

**DRAFT SOUTH AFRICAN STANDARD (DSS):
PUBLIC ENQUIRY STAGE****Document number** SANS 10400-XA (DSS3)**Reference** 7114/10400-XA/SM**Date of circulation** 2011-03-01**Closing date** 2011-05-03**Number and title:**

SANS 10400-XA: THE APPLICATION OF THE NATIONAL BUILDING REGULATIONS — PART X:
ENVIRONMENTAL SUSTAINABILITY — PART XA: ENERGY USAGE IN BUILDINGS

Remarks:**PLEASE NOTE:**

- The technical committee, SABS SC 59G: *Construction standards – Energy efficiency and energy use in the built environment* responsible for the preparation of this standard has reached consensus that the attached document should become a South African standard. It is now made available by way of public enquiry to all interested and affected parties for public comment, and to the technical committee members for record purposes. Any comments should be sent by the indicated closing date, either by mail, or by fax, or by e-mail to

SABS Standards Division
Attention: Compliance and Development department
Private Bag X191
Pretoria
0001

Fax No.: (012) 344-1568 (for attention: dsscomments)
E-mail: dsscomments@sabs.co.za

Any comment on the draft must contain in its heading the number of the clause/subclause to which it refers. A comment shall be well motivated and, where applicable, contain the proposed amended text.

- The public enquiry stage will be repeated if the technical committee agrees to significant technical changes to the document as a result of public comment. Less urgent technical comments will be considered at the time of the next amendment.

THIS DOCUMENT IS A DRAFT CIRCULATED FOR PUBLIC COMMENT. IT MAY NOT BE REFERRED TO AS A SOUTH AFRICAN STANDARD UNTIL PUBLISHED AS SUCH.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT SOUTH AFRICAN STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN LAW.

SOUTH AFRICAN NATIONAL STANDARD

The application of the National Building Regulations

Part X: Environmental sustainability

Part XA: Energy usage in buildings

SANS 10400-XA:2011
Edition 1

Table of changes

Change No.	Date	Scope

Foreword

This South African standard was approved by National Committee SABS SC 59G, *Construction standards – Energy efficiency and energy use in the built environment*, in accordance with procedures of the SABS Standards Division, in compliance with annex 3 of the WTO/TBT agreement.

This document was published in xxxx 2011.

Compliance with the requirements of this document will be deemed to be compliance with the requirements of part XA of the National Building Regulations, issued in terms of the National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977).

SANS 10400 consists of the following parts, under the general title *The application of the National Building Regulations*:

Part A: General principles and requirements.

Part B: Structural design.

Part C: Dimensions.

Part D: Public safety.

Part F: Site operations.

Part G: Excavations.

Part H: Foundations.

Part J: Floors.

Part K: Walls.

Part L: Roofs.

Part M: Stairways.

Part N: Glazing.

Part O: Lighting and ventilation.

Part P: Drainage.

Part Q: Non-water-borne means of sanitary disposal.

Foreword *(concluded)*

Part R: Stormwater disposal.

Part S: Facilities for persons with disabilities.

Part T: Fire protection.

Part V: Space heating.

Part W: Fire installation.

Part X: Environmental sustainability.

Part XA: Energy usage in buildings.

This document should be read in conjunction with SANS 10400-A.

Annexes A and B are for information only.

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The application of the National Building Regulations

Part X:

Environmental sustainability

Part XA:

Energy usage in buildings

1 Scope

This part of SANS 10400 provides deemed-to-satisfy requirements for compliance with part XA (Energy Usage in Buildings) of the National Building Regulations.

NOTE Part XA of the National Building Regulations, issued in terms of the National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977), is reproduced in annex A.

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.

ASTM C 177, *Standard test method for steady-state heat flux measurements and thermal transmission properties by means of the guarded-hot-plate apparatus.*

ASTM C 518, *Standard test method for steady-state thermal transmission properties by means of the heat flow meter apparatus.*

ASTM C 1363, *Standard test method for thermal performance of building materials and envelope assemblies by means of a hot box apparatus.*

SANS 204, *Energy efficiency in buildings.*

SANS 613, *Fenestration products – Mechanical performance criteria.*

SANS 1307, *Domestic solar water heaters.*

SANS 6211-1, *Domestic solar water heaters – Part 1: Thermal performance using an outdoor test method.*

SANS 6211-2, *Domestic solar water heaters – Part 2: Thermal performance using an indoor test method.*

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SANS 6946/ISO 6946, *Building components and building elements – Thermal resistance and thermal transmittance – Calculation method.*

SANS 10106, *The installation, maintenance, repair and replacement of domestic solar water heating systems.*

SANS 10252-1:2004, *Water supply and drainage for buildings – Part 1: Water supply installations for buildings.*

SANS 10254, *The installation, maintenance, replacement and repair of fixed electric storage water heating systems*

SANS 10400-A, *The application of the National Building Regulations – Part A: General principles and requirements.*

SANS 10400-K (SABS 0400-K), *The application of the National Building Regulations – Part K: Walls.*

SANS 10400-O, *The application of the National Building Regulations – Part O: Lighting and ventilation.*

3 Definitions

For the purposes of this document, the definitions given in SANS 10400-A (some of which are repeated for convenience) and the following apply.

3.1

Board of Agrément South Africa

body that operates under the delegation of authority of the Minister of Public Works

3.2

building envelope

elements of a building that separate a habitable room from the exterior of a building or a garage or storage area

3.3

certified thermal calculation software

software that is certified by the Board of Agrément South Africa, in terms of Agrément South Africa's Energy Software Protocols, as being fit for thermal modelling or calculation purposes in terms of the National Building Regulations

3.4

competent person

person who is qualified by virtue of his education, training, experience and contextual knowledge to make a determination regarding the performance of a building or part thereof in relation to a functional regulation or to undertake such duties as may be assigned to him in terms of the National Building Regulations

3.5

deemed-to-satisfy requirement

non-mandatory requirement, the compliance with which ensures compliance with a functional regulation

3.6

equipment

all control devices and components of systems other than appliances which are not permanently installed and integrated for the express purpose of providing control of environmental conditions for the building.

3.7**fenestration**

any glazed opening in a building envelope, including windows, doors and skylights

3.8**fenestration area**

area that includes glazing and framing elements that are fixed or movable, and opaque, translucent or transparent

3.9**functional regulation**

regulation that sets out in qualitative terms what is required of a building or building element or building component in respect of a particular characteristic, without specifying the method of construction, dimensions or materials to be used

3.10**nett floor area**

floor area excluding the area occupied by vertical elements including enclosed lift wells and enclosed stairs.

3.11**orientation**

direction that a building envelope element faces, i.e. the direction of a vector perpendicular to and pointing away from the surface outside of the element

3.12**plastering**

application of a suitable plaster, sand, portland cement and water to masonry interiors and exteriors to achieve a smooth surface

3.13**reference building**

hypothetical building that is used to determine the maximum allowable heat load for the proposed building

3.14**rendering**

application of a thin premixed surface of sand, cement and lime plaster to a masonry surface

3.15**R-value**

thermal resistance ($\text{m}^2\cdot\text{K}/\text{W}$) of a component

NOTE This is the inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area.

3.16**SHGC****solar heat gain coefficient**

ratio of the heat gain entering the space through the fenestration area to the incident solar radiation

3.17**suitable**

capable of fulfilling or having fulfilled the intended function, or fit for its intended purpose

3.18**total R -value**

sum of the R -values of the individual component layers in a composite element, including the air space and associated surface resistances measured in $\text{m}^2\cdot\text{K}/\text{W}$

3.19**total U -value**

thermal transmittance ($\text{W}/\text{m}^2\cdot\text{K}$) of the composite element, including the air space and associated surface emittance

4 Requirements**4.1 Hot water supply**

The functional regulation **XA2**, contained in part XA of the National Building Regulations (see annex A), shall be deemed to be satisfied where

- a) the population for which such building is designed is determined in accordance with Regulation A21;
- b) the hot water demand is determined in accordance with tables 2 and 5 of SANS 10252-1:2004;
- c) the storage requirement is based on maintenance of a hot water temperature of 60 °C;
- d) solar water heating systems comply with SANS 1307, SANS 10106 and SANS 10254 based on the thermal performance determined in accordance with the requirements of SANS 6211-1 and SANS 6211-2;
- e) all hot water service pipes are clad with insulation with a minimum R -value in accordance with table 1; and
- f) thermal insulation, if any, is installed in accordance with the manufacturer's instructions.

Table 1 — Minimum R -value of pipe insulation

1	2
Internal diameter of pipe mm	Minimum R -value ^a
≤ 80	1,00
> 80	1,50

4.2 Energy usage and building envelope

4.2.1 The functional regulation **XA3** contained in part XA of the National Building Regulations (see annex A) shall be deemed to be satisfied where,

- a) in any building of occupancy classified in terms of Regulation **A20** as A1, A2, A3, A4, F1, G1, or H1, a competent person certifies that such building (excluding garage and storage areas) has a theoretical annual energy consumption and demand, based on the design assumptions contained in 4.3, less than or equal to the values specified in tables 2 and 3; or

- b) in any building of occupancy classified in terms of Regulation **A20** as A1, A2, A3, A4, C1, C2, E1, E2, E3, E4, F1, F2, F3, G1, H1, H2, H3, H4, and H5, the orientation and shading are in accordance with the requirements of SANS 204, external walls are in accordance with the requirements of 4.4.4, fenestration is in accordance with the requirements of 4.4.5, roof assembly construction is in accordance with the requirements of 4.4.6, if in-slab heating is installed, it is in accordance with the requirements of 4.4.3, and services that use energy or control the use of energy, including heating, air conditioning and mechanical ventilation in accordance with SANS 204, and hot water systems in accordance with the requirements of 4.1 (services exclude cooking facilities and portable appliances); or
- c) in any building of occupancy classified in terms of Regulation **A20** as A1, A2, A3, A4, C1, C2, E1, E2, E3, E4, F1, F2, F3, G1, H1, H2, H3, H4, and H5, a competent person certifies that such building (excluding garage and storage areas) has a theoretical annual energy consumption and demand less than or equal to a reference building that complies with the requirements of 4.2.1(b).

4.2.2 The *R*-values, total *R*-values, total *U*-values and SHGC contained in SANS 204 may be used to comply with the requirements of Regulation **XA**.

NOTE The occupancy categories listed in tables 2 and 3 are those where there are sufficient collected data on actual building energy performance. Those excluded either have insufficient actual data, or are of such a nature that the internal processes are high energy consumers, or are of such variability in execution that a single norm would be unrepresentative.

Table 2 — Maximum energy demand per building classification for each climatic zone

1	2	3	4	5	6	7	8
Classification of occupancy of building	Description of building	Maximum energy demand ^a					
		VA/m ²					
		Climatic zone ^b					
		1	2	3	4	5	6
A1	Entertainment and public assembly	85	80	90	80	80	85
A2	Theatrical and indoor sport	85	80	90	80	80	85
A3	Places of instruction	80	75	85	75	75	80
A4	Worship	80	75	85	75	75	80
F1	Large shop	90	85	95	85	85	90
G1	Offices	80	75	85	75	75	80
H1	Hotel	90	85	95	85	85	90

^a The maximum demand shall be based on the sum of 12 consecutive monthly maximum demand values per area divided by 12/m² which refers to the nett floor area.

^b The climatic zones are given in annex B.

**Table 3 — Maximum annual consumption per building classification
for each climatic zone**

1	2	3	4	5	6	7	8
Classification of occupancy of building	Description of building	Maximum energy consumption kWh/(m ² ·a)					
		Climatic zone ^a					
		1	2	3	4	5	6
A1	Entertainment and public assembly	420	400	440	390	400	420
A2	Theatrical and indoor sport	420	400	440	390	400	420
A3	Places of instruction	420	400	440	390	400	420
A4	Worship	120	115	125	110	115	120
F1	Large shop	240	245	260	240	260	255
G1	Offices	200	190	210	185	190	200
H1	Hotel	650	600	585	600	620	630
NOTE 1 The annual consumption per square metre shall be based on the sum of the monthly consumption of 12 consecutive months.							
NOTE 2 Non-electrical consumption, such as fossil fuels, shall be accounted for on a non-renewable primary energy thermal equivalence basis by converting mega joules to kilowatt hours.							
^a The climatic zones are given in annex B.							

4.3 Design assumptions

Where the theoretical annual energy consumption of a building (excluding garages and storage areas) is calculated, certified thermal calculation software, climatic data published by Agrément South Africa, and the following design assumptions shall be used:

a) where artificial ventilation systems are provided:

- 1) the design occupancy times are in accordance with table 4,
- 2) the space temperature lies within the range of 19 °C to 25 °C for 98 % of the plant operation time,
- 3) ventilation is provided in accordance with the requirements of SANS 10400-O;
- 4) the internal heat gains in the building are from
 - i) the design population calculated in accordance with table 5 at an average rate of 75 W sensible heat gain per person;
 - ii) hot meals in a dining room, restaurant or café, at a rate of 30 W heat gain per person with the number of people calculated in accordance with table 5;
 - iii) appliances and equipment in accordance with table 6; and
 - iv) artificial lighting calculated with the design occupancy times in accordance with table 4;

b) hot water supplies comply with the requirements in 4.1; and

c) the maximum energy demand and maximum energy usage are calculated for the total building and not for individual tenancies.

Table 4 — Design occupancy times

1	2
Classification of occupancy of buildings	Design occupancy times hours per day/days per week
A1 and A2	18/7
A3 and G1	12/5
A4	6/4
F1	12/7
H1	24/7

Table 5 — Design population in accordance with SANS 10400-A

1	2
Class of occupancy of room or storey or portion thereof	Population
A1, A2, A4, A5	Number of fixed seats or 1 person per m ² if there are no fixed seats
E1, E3, H1, H3	2 persons per bedroom
G1	1 person per 15 m ²
E4	16 persons, provided that the total number of persons per room is not more than 4
C1, E2, F1, F2	1 person per 10 m ²
H5	16 persons per dwelling unit, provided that the total number of persons per room is not more than 4
C2, F3	1 person per 20 m ²
A3, H2	1 person per 5 m ²

Table 6 — Internal heat gains for appliances and equipment

1	2
Classification of occupancy of buildings	Internal heat gain W/m ²
G1	15
F1	5
Other occupancies	No load

4.4 Building envelope requirements

4.4.1 General

The functional regulation **XA3(a)** contained in part XA of the National Building Regulations (see annex A) shall be deemed to be satisfied where the building envelope complies with the requirements of 4.4.2 to 4.4.6 (inclusive).

4.4.2 Orientation

4.4.2.1 The building shall be compact in plan, with the rooms that are used most and the major areas of glazing placed on the northern side of the building to allow solar heat to penetrate the glazing during the winter months.

Living spaces should be arranged so that the rooms where people spend most of their hours are located on the northern side of the unit. Uninhabited rooms, such as bathrooms and storerooms, can be used to screen unwanted western sun or to prevent heat loss on the south-facing facades. Living rooms should ideally be placed on the northern side.

The longer axis of the dwelling shall be orientated so that it runs as near east/west as possible.

4.4.2.2 The roof overhang to the northern wall shall be sufficient to shade the windows from midday summer sunshine in accordance with SANS 204. Windows facing east and west should be limited in number and confined to the minimum required for daylight and ventilation.

4.4.3 Floors

If an in-slab in floor or in-screed heating system is installed, it shall be insulated underneath the slab with insulation that has a minimum *R*-value of not less than 1,0.

4.4.4 External walls (see SANS 10400-K for other walling requirements)

4.4.4.1 Non-masonry walls shall achieve a minimum total *R*-value of

a) climatic zones 1 and 6: 2,2

b) climatic zones 2, 3, 4 and 5: 1,9.

4.4.4.2 The following types of masonry walling comply with the *R*-value requirements:

a) double skin masonry with no cavity, plastered internally; and face masonry that is either plastered or unplastered externally; or

NOTE The cavity and grouted cavity walling systems exceed the minimum *R*-value of 0,35.

b) single leaf masonry walls with a nominal wall thickness greater than or equal to 140 mm (excluding plastering and rendering), plastered internally and rendered externally.

The requirements refer to the external walls of the habitable portions of the building fabric only.

4.4.4.3 For walling types not covered in 4.4.4.2, such walls shall achieve a minimum total *R*-value of 0,35. The total *R*-value shall be determined by means of a test conducted in accordance with ASTM C 1363, ASTM C 518 or ASTM C 177. Surface film resistance shall be in accordance with SANS 6946.

4.4.5 Fenestration

4.4.5.1 Buildings with up to 15 % fenestration area to nett floor area per storey are deemed to satisfy the minimum energy performance requirements.

4.4.5.2 Buildings with a fenestration area to nett floor area per storey that exceeds 15 % shall comply with the requirements for fenestration in accordance with SANS 204.

4.4.5.3 The fenestration air infiltration shall be in accordance with SANS 613.

4.4.6 Roof assemblies

4.4.6.1 A roof assembly shall achieve the minimum total R -value specified in table 7 for the direction of heat flow.

Table 7 — Minimum total R -values of roof assemblies

1	2	3	4	5	6	7
Description	Climatic zones					
	1	2	3	4	5	6
Minimum required total R -value ($\text{m}^2\cdot\text{K}/\text{W}$)	3,7	3,2	2,7	3,7	2,7	3,5
Direction of heat flow	Up	Up	Down and up	Up	Down	Up

4.4.6.2 A roof assembly that has metal sheet roofing fixed to metal purlins, metal rafters or metal battens shall have a thermal break consisting of a material with an R -value of not less than 0,2 installed between the metal sheet roofing and its supporting member.

4.4.6.3 Metal sheeting types of roofing assembly construction shall achieve the minimum total R -value in accordance with 4.4.6.1, with the installation of insulation that has an R -value as specified in table 8

Table 8 — Metal sheeting roof assemblies

1	2	3	4	5	6	7
Description	Climatic zones					
	1	2	3	4	5	6
Direction of heat flow	Up	Up	Down and up	Up	Down	Up
R -value ($\text{m}^2\cdot\text{K}/\text{W}$) of roof covering material	0,3				0,36	0,30
R -value of ceiling	0,05					
Added R -value of insulation	3,35	2,85	2,35	3,35	2,29	3,15

4.4.6.4 Clay tile types of roofing assembly construction shall achieve the minimum total R -value in accordance with 4.4.6.1 with the installation of insulation that has an R -value as specified in table 9.

Table 9 — Clay tile roof assemblies

1	2	3	4	5	6	7
Description	Climatic zones					
	1	2	3	4	5	6
Direction of heat flow	Up	Up	Down and up	Up	Down	Up
R -value ($\text{m}^2\cdot\text{K}/\text{W}$) of ceiling	0,05					
Added R -value of insulation	3,30	2,80	2,30	3,30	2,17	2,8

Annex A
(informative)

National Building Regulations
Part X: Environmental sustainability
Part XA: Energy usage in buildings

NOTE This annex is published for information only, to enable the evaluation of the suitability of this part of SANS 10400 to the proposed Part XA of the National Building Regulations.

DEPARTMENT OF TRADE AND INDUSTRY
NATIONAL BUILDING REGULATIONS AND BUILDING
STANDARDS ACT 2008 (ACT No. 103 of 1977)

SCHEDULE

**AMENDMENTS TO THE NATIONAL BUILDING REGULATIONS TO
INTRODUCE REQUIREMENTS FOR ENERGY USAGE IN BUILDINGS**

1 Regulation A7 is amended as follows:

A7 Layout Drawing

Add the following additional requirements:

- (l) where provided, the location, type and capacity of water heating installations; and
- (m) where provided, details of fenestration and insulation required to satisfy the energy usage requirements of Regulation XA.

2 Regulation A19 is amended as follows:

A19 Competent persons

Add the following additional requirement to sub-regulation A19(1)(a)(i):

XA3(b).

Add the following additional requirement to sub-regulation A19 (12):

- (c) Where Regulation XA is satisfied by a competent person in accordance with the requirements of SANS 10400-XA, the competent person who is responsible for such determination shall on completion of the construction and commissioning of the building submit to the local authority a fully completed Form 4 as contained in SANS 10400-A.

3 Regulation AZ2 is amended as follows:

AZ2 Definitions

Add the following additional definitions to Regulation AZ2:

“building envelope” means the elements of a building that separate a habitable room from the exterior of a building or a garage or storage area;

“certified thermal calculation software” means software certified by the Board of Agreement South Africa in terms of Agreement South Africa’s Energy Software Protocols as being fit for thermal modelling or calculation purposes in terms of these regulations;

“reference building” means a hypothetical building that is used to determine the maximum allowable heating load for the proposed building.

“orientation” means the direction a building envelope element faces, i.e. the direction of a vector perpendicular to and pointing away from the surface outside of the element.

4 Renumber Regulation X (Repeal of regulations) as Regulation AZ5 (Repeal of regulations).

Delete Part X Repeal of regulations and add the following **AZ5**:

AZ5 Repeal of regulations

The National Building Regulations published under Government Notice No. R 1081 of 10 June 1988 as amended by Government Notice No. R 1726 of 26 August 1988 are repealed from the date of the coming into operation of these regulations.

5 Add the following new regulation Part X:

Part X: Environmental sustainability

Part XA: Energy usage in buildings

REGULATION

XA1 In order to contribute to the reduction of greenhouse gases, buildings and extensions to buildings in respect of which plans and specifications are to be drawn and submitted in terms of the Act, having A1, A2, A3, A4, C1, C2, E1, E2, E3, E4, F1, F2, F3, G1, H1, H2, H3, H4 and H5 occupancies or building classifications in accordance with Regulation **A20**, excluding garage and storages areas contained within such occupancies, shall be designed and constructed so that they

- (a) are capable of using energy efficiently while fulfilling user needs in relation to vertical transport, if any, thermal comfort, lighting and hot water; or
- (b) have a building envelope and services which facilitate the efficient use of energy appropriate to its function and use, internal environment and geographical location.

Equipment and plant required for conducting the business of the occupant shall be excluded from these requirements.

XA2 At least 50 % (volume fraction) volume of the annual average hot water heating requirement shall be provided by means other than electrical resistance heating, including but not limited to solar heating, heat pumps, and heat recovery from other systems or processes.

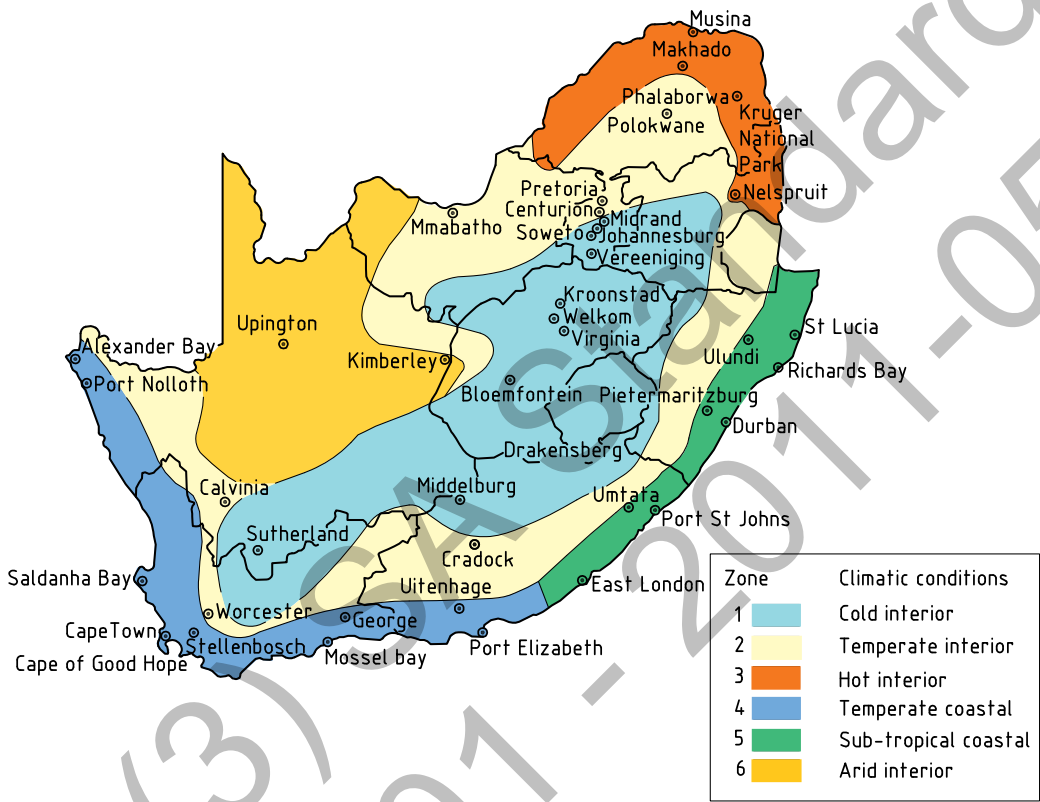
XA3 The requirements of sub-regulation **XA1** shall be deemed to be satisfied when such building is designed and constructed in accordance with the following requirements:

- (a) has an orientation of the longest axis, shading, services and building envelope in accordance with SANS 10400-XA; or

- (b) is the subject of a rational design by a competent person, which demonstrates that the energy usage of such building is equivalent to or better than that which would have been achieved by compliance with the requirements of SANS 10400-XA; or
- (c) has a theoretical energy usage performance determined using certified thermal calculation software, less than or equal to that of a reference building in accordance with SANS 10400-XA.

Annex B
(informative)

Climatic zones of South Africa



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Zone	Description	Major centre
1	Cold interior	Johannesburg, Bloemfontein
2	Temperate interior	Pretoria, Polokwane
3	Hot interior	Makhado, Nelspruit
4	Temperate coastal	Cape Town, Port Elizabeth
5	Sub-tropical coastal	East London, Durban, Richards Bay
6	Arid interior	Upington, Kimberley

Figure B.1 — Climatic zone map

Table B.1 — Locations in the climatic zones of South Africa^a

1	2	1	2	1	2
Location	Zone	Location	Zone	Location	Zone
Alexander Bay	4	Jacobsdal	6	Pretoria	2
Aliwal North	1	Jan Kempdorp	1	Prieska	6
Amsterdam	2	Johannesburg	1	Pudimoe	1
Baberton	2	Kammieskroon	4	Queenstown	2
Badplaas	2	Kainoplaagte	6	Reivilo	2
Barrydale	4	Kimberley	6	Richards Bay	5
Beaufort West	2	Kingwilliamstown	5	Richmond	2
Bloemfontein	1	Kirkwood	4	Riversdale	4
Boshoff	2	Klerksdorp	1	Rooibokkraal	3
Brakpan	1	Kokstad	2	Sabie	3
Brandfort	2	Komatipoort	3	Sakrivier	6
Butterworth	5	Kroonstad	1	Saldanha Bay	4
Calvinia	2	Kruger National Park	3	Sibasa	3
Cape Agulhas	4	Krugersdorp	1	Soweto	1
Cape of Good Hope	4	Kubus	4	Springs	1
Cape Town	4	Kuruman	2	St Lucia	5
Cederberg	4	Ladysmith	2	Standerton	1
Centurion	2	Laingsburg	1	Stellenbosch	4
Ceres	2	Makhado	3	Steytlerville	2
Colesburg	1	Marken	3	Stoffberg	2
Conway	1	Melmoth	5	Stutterheim	2
Cradock	2	Mica	3	Swartberg	1
Dealsville	1	Middelburg	1	Swellendam	4
Delmas	1	Midrand	1	Thabazimbi	3
Dendron	2	Mkuze	5	Toska	6
Derdepoort	2	Mmabatho	2	Touwsrivier	2
Dordrecht	1	Mosselbay	4	Uitenhage	4
Drakensberg	1	Musina	3	Ulundi	5
Dullstroom	1	Nelspruit	3	Umtata	5
Dundee	2	Newcastle	1	Upington	6
Durban	5	Nieuwoudtville	4	Utrecht	2
East London	5	Northam	2	Ventersdorp	2
Elliot	1	Olifantshoek	6	Vereeniging	1
Ermelo	1	Ottosdal	2	Victoria West	1
Estcourt	2	Oudshoorn	2	Vioolsdrif	2
George	4	Petrusburg	1	Virginia	1
Gouda	4	Phalaborwa	3	Volksrust	1
Grahamstown	4	Piet Plessis	2	Vryburg	2
Graskop	3	Piet Retief	2	Warrinton	2
Gravelot	2	Pietermaritzburg	5	Watervalboven	1
Giyani	2	Pilgrims Rest	2	Welkom	1
Harrismith	1	Pofadder	6	Wellington	4
Hartbeesfontein	1	Polokwane	2	Williston	1
Heidelberg	4	Pongola	2	Witbank	1
Hopetown	1	Port Elizabeth	4	Worcester	2
Hotazel	2	Port Nolloth	4	Zeerust	2
Hutchinson	1	Port St Johns	5		

^a These locations shall be used in defining the maximum energy demand, which varies in each climatic zone.