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DRAFT EAST AFRICAN STANDARD

Engine coolant — Specification

EAST AFRICAN COMMUNITY

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Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 068, Petroleum and petroleum products.

Attention is drawn to the possibility that some of the elements of this document may be subject of patent rights. EAC shall not be held responsible for identifying any or all such patent rights.

Engine coolant — Specification

1 Scope

This Draft East Africa Standard specifies requirements, sampling and test methods for glycol-type compounds which, when added at adequate concentrations to water in engine cooling systems, provide protection against overheating, rust and corrosion.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM D92, *Standard test method for flash and fire points by Cleveland open cup tester*

ASTM D380, *Standard test methods for rubber hose*

ASTM E394, *Standard test method for iron in trace quantities using the 1,10-phenanthroline method*

ASTM D412, *Standard test methods for vulcanized rubber and thermoplastic elastomers — Tension*

ASTM D471, *Standard test method for rubber property — Effect of liquids*

ASTM D512, *Standard test methods for chloride ion in water*

ASTM D516, *Standard test method for sulfate ion in water*

ASTM D1119, *Standard test method for percent ash content of engine coolants and antirust*

ASTM D1120, *Standard test method by boiling point of engine coolants*

ASTM D1121, *Standard test method for reserve alkalinity of engine coolants and antirust*

ASTM D1122, *Standard test method for density or relative density of engine coolant concentrates and engine coolants by the hydrometer*

ASTM D1123, *Standard test methods for water in engine coolant concentrate by the Karl Fischer reagent method*

ASTM D1126, *Standard test method for hardness in water*

ASTM D1176, *Standard practice for sampling and preparing aqueous solutions of engine coolants or antirust for testing purposes*

ASTM D1177, *Standard test method for freezing point of aqueous engine coolants*

ASTM D1287, *Standard test method for pH of engine coolants and antirust*

ASTM D1293, Standard test methods for pH of water

ASTM D1384, *Standard test method for corrosion test for engine coolants in glassware*

ASTM D1881, *Standard test method for foaming tendencies of engine coolants*

ASTM D2570, Standard test method for simulated service corrosion testing of engine coolants

ASTM D2809, *Standard test method for cavitation corrosion and erosion-corrosion characteristics of aluminum pumps with engine coolants*

ASTM D4057, *Standard practice for manual sampling of petroleum products*

ASTM D4177, *Standard practice for automatic sampling of petroleum and petroleum products*

ASTM D4327, *Standard test method for anions in water by suppressed ion chromatography*

ASTM D4340, *Standard test method for corrosion of cast aluminum alloys in engine coolants under heat-rejecting conditions*

ASTM D5827, *Standard test method for analysis of engine coolant for chloride and other anions by ion chromatography*

ASTM D5931, *Standard test method for density and relative density of engine coolant concentrates and aqueous engine coolants by digital density meter*

ASTM D6130, *Standard test method for determination of silicon and other elements in engine coolant by inductively coupled plasma-atomic emission spectroscopy*

ASTM D6660, *Standard test method for freezing point of aqueous ethylene glycol base engine coolants by automatic phase transition method*

ASTM E202, *Standard test methods for analysis of ethylene glycols and propylene glycols*

IP 36, *Determination of open flash and fire point — Cleveland method*EAS 914, *Mild steel nails — Specification*

ASTM D5931, *Standard Test Method for Density and Relative Density of Engine Coolant Concentrates and Aqueous Engine Coolants by Digital Density MeterASTM D4057, Standard Practice for Manual Sampling of Petroleum and Petroleum Products*

ASTM D4177, *Standard Practice for Automatic Sampling of Petroleum and Petroleum Products*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
engine coolant concentrate
glycol-type formulated liquid product intended to be diluted with water for use in engine cooling system. This is also referred to as coolant concentrate.

3.2
engine coolant (also known as pre diluted coolant /ready to use coolant)
liquid used for heat transfer from the engine to the radiator, usually containing specific amounts of glycol, water, corrosion inhibitors and a foam suppressor.

3.2.1
antifreeze coolant
engine coolant that provides a lower freezing point and mitigates rusting, corrosion and foaming

3.2.2
tropical coolant/summer coolant
engine coolant without freeze protection that mitigates corrosion and foaming. Also known as a summer/tropical coolant

3.3
glycol
includes mono-ethylene glycol, mono-propylene glycol and other glycols

3.4
organic inhibitors
formulation based on organic acids which reduces corrosion of the metals normally present in an engine cooling system

3.5
cavitation
highly localized corrosion of metal components resulting potentially in small pits or perforations (pitting)

3.6
batch
material from a single mix or, in the case of a continuous production process, material from a single day's production

4 Requirements

4.1 General requirements

4.1.1 The engine coolant shall be formulated from acceptable glycols (or a mixture of acceptable glycols), water, corrosion inhibitors, dye and a foam suppressor.

4.1.2 The engine coolant shall be a homogeneous liquid free from suspended matter and sediment

4.1.3 The engine tropical coolant shall be formulated to meet rust, corrosion, antifoam properties and no freeze protection.

4.2 Specific requirements

4.2.1 Physical requirements

4.2.1.1 The engine antifreeze coolant shall contain at least 33 % of the coolant concentrate when tested in accordance with ASTM D1122 or ASTM D5931

4.2.1.2 The engine coolant shall be formulated using deionized (demineralized) or distilled water or water with low mineral content. The water used shall meet the requirements given in Table 1 when tested in accordance with the test methods prescribed therein.

Table 1 — Water requirements for engine coolant

S/N	Property	Specific value	Test method
i.	Chlorides, µg/g, max.	25	ASTM D 5827 ASTM D512 ASTM D 4327
ii.	Sulphate, µg/g, max.	50.	ASTM D 5827 ASTM D 516 ASTM D 4327
iii.	Hardness, as $CaCO_3$, µg/g, max.	20	ASTM D 6130 ASTM D 1126
iv.	pH	5.5 – 8.5	ASTM D 1287 ASTM D 1293
v.	Iron, µg/g, max.	1.0	ASTM D 6130 ASTM E 394
NOTE 1 Use of water type listed in 4.2.1.2 will minimize formation of hard water scale and avoid introduction of mineral components such as chlorides and sulphates which can increase the corrosion rate of aluminium and iron. NOTE 2 Functional additives used for purposes other than depression of the freezing point may be included.			

4.2.2 Chemical requirements

4.2.2.1 The engine coolant concentrates, and the engine coolants shall conform to the physical and chemical requirements prescribed in Table 2 and Table 3 when tested in accordance with the test methods prescribed therein.

4.2.2.2 The requirements listed in Table 3 for engine coolants are prescribed for the coolant as packaged, without further dilution or adjustment, when tested in accordance with the test methods prescribed therein.

Table 2 — Physical and chemical requirements for concentrates

S/N	Property	Requirement	Test method
i.	Relative density, 15.5/15.5 °C	1.030 – 1.160	ASTM D 1122 ASTM D 5931
ii.	Freezing point[a, a,b] °C, 50 % vol in DI water, max.	-31.0	ASTM D 1177 ASTM D 6660[a]
iii.	Boiling point ˚C, undiluted, min	150	ASTM D 1120
iv.	Boiling point, [a, c] °C, 50 % vol in DI water, min.	104	ASTM D 1120
v.	Ash content, m/m, mass, %, max.	5	ASTM D 1119
vi.	pH, 50 %, vol in DI water	7.0 – 11	ASTM D 1287
vii.	Water, mass, %, max.	5	ASTM D 1123
viii.	Reserve alkalinity, ml	Report [d]	ASTM D 1121

[a] For purposes of determining conformance with this specification, an observed value shall be rounded "to the nearest unit" in the last right-hand digit used in expressing the specification limit, in accordance with the rounding method of Practice E29.

[b] Test Methods D1177 and D6660 work with glycol/glycerine mixtures. Field test devices based on refractive index and density are under development.

[c] Some precipitate may be observed at the end of the test. This should not be cause for rejection.

[d] Value as agreed upon between the supplier and the customer.

DI Distilled or Deionised water.

Table 3a — Physical and chemical requirements for engine anti-freeze coolant

S/N	Property	Requirement	Test method
i.	Relative density, 15.5/15.5°C, min.	1.065	ASTM D1122 ASTM D5931
ii.	Freezing point, [a,b] °C, undiluted, max.	−36.4	ASTM D1177 ASTM D6660
iii.	Boiling point, [a,c] °C undiluted, min.	104	ASTM D1120
iv.	Ash content, mass, %, max.	2.5	ASTM D1119
v.	pH, undiluted	7.0 to 11	ASTM D1287
vi.	Reserve alkalinity, ml	Report [d]	ASTM D1121

[a] For purposes of determining conformance with this specification, an observed value shall be rounded "to the nearest unit" in the last right-hand digit used in expressing the specification limit, in accordance with the rounding method of Practice E29.

[b] Test Methods D1177 and D6660 work with glycol/glycerin mixtures. Field test devices based on refractive index and density are under development.

[c] Some precipitate may be observed at the end of the test. This should not be cause for rejection.

[d] Value as agreed upon between the supplier and the customer.

Table 3b — Physical and chemical requirements for tropical coolant

S/N	Property	Requirement	Test method
i.	Relative density, 15.5/15.5°C, min.	1.01	ASTM D1122 ASTM D5931
ii.	pH, undiluted	7.0 to 11	ASTM D1287
iii.	Reserve alkalinity, ml	Report [a]	ASTM D1121
[a] Value as agreed upon between the supplier and the customer.			

4.2.2.3 All coolant concentrates and engine coolants shall conform to the performance requirements listed in Table 4 when tested in accordance with the test methods prescribed therein.

4.2.2.4 Coolant concentrates shall be diluted for performance testing as described in the individual ASTM test methods.

Table 4 — Performance requirements for coolant concentrates and engine coolants

Property	Specific value	Test method
1) Corrosion in glassware		ASTM D 1384 (BS 6580)
Test strip	Weight loss, mg/specimen	
Copper, max.	10	
Solder, max.	30	
Brass, max.	10	
Steel, max.	10	
Cast iron, max.	10	
Aluminium, max.	30	
2) Simulated service test		ASTM D 2570
Test strip	Weight loss, mg/specimen	
Copper, max.	20	
Solder, max.	60	
Brass, max.	20	
Steel, max.	20	
Cast iron, max.	20	
Aluminium, max.	60	
3) Corrosion of cast aluminium alloys at heat-rejecting surfaces, mg/cm²/week, max.	1.0	ASTM D 4340
4) Foaming		ASTM D 1881
Volume, ml, max.	150	
Break time, s, max.	5	
5) Cavitation-erosion rating for pitting, cavitation, and erosion of the water pump, min.	8	ASTM D 2809
NOTE For engine coolant concentrates, test solutions shall be prepared in accordance with the directions provided in the individual ASTM test methods.		

4.2.2.5 Coolants already circulating in the market shall pass the in-service basic corrosion test prescribed in Table 5.

Table 5 — In-service rust and corrosion test

Sampling	• Random samples of the brand to be tested shall be collected from different point of sales in the market. • A test tube measuring 150 mm in length and 16mm in diameter shall be used in this test. • 25 mm – 40 mm length mild steel nails will be used for this test. • The surface finish of the nails will be uncoated (refer to nail standards EAS 914).
Testing	• The test tube will be filled up to ¾ level with the coolant sample. • Three mild steel nails with no rust shall be put inside the test tube containing the coolant sample. • Another set of the mild steel nails shall be placed in a test tube that is ¾ full of ordinary tap water. This will act as the control test. • The two test sets shall be placed securely on a flat surface and be left undisturbed for the duration of the test. • Visual observations shall be carried out on a weekly basis for one month. • At the end of the test the nails will be removed from the two test tubes and visually examined for any traces of rust.
Requirements	• No rust should be observed in the steel nails from week 1 to week 4. • If rust is formed anytime during of the test period then the coolant sample shall have failed this test. • The steel nails in the control set (pure water) are expected to form rust throughout the test period. • The coolant colour shall not break down throughout the test period.
NOTE This test is only to be applied during market surveillance for coolants already in the market. It shall not be applied during the importation of coolants and coolants concentrates.	

4.3 Other requirements

4.3.1 Miscibility

On dilution of the coolant concentrate, any precipitate formed shall be such as to have no detrimental effect on the coolant circulation or on the anti-corrosion properties of the coolant.

NOTE Antifoaming agents may be immiscible, and if present, might be observed as either an oily film or as dispersed droplets.

4.3.2 Colour

4.3.2.1 The coolant shall be coloured.

4.3.2.2 The coolant dye shall be stable and shall not break down throughout the shelf life of the coolant.

5 Packaging

The condition of each container for the coolant shall be such as to have no detrimental effect on the quality of the product during normal transportation and storage. Only containers of the same size filled with coolant from the same batch shall be packed together in a carton.

6 Labelling

6.1 The following information shall be indelibly and legibly labelled on the container of the coolant, or on a label affixed to the container:

a) name and physical address of the manufacturer or supplier;

b) description of the product as “Tropical coolant” or “summer coolant” or “antifreeze coolant”;

c) declaration of ready to use or concentrate;

d) if concentrates, instructions for use;

e) batch number/identification;

f) net content;

g) date of manufacture;

h) date of expiry;

i) name of the product;

j) country of origin and

k) storage condition.

7 Sampling

Sampling of engine coolant shall be carried out in accordance with ASTM D4057 or ASTM D4177.

Annex A
(normative)

Notes to users

A.1 If the coolant contains a benzoate-nitrate type inhibitor, it should not be filled into or stored in containers that have zinc galvanized fittings that might come into contact with the material. Such contact might cause interaction between the inhibitor and the zinc, with the resultant liberation of hydrogen gas and possible rupture of the container during storage.

A.2 Whenever possible, the dilution of the coolant with water of excessive hardness should be avoided. Furthermore, the addition of other materials to a coolant might be detrimental to the stability and efficiency of the coolant. The indiscriminate mixing of different formulations of engine cooling system coolants (even if from the same manufacturer) should be avoided.

A.3 Service life limitation is important. The engine cooling system coolant covered by this standard becomes a corrosive agent once anti-corrosive agents are depleted. It is recommended that the in-vehicle usage of this coolant should not exceed a period of two years.

Bibliography

KS 2489:2021*: Petroleum and petroleum products— Engine coolant- Specification.*

TZS 2079:2017*: Engine coolant — specification*