SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

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Coolant Concentrate (Low Silicate, Ethylene Glycol Type Requiring an Initial Charge of Supplemental Coolant Additive) for Heavy-Duty Engines

1. ***Scope***—This SAE Recommended Practice applies to engine coolant concentrate, low silicate ethylene glycol base, for use in cooling systems of heavy-duty engines. An initial charge of supplemental coolant additive (SCA) is required when using this type of coolant concentrate.

   This document applies to engine coolant concentrates for heavy-duty engine requirements. SAE J1034 applies to coolant concentrates for automobile and light truck applications.

   For further information on engine coolants, see SAE J814.

2. ***References***—The following related documents may be referred to when carrying out the requirements of this document. Where there is any variance with this document, the requirements of this document shall prevail.

   Reference to the following publications is to the latest issues unless otherwise specified by the authority applying this document:

2.1 Applicable Publications—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

SAE Handbook
SAE J20—Coolant System Hoses
SAE J814—Engine Coolants
SAE J1034—Automotive and Light Truck Engine Coolant Concentrate—Ethylene-Glycol Type
SAE HS 40—Maintenance of Automotive Engine Cooling Systems

2.1.2 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

ASTM Annual Book of ASTM Standards
ASTM D 1119—Standard Test Method for Ash Content of Engine Coolants and Antirusts
ASTM D 1120—Standard Test Method for Boiling Point of Engine Coolants
ASTM D 1121—Standard Test Method for Reserve Alkalinity of Engine Antifreeze, Antirusts, and Coolants
ASTM D 1122—Standard Test Method for Specific Gravity of Engine Coolants by the Hydrometer
ASTM D 1123—Standard Test Methods for Water in Engine Coolant Concentrate by Karl Fischer Reagent Method
ASTM D 1176—Standard Method for Sampling and Preparing Aqueous Solutions of Engine Coolants or Antirusts for Testing Purposes
ASTM D 1177—Standard Test Method for Freezing Point of Aqueous Engine Coolant Solution
ASTM D 1287—Standard Test Method for pH of Engine Antifreeze, Antirusts, and Coolants
ASTM D 1384—Standard Test Method for Corrosion Test for Engine Coolants in Glassware
ASTM D 1881—Standard Test Method for Foaming Tendencies of Engine Coolants in Glassware
ASTM D 1882—Standard Test Method for Effect of Cooling System Chemical Solutions on Organic Finishes for Automotive Vehicles
ASTM D 2570—Standard Test Method for Simulated Service Corrosion Testing of Engine Coolants
ASTM D 2809—Standard Test Method for Cavitation Erosion-Corrosion Characteristics of Aluminum Pumps With Engine Coolants
ASTM D 3634—Standard Test Method for Trace Chloride Ion in Engine Coolant
ASTM D 4985—Standard Specification for Low Silicate Ethylene Glycol Base Engine Coolant Concentrate for Heavy Duty Engines, Requiring an Initial Charge of Supplemental Coolant Additive (SCA)
ASTM D 4725—Standard Terminology for Engine Coolants
ASTM E 29—Recommended Practice for Indicating Which Places of Figures are to be Considered Significant in Specified Limiting Values
ASTM E 202—Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols
STP120—Selection and Use of Engine Coolants and Cooling System Chemicals

3. Terminology

3.1 Life Expectancy—The period of protection for which the engine coolant is suitable for use in internal combustion engine cooling systems without adversely affecting coolant flow and heat transfer.

3.2 Engine Coolant—A solution used in an engine cooling system to transfer heat from the engine to the radiator, which provides adequate protection against freezing, boiling, and corrosion. In this document, engine coolant is comprised of 40 to 60% (see NOTE) coolant concentrate, water, and supplemental coolant additive.

NOTE—Forty percent provides freeze protection to –12 °F (–24 °C) while 60% provides freeze protection to –62 °F (–52 °C). Higher concentrations are not recommended because they can cause seal seepage, silicate gelation, and other problems. Lower concentrations are not recommended because they can result in inadequate freeze and corrosion protection.

3.3 Coolant Concentrate—A concentrated solution of ethylene glycol containing additives, such as corrosion inhibitors and a foam suppressor, which is used to prepare an engine coolant for use in internal combustion engine cooling systems.

3.4 Heavy-Duty Engine—A diesel, gasoline, or similarly fueled internal combustion engine, having operating characteristic of long duty cycle at or near maximum rated conditions. Such engines are typically used in Class 5 to 8 over-the-road vehicles; off highway machinery for agriculture, mining, earthmoving, and construction; high output stationary engine installations; and locomotive and marine installations.

3.5 Supplemental Coolant Additive (SCA)—A material added to the cooling systems of heavy duty engines to provide cavitation corrosion protection and minimize deposits on heat transfer surfaces not normally provided by the additives in the coolant concentrate (antifreeze). The SCA is also used to extend the useful life of the coolant by replenishing the additive at the appropriate maintenance interval.

4. General Requirements

4.1 The coolant concentrate shall consist of ethylene glycol containing additives (such as corrosion inhibitors and a foam suppressor) required to provide freeze and general corrosion protection to cooling system components of heavy duty engines. An initial charge of SCA is required for complete protection. Other glycols such as propylene and diethylene may be included providing the physical and performance properties are met.

4.1.1 The coolant concentrate shall contain sufficient water to ensure continued solution of the dissolved additives under recommended storage conditions.

4.1.2 The coolant concentrate is intended to be diluted with water and charged with an initial dose of SCA at the point of use to produce the desired engine coolant.

4.2 The coolant concentrate shall be clear and free from solids.

4.3 The coolant concentrate shall have an identifying color (preferably green or blue-green).

4.4 The coolant concentrate shall not affect nor be affected by its container after storage for one year when exposed to temperatures ranging from 0 °F (–18 °C) to 122 °F (50 °C).

4.5 The engine coolant life expectancy when using an engine coolant concentrate meeting the requirements of this document shall be a minimum of one year, when installed and maintained in accordance with the recommendations of the engine and coolant concentrate manufacturers and treated with appropriate maintenance doses of SCA.

4.6 The water used for preparing engine coolants for service shall be of such quality that it does not contain excessive solids, hardness salts, sulfates, or chlorides. Water containing excessive hardness salts may be softened to minimize formation of hard water scale. Excessive amounts of chloride and sulfate may increase the corrosion rate of the engine cooling system metals. The chloride and sulfate may be removed by deionization or distillation.

Water meeting the requirements in Appendix A is considered acceptable for service.

5. Detail Requirements

5.1 The engine coolant shall comply with the following detail requirements Table 1, the limits of which are absolute and not subject to correction for tolerances of test methods. The document for indicating which places of figures are to be considered significant shall be ASTM E 29. U.S. traditional units are standard. SI units may be approximate.

TABLE 1—

	MIN	MAX	TEST METHOD ASTM
Other glycols	—	15.0	E 202
Specific Gravity at 60 °F	1.110	1.145	D 1122
Freezing Point, 50% by volume in distilled H_2O, °F (°C)	—	–34 (–37)	D 1177
Boiling Point, °F (°C)			D 1120
Concentrate	325 (163)	—	
Dilute (50% by volume in distilled water)	226 (108)	—	
pH, dilute (50% by volume in distilled water)	7.5	11.0	D 1287
Chloride, ppm	—	25	D 3634
Total Apparent Water, % mass	—	5	D 1123
Corrosion (Glassware) loss in mass, mg			D 1384
Copper	—	10	
Solder	—	30	
Brass	—	10	
Steel	—	10	
Cast Iron	—	10	
Aluminum	—	30	
Corrosion (Simulated Service) loss in mass, mg			D 2570
Copper	—	20	
Solder	—	60	
Brass	—	20	
Steel	—	20	
Cast Iron	—	20	
Aluminum	—	60	
Ash content, % mass	—	5	D 1119
Foaming Tendency			D 1881
Foam Volume, mL	—	150	
Break Time, s	—	5	
Silicon, ppm	—	250	Under Consideration
Reserve alkalinity	10	—	D 1121
Cavitation Erosion Corrosion rating for pitting, cavitation, or erosion of the water pump.	8	—	D 2809

5.1.1 EFFECTS ON PAINTED FINISHES—There shall be no discoloration, loss of gloss, softening, swelling, or other visible effects when tested in accordance with ASTM D 1882 as modified to use paints typical of heavy duty engines and vehicles.

5.1.2 COMPATIBILITY WITH COOLING SYSTEM NONMETALS—Solutions of the coolant concentrate as normally used in cooling systems shall not have deleterious effects on the nonmetallic components, as determined from examination of the nonmetallic components used in conjunction with ASTM D 2570 corrosion test. The hoses used in the test shall conform to SAE J20. After test, the coolant hose must meet the physical requirements of the coolant immersion test of SAE J20 (J20R4, Class D-1).

6. Inspection and Labeling

6.1 Sampling—When testing to the requirements of this document a sample size of not less than 5 gal (20 L) shall be obtained for testing in accordance with ASTM D 1176 unless otherwise specified.

6.2 Labeling—Products claimed to meet this document shall be labeled on the containers:

"Meets SAE J1941".

PREPARED BY THE SAE COOLING SYSTEMS STANDARDS COMMITTEE

APPENDIX A

WATER QUALITY

TABLE A1—

Property	Requirement	ASTM Test Method
Total Solids (maximum)	340 ppm (19.9 grain/gallon)	D 1888
Total Hardness (as $CaCO_3$, maximum)	170 ppm (9.9 grain/gallon)	D 1126
Chloride (as Cl, maximum)	40 ppm (2.3 grain/gallon)	D 512
Sulfate (as SO_4, maximum)	100 ppm (5.8 grain/gallon)	D 516