

# ISOVER CRYOLENE for LNG and LPG applications

**Engineered thermal insulation solutions  
for cryogenic applications**



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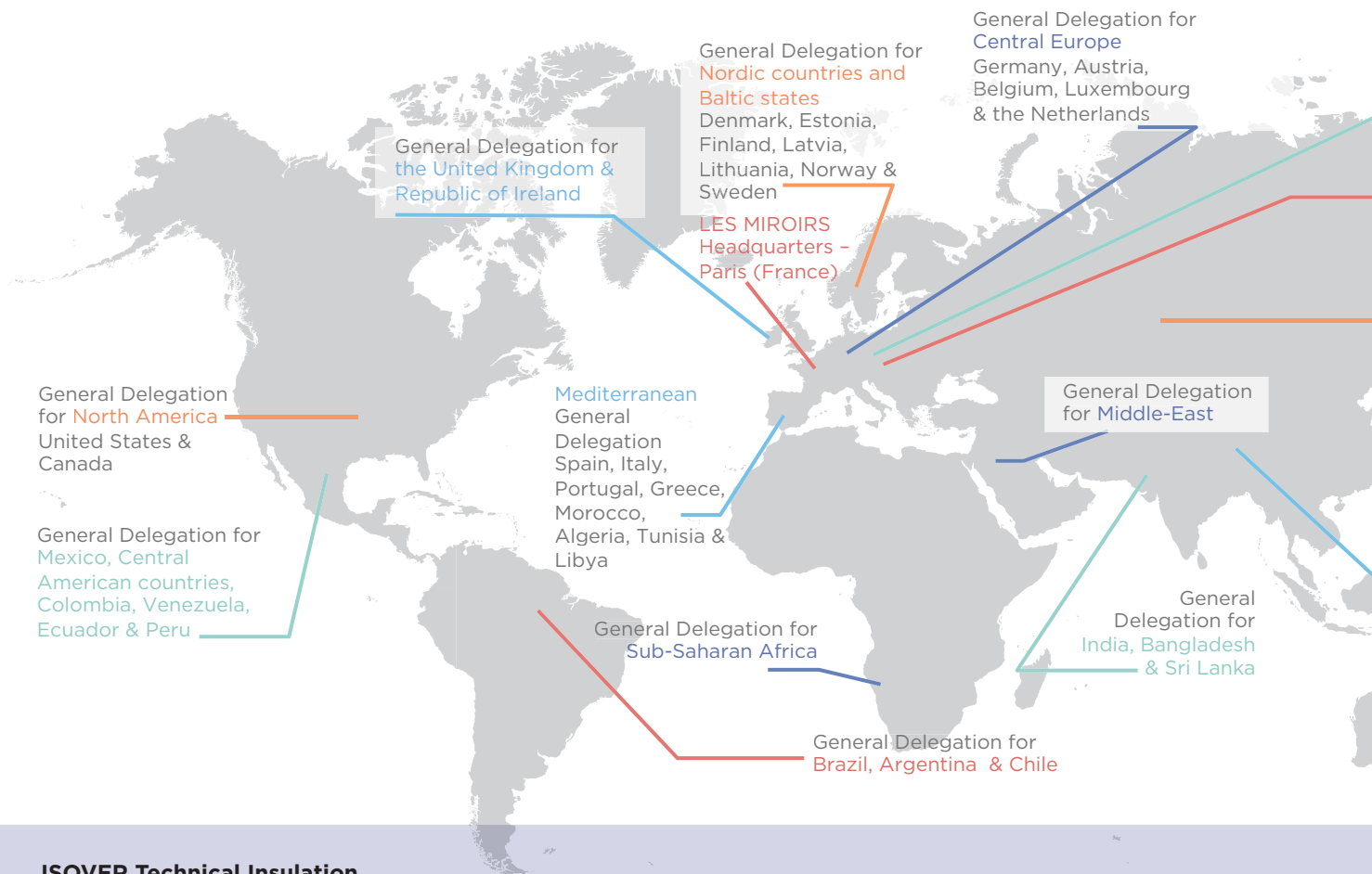
**ISOVER**  
SAINT-GOBAIN

# Introduction

## Saint-Gobain Group

Saint-Gobain designs, manufactures and distributes materials and solutions which are key ingredients in the wellbeing of each of us and the future of all. They can be found everywhere in our living places and our daily life: in buildings, transportation, infrastructure and in many industrial applications. They provide comfort, performance and safety while addressing the challenges of sustainable construction, resource efficiency and climate change.

**€39.1 billion in sales in 2016**  
**Operates in 67 countries**  
**More than 170,000 employees**



## ISOVER Technical Insulation

The ongoing rise in energy prices has highlighted the urgent need to reduce energy loss. This has led the insulation industry to focus on developing new and improved structural insulation products. The potential of energy savings in technical areas is still often underestimated or ignored.

As the world's leading insulation company ISOVER has highlighted the importance of effective insulation in the

so-called technical areas, such as Marine and Offshore, Industry, HVAC and Original Equipment Manufacturer (OEM), where effective insulation is not only important to save energy, but is often essential to personal protection.

We have used our recognised innovation skills to bring innovative and efficient technical solutions for these critically important markets.



# CRYOLENE - Solutions

Design specifications for storage tanks holding cryogenic fluid such as liquefied natural gas (LNG), liquid oxygen or nitrogen for chemical or combustion processes, are not only highly demanding in terms of construction, but also in terms of the insulation systems used. With the tank volume expanding and contracting depending on the level of liquid inside, the insulation must offer high levels of both compressibility and resilience.

To meet this requirement, ISOVER has developed the unique CRYOLENE solution for the insulation of cryogenic tank walls and roofs.

CRYOLENE products are highly resilient mineral wool rolls designed to retain their fibre elasticity over time at temperatures ranging from -170°C to +120°C. Different solutions have been developed for tank shells and suspended deck insulation. The product's extended length means that CRYOLENE solutions are easy and fast to install, with reduced thermal bridging.

Different facings, such as reinforced glass tissue or reinforced aluminium foil, give CRYOLENE products high tensile strength.

The properties and performance of CRYOLENE have been extensively tested by external laboratories, and the products are well-proven through decades of successful use worldwide in chemical and LNG applications.



General Delegation for  
Poland, Bulgaria  
Romania & Turkey

General Delegation for  
Albania, Czech Republic,  
Slovakia, Hungary & East  
Adriatic countries

General Delegation for  
Russia, Ukraine &  
Commonwealth of  
Independent States  
(CIS)

General Delegation for  
Asia-Pacific  
China, Australia,  
Cambodia, South Korea,  
Indonesia, Japan, Laos,  
Malaysia, New Zealand,  
Philippines, Thailand &  
Vietnam



# CRYOLENE - Specification



**Product description:**

- CRYOLENE is a highly resilient mineral wool blanket. It is faced on one side either with a reinforced glass tissue (V.V.) or a reinforced aluminium foil (A.A.).
- CRYOLENE is supplied in rolls for use as a resilient thermal insulation for all types of storage tanks and vessels operated at cryogenic temperatures.
- CRYOLENE is suitable for use in combination with Perlite and other cryogenic insulation materials.

**CRYOLENE standard product range:**

- CRYOLENE 681 for suspended decks
- CRYOLENE 682 for tankshells
- CRYOLENE 684 for pipe connections

**Tensile strength:**

- A unique manufacturing process of our mineral wool together with the incorporated facing, gives the CRYOLENE blanket high tensile strength values.

- Especially for the shell the reinforced aluminium foil facing has been carefully designed to prevent blanket failure resulting from the friction imposed during perlite filling and subsequent settling (Data Sheets of facings available upon request)

**Fire performance:**

The extremely low content of binder provides our CRYOLENE with an Optimum Fire Performance Euroclass Classification (testing in hand):

- With glass tissue (V.V.): A1  
Fire Spread Index = 0;  
Smoke Development Index < 20
- With aluminium foil (A.A.): A2-s1, d0.  
Fire Spread Index < 25;  
Smoke Development Index < 25

**Temperature range:** - 170 °C to + 120 °C.

CRYOLENE	Tolerance	Standard	CRYOLENE 681	CRYOLENE 682	CRYOLENE 684
density(kg/m <sup>3</sup> )	±5 %	EN 1602	12	17.5	24
thickness	-	EN 823	50 to 200 ( - 0 + 15 mm)	50 to 150 ( - 0 + 15 mm)	50 to 150 ( - 0 + 5 mm)
width (mm)*	±5 mm	EN 822	1,200 to 2,000		
length (mm)	- 0 + 200 mm	EN 822	Depends on thickness and product type Up to 40,000 for CRYOLENE 682		

\* Smaller and larger widths available on request

**Resilience: CRYOLENE 682**

CRYOLENE 682 successfully passes compression tests typically required by our Customers.

(e.g. Test according to SNCMP-ENTREPOSE):

Load KN/m <sup>2</sup>	Average (%)	Min (%)	Max (%)
0.5	65	59	71
1.0	50	44	56
2.5	35	29	40
4.0	29	25	33

Limit values of thickness under load as percentage of the nominal thickness

**Thermal conductivity W/(m·K)\***

\* FIW test reports N° F.2-1002a/04 and F.2-954a/04

	-150°C	-100°C	-50°C	0°C	10°C
CRYOLENE 681	0.015	0.021	0.028	0.037	0.039
CRYOLENE 682	0.013	0.019	0.026	0.034	0.036
CRYOLENE 684	0.013	0.019	0.026	0.034	0.036

**Thermal stability :** consistent longterm thermal performance even after temperature „shocks“.

**Corrosiveness :** meets requirements for use with aluminium, steel or copper.

**Water resistance :** non-hygroscopic.

**Fungus resistance :** does not breed or promote fungal growth.

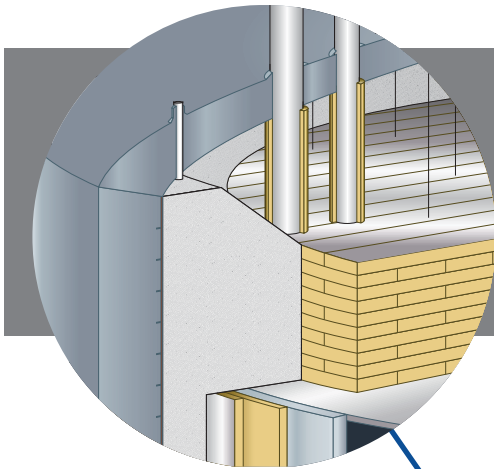
**Material Safety Data Sheet :** available on request.



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# CRYOLENE - Installation



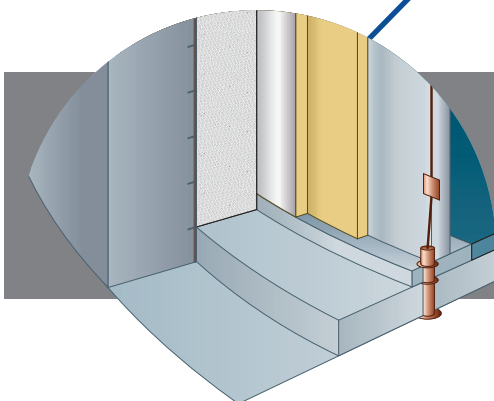
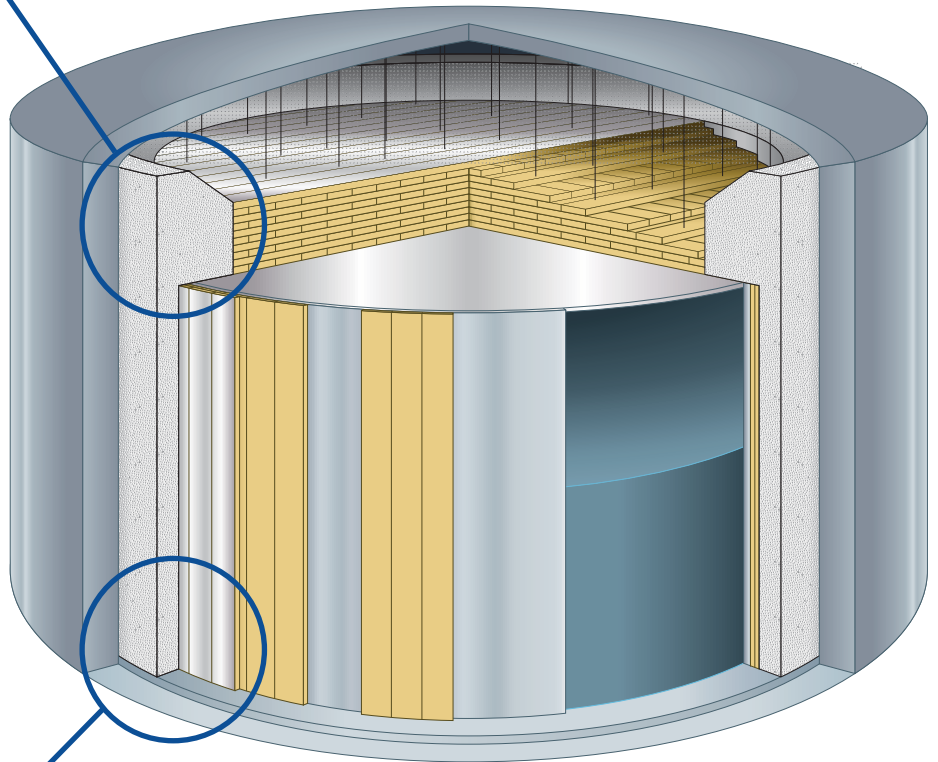
## Deck section:

The top layer of CRYOLENE must be covered by an Alu glass scrim laminate, a facing for mineral wool used as vapour barrier and reflection layer, to avoid dust drop into the insulation. Studs must be taped when penetrating insulation. It is recommended to install the last 2 m section of the deck after the wall perlite works have been completed.

## Vertical section:

CRYOLENE 682 with large dimensions (length up to 40 m, width up to 2.2 m) as well as optimum thermal, fire and tensile performance provides tremendous benefits for our customers:

- Reduced installation times: just one roll for the entire height
- More quantity of insulation installed in one go
- Less safety risk on site: less man-hours & less fire risk
- Easier installation: unrolling process top down or bottom up
- Better thermal performance due to less joints and bridges



## Vertical lower section:

All CRYOLENE layers have to be tightly butted, normally staged with alternate layers overlapped.

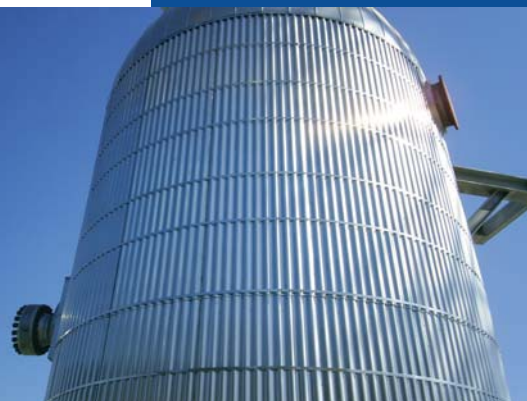


# CRYOLENE - References

ISOVER has more than 30 years practical experience in LNG insulation gained through participation in major projects worldwide. Sharing knowledge with our clients, we have developed optimised solutions that combine performance with practicality and reliability.

ISOVER takes its responsibilities to customers seriously, ensuring quality products through internal and external quality control and certification – coupled with just in time delivery so our products are there when you need them.

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Project	Country	Customer	Schedule	Products	Remarks
Montoir	France	Consortium	1983	CRYOLENE	LNG
Zeebrugge	Belgium	Consortium	1985	CRYOLENE 682	LNG
Enagas Huelva	Spain	CBI	1986	CRYOLENE	LNG
Dhabol	India	Raven / Insultec / Punj	2001	CRYOLENE 681 & 682	LNG
Hazira	India	Wanner	2002	CRYOLENE 684	LNG
Damietta	Egypt	Wanner	2002	CRYOLENE 684	LNG
Sines	Portugal	Entrepose Contracting	2003	CRYOLENE 681	LNG
Ratnagiri	India	Raven / Insultec / Punj	2006	CRYOLENE 682	LNG
Kharg Island	Iran	Tissot / Technip	2006	CRYOLENE 681 & 682	Ethylene
Reganosa	Spain	Entrepose Contracting	2006	CRYOLENE 681	LNG
Houston Freeport	USA	SPI / Technip	2007	CRYOLENE 681	LNG
Zeebrugge (Fluxys)	Belgium	Technigaz / Saipem	2007	CRYOLENE 681	LNG
Fos Cavaou	France	Sofregaz	2007	CRYOLENE 681	LNG
South Pars	Iran	Raven / Weir	2007	CRYOLENE 681 & 682	LPG
Adriatic LNG	Italy	Raven / Whessoe	2008	CRYOLENE 681 & 682	LNG (GBS)
Canaport	Canada	SNC / CENMC	2008	CRYOLENE 681	LNG
Pearl GTL	Qatar	Qatar Shell GTL	2008	CRYOLENE 684	LNG
Ratnagiri	India	Raven / Insultec / Punj	2008	CRYOLENE 682	LNG
Xinjiang Guanghui	China	Bis-Oki	2009	CRYOLENE 682	LNG
Arzew	Algeria	Entrepose Contracting	2009	CRYOLENE 681	LNG
Gate Rotterdam	Holland	Entrepose Contracting	2009	CRYOLENE 681	LNG
Algeria	Algeria	Prezioso	2009	CRYOLENE 684	LNG
Ratnagiri	India	Raven / Insultec	2009	CRYOLENE 682	LNG
Iran	Iran	Kaefer Wanner	2009	CRYOLENE 684	LNG
Tongyoung	Korea	Haniso / Jeong Yeon	2009	CRYOLENE 682	LNG
Canaport	Canada	CNC / SNAM	2009	CRYOLENE 681	LNG
Tananger	Norway	Glava / Bis Industrier	2009	CRYOLENE 682	LNG
Tongyeong	South Korea	Deawoo	2009	CRYOLENE 682	LNG
Tongyeong	South Korea	Hyundai	2009	CRYOLENE 682	LNG
Gate Rotterdam	The Netherlands	Entrepose Contracting	2010	CRYOLENE 681	LNG
Dabhol	India	Raven / Insultec	2010	CRYOLENE 682	LNG
Ningbo	China	Kaefer GmbH	2010	CRYOLENE 682	LNG
Huelva	Spain	UTE ACEC	2010	CRYOLENE 681	LNG
Nynäshamn	Sweden	Glava / Bis Industrier	2010	CRYOLENE 682	LNG
Guang'an	China	Chemtex USA	2010	CRYOLENE 681	LNG
Ningxia Hanas	China	Technip Malaysia	2010	CRYOLENE 681	LNG
UAE	UAE	Kaefer UAE	2010	CRYOLENE 684	LNG
Pyeongtaek	South Korea	Doosan	2010	CRYOLENE 682	LNG
Pyeongtaek	South Korea	Hanyang	2010	CRYOLENE 682	LNG
Nantong	China	Consortium	2010	CRYOLENE 681	LNG





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Project	Country	Customer	Schedule	Products	Remarks
<b>Pyeongtaek</b>	South Korea	Hyundai	2011	CRYOLENE 682	LNG
<b>Mexico LNG</b>	Mexico	Samsung Engineering	2011	CRYOLENE 681	LNG
<b>Nantong</b>	China	Consortium	2011	CRYOLENE 681	LNG
<b>Nantong</b>	China	Consortium	2012	CRYOLENE 681	LNG
<b>Sines</b>	Portugal	Lindner	2012	CRYOLENE 681	LNG
<b>Rotterdam</b>	The Netherlands	Entrepose Contracting	2012	CRYOLENE 681	LNG
<b>Tongyeong</b>	South Korea	KyungNam	2012	CRYOLENE 682	LNG
<b>Bungtau</b>	Vietnam	POSCO	2012	CRYOLENE 682	LPG
<b>Goteborg</b>	Sweden	Consortium	2013	CRYOLENE 681	LNG
<b>Dunkirk</b>	France	Entrepose Contracting	2014	CRYOLENE 681 & 684	LNG
<b>Świnoujście</b>	Poland	Saipem Prezioso	2014	CRYOLENE 681	LNG
<b>Ichthys</b>	Australia	Entrepose Contracting	2014	CRYOLENE 681	LNG
<b>Wheatstone</b>	Australia	Entrepose Contracting	2014	CRYOLENE 681	LNG
<b>Mexico DF</b>	Mexico	Maraldi	2014	CRYOLENE 682	Ethylene
<b>Kuwait</b>	Kuwait	Kaefer	2014	CRYOLENE 682	Ethylene
<b>Samcheok</b>	South Korea	Daerim	2014	CRYOLENE 681 & 682	LNG
<b>Samcheok</b>	South Korea	GS	2014	CRYOLENE 682	LNG
<b>NLTF</b>	Kuwait	GS Engineering	2014	CRYOLENE 681	LPG
<b>Pori</b>	Finland	Gasum	2015	CRYOLENE 681 & 684	LNG
<b>Samcheok</b>	South Korea	KyungNam	2015	CRYOLENE 682	LNG
<b>Samcheok</b>	South Korea	Daewoo	2015	CRYOLENE 681 & 682	LNG
<b>Samcheok</b>	South Korea	SCI	2015	CRYOLENE 682	LNG
<b>Samcheok</b>	South Korea	SK	2015	CRYOLENE 682	LNG
<b>Samcheok</b>	South Korea	Hyundai	2015	CRYOLENE 681 & 682	LNG
<b>Yamal</b>	Russia	Entrepose Contracting	2016	CRYOLENE 681 & 684	LNG
<b>Samcheok</b>	South Korea	POSCO	2016	CRYOLENE 681 & 682	LNG
<b>Boryeong</b>	South Korea	GS	2016	CRYOLENE 681 & 682	LNG
<b>Boryeong</b>	South Korea	SK	2016	CRYOLENE 682	LNG
<b>Samcheok</b>	South Korea	HanWha	2017	CRYOLENE 681 & 682	LNG
<b>Samcheok</b>	South Korea	Hanyang	2017	CRYOLENE 681 & 682	LNG
<b>SLNG</b>	Singapore	SCT	2017	CRYOLENE 681	LNG
<b>RGT-2</b>	Malaysia	SCT	2017	CRYOLENE 681	LNG



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