

MIL-C-10597E  
4 November 1983  
SUPERSEDING  
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24 June 1969

MILITARY SPECIFICATION

CLEANING COMPOUND WITH CONDITIONER AND INHIBITOR  
FOR ENGINE COOLING SYSTEMS

This specification is approved for use by the Army Materials and Mechanics Research Center, 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 one type and grade of cleaning compound, conditioner and inhibitor supplied in a kit, for cleaning, conditioning and inhibiting liquid cooling systems of engines on motor vehicles.

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

FEDERAL

O-O-690 - Oxalic Acid, Dihydrate, Technical

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Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Director, US Army Materials and Mechanics Research Center, ATTN: DRXMR-SMS, Watertown, MA 02172 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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/ FSC 6850 /

MIL-C-10597E

O-S-605 - Sodium Silicate Solution  
PPP-B-585 - Boxes, Wood, Wirebound  
PPP-B-601 - Boxes, Wood, Cleated Plywood  
PPP-B-621 - Boxes, Wood, Nailed and Lock-Corner

MILITARY

MIL-P-116 - Preservation, Methods of  
MIL-B-117 - Bag, Sleeve and Tubing - Interior Packaging  
MIL-B-26701E - Bottles, Screw Cap and Carboys Polyethylene Plastic  
MIL-A-53009 - Additive, Antifreeze Extender, Liquid Cooling Systems

STANDARDS

MILITARY

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

(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 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 Cleaner.

3.1.1 Components. The minor component shall be a solution of aluminum chloride in water. The major component shall be a granular powder consisting of a mixture of oxalic acid and cornstarch. The oxalic acid shall conform to the requirements of O-O-690, type II.

3.1.2 Physical characteristics. The physical characteristics of the cleaner shall conform to the requirements of table I, when tested by the methods indicated therein.

Table I. Physical characteristics

Characteristics	Requirements		Method paragraph
	Minimum	Maximum	
Major component (granular powder)			
Oxalic acid, calculated as anhydrous, grams	287.5	295.0	4.3.4.1
Cornstarch, percent by weight of major component	1.0	2.0	4.3.4.2
Minor component (liquid)			
Aluminum chloride solution, weight calculated as anhydrous $AlCl_3$ , grams	49.0	53.0	4.3.4.3.2

3.1.3 Chemical characteristics. The aluminum chloride solution shall conform to the requirements of Table II.

Table II. Chemical characteristics of aluminum chloride solution

Characteristics	Requirements		Method paragraph
	Minimum	Maximum	
Aluminum chloride, calculated as anhydrous, percent by weight	22.5	28.0	4.3.4.3.1
Chlorine, calculated as percent by weight of anhydrous aluminum chloride	75.0	80.0	4.3.4.3.3
pH of 1-percent $AlCl_3$ solution	3.15	3.35	4.3.4.3.4

### 3.2 Conditioner.

3.2.1 Components. The conditioner shall consist of two components. One component (sodium silicate) is a solution conforming to the requirements of O-S-605, class 1, and the other component (alkaline conditioner) is a granular powder. The conditioner shall be furnished in the same kit with the cleaner.

3.2.2 Physical characteristics. The physical characteristics of the conditioner components shall conform to the requirements of table III, when tested by the methods indicated therein. The materials are calculated on the anhydrous basis for uniformity and are not required to be present in this form.

Table III. Physical characteristics

Characteristics	Requirements		Method paragraph
	Minimum	Maximum	
Alkaline conditioner component			
Trisodium phosphate, anhydrous, grams	139	150	4.3.4.5
Borax, anhydrous, grams	115	125	4.3.4.6
Sodium carbonate, anhydrous, grams	50	60	4.3.4.7
Sodium silicate component			
Sodium silicate solution, total weight, grams	325	400	4.3.3.1.2

3.2.3 Chemical characteristics. The chemical characteristics of the alkaline conditioner shall conform to the requirements of table IV when tested by the method indicated therein. The chemical characteristics of the Sodium Silicate, Liquid Conditioner, shall conform to the requirements set forth in O-S-605, class 1, when tested as specified herein.

Table IV. Chemical characteristics

Characteristics	Maximum titer	Method Paragraph
Free alkali in the alkaline conditioner (Ml. 0.1N hydrochloric acid)	1.00	4.3.4.8

3.3 Inhibitor. The inhibitor shall conform to MIL-A-53009, and be furnished in a separate heat-sealed, waterproof bag (see figure 3). The bag shall contain a minimum of 282 grams (10 ounces) and a maximum of 292 grams, the weight to be determined in accordance with paragraph 4.3.3.1.1.

3.4 Material. The dry components shall be free flowing and shall retain these characteristics until used, if the individual containers are kept sealed as received until time of use. There shall be no evidence of leakage of powder from the packages or liquid from the bottles when inspected in accordance with paragraph 4.3.1.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract 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 that supplies and services conform to prescribed requirements.

4.1.1 All tests required herein for the testing components of this kit are classified as acceptance tests, for which necessary sampling techniques and methods of testing are specified in section 4.

4.1.2 Lot size. A lot shall consist of that number of kits which can be filled by the smallest component quantity (oxalic acid plus cornstarch, alkaline conditioner, or corrosion inhibitor) that can be homogeneously blended by the supplier at one time in one mixing unit.

#### 4.2 Sampling.

4.2.1 Sampling for inspection of filled kits. A random sample of filled kits shall be taken in accordance with MIL-STD-105 for the inspection specified in 4.3.1.

4.2.2 Sampling for inspection of the packaging and packing. A random sample of packs shall be taken in accordance with MIL-STD-105, inspection level S-2, for examination of the packaging and packing as specified in 4.3.2. The sample unit shall be one fully packed shipping container. Closed shipping containers shall be examined for closure defects.

4.2.3 Sampling for lot acceptance tests. Three (3) kits from each lot shall be selected at random and submitted to the laboratory for testing. After determining the total weight of each component in 4.3.3.1, a composite sample shall be used for acceptance tests. When specified by the procuring activity samples selected as above shall be submitted to the designated Government laboratory for verification testing.

#### 4.3 Inspection.

4.3.1 Inspection of filled kits. Inspection of filled kits (see 4.2.1) shall be conducted in accordance with the following classification of defects. The acceptable quality level (AQL) shall be 2.5 percent defective.

Defect	Method of inspection
Underfilling of components	4.3.3.1
Leakage of liquid from bottles	Visual
Leakage of powders from bags	Visual
Non-compliance of physical form of components	Visual
Dry components are not free flowing	Visual

#### 4.3.2 Inspection of packaging and packing.

4.3.2.1 Inspection of packaging. Inspection of packaging (see 4.2.2) shall be conducted in accordance with the following classification of defects for compliance with section 5.1 of this specification. The acceptable quality level (AQL) shall be 2.5 percent defective.

4.3.2.2 Inspection of packing. Inspection of packing (see 4.2.2) shall be conducted in accordance with the following classification of defects for compliance with section 5.2 of this specification. The acceptable quality level (AQL) shall be 2.5 percent defective.

Defect	Method of inspection	Requirement
Packaging not as specified	Visual	5.1.1, 5.1.2, 5.1.3
Self-shrinking cellulose band absent or not in accordance with figure 3	Visual	5.1.1, 5.1.2
Method of packaging not as specified	Visual	5.1.1, 5.1.2
Packing not as specified	Visual	5.2.1, 5.2.2, 5.2.3
Closure and strapping not as specified	Visual	5.2.1, 5.2.2
Gross weight exceeds that specified	Weigh	5.2.1, 5.2.2
Marking not as specified	Visual	5.3, 5.3.2
Instructions for use sheet missing or not as specified	Visual	5.3.1

#### 4.3.3 Inspection for physical characteristics.

##### 4.3.3.1 Total weight determination.

4.3.3.1.1 Dry components. Weigh the bag with the dry component to a tenth of a gram. Transfer the contents to a dry stoppered flask and reweigh the bag. Perform this operation for each of the three dry components. Record the difference in weight as the total weight of the major cleaner component (oxalic acid), of alkaline conditioner component and of inhibitor.

4.3.3.1.2 Liquid components. Weigh the bottle containing the liquid component to a tenth of a gram, after removing the self-shrinking band. Transfer the contents to a dry stoppered flask. Rinse the bottle five times with distilled water and once with 95 percent ethanol. Dry with a stream of air. Reweigh the bottle. Perform this operation for both liquid components. Record the difference in weight as the total weight of the minor cleaner component (aluminum chloride solution) and of the sodium silicate conditioner component.

##### 4.3.4 Inspection for chemical characteristics.

4.3.4.1 Determination of oxalic acid. The percentage of anhydrous oxalic acid shall be calculated from the number of milliliters of tenth normal potassium permanganate ( $\text{KMnO}_4$ ) used in the titration specified in O-O-690. For a sample of exactly 0.250 grams, the calculation shall be made as follows:

$$\text{Percent oxalic acid, anhydrous} = A = \text{ml. KMnO}_4 \times 1.8$$

$$\text{Weight oxalic acid, anhydrous, in package} = \frac{(\text{total weight from 4.3.3.1.1}) \times A}{100}$$

4.3.4.2 Determination of percent of cornstarch in oxalic acid. Twenty-five (25.00) grams of the oxalic acid component shall be placed into a weighed 100 ml. centrifuge tube (Corning 8200, 8160, or equal). Ethyl alcohol shall be added to the 100 ml. mark, the tube stoppered and shaken thoroughly until the oxalic acid is dissolved. The sample shall be centrifuged for 15 minutes at approximately 1750 r.p.m. The clear solution shall be decanted. Fifty (50) ml. of ethyl alcohol shall be added to the tube and the contents shaken up. The sample shall be centrifuged as indicated before. The wash alcohol shall be decanted. The alcohol left in the centrifuge tube with the cornstarch shall be removed by first evaporating on a steam bath for twenty minutes and then by placing the tube in an oven at  $110^\circ\text{C}$  for 30 minutes. The tube shall be cooled in a desiccator over calcium chloride for 30 minutes, then reweighed. The gain in weight shall be tentatively recorded as weight of cornstarch.

Two microscope slides, one with starch extracted from the oxalic acid and contained in the centrifuge tube, the other with known cornstarch, shall be prepared by placing the powder on the slide, mounting in Canada balsam, and covering with cover glasses. The form of the two starches, magnified 50 times, shall be compared under the microscope. When the two starches are found to be identical in general shape and form the following calculations shall be made:

$$\text{Percent cornstarch} = \text{weight of cornstarch} \times 4$$

If the two are not identical as indicated, the material shall be reported as failing the requirements for cornstarch, percent by weight, of 3.1.2, table I.

#### 4.3.4.3 Aluminum chloride.

4.3.4.3.1 Determination of percent aluminum chloride, anhydrous. Into a 100 ml. volumetric flask, weigh approximately 4 grams of the aluminum chloride solution taken from the glass stoppered flask of 4.3.3.1.2, to the fourth decimal and designate this weight as weight A. Dilute the weighed sample to the mark with distilled water and agitate to insure homogeneity. This solution will also be used in connection with paragraphs 4.3.4.3.3 and 4.3.4.3.4. Ten milliliters of this solution shall be transferred to a 400 ml. beaker by means of a pipet. The solution shall be diluted to 100 ml. with distilled water, 5 grams of ammonium chloride and a few drops of methyl red indicator added, and the solution heated just to boiling. Six normal  $\text{NH}_4\text{OH}$  shall be added dropwise until the color changes to a distinct yellow. The

solution shall be boiled 1 to 2 minutes and filtered at once through 9 cm. Whatman 41H filter paper or equivalent. The precipitate shall be washed with a 2-percent  $\text{NH}_4\text{Cl}$  solution. The precipitate with the filter paper shall be transferred to an accurately weighed crucible, charred, and then ignited for 5 to 10 minutes over a blast burner. The crucible shall be cooled in a desiccator and weighed, the gain in weight in grams being recorded as  $\text{Al}_2\text{O}_3$ , provided the precipitate is white. If the precipitate is other than white, the gain in weight shall be recorded as weight of unknown material, and the sample shall be assumed to contain less than the acceptable percent of anhydrous aluminum chloride.

$$\text{Percent aluminum chloride, anhydrous, by weight} = B = \frac{\text{weight Al}_2\text{O}_3 \times 2616}{\text{weight A}}$$

4.3.4.3.2 Total weight as anhydrous aluminum chloride (see table I).

$$\text{Weight as anhydrous} = \frac{\text{total weight (4.3.3.1.2)} \times B}{100}$$

4.3.4.3.3 Determination of percent chlorine in aluminum chloride (calculated as anhydrous) component. Ten milliliters of the solution prepared in 4.3.4.3.1 shall be transferred to a 400 ml. beaker by means of a pipet. The solution shall be diluted to 50 ml. with distilled water and 5 ml. of 6N nitric acid shall be added. The solution shall then be heated to  $90^\circ$  to  $95^\circ\text{C}$ . and 20 milliliters of standardized 0.1 N silver nitrate solution shall be added by means of a pipet, the solution being stirred during the addition. The solution shall be heated until the precipitate has coagulated, then filtered through Whatman No. 44 or equivalent filter paper. The filter paper and precipitate shall be washed with hot distilled water until free of silver nitrate (about six times). Five milliliters of a saturated water solution of ferric alum shall be added, as an indicator, to the filtrate and the solution shall be titrated to a permanent pink tint with a standardized 0.1 N ammonium thiocyanate solution.

Chlorine, percent by weight of anhydrous aluminum chloride = P

$$P = 3546 \times \frac{(20 \times \text{normality of AgNO}_3) - (\text{ml. NH}_4\text{CNS} \times \text{normality of NH}_4\text{CNS})}{\text{weight A}^* \times B^*}$$

\*From paragraph 4.3.4.3.1

4.3.4.3.4 Determination of pH of 1-percent solution of hydrated aluminum chloride. Prepare the 1 percent solution as follows: Dilute to 50 ml. in a volumetric flask, a pipeted volume of Y ml. of solution prepared in 4.3.4.3.1, calculated from:

$$Y = \frac{2760}{\text{weight A}^* \times B^*}$$

\*From 4.3.4.3.1



A pH meter, Beckman or equal, utilizing glass electrode, shall be standardized with a buffer pH = 7.0. A determination shall be made by means of the standardized meter on the 1-percent solution.

4.3.4.4 Sodium silicate. The chemical characteristics of the sodium silicate shall conform to the requirements of the specification when tested by the methods of O-S-605, class 1.

4.3.4.5 Determination of trisodium phosphate. Accurately weigh 2.0 grams of the alkaline conditioner. The sample shall be transferred to a 500 ml. volumetric flask, dissolved in distilled water and diluted to the mark. Fifty milliliters of this solution shall be pipeted into a 300 ml. Erlenmeyer flask and diluted to 100 ml. Ten milliliters of concentrated nitric acid and 10 g. ammonium nitrate shall be added to the flask. The solution shall be heated to 30 - 45°C. Fifty milliliters of the ammoniacal molybdate solution (see 4.3.4.5.1) shall be added. Do not heat the solution after addition of the molybdate solution. The solution shall be agitated by shaking or with a magnetic stirrer for 10 minutes. The precipitate shall be allowed to settle about 30 minutes. The solution shall be filtered through fine textured filter paper. The precipitate and flask shall be washed with five 15-20 ml. portions of 1 percent potassium nitrate solution. The paper shall then be washed similarly, starting at the rim. The paper and precipitate shall be returned to the flask, and standardized 0.5N (normality  $N_1$ ) sodium hydroxide added from a buret to decompose the precipitate. An excess of 2.0 ml. shall be added. Record volume  $V_1$  of 0.5N sodium hydroxide used. The sides of the flask shall be washed down and the volume made up to 150 ml. Six drops of phenolphthalein indicator shall be added. The solution shall be titrated with standardized 0.1N (normality  $N_3$ ) nitric acid until the pink color is discharged. The volume  $V_3$  of 0.1N nitric acid used shall be recorded. The solution shall be back titrated to the pink color with standardized 0.1N (normality  $N_2$ ) sodium hydroxide. The volume  $V_2$  of 0.1N sodium hydroxide used shall be recorded.

All solutions must be carbon dioxide free.

$$\text{Percent trisodium phosphate, anhydrous} = T = \frac{(\text{me NaOH} - \text{me HNO}_3) (7.1291)}{\text{weight of sample}}$$

$$\text{me NaOH} = \text{total } V_1 N_1 + V_2 N_2$$

$$\text{me HNO}_3 = V_3 N_3$$

$$\text{Weight trisodium phosphate, anhydrous} = \frac{(\text{Total weight from 4.3.3.1.1}) \times T}{100}$$

4.3.4.5.1 Preparation of ammoniacal molybdate solution. In a one liter beaker 61 g. crystalline ammonium molybdate, 57 g. ammonium nitrate and 47 ml. concentrated ammonium hydroxide shall be placed. Five hundred milliliters of water shall be added, and the beaker warmed to aid solution. The solution shall be filtered and made up to one liter.

4.3.4.6 Determination of borax. Accurately weigh 0.9 grams of the alkaline conditioner into a 300 ml. Erlenmeyer flask. Seventy-five milliliters distilled water shall be added to the flask. When solution is complete, barium chloride (5 percent solution) shall be added in slight excess while stirring. After settling, the solution shall be filtered through fine textured filter paper (Whatman 42 or equivalent). The flask and paper shall be washed with two 10 ml. portions of water. The paper shall be returned to the flask. Six normal hydrochloric acid shall be added to the flask to dissolve the precipitate, and the sample diluted to 50 ml. The sample shall be stirred to break up the paper. Six normal sodium hydroxide shall be added until the solution is alkaline and the phosphate has reprecipitated. A few drops of sodium hydroxide and a few drops of the barium chloride solution shall be added to check for completeness of precipitation. The solution shall be filtered and washed as before. The filtrates shall be combined and diluted to 200 ml. The solution shall be made slightly acid with 6 N hydrochloric acid. Two drops of methyl orange indicator shall be added and the solution made alkaline with standard 0.5 N sodium hydroxide to a clear lemon yellow color. The buret reading shall be recorded as  $V_m$ . Fifty milliliters of glycerine or 1 gm. mannitol and phenolphthalein indicator shall be added. The solution shall be titrated to the pink end-point. Glycerine in 5 ml. portions or mannitol in 0.5 g. portions shall be added and the titration continued until a permanent pink end-point is reached. The buret reading shall be recorded as  $V_p$ , the total alkali used in the titration.

$$\text{Percent Na}_2\text{B}_4\text{O}_7, \text{ anhydrous} = X = \frac{(V_p - V_m) (5.0307) (N)}{\text{weight of sample}}$$

$V_p$  - Volume standard sodium hydroxide to phenolphthalein end-point  
 $V_m$  - Volume standard sodium hydroxide to methyl orange end-point  
 N - Normality of sodium hydroxide (approx. 0.5 N)

$$\text{Weight borax, anhydrous} = \frac{(\text{Total weight from 4.3.3.1.1}) \times X}{100}$$

4.3.4.7 Determination of sodium carbonate. Accurately weigh 2.3 g. of the dry alkaline conditioner into a 4 ml. glass thimble. The apparatus (figure 1) with 15 ml. 6 N hydrochloric acid, and with rubber policemen covering the outlet from the calcium chloride drying tube and the gas inlet tube shall be weighed accurately. The thimble shall be carefully introduced into the flask with tweezers. The total weight of the apparatus, acid thimble with sample is known. The policemen covering the drying tube outlet shall be removed and the thimble overturned by tilting or jarring the flask. After the reaction has stopped, the gas inlet tube shall be connected to the purifying train of soda lime and calcium chloride tubes. The outlet tube shall be connected to the suction line. Air shall bubble in at the rate of 3 bubbles per second. After 25 minutes, the flask shall be disconnected, the policemen replaced, and the apparatus weighed. The operation shall be repeated for 10 minute intervals until the weight is constant.

$$\text{Percent sodium carbonate} = S = \frac{(\text{weight loss}) (240.86)}{\text{weight of sample}}$$

$$\text{Weight sodium carbonate, anhydrous} = \frac{(\text{Total weight from 4.3.3.1.1}) \times S}{100}$$

4.3.4.8 Free alkali. Ten grams of the dry alkaline conditioner, weighed to the second decimal, shall be placed in a 125 ml. glass stoppered Erlenmeyer flask. Fifty milliliters of absolute ethyl alcohol shall be pipeted into the flask. The flask shall be shaken vigorously for 2 minutes. The alcohol shall be filtered through double, fast paper (Whatman 41 or equivalent). Twenty milliliters, pipeted into a 120 ml. Erlenmeyer flask containing 20 ml. water, shall be titrated with standard 0.1N hydrochloric acid to the phenolphthalein end point. Free alkali shall be reported as milliliters of 0.1N hydrochloric acid as specified in table IV.

4.3.4.9 Inhibitor. The chemical characteristics of the inhibitor shall conform to the requirements of the specification when tested by the method of O-I-490.

4.4 Rejection. When any sample fails one or more requirements of section 3 of this specification when tested as specified in section 4, the lot represented by that sample shall be rejected.

## 5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Preservation and packaging shall be level A, B, or C as specified in the contract or order.

5.1.1 Level A. The dry components, oxalic acid, alkaline conditioner and inhibitor shall be placed into heat sealable waterproof bags conforming to MIL-B-117, type II, class b. The liquid components, aluminum chloride and sodium silicate, shall be placed into semi-rigid round polyethylene plastic bottles made of plastic conforming to MIL-B-26701E. The cap shall have a self-shrinking cellulose band extending down the neck of the bottle as indicated in figure 3. All components (see figure 3) and instruction sheet (see figure 2) shall be placed into a fiberboard box conforming to PPP-B-636, class 2, W6. Unless otherwise specified, closure shall be in accordance with the box specification. This is the unit package or kit. The method of packaging is method III of MIL-P-116.

5.1.2 Level B. The unit package shall be as specified in 5.1.1.

5.1.3 Level C. The unit packaging shall afford adequate protection against deterioration and physical damage during shipment from the supply source to the first receiving activity. The supplier may use his standard practice when it meets this requirement.

5.2 Packing. Packing shall be level A, B, or C as specified in the contract or order.

5.2.1 Level A. The unit package as described in 5.1.1 shall be packed into a nailed wood box, wood-cleated plywood box, wirebound wood box, conforming to PPP-B-621, class 2; PPP-B-601, overseas type; PPP-B-585, class 3. Boxes shall be closed and strapped in accordance with the applicable box specification. Unless otherwise specified, gross weight shall not exceed 200 lbs. for wood boxes.

5.2.2 Level B. The unit package as described in 5.1.2 shall be packed into a nailed wood box, wood-cleated plywood box, wirebound wood box, wood-cleated fiberboard box or solid or corrugated fiberboard box conforming to PPP-B-621, class 1; PPP-B-601, domestic type; PPP-B-585, class 1; PPP-B-591, domestic type, and PPP-B-636, class 1. Closure shall be in accordance with the applicable box specification. Unless otherwise specified, gross weight shall not exceed 200 lbs. for wood boxes and 90 lbs. for fiberboard boxes.

5.2.3 Level C. The unit package as described in 5.1.3 shall be packed in a manner to insure carrier acceptance and safe delivery at destination at the lowest transportation rate for such supplies, and conform to the requirements of the Uniform Freight Classification Rules or National Motor Freight Classification Rules, as applicable to the mode of transportation.

5.3 Marking. All shipping containers and unit packages shall be marked in accordance with requirements of MIL-STD-129.

5.3.1 Instructions for use. The instructions for use shall be printed on both sides, if needed, on an 8 by 10-1/2 inch sheet of white bond paper. All printing will be in capital letters with the underlined words in 12 point type and all other in 10 point type. Wording for instructions shall be as shown in figure 2.

5.3.2 Component marking. Each component of the kit shall be marked as indicated in figure 3.

## 6. NOTES

6.1 Intended use. The material covered by this specification comes in a kit consisting of a cleaning compound, a conditioner and an inhibitor. It is intended for use in motor vehicle engine cooling systems. It has been found that the conditioning treatment of silicate protecting and alkaline conditioning is essential following the cleaning process in order to deactivate the clean metal surface and to rid the system of corrosion products not removed by water flushing. When this is followed by the recommended inhibitor in the coolant, the radiator life is greatly increased.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Level of packaging and packing required (see 5.1 and 5.2).

6.3 The use of granulated material instead of powdered material in the dry alkaline conditioner is intended to prevent the packing of the conditioner in the container.

Custodian:

Army - MR  
Navy - SH  
Air Force - 68

Preparing activity:

Army - MR

Project No. 6850-0727

Review activities:

DLA - GS

User activities:

Army - AT

(KBWP# ID-0278A/DISK 0103A. FOR AMMRC USE ONLY)

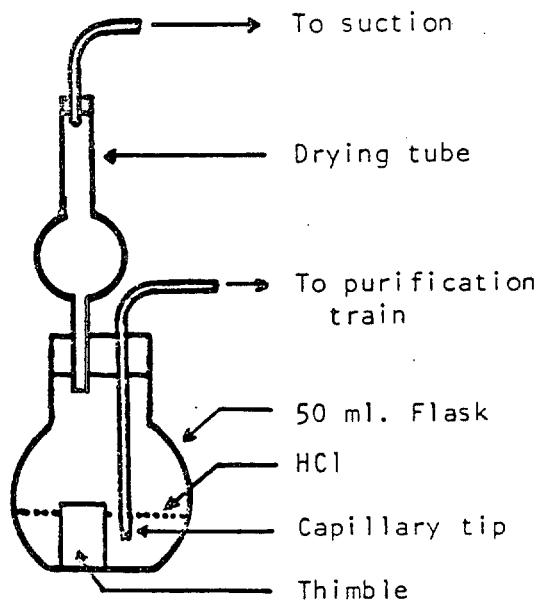


Figure 1

INSTRUCTIONS FOR USE

COOLING SYSTEMS MUST BE CLEANED, CONDITIONED, AND INHIBITED

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STEP 1 - CLEANING PROCESS.

THE CLEANER CONSISTS OF A DRY POWDER OXALIC ACID AND A LIQUID ALUMINUM CHLORIDE.

CLEANING

DRAIN CONTENTS OF COOLING SYSTEM COMPLETELY. FILL WITH CLEAN WATER TO WITHIN 2 INCHES OF OVERFLOW. IDLE ENGINE UNTIL TEMPERATURE REACHES 160-180°F. POUR SLOWLY CONTENTS OF BAG MARKED "OXALIC ACID" INTO RADIATOR. POUR CONTENTS OF BOTTLE MARKED "ALUMINUM CHLORIDE" INTO RADIATOR. IDLE ENGINE 20-25 MINUTES.

USE: ONE KIT FOR 11 TO 22 QT. COOLING SYSTEM  
TWO KITS FOR 23 TO 44 QT. COOLING SYSTEM  
THREE KITS FOR 45 TO 66 QT. COOLING SYSTEM

BEST RESULTS ARE OBTAINED IF CLEANING TIME IS NO LONGER THAN 25 MINUTES.

FLUSHING

OPEN ALL DRAIN COCKS AND REMOVE ENGINE BLOCK DRAIN. FLUSH CONTINUALLY, FLOODING COOLING SYSTEM WITH CLEAN WATER. KEEP ENGINE RUNNING FOR 25 MINUTES.

CAUTION

CLEANING PROCESS MUST BE COMPLETED BEFORE CONDITIONING PROCESS IS BEGUN.

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STEP 2 - CONDITIONING PROCESS

THE CONDITIONER CONSISTS OF A LIQUID SODIUM SILICATE AND A DRY POWDER ALKALINE CONDITIONER.

SILICATE PROTECTING

FILL COOLING SYSTEM WITH WATER. IDLE ENGINE UNTIL TEMPERATURE REACHES 160-180°F. SLOWLY ADD CONTENTS OF BOTTLE MARKED "SODIUM SILICATE". IDLE ENGINE FOR 15 MINUTES. DRAIN SYSTEM COMPLETELY.

USE: TWO BOTTLES FOR COOLING SYSTEMS OF 22 TO 44 QTS.  
THREE BOTTLES FOR COOLING SYSTEMS OVER 44 QTS.

ALKALINE CONDITIONING

FILL A 5 GALLON CAN TO WITHIN THREE QUARTERS INCH FROM THE TOP. ADD POWDER FROM BAG MARKED "ALKALINE CONDITIONER". EITHER STIR UNTIL DISSOLVED OR CLOSE CAN TIGHTLY AND IMMEDIATELY ROLL CAN BACK AND FORTH FOR 5 MINUTES. FILL SYSTEM WITH THIS SOLUTION. FOR OTHER SYSTEMS USE IN THIS PROPORTION OF 1 BAG FOR EACH 5 GALLONS OF WATER.

NOTE: SYSTEMS OF THE FOLLOWING CAPACITIES MAY BE FILLED WITH WATER, IDLED UNTIL THE TEMPERATURE REACHES 160-180°F. AND THE DRY CONDITIONER ADDED DIRECTLY:

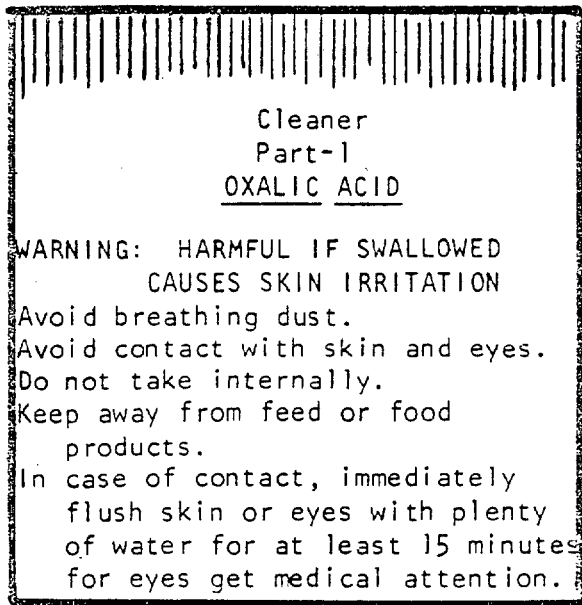
FOR 18-22 QTS. - ADD DRY CONDITIONER FROM ONE KIT  
36-44 QTS. - ADD DRY CONDITIONER FROM TWO KITS  
56-66 QTS. - ADD DRY CONDITIONER FROM THREE KITS

IDLE ENGINE FOR 55-60 MINUTES AFTER REACHING 160-180°F. DRAIN SYSTEM COMPLETELY. REFILL SYSTEM WITH CLEAN WATER. IDLE ENGINE FOR 15 MINUTES. DRAIN COMPLETELY.

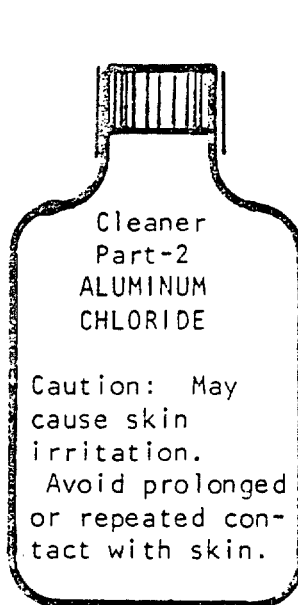
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STEP 3 - INHIBITING PROCESS

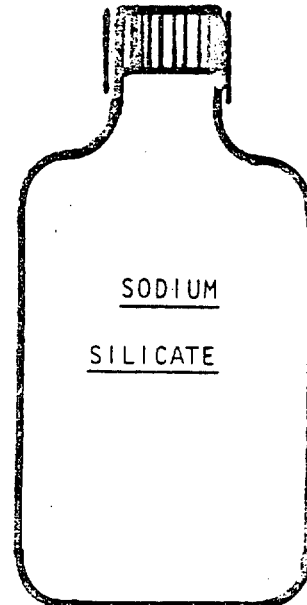
FILL A 5 GALLON CAN TO WITHIN THREE QUARTERS INCH FROM THE TOP. ADD POWDER FROM THE BAG (10 OZ.) MARKED "INHIBITOR". EITHER STIR UNTIL DISSOLVED OR CLOSE CAN TIGHTLY AND IMMEDIATELY ROLL CAN BACK AND FORTH FOR 5 MINUTES. FILL CLEANED AND CONDITIONED SYSTEM WITH THIS SOLUTION. WHEN ANTIFREEZE IS USED, INSTEAD OF ADDING WATER, ADD THIS SOLUTION. FOR OTHER SYSTEMS, USE INHIBITOR IN SAME PROPORTION OF 10 OZ. FOR EACH 5 GALLONS OF WATER.



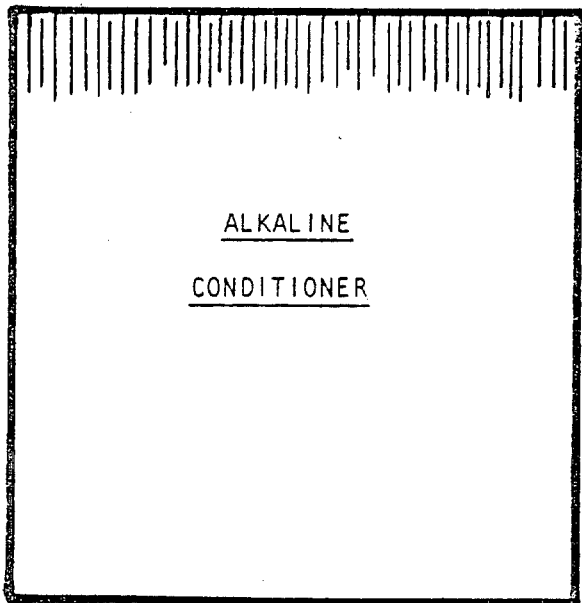
7 x 8



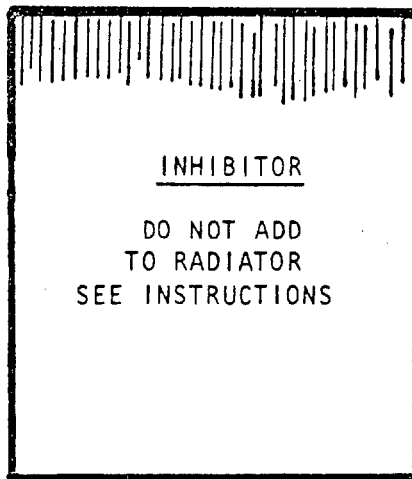
6 oz.



8 oz.



7 x 10



6 x 8

NOTES: BOTTLES SHALL BE PLACED INTO UNIT KIT IN UPRIGHT POSITION  
INSIDE DIMENSIONS OF BOX, PPP-B-636 FOR UNIT KIT IS 6x6x6

FIGURE 3



# 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

USER

MANUFACTURER

OTHER (Specify): \_\_\_\_\_

b. ADDRESS (Street, City, State, ZIP Code)

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) - Optional

b. WORK TELEPHONE NUMBER (Include Area Code) - Optional

c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional

8. DATE OF SUBMISSION (YYMMDD)