



Ethylene Glycol Based Extended Life Automotive Coolant DEX-COOL®

1 Scope

1.1 Material Description. This standard details the materials and performance requirements of an ethylene glycol based Organic Acid Technology (OAT) extended life engine coolant with a minimum recommended service interval of five (5) years or 150 000 miles when used at recommended concentrations.

1.2 Symbols. Not applicable.

1.3 Applicability. The extended life engine coolant is used to protect automotive engine cooling systems from corrosion, freezing and boiling. The extended life coolant concentrate is intended to be mixed with clean, potable water per the recommended limits specified in ASTM D3306. The concentrations to be used are specified in the Global Engine Coolant Mixture Best Practice Heating Ventilation and Air Conditioning Powertrain Cooling (PTC) (HVACPTC-229) unless deviation has been granted by the Global Subsystem Leadership Team (GSSLT). The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.

1.4 Remarks. Not applicable.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ASTM D412	ASTM D1287	ASTM D3182	ISO 37
ASTM D471	ASTM D1383	ASTM D3306	ISO 48
ASTM D1119	ASTM D1384	ASTM D3634	ISO 178
ASTM D1120	ASTM D1415	ASTM D4340	ISO 179
ASTM D1121	ASTM D1881	ASTM D5185	ISO 527-1
ASTM D1122	ASTM D1882	ASTM D5827	ISO 1817
ASTM D1123	ASTM D2570	ASTM D6660	ISO 3167
ASTM D1177	ASTM D2809	ASTM E202	SAE J2643

2.2 GM Standards/Specifications.

9982257	GMW3059	GMW15024	GMW16594
9986350	GMW3155	GMW15468	GMW17113
GMW3038	GMW14747	GMW16270	

2.3 Additional References.

- Global Engine Coolant Mixture Best Practice Heating Ventilation and Air Conditioning Powertrain Cooling (HVACPTC-229). The supplier shall work with the GM responsible to comprehend this requirement.
- GM Global Propulsion Systems, Sealing and Fastening Hardware Resource Center (HRC).
- Safety and Industrial Hygiene (S&IH) Technical Standard (TS), S&IH TS 3.4-160-02 (available at www.gmsupplypower.covisint.com).

3 Requirements.

3.1 Chemical Requirements. Coolants furnished to this test procedure are OAT based and shall contain **none** of the following materials:

- Nitrite or ethanolamine containing salts or additives.

Materials furnished to this test procedure shall have the composition limits shown in Table 1.

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Table 1: Chemical Performance Properties - Concentrate

Properties	Test Methods	Requirement (Weight %)
A. Ethylene Glycol	ASTM E202	85 minimum
B. Other Glycols	ASTM E202	10 maximum
C. Water ^{Note 1}	ASTM D1123	5 maximum (including water by hydration)
D. Ash	ASTM D1119	5 maximum
E. Chloride	ASTM D3634, ASTM D5827	25 ppm maximum
F. Silicon (from Silicate)	ASTM D5185	10 ppm maximum
G. Phosphorus	ASTM D5185	10 ppm maximum
H. Boron	ASTM D5185	10 ppm maximum

Note 1: Water may be used to aid in the dissolution of inhibitor salts, but the amount must be controlled so that the finished product conforms to the limits specified for freezing point.

3.2 Physical Requirements. Materials furnished to this test procedure shall meet the requirements shown in Table 2. The tests will be done on the coolant concentrate unless otherwise specified.

Table 2: Physical Performance Properties

Properties	Test Methods	Requirement
A. Relative Density (15.5 °C/15.5 °C)	ASTM D1122	1.11 to 1.14
B. Reserve Alkalinity	ASTM D1121	Report titration curve
C. pH	ASTM D1287 1 part concentrate plus 2 parts distilled water, by volume	7 to 9
D. Equilibrium Boiling Point	ASTM D1120 35% concentrate plus 65% distilled water by volume	163 °C minimum 104 °C minimum
E. Freezing Point	ASTM D1177 or ASTM D6660: 50% concentrate plus 50% distilled water by volume 35% concentrate plus 65% distilled water by volume	-37 °C maximum -20 °C maximum
F. Color	Color Stability Test(s) as specified by Coolant Committee.	Color stable orange (or alternate color as specified by Coolant Committee).
G. Staining Characteristics (change in reflectance)	ASTM D1882 Use panels coated with current production, light color, automobile finish	No change in surface appearance by discoloration, loss of gloss, softening or swelling allowed.
H. Foaming Characteristics	ASTM D1881 33 by volume coolant and Type II water	Increase in volume during aeration: 88 °C 50 mL maximum 23 °C ± 3 °C 125 mL maximum Foam break time after end of aeration: 88 °C within 5 s 23 °C ± 3 °C within 15 s

3.3 General Corrosivity. The extended life engine coolant shall contain corrosion inhibitors so that it will provide protection against metal corrosion in normally functioning systems for at least five (5) years or 150 000 miles or an extended time period as specified by the GM Commercial Contract. The candidate engine coolant shall satisfy the corrosion limits shown in Table 3 for the glassware (ASTM D1384) and simulated service (ASTM D2570) tests. The corrosion limits are given for maximum weight loss per specimen in the test indicated. The limits shown apply to the average of triplicate determinations. Single high values exceeding twice the mean value shall be discarded and replaced by other determinations. Report any pitting and crevice corrosion which may be indications of inadequate corrosion inhibition, whether or not the weight loss exceeds the value shown.

3.3.1 Glassware Test, ASTM D1384. The glassware test shall be run both at the ASTM D1384 standard of -18 °C (0 °F) freezing point and at 50 volume %. In addition to the metals shown in Table 3, weight losses shall also be reported for high lead solder (97% Pb, 2.5% Sn, and 0.5% Ag). The high lead solder weight loss is determined by repeating the ASTM D1384 test with high lead solder replacing the standard solder or by using a seven (7) metal coupon bundle containing electrically coupled high lead solder, copper, standard solder and brass specimens.

3.3.2 Simulated Service, ASTM D2570. The ASTM D2570 simulated service test shall be run at 44 volume % coolant concentrate. In addition to the requirements shown in Table 3, there shall be no pitting, cavitations or erosion of metal components of the water pump, beyond a fairly uniform surface roughening, on conclusion of 1064 h in the Simulated Service Corrosion Test. Reserve Alkalinity (RA) shall also be determined and reported. The RA shall not decrease by more than 25% to the endpoint pH 4.5 after completion of the Simulated Service Test.

3.3.3 GM Brazil (GMB) and other regions considering a 35% concentration may also request that the Simulated Service Test be performed using 35 volume % concentration.

3.3.4 General Corrosion Compatibility with Other Coolants. The candidate engine coolant shall also meet the ASTM D1384 requirements when tested in 1:3, 1:1, and 3:1 volumetric mixtures with the following:

- Coolant approved to GMW3420 and any other coolant type as selected by the Coolant Committee.

Table 3: ASTM D1384/ASTM D2570 Requirements

Corrosion Test	Maximum Weight Loss, mg			
	Copper and Brass	Solder	Steel and Cast Iron	Aluminum
Glassware (ASTM D1384)	10 mg	20 mg	10 mg	20 mg
Simulated Service (ASTM D2570)	20 mg	40 mg	20 mg	40 mg

3.4 Corrosion Inhibition at Aluminum Heat Rejecting Surfaces, ASTM D4340. The candidate engine coolant shall provide protection against corrosion of aluminum heat rejecting surfaces. The maximum allowed ASTM D4340 corrosion rate in mg/cm² in one week for the tests described as follows are shown in Table 4. The values are shown as averages of duplicate tests. The formation of a trace of solids in the test solution is permissible, but generation of enough solids to completely cover the sample after cool down is cause for rejection. The testing shall follow the procedures of ASTM D4340 with the following additions.

3.4.1 Test Solutions. In addition to the standard ASTM D4340 test solution (25 volume % coolant concentrate, 100 ppm chloride (as NaCl) in complete test solution), duplicate tests shall be run in 50 volume % coolant concentrate in deionized water on the test coolant. Other mixtures may also be requested by GM.

3.4.1.1 Cleaning Procedures. Weight losses of both test samples and blanks not exposed to coolant shall be measured twice. The first measurement is taken after the sample has been vigorously rinsed with a flow of deionized water (remove any loose solids via gentle wiping with a plastic gloved finger), rinsed with acetone, dried in an oven and cooled in a desiccator. The second measurement is taken after subsequent treatment in the standard acid cleaning solution as specified in ASTM D4340. The results for both the water cleaned and acid cleaned samples shall be reported. These results should also be corrected and reported for the weight loss/gain of a similarly cleaned blank specimen.