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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE RECOMMENDED PRACTICE

Submitted for recognition as an American National Standard

SAE J1034 | REV. MAR96

Issued 1973-06
Revised 1996-03

Superseding J1034 APR91

(R) AUTOMOBILE AND LIGHT TRUCK ENGINE COOLANT CONCENTRATE ETHYLENE GLYCOL TYPE

1. Scope

1.1 This SAE Recommended Practice applies to engine coolant concentrate, ethylene glycol base, for use in automotive and light truck engine cooling systems.

1.2 This document applies to engine coolant concentrates for aluminum compatible requirements. Please refer to SAE J1941 and J2307 DRAFT for coolants used in heavy-duty diesel engine cooling systems.

1.3 For further information on engine coolants, see SAE J814 and J2306.

2. References

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

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J20—Coolant System Hoses
SAE J814—Engine Coolants
SAE J1941—Coolant Concentrate (Low Silicate, Ethylene Glycol Type Requiring an Initial Charge of Supplemental Coolant Additive) for Heavy-Duty Engines
SAE J2306—Automobile and Light Truck Engine Coolant Concentrate Propylene Glycol Type
SAE J2307 DRAFT—Coolant Concentrate, Propylene Glycol Type for Heavy-Duty Engines

2.1.2 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

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 Coolants and Antirusts
ASTM D 1122—Standard Test Method for Specific Gravity of Engine Coolants Concentrates and Engine Coolants by the Hydrometer
ASTM D 1123—Standard Test Method for Water in Engine Coolant Concentrate by the 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 Coolants
ASTM D 1384—Standard 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 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 3306—Specification for Ethylene Glycol Base Engine Coolant for Automobile and Light Duty Service
ASTM D 3634—Standard Test Method for Trace Chloride Ion in Engine Coolants
ASTM D 4340—Standard Test Method for Corrosion of Cast Aluminum Alloys in Engine Coolants Under Heat Rejecting Conditions
ASTM D 4725—Standard Terminology for Engine Coolants
ASTM D 5216—Standard Specification for Propylene Glycol Base Engine Coolant for Automobile and Light Duty Service
ASTM E 29—Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
ASTM E 202—Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols

2.2 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

2.2.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE HS-40—Maintenance of Automotive Engine Cooling Systems

2.2.2 ASTM PUBLICATION—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM STP 120C—Selection and Use of Engine Coolants

3. Terminology

3.1 Life Expectancy—The time period 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 Concentrate—A mixture of ethylene glycol and 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.

3.3 Engine Coolant—A heat transfer 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. The solution is comprised of 40 to 70% coolant concentrate and water.

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 corrosion and freeze protection to the engine cooling system components. 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 additives.

4.1.2 The coolant concentrate is intended to be diluted with water at the point of use to produce the desired engine coolant operation requirements.

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

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

4.4 The coolant concentrate shall not affect nor be affected by its container after storage for 1 year when exposed to temperatures ranging from –18 °C (0 °F) to 50 °C (122 °F).

4.5 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 must 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 of Appendix A is considered acceptable for service.

5. Detail Requirements—The engine coolant and coolant concentrate shall comply with the detail requirements of Table 1, the limits of which are absolute and not subject to interpretation based on the precision and bias of the test methods. The recommended practices for indicating which places of figures are to be considered significant shall be ASTM E 29.

5.1 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.

5.2 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

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

7. Notes

7.1 Marginal Indicia—The (R) is for the convenience of the user in locating areas where technical changes have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

PREPARED BY THE SAE ACAP DIVISION 2—ENGINE COOLANT SUBCOMMITTEE

TABLE 1—PHYSICAL, CHEMICAL, AND PERFORMANCE REQUIREMENTS

	Temperatures are °C (°F)		
	Min	Max	Test Method ASTM
Other glycols, % mass	—	15.0	E 202
Specific Gravity at 15.6/15.6 °C (60/60 °F)	1.110	1.145	D 1122
Freezing Point, 50% by volume in distilled H_2O, °C (°F)	—	–37 (–34)	D 1177
Boiling Point, °C (°F)			D 1120
Concentrate	163 (325)	—	
Dilute, 50% by volume in distilled H_2O	108 (226)	—	
		—	
pH			D 1287
Dilute, 50% by volume in distill H_2O	7.5	11.0	
Chloride, ppm	—	25	D 3634
Total Apparent Water, % mass	—	5	D 1123
Ash content, % mass	—	5	D 1119
Foaming Tendency			D 1881
Foam Volume, mL	—	150	
Break Time, S	—	5	
Corrosion (Glassware) loss in mass, mg			D 1384
Copper	—	10	
Solder	—	30	
Brass	—	10	
Steel	—	10	
Cast Iron	—	10	
Aluminum	—	30	
Corrosion (Simulated Service)[1] loss in mass, mg			D 2570
Copper	—	20	
Solder	—	60	
Brass	—	20	
Steel	—	20	
Cast Iron	—	20	
Aluminum	—	60	
Corrosion of Heat Rejecting Cast Aluminum Alloy Surfaces[2], mg/cm²/week	—	1.0	D 4340
Cavitation Erosion-Corrosion (Rating)	8	—	D 2809

[1] Crevice and pitting corrosion of aluminum can be evaluated without the optional use of an aluminum radiator subjected to tank removal and tube sectioning for inspection at the completion of the test. The extent of corrosion can be quantified and reported using the internal corrosion rating system shown in Appendix B.

[2] This test requirement is applicable only to engine coolants intended for use in engines having aluminum heat rejecting surfaces such as cylinder heads and/or blocks.

APPENDIX A
WATER QUALITY

TABLE A1—WATER QUALITY

Property	Requirement	ASTM Test Method
Total Solids (max)	340 ppm (19.9 g/gal)	D 1888
Total Hardness (as $CaCO_3$, max)	170 ppm (9.9 g/gal)	D 1126
Chloride (as Cl, max)	40 ppm (2.3 g/gal)	D 512
Sulfate (as SO_4, max)	100 ppm (5.8 g/gal)	D 516
pH	5.5 to 9.0	D 1293

APPENDIX B
ALUMINUM RADIATOR INTERNAL CORROSION RATING SYSTEM

TABLE B1—ALUMINUM RADIATOR INTERNAL CORROSION RATING SYSTEM

Excellent	10	None	None
	9	Slight attack	No penetration into core
Very Good	8	Minor attack	No penetration into core
	7	Minor to moderate attack	Less than 2% penetration into core
Good	6	Moderate attack	Less than 5% penetration into core
	5	Moderate to fairly severe attack	5 to 10% penetration into core
Fair	4	Fairly severe attack	Up to 15% penetration into core
	3	Severe attack	Up to 50% penetration into core
Poor	2	Extensive attack	Over 50% penetration into core
	1	Extensive attack	Metallographic perforation, no observed leak
	0	Extensive attack	Perforation, observed leaks