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TECHNICAL COMMITTEE: EL 001: SOLAR WATER HEATERS

DRAFT ZIMBABWE STANDARD FOR

DOMESTIC SOLAR WATER HEATERS – MECHANICAL QUALIFICATION TESTS

This draft is now available for **public comments**. Your views and technical comments on it would be appreciated. If you have no specific comments to make but find it generally acceptable it would be helpful if you would notify us accordingly. Suggestions entailing revisions of the text should indicate the preferred wording using the attached template. The relevant clause number should be quoted against any comment.

All comments should be sent to the Committee Secretary **Mr P Chindara** at the address shown below.

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PREFACE

This draft Zimbabwe Standard EL 001 – D 1017/1: Domestic solar water heaters – Mechanical qualification tests, is an identical adoption of SANS 6210: 2013

This draft Zimbabwe Standard is being prepared by technical committee EL 001 – Solar Water Heaters, under the general direction of the Electrical and ICT Standards Council.

This draft standard makes reference to the following publications:

ISO 6509	:	Corrosion of metals and alloys – Determination of dezincification resistance of brass.
ZWS 213	:	Fixed electric storage water heaters.
SANS 1307	:	Domestic storage solar water heating systems.
ZWS 713	:	Domestic solar water heaters
Part 1	:	Thermal performance using an outdoor test method.
SANS 9227	:	Corrosion tests in artificial atmospheres – Salt spray tests .

The following interests are represented on the technical committee entrusted with the development of this standard:

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ZIMBABWE STANDARD

FOR

DOMESTIC SOLAR WATER HEATERS – MECHANICAL QUALIFICATION TESTS

1. SCOPE

This standard specifies test methods for the mechanical qualification of domestic solar water heaters.

2. DEFINITIONS

For the purposes of this standard, the definitions given in SANS 1307 and the following apply.

2.1 Acceptable. Acceptable to the authority administering this standard, or to the parties concluding the purchase contract, as relevant.

3. MECHANICAL QUALIFICATION TESTS FOR COLLECTORS

3.1 Sequence of Tests. Carry out the tests given in 3.2 to 3.6 on the same water heater and in the sequence given.

3.2 Stagnation test for collectors

3.2.1 Preparation. Mount the collector of the water heater as in practice (with sufficient representative interconnecting pipework and insulation, if applicable), with the inlets closed and the outlets open, and in a run-dry condition, i.e. with no transfer fluid anywhere in the collector.

3.2.2 Procedure. Expose the collector to insulation over a period of 15 to 30 consecutive days, keeping a record of the 2 daily insulation and the weather, until at least 315 MJ/m^2 cumulative insulation, or 30 days is reached.

3.2.3 Evaluation. Inspect the test installation regularly during this test, and each time record the date, the time of day, and any occurrence of changes that might impair the continued operation of the water heater, such as:

a) deformation of any part of the collector;

b) vapour deposition on the underside of the collector cover;

c) degradation of paint, sealants or insulation; or

d) degradation of the absorber paint film.

3.3 Test for Mechanical Strength

3.3.1 Test sample. The solar water heater presented for testing shall be a complete operating unit of one of the following types:

a) a close-coupled water heater;

b) an integral water heater;

c) a separate storage tank, collector and interconnecting pipework coupled together in an acceptable manner; or

d) any other water heater erected and coupled in an acceptable manner.

3.3.2 Fatigue and hydrostatic pressure test. Use the appropriate method given in ZWS 213 and test the water heater at a pressure equal to the marked working pressure. In the case of open (non-pressure) type water heaters, use a pressure of 50 kPa.

3.4 Test for Resistance to Rain Penetration of Collectors

3.4.1 Apparatus. Apparatus fitted with 12 spray nozzles of which the mounting positions can be so adjusted that the water sprays are directed onto the joints along the top and sides of the collector cover. The capacity of the nozzles is such that they deliver 165 ℓ of water p/h.

Test nozzles shall not be closer than 10 cm from the collectors.

3.4.2 Preparation of test collector. Test shall be performed on a fully assembled system.

Electrical components intended for indoor installation shall be protected against contact with water.

3.4.3 Procedure. Spray the collector for 5 min every 30 min for a period of 3 h, allowing the run-off water to drain away through the drain connection.

3.4.4 Evaluation. Observe whether the interior of the collector remains free from accumulated water, and evaluate in accordance with 3.2.3.

3.5 Test for Resistance of Collectors to Hail Damage

3.5.1 Procedure

3.5.1.1 Use a suitable apparatus that can fire an ice ball onto the test sample. Ensure that the ice ball is fired at the appropriate aperture area of the collector which is either.

a) the collector cover or, when it forms a permanent part of the collector, the hail screen of a covered collector,

b) the open absorber surface of unglazed or unprotected flat plate collectors, or

c) the evacuated tubes (as fitted on the system), to 12 perpendicular impacts (for flat plate collectors), each with an impact energy of 11 J ± 1 J, and delivered to various points on the tested surface. Ensure that eight of these points are between 30 mm and 50 mm from the inner edge of the collector.

3.5.1.2 In the case of evacuated tubes, only apply one impact to each tube at different positions. Ensure that at least one tube is impacted not less than 100 mm from the exposed bottom end, and at least one tube is impacted not less than 100 mm from the exposed top end.

3.5.2 Evaluation. Observe whether the collector or evacuated tubes suffers any damage that could impair its normal operation, and evaluate in accordance with SANS 1307.

3.6 Test for Resistance to Freezing

3.6.1 General. The transfer fluid used for this test shall be the same type and concentration as for all other tests on this system, specifically in accordance with the thermal performance test given ZWS 713-1.

3.6.2 Test room. A cold room in which the temperature can be controlled to any specific temperature of between −20 °C and +20 °C.

3.6.3 Procedure

NOTE. This procedure does not allow for testing of systems that include drain down valves, dumping valves, anti- freeze valves for freeze protection.

3.6.3.1 Install the system in the cold room. Ensure that:

a) it is filled to its normal capacity with the intended circulating fluid,

b) it is at its marked design pressure,

c) all operating components (for example, circulating pumps, pressure control valves and safety valves) are fitted in an acceptable manner and positioned as specified by the manufacturer,

d) the water temperature is between 30 °C and 37 °C,

e) electrical heating elements are disconnected,

f) any backup batteries shall be fully charged for the start of the test, and these batteries shall not be charged for the duration of all the test cycles, and

g) batteries and control panels are allowed to be outside of the test room.

3.6.3.2 Switch off the electrical supply, including PV cells, to the system, and connect any backup batteries.

3.6.3.3 Reduce the test room temperature to 5 °C ± 3 °C. Maintain this temperature for 180 min.

3.6.3.4 Reduce the test room temperature to −20 °C ± 3 °C in no longer than 60 min. Maintain this temperature for 120 min.

3.6.3.5 Increase the test room temperature to 20 °C ± 5 °C.

3.6.3.6 Disconnect any backup battery.

3.6.3.7 Maintain the test room temperature to 20 °C ± 5 °C for a minimum of 360 min.

3.6.3.8 Inspect the system for any failures (see 4.6.3).

3.6.3.9 the procedure described in 4.6.3.1 to 4.6.3.5 a further three times. Ensure that a total of four test cycles are completed. These steps can be repeated immediately, or with a time delay.

3.6.4 Evaluation. Inspect all components installed in the test room, and perform a pressure test (see 33.2). If necessary, identify any physical damage that could impair normal operation.

3.7 Test for Resistance to Dezincification. Use the method given in ISO 6509 to test all brass components in direct contact with potable water.

3.8 Test for Water Absorption of Composite and Plastics Components (excluding pipes)

3.8.1 Preparation. Cut a test specimen of the composite or plastics, of size approximately 50 mm × 50 mm from each sample. Seal composite specimens round the cut edges with a water-resistant sealing material to an acceptable thickness.

3.8.2 Procedure. Weigh the specimen to an accuracy of 0,05 %. Place it in a beaker of distilled water at room temperature for 28 d. Remove the specimen from the water, wipe off all surface moisture, and weigh the specimen again.

3.8.3 Calculation. Calculate the water absorption, expressed as a percentage by mass, using the following equation:

$$\text{Water absorption} = \frac{B - A}{A} \times 100$$

where

B is the mass of the specimen after immersion, expressed in grams (g);

A is the mass of the specimen before immersion, expressed in grams (g).

3.9 Test for Corrosion Resistance (excluding pipes)

3.9.1 Procedure. Visually inspect all exposed surfaces for any signs of corrosion that formed during the test process. If any corrosion is identified, perform a 1 000 h salt fog test on acceptably sized and prepared samples of the metallic materials (except intrinsically corrosion-resistant materials) of those system components that are exposed to the environment, in accordance with SANS 9227.

Seal the cut surfaces carefully with a compatible and corrosion-resistant coating before the salt fog test is started.

NOTE. In the case of large components, acceptably sized test specimens may have to be cut out.

3.9.2 Evaluation. Immediately after completing the salt fog test, inspect the samples first for penetration of the coating and then for any corrosion of the basic material under the coating. Compare the results with the requirements of the relevant specification.