

Combat noise in industrial pipe work

ROCKWOOL® ProRox® solutions



Improve your plant's safety by reducing noise and mitigating the effects of Corrosion Under Insulation

With the ever increasing push towards industrialization we are finding ourselves surrounded by sound. So, keeping noise levels under control is crucial **in creating** an environment where people feel at ease. Soundproofing **can effectively help reduce noise related health issues** like fatigue or stress which are seen as serious safety problems

for operators in the field. ROCKWOOL Technical Insulation can provide a full range of solutions to enhance safety of operation and people by reducing noise pollution, whilst helping to mitigate the effects of Corrosion Under insulation (CUI). See for yourself at rti.rockwool.com.

Reduce noise levels in industrial environments

Why? Noise is a serious issue!

Excessive noise poses great health and safety risks. Continual exposure to 80-100 dB (i.e. the sound of a vacuum cleaner or lawn mover) can result in hearing damage, fatigue, anxiety or other issues that impact safety and productivity and can cause accidents in the workplace. In offshore platforms, FLNG vessels, LNG and air separation plants sound levels can rise to a critical point, mainly caused by industrial pipework. Acoustic pipe insulation can help to keep the noise down.

Where does it come from?

Noise from pipes is typically generated by turbulent flow and dominated by characteristic tones related to pipe geometry, type of medium and fluid sound speed. It can be generated by plant equipment or the processing of fluids and gasses.

Noise can originate from multiple sources such as:

- Flow induced turbulence
- Cavitation and flashing
- Pumps and compressors
- Pressure fluctuations
- Valves or other pressure reducing devices
- Change of pipe diameter

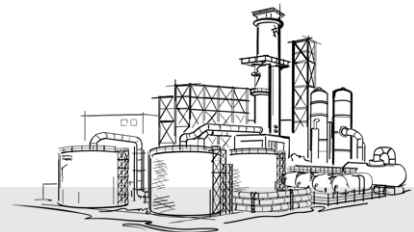
What does the international standard ISO 15665 say?



ISO 15665 is the standard that is widely accepted in the industry for designing the acoustic insulation of pipes valves and flanges.

The standard allows noise control engineers to select the correct insulation system during the design stage in order to ensure that specified noise targets are met.

Similar requirements are laid down in Norsok standard M-004 class 6,7 & 8, CINI 9.2.02, PIP INSA 1000 and ASTM E 1222. Shell poses additional requirements which are laid down within the Shell DEP 30.46.00.31-Gen specification. ISO 15665 sets out classes for acoustic pipework insulation systems. Insulation systems are classified by their insertion loss performance and the diameter of pipe onto which they are applied.



ProRox solutions according to ISO 15665 require only half the thickness!

Thanks to the open-fibre construction our ProRox solutions meet ISO 15665 standards for outstanding acoustic performance with up to half the thickness of conventional stone or mineral wool products. Less thickness also leads to a more efficient and cost-efficient install, a more effective use of installation crews, less storage space required for inventory and lower transportation costs at site.



And at the same time mitigate the effects of CUI

Keep your plant safe and sound

CUI is recognized as one of the industry's greatest challenges. It has been the cause of several accidents involving the loss of human life and personal injury, fire and pollution. Moreover, it can have a significant impact on a plant's overall operating costs accounting for up to 60% of pipeline maintenance costs and 10% of overall plant maintenance costs*. Dealing with CUI throughout the lifecycle of a project, from design to decommissioning, is crucial. In terms of materials, the most important focus areas are coating/metallization, cladding (jacketing) and insulation.

* Source: NACE International; 2003
Strategies to prevent Corrosion Under Insulation

When does CUI occur?

CUI is highly likely in equipment operating in the temperature range of 122-347°F (50-175°C), in both ordinary steel and stainless steel**. Corrosion is accelerated in environments with high salt concentrations (offshore and coastal installations), in humid environments and generally where equipment operates in cyclic temperatures. An estimated 80% of CUI events (such as corrosion resulting in leakages) are on pipes***, of which approximately 80% is on 4-inch or smaller diameter pipes.

** Source: NACE SP0198; 2017 Control of corrosion under thermal insulation and fireproofing materials
*** Source: Exxon study

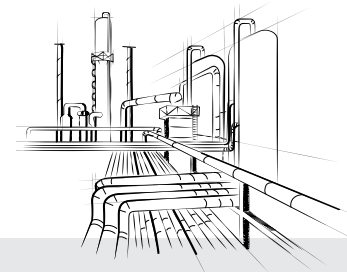
What does NACE* say on CUI?

* National Association of Corrosion Engineers - NACE SP0198-2017 (2.1.2)

CUI of carbon steel is possible under all types of insulation. The insulation type may only be a contributing factor. The insulation characteristics with the most influence on CUI are:

- Water retention, permeability and wettability of the insulation
- Water-leachable salt content in insulation, such as chloride, sulphate and acidic materials that may contribute to corrosion

*"Because CUI is a product of wet metal exposure duration, the insulation system that holds the least amount of water and dries most quickly should result in the least amount of corrosion damage to equipment.**"*



Our solution: ProRox with WR-Tech™

In addition to ProRox pipe sections, we upgraded our ProRox mat (wrap) with WR-Tech, so that these products have even better water repellent properties – proven 5 times less water absorption than other mineral wool product on the market! These water repellent properties are maintained at temperatures up to 482°F (250°C) even after heating and aging (also unique on the market). As these products absorb less water, they also dry more quickly reducing the time of wetness, and as NACE states, this results in less CUI.

Reducing water trapped underneath and/or inside insulation inhibits corrosion and maintaining a high level of system performance while reducing total life-cycle costs. ROCKWOOL ProRox with WR-Tech received the "2019 Corrosion Innovation of the Year Award" from NACE in recognition of its track record in advancing corrosion control in plant settings.



THE SOLUTION

We've got you covered with our ProRox insulation solutions

Our ProRox product line includes thermal, acoustic, fire-resistant and energy efficient stone wool insulation solutions. They reduce the noise level of industrial pipe in accordance with ISO 15665 Class A, B, C and Shell DEP — Class D.

Just 2 products to handle any project

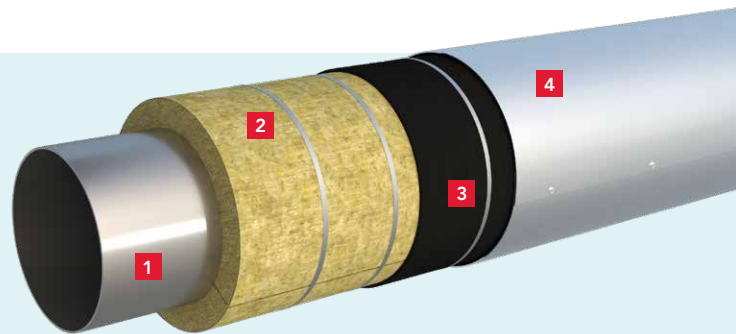


ProRox PS 960 with WR-Tech™

ProRox PS 960 is a mandrel wound pipe section produced with WR-Tech™ water repellent technology to mitigate the risk of corrosion under insulation (CUI). The highly durable stone wool insulation sections are supplied split and hinged for easy snap-on assembly. **Suitable for thermal and acoustic insulation of high temperature industrial pipe.**

ProRox acoustic solutions with pipe sections

- 1 Pipe
- 2 ProRox PS 960 pipe sections
- 3 Heavy mass layer
- 4 Metal (steel or aluminum) or polymeric cladding (jacketing)

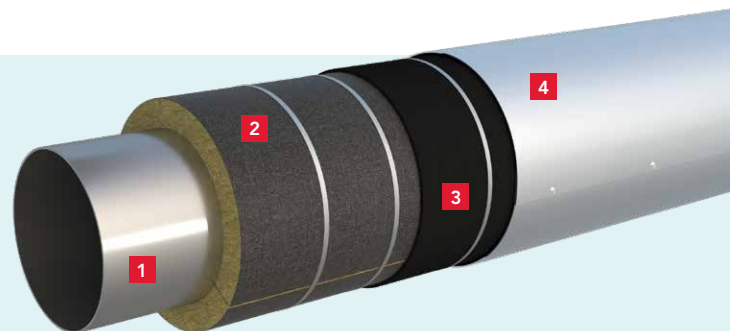


ProRox MA 961 with WR-Tech™

ProRox MA 961 is a rolled stone wool insulation mat (wrap) produced with WR-Tech™ water repellent technology to mitigate the risk of corrosion under insulation (CUI) and is as standard faced with black fibrous scrim. **Suitable for high-temperature industrial applications, such as large diameter piping, vessels, ducts and equipment.**

ProRox acoustic solutions with mats (wrap)

- 1 Pipe
- 2 ProRox MA 961 mat (wrap)
- 3 Heavy mass layer
- 4 Metal (steel or aluminium) or polymeric cladding (jacketing)



Define acoustic and thermal insulation in 3 steps:

STEP 1

Determine insulation class

Determine noise emissions/sources and the maximum allowable noise level to meet specification requirements.

Insulation class (see table below):

- ISO class A, type 1, 2 or 3
- ISO class B, type 1, 2 or 3
- ISO class C, type 1, 2 or 3
- Shell class D, type 2 or 3

STEP 2

Check additional requirements

To meet asset owner requirements.

- Insulation specification
- Applicable standards, industry guide line (e.g. PIP, CINI)
- Evidence needed - 3rd party test reports

STEP 3

Insulation selection & design

To determine the suitable insulation material keep in mind that time and potential risks will play an important role in selecting and designing the right acoustic insulation for industrial pipework. The following factors are to be taken into account:

- Application (hot or cold)
- Cladding (jacketing)
- Risk of CUI
- Space
- Installation:
 - # of layers / materials
 - Installation time
 - Simplicity / skilled labour
 - Health & safety (PPE required)
 - Commercial availability

i Use the table on page 6 to select your solutions per insulation protection.

ISO 15665 classes


















Class		Diameter in mm	Octave band centre frequency						
			125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
ISO	A1	Ø < 300	-4	-4	2	9	16	22	29
ISO	A2	300 ≤ Ø < 650	-4	-4	2	9	16	22	29
ISO	A3	650 ≤ Ø < 1000	-4	2	7	13	19	24	30
ISO	B1	Ø < 300	-9	-3	3	11	19	27	35
ISO	B2	300 ≤ Ø < 650	-9	-3	6	15	24	33	42
ISO	B3	650 ≤ Ø < 1000	-7	2	11	20	29	36	42
ISO	C1	Ø < 300	-5	-1	11	23	34	38	42
ISO	C2	300 ≤ Ø < 650	-7	4	14	23	34	38	42
ISO	C3	650 ≤ Ø < 1000	1	9	17	26	34	38	42
SHELL	D2	300 ≤ Ø < 650	-3	4	15	36	45	45	45
SHELL	D3	650 ≤ Ø < 1000	3	9	26	36	45	40	40

ISO 15665 is valid for pipes up to 1000 mm in diameter. Not applicable to the acoustic insulation of rectangular ducting and vessels or machinery. Insulation design based on material properties (as per part 9), such as dynamic stiffness, have shown to be less reliable, that is why acoustic systems are generally tested in an acoustic laboratory in accordance with ISO 15665 – Part 10



ProRox solutions

All ProRox solutions tested for class B and C require only half the thickness as specified by ISO 15665

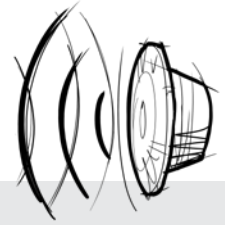
Nominal diameter (mm)	ISO 15665 Class	ProRox solution*		Thickness (mm)	Porous heavy mass layer, for example: [1] UlvaMassHD-3 mm (0.12"): 9 kg/m ² (1.8 lb/ft ²) [2] Vinaflex 2.5 mm (0.10"): 5 kg/m ² (1.0 lb/ft ²)
		ProRox PS 960	ProRox MA 961		
Aluminum cladding (jacketing) - 0.5 mm (0.02")					
Ø < 300 mm (12")	 A1 B1 C1		■	1 layer 50 mm (2")	1 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing)
300 mm ≤ Ø < 650 mm (12" ≤ Ø < 25")	 A2		■	2 layers 50 mm (2")	1 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing) 1 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - between insulation layers
	 B2 C2		■	1 layer 50 mm (2")	2 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing)
650 mm ≤ Ø < 1000 mm (25" ≤ Ø < 39")	 D2		■	2 layers 50 mm (2")	1 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing) 1 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - between insulation layers
	 A3 B3		■	1 layer 50 mm (2")	1 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing)
	 C3		■	1 layer 50 mm (2")	2 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing)
Steel cladding (jacketing) - 1.0 mm (0.04")					
Ø < 300 mm (12")	 A1 B1 C1		■	1 layer 50 mm (2")	1 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing)
300 mm ≤ Ø < 650 mm (12" ≤ Ø < 25")	 A2 B2 C2		■	1 layer 50 mm (2")	1 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing)
	 D2		■	2 layers 50 mm (2")	1 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing) 1 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - between insulation layers
650 mm ≤ Ø < 1000 mm (25" ≤ Ø < 39")	 A3 B3 C3**		■	1 layer 50 mm (2")	1 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing)
	 D3		■	2 layers 50 mm (2")	3 x Heavy mass layer 5 kg/m ² (1.0 lb/ft ²) - under cladding (jacketing) 2 x Heavy mass layer 5 kg/m ² (1.0 lb/ft ²) - between insulation layers
NEW: Now also introducing a unique Shell Class - D3 solution					
Polymeric cladding (jacketing)***					
Ø < 300 mm (12")	 A1 B1 C1		■	1 layer 50 mm (2")	2 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing)
300 mm ≤ Ø < 650 mm (12" ≤ Ø < 25")	 A2 B2 C2		■	1 layer 50 mm (2")	2 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing)
	 D2		■	2 layers 50 mm (2")	1 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing) 1 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - between insulation layers
650 mm ≤ Ø < 1000 mm (25" ≤ Ø < 39")	 A3 B3		■	1 layer 50 mm (2")	1 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing)
	 C3		■	1 layer 50 mm (2")	2 x Heavy mass layer 9 kg/m ² (1.8 lb/ft ²) - under cladding (jacketing)
NEW: Now also available a unique Shell Class - D3 solution					
	 D3		■	2 layers 50 mm (2") ProRox MA961	1 x Heavy mass layer 9 kg/m ² - between insulation 1 x Heavy mass layer 9 kg/m ² - under cladding (Polymeric cladding)

* All testing is done at ambient temperature at an internationally recognized / independent testing body. Test reports are available upon request.

** Only 0.8 mm (0.032") steel cladding needed.

*** e.g. UlvaShield

Key benefits of ProRox insulation



- **Advanced acoustic performance** with half the thickness required of conventional stone or mineral wool products.
- **Unique solution developed for Shell Class D3.**
- Superior CUI control with ProRox WR-Tech solutions which show **the highest water repellency**, 5x lower water absorption than the best available standard.
- Stone wool is not hazardous, **no special PPE*** required for handling or during installation.
- Our global supply chain featuring the ROCKWOOL factories combined with a wide reaching distribution network ensures timely delivery to any job site.
- Unique single-product versatility is **more cost efficient and easier to install** by eliminating multiple components.
- **Reduces total cost of plant ownership** by lowering maintenance costs, enhancing plant efficiency.

* Our ROCKWOOL ProRox solutions are made from volcanic rock and comply with Note Q, regulation (EC) No. 1272/200

Can we help you with your specification work?

To help you save time on high performing specification work and to satisfy your team and clients, ROCKWOOL Technical Insulation offers the following services:

- **Specification text**
- **Acoustic and thermal calculations**
- **AutoCAD drawings**
- **Third party test reports**

"We help you to achieve a reduction in total costs of installation due to our unique single source solution which is high quality, easy to install and cost-effective."



ROCKWOOL Technical Insulation

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 comes into contact with our 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 range of products 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. 11,700 passionate colleagues in 39 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 rti.rockwool.com.

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