

Zeitschrift: IABSE structures = Constructions AIPC = IVBH Bauwerke
Band: 7 (1983)
Heft: C-27: Recent structures: Part I

Artikel: LNG inground storage tanks (Japan)
Autor: The Tokyo Electric Power Co., Inc.
DOI: <https://doi.org/10.5169/seals-18278>

Nutzungsbedingungen

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

Conditions d'utilisation

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

Terms of use

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

Download PDF: 04.05.2026

ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>



4. LNG Inground Storage Tanks (Japan)

Owner:	<i>The Tokyo Electric Power Co., Inc.</i>
Engineers:	<i>The Tokyo Electric Power Co., Inc./Tokyo Electric Power Services Co., Ltd.</i>
Contractor:	<i>Kajima Corporation/ Simizu Construction Co., Ltd. (Civil Work)</i>
Site:	<i>Futtsu Thermal Power Station, The Tokyo Electric Power Co., Inc., Chiba-ken, Japan</i>
Dimensions:	<i>diameter: 70 m depth: 38 m side wall thickness: 2.3 m bottom slab thickness: 5.5 m</i>
Quantities of materials (per one tank for civil work):	<i>37,000 m³ concrete 6,000 t reinforcing bar</i>
Work's duration:	<i>43 months (including appurtenant work)</i>
Service date:	<i>1985</i>

Introduction

LNG (liquefied natural gas) is the colorless liquid which temperature is -162°C . LNG is very clean energy, that is, it doesn't include any impurities. The inground storage tank consists of inground cylindrical body, aboveground dome-shaped roof, and inner membrane container.

The reinforced concrete bodies — i.e. a cylindrical side wall and circular bottom slab — withstand several loads, such as earth pressure containing liquid pressure, etc. The stainless steel membrane works as a liquid container. There is a heat insulation layer between the concrete body and the membrane. The steel roof is a gas-tight structure supporting a suspended deck.

The greatest advantage of the inground LNG storage tanks is the high degree of safety: there is no possibility of liquid spilling onto the ground surface.

Design

In the design of the concrete body, the following loads are taken into consideration:

- dead weight
- gas pressure by vaporized LNG
- liquid pressure by LNG
- earth pressure
- ground-water pressure

- roof load
- thermal load
- loads caused by earthquake

Design loads (4) and (8) are not axisymmetrical. The thermal load means the function that generates the thermal stresses.

The thermal stresses are caused by the temperature distribution in the side wall and bottom slab, due to the cryogenic temperature of LNG.

The loads caused by earthquake are the earth pressure increase during earthquake, the inertia forces of concrete body and roof, and the dynamic liquid pressure of LNG.

The seismic coefficient is 0.3 at the ground surface.

Construction

The construction procedure of the inground tank is as follows:

- 1st step: construction of cut-off and retaining wall (slurry wall)
- 2nd step: excavation of the inner ground of the slurry wall
- 3rd step: casting of bottom slab concrete
- 4th step: casting of side wall concrete
- 5th step: erection of steel roof
- 6th step: installation of insulation and membrane

Research and Development

The following research and development has established the inground LNG storage technology:

1. research on the material properties under low temperatures — concrete, reinforcing bars, and reinforced concrete,
2. research on the seismic behavior of inground tank,
3. research on the properties of frozen soil and frost heaving,
4. development of analytic programme — heat conduction analysis, structural analysis, and seismic analysis,
5. development of the construction technology of deep slurry wall for the retaining and water cutoff wall,
6. development of the heater system technology to control the soil freezing,
7. development of the design and construction technology of mass concrete — such as very thick bottom slab.

(TEPC)

