



**Fraunhofer**

**TESTED<sup>®</sup>  
DEVICE**

KUKA Roboter GmbH  
Stainless steel 1.4021  
**Report No. KU 1610-849**

DUPLICATE

Statement of  
Qualification

Chemical Resistance

# Statement of Qualification

**Customer**  
 KUKA Roboter GmbH  
 Zugspitzstrasse 140  
 86165 Augsburg  
 Germany

**Component tested**

Category: Materials  
 Subcategory: Metals  
 Product name: Stainless steel 1.4021  
 (manufacturing date: 8/2016)

## Chemical resistance test

Standards/Guidelines: ISO 2812-1; ISO 4628-1; VDI 2083-17  
 The norms stated generally refer to the version valid at the time of the tests.

Testing equipment:
 

- Microscope
- Camera

Test environment parameters: Temperature: ..... 22 °C ± 0.5 °C

Test procedure parameters: Immersion method:
 

- Chemicals: ..... Formalin 37 %
- ..... Ammoniac 25 %
- ..... Hydrogen peroxide 30 %
- ..... Sulfuric acid 5 %
- ..... Phosphoric acid 30 %
- ..... Peracetic acid 15 %
- ..... Hydrochloric acid 5 %
- ..... Isopropanol 100 %
- ..... Sodium hydroxide 5 %
- ..... Sodium hypochlorite 5 %
- ..... Ethanol 99.5 %
- ..... Sodium hydroxide 20 %
- ..... Elma Clean 100 5 %
- ..... Microbac food 5 %
- ..... Desifor forte 5 %
- ..... Sodosil RA08 15 %
- Incubation time: ..... 1 h, 3 h, 6 h, 24 h

## Test result / Classification

The chemical resistance of stainless steel 1.4021 was classified according to ISO 4628-1 and VDI 2083-17 with the following results:

Chemical resistance	1 h	3 h	6 h	24 h
Formalin 37 %	0	0	0	0
Ammoniac 25 %	0	0	0	0
Hydrogen peroxide 30 %	0	0	0	0
Sulfuric acid 5 %	2	5	5	5
Phosphoric acid 30 %	5	5	5	5
Peracetic acid 15 %	0	0	0	0
Hydrochloric acid 5 %	4	5	5	5
Isopropanol 100 %	0	0	0	0
Sodium hydroxide 5 %	0	0	0	0
Sodium hypochlorite 5 %	0	2	3	4
Ethanol 99.5 %	0	0	0	0
Sodium hydroxide 20 %	0	0	0	0
Elma Clean 100 5 %	0	0	0	0
Microbac food 5 %	0	0	0	0
Desifor forte 5 %	0	0	0	0
Sodosil RA08 15 %	0	0	0	0

The classification is based on a worst-case consideration. In the process, damage was assessed according to the classification system used in ISO 4628-1 and VDI 2083-17:

0 = excellent                      3 = weak  
 1 = very good                    4 = very weak  
 2 = good                            5 = none

The measuring devices used for the qualification tests are calibrated at regular intervals; their results can be traced back to national and international standards. In cases where no national standards exist, the test procedure implemented complies with the technical regulations and norms applicable at the time of the test. The relevant documentation can be viewed on request at any time.

For further information about the test environment and parameters, please refer to the Fraunhofer IPA test report.

Fraunhofer Institute for Manufacturing Engineering and Automation IPA

Department of Ultraclean Technology and Micromanufacturing

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Stuttgart, December 14, 2016

Place, date of first document issued

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Place, current date

on behalf of   
 Frank Bürger, Project Manager Fraunhofer IPA