CHAPTER 10

COMPLIANCE WITH REGULATIONS & STANDARDS

Developments in the National Building Regulations for Energy Usage in Buildings

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COMPLIANCE WITH REGULATIONS & STANDARDS

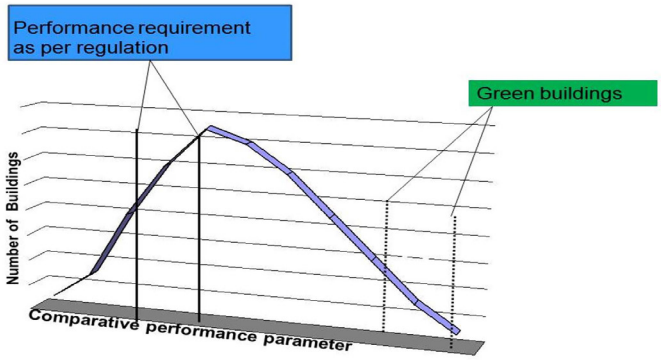
Introduction

The amendments to the National Building Regulations for Energy Usage in Buildings have been implemented with SANS 10400XA Energy Usage in Building established to meet these requirements. The modus operandi of the new Regulatory Environment is outlined in this Chapter.

The South African Constitution clause 24 requires that the Environment is protected, and this clause has given an imperative to Government and citizens establishing a Regulatory Environment, which will shift the nation to move towards a more sustainable future.

The publication of the Amended Regulations National Building Regulations and SANS10400XA; Energy Usage in building is a milestone in the progress towards sustainability for the South African building sector.

The combination effect of Regulation and the voluntary upgrade of the national stock of buildings, in response to market forces, should cause a gradual shift in improvement of performance of all buildings, as per the figure 10.1 below.



10.1 - Gradual movement towards compliance and increasing green building population

Over a period of time, the addition of the new and compliant buildings will add to the total building set and the proportion of non-compliant buildings will drop. The leadership position of the Green Buildings Council of South Africa will be preserved possibly by the addition of further stars, along with other sustainability measures, and the bar will continue to be raised with some buildings eventually achieving an energy positive status.

In line with public sentiment and this gradual improvement in the standard of energy efficiency of prestigious buildings, the norms for compliance with Regulation for all buildings, will need to be revised at some time in the future.

The SANS10400XA documents will therefore need to be continuously reviewed in order to continue to be relevant to the needs of society.

The SABS Technical Committee SC 59G: Construction Standards - Energy efficiency and Energy use in the built environment, is established in part for this purpose.

Amended Regulations

The amendments to the National Building Regulations are made in terms of the National Building Regulations and Standards Act 103 of 1977 and require that:

XA1:Buildings use energy-efficient materials and reduce Greenhouse Gas emissions in accordance with requirements detailed.

XA2: Not more than 50% of the annual volumetric requirement of domestic hot water may be supplied by means of electrical resistance heating.

XA3:Provides for three methods by which compliance with the functional Regulation (XA1) is demonstrated. Compliance with the requirements of Part XA of SA National Standard 10400 will be deemed to be in conformity with the requirements of Part XA of the National Building Regulations.

The Regulations, as published, are legally effective from 10 November 2011, and the Government is bound to promote and defend their implementation, via the mechanisms and procedures established to control new buildings. This is a function of municipalities and specifically Building Control Officers.

SANS 10400XA Satisfies the Regulations

SANS10400 Part XA: Energy Usage in Buildings, is “Deemed-to-Satisfy” the Regulations.

This document is therefore the logical starting point for those persons who need to demonstrate compliance with the Regulations, and this will apply to most projects except the Production and Warehouse portion of a building.

Regulation XA3 and SANS10400XA sets out three routes to compliance with SANS 10400XA, namely

a) Prescriptive provisions for the building envelope and services per XA3(a)
b) A Reference Building route per XA3(b)
c) The Energy Usage and Demand performance requirement method per XA3(c)

The three methods of compliance are all ‘Deemed-to-Satisfy the Regulations’, however, not all routes are generally available to all persons. A distinction is made between the projects for which compliance is demonstrated by way of a Rational Design by a “Competent Person – Energy” and projects for which the Building Envelope and Services route is followed. The latter route is available to all persons.

Rational Design Options

Two of the compliance routes established in Regulation XA3 and in SANS10400XA, provide that a Rational Design may be performed in compliance of the Regulations by the Competent Person.

The definition of a Rational Design is provided in the Regulations and is the application of a process of reasoning and calculation, possibly based on a widely accepted standard or document. In the wider sense (the) document may be a computer programme, such as reputable energy modelling software, which are usually based on standards like ANSI/ASHRAE Standard 140-2007.

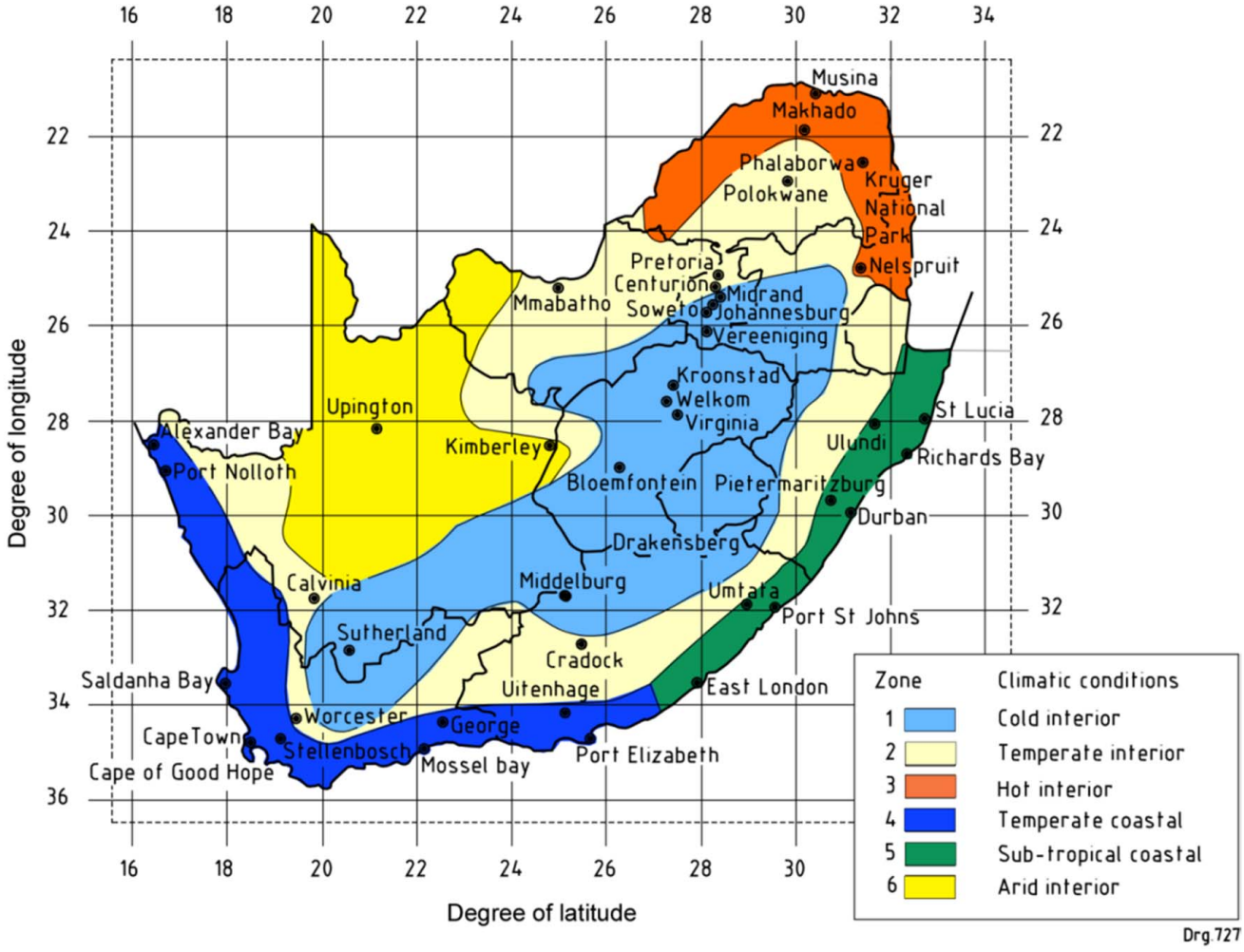
The Rational Design in terms of SANS10400XA can only be performed by the 'Competent Person (Energy).

Prescriptive Route

Regulation XA3 (a) provides that route (i) (the Building Envelope and Services route is generally available to the Appointed Person or his/her nominee, and is the person who may be responsible for the design of a building and compliance with the Regulations.

This route requires the detailed observance of all relevant provisions of SANS10400XA and SANS204, where specifically invoked.

The Climatic Zones



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

A.1 — Climatic zone map

Table A.1 - Locations of cities and towns according to climatic zone

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	Niewoudtville	4	Utrecht	2
East London	5	Northam	2	Ventersdorp	2
Elliot	1	Olifantshoek	6	Vereeninging	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
Guyani	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		

Compliance Route Decision

Regulation A19 sets out the administrative requirement for the Responsible Person (building owner) to make a declaration appointing a Professional (as identified by the Council for the Built Environment Act 43 of 2000), as the Appointed Person. This will in most cases be the architect, and this person is required to make a Declaration as to the means by which the regulations will be satisfied, and to provide the names of the Competent Persons who will assist the Appointed Person, on the requisite Form 1.

The acceptance of responsibility by the Competent Person is set out on Form 2, together with a Declaration by the Competent Person as to the qualifications, experience and contextual knowledge necessary to undertake such work, and the Local Authority's acceptance of the declarant as an approved Competent Person.

The responsibility assumed by the appointed Competent Person for a portion of the system is acknowledged in Form 3, which also contains critical design Information.

A Certificate of Completion is required on completion of the construction and commissioning of the building by submitting to the local authority a fully completed Form 4 as contained in SANS 10400-A. The implications for this are that the Competent Person (Energy) retains responsibility for seeing the energy aspects of project through to completion.

Energy Usage and Demand Compliance Route

The Energy efficiency performance requirements for the building types in occupancy categories specified (Offices, Shopping Centres and Institutional Buildings) are set out as per Table 2 & 3 below.

It will be necessary to perform a calculation or modelling of the theoretical annual energy usage and energy demand, to assess whether the required energy and demand criteria of Tables 2 & 3 are met.

Even for a very simple building it will be difficult to calculate the Annual Energy Usage to the degree of accuracy required. It is therefore assumed that most such estimates will be performed with software and computer programmes developed for the purpose.

Table 2

Maximum energy demand per building classification for each climatic zone							
Classification of occupancy of building	**Description of building**	**Maximum energy demand[a] VA/m²**					
		Zone					
		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 (incl. shopping malls)	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 m²which refers to the net floor area.

Table 3

Maximum annual energy usage per building classification for each climatic zone							
Classification of occupancy of building	**Description of building**	**Maximum annual energy usage kWh/m²/annum**					
		Zone					
		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 (incl. shopping malls)	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 meter shall be based on the sum of 12 months monthly : of consecutive months.
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.

Table 4

Design occupancy times	
Classification of occupancy of buildings (See annexure at end of Chapter)	**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

The theoretical annual energy consumption of the buildings are calculated using certified thermal calculation software and climatic data, as published by Agrément South Africa, to formulate the energy usage forecast.

In order to achieve a uniform basis for assessing building performance, standardised stipulations are required to be made, when using energy design software. These cover the following areas:

- Occupancy hours
- Occupancy density
- Small power internal heat gains
- Temperature set points for operation of the building
- Ventilation assumptions
- Heat gains for occupants

Building Envelope and Services Route

All buildings including residential buildings, hospitals and those classes of buildings which are not built according to a rational design by a 'Competent Person' and the performance requirements of Tables 2 & 3, need to be designed & built in accordance with paragraph 4.2.1 b) of the standard.

This section contains requirements for walls, fenestration & roofs, and floors if in-slab heating is installed, and for hot water. The orientation, shading and building services invoke the provisions of SANS 204: Energy Efficiency in buildings and these are hence deemed-to-satisfy.

This will require the architect and/or engineering professionals, as well the contractors to ensure that the prescriptive requirements of SANS10400XA and relevant parts of SANS204 are met.

This method of compliance is required to be selected by the Appointed Person at the outset of the project and may be implemented by the professional design and the construction team without the appointment of a Competent Person - Energy.

The Reference Building Route

A reference building is initially designed with all of the elements necessary in terms of the above Building Envelope and Components route, and is then compared with the planned design.

The initial building is modelled with the prescriptive aspects built into a base case design in order to establish a reference energy usage and demand budget. SANS10400XA is specific in regard to certain aspects of the buildings shell, but the balance of the detailed Deemed-to-Satisfy requirements for Building Services, are to be found in SANS204.

The design is thereafter modified with the required features of the professional team and the annual energy usage and demand is compared to the reference building.

If the modified design shows an equivalent or improved energy usage over the reference building it can be said to comply with the regulations.

Some potential for flexibility is built into the standard by the introduction of the so called 'Reference building method'. This will give opportunity to the architect or the engineering professionals or the Contractor to introduce innovative energy efficiency aspects which will yield the same or more energy efficient building than would be achieved by the application of the Building Envelope and Components methods.

This (Reference Building) method is exclusively available to the Competent Person - Energy.

Guidance and Comments as the choice of Compliance Routes

The factors influencing the choice of compliance route are:

- Size of projects
- Skills of the professional team
- Client preferences and willingness to pay for energy modelling

Clients will be advised to appoint a professional team with the requisite skills in the energy usage area. Thus, the architect, quantity surveyor should all be aware of the need to design for energy efficiency aspects, even if simply to meet the regulations, but also to make the appointment of the Competent Person - Energy, who can add considerable value to the project.

The Regulations are applicable to 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 A20 of Part A of the Regulations.

If the Competent Person – Energy is not appointed then the project has only the option of the prescriptive Building Envelope and Services route available to them.

If the Competent Person has at his or her disposal a team with

the requisite energy modelling expertise, then designs can be checked for compliance at an early stage, and a cost effective design can be developed, by way of the Rational Design options available in the regulations.

Compliance with Regulation & Standards for masonry walling in South Africa

The prescriptive requirements for walling of SANS 10400XA are easily met, and constitute little change in so far as Clay Brick walling is concerned. Walls are considered as either fundamentally low mass or as masonry solutions.

Low mass walling is required to have a level of thermal resistance which is differentiated between extreme and mild climates:

Climate Zones 1 and 6 : An R-value of 2.2m²K/W is required
Climate Zones 2,3,4 & 5 : An R-value of 1.9 m²K/W is required

Masonry walls are deemed to comply as follows:

- 140mm hollow concrete block, plastered and painted on both side
- A double skin masonry wall, plastered internally and painted
- Other masonry combinations should have an R-value of at least 0.35 2m²K/W

Research has indicated that the above masonry solutions are inadequate for an energy efficiency design and hence the walling solution offered in SANS 204 (the CR-Value approach) is suggested. This should be used as a Rational Design, with the Reference Building compliance route being applied, in order to optimise the walling and other energy saving solutions.

CR-value Application

Table 1: Sets out the minimum CR product requirements for various occupancies in differing climatic zones.

Table 2: Indicates how the CR-product values may be achieved with masonry walling.

Table 1 - Recommended CR-product values for Regions and Occupancies

Minimum Thermal Capacity & Resistance CR Product, in hours, for external walling						
Occupancy Group / Climate Zone	**1**	**2**	**3**	**4**	**5**	**6**
Residential E1-3,H1-5	100	80	80	100	60	90
Office & Institutional A1-4,C1-2,B1-3,G1	80	80	100	100	80	80
Retail D1-4, F1-3,J1-3	80	80	120	80	60	100
Unclassified A5, J4	NR	NR	NR	NR	NR	NR
Note: NR = No requirement						

Table 2 – Typical CR product values for masonry walls

Wall Type	106mm Double Brick (DB)	DB with 50mm air cavity	DB with R=0.5 cavity insulation	DB with R=1 cavity insulation
CR (hours)	40	60	90	130

Notes to the above tables

a) For the CR product values of walls, contact the relevant manufacturer/s.
b) Table 2 provides typical values for masonry walls, with or without additional insulation.
c) R=0.5 and R=1.0 refers to the thermal resistance of the insulation only, in m²K/W.
d) Thermal resistance that is added to external walling with high thermal capacity, should be placed in between layers e.g. in the cavity of a masonry wall.
e) Thermal resistance should not be added to the internal face of a wall with high thermal capacity.
f) Wall systems that have low thermal capacity and / or resistance will not meet the above requirements.
g) Designers should consider that interstitial condensation occurs in walling systems which are not able to prevent or accommodate moisture migration. The selection of vapour barriers and appropriate construction materials, including insulation, is important for the thermal efficiency of walling in climate zones where damp and high relative humidity is experienced.
h) Occupancies as per SANS 10400 A are listed below

NOTES