located approximately in the center. The peak acceleration magnitude of the sawtooth pulse is P and its duration is D . The measured acceleration pulse shall be contained between the broken line boundaries and the measured velocity change (which may be obtained by integration of the acceleration pulse) shall be within the limits of $V_i \pm 0.1 V_i$ where V_i is the velocity-change associated with the ideal pulse which equals $0.5 PD$. The integration to determine velocity change shall extend from $0.4D$ before the pulse to $0.1D$ after the pulse.

FIGURE 3. Terminal-peak sawtooth shock pulse configuration and tolerance limits.



NOTES:

- 1. Acceleration levels: $\pm$ g (peak).
- 2. The curve shall be extended to 2 Hz when test item resonances below 5 Hz are expected.

FIGURE 4. Vibration test curve.

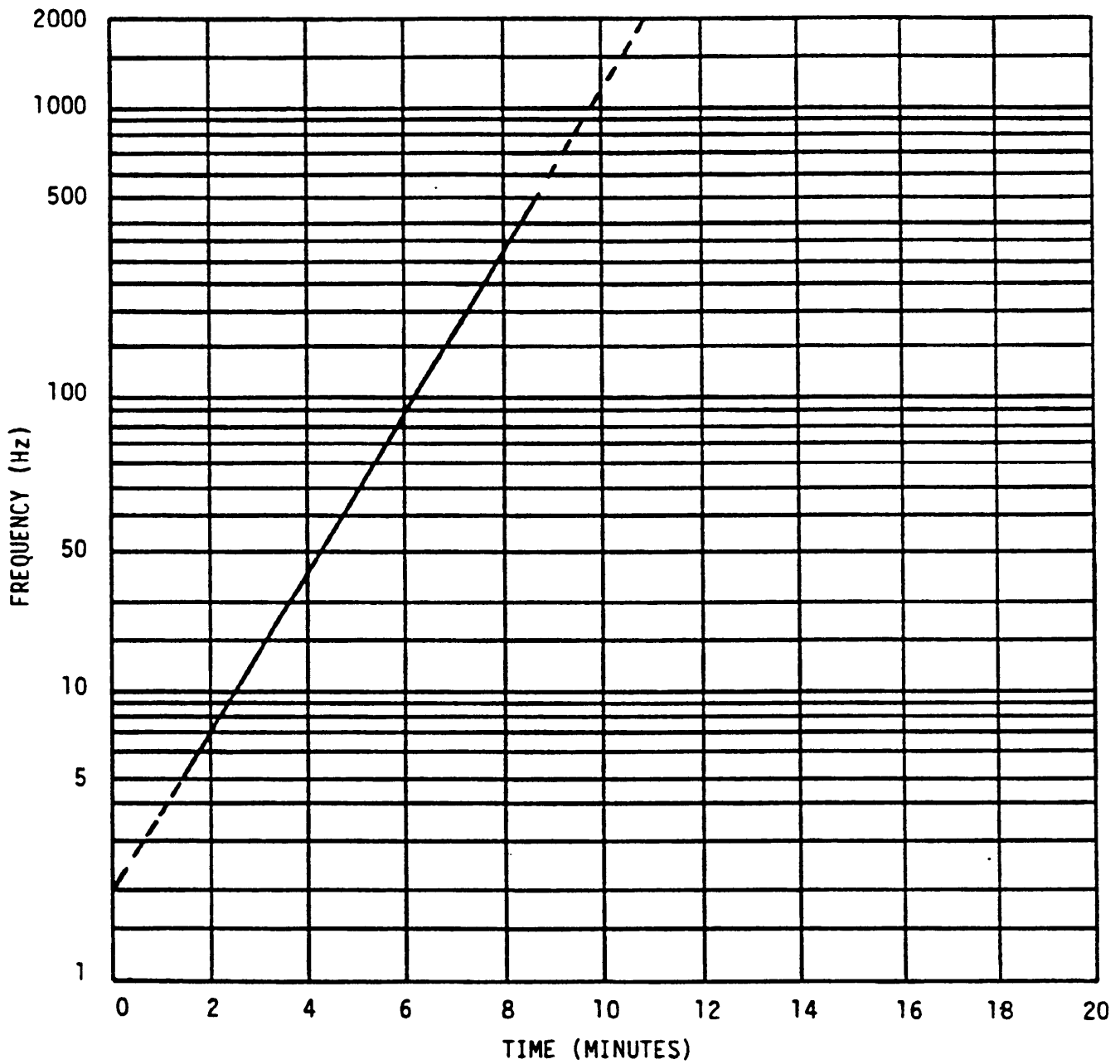


FIGURE 5. Logarithmic sweep.

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