



Carbon-steel wall thickness of chlorine equipment with regard to corrosion and erosion

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Agenda

- Introduction
- Specific risks for chlorine
- Process situations in chlorine plants
- Outlook for future recommendations
- Wall thickness for valves
- Summary



Introduction

- Carbon steel for dry chlorine equipment
- Standard calculation consider outside corrosion - 1mm added
- Protection layer of FeCl_3 (but vulnerable)
- Additional values for wall thickness recommended for chlorine to reduce the risk of leakage



Specific risks for chlorine




Specific risks for chlorine

❖ Corrosion from the product side

Destruction of the protection layer resulting in a corrosive liquid by:

- Ingress of moisture with chlorine - disturbed drying process
- Ingress of moisture during maintenance

❖ Erosion

- Erosion of the protection layer at the chlorine side



Process situations in chlorine plants

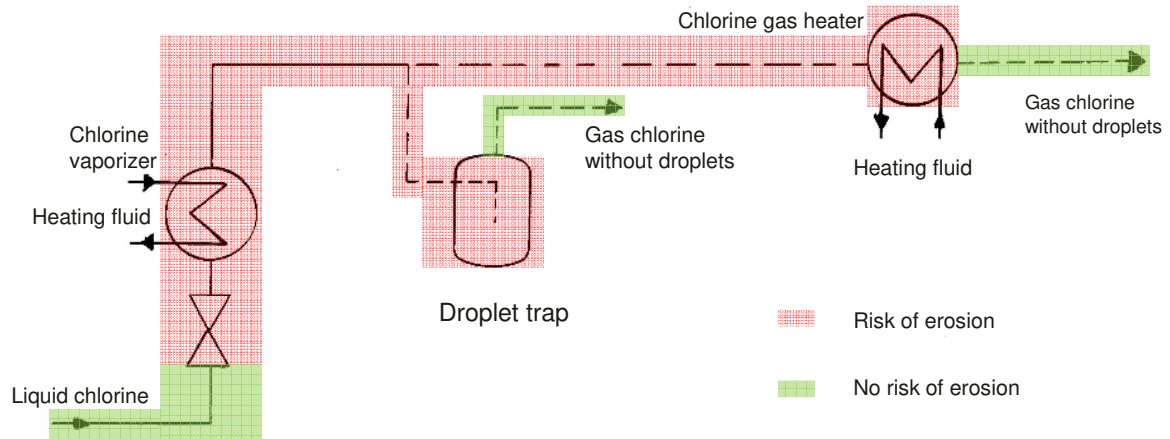


Process situations in chlorine plants

1. One phase flow - keep velocities below recommended velocity (20 m/s for gas and 2 m/s for liquid) to avoid erosion
 2. Two phase flow - in case of condensation/evaporation
 3. Valves - sound velocity during opening or closing
- Risk of erosion rising from 1. to 3.


Process situations in chlorine plants

Explanation of the different process situations in the chlorine liquefaction



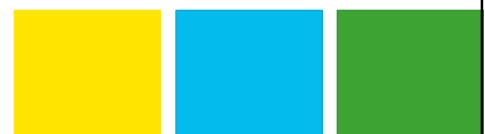
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Outlook for future recommendations




Outlook for future recommendations

- Existing GESTs have different recommendations for additive wall thickness
- Not coherent to the risk of erosion (rising from point 1 to 3)
- Equipment group has decided for coherent values:
 - 1 mm additive for one phase flow
 - 1,5 mm for two phase flow
 - Values for valves explained in the following slides

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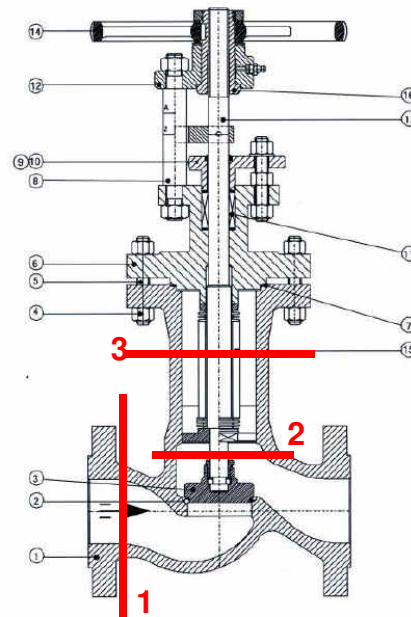
Wall thickness for valves

Wall thickness for valves

Different regions of a valve

- **1** Inlet and outlet with nominal diameter
- **2** Region after the seat
- **3** Region of the bonnet

Recent values recommend one wall thickness for the valves for a nominal diameter different for PN 40 and ANSI Class 300 from DN 25 to DN 150



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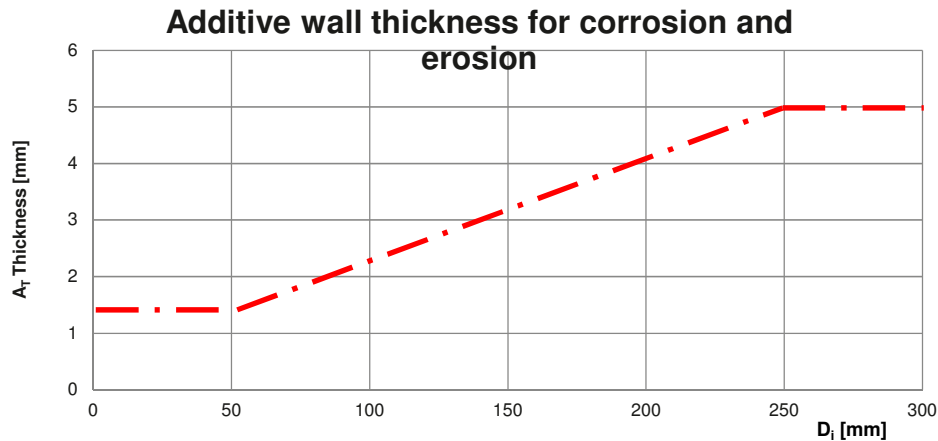
New recommendation of wall thickness for valves

- Recommendation additive values to calculation with EN 12516-1
- EN has included 1 mm for outside corrosion
- The number of acting a valve is an important issue for the erosion value
- The added values start at 1,5 mm for 25 mm to 50 mm and linear rising to 5 mm for 250 mm and bigger

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New recommendation of wall thickness for valves



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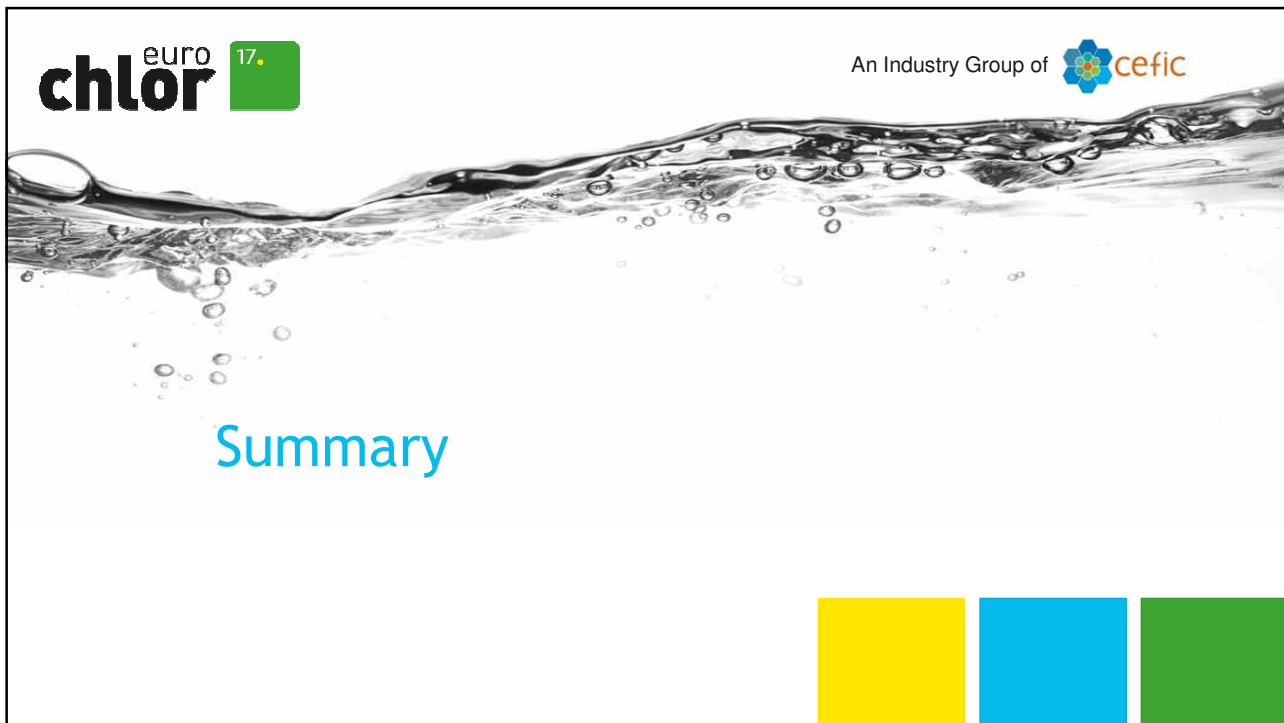
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New recommendation of wall thickness for valves

- Good experience with existing wall thickness of approved valves - mostly higher than the recommended values
- Problems with quality of casting with very high differences of wall thickness - bad casting quality cannot be compensated by higher wall thickness
- EN based calculation is easy to transfer for different pressure (PN 63 and PN 25)
- Common risk-based recommendation for DIN and ANSI

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Summary

- Corrosion from the inside and erosion are the main specific risks for leaks in chlorine plants
- The corrosion risk have all parts of the liquefaction plants by maintenance or disturbed drying process
- Erosion risk is rising from one phase flow over two phase flow to flow at acting valves
- Euro Chlor will prepare coherent recommendations for the erosion and corrosion risk in the near future

Thank you very much

Reinhard Mattick



Reinhard Mattick

It's time to say good by
and start the retirement

