ROCKWOOL™

TECHNICAL INSULATION

Insulating for Peak Performance

A comparison between stone wool mandrel wound pipe sections and calcium silicate

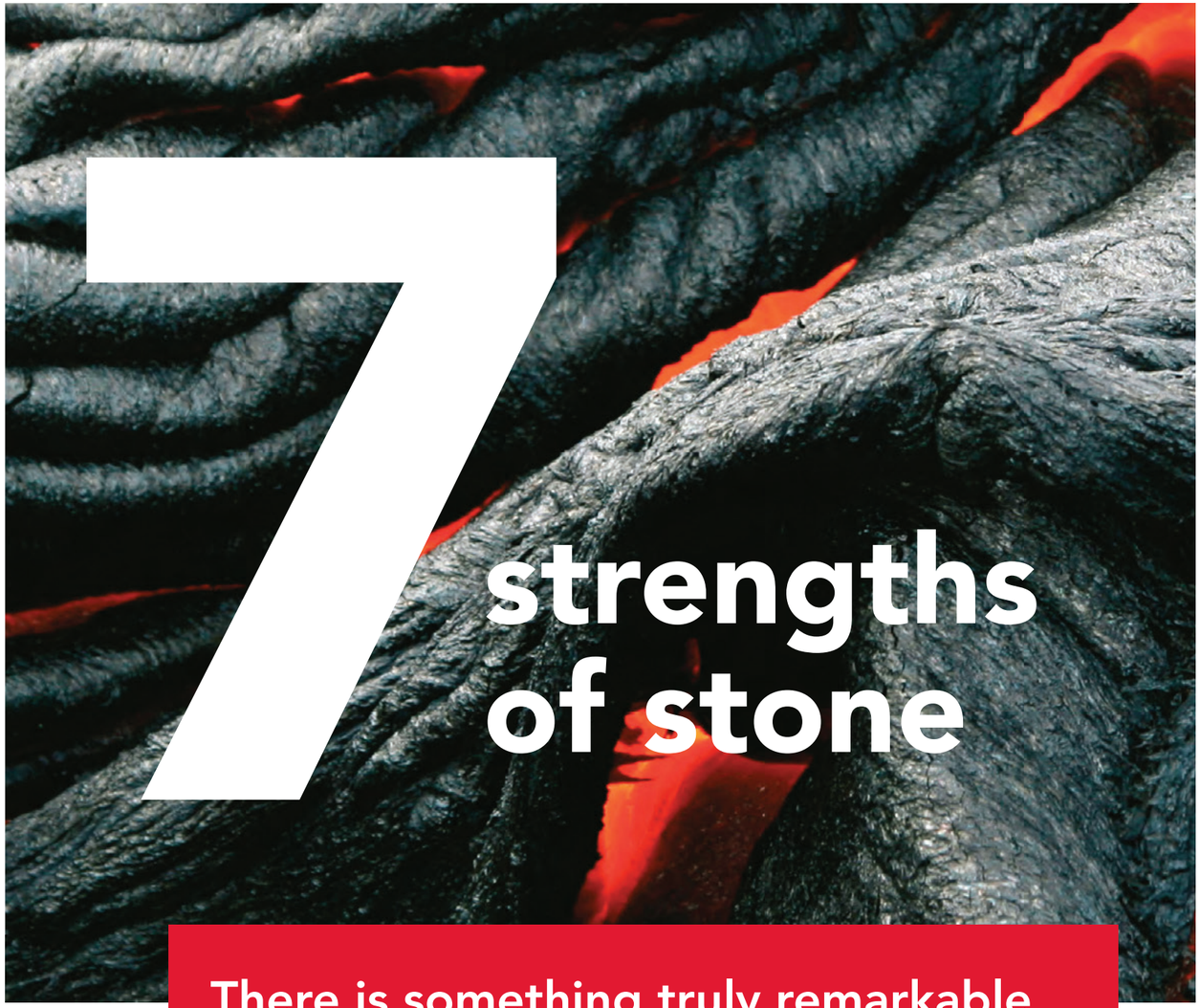
with WR TECH™

In any industrial process or plant, owners and operators want to ensure that their investment provides optimum functionality, efficiency and profitability throughout the life of the plant.

Designing an insulation system for these plants can be complex, and often, several primary and secondary design considerations must be satisfied at the same time. Minimizing thermal losses in heat transfer and storage can significantly reduce energy consumption, and proper insulation can ensure process efficiency particularly in processes where the temperatures must remain within narrow margins, such as in pipes and storage tanks.

Proper insulation can also help to reduce maintenance by mitigating the risk of corrosion under insulation (CUI) caused by moisture that penetrates the insulation.

Stone wool and calcium silicate are frequently specified insulation materials that are used in the same types of industrial facilities for similar temperature applications. However, the true performance of these materials is not well understood. This document provides information comparing ROCKWOOL ProRox® mandrel wound stone wool pipe sections with WR-Tech™ and calcium silicate, and shows that ProRox has many clear performance advantages.



7 strengths of stone

There is something truly remarkable about the natural power of stone

Fire Resilience
Withstand temperatures above 1000°C

Thermal Properties
Lower thermal conductivity means better thermal insulation performance

Acoustic Capabilities
Block, absorb or enhance sounds

Water Properties
When engineered to repel water, stone wool can mitigate CUI

Robustness
Longer-lasting performance and durability with easier installation

Circularity
Reusable and recyclable materials

Aesthetics
Match performance with aesthetics

ProRox insulation

Each of our ProRox products combines the 7 strengths of stone with one ambitious goal in mind: to minimize the human impact on our surroundings, while maximizing the safety and wellbeing of all the people interacting with our products.

ROCKWOOL stone wool is made from materials that nature itself produces in abundant quantities, one of the earth's inexhaustible resources – volcanic rock.
Our ProRox products are non-combustible and designed to remain stable at high temperatures, making them highly fire resilient. ProRox products have unique non-directional structures and densities that reduce airflow and sound transmissions, creating effective barriers to pipe noise and contribute to safer, quieter work environments. Our ProRox stone wool mandrel wound pipe sections are water repellent, yet vapor permeable meaning they absorb less water, dry faster, are more durable and have a very low water leachable salt content, minimizing the risk of corrosion under insulation.

ROCKWOOL Technical Insulation
8024 Esquesing Line, Milton, ON L9T 6W3, Canada
T. 1 800 265 68788 ROCKWOOL-rti.com

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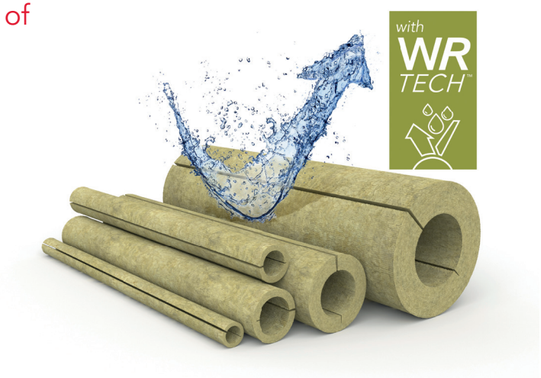
Water Properties

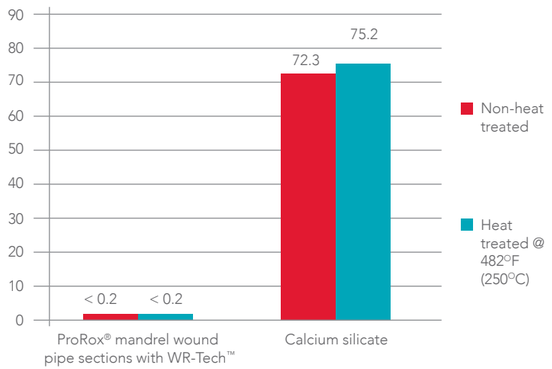
To ensure the most stringent requirements, ROCKWOOL recommends the inclusion of the European (EN) 13472* standard into insulation specifications.



All ROCKWOOL stone wool products meet EN 13472 (< 1 kg/m2).

Water repellency test – EN 13472

- EN 13472 — Thermal insulating products for building equipment and industrial installations — determination of short term water absorption by partial immersion of preformed pipe insulation
- This test determines the short-term water absorption by partial immersion of mandrel wound pipe insulation (simulates the water absorption caused by exposure to rain during product installation)
- 24-hour test that measures the water absorbed in kg/m2 of both non-heated and heat-treated material
- To meet EN compliance, the non-heated material needs to absorb < 1 kg/m2
- After heat aging at 482°F for 24-hours, the water absorbed by ProRox mandrel wound pipe sections with WR-Tech was < 0.2 kg/m2
- Calcium silicate absorbed and held substantially more water than ProRox mandrel wound pipe sections with WR-Tech



* There are no equivalent water absorption standards in North America for an ASTM C547 stone wool material. All ROCKWOOL stone wool products meet EN 13472 (< 1 kg/m2).

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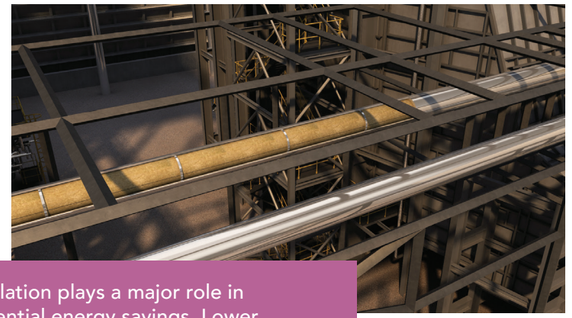
Thermal Properties

The design of thermal insulation for hot piping and equipment is based on process control, energy conservation (minimizing heat loss), and/or personnel protection.



Insulation plays a major role in potential energy savings. Lower thermal conductivity means better thermal insulation performance.

Insulation plays a major role in potential energy savings. Lower thermal conductivity means better thermal insulation performance:

- Cost savings for plant operators (less fuel consumption)
- Reduced CO2 emissions to the environment
- Lowers costs via:
  - less insulation
  - less jacketing
  - less installation labor
  - lighter system

For potential cost savings and to ensure optimal insulation thickness, or “economic thickness”, our ROCKASSIST™ program calculates the ideal insulation thickness for technical installations. Additionally, our team can generate comparative thickness tables to other materials.

Using thermal conductivity values from third party testing in accordance to ASTM C335, the table below shows ProRox mandrel wound pipe sections with WR-Tech and calcium silicate thicknesses required for a common personnel protection application*. As shown, calcium silicate typically requires 0.5” greater insulation thickness.

Material	4” pipe			12” pipe		
	400°F	600°F	1000°F	400°F	600°F	1000°F
ProRox® mandrel wound pipe sections with WR-Tech™	1.5”	2.5”	5”	1.5”	3”	6.5”
Calcium silicate	2”	3”	5.5”	2”	3.5”	7”

* Calculations measured using k-factor values via Tutco Scientific. Design criteria for calculations: Jacketing = new, bright aluminum (0.04 emittance), Maximum outer surface temp. = 140°F (personal protection), Ambient temp. = 77°F, Wind speed = 0 mph, Pipe = horizontal, steel

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Acoustic Capabilities

The primary reasons for utilizing insulating materials are to control noise and absorb sound, comply with standards (such as OSHA), improve working conditions, and diminish low frequency noise.

Insertion loss refers to reducing sound by adding insulation, jacketing, or both, to a system to limit and/or stop the sound from continuing to transmit outwards, and is also imperative in acoustical applications. Insertion loss is measured as the difference in sound power level (decibels) radiated from a noise source before and after the application of acoustic insulation. The greater the difference between the two measurements, the higher the insertion loss and the better the acoustic/sound reduction performance.

The following specifications are recommended for acoustic insulation of pipes, valves, and flanges:

ISO 15665: Acoustics

- Uses A, B, and C performance classification. Class A denotes the lowest performance and Class C denotes the highest/best performance

ISO 15665 / Shell DEP Specification No. 31

- Shell poses additional requirements that are represented within the Shell DEP Specification No. 31
- A version of the ISO 15665 standard to include a higher noise attenuation (Class D)

Product Property	Standard	ProRox	Calcium silicate
Insertion loss	ISO 15665 Class A, B, & C	✓	X
	ISO/Shell Class D	✓	X

Stone wool is amongst the most effective acoustic insulation solutions because its open, porous structure makes it a highly-efficient sound absorber. Having higher air flow resistivity means better sound attenuation.

Alternatively, calcium silicate is a rigid material that will transfer sound more easily (via vibrations) and directly through the insulation because of its high density and small cracks in the material.

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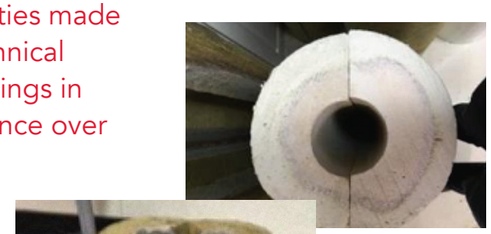
Robustness

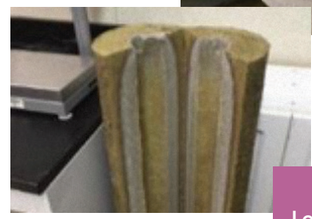
It typically costs more to manage and maintain a facility over its life than to build it. Facilities made of durable components require less technical supervision and repair, which means savings in energy and materials used for maintenance over the lifetime of the facility.

- Stone wool insulation won't shrink or crumble. The physical structure of stone wool allows it to keeps its shape and toughness, despite changes in temperature or humidity
- Due to its smart fiber assembly, stone wool is easy-to-fit, adapting to all types of irregularities

Cellulosic Fiber Oxidation vs. Binder Oxidation
Organic material exists in both stone wool and calcium silicate. While it's well-known that stone wool has a level of binder oxidation at higher temperatures, the industry is typically unaware that calcium silicate's cellulosic fibers (which give it structure) also oxidize.



Calcium silicate after high temp exposure



Stone wool after high temp exposure

Loss on ignition:
- **Stone wool – 3%**
- **Calcium silicate – 9.7%**

Installation Benefits (mandrel wound pipe sections)

ProRox	Calcium silicate
Not brittle, no cracks	Brittle, cracks easily
Can be dropped	Cannot be dropped
Very resistant to damage	Breakage very common
Lightweight	Heavy
Cuts with a knife	Mechanical saws required
Flexible	Rigid
No skill required	Skill required
Very clean	Very dusty
Little waste	High waste
Fast installation times	Long installation times

Approx. 15-20% more labor hours are required for installing calcium silicate

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ROCKWOOL Technical Insulation is part of the ROCKWOOL Group and is offering advanced technical insulation solutions for the process industry as well as marine & offshore.

At the ROCKWOOL Group, we are committed to enriching the lives of everyone who experiences our product solutions. Our expertise is perfectly suited to tackle many of today's biggest sustainability and development challenges, from energy consumption and noise pollution to fire resilience, water scarcity and flooding. Our product range reflects the diversity of the world's needs, while supporting our stakeholders in reducing their own carbon footprint.

Stone wool is a versatile material and forms the basis of all our businesses. With approx. 10,500 passionate colleagues in 38 countries, we are the world leader in stone wool solutions, from building insulation to acoustic ceilings, external cladding systems to horticultural solutions, engineered fibres for industrial use to insulation for the process industry and marine & offshore.

All explanations correspond to our current range of knowledge and are therefore up-to-date. The examples of use outlined in this document serve only to provide a better description and do not take special circumstances of specific cases into account. ROCKWOOL Technical Insulation places great value upon continuous development of products, to the extent that we too continuously work to improve our products without prior notice. We therefore recommend that you use the most recent edition of our publications, as our wealth of experience and knowledge is always growing. Should you require related information for your specific application or have any technical queries, please contact our sales department or visit our website www.rockwool-rti.com.

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ROXUL INC.
8024 Esquesing Line,
Milton, ON L9T 6W3, Canada
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ROCKWOOL-rti.com

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