MESA ENGINEERING

SERVICES CATALOG
2026



LNG · CRYOGENIC MEMBRANE SYSTEMS

MARK III
MEMBRANE SYSTEMS

Panel bonding · Triplex secondary barrier · Membrane welding · Quality control

PHONE
+7 922 480 91 81

E-MAIL
info@mesa-eng.com

INSTAGRAM
@mesa.engineering



CATALOG

Mark III

Photo: Thinfourth, Wikimedia Commons, CC0 1.0

TABLE OF CONTENTS

Contents

01 What Is a Membrane System — 03
Purpose and applications

02 Membrane or 9% Ni Tank — 04
Key advantages

03 Mark III Design — 05
Layer-by-layer section

04 Corrugations, Knots and Corners — 06
Membrane details

05 Materials — 07
What the system is made of

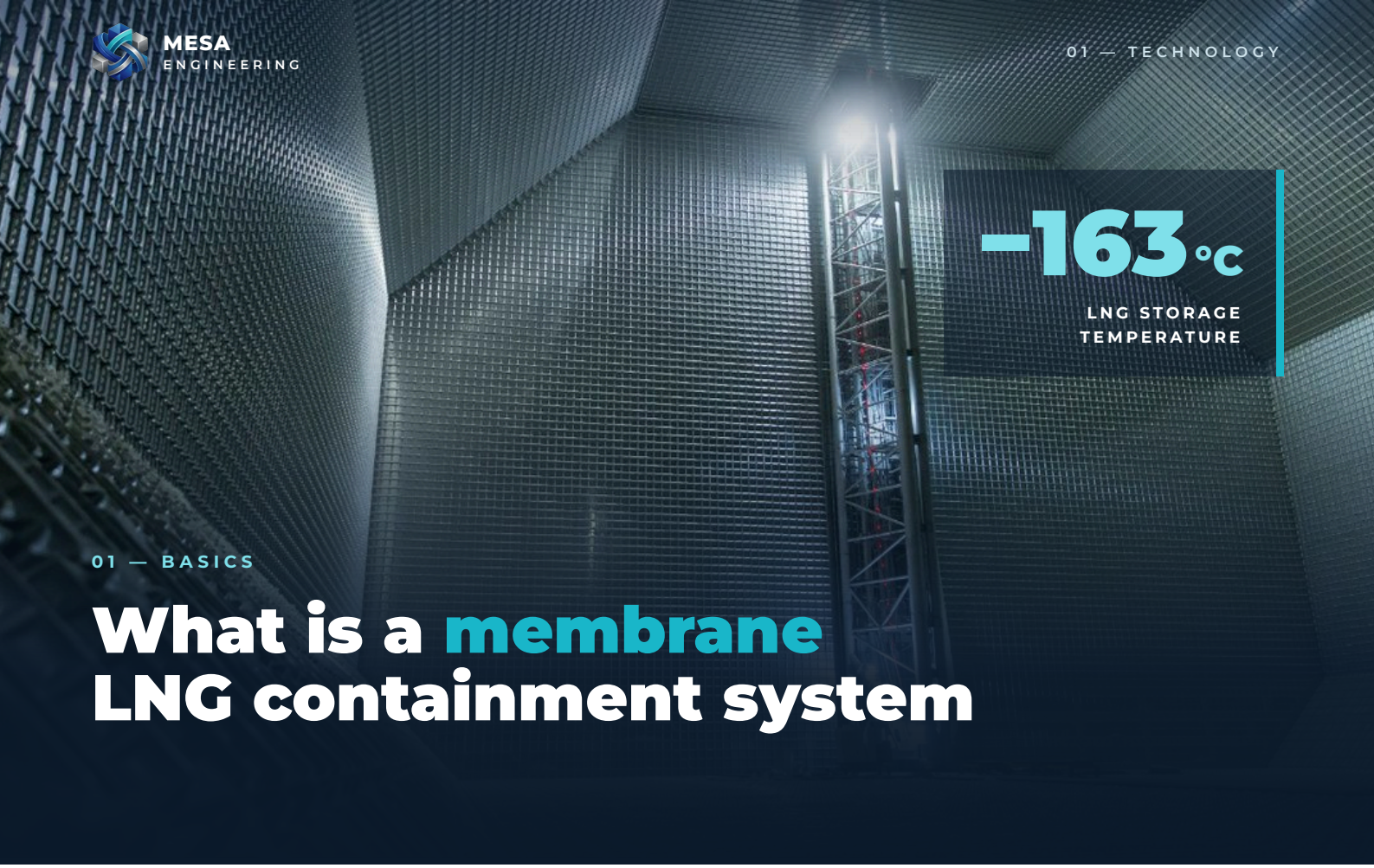
06 Bonding and Welding — 08
Installation technology

07 Work Sequence — 09
10 stages

08 Quality Control — 10
Testing and acceptance

09 Team Experience — 11
Arctic LNG 2 · Zvezda Shipbuilding Complex

10 Why MESA · Contacts — 13



−163 °C

LNG STORAGE TEMPERATURE

01 — BASICS

What is a membrane LNG containment system

Primary membrane

thin corrugated stainless steel sheet in contact with the LNG

Secondary barrier

backup liquid-tight envelope

Insulation

load-bearing reinforced polyurethane foam panels

APPLICATIONS

LNG carriers

membrane tanks are the main type of cargo containment

FSRU / FSU

floating storage and regasification

GBS

tanks inside concrete gravity-based structures

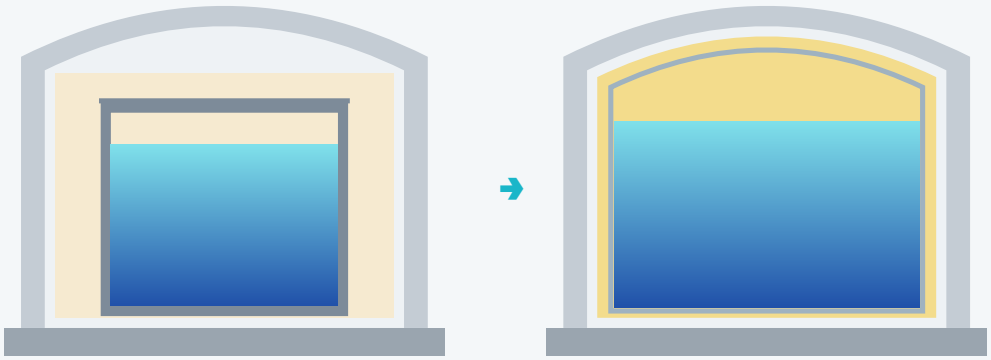
Onshore tanks

full-containment membrane tanks

02 — COMPARISON

Membrane or 9% Ni tank

LNG tanks use two main solutions: a self-supporting inner tank made of 9% nickel steel, or a thin membrane on a load-bearing structure.



9% Ni inner tank
thick-walled steel + loose-fill insulation

1.2 mm membrane
panels + membrane on the wall

Simplified diagram, not to scale.

1.2 mm instead of a thick wall

Liquid tightness is provided by the thin membrane; loads are carried by the supporting structure.

More usable volume

The membrane and panels take up less space than a separate inner tank.

Prefabricated components

Standard factory-made panels and sheets, assembled on site.

Corrugations vs. deformation

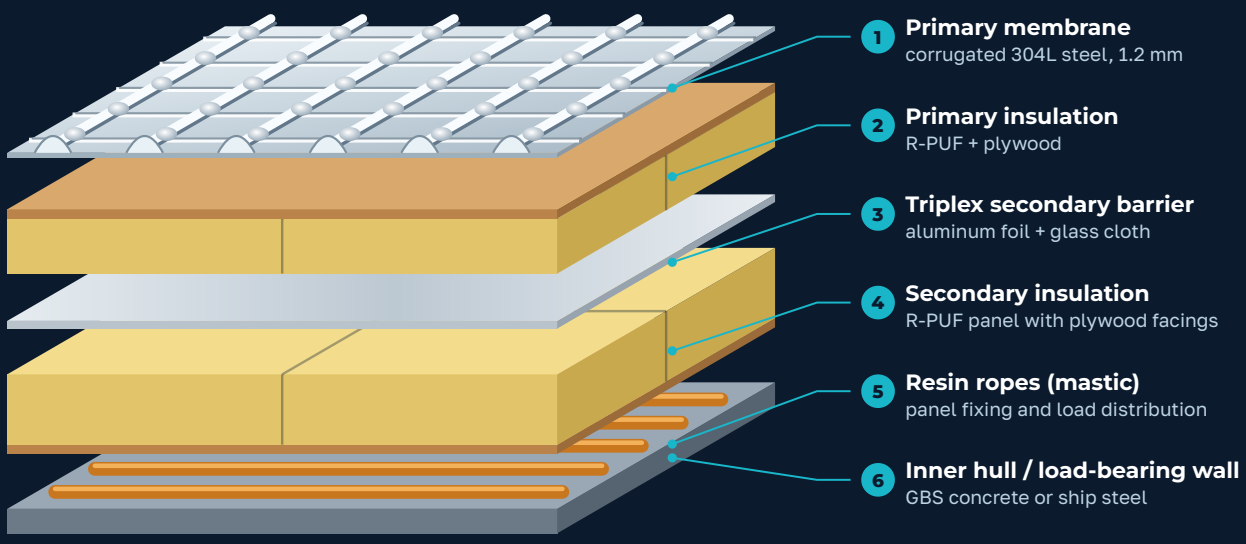
A double grid of corrugations accommodates thermal contraction.

up to ~10% more LNG in the same concrete outer shell, according to GTT data for onshore membrane tanks

03 — DESIGN

How the Mark III system is built

The membrane, insulation and secondary barrier form a single prefabricated system fixed directly to the load-bearing structure.



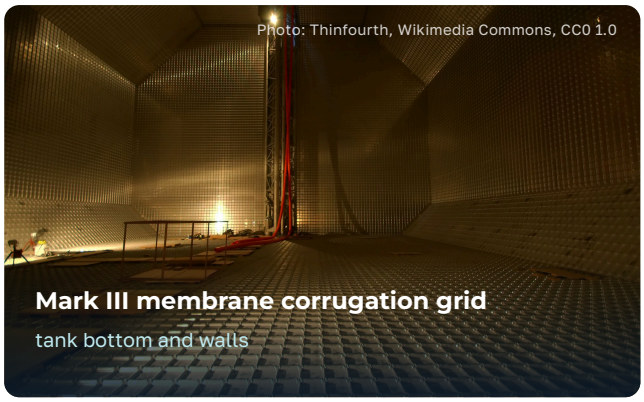
Exploded view; in the factory-made panel, the Triplex secondary barrier sits between the polyurethane foam layers. Simplified diagram, not to scale.

LIQUID TIGHTNESS	THERMAL INSULATION	LOAD TRANSFER
Membrane + Triplex	R-PUF panels	Plywood + mastic

304L	1.2 mm	3 × 1 m	R-PUF
STAINLESS STEEL OF THE PRIMARY MEMBRANE	MEMBRANE THICKNESS	STANDARD SHEET AND PANEL SIZE	REINFORCED POLYURETHANE FOAM

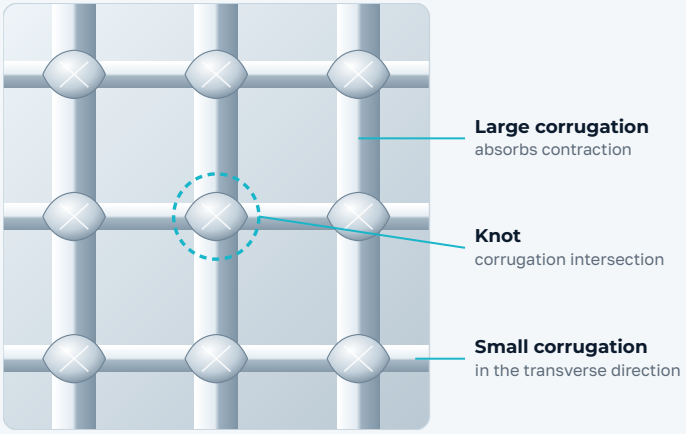
04 — DETAILS

Corrugations, knots & corners



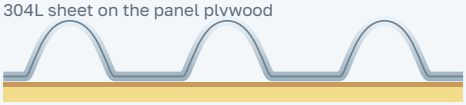
TOP VIEW

Double corrugation grid



SECTIONS

Large corrugation
304L sheet on the panel plywood

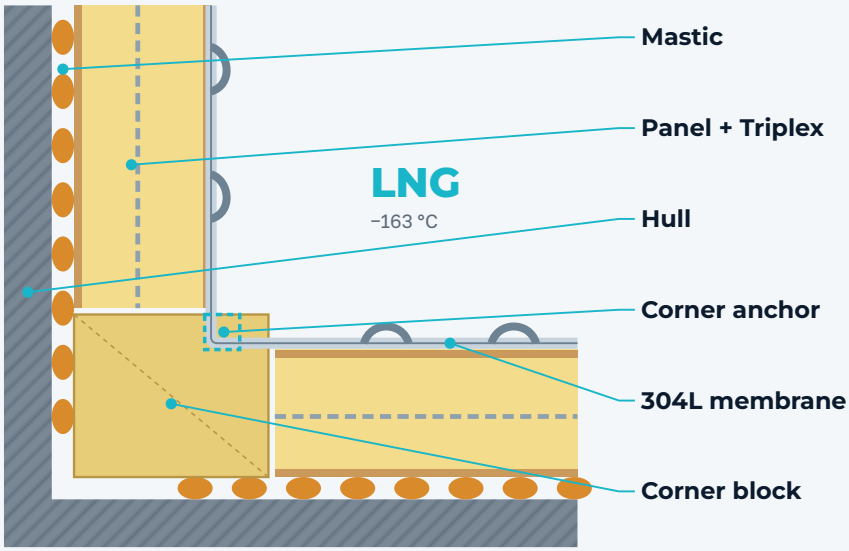


Small corrugation
lower height, transverse direction



CORNER ZONE

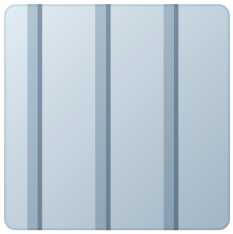
Bottom-to-wall corner



Simplified diagram, not to scale.

05 — MATERIALS

What the system is made of



304L membrane

Corrugated 1.2 mm stainless steel sheets, standard size 3 × 1 m.



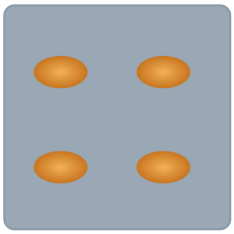
R-PUF panels

Glass-fiber-reinforced polyurethane foam with plywood facings on both sides.



Triplex

Aluminum foil between layers of glass cloth and resin; acts as the secondary barrier.



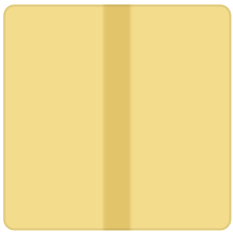
Resin ropes

Resin-based mastic that fixes the panels and transfers loads evenly.



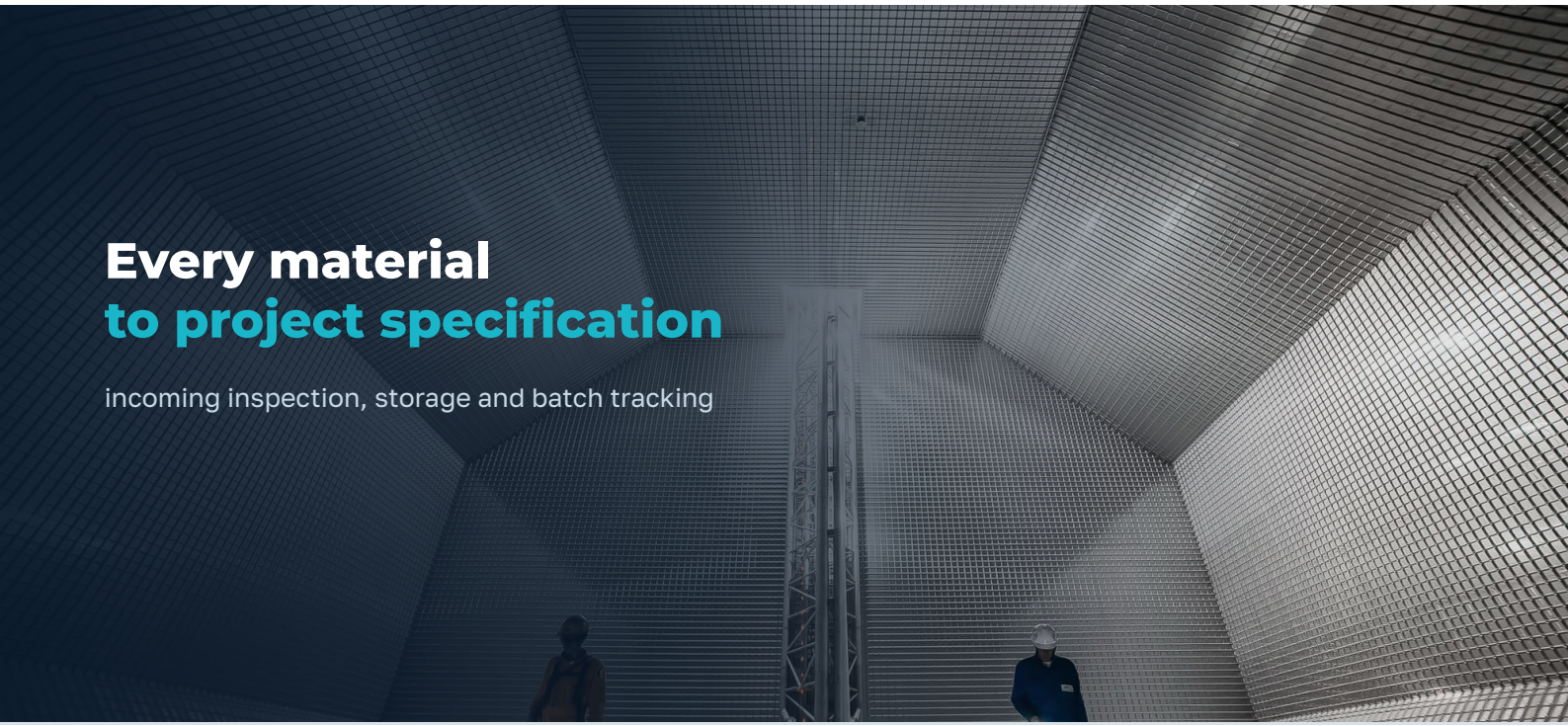
Anchoring elements

Embedded panel inserts and corner anchors for fixing the membrane.



Joint filling

Insulating inserts and cover pads between panels.



Every material to project specification

incoming inspection, storage and batch tracking



06 — INSTALLATION

Bonding and welding

BONDING

Insulation and secondary barrier

- Applying resin ropes to the layout marks
- Installing and leveling the panels
- Filling the joints between panels
- Bonding flexible Triplex over the joints
- Monitoring curing conditions

WELDING

304L primary membrane

- Laying out the corrugated sheets
- Lap welding onto the anchoring elements
- Automatic and semi-automatic gas tungsten arc welding (TIG)
- Manual welding of knots and corner elements
- Qualified welders and welding procedures

07 — PROCESS

Work sequence

01 **Layout**
surveying and substrate preparation

02 **Mastic**
resin ropes to layout marks

03 **Panels**
installation and leveling

04 **Joints**
filling with insulation

05 **Triplex**
secondary barrier bonding

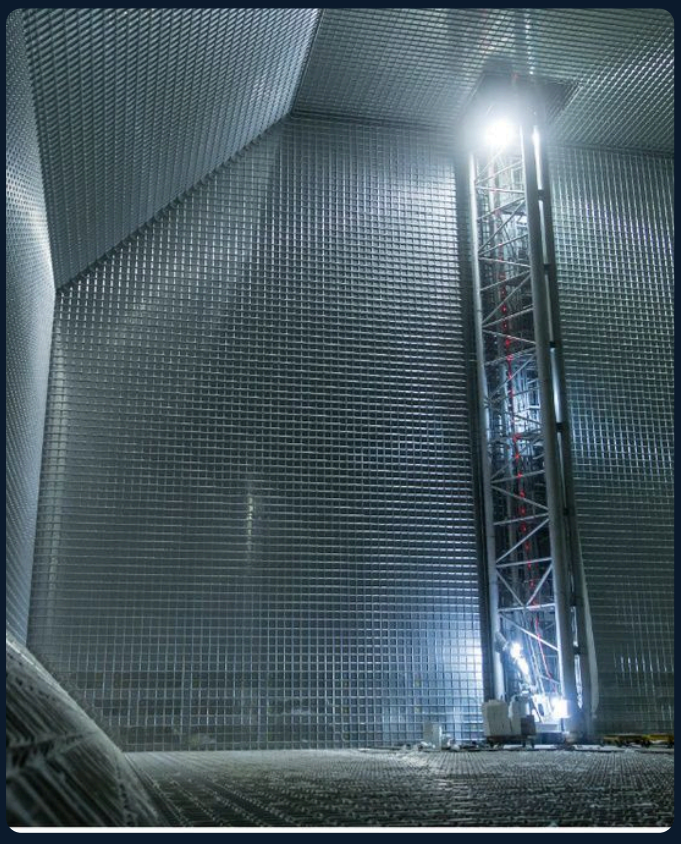
06 **Testing**
secondary barrier tightness

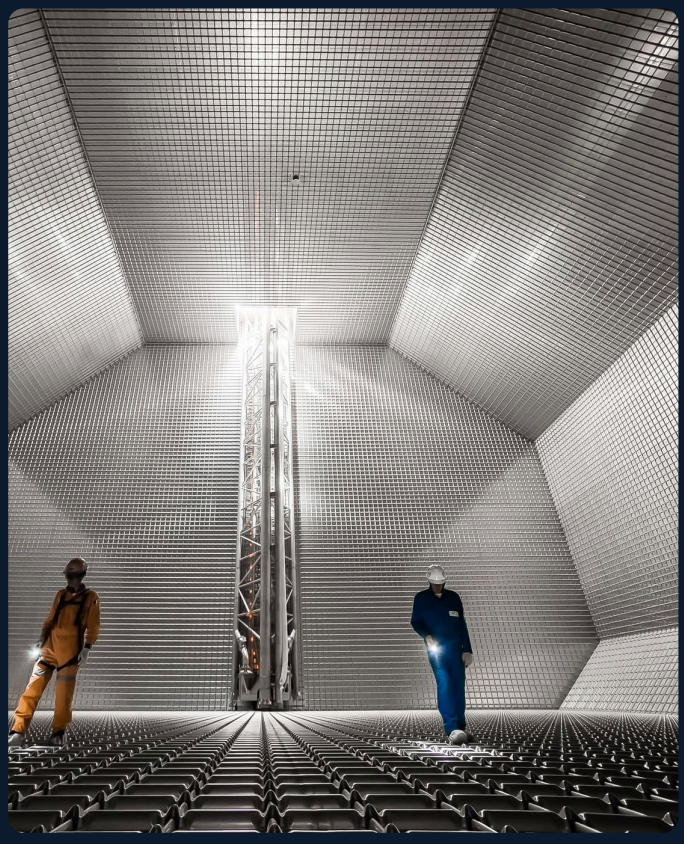
07 **Cover pads**
closing the primary insulation

08 **Welding**
304L membrane sheets

09 **Testing**
primary membrane tightness

10 **Handover**
as-built documentation





Typical sequence; the actual order is defined by the project method statement.

08 — QUALITY

Inspection of every seam

Inspection methods and scope as per the project test program.

Visual and dimensional
flatness, gaps, panel position

Bonded joints
layer thickness, adhesion, witness samples

Vacuum box
local testing of welds

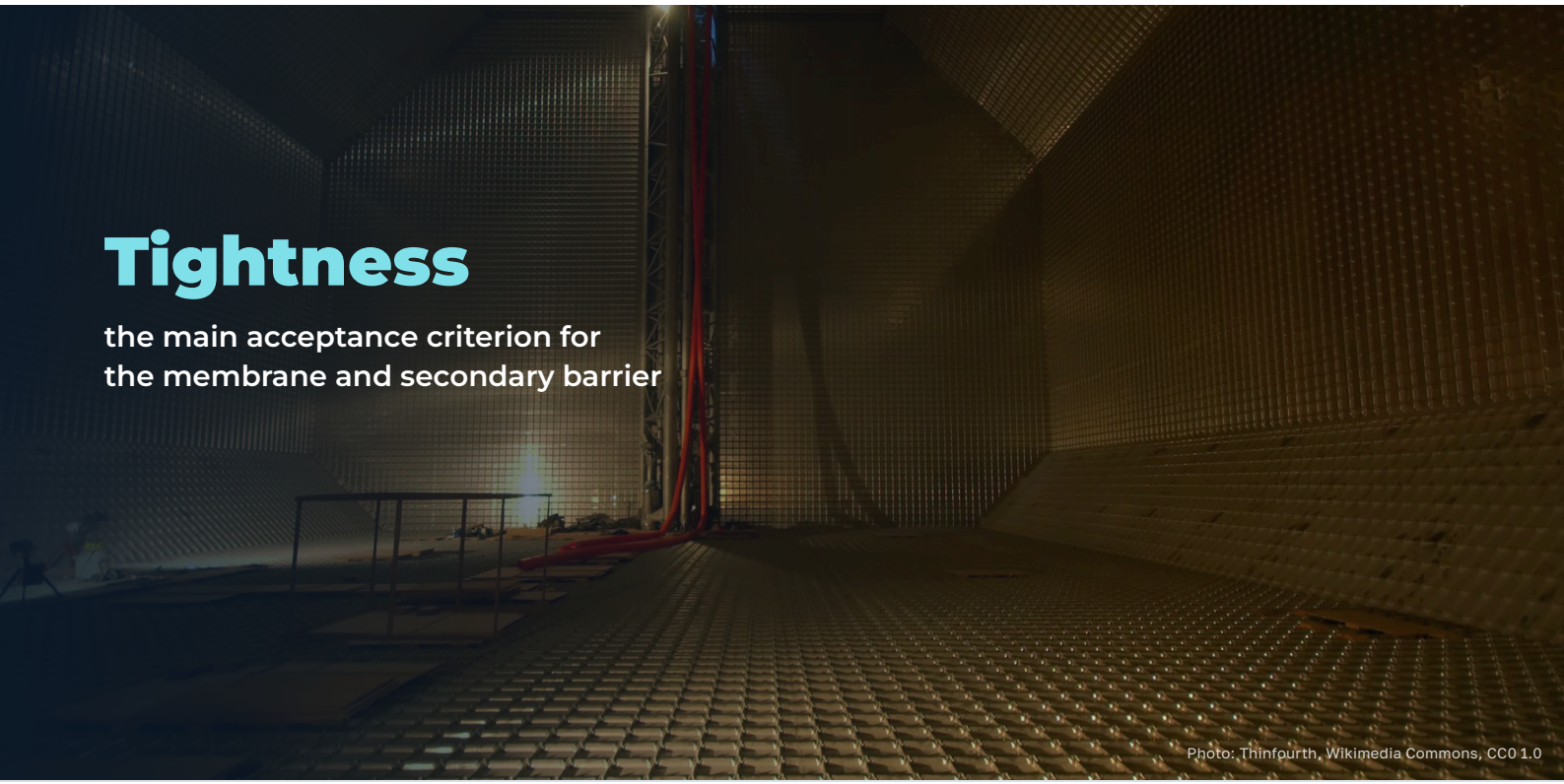
Ammonia test
tightness of membrane welds

Helium test
leak detection with tracer gas

Global tests
secondary barrier tightness

Documentation
logs, test reports, as-built drawings

Qualification
welders, bonders, procedures



Tightness

the main acceptance criterion for the membrane and secondary barrier

Photo: Thinfourth, Wikimedia Commons, CC0 1.0

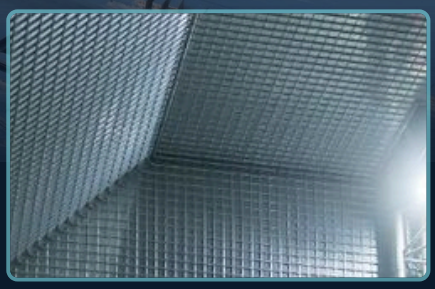
01

LNG · ARCTIC · GBS

Arctic LNG 2 — GBS

Belokamenka, Murmansk Region

Our team has experience installing the membrane system at the Arctic LNG 2 project site, in the LNG tanks of the gravity-based structures.





reinforced concrete gravity-based structure (GBS) · simplified diagram

3
GBS UNITS
IN THE PROJECT

2
LNG TANKS
IN EACH GBS

114,500 m³
CAPACITY OF
EACH TANK

TEAM EXPERIENCE

- Panel bonding
- Secondary barrier
- Membrane welding
- Engineering supervision
- Quality control

Tank data from public sources (GTT, 2019). GTT's membrane technology for GBS (GST®) is based on Mark III. Team experience gained before MESA Engineering was founded.

02

SHIPBUILDING · ARC7 LNG CARRIERS

Zvezda Shipbuilding Complex

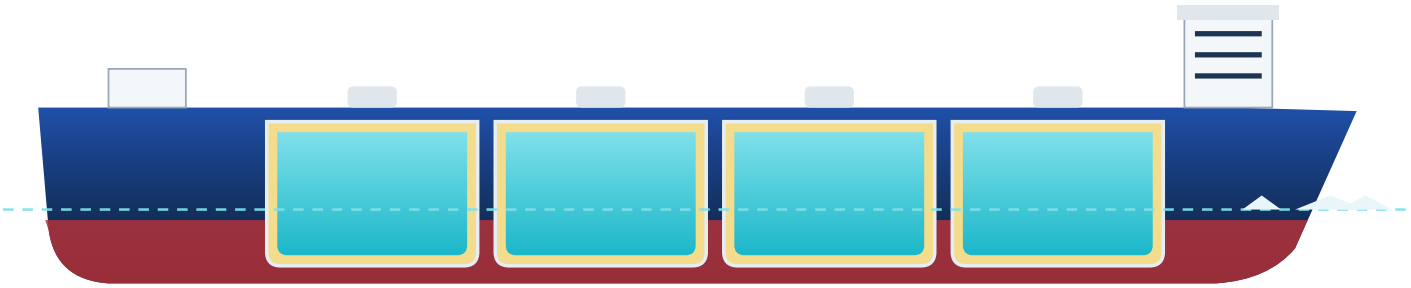
Bolshoy Kamen, Primorsky Krai · Russian Far East

2
ARC7 ICE-CLASS LNG CARRIERS

172,600 m³
CARGO CAPACITY OF SERIES VESSEL

300 m
VESSEL LENGTH

Mark III
MEMBRANE CARGO CONTAINMENT SYSTEM



Arc7 ice-class LNG carrier · membrane-type cargo tanks · simplified diagram

TEAM EXPERIENCE

Work on the membrane cargo containment system of two Arc7 ice-class LNG carriers of the series for the Arctic LNG 2 project was performed at the cargo tank installation stage.

SCOPE OF WORK

- Insulation panels
- Secondary barrier
- 304L membrane
- Quality control

Series vessel specifications from public sources. Team experience gained before MESA Engineering was founded.

10 — ADVANTAGES

Why MESA Engineering?



Experienced team 01

Over 70 specialists with Mark III experience: bonders, welders, engineers and supervisors.

Qualified personnel 02

Welders and bonders certified to work with the technology.

Quality control 03

Step-by-step inspection, testing, as-built documentation.

Health and safety 04

Confined-space work, permits, daily safety briefings.

Arctic experience 05

Membrane installation in harsh climatic conditions.

Ready to mobilize 06

Established crews and engineering staff ready to start on a new site.

CONTACTS

MESA ENGINEERING

MESA Engineering LLC

PHONE
+7 922 480 91 81

E-MAIL
info@mesa-eng.com

INSTAGRAM
@mesa.engineering

ADDRESS
108826, Moscow, Kommunarka,
Potapovskaya Roshcha St. 3, bldg 2, office 5P

Mark III membrane systems · installation · quality control

CATALOG · 2026

GTT, Mark III and GST are trademarks of GTT. They are mentioned for information purposes only and do not imply any partnership or license.