



UNIVERSITAT POLITÈCNICA DE CATALUNYA  
BARCELONATECH

Escola Superior d'Enginyeries Industrial,  
Aeroespacial i Audiovisual de Terrassa



Bachelor's Thesis

# Project for the installation of a ring of demineralized water in a chemical plant

## ATTACHMENTS

**Degree:** Bachelor's degree in engineering of Aerospace Vehicles

**Student:** Oriol Rodriguez

**Director:** Xavier Roca

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## Confidential names and values

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*To keep the confidentiality of the facilities and operations of the company, the significant names and values used in this report must be interpreted as approximate values or references that does not represent the reality of the company or the project.*

*Names identifying elements have been modified for the same reason.*



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# Attachment 1: Quality standard and requirements for hygienic pipe design

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## Principles

The hygienic design principles are:

- Cleaning ability
- Surface roughness
- Avoiding splits and slits
- Flow dynamical design
- Self-drainage and depletion
- No sharp edges or angles
- Compatibility of the used materials
- Welded joints by orbital welding technology

## Receptacles

For the choice and equipment of receptacles the following aspects have to be observed:

1. The receptacle has to be self-draining and sludge formation has to be avoid in any case.
2. The receptacle has to be heated by a heating jacket and not by an inside pipe bundle. Cleaning of inside pipe bundles according to the CIP technology is difficult and manual cleaning would be necessary.
3. Sensors and gauges which immerse into the receptacles should be reduced to a minimum and sufficiently saved against contamination always on upper side of pipe.
4. Pipe attachments should not immerse into the vessel. Tank and draining can rarely be CIP-cleaned in one step.
5. The receptacle's lid should have a smooth surface inside.
6. Agitators and drivers should be installed on the top.
7. The receptacles should not have lateral manholes.

In general, vertical receptacles can be cleaned more easily than horizontal ones.

## Piping

Piping's have to be corrosion-resistant. The material has to be neutral towards the product, i.e. neither color nor odor (clarity) may be affected. The currently used, longitudinally welded pipes generally meet even high requirements. The cost of seamless and welded pipes should be compared. Frequently, relatively thin-walled pipes of metric dimensions, which are known as "milk pipes" or

"dairy piping" in Germany, are used. The use of these pipes combines optimal technology and the required microbiological safety.

Stainless steel is resistant against most of the cleaning agents and disinfectants, only the presence of halogenide-ions results in pitting corrosion. Therefore, particularly chlorous agents (concentration > 50 mg/l) have to be avoided.

Basically, the following aspects have to be observed even during planning a piping system and for all subsequent modifications:

1. guarantee self-draining and a gradient of approx. 2% in all pipes
2. no stagnant volumes (air bubbles, liquid accumulation)
3. avoidance of sagging pipe lines
4. option of dismantling the piping system is useful. In view of inspection and cleaning works also the option of dismantling pipeline parts is advantageous
5. regarding pipe contractions:
  - a. avoid slow reduction, large bounds of nominal width values (stagnant volumes). Better: use of asymmetric reduction, which are more self- draining and which do not require an increased gradient
6. choice of suitable in-line-measuring instruments, outwardly closed, adequately sealed, easily exchangeable for cleaning purposes.