



Cryogenic insulation for reliability and performance
INDUSTRIAL PROCESS PIPEWORK AND TANKS



Armaflex[®]
FLEXIBLE CRYOGENIC SYSTEMS
PATENT PENDING

Armaflex Cryogenic Systems are high-performance thermal insulation systems designed to meet the demands of low-temperature environments. These multi-layered systems provide exceptional thermal performance, reduce the risk of corrosion under insulation, and minimise the time needed for installation.

Armaflex Cryogenic Systems are used on pipelines, tanks and equipment in production plants for petrochemicals, industrial gases, and agricultural chemicals. These systems are also designed for use on the import/export pipelines and process areas of LNG facilities. The consistent performance of Armaflex provides significant benefits to facility operators, including improved process control, reduced boil-off and on-going energy savings.

Unique Combination of Features

Armaflex cryogenic foams combine in a single material the key performance qualities that are traditionally only achieved through the labour-intensive combinations of several other materials (e.g. rigid foams combined with vapour retarders and contraction joints). They combine low thermal conductivity, in a light-weight (low density) foam that remains flexible at low temperatures. This flexibility provides a system that inherently absorbs vibrations and impact, to provide a robust and low-maintenance solution to the insulation of cryogenic pipelines, vessels and equipment.

Proven Performance

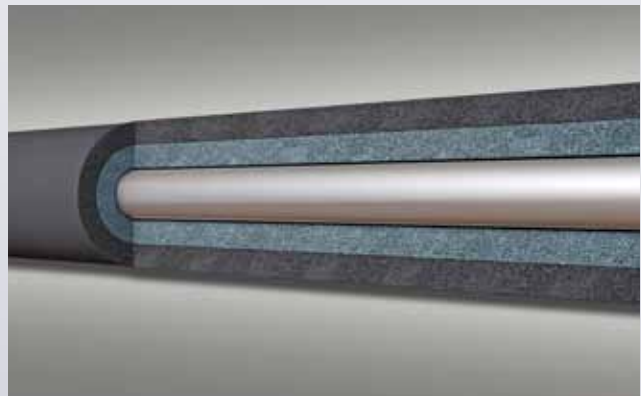
Armaflex elastomeric foams are widely recognised as a highly reliable material for cold applications. Since their invention in the 1950s by Armacell, which was then the insulation division of Armstrong World Industries, the applications of these foams has broadened to a diversity of industrial applications. In more recent decades this has included both thermal and acoustic solutions for heavy industry and petrochemical plants. Through continuous innovation and technical leadership, Armacell has developed a range of cryogenic systems (Patent Pending).



Key Benefits of Armaflex Cryogenic Systems:

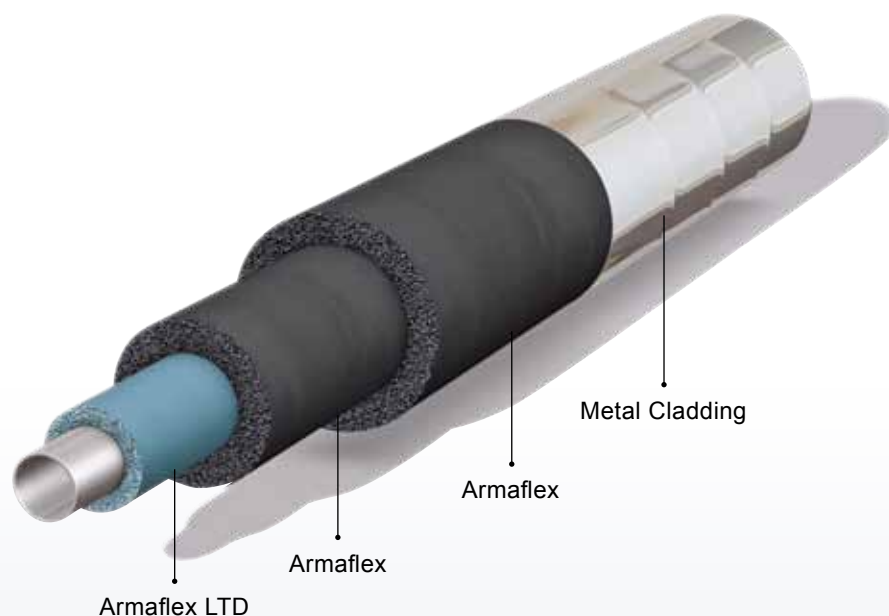
- » Low thermal conductivity
- » Built-in vapour resistance
- » Reduced risk of crack development and propagation
- » Suitable for applications from -196 °C to +125 °C
- » Low temperature flexibility
- » Built-in shock absorbance
- » Built-in contraction and expansion joints
- » Low density and weight
- » Cost effective
- » Low complexity to increase ease of installation
- » Fewer seams to provide a faster and more secure installation
- » Easily applied to awkward and difficult shapes
- » Easily handled and transported
- » Free of fibres, dust, CFCs and HCFCs

Only Armacell offers specific elastomeric solutions to provide Thermal Insulation Systems, Acoustic Insulation Systems, and Thermal-Acoustic Insulation Systems. These systems provide substantial benefits over conventional materials used for industrial and chemical processes at cryogenic temperatures.



Armaflex Cryogenic Systems

Armaflex Cryogenic Systems are multi-layered composites that combine the most cost-effective solution with low-temperature reliability. The Armaflex solution provides dedicated systems to maximize mechanical properties and overcome thermal stress.



Armaflex Cryogenic System

- » Armaflex Cryogenic Systems are suitable for temperatures to -196°C .
- » Inner layers of Armaflex LTD provide optimum mechanical properties at cryogenic temperatures, whilst outer layers of NBR-based Armaflex provide excellent thermal efficiency at the least cost.
- » Armaflex LTD is a purpose-built low-temperature Diene Terpolymer, providing low-temperature flexibility to minimise thermal stress.
- » The distinctive colour of Armaflex LTD facilitates installation and inspection.
- » The Armaflex System is fitted without vapour barriers over the insulation material. The high water-vapour resistance of Armaflex fulfills this function.
- » Armaflex Cryogenic Systems do not need traditional open-cell, fibrous in-fill pieces for contraction and expansion joints. The material itself can be fitted under compression to fulfill this function.

Armaflex LTD is suitable for applications to -110°C in its standard form. For some applications below -110°C the system is installed with an anti-abrasive foil bonded to the inner surface layer. Armaflex LTD anti-abrasive foil imparts superior surface strength to ensure long-term performance on pipework subject to vibration and regular movement. For operating temperatures below -180°C , Armaflex LTD is installed with an additional gas-tight barrier to prevent liquifaction of oxygen.

LNG Terminals



Ethylene Pipelines



Storage Tanks



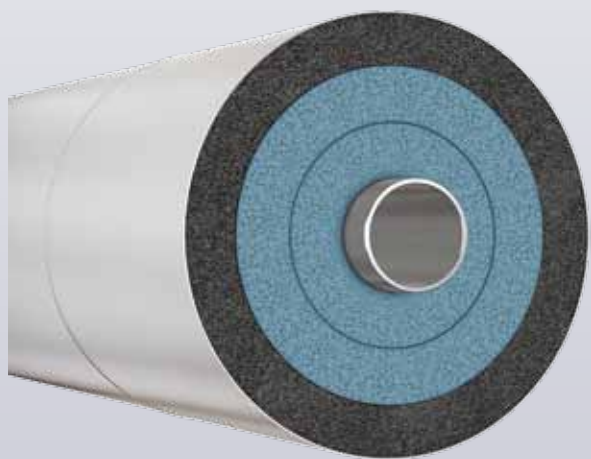
Ammonia Pipelines



Key Technical Properties

Property	Test Standard	Armaflex LTD	AF/Armaflex and Armaflex LT
Material Type	—	Diene Terpolymer	NBR
Thermal Conductivity (W/m·K) (λ)	ASTM C177 EN 12667	0.034 at -50 °C 0.028 at -100 °C 0.021 at -165 °C	0.035 at +20 °C 0.033 at 0 °C 0.028 at -50 °C
Density	ASTM D 1622	60 – 70 kg/m ³	40 – 60 kg/m ³
Recommended Operating Temperatures	NA	-196 °C to +125 °C	-50 °C to +105 °C
Closed Cell Content	ASTM D 2856	> 95%	> 95%
Water Vapour Permeability	ASTM E96	NA	$< 1.98 \times 10^{-11}$ g/(m·s·Pa)
Water Vapour Transmission Resistance Factor (μ -value)	EN 12086 EN 13469	NA	$\mu > 10,000$
PH	ASTM C871	6.0 – 8.0	6.0 – 8.0
Tensile Strength (MPa)	ASTM D 1623	0.30 at -100 °C 0.25 at -165 °C	0.15 at 0 °C 0.18 at -40 °C
Compressive Strength	ASTM D 1621	≤ 0.37 N/mm ² (2mm displacement) at -100 °C	≤ 0.16 N/mm ² (2mm displacement) at -40 °C

Solutions for Temperatures Below -110 °C



To meet the unique demands of insulation for low temperature pipelines, the Armaflex Cryogenic Systems incorporate additional features for applications to -196 °C. For these applications, the inner-most layer of Armaflex LTD is fabricated with an anti-abrasive layer of reinforced foil. This anti-abrasive layer provides added surface strength and gives enhanced protection from severe vibration and pipe movement.

Armaflex LTD is well suited to large thermal shifts expected from both facility operation and the cleaning of process piping. Armaflex LTD is heat resistant to +125 °C, providing the necessary tolerance expected during pipe cleaning with pressurised vapour or hot fluids.



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