Designation: D 5752 – 04

Standard Specification for Supplemental Coolant Additives (SCAs) for Use in Precharging Coolants for Heavy-Duty Engines[1]

This standard is issued under the fixed designation D 5752; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers the general, physical, chemical, and performance requirements for Supplemental Coolant Additives (SCAs) at a precharged level in the cooling systems of heavy-duty engines.

NOTE 1—After precharging, SCAs are customarily used periodically to service cooling systems at ¼ to ⅓ the precharged dosage to compensate for additives lost through dilution and depletion.

1.2 The SCA products meeting this specification are intended for use with water or recommended dilutions of coolant concentrates or prediluted engine coolants. Engine coolant products shall be of the low-silicate type and, if ethylene glycol based, shall meet Specification D 4985. Propylene glycol base low-silicate-type coolant products may also be used, if these materials meet the chemical and performance requirements of Specification D 4985.

1.3 The SCA concentrate before dissolution may be in either liquid, solid, or slurry form. The form is as agreed upon between the manufacturer and the user.

1.4 The values stated in SI units are to be regarded as standard. The inch-pound units in parentheses are approximate equivalents provided for information only.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are given in 4.1.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 512 Test Method for Chloride Ion in Water
D 516 Test Method for Sulfate Ion in Water
D 1119 Test Method for Ash Content of Engine Coolants and Antirusts
D 1121 Test Method for Reserve Alkalinity of Engine Coolants and Antirusts
D 1126 Test Method for Hardness of Water
D 1193 Specification for Reagent Water
D 1287 Test Method for pH of Engine Coolants and Antirusts
D 1293 Test Methods for pH of Water
D 1384 Test Method for Corrosion Test for Engine Coolants in Glassware
D 1881 Test Method for Foaming Tendencies of Engine Coolants in Glassware
D 1882 Test Method for Effect of Cooling System Chemical Solutions on Organic Finishes for Automotive Vehicles
D 1888 Test Methods for Particulate and Dissolved Matter in Water
D 2570 Test Method for Simulated Service Corrosion Testing of Engine Coolants
D 2809 Test Method for Cavitation Corrosion and Erosion-Corrosion Characteristics of Aluminum Pumps with Engine Coolants
D 3634 Test Method for Trace Chloride Ion in Engine Coolants
D 4327 Test Method for Anions in Water by Chemically Suppressed Ion Chromatography
D 4340 Test Method for Corrosion of Cast Aluminum Alloys in Engine Coolants Under Heat-Rejecting Conditions
D 4985 Specification for Low Silicate Ethylene Glycol Base Engine Coolant for Heavy Duty Engines Requiring an Initial Charge of Supplemental Coolant Additive (SCA)
D 5827 Test Method for Analysis of Engine Coolant for Chloride and Other Anions by Ion Chromatography
D 5828 Test Method for Compatibility of Supplemental Coolant Additives (SCAs) and Engine Coolant Concentrates
D 6129 Test Method for Silicon in Engine Coolant Concentrates by Atomic Absorption Spectroscopy
D 6130 Test Method for the Determination of Silicon and Other Elements in Engine Coolant by Inductively Coupled Plasma-Atomic Emission Spectroscopy

[1] This specification is under the jurisdiction of ASTM Committee D15 on Engine Coolants and is the direct responsibility of Subcommittee D15.07 on Specifications.
Current edition approved May 1, 2004. Published June 2004. Originally approved in 1995. Last previous edition approved in 1998 as D 5752 - 98.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

D 6471 Specification for Recycled Prediluted Aqueous Glycol Base Engine Coolant (50 % Minimum) for Automobile and Light-Duty Service

D 6472 Specification for Recycled Glycol Base Engine Coolant Concentrate for Automobile and Light-Duty Service

E 1177 Specification for Engine Coolant Grade Glycol

G 32 Test Method for Cavitation Erosion Using Vibratory Apparatus

3. General Requirements

3.1 The SCA concentrate upon addition to water or water/glycol mixtures at the SCA manufacturer's recommended addition level shall provide, excepting freeze and boil protection, the same performance as coolants meeting Specification D 4985.

3.2 Liquid SCA concentrates shall be storable in the manufacturer's original container at temperatures from −7 to + 55°C (20 to 130°F) without chemical change. Any precipitation of ingredients evidenced by the dropout of solid material or liquid turbidity shall disappear upon agitation and warming of the solution to a temperature exceeding 2°C (35°F).

3.3 Solid, slurry, and paste forms of SCA concentrate shall be so formulated and packaged as to prevent chemical or physical change during storage before use. This requirement applies to storage temperatures of −7 to + 55°C (20 to 130°F), regardless of humidity.

3.4 The SCA concentrates, when used according to the manufacturer's recommendations, shall dissolve totally in the test solutions required in this specification. A light haze is permitted.

3.5 If an engine, vehicle, or servicing organization recommends adding an SCA product to a fully formulated coolant, the recommending organization assumes responsibility for determining the compatibility and conducting suitable tests. ASTM has developed a compatibility test (Test Method D 5828), which may be used. At the present time, it is recommended that SCAs be used only in conjunction with coolant products meeting Specification D 4985.

4. Preparation of Test Solutions

4.1 The preparation of test solutions for this specification is listed in Table 1. Where ethylene glycol is required, it shall meet Specification E 1177. Where distilled water is required, it shall conform to Type IV of Specification D 1193. If propylene glycol is to be used to meet the requirements of this specification as established in Table 1 and Table 2, the propylene glycol shall also meet Specification E 1177. (**Warning**—Propylene glycol base coolants have not been extensively tested for precharging with an SCA, and therefore, the effect of different glycol products on property performance is not well established.)

4.2 The quantity of any freshly prepared test solution required in this specification shall be sufficient to perform the specific tests. However, no test solution shall be stored longer than 96 h before initiation of a specific procedure.

TABLE 1 Composition of Test Solutions for Table 2 Performance Requirements[A]

Test Method	SCA Concentrate	Solvent Mixture
D 1384	one-half manufacturer's recommended precharged level	standard corrosive water[B]
D 1384	three times manufacturer's recommended precharged level	33 vol % ethylene glycol in standard corrosive water[B,C]
D 1881	manufacturer's recommended precharge level	33 vol % ethylene glycol in standard corrosive water[B,C]
D 2570	manufacturer's recommended precharge level	44 vol % ethylene glycol in standard corrosive water[B,C]
D 2809	manufacturer's recommended precharge level	16.7 vol % ethylene glycol in standard corrosive water[B,C]
D 4340	manufacturer's recommended precharge level	165-mg/L NaCl dissolved in a 1-L solution of 25 vol % ethylene glycol in deionized water[C,D]

[A]Test solution to be prepared according to Section 4.

[B]See Section 7 of Test Method D 2570 for composition and method of preparation of standard corrosive water.

[C]Ethylene glycol shall meet Specification E 1177. If propylene glycol is used as an alternate to ethylene glycol, the propylene glycol shall also meet Specification E 1177. (See **Warning** in 4.1.)

[D]Water conforming to Type IV of Specification D 1193 is acceptable.

TABLE 2 Performance Requirements[A]

Property	Specific Values	Test Method
Corrosion in glassware mass loss, mg/specimen		D 1384
Copper	10 max	
Solder	30 max	
Brass	10 max	
Steel	10 max	
Cast iron	10 max	
Aluminum	30 max	
Simulated service test mass loss, mg/specimen		D 2570
Copper	20 max	
Solder	60 max	
Brass	20 max	
Steel	20 max	
Cast iron	20 max	
Aluminum	60 max	
Foaming		D 1881
Volume, mL	150 max	
Break time, s	5 max	
Water pump cavitation erosion-corrosion rating	8 min	D 2809
Corrosion of cast aluminum alloys at heat-rejecting surfaces, mg/cm^2/week	1.0 max	D 4340
Ultrasonic cavitation resistance	see Annex A1	under development
SCA-glycol base coolant compatibility	[B]	D 5828
Hot surface scaling and deposits resistance[C]	...	under development

[A]Test solutions for use in meeting Table 2 performance requirements are to be prepared according to Table 1.

[B]SCA products may be required to meet a compatibility requirement. Although Test Method D 5828 has been developed, ASTM has not established allowable limits. Until allowable limits have been approved, an agreement must be established between the SCA manufacturer and engine or vehicle user. This agreement shall include a definition of the test procedure, acceptable equipment, and the performance rating criteria.

[C]See Appendix X2 for additional information.

5. Detailed Requirements

5.1 Test solutions prepared according to Table 1 shall meet the performance requirements in Table 2, the general requirements in Table 3, and the physical and chemical requirements in Table 4.

TABLE 3 General Requirements

Property	Specific Value	Test Method
Effect on nonmetals[A]	no adverse effect	under consideration
Storage stability	see 3.2 and 3.3	...

[A]Evaluate using the SCA concentrate at the manufacturer's recommended precharge level in a 50:50 volume mixture of distilled water and ethylene glycol or distilled water and propylene glycol, each glycol conforming to Specification E 1177.

5.2 The SCAs shall additionally provide added protection in operating engines against cavitation corrosion (also termed liner pitting) and against scaling of internal engine hot surfaces. Hot surfaces are typically within the engine head, head spacer, or liquid-cooled exhaust manifold. The American Society for Testing and Materials has test methods under development for both cavitation corrosion and hot surfaces scaling. Until these procedures are adopted as ASTM standards, the mandatory requirements of Annex A1 shall apply.

TABLE 4 Physical and Chemical Properties

Property[A]	Specific Values	Test Method
Ash content, dissolved in distilled water, mass, %	5 max	D 1119
pH, in distilled water	7.5 to 11.0	D 1287
Reserve alkalinity, in distilled water	report[B]	D 1121
Chloride ion, in distilled water, ppm	25 max	D 3634, D 5827
Silicon, in distilled water, ppm	250 max	D 6129, D 6130
Effect on vehicle finish	no effect[C]	D 1882

[A]Property must be met with the specified solution, at an SCA precharge addition level recommended by the SCA manufacturer. (This is usually 3 % by volume.)

[B]Value agreed upon between the supplier and the customer.

[C]Currently, many heavy-duty engine manufacturers and vehicle manufacturers that use these engines prepare test panels using the specific paint finishes used on their actual products. Coolant product manufacturers and equipment builders should agree on the exact test procedures and acceptance criteria on an individual case basis.

6. Keywords

6.1 heavy-duty engine coolants; precharging heavy-duty engines; SCA; supplemental coolant additives

ANNEX

(Mandatory Information)

A1. CHEMICAL REQUIREMENTS FOR SCAs

A1.1 Test methods to determine cavitation corrosion resistance are under development. Several chemical compositions of SCAs have been extensively tested by producers and users and found to minimize satisfactorily cylinder liner cavitation in actual test engines. Until such time as an ASTM procedure is adopted that effectively evaluates cylinder liner cavitation corrosion, SCA formulations under this specification shall provide the following when used at the SCA manufacturer's recommended precharge addition level:

A1.1.1 A minimum concentration of nitrite as (NO_2^-) in the cooling system of 1200 ppm, or

A1.1.2 A minimum combined concentration of nitrite as (NO_2^-) plus molybdate as (MoO_4^{-2}) in the cooling system of 780 ppm. At least 300 ppm each of NO_2^- and MoO_4^{-2} must be present.

A1.1.3 Concentrations below these levels may not provide sufficient protection. (See X1.1.3.2 for further information.)

A1.2 Composition limits in A1.1 are waived provided:

A1.2.1 The SCA producer and engine manufacturer agree to specified composition limits for one or more chemical ingredients other than those stated in A1.1.

A1.2.2 Both parties agree to accept laboratory data or in-service performance experience demonstrating that the alternate composition exerts a positive influence on reducing cavitation corrosion in an operating engine.

A1.2.3 In-service qualification tests may consist of single- or multiple-cylinder engine tests. At the option of the engine or vehicle manufacturer, such testing may be conducted in "loose engines" or in engines fully integrated into an application such as a vehicle, a power boat, or a stationary power source. One such test has been developed.[3]

A1.3 Chemical composition requirements for cavitation corrosion protection will be removed from this specification and replaced with an ASTM test method when a test method is developed and adopted.

A1.4 No specific chemical composition requirements for hot surface scaling and deposit resistance have been established at this time. A test procedure for this property is under development and will be incorporated into Table 2 when a procedure is approved by ASTM.

A1.5 Lack of compatibility between the coolant and SCA product's chemistry results in chemical ingredient dropout from solution, with potential adverse effects in the vehicle or engine cooling system. A test procedure for compatibility has been developed, Test Method D 5828, and may be used to establish compatibility between the coolant and the SCA product.

[3] "A Comparison of Engine Coolant in an Accelerated Heavy-Duty Engine Cavitation Test," SAE Technical Paper 960883, SAE International, 400 Commonwealth Drive, Warrendale, PA 15096–0001.