Freyssinet Post-Tensioning System for Liquefied Natural Gas Tanks

Design, Build, Maintain

Freyssinet
SUSTAINABLE TECHNOLOGY

CX1

CE

Front page picture:
Costa Azul, Mexico,2 tanks of 160,000 m³

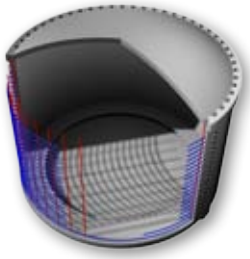
Ikdu, Egypt, 2 tanks of 140,000 m³

Cameron, USA, 3 tanks of 160,000 m³

Sakai LNG, Japan,
3 tanks of 140,000 m³

Prestressed concrete tanks for cryogenic use

Liquefied natural gas (LNG) is natural gas that has been super cooled to a temperature around -162°C whereby it condenses into a liquid form. The liquid, which remains at normal atmospheric pressure, occupies 600 times less space than gas and weighs 45% of an equivalent amount of water, making LNG easy to transport and store. The outer shell of a typical LNG tank is a containment vessel made in prestressed concrete.



Prestressing technology consists in applying permanent compressive stresses induced by high-strength steel tendons stressed in the concrete in order to strengthen the structure and ensure the liquid tightness of the LNG at very low temperature.

The quality and performance of the Freyssinet cryogenic prestressing system make it the solution of excellence for the building of LNG storage tanks.

Freyssinet post-tensioning jacks with hydraulic lock-off system

Pluto, Australia, 2 tanks of 120,000 m³

Rayong, Thailand, 2 tanks of 160,000 m³

Sakhalin, Russia, 2 tanks of 100,000 m³

Fos-sur-Mer, France, 3 tanks of 110,000 m³

Bonny Island, Nigeria, 2 tanks of 150,000 m³

Guangdong, China
2 tanks of 160,000 m³

Freyssinet experience: Innovation and expertise to risk out your project

Freyssinet, a world leader in post-tensioning, designs and implements technically and economically optimised solutions and brings together assets that contribute to LNG projects success.

As a result of continuous research and development work over more than seventy years, Freyssinet has developed a complete range of innovative products and processes designed to support its Clients and to meet the specific requirements of LNG tanks.

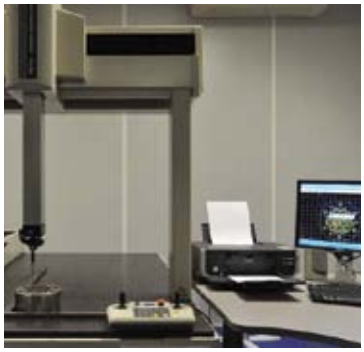
Freyssinet system complies with the European Technical Agreement Guideline (ETAG 013) known as one of the most stringent international standard for post-tensioning kits. Freyssinet is the holder of the ETA n°06/0226, covering the application under cryogenic conditions, and of the CE marking certificate n°1683 - CPD-0004.

Freyssinet integrated offer: from studies to construction

- Design, engineering and tests
- Construction methods
- Materials and equipments supply
- Technical assistance and works implementation

Freyssinet C-system anchorage

This engineering contractor culture makes Freyssinet the ideal partner for LNG tanks projects in the respect of the highest quality and safety requirements. The Freyssinet expertise goes hand-in-hand with the professionalism of its teams, located all over the world and trained within the Freyssinet PT Academy.



Production control in Freyssinet factory in France

Cryogenic test on Freyssinet C-system

Reference List for LNG & LPG Tanks with Prestressed Concrete

Project	Country	Date	Client	Tanks number & capacity
Montoir de Bretagne	France	1978-1982	Gaz de France	3 x 120,000 m³
Maasvlakte	Netherlands	1980-1982	Protech international BV / Schiedam	2 x 57,250 m³
Das Island	Abu Dhabi	1983-1985	Pullman Kellog / Tractobel	3 x 80,000 m³ + 4 x 50 000 m³
Himeji Plant No.1-2-3	Japan	1983-1988	Obayashi Corp. / Konoike	3 x 80,000 m³
Zeebrudge	Belgium	1986-1988	Tractobel	3 x 100,000 m³
Senboku No.2 -16,17	Japan	1990-1996	Obayashi Corp. / Konoike	2 x 140,000 m³
Ereglesi	Turkey	1991-1993	SN Techni Gaz	3 x 85 000 m³
Pyeong Taek	South Korea	1991-1993	UIE Technigaz & Korea Gas Corp	5 x 100,000 m³
Nihon Gas	Japan	1993-1996	Obayashi Corp.	1 x 36,000 m³
Sasebo No.2 Plant	Japan	1993-1996	Obayashi Corp.	1 x 1,000 m³
Bonny Island	Nigeria	1996-1998	Dukim / Dumez	5 x 150,000 m³
Senboku No.2 -18	Japan	1997-2000	Obayashi Corp. / Konoike	1 x 180,000 m³
Atlantic	Trinidad	1998-1999	Bechtel / Whessoe	2 x 130,000 m³
Formosa	Taiwan	2000-2002	Tractobel	3 x 80,000 m³
Aliaga	Turkey	2000-2001	Egegaz	3 x 170,000 m³
Petronas MLN3, Bintulu	Malaysia	2000-2002	TKK /Sato Kogyo	1 x 120,000 m³
Himeji Plant No.2-4	Japan	2000-2003	Obayashi Corp. / Konoike	1 x 180,000 m³
Okayama Gas	Japan	2001-2002	Obayashi Corp.	1 x 7,000 m³
Shikoku Gas	Japan	2001-2002	Obayashi Corp.	1 x 14,000 m³
Atlantic	Trinidad	2002-2003	Bechtel / CB&I	1 x 160,000 m³
Mizushima Plant No.1	Japan	2002-2006	Obayashi Corp. / Takenaka Civil Eng.	1 x 160,000 m³
Sakai LNG Center 1-3	Japan	2002-2007	Shimizu Corp.	3 x 140,000 m³
Nihon Gas NO.2	Japan	2003-2006	Obayashi Corp.	1 x 50,000 m³
Guangdong	China	2004-2006	STTS	2 x 160,000 m³
Huelva IV, V & VI	Spain	2004-2009	Technigaz / Inigaz / Necso UTE / Acciona Infraestructuras	3 x 150,000 m³
Idku	Egypt	2004-2006	Bechtel	2 x 140,000 m³
South Pars	Iran	2004-2006	TIJD JV	2 x 55,000 m³ - 2 x 40,000 m³
Altamira	Mexico	2004-2006	IHI ICA / Fluor Daniel	2 x 150,000 m³
Sakhalin	Russia	2004-2007	CB&I	2 x 100,000 m³
Mugardos I & II	Spain	2005-2006	Acciona Infraestructuras / Tractobel	2 x 150,000 m³
Fos sur Mer	France	2005-2007	Besix / Demathieu et Bard	3 x 110,000 m³
Yankee Gas	USA	2005-2007	CB&I / O&G	1 x 348 BBL
Costa Azul	Mexico	2005-2006	Vinci Construction Grands Projets	2 x 160,000 m³
Grain LNG phase 1 & 2	UK	2005-2011	CB&I / Taylor Woodrow / Balfour Beatty NCC JV	4 x 190,000 m³
Canaport	Canada	2006-2007	SNC / CEMNC / Saipem	2 x 150,000 m³
Cameron	USA	2006-2008	AKIC / IHI	3 x 160,000 m³
Zeebrudge	Belgium	2006-2008	CFE	1 x 180,000 m³
Adriatic LNG Termnial	Spain	2006-2008	Acciona Infraestructuras	2 x 125,000 m³
Cartagena V	Spain	2007-2009	Acciona Infraestructuras / Initec	1 x 150,000 m³
Pluto	Australia	2008-2009	CB&I	2 x 120,000 m³
Soyo	Angola	2008-2010	TKK / Bechtel	2 x 159,000 m³ - 1 x 88,000 m³ - 1 x 59,000 m³
Gate	Netherlands	2008-2010	CFE	3 x 180,000 m³
Mizushima Plant No.2	Japan	2008-2010	Obayashi Corp.	1 x 160,000 m³
Rayong	Thailand	2008-2010	GS Engineering & Construction	2 x 160,000 m³
Pyeong Taek #21	South Korea	2008-2011	Hyun-Dai E&C	1 x 200,000 m³
Hinoura Plant	Japan	2008-2011	Shimizu Corp.	2 × 180,000 m³
Dalian & Jiangsu	China	2008-2011	HQCEC	6 x 160,000 m³
Skikda	Algeria	2009-2010	Vinci Construction Grands Projets	1 x 150,000 m³ - 2 x 66,200 m³
Manzanillo	Mexico	2009-2011	Samsung	2 x 150,000 m³
Naoetsu Tanks	Japan	2009-2011	Shimizu Corp.	2 × 180,000 m³

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