KENYA STANDARD **DKS 2802-9:2019**

ICS

Masonry units — Methods of test

Part 9:

Determination of moisture expansion of large horizontally perforated clay masonry units

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TECHNICAL COMMITTEE REPRESENTATION

The following organizations were represented on the Technical Committee:

National Housing Corporation
Kenya Clay Products Ltd
Coast Clay Works Ltd
Consumer Information Network
University of Nairobi
Kenya Industrial Research & Development Institute
Architectural Association of Kenya
M&O Consulting Engineers
Kenya Association of Manufacturers,
Kenya National Federation of Jua Kali Association
Lake Basin Development Authority
Kenya Bureau of Standards — Secretariat

REVISION OF KENYA STANDARDS

In order to keep abreast of progress in industry, Kenya Standards shall be regularly reviewed. Suggestions for improvements to published standards, addressed to the Managing Director, Kenya Bureau of Standards, are welcome.

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Foreword

This Kenya Standard was prepared by the Clay and Clay Products Technical Committee under the guidance of the Standards Projects Committee and in accordance with the procedures of the Kenya Bureau of Standards.

During the development of this standard, reference was made to the following documents:

BS EN 772-19:2000 Methods of test for masonry units - Part 19: Determination of moisture expansion of large horizontally perforated clay masonry units.

Acknowledgement is hereby made for the assistance received from these sources.

Masonry units — Methods of test

Part 9:

Determination of moisture expansion of large horizontally perforated clay masonry units

1. Scope

This Kenyan Standard specifies an accelerated method of determining the moisture expansion of large clay units with horizontal perforations that have one dimension equal to or greater than 400 mm and shell thicknesses less than 12 mm.

2. Normative references

The following referenced documents are indispensable for the application 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.

DKS 2801-1 Specification for masonry units - Part 1: Clay masonry units

3. Principle

This test measures the length change of test specimens caused by subjecting them to boiling water for a 24 h period.

4. Symbols

l_i is the initial length an individual specimen after kiln retiring and cooling at ambient temperature, (mm)

R_{in} is the reading from the invar reference bar using the direct reading gauge, (mm)

l_{s1} is the first deviation which is the difference between the first reading from an individual specimen ($R_{\delta 1}$) after kiln retiring and cooling to ambient temperature and the reading from the invar reference bar (R_{in}), in (mm).

l_{s2} is the second deviation which is the difference between the second reading from an individual specimen ($R_{\delta 2}$) after kiln retiring, cooling to ambient temperature and subsequent 3 h hold and the reading from the invar reference bar (R_{in}), (mm)

l_{m1} is the mean initial deviation of an individual specimen, (mm)

l_{s3} is the third deviation which is the difference between the third reading from an individual specimen ($R_{\delta 3}$) 1 h after cooling following boiling water treatment and the reading from the invar reference bar (R_{in}), (mm)

l_{s4} is the fourth deviation which is the difference between the fourth reading from an individual specimen ($R_{\delta 4}$) 24 h after the third reading ($R_{\delta 3}$) and the reading from the invar reference bar (R_{in}), (mm)

l_{m2} is the mean final deviation of an individual specimen, (mm)

e_s is the moisture expansion of an individual specimen, (mm/m)

e_m is the mean value of moisture expansion, (mm/m)

5. Apparatus

5.1. Reference bars of nickel steel (invar) of the approximate length of the test specimens.

5.2. Kiln capable of maintaining a rate of rise of temperature of approximately 50 °C/h and a temperature of 600 °C ± 15 °C.

5.3. Suitable type of **measuring frame** fitted with a dial gauge, a transducer or similar device, with an accuracy of at least 0,01 mm (see example in Figure 1).

5.4. Vernier callipers or other suitable apparatus for linear measurement to the nearest 0,1 mm.

5.5. Special measurement reference pads and adhesive, if necessary.

5.6. Apparatus for maintaining the test specimens in boiling water for 24 h.

5.7. Desiccator capable of holding all the specimens.

6. Sampling

The method of sampling shall be in accordance with DKS 2801-1. The minimum number of specimens shall be six, but a larger number may be specified in the product specification in which case that larger number shall be used.

7. Procedure

7.1. Preparation

Cut a specimen out of a shell from each masonry unit parallel to the perforations. The length shall be as great as possible between 150 mm to 250 mm, depending on the reference bars (5.1). The minimum width shall be 40 mm. Prepare the ends of the specimens as necessary so that the measuring device bears onto flat surfaces perpendicular to the axis of the specimen.

Note: Special end preparation may have to be carried out on the specimens before being measured, e.g. special adhesive measurement reference pads (5 .5) or depressions cut in ends of specimen as appropriate.

7.2. Retiring

If the specimens have been wetted during preparation then store them for 24 h at ambient temperature.

Retire the specimens in a kiln (5.2), maintaining a temperature rise of 50 °C/h until a temperature of 600° C ± 15 °C has been reached. Maintain this temperature for 4 h.

Allow the specimens to cool inside the kiln. When the temperature has fallen to 70 °C remove the specimens and keep them in a desiccator (5. 7) at ambient temperature for at least 20 h.

7.3. Initial measurement

7.3.1.Initial measurement of total length (l_i)

Determine and record the length (l_i) of each specimen to the nearest 0,1 mm using vernier callipers (5.4) or other suitable apparatus. Choose the invar reference bar accordingly.

7.3.2.Measurement of first and second deviations (l_{s1} and l_{s2}) and mean initial deviations (l_{m1})

The readings required by this sub-clause are made using the measuring frame (5 .3) and to the nearest 0,01 mm.

Take and record the reading of the invar reference bar (R_{in}).

Take and record the first reading of each specimen after kiln refiring and cooling to ambient temperature ($R_{\delta 1}$). Calculate and record, for each specimen, the first deviation (l_{s1}), i.e. the difference between $R_{\delta 1}$ and R_{in} to the nearest 0,01 mm.

Take and record the second reading of each specimen after kiln refiring, cooling to ambient temperature and subsequent 3 h hold ($R_{\delta 2}$). Calculate and record, for each specimen, the second deviation (l_{s2}), i.e. the difference between $R_{\delta 2}$ and R_{in} to the nearest 0,01 mm. Examples of deviations are illustrated in Figure 2.

For each specimen, record the initial deviation (l_{m1}) as the mean of (l_{s1}) and (l_{s2}) to the nearest 0,01 mm.

7.4. Boiling water treatment

Immerse the specimens in boiling water (5.6) for 24 h. The test specimens shall be supported clear of the base of the tank and shall not be in contact with the sides.

Remove the test specimens and allow them to cool at room temperature.

7.5. Measurement of third and fourth deviations (l_{s3} and l_{s4}) and mean final deviations (l_{m2})

The readings required by this sub clause are made using the measuring frame and to the nearest 0,01 mm.

Take and record the reading of the invar reference bar (R_{in}).

Take and record the third reading of each specimen 1 h after cooling following boiling water treatment ($R_{\delta 3}$). Calculate and record, for each specimen, the third deviation (l_{s3}), i.e. the difference between $R_{\delta 3}$ and R_{in} to the nearest 0,01 mm.

Take and record the fourth reading of each specimen ($R_{\delta 4}$) 24 h after the third reading ($R_{\delta 3}$). Calculate and record, for each specimen, the fourth deviation (l_{s4}), i.e. the difference between $R_{\delta 4}$ and R_{in} to the nearest 0,01 mm.

For each specimen, record the final deviation (l_{m2}) as the mean of (l_{s3}) and (l_{s4}) to the nearest 0,01 mm.

8. Expression of results

For each specimen calculate the moisture expansion due to the boiling water treatment (es) to the nearest 0, 1 mm/m as follows;

$$e_s = \frac{|l_{m2} - l_{m1}|}{l_i} \times 1\,000\ (\text{mm/m})$$

From the individual values (e_s) calculate the mean value of the moisture expansion (e_m) to the nearest 0,1 mm/m.

9. Test report

The test report shall contain the following information:

a) the number, title and date of issue of this Kenyan Standard,

b) the name of the organization that carried out the sampling and the method used;

c) the date of testing;

d) the type, origin and designation of the masonry unit by reference to DKS 2801-1;

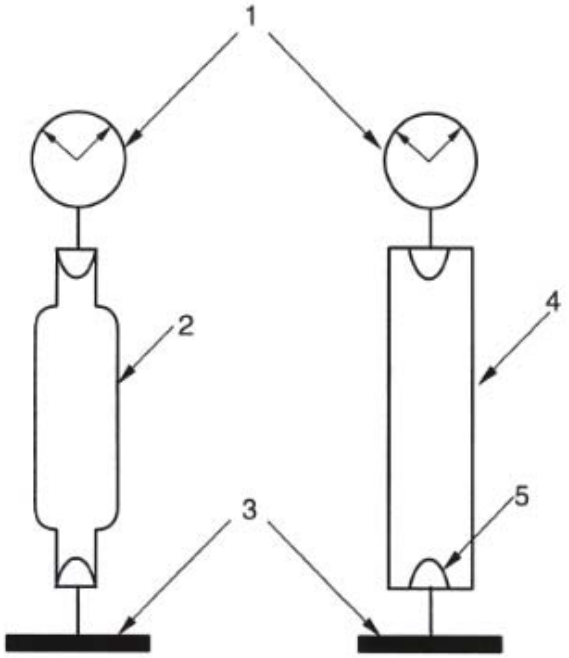
e) the number of specimens in the sample;

f) the date of delivery of the specimens to the testing laboratory;

g) the moisture expansion e_s for each specimen expressed in mm/m, to the nearest 0,1 mm/m;

h) the mean value e_m of moisture expansion expressed in mm/m, to the nearest 0,1 mm/m;

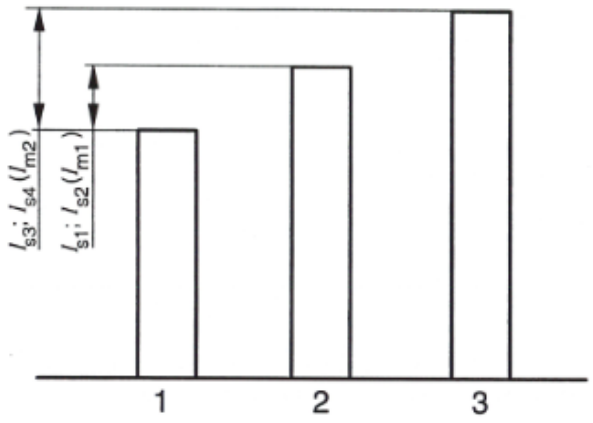
i) remarks (if any).



Key

1 Dial or digital measuring gauge
2 Invar reference bar
3 Support
4 Specimen
5 Contact of measuring frame

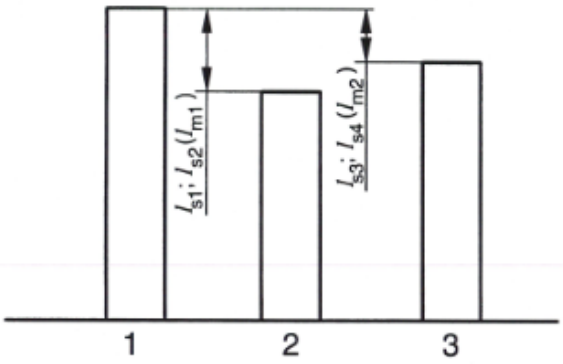
Figure 1 – Measuring frame showing measurement of invar reference bar and of specimen



Key

1 Invar bar
2 Specimen after refiring
3 Specimen after boiling water treatment

a) case where the invar bar is shorter than the specimen



b) case where the invar bar is longer than the specimen

Key

1 Invar bar
2 Specimen after refiring
3 Specimen after boiling water treatment

Figure 2 – Examples of deviations