

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

**USE OF ANTIFREEZE SOLUTIONS, ANTIFREEZE EXTENDER, CLEANING COMPOUNDS, AND TEST KIT IN
ENGINE COOLING SYSTEMS**

Headquarters, Department of the Army, Washington, D.C.
3 January 1997

Reporting Errors and Recommending Improvements

You can help improve this bulletin. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-IM-OPIT, Warren, MI 48397-5000. We will send you a reply.

1. **Purpose** This bulletin provides instructions for engine cooling system maintenance.
2. **Scope**

The instructions contained in this bulletin apply to TACOM equipment. When information contained in this bulletin conflicts with other published data, these instructions prevail. For vehicles under warranty, the manufacturer's instructions will prevail through the life of the warranty.

3. **General**

- a. The following National Stock Numbers and specifications pertain to the described materials:

*This bulletin supersedes TB 750-651, 12 February 1989.

Table 1. Materials and Test Equipment

NOMENCLATURE	NSN	QTY	REFERENCE
Antifreeze, Ethylene Glycol, Inhibited, Heavy Duty, Single Package	6850-00-181-7929	1-gal.	MIL-A-46153
	6850-00-181-7933	5-gal.	
	6850-00-181-7940	55-gal. dr	
Antifreeze, Arctic-type	6850-00-174-1806	55-gal. dr	MIL-A-11755
Antifreeze Extender Additive	6850-01-160-3868	Quart	MIL-A-53009
Cleaning Compound w/Conditioner for Engine Cooling Systems	6850-00-598-7328	Kit	MIL-C-10597
Tester, Antifreeze/Battery	6630-00-105-1418	Each	
Test Kit, Reserve Alkalinity	6630-01-011-5039	Kit	

b. Arctic-type antifreeze (MIL-A-11755), antifreeze (MIL-A-46153) and antifreeze extender additive (MIL-A-53009) are compatible with both cast iron and aluminum engine blocks and parts, and all other common cooling system metals. Do not use antifreeze extender additive (MIL-A53009) with arctic antifreeze.

4. Requirements

a. Retain antifreeze (MIL-A-46153) in engine cooling systems for as long as the coolant meets the freeze point requirement and the reserve alkalinity requirements in paragraph 6.

b. Maintain a 60% - 40% antifreeze (MIL-A46153) and water mixture in cooling systems even in areas where temperatures never get down to the freeze point. A 60% - 40% mixture not only protects against freezing down to -50 degrees, but is a far better coolant than plain water when operating in hot climates.

(1) Drain, clean, and flush any cooling system that is contaminated, despite coolant installation date. Paragraph 7. contains information on the cleaning compound kit. Detailed instructions for draining, cleaning, and flushing cooling systems are given in TM 750-254 (Cooling Systems: Tactical Vehicles).

(2) For items that are under warranty, follow the manufacture's recommendations until the warranty has expired. Do not use commercial antifreeze in Army vehicles past the warranty period. When switching over to MIL-A-46153 antifreeze, flush the cooling system to remove all of the commercial antifreeze.

(3) Periodically test MIL-A-46153 coolant for reserve alkalinity and protection level. Do not test commercial brands of antifreeze and arctic-type antifreeze (MIL-A-11755). Change that type of antifreeze annually or sooner if it is contaminated.

c. Replace arctic-type antifreeze (MIL-A-11755) on an annual basis, preferably at the beginning of the cold weather season.

5. Antifreeze Protection

a. When cooling system protection is required for temperatures down to -50 F (-47 C), prepare a 60% - 40% solution of MIL-A-46153 antifreeze and water (1 1/2 gallons of antifreeze to 1 gallon of water). Use a 60% - 40% mixture of antifreeze/water to top off or to refill a cooling system that requires the addition of coolant for any reason.

CAUTION

Never mix arctic-type antifreeze (MIL-A-11755) with water or inhibitor. Always use arctic-type antifreeze full strength.

b. In areas where the temperature is expected to go below -50 F (-47 C), use arctic-type antifreeze (MIL-A-11755). Use only full strength arctic-type antifreeze to top off cooling systems winterized with MIL-A-11755.

6. Preventive Maintenance

During scheduled maintenance services, or during climatic change service, test and inspect the cooling system. Perform a. through c. below. See paragraph 9. for recording requirements.

a. Test for antifreeze protection, when applicable, by use of a combination antifreeze and battery tester, **NSN** 6630-00-105-1418.

NOTE

A freeze protection indication other than -50 F (-47 C) requires corrective action. Partially drain the coolant and replace with water or antifreeze to bring the freeze protection to -50 F (-47 C).

b. Test for reserve alkalinity (corrosion protection) using the test kit, **NSN** 6630-01-011-5039. The color of the test stick, after the test, will identify the condition of the coolant and its corrosion protection. Instructions for use of the test stick, and color interpretations, are as follows:

NOTE

Do not use test stick at temperatures below +50 F (+10 C) or above +85 F (+30 C).

- (1) Dip test stick into coolant (antifreeze solution), and remove immediately.
- (2) Fifteen seconds after dipping, compare color on the test stick with the color chart on the container. Record the color in the "remarks" block of DD Form 314 (Preventive Maintenance Schedule and Record).
 - (a) Blue indicates coolant is safe to use.
 - (b) Green indicates reserve alkalinity and corrosion protection of coolant is marginal. You can safely use this coolant until the next service inspection.

NOTE

Do not use antifreeze extender additive (MIL-A-53009) with arctic antifreeze in the cooling system.

- (c) Yellowish green indicates the coolant is unsafe to use. If the log (DD Form 314) identifies the coolant as the original charge, then add three percent by volume (1 pint per 17 quarts) of the antifreeze extender additive (MIL-A-53009) to the cooling system. Addition of extender (MIL-A-53009) to antifreeze is a one time service. When the extender is added to the antifreeze, record the date in the "remarks" block of the DD Form 314. If the log (DD Form 314) indicates that the coolant was extended before, or the coolant is arctic antifreeze, drain the coolant and replace with fresh coolant.
- c. Inspect for coolant cleanliness by withdrawing a small amount of coolant into a clean container. Look for excessive rust, foreign particles, and/or sediment. Drain, clean, and flush any cooling system that is contaminated.

7. Use of Engine Cooling System Cleaning Compound

- a. Do not use engine cooling system cleaning compound (MIL-C-10597), as a routine maintenance procedure each time antifreeze is added or drained from the cooling system. Use the compound only when necessary to clean heavily rusted or partially clogged cooling systems.

- b. Engine cooling system cleaning compound (MIL-C-10597) is a kit and consists of:
- (1) Cleaner, part 1, Oxalic Acid.
 - (2) Cleaner, part 2, Aluminum Chloride.
 - (3) Sodium Silicate Conditioner.
 - (4) Alkaline Conditioner.
 - (5) Instruction Sheet.

8. Recycling of Military Antifreeze (MIL-A-46153)

a. Recycling of used military antifreeze is now authorized and recommended. Recycling used antifreeze conserves resources, reduces the cost of new antifreeze purchases, and reduces the cost and problems of used antifreeze disposal.

b. An Antifreeze Recycling Users Guide is available from The U.S. Army Tank-automotive and Armaments Command, Mobility Tech Center- Belvoir, (Mr. Dwayne Davis), at DSN 654-3720 or Commercial (703) 704-3720. The users guide provides product recommendations, operating procedures, and precautions.

c. Currently, two antifreeze recycler units are approved for Army use. Their features are in table 2, below. You should base your selection of an antifreeze recycler system on your organization's needs and resources.

NOTE: This information is not meant as an endorsement of one product over another.

Table 2. Summary of Commercial Antifreeze Recycler Features

Model	Cool'r Clean'r System	BE-15C or BE-55C (15 gal batch) (55 gal batch)
Manufacturer	BG Products Inc Phone: 316-265-2686	Finish-Thompson Phone: 814-455-4478
Process Type	Ion Exchange	Vacuum Distillation
Process Rate (gal/hr)	180	1 (BE-15C) 3.2 (BE-55C)
Replacement Filter Required	Yes (1 & 5 micron filters)	None

Table 2. Summary of Commercial Antifreeze Recycler Features (Cont.)

Filter Replacement Interval	@ Every 200-500 gallons	NA
Supplemental Additives Required	BG 570A/B (Heavy Duty), Dearborn Chemical	First Brands
Ease Of Operation	Difficult	Moderately Difficult
Personnel Required	1	1
Hazardous Waste Remaining	Spent Filter	NA
National Stock Number Price	6850-01-380-9034 (with 1 set of filtration tanks) \$9,153.31	6850-01-387-5654 BE-1 5C (15 gal batch unit) \$4,721.50
National Stock Number Price	6850-01-380-9034 (with 2 sets of filtration tanks) \$13,768.65	6850-01-387-2551 BE-55C (55 gal batch unit) \$11,972.62

e. Using other recycling systems, services, or products may not adequately recycle MIL-A-46153 antifreeze or may produce a product that is not compatible with MIL SPEC antifreeze. These incompatibilities will lead to increased cooling system maintenance and possibly premature failure of water pumps, heater cores, and other cooling system components.

f. Do not use MIL-A-53009, Antifreeze Extender Additive with recycled antifreeze; it could also cause chemical incompatibilities and damage your cooling system. Replace or recycle previously recycled antifreeze after determining that the additives are depleted.

9. Recording

a. When cooling systems have arctic-type antifreeze (MIL-A-11755) or commercial brand antifreeze (when the equipment is still under warranty), record the installation date and the degree of protection in the "remarks" block of DD Form 314.

b. When cooling systems are serviced with antifreeze, MIL-A-46153, record the degree of protection, the condition of the cooling system and the use of antifreeze extender, MIL-A-53009 in the "remarks" block of DD Form 314. This information ensures that original charges of antifreeze are extended at least one time. Do not re-extend already extended antifreeze. Drain and replace with fresh coolant.

10. **References**

a. Forms

DD Form 314 Preventive Maintenance Schedule and Record

DA Form 2028 Recommended Changes to Publications and Blank Forms

b. Technical Manuals

TM 750-254 Cooling Systems: Tactical Vehicles

By Order of the Secretary of the Army:

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Administrative Assistant to the
Secretary of the Army
02879

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THE METRIC SYSTEM AND EQUIVALENTS

WEIGHT MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
 1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
 1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
 1 Kilogram = 1000 Grams = 2.2 lb.
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
 1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
 1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
 1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

TEMPERATURE

$5/9(^{\circ}\text{F} - 32) = ^{\circ}\text{C}$
 212° Fahrenheit is equivalent to 100° Celsius
 90° Fahrenheit is equivalent to 32.2° Celsius
 32° Fahrenheit is equivalent to 0° Celsius
 $9/5^{\circ}\text{C} + 32 = ^{\circ}\text{F}$

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
its	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
ometers per Liter	Miles per Gallon	2.354
ometers per Hour	Miles per Hour	0.621



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