RECO-COOL

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COOLANT SPECIFCIATIONS AND TEST METHODS

Within the global coolant market there are, as in most products, standards and specifications that aim to protect and inform consumers with regards to the quality of the coolant that they are purchasing. Most OEMs have specifications that coolants must meet in order to be either approved by them or allow a consumer to feel confident that a coolant they are purchasing is suitable for use in their vehicles. The same also applies with local standards organisations (eg ASTM, BS, DIN and JAS). A brief list of standards is given in appendix 1, it is by no means exhaustive but acts as a series of examples of the type of standards that are present in the marketplace.

Each standard is generally based around a series of performance tests and chemical characteristics that characterise the performance and chemical properties of the coolant. In this way the properties of a coolant can be quantified and therefore compared to the criteria within each standard. The tests that are outlined in most specifications are generally common and follow ASTM methodology. In some cases there are slight deviations from the general ASTM methods, however the significance of the test result is not altered by the company or country specific variation in the test methodology.

Below is a list of the tests that contribute to coolant standards with a brief outline to the significance of each test. The tests are divided into two groups,

a) laboratory based tests which are generally used for product approval and development and also quality assurance purposes, and

b) Performance based tests that are generally used for product approval and development.

LABORATORY BASED TESTS

ASTM D 1122 (Standard Test Method for Density or Relative Density of Engine Coolant Concentrates and Engine Coolants By the Hydrometer)
The relative density of an engine coolant may be used to determine the approximate percent glycol, freezing point, and boiling point provided the glycol type is known.

ASTM D1177 (Standard Test method for Freezing Point of Aqueous Engine Coolants)
The freezing point of an engine coolant indicates the coolant freeze protection and can be used to determine the glycol content of a coolant if the glycol type is known.

ASTM D1120 (Standard Test Method for Boiling Point of Coolants)
The boiling point of the coolant gives the initial boiling point of the coolant at atmospheric pressure.

ASTM D 1119 (Standard Test Method for Percent Ash Content of Engine Coolants and Antirusts)
This test is designed to aid in identifying types of coolant and antirusts. Ash is primarily due to inorganic inhibitors.

ASTM D 1287 (Standard Test Method for pH of Engine Coolants and Antirusts)
The pH of a coolant determines wether the coolant is alkaline, neutral or acidic. pH is used in quality control with the general desire that pH is alkaline. Depending on the technology of the coolant the pH may vary from approximately neutral (pH 7) to pH 11.

ASTM D 3634 (Standard Test Method for Trace Chloride Ion in Engine Coolant)
Chloride is a common corrosive ion that can potentially be found in coolants, usually from the use of poor quality water. It may also be determined by ASTM 5827 (Standard Test Method for Analysis of Engine Coolant for Chloride and Other Anions by Ion Chromatography).

ASTM 1123 (Standard Test Methods for Water in Engine Coolant Concentrate by the Karl Fischer Reagent Method).
Water content in coolant concentrates is defined in standards (usually 5%) to ensure that premixed coolants are not marketed as concentrates.

ASTM D1121 (Standard Test Method for Reserve Alkalinity of Engine Coolants and Antirusts)
Reserve alkalinity is a term applied to engine coolants and antirusts to indicate the amount of alkaline components in the product. Generally most metals in an automotive cooling system corrode less in mildly alkaline solutions. The misuse of reserve alkalinity to indicate the quality of the coolant is common (“the higher the reserve alkalinity – the better the coolant”). This is not true; different coolant technologies display a different reserve alkalinity. The use of reserve alkalinity should therefore be used in association with product knowledge and product history.

ASTM D 1882 (Standard Test Method for Effect of Cooling System Chemical Solutions on Organic Finishes for Automotive Vehicles)
This test distinguishes cooling system fluids and chemicals that do or do not have a tendency to change the automotive surface finish. It is not desirable to have a coolant that alters the finish of an automotive surface.

ASTM 1881 (Standard Test Method for Foaming Tendencies of Engine Coolants in Glassware).
This test evaluates the tendency of an engine coolant to foam under controlled conditions. If foaming occurs in a coolant the heat transfer properties of the coolant are compromised as the foam acts as an insulator. In addition to this effect a foaming coolant also increases the risk of cavitation and erosion corrosion.

PERFORMANCE BASED TESTS

ASTM D-1384 (Standard Test Method for Corrosion Test for Engine Coolants in Glassware)
This test is a general test that distinguishes between coolants that are definitely lacking in their corrosion protection perspective than those that are worthy of further testing. In this test a coolant sample is diluted with “corrosive water” i.e water that has 100ppm of sulfate, chloride and bicarbonate ion added to it. The purpose of the dilution with corrosive water is to place the coolant under stress throughout the test. The sample is then placed in an experimental apparatus with metal coupons (each coupon being made of a metal that is found in a cooling system) and then boiled for 14 days. At the end of this time the corrosion that has occurred on the metal coupons is determined by the weight loss of each coupon.

ASTM D-4340 (Standard Test Method for Corrosion of Cast Aluminium Alloys in Engine Coolants Under Heat-Rejecting Conditions)
This test is a selective screening test that will distinguish coolants that are unsuitable for use with aluminium engine heads. The purpose of the test is to place the coolant under stress and then quantify its performance in preventing aluminium corrosion. This is done by over-diluting a coolant with a sodium chloride solution and then placing it in contact with an aluminium surface at 135 deg C for a week. The effectiveness of the coolant for preventing corrosion of the aluminium under these conditions is evaluated on the basis of the weight change of the test specimen.

ASTM D-2809 (Aluminium Water Pump Cavitation/Erosion Corrosion Test)
This test is used to distinguish coolants that contribute to cavitation corrosion and erosion corrosion of aluminium automotive water pumps and those that do not. In the test a coolant is over-diluted with corrosive water and placed in a simulated cooling system. Within the simulated system is an aluminium pump that serves as a test component in evaluating the corrosion effect of the coolant under test.

ASTM D-2570 (Simulated Service Corrosion Test)
This test method follows a closer approach to engine cooling system conditions and provides a better evaluation of engine coolants than is possible from laboratory performance tests. In this test a coolant that has been diluted with corrosive water is circulated for 1064 hours in a simulated engine cooling system. Within the cooling system metal coupons made from the typical metal found in a cooling system are placed. At the end of the test the corrosion

inhibiting properties of the coolant are determined by measuring the mass loss of the metal coupons and by a visual inspection of the interior components of the cooling system.

Common Coolant Specifications
Listed below are some common coolant specifications. The list is by no means exhaustive however they do demonstrate the “typical” type of specification present in the marketplace. It should be noted that OEMs tend to have their own specific tests pertinent to their own engines however they all tend to follow a similar basic set of requirements. Please refer to the Reco-Cool TDS for the specific coolant

GM 1825M
This is the General Motors performance requirement for an automotive engine coolant.

GM 1899M
This is the General Motors performance requirement for a light duty and heavy-duty diesel engine coolant.

Ford ESE M97B44-A
This is the Ford engineering specification performance requirement for passenger car and light truck engine coolant.

Ford ESE M97B18-C
This is the Ford engineering specification performance requirement for diesel and tractor engines.

ASTM D-3306
This is the ASTM performance specification for an ethylene glycol based automotive coolant.

ASTM D-4985
This is the ASTM performance specification for an ethylene glycol based coolant for heavy-duty diesel engines.

ASTM D-6210
This is the ASTM performance specification for fully-formulated ethylene-glycol based engine coolants for heavy-duty engines

SAE J1034
This is the Society of Automotive Engineers standard performance specification for an automotive engine coolant.

SAE J1941
This is the Society of Automotive Engineers standard performance specification for a diesel engine coolant.

The Maintenance Council (TMC RP 329)
TMC RP 329 is a recommended practice (RP) developed by The Maintenance Council (TMC) of American Trucking Associations. This recommended practice is a fleet purchasing specification for nitrite containing ethylene glycol coolants, suitable for heavy duty diesel applications. Major engine manufacturers including Detroit Diesel and Cummins quote to TMC RP 329 in their coolant specifications.