Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.

ISBN 978-0-626-26897-8

# SANS 1058:2012

Edition 2.1

# SOUTH AFRICAN NATIONAL STANDARD

## Concrete paving blocks

**Published by SABS Standards Division**
**1 Dr Lategan Road Groenkloof ✉ Private Bag X191 Pretoria 0001**
**Tel: +27 12 428 7911 Fax: +27 12 344 1568**
**www.sabs.co.za**
**© SABS**

SABS

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.

**SANS 1058:2012**
Edition 2.1

**Table of changes**

| Change No. | Date | Scope |
|---|---|---|
| Amdt 1 | 2012 | Amended to update referenced standards and to change the requirements in table 2. |

## Acknowledgement

The SABS Standards Division wishes to acknowledge the valuable assistance derived from publications of the Concrete Manufacturer's Association (CMA).

## Foreword

This South African standard was approved by National Committee SABS SC 59A, *Construction standards – Cement, lime and concrete*, in accordance with procedures of the SABS Standards Division, in compliance with annex 3 of the WTO/TBT agreement.

This document was published in February 2012.

This document supersedes SANS 1058:2010 (edition 2).

A vertical line in the margin shows where the text has been technically modified by amendment No. 1.

Annex A forms an integral part of this document. Annex B is for information only.

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



## Contents

Page

Acknowledgement

Foreword

1 Scope ..... 3

2 Normative references ..... 3

3 Definitions ..... 4

4 Requirements ..... 4

5 Marking ..... 6

6 Inspection and methods of test ..... 6

**Annex A** (normative) Notes to purchasers ..... 16

**Annex B** (informative) Quality verification of concrete paving blocks produced to the requirements laid down in the standard ..... 16

**Bibliography** ..... 17

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



**This page is intentionally left blank**

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



# Concrete paving blocks

## 1 Scope

This standard covers blocks made from concrete, which are used for the construction of paved surfaces.

## 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. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

EN 12878, *Pigments for the colouring of building materials based on cement and/or lime – Specifications and methods of test.*

SANS 1083, *Aggregates from natural sources – Aggregates for concrete.*

~~SANS 1491-1, *Portland cement extenders – Part 1: Ground granulated blast furnace slag.*~~ **Amdt 1**

~~SANS 1491-2, *Portland cement extenders – Part 2: Fly ash.*~~ **Amdt 1**

~~SANS 1491-3, *Portland cement extenders – Part 3: Silica fume.*~~ **Amdt 1**

SANS 50197-1/EN 197-1, *Cement – Part 1: Composition, specifications and conformity criteria for common cements.*

SANS 50450-1, *Fly ash for concrete – Part 1: Definition, specifications and conformity criteria* **Amdt 1**

SANS 50450-2, *Fly ash for concrete – Part 2: Conformity evaluation* **Amdt 1**

SANS 53263-1, *Silica fume for concrete – Part 1: Definitions, requirements and conformity criteria* **Amdt 1**

SANS 53263-2, *Silica fume for concrete – Part 2: Conformity evaluation* **Amdt 1**

SANS 55167-1, *Ground granulated blast furnace slag for use in concrete, mortar and grout – Part 1: Definitions, specifications and conformity criteria* **Amdt 1**

SANS 55167-2, *Ground granulated blast furnace slag for use in concrete, mortar and grout – Part 2: Conformity evaluation* **Amdt 1**

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



## 3 Definitions

For the purposes of this document the following definitions apply.

**3.1**
**acceptable**
acceptable to the authority administering this standard, or to the parties concluding the purchase contract, as relevant

**3.2**
**block**
paving block with all overall plan dimensions being less than 295 mm manufactured in concrete, and used in the construction of paved surfaces

**3.3**
**defective**
product that fails in one or more respects to comply with the requirements of the standard

## 4 Requirements

### 4.1 Materials

#### 4.1.1 Cement

The cement shall comply with the requirements of SANS 50197-1. If extenders are used they shall comply with the requirements of SANS 50197-1, SANS 55167-2, SANS 50450-1, SANS 50450-2, SANS 53263-1 and SANS 53263-2. **Amdt 1**

#### 4.1.2 Aggregates

Aggregates shall comply with the requirements of SANS 1083.

#### 4.1.3 Water

The water used in the mixing of the concrete shall be free from impurities that might impair the strength or durability of the concrete.

#### 4.1.4 Pigments

Pigments used for colouring the concrete shall comply with the requirements of EN 12878.

### 4.2 Shape, appearance, colour and texture

#### 4.2.1 Shape

All blocks shall conform to the appropriate designated shape.

#### 4.2.2 Appearance

All blocks shall be sound and free of cracks or other defects that would interfere with the proper placing of the blocks or significantly impair the strength or the permanence or the appearance of the paved surfaces.

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



### 4.2.3 Colour

When blocks are required to have coloured wearing surfaces the colour shall be as agreed and extend from the exposed surface at least 6 mm into the block.

### 4.2.4 Surface texture

The surface texture of the blocks shall be as agreed.

NOTE Should the purchaser so require, the manufacturer should supply to the purchaser, for his retention, a sample of three blocks of the agreed colour and surface texture. This sample serves as a reference sample of the possible range of the colour and surface texture at the time of order.

## 4.3 Dimensions

### 4.3.1 Linear

The work size of a block, as indicated by the overall length, overall width and overall height shall be as required and, when determined in accordance with 6.3, shall not differ from the required nominal values by more than the applicable tolerance given in table 1.

Critical dimensions and their tolerances shall be as required.

**Table 1 — Tolerances**

| 1 | 2 |
|---|---|
| **Dimension** | **Tolerances** mm |
| Length | ± 2 |
| Width | ± 2 |
| Height | ± 3 |

### 4.3.2 Cross-sectional squareness

The height of the block as measured at any point along the perimeter of the block shall not vary by more than 2 %.

## 4.4 Tensile splitting strength

The average and individual tensile splitting strengths of blocks determined in accordance with 6.4 shall be at least the values given in table 2 appropriate to the class of block.

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



**Table 2 — Tensile splitting strength of blocks**

| 1 | 2 | 3 |
|---|---|---|
| **Class** | **Tensile splitting strength** MPa | |
| | **Average** | **Individual** |
| 30/2.0 | 2,0 | 1,5 |
| 40/2.6 | 2,6 | 2,0 |
| NOTE 1 30/2,0 is indicative of a design compressive strength of 30MPa and a required tensile splitting strength of 2,0MPa<br><br>NOTE 2 40/2,6 is indicative of a design compressive strength of 40MPa and a required tensile splitting strength of 2,6MPa. | | |

**Amdt 1**

## 4.5 Abrasion resistance

The average and individual mass loss of blocks determined in accordance with 6.5 shall not exceed 15 g and 20 g respectively. **Amdt 1**

## 4.6 Water absorption

The average and individual water absorption of blocks determined in accordance with 6.6 should not exceed 6,5 % and 8,0 % respectively. **Amdt 1**

# 5 Marking

Each consignment of units shall be accompanied by a delivery note in which the following information is given:

a) the manufacturer's name;

b) the trade name, or trademark of the product;

c) the date of manufacture or related code number;

d) in the case of units having a coloured finish, the colour; and

e) the quality mark.

# 6 Inspection and methods of test

## 6.1 Inspection and test frequency

Test specimens are to be selected at random and at periodic intervals throughout the production shift as given in table 3.

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



Table 3 — Inspection and test frequency

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| **Aspect** | **Production** | **Clause** | **Frequency** |
| Shape, appearance, colour and texture | All | 4.2 | 12 blocks per machine per shift |
| Dimensions | Per machine | 4.3 | 12 blocks per machine per shift |
| Tensile splitting strength | Per machine | 4.4 | 12 blocks per machine per shift |
| Abrasion resistance[a] | Per machine | 4.5 | 8 blocks per machine per shift |
| Water absorption | Per machine | 4.6 | 6 blocks per machine per shift |
| NOTE The same test specimens can be used for more than one of the above tests. | | | |
| [a] This test is not required for blocks with an exposed aggregate surface. | | | |

## 6.2 Shape, appearance, colour and texture

Inspect the units and check for compliance with the requirements of 4.2.

## 6.3 Dimensions

### 6.3.1 Apparatus

**Measuring equipment** capable of measuring with an accuracy of 0,5 mm.

### 6.3.2 Procedure

**6.3.2.1** Remove any loose particles from the faces of the blocks.

**6.3.2.2** Take all linear measurements to the nearest 0,5 mm. Measure the critical dimensions of units of irregular shapes and squareness in a way that results in repeatable and reproducible values.

**6.3.2.3** Check for compliance with the requirements of 4.3.

## 6.4 Tensile splitting strength test

### 6.4.1 Apparatus

**A testing machine** with the following characteristics:

a) having a scale with an accuracy of ± 3 % over the range of the anticipated test loads, and be capable of increasing the load at specified rates;

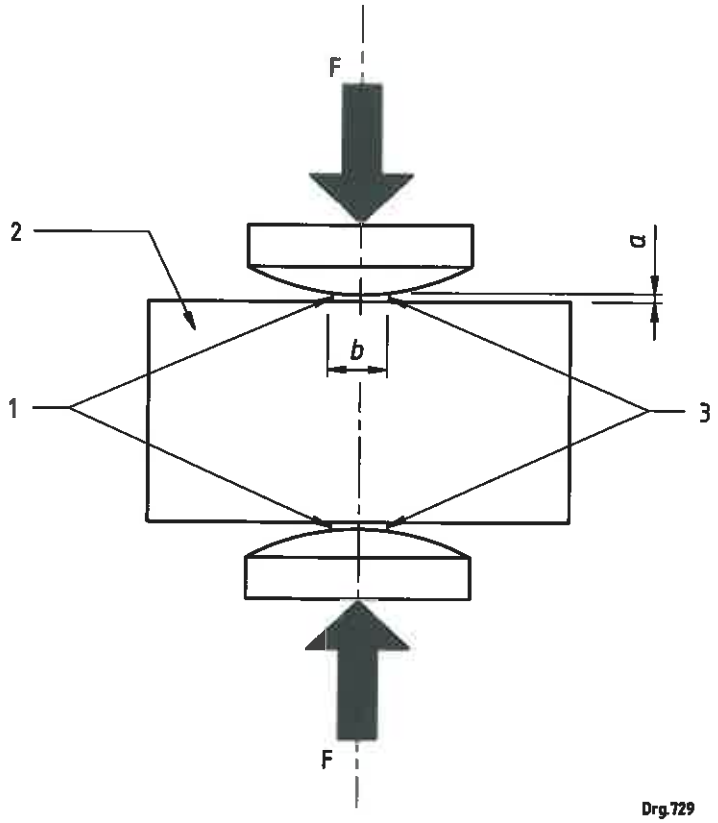
b) equipped with a device composed of two rigid bearers (see figure 1) whose contact surface has a radius of 75 mm ± 5 mm;

c) with two bearers held in the same vertical plane with a tolerance of ± 1 mm at the bearers end, with the upper bearer able to rotate in its transverse axis; and

d) with two packing pieces of plywood being 10 mm ± 1 mm wide, 4 mm ± 1 mm thick and at least 10 mm longer than the anticipated fracture plane.

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.






**Key**

| | | | |
|---|---|---|---|
| 1 | Packing pieces | *a* | Thickness of packing piece |
| 2 | Paving block | *b* | Length of packing piece |
| 3 | Rigid bearers | F | Applied test load |

**Figure 1 — Principle of testing**

### 6.4.2 Preparation of test blocks

**6.4.2.1** Only whole blocks shall be tested. If a face is rough, textured or curved it shall be prepared by grinding or capping. The least amount of materials shall be removed to produce a flat face.

NOTE Other methods of preparation can be used for routine testing providing there is a correlation between the results of the two methods, for example, using un-ground rough textured or curved blocks instead of ground blocks.

**6.4.2.2** Immerse the blocks in water at 20 °C ± 5 °C for 24 h ± 3 h, remove, wipe dry and test immediately.

### 6.4.3 Procedure

**6.4.3.1** Place the block in the testing machine with the packing pieces on the upper face and the bed face in contact with the bearers. Ensure that the packing pieces and the axes of the bearers are in line with the splitting section of the block.

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



**6.4.3.2** Split the section(s) chosen according to the following order of priority:

a) Test the sample along the longest splitting section of the block, parallel and symmetrical to the edges, such that the distance of the splitting section to any side face is at least 0,5 times the block thickness over at least 75 % of the splitting section area.

b) If the above mentioned condition cannot be met, test the sample along two splitting sections chosen in a way that the distance of one splitting section to the other splitting section or to any side face of the block is at least 0,5 times the block thickness over at least 75 % of the splitting section length considered.

c) If neither of the above mentioned conditions can be met, split the sample chosen in such a way that the greatest total proportional section length satisfies the distance requirement.

d) If the block section is square, hexagonal or circular in plan, split the sample so that the shortest length passes through the centre of the plan area.

**6.4.3.3** Apply the load smoothly and progressively at a rate which corresponds to an increase in stress of 0,05 MPa/s ± 0,01 MPa/s.

**6.4.3.4** Record the failure load.

**6.4.3.5** Calculate the area of the failure plane(s) of the block tested using the following equation:

$$S = L \times t$$

where

$S$ is the area of the failure, expressed in square millimetres ($mm^2$);

$L$ is the mean of two measurements of the failure length, one at the top and one at the bottom of the block, expressed in millimetres (mm);

$t$ is the thickness of the block at the failure plane, and is the mean of three measurements; one in the middle and one at either end, expressed in millimetres (mm).

### 6.4.4 Calculation of test results

**6.4.4.1** If testing is performed along two transverse test sections of the same block, the splitting strength of the block is considered the mean of the two individual results.

**6.4.4.2** Calculate the strength $T$ of the block tested using the following equation:

$$T = 0{,}637k \times \frac{P}{S}$$

where

$T$ is the strength, expressed in megapascals (MPa);

$k$ is a correction factor for the block thickness determined from table 4;

$P$ is the failure load, expressed in newtons (N);

$S$ is the area of the failure, expressed in square millimetres ($mm^2$).

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



**Table 4 — Thickness correction factor, *k***

| 1 | 2 |
|---|---|
| **Thickness** *t* mm | **Correction factor** *k* |
| 40 | 0,71 |
| 50 | 0,79 |
| 60 | 0,87 |
| 70 | 0,94 |
| 80 | 1,00 |
| 90 | 1,06 |
| 100 | 1,11 |
| 110 | 1,15 |
| 120 | 1,19 |
| 130 | 1,23 |
| 140 | 1,25 |

**6.4.4.3** Calculate the strength of each block and the average of the 12 blocks and check for compliance with 4.4.

## 6.5 Abrasion resistance test

### 6.5.1 Apparatus

**6.5.1.1 A well-ventilated drying oven** with a cubic capacity of not less than 3 times the total volume of specimens being dried and capable of maintaining a temperature of 110 °C ± 8 °C.

**6.5.1.2 Balance** of adequate capacity and accurate to within 0,1 g.

**6.5.1.3 Tumbler machine** with the following:

a) A rectangular steel container with

1) dimensions specified in figures 2 and 3,

2) ends secured through their centres to a steel shaft that projects from the ends and is supported so that it can rotate freely about its longitudinal axis, and

3) four sides having centrally placed openings. (See figure 2.)

b) Angle plates fitted to each corner of the interior of the container, forming a 45° ± 1° angle at the intersection of plate and container. The angle plates shall finish flush with the external surface of the container.

Steel of Brinell hardness grade 360 to grade 400 is required for the angle plates.

c) A horizontal axes kept in an exact horizontal position (0° to 0,5° to the horizontal) throughout the test.

d) Cover plates that

1) consist of 8 mm thick hardened steel to cover the four sides of the container,

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



2) have four tapering holes each (see figure 2) and provided with at least three locating pins to ensure their accurate placement over the openings of the box,

3) have holes that are offset from the axial centre in the direction of the rotation of the container, and

4) when they are clamped to the sides, ensure that

- an imaginary line tangential to the four openings at the reverse side of the plate would be parallel with the axis of the drive shaft, and

- sufficient space exists between the container and the cover plates to allow dust to escape. When measured at 8 equi-spaced points around the perimeter of each cover plate, the average gap shall be ≥ 2 mm.

NOTE 1 Distortions caused by use and those existing from manufacture would normally comply with the requirements given in (3) and (4).

NOTE 2 When the cover plates fit so tightly as to not satisfy this requirement, a placement of 2 mm thick washers around the locating pins will provide an adequate gap.

NOTE 3 Current machines, which have angle plates and cover plates and which are not of the correct steel hardness, may be used until new plates are required.

e) Clamping plates designed so as to ensure that the test specimens are firmly secured to the cover plate for the duration of the test without causing damage. This requires the use of two timber packing blocks per specimen between the cover plate and the specimens. (See figure 3.)

f) A revolution counter fitted to the tumbler.

g) An acceptable driving mechanism capable of rotating the tumbler at a rate of 60 r/min ± 1 r/min.

The tumbler drive shall only be able to rotate the tumbler in the direction of the offset of the holes in the cover plates.

h) Six hundred steel ball bearings, each of which is 15,9 mm ± 0,1 mm in diameter, and weighing 16,2 g ± 0,2 g.

NOTE The tumbler machine has 16 holes so either specimens from 2 machines or from 2 production shifts can be tested simultaneously.

**6.5.1.4 Vacuum cleaner** with hand brush attachment.

**6.5.1.5 Timing device** capable of being read to the nearest second.

### 6.5.2 Preparation of test blocks

These test blocks may be full units or cut from larger blocks and shall have a test face of sufficient size to fully cover the holes in the cover plates.

Blocks larger than these dimensions may be cut wet with a diamond saw before testing. Such cutting blocks shall leave the test area of the wearing face to be tested undamaged.

### 6.5.3 Procedure

**6.5.3.1** Thoroughly remove all loose particles from all blocks so that any subsequent loss in material is only due to abrasion. Either washing or dry brushing can be used.

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



**6.5.3.2** Condition blocks by drying in a ventilated oven at 100 °C ± 5 °C for 24 h ± 3 h.

**6.5.3.3** Allow all blocks to cool in the laboratory for a minimum of 5 h before testing.

**6.5.3.4** Within 30 min before testing, determine the mass of each test specimen, $m_1$, to the nearest 0,1 g.

**6.5.3.5** Secure the test blocks to the abrasion testing machine with their wearing face inwards and centrally (on width) placed over the apertures in the cover plate.

For double-sided pavers that have two differently textured wearing faces, test the two surfaces independently.

Add the steel balls to the container before securing the last block.

**6.5.3.6** After all holes are covered by test specimens, run the machine for $3600^{+30}_{-0}$ revolutions at the rate of 60 r/min ± 1 r/min.

**6.5.3.7** At the end of the tumbling, carefully detach the blocks.

**6.5.3.8** Thoroughly remove all dust and loose particles from the test blocks by brushing and vacuuming.

**6.5.3.9** Within 30 min of cleaning, weigh each test block, and record its mass, $m_2$, to the nearest 0,1 g.

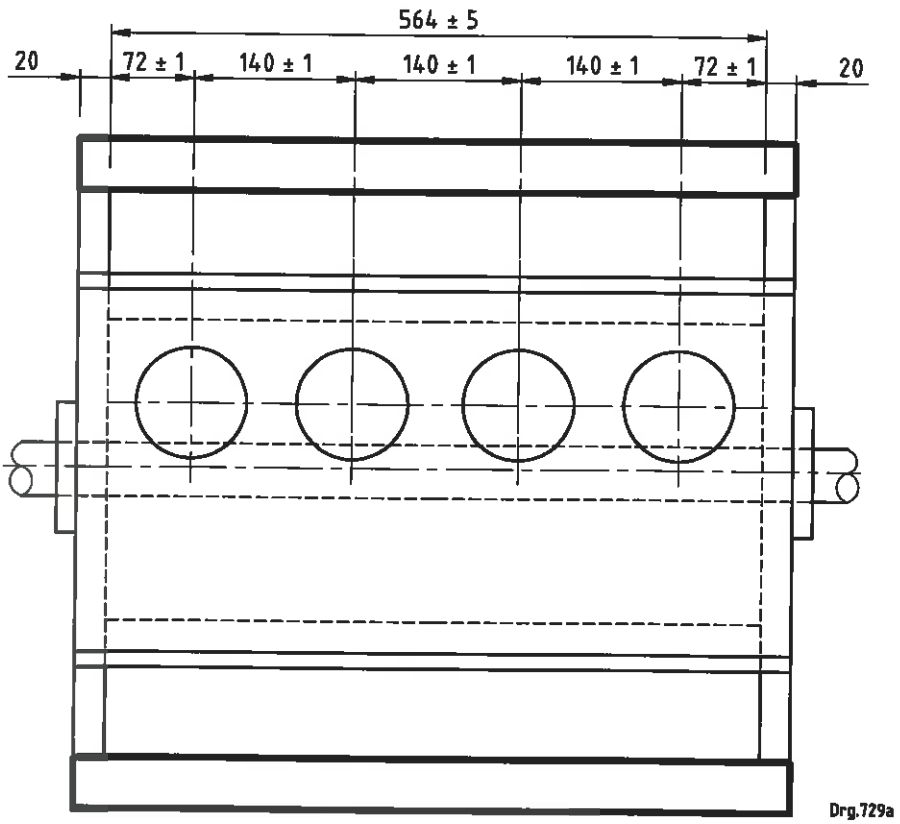
### 6.5.4 Calculation

Calculate the mass loss of each block, $(m_1 - m_2)$, and the average mass loss of the 8 blocks, and check for compliance with 4.5.

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



Dimensions in millimetres




NOTE Dimensions without tolerances are nominal.

**Figure 2 — Tumbler with cover plates – Plan**

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



Dimensions in millimetres

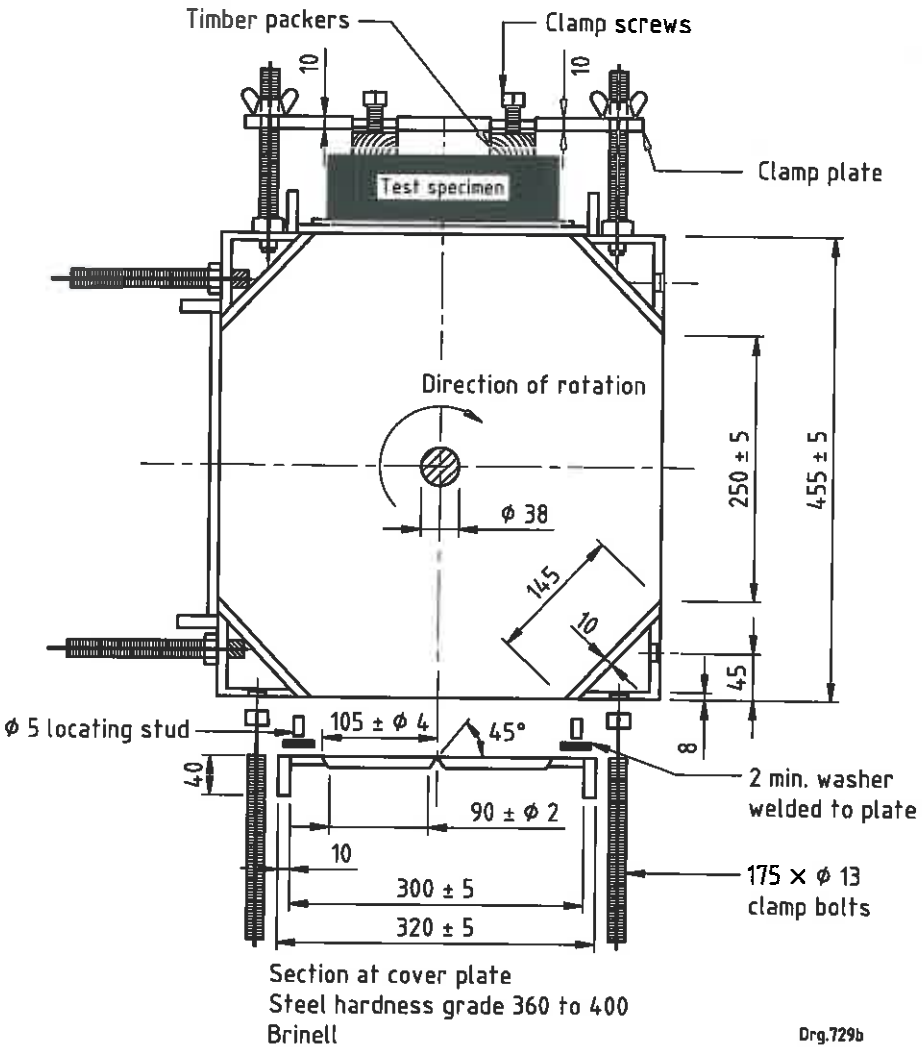



**Figure 3 — Tumbler – Section**

## 6.6 Water absorption test

### 6.6.1 Apparatus

**6.6.1.1 A well-ventilated drying oven** capable of accommodating 6 specimens and capable of maintaining a temperature of 100 °C to 105 °C.

**6.6.1.2 Balance or mass meter** with a capacity of 30 kg and accuracy of 1 g.

### 6.6.2 Procedure

**6.6.2.1** Dry the blocks in the oven for 24 h ± 3 h at a temperature of 100 °C ± 5 °C.

**6.6.2.2** Allow all blocks to cool in the laboratory for a minimum of 5 h before testing.

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



**6.6.2.3** Determine and record the mass of each block, $m_1$.

**6.6.2.4** Submerge the blocks in water at a temperature of 20 °C to 25 °C for 24 h ± 3 h.

**6.6.2.5** Remove the blocks from the water and remove the excess surface water with a damp cloth.

**6.6.2.6** Immediately determine and record the mass of each block, $m_2$.

**6.6.2.7** Check for compliance with 4.6.

### 6.6.3 Calculations

**6.6.3.1** Calculate the water absorption, $W_a$, using the following equation:

$$W_a = \frac{m_2 - m_1}{m_1} \times 100$$

**6.6.3.2** Calculate the percentage water absorption of each block and the average of the 6 blocks.

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



# Annex A
(normative)

## Notes to purchasers

**A.1** The following requirements shall be specified in tender invitations and in each order or contract:

a) the nominal (stated) dimensions (see 4.3); and

b) the class (see 4.4).

**A.2** The following requirements shall be agreed upon between the manufacturer and the purchaser:

a) the surface texture and colour (see 4.2); and

b) when relevant, the sampling plan (see B.2).

# Annex B
(informative)

## Quality verification of concrete paving blocks produced to the requirements laid down in the standard

**B.1** When a purchaser requires ongoing verification of the quality of concrete paving blocks, it is suggested that, instead of concentrating solely on evaluation of the final product, he also direct his attention to the manufacturer's quality system. In this connection it should be noted that SANS 9001 covers the provision of an integrated quality system.

**B.2** If no information about the implementation of quality control or testing during manufacture is available to help in assessing the quality of a lot, and a purchaser wishes to establish by inspection and testing of samples of the final product whether a lot of the blocks produced to this standard complies with its requirements, a sampling plan based on applicable statistical tables should be agreed upon between the manufacturer and purchaser.

It should be noted that

a) such a sampling plan applies to fully manufactured products only, and

b) a lot that in terms of the plan is deemed to comply with the standard, could contain defective blocks to an extent proportional to that permitted by the relevant acceptance numbers given in the sampling table.

Copyright protected. This standard may only be used and printed by subscribers to the SABS' Complete Collection of Standards and Related Documents in accordance with a formal copyright agreement.



## Bibliography

SANS 9001/ISO 9001, *Quality management systems – Requirements.*

© SABS