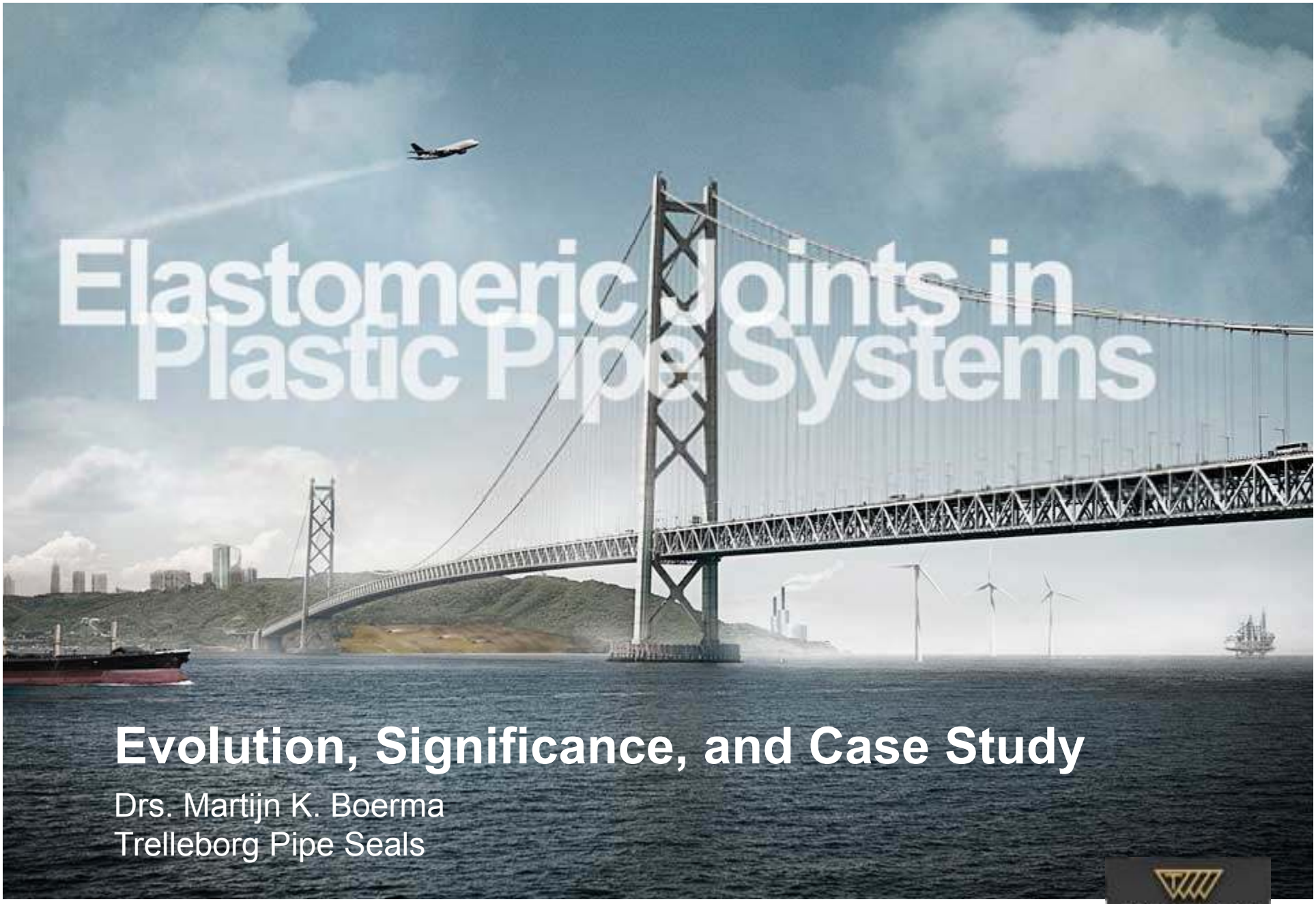
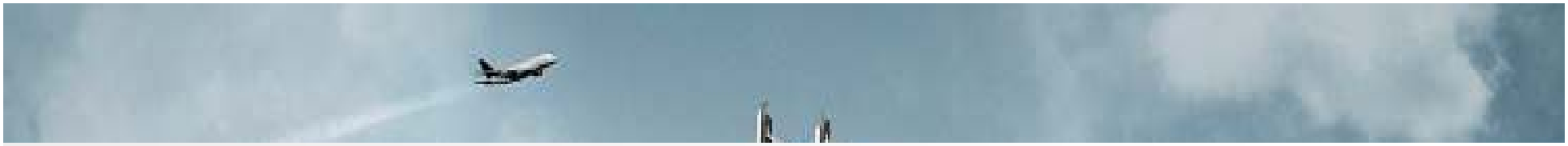


Evolution, Significance, and Case Study

Drs. Martijn K. Boerma
Trelleborg Pipe Seals

TRELLEBORG



Trelleborg Group

Focused

polymer group

1905

founded

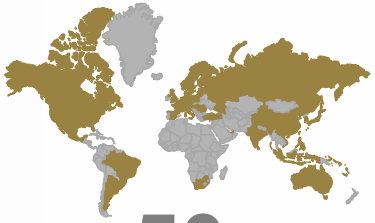
Annual sales

USD ~4 billion

Approximate group pro forma

~23,000

employees



~50 countries

~110

facilities

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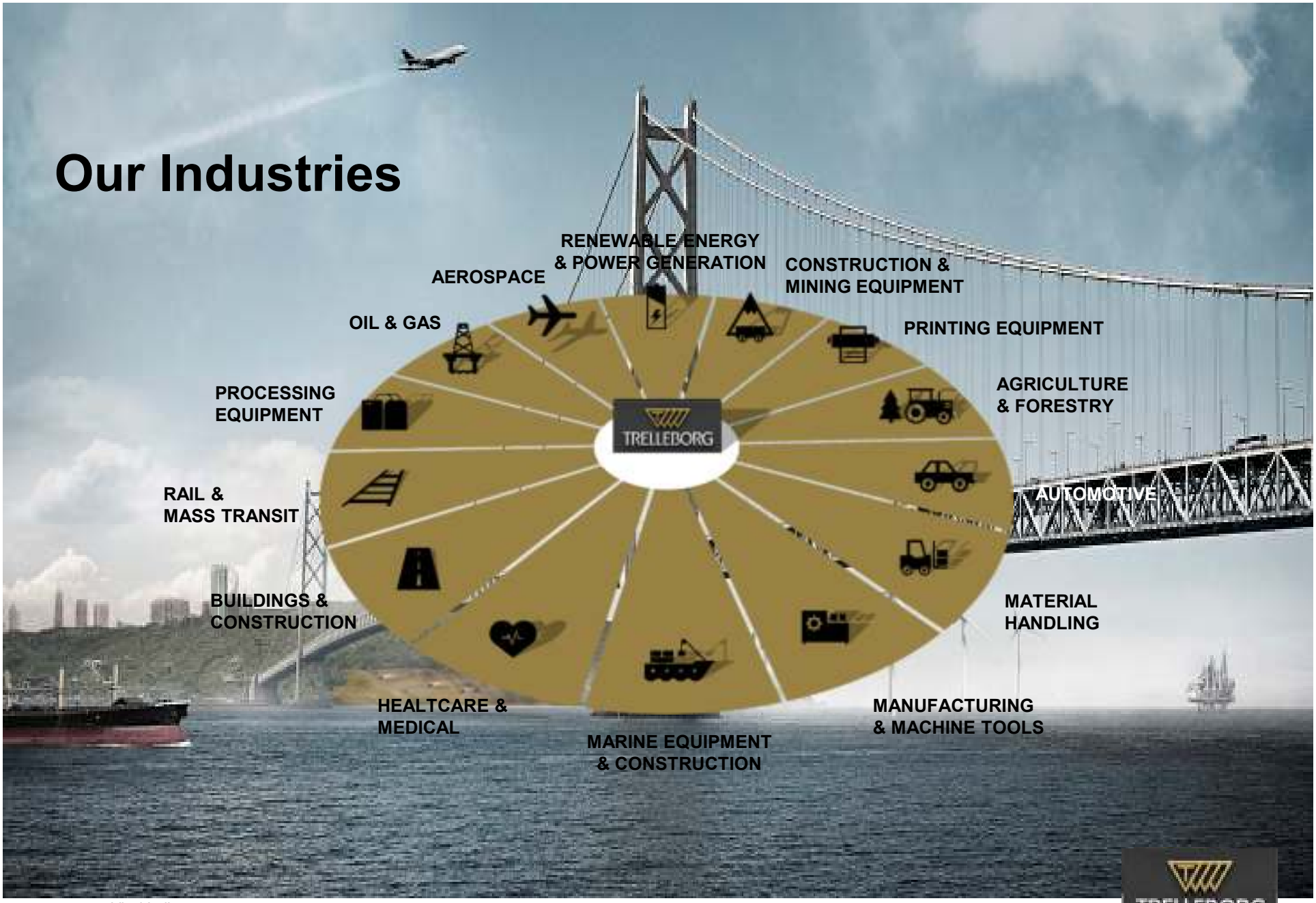
Our Industries



Critical applications in demanding environments

Seal

Damp

Protect

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Evolution

The Ancient Romans knew the value of water

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Evolution of Pipes

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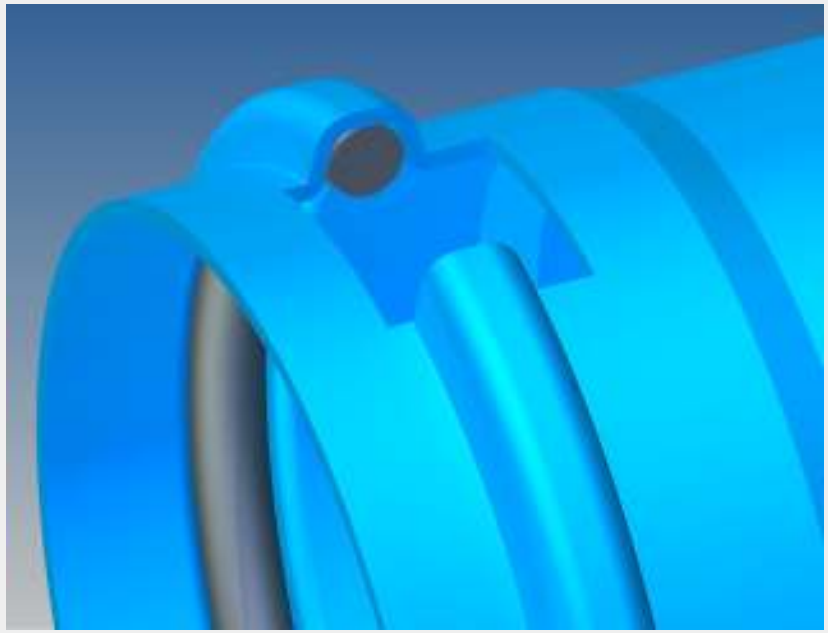
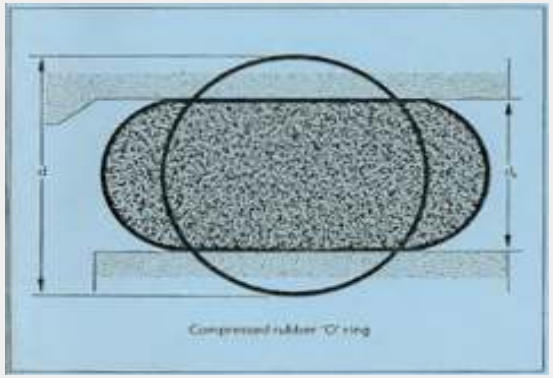
It all started with the O-Ring

- Good, robust performance
- Relies on installation skill
- High jointing force
- Easy to displace during jointing





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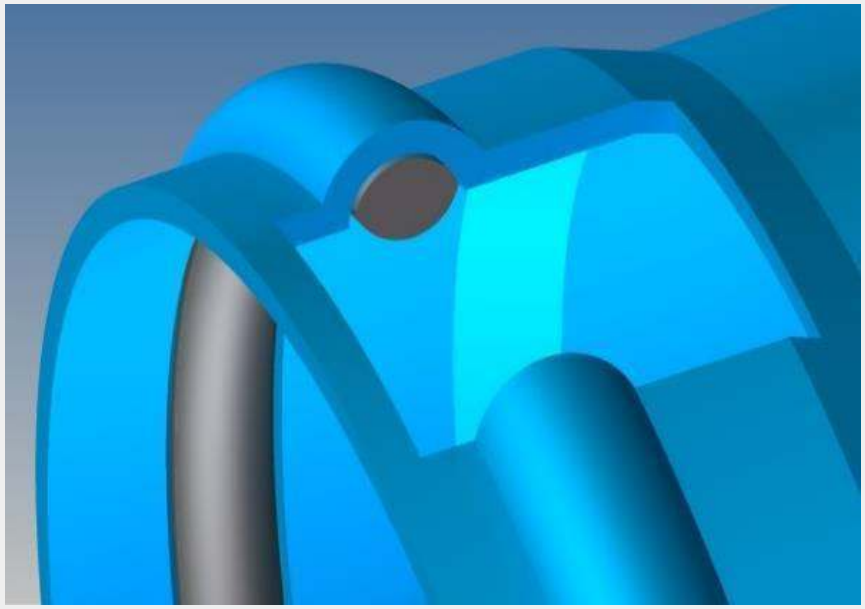
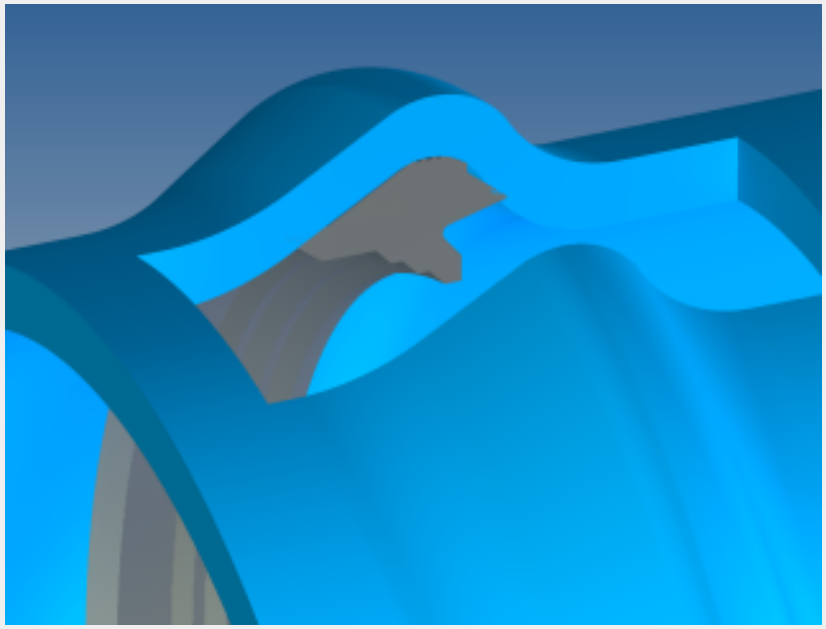
Pre-formed O-Rings (Lens Rings)

- Some reduction in jointing force
- Still relies on installation skill
- Still easily displaced during jointing



The ‘Lip’ seal

- Rearward trailing lip
- Reduced joint force
- Spigot pins the seal in place before full compression occurs
- Reduced possibility of seal displacement



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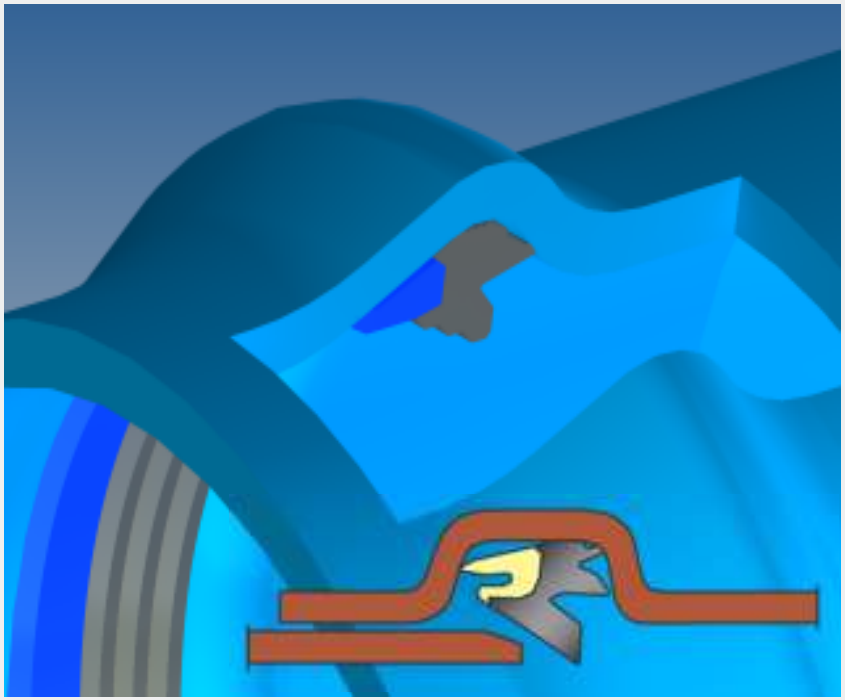
Retaining ring

- Composite seal: elastomeric sealing element co-moulded to a PP retaining system
- Highest level of seal stability
- No loss or displacement during transport and installation
- Used for both high pressure and non-pressure pipes



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The process of integrating seals

The pipe is heated to allow forming of the socket

The seal is automatically loaded on the socketing mandrel against the support flange

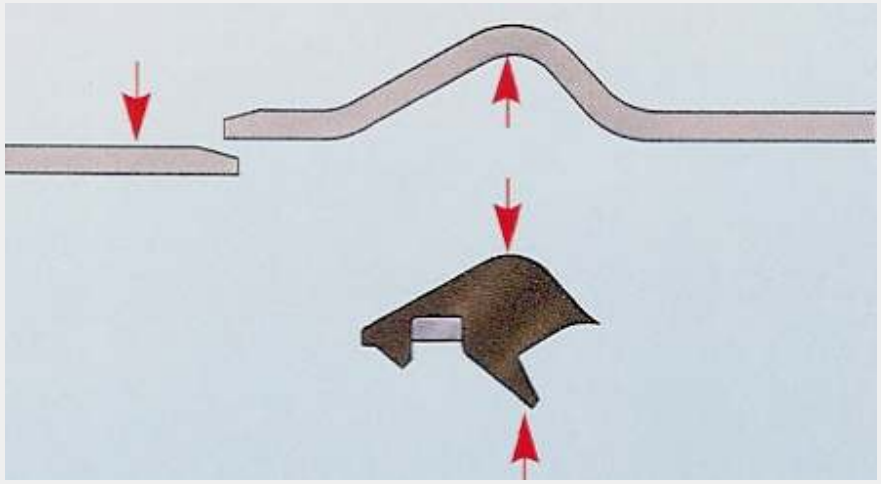
The mandrel is inserted into the softened pipe which flows over the seal, thus forming the socket

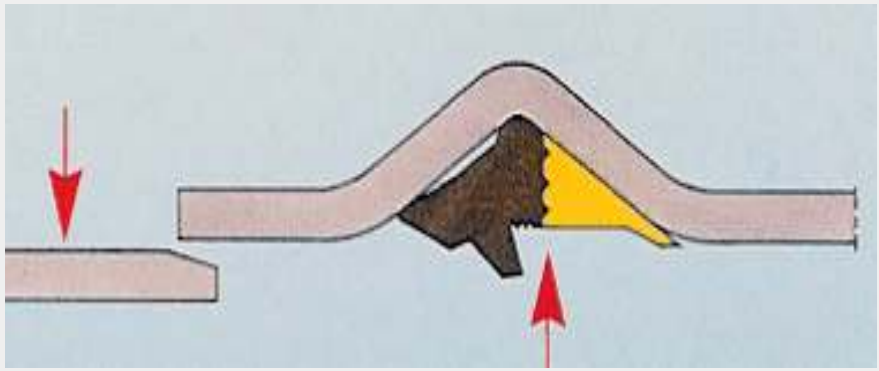
The support flange is retracted, and internal vacuum and external pressure forms the pipe around the contours of the seal

The pipe socket is cooled, either by air or water, and the mandrel withdrawn from the socket

Watch the full movie online

Joint tolerances





4 tolerances to be controlled:

- Internal diameter of socket
- External diameter of seal
- Internal diameter of seal
- External diameter of spigot

Integrated System = only 2

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Advantages of integration

- Reduced tolerances
- Always the correct seal in the correct place
- No possibility of seal displacement during stocking, transportation, and installation

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Trends and innovation

- Rise of PVC-O
- Restraint systems
- Ever increasing sizes
- Corrugated pipes (DWC/SWP)

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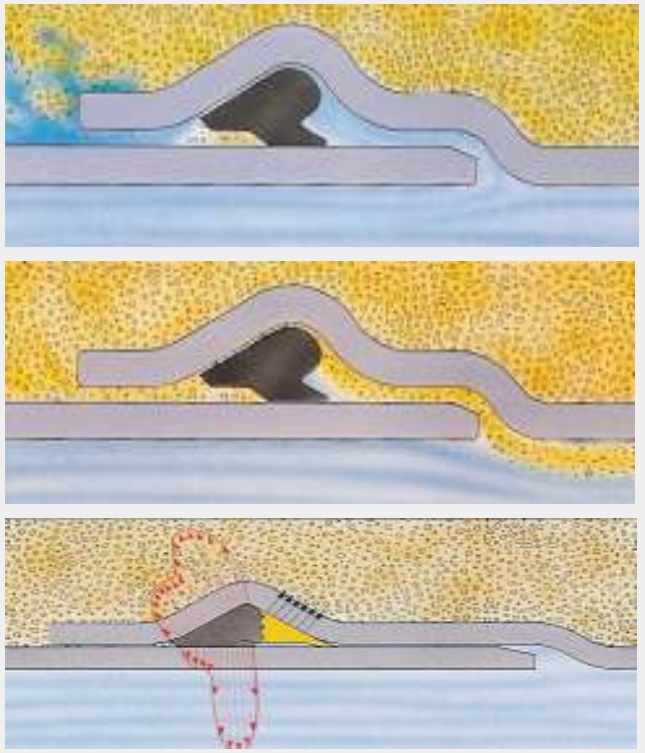
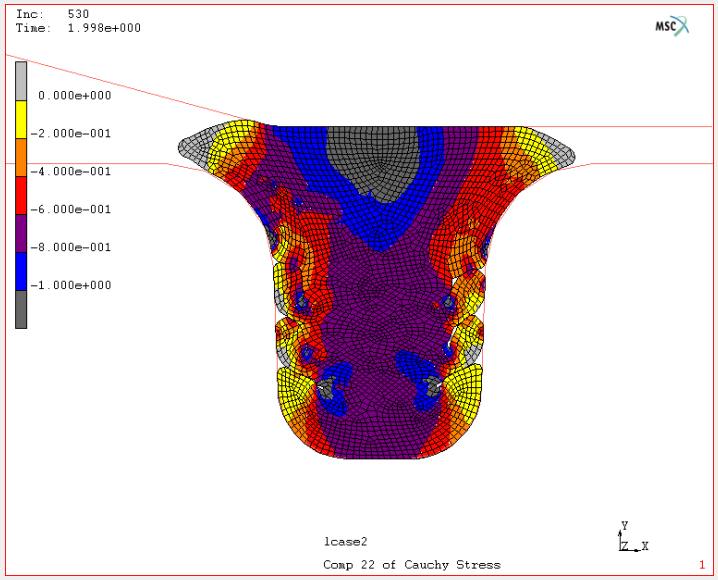
Significance

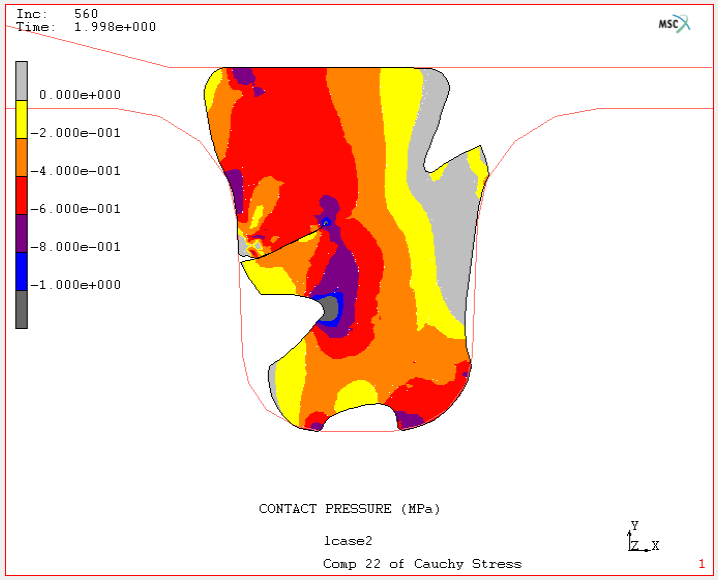
Preventing infiltration & exfiltration

- Good internal pressure performance (exfiltration)
- Design must also ensure adequate external pressure performance (infiltration)
- Combination of ‘lip’ and ‘compression’ is the most robust design



Intelligent design

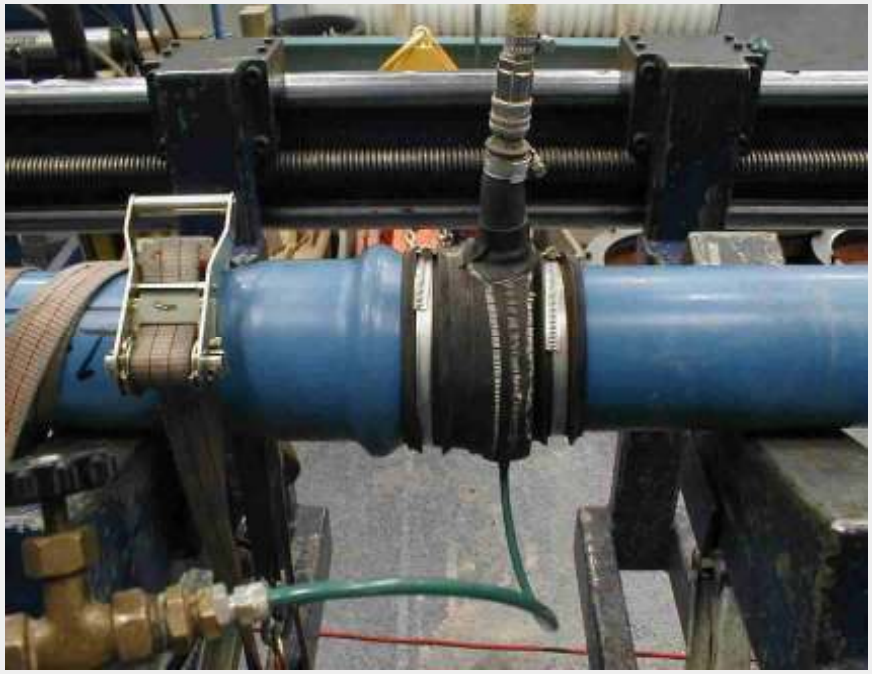




Tested and approved

Pulsation Test

Internal Pressure	Pulsation Cycles	Test Time min.
-80 kPa		60
2.5 Mpa		60
-50 kPa – 1.3 Mpa	500	
2.5 Mpa		60
-50 kPa – 1.3 Mpa	1000	
2.5 Mpa		60
-50 kPa – 1.3 Mpa	1500	
2.5 Mpa		60
-50 kPa – 1.3 Mpa	2000	
2.5 Mpa	Joint deflected to plastic contact	60



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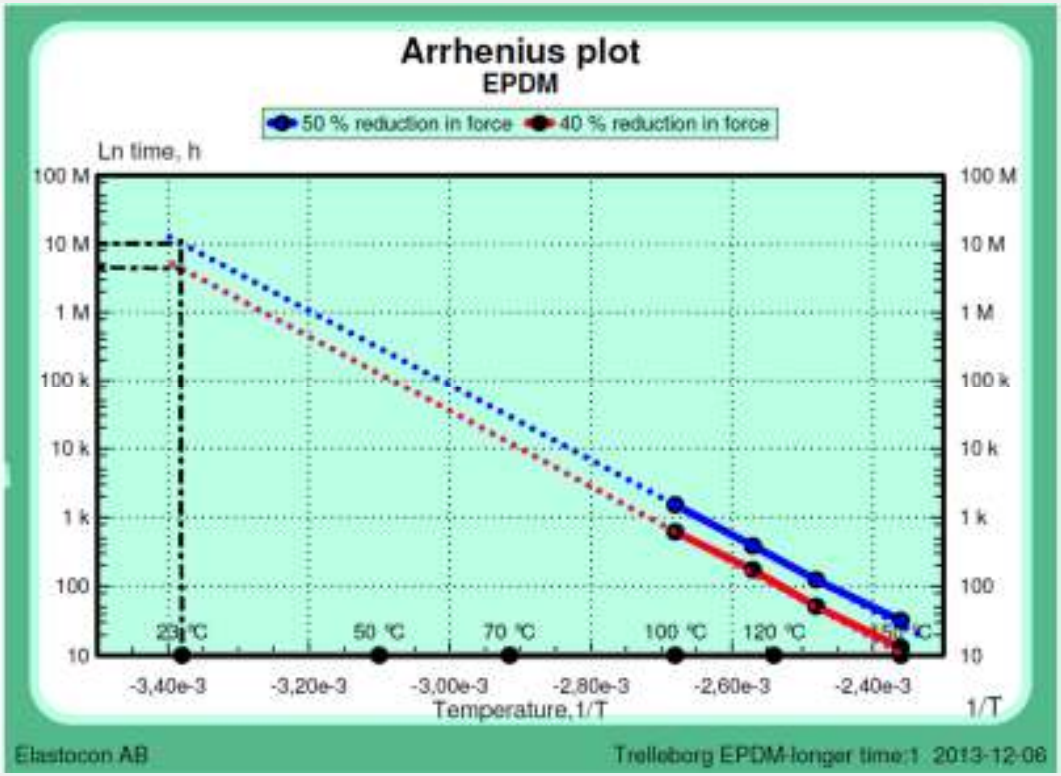
Lifetime of seals

- Stress relaxation under compression
- 40% & 50% reduction in force
- Potential life time of >500 years



Top quality sealing systems

- Good sanitation and hygiene require quality sewer and drinking water systems
- The connection is the weakest link
- High quality rubber rings help solving leakages and allow for easy installation
- Compared to the total lifetime cost of a PVC sewer pipeline a high quality rubber seal is **less than 1%**
- Zero leakage, total performance

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Water systems in India

“Around 80% of sewage in Indian cities flows into water systems.”

Source: Times of India

“Horrifying fact: almost all India’s water is contaminated by sewage. Eighty percent of our surface water is contaminated and 80% of the pollution comes from domestic sewage.”

Source: Water Aid India

“The absence of clean running water and efficient sewerage systems is a major factor in the spread of poverty-related waterborne diseases in India's major cities and increasing air pollution from the stench.**”**

Source: The Telegraph (UK)

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Water systems in India


Huge opportunity for improvement
© AP
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Investing in the future- the AMRUT program

6.2 billion Euro investment projected over a period of 5 years

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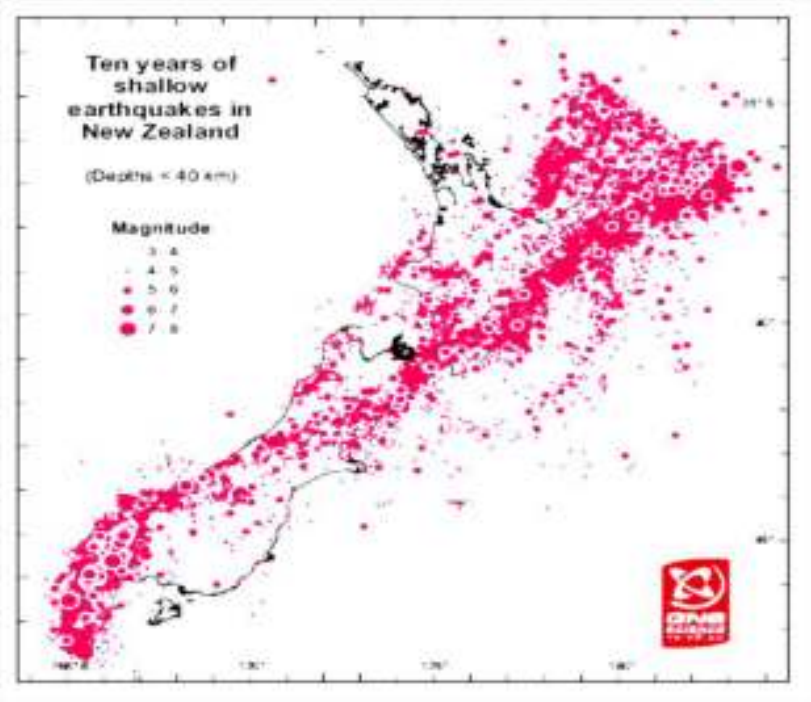
Sealing
Systems
TRELLEBORG

Case Studies

Seismic activity

- Cannot be controlled nor contained
- No pipe is “earthquake-proof”
- Plastic pipes perform better than any other type of pipe
- Flexibility is key
- Less breakage, fewer leakages
- Compatibility with other pipe systems
- Most pipes have been replaced by PVC-O



Largest seaport in Caspian sea

- Türkmenbaşi Seaport – ferry passenger and cargo terminal
- 1,200,000 m^2 port
- 9 km of wastewater plastic pipelines and 50 km of stormwater pipeline

- Trelleborg only supplier to provide tailor made connector to this volume
- Kor-N-Seal® for 3 different types of corrugated pipes
- 25 years+ watertight seal warranty

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The Great Man Made River

- Desertification
- Libya: one of the driest places in the World
- < 5% of the country receives enough water
- Desalination plants
- 3000 km of 4 meter pipes
- 4.5 million cubic meters of water
- 1250 tons of sealing material

Vinyl India
April 2018

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