

Smarter Sealing Systems

Water Infrastructure | Dry dock

Trelleborg Group

A world leader in engineered polymer solutions



Year 2022

Trelleborg Infrastructure



Rubber Technology

Design philosophy

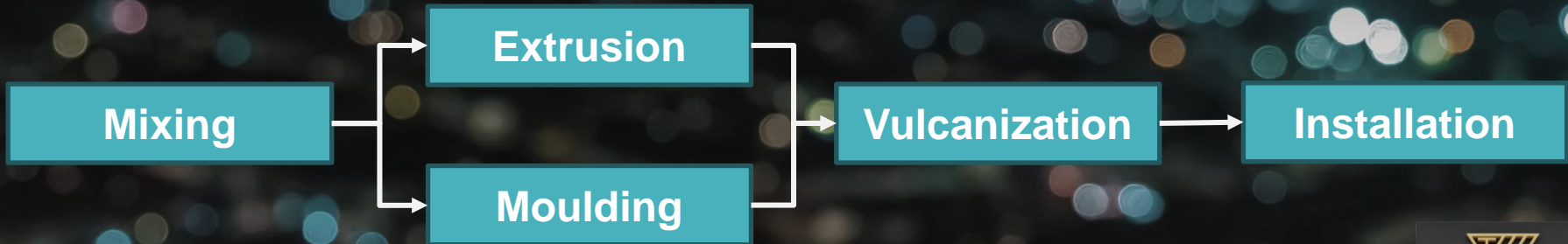
- Seal
- Damp
- Protect

Types of rubber

- NR (Natural rubber)
- SBR (Styrene-butadiene)
- EPDM
(Ethylene propylene diene monomer)
- CR (Chloroprene)

And many more

Rubber processing



Rubber Technology

Selecting the right compound

- Mechanical properties
 - Hardness (stiffness)
 - Compression set
 - Relaxation
- Chemical properties
 - Ozone resistance
 - UV resistance
 - Seawater resistance
- Producibility
 - Extrudability
 - Mouldability

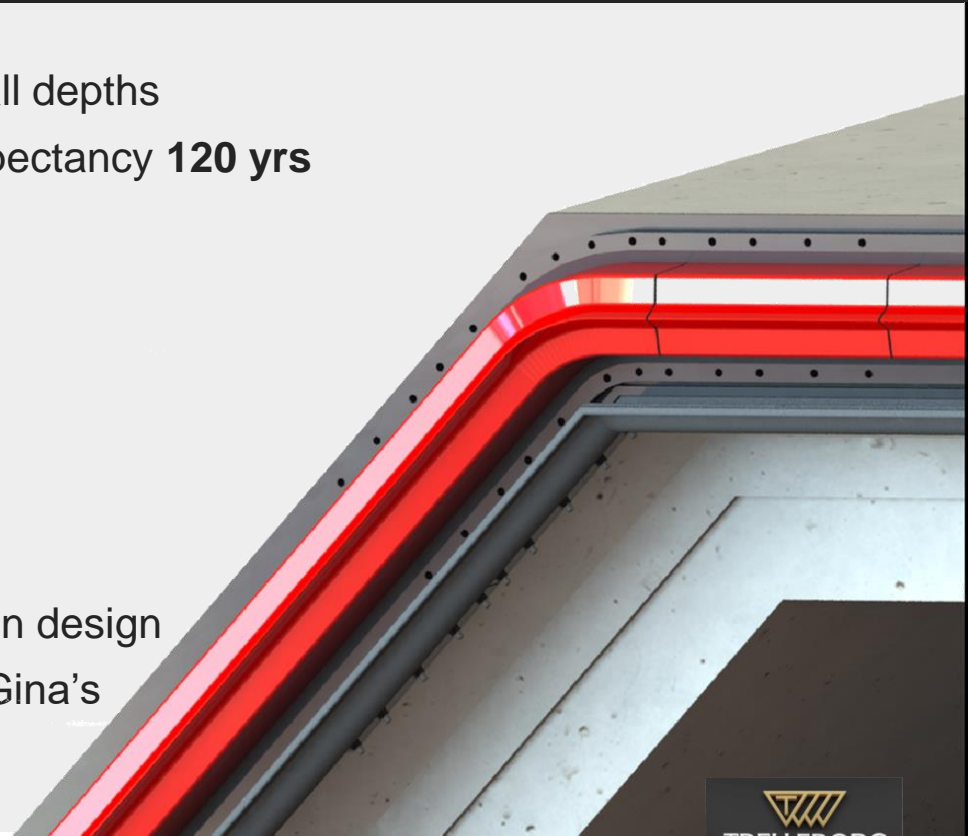


Portfolio: Gina Types

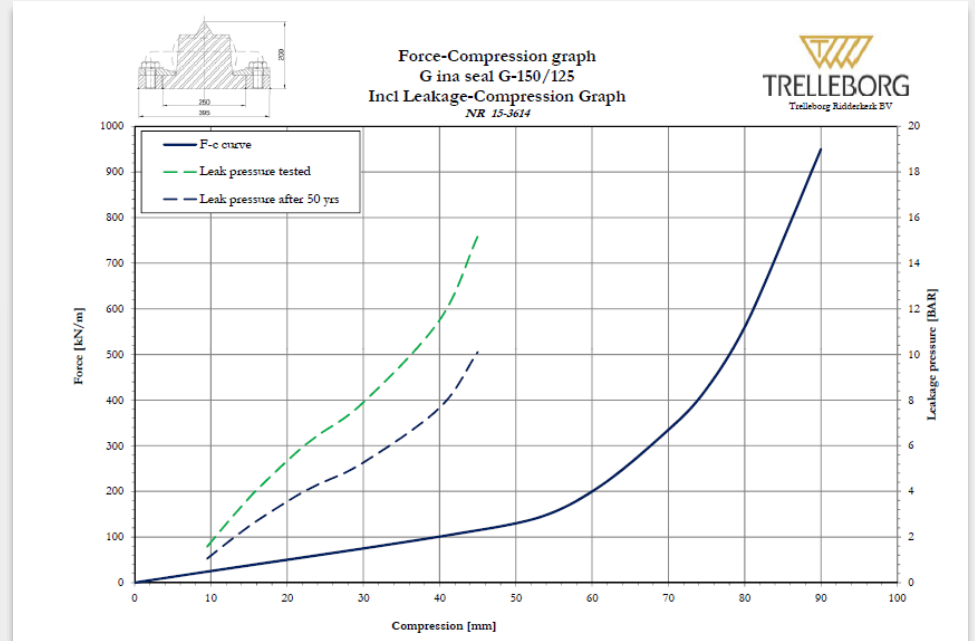
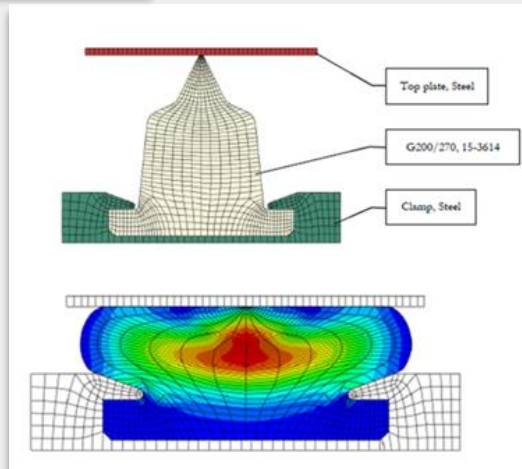
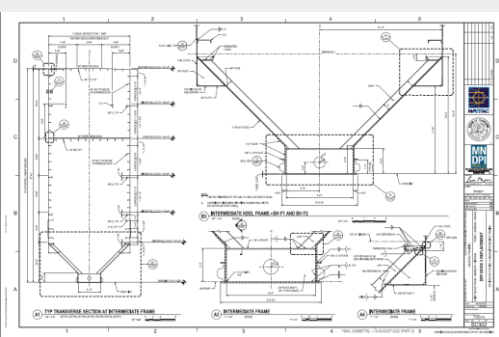


Gina Gasket

- 3 to 4 compounds specially engineered to fit all depths
- Low aging behaviour (lab tested): Lifetime expectancy **120 yrs**
- High allowable shear movement
- Low initial compression force (soft nose)
- Low relaxation (lab tested)
- High stability due to shape and solid base
- Highly resilient (lab tested)
- Easy installation and immersion
- Detailed engineering with best practice solution design
- More than 60 years of experience producing Gina's



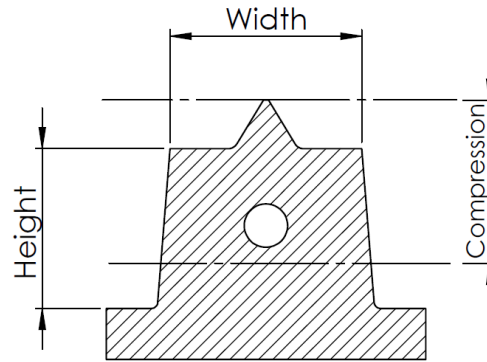
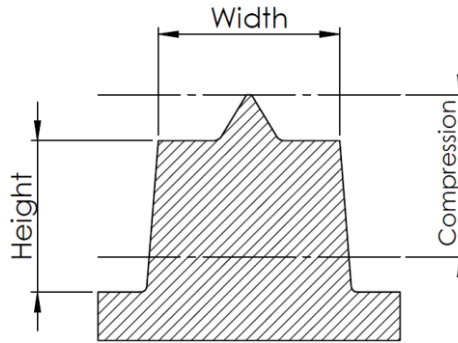
Gina Gasket



Gina Design and Selection

Design:

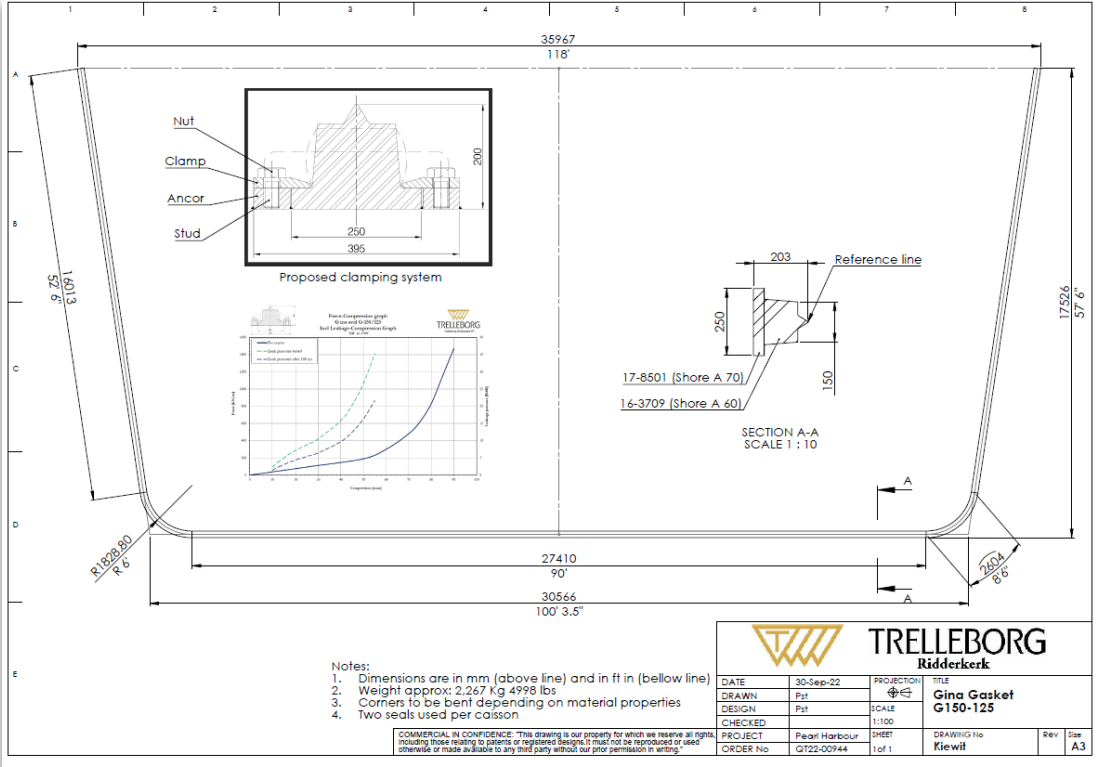
- Height
- Width
- Shape of nose
- Hole or solid
- Inlay
- Hardness (compound)



Selection:

- Bottom water depth
- High/low tide level
- Gate size
- Lifetime expectancy
- Construction tolerances

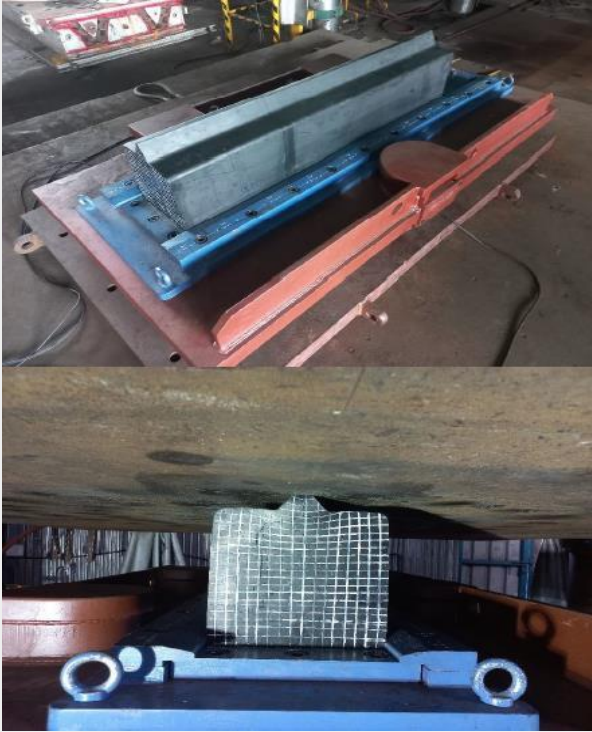
Typical Trelleborg Dry Dock Gina Drawing



Seals are Tested under Different Circumstances

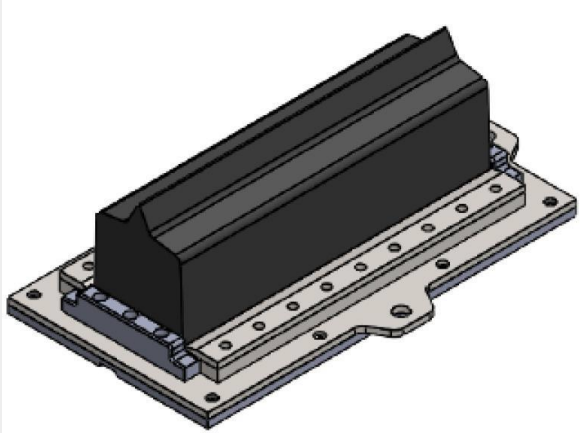


Force Compression Test



This test is executed to validate the seals stiffness to comply to project specification

Shear Test



This test is executed to investigate the shear stiffness of the Gina gasket. Shear might take place in the construction during settlement of ground



Water Tightness Test

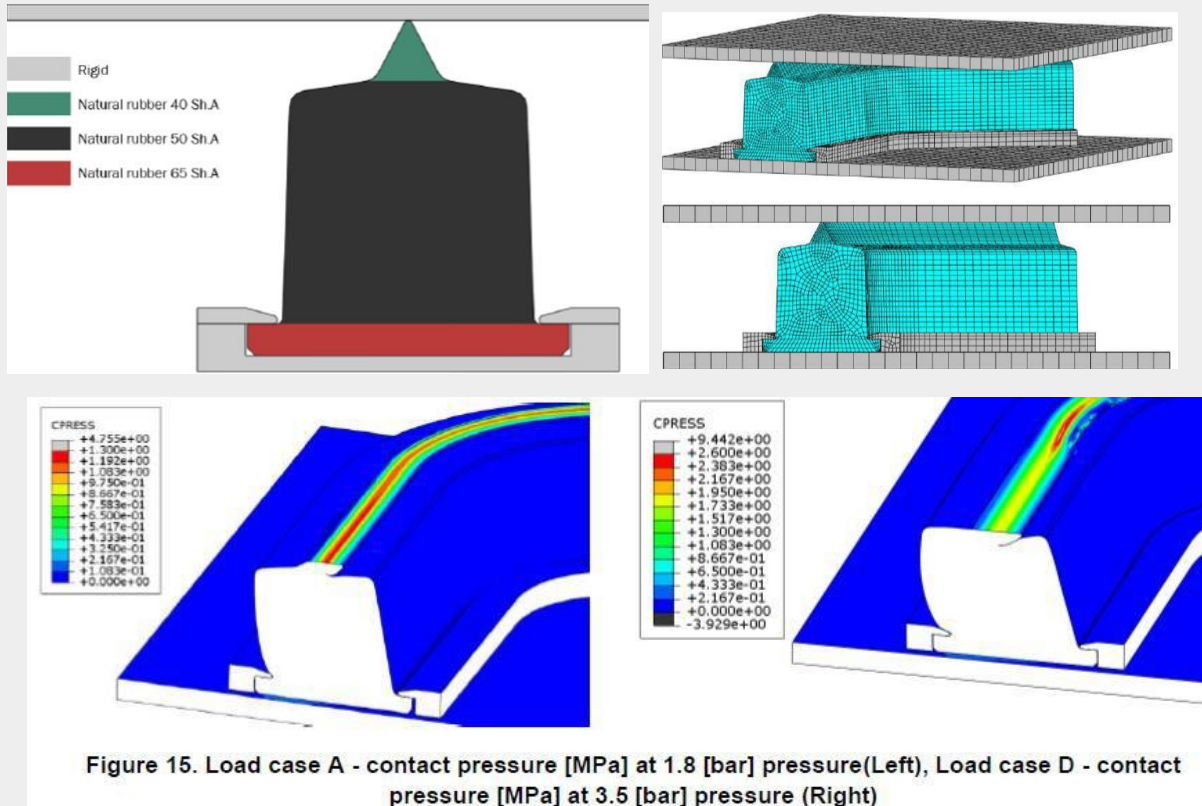


This test validates the Gina gasket regarding the project waterpressure. The Gina seal is often tested until failure to investigate its maximum capacities



Figure 9. Failure mode at 80 mm compression at 5.8 bar

FEA Capabilities

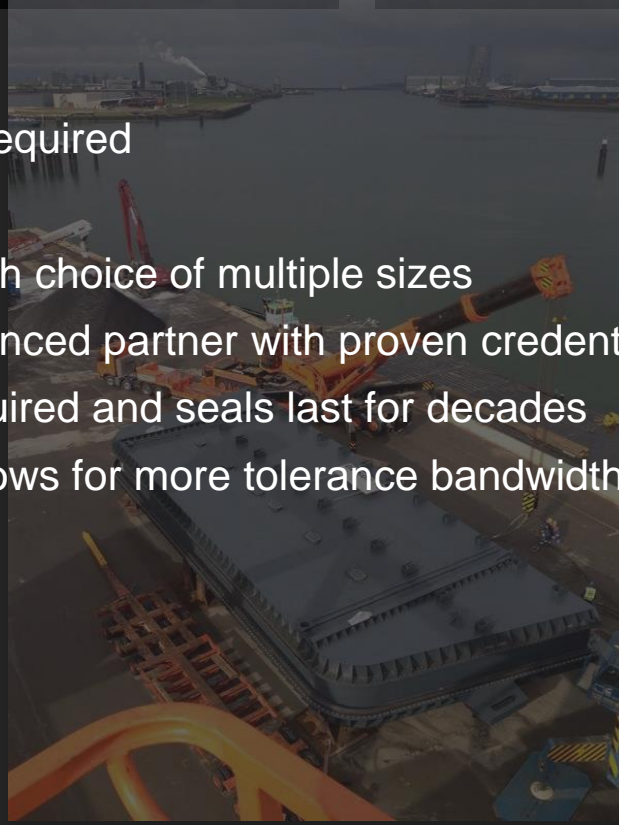


Finite element analysis is used to determine gina gasket **displacement**, **contact pressure**, **internal stress** and **strain** within the material

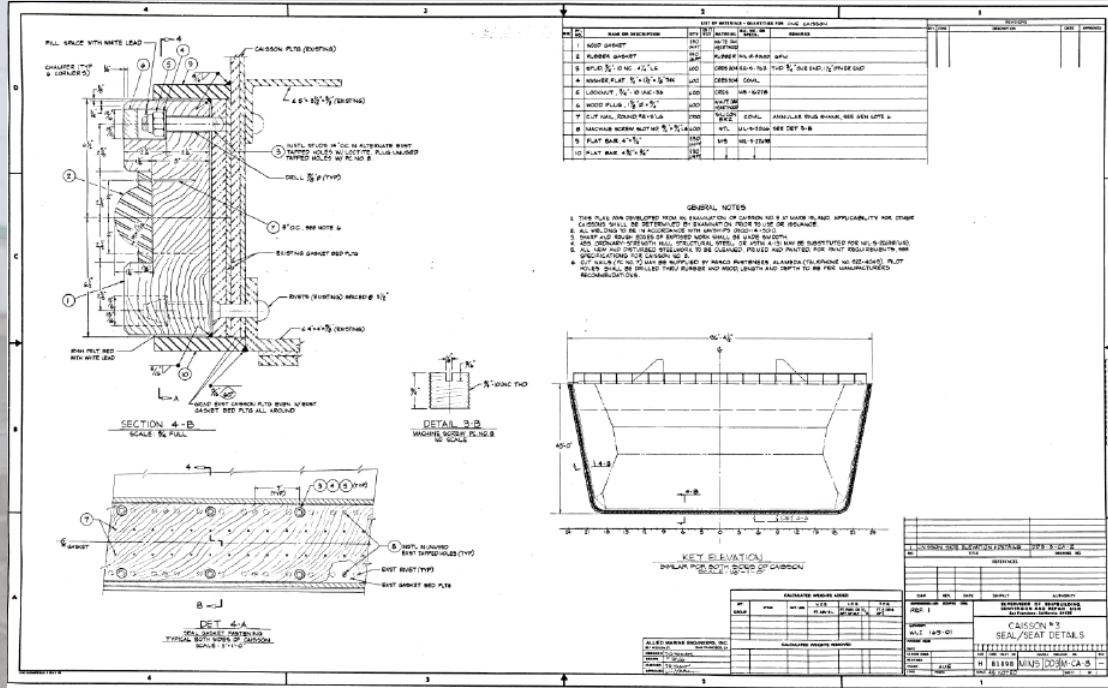
Projects: Floating Dry Dock Door

Gina gaskets

- No auxiliary pumps required
- Less fixation material
- Easier installation with choice of multiple sizes
- Work with an experienced partner with proven credentials in dry docking
- No maintenance required and seals last for decades
- Various hardness allows for more tolerance bandwidth on the concrete or steel



Case Study: Dry Dock Gate Point Hope



Specification

- Renovation project
- Replacing Wooden Blocks
- 2 x U frame shaped Gasket
- +/- 40m per U frame
- Naden drydock (Canada)
- Damaged Sill
- Point Hope Marine

Case Study: Dry Dock Gate Point Hope

Design process

Preliminary



Detailed



Validation



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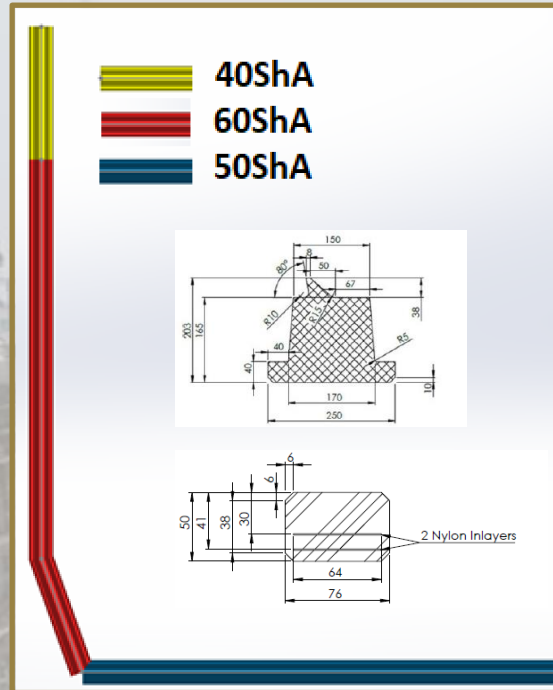
Case Study: Dry Dock Gate Point Hope

Design process

Preliminary

Detailed

Validation



Preliminary design

- Seal selection
 - Compression seals: CS-76/50
 - Compression seals: CS-80/100
 - Compression seals: G150/125
 - Compression seals: Offset nose
 - Compression seals: Inlay
- General arrangement drawing

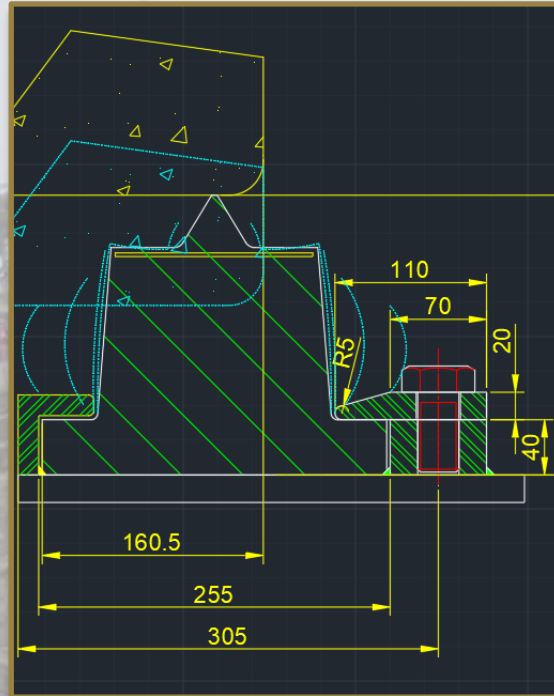
Case Study: Dry Dock Gate Point Hope

Design process

Preliminary

Detailed

Validation



Detailed design

- Compression seal: Gina 150/125
- Fixation clamping new design
- Nylon inlay
- Hydrostatic pressure load
- Min/Max compression
- Custom mould design to fit geometry corner

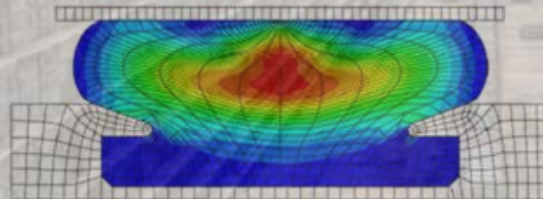
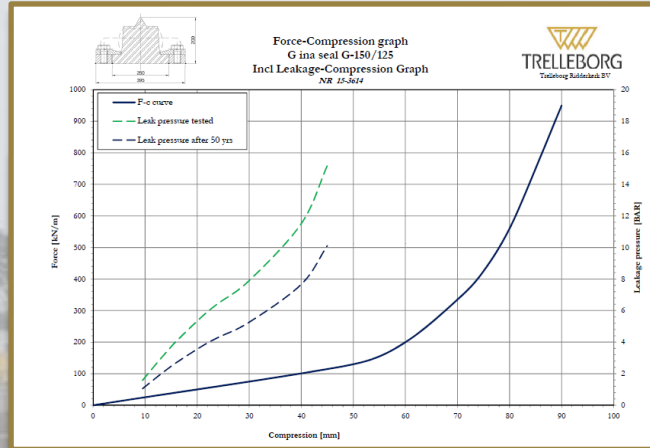
Case Study: Dry Dock Gate Canada

Design process

Preliminary

Detailed

Validation



Validation

- Historical data
- FEA analyses
- Factory test



Case Study: Dry Dock Gate Point Hope



Case Study: Dry Dock Gate Point Hope





Project Maeslantkering

- The Nord Sea Flood 1953
- Delta Works
- Hoek van Holland
- Maeslantkering 1997
- Largest moveable storm surge



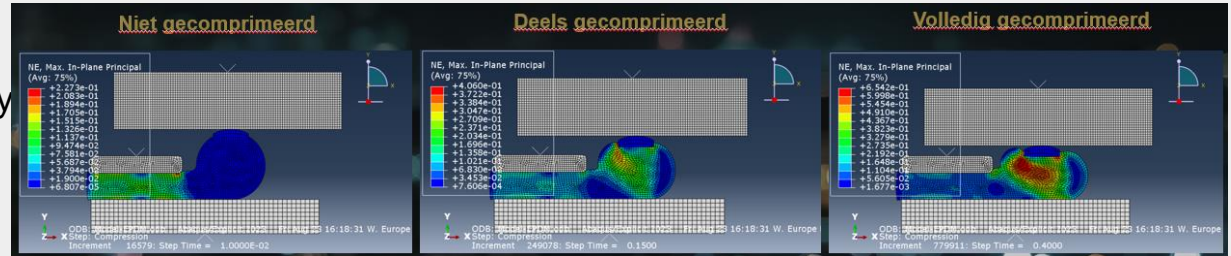
Scope **Maeslantkering**

Renovation project
Awarded May 2024



Challenges

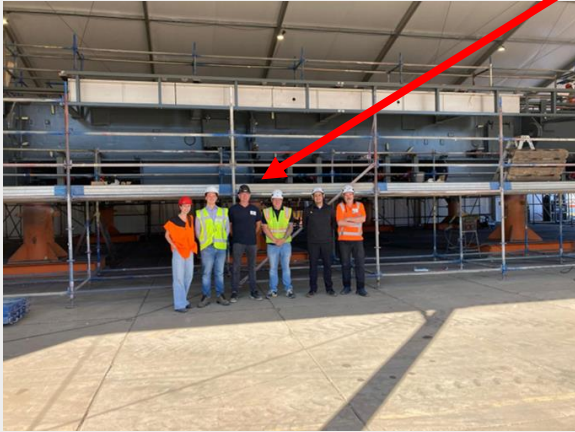
- Design changes
- Change of production facility
- Storm season
- On site welding
- Heat wave



Maeslantkering Protecting the essential

- TMEQ
- TSPL
- TRID

100% Teamwork - Thank you



Customers

Contractors

- KIER
- Strabag
- EDF
- BAM
- VHB
- PEAB
- Skanska
- Besix

Construction

- Cimolai
- Hollandia
- Labrujere

Distributors

- Hakron
- HauCon
- Fenconor
- Freyssinet

Engineering offices

- ARUP
- Aecom
- IDOM
- SPIE
- Jacobs



TRELLEBORG