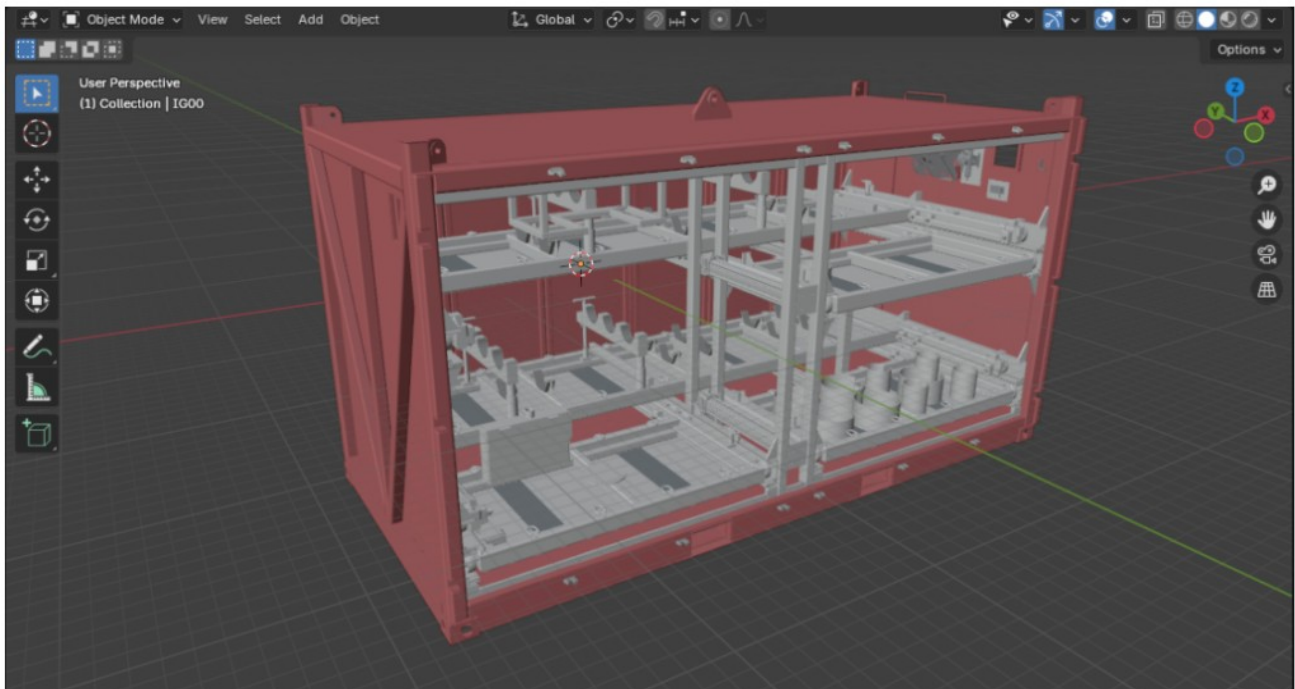


## CASE STUDY

# Offshore Containers

## DNV 2.7-1 Certified — Well Service & General Purpose

Design · Engineering · Structural Analysis · Classification · Fabrication Support



**APPLICATION**  
Well Service Operations

**CONTAINER TYPE**  
Bespoke / Custom

**ENVIRONMENT**  
Offshore — Global

**CLASSIFICATION**  
DNV 2.7-1

### OVERVIEW

## Bespoke DNV 2.7-1 Offshore Container Design for Well Service Applications

Offshore containers are among the most operationally critical pieces of equipment on any drilling rig or offshore platform. Every piece of equipment, tool, chemical, or supply that moves between a support vessel and the installation does so inside a certified container. The integrity of that container — its structural performance under lifting, its corrosion resistance over time, its ability to protect cargo in the most severe sea conditions — directly determines the safety of deck operations and the continuity of the drilling programme. Ingeniat was engaged to design and engineer a batch of bespoke offshore containers for well service applications, certified to DNV Standard for Certification No. 2.7-1 Offshore Containers.

The containers span a range of configurations — from general purpose open-top and closed units to purpose-built chemical and waste storage variants — all designed to a common structural and coating standard, and tailored to specific cargo and operational requirements communicated by the client.

All units were engineered with structural analysis, lifting arrangement design, and full classification documentation managed by Ingeniat from initial concept through to DNV certificate issue.

## PROJECT FACTS

### Key Parameters

**DNV 2.7-1**

Primary certification standard

**-40°C**

Design temperature — low-temperature option

**2 high**

Safe stacking without detaching slings

**20 t**

Maximum rated payload

**Norsok M-501**

Coating system specification

**4-point**

Certified lifting arrangement

## THE CHALLENGE

### Custom Performance Within a Stringent Certification Framework

The client's requirement was not simply for standard catalogue containers. The well service scope demanded containers configured around specific cargo — chemical tote tanks, tool baskets, pressure equipment, and waste collection units — each with its own structural loading profile, internal arrangement, and interface requirement with crane systems and deck handling equipment. Standard container catalogues do not address these needs without compromise.

Simultaneously, every unit must achieve DNV certification without exception. Offshore cranes are rated, sling sets are certified, and every lift from vessel deck to installation deck is governed by documented load cases and lifting arrangements. A container that does not carry current certification cannot be lifted — and cannot be used. Meeting this certification requirement for bespoke geometry and non-standard payloads requires detailed structural design and proactive engagement with the certification body from the earliest design stage.

Temperature performance added a further design constraint. Operations in North Sea and Arctic-adjacent environments require structural steel selection and weld procedure qualification to guarantee impact toughness at -20°C as standard, and -40°C for the most demanding operational profiles. Coating system specification must be validated for continuous seawater splash exposure and UV degradation across multi-year inspection intervals.

*“The containers needed to do more than pass certification — they needed to function correctly for the specific cargo, in the specific handling environment, for years of intensive offshore service without structural degradation or coating failure.”*

Ingeniat Project Documentation

## Full Engineering and Classification Delivery

Ingeniat's scope covered the complete design and classification lifecycle for the container batch, from initial concept configuration through to DNV certification and fabrication drawing issue. The scope was executed under a single engineering management umbrella, ensuring consistency across all units and efficient resolution of any technical interface with DNV.

SCOPE AREA	DELIVERABLES & ACTIVITIES
<b>Concept Configuration</b>	Unit type selection and configuration layout for each variant in the batch. Dimensional envelope agreed against client cargo and handling requirements. Lifting arrangement concept defined. Interface with client's crane and sling set confirmed.
<b>Structural Design</b>	Full structural design of primary frame, corner castings, lifting lugs, baseframe, and secondary structure for each unit type. High tensile carbon steel grade selection for low-temperature performance. Weld joint design and connection detailing for all primary structural elements.
<b>Lifting Arrangement Design</b>	Four-point lifting arrangement designed and documented for each unit configuration. Sling angle assessment. Lifting lug sizing and weld design to DNV 2.7-1 appendix requirements. Certified lifting set specification issued for procurement.
<b>Structural Analysis (FEA)</b>	Finite element analysis of primary structural components for non-standard geometries and extended payload configurations. Load case assessment covering static lift, dynamic offshore handling, stacking, and racking loads per DNV 2.7-1.
<b>Stacking Analysis</b>	Stacking stack assessment for two-unit-high stacking without detachment of lifting slings. Corner fitting load transfer assessment. Fork pocket reinforcement sizing where applicable.
<b>Coating Specification</b>	Full coating specification to NORSOK M-501 and ISO 12944 for offshore marine environment. Surface preparation grade, primer system, intermediate coats, and topcoat defined. Inspection plan with hold points for each coat.
<b>Classification Society Liaison</b>	Design submission to DNV for certification under No. 2.7-1 (and 2.7-2 / 2.7-3 where applicable). Technical response to all class queries. Management of design approval process through to certificate issue for each unit.
<b>Fabrication Drawing Package</b>	Full fabrication drawing set including general arrangement, structural details, weld joint details, lifting lug details, and material schedule. Drawings issued for fabrication after DNV design approval.
<b>Documentation Package</b>	Certificate of conformance, material traceability documentation, DNV certificate for each unit, lifting set certificate, as-built drawing register, and inspection records issued as a complete documentation package per container.

## Structural Design — DNV 2.7-1 Compliance Framework

DNV 2.7-1 defines load cases that an offshore container must survive without structural failure or permanent deformation. The governing load combination for standard containers is the dynamic offshore handling case, which applies a dynamic amplification factor to the static payload to represent the accelerations experienced during crane lifts between vessels and installations in sea states typical of offshore operations. For non-standard container geometries and elevated payloads, analytical demonstration of compliance requires a detailed structural model rather than the simplified calculation methods permitted for standard units.

Ingeniat developed finite element models for each bespoke configuration in the batch. The primary structural frame, lifting lug connections, and baseframe were all explicitly modelled and assessed against the permissible stress and deflection criteria in the standard. The FEA results also informed any reinforcement required at connection nodes where secondary structure interfaces with the primary frame — a detail that frequently governs in custom designs that incorporate internal shelving, overhead cranes, or intermediate decks.



## Lifting Arrangement and Sling Set Design

Every DNV 2.7-1 container carries a certified four-point lifting arrangement. The geometry of that arrangement — specifically the sling angles formed when the container is suspended — directly determines the vertical and horizontal load components imposed on each lifting lug. Shallow sling angles increase horizontal load significantly, and the standard places limits on minimum sling angle to control this.

For containers with unusual aspect ratios or offset centre-of-gravity loads due to fixed internal equipment, the standard lifting arrangement may not produce acceptable sling angles without design intervention. Ingeniat calculated the suspended centre of gravity for each unit configuration and confirmed the lifting arrangement geometry produced compliant sling angles before finalising lug positions and sling set specification.

## Governing Standards and Classification

All containers in the batch were designed and engineered to comply with the following primary standards. Classification liaison with DNV was managed entirely by Ingeniat, covering design review submission, technical query management, and the preparation of all documentation required for formal certification of each unit.

STANDARD / REQUIREMENT	APPLICATION
DNV 2.7-1	Offshore Containers — primary standard governing design, fabrication, and certification of all containers in the batch
DNV 2.7-2	Service Containers — applied to A60-rated enclosed module variants; fire protection, ventilation, and pressurisation requirements
DNV 2.7-3	Portable Offshore Units — applied for extended payload ratings beyond standard 2.7-1 limits, up to 50 tonnes
EN 12079 / ISO 10855	Offshore containers and associated lifting sets — complementary standard reference for lifting set certification and documentation
NORSOK M-501	Surface preparation and protective coating system applied to all structural steelwork; coating system validated for offshore marine environment
ISO 12944	Corrosion protection of steel structures by protective paint systems — applied in conjunction with NORSOK M-501 as corrosion protection design basis
EN 1090	Fabrication and structural assessment of steel structures — primary structural welding and fabrication standard for baseframe and secondary structure
NORSOK Z-015	Temporary equipment requirements applied where containers are classified as temporary offshore equipment on installations

## FABRICATION & MATERIAL REQUIREMENTS

### Material Selection and Fabrication Compliance

Structural steel for all primary frame components was specified to EN 10025 Grade S355J2/K2 as a minimum, with Charpy impact test requirements confirmed for the design temperature. For the low-temperature option (-40°C), Grade S355K4/NL or equivalent with enhanced notch toughness was specified for all primary structural members. Material certificates (EN 10204 3.1) were required for all primary structural steel and lifting lug plate material.

- ✓ **Primary structural steel:** EN 10025 S355J2/K2 minimum; S355K4/S355NL for -40°C design temperature option; 3.1 material certificates
- ✓ **Lifting lugs:** High-strength steel with Charpy impact test qualification; full-penetration weld to primary frame member; NDT required on all lug welds (volumetric inspection).
- ✓ **Corner castings:** ISO 1161 castings or equivalent; full load capacity to DNV 2.7-1 Appendix A
- ✓ **Fork pockets:** Reinforced tube sections; fork entry dimensions to ISO 6055; rated load marked on unit
- ✓ **Welds — primary structure:** Full penetration or fillet welds as per design; weld procedure qualification (WPS/PQR) to EN ISO 15614-1; welder qualification to EN 9606-1
- ✓ **Weld inspection:** Visual inspection 100%; magnetic particle testing (MT) on all primary structural welds and lug welds, volumetric inspection where applicable.

## COATING SYSTEM

### NORSOK M-501 Offshore Coating Programme

The coating system was specified to NORSOK M-501 System 1 (epoxy zinc-rich primer, epoxy intermediate, polyurethane topcoat) for the marine atmospheric and splash zone exposure categories applicable to containers in service on offshore installations. All surfaces were prepared to Sa 2.5 per ISO 8501-1 before primer application.

A formal coating inspection plan was developed with defined hold points at each stage: surface preparation, primer application, intermediate coat, and final topcoat. Dry film thickness (DFT) measurement was carried out at minimum density per ISO 19840, and all readings were recorded in inspection reports forming part of the final documentation package for each container. Inspection personnel were FROSIO or NACE certified.

### Inspection and Certification

Each container was subject to a formal inspection programme covering structural completion, weld inspection, dimensional check against fabrication drawings, coating inspection, and final verification of all markings, placard plates, and documentation. The DNV surveyor witnessed the final inspection and lifting test prior to certificate issue.

Lifting tests (prototype and production testing) were carried out at the rated payload in accordance with DNV 2.7-1 requirements, including a separate lifting test for the single padeye located at the center of the roof, suitable for empty lift only. All units passed the proof load test without permanent deformation or structural anomaly. Certificates were issued for each unit individually, with unique identification numbers engraved on the permanently affixed data plate.

## OUTCOME

### Certified Capacity — Ready for Offshore Service

All units in the batch achieved DNV 2.7-1 certification without material technical comments during the design review process — a result of front-end investment in detailed structural analysis and proactive engagement with DNV from the earliest design stage. The certification timeline was met within the fabricator's planned production schedule, allowing the containers to be ready for the planned offshore mobilisation date.

The extended payload variants certified under DNV 2.7-3 provide the client with rated lifting capacity up to 50 tonnes, unlocking handling options for heavy equipment packages that cannot be accommodated in standard 2.7-1 containers. The A60-rated module variants certified under DNV 2.7-2 provide a fire-rated, pressurised enclosure capability for housing sensitive instrumentation and control equipment in hazardous area environments.

**DNV**

Certified — all units, first review

**20 t**

Maximum rated payload

**-40°C**

Design temperature — low-temperature option

**100%**

Scope delivered to specification

## RELATED CAPABILITIES

### Drilling Solutions — Broader Scope of Supply

The offshore container scope is representative of Ingeniat's broader capability in bespoke offshore structure and module engineering. The same design methodology, structural analysis approach, classification management, and documentation framework is applied across the full range of Ingeniat's drilling and offshore services.

<b>Drill Cuttings Reinjection Systems</b> High-pressure slurry injection for zero-discharge cuttings disposal	<b>Driller Cabins</b> Zone 1 pressurised; structural, HVAC, fire & gas, ergonomics
<b>Drill Cuttings Handling Systems</b> Collection conveyors, transfer systems, skip loading	<b>Local Equipment Rooms (LERs)</b> A60 fire-rated; Zone 1/2; permanent or temporary (NORSOK Z-015)
<b>Drilling Mud Treatment Systems</b> Degassers, centrifuges, mud mixing and weighting	<b>Filtration &amp; Separation Systems</b> Sand handling, produced water, bulk loading filter packages
<b>Drilling Mud Cooling Systems</b> Mud cooler skid design for high-temperature formations	<b>Bespoke Offshore Modules</b> Chemical injection, methanol injection, gas scrubbing, riser gas handling
<b>Chemical Storage Skids</b> ATEX-rated chemical injection and storage packages	<b>Finite Element Analysis</b> Class-accepted FEA for pressure vessels, lifting analysis, fatigue

## COMPLEMENTARY SERVICES

Beyond drilling systems and offshore modules, Ingeniat provides services directly relevant to offshore drilling operators and installation owners across green ship solutions (BWMS engineering, EGCS retrofits, waste treatment), structural FEA and analysis (class-accepted structural analysis, lifting analysis, fatigue assessments for pressure vessels and offshore structures), and compliance advisory (CII, EU ETS, and MARPOL compliance for offshore support vessels and drilling fleet operators).

### Discuss Your Project

For technical enquiries regarding offshore container design, DNV certification, bespoke module engineering, or structural analysis, contact us directly.

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