

O-L-160a  
~~September 28, 1967~~  
SUPERSEDED  
Fed. Spec. O-L-160  
September 10, 1956

FEDERAL SPECIFICATION

LEAK PREVENTIVE COMPOUND, RADIATOR

This specification was approved by the Commissioner,  
Federal Supply Service, General Services Administration,  
for the use of all Federal agencies.

1. SCOPE

1.1 This specification covers one type of leak preventive compound for use in the cooling system of internal combustion engines (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 Specifications and standards. The following specifications and standards, 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.

Federal Specifications:

O-A-548 - Antifreeze, Ethylene Glycol, Inhibited.  
RR-8-366 - Sieves, Standard for Testing Purposes.  
PPP-B-636 - Box, Fiberboard.  
PPP-C-96 - Cans, Metal, 28 Gage and Lighter.

Federal Standard:

Fed. Std. No. 123 - Marking for Domestic Shipment (Civilian Agencies).

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., 20402.

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Washington, D. C., Atlanta, Chicago, Kansas City, Mo., Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, Wash.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Standards:

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.  
MIL-STD-129 - Marking for Shipment and Storage.

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring 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.

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Uniform Freight Classification Rules:

(Application for copies of Uniform Freight Classification Rules should be addressed to the Uniform Freight Classification Committee, 202 Chicago Union Station, Chicago 6, Illinois.)

National Motor Freight Classification Rules:

(Application for copies should be addressed to the National Motor Freight Classification Board, 1616 P Street, N. W., Washington, D. C., 20036.)

American Society for Testing and Materials (ASTM) Standard:

ASTM D 664 - Method of Test for Neutralization Number by Potentiometric Titration.

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

3. REQUIREMENTS

3.1 Material. The cooling system leak preventive compound shall consist of a volatile solution containing a filler, a water-dispersible binder, and additives, such as preservatives and rust inhibitors, required to prevent deterioration of the compound within the container and to protect the cooling system metals. The material shall be nonabrasive and shall be free of silicates, or materials subject to fungal or bacterial attack for which no preservative is provided, and free of any other material which may have a harmful effect on the radiator or other components of the cooling system of an engine. The compound shall not clog the tubes of the radiator, and shall be readily removable from the cooling system by means of cooling system cleaners.

3.2 Physical and chemical requirements. The leak preventive compound (hereinafter referred to as the compound) shall conform to the physical and chemical requirements specified hereafter.

3.2.1 Volatile matter. The evaporation loss of the compound shall not exceed 90 percent, by weight, when determined in accordance with 4.3.1.

3.2.2 Solubility of nonvolatile matter. When mixed with water and allowed to stand for two hours, the nonvolatile matter of the compound shall not form into lumps, nor leave any hard residue in the test container, when tested in accordance with 4.3.2.

3.2.3 pH value of mixtures of the compound.

3.2.3.1 Water mixture. The pH value of a mixture of the compound and distilled water shall be in the range of 6.0 to 9.5, when tested in accordance with 4.3.3.1.

3.2.3.2 Inhibited ethylene glycol mixture. The pH value of a mixture of the compound and borax-inhibited ethylene glycol solution shall be in the range of 7.0 to 8.0, when tested in accordance with 4.3.3.2.

3.2.4 Dispersibility in water and inhibited ethylene glycol. The compound shall be dispersible in water and in borax inhibited ethylene glycol solutions. The mixtures of the compound with these liquids shall show no gelling or gumming. All phases of the mixtures shall pass through a U. S. No. 16 standard test sieve (not more than 20 separate small particles of the filler may be retained on the sieve), when tested in accordance with 4.3.4.1 and 4.3.4.2.

3.2.5 Leak stoppage. The compound when used with water or inhibited glycol-water solution shall effectively stop leakage through 1/32 inch diameter holes and hold under a pressure of 15 p.s.i. when tested in accordance with 4.3.5.

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 specified herein. Except as otherwise specified the supplier may utilize his own facilities or any commercial laboratory acceptable to 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 that supplies and services conform to the prescribed requirements.

4.2 Sampling.

4.2.1 Lot. For purposes of sampling, a lot shall consist of all the compound produced by one manufacturer, and offered for delivery at one time.

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4.2.2 Sampling for inspection of filled containers. A random sample of filled containers shall be taken from each lot in accordance with MIL-STD-105 at inspection level I and acceptable quality level (AQL) = 2.5 percent defective, to verify compliance with all stipulations of this specification regarding fill, closure, marking, and other requirements not involving tests.

4.2.3 Sampling for tests. A minimum of four containers shall be taken from each lot for test purposes.

4.3 Tests. The test methods specified hereafter shall be used in determining compliance of the material under test with the corresponding requirement specified in section 3 of this specification.

4.3.1 Volatile matter. Place approximately 20 grams of well mixed compound, weighed to the nearest 0.1 gram, in a tared Petri dish (approximately 100 mm. in diameter and 15 mm. in depth). Place the dish and its contents for 48 hours in a draft-free oven maintained at  $210^{\circ} \pm 2^{\circ}$  F. At the end of this period remove the dish from the oven, place it in a desiccator, cool to room temperature, and weigh it to the nearest 0.1 gram. Retain the nonvolatile residue for the determination of the solubility (see 4.3.2). Calculate the percentage of volatile matter as follows:

$$\text{Percent volatile matter} = \frac{(W - R)}{W} 100$$

in which:

W = initial weight of sample, in grams  
R = weight of residue, in grams

4.3.2 Solubility of the nonvolatile matter. Add 25 ml. of distilled water to the nonvolatile residue retained from the volatile matter test (see 4.3.1), and mix thoroughly. Allow the mixture to stand for two hours at room temperature. At the end of this period, examine the mixture for formation of lumps and for hard deposits in the test container.

4.3.3 pH value of compound mixtures.

4.3.3.1 Water mixture. Place 5.0 ml. of the well-mixed compound in an 8-ounce screwcap glass jar. Add 200 ml. of distilled water to the jar; cover it, shake the contents, allow the jar to stand for 10 minutes and filter. Determine the pH value of the filtrate, using the glass electrode and reference calomel electrode specified in ASTM Method D 664.

4.3.3.2 Inhibited ethylene glycol mixture. Place 5.0 ml. of the well-mixed compound in an 8-ounce screwcap glass jar. Add 200 ml. of a 1:1 mixture of borax-inhibited ethylene glycol, conforming to O-A-548, type I, and distilled water, to the jar; cover it, shake the contents, allow to stand for 10 minutes and filter. Determine the pH value of the filtrate using the glass electrode and reference calomel electrode specified in ASTM Method D 664.

4.3.4 Dispersibility.

4.3.4.1 In water. Place 5.0 ml. of the well-mixed compound in an 8-ounce screwcap glass jar. Add 200 ml. of distilled water to the jar; cover it, shake the contents, and allow the jar to stand for 10 minutes. Again shake the contents of the jar until thoroughly mixed, and pour it through a U. S. No. 15 standard sieve conforming to RR-8-366. Rinse the jar and sieve with 200 to 300 ml. of distilled water. Examine the sieve for any retained material and for evidence of gumming or gelling of the water-compound mixture.

4.3.4.2 In inhibited ethylene glycol mixture. Place 5.0 ml. of the well-mixed compound in an 8-ounce screwcap glass jar. Add 200 ml. of a 1:1 mixture of inhibited ethylene glycol, conforming to O-A-548, and distilled water, to the jar; cover it, shake the contents, and allow to stand for 10 minutes. Again shake the contents of the jar until thoroughly mixed, and pour it through a U. S. No. 15 standard sieve conforming to RR-8-366. Rinse the jar and sieve with 200 to 300 ml. of distilled water. Examine the sieve for any retained material and for evidence of gumming or gelling of the ethylene glycol-compound mixture.

4.3.5 Leak test.

4.3.5.1 Apparatus (see figure 1). The leak test unit shall consist of a pressurized reservoir, a circulating pump, and an electric heating unit.

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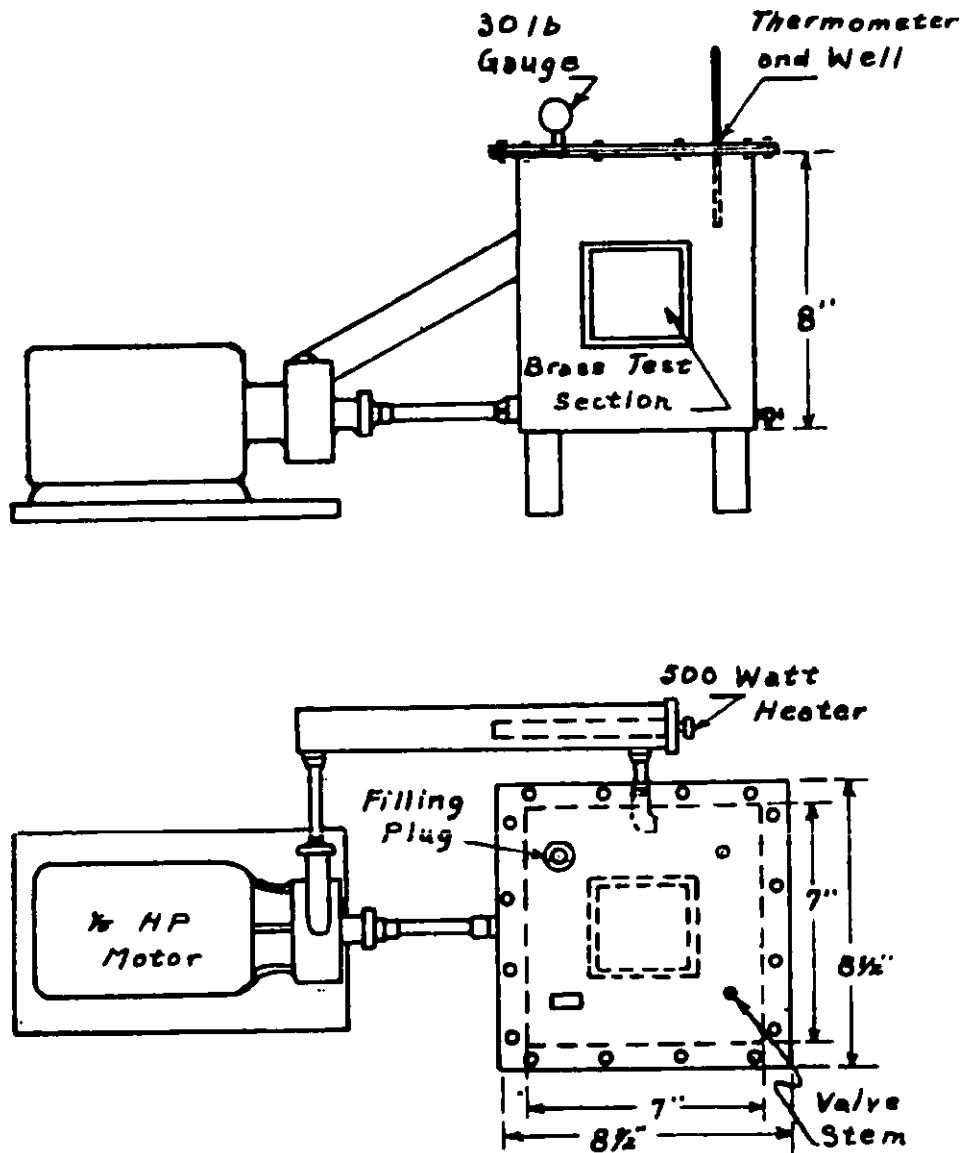


FIGURE 1. Leak test apparatus.

4.3.5.1.1 Reservoir. The reservoir shall be approximately 7 by 7 by 8 inches high. Total capacity of the assembled unit shall be between 1.7 and 2.0 gallons. The reservoir shall be constructed of stainless steel or brass, minimum thickness 0.062 inch, in order to withstand a pressure of 20 p.s.i. The top of the reservoir is so constructed that it may be removed for thoroughly cleaning the interior of the reservoir. Two openings having approximately 2-1/2 by 2-1/2 inches of free working area shall be cut in the reservoir. One of the openings shall be centered on the bottom of the reservoir and one centered on the side of the reservoir. Two test sections constructed of brass, not to exceed 0.015 inch in thickness, shall be soldered or bolted over the openings in the reservoir. The bottom test section shall contain one 1/32-inch diameter hole in the center of the section. The side test section shall contain two 1/32-inch diameter holes spaced 1-1/2 inches apart on the horizontal center line of the test section. The reservoir shall contain a drain on the side or bottom of the reservoir for aid in draining or withdrawing test liquid. The top of the reservoir shall have an opening for filling, thermometer well, pressure gauge (0 to 30 lbs. minimum) and a means of applying air pressure, such as a tire valve stem. The outlet opening or suction connection to the circulating pump is situated near the bottom on a side of the reservoir. The inlet opening or discharge connection of the circulating pump is situated near the top on a side of the reservoir. For ease of construction the inlet and outlet openings shall be on adjacent sides of the reservoir. The inlet opening shall be baffled to insure that the liquid discharge is not directed on any of the test

openings (see figure 1).

4.3.5.1.2. **Circulation pump.** The circulation pump shall be capable of circulating a minimum of eight gallons of water per minute against zero head. The packing gland of the pump should be capable of withstanding 20 p.s.i. without excessive leakage. Inlet and outlet connections shall be not less than 1/4 inch standard water pipe. The electric motor for the circulation pump should have a power rating of not less than 1/5 hp.

4.3.5.1.3. **Heating element.** The heating element shall be of the immersion cartridge type and shall have a power rating between 300 and 500 watts. The heating element functions best when installed in the discharge pipe of the circulation pump. A rheostat or variable transformer shall be employed in series with the heating element for controlling water temperatures.

4.3.5.1.4. **Calculation of compound.** The capacity in gallons of the leak test unit shall be determined by filling with tapwater at room temperature. On the basis that 3 fluid ounces of leak preventive compound is required for each one gallon capacity of the test unit, calculate the exact amount of leak preventive compound required (5.6 to 6.0 ounces of leak preventive compound required for the 1.7 to 2.0 gallon capacity test unit. One fluid ounce equals 29.6 ml.).

4.3.5.2. **Procedure with water as a coolant.** The test unit is disassembled and thoroughly cleaned of any remaining leak preventive compound and scale from previous tests. Cleaning of the unit is accomplished by means of scouring powder and a stiff bristle brush. All test openings shall be inspected to insure they are open. The unit is reassembled and filled to overflowing with tapwater. All test openings shall show leakage. Withdraw 800 to 1000 ml. (27 to 34 fl. oz.) of water. Place the required amount of well-mixed compound under test, determined in accordance with 4.3.5.1.4, in a beaker with 50 ml. of water, and thoroughly mix. Start the circulation pump, and with all test openings leaking, slowly add the leak preventive. All openings shall stop leaking within 120 seconds after all the leak preventive mixture has been added to the reservoir. Circulation is continued for 10 minutes. In the event that overflow due to excessive foaming is observed, withdraw an additional 500 to 800 ml. (17 to 27 fl. oz.) of liquid and retain. The side of the reservoir is then struck 3 sharp blows below the test openings and 3 sharp blows above the test openings with a wooden rod, 3/8 to 1/2 inch in diameter and 16 inches in length. Care shall be taken to refrain from striking closer than 1 inch to the test openings. All leaks shall stop within 120 seconds, slight seepage being permitted. With the reservoir vented to the atmosphere and the circulating pump running, heat is applied until the temperature of the water in the test unit reaches  $180^{\circ} \pm 3^{\circ}$  F. The side of the reservoir is then struck 3 sharp blows below the test openings and 3 sharp blows above the test openings with the wooden rod. All leaks shall stop leaking within 120 seconds. Circulation is continued for 30 minutes, after which the test unit is shut down and cooled to room temperature within a 16 hour period. At the termination of the 16 hour period, the water level in the reservoir is raised to within 1 inch of the top of the reservoir. (Any retained solution containing leak preventive compound is added at this time.) The unit is pressure sealed. The circulation pump is started and heat is applied until the temperature of the water in the reservoir reaches  $180^{\circ} \pm 3^{\circ}$  F. The pressure in the reservoir is maintained at between 8 and 10 p.s.i. Should any leaks occur during this period, they shall stop leaking within 120 seconds, slight seepage being permitted. When the temperature in the reservoir reaches  $180^{\circ} \pm 3^{\circ}$  F. a pressure of  $10 \pm 0, -1$  pound, is maintained for a period of 4 hours. At the termination of the 4 hour period, a pressure of 15 p.s.i. is applied to the reservoir for 1 minute. No leakage shall occur at the test openings. The pressure is lowered to 10 p.s.i. after the 1 minute period, and maintained for 10 minutes. No leakage shall occur at the test openings when the side of the reservoir is struck 3 sharp blows below the test openings and 3 sharp blows above the test openings with the wooden rod.

4.3.5.3. **Procedure with antifreeze as a coolant.** The test unit is disassembled and thoroughly cleaned of any remaining leak preventive compound and scale from previous tests. Cleaning of the unit is accomplished by means of scouring powder and a stiff bristle brush. All test openings shall be inspected to insure they are open. The unit is reassembled and filled to overflowing with a mixture of one part of packaged inhibited ethylene glycol, conforming to O-A-548, and two parts of tap water. All test openings shall show leakage. Withdraw 800 to 1000 ml. (27 to 34 fl. oz.) of the antifreeze coolant. Place the required amount of well-mixed compound under test, determined in accordance with 4.3.5.1.4, in a beaker with 50 ml. of the antifreeze coolant, and thoroughly mix. Start the circulation pump and with all test openings leaking, slowly add the leak preventive mixture. All openings shall stop leaking within 150 seconds after all the leak preventive mixture has been added to the reservoir. Circulation is continued for 10 minutes. In the event that overflow is observed due to excessive foaming withdraw an additional 500 to 800 ml. (17 to 27 fl. oz.) of the liquid and retain. The side of the reservoir is then struck 3 sharp blows below the test openings and 3 sharp blows above the test openings with a wooden rod, 3/8 to 1/2 inch in diameter and 16 inches in length. Care should be taken to refrain from striking closer than one inch to the test openings. All flow shall stop within 150 seconds, slight seepage being permitted. With the reservoir vented to the atmosphere and the circulation pump running, heat is applied until the temperature of the coolant in the test unit reaches  $180^{\circ} \pm 3^{\circ}$  F. The side of the reservoir is then struck 3 sharp blows below the test openings and 3 sharp blows above the test openings with the wooden rod. All leaks shall stop leaking within

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150 seconds. Circulation is continued for 30 minutes, after which the test unit is shut down and cooled to room temperature within a 16 hour period. The water level in the reservoir is raised to within 1 inch of the top of the reservoir. (Any retained solution containing leak preventive compound is added at this time.) The unit is pressure sealed, the circulation pump is started, and heat is applied until the temperature of the water in the reservoir reaches  $180^{\circ} + 3^{\circ}$  F. The pressure in the reservoir is maintained at between 8 to 10 p.s.i. Should any leaks occur during this period, they shall stop leaking within 150 seconds, slight seepage being permitted. When the temperature in the reservoir reaches  $180^{\circ} + 3^{\circ}$  F., a pressure of  $10 + 0, -1$  pound is maintained for a period of 4 hours. At the termination of the 4 hour period, a pressure of 15 p.s.i. is applied to the reservoir for 1 minute. No leakage shall occur at the test openings. The pressure is lowered to 10 p.s.i. after the 1 minute period and maintained for 10 minutes. No flow shall occur at the test openings when the side of the reservoir is struck 3 sharp blows below the test openings and 3 sharp blows above the test openings with the wooden rod.

4.3.6 Additional tests. The right is reserved by the procuring agency to make such additional tests and analyses as it may deem necessary to determine compliance of the material with the requirements of this specification.

## 5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A, B, or C, as specified (see 6.2).

5.1.1 Level A. The compound shall be packaged in 12-ounce screwcap cans conforming to the requirements of PPP-C-96, type VIII. Cans shall be coated in accordance with the requirements for plan B of PPP-C-96.

5.1.2 Level B. The compound shall be packaged in 12-ounce screwcap cans conforming to the requirements of PPP-C-96, type VIII. Cans shall be coated in accordance with the requirements for plan A of PPP-B-96.

5.1.3 Level C. The compound shall be packaged in 12-ounce quantities, unless otherwise specified, to afford adequate protection against deterioration and damage during shipment from the supplier to the initial destination.

5.2 Packing. Packing shall be level A, B, or C, as specified (see 6.2).

5.2.1 Level A. The compound packaged as specified in 5.1, shall be arranged and packed for shipment in accordance with the level A packing requirements for 1-quart, type VIII, cans as specified in the appendix to PPP-C-96.

5.2.2 Level B. The compound, packaged as specified in 5.1, shall be packed in accordance with the level B packing requirements as specified for 1-quart, type VIII, cans of PPP-C-96, except that unless otherwise specified (see 6.2), boxes conforming to PPP-B-636, class domestic, shall be used.

5.2.3 Level C. The compound packaged as specified in 5.1, shall be packed to insure carrier acceptance and safe delivery at destination, in containers complying with the rules and regulations applicable to the mode of transportation.

5.3 Marking. In addition to the markings required by 5.3.1 or 5.3.2 each container shall be marked with the instructions for use.

5.3.1 Civil agencies. In addition to markings required by the contract or order, the interior packages and shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.3.2 Military agencies. In addition to markings required by the contract or order, the interior packages and the shipping container shall be marked in accordance with MIL-STD-129.

## 6. NOTES

6.1 Intended use. The cooling system leak preventive compound is intended as a temporary seal for small cracks and pinhole leaks in the radiator and cooling system of internal combustion engines. It is particularly intended for sealing leaks in thin metal sections which are in a high velocity zone. The water soluble binder found in a leak preventive compound usually hardens only when in contact with air and heat. This compound is not intended to stop seepage of the coolant at the circulating pump shaft. This compound is not intended to function as an antiseepage and cooling system conditioner but MIL-C-51047, "Compound, Antiseepage, for Cooling System, Internal Combustion Engine", should be used where an antiseepage compound is required.

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5.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents.

- a. Title, number, and date of this specification.
- b. Quantity required, number of containers.
- c. Level of packaging and level of packing required (see section 5).
- d. Type of box for level A pack (see 5.2.1).
- e. Type of box for level B pack, if other than fiberboard (see 5.2.2).
- f. Can size for level C package, if other than 12-ounce (see 5.2.3).

CUSTODIANS:

Army - MR  
 Navy - YD  
 Air Force - 68  
 Civil - CSA

Review activities:

Army - MR, MU  
 Navy - MC, YD  
 Air Force - 68

User activity:

Navy - MC

Preparing activity:

Army - MR

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<b>INSTRUCTIONS</b>		
This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.		
SPECIFICATION <b>O-L-160a, Leak Preventive Compound, Radiator</b>		
ORGANIZATION	CITY AND STATE	
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT \$
MATERIAL PROCURED UNDER A <input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A. GIVE PARAGRAPH NUMBER AND WORDING.		
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.		
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3. IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO      IF "YES" IN WHAT WAY?		
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED BY (Printed or typed name and activity)		DATE

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REPLACES NAVSHIPS FORM 4863, WHICH IS OBSOLETE