CEM BRICK

THERMAL BRICK

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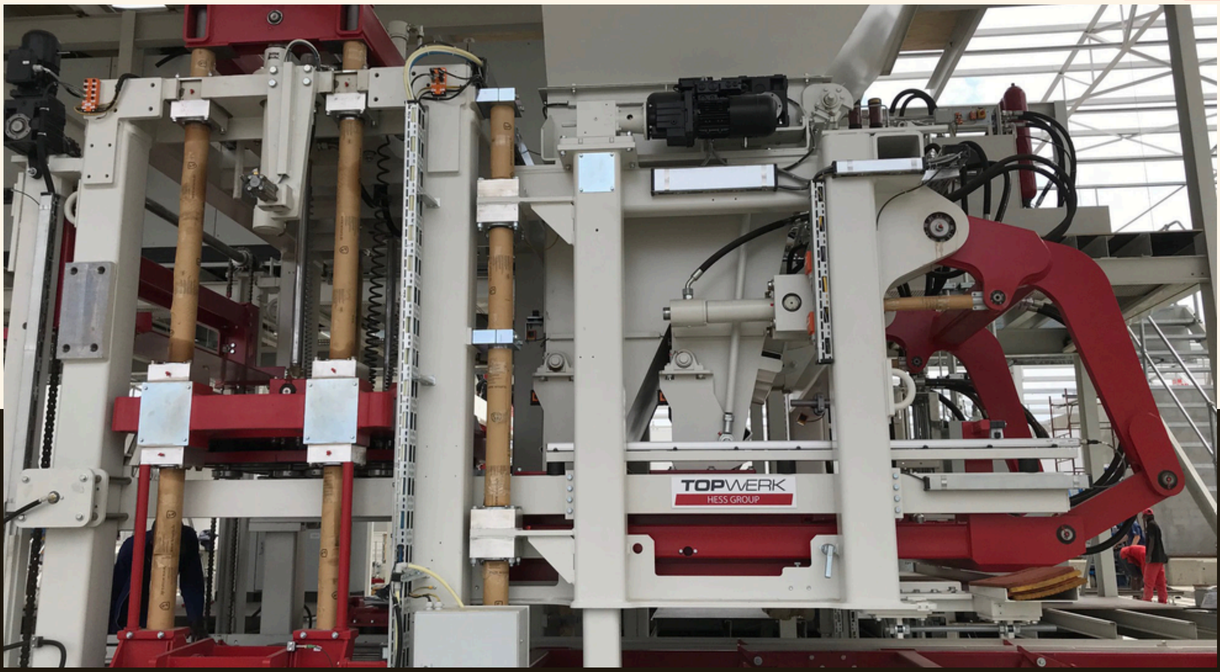


WELCOME

Redefining the Future of Construction with Strength, Innovation, and Integrity.

With over two decades of excellence that have stood the test of time, Cem Brick has cemented its reputation as a leader in the building and paving industry since its establishment in 2004 by visionary brothers Josè and Manny Spinola. The company has been built on a foundation of commitment to quality, and as its name suggests, Cem Brick is meant to represent the seamless combination of cement and brick -a simple, but powerful identity that speaks directly to the company's mission.

From the outset, Josè and Manny had envisioned a company that would not only deliver exceptional products but raise the standard for customer service and technical support. Their expertise in construction and paving has enabled Cem Brick to guide clients through every single stage of application and installation - but what truly sets Cem Brick apart is its people-centered approach.
As a privately-owned South African company, Cem Brick places a strong emphasis on employment equity and skills development - with leadership actively promoting training, empowerment, and staff retention -building a team of capable professionals, who will remain loyal and happy in the industry. This commitment fosters a culture of growth, accountability, and mutual respect, "...our directors are always willing to assist clients on a personal level," they affirm, underscoring a philosophy rooted in a sense of partnership.

Despite exponential growth, the company remains anchored by its mission to deliver quality without compromise, just as their slogan says, "We make concrete promises"

INTRODUCTION

Looking toward the future, Cem Brick has its eyes firmly set on sustainability and innovation, with their newest offering, the Thermal Brick - a groundbreaking solution set to transform building practices: designed with unique thermal properties, it enables the construction of no-cavity walls - a move that promises energy efficiency and cost-effectiveness without compromising structural integrity. This product reflects Cem Brick's long-term vision: to remain a cornerstone in an evolving industry while driving forward job creation, technological advancement, and social responsibility.

Wall options that comply with SANS 10400XA

A) Thermal Brick Wall

- A one brick 220mm **solid wall** built using Cem Brick Thermal insulated brick, build with two masonry layers, without a cavity.
- The bricks themselves provide insulation due to their low thermal conductivity.
- Used without a cavity and meeting the Thermal Resistance (R-value) for climate zone 1.

B) Cavity Wall

- A double-leaf wall made of two masonry layers (outer and inner), separated by a cavity.
- The cavity is usually filled or partially filled with insulation material (e.g. mineral wool, foam board, or polystyrene beads).
- Designed primarily for thermal insulation and moisture control.

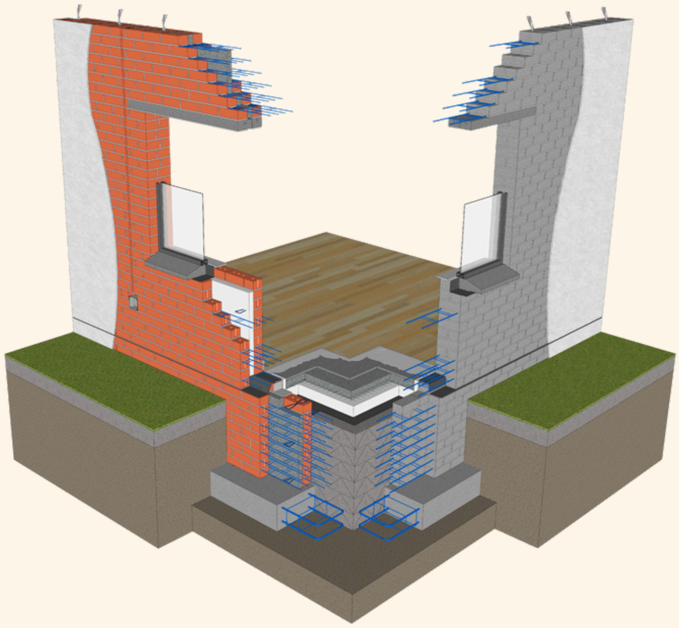


Fig A: Cem Brick Thermal Brick wall vs Clay cavity wall

Advantages of a No-Cavity Walls (Solid Walls)

- Less m² or more usable space
- Lowering opportunity cost.
- Simple Construction
- Quicker and easier to build; build as a solid wall.
- Fewer materials involved—no wall ties, no concrete infill, no formwork, less brick force and no gaps to manage.
- Stronger Structural Integrity, no bulging of walls.
- Avoids issues like:
  - Water penetration into cavity insulation.
  - Poorly installed cavity insulation reducing effectiveness.
  - Corroded wall ties over time.
- Solid walls tend to be more robust and can support heavier loads.
- Better suited to bearing structural loads.
- Up to 15% lighter than our normal bricks.
- More Compact Design
- Takes up less space than cavity walls.
- Less Risk of Cavity Wall Problems

Recycled material used

- Usage of recycled material in production of the Cem Brick Thermal Brick

Better Thermal Mass

- Solid walls (especially Cem Bricks Thermal Brick masonry unit) can absorb and slowly release heat, which can help stabilize indoor temperatures in some climates.

Cost-Effective in Certain Contexts

- Avoiding the complexity of cavity construction will lower labor and material costs.

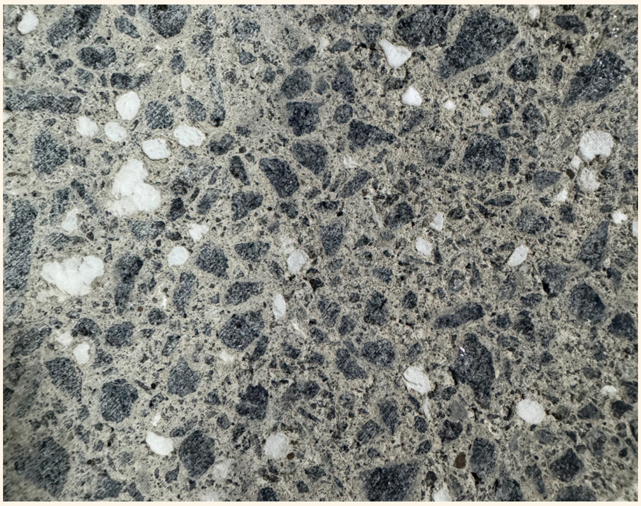


Fig B: Cem Brick Thermal Brick

Comparison between the Cem Brick Thermal Wall and a Clay Cavity Wall

Feature	Cem Brick Thermal Brick Wall	Clay Cavity Wall
Wall Structure	Single solid wall	Two walls with a gap (cavity) between
Insulation Source	Insulating is in the brick itself	Insulation in the cavity
Moisture Barrier	Not inherent; requires external protection	Cavity reduces moisture transfer

Thermal Performance

Aspect	Cem Brick Thermal Brick Wall 210mm	Clay Cavity Wall 270mm
R-Value (Thermal Resistance) (m² K/W)	0,62	0.63
K-Value (Thermal Conductivity (W/m.K)	0.5244	0.82
CR-Value (Thermal Capacity) (Hours)	75	65

Construction & Use Cases

Aspect	Cem Brick Thermal Brick Wall	Clay Cavity Wall
Construction Speed	Much faster (less skill to build)	Slower (more components, wall ties, concrete etc.)
Common in	Cold climates	Wet climates
Cost	Less expensive overall	More expensive due to materials, labor, time and additional area.

Feature	Cem Brick Thermal Brick Wall	Clay Cavity Wall
Insulation Type	Inherent in bricks	Separate cavity fill
Moisture Protection	Needs to be plastered and painted	Built-in via cavity
Build Complexity	Simpler	More complex
Thermal Efficiency	Meets current standards	Meets current standards
Time and area utilization	Less area for building and time to build	Larger area of building footprint and more time consuming

OUR GOAL

Advantages of a Cem Brick Thermal Brick Building over a Clay Brick Cavity Wall

1. Simpler and Faster Construction

- Fewer components: No need for wall ties, cavity insulation, or second leaf, no concrete infill, no formwork, less brick force.
- Less labor-intensive: Easier and faster to build, less artisan skill required to build.
- Quicker construction: Solid 220mm wall with no cavity allows more layers to be built per day.

2. Thinner Wall for the Same R-value

- Cem Brick Thermal bricks can achieve similar insulation with less wall thickness compared to cavity walls.
- Saves internal floor space or reduces overall building footprint.

3. Less Risk of Cavity-related Failures

- Structural:
  - Cracking and Bulging
  - Mold growth
  - Wall tie corrosion
- No issues like:
  - Water penetration into cavity insulation
  - Wall tie corrosion
  - Incomplete insulation fill
  - Settlement of blown-in cavity insulation

4. More Sustainable (in some systems)

- Thermal bricks are made with reduced-energy materials or recycled content.
- Less wall material used overall = lower embodied carbon (in some cases).

5. Risk in cavity walls

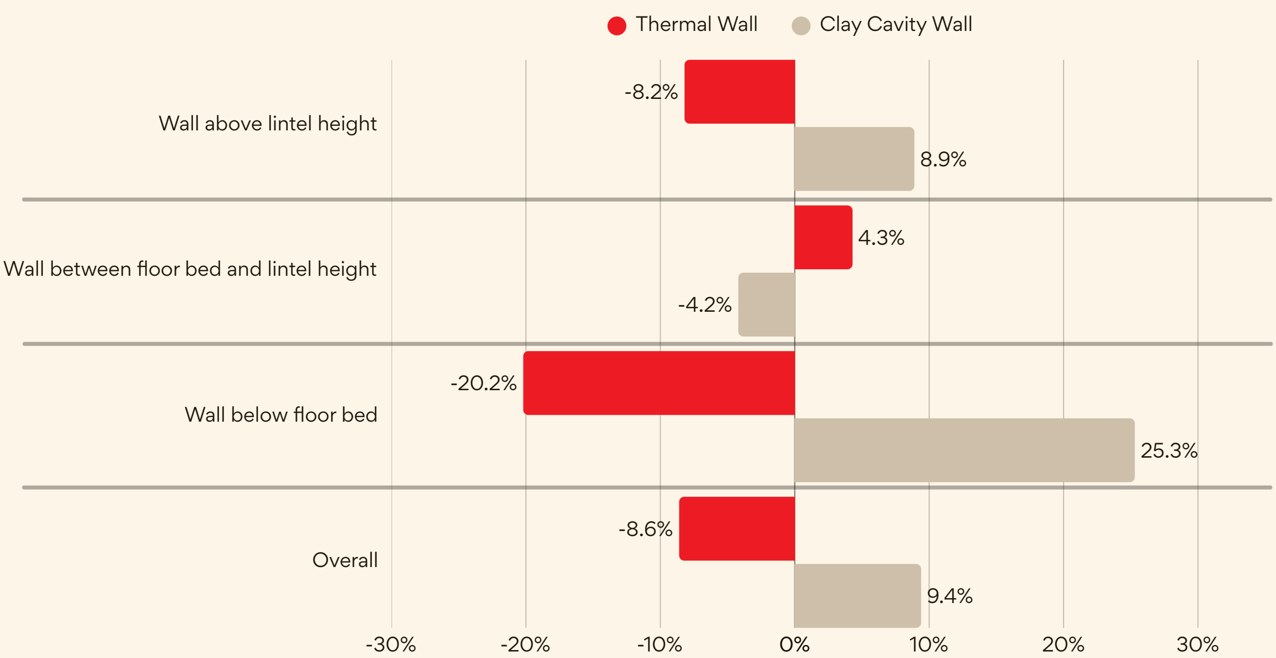
Moisture penetration causing dampness:

- Moisture can enter the cavity wall through cracks in the exterior brickwork, mortar bridging, or inadequate sealing at the top of the wall, poor window sill construction and sealing.
  - Possible condensation: Poor ventilation or inadequate insulation in the cavity can lead to condensation forming on the inner surface of the wall, especially in areas with cold spots.
  - Possible result of dampness and condensation can lead to mold growth, which can be a health issue.
- Potential causes of poor construction of cavity walls and inadequate sealing or leaving debris in the cavity can lead to problems. Settlement, substance or inadequate wall ties can cause cracks and bulging in the wall.

Summary Comparison

Feature	Cem Brick Thermal Brick Building	Clay Brick Cavity Wall
Build Speed	✅ Much faster	❌ Slower (multi-layered)
Wall Thickness	✅ Thinner for same insulation	❌ Thicker overall
Cold Bridging	✅ Less prone	❌ Risk at ties and junctions
Moisture Protection	❌ Needs good external layer	✅ Built-in via cavity
Thermal Mass	✅ High (depends on block type)	❌ Moderate
Airtightness	✅ Easier to achieve	❌ More detailing needed
Durability in wet climates	❌ Needs weatherproofing	✅ More resilient
Structural	✅ No risk in bulging	❌ Risk in Bulging of wall
Rational Design	❌ Requires	✅ Deemed fit

COST COMPARISON



Cem Brick Thermal Brick Wall: Summary

Approximate Difference in price per rm

- **- 8.6%** Less expensive

Clay cavity wall: Summary

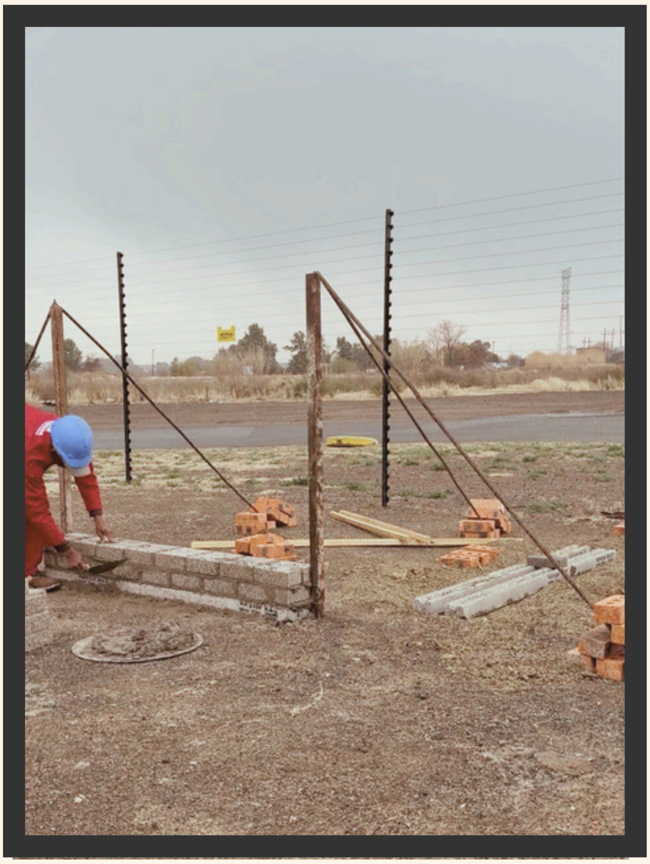
Approximate Difference in price per rm

- **9.4%** More expensive

Building time study

It took 30min to set up and build a 220mm Cem Brick Thermal Brick **(solid wall)** that is 1.8m in length and two courses high.

It took 1h17min to set up and build a 270mm Cavity Wall that is 1.8m in length and two courses high.



Understanding thermal performance theory K- and R- Values

1. Basic theory of heat transmission
2. Thermal conductivity (K-value)
3. Thermal Resistance (R-value)
4. How thermal conductivity is measured
5. Application of R-values in building thermal design
6. Calculation of R-value of building elements

1. Basic theory of heat transmission

Heat (thermal energy) flows from hot area to cold area.

Second law of Thermodynamics

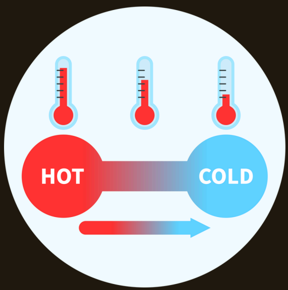


Fig C1: Heat flow

Heat (thermal energy) is transferred through Conduction, Convection and Radiation.

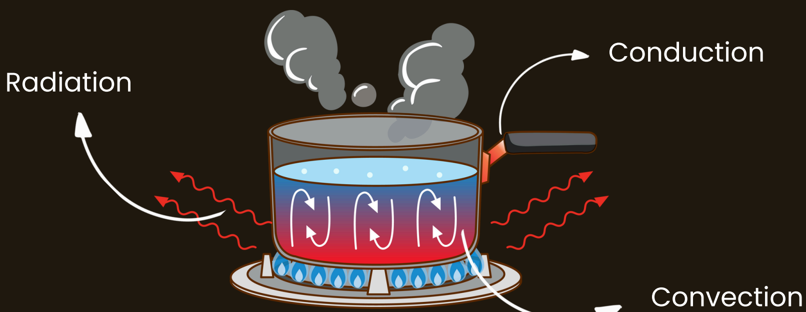


Fig C2: Heat transmission

Conduction

Conduction is the transfer of heat between substances that are in direct contact. It involves the movement of heat through a material by the collision of particles, without any overall movement of the material itself. Essentially, it's how heat moves from a hotter object to a cooler one when they touch.

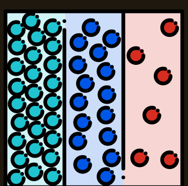


Fig C3: Density

Decrease in conduction

Convection

Convection is a process of heat transfer that occurs in fluids (liquids and gases) due to the movement of the heated fluid itself. When a fluid is heated, it expands, becomes less dense, and rises, while cooler, denser fluid sinks to take its place, creating a cycle of movement known as a convection current.

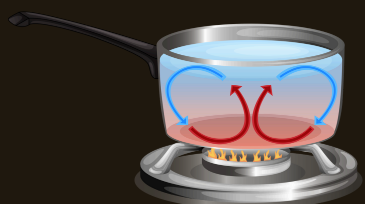


Fig C4: Convection

Radiation

Is heat that travels as invisible energy waves from warm objects. This heat can travel through empty spaces, like how the Sun's heat reaches earth.

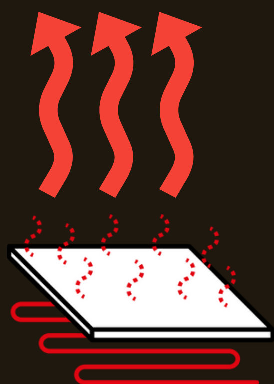
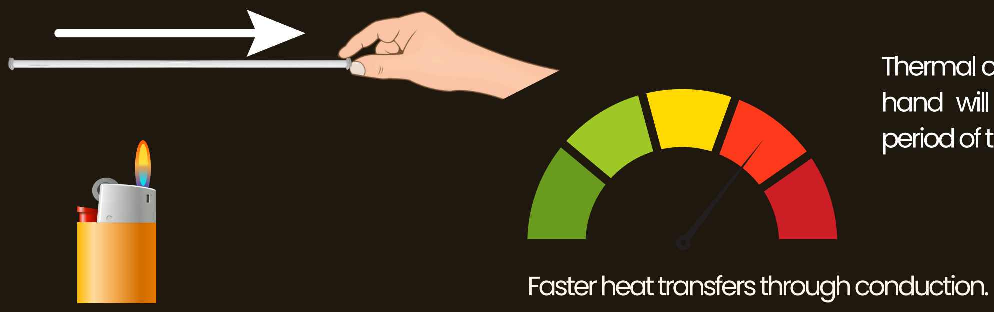


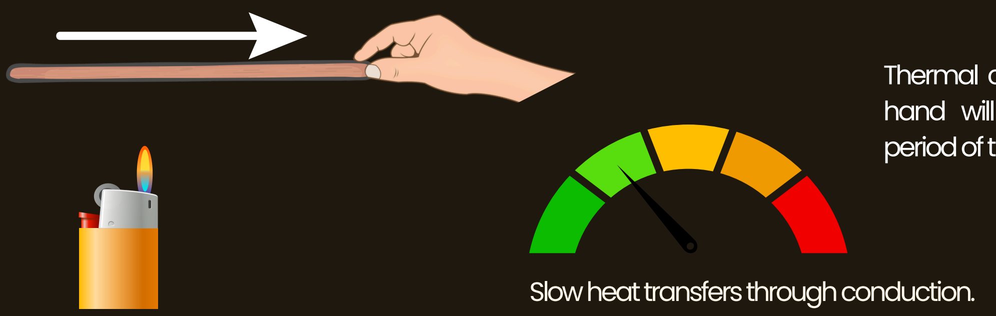
Fig C5: Radiation

2. Thermal conductivity (K-value):

Thermal conductivity (K-value) is the measure of materials ability to conduct heat. It is the rate/speed at which heat travel through a given material. Heat will travel faster through steel than through timber.



Thermal conductivity of metal is higher. The hand will receive the heat after a short period of time.



Thermal conductivity of timber is low. The hand will receive the heat after longer period of time.

Fig C6: Speed of heat transfer

The higher the thermal conductivity the higher the materials ability to conduct heat and vice versa.

Thermal conductivity is heat flow in Watts (Joules per second) across a cross section of 1m² and a length of 1m if the difference between the two faces is 1K (1°C). Thermal conductivity is expressed in W/mK.

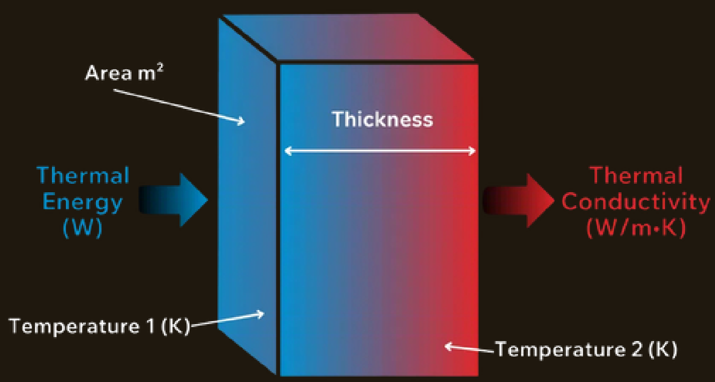


Fig C7: The thermal conductivity constant

The higher the thermal conductivity the higher the materials ability to conduct heat and vice versa.

Thermal conductivity is heat flow in Watts (Joules per second) across a cross section of 1m² and a length of 1m if the difference between the two faces is 1K (1°C). Thermal conductivity is expressed in W/mK.

The rate at which heat travels through materials of the same composition will be equal. Thermal conductivity can be regarded as a constant. For each material there is a documented thermal conductivity constant.

Typical conductivity of various building materials are in the table below:

Material	Thermal Conductivity (W/mK)	Material	Thermal Conductivity (W/mK)
Cem Brick Thermal Brick	0.5244	Screed (sand and cement)	0.41
Cement Brick (2000 kg/m³)	1.26	Mortar	0.81
Concrete (dense)	1.40	Polystyrene	0.032
Sand cement plaster	0.50	Polyurethane	0.025
Clay brick	0.82	Timber (softwood)	0.14
Steel	16-80		

Table 1: Thermal conductivity values

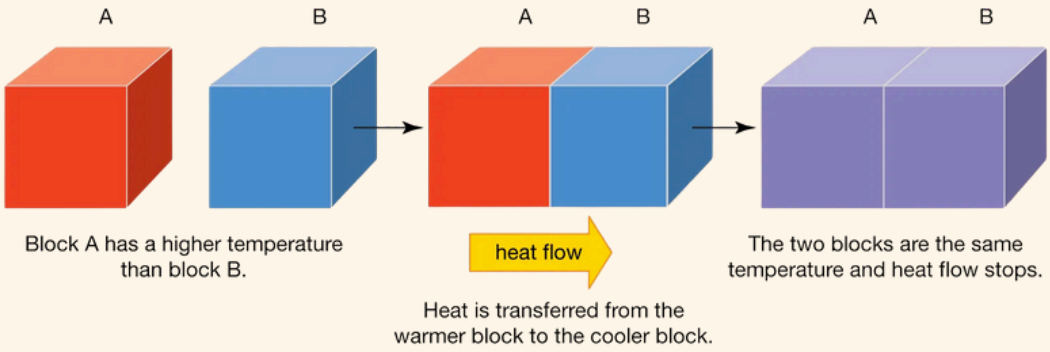
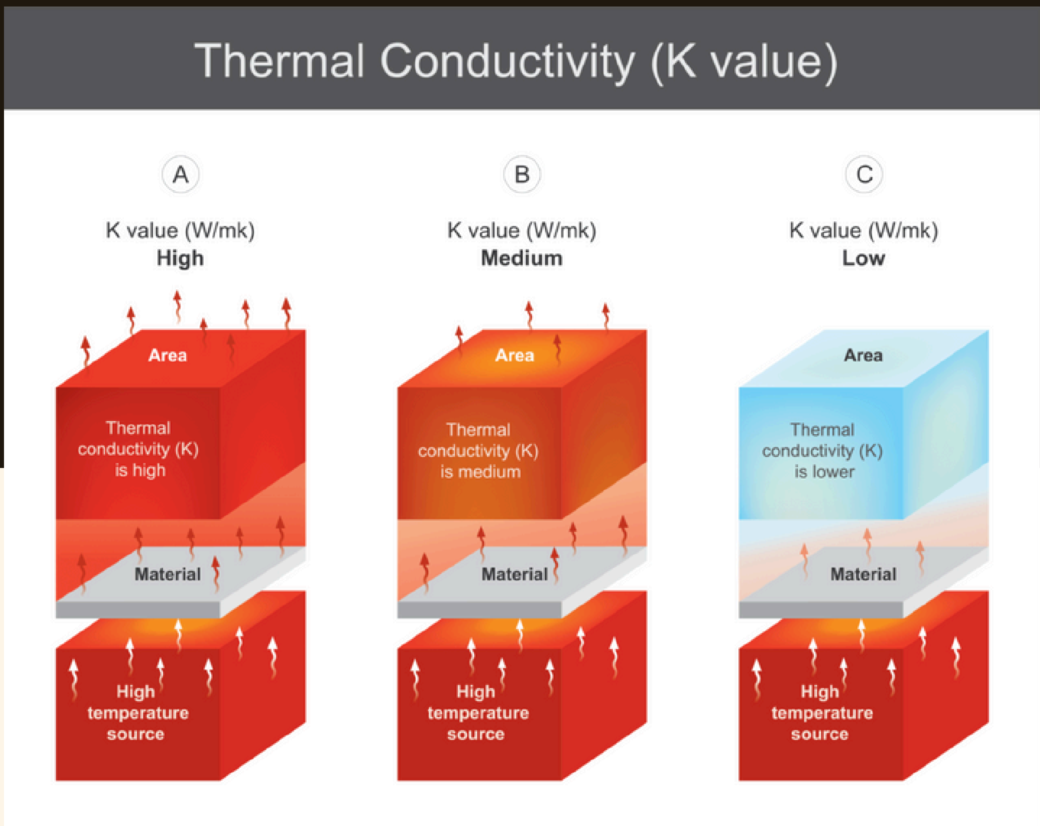


Fig C8: Thermal conductivity

3. Thermal Resistance (R-value):



Thermal resistance is a measure of a given material's resistance to heat flow. Thermal resistance introduces defined material thickness/length to the heat transmission theory.

In the diagram below, it will take longer time for the hand to feel the heat in the longer rod. Therefore, the long rod has high resistance to heat flow. That is, the longer rod has high thermal resistance (R-value) when compared to a shorter rod.

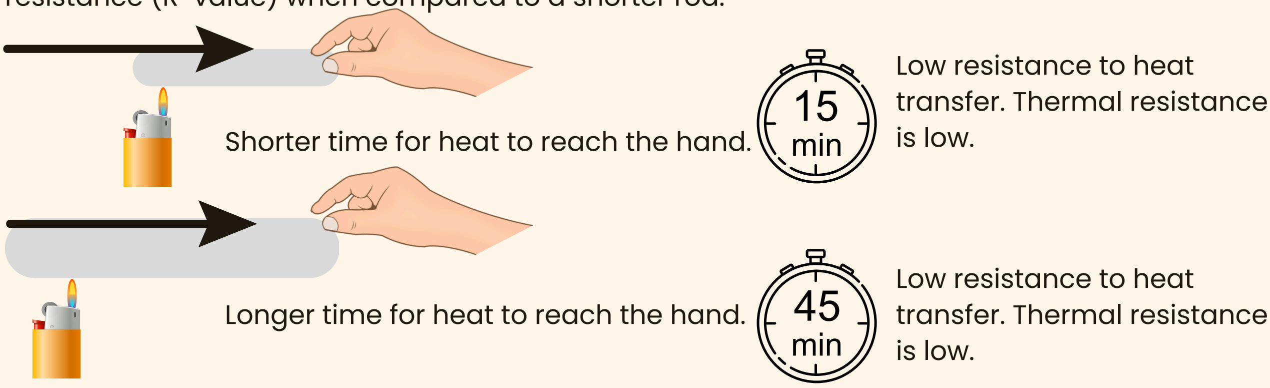


Fig C9: Speed of heat transfer

Different materials of similar length/thickness can also be compare using thermal resistance in the diagram below, it will take longer time for the hand to feel the heat in the timber rod. Therefore, the timber rod has high resistance to heat flow. That is, timber rod has high thermal resistance (R-value) when compared to metal of the same dimensions.

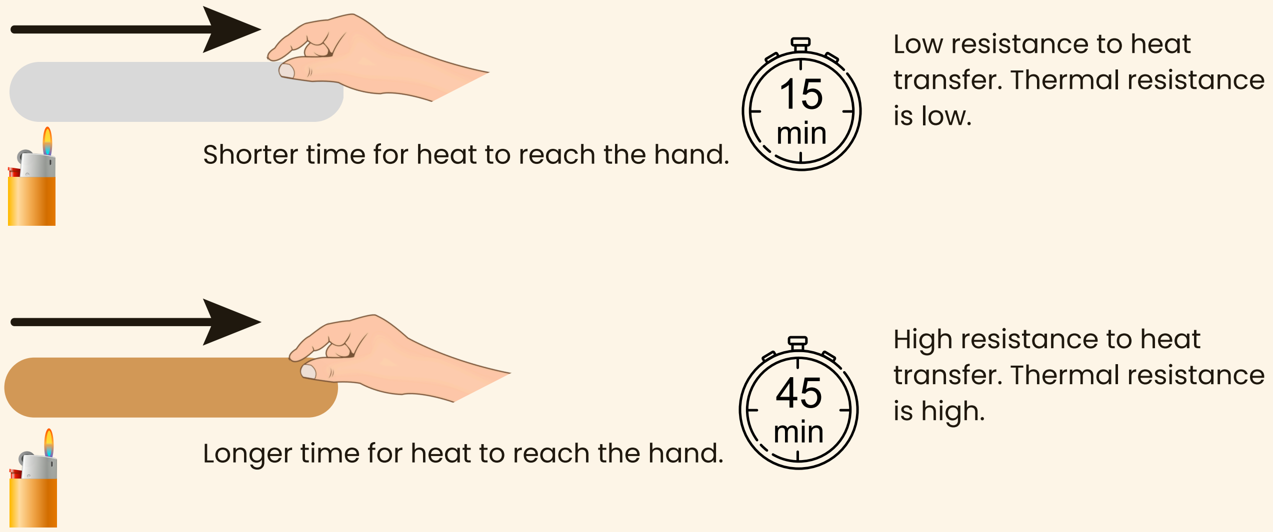


Fig C10: Speed of heat transfer

Thermal resistance introduces thickness to heat transmission of materials. Thermal resistance allows us to compare thermal performance of the same material with different dimensions or different materials of given thickness/length.

Thermal resistance is a measure of a given material's resistance to heat flow across a temperature gradient. Thermal resistance is calculated as follows:

$$\textit{Thermal Resistance (R-value)} = \frac{\textit{Thickness (m)}}{\textit{Thermal Conductivity (K-value)}}$$

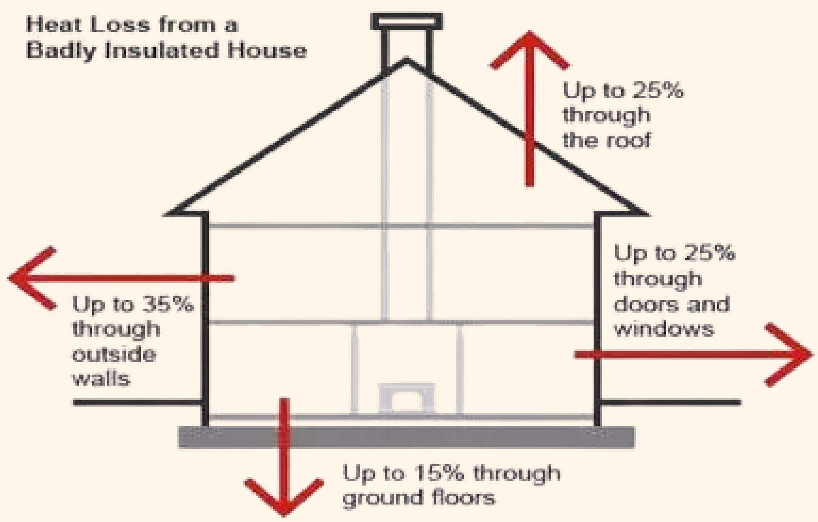
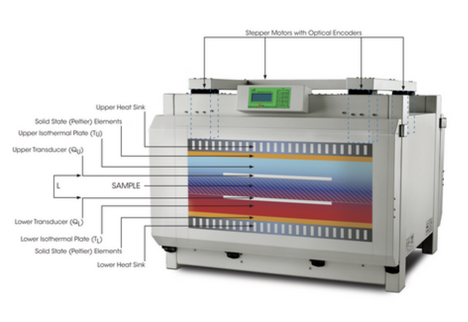


Fig C11: Loss of heat in badly isolated house

4. How thermal conductivity is measured



$$\lambda = \frac{Q}{A} \frac{L}{\Delta T}$$

UNITS: (W/mK) (Btu in/h ft²F)

$$R = \frac{1}{\lambda} L$$

UNITS: m²K/W (h-ft²-F/Btu)

Fig C12: HEAT FLOW METER LaserComp Heat Flow Meter

Fig C13: Thermal conductivity measurement

FOX instruments utilize a steady state technique for the determination of thermal conductivity. The Heat Flow Meter Method, designed specifically for insulating materials, is defined by international standards ASTM C518, ISO 8301, and DIN EN 12667. This cost-effective and practical method is widely recognized and preferred by industry professionals throughout the world for its speed, simplicity, and accuracy.

In a heat flow meter, a specimen is positioned between two temperature controlled plates. These plates establish a user-defined temperature difference (ΔT) across the sample. The sample thickness (L) is set to match the target thickness of compressible samples, or the actual sample dimension. Accurate sample thickness is critical. Only the FOX Series incorporates four optical encoders, one at each corner, to ensure the utmost accuracy. The resulting heat flux (Q/A) from steady-state heat transfer through the specimen is measured by two proprietary thin film heat flux transducers covering a large area of upper and lower sample surfaces. This unique technology, unlike competitive designs, insures the most sensitive and exact measurement of heat flow.

The average heat flux is used to calculate the thermal conductivity (λ) and thermal resistance (R), according to Fourier's Law.

5. Application of R-values in building thermal design:

Thermal resistance (R-value) allows us to apply heat transfer theories to buildings because R-values take into consideration the type and thickness of material. However, building structures are inherently complex because they consist of composite elements and are influenced by the surrounding environment.

To account for the surrounding environment and composites, air-films and air-voids have to be considered.

Air Films Resistance

Air Films Resistance Air films are a result of surface convection currents between an object and its surrounding air. Heating and cooling of objects affects the temperature of the adjacent air. The resulting mini-convection currents have the effect of increasing the resistance of the flow of heat on the surface. This is called air-film resistance. Air film resistance has to be included in building element calculations.

Air-film are also influenced by the direction (up/down/horizontal) of heat flow and the movement of air around it.

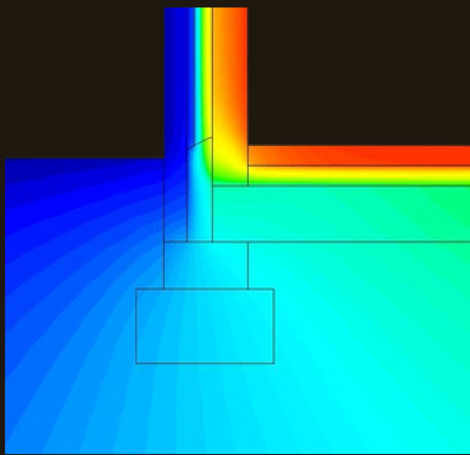
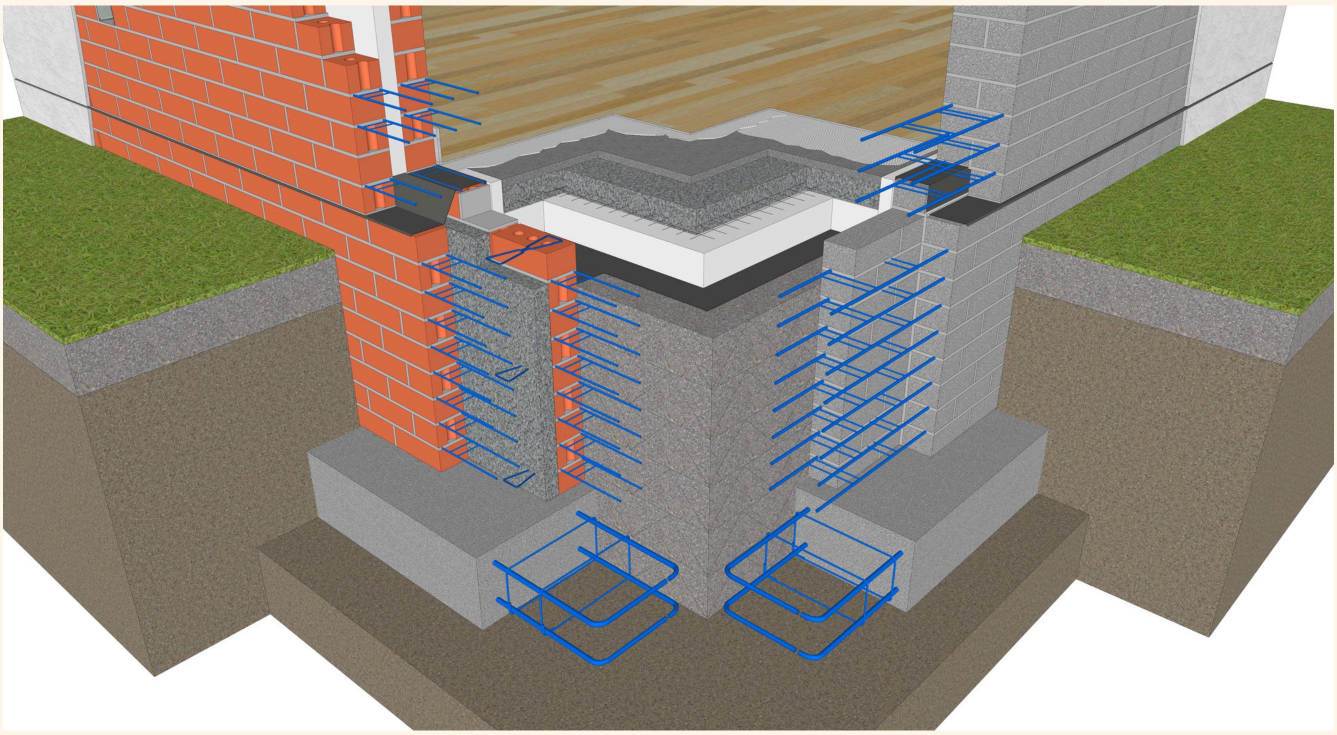


Fig C14: Air films



Air spaces

Heat transfer across air-spaces is complicated process involving convection and radiation. Heat transfer through air-space will depend on radiation reflection of the surfaces enclosing the air-space, temperature difference between opposite surfaces and the size of the air-space.

High degree of accuracy can be achieved through calculations. However high degree of accuracy cannot be justified due to a lot of known variable that may include blocked cavities, variable cavity width etc. Simplified values for most practical applications are used.

Air-voids are also influenced by the direction (up/down/horizontal) of heat flow and ventilation. Typical R-values of air-voids are shown in the table below.

Description	Position of Air film	Direction of Heat flow	R-value
Air-Space - Non Reflective	Horizontal	Up	0.15
	Horizontal	Down	0.22
	Horizontal	Horizontal	0.16

Table 2: R-values of air spaces

Air spaces are either intentional or accidental ventilated and in most cases ventilation is ignored. Only in extreme cases (2% ventilation area for cavities over 50 mm in size) does it need to be considered.

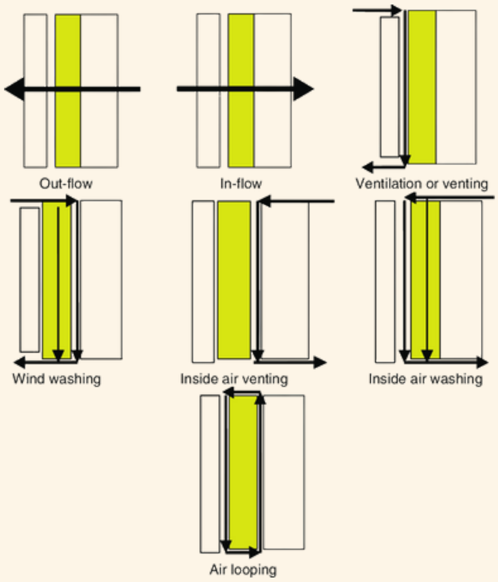


Fig C15: Different air flow modes in cavity walls

Information compilation

For more precise results, the percentage of area for plaster and air space between the bricks were incorporated in the calculation hereunder.

Using Equation as per SANS 10400 XA:

$$R = \frac{1}{U} = \frac{1}{h_i} + \frac{1}{h_o} + \left(\frac{1}{a_1} + \frac{1}{a_2} + \dots + \frac{1}{a_n}\right) + \left(\frac{d_1}{k_1} + \frac{d_2}{k_2} + \dots + \frac{d_n}{k_n}\right) m^2\,K/W^{-1}$$

Where:	R = The total thermal resistance of the wall	
hi	= coefficient of heat transfer for inner surface of wall,	22.7 W/m2K
ho	= coefficient of heat transfer for outer surface of wall	22.7 W/m2K
a1 . . .an	= air-spaces coefficient of heat transfer	6,1 W/m2K
d1 . . .dn	= thickness of each successive layer of materials	m
k1 . . .kn	= thermal conductivity of n successive layers or different materials comprising the element (W/mK)	

Tabel 3

TABLE 10

Unit thermal resistance (the *R*-value) of common components used in buildings

Component	*R*-Value m² · °C/W	*R*-Value ft² · h · °F/Btu	Component	*R*-Value m² · °C/W	*R*-Value ft² · h · °F/Btu
Outside surface (winter)	0.030	0.17	Wood stud, nominal 2 in × 6 in		
Outside surface (summer)	0.044	0.25	(5.5 in or 140 mm wide)	0.98	5.56
Inside surface, still air	0.12	0.68	Clay tile, 100 mm (4 in)	0.18	1.01
Plane air space, vertical,			Acoustic tile	0.32	1.79
ordinary surfaces			Asphalt shingle roofing	0.077	0.44
(ε_{eff} = 0.82):			Building paper	0.011	0.06
13 mm ($\frac{1}{2}$ in)	0.16	0.90	Concrete block, 100 mm (4 in):		
20 mm ($\frac{3}{4}$ in)	0.17	0.94	Lightweight	0.27	1.51
40 mm (1.5 in)	0.16	0.90	Heavyweight	0.13	0.71
90 mm (3.5 in)	0.16	0.91	Plaster or gypsum board,		
Insulation, 25 mm (1 in)			13 mm ($\frac{1}{2}$ in)	0.079	0.45
Glass fiber	0.70	4.00	Wood fiberboard, 13 mm ($\frac{1}{2}$ in)	0.23	1.31
Mineral fiber batt	0.66	3.73	Plywood, 13 mm ($\frac{1}{2}$ in)	0.11	0.62
Urethane rigid foam	0.98	5.56	Concrete, 200 mm (8 in)		
Stucco, 25 mm (1 in)	0.037	0.21	Lightweight	1.17	6.67
Face brick, 100 mm (4 in)	0.075	0.43	Heavyweight	0.12	0.67
Common brick, 100 mm (4 in)	0.12	0.79	Cement mortar, 13 mm (1/2 in)	0.018	0.10
Steel siding	0.00	0.00	Wood bevel lapped siding,		
Slag, 13 mm ($\frac{1}{2}$ in)	0.067	0.38	13 mm × 200 mm		
Wood, 25 mm (1 in)	0.22	1.25	(1/2 in × 8 in)	0.14	0.81
Wood stud, nominal 2 in × 4 in (3.5 in or 90 mm wide)	0.63	3.58			

Calculations

Double leaf thermal brick wall with SANS XA values for Int & Ext Air

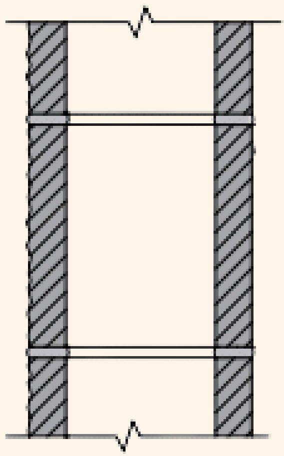
	Cem Brick Thermal Brick with Normal 15mm Plaster Internal & External						
	Ext. Air	Ext. Plaster	Masonary Wall	Masonary Wall	Int. Plaster	Int. Air	
K-Value	1	0.015	0.105	0.105	0.015	1	
	20	0.5	0.5244	0.5244	0.05	9.4	
R-value	0.05	0.03	0.200228833	0.200228833	0.03	0.106383	0.617
							TOTAL R-VALUE

From the above we can conclude that the wall' composite materials will meet the minimum requirements, and we can approve it to comply with the SANSXA wall R values.

6. Calculation of R-value of building elements:

Total R-value of a layered construction can be determined by adding the R-value of different components.

Calculate Total R-value of a Cem Brick Thermal Brick exterior wall plastered on both sides will be calculate as follows:



$$R_{total} = R_{ext.air} + R_{plaster} + R_{thermal.brick} + R_{plaster} + R_{int.air}$$

$$R_{total} = = 0.05 + 0.03 + 0.40 + 0.03 + 0.11$$

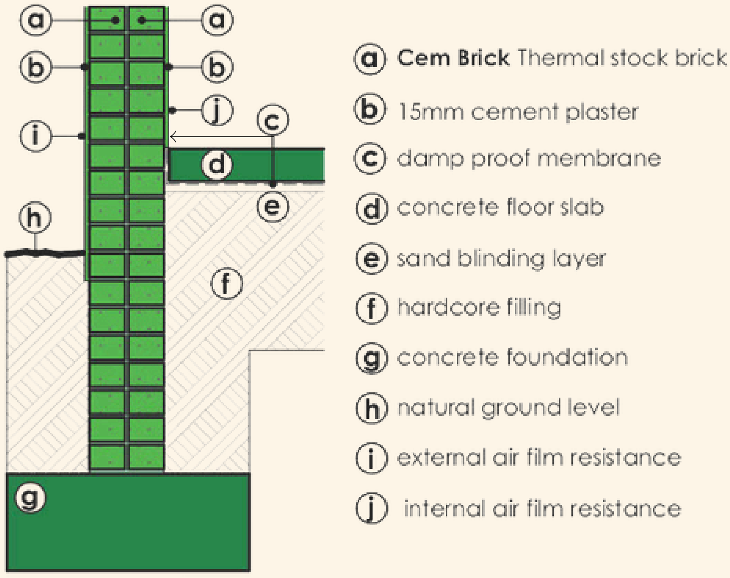
$$R_{total} = 0.62 \text{ m}^2 \text{ K/W}$$

$R_{ext.air}$	Exterior air-film reisistance R-value = 0.05 m² K/W
$R_{plaster}$	15mm Cement plaster with thermal conductivity of 0.5 R-value = 0.015/0.5 = 0.03 m² K/W
$R_{thermal.brick}$	210mm Cem Brick Thermal Brick R-value = (210)/0.5244= 0.4 m² K/W
$R_{plaster}$	15mm Cement plaster with thermal conductivity of 0.5 R-value = 0.015/0.5 = 0.03 m² K/W
$R_{int.air}$	Interior air-film reisistance R-value = 0.11 m² K/W

HOW TO SUBMIT BUILDING PLANS USING CEM BRICK THERMAL BRICK TO LOCAL AUTHORITIES AND COUNCIL;

STEP 1: Submit Plan with drawing of Cem Brick Thermal Brick. This exact diagram has to be submitted, Mangaung Council has approved this specific diagram. Downloadable from our website under **Thermal Brick, Rational Design**.

SANS 10400 XA 2022 wall thermal calculation	
building element	thermal R-value
external air film resistance	0.05
15mm cement plaster	0.03
thermal stock brick	0.2
thermal stock brick	0.2
15mm cement plaster	0.03
internal air film resistance	0.11
TOTAL	**0.62**



Wall Section

Cem Brick Thermal Brick complies with industry standards. The tests done by Cem Brick confirms that the Cem Brick Thermal Brick satisfy the minimum value as prescribed. The above diagram is proof that a rational design has been done on the product.

Refer to Frans Dekker's video on our website.

Frans Dekker

- Managing Director, South African Institute of Architectural Technologists (SAIAT)
- Leads the South African Institute of Architectural Technologists (SAIAT).
- A SACAP-registered Professional Senior Architectural Technologist with a private practice based in Vryheid, KwaZulu-Natal, South Africa.
- Active in CPD workshops on national building regulations since 2008.
- Represents SAIAT in several SABS committees, including convening workgroups for various SANS10400 parts and chairing subcommittees under TC059 focusing on energy efficiency and universal access.

Cem Brick Thermal Brick product spec 7 and 10.5 mpa

Thermal Stock Brick

Product Specifications	
Product Name:	Thermal Stock Brick
Masonry Classification:	Concrete Masonry Unit
SANS Compliant to:	SANS1215:2008
Dimensions (LxWxH):	210 x 105 x 70 mm
Density:	2082 kg/m3
Surface Texture:	Adequate adhesion for plaster
Rendering:	Compulsory - 15mm Cement Plaster (Internal & External)
Nominal Compressive Strength:	7.5mpa or 10.5 Mpa (MTO)
Drying Shrinkage:	Less than 0.06 %
Expansion on re-wetting:	Less than 0.02 % of Drying Shrinkage
Soundness:	Compliant with Standard
Thermal	
Measured thermal conductivity: K-Value	0.5244 W/m.K
Calculated thermal resistance per 105mm width. R Value per Single Unit:	0.2002 m2.K/W

CMACS APPROVED

R Value Calculation of Two (2) leaf wall

210 mm Wide Thermal Stock Brick wall, rendered both sides with 15mm cement plaster

	External Air	External Plaster	Thermal Stock Brick	Thermal Stock Brick	Internal Plaster	Internal Air	Total R-Value
Dimensions of Unit / Unit	1	0.015	0.105	0.105	0.015	1	
Thermal Resistance W/m.K	20	0.5	0.5244	0.5244	0.5	9.4	
R-Value	0.05	0.03	0.20	0.20	0.03	0.11	**0.62**

Our Thermal Stock Brick complies to all requirements of SANS 1215:2008 and carry's the **CMACS** Mark of Approval

External Professional Engineers have assessed the product and confirm compliance with SANS1215:2008, SANS 10400-T 2020, SANS 10400-K and SANS 10400-XA 2021. If built according to SANS 2001 Construction Works, SANS 10400 and the national building regulations, and in accordance with an approved professional design or drawing.

All tests has been undertaken by Professionals and are available upon request.

Manufacturer : Cem Brick Manufactures (Pty) Ltd Reg no 2018/008835/07

Patent : Pending Registration in South Africa

Issued Date: 05 September 2024

THANK YOU

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