



VDL ETG T&D

# OVERVIEW OF POTENTIAL MANUFACTURING TECHNIQUES FOR CORRUGATED BEAMTUBE

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STRENGTH THROUGH COOPERATION

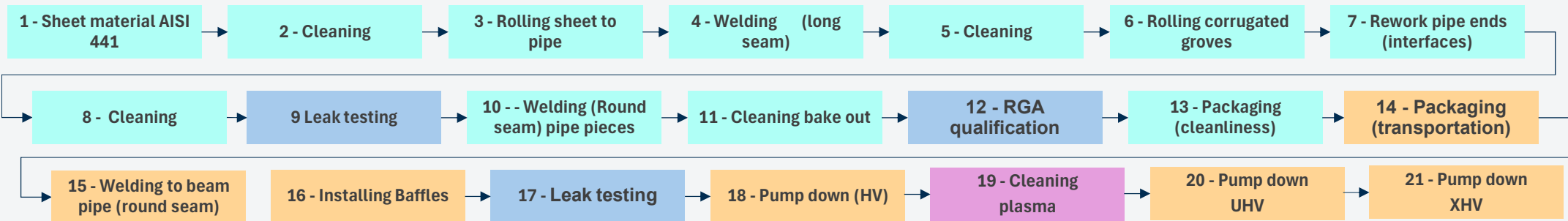
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- Description Beam pipe realisation processes
- Vacuum basics
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- Beamtube rolling
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- Packaging



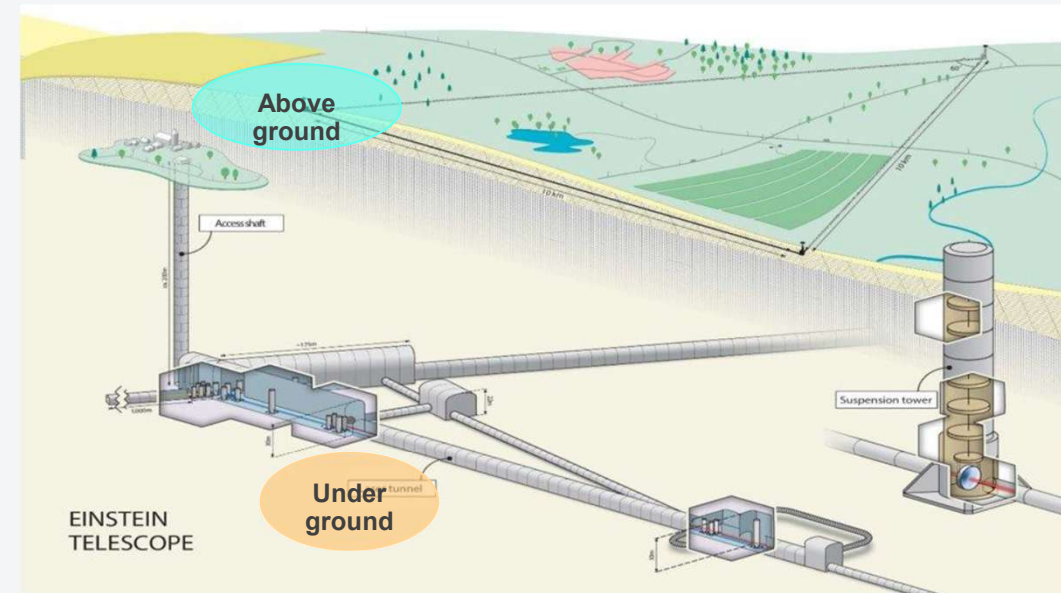
Dimensions and shape

# DESCRIPTION BEAM PIPE REALISATION PROCESSES



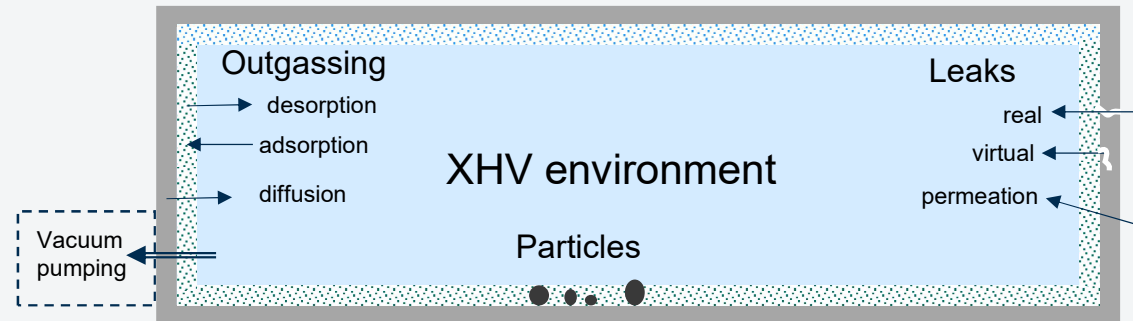
## Work packages:

- Work Package 1: Industrialization for manufacturing and cleaning of 120km corrugated vacuum beampipe
- Work Package 2: Measurement and quality control of the cleanliness
- Work Package 3: Industrialization of the packaging and logistics from production to installation and maintenance
- Work Package 4: Plasma assisted bake-out and cleaning

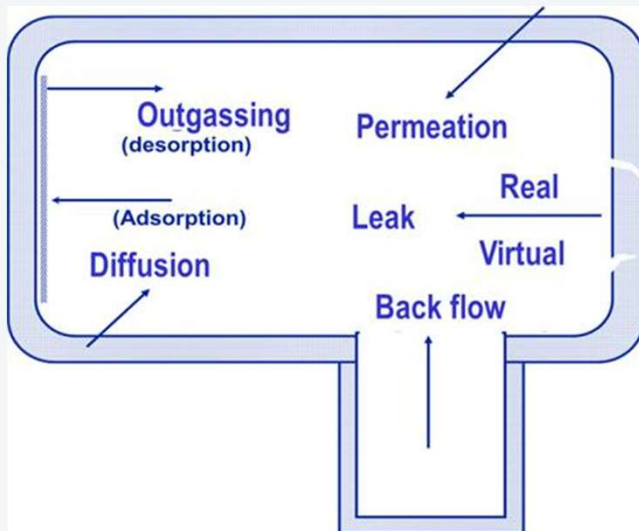


# VACUUM BASICS

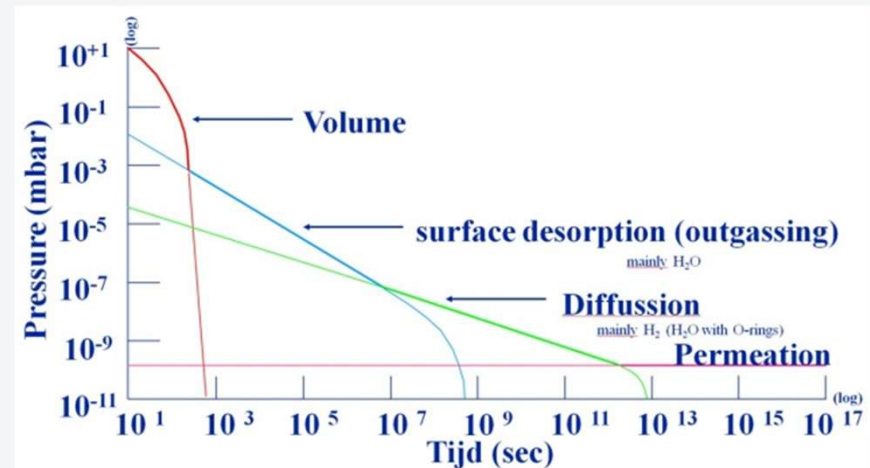
$$p[\text{mbar}] = \frac{Q[\text{mbar} \cdot \text{l} / \text{s}]}{S[\text{l} / \text{s}]}$$



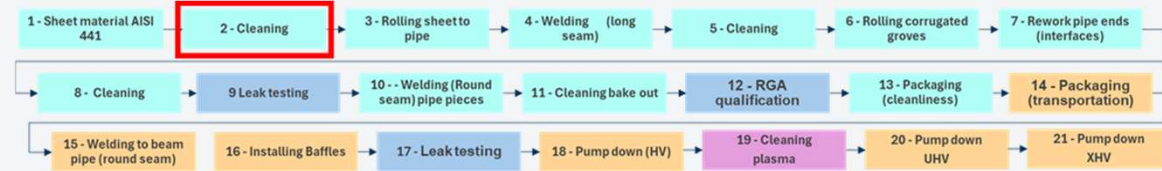
Gas load



Pump down



# BEAMTUBE MATERIALS



➤ First check if base material (AISI 441) can achieve the Outgassing requirements?

RGA Tool VDL ETG:

Inner surface 2092 [cm<sup>2</sup>]

Pumping speed 9 [l/s]

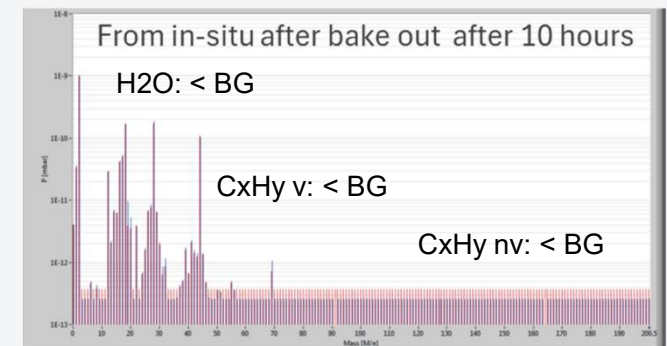
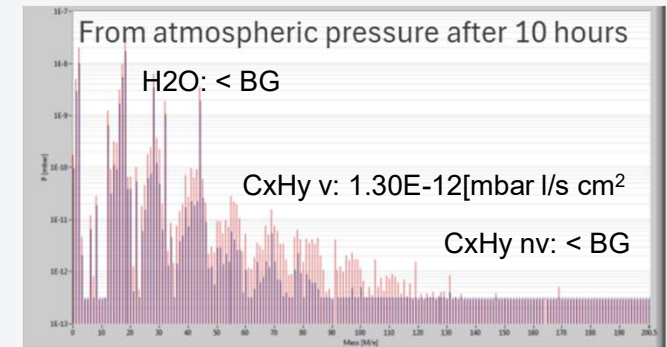
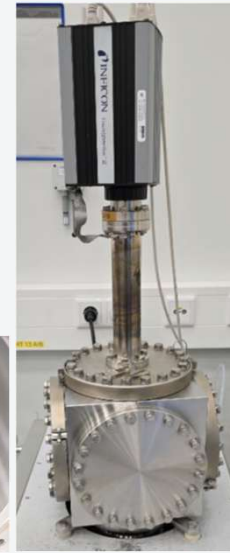
Mass spectrometer Inficon Transceptor 2

- Mass Range 1-200AMU
- Resolution: < 1amu wide @ 10% peak height over the entire mass range
- Minimum detectable partial pressure:  $6.6 \times 10^{-15}$  Mbar

Pressure gauge Inficon BCG450

- Accuracy 10-8 ... 50 mbar % of reading  $\pm 15$

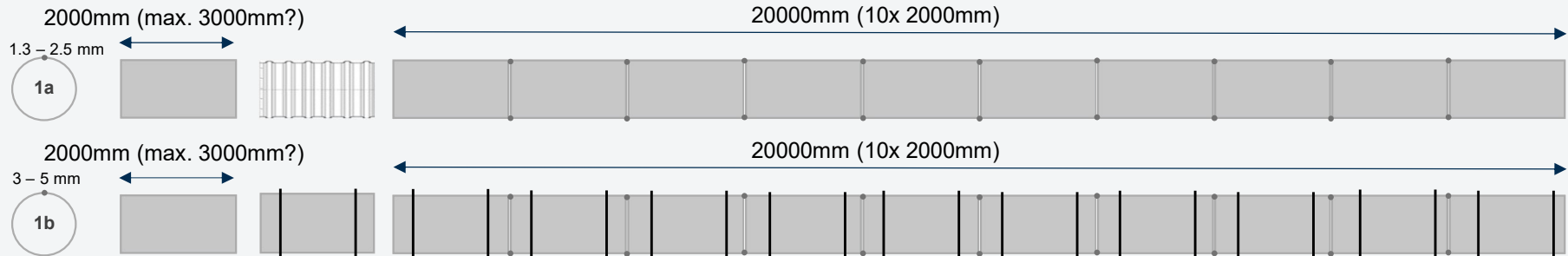
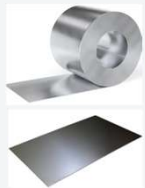
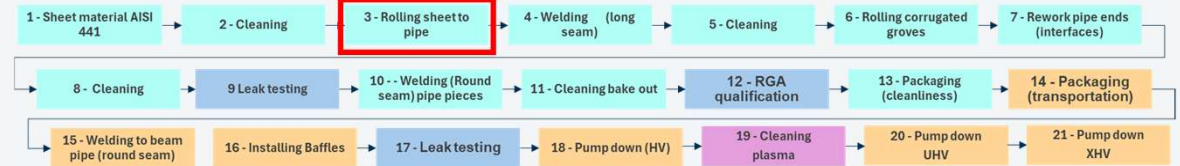
Background measurements RGA tool [mbar l/s] ([mbar l/s cm<sup>2</sup>])



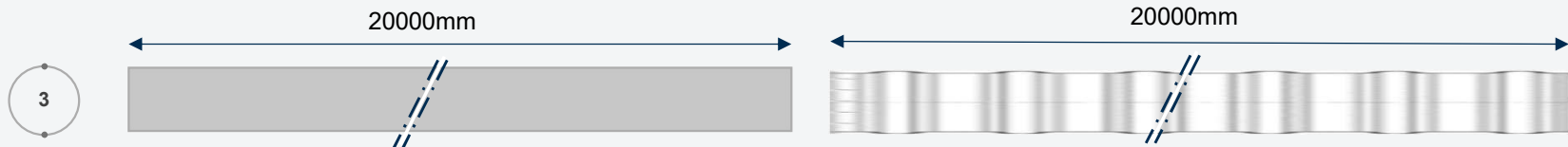
- |  |  |
|--|--|
| • From atmospheric pressure after 10 hours | • From in-situ after bake out after 10 hours |
| • H2O            2.28E-07    (1.09E-10)    | • H2O            8.87E-10    (4.24E-13)      |
| • CxHy v        8.39E-10    (4.01E-13)     | • CxHy v        1.24E-10    (5.94E-14)       |
| • CxHy nv       2.69E-10    (1.28E-13)     | • CxHy nv       2.17E-10    (1.04E-13)       |



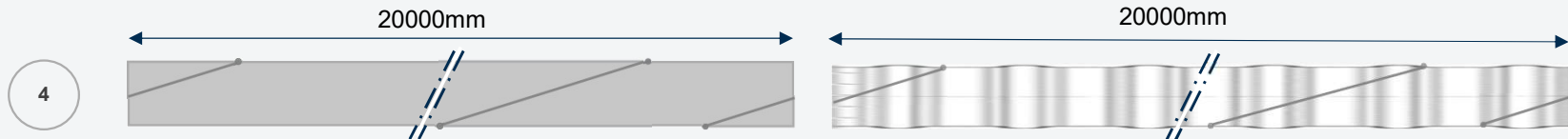
# BEAMTUBE ROLLING



20m beam pipe made of 10 pieces of 2m. Process: rolling pipe piece, welding (long seam) , rolling corrugation or supporting rings, welding (round seam). Welding length: 48.28 m



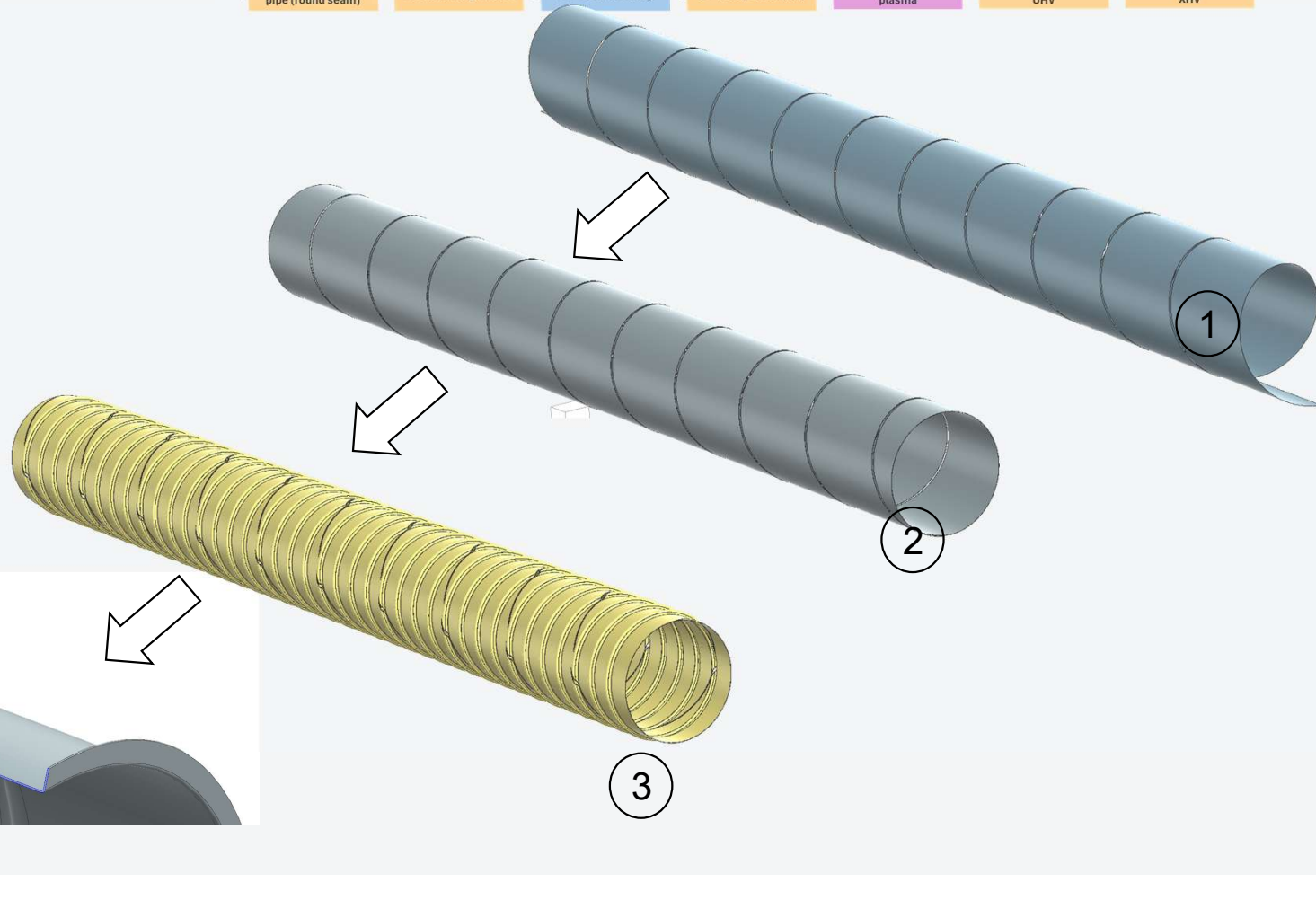
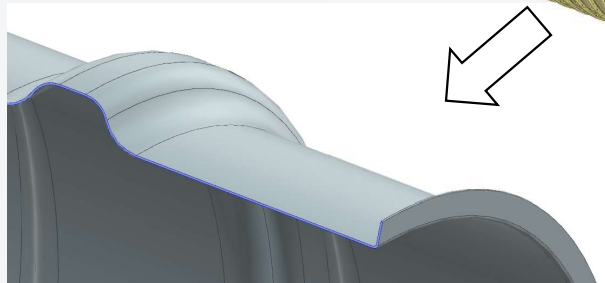
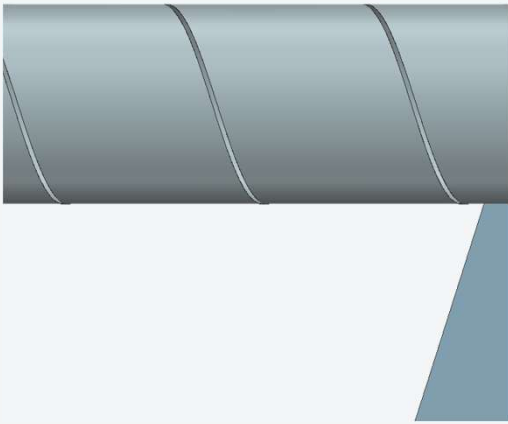
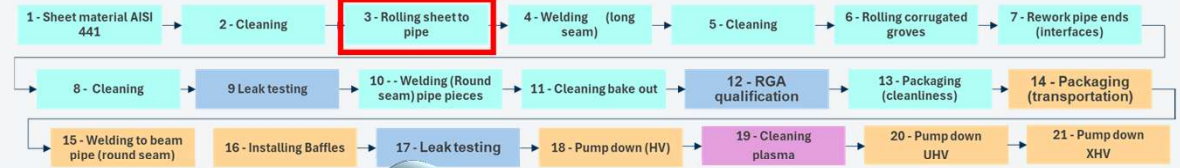
20m beam pipe made of 2 pieces of sheet metal. Process: rolling pipe piece, welding (2 x long seam) , rolling corrugation. Welding length: 40 m



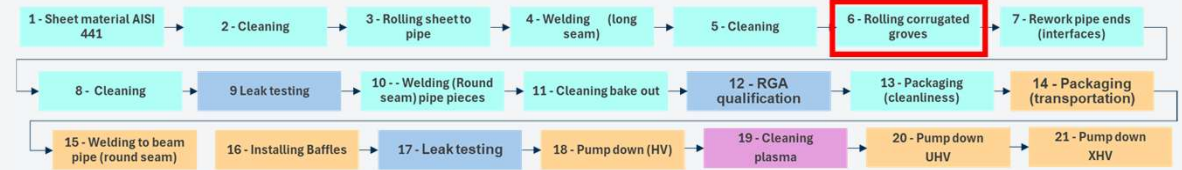
20m beam pipe made of 1 pieces of sheet metal (band width 2 m). Process: spiral rolling pipe piece, welding (1 x long spiral seam) , rolling corrugation. Welding length: 31,5 m

# BEAMTUBE ROLLING

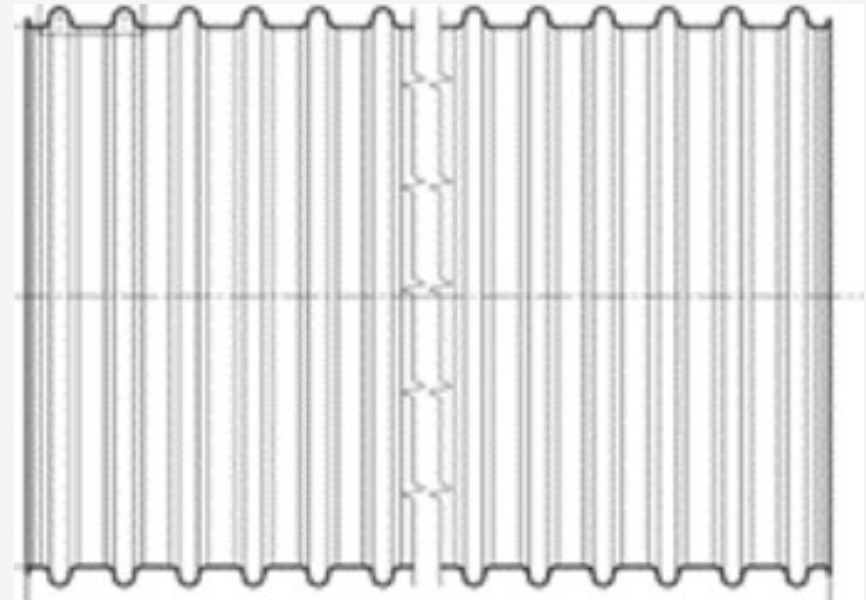
## SPIRAL ROLLING PIPE PIECE



# ROLLING CORRUGATION

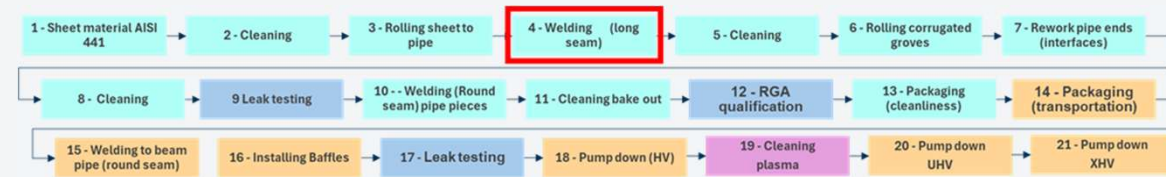


In development, no information available yet





# WELDING



In development, still working on selection of welding techniques;

Welding techniques:

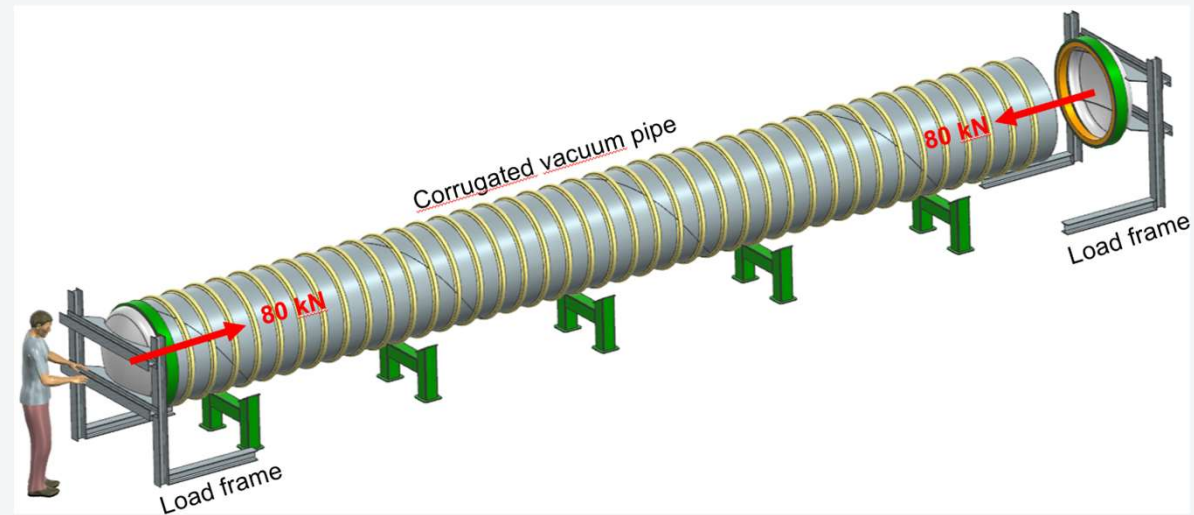
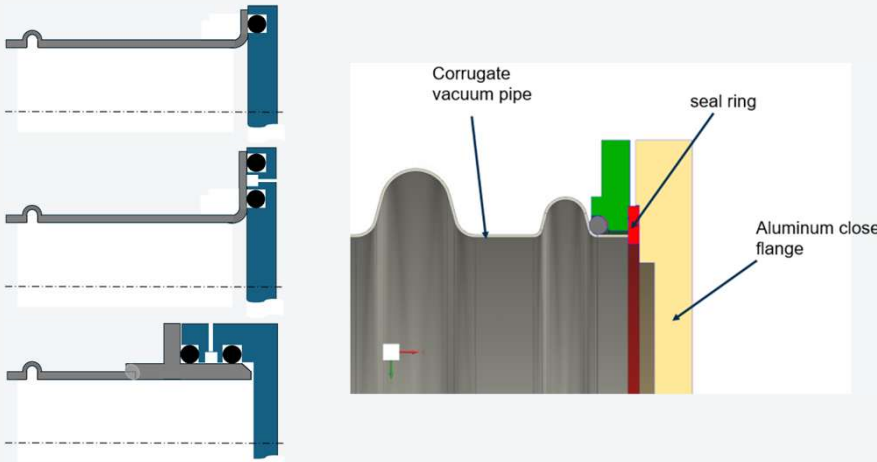
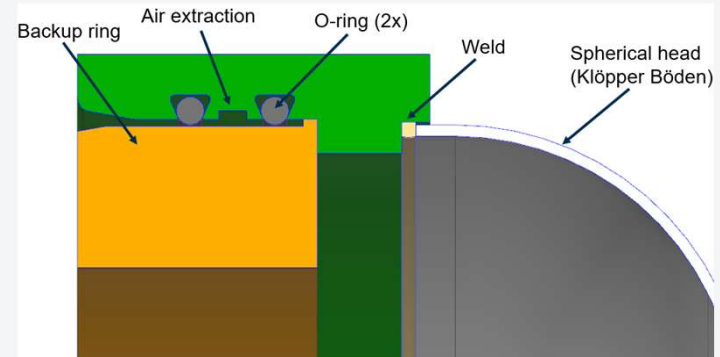
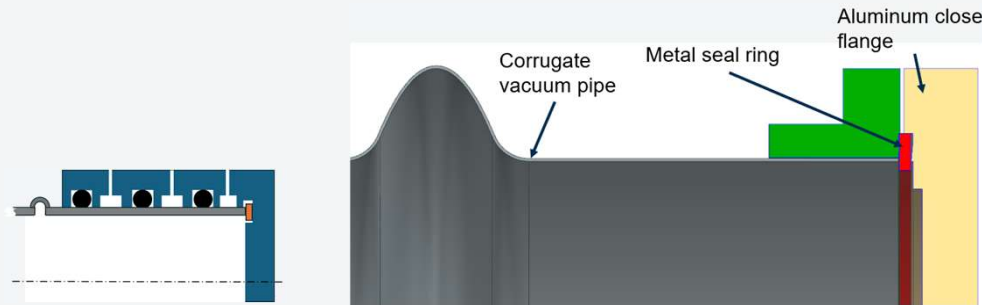
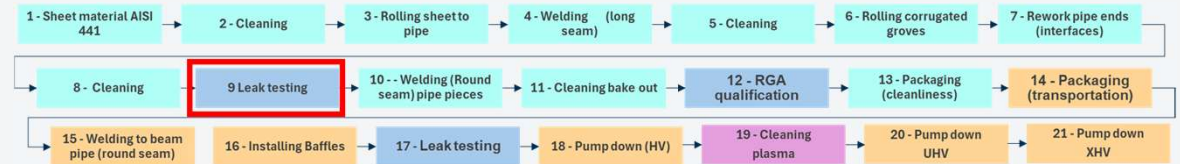
- Orbital TIG welding
- K-TIG welding
- Vacuum laser welding

Key-words:

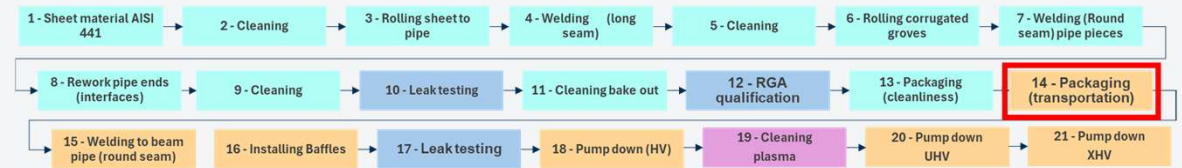
- Reliability
- Process control
- Speed
- Cleanliness
- Automation

# LEAK TESTING

Leak test flange options:



# PACKAGING



In development, no information available yet

# TRANSPORTATION

