

CLEANING STAINLESS STEEL

STP 538



AMERICAN SOCIETY FOR TESTING AND MATERIALS

CLEANING STAINLESS STEEL

A symposium
presented by Committee A-1
on Steel, Stainless Steel and
Related Alloys, and Committee D-12
on Soaps and Other Detergents,
AMERICAN SOCIETY FOR
TESTING AND MATERIALS
Cleveland, Ohio, 17-19 Oct. 1972

ASTM SPECIAL TECHNICAL PUBLICATION 538

E. S. Kopecki, symposium chairman

List price \$18.00

04-538000-02



AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 Race Street, Philadelphia, Pa. 19103

©by AMERICAN SOCIETY FOR TESTING AND MATERIALS 1973

Library of Congress Catalog Card Number: 73-80188

NOTE

**The Society is not responsible, as a body,
for the statements and opinions
advanced in this publication.**

**Printed in Tallahassee, Fla.
October 1973**

Foreword

The symposium on Cleaning Stainless Steel was presented 17-19 October 1972, in Cleveland, Ohio, and was sponsored by Committee A-1 on Steel, Stainless Steel and Related Alloys, and Committee D-12 on Soaps and Other Detergents. E. S. Kopecki, Committee of Stainless Steel Producers of the American Iron and Steel Institute, presided as the symposium chairman.

Related ASTM Publications

Stainless Steel for Architectural Use, STP 454 (1969), \$9.75, 04-454000-02

Contents

Introduction	1
Standard Recommended Practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems	3
Scope	3
Applicable Documents	4
Design	4
Precleaning	4
Descaling	4
Cleaning	5
Inspection After Cleaning	9
Precautions	11
Alkaline Cleaning of Stainless Steel: An Overview—R. A. RAUSCHER	17
Applications of Alkali Bases	17
Composition of Cleaners	18
pH Levels	19
Rinsing	19
Disposal Problems	20
Cost Factors	22
Conclusions	22
Cleaning Stainless Steel with Alkaline Solutions—R. K. BRANDT AND M. J. BACH	23
Soils	24
Cleaners	24
Laboratory Testing	27
Control Methods	27
Water	28
Rinsing	29
Handling and Safety	29
Disposal	30
Summary	30
Solvent Cleaners—Where and How to Use Them—M. Z. POLIAKOFF	33
What Is the Composition of Solvent Cleaners?	33
Where Are Solvent Cleaners Used?	37
How Are Cleaning Solvents Used?	39

How Can Solvent Cleaners Be Used Safely?	40
Conclusions	42
Role of Organic Acids in Cleaning Stainless Steels—W. J. BLUME	43
Properties	43
Applications	44
Conclusions	52
Selection of a Proper Vapor Degreasing Solvent—W. L. ARCHER	54
Environmental Concerns	55
Occupational Safety and Health Act	57
Requirements of a Vapor Degreasing Solvent	59
Worker Safety	61
Degreaser Operating Procedures	62
Summary	63
Stability of Trichlorotrifluoroethane-Stainless Steel Systems—	
R. A. GORSKI	65
Objective	65
Test and Evaluation Methods	67
Experimental Procedure and Results of Sealed-Tube Tests	68
Experimental Procedure and Results of U-Bend Tests	69
Summary	75
Conclusion	75
Acid Cleaning of Stainless Steel—W. J. ROBERTS	77
What Is Acid Cleaning?	77
Why Acid Clean Stainless Steel?	77
General Chemistry of Acid Cleaning	79
Acid Cleaners	80
Applied Acid Cleaning	81
Acid Cleaning Pre-Treatments (Before)	81
Acid Cleaning Post-Treatments (After)	85
Conclusion	89
Passivation Treatments for Resulfurized, Free Machining Stainless Steels—	
MICHAEL HENTHORNE AND R. J. YINGER	90
The Passivation Treatment Itself	92
Effect of Passivation on Corrosion Resistance	94
Discussion of Passivation Effects	96
Dissolution of Tool Steels in Passivation Solutions	103
New Molten Salt Systems for Cleaning Stainless Steels—	
R. H. SHOEMAKER	106
Scale Removal	106
Pickling Acids	107

Mechanical Methods	107
Salt Bath Conditioning and Cleaning	108
Reactions of Molten Salts	109
Salt Bath Equipment	110
Future Continuous Anneal and Pickle	116
Conclusion	117
Anodic Treatment Improves Surface Properties of Stainless Steel—	
JANE SORENSEN AND GEORGE SHEPARD	118
Effect of Bright Annealing	119
Development of an Anodic Pretreatment	120
Effect of Anodic Pretreatment	124
Conclusions	125
Vibratory Cleaning, Descaling, and Deburring of Stainless Steel Parts—	
T. L. GRIFFIN	126
The Tumbling Barrel	127
Centrifugal Finishing Machines	128
Spindle Finishing Machines	128
Vibratory Finishing Machines	129
Media	130
Compounds	131
Descaling Compounds	132
Burnishing Compounds	133
Abrasive Compounds	133
Summary	134
Extrude Hone Process and Its Applications to Stainless Steel Components—	
R. S. CREMISIO	135
Extrude Hone Machine	135
Tooling	137
Media	138
Conclusions	146
Pre-Service Cleaning Philosophy for Boiling Water Reactors—	
W. L. WALKER	147
Procedures Versus Philosophy	147
Cleaning Procedure	150
Development of a Cleaning Philosophy	151
Summary	153
Cleaning Stainless Steel Heat Transport Systems for Liquid Metal Service—	
P. S. OLSON	154
Characteristics of Liquid Metal Heat Transport Systems	155
Fabrication Cleaning	158

Installation Cleanliness Requirements	160
Purging or Evacuation and Sodium Filling	163
Summary	164
Theoretical Analysis of Sodium Removal from Fast Flux Test Facility Fuel	
Subassemblies—R. R. BORISCH	165
Argon Flow Rates for Cooling	167
Loss of Cooling	170
Flushing with Water	171
Drying	171
Summary	172
Discussion	173
Cleaning of Fluid Systems and Associated Components During Construction	
Phase of Nuclear Power Plants—J. H. HICKS	175
Commentary on Cleaning Standard	176
Recent Developments and Future Plans	185
Cleanliness Requirements in the Chemical Industry—C. J. VEITH	187
History	188
Cleanliness in New Chemical Plants	189
Stainless Steel Uses in the Chemical Industry	190
Summary	195
Design Principles and Operating Practices Affecting Clean-In-Place Procedures of Food Processing Equipment—D. A. SEIBERLING	196
Typical CIP Procedures and Recirculating Equipment	197
Automated Process Piping Systems	199
Product Valves	200
Spray Cleaning of Processing and Storage Vessels	203
Heat Exchangers	206
Summary	208
Cleaning Heat Exchanger Tubing in Industry with the M.A.N. Automatic On-Load Tube Brushing System—J. J. WEGSCHEIDER	210
Automatic Tube Cleaning Is the Answer	211
Every Tube Has Its Own Brush	211
Even Hard Scale Formation Can Be Prevented	212
Automatic Cleaning System Is Available for	
Many Tube Sizes	213
Conclusion	214
Experiences with Cleaning Stainless Steel Condensers on Allegheny Power System Stations—D. M. HARBAUGH	215

History of Stainless and Continuous Cleaning	215
Performance of Cleaning Systems	216
Summary	219

Premature Failure of Type 316 Stainless Steel Condenser Tubing in Brackish

Water —E. W. LESCHBER	220
Discussion	220
Conclusions	222
Recommendations	223

Improving Condenser Performance with Continuous In-Service Cleaning

of Tubes —D. S. DETWILER	224
Methods of Tube Cleaning	224
Mechanical Cleaning Versus Other Methods	225
Tube Restoration as Well as Maintenance	228
Conclusion	228

