



Does hygienic design make a difference?

It is possible to optimize - but choose wisely where to do it....

- remember biofilm is always an issue

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Agenda

Does hygienic design make a difference?

- What is hygienic design - what to remember - and a few examples
- Compromises - know they are there - what to do about them ?
- Requirements specification - example if no requirements
- Example - little change in hygienic design and the cleaning procedure



Hygienic design

4 principles to remember

1. The materials used should be inert and suitable for use to food contact
 - Link to FVST, FKM - stainless steel (danish) - guidelines:
<https://www.foedevarestyrelsen.dk/SiteCollectionDocuments/Kemi%20og%20foedevarekvalitet/FKM/Rustfrit%20st%C3%A5l.pdf>
2. Contact surfaces should be without cracks and corrosion.
 - As smooth as possible
3. The equipment should protect the product / food against contamination
4. The equipment should be drainable, easy to clean and accessible

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With hygienic design..

- What happens to the hot spots where not using hygienic design
 - Not easy to clean - more often residues of biofilm (from the production) left on the equipment
 - Biofilm - cross contamination of the production with pathogens or quality reducing microorganisms
 - Bio-corrosion - because of the residues of the biofilm on the surface
- Important to use hygienic design as much as possible to secure the cleaning procedure to be:
 - Effective and as quick as possible - opportunity to longer production time
 - To minimize cross contamination
 - To prolong lifetime for the equipment (ex. less corrosion)

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Important to remember:

2 component of equipment - each constructed with hygienic design - it is possible to destroy this - if the components are joint together in the wrong way

Then - the overall hygienic design of the produktion line is not there

!!

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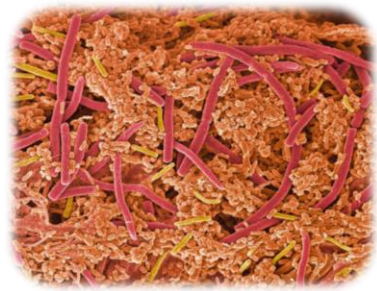
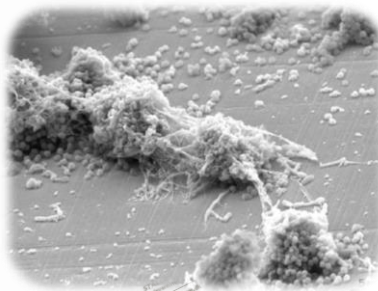
Evaluation of the hygienic design

Stålcentrum-regi

EVALUERINGSSKEMA TIL ANVENDELSE VED VURDERING AF
PROCESUDSTYR I FØDEVAREINDUSTRIEN

- SKEMAET BRUGES TIL AT VURDERE OG ANVENDT TIL EGENKONTROLLEN
SAMT VED LØST, HJÆLP, VEJLEDNING FORBEREDELSE UDEN OG MED
FØRSTÅELSE, SÅVEL SOM SAMMENLIGNING.
- PRIMÆR FUNKTION: EGENKONTROL AF EKSISTERENDE UDSTYR
- SEKUNDÆR FUNKTION: BEVARELSER, UDVEJSLING AF NYT UDSTYR
- BEVARELSER OG UDVEJSLING AF NYT UDSTYR

Use the Evaluation schema as a tool
to remember more details



Link:

http://www.staalcentrum.dk/wp-content/uploads/2017/05/evalueringsskema_rev_2_5_form_for_acrobat_reader_261011.pdf

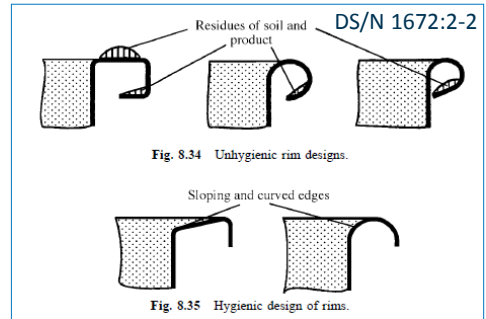
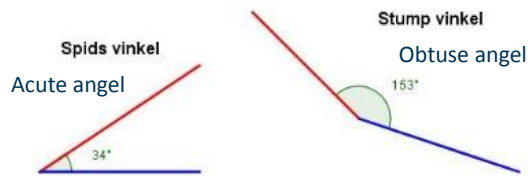
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The evaluation schema - different rows of questions

- **Q1** - demand to the materials resistance to standard cleaning
 - Hot water - high/low pH - oxidizing detergent etc.
- **Q2** - Geometry
 - Is there any acute angles ? It is much easier to clean the obtuse angle than the acute angle

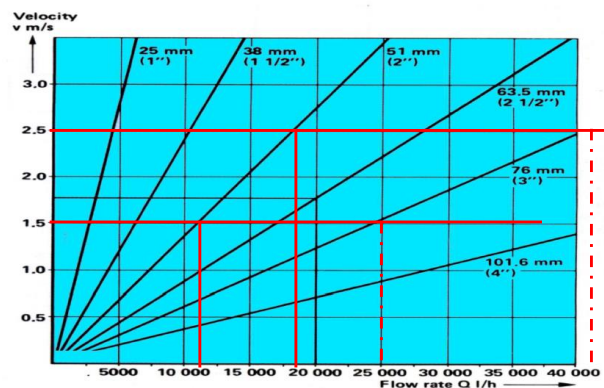


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Change in the dimensions in the pipes - different inch hygienic critical point



- For an optimal cleaning of the pipe: the turbulent flow rather than the laminar flow
- Between 1.5 - 2.5 meter /sec.
 - 2" pipe: around minimum 11.000 liter / hour - maximum 18.000 liter / hour
 - 3" pipe: around minimum 25.000 liter/ hour - maximum 41.000 liter / hour

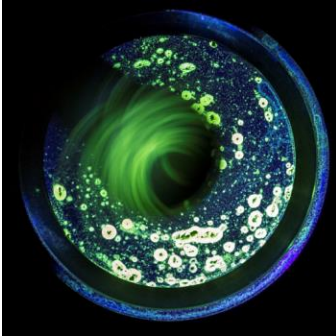
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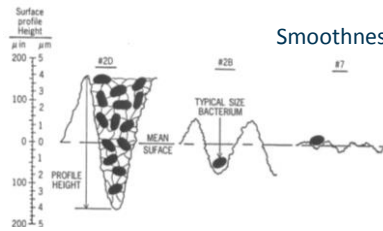


The evaluation schema - different rows of questions

- Q3 - Finish of the surface
 - How smooth is the surface
 - Is there any cracks - pittings etc.

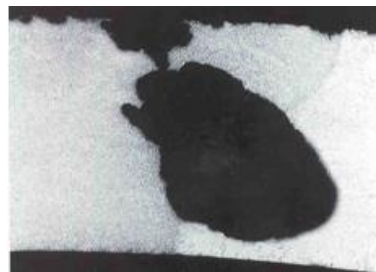


Corrosions - pittings



Smoothness of the surface

All small pittings you can see in the top of the surface is like this.... underneath



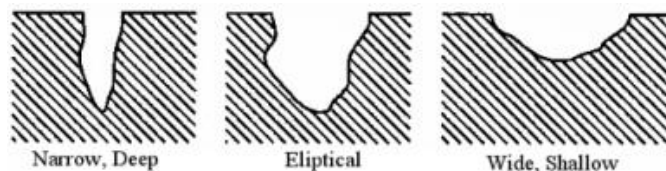
- Q4 - joints - weldings etc.

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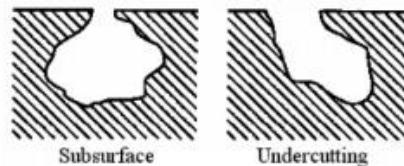
Corrosion - pitting

Understand the importance - why do pittings give problems with microorganisms



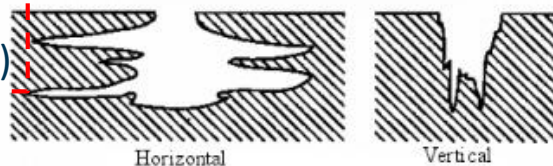
Pittings ~
autocatalytic process

pH ~ stomach acid (pH 1.5)
Salt concentration ~
3 times the North Sea (11%)



Link:

http://www.corrosionclinic.com/types_of_corrosion/pitting_corrosion.htm



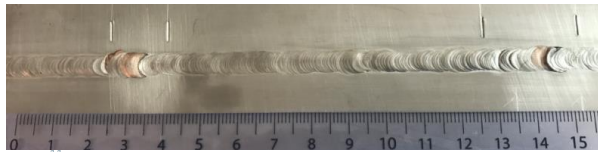
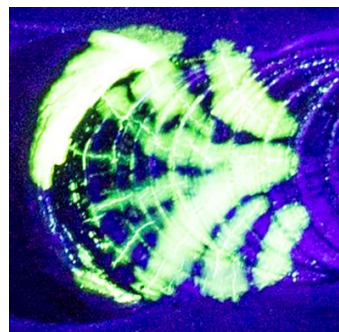
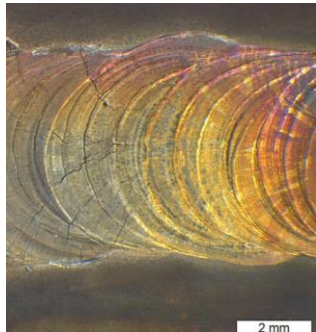
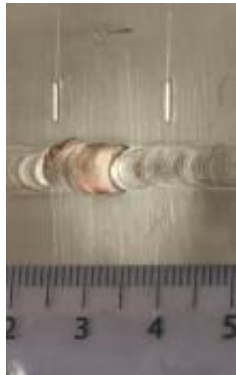
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"Detection of defects and cracks in production equipment"

"Detektion af fejl og revner i procesudstyr"

Artikler i Plus Proces nr. 7 (24.okt 2017)



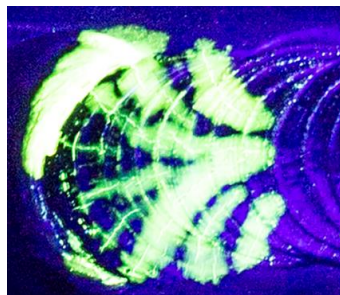
How is the microbiology and formation of biofilm down in the cracks ?
Is it easy to clean down in these cracks ?

Size (volume) of the crack - number of microorganisms (teoretical)



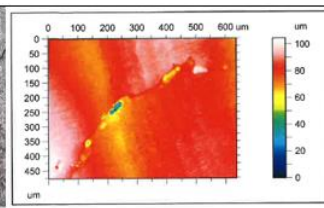
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Artikler i Plus Proces - nr. 7 2017 - fortsat



stereomicroscope

Confocal microscope



Tabel 1:

Mål af revner på svejsesøm og fejl på testpanel samt det teoretiske niveau af mikroorganismer, der kan være i den pågældende revne

Emne	Mål		Beregnet volumen - μm^3 (længde over 50 μm)	Synlig ved:		Antal pr. revne/fejl		
	Bredde μm	Dybde μm		Penetrant	Fremkaldet	Kokker	Stave	Listeria
Svejsesøm - Revne 1,a	25	50	62500	X	X	10^5	10^3-10^7	10^5
Svejsesøm - Revne 2,b	31	40	62000	X	X	10^5	10^3-10^7	10^5
Testpanel - Fejl 1,c	28	30	42000		X	10^5	10^3-10^7	10^5
Testpanel - Fejl 2,d	12	10	6000		X	10^4	10^2-10^6	10^4

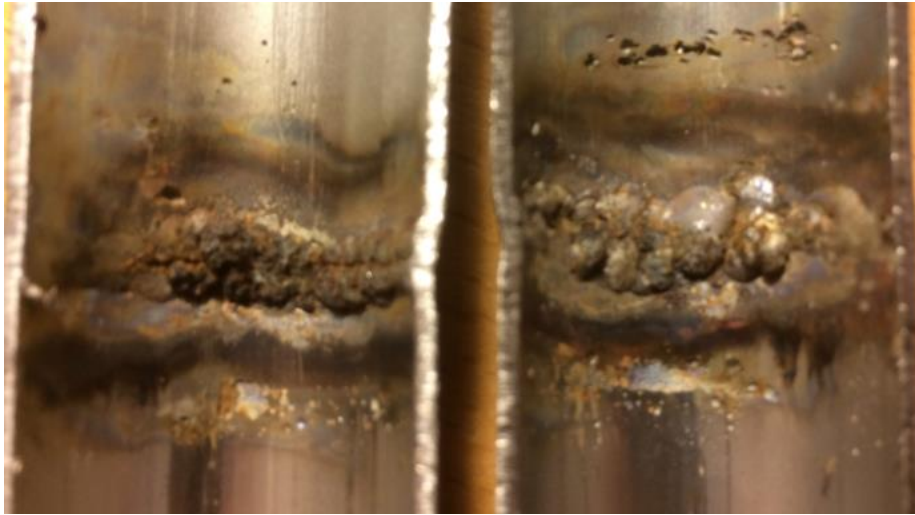
Resultat af opmålingen af revnerne (a og b) på svejsesøm og fejlene på testpanel (c og d), som angivet i Figur 7. Volumen er beregnet over en afstand på 50 μm under forudsætning af, at bredde og dybde ikke ændrer sig. Ligeledes er der angivet, om revnen eller fejlen er synlig blot med 'penetrant', eller om der også skal anvendes 'fremkaldet' for at se fejlen. Det teoretiske antal mikroorganismer er beregnet ud fra den gennemsnitlige størrelse af hhv. kokker og stave. Volumen er udregnet efter formler: $V_{\text{kokker}} = 4/3 \cdot 3,14 \cdot r^3$ og $V_{\text{stave}} = 3,14 \cdot r^2 \cdot \text{længde}$.



Point:

Small cracks - that you can not see - can contain a lot of microorganisms

Pipe and welding



How is the flow across this welding -
how do you think the cleaning in the pipe are going to be ?

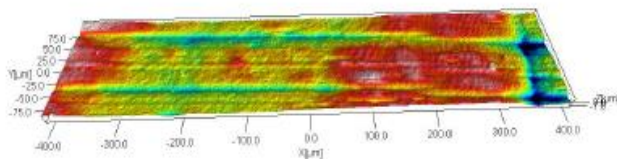
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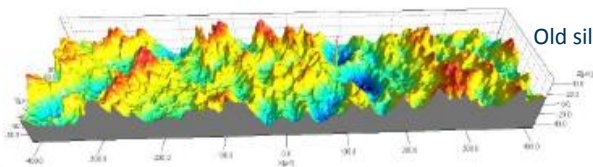
Used equipment - when is it the right time to change?

New silicone hose



1

Old silicone hose



2

- It is also important to think about the hygienic design in older - or used - equipment.
- Is it still possible to clean the surface - overall

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The evaluation schema - different rows of questions

- Q5 - installations
 - Electrical - air etc.



Is this easy to clean ??

- Q6 - "cleaning friendly"
 - Drainabel - accessible - formation of aerosols etc.

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Compromises - we know they are taken

- Important to know where the compromises are
- What to do about these compromises:
 - Change the construction - if possible
 - If not possible - Change the cleaning procedure, maybe it is necessary to use a brush
 - And / or use these compromises / hot spots for not using hygienic design in the cleaning validation

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Requirements specification

- If no requirement are specified - you maybe get a welding that can not tolerate water or a welding that have not been made in the right way - risk of corrosion

Example - change a little in the hygienic design and in the cleaning procedure - open equipment

- Important:
 - Minimum of cracks and corrosion pitting's
- Savings compared with the ordinary cleaning procedure
 - 9 % in time spent on cleaning in the specific area
 - Means - possible more production time or use the spent time to extra cleaning other places
 - 17% in consumption of water - price "water in" - "water out" and energy used for heating the water to 55°C
 - 5% in cleaning agents (cleaning and disinfection)
 - Reduction in consumption of chlorine: 40%
- Important to make sure that the cleaning validation is taken on the most critical Hot Spots - where there is no og minimal of hygienic design

Further information at forcetechnology.com

