

Overcome cleaning challenges for critical applications - Comparing modified alcohol, hydrocarbons, chlorinated solvents and water



The PQCW offers practical, hands-on and independent, training in cleaning.

More Info
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pqcw@shsu.edu



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 Cleaning Research
 Group at SHSU
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 Kanegsberg**
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ed@bfksolutions.com



Michael Onken
 SAFECEM
m.onken@safechem.com

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Hosts: The Product Quality Cleaning Workshop Team



Barbara and Ed Kanegsberg - "The Cleaning Lady and the Rocket Scientist"

- BFK Solutions - Consultants in Critical Cleaning
- Authors and Editors of the two-volume CRC Handbook for Critical Cleaning
- Independent evaluations and recommendations
- Co-chairs of the Product Quality Cleaning Workshops
- barbara@bfksolutions.com and ed@bfksolutions.com



Darren Williams - "The Professor"

- Professor of Physical Chemistry at Sam Houston State University
- Leader of the Cleaning Research Group
- Co-chair of the Product Quality Cleaning Workshops
- Performs cleaning trials and formulates cleaning chemistries
- williams@shsu.edu

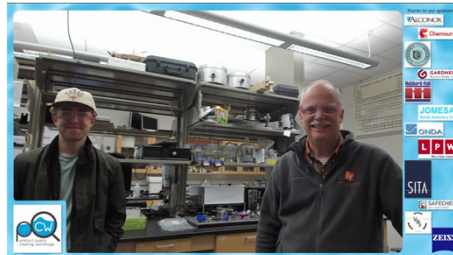


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PQCW - Workshops for Terrific Products

- ▶ “While I would prefer to have been at in-person laboratories so I could have hands-on experiences with cleaning processes, **I really liked the two-week virtual PQCW.**”
- ▶ “People with different functions within our company, including Strategic **Sourcing**, Project **Management**, and **Manufacturing Engineering**, attended.
- ▶ “We learned a lot; and we have made changes. We are **refining our own cleaning** requirements and putting together training programs.
- ▶ “For example, we used the workshop to develop **black light testing and fixtures**; and we have already set up a one-hour “**Parts Washing 101**” training course.
- ▶ “The section about **EPA amended TSCA had useful, timely information.**”
 - Christian Johnson, Engineer, Yaskawa, participant, PQCW21



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Our Speaker



Michael Onken - Market Development Manager - SAFECHEM

- Degrees in both Chemistry and Business
- Nearly 10 years of experience in the metal cleaning industry
- Advises companies on the use of modified alcohols for optimizing parts cleaning process
- Responsible for the modified alcohol business at SAFECHEM
- Member and guest speaker at cleaning and hardening associations (FiT and AWT)
- m.onken@safechem.com

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CHEM-AWARE™

OVERCOME CLEANING CHALLENGES
FOR CRITICAL APPLICATIONS -
COMPARE MODIFIED ALCOHOL,
HYDROCARBONS, CHLORINATED
SOLVENTS AND WATER

PQCW Webinar, 01/25/2022



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QUESTION 1: HOW DO YOU CLEAN
TODAY?



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Overcome cleaning challenges for critical applications

Influencing factors for technical cleanliness

What are the cleanliness requirements?

Kind of contamination	Materials	Geometry / size of parts
 <small>https://www.dmggroup.com/</small>	 <small>https://www.comsol.com/</small>	 <small>https://www.dnc-technology.de/</small>
 <small>Hydrotec.de</small>	 <small>www.ipdirectory.com</small>	<p><i>trans</i>-1,2-dichloroethene</p>  Water-based cleaner Modified Alcohol <small>https://www.comsol.com/</small>

Economic Factors



EH&S









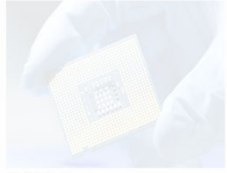


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Overcome cleaning challenges for critical applications

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Economic Factors





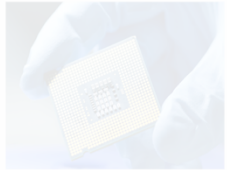
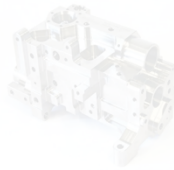

EH&S


- Regulations regarding / impacts on environment, health and safety

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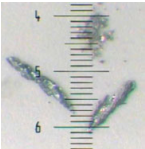
Overcome cleaning challenges for critical applications

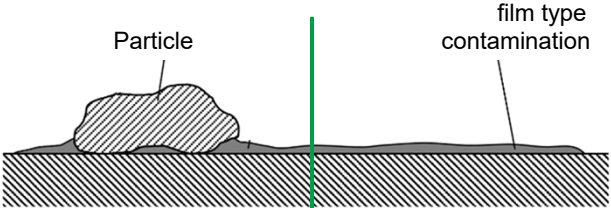
Influencing factors for technical cleanliness			Economic Factors
Kind of contamination	Materials	Geometry / size of parts	<ul style="list-style-type: none"> Process stability/ process security Throughput Re-use and recycling Energy consumption Costs of cleaning media Disposal costs Running costs
 	 	 	
What are the cleanliness requirements?			EH&S
			<ul style="list-style-type: none"> Regulations regarding / impacts on environment, health and safety


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Overcome cleaning challenges for critical applications







- Perchloroethylene can be beneficial because of the weight
- Hydrocarbons (HC) and Modified alcohol (MA)/HC mixture have worst particle removal capacities
- Aqueous cleaners can electrostatically load the particles
- MA are a very good compromise**

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Overcome cleaning challenges for critical applications

Successful cleaning is the result of four factors

Alkaline
Neutral
Acid

Time
Temperature
Mechanics
Chemistry

Organic Solvents
Hydrocarbons
Halogenated Solvents
Modified Alcohols

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Overcome cleaning challenges for critical applications

Non polar / water insoluble

Water soluble / polar

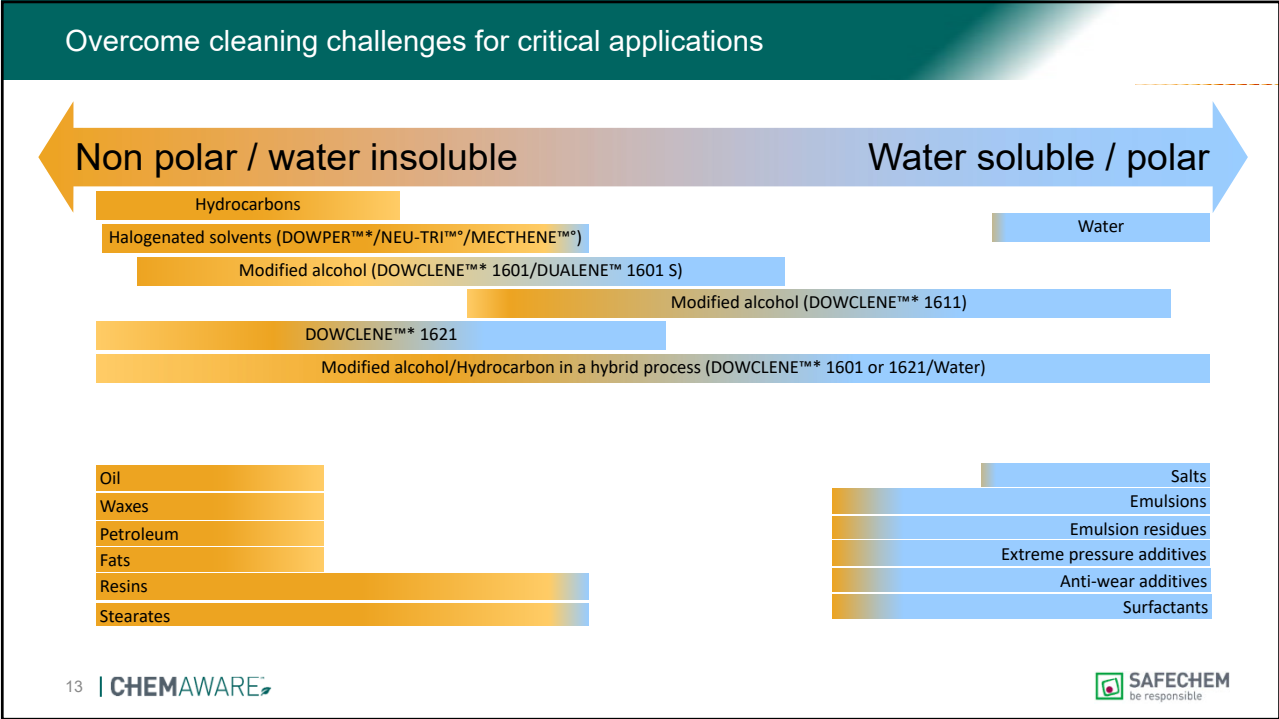
Oil & HC Solvents

Water

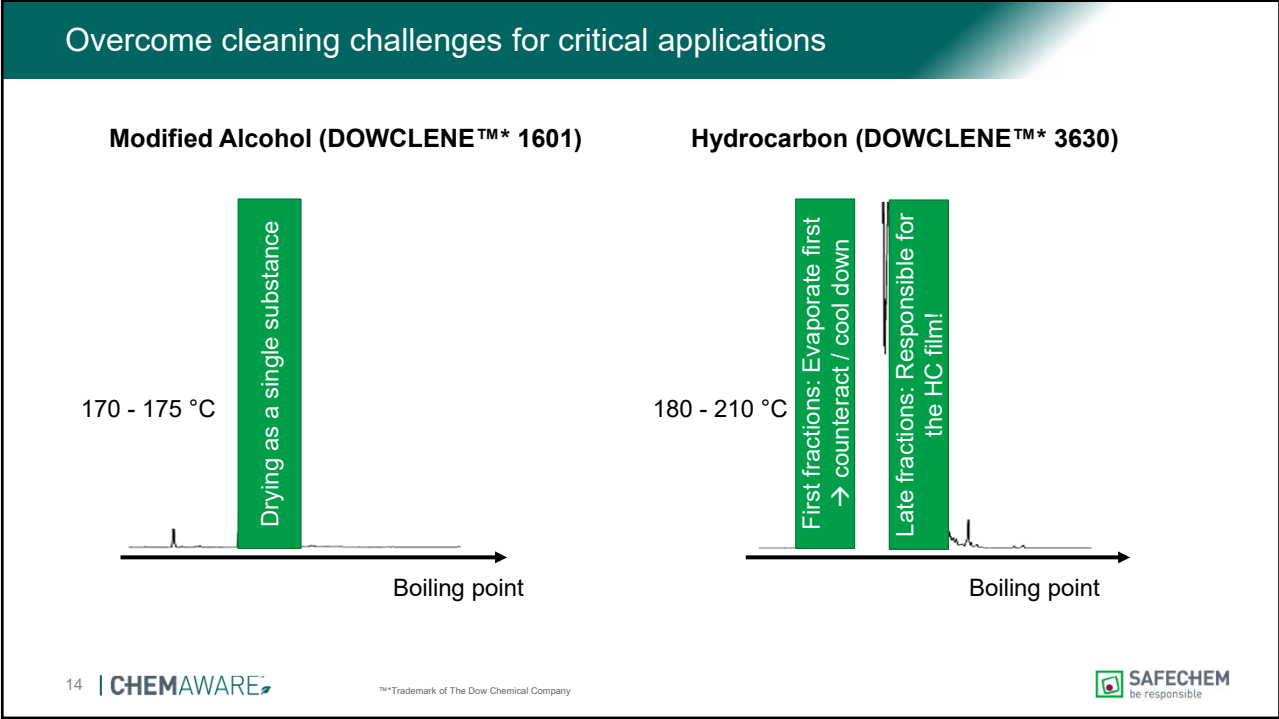
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Polar Contaminations		Non-Polar Contaminations	
AQ Cleaning	Solvent Cleaning	AQ Cleaning	Solvent Cleaning
			

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Overcome cleaning challenges for critical applications

Influencing factors for technical cleanliness			Economic Factors
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EH&S			<ul style="list-style-type: none"> Regulations regarding / impacts on environment, health and safety

What are the cleanliness requirements?

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Influencing factors for technical cleanliness

Kind of contamination	Materials	Geometry / size of parts
 <small>https://www.researchgate.net/publication/312111111</small>	 <small>https://www.researchgate.net/publication/312111111</small>	 <small>https://www.dfd-technology.de/</small>
 <small>https://www.researchgate.net/publication/312111111</small>	 <small>https://www.researchgate.net/publication/312111111</small>	 <small>https://industrialcleaner-industrie.de/</small>

Economic Factors

- Process stability/ process security
- Throughput
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- Energy consumption
- Costs of cleaning media
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- Running costs

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- Regulations regarding / impacts on environment, health and safety

What are the cleanliness requirements?



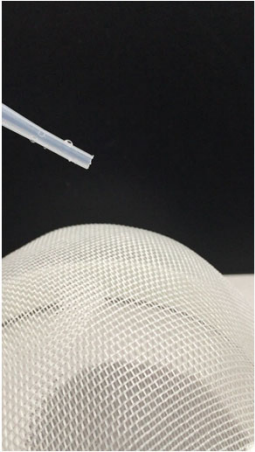


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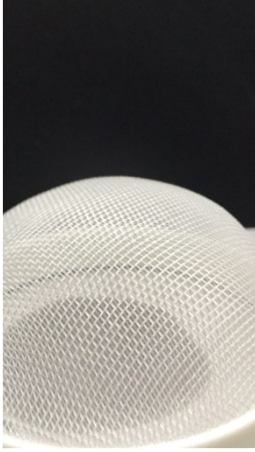
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Comparison surface tension


Water




Solvent



What are the cleanliness requirements?





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QUESTION 2: ARE YOU SATISFIED WITH THE CLEANING PERFORMANCE?

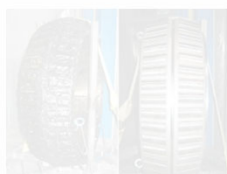


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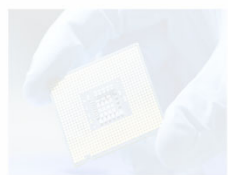
Overcome cleaning challenges for critical applications

Influencing factors for technical cleanliness

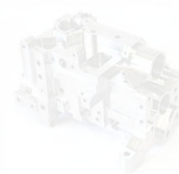
Kind of contamination



Materials



Geometry / size of parts



Economic Factors

- Process stability/ process security
- Throughput
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What are the cleanliness requirements?

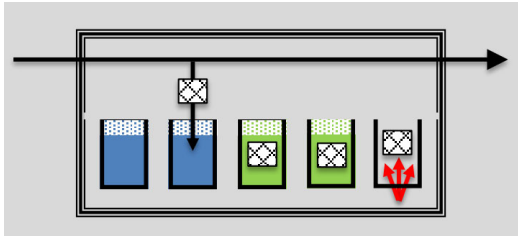
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Overcome cleaning challenges for critical applications

Efficiency of aqueous cleaning



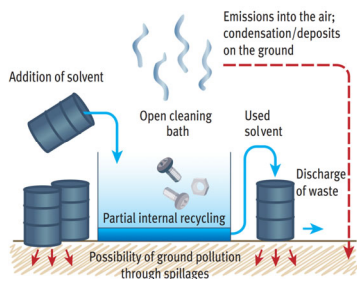
Amounts per 100 kg (220 lb) oil removed



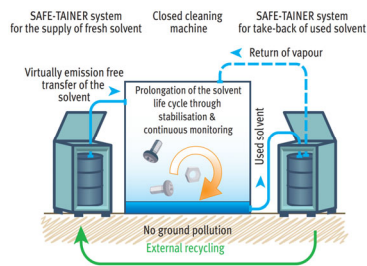
SOLVENTS ARE UNSUSTAINABLE?

How do they work?

Outdated Technology



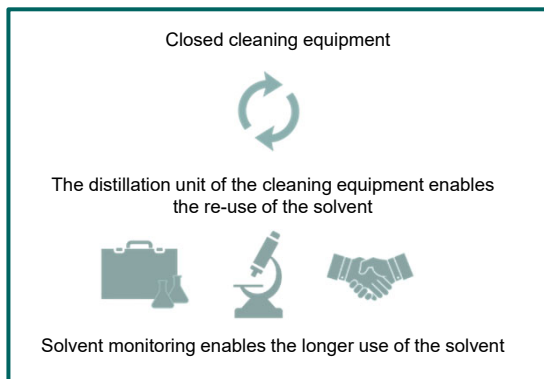
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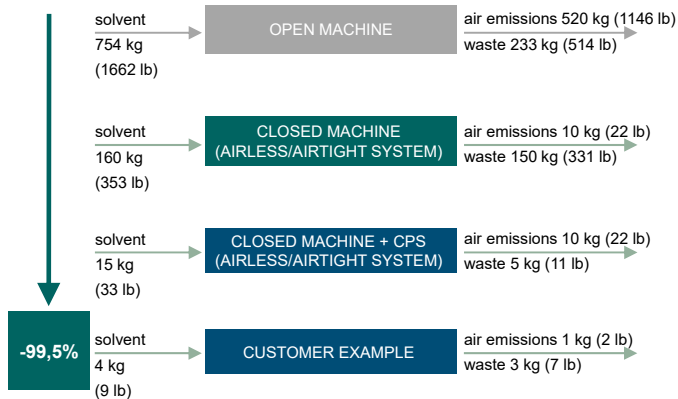
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Amounts per 100 kg (220 lb) oil removed



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Thorough understanding of the plant is important for using the solvent

Temperature Time
Mechanics Chemistry

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Economic Factors / Re-use and Recycling

Perchloroethylene	Modified alcohols	Hydrocarbons	Oils
121 °C	170 - 175 °C	180 - 210 °C	> 250 °C

ΔT2

ΔT1

The higher the temperature difference between the boiling point of the cleaning agent, and the boiling point of the oil, the better both products can be separated.

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Total energy required for conversion of a liquid substance into gas (per J/g)

		DOWPER™* MC	DOWCLENÉ™* 1601	Hydrocarbons	Water
Specific heat ²	J/g	0.9	2.6	2	4.18
Temperature difference (between 20 °C room temperature and respective boiling point)	°C	101	80 [†]	80 [†]	80
Total specific heat required to reach boiling temperature	J/g	90.9	208	160	334.4
Vaporization heat ³	J/g	209	280	275	2,260
TOTAL ENERGY	J/g	300	488	435	2,594

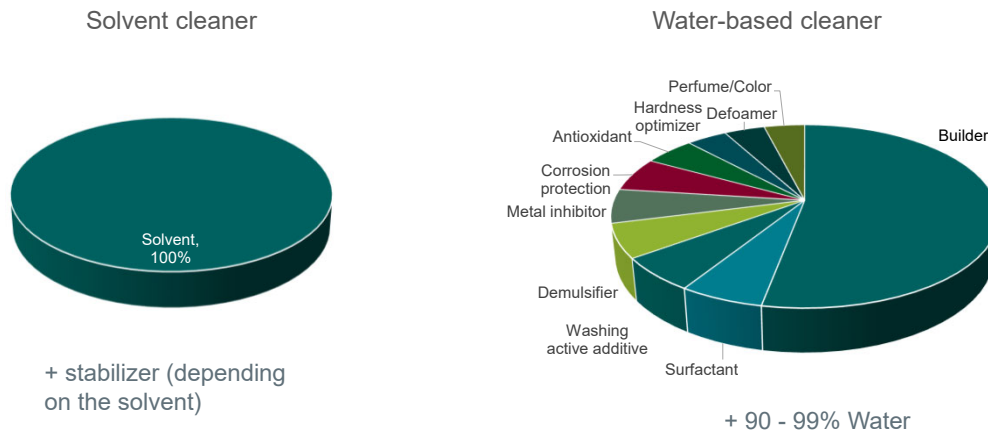
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The formulation of solvent and water based cleaner are completely different!



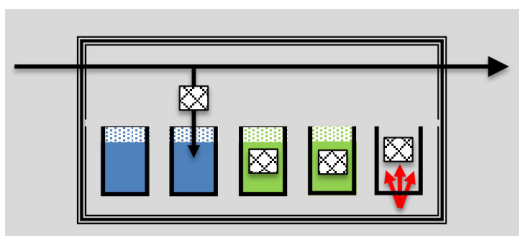
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Principle of water-based cleaning



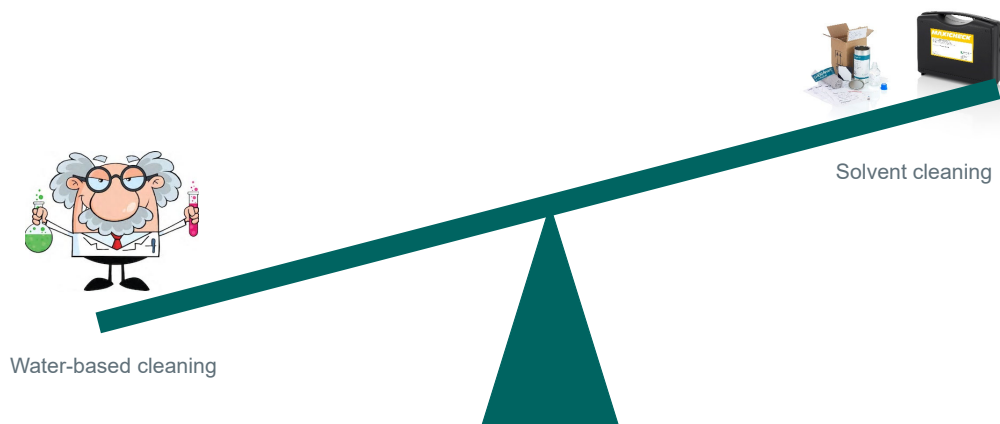
The cleaning quality depends on the number of rinsing bath with demineralized water

→ With increasing cleaning requirements the investment costs increases as well as the space requirement

- Cleaner concentration must be constant for a constant cleaning result
- Carry-over of cleaner into the rinsing bath

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Effort for media monitoring



Overcome cleaning challenges for critical applications

Process safety

DUALENE™ 1601 S and DOWCLENE™* 1621 are already stabilized in their first delivery, DOWCLENE™* 1601 can be stabilized, to ensure they work in the safety zone from the very beginning.

Mandatory monitoring with MAXICHECK™ test kits reveals potential challenging situations and provides recommendation on addition of stabilizer if required.

Continue solvent monitoring and stabilization (if required) to safeguard your equipment and extend solvent lifespan.

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™Trademark of The Dow Chemical Company

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Overcome cleaning challenges for critical applications

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CUSTOMER EXAMPLE / SUMMARY



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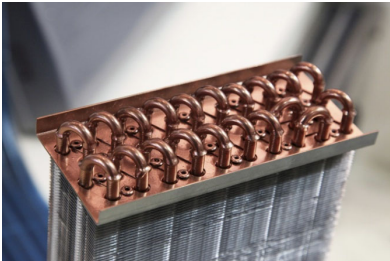
Customer Example / Summary

Use of DOWCLENES™* 1601 at HS Marston Aerospace Limited (UTC Aerospace)

- Supplier of aerospace industry
- Production of heat exchangers for aircrafts

Cleaning requirement:

- Cleaning of heat exchangers
- Brazing process after cleaning



Chlorinated Solvent N-Propylbromide 2011 Modified Alcohol Time
Water-based Cleaning Fluorinated Solvent 2020 3rd Machine Installation

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SAFECHEM Dedicated Contact in the US



SAFECHEM North America Inc.

Chris Tivnan - Sales Manager NAA

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E-mail: c.tivnan@safechem.com

Time for Questions



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More Info

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