

AN ACOUSTIC AND THERMAL SOLUTION

ArmaSound Industrial Systems AF

Combining ArmaFlex® insulation and ArmaSound® Barriers into high-performing, noise control systems. ArmaSound Industrial Systems offer superior noise control, thermal performance and industry leading CUI mitigation in one innovative solution.

www.armacell.com/energy



Contact us:
acoustic.services@armacell.com



armacell
ArmaSound®

INTEGRATED ACOUSTIC AND THERMAL SOLUTION.

INNOVATION

ArmaFlex based ArmaSound Industrial Systems are a cornerstone of the ArmaFlex and ArmaSound based insulation systems pioneered by Armacell. These noise control systems minimise CUI and provide combined thermal insulation and noise reduction in a single solution. Additionally, significant lifetime savings can be achieved through reduced inspection and lower maintenance costs. High acoustic insertion loss is achieved in combination with reduced insulation thickness and proven project performance. Armacell's standard systems meet ISO 15665 classifications and bespoke solutions are also available.

Proven performance, installed on Energy projects worldwide.

Sound performance



Thermal performance



Reduces risk of CUI



[Learn more](#)

ARMASOUND INDUSTRIAL SYSTEMS AF

ArmaSound Industrial Systems comprise several combinations of ArmaFlex, ArmaSound RD240 and ArmaSound Barrier to provide combined thermal and acoustic benefits. Various cladding materials (Arma-Chek R, metal or glass-reinforced plastic cladding) can be used. ArmaSound Industrial Systems provide significant noise reduction for all process pipework typically used in the energy destination market.

OTHER ARMASOUND INDUSTRIAL SYSTEMS

ArmaSound Industrial Systems are also available as ArmaGel® based systems and for equipment noise control. Where fixed acoustic insulation is not desirable, our ArmaGel based ContraFlex® removable ArmaSound Industrial Systems are the ideal solution. Please visit our website or contact us for more information.



FEATURES & BENEFITS

Each of the individual insulation materials used in our acoustic insulation systems comes with its own set of features and benefits. However, superior performance is achieved when optimally engineered together.

We innovate and focus on materials and systems that deliver superior performance.

// Designed to deliver

We have developed a dedicated range of industrial materials meeting the demanding requirements of the oil and gas, petrochemical and power plant sectors.

// Lifetime performance

Resistance to moisture plus an optimal system design delivers long-term predictable thermal and acoustic stability and enhanced process performance.

// Two in one

Our insulation materials combine thermal and acoustic performance and can also be engineered with traditional insulation materials for specific demands.

// Resistance to damage

Flexible materials do not crack, break or crumble and are resistant to vibration and mechanical abuse.

Flexible, thinner and lighter systems. Easy maintenance. Connecting your business with lower lifecycle costs.

// Reduce space and weight

Up to 60% reduced thickness for improved space efficiency and a smaller plant footprint, reduced supporting steel work and weight.

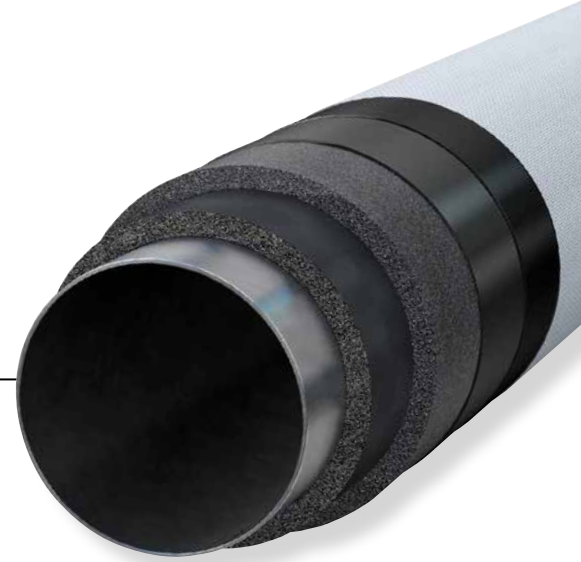


// Straightforward installation

Our flexible insulation materials are straightforward to install and fabricate. Their flexibility allows them to fit better, reducing re-work and wastage.

// Protect workers and the environment from noise

Armaflex based ArmaSound Industrial Systems offers enhanced protection for workers and the surrounding environment from plant noise.



Mitigate the spread of Corrosion Under Insulation (CUI). Best-in-class noise reduction.

// Integrated vapor barrier

ArmaFlex and Arma-Chek covering systems are flexible and resilient to both water and water vapour ingress.

// Reduce the risk of CUI

Utilising our closed-cell ArmaFlex insulation and carefully designed insulation systems, we mitigate moisture ingress, creating a tortuous path for water and significantly reducing the risk of CUI onset and spread.

// Reduce the risk of water trapped at the pipe surface

Flexible materials and well performed application techniques means a better fit around complex parts and no voids between insulation and pipe, where water could otherwise collect with rigid or less flexible materials.

// Eliminate the risk of galvanic corrosion

Systems qualified with elastomeric or GRP jacketing eliminates the opportunity for galvanic corrosion

// Noise Reduction

Our technical acoustic insulation systems meet ISO15665 classifications and offer superior noise mitigation compared to traditional systems.

The ArmaSound Industrial Systems are Armacell's answer to true innovation for the oil and gas, petrochemical and power plant markets.

PROVEN PERFORMANCE

ArmaSound Industrial Systems are tested by recognised institutes and satisfy - and in many cases exceed - the requirements of the main standards on noise control, such as ISO 15665 Class A to Class D and Shell DEP 31.46.00.31 Class D specification, NORSOK standard R-004 (M-004) Class 6, 7 and 8 and ASTM E 1222.

ArmaSound in practice: acoustic treatment of plants

The graphics below illustrate typical noise levels and potential noise reduction around a gas processing plant without acoustic treatment (fig. 1) and with ArmaSound Industrial Systems acoustic treatment (fig. 2).

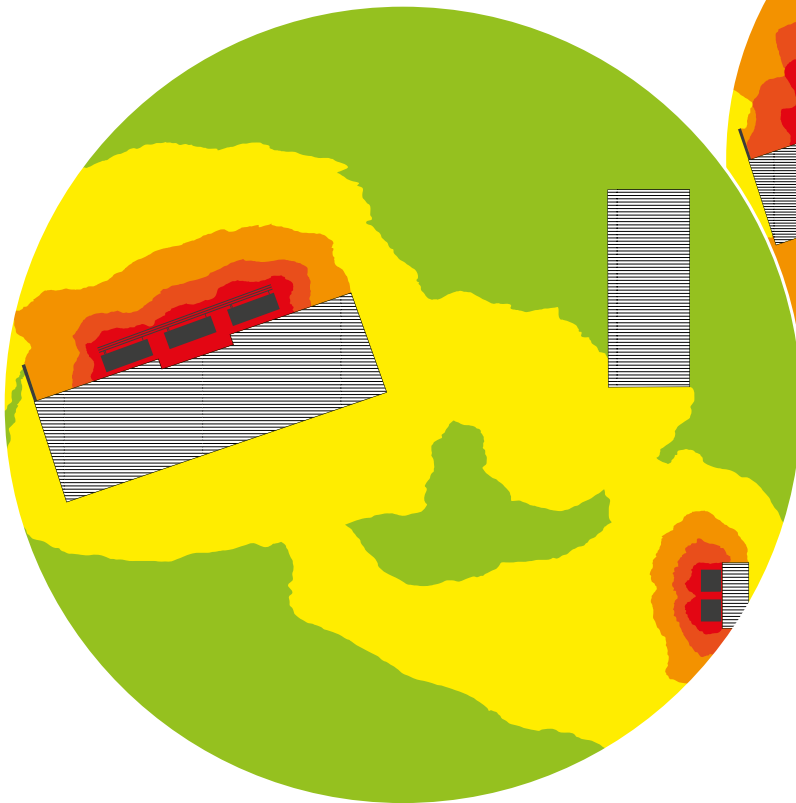


Fig 2: Acoustically treated plant

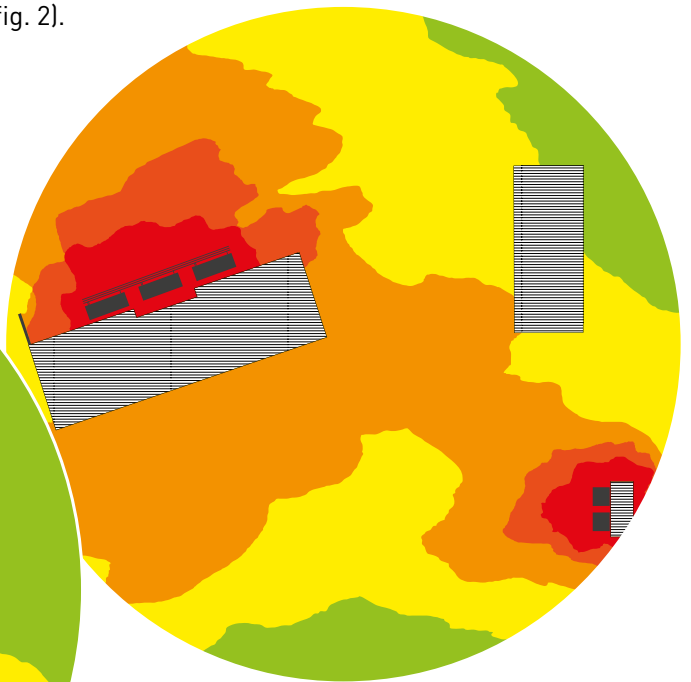
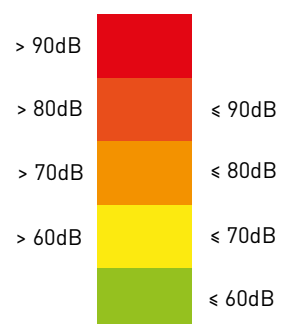


Fig 1: Acoustically untreated plant

Noise levels in dB.

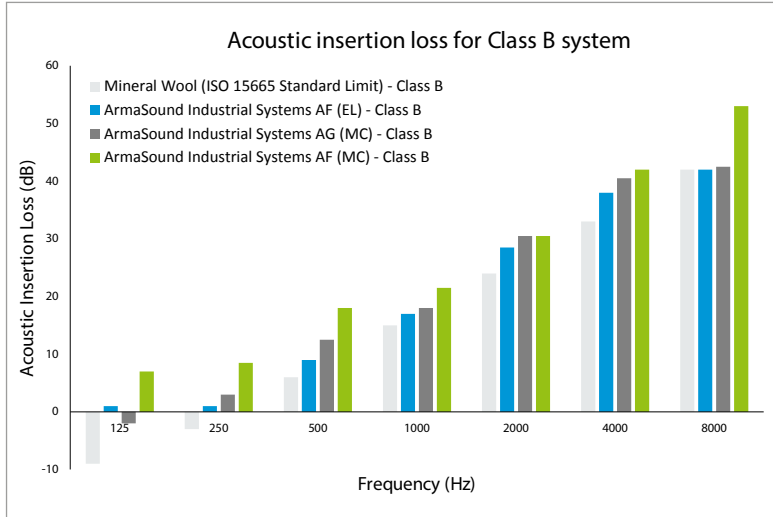


Caring about Health, Safety & Environment

Reduced noise levels are inherently beneficial for the environment. The impact of noise from industrial plants has significant effects on health, safety and the environment. Noise induced hearing loss, compromised communication, loss of amenity and detrimental effects on wildlife are all consequences of a noisy plant. Use of our ArmaSound Industrial Systems provides noise attenuation in valves and pipework and should be a cornerstone in any plants' noise reduction strategy.



PERFORMANCE DELIVERED



EXCELLENT RESULTS

Class-based classification requires that a system design meets or exceeds the performance of a traditional mineral wool-based acoustic system. All ArmaSound Industrial Systems configurations meet the classifications of ISO 15665.

The enhanced low frequency performance means that in many cases a lower class of ArmaSound Industrial System (ArmaFlex or ArmaGel based) can be recommended as a thinner, lighter, lower-cost alternative to a higher class of mineral wool-based acoustic system.

* Example based on ISO 15665 calculations

Learn more: [our services](#)

Efficient and practical engineering solutions for your acoustic and insulation challenges:

- Acoustic surveys / system design
- Specification support
- TIPCHECK energy audit
- Bespoke proof-point testing
- System optimisation
- MTO - material take off tool
- Technical training
- Mock up and trial installation
- Installation instructions
- Application training
- Inspection and site support

ACOUSTIC PERFORMANCE

Acoustic Standard ISO 15665 is an international standard that defines the acoustic performance of pipe insulation. This performance is categorised into classes A, B, C and D* based on measured acoustic insertion loss.

Furthermore, it defines a standardised test method for measuring the acoustic performance of any type of construction, thereby allowing existing and new insulation constructions to be rated against the specific classes.

Insulation systems are classified by their acoustic insertion loss performance and the diameter of pipe onto which they are applied. 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. ISO 15665 allows for any acoustic system configuration to be qualified providing that it meets the acoustic insertion loss requirements.

ISO 15665 classification table and Shell DEP Class D				Octave band centre frequency Hz						
Class	Nominal pipe diameter D (mm)		125	250	500	1000	2000	4000	8000	
	Lower limit	Upper limit	Minimum insertion loss (dB)							
A	A1	-	< 300	-4	-4	2	9	16	22	29
	A2	≥ 300	< 650	-4	-4	2	9	16	22	29
	A3	≥ 650	< 1,000	-4	2	7	13	19	24	30
B	B1	-	< 300	-9	-3	3	11	19	27	35
	B2	≥ 300	< 650	-9	-3	6	15	24	33	42
	B3	≥ 650	< 1,000	-7	2	11	20	29	36	42
C	C1	-	< 300	-5	-1	11	23	34	38	42
	C2	≥ 300	< 650	-7	4	14	24	34	38	42
	C3	≥ 650	< 1,000	1	9	17	26	34	38	42
D*	D2	≥ 300	< 650	-3	4	15	36	45	45	45
	D3	≥ 650	< 1,000	3	9	26	36	45	40	40

*Class D is also classified according to the Shell DEP 31.46.00.31 specification.

ArmaSound calculated broadband insertion loss

For typical industrial plants, measured calculated broadband insertion loss (noise reduction) of ArmaSound Industrial Systems is often higher than the minimum required in ISO 15665.

See noise reduction prediction comparison in the table below:

ISO 15665 Specification / Performance dB(A)	Control Valve	Centrifugal Compressor	Centrifugal Pump	Reciprocating Compressor
ISO 15665 - Class A2 (Mineral Wool Construction)	14	10	4	5
ArmaSound Industrial System AF (EL)	16	12	5	7
ArmaSound Industrial System AF (MC)	20	17	11	13
ArmaSound Industrial System AF (GRP)	16	12	5	7
ISO 15665 - Class B2 (Mineral Wool Construction)	18	13	5	6
ArmaSound Industrial System AF (EL)	21	17	10	11
ArmaSound Industrial System AF (MC)	27	24	17	18
ArmaSound Industrial System AF (GRP)	22	18	11	11
ISO 15665 - Class C2 (Mineral Wool Construction)	24	20	10	10
ArmaSound Industrial System AF (EL)	29	24	16	16
ArmaSound Industrial System AF (MC)	32	27	18	19
ArmaSound Industrial System AF (GRP)	29	25	16	16
ISO15665 / SHELL DEP 31 - Class D2 (Mineral Wool Const.)	27	22	12	13
ArmaSound Industrial System AF (EL)	27	23	13	14
ArmaSound Industrial System AF (MC)	34	30	20	21
ArmaSound Industrial System AF (GRP)	31	26	16	15

Based on ISO 15665 calculations.

Legend:

AF	ArmaFlex	MC	Metal cladding
EL	Elastomeric	GRP	Glass reinforced plastic

ISO 15665 mineral wool construction insertion loss values for Classes A2, B2, C2 and D2 are based on mineral wool and metal jacketing.

THE COMPONENTS



The secret to superior performance is in the engineered multi-layer design: higher efficiency, thinner and lighter. A deep understanding of the different insulation materials and how they behave when used together, led us to the development of ArmaSound Industrial Systems. Each system is tested and evaluated by independent, internationally renowned acoustic institutes and laboratories.

OUR SECRET: ENGINEERED LAYER DESIGN

// ArmaFlex® Industrial: high performance thermal insulation

ArmaFlex is Armacell's product heritage. Today, in its 7th product generation, this flexible, light-weight, high-tech material features an insulating closed-cell structure with low thermal conductivity and an in-built water vapour barrier. It is fibre-dust free, and a key element in our layering system for effective acoustic decoupling (isolation).

// ArmaSound® RD240: enhanced sound absorption

ArmaSound RD240 is an advanced open-cell, fibre-dust free acoustic insulation material. It offers excellent sound absorption behaviour across the entire frequency range. This, coupled with its high density and inherent damping ability, provides excellent acoustic performance in thinner layers than traditional systems. It is also suitable in some applications as an acoustic barrier.

// ArmaSound® Barrier E: efficient sound barrier

ArmaSound Barrier E is a vinyl sound barrier mat loaded with naturally occurring minerals. The product is free of lead, unrefined aromatic oils and bitumen. With its high density, the product combines minimum thickness with an excellent reduction of the transmission of air-borne sound while enhancing the insertion loss performance of pipe insulation system.





MULTIPLE SYSTEMS, MULTIPLE USES

ArmaSound Industrial Systems AF are available in various insulation and cladding configurations for industrial applications ranging from -40 °C to +125 °C (-40 °F to 257 °F).

UP TO
30%
INSTALLED COST
SAVINGS

UP TO
60%
THINNER
SYSTEMS

// **ArmaSound® Barrier D:**
efficient sound barrier

ArmaSound Barrier D is a high performing viscoelastic sound barrier. The product is free of lead, unrefined aromatic oils and bitumen. This flexible material combines minimum thickness with an excellent damping and reduction of the transmission of air-borne sound. Used primarily with metal jacketed systems, ArmaSound Barrier D enhances the insertion loss performance of metal clad pipe insulation systems.

// **Arma-Chek® R cladding:**
durable mechanical protection

Arma-Chek R is a particularly resilient, non-metallic flexible cladding system formulated with CSPE. Reducing the corrosion and installation issues associated with metallic covering systems, Arma-Chek R has been designed to work in harmony with ArmaFlex insulation, expanding and contracting as required. It further enhances the insertion loss performance of our acoustic insulation systems.

FOR
TEMPERATURES FROM

-40 °C to
+125 °C

(-40 °F - 257 °F)



THE COMPONENTS



INSTALL IT. TRUST IT.

HT/ArmaFlex Industrial

Industrial grade FEF insulation material designed for applications with elevated temperatures in oil and gas industry

- // High density and mechanically robust for superior stability and multi-layer application
- // Enhanced temperature capability
- // Built-in water vapor barrier reduces risk of corrosion under insulation (CUI)
- // Retains its physical characteristics throughout its service life
- // Low maintenance and repair costs
- // Low leachable chloride content (1.30 ppm) to minimise stress corrosion cracking (SCC)
- // Low thermal conductivity to maximise energy losses



armacell
ArmaFlex



INSTALL IT. ENJOY QUIETNESS.

ArmaSound RD240

Optimal performance at lower thickness

- // Excellent sound absorption behaviour
- // Highly hydrophobic, open-cell structure designed to resist water ingress
- // Air-flow resistivity and complex pore geometry for maximum acoustic benefit
- // Easy application and low maintenance
- // Designed for use in demanding environments



armacell
ArmaSound


// +Info:



// +Info:



OUR SECRET: ENGINEERED LAYER DESIGN






INSTALL IT. ENJOY QUIETNESS.

ArmaSound Barrier D

High performance sound barrier for a quieter environment

- // Safe, non-staining and effective direct replacement of bitumen damping materials
- // Excellent damping properties
- // Improved flexibility to bitumen barrier materials
- // Fully recyclable







INSTALL IT. ENJOY QUIETNESS.

ArmaSound Barrier E

High performance noise barrier for ArmaSound Industrial Systems

- // Excellent at reducing the transmission of airborne sound
- // Enhances the insertion loss performance of pipe insulation
- // Flexible, easy to install
- // Mean sound reduction index R = 28 dB
- // Free of lead, unrefined aromatic oils and bitumen
- // Integral component of ArmaSound Industrial Systems
- // Compliant to ISO 15649 Class C and Shell DEP 31.46.00.31-Gen Class D
- // Satisfies acoustic class B according to NORSOK M-004
- // Sound Transmission Class (STC) from 28 to 31 dB


INSTALL IT. SAFEGUARD YOUR EQUIPMENT.

Arma-Chek R

Flexible non-metallic covering for industrial insulation

- // Flexible polymeric covering formulated with CSM (CSPE) with combined acoustic barrier performance, ISO 15649 compliant
- // Excellent mechanical and weathering protection
- // Specially developed for use in offshore and industrial environments
- // Reduces the risk of corrosion under insulation (CUI)
- // Resistant to UV, salt water and chemicals
- // In-built water vapour barrier $\mu < 0.001$
- // Works in harmony with ArmaPipe, expanding and contracting as required
- // IMO certified




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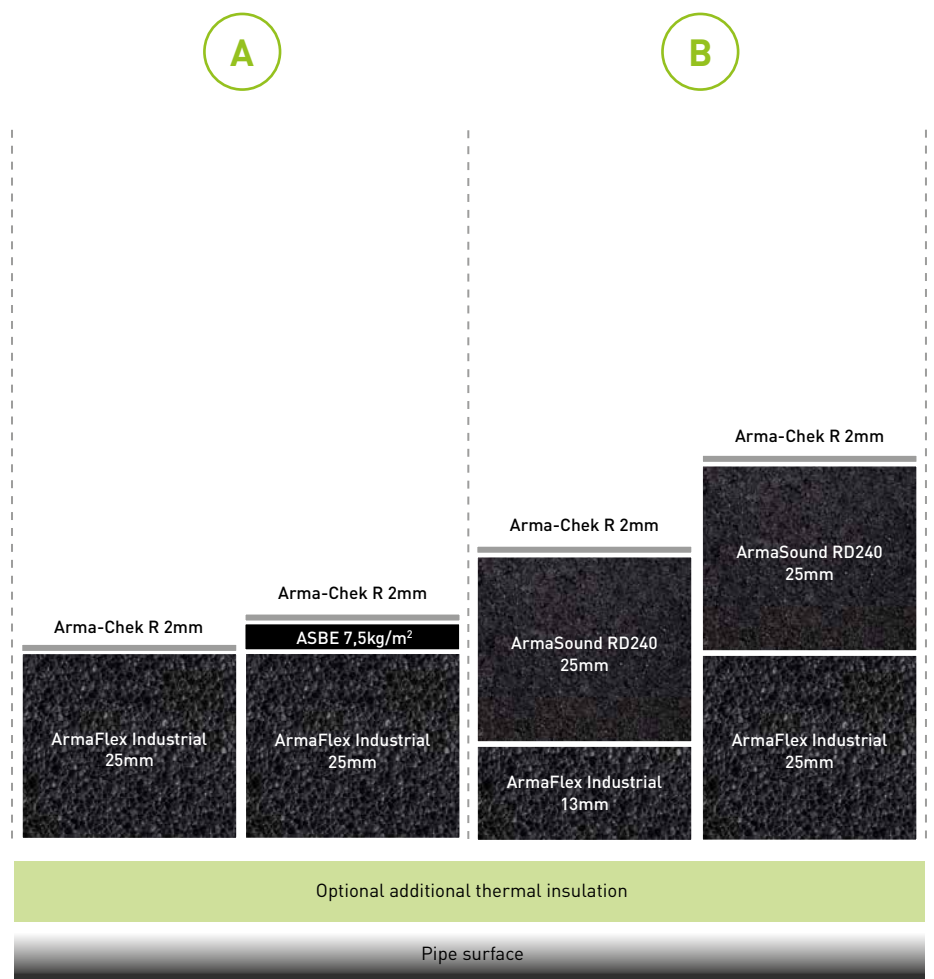
Bespoke systems for highest efficiency

SUMMARY

ARMASOUND INDUSTRIAL SYSTEMS AF (EL)

This system is constructed with different combinations of ArmaFlex Industrial, ArmaSound RD240, ArmaSound Barrier E and protected with Arma-Chek R flexible elastomeric covering.

Acoustic classification is rated A through D for increasing insertion loss requirements according to ISO 15665, ASTM E1222 and Shell DEP 31.46.00.31.



Acoustic class	A1 & A2	A3	B1 & B2	B3
Minimum ArmaFlex/ArmaSound Thickness	25 mm	25 mm	38 mm	50 mm
Total Mass per unit Area of Barrier	0 kg/m ²	7.5 kg/m ²	0 kg/m ²	0 kg/m ²
Total Thickness of Acoustic System	27.0 mm	30.0 mm	40.0 mm	52.0 mm
Total Mass per unit Area of Acoustic System	5.2 kg/m ²	12.7 kg/m ²	10.2 kg/m ²	11.2 kg/m ²

A. Classification: Numbers 1 through 3 represent the pipe size:

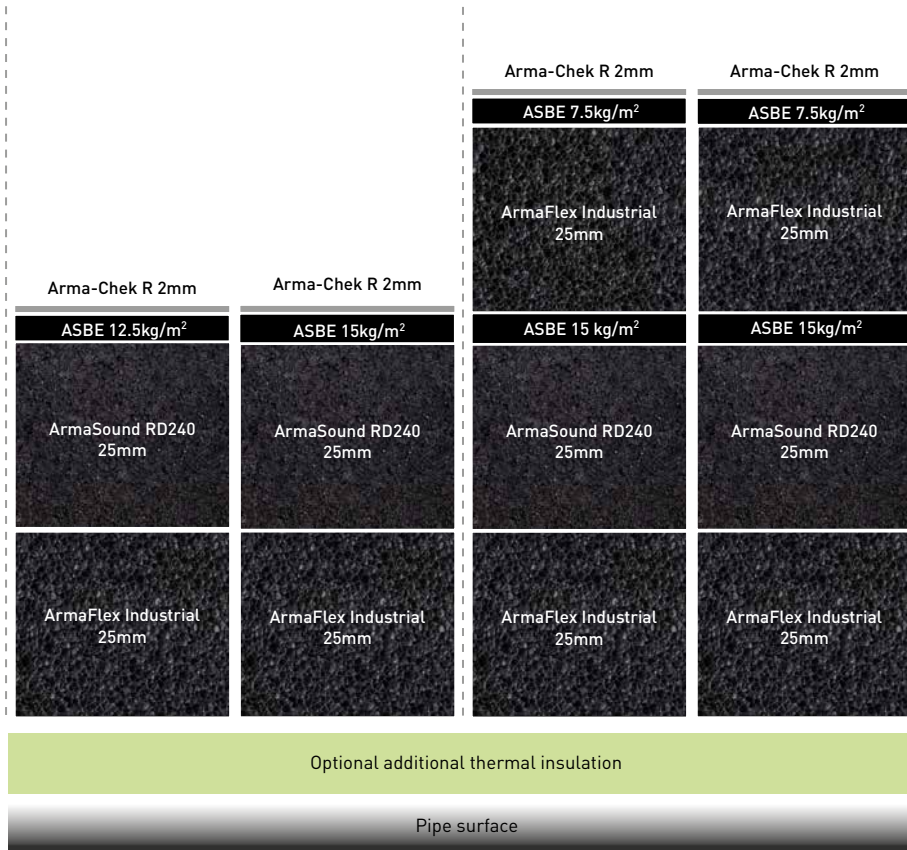
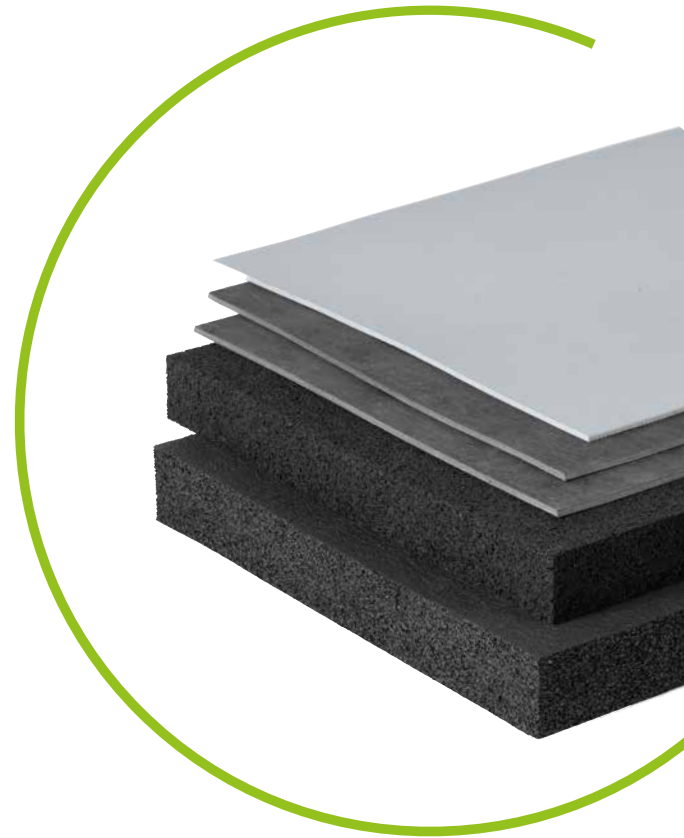
- "1" for pipes below DN300 (12 in./300mm)
- "2" for pipes between DN300 and DN650 (12 in./300mm. to 26 in./650mm.)
- "3" for pipes greater than DN650 (26 in./650mm.)

Note 1: All systems meet ISO 15665/ASTM E1222/Shell DEP Insertion Loss classification from lowest to highest listed – e.g. ArmaSound Industrial Systems AF (EL) Class C2 meets Class A2, B2 and C2.

Note 2: ISO15665/Shell DEP 31.46.00.31 do not have a Class D1

B. ArmaSound Barrier E (ASBE) can be applied in multiple layers as long as the mass is equivalent

C. Arma-Chek R Jacketing must have a mass per unit area $\geq 3.2\text{kg/m}^2$ (0.66 psf)



Arma-Chek R
ArmaSound Barrier E

ArmaSound RD240

ArmaFlex Industrial

Additional thermal layers (if required) to be installed below the acoustic system

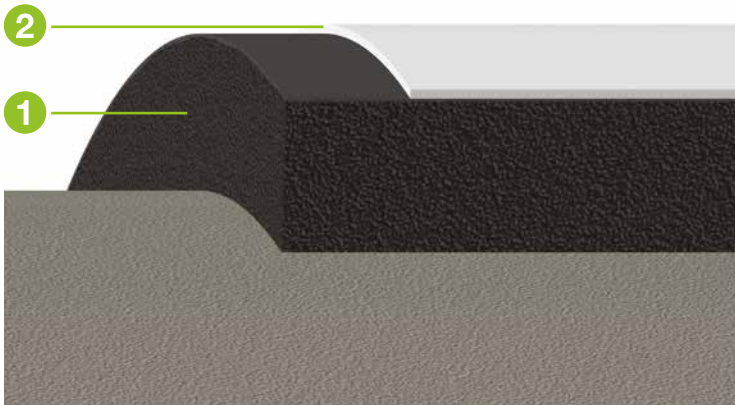
Metal Substrate

C1 & C2	C3	D2	D3	Acoustic class
50 mm	50 mm	75 mm	75 mm	Minimum ArmaFlex/ArmaSound Thickness
12.5 kg/m ²	15 kg/m ²	22.5 kg/m ²	22.5 kg/m ²	Total Mass per unit Area of Barrier
57.0 mm	58.0 mm	86.0 mm	86.0 mm	Total Thickness of Acoustic System
23.7 kg/m ²	26.2 kg/m ²	35.7 kg/m ²	35.7 kg/m ²	Total Mass per unit Area of Acoustic System

THE COMPONENT

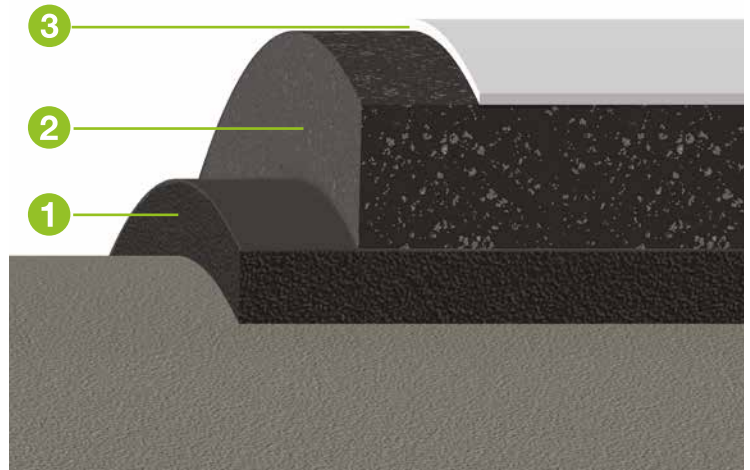
ARMASOUND INDUSTRIAL SYSTEMS AF (EL)

AF (EL) | CLASS A2



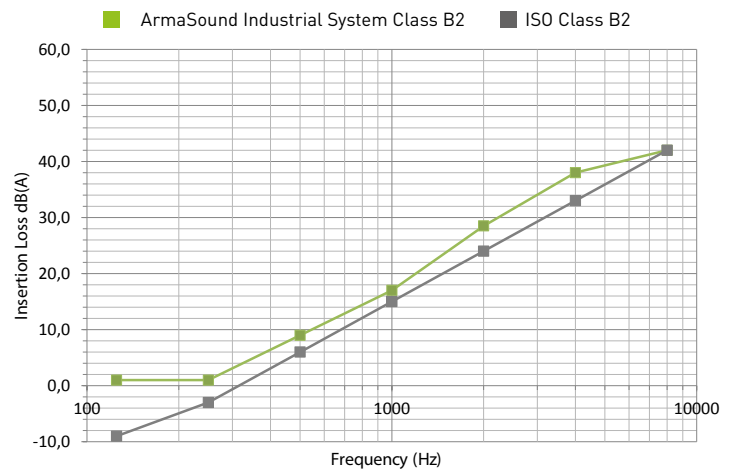
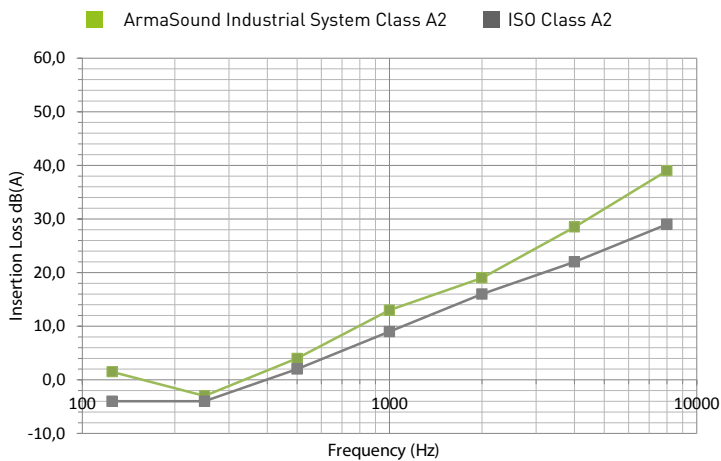
- 1 ArmaFlex Industrial 25 mm
- 3 Arma-Chek R 2 mm

AF (EL) | CLASS B2



- 1 ArmaFlex Industrial 13 mm
- 2 ArmaSound RD240 25 mm
- 3 Arma-Chek R 2 mm

Test results acc. to ISO 15665



Test results Class A2

Octave band centre frequency Hz

	125	250	500	1000	2000	4000	8000
Insertion loss, dB	1.5	-3.0	4.0	13.0	19.0	28.5	39.0
ISO 15665 Class A2	-4.0	-2.0	2.0	9.0	16.0	22.0	29.0

Total thickness (mm): 27.0
Total weight, flat (kg/m²): 5.2

Test results Class B2

Octave band centre frequency Hz

	125	250	500	1000	2000	4000	8000
Insertion loss, dB	1.0	1.0	9.0	17.0	28.5	38.0	42.0
ISO 15665 Class B2	-9.0	-3.0	6.0	15.0	24.0	33.0	42.0

Total thickness (mm): 40.0
Total weight, flat (kg/m²): 10.2

NTS

ArmaSound Industrial Systems AF (EL) is based on ArmaFlex with elastomeric Arma-Chek R cladding.

Results of testing:

- Systems A, B and C according to ISO 15665
- System D according to ISO15665 and Shell DEP 31.46.00.31-Gen. specification

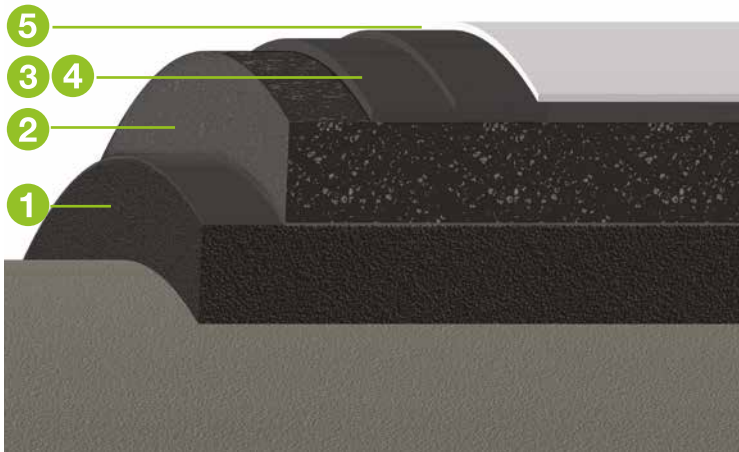
Conditions:

Test results for nominal pipe-Ø: from 300mm to 650mm.

Weight and thickness based on typical values. Industrial grade ArmaFlex materials are to be used for the ArmaFlex layers. All data and technical information are based on results achieved under typical application conditions.

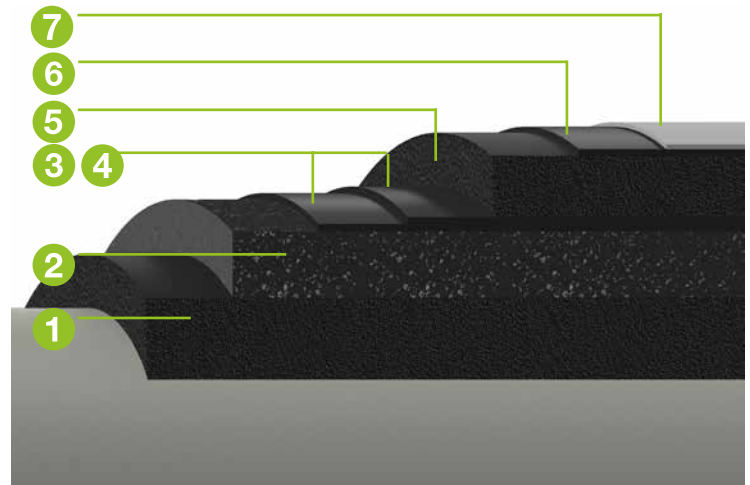
For each component the thickness in [mm] is provided.

AF (EL) | CLASS C2



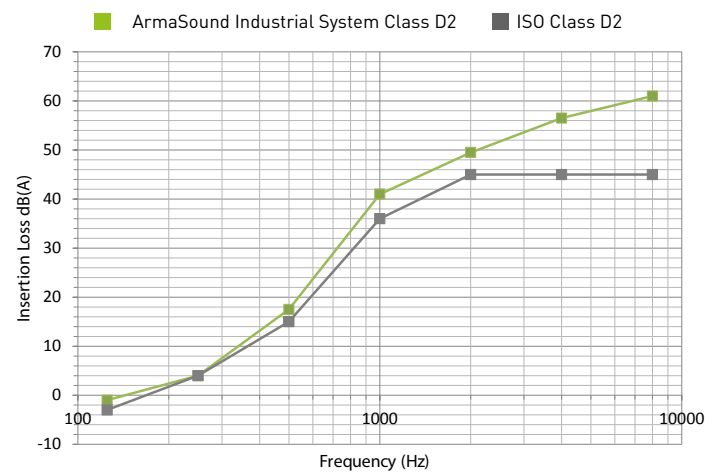
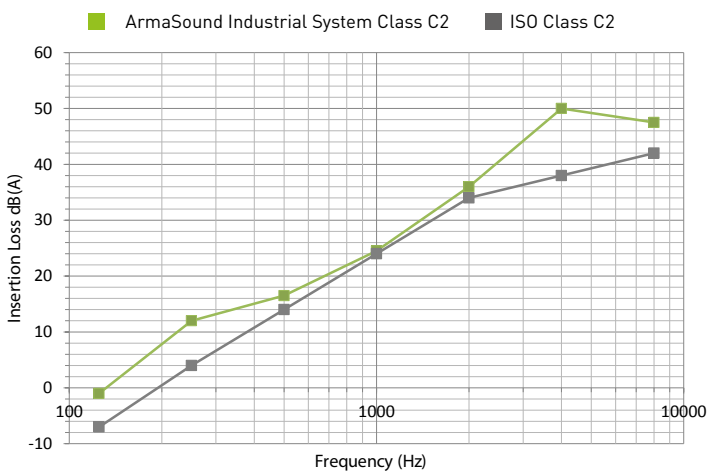
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|---|---------------------|-------|---|---------------------|------|
| 1 | ArmaFlex Industrial | 25 mm | 4 | ArmaSound Barrier E | 2 mm |
| 2 | ArmaSound RD240 | 25 mm | 5 | Arma-Chek R | 2 mm |
| 3 | ArmaSound Barrier E | 3 mm | | | |

AF (EL) | CLASS D2



- | | | | | | |
|---|---------------------|-------|---|---------------------|-------|
| 1 | ArmaFlex Industrial | 25 mm | 5 | ArmaFlex Industrial | 25 mm |
| 2 | ArmaSound RD240 | 25 mm | 6 | ArmaSound Barrier E | 3 mm |
| 3 | ArmaSound Barrier E | 3 mm | 7 | Arma-Chek R | 2 mm |
| 4 | ArmaSound Barrier E | 3 mm | | | |

Test results acc. to ISO15665 and Shell DEP 31.46.00.31-Gen.



Test results Class C2

Octave band centre frequency Hz

	125	250	500	1000	2000	4000	8000
Insertion loss, dB	-1.0	12.0	16.5	24.5	36.0	50.0	47.5
ISO 15665 Class C2	-7.0	4.0	14.0	24.0	34.0	38.0	42.0

Total thickness (mm): 57.0
Total weight, flat (kg/m²): 23.7

Test results Class D2

Octave band centre frequency Hz

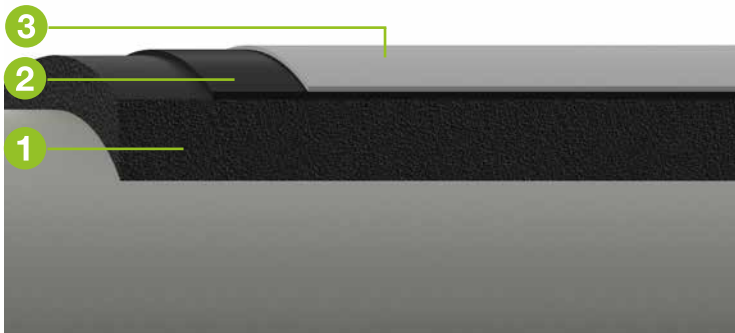
	125	250	500	1000	2000	4000	8000
Insertion loss, dB	-1.0	4.0	17.5	41.0	49.5	56.5	61.0
ISO 15665 Class D2	-3.0	4.0	15.0	36.0	45.0	45.0	45.0

Total thickness (mm): 86.0
Total weight, flat (kg/m²): 35.7

THE COMPONENT

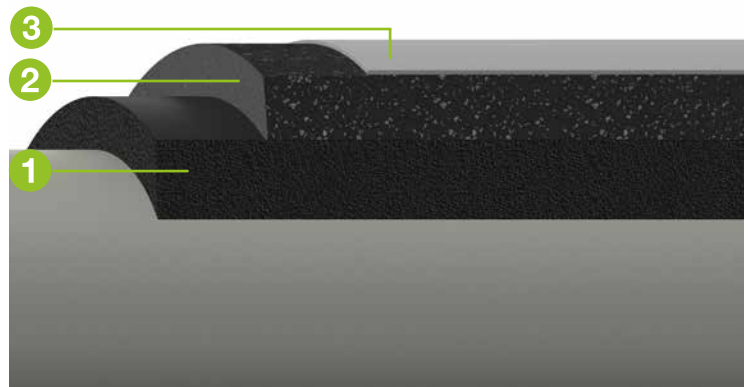
ARMASOUND INDUSTRIAL SYSTEMS AF (EL)

AF (EL) | CLASS A3



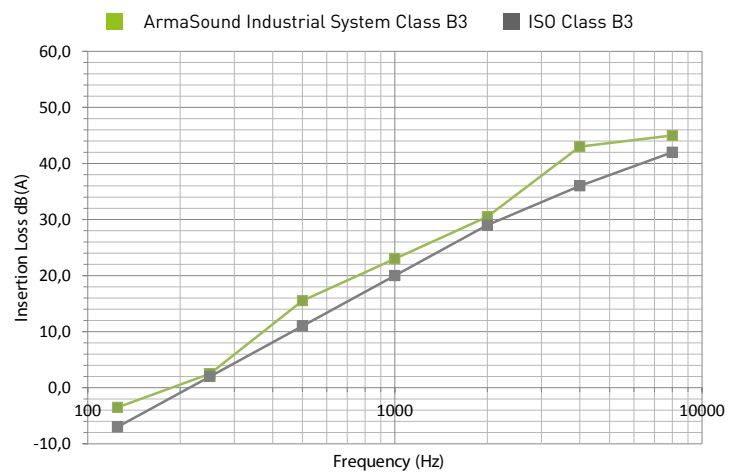
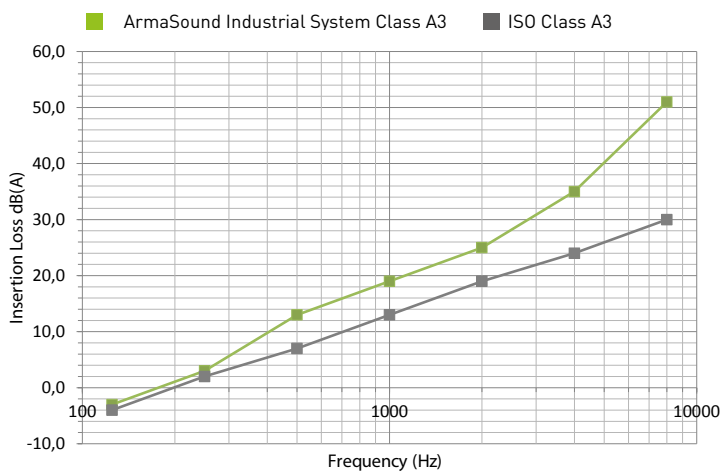
- 1 ArmaFlex Industrial 25 mm
- 2 ArmaSound Barrier E 3 mm
- 3 Arma-Chek R 2 mm

AF (EL) | CLASS B3



- 1 ArmaFlex Industrial 25 mm
- 2 ArmaSound RD240 25 mm
- 3 Arma-Chek R 2 mm

Test results acc. to ISO 15665



Test results Class A3

Octave band centre frequency Hz

	125	250	500	1000	2000	4000	8000
Insertion loss, dB	-3.0	3.0	13.0	19.0	25.0	35.0	51.0
ISO 15665 Class A3	-4.0	2.0	7.0	13.0	19.0	24.0	30.0

Total thickness (mm): 30.0
Total weight, flat (kg/m²): 12.7

Test results Class B3

Octave band centre frequency Hz

	125	250	500	1000	2000	4000	8000
Insertion loss, dB	-3.5	2.5	15.5	23.0	30.5	43.0	45.0
ISO 15665 Class B3	-7.0	2.0	11.0	20.0	29.0	36.0	42.0

Total thickness (mm): 52.0
Total weight, flat (kg/m²): 11.2

NTS

ArmaSound Industrial Systems AF (EL) is based on ArmaFlex with elastomeric Arma-Chek R cladding.

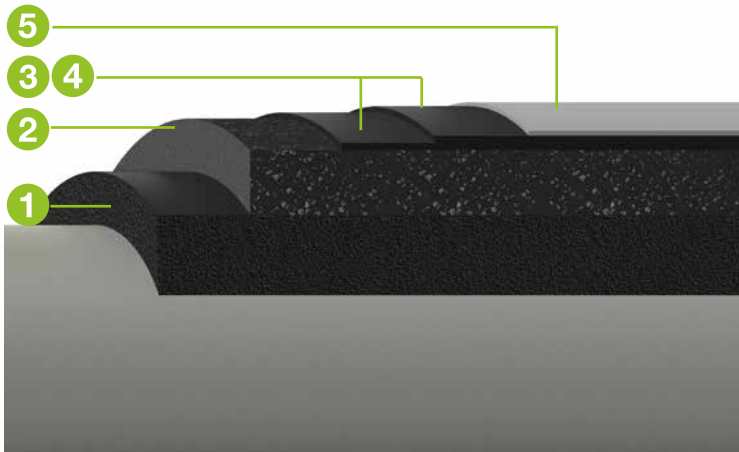
Results of testing:

- Systems A, B and C according to ISO 15665
- System D according to ISO15665 and Shell DEP 31.46.00.31-Gen. specification

Conditions:

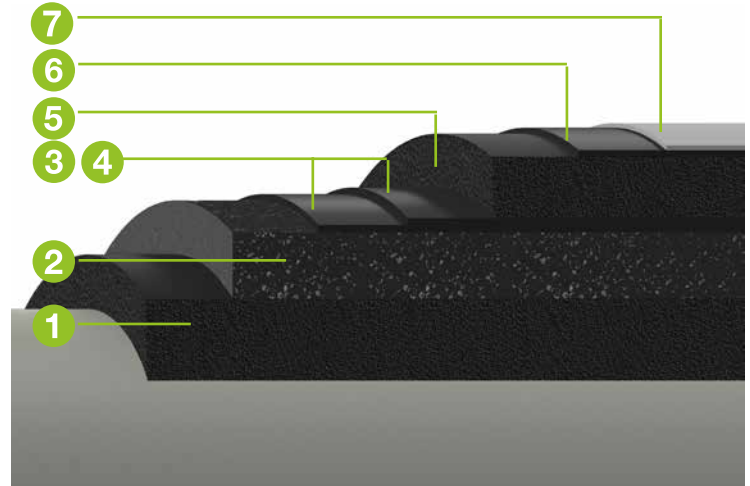
Test results for nominal pipe-Ø: from 650mm to 1000mm.
 Weight and thickness based on typical values. Industrial grade ArmaFlex materials are to be used for the ArmaFlex layers. All data and technical information are based on results achieved under typical application conditions.
 For each component the thickness in [mm] is provided.

AF (EL) | CLASS C3



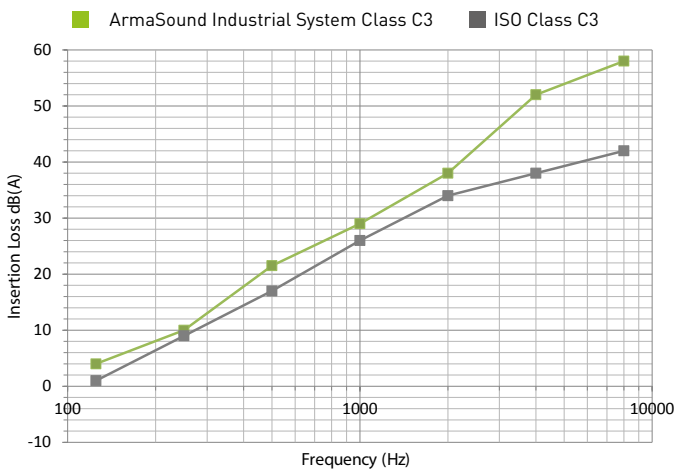
- | | | | | | |
|---|---------------------|-------|---|---------------------|------|
| 1 | ArmaFlex Industrial | 25 mm | 4 | ArmaSound Barrier E | 3 mm |
| 2 | ArmaSound RD240 | 25 mm | 5 | Arma-Chek R | 2 mm |
| 3 | ArmaSound Barrier E | 3 mm | | | |

AF (EL) | CLASS D3



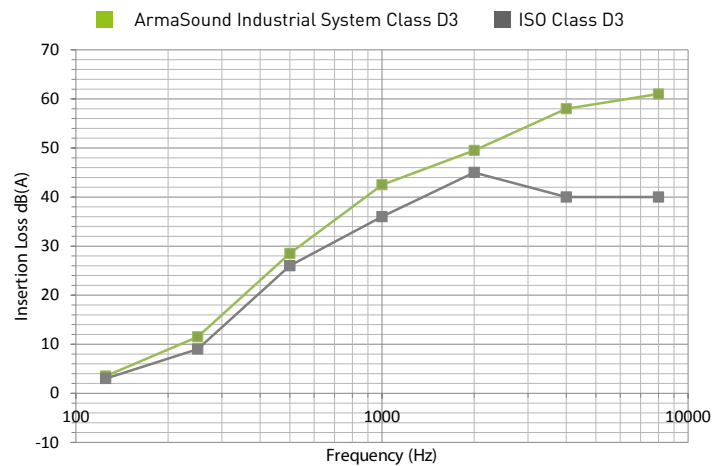
- | | | | | | |
|---|---------------------|-------|---|---------------------|-------|
| 1 | ArmaFlex Industrial | 25 mm | 5 | ArmaFlex Industrial | 25 mm |
| 2 | ArmaSound RD240 | 25 mm | 6 | ArmaSound Barrier E | 3 mm |
| 3 | ArmaSound Barrier E | 3 mm | 7 | Arma-Chek R | 2 mm |
| 4 | ArmaSound Barrier E | 3 mm | | | |

Test results acc. to ISO15665 and Shell DEP 31.46.00.31-Gen.



Test results	Octave band centre frequency Hz						
	125	250	500	1000	2000	4000	8000
Class C3							
Insertion loss, dB	4.0	10.0	21.5	29.0	38.0	52.0	58.0
ISO 15665 Class C3	1.0	9.0	17.0	26.0	34.0	38.0	42.0

Total thickness (mm): 58.0
 Total weight, flat (kg/m²): 26.2



Test results	Octave band centre frequency Hz						
	125	250	500	1000	2000	4000	8000
Class D3							
Insertion loss, dB	3.5	11.5	28.5	42.5	49.5	58.0	61.0
ISO 15665 Class D3	3.0	9.0	26.0	36.0	45.0	40.0	40.0

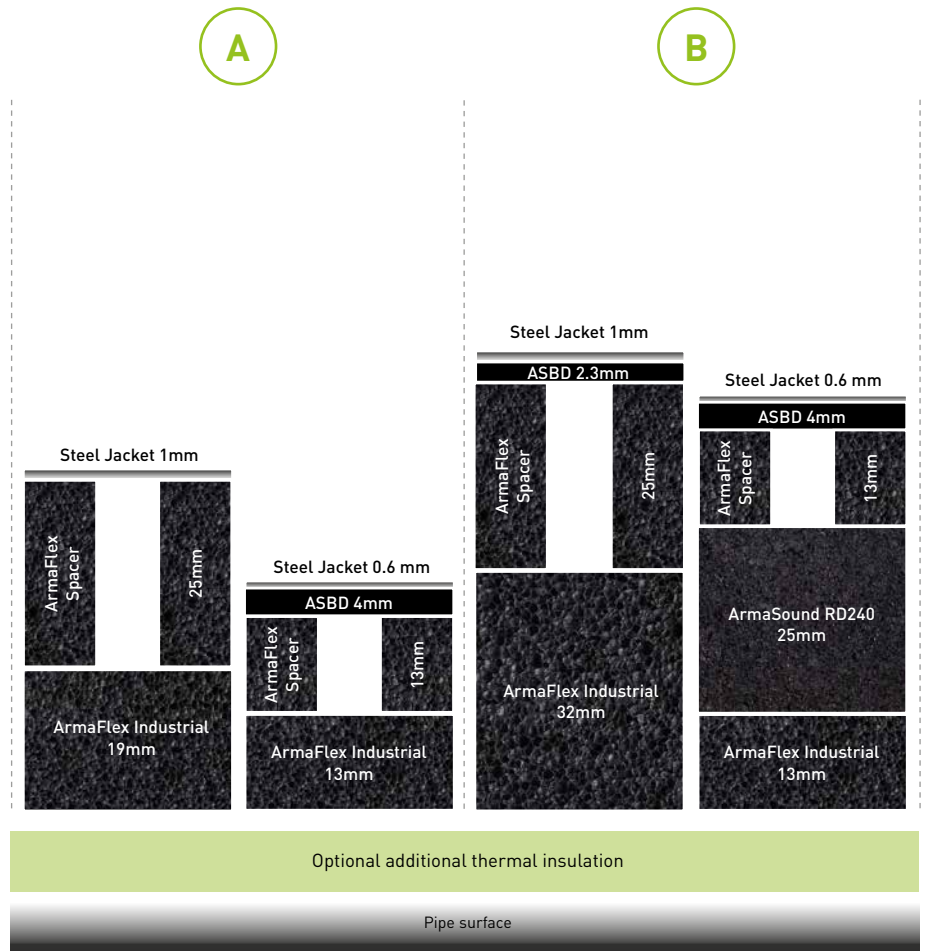
Total thickness (mm): 86.0
 Total weight, flat (kg/m²): 35.7

SUMMARY

ARMASOUND INDUSTRIAL SYSTEMS AF (MC)

This system is constructed with different combinations of ArmaFlex Industrial, ArmaSound RD240, ArmaSound Barrier D and ArmaFlex Industrial Spacer, protected with a steel jacket.

Acoustic classification is rated A through D for increasing insertion loss requirements according to ISO 15665, ASTM E1222 and Shell DEP 31.46.00.31.



Acoustic class	A1 & A2	A3	B1 & B2	B3
Minimum ArmaFlex/ArmaSound Thickness	44 mm	26 mm	57 mm	51 mm
Total Mass per unit Area of Barrier	0 kg/m ²	7 kg/m ²	4 kg/m ²	7 kg/m ²
Total Thickness of Acoustic System	45.0 mm	30.6 mm	60.3 mm	55.6 mm
Total Mass per unit Area of Acoustic System	9.4 kg/m ²	12.8 kg/m ²	14.5 kg/m ²	18.8 kg/m ²

A. Classification: Numbers 1 through 3 represent the pipe size:

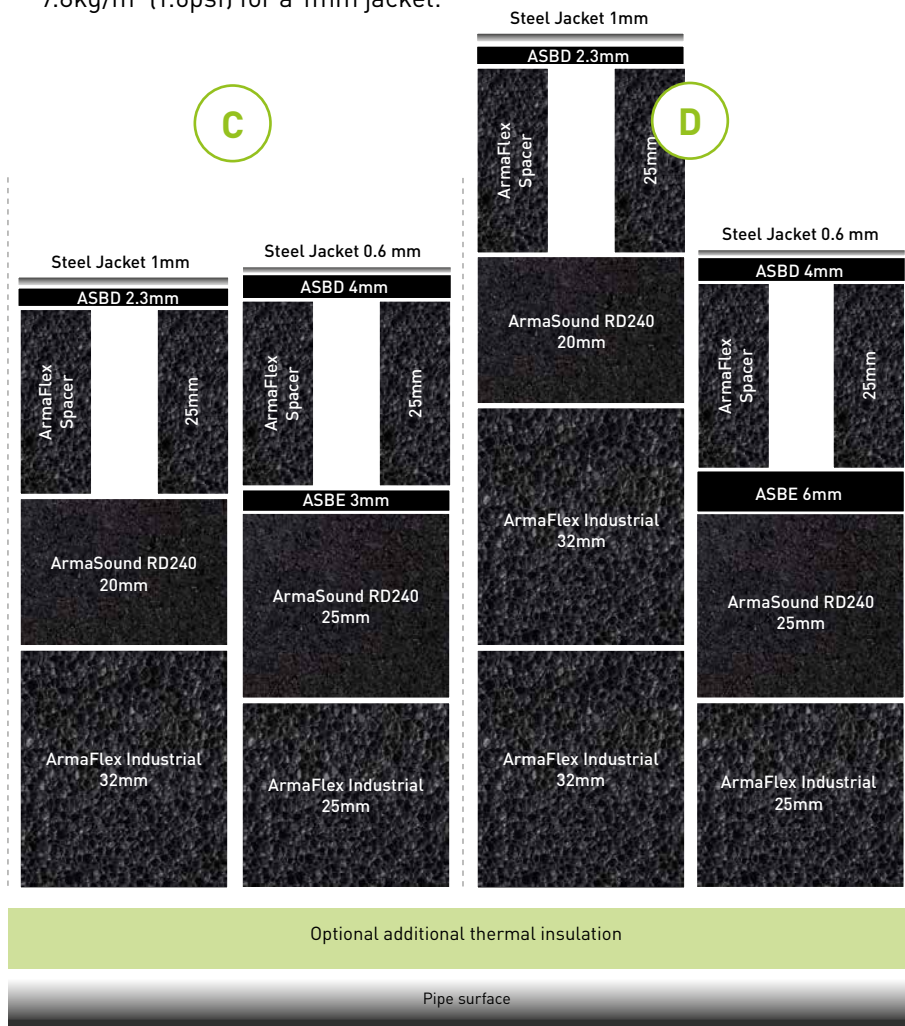
- "1" for pipes below DN300 (12 in./300mm)
- "2" for pipes between DN300 and DN650 (12 in./300mm. to 26 in./650mm.)
- "3" for pipes greater than DN650 (26 in./650mm.)

Note 1: All systems meet ISO 15665/ASTM E1222/Shell DEP Insertion Loss classification from lowest to highest listed – e.g. ArmaSound Industrial Systems AF (MC) Class C2 meets Class A2, B2 and C2.

Note 2: ISO15665 and Shell DEP 31.46.00.31 do not have a Class D1

B. ArmaSound Barrier E (ASBE) can be applied in multiple layers as long as the mass is equivalent

C. Steel jacketing: mass per unit area $\geq 4.7\text{kg/m}^2$ (0.96psf) and 7.8kg/m^2 (1.6psf) for a 1mm jacket.



Steel jacket
ArmaSound Barrier D
ArmaFlex Industrial Spacer

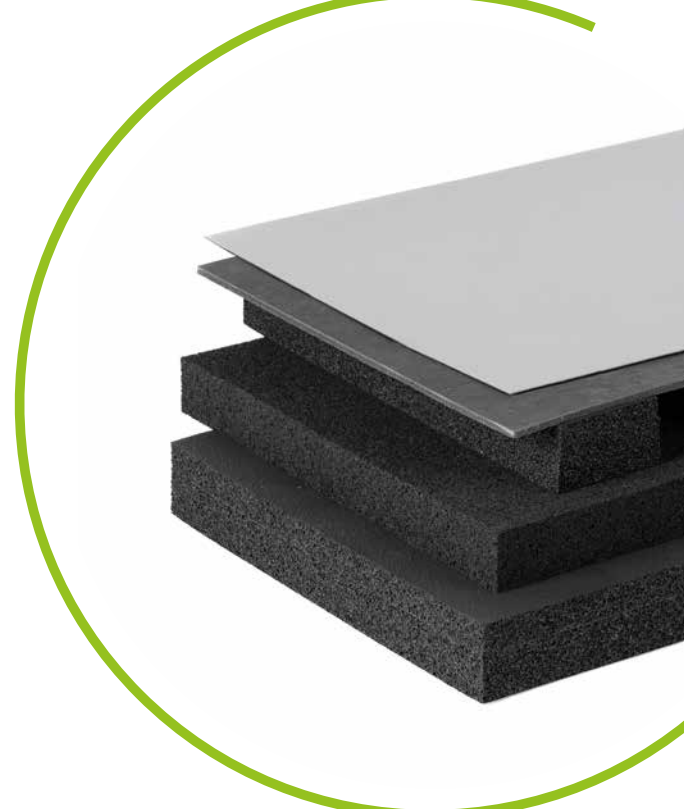
ArmaSound Barrier E
ArmaSound RD240

ArmaFlex Industrial

Additional thermal layers (if required) to be installed below the acoustic system

Pipe surface

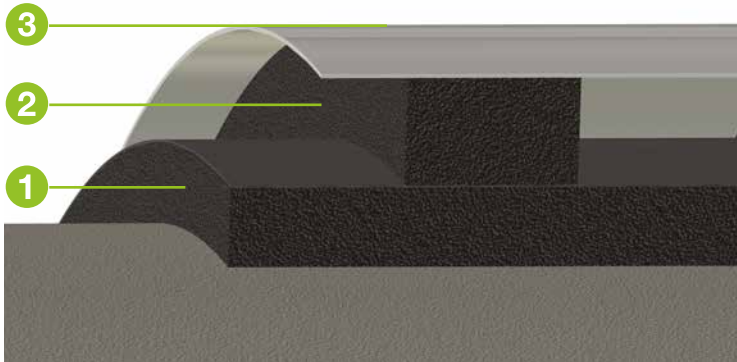
C1 & C2	C3	D2	D3	Acoustic class
77 mm	75 mm	109 mm	75 mm	Minimum ArmaFlex/ArmaSound Thickness
4 kg/m ²	14.5 kg/m ²	4 kg/m ²	22 kg/m ²	Total Mass per unit Area of Barrier
80.3 mm	82.6 mm	112.3 mm	85.6 mm	Total Thickness of Acoustic System
19.3 kg/m ²	27.3 kg/m ²	21.9 kg/m ²	34.8 kg/m ²	Total Mass per unit Area of Acoustic System



THE COMPONENT

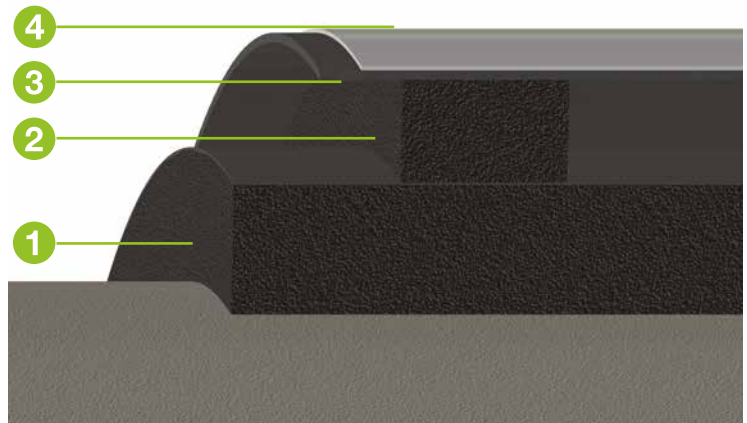
ARMASOUND INDUSTRIAL SYSTEMS AF (MC)

AF (MC) | CLASS A2



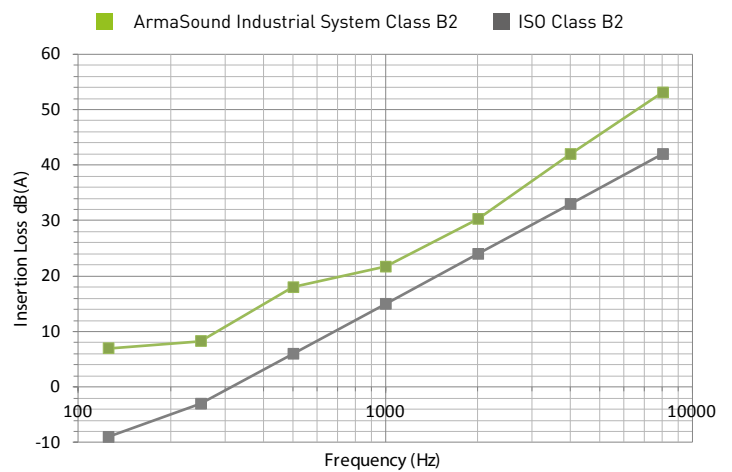
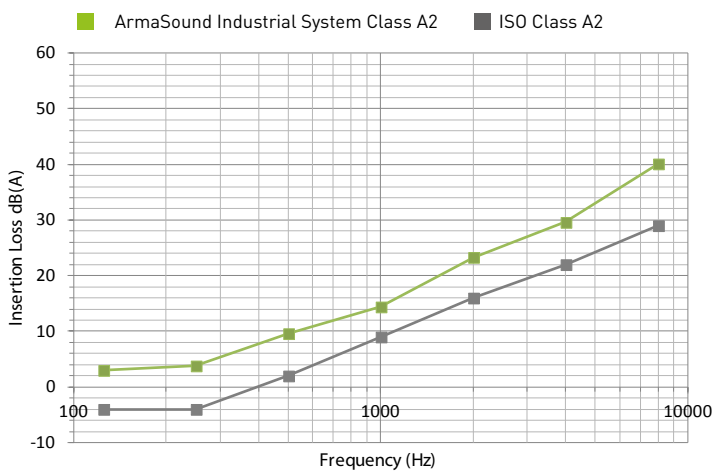
- 1 ArmaFlex Industrial 19 mm
- 2 ArmaFlex Spacer 25 mm
- 3 Steel Jacket 1 mm

AF (MC) | CLASS B2



- 1 ArmaFlex Industrial 32 mm
- 2 ArmaFlex Spacer 25 mm
- 3 ArmaSound Barrier D 2.3 mm
- 4 Steel Jacket 1 mm

Test results acc. to ISO 15665



Test results Class A2

Octave band centre frequency Hz	Octave band centre frequency Hz						
	125	250	500	1000	2000	4000	8000
Insertion loss, dB	3.0	3.8	9.6	14.4	23.3	29.6	40.1
ISO 15665 Class A2	-4.0	-4.0	2.0	9.0	16.0	22.0	29.0

Total thickness (mm): 45.0
Total weight, flat (kg/m²): 9.4

Test results Class B2

Octave band centre frequency Hz	Octave band centre frequency Hz						
	125	250	500	1000	2000	4000	8000
Insertion loss, dB	7.0	8.3	18.0	21.7	30.3	42.0	53.1
ISO 15665 Class B2	-9.0	-3.0	6.0	15.0	24.0	33.0	42.0

Total thickness (mm): 60.3
Total weight, flat (kg/m²): 14.5

NTS

ArmaSound Industrial Systems AF (MC) is based on ArmaFlex with metal cladding.

Results of testing:

- Systems A, B and C according to ISO 15665
- System D according to ISO15665 and Shell DEP 31.46.00.31-Gen. specification

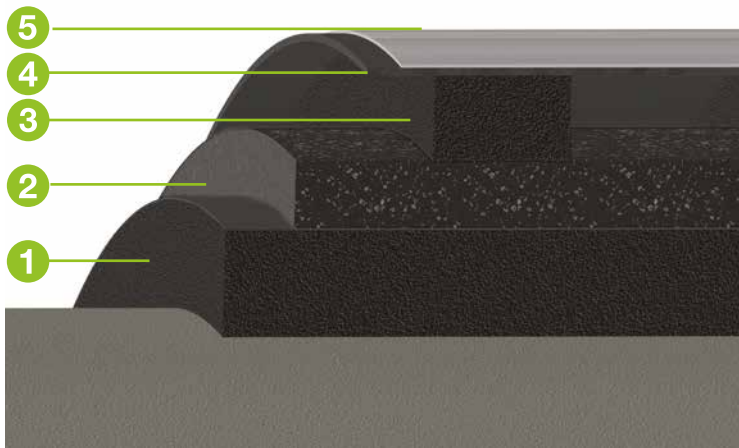
Conditions:

Test results for nominal pipe-Ø: from 300mm to 650mm.

Weight and thickness based on typical values. Industrial grade ArmaFlex materials are to be used for the ArmaFlex layers. All data and technical information are based on results achieved under typical application conditions.

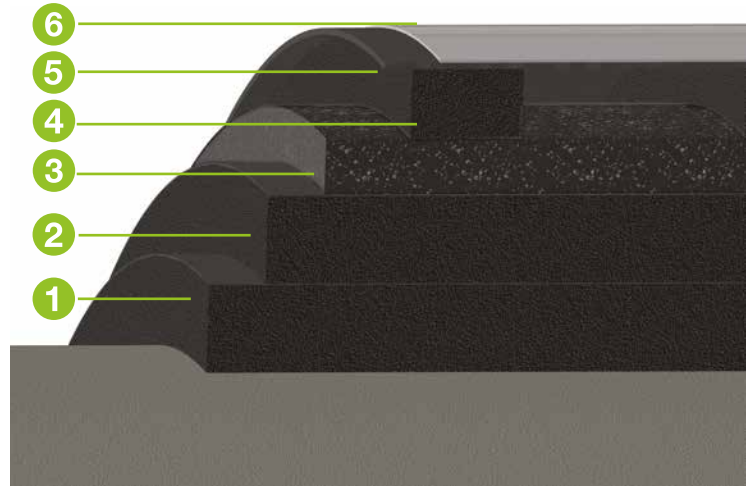
For each component the thickness in [mm] is provided.

AF (MC) | CLASS C2



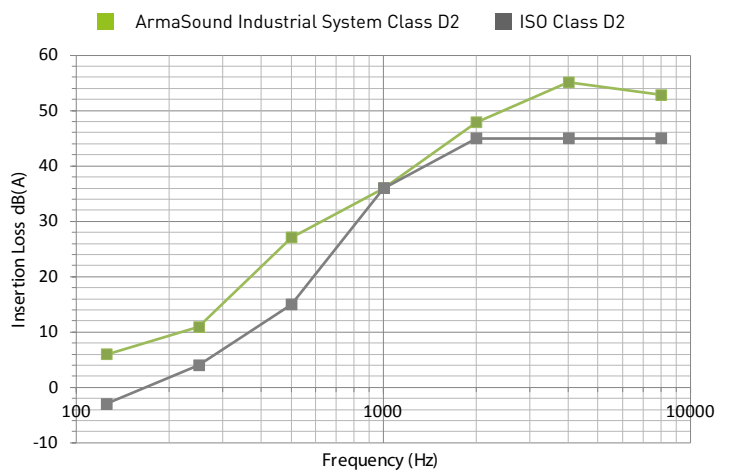
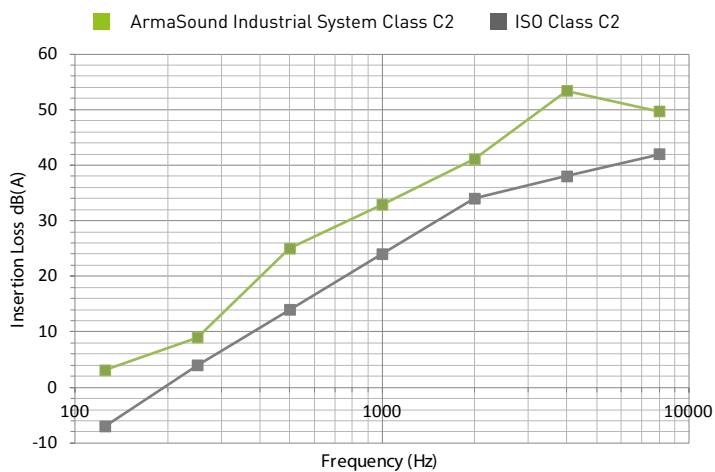
1	ArmaFlex Industrial	32 mm	4	ArmaSound Barrier D	2.3 mm
2	ArmaSound RD240	20 mm	5	Steel Jacket	1 mm
3	ArmaFlex Spacer	25 mm			

AF (MC) | CLASS D2



1	ArmaFlex Industrial	32 mm	4	ArmaFlex Spacer	25 mm
2	ArmaFlex Industrial	32 mm	5	ArmaSound Barrier D	2.3 mm
3	ArmaSound RD240	20 mm	6	Steel Jacket	1 mm

Test results acc. to ISO15665 and Shell DEP 31.46.00.31-Gen.



Test results Class C2

Octave band centre frequency Hz

	125	250	500	1000	2000	4000	8000
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Insertion loss, dB	3.1	9.0	25.0	32.9	41.1	53.4	49.7
ISO 15665 Class C2	-7.0	4.0	14.0	24.0	34.0	38.0	42.0

Total thickness (mm): 80.3
Total weight, flat (kg/m²): 19.3

Test results Class D2

Octave band centre frequency Hz

	125	250	500	1000	2000	4000	8000
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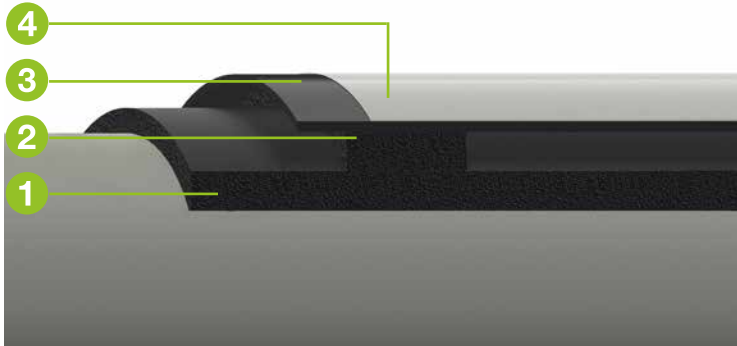
Insertion loss, dB	6.0	10.9	27.1	36.0	47.9	55.1	52.8
ISO 15665 Class D2	-3.0	4.0	15.0	36.0	45.0	45.0	45.0

Total thickness (mm): 112.3
Total weight, flat (kg/m²): 21.9

THE COMPONENT

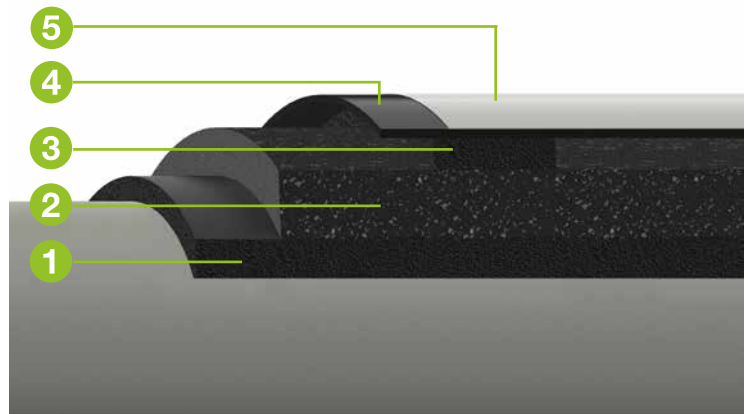
ARMASOUND INDUSTRIAL SYSTEMS AF (MC)

AF (MC) | CLASS A3



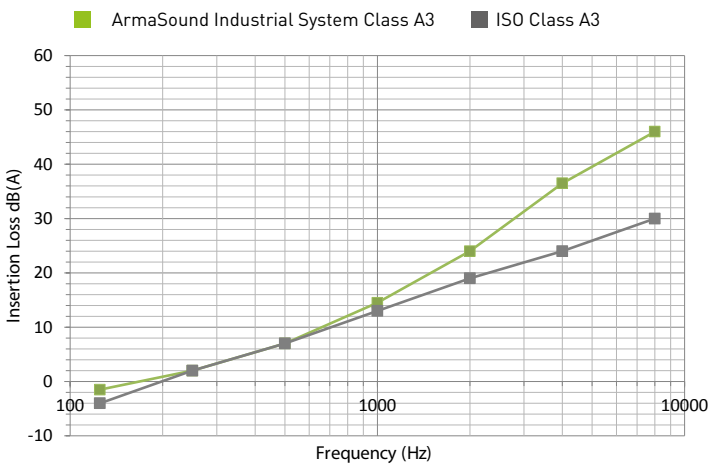
- 1 ArmaFlex Industrial 13 mm
- 2 ArmaFlex Spacer 13 mm
- 3 ArmaSound Barrier D 4 mm
- 4 Steel Jacket 0.6 mm

AF (MC) | CLASS B3



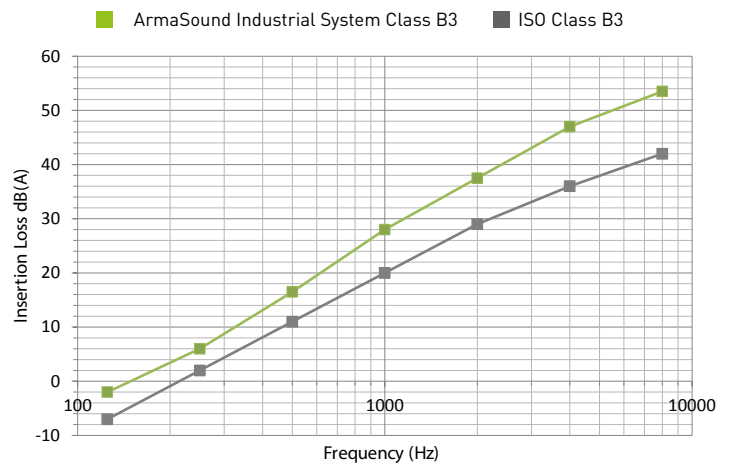
- 1 ArmaFlex Industrial 13 mm
- 2 ArmaSound RD240 25 mm
- 3 ArmaFlex Spacer 13 mm
- 4 ArmaSound Barrier D 4 mm
- 5 Steel Jacket 0.6 mm

Test results acc. to ISO 15665



Test results	Octave band centre frequency Hz						
	125	250	500	1000	2000	4000	8000
Class A3							
Insertion loss, dB	-1.5	2.0	7.0	14.5	24.0	36.5	46.0
ISO 15665 Class A3	-4.0	2.0	7.0	13.0	19.0	24.0	30.0

Total thickness (mm): 30.6
Total weight, flat (kg/m²): 12.8



Test results	Octave band centre frequency Hz						
	125	250	500	1000	2000	4000	8000
Class B3							
Insertion loss, dB	-2.0	6.0	16.5	28.0	37.5	47.0	53.5
ISO 15665 Class B3	-7.0	2.0	11.0	20.0	29.0	36.0	42.0

Total thickness (mm): 55.6
Total weight, flat (kg/m²): 18.8

NTS

ArmaSound Industrial Systems AF (MC) is based on ArmaFlex with metal cladding.

Results of testing:

- Systems A, B and C according to ISO 15665
- System D according to ISO15665 and Shell DEP 31.46.00.31-Gen. specification

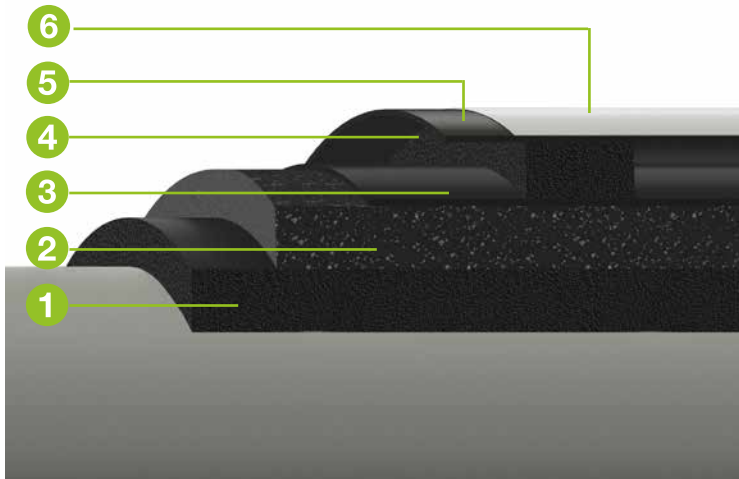
Conditions:

Test results for nominal pipe-Ø: from 300mm to 650mm.

Weight and thickness based on typical values. Industrial grade ArmaFlex materials are to be used for the ArmaFlex layers. All data and technical information are based on results achieved under typical application conditions.

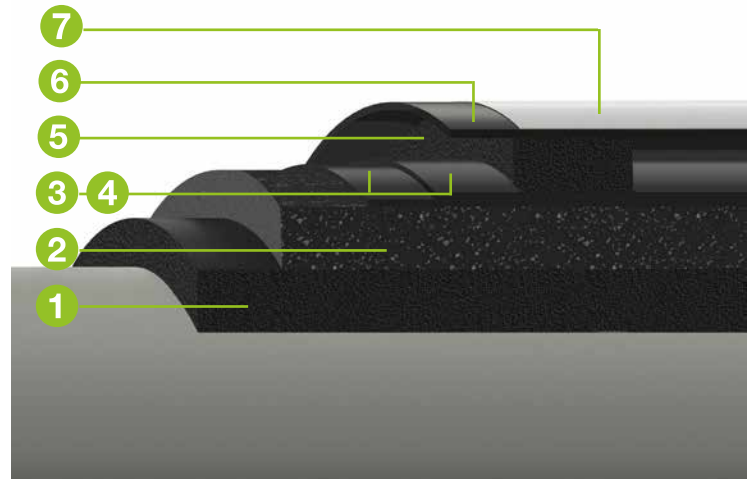
For each component the thickness in [mm] is provided.

AF (MC) | CLASS C3



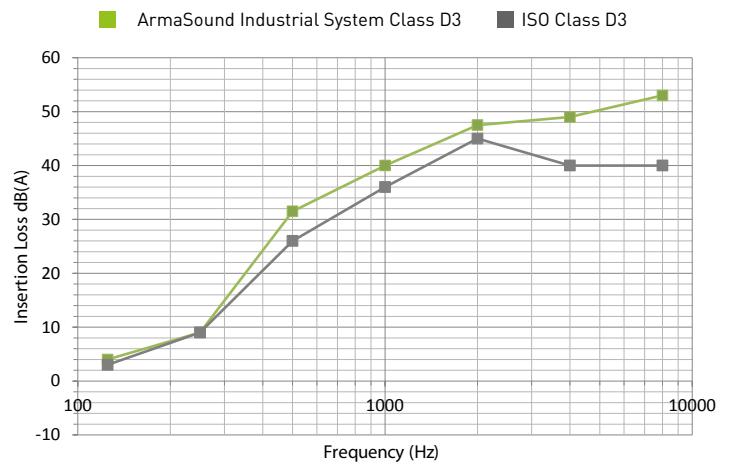
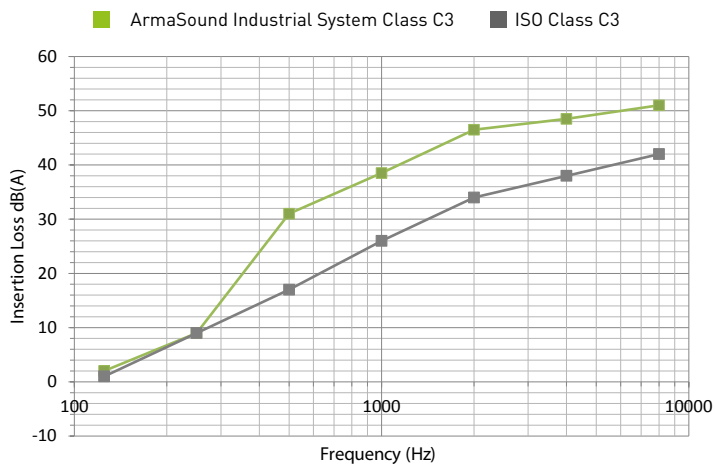
- | | | | | | |
|---|---------------------|-------|---|---------------------|--------|
| 1 | ArmaFlex Industrial | 25 mm | 4 | ArmaFlex Spacer | 25 mm |
| 2 | ArmaSound RD240 | 25 mm | 5 | ArmaSound Barrier D | 4 mm |
| 3 | ArmaSound Barrier E | 3 mm | 6 | Steel Jacket | 0.6 mm |

AF (MC) | CLASS D3



- | | | | | | |
|---|---------------------|-------|---|---------------------|--------|
| 1 | ArmaFlex Industrial | 25 mm | 5 | ArmaFlex Spacer | 25 mm |
| 2 | ArmaSound RD240 | 25 mm | 6 | ArmaSound Barrier D | 4 mm |
| 3 | ArmaSound Barrier E | 3 mm | 7 | Steel Jacket | 0.6 mm |
| 4 | ArmaSound Barrier E | 3 mm | | | |

Test results acc. to ISO15665 and Shell DEP 31.46.00.31-Gen.



Test results

Octave band centre frequency Hz

Class C3	125	250	500	1000	2000	4000	8000
Insertion loss, dB	2.0	9.0	31.0	38.5	46.5	48.5	51.0
ISO 15665 Class C3	1.0	9.0	17.0	26.0	34.0	38.0	42.0

Total thickness (mm): 82.6
 Total weight, flat (kg/m²): 27.3

Test results

Octave band centre frequency Hz

Class D3	125	250	500	1000	2000	4000	8000
Insertion loss, dB	4.0	9.0	31.5	40.0	47.5	49.0	53.0
ISO 15665 Class D3	3.0	9.0	26.0	36.0	45.0	40.0	40.0

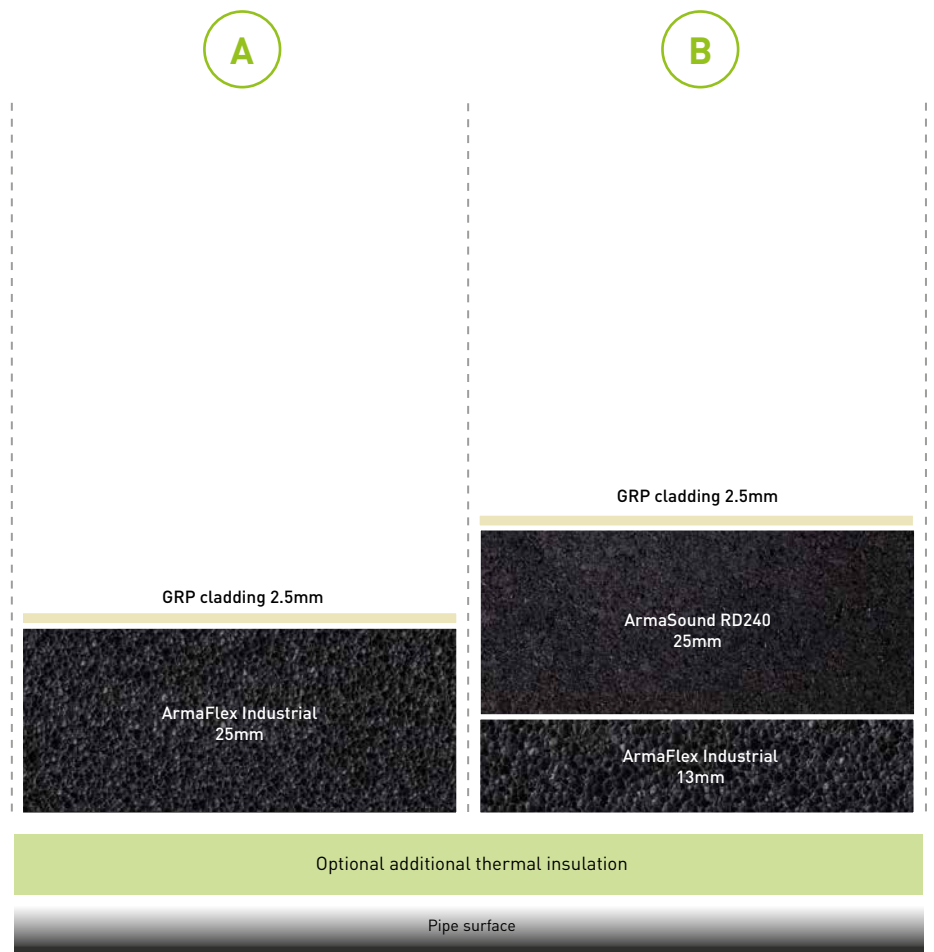
Total thickness (mm): 85.6
 Total weight, flat (kg/m²): 34.8

SUMMARY

ARMASOUND INDUSTRIAL SYSTEMS AF (GRP)

This system is constructed with different combinations of ArmaFlex Industrial, ArmaSound RD240, ArmaSound Barrier E and ArmaFlex Industrial Spacer, protected with GRP cladding.

Acoustic classification is rated A through D for increasing insertion loss requirements according to ISO 15665, ASTM E1222 and Shell DEP 31.46.00.31.



Acoustic class	A1 & A2	B1 & B2
Minimum ArmaFlex/ArmaSound Thickness	25 mm	38 mm
Total Mass per unit Area of Barrier	0 kg/m ²	0 kg/m ²
Total Thickness of Acoustic System	27.5 mm	40.5 mm
Total Mass per unit Area of Acoustic System	6.8 kg/m ²	11.9 kg/m ²

A. Classification: Numbers 1 through 3 represent the pipe size:

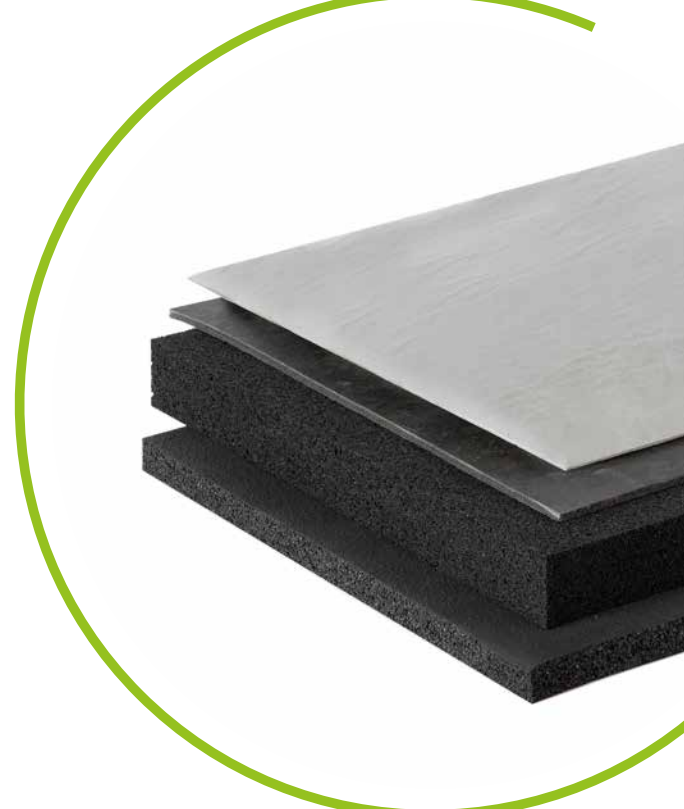
- "1" for pipes below DN300 (12 in./300mm)
- "2" for pipes between DN300 and DN650 (12 in./300mm. to 26 in./650mm.)
- "3" for pipes greater than DN650 (26 in./650mm.)

Note 1: All systems meet ISO 15665/ASTM E1222/Shell DEP Insertion Loss classification from lowest to highest listed – e.g. ArmaSound Industrial Systems AG (MC) Class C2 meets Class A2, B2 and C2.

Note 2: ISO15665 and Shell DEP 31.46.00.31 do not have a Class D1

B. ArmaSound Barrier E (ASBE) can be applied in multiple layers as long as the mass is equivalent

C. GRP Jacketing must have a mass per unit area $\geq 4.9 \text{ kg/m}^2$ (1.0 psf)

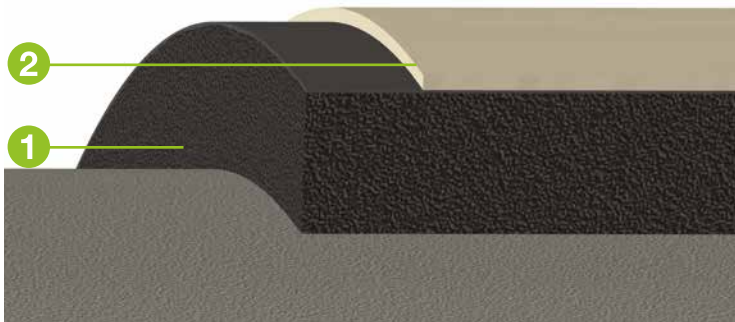


C1 & C2	D2	Acoustic class
38 mm	88 mm	Minimum ArmaFlex/ArmaSound Thickness
10.0 kg/m ²	12.5 kg/m ²	Total Mass per unit Area of Barrier
44.5 mm	95.5 mm	Total Thickness of Acoustic System
21.9 kg/m ²	31.6 kg/m ²	Total Mass per unit Area of Acoustic System

THE COMPONE

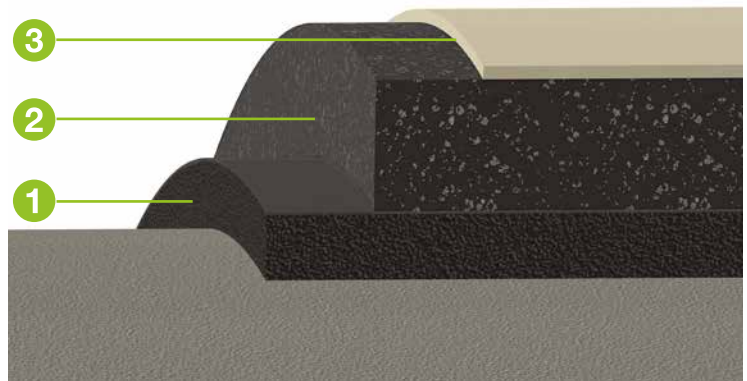
ARMASOUND INDUSTRIAL SYSTEMS AF (GRP)

AF (GRP) | CLASS A2



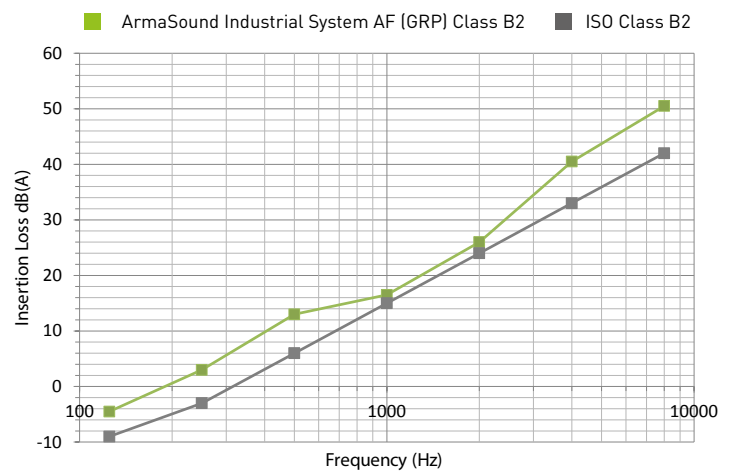
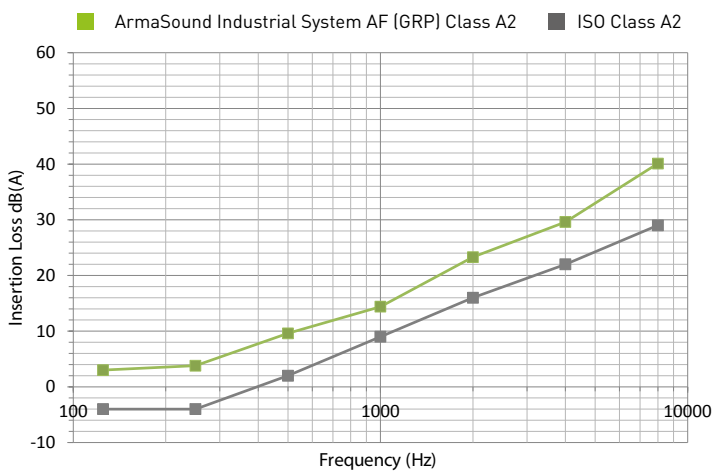
- 1 ArmaFlex Industrial 25 mm
- 2 GRP cladding 2.5 mm

AF (GRP) | CLASS B2



- 1 ArmaFlex Industrial 13 mm
- 2 ArmaSound RD240 25 mm
- 3 GRP cladding 2.5 mm

Test results acc. to ISO 15665



Test results Class A2

Octave band centre frequency Hz

	125	250	500	1000	2000	4000	8000
Insertion loss, dB	1.5	-3.5	4.0	13.0	19.0	28.5	39.0
ISO 15665 Class A2	-4.0	-4.0	2.0	9.0	16.0	22.0	29.0

Total thickness (mm): 27.5
Total weight, flat (kg/m²): 6.8

Test results Class B2

Octave band centre frequency Hz

	125	250	500	1000	2000	4000	8000
Insertion loss, dB	-4.5	3.0	13	16.5	26.0	40.5	50.5
ISO 15665 Class B2	-9.0	-3.0	6.0	15.0	24.0	33.0	42.0

Total thickness (mm): 40.5
Total weight, flat (kg/m²): 11.9

NTS

ArmaSound Industrial Systems AF (GRP) is based on ArmaFlex with GRP (glass-reinforced plastic) cladding.

Results of testing:

- Systems A, B and C according to ISO 15665
- System D according to ISO15665 and Shell DEP 31.46.00.31-Gen. specification

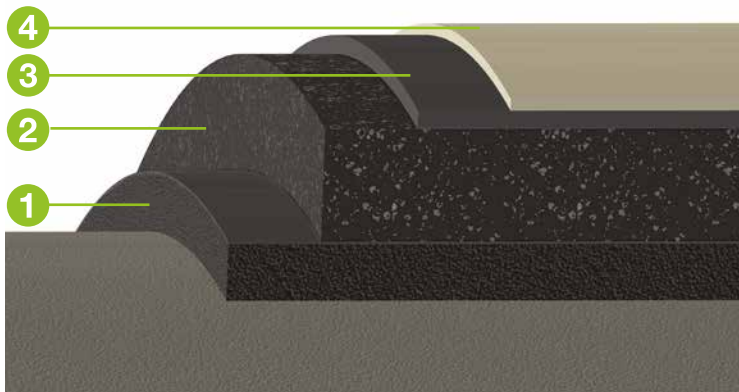
Conditions:

Test results for nominal pipe-Ø: from 300mm to 650mm.

Weight and thickness based on typical values. Industrial grade ArmaFlex materials are to be used for the ArmaFlex layers. All data and technical information are based on results achieved under typical application conditions.

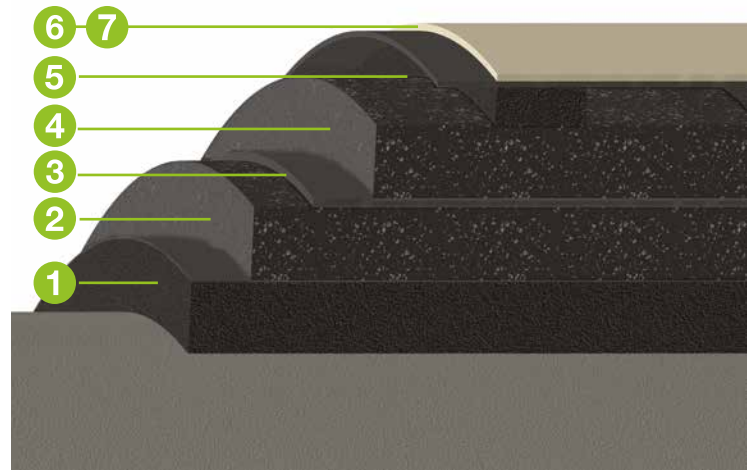
For each component the thickness in [mm] is provided.

AF (GRP) | CLASS C2



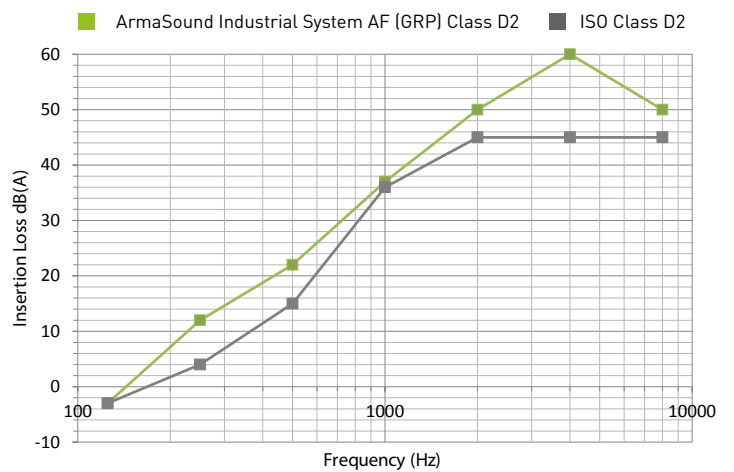
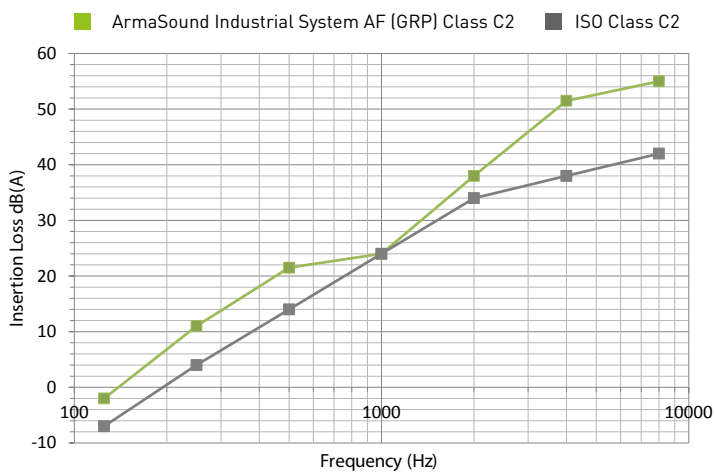
1	ArmaFlex Industrial	13 mm	4	GRP cladding	2.5 mm
2	ArmaSound RD240	25 mm			
3	ArmaSound Barrier E	4 mm			

AF (GRP) | CLASS D2



1	ArmaFlex Industrial	25 mm	4	ArmaSound RD240	25 mm
2	ArmaSound RD240	25 mm	5	ArmaFlex Spacer	13 mm
3	ArmaSound Barrier E	3 mm	6	ArmaSound Barrier E	2 mm
			7	GRP cladding	2.5 mm

Test results acc. to ISO15665 and Shell DEP 31.46.00.31-Gen.



Test results Class C2

Octave band centre frequency Hz

	125	250	500	1000	2000	4000	8000
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Insertion loss, dB	-2.0	11.0	21.5	24.0	38.0	51.5	55.0
ISO 15665 Class C2	-7.0	4.0	14.0	24.0	34.0	38.0	42.0

Total thickness (mm): 44.5
Total weight, flat [kg/m²]: 21.9

Test results Class D2

Octave band centre frequency Hz

	125	250	500	1000	2000	4000	8000
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Insertion loss, dB	-3.0	12.0	22.0	37.0	50.0	60.0	50.0
ISO 15665 Class D2	-3.0	4.0	15.0	36.0	45.0	45.0	45.0

Total thickness (mm): 95.5
Total weight, flat [kg/m²]: 31.6

// Email

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Technical enquiries

acoustic.services@armacell.com

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ABOUT ARMACELL

As the inventor of flexible foam for equipment insulation and a leading provider of engineered foams, Armacell develops innovative and safe thermal and mechanical solutions that create sustainable value for its customers. Armacell's products significantly contribute to global energy efficiency making a difference around the world every day.

With more than 3,300 employees and 25 production plants in 19 countries, the company operates two main businesses, Advanced Insulation and Engineered Foams. Armacell focuses on insulation materials for technical equipment, high-performance foams for acoustic and lightweight applications, recycled PET products, next-generation aerogel technology and passive fire protection systems.

For more information, please visit:
www.armacell.com


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